GOVERNMENT OF INDIA
MINISTRY OF MINES

ISSN 0972-3625

INDIAN MINERALS YEARBOOK 2022

GENERAL REVIEWS

VOLUME I

INDIAN BUREAU OF MINES

Government of India
Ministry of Mines
Indian Bureau of Mines

INDIAN MINERALS YEARBOOK 2022

VOLUME - I
GENERAL REVIEWS

Issued by
Controller General
Indian Bureau of Mines
NAGPUR

OCTOBER, 2024

INDIAN BUREAU OF MINES

Controller General (In-charge)

Sanjay Lohiya, IAS

Additional Secretary & Controller General (In-charge)

Pankaj Kulshrestha

CCOM-MES (I/c)

MINERAL ECONOMICS DIVISION

Chief Mineral Economist
D.S. Walde

Suptdg Mineral Economist
Dr S.K. Shami
P. Mishra
A.K. Ray

Mineral Economists (Int.)
G.K. Sharma
J.G. Padole
A. Paul

Deputy Mineral Economists (Int.)
Amit Kumar
M.K. Meena

Consultant
Dr. P.K. Jain

MINING & MINERAL STATISTICS DIVISION

Director (s)
Anil H. Ramteke

Assistant Mineral Economists (s)
Deepak Thapa
C.K.Meshram
S.M.Karnase
R.P.Likhar
Siddharth Sahu

Senior Statistical Officers
S.V.S.R. Kota
H.K.Dhruw
Rajednra Kumar
Bhupender
Smt. S.K. Pasin
Smt. S.S. Ecka
Anil Kumar Shaw

Junior Statistical Officers
Dinesh D. Wanjari
Indu PrakashTiwari
Vinod Kr Shukla
Pawan Kumar

PUBLICATION SECTION

Chief Editor
M. Sumesh

Senior Editor
R.K. Sushan Singh

Editor
Eswar Singh K.R.

Assistant Editors
A.P. Mishra
Shrishty Singh
Chandan Kumar

Technical Assistant
Rucha.G. Warhade

Pressman
B.G. Mahajan
Yogita Wasnik
Pravin R. Thune
Rajesh S. Dhopte

Chainman
Ritesh M. Patil

PREFACE

Indian Minerals Yearbook–2022 (IMYB–2022) is the 61st Edition in its Series and comprises three Volumes. This book titled 'Mineral Reviews' is the third Volume and it contains 31 Reviews of important minerals produced in the country which are arranged in an alphabetical sequence. Each Review provides valuable insights on resource/reserve positions; production, stock & prices, mining, marketing & transport; usage & specifications; trade policy; world review; foreign trade; and future outlook of the minerals. The data coverage of this Edition, i.e., IMYB–2022 pertains to the year 2021-22.

This Edition of IMYB, i.e., IMYB–2022, in departure from the earlier editions and in consequence of the notifications of the Government of India declaring 31 major minerals as minor minerals, has a single consolidated chapter dedicated to Minor Minerals which includes 22 sub-chapters on various minor minerals produced in the country. Many minerals which hitherto were covered as individual Mineral Review after the realignment of chapters have been consolidated into a single Review on Minor Minerals.

Be that as it may, attempts nevertheless have been made to comprehensively cover the various minerals explored and extracted in India at the micro-level with inclusions of all recent updates. It has been our continuous endeavour to improve upon the coverage of the Yearbook and to present a complete perspective of all domains that have relevance to minerals and metals to the fullest extent possible.

This year there has been a transformational change in the aesthetics especially in the get-up and layout of the book. Refreshing changes in terms of colour- scheme and presentation of content have been effectvated with a belief that these would engage the attention of the readers. Additioned features by way of presentation of tables, illustration (both pictorial & graphical) along with highlight-jottings are expected to add value to the book.

This Yearbook is the outcome of the joint efforts of the Bureau's Mineral Economics Division and Mining & Mineral Statistics Division. While preparing this Volume, relevant inputs have been drawn from the reports of various Divisions of IBM. Various survey reports/annual reports, technical journals, periodicals of various organisations, including the affirmative responses received from the Mineral Industry on statutory and non-statutory basis, have also been referred and information from related websites too were resourced and incorporated wherever necessary, during the compilation & formulation of this Volume.

The Bureau is indebted to Central and State Government Departments, Public Sector Undertakings, Public and Private Companies and Research Organisations, Mineral-Based Industries & Associations concerned with mines, minerals and mineral-based industries for their support & cooperation in lending and sharing information. It is firmly believed that this Edition of Indian Minerals Yearbook, i.e., IMYB–2022 is in the lines of its predecessors and will serve the interest of all its referring/reading clientele who in the past have reposed such unshakable faith in the authenticity of the data/information published in the Series.

Nagpur
Date: . . 2024

(Sanjay Lohiya)
IAS
Additional Secretary &
Controller General (In-charge)
Indian Bureau of Mines

Volume- I

GENERAL REVIEWS

Contents

EXPLANATORY NOTES AND SOURCES

The statistics presented in this publication are in metric units and the prices quoted are in the Indian currency unless otherwise stated.

The stage of measurement of quantity is normally the mine output which refers to the form in which the minerals are extracted. It also includes the usual processing operations done at the mine site to render the ore marketable. Exceptions to the above definition are gold and silver for which the metal output is considered, and for copper, lead & zinc, the concentrates.

The value of the mineral is reckoned in terms of the Ex-Mine Price which represents the sale value of the mineral at the mine site. The value of production of minerals is calculated by multiplying in each case the quantity of production and pit's mouth value per unit as furnished by the mine owners in the returns under MCDR 1988 in all cases except captive mines where the value is calculated on the basis of the cost of production. In case of fuel minerals, the production value figures in respect of coal & lignite are supplied by the Office of the Coal Controller, Kolkata, on annual basis. Regarding petroleum and natural gas (utilised), value published by the National Accounts Division, Central Statistical Office, is used. Value of sulphur produced as by-product from fertilizer plants and oil refineries is not included in the value of mineral production. The value of non-ferrous metals is furnished by the respective units. The export valuation is on the basis of free on board (f.o.b.) inclusive of export duty, wherever such duty is levied. The basis of valuation of imports is the cost, insurance and freight (c.i.f.) value.

Break-ups may not add to total in some tables due to rounding-off.

Sources

The statistical data presented in this publication have been taken from a large number of sources as listed below:

Minerals other than fuels, atomic minerals and 'minor minerals'

The basic data relating to major minerals except coal, petroleum and natural gas are collected by IBM under Rule 45 of the MCDR, 1988 framed under the Mines and Minerals (Development and Regulation) Act, 1957. These Rules cover all the States and Union Territories of the Indian Union and apply to all minerals except i) petroleum and natural gas, ii) coal, lignite and sand for stowing, iii) minor minerals, and iv) any mineral declared as prescribed substance by Atomic Energy Act, 1962. Data on sulphur are collected from fertilizer plants and oil refineries.

Ilmenite, rutile, monazite, rare earths and zircon

Indian Rare Earths Ltd; Kerala Minerals and Metals Ltd; Department of Atomic Energy, Mumbai, and Private Sector producers and processors.

Fossil fuel

a) Coal and lignite	Coal Controller, Kolkata and the Coal Directory of India.
b) Crude oil and natural gas	i) Economics and Statistics Division of the Ministry of Petroleum & Natural Gas, Government of India, New Delhi, and
	ii) Indian Petroleum & Natural Gas Statistics, Ministry of Petroleum & Natural Gas, Government of India.
	iii) Basic Statistics on Petroleum & Natural Gas, Ministry of Petroleum & Natural Gas, Government of India.
	iv) National Accounts Division, Central Statistical Office, Ministry of Statistics and Programme Implementation, Government of India

Minor minerals

Respective State Governments. 'Minor minerals' are defined in Clause (e) of Section 3 of the Mines and Minerals (Development and Regulation) Act, 1957. The current list of 'minor minerals' includes minerals, such as, building stones, gravel, ordinary earth, ordinary clay, ordinary sand other than sand used for prescribed purposes (i.e. used for other than refractory, ceramics, metallurgical, stowing in coal mines and optical purposes, and in manufacture of silvicrete cement, sodium silicate, pottery and glass), boulder, shingle, chalcedony or impure quartz pebbles (used for ball mill purposes or filling for boreholes or for decorative purposes in buildings), limeshell, kankar, and limestone used in kilns for manufacture of lime used as building material, murrum, brick earth, fuller's earth, bentonite, road metal, rehmatti, slate and shale used for building material, stones used for household utensils, marble, quartzite and sandstone when used for

purpose of building or for making road metals and household utensils and saltpetre. In addition to the minerals already declared, 31 more minerals have been declared minor minerals vide Notification S.O 423(E), dated 10th February, 2015, namely, (i) Agate, (ii) Ball Clay, (iii) Barytes, (iv) Calcareous Sand, (v) Calcite, (vi) Chalk, (vii) China clay, (viii) Clay

(Others), (ix) Corundum, (x) Diaspore, (xi) Dolomite, (xii) Dunite or Pyroxenite, (xiii) Felsite, (xiv) Felspar, (xv) Fireclay, (xvi) Fuschite Quartzite, (xvii) Gypsum, (xviii) Jasper, (xix) Kaolin, (xx) Laterite, (xxi) Limekankar, (xxii) Mica, (xxiii) Ochre, (xxiv) Pyrophyllite, (xxv) Quartz, (xxvi) Quartzite, (xxvii) Sand (Others), (xxviii) Shale, (xxix) Silica Sand, (xxx) Slate and (xxxi) Steatite or Talc or Soapstone.

Trade statistics

Monthly Statistics of the Foreign Trade of India, issued by the DGCI&S, Kolkata

Prices

a) Minerals

i) Principal producers and exporters
ii) Coal Controller, Kolkata
iii) Industrial Minerals (UK)
iv) Basic Statistics on Indian Petroleum & Natural Gas, Ministry of Petroleum & Natural Gas, Government of India.
v) DGCI&S, Kolkata (Import Value)

b) Metals

i) Producers and exporters
ii) Reserve Bank of India Bulletin
iii) World Metal Statistics (WBMS)
iv) London Metal Exchange (Website)
v) Minerals & Metals Review (Monthly/Yearly)

World information & statistics

i) Mineral Commodity Summaries (USGS)
ii) World Mineral Production (BGS)
iii) Minerals Yearbook (USGS)
iv) World Metal Statistics (WBMS)
v) Mineral Industry Surveys (USGS)
vi) Canadian Minerals Yearbook

Minerals Consumption

Data obtained on statutory and non-statutory basis from industrial units consuming minerals/ores. Data have also been obtained in some cases from Central Government Ministries. The consumption indicated relates to the number of reporting units in the organised sector only. Estimated consumption data is based on statistical norms in vogue.

from National

Reserves/resources of minerals in India have been taken from National Mineral Inventory prepared by IBM as per UNFC system. The source of information for the world resources of minerals is given against each mineral.

Port facilities

Annual Report of the Ministry of Shipping, Indian Ports Association, Major and Minor Port Authorities and exporters of minerals.

Research and Development

IBM's Ore Processing Laboratory, National Laboratories under the Council of Scientific & Industrial Research, and Ore Dressing Division of BARC and R&D laboratories in the Public/Private Sector.

Besides, Annual Reports of various Ministries of Government of India, Annual Reports, Brochures and Websites of Public Sector undertakings and private companies, Bulletins concerned with minerals and mineral-based industries, etc. were also referred.

Information /data Liability Disclaimer

The reviews as presented in the Indian Minerals Yearbook are the product of the concerted efforts of in-house authors. In preparation of manuscripts, the authors resourced data/information from various sources, such as, published information on the internet, various publications, Annual reports etc. Major chunks of information have actually been collated internally from the different Divisions of Indian Bureau of Mines which regularly and routinely are in the cycle of gathering data /information through correspondences.

All these sourced information/data that get included in the General/Mineral Reviews are subjected to analyses, interpretations and sometimes extrapolations in the case of paucity of data.There have been instances when the data have been used 'as it is' hence it is recommeneded that the readers apply discretion in discerning the data for their further utilisation for general or scientific purposes.

Indian Bureau of Mines while processing of the sourced data/information undertakes its best efforts to ensure accuracy and to verify that the data published have been selected on the basis of thorough scientific judgement. However, IBM would make no warranties to that effect, and shall not be liable for any consequent damage that may result from errors or omissions in the database contained there in.

ABBREVIATIONS

The abbreviations and symbols/units used in the Publication are as follows:

AMD	Atomic Minerals Directorate for Exploration and Research
APMDC	Andhra Pradesh Mineral Development Corp. Ltd
BALCO	Bharat Aluminium Company Ltd
BARC	Bhabha Atomic Research Centre
BGML	Bharat Gold Mines Limited
BGS	British Geological Survey, UK
BIS	Bureau of Indian Standards
BISAG	Bhaskaracharya Institute of Space Applications & Geo-Informatics
BOT	Build, Operate, Transfer
BSMDC	Bihar State Mineral Development Corp. Ltd
CAPEXIL	Chemical and Allied Export Promotion Council
CBM	Coal Bed Methane
CCI	Cement Corporation of India Ltd
c.i.f.	Cost, Insurance and Freight
CMDC	Chhattisgarh Mineral Development Corporation
CMPDI	Central Mine Planning & Design Institute
CSO	Central Statistical Office
DAE	Department of Atomic Energy
DES	Directorate of Economics & Statistics
DGCI&S	Director General of Commercial Intelligence and Statistics
DGH	Directorate General of Hydrocarbons
DGM	Directorate of Geology and Mining
DGPS	Differential Global Positioning System
DMG	Directorate of Mining and Geology
DMF	District Mineral Foundation
EEZ	Exclusive Economic Zone
EU	European Union
FDI	Foreign Direct Investment
FIMI	Federation of Indian Mineral Industries
f.o.b.	free on board
f.o.b.t.	free on board trimmed
f.o.r.	free on rail
GMDC	Gujarat Mineral Development Corp. Ltd
GSI	Geological Survey of India
GVA	Gross Value Added
HCL	Hindustan Copper Ltd
HGML	Hutti Gold Mines Co. Ltd
Hindalco	Hindalco Industries Ltd
HZL	Hindustan Zinc Ltd
IBM	Indian Bureau of Mines
IMMT	Institute of Minerals & Materials Technology (Formerly RRL, Bhubaneswar)
IREL	Indian Rare Earths Ltd
ISRO	Indian Space Research Organisation
JPC	Joint Plant Committee
JV	Joint Venture
KCC	Khetri Copper Complex
KMML	Kerala Minerals & Metals Ltd
LAPL	Large Area Prospecting Licence
LME	London Metal Exchange
MALCO	Madras Aluminium Company Ltd
M(A)R	The Mineral (Auction) Rules
MCDR	Mineral Conservation and Development Rules
M(EMC)R	The Minerals (Evidence of Mineral Contents) Rules
MCR	Mineral Concession Rules
MECL	Mineral Exploration Corporation Ltd
ML	Mining Lease
MMDR Act	Mines & Minerals (Development & Regulation) Act
MMTC	Minerals and Metals Trading Corp. Ltd
MoEFCC	Ministry of Environment, Forest and Climate Change
MoU	Memorandum of Understanding
MSS	Mining Surveillance System
MTS	Mining Tenement System
MSTC	Metal Scrap Trade Corp. Ltd
NA	Not Available
NAS	Not Available Separately
NALCO	National Aluminium Co. Ltd
NCMT	National Centre of Mineral Targeting
ND	Not Determined
NELP	New Exploration Licensing Policy
NES	Not Elsewhere Stated
NFL	National Fertilizers Ltd
NLC	Neyveli Lignite Corporation Ltd
NMDC	National Mineral Development Corp. Ltd
NMET	National Mineral Exploration Trust
NMEP	National Mineral Exploration Policy
NMI	National Mineral Inventory
NML	National Metallurgical Laboratory
NRSC	National Remote Sensing Centre
NTPC	National Thermal Power Corp. Ltd
NQ	Not Quoted
N/v	Near Village/s
OIL	Oil India Ltd
OMC	Orissa Mining Corporation Ltd
ONGC	Oil and Natural Gas Corporation Ltd

PMKKKY	Pradhan Mantri Khanij Kshetra Kalyan Yojana
PL	Prospecting Licence
PPP	Public Private Partnership
RP	Reconnaissance Permit
RRL	Regional Research Laboratory
RSMML	Rajasthan State Mines and Minerals Ltd
SAIL	Steel Authority of India Ltd
SBICAP	SBI Capital Markets Limited
SCCL	Singareni Collieries Company Ltd
SDF	Sustainable Development Framework
SEZ	Special Economic Zone
SMC	Sikkim Mining Corporation Ltd
STD	Standard (Code of UNFC)
TAMIN	Tamil Nadu Minerals Ltd
TAMRA T	ransparency, Auction Monitoring and Resource Augmentation
TERI	The Energy and Resources Institute
tpd	tonnes per day tpy tonnes per year
TSL	Tata Steel Ltd (formerly Tata Iron and Steel Co. Ltd)
TW	Territorial Waters
UAE	United Arab Emirates
UK	United Kingdom
UNFC	United Nations Framework Classification
USA	United States of America
USGS	United States Geological Survey
UT	Union Territory
VE	Visual Estimate
VISL	Visvesvaraya Iron & Steel Ltd
w.e.f.	with effect from
(e)	Estimated
(P)	Provisional
(R)	Revised
(U)	Under reference
--	Nil
++	Negligible

UNITS UNITS

cm	centimetre
m	metre
mm	millimetre
cu m	cubic metre
'000 cu m	thousand cubic metres
m cu m	million cubic metres
sq m	square metre
km	kilometre
ha	hectare
sq km	square kilometre
t	tonne
'000	tonnes thousand tonnes
lkm	line kilometre
ct	carat
g	gram
kg	kilogram
₹	Indian rupees
₹ '000	thousand rupees
kWh	kilowatt-hour
s	second

Conversion Table

Troy oz	31.1035 g
kg	2.2046 lb
tonne	Metric ton of 2,204.6 lb
ton	Long ton of 2,240 lb
cwt	112 lb
foot	0.3048 m
Crore	Ten million
Lakh	Hundred thousand

Classification of Reserves/Resources of Various Minerals as per United Nations Framework Classification (UNFC) System

The classification of reserves/ resources of various minerals based on UNFC system were first prepared by IBM as on 1.4.2000 and later, as on 1.4.2005. Reserves/resources are furnished mineralwise in State Reviews and gradewise and statewise in Mineral Reviews. Quinquennially updated resources for 43 minerals as on 1.4.2010 and for 70 minerals as on 1.4.2015 have been included in this Edition of Indian Minerals Yearbook in State Reviews and Mineral Reviews. The process for updating the National Mineral Inventory as on 1.4.2020 for 46 minerals is currently in progress. The amendment to Mineral Conservation & Development Rules,1988 vide Gazette Notification No.185 dated 17.4.2003 makes it statutory for all non-coal major mineral mine-owners to report their reserves data as per UNFC and for Mining Lease applications to submit mining plans accordingly. Detailed guidelines, definitions, etc. concerning UNFC were issued by IBM on 3 June 2003 and published in the edition of Mineral Conservation & Development Rules, 1988.

The UNFC consists of a three-dimensional system with the following three axes : Geological Assessment, Feasibility Assessment and Economic Viability. The process of geological assessment is generally conducted in stages of increasing details. The typical successive stages of geological investigation, i.e., reconnaissance, prospecting, general exploration and detailed exploration, generate resource data with a clearly defined degree of geological assurance.

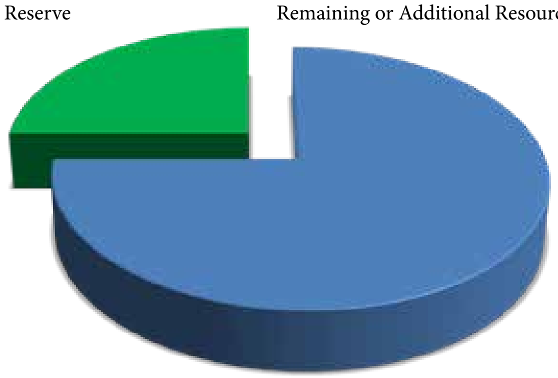
These four stages are, therefore, used as geological assessment categories in the classification. Feasibility assessment studies form an essential part of the process of assessing a mining project. The typical successive stages of feasibility assessment, i.e., geological study as initial stage followed by prefeasibility study and feasibility study/mining report are well-defined. The degree of economic viability (economic or sub-economic) is assessed in the course of prefeasibility and feasibility studies. A prefeasibility study provides a preliminary assessment with a lower level of accuracy as compared to that of a feasibility study which assess the economic viability in detail.

It is a three-digit-code-based system, the economic viability axis representing the first digit, the feasibility axis, the second digit and the geologic axis, the third digit. The three categories of economic viability have codes 1, 2 and 3 in decreasing order. Similarly, the three categories of feasibility study have also codes 1, 2 and 3 while the four stages of geological assessment are represented by 4 codes, i.e., 1 (detailed exploration), 2 (general exploration), 3 (prospecting) and 4 (reconnaissance). Thus, the highest category of resources under UNFC system will have the code (111) and lowest category, the code (334). The various terms used in this classification and their definitions in brief are as follows:

Total Mineral Resources

Reserve plus Additional or Remaining Resource comprise the Total Resource, or Total Resource minus Reserve gives the Remaining Resource.

Total Resources



Diagramatic Representation of Reserve and Resource

A. Mineral Reserve

Economically mineable part of measured and/or indicated mineral resource.

(i) Proved Mineral Reserves (111)
Economically mineable part of Measured Mineral Resource.

(ii) Probable Mineral Reserves (121 & 122)

Economically mineable part of indicated or in some cases, a measured mineral resource.

B. Mineral Resource

A Mineral Resource (Remaining or Additional Resource) is the balance of the Total Mineral Resources that have not been identified as Mineral Reserve.

(i) Measured Mineral Resource (331)

That part of mineral resource for which tonnage, density, shape, physical characteristics, grade and mineral content can be estimated with a high level of confidence, i.e., based on detailed exploration.

(ii) Indicated Mineral Resource (332)

Tonnage, density, shape, physical characteristics grade and mineral content can be estimated with reasonable level of confidence based on exploration, sampling and testing information, location of borehole, pits etc.

(iii) Inferred Mineral Resource (333)

Tonnage, grade and mineral content can be estimated with low level of confidence inferred from geological evidence.

(iv) Reconnaissance Mineral Resource (334)

Estimates based on regional geological studies and mapping, airborne and indirect methods, preliminary field inspections as well as geological inference and extrapolation.

(v) Prefeasibility Mineral Resource (221 and 222)

That part of an indicated and in some circumstances measured mineral resource that has been shown by prefeasibility study as not economically mineable or can become economically viable subject to changes in technological, economic, environmental and/or other relevant conditions.

(vi) Feasibility Mineral Resource (211)

That part of measured mineral resource, which after feasibility study has been found to be economically not mineable.

Definition of Uneconomic Occurrence

Materials of estimated quantity, that are too low in grade or for other reasons are not considered potentially economic. Thus, Uneconomic Occurrence is not part of a mineral resource. If quantity and quality are considered worthy of reporting, it should be recognised that an Uneconomic Occurrence cannot be exploited without major technological and/or economic changes, which are not currently available.

Mineral Occurrence

A mineral occurrence is an indication of mineralisation that is worthy of further investigation. The term mineral occurrence does not imply any measure of volume/tonnage or grade/quality and is thus not part of a mineral resource

1. Indian Mineral Industry & National Economy

6.5-7.0
%, Estimated growth of Indian economy in 2022-23

₹ 1,22,142
Carore Velue of metlics in erals in 2021-22

₹ 10,606
Carore Velue of metlics in erals in 2021-22

2.4
%, Share of Mining and Quarrying Industry of the GVA at current prices

NATIONAL ECONOMY

In general, global economic shocks in the past were severe but spaced out in time. This changed in the third decade of this millennium. At least three shocks have hit the global economy since 2020. It all started with the pandemic-induced contraction of the global output, followed by the Russian-Ukraine conflict leading to a worldwide surge in inflation. Then, the central banks across economies led by the Federal Reserve responded with synchronised policy rate hikes to curb inflation. The rate hike by the US Fed drove capital into the US markets causing the US Dollar to appreciate against most currencies. This led to the widening of the Current Account Deficits (CAD) and increased inflationary pressures in net importing economies. The rate hike and persistent inflation also led to a lowering of the global growth forecasts for 2022 and 2023 by the IMF in its October 2022 update of the World Economic Outlook. The frailties of the Chinese economy further contributed to weakening the growth forecasts. Slowing global growth apart from monetary tightening may also lead to a financial contagion emanating from the advanced economies where the debt of the non-financial sector has risen the most since the global financial crisis. With inflation persisting in the advanced economies and the central banks hinting at further rate hikes, downside risks to the global economic outlook appear elevated.

The Indian economy, however, appears to have moved on after its encounter with the pandemic, staging a full recovery in FY22 ahead of many nations and positioning itself to ascend to the pre-pandemic growth path in FY23. Yet in the current year, India has also faced the challenge of reining in inflation that the European strife accentuated. Measures taken by the government and RBI, along with the easing of global commodity prices, have finally managed to bring retail inflation below the RBI upper tolerance target in November 2022. However, the challenge of the depreciating rupee, although better performing than most other currencies, persists with the likelihood of further increases in policy rates by the US Fed. The widening of the CAD may also continue as global commodity prices remain elevated and the growth momentum of the Indian economy remains strong. The loss of export stimulus is further possible as the slowing world growth and trade shrinks the global market size in the second half of the current year.

Despite these, agencies worldwide continue to project India as the fastest-growing major economy at 6.5-7.0 per cent in FY23. These optimistic growth forecasts stem in part from the resilience of the Indian economy seen in the rebound of private consumption seamlessly replacing the export stimuli as the leading driver of growth. The uptick in private consumption has also given a boost to production activity resulting in an increase in capacity utilisation across sectors. The rebound in consumption was engineered by the near-universal vaccination coverage overseen by the government that brought people back to the streets to spend on contact-based services, such as restaurants, hotels, shopping malls, and cinemas, among others. The world's second- largest vaccination drive involving more than 2 billion doses also served to lift consumer sentiments that may prolong the rebound in consumption. Vaccinations have facilitated the return of migrant workers to cities to work in construction sites as the rebound in consumption spilled over into the housing market. This is evident in the housing market witnessing a significant decline in inventory overhang to 33 months in Q3 of FY23 from 42 months last year.

The Capital Expenditure (Capex) of the central government, which increased by 63.4 per cent in the first eight months of FY23, was another growth driver of the Indian economy in the current year, crowding in the private Capex since the January-March quarter of 2022. On current trend, it appears that the full year's capital expenditure budget will be met. A sustained increase in private Capex is also imminent with the strengthening of the balance sheets of the Corporates and the consequent increase in credit financing it has been able to generate. A much- improved financial health of well-capitalised public sector banks has positioned them better to increase the credit supply.

Consequently, the credit growth to the Micro, Small, and Medium Enterprises (MSME) sector has been remarkably high, over 30.6 per cent, on average during Jan-Nov 2022, supported by the extended Emergency Credit Linked Guarantee Scheme (ECLGS) of the Union government. The increase in the overall bank credit has also been influenced by the shift in borrower's funding choices from volatile bond markets, where yields have increased, and external commercial borrowings, where interest and hedging costs have increased, towards banks. If inflation declines in FY24 and if real cost of credit does not rise, then credit growth is likely to be brisk in FY24. India's economic growth in FY23 has been principally led by private consumption and capital formation. It has helped generate employment as seen in the declining urban unemployment rate and in the faster net registration in Employee Provident Fund. Still, private capex soon needs to take up the leadership role to put job creation on a fast track. Recovery of MSMEs is proceeding apace, as is evident in the amounts of Goods and Services Tax (GST) they pay, while the Emergency Credit Linked Guarantee Scheme (ECGLS) is easing their debt servicing concerns. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) has been directly providing jobs in rural areas and indirectly creating opportunities for rural households to diversify their sources of income generation. Schemes like PM-Kisan and PM Garib Kalyan Yojana have helped in ensuring food security in the country, and their impact was also endorsed by the United Nations Development Programme (UNDP). The results of the National Family Health Survey (NFHS) also show improvement in rural welfare indicators from FY16 to FY20, covering aspects like gender, fertility rate, household amenities, and women empowerment.Global growth has been projected to decline in 2023 and is expected to remain generally subdued in the following years as well. The slowing demand will likely push down global commodity prices and improve India's CAD in FY24. However, a downside risk to the Current Account Balance stems from a swift recovery driven mainly by domestic demand addressing-cost-living-crisis-developing-countries-poverty-and-vulnerability-projections- and-policy responses.

State of the Economy 2022-23: Recovery Complete 3 and, to a lesser extent, by exports. The CAD needs to be closely monitored as the growth momentum of the current year spills over into the next. Growth is expected to be brisk in FY24 as a vigorous credit disbursal, and capital investment cycle is expected to unfold in India with the strengthening of the balance sheets of the corporate and banking sectors. Further support to economic growth will come from the expansion of public digital platforms and path-breaking measures such as PM GatiShakti, the National Logistics Policy, and the Production-Linked Incentive

India's Merchandise Trade

India's exports of both goods and services have been exceptionally strong so far in 2021-22. Merchandise exports have been above US$ 30 billion for eight consecutive months in 2021-22, despite a rise in trade costs arising from global supply constraints such as fewer operational shipping vessels, exogenous events such as blockage of Suez Canal and COVID-19 outbreak in port city of China etc. Concurrently, net services exports have also risen sharply, driven by professional and management consulting services, audio visual and related services, freight transport services, telecommunications, computer and information services. From a demand perspective, India's total exports are expected to grow by 16.5 per cent in 2021- 22 surpassing pre-pandemic levels. Imports also recovered strongly with revival of domestic demand and continuous rise in price of imported crude and metals. Imports are expected to grow by 29.4 per cent in 2021-22 surpassing corresponding pre-pandemic levels.

Exports

Following the global trend, India's merchandise exports recovered strongly from the pandemic-induced collapse and registered positive growth in the current financial year. During 2021-22 (April-December), the merchandise exports recorded growth of 49.7 per cent to US$ 301.4 billion, compared to corresponding period of last year and 26.5 per cent over 2019-20 (April- December), exceeding the pre-pandemic levels. Out of an ambitious export target of US$ 400 billion set for 2021-22, India has already attained more than 75 per cent of it by exporting goods worth US$ 301.4 billion, which is actually higher than the export target of US$ 300 billion set for the April-December period of 2021-22.

Trade Deficit

Foregin Direct Investment (FDI)

Measures taken by the Government to put in place an enabling investor friendly FDI Policy has resulted in increased FDI inflows setting up new records. FDI inflows in India stood at US $ 45.14 billion in 2014-15 and have continuously increased since then. India registered its highest ever annual FDI inflow of US$ 81.97 billion (provisional) in 2020-21 reflecting a growth of 10 per cent as compared to the previous year. The increase has been on the back of growth of 20 per cent in 2019-20. In the year 2021-22, FDI inflow grew by 4 per cent in the first six months to reach US$ 42.86 billion as compared to US$ 41.37 billion for the same period of last year.

As per DPIIT report statement on sector-wise FDI equity inflows during the year 2021-22, FDI in Mining Sector was ₹ 26,08.53 crore.

MINING INDUSTRY

The index of mineral production (excluding atomic and minor minerals) (with base year 2011-12=100) for 2021-22 at 113.3 displayed an increase of 12.2 % as compared to the previous year.

The value of metallic minerals in 2021-22 at ₹ 1,22,142 crores increased by about 69.2% over the previous year.

The value of production of non-metallic minerals at ₹ 10,606 crores during 2021-22 increased by 14.8% as compared to the previous year (Table-1).

Table – 1 : Indian Mineral Industry : Value of Production*

2019-20 to 2021-22

(In ₹ crore)

Sector	2019-20 (R)	2020-21 (R)	2021-22 (P)
Total : All Minerals	**165325**	**158869**	**202095**
Metallic minerals	68298	72198	122141
Non-metallic minerals	9503	9236	10605
Minor minerals	87523	77434	69347

** Excluding the minerals declared as prescribed substances under the Atomic Energy Act,1962; fuel minerals.*

Reporting Mines

Reporting mine is defined as "A mine reporting production or reporting 'nil' production during a year but engaged in developmental work; such as, overburden removal, underground driving, winzing, sinking work, exploration by pitting, trenching or drilling as evident from the MCDR returns".

There were 1,311 reporting mines (excluding fuel minerals, atomic fuel and minor minerals) in India located in all states and UTs during 2021-22. Among them, 545 belong to metallic minerals and 766 to non-metallic minerals. There were 157 mines in public sector and the rest of 1,154 mines were in private sector (Table-2).

Table – 2 : Number of Reporting Mines#

2019-20 to 2021-22

Sector	2020-21	2021-22 (P)
All Minerals	**1323**	**1311**
I (i) Public sector	156	157
(ii) Private sector	1167	1154
II (i) Metallic minerals	589	545
(ii) Non-metallic minerals	734	766

Note: #: Excluding atomic, fuel and minor minerals.

Role of Public Sector

The public sector has played important role in the overall mineral production in 2021-22.

The entire production of Copper Ore & Conc., among metallic mineral and Diamond, Fluorite, Salt (Rock) and Selenite in respect of non-metallic minerals was reported from the public sector. By and large, the entire production of Gold, Tin Conc. and Phosphorite came from public sector during 2021-22.

Gross Value Added from Mining & Quarrying Sector

The Ministry of Statistics & Programme Implementation has released the provisional estimates of national income, revising the base year from 2004-05 to 2011-12 in the year 2015. The industry-wise estimates are now presented as Gross Value Added (GVA) at basic prices. Certain changes have been made in this series including for Mining & Quarrying industry. During 2021-22 Mining and Quarrying industry accounted for about 2.4 % of the GVA at current prices. The GVA at current and constant prices for the period from 2019-20 to 2021-22 are given in (Tables- 3 & 4).

Table - 3 : Gross Value Added at Basic Price, 2019-20 to 2021-22

(At 2011-12 prices) (31.05.2022)

(in ₹ crore)

Industry	2019-20 (2nd RE)	2020-21 (1st RE)	2021-22 (PE)	% Change in 2021-22 over the previous year
GVA (All)	**13,219,476**	**12,585,074**	**13,605,474**	**8.1**
Mining & Quarrying	321,766	294,024	327,984	11.5

Source: CSO *RE:Revised Estimates* *PE:Provisional Estimates*

Table - 4 : Gross Value Added at Basic Price, 2019-20 to 2021-22

(At Current Prices) (31.05.2022)

(in ₹ crore)

Industry	2019-20 (2nd RE)	2020-21 (1st RE)	2021-22 (PE)	% Change in 2021-22 over the previous yearr
GVA (All)	**18,355,109**	**18,057,810**	**21,349,399**	**18.2**
Mining & Quarrying	358,517	324,980	513,076	57.9

Source: CSO *RE:Revised Estimates* *PE:Provisional Estimates*

Employment

The average daily employment of labour engaged in mining sector (excluding fuel minerals, atomic and minor minerals) was 1,09,304 in 2021-22. Out of this, 36,080 or 33 % were in public sector and 73,224 or 67 % in private sector. Metallic minerals accounted for 80 % and non-metallic minerals 20 % of the total labour force during the year.

As per World Mineral Production, 2017-21, British Geological Survey, India's ranking in 2021 in world production in term of quantity was 2nd in Steel (crude/liquid) and aluminium (primary) followed by 3rd in Zinc (slabs) and chromite; 4th in iron ore; 5th in Bauxite; 7th in manganese ore. The statistics on indigenous and world production of principal minerals and metals are given in Table-5.

Table-5: Contribution and Rank of India in World Production of

Principal Minerals & Metals, 2021

Sector	Unit of Commodity	Production quantity		Contributioh (Percentage)	India's rank in World order$
		World	India*		
Metallic Minerals					
Bauxite	'000 tonnes	342600	22495	6.56	5th
Chromite	'000 tonnes	35100	3785	10.78	3rd
Iron ore	million tonnes	3108	254	8.17	4th
Manganese ore	'000 tonnes	56200	2347	4.17	7th
Industrial Minerals**					
Magnesite	'000 tonnes	34300	113	0.32	17th
Apatite &					
Rock phosphate	'000 tonnes	222000	1395	0.62	19th
Metals					

Sector	Unit of Commodity	Production quantity		Contributio (Percentage)	India's rank inWorld order $
		World	India*		
Aluminium (primary)	'000 tonnes	67000	4016	5.99	2th
Copper (refined)	'000 tonnes	24800	484	1.95	11th
Steel (crude/liquid)	million tonnes	1915	120.007	5.6	2nd
Lead (refined)e	'000 tonnes	14400	191	1.32	12th
Zinc (slab)	'000 tonnes	14000	775	5.53	3rd

Source: World mineral production data compiled from World Mineral Production, 2017-2021; British Geological Survey.
** Figures relate to financial year 2021-22 and MCDR returns for production data.*
Not e: Data in respect of World Mineral Production is on calendar year basis, however the data on India's production is based on financial year.
*** As per Government of India Notification S.O. 423(E) dated 10th February, 2015, following minerals have been declared as minor minerals: i) barytes ii) dolomite iii) felspar iv) fireclay v) quartz/silica sand and vi) talc/steatite/soapstone &pyrophyllite, hence not included in the table due to non-availability of production data with respect to India.*
$: India's rank based on production mentioned in World Mineral Production 2017-21;British Geological Survey.
#: Figure relates to both primary and secondary refined lead and include the lead content of antimonial lead.
e: Estimated

POLICY

National Mineral Policy

National Mineral Policy, 2019, has been approved by the Union Cabinet, on 28th February 2019. The aim of National Mineral Policy, 2019, is to have a more effective, meaningful and implementable policy that brings in further transparency, better regulation and enforcement, balanced social and economic growth as well as sustainable mining practices.

The National Mineral Policy, 2019, includes provisions which aim to boost the Mining Sector, such as,

- introduction of Right of First Refusal for RP/PL holders,
- encouraging the Private Sector to take up exploration,
- auctioning of virgin areas for composite RP- cum- PL-cum-ML on revenue share basis,
- encouragement of merger and acquisition of mining entities,
- transfer of mining leases and creation of dedicated mineral corridors to boost Private Sector mining areas,
- proposes to grant status of industry to mining activity to boost financing of mining for Private Sector and for acquisitions of mineral assets in other countries by Private Sector,
- proposes to auction mineral blocks with prembedded clearances to give fillip to auction process,
- propose to make efforts to harmonise taxes, levies & royalty with world benchmarks to help Private Sector.

The NMP-2019 will ensure more effective regulation. It will lead to sustainable Mining Sector development in future while addressing the issues of project-affected persons especially those residing in tribal areas.

Star Rating of Mines

Ministry of Mines, in its endeavour for taking up exhaustive and universal implementation of the Sustainable Development Framework (SDF) in mining, has evolved a system of Star

Rating of Mines.

The Ministry of Mines instituted the Sustainable Development Framework (SDF) for taking up mining activity, encompassing inclusive growth, without adversely affecting the social, economic and environmental well-being, at present and also in future generation. It has been instituted as a two-tier system providing self-evaluation templates to be filled in by the mine operator followed by validation through Indian Bureau of Mines.

The evaluation templates for Star Rating was notified vide Notification dated 23.05.2016 for major minerals.

Based on the performance of the mining lease, 1 to 5 star rating would be awarded. The prospect of getting higher Star Rating is expected to drive miners to quickly adopt sustainable mining practices. In recently notified Mineral Conservation & Development Rule, 2017, Star Rating for mines has been included as statutory provision for achieving of minimum 3 stars.

A web enabled online system for evaluation of measures has been developed and launched on 18th August, 2016 as a vital step for ensuring compliance of environmental protection and social responsibility by the Mining Sector. A template for star rating of minor minerals is also being prepared.

During the year 2021-22, till (31st Dec-2021), a total of 987 online templates for the assessment year 2020-21 have been filed by the lessees. Validation of the submitted template for final evaluation is under progress and so far 411 leases field varification has been completed.

LEGISLATIVE FRAMEWORK

The details of Legislative Framework are provided in the Review on "Mineral Policy and Legislation" under "General Review".

Auction of Mineral Blocks

As per information available on website of Ministry of Mines as on 28.12.2023, a total of 336 mineral blocks have been auctioned successfully across 13 States.

Measures taken to Control Illegal Mining

Illegal mining means any reconnaissance or prospecting or mining operation undertaken by any person or a company in any area without holding a reconnaissance permit or a prospecting licence or, as the case may be, a mining lease as required under Sub-section (1) of Section 4 of the MMDR Act. Section 23C of Mines and Minerals (Development and Regulation) Act 1957, empowers the State governments to frame rules to prevent illegal mining and the State Government may by notification in the official gazette, make such rules for preventing illegal mining, transportation and storage of minerals and for the purposes connected therewith in the State.

There is a three-pronged strategy for prevention of illegal mining viz. constitution of task force by the State government at State and District Level, framing of rules under Section 23C of the MMDR Act, 1957 and furnishing of quarterly returns on illegal mining for review to the Central Government. The details of States who have constituted task force at State level, framed Rules under Section 23C of the MMDR Act, 1957 and have furnished quarterly returns on illegal mining to IBM are as follows:

Twenty-two State Governments have constituted the task force. The function of the task force is to review the action taken by member departments for checking the illegal mining activities in their respective jurisdiction.

Twenty-one State Governments have framed the rules under Section 23C of MM (D&R) Act, 1957 to curb illegal mining. The State government submits quarterly returns on prevention of illegal mining to IBM. These returns contain details, such as, number of cases detected and action taken thereon etc. IBM on receipt of the returns from the various State governments, consolidates the information and sends it to the Ministry at the end of each quarter.

The Mineral Conservation and Development Rules, 2017 (MCDR) provides measures to ensure systematic & scientific mining. Rule 45 of the MCDR provides for the mining companies to submit periodic reports on the extraction and disposal of the mined material. Rule 45 of MCDR also facilitates end-to-end national-scale accounting of all minerals produced in the country from the pit head to its end-use, reducing the scope for illegal mining, royalty evasion, etc. The amended Rule 45 now makes it mandatory for all miners, traders, stockist, exporters and end-users of minerals to register and report on the production, trade and utilisation of minerals to the State Government (s) and Indian Bureau of Mines

Space Technology for Checking Illegal Mining

Indian Bureau of Mines (IBM) has entered into an MoU with National Remote Sensing Centre (NRSC), for a pilot project "Sudoor Drishti" to demonstrate the feasibility of using High Resolution Satellite Imagery and Digital Elevation Model (DEM) in monitoring mining activities / changes over selected group of mines.

Application of Drone Technology in Mining

Furthering the efforts to utilize new technology, the Ministry of Mines has explored the applicability of the Unmanned Aerial Vehicles (UAV) Technology or commonly referred to as 'UAVs' for the mining sector. The UAV-based remote sensing is an emerging technology, increasingly used in agriculture, environmental, geology, mining, town planning and forestry applications and other applications. UAVs, typically operate at lower altitudes than manned aircraft and are also able to provide unique data with regard to spatial resolution angle of view. Compared to manned fixed-wing aircraft, typically used in aerial remote sensing, UAVs can provide lower ground sample distances (GSD) or higher spatial resolutions on the ground. After a successful pilot project during 2020-21 to ascertain the efficacy of using Unmanned Aerial Vehicles (UAV) to monitor the mining activities in the country, necessary amendments were made in the Mineral Conservation and Development Rules 2017 to include submission of digital images to IBM. The MCDR, 2017 vide rule 34A now mandates the mineral concession holders to submit digital aerial images to IBM on an annual basis. The digital images to be submitted to IBM will be based on drone (UAV) survey of the mines having production capacities of more than 1 million ton or lease area of 50 hectares or more based on the Standard Operating Procedure laid down by IBM. For other mines the lessee will be required to submit satellite images based on the SOP laid down by IBM.

The regular survey of the mines using drones will bring in more transparency and create more awareness to work following the proposals in the mining plans. The miners can self- regulate themselves to ensure that all their activities are restricted within the lease area and meet the requirements of the mining plan. In effect all future submissions of mining plans or modifications will be based on drone survey carried out in the mines resulting in better and scientific mining plans reflecting the actual ground realties. The mine surveys can be taken up at a faster pace using drone surveys there by increasing the accuracy and also reducing the time of survey.

To facilitate the regional offices in processing the drone and satellite image data, necessary hardware & software infrastructure is being provided progressively in a phased manner.

Mining Surveillance System (MSS)

MSS Project using satellite remote sensing technology together with information technology has been developed and rolled out for major & minor minerals to curb cases of illegal mining.In the third phase of 2021-22 priliminary, a total of 177 triggers across the country are generated for major minerals and uploaded on the portal for further transmission to the state governments. During 2021-22, field verification reports in respect of 79 triggers for major minerals have been received out of which unauthorised mining in ten cases of major minerals have been confirmed by the state government.

District Mineral Foundation / Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMK-KKY)

District Mineral Foundation (DMF) established by contributions from the mining companies, came into force specially for addressing the long-time grievance of the neglected civil society consisting of people affected by mining activities. Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY) scheme formulated for the welfare and development of the mining affected areas and people under DMF was also launched. About ₹ 56,369 crore have been collected till 30.11. 2021. Under the PMKKKY, 2,15,082 projects have been sanctioned. Till 31.11.2021, funds to the tune of ₹ 28,072.91 crore have been utilised and about ₹ 50,602.59 crore have been allocated.

Mining Tenement System (MTS)

The Mining Plan, Star Rating and OAS modules are under testing. The SRS V3.1 of Phase II Modules, i.e., Grant and Execution of Concession, Inspection Module, GIS Module, IBM existing databases, ML WMIMP, NMI, MCP and Final Mine Closure Plan modules are under examination.

The details of Legislative Framework are provided in the Review on "Mineral Policy and Legislation" under "General Review".

Indian Bureau of Mines (IBM)

IBM plays the role of National Repository of mineral data through maintaining a data bank of mines and minerals by developing advanced IT-based Mineral Information System. IBM also carries out mining research project on need-based aspects of mining; and conducts mineral beneficiation studies, including mineralogical testing and chemical analysis; and preparation of mineral maps. Indian Bureau of Mines (IBM), as a facilitator to the Mineral Industry, performs multifarious functions, such as, providing technical consultancy services for conducting feasibility studies, environment impact assessments, environment management plans, etc. as a storehouse of data.

A Remote Sensing Centre has been set up at IBM in 2018. Multi-mineral leasehold maps are updated on ARC-GIS platform. All the maps viz lease boundaries, Geological layer and toposheet layer has been integrated for the state of Goa & Maharashtra. During 2021-22, the vectorisation of 61 toposheets and plotting of 273 mining leases and attachment of Assam, Meghalaya, Manipur, Kerala, Haryana, Himachal Pradesh, West Bengal and Jammu & Kashmir (UT) were completed. Up to march 2022, georeferencing, projection and vectorization of all the 561 identified toposheets having major mineral leaseholds were completed.

Mineral beneficiation studies were carried out by IBM to encourage value addition, conservation and development of mineral resources. During 2021-22, 40 Ore dressing investigations, 17,424 chemical analyses, 2,344 mineralogical examinations and 3 in-plant studies were completed.

The Project on Mining Surveillance System (MSS) was undertaken by Indian Bureau of Mines, Ministry of Mines, and BISAG (Bhaskaracharya Institute for Space Applications and Geo- informatics) of Ministry of Electronics and Information Technology (MEITY) to develop a system for detection of incidence of illegal mining by use of space technology and Surveillance of area up to 500 m outside the lease boundary to check instances of illegal mining. The deterrence effect of 'Eyes watching from the Sky' would be extremely useful in curbing instances of illegal mining.

IBM undertakes preparation of National Inventory of mineral resources on a quinquennial basis. Under this programme, implementation of UNFC system was adopted in 2002 replacing the earlier resource classification based on Indian system. The last National Mineral Inventory (NMI) was updated as on 01.04.2015 for 71 minerals. The preparatory work towards updation of National Mineral Inventory (NMI) as on 01.04.2020 for 46 major minerals was completed.

RESEARCH & DEVELOPMENT

The Science and Technology (S&T) programmes of the Ministry of Mines, Government of India, cover the disciplines of Geology, Exploration, Mining, Beneficiation & Mineral Processing, Rock Mechanics, Ground Control & Non-ferrous Metallurgy and Environmental issues related to Mining & Metallurgy.

During the 21^{st} PERC meeting held on $13\text{-}14^{th}$ Dec. 2021, a total of 215 project proposals, as received under S&T Program Scheme of Ministry of Mines. After screening, 51 proposals covering five areas, namely (i) Geosciences and Exploration; (ii) Mining; (iii) Mineral Processing & recovery from waste; (iv) Metal Extraction (Metallurgical processes); and (v) Alloys, specialty materials and product; were shortlisted for further presentation by the respective Principal Investigators (PIs). Based on the detailed review and evaluation, the PERC recommended 28 Project Proposals with or without changes to SSAG.

The Research & Development (R&D) work in the field of Ores & Minerals is being carried out by IBM, JNARDDC, CSIR & allied laboratories, other research organisations relating to mineral/metal and various mining & mineral-based industries. Available information, details of some of the R&D. The research & development details are covered in the Review on "Research & Development" under "General Review".

FOREIGN TRADE

As per the World Trade Statistics Review 2022, India's ranking amongst the leading exporters in the world merchandise trade improved from 30 in 2004 to 18 in 2021 with a share of 1.80%. Similarly, India's ranking amongst the leading importer in world merchandise trade was 10 in 2021 as compared to 23 in 2004 with ashare of 2.5 per cent.

Exports

During the year 2021-22, the value of exports (including re-exports) of ores and minerals at ₹ 2,57,863 crore accounted for about 8.19% of the total value of all merchandise exported from India. The value of exports of ores & minerals which increased from ₹ 1,96,654 crore in 2020-21 to ₹ 2,57,863 crore in 2021-22. The value of mineral exports showed an increase of 31.13% in 2021-22 as compare to that of the previous year.

Diamond (total) continued to be the largest constituent item with a share of 73.44% in the total value of mineral exports in 2021-22. Next in the order of share were iron ore with the contribution of 9.36% followed by granite 4.90%, precious and semi-precious stone (cut & uncut) 1.96% and alumina 1.84%. The individual share of remaining minerals in the total value of exports of ores and minerals from India during the year under review was less than one per cent. The value of exports of ores & Minerals (including re-exports) showed a mixed trend for most of the minerals in 2021-22 as compared to that of the previous year. A significant increase was also noticed in some cases. The exports value of minerals which have shown significant growth are coke (759.71%) and Sulphur excluding sublimed Precipited & colloidal) (385.39%). On the other hand, the exports value recorded significant decline in the cases of Limestone (89.40%), copper ores & conc. (48.44%), and Iron ore (33.40%), as compared to that in the previous year.

The value of exports (including re-exports) of metals & alloys at ₹ 3,47,457 crore in the year 2021-22 reg- istered an increase of 67.67% as compared to ₹ 2,07,222 crore in the previous year. The contribution of metals & alloys in the total value of India's exports was 11.04% during the year under review.

Iron & steel with a share of 58.54% continued to hold the top position in the value of metals/alloys exported from India in 2021-22. Aluminium and alloys including scrap is in the second place and accounted for 22.79% value. Ferroalloys and copper & alloys (including brass & bronze) occupied the third & fourth place with a contribution of 7.81% and 4.93%, respectively. The contributions of zinc & alloys including scrap and silver were 2.15% and 1.04% pig & cast iron (incl. speigeliesen) and lead & alloy including scrap were 1.42% & 1.16% respectively. The individual share of other remaining metals and alloys was less than one per cent.

Imports

The value of imports of ores & minerals in 2021- 22 accounted for 33.92% of the total value of all merchandise imported into India. During 2021-22, the total value of imports of ores and minerals at ₹ 15,51,380 crore registered an increase of 96.05% as compared to ₹ 7,91,320 crore in the year 2020-21.

Petroleum (crude) continued to be the largest constituent item with a share of 58.91% in the total value of minerals imported in 2021-22. Next in order of importance were diamond with a share of 13.26%, coal (ex.lignite) with 14.75% and natural gas with 6.48%. The combined share of these four minerals was 93.40% in 2021-22 as against 93.82% in the previous year.

The value of imports of metals & alloys at ₹ 6,26,927 crore showed an increase of 43.92% in 2021-22 as compared to ₹ 4,35,927 crore in the previous year. The share of metals & alloys in the total value of all merchandise imported to India was about 13.70% in 2021-22.

Gold, non-monetary & monetary (total), with a share of 54.89% continued to occupy the top position in the total value of imports of metals and alloys in 2021-22. Iron & steel is placed in the second position and accounted for share of 18.49%, copper & alloys including brass & bronze occupied the third place with a share of 8.39% and aluminium & alloys including scrap occupied the fourth place with a share of 7.22%. Next in the order were silver with 3.90% followed by ferro- alloys, Nickel & Alloys incl. scrap with 1.97% and 1.27% respectively. The individual share of remaining metals was less than one per cent of the total value of metals & alloys.

VALUE-ADDED EXPORT TRADE

India's foreign trade includes exports of minerals, both in the raw form and semi-processed & processed forms like mineral-based primary manufactured products.

Ores and minerals contributed significantly to India's exports trade in 2021-22 with a share of about 8.19% (i.e., ₹ 25,78,629 million) in the total value of all merchandise. The contribution of minerals in exports in raw/unprocessed forms was about ₹ 3,68,369 million and in semi-processed/ processed forms was about ₹ 22,10,260 million. The manufactured mineral-based commodities (final stage of transformation) contributed about ₹ 68, 52, 836 crore to the total value of exports of all merchandise. The value-added semi-processed/ processed minerals figuring in India's foreign trade included cut & polished diamond/ emerald, pulverised barytes, steatite, felspar (cut), garnet, calcined magnesite, magnesia (fused), magnesite (dead-burnt), magnesium oxide, slate (worked), processed mica & manufactured mica products, coke, cut & polished dimension stones, alumina, etc. The manufactured mineral-based commodities included metals & alloys and products thereof, cement, firebricks & other refractory materials, clay-bonded graphite crucibles & silicon carbide crucibles, manganese dioxide, asbestos-cement products, i norganic chemicals l ike l ime & fluorine chemicals, refined borax & borates, elemental phosphorus & phosphoric acid, titanium dioxide, petroleum products, phosphatic & potash fertilizers, etc. Table-6 provides data on contribution of various value-added minerals and mineral-based products to India's exports during 2019-20 to 2021-22.

INFRASTRUCTURE

Infrastructure

In order to achieve the GDP of $5 trillion by 2024-25, India needs to spend about $1.4 trillion over these years on infrastructure. During FYs 2008-17, India invested about US$1.1 trillion on infrastructure. However, the challenge is to step up infrastructure investment substantially.

Keeping this objective in view, National Infrastructure Pipeline (NIP) was launched with projected infrastructure investment of around Rs. 111 lakh crore (US$ 1.5 trillions) during FY 2020- 2025 to provide world-class infrastructure across the country, and improve the quality of life for all citizens. It also envisages to improve project preparation and attract investment, both domestic and foreign in infrastructure. NIP was launched with 6,835 projects, which has expanded to over 9,000 projects covering 34 infrastructure sub- sectors. During the fiscals 2020 to 2025, sectors such as energy (24 percent), roads (19 percent), urban (16 percent), and railways (13 percent) amount to around 70 percent of the projected capital expenditure in infrastructure in India. Sector wise break- up of the pipeline for the period 2019-20 to 2024-25 is given in figure 23. NIP has involved all the stakeholders for a coordinated approach to infrastructure creation in India to boost short-termas well as the potential GDP growth.

NITI Aayog has developed the 'National Monetisation Pipeline (NMP Volumes 1&2)' in consultation with infrastructure line ministries. Asset monetisation, entails a limited period license/ lease of an asset, owned by the government or a public authority, to a private sector entity for an upfront or periodic consideration. The private sector entity is expected to operate and maintain the asset based on the terms of the contract/concession, generating returns through higher operating efficiencies and enhanced user experience. Funds, so received by the public authority, are reinvested in new infrastructure, or deployed for other public purposes. Such contracts include provision for transfer of asset back to the authority at the end of the period.

A robust asset pipeline has been prepared to provide a comprehensive view to investors and developers of the investment avenues in infrastructure. The pipeline includes selection of de- risked and brownfield assets with stable revenue generation profile (or long rights) which will make for an attractive investment option. Total indicative value of NMP for core assets of the Central Government has been estimated at Rs 6.0 lakh crore over 4-year period (5.4 percent of total infrastructure investment envisaged under NIP).

Coal

Coal production (provisional) at 778.21 million tonnes in 2021-22 was increased by 14.77% from that of 716.083 million tonnes in 2020-21. In 2021-22, out of the total production of coal, 6.25% (51.702 million tonnes) was of coking coal and the remaining 726.508 (671.29 million tonnes) was of non-coking coal.

Electricity

Electricity is essential for powering economic activity and is also required in leisure time. The Power Sector has witnessed substantial transformation from both the demand and supply-side.

The installed capacity was 395 GW as on 31.01.2022. During the year 2021-22 the total generation of energy (including imports and renewable sources of energy) was 1234.298 BU (up to January, 2022). During the year 2021-22 (up to December, 2021), peak shortage was 1.2% and the energy shortage was 0.4% as compared to 0.7% and 0.5%, respectively in the previous year.

Transport

Railways

Indian Railways (IR) with over 68,000 route km is the third largest network in the world under single management. During the year 2021-22, Indian Railways carried 1418.84 million tonnes of freight traffic and 3,519 million passengers making it the world's largest passenger carrier and 4th largest freight carrier.

Civil Aviation

India is one of the fastest growing market for civil aviation in the world. It is expected to become the third largest overall (including domestic and international traffic) by the year FY25.

India's domestic traffic has more than doubled from around 61 million in FY14 to around 163.74 million in 2021.

Ports and Shipping

The Major Ports in the country have an installed capacity of 1,597.59 MTPA and handled traffic of 720.05 MT during 2021-22. While increasing the capacity of major ports, Ministry of Shipping has been striving to improve the operational efficiencies through mechanisation, digitisation and process simplification. As a result key efficiency parameters have improved considerably. The Average Turnaround Time in 2021-22 improved to 53.34 hrs as against 55.99 hrs in 2020-21. The Average Output Per Ship Berthday has increased from 12,458 tonnes in 2015-16 to 21,002 tonnes in 2021-22.

Roads

Road infrastructure in the form of a network of national highways, state highways, district roads, rural roads, and urban roads acts as a major mode of transportation and connectivity for the country's diverse population of consumers and businesses. Roads supplement the other modes of transport through last-mile connectivity to the far-flung regions of the country.

There has been an increase in the construction of National Highways (NHs)/roads over time, with 10,457 km of roads constructed in FY22 as compared to 6,061 km in FY16. In FY23 (until October 2022), 4,060 km of NHs/roads were constructed, which was around 91 per cent of the achievement in the corresponding period of the previous financial year. Total budgetary support for investment in the sector has been increasing rapidly in the last four years and stood at around ₹ 1.4 lakh crore during FY23 (as of 31 October 2022).

PERFORMANCE OF SELECTED MINERAL-BASED INDUSTRIES

Steel

Globally, India is the second largest producer of crude steel in the world after China. During 2021-22, crude steel production stood at 120.293 million tonnes. The total export of finished steel with highest volume of 13.49 million tonnes during 2021-22.

Cement

As per DIPP Annual Report, production of cement during 2021-22 was 360.19 million tonnes as against 299.94 million tonnes in 2020-21 and registered an increase of about 20% per cent. The induction of advanced technology has helped the industry immensely to improve its efficiency by conserving energy, fuel and addressing the environmental concerns. Cement Industry has been undergoing a transition with modernisation and upgradation of technology particularly with a view to conserve energy. India exports cement including white cement and other cement clinker. The exports of cement (total) decreased to 1.90 million tonnes in 2021-22 from 2.80 million tonnes in 2020-21.

Petroleum Oil and Refineries

Crude oil production & condensate in 2021- 22 at 29.69 million tonnes registered a nominal decrease of 2.63% as compared to that in 2020-21. The production of natural gas (utilised) was at 34.02 Billion cubic metres in 2021-22, 18.66% higher than 28.67 billion cubic metres achieved in 2020-21. The total refining capacity in the country was about 251 MMTPA in 2021-22. Production of petroleum products (including LPG production from natural gas) was 254.31 million tonnes in 2021-22 as compared to 254.31 million tonnes in 2020-21.

SELF-RELIANCE IN MINERALS & MINERAL- BASED PRODUCTS

India continued to be wholly or largely self-sufficient in minerals which constitute primary mineral raw materials that are supplied to industries, such as, iron & steel, cement etc. India is self-sufficient in iron ore, Kyanite,Sillimanite, Aluminium (Primary) Lead (Primary) and Zinc. India is deficient in Bauxite, Chromite, Limestone, Magnesite, Manganese Ore, Rock Phosphate and Copper, which were imported to meet the demand for either blending with locally available mineral raw materials and/or for manufacturing special qualities of mineral-based products. To meet the increasing demand of uncut diamonds, emerald and other precious & semi-precious stones by the domestic Cutting and Polishing Industry, India is dependent on imports of raw uncut stones for their value-added re-exports is furnished in Table -7.

Table – 6 : Contribution of Value-added (Processed) Minerals & Mineral-based Products in India's Export* Trade, 2019-20 to 2021-22

(By Principal Countries)

Sl. No.	Commodity group	Value of exports (₹ million)			Contribution (percentage)		
		2019-20	2020-21(R)	2021-22(P)	2019-20	2020-21	2021-22 (P)
1	All Merchandise	22198541	21590432	31470214	100	100	100
2	Ores & Minerals	1896831	1966539	2578629	8.54	9.1	8.19
	2.1 Raw/Unprocessed form	292637	472525	368369	1.32	2.18	1.17
2.2.	Semi-processed/ processed forms (preliminary and intermediate stages of processing)	1604194	1494014	2210260	7.23	6.91	7.02
3	Manufactured Mineral-based Commodities (final stage of transformation)	4251969	3694502	6852836	19.15	17.11	21.77
	3.1 Metals/Alloys	1660988	2072220	3474571	7.48	9.59	11.04
	3.2 Others	2590982	1622282	3378265	11.67	7.51	10.73

Figures rounded off.

** Including re-exports.*

Table-7: Degree of Self-sufficiency in Principal Minerals & Metals, 2021-22 (P)

Sl. No.	Commodity	Demand/ Domestic Consumption ('000 tonnes)	Supply/Domestic supply ('000 tonnes)	Order of selfsufficiency (%)
Minerals				
1	Bauxite	25124	22495	90
2	Chromite	4028	3785	94
3	Iron ore	234000	254000	100
4	Kyanite	9	10	100
5	Limestone	408182	392760(e)	96
6	Magnesite	618	113	18
7	Manganese ore	8734	2347	27
8	Rock phosphate (including apatite)	11053	1395	13
9	Sillimanite	3	5	100
Metals				
10	Aluminium (primary)	2896	4016	100
11	Copper (cathode)	868(b)	484	56
12	Lead (primary)	186(c)	191	100
13	Zinc	640(d)	775	100

Source: Production: MCDR Returns for production data and trade data from DGCI&S.
** : Apparent Consumption:(production+ import-export)*
Note: As per Government of India Notification S.O. 423(E) dated 10th February, 2015, the following minerals have been declared as minor minerals: i) barytes ii) dolomite iii) felspar iv) fireclay v) quartz/silica sand vi) talc/steatite/soapstone & vii) pyrophyllite, these have not been in cluded in the table due to non-availability of production data for the year 2021-22.

Even in cases where almost entire domestic demand is satisfied by domestic supplies, some quantities of certain special quality/types of minerals and metals/ferroalloys are imported to meet the requirement in certain specific end-uses.

a/ Excludes production of limestone as a minor mineral, calcite & chalk and includes limeshell, limekankar& marl.

b/ Based on production of copper cathode and imports & exports of copper & alloys.

c/ Based on production of lead (primary), and imports & exports of lead & alloys.

d/ Based on production of zinc (ingots) and imports & exports of zinc & alloys.

2. Mineral Policy & Legislation

Reimbursement of Exploration Expenditure Rules, 2022	Odisha Artisan Grade Stone Policy, 2021	Setting up of Dedicated Mineral Rail Corridors	Policy for long-term ore linkage

POLICY

1. National Mineral Policy 2019

National Mineral Policy, 2019 has been approved by the Union Cabinet on 28th February, 2019.

Objective

The aim of National Mineral Policy 2019 is to have a more effective, meaningful and implementable policy that brings in further transparency, better regulation and enforcement, balanced social and economic growth as well as sustainable mining practices.

Details

The National Mineral Policy, 2019 includes provisions which will give boost to Mining Sector such as:

- introduction of Right of First Refusal for RP/PL holders;
- encouraging the Private Sector to take up exploration;
- auctioning in virgin areas for composite RP-cum- PL-cum-ML on revenue share basis;
- encouragement of merger and acquisition of mining entities;
- transfer of mining leases and creation of dedicated mineral corridors to boost Private Sector mining areas;
- proposes to grant status of industry to mining activity to boost financing of mining for Private Sector and for acquisitions of mineral assets in other countries by Private Sector;
- proposes to auction mineral blocks with pre embedded clearances to give fillip to auction process; and
- proposes to make efforts to harmonise taxes, levies & royalty with world benchmarks to help Private Sector

2. Notification DMG/34/AUCTION CELL/ DUMP POLICY/2023/2044

The "Policy for regulating iron ore dump handling in the State of Goa" is hereby published for the general information of the public. By order and in the name of the Governor of Goa. Dr. S. Shanbhogue, Director & ex officio Joint Secretary. Panaji, 13th September, 2023 Notification DMG/34/AUCTION CELL/DUMP POLICY/2023/2045 Policy for Regulating Iron Ore Dump Handling in the State of Goa Preamble.— The Hon'ble Supreme Court, in Writ Petition (Civil) No. 435 of 2012 filed by Goa Foundation versus the Union of India and others (hereinafter referred to as Goa Foundation I), amongst others, declared vide its Judgment and order dated 21-04-2014 as follows:

(i) the deemed mining leases of the lessees in Goa expired on 22-11-1987 and the maximum of 20 years renewal period of the deemed mining leases in Goa expired on 22-11-2007 and consequently mining by the lessees after 22-11-2007 was illegal and hence the impugned order dated 10-09-2012 of Government of Goa and the impugned order dated 14-09-2012 of the MoEF, Government of India are not liable to be quashed (ii) dumping of minerals outside the leased area of the mining Lessees is not permissible under the MMDR Act and the Rules made thereunder'. Prior to pronouncement of the said Judgment and Order dated 21-04-2014, the State of Goa had notified the Policy for regulating the mining dumps on Government and private lands, and related issues on 03-09-2013. It was a one-time policy formulated for dealing with the issue of mining dumps and other related issues. The said policy largely concerned itself with the violation of the provisions of the Goa Land Revenue Code by virtue of the occupation of Government land and private lands, by mining dumps stacked by the erstwhile leaseholders in the absence of obtaining permission and/or paying the requisite fees towards the conversion of the land use. The said Policy condoned the use of the land upon payment of conversion fees by the erstwhile lease holders. In addition to the above, the erstwhile lease holders were also permitted to thereafter remove the dumps from Government land. However, subsequent to the notification of the said Policy the Hon'ble Supreme Court in Goa Foundation I, declared dumping of minerals outside the lease area itself as illegal. Therefore, in light of the Judgment and order passed in Goa Foundation I, so far as the Policy for regulating the mining dumps on Government and private lands, and related issues collected the conversion charges, fines and rent from the erstwhile lease holders, the same cannot be faulted with, as upon payment of the said amounts the conversion without valid authorization of the land use whereupon the dumps stand, was condoned; however, as the activity of dumping outside the lease area is declared as without valid authorization by the Hon'ble Supreme Court, the erstwhile leaseholders do not have a right to handle the dump, except in accordance with the policy decision reflected herein. Therefore, the present policy is in continuation and modification of the earlier policy for regulating the mining dumps on Government and privatelands, and related issues. The Hon'ble Supreme Court by its Order dated 11-11-2013 passed in Goa Foundation I constituted an Expert Committee consisting of 6 members to conduct a Macro-EIA study and propose a ceiling of the annual excavation of Iron Ore from the State of Goa, and also sought opinion of the Expert Committee on how to deal with the mining dumps outside the leased area. Further, the Judgment and Order passed in Goa Foundation I, amongst others directed as follows: '88.11. The Expert Committee will submit its report within six months from today on how the mining dumps in the State of Goa should be dealt with and will submit its final report within twelve months from today on the cap to be put on the annual excavation of iron ore in Goa'. As directed vide the Judgment and order passed in Goa Foundation I, the Expert Committee submitted its reports. The issue regarding dumps was covered in the interim report dated 14-10-2014 and the final report dated 12-04-2015 of the Expert Committee. The Government of Goa, thereafter filed an Interlocutory Application bearing No. 6524/2020 before the Hon'ble Supreme Court therein praying for permission to carry out dump mining on the basis of the recommendations of the Expert Committee, which application was allowed vide Order dated 13-12-2022, thereby permitting the Government of Goa to carry out dump mining activities in accordance with the Expert Committee's Report and specifically paragraph No. 6 that is containing the recommendation of the Expert Committee. The Expert Committee in its report dated 12-04-2015 has recorded as follows: 'However, in the State of Goa, the segregation of various categories of mined materials is not very clear. In earlier days and as late as 2005, only saleable material was segregated and the rest was put in dumps. Slowly and steadily miners in Goa adopted segregation methods that conform to the above categorization of mined products in Goa. However, there are several mines which are continuing with the old practice. As a result, the dumps in Goa that are considered to be waste may contain Fe vales of unknown range and also other associated and industrial minerals.' 'Dumps or stacks of ore (raw or processed) that are marketable presently are not dealt within this report' 'There has been no observation and/or order in the judgement of this Court dated 21st April, 2014, on ownership and/or expropriation of dumps within or outside the mining lease. Therefore, the levy of fees and the handling of the dumps is a State matter and needs to be governed by the State, in accordance with the Goa (Prevention of Illegal Mining, Storage, Transportation of Minerals) Rules, 2013 and GMP 2013, other relevant Acts and Rules.' 'Upon considering the amendment brought about to the Land Revenue Code, the Committee suggested that the appropriation/ ownership of the dumps outside the lease area is in the domain of the Government of Goa. However, by bringing an amendment in the LRC, and its being as per a Mining Plan (approved by IBM), handling of the dumps located outside the lease area becomes the prerogative of the lessees. In view of this, the Committee suggested that the Government of Goa may formulate a sound dump handling policy, in line with the above judgments/acts/ rules, and after taking into consideration the aspects of environment, ecology, economy of the area and conservation of minerals.' Further, the Expert Committee has classified valuable mineral fraction as: a) Ores (Marketable), b) Sub-grade Ore (above threshold value) and c) Low-grade Ore (below threshold value). In light of the decision of the Hon'ble Supreme Court dated 13- 12-2022 passed in I. A. No. 6524/2020, the report of the Expert Committee, the Judgment and order dated 21-04- 2014 passed in Goa Foundation I, and the Goa Mineral Policy 2013 the Government of Goa is hereby pleased to frame the present policy for regulating dump handling in the State of Goa. The dumps which were created by the mining companies in the land/areas which are not shown in the mining plan were not even permitted by the State Government or any other Authority. Therefore, the Government of Goa has deemed it fit to treat dumps situated outside the lease area but depicted on the mining plan and the dumps situated outside the lease area but not depicted on the mining plan differently. The mining plans which depicted the dumps outside the lease area were duly approved by the Indian Bureau of Mines at the relevant point of time. The Mining plan as per the MC Rules was required to include the handling of waste, mineral rejects, a tentative estimate about accretion of mine waste and its manner and mode of disposal and confinement.

1. Scope of the Policy.—

1.1. As per the declarations provided by the Concessionaires/erstwhile Lessees, the total stock of dumps in Goa exceeds 700 Million Metric Tons as on date. However, some of these dumps were already worked since then.

1.2. Dump constitutes the excavated material accumulated in the form of heap or pile on the surface of the land or stocked on the demineralized area temporarily or permanently during mining, and the material stocked or piled can be re-handled as and when required not only for recovery of Fe mineral and associated minerals but also to fulfil the norms of mine closure plan as specified by the regulatory bodies. Therefore, dumps include not only the piles of stocks of exploitable Fe mineral, but it also includes wastes and tailings.

1.3. A Dump site would mean and include earmarked areas either within the mining lease or outside the lease area utilized for storing ore, overburden lumps or fines, rejects, sub-grade material, tailings or earth/soil generated during mining operation or extraction of ROM.

1.4. The present policy shall cover all dumps including tailing dumps, existing as on date, inventoried and not inventorized created from mining activities and which fall within and outside the lease areas, irrespective of whether they form a part of the inventory of dumps maintained by the Department of Mines and Geology or not. However, the present Policy shall not apply to those dumps which are located within the lease areas of leases which have been successfully auctioned under sub-section (4) of section 8A of the MMDR Act. This is necessitated as it is not practical to have two operators separately for dump mining and actual mining within the lease area. Therefore, it is proposed that the successful bidder in the auction process is allowed to handle dumps along with other mining activity, subject to having obtained all the necessary approvals and upon the execution of the lease deed between the Directorate of Mines and Geology and the proposed lessee.

2. Dumps situated outside the lease area on private property.—

2.1. All dumps which have not been approved or shown in the mining plan sanctioned by the IBM shall be deemed to be completely illegal and neither the lease holder nor any other person shall have any right to the same. Such dumps shall be compulsorily auctioned by the Government.

2.2. With respect to the inventoried dumps situated on private properties falling outside the lease area, but depicted on the mining plan, only if the Conversion fees in terms of the Policy for regulating the mining dumps on Government and private lands, and related issues and the fine contemplated under sub- section 1A of section 33 of the Goa Land Revenue Code, have been paid; the erstwhile lease holder shall be permitted to remove the dump within a period of five years from the date of publication of the present policy or such further period as may be notified, subject to payment of royalty and complianceof all statutory requirements.

2.3. The erstwhile lease holders who fall under category 2.2. above shall not handle such dumps without the prior permission from the Director of Mines and Geology. The erstwhile lease holder shall prepare a proper plan of handling such dump including the manner in which the same shall be processed and transported. The Directorate of Mines and Geology shall verify upon inspection and the following details shall be identified; details of Mining Lease associated with the site or the person, company, body incorporated, agency, association of person associated with the site, details about ownership of the site, the right under which the said site was used for dumping, permission for temporary use on rent, details of date since the site is or was being used for the purpose of dumping or stocking, the person, company, agency or any other body that is responsible for the site and authorization for the same.

2.4. Samples shall also be collected from three random points of the dump in order to ascertain the Fe content of the material forming the dump.

2.5. With respect to the all dumps (inventoried or not) situated on private property outside the lease area and whether depicted on the mining plan or not, and wherein the conversion fees with respect to the said land in terms of the Policy for regulating the mining dumps on Government and private lands, and related issues and the fine contemplated under sub-section 1A of section 33 of the Goa Land Revenue Code have not been paid by the erstwhile lease holder, all such dumps shall be auctioned by the Government of Goa.

2.6. With respect to the dumps situated outside the lease area but not depicted on the mining plan, the dump shall be auctioned by the Government of Goa.

3. Dumps situated outside the lease area on Government property.—

The dumps situated outside the lease area, on Government property shall be auctioned irrespective of whether the same is depicted on the mining plan and payment of Conversion fees in terms of the Policy for regulating the mining dumps on Government and private lands, and related issues and the fine contemplated under sub- section 1A of section 33 of the Goa Land Revenue Code has been paid by the erstwhile lease holder.

4. Dumps within the lease area wherein the lease area has not been auctioned nor proposed for auction under section 8A of the MMDR Act.—

With respect to the leases which have not been put up for auction and are neither proposed for auction in terms of section 8A of the MMDR Act, the Government has already issued Rule 12(1) (hh) notices to such lease holders and as such the lease holders do not have any rights whatsoever to such dumps. These dumps shall be auctioned by the Government of Goa.

5. Manner in which the dumps will be auctioned.—

5.1. The State of Goa shall auction the dumps in accordance with the e-auction policy devised by the State of Goa for such dumps.

5.2. Priority handling of dumps will be accorded to dumps which are unstable, adjoining water bodies or otherwise sensitive in nature.

5.3. Prior to processing any dump for auction, the Directorate of Mines and Geology will conduct a dump profile study of each dump.

5.4 . With respect to the dumps that have not been declared and as such do not form a part of the inventory of dumps maintained by the Government of Goa, the Director of the Directorate of Mines and Geology or his representative, shall upon receiving information of the existence of such a dump, carry out an inspection and add the said dump to the inventory of dumps. The said dump shall thereafter be auctioned in terms of the procedures contemplated in the present policy, irrespective of whether the dump is situated within a lease area or outside the lease area, and/or situated on private land or situated on Government land.

5.5. In the first phase, the un-stabilized dumps lying outside the lease area will be taken up for auction no sooner, the dump profile study is completed qua the said dump.

5.6. The operator for dump mining outside the lease area will be selected through a competitive bidding process. The successful bidder in the auction process shall need to take all necessary approvals as may be required including environmental clearance from the competent authority, if applicable, consent to operate and various other approvals as may be required from the different authorities.

5.7. Since some of the dumps are within forest areas including Sanctuary causing problem for wildlife. The State Government will seek special approval (if required) from the MOEF for the removal of these dumps and/or for the purpose of filling of large pits of closed mines in the interests of afforestation, and wildlife preservation and only upon receiving a report from Forest Department that the removal of such dump is in the interest of the flora, fauna, forest cover and in the interest of wildlife, shall the State Government allow the removal of such dumps.

5.8. Apart from payment of royalty, the successful bidder shall also pay DMF, GIOPF and NMET, whichever are applicable under the MMDR Act, 1957 and the rules made thereunder, and any other charges as may be prescribed from time to time by the State Government.

5.9. The Government, in the e-auction policy devised will prescribe the time frame for obtaining the statutory approvals/ clearances/permissions, timelines for carrying out dump mining and clearing the dumps, schedule of payments to be made to the Government and all other conditions as may be required for conduct of dump mining by the successful bidder.

5.10. The entire proceeds of the dump mining activity by the successful bidder will go to the Government treasury and no firm or person is eligible for any claim of whatsoever nature towards any monetary benefit from such proceeds.

5.11.The Government shall not be responsible for any dispute between the erstwhile mining leaseholder, the successful bidder, the land owner and/or any other party, and the successful bidder shall indemnify the Government to that extent.

5.12.Until the study by NEERI into what the optimum quantum of fresh mining in Goa State should be, an ad hoc limit of 25 million tons for dump transportation on public roads is hereby imposed.

6. Compensation to be paid to for breach of surface rights.—

6.1. Where the dump is situated on the property belonging to a private entity and the continuous presence and working of the dump on the said property leads to infringement of the rights of the private entity, the said private entity shall be entitled to compensation in terms of sub-section (4) of section 36 of the Goa Land Revenue Code.

6.2. Rent/Occupation fees will be payable to the Government of Goa with respect to dumps situated on Government land at the rate as prescribed in the e- auction policy to be devised by the State of Goa.

7.Proceedings and recoveries.

7.1. The auction of the dump, will not come in the way of the Government of Goa taking action under the provisions of the Goa Land Revenue Code and the Policy for regulating the mining dumps on Government and private lands, and related issues against the party that had created the dump, on Government land outside the lease area, or against the owner of the land wherein the said land upon which the dump stands belongs to a private entity. Save and except those cases wherein proceedings under section 33(1A) of the Goa Land Revenue Code have been initiated and the relevant conversion fees and fines have already been paid.

7.2. In the event the dump in question is the subject matter of an SIT inquiry, the same can be auctioned upon intimation to the SIT, as the continued presence of the dump in no manner facilitates or assists the investigation.

8. Precautions to be carried out whilst carrying out dump mining.—

8.1. Whilst carrying out dump mining all the necessary care and precaution ought to be taken in order to prevent any threat to life, any health hazard, loss of lives from dump sliding etc.

8.2. All reasonable measures need to be put into place to prevent run-off from the dump, siltation and pollution of fields and rivers, estuaries and marshes, and overall degradation of the surrounding environment.

9. Cancellation and modification of earlier policies.—

9.1. The Goa Mineral Policy 2013, to the extent it deals with dump and dump handling stand cancelled for all purposes and shall no more be enforceable.

9.2. The policy for regulating the mining dumps on Government and private lands, and related issues shall stand modified to the extent it is inconsistent with this policy and any such inconsistent clauses in the policy shall be deemed to have been cancelled for all purposes.

10. Powers of the State Government.— Notwithstanding anything contained in the foregoing paragraphs of the present Policy, the State Government, by issuance of notification in the Official Gazette, may amend or withdraw any of the provisions mentioned here in above. By order and in the name of the Governor of Goa. Dr. S. Shanbhogue, Director & ex officio Joint Secretary.Panaji, 13th September, 2023.

LEGISLATION

Notifications

Important Notifications notified/issued during the period under review are furnished below:

Ministry of Mines

A. Notification No. S.O. 207(E) dated the 12th January, 2023, reads—In exercise of the powers conferred by the second proviso to sub-section (1) of section 4 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government hereby rescinds the notification of the Government of India in the Ministry of Mines number S.O. 2307(E), dated the 18th May, 2022, published in Gazette of India, Part II, section 3, sub-section (ii), dated the 18th May, 2022, except as respects things done or omitted to be done before such rescission, with effect from the date of publication of this notification.

B. Notification No. S.O. 575 (E) dated the 3rd February, 2023, reads— In exercise of the powers conferred by the second proviso to sub-section (1) of section 4 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government hereby notifies the Jharkhand Exploration and Mining Corporation Limited, Ranchi for the purposes of the said proviso subject to the condition that the Jharkhand Exploration and Mining Corporation Limited, Ranchi shall make available the data generated in respect of the prospecting operations undertaken by it to the concerned State Government.

2. This notification shall come into force on the date of its publication in the Official Gazette.

C. Notification No. S.O. 719(E) dated the 14th February, 2023, reads, —In exercise of the powers conferred under rule 58 of the Mineral Conservation and Development Rules, 2017 and with the previous approval of the Central Government in the Ministry of Mines, the Controller General, Indian Bureau of Mines hereby directs all the holders of mining lease and the preferred bidders who are issued with a letter of intent for grant of a mining lease to submit a copy of the digital aerial images which they submit to Indian Bureau of Mines under rule 34A of the said rules to the State Government also within the time specified in rule 34A of the said rules.

2. This order shall come into force on the date of its publication in the Official Gazette.

D. Notification No.S.O. 789(E) dated the 21st February, 2023, reads — In exercise of the powers conferred by Section 3 of the Public Premises (Eviction of Unauthorized Occupants) Act 1971, the Central Government do hereby appoints, the officer mentioned in column (1) of the table below being officer equivalent to the rank of Gazetted Officer of Government to be Estate Officer for the purpose of said Act, and further directs that the said officer shall exercise the powers and duties imposed by or under the said Act, within the local limits of his jurisdictions in respect of the Public Premises specified in column (2) of the said table.

Name and Designation of the officer	Categories of Public Premises and local limits of jurisdiction
1	2
Shri. Shashi Ranjan Director, Additional charge of Chief Security Officercum- Estate Officer, Bharat Gold Mines Limited Oorgaum Post, Kolar Gold Fields District : Kolar (Karnataka)	Property held by Bharat Gold Mines Limited at Kolar Gold Fields, Post : Oorgaum, District : Kolar, (Karnataka) (As contained in Annex – I) Property held by Bharat Gold Mines Limited at Ramagiri Mines, Post : Dharamavaram, District : Anantapur, (Andhra Pradesh) (As contained in Annex – II)

BHARAT GOLD MINES LIMITED (A Government of India Enterprise) Details of property held by BGML at K.G.F. Kolar District, Oorgaum Post, Karnataka State – 563120

Sl. No.	Land / Locations	Nos. of House	Total area purchased	Date of Purchase	Purchase value in Rs.	Village	Taluk	District
1	ND Mine Workmen							
	Houses :							
	a) Single Hutments	3164	480	28.03.1977	1391880	Kediregowdana Kote	Bangarpet	Kolar
	b) Double Hutments	132	71	28.03.1977	205883	GollaHalli,	Bangarpet	Kolar
	c) Measonary model	552	174	28.03.1977	504558	Doddarahalli	Bangarpet	Kolar
	houses					Doddurkarapanahalli		
	d) Quarters	253	152	28.03.1977	440764	Pitchahalli	Bangarpet	Kolar
	e) Bunglows	62	68	28.03.1977	197184	ReddiedHalli	Bangarpet	Kolar
	f) Industrial Area	—	4120.12	28.03.1977	11947359	Dasarahosaalli	Bangarpet	Kolar
	Total	4163	5065.12		14687628			
2	Champion Reef							
	MineWorkmen Houses :							
	a) Single Hutments	3433	488	28.03.1977	1415083	SwarnaKuppa	Bangarpet	Kolar
	b) Double Hutments	156	59	28.03.1977	171086	Nachihalli, Peddapalli	Bangarpet	Kolar
	c) Measonary model	147	41	28.03.1977	118890	Oorgaum Village	Bangarpet	Kolar
	d) Quarters	335	422	28.03.1977	1223699	Ganganathodi	Bangarpet	Kolar
	e) Bunglows	117	310	28.03.1977	898926	Bodigurki	Bangarpet	Kolar
	f) Industrial Area	—	1957.09	28.03.1977	5675091	Kathihalli	Bangarpet	Kolar
	Total	4188	3277.09		9502775			
3	Mysore Mine Workmen							
	Houses :							
	a) Single Hutments	1676	459	28.03.1977	1330990	Dasarahosaalli	Bangarpet	Kolar
	b) Double Hutments	347	141	28.03.1977	408866	Byatrayanahalli	Bangarpet	Kolar
	c) Measonary model	266	155	28.03.1977	449463	Doddakallshalli	Bangarpet	Kolar
	houses					Oorgaum Village		
	d) Quarters	210	174	28.03.1977	504558	Ukkarahalli, Kathihalli	Bangarpet	Kolar
	e) Bunglows	61	370	28.03.1977	1072911	Chinnakote,	Bangarpet	Kolar
	f) Industrial Area	—	2468.07	28.03.1977	7156811	Bovinahalli	Bangarpet	Kolar
	Total	2560	3767.07		10923599			
	TOTAL SUMMARY :							
1	a) ND Mine Workmen	4163	5065.12		14687628			
	Houses							
2	b) Champion Reef Mine	4188	3277.09		9502775	Bangaradagani	Bangarpet	Kolar
3	c) Mysore Mine	2560	3767.07		10923599			
	Workmen Houses							
	Total	10911	12109.28		35114002			

Note: For all the villages common village name referred as Bangaradagani village for BGML land.

E. Notification No. S.O. 934(E), dated, 28th February, 2023, —In exercise of the powers conferred under the second proviso to sub-section (1) of section 4 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957) and consequent

upon accreditation provided by the National Accreditation Board for Education and Training of the Quality Council of India, the Central Government hereby notifies the following agencies as specified in the guidelines for notification of accredited private exploration agencies issued by the Government of India in the Ministry of Mines vide order no. M.VI- 16/15/2021- Mines VI, dated the 12th August, 2021 (hereafter referred to as the said guidelines for notification of accredited private exploration agencies) for the purposes of the said second proviso to sub-section (1) of section 4 of the said Act:Table– 3 : Exploration agencies for the purposes of the said second proviso to sub-section (1) of section 4 of the said Act:

2.The agencies shall carry out prospecting operations in compliance with the conditions specified in the said guidelines for notifications of accredited private exploration agencies.

3.This notification shall come into force on the date of its publication in the Official Gazette and shall remain valid for a period of three years from the date of notification or till expiry or termination of the accreditation granted, whichever is earlier

Serial Number	Exploration Agency	Categoryof Exploration Agency
1	M/s Novomine India Private Limited	A
2	M/s Infrastructure Logistics Private Limited	B

F. Notification No. S.O. 2185(E). dated the 12th May, 2023—Whereas, Ministry of Environment, Forest and Climate Change issued a notification S.O.5481(E) dated 31 December, 2021 mandating filling of fly ash in the mine voids and mixing of the same to the extent of 25% with the external dumps in all working leases located within 300 kms of radius from any Thermal Power Plant. Whereas, a safety and feasibility study is required to be undertaken for all such operational mines with the due permissions from DGMS and other regulatory authorities. Therefore, in pursuance to the Rule-58 of Mineral Conservation and Development Rules, 2017, it is hereby directed to undertake this study within a period of 60 days. It is further directed to submit a copy of the study report forthwith to the respective Regional Controller of Mines under whose jurisdiction the lease is located. This order shall come into force on the date of its publication in the official gazette.

G. Notification No.G.S.R. 563(E), dated, , the 28th July ,2023.—In exercise of the powers conferred by the proviso to article 309 of the Constitution and in supersession of the Indian Bureau of Mines, Director (Ore Dressing), Chief Ore Dressing Officer, Superintending Officer (Ore Dressing), Ore Dressing Officer, Deputy Ore Dressing Officer, Assistant Ore Dressing Officer and Assistant Research Officer (Ore Dressing) Recruitment Rules, 2003 in so far as it relates to the post of Assistant Research Officer (Ore Dressing), except as respect things done or omitted to be done before such supersession, the President hereby makes the following rules regulating the method of recruitment to the post of Assistant Research Officer in the Indian Bureau of Mines, Ministry of Mines, namely:—

1. Short title and commencement. —

(1) These rules may be called the Ministry of Mines, Indian Bureau of Mines, Assistant Research Officer, Group 'B' Post, Recruitment Rules, 2023

(2) They shall come into force on the date of their publication in the Official Gazette.

2. Number of posts, classification and Level in the pay matrix.— The number of the post, its classification and the level in the Pay Matrix attached thereto shall be as specified in columns (2) to (4) of the Schedule annexed to these rules.

3. Method of recruitment, age-limit, qualifications, etc.- The method of recruitment, age-limit, qualifications and other matters relating to the said post shall be as specified in columns (5) to (13) of the said Schedule.

4. Disqualification. — No person,- (a) who has entered into or contracted a marriage with a person having a spouse living; or (b) who having a spouse living, has entered into or contracted a marriage with any person, shall be eligible for appointment to the said post: Provided that the Central Government may, if satisfied that such marriage is permissible under the personal law applicable to such person and the other party to the marriage and that there are other grounds for so doing, exempt any person from the operation of this rule.

5. Power to relax.—Where the Central Government is of the opinion that it is necessary or expedient so to do, it may, by order and for reasons to be recorded in writing, and in consultation with the Union Public Service Commission relax any of the provisions of these rules with respect to any class or category of persons.

6. Saving. — Nothing in these rules shall affect reservation, relaxation of age-limit, and other concessions required to be provided for the Scheduled Castes, the Scheduled Tribes, Other Backward Classes, ex-Servicemen and other special categories of persons in accordance with the orders issued by the Central Government from time to time in this regard.

SCHEDULE

Name of post.	Number of post	Classification.	Level in pay matrix.	Whether selection post	Age- limit for direct recruits. or nonselection post.
1	2	3	4	5	6
Assistant Research Officer.	4* (2023) *Subject to variation dependent on workload.	General Central Service, Group, 'B', Ministerial.	Level-7 in the pay matrix (Rs. 44900-142400).	Selection post.	Not exceeding thirty years. (Relaxable -for the Government servants upto five years in accordance with the instructions or orders issued by the Central Government). **Note:** The crucial date for determining the age-limit shall be as advertised by the Union Public Service Commission

Educational and other qualifications required for direct recruits.	Whether age and educational qualifications prescribed for direct recruits will apply in the case of the promotees.	Period of probation, if any.	Method of recruitment, whether by direct recruitment or by promotion or by deputation/ absorption and percentage of the vacancies to be filled by various methods
7	8	9	10
Essential: (i) Masters Degree in Ore Dressing or Mineral Processing or Geology or Physics or Chemistry from a recognized university or institution Or Bachelor of Engineering or Bachelor of Technology degree in Mineral Engineering or Chemical Engineering or Metallurgy from a recognized university or institutions. (ii) Two years experience in conducting mineral beneficiation or mineral characterization for beneficiation of various ores and minerals from a recognized laboratory or beneficiation plant. **Desirable:** Master of Technology in Mineral Engineering from a recognised University or institution. **Note 1:** Qualifications are relaxable at the discretion of the Union Public Service Commission, for reasons to be recorded in writing, in the case of candidates otherwise well qualified. **Note 2:** The qualification(s) regarding experience is/are relaxable at the discretion of the Union Public Service Commission, for reasons to be recorded in writing in the case of candidates belonging to the Scheduled Castes or the Scheduled Tribes if at any stage of selection the Union Public Service Commission, is of the opinion that sufficient number of candidates from these communities possessing the requisite experience are not likely to be available to fill up the vacancies reserved for them.	Age: No Educational qualification: Yes	Two years for direct recruits. **Note:** Direct recruits are required to successfully complete a mandatory least two weeks duration, as prescribed by the competent authority, for completion of probation. of probation Note: Direct recruits are required to successfully complete a mandatory least two weeks duration, as prescribed by the competent authority, for completion of probation. of probation	(i) Eighty per cent. by direct recruitment; (ii) Twenty per cent. by promotion failing which deputation.

In case of recruitment by promotion or by deputation/ absorption, grades from which promotion or deputation/ absorption to be made.	If a Departmental Promotion Committee exists what is its composition	Circumstances in which Union Public Service Commission is to be consulted in making recruitment.

11	12	13
Promotion: Junior Technical Assistant (Ore Dressing) in level-6 (Rs. 35400- 112400) with five years service in the grade rendered after appointment thereto on a regular basis and successfully completed four weeks inservice training in the field of Mineral Processing conducted by the Indian Bureau of Mines or any recognised Institute. **Note :** Where juniors who have completed their qualifying or eligibility service are being considered for promotion, their seniors would also be considered provided they are not short of the requisite qualifying or eligibility service by more than half of such qualifying or eligibility service or two years, whichever is less and have successfully completed their probation period for promotion to the next higher grade along with their juniors who have already completed such qualifying or eligibility service. **Deputation:** Officers under the Central Government or State Governments or Union territories: (a) (i) holding analogous posts on regular basis in the parent cadre or Department; or (ii) with five years service in the grade rendered after appointment thereto on a regular basis in level-6 in the pay matrix (Rs. 35400- 112400) or equivalent in the parent cadre ordepartment; and (b) possessing the educational qualification and experience prescribed for direct recruits under column (7). Note 1: The Departmental officers in the feeder gradewho are in direct line of promotionshall not be eligible for consideration for appointment on deputation. Similarly, deputationists shall not be eligible for consideration for appointment by promotion. Note 2: Period of deputation in another Ex-cadre post held immediately preceding this appointment in the same or some other organisation or Department of Central Government shall ordinarily not exceed three years. Note 3: The maximum age-limit fo appointment by deputation shall be not exceeding fifty-six years as on the closing date of receipt of applications.	**Group 'B' Departmental Promotion Committee (for considering promotion) consisting of:-** 1. Superintending Officer (Ore Dressing), Indian Bureau of Mines - Chairman; 2. Ore Dressing Officer, Indian Bureau of Mines - Member; 3. Senior Administrative Officer,	Consultation with Union Public Service Commission is necessary while making direct recruitment.

H. Notification No S.O. 3684(E). the 17 th August, 2023 —In exercise of the powers conferred by sub-section (2) of section 1 of the Mines and Minerals (Development and Regulation) Amendment Act, 2023 (16 of 2023), the Central Government hereby appoints the 17th day of August, 2023 as the date on which the said Act shall come into force.

I. Notification No.S.O. 3685(E) dated the 17th August, 2023.—In exercise of the powers conferred by sub- section (2) of section 1 of the Offshore Areas Mineral (Development and Regulation) Amendment Act, 2023 (17 of 2023), the Central Government hereby appoints the 17th day of August, 2023 as the date on which the said Act shall come into force.

J. Notification S.O F. No. M. I-4/1/2021-Mines I., datet the 18th August, 2023 — In continuation of this Ministry's Resolution No. 4 (2) 97-M.I dated. 12.03.2009 (hereinafter referred to as the principal resolution) and its subsequent resolutions amending the principal resolution vide resolution No 4(2)/97-M-I dated 08.06.2009, No.4(6)/2013-M.I dated 07.05.2013, No.M.I-4/I/2017- Mines-I dated 10.12.2018 and No. M.I-4/1/2019-Mines I dated 17.05.2019 regarding reconstitution of the Central Geological Programming Board (CGPB) and its twelve committees, the following has been decided by the Central Government in the Ministry of Mines, namely:—

(i) In the principal resolution, for Para 7, the following shall be substituted, namely: —

"7. It is, therefore, ordered that with immediate effect, the Central Geological Programming Board shall be constituted as follows: —

(a) Secretary, Ministry of Mines - Chairman

(b) Additional Secretary, Ministry of Mines - Member

(c) Director General, Geological Survey of India - Member

(d) Joint Secretary (Policy) - Member

(e) Representatives (not below rank of Joint Secretary) from - Members (12)

(i) Ministry of Environment, Forest and Climate Change

(ii) Ministry of New and Renewable Energy

(iii) Ministry of Earth Sciences

(iv) Ministry of Civil Aviation

(v) Ministry of Water Resources, River Development and Ganga Rejuvenation

(vi) Ministry of Coal

(vii) Ministry of Steel

(viii) Ministry of Defence

(ix) Department of Science & Technology

(x) Ministry of Petroleum and Natural Gas

(xi) Department of Space

(xii) Department of Atomic Energy

(f) Advisor (Minerals), NITI Aayog - Member

(g) Heads of Central Organizations from: - Members (30)

(i) Central Ground Water Board (CGWB)

(ii) Central Water Commission (CWC)

(iii) Indian Bureau of Mines (IBM)

(iv) Mineral Exploration & Consultancy Limited (MECL)

(v) Coal India Limited (CIL) and its associates

(vi) CSIR-Central Institute of Mining and Fuel Research

(vii) Central Mine Planning & Design Institute Limited (CMPDI)

(viii) The Singareni Collieries Company Limited (SCCL)

(ix) NLC India Limited

(x) IIT (ISM) Dhanbad

(xi) National Geophysical Research Institute (NGRI)

(xii) Wadia Institute of Himalayan Geology (WIHG)

(xiii) Directorate General of Hydrocarbons (DGH)

(xiv) Oil and Natural Gas Corporation (ONGC)

(xv) The Keshava Deva Malaviya Institute of Petroleum Exploration (KDMIPE)

(xvi) Atomic Minerals Directorate for Exploration and Research (AMDER)

(xvii) Survey of India (SOI)

(xviii) Geological Society of India

(xix) The Mining, Geological and Metallurgical Institute of India (MGMI India)

(xx) Central Pollution Control Board (CPCB)

(xxi) CSIR-National Environmental Engineering Research Institute (NEERI)

(xxii) National Remote Sensing Centre (NRSC)

(xxiii) National Centre for Polar and Ocean Research (NCPOR)

(xxiv) CSIR-National Institute of Oceanography (CSIR-NIO)

(xxv) Jawaharlal Nehru Aluminium Research Development and Design Centre

(JNARDDC), Nagpur, Maharashtra

(xxvi) National Mineral Exploration Trust (NMET)

(xxvii) National Disaster Management Authority (NDMA)

(xxviii) NMDC Limited

(xxix) MOIL Limited

(xxx) KIOCL Limited

(h) Secretaries to the State Governments, Mining and Geology/Industry/Department-

(Directors, Mining & Geology would be Permanent Invitees)

\- Members

(i) Representatives of Industry, from organizations, namely: - Members (06)

(i) Federation of Indian Mineral Industries (FIMI)

(ii) Confederation of Indian Industry (CII)

(iii) Tata Steel

(iv) Rungta Mines

(v) Geomysore Services India Pvt. Ltd.

(vi) Hindustan Zinc Limited (HZL)

(j) Addl. Director General/Dy. Director General, Geological Survey of India (GSI)in charge of Regions, Map & Publication, Information Technology & Training Institute -Members

(k) Addl. Director General/Dy. Director General, Policy Support System-Planning & Monitoring, Geological Survey of India (GSI) -Member Secretary

The Chairman may nominate a special representative of any other organization related to geoscience as a Special Invitee to a meeting of the Board or as a Permanent Invitee to all meetings of the Board."

(ii) In the principal resolution, for the Annexure A, the following Annexure shall be substituted, namely: —

"Annexure A

COMPOSITION AND TERMS OF REFERENCE OF THE COMMITTEES

Committee I. Ferrous Minerals (Iron, Manganese, Chromite, etc)

Convenor: Addl. Director General/ Dy. Director General, Geological Survey of India (GSI), Eastern Region (ER),

Kolkata

Member Secretary: Director, Policy Support System, Geological Survey of India (GSI), Eastern Region (ER), Kolkata

Members:

1. Ministry of Steel (Director-Tech Level)
2. Ministry of Mines, Director (Policy)
3. Ministry of Environment, Forest and Climate Change (Director Level)

4. DMG, Govt. of Karnataka
5. DMG, Govt. of Andhra Pradesh
6. DMG, Govt. of Goa
7. DGM, Govt. of Rajasthan
8. DGM, Govt. of Maharashtra
9. MRD, Govt. of Madhya Pradesh
10. DGM, Govt. of Chhattisgarh
11. DMG, Govt. of Jharkhand
12. DG, Govt. of Orissa
13. Indian Bureau of Mines (IBM)
14. Mineral Exploration & Consultancy Limited (MECL)
15. Tata Iron and Steel Company (TISCO)
16. Federation of Indian Mineral Industries (FIMI)
17. National Mineral Exploration Trust (NMET)
18. National Mission Head-II, GSI
19. Regional Mission Head-II, GSI (Eastern Region & Southern Region)
20. Dy. DG of State Units; Directors of GSI associated with the items of Ferrous Group investigations;

    Director, PSS-P&M-2, GSI, CHQ, Kolkata; and Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. NMDC Limited
ii. Orissa Mining Corporation Ltd. (OMC)
iii. Jindal Steel and Power Ltd. (JSPL)
iv. Manganese Ore (India) Ltd. (MOIL)
v. Steel Authority of India Limited (SAIL)
vi. United Exploration India Pvt. Ltd.
vii. Ecomen Laboratories Pvt. Ltd.
viii. JSW Steel

Committee II. Precious Metals & Minerals (Gold, Platinum Group of Elements, Diamond & Precious Stones)

Convener: Addl. Director General/ Dy. Director General, Geological Survey of India (GSI), Southern Region (SR), Hyderabad

Member Secretary: Director, Policy Support System, Geological Survey of India (GSI), Southern Region(SR), Hyderabad

Members:

1. Director (Mines IV), Ministry of Mines
2. Representative of the Ministry of Environment, Forest and Climate Change (MoEFCC)
3. DMG, Govt. of Karnataka
4. DMG, Govt. of Andhra Pradesh
5. DGM, Govt. of Tamil Nadu
6. DGM, Govt. of Maharashtra
7. MRD, Govt. of Madhya Pradesh
8. DMG, Govt. of Jharkhand
9. DG, Govt. of Odisha
10. DGM, Govt. of Chhattisgarh
11. DGM, Govt. of Uttar Pradesh
12. DMG, Govt. of Rajasthan
13. Federation of Indian Mineral Industries (FIMI)
14. Mineral Exploration & Consultancy Limited (MECL)
15. Indian Bureau of Mines (IBM)
16. National Geophysical Research Institute (NGRI)
17. Geo Mysore Services (India) Ltd.
18. National Mineral Exploration Trust (NMET)
19. National Mission Head-II, GSI
20. Regional Mission Head-II, GSI (Eastern Region & Central Region)
21. Dy.DG of State Units; Directors of GSI associated with the items of Precious Metals & Minerals Group investigations; Director, PSS-P&M-2, GSI, CHQ, Kolkata; and Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. Hutti Gold Mines Company Ltd. (HGML)
ii. Rungta Mines Pvt. Ltd.
iii. Deccan Gold Mining Ltd.
iv. Ramgad Mining and Minerals Pvt. Ltd.
v. NMDC Limited
vi. Aditya Birla Group (Essel Mining)
vii. IIT (ISM) Dhanbad
viii. CSIR-Institute of Minerals and Materials Technology (IMMT), Bhubaneswar, Odisha.
ix. Maheshwari Mining Pvt. Ltd (MMPL)
x. Geovale Services Pvt. Ltd.
xi. Gemcokati Exploration Private Limited.

Committee III. Non-Ferrous and Strategic Minerals (Basemetal, Tin, Tungsten, Bauxite)

Convener: Addl. Director General/ Dy. Director General, Geological Survey of India (GSI), Western Region (WR), Jaipur

Member Secretary: Director, Policy Support System, Geological Survey of India (GSI), Western Region (WR), Jaipur

Members:

1. Ministry of Mines, Director (Metal-I)
2. DMG, Govt. of Andhra Pradesh
3. DMG, Govt. of Rajasthan
4. DGM, Govt. of Maharashtra
5. DGM, Govt. of Tamil Nadu
6. DMG, Govt. of Karnataka
7. DG, Govt. of Orissa

8. DGM, Govt. of Jharkhand
9. Atomic Minerals Directorate for Exploration and Research (AMDER)
10. Indian Bureau of Mines (IBM)
11. Mineral Exploration & Consultancy Limited (MECL)
12. Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur, Maharashtra
13. The Energy and Resources Institute (TERI)
14. National Mineral Exploration Trust (NMET)
15. National Mission Head-II, GSI
16. Regional Mission Head-II, GSI (Western Region & Central Region)
17. Dy. DG of State Units; Directors of GSI associated with the items of Strategic and Non-ferrous investigations; Director, PSS- P&M- 2 , GSI , CHQ, Ko lkata; and Dire c t or, CG PB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. Defence Research and Development Organisation (DRDO, Hyderabad)
ii. Hindustan Copper Limited (HCL)
iii. National Aluminium Company Limited (NALCO)
iv. Defence Metallurgical Research Laboratory (DMRL, New Delhi)
v. HINDALCO
vi. IMMT, Bhubaneshwar
vii. IREL (India) Limited, Kerala
viii. Kerala Rare Earths and Minerals Ltd.
ix. Bhabha Atomic Research Centre (BARC)
x. Geo Mysore Services India Pvt. Ltd.
xi. Geovale Services
xii. Council on Energy, Environment and Water (CEEW)
xiii. Centre for Social and Economic Progress (CSEP)
xiv. Hindustan Zinc Limited (HZL)

Committee IV: Industrial and Fertilizer Minerals

Convener: Addl. Director General/ Dy. Director General, Geological Survey of India (GSI), Central Region (CR), Nagpur

Member Secretary: Director, Policy Support System, Geological Survey of India (GSI), Central Region (CR), Nagpur

Members:

1. Director (Tech.), Ministry of Mines
2. Director, Ministry of Fertilizer
3. Director, Department of Industry
4. DGM, Govt. of Rajasthan
5. DGM, Govt. of Uttar Pradesh
6. CGM, Govt. of Gujarat
7. MRD, Govt. of Madhya Pradesh
8. DMG, Govt. of Meghalaya
9. DGM, Govt. of Maharashtra
10. DGM, Govt. of Jammu & Kashmir
11. DMG, Govt. of Andhra Pradesh
12. DMG, Govt. of Karnataka
13. DG, Govt. of Odisha
14. Geological Wing, Dept. of Industries, Govt. of Himachal Pradesh
15. DGM, Govt. of Chhattisgarh
16. DGM, Govt. of Assam
17. DMG, Govt. of Telangana
18. DGM, Uttar Pradesh
19. DGM, Rajasthan
20. DGM, Bihar
21. Indian Bureau of Mines (IBM)
22. Mineral Exploration & Consultancy Limited (MECL)
23. National Mineral Exploration Trust (NMET)
24. National Mission Head-II, GSI
25. Regional Mission Head-II, GSI (Southern Region & North Eastern Region)
26. Dy.DG of State Units (Rajasthan or Madhya Pradesh); Directors of GSI associated with the items of Industrial and Fertilizer Mineral Group investigations; Director, PSS-P&M-2, GSI, CHQ, Kolkata; and Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. Representative of Cement Industry (ACC Limited)
ii. FCI Aravalli Gypsum and Minerals India Ltd.
iii. Rajasthan State Mines and Minerals limited (RSMML)
iv. Ultratech Cement

Committee V: Energy Minerals & Resources (Coal, Lignite & Geothermal)

Convener: Dy. Director General & HoD, Natural Energy Resources (NEnR), M-IIB, Geological Survey of India (GSI), Kolkata

Member Secretary: Director, NEnR, M-IIB, Geological Survey of India (GSI), Kolkata

Members:

1. Ministry of Coal (Director-Technical level)
2. Ministry of Mines (Director-Technical)
3. Ministry of New and Renewable Energy (Director-Technical level)
4. NITI Aayog (Advisor/Joint Advisor: Power & Energy)
5. DGM, Govt. of Maharashtra
6. CGM, Govt. of Gujarat
7. DGM, Govt. of Rajasthan

8. DGM, Govt. of Chhattisgarh
9. DMG, Govt. of Jharkhand
10. DMM, Govt. of West Bengal
11. DG, Govt. of Odisha
12. MRD, Govt. of Madhya Pradesh
13. DGM, Govt. of Tamil Nadu
14. DMG, Govt. of Andhra Pradesh
15. DGM, Govt. of Uttar Pradesh
16. DMG, Govt. of Telangana
17. DGM, Govt. of Assam
18. DMG, Govt. of Meghalaya
19. DGM, Govt. of Nagaland
20. DGM, Govt. of Arunachal Pradesh
21. DGMR, Govt. of Mizoram
22. DG, Hydrocarbons
23. CSIR-NGRI
24. NLC India Limited
25. Mineral Exploration & Consultancy Limited (MECL)
26. CIL (CMPDIL, Ranchi)
27. The Singareni Collieries Company Limited (SCCL)
28. CSIR-CIMFR
29. The Energy and Resources Institute (TERI)
30. National Mineral Exploration Trust (NMET)
31. Chief Engineer, CHQ, GSI
32. Dy. DG, Policy Support System Planning & Monitoring, GSI
33. Dy. DG., Central Chemical Lab, CHQ, GSI
34. National Mission Head-II, GSI
35. Regional Mission Head-II, GSI (North Eastern Region & Eastern Region)
36. Directors of GSI associated with Energy Minerals & Resources (Coal, Lignite & Thermal); Director, PSS P&M-2, GSI, CHQ, Kolkata; and Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. Steel Authority of India Limited (SAIL)
ii. Tata Steel
iii. NTPC Limited
iv. CSIR-NML, Jamshedpur
v. The Mining, Geological & Metallurgical Institute of India (MGMI)
vi. Adani Enterprises
vii. Jindal Steel and Power Limited (JSPL)

TERMS OF REFERENCE FOR COMMITTEES OF THE CGPB FOR MINERALS (COMMITTEE-I TO COMMITTEE-V)

Committee-I: Ferrous Minerals, Committee-II: Precious Metals & Minerals, Committee-III: Non Ferrous and Strategic Minerals, Committee-IV: Industrial and Fertilizer Minerals and Committee-V: Energy Minerals and Resources Committees of the CGPB were reconstituted with the following terms of reference: -

1. To formulate annual and five year plans for regional, detailed and promotional exploration on a national scale.
2. To review the work done so far relating to the activity domain of the Committee including the ongoing programs along with the utilization of the budget of promotional exploration schemes sponsored by different Ministries of Government of India.
3. To coordinate the exploration work by Government, Public and Private agencies as per the defined plan objectives and priorities.
4. To facilitate and promote partnership between Central and State organizations and Public-Private partnership in exploration.
5. To prepare status papers, long/short term perspective plans, updating manual of end-users specifications keeping in view progressive advancement of knowledge and technology.
6. To prepare and update the database (including status map) of all regional and detailed exploration involving Central, State and private agencies.
7. To formulate methodology and act as a nodal agency for data sharing and dissemination.
8. To advise government on conservation and optimum utilization of minerals taking into consideration the future needs of the country through adoption of scientific mining, ore dressing and beneficiation technology in tune with global standards.
9. To ensure uploading of the data in the National Geoscience Data Repository (NGDR) as per the Mineral Exploration Reporting Template (MERT) by the CL/ML/ EL holders and other agencies engaged in mineral exploration, as per rule, and monitor its availability in public domain after lock-in period through an identified system.
10. To prioritize Research and Development work in the mineral sector related to exploration techniques, modernization of field/sampling equipments and beneficiation.
11. To advise Government on human resource development and training of personnel in order to strengthen the manpower of Central and State organizations.

The Committee shall have the power to co-opt other institutions as invitees as felt necessary for fruitful deliberation of the Committee.

Committee VI: Marine Geology & Exploration and Coastal Geoscience

Convener: Dy. Director General & HoD, Geological Survey of India (GSI), Marine & Coastal Survey Division (MCSD), Mangaluru

Member Secretary: Director, Policy Support System(PSS), Geological Survey of India (GSI), Marine & Coastal Survey Division (MCSD), Mangaluru

Members:

1. Ministry of Mines, New Delhi (Director Tech Level)
2. Ministry of Earth Sciences, New Delhi (Director Tech Level)
3. Department of Science & Technology (DST), New Delhi (Director Tech Level)
4. Indian Bureau of Mines (IBM), Nagpur
5. Directorate General of Hydrocarbon, New Delhi
6. DG, Govt. of Odisha
7. DMG, Govt. of Andhra Pradesh
8. DGM, Govt. of Tamil Nadu
9. DMG, Govt. of Kerala
10. DMG, Govt. of Karnataka
11. DGM, Govt. of Maharashtra
12. DMG, Govt. of Goa
13. CGM, Govt. of Gujarat
14. National Centre of Polar & Ocean Research (NCPOR), Goa
15. National Institute of Oceanography (NIO), Goa
16. Atomic Mineral Directorate for Exploration and Research (AMDER), Hyderabad
17. National Mission Head-IA, GSI
18. National Mission Head-II, GSI
19. Dy. DG of State Units; Directors of GSI associated with the investigations on Marine Geology & Exploration and Coastal Geoscience; Director, PSS- P&M-1, GSI, CHQ, Kolkata; and Director, CGPB

Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. Shipping Corporation of India (SCI), Mumbai
ii. Indian Navy (IN), New Delhi
iii. National Physical Oceanographic Laboratory (NPOL), Cochin
iv. National Hydrographic Office (NHO), Dehradun
v. Space Application Centre (SAC), Ahmedabad
vi. Indian National Centre for Ocean Information Services (INCOIS), Hyderabad
vii. National Institute of Ocean Technology (NIOT), Chennai
viii. Coastal Erosion Directorate, Central Water Commission, New Delhi
ix. Integrated Coastal and Marine Area Management (ICMAM), Chennai
x. Geomarine solutions

TERMS OF REFERENCE FOR COMMITTEE VI (MARINE) OFTHECGPB

1. To formulate annual and five year plans on a national scale.
2. To review the work done so far relating to the activity domain of the committee including ongoing projects
3. To make concrete suggestions on the various on- going programmes of GSI and other organizations with reference to the Plan objectives;
4. To recommend changes, if necessary, in priorities assigned to various items of work. The priorities and sharing of responsibilities between MoM and MoES have to be defined with respect to (a) systematic seabed mapping and regional offshore mineral exploration in Exclusive Economic Zone (EEZ) and also allocated deep sea areas as per mineralization and (b) systematic seabed mapping of the Extended EEZ in future.
5. To update the classification of the coastal morphology and digitization of the data with a view to use these data for planning remedial measures for coastal disasters.
6. To propose reclassification of offshore data generated by various organizations for data dissemination to various user agencies keeping in view the strategic and classified nature of the offshore data and to work out the modalities of exchanging the same amongst member organizations as well as in the public domain.
7. To prepare status papers, long/short term perspective plans and creating end users specifications in view of the new developments in NMP 2019.
8. To suggest collaborative programme between GSI and other member organizations and specialized institutions in India and abroad for development of knowledge in marine geosciences.
9. To advise on any matter of special significant relating to particular activity domain viz., coastal geoscience, geotechnical parameters, environmental assessment etc. as considered necessary by the Committee.
10. The Committee shall have the power to co-opt other institutions as invitees as felt necessary for fruitful deliberation of the Committee.

Committee VII: Airborne Survey & Remote Sensing

Convener: Dy. Director General & HoD, Geological Survey of India (GSI), Remote Sensing and Aerial Survey (RSAS), Bengaluru

Member Secretary: Dy. Director General & HoD, Geological Survey of India (GSI), Remote Sensing and Aerial Survey (RSAS), Bengaluru

Members:

1. Ministry of Mines, New Delhi (Director Tech Level
2. Ministry of Defence (Director Tech Level)
3. Indian Bureau of Mines (IBM)
4. DGM Govt. of Madhya Pradesh
5. DG, Govt. of Odisha
6. DMG, Govt. of Rajasthan

7. DMG, Govt. of Andhra Pradesh
8. DMG, Govt. of Karnataka
9. DGM, Govt. of Chhattisgarh
10. DGM, Govt. of Maharashtra
11. CGM, Govt. of Gujarat
12. National Remote Sensing Center (NRSC)
13. Oil and Natural Gas Corporation (ONGC)
14. Atomic Minerals Directorate for Exploration & Research (AMDER)
15. Central Ground Water Board (CGWB)
16. DG, Hydrocarbons (DGH), New Delhi
17. National Geophysics Research Institute (NGRI)
18. All Regional Remote Sensing Service Centres (RRSC-ISRO)
19. Orissa Mining Corporation (OMC)
20. Hutti Gold Mines Company Limited (HGML)
21. Mineral Exploration & Consultancy Limited (MECL)
22. Uranium Corporation of India Limited (UCIL)
23. M/s Singareni Collieries Co. Ltd., Telangana
24. National Mineral Development Corporation (NMDC)
25. Kudremukh Iron Ore Co. Ltd., Bengaluru
26. CMPDI, Ranchi
27. Axiom Exploration Group Ltd.
28. National Mission Head-IB, GSI
29. National Mission Head-II, GSI
30. Regional Mission Head-I, GSI (Western Region & Southern Region)
31. Dy. DG of State Units; Directors of GSI associated with the investigations on Airborne Survey & Remote Sensing; Director (PGRS);Director, PSS-P&M-1, GSI, CHQ, Kolkata; and Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. Director General of Civil Aviation (DGCA)
ii. Geological Society of India
iii. Indian Institute of Remote Sensing (IIRS), Dehradun
iv. Karnataka, Gujarat, Rajasthan State (Remote Sensing Centres)
v. Project Coordinator, ASRS Group (AMD)
vi. McPhar India
vii. Sanders Geophysics India Private Limited

TERMS OF REFERENCE FOR COMMITTEE VII (AIRBORNE SURVEY & REMOTE SENSING) OF THE CGPB

1. To formulate annual and five year plans on a national scale.
2. To review the work done by various organizations so far relating to the activity domain of the committee.
3. To make concrete suggestions on the various ongoing programmes of GSI and other organizations with reference to the Plan objectives.
4. To develop mutual interaction and collaboration amongst the different organizations with a view to share databases and developing applications for making least use of the information for geoscientific purposes.
5. To promote dissemination of aerogeophysical data and maps in the public domain and find out ways to remove restrictions in sharing aerogeophysical data or suggest suitable measures necessary from time to time.
6. To review and monitor technological developments in airborne and heliborne remote sensing and suggest new and cutting-edge technology for adoption for survey and mapping, including hyperspectral and gravity mapping.
7. To review the prevalent rules/ restrictions of acquisition, processing, utilization, archiving and publication of data accrued through Exploration License (EL).
8. To advise the Government on any related matter as the Committee considers necessary.

The Committee shall have the power to co-opt other institutions as invitees as felt necessary for fruitful deliberation of the Committee.

Committee VIII: Geology & Mineral Resources of North Eastern Region (NER)

Convener: Addl. Director General/ Dy. Director General, Geological Survey of India (GSI), North Eastern Region (NER), Shillong

Member Secretary: Director, Policy Support System (PSS), Geological Survey of India (GSI), North Eastern Region (NER), Shillong

Members:

1. Director (Technical), Ministry of Mines
2. Advisor (Technical Programming Planning Co-ordination), Ministry of Mines
3. Representative of NITI Aayog, Govt. of India (Advisor-Mines)
4. Representative of MoES, Govt. of India
5. Representative of MoEFCC, Govt. of India
6. Indian Bureau of Mines (IBM)
7. Mineral Exploration & Consultancy Limited (MECL)
8. Central Ground Water Board (CGWB)
9. Central Water Commission (CWC)
10. Oil and Natural Gas Corporation (ONGC)
11. Atomic Minerals Directorate for Exploration and Research (AMDER)
12. DGM, Government of Arunachal Pradesh
13. DGM, Government of Assam
14. DCI, Government of Manipur
15. DMG, Government of Meghalaya

16. DGMR, Government of Mizoram
17. DGM, Government of Nagaland
18. DIC, Government of Tripura
19. DMMG, Government of Sikkim
20. Tata Iron & Steel Ltd, Tatanagar
21. Central Mine Planning and Design Institute Ltd (CMPDIL)
22. Dy. Director General, GSI Training Institute, Hyderabad
23. Dy. DG, GSI, NEnR, M-IIB, GSI, Kolkata
24. National Mission Head-II, GSI
25. Regional Mission Head-II, GSI, NER
26. Dy. DG of State Units; Directors of GSI associated with the investigations on Geology & Mineral Resources

of NER; Director, PSS-P&M-2, GSI,CHQ, Kolkata; and Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. Representative of DONER, Govt. of India (Director level)
ii. NEC (Advisor, Minerals)
iii. Brahmaputra Board
iv. Border Road Organisation
v. Oil India Limited (OIL)
vi. NHPC Limited
vii. NTPC Limited
viii. North Eastern Electric Power Corporation Limited (NEEPCO)
ix. North East Institute of Science & Technology (formerly RRL), Jorhat
x. Representative from Geology Dept., Nagaland University
xi. Representative from Geology Dept., Manipur University
xii. Representative from Geology Dept., Guwahati University
xiii. Representative from Geology Dept., Dibrugarh University
xiv. Representative from Geology Dept., Tezpur University
xv. Representative from Geology Dept., Assam University, Silchar
xvi. Representative from Geology Dept. Sikkim University, Gangtok
xvii. Northeastern Hill University, Shillong
xviii. IIT, Guwahati
xix. Lafarge India Pvt. Ltd.
xx. North Eastern Frontier Railway
xxi. National Highways & Infrastructure Development Corporation Limited (NHIDCL)
xxii. North Eastern Coal Limited (unit of CIL only)
xxiii. Oil and Natural Gas Corporation (ONGC)
xxiv. Coal India Limited
xxv. Star Cement

TERMS OF REFERENCE FOR COMMITTEE VIII (NORTH EASTERN REGION) OF THE CGPB

1. To formulate annual and five year plans on a regional scale.

2. The Committee to act as a common platform for all participants (Govt., public, private, universities, R&D institutions etc.) in the field of Geoscience activity.

3. To monitor and coordinate all earth science related activity in the NER by the different stakeholders, both public and private, for mapping, exploration & exploitation of mineral resources.

4. To address all issues related to the fragile ecosystem of the Region in terms of both natural and anthropogenic hazards.

5. NER being the hydropower store house of the country with both public and private organizations engaged for its development, the Committee will act as a common platform to deliberate/ resolve all issues particularly directed towards geological surprises and engineering solutions on water resource development.

6. To recommend changes, if necessary, in priorities assigned to various items of work.

7. To prepare status papers on various emergent issues, long/ short term perspective plans.

8. The Committee shall have power to co-opt other institutions as invitees as felt necessary for fruitful deliberation of the Committee.

Committee IX: Geoscientific Investigations (Geotechnical investigation, Natural Hazards, Climate Change, Environmental Geology, Shallow subsurface Geology & Subsurface Hydrology)

Convener: Addl. Director General/ Dy. Director General, Geological Survey of India (GSI), Northern Region (NR), Lucknow Member Secretary: Director, Policy Support System (PSS), Geological Survey of India (GSI), Northern Region (NR), Lucknow

Members:

1. Ministry of Mines, (Director Technical)
2. Ministry of Environment, Forest and Climate Change
3. Ministry of Earth Sciences, New Delhi
4. National Remote Sensing Centre (NRSC), ISRO
5. DGM, Government of Jammu & Kashmir
6. Geological Wing, Department of Industries, Government of Himachal Pradesh
7. Geology & Mining Unit, Government of Uttarakhand
8. DGMs of North Eastern States
9. National Environmental Engineering Research Institute, Nagpur

10. Central Ground Water Board (CGWB)

11. National Mission Head-IV, GSI

12. Regional Mission Head-IV, GSI (Northen Region, Southern Region)

13. Dy.DGs and Directors of GSI associated with Geoscientific Investigations (Geotechnical investigation, Natural Hazards, Climate Change, Environmental Geology, Shallow Subsurface Geology & Subsurface

Hydrology);Director,PSS-P&M-4, GSI,CHQ, Kolkata; and Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. National Disaster Management Authority, New Delhi

ii. National Institute of Hydrology, Roorkee

iii. Central Electricity Authority (CEA)

iv. National Hydroelectric Power Corporation (NHPC)

v. NWDA

vi. G.B.Pant Institute of Himalayan Environment and Development, Almora

vii. Central Pollution Control Board

viii. Snow and Avalanche Study Establishment (SASE), Chandigarh

ix. Department of Civil Engineering, IIT Kanpur

x. Institute of Seismological Research, Gandhinagar

xi. SDM/RC, Government of Jammu & Kashmir

xii. SDM/RC, Government of Himachal Pradesh

xiii. SDM/RC, Government of Uttarakhand

xiv. SDM/RC, Government of Northeastern States

xv. National Institute of Rock Mechanics (NIRM)

xvi. National Geophysical Research Institute (NGRI)

TERMS OF REFERENCE FOR COMMITTEE IX (GEOSCIENTIFICINVESTIGATIONS)OFTHECGPB

1. To formulate annual and five year plans on a national scale.

2. To advise the Government from time to time on societal issues arising out of natural hazards and to suggest probable preventive/mitigation measures including rehabilitation.

3. To monitor and collect data systematically (where possible on a spatial basis) on a large number of parameters relating not only to landslides and earthquakes, but also other public-health and public good issues having a geospatial dimension like Arsenic, Fluorine pollution, etc.

4. To review the work done by different organizations including Standing Committee on Geosciences (SC-G) under Planning Committee-Space Applications Management System (PC-SAMS), PM Committee on Climate Change, etc. and to assess their proposals for future work and to identify the gap areas for future course of action in the geoscientific domains under the purview of the Committee.

5. Promoting use of the state-of-the-art research in the geo-environmental and natural hazard domains for effective management of the earth system and its resources.

6. To enable integration of relevant data sets including spatial data in order to help develop a GIS application for planning, management, prevention, etc. in respect of various geoscientific related events including natural hazards.

7. To advise CGPB on any other urgent matter relating to the particular activity domain, as considered necessary by the Committee.

8. The Committee is empowered to convene meetings on smaller groups on specialized subject matter with specific agenda.

9. The Committee may co-opt other institutions as invitees as and when necessary for fruitful deliberations.

Committee X: Fundamental and Multidisciplinary Geoscience

Convener: Addl./Dy. Director General & National Mission Head-IV, Geological Survey of India (GSI), Kolkata

Member Secretary: Director, M-IV, National Centre of Excellence in Geoscience Research (NCEGR), Geological Survey of India (GSI), Kolkata

Members:

1. Director (Technical), Ministry of Mines, New Delhi

2. Representative from Dept. of Science and Technology, Govt. of India

3. Oil and Natural Gas Commission, Dehradun

4. National Geophysical Research Institute, Hyderabad

5. Wadia Institute of Himalayan Geology, Dehradun

6. Representative of Indian Bureau of Mines

7. Representative of Atomic Mineral Directorate of Exploration and Research

8. Regional Mission Head-IV, GSI (Northern Region, Eastern Region, Southern Region)

9. DDGs and Directors of GSI connected with Mission – IV Laboratories, programmes on Fundamental

Geoscience; Dy. Director General, Training Institute; Director, PSS-P&M-4, GSI, CHQ, Kolkata; and

Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. Representative of CSIR

ii. Indian Meteorological Department, Delhi

iii. Representative from Geology Dept., Punjab University

iv. Representative from Geology Dept., Calcutta University

v. Representative from Geology Dept., Anna University

vi. Representative from Geology Dept., Jadavpur University

vii. Representative from Geology Dept., Delhi University

viii. Representative from Geology Dept., M.S. Baroda University

ix. Representative from Geology Dept., Mysore University

x. Representative from Geology Dept., Osmania University

xi. Representative from IIT's (Kharagpur, Mumbai, Roorkee)

xii. Representative from Centre for Earth Science Studies, Thiruvananthapuram

xiii. Representative from Defence Metallurgical Research Laboratory (DMRL, Hyderabad)

xiv. Representative from NCEMP, Allahabad

xv. Representative from Birbal Sahni Institute of Palaeosciences, Lucknow

xvi. Representative of Indian School of Mines and Applied Geology

xvii. Representative of NEERI

xviii. Representative of CGWB

xix. Representative of Zoological Survey of India

xx. Representative of Botanical Survey of India

xxi. Representative from Geology Dept., Pondicherry University

xxii. Representative of National Institute of Oceanography

xxiii. Representative from Dept. of Geology, Savitribai Phule University, Pune

xxiv. Representative from Earth Sciences IISER Kolkata

xxv. Representative from Geological Studies Unit Indian Statistical Institute

xxvi. Hindustan Zinc Limited (HZL)

xxvii. Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC)

xxviii. Mineral Exploration & Consultancy Limited (MECL)

TERMS OF REFERENCE FOR COMMITTEE-X (FUNDAMENTALAND MULTIDISCIPLINARY GEOSCIENCE) OFTHECGPB

1. To promote and prioritize research in the field of fundamental and applied Geoscience (Geology, Geophysics, Geochemistry, Geomatics).

2. To encourage better understanding of geological process in the crust and lithosphere, evolution of earth, localization of minerals, etc.

3. To review the state of education in Geosciences and make recommendations to improve the quality of geoscientific education particularly at higher levels in order to improve the pool of geoscience talent.

4. To review policy relating to Geoscientific research and make recommendations for improving research infrastructure, funding etc; and ensure better mutual coordination between field practices and fundamental research.

5. To continuously review global technological advancements in instrumentation (analytical and scientific) and methodologies and recommend state- of-the-art techniques to be adopted, in order to modernize the laboratories, to bring these at par with international standards.

6. To facilitate and coordinate sharing of laboratory facilities available with different organizations for optimum use.

7. To promote R&D work for evolving new and efficient techniques in the mineral exploration and mining, for locating new mineral resources, value addition, maximizing utilization and conservation of existing natural resources.

8. Participation of different organizations in preparation of Standard Reference Material.

9. To help improve the geoscientific knowledge within the States and Central institutions by training or other knowledge acquisition measures for the existing personnel both in field and laboratory techniques and to suggest knowledge sets of personnel for the future.

10. To focus on the long-term and short-term activity domains and working plans of different organizations.

11. Collection, maintenance, preservation and documentation of earth science samples for curatorial, geological and chemical studies and for exhibition and display purposes.

Committee XI: Geoinformatics & Data Management

Convener: Addl./Dy. Director General & National Mission Head-III, Geological Survey of India (GSI), Kolkata

Member Secretary: Director (TC), Mission-III, Geological Survey of India (GSI), Kolkata

Members:

1. Director (Technical), Ministry of Mines
2. Indian Bureau of Mines (IBM)
3. Mineral Exploration & Consultancy Limited (MECL)
4. Ministry of Earth Sciences (MoES)
5. Department of Science and Technology (DST) (dealing with geospatial policies and issues)
6. Atomic Minerals Directorate for Exploration and Research (AMDER)
7. Directorate of Geology and Mining of all States and Union Territories
8. Oil and Natural Gas Corporation (ONGC)
9. Survey of India (SOI)
10. National Remote Sensing Centre (NRSC)
11. National Geophysical Research Institute (NGRI)
12. Central Ground Water Board (CGWB)
13. DDGs in-charge of National Geoscience Data Repository(NGDR) and Online Core Business Integration System (OCBIS)
14. DDGs and Directors of GSI associated with programmes on Geoinformatics and data management, NGDR; Director PSS-P&M-3, GSI, CHQ, Kolkata; and Director, CGPB Secretariat, DGCO, New Delhi

Permanent Invitees: -

i. DDG (NIC) dealing with GIS

ii. Technical Director (NIC) Ministry of Mines

iii. AMD (NIC)

iv. One representative of each State to be nominated by Secretary (Information Technology) of the State

v. National Spatial Data Infrastructure (NSDI)

vi. National Geospatial Programme Division (erstwhile NRDMS)

vii. India Meteorological Department (IMD)

viii. National Disaster Management Authority (NDMA)

ix. Ministry of Home Affairs (MHA)

x. Bhaskaracharya Institute for Space Applications and Geoinformatics (BISAG-N)

xi. Maharashtra Remote Sensing Application Centre (MRSAC)

TERMS OF REFERENCE FOR COMMITTEE XI (GEOINFORMATICS) OFTHECGPB

1. To promote use of information technology in geoscientific activity, develop Geoinformatics with a strong spatial and attribute database.

2. To facilitate coordination among geoscientific agencies to develop common standards and sharable databases under the NSDI architecture and in line with the directives of Geospatial Data Promotion and Development Committee (GDPDC) from time to time; and encourage wide and easy dissemination of geoscientific information through internet-based technologies.

3. To review the National Geoscience Data Repository (NGDR) and take advice from stakeholders for improving NGDR.

4. To coordinate with Mining Tenement & Registry System developed by IBM.

5. To formulate policy and advice CGPB for providing access to quality and unique geospatial and non-spatial data.

6. To develop new methodologies for sophisticated management of data through the use of domain enriched software to produce 3D and modelling out puts.

7. To review the work done so far relating to the activity domain of the Committee, with reference to GSI portal.

8. The Committee shall have power to co-opt other institutions as invitees as felt necessary for fruitful

deliberations of the Committee

Committee XII: Geoscience for Sustainable Development

Convener: Joint Secretary (Policy), Ministry of Mines Member Secretary: Director (Tech.), Ministry of Mines Members:

1. Advisor (TPPC), Ministry of Mines

2. Representative of Ministry of Environment, Forest & Climate Change, MoEFCC

3. Representative of the Department of Science & Technology

4. Representative of Ministry of Health and Family Welfare

5. Representative of Ministry of Agriculture and Farmers' Welfare

6. Representative of Ministry of Rural Development (MoRD)

7. Representative of Department of Land Resources

8. Representative of Ministry of Housing and Urban Affairs

9. Representative of Ministry of Water Resources, River Development and Ganga Rejuvenation

10. Representative of Ministry of Earth Sciences

11. National Environm ental Engineering Research Institute (NEERI)

12. Indian Bureau of Mines (IBM)

13. Central Ground Water Board (CGWB)

14. State Agencies dealing with GIS/Spatial data application (to be nominated by respective State Governments)

Permanent Invitees: -

i. 10 NGOs of all India character having track record of dealing with issues relating to sustainable development to be nominated in consultation with the Ministries/ Departments at S. No. 2 to 10 above.

ii. Centre for Science and Environment, New Delhi

iii. ICAR-NBSS&LUP

iv. National Spatial Data Infrastructure (NSDI)

v. National Geospatial Programme Division (erstwhile NRDMS)

vi. School of Environment Sciences, JNU

vii. Indian Institute of Remote Sensing, Dehradun

viii. Indian National Centre for Ocean Information Services, Hyderabad

ix. The Energy and Resources Institute (TERI)

x. Representatives from CSIR

TERMSOFREFERENCEFORCOMMITTEEOFTHE CGPB FOR XII (GEOSCIENCE FOR SUSTAINALE DEVELOPMENT)

1. To facilitate integration of geoscience into policy making for environmental issues and to transmit the concepts to potential interest groups including policy makers, non-governmental environmental agencies and general public.

2. Help develop a framework and methodology for promoting sustainable development strategies (including

optimum land use) through best use of geoscientific data gathered in the course of survey and exploration by GSI and other geoscientific organizations in the country.

3. Assist nodal agencies concerned by developing new areas for geoscientific data collection, particularly spatial data such as geomorphology to help them analyse ecosystem functions and make informed planning decisions.

4. The Committee may co-opt other institutions as invitees."

K. Notification No.S.O. 3848(E). dated, the 31st August, 2023—In exercise of the powers conferred by sub- sections (1) and (2) of section 16 read with section 17 and sub-section (3) of section 25 of the Bureau of Indian Standards Act, 2016 (11 of 2016), the Central Government is of the opinion that it is necessary so to do in the public interest and after consulting the Bureau of Indian Standards, hereby makes the following order, namely:—

1. Short title and commencement.—(1) This Order may be called the Nickel (Quality Control) Order, 2023.

(2) This Order shall come into force with effect from three months from the date of publication of this notification.

2. Application.—This Order shall apply in relation to goods or article specified in column (1) of the Table below, but shall not apply to goods or article meant for export.

3. Compulsory use of Standard Mark.—Goods or article specified in the column (1) of the said Table shall conform to the corresponding Indian Standard mentioned in the column (2) therein and shall bear the Standard Mark under a licencefrom the Bureau of Indian Standards in accordance with Scheme-1 of Schedule-II to the Bureau of Indian Standards (Conformity Assessment) Regulations, 2018.

4. Certifying and enforcing authority. —The Bureau of Indian Standards shall be the certifying and enforcing authority for the goods or article specified in the column

(1) of the said Table.

Goods or article	Indian Standard	Title of Indian Standard
1	2	3
Nickel Powder	IS 7506:1987	Specification for Nickel Powder

Note: For the purposes of the Table, it is clarified that the latest version of Indian Standards established and published by the Bureau from time to time in accordance with the provisions of clause (17) of section 2 of the Bureau of Indian Standards Act, 2016 (11 of 2016), shall apply from the date of such publication

L. Notification S.O. 3847(E), dated, the 31st August, 2023.—In exercise of the powers conferred by subsections (1) and (2) of section 16 read with section 17 and sub-section (3) of section 25 of the Bureau of Indian Standards Act, 2016 (11 of 2016), the Central Government is of the opinion that it is necessary so to do in the public interest and after consulting the Bureau of Indian Standards, hereby makes the following order, namely: -

1. Short title and commencement - (1) This Order may be called the Copper (Quality Control) Order, 2023.

(2) This Order shall come into force with effect from three months from the date of publication of this notification.

2. Application - This Order shall apply in relation to goods or article specified in column (1) of the Table below, but shall not apply to goods or article meant for export.

3. Compulsory use of Standard Mark - Goods or article specified in the column (1) of the said Table shall conform to the corresponding Indian Standard mentioned in the column (2) therein and shall bear the Standard Mark under a licence from the Bureau of Indian Standards in accordance with Scheme-1 of Schedule-II to the Bureau of Indian Standards (Conformity Assessment) Regulations, 2018.

4. Certifying and enforcing authority - The Bureau of Indian Standards shall be the certifying and enforcing authority for the goods or article specified in the column (1) of the said Table.

Goods or article	Indian Standard	Title of Indian Standard
1	2	3
Copper	IS 191:2007	Copper-Specification

Note: For the purposes of the Table, it is clarified that the latest version of Indian Standards established and published by the Bureau from time to time in accordance with the provisions of clause (17) of section 2 of the Bureau of Indian Standards Act, 2016 (11 of 2016), shall apply from the date of such publication.

M. Notification G.S.R. 642 (E). dated the 31st August, 2023 — Inexercise of the powers conferred under the second proviso to sub- section (1) of section 4 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957) and consequent up on ac cr editation provided by the National Accreditation Board for Education and Training of the Quality Council of India (QCI-NABET), the Central Government hereby notifies M/s Engeotech Consultant under 'Category A Exploration Agencies' as per the 'Guidelines for notification of accredited private exploration agencies' issued by the Government of India in the Ministry of Mines vide order No. M.VI-16/15/2021-Mines VI, dated the 12th August, 2021 (hereafter referred to as the said guidelines).

2. The said agency shall carry out prospecting operations in compliance with the conditions specified in the said guidelines.

3. This notification shall remain in force for a period of three years from the date of its publication or till the expiry or termination of the accreditation granted, whichever is earlier.

N. Notification S.O. 3846 (E) dated the 31st August, 20 23 .— In exercise of the powers conferred by sub-sections (1) and (2) of section 16 read with section 17 and sub-section (3) of section 25 of the Bureau of Indian Standards

Act, 2016 (11 of 2016), the Central Government is of the opinion that it is necessary so to do in the public interest and after consulting the Bureau of Indian Standards, hereby makes the following order, namely: -

1. Short title and commencement.- (1) This Order may be called the Aluminium and Aluminium Alloys (Quality Control) Order, 2023.

(2) This Order shall come into force with effect from three months from the date of publication of this notification.

2. Application.- This Order shall apply in relation to goods or article specified in column (2) of the Table below, but shall not apply to goods or article meant for export.

Sl. No	Goods or article	Indian Standard	Title of Indian Standard
1	2	3	4
1	Aluminium and aluminium alloy ingots and castings	IS 617:1994	Cast aluminium and its alloys Ingots and castings for general engineering purposes
2	High purity primary aluminium Ingot	IS 11890:1987	
3	Aluminium alloy ingots for	IS 6754:1972	Specification for aluminium alloy ingots for remelting for general engineering purpose
4	Primary aluminium ingots for remelting	IS 2590:1987	Specification for Primary aluminium ingots for remelting for
5	Aluminium ingots billets and wire bars (EC GRADE)	IS 4026:2023	Aluminium ingots billets and wire bars (EC GRADE)

Note: For the purposes of the Table, it is clarified that the latest version of Indian Standards established and published by the Bureau from time to time in accordance with the provisions of clause (17) of section 2 of the Bureau of Indian Standards Act, 2016 (11 of 2016), shall apply from the date of such publication.

3. Compulsory use of Standard Mark.- Goods or article specified in the column (2) of the said Table shall conform to the corresponding Indian Standard specified in column (3) therein and shall bear the Standard Mark under a licence from the Bureau of Indian Standards in accordance with Scheme-1 of Schedule-II to the Bureau of Indian Standards (Conformity Assessment) Regulations, 2018.

4. Certifying and enforcing authority.- The Bureau of Indian Standards shall be the certifying and enforcing authority in respect of the goods or article specified in the column (2) of the said Table

O. **Notification No.S.O. 3890(E). dated the 1st September, 2023** —WHEREAS, vide notification of the Government of India, Ministry of Mines number G.S.R. 860(E), dated the 16th December, 2021 (hereinafter referred to as the said notification) issued in exercise of the powers conferred by clause (a) of sub-section (1) of section 26 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957) (hereinafter referred to as the Act), the Central Government directed that certain powers of the Central Government shall also be exercisable by Dr. Veena Kumari Dermal, Joint Secretary to the Government of India in the Ministry of Mines; And whereas, the Act has further been amended by the Mines and Minerals (Development and Regulation) Amendment Act, 2023 (16 of 2023), inter alia, inserting therein section 11D which empowers the Central Government to conduct auction for grant of mining lease or composite licence in respect of minerals specified in Part D of the First Schedule to the Act; Now therefore, in exercise of the powers conferred by clause (a) of sub-section (1) of section 26 of the Act, the Central Government hereby makes the following amendment in the said notification, namely:— In the said notification, in paragraph 1, for the words, brackets and figures "and the provisos to sub-section (4) and (5) of section 11", the words, figures and letter ", the provisos to sub-sections (4) and (5) of section 11 and section 11D" shall be substituted.

2. This notification shall come into force on the date of its publication in the Official Gazette

P. Notification No. S.O. 2185 (E) dated, the 12th May, 2023 .—Whereas, Ministry of Environment, Forest and Climate Change issued a notification S.O.5481(E) dated 31 December, 2021 mandating filling of fly ash in the mine voids and mixing of the same to the extent of 25% with the external dumps in all working leases located within 300 kms of radius from any Thermal Power Plant. Whereas, a safety and feasibility study is required to be undertaken for all such operational mines with the due permissions from DGMS and other regulatory authorities. Therefore, in pursuance to the Rule - 5 8 of Mineral Conservation and Development Rules, 2017, it is hereby directed to undertake this study within a period of 60 days. It is further directed to submit a copy of the study report forthwith to the respective Regional Controller of Mines under whose jurisdiction the lease is located. This order shall come into force on the date of its publication in the official gazette.

S. Notification No.S.O. 4917(E). dated, the 15th September, 2022—In pursuance of Sub-Rule (4) of Rule 10 of the Official Language (Use for official purposes of the Union) Rules, 1976 (as amended, 1987) the Central Government hereby notifies the following office of Geological Survey of India, subordinate office of the Ministry of Mines, more than 80% Staff whereof have acquired working knowledge of Hindi: 1. Geological Survey of India, Marine and Coastal Survey Division, Mangaluru.

T. Notification NO. G.S.R. 682(E). dated the 22nd September, 2023—In exercise of the powers conferred by section 11B of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government hereby makes the following rules further to amend the Atomic Minerals Concession Rules, 2016, namely:— 1. Short title and commencement:— (1) These rules may be called the Atomic Minerals Concession (Amendment) Rules, 2023.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Atomic Minerals Concession Rules, 2016 (hereinafter referred to as the said rules), for rule 37, the following rule shall be substituted, namely:—"37.

Type of deposit and Principal Minerals	G4 stage	G3 stage	G2stage	G4stage	Remarks
"III. Rare metal and REE occurring in pegmatites, reefs and veins/ pipes.	Scout drilling/ random pitting/ trenching as per necessity	10 to 25 pits/ trenches per sq.km. In case of drilling, borehole spacing may be 40m x 20m or 40m x 40m.	Pitting/ Trenching/ preferably at 20m interval.In case of drilling, borehole spacing may be 20m x 10m or 20m x 20m.	Exploratory open pit or boreholes at 10m x 10m or closer or underground sampling with bulk determination of grades and recovery where ever necessary.	
IIIA. Rare metal and REE occurring in carbonatite and other alkali igneous rocks					
(i) Tabular Rare metal and REE deposits	Scout drilling/ random pitting/ trenching as per necessity	Borehole grid/ sample spacing may be 400m x 200m or closer	Borehole grid/ sample spacing may be 200m x 100m or closer	Borehole grid/ sample spacing may be 100m x x 100m or closer	
(ii) Lenticular Rare metal and REE deposits in the form of veins / lenses	Scout drilling/ random pitting/ trenching as per necessity	Borehole grid/ sample spacing may be 200m x 200m or closer	Borehole grid/ sample spacing may be 100m x 100m or closer	Borehole grid/ sample spacing may be 100m x 50m or closer.".	

Penalty.— Whoever contravenes the provisions of sub-rules (4) and (6) of rule 4, second proviso to sub rule (1) or proviso to sub-rule (2) of rule 5 or rule 7 or rule 8 or rule 9 or rule 10 or sub-rule (11) of rule 13 or sub-rule (6) of rule 14 or sub-rule (2) of rule 15 or rule 16 or rule 20 or rule 21 or rule 28 or rule 31 shall be punishable with imprisonment for a term which may extend to two years or with fine which may extend to rupees five lakhs, or with both, and in the case of a continuing contravention, with additional fine which may extend to rupees fifty thousand for every day during which such contravention continues after conviction for the first such contravention."

3. In the said rules, in Schedule B, in Part III, in the table, for serial number III and the entries relating thereto, the following serial number and entries shall be substituted, namely: —

U. Notification NO.S.O. 4596(E). dated the 29th September, 2022—In exercise of the powers conferred under the second proviso to sub-section (1) of section 4 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957) and consequent upon accreditation provided by the National Accreditation Board for Education and Training of the Quality Council of India, the Central Government hereby notifies the following agencies as specified in the guidelines for notification of accredited private exploration agencies issued by the Government of India in the Ministry of Mines vide order no. M.VI-16/15/2021-Mines VI, dated the 12th August, 2021 (hereafter referred to as the said guidelines for notification of accredited private exploration agencies) for the purposes

Serial Number	Exploration Agency	Category of Exploration Agency
1	M/s Geo Exploration and MIning Solutions	A
2	M/s Geo Marine Solutions Pvt. Ltd.	B
3	M/s Ecomen Laboratories Pvt. Ltd.	A

of the said second proviso to sub-section (1) of section 4 of the said Act:

2. The agencies shall carry out prospecting operations in compliance with the conditions specified in the said guidelines for notifications of accredited private exploration agencies.

3. This notification shall come into force on the date of its publication in the Official Gazette and shall remain valid for a period of three years from the date of notification or till expiry or termination of the accreditation granted, whichever is earlier.

V. Notification NO.G.S.R. 736(E).dated the 12th October, 2023—In exercise of the powers conferred by sub-section (3) of section 9 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government hereby makes the following further amendments in the Second Schedule to the said Act, namely:—

2. In the Second Schedule to the Mines and Minerals (Development and Regulation) Act, 1957,—

(i) after item 28 and the entries relating thereto, the following item and entries shall be inserted, namely:—

"28A.	Lithium:	Three per cent. of London Metal Exchange price chargeable on the Lithium metal in the ore produced.";

(ii) in item 33, for the word "Monazite", the words "Monazite occurring in beach sand minerals" shall be substituted;

(iii) after item 34 and the entries relating thereto, the following item and entries shall be inserted, namely:—

"34A.	Niobium: (i) Primary (produced from ores other than Columbite-tantalite	Three per cent. of average sale price of Niobium metal chargeable onthe Niobium metal contained in the ore produced.
	(ii) By-product (produced from ores other than Columbitetantalite	Three per cent. of average sale price of Niobium metal chargeable on the by- product Niobium metal contained in the ore produced

(iv) after item 38 and the entries relating thereto, the following item and entries shall be inserted, namely:—

"38A	Rare Earth Elements (produced from ores other than Monazite occurring in beach sand minerals):	One per cent. of average sale price of Rare Earth Oxide (REO)chargeable on the Rare Earth Oxide contained in the ore produced.".

W. Notification No. G.S.R. 737(E), dated , the 12th October, 2023—In exercise of the powers conferred by section 13 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government hereby makes the following rules further to amend the Minerals (Other than Atomic and Hydro Carbons Energy Mineral) Concession Rules, 2016, namely:—

1. Short title and commencement.— (1) These rules may be called the Minerals (Other than Atomic and Hydro Carbons Energy Mineral) Concession (Amendment) Rules, 2023.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Minerals (Other than Atomic and Hydro Carbons Energy Mineral) Concession Rules, 2016,—

(i) in rule 44, after clause (i), the following clause shall be inserted, namely:—

"(ia) In respect of Lithium, the equivalent lithium metal prices calculated on the basis of the weekly prices of lithium hydroxide monohydrate or other appropriate compound of lithium published by London Metal Exchange in a month shall be multiplied by the reference rate for the day of publication of the Reserve Bank of India or any agency authorised by the Reserve Bank of India, for the currency in which the price is obtained.";

(ii) in rule 45, after sub-rule (4), the following sub-rule shall be inserted, namely:—

"(5)(a) The Indian Bureau of Mines shall publish average sale price of Rare Earth Oxide in Indian Rupees on the basis of prices published by United States Geological Survey (USGS) or other reputed publications by multiplying the price of Rare Earth Oxide by average reference rate of Reserve Bank of India for the month for the currency in which the price is obtained and in case the price of Rare Earth Oxide is not available on monthly basis, the average sale price shall be published on the basis of price of Rare Earth Oxide for the last available calendar year.

(b) The State Government shall arrive at average sale price of the ore containing Rare Earth Elements in the following manner, namely:—

Average sale price of the Rare Earth Elements	Sum of (percentage of individual rare earth ore containing oxide contained in the ore multiplied by average sale price of that rare earth oxide published by Indian Bureau of Mines).

6) The Indian Bureau of Mines shall publish average sale price of Niobium in Indian Rupees on the basis of prices published by United States Geological Survey (USGS) or other reputed publications for Ferro- Niobium for the last available calendar year by multiplying such price with the following, namely:—

(i) average reference rate of Reserve Bank of India for the said calendar year, and

(ii) the conversion factor of 1.59."

3. Status of Reconnaissance Permits, Prospecting Licences and Mining Leases in India

3,095 No. of mining leases are in force in the country in 22 States covering an area of 3,06,398.76 hectares	**92%** of Mining leases are in the Private Sector	**8%** of Mining leases are in the Public Sector

INTRODUCTION

Under the Mines & Minerals (Development and Regulation) Act, 1957 and the Minerals (Other than Atomic and Hydrocarbons Energy Minerals) Concession Rules, 2016, the State Governments would grant mineral concessions. Amineral concession" means either a reconnaissance permit, prospecting licence, mining lease, composite licence or a combination of any of these and the expression "concession" shall be construed accordingly.

A "reconnaissance permit" (for the holder of a reconnaissance permit which was granted prior to January 12, 2015) means a permit granted for the purpose of undertaking reconnaissance operations. Reconnaissance Operations means any operations undertaken for preliminary prospecting of a mineral through regional, aerial, geophysical or geochemical surveys and geological mapping, but does not include pitting, trenching, drilling (except drilling of boreholes on a grid specified from time to time by the Central Government) or sub-surface excavation.

A "prospecting licence"(for the holder of a reconnaissance permit which was granted prior to January 12, 2015) means a licence granted for the purpose of undertaking prospecting operations. Prospecting Operations means any operations undertaken for the purpose of exploring, locating or proving mineral deposit.

A "composite licence" means the prospecting licence-cum-mining lease which is a two stage concession granted for the purpose of undertaking prospecting operations followed by mining operations in a seamless manner.

Also the State Governments are required to submit a copy of every mineral concession granted or renewed under the Act and Rules made thereunder within two months of such grant or renewal to the Controller General, Indian Bureau of Mines and the Director General, Directorate General of Mines Safety under Rule 59 (1) of Minerals (Other than Atomic and Hydrocarbons Energy Minerals) Concession Rules, 2016. Additionally, the State Governments also have to submit a consolidated Annual Return of all mineral concessions granted or renewed under the Act and rules made thereunder to the Controller

General, Indian Bureau of Mines, in such form as may be specified for the purpose and a copy shall also be supplied to the Director General, Directorate General of Mines Safety under Rule 59 (2) of Minerals (Other than Atomic and Hydrocarbons Energy Minerals) Concession Rules, 2016 not later than the 30th day of June following the year to which the return relates.

RECONNAISSANCE PERMITS, PROSPECTING LICENCES AND COMPOSITE LICENCES

No information from the State Governments/ Union Territories is reported regarding grant of reconnaissance permit/ prospecting lincence/ composite licence for minerals (other than Atomic Minerals, Coal, Lignite, Petroleum, Natural Gas and Minor Minerals) during the period.

MINING LEASES

Section 3(c) of the Mines & Minerals (Development & Regulation) Act 1957 defines "Mining Lease" (ML) as a lease granted for the purpose of undertaking mining operations and includes a sub-lease granted for such purpose. The Act defines "mining operations" as any operations undertaken for the purpose of winning any mineral.

The status of mining leases of 40 Metallic and Non-metallic minerals (excluding Atomic Minerals, Coal, Lignite, Petroleum, Natural Gas and Minor Minerals) as on 31.3.2022 (P) indicates that 3,095 mining leases were in force in the country in 22 States covering an area of 2,78,008.94 hectares.

The statewise summary of existing mining leases as on 31st March 2020, 2021 and 2022 is detailed in Table-1. The mineral-wise summary of existing mining leases as on 31.3.2022 (P) is furnished in Table-2 .

Sectorwise distribution of mining leases as on 31.3.2022 (P) is furnished in Table-3. Areawise distribution of Leases (frequency in Hect.) as on 31.3.2022 (P) is furnished in Table-4.

The statewise break up of mining leases as on 31.3.2022 as reflected in Table-1 indicates that Madhya Pradesh was leading with 613 mining leases followed by Tamil Nadu (459), Gujarat (440), Andhra Pradesh (379), Karnataka (298), Chhattisgarh (175), Rajasthan (168), Maharashtra (130), Odisha (117), Jharkhand (100) and Telangana (80). These 11 States together accounted for about 96% of the total mining leases in force. Of the total mining lease area covered by different States, Madhya Pradesh aceuvnted for (13.61%), Rajasthan (12.42%), Odisha (12.18%), Karnataka (11.89 %), Gujarat (9.65 %), Chhattisgarh (9.43%), Andhra Pradesh (9.15%), Jharkhand (6.50%), Maharashtra (4.63%) and Telangana (3.68%). These ten States accounted for about 93.15% of the total mining lease area granted and the remaining 6.85% was accounted for by the rest of the 12 States.

During 2021-22, mining leases in force were in both Private and Public Sectors which included Central and State Government Undertakings. Out of the total 3,095 mining leases in force in the country, 2,858 (92%) mining leases with an area of 2,04,819.71 hectares (73.67%) are in the Private Sector and the remaining 237 (8%) with an area of 73,189.23 hectares (26.33%) are in the Public Sector.

In the Metallic Minerals, Ferrous group of minerals include iron ore, manganese ore, chromite, while the Non-ferrous group of minerals comprise bauxite, copper ore, lead & zinc ores, molybdenum, nickel, tin and the noble metals which include gold, silver and platinum group of metals. Mining Leases and Composite Licences granted through Auction during 2021-22 are purnished in Table-5.

Table-1 : Existing Mining Leases*as on 31st March 2020, 2021 and 2022 (P)

(By States)

State	as on 31.03.2020		as on 31.03.2021 (P)		as on 31.03.2022 (P)	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
India	**3437**	**312645.72**	**3314**	**306398.76**	**3095**	**278008.94**
Andhra Pradesh	403	27918.98	400	26743.81	379	25450.49
Assam	7	889.5	7	889.5	7	889.5
Bihar	1	53.38	1	53.38	1	53.38
Chhattisgarh	185	24593.89	181	25062.33	175	26210.55
Goa	15	2378.65	11	528.49	9	442.49
Gujarat	416	26821.1	415	27535.8	440	26836.82
Haryana	4	46.85	4	46.85	4	46.85
Himachal Pradesh	42	2459.78	42	2459.78	40	2448.58
Jammu & Kashmir**	37	1984.12	37	2020.43***	37	2020.43***
Jharkhand	146	21980.61	122	19902.95	100	18068.24
Karnataka	379	39116.01	313	34984.36	298	33047.05
Kerala	5	421.65	5	432.4	5	421.65
Madhya Pradesh	702	40555.4	714	44342.37	613	37838.75

State	as on 31.03.2020		as on 31.03.2021 (P)		as on 31.03.2022 (P)	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
Maharashtra	169	14106.03	164	14540.58	130	12872.74
Meghalaya	21	789.34	21	789.34	21	789.34
Odisha	172	55108.72	154	49587.23	117	33872.45
Rajasthan	195	33394.21	163	33561.83	168	34528.73
Sikkim	3	96.32	3	96.32	-	-
Tamil Nadu	464	9061.66	463	9170.16	459	9158.7
Telangana	84	10887.16	82	10485.4	80	10227.38
Uttar Pradesh	4	2960.19	4	2960.19	4	2579.56
Uttarakhand	7	191.79	7	191.79	7	191.79
West Bengal	1	13.47	1	13.47	1	13.47

** Excluding Atomic Minerals, Coal, Lignite, Petroleum and Natural Gas & Minor Minerals*
Source: Data received from various State Governments,
Respective State Government (DGMS/DMGS etc).
*** formed a new Union Territoty to be known as the Union Territory of Jammu & Kashmir vide Gazette Notification No. 53, New Delhi, the 9th August, 2019/Shravana 18, 1941 (Saka)*
**** Including mining lease in Ladakhh (U/T).*
Note:- The data received from respective Regional Offices of IBM have also been taken in account wherever necessary.
(P): Provisional

Table-2 : Existing Mining Leases* as on 31.3.2022 (P)

(By Minerals)

Sl. No.	Mineral	No. of Leases	Lease Area (ha)
1	Amethyst	2	5.83
2	Apatite	1	13.47
3	Bauxite	335	23817.25
4	Borax	1	159
5	Chromite	19	3293.07
6	Copper ore	9	3916.85
7	Diamond	2	275.96
8	Emerald	1	46.32
9	Epidote	1	4.05
10	Fluorite	10	326.24
11	Garnet	28	154.68
12	Gold	10	6934.49
13	Graphite	32	1342.11
14	Iolite	5	61.26
15	Iron ore	321	50142.48
16	Kyanite	14	231.11
17	Lead & zinc ore	11	7274.25
18	Limeshell	25	1072.15
19	Limestone	1856	160922.08
20	Magnesite	36	2313.54
21	Manganese ore	217	10503.8
22	Moulding sand	6	39.24
23	Perlite	1	144.88
24	Rock phosphate	7	1534.24
25	Rock salt	1	8.12
26	Sapphire	1	673.4
27	Semi-precious stones	16	255.04
28	Selenite	4	625.35
29	Siliceous earth	35	271.71

Sl. No.	Mineral	No. of Leases	Lease Area (ha)
30	Sillimanite	2	33.34
31	Stibnite	1	40.47
32	Tin	15	319.17
33	Vermiculite	55	951.3
34	Wollastonite	15	302.69
	Total	**3095**	**278008.94**

** Excluding Atomic Minerals, Coal, Lignite, Petroleum and Natural Gas & Minor Minerals*
Source: Data received from various State Governments
Note:- The data received from respective Regional Offices of IBM have also been taken in account wherever necessary.
(P): Provisional

Table – 3 : Existing Mining Leases* as on 31.3.2022 (P)

(By Sectors)

Sector	No. of Leases	Percent (%)	Area (ha)	Percent (%)
Total	**3095**	**100**	**278008.94**	**100**
Public	237	7.66	73189.23	26.33
Private	2858	92.34	204819.71	73.67

**Excluding Atomic Minerals, Coal, Lignite, Petroleum and Natural Gas & Minor Minerals*

Source: Data received from various State Governments

Table-4 : Areawise Status of Lease (Frequency In Hect.) (Other than Atomic, Hydrocarbons Energy & Minor Minerals)

as on 31.3.2022(P)

(All India)

Frequency In (ha)	No. of Leases	Lease Area (ha)
0 to 2	378	488.02
>2 to 5	859	3329
>5 to 10	365	2689.51
>10 to 20	332	4857.11
>20 to 50	397	12978.39
>50 to 100	233	16819.7
>100 to 200	180	25805.24
>200 to 500	196	64065.23
Above 500	155	146976.74
Total	**3095**	**278008.94**

Source:- Respective State Government (DGMS/DMGS ete).

Note:- The data received from respective regional offices of IBM have also been taken in account wherever necessary.

(P): Provisional

Table 5:- Mining leases and Composite Licenses Granted through Auction during the Year 2021- 22.

(All India)

S. No.	State	Name of the Block	Mineral	Date of auction	ML/CL	Area (In Ha)
1	Andhra Pradesh	Gorlagutta	Limestone	27.05.2021	ML	181.03
2	Andhra Pradesh	Devada Block	Mangnese	04.10.2021	ML	81.95
3	Andhra Pradesh	Gutupalli, Kurnool	Iron Ore	26.10.2021	ML	29.75
4	Andhra Pradesh	Veldurthy Iron Ore Block	Iron Ore	15.03.2022	ML	22.044
5	Chhattisgarh	Kathiya-Pachri Block	Limestone	11.10.2021	ML	323.332
6	Chhattisgarh	Nahardih-Maghaipur	Limestone	12.10.2021	ML	365.252
7	Gujarat	Mevasa	Bauxite	12.05.2021	ML	8.73
8	Gujarat	Satpara	Bauxite	07.05.2021	ML	5.54

S. No.	State	Name of The Block	Mineral	Date of auction	ML/CL	Area (In Ha)
9	Gujarat	Lamba	Bauxite	11.05.2021	ML	6.63
10	Gujarat	Jodhpur Study Area	Limestone	17.02.2022	ML	30.097
			& Marl			
11	Gujarat	Harsol Block-1	Limestone	17.02.2022	ML	6.28
			& Marl			
12	Karnataka	Hanamaneri	Limestone	10.12.2021	ML	730
13	Karnataka	Ravur	Limestone	09.12.2021	ML	430
14	Karnataka	ML No. 2584 M/s Auro Minerals	Iron Ore	21.02.2022	ML	32.05
15	Karnataka	ML No. 2586 M/s Gogga	Iron Ore	19.01.2022	ML	15025
		Gurushanthaiah and Brothers				
16	Karnataka	Bommanalli	Limestone	14.01.2022	ML	500
17	Karnataka	AjjanahalliTumakuru	Gold	28.03.2022	CL	9.49
18	Karnataka	Diggaon	Limestone	23.03.2022	ML	786.32
19	Karnataka	Belagatta, Chitradurga	Gold	30.03.2022	CL	2501.58
20	Karnataka	M/s Tiffin Barytes Asbestos &	Iron Ore	03.02.2022	ML	191.3
		Paints Ltd, ML No 2293				
21	Madhya Pradesh	RamstahnGhunchihai Block	Limestone	13.07.2021	ML	1917.15
22	Madhya Pradesh	Jamuwantikala	Limestone	07.01.2022	ML	6.313
23	Madhya Pradesh	Tikar, Distt. Rewa	Bauxite	04.01.2022	ML	26.77
24	Madhya Pradesh	Mardeora, Distt.	Rock	05.01.2022	ML	9.951
		Chhatarpur	Phosphate			
25	Maharashtra	Kurai	Limestone	11.01.2022	ML	480.8
26	Maharashtra	Hivra	Manganese	11.01.2022	ML	6.9
27	Maharashtra	Girola(Jamdi)	Kyanite	11.01.2022	ML	6.55
28	Maharashtra	MandriPanchala	Manganese	11.01.2022	CL	44.77
29	Maharashtra	Dongargaon Block	Limestone	31.03.2022	ML	252.36
30	Maharashtra	Chikhalgaon (West) Block	Bauxite	31.03.2022	ML	21.87
31	Maharashtra	Bidwadi Block	Graphite	31.03.2022	ML	157.02
32	Maharashtra	Ajgaon Block	Iron Ore	31.03.2022	CL	840
33	Maharashtra	Ghanpur Mudholi (West)	Copper & Gold	31.03.2022	CL	917.42
34	Odisha	Nadidih Iron Ore	Manganese	16.09.2021	ML	117.21
		Iron Manganese Block(Feegrade)				
35	Odisha	Kasia Iron Ore &	Iron Ore	16.09.2021	ML	194.19
		Dolomite Block	& Dolomite			
36	Odisha	Nadidih Iron Ore Block (BICO)	Iron Ore	16.09.2021	ML	74.5
37	Odisha	Chandiposhi Iron Ore Block	Iron Ore	16.09.2021	ML	131.58
38	Odisha	JumkaPathiriposhi	Iron Ore	16.09.2021	ML	158.509
		Pahar Iron Ore Block				
39	Odisha	Dholtapahar Iron Ore Block	Iron Ore	16.09.2021	ML	60.51
40	Odisha	Gandhalpada Iron Ore Block	Iron Ore	16.09.2021	ML	241.1
41	Odisha	NetrabandhaPahar (West)	Iron Ore	16.09.2021	ML	74.37

S. No.	State	Name of The Block	Mineral	Date of auction	ML/CL	Area (In Ha)
42	Odisha	Pureibahal Block	Iron Ore	04.10.2021	ML	64.337
43	Odisha	BeheraBhanjipali Limestone Block	Limestone	29.03.2022	ML	119.143
44	Odisha	Naringpanga Graphite Block	Graphite	29.03.2022	ML	4.3
45	Rajasthan	Rata-Mandha-1A(RM-1A)	Limestone	16.12.2021	ML	420
46	Rajasthan	Harima Pithasar Nagaur, Blocks 3D2	Limestone	20.12.2021	ML	424.086
47	Rajasthan	Gothra-Parasrampura West block	Limestone	24.01.2022	ML	287.754
48	Rajasthan	Block- 3C-1 n/v Deh-Harima	Limestone	27.01.2022	ML	300.75
49	Rajasthan	Block- 3C-2 n/v Deh-Harima	Limestone	28.01.2022	ML	386.02
50	Rajasthan	Gothra-Parasrampura East block	Limestone	25.01.2022	ML	460.4
51	Rajasthan	SindwariChariya Block A	Limestone	16.02.2022	ML	203.55

4. Exploration & Development

The National Mineral Policy 2019 has proposed to increase production of Major Minerals by 200% in 7 years and to reduce trode deficit in Mineral Sector by 50% in 7 years

12,393.1
sq. km, Large-scale mapping were conducted by GSI in 2020-21

200.11
sq.km Detailed mapping were carried out by GSI, 2021-22

1,54,937
m, Drilling were carried out by GSI, 2021-22

NATIONAL MINERAL POLICY

The Hon'ble Supreme Court in its judgment dated 02.08.2017 in the Writ Petition (Civil) No.114 of 2014 inter alia directed the Union of India to revisit the National Mineral Policy (NMP), 2008 and announce a fresh and more effective and meaningful policy.

In compliance with the directions of the Hon'ble Supreme Court, Ministry of Mines (MoM) vide its Order No. 15/1/2017-MV dated 14.08.2017 had constituted a Committee. The Committee included representatives from Central Ministries, State Governments, Industry Associates, Professional Bodies and it also consulted NGOs and many other Stakeholders. The Committee went about the consultative process with problem-solving approach and held four meetings wherein exhaustive discussions on the issues raised by the stakeholders were deliberated.

The Committee submitted its report to the Ministry on 31.12.2017. Based on the report submitted by the committee, Ministry of Mines prepared a draft National Mineral Policy (NMP), 2018 and uploaded it on the official website of the Ministry on 10.01.2018 for seeking comments/ suggestions from the stakeholders.

Based on the Committee's Report and the inputs received from stakeholders during subsequent consultations, the Ministry of Mines prepared the National Mineral Policy 2019. The Union Cabinet in its meeting held on 28.02.2019 approved the "National Mineral Policy 2019". The salient features of the "National Mineral Policy 2019" are as follows:

- It proposes to increase the production of major minerals by 200% in 7 years. It also proposes to reduce trade deficit in Mineral Sector by 50% in 7 years.
- It aims to attract private investment through incentives like financial package, right of first refusal at the time of auction etc. or any other appropriate incentive as per international practice.
- Introduces the concept of Exclusive Mining Zones having in-principle statutory clearances for grant of mining lease. It also proposes to identify critically fragile ecosystem and declare such areas as 'no-go areas'/inviolate areas.
- It emphasises implementation of all relevant Acts/Rules related to rehabilitation & resettlement and welfare of tribal communities while grant of mineral concessions.

- Encourages States to auction mineral blocks with pre-embedded statutory clearances.
- To institutionalise the mechanism for ensuring sustainable growth of Mining Sector, an interministerial body is proposed.
- Endeavors shall also be made to grant mining the status of Industry.
- In case of small deposits of precious metals and base metals, the establishment of common smelting and refining facilities shall be encouraged.
- It seeks to align downstream regulations for the exploration, development and acquisition of overseas mineral assets for ensuring its adequate supply which are not available in the country.
- It focuses on a long-term export-import policy for the Mineral Sector to provide stability for investing in large-scale commercial mining activity.
- Efforts shall be made to benchmark and harmonise royalty and all other levies and taxes with mining jurisdiction across the world.
- It also introduces the concept of Inter-Generational Equity which is also recognised by the Hon'ble Supreme Court in various judgments.

MINERAL INVESTIGATIONS & EXPLORATION

Geological Survey of India (GSI)

Geological Survey of India (GSI) is an attached office of Ministry of Mines (MoM) and is responsible for mineral resource assessment of the country in addition to the updation of national geoscience information. Natural resource assessment is achieved through the mineral investigations and exploration by acquisition of surface and sub-surface data along with the available geoscience data, i.e., baseline geoscience data.

The exploration programmes of GSI for the field Season 2021-22, were prioritised based on the recommendations of CGPB meeting, CGPB committee meetings & SGPB meetings of different States and time to time guidelines received from MoM.

Mission II: Natural Resources Assessment is categorised into

1. Mission IIA: Mineral Resource Assessment (Non-energy)
2. Mission IIB: Natural Energy Resources (Coal, lignite, shale gas, geothermal etc.)

During FS 2021-22, a total of 251 programmes (including 11 exploration programmes of M&CSD) were taken up under Mission-II. The target vis-à-vis achievement made under Large-scale Mapping (LSM), Detailed Mapping (DM) and drilling pertaining to FS 2021-22 is tabulated as below:

The details of exploration work carried out by GSI and DMG, Rajasthan; NMDC; Hutti Gold Mine & GMDC are furnished in Tables-1 & 2 respectively.

Activity	Target	Achievement
LSM (sq. km)	10,000	12393.10
DM (sq. km)	120	200.11
Drilling (meter)	1,30,000	154957.30

Table 1- Exploration Carried out by GSI 2021-2022

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Chhattisgarh, Balrampur	Burhabagicha area	1:12500	100 sq. km	-	-	Mapping, Samp-ling	A G-4 stage exploration for base metal and associated minerlisation was carried out in Burhabagicha area, Balrampur District, Chhattisgarh. About 169 samples (101 bedrock, 50 pit/trench and 18 of stream sediment) were collected for trace element analysis, 23 for petrochemical studies and 45 for PS/SEM/OM studies. The area around Burhabagicha encompasses supracrustals of meta-volcano sedimentaries, meta-sedimentaries, meta-basics and granitoids. Acid- to intermediate- metavolcanic is the host rock for sulphide mineralisation. Oxidised zone was developed between west of Chilma and Kotaghna through Burhabagicha. Sphalerite and galena associated with pyrite were 40µm to 400µm and 2µm to 30µm in size. The values of Cu in acid to intermediate metavolcanic bedrocks ranged from 10 ppm to 90 ppm. Pb ranged from <10–140 ppm and Zn ranged from 10 ppm to 200 ppm. Ni <10 ppm to 170 ppm, Co <10 ppm to 30 ppm and Cr <10 ppm to 59 ppm in the host rock. Similarly, Ag values between <1 ppm and 3 ppm and Cd values <10 ppm were found in the yield. Au value in this unit was recorded <50 ppb. As in it ranged from 2 ppm to 749 ppm.
Maharashtra, Gadchiroli	Chamorshi, Kurul, Bhiwapur area	1:12500	100 sq. km	-	-	Mapping, Sampling	A G-4 stage exploration for copper and associated base metal was carried out in this area. The investigation area was located in the southwestern part of Bastar Craton (BC) (G-). A NNW-SSE trending mineralised quartz reef located about 2 km north of Chamorshi town was approximately 1 km long and 30 to 50 m wide with a dip of 60° to 65° towards west. Mineralisation was observed in the form of pyrite, chalcopyrite and bornite along with secondary ores of malachite and azurite. The chemical analysis results of BRS from the Chamorshi quartz reef (n=45) indicated copper concentration ranging from 50 to 3,700 ppm (Avg.= 655 ppm). Channel samples showed copper values were ranging from 410 to 3,100 ppm (Avg.= 1,204 ppm). Overall analytical results indicate a higher concentration of copper in bedrock samples. Owing to the encouraging results of the bedrocks samples, the Chamorshi quartz reef with strike length of 1 km length and 30 to 50 m width was labelled most potential mineralised reef in the area.
Maharashtra, Chandrapur	Tambegadi-Pathari area	-	1.5 sq. km	2	285 m	Mapping, Sampling, Drilling	Investigations with an objective to establish copper and associated mineralisation (G3) involved detailed geological mapping of 1.5 sq. km. covered around Tambegadi and Pathri blocks. The Bengpal gneiss in the area is feebly mineralized intermittently in the form of pyrite, galena and minor chalcopyrite. Two boreholes (MHCT-1, 2) with cumulative drilling of 285 m were completed in Tambegadi block. All the boreholes were planned at 60m vertical depth of intersection and 200 m strike spacing. Boreholes MHCT-1, 2 did not intersect any significant mineralisation. Mineralisation was seen to be confined to 250m x 120m zone in the Tambegadi block within the ferruginised basement granite gneiss. Mineralisation intermittently occurred with diminishing nature in lateral and also depth extent within this zone. However, it was observed from drill core analysis that the mineralisation was purely confined to the upper oxidative surficial level of not more than 40m in both the borehole cores. Mineralisation in the sub-surface was observed to be insignificant to almost non-existent. This was confirmed by chemical analytical results of borehole core samples. Demarcation of clear zones was not possible in this case due to lack of proper concentration and lateral continuity along the strike.
Madhya Pradesh, Jhabua	Balhati-Hiri Chhota-Chotyabarari-Burkui Badi area	1:12500	1.5 sq. km	-	-	Mapping, Sampling	The objective of the work (G4) was to search for copper and associated scandium, vanadium mineralisation in the Deccan basalts. During the field visit, 100 BRS, 30 PTS, 50 Soil samples and 15 PCS were collected from the study area. The BRS collected from the study area showed highest value of 388 ppm of Cu over Flow number 3-4 of Kalisindh Formation near Dhamoi. Highest value of Vanadium as 441 ppm was reported from the contact zone between Kalisindh Flow 1 and Flow 2 near Hiri Bada. Anomalous values for Cu (270–345 ppm) were recorded from the soil zones developed over the Flow 1 of Kalisindh Formation near Balhati-Hiri Bada areas.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Madhya Pradesh, Alirajpur District	Kosduna South Block	1:2000	1.5 sq. km	4	471.0 m	Mapping, Sampling, Drilling	Kosduna South block reveals presence of Phyllite, Biotite Granite, Sheared Quartz veins and calcareous gritty, pebbly sandstone, and fossiliferous limestone of Bagh group. Both phyllite and Biotite granite is intruded by sheared quartz veins. These quartz veins showed evidence of copper mineralisation in the form of malachite stains and at places very fine specks of pyrite and chalcopyrite was also noticed. During FS 2021-22 under G-3 stage exploration, a total of 471.0 m drilling with 4 boreholes of 1st levels were drilled across the mineralised quartz vein at 200 m strike spacing to intersect the mineralisation at 60 m vertical depth. Based on the chemical analyses of drilled boreholes data, it was found that the grade of Cu mineralisation was poor in Kosduna South block. Analytical results of core samples showed <0.1 % Cu. The Cu values were not significant in core samples, BRS/ Channel samples as well as in PTS samples. Dominantly dissemination and specks of pyrite were noticed both in chlorite schist and quartz veins along with rare to occasional occurrence of chalcopyrite mineralisation. The mineralisation is very sporadic in nature and irregular in habit. Due to poor mineralisation in the block, the project was prematurely closed as per recommendations/ suggestions from competent authority.
Madhya Pradesh, Dewas	Saktia, Bagda and Biloda Block	-	-	-	270m	Sampling, Drilling	Dewas District comprised three blocks, namely, Saktia block (0.75 sq. km), Bagda block (1.0 sq. km) and Biloda block (0.75 sq. km). In Saktia block, promising base metal mineralisation (G3) was observed in association with smoky quartz vein which was found intruding into grey top ink medium-grained granite near contact with porphyritic granite. Channel sampling yielded two-meter zone in Ch-1 (Cu–7,880 ppm, Pb–2,430 ppm & Cu–5555 ppm, Pb–900 ppm) and one meter mineralisation in Ch-2 Cu–5,800 ppm, Pb–5820 ppm. MPDSB-1 was drilled up to a depth of 140 m which intersected the mineralisation at 60m vertical depth. Three small zones of mineralisation intersected in MPDSB-1, Z-I (56.5 m–57 m) having (0.1% Cu, 0.4% Pb & 0.23% Zn), Z-II (73.30 m–74.30 m) having 0.13% Cu, 0.47% Pb & 0.8% Zn), Zone-III (81.57 m–82.27 m) having (0.85% Cu & 0.40% Pb). Bedrock spot sample from the quartz vein yielded Cu–50 ppm to 395 ppm, Pb–505 ppm to 1.01% and Zn–980 ppm to 2,620 ppm with 25 ppb to 360 ppb of gold value. Based on the above background values, first Borehole MPDBB-1 was carried out in Bagda block aimed at intersecting quartz vein. A 2-meter zone (84.40 m–86.40 m, of 0.71% Zn) was encountered in the borehole. The quartz vein showed a few disseminated and sporadic specks of chalcopyrite, galena and pyrite. First Borehole MPDCB-1 was carried out in Biloda block aiming to intersect the quartz vein at first level and was drilled up to a depth of 130 m. The borehole data showed granite veins in the form of tongue and apophyses intruding into chlorite schist along with thin quartz veins. Pyritiferous zone was observed from 63 m–95.15 m depth with disseminated, occasional and sporadic grains of chalcopyrite.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Madhya Pradesh, Betul	Biskhan Block	-	1.28 sq. km	13	2010 m	Mapping, Sampling, Drilling	In G-2 stage investigations, a total of 2,010 m drilling were carried out in 13 boreholes to assess the potential of remaining geochemical anomaly and to intersect already drilled boreholes of FS 2016-17 systematically at 120 m vertical depth of the geochemical anomaly to enhance ore resource in Biskhan block, Betul District, MP. Besides drilling, 40 cu.m pitting with 40 trench samples, 551 core samples, and 05 samples for SEMEDX. 10 L km geophysical mapping by SP, IP and magnetic method and geophysical logging of all boreholes were carried out in extended Biskhan block. Sulphide mineralisation comprising pyrite, sphalerite, pyrrhotite and occasional chalcopyrite occurred in the form of dissemination, streaks and occasionally thin veins associated with garnet. The borehole data indicated that the intersected ore bodies showed irregular distribution of ores with pinch and swell structure along the strike as well as depth. In Biskhan extended block, where G2 stage investigation was carried out over 1.28 sq. km area, ore resource was estimated with the help of cross-section method and LV method based on the data from the 39 boreholes at 1 % Zn cut off. The resource estimated by cross-section method at 1% Zn cut off was 33,82,833.688 tonnes or 3.383 million tonnes with an average grade of 1.136% Zn and average width of 10.25 m in three mineralised zones over 1.28 sq. km area. The reserve estimated by LV method at 1% Zn cut-off was 29,29,917.669 tonnes or 2.93 million tonnes with an average grade of 1.14% Zn and average width of 10.25 m in three mineralised zones over 1.28 sq. km area.
Madhya Pradesh, Balaghat & Chhattisgarh, Rajnandgaon	Ramgarhi, Pathratola and Rol village parts	1:12,500	100 sq. km	-	-	Mapping	The objective was to identify and delineate Cu and associated mineralisation (G4) in the area and to study mineralogy, geochemistry, mode of occurrence of Cu mineralisation. The study area showed evidence of hydrothermal alteration in the form of epidotisation, chloritisation, sericitisation and potassic alteration in granites, however no zonation in alteration was observed. Surface indications of mineralisation included disseminations of chalcopyrite, pyrite, bornite, molybdenite and malachite stains in pink granites and oxidised coatings on brecciated quartz reef. Based on incidences of surface mineralisation four areas - near SE of Salghat, Sudhintola, Sivani and Pathratola were demarcated as potential zones for base metal mineralisation.
Madhya Pradesh, Shahdol and Sidhi	Parsili-Tal-Karmahi area	1:12,500	100 sq. km	-	-	Mapping, Sampling, Pitting, Trenching	Large-scale mapping, Bedrock samples (100), Petrochemical samples (50), Petrological samples (20), stream/soil samples (25), EPMA (10), PGE (15) and Pitting/Trenching samples (25) were collected and sent for chemical analysis (G4). Partially received analytical results revealed positive encouraging values of Cu, Ni, and Cr which ranged from <10 ppm to 3050 ppm, <10 ppm to 860 ppm, and <10 ppm to 0.48% respectively. BRS sample collected from laterite showed Vanadium value at 710 ppm. PCS samples collected from laterite showed value of Vanadium at 1,753 ppm & 36.87% Al_2O_3, PCS sample collected from reddish-brown tuff showed Vanadium value at 792 ppm & 23 % Al_2O_3, PCS sample collected from purple friable banded rock showed Al_2O_3 value as 16.41% & 12.17% K_2O, PCS collected from gabbro showed Cr value at 3,524 ppm & 450 ppm Ni, PCS collected from mafic-ultramafic near Parsili showed 3,611 ppm Cr & 462 ppm Ni.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Madhya Pradesh, Dewas District	Tipras area	1:12,500	-	-	-	Mapping, Sampling	The study area comprises of metavolcano sedimentary sequence of the Mahakoshal Group, Harda Granitoids and chert breccia along with stromatolitic as well as non-stromatolitic dolomite of Bijawar Group. The host rock of base metal mineralisation (G4) showed smoky grey quartz vein having dimension 70 m in length and 15 m width and was observed generally trending in east-west direction as intrusive body into medium-grained monzogranite near the contact with porphyritic granite. The surface manifestation for copper mineralisation was present in the form of stains of malachite along the fracture planes. Stain of malachite, usually found along the weak planes, suggest that the precipitation of secondary Cu mineral may have formed due to interaction of fresh sulphides with fluids and precipitated along the fracture planes. Chalcopyrite and galena were present in disseminated form in the quartz vein. In some other places, in Masuriya area, base metal mineralisation was observed near the contact of metasediment of Mahakoshal Group and foliated Hard granitoid, near Gaulaguthan, mineralisation indication was observed near the contact of foliated diorite of Harda granitoids and metasediment of Mahakoshal Group but their values of Cu, Pb and Zn did not show as promising as to be a mineralised zone. Chemical analysis results revealed Cu values varing from 520 ppm to 945 ppm from the 70 m*15 m Tipras quartz vein showed lead values less than 5 ppm and zinc values less than 20 ppm. Also, value of Ni (25 ppm to 56 ppm), Zn (20 ppm to 140 ppm), and Co (20 ppm to 35 ppm) in the Diorite. In this area trench and soil sampling were also carried out but values from both types of sampling showed less than 100 ppm.
West Bengal, Purulia District	In and around Kunchia	-	-	-	-	Sampling	Sulphide mineralization is noted only in Dalma Group of rocks, in which carbon phyllite contains more sulphide mineralization than any other lithounits. Sulphide minerals were found to be more abundant in the country rock i.e., carbon phyllite than those in quartz veins. Mineralised (G4) quartz veins were very thin, discrete, colourless showing parallel relationship with the main foliation (315°/45° towards 225°). Disseminated specks of arsenopyrite, chalcopyrite and bornite were observed in meta-basalt along Mirgichami-Rajagram road section. Malachite stains were observed in volcanic agglomerates exposed west of Kumaridih, where the country rock was highly sheared. Variolite basalt exposed south of Balidiha area was found to contain pyrite specks and disseminations. Outcrops of amphibolite containing chalcopyrite also showed malachite stains at places near Village Bangri.
Jharkhand, East Singhbhum District	In and around Kunchia	-	-	-	-	Sampling	The area (G4) exposed carbon phyllite, amphibolite/meta-gabbro, meta-basalt, amygdular basalt, variolite basalt, talc tremolite schist, meta- ultramafite, volcanic agglomerate, quartzite, chlorite schist and calc-silicate of Dalma Group and garnetiferous mica schist, staurolite-bearing garnetiferous mica schist and chlorite phyllite of Chaibasa Formation of Singhbhum Group. Sulphide mineralisation was noted only in Dalma Group of rocks, in which carbon phyllite contained more sulphide mineralisation than any other lithounits. Streaks and stringers of arsenopyrite, chalcopyrite, bornite, pyrite and pyrrhotite were noted in carbon phyllite and also in quartz veins present within carbon phyllite in Shisda, Doledih, Dulardih, Gobarghusi and south of Karakata along Jora Nala section. Groove samples were collected from the visible specks of sulphides present in carbon phyllite and trench samples were collected to know the extension of the mineralised zone.
Jharkhand, Palamau District	Sokra- Chando area	-	-	-	-	-	Hornblende biotite granite gneisses, garnet biotite gneiss, foliated alkali-feldspar granites and its coarse-grained variety were the major rock types found in the area. Garnet biotite gneiss was the most deformed rock overlaid by hornblende biotite granite gneiss. Calcsilicate/ Ferrugenous Quartzite/Amphibolite were seen to have wavy erosional contact with biotite hornblende granite gneiss. Foliated alkali feldspar granite was observed to have intrusive contact. Kyanite-Magnetite Schist, Dolomite and graphite with quartz veins were associated along shear planes and have sheared contact with other rocks. Mineralisation (G4) was found in the form of en-echelon hydrothermal veins mostly associated with calc-silicate (magnetite mineralisation) and quartz veins (graphite mineralisation).

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Odisha, Mayurbhanj District	Kesharpur East block	-	-	-	2243.55 m	Mapping, Sampling, Pitting, Trenching	During the investigation 10 cu m pitting and trenching were carried out with collection of 335 CS, 10 PS, 10 OM., 10 XRD, 10 EPMA, 10 sulphur isotope and 10 fluid inclusion samples for petrographic and other laboratory studies. Different rock types exposed in the area were quartzite, hornblende biotite schist, augen gneiss, hornblende granite gneiss, leucogranite and dolerite with numerous quartz veins. The surface manifestation of mineralisation (G2) in the area was in the form of old workings, malachite and azurite stains. Surface investigation trenching was carried out along the borehole profile lines perpendicular to the strike to expose the host rock across the mineralised zone. The analytical results of trench varied from 79 ppm to 9,230 ppm. During FS 2020-22, total of 15 boreholes were drilled and the average thickness of sulphide zone was 40 m but varied from 15 m to 80 m. The cumulative thickness of copper lode intersected was 26.20 m. The average grade of Cu varied from 0.25% to 1.26% and thickness varied from 2.20 m to 22.65 m.
Odisha, Mayurbhanj District	Nimaidihi block	-	-	-	-	Sampling, Pitting, Trenching	On the basis of surface indications of mineralisation (G3) and pitting/trenching over 71cu.m and lodes intersected in boreholes drilled in FS 1971-77, a copper mineralised zone (MZ-I) with approximate strike length of 500 m and average width of 5m–35m (with partings in between) was delineated in the central part of the block. The average grade of the zone was around 0.2% Cu. In the northern part, two copper mineralised zones were delineated. In FS 2021-22 and FS 2022-23 (spillover), a total of 626.15 m drilling were carried out in four first level boreholes ODND-1, ODND-2, ODND-3 and ODND-4. The borehole ODND-1 has intersected mineralisation zone from 71.60 m to 78.50 m i.e.,6.90 m (0. 1% to 0.2% Cu (V.E.), from 78.50 m to 96.00 m i.e., 17.50m (0.2% to 0.3% Cu (V.E.) and 86 m to 91.40 m i.e., 5.40 m×0.33% Cu (part analysis), and from 96.0 m to 102.0 m i.e., 6.0 m (0.1% to 0.2% Cu (V.E.) in the form of specks, stringers, disseminations, vein filled and foliation parallel chalcopyrite and pyrrhotite. The Borehole ODND-2 intersected mineralisation zone from 67.40 m to 70.90 m i.e., 3.50 m, 75.40 m to 82.10 m i.e., 6.70 m, 87.10 m to 90.10 m i.e., 4.10 m, 109.0 m to 111.50 m i.e., 2.50 m, 115.0 m to 127.25 m i.e., 12.25 m, 130.30 m to 147.50 m i.e., 17.20 m and 154.60 m to 159.60 m i.e., 5.0 m with 0.1% to 0.3% Cu (V.E.) and 119.60 m to 121.60 m i.e., 2.0 m × 0.39% Cu value (part analysis). The Borehole ODND-3 intersected mineralisation zone from 109.50 m to 113.10 m i.e., 3.60 m (0.2% to 0.5 % Cu (V.E.), 125.0 m to 129.30 m i.e., 4.30 m and 133.70 m to 153.75 m i.e., 10.05 m with 0.1% to 0.2% Cu (V.E.) in the form of massive, chunk, cluster
							and vein filled pyrrhotite and chalcopyrite. The Borehole ODND-4 intersected mineralisation in the form of specks, disseminations, vein filled, stringers of chalcopyrite with pyrrhotite from 46.56 m to 76.67 m i.e., 30.11 m (0.1% to 0.3% Cu (V.E.) and 123.95 m to 127.95 m i.e., 4.0 m (0.2% to 0.4 % Cu (V.E.).
Odisha, Bolangir District	Ampali-Badipura -Saintala area	1:12500	60 sq. km	6	446.0 m	Mapping, Drilling, Sampling, Pitting, Trenching	During investigation 46 channel samples, 53 Pit/Trench samples, 21 Regolith samples and 37 core samples were collected. The occurrence (G4) of lead ore as stringers and specks of galena in a brecciated quartz vein at Badipura and Jalorpadar area were observed. The old workings near Badipura and Jalorpdar area for galena observed well within the brecciated quartz veins, on surface old working pits were of roughly 15 m X 20 m and 25 m X 20 m in dimension respectively. Channel sampling was carried out on the brecciated quartz veins and allanite-fluorite rock and sent for chemical analysis to test its potential for base metal and REE mineralisation respectively. The analytical results of channel samples (7) of allanite-rich rock showed total REE ranging from 12.60% to 14.29% and it showed an enrichment of LREE mostly La and Ce up to a value of 5.15% and 6.10% respectively while it was remarkably low in HREE which ranged from 398.71 ppm to 437.32 ppm. In almost all the boreholes, the brecciated zone were intersected and specks of sulphides mostly pyrite and few chalcopyrites were observed. In borehole 4.0 m thick sulphide zone consisting of pyrite and chalcopyrite in khondalite was observed.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Meghalaya, East Khasi Hills District	Mawlyndep to Mawmin-Nongbsap villages	1:12,500	50 sq. km.	-	-	Mapping, Sampling, Pitting, Tenching	During the investigation, pitting/trenching of 50 cu.m, 118 bedrock sampling and 50 soil samplings in the surrounding of Barapani Shear Zone (G4) were carried out. Bedrock samples from Carbonaceous phyllite, calc-silicate, meta-volcanoclastic and quartz veins showed >100 ppm As values and maximum up to 2,954 ppm in quartz vein. Sample collected from carbonaceous phyllite and calc-silicate rock showed >250 ppm Zn values and a maximum of up to 3,028 ppm Zn in one sample from calc-silicate rock. Samples from carbonaceous phyllite showed TiO_2 concentration at 4.47 and 5.06 % whereas samples from laterite showed 7 and 7.17 % TiO_2. Samples collected from meta-volcanoclatsic, meta-rhyolite, calc-silicate, quartz vein and carbonaceous phyllite showed Li content as >20 ppm and a maximum of up to 57 ppm in meta-volcanoclatic. About 29 bedrock samples collected from meta-volcanoclastic, carbonaceous phyllite, and calc-silicate showed Cs content as >10 ppm and a maximum of up to 23.31 ppm in meta-volcanoclastic and 23.01 ppm in carbonaceous phyllite. Scanning electron microscopic (SEM) showed, arsenopyrite, pyrrhotite, pyrite, colevllite, galena, chalcopyrite and LREE-bearing carbonate and phosphate phases.
Meghalaya, East Garo Hills District	Jalwagiri and Gambil area	1:12,500	-	-	-	Mapping	The main objective of the large scale mapping was to assess the potentiality of base metal mineralization in a thin body of calc silicate rock in and around Rongge village, East Garo Hills District, Meghalaya. The biotite and augen gneisses form a major part of the gneissic complex (G4). These were found intruded by Late Proterozoic porphyritic granite, pegmatite and Cretaceous dolerite dykes. The calc-silicate bodies trends ENE-WSW, with maximum dimension of 250 m x 5 m, near Village Rongge and 100 m x 5 m in Bongsi Dogru in the northern part. The occurrence of the minor sulphide mineralisation was seen structurally controlled along fold hinges. Blue staining of covellite along the trace of axial plane within the thin amphibolite bands and within the pegmatite veins was recorded. Sulphide mineralisation and covellite staining were also observed within the central part of the amphibolite band that swerves from NW-SE to NE-SW strike from south to north. At the north eastern part just in Village Rongge, thin band of calc-silicate rock was observed at the extreme north-eastern part of the mapped area with profuse development of sulphide mineralisation. The identified sulphide minerals were mainly pyrite, chalcopyrite and arsenopyrite. Outcrops of mineralised calc-silicate body with rib and groove structures showed apparent gossanisation. The trend of the mineralised body was NE-SW and was traced over a strike length of 250 m (which may continue) with 5 m width.
Uttarakhand, Pithoragarh District	Askot- Thal area	1:12,500	50 sq. km.	-	-	Mapping, Sampling, Pitting, Trnching	Investigation at Thal and Askot area of Pithoragarh District, Uttarakhand was conducted to assess the base metal and gold mineralisation (G4) potentiality of the study area. The area comprised rocks of Paleoproterozoic Age belonging to Lesser Himalayan Crystalline and Mesoproterozoic Age of Garhwal Group of rocks. Lithounits included gneissic rocks of granitic composition and quartzite, amphibolites, phyllite, schist, impure dolomite and limestone of Berinag and Pithoragarh Formation. Systematic bedrock and pitting-trenching sampling were carried out. A total of 150 bedrock samples (BRS), 50 pitting / trenching samples, 20 heavy mineral samples, 13 petrochemical samples, 38 petrographic samples and 10 ore microscopic samples were collected. Analytical results of Cu, Pb, Zn and Au were found varying from <5 to 597ppm, <20 to 198ppm, <5 to 711ppm & <0.05 to 1ppm respectively. The total 10-line km of surface induced potential (IP), self-potential (SP), resistivity and magnetic geophysical survey were carried out to identify areas of interest that stands out with the surficial minerallisation evidence and chemical results. Signature of high chargeability and low resistivity with prominent low negative SP anomaly was recorded in western part of the mapped area.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Jammu & Kashmir (UT), Reasi District	Sersandu to Kherikot to Rahotkot -Darabi areas	1:12,500	50 sq. km	-	76.50 m	Mapping, Drilling, Sampling, Pitting, Trnching	During the investigation (G4), pitting / trenching of 25 cu.m was carried out. In 59 nos. BRS samples, the total REE varied from 61.6 ppm to 203.7 ppm. In 4 samples Pb ranged from 1,113 ppm to 1.2%; in 4 samples Zn ranged from 2,668 ppm to 5.0%. In Renkakot/Paddar area, 03 channel samples were collected from flaggy limestone adjoining the old workings which showed Zn values ranging from 5% to 15% and Pb values ranging from 1,025 ppm to 4,199 ppm. In Samatkhad area, 03 channel samples were collected from brecciated quartzite which analysed Pb values from 955 ppm to 5,577 ppm. Besides, 05 chip samples were collected from the brecciated quartzite unit in the T5 Tunnel area after analysis showed Pb values at 521 ppm to 11,995 ppm, and Zn at 588 ppm to 7558 ppm. Keeping in view the accessibility of these different locations, scout borehole drilling of 76.50 m was carried out in T5 Tunnel area.
Dehradun District	Tons Valley	1:12,500	50 sq. km	-	-	Mapping, Sampling	The area comprises the rocks of Lesser Himalaya of Mesoproterozoic Age. During investigation (G4) a total of 100 bedrock samples (including channel sample), 50 stream sediment samples were systematically collected to interpret the nature and extension of mineralisation. In addition, 20 petrographic samples, 3 ore microscopic samples were collected to identify lithologies, ore mineral present in the study area. The analytical value of Pb, Zn, Cu and Au of bedrock samples ranged from 20 ppm to 151 ppm, 5 ppm to 241 ppm, 2.5 ppm to 2,731 ppm and < 5 ppm respectively. Similarly, the analytical value of Pb, Zn, Cu and Au of stream sediment samples ranged from 20 ppm to 47 ppm, 28ppm to 192 ppm, 6 ppm to 123 ppm and <5 ppm respectively.
Uttarakhand, Pithoragarh District	Nachani road section, Dhari road section, Askote road section, and Pithoragarh road section	1:12,500	115 L km	-	-	Mapping, Sampling	The area (G4) was part of Lesser Himalaya, which comprises of lithounits, viz, Central Crystallines of Dharmagarh & Askot of undifferentiated Protereozoic Age, meta-sedimentaries of Rautgara Formation, Pithoragarh Formation and Berinag Formation of Garhwal Group of Proterozoic Age. Carbonaceous slate/phyllite was seen mainly associated with quartzite and phyllite and occurred within Pithoragarh Formation. Four prominent bands were delineated near Maspati, Bhunigaon, Pankholi and Ghatigad. Width of these bands varied from 30 cm to 30 m. A total of 121 samples for analytical studies, 34 samples for petrographic study, 08 samples for ore microscopy study, 32 samples for fixed carbon and sulphur content analysis, 10 samples for EPMA study and 04 samples for XRD study were collected. The total carbon content of 17 samples analysed varied from 0.54% to 6.38%. A few samples of carbonaceous phyllite did show element concentration (Rb- 158ppm, Sr-62.67 ppm, Th-16.97 ppm, U-5.35 ppm and Mo-5.06ppm).
Andhra Pradesh, Nellore and Kadapa	Adurupalli and Dasarapalli area	-	-	-	-	Sampling, Trenching	The area for the G4 stage base metal investigation lies in the Vinjamuru domain of Nellore Schist Belt. The area mainly exposed meta-basic volcanic and bands of meta-acid volcanics along with metapelite, quartzite belonging to the Chaganam Formation of Gudur Group. Meta-basic volcanic rocks were represented by Plagioclase-actinolite-epidote-chlorite schist, garnet-bearing chlorite schist and amphibolite and the metapelites
districts							was represented by quartz muscovite schist. A few anomalous values of Cu were recorded in the north-eastern part of the study area, south of Village Kottavuru and mostly from the thin quartz veins associated with meta-acid volcanics. Bedrock samples and Trench sample showed values of Cu ranging from 0.06% to 0.14%. Maximum values obtained from chemical analysis in bedrock sample of the following elements Zn, Pb, Ge, In and Sb were 175 ppm, 40 ppm, 3.57 ppm, 0.93 ppm and 0.27 ppm respectively whereas maximum values of germanium, zinc and lead obtained from Trench sample were 5.02 ppm, 170 ppm and 50 ppm. Base metal mineralisation in the study area was very sporadic and discontinuous.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Andhra Pradesh, Nellore District	Masayapeta Block	-	-	-	1500 m	Drilling, Sampling	The G2 stage copper exploration item was taken up in Masayapeta block in Nellore District, Andhra Pradesh. A total of 1,500 m (± 20%) of drilling were planned with spacing of 100 m or closer in Masayapeta Block. Geophysical survey in 20 L km was completed which brought out four moderates to high Chargeability (> 8mV) which corroborate with high to moderate resistivity. A total of of 226 m drilling were completed in FS 2021-22. Occurrences of sulphides (chalcopyrite, covellite, digenite and pyrite) were observed in intercalated quartzite-schistose rock, quartzite and quartz vein lithounits at various levels in the depth ranged between ~69 m and ~170 m. With completion of the total drilling target and chemical analysis of core samples, the anomalous zone of copper mineralisation can be elucidated in detail with more accurate estimate of resource
Karnataka	Kennedlu-Kurmerdikere area, Chitradurga Schist Belt	1:12500	144 sq. km.	-	-	Mapping, Sampling	Copper mineralisation (G3) in Ingaldhal associated with the metavolcanic suite was referred as "VMS type" and its possible southern extension was examined by systematic geochemical prospecting by the collection of 152 BRS, 100 PTS, 30 PCS and PS each, 10 samples each for EPMA, SEM and XRD studies. Systematic gridded soil sampling in 500 m intervals has also been carried out to characterize the shear-related carbonatisation and possible secondary dispersion halo along the eastern limb. Surface manifestations of mineralisation were in the form of stockworks of smoky quartz characterised by malachite staining and disseminated chalcopyrite and pyrite in carbonated metabasalt; gossanised zone within metabasalt; limonitised brecciated metabasalt. Out of 252 BRS and 100 PTS samples, chemical results of base metals were received for 135 BRS and 60 PTS. Maximum value of Pb, Zn, Cu and Co assayed was 2,850 ppm, 1,400 ppm, 1,500 ppm and 345 ppm respectively.
Karnataka, Haveri District	Yelvatti block, Shiggaon Taluk	1:2000	2 sq. km.	5	738.15 m	Mapping, Drilling, Sampling, Trnching	During the period of investigation (G4) 100 cu.m trenching with 100 trench samples, 150 soil samples, 50 bedrock, 20 petrochemical and 20 petrology samples were collected. The area comprised rocks of meta-argillite, cherty quartzite which were intruded by later quartz veins. Meta- argillite and cherty quartzite showed a general trend of N-S with moderate dip due east. Meta-argillite was highly weathered and formed a low-lying area. Cherty quartzite formed a resistant ridge within themeta-argillite extending over the strike length of 750 m with varied width of 5 m to 25 m. Bedrock samples of cherty quartzite analysed Au from 30 ppb to 435 ppb and Pb+Zn from 623 ppm to 4,865 ppm and Cu from 197 ppm to 1,618 ppm. Soil samples collected in the strike extension of cherty-quartzite analysed Cu from 110 ppm to 1,115 ppm, Pb from 65 ppm to 30,110 ppm, Zn from 150 ppm to 5,230 ppm and Au from 25 ppb to 47 ppb. Four cherty quartzite trench samples analysed Pb+Zn from 990 ppm to 4,930 ppm, Cu from 310 to 505 ppm and Au from 35-100 ppb. Trench samples from altered meta-argillite in contact with cherty quartzite analysed Pb+Zn from 525 ppm to 4,385 ppm, Cu from 120 ppm to 565 ppm and 5 samples analysed Au from 35 ppb to 110 ppb. Trench samples of non-altered meta-argillite analysed Pb+Zn from 95 ppm to 1,090 ppm, Cu from 65 to 140 ppm. The drill core samples of KHY-1B showed 3 m Pb+Zn zone with average grade of 1.5%.
Telangana, Nalgonda District	Pedda Adisarlapalli block	1:12,500	125 sq. km.	-	-	-	During the period of investigation, BRS (75), soil (23) Pitting/trenching (51) samples were collected. The surface indications of mineralization (G4) were in the form of malachite staining and dissemination of sulphide minerals within quartz vein, pegmatite and associated granites. The major sulphide minerals were chalcopyrite, pyrite, galena with minor amount of azurites beside this sporadic occurrence of allanite and fluorite were observed in quartz-feldspathic vein and calcite vein. The analytical results of BRS, PT and soil samples showed no significant mineralisation in the investigated area.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Andhra Pradesh, West Godavari District	Velagapadu area	-	-	-	-	Sampling	The (G4) trough cross bedded sandstone contained thin layer (0.5 mm to 2 mm) of dark color mineral layers comprising heavies. Sandstones were broadly uniform in composition and contained 66% of clasts of quartz and minor feldspar set in a ferruginous cement. The quartz grains of trough cross bedded sandstone were dusted with inclusions of minerals viz. monazite, allanite and zircon. Grains of the REE-bearing phases were also seen to occur in the ferruginous cement. Magnetite, ilmenite, amphibole, haematite, monazite, zircon and rutile were the main constituents of the heavy minerals in stream sediments. The total REE values ranged from 137 ppm to 1,508 ppm in BRS; from 214 ppm to 717 ppm in PCS; from 298 ppm to 10,673 ppm in stream sediment samples; from 294 ppm to 1,337 ppm in PTS; from 232 ppm to 3,163 ppm in soil sample and 22,143 ppm to 56,462 ppm in heavy mineral samples. REE enrichment was observed mainly in the stream sediment and rarely in soil. Monazite, allanite, xenotime and zircon were the minerals that contributed to the REE enrichment in the stream sediment. Catchment areas of two streams were identified as potential area of REE enrichment.
Rajasthan, Sikar District	Ravji Ki Dhani, Nim Ka Thana Belt	1: 2,000	--	-	-	Mapping, Sampling	Copper mineralisation (G3) was observed in the form of malachite stains and disseminations of chalcopyrite, bornite and chalcocite. At some places quartz veins intruded into amphibole marble along and across the strike also carry disseminated bornite and chalcocite. The lithologies intersected along the boreholes were amphibole + biotite marble, biotite + amphibole marble, mica schist and amphibolite. The investigation established the occurrence of sub-surface copper mineralisation, hosted by amphibole marble and quartz biotite schist of the Kushalgarh Formation of the Ajabgarh Group. Sulphide mineralisation in the drilled boreholes was seen manifested in the form of fine disseminations, specks with occasional stringers, vein fillings and fracture fillings of the copper ore minerals, namely, chalcocite, bornite, chalcopyrite and occasionally covellite associated with pyrite.Mineralisation showed either foliation parallel or cross cutting relationship with the host rock.
Rajasthan, Sikar District	Tejawala South Block, Nim Ka Thana Belt	-	-	-	-	Mapping, Drilling	A G3 stage exploration in North Tejawala, Nim Ka Thana, was taken up to delineate the zones of base metal mineralisation. Detailed geological mapping reveals presence of quartzite, tremolite bearing dolomitic marble, quartz mica schist, amphibolite and conglomerate of the Kushalgarh Formation of the Ajabgarh Group of the Delhi Supergroup. The rocks were observed to have undergone three phases of deformation. Copper mineralisation was observed in the form of malachite stains and disseminations of chalcopyrite and bornite. Two mineralised zones MZ-I & II were delineated in central and eastern part of the block, respectively. Exploration by drilling indicated that the sulphide mineralisation were in the form of vein filled, fracture filled and along foliation planes in fine disseminations which took form as chalcopyrite, pyrite and pyrrhotite with few specks of bornite and covellite.
Rajasthan, Sikar District	Tejawala South Block, Nim Ka Thana Belt	-	-	-	-	Mapping, Drilling	The G3 stage exploration was taken up in South Tejawala, Nim Ka Thana, to delineate the zones of base metal mineralisation. Detailed mapping revealed presence of quartzite, tremolite-bearing dolomitic marble, quartz mica schist, oligomictic conglomerate and amphibolite. The copper mineralisation was observed in the form of malachite and azurite staining in amphibolite, quartz mica schist, conglomerate and quartzite. Exploration by drilling indicated that the sulphide mineralisation was in the form of vein, fracture and vugs filling type and along foliation planes as fine disseminations of chalcopyrite, pyrite and pyrrhotite with a few specks of bornite and covellite.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Alwar District	Raipur-Mundawar area	1:12500		50 sq. km.		-	During the course of large-scale geological mapping copper mineralisation (G4) was recorded in the tremolite marble of the Thanagazi Formation and Impure Marble of Kushalgarh formation in the form of sulphides mainly chalcopyrite, bornite with malachite staining occurred as disseminations and occasionally as thin stringers. The copper mineralisation in the area was litho controlled. Towards south of Pehal, an old working pit (strike length: 30 m, width: 20 m and depth: 10 m) was demarcated in tremolite marble. It showed malachite staining and oxidised specks of chalcopyrite. A total of 150 samples (BRS and Channel samples) were collected from 6 channels and 2 trenches in area. The analytical result of the bedrock samples indicated the occurrences of different mineral in the range of Cu (<10 to 33,000 ppm), Co (<15 to 40 ppm), Ni (<15 to 70 ppm), Pb (<25 to 30 ppm), Zn (<5 to 10 ppm), Ag (<5 ppm) Cd (<5 ppm) and Au (<0.05 to 0.17 ppm). The mineralisation in these zones was observed as zones of malachite staining with minor occurrence of specks of chalcopyrite, pyrite, bornite and old working. MZ-I was observed just south of Pahel area. The analytical results of the Channel RM/CH1 and RM/CH/2 from MZ-I were encouraging. The Channel RM/CH/1, analysed a maximum of 0.45% and minimum of 20 ppm Cu. and the Channel RM/CH/2, analysed a maximum of 2% and minimum of 20 ppm Cu. The analytical results of the Channel RM/CH4 and RM/CH/5 from MZ-II were also encouraging. The Channel RM/CH/4, analysed a maximum of 1.10% and minimum of 30 ppm Cu and the Channel RM/CH/5, analysed a maximum of 0.10% and minimum of 165 ppm Cu.
Rajasthan Sikar District	west of Narda	1:2000	1.50 sq. km.	-	-	Mapping, Drilling	During the period of investigation (G3) a number of channels were laid across the scapolite-bearing banded impure marble over 1,000 m strike length and 11 m to 20 m width based on the presence of malachite stains and fresh specks of pyrite and chalcopyrite. On thebasis of surface anomalous values for Cu, a total 06 first-level boreholes RJSWN-01 to RJSWN-06 and 01 no. second-level borehole RJSWN-07 were drilled to evaluate the sub-surface potentiality of base metal and other precious metals in west of Narda block. All the boreholes intersected scapolite-bearing banded impure marble along with partings of biotite and amphibole-rich marble along with quartz and calcite veins. In Borehole no. RJSWN-07, apart from scapolite-bearing banded impure marble, quartzite with bands of garnetiferous quartz biotite schist was also intersected at a deeper level (approx. 193 m to 230 m). Fine disseminated pyrite, pyrrohtite, chalcopyrite and bornite along with fracture and vein filled pyrite and chalcopyrite were reported in the boreholes. The analytical results of channels WNRDCH-1 (1m x 0.35% Cu), WNRDCH-2 (2m x 0.10% Cu) and WNRDCH-4 (7m x 0.85% Cu) indicated anomalous values for Cu.
Rajasthan, Sikar District	Adharshila Dariba Block,Nim Ka Thana	-	-	8	-	Mapping, Drilling	The G3 stage exploration was taken up. The different lithounits exposed in the study area were carbon phyllite, amphibole rich dolomitic marble, impure banded dolomitic marble, impure marble, scapolite-bearing dolomitic marble, brecciated dolomitic marble and ferrugenised breccia of Ajabgarh Group and quartzite of Alwar group of Delhi Supergroup. Two mineralisation zones MZ-I and MZ-II were delineated on the basis of surface indications of mineralisation within impure banded dolomitic marble. The width of MZ-I varied from 2 m to 6 m with grade variying from 0.15% Cu to 0.23 % Cu and width of MZ-II varied from 4 m to 10m with grade varying from 0.20% Cu to 0.45 % Cu. The main copper ore minerals identified in the area were bornite, chalcocite and chalcopyrite in ore petrography. Analytical results of samples from Borehole RJSAE-6 established one copper lode from 93.70 m to 98.70 m (5.00 m) with 0.42 % Cu. A total of 8 boreholes RJSAE-1 to RJSAE-8 were drilled to check the depth and lateral continuity of the copper mineralisation. All borehole intersected indication of sulphide mineralisation as per visual estimation.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Jhunjhunu District	Pratappura block	1:2000	-	-	-	Mapping, Sampling	In the G3 stage exploration of the study area calcareous components were seen to be dominant. Garnet biotite schist that was exposed in the maximum part of the study area comprised of large garnet (diameter~4.2cm to 1cm) with biotite, plagioclase, and quartz. Dolomite was impure in nature and consisted of quartz, dolomite, calcite and ankerite. These exposed in eastern margin of the study area, showed elephant skin weathering. Quartzite mainly occurred at higher elevation in the study area bearing characteristics of yellowish white in colour, medium grain showed well-developed foliation planes. Amphibolite and granite occur as intrusive rocks in the area. Amphibolite dyke was melanocratic in nature, consisted of mainly plagioclase and pyroxene, and showed typical saltpepper texture. Evidences of at least three generations of deformations were observed within the lithounits. The surface evidences of mineralisation were observed to be well preserved in the form of malachite stain, box- work structure, gaussan zone, slag, old workings, and occurrences of Ocimum centraliafricanum or copper plant were noticed. Occurrence of old working was present mainly in the contact of quartzite and garnet-biotite-schist along F2 fold hinges. A total of 10 channels were laid mainly targeting the garnet-biotite schist and impure dolomite, on which EPCH-1, 2 and 9 on garnet- biotite schist and EPCH-4, 6 and 8 on impure dolomite that indicated positive results. The maximum copper zone identified on the channel at EPCH-2 showed 0.56% Cu with a thickness of 15.0 m. The maximum Pb concentration delineated at EPCH-4 showed 5.0 m thick with an average grade of 0.44%. The maximum Zn observed at EPCH-4 showed 7.0 m thickness with an average grade of 0.47%.
Rajasthan, Sikar District	East of Jaitpura	1:2000	2.52 sq. km.	09	1178 m	Mapping, Drilling, Sampling	G3 stage investigation in the area mainly exposed the metasedimentary rocks of Thanagazi Formation; with intrusive granite. A major portion of the study area was covered with the carbonate rocks, which included dolomitic marble, actinolite-bearing dolomitic marble, scapolite-bearing banded silicious marble and scapolite-bearing biotitic marble. The copper mineralisation was found to be associated along an estimated 1.5 km strike length and hosted within banded impure marble, dolomitic marble, actinolite-bearing marble and biotite-bearing marble. The dolomitic marble, actinolitic marble and the banded impure marble were the major and important host rock of the mineralisation. Occurrence of fresh copper sulphide minerals, such as, bornite, chalcocite and chalcopyrite along the quartz veins as well as along the bedding planes and foliations as disseminations were noted. Aggregates and clusters of bornite and chalcocite were observed mainly within dolomitic marbles. The sulphide minerals found in the area were chalcopyrite, pyrite, pyrrhotite, bornite and chalcocite. Specular haematite was also present in abundance. The copper sulphide minerals mainly occurred as fine disseminations through the host rock-dolomitic marble and banded impure marble, although occurrence of chalcopyrite was also noted as fracture filling, within quartz-calcite veins, both in hand specimens and core samples. A total of 12 channels were laid across the strike of the mineralisation covering the entire strike length of 1.5 km. Based on the chemical data from the channel samples, it was observed that the thickness of the mineralised zone varied from 2 m to 15 m on surface. Cu values as high as 3.42 % were noted in Channel no EJPCH-12 located at the eastern limb of the semi-regional fold. On the basis of analytical data from the surface samples (Channel samples and BRS), the study area was found to be prospective in terms of Cu mineralisation. 9 first-level boreholes with a total of 1,178 m drilling was carried out.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Alwar District	Khan Ka Guwara Area, Pratapgarh, Thanagazi Tehsil	-	-	-	-	Mapping, Sampling	A G2 stage investigation revealed mineralisation in the study area in the form of fresh sulphide ores and malachite staining was also noted in the impure marble of the Dogeta Formation, near Buchar Bandh area and amphibolite and chlorite-garnet-amphibole schist of the Tehla Formation near Khan ka Village Guwara. The sulphides constituted pyrite, chalcopyrite ± pyrrhotite and chalcocite. Some sulphides occurred as fine disseminations while other sulphide minerals and malachite stains were seen to occur along the S1 foliation planes and veins running parallel to it. The malachite stains were mostly in situ in the impure marble of the Dogeta Formation and were present in close association with sulphides. Under the microscope, the primary sulphides, pyrite and chalcopyrite, showed disseminated as well as fracture filling textures, while the secondary chalcocite showed replacement texture, formed by partial replacement of the primary chalcopyrite along the grain boundaries and fractures. The malachite formation resulted from later oxidation of sulphides by the action of descending solutions. Chemical analysis of bedrock samples indicated Cu values ranging from 10 ppm-1.1%, while Au values showed a ranged of 100 ppb-380 ppb.The higher copper and gold values were from the amphibolite and chlorite-garnetamphibole schist of the Tehla Formation near Khan ka Guwara Village, while high Cu values were also reported from the impure marble of the Dogeta Formation near Buchar Bandh. A channel of 12 m length was cut across the strike in amphibolite of the Tehla Formation, in front of the old working near Village Kali Barkhari. Along the channel, Cu values ranged from 30 ppm to 0.18%, with an average of 603 ppm. Two mineralised zones were marked in the study area, namely, MZ I of 1.6 km×1 km dimension in amphibolite and chlorite-garnet amphibole schist of the Tehla Formation, near Kali Barkhari- Khan ka Guwara villages and MZ II in impure marble of the Dogeta Formation of 580 m×550 m dimension, near Buchar Bandh.
Rajasthan, Alwar District,	Suratgarh block, Thanagazi tehsil	1:2000	1.00 sq. km.	10	1251.30 m	Mapping, Sampling, Drilling, Trenching	As part of G3 stage investigation, a total of 180 core samples were prepared and 33 cu m pitting/trenching were carried out and a total of 20 PTS samples, 90 BRS/ channel samples, 10 petrological samples and 10 ore mineral samples were collected. The lithologies intersected in the boreholes drilled in Suratgarh block are brecciated quartzite, dolomitic marble intercalated with thin bands of quartzite, banded dolomitic marble and thin veins and vein lets of quartz and carbonate. Sulphide mineralisation was intersected in the form of specks, dissemination, vein and fracture filled bornite, chalcopyrite and pyrrhotite. Borehole RJAS-1 intersected 1 m thick lean mineralised zone of 0.12% Cu. Borehole RJAS-2 intersected two lean mineralised zones of 1 m thick with 0.11% and 0.13% Cu. The analytical results were awaited to estimate the resource of the block.
Rajasthan, Ajmer District	Harmara-Tiloniya areas, Kishangarh Tehsil	-	-	-	-	Mapping, Sampling	G4 stage investigation revelead that most of the area was peneplain and covered by cultivated land with 4 m to 5 m thick soil cover, scanty outcrops and hillocks. Surface indication of mineralisation was observed in the form of malachite staining in the central part. Whereas primary sulphides were observed in the well dumps near Village Bhojiyawas, Harmara and Tiloniya area in the form of specks, stringers as well as in dissemination in the form of pyrite, chalcopyrite and pyrrohtite. Mineralisation was observed mainly along foliation planes as well as dissemination. The major host rock in the Bhojiyawas area were magnetite-andalusite-quartzite with schist intercalation, Garnetiferous-mica-schist and quartzite whereas carbonate hosted sulphide mineralisation was recorded in the south-east of Tiloniya and small patches in the south-west of Bhojiyawas and near Ralavata area. Apart from base metal graphite-bearing mica-schist was recorded in the north-western part of the area near Sursura.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Bhilwara District	Lanpiya-Mahuakhurd area	1:2000	-	-	-	Mapping, Sampling	In G3 stage investigation, it was observed that malachite staining was present at several places in Calc silicate rock. The BMQ band present in the area, showed signature of weakly developed oxidised and gossanised zone. The oxidised zones have direct relevance with the base metal as well as iron mineralisation in the study area. Sulphide mineralisation in the form of specks of sphalerite and veins of galena was observed in the lithounit. A total of 34 samples were tested for their Total Metal Content (TMC) in the field using Cold Extraction Titration method. About 29 bedrock samples and 5 soil samples were taken separately. The TMC of the BMQ as estimated by cold extraction method ranged between 6,000 ppm and 17,000 ppm and this was corroborated with analytical results of anomalous Pb+Zn values. All the bedrock samples collected from BMQ band yielded anomalous high (Pb+Zn) values ranging between 0.25% and 5.59%, averaging 1.53% (Pb+Zn) in 21 bedrock samples of BMQ. The BMQ band consistently yielded anomalous high Pb+Zn values in channel and trench samples in the range of 1.16%-2.24% and 0.28%- 2.46% respectively.
Rajasthan, Bhilwara and Chittorgarh Districts	Karjiyakhera-Manyas-Karas area	1:12500	100 sq. km.	-	-	Mapping, Sampling, Drilling, Trenching	In G4 stage the investigation that was carried out in the area which involved 111 cubic meters of trenching, collection of 152 bedrock samples (BRS) and 17 samples for petrochemical analysis (PCS) to trace the base metal potential of the area. About 23 samples for petrological studies, 8 samples for ore microscopic studies and 6 samples for XRD analysis were also collected. The surface indication of mineralisation in the study area was quite prominent. Old working, malachite stains and specks of sulphides like chalcopyrite, bornite and pyrite were observed in the calc-silicates of Rewara Formation. Based on the surface indications of mineralisation, favourable lithological and structural set up random litho samples were collected and analysed semi-quantitatively by Cold Extraction Kit (CX Kit) in the field itself. The amphibole-rich band of calc amphibole, calc silicate and ferruginised sheared dolomite analysed 3,200 ppm to 10,200 ppm TMC. Somi mineralised zone with 750 m X 100 m and Sankhli mineralised zone was 700 m X 95 m were established. The maximum value of Cu, Pb and Zn in the study area was 2,900 ppm, 2,100 ppm and 1,300 ppm respectively.
Rajasthan, Pali and Ajmer Districts	Kotra and Kalinjar villages	1: 12,500	100 sq. km.	-	-	Mapping, Sampling	The G4 stage surface geochemical evaluation of the area involved collection of 200 bedrock samples (random), 50 trench samples, 10 PCS, 10 thin polished sections each for petrographic studies and ore microscopy, 05 bedrock samples for XRD analysis and 05 samples for EPMA studies. Surface indications of base metal mineralisation were observed in the form of malachite stains, liminotisation in impure marble, calc schist of the Sendra Formation and horblende schist of the Phulad Ophiolite Suite and occasional specks of chalcopyrite and bornite in calc schist near Karuntiya. About 200 BRS samples were collected and sent for analysis. Analytical results of 200 BRS samples were received excluding that of Cr and Ba. Only three samples showed anomalous Cu values above 0.1%. BRS- 30 near Karuntiya showed 0.51% Cu value in calc schist, BRS-63 west of Durgawas showed 0.12% Cu value in granite gneiss and BRS-68 in Northwest of Seliberi showed 0.12% Cu value in hornblende schist of Phulad Ophiolite Suite. Analytical results of 50 trench samples were received excluding that of Cr and Ba.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Udaipur District	Rupatalai block	1:2000	1 sq. km.	6	778 m	Mapping, Sampling, Drilling	As part of G3 stage investigations, 108 core samples were generated. The study area comprises of Sawadri Group and Ran Igneous Complex of Mangalwar Complex of Bhilwara Supergroup which belongs to the Archean age. Lithologies mapped in the block area were granite gneiss, dolomite, ferruginous quartzite, micaceous quartzite, amphibolites and syenogranite. General trend of the foliations in all the lithology was almost the same and was seen striking in WNW-ESE direction with moderate dip amount varied from 40˚-50˚ northeasterly. Surfacial indication of sulphide mineralisation was mostly observed in the form of extensive ferruginisation and gossanisation within ferruginous quartzite, malachite staining and sometimes very tiny crystals of pyrite and chalcopyrite were found along foliation planes in micaceous quartzite and also in granite gneiss at some places. Six boreholes RJUR-01, RJUR-02, RJUR-03, RJUR-04, RJUR-05 and RJUR-06 were drilled in the block with drilling depth of 110 m, 85 m, 96 m, 124 m, 260 m and 103 m respectively that totaled to 778 m of drilling. In Borehole RJUR-01, two mineralised zones (3.75 m and 4.25 m) were intersected with visual estimation of 1% Cu sulphide and two sulphide zones (dominantly pyrite with very less amount of chalcopyrite) were intersected. In Borehole RJUR-02, 4 pyrite rich zones were intersected with very less Cu sulphide. In Borehole RJUR-03, 2 sulphide zones (dominantly pyrite with very less amount of chalcopyrite) were intersected. In Borehole RJUR-04, one pyrite rich zone (8 m) and one Cu sulphide zone (1.3 m) were intersected. In Borehole RJUR-05, one zone (3.25 m) of chalcopyrite (V.E. 0.4%) and one pyrite zone (69 m) were intersected. In Borehole RJUR-06, 4 zones (1 m, 3 m, 3 m and 2.95 m) of chalcopyrite (V.E. 0.4% Cu sulphide) were intersected.
Rajasthan, Bhilwara District	Balyakhera, Malikhera and Kotriareas	1:12,500	110 sq. km.	-	-	Mapping, Sampling, Drilling, Trenching	As part of G4 stage investigations, a total of 11 bedrock/channel samples and 56 trench samples have collected. About 10 petrochemical samples, 27 petrographic samples and 12 ore microscopic samples were also collected. Surface indications of mineralisation noted in the area were old workings, slag, ferruginisation, limonitisation, gosanisation, malachite-azurite stains as well as presence of fresh sulphides. Hornblende schist within muscovite schist of the Samodi Formation showed ferruginisation, limonitisation, gosanisation with encrustations of malachite and azurite. The copper and associated mineralisation was seen manifested by the occurrence of chalcopyrite, bornite, galena, sphalerite and occasional covellite specks, fracture-filled veins of malachite in amphibole marble of Samodi. Only malachite staining was observed along the fracture planes in both the walls of old workings in Village Salampura. However, appreciable degree of mineralisation was noted in the biotite- schist ±garnet of the Tiranga Formation in the form of vein fillings and stringers of chalcopyrite mainly along fracture and S2 foliation planes SW of Salampura Village. Malachite was also noted as stains along fractures in calc-gneiss of the Rewara Formation. Specks of pyrite and arsenopyrite with occasional chalcopyrite were also noted in quartzite of the Pur Formation. Pyrite, chalcopyrite, bornite, covellite, galena and sphalerite associated with calcite veins emplaced along the secondary planar features like foliation/fracture planes indicate hydrothermal activity in the area which in turn indicate epigenetic nature of mineralisation.
Rajasthan, Chittorgarh District	Hirakhedi Block	1:2000	3.5 sq. km.	-	-	Mapping, Sampling, Drilling, Trenching	In G3 stage investigation, during detailed geological mapping a total of 64 bed rock/channel samples, 50 pit/ trench samples, 11 petrochemical samples, 15 petrological samples, 10 ore microscopic samples and 05 EPMA samples were collected. A zone of brecciation was seen in calc silicate rock and it extends in NE-SW direction. The surface indications of mineralisation observed in the area included the presence of malachite staining, small specks of pyrite, bornite, covellite and chalcopyrite in calc-silicate rock. Two potential Cu mineralisation zones trending roughly in NE-SW direction were demarcated on the surface based on anomalous Cu values (0.25% and 0.80% Cu) from well dump and strong IP anomaly. Pseudo section along S600 and S2000 traverse lines indicated that the mineralisation starts approx. at 24 m depth and the IP anomaly contours were open downwards.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Bhilwara District	Lakhola Block	-	---	5	670.0 m	Mapping, Sampling, Drilling	In G3 stage investigation, a total of 200 core samples, 40 channel samples, 5 petrochemical samples, 25 petrographic and 5 samples for EPMA and XRD analysis were collected. Four first-level boreholes (RJLK-01, RJLH- 02, RJLK-03 and RJLK-05) were drilled at 200 m spacing along the mineralised zone (MZ-I) to check the sub-surface and strike continuity of mineralisation in the block. The first Borehole RJLK-01 was drilled along the profile of Channel- 03 (2.0 m x 0.21% Cu) in which a Cu zone of 2m x 0.21% was intersected from 99.50 m to 101.50 m depth along the borehole within altered calc-silicate rock. The second and third Boreholes (RJLK-02 and RJLK-03) did intersect copper mineralisation, but the analytical values were not significant. Maximum Cu value reported from Borehole RJLK-02 was 955 ppm and in RJLK-03 it was 700 ppm. The fifth Borehole RJLK-05 was drilled in the block to check the northward strike continuity of the mineralisation intersected in Boreholes RJLK-01 and RJLK-02. No significant Cu mineralisation could be intersected in this borehole except minor disseminations of chalcopyrite, pyrite and pyrrhotite in calc-silicate rock. The Boreholes RJLK-02, RJLK-03 and RJLK-05 intersected sulphides mostly fracture filled chalcopyrite, bornite, pyrite and pyrrhotite in the form of disseminations, specks and stringers with in the altered calc-silicate and garnetiferous mica-schist but copper sulphides in these boreholes were not significant enough for delineation of zones on the basis of visual estimation. One borehole intersected carbonaceous phyllite which was mineralised with pyrite and pyrohhotite in the form of very thin stringers and veins. No significant copper mineralisation was intersected in this borehole also.
Rajasthan, Alwar District	Baraud-Dooghera	1:12,500	100 sq. km.	-	-	Mapping, Sampling, Trenching	The G4 stage investigation included 700 sq. km. ASTER image processing and collection of a total of 150 bed rock/channel samples and 50 trench samples. Apart from this, 20 samples for petrography, 10 samples for ore microscopy, 10 samples for petrochemical analysis and 25 of water samples were collected. The surface indications of base metal mineralisation were present in the form of malachite stains and fresh sulphides i.e.,, chalcopyrite, covellite, bornite, pyrrhotite and pyrite within impure dolomitic marble, carbon phyllite and brecciated quartzite as well as in quartz veins. A mineralisation zone MZ-I was delineated on the basis of surface indications of mineralisation within impure dolomitic marbles of Kushalgarh Formation. Apart from this, surface indication of graphite mineralisation was also observed. Graphite present in the study area was thinly laminated/bedded with flaky to crystalline morphology. It was seen hosted by graphite-bearing mica schist, carbon phyllite and garnet-bearing mica schist. Copper mineralisation in the study area was seen manifested by presence of gossan zone in ferruginous brecciated quartzite of Sariska Fm. Based on these surface indications for copper mineralisation, one mineralised zone (MZ-I) was demarcated. The chemical result of 03 number of channel samples (DBCH-2, 3 and 4) showed Cu, Mn and Fe content from 10 ppm to 0.72%, 80 ppm to 0.17% and 0.70% ppm to 12.50% respectively. The channel samples (DBCH-4) analysed a maximum of 0.72% Cu, with 6m x 0.28% Cu, 2 m x 0.21%, 4 m x 0.1% and 3 m x 0.1%. The chemical result of 50 of pitting/trenching-cum-channel samples indicated insignificant amount of copper content (10 ppm to 160 ppm). Graphite mineralisation was also observed within graphite mica schist, carbonaceous phyllite and garnet-bearing mica schist.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Alwar and Dausa districts	Golana, Kesupura, Goarah Gujar and Jamrauli areas	1:12,500	50 sq. km.	-	-	Mapping, Sampling, Trenching	During G4 stage investigation a total of 100 bedrock samples (90 random and grid bedrock samples and 10 channel samples collected from 01 channels), 50 trench samples, 20 Petrochemical Samples, 20 petrological samples, 10 ore microscopy samples, 05 samples for XRD and 05 samples for EPMA were collected and submitted for analysis. The rocks exposed in the study area belong to the Mangalwar complex and metasediments of the Delhi Supergroup (DSG). The meta-sediments of the Delhi Supergroup rest unconformably over gneissic basement of the Mangalwar Complex. In the area all three members of DSG, i.e. Raialo Group, Alwar Group and Ajabgarh Group are exposed. Surface manifestations of copper mineralisation were observed within the amphibolites of Tehla Formation and phyllite of Rajgarh Formation in the form of malachite staining along the S1 foliation plane. Random bedrock samples were collected from throughout the amphibolite body along with a 10 m channel near Jhajhi-Rampura area. BRS-81, BRS-82 and BRS-91 showed 7.83%, 3.14% and 0.20% copper values respectively.
Rajasthan, Nagaur District	Degana Gaon block	1:12,500	100 sq. km.	-	-	Mapping, Sampling, Trenching	As part of G4 stage investigation, during the geological mapping 200 bedrock sample (BRS), 10 PCS samples, 10 petrological samples and 10 OM sample and 50 trench (channel) samples were collected to assess the potential for base metal, REE associated mineral in the area. Moreover, 50 cu. m of trenching was also carried out to expose the various litho-units. Apart from the NQT 14 samples were collected from the graphitic schist to know the fix carbon content and to establish the strike continuity of the graphitic band. General trend of all the rock type occurring in the area was NNE-SSW to N-S dipping towards west. Graphitic schist was grey to black in color and fine to medium grain rock. Foliation planes were well developed and trending NNE-SSW to N-S dipping towards west. Mineralisation in the study area was present in the form of fresh sulphides i.e., chalcopyrite, pyrite and pyrrhotite. The host rock for this mineralization in the demarcated zone was either graphitic schist or andalusite-bearing graphitic schist. The area was evidenced by the presence of graphitic bands. Two major prominent laterally persistent band of graphitic schist was demarcated from Deganagaon to kumharon ki Dhani Village having strike length of 4 km. The thickness of the band ranged from 1 to 3 m with numerous thin bands. The fix carbon value was recorded in these bands was up to 4 %.
Rajasthan, Pali District	Chitar, Sanderiya and Kanecha Village	-	-	-	-	Mapping, Sampling	During G4 stage investigation, surface manifestations of mineralisation like malachite, azurite, ferruginisations, and sulphide leaching and skarn zones were noticed in the field. The petrographic study showed occurrences of bornite, chalcocite, covellite, digenite and chalcopyrite in the mineralised rock. The analytical values in channel samples received so far indicated encouraging values of Cu up to 3,200 ppm and 3,600 ppm. The analytical values of serpentinite showed encouraging values of Ni which was up to 3,000 ppm.
Rajasthan, Udaipur District	Bara-Parshad area	1:12,500	100 sq. km.	4	534 m	Mapping, Sampling, Drilling	During G4 stage investigation, the samples collected were as follows: 150 bedrock samples, 10 PT samples, 42 channel samples and 100 core samples for chemical analysis, 10 samples for petrochemical study, 5 samples for XRD and 30 samples for petrographic studies. Major surface indications of mineralisation were in the form of old workings, presence of chalcopyrite, pyrite, galena and sphalerite in dolomite and malachite staining. The old workings occurred as trenches along the strike and as vertical shaft in Dolomite band. Mineralisation in the dolomite occurred in the form of disseminations and fracture fillings concentrated along F2 deformation. The Boreholes RJBP-1 and RJBP-2 intersected significant concentration of sulphide mineralisation mainly in the form of disseminations and fracture filled galena, sphalerite, chalcopyrite and pyrite in the form of specks, stringers and veins in dolomite. The Boreholes RJBP-3 and RJBP-4 intersected sulphides in dolomite

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Gujarat Dahod District	-	1:12500	40 sq. km.	-	-	Mapping, Sampling, Trenching	During G4 stage investigation, the samples collected were as follows: 137 bedrock samples (BRS), 50 stream sediment and soil samples, 50 pit & trench samples. Manganese ore was observed in the shear zone in the form of veins, veinlets having width up to 8 cm. Surface indication of base metal mineralisation was observed in the form of malachite staining in dolomite in Khunta and Handia area. Manganiferrousphyllite and quartzite were observed in Sagan old working quarry. Manganese ore was also observed in the quartz veins in and around Ghora, Pipli area.
Rajasthan, Banswara District	Lakai, Handia and Pipali area	1:12500	40 sq. km.	-	-	Mapping, Sampling, Trenching	During G4 stage investigation, the samples collected were as follows: 137 bedrock samples (BRS), 50 stream sediment and soil samples, 50 pit and trench samples. Dolomite, quartzite and phylllite were the main lithologies observed in the area. Small outcrops of granite, meta-greywacke, chlorite schist and BIF were also observed in the area. Manganese was observed in the shear zone in the form of veins, veinlets having width up to 8 cm. Surface indication of base metal mineralisation was observed in the form of malachite staining in dolomite in Khunta and Handia area. Manganiferrousphyllite and quartzite were observed in Sagan old working quarry. Manganese was also observed in the quartz veins in and around Ghora, Pipli area.
Antimony							
Himachal Pradesh, Lahaul and Spiti (On expedition basis)	Bara Shigri glacier	1:12,500	25 sq. km.	-	-	Mapping, Sampling	During the reconnaissance survey (G4) for antimony, associated base metals and REE, a total of 151 channel samples were collected across the pegmatite veins, granite bodies and pegmatite bodies to evaluate the potentiality of antimony, associated base metals and REEs. Besides, 30 samples for petrographic, 05 samples for XRD and 10 samples for EPMA, were also collected and studied. On the basis of field observations and analytical results, it was inferred that two phases of granite were exposed in the study area. The granite on the left bank of Bara Shigri nala was medium to coarse-grained, comprising of quartz, plagioclase feldspar, K feldspar, tourmaline, muscovite and biotite. Encouraging lithium values, i.e., >100 ppm were obtained in 39 channel samples.
Bauxite							
Maharashtra Sindhudurg	Math budruk	1:12500	-	-	-	Mapping, pitting, sampling	The Al_2O_3 content in BRS varied from 17.91% to 56.57 % and correspondingly SiO_2 content varied from 1.3% to 22.81%. Gallium values ranged from 31 ppm to 76 ppm. The Al_2O_3 content in pit samples ranged from 19.67 % to 59.23% and SiO_2 values ranged from 1.72% to 33.50%. Based on the Al_2O_3, SiO_2 and Fe_2O_3 value in bedrock and pit samples, laterite was classified into ferruginous laterite, aluminous laterite and bauxite. Cumulative area of 10.36 sq. km. and 34.68 sq. km. were delineated as potential for bauxite and aluminous laterite respectively. Bauxite was seen present as pockets as well as lenses in laterite. XRD and ore microscopic studies of representative samples collected from bauxite showed that gibbsite was the dominant ore mineral with minor minerals like anatase, haematite and goethite.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Madhya Pradesh Dindori (G3)	Khapripani block, Bajag Tehsil	1:4000	5 sq. km.	28	614.0 m	Mapping, drilling, sampling	A total of 599 core samples were generated and analysed for Al_2O_3, SiO_2, P_2O_5, Fe_2O_3, CaO, MgO, Na2O, K2O, TiO_2, MnO, Ga, V, REE, Reactive Silica & L.O.I. to assess the degree of laterisation and formation of bauxite and aluminous laterite. A total sum of 6.67 million tonnes (5.26 float & 1.41 in situ) of bauxite with an average of 39.41% $Al2O_3$, 47.89 million tonnes (24.63 float & 23.26 in situ) of aluminous laterite with an average of 28.61% Al_2O_3 and 3.04 million tonnes (1.07 float & 1.96 in situ) of ferruginous laterite with an average of 15.93% Al_2O_3 resources was estimated in Khapripani block among which 4.74 million tonnes (4.24 float & 0.50 in situ) of bauxite, 23.07 million tonnes (15.63 float & 7.44 in situ) of aluminous laterite and 0.66 million tonnes (0.43 float & 0.22 in situ) of ferruginous laterite having more than 0.1% (cutoff) of vanadium mineralization are recoverable. Those mineralised zones also having some good values of gallium (up to 129 ppm) could also be recovered as by products.
Cobalt							
Karnataka, Shimoga (G4)	Gilalagundi	1:12500	100 sq. km.	-	-	Mapping & Sampling	Reconnaissance survey (G4) was carried out for Cobalt, Manganese and associated poly-metallic mineralization in Gilalagundi area. The area can be divided into 04 parts, the western, the central, the eastern and the north / north east part. The eastern part was dominated by quartz-chlorite-schist and its variants. The central by ferruginous phyllite, interbanded with brecciated chert / cherty quartzite and banded iron formations. The western domain was mainly characterised by meta-argillite-chert-volcanic suite. The mineralisation was observed to be confined to ferruginous phyllite and brecciated chert / cherty quartzite. Botryoidal, box work, cavity fillings, replacement structures were observed in the investigated block. A total of 19 samples have shown the assay values of Co as more than 125 ppm, the maximum being 0.26% reported from sample collected from brecciated chert / cherty quartzite, Arasalu RF, which falls in central domain of studied block and 03 samples have shown the assay value of manganese as more than 10 %. The analytical results of trench samples have shown the assay value of Cobalt in Trench no. 04 to a maximum up to 0.44 % with an average of 772 ppm x 10 m, carried out at Arasalu RF. The XRF analysis of petrochemical samples corroborated with BRS. A total of 11 numbers of pockets of Mn / Fe oxides were identified in the investigated block, making the Arasalu, Gilalagundi and Konehosuru segments.
Diamond							
Chhattisgarh, Raigarh District	Raigarh area	-	700 sq. km.	-	-	Mapping, Sampling	In G4 stage investigation PCS sample collected during the field season, showed that the SiO_2 ranged from (45.99 to 54.66) wt%, Al_2O_3 ranged from (9.65 to 18.89) wt%, Fe_2O_3 ranged from (7.57 to 15.98) wt%, MgO ranged from (1.15 to 9.95) wt%, K_2O ranged from (0.52 to 7.33) wt%, CaO ranged from (2.74 to 9.39) wt%. The Cr and Ni content ranged from (30-650) ppm, and (07-176) ppm respectively. EPMA study of HMS samples showed that the garnets were non-kimberlitic, spessertine to almandine of crustal origin.
Madhya Pradesh, Chattarpur, Sagar and Tikamgarh Districts & Uttar Pradesh Lalitpur District	Barayatha block	-	-	-	-	Mapping, Sampling	Geologically, the Barayatha block comprises Bundelkhand Granite Massif in the northern part whereas the southern part is occupied by Bijawar, Vindhyan, and Deccan Trap. As part of G4 stage investigations, during the fieldwork, delineated PGRS lineaments in the map were checked in-ground as structural lineaments, intersections that were favorable for the emplacement of kimberlite/lamproite. Besides field traverses, systematic stream sediment sampling was carried out with the help of a drainage map. Sample processing was done for recovering heavy mineral concentrate (HMC) which were examined for kimberlite indicator minerals under the stereo-microscope.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Odisha, Bargarh District	Padampur-Paikamal-Jharbandh area	-	675 sq. km	-	-	Mapping, Sampling	During G4 stage investigation, it was observed that the cratonic lithounits included granite gneisses of different varieties mostly banded gneisses with minor migmatitic and porphyritic varieties, quartz mica schist and minor unmappable units of low-grade metasedimentary schists. The lithounits of EGMB occupied major parts of the study area which include garnetiferous granite gneiss, khondlite and quartzite. Heavy minerals, such as, garnet, ilmenite, spinel, zircon, amphiboles, pyroxenes and epidote were recovered after separation from the stream sediment samples. A total of 110 such suspected heavy mineral grains were selected for further analysis by EPMA and SEM, of which 67 grains were selected for EMPA and 43 grains were selected for SEM studies. These heavy minerals include 52 nos. of suspected garnets, 16 nos. of suspected ilmenites, 06 nos. of suspected spinel, 31 nos. of suspected diopside grains and 05 nos. of suspected grains which could not been identified by microscopic observation.
Andhra Pradesh, Anantapur District	Kanaga napalle –Dharm avaram area	1:50,000	790 sq. km.	-	-	Mapping, Sampling	In G4 stage investigation The study of stream sediment sample revealed that the present area contained heavy minerals like ilmenite, spinel, garnet, diopside, epidote, amphibole, zircon, apatite, tourmaline and sulphides. The ilmenites turned out to be magnesian ilmenites which was prime indicator mineral of Kimberlite Clan of Rocks. These picro ilmenites contained high MgO (7.43 to 8.68 wt%), high Cr_2O_3 (1 to 3 wt%) and low MnO (<0.5 wt%).
Tamil Nadu, Vellore, Tirupathur districts & Andhra Pradesh Chittoor District	-	-	700 sq. km.	-	-	Mapping, Sampling, Drilling, Trenching	The G4 stage investigation showed that the investigation area comprised Archaean rocks of charnockites, Archaean to Paleoproterozoic Peninsular Gneissic Complex to II (PGC to II), basic intrusive of Mesoproterozoic Age, Alkali Complex and acid intrusive of Neoproterozoic Age and Quaternary alluvium and the study area falls in the southern peripheral continuation of the Dharwar craton. Based on the integrated map of Geology, Drainage, Lineament data, NGCM, ground and aeromagnetic anomaly zones and target zones (Zone-I to Zone-X) were demarcated in the integrated map. During the course of field works, points of intersected lineaments, dyes, and anomaly zones were checked, 25 new mafic dykes and 04 of ultramafic dykes were identified and reported, 10 cu. m of pitting were excavated and 10 samples were collected alongwith 18 PS samples, 225 stream sediment samples.
Emerald							
Rajasthan, Rajsamand District	Kalaguman-Dhaneen-Nathela areas	1:12,500	100 sq. km	-	-	Mapping, Sampling, Trenching	During G4 stage investigation, a total of 200 bedrock samples, 37 petrographic samples (PS), 20 petrochemical samples (PCS), and 55 pitting/trenching samples (PTS) were collected. The studied deposits were formed by the metasomatic reaction between muscovite (± garnet ± tourmaline) pegmatites and lenticular bodies of altered ultramafic rocks that were seen hosted by the Bhilwara Supergroup gneisses (BGC). This reaction produced phlogopite schists containing the exometasomatic emeralds, as in all other granite-related emerald deposits. The concentration and distribution of chromium in the host rock and beryllium content of the hydrothermal fluids, derived from the pegmatites, seem to be the most significant factor for the development of emeralds. Field studies confirmed that a lithological association i.e., schistose, mafic/ultramafic intruded by beryllium-bearing pegmatites was a must for the mineralisation of emerald, apart from the lithological control and structural control.
Regional Mineral Targeting (RMT) & Research Project (RP)							

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Chhattisgarh	Bastar Craton, Sonakhan Greenstone Belt and its surrounding areas	-	4000 sq. km.	-	-	Mapping, sampling	Field work was carried in the delineated potential blocks - (1) Rajpur-Barnaidadar, (2) Rachpalpur- Karankhol-Arangi blocks and (3) Chandranagar- Lohadadar block in an around Rajpur, Barnaidadar, Remratola, Jarra, Kothari, Lohadar, Rajpur, Balenda, Karankhol areas. BRS samples collected systematically from this zone yielded anomalous values of Au in BRS- 42E (Au- 1.24 ppm); BRS-48D1 (Au-0.5 ppm), BRS-48D2 (Au-8.8 ppm) and BRS-42D (Au-0.8 ppm). This was further supported by presence of continuous high chargeability and low resistivity geophysical profile along this zone. Presence of numerous fracture/fault systems were also inferred from the magnetic maps towards the south of Rajpur-Barnidadar block near Tulsidipa. The rock types exposed in Rachpalpur- Arangi-Karankhol block were bimodal volcanic (Basalts and rhyolites), subvolcanics (rhyolitic granophyre) and gabbroic intrusives. In this block, the quartz-epidote alteration zone was identified near the contact of granophyre and gabbro. The altered granophyre showed impregnation of NE-SE trending small quartz-epidote veinlets, invariably laden with disseminated pyrite, arsenopyrite and native gold as well as oxidised box work and pits. Preliminary study showed that these quartz veins were mineralised and followed the fracture systems (Fr1, Fr2 and Fr3) present in the area.
Madhya Pradesh, Balaghat and Maharashtra, Nagpur and Bhandara	Sausar Mobile Belt	-	-	-	-	-	Regional mineral targeting to search for potential areas for tin, tungsten, manganese, cobalt and other mineralization was carried out in the Sausar Mobile area. The areas includes: Kachekhani area: At Kachekhani area a major NE-SW trending quartz vein with southerly dip of 50° was seen emplaced along the foliation of the quartz mica schist- quartzite sequence of Sausar Belt. This arsenopyrite-bearing quartz vein lies close to the boundary of CIS (Central Indian shear). This vein was intermittently traced over a stretch of 4 km from Kachekhani to Mohegaon Village. Skarn zones: During fieldwork skarn zones were identified at (i) Village Dhobitola, north of Tumsar (ii) Hivra area, near Mansar. Development of tremolite, actinolite, diopside, epidote and garnet skarn assemblage was established. REE & RM potential along the western extension of Dongarla area: Field studies revealed the presence of widespread in situ talus material of abundant feldspar and mica indicating a concealed zone of primary pegmatite within the basement biotite gneiss over an aerial extent of 1.5 sq km on the weathered pegmatite located 2 km west of Village Dongarla. Kawlapur mica bearing pegmatite: Test drilling carried out at Kawlapur area in Nagpur District indicated the presence of mica-bearing pegmatite within the basement gneiss. Muscovite books were noticed within the pegmatite core.
Madhya Pradesh, Jabalpur, Katni, Umariya, Rewa, Shahdol, Satna, Sidhi	Mahakoshal belt	-	1000 sq. km.	-	-	Mapping, sampling	The objective of this work was to assess the mineralization potentiality for gold, basemetal and critical minerals in the area. The project involved collection of data, consultation of literature, Aerial Reconnaissance and PGRS studies, preparation of prospectivity map and collection of 100 bedrock samples, 10 petrological samples, 4 EPMA samples and 20 XRD samples collection. Analytical value of Cu from 0.11% to 7.36% was recorded in 5 bedrock samples. Higher Cu was recorded in quartz vein in carb phyllite and Basic body. Au of 1.15 ppm was recorded in quartz vein at Dhandukau area.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Odisha, Deogarh, Sambalpur, Jharsuguda and Sundergarh	Adas-Sargipali mineralised belt	-	6000 sq. km.	2	415 m	Mapping & Drilling	The present work was proposed with the objective to validate the aero-geophysical anomaly zones marked in these areas through scout drilling, to establish sub-surface geology and assess their mineral potentiality. The areas identified for scout drilling were Iswarpali, Kolabira and Chottabanga. However, one more area i.e., Dengasargi was also taken up for scout drilling based on malachite stains and sulphide mineralisation observed in the outcrops of mafic granulite. During FS 2021-22, two scout boreholes were drilled, one each in Iswarpali and Dengasargi area located along the eastern strike extension of Adash- Rampalli copper prospect within the EGMB. A total of 415 m drilling in two boreholes were completed till 31st March, 2022. In both the boreholes, considerable thickness of sulphide mineralisation represented by chalcopyrite, bornite, covelite, pyrrhotite and pyrite were intersected. The mineralisation occurred in the form of dusty dissemination, stringers, fracture and vein filling. The host rock for sulphide mineralisation in Iswarpali and Dengasargi area was mafic granulite and amphibolites, respectively. Wall rock alteration/Hydrothermal alteration in the form of kaolinisation, sericitisation
							(white mica), albitisation and silicification with pyritisation was observed in the hanging wall side or close proximity to the shear zone. Epidotisation was observed at fracture planes. At places, the alteration was so intense that the primary textural features of the rock were obliterated. Analytical results of Borehole ODAS-01 drilled in Iswarpali indicated a copper mineralised zone of 4.5 m thickness with 0.43% Cu. Although, bedrock samples from Dengasargi area showed malachite stains, the presence of chalcopyrite exsolution lamellae within bornite was observed in polished sections. The result of drill core samples showed copper ranging from 7 ppm to 239 ppm. The Kolabira area was seen to be under the cover of thick pile of sediments with very few outcrops of sheared granite gneiss and sheared quartzite. However, the area was identified for scout drilling to verify the very sharp high magnetic anomaly. On analysis of NGCM data, it was observed that the composite samples showed significant ΣREE values going up to about 4,000 ppm and their distribution pattern more or less followed the trend of aeromagnetic anomaly.
Jharkhand, Ranchi, East and West Singhbhum, Khunti, Saraikela-Kharsawan districts	North Singhbhum Mobile Belt (NSMB)	5000 sq. km.	-	6	1200 m	Sampling & Drilling	The regional mineral targeting (RMT) was a three-year project (FS 2019-22) aimed to develop models to explore target areas potential for mineralisation covering 5,000 sq. km. area in and around North Singhbhum Mobile Belt (NSMB) in Jharkhand. A total 16 mineral prospect zones were demarcated out of which three zones from Lilam (73J/02) to Sankodih (73F/13) encompassing the Singhbhum Copper Belt were validated during FS 2021-22 using detailed geophysics, geochemical sampling and scout drilling. Mineralisation observed in the form of pyrite, chalcopyrite, bornite, arsenopyrite, sphalerite and covellite as stringers and fine dissemination in quartz chlorite schist, quartz chlorite sericite schist, silicious rock and chlorite schist. The mineralisation was in the form of stringers and dissemination mainly sheared controlled and hydrothermal in nature. Available results of BRS showed Cu in the ranged 1,114 ppm-40,514 ppm in 10 samples, 1,228 ppm-1,626 ppm Ni in two samples and 0.10 ppm-0.23 ppm Au in Semulbera and Rangamatiya blocks. In core samples of Semulbera, gold value ranged from 0.10 ppm-1.28 ppm in 35 samples; and Cu from 1,011 ppm-4,079 ppm in 21 samples. EPMA studies of core samples confirmed the presence of sulphide and oxide phases as chalcopyrite, chalcosite, sphalerite, arsenopyrite, pyrite, molybdenite, uraninite etc.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Haryana & Rajasthan	Base metal potential areas in parts of North Delhi fold belt	-	-	-	-	Mapping, Drilling, Sampling	The Regional Mineral Targeting (RMT) project was carried out to identify the potential unexplored/concealed areas for base metal mineralisation with predictive theoretical exploration models using GIS techniques. Based on the moderate to high chargeability, encouraging Cu value and final prospectivity map, three scout boreholes were drilled in Ghatesar (HMGBH-1), Raghunathpura (HMRBH-1) and Akoda (HMABH-1) areas, Mahendargarh District, Haryana. HMGBH-1 was drilled to a total depth of 440.85 m, HMRBH-1 292 m and HMABH-1 134.45 m respectively. Analytical results of core samples of HMGBH-1 showed the highest Cu value of 551 ppm with a mean of 115.01 ppm, Zn 1,359 ppm with a mean of 149.65 ppm, Pb 78 ppm with a mean of 19 ppm, V 847 ppm with a mean of 213 ppm, La 141.10 ppm with a mean of 73.60 ppm and Ce 1,629 ppm with a mean of 167.31 ppm. In HMRBH-1, the highest Cu value was 1,445 ppm with a mean of 189.6 ppm and Zn was 187 ppm with a mean of 72.58 ppm. A ground geophysical survey was carried out comprising a total of 60 L Km of SP, IP and Resistivity in Khoondroth Block and Baner Block. Surface, as well as sub-surface samples, showed scattered higher values of base metals and REE.
Karnataka, Eastern Dharwar Craton, Raichur Yadgir & Gulbarga districts	Hutti-Maski, Raichur-Deodurg, Gurgunta Schist Belts	-	-	-	-	Mapping. Drilling, Sampling	The Regional Mineral Targeting (RMT) around Raichur-Deodurg and Hutti-Maski Schist Belts was extended to the FS 2021-22 with scout drilling and data integration of two additional toposheets 56D/07 and 56D/08. A total of 1,495 m drilling were carried out in 07 different blocks, such as, Tintani, Hebbal Buzurg, Gonawatla, Mincheri, Gaudur, Goldinni and Chikkahonnakuni. The first five blocks were associated with breccia hosted copper and the other two were orogenic gold mineralisation. Traverse mapping was carried out for 100 lkm in different blocks, namely, Nilogal, Kodekal and Balshettihal to understand the nature and controls of mineralisation. The analysis of core samples from first Borehole KYT-01 reported an average Cu value of 0.22% over 17.8 m (from 109 to 126.8). The second Borehole KYT-02 located 550 m west of KYT-01 comprised three zones with average copper values 0.2% Cu over 2 m, 0.16%/4.5 m (147 to 151.5m) and 0.17%/4.4 m (151.5 to 155.9 m). The scout borehole drilled at Hebbal which intersected lean mineralised zones was having fractured filled Py+Cpy. The analytical results showed a 2 m wide zone with average Cu of 0.17%. Boreholes drilled at Mincheri and Gonawatla intersected the brecciated silicified reef showing chlorite alteration in patches and pyrite disseminations. The scout borehole drilled at Gaudur intersected nine sulphidic zones characterised by pyrite- pyrhotite-chalcopyrite association. The borehole at Chikkahonnakuni intersected nearly 20 m wide brecciated meta-andesite and quartz breccia showing quartz-chlorite-tourmaline alteration and fracture filled Py+Cpy. Though the analysis of core samples did not report Au values, a 5m zone of Cu mineralisation with average of 0.2% was reported. Similarly, borehole at Goldinni intersected three sheared tourmaline- bearing pegmatite showing gold values 0.3g/t/2.5 m (23.5- 26 m). The sheared amphibolite at 166 m reported 1.2g/t Au over 0.5 m. The traverse mapping carried out around Balshettihal brought out a 250 m highly oxidised breccia zone with intense malachite staining and haematite alteration. It was found that the breccia was 6-7 km long and formed the western extension of Tintani breccia. The trenches excavated at south of Buddini exposed highly altered smoky quartz veins with Fe alteration and boxwork which reported gold values up to 1.27 ppm.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Karnataka, Eastern Dharwar Craton	Hungund Kushtagi schist belt	-	-	-	-	Drilling, Sampling	Based on the Geophysical survey and analytical data received, scout boreholes were drilled to test the mineralisation in the area. The chemical analysis of core samples of KKA-1 (Amrapur old working) showed high Au values for a length of 12 m with an average grade of 1.9 g/t. The Au mineralisation was mainly present in quartz-carbonate veins within felsic volcanics. The major sulphides were pyrite and pyrrhotite. The major alterations were chlorite and carbonate alteration. In Gadi Sunkapur area, high BRS values for gold was reported for the first time from a barite quarry. The high gold values (114 ppm, 17.4 ppm, 12.06 ppm, 1.58 ppm and 1 ppm) were reported from a quartz chlorite barite vein at Gadi Sunkapur barite quarry. Major alterations were carbonate, chlorite, haematite and biotite-chlorite- garnet alteration. One scout Borehole KRM-1 was drilled at Malatgud to test for Mo-Cu mineralisation exposed in a granite quarry. This borehole was drilled up to 199.60 m, and intersected medium-grained grey and pink granite with biotite, chlorite and haematite alterations. Mo mineralisation was observed from 90 to 118 m in the form of disseminations. Two other scout Boreholes KKN-1 and KKK-1 drilled in Naranhal and Kalmalli to test for Au-mineralisation intersected sulphide-bearing zones. The results of these scout boreholes were not encouraging. Another scout Borehole KKM-1 in Mudalgundi was to continue at Mudalgundi to test for Au-mineralisation. Spin-off proposals from RMT area will be prepared after receiving the analytical results of all the boreholes.
North-western Rajasthan, Barmer and Jodhpur districts	Malani Igneous Suite	-	-	-	-	Sampling	The main objective of this work was to identify the mineral system and delineate the areas for G-4 investigations for REE & RM and base metal mineralization in Malani Igneous Suite. The total area of RMT-II block was 3,500 sq. km. The geology of the area was marked by two different phases of volcanic episodes, sedimentary rocks and quaternary sediments. Two phases of igneous activities i.e.,, the Malani Igneous Suite (MIS) of Neoproterozoic Age (Ca. 750 ma) and Sarnu-Dandali Alkali complex of Upper Cretaceous to Eocene Age may be fertile for REE and RM mineralisation. In pursuance of envisaged targets during F.S 2021-22, rock, regolith and water sampling was carried out along ground geophysical survey (gravity and magnetic) of 276.5 L km survey at 100 m station interval and 300 m line spacing in selected five sub-blocks, to establish the ground control of buried ring structures and favourable host rock/structures for mineralisation. The maximum ΣREE+Y value analysed in rock samples was up to 0.41%. The ground water samples analysed maximum values of La (5.46 ppb), Ce (6.59 ppb) and Y (0.50 ppb), which was higher than that of samples from Siwana area. The EPMA analysis revealed the presence of parisite, thorite, monazite, allanite, britholite and rare-earth elements bearing ilmenite in porphyritic rhyolite. On the basis of geochemical and geophysical signatures, five sub-blocks (Shergarh-Tena, Nausar, Khatu, Gida and. Chilanadi) were delineated for further probing by scout drilling in FS 2022-23, to check the possibility of REE & RM mineralisation in the block.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Northern Rajasthan, Sikar, Nagaur, Ajmer and Jaipur districts	Khandela-Kishangarh Sectors	-	-	10	-	Drilling	Mineral Targeting (Phase -II) was carried out for basemetal and associated precious metals in the area in Northern Rajasthan with an objective to identify the mineral system and to extract information regarding sub-surface host lithology, possible mineralisation to generate new G3 block/blocks for future exploration. On the basis of surface evidences of mineralisation, analytical data, five areas/blocks were narrowed down for detailed ground geophysical surveys (magnetic survey, self- potential survey, induced polarisation survey and apparent resistivity survey). On the basis of this survey, boreholes were planned to delineate the sub-surface continuity of the mineralisation of the potential blocks. The borehole in Ladera block was drilled and intersected 115 m of cumulative sulphide zones along the borehole. In Harmara West Block, three scout boreholes were drilled and all the three boreholes intersected sulphide zones comprised of pyrite and chalcopyrite. Two scout boreholes were drilled in Kesharpura Block. The first borehole intersected ~160m of cumulative sulphide zones along BH associated with pyrrhotite, sphalerite, chalcopyrite, pyrite. In Kayad North Block, three scout boreholes were drilled and these intersected sulphide mineralisation in the form of sphalerite, pyrrhotite, and disseminations of pyrite and chalcopyrite. One scout borehole was drilled in Kesharpura West block which intersected 20m cumulative sulphides zones associated with disseminations of pyrite, pyrrhotite and chalcopyrite.
Gemstone							
Jammu & Kashmir Kishtwar District	West of Machail area	1:12,500	51 sq. km	-	-	Mapping, Sampling	During the period of investigation a total of 80 bedrock samples, 15 PCS, 30 heavy mineral samples, 30 stream sediment/ colluvial samples and 20 PT samples were collected (G4) to evaluate the potentiality of gemstone and REE in the study area. On the basis of field observations, the existing six mines (M1-M6) along south portal and one mine (M7) on the north portal of the Neelam Khan area is recommended to restore for further mining with proper Mine Plan involving Mining Engineer, Blasting Expert, Rock Mechanical Engineer and Geologist to avoid any subsidence or mishap during mining. The detailed geological mapping (DM) on 1:500/ 1:1000 scale of Neelam Khan area would be carried out to delineate the zone of resource- bearing pegmatite veins. It was also recommended to carryout grid pattern sampling of the scree/ stream sediments/ glacier moraine deposits in the SW slope/ area of the Neelam Khan along with bulk samples to establish concentration and distribution of placer gemstone deposit in the area.
Gold							
Jharkhand Seraikela-Kharsawan & West Bengal Purulia	Berasi-Hurrupat hardih area & Matkangara area	-	-	-	-	Sampling	During reconnaissance survey (G4) for gold and associated minerals, it was observed that the area was occupied by different varieties of acidic volcanic rock along with different other lithologies like granite gneiss, mica schist, amphibolite, ferruginous cherty quartzite, cherty quartz reef, black shale, younger sheared granitic intrusive, gabbro/ultramafic rock, and quartz veins. In terms of Au mineralisation, visible gold grains were observed in pan concentrate of stream sediments samples near Jugilang, Muru and in slopes of cherty quartz reef. Six samples showed positive anomalous values ranging 60 ppb to 300 ppb. Two samples showed anomalous value of 180 ppb and 300 ppb in cherty quartz reef extending from Suraidih to Sindurpur. Native gold grains were observed in the cherty variant in EPMA studies. Au value in the order of 250-300 ppb was also obtained in trace element analyses of pyrites from the cherty quartz reef. Around 230 ppb gold has also been noted within galena structure during EPMA studies in Matkangara area. In ferruginised cherty quartzite near Matkangara Cu up to 730 ppm, Pb up to 5.45%, Zn up to 2,552 ppm were recorded. In stream sediment sample, gold values upto 310ppb was wofed.
							noted. In ferruginized cherty quartzite near Matkangara Cu upto 730 ppm, Pb upto 5.45%, Zn upto 2552 ppm was recorded.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Odisha, Keonjhar	Gopur block area	1:1000	1.5 sq. km.	9	1563.15	Mapping, Sampling, Drilling	During the G3 stage investigation, Gold mineralisation in the IOG was seen associated with zone of intense silicification and hydrothermal alteration within the metabasalt. The NNE-SSW trending central lode was probed with 9 boreholes with 100 m spacing. Among which sulphide mineralisation zone was encountered in eight boreholes. In the southern part, there was another lode, where four first-level boreholes and one second level borehole OKG-16 were drilled with 100 m spacing. Among which sulphide mineralisation zone was encountered in three boreholes. The sulphide mineralisation, such as, pyrite, arsenopyrite, very few chalcopyrite and gold (observed from ore petrography study) were observed within metabasalt with quartz, epidote and carbonate veins. The sulphide mineralisation was observed along the foliation planes and in association with quartz and epidote veins.
UT Jammu & Kashmir, Kupwara	Lashteal, Mandma sou and Gagarnar area, Lolab valley	1:12,500	50 sq. km	-	-	Mapping, Sampling	Large scale mapping (LSM) was carried for gold and associated mineralization in Lashteal, Madmadou and Gagarnar areas in Lolab valley of Kupwara district, UT: J&K. The Cu concentration (G4) in 100 of BRS samples varied from 5.09 ppm to 3,256 ppm (Avg. 166.77 ppm), whereas in 50 channel samples it varied from 9.00 ppm to 11659.0 (1392.49 ppm).
Uttar Pradesh, Sonbhadra	Hasra-Raigarh-Kurkuti area	1:12,500	105 sq. km	-	-	Mapping, Sampling	The mapped (G4) area was covered by rocks of Parsoi Formation and Agori Formation of Mahakoshal Group. Au values above 0.05 ppm obtained in seven bedrock samples and varied from 0.05 to 0.21 ppm. Cu value ranged from 5 ppm to 67 ppm, Pb varied from 20 ppm to 206 ppm, Zn varied from 5 ppm to 124 ppm and Co varied from 39 ppm to 29.7 ppm. Au concentration in 50 channel and 50 trench samples obtained values below 0.05 ppm.
Andhra Pradesh, Kadapa district	Bhagampalle-Kasinag aram area	-	-	-	-	Mapping, Sampling	The quartz carbonate veins within quartz chlorite schist form the main zone of mineralisation (G4). Visible specks of pyrite, chalcopyrite and in rare cases, gold were observed within this zone. Most of the sample's showed <25 ppb gold and a few samples showed 40-120 ppb. The BIF (banded magnetite quartzite) bands gave up to 39% FeOt, but the width of the band was very less. The pitting/trenching and soil/stream sediment samples showed <25 ppb value for gold for all the samples.
Chhattisgarh, Jashpur	Pharsabahar - Tuba area	1:12,500	100 sq. km	-	-	Mapping, Sampling, Pitting, Trenching	During the period of investigation (G4), 50 cu m pitting, trenching and sampling were carried out in the potential areas along with the collection of 50 stream sediment samples and 100 bedrock samples respectively. Geologically, the area of investigation was composed of rocks of Chotanagpur Gneissic Complex that falls within Bilaspur-Raigarh-Sarguja belt consisting of granodiorite-gneiss, meta gabbro and amphibolite with its variants. These rocks were seen traversed by 3 generation of quartz veins of varying dimension. The second-generation quartz veins were generally mineralised with gold values. Pyrite, arsenopyrite, galena, azurite, chalcopyrite was often seen associated with this quartz vein. Five blocks identified were Tuba block, Mankarkunda block, Bangaon block, Northern most Pandripani block and Barkaspali block. Highest value for gold in PT/BRS/46 was 36.68 ppm collected from Tuba Village from intense ferruginised quartz venations within granodiorite; in association with Pb 0.23%, As 68.12 ppm and Hg 13 ppb.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Chhattisgarh Badoda bazar and Bhilaigarh	Saliha-parsapali areas	1:12,500	100 sq. km	-	-	Mapping, Sampling, Pitting, Trenching	During the G4 stage investigation petrochemical samples (PCS), 20 of petrographic samples (PS), 100 of bedrock samples (BRS) were collected (G4). About 100 cu. m pitting/trenching was carried out along with collection of 100 of pitting/trenching samples (PTS) (G4). In addition to these, 50 of stream sediment samples were collected from mostly first order streams (rarely from second order) and submitted for analysis. The area was observed to be represented by volcano-sedimentary sequence belonging to Sonakhan Group, basic and acid igneous suite belonging to Bilari Group and younger intrusive granitoids and basic dykes. Silt size gold grains were recovered
							during the panning of the stream sediments. Visible specks of sulphide (mostly pyrite) were recorded at the contact zones within metabasalt, metagabbro and metarhyolite. The highest value for gold (Au-3.64 ppm) was obtained from BRS-85 collected from intense ferruginised quartz venations within metarhyolite of Barkachhar area. The BRS-90 with Au of 0.26 ppm & BRS-92 with Au value of 0.25 ppm were recorded from soil samples of silicified metarhyolite collected to the south of Dhourabhata area and BRS-96 with Au value of 0.41 ppm was obtained from ferruginous chert to the SW of Village Pachperiya.
Karnataka, Haveri	Sidlapur Block, Singgaon Taluk	1:1000	2 sq. km.	8	671.20 m	Mapping, Sampling, Pitting, Trenching	During the period of investigation (G3), 186 cu. m trenching and 671.20 m of drilling were carried out. Apart from this, a Geophysical Survey (G3) involving IP, Resistivity and Magnetic method of 42.5 l km was also carried out. The mapping has brought out presence of two major and three minor banded ferruginous quartzite (BFQ) units within a meta-greywacke/ argillite. The general trend of the bedding (S0) were N10°W to S10°E dipping gently towards east. Mesoscopic folds of S- asymmetric nature were observed at many places with 10º to 35º plunge towards north. The bands were characterised by intense limonitisation, silicification, ferruginisation and sericitisation and often noticed with disseminated cubic pyrites and stringers of sulphides. The Total Field Magnetic anomaly contour map showed high intensity Magnetic signatures along two prominent trends, one was NNW to SSE to NS trending local geological trend. The detailed magnetic survey, IP and Resistivity survey by gradient array has revealed one prominent anomalous zone in the central part of the study area with a strike length of 2 km with depth varing from 10-20 m. Majority of the boreholes intersected silicified zone characterised with intense carbonitisation along with presence of pyrites in the form of lamination, chunks, smears, stringers and disseminations. This zone was also demarcated with magnetite laminations in rhythmic fashion and some borehole intersected BFQ also. While the silicified zone ranged in thickness from 2.05 to 6.45 m, portion with magnetite layering varied in thickness from 0.1 to 2.14 m. Sympathetic zone (Zone-II) marked with carbonitisation in the form of secondary veins and veinlets were marked in for about 300 m in KHSB-1 & 2 in the northern segment. The analytical results received till date revealed that the Borehole no. KHSB-1 showed 0.417 g/t/0.5m for Zone-I. The Zone-II in KHSB-1 showed the average Au value of 0.030g/t/0.5m. The Zone-I of Borehole no. KHSB-2 showed auriferous lode averaging 2.8 g/t/2m whereas Zone-II showed only 0.037g/t/0.5m. The corresponding trench i.e., STR-4 in the same profile line showed indication of Au value of 0.83g/t/1m. KHSB-3 showed 0.628 g/t/0.5m and KHSB-5 showed average assay value of 0.75g/t/0.5m.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Karnataka, Chikamaglur and Davangere	Hanni, Bukkumbudi, and adjoining areas	-	-	-	-	Sampling	The area falls within the eastern margin of the Shimoga Schist Belt in western Dharwar craton (G4). The area comprised metavolcano- sedimentary suite of rocks unconformably lying over the basement granitic gneiss of the Peninsular Gneissic Complex (PGC). The volcano-sedimentary rocks were represented by basal conglomerate, quartzite, quartz-chlorite carbonate schist, quartz sericite schist belonging to Chitradurga Group. During the geological traverse the different lithologies observed were, Granite gneiss, Titaniferous- vanadiferous magnetite (TVM) bands, Meta- pyroxenite, Talc tremolite actinolite schist, Tremolite actinolite schist, Conglomerate, Quartz- Chlorite schist, Quartzite, Quartz sericite schist, Anorthositic gabbro, Serpentinite, gabbro and dolerite dykes. Based on the surface manifestation of magnetite, sulphide mineralisation and surface alteration fifteen feeble narrow anomalous zones were identified. The chemical analysis for Au received for 125 samples showed five samples that analysed>100 ppb (Au) ranging from 25 to 435 ppb in conglomerate, Meta pyroxenite and TVM rocks. The base metal analytical results received for 89 samples ahowed Cu in bedrock samples yielding a maximum of 1,655 ppm average 0.1% @ 3m in quartz-chlorite schist rock. Mn values ranged from 90 to 6,100 ppm and nine samples analysed >24% for Fe in TVM bands.
Kerala, Palakkad and Malappuram	Mulliakurss - Vattathur	1:12500	100 sq. km	-	-	Mapping, Sampling	During G4 stage investigations, 108 bedrock samples, 50 trench samples, 25 regolith samples and 50 stream sediment samples, 13 petrochemical samples, 5 XRD samples and 5EPMA samples were collected. The area exposed rocks viz. banded magnetite quartzite, pyroxene granulite, amphibolte and metapyroxenite of Wayanad Group, charnockite of Charnockite Group andbiotite gneiss and granite gneiss of Peninsular Gneissic Complex. Indications of mineralisation in the form of pyrite disseminations, chalcopyrite, pyrrhotite and bornite were observed in quartz veins, gneisses and banded magnetite quartzite. Intense limmonitisation and silicification of BMQ also acted as surface indications of mineralisation. About 23 old workings in the form of inclines, shafts and narrow trenches were observed near Maruthumppara, Vettathur, Nattukal, Thazhekkod and Telakkad in BMQ bands and associated laterites and the excavations followed the trend of BMQ bands. About 2 to 9 m wide and 10 to 40 m long NW-SE trending three leached zones were mapped around Pattikkad, Ponniyamkurussi, Vettathur and Mulliakurussi areas within charnockite and gneisses. In this leached/limonitic zone fresh pyrite, chalcopyrite was noticed and sensed smell of sulphur from this zone. These also were indications to show the evidence of mineralisation. Available analytical results showed Au values in bedrock samples as below detection level, i.e., <0.05ppm and that in stream sediments (2 nos.) analysed 0.2 ppm.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Tamil Nadu, Tiruvan - namalai	Chengam - Uchimal - aikuppam	1:12500	100 sq. km	-	-	Mapping, Sampling	As part of G4 stage investigation, reconnaissance survey was carried out in Chengam and Uchimalaikuppam areas to delineate potential zones for gold and associated mineralisation; collection of bedrock, groove as well as stream sediment samples were also carried out. LSM brought out seven lithologies in the investigated area. They were charnockite, pyroxene granulite, banded magnetite quartzite (BMQ), granite gneiss, quartzo-feldspathic rock, dolerite dyke and milky white quartz vein. Ore microscopic study revealed that the sulphide phases like chalcopyrite and pyrite occurred as disseminations in association with oxides and silicates. Sulphides also occurred along the fracture planes of garnet grains. The oxide phases include magnetite, haematite and ilmenite. Magnetite crystal retained its idiomorphic form but totally replaced by haematite giving rise to martitisation texture. About 50 samples were collected from higher to lower order streams covering the whole investigated area to delineate source of gold. Out of 50, 42 stream sediment samples were collected from 2nd/3rd order stream which were cutting across the BMQ bands. Out of 50, 9 stream samples yielded gold specks along with heavies during panning. The gold grains showed spherical, elliptical, dumble and ameboid shape and size varied from 252.17 µm to 1,610.65 µm. However, analytical results of 50 stream sediment did not yield any gold value. About 100 BRS were collected from BMQ and associated litho-units. Out of 40 BRS, 3 samples showed Au values ranging from 48 ppb to 102 ppb. Maximum values of Arsenic (As), Bismuth (Bi), Molybdenum (Mo) and Tungsten (W) were 14.74 ppm, 0.18 ppm, 44.45 ppm and 11.53 ppm respectively. Out of 10 prioritised samples collected from silicified BMQ, 2 samples showed Au value ranging from 0.08 ppm to 0.18 ppm. Cu values varied from 130 ppm to 1,160 ppm. Cobalt (Co) values varied from 30 ppm to 100 ppm, nickel (Ni) values varied from 40 ppm to 390 ppm and FeO (%) was analysed up to 31.38% in silicified BMQ. Out of 100 groove samples, 7 samples showed gold values varying from 26 ppb to 340 ppb. These 7 groove samples were collected from silicified and gossanised BMQ bands in the south western part of Uchimalaikuppam RF and northeast of Pudur.
Rajasthan, Udaipur District	Rathri-Harmatiya Khurd	1:12500	50 sq. km	-	-	Mapping, Sampling	The main objective of this work was to assess the nature and potentiality of gold and base metal mineralization. Geologically, the study area exposes the rocks of Mangalwar complex and Aravalli Supergroup. Different rock types observed during mapping (G4) included granite gneiss of Mangalwar complex and the rocks belonged to Aravalli Supergroup and comprised dolomitic marble, garnet-biotite-schist, calc-silicate, amphibolite, metavolcanics intruded by quartzo-feldspathic veins. Evidences of mineralisation in the area occurred in the form of small old workings/ pits, gossanisation, ferruginisation, malachite staining, silicification, dissemination of pyrite grains
Rajasthan, Udaipur and Dungarpur	Bara Talav-Jharap- Bori	1:12500	50 sq. km	-	-	Mapping, Sampling, Trenching	Geologically, study area is occupied by the rocks of Mangalwar complex of Archaean age and Aravalli Supergroup of paleo-proterozoic age. Mangalwar complex is represented by the banded biotite granite gneiss. The banded biotite granite was observed as gneiss medium to coarse grains, dark greyish to white gray in colour (G4). The banding in the gneisses was marked by dark bands rich in ferromagnesian minerals mainly biotite and light-coloured band rich in quartzo-felspathic material. During mapping (G4), a gossan zone was also identified. It was seen associated near to the contact of dolomitic marble and garnetiferous mica schist around Bara-Talav area. The dimension of the zone was approximately 400 m length and 40-50 m in thickness. During the course of mapping, 50 cu. m trenching work was carried out through 6 trenches.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Udaipur District	Devgaon Block	1:2000	1.5 sq. km	-	-	Mapping, Sampling	The area (G3) of 1.5 sq. Km falls in parts of the toposheet no. 45L/04. As per the objective, 200 samples were to be collected for surface sampling and 1,000 m drilling was to be completed. The lithounits exposed in the area belong to of Banswara Formation of Udaipur Group of AravalliSupergroup. The main lithounits were quartz biotite schist, metabasics and para-gneiss. Pegmatites, dolerite dykes and quartz veins occurred as intrusive. Gossan/ ferruginisation were developed within meta-basic and pegmatite lithounits. The surface evidences of mineralisation were seen in the form of malachite/ azurite stains, presence of ferruginous zones, gossan outcrops and fresh sulphide within gossan and hydrothermal alteration. On the basis of surface evidences of mineralisation and geochemical analytical results and detailed geological mapping, a surface mineralisation zone was delineated. This zone was mostly confined within metabasic and pegmatite rock. The dimensions of this zone were 800-900 m in length and 20-100 m in width. The results of most of the surface samples showed appreciable gold and copper mineralisation.
Rajasthan, Banswara	Ghatiyana Block	-	-	11	1249.00 m	Mapping, Sampling, Tren ching, Drilling	The main lithounits were phyllite, quartz albite epidote rock, and impure marble and quartz veins. Phyllite was the most dominant lithounits having well-developed foliation. Central part of the area was occupied by thin impure marble bands and quartz albite epidote rock. The surface mineralisation in the area was manifested by malachite / azurite stain, hydrothermal alterations, gossans, ore grinding implements and presence of fresh sulphides like pyrite, pyrrhotite, chalcopyrite and bornite. Based on the detailed geological mapping (G3) and channel sampling at a regular interval of nearly 100 m along strike, trench sampling and bedrock sampling, one surface mineralisation zone (MZ-I) was delineated having dimension of nearly 1.3 km strike length and 6-10 m width. A total of thirteen channels of the various lengths were laid along the strike and a total of 161 channel samples, 31 trench samples and 50 bedrock samples were also collected. Channels showed encouraging value of copper. Chemical result of channels showed copper (Cu) in the ranged of 170 ppm to 2.00 % with an average value of 0.23 %, while gold (Au) varied from <0.05 ppm to 0.23 ppm with an average of 0.07 ppm. All boreholes intersected significant sulphide mineralisation in the form of chalcopyrite, bornite, and covellite (VE = 1% to 2%). A few native copper grains were also present in core samples.
Rajasthan, Sirohi District & Gujarat, Sabarkantha District	Shemlabhuj and Bahara area	1:12500	50 sq. km	-	-	Mapping, Sampling	As part of G4 stage investigation, total 100 bedrock samples/channel samples, 30 stream/soil samples, 20 samples for petrological study, 10 samples for ore microscopy study and 50 PTS samples were collected. In one dyke of gabbro, cumulates of mafic minerals were observed which may be potential in terms of PGE mineralisation. A well-developed Gossan of dimension 200 X 50m was observed over granite gneiss near Village Shemlabhuj showing pyrite and chalcopyrite at places. In western part of the block-brecciated quartz vein was observed in granite gneiss having pyrite and chalcopyrite at places.
Graphite							
Chhattisgarh, Balrampur	Oranga-Revatipur	1:4000	3.6 sq km	16	1392 m	Mapping, Sampling, Trenching, Drilling	A G3 stage investigation was carried out for graphite in Oranga-Revatipur area. Area mainly comprises of meta-sedimentary sequences of the Older Metamorphic Group and consist quartzite, quartz mica schist, graphite mica schist, calc silicate and amphibolite. A total of 59.2 cu. m of trenching was carried out and 55 trench/pit samples were analysed for fixed carbon analysis. A total of 10 petrochemical samples (PCS) and 20 petrological samples (PS) were analysed. A total of 16 first-level boreholes were drilled with 200 m spacing in the block area. A total of 1,392 m was drilled in first-level boreholes and 487 core samples were generated during Field Season 2020-21 & 2021-22 of G-3 stage mineral investigation. In borehole graphite mica schist was found to have varying thickness from 1 m to 60 m and was intercalated with quartz mica schist and calc silicates. Analytical result of drilled core samples reveals the fixed carbon content which was found ranging from 4.47% to 10.33%.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Madhya Pradesh, Jhabua District and Gujarat, Dahod District	Patra-Guvali-Satsera-Gopalpura area	1:12500	-	-	-	Mapping, Sampling, Pitting/ Trenching	Based on limited exposures and pitting / trenching in soil cover area, the graphite hosting carbonaceous phyllite body was traced over a cumulative strike length of 1.29 km from south of Village Patra to Village Dhebar. The north Patra mineralised zone was 650 m and thickness varied from 10 m to 140 m. The overall strike direction of the Patra south band varied from N730W- S730E to N400W- S400E. Sample no. B045 with maximum values of 8.21% was from north Patra mineralised zone. Keeping the cut-off value of fixed carbon at 2%, 8 m wide and 150 m long mineralised zone was established in Trench CH-03 with average fixed carbon content of 2.09%. A total of 05 graphite samples were studied through Laser Raman Spectroscope. It was confirmed that the entire sample contained graphite. The analytical data for MnO, V and Ni of 25 samples out of 100 were received. Spot samples showed MnO values of 42.39% and 42.11% from Anas River block. The same samples also showed V results of 194 ppm and Ni results of 141ppm. The Mn ore was found to occur in association with smaller exposed quartzite bodies in and around Mandli and Rampura. The strike of the quartzite varied from N5°E to N40°E and the dips ranged from 20°-65° to the west. The ore was chiefly psilomelane and braunite with some pyrolusite.
Madhya Pradesh, Alirajpur & Jhabua	Badi Miriyavat-Juwari Bari-Semlaya area	1:12500	-	-	-	Mapping	The rocks exposed in the study area (G4) showed a general trend in NW-SE direction with moderate to steep dip towards SW. During the large-scale mapping, five discontinuous lensoidal graphite bands were identified trending NW-SE direction, in which two major graphite bands varied in length from 870 m to 1.1 km and width from 77 m to 330 m, were exposed from Juwari Bari in the south up to Jawas in the northwest. In addition to these, three comparatively smaller bands varied in length from 300 m to 500 m and width from 50 m to 90 m of carbon phyllite/graphite schist/grey carbonaceous marble were demarcated in the eastern part of the study area. The graphite mineralisation in the study area was mainly associated with carbonaceous marble and carbon phyllite. It mostly occurred along the foliation planes as thin layers, small patches, pockets and lumps within the carbon phyllite/graphite schist/grey carbonaceous marble. Carbon phyllite/graphite schist/grey carbonaceous marble was seen to occur as lensoidal bodies on the surface. The presence of graphite in the mineralisation zones were confirmed by the study of thin polished sections. The carbonaceous marble was mainly associated with the carbon phyllite/graphite schist and phyllite which was in contact with the quartzite of Aravalli Supergroup.
Madhya Pradesh, Sidhi	Bahera-Goriara block (G3 stage), Mahakoshal group	1:2000	1 sq. km.	8	-	Mapping, sampling, drilling	A total of 10 PCS, 10 trace elements, 50 channel/groove samples, 10 PS, 05 BRS and 05 EPMA/Ore microscopy samples were collected. A total of 08 boreholes in a series pattern were planned from Bahera to Village Goriara at a 200 m interval so to intersect mineralisation at a 30 m vertical depth. About 03 boreholes were supported by channel/groove sampling of graphitic-bearing lenses carried out during G4 stage of exploration and 50 channel/ groove sampling were carried out in front of section line of remaining 05 boreholes for borehole planning. Along Borehole no. MPSBG-1, detailed geological and geophysical logging for 82.70 m was under taken. Graphitic carbonaceous phyllite was intersected from 19.50 m to 23.50 m and 56.80 m to 81.30 m, totaling to 24.80 m of mineralised zone (true width 21.50m) for which sampling was completed and samples were submitted on priority basis. The mineralisation intersected along the borehole suggested continuity of graphite-bearing lenses till 30m vertical depth and ~300 m RL. Also, abundant malachite grains/encrustation was encountered during logging which suggest base metal potentiality of the area.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Jharkhand, Palamu	Adhmaniya block	-	-	13	-	Drilling, sampling	The area (G3) exposed rocks of i) Unclassified Metamorphics, ii) Chhotanagpur Gneissic Complex, and iii) acid and basic intrusive that have intruded in different rock types. The host rocks for mineralization in the area are graphite-bearing sillimanite schist and granite gneiss. The graphite mineralization is in the form of lenticular bands disposed of in an enchelon pattern. Two graphite schist bands trending in WNW-ESE were delineated. The southern band was 700 m in length with a moderate dip southwesterly. The northern band was bifurcated into two branches having an approximate strike length of 200m and 650m dipping moderately towards the southwest. The ground geophysical survey (SP) of 29 LKM was carried out in this block. Two anomalous zones were delineated on the SP map. Zone-I in the southern part of the block was approx. 700 m in strike direction whereas Zone-II was swerving and branched into two parts. Graphite mineralisation was picked up well by SP anomaly. Out of the total 13 boreholes, boreholes JHPA-01, JHPA-02, JHPA-03 and JHPA-04, and JHPA-05 were drilled in the southern band of the area. Proximate analysis of 55 BRS and 63 core samples were received. Fixed carbon up to 25.23 % and vanadium up to 1,359 ppm were obtained from Bedrock samples (n=55). In Borehole JHPA-01 weighted average was of 9.57%, FC for 63 m sample length with a maximum FC up to 17.28%. In Borehole JHPA-02 weighted average was of 9% FC for 30 m sample length with a maximum FC up to 15.1%. In Borehole JHPA-11, three enriched zones of vanadium were intersected. Zone-I, Zone-II and Zone-III had weighted average of 887 ppm (17 m sample length), 833 ppm (27 m sample length), and 660 ppm (17 m sample length) respectively. In Borehole JHPA- 02, 28 m sample length with a weighted average of 906 ppm of vanadium while in Borehole JHPA-13 a zone of 18 m sample length with a weighted average of 645 ppm were intersected.
Jharkhand, Palamau (G3)	Karma block	-	-	-	872 m	Drilling, sampling	The two graphite mineralised zones with strike lengths of 600 m and 550 m were established with the support of geological, geochemical, and ground geophysical surveys. The SP survey was carried out and the data were processed and analysed to identify the possible zone of occurrences of graphite mineralised body and its strike continuity in soil-covered areas. The sub-surface persistence of mineralised zones was validated by putting nine boreholes at an interval of 200 m with total drilling of 872 m, and 402 core samples of one-meter length were generated. The analytical results so far received, were encouraging for bedrocks and core samples. The average fixed carbon for BRS and PTS was 14.56% and 7.16% respectively. The Borehole JHPK-01 intersected a lode of 49 m length along the borehole with a weighted average of 8.5% Fixed carbon (FC) and in JHPK-02 three mineralised zones were intersected with 14 m, 6 m, and 3 m length and weighted average of 7.48%, 5.18% and 4.81% FC respectively. In Borehole JHPK- 04, two lodes of 36 m and 4 m along the borehole with a weighted average of 5.64% and 4.26% FC respectively were intersected. Three lodes of 8 m, 20 m, and 15 m of graphite were intersected in Borehole JHPK-07 with 2.02%, 6.44% and 4.99% FC respectively. In Borehole JHPK-08, a lode of 8 m length along the borehole with a weighted average of 4.54 % FC was intersected.
Jharkhand Palamu (G3)	Siuri block	-	-	14	-	Drilling, Sampling	The study area (G3) comprises a different variant of granite gneiss and granitoids of Chhotanagpur Granite Gneissic Complex (CGGC) and metasediments of the Proterozoic age. Based on the detailed mapping, the surface indication of mineralization and the geophysical survey (Self-Potential method), two mineralized zones has been delineated in the mapped area. Mineralised Zone-I has an extension of 550 m along the N-S strike length and a width of 170 m. However, Mineralised Zone-I was seen bifurcated into two parts in the northern part, the western part was nine-meter thick while the eastern part was 20m in width. Mineralised Zone-II in the northern part of the block was with a strike length of 400 m and with varying width from 25 m in the north to ten metres in the south. Another mineralised band was mapped in the northern part of the Mineralised Zone-II which.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							was about 120 m in strike length and with a width of 25 m across the strike. Graphite schist is the important host rock for graphite mineralisation. Graphite occurred along the foliation plane as isolated flat, plate-like grains with broken, irregular or angular edges. Besides this, sulphide mineralisation mainly pyrite was observed both as dissemination and stringers within the graphite schist and calc-silicate. A total of 14 inclined boreholes at an angle of 45° except one borehole at 60° were planned at 200 m intervals along the strike that intersect the mineralised body at approx. 30 m vertical depth. In Mineralised Zone-1 (NE part of the block), eight boreholes (JHPS-01, JHPS-02, JHPS-03, JHPS-04, JHPS-05, JHPS-08, JHPS-09 and JHPS-14) were drilled. The graphite mineralised zones intersected approx. 32 m thick in JHPS-01, 20 m in JHPS-02, 19 m in JHPS-03, 5 m in JHPS-04, 22 m in JHPS-05, 05m in JHPS-08 and 11 m in JHPS-09 along the boreholes. In Mineralised Zone-2, six boreholes were drilled (JHPS-06, JHPS-07, JHPS-10, JHPS-11, JHPS-12, and JHPS-13). The graphite-bearing schist was approx. 42 m in JHPS-07, 28 m in JHPS-10, 10 m in JHPS-11, 12 m in JHPS-12 and 15 m in JHPS-13 along the boreholes. The chemical analyses received to date showed that in bedrock samples, fixed carbon varied from 5.11% to 18.57% and V concentration varied from 183 to 2,501 ppm
Jharkhand, Palamu And Latehar (G4)	Nawadih-Gurha area	-	-	-	-	Sampling	During the G4 stage investigation, a total of 15 bands of graphite in the form of linear continuous and discontinuous bodies were delineated. The strike length of the band varied from 332 m to 1.07 km and the width varied from 84 m to 375 m. The host rocks for graphite mineralisation in the area were granite gneiss, quartzite and granulite. The analytical result of 102 BRS and 100 PTS yielded 13.46% average fixed carbon. About 79 BRS yielded more than 10% FC. So far 61 BRS for Vanadium were analysed and these showed encouraging concentrations in the ranged of 73 to 4,859 ppm and the average was 782 ppm. Seventeen samples out of 61 yielded more than, 1000 ppm of Vanadium which was very close to the present cut-off value.
Odisha, Nayagarh	Daspalla Block, Tumandi Village	2.3	-	23	1733.5	Mapping, Pitting, Trenching, Drilling	The ore body (graphite) is hosted within khondalite and migmatised khondalite and graphite occurs as disseminations. About 50 cubic metre of pitting and trenching work were completed. Five occurrences of graphite mineralisation, near Tumandi-Narajipara area were observed in the quarry and pond. All the quarry sections were aligned in N-S direction. Apart from that 33 BRS samples and 36 trench and pit samples were collected in the study area as well as in the periphery of the study area. All the 69 samples were showing high values of fixed carbon (FC%). The FC value varied from 3.6% to 21.56% in trench samples and 2.13% to 25.02% in BRS in the study area. As the graphite body was seen mostly concealed beneath the surface, 1st level boreholes were planned on the N-S aligned quarry sections based on results of trenches. Out of 23 boreholes drilled so far, 20 were 1st level boreholes and 03 were 2nd level boreholes. About 410 core samples were collected so far from 23 boreholes. As per the visual estimation of all the drilled boreholes, 26 m of graphite occurrences were delineated in borehole no. ODT-6 from 26.5 m to 52.5 m and as per the chemical analysis, three graphite zones were delineated having 3.47% FC from 28 m to 38.5 m depth, 3.13% of FC from 41 m to 46 m and 3.04% of FC from 47.5 m to 53.5 m depth. All the boreholes intersected graphite zones except borehole ODT-9 & ODT-14. The thickest graphite zone was delineated in Borehole no. ODT-22, i.e., 29.5 m graphite zone from 24.5 m to 54 m depth. As per the visual estimation of graphite zones in all the 20 1st level boreholes, geological profile lines of 8 boreholes i.e., ODT-5, 6, 7, 8, 15, 16, 17 & 22 were selected for 2nd level drilling.
Arunachal Pradesh, West Siang (G3)	Kalamati area	1:2000	1.5 sq. km	-	194.55 m	Mapping, Drilling, Sampling	In Kalamati block, spot BRS samples from carbonaceous phyllite showed vanadium values up to 4,639 ppm with Fixed Carbon up to 8.6 %, channel samples showed vanadium values in the ranged from 106 to 1,282 ppm, Zn values up to 3,017 ppm and Ni up to 788 ppm. Trench samples showed vanadium values from 582 to 1,285 ppm with average of 912.3 ppm and Zn values from samples of one trench yielded from 409 to 1,904 ppm with average of 804.7 ppm. In fulfilling the objective, the carbonaceous band in Kalamati block was targeted by incline Borehole no. ARWSK- 01. Drilling in this borehole was done up to 194.55 m and the major lithologies intersected in the borehole were grey phyllite and quartzite. Only a thin band of carbonaceous phyllite mixed with grey phyllite was intersected from 147.0 m to 149.0 m.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Arunachal Pradesh, Lower Subansiri (G3)	Radhpu block	1:2000	1.5 sq. km.	10	1279.55 m	Mapping, Sampling, Drilling	A G3 stage of preliminary exploration for Graphite and Vanadium was taken up in Radhpu Block in Lower Subansiri District of Arunachal Pradesh. Surface sampling have yielded Vanadium values ranging from 525-2,189 ppm & Fixed Carbon ranging from 6.30% to 13.69%. Five boreholes were drilled on Band I and five on Band II with more or less 200 m spacing. The total drilling completed in both the bands was 1,279.55 m and a total of 498 core sample were generated from the mineralised zone intersected from all the boreholes. Band I intersected at first-level (30 m vertical intersection) in BH1 (True width of 20 m with wt. avg. value of 4,762 ppm V2O5 and 11.24% FC), BH3 (True width of 18.91 m with wt. avg. value of 4,069 ppm V2O5 and 11.47% FC), BH4 (True width of 59.8 m with wt. avg. value of 4,762 ppm V_2O_5, 11.24% FC), BH6 (True width of 40 m with wt. avg. value of 1,861 ppm V_2O_5, 11.45% FC), BH7 (True width of 25 m with wt. avg. value of 2,583 ppm V_2O_5, 10.58% FC) and intersected at deeper level (140 m vertical intersect) in BH8 (True width of 51.1 m with wt. avg. value of 1,828 ppm V2O5, 9.7% FC). Band II was intersected at first-level (30 m vertical intersection) in BH2 (True width of 6.23 m with wt. avg. value of 2,626 ppm V_2O_5, 15.23% FC), BH5 (True width of 7 m with wt. avg. value of 1,197 ppm V_2O_5, 5.17% FC), BH8 (True width of 9 m with wt. avg. value of 333 ppm V_2O_5, 18.03% FC), BH9 (True width of 12 m with wt. avg. value of 552 ppm V_2O_5, 6.31%FC) and BH10 (True width of 23 m with wt. avg. value of 431 ppm V2O5, 5.8% FC).
Andhra Pradesh East Godavari	Burugubanda	-	-	7	1171.5 m	Drilling	The investigation was taken up with an objective to delineate the graphite mineralisation zone and to assess the resource for graphite and associated elements in G2 stage. In G2 investigation, the first Borehole AEB-1 intersected graphite mineralised zone from 168.00 m to 178.00 m with total 10 m of apparent thickness with visual estimation of 7- 10% FC. The In Borehole AEB-5, the graphite zone intersected from 132.00 m to 137.30 m with visual estimation of 7-10% FC. In Borehole AEB- 2, the graphite zone intersected from 152.39 m to 155.70 m with visual estimation of 8-10% FC. In Borehole AEB-1A, the graphite zone intersected from 97.00 m to 100.00 m. In Borehole AEB-4, the graphite zone was intersected from 175.00 m to 180.00 m with visual estimation of 7-10% FC. In Borehole AEB-6, one thin graphite zone was intersected from 18.75 m to 20.50 m with visual estimation of 1-2% FC and another zone at 1,11.25 m to 114.00 m with visual estimation of 5- 10% FC. The graphite mineralised zone was observed associated with quartzo-feldspathic pegmatite and garnet-bearing pegmatite. The graphite was fine-grained and flaky type in nature. The borehole geophysical logging of 586 m was completed. As per analytical result received for AEB-5 boreholes, the ranged of max. value observed were 1.40 % to 21.59 % FC & and in case of tungsten in 6.23 ppm to 142.49 ppm. The drilling is under progress—the depth continuity and the exact lateral extension of the mineralised zone in the area are yet to be confirmed.
Tamil Nadu, Sivaganga (G4)	Eastern part of Sivaganga Graphite Belt	1:12500	100 sq. km	-	-	Mapping	The general trend of the rock type noticed in the study area was N80°E-S80°W with dipping towards south direction but in some of the trenches it was found dipping towards northernly directions. Based on LSM mapping, graphite mineralisation associated with epidotised quartzo- feldspathic rock and carbonate vein was reported in north of Village Ulaganathapuram. The strike continuity extends 500 m long and trended till in WSW-ENE direction. Flake nature of graphite mineralisation was seen concentrated in sheared portion of host rock. Analytical results of 142 trench samples collected from 7 graphite occurring trenches indicated that the FC varied from 0.01 % to 31.63 %, VM varied from 2.03 % to 28.03 %, Moisture varied from 0.07 to 4.82 % and Ash varied from 60.88 to 92.61 %. However, 34 trench samples showed >20 % FC, 66 trench samples showing >10 and 5 and <10 % FC value.
Gypsum							

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Himachal Pradesh, Lahaul and Spiti	Giu and Hurling	1:12500	25 sq. km	-	-	Mapping, Sampling	Preliminary exploration (G3) was carried out for gypsum in Giu and Hurling area. Gypsum bands delineated in Nichala Chango area was observed to have a strike length of approx. 175 m with thickness of approx. 30 m. The weighted average of gypsum (CaSO4.2H2O) in Nichala Chango was 97.75%. In Chango area, the strike length of gypsum band was approx. 450 m with thickness of approx. 40 m. and weighted average of gypsum ($CaSO_4.2H_2O$) was 96.79%.
							In Sumdo area, the cumulative strike length of gypsum bands was approx. 500-600 m with thickness of approx. 30 m and weighted average of gypsum ($CaSO_4.2H_2O$) was 96.56%. On the basis of analytical data of Borehole (HPLSGBH-01) in Giu block, the cumulative true thickness of the gypsum band was 52.45 m with 85.60% weighted average of $CaSO_4.2H_2O$.
Iron							
Bihar, Jamui District	Bhanta block	-	-	7	-	Mapping, Sampling, Drilling	In G3 stage investigation, preliminary exploration for magnetite was taken up in Bhanta block to establish the continuity of the already proved ore body of adjoining Majos block with significant resource. Seven boreholes were drilled which intersected different types of ore-bearing zones viz. Lateritic soil, BMQ associated with intermittent quartz mica + amphibole schist and Biotite/ amphibole-bearing mica schist with thin bands of magnetite. In Boreholes BJB-02, BJB-04 and BJB 05, Biotite/amphibole bearing mica schist with thin bands of magnetite were intersected. The exploration works in the block established the continuity of the Major ore band for about 500 m
Karnataka, Haveri and Devanagere districts	Melebnur area	1: 12,500	100 sq. km	-	-	Mapping, Sampling, Trenching	In G4 stage investigation a total of 165 BRS, 100 Soil samples and 35 trench samples were collected to assess the mineral potential zone. The primary mineralisation observed in BIF was magnetite, whereas manganese oxides were secondary mineralisation. A pocketiferous highly oxidised and limonitised zone was observed as yellowish and orange stain. The thickness of this oxidised zone was 2-3 cm and extended about 15 m. The metabasalt unit appeared as greenish, medium-grained, hard, compact or foliated, comprising of plagioclase + pyroxene + chlorite + garnet. This lithounit was observed to be intruded by sulphide-rich (chalcopyrite-pyrite) carbonate veins; also observed were disseminated specs of chalcopyrite in Metabasalt. Meta-quartz porphyry covered a significant area of toposheet and was well exposed at the central part of the block area as a folded sequence. The analytical results of BRS samples (74) collected from the BFC band-I in Malebennur area showed 10-35.85% Fe (Fe>25% , N=6), 0.09 to 3.8% Mn,<0.025% Ni, 130-900 ppm Zn, 10-600 ppm Cu and 10- 80 ppm Pb. Based on the Fe content, the sample was classed as very low grade. Au values received for 65 BRS samples and 44 soil/regolith samples showed values <25 ppb. Li values obtained for BRS samples (24 nos.) collected from BIF band showed average Li content as 9 ppm whereas 11 samples showed Li content as >10 ppm. Analytical results of PTS samples showed Fe content as 1-12% and Mn as 0.02-0.5 % whereas Cu, Pb, Zn, Ni and Cr content was not of significance from exploration point of view. About 15 Channel/groove samples collected from the highly oxidised limonitic zone located south- west of Village Bevinahalli showed Fe content ranging from 11 to 38.33% with an average of 28%.
Manganese							

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Chhattisgarh Korea District	Devra-Jatashankar area	1: 12500	100 sq. km	-	-	Mapping, Sampling	The study area (G4) Devra-Jatashankar lies in the north- eastern part of Toposheet no. 64I/03 (~95%) and the northwestern part of Toposheet no. 64I/07 (~5%). These encrustations were mostly formed over the sandstone surface and in fracture, crack and joint zones. Further indications reveal that encrustation seems to form wherever it was exposed to the atmosphere. There were some penetrative encrustations in sandstones of Parsora Formation. The surface encrustation was thicker while those that were penetrative were thinner (<0.5cm). In BRS samples the MnO values ranged from 0.01% to 21.57% with an average of 1.05% and Ba values ranged from 45 ppm to 41,255 ppm. In PCS samples, the MnO values read 0.03% to 7.21% with an average of 1.34% and Ba values ranged from 91 ppm to 43,149 ppm. In PTS samples the MnO values varied from 0.01% to 0.19% with an average of 0.04% and Ba values ranged from 552 ppm to 4,710 ppm. Analytical results of BRS, PCS and PTS samples suggest that the encrustation was rich in iron (Fe_2O_3 ranged from 14.4% to 52.56%) while showing very low manganese value in most of the analysed samples.
Odisha, Bolangir District	Uchhabapalli - Thakurpalli Block	-	2.05 sq. km	-	386 m	Mapping, Drilling, Trenching	In G2 stage investigations, the major lithounits in the block were khondalite (quartz -feldspargarnet-sillimanite+graphite schist/ gneiss), calcsilicate rocks (calc gneiss and calc- granulite), quartzite, and late intrusives include pegmatite and quartz-veins. General strike varied from NNE-SSW directions with sub-vertical dip towards east in Thakurpalli block in the south to NW-SE directions in Uchhabapalli area in the north. The Mn ore occurred within shallow synformal structure of the calc-silicate rock. A total 2.05 sq km detailed geological mapping was carried out in the block along with 55 cu. m Pitting / trenching. The average grade of channel sample was 15.95% Mn. A total 386 m drilling were carried during FS 2021-22. All the boreholes intersected mineralised zone with cumulative thickness 2 m to 15 m except ODUT-3 and the strike length of mineralized zone was approximately 2700 m in Uchhabapalli-Thakurpalli area.
Odisha Bolangir District	Dandapani Block	-	1.60 sq. km	2	127.50 m	Mapping, Drilling, Pitting/ Trenching, Sampling	In G2 stage investigations, the major lithounits were found to be khondalite (quartz to feldspar-garnet-sillimanite+graphite schist/ gneiss), calc-silicate rocks (calc gneiss and calc-granulite), quartzite, meta-breccia and late intrusives that included pegmatite and quartz-veins. The general strike of lithounits in the block trends NE-SW directions with moderate to sub-vertical dip towards NW direction. Manganese ore bodies were bounded by calc-gneiss/calc-granulite either on footwall or hanging-wall or on both sides. The contact of calc-silicate and manganiferous quartzite was distinctly sharp. A total of 1.60 sq km detailed geological mapping along with 90 cu. m pitting / trenching were carried out with collection of PTS from Mn soil, Float ore and Mn ore areas. About 15 channel samples were also collected to correlate the surface and sub-surface potential of the area.The average grade of channel sample was 30% Mn. A total of 127.50 m drilling were carried during FS 2021-22. The two boreholes intersected mineralised zone with cumulative thickness of 3 m to 4.5 m. Part analytical results showed 15% Mn to 19% Mn.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Andhra Pradesh, Viziana garam	Gurla-Madhupada area	-	-	-	-	Mapping, Trenching, Sampling	Under G4 stage investigation, the geology of study area shows different lithologies of Khondalite suite, Charnockite suite and Migmatite suite that were exposed with later intrusions of pegmatite veins, quartz veins and quaternary flood plain sediments. In the area major hills of garnet quartzofeldspathic gneiss ± manganese ± graphite ± sillimanite trending NNW-SSE were localised in the eastern part and the outcrops of calc granulite were discontinuous NW-SE trending band. A manganese zone with interpreted strike length of 500m and approximate width of 20m with an overburden of 5-6m was demarcated. However, the manganese mineralisation in Dummeda hill area was discontinuous and occurs in small pockets of a few meters dimension. The dimension and depth continuity of this zone was established with pitting and trenching. The exposed manganese zone in the profile section was abundant with float ores at top followed by kaolinised/altered zone and subsequent manganese mineralisation indicating supergene nature of mineralisation. The sub-surface continuity of the zone was tested by pitting/trenching in the area. A total of 79 bedrock samples were collected from possible manganese and molybdenum mineralisation zones. In total 43 channel bedrock samples were collected for manganese mineralisation across the strike of the manganese band at equal intervals and remaining 36 bedrock samples were collected for targeting Mo, W and Sn from quartz vein within calc-granulite and garnet-bearing granite. The assay value of the bedrock samples from study area indicated MnO value ranging from 0.29% to 24.46% with an average of 3.79%, similarly in pit and trench samples MnO value ranged from 0.07% to 7.99%. The molybdenum value in bedrock sample from the area ranged from 1.04 ppm to 18.38 ppm with majority of samples ranging from 10-15 ppm, in trench sample the assay value ranged from 0.62 to 19.67ppm. The tungsten value in the bedrock samples ranged from2.50ppm to 28.79ppm with mean of 4.51ppm and all the values for tin in the area were less than 5ppm.
Andhra Pradesh, Srikakulam and Vizianagaram	Batuva-Kondadi area	1:12,500	120 sq.km	-	-	Mapping, Trenching, Sampling	Under G4 stage investigation, 100 BRS samples, 95 PTS samples, 10 PCS samples, 20 PSsamples and 10 ore microscopy samples were collected. In the study area, rocks belonging to Khondalite and Migmatite Suites of EGMB were exposed. Manganese mineralisation observed at northeastern part of the study area near Gadabavalasa area. Series of abandoned Mn mine pit at varied dimensions identified wherein manganese occurred along with quartzite and garnet-sillimanitegneiss. The strike of the mineralisation zone occurred parallel to sub- parallel to S1 foliation plane that trends in N330° dipping 50°-75° due NE. Manganese occurrence in the abandoned pit was observed in the north-western part of the block near Mandiravalasa area where the ore body had dimension of 2 to 5 m width and 1.5 km strike length associated with quartzo-feldspathic gneiss and quartzite. The trend of the ore body was N330° dipping 60-75° due NE that was bordered by quartzite in NE and granite gneiss in NW. Low to medium grade manganese occurrence in the form of syngenetic type associated with quartzite was noticed near Batuva area in abandoned pits. Manganese occurred along with S1 foliation of quartzite having interpreted dimension of 2-5m width and 500m of strike length. The identified zone having strike direction of N320° having dip amount from 50°-65° due NE. Bedrock samples collected from Gadabavalasa area showed analytical values of MnO ranging from 5% to 29% with an average grade of 16%. Analytical values of MnO in bedrock samples collected from the abandoned Mn ore pit in Mandiravalasa ranged from 0.02% to 31% with an average grade of 6%. Analytical results of BRS samples from Batuva area showed =MnO value varying from 8% to 36% with average value of 19.5%. Analytical result of trench samples from Gadabvalasa and Batuva area encouraging value of Mn% ranging from 0.19 to 3 % and 0.22% to 15.09% respectively. Potential and sizeable manganese ore-bodies were persistent in Gadabavalasa, Mandiravalasa and Batuva area with encouraging dimension and MnO values. During Large-scale Mapping three potential manganesezones were identified in Gadabavalasa, Mandiravalasa and Batuva area.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Andhra Pradesh, Vizianagaram	Palavalasa and Laxmipuram Blocks, Eastern Ghat Mobile Belt	1:2000	2 sq km	-	-	Mapping, Drilling, Trenching, Sampling	Under G3 stage investigation, during detailed mapping the lithounits observed were laminated quartzite/ feldspathic quartzite, garnet- sillimanite gneiss and garnetiferous quartzo-feldspathic gneiss. In Palavalasa Block, the dominant foliation trends in NW-SE direction with a variable dip of 55°- 70° towards SW. The Mn zone studied in old working also trends in N45°W-S45°E direction. While carrying out detailed mapping in Palavalasa Block, an old working with a strike length of about 80 m and width of about 20 m with 10 m depth was studied in detailed. In the extension of this old working few trenches were excavated at interval of 150m. These trenches expose the mineralised zone at depth of 1.5m. Hence, aninterpreted mineralised zone with a strike length ofabout 600 m and a varied width of about 10-20m in NW-SE direction was established. This interpreted mineralised zone was tested through first-level Borehole nos. AVP-1, AVP-2 and AVP-3 and second-level Borehole no. AVP-5. The litho-units encountered within these boreholes were mainly laminated quartzite/ feldspathic quartzite, garnet-sillimanite gneiss, altered quartzo-feldspathic rock, calc-granulite and garnetiferous quartzofeldspathic gneiss (leptynite). The Mn mineralised zone was intersected in all the boreholes at different depth levels as bands of varied thickness of 2-7 m. The mineralised zone was found to be confined between feldspathic quartzite in association with altered quartzofeldspathic rock. While in Laxmipuram Block, four of old working were noticed and studied during detailed mapping. The mineralisation in this block trends NNW-SSE with steeply dip due EEN. Based on the disposition of mineralised zone within these old mines and litho-structural setup, an interpreted mineralised zone of about 400m strike length with a varied width of 10-20m was established. Trenches made to check this interpreted zone could not expose significant Mn mineralisation due to thick soil cover. Later two of first-level boreholes viz; AVL-1 and AVL-2 were planned and drilled to test this interpreted zone. The Borehole no. AVL-1 could not intersect any Mn zone whereas a 14m wide Mn zone was intersected in AVL-2. The analytical result of core samples from Borehole no. AVP-1A assay Mn in the ranged from 2.52% to 12.51% with an average of 6.08%. Only two core samples of AVP-1A could assayed Mn >10%. A channel of 5 BRS from old mine-1 in Laxmipuram block assayed Mn in the range of 7.03%-14.95%.
Rajasthan, Rajsamand	Negariya block	-	-	19	-	Mapping, Drilling, Trenching, Sampling	In G3 stage investigation, the area lies under Survey of India T.S. nos. 45H/9&13. The lithologies exposed in this block were brecciated ferruginised quartzite with or without manganese, quartzite, calcareous quartzite and intercalated phyllite with minor dolomite and granite gneiss exposed as basement rock. In the mapped area, manganese bearing horizons were exposed in 3 linear hills trending NS to N10°E in western, central and North-Eastern part. Manganese was associated with brecciated ferruginised quartzite. The manganese exposure on western hill extended discontinuously for a strike length of 900m, on central hill for a strike length of 650m and northeasterly hill for a strike length of 650m. A total of 7 trenches were excavated in all the three bands. Chemical analysis of Trench no. T1 has analysed 13.82 % MnO over 4m, Trench no. T2 indicated30.34% MnO over 9 m, Trench no. T3 indicated 20.8% MnO over 10 m, Trench no. T4 indicated 12.51% MnO over 6m and Trench no. T7 indicated MnO values of 13.95% and 10. 17% MnO over 4m width. A total of 19 boreholes (2 inclined and 17 vertical) were drilled with total meterage of 710.54 m and the exploration was completed in this block. Maximum width of manganese mineralised zone exposed on the surface was35 m with average width of around 20m. The maximum thickness of manganiferous horizon intersected in the borehole was 17m in Borehole RJRN-04 and average thickness of manganiferous horizon was about 10 m. The maximum depth of manganiferous horizon was up to 28.5m in Borehole RJRJ-09.
Limestone							

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Sikar	Natha ka Nagal block, Maonda	1:2000	1.63sq. km	8	434.20m	Mapping, Sampling, Drilling	During the preliminary exploration for cement grade limestone, 08 of boreholes each having a depth of 50m with having borehole spacing of 400m were drilled. A total of 8 boreholes (RJNN-1 to RJNN-8) were drilled in the area, which involved 434.20 m of drilling. The rock types exposed in the block were micaceous quartzite, dolomitic marble, mica schist, quartz-feldspar vein and impure marble of the Kushalgarh Formation of the Ajabgarh group. During the investigation, 07 bedrock samples were collected and analysed. The chemical analysis of 07 of bedrock samples from impure marble indicated weighted average grade of CaO-48.97%, SiO_2-5.71%, MgO-4.32%, Al_2O_3-0.56% and Fe_2O_3-0.57%. About 03 samples out of 07 have more the 5% MgO. Analytical results of bedrock samples indicate that impure marble unit (high CaO and low SiO_2 except high MgO) was suitable for cement grade. Impure marble was intersected in 05 bore holes out of 08 boreholes. Borehole RJNN-2, RJNN-6 and RJNN-7 intersected thick micaceous quartzite.
Rajasthan, Sikar	Jhilo Block, Maonda	1:2000	1.70sq. km	309	708m	Mapping, Sampling, Drilling	During the preliminary exploration (G3 stage) for cement grade limestone, course of investigation PCS samples, PS samples were collected. A total of 1.7 sq. km area was mapped on scale1:2000 of which 1.60 sq. km in 2021-22 & 0.10 sq. km in 2022-23 with total drilling of 708m. The general trend of the litho-units was NNE-SSW with moderate to steep dipping towards east. In general, lithounits of the area show edimprints of regional metamorphism. It was evident from the metamorphic mineral assemblage, that the lithounits of the area had undergone green schist to lower amphibolites facies of metamorphism. Development of amphiboles in impure carbonate indicated amphibolites facies of metamorphism.
Lithium							
Jharkhand, Koderma	Pihra	1:12500	100 sq. km	-	-	Sampling	During Reconnaissance survey (G4) for Li, Cs, REE and Rare metals, collection of 100 bedrock samples, 100 pitting and trenching samples, 100 soil samples for chemical analysis, 15 petrographic studies and 25 heavy mineral studies were undertaken to assess the potentiality of Rare metal and REE in the study area. Biotite, garnet and tourmaline at places were noticed. The area of investigation lies in the southernmost part of the Bihar Mica Belt (BMB). Major part of the study area is covered by the Metamorphic of Bihar Mica Belt whereas the rocks of CGGC are exposed in SE and NE part of toposheet. The BMB appears to be a nearly E-W trending anticlinorium with several subsidiary folds. The pegmatites in the study area of Bihar Mica Belt are oriented along N-S to NW-SE and NE-SW to E-W. The pegmatites are very coarse grained with quartz, feldspar (both orthoclase and plagioclase), muscovite as major constituents with minor amount of biotite, garnet and tourmaline at places. The pegmatites also contain beryl, columbite-tantalite and ilmenite, as accessory. Megascopically, a few of these pegmatites were of zoned type where as a well-developed quartz core was found in the middle portion of the lensand was surrounded by intergrowth zone of admixture of quartz and feldspar (both k-feldspar and plagioclase).

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Jharkhand, Giridih	Gawan	-	-	-	-	Sampling	During Reconnaissance survey (G4) for Li, Cs, REE and Rare metals, numerous concordant and discordant pegmatite veins of variable dimensions were mapped. Pegmatites may be of two to three generation trending in N-S to NW-SE and NE-SW to E-W intruded into mica schist of BMB. Maximum dimension ofpegmatite having 20-70 m width and 50-250 m length intruded along the foliation plane of mica schist and quartzite mica schist. These pegmatites also contained beryl, columbite-tantalite, as accessory. Based on field observation and mineralogical composition, pegmatites were classified into two; Type-I: Pegmatites trending almost E-W to NW-SE and parallel to the major foliation planes and composed of quartz, feldspar, muscovite as major minerals, tourmaline and garnet crystals were also observed. Crystals of beryl were also found to be associated with some of the pegmatitesnear Rajpura Village. Type-II: Pegmatites trending almost N-S and NE-SW, some of the pegmatites were zoned pegmatites. It was observed that pegmatites intruded in Mica schist and quartz mica schist were composed of quartz, K-feldspar, Muscovite, tourmaline and garnet. Out of the results of 173 samples received so far, three samples showed >1000 ppm value for tREE. A trench sample (GW/T1/01) from Trench-01 excavated near Village Gumgi showed 1205.5 ppm values for tREE. A stream sediment sample (GW/SSS/07) collected near Kaha Pahar showed 1009.8 ppm value and a bedrock sampleof Hazaribaghgranite (GW/BRS/32) collected near west of KalaPahar showed 1028.1 ppm value for ΣREE.
Arunachal Pradesh, West Kameng	Nafra	1:12500	50sq. km	-	-	Mapping & Sampling	Reconnaissance survey (G4) for lithium, tin & tungsten minerals was carried out in Khellong-Khazalang areas, West Kameng district, Arunachal Pradesh. A total of 25 cu. m of trenching were done in areas of estimated strike extension of the pegmatite veins. However, the bedrock was not exposed in trenches. A total of 25 soil samples from the trenches yielded 33-110 ppm Li. Total 11 channels were made in the pegmatite, contact zones of gneiss, quartz vein, quartzite, greyphyllite, graphite schist, chlorite quartz mica schist. A total of 67 bedrock samples (including 28 channel samples), 30 stream sediment samples, 20 petrochemical samples, 20 petrological samples, 20 ore mountsamples, 10 regolith samples, 20 heavy mineral samples were collected. The stream sediment samples yielded 10 to 105 ppm Li, 3.5 to 15.9 ppm Sn, 0.9 to 5.1 ppm W. Regolith samples yielded <5 to 63 ppm Li from 10 samples, 3.5 to 11.8 ppm Sn, 1.1 to 2.5 ppm W. 9 nos of PCS samples yielded 48 to 330 ppm Li. Micaceous quartzite in chlorite schist reported the maximum of 330ppm. 11 nos PCS samples yielded 2.6 to 8.4 ppm Sn and 1 to 3.4 ppm W. Li value analysed from chlorite-quartz mica schist yielded 25 ppm to 302 ppm Li from 6 bedrock samples. Pegmatite veins yielded 14 ppm to 65 ppm Li from 10 samples. One sample of granite yielded 70 ppm Li. Quartz veins yielded <5 ppm to 21 ppm Li from 8 samples. Granite gneiss yielded <5 ppm to 116 ppm Li from 21samples. Sn values from available 26 nos bedrock samples have yielded upto 24 ppm. W values from available 26 nos bedrock samples yielded 0.6 to 52.5 ppm. W values from quartz/quartz-feldspathic veins yielded 0.6 ppm to 52.5 ppm. W values from granite gneiss yielded a maximum of 18 ppm. The chlorite quartz schist has sampled Li values of 280 to 330 ppm from three samples. The relative high values of Li in the schist may be attributed to the granite derived Li-rich fluids from the Bomdila gneiss. Based on the studies carried out and analysis results obtained, the Li, Sn, W values in the study area were not encouraging, except for some relatively higher values of Li from chlorite quartz mica schist up to 330 ppm.
Andhra Pradesh, Anantpur and	Parnapalle-Lopatanutula	-	100sq. km	-	-	Mapping & Sampling	Large-scale Geological Mapping (G4 stage) covered in an area of 100 sq. km with collection of BRS, soil samplings in grid pattern, PTS and stream sediment sampling for chemical analysis. SEM. EPMA, Heavy Minerals and XRD samples for laboratory studies was carried out to ascertain the mineralisation potentialityof the area and to i dentify

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Kadapa							and delineate potential zone of lithium mineralisation. The Radiometric survey of 30 line km was conducted using portable gamma ray spectrometer and recorded K, U and Th count of the given area.The integrated map formed using LSM map and K count data clearly demarcate a common zone for tuffaceous sediment beds. As of now analytical results of 15 BRS were received which showed encouraging values and helped in demarcation of mineralised zone. Tuffaceous sediment having thickness in between 5-70 cm and associated shale with siltstone of 30 cm-3m identified as the source of anomalous values of lithium in stream sediment samples Li values in 8 tuff samples was in between 80-322 ppm and in 4 shale with siltstone samples was 47-252 ppm and a very low value was recorded in dolomite and chert.The mineralised zone comprised of tuffaceous beds and associated shale with siltstone beds and interbedded dolomite was approximately 15-20 m thick, and having a strike length of approximately 12 km in discontinuous manner.
Molybdenum							
Madhya Pradesh, Satna & Uttar Pradesh, Banda	Pataude	-	-	-	-	Sampling	Reconnaissance Survey for Molybdenum and Associated Mineralisation (G4) was done in the area. The main stratigraphy units of the area were Bundelkhand Granitoid Complex (BGC), Vindhyan Supergroup and Banda Alluvium. The area comprised wide extent of rocks i.e., older supracrustals and metamorphics, gneiss, migmatites, granitoids, rhyolite, mafic dykes, quartz reefs which were mainly part of BGC and different sedimentary rocks of Semri and Kaimur Group of Vindhyan Supergroup which represented both carbonaceous and arenaceous lithounits. Occurrences of molybdenite as specks were observed mainly within the quartz and quartzo-feldspathic veins near Korari, Gonda, Gonda ka Pahar, Karin Pathar ka Pahar area which were exposed mainly at the rock quarry. At places molybdenite were associated with other sulphides i.e., pyrite, chalcopyrite which were confirmed during ore microscopy study. The quartz veins were mainly trending ENE-WSW to E-W and were also intruded in the migmatite. Sulphide mineralisation in the form of pyrite, chalcopyrite and few bornite specks were observed along the E-W to NE-SW trending slip plane which were parallel to the joint sets. As per the received analytical results, in seven samples including BRS, pit sample Cu values ranged from 550 ppm to1,140 ppm.The occurrences of all the sulphides present in the study area were extreme rarely exposed at or near the surface.These were mostly observed at an average depth of 15-20m from the surface and mostly observed in the quarry sections. The sulphide minerals mainly occurred as disseminated forms. Three bands of banded iron formation (BHQ) were observed near south of Nardaha Village having 100m length and 0.5m width and total Fe content was analysed up to 37%.
Assam, Kamrup Metropolitan	Helagog-Khaloibari	-	-	8	60m	Drilling & Sampling	A G3 stage investigation for molybdenum and associated mineralisation was carried out in Helagog- Khaloibari, area. Area lies at the NNE corner of the Shillong Plateau. The area exposed sillimanite garnet quartz mica schist of older metamorphic, migmatite of Assam Meghalaya Gneissic Complex, meta gabbro of Khasi metamafics and pegmatites. Migmatite were characterised by migmatitic textures like stromatic, dictyonitic, schollen/raft, ptygmatic, dilation and schlieren structures. In Helagog quarry, at least four molybdenite bearing pegmatite veins were noticed which occurred either as dikes (veins) or as segregations or as pods. Bed rock samples showed that the molybdenum values ranged from 0.25 to 276.75 ppm. The higher values of Mo i.e.,, 276.76 and 178.02 ppm were reported from the molybdenite bearing pegmatite vein in Helagog quarry where the population density of the molybdenite flakes was more. In Khaloibari quarry although molybdenite flakes were visible through naked eye

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							only a few grab samples from the molybdenite- bearing pegmatite veins showed elevated values i.e.,56.21 and 30.85 ppm and remaining samplesdid not showany significant values of Mo which may be due to occurrences of highly disseminated molybdenite flakes. Eight inclined boreholes (ASKMH-01, 03, 05, 07 and ASKMK- 02, 04, 06, 08) were drilled in Helagog and Khaloibari blocks to intersect the molybdenite-bearing pegmatite body.
Andhra Pradesh, Anantapur	CR Palle-Indukurupalle	-	-	-	-	Sampling	Reconnaissance survey (G4) for molybdenum, gold and associated mineralization was carried out in Kadiri schist belt, Anantapur district. It was observed that molybdenum specks were generally associated with very thin (5 cm to 40 cm) pegmatite veins in Metarhyolite. Near Village Barrepalle sulphide mineralisationwas observed in pegmatite veins (20-30 cm). The strike of theseveins was NE, NNE and E-W directions. At few places, molybdenite was associated with 1-2 cm vein ofsulphides hosted by altered hornblende biotite granite near Village Barrepalle. Soil samples were collected from CR Palle and Barrepalle area to check the secondary dispersion of sulphides in soil which may lead to the hidden mineralisation.The host rock i.e., metarhyolite, pegmatite veins showed pale yellow to reddish brown color alterations along the mineralisation. In CR Palle area (1 sq.km) molybdenum mineralisation with in pegmatite veins (10 to 50 cm thick) having intermittent strike length of about 900m was observed. The chemical analyses of bedrock samples from CR Palle area showed maximum 672.92 ppm of Mo value while Au values were <25 ppb. About 6 samples showed >50 ppm Mo values and 18 samples showed >10 ppm of Mo values. In Barrepalle area molybdenum mineralisation within pegmatite veins (10 to 30 cm thick) trending in N40°E and also the molybdenum mineralization was carried along fractures planes (N60°E, N40°E,N340°W) of 1 to 5 mm thick which were traceable for strike length of about a few metres. The chemical analyses of bedrock samples from Barrepalle area showed maximum 2,980.03 ppm of Mo value while Au values were <25ppb. About 5 samples showed > 2000 ppm Mo values while 9 samples showed >50 ppm Mo values and 19 samples showed >10 ppm of Mo values.
Andhra Pradesh, Nellore	Chinna Varimadugu-Kand uravaripalle	-	-	-	-	Sampling	Under G4 stage intevtigation, the mapped area mainly consisted rocks of Gudur Group belonging to Malakonda formation followed up by PGC-II (variants of granite gneiss) and intruded by gabbro, dolerite, calc- silicate, pegmatite and quartz veins. Bedrock samples (90nos.) received showed TREE ranging from 7.54-967.42 ppm with an average of 397.3 ppm, LREE max. 946.01 ppm. Analytical values of Mo in bedrock samples ranged from 0.35-10.84 ppm with an average of 3.74 ppm. Besides, the bedrock sample of malachite staining taken from the quartz vein within calc-silicate showed Cu 7.4% with Cs value of 48 ppm.The principal REE mineral phases were represented by monazite, xenotime, allanite, apatite, thorite and parisite. EPMA study conducted on five samples showed monazite, apatite, zircon and quartz as the major phase associated with tourmaline bearing quartz vein and monazite, apatite, biotite, zircon with biotite granite gneiss. Yttrium phosphate along with monazite and biotite was observed in the garnet biotite granite gneiss.In the area, west of Ayyavaripalle, titano-magnetite and ilmenite were recorded within zoned pegmatites.

State District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Andhra Pradesh, Anantapur	Charupalle-Kalas amudram-Batrepalle	-	-	-	-	Sampling	G4 stage mineral exploration work was taken up for delineation of potential zones and possible occurrences of Molybdenum, gold and other associated mineralisation, nature of causative rocks and their characterisation in the central part of Kadiri Schist Belt (KSB) and granitoids (PGC II)of Central and Eastern Dharwar Craton. KSB embodies amphibolite, diorite, meta-andesite, meta-basalt, meta-rhyodacite, meta- rhyolite, quartz feldspar porphyry and agglomerate which were overlain by PGC-II granitoids with quartz to pegmatite veins and dolerite dykes as younger intrusive. The base metal, molybdenum, nickel and gold mineralization was identified along 20º-200º trending quartz-calcite vein with potassic alteration (fracture filling type) intruded in sheared meta-rhyodacite and dolerite dyke at north of Patnam along Maddeleru river bed in form of grains and specks. The highest value of Zn obtained from Patnam zone was 4924 ppm with four values above 2000 ppm; highest valueof Cu was 568 ppmwith total four values above 300 ppm and highest value of Pb was 5.176% and four values were above 1%. Highest value of Mo obtained from thiszone was 19.05 ppm. Whereas, in Alampur zone, highest value of Mo recorded from evolved alkali feldspar granite was 2116 ppm with other two values over 30ppm. Anomalous values of Cu ranged from 90 to 1,518 ppm with two values above 400 ppm.
Karnataka, Yadgir	Devarapalli	1:12500	100sq. km	-	-	Mapping & Sampling	Reconnaissance survey (G4) was carried out for molybdenum and associated elements. An area of 100 sq. km was covered by LSM on 1:12,500 scale with 50 cu. m of trenching and collected 150 nos. of BRS, 50 nos. of PTS, 56 nos. of SS, 15 nos. of PCS, 25 nos. of TPS and 10 ORM samples. The LSM of the area comprises dominantly of granitoids and gneisses with lenses of amphibolite, BIF, acid & basic dykes and Deccan Volcanics. The BIF, talc actinolite schist and tremolite schist of Dharwar Supergroup (Archean) were seen as small linear outcrops within PGC-II. Older amphibolites were seen as smaller enclaves and xenoliths within the gneisses and granites. These veins were considered to be potential target zones for Mo and associated elements. One such pegmatite vein carried Mo mineralisation in the form of stringer observed in north east of Kamalanagar. However, no significant Mo occurrences were observed in the area.
Karnataka, Chitradurga	Doddaularthi	1:12500	500 sq. km	-	-	Mapping & Sampling	Reconnaissance survey (G4) was carried out for Molybdenum-tungsten and associated mineralization. The area forms the eastern part of the Western Dharwar Craton (WDC), represented by biotite gneiss & migmatite gneiss of Peninsular Gneissic Complex-I (PGC-I), granodiorite, younger intrusives of dolerite, pegmatite and quartz vein. Sargur rocks were represented by Amphibolite, garnet biotite ± sillimanite schist and Banded Magnetite Quartzite (BMQ) occurred as enclaves within the biotite gneiss in varied dimensions from few mm to few meters. Two sets of dolerite dykes were noticed in the mapped area. Earlier one was intruded along NNW-SSEdirection and later one intruded along the E-W direction.The trend of the gneissic plane varied fromN-S to NW-SE dipping moderate to steeply towards NE. At-least three sets of fracture plane were noticed out of which two sets of very prominent, first set offracture plane was NW-SE dipping moderately towards northeast and second set of fracture plane NNE-SSE dipping very steeply towards northwest. Few specks of fine grained molybdenite identified in the quartz vein associated k-feldspar alteration and iron oxidealteration intruded along the shear plane hosted in the biotite gneiss. Copper mineralisation noticed in the form of presence of chalcopyrite and malachite staining hosted in K-feldspar altered of Thippareddihalli. A total of 67 of soil samples were collected; 26 soil sample results were available out of which only one reported Mo values of 10.28 ppm. A total of 105 of BRS were collected; 63 of BRS results were available out of which three samples reported Mo values from 10.09 to 27.58 ppm and seven samples analysed W value from 10.90 ppm to 75.30 ppm. A total of 76 of trenching samples were collected, all the trench samples analytical results were available out of which one sample reported 12.31 ppm of Mo and 16 of samples reported W values from10.37 to 48.98 ppm.

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Hanumangarh	NaiBasti Block in Satipura sub- basin of Nagaur Ganganagar evaporite basin	1: 4000	6 sq. km	9	6590.50m	Mapping, Drilling	A G3 investigation is carried out for potash. Based on borehole logging data, the intersected litho- units were Quaternary sediments, Nagaur Group, Hanseran Evaporite Group (HEG) and Jodhpur Group. HEG consisted of halite, anhydrite/gypsum, dolomite, magnesite, polyhalite and sylvite with thin layers of red/ greenish grey clay. Seven major halite cycles, were observed in HEG. Primary structures like bedding, laminations, graded bedding; burrow structure and penecontemporaneous deformational structure were present in Quaternary sediments and Nagaur Group. On the other hand, algal stromatolitic structures were also preserved in the dolomitic unit of HEG. Minor faults and slip planes were observed within the rocks of Nagaur Group and HEG. Jodhpur Group consisted of hard and compact reddish-brown sandstone. Potash mineralization was mainly associated with the H2 halite cycle, where visual mineralisation of sylvite and polyhalite occurred within depth ranged of 645m to 680m. The prominent sylvite rich zone varied from 0.30m to 2.00m thickness. Analytical results of submitted samples were awaited.
Silver							
Rajasthan, Bhilwara District	Bharak North Block	-	-	-	1200m	Mapping, Sampling, Drilling	Preliminary exploration was carried out for silver and base metal mineralization. In G3 study various litho units mapped during the F.S. 2021-22 were calc-silicate rock, amphibolite, siliceous dolomite, oxidised siliceous dolomite, stromatolitic dolomite, carbon phyllite, metachert, phyllite and ferruginised quartz amphibole rock. Surface indication of silver mineralisation was observed in the form of dendrites developed on bedding plane, fractured surfaces and joint plane of siliceous dolomite exposed at the contact of calc-silicate rock. Siliceous dolomitewas oxidised along two different planes. First zone of oxidised siliceous dolomite was exposed at the contact of calc-silicate rock and siliceous dolomite in the NE corner of the block. Second zone of oxidised siliceous dolomite was exposed well within siliceous dolomite where most of the boreholes were drilled in which significant silver mineralisation was intersected. Bed rock samples collected from oxidised siliceousdolomite exposed at the contact of calcsilicate rock and siliceous dolomite assayed for Pb, Zn and Ag. Chemical analysis data of 150 BRS as well as 120 channel samples were received. Chemical analysis data showed that 14 BRS were analysed anomalous for Cu, Pb, Zn and Ag. Channel sample anomalous assay values of 10 samples for Pb, Zn and Ag ranged from 0.16% to 0.33%, 0.11% to 0.98% and 5ppm to 25ppm respectively.The silver mineralization assayed in the siliceous dolomite indicated strong correlation with Pb and Zn.
Tin							
Arunachal Pradesh, East Kameng	Seppa	-	-	-	-	-	Under G4 stage investigation, Large Scale mapping of a 52 sq km block on 1:12,500 scale was carried out to evaluate the potential of Tantalum and Caesium mineralization in the assigned area. The area was located in the western part of Arunachal Pradesh exposing rocks of meta-sedimentaries comprising quartz mica schist & schistose quartzite belonging to the Seppa Formation (equivalent with Khetabari Fm.) and garnet biotite gneiss, biotite gneiss belonging to the Lumdung Gneiss (equivalent with Bomdila Gneiss) of the Bomdila Group of Palaeo-proterozoic Age, followed by amphibolite and tourmaline bearing pegmatites as the younger intrusive. The highest value of Cs was 23.24 ppm, with values ranging from 3.5 ppm - 23.24 ppm in stream sediment and 17.34 ppm in BRS and 15.678 ppm (Channel-CH1A), 15.652 ppm (Channel- CH4) and 20.66 ppm (Trench T4) all in pegmatite band 1. The highest value of W was 763.397 ppm (remarkably high), with values ranging from 2 ppm 19.22 ppm in stream sediment, and17.34 ppm in BRS and 11 ppm to 127.75 ppm in Channel-CH1A, 3 ppm to 10 ppm in Channel-CH4 all in pegmatite band 1,and less than 6 ppm in channels 3&4. The tantalum values were not as remarkable as the highest value 9.44 ppm in BRS. Two channel samples (CH-5) have high uranium values 58 ppm & 93 ppm. Few stream sediment samples have 20 ppm to 30 ppm U and 18 SSS have thorium values greater than 60 ppm.

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Jammu &Kashmir, Udhampur and Kathua	Bikindra and Khabbi	1:12500	50 sq. km	-	-	-	A G4 investigation is carried out for Tin, Tungsten and associated minerals in this area. Lithounits were delineated 1) phyllite of Salkhala Formation 2) Jamotha/Kaplas Granite of Palaeozoic Age, with sharp contact between Salkhala Fm. and Kaplas Granite. Presence of tourmaline was observed in Kaplas Granite around Bikindra peak. Dolerite dike with dimension of 50 x 20 meters was observed within Kaplas Granite near Ute De Khabi.
Uttar Pradesh, Mahoba	Bilkhi and Bara	1:12500	100 sq. km	-	-	Mapping & Sampling	A G4 stage investigation involving large scale mapping of 100 sq. km on 1:12,500 scale was carried out for reappraisal of tin, tungsten and associated mineralization in this area. Total 54 bedrock samples and 50 trench samples. Night survey with the help of UV lamp was carried out in Gopalpur, Bilkhi, Murani and Bara areas. Bright fluorescent green minerals which may be REE phase/radioactive minerals and Powellite (Ca (MoO_4) in pegmatite veins with bluish white fluorescence were observed. Molybdenite (MoS_2) and sulphide phases do not showed any fluorescence.In BRS samples, the Cu value ranged from <5 ppm to 2,084 ppm (maximum in quartz vein intruded in medium grained granite). Mn values ranged from 13ppm to 1,326 ppm and Pb values ranged from <20 ppm to 1,320 ppm (maximum in quartz reef of Bilrahi RF). Chemical results for Zn, Sn, Mo and W did not show any encouraging values. Only one BRS sample showed 247.41 ppm Mo. Out of 50 trench samples, chemical results for base metal viz. Cu value ranged from <5 ppm to 2,478 ppm, Pb value ranged from <20 ppm to 129 ppm and Zn value ranged from17 ppm to 109 ppm. In Trench-1 from Medium grained K-feldspar granite Mn of 1,132 ppm was obtained. Results of 4 samples from Trench-3 excavated in Tola Shyam quartz reef showed Cu values 1,194 ppm,1,316 ppm,2,478 ppm and 2,472 ppm respectively. Analytical results for Sn, Wand Mo values were not very encouraging.
Tungsten							
Madhya Pradesh, Betul	Sonaghati-Chiklar-Rawanpudi -Khandara	1:12,500	100 sq. km	-	-	Mapping, Sampling & Pitting/ Trenching	A G4 stage investigation involving large scale mapping of 100 sq. km on 1:12,500 scale was carried out in this area. Tungsten and associated mineralisation in the area along with pitting and trenching of 30 cu.m., collection of bedrock samples, soil samples and petrological Four Calcsilicate bodies were found for possible Tungsten mineralisation based on their distinct litho assemblages and mode of occurrence, viz. Chikhlar Calc silicate, Ampani nala Calc silicate, Dharakhoh Calc silicate and lensoidal Calc Silicate bodies. The Calc silicate rock found in the west of Chikhlar was 5 to 7 m thick and extends for about 25-30 m in its strike direction of ENE-WSW and showed bluish-greenish fluorescence while subjected to UV lightindicating presence of Tungsten mineral. The Calc-silicate band of Ampaninala was80-100 m thick and 350-400 m in its strike direction of ENE- WSW. It was mainly composed of fine-grained silica and thin veins of calcite. The Dharakhoh Calc silicate body was having much higher calcite than Chikhlar body but it was slightly coarser than Calc silicate of Chikhlar. Some lensoidal calc silicate bodies having 2-3m in length were also recorded near Ampani nala area. Chemical analysis results reveal the presence of 150 ppm of Cu, 40 ppm Pb, 155 ppm Zn for, 91 ppm Vin calc silicate rock, whereas sheared porphyritic granite, which was adjacent to calcsilicate body, records 35 ppm Cu, 45 ppm Pb, 105 ppm Zn, <1 ppm Ag and Cd. Calc silicate body records <0.5 ppm Mo, 7.11 ppm Sn, whereas, sheared porphyritic granite records 1.04 ppm Mo and 12.22 ppm Sn as reported from chemical analysis of BRS samples.Values of 1.64 ppm and 2.03 ppm for Tungsten (W) were recorded in calc silicate and sheared porphyritic granite respectively. Samples collected from the contact between calc silicate and granite were showing gold values of <25 ppb and 30 ppb. Chemical analysis of PTS samples showed 55 ppm Cu, 25 ppm Pb, 105 ppm Zn, <1 ppm Ag, Cd. The analytical results of soil samples showed 7 5ppm Cu, 30 ppm Pb, 90 ppm Zn,<1 ppm Ag and Cd.

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Jharkhand, Giridih	Kakakudar-Gaganpur	-	-	-	-	Sampling	Reconnaissance survey (G4) for tungsten, copper and gold was carried out. Copper, lead, zinc, etc at Gaganpur, Jhalakdiha, Kakakuddar and Chandio villages (east to west respectively) occurred within the granite and/ or granite with mica-schist enclaves. Surface manifestation of mineralization occurred as stains (malachite, azurite etc) in the Unclassified Metamorphics rock of Chandio, Gaganpur areas. Mineralisation can be correlated to skarn type in the area wherein previous sedimentary units were intruded by late granite fluxes resulting in contact metasomatism and subsequent formation of skarn minerals. From the available chemical analytical data significant values of copper (3,934mg/kg), Zn (2,587mg/kg), Mo (294.31 ppm) were observed near Kakakuddar old workings. An elevated Pb value of 5,961 mg/kg was analysed from trench-1 close to Kakakuddar old working. Panned stream sediment samples collected close to Kakakuddar old working gave Th value of 1,229.45 ppm. Pb value amounting to 3,752 mg/kg and Ag value of 3.22 ppm were reported near Chandio old working besides Au value as high as 0.18 ppm from the soil sample which was further corroborated by value of 0.80 ppm of Au from Trench-5 sample. Au value of 0.43 ppm was analysed from tremolite schist towards S of Chandio old working. The lab study was in progress.
Meghalaya, East Khasi Hills, Rhiboi and West Jaintia Hills	Kyrdem	1:12500	50 sq. km	-	-	Sampling & Mapping	G4 stage investigation for tungsten and associated mineralization was carried out in and around the contact between Shillong Group of rocks the Kyrdem Pluton. Large scale mapping (1:12,500) of 50 sq. km was carried out in the Kyrdem area and in and around the contact between Shillong Group of rocks the Kyrdem Pluton. The calc silicate band was reported in the Lumsyntung area. Three phases of deformation were recorded at Mawtari and Klew Village scheelite mineralisation which was associated with sulphide minerals was observed along the fracture plane developed in the ferruginous porphyritic granite. The control of mineralisation may be due to the hydrothermal fluid which has interacted or remobilised the wall rock along the fracture plane and given rise to the formation of tungsten bearing minerals like scheelite and wolframite. The tungsten value in 10 samples was 358 ppm, 225 ppm, 302 ppm and 152 ppm, 227 ppm, 132 ppm, 48 ppm 31 ppm, 30 ppm, 13.3 ppm respectively, in the porphyritic granite at Mawtari and Village Klew. Lithium values of 208 ppm, 131ppm, 112ppm, 83 ppm, 78 ppm were indicated from amphibolites and pegmatite vein intruded into it.
Uttarakhand, Bageshwar and Pithoragarh	Chaukori	1:12500	-	-	-	-	Reconnaissance survey (G4) was carried out for reappraisal of tungsten, tin, and REE mineralization. A total of 70 L km traverse mapping was carried out to assess aotentiality of W, Sn and REE mineralisation around Chaukori area, Bageshwar and Pithoragarh Districts of Uttarakhand in parts of toposheet nos. 53O/13 and 62C/01. Total 300 stream sediment samples (SSS), 30 bedrock samples (BRS), 24 petrological samples, 10 XRD samples and 05 EPMA samples were collected. Out of 300 SSS, 190 REE, W and Sn values ranged from 44.40 ppm to 435.49ppm, <0.51 ppm to16.78 ppm and 1.03 ppm to 39.26 ppm respectively. Analysis of 11 BRS samples showed REE, W and Sn ranged from 68.92 ppm to 344.54 ppm, 0.62 ppm to6.78 ppm and 2.83 ppm to 14.96 ppm, respectively.
Uttar Pradesh, Sonbhadra	Gulaljharia-Chakdumra	1:12500	100 sq. km	-	-	Sampling	Reconnaissance survey (G4) was carried out for reappraisal of tungsten and associated mineralization in parts of Sol Toposheet nos. 63P/4, P/7 and P/8. A total of 58 of BRS, 75 of SS and 75 of trench samples were analysed for assessing the potentiality of tungsten. During night survey, blue fluorescence confirming scheelite under UV light were observed in the K-feldspar granite gneiss (within catchment of Thema nadi) in Japla, Gulaljhariya,Dudhi RF and Mahuaria villages. From analytical results of one hundred forty-five samples, only five samples have yielded W value of 32.59 ppm, 48.53 ppm, 64.94 ppm, 149.35 ppm and 292.06 ppm. Highest value of tungsten of 292.06 ppm was obtained from the first order stream sediment sample collected from weathered phyllite intruded by quartz vein at Korgi Village. Thorium and Uranium values upto 163.95 ppm and 59.15 ppm respectively were obtained from the bedrock samples of K-feldspar granite gneiss.

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Rajasthan, Pali	Mohangarh (Motiya)	1:2000	2 sq. km	-	-	Sampling & Mapping	Preliminary exploration (G3) was carried out for for tungsten, lithium and associated mineralization in an around Mohangarh (Motiya) where two major lithounits were identified and demarcated viz. mica schist/ phyllite and granite gneiss. Mica schist was fine grained rock with quartz, mica as essential mineral composition. Granite Gneiss was coarse to medium grained leucocratic rock with Quartz (55- 60%), feldspar (35-40%), mica (3-4%), tourmaline (1- 2%) as major mineral phases. Total five major mineralised quartz and quartz tourmaline veins with visible wolfram grains of varied size from 1 mm to 6 cm were identified and recorded. These veins varied in thickness from 5 cm to 2m and exposed strike length was about 700m. The general trend of quartz and quartz tourmaline veins was NS, NNE-SSW with sub-vertical dip. These veins were branched, swirling in nature and dipping either side at places. Total 50 Channel samples, 100 bedrock samples, 50 polished sections, 30 petrochemical samples and 25 soil samples had been collected. The analytical results 21 bedrock samples were received from which one sample showed 28,000 ppm tungsten while another sample showed up to 6,000 ppm tungsten.
Vanadium							
Arunachal Pradesh, West Siang	Kaying	1:12,500	50 sq. km	-	-	Mapping & Sampling	Under G4 stage investigation during reconnaissance survey for vanadium, graphite, REE, and base metals, three bands of carbonaceous phyllite were delineated. In the northern part ofthe study area, a band of crystalline limestone was mapped, to the north-westof Village Kaying, 2 bands of tourmaline-bearing pegmatite have also been mapped. A total of 60 bedrock samples (including channel samples), 20 trench samples and 10 Petrochemical samples were systematically collected and analysed chemically. Analytical results for carbonaceous phyllite show vanadium values ranged from 101-1,303 ppm, chromium values ranged between 88-1,688 ppm, copper up to 1,262 ppm, rubidium values ranged from 76-830 ppm, lead up to 683 ppm, tin values ranged from 2-26 ppm, tungsten up to 100 ppm, chromium values up to1,062 ppm and arsenic values ranging from 2-1,360 ppm. PCS sample of quartzite exhibits LREE value of 221 ppm and HREE value of 27.5 ppm, dolomitic limestone exhibits LREE value of 4 ppm and HREE value of 0.8 ppm. Bedrock samples of carbonaceous phyllite exhibit LREE values ranging from 104-348 ppm and HREE value sranged from 3-26 ppm. Also, the chemical analysis of the samples from the study area has not given encouraging values for gold sofar with values of up to 50 ppb. Trench samples have yielded chromium values ranging from 342-1590 ppm with an average of 970 ppm. The petrochemical samples of carbonaceous phyllite/graphite have yielded vanadium values up to 3,125 ppm, chromium values up to 1,688 and copper up to 1,368 ppm.
Arunachal Pradesh, Kra- Daadi	Talangriang-Pakba-Jamin	1:12:500	50 sq. km	-	-	Mapping & Sampling	During reconnaissance survey (G4 stage) for vanadium, graphite and associated elements, 108 BRS, 52 PTS, 12 PS, 10 OM and 24 PCS were collected under LSM. During the course of LSM, five carbonaceous phyllite bands were identified and same were delineated. These were : Band 1: Carbonaceous phyllite band in the Talangiang area was traced for a strike length of 600m (0.6km) with the width varying from 80m to145m. Band 2: Carbonaceous phyllite band was exposed in the area south of zero point was traced for a strike length of 3.4 km within block and 1.2km strike length was observed outside of the this marked block with the width varying from 10 m to 35 m. Band 3: Carbonaceous phyllite band was exposed in the Pungrung-Pakba area was delineated for strike length of 9.7 km with the width varying from 10 m to 75 m. Band 4: First time reported a carbonaceous phyllite band in the Layang-Chate area was delineated for a strike length of 5.6 km with the width varying from 10m to 35m. Band 5: Carbonaceous phyllite band was exposed to the north of zero point was traced for a strike length of 1.5 km with width varyingfrom 10 to 15m. Leaching, ferruginisation, yellow and red colour alterations were noticed in the many spots in the carbonaceous phyllite bands and were indicative of sulphide mineralisation. The results of channel samples from carbonaceous phyllite showed the value of Vanadium varied from 289 ppm to 517 ppm and that of Au was less than 50 ppb. The results of pitting and trenching samples from carbonaceous Vanadium values

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							Ranged from 108 ppm to 665 ppm. The fixed carbon content in the carbonaceous phyllite varied from 0.52% to 8.95%. The analytical results of 24 PCS reveal that Fe_2O_3 content in the carbonaceous phyllite band varied from 8.81 - 10.90 % and one sample from yellow coloured encrustation found in thecarbonaceous phyllite in Chate area showed the values varied from17- 27%.
Arunachal Pradesh, Lower Subansiri	Sito- Sikhe	-	1 sq. km	-	-	Mapping, Sampling, Pitting & Trenching	A G3 stage of preliminary exploration for Graphite and Vanadium in Sito-Sikhe Block was proposed for one-year item in order to assess the economic potentiality of Vanadium in the Sito-Sikhe area. Detailed mapping of 1 km2 was carried out in and around Sito-Sikhe villages of Lower Subansiri district in parts of Toposheet No. 83 E/10. During this preliminary exploration for vanadium, graphite and associated minerals Vanadium and graphite mineralisation showed close affinity with the meta sedimentaries of the area which comprise of NNE-SSW trending carbonaceous phyllite/schist bands of Khetabari Formation and were an integral part of Bomdila group. Surface explorations by systematic collection of BRS, pitting and trenching was also carried out. A total 76 BRS were collected through channel sampling from the entire strike of the mineralised band (carbonaceous phyllite) at regular intervals of 150 to 200 m which yielded weighted average of 2,350.02 ppm of Vanadium. Vanadiumvalues reach up to 18,500 ppmin some of the channel samples. They were also ch aracterised by high ash content (approximately 80-85%), fixed carbon content ranging from 7.17to 17.56%. Sub-surface continuity of the mineralised band will be ascertained by drilling during F.S. 2022-23.
Arunach al Pradesh, Pakke Kessang	Pakro	1:2,000	1 sq. km	6	101.5m	Mapping & Drilling	During the preliminary Exploration (G3 stage) for Vanadium, Graphite and associated minerals, the study area exposed Bomdila Group of rocks of Palaeo-proterozoic Age and comprises NE-SW trending garnet muscovite/ biotite schist, amphibolites, graphite bearing zone of Khetabari Formation and granite gneiss, mylonitic granite gneiss of Ziro Gneiss. Cumulative strike length 1400m of graphite bearing mineralised zone was delineated having a variable thickness ranging between 3m -18m with partings of garnet muscovite/ biotite schist in between. The presence of graphite and vanadium occurrences in Pakro block was restricted to garnet muscovite/biotite schist of Khetabari Formation. This mineralization was of stratified (bedded) type. The mineralization was sheared controlled, the host rock was deformed/sheared and evidence of shearing could be seen in the form of shear sense indicators present within graphite band and host rock. Surface sampling of the zone yielded vanadium values up to 3,300 ppm with an average of 1,100 ppm along with 10.33% Fixed Carbon and 0.45% TREE. Channel sampling has also yielded max value of 200 ppb of gold in graphitic schist. A total number of six boreholes were proposed to intersect the mineralised body, of which one borehole was completed at a depth of 101.5m.In the borehole three graphitic bands were intersected having varied thickness ranging from 2m to 13m.
Uncovered project							
West Bengal, Jharkhand and Odisha	Singhbhum Craton and North Singhbhum Mobile Belt	-	-	-	-	Mapping & Sampling	During traverse within Badampahar-Gorumahisani Belt, a completely different litho unit of andalusite schist in association with phyllite-micaceous quartzite was mapped. This unit was capped over the metabasalt-ultramafic sequence of Badampahar- Gorumahisani Belt near Tiring area. This litho-assemblage was similar to the Singhbhum Group of rocks and might be present here as a thrust nappe. A number of shear zones had been marked within Badampahar- Gorumahisani Belt and well within the central portion of Dhanjori basin and sampled judicially. A special emphasis, in the light of structural data collection and sampling, had been given on the unexplored central part of Dhanjori Basin. The geophysics team was engaged in the integration and interpretation of ground geophysical anomalies of regional geophysical mapping with the Aeromagnetic data obtained from RSAS, Bangalore. During the geophysical data study, interesting and unusual Bouger Gravity Anomaly and Magnetic anomaly was delineated within the metabasalts of Dhanjori Basin. During the course of fieldwork, the transect line to 1 had been extended from 130 l km to 160 l km

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							in the southern direction and the 2nd transect line which was well within the Singhbhum Granitoids only, was discarded. Therefore, the surplus line kms will be utilised in the survey of anomalous central part of Dhanjori basin.
Rajasthan, Madhya Pradesh and Uttar Pradesh	Aravalli and Bundelkhand Cratons	-	-	-	-	Drilling	Drilling and related geological and geophysical logging was completed as part of Phase-II work during FS 2020-21 in Churu and Dausa sector. In FS2021-22, drilling was carried out near Gujar-guwara and Village Gadarwada-gujran of Dausa sector through five boreholes. Three boreholes were drilled near Gujar-guwara area whereas two boreholes were drilled around Village Gadarwada-gujran.Thethreeboreholes drilled near Village Gujar-Guwara have intersected sulphides in the form of mostly chalcopyrite and pyrite as dominant sulphide phases with minor amount of bornite and chalcocite in the shallow zone. In Gadarwada-gujranblock, the boreholes intersected veins, smears and dissemination of pyrrhotite-pyrite rich zone within the staurolite bearing quartz-biotite schist host.
Rajasthan,	Hanotiya, Vijainagar, Raila, Jaiswanpura	-	-	-	-	Samplig, Mapping, Drilling	The study area covered in the toposheet No. 45K/09 &10 is almost under soil cover except some outcrops which were observed along the nala section, trenches and in the form of hills, exposed near Sathana, Hanotiya and Pur-Banera areas. Systematic and detail bedrock samples were collected to know the chemical composition, petrography, ore microscopy and alteration mineralogy. Hydro-geochemical sampling was being carried out to identify the distal foot printing of mineral occurrences. Geological traverses were taken in the study area to observe exposed lithounits, collection of ground water samples, petrological and petrochemical samples. During FS2021-22 a total of 254 ground water samples, 40PCS, 15 PS and 10 OM sample were collected from the field area. Based on the analytical results samples collected during FS 2020-21 and 2021-22, 06 potential areas were identified for further detailed studies. Detailed ground geophysical survey was carried out in Lambia Kalan block which was selected based on results of hydro-geochemical sample having Zn-793 ppb, Pb-5.3 ppb and Cu-98 ppb. The Borehole RJABH-01 was drilled at Lambia kalan block where detailed ground geophysical surveys were carried out and two separated zones (Z-I & Z-II) were identified ~45- 50 m below the surface and having an estimated width of about 40 m for Z-Iand~38 m for Z-II. The borehole intersected garnetiferous granite gneiss with thin partings of amphibolites at places along the run. A sulphide zone was identified in the borehole from 92.0 m to 98.5 m in the rocks intersected by the borehole, few check samples were taken from the borehole An inclined borehole was planned at the location to test the anomalous values observed in water samples collected from the area and to intersect the litho-units for updation of predictive geological map. The borehole was drilled up to 260 m depth. The borehole intersected amphibolite and Gt-gneiss bands. Sulfide mineralisation was identified in the amphibolites band. The borehole intersected granite gneiss, Gt-bt-gneiss and bands of amphibolite. The inclined borehole intersected granite, Gt-bt-gneiss and thin bands of amphibolite in the area. Few sulphide-bearing bands confined to amphibolite were identified in the borehole and samples were collected from those bands. A 115.0m vertical borehole was drilled at Lakshmipura for this purpose.The borehole intersected Gt-bt-gniess, mica schist and thin bands of amphibolite in the area.
Rajasthan, Churu, Nagaur, Sikar	Salasar, Sujangarh, Ladnun, Nimbi Jodha area	-	-	7	1010	Samplig, Mapping, Drilling	The present study area includes SoI toposheet no. 45I/6 & 46I/10, covering an area of approximately 1400 sq. km in parts of Churu, Nagaur and Sikar Districts of Rajasthan. The Delhi Supergroup of rocks include chlorite schist (metabasic volcanics), Serpentinites (ultramafics) with minor metabasics, slate, phyllite with quartzite intercalations and amphibolite- dolerite -granitoid migmatite sequence. Rhyolites were the main rock type of the Malani Igneous Suite. Geophysical derivative maps prepared using aerogeophysical data and ground geophysical data were studied and utilised during reconnaitory traverses and sampling. In course of field work, 100 hydrogeochemical samples, 16 PCS, 24 PS, 10 EPMA and 10 XRD samples were collected and submitted for analysis. Using the results of anions and cations of water samples from FS

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							2020-21, Gibbs plot were prepared to identify the sample from zone of rock water interaction, and further only those values were plotted in the integrated map to identify favourable zone. Ultramafics and serpentinite exposure observed in excavation pit near Chaparra Village, which further supports the sub-surface continuity of the same lithological unit from Gunpaliya in the south west to Via Sardi-Chappara and further north wards. This finding well corroborates with the aeromagnetic analytical signal data. Petrographic studies were carried out for 21 sections including PS, TPS and OM sections. The geophysical derivative anomalies and hydro-geochemical anomalies to under stand the host rock and disposition of causative body under thick sand cover. The sub-surface data from the drill cores were used for preparation and updating of the predictive geological map. Low bouguer anomaly zone extending from Jaswanthgarh-Ladnun and Sujangarh was expected to be a part of Erinpura granite, was later concluded after drilling of borehole no RJCN05, Jaswanthgarh. Geological core logging for 07 boreholes were done along with submission of 74 processed core samples for chemical analysis, 14 petrochemical samples, 22 petrological samples. Analytical results of core samples and PCS were yet to be received.
Andhra Pradesh and Karnataka	Tumbiganur, Ramasagaram and Thimasamu-dram East blocks.	-	-	-	-	Samplig, Drilling	Based on geological traverses followed by petrography and SEM study in the geophysical anomaly area, drilling in the Ramasagram and Tumbiganur block were taken up to test the geophysical anomaly. Two scout boreholes were drilled in the Ramasagram block. The litho variants intersected in these boreholes were carbonate veins, diorite, porphyritic mafic dyke and PGC-II. In these two boreholes, feeble occurrences of mineralization were found as in the form of disseminated sulfides, particularly in association with the mafic-rich portions. The detailed SEM studies on these samples showed the presence of multi-metal sulfides like pyrrhotite, chalcopyrite, pyrite, gold, PGEs, sphalerite and pentlandite. A verticalborehole was drilled in the area based on the geophysical signature, intersected PGC and diorite (mafic enclaves). The detailed core logging studies revealed that disseminated sulphide was mostly pyrites, associated with mafic-rich portions. Petrography studies showed that these samples contain plagioclase, biotite, hornblende, chlorite, epidote, pyrite and chalcopyrite. SEM studies revealed the presence of palladium to tellurium to bismuth and palladium to gold association in the samples. Au mineralisation in the Ramagiri-Penakacherla greenstone belt.The main rock types encountered in deep borehole were altered chlorite schist, thin BIF, sericite chlorite schist and meta-basalt. Sulfide mineralisation intersected at various levels in the form of dissemination and minor stringers of sulphide. The analytical result of the samples has shown that Cu-35-275 ppm (n=59), Zn 40-165 ppm (n=49) and Ti 0.7%to 0.99% (n=49). The SEM and EPMA analysis display opaques were pyrites, chalcopyrite, and galena, with minor gold of 5-10-micron size. The geological setting, ore mineral assemblage, fluid nature, and alteration zone characterize the orogenic gold mineralisation at Bhadrampalli. Based on the SEM-EPMA study in Gooty mafic intrusion, few PGE grains were identified in association with sulphide and oxide phases. Preliminary classification of the Cr-Spinel indicates that the Gooty mafic rocks may belong to the Alaskan-type complex, which requires further detailed study to understand the nature and potential of Cr-Ni-PGE mineralisation and geodynamic significance.
REE & RM							
Chhattisgarh, Mahasamund	Sorid-Nawagaon	1:12,500 .	110 sq.km	-	-	Mapping & Sampling	During reconnaissance survey (G4 stage) for locating REE (critical elements) mineralisation, a total of 60 of stream sediment samples, 35 of PCS samples, 35 of BRS, 25 nos of PS, 25 of soil samples and 25 of PTS were collected, 60 of heavy mineral samples were processed via panning, jigging, magnetic separation and there after bromoform separation and studied under microscope. Analytical results of samples were received showing the concentration of tREE in BRS samples ranged from 529.57 to 944.87 ppm, PTS samples ranged from 501.8 to 1,456.3 ppm and PCS samples ranged from 520.48 to 1,403.42 ppm. From

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							the analytical results of REE, it was observed that bedrock samples from equigranular granite around Hadabandh area were better locales for REE concentrations. Pit samples from porphyritic granite, to the North of ArandVillage also provided higher tREE concentration of 1,403.42 ppm.
Chhattisgarh, Balrampur District & Jharkhand, Garhwa	-	-	-	-	-	Sampling	During the reconnaissance survey (G4 stage) for REE, the area was mainly occupied by granite and metasedimentary rocks of the Chhotanagpur Gneissic Complex (CGC). The area has anomalous zones of Total REE (TREE) mainly as secondary concentration along the stream as well as in soil profile. The maximum value of TREE in 1st/2nd orderstream sediment samples, soil sample, colluvial sample, and bedrock sample reported was 4718.47 ppm, 723.65 ppm, 3370 ppm and 2951 ppm respectively. Heavy mineral phases were monazite, zircon, allanite, tourmaline, magnetite, ilmenite, titanite, and cassiterite. Allanite bearing pegmatite mapped in south-western part and cassiterite bearing pegmatite vein discovered in southeastern area.tREE content of stream sediments defines anomalous zones in the central, southeastern and northeastern part of the study area.
Chhattisgarh,Korba District	Tarmaparah & Konkona area	1:12,500	100 sq. km.	-	-	Mapping	During reconnaissance survey in parts of SoI toposheets no 64J/06 and J/10. for lithium and associated rare metals, Five varieties of granitic rocks including (i) foliated granite, (ii) leucocratic equigranular granite, (iii) medium to coarse-grained syeno- to monzogranite, (iv) granitic pegmatite and (v) granodiorite were delineated and pegmatites were also mapped. Near Jongridongri, the pegmatites showed compositional zoning and were divided in to 3 distinct zones with different mineralogical variation. Values of Li ranged from 6.56-193.58 ppm. The analytical values only showed significant concentration of Rb in many granites (as high as 1,107 ppm). The values of Nb and Ta in the equigranular granite ranged from 1.39-105.94 ppm and 0.77-16.86 ppm respectively. In the pegmatitic Ta value ranged from 0.19-146.24 ppm and Nb value ranged from 1.44-197.34 ppm, respectively.
Chhattisgarh, Kanker	Daldali-Gattagurum	-	-	-	-	Sampling	During reconnaissance Survey for Locating REE Mineralisation, the Bengpal Group in the area consisting of granite gneiss/migmatite gneiss, quartz- sericite schist, banded haematite quartzite, and fuchsite quartzite along with Dongargarh Granitoids of equigranular monzogranite, porphyritic monzogranite, fine-grained monzogranite and granodiorite. Presence of REE phases of minerals like allanite, spinel and Zircon crystals was identified in pegmatite intruded within monzogranite and observed in Petrological and XRD studies. Geochemically, granite falls in the field of monzogranite and all the gneiss samples in quartz-rich granitoids field of QAP diagram. Monzogranites were peraluminous and enriched in LREE. The chondrite normalised REE patterns of granite and granodiorite samples were moderate to highly fractionated (La/YbN=1.34-121.88), moderately enriched LREE (La/SmN=2.41- 9.75) with more or less flat HREE segment (Gd/YbN=0.60-5.51. In panned stream sediment samples, the ΣREE value varied from 221.4 to 31370 ppm of which the ΣLREE contributes from 200.65 to 30246.4 ppm and ΣHREE from 13.31 to 1181.68 ppm. Besides the other trace elements present were Nb (8.23-1932.97 ppm), Rb (19.13-240.15 ppm), Cs (1.5-22.3 ppm), Be (1-3.45 ppm), Ta (0.52-122.98 ppm), Th (27.09-4816.2 ppm), U (2.49-49.9 ppm), W(0.52to19.95 ppm), Mo (0.51 -8.57 ppm) and Cs (2.05-3.6 ppm). The analysed pegmatite sample in porphyritic granite has yielded ΣLREE values of 1,522.89 ppm. The trench samples showed ΣREE value of 543.23 ppm and the ΣLREE varied from 67.52 to 524.95 ppm and ΣHREE from 3.22 ppm to 22.22 ppm.
Chhattisgarh, Balrampur	Belangi	1:12,500	300 sq. km.	-	-	Mapping, Sampling, Pitting & Trenching	A G4 stage investigation was carried out in Belangi area. The block area falls in the SoI toposheet no. 64I/13. Aerial reconnaissance and PGRS study of 300 sq. km. area has been done of which an area of 100 sq. km. was covered by large scale mapping mapping on 1:12,500 scale. During the reconnaissance survey for rare metals the lithologies exposed in the area were quartz mica schist, calc-sillicate, banded

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							ferruginous quartzite, migmatite, foliated monzogranite, porphyritic granite, sheared leucogranite, pillowed basalt, fault breccia, pegmatites, quartz veins and dolerite dykes. Rare metal bearing pegmatites were found near Belangi, NW of Belangi, near Karimati villages. The main rare metal bearing minerals identified were mostly coltan (columbite-tantalite group of minerals) and coarse light pinkish tinged mica (Li-mica). Pegmatites were coarse grained and mainly consisted of quartz, K-feldspar, mica (muscovite and biotite) and black tourmaline as accessory mineral along with columbite and tantalite. An old working (20m x 50m appox.) of base metal sulphide mineralisation (galena, malachite, limonite, azurite, bornite, sphalerite and pyrite) within brecciated quartzite and slag dump were recorded in Khani Pahar area. Graphite band was also recorded at place hosted in graphite schist. A total of 70 cu. m pitting and trenching done and 70 PTS/Channel samples, 10 PCS samples, 50 BRS (200m x 200m) samples, 10 PS samples, 10 EPMA samples, 10 SEM samples and 20 XRD samples were collected and submitted for analysis. A total of 25 heavy mineral samples were partially processed via panning, jigging, magnetic separation and thereafter bromoform separation. Microscopic study of processed HMS samples was going on. HMS samples mainly comprised of sphene and zircon.
Maharashtra, Nagpur	Ghotitola-Warghat	-	-	-	-	Mapping & Sampling	During reconnaissance survey (G4 stage) for Rare Earth Elements (REE) and Rare Metals (RM) mineralisation, number of simple pegmatite and a few complex zoned pegmatite veins was mapped in the area. Petrological study of rock samples from this area has revealed the presence of allanite, apatite, monazite and zircon which may have contributed towards the relative high concentration of total REE in the rock. The Stream sediment samples collected from 1st order stream were panned and heavy minerals were segregated from it. SEM studies have confirmed the presence of REE minerals such as monazite, Zircon, etc. Signatures of fluid migration were seen both in field and thin section study. The chemical analytical results of 35 bedrock samples showed ΣREE ranging from 3.68 to 390.08 ppm. The chemical analytical results of 27 stream sediment samples out of 50 samples submitted showed ΣREE ranging from 529.33 to 46,644.99 ppm. Highest concentration of ΣREE in the stream sediment sample was observed in the North of Village Pauni.
Maharashtra, Sindhudurg	Pat-Parula	1:12,500	100 sq. km.	-	-	Mapping & Sampling	During reconnaissance survey (G4 stage) in parts of toposheet 48 E/09 for REE a total of 50 groove samples were collected from 16 weathered profiles. Among them, 8 samples showed tREE values more than1,000 ppm, 3 samples showed more than 1,500 ppm and highest value was 2,951.76 ppm. In case of regolith samples, out of 50 samples, 9 samples showed more than 1,000 ppm, 16 samples showed values more than 500 ppm and highest value was 1,696.2 ppm. Among the 20 bedrock samples collected, 3 samples showed tREE values of greater than 800 ppm (highest tREE value of 914.59ppm), 3 samples showed more than 700 ppm, 4 samples showed more than 600 ppm and 4 samples showed more than 500 ppm. Based on analytical results, it can be concluded that REE enrichment was gradually increasing from bedrock to regolith and from regolith to weathered profile (B to lower A horizon) developed over granitoid. In SEM and EPMA studies, allanite, britholite, Bastnasite and Biraite were also present as REE bearing phases. On the basis of field observation, petrography and analytical results, 5 sq. km area was demarcated on surface (length 2.5km and average width 2km) as potential area for REEs.
Madhya Pradesh, Barwani Dhar	Kikarwas-Pipanpura-Ghongsi-Barkhedi	-	100 sq. km	-	-	Mapping & Sampling	During reconnaissance survey (G4 stage) for REE and Associated Mineralisation, the study area comprises parts of Bagh Group, represented by sandstone and limestone, which were restricted to north-west of the area and Deccan traps, lies in Sol Toposheet number 46J/12. The XRD result indicated that the carbonate dykes primarily consist of quartz, calcite and limestone/dolomite along with a minor amount of ironoxide. The PCS results revealed that the carbonate dykes have high silica (about 50%), alumina

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							(about 12%), Fe (about 12%), CaO (about 24%) and MgO (6%) which differs from the considerable criteria to carbonatite. They also have low Ba and Sr. XRD results also disclosed the high amount of silica.These may be hybrid carbonate rock which was emplaced along the fracture planes contemporaneously associated with the faulting activity which forms the clasts of basalt and carbonate which were further intruded by calcite veins. The analytical results did not yield any significant values of REE. Peculiarly, vanadium was present in considerable amounts, ranging up to 2,800 ppm. The copper was also reported up to 500 ppm.
Madhya Pradesh, Hoshangabad	Ramanagar formation of Narmada Alluvium	1:12,500	100 sq.km	25	182.50m	Mapping, Sampling & Drilling	A G4 satge investigation of the area which lies in SoI toposheet no 55F/14 was carried out. The major lithologies exposed in the area ranges from Precambrian to Recent. During the reconnaissance survey for Hf, Nb, Y and REE's andassociated mineralisation it was studiedthat the oldest rock types were Quartz arenite, carbonate- dolomites, phyllite and ultramafic rocks of Sleemanabad Formation belonging to Mahakoshal Super Group. Five of soil and stream samples collected from study area shown that the values of Σ REE varied from 108.41 ppm to 4,427.97 ppm. The study area was divided into four sub-blocks as Nimsadiya block, Anchalkheda block, Pahanbarriblock and Babai Block. A total of 150 soil and stream samples were collected from the sub-blocks, following a minimum 500 m distance away from the Tawa River on either side. A total of 182.50 m of auger drilling were carried out in 25 boreholes following a minimum distance of 1,600 m x 1,600 m between the boreholes. Depth of the boreholes kept between intersection of the pebble bed (about 6 to 7 m deep) or maximum up to 8.50 m. Samples were collected and processed for heavy mineral separation at Dhargaon Lab, CR, GSI, Nagpur. Out of 25 boreholes, 7 boreholes were drilled in older formations such as Banetha and Hirdepur to search the REE potential zones in older formations also. Out of 175 submitted samples (150 soil and stream samples and 25 auger drill samples), analytical results of 61 samples were received so far and the total REE values in the analysed samples varied from132.69 ppm to 1057.85 ppm, wherein, sample no. 20, collected from 1km North of Village Jasalpur was analysed maximum value of LREE and HREE as 1,012.76 ppm and 45.09 ppm respectively. The same sample showed higher values of Hf, Nb and Y also. Hf, Nb and Y valueswerevaried from 6.00 ppm to 61.28 ppm, 6.29 ppm to 38.75 ppm and 13.28 ppm to 84.32 ppm respectively. LREE values varied from 125.67 ppm to 1,012.76 ppm and HREE values from 6.87 ppm (sample no. 20) to 45.09 ppm (sample no. 22).
Madhya Pradesh, Chhatarpur	Chauka-Para	-	-	-	-	Sampling	During the reconnaissance survey (G4 stage) for REE mineralization in parts of SoI toposheet no. 54P/09, it was studied that the area was a part of Bundelkhand Granitoid Complex. The older metamorphics occurred as enclaves that comprised migmatite and gneiss. Coarse-grained granite and medium to grained granite were main constituents of BGC. As per the available chemical analysis data, BRS samples showed ΣREE value ranged from about1.84 ppm to 983.41 ppm. High REE values for BRS were recorded in syenite veins in Budhor area. ΣREE in the soil sediment samples in the area ranged from about 166.64 to 1107 ppm. High REE for soil samples were recorded in coarse grained granite near Budhor and Chauka areas.
Bihar, Banka	Karada Block	1:4,000	4 sq. km.	-	224m	Mapping, Sampling, Pitting/ Trenching & Drilling.	During preliminary exploration (G4 stage) for REE and Rare Metals 50 cu. m of pitting/trenching, 224 m of auger drilling and surface geochemical sampling viz. 50BRS, 53 PTS, 10 PCS and 194 auger soil samples were collected. Available analytical results of 104 auger soil samples indicated tREE value ranging from 98 ppm to 1,314 ppm, out of which 43 samples showed tREE value > 500 ppm with an average of 716 ppm. About 15 bedrock samples indicated tREE value ranging from 27.66 ppm to 877.5 ppm whereas, 4 samples yielded tREE value > 500 ppm.

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Bihar, Bhagalpur	Batesarthan-Kasri-Jagarnathpur Block	1:4000	7.2 sq. km	8	706.25m	Mapping, Drilling & Sampling	During preliminary exploration (G3 stage) for REE, fireclay and aluminous laterite, the mapping, granitoids and granite gneiss of CGC, overlain by the gritty and ferruginous sandstone of Dubrajpur Formation were observed. A total of 706.25 meters in 400m x 400m spacing was drilled in Batesarthan and Kasri Block, to assess the fireclay along with the potentiality of REE and aluminous laterite. Two boreholes were drilled in Batesarthan Block and in the first borehole; alternate bands of clay and sandstone of Dubrajpur Formation were intersected up to a depth of 47.90 m, after which grey carbonaceous shale was intersected. Within the grey carbonaceous shale, streaks and patches of coal varied in thickness from 1cm to 15cm was intersected in a zone from 59.60 m to 77.90 m. In the secondborehole, intertrappean clay of Rajmahal Formation was intersected from 4.5m to 11.10 m, after which alternate bands of clay and sandstone of Dubrajpur Formation were intersected up to a depth of 56.95 m. In Kasri Block six boreholes were drilled and clay bands were intersected in all the boreholes. Laterite was intersected in four boreholes, with vertical thickness ranging from 4 m to 13.5 m.
Bihar Banka	Jogmaran Block	1:4000	4 sq. km.	-	179.35m	Mapping, Drilling & Pitting/ Trenching	During preliminary exploration (G3 stage) for REE and RM, The auger drilling of 179.35 m, pitting/trenching of 50 cu. m and collection of 196 auger soil samples, 102 bedrock samples was undertaken. The block forms part of Chhotanagpur Gneissic Complex and was represented by amphibolite, granite gneiss, and intrusives viz. granite, pegmatite and quartz vein. Auger drilling was carried out systematically on 200 m x 200 m grid pattern for sampling of in-situ soil profile developed over various litho-units and drilled up to maximum depth of 2.60 m. Results of 99 auger soil samples indicated ΣREE values ranging from 166.35 ppm to 1325.28 ppm, out ofwhich 21 samples showed ΣREE value > 500 ppm with an average of 825.75 ppm whereas, that of 18 bedrock samples indicated ΣREE values ranging from 151.23 ppm to 725.07 ppm where only one sample yielded ΣREE value > 500 ppm.
Bihar, Banka	Bhairoganj Block	1:2000	-	-	-	Mapping, Drilling & Sampling	During preliminary exploration (G3 stage) for REE and RM, the auger drilling in 200 m x 200m grid spacing and collection of auger soil samples, pit/ trench samples, bedrock samples, petrochemical samples, heavymineral samples and bulk samples withthe objective to estimate the resources of REE and RM in soil profile and weathered rock was undertaken. Geologically, the area was composed of the lithologies of the Chhotanagpur Gneissic Complex (CGC). The values of ΣREE in the pits/trenches samples varied from 110 to 1749 ppm (avg. 513 ppm with n=100). The total estimated resource of ΣREE for unprocessed auger soil samples by extended area method was 3.12 MT with an average grade of 401 ppm at a cut-off grade of 300-500 ppm and 1.17 MT with an average grade of 636 ppm at a cut-off grade of >500 ppm which can be categorised as 333 category as per the UNFC.
Bihar, Banka	Lattu Pahar Block	1:2000	3 sq. km.	-	-	Mapping, Sampling & Pitting/ Trenching	Preliminary exploration (G3 stage) for REE and RM in Lattu Pahar Block was carried out with the objective to estimate the resources of REE and RM in soil profile and weathered rock. The different soil horizons along with collection of auger soil samples, pit/trench samples, bedrock samples, petrochemical, petrological and bulk samples. Analytical results of 128 auger soil samples received so far indicated ΣREE values ranging from 38 ppm to 1,183 ppm where high valuesof ΣREE were observed over migmatite and granitic gneiss. Bedrock samples showed ΣREE values ranging from 12 ppm to 1,215 ppm and pit and trench samples showed ΣREE values ranging from 60 ppm to 1,065 ppm respectively with maximum value of ΣREE observed in pit dug over granitic gneiss country.
Bihar, Banka	Arpathal Block	1:4000	4 sq. km.	-	207.95	Drilling, Sampling & Pitting/ Trenching	During preliminary exploration (G3) for REE and Rare Metals, the block under investigation forms part of Chhotanagpur Gneissic Complex and was represented by migmatite gneiss, granite gneiss, intrusive granite, pegmatite and enclave of amphibolite. The area along with auger drilling, pitting/trenching and bedrock sampling. Auger drilling on 200 m x 200 m grid pattern was carried out over the in-situ soil profile. A total of

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							207.95 m auger drilling were carried out with 211 auger soil samples, 50 cu.m pitting with collection of 50 pit samples and 110 bedrock samples. Bedrock sampling was carried by means of channeling within all the lithounits present in the area and special emphasis was given to younger granites in which high REE values was reported earlier. Pitting on the flanks of streams, preferably at the meandering, was carried out to have idea about the placer pockets in the study area.The sediments collected from 1 cu. m. pit was weighed and panned to separate out heavies, and the heavies separated was processed and sent to Chemical lab for the analysis of REE/RM.
Jharkhand, Palamu	Sildag-Chhatarpur-Tenpa	-	-	-	-	Sampling	During reconnaissance survey (G4 stage) for REE and Rare metals, the area forms apart of CGGC and its regional trend varied from NE-SW to NW-SE. The major lithounits exposed in the area were migmatites, biotite granite gneiss (± garnet), granite gneiss, porphyritic granite, pink granite, grey granite, pegmatites, amphibolites, dolerite and ultramafics. In the NW part of the study towards south of Liwar Village, a bouldery outcrop of ultramafics was mapped. This ultramafic body showed NE-SW trend and lies with in the migmatites. Grey granite was exposed near Village Kangalidih. In these granites sulphides were observed which occurred as fracture filling and disseminations. Pegmatite vein of dimension (270 x 25) m has also been noted in this lithounit. Village Manea pyrite and chalcopyrite grains were alligned along the gneissic plane of the biotite gneiss.In bedrock samples, maximum concentration of 2,450 ppm of ΣREE was recorded east of Village Basdihar in migmatites rock.
Jharkhand, Hazaribagh	Darudih, Jharpo and Banhe	-	-	-	-	Sampling	During reconnaissance survey (G4 stage) for REE and Rare metals, the area exposed rocks of Unclassified Metamorphics, represented by calc-silicate, calc- amphibolite, gneissose amphibolite and amphibolite; and granite gneiss suites of CGC, represented by granite gneiss, migmatite gneiss, garnet bearing granite gneiss, hornblende gneiss and quartzo-feldspathic gneiss. These rocks were invariably intruded by younger intrusives such as pegmatite, aplite and quartz vein. The area has subdued topography and largely peneplain supporting cultivation. The exposures were limited along the major river sections. From NGCM data and field conditions it appears that the REE/RM mineralization was of secondary origin and was concentrated within the weathered profile. The area also accommodates many linear pegmatite bodies along and across the Siwanenadi. The analytical results of 30 BRS samples showed that the tREE values in pegmatite ranged from 40 ppm to 1,124 ppm, in migmatite gneiss from77 ppm to 999 ppm and rest other showed very low values. The tREE values for 44 colluvial samples ranged from 74 ppm to 1,069 ppm and instream sediment samples collected from Bhandarbar and Hatwe area in the south it ranged from 1,546 ppm to 1,854 ppm. The REE-bearing mineral phases such as xenotime, monazite, zircon and a few apatites were identified. A few REE-bearing mineral phases such as monazite, zircon, allanite and apatite were observed in thin sections of hornblende gneiss, calc-silicate, gneissose amphibolite and migmatite gneiss.
Jharkhand, Palamau	Chiyanki-Leslieganj	-	-	-	-	Mapping, Sampling & Pitting/ Trenching	During reconnaissance survey (G4 stage) for REE and Rare metals, the major litho units included in Chhotanagpur Granite Gneissic Complex (CGGC) were mainly granite gneiss, migmatites and granite. The rare-earth elements (REE) and rare metals(RM) bearing minerals were not observed in the mapped area except for few allanites, non-magnetic black coloured mineral suspected RM, garnet and biotite-muscovite books and tourmaline in pegmatite near Jhabar. In case of stream sediments, ΣREE values ranged from 97 ppm 1,860 ppm. Results of 3 stream sediments samples showed ΣREE+Sc+Y values exceeding 1,000 ppm. Total REE values of PTS varied from 97 ppm to 1,433 ppm. Analysis of 44 PTS showed ΣREE+Sc+Y values ranging from 501 ppm-889 ppm and 3 PTS showed more than1000 ppm with values ranging from 1003.31-1534.38 ppm. The pitting trenching samples also brought about some good concentrations of Nb.Trench samples, T3/CLG showed Nb, 70-276 ppm, T10/CLG sample showed Nb, 79-175 ppm and T10/CLG sample showed Nb>200 ppm from Ganke sector, Khairahi hillin western part.

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
Jharkhand, Palamau	Karke-Banutikar	-	-	-	-	Sampling	During reconnaissance survey (G4 stage) for REE and Rare metals, the REE mineralization in various intrusive like granite and different generation of pegmatite veins were targeted. The magnetite bearing pegmatites were observed mostly at the north-western part of the study area around Kusumahi and Baghmar villages, were quite thick (maximum upto 50 m) and had length (upto1.5 km). While the mica-bearing pegmatites were found mostly in the central and southern part of the studyarea, south of Gobardha and Samda villages which were of relatively smaller dimension. The part analytical results did not showed any encouraging values of total REE (ΣREE). The maximum ΣREE value for the BRS sample went up to 438 ppm (in the gneissose granite) and for the PTS samples maximum ΣREE value goes up to 584 ppm (in the pegmatite vein). In the stream sediment samples only one sample has ΣREE value of 1,232 ppm. All these values of ΣREE in the available analytical results of various sample media did not show any anomalous values worthy of any economic significance.
Jharkhand, Deoghar Bihar, Banka	Jamua-Punsiya	1:12500	100 sq. km.	-	-	Sampling, Drilling &Pitting/ Trenching	During reconnaissance survey (G4 stage) for REE and Rare metals, the litho-geochemical sampling in the form of bedrock sampling, pitting/ trenching and stream sediment & soil sampling and auger drilling by hand auger for chemical analysis, petrological samples for petrographic, ore microscopic & EPMA studies, to know the mineral potential and encouraging zone for REE and RM of the area was undertaken. NE-SW trending minor lineaments were noticed, which followed general trend of Bihar Mica Belt (BMB). The scrubby land and barren land cover low-lying undulating terrain was occupied by granitic gneisses. A total of 339 samples were collected, processed and submitted to the Chemical Laboratory, ER, Kolkata for analysis for copper REE and RM mineralisation. Soil, BRS and PTS samples were analysed for total REE, 7 samples showed tREE values more than 500 ppm. Four soil samples have tREE values as 610 ppm, 617 ppm, 661 ppm, 754 ppm and 763 ppm respectively. BRS collected near Village Birniya western part of the study block have tREE values as 667.43 ppm and Pit sample collected near Village Maheswar Kharbali north of Nandanpahad area have tREE values as946.13 ppm and 829.70 ppm from B and C horizon.
Jharkhand, Palamu	Bangasi-Chhotahasa	-	-	-	-	Mapping	During reconnaissance survey (G4 stage) for REE and Rare metals, two different phases of pegmatite unit were marked based on their disposition and trend pattern. The bedrock samples were concentrated from the younger intrusive only. In the west of Chothasa, an excavated weathered outcrop was exposed where quartz veins and syenite bodies were intruded into the amphibolite unit. The granites were quite variable in character ranging from fine-grained to porphyritic varieties containing feldspar phenocrysts size of 1mm to 3 cm max. The colour of granites varied from greyish to buff white. Two types of granite were observed aroundTalapara and south of Baranw Village. Mafic intrusive in the form of gabbro/diorite were intruded in the gneissic country rock. Analytical result of Rb value ranged from 2.85 ppm to 1,236 ppm. The total REE content in BRS samples ranged from 8.05 ppm to 623.90 ppm. Analytical results of Rb in pegmatite PTS samples ranged from 6.30 ppm to 1,567 ppm. The total REE content in PTS samples varied from 6.30 ppm to 869 ppm.
Jharkhand, Ranchi (G3)	Kutru-Dimra	1:4000	10 sq. km.	135	203.91m	Drilling & Sampling	During preliminary exploration (G3 stage) for REE and Rare metals, it was found that garnet-bearing quartz muscovite graphite schist was wide spread rock as major country rock in the block. Graphite mineralisation was found along foliation in this schistose litho-unit near Kotam, Asurkoratoli, Kusumtikra, Ludmu and Losera localities. Fixed carbon values ranged from0.92 to 5.12% FC out of 10 bed rock samples. Calcsilicate, and amphibolite/ metagabbro bodies and widely exposed in southern hillocks, central southeast and south-west and in the northern part of the study area. The E-W to WNW- ESE trending parallel to sub-parallel sets of pegmatite bodies were mapped in Ludmuto Losera-Kusumtikra to Asurkoratoli sector. Outcrop widths of these bodies were noticed from few centimetres to 10 meters which showed more persistent strike length up to several meters to kilometre. These bodies were suspected as major host rock for occurrences of REE

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							and RM bearing minerals as based on surface indication and presence of suspected REE and RM bearing mineral phases like beryl, tourmaline, ferro columbite, tantalum columbite, yellowish green and dark brown mica, allanite, rutile, monazite and spinel which was later confirmed by XRD, petrography studies. A total of 203.91 m auger drilling was completed by 135 boreholes which were drilled in 200 m X 200 m grid pattern along with collection of 402 auger core samples.
Jharkhand, Ranchi	Tatisilwai North	-	-	-	400	Drilling & Sampling	During preliminary exploration (G3 stage) for REE and Rare metals, major rock types exposed in the study area comprised of porphyritic granite gneiss/ augen gneiss, sheared granite, granite gneiss, amphibolite and quartzo-feldspathic lenses along with quartz. The general trend of foliation planes in sheared granite/ granite gneiss was E-W, dipping at 50° to 62° towards north. The area was highly sheared and falls within the North Purulia shear zone. Few old workings of barite area were also observed in the south-eastern and south-western part of the study area. A total of 400 m auger drilling was completed alongwith collection of 407 of soil samples, 50 of BRS. Analytical results of bedrock samples (n=50) showed ΣREE values ranged from 25.22 ppm to 6,553.78 ppm with a mean value of 552.38 ppm. Out of 50 samples, 1 bedrock sample (baritechunks) which was collected from barite old working showed ΣREE value of 6,553 ppm, another bedrock sample (barite bearing granite) showed ΣREE value of 2,224 ppm and another bedrock sample from granite showed ΣREE value of 644 ppm. From the above results, it was evident that barite-bearing granite or barite chunks were enriched in REE. Analytical result of soil samples from boreholes (n=387) showed that ΣREE valuesranged from 147.06 ppm to 3324.16 ppm with an average grade of 723.12 ppm. Out of 387 samples, 14 samples showed ΣREE values greater than 1,500 ppmand highest value of 3,324.16 ppm with an average grade of 1,856.49 ppm, 54 samples showed ΣREE values between 1,500-1,000 ppm with an average grade of 1166.34 ppm, 209 samples showed ΣREE values between 1,000-500 ppm with an average grade of 700.94 ppm, 99 samples showed ΣREE values between 500-300 ppm with an average grade of 420.70 ppm and 11 samples showed ΣREE value less than 300 ppm with an average gradeof 233.67ppm. A total of 20.10 MT resourceswere estimated. Out of 20.10 MT resources, 13.80 MT comes from B-horizon/ layer-1 soil and rest of the resources comes from C-horizon/layer-2 soil.
Jharkhand, Ranchi	Tatisilwai south	-	10.3 sq. km.	-	-	Sampling	During preliminary exploration (G3 stage) for REE and Rare metals, the area exposed porphyritic granite, granite, granite gneiss, porphyritic granite gneiss, migmatite granite gneiss, amphibolite, pegmatite and quartzo-feldspathic lenses along with quartz vein and quartz reef. Two pits dug near barite old working showed ΣREE of 1,000 ppm (Pit-1) and in the ranged 2,000-2,500 ppm (Pit-4) with the presence of monazite, zircon and xenotime in heavies. The Pit-2, excavated along eastward extension of barite veins, yielded ΣREE of 1,132 ppm and 1,570 ppm from weathered rock samples of -80 mesh size and -120 mesh size respectively. Further eastward, in Pit-3, excavated on a river terrace, ΣREE was found to be 500 ppm. It was observed from the chemical analysis of orientation survey that higher values were obtained in the -120 fractions and higher ΣREE values were observed in the top horizon /first horizon. The heavy minerals were separated for 150 soil samples, of which 15 were studied and few REE-bearing minerals were identified such as xenotime, zircon and monazite, all belonging to phosphate phase. Available analytical results of 90 soil samples yielded ΣREE in the range of 86.33 ppm to 4,065.29 ppm with more than 1,000 ppm in 14 samples. A more fruitful assessment of resources can be drawn after the availability of all chemical and petrological results.
Odisha, Koraput	Koraput Alkaline Complex	-	-	-	-	Mapping	During Reconnaissance survey (G4 stage) for REE and RM, the area under investigation forms a part of Western Khondalite Zone (WKZ) and mainly constituted conformable interbanded sequence comprising khondalite and charnockite along with small patches of magnetite quartzite and pyroxene granulite which was intruded by granite and gabbro-dioritic suite of rocks associated with late phase intrusion of anorthosite,

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							nepheline syenite, alkali syenite, and pegmatite. REE and RM mineralization was mainly confined to granite, pegmatite and syenite of the study area. Based on the available analytical results, the REE concentration of a regolith sample (C-horizon) collected from Bagharagurha syenite has analysed as 854 ppm. The four elements Nb, Sc, Y, and Zr of 49 regolith/soil samples have received. The Zr has analysed maximum 1,146 ppm while that of other elements were less than 150 ppm.
Odisha, Nayagarh	Khuntapada-Purushottam-pura	1:12500	-	-	-	Sampling & Pitting/ Trenching	During reconnaissance survey (G4 stage) for REE and RM, the area of investigation being part of the EGMB, lithounits exposed in the area were khondalite, granite gneiss, leptynite, pyroxene granulite, leptynite and pegmatite. Large scale as well as detail mapping revealed that granite gneissic country rock was intruded by several leucocratic coarse grained to pegmatoidal syenite veins. Titanite crystals were found associated with the pyroxenite bodies which could be the source of REE. The petrographic studies of syenite, pyroxenite and their contact revealed that heavy minerals like alanite and titanite were present in pyroxenite and along the contact between pyroxenite and syenite which could be the possible source of REE. Analytical results for regolith samples indicated that tREE content in regolith varied from 184.90 ppm to 3847.48 ppm with an average of 782.83 ppm. Whereas, in BRS total REE varied from 84.409 ppm to 7436.458 ppm and in stream sediment samples it varied from 214.87 to 1118.19 ppm. Rubidium concentration in regoliths varied from 30.46 ppm to 314.23 ppm with an average of 166.18 ppm which was more than the average crustal abundance of 150 ppm in granitic rocks. After XRD and EPMA study, the mineral phases contributing for REE & RM content can be identified.
Odisha, Boudh and Subarnapur	Damamunda-Bilasapur	-	-	-	-	Mapping	During reconnaissance survey (G4 stage) for REE and RM, the mapped area lies in the Western Khondalite Zone of Eastern Ghats Mobile Belt (EGMB) in Boudh and Subarnapur districts of Odisha. The general strike of foliation observed in the rock types was NE-SW direction with moderate to steep dip towards southeast. In Damamunda-Bilaspur block, a total of 74 nos. of pegmatite veins have been mapped. These pegmatite veins occurred as clusters and were demarcated into five zones (Guruvelipadar, Bagira, Sanrahajor, Kadampal and Dumuriminda) which were suspected as potential zones of REE and RM. Both simple and zoned pegmatites were observed in the area. Pegmatites were composed of quartz, plagioclase, alkali feldspar, muscovite, biotite, tourmaline, magnetite, monazite and zircon. Four (4) of garnet rich zones within the granite gneiss in Tel River section were sampled for REE. Out of 270 samples submitted for chemical analysis, results of only 73 samples were received. The analytical results yielded maximum tREE value up to 1.14% (in heavy concentrate). Stream sediments yielded tREE value up to 5,340 ppm, soil/regolith yielded value up to 3,988 ppm where the BRS yielded value up to 908 ppm. Garnet rich veins in granite gneiss yielded tREE value up to 908 ppm. XRF analysis of one ilmenite sample collected from a stream nearer to pegmatite cluster of Dumuriminda (near Damamunda) area (demarcated as Zone-V) revealed that it contained Nb_2O_5: 555.4 ppm, Au: 42.1 ppm, TiO_2:46.9% and Fe_2O_3: 47.05%. The potentiality of the area can be established after getting complete analytical results.
Jharkhand, Ranchi & West Bengal, Purulia	Nawadih-Uparbarga-Brajapur	-	-	-	-	Sampling	During reconnaissance survey (G4 stage) for REE and RM, the surface manifestation of mineralisation inpegmatite was indicated by different features like the presence of radioactive halos, localisation of fine-grained dark minerals, presence of RM or REE mineral phases, and sometimes rare ferruginisation. Although the rock was mostly constituted of muscovite, in many portions, it contained well-developed brownish-black (zinnwaldite?) and greenish-colored mica books along with prominent rounded to sub-rounded, deep red to brownish red mineral phases. Occasionally, it contained brownish-black colored, non-magnetic mineral phases which were suspected as columbite-tantalite. The XRD study of one pegmatite sample with reddish-brown mineral phases reported the occurrence of ferro- columbite in a trace amount. Hence, the presence

Base Metal	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore-holes	Mete-rage		
							of these mineral phases possibly points to the fertile nature of the pegmatites. Out of various pegmatite bodies demarcated, the pegmatite bodies north of Sondimra-Ulladaka-Sargadih-west of Ambadih and north of Digardih area was found to be the prominent one reaching several km (~5 km) in length and ~ 150 m in width and it very closely falls in the strike extension of pegmatites of Belamu Pahar, West Bengal.
West Bengal, Purulia	Biltore-Golamara-Chalania	-	-	-	-	Sampling	Biltore-Golamara-Chalania block belongs to the gneissic rocks of Chhotanagpur Gneissic Complex (CGC) and falls in part of toposheet no 73I/7. During reconnaissance survey (G4 stage) for REE and RM, Discrete shear zones were noticed within PGG towards south of Village Kaluhar. Mineralised and non-mineralised pegmatite veins were observed in the mappedarea.Nonmineralised veins area coarse grained quartz, feldspar rich, often contained magnetite crystals. These veins were present in all the lithounits. The mineralised veins were thin, green/black colored epidote, amphibole, allanite, fluorite and apatite bearing veins ± sulphide. Quartz and feldspars were comparatively less. Thickness of these veins varied from few millimeters to 5 cm. These veins were observed to be restricted mainly within porphyroclastic granite gneiss. Clusters of REE veins were observed mainly in three locations. One cluster lies towards north of Village Golamara, second cluster occurred towards west of Jaleshwar, Village Mahuda and the third cluster was located towards south of Baikata and Village Baghra.
West Bengal, Darjeeling	Senada, Panchang	1:12500	50 sq. km.	-	-	Sampling	During reconnaissance survey (G4 stage) for REE and RM, 102 BRS, 50 PTS, 10 PCS and 15 PS samples were collected. The study area was covered pre-dominantly by Darjeeling Gneiss which comprised of banded migmatite gneiss and garnet biotite gneiss. Regional trend observed in Darjeeling gneiss was NE-SW with two major joint sets (NE-SWandE-W).Chungthang Formation comprising of garnet mica schist (± staurolite) and muscovite biotite schist and Daling Group represented by Chl-sericite schist with quartzite bands were exposed in the eastern part. REE bearing mineral phases like allanite, zircon, apatite, sphene, tourmaline and monazite with pleochroic halos were identified from Darjeeling gneiss and garnet mica schist during thin section studies. Sulphides i.e., pyrite and chalcopyrite observed in thin section slides of Darjeeling Gneiss. Chemical analysis results received till date showed that 17 BRS samplesover garnetiferous biotite gneiss of Darjeeling Gneiss had average tREE concentration with ranged from 329.14 ppm-827.01 ppm with an average of TREE-578.39 ppm; HREE-33.88 ppm and LREE- 544.51 ppm. Four PCS samples (received till date) showed TREE concentration ranged from 473.25 ppm - 652.39 ppm. The samples showed LREE enrichment in comparison to HREE.
Assam, Karbi Anglong	Lakhojan	1:12500	75 sq. km.	-	302.25	Drilling & Sampling	During reconnaissance survey (G4 stage) for REE and RM, the area was occupied by the migmatite gneisses of AMGC, Shillong group phyllites, quartzites, schists, and late Proterozoic granitoids. A total of 302.25 m auger drilling (52 nos.) was carried out at 800m spacing in a gridded pattern over soil developed over granitoids and migmatite gneisses. The chemical analysis of the 150 auger samples from B horizon which had thickness up to 2.0 m showed ΣREE values ranged from 156.68 to 2,067.53 ppm (average 577.71 ppm). The B+C horizon was often thick up to 9.0 m showed ΣREE varied from 154.67 to 1,467.39 ppm(average 481.60 ppm) and the C horizon of 1 to 6.0 m had the range of ΣREE from 180.29 to 1,294.83ppm (average 523.92 ppm). Resources of each mineralised zones in the boreholes were calculated by considering bulk density as 1.21 g/cm3. The total REE resource in the block was estimated as 45.18 million tonnes with an average grade of 727 ppm. As per the UNFC classification, the present investigation of the mineral resources was codified as 334 and the average grade of 727 ppm for ΣREE was not encouraging for further exploration.

State/District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore holes	Meterage		
	Thalisain	1: 12,500	5. 0 sq. km			Sampling	During reconnaissance survey (G4 stage) for REE and RM, 100 bedrock, 80 stream sediment and 10 petrochemical samples were collected. Besides, 27 samples were collected for petrographic study. Analytical results of bedrock samples yielded W values ranging from <0.50 ppm to 448.41 ppm, Sn from <1.00 ppm to 1,547.00 ppm, Ta from <0.20 ppm to 149 ppm, and V from 20 ppm to 1,686 ppm.
Uttarakhand, Uttarkashi	Gangotri Granite	1: 125,00	20 sq. km.	-	-	Mapping & Sampling	Reconnaissance survey (G-4 stage) was carried out to assess REE, Sn, W, Mo, and Rare Metals mineralisation, in and around Gangotri area, Uttarkashi District, Uttarakhand. The geological mapping of 20sq. km area on scale 1:12,500 and traverse mapping of 65 L. km on scale 1:25,000 was accomplished. A total of 110 bedrock samples, 30 stream sediment/slope wash samples, and 40 XRD samples were collected. Bedrock samples from Block-I containd the value of lead (Pb) from 10 ppm to 23%, Zinc (Zn) concentrations in these samples ranged from 10 ppm to 5,242 ppm. Copper (Cu) value varied from 2.5 ppm to 1,498 ppm and Silver (Ag) concentration ranged from 2.5 ppm to 168 ppm.
Uttar Pradesh, Sonbhadra	Khajuri-Pachpheri					Sampling	During reconnaissance survey (G4 stage) for REE and RM, Out of 100 BRS samples 89 samples showed ΣREE values ranged from 7 ppm to 1155 ppm, with an average of 305 ppm hosted in foliated K-feldspar granite with magnetite bearing K-feldspar Granite veins of few mm to 1.5cm thick. The highest value of REE was yielded from pegmatite vein (tourmaline-bearing) hosted in foliated K-feldspar granite exposed in Ahirantola area. Trench samples showed ΣREE values in 28 samples ranged from 57 ppm to 978 ppm, with an average of 373 ppm. Out of 30 soil samples, 25 samples showed ΣREE values of ranged from 88 ppm to 636 ppm, with an average of 317 ppm. Granites were classified under volcanic arc granites (VAG) to post orogeny granites (POG) setting.
Karnataka, Raichur	Kallingsugur and Niralkeri	-	100 sq. km.	-	-	Mapping & Sampling	During reconnaissance survey (G4 stage) for REE and RM, the major lithounits exposed in the investigated area were Pink granite, porphyritic granite, hornblende- granite, Syenite/Monzonite and dolerite. Younger intrusives occurred in the form of K-feldspar and plagioclase rich pegmatite vein and smoky quartz vein in pegmatite veins, bluish coloured minerals and presence of allanite; magnetite was also observed at some places such as villages Anehosur and Rampur. REE mineralization was associated with the smoky quartz vein in association with Syenite and Pink granite. Wall rock alteration was also observed in the form of limonitisation, silicification and brecciation was in quartz veins and pegmatite veins in the north and west of Village Anehosur. REE mineralization was associated with syenite, pink granite and younger intrusives such as quartz and pegmatite veins. It was lithologically controlled by the wall rock alteration in the form of limonitisation, ferruginisation, silicification and brecciation in smoky quartz veins and pegmatite veins in Syenite and Pink granite. On the basis of geochemical results, five samples of Syenite and Pink granite of Anehosur and Niralkeri area showed Total REE value ranged from 309.50 ppm up to 390.53 ppm. Ba values ranged from 506ppm to 2,085ppm in 28 samples, Sr value ranged from 384-1,400 ppm in 18 samples and Li ranged from 23-104 ppm.
Karnataka, Tumkur Andhra Pradesh, Anantapur	Obaga napalli-Mushtivar larnanda	-	-	-	-	Mapping & Sampling	During Reconnaissance survey (G4 stage) for REE and RM, The dominant litho types mapped in the area were alkali feldspar granite of PGC-II, alkali feldspar granite, syenogranite, monzogranite of Closepet Granite clan, porphyritic granodiorite and small granodiorite migmatite gneiss patches within syenogranite and alkalifeldspar granite. Pegmatite and quartz veins (acid intrusive) intruded into the granitoid rocks of the area. Dolerite dykes trending N310˚-330˚, N60˚-70˚ and E- W cut across these litho-units. Total 101 BRS, 52 SS, 25 PTS, 11 PCS, 21 PS, 25 SSS, 10 XRD, 10 HMS, 10 SEM and 10 EPMA samples from were collected Obaganapalli-Mushtivarlamanda area. REE mineralisation was observed within syenoganite and syenite and quartz syenite vein and in some pegmatite veins the form of well-developed allanite grains around area. To trace the continuity of mineralisation, Pit- trench mapping and soil sampling were carried out in Andepalle, Timmapuram, and Gudellaarea. Highest ΣREE were recorded in BRS-37(0.63%) in Andepalle area and BRS-9 (0.14%), BRS-18 (0.11%) from south of Kadiridevarpalle area, BRS-48 (0.09%) near Gudella

State/District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore holes	Meterage		
							Village and slight high value BRS 40 (0.08%) sample in syenogranite from Village Obaganapalle were also recorded. High ΣREE (0.38%) observed in PCS -11from quartz syenite Andepalle area. Petrographic study evidenced the presence of REE phases like zoned zircon, allanite, monazite, apatite and epidote. Sulphides viz. chalcopyrite, pyrite and covellite observed in syenogranite and alkali feldspar granite.An EPMA and SEM study on selected sections confirmed apatite, allanite, cesium, monazite, thorite,and rutile, bastanasite apart from epidote, zircon, and plagioclase phases.
Kerala, Idukki	Devikulam	1: 12500	100 sq. km.	-	-	Mapping & Sampling	During reconnaissance survey (G4 stage) for REE and RM, the area consisted of calc-granulite and garnetiferous hornblende-biotite gneiss of Khondalite Group, charnockite of Charnockite Group, hornblende-biotite gneiss of Peninsular Gneissic Complex-II with foliated granite, granite and pegmatite. The field study implied that the granite and associated pegmatites were the favorable rock for REE mineralisation. In the study area, number of non-mappable pegmatites was observed within different lithounits. Systematic sampling was carried out to know the concentration of REE along with Augur drilling was also carried out in gridded pattern where soil samples developed over granite. In hornblende biotite gneiss, the ΣLREE values ranged from 402.97 to 840.42 ppm with mean value of 621.70 ppm, the ΣHREE values ranged from 9.46 to 20.84 ppm with mean value of 15.15 ppm and the ΣREE values ranged from 412.44 to 861.26 ppm with mean value of 636.85 ppm. In foliated granite, the ΣLREE values ranged from 157.18 to 1,288.85 ppm with mean valueof 592.94 ppm, the ΣHREE values ranged from3.07 to 62.31 ppm with mean value of 24.29 ppm and the ΣREE values ranged from 161.39 to 1,351.18 ppm with mean value of 617.24 ppm. In granite, theΣLREE values ranged from 39.23 to 5,145.41 ppm with mean value of 533.05 ppm, the ΣHREE values ranged from 0.87 to 33.37 ppm with mean value of 9.31 ppm and the ΣREE values ranged from 40.19 to 5,178.79 ppm with mean value of 542.32 ppm. In pegmatite, the ΣLREE values ranged from 64.225 to 11,136.06 ppm with mean value of 820.72 ppm, the ΣHREE values ranged from 1.50 to 191.52 ppm with mean value of 16.44 ppm and the ΣREE values ranged from 66.96 to 1, 1327.59 ppm with mean value of 837.22 ppm. In regolith samples, the ΣLREE values ranged from 112.45 to 4994.51 ppm with mean value of 784.47 ppm, the ΣHREE value ranged from 6.12 to 82.89 ppm with mean value of 20.25 ppm and the ΣREE value ranged from 129.11 to 5,077.40 ppm with mean value of 804.73 ppm. In core samples, the ΣLREE values ranged from 85.80 to 4,149.8 ppm with mean value of 777.42 ppm, the ΣHREE value ranged from 11.11 to 43.50 ppm with mean value of 21.80 ppm and theΣREE value ranged from 97.50 to 4,169.27 ppm with mean value of 799.23 ppm. In stream sediment samples, the ΣLREE values ranged from 85.80 to 4,149.8 ppm with mean value of 777.42 ppm, the ΣHREE value ranged from11.11 to 43.50 ppm with mean value of 21.80 ppm and the ΣREE value ranged from 97.50 to 4,169.27 ppm with mean value of 799.23 ppm.
Tamil Nadu, Coimbatore	Somanur-Tekkalur	1:12500	-	-	-	Mapping & Sampling	During reconnaissance survey for REE and RM, the G4 stage investigation was taken up with an objective to delineate REE & RM mineralisation in granite and other associated lithology. Heavy mineral from bedrock sample and stream sediment sample were studied under SEM for identification of REE bearing mineral phases. A total of 73 BRS samples were received, of which 05 sample collected from fineto medium-grained granite has analysed >500 ppm of TREE. REE bearing mineral phases like Bastnasite, Allanite, Thorite, Xenotime and Monazite were identified by SEM-EDX. It was inferred that these mineral assemblages might have contributed to the REE values in the analysed samples.
Tamil Nadu, Vellore	Rasimalai Syenite Complex	1: 12500	104 sq. km.	-	-	Mapping & Pitting / Trenching	During reconnaissance survey (G4 stage) for REE and RM, the dominant lithology mapped during the investigation were charnockite, epidote-hornblende- biotite gneiss, syenite (pink syenite and grey syenite), dolerite dyke, metagabbro, pyroxene-granulite, pegmatite veins, quartzo-feldspathic vein, quartz vein and quartz-baryte vein. Garnetiferous charnockite were intruded by several criss-cross quartz veins which contain molybdenum mineralisation. Molybdenum occurred in the form of flakes as well as in the form of.

State/District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore holes	Meterage		
							dissemination. In bedrock samples (BRS), it was observed that pegmatite exposed in the upstream direction of unit cell (63-C) yielded ΣREE of 498 ppm and the pink syenite in the Rasimalai area showed ΣREE up to 566 ppm and grey syenite has shown a maximum of 178 ppm ΣREE. Apart from REE, Ba occurrence in syenite ranged from 814 to 2,010 ppm and Sr varied from 374 to 1,375ppm. In south western part of Rasimalai area, quartz-baryte vein (~20mwidth and~200m length) was found to contain Ba value of 16.23%, Sr of 2,704ppm and ΣREE of 575 ppm and Mo 104 ppm. In regolith samples, ΣREE (La to Lu) ranged from 64.17 to 3,014.83 ppm with mean value of 283.80 ppm. In colluvial samples, ΣREE (La to Lu) was obtained up to 400 ppm. Ba value ranged up to 6.67% in colluvial sample of quartz barite vein
Telangana, Mancherial	Jaipuram	1:12500	100 sq. km.	-	-	Mapping & Sampling	During reconnaissance survey (G4 stage) for REE and RM, the dominant lithounits of the Jaipuram area were feldspathic sandstone (Middle Kamthi Fm) and ferruginous sandstone belongs (Upper Kamthi Fm) and has gradational contact. Multiple deformation episodes viz., NNW-SSE, ENE-WNW and WNW-ESE observed in the area, which exhibited by joints and faults and, controls distribution of outcrops, shifting of rock, repetition of beds and, development of steps like cliff sections and erosional landforms. The REE mineralisation found as REE bearing minerals associated with heavy minerals. Ilmenite, magnetite, monazite and zircon were the major heavies. The visible high concentration of heavy minerals observed to be associated with Fe-soil areas, which dominantly developed from weathering of ferruginous sandstone. The available chemical analyses indicated that, in all media, Ti was the dominant element followed by Zr and TREE. The heavy minerals samples had 1.18-8.3% TREE (avg.3.47%), 3.3-27.35% Ti (avg. 11.17%), 0.99-13.64% Zr (avg.4.22%) and 0.18-1.16% Th (avg.0.51%), especially in +85 mesh size fraction. In bedrock samples, feldspathic sandstone contained average 0.05% TREE, 1% Ti and, 0.09% Zr, while the Fe-laminated feldspathic sandstone showed average values of 0.05% TREE, 0.66% Ti and, 0.06% Zr. The average 0.05% TREE, 0.75% Ti and 0.1% Zr were observed in ferruginous sandstone, which were comparable with analytical values of soil samples (wt. avg. 0.04% TREE,0.9% Ti and, 0.2% Zr). Based on geological and geochemical parameters, two potential Fe-soil zones were identified namely Zone-1 and Zone-2.
Telangana, Bhadradri-Kothagudem	Kamalapuram-	-	135 sq. km.	-	-	-	During reconnaissance survey for REE and RM, G4 stage REE investigation was carried out in an area of about 135 sq. km.The area forms part of the Chintalapudi sub-basin, southeast extension of Pranhita to Godavari Gondwana main basin and was situated northeastern side of Telangana state. Study revealed that ΣREE value of HMS (heavy minerals) from stream sediment varied from 0.003 to 2.24 % with an average of 0.26% whereas, SSS showed 0.248% to 3.118%with an average of 1.41%. On the other hand, ΣREE value ranged between 126.88 and 3411.58 ppm (average 1214.0 ppm) in the heavy fraction separated from soil regolith sample and whereas it varied between 318.84 and 2602.19 ppm with an average of 893.27 ppm in
							clay fraction. However, it ranged between126.88 and 13249.96 (average 2102.91 ppm) in soil regolith (raw). The ΣREE values of BRS sample varied between 105.79 and10216.57 ppm with an average of 787.07 ppm as well.In all thecases, ΣLREE dominated over ΣHREE. Study also revealed that Monazite was the main contributing mineral phase for high REE incidence. The analytical results indicated that the REE bearing mineral phase was present in all the three mediums (bedrock, soil regolith and stream sediment) but the level of concentration varied significantly. The high values of REE in the stream sediments (HMS) were recorded in the peripheral zone particularly towards the south-eastern and southern part of the block.

State/District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore holes	Meterage		
Telangana, Bhadradri-Kothagudem	Gangaram Block	1:4000	10.7 sq. km.	-	-	-	A preliminary exploration for REE was carried out in Pata Gangaram block of 10 sq. km area on 1: 4,000 scale in parts of SoI Toposheet No. 65C/15. During this investigation, detailed mapping has been done for total 10.7 sq. km area. Soil sample from 31 locations and 11 stream sediment samples were collected within the 3 sq. km block area (considered for G3- stage Resource). Total 144 soil samples were collected from the selected 31 locations (as per MEMC guideline for G3-Stage resource estimation for placer type of deposit). Among these, sampling with 50cm vertical interval was done from the 17 exposed soil profiles. Samples were also collected from the pit of 1 m depth in rest of the 14 locations dueto absence of exposed soil profile. The SEM study revealed that the major mineral phases in different media of samples were Monazite, Zircon, Ilmenite, Rutile, and few silicates (mostly of quartz). Among the heavy mineral, Monazite was the only REE bearing mineral and ilmenite having higher modal abundance compared to both monaziteandzircon. Geophysicalmethodlike vertical electrical sounding (VES) was carried out to assess the soil thickness in the area. Bulk density for both stream sediment and soil was measured using cylindrical method and it was estimated as ~ 1.55 gm/cc and ~ 1.47 gm/cc respectively. The average modal proportion of heavy mineral present in stream sediment was calculated as 20 gm/kg and for soil it was about 1.52 gm/kg. REE resource will be estimated for this block based on chemical results.
Rajasthan, Sirohi	Mungthala-Mawal-Bhaisasing	1:12500	100 sq. km.	-	-	Sampling	Reconnaissance survey (G4 stage) for Niobium and Beryllium was carried out in these areas. A total of 167 bedrock sample, 30 pit/trench sample, 26 petro-chemical sample, 40 soil sample, 40 stream sediment sample and 20 heavy mineral samples were collected during field work. All the samples were submitted to chemical division, GSI, WR for chemical analysis. Apart from this, 24 petrological samples, 20 ore microscopy samples, 5 XRD and 5 EPMA samples were also collected for various studies. The litho-units observed during mapping were calc- silicate rock, impure marble, skarn, biotite granitoid, medium and coarse grained granitoid, gabbro, and sheared/brecciated cherty quartzo-feldspathic rock.
Rajasthan, Bhilwara	Mahendra garh-Gundli-Bawri	-	130 sq. km	-	-	Sampling & Pitting/ Trenching	Reconnaissance survey (G4 stage) for Neodymium and Associated Ree was carried out in these areas. Geologically the area exposed the Rajpura Dariba group of rocks of Bhilwara Supergroup along with Erinpura granite/Anjana granite and other intrusives. The main lithologies mapped during the fieldwork were sillimanite-garnet-muscovite-biotite schist / Garnet-mica-schist / Garnetiferous meta-psammite and garnetiferous meta-pellite of Bhinder formation, Quartzite of Dariba formation, Garnetiferous amphibolites / Metabasic rock as an intrusive, Porphyritic granite / gneiss of Erinpura / Anjana granite and other intrusive such as pegmatite granite/Leucogranite/Pinkgranite and pegmatite veins/reefs. A total of 65 bedrock samples, 50 pitting/ trenching samples, 100 soil samples over bedrocks, 70 stream sediment samples from paleo-channels, 50 heavy mineral (fluorapatite, garnet, and magnetite observed in few samples) samples, 22 petrochemical samples, 21 petrological samples, 21 ore microscopy samples, 05 EPMA samples, 05 XRD samples were collected. Selective Pegmatites were sampled to check for Beryl enrichment.
Rajasthan, Barmer	Sainji Ki Beri-Meli	1:12,500	108 sq. km.	-	-	Mapping & Sampling	A G4 stage exploration in Sainji Ki Beri-Meli area in SoI toposheet no. 45C/06 was taken up to delineate zones of REE & associated RM mineralization and to demarcate younger intrusive phases. Large scale geological
							mapping was carried out along with collection of various sample media. During mapping, a total of 29 different flows of rhyolites were marked on the basis of the characteristics of groundmass colour, mineral composition of phenocrysts (viz. globular quartz, K-feldspar, Na- feldspar etc.), size and shape of the phenocrysts (viz. tabular, lath etc.) the ratio between groundmass and phenocrysts as well as presence of vesicles.

State/District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore holes	Meterage		
Rajasthan, Barmer	Nimale Ki Pahari-Dantala	1:12500	100 sq. km.	-	-	Mapping & Sampling	A G4 stage exploration in Nimale ki Pahari area in SoI toposheet 45C/06 & 10 was taken up to delineate zones of REE & associated RM mineralisation and to demarcate younger intrusive phases. Large scale geological mapping was carried out along with collection of various sample media. The area exposed rocks of volcanic origin (mostly variants of rhyolite, with basalt) and plutonic origin (mostly granite). General dip of volcanic flows near Dantala and Nimale ki Pahari were south to south-east with average dip of15-25degrees. Rocks of intermediate composition (andesitic and dacitic) were commonly observed in the eastern part of the study area comprising hillocks of Baloo and Arjiyana. Dykes showed varied width and length ranging from 2-3 meters and 400-500 meters respectively. Chemical results of most of the submitted samples were awaited.
Rajasthan, Barmer	Indrana-Siwana	1:12500	100 sq. km.	-	-	Mapping & Sampling	A G4 stage exploration in Indrana Siwana area in SoI toposheet 45C/06 & 10 was taken up to delineate zones of REE & associated RM mineralisation and to demarcate younger intrusive phases. Large scale geological mapping was carried out along with collection of various sample media. Rocks of volcanic and plutonic phases were mapped. The porphyritic and aphanitic varieties of rhyolite were the major volcanic phases observed in the area. The plutonic phases observed in the area are dominated by grey, coarse grained granodiorite / granite. Two sets of major joint patterns area observed in the area. These are along NNW-SSE and E-W in trend dipping westerly and southerly, respectively. The youngest intrusive phases in the area are dykes which have intruded along the joint planes with discordant as well as sheet type field relation.
Rajasthan, Barmer	Kundal-Dhiran	1:12500	100 sq. km.	-	-	Mapping & Sampling	A G4 stage exploration in Kundal Dhiran area in SoI toposheet no. 45C/06 was taken up to delineate zones of REE & associated RM mineralisation and to demarcate younger intrusive phases. Large scale geological mapping was carried out along with collection of various sample media. The lithounits mapped in the area were of older volcanic phase followed by plutonic Siwana granite which was further followed by younger felsic, basic and micro granite dykes. Chemical results of most of the submitted samples are awaited.
Rajasthan, Barmer	Sukleswar Ka Mandir	1.431	2.0 sq. km	-	-	Mapping & Sampling	A G3 stage exploration was taken up in the WNW of Sukleswar ka Mandir area near Siwana in SoI toposheet no. 45C/06 to establish the sub-surface continuity & estimate the resource of REE & RM mineralisation. Detailed geological mapping was carried out alongwith collection of various sample media. The area mapped exposed peralkaline Siwana granite which was classified into K-feldspar rich granite and porphyritic riebeckite granite along with a E-W trending andesite/rhyolite unit. Systematic bedrock sampling in grid pattern was carried out through out the area from the variants of granite. Younger sub vertical intrusive dyke in granite varied in composition from micro-granite, grano-diorite to felsites and roughly trend along N-S and some along E- W directions. The thickness of individual dykes varied from 2 cm to 2.7 m. Analytical results of channel samples received so far, indicated that most of thedykes cutting through granites were enriched in REE & RM content in comparison to variants of granite. ΣREE of 4,058 ppm and Zr up to 9,600 ppm was reported from the dyke. The ΣREE content in samples from granites varied between 1,100 ppm to 2,100 ppm. Complete analytical results of bedrock, soil and channel samples were awaited. Drilling operation was initiated on 27th February, 2022 and 87m was drilled in BH No. RBSM-1 till 31stMarch, 2022.
Rajasthan, Jaipur	Asalpur, Boraj, Bichun	-	-	-	-	Sampling	During reconnaissance survey (G4 stage) for Rare Earth Elements, Rare Metals and Base metals, in the BGC terrain around Bichun, Nayagaon, Asalpur, Dangarwara, albitite/ albitised zones with sizeable dimensions were identified. Albitites in the study area occurred as NNE to SSW, NE to SW and NW to SE trending bodies. A total of 60 Water sample showed values of Tantalum as 660, 600 and 660 (ppm) and Thorium as 620, 940

State/District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore holes	Meterage		
							and 540 (ppm) in samples collected from Mokhampura, south of Bichun and SE of Bichun respectively. Eight water samples namely showed Zn value more than 1,000 pbb collected from 900 ms east of Village Akoda, 1.3 km SE of Akoda, near Mokhampura, 2 kms NE of Bichun,1.8 km SE of Bandhebalaji, Ugras, 1.3 km NE of Gopalpura and 1 km SW of B oraj respectively. Maximum value of Zn was 12,060.65 ppb, collected from 1.8km east of Bandhebalaji Village. Uranium value ranged from 0.5 to 90.7 ppb. There were two batches of samples one 4.8km SW of Bichun and another 2 km east of Bandhebalaji upon lithology granite gneiss which showed high concentrations of Cu, Pb and Zinc. The one occurring SWof Bichun have Cu, Pb and Zn concentrations as 232.73 ppb, 54.61 ppb and 2,175.487 ppb respectively and the other batch 2 km east of Bandhebalaji have Cu, Pb and Zn concentrations as 27.41 ppb, 101.74 ppb and 12,060.538 ppb respectively. The highest total concentration of La and Ce (3.26 ppb) was observed near Bicun over quartzite and the highest U concentration (90.75ppb) was observed 5km east of Asalpur in granite gneiss. The highest Ba concentration (264.25 ppb) was observed near Ugras in Granite Gneiss. Chemical analysis results (XRF) of 100 BRS was received which did not show any significant concentrations. Cu, Pb and Zn concentrations were lower than 100 ppm.
Rajasthan, Sikar	South East of Nanagwas	0.736	1 sq. km.	-	-	Mapping & Sampling	A G3 stage investigation was carried out in tha area. The Southeast of Nanagwas area was located about 20 kms east of Neem ka Thana tehsil, Sikar District, Rajasthan. The area falls in SoI toposheet No. 45M/14. Geologically, the area exposed the rocks of the Ajabgarh Group of the Delhi Supergroup. The exposed lithounits were quartz biotite schist with magnetite band and banded impure marble of the Kushalgarh Formation, quartzite of the Seriska Formation and Jaitpura granite. Apart from this, numerous intrusive bodies, viz. pegmatite veins, quartz veins, calcite veins, albitite veins were present in the study area. General strike of rocks was NE to SW and dip varied from 55° to 85° towards west. The area had undergone three phases of deformation. Total 09 geochemical profiles were led across the quartz biotite schist with magnetite band/partings over 1500 m strike length and 0.50 to 03 m width. Occurrence of base metal mineralisation was also demarcated over 250 m strike length with very restricted width of about 1m in the form of fresh copper sulphides i.e., chalcocite, bornite and chalcopyrite along with pyrite and malachite stains. The analytical results of channels SENCH-01 (2m x 0.26% tREE), SENCH-02 (0.50m x 0.24% tREE), SENCH-03 (0.50m x 0.11% tREE), SENCH-04 (1.5m x 0.17% tREE), SENCH-05 (3.0m x 0.68% tREE), SENCH-06 (1m x 0.19% total REE and 2m x 0.24% tREE), SENCH-07 (3m x 0.21% tREE) and SENCH-08 (2.5m x 0.14% tREE) indicated anomalous values of tREE on surface. On the basis of surface anomalous values of tREE, a total 09 nos. of first level boreholes RJSSN-01 to RJSSN-09 were drilled to evaluate the subsurface potentiality of REE and Rare Metals in SE of Nanagwas area.
Rajasthan, Jaisalmer	Jaisalmer-Pokran	-	-	-	-	Mapping & Sampling	A G4 stage investigation was carried out for REE & Rare metals in tha area. The basalts were mainly exposed in the southernand south-western part of mapped area around Marwa. This granite represents the second of Malani magmatism. Various aplitic veins, from where appropriate sampling was undertaken. REE mineralisation was reported from the granitoids in nearby areas. Grid sampling and appropriate number ofchannel sampling was carried out extensively in the granitoids of the area for the purpose of demarcation of potential REE zones. The last phase of MIS represented by dykes also was reported to have high potential for HREE and yttrium. A similar association was observed in the mapped area and samples were collected accordingly to check the REE potential in the mapped area. Thin felsic veins were observed within the rhyolites at places which showed intense kaolinitisation. These were also reported to be enriched in REE and samples were collected of the same for analysis.

State/District	Location	Geological mapping		Drilling		Details of work done	Result obtained/Remark
		Scale	Area (sq. km)	Bore holes	Meterage		
Gujarat, Banaskantha	Jalotra-Vaghor	-	-	-	-	Mapping & Sampling	A G4 stage investigation was carried out for REE & Rare metals in tha area. Geologically, the area was comprised of Sendra Ambaji Granitoids intrusive in metasediments of Delhi Supergroup. A mafic dyke of nearly 2km length and 0.15 km width trending N-S was observed near Village Motipura which cut across by several aplite and microgranite dykes all trending almost along N50°W-S50°E. Two major shear zones trending in NS andNW-SE were present along with small scale shearing were observed in the study area characterised by mylonitic rock. Based on the field observations, petrographic study and proximity indicators, it seems that late phase microgranite, fluorite bearing quartz syenite and altered granite were potential host for the REE and RM mineralisation. In the thin section study, zircon, monazite, fluorite were observed in K-feldspar rich granite and quartz syenite. Alteration like epidotisation, silicification, greisenisations were observed in investigated block, which also indicated enrichment REE and RM bearing phases in altered zones in granite.
Gujarat, Panchmahal, Chhota Udepur and Dahod	Khokhra-Mithibor	-	-	-	-	Sampling	A G4 stage investigation was carried out for REE & Rare metals in tha area. Geologically (G4), the area was represented by granite gneisses, metasediments of Lunavada Group and Godhra Granitoids. Isolated and thin bands of impure marble are observed as enclave and cut off patches within K-feldspar rich two mica granite. Late magmatic activity in the form of syenite, pegmatites, aplites and quartz vein are found as intrusive into all the variants of Godhra granite throughout the study area. One panned heavy was collected by crushing 2kg of bedrock samples of syenite having metallic lustre mineral for identification of REE and RM mineral phases.
Gujarat, Kawant Taluka, Chhota Udepur	Ambadungar Carbonatite Complex	-	-	10	5727 m	Driliing & Sampling	A G2 stage Rare Earth Elements and Rare Metal exploration with drilling of 5,727 m to explore the occurrences of REE beneath the basalt of Deccan Trap was carried out in Central block Ambadungar area in Ambadongar Carbonatite Complex. Lithologically, the area comprises different varieties of carbonatite carbonate sandstone, phonolite, basalt, dolerite-dyke and quartz veins. The EPMA study of core samples indicated the presence of REE associated mineral phases like bastnasite, parasite, synchesite, apatite, fluoro apatite and monazite whereas the RM minerals were mainly associated with Pyrochlore. The drilling of 5,727 m was completed to assess the potentiality of carbonatites for REE and Niobium.A total of 10 vertical boreholes were drilled in the central block of Ambadungar area with 500 to 600 m vertical depth at 100 m x 100 m regular interval. The carbonatite occurred beneath the basalt at vertical depth of 55 m to 90 m whereas the average depth was 100 m. During the exploration out of 5,727 m of drilling 4,728 m of carbonatite zone which was favorable for REE and Niobium mineralisation was observed. The zoneof REE and Niobium mineralised carbonatite was observed in each borehole and their vertical depth varied from 450 to 500 m. Besides REE, Pyrochlore, sulphide and magnetite with pyrochlore mineralisation were also observed in core of different boreholes. Based on the previous analytical data of the core samples, these carbonatite showed encouraging value (0.4% average grade with 0.25% cut off) for REE and for Niobium.

Table-2-Exploration carried out by DMG, Rajasthan; NMDC; Hutti Gold Mine & GMDC

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling (nos	Remarks Reserves/resources estimated
		Scale	Area (sq. km)	Bore holes	Mete-rage		
DMG, Rajasthan Limestone	N/v - Hariyav, Jaspura Tehsil Vallabh - nagar District - Udaipur	1:4000	1 sq. km	3	132 m	105	Core drilling for 105 m on three boreholes for sub-surface exploration was continued. A total 9 boreholes were drilled on this project. During field season: 2019-22 on Project LS-15 & LS-11 about 583 m drilling spread over 07 boreholes was carried out. Total 456 core samples were prepared and analysed for Cement Grade Limestone. On the basis of drilled borehole, the resource estimated about 74.21 MT, G2 level exploration was carried out.
DMG, Rajasthan Limestone	n/v Shyamgarh, Kanakhera, Pakriyawas, Kesarpura, Sivpura ghata etc. Tehsil-Masuda & Beawar, District-Beawar.	1:4000	1.50 sq. km	-	472 m	-	Geologically the area comprises of calc-schist, calc-silicate, limestone, quartzite & mica-schist of Kumbhalgarh Group of Delhi Supergroup along with intrusive of granite, pegmatite and vein quartz etc. A total 472 m diamond drilling was done in 1.5 sq.km area.
DMG, Rajasthan Limestone	n/v Aughar, Tanda, Majola etc. teh. Shahbad distt. Baran	-	10.5 sq. km	17	306 m	220	Exploration was carried out in n/v Aughar, Tanda, Majola, etc. teh. Shahbad in Baran District for Limestone. In drilled boreholes one to two zones of limestone/siliceous/cherty limestone were intersected. A total 306 m core drilling in 17 boreholes was performed and a total 220 core samples were collected for analysis. A total 13.13 million tonnes of inferred geological resources on UNFC G-3 level were estimated spreading over 7 boreholes.
DMG, Rajasthan Basalt	N/v Mishroli, Gangaliya kheri, Marlawada etc., Tehsil-Pachpahar, Dist. Jhalawar.	1:50000	110.0 sq. km	-	-	9	A geological mapping was carried out in an area of N/v Phaldi, Bansthuni, etc tehsil- Kishanganj in Baran District for Sandstone. Regional Mineral Survey - 100.0 Sq. Km.; Regional Geological mapping - 20.0 Sq. Km. and Detailed Geological Mapping - 3.0 Sq. Km. carried out.
		1:10000	20.0 sq. km				
		1:4000	3.0 sq. km				
DMG, Rajasthan Sandstone DMG, Rajasthan Sandstone	N/v Phaldi, Bansthuni, etc tehsil-Kishanganj, dist.-Baran.	1:50000	100.0 sq. km	-	-	-	A geological mapping was carried out in an area of N/v Phaldi, Bansthuni, etc tehsil- Kishanganj in Baran District for Sandstone. Regional Mineral Survey - 100.0 Sq. Km.; Regional Geological mapping - 20.0 Sq. Km. and Detailed Geological Mapping - 3.0 Sq. Km. carried out.
		1:10000	20.0 sq. km	-	-	-	
		1:4000	3.0 sq. km	-	-	-	

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling (nos	Remarks Reserves/resources estimated
		Scale	Area (sq. km)	Bore holes	Mete-rage		
DMG, Rajasthan SMS and Cement grade limestone	N/v Sam, Tehsil & Distt Jaisalmer	RGM (R.F: 1:10000) DGM (R.F. 1:6336	RGM-10 sq. km; DGM-02 sq. km	10	463 m	287	During the year 2021-22 total 463 m drilling spread over 10 of bore holes were carried out for SMS & cement grade limestone n/v Sam. Thickness of SMS grade limestone varied 4.50 to 12.75 m (Average thickness 8.83 m) in 9 boreholes & underlying chalky cement grade limestone varied from 20 to 36 m (Average thickness 30 m) in 10 boreholes. Visually chalky limestone (Cement grade) was 120 MT and Hard Compact Bouldary (SMS grade) limestone was 33.94 MT resource calculated.
DMG, Rajasthan Dimensio nal Stone / Masonry Stone	N/v Purohitsar, Tehsil Pokaran, Distt. Jaisalmer	RGM (R.F: 1:10000) DGM (R.F. 1:6336)	RMG: 05 sq. km; DGM: 02 sq. km	-	-	-	Mapping and delineation of sandstone suitable for dimensional stone / masonry stone carried out. The total 05 sq. km RGM and 2 sq. km DGM were carried out n/v Hajiron Ki Dhani, Tehsil Pokaran, Distt. Jaisalmer. About 0.50 sq. km area comprised marron to reddish colour medium-grain sandstone, thickness varied from 0.50 to 3.50 m (cumulative thickness) and potential for masonry stone discovered.
DMG, Rajasthan Limestone	N/v Chakeri, Raitha kalan, Ninoni, Hingoli, Olwara and Dubbi Banas Tehsil; Tehsil Sawai madhopur & Malarna, District - Sawai madhopur	1: 10000 1:4000	RMG- 30 Sq. Km.; DGM- 05 Sq. Km.	-	-	-	Geologically the area comprised sandstone with grit & limestone rock of Satola Group of Vindhyan Supergroup. The limestone bands were found discontinuously exposed in an area of about 2,200 m x 10-120 m n/v Chakeri, Raitha kalan, Tehsil Sawai madhopur, in about 3,600 m x 10-250 m area n/v Ninoni, Hingoli, Olwara, Tehsil Sawai madhopur and in about 4000m x 100-1,000 m area n/v Dubbi Banas river bridge, Tehsil Sawai madhopur & Malarna. The limestone was Cherty in nature at surface.
DMG, Rajasthan Sandstone (Splitable/ Blockable), Masonary Stone	N/v Chhakra, Teh- Wazirpur, District- Sawai madhopur; N/v Kota, Teh.- Masalpur and N/v Girwarpura, Raghuvansi, Teh.- Karauli & District- Karauli.	-	DGM- 2Sq. Km.	-	-	-	The Chhakra area was proposed for delineation of masonry stone and total 9 plots of masonry stone were delineated n/v Chhakra, Teh- Wazirpur, District- Sawai madhopur.
NMDC, Iron Ore (haematite	Bacheli (D-5)	-	-	23	4102.0 m	-	Exploration was carried out in the area of Bacheli (D-5). A total 4,102 m drilling were done in 23 boreholes

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling (nos	Remarks Reserves/resources estimated
		Scale	Area (sq. km)	Bore holes	Mete-rage		
NMDC, Iron Ore (haematite)	Bacheli (D- 10)	-	-	26	2375 m	-	Exploration was carried out in the area of Bacheli (D- 10). A total 2,375 m drilling were done in 26 boreholes.
Hutti Gold Mine Gold	Village: Hutti, Taluk: Lingasugur, Dist: Raichur, Karnataka	1:400	0.868 sq. km (under ground mappin g)	-	-	5293	The Hutti Gold Deposit had a definite Stratigraphic, lithological and structural control. The wall rock alteration, vein Formations and primary gold-quartz sulphide minertalisation occurred contemporaneously with first fold deformation. During 2021-22 the reserve calculated as per UNFC proved Category was 15.58 Million Tonnes @ 4.38 Au g/t. Tonnes; Probable} 3.36 Million Tonnes @ 4.10 Au g/t.
GMDC Lignite	Tadkeshwar, Surat	-	9.65 sq. km	-	-	-	Lignite seams were occurring as interbedded deposits within tertiary formation belonging to Eocene & Oligocene epochs, consisting of sandstone, limestone and carbonaceous shale.
GMDC Lignite	Matonnomadh , kutch	-	-	20	1279.8	-	To know the existence of mineral & ascertaining the reserve on the basis of 20 boreholes were drilled. A total 1.2 MT (Approx.) in Measured (STD 331) category resource calculated.
GMDC Lignite	Mine lease area in vill.- tagadi, Po malpar, Ta & dist.- Bhavnagar, Gujarat.	-	-	18	1275	-	Drilling was carried out to established Lignite Boundary & confirmation of lignite seams, hard strata etc.
GMDC Bauxite	Wandh-1 Bauxite Mine	-	-	15 (pit)	58.70	6	Pitting of 1.82 x 0.91 x 3.96 m was done for confirmation of qualitative bauxite adjoining to the mine pit edge.
GMDC Bauxite	Nana Goniyasar Bauxite Mine	-	-	7 (pit)	29.80	4	Pitting of 1.82 x 0.91 x 4.26 m was done for confirmation of qualitative bauxite adjoining to the mine pit edge.
GMDC Bauxite	Naredi-2 Bauxite Mine	-	-	8 (pit)	33.75	-	Pitting of 1.82 x 0.91 x 4.26 m was done for confirmation of qualitative bauxite adjoining to the mine pit edge.
GMDC Lignite/ Limestone (associated mineral encountered in overburden	Lignite project Panandhro, taluka-lakhpat, distt.- Kutch, Gujarat	1:10000	1.72 sq. Km.	-	-	-	This was a elliptical basin. The strata including the lignite seam. The Laki series of middle Eocene Age contained formations like shale, clay, lignite & gypsum.

5. Research & Development

Ministry of Mines has launched SATYABHAMA (Science and Technology Yojana for Aatmanirbhar Bharat in Mining Advancement) Port (research. mines.gov.in), dedicated to project proposals under Science and Technology Programme Scheme of Ministry of Mines

000
No. of project proposals were received online on the portal as per Minutes of 20th PERC meeting held during 23-25 Nov. 2020

00
New project proposals were recommended with or without changes to SSAG

Recognising the paramount importance of safety, economy, speed and the efficiency in extraction of mineralr esources and its convergence into viable economic alloys and metals, National Mineral Policy (NMP), 2019 has accorded higher priority to Research & Development (R&D) programmes. With a view to promote R&D in the Mining Sector, Ministry of Mines has launched a comprehensive Science & Technology Programme which includes R&D component.

The under lying principle behind R&D component of Science and Technology (S&T) programmes is to foster utilisation of the available mineral resources judiciously, economically, efficiently in a sustainable manner. Under the R&D component of the S&T Programme, Research projects are funded through grant- in- aid by Ministry of Mines. The broad thrust areas for supporting research in Mining Sector include (i) Prospecting exploration for strategic and rare- earth minerals; (ii) Mining methods which include rock mechanics, mine designing, mining equipment, energy conservation, environmental protection and mine safety; (iii) Improve efficiency in process, operations, recovery of by-products and reduction in specification and consumption norms; (iv) Metallurgy and mineral beneficiation techniques to utilise lower-grade and finer size ores; (v) Extraction of value-added products from mine waste, plant tailings, etc.; (vi) Development of new alloys and metal related products, etc.; (vii) Evolve low capital and energy saving processing systems; and (viii) Production of materials of high purity.

Ministry of Mines has launched SATYABHAMA (Science and Technology Yojana for Aatmanirbhar Bharat in Mining Advancement) Portal (research. mines. gov. in), dedicated to project proposals under Science and Technology Programme Scheme of Ministry of Mines. Based on scrutiny which passes through different stages of eva luation including p resentation of shortlisted projects before the Project Evaluation and Review Committee (PERC) and final approval of an inter- ministeria l Stand ing Scientific Advisory Group (SSAG), grants are given to the projects submitted by R&D institutions.

During the year 2021-22, project proposals under the S&T Scheme of Ministry of Mines were invited online through SATYABHAMA portal. As per Minutes of 21st PERC meeting held during 13-14 Dec. 2021, a total number of 215 project prop osa ls were received online on the SATYABHAMA portal (research.mines.gov.in). A two-stage review process was a dopte d to evaluate the proposals for recommendation to Standing Scientific Advisory Group (SSAG). The first stage comprised of preliminary screening of the proposals done by at eam of experts constituted by Ministry of Mines. Based on the guidelines as adopted in 14th PERC, the experts conducted pre-screening of the proposals. After screening, 51 proposals covering five areas, namely, (i) Geosciences and Exploration (ii) Mining (iii) Mineral Processing & recovery from waste (iv) Metal Extraction (Metallurgical processes) and (v) Alloys, speciality materials and product; were short listed for further review in the second stage. These 51 proposals along with 6 resubmitted project proposals (based on remarks of 20th PERC), thus totalling to 57 project proposals were examined by 21st PERC. Out of these 57 new project proposals, PERC has recommended 20 proposals for funding under S&T Programme Scheme of Ministry of Mines. Besides, progress reports/ final reports, requests for time extension, etc. of 32 ongoing projects were also considered by the committee for review in the 21st PERC Meeting and review meeting of PERC held on 9th July, 2021.

The SSAG noted that 52nd SSAG remarked to re- examine 5 project proposals which were recommended by 20th PERC. The Committee was informed that these projects were re-examined in the Ministry and in the meeting dated 8th April, 2021 chaired by Joint Secretary, Ministry of Mines. The recommendations of the said meeting were presented before the 53rd SSAG.

The proposals recommended by the PERC were further considered during 53rd meeting of the SSAG held on 20th Jan 2022. These were presented by director (Technical), Ministry of Mines & Member Secretary. After detailed deliberation, SSAG re comme nde d/ appr oved 25 pro j ect proposals (Table-1).

After deliberation, the SSAG accepted the final report and approved the closure of the 17 projects (Table-2) and release of remaining funds, subject to finalisation of accounts and other relevant procedures.

Based on recommendations of PERC the SSAG has also approved, time extension for 15 ongoing projects (Table-3).

Table -1: Details of Projects Recommended/Approved under S & T Programme, Ministry of Mines during 53rd meeting of SSAG

Sl. No.	Project Title	Implementing Institution	Project Cost & Duration of Project
1	Definition of delay sequencing in blast designs using advance analytical techniques for optimisation of blast fragmentation and improving mine economics in non-coal mines	CSIR, Central Institute of Mining and Fuel Research National Institute of Technology Karnataka Surathkal; and Anna University	₹ 42 lakhs (MoM - ₹ 40 lakhs, MSPL Limited – ₹ 2 lakhs) Duration: 2 years
2	Investigation on the development Al-Al Cladding Material through Compound Casting Process- Experiments and Numerical Simulations	Maulana Azad National Institute of Technology, Bhopal	₹ 49.575 lakhs (MoM - ₹ 39.075 lakhs + NALCO – ₹ 10.5 Lakhs) Duration: 2years
3	Red Mud Valorisation to Achieve Zero Waste, Conversion of Residue Into Diagnostic X-Ray Shielding Tiles After Recovery of Scandium	CSIR, Advanced Materials and Processes Research Institute; Jawaharlal Nehru Aluminium Research Development and Design Centre	₹ 7,180,384.00 Duration: 2 years
4	Bio-Reverent- Recover of Ga, Ge and In through innovative biotechnology and process integration	Indian Institute of Technology, Delhi	₹ 14.9856 lakhs Dration: 2 years
5	Un-diluted Recycling of Cast Aluminium Alloys Containing High Fe Impurity Suitable for SMEs	BML Munjal University Jawaharlal Nehru Aluminium Research Development and Design Centre	₹ 8,857,900.00 Duration: 2 years
6	Novel Material Manufacturing method for Large Volume Cast Metal Matrix Nanocomposites (Ultra-Cast)	Malaviya National Institute of Technology, Jaipur & CSIR, National Institute for Interdisciplinary Science and Technology	₹ 50 Lakhs Duration: 2 years
7	Technology development for holistic utilisation of red mud for extraction of metallic values and residue utilisation	Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur.	₹ 75.21225 lakhs (MoM - ₹ 30.575 lakhs + Industry - ₹ 44.63725 lakhs) Duration:3 years
8	Polymerised Molecular Receptor as Solid Sorbents or Size-Selective Recognition and Separation of Rare-earth Elements.	CSIR, Central Salt and Marine Chemicals Research Institute	₹ 8.99 Lakhs (seed money) Duration: 1 year
9	Production of Onyx-grade ATH (sodium bicarbonate route) using low-grade bauxite from Kuchchh region of Gujarat	Kalinga Institute of Industrial Technology, Bhubaneshwar, and Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur.	₹ 6,742,500.00 Duration: 2 Years

Sl. No.	Project Title	Implementing Institution	Project Cost & Duration of Project
10	Utilisation of chromite over burden (mining waste in Odisha) as an oxygen carrier material for clean energy (hydrogen) production using chemical looping technique	Indian Institute of Technology Kharagpur M/S Tata Steel Limited, R&D, Jamshedpur	₹ 53.7 lakhs (MoM - ₹ 44.7 lakhs, , Tata Steel – ₹ 9 lakhs) 2 Years
11	Synthesis and Development of Hybrid Carbon Nanocomposites and Polymer Emulsions as Flocculants for Mining Industry	CSIR, National Institute for Interdisciplinary Science and Technology	₹ 14.94612 Lakhs Duration: 18 Months
12	Development of Novel Hydrometallurgical Technological Process Package for extraction and separation of Niobium, Tantalum and Rare Earths from Columbite and Tin Slag	CSIR, National Metallurgical Laboratory	₹ 50 lakhs (MoM- ₹ 40 Lakhs, MO INFRA-₹ 10 Lakhs) Duration: 2 years
13	Design and Development of Real-Time Ground Behaviour Monitoring System (RT-GBMS) for Underground Metal Mines — An Innovative ICT based Solution	Trident Academy of Technology, Bhubaneswar (NGO - Dinabandhu Foundation for Educational Research and Socio-economic Development and National Institute of Technology Rourkela	₹ 49 lakhs (MoM- ₹ 39.88 Lakhs, MOIL – ₹ 10 lakhs) Duration: 3 Year
14	Solid-state recycling of aluminium chips (waste) for production of billets for pilot-scale extrusion	Jawaharlal Nehru Aluminium Research Development and Design Centre	T 4988900.00 Duration: 2Year
15	End-to-End Technology Development and Scale-up (TRL-7) for Cobalt Recovery, Cobalt alloy and components for Bio-Medical Applications	Non-ferrous Materials Technology Development Centre	₹ 198.675 lakhs (MoM- ₹ 91.295 lakhs,CuraSigna - 41.6 Lakhs, NFTDC-Hydarbad Duration: 2 years
16	Carbonaceous Nanomaterials from Graphite Sources of Arunachal Pradesh for Electrochemical Energy Storage and Sensor Applications	CSIR–North East Institute of Science and Technology	₹ 20 lakh (seed money) Duration: 1 year
17	Recovery of metallic values from the discarded copper slag	CSIR, Institute of Minerals and Materials Technology	₹ 20 Lakhs Duration: 2 year
18	Characterisation of Orogenic Style Gold Mineralisation in the BIFs of Dharwar–Shimoga Basin, Exploration Guides for Prospect-scale targeting of sub-surface Gold	Global Academy of Technology, Bengaluru (NGO - National Education Foundation)	₹ 25 Lakhs (seed money) Duration: 12 months
19	Overburden, sand and industrial waste as mine fills and their impact on soil morpho-dynamicity and sustainable developments	Kalinga Institute of Industrial Technology (KIIT) University, Bhubaneswar	₹ 25 lakhs Duration: 3 years
20	Development of medium strength Al-Mg-Si (AA6082 based) alloy for high-end strategic applications (extruded or drawn tubes)	Indian Institute of Technology, Gandhinagar and Jawaharlal Nehru Aluminium Research Development & Design Centre, Nagpur	₹ 9,751,680.00 Duration: 2 Years
21	Geo-technological evaluation of Bauxite and Laterite deposits of Chhattisgarh State by using Geospatial technology under Smart Mining 4.0	Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur, Chhattisgarh Council of Science & Technology, Government of Chhattisgarh, Raipur.	₹ 45 Lakhs Duration: 2 years
22	Development of low-cost filler material utilising Lithomargic clay for Paint Industry as per IS 68 2006 standard	Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur	₹ 45 Lakhs Duration: 2 year
23	Fabrication of All2O3 containing cellulose based Ag NPs encapsulated Collagen dressing and investigation of its Therapeutic Opportunities in Diabetic Wound Healing	Kalinga Institute of Industrial Technology, Bhubaneswar and Nehru Aluminium Jawaharlal Research Development and Design Centre, Nagpur	₹ 30 Lakhs (₹ 15 Lakhs - KIIT and ₹ 15 lakhs –JNARDDC) Duration: 2 years
24	Development of prototype aluminium seat frame for passenger buses.	Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur and Automotive Research Association of India	₹ 100 Lakhs (JNARDDC – ₹ 60 Lakhs & ARAI – 15 lakhs 40 Lakhs) Duration: 2 Years
25	Development of India specific scientific framework to promote the beneficial reuse, rehabilitation or remediation of landscape affected by abandoned mines or flyash ponds or slags	Indian Institute of Technology, BHU Varanasi and other institutes.	15 lakhs 49.98 Lakhs Duration: 2 Years

Source: Minutes of 53rd meeting of SSAG.

Table -2: Details of Acceptance of Final Report and Closure of Completed Projects under S & T Programme, Ministry of Mines during 53rd meeting of SSAG

Sl. No.	Project Title	Implementing Institution
1	Enhanced recovery of manganese as electrolytic manganese dioxide (EMD) from ferromanganese mine tailings through bioleaching	Siksha O Anusandhan University, Khandagiri, Bhubaneswar
2	Development of environment friendly blasting techniques-	Indian School of Mines, Dhanbad
3	Rare-earth mineral concentration in the beach sands of Uttara Kannada coast: their economic viabilities and sustainable mining	SDM College of Engineering and Technology, Dhavalagiri,Dharward
4	Fabrication of advanced ceramic nanocoatings for automotive Applications-	Christ University, Bengaluru and Jawaharlal Nehru Aluminium Research Development & Design Centre, Nagpur
5	Value-added electrochemical devices from zircon obtained from Beach sands of Odisha	Indian Institute of Technology, Bhubaneswar
6	Development of metal-graphene alloys, Department of Materials Engineering	Indian Institute of Science, Bengaluru.
7	Texturally controlled micro-chronological and extraction protocol studies on Pt Chromite mineralisation—Preliminary Studies	Centre for Earth Sciences, Indian Institute of Science, Bengaluru &
8	High performance of rare-earth metal as electrode material for super-capaciter application and fuel cell	Velammal Institute of Technology, Panchetti, Chennai
9	Development of open cell aluminium foams for heat sink and EMI shielding Application	Advanced Materials and Processes Research Institute (AMPRI), Bhopal
10	To study the fire retardancy of nano-ATH in polymers-	Jawaharlal Nehru Aluminium Research Development and Design Centre and Central Institute of Plastics & Engineering Technology (CIPET)
11	Techno-economic survey of aluminium scrap recycling in India-	Jawaharlal Nehru Aluminium Research Development and Design Centre
12	Assessment of Udaipur rock phosphate, low-grade potassium feldspar and lignite mine waste for the development of organo- mineral fertilizer formulations	ICAR, Central Arid Zone Research Institute, Jodhpur, Rajasthan
13	Characterisation and beneficiation of lithium bearing minerals from Indian deposits.	CSIR–National Geophysical Research Institute and Indian Institute of Science, Bengaluru
14	Development of ready-to-use assorted sand for construction activities from zinc refining wastes and marble powder	Manipal University, Jaipur
15	Process Feasibility studies for the development of high purity aluminium through segregation process	NFTDC PO. Kanchanbagh, Hyderabad
16	Value addition of calcined bauxite for possible use as abrasives in waterjet cutting applications	Dept of Mech Engg, SSN College of Engg, Kalavakkam, Chennai,
17	Recovery studies of gold and other values using non-cyanide reagents from tailing dump of Bharat Gold Mines Ltd	Nonferrous Materials Technology Development Centre (NFTDC), Hyderabad

Table 3 - Details of time Extension to Ongoing Projects under S & T Programme, Ministry of Mines during 53rd Meeting of SSAG

S.N	Project Title Institue	Extension upto
1	Bench-scale study on extraction of pure silica and smelter-grade aluminium Fluoride from Coal Fly Ash (CFA) — JNARDDC, Nagpur	March, 2022
2	Improving fracture resistance of rocks through adhesive bonding for underground mining application — India Institute of Technology (ISM), Dhanbad	March, 2022
3	Development of novel nanoporous hollow Fibre membrane based unit for the effective treatment of mine waste water — National Institute of Technology, Karnataka, Surathkal	March, 2022
4	Mineral chemistry, isotope geochemistry, geochronology and metallogeny of rare and rare-earth metals present in the alkaline carbonatite complexes associated to the Narmada-Son rift zone, western India — Banaras Hindu University, Varanasi	Mar-22
5	Development of a novel underground mining method for exploitation of chromite deposits from friable ore body and host rocks of Sukinda Valley, Odisha — Department of Mining Engineering, IIT, Kharagpur	June, 2022
6	Use of overburden clay as alternate for aggregate — Indian Institute of Technology Madras, Chennai & Neyveli Lignite Corporation Ltd (NLC Ltd)	June, 2022
7	Integrated geological, geochemical and geophysical studies for the delineation of chromitite extensions in Nuggihalli Schist Belt and implications for Ni-Cu+-PGE mineralisation — CSIR–National Geophysical Research Institute and Indian Institute of Science, Bangaluru	June, 2022

S.N	Project Title Institue	Extension upto
8	Utilisation of aluminium dross to achieve zero waste – A bench-scale study Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur and CSIR –National Environmental Engineering Research Institute, Nagpur,	June, 2022
9	Treatment of Acid Mine Drainage for Heavy Metal Removal — Indian Institute of Technology, Mandi	June, 2022
10	Development of graphene-based membranes from graphite ore for desalination— CSIR–National Institute for Interdisciplinary Science and Technology	August, 2022
11	Investigation of the dynamics & mechanism of flocculation by polymers and biopolymers for separation of solid particles of high rate thickeners in mineral processing industries. — CSIR–National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram	December, 2022
12	Direct production of Fe-Cr- Ni-Mn stainless alloy from mine waste by thermal plasma process — CSIR – Institute of Minerals & Materials Technology, Bhubaneswar	December, 2022
13	Production and certification of certified reference materials (CRMs) for the analysis of aluminium alloy — Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur.	December, 2022
14	Recovery of scandium metal from acid leach liquor from titanium mineral industries. — CSIR–National Institute for Interdisciplinary Science and Technology (NIIST)	January, 2022
15	Processing of spent and natural graphite for energy and aerospace application —	January, 2022

Source: Minutes of 53rd meeting of SSAG.

RESEARCH & DEVELOPMENT

The Research & Development (R&D) work in the field of Ores & Minerals is being carried out by IBM, JNARDDC, CSIR & allied laboratories, other research organisations relating to mineral/ metal and various mining & mineral-based industries. As per available information, details of some of the R&D work conducted or completed by various organisations during 2021 -22 are furnished below:

Indian Bureau of Mines (IBM)

Important R&D activities carried out by IBM during the year 2021-22 are summarised below:

A. Mineral Processing Division, IBM

Copper Ore

Beneficiation studies on a copper ore, G2 stage exploration sample from Udaipur District, Rajasthan— The sample assayed 0.60% Cu, 8.60% Fe(T), 49.01% SiO_2, 9.46% Al_2O, 10.70% CaO_3 5.82% MgO, 0.79% S(T), 1.48% TiO_2, 0.01% Zn, 0.01% Pb, 0.96% LOI, 2.1% Na O and 0.32% K_2O Flotation tests with optimised condition produced a copper concentrate assaying 25.76% Cu, with 90.05% Cu recovery and wt% yield of 2.10

Beneficiation studies on a Copper Ore, G2 stage Exploration sample from Giridih District, Jharkhand— The sample assayed 0.82% Cu, 0.14% Pb, 0.46% Zn, 3.48 ppm Ag, 4.57% Fe, 6.84 % Fe_2O_3 , 73.2% SiO_2 , 3.46% Al_2 O_3 , 2.08% CaO, 2.32% MgO and 2.58% S. The sample process route involved employing optimised grind, regrinding of rougher float and two stages cleaning. The 2nd cleaner float assayed 24.01% Cu, 3.62% Pb, 2.59% Zn with wt.% yield of 2.5 and recovery of 79.3% Cu, 69.2% Pb and 13.8% Zn respectively Beneficiation studies on a Copper ore, G2 stage exploration sample from Mayurbhanj District, Odisha— The sample assayed 0.32% Cu, 0.017% Pb, 0.065% Zn, 53.1% SiO , 11.77% Al_2O_3 15.51% Fe_2O_3,1.07 % S(T), 3.05% CaO, 2.57% MgO, 1.24% TiO_2, 0.94 P2O5, 677 ppm Ni, 128 ppm Co, 44 ppm Mo and 2.28 % LOI. The process route involved grinding followed by froth flotation and two stages cleaning. The 2nd cleaner concentrate assayed 23.12% Cu, 1.1% Pb, 0.76% Zn, 0.22% Ni, 0.17% Co with Cu recovery of 77.7% and wt% yield of 1.1.

Zinc Ore

Beneficiation studies on a Zinc Ore, G2 stage exploration sample from Betul district, Madhya Pradesh— The ore assayed 1.02% Zn, 0.09% Cu, 0.14% Pb, 69.05% SiO_2, 12.45% Al_2O_3, 4.60% Fe(T), 2.45% MgO, 1% S, 28 ppm Co, 30 ppm Ni, 08 ppm Ag and 11 4 ppm Mo . Be nefic ia t io n route comprising of grinding followed by flotation was developed. The Zn rougher float with two cleaning stages yielded a zinc concentrate assaying 50.22% Zn, 3.25% Pb, 3.03% Cu with 81.9% Zinc recovery and weight% yield of 1.8.

Graphite

Beneficiation studies on a Graphite ore, G2 stage exploration sample from Dhenkanal District, Odisha— The sample assayed 5.82 % Fixed Carbon, 67.29% SiO_2, 7.86% Fe_2O_3 , 7.50% Al O , 2.45% CaO, 1.55% MgO, 0.95% TiO_2, 1.21% S and 7.81% LOI. The process route evolved consisted of grinding, froth flotation and five stages cleaning of rougher float with successive regrinding of each float. The 5th cleaner concentrate assayed 68.05% FC with a FC recovery of 85.1% and wt% yield of 7.2.

Iron Ore

Beneficiation study on an iron ore, G-2 stage exploration sample from Keonjhar district, Odisha— The sample assayed 54.14% Fe(T), 3.85% Al_2O_3, 2.31% SiO_2, 0.18% P_2O_5, 0.43% TiO^2, 0.61% Mn, 0.01% S(T) and, 3.67% LOI. Dry beneficiation route employing magnetic separation and wet beneficiation route employing magnetic & gravity separation were employed. The composite concentrate assayed 63.37% Fe(T), 0.91% Al_2O_3, 3.62% SiO_2 and 2.55% LOI with a total Fe recovery of 36.8% and wt% yield of 31.3. Another Grade II concentrate assayed 62.24% Fe(T), 1.06% Al_2O_3, 5.51% SiO_2 and 2.90% LOI with a total Fe recovery of 48.3% and wt% yield of 41.8. Beneficiation studies on an siliceous iron ore sample from Keonjhar, Odisha— The sample assayed 40.56% Fe(T), 3.53% Fe_2O_3, 58.0% Fe2O3, 39.94% SiO_2, 0.45% Al2O3, 0.11% Na2O, 0.08% K2O, 0.08% P and 0.36% LOI. The process route employing stage grinding, gravity separation and regrinding of table middling and tails followed by Mozley gravity separation yielded a composite concentrate assaying 65.65% Fe(T), 5.83% SiO_2, 0.24% Al_2O_3 with Fe(T) recovery 92.5% and wt.% yield of 59.0. Beneficiation studies on a Magnetite Iron Ore, G-2 stage exploration sample from Jamui District, Patna, Bihar— The sample assayed 34.67% Fe (T), 12.76% FeO, 39.38% SiO_2, 3.43% Al_2O_3, 2.45% CaO 1.76% MgO, 0.17% Na O, 0.63% K O, 1.38% P O .

The process route employing stage grinding and gravity separation yielded a concentrate assaying 67.39% Fe(T), 19.96% FeO, 3.53% SiO_2, 0.17% Al_2O_3, 0.11% Na_2O, 0.13% K_2O, 0.05% P_2O_5 with Fe(T) recovery of 83.6% and weight percent yield of 43.0.

Manganese Ore

Beneficiation studies on a Manganese ore, G2 stage exploration sample from Chota Udepur District, Gujarat— The sample assayed 19.51% Mn(T), 4.89% Fe(T), 37.41% SiO_2, 2.49% Al_2O_3, 8.58% CaO, 0.52% P2O5 and 0.87% BaO. The process route consisted of size reduction, wet screening, gravity separation (for coarse & fine particles separately) and magnetic separation on composite slimes. The Composite Concentrate assayed 35.06% Mn(T), 6.54% Fe(T), 13.61% SiO_2 and 1.81% Al2O3 with a Mn(T) distribution of 61.6% and wt.% yield of 34.0.

Rare Earth Elements (REE) and Rare Metal (RM) Bearing Carbonatite

Beneficiation studies on Rare-Earth Elements (REE) and Rare Metal(RM) bearing Carbonatite Sample, G-2 stage exploration sample from Gujarat— The sample assayed 28 . 84 % Ca O, 22.18% SiO2, 7.69% Fe2O3, 3.64% MgO, 1.73% Al_2O_3, 3.11% K_2O, 1.76% P_2O_5, 0.2% CaF_2, 1.66% SO_3 and 26.97% LOI, with total REE of 4,006 ppm, Nb 1,074 ppm and Sr 3,172 ppm. R&D study employing different process r oute were experimented viz. (i) Froth flotation followed by gravity separation process on rougher tails, (ii) Froth Flotation process followed by wet high intensity magnetic separation, (iii) Gravity separation followed by flotation on gravity tails and wet high intensity magnetic separation on gravity middling and rougher float separately, (iv) Leaching on the as received sample with acids.

Acid leaching processes found to be more effective in enriching rare-earth elements. The leach residue assayed 8,738 ppm total REE and 2,445 ppm Nb with the recovery of 93.1% total REE and 97.1% Nb with 44% weight percent yield

Rock Phosphate

Beneficiation studies on a Rock Phosphate ore, G2 stage exploration sample from Lalitpur, Uttar Pradesh— The sample assayed 10.98% P O 67.44% SiO_2, 3.26% Fe_2O_3, 2.17% Al_2O_3, 11.61% CaO, 0.38% Cl, 0.20% organic carbon and 1.47% LOI. The process route evolved consisted of crushing, grinding and froth flotation with three cleanings of rougher float. The 3 rd cleaner concentrate assayed 33.70% P2O5 and 16.21% SiO2 with a P2O5 recovery of 52.8% and wt% yield of 17.1.

B. TMP Division, IBM

1. Regional Mineral Development Studies (RMDS) for Effective Utilisation of Low-grade Iron Ore Fines & Slimes of Bailadila Iron Ore Mines of M/s National Mineral Development Corporation, Bailadila Sector, Chhattisgarh

This study was carried out in 2019-20 and completed in the year 2020-21. The purpose of the study was to facilitate the formulation of policies, guidelines for planning regional development of mineral pertaining to low-grade iron ore fines/ slimes, which were generated during the crushing, screening & washing process and was stacked as dumps and slimes (less than 0.15 mm) that were discarded into the tailing pond. As the high-grade iron ores have got exhaustively mined, it has become imperative to use low-grade iron ores, fines and slimes to meet the growing demand. Also, generation of fines & slimes during mining & processing contributes to loss of minerals to substantial extent of the total run-of-the-mine (ROM) and are often discarded as waste into waste dumps / tailing ponds, containing considerable a mounts of iron. Therefore, beneficiation of tailings/ slimes has become necessary for optimal utilisation of the resources.

The study has been made to assess the low- grade ore fines/slimes (ultra-fines), available in dumps/slimes dams and those that are likely to be generated in the Bailadila sector in course of mining and processing, which can be utilised by adopting appropriate beneficiation methods to recover the valuable minerals for utilisation in Iron & Steel Industry. These rejects would otherwise remain un-utilised. Under the study, the reviews of in situ O/B removal/ROM production trend; Grade of feed to Beneficiation Plant; existing crushing & screening processes; material balance in beneficiation process flow; recovery in respect of lumps & fines (quantity/quality) for supply to Steel Plant/Sales; low-grade fines/slimes loss/de- silted slimes (quantity/ quality) and prospect of valuable minerals and review of sub-grade/low grade generation; and stacking & de-silted slimes/ dumps have been carried out.

On analysing the data, the availability of low– grade ore (between 45 and 55% Fe), which is not utilised by lessee at present, varied from 22.74% to 40.34%. Immediate attention was drawn for consumption of low-grade ore available in the lease by up-gradation of the ore or by blending as per the requirement. The existing was hing methodology adopted in NMDC which involved discarding of slimes that contained Fe value between 45% & 55% or more. These slimes get usually put-up in slime dams/ponds every year in the tune of approximately 2 to 3 million tonnes. The need was felt to utilise these lost minerals by bringing them ba ck in main stream using techniques of beneficiation involving gravity, magnetic and flotat ion process etc. Such recovered slimes can be used for pellet/sinter manufacturing. Based on the above study, the following recommendations for effective utilisation of low-grade iron ore fines & slimes of Bailadila Iron ore Mines of M/s NMDC were suggested:

(i) It is estimated that a decrease in alumina content in sinter feed from 3.1% to 2.5% will improve DRI by at least six points, lower blast furnace coke rate by 14 kg per tonne of hot metal yield increases productivity by about 30% under Indian operating conditions. By reducing the presence of these contaminants in the feed material, the processing of iron ore becomes viable as a result of the cost reduction in metallurgical process.

(ii) The quantities of slimes accumulated over the years, already available in f ine form assay reasonably high per cent of Fe. Therefore if properly beneficiated, these sl imes can be considered a national resource rather than a waste of no value. The alumina content of the slimes, if brought to less than 2% Al_2O_3 in the beneficiated product will (a) lead to better utilisation of national resources, and (b) reduce environmental hazards associated with storage and disposal of slimes.

The above scenario demands concerted & innovative efforts to process the slimes to recover the iron values and this will be a step forward for conservation of natural resource and will provide opportunity for sustainable growth.

Jawaharlal Nehru Aluminium Research Development & Design Center (JNARDDC)

1. Completed Projects

1.1 Fabrication of Advanced Ceramic Nano-coatings for Automotive Applications - S&T Mines and Christ University : The objective of the project was to —

(i) Use organic binders to prepare micron sized agglomerates of commercially available non-plasma sprayable nano-sized ceramic compositions feed stock materials, such as, Stabilised Zirconia, Alumina, Alumina –Titania etc. Raw material synthesis of nano powders also will be carried out.

(ii) Use the micron-sized spherical agglomerates consisting of nano-structured feed material into a plasma spray equipment to form nano-structured Plasma Spray Coatings on aluminium / aluminium alloy substrates.

(iii) Deposition of homo genous a lumina nanocoatings on aluminium/ aluminium alloy substrates using sol-gel technique

(iv) Characterisation of the as-synthesised nano- structured coatings for structural phase and microstructure, and very importantly adhesion to aluminium and its alloy metal substrates.

(v) Study the potential of using the above developed fine quality ceramic nanocoatings for certain automotive applications e.g. Zirconia- based nano- coatings for engine components (piston crown), wear resistant alumina/alumina- titania coatings for wear resistant bearings etc.

(vi) The project aimed to develop a technology to prepare nano-sized plasma spray powder from na no - ce ramic (commercial) compositio ns involving alumina and zirconia (in line with Make in India Concept).

The final report of the finding showed that small addition of nano-alumina to micron alumina significantly reduces the sintering temperature. 99 .0 MA+1 .0 NA from chamber offered high densification. Further optimisation of spray drying parameters to control the agglomerated particle size in the chamber is expected to provide a higher yield of the desired composite as well. In addition to the development of two technologies (nano-plasma sprayable powder synthesis & nano-coatings synthesis via APS) were filed under this project Based on successful lab-scale findings the pilot- scale work can be taken up.

1.2 Techno-economic Survey of Aluminium Scrap Recycling in India— (S&T Mines) : The objective of the project is summarised below:

(i) To "Establish techno-economic scenario of Aluminium Scrap Recycling Industry in the country" for which field survey, online survey and secondary research were carried out.

The project findings revealed that domestic recycling of aluminium provides employment apart from its energy and emission advantages , however, there are several challenges to overcome. These challenges include lack of system for domestic scrap collection and processing, high capital infrastructure for scrap pre-treatment and QA, logistics, lack of dedicated recycled zones, concerns regarding quality, lack of R&D, etc. Government initiatives like National Non-Ferrous Metal Scrap Recycling Policy (MoM), National Resource Efficiency Policy (MoEF&CC), Circular Economy in Scrap Metal (NITI Aayog & MoS), Vehicle Scrappage Policy (MoRTH), Resource Efficiency in Aluminium (MoM), Non-Ferrous Metal Import Monitoring system (MoM), Motor Vehicles (Registration and Functions of Vehicle Scrapping Facility) Rules (MoRTH), etc. are expected to address majority of these problems and prepare the domestic Aluminium Recycling Industry to increase its share in total aluminium production in near future.

1.3 Development of ceramic proppant from low- grade materials (Partially Lateritised Khondalite -PLK, Fly ash, etc.)— Phase-II-Scale up studies, NALCO, Bhubaneswar: The objective of the project is enumerated as below

(i) Setting up of scale-up facility to produce proppants from low-grade materials (PLK, etc.), additives, and optimisation at bench-scale (10-15 kg /day processing).

(ii) Characterisation and validation of product.

(iii) Flow sheet development.

The result shows that the sphericity and roundness of granules are in the range of 0.6 to0.8 and 0.6 to 0.8 respectively. The acid solubility of calcined granules is in the range of 2–7 %. The analysis of various calcined granules shows turbidity values in the range of 20–60 FTU/NTU which are within the limit value of = 250. The validation tests on proppant sample were carried out from an external NABL accredited laboratory. Ceramic proppants are highly useful in extraction of oil and gas as they can withstand a much greater crush strength than traditional frac sand and they also provide high conductivity to increase the oil and gas pr od uctio n o utput. Suc cessful commercialisation of this process will lead to utilisation of low-grade materials and benefit the Oil and Gas sector.

1.4 An innovative and viable process for recovery of iron values from red mud and processing of non-iron material for developing value-added products – Complete Utilisation of red mud". NALCO, Bhubaneshwar (Jointly with IMMT Bhubaneswar & Eesavyasa Tech, Pvt Ltd. Telangana) : The objective of the project is summarised as below:

(i) Development of an innovative and viable process for recovering iron values from red mud generated at NALCO's alumina refinery.

(ii) Value-added utilisation of non-magnetic tailing as insulating material.

The test report showed thermal conductivity of geopolymer block prepared with on-mag tailing (IMMT) against vespel standard in the range 0.402 to 0.412 watts per meter-kelvin (W/(m·K). The repor t confirmed that the blo cks are good insulating material suitable for building materials and other related applications. The finding provided a viable process option for complete value added utilisation of red mud.

2. Ongoing Projects

2.1 Bench-scale study on extraction of pure Silica and smelter-grade Aluminium Fluoride f rom Coal Fly Ash (CFA)– S& T (Mines) (sponsored by Ministry of Mines): Coal Fly Ash (CFA) is one of the solid waste generated in thermal power plants during the process of power generation. India's commercial energy demand is met through the country's vast coal reserves and the coal fly ash generating from all coal-based thermal power plants are accumulate. These accumulations typically contains 27–31% alumina (Al_2O_3), 56–60% silica (SiO_2) and 9-13% oxides of elements (Ca, Mg, Na, Fe, Ti etc.). Pure silica is used in structural materials, microelectronics (as an electrical insulator, semiconductors etc.), and as components in the food and pharmaceutical industries. In this project work efforts are being carried out to study bench-scale (0.5–1 kg CFA) extraction of pure silica and aluminium fluoride by treating CFA with appropriate mineral acid.

2.2 Utilisation of aluminium dross to achieve zero waste – A bench-scale study project report sponsored by Ministry of Mines : The main objective of the project is to develop the bench- scale process for preparation of Poly Aluminium Chloride (PAC) from waste aluminium dross and to prepare castable refractory from residual dross for industrial applications to achieve zero waste. The potential benefit in preparing PAC from aluminium dross is providing alternative source to primary material and reduction in waste disposed to landfills.

2.3 Production and certification of certified reference materials (CRMs) for the analysis of aluminium alloy sponsored by Ministry of Mines: The main objective of the project is to produce certified reference materials (CRMs) for aluminium a l loys a t JNARDDC for the benefit of the Aluminium Industry and to provide import substitute. Being accredited with ISO 17025 by NABL for its analytical facilities, JNARDDC is well-placed to produce CRMs. In this regard, accreditation in accordance with ISO 17034 is under progress. Initially, the development of CRM for one wrought and one cast alloy will be taken up and the range will be expanded subsequently.

This will be an import substitute to high quality CRMs for Aluminium Sector.

2.4 Geo-technological evaluation of Bauxite and Laterite deposits of Chhattisgarh State by using Geospatial technology under Smart Mining 4.0 (with Chhattisgarh Council of Science & Technology, Government of Chhattisgarh, Raipur) sponsored by Ministry of Mines: At present there is limited geo-technological information about Chhattisgarh bauxite and laterite deposits to confirm utilisation for metal lurgical and non-metal lurgical applications. Accordingly, JNARDDC has joined hands with Chhattisgarh Council of Science & Technology, Government of Chhattisgarh, Raipur to undertake this project. The project outcome will lead to creation of a digital database which will be highly useful to identify suitable deposits for industrial applications using geo-informatics technology. It will assist the state govt in auctioning of blocks. Efforts will be made to make the database available through Mobile App.

2.5 Solid-state recycling of aluminium chips (waste) for production of billets for pilot scale extrusion sponsored by Ministry of Mines: The aim of this project is to utilise aluminium swarf/ chips (waste) of AA6063 and AA2024, which are generated during machining of components, for the production of aluminium billets for extrusion.

2.6 Technology Development for Holistic Utilisation of Red Mud for Extraction of Metallic Value & Residue Utilisation [with NML, Jamshedpur, IMMT, Bhubaneswar, NALCO, HINDALCO & VEDANTA] under aegis of NITI Aayog sponsored by Ministry of Mines: Under the NITI Aayog initiative the primary industries and 3 R&D labs have joined hands for development of feasible processing options for all metal extraction and REE enrichment from red mud and for further research, development and commercialisation to other industries. The outcome will lead to development of a Master Flow sheet for selected grades of red mud with energy and material balance equipped with techno-economic feasibility.

2.7 Red mud valorisation to achieve zero waste, conversion of residue into diagnostic X-ray shielding tiles after recovery of scandium (sponsored by Ministry of Mines with CSIR- AMPRI, Bhopal) :: The main objective of this project is to convert red mud into economically valuable very high energy X-ray and gamma ray shielding blocks, which is suitable for building radiation therapy bunkers, nuclear power plants, food sterilisation plants, etc., and thereby to promote the zero-waste concept.

2.8 Development of Process for 4N High Pure Alumina (HPA) and Substrate Making for its Validation in LED applications sponsored by NALCO, Bhubaneswar Odisha (Jointly with IIT, Bhubaneswar & Anna University): While India is one of the highest users of LEDs, neither the raw material is prepared nor is the product manufactured in India. All LEDs that are available in market are assembled after their import. The project aims to develop an indigenous process to prepare 4N (99.99%) pure grade alumina (HPA) that has potential for use in LED applications.

2.9 Development of DC cast Al Alloy for Yoke in automobile applications, Sponsored by NALCO Bhubaneswar (Jointly with ARAI, Pune): Automotive yoke is usually made of steel or cast iron. Aluminium a lloys are widely used in automotive applications due to excellent strength- to-weight ratio which significantly reduces the fuel consumption and also enables to meet emission norms. The project aims to develop a new DC cast Al Alloy followed by development of the pro totyp e yoke use d i n a utomo bi le applications.

2.10 Demonstration-cum- heat treatment, leaching-recycling and liming study of JNARDDC-NALCO process (by utilising 5,060 kg batch of 1st cut SPL)—sponsored by NALCO Bhubaneshwar): Based on the success of bench- scale studies (1kg) for detoxification of 1st cut SPL material and recovery of caustic and fluoride, JNARDDC has undertaken the Demonstration- cum-heat treatment, leaching-recycling and liming study of JNARDDC-NALCO process by utilising 50-60 kg batch of 1st cut SPL. The project aims to provide the mass balance, CAPEX and OPEX for scaling up the process to commercial level.

2.11 Instrument for Realtime measurement of anode current distribution o f aluminium electrolysis cell sponsored by Dept of Science and Technology (DST, New Delhi) : Online current distribution measurement helps to observe changes in current distribution with changing conditions in the cell for a period of time which provides option to improve cell efficiencies and reduction in cell instabilities. The project aims to develop an instrument which will be able to make real-time continuous measurement of ACD in place of existing manual measurement system for its successful commercialisation in industry.

2.12 Instrument for Instantaneous and onsite measurement of aluminium electrolysis bath parameters: sponsored by Dept of Science and Technology (DST, New Delhi): JNARDDC has already developed the methodology to establish the relationship of cooling curve with bath para meter s on the b asis of plant and l ab experiments and has successfully developed the basic instrument for instantaneous measurement of important bath parameters. The project aims to develop the instrument which can be used in plants fo r regular measur eme nts o f ba th parameters by addition/changes in the basic instrument in the terms of software & hardware for its commercialisation.

2.13 Development and Supply of an Instrument for Instantaneous Onsite Measurement of Bath Parameters sponsored by BALCO, Korba : JNARDDC has developed unique equipment capable of simultaneous measurement of vital bath parameters which will prove to be a boon to the aluminium smelters. Measurement time is around 5 minutes and all bath parameters are instantly available which otherwise are measured separately and requires sufficiently long time (12–14 hrs). The real time bath parameters information made available by the Instrument can easily be coupled with the other known pot operating conditions, such as, noise, voltage modifiers and state of feed control which helps in improved energy efficiency, current efficiency ultimately leading to enhanced cell performance. Studies shall be undertaken of the plant cond it ions for customising the equipment design to meet Balco's requirements followed by plant trials, fine- tuning, demonstration/ validation (50 measurements) and training to operators.

3. Collaborative work

JNARDDC is collaborating with the following agencies for various R&D projects:

3.1. NITI AAYOG: Development of effective handling, storage, usage and management of red mud is a major concern for the global community as a whole. ln order to make India self-reliant in Rare-earth Extractions ("REEs"), NITI Aayog has identified many secondary resources for rare earth extraction among which Red Mud is the only known resource of scandium, a REE, which is more enriched as compared to native bauxite. Under the aegis of NITI Aayog multiple institutions including JNARDDC are involved in development of feasible processing options for all metal extraction from Red Mud.

3.2 Department of Science and Technology (DST): JNARDDC has undertaken 2 projects (i) Instrument for Realtime measurement of anode current distribution of aluminium electrolysis cell & (ii) Instrument for Instantaneous and onsite measurement of aluminium electrolysis bath parameters under various R&D programs of DST.

3.3 Chhattisgarh Council of Science & Technology : (CCOST), Raipur an autonomous body of Government of Chhattisgarh joined hands with JNARDDC for Geo-technological evaluation of Bauxite and Laterite deposits of Chhattisgarh State by using Geospatial technology under Smart Mining 4.0. The joint venture activity for Bauxite

Mining 4.0 will open up new vistas for utilisation of advance RS, GIS, GPS technology in the area of laterite and bauxite ore utilisation by the Aluminium industries.

3.4 CSIR – Advanced Materials and Processes Research Institute (AMPRI), Bhopal : JNARDDC and AMPRI, Bhopal have undertaken a joint project which aims to convert red mud into economically valuable very high energy X-ray and gamma ray shielding blocks, which is suitable for building radiation therapy bunkers, nuclear power plants, food sterilisation plants, etc., and thereby to promote the zero-waste utilisation of red mud.

3.5 MRAI (Material Recycling Association of India): JNARDDC successfully completed a joint project "Techno-economic Survey of Aluminium Scrap Recycling in India" with MRAI. The final survey report will assist the Government in formulating policies for the sector.

3.6 CSIR–Institute of Minerals and Materials Technology, IMMT Bhubaneswar: A joint project titled "An innovative and viable process for recovery of iron values from red mud and processing of non-iron material for developing value added products – Complete Utilisation of red mud- sponsored by NALCO" was completed in collaboration with IMMT, Bhubaneshwar and Eesavyasa Tech, Pvt Ltd. Telangana. A multi-institutional project "Technology Development for Holistic Utilisation of Red Mud for Extraction of Metallic Value & Residue Utilization" is also under process".

3.7 Christ University, Bangalrur: Christ University and JNARDDC successfully developed a technology to prepare nano-sized plasma spray powder from nano- ceramic (commercial) compositions involving alumina and zirconia (in line with Make in India Concept). The outcome of the project could lead to overall life enhancement of automobile components. Two patents were filed for the process.

3.8 Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India: JNARDDC is the aluminium sector expert under PAT-2 / PAT-3 (Perform, Achieve & Trade) Scheme in the National Mission for Enhanced Energy Efficiency (NMEEE) under Climate Change of Bureau of Energy Efficiency (BEE), Ministry of Power. The Centre has successfully carried out technical evaluation under PAT1 & 2 to support the BEE in reducing energy consumption of Aluminium Sector. Presently evaluating PAT-3 scheme. The recommendation will help BEE in generation and trade of e-certificates under PAT scheme.

3.9 Bureau of Indian Standards (BIS): JNARDDC is in the process of formulating recommendations for BIS regarding setting up standards for aluminium scrap and other aluminium alloys. The Centre is assisting BIS to develop methods and methodology for testing and analysis of materials related to Aluminium Sector.

3.10 IIT, Bhubaneswar & Anna University: The NALCO, Bhubaneswar sponsored project "Development of Process for 4N High Pure Alumina (HPA) and Substrate Making for its Validation in LED applications" is being executed in collaboration with IIT-Bhubaneswar and Anna University. India does not have a production base of LED due to import of 3N and 4N alumina. In view of the market, product potential and availability of raw materials in India, the project outcome has a commercial potential to add to the vision of Make in India program suitable for LED (Light Emitting Diode) and Semiconductor applications.

3.11 CSIR – National Metallurgical Laboratory (NML), Jamshedpur : Under the aegis of NITI Aayog multiple institutions including NML, Jamshedpur are involved in development of feasible processing options for all metal extraction from Red Mud "Technology Development for Holistic Utilisation of Red Mud for Extraction of Metallic Value & Residue Utilisation"

3.12 Automotive Research Association of India (ARAI), Pune: ARAI is the leading automotive R&D organisation of the country affiliated to the Ministry of Heavy Industries, Government of India. ARAI is the prime Testing and Certification Agency notified by Government of India under Rule 126 of Central Motor Vehicle Rules, 1989. JNARDDC and ARAI have taken a joint project with NALCO for development of a new DC cast Al Alloy followed by development of the prototype yoke used in automobile applications. The prototype forging of yoke will be carried out at ARAI.

3.13 Ministry of Mines: JNARDDC is the designated aluminium sector expert / nodal agency for the following key authorities– (i) Non-ferrous Scrap Recycling framework (ii) Zero waste policy for non- ferrous primary and secondary sector; (iii) NMIMS (Aluminium & Copper import monitoring system) (iv) Metal Recycling Authority (MRA) – to carry out the non-statutory functions earmarked for MRA as stipulated in the "National Non-Ferrous Metal Scrap Recycling Framework 2020"; and (v) Resource efficiency in Aluminium Sector

National Institute of Rock Mechanics (NIRM)

National Institute of Rock Mechanics carries out various investigations in the area of rock engineering and rock mechanics. The Institute extends R&D support and expertise to the Mining Sector (underground, opencast and quarries), Energy Sector (hydel, thermal and nuclear power) and Infrastructure Sector (rail, road, metro, irrigation, urban construction, etc.). Key area of activities of the Institute invlves site characterisation which includes geological, geophysical and geotechnical investigations, excavation engineering, controlled blasting, numerical modelling, engineering seismology, seismotectonic studies, mine design, slope stability, laboratory testing of rock samples and wire ropes and in situ testing of various mining accessories using NDT technique.

NIRM has successfully completed 50 projects of which 21 projects were from Mining Sector, 15 from Hydropower Sector, 5 from Nuclear Sector, 2 from Thermal Sector 22 from Power Sector and 6 from Infrastructure Sector and one from Oil & Gas. NIRM was awarded 56 new projects during this financial year. Out of 56 new projects, 24 projects were from Mining Sector, 14 from Hydropower Sector, 3 from Nuclear Sector, 14 from Infrastructure Sector, and one from Thermal Sector.

During the year 2021-22, NIRM has made remarkable contributions to the development of safe and economic practices for coal, metal and opencast mines unde r difficult geomining conditions. Major projects have been oriented to reduce the r i sk and haza rd by mod i fying/ monitoring the mining methods and adopting best safety practices, while enhancing/sustaining the rate of production Some of the major ongoing projects that are being executed by the Institute during the financial year include:

(i) For Malanjkhand copper mine, numerical modelling was carried out for slope stability assessment for the open cast and to design underground stope dimensions, sequence and support system;

(ii) In situ stress was determined for designing the proposed underground mining at Baroi–Zawarmala, Mochia-Balaria and Rampura Agucha. The mining of the ore has reached up to 500 m below surface. The mine authorities are planning to develop stope blocks at lower levels below the mined out area. Insitu stress is one of the important input parameters which dictates the size of the stopes.

(iii) Impact of ground vibration was studied at Zuari limestone mine, Andhra Pradesh.

(iv) Studies were conducted at Chintalayapalle, Kanakadripalli, and Kolimigundla limestone mines, Kurnool District, Andhra Pradesh to optimise the blast design.

(v) Hindustan Zine Limited, Rajasthan intended in review options for depillaring of ramnant pillars in BK series to add a new production centre considering back filling of voids in the BK series at Baroi Mine.

(vi) A review study was conducted for the effective implementations of the stability measur es recommended earlier to M/s Pallava Granites, Chimakurthy, And hra Pradesh. The Ramco Cements Limited is setting up a green field cement plant with 3.15 MTPA Clinker, 2 MTPA Cement and 50 MW power plant at Kolimigundla Mandal, Kurnool District, Andhra Pradesh. The Ramco Cements Limited awarded the scientific study to NIRM to conduct ground vibration and air overpressure studies at these three mines.

(vii) Scientific study was conducted at Redi Iron Ore Mine of M/s Minerals and Metals, Redi Village , Vengurla Taluka, Sind hud urg, Maharashtra. The safety of the mine pit and waste disposal (dump) by keeping the minimum distance from the houses/structures to its maximum depth of working and safe minimum distance from waste dump along with safe ultimate pit slope was evaluated.

(viii) M/s Jindal Steel Work (JSW) is operating an open cast Narayana iron ore mine near the village Narayanapura, Hospet. NIRM was requested to arrive at better blast design parameters to minimise side effects and also to optimise the fragmentation that NIRM carried out during initial field investigations. Work is under progress.

(ix) M/s UltraTech Ltd has approached NIRM to conduct Scientific Study for stability assessment and monitoring of Pit and Dump at 3 sites; namely Budgauna, Hinauti and Majhgawan Limestone mines at Sidhi Cement works.

(x) Scientific Study for slope stabilisation and monitoring of ground movement of South Face, Mine 1 of NLCIL, Neyveli, Tamil Nadu was carried out. No significant movement was observed.

(xi) M/s Midwest Granite Pvt Ltd, intended to carry out scientific studies for optimising the bench parameters and design of final pit slope to work up to a depth of 150 m from the surface.

(xii) NIRM carried out MASW survey and vibration data at the top and bottom of three tailing dam of the Bailadila iron ore mine of National Mineral Development Corporation Limited in Bastar, Chhattisgarh.

(xiii) The assessment of ground conditions around the sites of sinkholes and subsidence in the coal mining district of Umaria, Madhya Pradesh was t aken up by NIRM in compliance with the directions of the Hon'ble NGT.

(xiv) M/s Minerals and Metals is operating Iron Ore Mine at Village Kalane, Dodamarg Taluka, Sindhudurg district, Maharashtra. The total lease area is 32.25 ha. A detailed geotechnical study was conducted to design the slopes and assess the stability of the pit.

(xv) NIRM conducted trial blasts at Andhra Pradesh Mineral Development Corporation Ltd (APMDCL), dolo mite ope n cast mine at Mangampet, Kadapa District, to optimise the blast design for excavation. Blasting is to be carried out in the vicinity of a public road (500 m from mining area).

(xvi) The NLC India Ltd (formerly Neyveli Lignite Corporation Limited) is operating a captive Barsingsar Lignite Mine of 2.10 MTPA (peak) near Village Barsingsar, Bikaner District, Rajasthan. A detailed geotechnical study was conducted to assess the stability of pit slope and dump of the mine.

CSIR–Central Electrochemical Research Institute

1. R&D (Ore Preparation and Processes)

Research and development work carried out in the field of extractive metallurgy and ore preparation, having bearing on Mineral Industry are given below:

(i) Processing of High phosphorous and High Manganese ores, sponsored by Vedanta, Iron ore Sesa, Goa.

(ii) Extraction of metallic Zinc ash and Zinc through electro-hydrometallurgical processes, for Deep constructions, Gujarat.

(iii) Electrowinning of metallic iron from ferrous sulphate solution, sponsored by JSW Ltd.

2. R&D in building Materials (Minerals and Mineral-based Products in Construction Activities, Substitution etc.)

A feasibility study was made for the first time by using graphite ore tailings (GOTS) (obtained from Tamil Nadu Minerals (TAMIN), Sivaganga), as a replacement material for river sand in making mortar and concrete. As-received GOTS and treated GOTS (T-GOTS) at 1,000 °C (1,832 °F) were replaced with river sand and various percentages of replacement ranging from 10 to 100%, and their strength evaluation, were done by conducting compression and split tensile tests in mortar and concrete. Bond strength was evaluated using a pullout test and the permeability characteristic was assessed by water absorption and effective porosity tests. The quality of the concrete was assessed by electrical resistivity and ultrasonic pulse velocity measurements. The corrosion resistance evaluation was done by half-cell potential measurement, alternating current impedance or electrochemical impedance spectra, and potentio-dynamic polarisation studies. From the studies, it is observed that river sand may be replaced with 40% T-GOTS and can be effectively used for structural repair applications.

3. R&D work on Recovery of Marine Chemicals and By-products, viz, Salt, Potash, Bromine, Iodine, Gypsum and Magnesium Chemicals:

Electro winning of Magnesium Metal from Spent Magnesium chloride Liquor by Molten Sa l t Electro lysis sp onsor ed by United Phosphorous Limited.

4.R&D Projects on Metallurgy and Mineral Processing

4.1 Extraction of Neodymium Metal by Molten Salt Electrolytic Process (Sponsored by Indian Rare Earths Ltd)

The objective is to produce Rare-earth Metals & Alloys from Rare Earth Oxides/Chlorides produced by IREL from Beach Sand Minerals. The following deliverables were achieved:

(i) Electrowinning of neodymium metal (Nd99) from molten salt electrolytes was successfully carried out under optimised conditions using chloride melts.

(ii) Electrowinning of neodymium–iron, used as master alloy for NdFeB magnets was demonstrated at various current d ensities a nd ba th compositions.

(iii) Yield: Nd metal at 10 g/batch & Nd-Fe alloy at 100 g/batch ; Scaling up is in progress.

4.2 Electro-hydrolysis of low-grade manganese ore to gamma MnO_2 (Sponsored by Tata Steel Ltd)

The objective is to develop an Electrowinning process for the preparation of γ -Manganese dioxide from low-grade Indian manganese ores. The following deliverables were achieved:

(i) The manganese ore received from Tata steel Ltd was ball milled a nd analyse d for its composition using X-ray Diffraction and XRF.

(ii) The finely ground ore was then leached with sulphuric acid and iron impurity was removed by precipitation. The final light pink electrolyte had Mn concentration of 55–60 g/l.

(iii) Electrowinning was carried out at 2 liters capacity using polished stainless steel sheet cathode and Titanium mesh anode. Electrolysis was carried out by varying the current density at a elevated temperature

(iv) The deposited γ -MnO was scraped from the anode, washed with DM water and examined for its purity by XRD, XRF and FT- Raman Spectroscopy, and microstructure was studied using FE-SEM.

4.3 Effect of impurities on zinc electroplating: Comparison of Special High Grade (99.995%) and Electroplating Grade (99.997%) Zinc raw material (Sponsored by Hindustan Zinc Ltd)

The objective was to understand the effect of impurities in EPG and SHG grade zinc in terms of current efficiency, microstructure and corrosion resistance. The following deliverables were achieved:

(i) EPG-Zn exhibited better Current Efficiency during acidic zinc electroplating.

(ii) Zinc samples electroplated from EPG-Zn exhibited more Co mpac t and Cr ystalline microstructure and exhibited Better Corrosion Resistance than SHG-Zn.

CSIR–National Metallurgical Laboratory (NML)

CSIR-NML continues to play a vital role in providing scientific solutions to the industries in the areas of minerals, metals and materials. Mineral Processing Division of CSIR-NML has been engaged in R & D in characterisation, beneficiation and agglomeration of ores and mineral fines. Presently, the Mineral Processing Division is focussing on Fine particle processing, Dry beneficiation, Mathematical modeling & simulation, Plant performance auditing & improvement, and Equipment development. During 2021-22, the following were some important R&D programmes and projects that were under execution:

(i) Studies on Beneficiation of Bauxite Sample for Reduction of Reactive Silica

Under the present investigation, studies were undertaken on processing of bauxite samples sourced from Chhattisgarh region for possible reduction of reactive silica to ~4% from a feed containing high reactive silica ranging from ~ 6 to 11 .5 %. Characterisation of the bauxite ore as revealed from the sample showed various types of textures, like, oolitic, colloform and replacement. The samples contained abundant gibbsite and boehmite, followed by clay, altered/ translucent silicate and opaque minerals (Fe-oxides /hydroxides) and anatase. The beneficiation study included scrubbing & washing, gravity separation, magnetic separation and froth flotation. Scrubbing & washing studies demonstrated that there is significant reduction in reactive silica content (to ~2%) with increase in total available alumina content in the washed product. The reduction in reactive silica in the washed product was possible because of the removal of the fine particles, which contained significant proportion of reactive silica in them. Process technologies/ flow sheets have been developed for low-grade bauxite samples obtained from different mines of Chhattisgarh region.

(ii) Dry Beneficiation of Limestone Samples for Removal of Iron-bearing and Other Magnetic Impurities

The current studies will explore the possibility of reduction of iron from 1.5% to 0.08% Fe2 O3 for rejected limestone sample and 0.2% to 0.08% for regular limestone. Attempt was made to reduce the transition elements content from limestone to impr ove the clinker quality. B ased on character isa t io n and l ibe ration s tudy, t he beneficiation of limestone through dry magnetic separation and Air table for the separation of contaminants from limestone, was explored. In addition, a beneficiation process for reduction of impurities present in rejected limestone sample at the mining site was developed.

(iii) Development of Dry Beneficiation Process Technology for Low-grade Iron Ore for Iron and Steel Making

The current project aims to develop a dry beneficiation process technology for iron ore to produce sinter and pellet feed concentrates. Due to the unavailability of dry density separator technology for iron ore, the project aims at developing laboratory-scale dry density separators. As a part of the project, two indigenous dry separators at laboratory scales were fabricated: 1) Air pulsated stratifier 2) Terminal velocity separator. Iron ore with size range -20 mm to + 6 mm was processed in the air pulsated stratifier, and ores with size range -3 mm to +1mm was processed in the terminal velocity separator. Enhancement by 2-3% of Fe content with iron ore feed having Fe content of 59.5 to 60% was obtained in a single stage operation of the air pulsated stratifier. Similarly, in the terminal velocity separator, iron ore Fe c ontent was enhanced by 2% in a single stage operation.

(iv) Continuous Pilot-scale Reverse Flotation of Iron Ore

Reverse flotation method is used for beneficiation of iron ores wherein silica gangue is selectively floated from iron ore using reagents. The sponsor had carried out studies on different reagent scheme to improve the selectivity of the flotation process. With the encouraging results of batch pilot-scale studies (20–25 kg) obtained in an earlier project carried out at CSIR-NML, continuous pilot-scale flotation of 15 tons of de-slimed product of iron ore slime was conducted, and it validated the bench-scale results.

(v) Effective Utilisation of Middlings and Fines of Coking Coal Washery for Recovery of Carbon Values.

Cokis coal is a scarce commodity in India. Its reserves is about 10.8% of the total reserves of around 320 Billion tonnes. The middlings generated from the coking coal washeries are used presenthy for power generation. It contains good amount of carbon values which can be recovered. This substantial amount of middlings can be an excellent potential source of coking coal. The coking coal resources can be conserved by recovering extra low ash coking coal from the washery middlings by suitable beneficiation processes. Keeping in view the above, a project has been undertaken to develop a suitable process for gainful utilisation of the middlings of the coking coal washeries towards the enhancement of the carbon recovery for coke making.

(vi) Processing of Hydrocyclone Underflow for Recovery of Silver

NML undertook the investigation to find the possibility of recovering silver from the hydrocyclone underflow of the Lead-Zinc beneficiation plant using enhanced gravity separator. The plant tailing consists of 179 ppm of silver. Bench- scale experiments were carried out using a Falcon concentrator. Initial experimental results indicate the prospect of upgradation of silver metal recovery from the tailing. Detailed study is in progress.

(vii) Studies on Processing of Iron ore Sample for Beneficiation Plant.

The as-received sample was assayed at 61.60% Fe, 2.72% Al_2O_3 , 5.70% SiO2 , and 2.87% LOI. The mineralogical study of the sample revealed that the iron ore consists of a substantial amount of goethite and haematite. In coarser fractions, most of the haematite were seen interlocked with goethite and clay minerals. Liberation studies were carried out by modal analysis on different size classes using zoom stereomicroscope. Significant variation in concentrate yield (53–63 wt.%) was observed with 64–66 % iron content. Considering the desirable particle granulometry, around 66-67% by weight (magnetic and middling product) pellet grade material was produced with an iron content of around 63.5%.

(viii) A Study on Hydrodynamics Characteristics in Separation of Minerals in a Monolithic Flotation Column

To investigate, a monolithic flotation column was developed. The column was made of transparent cylindrical Perspex, and inside the cylindrical column, the channels were made using transparent Perspex. This column would eliminate or reduce the back-mixing in the gas and liquid phase, reduce channeling, reduce entr ainment , provide homogeneous bubble size distribution, low coalescence rate and high residence time. Knowledge of flow regime and gas holdup characteristics of the system will be helpful in the improvement of a flotation column performance by reducing pressure fluctuation, by directing transport processes and by volume production.

(ix) Characterisation of Microbubbles and its Subsequent Application in fine Particle Separation

Atest sample showed Pulp density varying between 6 and 15% solid (w/w). Minimum ash of 13.07% was obtained at collector dosage of 500 gpt, but yield at this level was found to be low. For 19% ash the best yield obtained was at collector dosage of 1000 gpt. Therefore, further experiments in the flotation column were done at 1,000 gpt of pine oil with variation of airflow rate and changing other parameters. It was found that with increase in airflow rate the yield increased to 57% with 20% ash at the same operating condition.

(x) Evaluation of Binder Properties for Pelletisation

Efficacy of binder was evaluated based on characterisation of the green and fired pellets, such as, GCS, CCS, Drop number and Porosity. It was observed that impact of organic binder on pellet strength was very high and around 600 CCS was achieved by using the organic binder, but it has negatively affected the porosity and drop number.

(xi) Feasibility Studies on Flotation of High- Magnesia Limestone from Maharashtra And High- Silica Limestone from Rajasthan

The objective of this project work was to obtain a concentrate with less than 3% MgO with optimum recovery from a high-magnesia low-grade limestone analysing 43.46% CaO, 7.50% SiO2 and 6.54% MgO. The process optimisation for MgO reduction was carried out. The work involved initial sample preparation and characterisation of the low-grade limestone followed by process methodology planning, execution by experimental studies and process optimisation for silica reduction.

Manganese Ore India Ltd (MOIL)

MOIL has carried out R&D activities to improve the safety and productivity in the mines by introducing modern technology in collaboration with CSIR R& D laboratories, reputed academic and R&D Institutions of the country. In 2021-22 for many R&D projects, MOIL had engaged and was associated with several institutions.

Research and Development Projects

1.1 Rock Mechanics : For the use and implementation of the procured Rock mechanic instruments for mines safety, experts at CSIR Central Institute of Mining and Fuel Research (CIMFR) have been approached and they have been give n the work o f instr umentatio n, installation and interpretation of the strata conditions for a period of one year for the seven Underground Mines of MOIL Limited.

1.2 Underground Rock Mechanic Study: Underground Rock Mechanic Studies of Ukwa mine and Balaghat mine have been done by CSIR– Central Institute of Mining and Fuel Research (CIMFR) for decision making towards better productivity and safer mining environment.

1.3 Evaluation of Stoping Parameters: In accor dance with proposal of the Strategic Management Group to have a trial stoping method of sub- level stoping to increase the rate of production and safety standards, CSIR–Central Institute of Mining and Fuel Research (CIMFR) was engaged for "Evaluation of Stoping parameters, stope design and implementation of planned sub-level stoping at Chikla-B section of Chikla Mine". This trial stoping method, if successful a nd econo mic, may o pen new possibilities for MOIL to modify our recent stoping methods for better productivity and safety.

1.4 Scientific Studies for Support Requirement: Studies for evaluation of support requirement in stope and stability assessment of drivages at Beldongri Mine are being carried out by CSIR– Central Institute of Mining and Fuel Research (CIMFR).

1.5 Ventilation Studies: Studies for ventilation at stope and concreted drive at Beldongri Mine are being carried out by Visvesvaraya National Institute of Technology (VNIT), Nagpur.

1.6 Development of New Software: To handle the vast amount of data produced in day-to-day activities at Mine Planning department, development of Data Management website/ application is under process. This will not only help to organise the large data (and prevent data loss), but will also make it easy and handy for Mine geologist to access the data at a common interface. The necessary developments are underway.

Technology Absorption

2.1 Pani Project (Mining outside in the State of Maharashtra and Madhya Pradesh): MOIL has an expertise from mine to mill in manganese ore mining in India. Gujarat Mineral Development Corporation (GMDC) has signed a MoU with MOIL to explore the possibilities of mining of manganese ore in Pani area of Chota Udepur district, Gujarat. A tripartite MoU between MOIL, GMDC and MECL has been signed to carry out exploration in Village Pani. MECL earlier carried out exploration and proved reserves/resources of manganese ore around 9.5 million tonnes. Based on the exploration work done at Pani project, TEFR has been prepared. MOIL is planning to sign a JV with GMDC to commence mining operations.

2.2 Use of Remote Sensing: On the basis of Remote Sensing studies carried out by National Remote Sensing Centre (NRSC), Hyderabad, in four districts of Madhya Pradesh, viz Balaghat, Jhabua, Jabalpur and Chhindwara, the Company has reserved area under Sub-rule (1) of Rule 67 of the Mineral (other than Atomic Hydrocarbon Energy) Concession Rule 2016 to carry out exploration work in Chhindwara and Balaghat districts and application for reservation has been done in Jabalpur and Jhabua districts. Based on the remote sensing studies and field work, the Govt . of M.P. has granted reservation for exploration in two districts, i.e, Balaghat and Chhindwara. MOIL has identified few blocks in which exploration will be done in the year 2022-23 . Elaborate exploration proposal has been prepared from G-4, G-3 and G-2 level of exploration.

2.3 Petrological Laboratory: To understand the genesis of the Manganese ore, Mine-Planning Department has established a Remote Sensing and Petrological lab to study the petrological and mineralogical characteristics of samples collected in field from different areas. The data generated is being utilised in geological reports for onward submission to various statutory organisations like DGMS, IBM, DGM etc.

2.4 Rock Mechanics Laboratory: Mine planning Department has also established a Rock Mechanics lab to conduct Geotechnical studies of various lithology available at all Mines of MOIL. This will help to know various parameters of rocks which will be useful in preparation of mining plans and method of working for better safety and higher productivity. It helps to generate technical reports for onward submission to regulating authorities like DGMS, IBM, DGM etc. for safer mining operations with higher productivity.

2.5 Mine Ventilation: Ventilation reorganisation studies for deeper levels have been conducted at Gumgaon by Indian Institute of Technology (IIT), Kharagpur. Accordingly, large diameter ventilation fan has been installed at Gumgaon Mine with energy saving devices. It has improved the face ventilation and productivity of underground section of the mines. The studies are underway at Chikla and Ukwa Mine for productivity improvement.

2.6 Mines Safety: MOIL has installed rock mechanics instruments at 7 underground mine for safety of men and machines in the stopes as per the guideline of DGMS.

National Mineral Development Corporation Ltd (NMDC)

NMDC R&D centre is dedicated to undertake product and technology development projects related to ores, minerals and steel making to maintain its excellence in process performance. R&D centre has made significant contribution not only to NMDC operating projects b ut also to Indian industries and is recognised by Department of Scientific and Industrial Research (DSIR).

R&D centre undertakes works related to mineral processing, flow sheet development, mineralogical s tudies, material handling & storage, metallurgical studies of iron ore and coal, chemical analysis etc. The R&D centre is equipped with state-of-the-art laboratory equipment to analyse different minerals, coal, metal and non- metals. Some of the facilities includes XRD, WD- XRF, ICP-AES, GFAAS, SEM,RUL, CS, Pilot coke oven, Blast furnace simulation (Softening & melting furnace), Dilatometer & Plastometer, TGA, Dry air & APIC Jig, WHIMS, Ring shear tester, Ab rasio n t este r, Vicke r s ha rdness t ester, Advanced Rheometer, Friction angle tester, Zeta potential, Automatic mineral analyser, Stereo microscope, Batch & Pilot plant facilities for Mineral processing and Agglomeration. Various research projects completed by the R&D Centre are enumerated below:

The thrust of NMDC Limited's R&D Centre is towards—

1. Conservation of Energy: Minimising the production loss due to flowability related issues in handling and storage of bulk solids (like iron ore, coal, flyash etc). Use of alternate and better screening media to achieve better productivity. Addition of external agent to wet & sticky iron ore to improve flowability and screen efficiency Utilization of mines waste for value-added product like development of building materials.

2. Technology Absorption—

(a) Development of Vision Enhancement System for foggy Weather at Bacheli.

(b) Utilising 100% iron ore fines in the existing beneficiation circuit at pellet plant Donimalai.

(c) Designing of jamming free Rapid wagon loading system in Kirandul complex.

(d) Development of technology for dry processing and beneficiation.

Apart from the above thrust areas, R&D centre also undertakes collaborative projects with reputed organisations and institutes across the globe having expertise in the field of waste utilisation, mining, beneficiation and other allied areas.

3. Projects of NMDC Mines/Projects

(a) Physical and metallurgical characterisation of iron ore samples received from Bailadila sector.

(b) Various samples received for characterisation and che mica l analysis fr om Investigation department.

(c) Exploring possibilities of utilising 100% iron ore fines in the existing beneficiation circuit at pellet plant Donimalai.

(d) Evaluation of indigenous wear liner to be used in NMDC mines— An import substitution initiative for ATMANIRBHAR BHARAT.

(e) Development of vision enhancement system for foggy weather at Bacheli (In collaboration with CSIR–CIMFR).

(f) Design inputs for Rapid wagon loading system at Kirandul complex.

4. In-house Developmental Research Projects

(a) Process Improvement:

(i) Development of high- grade pellets or ultra pure grade pellet.

(ii) Develop a process for 100% utilisation of ultra fines iron ore in sinter making.

(iii) Utilization of mining waste (slime) to produce building materials.

(iv) Investigate the effect of Alumina content on flow properties of iron ore.

(v) Development of comprehensive report on the flow characteristics of different types of coal.

b) Strategic Technology Absorption—

(i) Beneficiation of low-grade coal after removal of volatile matters.

(ii) Preparation of sodium base silica and recovery of TiO^2 from kimberlite.

(iii) Study of making of value-added product from mines slimes/tailings.

c) Collaborative Programmes under progress

Sl. No.	Collaborating Institutes	Title and Nature of Work
(i)	CSIRO, Australia	Characterisation and beneficiation studies on laterite/ goethite iron ore. Development of dry essing of hydrated iron ore.
(ii)	CSIR–IMMT,	a) Modeling & Optimisation Bhubaneswar of high con centration Iron ore fines/ concentrate slurry b)Development of obtained from blue dust in energy & sensors devises. c)Dry beneficiation of iron ore and coal using VSK Separator
(iii)	CSIR–CIMFR	Development of Vision enhancement system for foggy weather

Tata Steel Ltd

During the year under review, in order to utilise and generate value from the captive low-grade raw materials, the company has completed the lab-scale studies to utilise captive low-grade manganese ore and produce high value products, such, as Electro- lytic Manganese Metal and High Purity Manganese Sulphate to cater to the requirements of the Battery Manufacturing Industry.

Besides, some efforts made towards technology absorption in respect of ores & minerals and min- eral-based products are given below:

A. Projects under Research and Development

1. Jamshedpur

1.1 Partial replacement of lime by limestone as a fluxing agent in BOF process: Partial replacement of lime with limestone as a fluxing agent in the BOF process is a step towards sustainable steel making. A plant trial has been carried at LD#3 shop of TSL Jamshedpur replacing 10% of lime with limestone. This has led to a decrease in lime consumption by 700 kg/TCS, lump iron ore reduction by 400 kg/TCS and improved dephosphorisation degree by 1% and phosphorous partition ratio by 4 points. Estimated reduction in CO_2 emission was estimated to be around 2 kg/TCS.

1.2 Improvement in plant yield at wet processing plant of Noamundi through small diameter hydrocyclone: Slime generated during the washing process was treated in the existing hydrocyclone (650 mm dia.) which cuts at 45-micron to recover iron values. Further reduction in cut size helped recovering more iron values. Based on a lab study, a small diameter hydrocyclone (400 mm dia.) was selected which cuts at 25-micron size. The labs-scale study was followed by demo trial at plant. New hydrocyclone was then installed and implemented — plant data for a period of six months showed improvement in plant yield by 1.8%.

1.3 Application of glidants to reduce stickiness of iron ore fines: The stickiness delay during unloading of Blended Fines Ore (BFO) is a concern for regular plant operations. Surface modifying glidants when coated on iron ore particles, improves flowability of the mass through sliding of interacting surfaces. Lab tests with various glidants and lubricants showed that stickiness delay can be reduced by 0.25 to 0.5 g/ kg addition of glidants. After conducting technoeconomic due diligence, plant trials were conducted with two silica based glidants.

1.4 Development of Antimicrobial colour coated sheet: A coating formulation with Anti-bacterial and Anti COVID-19 functional properties was developed by dispersing functionalised nano additives in a paint system. The coated steel substrate qualifies the anti-bacterial and Anti-COVID-19 measurement tests as per standards JIS Z 2801; ISO 21702.

1.5 Development of Copper free MIG wire: Copper coating on MIFG wire possess peeling issues during welding and also, copper fumes are hazardous to operators. R&D has developed an environmental friendly coating, which can eliminate the copper coating on MIG wire. A plant trial has been conducted with the novel coating formulation – the novel coating formulation meets the desired welding criteria.

1.6 Pulse iron ore sintering: Tata Steel R&D has developed a new methodology in iron ore sintering called "Pulse Sintering". Unlike conventional sintering process where the suction is continuously downdraft, pulse sintering helps in to broaden the flame and, increases sinter heating index by improving heat transfer rate of flowing gas. This concept was successfully implemented in sinter plant at TSL and observed improved flame- front propagation and, lowers sinter return fines generation.

(B) Kalinganagar Raw Material Handling System and Logistics

(i) Robot Operation in wagon tippler: Elimination of MMI during coupling and decoupling activity.

(ii) Modification of CHP HMI mapping of all the piles in yard: By mapping of the Coal stockpiles in HMI resulted in elimination of mixing of different grades of material due to human error

(iii) Productivity enhancement of Conveyor through effective Braking: By measuring and setting up the conveyor stoppage time in sync with preceding and succeeding conveyor resulted in elimination of jamming in conveyor circuits.

(iv) Prevention of Dumper Movement during its Body raised condition: By setting a timer-based operation of body raised dumper movement helped resolve multiple serious incidents.

(v) Enhanced reliability of Moving equipment through installation of Drag Chain: This system is aimed at eliminating the failure of composite cable along with minimising the risk of electrocution.

(vi) Safety reliability improvement through smart fencing system in wagon tippler: This ensures elimination of unsafe condition arising due to MMI during rake unloading.

(vii) Preparation of Intelligent Ore and Flux Dispatcher (IOFD) decision making system: This will help in planning effective engagement of stacker reclaimer during day-to-day operation.

(viii) Setting up of Tyre washing facility: Reduction in fugitive dust emission caused by movement of vehicles on road.

(ix) Robot Operation in Wagon Door Opening and Closing in Outbound Logistics: This will help in elimination/ reduction of MMI during opening and closing of wagon doors for finished Good Despatch.

(C) Sinter Plant

(i) Digital Twin model for Sinter Plant: Integrated model with simulation and recommendations to improve Key KPIs of Sinter Plant.

(ii) Digital model for sinter size analysis: Improve mean size of sinter dispatch to BF.

Hindustan Zinc Ltd (HZL)

Specific areas in which R&D has been carried out by Hindustan Zine Ltd in 2021-22 are summarised below:

(i) Enhance grade and recovery of metals during mineral processing on various circuits

(ii) Improve recovery of metals from Cu dross and fume zinc-oxide generated in lead smelting process

(iii) Improve recovery of metals in existing ancillary processes for waste generated in zinc leaching process

(iv) Development of value-added products

(v) Imp ro ve ment of current efficienc y in electrowinning of Zinc

(vi) New process development for treating waste generated in zinc leaching process

(vii) Sintering challenges in ISF with Pb-Zn concentrate

(viii) Alternative utilisation of jarosite and jarofix to reduce environmental footprint

(xi) Utilisation of mixed salt generated in Zero Liquid Discharge process

(x) Geo-Metallurgical performance like ore hardness, minerology and flotation performance for individual ore types across HZL mines.

(xi) Automated Minerology equipment (FESEM with Minerologic software) installation and initiate use for characterisation of ore and in process samples.

(xii) Feasibility tests to address graphite challenge in ores by evalua tingvariousr eagents performance, gravity separation, flotation and de- sliming techniques.

(xiii) Technical support to mills for operational issues like high rejects from grinding mills, increased misplacements and poor concentrate quality.

(xiv) Silver recovery improvement by testing of alternater eagents and enhanced gravity separation.

(xv) Utilisation of ground blast furnace slag as a binder in paste fill plant

(xvi) Chloride-based leaching bench-scale testwork conducted to enhance Zn recovery and reduce the waste footprint in Zn Hydro process

Hindustan Copper Ltd (HCL)

HCL has undertaken the following R&D projects in 202-22.

(i) Study on Feasibility of Changing mining method from Track to trackless at Khetri Mine, Rajasthan and Cost Benefit analysis in order to achieve enhanced production & productivity.

(ii) Study of requirement and selection of suitable Mine Communication System in Underground mine of MCP.

(iii) Geotechnical Study and Numerical Modeling by Stability analysis of open-pit and underground mine of MCP, Risk assessment for optimisation of support system design.

(vi) Developing software-based 3D Geological ore body modeling and mine planning system for MCP underground mines with real- t ime updating incorporating geological and mining data for short- and long-term production planning.

(v) Study for debottlenecking and capacity enhancement provision for concentrator plant, Khetri.

(vi) Numerical modeling and 3 D Subsidence analysis for Mine lease areas of ICC unit.

(vii) Around 1,70,000 MT of old lean ore from mines was treated in two phases exclusively and metal recovered was 708 CMT.

6. Port Facilities

1,323.80
(million tonnes), Total cargo handled at Indian Ports (Major and Non-major) in 2021-22

54.5
Share of the maritime cargo traffic of the country was handled by the twelve Major ports in India in 2021-22

720.1
(million tonnes), The total traffic handled by the major ports in 2021-22

GENERAL

Growth

Ports are economic and service provision entities of remarkable importance because they act as a place for the interchange of two transport modes, maritime and land, whether by rail or road. India has a long coastline of about 7,517 km spread across the western and eastern shelves of the mainland and also along the islands. It is a strategic geographical asset for country's trade. There are twelve major ports in India out of which six are located on the East Coast and six on the West Coast. In addition, there are about 217 notified non-major ports in the country. State-wise and coast-wise number of major ports and non-major ports are provided in Table-1. Shipping plays an important role in the economic development of the country, especially in India's International Trade. The total cargo handled at Indian Ports (Major and Non-major) increased to 1,323.80 million tonnes in 2021-22 from 1,249.99 million tonnes in 2020-21 reflecting an increase of 5.9% during 2021-22. India's major ports handled around 54.4% of the cargo handled at Indian ports. The growth profile of cargo throughput at India's Major and Non-major ports in terms of their coastal and overseas trade during 2019-20 to 2021-22 is reflected in Table-2.

Table -1 : Number of Major and Non-Major Ports in the Maritime States

(As on 31.03.2022)

State/ U.T.	Number of Major Ports	Number of Non-Major Ports	Total Number of Ports
WEST COAST			
Gujarat	1	48	49
Maharashtra	2	48	50
Goa	1	5	6
Daman & Diu	-	2	2
Karnataka	1	13	14
Kerala	1	17	18
Lakshadweep Islands	-	10	10
EAST COAST			
Tamil Nadu	3	17	20
Puducherry	-	3	3
Andhra Pradesh	1	15	16
Odisha	1	14	15
West Bengal	1	1	2
Andaman & Nicobar Islands	-	24	24
TOTAL	**12**	**217**	**229**

Source: Basic Port Statistics of India, 2021-22.

Table -2 : Growth in Cargo Traffic at Indian Ports (In%)

Port	2019-20			2020-21			2021-22		
	OT	CT	TT	OT	CT	TT	OT	CT	TT
Major	2.32	-3.96	0.82	-3.64	-7.77	-4.57	4.45	16.27	7.04
Non-major	7.15	-2.44	5.57	-4.71	-14.06	-6.14	2.99	14.35	4.58
All Ports	4.63	-3.41	2.98	-4.16	-10.1	-5.3	3.74	15.59	5.9

Note: OT– Overseas Cargo Traffic; CT– Coastal Cargo Traffic; TT– Total Cargo Traffic

Source: Basic Port Statistics of India, 2021-22.

The period 2001-02 to 2021-22 saw compound annual growth rate (CAGR) of 6.4% in total cargo throughput at Indian ports. The compound annual growth in Cargo handled at Major ports and Non-major ports was 4.7% and 9.7% during 2001-02 to 2021-22. The growth in cargo handled by Major ports and Non- major ports during 2021-22 registered growth of 7.0% and 4.6% respectively. Commodity-wise traffic handled, in respect of principal commodities, by all the ports (Major & Non-major) in India from the year 2019-20 to 2021- 22 are presented in Table-3.

Table - 3 : Commodity-wise Traffic handled by All Ports

(In million tonnes)

Sl.No.	Commodity-wise Traffic	2019-20	2020-21	2021-22
1	P.O.L (Crude & Products)	418.79	348.69	366.24
2	Iron ore	95.65	107.32	94.69
3	Building Material	15	13.89	12.7
4	Coal	297.4	256.77	268.16
5	Fertiliser raw material	32.11	31.36	29.97
6	Other/cargo	461.01	491.96	552.05
	Total	**1319.97**	**1249.99**	**1323.8**

Source: *Ministry of Shipping. Annual Report. 2021-22*

The commodity composition of the total traffic at Indian Ports has shown changes over the years. POL & its products continue to be the single largest commodity handled by the ports, constituting 27.7% of the total seaborne traffic followed by Coal (20.3%), Iron ore (7.2%) and FRM (2.3%) in 2021-22.

The share of Major ports and Maritime States of India in terms of cargo handled is furnished in Table–4. Amongst the States, Gujarat has emerged as the premier maritime State in terms of port traffic and accounted for 40.2% of the total cargo handled at Indian ports. It is also noteworthy that about 67% of the cargo handled by Non-major ports pertains to the State of Gujarat. In terms of total port traffic, Gujarat is followed by Maharashtra (14.2%), Andhra Pradesh & Odisha (11.9% each) and Tamil Nadu with share of 9.8% in India's total seaborne traffic. The twelve major ports in India handled about 54.4% of the maritime cargo traffic of the country in 2021-22. Traffic handled at the major ports has been increasing over the years in tandem with the economic activity and volume of t rade turnover. The total traffic handled by the Major ports has recorded around 24 increase from 581.3 million tonnes in 2014-15 to 720.1 million tonnes in 2021-22.

The Ministry of Shipping encompasses within its fold Major ports and Inland water transport among others. All Major ports in the country presently have both rail and road connectivity.

Table - 4 : State-wise Cargo Traffic at Indian Ports during 2021-22

(In million tonnes)

Sl.No.	State	Major Ports	Non-major ports	Total
1	Gujarat	127.1	405.39	532.49
2	Maharashtra	135.89	52.47	188.36
3	Goa	18.46	0.03	18.48
4	Karnataka	39.3	0.79	40.08
5	Kerala	34.55	0.14	34.69
6	Tamil Nadu	121.43	7.84	129.27
7	Andhra Pradesh	69.03	87.98	157.01
8	Odisha	116.13	41.54	157.68
9	West Bengal	58.18	0	58.18
10	Others[a]	0	7.37	7.37
11	Total	720.05	603.75	1323.8

Note: (a) Includes Puducherry, A&N Islands and Lakshadweep Port

Source: *Ministry of Shipping, Annual Report, 2021-22.*

Sethusamudram Corporation Ltd (SCL)

The project is kept in abeyance in view of the litigations filed in the Supreme Court of India.

Private Sector Participation in Major Ports

The Private Sector is envisaged to fund projects under Public-Private-Partnership (PPP) mode through Design-Build-Finance-Operate- Transfer (DBFOT) or Build-Operate-Own-Transfer (BOOT) models. As per the report of Indian Port Association, the details of projects awarded are furnished in Table-5.

Table-5: PPP Projects Under Implementation/Operation in Major Ports

Sl.No.	Projects/Development	Estimated Cost (In ₹ crore)	Capacity (MMTPA)
Projects under Implementation: (As on 31.05.2020)			
Jawaharlal Nehru Port Trust (JNPT)			
1	Development of Container Terminals of 2,000 m length at JNPT (4th Container terminal)	7915	60
Kamarajar Port Ltd (Ennore)			
2	Modification of existing Iron Ore Terminal to also handle coal (SIOTL)	229	12
3	Development of Marine Liquid Terminal-II on DBFOT Basis	393	3
4	Development of LNG Terminal on Captive Basis	5151	5
5	Development of IOCL Oil Jetty (Captive)	480	3
6	Construction of Coal Berth 3 for TANGEDCO (Captive)	235.14	9
7	Construction of Coal Berth 4 for TANGEDCO (Captive)	244.51	9

Table-5 (Contd.)

Sl.No.	Projects/Development	Estimated Cost (In ₹ crore)	Capacity (MMTPA)
Deendayal Port Trust			
8	Development of Oil Jetty to handle liquid cargo ship bunkering Terminal	233.5	3.39
9	Development of Marine Liquid Terminal Facilities consisting of SPM & Two product jetties in KPT waters at OOT, Vadinar on captive-use basis	448	24.5
Kolkata Port Trust			
10	Setting up of Liquid Cargo Handling Jetty at Shalukkhali, Haldia Dock -II	172.52	2.43
Mormugao Port Trust			
11.	Redevelopment of Berths 8, 9 and Barge Berths	1145.36	19.22
New Mangalore Port Trust			
12	Provide Handling Equipment at Berth No. 18 (Old Berth no.12) for handling bulk cargo & containers under PPP Mode	469.46	6.73
13	Mechanisation of Berth No. 14 for handling container and other clean cargo on PPP mode	280.71	6.02
Paradip Port Trust			
14	Development of New Coal Berth for handling Coal imports at Paradip Port on BOT basis.	655.56	10
15	Development of Clean Multi-cargo Berth in Southern Dock	430.78	5
16	Development of Deep Draft Iron Ore Berth	740.19	10
17	Mechanisation of EQ1 to EQ3 berths	1437.76	30
Visakhapatnam Port Trust			
18	Development of East Quay-1A (EQ-1A) berth on south side of EQ-1 berth in the Inner harbour of Visakhapatnam Port on DBFOT basis	313.39	7.36
19	Extension of existing container MTEUs terminal	633.11	0.54
VOC Port Trust, Tuticorin			
20	Construction of North Cargo Berth-II	332.16	7
21	Development of Shallow draught Berth on PPP mode for handling construction materials	65.37	
22	Development of facilities for Handling Thermal Coal for SPIC Electric Power Corpn Pvt Ltd (SEPC)	214.5	2.5
Mumbai Port Trust			
23	Bunkering Terminal	50	2
PPP & Captive Projects under Operation			
Chennai Port Trust			
1	Container Terminal-1 M/s CCTPL	790.6	31.3
2	Development of 2nd Container Terminal (M/s CITPL)	783.32	29.5
Cochin Port Trust			
3	Vallarpadam Container Terminal ICTT	2118	40
4	LNG Terminal	4182	5

Table-5 (Contd.)

Sl.No.	Projects/Development	Estimated Cost (In ₹ crore)	Capacity (MMTPA)
5	Crude Oil Handling Facility for BPCL-Kochi Refinery (Formerly KRL— a Central PSU) (Captive)	720	13
JLN Port Trust			
6	Container Terminal, NSICT	750	13.2
7	Extension of container berth by 330 m towards north	600	10
8	Third Container Terminal	1078	15.6
9	BPCL Jetty (Captive)	200	5.5
Kamarajar Port Ltd (Ennore)			
10	Development of Marine Liquid Terminal – I on DBFOT Basis	252	3
11	Development of Coal Terminal for users other than TNEB on BOT basis	399	8
12	Development of Container Terminal on DBFOT basis (2 phases) (Ph-1- Rs 724 Cr and Ph-2- Rs 546 Cr)	1270	16.8
13	Development of Multi-Cargo berth on DBFOT Basis	151	2
14	Coal Berth-1 for TANGEDCO (Captive)	80.38	8
15	Coal Berth-1 for TANGEDCO (Captive)	80.38	8
Deendayal Port Trust			
16	Development of 13th Berth other than liquid and container cargo berth	188.87	1.5
17	Development of 15th multipurpose cargo berth at Kandla	188.87	1.5
18	Container Freight Station	41.07	3
19	Dry Bulk Terminal off Terka near Tuna on BOT basis (Outside Kandla Creek)	1060	14.11
20	Development, operation & maintenance of Container Terminal (Berth 11 & 12) on BOT	159.81	7.2
21	Oil Jetty for IOCL (Captive)	20.7	2
22	Oil Jetty related facilities at Vadinar (ESSAR) (Captive)	750	13.5
23	Fifth Oil Jetty (IFFCO)(Captive)	24	2
24	Setting up of Captive Barge	27	1.5
	Jetty at Old Kandla (IFFCO)		
Kolkata Port Trust			
25	Multipurpose Berth No. 12	35	1.12
26	Multipurpose Berth No. 4A	150	2
Mormugao Port Trust			
27	Development of Coal Handling Terminal at Berth No.7	406	4.61
28	Bulk Cargo berths No. 5A & 6A	250	5
New Mangalore Port Trust			
29	Setting up of Bulk Cement Handling facility for M/s Ambuja Cement Ltd (Captive)	98	1
30	Construction of Captive Jetty for handling Coal by M/s UPCL	376.52	5.4

Table-5 (Contd.)

Sl.No.	Projects/Development	Estimated Cost (In ₹ crore)	Capacity (MMTPA)
Paradip Port Trust			
31	Mechanisation of Cargo Handling Project-1	37.32	2
32	Mechanisation of Cargo Handling Project-2	25.13	2
33	a) By OSL b) By Bothra Shipping Services c) By ABCT Pvt. Ltd Supply, installation of 3 Nos. of HMC	87.75	3.75
34	a) By Crew Pvt. Ltd (60T) b) By OSL (100 T) c) By OSL (60 T)	87.75	3.75
35	Captive Fertilizer Berth to PPL	20	4
36	Captive Fertilizer Berth to IFFCO	26.17	4
37	Construction of SPM Captive Berth	500	15
38	Mechanisation of Central Quay-III Berth	40	6
39	Construction of 2nd SPM Captive Berth	746.17	11
40	Construction of 3rd SPM Captive Berth	746.17	11
41	Development of South Oil Jetty (Captive)	222.29	10
Visakhapatnam Port Trust			
42	Multipurpose Berths-EQ-8 & EQ-9	320.29	6.47
43	Container Terminal, Outer harbour	86.35	5.6
44	Development of WQ-6 berth for handling Dry Bulk Cargoes	114.5	2.08
45	Development of EQ-10 berth for handling Liquid Cargoes	55.38	1.84
46	Mechanised Coal handling facilities at GCB in the Outer Harbour	444.1	10.18
47	Development of EQ-1 Berth	323.18	6.41
48	Upgradation of existing facility in the outer harbour and creation of new facility in the inner harbour for handling iron ore.	845.41	23
49	Single Point Mooring —Captive facility developed by H.P.C.L	643.48	8
VOC Port Trust, Tuticorin			
50	Development of 7th Berth as Container Terminal	135	5
51	Berth No.8 Container Terminal	312.32	7.2
52	Deployment of one number additional Harbour Mobile Crane at III & IV	24.6	4.36
53	Upgradation of Mechanical handling equipment in Berth No.1 to Berth No.6 and Berth No. 9	49.2	8.72
54	NTPL Captive berth — North Cargo Berth I (Captive)	43.72	6.3
55	Coal Jetty-I & II	-	6.25

Source : *Indian Port Association*

Inland Water Transport (IWT)

India has large number of inland waterways consisting of rivers, canals, backwaters, creeks, lakes, etc., which have the potential for development of efficient waterways transport network. IWT is referred to as operationally cheaper, high in fuel efficiency and environmental-friendly mode of transport. Inland Waterways Authority of India (IWAI) came into existence on 27.10.1986 for development and regulation of inland waterways for the purpose of shipping & navigation. The Authority primarily undertakes projects for development and maintenance of IWT infrastructure on National Waterways through grant received from Ministry of Shipping. This mode of transport is a potential supplement to the overburdened rail and that of congested roads and efforts are underway to develop this mode of transportation and to operationalise it.Waterways declared as National Waterways by the Act of Parliament come under the purview of Central Government, while other waterways remain under the respective State Government's domain.

The Kolkata Port, being a riverline port and strateigically connected to National Waterway No. 1 and National Waterway No.2, has huge potential in respect of movement of cargo through Inland Water Transport (IWT) mode.

National Waterways

A major boost to IWT Sector has been provided by the Government of India through enactment of National Waterways Act, 2016 (No.17 of 2016) dated 26 March, 2016 which came into force w.e.f 12 April, 2016. With the enactment of the National Waterways Act, 2016, the total number of national waterways is now 111 including 05 waterways declared through earlier Acts. These 111 National Waterways cover a total length of 20,375 km spread across 24 States in the country. National Waterways of India are well in line to become the lifeline of the country.

Development of National Waterways

National Waterway-1: Allahabad–Haldia stretch of the Ganga–Bhagirathi-Hooghly River System (Total length of 1,620 km as declared in 1986) runs in the States of Uttar Pradesh, Bihar, Jharkhand and West Bengal.

During 2020-21, Bandalling works of 4,800m in Tribeni-Rajmahal (399 km) stretch and 16,110m in Rajmahal–Chunar (801 km) stretch were executed for developing and maintaining the navigation channel (fairway). Besides, 0.38 lakh m3 dredging in Tribeni – Rajmahal stretch and 1.62 lakh m3 dredging in Rajmahal–Varanasi / Chunar stretch were carried out by deploying IWAI's dredgers apart from dredging carried out under Assured Depth Contracts.

National Waterway-2 : Dhubri–Sadiya stretch of River Brahmaputra (Total length of 891 km as declared in 1988) is in the State of Assam. Many rivers join this mighty river to form a fish bone structure. About 1,687 km stretches of tributaries of Rivers Brahmaputra and Barak have been identified in NER having potential for development as feeder route.

During the year 2019-20, in Phase-I stretch, dredging work has been completed at critical shoal locations. Land acquisition for permanent terminals at Muktyala, Harschandrapuram and Ibrahimpatnam is in progress and construction of four floating terminal too is in progress.

National Waterway-3: Kottapuram–Kollam stretch of West Coast Canal along with Udyogmandal and Champakara Canals (Total length of 205 km as declared in 1993) is in the State of Kerala. The NW-3 was extended by another 165 km towards North from Kottapuram to Kozhikode during April 2016 with declaration of National Waterway Act, 2016.

Preparation of two stage DPR for the development of extended stretch is under progress.

National Waterway-4: For development of the National Waterway-4 in Andhra Pradesh, an MoU was signed with Government of Andhra Pradesh on 14th April, 2016. A project has been sanctioned for ₹ 96.0 crore for developing the stretch between Vijayawada and Muktyala (82 km) of River Krishna in Phase–I. Dredging work was taken up at critical shoals in Vijayawada to Muktyala (82 km) stretch of River Krishna as a part of Phase – I development.

National Waterway-5: For developing 332 km stretch in 2 phases between Talcher and Paradip / Dhamra on NW-5, an MoU (Memorandum of Understanding) with Government of Odisha, Paradip Port and Dhamra Port Co. Ltd was signed by IWAI on 30.6.2014. The Phase-1 development of 212 km stretch between Pankapal and Paradip/Dhamra is already under progress. Applications for CRZ and wildlife clearance were submitted to OCZMA and views of OCZMA obtained. Monthly Longitudinal thalweg survey between Paradip/ Dharma and Pankapal is being conducted.

National Waterway-6: River Barak was declared as National Waterway-16 (NW-16) in the year 2016. It connects Silchar, Karimganj and Badarpur in Cachar valley of Assam with Haldia and Kolkata ports through Indo-Bangladesh Protocol (IBP) Route.

Development of 106 New National Waterways

National Waterways Act, 2016 (No.17 of 2016) was published in the Gazette of India Extraordinary Part II and Section I dated 26th March, 2016 (which came into effect from 12th April, 2016) along with the list of 106 new National Waterways.

Status of 106 New National Waterways

Feasibility Studies (FSs) were initiated on 106 National Waterways (NWs) by Inland Waterways Authority of India (IWAI), out of which, studies on 103 NWs have been completed. Based on the finding of FSs, 36 NWs have so far been found feasible for development. Based on the Detailed Project Reports, development work have been initiated on 8 most viable NWs.

Accordingly, a Restructuring Committee has been constituted to initiate the restructuring process on an urgent basis.

As part of the preparatory works to undertake development on 106 new National Waterways, IWAI has grouped them under 3 categories as under:

Category–I: Eight waterways which are considered to be the most viable and the following stretches have been taken up for development in Phase-I.

1. River Barak (NW-16) – Silchar to Bhanga (71 km).
2. River Gandak (NW-37) – Ganga confluence to Bagaha Bridge (250 km approx.)
3. Sunderbans (Protocol Route) Waterways (NW-97)– Namkhana to Athara Banki Khal (172 km).
4. Three NWs of Goa: would be taken up through Govt. of Goa & Mormugao Port Trust:
   i) River Cumberjua (NW-27),
   ii) River Mandovi (NW-68),
   iii) River Zuari (NW-111)
5. Alappuzha–Kottayam–Athirampuzha Canal (NW -9) - Alappuzha–Kottayam.
6. River Rupnarayan (West Bengal) (NW - 86): Approximately 34 km between Geonkhali and Kolaghat

Accordingly, consultancy assignments for preparing EPC tender documents contract and environmental studies for these waterways were undertaken in phased manner.

Category – II: Forty-six waterways which are in the coastal regions and have some tidal stretches were clubbed in Category-II. Two stage DPR studies (Stage

I – Feasibility study and based on viability and Stage

II – DPR study) for all the rivers were awarded. On evaluation of Feasibility Study reports, Consultancy services for 2nd stage study, i.e., preparation of DPRs were taken up for 26 NWs while 20 NWs were not found feasible. Out of 26 NWs, 24 DPRs were received and taken up for finalisation. DPR of NW- 53 (Kalyan – Thane – Mumbai Waterway, Vasai Creek and River Ulhas) was in the process of being finalised by Thane Municipal Corporation and preparation of DPR of River Tizu (NW-101) was initiated.

Category – III: The remaining 52 NWs which are located in remote, inaccessible and hilly regions were grouped in this category. Initially, only Feasibility Study reports for all these 52 NWs were awarded. The DPR work for River Yamuna (NW-110) and River Jhelum (NW- 49) was awarded in the year 2017-18.

Recent Initiatives

Initiatives for Growth of Traffic on National Waterways

1. Fairway Development Works: Fairway development works to ensure Least Available Depth (LAD) of 3.0 meter in Haldia-Barh, 2.5 meter in Barh-Ghazipur and 2.2 meter in Ghazipur – Varanasi stretches on NW-1 are in progress under the Jal Marg Vikas Project (JMVP) which has been undertaken by IWAI with technical and financial assistance from World Bank. Similarly, to improve the connectivity between NW-1 and NW-2/ NW-16 via the Indo-Bangladesh protocol route, the critical and shallow stretches between Sirajganj and Daikhowa on protocol Route No.1 & 2 and Ashuganj and Zakiganj on protocol Route No.3 & 4 in Bangladesh are being jointly developed by India and Bangladesh for round the year navigability (with targeted LAD of 2.5 m).

2. Operations & Management of IWAI's Terminals by Private Operators: IWAI is in the process of handing over its terminals on all NWs to private operators on PPP basis. The newly constructed Multimodal Terminals (MMTs) at Varanasi (capacity 1.26 million tonnes), Sahibganj (capacity 3.03 million tonnes) and Haldia (capacity 3.18 million tonnes) on NW-1 under JMVP are in the process of being tendered out to private operators on PPP basis for operation and maintenance. Similar exercise is in progress for IWAI's terminals at Gaighat (Patna) on National Waterway-1 and Dhubri, Pandu (Guwahati) on National Waterway-2.Subsequently, IWAI's terminals on NW-3 and NW-16 are also planned to be handed over for O&M to private players. Appointment of O&M operators will bring in necessary operations and marketing experience and contribute to increasing traffic on the IWT mode.

3. Policy for Development of Private Jetty/ Terminal:

With the growth of IWT traffic on NWs, private entities have exhibited interest to build and operate private terminals on NWs. Allowing private entities to build, operate and manage the terminals will enable rapid development of terminal network on NWs. In view of the advanta ges associated with Private Sector participation in development of terminals on NWs, IWAI has proposed to permit the Private Sector to develop their own jetties and operate them on commercial basis. Recently, IWAI has permitted RO-RO operations by private operators on NW-1 using their land on banks as landing points on temporary basis.

4. Facilitation of Cargo Transportation by the Local Community: IWT has been traditionally used by the local community for transportation of their produce and passengers. Facilitation of movement of goods on waterways and local level as part of the Arth Ganga vision will further enhance use of IWT.

5. Enhanced Regional Trade using IWT Mode – Trade between Bhutan and Bangladesh: Stone exporters from Bhutan have identified Inland waterways as an alternate mode of transportation considering the benefits a sso ciated with waterways mode, such as, lower transportation cost, larger shipment size compared to road, avoiding congestion on land routes etc.

Sagarmala

Maritime sector in India has been the backbone of the country's trade and has grown manifold over the years. To harness the potential of India's 7,517 km long coastline, 14,500 km of potentially navigable waterways and strategic locations on key international maritime trade routes, the Government of India has embarked on the ambitious Sagarmala Programme, Sagarmala which aims to promote port-led development in the country, was approved by the Union Cabinet on 25th March 2015. The vision of Sagarmala is to reduce logistics cost for both domestic and EXIM cargo with minimal infrastructure investment. Studie s und er Sa garma la have i denti i ed opportunities for reducing overall logistics costs, thereby improving the overall eficiency of the economy and increasing competitiveness of exports.

As of December, 2021, 802 projects worth ₹ 5.54 lakh crore have been identified for implementation by 2035 under the Sagarmala Programme. Out of which, 185 projects worth ₹ 94,788 crore have been completed and 211 projects worth ₹ 2.09 lakh crore are under implementation. In addition to the above, 406 projects worth ₹ 2.49 lakh crore are under various stages of development.

Under the budget head of Sagarmala, 124 projects worth ₹ 7,690 crore have been sanctioned with a contribution of ₹ 3,113 crore, funds in tune of ₹ 1,545 crore were already released by December, 2021.

In year 2021, 19 projects with total investment of ₹ 8,862 crore have been completed. Seven projects worth ₹ 6,280 crore were implemented by Central Ministries, 8 projects costing ₹ 2,543 were completed at Major ports and 4 projects amounting to ₹ 40 crore were executed by State Maritime Bo ar ds. T hree pr oje cts foc ussing on Port Modernisation, 10 projects relating to port connectivity, 1 project of SEZ at JNPT and 5 projects under the pillar of coastal shipping and IWT are at various stages of completion.

Out of all completed projects, 7 projects worth ₹ 341.52 crore have been supported financially to the tone of ₹84.86 crore under the Sagarmala scheme. Major projects completed in 2021 included widening of Korampallam bridge at VoC Port, 2nd railway line from Durgachak to Haldia Dock Complex, Coastal berth at JNPT, Mechanisation of EQ1-EQ2 and EQ3 on BOT basis at Paradip Port, Special Economic Zone (SEZ) at JNPT, RORO jetties at Bhayander, Malvan, Belapur and Narangi in Maharashtra for promotion of RORO and passenger services etc.

MAJOR PORTS

Major ports are under the jurisdiction of the Government of India and are governed by the Major Port Trust Act, 2013, except Kamarajar port (Ennore port), which is administered under the Companies Act, 2013.

There are twelve Major ports in the country, (6 on the Eastern Coast and 6 on the Western Coast) viz, Kolkata – Haldia , Paradip, Visakhapatnam, Chennai, Kamarajar (Ennore) and V.O.Chidambaranar (formerly Tuticorin) on the East Coast and Cochin (in Kochi), New Mangalore, Mormugao, Jawaharlal Nehru, Mumbai and Kandla on the West Coast. Of these, Paradip, Visakhapatnam, Chennai, New Mangalore and Mormugao ports were the five leading iron ore handling ports having mechanical ore handling system.

The Cargo traffic in terms of coastal and overseas categories at Major Ports during 2020- 21 & 2021-22 are furnished in Table 6.

Table - 6 : Traffic Handled (cargo) at Major Ports

2020-21 & 2021-22

(In million tonnes)

Sl.No.	Ports	2020-21	20221-22
1A.	Kolkata	15.9	15.3
1B.	Haldia	45.47	42.88
2	Paradip	114.55	116.13
3	Visakhapatnam	69.84	69.03
4	Ennore (Kamarajar)	25.89	38.74
5	Chennai	43.55	48.56
6	V.O. Chidambaranar (formerly Tuticorin)	31.79	34.12
7	Cochin	31.5	34.55
8	New Mangalore	36.5	39.3
9	Mormugao	21.99	18.46
10	Mumbai	53.32	59.89
11	JNPT	64.81	76
12	Deendayal (kandla)	117.57	127.1
	Total	**672.68**	**720.05**

Figures rounded off

Source: *Basic Port Statistics of India, 2021-22.*

Commodity-wise break-up of traffic handled at the Major ports in India during 2020-21 & 2021-22 is furnished in Table - 7.

Table - 7 : Commodity-wise Cargo Traffic Handled at Major Ports

(In million tonnes)

Sl.No.	Commodity	2020-21	2021-22
1	P.O.L (Crude & Products)	191.06	203.19
3	Fertilizer	10.38	7.49
4	Fertilizer Raw material	7.57	8.6
2	Iron ore	64.33	52.24
5	Coal*	102.93	123.25
6	Food grain	1.56	7.03
7	Other/cargo	294.86	318.25
	Total	672.68	720.05

Source: *Basic Port Statistics of India, 2021-22.*

** Thermal Coal & coking coal*

Cargo Handling Capacity and Cargo Handled

Cargo handling capacity at Major ports has also risen with traffic. The capacity which was placed at 871.5 million tonnes at the end of 2014- 15 has increased to a level of 1,534.9 million tonnes at the end of 2019-20 and further increased to 1,597.59 million tonnes during 2021-22.

The capacity addition and the productivity improvements achieved by the Major ports coupled with growing participation of Private Sector in cargo handling have had favourable impact on efficiency of cargo handling operations at India's Major ports. The capacity utilisation which was 66.7 % in 2014-15, reduced to 45.1% in 2021-22 The port-wise capacity and capacity utilisation for the year 2021-22 is provided in Table - 8.

Table - 8 : Major-Port-wise Capacity Utilisation during 2021-22

(In million tonnes)

Name of the Port	Capacity	Capacity Utilisation (%)
SMP Kolkata Dock System and SMP Haldia Dock Complex	92.77	62.71
Paradip	289.75	40.08
Visakhapatnam	134.18	51.45
Kamarajar	91	42.57
Chennai	135	35.97
V.O.Chidambaranar	111.46	30.61
Cochin	78.6	43.96
New Mangalore	108.96	36.06
Mormugao	63.4	29.11
J.L. Nehru	141.37	53.76
Mumbai	84	71.3
Deendayal	267.1	47.59
ALL PORTS	**1597.59**	**45.07**

PORT-WISE REVIEW OF MAJOR PORTS

Syama Prasad Mookerjee Port, Kolkata (SMPK)

SMPK is the only riverine major port in India having an existence of 150 years. It has a vast hinterland comprising the entire Eastern India including West Bengal, Bihar, Jharkhand, Uttar Pardesh, Madhya Pardesh, Assam, North East Hill States and the two landlocked neighbouring countries namely, Nepal and Bhutan. The port has twin dock systems viz. Kolkata dock System (KDS) on the eastern bank and Haldia Dock Complex (HDC) on the western bank of River Hooghly. SMP, Kolkata handled 61.368 million metric tonns (MMT) of cargo trafic during 2020-21 (3rd highest annual throughput) and 42.143 MMT during 2021-22 (up to December, 2021) vis-avis 63.983 MMT during 2019-20, registering a nominal decline of 4.09%, despite the outbreak of Pandemic COVID-19 and severe 'Amphan' cyclone unleashing in May 2020. SMPK ranked 5th in trafic handling in 2020-21, vis-a-vis other Major Ports of India. HDC handled 45.468 MMT of cargo during 2020-21 (Provisional 31.032 MMT during 2021-22 up to December, 2021) and KDS handled 15.90 MMT of cargo in 2020-21 (Provisional 11.111 MMT during 2021-22 up to December, 2021).

Notable Achievements/Developments in 2020-21

SMP, Kolkata has signed a slew of MoUs with an economic investment of around Rs 29,000 crore ahead of the Maritime India Summit 2021 in March 2021 in areas of ship repair, ship building, creation of a digital port framework, transloading operations, inland waterway services, logistics operations etc. which will lend a major boost to the whole maritime ecosystem of the hinterland. For the first time in the history of Major Ports of India, Ship-to-Ship (STS) operation of LPG was undertaken by SMPK and BPCL Limited at Sandheads on 15.10.2021. The Mother vessel YUSHAN with a parcel load of 44,551 MT cargo carried out operation with daughter vessel HAMPSHIRE and within a short span of around 17 hours a quantity of 23,051 MT of cargo was transferred to the daughter vessel. SMP, Kolkata continued its Ship-To-Ship (STS) transfer of Carbon Black Feed Stock (CBFS) for Chemical Industry on 20.12.2021 between vessel BW Tagus with 55,576 MT on board & MT PGC Companion and 27,846 MT of CBFS was offloaded within a span of 10.5 hrs. SMPK is the first Major Port to adopt ROIP System (Radio over Internet Protocol) as Effective Long Range Marine communication, covering the River Hugli estuary [with 4 base stations at Kolkata, Hugli Point, Haldia & Sagar Pilot Station] from Kolkata to Sandheads. This sustem was inaugurated on 25.10.2021. Vessels at Sandheads can now directly communicate via Radio, especially during storms and inclement weather.

Paradip Port

Paradip Port is one of the major ports in India. Government of India took over the management of the port from the State Government on 1st June, 1965, and declared Paradip Port as the eighth Major port in India on 18th April, 1966 making it the first Major port in the East Coast commissioned in independent India. Paradip Port is situated 210 nautical miles south of Kolkata and 260 nautical miles north of Visakhapatnam at Latitude 20 – 15'58.63 N and Longitude 86' – 40-27".34 E. The Port handled 114.55 MMT of traffic in 2020-21(Provisional 83.604 MMT during 2021-22 up to December, 2021). The port has Seventeen (17) berths/jetties plus Three (3) SPMs & One (1) Ro-Ro Jetty) for handling different types of cargoes with an effective Rated capacity of 302 MTPA and Desired capacity of 182.25 MTPA.

Notable Achievements during the Year

Presently port is the 2nd largest cargo handling Major Port in India. The port has been clocking over 100 MMT of cargo volume handling in a financial year since last 4 years. During 2020-21, the port handled an all-time high cargo volume of 114.55 MMT despite Covid challenges registering a cargo growth of 1.86 MMT over previous FY 2019-20. Highest number of vessels handled at the port during 2020- 21was 2051 which is 38 more than the vessels handled during 2019-20. Highest number of railway rakes handled during 2020-21 was as 14,371 compared to 13,216 rakes in 2019-2020 i.e. an increase of 8.73%. The Average Vessel Turn Round Time (TRT) reduced to 54.74 hrs during 2021-22 (up to December, 2022) from 58.10 hrs during 2020-21. The Average Pre- Berthing Delays (PBD) reduced roughly by 60% from 15.32 hrs during 2019-20 to 6.20 hrs during 2020-21. Mechanised Coal handling plant achieved highest loading output of 6,080 TPH / 1,45,921 TPD, completing 1,36,294 tonnes in 22.25 hrs in Cape size vessel Orion I. The port handled the highest ever Average Rakes per day, i.e., 51.82 Nos in February' 2021. Wherein, the Average of Incoming & Outgoing Rakes were 29.93 & 21.89 respectively. Edible oil carrying vessels with very low discharge rate were seen being handled through Mediterranean mooring pattern at the unused waterfront off FB-I berth. Thereby avoiding occupancy of other commercial berth for longer period due to slow rate of cargo operation. Despite draft challenges for handling Cape-size vessels, Baby Cape-size vessels were handled at port berths.

NEW MANGALORE PORT

New Mangalore Port was declared as the 9th Major Port on 4th May 1974 and was formally inaugurated on 11th January 1975. The Port has 16 berths and 1 SPM (Single Point Mooring) with a rated capacity of 112.51 MTPA. It handled trafic of 27.455 MMT (Provisional) during the year 2021-22 (up to December 2021). NMPT has plans for development of one more deep draft multipurpose general cargo berth (Berth No.17) adjacent to the existing Berth no. 8 for handling general break bulk cargo and Ro- Ro consignments.

Notable Achievements during the Year

Highest parcel size of 1,13,642 MT of steam coal handled at B.16 for Mangalore Coal Terminal Pvt. Ltd (JSW) was from vessel GREAT QIN which berthed on 10-5-2021. This is the highest parcel ever handled at the berths of the port surpassing the earlier record of 1,07,102 MT handled in April 2013.

During May 2021 the port handled 5 Naval vessels carrying 370 MT of Liquid Medical Oxygen in containers as donation from Kingdom of Bahrain/ Kuwait and Indian Community from Kuwait to Indian Red Cross Society under Operation Samudrasetu-II launched by Indian Navy Container vessel SSL BRAHMAPUTRA with an LOA of 260 m that called at the port on 15-6-2021 and unloaded 1,521 TEUs (25,864 tonnes) of raw cashew from Africa and loaded 300 TEUs of export containers. This is the highest parcel size of containers ever handled at the Port.

Record container traffic of 17,258 TEUS was handled in June 2021 surpassing the earlier record of 16,066 TEUs handled in March 2020. The port handled the first bulk import of Ammonium Sulphate for MCF from the vessel Majestic Maria which called at the Port on 8-8-2021 (11,000 tonnes).

The port handled new chemical cargo 2 - Ethylhexyl acrylate for IMC in vessel Ginger Hawk on 27-7-2021. Container vessel Mogral, a new CCG service commenced operation on 14-8 2021. This service will cover East Coast(Mundra-Mangalore-Cochin Colombo-Chennai-Vizag-Krishnapatnam Katupalli-Colombo-Cochin Mundra).

Cochin Port

The modern Port of Cochin was developed during the period 1920-1940 due to the untiring efforts of Sir Robert Bristow. The port of Cochin is located on the Willington Island at Latitude 9'58" North and 76'14' East on the South-West coast of India about 930 km south of Mumbai and

320 km North of Kanyakumari. With its strategic location on the South-West Coast of India and at a commanding position at the crossroads of the East-West Ocean trade, the port is a natural gateway to the vast industrial and agricultural produce markets of the South-West India. The hinterland of the Port includes the whole of Kerala State and parts of Tamil Nadu and Karnataka States. A study carried out on the traffic flow in the hinterland of the Port indicates that about 97% of the total volume of traffic is accounted for by Kerala State. Cochin with its proximity to the international sea route between Europe and the Far East and Australia can attract a large number of container lines offering immense business opportunities.

Cochin Port has 21 Berths including 1 SPM with an effective rated capacity of 73.67 MTPA. The Port handled 31.50 MMT cargo traffic during 2020-21. The cargo handled by the port includes POL, Cement, Fertilizers, Fertilizer Raw Material (Dry) and others. Cochin Port registered the total throughput of 25.24 MMT in 2021-22 (April–December, 2021), an increase of 17.99% over the same period of 2020-21. POL throughput registered 15.15 MMT, an increase of 22.47% over the corresponding period of 2020-21. Containers that led the recovery trend over the past few months reached the throughput of 5.55 lakh TEUs in 2021-22 (April–December), registering the g rowth of 16.11% over the corresponding period of 2020-21.

Notable Achievements during the Year

Kochi–Mangaluru natural Gas Pipeline was dedicated to Nation by Hon'ble Prime Minister at GAIL Terminal on 05.01.2021. Hon'ble Prime Minister of India inaugurated "Sagarika' International Cruise Terminal, Jetty for Ro-Ro vessels of IWAI & foundation stone was laid for reconstruction of South Coal Berth (SCB) at Wellington Island on 14.02.2021.

Jawaharlal Nehru Port

Constructed in the mid 1980s and commissioned on 26th May, 1989, Jawaharlal Nehru Port has come a long way by becoming a world-class international container handling port. It is situated in between 18 56'43" North and 72 56'24" East along the eastern shore of Mumbai harbour off Elephanta Island. Jawaharlal Nehru Port is an all-weather tidal Port having 16 berths with an effective rated capacity of 118.00 MTPA.

The Port handled a Traffic of 56.07 MMT during 2021 -22 (up to December- 2021) of which containerised cargo account for 51.01 MMT which is 90.98% of the total traffic. The port has 5 fully automated Container Terminals with a total container handling capacity of 7.7 Million TEUs, a Liquid Terminal of 7.2 MMT capacity and a shallow water berth having capacity of 4.5 MMT for handling container, break bulk, dry bulk and liquid cargo. Four of the Container Terminals are operating in PPP format in partnership with major global terminal operators, namely, DP World (2 terminals), AP Moler Terminals (APM terminals), and Port of Singapore Authority (PSA). A new Container Terminal, Bharat Mumbai Container Terminal Pvt. Ltd. (BMCTPL), SPV of Port of Singapore (PSA) with a total capacity of 60 MMT (4.8 million TEUs) was commissioned for operations under Phase -1 (2.4 million TEUS) on 18th February 2018. Phase-II (2.4 million TEUs) is expected to start in 2025.

Notable Achievements during the Year

During the calendar year 2021(Jan.–Dec., 2021), JN Port handled total traffic of 76.14 MMT (22.17% growth) and container traffic of 5.63 million TEUs (25.86% growth), highest ever traffic handled in a year since inception of the port. Nhava Sheva International Gateway Terminal (NSIGT) and the newly commissioned BMCT for the first time crossed 1 million TEUs mark in a year (12 months period). NSIGT handled 1.17 Million TEUs (11,66,019) and BMCT handled 1.17 Million TEUs (11,70,502) during the calendar year of 2021. In order to give momentum to coastal shipping, JNPT has constructed the 250 m long Coastal Berth with backup area reclamation of 11 hectares.

JN Port commenced the handling of dwarf containers from September, 2021. The first lot of 20 laden Dwarf containers with import cargo transfer from ISO container handled in the Dwarf Container Depot was moved by train to ICD Kanpur which was virtually inaugurated by Hon'ble Union Minister of Ports, Shipping, Waterways & Ayush. The cargo moved in the first lot of 20 dwarf containers consisted of PVC Resin suspension (Grade TC1000) imported from Japan by M/s Supreme Industries.

Mumbai Port

Mumbai Port is the second oldest Major Port in India after Kolkata. The port has long been the principal gateway of India. Strategic location is one factor in its special favour. It lies midway along the West Coast of India and is gifted with a natural deep-water harbour of 400 sq. km protected by mainland of Konkan on its east and island of Mumbai on its west. The deep waters in the harbour provide secure and ample shelter for shipping throughout the year.

Originally a general cargo port, today Mumbai Port is multi-purpose port handling all types of cargo viz break bulk, dry bulk, liquid bulk and containers. The port has extensive wet and dry dock accommodation to meet the normal needs of ships using the port. The port provides services/ facilities from pilotage to berthing, storage to delivery of cargo and ancillary services of running Container Freight Station (CFS), Port Railways as also maintenance of crafts, equipment and building. The port has 32 berths (including OCT) with an effective rated capacity of 82.85 MTPA. The port handled traffic of 44.32 MMT during 2021-22 (up to December, 2021). The major cargo commodity handled is POL (61.32% of the total traffic).

Notable Achievements during the Year

Financial Year 2020-21, was the year of the "COVID-19"— the pandemic affected the entire EXIM trade globally. Despite the pandemic, Mumbai Port Trust acquitted itself creditably by handling 53.32 MMT cargo.

During the lock down, in spite of non- availability of sufficient staff, Mumbai Port continued to handle a large range of cargo, such as, steel, sugar, pulses, fertilizers, cement, calcite chips, lube/base oil, bitumen, motor vehicles, crude oil, POL products and chemicals at its berths in Indira Dock, Marine Oil Terminal–Jawahar Dweep, Chemical Terminal – Pir Pau and Mid- stream. The cargo operation in the docks was carried out, despite bare minimum labour due to lockdown necessiated on account of COVID-19 and by hiring private labour by arranging bus services for essential staff.

Mumbai Port achieved the rare feat of simultaneous sign-off of 912 crew from the Cruise Ship "Anthem of Seas" and sign-on of equal number on another Cruise Ship "Celebrity Infinity" in a single day on 16th June 2020 with advance planning of the Port, various Government authorities and the Shipping Agents.

At Jawahar Dweep Oil Terminal, there are 4 existing berths. For handling large crude oil vessels, the project of constructing new berth, Jawahar Dweep-5 (JD-5), was taken up and completed in December 2020. First vessel "Ice Transporter" berthed on 30.1.2021. A total of 27 tankers were handled till 31st March 2021. The vessel "Barbarosa" which berthed on 29th March 2021 with the largest parcel size of 1,42,236 tonnes of Crude Oil was discharged in just 35 hours. At 8th International Samudra Manthan Awards 2021, held on 16.12.2021, Mumbai Port was awarded Terminal of the year (Non- speciic) for its Car Terminal.

Kamarajar Port Limited (Ennore)

Kamarajar Port Limited (KPL), the 12th Major Port under the Ministry was commissioned in 2001, primarily as a Coal Port dedicated to handling Thermal Coal requirements of Tamil Nadu Electricity Board (TNEB). KPL has the distinction of being the only corporate port amongst the Major Ports administered by the Central Government. The Port is functioning on landlord model with cargo handling operations either through BOT or captive models. As a part of disinvestment process, the entire Government of India shares have been transferred to Chennai Port Trust on 27.03.2020. KPL has become a subsidiary of Chennai Port Trust. Over the years, the port, which was primarily handling coal at initial stage, has developed as a multi cargo port and now has seven berths with handling capacity of 54.44 MTPA for handling coal, POL, LPG, LNG, automobile units, Containers and general cargoes. The Port handled traffic of 27.995 MMT during 2020-21 (up to December).

Notable Achievements during the Year

KPL handled the largest Cape size Coal vessel at Common User Coal Terminal operated by M/s Ennore Coal Terminal Pvt. Ltd on 12.06.2021. The Vessel Emperor Pampero having a parcel size of 1,37,989 MT of Steam Coal imported from Australia for M/s OPG Power Generation Pvt. Ltd docked at the port. The highest DWT 1,82,567 MT vessel with a draft of 15 m and the length & beam of 292 m & 45m respectively and the above parcel size ever was handled at this terminal. The Mobile X-Ray Container Scanner system installed at Kamarajar Port was commissioned on 01.07.2021. The Mobile X-Ray Container Scanner system is operated by the Container Scanner division of Chennai Customs. The Principal Commissioner of Customs, Chennai-III, has issued a Public Notice No. 43/2021-22 dated 30.06.2021 regarding the commencement of regular operations of Mobile X-Ray Container Scanner (MXCS) system at Kamarajar Port with effect from 30.06.2021.

The office of the Director General of Foreign Trade (DGFT) vide its Public Notice No. 15/2015-2020 dated 20.07.2021 has issued a notification enlisting Kamarajar Port as the 18th Port for import of un- shredded metallic scrap consequent to the installation and operationalization of Mobile X-Ray Container Scanner system and Radiation Portal Monitors.

Container Shipping Line, M/s. Maersk Line India, operating at Kamarajar Port has upgraded their existing Container weekly services viz. (i) Shuttle service to ME7 service (directly connecting to Europe) and (ii) Chennai Express service to FI4 service (connecting Southeast Asia with India and Pakistan) with effect from 03.08.2021 and 13.08.2021 respectively. Kamarajar Port handled the highest Container volume of 4,958 TEU's in the vessel Santa Rita berthed at Container Terminal on 24.08.2021.

Kamarajar Port handled the largest Gypsum vessel at Multi Cargo Terminal operated by M/s. Ennore Bulk Terminal Pvt. Ltd on 02.09.2021. The Vessel Birte Oldendorff (DWT 1,13,921 MT, length 250M and beam 43M) with parcel size of 1,05,215 MT of Gypsum imported from Oman for M/s Saint Gobain India Pvt Ltd and M/s Eastern Bulk Trading & Shipping Pvt Ltd arrived with a draft of 14.50 M. Kamarajar Port handled the highest Container volume of 46,513 TEUs in December 2021. Kamarajar Port has awarded the work for Construction of Automobile Export/ Import Terminal-II to M/s L&T Geostructure Pvt. Ltd., Chennai on 12.11.2021 for an amount of ₹ 149.36 crore. (excl. GST).

Chennai Port

Chennai Port is an all weather artificial harbour with one Outer Harbour and one Inner Harbour with a wet Dock and a Boat Basin with round the clock navigation facilities. The Port was established in 1875 located at 130 06' N latitude and 800 18' E-longitudes on the Bay of Bengal.

Chennai Port handled a cargo tonnage of 43.55 MMT during 2020-21. During 2021-22 tonnage handled upto December 2021 was 35.62 MMT which comprised 21.80 MMT of Import and 13.82 MMT of Exports. During 2020-21, 13,86,926 TEUs of containers were handled, whereas in the previous year 13,83,971 TEUs were handled. During the current year 2021-22 12,06,956 TEUs with a cargo of 2,32,94,251 tonnes have been handled up to December 2021.

Notable Achievements during the Year

The Second Very Large Crude Carrier (VLCC) on account of Chennai Petroleum Corporation Ltd, M.T. Bright Pioneer with a length of 333 M, Beam of 60 M and DWT of 3,00,000 MT was berthed at Bharathi Dock III on 09.04.2021 for discharge of Crude Oil. It may be noted that the Chennai Port was the 1st Major Port in India to berth a VLCC vessel at alongside berth, when it berthed M.T. New Diamond on 31.08.2018.

Chennai Port recorded landmark single day performance of overall cargo handling of 3,12,549 tonnes on 30.04.2021 surpassing the previous record of 2,92,745 tonnes on 17.11.2008. Container Vessel CMA CGM BERLIOZ berthed at Chennai Port's second container Terminal M/s Chennai International Terminal Pvt. Ltd, on 19.05.2021 recorded landmark performance by handling Containers of 8819 TEUS comprising Import of 4645 TEUs and Export of 4174 TEUs and sailed on 22.05.2021. The above noteworthy achievement surpassing the previous record of 8397 TEUs per vessel of APL ENGLAND on 08.12.2020. Chennai Port recorded handling of 9,283 TEUs in a single day on 23.07.2021 surpassing the previous record handling of 9,064 TEUs on 30.04.2021. On 11th December 2021, Chennai Port created a new record by loading 38,079 tonnes of Barytes on a single day at JD 4 from the vessel RB EDEN surpassing the earlier record of 35,671 tonnes of barytes at JD 4 from the Vessel FYLA on 04.10.2021.

Mormugao Port

Mormugao Port, situated on the west coast of India, is more than 135 years old port. It has modern infrastructure capable of handling a wide variety of cargo. I t is a natural harbour protected by a breakwater and also by a mole. The Port has an approach channel of depth 14.4 m. The existing rail and road connectivity provides seamless logistic network to the rest of the Country. There is a modern Vessel Trafic Management System installed for providing reliable modern services. The existing VTMS system is being replaced with new System. The Mormugao Port has 3 Non-cargo berths and 7 Cargo berths, in addition 3 Mooring Dolphins for handling cargoes. The effective rated capacity of the port is 62.50 MTPA. There is a dedicated cruise berth of 450 m length alongside of Breakwater for Cruise vessels and for use of Navy and Coast Guard. The port handled traffic of 13.42 MMT during 2021-22 (up to December, 2021). The project relating to Redevelopment of Berth no. 9 and three Jetties for handling of dry bulk cargo with mechanised system on PPP basis is in process.

Notable Achievements during the Year

The Hon'ble Union Minister, of Ports, Shipping and Waterways (MoPSW) along with Hon'ble Union Minister of State for Ports, Shipping & Waterways and Tourism, visited Mormugao Port on 11th December, 2021 and in the presence Chairman - MPT and Dy. Chairman – MPT inaugurated The "River Cruise Services", operated by M/s. Vijai Marine Services Pvt. Ltd at Mormugao Port, which is first of its find in South Goa. In order to contain dust pollution due to handling of dusty cargo, the Port has commissioned 2 Automatic Truck Wheel Washing units at a cost of ₹ 38,56,761/-. This initiative is expected curb the air pollution caused due to continuous movement of trucks.

V.O. Chidambaranar Port

V. O. Chidambaranar Port, the 10th Major Port of India is situated 540 km South West of Chennai. As a gateway Port with 15 berths, drafts ranging from 8.60 metres to 14.20 metres is equipped to handle a wide spectrum of Container, Dry, Liquid and Break bulk cargoes.

Aided by the state-of-the-art infrastructure, dedicated terminal operators, Port user community and efficient human resource, the Port which is in close proximity to the Mainline sea route and excellent rail & road connectivity has been the harbinger of socio-economic development of the southern Tamil Nadu region.

V.O. Chidambaranar Port is located strategically close to the East-West International sea routes on the South Eastern coast of India at latitude 80 45'N and longitude 780 13'E located in the Gulf of Mannar, with Sri Lanka on the South-East and the large land mass of India on the West. The Port is well sheltered from the fury of storms and cyclonic winds and is operational round the clock all through the year. The Port has 15 berths with an effective rated and re-rated capacity of 95.00 MMTPA and 69.30 MMTPA. It handled traffic of 26.06 MT during the year 2021-22 (up to December, 2021).

Notable achievements of the Year

On 14.05.2021, V.O. Chidambaranar Port created a new record for handling a coal vessel with highest parcel size. The Panama lagged vessel 'MV BASTIONS' arrived from the Port of Muara Berau, Indonesia, with 92,935 tonnes of Coal consigned for Tamil Nadu Newsprint and Papers Ltd, bettering the previous handling of highest parcel size for vessel 'MV Star Sirius', with 92,028 tonnes of Coal handled at the Port on 11.04.2021.

On 10.06.2021, the Port handled a single export consignment of 24 windmill blades of length 77.50 metres, the longest of its kind handled through VOC Port. The vessel PAC ALCOR with length overall (LOA) of 199.9 metres, was berthed at the Port on 10.06.2021 and the loading of the 77.50 metres long wind blades were carried out diligently, using Ship's Hydraulic cranes and Harbour Mobile Cranes of the Port. The Windmill blades were safely transported using specialised wind blade and tower transportation flat bed trucks all the way from Sriperumbudur to Thoothukudi. The long wind blades were stacked three high, conforming to the safety standards and the vessel sailed from the Port on 13th June 2021 for the Port of Aransas, USA.

On 29.08.2021, the Port created a new record for handling a vessel with highest parcel size of 93,719 tonnes (Limestone), bettering the previous record for handling the vessel with highest parcel size of 92,935 tonnes (Coal) by the vessel Bastions on 14.05.2021.

On 04.12.2021, V.O. Chidambaranar Port contributed

₹ 18.00 Lakhs to the District Administration, as a Corporate Social Responsibility (CSR) initiative, for procurement of high power pumps. The high power pumps are generally used to expedite dewatering of waterlogged areas of Thoothukudi city and other areas on a war footing basis to restore normalcy during flood situation. The Chairman, V.O. Chidambaranar Port, handed over the Cheque for ₹ 18 Lakhs to the District Collector, Thoothukudi District, in the presence of Deputy Chairman, VOC Port at the Port's Administrative Office.

Deendayal Port (Kandla)

Deendayal Port (erstwhile Kandla Port) was established in the year 1950 as a Central Government Project. The Union Government took over Kandla for its development as a Major Port. Kandla Port has 34 berths including SPM, Oil Jetties and Dry Cargo with an optimum rated capacity of 261.10 MTPA. The Port handled 96.51 MMT of traffic during 2021-22 (up to December 2021). The Cargo handled comprised POL, Iron Ore, Fertilizers, Coal (Thermal/ coking) etc.

Notable Achievements during the Year

The port its retains Numero Uno position and handled 117.57 MMT cargo during 2020-21. The port won the "India Maritime Award" under "Best Major Port of the Year Award (Non-Containerised) category" organised by Daily Shipping Times. On 07th July' 2021, the Union Minister virtually inaugurated and Oxygen Plant, set up by the port at Rambaug Hospital, Adipur. Oxygen Generator Plant of capacity 2000 LPM, at Sir T. Hospital Bhavnagar, got Inaugurated on 12th July' 2021 by the Hon'ble Union Minister for Health & Family Welfare, Chemicals & Fertilizer. The Hon'ble Union Minister for P, S & W and AYUSH, also joined the inaugural function conducted virtually.

On 11th August 2021, the Quality Mark Award (10th Edition) was organised at Ahmedabad, where Deendayal Port, the No. 1 Major Port of India has been recognised and honoured as "Pioneer Industry in Maritime Services" for its outstanding cargo handling of 117.57 MMT during the Year 2020-21. The union Minister of State (IC) for Ports, Shipping & Waterways virtually inaugurated a Medical Oxygen Generator unit with Medical oxygen copper piping network & Fire-fighting system and automatic oxygen source changeover system through oxygen cylinder bank at Deendayal Port hospital, Gopalpuri virtually on 2nd June 2021.

Visakhapatnam Port

The Port of Visakhapatnam, located almost midway between Kolkata and Chennai on the East Coast of India at latitude 17041' and longitude 83017' was opened to ocean traffic on 7th October, 1933 and has been serving a vast hinterland since then. Capacity of the Port as on 31.12.2021 is 126.89 MMT. The Port has a total of 27 berths and one SPM for cargo handling. The inner harbour has 21 berths and the outer harbour has 6 berths and one SPM. The inner harbour can accommodate fully laden Panamax vessels of draft up to 14.5 meters and the outer harbour can accommodate vessels of 2,00,000 DWT with a draft up to 18.10 meters. Port of Visakhapatnam has the distinction of possessing Supercape handling facility and the deepest Container terminal among Major Ports of India. The Port handled 50.91 MMT of traffic during 2021-22 (up to December 2021).

Notable Achievements during the Year

MoU was signed during the month of May 2021 with M/s HPCL (exclusive Capital user) for up- gradation of Fire Fighting system at OSTT berth as deposit work by the port for HPCL at a cost of ₹ 37.00 crore was undertaken. On 26th June, 2021 the Hon'ble Vice-President of India visited Visakhapatnam Port and reviewed the Port activities by having an interaction session with Chairman and other oficials. The Hon'ble Vice-President of India appreciated the effort undertaken in running the entire port activities with Solar Energy, 24 hour automated payment gateway with auto receipt and status report made available for trade and all port users.

Parliamentary Standing Committee on 'Empowerment of Women' led by the Chairperson along with other Parliamentarians visited the port on 17.9.2021. The Committee reviewed the CSR activities undertaken in connection with Women Empowerment in the port. The Hon'ble Minister of State for Ports, Shipping & Waterways visited the port on 23.9.2021. The Hon'ble Minister inaugurate the "Grade Separator from H-7 to Convent Junction" and laid Foundation stone for "Development of Cruise Terminal". A supplementary agreement was reached on 29th October 2021 between M/s VGCBPL and the port to utilise the facility for other compatible cargoes by port when the VGCBPL berth is free from handling operations under the main agreement. Vessels up to 43 m beam and LOA 260 m were handled in Inner harbour (Northern arm) during day light and calm weather conditions on trial basis from 11.11.2021. The upgraded Visakhapatnam–Kirandul train, Linke Hofmann Busch and vista dome coaches were flagged off on 22.11.2021 by the Honble vice President of India 21.11.2021 to 24.11.2021.

SHIPPING

Shipping plays an important role in the economic development of the country, especially in India's international trade. The Indian Shipping Industry also plays an important role in the energy security of the country as energy resources, such as, coal, crude oil and natural gas are mainly transported by ships. Further, during a crisis situation, Indian shipping contributes to ensure uninterrupted supply of essentials and serves as the second line of defense. The salient features of India's shipping policy are the promotion of national shipping to increase self- reliance in the carriage of country's overseas trade and protection of stakeholder's interest in EXIM trade. India's national flagships provide an essential means of transport for crude oil and petroleum product imports. The national shipping also contributes to the foreign exchange earnings of the country. India has been a founder member of the International Maritime Organisation (IMO), a specialised agency set up under the United Nations, primarily dealing with the technical aspects of shipping relating to Maritime Safety, Protection of Marine Environment, Standards of Training and related legal matters. India has been participating in various meetings of the IMO Committees, Sub- committees, Council and Assembly and has actively contributed towards the development of various Conventions, Protocols, Codes and Guidelines developed by the IMO.

To promote Indian tonnage and to save precious foreign exchange, the Cabinet on December 10, 1957 had decided that in all negotiations for large contracts involving shipping arrangements by Central Government Departments, State Government Departments and Public Sector Undertakings (PSUs) under them, the Department of Transport would invariably be consulted and all such import contracts were to be finalised on FOB/FAS (Free on Board/ Free Alongside Ship) basis and those for exports on C& F/ CIF (Cost and Freight/ Cost, Insurance and Freight) basis and in case of departure from the norm, prior permission was required to be obtained from Department of Transport on a case-to-case basis. In the changed context of economic liberalisation and new thrust on competitiveness and performance improvement of PSUs, the Government on November 15, 2001 decided that while the existing policy for placing import contracts on FOB/FAS basis will continue, the policy was relaxed in the case of exports. Government Departments/ PSUs were permitted to finalise export contracts on FOB/FAS basis without seeking prior clearance from the Ministry. The emerging sectors, where there is a potential for enhancing trade (exports and imports), need to be focused upon and ways to open up sea routes on these sectors need to be considered. Some examples are the International North- South Transport Corridor (INSTC) route, which would considerably shorten the distance from India to Commonwealth of Independent States (CIS) through Iranian ports; the routes to Southeast Asian countries, which still have the scope for development, like Thailand, Vietnam etc., akin to the sea routes which were opened up for Bangladesh and Myanmar (as part of Act East Policy of the Government). Over the years, India's overseas trade expanded considerably both in terms of composition and direction due to the policy of export promotion pursued by the Government. At the same time, efforts were made to provide and improve the trade related infrastructure, especially transport, to facilitate the movement of traffic more efficiently. So far as the movement of traffic by ships to overseas destinations was concerned, both Indian as well as foreign flag ships operating consortium liner shipping services have been providing the services either directly or through transshipment arrangements for the general cargo in break-bulk or containerised form. Similarly, for bulk cargo moving either as imports or exports, the services of transships, both Indian and foreign, usually engaged on chartering basis, are available to all the destinations. Improvement index port related infrastructure has been a consistent endeavour to promote exports. Inadequacies in seamless transport through road, rail, ports and airports are obstacles faced in the infrastructure development for promoting exports. However, it is a fact that in the Transport Sector, most of the funding in our country has been towards the railways, road and highways sectors. While the importance of roads and railways in the economy is undeniable, there is also a greater need to encourage the Maritime Sector to enable it to achieve its full potential. Thus, there is a strong case for supportingwaterway transportation.

NON-MAJOR PORTS

There are 217 non-major ports situated along the peninsula coastline and sea-islands. These ports are located in Gujarat (48), Maharashtra (48), Goa (5), Daman & Diu (2), Karnataka (13), Kerala (17), Lakshadweep (10), Tamil Nadu (17), Puducherry (3), Andhra Pradesh (15), Odisha (14), West Bengal (1) and Andaman & Nicobar Islands (24). Out of these 217 Non-major ports, only some ports are well developed and provide all-weather berthing facilities for cargo handling. In 2021-22, 66 Non-major Ports were reported to have handled cargo traffic. Recognising the importance of Non-major ports, maritime States have launched initiatives for their development, through the participation of Private Sector. This has led to significant growth in the cargo traffic handled by the Non-major ports in the past few years. Non-major ports in India collectively handled 603.75 million tonnes of traffic during the year 2021-22 as compared to 577.30 million tonnes of cargo handled in 2020-21. The cargo handled at Indian ports reflects a growth of 4.6% in 2021-22 as compared to decline of 6.1% growth registered in 2020-21. At a disaggregated level, the overseas cargo traffic increased by 3.0% in 2021-22 compared to decline of 4.7% recorded in 2020-21. Coastal cargo traffic increased by 15.6% in 2021-22 as compared to a decline of 14.1 % in 2020-21. Container and Other commodity (37.6%) was the largest commodity handled at Non-major ports in 2021-22 followed by POL & Products (27.0%), Coal (24.0%), Iron ore (7.0%), Fertilizer & FRM (2.3%) and Building Material (2.1%). Commodity composition of traffic handled by Non-major ports during the year 2020-21 and 2021-22 is furnished in Table-9

Table 9: Traffic Handled at Non-major Ports

2020-21 and 2021-22

Commodity	2020-21	2021-22
POL & its Products	157.63	163.05
Iron Ore	42.99	42.46
Building Material	13.89	12.7
Coal*	153.84	144.92
Fertiliser & FRM	13.41	13.88
Others	195.55	226.75
Total	577.3	603.75

Source: *Basic Port Statistics 2021-22*

**Thermal Coal & Coking Coal*

MARITIME STATES – NON-MAJOR PORTS

Maritime State-wise traffic handled at Non-major ports in the recent years is reflected in Table 10.

Table 10 : State-wise Traffic Handled by Non-Major Ports

(In Million Tonnes)

State	2019-20	2020-21	2021-22
Gujarat	411.79	387.57	405.39
Maharashtra	43.66	39.84	52.47
Andhra Pradesh	99.91	89.64	87.98
Tamil Nadu	11.37	7.41	7.84
Karnataka	0.94	0.79	0.79
Odisha	35.27	43.03	41.54
Others	12.12	9.03	7.73
Total	615.05	577.3	603.75

Source:- *Basic Port Statistics 2021-22*

Others includes Kerala, Andaman & Nicobar Islands, Puducherry, Goa & Lakshadweep.

Gujarat

Gujarat is a principal maritime State with a natural coastline of about 1,215 km. (16% of India's total coastline). The State has 48 Non-major ports which are under the jurisdiction of Gujarat Maritime Board (GMB) since April, 1982. Out of 48 Non-major ports, traffic is handled at 17 Non-major ports. The remaining 31 Non-major ports are used for fishing activities and have negligible traffic. Gujarat has the advantage of a vast hinterland covering the Northern and Central Indian States and as a result, there is high demand for the services offered by the Non- major ports in Gujarat. The participation of the Private Sector has been a significant contributing factor in the development of Non-major ports in Gujarat. The total cargo traffic handled at the Non-major ports of Gujarat during 2021-22 was of the order of 405.39 million tonnes as against 387.57 million tonnes in 2020-21, reflecting an increase of 4.6% in 2021-22 as compared to decline of 5.9% in 2020-21. Non-major ports of Gujarat account for around 67.1% of the total cargo handled by Non-major ports in India during 2021-22. Overseas traffic in 2021-22 was 359.88 million tonnes with the remaining 45.51 million tonnes being coastal traffic. GAPL port handled the highest cargo tonnage of 144.21 million tonnes (35.6%) of the total cargo handled by Non-major ports in Gujarat in 2021-22. Main commodities handled by GAPL port is Container cargo that contributes to 61.8 % of the traffic handled at the port. Sikka Port handled the cargo tonnage of 127.98 million tonnes in 2021- 22 as compared to 121.42 million tonnes handled in 2020-21. This port accounted for 31.6% of the total cargo handled by the Non-major ports in Gujarat in 2021-22, and has witnessed increase in the cargo traffic ever since the commissioning of Gujarat Adani Port Ltd facility. Main commodities handled by GAPL port are Container, Coal and POL & its products. Magdalla Port handled 32.47 million tonnes of cargo in 2021-22 with a share of 8.0% in total traffic. Major commodities handled by the port is 'POL & its products'. Dahej port accounted for 31.68 million tonnes (7.8%) of the cargo traffic in 2021-22. Major commodities handled by the port are coal & iron ore. The important ports which sho wed increase in the cargo handled during 2021-22 were Sikka, Magdalla, Mul-Dwarka, GAPL, Dahej Pipavav while Jafarabad and Bedi recorded decline for 2021-22 as compared to 2020-21. POL & products and Other Commodities accounted for 39.6% of the total cargo handled in 2021-22. This was followed by Coal (13.0%), Iron Ore (3.9%), Building Material (2.0%) and Fertilizer & FRM (1.9%).

Andhra Pradesh

Andhra Pradesh is another important maritime State with a coastline of around 975 m. There are 15 Non-major ports in

Andhra Pradesh, of these, 4 ports normally handled cargo traffic and these are: Rawa, Kakinada Anchorage/Kakinada Deep Water Port, Gangavaram and Krishnapatnam. The State share in the total traffic handled by all Non-major ports in the country during 2021-22 was 14.6%. Non-major ports in Andhra Pradesh collectively handled 87.98 million tonnes of cargo during 2021-22 as compared to 89.64 million tonnes in 2020-21, registering a decline of 1.8% in traffic. The overseas traffic during 2021-22 was 75.15 million tonnes (85.4%) of the total cargo traffic in Non-major ports of Andhra Pradesh and coastal traffic was of the order of 12.84 million tonnes (114.6%) of total cargo traffic. Krishnapatanam handled the highest cargo 14.12 million tonnes (45.6%) followed by Gangavaram (34.1%), Kakinada Deep Water (16%), Kakinada Anchorage (3.3%) and Rawa port (1.0%). Commodity-wise analysis of the total cargo handled by the Non-major ports in Andhra Pradesh indicates that Coal (52.1%), Other Cargo (34.4%), Fertiliser & FRM (5.5%) Iron ore (5.0%) , POL & Product (1.6%) and Building material (1.4%) were the principal items of cargo handled during 2021-22 by the Non-major ports of Andhra Pradesh

Maharashtra

Maharashtra has a coastline of around 653 km with 48 notified Non-major ports. Out of these only 16 ports handled cargo traffic during 2021-22. The total cargo traffic handled at the Non-major ports of Maharashtra during 2021-22 was 52.47 million tonnes as compared to 39.84 million tonnes in 2020-21. This shows increase of 31.7%. Out of 52.47 million tonnes of total cargo handled by Non-major ports in Maharashtra, Overseas traffic increased by 21.0% to 25.44 million tonnes in 2021-22 from 21.02 million tonnes in 2020-21 while Coastal traffic-increased by 44% to 27.03 million tonnes in 2021-22 from 18.82 million tonnes in 2020-21. Dharamtar is the leading Non-major port of Maharashtra with traffic of 20.18 million tonnes accounting for 38.5% of total traffic at Non-major ports handled in the State. Commodity- wise break-up of the cargo handled by the Non-major ports of Maharashtra indicates that Coal traffic of 22.76 million tonnes constituted 43.4% of the total cargo handled in 2021-22 followed by Iron ore (29.1%), Other commodities (22.3%), Building Material (5.0%) and POL & Products (0.3%).

Goa

Goa has a coastline of about 118 km. There are 5 Non–major ports in Goa. Out of this only one port, Panaji normally handles cargo traffic. Panaji port handled cargo traffic of 0.03 million tonnes during 2021-22 as compared with 0.04 million tonnes handled in the previous year . Iron ore and Coal have been the principal commodity handled at the port, but due to ban on mining of iron ore, the cargo traffic at minor port of Goa had declined drastically after 2011-12. The Coal handled decreased from 0.41 million tonnes in 2014-15 to 0.002 million tonnes during 2021-22.

Karnataka

Karnataka has a coastline of around 280 km with 13 Non-major ports. Out of these, only 2 ports normally handled cargo traffic during 2020-21. Non-major ports in the State handled 0.79 million tonnes of cargo traffic during 2021-22 as compared to 0.79 million tonnes in 2020-21 reflecting same level of cargo handled in both the years. The contribution of the Karwar Port was 0.73 million tonnes cargo which constitutes 92.9% of total cargo handled by Non-major ports in Kanrnatka in 2021-22.

Tamil Nadu

Tamil Nadu has a coastline of around 906 km. The State has 17 Non-major ports, out of which only 6 ports handled cargo traffic. During 2021-22 the non- major ports in Tamil Nadu collectively handled 7.84 million tonnes of cargo traffic as compared to 7.41 million tonnes in the previous year. Kattupalli port handled the maximum traffic of 7.44 million tonnes during 2021-22 accounting for 94.9% followed by Cuddalore port (0.30 million tonnes) accounting for 3.9% and Other Ports (0.1 million tonnes) accounted for 1.2% of the total traffic handled by all the Non major ports in the State. The commodity-wise breakup of traffic handled at Non-major ports in Tamil Nadu indicates that Other Commodities constitute to be the major item of cargo handled (96.1%) followed by POL & Products (0.31 million tonnes) with a share of 4.0% of the traffic.

Odisha

Odisha has a coastline of 480 kms. from Andhra Pradesh border in Ganjam District to West Bengal border in Balasore District. It is endowed with conducive, unique, natural and strategic port locations. The Government of Odisha identified 14 potential sites for development of Minor Ports. To facilitate developers for development of Minor Ports, Government of Odisha framed the Port Policy during the year 2004. The advantages for development of sea ports in Odisha includes availability of a vast hinterland generating cargo, comprising of other developing Eastern and Central Indian States, mineral- rich hinterland which offers long-term potential for cargo which need seaport facility in Odisha. The State has 14 Non-major ports, out of which only 2 ports handled cargo traffic. During 2021-22, the Non-major ports in Odisha collectively handled 41.54 million tonnes of cargo traffic as compared to 43.03 million tonnes in the previous year showing an decrease of 3.5%. The commodity-wise breakup of traffic handled at Non-major ports in Odisha indicate that Coal constitute the major item of cargo handled (19.57 million tonnes) with a share of 47.1% followed by Other commodity (35.2%) Iron ore (16.6%) and Fertiliser and FRM Dry (1.1%).

FUTURE OUTLOOK

The Logistics Sector is the backbone of any economy. Even at times of weak economic sentiments, the Industry will continue to witness growth. India is currently the prime logistics service provider globally. Besides other modes of transportation, maritime logistics is one sector that can grow tremendously unless it is fully explored.

Apart from this, India Maritime Sector is considered significant as it is strategically located on the world's shipping routes, having longest coastline of about 7,517 km. With 12 Major and 200+ Non-major ports, along with a vast network of navigable waterways, the scope of increasing the trade volume is enormous.

The Major Ports in India have been witnessing sustained growth in the last few years, due to the novel & progressive pathways pursued by Ministry of Shipping. Major fillip to the Port Sector by way of introducing vital and long overdue futuristic Port- led development programmes including Sagarmala has been emplaced. The Ministry has intended on upgrading and developing the Major Ports of India on par with the International Ports.

India's port facilities are in for a major overhaul as development of ports and augmentation of cnapacities and significant for economic vibrancy and growth.

7. Mineral-based Industries

000
million tonnes, Targeted domestic steel production by 2030

000
million tonnes, Production of aluminium in 2021-22

00
million tonnes, Production of copper ore in 2021-22

Minerals are vital raw materials for many basic industries and are major components for growth and industrial development. The management of mineral resources, hence, has to be closely integrated with the overall strategy for development and exploitation of minerals, alligning with the long-term national goals. In tune with the Economic Liberalisation Policy adopted in July 1991 , the National Mineral P olicy announced in March 1993 has opened the Mineral Sector for private entrepreneurs, both domestic and for e ign. The changing global scenario necessitated revision in the National Mineral Policy which led to notifying of National Mineral Policy 2019, with an objective to have more effective, meaningful and implementable policy that which ensures transparency, better regulation and enforcement, balanced social and economic growth as well as sustainable mining practices.

The National Mineral Exploration Policy (NMEP) approved by Government of India in June, 2016, aims at accelerating the exploration activity in the country through enhanced participation of the Private Sector and these policy initiatives are expected to bring about a turnaround to the entire Mineral Sector across the country.

Capacity and production of important mineral-based products are detailed in Table-1.

Table – 1 : Capacity and Production of Important Mineral-based Products, 2020-21 to 2021-22

Mineral-based product	Unit of quantity	Annual Installed capacity	Production	
			2020-21	2021-22 (P)
Ferrous Metals				
Sponge iron	million tonnes	49.273	34.376	39.20
Crude/liquid steel	"	154.062	103.545	120.293
Ferroalloys				
Ferrochrome/Chargechrome	'000 tonnes	1690*	868	1113
Ferromanganese	"	3160$	NA	NA
Silicomanganese	"	-	329	349
Ferrosilicon	"	250	NA	NA
Magnesium Ferro-Silicon	"	-	10	15
Ferromolybdenum	tonnes	-	428	436
Ferrotitanium	"	-	249	416
Ferrovanadium	"	-	634	850
Ferroaluminium	"	-	1119	1139
Non-ferrous Metals				
Aluminium	million tonnes	4.126	3.62	4.02
Copper (Cathode)	'000 tonnes	785	364	359
Lead (primary)	"	210	214	191
Zinc Ingots	"	951^	715	776
Silver@	tonnes	966	706	647
Cement	million tonnes	590	300	360
Complex Fertilizer	lakh tonnes	85.97#	93.21	83.27
SSP	"	123.15#	49.35	53.34
DAP	"	74.52#	37.74	42.22

Figures rounded off.
Sources: 1. Annual Statistics 2021-22, JPC ; Annual Report 2022-23 Vedanta Ltd.

2.MSMP - March, 2022; IMYB 2022 Data supplied by MMS Division, IBM ; Annual Report 2022-23, DPIIT 3 . Monthly Summary on Minerals & Non Ferrous Metals , Ministry of Mines.
4.Fertilizer statistics 2022-23, Fertilizer Association of India. # : Capacity as on 1.11.2023
5.Annual Report, 2021-22 & 2022-23, Department of Fertilizers,Govt. of India.
**The Installed capacity of Chomium Alloys as per source available in ferro alloys IMYB Review- 2022.*
$ The Installed capacity of Manganese Alloys as per source available in ferro alloys IMYB Review- 2022.
@ As per data available in silver IMYB Review- 2022 it excludes by-product recovery of silver by Hindalco Industries Ltd at Dahej, Gujarat from imported copper concentrates
^ : As per data available in Lead & Zinc IMYB Review 2022

FERROUS METALS

India is poised for brownfield expansion of existing steel plants, backward integration of re-rollers, forward integration of DRI or pig iron producers unfolding of a few greenfield projects The National Steel Policy 2017 projected a target of 300 million tonnes of domestic steel production by 2030. The total production of finished steel during 2021-22 stood at 113.597 million tonnes of which the contribution of SAIL, TSL Group, RINL, AM/NS, JSWL & JSPL stood at 57%.

In view of the long-term demand projection for steel, the Government adopted a two-pronged strategy for increasing steel production in the country through modernisation and expansion of existing Public Sector steel plants in the country and encouraging creation of new steel capacities in Private Sector.

Pig Iron

Pig iron is one of the basic raw materials required by the Foundry & Casting Industry for manufacturing various types of castings for the engineering section. The domestic production of pig iron was at 6.262 million tonnes in 2021-22, a growth of 28.4 % as compared to the production of 4.877 million tonnes in the last year. Plant-wise capacity details as available in respect of major pig iron units are furnished in Table-2

Table – 2 : Capacity of Principal Pig Iron Units

(In lakh tonnes)

Sl.No.	Unit	Location	Capacity
1	JSW Steel Ltd	Vijaynagar, Karnataka	120
2	Tata Steel Ltd	Jamshedpur, Jharkhand	96
3	Rashtriya Ispat Nigam Ltd	Visakhapatnam, Andhra Pradesh	63
4	SAIL—Rourkela Steel Plant	Odisha	44
5	SAIL—Bokaro Steel Plant	Jharkhand	43.6
6	SAIL—Bhilai Steel Plant	Chhattisgarh	39.25
7	Tata Steel Ltd (BSL)	Odisha	39.19
8	JSW Steel Ltd	Dolvi, Maharashtra	35

Source: JPC

Sponge Iron

Commercial production of sponge iron in India commenced in 1980. Sponge Iron India Ltd was first to set-up a plant in 1980 at Palwancha, district Khammam in Telangana.

The production of sponge iron was 39. 2 million tonnes in the year 2021-22 as compared to 34.376 million tonnes in the previous year. State- wise no of units, capacity & production details as available in respect of sponge iron units are furnished in Table-3.

Table-3: State-wise Capacity and Production of Sponge Iron (2021-22)

State	No.of working Units	Working Capacity	Annual Production
Total	288	49273	39200
Western Region	90	21044	16666
Chhattisgarh	69	9284	8217
Goa	3	221	217
Gujarat	9	8027	6151
Maharashtra	9	3512	2080
Eastern Region	135	21273	17188
Jharkhand	24	3443	2431
Odisha	76	12508	9675
West Bengal	35	5323	5082
Northern Region	4	537	385
Uttar Pradesh	4	537	385
Southern Region	59	6419	4961
Andhra Pradesh	5	761	438
Karnataka	38	4643	3784
Tamil Nadu	6	528	342
Telangana	10	487	397

Source : Annual statistics 2021-22, JPC

Finished Steel/Saleable Steel

Some significant facts on Indian Steel Industry are as follows:

1. The National Steel Policy (NSP) was announced in 2017. The New Steel Policy, 2017 aspires to achieve 300 million tonnes of steel making capacity by 2030.
2. As per data available in annual statistics 2021-22 of JPC, the total finished steel exports reached 13.494 million tonnes in 2021-22, registering a growth of 25.1% over the year 2020-21 while imports have continued the declining trend of recent years and registered a decline of 1.7 % with 4.669 million tonnes in 2021-22 compared to previous year.

Details about capacity and production of crude liquid steel and production of hot metal by main producers for the year 2020-21 & 2021-22 are furnished in Table-4.

Table – 4 : Capacity and Production of Hot Metal and Crude/Liquid Steel, 2020-21 and 2021-22

(By Principal Producers)

(In '000 tonnes)

Unit	Annual installed capacity Crude/Liquid steel	Production Hot metal		Production Crude/Liquid steel	
		2020-21	2021-22	2020-21	2021-22
Public Sector					
Steel Authority of India Ltd (SAIL)	20632	16581	18734	15213	17363
Rashtriya Ispat Nigam Ltd (Andhra Pradesh)	6300	4681	5774	4302	5272
Private Sector					
JSW Steel Ltd	23000	14389	16794	14780	18023
Tata Steel Ltd Group	20600	17775	19405	17204	19464
AM/NS (Essar Steel Ltd)	9600	3331	3335	6696	7295
Jindal Steel & Power Ltd	8100	5862	6068	6859	7458
Others	65831	6647	8112	38491	45419

Source: Annual Statistics 2021-22, JPC

BF/BOF/ & EAF/IF INDUSTRY

Performance of the BF/BOF & EAF/IF Industry is summarised below:

Basic Oxygen Furnace (BOF)

Presently, there are around 18 Basic Oxygen Furnace units which are available in the Indian Iron & Steel Sector with a total capacity of 66.295 million tonnes and produced 54.585 million tonnes of crude steel through BOF route in 2021-22 at 82 % of its capacity utilisation.

Electric Arc Furnace (including corex & MBF/EOF)

Crude steel produced in the Electric Arc Furnace (including corex & MBF/EOF) is mostly by recycling of steel scrap using Electric Arc Furnace (EAF). Electric Arc Furnace units, which are popularly known as mini steel plants, are significantly contributing to the production of steel in the country. Presently, in the Electric Arc Furnaces, there are 36 working units with total capacity of 36.728 million tonnes and produced 30.498 million tonnes crude steel through EAF route in the year 2021-22 at 83 % of its capacity utilisation. The recent developments in EAF technology, viz, to increase oxygen consumption, to reduce power consumption and to reduce tap time have led to increase in metal production. The development of thin slab casting has made EAF route more productive. This route enables slab strips rolling at lesser cost, facilitating production of cheaper strips/sheets than those that can be achieved through BF/BOF route.

Induction Furnace (IF)

Presently, EAF-based industries in India are yet to switch to induction furnace route. An induction furnace is an electrical furnace in which heat is g enerated through electromagnetic induction in an electrically conductive medium. Induction furnaces use steel melting scraps, sponge iron and pig iron/cast iron. On an average, the proportion of these items is 40% sponge iron, + 10% cast iron or pig iron and the remaining is steel melting scraps. There are presently 847 IF working units with total capacity of 51.040 million tonnes which produced 35.211 million tonnes crude steel through IF route in 2021-22 at 69 % of its capacity utilisation. These units are better than their EAF counterparts mainly because of their low cost of production and other factors mainly related to local market supply-demand conditions. Over the time, the IF sector has witnessed considerable technological upgradation with better charge-mix of DRI and refining facilities.

FERROALLOYS

The Indian Ferroalloy Industry was established during the second Five-year plan as an ancillary Industry to cater to the growing needs of the domestic Steel Industry. As a deoxidant and alloying agent, ferroalloys are in demand for crude steel and alloy steel production. Bulk ferroalloys of high-carbon category are produced by large-scale industries. The Noble ferroalloys are of low-carbon category and include ferrovanadium, ferrotungsten, ferroniobium, ferromolybdenum and ferrotitanium. There are also a number of units under the Small-scale Sector for the manufacture of ferroalloys, particularly, ferrosilicon, ferrochrome and ferromanganese.

India is the net exporter of ferroalloys. India is an established regular exporter of high-carbon ferro- manganese, silicomanganese and high-carbon ferrochrome.

The capacity of Indian Ferroalloys Industry is furnished in Table-5. The details about ferroalloys are discussed in the Review on Ferroalloy in Vol.II of this publication (IMYB).

Table – 5 : Capacity of Ferroalloys Industry

(In tonnes per annum)

Ferroalloys	Installed capacity
Bulk Ferroalloys :	**5100000**
Manganese alloys	3160000
Chrome alloys	1690000
Ferrosilicon	250000
Noble Ferroalloys :	**50000**

Source: Indian Ferroalloys Producer's Association (IFPA), Mumbai.

Bulk Ferroalloys

Bulk ferroalloys consist of principal alloys, viz, ferromanganese, silicomanganese, ferrochrome, charge chrome and ferrosilicon. The production data of different kinds of ferroalloys was not received from IFAPA as well as from other sources. However, the production data as partial coverages on ferro alloys that have been published in IBM's Monthly Statistics of Mineral Production (MSMP) in its March, 2022 have been mentioned below which does not reflect the actual entire production of ferroalloys in the country.

Ferromanganese and Silicomanganese

The total production of silicomanganese was 3,49,414 tonnes in the year 2021-22, as compared to 3,29,295 tonnes in the previous year. MOIL has a Ferro Manganese Plant of 12000 (TPY) capacity at Balaghat. The production of ferromanganese reported by MOIL was at 10,245 tonnes in the year 2021-22 as against the 8, 851 tonnes in the previous year. As part of diversification strategies, MOIL is aiming to set up new ferro alloy plants at strategic locations near their mines.

Ferrochrome and Charge chrome

Stainless and Alloy-steel Industry are the chief consumers of ferrochrome.

The total production of ferrochrome in 2021-22 was about 11,13,000 tonnes, as compared to 8,68,000 tonnes in previous year.

Noble Ferroalloys

Noble Ferroalloys are one of the vital inputs required for producing special types of steel & alloy. The total capacity of noble ferroalloys, was around 50,000 tpy and they majorly include ferromolybdenum, ferro-vanadium, ferrotungsten, ferrotitanium, ferro- silico-magnesium, ferroaluminium, ferroboron, etc. Mishra Dhatu Nigam (A Govt. of India Undertaking), produced different types of super-alloy, chiefly, cobalt, molybdenum, titanium and tungsten-based super-alloys and products.

The production (partial coverage) of various noble ferroalloys is furnished in Table-6.

Table – 6 : Production of Noble Ferroalloys

(in tonnes)

Ferroalloy	Quantity
Ferromolybdenum	**436**
Ferrotitanium	416
Ferrovanadium	850
Ferroaluminium	1139

Source: MSMP-March, 2022

Electrolytic Manganese Dioxide (EMD)

EMD is consumed along with natural manganese dioxide for the manufacture of dry battery cells. EMD is made of manganese and is used in making batteries and is also an input in pharmaceutical industry. MOIL has the only EMD manufacturing plant in India, located near MOIL's Dongri Buzurg mine in Bhandara district of Maharashtra, having a capacity of 1,500 tpy. The production of EMD by MOIL was 1,202 tonnes in 2021- 22 as against 1,070 tonnes in 2020-21.

NON-FERROUS METALS

Aluminium

There were four companies with a total installed capacity of 4.126 million tonnes in operation. NALCO, the only Public Sector Company in aluminium & alumina segment, has an installed capacity of 0.46 million tpy at Angul, Odisha. The three companies with six plants – Aditya, Hirakud, Mahan & Renukoot of Hindalco Industries Ltd; Korba of BALCO Ltd. and Jharsuguda of Vedanta Ltd. are in the Private Sector having a total installed capacity of 3.666 million tpy .

The production of aluminium in 2021-22 was 4.02 million to nnes as co mp are d to 3.62 million tonnes in the previous year. The installed capacity and production of a luminium in 2020-21 and 2021-22 are enumerated in Table-7

Table – 7 : Capacity and Production of Aluminium, 2020-21 and 2021-22

(In million tonnes)

Producer	Annual Capacity	Production	
		2020-21	2021-22 (P)
Total	**4.126**	**3.62**	**4.01**
Public Sector			
National Aluminium Co. Ltd (Angul)	0.46	0.418	0.46
Private Sector			
Bharat Aluminium Co. Ltd (Korba)	0.57	0.57	0.58
Hindalco Industries Ltd (Aditya, Hirakud, Mahan & Renukoot)	1.346	1.23	1.294
Vedanta Aluminium Ltd (Jharsuguda)	1.75	1.4	1.68

Figures rounded off.

Source: Monthly Summary on Minerals & Non Ferrous Metals, Ministry of Mines. Information received from individual plants/Annual reports / Data provided by MMS Division, IBM.

Alumina

The production of alumina (including calcined alumina) was 7.23 million tonnes in 2021-22 as compared to 6.52 million tonnes in the previous year. The details of alumina producers in the country, their capacities and production are provided in Table-8.

Table – 8 : Capacity and Production of Alumina (including calcined alumina) 2020-21 and 2021-22

(In million tonnes)

Producer	Annual Capacity	Production	
		2020-21	2021-22 (P)
Total	**7.9**	**6.52**	**7.23**
Public Sector			
National Aluminium Co. Ltd (Damanjodi)	2.1*	2.2	2.11
Private Sector			
Bharat Aluminium Co. Ltd	0.200#	-	-
Hindalco IndustriesLtd	3.6	2.63**	3.15**
Vedanta Aluminium Ltd (Lanjigarh)	2	1.69	1.97

Figures rounded off.

Source: Information received from individual plants/Annual Reports.

** (Normative capacity)*

*** It includes the Calcined Alumina also as produced by Utkal Alumina International Limited.*

 # Plants remained non-operational during the year.

Hindalco's Renukoot Integrated Smelter uses alumina produced in their plant for producing aluminium.

National Aluminium Co. Ltd

The Company has a 68.25 lakh TPA Bauxite Mines in north and central block as well as 31.50 lakh TPA Bauxite Mines in south block at Panchpatmalli. The NALCO has 21.00 lakh TPY (normative capacity) Alumina Refinery located at Damanjodi in Koraput district of Odisha, and 4.60 lakh TPYAluminium Smelter & 1200MW Captive Power Plant located at Angul, Odisha. The surplus alumina that remains after internal consumption is sold to third parties in the export market and a small portion is also sold to the domestic market. NALCO is in the process of setting up of its 5th Stream in its existing Alumina Refinery which shall add 1.0 million tonnes to its existing installed capacity of 2.1 million tonnes per year. The capacity of port facilities of NALCO at Visakhapatnam is 1.4 million tpy for alumina export / caustic soda Lye Import. NALCO has constituted JV company with M/s Mishra Dhatu Nigam Ltd named Utkarsh Aluminium Dhatu Nigam Ltd in August, 2019 for establishment of high-end aluminium alloys plant of 60,000 TPA capacity in Nellore district, Andhra Pradesh.

Vedanta Group

Vedanta Aluminium is amongst the world's top aluminium producers, and India's largest producer of aluminium, catering to discerning customers in nearly 50 countries. BALCO is a Private Sector Company with an integrated alumina/aluminium complex at Korba in Bilaspur district in Chhattisgarh. The Company has two captive bauxite mines. The Company's two alumina refineries are located at Korba, Chhattisgarh and Lanjigarh, Odisha, with an installed capacities of 2.0 lakh tpy and 20.0 lakh tpy, respectively. The total capacity of the Korba and Jharsuguda smelter is 0.57 million tpy and 1.75 million tpy, respectively with total smelter capacity of around 23 lakh tpy. The Company also has the capacities to produce ingots, wire-rods billets, bushbars and rolled products. The state-of-the- art alumina refinery at Lanjigarh, feeds the aluminium smelters at Jharsuguda and BALCO and forms a crucial link in the value chain.

Hindalco Industries Ltd

Hindalco Industries Ltd has alumina refining and aluminium production capacity of around 3.6 million tonnes and 1.3 million tonnes, respectively. Hindalco Aluminium Smelting operations are located at Renukoot in Uttar Pradesh, Aditya Aluminium in Odisha, Mahan Aluminium in Madhya Pradesh and Hirakud in Odisha.

All these facilities combined produce around 1.3 Million tons of primary aluminium in a year. Hindalco, at Renukoot, having smelting capacity of 4,10,000 tpa at present, operates across the aluminium value chain from bauxite mining, alumina refining, aluminium smelting to downstream rolling and extrusions. The integrated facility houses an alumina refinery and smelter along with facilities for production of semi-fabricated products namely conductor redraw rods, sheet and extrusions.Aditya Aluminium is a smelter-power plant complex at Lapanga in Sambalpur district of Orissa with 3,60,000 tonnes smelter supported by a 6 x 150 MW coal based captive power. Mahan Aluminium, located in Bargawan, Singrauli district, Madhya Pradesh, is an integrated aluminium smelting complex, which comprises 3,59,000 TPA of aluminium smelter supported by a 900MW power plant.The capacity of Smelter Plant of Hirakud for production of Aluminium is around 2,16,000 MTA.Aditya and Mahan Aluminium smelters are operating on state-of-the-art AP36 technology. Hindalco's plants are equipped with sophisticated rolling mills and finishing equipment.Hindalco's finished products include, alumina, primary aluminium in the form of ingots, billets & wire rods, value-added products, such as, rolled products, extrusion and foils.Hindalco is the largest manufacturer of entire range of Flat Rolled Products. The Hirakud Flat Rolled Products (FRP), produce rolled products, extrusion products and wire rods. Novelis, a wholly owned subsidiary of Hindalco, is the world's largest flat rolled aluminium producer and recycler with a rolling capacity of 4 Million MT and recycling capacity of 2.5 Million MT. Alumina refineries are located at Utkal, Renukoot, Muri and Belagavi.Hindalco. Utkal Alumina (Odisha) with an installed capacity of 2.2 million tpy alumina refining, continues to be the most economical and efficient alumina producing plant globally. The other alumina refineries capacities are around 0.700 million tonnes, 0.350 million tonnes and 0.450 million tonnes at Renukoot, Belagavi (Karnataka) and Muri (Jharkhand), respectively.

Cadmium

Cadmium (99.95min.) is obtained as a by-product from zinc smelters of HZL at Debari, Visakhapatnam, Chanderiya and of BZL, Binanipuram. These together have an annual capacity of 913 tonnes. Out of the total annual installed capacity 913 tpy, HZL accounted for 833 tpy capacity. Binani Zinc Ltd (Edayar Zinc Ltd) reported the remaining 80 tpy capacity. HZL produces cadmium of high quality in its zinc smelters which is casted in the form of pencils weighing from 250 g to 500 g. The purity is 99.95% Cd (max.) at Debari; 99.97% Cd (max.). These by-products of cadmium are cast in the form of pencils weighing from 250 g to 500 g. In India, cadmium is consumed in industries like paint, glass and chemicals. No cadmium production is reported in 2021-22, however the last reported production of cadmium was 47 tonnes in 2017-18.

Copper

The production of copper ore at 3.56 million tonnes in 2021-22 increased by 9% as compared to that in the previous year. The metal content in the ore produced in 2021-22 works out to 27,622 tonnes as against 25,623 tonnes in 2020-21.

Hindustan Copper Ltd produces copper metal from the ore produced at their captive mines. Vedanta Limited (formerly known as sterlite Industries (India) Ltd.) and Hindalco Industries Ltd. produce copper metal from imported copper concentrates. Details regarding capacity and production of copper are furnished in Table-9.

Table – 9 : Capacity and Production of Refined Copper (Cathodes)

(In '000 tonnes)

Producer	Annual Capacity	Production	
		2020-21	2021-22 (P)
Total	**785**	**363**	**484**
Hindustan Copper Ltd	68.5*	-	-
SSL/ Vedanta Ltd	216	101	125
Hindalco Industries Ltd	500	262	359

Figures rounded off .
Source: Monthly Summary on Minerals & Non Ferrous Metals , Ministry of Mines; Data received from MMS Division, IBM
** As per information available in the Annual Report HCL 2021-22, although the Installed Capacity is 99.5 thousand tonnes (KCC - 31 thousand tonnes & ICC - 18.5 thousand tonnes, GCP - 50 thousand tonnes), due to economic consideration the Company suspended KCC Smelter & Refinery from December 2008.*

Production of refined copper (cathodes) in 2020- 21 and 2021-22 was 363 thousand tonnes and 484 thousand tonnes, respectively.

Hindustan Copper Ltd

Hindustan Copper Ltd is a Mini Ratna Government of India Enterprise under the administrative control of Ministry of Mines. HCL is the only producer of copper ore in the country. HCL has two smelters one at Indian Copper Complex (ICC), Ghatsila, East Singhbhum district in Jharkhand and other is at Khetri Copper Complex (KCC), Khetrinagar, district Jhunjhunu, Rajasthan.The annual working installed capacity of the HCL for copper cathode production is 68,500 tpy. Refinery at ICC also has a Wire Bar Casting Plant with a capacity of 8,400 tpy and a Brass Rolling Mill that manufactures brass sheets by using copper produced at ICC. The aggregate installed capacity of wire bars is 39,400 tpy and wire rod capacity is 60,000 tpy at HCL. It also has a precious metal recovery plant for the recovery of gold, silver, selenium, tellurium and nickel sulphate and copper sulphate at Ghatsila. Though HCL has an installed capacity of 390 tonnes in respect of nickel sulphate, no production of nickel sulphate was reported since 2004-05.

The capacity of Khetri Copper Complex (KCC) smelter is 31,000 tpy. However, HCL has shut down the Khetri smelting refining plant due to economic reasons. KCC has a concentrator plant at Khetri in Jhunjhunu district, Rajasthan, having a capacity of 2.02 million tpy. KCC & ICC Ghatsila, Jharkhand with 1.55 million tpy each and Malanjkhand, Madhya Pradesh with two million tpy capacity also operate sulphuric acid plant.

Chhattisgarh Copper Ltd (CCL) established in the year 2018 is a joint venture Company between Hindustan Copper Ltd and Chhattisgarh Mineral Development Corporation Ltd. The Company was established for exploration, mining and beneficiation of copper and its associated minerals in the State of Chhattisgarh.

Gujarat Copper Project (formerly Jhagadia Copper Ltd)

Gujarat Copper Project is located at Jhagadia in Bharuch district, Gujarat. HCL acquired the assets of Jhagadia Copper Ltd and renamed it as GCP. It is a scrap-based electrolytic smelter that produces cathodes with a capacity of 50,000 tpy and additional 20,000 tpy of copper anodes. The plant was in t echnical collab ora t i on with Outo kumpu Te chnolo gy (former ly Bolid en Contech AB), Sweden. The precious metals like gold, silver, platinum, palladium, etc. are also recovered as part of anode slime during the refinery process. The refinery is based on ISA-Technology from Mount ISA Mines Ltd, Australia.

Vedanta Ltd (Sterlite copper)

Vedanta Limited, a subsidiary of Vedanta Resources Limited, is one of the world's foremost natural resources conglomerates, with primary operations in zinc-lead-silver, iron ore, steel, copper, aluminium, power, nickel, and oil and gas. Tuticorin smelter and refinery of Vedanta are currently not in operation.The Tamil Nadu Pollution Control Board (TNPCB) vide order, dated 9 April 2018, rejected the consent renewal application of Vedanta Limited for its copper smelter plant at Tuticorin.It directed Vedanta not to resume production operations without formal approval/ consent (vide order dated 12 April 2018) and directed the closure of the plant and the disconnection of electricity (vide order dated 23 May 2018).

The Government of Tamil Nadu also issued an order dated 28 May 2018 directing the TNPCB to permanently close and seal the existing copper smelter at Tuticorin; this was followed by the TNPCB on 28 May 2018. Vedanta Limited filed a composite appeal before the National Green Tribunal (NGT) against all the above orders passed by the TNPCB and the Government of Tamil Nadu. In December 2018, NGT set aside the impugned orders and directed the TNPCB to renew the CTO. The order passed by the NGT was challenged by Tamil Nadu State Government in the Hon'ble Supreme Court.

The Company had filed a Writ Petition before the Madras High Court challenging the various orders passed against the Company in 2018 and 2013. On 18 August 2020, the Madras High Court delivered the judgement wherein it dismissed all the Writ Petitions filed by the Company. The Company has approached the Supreme Court and challenged the said High Court order by way of a Special Leave Petition (SLP) to Appeal and also filed an interim relief for care & maintenance as well as trial operation of the plant. The matter was then listed on 2 December 2020, before the Supreme Court. The Bench after having heard both the sides on the interim relief of trial operation of the Plant, concluded that at this stage the interim relief could not be allowed. The 2,16,000 tpy copper cathode refinery of Sterlite located in Chinchpada at Silvassa in the Union Territory of Dadra & Nagar Haveli, predominantly caters to the domestic market. The technology for refineries and Continuous Cast Copper Rod Plant is of MIM, Australia and Continuous Properzi, Italy, respectively.

Hindalco Industries Ltd (Birla Copper)

The Company's copper smelters located at Dahej, Lakhigam, district Bharuch, Gujarat, has an installed capacity of 5,00,000 tpy. The copper operation consists of producing copper through smelting, refining copper from imported copper concentrates and converting refined copper cathode into continuous cast rod. It is now one of the world's largest smelter at a single location. It is based on Outokumpu Technology. The Company also produces continuous cast copper rods (CCR) with an annual capacity of 97,200 tonnes. In the process of extraction of copper metal, by-products

Lead

The total installed capacity of primary lead smelting was 2,10,000 tpy. The smelting capacity of HZL for lead is distributed between two smelters at Chanderiya (90,000 tpy) and Dariba (1,20,000 tpy). Primary lead was produced entirely by HZL at lead-zinc smelter at

Chanderiya, district Chittorgarh, and Rajpura–Dariba Plant, district Udaipur, Rajasthan.

There are a number of secondary producing units in the Organised and Unorganised Sector. Lead acid batteries are the major consumer of lead metal in the country.

Zinc

HZL is the major producer of Zinc. The smelting capacity of HZL for zinc is distributed between three smelters at Debari (88, 000 tpy), Chanderiya (5,85,000 tpy) and Dariba (2,40,000 tpy). Edyar Zinc Ltd's plant at Binanipuram, Kerala, has a capacity of 38,000 tpy. Thus, the smelting capacity for zinc in the country is 9,51,000 tpy.

The primary product of Debari and Vizag smelters is high-grade zinc, while cadmium is recovered as by-product. Chanderiya smelter complex with a total capacity of 5,85,000 tpy of zinc is the world's largest single location zinc smelting complex. Besides lead and zinc, HZL also produces silver as by-product at its Pant Nagar plant in Uttarakhand whose capacity is 800 tonnes per year. The data on total capacity and production of primary lead and zinc ingots in 2020-21 and 2021-22 are furnished in Table-10.

Table – 10 : Capacity and Production of Primary Lead and Zinc Ingots

(In tonnes)

Producer	Lead capacity (tpy)	Production		Zinc capacity (tpy)	Production	
		2020-21	2021-22 (P)		2020-21	2021-22 (P)
Hindustan Zinc Ltd	**210000**	**214399**	**191185**	**913000**	**715445**	**775808**
Edayar Zinc Ltd. (formerly, Binani Zinc Ltd.)	-	-	-	38000	-	-
Total	**210000**	**214399**	**191185**	**951000**	**715445**	**775808**

ABRASIVES

Natural abrasives, which include calcite, emery, diamond, zircon, corrundum, novaculite, pumice, etc. are generally sold as dressed stones. Synthetic abrasives include borazon, ceramic, dry ice, glass powder, silica carbide, etc. Commercial abrasives are manufactured in many shapes as bonded or coated abrasives including belt discs, wheels, sheets, blocks, rods and loose grains. A large number of units exist in the Unorganised sector. However, important producers of coated abrasives were: Grindwell Norton Ltd, Mora, Uran, district Raigad, Maharashtra; Flexoplast Abrasives (India) Ltd, Aurangabad, Maharashtra; Associated Abrasives Ltd, Nashik, Maharashtra; Carborundum Universal Ltd, Chennai, Tamil Nadu; Cutfast Abrasives Tools Pvt. Ltd, Chennai, Tamil Nadu; and John Oakey and Mohan Ltd, Ghaziabad, Uttar Pradesh. Important producers of bonded abrasives (grinding wheels) are Associated Abrasives Ltd, Nashik, Maharashtra; Carborundum Universal Ltd, Chennai, Tamil Nadu; Cutfast Abrasives Tools Pvt. Ltd, Chennai, Tamil Nadu; and K.L. Thirani & Company Ltd, Kolkata, West Bengal.

Silicon Carbide (SiC)

Silicon Carbide (SiC) is a synthetic material most commonly produced by the so called Archean process in electrical resistance furnaces. SiC does not occur naturally except in some types of pre- solar metorites, along with diamonds. SiC can be produced either in black colour or green colour depending on the raw material. SiC products have applications in metallurgical refractories, abrasives, slurry wire sawing, and for technical ceramics.

Major producers of silicon carbide are: Grindwell Norton Ltd, Renigunta, Andhra Pradesh and at Bengaluru, Karnataka; Indian Metals & Carbide Ltd, Therubali, Odisha; Carborundum Universal Ltd, Tiruvottiyur, district Chennai, Tamil Nadu; and Speedfam (India) Pvt. Ltd, Navi Mumbai, Maharashtra.

CEMENT

The Cement Industry which is one of the key infrastructure industries recorded exponential growth pattern in successive years since the introduction of partial decontrol in 1982, total decontrol in 1989 and post delicencing of the Industry and Policy Reforms initiated in 1991. As per DIPP, with more than 590 million tonnes per annum of cement production capacity, India is the second largest cement producer in the world and accounts for over 8 percent of global installed capacity. The capacity utilization of Indian Cement Industry during the last 10 years has fallen from 83% to 60%. The continuous downward trend of capacity utilization is indicative of the idle capacity of over 230 million tonne which is growing year by year. The cement industry comprises about 150 integrated large cement plants, 116 grinding units, 62 mini cement plants and 5 clinkerization units. The total production of cement in 2021-2022 was about 360 million tonnes as compared to around 300 million tonnes in the previous year. The Cement Industry produces a variety of cement, such as, Ordinary Portland Cement (OPC) Portland Pozzolana Cement (PPC), Portland Blast Furnace Slag Cement (PBFC), Oil Well Cement, White Cement, etc. to suit a host of applications. Cement consumption is expected to reach 450.78 million tonnes by the end of FY2027

ASBESTOS–CEMENT PRODUCTS

The installed capacity of asbestos–cement pressure pipes in the Organised Sector was about 1,49,640 tpy. Production capacity of asbestos cement sheets was not available. By virtue of the high tensile strength and bonding properties with cement, it is used in the manfacture of fibre cement products.

Industries that deal with asbestos–cement products include Everest Building Products Ltd which has units located at Kymore in Madhya Pradesh and at Podanur in Tamil Nadu. Similarly, Hyderabad Industries Ltd has three plants at

Sanatnagar, RangaReddy district in Andhra Pradesh; Jasidih in Jharkhand; and Ballabhgarh in Haryana. Ramco Industries Ltd has three plants at Arakkonam, district Vellore, Tamil Nadu; Karur in district Dharwad, Karnataka; and Maksi in district Shajapur, Madhya Pradesh. Southern Asbestos Cement Ltd has two plants at Karur in district Dharwad, Karnataka; and Arakkonam, district Vellore in Tamil Nadu. Shree Pipes Ltd Hamirgarh, district Bhilwara, Rajasthan; Malabar Building Products Ltd, Malakunnathukavu, district Thrissur, Kerala; Konark Cement and Asbestos Industries Ltd at Bhubaneswar in Odisha; Shri Digvijay Cement Co. Ltd, Digvijaynagar, Ahmedabad in Gujarat; Uttar Pradesh Asbestos Ltd, Mohanlalganj, district Lucknow, Uttar Pradesh; Assam Asbestos Ltd, Bonda, Narangi, district Guwahati, Assam; Utkal Asbestos Ltd, Dhenkanal in Odisha; and Visaka Asbestos, Pattencheru (Medak) in Andhra Pradesh are some of the other industries that produce asbestos cement products.

Besides, Swastik Industries, Pune, in Maharashtra; Kalani Asbestos, a Division of Kalani Industries Pvt. Ltd, Pitampur, district Dhar in Madhya Pradesh; Tamil Nadu Asbestos (Pipes), a unit of Tamil Nadu Cement Corp. Ltd, Mayanur, district Tiruchirapalli in Tamil Nadu; and Ganga Asbestos Cement Ltd, Raebareli in Uttar Pradesh produced only asbestos pressure pipes. The present status of all these asbestos cement units is not available with Indian Bureau of Mines.

REFRACTORY INDUSTRY

Refractory Units fall under Medium and Small-scale Sectors. Steel Industry is the biggest group of customers of this Industry, which consumes about 70% of total refractory production, followed by 12% in cement, 5–6% in non-ferrous, 3% in glass and balance in other industries. There are more than 100 refractories in India, out of which around 14 are major, 33 are medium-sized and the rest are relatively smaller in respect of production.The estimated annual installed capacity of all types of refractory was 2,015 thousand tonnes and the production in 2020-21 of all types of refractories was1,264.06 thousand tonnes as compared to 1,208.92 thousand tonnes in 2019-20. Bharat Refractories Ltd (BRL), a Government of India Undertaking, has four units that are engaged in the manufacture and supply of various kinds of refractories to the integrated steel plants and to smaller steel plants. The important refractory producers are Calderys India Refractories Ltd, Associated Ceramic Ltd, Dalmia Bharat Ltd, IFGL Refractories Ltd, Orient Refractories Ltd, TRL Krosaki Refractories Ltd, Vesuvius India Ltd, Maithan Ceramic Ltd, National Refractories, etc.

With the modernisation and renovation of steel plants, the requirements for various types of refractories have undergone revolutionary changes. The stress is now on for more sophisticated products like precast monolithics. The domestic Refractory Industry, taking cue of this change, has acquired the technical know-how for production of sophisticated refractories, such as, magnesia carbon bricks, new generation sliding-gate plate refractories, for ladles, gunning materials and castables. Manufacture of carbon bonded silicon carbide crucible and clay graphite foundry products is continuously done with constant upgradation for production of improved products. The use of these special refractories has brought down the consumption of refractories per tonne of steel production. However, the customers are benefited by way of improved performance, lower shutdown time and savings on energy. The specific consumption of refractories at present in integrated steel plants varies from 8 to 10 kg/tonnes of crude steel as compared to 6–8 kg/tonnes of crude steel in advanced countries. Refractories play important role in the efficient performance of different manufacturing process of steel, aluminium, glass, cement, petrochemical, industries and improves the quality of the products. It is apt to mention here that the marketing of refractories is totally different presently in companies in comparison to the situation that existed 30 years back as the users decide the prices of refractories on the total performance basis.

The price and supply of imported raw materials are subject to international demand and supply situation and most of the refractory makers are completely dependent on imported raw materials, especially for making high-end products. Refractory production in India during 2019-20 & 2020-21 is furnished in Table-11.

Table – 11: Refractory Production in India, 2019-20 and 2020-21

(In tonnes)

Item	Production	
	2019-20	2020-21
Total	**1208926**	**1264064**
Fireclay Bricks & Shapes	197803	197148
High Alumina Bricks & Shapes	230319	225911
Silica Bricks & Shapes	79259	65437
Basic Bricks & Shapes	180299	173386
Monolithics/ Castables/ Pre-cast Blocks	392837	470256
Special Products (incl cc)	60802	61964
Others	67607	69962

Source: IRMA Journal volume LIV No.3 September 2021

CERAMIC & GLASS INDUSTRY

Ceramic Industry

Ceramic Industry in India is about 100 years old. The main product segments in ceramic industry are the Wall tile, Floor tile, Vitrified tile and Industrial tile segments. Ceramic products are made from clay and felspar and are manufactured in Large and Small-scale Sectors with wide variations in type, range, quality and standard. Ceramic items have properties, such as, glassy smooth finish, high thermal shock resistance, poor thermal electrical conductivity, high abrasion resistance, acid resistance and weather resistance. During the last two decades, there has been a phenomenal growth in the field of ceramics to meet specific demands of the industry, such as, high alumina ceramics, cutting tools and other structural ceramics. The state-of-the-art technology of international standards are adopted for production of high quality, ceramic goods in the country. The major industries include Kajaria Ceramics, Somani Ceramics, Asian Granite India, Orient Ceramics & Industries, Nitco, Regency Ceramics, Euro Ceramics, Bell Ceramics, RAK Ceramics etc. Ceramics Technological Institute (CTI), Bengaluru, a National Level Institute for R&D in BHEL, offers the much-needed technical support for product development by enabling the Indian Ceramic Industry to adopt a modernised technology for development of new and advanced ceramics. Areas of research are nano-technology, separation technology, microwave processing, etc.

Ceramic Tiles

Following the de elopment and growth of the Building Industry, ceramic glazed tiles producing industries too flourished considerably during the last decade. Indian tiles are competitive in the international market and are chiefly exported to East and West Asian countries. In India, both traditional methods of manufacturing (tunnel) as well as the latest single fast firing methods are in vogue in manufacturing of ceramic tiles.

Sanitarywares

The basic raw materials for sanitaryware are felspar, ball clay, kaolin and quartz. The major manufacturers of sanitaryware include Hindustan Sanitaryware Industries Ltd, Parryware oducts, Cera Sanitaryware, Neycer India, Kohler India, Toto, RAK Ceramics India, Duravit Sanitaryware Pvt. Ltd, Golf Ceramics, etc.

Potterywares

Potterywares include crockery and tableware and its manufacturers are a part of an age old handicraft industry in the country. Produced both in the Large-scale and the Small-scale Sectors, there were 16 units in the Organised Sector with a total installed capacity of about 43,000 tpy, while in the Small-scale Sector, there were over 1,400 plants with a capacity of 3 lakh tpy. Out of these, over 600 units are located in Uttar Pradesh. The present status of all these Potterywares units is not available with Indian Bureau of Mines.

Glass Industry

The Glass Industry includes manufacturing unit that makes glass products, such as, glass containers and hollow-wares, tablewares, flat glass (including float, sheet, figured, wired and safety, mirror glass), speciality glass (such as, electronics, optics, lighting, ophthalmic lenses) vacuum flasks, refills, laboratory glasswares, fibre glass, kitchen glassware, glass bangles, etc. Principal raw materials used in the manufacture of glass are silica sand, soda ash, calcite, dolomite, etc.

Glass Industry comes under the category of delicensed industry and manufacturing units are spread all over India. The large-scale producers are located mostly in Mumbai, Kolkata, Bengaluru, Hyderabad and in Gujarat and are equipped mostly with modern melting furnace technology. The Medium and Small-scale Industries, on the other hand, include cottage industries that still use outdated technology for production of glass products. The share of Organised Sector in the Glass industry is dominant at about 55% whereas, the Unorganised Sector accounts for about 45%. There is considerable scope and demand for glass fibre products, particularly due to growth in Petrochemical Sector, solar products, Packaging Industry and allied products. Glass Industry in India remained in the form of Cottage Industry till the beginning of 20th century. First glass plant in India was set-up in August 1908 by freedom fighter & Bharat Ratna Lokmanya Bal Gangadhar Tilak at Talegaon in the State of Maharashtra. Glass Industry in India has made a steady progress since then, particularly after independence. Firozabad, known as glass city of India, continues to be a place of master craftsmen and entrepreneurs, where traditional processes are still used for production of a wide variety of glass items. About 70% of the total glass production in the Unorganised Sector in the country is contributed by Firozabad Glass Industry.

Glass Containers and Hollow-wares

Glass containers are ideal packaging medium, but are increasingly being replaced by other packaging materials like plastic, PET, aluminium and tetrapack. The major producers include Hindustan National Glass & Industries, Piramal Glass, Haldyn Glass Gujarat, La Opala RG, Mohan Meakin, Gujarat Glass, Associated Glass Industries (AGI), etc.

Laboratory Glasswares

There were six units in this Sector which manufacture neutral glass tubing, laboratory glasswares and chemical process equipment. The installed capacity of neutral glass tubing was 46 , 600 tpy. The data on production are not available. The demand for neutral glass tubing has not picked up due to sizeable switch over from glass items to plastic items.

Flat Glass

Silica sand, dolomite, limestone are some of the mineral ingredients used in the manufacture of flat glass. The term flat glass includes float glass, sheet glass or plate glass, figured and wired glass. These are further processed into mirror, toughened glass, laminated glass, double glazing, etched glass, glass doors, etc. The total capacity of Flat Glass Industry in India is about 1.2 million tonnes annually for which the major producers are Saint Gobain Glass, Asahi India Glass, Gujarat Guardian Glass, Gold Plus Glass and Hindustan National Glass.There has been growing acceptability of the Indian flat glass products in the global market.

Fibre Glass (Glass-reinforced plastic)

Silica sand, limestone, kaolin, fluorspar, dolomite, etc. are some of the important minerals used in manufacturing fibre glass. Fibre glass is highly capital and technology-intensive Industry. Fibre glass is lighter than aluminium but stronger than steel. Moreover, being an inorganic material, it does not pose any health hazard.

GRANITE INDUSTRY

Major production of granite in raw as well as processed form is generally from Andhra Pradesh, Rajasthan, Karnataka, Tamil Nadu and Gujarat. Granite is used in monuments, building slabs, tiles, surface plates, etc. Over 160 varieties of granite with exotic colours/shades have been identified as products that could be exported after processing.

Granite is a minor mineral as defined under Section 3(e) of MMDR Act, 1957, and as per Section 15 of MMDR Act, 1957, all powers to make rules and grant of Mineral Concessions for minor minerals have been entrusted with concerned State Government. Granite Conservation and Development Rules, 1999; were notified separately on 1.6.1999 for ensuring systematic/scientific exploitation and conservation of granite resources of the country. The deposits are dispersed widely across all parts of the country.

Granite is a Non-scheduled Industry and the processing of granite is a phenomenon that was started in 1930s. The mining and processing techniques of granite adopted in the country have improved over the years. Looking at its export potential, the Government of India has been encouraging setting up of 100% EOU in this Sector to promote export of value-added granite products. Exports of granite are freely allowed. The export of Granite Blocks/ Tiles (polished) during 2019-20 was 190 thousand tonnes as compared to 213 thousand tonnes during previous year.

CHEMICALS

Caustic Soda (Sodium hydroxide)

Caustic soda is a basic inorganic chemical prepared by electrolysis of salt brine and is consumed in Textile, Organic chemicals, Alumina, Paper & Pulp, Soaps & Detergents, Inorganic chemicals and for water treatment. These sectors accounted for almost 76.1% of the demand in the country.

A significant quantity of caustic soda is used in the manufacture of other inorganic chemicals and dyestuffs, in metallurgical operations and in petroleum refining. In the year 2021-22, the total installed capacity of caustic soda was 41.51 lakh tonnes as compared to 38.98 lakh tonnes in the previous year. The production of caustic soda during 2021-22 was 34.63 lakh tonnes as compared to 29.64 lakh tonnes in the previous year. The major Indian producers are Gujarat Alkalies & Chemicals, Grasim Industries, Nirma, Shriram Alkali & Chemicals, Reliance Industries, Aditya Birla Chemicals (India), etc.

Soda Ash

Soda ash is an important chemical used widely as a raw material in the manufacture of glass and glassware, sodium silicate, textile, paper & pulp, in metallurgical industries, desalination plants and in the preparation of a host of chemicals. Soda ash is an essential ingredient in the manufacture of detergent, soap, sodium salts and dyes. The major soda ash producers are Tata Chemicals, Gujarat Heavy Chemicals Ltd, Nirma, Saurashtra Chemicals, DCW, etc. The manufacture of soda ash in India started in 1932 at Dhrangadhra in Gujarat with installed capacity of 50 tpd.

In the year 2021-22, the total installed capacity of soda ash was 36.14 lakh tonnes which was same as in the previous year. The production of soda ash during 2021-22 was 30.78 lakh tonnes as compared to 26.38 lakh tonnes in the previous year.

Calcium Carbide

Calcium carbide is used in the manufacture of flammable acetylene gas for Rubber, Synthetic and Plastic Industry. It is used as a raw material for manufacturing various rubber goods. It is self- reinforcing filler. It is also used for cutting & welding of metals besides its use in manufacturing various chemical substances. The major Indian producers are Birla Carbide, TECIL, ICML and Panyam.

In the year 2021-22, the total installed capacity of calcium carbide was 1.12 lakh tonnes which was same as in the previous year. The production of calcium carbide during 2021-22 was 0.98 lakh tonnes as compared to 0.86 lakh tonnes in the previous year.

Synthetic Cryolite (Na_3AlF_6)

Navin Fluorine chemical Ltd, Bhestan, Gujarat, is an important producer of synthetic cryolite. Other producers are Tanfac Industries Ltd, Cuddalore, Tamil Nadu; (Aditya Birla Group) and Adarsh Chemicals and Fertilizers Ltd, Udhna, Gujarat. GMDC, Gujarat has a beneficiation plant at Village Kadipani that produces 96% CaF_2 acid-grade & 90% CaF_2 metallurgical-grade concentrate. The acid-grade finds use in aluminium fluoride, synthetic rutile and fluorine chemicals.

Aluminium Fluoride

Aluminium fluoride, with the molecular formula AlF_3, is an inorganic compound that is used in a variety of industrial processes, most notably in the production of aluminium. It is a colourless solid that can be made synthetically or can be naturally found as the minerals, rosenbergite and oskarssonite. The important units that produce aluminium fluoride include Navin Fluorine Industries, Maya Rasayan Ltd, Mumbai, Tanfac Industries Ltd, SPIC and Aegis Chemical Industries Ltd.

Titanium Dioxide

Titanium Dioxide (TiO_2) is a chemically inert white pigment used in a wide range of consumer products from paints, paper and toothpaste to plastics and cement. The key raw materials used in the production of TiO_2 are ilmenite and rutile found mainly in coastal regions of Tamil Nadu, Kerala, Andhra Pradesh and Odisha. Anatase and rutile are the two major types of TiO2 which are manufactured by the sulphate and chloride process, respectively. The 4 key players in the Indian Titanium Dioxide Industry are Kerala Minerals and Metals Limited (KMML), Travancore Titanium Products Limited (TTPL), Kilburn Chemicals (VVTi Pigments Ltd) and Kolmak Chemicals Ltd.

In the year 2021-22, the total installed capacity of Titanium Dioxide was 82.50 thousand tonnes which was same as in the previous year. The production of Titanium Dioxide during 2021-22 was 56.96 thousand tonnes as compared to 51.22 thousand tonnes in the previous year.

Sulphuric Acid

Sulphuric Acid is primarily being used as a feedstock for the synthesis of nitrogenous and phosphatic fertilizers against the backdrop of its abundant demand from the fertilizer industry. Besides, the growing consumption of Sulphuric Acid in the water treatment process and metal processing is anticipated to contribute well to propel its demand in the forecast period. Sulphuric Acid can be produced by either the smelter or sulfur route. The annual capacity of sulphuric acid in the year 2022-23 is around 16.470 million tonnes. There are several organised and unorganised players operating in the country's Sulphuric Acid market, making it highly fragmented. Hindustan Zinc Limited is one of the largest manufacturer of Sulphuric Acid operating in the domestic market. They produce 98 % concentrated Sulphuric Acid at their production facilities in Chanderia (Installed Capacity – 0.6 Million Tonnes annually), Debari (Installed Capacity – 0.3 Million Tonnes annually) and Dariba (Installed Capacity – 0.6 Million Tonnes annually) in the state of Rajasthan. In addition, sulphuric acid is also recovered at HCL, Hindalco & Sterlite

Phosphoric Acid

Important units that produce phosphoric acid of various grades, such as, pharma-grade, food- grade, technical-grade, analytical reagent grade, etc. include Gujarat State Fertilizer & Chemicals Ltd,Vadodara, Gujarat; Fertilizers and Chemicals Travancore Ltd, Udyogmandal, Kerala; Fertilizers and Chemicals Travancore Ltd, Cochin II, Kerala; Coromandel International Ltd, Vizag (A.P.); Coromandel International Ltd, Ennore (A.P.); Green Star Fertilizers Ltd, Tuticorin, Tamil Nadu; IFFCO Ltd, Paradeep Odisha; Krishna Phoschem Ltd, Meghnagar (M.P.); Madhya Bharat Agro Products Ltd,Sagar (M.P.); Paradeep Ohos. Ltd, Paradeep, (Odisha); Patel Phoschem Ltd, Udaipur (Raj.); Rashtriya Chemicals & Fertilisers Ltd, Trombay (Maharashtra). As on 01.11.2023, the total manufacturing capacity of phosphoric acid (as P_2O_5) is around 23 .73 lakh tonnes per annum. The production of phosphoric acid (as P2O5) in the year 2021-22 is estimated around 17.53 lakh tonnes. The important uses of phosphoric acid are in the manufacture of phosphatic fertilisers, agricultural feed, waxes, polishes, soaps & detergents, and in waste water treatment, tea-leaf processing, sugar refining, as well as anodising & stabilising agent.

Ferro-phosphorus (FeP)

Ferro-phosphorus is obtained as a by-product during steel manufacturing, during the production of yellow phosphorus or is smelt by phosphate rock & ferro-rock in blast furnace. It is used as an ingredient in high strength low-alloy steel, foundry products, as de-oxidiser in Metallurgy Industry & as a brake liner with 23% minimum phosphorus and 1% maximum carbon. Ferrophosphorus is also used as a dying agent and as an additive in metallic paints.

Red Phosphorus

Star Chemicals (Bombay) Pvt. Ltd and United Phosphorus Ltd, Gujarat, are the leading manufacturers and suppliers of red phosphorus in the country. It is mainly consumed in the Match Industry for making strike plate of match box. Besides, in Agriculture Industry, it is used as fumigant and in the making of pesticides. Red phosphorus finds application in the manufacture of phosphoric acid, semi-conductors and also as flame retardant for polymers. It is also used in pharmaceuticals for synthesis of drugs. In the year 2021-22 , the total installed capacity of Red Phosphorus was 1.68 thousand tonnes which was same as in the previous year. The production of Red Phosphorus during 2021-22 was 1.15 thousand tonnes as compared to 1.07 thousand tonnes in the previous year.

Borax

Borax is used as a component of glass, ingredient in enamel glazes, pottery & ceramics. The main manufacturers of borax is Borax Morarji Ltd with an installed capacity of 24,000 tpy at Dahej, GIDC in the State of Gujarat. The plant uses imported crude sodium borate concentrates (rasorite) and crude calcium borate (colemanite) as these are not produced indigenously. Indo-Borax & Chemical Ltd also operates borax and boric acid plants at Pithampur, Madhya Pradesh. As a thumb rule, for one tonne production of boric acid about 2 tonnes of boro-gypsum is produced. However, boro- gypsum does not have ready market for its disposal.

CHEMICAL FERTILIZERS

In India, the Agricultural Sector plays a vital role in the economic development of the country as securing food for 1.4 billion plus population is a mammoth task. To maximise agricultural output, it is imperative that better agricultural methods, and greater, but judicious use of fertilizers be put to effect. The application of fertilizers is well known for over a hundred years, but the use of chemical fertilizer started in the beginning of this century. The first phosphate fertilizer plant in India was commissioned in 1906. Since then, the Phosphatic Fertilizer Industry has grown considerably, but, the growth has not been able to keep pace with the ever increasing demand.

At present, there are 33 large size urea plants in the country manufacturing urea, 21 units producing DAP & other Complex fertilizers and 102 units for production of SSP.

As per Fertilizer Association of India, as on 01.11.2023 the total installed capacity of Urea, DAP, Complex fertilizer and SSP stands at 313.02 lakh tonnes, 74.52 lakh tonnes, 85.97 lakh tonnes and 123.15 lakh tonnes, respectively. In the year 2021-22, the production of total nutrients ($N+P_2O_5$) was 18.58 million tonnes. The imports and and consumption of total nutrients ($N+P_2O_5+K_2O$) in the year 2021-22 were 9.82 million tonnes and 29.79 million tonnes, respectively. India is the second largest consumer and third largest producer of finished fertilizers in the world. India is net importer of fertilizers, both finished products as well as raw materials Different types of straight and complex fertilizers are manufactured from rock phosphate, such as, SSP, DAP, nitrophosphate, urea ammonium phosphate etc.

In the absence of commercially exploitable resources of potash in the country, the entire demand of potassic fertilizers is met through imports. The capacity and production of different types of fertilizers are provided in Table-12.

Table – 12 : Installed Capacity and Production of Various Types of Fertilizers

(In lakh tonnes)

Products	No. of Units	Installed Capacity* (as on 01.11.2023)	Production	
			2020-21	2021-22
Urea	**33**	**313.02**	**246.05**	**250.72**
DAP	21	74.52	37.74	42.22
Complex Fertilizers		85.97	93.21	83.27
SSP	102*	123.15	49.35	53.34

Source: Annual Report 2021-22 and 2022-23, Department of Fertilizer. Fertilizer statistics*

The principal list of fertilizer plants is furnished in Table-13.

Table – 13 : Principal Fertilizer Plants

Sl. No.	Plant	Location
Public Sector		
1	National Fertilizer Ltd	Nangal and Bhatinda (Punjab), Panipat (Haryana),Vijaipur-I & II (Madhya Pradesh)
2	Brahmaputra Valley Fertilizer Corp. Ltd	Namrup- II and III (Assam)
3	Fertilizers & Chemicals Travancore Ltd	Udyogmandal and Cochin-I & II (Kerala)
4	Rashtriya Chemicals & Fertilizers Ltd	Thal Vaishet,Trombay I & IV and Trombay V (Maharashtra)
5	Madras Fertilizers Ltd	Manali (Tamil Nadu)
6	Steel Authority of India Ltd	Rourkela (Odisha),Bhilai (Chhattisgarh),Bokaro (Jharkhand),Durgapur (West Bengal),IISCO,Burnpur-Kulti (West Bengal)
7	Hindustan Urvarak & Rasayan Ltd*	Gorakhpur (Uttar Pradesh),Barauni (Bihar),Sindri (Jharkhand)
8	Ramagundam Fertilizers & Chemicals Ltd*	Ramagundam (Telangana)
9	Rashtriya Ispat Nigam Ltd	Visakhapatnam (Andhra Pradesh) (Visakhapatnam Steel Plant)
Private Sector Large Units		
8	Gujarat State Fertilizers & Chemicals Ltd	Vadodara and Sikka I & II (Gujarat)
9	KRIBHCO Fertilisers Ltd	Shahjahanpur (Uttar Pradesh)
10	Yara Fertilisers India	Babrala (Uttar Pradesh)
11	Matix Fertilizers & Chemicals Ltd	Panagarh (West Bengal)
12	Coromandel International Ltd.	Vizag and Kakinada (Andhra Pradesh), Ennore ,(Tamil Nadu)
13	Krishna Phoschem Ltd	Meghnagar (Madhya Pradesh)
14	Gujarat Narmada Valley Fertilizers & Chemicals Ltd	Bharuch (Gujarat)
15	Greenstar Ferts. Ltd.	Tuticorin (Tamil Nadu)

Sl. No.	Plant	Location
16	Madhya Bharat Agro Product Ltd	Sagar II (Madhya Pradesh)
17	Mangalore Chemicals & Fertilizers Ltd	Mangalore (Karnataka)
18	Nagarjuna Fertilizers & Chemicals Ltd	Kakinada I & II (Andhra Pradesh)
19	Tuticorin Alkali Chemicals & Fertilizers Ltd	Tuticorin (Tamil Nadu)
20	Indorama India Pvt.Ltd	Jagdishpur (Uttar Pradesh), Haldia (West Bengal)
21	Mahadhan Agri Tech Ltd	Taloja (Maharashtra)
22	Shriram Fertilisers & Chemicals	Kota (Rajasthan)
23	Southern Petrochemical Industries Corporation Ltd	Tuticorin (Tamil Nadu)
24	Chambal Fertilizers & Chemicals Ltd	Gadepan I, II & III Kota (Rajasthan)
25	Kanpur Fertilisers & Chemicals	Kanpur (Uttar Pradesh)
26	Paradeep Phosphates Ltd	Paradeep (Odisha), Zuari Nagar (Goa)
27	Hindustan Chemicals Co.	Surat (Gujarat)
Co-operative Sector		
28	Indian Farmers Fertiliser Co-operative Ltd	Kalol and Kandla (Gujarat), Aonla I & II, Phulpur I & II (Uttar Pradesh), Paradeep (Odisha)
29	Krishak Bharti Co-operative Ltd	Hazira (Gujarat)

Types of fertilizers produced in India are detailed below:

A) **Straight Nitrogenous Fertilizers:**

1) Ammonium Sulphate (AS)
2) Calcium Ammonium Nitrate (CAN)
3) Ammonium Chloride
4) Urea

B) **Straight Phosphatic Fertilizers:**

1) Single Super Phosphate (SSP)
2) Triple Super Phosphate (TSP)

C) **NP/NPK Complex Fertilizers:**

1) Urea Ammonium Phosphate
2) Ammonium Phosphate Sulphate
3) Diammonium Phosphate (DAP)
4) Mono ammonium Phosphate (MAP)
5) Nitro phosphate
6) Nitro phosphate with Potash
7) NP/ NPK

PAPER & PAPER BOARD INDUSTRY

The Indian Paper Industry accounts for about 5% of the world's total production of paper. There are around 912 units which are manufacturing pulp, paper, paper board and newsprint with an installed capacity of nearly 29.11 million tonnes out of which 5.51million tonnes are lying idle. As on date around 538 mills are in operation and with a total operating capacity of around 25.28 million tonnes, the industry has almost achieved pre-covid levels of production. The total production for the year of 2021-22, stood at 22.43 million tonnes exhibiting an increase of 3.4% on YoY basis. In the year 2021-22, the total capacity utilisation stood at around 89% and the total consumption of paper, paperboard, and newsprint stood at 21.07 million tonnes. Our per capita paper consumption has increased to 15-16 kg, largely propelled by increase in demand of packaging papers. However, looking at the average per capita consumption pof 52 kg at the international level, we have a headroom for increasing the consumption to at least about three times the present rate. In the year 2021-22, the global share of the country in contribution of paper, paper board and newsprint production is 5.6%. In terms of production, India is placed at No. 5 in the global paper producing nations. Global average growth of production of paper, paperboard and newsprint is around 1%, whereas in India average growth of this industry is about 3-4 %. Thus, India offers one of the very few markets in the world that exhibits growth potential for paper and paper board. During the year 2021-22, 2.17 million tonnes of paper, paper board and newsprint were imported and about 3.53 million tonnes of paper, paper board and newsprint were exported. The Indian Paper Industry is in a fragmented structure, consisting of small, medium and large paper mills having capacity ranging from 5 to 1,650 tonnes per day. The Sector uses wood, agro residues and waste paper as input substrates for production. Presently, in the total production, the share of wood, agro and waste paper based mills stand at 19.26%, 5.84% and 74.9%, respectively. The Newsprint Sector in the country is governed by the Newsprint Control Order (NCO), 2004. At present, there are 125 mills registered under the Schedule to the NCO. However, due to prevalent market conditions, only 79 mills are under production with an operating capacity of 2.22 million tonnes, which accounts for 67% of the total capacity of 3.30 million tonnes registered under the schedule. Minerals like china clay, limestone, talc, salt, sulphur, etc. besides coal as fuel are used for purposes, such as, filler, coating & surface sizing, etc., in this Industry and also play vital role in quality control.

PAINT & ALLIED PRODUCTS INDUSTRY

The Paint & Allied Products Industry comprises paints, enamels, varnishes, pigments, synthetic resins, printing inks, etc. Approximately, 65% of the production is contributed by the Organised Sector. The per capita consumption of paint in India is around 4 kg.

The Indian Paint Industry is expected to grow at a rate of 12–13% annually. India is self-sufficient in the production of paints. Barytes, bentonite, calcite, china clay, mica powder, rutile, talc/steatite/soapstone, ochre, silica & dolomite powder are some of the important minerals consumed in the Paint Industry.

PETROLEUM REFINERIES

There were 23 refineries operating in the country (20 in Public/Joint Sector and 3 in Private Sector). India is the fourth largest refiner in the world. While production is largely in the hands of publicly owned companies, India's largest refineries are privately owned, notably the world's largest refinery is Reliance-owned Jamnagar refinery located on the western coast of Gujarat.

Installed capacity and Refinery-wise Crude Oil processed are provided in Table-14.

Table – 14: Installed Capacity and Refinery-wise Crude Oil Processed

(In '000 tonnes)

Refinery	Annual installed capacity (as on 1.4.2022)	Refinery Crude throughput		
		2019-20	2020-21	2021-22 (P)
Total	**251220**	**254386**	**221773**	**241703**
Public/Private Sector & Subsidiaries	**143920**	**144716**	**127504**	**138081**
IOCL, Digboi, Assam	650	664	605	708
IOCL, Guwahati, Assam	1000	892	849	730
IOCL, Barauni, Bihar	6000	6516	5469	5620
IOCL, Koyali, Gujarat	13700	13075	11603	13474
IOCL, Haldia, West Bengal	8000	6463	6759	7305
IOCL, Mathura, Uttar Pradesh	8000	8948	8926	9123
IOCL, Bongaigaon, Assam	2700	2045	2450	2639
IOCL, Panipat, Haryana	15000	15038	13181	14849
IOCL, Paradeep, Odisha	15000	15778	12508	13217
BPCL, Mumbai, Maharashtra	12000	15017	12941	14437
BPCL (formerly KRL), Kochi, Kerala	15500	16515	13282	15402
HPCL, Mumbai, Maharashtra	9500	8065	7374	5558
HPCL, Visakhapatnam, Andhra Pradesh	8300	9115	9050	8410
CPCL, Manali, Tamil Nadu	10500	10161	8243	9040
CPCL, Narimanam, Tamil Nadu	0	-	-	
Numaligarh Refinery Ltd, Numaligarh, Assam	3000	2383	2707	2624
MRPL, Mangaluru, Karnataka	15000	13953	11475	14871
ONGC, Tatipaka, Andhra Pradesh	70	87	81	75
Joint Venture	**19100**	**20155**	**16262**	**20437**
Bharat Oman Refineries Ltd, Bina@	7800	7913	6190	7410
HPCL Mittal energy Ltd (HMEL), Bathinda#	11300	12242	10072	13027
Private Sector	**88200**	**89515**	**78008**	**83186**
RIL, Jamnagar, Gujarat	33000	33019	34100	34757
RIL, Jamnagar (SEZ), Gujarat	35200	35876	26841	28264
Nyara Energy Ltd (NEL),Vadinar, Gujarat	20000	20620	17067	20164

Source: Indian Petroleum and Natural Gas Statistics, 2021-22, Ministry of Petroleum & Natural Gas, Government of India.
@: Bharat Oman Refineries Ltd (BORL) is a Joint Venture Company promoted by BPCL and Oman Oil Company Ltd (OOCL).
#: HPCL Mittal Energy Ltd is a Joint Venture Company promoted by HPCL and Mittal Energy Investment Pvt. Ltd.
Note: (i) CPCL and BRPL are subsidiaries of IOCL; NRL of BPCL; and MRPL of ONGC.
(ii) Crude throughput in terms of crude oil processed.
(iii) Total may not tally due to rounding off.
(iv) CPCL refinery is under shutdown due to limitation in meeting required product specification.

The total refining capacity in the country as on 01.04.2022 is around 251.22 million tpy. The total crude throughput increased to 241.77 million tonnes in 2021-22 from 221.77 million tonnes in 2020-21. Production of petroleum products from crude oil was 254.31 million tonnes in 2021-22 as against 233.51 million tonnes in 2020-21. Import of petroleum crude was 220.03 million tonnes in 2021-22 as against 188.18 million tonnes in 2020-21. During 2021-22, crude oil and condensate production in the country was at 29.69 million tonnes, while the natural gas production was at 34.02 billion cubic metres (BCM).

The details of capacity expansion and development are reflected in the Review on Petroleum and Natural Gas in Vol-III, IMYB, 2022.

FOUNDRY

The Indian Foundry Sub-sector is the key feeder to the Engineering Industry. Foundry Industry, on the advice of National Manufacturing Competitiveness Council (NMCC), New Delhi, under Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, has prepared draft Vision Document 2020 in which it is envisaged that there must be doubling of production with enhanced energy efficiency, technological modernisation and greenfield expansion to realise the goals envisioned.

Indian Foundry Industry is the third largest in the world. This Industry is now well established in the country and is spread across a wide spectrum consisting of large, medium, small and tiny sectors.

Typically, each foundry cluster is known to cater to specific end-use markets. The Coimbatore cluster is famous for pump-sets castings; Kolhapur and Belgaum cluster for automotive castings; Rajkot cluster for diesel engine castings and Butala– Jalandhar cluster mainly for machine parts and agricultural implements. Advanced countries like USA, Japan, Germany are unlikely to add much capacity due to stringent pollution control norms there. India can thus have a dominant presence in this field and can become an important casting supplier to the world.

Although intermediate mineral-based products like pig iron, scrap of metals and ferroalloys, etc. are main inputs for foundry, minerals like bentonite, coke, coal, fireclay, fluorite, iron ore, limestone, silica sand, zircon flour, etc. are also being consumed by the Foundry Industry.

The Indian Foundry Sub-sector is the key feeder to the Engineering Industry. Foundry Industry, on the advice of National Manufacturing Competitiveness Council (NMCC), New Delhi, under Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, has prepared draft Vision Document 2020 in which it is envisaged that there must be doubling of production with enhanced energy efficiency, technological modernisation and greenfield expansion to realise the goals envisioned.

Indian Foundry Industry is the third largest in the world. This Industry is now well established in the country and is spread across a wide spectrum consisting of large, medium, small and tiny sectors.

Typically, each foundry cluster is known to cater to specific end-use markets. The Coimbatore cluster is famous for pump-sets castings; Kolhapur and Belgaum cluster for automotive castings; Rajkot cluster for diesel engine castings and Butala– Jalandhar cluster mainly for machine parts and agricultural implements. Advanced countries like USA, Japan, Germany are unlikely to add much capacity due to stringent pollution control norms there. India can thus have a dominant presence in this field and can become an important casting supplier to the world.

Although intermediate mineral-based products like pig iron, scrap of metals and ferroalloys, etc. are main inputs for foundry, minerals like bentonite, coke, coal, fireclay, fluorite, iron ore, limestone, silica sand, zircon flour, etc. are also being consumed by the Foundry Industry.

8. Production

12.2%
increase in Mineral Production was reported in 2021-22

Rs 1,22,141 crore
Value of production of Metallic Minerals in 2021-22

Rs 10,606 crore
Value of production of Non metallic Minerals in 2021-22

MINERALS

The mineral production (excluding atomic minerals and Minor Minerals) in India increased by 12.2 % (as per index of mineral production base year 2011-12) during 2021-22 as compared to the previous year due to increase in the production of Raw Coal, Lignite and Natural gas among fuel minerals; Bauxite, Chromite, Gold, Iron Ore, Zinc Conc. etc. among metallic minerals and Fluorite (graded), Graphite, Kyanite, Limestone, Magnesite, Selenite, Vermiculite and Wollastonite, etc. among non-metallic minerals.

Fuel Minerals

The production of coal at 778 million tonnes during 2021-22 increased by about 8.7 % as compared to the previous year. The production of Lignite at 47 million tonnes during 2021-22 increased by about 25.3 % as compared to the previous year. The production of petroleum (crude) at 29.7 million tonnes decreased by 2.6 % whereas as production of natural gas at 34,024 m.cu.m increased by 18.7% as compared to that of the previous year.

Offshore regions remain the largest producing area and contributed 49% of total production of petroleum (crude oil) followed by Rajasthan (20%), Gujarat (16%) and Assam (13%). The remaining 2% was contributed by Tamil Nadu, Andhra Pradesh, Arunachal Pradesh and Tripura. Offshore region, the largest source for natural gas in the country accounted for 67% of the total production, while Assam contributed 10 per cent. The remaining was contributed by a few other States (Table-1).

Metallic Minerals

The value of production of metallic minerals in 2021-22 at ₹ 1,22,142 crore increased by about 69.2 % over that of the previous year mainly due to higher production reported for iron ore, zinc concentrate, chromite, silver and bauxite. Among the principal metallic minerals, iron ore contributed 96,381 crore or 79%, zinc (concentrate) ₹ 8,182 crore or 7%, chromite 4,730 crore or about 4%. silver ₹ 4,212 crore or 3%, bauxite 2,477 crore or about 2%, Lead Conc. 2.237 crore or about 25%, manganese ore 22,224 crore or about 2% and the remaining value was from copper (concentrates), gold, and tin concentrates in the total value of metallic minerals.

The production of iron ore at about 254 million tonnes in 2021-22 increased by 24% over that of the previous year. Production of iron ore was mainly from Odisha (53.8%), Chhattisgarh (16.3%), Karnataka (15.9%), and Jharkhand (9.7%) during the year. The remaining 4.3% production was reported from Andhra Pradesh, Goa, Madhya Pradesh, Maharashtra and Rajasthan.

The production of chromite at 3.786 million tonnes in 2021-22 increased by 34% as compared to the previous year. Odisha reported almost entire output of chromite in the country. The production of copper ore at 3.57 million tonnes was 9% up, while that of copper concentrate at 114 thousand tonnes in 2021-22 increased by 5% as compared to the previous year. The average metal content in the concentrate produced works out to 23.13% Cu in 2021-22 as against 23.12% Cu in the previous year. The production of manganese ore at 2.69 million tonnes in 2021-22 decreased nominally as compared to that in the previous year. Of the total production of manganese ore in 2021-22, Madhya Pradesh continued to be the largest producer by contributing 32%, followed by Maharashtra (27%), Odisha (19%) and Karnataka (14%). The remaining production was reported by Andhra Pradesh, Rajasthan and Telana.

Production of primary gold in 2021-22 at 1,251 kg increased by 11% as compared to that in the previous year. Karnataka was the leading producer of gold accounting for 99% of the total production. The remaining production was reported from Jharkhand. The production of bauxite at 22.49 million tonnes in 2021-22 increased by 10% as compared to the previous year. Odisha with 73% contribution was the leading producer of bauxite followed by Gujarat (9%), Jharkhand (8%), Chhattisgarh(4%), Maharashtra (2.8%) and Madhya Pradesh (2.7%). The production of lead concentrate at 368 thousand tonnes decreased by 2.4 % and that of zinc concentrate at 1,594 thousand tonnes increased by 5% over the previous year. Rajasthan was the only State reporting production of lead concentrate and zinc concentrate during 2021-22. The lead concentrates produced in Rajasthan during 2021-22 was of grade 58.76% Pb as against 57.11% Pb in previous year. Metal content of zinc concentrates produced in Rajasthan worked out to 50.16% Zn in 2021-22 as against 50.07% Zn in the previous year (Table-1).

Non-Metallic Minerals

The value of production of non-metallic minerals at ₹ 10,606 crore during 2021-22 increased by 14.8% as compared to the previous year (Table-1).

Reporting Mines

Re porting mine is defined as " A mine reporting production or reporting 'nil' production during a year but engaged in developmental work such as, overburden removal, underground driving, winzing, sinking work, exploration by pitting, trenching or drilling as evident from the MCDR returns".

There were 1,311 reporting mines (excluding fuel minerals, atomic fuel and minor minerals) in India located in all States and UTs during 2021-22. Among them, 545 belong to Metallic minerals and 766 to Non-metallic minerals. There were 157 mines in Public Sector and the rest of 1154 mines were in Private Sector.

Employment

The average daily employment of labour engaged in mining sector (excluding fuel minerals, atomic and minor minerals) was 1 ,09 ,304 in 2021-22. Out of this, 36,080 or 33 % were in Public Sector and 73,224 or 67 % in Private Sector. Metallic minerals accounted for 80 % and non- metallic minerals 20 % of the total labour force during the year.

Role of Public Sector

The Public Sector has played sigmficant role in the overall mineral production in 2021-22.

The entire production of Copper Ore & Conc., among metallic mineral and Diamond, Fluorite, Salt (Rock) and Selenite in respect of non-metallic minerals was reported from the Public Sector. By and large, the entire production of Gold, Tin Conc. and Phosphorite came from Public Sector during 2021-22 (Table-2).

Index of Mineral Production

The index of mineral production (excluding atomic and minor minerals) (with base year 2011-12=100) for 2021-22 at 113.3 has increased 12.2 % as compared to the previous year (Table-3).

Gross Value Added from Mining & Quarrying Sector

The Ministry of Statistics & Programme Implementation has released the provisional estimates of national income, revising the base year from 2004-05 to 2011-12 in the year 2015. The industry-wise estimates are now presented as Gross Value Added (GVA) at basic prices. Certain changes have been made in this series including for Mining & Quarrying industry. During 2021-22 Mining and Quarrying industry accounted for about 2.4 % of the GVA at current prices. The GVA at current and constant prices for the period from 2019-20 to 2021-22 is furnished in Tables-4 & 5.

Table - 1 : Mineral* Production in India, 2019-20 to 2021-22

(By Mineral Groups & Minerals)

(Value ₹ '000)

Mineral	Unit	2019-20		2020-21		2021-22(P)	
		Quantity	Value$	Quantity	Value$	Quantity	Value$
All Minerals			**1653255998**		**1588690573**		**2020953828**
Fuel Minerals							
Coal	'000t	730874	n.a	716083	n.a	778210	n.a
Lignite	'000t	42096	n.a	37895	n.a	47492	n.a
Natural Gas (ut.)	m c m	31184	n.a	28673	n.a	34024	n.a

Mineral	Unit	2019-20		2020-21		2021-22(P)	
		Quantity	Value$	Quantity	Value$	Quantity	Value$
Petroleum(crude)	'000t	32170	n.a	30494	n.a	29691	n.a
Metallic Minerals			**682983311**		**721985419**		**1221419286**
Bauxite	t	21825227	16299333	20380548	16793448	22493947	24767048
Chromite	t	3929260	32134395	2830413	21862796	3785625	47298073
Copper Conc.	t	124586	8448405	108718	8533354	114421	10951112
Copper Ore	t	3952472	-	3272915	-	3569632	-
Gold	kg	1742	6495723	1127	5475470	1251	6011677
Gold Ore	t	595511	-	437669	-	491160	-
Iron Ore	'000t	244083	496430578	205041	527292469	253973	963813280
Lead & Zinc Ore	t	14479032	-	15455342	-	16338461	-
Lead Conc.	t	351746	18260832	376923	18810483	368040	22366174
Manganese Ore	t	2910186	18849100	2703313	17415461	2695991	22240539
Silver	kg	609340	25616104	705796	42664424	647140	42123586
Tin Conc.	kg	15530	10337	16865	10413	26292	31979
Zinc Conc.	t	1446824	60438504	1513996	63127101	1594086	81815818
Non-Metallic Minerals			**95038914**		**92361844**		**106057078**
Diamond	crt	28816	352472	13917	147696	266	18051
Fluorite(graded)	t	1315	8844	1052	8018	1237	8831
Garnet (abrasive) #	t	568	1775	7114	26378	8182	29880
Graphite (r.o.m.)	t	34674	55908	35386	87147	57264	95192
Iolite	kg	90	579	16	73	27	191
Kyanite	t	3498	12728	4925	9251	9432	17578
Limeshell	t	4600	18730	-	-	100	220
Limestone	'000t	359464	88890081	349120	86484948	392760	97349550
Magnesite	t	102554	351947	74661	314676	113495	450169
Marl	t	2148854	412463	2216414	417184	1853481	326498
Moulding Sand	t	12905	3766	14363	4150	16843	5080
Phosphorite	t	1400189	4731313	1455829	4694525	1395079	7616476
Salt (rock)	t	130	1447	486	14156	286	6125
Selenite	t	2154	4206	402	602	756	1022
Siliceous Earth	y	19367	11710	23823	14686	31783	21209
Sillimanite	t	13221	37903	11110	13987	3432	7973
Sulphur **	t	900942	-	737337	-	880858	-
Vermiculite	t	2774	3347	1260	2157	3061	3768
Wollastonite	t	124757	139695	103902	122210	108383	99265
Minor Minerals @			**875233773**		**774343310**		**693477464**

** Excluding the minerals declared as prescribed substances under the Atomic Energy Act,1962.*
$ Excludes the value of fuel minerals.
*** Obtained as by-product from fertilizer plants and oil refineries. The coverage relates to PSUs only*
@ : Figures for earlier year(s) have been repeated as estimates, wherever necessary, because of non-receipt of data from respective state governments.
 # Other than BSM (Beach Sand Minerals)

Table - 2 : Mineral* Production (Quantity), 2020-21 and 2021-22
(By Sectors)

Mineral	Unit	All India		Public Sector		Private Sector		Share of Public Sector in Total Production		Overall increase or decrease in production in 2021-22 over 2020-21
		2020-21	2021-22 (P)	2020-21	2021-22 (P)	2020-21	2021-22 (P)	2020-21	2021-22 (P)	
Metallic Minerals										
Bauxite	tonne	20380548	22493947	10675623	11066084	9704925	11427863	52.38	49.2	10.37
Chromite	tonne	2830413	3785625	1123742	1163755	1706671	2621870	39.7	30.74	33.75
Copper conc.	tonne	108718	114421	108718	114421	-	-	100	100	5.24
Copper ore	tonne	3272915	3569632	3272915	3569632	-	-	100	100	9.07

Mineral	Unit	All India		Public Sector		Private Sector		Share of Public Sector in Total Production		Overall increase or decrease in production in 2021-22 over 2020-21
		2020-21	2021-22 (P)	2020-21	2021-22 (P)	2020-21	2021-22 (P)	2020-21	2021-22 (P)	
Gold	kg	1127	1251	1116	1239	11	12	99.02	99.04	11
Gold ore	tonne	437669	491160	434810	486629	2859	4531	99.35	99.08	12.22
Iron ore	'000 t	205041	253973	75884	99809	129157	154164	37.01	39.3	23.86
Lead & Zinc ore	tonne	15455342	16338461	-	-	15455342	16338461	-	-	5.71
Lead conc.	tonne	376923	368040	-	-	376923	368040	-	-	-2.36
Manganese ore	tonne	2703313	2695991	1152550	1238814	1550763	1457177	42.63	45.95	-0.27
Silver	kg	705796	647140	120	127	705676	647013	0.02	0.02	-8.31
Tin conc.	kg	16865	26292	13859	24813	3006	1479	82.18	94.39	55.9
Zinc conc.	tonne	1513996	1594086	-	-	1513996	1594086	-	-	5.29
Non-Metallic Minerals*										
Diamond	carat	13917	266	13917	266	-	-	100	100	-98.09
Flourite Graded	tonne	1052	1237	1052	1237	-	-	100	100	17.59
Garnet (Abrasive)#	tonne	7114	8182	-	-	7114	8182	-	-	15.01
Graphite R.O.M.	tonne	35386	57264	10026	36214	25360	21050	28.33	63.24	61.83
Iolite	kg	16	27	-	-	16	27	-	-	68.75
Kyanite	tonne	4925	9432	540	4357	4385	5075	10.96	46.19	91.51
Limeshell	tonne	-	100	-	-	-	100	-	-	-
Limestone	'000 t	349120	392760	8668	11271	340452	381489	2.48	2.87	12.5
Magnesite	tonne	74661	113495	30621	61322	44040	52173	41.01	54.03	52.01
Marl	tonne	2216414	1853481	-	-	2216414	1853481	-	-	-16.37
Moulding sand	tonne	14363	16843	-	-	14363	16843	-	-	17.27
Phosphorite	tonne	1455829	1395079	1357949	1295549	97880	99530	93.28	92.87	-4.17
Salt (rock)	tonne	486	286	486	286	-	-	100	100	-41.15
Selenite	tonne	402	756	402	686	-	70	100	90.74	88.06
Siliceous earth	tonne	23823	31783	-	-	23823	31783	-	-	33.41
Sillimanite	tonne	11110	3432	-	-	11110	3432	-	-	-69.11
Sulphur**	tonne	737337	880858	737337	880858	-	-	100	100	19.46
Vermiculite	tonne	1260	3061	510	691	750	2370	40.48	22.57	142.94
Wollastonite	tonne	103902	108383	-	-	103902	108383	-	-	4.31

** Excluding Atomic, Fuel and minor minerals*

*** Obtained as by-product from fertilizer plants and oil refineries. The coverage relates to PSUs only.*

 # Other than BSM (Beach Sand Minerals)

Table - 3 : Index of Mineral Production, 2019-20 to 2021-22
(Excluding Atomic Minerals)

(Base 2011-12=100)

Year	Index of mineral production 1000	Coal & lignite 306.854	Crude petroleum & natural gas 444.318	Metallic minerals 230.004	Non-metallic minerals 18.824
2019-20	109.6	134.6	75.4	141.3	120.9
2020-21	101	131.4	70.7	117.7	117.4
2021-22 (P)	113.3	143.5	74.4	146.8	130.1

Note: Figures in parentheses indicate the weights attached to respective groups

Table - 4 : Gross Value Added at Basic Price, 2019-20 to 2021-22
(At Current Prices) (31.05.2022)

(in ₹ crore)

Industry	2019-20 (2nd RE)	2020-21 (1st RE)	2021-22 (PE)	% Change in 2021-22 over the previous year
GVA (All)	18,355,109	18,057,810	21,349,399	18.2
Mining & Quarrying	358,517	324,980	513,076	57.9

Source : CSO RE: Revised Estimates PE : Provisional Estimates

Table - 5 : Gross Value Added at Basic Price, 2019-20 to 2021-22

(At 2011-12 prices) (31.05.2022)

(in ₹ crore)

Industry	2019-20 (2nd RE)	2020-21 (1st RE)	2021-22 (PE)	% Change in 2021-22 over the previous year
GVA (All)	13,219,476	12,585,074	13,605,474	8.1
Mining & Quarrying	321,766	294,024	327,984	11.5

Source : CSO RE: Revised Estimates PE : Provisional Estimates

METALS

Ferrous Metals

As per data available in monthly publication of Indian Bureau of mines 'Monthly Statistics of Mineral Production, March 2022' India produced 113.6 million tonnes of Finished Steel (including C.R. sheets), 120 million tonnes of Semi-finished Steel, 5.7 million tonnes of Pig iron and 39 million tonnes of Sponge Iron in 2021-22.

Production of various items of Iron & Steel (Ferrous Metals) for the last three years is furnished in Table-6.

Table – 6: Production of Ferrous Metals, 2019-20 to 2021-22

(In '000 tonnes)

Ferrous Metal	2019-20	2020-21	2021-22
Finished steel			
(including C.R. sheets)	102058	95122	113596
Semi-finished steel			
(including steel ingots)	109216	103044	120007
Pig iron	5508	4839	5759
Sponge iron	37141	34155	39031

Source: Monthly Statistics of Mineral Production ; March 2022, Indian Bureau of Mines, Nagpur

Ferroalloys

Indian Bureau of Mines collects production figures of ferroalloys from the producing plants in the country on non-statutory basis.

The information on production of ferroalloys was received from only some of operating plants in 2021-22. As such the production data presented here relates to the extent received and may not reflect the entire production of ferroalloys in the country. Production of ferroalloys for the years 2019-20 to 2021-22 , to the extent received (including partly estimated due to non-receipt of data), is presented in Table - 7.

Table – 7: Production of Ferroalloys, 2019-20 to 2021-22

Ferroalloys	Unit	2019-20	2020-21	2021-22 (P)
Ferrochrome	tonne	921000	868000	1113000
Ferromanganese	tonne	NA	NA	NA
Ferrosilicon	tonne	NA	NA	NA
Ferroboron	kg	NA	NA	NA
Ferromolybdenum	kg	527359	428210	435860
Ferroniobium	kg	NA	NA	NA
Ferrotitanium	kg	120762	249162	416109
Ferrovanadium	kg	664541	634160	850120
Ferroaluminium	kg	1461388	1119259	1138829
Magnesium Ferrosilicon	tonne	13930	10220	15081
Silicomanganese	tonne	320594	329295	349414

Source: Monthly Statistics of Mineral Production ; March 2022, Indian Bureau of Mines, Nagpur

Non-Ferrous Metals

The production of a luminium at 4,017 thousand tonnes in 2021-22 registered a increase of 11% as compared to that in previous year.

Smelting and refining of copper is carried out by Hindustan Copper Ltd in their existing plants located at Ghatshila (Jharkhand) and Raigad (Chhattisgarh). Copper metal is also produced from imported copper concentrates at the plant of Vendanta Ltd [formerly Sterlite Industries (India) Ltd] and Hindalco Industries Ltd. There was nil production of copper blister in 2020-21 and 2021-22. The production of copper cathodes at 4,83,994 tonnes in 2021-22 increased by 33% as compared to that in the previous year. The production of copper continuous cast wire rods at 3,51,464 tonnes in 202-22 inreased by 3 % as compared to that in the previous year.

The production of lead (primary) at 1,91,185 tonnes in 2021-22 decreased by 11% as compared to that in the previous year. No production of lead (secondary) was reported since last ten years. The production of zinc ingots in 2021-22 was 7,75,808 tonnes which showed an increase of 8 % from that of previous year (Table-8).

Table – 8: Production and Value of Non-Ferrous Metals, 2019-20 to 2021-22

(Quantity in tonnes; Value in ₹ '000)

Ferroalloys	Unit of quantity	2019-20		2020-21		2021-22	
		Quantity	Value	Quantity	Value	Quantity	Value
Aluminium	tonnes	3635089	455960160	3619237	415967702	4016621	714320466
Cadmium	tonnes	-	-	-	-	-	-
Copper (blister)	tonnes	3997	NA	-	-	-	-
Copper (cathode)	tonnes	408003	176011710	363609	190616200	483994	363507671
Copper (continuous cast wire rod)	tonnes	349475	155090811	341563	188445400	351464	261303186
Gold#	kg	8382	31283423	7387	35814249	9931	47676677
Lead (primary)	tonnes	181365	29111241	214399	34531700	191185	34944605
Silver#	kg	672380	28267504	746377	45207924	713637	46421186
Tin	kg	6063	7361	-	-	-	-
Zinc ingot	tonnes	688282	137840297	715445	147976396	775808	202092090

Source: # : Includes production reported by Hindalco Industries which is excluded in mineral production tables.

Precious Metals

Gold primary is produced from gold ore by HGML in the State of Karnataka. Gold is also recovered as by-product from copper slime of Hindalco Industries Ltd in Gujarat. The total production of gold bullion during the year 2021-22 at 9,931 kg increased by 34 % as compared to 7,387 kg in the previous year.

Production of silver in India is reported as a by- product from lead and zinc concentrates and copper slime and as a co-product of gold refining.

The production of silver at 7,13,637 kg registered a decrease of 4 % as compared to that in the previous year.

Other Metals

Production of cadmium is reported as a by-product of zinc smelting and was nil in 2021-22.

9. Prices

In the Mumbai and Delhi domestic market, mostly upward trend was observed in 2021-22 in the prices of non-ferrous metals as compared to the previous year.

Prices of most of the items of steel have registered a positive growth during 2021-22.

MINERALS

Domestic Markets

Fuel Minerals

The pit head prices of different varieties of coking coal, semi-coking coal and the weighted average of crude oil prices are furnished in Table-1.

Table – 1: Pit Head (run-of-mine) of Price (in ₹ /tonne) of Coking Coal Applicable for Consumers other than Power Utilities (including IPPs), Fertiliser and Defence (Price in ₹ /tonne) & Weighted Average Crude Oil Prices

(In ₹ per tonne)

Grade	2019-20	2020-21	2021-22
South Eastern Coalfields Ltd			
Semi-Coking grade I	2260	2260	2260
Semi-Coking grade II	1890	1890	1890
Eastern Coalfields Ltd (Ranigunj)			
Semi-Coking grade I	2800	2800	2800
Semi-Coking grade II	2330	2330	2330
Bharat Coking Coal Ltd			
Washery grade I	5028	5028	5028
Washery grade II	3840	3840	3840
Washery grade III	3060	3060	3060
Washery grade IV	2892	2892	2892
Western Coalfields Ltd			
Washery grade II	2220	2220	2220
Washery grade III	1830	1830	1830
Washery grade IV	1680	1680	1680
Central Coalfields Ltd			
Washery grade I	3450	3450	3450

Table-1 Concld.

Grade	2019-20	2020-21	2021-22
Washery grade II	3210	3210	3210
Washery grade III	2750	2750	2750
Washery grade IV	2300	2300	2300
CRUDE OIL			
Basic Price Offshore	31604	24187	43745
Basic Price Onshore	30488	23081	41088
Basic Price Offshore & onshore	31237	23832	42874

Sources : *1. Coal directory of India 2021-22, Ministry of Coal, for prices of coal.*
2. Indian Petroleum & Natural Gas Statistics, 2021-22, Ministry of Petroleum & Natural Gas, for basic prices of crude oil.
Note: Prices of BCCL (unspecified) has been substituted with BCCL due to non availability of prices.

METALS

Domestic Markets

In the Mumbai and Delhi domestic markets mostly upward trend observed in 2020-21 in the prices of non-ferrous metals as compared to the previous year. Prices of Metals (Non-ferrous) in domestic markets are listed in Table-2(A)& 2(B).

Prices of most of the items of steel have registered a positive growth during 2021-22. Prices of steel in domestic markets are listed in Table – 3.

Foreign Markets

The Prices of Metals in foreign market They are listed in Table-4

Table – 2 (A) : Prices of Metals (Non-Ferrous), March 2021 & March 2022 (Domestic market)

(In ₹ per quintal)

Grade	Market	(Mar 2021)	(Mar 2022)
Aluminium			
Utensil Scrap	Mumbai	14700	20376
Ingot	Mumbai	19340	29362
Wire Scrap	Mumbai	18175	23490
Sheets (Scrap)	Delhi	17885	27776
Utensil Scrap	Delhi	14445	20319
Wire Scrap	Delhi	18710	23152
Brass			
Honey	Mumbai	41605	51476
Utensil Scrap	Mumbai	42425	54167
Sheet Cutting	Mumbai	45620	54910
Gun Metal Scrap	Delhi	44675	57086
Copper			
Wire Scrap	Mumbai	68920	79424
Utensil Scrap	Mumbai	61665	71110
Wire Rod	Mumbai	59910	80567
Wire Bar	Mumbai	69340	79014
Cathode	Mumbai	71675	82095
Wire Scrap	Delhi	62595	81481
Wire	Delhi	66305	79338
Mixed Scrap	Delhi	66910	77290
Lead			
Ingot	Mumbai	17025	18967
Soft	Delhi	16830	18610
Hard (4%)	Delhi	18135	18286

Table-2 (A) Concld.

Grade	Market	(Mar 2021)	(Mar 2022)
Nickel			
Ingot	Mumbai	126900	259100
Ingot(4x4)	Delhi	126810	257148
Tin			
Ingot	Mumbai	221275	389248
Ingot	Delhi	220630	389010
Zinc			
Ingot	Mumbai	23205	33633
Ingot	Delhi	25190	33243
Dross	Delhi	22605	33071

Source: *Minerals and Metals Review.*

Table – 2 (B) : Prices of Metals (Non-ferrous), 2019-20 to 2021-22 (Domestic market)

Grade	Market	2019-20	2020-21	2021-22
Gold*				
24 C	Mumbai	33567	NA	NA
Standard	Delhi	35372	NA	NA
Biscuits	Delhi	35276	NA	NA
Sovereign #	Delhi	34440	NA	NA
24 C	Chennai	35393	NA	NA
Silver**				
0.999 (Finesse)	Mumbai	42598	NA	NA
0.999 (Finesse)	Delhi	41318	NA	NA
Ready	Chennai	45063	NA	NA

**: Prices in ₹./10g*

***: Prices in ₹./kg*

#: per piece

&: Prices of gold & silver are not reported during the year 2020-21 and 2021-22 due to non-availability of data.

Source: Minerals and Metals Review.

Table – 3: Prices of Steel, 2018-19 to 2019-20 & 2021-22 (Domestic market)

(In ₹ per tonne)

Grade	Market	2018-19	2019-20	2021-22
TMT Bars (ISI, 8mm)	Delhi	46180	45044	62500
MS Squares (8mm)	"	45044	50525	60650
MS Angles (25 x 3mm)	"	45135	50265	62250
Channels (75 x 40 mm)	"	44827	49560	62813
Joists (150 x 75 mm)	"	44546	51325	63875
Melting Scrap	"	26217	39775	50500
Induction Ingots	"	35698	33517	64700
TMT Bars (local 8 mm)	Mumbai	44998	43838	62550
MS Rounds (8 mm)	"	43658	42258	60650
MS Angles(40 x 6 mm)	"	40671	44619	62250
Joists (150 x 75 mm)	"	44538	42977	62813
Melting Scrap (Foundry Grade)	"	-	-	55000
Melting Scrap (Steel Grade)		-	-	49000

Table-3 Concld.

Grade	Market	2018-19	2019-20	2021-22
Melting Scrap (CRCA)		-	-	54000
Induction ingots	"	36119	33170	64700
Arc Ingots	"	36238	33835	64950
Concast Billet ingots	"	36529	34148	59800
TMT Bars (ISI, 8 mm)	Kolkata	46447	45398	63510
MS Squares (8 mm)	"	45726	44944	62110
MS Angles (25 x 3 mm)	"	45242	44773	62750
Channels (75 x 40 mm)	"	47124	44898	62100
Joists (150 x 75 mm)	"	44633	43079	61538
Induction Ingots	"	36190	33982	61900
Arc Ingots	"	36329	34257	64275
Concast Billet Ingots	"	36433	34444	58550
Induction ingots (round)	Gobind (Punjab)	35970	31693	58550
Blooms(SAIL, 150 mm)	"	36016	31660	59750
Old Ship Breaking Scrap	"	29510	29126	48425
Melting Scrap (rolling)	"	33271	28166	51075
MS Rounds (10 mm)	"	45075	43367	66775
MS Squares (8 mm)	"	47033	46018	69575
MS Angles (25 x 3 mm)	"	45313	44051	69475
MS Sponge Iron	"	26529	24566	39425
MS Flat (3 x 20 mm)	"	45300	43339	69075
Pig Iron Foundry Grade – A*	Mumbai	-	-	62500
Pig Iron Foundry Grade – B**	Punjab	-	-	62625
Pig Iron Steel Grade	Punjab	-	-	60625

Source: *Minerals & Metals Review.*
Data for the year 2020-21 is not available.
Data availability has been changed to monthly instead of yearly.
A: Low Sulphur/Phosphorusi.e.0.09% Max. which is used in Critical automotive engine components and specialised casting.*
*B**: High Sulphur / Phosphorusi.e.above 0.09% which is used in Non-critical castings.*

Table – 4: Prices of Metals, 2019-20 to 2021-22 (Foreign Markets)

Metal/Grade	Unit	Currency	2019-20	2020-21	2021-22*
Aluminum HG	Tonne	$	1835.89	1944.56	NA
Antimony (min 99.65 %)	Tonne	$	6100	NA	NA
Bismuth (min 99.99 %)	Pound	$	2.7	NA	NA
Cadmium (min 99.95%)	Pound	Cents	123	NA	NA
Cadmium (min 99.99%)	Pound	Cents	124	NA	NA
Chromium (min 99%)	Tonne	$	6300	NA	NA
Cobalt (99.80%)	Pound	$	16.55	NA	NA
Copper Grade A	Tonne	$	5947.91	6513.25	NA
Germanium Dioxide	kg	$	1100	NA	NA
Gold (London)	tr OZ	$	1566.9	NA	NA
Indium	kg	$	165	NA	NA
Iridium (min 99.9 %)	tr OZ	$	1550	NA	NA
Lead	Tonne	$	2051.63	2077.72	NA
Magnesium (min 99.9 %)	Tonne	$	2200	NA	NA
Manganese (min 99.7%)	Tonne	$	1620	NA	NA
Mercury	Flask	$	2400	NA	NA
Molybdenum Molybdic Oxide	Pound	$	9.5	NA	NA
Nickel	Tonne	$	12178.96	13282.19	NA

Table- 4 Concld.

Metal/Grade	Unit	Currency	2019-20	2020-21	2021-22*
Palladium (min 99.9%)	tr OZ	$	2087	NA	NA
Platinum (min 99.9%)	tr OZ	$	978	NA	NA
Rhodium (min 99.9%)	tr OZ	$	8200	NA	NA
Ruthenium (min 99.9%)	tr OZ	$	260	NA	NA
Selenium	Pound	$	7	NA	NA
Silver (London)	tr OZ	$	17.77	NA	NA
Silicon	Tonne	$	1840	NA	NA
Tungsten	mtu	$	245	NA	NA
Tin HG	Tonne	$	18802.74	21140.99	NA
Vanadium Pentoxide, min 98%V	mtu	$	5.85	NA	NA
Zinc SHG	Tonne	$	2545.65	2623.85	NA

NA: Not Available
**: Data is not available annually.*
Tr OZ: Troy Ounce
Source: Minerals and Metals Review.

10. Foreign Trade

1,96,654 Rs crore, value of exports (including re-exports) of ores and minerals in 2020-21	**1,96,654** Rs crore, value of exports of ores & minerals in 2020-21	**34.26** %, Share in total value of all merchandise imported into India

EXPORTS

Ores & Minerals

During the year 2021-22, the value of exports (including re-exports) of ores and minerals at ₹ 2,57,863 crore accounted for about 8.19% of the total value of all merchandise exported from India. The value of exports of ores & minerals which increased from ₹ 1,96,654 crore in 2020-21 to ₹ 2,57,863 crore in 2021-22. The value of mineral exports showed an increase of 31.13% in 2021-22 as compare to that of the previous year.

Diamond (total) continued to be the largest constituent item with a share of 73.44% in the total value of mineral exports in 2021-22. Next in the order of share were iron ore with the contribution of 9.36% followed by granite 4.90%, precious and semi-precious stone (cut & uncut) 1.96% and alumina 1.84%. The individual share of remaining minerals in the total value of exports of ores and minerals from India during the year under review was less than one percent.

The value of exports of ores & Minerals (including re-exports) showed a mixed trend for most of the minerals in 2021-22 as compared to that of the previous year. A significant increase was also noticed in some cases. The exports value of minerals which have shown significant growth are coke (759.71%) and Sulphur excluding sublimed Precipited & colloidal) (385.39%). On the other hand, the exports value recorded significant decline in the cases of Limestone (89.40%), copper ores & conc. (48.44%), and Iron ore (33.40%), as compared to that in the previous year.

Ores and minerals were exported to various countries in 2021-22. About 86.65% of the total value of exports of ores and minerals was confined to only ten countries. During 2021-22, USA occupied the top position in terms of value accounting for 30.07% of the total value of mineral exports, Hong Kong was in the second place and contributed 22.28% followed by China (10.45%), Belgium (7.75%),UAE

(6.96%), Israel (4.17%),Thailand (3.31%), Japan (1.46%), UK (1.41%) and Vietnam (0.99%). The individual share of remaining countries was less than one per cent.

Countrywise analysis of value of mineral exports revealed that exports of minerals witnessed significant positive growth as compared to the previous year for philippines (1126.04%), Croatia (591.57%), Romania (331.90%), South Africa (316.89%), Italy (263.31%), France (143.40%), Netherlands (121.77%) and Belgium (107.02%).

However, value of export of ores & minerals declined significantly in respect of Bangladesh (59.78%), China (29.11%), Algeria (17.63%), Baharain (17.16%), Japan (10.43%) and Kuwait (9.72%). (Tables -1 to 3).

Table-1 : Exports of Ores and Minerals (including re-exports), 2019-20 to 2021-22

(Value in ₹ '000)

Ores & Minerals	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Minerals		**	**1896831578**	**	**1966539540**	**	**2578629646**
Abrasive (Natural)	tonne	92241	1568206	23411	376713	14106	236450
Alabaster	tonne	27	256	4	184	++	11
Alumina	tonne	1330038	30900409	1265941	28280781	1487035	47334417
Andalusite	tonne	19	1240	9	476	18	1233
Arsenic Sulphide (Natural)	tonne	++	69	277	1697	51	505
Asbestos: Total	tonne	1001	31011	299	11991	1906	68026
Asbestos (Chrysotile)	tonne	997	30994	275	11895	1905	67961
Asbestos (Others)	tonne	4	17	24	96	1	65
Ball Clay	tonne	153658	398714	170915	410109	266680	664037
Barytes	tonne	2221693	12896670	1010894	6261470	1874837	11075666
Bauxite	tonne	524229	1421269	240841	951442	378081	1005256
Bentonite	tonne	1647485	5674970	1557484	5215656	1585962	5850483
Borax: Total	tonne	2977	359860	2996	414601	4725	656472
Natural Borate	tonne	214	6806	55	5633	44	3489
Sodium Borate	tonne	773	54235	741	56265	1534	104106
Other Borates	tonne	1990	298819	2200	352703	3147	548877
Building And Monumental Stones Nes	tonne	12612479	15692854	13134116	24200968	13295779	24912268
Calcite	tonne	36433	273950	23867	155049	24789	163372
Chalk	tonne	1317	8022	1104	6155	1129	7557
Chromite: Total	tonne	33898	867910	2872	71979	2625	89710
Chrome Ore Others	tonne	3433	132477	2668	68875	2614	76859
Chrome Ore Conc.	tonne	30465	735433	204	3104	-	-
Chrome Ore Lumps	tonne	-	-	-	-	11	12851
Clay (Others)	tonne	50365	476744	45346	402787	49635	361745
Coal(Ex Lignite)	000't	1045	5929549	2943	5736794	1314	11233701
Coal Gas	tonne	-	-	-	-	++	2
Coal:Lignite	000't	3	319838	2	234709	1	203336
Cobalt Ores & Conc.	tonne	2	9478	-	-	-	-
Coke	tonne	111507	2383337	207412	4771075	1299461	41017403
Copper Ores & Conc.	tonne	212659	20450948	82463	7689376	34827	3964549
Corundum (Natural)	tonne	-	-	62	137	89	241
Diamond		**	1400336074	**	1258209200	**	1893641728
Diamond (Mostly Cut)		**	1399742298	**	1257345848	**	1892188684

Table-1 Concld.

Ores & Minerals	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Diamond (Industrial)	Crt	7410678	387188	7015880	688082	12125962	1162179
Diamond Powder	000 crt	8650	206588	10628	175270	13991	290865
Diatomite	tonne	4302	72842	3240	69439	1964	58544
Dolomite	tonne	91431	349684	95892	349090	113380	391843
Earth Clay	tonne	2652	18037	3881	22220	3775	53782
Emerald (Cut & Uncut): Total		**	17387875	**	5316603	**	10808861
Emerald (Uncut)	tonne	34	60040	++	45741	5945	10596194
Emerald (Cut)	000 crt	21960	17327835	4076	5270862	++	212667
Felspar (Natural)	tonne	640709	3225696	705280	3931135	763219	4194510
Felspar (Cut & Uncut): Total		**	203185	**	198059	**	254062
Felspar (Uncut)	tonne	76	20001	24	30923	33	22261
Felspar (Cut)	000 crt	25483	183184	10839	167136	16944	231801
Fire Clay	tonne	5172	41898	5324	43606	4473	45578
Flint	tonne	1195	8014	406	2953	570	5837
Fluorspar	tonne	1368	51562	474	22436	844	43463
Garnet (Abrasive)	tonne	74697	1254539	76799	1265586	81270	1433741
Garnet (Cut And Uncut): Total		**	366806	**	280824	**	378455
Garnet (Uncut)	tonne	134	33736	111	20194	29	19303
Garnet (Cut)	000 crt	42177	333070	76049	260630	12258	359152
Granite : Total	tonne	6678131	102248504	7522159	113279766	7572368	126460352
Granite (Crude Or Roughly Trimmed)	tonne	4015876	30475234	4705266	32700873	4290170	35806960
Granite (Cut Blocks/Slabes)	tonne	698624	8397611	674353	8810152	895870	11084741
Granite (Polished Blocks/Tiles)	tonne	190023	4577912	240445	5969769	241062	5419911
Granite (Others)	tonne	1773608	58797747	1902095	65798972	2145266	74148740
Graphite (Natural)	tonne	607	32629	716	42994	764	46963
Gypsum	tonne	151722	578922	213061	723888	220634	765738
Iron Ore: Total	000't	36625	186092710	57723	362556021	26494	241480427
Iron Ore Conc: Non Agglomated	000't	153	559743	363	1781069	100	669724
Iron Ore: Fines	000't	22374	83422738	40661	215190641	14570	83677314
Iron Ore: Lumps	000't	1480	8779976	2239	13118637	433	1876849
Iron Ore Pellates	000't	12618	93305204	14460	132419634	11391	155225838
Iron Ore Pyrites	000't	++	25049	++	46040	++	30702
Kaolin	tonne	431536	1929478	287260	1610489	339591	2398327
Kieselguhr	tonne	113	2399	27	917	28	516
Kyanite	tonne	143	2627	252	9033	1655	15376
Lead Ores & Conc.	tonne	3	202	9	1076	12	1595
Limestone	tonne	3760402	4656567	3528973	42939083	12160342	4551537
Magnesite : Total	tonne	5453	147073	5477	171020	5384	173809
Magnesia (Fused)	tonne	55	2691	41	863	2	585
Magnesite (Not Calcined)	tonne	75	1632	220	5202	436	11483
Magnesite (Calcined)	tonne	35	1111	100	2102	117	5014

Table-1 Concld.

Ores & Minerals	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Magnesite:Dead-Burnt Magnesia	tonne	684	10665	2	93	208	6829
Magnesium Oxide	tonne	2152	103450	1646	119899	1886	110791
Magnesite (Other)	tonne	2452	27524	3468	42861	2735	39107
Manganese Ore: Total	tonne	58198	254643	82363	974940	113606	588189
Manganese Ore (46% Or More Mn)	tonne	5	299	10	330	21	1059
Manganese Ore (35% Or More But Below 46% Mn)	tonne	8987	137409	40108	698245	18379	321424
Manganese Ore (30% Or More But Below 35% Mn)	tonne	-	-	20200	214707	-	-
Manganese Ore (Ferruginous, 10 % Or More But Below 30%)	tonne	-	-	-	-	24570	59450
Manganese Ore (Others)	tonne	49206	116935	22045	61658	70636	206256
Marble : Total	tonne	310613	9010909	295085	10082272	324267	11352007
Marble (Dresssed)	tonne	182976	2969818	148619	2115113	158060	2361734
Marble (Others)	tonne	127637	6041091	146466	7967159	166207	8990273
Mica: Total	tonne	116854	4909143	144121	5733785	151706	6594832
Mica (Unmanufactured): Total	tonne	115652	3719906	143291	4724093	150805	5113041
Mica (Blocks)	tonne	2754	359574	1870	354192	1469	390254
Mica (Condenser Films)	tonne	120	6098	13	239	-	-
Mica (Powder)	tonne	73525	2295741	84031	2811539	110005	3535632
Mica (Splittings)	tonne	20037	474627	28810	753109	23581	672270
Mica (Waste & Scrap)	tonne	19216	583866	28567	805014	15750	514885
Mica (Worked): Total	tonne	1202	1189237	830	1009692	901	1481791
Mica (Bricks)	tonne	++	227	1	115	++	512
Mica (Cond. Films, Plates, Cuts Nes)	tonne	59	11326	32	18288	44	14811
Mica (Sheets & Strips)	tonne	18	98173	19	115884	11	94814
Mica (Washers & Discs)	tonne	9	19564	7	14057	4	23513
Mica Worked (Others)	tonne	1069	1053548	758	857896	823	1338217
Micanite & Other Built-Up Mica	tonne	47	6399	13	3452	19	9924
Molybdenum Ores & Conc.	tonne	3	3023	45	43181	++	120
Natural Gas	tonne	52408	2202387	17992	658242	3	883
Nickel Ores & Conc.	tonne	++	++	-	-	20	5183
Niobium Or Tantalum Ores & Conc.	tonne	361	943	++	217	++	18
Ochre: Total	tonne	2934	72045	4126	71626	6085	103351
Ochre: Earth Colours	tonne	1964	23594	3276	44387	5159	63310
Ochre:Yellow Ochre	tonne	263	11339	212	9000	153	7416
Persian Red	tonne	++	1	13	1666	-	-
Red Oxide	tonne	707	37111	625	16573	773	32625
Precious & Semi-Precious		**	12083066	**	23463605	**	50616826

Table- 1 Concld.

Ores & Minerals	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Stones (Cut & Uncut):Total							
Precious & Semi Precious Stones (Uncut)	tonne	2194	822702	2250	1300940	7420	31012547
Precious & Semi Precious Stones cut	000 crt	2617919	11260364	1300016	22162665	1291573	19604279
Preciuos Metal Ores & Concentrates	kg	-	-	260175	5435	26253	1265
Quartz And Quartzite: Total	tonne	944041	6087293	772127	6213690	965159	7559270
Quartz (Natural)	tonne	768686	4685362	692520	5289217	863212	6770721
Quartzite (Natural)	tonne	175355	1401931	79607	924473	101947	788549
Rock Phosphate	tonne	257	2015	825	5602	540	11316
Salt (Other Than Common Salt)	tonne	11681705	13681149	8260913	10571743	8863780	13393717
Sand (Excl. Metal Bearing)	tonne	1894	32610	1178	13630	619	17107
Sandstone	tonne	795763	10434171	794445	11220825	691771	11282294
Silica Sand	tonne	2391	14934	43061	63008	825	4928
Sillimanite	tonne	1025	14961	4998	94359	3120	64355
Slate : Total	tonne	61143	1983349	66335	2453970	68569	2733090
Slate (Worked)	tonne	10751	922884	13975	1250220	18913	1526699
Slate (Others)	tonne	50392	1060465	52360	1203750	49656	1206391
Steatite : Total	tonne	250649	3583316	283303	4364076	324593	5201974
Steatite Blocks	tonne	180	4393	468	8525	292	5970
Steatite Lumps	tonne	71309	978177	107566	1744449	136104	2316878
Steatite Powder & Others	tonne	179160	2600746	175269	2611102	188197	2879126
Sulphur (Exc. Sublimed Precipited & Colloidal)	tonne	802175	3872834	802713	4328627	1290620	21010532
Tin Ores & Conc.	tonne	++	1	-	-	-	-
Titanium Ores & Conc.: Total	tonne	246203	4995763	246534	5348323	215910	6155343
Titanium Ores & Conc.(Ileminite)	tonne	246179	4992946	246534	5348321	215857	6148952
Titanium Ores & Conc.(Rutitle)	tonne	16	2000	++	2	52	6239
Titanium Ores & Conc.(Others)	tonne	8	817	-	-	1	152
Tungsten Ores & Conc.	tonne	-	-	-	-	13	7139
Vanadium Ores & Conc.	tonne	10	10801	-	-	-	-
Vermiculite	tonne	634	7902	853	11573	1263	21780
Witherite	tonne	++	156	++	104	++	128
Wollastonite	tonne	14582	298591	13716	311809	11705	282266
Zinc Ores & Conc.	tonne	317	15828	399	20716	1762	46757
Zirconium Ores & Conc.	tonne	1	78	++	21	++	180
Other Minerals Nes	tonne	3643829	4587040	3842874	4244574	3419980	5523312

Source: DGCI & S, Kolkata
P: Provisional
++: Negligible, -: Nil
***: Quantity not additive*

Table – 2: Value of Exports of Ores & Minerals (including re-exports), 2019-20 to 2021-22

(By Principal Ores & Minerals)

Ores & Minerals	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
All Minerals	**1896831578**	**100**	**1966539540**	**100**	**2578629646**	**100**	**31.13**
Diamond	1400336074	73.83	1258209200	63.98	1893641728	73.44	50.5
Iron Ore	186092710	9.81	362556021	18.44	241480427	9.36	-33.4
Granite	102248504	5.39	113279766	5.76	126460352	4.9	11.64
Precious & Semi-precious Stones (cut & Uncut):total	12083066	0.64	23463605	1.19	50616826	1.96	115.72
Alumina	30900409	1.63	28280781	1.44	47334417	1.84	67.37
Coke	2383337	0.13	4771075	0.24	41017403	1.59	759.71
Building And Monumental Stones Nes	15692854	0.83	24200968	1.23	24912268	0.97	2.94
Sulphur (exc. Sublimed Precipited & Colloidal)	3872834	0.2	4328627	0.22	21010532	0.81	385.39
Salt (Other Than Common Salt)	13681149	0.72	10571743	0.54	13393717	0.52	26.69
Marble	9010909	0.48	10082272	0.51	11352007	0.44	12.59
Sandstone	10434171	0.55	11220825	0.57	11282294	0.44	0.55
Coal(ex Lignite)	5929549	0.31	5736794	0.29	11233701	0.44	95.82
Barytes	12896670	0.68	6261470	0.32	11075666	0.43	76.89
Emerald (cut & Uncut)	17387875	0.92	5316603	0.27	10808861	0.42	103.3
Quartz And Quartzite	6087293	0.32	6213690	0.32	7559270	0.29	21.66
Mica	4909143	0.26	5733785	0.29	6594832	0.26	15.02
Titanium Ores & Conc.	4995763	0.26	5348323	0.27	6155343	0.24	15.09
Bentonite	5674970	0.3	5215656	0.27	5850483	0.23	12.17
Other Minerals Nes	4587040	0.24	4244574	0.22	5523312	0.21	30.13
Steatite	3583316	0.19	4364076	0.22	5201974	0.2	19.2
Limestone	4656567	0.25	42939083	2.18	4551537	0.18	-89.4
Felspar (natural)	3225696	0.17	3931135	0.2	4194510	0.16	6.7
Copper Ores & Conc.	20450948	1.08	7689376	0.39	3964549	0.15	-48.44
Slate	1983349	0.1	2453970	0.12	2733090	0.11	11.37
Kaolin	1929478	0.1	1610489	0.08	2398327	0.09	48.92
Garnet (abrasive)	1254539	0.07	1265586	0.06	1433741	0.06	13.29
Bauxite	1421269	0.07	951442	0.05	1005256	0.04	5.66
Gypsum	578922	0.03	723888	0.04	765738	0.03	5.78
Ball Clay	398714	0.02	410109	0.02	664037	0.03	61.92
Borax	359860	0.02	414601	0.02	656472	0.03	58.34
Other Minerals	7784600	0.41	4750007	0.24	3756976	0.15	-20.91

P: Provisional

Source: DGCI & S, Kolkata

Table - 3 : Value of Exports of Ores & Minerals (including re-exports), 2019-20 to 2021-22

(By Principal Countries)

Ores & Minerals	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
All Countries	**1896831578**	**100**	**1966539540**	**100**	**2578629646**	**100**	**31.13**
USA	528711991	27.87	493499087	25.09	775283196	30.07	57.1
Hong Kong	470206976	24.79	447951892	22.78	522968433	20.28	16.75
China	219411030	11.57	380077162	19.33	269437808	10.45	-29.11
Belgium	151255522	7.97	96560613	4.91	199900233	7.75	107.02
UAE	114164809	6.02	104335194	5.31	179559328	6.96	72.1
Israel	64807168	3.42	61431650	3.12	107492020	4.17	74.98
Thailand	45600085	2.4	47659389	2.42	85463819	3.31	79.32
Japan	44424844	2.34	42054415	2.14	37666712	1.46	-10.43
UK	22863008	1.21	26731073	1.36	36373510	1.41	36.07
Vietnam	13629494	0.72	16797196	0.85	25418876	0.99	51.33
Italy	8155826	0.43	6717453	0.34	24405274	0.95	263.31
Bangladesh	17208196	0.91	55737626	2.83	22420438	0.87	-59.78
Indonesia	4663874	0.25	9845335	0.5	19256998	0.75	95.6
Korea Rep of	16181300	0.85	14650431	0.74	18673345	0.72	27.46
Oman	6063245	0.32	12308820	0.63	17560103	0.68	42.66
Botswana	8709480	0.46	9889759	0.5	17209700	0.67	74.02
Australia	10290892	0.54	10907001	0.55	16985203	0.66	55.73
South Africa	3266621	0.17	3680561	0.19	15344009	0.6	316.89
France	7464099	0.39	6279841	0.32	15284936	0.59	143.4
Malaysia	14263474	0.75	11498522	0.58	13864237	0.54	20.57
Germany	8388465	0.44	8452053	0.43	13757661	0.53	62.77
Nepal	11736648	0.62	10092486	0.51	13236890	0.51	31.16
Switzerland	9128473	0.48	4955789	0.25	9863912	0.38	99.04
Canada	5942188	0.31	6324114	0.32	9828951	0.38	55.42
Singapore	15283658	0.81	6303074	0.32	8125303	0.32	28.91
Saudi Arabia	8755015	0.46	8618105	0.44	8119577	0.31	-5.78
Poland	3323492	0.18	4179084	0.21	7895620	0.31	88.93
Netherlands	2248225	0.12	3266707	0.17	7244455	0.28	121.77
Turkey	9766260	0.51	4371213	0.22	6605758	0.26	51.12
Brazil	1581689	0.08	5207377	0.26	6227607	0.24	19.59
Egypt	4753153	0.25	4161003	0.21	5870241	0.23	41.08
Qatar	3057265	0.16	4047316	0.21	5467328	0.21	35.09
Taiwan	6259954	0.33	3637479	0.18	5123655	0.2	40.86
Bhutan	2140556	0.11	2389754	0.12	4082048	0.16	70.81
Philippines	401670	0.02	273903	0.01	3358161	0.13	1126.04
Croatia	459963	0.02	424795	0.02	2937756	0.11	591.57
Spain	2662435	0.14	1780286	0.09	2531040	0.1	42.17
Russia	1523221	0.08	1470036	0.07	2468849	0.1	67.94
Baharain	947010	0.05	2866324	0.15	2374401	0.09	-17.16
Romania	497873	0.03	536699	0.03	2317998	0.09	331.9

Table- 3 Concld.

Ores & Minerals	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
Sri Lanka	1537180	0.08	1269968	0.06	2087422	0.08	64.37
Kuwait	2055959	0.11	1690266	0.09	1526007	0.06	-9.72
Ireland	1034946	0.05	1224230	0.06	1517793	0.06	23.98
Algeria	1434302	0.08	1818974	0.09	1498228	0.06	-17.63
Libya	1736427	0.09	938054	0.05	1354887	0.05	44.44
Other Countries	18833617	0.99	17627431	0.9	22639920	0.88	28.44

P: Provisional
Source: DGCI&S, Kolkata

Metals & Alloys

The value of exports (including re-exports) of metals & alloys at ₹ 3,47,457 crore in the year 2021-22 registered an increase of 67.67% as compared to ₹ 2,07,222 crore in the previous year. The contribution of metals & alloys in the total value of India's exports was 11.04% during the year under review.

Iron & steel with a share of 58.54% continued to hold the top position in the valu e of metals/alloys exported from India in 2021-22. Aluminium and alloys including scrap is in the second place and accounted for 22.79% value. Ferroalloys and copper & alloys (including brass & bronze) occupied the third & fourth place with a contribution of 7.81% and 4.93%, respectively. The contributions of zinc & alloys including scrap and silver were 2.15% and 1.04% pig & cast iron (incl. speigeliesen) and lead & alloy including scrap were 1.42% & 1.16% respectively. The individual share of other remaining metals and alloys was less than one per cent.

As compared to previous year, the value of exports for different important metals had shown a mixed trend in 2021-22. The export value of Iron and Steel registered a huge spike of 814.49%, Aluminium and alloys incl.Scrap (211.29%), Ferralloys (145.78%), Copper & alloys (incl. Brass & Bronze) (126.84%), Zinc & Alloys incl. Scrap (112.35%), However, the export values showed significant negative growth during 2021-22 as compared to that of the previous year in the cases of Other Metals and Alloys (97.54%), Molybdenum & Scrap (89.29%),Titaniam & Alloys (incl.Wast &Scrap) (12.97%).

India exported metals & alloys to various countries in 2021-22. Bulk of the metals and alloys having share of more than 1% to the total value were exported to 29 countries. These countries together accounted for 90.04% of the total value of exports during 2021-22. USA led the group with a share of 10.77% followed by China (8.62%), Italy (6.27%), Republic of Korea (5.75%),UAE (5.74%), Turkey (5.35), Vietnam (4.62%) and Belgium (4.07%). The individual share is less than four per cent in respect of the remaining countries.

The countries that have recorded significant increase in value of exports of metals & alloys during the year 2021-22 are Croafia (4725.01%), Turkey (493.87%), Egypt (24 7.05%), G reec e (22 4 . 84 %), Netherlands (185.53%), South Africa (165.15%) and Poland (164.71%).

On the other hand, decline in the value of exports of metals & alloys was observed in Malaysia only (59.68%), during the year under review (Tables - 4 to 6).

Value of exports of selected Mineral-based products at ₹ 3,39,459 crore in the year 2021-22 registered an increase of 108.16% as compared to that of ₹ 1,63,069 crore in the previous year. Exports of selected mineral-based products during 2019-20 to 2021-22 are furnished in Table -7

Table-4 : Exports of Metals and Alloys 2019-20 to 2021-22

(Value in ₹ '000)

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Metals & Alloys		**	**1660987438**	**	**2072220863**	**	**3474571089**
Aluminium And Alloys Incl. Scrap	tonne	2371062	361046684	2735588	427759670	3454121	791688112
Antimony Alloys And Scrap	tonne	2217	927375	2134	932922	1918	1507988
Bismuth & Scrap	tonne	++	1053	++	2528	11	45115
Boron	tonne	++	91	5	525	++	6093
Cadmium (Incl. Waste & Scrap)	tonne	268	35680	208	24971	169	23278
Copper (Cement Copper Precipitated)	tonne	++	367	4	1066	501	25047
Chromium & Alloys	tonne	157	112563	168	119489	284	229068

Table- 4 Concld.

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Cobalt & Alloys(Incl Waste And Scrap): Total	tonne	105	220380	340	364327	1340	895452
Cobalt & Alloys	tonne	87	199965	340	364006	1309	812402
Cobalt & Scrap	tonne	18	20415	++	321	31	83050
Copper & Alloys (Incl. Brass & Bronze): Total	tonne	140857	60527102	209332	102064524	246963	171342596
Brass & Bronze	tonne	50669	21447989	61018	30956169	56963	41245793
Brass & Bronze (Scrap)	tonne	1064	312010	1484	511456	2020	1002659
Copper & Alloys	tonne	81388	35989492	139540	67619065	169736	120781592
Copper (Scrap)	tonne	7736	2777611	7290	2977834	18244	8312552
Ferro Alloys : Total	tonne	1715919	118100709	1843322	127735114	2537463	271246477
Ferro-Boron	tonne	51	11143	39	9728	33	11024
Ferro-Chrome	tonne	732431	48794984	720539	49939983	753389	76899138
Ferro-Cobalt	tonne	++	75	++	29	++	250
Ferro-Columbium	tonne	1	2901	++	1522	1	1787
Ferro-Manganese	tonne	262265	19796179	335229	23997006	638850	74044066
Ferro-Molybdenum	tonne	129	146529	279	324540	324	529440
Ferro-Nickel	tonne	++	197	77	65052	1	2822
Ferro-Niobium	tonne	26	52730	14	25114	25	69528
Ferro-Phosphorous	tonne	80	10878	77	11038	156	16804
Ferro-Selenium	tonne	++	1365	++	979	5	3653
Ferro-Silicon	tonne	18754	1601611	11236	1194260	19567	3246485
Ferro-Titanium	tonne	3227	678896	2553	567131	1860	689076
Ferro-Tungsten	tonne	++	1223	++	1150	1	4368
Ferro-Vanadium	tonne	531	883571	240	346840	168	353217
Ferro-Zirconium	tonne	5	2914	3	1644	16	7127
Ferro Silico-Chrome	tonne	3	638	32	12095	20	8932
Ferro-Silico-Magnesium	tonne	7153	770985	4192	483234	6407	1098652
Ferro Silico-Manganese	tonne	682846	44374533	764747	50326047	1112950	113600728
Ferro-Alloys (Others)	tonne	8417	969357	4065	427722	3690	659380
Gold (Non-Monetory & Monetory):Total	kg	1730	5742699	4191	18895717	126	463986
Gold-Monetory	kg	-	-	++	25	-	-
Gold-Nonmonetory: Total	kg	1730	5742699	4191	18895692	126	463986
Gold,Non-Monetory, Other Unwrought Forms	kg	1575	5300969	4191	18894458	114	423280
Gold,Non-Monetory, Powder	kg	-	-	++	16	++	565
Gold,Non-Monetory:Other Semimanufactured forms	kg	155	441730	++	1218	12	40141
Gold-Clad Metals/Base Metals Nes	tonne	++	19	++	306	++	770
Iron & Steel : Total		**	1019955563	**	1225105321	**	2034353812
Iron & Steel (Finished Steel Inc. Cr Sheet)	tonne	4631222	309262120	6108963	358432755	6798430	607736761
Iron & Steel (Semi-Finished Steel Incl. Stl Ingo)	tonne	7957507	320684584	12577510	480956813	13492292	874972590
Iron & Steel (Steel Wire)	tonne	159597	23911264	169631	25750975	250944	48353501
Iron & Steel (Sponge Iron)	tonne	898475	17286760	524566	11248671	789189	25256226
Iron & Steel (Scrap)	tonne	11876	688320	25613	649151	11492	941199

Table- 4 Concld.

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Iron & Steel: Alloy Steel (Granules)	tonne	484	29004	422	29056	678	45269
Iron & Steel: Alloy Steel (Powder)	tonne	68	9067	4	1760	129	66798
Iron & Steel (Other Finished Steel, Nes)		**	339926285	**	340587784	7294134	464631364
Iron & Steel Material	tonne	84891	4478671	70062	4250996	92907	7905836
Iron & Steel (Stainless Steel)	tonne	8181	3679488	12889	3197360	16901	4444268
Lead And Alloys Incl. Scrap: Total	tonne	174939	26422498	176601	25845466	229864	40542449
Lead & Alloys	tonne	174936	26421811	176569	25841849	229727	40523557
Lead & Scrap	tonne	3	687	32	3617	137	18892
Magnesium & Scrap	tonne	2373	294359	1266	143710	7269	1314210
Manganese & Alloys (Incl Waste & Scrap): Total	tonne	418	343896	469	375616	616	631089
Manganese Waste & Scrap	tonne	24	5916	32	9094	48	24712
Manganese & Alloys: (Wrought & Unwrought)	tonne	136	119131	188	106409	288	307908
Manganese & Alloys Nes	tonne	258	218849	249	260113	280	298469
Mercury	tonne	58	312409	42	184648	18	99467
Molybdenum & Scrap	tonne	82	122342	119	182537	365	342257
Nickel And Alloys Incl. Scrap: Total	tonne	16890	6532327	2937	4147078	5893	9407073
Nickel & Alloys	tonne	15634	5830642	2269	3763280	4199	8103812
Nickel Scrap	tonne	1256	701685	668	383798	1694	1303261
Other Rare Metals Nes	tonne	++	20064	++	366	3	16304
Pig & Cast Iron (Incl. Speigeliesen)	tonne	440432	10737676	1123792	30155194	1250907	49495194
Platinium Alloys & Related Metals: Total	kg	604	1681684	616	3535012	1194	4795081
Platinum (Powder, Unwrought & Others)	kg	259	524194	507	552422	869	917208
Other Metals Of Platinum Group	kg	345	1157490	109	2982590	325	3877873
Platinium - Clad Base /Precious Metal	kg	-	-	700	50	70	6
Precious Metals / Metals Clad With Precious Metals	tonne	1054	4499703	3827	13371985	3045	12713613
Selenium	tonne	18	46422	40	43423	39	81781
Silicon	tonne	175	19030	159	23239	365	119140
Silver	tonne	30	680127	615	33934966	89	3633631
Silver Clad Base Metals	kg	3898	12268	6026	23892	2979	14664
Tantalum & Scrap: Total	tonne	3	40266	5	55163	6	80552
Tantalum Alloys Unwrought	tonne	3	37811	5	54121	3	40332
Tantalum & Scrap	tonne	++	2455	++	1042	3	40220
Tellurium	tonne	++	122	++	37	++	17
Tin & Alloys Incl. Scrap: Total	tonne	944	740863	750	784385	1191	1494894
Tin & Alloys	tonne	681	694813	570	731861	721	1432470
Tin & Alloys : Worked	tonne	263	46041	178	51368	469	62201
Tin (Scrap)	tonne	++	9	2	1156	1	223

Table- 4 Concld.

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Titanium & Alloys (Incl. Waste & Scrap)	tonne	486	546039	253	443579	131	386027
Tungsten Alloys & Scrap	kg	313499	870314	292331	835275	1209171	2600160
Zinc And Alloys Incl. Scrap: Total	tonne	212702	40372945	300018	55103971	283204	74950497
Zinc & Alloys	tonne	212592	40361623	299936	55094321	283200	74949996
Zinc (Scrap)	tonne	110	11322	82	9650	4	501
Zirconium & Scrap	tonne	++	21799	++	24791	3	25189

Source: DGCI & S, Kolkata

P: Provisional

Table-5 : Value of Exports of Metals and Alloys, 2019-20 to 2021-22

(By Principal Metals & Alloys)

Metals & Alloys	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
All Metals & Alloys	**1660987438**	**100**	**2072220863**	**100**	**3474571089**	**100**	**67.67**
Iron & Steel	1019955563	61.41	1225105321	59.12	2034353812	58.55	66.06
Aluminium And Alloys Incl. Scrap	361046684	21.74	427759670	20.64	791688112	22.79	85.08
Ferro Alloys	118100709	7.11	127735114	6.16	271246477	7.81	112.35
Copper & Alloys (incl. Brass & Bronze)	60527102	3.64	102064524	4.93	171342596	4.93	67.88
Zinc And Alloys Incl. Scrap	40372945	2.43	55103971	2.66	74950497	2.16	36.02
Pig & Cast Iron (incl. Speigeliesen)	10737676	0.65	30155194	1.46	49495194	1.42	64.13
Lead And Alloys Incl. Scrap	26422498	1.59	25845466	1.25	40542449	1.17	56.86
Precious Metals / Metals Clad With Precious Metals	4499703	0.27	13371985	0.65	12713613	0.37	-4.92
Nickel And Alloys Incl. Scrap	6532327	0.39	4147078	0.2	9407073	0.27	126.84
Platinium Alloys & Related Metals	1681684	0.1	3535012	0.17	4795081	0.14	35.65
Silver	680127	0.04	33934966	1.64	3633631	0.1	-89.29
Tungsten And Alloys Incl. Scrap	870314	0.05	835275	0.04	2600160	0.07	211.29
Antimony Alloys And Scrap	927375	0.06	932922	0.05	1507988	0.04	61.64
Tin And Alloys Incl. Scrap	740863	0.04	784385	0.04	1494894	0.04	90.58
Magnesium & Scrap	294359	0.02	143710	0.01	1314210	0.04	814.49
Cobalt & Alloys (incl Waste And Scrap)	220380	0.01	364327	0.02	895452	0.03	145.78
Manganese & Alloys (incl Waste & Scrap)	343896	0.02	375616	0.02	631089	0.02	68.01
Gold (non-monetory & Monetory):total	5742699	0.35	18895717	0.91	463986	0.01	-97.54
Titanium & Alloys (incl. Waste & Scrap)	546039	0.03	443579	0.02	386027	0.01	-12.97
Molybdenum & Scrap	122342	0.01	182537	0.01	342257	0.01	87.5
Other Metals And Alloys	622153	0.04	504494	0.02	766491	0.02	51.93

P: Provisional

Source: DGCI & S, Kolkata

Table-6 : Value of Exports of Metals and Alloys, 2019-20 to 2021-22

(By Principal Countries)

Country	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
All Countries	**1660987438**	**100**	**2072220863**	**100**	**3474571089**	**100**	**67.67**
U S A	183309784	11.04	181147665	8.74	374045858	10.77	106.49
China	74601591	4.49	282137796	13.62	299643455	8.62	6.2
Italy	74776642	4.5	88655244	4.28	217854671	6.27	145.73
Korea	104730742	6.31	117726820	5.68	199604000	5.74	69.55
UAE	99533217	5.99	94721649	4.57	185822430	5.35	96.18
Turkey	15187741	0.91	27009450	1.3	160402261	4.62	493.87
Vietnam	87603977	5.27	89994420	4.34	141424098	4.07	57.15
Belgium	41428319	2.49	50892573	2.46	131252203	3.78	157.9
Nepal	88483203	5.33	86311070	4.17	123997053	3.57	43.66
Netherlands	28229925	1.7	29377804	1.42	83882891	2.41	185.53
UK	34404603	2.07	67194772	3.24	77293537	2.22	15.03
Taiwan	36440572	2.19	46133098	2.23	74803461	2.15	62.15
Germany	43590629	2.62	42938548	2.07	72966621	2.1	69.93
Spain	28551673	1.72	32978681	1.59	72721171	2.09	120.51
Bangladesh	46545576	2.8	41676869	2.01	67615713	1.95	62.24
Thailand	33538503	2.02	42712830	2.06	65156296	1.88	52.55
Indonesia	24313402	1.46	34626189	1.67	63237913	1.82	82.63
Japan	28381267	1.71	29959601	1.45	61037039	1.76	103.73
Mexico	20240203	1.22	22986274	1.11	57676583	1.66	150.92
Singapore	15657027	0.94	37943474	1.83	51480652	1.48	35.68
Malaysia	113572297	6.84	125849163	6.07	50737053	1.46	-59.68
Saudi Arabia	28852422	1.74	34252627	1.65	49642855	1.43	44.93
Greece	4773947	0.29	13470442	0.65	43757201	1.26	224.84
Egypt	10833409	0.65	12579893	0.61	43658472	1.26	247.05
Poland	14585426	0.88	15982508	0.77	42308074	1.22	164.71
Sri Lanka	20424545	1.23	22297606	1.08	39020316	1.12	75
Brazil	20356436	1.23	24931404	1.2	38966104	1.12	56.29
Canada	30498069	1.84	31322349	1.51	38532307	1.11	23.02
South Africa	9251850	0.56	11756736	0.57	31172657	0.9	165.15
Australia	14102349	0.85	21192418	1.02	30801483	0.89	45.34
Hong Kong	5977392	0.36	12890895	0.62	30422197	0.88	136
Oman	19834532	1.19	25806700	1.25	28359778	0.82	9.89
Qatar	13081294	0.79	15262845	0.74	26722441	0.77	75.08
Kenya	7106422	0.43	15616109	0.75	26360428	0.76	68.8
Croatia	328378	0.02	460888	0.02	22237881	0.64	4725.01
Russia	11073961	0.67	13891831	0.67	22118352	0.64	59.22
Philippines	8697510	0.52	12534275	0.6	20023101	0.58	59.75
France	15438443	0.93	14999110	0.72	19783705	0.57	31.9
Switzerland	5839518	0.35	16039870	0.77	17451305	0.5	8.8
Portugal	5936076	0.36	8071537	0.39	14227818	0.41	76.27
Israel	6397412	0.39	6434422	0.31	14015310	0.4	117.82
Nigeria	12649001	0.76	9324379	0.45	12086096	0.35	29.62
Romania	4065640	0.24	6650468	0.32	11245203	0.32	69.09
Tanzania	4939038	0.3	7631409	0.37	10830542	0.31	41.92
Denmark	3836033	0.23	4645283	0.22	8243728	0.24	77.46
Other Countries	158987442	9.57	141200869	6.81	199928776	5.75	41.59

Source: DGCI & S, Kolkata

Table- 7 : Exports of Selected Mineral-based Products, 2019-20 to 2021-22

(Value in ₹ '000)

Mineral-based Product	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Item		**	**2601579579**	**	**1630698738**	**	**3394598165**
Aluminium Fluoride	tonne	1362	120976	2045	187158	984	24720
Asbestos Cement Products	tonne	91101	1447617	89833	1444464	116492	1876220
Asbestos Fibre Products	tonne	43298	5071610	41739	5548536	49044	6902347
Bleaching Powder	tonne	23948	677278	21509	734237	30919	931596
Boric Acid	tonne	1520	121969	1952	160749	1384	176162
Briquets Of Coke, Semi-Coke of Coal	tonne	210	1722	51	728	272	2410
Calcium Carbide	tonne	370	24367	129	11213	787	97371
Caustic Soda	tonne	187484	5453186	275516	6028001	343042	13196705
Cement : Total	tonne	2840277	9539871	2806874	8761533	1901076	6187851
Cement (Portland Grey)	tonne	1892277	6173135	1528080	4528743	995557	3314929
Cement (Portland White)	tonne	18164	176655	18384	179863	18285	177863
Cement Clinker	tonne	800076	2709413	1094051	3410629	734859	1972316
Cement (Others)	tonne	129760	480668	166359	642298	152375	722743
Cryolite And Chiolite	tonne	52	4296	149	8467	126	12127
Graphite (Artificial)	tonne	24745	3555899	21744	2820004	28218	4090984
Graphite Bricks & Shapes	tonne	95	5141	515	8408	59	4099
Graphite Crucibles	tonne	20	2256	416	28081	397	49894
Hydrofluoric Acid	tonne	2474	237996	1931	164258	1325	132129
Manganese Oxide: Total	tonne	28485	1382052	29116	1357914	21148	986863
Manganese Dioxide	tonne	11412	549640	4476	227849	5297	258822
Manganese Oxides (other than Mn Dioxide)	tonne	17073	832412	24640	1130065	15851	728041
Non-Ferrous Ash & Residues	tonne	417955	1739634	319494	514364	278914	2224341
Non-Ferrous Ash & Residues	tonne	415378	1707211	317963	491875	276905	2172866
Non-Ferrous Base Metals Scrap	tonne	2577	32423	1531	22489	2009	51475
Other Refractory Manufactures	tonne	37658	5065199	64780	6895845	551138	8958764
Petroleum Products: Total*	000'tonne	65685	2540180000	56769	1571680000	62713	3316150000
Phosphoric Acid	tonne	2630	196837	460	50475	9187	1228169
Phosphorus (Elemental)	tonne	650	256687	583	246040	627	362922
Phosphotic Fertilizers	tonne	172	13729	385	15631	428	16776
Potash Fertilizer	tonne	29565	1014818	26583	673799	5877	209314
Potassium Nitrate	tonne	985	168082	827	165914	917	187910
Refractory Bricks	tonne	226260	14825818	291949	13735641	830258	13283270
Silicon Carbide Crucibles	tonne	3023	690399	3728	624851	30137	888930
Slag Dross Etc. From Iron & Steel Exc. Granu	tonne	131880	702416	152818	951045	289895	2753273
Soda Ash	tonne	137747	2713657	149930	2376038	250630	5373921
Sodium Nitrate	tonne	149	7890	272	10289	427	25774
Sodium Nitrite	tonne	14465	661146	15629	727353	17044	1001187
Sulphur (Sublimed precipitated & Colloidal): Total	tonne	16811	1917964	15756	1777105	17607	1941916
Sulphur (Colloidal)	tonne	0	24	0	9	0	9
Sulphur Precipitated	tonne	1	155	2	543	0	16
Sulphur Sublimed	tonne	16810	1917785	15754	1776553	17607	1941891
Titanium Oxide & Dioxide: Total	tonne	38506	3779067	28419	2990597	48003	5320220

Mineral-based Product	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Titanium Dioxide	tonne	6231	1065352	6481	1152120	6049	1538174
Titanium Oxides (Other Than Titanium Dioxides)	tonne	32275	2713715	21938	1838477	41954	3782046

P: Provisional
Source: DGCI & S, Kolkata
**Source: Ministry of Petroleum & Natural Gas Statistics*
**Quantity not additive*

IMPORTS

Ores and Minerals

The value of imports of ores & minerals in 2021-22 accounted for 33.92% of the total value of all merchandise imported into India. During 2021-22, the total value of imports of ores and minerals at ₹ 15,51,380 crore registered an increase of 96.05% as compared to ₹ 7,91,320 crore in the year 2020-21.

Petroleum (crude) continued to be the largest constituent item with a share of 58.91% in the total value of minerals imported in 2021-22. Next in order of importance were diamond with a share of 13.26%, coal (ex.lignite) with 14.75% and natural gas with 6.48%. The combined share of these four minerals was 93.40% in 2021-22 as against 93.82% in the previous year.

The value of imports of some ores & minerals in 2021-22 has increased as in the cases of Precious metal ores &Concentrates (4799.39%) , Iron ore (319.05%), Copper ores &Conc (278.89%), Sulphur (exe. Sublimed Prelipited & Colloidal) (222.99%), Precious & Semi- Precious Stone (cut & uncut) : total (168.75%), as compared to that in the previous year. However imports of all the ores & minerals registered positive growth over previous year.

During 2021-22, ores and minerals were imported from various countries. Bulk of ores & minerals having share more than 1% to total value were imported from 19 countries.These 19 countries, accounted for about 88.59% of the total value of ores & minerals imported in 2021-22. Iraq occupied the top position in 2021-22 in terms of imports value and accounted for 14.61% of the total mineral imports. Next in the order was UAE with 11.89% share followed by USA (10.22%), Australia (6.94%), Nigeria (4.82%),

Kuwait (3.84%),Indonesia (3.70%), Qatar (3.40%), Belgium (2.83%), South Africa (2.61%), Russia (2.43%), Oman (2.43%), Mexico (1.64%), Hong Kong

(1.61%), Angola (1.31%), Brazil (1.28%), Colombia (1.13%) and Egypt (1.06%), The individual share of remaining countries was less than one per cent.

Countrywise analysis of value of imports of ores and minerals in 2021-22 revealed that imports value from Peru reported increase of about 417 times (41769%); Norway by over 19 times (1936%). The other countries which recorded significant increase in the value of imports of ores and minerals during the year were Congo PR (488%), Cameroon (334%), Ecudor (268%), China (245%) and Singapore (240%). However, imports value showed a decline in respect of Other Countries (25.74%). (Tables - 8 to 10).

Table - 8 : Imports of Ores & Minerals, 2019-20 to 2021-22

(Value in ₹ '000)

Ores & Minerals	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Minerals		**	**11515303006**	**	**7913202918**	**	**15513800326**
Abrasives (Natural)	tonne	4234	59872	3221	55212	3718	78311
Alabaster	tonne	1040	32801	826	27872	1572	59681
Alumina	tonne	1844483	49829384	2334786	57491719	2549567	82447635
Andalusite	tonne	17618	425962	15217	428831	10419	344730
Antimony Ores And Concs.	tonne	7656	1265983	5977	1072406	4555	1499919
Arsenic Sulphide (Natural)	tonne	7	995	4	570	18	2119
Asbestos: Total	tonne	361163	12432333	308506	11851124	437511	16631390
Asbestos (Chrysotile)	tonne	360839	12422164	308100	11840174	436977	16613219
Asbestos (Others)	tonne	324	10169	406	10950	534	18171
Ballclay	tonne	126794	1115239	65828	765439	93855	1134427
Barytes	tonne	15436	427967	11691	313860	16577	523859
Bauxite	tonne	2246681	10817757	3034041	13709540	3009079	18963241
Bentonite	tonne	72618	882272	90933	1019395	142010	2131123
Borax: Total	tonne	176421	5644322	194448	6337254	223368	7973967
Natural Borate	tonne	84699	2157324	83207	2113660	101337	2910832

Table- 8 Concld.

Ores & Minerals	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Sodium Borate	tonne	81531	2776165	101477	3557620	111210	4188993
Other Borates	tonne	10191	710833	9764	665974	10821	874142
Building & Monumental Stones Nes	tonne	47971	523956	16327	360034	44482	422105
Calcite	tonne	63458	302799	67643	374975	41688	290721
Chalk	tonne	105	4131	66	2661	64	2197
Chromite: Total	tonne	124693	2065047	156211	2257733	245710	4232459
Chrome Ore Others	tonne	42983	739986	73353	1015587	130179	2296377
Chrome Ore Conc.	tonne	891	24896	4013	93937	4987	126819
Chrome Ore Lumps	tonne	80819	1300165	78845	1148209	110544	1809263
Clay (Others)	tonne	20961	317309	12562	241521	14245	279441
Coal(Ex Lignite)	000' t	248545	1527478152	215260	1160506410	208636	2288189160
Coal:Lignite	000' t	1	5170	1	5746	1	9495
Cobolt Ores & Conc.	tonne	2	9253	++	325	1	6917
Coke	tonne	2912775	61067396	2463036	44821773	2501153	81047701
Copper Ores & Conc.	tonne	821555	86675247	415136	59071579	1018934	223814328
Corundum (Natural)	tonne	-	-	1	79	++	10
Diamond: Total		**	1487354319	**	1283511854	**	2056382187
Diamond (Industrial)	Crt	10427197	6024784	8725537	4362112	16457278	10785779
Diamond (Mostly Cut)		**	1479515995	**	1277251339	**	2042729864
Diamond Powder	000 crt	816431	1813540	839962	1898403	1238216	2866544
Diatomite	tonne	4950	152229	7099	212766	1787	94373
Dolomite	tonne	5539814	6555288	3505151	5075300	5510404	9682992
Earth Clay	tonne	2	343	3	450	2	247
Emerald (Cut & Uncut)		**	24403510	**	7997796	**	16560915
Emerald (Uncut)	tonne	136	13871900	49	6640030	58	14007706
Emerald (Cut)	000 crt	90367	10531610	9842	1357766	3174	2553209
Felspar (Natural)	tonne	8198	101216	13187	78978	2795	54485
Felspar (Cut & Uncut)		**	83631	**	8094	**	22005
Felspar (Uncut)	tonne	14	67870	1	3741	37	13619
Felspar (Cut)	000 crt	2142	15761	883	4353	774	8386
Fireclay	tonne	1896	100241	2326	100595	898	58418
Flint	tonne	6279	62362	9209	85170	8611	83205
Fluorspar	tonne	239589	7225937	220573	6090596	286224	7792038
Garnet (Abrasive)	tonne	391	6189	345	14712	140	1789
Garnet (Cut And Uncut)		**	184466	**	97335	**	183591
Garnet (Uncut)	tonne	56	129065	11	64770	23	141280
Garnet (Cut)	000 crt	4969	55401	1437	32565	1299	42311
Granite : Total	tonne	56169	1846960	37304	1320021	35032	1279464
Granite (Crude Or Roughly Trimmed)	tonne	38755	1011671	25874	829212	26944	891720
Granite (Cut Blocks/Slabes)	tonne	11265	270578	7071	175377	5980	176076
Granite (Polished Blocks/Tiles)	tonne	674	24389	1501	51776	733	22736
Granite (Others)	tonne	5475	540322	2858	263656	1375	188932
Graphite (Natural)	tonne	41405	1863220	40153	1808218	54047	2651642
Gypsum & Plaster	tonne	5460746	8415195	4762012	7372934	5632758	11823817
Iron Ore: Total	000' t	1245	9409772	766	8445221	6683	35389345
Iron Ore Conc: Non-Agglomated	000' t	420	3063619	154	1484523	1446	9469224
Iron Ore Fines	000' t	223	1291301	++	852	4075	15630812

Table- 8 Concld.

Ores & Minerals	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Iron Ore Lumps	000' t	543	4530382	166	1800782	927	8903226
Iron Ore Pellates	000' t	54	438140	379	4612581	170	874034
Iron Ore Pyrites	000' t	5	86330	67	546483	65	512049
Kaolin	tonne	231662	3933899	237144	4431804	223127	5048415
Kieselgurh	tonne	66	9247	10	1543	++	64
Kyanite	tonne	1112	33476	1238	42080	1668	53418
Lead Ores & Concs.	tonne	3283	166725	5473	325104	5325	255224
Lime Stone	tonne	25639508	37429909	22797801	32911759	27582767	49014650
Magnesite : Total	tonne	365053	9468163	364577	7657838	510898	13106490
Magnesia (Fused)	tonne	16325	823312	25215	1135547	42306	2614441
Magnesite (Not Calcined)	tonne	63874	185153	57993	159537	136894	317688
Magnesite (Calcined)	tonne	50567	1645695	59514	919930	44231	940743
Magnesite:Dead-Burnt Magnesia	tonne	160465	5018483	133034	3360002	170744	5340576
Magnesium Oxide	tonne	55765	1208334	63442	1402374	67331	2067467
Magnesite (Other)	tonne	18057	587186	25379	680448	49392	1825575
Manganese Ore: Total	tonne	4316572	41282100	4058590	55242138	6500149	96424799
Manganese Ore (46% Or More Mn)	tonne	191766	3997776	182048	3156903	185816	3797474
Manganese Ore (35% Or More But Below 46% Mn)	tonne	1871739	26995931	2942210	39070738	4464163	69812534
Manganese Ore (30% Or More But Below 35% Mn)	tonne	432072	4049808	449497	3789163	929453	9970098
Manganese Ore (Ferruginous, 10 % Or More But Below 30%	tonne	47639	394579	168371	1218726	307008	2929378
Manganese Ore (Others)	tonne	1773356	5844006	316464	8006608	613709	9915315
Marble : Total	tonne	951361	17923694	645253	12032307	1073654	21110673
Marble (Dresssed)	tonne	900860	14764327	623229	10660272	1038849	18724997
Marble (Others)	tonne	50501	3159367	22024	1372035	34805	2385676
Mica: Total	tonne	3645	1280925	2987	1252020	3338	1319896
Mica (Unmanufactured)	tonne	1626	135689	1273	140981	1569	157461
Mica (Blocks)	tonne	218	11184	56	15557	79	12727
Mica (Powder)	tonne	535	63928	542	75765	508	61955
Mica (Splittings)	tonne	461	43169	515	43414	981	82548
Mica (Waste & Scrap)	tonne	412	17408	160	6245	1	231
Mica (Worked)	tonne	2019	1145236	1714	1111039	1769	1162435
Mica (Cond. Films, Plates, Cuts Nes)	tonne	33	33469	53	55589	4	6768
Mica (Washers & Discs)	tonne	++	2	++	55	++	542
Mica (Sheets & Strips)	tonne	156	32761	101	20939	238	49539
Mica (Bricks)	tonne	-	-	++	406	++	43
Mica Worked (Others)	tonne	1830	1079004	1560	1034050	1527	1105543
Molybdenum Ores & Conc.	tonne	7901	9809780	9177	8848441	9114	15470962
Natural Gas	tonne	24416607	684667281	25054872	583289424	23417029	1005206968
Nickel Ores & Concs.	tonne	++	204	37	6404	106	16165
Niobium Or Tantalum Ores And Concs.	tonne	16	21764	2	489	2	488
Ochre: Total	tonne	188	35754	391	82224	648	149495
Ochre: Earth Colours	tonne	152	14871	228	18018	309	45117

Table- 8 Concld.

Ores & Minerals	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Ochre:Yellow Ochre	tonne	7	6286	7	6308	9	6219
Ochre: Persian Red	tonne	++	147	-	-	3	473
Ochre: Red Oxide	tonne	29	14450	156	57898	327	97686
Petroleum (Crude)	000' t	220869	7281122511	188182	4396561618	220034	9139168005
Precious & Semi-Precious Stones (Cut & Uncut):Total		**	41191154	**	47935435	**	128825205
Precious & Semi Precious Stones (Uncut)	tonne	2435	6169055	2024	6847282	4323	10225806
Precious & Semi Precious Stones Cut	000 crt	623818	35022099	432603	41088153	383623	118599399
Preciuos Metal Ores & Concentrates	kg	273	736	10743	48509	799178	2376644
Quartz & Quartzite: Total	tonne	1155	40682	1098	50333	7792	211384
Quartz (Natural)	tonne	718	9960	206	6940	1049	28661
Quartzite (Natural)	tonne	437	30722	892	43393	6743	182723
Rock Phosphate	tonne	7654867	54205952	7781423	53709109	9659818	104667349
Salt (Other than Common Salt)	tonne	65263	466170	98042	645494	69549	512396
Sand, Excl. Metal Bearing	tonne	198862	502131	57812	400291	5121	348319
Sandstone	tonne	28	693	16	480	130	2691
Silica Sand	tonne	21392	218841	21356	238740	57095	527973
Sillimanite	tonne	609	10781	606	11571	801	13972
Slate	tonne	111	3818	49	3784	109	5741
Steatite : Total	tonne	5809	325939	5332	344649	9978	407255
Steatite Blocks	tonne	170	1744	-	-	2	246
Steatite Lumps	tonne	724	2205	156	501	641	2117
Steatite Powder & Others	tonne	4915	321990	5176	344148	9335	404892
Sulphur (Excl. Sublimed,Ppt. & Colloidal)	tonne	1235102	8239656	1463291	10948268	1895211	35362092
Tin Ores & Concs.	tonne	++	206	2	899	++	299
Titanium Ores & Conc.: Total	tonne	138042	3965292	78747	3440562	111653	5292058
Titanium Ores And Conc.(Ileminite)	tonne	109771	1963147	43894	907344	77003	2326341
Titanium Ores And Conc.(Rutitle)	tonne	20589	1689194	29562	2224774	22960	2479934
Titanium Ores And Conc. (Others)	tonne	7682	312951	5291	308444	11690	485783
Tripoli Earth	tonne	19	1116	-	-	19	1174
Tungsten Ores & Concs.	tonne	447	69234	121	9104	151	14800
Vanadium Ores & Others	tonne	7006	349104	999	77967	5869	436744
Vermiculite (Raw)	tonne	416	11024	696	17234	1096	25520
Witherite	tonne	7	263	++	10	-	-
Wollastonite	tonne	22616	294800	24049	370375	30625	675667
Zinc Ores & Concs.	tonne	101	2667	804	9530	720	24772
Zirconium Ores & Conc.	tonne	56166	6073420	68675	6993378	94839	11260337
Other Minerals Nes	tonne	641544	2995670	544580	2325905	678649	4316773

Source: DGCI & S, Kolkata
P: Provisional
++: Negligible
***: Quantity not additive*

Table -9 : Value of Imports of Ores & Minerals (including Re-import), 2019-20 to 2021-22

(By Principal Countries)

Ores & Minerals	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
All Minerals	**11515303006**	**100**	**7913202918**	**100**	**15513800326**	**100**	**96.05**
Petroleum (crude)	7281122511	63.23	4396561618	55.56	9139168005	58.91	107.87
Coal (ex Ligbite)	1527478152	13.26	1160506410	14.67	2288189160	14.75	97.17
Diamond	1487354319	12.92	1283511854	16.22	2056382187	13.26	60.22
Natural Gas	684667281	5.95	583289424	7.37	1005206968	6.48	72.33
Copper Ores & Conc.	86675247	0.75	59071579	0.75	223814328	1.44	278.89
Precious & Semi-precious Stones (cut & Uncut):total	41191154	0.36	47935435	0.61	128825205	0.83	168.75
Rock Phosphate	54205952	0.47	53709109	0.68	104667349	0.67	94.88
Manganese Ore	41282100	0.36	55242138	0.7	96424799	0.62	74.55
Alumina	49829384	0.43	57491719	0.73	82447635	0.53	43.41
Coke	61067396	0.53	44821773	0.57	81047701	0.52	80.82
Limestone	37429909	0.33	32911759	0.42	49014650	0.32	48.93
Iron Ore	9409772	0.08	8445221	0.11	35389345	0.23	319.05
Sulphur (exc. Sublimed Precipited & Colloidal)	8239656	0.07	10948268	0.14	35362092	0.23	222.99
Marble	17923694	0.16	12032307	0.15	21110673	0.14	75.45
Bauxite	10817757	0.09	13709540	0.17	18963241	0.12	38.32
Asbestos	12432333	0.11	11851124	0.15	16631390	0.11	40.34
Emerald (cut & Uncut)	24403510	0.21	7997796	0.1	16560915	0.11	107.07
Molybdenum Ores & Conc.	9809780	0.09	8848441	0.11	15470962	0.1	74.84
Magnesite	9468163	0.08	7657838	0.1	13106490	0.08	71.15
Gypsum	8415195	0.07	7372934	0.09	11823817	0.08	60.37
Zirconium Ores & Conc.	6073420	0.05	6993378	0.09	11260337	0.07	61.01
Dolomite	6555288	0.06	5075300	0.06	9682992	0.06	90.79
Borax	5644322	0.05	6337254	0.08	7973967	0.05	25.83
Fluorspar	7225937	0.06	6090596	0.08	7792038	0.05	27.94
Titanium Ores & Conc.	3965292	0.03	3440562	0.04	5292058	0.03	53.81
Kaolin	3933899	0.03	4431804	0.06	5048415	0.03	13.91
Other Minerals Nes	2995670	0.03	2325905	0.03	4316773	0.03	85.6
Chromite	2065047	0.02	2257733	0.03	4232459	0.03	87.46
Graphite (natural)	1863220	0.02	1808218	0.02	2651642	0.02	46.64
Preciuos Metal Ores & Concentrates	736	0	48509	0	2376644	0.02	4799.39
Other Minerals	11756910	0.1	10477372	0.13	13566089	0.09	29.48

Source: DGCI & S, Kolkata
P:Provisional

Table- 10 : Value of Imports of Ores & Minerals (including Re-import), 2019-20 to 2021-22

(By Principal Countries)

Country	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
Grand Total	**11515303006**	**100**	**7913202918**	**100**	**15513800326**	**100**	**96.05**
Iraq	1613786345	14.01	951898110	12.03	2266196177	14.61	138.07
UAE	1242431153	10.79	1017894598	12.86	1843987354	11.89	81.16
Saudi Arabia	1446490894	12.56	798697210	10.09	1721278315	11.1	115.51
USA	806756883	7.01	836948848	10.58	1586164944	10.22	89.52

Table-10 Concld.

Country	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
Australia	579300065	5.03	491512945	6.21	1076064677	6.94	118.93
Nigeria	711621877	6.18	409344897	5.17	747501535	4.82	82.61
Kuwait	342816907	2.98	231464773	2.93	596318462	3.84	157.63
Indonesia	485969389	4.22	395918292	5	574654486	3.7	45.14
Qatar	414677870	3.6	309014143	3.91	527094184	3.4	70.57
Belgium	362970553	3.15	264518200	3.34	438749857	2.83	65.87
South Africa	285908142	2.48	241002978	3.05	405469645	2.61	68.24
Russia	242618163	2.11	176807689	2.23	376212689	2.43	112.78
Oman	102239806	0.89	128077798	1.62	335925209	2.17	162.28
Mexico	235589576	2.05	146551950	1.85	255035385	1.64	74.02
Hong Kong	234382027	2.04	217688153	2.75	250330723	1.61	15
Angola	257426729	2.24	137782628	1.74	203521139	1.31	47.71
Brazil	84781547	0.74	74961113	0.95	198682221	1.28	165.05
Colombia	20760739	0.18	69861350	0.88	175537868	1.13	151.27
Egypt	95506536	0.83	78132837	0.99	164988147	1.06	111.16
Singapore	67570524	0.59	39441256	0.5	134462362	0.87	240.92
Israel	45985748	0.4	50015508	0.63	110568654	0.71	121.07
Congo P Rep	39805443	0.35	16347508	0.21	96191250	0.62	488.42
Norway	11695165	0.1	4551909	0.06	92682312	0.6	1936.12
Malaysia	127928663	1.11	74447498	0.94	92681696	0.6	24.49
Mozambique	42250357	0.37	25000891	0.32	77575867	0.5	210.29
Canada	108498295	0.94	55949686	0.71	75916712	0.49	35.69
Chile	59936479	0.52	32458431	0.41	74894353	0.48	130.74
Gabon	3284695	0.03	26129785	0.33	72573087	0.47	177.74
China	31195013	0.27	19704470	0.25	68099047	0.44	245.6
Equtl Guinea	67957388	0.59	20383646	0.26	65032984	0.42	219.04
Ecuador	17953281	0.16	17501977	0.22	64408792	0.42	268.01
Cameroon	44675268	0.39	13596588	0.17	59029019	0.38	334.15
Algeria	118040691	1.03	25776167	0.33	54931611	0.35	113.11
Turkey	68803213	0.6	38261935	0.48	52303565	0.34	36.7
Thailand	28395961	0.25	24462173	0.31	52204049	0.34	113.41
Jordan	23545576	0.2	21341424	0.27	43889310	0.28	105.65
Botswana	52770671	0.46	32833354	0.41	38419662	0.25	17.01
Poland	19767781	0.17	18748083	0.24	37164085	0.24	98.23
Switzerland	17365858	0.15	17499548	0.22	34064549	0.22	94.66
UK	21736353	0.19	14354048	0.18	32957069	0.21	129.6
Brunei	41534342	0.36	24057370	0.3	29000732	0.19	20.55
Vietnam	18102249	0.16	12579785	0.16	27330421	0.18	117.26
Japan	22063842	0.19	18012309	0.23	27088618	0.17	50.39
Peru	8772085	0.08	63351	0	26524941	0.17	41769.81
Morocco	18282211	0.16	17442769	0.22	26494131	0.17	51.89
Other Countries	821350653	7.13	274162937	3.46	203598431	1.31	-25.74

P: Provisional
Source: DGCI&S, Kolkata

Metals & Alloys

The value of imports of metals & alloys at ₹ 6,26,927 crore showed an increase of 43.92% in 2021-22 as compared to ₹ 4,35,927 crore in the previous year. The share of metals & alloys in the total value of all merchandise imported to India was about 13.70 % in 2021-22.

Gold, non-monetary & monetary (total), with a share of 54.89% continued to occupy the top position in the total value of imports of metals and alloys in 2021-22. Iron & steel is placed in the second position and accounted for share of 18.49%, copper & alloys including brass & bronze occupied the third place with a share of 8.39% and aluminium & alloys including scrap occupied the fourth place with a share of 7.22%. Next in the order were silver with 3.90% followed by ferro- alloys, Nickel & Alloys incl. scrap with 1.97% and 1.27 % respectively. The individual share of remaining metals was less than one per cent of the total value of metals & alloys.

The value of imports of the metals & alloys that showed significant growth included Silver with 310.29%; Manganese & Alloys (incl. Waste Scrap)158.50%; Ferro Alloys 122.97%; and Other Rare Metals NES 122.95% in 2021-22 as compared to that in the previous year. On the other hand, during 2021-22, the value of imports of metals and alloys that showed a declining trend as compared to the previous year was mainly in the case of Precious Metals, Metals clad with precious Metals (48.29%), cadmium (9.02%), (incl.waste & scrap) and Mercury (8.57%).

India imported metals & alloys from various countries in 2021-22. Bulk of the metals and alloys having share of more than 1% of the total value were imported from 21 countries which accounted for 85.50% of the total value of metals & alloys imported in 2021-22. Switzerland occupied the top position with a share of 24.96% of the total value of metal imports in 2021-22 followed by UAE in second place with a share of 9.43%. The countries next in order were China in third place with a share of 6.01%, South Africa 6.01% followed by Rep. of Korea at the 5th place with share of 4.60% and Guinea at 6 th place with 3 . 97 %. The other countries with share more than 3% included USA (3.56%), Japan (3.30%) and UK (3.09%). The contribution of countries with share less than 3% but more than 2% included Peru (2.77%), Bolivia (2.46%), Singapore (2.30%) and Hong Kong (2.20%). The remaining countries are those with a share less than 2 per cent.

During the year under review, imports in terms of value from Swaziland increased manifold by 417.60% and for many other countries imports value rose up more than 100%, for instance, Tanzania (195.91%), Indonesia (195.14%), Dominic Rep (157.24%) and Guinea (135.30%). The other countries which recorded significant positive growth in imports included Mozambique(135.30%), Brazil (114.03%), Bhutan (105.39%), Kuwait (103.74%), Turkey (95.01%) and Bolivia (80.93%), as compared to the previous year. On the other hand, the value of imports of metals & alloys showed a declining trend in the case of many countries, prominent among them were Mexico (21.15%), Singapore (1.55%) and Philippines (0.67%). Imports of selected mineral-based products during 2019-20 to 2021-22 are furnished in Table-14. Value of imports of selected mineral- based products at ₹ 2,25,030 crore in the year 2021-22 registered an increase of 61.65% as compared to that of ₹ 1,39,200 crore in the previous year (Table 11 to 14).

Table-11: Imports of Metals and Alloys 2019-20 to 2021-22

(Value in ₹ '000)

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Metals & Alloys		**	4167271075	**	4356107118	**	6269271863
Aluminium & Alloys Incl. Scrap	tonne	2152419	310945506	2060227	299126164	2334438	452887747
Antimony Alloys & Scrap	tonne	1465	660699	1319	591363	1173	998247
Bismuth & Scrap	tonne	192	107726	277	135511	286	189060
Boron	tonne	++	2193	++	1899	++	2818
Cadmium & Scrap	tonne	9640	1787948	8249	1338734	6787	1218010
Chromium Alloys & Scrap	tonne	1514	923957	1329	786755	1451	925819
Cobalt Alloys & Scrap: Total	tonne	1294	4216990	802	2898721	1130	5852552
Cobalt & Alloys	tonne	1294	4216990	802	2898714	1128	5850055
Cobalt & Scrap	tonne	-	-	++	7	2	2497
Copper & Alloys (Incl. Brass & Bronze): Total	tonne	896848	361304774	744819	341717156	823597	526294673
Brass & Bronze	tonne	23552	12369100	19468	11486251	20218	15778525
Brass & Bronze (Scrap)	tonne	144126	39170225	138389	40285631	133181	65116768
Copper & Alloys	tonne	616456	280500278	496358	261483027	553443	392177470
Copper (Scrap)	tonne	112714	29265171	90604	28462247	116755	53221910

Table- 11 Concld.

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Copper (Cement Copper Precipitated)	tonne	++	763	39	5489	281	8758
Ferro Alloys : Total	tonne	483127	63432050	421980	55319083	608617	123345004
Ferro-Boron	tonne	1166	190257	1238	197093	1046	215732
Ferro-Chrome	tonne	29999	3893862	39002	4897369	44631	8360932
Ferro-Charge-Chrome	tonne	5654	328099	14004	741433	8832	769273
Ferro-Cobalt	tonne	++	1746	++	1402	-	-
Ferro-Manganese	tonne	95706	6607464	66089	4785976	40881	7059207
Ferro-Molybdenum	tonne	2531	3120808	2883	3115738	2558	6140376
Ferro-Nickel	tonne	113151	25036565	79737	16875880	249315	55890205
Ferro-Niobium	tonne	2778	5483410	3026	5857814	3982	8642844
Ferro-Phosphorous	tonne	2577	71363	2006	55172	3746	148545
Ferro-Silicon	tonne	215181	16171706	194439	16370102	212256	28265119
Ferro-Titanium	tonne	1157	299792	462	109565	731	300529
Ferro-Tungsten	tonne	4	9250	13	23282	2	4892
Ferro-Vanadium	tonne	595	1143397	480	613762	900	1806932
Ferro-Zirconium	tonne	342	41178	374	51237	522	96181
Ferro Silico-Chrome	tonne	37	14448	-	-	100	12778
Ferro-Silico-Magnesium	tonne	3128	294705	2765	289625	4299	631424
Ferro Silico-Manganese	tonne	6172	344396	10497	546336	26676	2741398
Ferro-Alloys (Others)	tonne	2949	379604	4965	787297	8140	2258637
Gold (Non-Monetory & Monetory):Total	kg	719905	1992494952	651238	2542884698	879010	3440928249
Gold-Monetory	kg	-	-	-	-	-	-
Gold-Nonmonetory: Total	kg	719905	1992494952	651238	2542884698	879010	3440928249
Gold,Non-Monetory, Powder	kg	++	471	++	51	++	5
Gold,Non-Monetory:Other Semi-manufactured forms	kg	1981	6047059	1864	7902576	10521	45336972
Gold,Non-Monetory, Other Unwrought Forms	kg	717924	1986447422	649374	2534982071	868489	3395591272
Gold-Clad Metal /Base Metals Nes	tonne	++	270	++	1694	++	52
Iron & Steel : Total		**	1013874204	**	826381853	**	1159500736
Iron & Steel (Finished Steel Inc. Cr Sheet)	tonne	4024286	358688033	3123084	281364644	3186329	400431501
Iron & Steel (Semi-Finished Steel Incl. Stl Ingo)	tonne	3008429	146062138	1848059	97340310	1504120	116884064
Iron & Steel (Steel Wire)	tonne	185193	17301064	151105	15473255	149312	21164209
Iron & Steel (Sponge Iron)	tonne	65244	1263296	68343	1315159	37451	1088387
Iron & Steel (Scrap)	tonne	6776675	241791670	5393385	213404783	4976246	323514680
Iron & Steel: Alloy Steel (Granules)	tonne	20530	1083770	17284	1015659	18629	1463023
Iron & Steel: Alloy Steel (Powder)	tonne	3661	579712	2596	590464	3450	911990
Iron & Steel (Other Finished Steel, Nes)		**	202485997	**	187149323	**	239661220

Table- 11 Concld.

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Iron & Steel Material	tonne	527392	31485891	385727	21247947	526903	46871076
Iron & Steel (Stainless Steel)	tonne	71949	13132633	39876	7480309	32950	7510586
Lead And Alloys & Scrap: Total	tonne	348747	49923441	314954	45882809	303573	52969860
Lead & Alloys	tonne	256132	37990315	245841	36498550	225448	40056256
Lead (Scrap)	tonne	92615	11933126	69113	9384259	78125	12913604
Magnesium & Scrap	tonne	24680	4508647	25841	4604195	28845	10442217
Manganese & Alloys (Incl Waste & Scrap): Total	tonne	45195	6188389	37247	4933243	40463	12752665
Manganese & Alloys: (Wrought & Unwrought)	tonne	44580	5882186	36890	4838565	39842	12402477
Manganese & Alloys Nes	tonne	598	303087	357	94678	621	350188
Manganese Waste & Scrap	tonne	17	3116	-	-	-	-
Mercury	tonne	130	472838	112	456185	93	417082
Molybdenum & Scrap	tonne	429	1545908	430	1540722	554	2453374
Nickel And Alloys Incl. Scrap: Total	tonne	48425	55491356	56536	55125443	51519	79427347
Nickel & Alloys	tonne	45294	53854179	53248	53022663	48437	77416339
Nickel (Scrap)	tonne	3131	1637177	3288	2102780	3082	2011008
Other Rare Metals Nes	tonne	150	464961	212	520361	1836	1160126
Pig & Cast Iron Incl. Spiegeliesen	tonne	47749	3618533	36920	3368526	43732	4890464
Platinium Alloys & Related Metals	kg	9299	25809821	10719	38332024	9603	37563471
Platinum (Powder, Unwrought & Others)	kg	4705	10157862	5184	11561645	6020	14641574
Other Metals Of Platinum Group	kg	4594	15651959	5535	26770379	3583	22921897
Platinium - Clad Base /Precious Metal	kg	6	14483	73	42046	178	72575
Precious Metals / Metals Clad With Precious M	tonne	114	482326	328	5267483	320	2723812
Selenium	tonne	574	708675	701	681519	508	712159
Silicon	tonne	55221	6137456	64800	8323238	77220	17371458
Silver	tonne	5421	191617874	1484	59602766	4422	244542763
Silver Clad Base Metal	kg	574	5565	500	7518	4862	22436
Tantalum & Scrap: Total	tonne	1	83353	1	92405	412	184858
Tantalum alloys unwrought	tonne	1	83353	1	92405	5	99544
Tantalum & scrap	tonne	-	-	-	-	407	85314
Tellurium	tonne	3	23332	2	21250	3	18935
Tin & Alloys (Incl. Scrap): Total	tonne	11746	15254405	10797	14848133	10809	28696669
Tin & Alloys	tonne	11225	14998805	10382	14585191	10333	28331809
Tin & Alloys : Worked	tonne	521	255514	415	262942	476	364860
Tin (Scrap)	tonne	++	86	-	-	-	-

Table- 11 Concld.

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Titanium & Alloys (Incl. Waste & Scrap)	tonne	8347	7448533	8875	5480218	9369	7998954
Tungsten And Alloys Incl. Scrap	kg	385732	1467498	326673	1451447	364880	1805805
Zinc And Alloys (Incl. Scrap)	tonne	249502	46153989	189197	34313169	227424	50722547
Zinc & Alloys	tonne	173997	34384910	139769	27338160	148376	36587059
Zinc (Scrap)	tonne	75505	11769079	49428	6975009	79048	14135488
Zirconium & Scrap	tonne	40	97660	3	23298	45	170561

Source: DGCI & S, Kolkata
P: Provisional, R: Revised
++: Negligible, -: Nil
***: Not additive*

Table-12: Value of Imports of Metals and Alloys, 2019-20 to 2021-22

(By Principal Metals & Alloys)

Metals & Alloys	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
Grand Total	**4167271075**	**100**	**4356107118**	**100**	**6269271863**	**100**	**43.92**
Gold (non-monetory & Monetory):total	1992494952	47.81	2542884698	58.38	3440928249	54.89	35.32
Iron & Steel	1013874204	24.33	826381853	18.97	1159500736	18.49	40.31
Copper & Alloys (incl. Brass & Bronze)	361304774	8.67	341717156	7.84	526294673	8.39	54.01
Aluminium And Alloys Incl. Scrap	310945506	7.46	299126164	6.87	452887747	7.22	51.4
Silver	191617874	4.6	59602766	1.37	244542763	3.9	310.29
Ferro Alloys	63432050	1.52	55319083	1.27	123345004	1.97	122.97
Nickel And Alloys Incl. Scrap	55491356	1.33	55125443	1.27	79427347	1.27	44.08
Lead And Alloys Incl. Scrap	49923441	1.2	45882809	1.05	52969860	0.84	15.45
Zinc And Alloys Incl. Scrap	46153989	1.11	34313169	0.79	50722547	0.81	47.82
Platinium Alloys & Related Metals	25809821	0.62	38332024	0.88	37563471	0.6	-2
Tin And Alloys Incl. Scrap	15254405	0.37	14848133	0.34	28696669	0.46	93.27
Silicon	6137456	0.15	8323238	0.19	17371458	0.28	108.71
Manganese & Alloys (incl Waste & Scrap)	6188389	0.15	4933243	0.11	12752665	0.2	158.5
Magnesium & Scrap	4508647	0.11	4604195	0.11	10442217	0.17	126.8
Titanium & Alloys (incl. Waste & Scrap)	7448533	0.18	5480218	0.13	7998954	0.13	45.96
Cobalt & Alloys (incl Waste And Scrap)	4216990	0.1	2898721	0.07	5852552	0.09	101.9
Pig & Cost Iron (incl. Speigeliesen)	3618533	0.09	3368526	0.08	4890464	0.08	45.18
Preciuos Metals/Metals	482326	0.01	5267483	0.12	2723812	0.04	-48.29

Table- 12 Concld.

Metals & Alloys	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
Clad With Preciuos Metals							
Molybdenum & Scrap	1545908	0.04	1540722	0.04	2453374	0.04	59.24
Tungsten And Alloys Incl. Scrap	1467498	0.04	1451447	0.03	1805805	0.03	24.41
Cadmium (incl. Waste & Scrap)	1787948	0.04	1338734	0.03	1218010	0.02	-9.02
Other Rare Metals Nes	464961	0.01	520361	0.01	1160126	0.02	122.95
Antimony Alloys And Scrap	660699	0.02	591363	0.01	998247	0.02	68.8
Chromium & Alloys	923957	0.02	786755	0.02	925819	0.01	17.68
Selenium	708675	0.02	681519	0.02	712159	0.01	4.5
Mercury	472838	0.01	456185	0.01	417082	0.01	-8.57
Other Metals & Alloys	335345	0.01	331110	0.01	670053	0.01	102.37

Source: DGCI & S, Kolkata
P: Provisional

Table-13: Value of Imports of Metals and Alloys, 2019-20 to 2021-22

(By Principal Countries)

Metals & Alloys	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
All Countries	4167271075	100	4356107118	100	6269271863	100	43.92
Switzerland	1039728485	24.95	1201797774	27.59	1564907587	24.96	30.21
UAE	310559135	7.45	411090037	9.44	591002469	9.43	43.76
China	298228269	7.16	253099822	5.81	376977637	6.01	48.94
South Africa	134464819	3.23	246653484	5.66	319969889	5.1	29.72
Korea Rep. of	244310288	5.86	191626385	4.4	288127635	4.6	50.36
Guinea	17919211	0.43	105674630	2.43	248657333	3.97	135.3
USA	234443282	5.63	199853317	4.59	223363766	3.56	11.76
Japan	177505748	4.26	162204785	3.72	206886097	3.3	27.55
UK	165877334	3.98	110728782	2.54	194002191	3.09	75.2
Peru	101475207	2.44	111217188	2.55	173847784	2.77	56.31
Bolivia	59810123	1.44	85111551	1.95	153988602	2.46	80.93
Singapore	62990591	1.51	146390033	3.36	144120534	2.3	-1.55
Hong Kong	99480092	2.39	87314320	2	137895844	2.2	57.93
Tanzania	44347948	1.06	42337240	0.97	125279262	2	195.91
Indonesia	81912364	1.97	40875240	0.94	120637568	1.92	195.14
Germany	62665932	1.5	65525774	1.5	99569459	1.59	51.95
Australia	52218415	1.25	72900094	1.67	89268691	1.42	22.45
Malaysia	102730921	2.47	71177450	1.63	82123026	1.31	15.38
Ghana	92620018	2.22	67204084	1.54	80349443	1.28	19.56
Thailand	59629957	1.43	58326516	1.34	76221571	1.22	30.68
Brazil	34749039	0.83	29317748	0.67	62749799	1	114.03
Vietnam	59711979	1.43	51232884	1.18	61267425	0.98	19.59
Saudi Arabia	49037679	1.18	32755487	0.75	57540914	0.92	75.67
Russia	28529347	0.68	35261589	0.81	53611438	0.86	52.04
Netherlands	38247049	0.92	31735149	0.73	51389965	0.82	61.93
Dominic	24973191	0.6	18134943	0.42	46650133	0.74	157.24

Table- 13 Concld.

Metals & Alloys	2019-20		2020-21		2021-22 (P)		% increase (+) or decrease (-) in 2021-22 over 2020-21
	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	Value (₹ '000)	% share in total value	
Colombia	30839214	0.74	28940987	0.66	43209967	0.69	49.3
Belgium	30976136	0.74	32504807	0.75	38751219	0.62	19.22
Italy	33425420	0.8	27524684	0.63	36599369	0.58	32.97
Argentina	15651645	0.38	23981232	0.55	35261734	0.56	47.04
Taiwan	19057272	0.46	19372549	0.44	30777560	0.49	58.87
Burkina Faso	35007113	0.84	24285988	0.56	27847181	0.44	14.66
Canada	18375709	0.44	17870630	0.41	25339341	0.4	41.79
France	19939367	0.48	20627600	0.47	23510746	0.38	13.98
Sweden	14422660	0.35	13913307	0.32	20452695	0.33	47
Mozambique	3595268	0.09	8684725	0.2	19997140	0.32	130.26
Kuwait	9173989	0.22	9608378	0.22	19575783	0.31	103.74
Bhutan	11487853	0.28	9282769	0.21	19066273	0.3	105.39
Swaziland	99508	0	3344428	0.08	17310686	0.28	417.6
Baharain Is	8291276	0.2	11511478	0.26	16546742	0.26	43.74
Mexico	13911135	0.33	18982225	0.44	14967523	0.24	-21.15
Spain	10644554	0.26	8791657	0.2	14121787	0.23	60.63
Philippines	6076592	0.15	14087147	0.32	13993333	0.22	-0.67
Norway	9349399	0.22	11517093	0.26	13486755	0.22	17.1
Turkey	8342989	0.2	6699718	0.15	13065202	0.21	95.01
Other Countries	190437553	4.57	115029410	2.64	194984765	3.11	69.51

Source: DGCI & S, Kolkata
P: Provisional

Table- 14 : Imports of Selected Mineral-based products, 2019-20 to 2021-22

(Value in ₹ '000)

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Item		**	1541499125	**	1392000442	**	2250309235
Aluminium Fluoride	tonne	40362	3791019	61225	4805867	74348	5287781
Asbestos Cement Products	tonne	25008	570692	19306	466845	20721	590388
Asbestos Fibre Products	tonne	3577	2740754	2309	2750723	3353	3130952
Bleaching Powder	tonne	17	2780	34	5524	31	6228
Boric Acid	tonne	4826	210517	6897	313194	7412	378403
Briquets Of Coke, Semi-Coke Of Coal	tonne	++	2236	++	222	108	3681
Calcium Carbide	tonne	31217	1450665	32665	1774852	22008	1576090
Caustic Soda	tonne	309346	8798197	248057	5549454	203275	7734743
Cement : Total	tonne	2214478	9003784	2350442	9302473	2028180	9220479
Cement (Others)	tonne	230950	1922703	291131	2067663	283181	2183376
Cement (Portland Grey)	tonne	372431	1757397	393659	1851543	345549	1635014
Cement (Portland White)	tonne	148098	1115330	174241	1321486	187661	1473250
Cement Clinker	tonne	1462999	4208354	1491411	4061781	1211789	3928839
Cryolite And Chiolite	tonne	2763	129329	6338	174382	4167	152877
Graphite (Artificial)	tonne	47511	4870675	54327	5422418	75657	8125841
Graphite Bricks & Shapes	tonne	9408	16170	5430	21390	200053	23733
Graphite Crucibles	tonne	1	2573	906	50672	296	38483
Hydrofluoric Acid	tonne	969	89459	2095	177923	1122	133130

Table- 14Concld.

Metals & Alloys	Unit	2019-20		2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Manganese Oxide: Total	tonne	18239	1325712	25687	1565080	29224	2103412
Manganese Dioxide	tonne	10607	963139	12996	1016479	11268	1267664
Manganese Oxides (other than Mn Dioxide)	tonne	7632	362573	12691	548601	17956	835748
Petroleum Products: Total*	000'tonne	43788	1257420000	43248	1094300000	42062	1886360000
Non-Ferrous Ash & Residues#	tonne	24946	2566897	66023	7976670	68776	10876447
Other Refractory Manufactures &	tonne	24682	4682877	131311	4122283	529721	5908835
Phosphotic Fertilizers	tonne	16	2324	++	51	++	245
Phosphoric Acid	tonne	2501094	119766817	2514246	124688967	6442448	186191658
Phosphorus (Elemental)	tonne	33751	6552640	42551	8199312	52577	17336452
Potash Fertilizer	tonne	4040268	83239621	5250814	94059271	3020152	77176503
Potassium Nitrate	tonne	208	34447	58	7553	153	16481
Refractory Bricks	tonne	409154	14567881	265070	10879704	14632269	12745613
Silicon Carbide Crucibles	tonne	63	20742	386	70638	918	135424
Slag (Dross Etc. From Iron & Steel Exc. Granu	tonne	64674	527863	84962	592855	94710	540217
Soda Ash	tonne	847704	15251459	719730	11480417	563139	9700159
Sodium Nitrate	tonne	677	22798	1281	36525	1207	39664
Sodium Nitrite	tonne	16616	631340	11053	434032	13368	744245
Sulphur (Sublimed ppt. & Colladial): Total	tonne	752	42667	862	191861	959	335922
Sulphur (Colloidal)	tonne	54	8729	39	8477	27	10666
Sulphur Precipitated	tonne	528	9533	9	1568	39	6196
Sulphur Sublimed	tonne	170	24405	814	181816	893	319060
Titanium Oxide & Dioxide:Total		16591	3164190	13514	2579284	15233	3695149
Titanium Dioxide	tonne	16416	3082535	13389	2510726	15135	3623000
Titanium Oxides(Other Than Titanium Dioxides)	tonne	175	81655	125	68558	98	72149

Source: DGCI & S, Kolkata
P: Provisional, R: Revised, ++: Negligible, -: Nil
***: Not additive*
**Source: Ministry of Petroleum & Natural Gas Statistics*
 # Includes Non-ferrous Ash & Residues and Non-ferrous Base Metals Scrap
& includes Other Redractory Manufactures and Goods of Siliceous Fossil Metals/Earths

11 State Reviews

Summary

The mineral production (excluding atomic miner- als and Minor Minerals) in India increase by 12.2% (as per index of mineral production base year 2011-12) dur- ing 2021-22 as compared to the previous year. The complete increase in production may be attributed to country wide lock-down during the first quarter of the financial year.

Mineral production (Fuel, Mettalic, Non-mettalic and Minor minerals) was reported from 31 states, union ter- ritories and off shore regions during the year 2021-22. The state value of MCDR mineral was reported at Rs. 202095 crore. The major part of the value of MCDR mineral production was confined to seven states namely Odisha, Rajasthan, Chhattisgarh, Karnataka, Andhra Pradesh, Telangana and Maharashtra.(Table-1).

The total number of reporting mines (excluding fuel, atomic and minor minerals) at all India level were 1311 in 2021-22. Out of these, 263 were from Madhya Pradesh, 143 from Gujarat, 132 from Karnataka, 128 from Odisha, 113 from Chhattisgarh, 108 from Andhra Pradesh, 91 from Rajasthan and 86 from Tamilnadu. Re- maining mines were reported from other states. (Table-2)

Mineral wise reserves/ resourses in the coun- try as on 01.04.2020 are furnished in Table-3.

Table – 1 : Value* of Mineral Production, 2019-20 to 2021-22

(By States & Union Territories)

(In ₹ '000)

State/Union Territory/Region	2019-20	2020-21	2021-22(p)
India	**1653255998**	**1588690573**	**2020953828**
Andhra Pradesh	166218264	130994104	137139910
Arunachal Pradesh	455845	397944	416302
Assam	814755	783615	851501
Bihar	42983377	43021892	43087082
Chhattisgarh	118108145	153480094	240475866
Goa	398896	1157858	296446
Gujarat	76880978	54458025	46777610
Haryana	1718901	1718901	1718901
Himachal Pradesh	3932318	4191870	4410341
Jammu & Kashmir	3710260	1937922	4698403
Jharkhand	32278813	30845510	58300177
Karnataka	100582716	127485054	197871132
Kerala	31123523	16486191	34086624
Ladakh	373050	756538	769885
Madhya Pradesh	147021686	63585432	38688990
Maharashtra	82465290	74869659	73947908
Manipur	2866	2866	2866
Meghalaya	3431243	3148600	3331595
Mizoram	983323	1071305	1646923
Nagaland	1774	1774	1774
Odisha	343507062	303806246	586973477
Punjab	28701	2546800	1749900
Rajasthan	257025185	308261370	305036202
Sikkim	18787	18787	18787
Tamil Nadu	9771097	8511562	9106493
Telangana	149069086	177329636	112966932
Tripura	50577	46688	43089
Uttar Pradesh	57073325	57036657	56816008
Uttarakhand	1649607	2205004	1782195
West Bengal	21391866	18310969	57763181
Andaman Nicobar Island	184682	221700	177328

** Excluding the minerals declared as prescribed substances under the Atomic Energy Act,1962 and fuel minerals .*

Table – 2 : Number of Reporting Mines*, 2019-20 to 2021-22

(By States)

State	2019-20	2020-21	2021-22 (p)
India	**1370**	**1353**	**1311**
Andhra Pradesh	122	110	108
Assam	3	2	2
Bihar	1	1	1
Chhattisgarh	102	102	113
Goa	48	42	28
Gujarat	184	154	143
Himachal Pradesh	26	23	24
Jammu & Kashmir	17	19	16
Jharkhand	54	46	44
Karnataka	148	141	132
Kerala	2	1	1
Madhya Pradesh	223	241	263
Maharashtra	73	72	73
Meghalaya	19	19	16
Orissa	130	154	128
Rajasthan	85	88	91
Tamil Nadu	92	98	86
Telangana	36	36	39
Uttar Pradesh	2	2	2
Uttarakhand	3	2	1

** Excluding atomic minerals, fuel minerals and minor minerals.*

Table – 3: Reserves/Resources of Minerals as on 1.4.2020: India

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Andalusite	**000 tonnes**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**58040**	**56210**	**11800**	**126050**	**126050**
Antimony														
Ore	tonne	0	0	7503	7503	0	0	592	0	0	10588	0	11180	18683
Metal	tonne	0	0	75	75	0	0	5.92	0	0	174	0	179.92	254.92
Apatite	tonne	27715	0	1680	29395	499149	0	0	2281521	11481250	5801338	1017646	21080904	21110299
Asbestos	tonne	0	0	0	0	2488022	3113446	4062376.4	100687	2527959	10557777	57800	22908067	22908067
Bauxite	000 tonnes	560865	15553	70076	646493	268398	128409	316835	526286	843058	2044653	184116	4311754	4958248
Borax	tonne	0	0	0	0	0	0	0	0	0	0	74204	74204	74204
Chromite	000 tonnes	40635	15229	22672	78535	52696	10545	44395	1630	53008	70440	20435	253150	331685
Cobalt (Ore)	million tonnes	0	0	0	0	0	0	0	30.63	2	0.28	12	44.91	44.91
Copper														
Ore	000 tonnes	128267	20045	15580	163891	83102	111376	41368	135884	340902	778987	5360	1496979	1660870
Metal	000 tonnes	1664.12	313.64	183.81	2161.57	873.59	428.09	246.48	1655.35	2748.95	4051.37	31.69	10035.52	12197.09
Diamond	carat	847400	0	159	847559	0	0	0	304601	1524317	29047514	0	30876432	31723991
Diatomite	000 tonnes	0	0	0	0	634	0	0	0	0	2251	0	2885	2885
Emerald	kilogram	0	0	0	0	0	0	0	0	0	0	55869	55869	55869
Fluorite	tonne	228393	163860	11988	404241	9340556	771934	768573	1727945	6239589	1578067	161575	20588239	20992480
Garnet	tonne	8539520.7	50946	5	8590472	1835546	1624128	4622014	138905	10226601	28066885	902574	47416654	56007126
Gold														
Ore														
(Primary)	tonnes	20271400	3420000	36700	23728100	4498133	3821500	1741321.2	9658248	109446798	238863938	126476333	494506270	518234370
Metal														
(Primary)	tonnes	79.26	13.44	0.06	92.76	16.93	9.11	5.64	22.05	159.41	236.26	65.1	514.5	607.26
Ore														
(Placer)	tonnes	0	0	0	0	0	0	0	0	2552000	23569000	0	26121000	26121000
Metal														
(Placer)	tonnes	0	0	0	0	0	0	0	0	2.29	3.57	0	5.86	5.86
Graphite	tonne	4386467	0	4176944	8563411	7964326	3461288	6166401	796464	10679490	31827080	142165128	203060176	211623587
Iron Ore														
(Haematite)	000 tonnes	4559856.5	508158	1141019.5	6209034	3181005	2404790.4	2005363.1	1010483.61	1805532	4827512	2614185	17848870	24057905
Iron Ore														
(Magnetite)	000 tonnes	71930	385	130508	202823	307652	16082	72127	1513168	2036982	6383274	695507	11024791	11227614

Table-3 (Contd.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Kyanite	tonne	393358	331193	122314	846865	1331061	940452.02	1864398.3	561680	3577402	96560462	0	104835455	105682321
Lead & Zinc														
Ore	000 tonnes	28791	63331	11153	103275	4627	23663	13784	51613	196911	368094	4530	663222	766497
Lead Metal	000 tonnes	503.7	1188.47	208.02	1900.19	140.42	534.83	286.02	1117.33	2283.43	6607.77	0	10969.8	12869.99
Zinc Metal	000 tonnes	2356.56	4592.03	489.46	7438.05	448.15	1121.12	599.62	3540.38	5840.74	14080.66	101.65	25732.32	33170.37
Lead+Zinc														
Metal	000 tonnes	0	0	0	0	0	0	0	0	0	120.76	22.37	143.13	143.13
Limestone	000 tonnes	14701910	1065305	3261256	19028470	7665106	6442697	9261072	7528921	32250068	135833401	9579524	208560789	227589259
Magnesite	000 tonnes	57934	6354	1782	66070	80983	24858	40132	59010	59652	128104	309	393047	459118
Manganese														
Ore	000 tonnes	61510	6081	7450	75041	76106	51162	80580	29600	61205	117986	11944	428583	503624
Marl	tonne	50825000	17210000	110000	68145000	26474477.33	4189000	0	0	0	390000	0	31053477	99198477
Molybdenum														
Ore	tonne	0	0	0	0	0	1500000	0	2382000	3269204	19884394	167800	27203398	27203398
Contained MoS2 tonne	0	0	0	0		0	1050	0	1599.54	1733.29	12457.39	50.34	16890.56	16890.56
Nickel Ore	million tonnes	0	0	0	0	0	21	21	31	53	63	0	189	189
Perlite	000 tonnes	0	0	0	0	140	683	595	0	0	0	988	2406	2406
Platinum Group														
of Metals	tonnes of metal													
(PGM)	contained	0	0	0	0	0	0	0	0	11.66	7.4	1.86	20.92	20.92
Potash	million tonnes	0	0	0	0	0	0	0	0	18151	4125	814	23091	23091
Pyrite	000 tonnes	0	0	0	0	27129	0	32597	9590	77729	1527356	0	1674401	1674401
Rare-Earth														
Elements(REE)	tonne	0	0	0	0	0	0	0	0	430353	26042.49	3332	459727.49	459727.49
Rock Phosphate	tonne	27103158	0	3772935	30876093	13669080	29796846	34526541	2879833	3539750	186657066	9308275	280377392	311253485
Rock Salt	000 tonnes	0	3860	0	3860	3360	940	4620	0	0	0	0	8920	12780
Ruby	kilogram	0	0	0	0	0	429	3296	0	0	1623	0	5349	5349
Sapphire	kilogram	0	0	0	0	0	0	0	0	0	450	0	450	450
Sillimanite	tonne	7968444.8	3655	290200	8262300	503301	23406	20549508	4771654	17630364	16115664	4411195	64005091	72267391
Silver														
Ore	tonne	61604192	67971000	40870828	170446020	2330000	18445543	53914460	41320000	70926000	211261729	0	398197732	568643752

Table-3 (Contd.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Metal	tonne	2155.3	4981.73	570.04	7707.07	172.2	824.44	663.67	3881.88	4575.73	12442.92	0	22560.84	30267.91
Sulphur														
(Native)	000 tonnes	0	0	0	0	0	0	0	0	0	210	0	210	210
Tin														
Ore	tonne	2075	0	25	2101	22594540	3213	31330134	168457	561080	29063370	0	83720794	83722895
Metal	tonne	963.19	0	10.8	973.99	33384.66	1116.41	54089.46	813.29	231.63	13147.46	0	102782.91	103756.9
Titanium	tonne	15914697	64860	19068	15998625	10928991	91828	0	2610618	49666080	344212444	3598565	411108526	427107150
Tungsten														
Ore	tonne	0	0	0	0	2230000	0	173063	23276152	23259954	23912049	16581246	89432464	89432464
Contained														
WO3	tonne	0	0	0	0	3568	0	450	19298.8	16994.84	99772.15	4566.28	144650.07	144650.07
Vanadium														
Ore	tonne	0	0	0	0	276530	1720000	4108100	0	232000	18297225	0	24633855	24633855
Contained														
V2O5	tonne	0	0	0	0	1106.12	2835	6032.4	0	487.2	54133.29	0	64594.01	64594.01
Vermiculite	tonne	1562108	0	28888	1590996	76900	71397	25956	9800	20179	552279	8716	765227	2356223
Wollastonite	tonne	2388641	190739	101598	2680978	4563016	1245009	8559760	0	3325042	4597200	137461	22427488	25108466
Zircon	tonne	669466	0	0	669466	422758	4225	0	140926	39300	1019770	47456	1674435	2343901

ARUNACHAL PRADESH

The most important mineral resource of the State is petroleum & natural gas and its chief occurrence is reported in Ningru and Dam Duma areas

Petroleum (crude) and Natural gas (ut.) were the important minerals produced in Arunachal Pradesh

₹40
Crore, value of Minor Minerals' production was estimated for the year 2020-21

Mineral Resources

The most important mineral resource of the State is petroleum & natural gas and its chief occurrence is reported in Ningru and Dam Duma areas. These hydrocarbon deposits are located in the Assam Arakan Fold Belt (AAFB) and Upper Assam basin in the State. The State also reports resources of coal in Namchick Namphuk and Miaobum Coalfields; Copper in East Kameng district, dolomite in West Kameng district; fuller's earth in Tirap district; graphite in Lohit, East Siang and Upper Subansiri districts; limestone in Dibang Valley, Lohit, East Siang and Upper Subansiri districts and quartzite in West Kameng district (Tables-1 and 2).

Exploration & Development

Exploration activities carried out by GSI for lithium,tin, vanidium and tungsten during the year 2021-22 are furnished in Table-3.

Production

Petroleum (crude) and Natural gas (ut.) were the important mineral items produced in Arunachal Pradesh. The value of minor minerals' production was estimated at 42 crore for the year 2021-22 (Table - 4).

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020 : Arunachal Pradesh

Mineral	Unit	Total Reserves (A)	Reserves				Total resources	Total Resources (A+B)
			Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	(A+B)	
Copper								
Ore	'000 tonnes	-	-	-	10	10	10	
Metal	'000 tonnes	-	-	-	0 .02	0.02	0.02	
Graphite	tonne	-	-	3200000	73118257	76318257	76318257	
Limestone	'000 tonnes	-	49220	433575	1	482796	482796	

Figures rounded off.

Table – 2 : Reserves/Resources of Coal as on 1.4.2022: Arunachal Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	**31**	**40**	**19**	**90**
Namchik-Namphuk	31	40	13	84
Miao Bum	–	–	6	6

Source: Coal Directory of India, 2021-22.

Table – 3: Details of Exploration Activities in Andhra Pradesh, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI							
Lithium, Tin & Tungsten							
West Kameng	Nafra area	1:12500	50	-	-	100	Reconnaissance survey for lithium, tin & tungsten minerals was carried out in Khellong-Khazalang areas, West Kameng district, Arunachal Pradesh. An area of 50 sq. km. area was taken up for reconnaissance survey with large scale mapping on 1:12500 scale. A total of 25 cu. m of trenching were done in areas of estimated strike extension of the pegmatite veins. However the bedrock was not exposed in trenches. Total 25 nos soil samples from the trenches yielded 33-110 ppm Li. 11 nos. of channels were made in the pegmatite, contact zones of gneiss, quartz vein, quartzite, grey phyllite, graphite schist, chlorite quartz mica schist. A total of 67 nos. bedrock samples (including 28 channel samples), 30 nos. stream sediment samples, 20 nos. petrochemical samples, 20 nos. petrological samples, 20 nos. ore mount samples, 10 nos regolith samples, 20 nos heavy mineral samples were collected. The stream sediment samples yielded 10 to 105 ppm Li, 3.5 to 15.9 ppm Sn, 0.9 to 5.1 ppm W. Regolith samples yielded <5 to 63 ppm Li from 10 samples, 3.5 to 11.8 ppm Sn, 1.1 to 2.5 ppm W. 9 nos of PCS samples yielded 48 to 330 ppm Li. Micaceous quartzite in chlorite schist reported the maximum of 330 ppm. 11 nos PCS samples yielded 2.6 to 8.4 ppm Sn and 1 to 3.4 ppm W.Li value analysed from chlorite-quartz mica schist yielded 25 ppm to 302 ppm Li from 6 bedrock samples. Pegmatite veins yielded 14 ppm to 65 ppm Li from 10 samples. One sample of granite yielded 70 ppm Li. Quartz veins yielded <5 ppm to 21 ppm Li from 8 samples. Granite gneiss yielded <5 ppm to 116 ppm Li from 21 samples. Sn values from available 26 nos bedrock samples have yielded upto 24 ppm. W values from available 26 nos bedrock samples yielded 0.6 to 52.5 ppm. W values from quartz/quartz-feldspathic veins yielded 0.6 ppm to 52.5 ppm. W values from granite gneiss yielded a maximum of 18 ppm. The chlorite quartz schist has sampled Li values of 280 to 330 ppm from three samples. The relative high values of Li in the schist may be attributed to the granite derived Li-rich fluids from the Bomdila gneiss. Based on the studies carried out and analysis results obtained, the Li, Sn, W values in the study area are not encouraging, except for some relatively higher values ofLi from chlorite quartz mica schist upto 330 ppm.

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Tin							
East Kameng	Seppa area	1:12,500	52	-	-	-	Large Scale mapping of a 52 sq. km. block on 1:12,500 scale was carried out to evaluate the potential of Tantalum and Caesium mineralisation in the assigned area. The area is located in the western part of Arunachal Pradesh exposing rocks of meta-sedimentaries comprising quartz mica schist & schistose quartzite belonging to the Seppa Formation (equivalent with Khetabari Fm.) and garnet biotite gneiss, biotite gneiss belonging to the Lumdung Gneiss (equivalent with Bomdila Gneiss) of the Bomdila Group of Palaeo-proterozoic age, followed by amphibolite and tourmaline bearing pegmatites as the younger intrusive. On the basis of Large-Scale Mapping, by visual estimation and based on physical properties, 3 pegamtite bands have been physically identified namely: Band 1, Band 2 & Band 3. Band 1 which is the major Tourmaline bearing pegmatite band with 60 m thickness and ~1km strike length near Pachi area with partial kaolinisation at places. Band 2 a relatively smaller pegmatite band with 20-25 m thickness and 200 m strike length. Band 3 a kaolinised pegmatite band of ~10 m thickness and 100-150 m strike length. Besides, this, there are several surface manifestations like leaching, iron staining etc which were indications of sulphides were also studied and sampled. The highest value of Cs is 23.24 ppm, with values ranging from 3.5 ppm -23.24 ppm in stream sediment, and 17.34 ppm in BRS and 15.678 ppm (channel-CH1A), 15.652 ppm (channel-CH4) and 20.66 ppm (trench T4) all in pegmatite band 1. The highest value of W is 763.397 ppm (remarkably high), with values ranging from 2 ppm 19.22 ppm in stream sediment, and 17.34 ppm in BRS and 11 ppm to 127.75 ppm in channel-CH1A, 3ppm to 10 ppm in channel-CH4 all in pegmatite band 1, and less than 6 ppm in channel 3 & 4. The tantalum values are not so remarkable as the highest value 9.44 ppm in BRS. Two channel samples (CH-5) have high uranium values 58 ppm & 93 ppm. Few stream sediment samples have 20 ppm to 30 ppm U and 18 SSS have thorium values greater than 60 ppm
Vanadium							
West Siang	Kaying Village	1:12500	50	-	-	90	A total of 50 sq. km. area was mapped in large scale (1:12,500 in and around Kaying area of West Siang district, Arunachal Pradesh to delineate and assess the potentiality of the area for vanadium, graphite, REE and base metal mineralisation. Three bands of carbonaceous phyllite have been delineated for the first time in the area, with about 2 kilometers in strike length and thickness of 15-20 meters. In the northern part of the study area, a band of crystalline limestone has been mapped for the first time with a thickness of roughly 15-20 meters and a strike extension of 3 kilometers. To the northwest of Kaying Village, two bands of tourmaline bearing pegmatite have also been mapped with a thickness of 10-15 meters and a strike extension of 500 meters approximately. A total of 60 nos of bed rock samples (including channel samples), 20 nos of trench samples and 10 nos of Petrochemical samples were systematically collected and analysed chemically. Analytical results for carbonaceous phyllite exhibit vanadium values ranging from 101-1303 ppm, chromium values ranging between 88-1688 ppm, copper up to 1262 ppm, rubidium values ranging from 76-830 ppm, lead up to 683 ppm, tin values range from 2-26 ppm, tungsten up to 100 ppm, chromium values up to 1062 ppm and arsenic ranging from 2-1360 ppm. PCS sample of quartzite exhibits LREE value of 221ppm and HREE value of 27.5 ppm, dolomitic limestone exhibits LREE value of 4ppm and HREE value of 0.8 ppm. Bed rock samples of carbonaceous phyllite exhibit LREE values ranging from 104-348 ppm and HREE values range from 3-26 ppm. Also, the chemical analysis of the samples from the study area has not given encouraging values for gold so far with values of up to 50 ppb. Trench samples have yielded chromium values ranging from 342-1590 ppm with an average of 970 ppm. The petrochemical samples of carbonaceous phyllite/graphite have yielded vanadium values up to 3125 ppm, chromium values up to 1688 and copper up to 1368 ppm.

Table-4 : Mineral Production in Arunachal Pradesh, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**-**		**455845**	**-**		**397944**	**-**		**416302**
Natural Gas (ut.)	m c m	-	45	-	-	56	-	-	58	-
Petroleum (crude)	'000t	-	56	-	-	54	-	-	48	-
Minor Minerals		-	-	455845	-	-	397944	-	-	416302

$ Excludes the value of Fuel minerals.

ASSAM

Petroleum (crude), Natural gas (ut.), Coal and Limestone were the principal minerals produced in Assam in 2020-21	H31 crore estimated Value of production minor minerals in 2020-21	Mines in Assam in case of MCDR minerals in 2020-21

Mineral Resources

Coal, petroleum & natural gas, limestone, fuller's earth, sillimanite and minor minerals are the chief mineral resources of the State. Coal occurs in Mikirs Hills, Dilli-Jeypore, Makum and Singrimari coalfields. Coal extracted from the State is friable and contains high sulphur. Petroleum & natural gas occurs in Digboi oilfields, Lakhimpur district and at Moran Rudrasagar oilfields in Sivasagar district located in Assam Arakan Fold Belt (AAFB), Upper Assam and Assam basins. Lime st one occurs in Kar bi Anglong, North Cachar Hills and Nowgaon districts. Besides, china clay occurs in Karbi Anglong and North Lakhimpur districts; fireclay in Dibrugarh, Karbi Anglong, North Cachar Hills & North Lakhimpur districts; fuller's earth in Nalbari district; granite in Goalpara, Kamrup & Karbi Anglong districts, iron ore (haematite) in Kokrajhar district; iron ore (magnetite) in Dhubri, Goalpara & Kokrajhar districts; quartz/silica sand in Nowgaon district; and sillimanite in Karbi Anglong & Nowgaon districts. The reserves / resources of coal and minerals are furnished in (Tables -1 and 2).

Exploration & Development

GSI carr i ed o ut exp l or a t ion fo r RE E an d Molybdenum in Assam during 2021-22. Details of the activities are furnished in Table-3.

Table – 1: Reserves/Resources of Coal as on 1.4.2023 : Assam

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	465	57	3	525
Singrimari	-	14	-	14
Makum	432	21	-	453
Dilli-Jeypore	32	22	-	54
Mikir Hills	1	-	3	4

Source: Coal Directory of India 2022-23.

Table – 2 : Reserves/Resources of Minerals as on 1.4.2020 : Assam

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Iron Ore (Haematite)	'000 tonnes	-	-	-	-	-	-	-	-	8600	22290	-	30890	30890
Iron Ore (Magnetite)	'000 tonnes	-	-	-	-	-	-	-	-	-	15380	-	15380	15380
Limestone	'000 tonnes	23442	-	164687	188130	170039	27593	100319	67000	39859	1278730	-	1683540	1871670
Sillimanite	tonne	-	-	-	-	-	-	-	-	850000	6700	3748000	4604700	4604700

Figures rounded off

Table – 3 : Details of Exploration Activities in Assam, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **REE Mineralisation**							
Karbi Anglong	In and around Lakhojan area	1:12,500	75	52	302.25	150	A G-4 stage investigation involving large-scale mapping of 75sq. km on 1:12,500 scale was carried out along with auger drilling (300 m), pitting and trenching in the regolith, and collection of PTS, PCS, EPMA, and XRD samples. Geologically, the area is occupied by the migmatite gneisses of AMGC, Shillong group phyllites, quartzites, schists, and late Proterozoic granitoids. A total of 302.25 m auger drilling (52 nos.) were carried out at 800m spacing in a gridded pattern over soil developed over granitoids and migmatite gneisses. From auger drilling, it has been established that the thickness of the soil profile ranged from 1 to 10 meters and often large granite boulders were encountered. Within the soil profile, A-horizon with thickness varying from 0.50 to 1.0 meter, B-horizon ranging from 1 to 4 meters and the mixed B+C-horizon constituting significant portion of regolith having thickness of 2 to 9 meters were encountered. The chemical analysis of the 150 auger samples from B horizon whose thickness ranged up to 2.0 m showed SREE values ranging from 156.68–2,067.53 ppm (average 577.71 ppm). The thickness of B+C horizon is often thick up to 9.0 meters and show SREE varing from 154.67–1467.39 ppm (average 481.60 ppm) and the C horizon with thickness ranging from 1 to 6.0 m showed SREE ranging from 180.29–1294.83ppm (average 523.92 ppm). Resources of each mineralised zones in the boreholes were calculated by considering bulk density as 1.21 g/cm3. The total REE resource in the block was estimated at 45.18 million tonnes with an average grade of 727 ppm. As per the UNFC classification, the present investigation of the mineral resources was codified as 334 and the average grade of 727 ppm for SREE is not encouraging enough for further exploration.
Molybdenum and associated mineralisation							
Kamrup Metropolitan	Helagog-Khaloibari area	-	-	-	-	-	A G3 stage investigation for molybdenum and associated mineralisation was carried out in Helagog-Khaloibari, area. The study area lies at the NNE corner of the Shillong Plateau. The area exposes sillimanite, garnet, quartz, mica schist of older metamorphic, migmatite of Assam Meghalaya Gneissic Complex, meta gabbro of Khasi metamafics and pegmatites. Migmatite was characterised by migmatitic textures like stromatic, dictyonitic, schollen/raft, ptygmatic, dilation and schlieren structures. At least five varieties of pegmatites were observed which included pyrite chalcopyrite- bearing pegmatite veins, molybdenite- bearing pegmatite veins, magnetite- bearing pegmatite veins, miarolitic pegmatites veins and beryl-bearing pegmatite veins. In Helagog quarry, at least four molybdenite bearing pegmatite veins were noticed which occurred either as dikes (veins) or as segregations or as pods. The length of the veins ranged from 3m to 21 m with ranging width from 0.15 m to 12m in anastomosing pattern with varied trend from N-S to E-W with sub-horizontal to vertical dip in southerly direction. In Khaloibari quarry, the length of the pegmatite veins ranged from 5m to 15m with thickness ranging from 0.2m to 0.7m and a few veins occurred as segregations with random orientations. Molybdenite flakes were present at the interstices between the cleavage planes of biotite and cleavage planes of orthoclase and at places as disseminations in smoky quartz. Dominantly molybdenite showed close association with either book of biotite or with layers/patches of biotite segregations within the pegmatite veins. Analytical results of bedrock samples showed that the molybdenum values ranged from 0.25 to 276.75 ppm. The higher values of Mo i.e., 276.76 and 178.02 ppm were reported from the molybdenite-bearing pegmatite vein in Helagog quarry where the population density of the molybdenite flakes was high. In Khaloibari quarry although molybdenite flakes were visible in naked eye only a few grab samples from the molybdenite-bearing pegmatite veins showed elevated values i.e., 56.21 and 30.85 ppm. The remaining samples did not show significant value of Mo which may be due to occurrences of molybdenite flake which were highly disseminated in nature.

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							Both grab and channel samples showed TREE value ranging from17.85 to 1,348.93 ppm. Most of the anomalousTREE value i.e. 503.78 to 1,348.93 ppm were confined to the molybdenite-bearing pegmatite veins from both Helagog and Khaloibari quarries.Tungsten value in the study area ranged from 0.43 to 185.36 ppm. Most of the elevated values of tungsten i.e., 100.73 to 185.36 ppm were confined to the pyrite-chalcopyrite-bearing pegmatite veins.

Production

Petroleum (crude), Natural gas (ut.), Coal and Limestone were the principal minerals produced in Assam State in 2021-22. The value of minor minerals' production was estimated at 31 crore for the year 2021-22. There were 2 reporting mines in 2021-22 in Assam in case of MCDR minerals (Table - 4).

Table-4 : Mineral Production in Arunachal Pradesh, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**3**		**814755**	**2**		**783615**	**2**		**851501**
Coal	'000 t	-	517	-	-	36	-	-	28	-
Natural Gas (ut.)	m cu m	-	3141	-	-	2995	-	-	3371	-
Petroleum(crude)	'000 t	-	4093	-	-	3902	-	-	3988	-
Limestone	'000 t	3	1552	500950	2	1552	469810	2	1681	537696
Sulphur #	t	-	5955	-	-	6447	-	-	6545	-
Minor Minerals @		-	-	313805	-	-	313805	-	-	313805

Note : The number of mines excludes Fuel and Minor minerals.
$ Excludes the value of Fuel minerals.
 # Recovered as by-product from oil refinery.
@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, as per the available information, the principal mineral-based industries in the Organised Sector in the State are furnished in Table - 5.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Asbestos Products	
Assam Roofing Ltd, Bonda, Distt. Kamrup.	58
Cement	
Barak Valley Cements Ltd, Jhoom Basti,	330
Badarpurghat, Distt. Karimganj.	
Calcom Cement (Dalmia Subsidiary),	1720
Distt. Nagaon.	
CCI Ltd, Bokajan, Distt. Karbi Anglong.	200
Cement Manufacturing Co. Ltd, Chamata	2000
Pathar, P. O. Sonapur, Distt. Kamrup (G).	
Purbanchal Cement, Vill. Sarutari,	360
Distt. Kamrup	
Topcem Cement Gauripur Kamrup	660
Fertilizer	
Assam State Fertilizer & Chemicals Ltd,	33 (SSP)

Table-5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Chandrapur, Distt. Kamrup	16.5
(H2SO4)	
Brahmaputra Valley Fertilizers Corpn. Ltd,	510
(Urea)	
Namrup (Namrup II & III), Distt. Dibrugarh.	45 (SSP)
Progressive Fertichem Pvt. Ltd,	
Topatoli, Kamrup.	
Iron & Steel	
Shri Ganapati Ispat Pvt Ltd, Tinsukia.	NA
Petroleum Refinery	
Indian Oil Corporation, Bongaigaon.	2350
Indian Oil Corporation, Moonmati, Guwahati.	1000
Indian Oil Corporation, Digboi.	650
NRL, Numaligarh, Golaghat.	3000

Note: Data, as not readily available for fertilizer and cement industries on respective websites, was taken from Indian Fertilizer Scenario, FAI Statistics, and Survey of Cement Industry & Directory, respectively.

Bihar

94%
Pyrite resources is located in BiharAssam in 2020-21

₹ 4272 crore
Value of minor mineral's production is reported in 2020-21

1
Mine reported limestone production in Bihar in 2020-21

Limestone is the only major mineral produced in Bihar

Mineral Resources

Bihar is the principal holder of country's pyrite resources and possesses 94% of resources. The important mineral occurrences in Bihar are coal in Rajmahal coalfield; limestone in Kaimur (Bhabhua), Monghyr & Rohtas districts; mica in Nawada district; quartz/silica sand in Bhagalpur, Jamui, Monghyr & Nalanda districts; quartzite in Lakhisarai, Monghyr & Nalanda districts; and talc/soapstone/steatite in Monghyr district. Besides, occurrences of bauxite in Monghyr & Rohtas districts; china clay in Bhagalpur & Monghyr districts; felspar in Gaya, Jamui & Monghyr districts; fireclay in Bhagalpur & Purnea districts; gold in Jamui district; granite in Bhagalpur, Gaya, Jahanabad & Jamui districts; iron ore (haematite) in Bhagalpur district; iron ore (magnetite) in Gaya & Jamui districts; lead-zinc in Banka & Rohtas districts; and pyrites in Rohtas district have been reported (Tables - 1 & 2).

Exploration & Development

GSI carried out exploration for coal, REE, Potash and Iron ore. Details of exploration activities conducted by GSI during 2021-22 are furnished in Table-3.

Production

Limestone is the only major mineral produced in Bihar. The value of minor minerals' production is estimated as 4,272 crores for the year 2021-22. There was a single reporting mine in Bihar for MCDR mineral which relates to Limestone.

Table – 1 : Reserves/Resources of Coal as on 1.4.2022 : Bihar

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Coalfield	Proved	Indicated	Inferred	Total
Total/Rajmahal	310	4080	48	4437

Source: Coal Directory of India, 2022-23

Table – 2 : Reserves/Resources of Mineral as on 1.4.2020 : Bihar

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Bauxite	'000 tonnes	-	-	-	-	-	-	-	-	-	4114	-	4114	4114
Gold														
Ore	tonne	-	-	-	-	-	-	-	-	-	128884860	94000000	222884860	222884860
Metal	tonne	-	-	-	-	-	-	-	-	-	21.6	16	37.6	37.6
Iron Ore (Haematite)	'000 tonnes	-	-	-	-	-	-	-	-	-	55	-	55	55
Iron Ore (Magnetite)	'000 tonnes	-	-	-	-	-	-	-	-	48850	589	-	49439	49439
Lead-Zinc Ore														
Ore	'000 tonnes	-	-	-	-	-	-	-	-	435	11000	-	11435	11435
Lead metal	'000 tonnes	-	-	-	-	-	-	-	-	-	24	-	24	24
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	-	14.75	24	-	38.75	38.75
Limestone	'000 tonnes	11807	-	-	11807	3388	2558	1675	67926	135740	772343	10558	994188	1005995
Potash	Million tonnes	-	-	-	-	-	-	-	-	-	230	-	230	230
Pyrite	'000 tonnes	-	-	-	-	13462	-	9680	-	51419	1500000	-	1574561	1574561
Rare-Earth Elements	tonne	-	-	-	-	-	-	-	-	-	1459	-	1459	1459

Figures rounded off

Table – 3 : Details of Exploration Activities in Bihar, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **Iron Ore**							
Jamui	Bhanta block	-	-	-	-	173	Preliminary exploration for magnetite was taken up in Bhanta block to establish the continuity of the already proved ore body of adjoining Majos block with significant resource, which is under consideration of auction by Govt. of Bihar. Situated in the northeastern extremity of the Chhotanagpur Plateau, the block is mostly flat and covered by alluvium of Jamui Formation with no surface exposure of rock/ore body. Seven boreholes were drilled which intersected different types of ore-bearing zones viz. Lateritic soil, BMQ associated with intermittent quartz-mica +amphibole schist and Biotite/amphibole bearing mica schist with thin bands of magnetite. BMQ associated with intermittent layers of quartz-mica +amphibole schist was only intersected in boreholes BJB-01, BJB-06 and BJB-07. In boreholes BJB-02, BJB-04 and BJB-05, Biotite/amphibole bearing mica schist with thin bands of magnetite were intersected. The exploration works in the block established the continuity of the Majos ore band for about 500m. Resource will be estimated after receipt of complete analytical data.
REE and Rare Metals							
Banka	Karada block	1:4000	4	-	224	307	Preliminary exploration for REE/RM was carried out in Karada block by means of detailed mapping of 4 sq. km. area on 1:4,000 scale, 50 cu. m of pitting/trenching, 224 m of auger drilling and surface geochemical sampling viz. 50 BRS, 53 PTS, 10 PCS and 194 auger soil samples. The block exposes two different lithodomains viz. unclassified metamorphics and Chhotanagpur gneissic complex. The Unclassified Metamorphic Group includes granulites, amphibolite and tremolite-actinolite schist which occur in the form of enclaves within the Chhotanagpur gneissic complex. Migmatite gneiss, amphibole bearing gneiss and granite gneiss belong to the Chhotanagpur Gneissic Complex. Quartz and pegmatite veins are exposed as later Intrusive Available analytical results of 104 nos. auger soil samples indicate tREE value ranging from 98 ppm to 1314 ppm, out of which 43 nos. of samples shows tREE value > 500 ppm with an average of 716 ppm. 15 nos. bedrock samples indicate tREE value ranging from 27.66 ppm to 877.5 ppm where 4 nos. of sample yielded tREE value > 500 ppm.
	Jogmaran block	1:4000	4	-	179.35	298	Preliminary exploration for REE and RM in Jogmaran block was carried out during FS 2021-22 by means of detailed geological mapping (1:4000 scale) of 4 sq. km area, auger drilling of 179.35 m, pitting/trenching of 50 cu. m and 196 auger soil samples, 102 bedrock samples were collected. The block forms part of Chhotanagpur Gneissic Complex and is represented by amphibolite, granite gneiss, intrusives viz. granite, pegmatite and quartz vein. Auger drilling was carried out systematically on 200 m x 200 m grid pattern for sampling of in-situ soil profile developed over various litho-units and drilled upto maximum depth of 2.60 m. B-horizon forms the major part of the soil profile than A and C-horizons. Available analytical results of 99 nos. auger soil samples indicate SREE value ranging from 166.35 ppm to 1325.28 ppm, out of which 21 nos. of samples shows SREE value > 500 ppm with an average of 825.75 ppm. Results of 18 nos. bedrock samples indicate SREE value ranging from 151.23 ppm to 725.07 ppm where only one sample yielded SREE value > 500 ppm.
	Bhairoganj block	1:2000	4	-	-	-	During F.S. 2021-2022 detail mapping on 1:2,000 scale was carried in parts of toposheet no. 72L/10 as the G-3 item of preliminary exploration for REE and rare metals in Bhairoganj Block, Banka district, Bihar along with auger drilling in 200 x 200m grid spacing with collection of auger soil samples, pit/ trench samples, bedrock samples, petrochemical samples, heavy mineral samples and bulk samples with the objective to estimate the resources of REE and RM in soil profile and weathered rock. Geologically, the area is composed of the lithologies of the Chhotanagpur Gneissic Complex (CGC). The SREE values of auger soil samples in the A-horizon varies from 297 to 730 ppm [avg. 451 ppm (n=146)] whereas

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							in the B-horizon the value of SREE varies from 98 to 1116 ppm (avg. 418 ppm (n=146) ppm] respectively. In the C-horizon, the SREE varies from 102 ppm to 1833 ppm (avg. 450 ppm with n=146). The values of SREE in the pits/trenches samples varies from 110 to 1749 ppm (avg. 513 ppm with n=100). The total estimated resource of SREE for unprocessed auger soil samples by extended area method is 3.12 MT with an average grade of 401 ppm at a cut-off grade of 300-500 ppm and 1.17 MT with an average grade of 636 ppm at a cut-off grade of >500 ppm which can be categorised as 333 category as per the UNFC.
Potash							
Rohtas	Madhukupia-	1:4000	8	-	-	-	Detailed Mapping of 8 sq. km area was carried out (on 1:4000 scale) in Madhukupia-Katudanr block area, the litho units mapped belongs to Semri Group of Vindhyan Supergroup and remaining part of the block is covered by alluvium. The Fawn Limestone Formation is overlain by rocks of Glauconitic Sandstone Formation. Glauconitic Sandstone Formation consists of fine-grained sandstone and shale intercalation at the base, followed by khaki sandstone with characteristic spheroidal weathering, quartz arenite unit, glauconitic sandstone and the upper quartz arenite. In the study area the bedding trend is N70°E-S70°W, with dip ranging from 18° to 50° towards north. A total of 10 vertical boreholes were drilled at 800m X 400m (BRMK-01 to BRMK-10) spacing in the block to assess the glauconite resources of 8 sq. km area by 725m drilling. The glauconitic sandstone was intersected in boreholes BRMK-01, BRMK-02, BRMK-03, BRMK-04, BRMK-05, BRMK-06, BRMK-07, BRMK-08 & BRMK-10 and fine-grained sandstone with occasional intercalation of quartz arenite was intersected in BRMK-09. A total of 50 nos. of bedrock samples from anticipated mineralised horizons, 50 nos. of PTS samples from 50 cu.m. pitting/ trenching were collected. In bedrock samples fine grained sandstone yielded a maximum of 4.35% K_2O, Glauconitic Sandstone a maximum of 3.26% K_2O and green shale (Fawn Limestone Formation) 4.93% K_2O. Pit sample comprising of fine-grained sandstone yielded maximum of 4.91% K_2O.
Coal							
Bhagalpur	Shivnarayan-pur area, Northern Extension of Hura Coalfield, Rajmahal Coalfields	-	30	7	-	-	Reconnaissance survey for Gondwana coal exploration under thick Gangetic alluvium in Shivnarayanpur Area, Rajmahal Coalfields, Bhagalpur District, Bihar commenced on 15.05.2021 and had achieved 1644.00 m drilling in seven boreholes (BRRBSA-1 to 7) in FS 2021-22. An area of 30 sq. km. has been covered through Large Scale Mapping.The subsurface data of Shivnarayanpur Area reveals occurrence of Barakar Formation under the cover of younger Dubrajpur Formation and Alluvium in ascending order. In the area of exploration, no outcrop is exposed and the entire area is covered by thick pile of Gangetic Alluvium resting over the uneven surface of Dubrajpur Formation. Alluvium ranges in thickness from 45.70 m (BRRBSA-1) to 112.25 m (BRRBSA-3) and it is represented by yellow to yellowish-brown red silty clay, sandy clay and soil with white to light grey irregular patches. The underlying Dubrajpur Formation consists of mostly arenaceous lithology represented by ferruginous/quartzose sandstone with floating pebbles. It has been intersected in boreholes BRRBSA-1,2, 4 & 5 with thickness ranging from 6.35 m (BRRBSA-4) to 14.10 m (BRRBSA-2). It is further underlined by coal bearing Barakar Formation having thickness ranging between 19.10 m (BRRBSA-3) to 386.10 m (BRRBSA-5) and comprising of sandstone, shale, siltstone, carbonaceous shale and coal. The sandstone unit in this Formation is basically feldspathic, light grey to off-white and the grain size varies from very fine to very coarse-grained. The shale unit is grey to dark grey and at places intercalated with thin carbonaceous bands/streaks at places. Basement metamorphics represented by granitic gneiss with alternate layers of dark flaky minerals and leucocratic quartzo feldspathic minerals and augen to elongated feldspars. Total cumulative coal thickness encountered in seven boreholes (BRRBSA-1 to 7) is 74.40 m which is varying borehole wise from 0.50 m (BRRBSA-4) to 34.95 m (BRRBSA-5) with the thickest seam section 5.00 m occurs at roof depth of 164.60 m (BRRBSA-2).

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
	Regalla Sector	1:10,000	10	-	2854.25	-	South-eastern part of the Godavari Valley Coalfield was taken up during Field Season 2021-22. Large-scale mapping of 10 sq. km. area has been carried out in 1:10,000 scale. The mapped area consists of the Upper Kamthi Formation of the Upper Gondwana sediments. The sub-surface data of the boreholes (TBKR-1 to TBKR-3) reveals the occurrence of a thick pile of Upper Gondwana sediments (Upper Kamthi and Middle Kamthi formations), Lower Gondwana sediments (Lower Kamthi Formation, Barren Measures, Barakar Formation and Talchir Formation) and basement Pakhal group of rocks. A total of 2854.25 m drilling was achieved in three boreholes, namely TBKR-1 to TBKR-3. A total of 28.12 m of coal sample was collected from three boreholes. The coal seams were intersected between 503.64 m (TBKR-1) to 898.65 m (TBKR-2) depth, and borehole wise maximum cumulative thickness of coal is intersected in the borehole TBKR-2 (14.65 m). The results of the Overall Proximate Analysis of coal samples of two boreholes (TBKR-1 and TBKR-2) show that both the coal seam zones of the Lower Kamthi (G-13 to G-16 grade) and Barakar (G-8 to G-14 grade) come under power grade quality

Table – 4 : Mineral Production in Bihar, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**1**		**42983377**	**1**		**43021892**	**1**		**43087082**
Limestone	'000t	1	556	263446	1	1000	301961	1	987	367151
Sulphur #	t	-	6843	-	-	7135	-	-	8160	-
Minor Minerals @		-	-	42719931	-	-	42719931	-	-	42719931

Note : *The number of mines excludes Minor minerals.*
 # Recovered as by-product from oil refinery.
@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the principal mineral-based industries in the Organised Sector in the State with their total installed capacities are furnished in Table - 5.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Cement	
Eco cement Durgawati Bhabhua	1000
Kalyanpur Cements Ltd, Banjari, Dist. Rohtas.	1000
Kanodia Cement Bhabhua Bangar Cement	1200
Shree Cement Ltd, Jasoia Aurangabad Grinding Unit, Aurangabad.	3600
Shree Cement Ltd, New Bihar Cement plant, Aurangabad	2000
UltraTech Cement plant, Patliputra	1900
Petroleum Refinery	
Indian Oil Corporation, Barauni.	6000

Note: Data, for fertilizer industries, is taken from Indian Fertilizer Scenario, FAI Statistics,.

Chhattisgarh

In India the State accounts for:
36% Tin ore
11% Dolomite
20% Iron ore (haematite)
4% Diamond & Marble
18% Coal

Coal, Bauxite, Iron Ore, Tin Conc., Graphite (r.o.m.), Limestone and Moulding Sand are the major minerals produced in Chhattisgarh

100
Reporting mines in case of MCDR Minerals were reported in 2020-21

Mineral Resources

Chhattisgarh is the sole producer of tin concentrates and moulding sand. It is one of the leading producers of coal, dolomite, bauxite and iron ore. The State accounts for about 36% tin ore, 20% iron ore (haematite), 18% coal, 11% dolomite and 4 % each diamond & marble resources of the country. Important mineral occurrences in the State are bauxite in Bastar, Bilaspur, Dantewada, Jashpur, Kanker, Kawardha (Kabirdham), Korba, Raigarh & Sarguja districts; china clay in Durg & Rajnandgaon districts; coal in Korba, Raigarh & Sarguja districts; dolomite in Bastar, Bilaspur, Durg, Janjgir-Cha mpa, Raigarh & Raipur districts; and iron ore (haematite) in Bastar district, Bailadila deposit in Dantewada district, Chhote Dongar deposit in Kanker district, Rowghat, Chargaon, Metabodeli & Hahaladdi deposits in Rajnandgaon district and Boria Tibbu deposits in Dalli-Rajhara area, Durg district. Bailadila-Rowghat hill ranges in the State are considered to be one of the biggest iron ore fields in India. Limestone occurs in Bastar, Bilaspur, Durg, Janjgir-Champa, Kawardha (Kabirdham), Ra igarh, Raipur & Rajnandgaon districts; quartzite in Durg, Raipur, Rajnandgaon & Raigarh districts; and talc/soapstone/ steatite in Durg & Kanker districts.

Othe rmine rals found in the State a re corundum in Dantewada district; diamond and other gemstones in Raipur, Mahasamund & Dhamtari districts; fire clay in Bilaspur, Raigarh & Rajnandgaon districts; fluorite in Rajnandgaon district; garnet & marble in Bastar district; emerald & gold in Raipur district; granite in Bastar, Kanker & Raipur districts; quartz/silica sand in Durg, Jashpur, Raigarh, Raipur & Rajnandgaon districts; and tin in Bastar & Dantewada districts (Table-1). The reserves/ resources of coal are furnished in Table-2.

Exploration & Development

The details of exploration activities conducted by GSI during 2021-22 are furnished in Table - 3.

Production

Coal, Bauxite, Iron Ore, Tin Conc., Limestone and Moulding Sand are the major minerals produced in Chhattisgarh. The value of minor minerals' production is estimated as 1024 crores for the year 2021-22. There was 113 reporting mines in 2021-22 for MCDR minerals (Table - 4).

Mineral-based Industry

The present status of each mineral-based industry is not readily availabl e. However, the princip al mine ral- b ase d ind ustries in t he organised sector in the State are furnished in Table - 5.

Table – 2 : Reserves/Resources of Mineral as on 1.4.2020 : Bihar

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Bauxite	000' tonnes	19202	1073	3420	23695	14306	4727	46620	37763	75682	771015	18747	968860	992555
Diamond	carat	-	-	-	-	-	-	-	-	-	1304000	-	1304000	1304000
Fluorite	tonne	-	-	-	-	65889	153132	9288	185485	5573	126088	-	545455	545455
Garnet	tonne	-	-	-	-	-	-	-	-	-	28800	-	28800	28800
Gold														
Ore (Primary)	tonne	-	-	-	-	-	-	-	-	600000	4241033	-	4841033	4841033
Metal (Primary)	tonne	-	-	-	-	-	-	-	-	1.8	3.71	-	5.51	5.51
Graphite	tonne	5282	-	-	5282	-	1330	-	-	-	-	-	1330	6612
Iron Ore (Haematite)	000' tonnes	1289443	99927	204363	1593732	348648	17215	46166	171548	552653	993652	868497	2998379	4592111
Iron Ore (Magnetite)	000' tonnes	29319	-	46557	75876	12263	-	17782	-	-	-	-	30045	105921
Limestone	000' tonnes	1364595	65530	56227	1486351	1658144	903350	298720	1456579	1778018	5630057	-	11724867	13211218
Tin														
Ore	tonne	2075	-	25	2101	1791	2560	94	168457	559914	29062361	-	29795176	29797277
Metal	tonne	963.19	-	10.8	973.99	1122.95	603.94	29.07	813.29	209.43	13130.9	-	15909.58	16883.57

Figures rounded off.
 # Declared as minor mineral vide Gazette notification dated 10.02.2015.

Table – 2 : Reserves/Resources of Coal as on 1.4.2023 : Chhattisgarh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	37236	42294	1244	80774
Sohagpur	94	434	-	529
Sonhat	950	1983	2	2940
Jhilimili	228	39	-	267
Chirimiri	320	11	31	362
Bisrampur	2014	678	5	2698
East Bisrampur	-	165	-	165
Lakhanpur	456	3	-	459
Panchbahini	-	11	-	11
Hasdeo-Arand	2032	3273	223	5529
Sendurgarh	153	126	-	279
Korba	8769	4212	49	13030
Mand-Raigarh	20091	28289	847	49228
Tatapani-Ramkola	2128	3064	85	5278

Source: Coal Directory of India, 2022-23.

Table – 3: Details of Exploration Activities in Chhattisgarh, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **Manganese and Barium**							
Korea	Devra-Jatashankar	1: 12,500	100	-	-	90	The Devra-Jatashankar area lies in the north-eastern part of toposheet no. 64I/03 (~95%) and the north-western part of toposheet no. 64I/07 (~5%). The area is predominantly covered with sandstone of Raniganj, Parsora and Pali formations of Gondwana Supergroup. An area of 100 sq. km mapped on a scale of 1: 12,500 and collected BRS (50), PCS (10), PTS (30) samples. Botryoidal form encrustations are present at a few places over sandstone of Parsora and Pali formations. Encrustation over sandstones of Pali and Parsora formations are present at places ranging in thickness from 0.1 cm to 15cm. These encrustations are mostly formed over the sandstone surface and in fracture, crack and joint zones. It indicates that encrustations are formed wherever it is exposed to the atmosphere. There are some penetrative encrustations in sandstones of Parsora Formation. The surface encrustation is thicker while those that are penetrative are thinner (<0.5cm). In BRS samples the MnO values range from 0.01% to 21.57% with an average of 1.05% and Ba values range from 45 ppm to 41255 ppm. In PCS samples the MnO values range from 0.03% to 7.21% with an average of 1.34% and Ba values range from 91 ppm to 43149 ppm. In PTS samples the MnO values vary from 0.01% to 0.19% with an average of 0.04% and Ba values range from 552 ppm to 4710 ppm. Analytical results of BRS, PCS and PTS samples suggest that the encrustation is rich in iron (Fe_2O_3 ranging from 14.4% to 52.56%) while showing very low manganese value in most of the analysed samples
Gold and associated mineralisation							
Jashpur	Phar saba har-Tuba area	1:12,500	100	-	-	150	G-4 Stage was initiated during Field Season 2021-22 in parts of Toposheet no. 64N/ 14 in Jashpur district. During the period of investigation, an area of 100 sq. km. was mapped on 1: 12,500 scale with objective to identify the host control for gold mineralistaion as well as the existing litho- structure in the area. Total 50 cu m pitting, trenching and sampling has been carried out in the potential areas along with the collection of 50 nos of stream sediment samples and 100 bed rock samples respectively. Geologically the area of investigation is composed of rocks of Chotanagpur Gneissic Complex and falls within Bilaspur-Raigarh-Sarguja belt consist of granodiorite-gneiss, meta gabbro and amphibolite with its variants. These rocks are traversed by 3 generation of quartz veins of varying dimension. The second-generation quartz

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							veins are generally mineralised with gold values. Pyrite, arsenopyrite, galena, azurite, chalcopyrite is often seen associated with this quartz vein. Five blocks identified are Tuba block, Mankarkunda block, Bangaon block, Northern most Pandripani block and Barkaspali block. Gold value in Zone-I of Tuba block is 0.052 ppm, 0.51 ppm, 0.24 ppm, 0.068 ppm (trench-2 value) and 3.73 ppm and 0.41 ppm (BRS value) and in Zone-II of Tuba block is 0.056 ppm (trench-1 value) and 0.34 ppm and 0.28 ppm in BRS value. Besides BRS value adjacent to zones are 0.395 ppm, 7 ppm and 0. 14 ppm. In Mankarkunda block gold values are 0.20 ppm and 0.16 ppm (trench-13) and 0.06 ppm and 0.375 ppm (BRS value) and 0.86 ppm in trench-3 and 1.4 ppm in BRS at west. Highest value for gold in PT/BRS/46 is 36.68 ppm collected from Tuba village from intense ferruginised quartz venations within granodiorite; in association with Pb 0.23%, As 68.12 ppm and Hg 13 ppb. Sample PT/BRS/45 is with maximum value of Au 3.72 ppm and As having 30.95 mg/kg collected from mineralised quartz vein Tuba village. Sample PT/BRS/24 with maximum value of Au 15.8 ppm, As 22447.32 ppm, Pb 400 ppm, Bi 7.09 ppm and Hg 50 ppb collected from sheared ferruginised granodiorite with quartz chert band at north of Pandripani village.
Baloda Bazar & Bilaigarh	Saliha-Parsapali area	1:12,500	100	-	-	-	A total of 100 sq. km large scale mapping on 1: 12,500 scale has been carried out, in and around Saliha-Parsapali area, Baloda Bazar district and Bilaigarh Chhattisgarh in toposheet no. 64K/10& 64K/14. Apart from mapping, 15 nos. of petrochemical samples (PCS), 20 nos. of petrographic samples (PS), 100 nos. of bed rock samples (BRS) were collected. About 100 cu. m pitting/trenching was carried out along with collection of 100 nos. of pitting/trenching samples (PTS). In addition to these, 50 nos. of stream sediment samples were collected from mostly first order streams (rarely from second order) and submitted for analysis. The study area represented by volcano-sedimentary sequence belongs to Sonakhan Group, basic and acid igneous suite belonging to Bilari Group and younger intrusive granitoids and basic dykes. These rocks are intruded by mafic-ultramafic intrusives, undeformed granitoids, younger dykes and quartz veins. Quartz veins in this area are milky white in nature and at places oxidised. Silt size gold grains are recovered during the panning of the stream sediments. Visible specks of sulphide (mostly pyrite) have been recorded at the contact zones within metabasalt, metagabbro and metarhyolite. The analytical data reveals highest value of Cu (0.12%) recorded from bed rock sample (BRS-7) of altered gabbro near Harilchhaper village. The highest value for gold (Au-3.64 ppm) is obtained for BRS-85 collected from intense ferruginised quartz venations within metarhyolite of Barkachhar area. The BRS-90 having Au of 0.26 ppm & BRS-92 with Au value of 0.25 ppm is recorded from soil samples of silicified metarhyolite collected to the south of Dhourabhata area and BRS-96 with Au value of 0.41 ppm is obtained from ferruginous chert to the SW of Pachperiya village.
Base Metal							
Balrampur	Burhaba gicha area	1:12,500	100	-	-	237	A G-4 stage exploration for basemetal was carried out in Burhabagicha area, Balrampur District, Chhattisgarh with an objective to search for potential zones of basemetal mineralisation. 100 sq.km. was mapped under Large Scale Mapping on 1: 12500 scale with collection of 169 nos. samples (101 nos. bedrock, 50 nos. pit/trench and 18 nos. of stream sediment) for trace element analysis, 23 Nos. for petrochemical studies and 45 Nos. for PS/SEM/OM studies. The area around Burhabagicha encompasses supracrustals of meta-volcano sedimentaries, meta-sedimentaries, meta-basics and granitoids. Acid- to intermediate- metavolcanic is the host rock for sulphide mineralisation. Oxidised zone is developed between west of Chilma and Kotaghna through Burhabagicha. It is characterised by sulphide-sulfosalt, iron oxide stain and very rare malachite stain. Sulphide in the host present in the form of dissemination, streak and vein. Mineral assemblage recorded is pyrite, sphalerite, galena and REE. Pyrite is the abundant sulphide mineral recorded.

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							Sphalerite is occasionally present mainly as fracture filling in pyrite. Galena is rare to occasional present as dissemination in the pyrite. Monazite and xenotime are present occasionally. Sphalerite and galena associated with pyrite is 40 µm to 400 µm and 2 µm to 30 µm in size. The values of Cu in acid to intermediate metavolcanic bedrocks range from 10 ppm to 90 ppm. Pb ranges from <10-140 ppm and Zn ranges from 10 ppm to 200 ppm. Ni <10 ppm to 170 ppm, Co <10 ppm to 30 ppm and Cr <10 ppm to 59 ppm recorded in the host rock. It yields Ag values between <1 ppm and 3 ppm and Cd values <10 ppm. Au value in this unit is recorded <50 ppb. As in it ranges from 2 ppm to 749 ppm.
Base Metal							
Balrampur	Burhaba gicha area	1:12,500	100	-	-	237	A G-4 stage exploration for basemetal was carried out in Burhabagicha area, Balrampur District, Chhattisgarh with an objective to search for potential zones of basemetal mineralisation. 100 sq.km. was mapped under Large Scale Mapping on 1: 12500 scale with collection of 169 nos. samples (101 nos. bedrock, 50 nos. pit/trench and 18 nos. of stream sediment) for trace element analysis, 23 Nos. for petrochemical studies and 45 Nos. for PS/SEM/OM studies. The area around Burhabagicha encompasses supracrustals of meta-volcano sedimentaries, meta-sedimentaries, meta-basics and granitoids. Acid- to intermediate- metavolcanic is the host rock for sulphide mineralisation. Oxidised zone is developed between west of Chilma and Kotaghna through Burhabagicha. It is characterised by sulphide-sulfosalt, iron oxide stain and very rare malachite stain. Sulphide in the host present in the form of dissemination, streak and vein. Mineral assemblage recorded is pyrite, sphalerite, galena and REE. Pyrite is the abundant sulphide mineral recorded. Sphalerite is occasionally present mainly as fracture filling in pyrite. Galena is rare to occasional present as dissemination in the pyrite. Monazite and xenotime are present occasionally. Sphalerite and galena associated with pyrite is 40 µm to 400 µm and 2 µm to 30 µm in size. The values of Cu in acid to intermediate metavolcanic bedrocks range from 10 ppm to 90 ppm. Pb ranges from <10-140 ppm and Zn ranges from 10 ppm to 200 ppm. Ni <10 ppm to 170 ppm, Co <10 ppm to 30 ppm and Cr <10 ppm to 59 ppm recorded in the host rock. It yields Ag values between <1 ppm and 3 ppm and Cd values <10 ppm. Au value in this unit is recorded <50 ppb. As in it ranges from 2 ppm to 749 ppm.
REE							
Mahasamund	Sorid-Nawagaon area	1:12,500	110	-	-	265	An area of about 110 sq. km. was covered by reconnaissance mapping on 1:12,500 scale. A total of 60 nos. of stream sediment samples, a total of 35 nos. of PCS samples, 35 nos. of BRS, 25 nos of PS samples, 25 nos. of soil samples and 25 nos. of PTS samples have been collected and submitted for analysis. Total 60 nos. of heavy mineral samples have been processed via panning, jigging, magnetic separation and thereafter bromoform separation and studied under microscope. Mainly the area is covered with porphyritic granite and equigranular granite belonging to the Dongargarh Granitoids and some part is covered with Lohardih sandstone. The porphyritic granite is leucocratic, very coarse to coarse grained, massive and is composed of quartz, alkali feldspar, and plagioclase as essential minerals whereas biotite and muscovite are as accessories. Equigranular granite is leucocratic, medium grained, massive to feebly foliated and consists of quartz, alkali feldspar, and plagioclase as essential minerals whereas, biotite, muscovite, and epidote as accessories. Analytical results of samples were received showing the concentration of tREE in BRS samples ranged from 529.57 to 944.87 ppm, PTS samples ranged from 501.8 to 1456.3 ppm and PCS samples ranged from 520.48 to 1403.42 ppm. From the analytical results of REE, it is observed that bed rock samples from equigranular granite (monzogranite) around Hadabandh area are better locales for REE concentrations. Pit samples from porphyritic granite, to the North of Arand village also provided higher tREE concentration of 1403.42 ppm.

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Lithium and associated rare metals							
Korba	Tarmapahar and Konkona area	1:12,500	100	-	-	-	A total of 100 sq. km. large scale mapping on 1:12,500 scale was carried out in and around Tarma pahar and Konkona area, Korba district, Chhattisgarh in parts of toposheets no 64J/06 and J/10. Five varieties of granitic rocks including (i) foliated granite, (ii) leucocratic equigranular granite, (iii) medium to coarse-grained syeno- to monzogranite, (iv) granitic pegmatite and (v) granodiorite were delineated and pegmatites were also mapped. The leucogranite also grades into very coarse-grained granitic pegmatite and occurs in close association with Li-mica bearing pegmatites and also occurs as irregular patches within the equigranular leucogranite. It contains mica books (white and golden brown) and profuse tourmaline. Field studies suggest cogenetic relation between leucogranite coarse-grained syeno- to monzogranite and granitic pegmatite. The pegmatites are mostly exposed as amoeboidal patches in the granites. South of Tarma Pahar, the pegmatites mostly have an E-W trend with a high dip of 80° towards N. Some pegmatites south of Tarma Pahar have a NW-SE trend. These comprise of quartz, alkali feldspar, minor garnet, muscovite, tourmaline and golden-brown mica. Near Jongridongri, the pegmatites show compositional zoning and have been divided in to 3 distinct zone with different mineralogical variation. As per the chemical data received the values of Li in the bedrock samples are not encouraging. Values of Li range from 6.56-193.58 ppm. The analytical values only show significant concentration of Rb in many granites (as high as 1107 ppm). The values of Nb and Ta in the equigranular granite range from 1.39-105.94 ppm and 0.77-16.86 ppm respectively. In the pegmatitic Ta value ranges from 0.19-146.24 ppm and Nb value ranges from 1.44-197.34 ppm respectively.
Graphite							
Balrampur	Oranga-Revatipur areas	1:4000	3.6	16	1392	572	A G-3 stage preliminary exploration for graphite was carried out in Oranga-Revatipur areas in Balrampur district, Chhattisgarh during FS 2021-22. The study area falls in the northern part of Chhattisgarh, in toposheet no. 64M/5 and belongs to Bilaspur-Raigarh-Surguja (BRS) metamorphic belt. Area mainly comprises of meta-sedimentary sequences of the Older Metamorphic Group and consist quartzite, quartz mica schist, graphite mica schist, calc silicate and amphibolite. An area of 3.6 sq. km. was covered by Detailed Mapping on 1:4000 scale followed by geophysical survey of 12 L.km. A total of 59.2 cu. m of trenching was carried out and 55 nos. of trench/pit samples were analysed for fixed carbon analysis. A total of 10 petrochemical samples (PCS) and 20 petrological samples (PS) were analysed. A total of 16 nos. of first level boreholes have been drilled with 200 m spacing in block area. A total of 1392 m was drilled in first level boreholes and 487 nos. core sample generated during Field Season 2020-21 & 2021-22 for G-3 stage of mineral investigation. In borehole graphite mica schist has varying thickness from 1 m to 60 m and is intercalated with quartz mica schist and calc silicates. Analytical result of drilled core samples reveals the fixed carbon content ranging from 4.47% to 10.33%.
Coal							
Surguja	Aklasarai Area, Sonhat Coalfield	1:10000	45	-	3100.05	-	A total of 45 sq.km area has been geologically mapped on 1:10,000 scale. Major part of the mapped area is covered by the rocks of Raniganj Formation, the Barren Measures occur as outliers in the north and north-western part and the Parsora Formation are exposed in the ridges to the north of the exploration area. The Parsora Formation rocks are represented predominantly by quartz arenite with thin beds of variegated shale, siltstone with clay clasts of varying dimension. The Raniganj Formation is characterised by grey shale, interlaminated, ripple laminated fine grained sandstone/siltstone and shale (heterolith) and fine to medium grained cross bedded sandstone and coal seams. The shales, siltstone and the carbonaceous shales belonging to this formation carry a variety of plant fossils viz. Glossopteris, Gangamopteris, Vertebraria indica etc. The Barren Measures outcrop, occupying the northern part of area, is surrounded by the rocks of Raniganj Formation. Barren Measures is mainly

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							represented by medium to coarse grained, occasionally gritty, light grey sandstone and occasional coal seams, the coal seams are shaly in nature. Barakar Formation the area is represented by greyish white, clayey matrix, medium to coarse grained, cross-bedded sandstone. The lithological assemblage of Talchir Formation is represented by diamictite, sandstone, conglomerate, rhythmite, greenish and chocolate needle shale, shale-siltstone alternation and moderately to poorly sorted greyish white sandstone of varying grain sizes. General Strike of beds is ENE-WSW and dipping towards NW with dip amount varying from 3° to 5° in the major part of the area. Two faults are interpreted in the area on the basis of subsurface data of boreholes. A total of four boreholes drilled in the area. The total drilling is 3100.05 m till date and total of 68.31 m coal is encountered in all the four boreholes. Five regional coal seams (I to V & one local seam) intersected within a depth range of 108.18 m and 759.10 m. Thickness varying from Min-0.52 m (Seam-I, SHA-1) to Max- 16.44 m (Seam-IV, SHA-3) and local seam Seam-VL of 0.56 m at the depth of 317.28 m also at 108.18 m (0.68 m) and 126.87 m (0.50 m) in SHA-4. Borehole wise thickness is 11.20 m (SHA-1), 19.99 m (SHA-2), 24.73 m (SHA-3) and 5.97 m (SHA-4). Band by band analysis of borehole no. SHA-1 and SHA-4 shows the significant result i.e., moisture content <2% in most of the samples. Further analysis (SHA-1) of caking grade varies from C to D after conducting LTGK (low temperature gray king) coke essay. Barakar coal seams are moderate in thickness and fairly persistent over the Aklasarai area. Five coal seams (Seam-I to V) of regional extent have been encountered in the area (SHA-1), four coal seams (Seam-I to IV) of regional extent have been encountered in the SHA-2, four coal seams (Seam-II to V) of regional extent have been encountered in the SHA-3 and three Barakar coal seam have been encountered (Seam-III to V). All coal seams are intersected between 108.18 m and 759.10 m depths in Barakar Formation. The cumulative thickness of the individual coal seams is varying from less than a meter to 16.44 m. The thickest coal seam in all the drilled boreholes is seam no. IV which is having thickness ranging from 2.14 m (SHA-4) to 16.44 m (SHA-3). ?REEs in coal samples of the study area varies from 104.50 ppm to 352.20 ppm. While in carbonaceous shale samples it varies from 141.30 to 443.20 ppm and in shale samples the ?REEs varies from 134.40 ppm to 382.90 ppm. LREE and MREE is attributed due to presences of apatite, plagioclase and mica in the source rock. Whereas, positive Tm anomaly represent the presence of zircon and garnet in the source rock. Petrographic study of five sandstone samples from Barakar Formation was carried out and it reveals that the sandstones are arkose to sub-arkose (after Folk, R.L., 1980) in composition. In Aklasarai area, a total of 950.76 million tonnes coal resource of 'Reconnaissance Resource' category has been estimated over an area of 45 sq. km.
Raigarh	Dhibodih Area, Mand-Raigarh Coalfield	1:10000	49	-	-	-	Large scale mapping (RF 1:10,000) of 49.00 sq. km. area has been carried out during this period. The present area is covered by rocks of Kamthi Formation. The Kamthi Formation is composed of reddish-brown medium to coarse grained cross bedded sandstone with occasional clay clasts, at places ferruginous in nature. Further subsurface investigation by drilling revealed the litho-assemblages of Lower Gondwana sequence belonging to Barakar Formation, Barren Measures and Raniganj Formation. The contact between Barren Measures and Barakar Formation as well as Barren Measures and Raniganj Formation are gradational. Subsurface data in the Dhibodih Area depicts lithological association of medium to very coarse-grained subarkosic sandstone, heterolithic sequence of siltstone, grey shale, mudstone, carbonaceous shale, and regionally persistent thick coal seams of economic importance. Barren Measures rocks comprises mostly of dark grey to ash grey mudstone/ shale and siltstone with a minor amount of light grey, very fine to fine grained sandstone, and interbanded sequence of sideritic claystone with few local Barren Measures seams. The Raniganj Formation is characterised by a cyclic sequence of fining upward medium to fine grained sandstone and heteroliths of siltstone, mudstone, and shale with the occurrence of two local coal seams (R-III & R-I) having cumulative thickness ranges from 0.50 m to 3.05 m. The subsurface studies in Dhibodih Area revealed a general strike of N75°W-S75°E with a southwesterly dip of 3°.

Table –4: Mineral Production in Chhattisgarh, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**102**		**118108145**	**102**		**153480094**	**113**		**240475866**
Coal	'000t	-	157745	-	-	158410	-	-	154120	-
Bauxite	t	15	1565307	1609377	14	716296	751459	13	968247	1085795
Iron Ore	'000t	20	34728	99153323	21	36839	132201316	21	41313	218099187
Tin Conc.	kg	6	15530	10337	5	16865	10413	6	26292	31979
Graphite (r.o.m.)	t	1	908	409	1	1701	2041	1	-	-
Limestone	'000t	57	42699	10200663	57	40378	10139974	68	41888	11009962
Moulding Sand	t	3	12905	3766	4	14363	4150	4	16843	5080
Minor Minerals		-	-	7130270	-	-	10370741	-	-	10243863

Note : The number of mines excludes Fuel and minor minerals.
$ Excludes the value of Fuel minerals.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Aluminium	
Bharat Aluminium Co. Ltd (Unit I & II),	200# (Alumina)
Korba.	570 (Aluminium)
(#Plants remained non-operational during the year).	
Cement	
ACC Ltd, Jamul, Distt Durg.	2400
Ambuja Cements Ltd, Bhatapara,	3500
Distt. Raipur.	
Bhilai Jaypee Cement Ltd,	2200
Bhilai, Distt Durg (G).	
Century Cement, Baikunth, Distt Raipur.	2100
Century Textile & Industires Ltd,	2400
Tandwa, Tilda	
Emami Ltd, Baloda Bazar, Distt Raipur	2500
	3200 (clinkar)
Emami Ltd, Risda Baloda Bazar, Distt Raipur	2500
Emami Cement Ltd, Risda Baloda Bazar	3000
J. K. Laxmi, Durg	2.7
J. K. Laxmi Cement Ltd, Malpurikhurd,	2400
khasadhe, Dhamdha	
Lafarge India Pvt. Ltd, Arasmeta,	1.8
Distt Janjgir-Champa.	
Lafarge India Pvt. Ltd, Sonadih, Distt Raipur	550
NUVOCO Vistas Co. Ltd	1000
Sonadih Cement Plant,	
Rasedi, Baloda Bazar	
Shree Cement, Baloda Bazar, Distt Raipur	3000
Shree Cement Ltd, Khapradih Simga,	3000
Balrampur.	

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
UltraTech Cement Ltd, Hirmi, Distt Raipur.	1900
UltraTech Cement Ltd, Rawan, Distt Raipur.	2500
Chemical	
Indu Ragukul Food &	1.5 (Sodium Dicromate)
Chemical Pvt. Ltd,	2.7 (Sodium chromate)
Rajghatta, Kharsia	1.35 (Sodium sulphate)
Electrode	
Bhanpuri, Raipur	
Calcutta Electrode Pvt. Ltd,	7.4
Fertilizer	
BEC Fertilizers, Sirgitti, Distt Bilaspur	850000
Dharamsi Morarji Chemical Co. Ltd,	183 (SSP &
Kumhari, Distt. Durg.	H_2SO_4)
Khaitan Chemicals & Fertilizers Ltd,	66 (SSP)
Distt Rajnandgaon.	49.5 (H_2SO_4)
Iron & Steel	
Bhilai Steel Plant, Bhilai	6334 (Sinters)
	4700 (Pig iron)
	3925 (crude/liquid steel)
	30 (Refractory bricks)
Jindal Steel & Power Ltd, Raigarh	2500 (Sinters)
	1320 (Sponge iron)
	8600 (Crude/liquid steel)
Jayaswal NECO Industries Ltd,	650 (Pig iron)
Siltara, Distt Raipur.	255 (Sponge iron)
	1200 (pellets)
	1200 (Steel)
Monnet Ispat & Energy Ltd,	962.3 (Sinters)
Naharpalli, Raigarh	612.5 (Pig iron)
	750 (MS billet)
	450 (TMT Bar)
Sarda Energy & Minerals Ltd, (formerly	600 (Pellets)
Raipur Alloys & Steel Ltd), IGC,	360 (Sponge iron)
Siltara, Distt Raipur.	240 (Finished steel)
Shri Bajrang Power & Ispat Ltd,	210 (Sponge iron)
Borjhara, Distt Raipur.	130 (Steel)
	1200 (pellets)
Sponge Iron	
A.P.I. Ispat & Power Tech. Pvt. Ltd,	210
Siltara Billets, Raipur	
Alliance Integrated Metallics Ltd,	500
Bemta, Distt Raipur.	
Anjani Steel Ltd, Ujalpur, Distt Raigarh	108
Arti Sponge & Power Ltd, Siltara, Distt Raipur	60
Ambika Ispat (I) Pvt Ltd, Tarainal, Distt Raigarh	30
Baldev Alloys Pvt. Ltd, Siltara, Raipur	30
Bhagavati Power & Steel Pvt Ltd,	60
Siltara, Distt Raipur	
B.S. Sponge Pvt Ltd, Taraimal, Raigarh	90

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Crest Steel & Power Pvt. Ltd,	231
IGC Borai, Distt Durg	
Devi Iron & Power Pvt Ltd, Tandira, Distt Raipur	90
Drolia Electro Steel Pvt Ltd, Siltara, Raipur	66
Euro Pratik Ispat Pvt Ltd, Charoda, Distt Raipur	30
Gravity Treksim Pvt Ltd, Siltara, Distt Raipur	30
Godavari Power & Ispat Ltd, Siltara,	495
Distt Raipur	2100 (pellets)

Delhi

Kaolin deposits are found in an area west of Qutub Minar at Mehrauli, Masoodpur, Kusumpur and Mahipalpur.

In addition, occurrences of fireclay and silica material known as Badarpur sand/quartzite have also been reported from Delhi

Mineral Resources

Kaolin deposits are found in an area west of Qutub Minar at Mehrauli, Masoodpur, Kusumpur and Mahipalpur. In addition, occurrences of fireclay and silica material known as Badarpur sand/quartzite have also been reported from Delhi (Table -1).

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the princip al Mine ral- base d Ind ustries in t he Organised Sector with their total installed capacities are furnished in Table-2.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2015 : Delhi

Mineral	Unit	Reserves			Remaining resources				Total Resources (A+B)
		Proved STD111	Probable STD122	Total (A)	Measured STD331	Indicated STD332	Inferred STD333	Total (B)	
China clay#	'000 tonnes	-	-	-	857	630	3802	5289	5289
Fireclay#	'000 tonnes	-	-	-	6	13	45	64	64

Figures rounded off.

 # Declared as Minor Mineral vide Gazette Notification dated 10.02.2015.

Table – 2 : Principal Mineral-based Industries

Industry	No. of units	Total installed capacity (tpy)
Abrasive	1	120
Activated earth	1	3,600
Alum	1	35,500
Asbestos products	1	25,000
Bleaching powder	1	10,000
Caustic soda	1	15,080
Ceramic & stoneware pipes	2	18,500
S. R. Industries Electrode, Narela	1	1800
Refractory	2	39,000

Goa

Goa is well-known for its iron and manganese ores	₹ 26 Crore, value of minor mineral's production was estimated for the year 2020-21	39 Mines in case of MCDR minerals reported production in 2020-21

Mineral Resources

Goa is well-known for its iron and manganese ores. Bauxite and laterite are the other minerals produced in the State. Iron and manganese ore belts extend from south-east to north-west of the State. Manganese ores are associated with iron ores and occur as pockets of various sizes in the form of concretionary pebbles in shales. Important iron ore and manganese ore deposits are located at Bicholim, Sanguem and Satari talukas. Bauxite occurs in the North and South Goa districts; kaolin reportedly occurs in South Goa district, while quartz/silica sand deposits occur in both North and South Goa districts (Table -1).

Exploration & Development

No mineral exploration activities were reported by GSI during 2021-22.

Production

No mineral production except minor mineral was reported from Goa. The value of minor mineral's production is estimated as 30 crore for the year 2021-22. There was 28 reporting mines in 2021-22 in case of MCDR minerals (Table - 2).

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the principal Mineral-based Industries in t he Organised Sector in the State are provided in Table -3.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020 : Goa

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Bauxite	'000 tonnes	7963	-	1650	9613	5222	1097	8195	6820	-	36910	-	58244	67857
Iron ore (Haematite)	'000 tonnes	96558	7666	13012	117235	435300	255162	182675	22126	12727	166631	5701	1080322	1197557
Iron ore (Magnetite)	'000 tonnes	4364	-	626	4990	59509	14516	33512	-	-	151811	1997	261345	266336
Manganese ore	'000 tonnes	31	-	34	65	14028	1479	9177	48	262	9442	-	34436	34501

Figures rounded off.

Table-2: Mineral Production in Goa, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**48**		**398896**	**42**		**1157858**	**28**		**296446**
Iron Ore	'000t	45**	-	-	40	1003	897737	27**	-	-
Manganese Ore *	t	3	-	-	2	-	-	1	-	-
Minor Minerals		-	-	398896	-	-	260121	-	-	296446

Note :The number of mines excludes Minor minerals.
*** Only labour reported, production activity stopped by S.C. Order.*
** Only labour reported.*

Table – 3 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Counterweight	
Asavari Vishwanath Parulekar,	15
Convale Bardez	
Fertilizer	
Zuari Industries Ltd, Zuarinagar,	495000 (Urea)
Distt South Goa.	500000 (NP/NPKs)
	330 (DAP)
Pellets	
Mandovi Pellets Ltd, Mandovi, Shiroda.	NA
Chowgule & Co. Ltd	NA
Pig Iron	
Sesa Goa Ltd, Bicholim.	625
Aparant Iron & Steel Pvt. Ltd, Sanguem	160
Vedanta Ltd, Amona, Bicholim	832
	1000 (Sinter)
Sponge Iron	
Ambey Metallic Ltd, Pissurlem, Sattari.	36
Goa Sponge & Power Ltd, Santona.	90
Shraddha Ispat Pvt. Ltd, Santona, Sanguem.	72
Ferroalloys	
Karthik Alloys Ltd, Cuncalim.	3.2

Note: *Data, for fertilizer industries, is taken from Indian Fertilizer Scenario, FAI Statistics.*

Gujarat

The State is the sole holder of the country's chalk, marl and perlite resources	₹ 4,794 crore Estimated value of production of minor minerals in 2020-21	143 Reporting mines in 2020-21 in case of MCDR minerals

Mineral Resources

Gujarat is the sole producer of chalk and is the principal producer of clay (others), fluorite (graded), kaolin, silica sand, lignite, petroleum & natural gas and marl in the country. The State is the sole holder of the country's chalk, marl and perlite resources and possesses 66 % fluorite, 28% diatomite, 25% bentonite, 18% granite, 12% wollastonite, 10% limestone and 9% bauxite resources.

The important mineral occurrences in the State are: bauxite in Amreli, Bhavnagar, Jamnagar, Junagadh, Kheda, Kachchh, Porbandar, Sabarkantha & Valsad districts; ball clay in Banaskantha, Bharuch, Kachchh & Patan districts; bentonite in Amreli, Bhavnagar, Jamnagar, Kachchh & Sabarkantha districts; china clay in Amreli, Banaskantha, Bhavnagar, Jamnagar, Junagadh, Kachchh, Mahesana & Sabarkantha districts; chalk in Porbandar district; diatomite in Bhavnagar district; dolomite in Bhavnagar & Vadodara districts; fireclay in Bharuch, Kachchh, Mahesana, Rajkot, Sabarkantha, Surat & Surendranagar districts; fluorite in Vadodara & Bharuch districts; gypsum in Bhavnagar, Jamnagar, Junagadh, Kachchh and Surendranagar districts; l ignite in Bharuch, Bhavnagar, Kachchh & Surat districts; limestone in Amreli, Banaskantha, Bharuch, Bhavnagar, Jamnagar, Junagadh, Kheda, Kachchh, Panchmahals, Porbandar, Rajkot, Sabarkantha, Surat, Vadodara & Valsad districts; marl in Amreli, Junagadh & Porbandar districts; ochre in Banaskantha, Bhavnagar & Kachchh districts; perlite in Rajkot district; petroleum and natural gas in oil fields of Ankaleshwar, Kalol, Navgam, Balol & Cambay in Cambay onshore and offshore basins; quartz/silica sand in Bharuch, Bhavnagar, Dahod, Kheda, Kachchh, Panchmahals, Rajkot, Sabarkantha, Surat, Surendranagar, Vadodara & Valsad districts; and talc/soapstone/steatite in Sabarkantha district.

Other minerals that occur in the State are: apatite and rock phosphate in Panchmahals district; calcite in Amreli & Bharuch districts; copper ore in Banaskantha district; granite in Banaskantha, Mahesana & Sabarkantha districts; graphite in Panchmahals district; lead-zinc and marble in Banaskantha & Vadodara districts; manganese ore in Panchmahals & Vadodara districts; vermiculite in Vadodara district; and wollastonite in Banaskantha district. The lignite resources are located in Bharuch, Bhavnagar, Kachchh and Surat districts (Tables - 1 and 2).

Exploration & Development

The details of exploration activities conducted by GSI during 2021-22 are furnished in Table - 3.

Production

Lignite, Natural Gas, Petroleum (Crude), Bauxite, Limestone etc were reported from Gujarat. The value of minor mineral's production is estimated as 4000 crore for the year 2021-22. There was 143 reporting mines in 2021-22 in case of MCDR minerals (Table-4).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the important mineral-based industries in the Organised Sector in the State are furnished in Table - 5.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020 : Gujarat

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Apatite	tonne	-	-	-	-	-	-	-	-	-	-	351000	351000	351000
Bauxite	'000 tonnes	83448	2005	15777	101230	86746	41434	21913	29145	22107	82774	11678	295797	397027
Copper														
Ore	'000 tonnes	-	-	-	-	2013	2371	969	129	-	7131	-	12613	12613
Metal	'000 tonnes	-	-	-	-	31.2	35.8	19.67	0.69	-	113.38	-	200.74	200.74
Diatomite	'000 tonnes	-	-	-	-	-	-	-	-	-	811	-	811	811
Fluorite	tonne	-	-	-	-	8630000	-	-	-	5723360	1920	-	14355280	14355280
Graphite	tonne	-	-	-	-	-	-	-	-	2520805	835000	-	3355805	3355805
Lead-Zinc Ore														
Ore	'000 tonnes	-	-	-	-	2013	2371	969	129	-	200	-	5682	5682
Lead metal	'000 tonnes	-	-	-	-	81.94	88.2	34.41	3.9	-	-	-	208.45	208.45
Zinc metal	'000 tonnes	-	-	-	-	111.73	111.44	37.13	1.1	-	-	-	261.4	261.4
Lead-Zinc metal	'000 tonnes	-	-	-	-	-	-	-	-	-	0.9	-	0.9	0.9
Limestone	'000 tonnes	722663	115984	64467	903115	507311	254583	176439	79919	2593098	18317659	160	21929169	22832284
Manganese Ore	'000 tonnes	695	-	0	695	-	-	-	-	-	2180	-	2180	2875
Marl	tonne	50825000	17210000	110000	68145000	26474477	4189000	-	-	-	390000	-	31053477	99198477
Perlite	'000 tonnes	-	-	-	-	140	683	595	-	-	-	988	2406	2406
Rare Earth Elements	tonne	-	-	-	-	-	-	-	-	424000	-	-	424000	424000
Rock Phosphate	tonne	-	-	-	-	-	-	-	-	-	314820	-	314820	314820
Vermiculite	tonne	-	-	-	-	-	-	-	-	-	1960	-	1960	1960
Wollastonite	tonne	-	-	-	-	-	-	-	-	-	1990000	-	1990000	1990000

Figures rounded off.

Table – 2: Reserves/Resources of Lignite as on 1.4.2023: Gujarat

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	1278.65	283.7	1159.7	2722.05
Kachchh	335.61	56.4	33.09	425.1
Bharuch	724.76	118.59	491.23	1334.58
Bhavnagar	–	–	299.17	299.17
Surat	218.28	108.71	336.21	663.2

Source: *Coal Directory of India 2022-23.*

Table – 3 : Details of Exploration Activities in Gujarat, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI REE & RM							
Banaskantha	Jalotra-Vaghor area	-	-	-	-	-	Geologically the area is comprised of Sendra Ambaji Granitoids intrusive in metasediments of Delhi Supergroup. It mainly consists of syn-tectonic and post tectonic granites. Granitoids are intruded by several microgranite, of varying size, mafic dyke, Basaltic dyke, apliteveins, quartz veins and quartzo-feldspathic veins. In majority, two variants of SendraAmbajigranitoids i.e., Plagioclase rich porphyritic granite, K-feldspar rich porphyritic granite are observed in the area. Rapakivitexture in porphyritic granite is observed throughout the area. Quartz syenite is intruded into both the variants of granites. Alteration in syenite is observed in the form of epidotisation and secondary crystallisation of quartz and flourites along fracture and joint planes. A mafic dyke of nearly 2 km length and 0.15 km width trending N-S is observed near Motipura village which cut across by several aplite and microgranite dykes all trending almost along N50°W-S50°E. The last phase magmatic activity in the area is represented by microgranite in the form of dykes throughout the mapped area along with aplite vein, quartz vein and few quartzo-feldspathic veins. Two phases of microgranites were observed during fieldwork. Older phase is in the form of xenoliths in porphyritic granites and younger phase is in the form of dyke. Two major shear zones trending in NS and NW-SE are present along with small scale shearing have been observed in the study area characterised by mylonitic rock. Based on the field observations, petrographic study and proximity indicators, it seems that late phase microgranite, fluorite bearing quartz syenite and altered granite are potential host for the REE and RM mineralisation. In the thin section study, zircon, monazite, fluorite are observed in K-feldspar rich granite and quartz syenite. Alteration like epidotisation, silicification, greisenisations have been observed in investigated block, which also indicate enrichment REE and RM bearing phases in altered zones in granite.
Chhota Udepur and Dahod	Khokhra-Mithibor area of Panchmahal	-	-	-	-	-	A G2 stage exploration with drilling of 5727 m to explore the occurrences of REE beneath the basalt of Deccan Trap was carried out in Central block Ambadungar area in Ambadongar Carbonatite Complex. Lithologically the investigation area comprises different varieties of carbonatite (Sovite, brecciated carbonatite, ferro-carbonatite/Ankerite), carbonate sandstone, phonolite, basalt, dolerite dyke and quartz veins. The pyrochlore crystals with magnetite observed within sovite, brecciated carbonatite and ferro carbonatite in Ambadungar area. Petrography study reveals that the carbonatite mainly is constituted of 80% to 90% calcite whereas apatite, amphibole, pervoskite, zircon and barite occurs as minor constituents. The EPMA study of core samples indicated the presence of REE associated mineral phases like bastnasite, parasite, synchesite, apatite, fluoro apatite and monazite whereas the RM minerals are mainly associated with Pyrochlore.The drilling of 5727 m was completed in FS: 2021-22 and 2022-23 (spill over) to assess the potentiality of carbonatites for REE and Niobium. A total 10 nos. of vertical borehole was drilled in the central block of Ambadungar area with 500 to 600 m vertical depth at 100 x 100 m regular interval. The carbonatite

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							occurs beneath the basalt at vertical depth of 55 m to 90 m whereas the average depth is 100 m. During the exploration out of 5727 m of drilling 4728 m of carbonatite zone which is favorable for REE and Niobium mineralisation has been observed. The zone of REE and Niobium mineralised carbonatite is observed in each borehole and their vertical depth varies from 450 to 500 m. Besides REE, Pyrochlore, sulphide and magnetite with pyrochloremineralisation are also observed in core of different borehole. Based on the previous analytical data of the core samples, these carbonatite show encouraging value (0.4% average grade with 0.25% cut off) for REE and (400 ppm average grade with 200 ppm cut off) for Niobium.
Graphite							
Dahod	Patra-Guvali-Satsera-Gopalpura area	1:12500	-	-	-	-	The large-scale mapping on 1:12,500 scale reveals that the area comprises rocks of Kalinjara Formation belonging to Meghnagar Group of Aravalli Supergroup of rocks. It comprises marble, chlorite schist, carbonaceous phyllite, graphite schist, quartzite, calc silicate, phyllite, dolomitic marble and quartz mica schist and biotite gneiss. The Lunawada Group is unconformably overlain by rocks belonging to Bagh Series which are in turn overlain by Deccan traps, while it is underlain by Udaipur group of rocks represented by granite Gneisses and amphibolites. During the mapping, four separate discontinuous graphite-bearing zones in carbonaceous phyllite were recorded in the area. Based on limited exposures and pitting / trenching in soil cover area, the graphite hosting carbonaceous phyllite body has been traced over a cumulative strike length of 1.29 km from south of Patra village to Dhebar village. The graphite schist/carbonaceous phyllite band occurs as patchy, impersistent lenses and sometimes associated with impure dolomite. The south Patra graphite schist/ carbonaceous phyllite band has been marked in south of Patra village. The graphite in the south part of this zone is amorphous, hard and thus doesn't qualify the cut-off grade of 10% fixed carbon for amorphous variety. However, the graphite in the northern part is soft, silver-gray to black in colour, greasy and soils hands. Mostly it occurs along the foliation planes as thin layers, small patches and pockets. The north Patra mineralised zone is 650 m and thickness vary from 10 m to 140 m. The overall strike direction of the Patra south band varies from N730W- S730E to N400W- S400E. Sample no. B045 with maximum values of 8.21% is from north Patra mineralised zone. Keeping the cut-off value of fixed carbon at 2%, 8 m wide and 150 m long mineralised zone has been established in trench CH-03 with average fixed carbon content of 2.09%. The Dhebar zone exposed on the right bank of Anas River is flanked by quartzite of Kalinjara Formation on east and Anas bank phyllite on west. The length of the body is ~170 m with thickness of ~12 m. The graphite is lensoidal, much friable here and grey. It shows greasiness and soils hand. The mineralised zone could not be established as the average grade is <2%. Total 05 numbers of graphite samples were studied through Laser Raman Spectroscope. It is confirmed that all the sample contains graphite. The analytical data for MnO, V and Ni of 25 samples out of 100 have been received. Spot samples have given MnO values of 42.39% and 42.11% from Anas River block (Gogia et.al., 2012). The same samples have also given V results of 194 ppm and Ni results of 141 ppm. The manganese-ore deposits observed in the study area occur within the village limits of Rampura and of Mandli. The Mn ore occur associated with smaller exposed quartzite bodies in and around Mandli and Rampura. The deposits occur associated and interbanded with quartzites and form fairly prominent hillocks in the phyllite country. The strike of the quartzite varies from N5°E to N40°E and the dips range from 20°-65° to the west. The ore is chiefly psilomelane and braunite with some pyrolusite.

Table – 4 : Mineral Production in Gujarat, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**184**	**-**	**76880978**	**143**	**-**	**54458025**	**143**	**-**	**46777610**
Lignite	'000t	-	10357	-	-	10813	-	-	13331	-
Natural Gas (ut.)	m cu.m	-	1342	-	-	1138	-	-	1017	-
Petroleum (crude)	'000t	-	4707	-	-	4651	-	-	4627	-
Bauxite	t	68	2076329	1439889	63	1497712	1198490	58	2018309	1683681
Manganese Ore	t	1*	-	-	-	-	-	-	-	-
Limestone	'000t	115	22868	5204303	91	22227	5080904	85	23543	4959400
Marl%	t	-	1646104	318711	-	1300333	243556	-	900560	133211
Sulphur#	t	-	97107	-	-	82450	-	-	117588	-
Minor Minerals		-	-	69918075	-	-	47935075	-	-	40001318

Note : *The number of mines excludes Fuel and Minor minerals.*
$ Excludes the value of Fuel minerals.
** Only labour reported.*
% Associate with Limestone.
 # Recovered as by-product from oil refineries.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Abrasives	
Bombay Mineral Limited	86.4 (Abrasive Grain)
Jam Khambhalia	
Carborandum Universal Ltd,	NA
Okha, Distt Jamnagar.	
Carborandum Universal Ltd,	NA
Bhatia, Distt Jamnagar	
Flexo-Plast Abrasives, Ahmedabad	NA
Orient Abrasive Ltd, Porbandar	75 (Abrasive Grain)
	150 (Calcined Bauxite)
	30 (Castable Refractory)
Asbestos Products	
Ramco Industries Ltd, Singura, Distt Kachchh.	72
Sanghi Industries Ltd,	36
Sanghipuram, Distt Kachchh.	
U.P. Asbestos Ltd, Valsad.	36
Cement	
Ambuja Cements Ltd, Ambuja Nagar, Distt Junagadh.	5700
Ambuja Cement Ltd, Magdalla, Distt Surat (G).	1560
Mehta Group Gujarat Sidhee Cement, Sidheegram,	1200
Sutrapada Distt Junagadh.	
Mehta Group Saurashtra Cement Ltd, Porbandar,	1500
Distt Junagadh.	
Saurashtra Cement Ltd, Ranavav Porbandar,	3063
Hi Bond Cement, Gondal.	1200
J.K. Laxmi, Kalol, Distt Ganghinagar (G).	1000
J.K. Laxmi, Surat	1350
Sanghi Industries Ltd, Sanghipuram, Distt Kachchh.	4000

Table-5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Shree Digvijay Cement Co. Ltd, Digvijaygram, 1200 (43 Gr.)	
Sikka Distt Jamnagar.	1200 (53. Gr.)
	1200 (PPC)
	1200 (Oil well cement)
	1200 (Sulphate Resisting P.C.)
Tata Chemicals Ltd, Mithapur, Distt Jamnagar.	500
UltraTech Cement Co. Ltd, Pipavav,	6400
Distt Amreli.	
UltraTech Cement Ltd, (Narmada Cement),	1450
Jafrabad, Distt Amreli.	
UltraTech Cement Ltd, (Gujarat Cement),	6400
Kovaya, Babarkot, Rajula Jafrabad,	
UltraTech Cement (formerly a unit of JCCL),	2400
Sewagram, Abdasa, Distt Kachchh.	
UltraTech Cement (formerly a unit of JCCL),	2400
Wanakbori, Distt Kheda (G).	
UltraTech Cement Ltd, Magdalla (G).	750
Sparta Cements & Infra Ltd. Bhuj	1000
Vadraj Cement, Mora, Surat	6000
Ceramic	
Unifrax India, Lakhtar	7.5 (Ceramic fiber product)
Orient Glazes Ltd, OGPL	35.53
Kheda Unit Radhu	
Chemical	
Baroda Rayon Corpn. Ltd, Surat.	15000 (yarn)
	21600 (H2SO4)
	2.2 (sodium sulphate)
Century Chemicals, Nava Nanga,	108
Distt Jamnagar.	(refined salt)
Gujarat Alkalies & Chemicals Ltd,	14.9
Baroda.	(caustic soda)
Gujarat Alkalies & Chemicals Ltd,	242.6
Dahej, Distt. Bharuch.	(caustic Soda)
	151.4 (Cl)
	33.408 (phosphoric acid)
GHCL Limited, Sutrapada.	1100 (Soda Ash)
	71 (Sodium bicarbonate)
Indian Rayon Industries Ltd,	21 (yarn)
Veraval, Distt Junagadh.	35.7 (H2SO4)
	10 (carbon disulphide)
	9.3 (sodium sulphate)
	91.3 (caustic soda)
Kamadhenu Nutrients Pvt.ltd.	10.8
Panoli,Ankleshwar	(Dicalcium phosphate)
Kohler India Corp. Pvt. Ltd,	15.02 (2Pc B)
Jhagadia,Talodara	8.29 (lav)
	2.25 (Pedestal)
	4.73 (tank)
Navin Fluorine Industries Ltd, Surat.	22 (HF)

Table-5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Nirma Cement Ltd, Ranavav	421.2 (Soda ash)
Nirma Soda Ash Plant	1008 (Soda Ash Light)
Kalatalav, Bhavnagar	648 (Soda Dense)
	144 (Refined Sodium Bicarbonate)
	Vaccun Salt (864)
Saurashtra Chemicals Ltd,	365 (soda ash)
Porbandar, Distt Porbandar	20.4 (caustic soda)
	26.4 (refined bicarbonate)
Shree Sulphurics Pvt. Ltd,	58 (H_2SO_4)
Ankleshwar, Distt Bharuch.	12 (chloro-
	sulphuric acid)
Tata Chemicals Ltd, Mithapur,	875 (soda ash)
Distt Jamnagar.	
Copper Smelter	
Hindalco Industries Ltd,	500 (copper smelting)
Birla Copper, Dahej,	1670 (H_2SO_4)
Distt Bharuch.	15 tonnes (Au)
	150 tonnes (Ag)
HCL, Gujarat Copper Project,	50 (electrolytic copper)
Jhagadia, Distt. Bharuch.	20 (copper anodes)
Electrode	
Power Electrode Varaval Shapar	0.6
Kotda Sangani	
Fertilizer	
Aarti Fertilizers, Vapi, Valsad	132 (SSP)
Coromandel International Ltd (Formerly	100 (SSP)
Liberty Phosphate Ltd), Nandesari, Vododara	367 (urea)
GSFC, Vadodara	108 (DAP)
	200 (complex)
	196 (AS)
GSFC, Sikka (Sikka - I & II), Jamnagar	326 (DAP)
GNFC, Bharuch	636.9 (urea)
	142.5 (complex)
Hindalco Industries Ltd, Dahej,	400 (DAP/
Distt Bharuch	complex)
IFFCO Ltd, Kandla, Distt. Kachchh	2420
IFFCO Ltd, Kalol, Distt. Gandhinagar	602 (urea)
Khaitan Chemicals & Fertilizers Ltd,	200 (SSP)
Dahej, Bharuch	
KRIBHCO Ltd, Hazira, Distt. Surat	2195 (urea)
Narmada Agro Chemicals Pvt. Ltd,	33000 (SSP)
Mangrol, Junagadh	
Narmada Bio-chem Pvt. Ltd, Kalyangadh,	196000 (SSP)
Ahmedabad	
Nirma Ltd, Moraiya, Ahmedabad	100 (SSP)
Sona Phosphates Ltd, Sarigam, Valsad	15 (SSP)
T J Agro Fertilizers Pvt. Ltd, Navsari	22 (SSP)
Foundry	
Steelcast Ltd, Ruvapuri Road, Bhavnagar	30
Intolcast Pvt. Ltd, 16, 17 & 19 Ankur	2.4 (steel casting)
Industrial Complex, Rajkot Gundal Road	

Table-5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Shaper, Rajkot	
Intricast Pvt. Ltd, 25/28 Galaxy	1.08 (steel casting)
Industrial Estate, Rajkot Gundal Road	
Shaper, Rajkot	
Invac Cast Pvt. Ltd, 444, 453 & 455	2.4 (steel casting)
Nana Fofadia Road Bamangam, Vadodara	
Gujarat Intuxt Ltd.184/P, Rajkot Gundal	1.8 (steel casting)
Road Shaper, Rajkot	
Iron & Steel	
Essar Steel Ltd, Hazira,	6700 (sponge iron)
Distt Surat	10000 (crude/liquid steel)
Jindal Saw Ltd, Samaghogha,	900 (Sinter)
Mundra	580 (Pig Iron)
Ferro Alloys	
Baroda Ferro Alloys Ltd, Panchmahals.	3.5
Essel Mining & Industries Ltd, Vapi, Distt Valsad.	9
Electro Ferro Alloys Ltd, Ahmedabad.	0.3
Sponge Iron	
Electrotherm India Pvt. Ltd, Samakhalli,	75
Distt Kachchh	
Gallant Metal Ltd, Samakhialli, Distt Kachchh	225000
Global Hi-Tech Industries Ltd, Bhuj, Distt Kachchh	105
Welspun Steel Ltd, Versamedi, Anjar	144
Glass	
Alembic Glass Industries Ltd, Baroda.	35
Bhagwati Glass Containers Ltd, Kalol.	8.7
Bharat Glass Tube Ltd, Bharuch.	7.2
Gobind Glass & Industries Ltd, Kadi.	NA
Gopal Glass Works Ltd, Budasan,	40.6
Distt Mahesana.	
Gujarat Borosil Ltd, Govali, Distt. Bharuch.	62.5
Piramal Glass Ltd, Jambusar.	355 (tpd)
Piramal Glass Ltd, Kosamba.	340 (tpd)
Haldyn Glass (Gujarat) Ltd, Padra, Vadodara.	320 TPD
Prestige Glass Industries Pvt Ltd, Vagra.	11.5
Petroleum Refinery	
IOCL, Koyali.	13700
RPL, Jamnagar	33000
RPL, Jamnagar (SEZ).	27000
Essar Oil Ltd, Vadinar.	20000
Refractory	
Calders India Refractorie Ltd,	42
Bhayati Jambudiya, Wankaner	
Lilanand Magnesite Pvt. Ltd,	10.8
Dharmpur, Ranavav	
Synthetic Gas	
Reliance Industries Ltd, JG-DTA	13122.48
Gasification Area, Kunalus Lalpur	
Calcined Bauxite	
Birla VXL Ltd, Porbandar	36

Table-5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Bombay Minerals Ltd, Jamkhambhaliya	96
Gujarat Credo Mineral Industries Ltd,	500 (dry beneficiated)
Naredi, Abdasa	10 (processed bauxite)
Saurashtra Calcine Bauxite & Allied	39
Industries Ltd, Bhatia	
Shri Natraj Ceramics & Chemical	24
Industries Ltd, Khambhaliya	
G: Grinding Unit	

Data, not readily available for fertilizer and cement industries on respective websites, is taken from Indian Fertilizer Scenario, FAI Statistics, and Survey of Cement Industry & Directory, respectively.

Haryana

Sulphur was the main mineral item reporting production in the State

₹172 crore
value of minor mineral's production were estimated for the year 2020-21

Mineral Resources

The State is the principal holder of country's resources of slate (85%), tin ore (64%), quartz-silica sand (42%) and quartzite (53%). The principal minerals that are found to occur in Haryana are china clay in Faridabad, Gurgaon & Rewari districts; l imestone in Ambala, Bhiwani, Mahendragarh & Panchkula districts; quartz/silica sand in Bhiwani, Faridabad, Gurgaon & Mahendragarh districts; quartzite in Faridabad & Gurgaon districts; and slate in Mahendragarh & Gurgaon districts. Other minerals, such as, barytes, calcite, felspar & marble occur in Mahendragarh district; copper in Bhiwani & Mahendragarh districts; dolomite in Ambala & Mahendragarh districts; granite in Bhiwani district; and tin & tungsten mineralisations in Tosham area of Bhiwani district have also been reported (Table-1).

Exploration and Development

The details of exploration activities conducted by GSI during 2021-22 are furnished in Table-3.

Production

Sulphur was the main mineral item reporting production in the state. The value of minor minerals' production is estimated as 172 crores for the year 2021-22 (Table-2).

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the important large and medium-scale Mineral-based Industries in the Organised Sector in the State are furnished in Table - 4.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020: Haryana

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Copper														
Ore	'000 tonnes	-	-	-	-	-	2230	-	-	20900	30678	-	53816	53816
Metal	'000 tonnes	-	-	-	-	-	11.82	-	-	73.19	94	-	179.01	179.01
Limestone	'00 tonnes	-	-	-	-	1425	15507	3382	-	2200	52163	-	74677	74677
Tin														
Ore	tonne	-	-	-	-	22580000	-	31330000	-	-	-	-	53910000	53910000
Metal	tonne	-	-	-	-	32187.8	-	54032.8	-	-	-	-	86220.6	86220.6
Tungsten														
Ore	tonne	-	-	-	-	2230000	-	-	-	-	-	-	2230000	2230000
Contained														
WO3	tonne	-	-	-	-	3568	-	-	-	-	-	-	3568	3568

Figures rounded off.

Table-2 : Mineral Production in Haryana, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**-**		**1718901**	**-**		**1718901**	**-**		**1718901**
Sulphur #	t	-	170907	-	-	138025	-	-	178740	-
Minor Minerals @		-	-	1718901	-	-	1718901	-	-	1718901

Recovered as by-product from fertilizer plant.

@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

Table – 3 : Details of Exploration Activities in Haryana, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI REE & RM							
Mahendragarh	Mosnuta area	-	-	-	-	-	The investigated area is a part of the Delhi Supergroup and exposes the rocks of Golwa-Gangutana Formation and Deota-Dantal Formation of Ajabgarh Group which are intruded by the several younger pegmatites of Post Delhi Intrusive. For the first time, three bands of the carbonaceous phyllite from the Golwa-Gangutana Formation have been reported from the North Delhi Fold Belt (NDFB) located at three different locations in the investigated area viz. first band of about 100-120m in thickness, having 1.0 km strike length observed near Golwa, the second band of 80-90m in thickness, having a strike length of 800m near SE of Patan & third band is having an outcrop exposure present in 1 sq. km of an area identified from west of Nangal Durgu. Chemical results of 18 nos. of BRS samples from carbonaceous phyllite bands from various locations yielded vanadium values ranging from 229 ppm to 1009 ppm (Avg. 532 ppm) whereas in the pit samples (18 nos.) vanadium values ranging from 244ppm to 1459ppm (Avg. 744ppm).

Table - 4: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Asbestos Products	
Hyderabad Industries Ltd, Ballabgarh.	91.7
Cement	
Shree Cement (formerly, unit of Jaypee Cement), Panipat (G).	1500
J K Cement Ltd, Jharli, Distt Jhajjar (G).	1500
J K Laxmi, Bijitpur, Distt Jhajjar (G).	1300
UltraTech Cement, Panipat (G).	1300
UltraTech Cement, Jhajjar (G).	1600
Ceramic/Sanitaryware	
Hindustan Sanitaryware & Industries Ltd, Bahadurgarh.	1.4
SPL Ltd, Bahadurgarh.	35000 (sq m/day)
Somany Ceramics Ltd, Kassur, Distt Jhajjar.	10.4 (Mill sq m)
Chemical	
Oriental Carbon & Chemicals Ltd, Dharuhera, Distt Rewari.	28500
Bhalla Chemical Works Pvt Ltd, Ballabgar h.	10 (Zirconium derivaties) 5 (Zirconium silicate opacifiers)
Saint Gobain Gyproc India Ltd (formerly India Gypsum Ltd), Jind.	NA
S. B. Zircon Pvt. Ltd. Sikri, Ballabhgarh	3(Zirconium opacifiers)
Varun Electrode Pvt Ltd, Panipat.	3.6
Electrode	
Devay Udyog, Charkhi Dadri	0.4
Fertilizer	
NFL, Gohana Road, Panipat.	511.5 (Urea)

Table- 4 (Concld.)

Industry/plant	Capacity ('000 tpy)
	8.70 (S)
Kisan Phosphates Pvt. Ltd,	132 (SSP)
Gawar, Hisar.	
Nitin Chemicals & Fertilizers Ltd,	20 (SSP)
Rukri, Ambala.	
Iron & Steel	
Jindal Stainless Ltd, Hisar.	780 (stainless steel)
Ferroalloys	
Haryana Ferro Alloys Ltd,	2.5
Glass	
Haryana Sheet Glass Ltd, Sevli,	89.5
Distt Sonipat.	
Hindustan National Glass &	690 TPD
Industries Ltd, Ballabgarh.	
Petroleum Refinery	
IOCL, Panipat.	15000
Refractory	
Bhaskar Refractories & SW	12
Pipes (P) Ltd, Amar Nagar.	
G: Grinding Unit	

Note: *Data, not readily available for Fertilizer and Cement Industries on respective websites, is taken from Indian Fertilizer Scenario, FAI Statistics and Survey of Cement Industry & Directory, respectively.*

Himachal Pradesh

Limestone and Salt (rock) were the principal minerals reporting production in the State

H70 crore
Value of minor mineral's production were estimated for the year 2020-21

24
Mines in Himachal Pradesh reported production in 2020-21

Mineral Resources

The State is the sole holder of country's antimony ore and rock salt resources. Limestone and shale are the important minerals produced in the State. Barytes occurs in Sirmaur district; limestone in Bilaspur, Chamba, Kangra, Kulu, Mandi, Shimla, Sirmaur & Solan districts; and rock salt in Mandi district. Other minerals that occur in the State are antimony in Lahaul & Spiti districts; gypsum in Chamba, Sirmaur and Solan districts; magnesite in Chamba district; pyrite in Shimla district; and quartz, quartzite & silica sand in Una district Table - 1.

Exploration & Development

The exploration activities reported by GSI during 2021-22 are furnished in Table-2.

Production

Limestone and Salt (rock) were the principle minerals reporting production in the state. The value of minor minerals' production was estimated as 144 crores for the year 2021-22. There were 24 reporting mines in Himachal Pradesh in 2021-22. (Table-3).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the principal mineral-based industries in the Organised Sector in the State are furnished in Table - 4.

Table – 1: Reserves/Resources of Minerals as on 1.4.2020: Himachal Pradesh

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Antimony														
Ore	tonne	-	-	-	-	-	-	-	-	-	10588	-	10588	10588
Metal	tonne	-	-	-	-	-	-	-	-	-	174	-	174	174
Limestone	'000 tonnes	696165	249863	75984	1022012	78403	653158	21105	1529950	5079	3295168	14271	5597134	6619146
Magnesite	'000 tonnes	-	-	-	-	-	-	-	-	-	298	-	298	298
Pyrite	'000 tonnes	-	-	-	-	-	-	-	-	-	2560	-	2560	2560
Rocksalt	'000 tonnes	-	3860	-	3860	3360	940	4620	-	-	-	-	8920	12780

Figures rounded off.

Table – 2 : Details of Exploration Activities in Himachal Pradesh, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI							
Antimony							
Lahaul and Spiti	Bara Shigri glacier	1:12500	25	-	-	-	Large Scale Mapping on 1:12,500 scale covering an area of 25 sq. km has been carried out near Bara Shigri glacier, Lahaul and Spiti district, Himachal Pradesh. A total of 151 nos. channel samples were collected across the pegmatite veins, granite bodies and pegmatite bodies to evaluate the potentiality of antimony, associated base metals and REEs. Besides, 30 nos. samples for petrographic, 05 nos. samples for XRD and 10 nos. samples for EPMA, were also collected and studied. On the basis of field observations and analytical results, it is inferred that two phases of granite are exposed in the study area. The granite on the left bank of Bara Shigri nala is medium to coarse grained, comprising of quartz, plagioclase feldspar, K feldspar, tourmaline, muscovite, biotite. Encouraging lithium values i.e., > 100 ppm were obtained in 39 channel samples.
Gypsum							
Lahaul and Spiti	Giu and Hurling blocks	1:12500	25	-	-	-	A total of 25 sq. km. large scale mapping on 1:12,500 scale was carried out in parts of toposheets 52L/12 & 53I/9. Gypsum bands delineated in Nichala Chango area having strike length of approx. 175m with thickness of approx. 30m. The weighted average of gypsum ($CaSO_4.2H_2O$) in Nichala Chango is 97.75%. In Chango area, the strike length of gypsum band is approx. 450m with thickness of approx. 40 m. and weighted average of gypsum ($CaSO_4.2H_2O$) is 96.79%. In Sumdo area, the cumulative strike length of gypsum bands is approx. 500-600m with thickness of approx. 30m and weighted average of gypsum ($CaSO_4.2H_2O$) is 96.56%. On the basis of analytical data of borehole (HPLSGBH-01) in Giu block, the cumulative true thickness of the gypsum band is 52.45m with 85.60% weighted average of $CaSO_4.2H_2O$.

Table – 3 : Mineral Production in Himachal Pradesh, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**26**		**3932318**	**23**		**4191870**	**24**		**4410341**
Limestone	'000t	25	12527	2746801	22	12018	2618878	23	13710	2966412
Salt (rock)	t	1	130	1447	1	486	14156	1	286	6125
Minor Minerals		-	-	1184070	-	-	1558836	-	-	1437804

Table - 4: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Cement	
ACC Ltd, Gagal (Gaggal I & II),	4400
Distt Bilaspur	2870 (Clincker)
Ambuja Cement, Suli, P.O. Darlaghat,	1600
Distt Solan	
Ambuja Cement, Nalagarh, Distt Solan	1500
Asian Concretes and Cements Pvt Ltd,	1300
Bir Palsi, Distt Solan	
CCI Ltd, Rajban, Distt Sirmaur	250
Ultra Tech Cement Ltd,	2540
Bagga, Distt Solan	
UltraTech Cement Ltd, (Blending &	2000
Grinding), Bagheri Solan	

Note: Data, not readily available for cement industries on respective websites, is taken from Survey of Cement Industry & Directory

Jammu & Kashmir

Coal and Limestone were the principal mineral items reporting production in the State

H164
Crore, value of minor mineral's production were reported in

19
Reporting mines in case of MCDR of minerals in 2021-22

Mineral Resources

Jammu & Kashmir is the sole holder of country's borax, sapphire and sulphur (native) resources and possesses 33 % graphite, 23 % marble and 14% of gypsum. Coal, gypsum and limestone are the important minerals produced in the State. Coal occurs in Kupwara district; gypsum in Baramulla & Doda districts; limestone in Anantnag, Baramulla, Kathua, Leh, Poonch, Pulwama, Rajauri, Srinagar & Udhampur districts; and magnesite in Leh & Udhampur districts.

Other minerals that occur in the State are bauxite & china clay in Udhampur district; bentonite in Jammu district; borax & sulphur in Leh district; diaspore in Rajouri & Udhampur districts; graphite in Baramulla district; lignite & marble in Kupwara district; quartz & silica sand in Ana ntnag, Doda & Udhampur districts; quartzite in Anantnag district; and sapphire in Doda district (Tables - 1 and 2).

Exploration & Development

The details of exploration carried out by GSI in the State during 2021-22 are furnished in Table - 3.

Production

Coal and Limestone were the principal mineral items reporting production in the state. The value of minor minerals' production is estimated as Rs.434 crores for the year 2021-22. There were 16 reporting mines in 2021-22 in case of MCDR minerals.(Table-4).

Mineral-based Industry

Jammu & Kashmir Cements Ltd, a State Government Undertaking, operates a cement plant of 4.00 lakh tpy capacity at Khrew in Pulwama district and 1.00 lakh tpy capacity at Samba, Jammu. The Company also owns a small cement plant of 20,000 tpy capacity located at Wuyan in Srinagar district, besides two other tiny cement plants that have a total capacity of 5,20,000 tpy. Khyber Industries (P) Ltd operates a cement plant of 3,30,000 tpy in the State. The State also has a 1,800 tpy capacity Unit that manufactures ceramic and refractory products in District Kathua. A 3,000 tpy capacity calcium carbide plant is situated at District Pulwama. J.K. Minerals Ltd has a plant of 30,000 tpy of DBM and 75,000 tpy of sized magnesite at Chipprian deposit near village Panthal in Udhampur district in the State. (Table-5)

Table – 1: Reserves/Resources of Minerals as on 1.4.2020: Himachal Pradesh

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Bauxite	'000 tonnes	-	-	-	-	-	-	-	1323	182	1220	-	2725	2725
Borax	tonne	-	-	-	-	-	-	-	-	-	-	74204	74204	74204
Graphite	tonne	-	-	-	-	-	-	-	-	-	1059520	61681035	62740555	62740555
Limestone	'000 tonnes	156757	15852	12881	185490	122422	45566	58608	67456	26704	1703261	218054	2242071	2427561
Magnesite	'000 tonnes	-	-	-	-	-	-	-	-	-	150	45	4145	4145
Sapphire	kilogram	-	-	-	-	-	-	-	-	-	450	-	450	450
Sulphur (Native)	'000 tonnes	-	-	-	-	-	-	-	-	-	210	-	210	210

Figures rounded off

able – 2 : Reserve/Resource of Lignite as on 1.4.2023: Jammu & Kashmir

(In million tonnes)

District	Proved	Indicated	Inferred	Total
District	Proved	Indicated	Inferred	Total
Total/Kupwara	–	20.25	7.3	27.55

Source: Coal Directory of India, 2022-23.

Table –3 : Details of Exploration Activities in Jammu & Kashmir, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI							
Gold and associated minerals							
Kupwara	Lolab valley	1:12500	50	-	-	150	Large scale mapping (LSM) of 50 sqkm on 1:12,500 scale was carried for gold and associated mineralisation in Lashteal, Madmadou and Gagarnar areas in Lolab valley of Kupwara district, UT: J&K. The Cu concentration in 100 nos. of BRS samples varies from 5.09 ppm to 3256 ppm (Avg. 166.77 ppm), whereas in 50 nos. channel samples it varies from 9.00 ppm to 11659.0 (1392.49 ppm). The geophysical survey such as the magnetic anomaly clearly depicts the structural deformation and displacement of quartz vein in the area. The low SP anomaly near old workings indicates the possibility of sulphide mineralisation in the area. However, SP anomalies and magnetic anomaly and IP/resistivity map are not in the appreciable range and further investigation in the area is recommended.
Gemstones (sapphire, ruby etc.) and REE							
Kishtwar	West of Machail area	1:12500	51	-	-	175	An area of 51 sq. km was mapped on 1:12,500 scale and a total of 80 bed rock samples, 15 PCS, 30 heavy mineral samples, 30 stream sediment/colluvial samples and 20 PT samples were collected to evaluate the potentiality of gemstone and REE in the study area. On the basis of field observations, the existing six mines (M1-M6) along south portal and one mine (M7) on the north portal of the Neelam Khan area is recommended to restore for further mining with proper Mine Plan involving Mining Engineer, Blasting Expert, Rock Mechanical Engineer and Geologist to avoid any subsidence or mishap during mining. The detailed geological mapping (DM) on 1:500/ 1:1000 scale of Neelam Khan area may be carried out to delineate the zone of resource bearing pegmatite veins. It is also recommended to carryout grid pattern sampling of the scree/ stream sediments/ glacier moraine deposits in the SW slope/ area of the Neelam Khan along with bulk samples to establish concentration and distribution of placer gemstone deposit in the area.
Base Metal							
Reasi	Sersandu-Kherikot-Rahotkot-Darabi areas	1:12500	50	-	76.50	-	Large scale mapping of 50 sq. km area on 1:12,500 scale has been carried out along with pitting / trenching of 25 cubic m. In 59 nos. BRS samples the total REE varies from 61.6 ppm to 203.7 ppm. In 4 samples Pb ranges from 1113 ppm to 1.2%, in 4 samples Zn ranges from 2668 ppm – 5.0%. In Renkakot/Paddar area, 03 nos. channel samples collected from flaggy limestone adjoining the old workings have shown Zn values 5% to 15% and Pb values 1025 ppm to 4199 ppm. In Samatkhad area, 03 nos. channel samples collected from brecciated quartzite have analysed Pb-955 to 5577ppm. Besides, 05 nos. chip collected from the brecciated quartzite unit in the T5 Tunnel area have analysed and results are as Pb 521ppm to 11995ppm, Zn 588ppm to 7558 ppm. Keeping in view the accessibility of these different locations, scout borehole drilling of 76.50m has been carried out in T5 Tunnel area.
Tin							
Udhampur and Kathua	Bikindra and Khabbi areas	1:12500	50	-	-	-	Carried out LSM on 1:12,500 of 50 sq. Km area and following lithounits have been delineated 1) phyllite of Salkhala Formation 2) Jamotha/Kaplas Granite of Palaeozoic age, with sharp contact between Salkhala Fm. and Kaplas Granite. Presence of tourmaline have been observed in Kaplas Granite around Bikindra peak. Dolerite dike with dimension of 50 x 20 meters has been observed within Kaplas Granite near Ute De Khabi.

Table – 4 : Mineral Production in Jammu & Kashmir, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**17**		**3710260**	**19**		**1937922**	**16**	**-**	**4698403**
Coal	'000t	-	14	-	-	10	-	-	11	-
Limestone	'000t	17	959	280284	18	1173	300656	16	1156	354825
Magnesite	t	-	-	-	1*	-	-	-	-	-
Minor Minerals@	-	-	3429976	-	-	1637266	-	-	4343578	

Table - 4: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Jammu & Kashmir Cement Ltd, Khrew, Pulwama	400
Jammu & Kashmir Cement Ltd, Samba Jammu.	100
Jammu & Kashmir Cement Ltd, Wuyan Srinagar.	200
Khyber Industries (P) Ltd	330
Ceramic & Refractory Product, Kathua.	1.8
Calcium Carbide Plant, Pulwama	3
J. K. Mineral Ltd, Chipprian, Panthal, Udhampur	30 (DBM) 75 (Magnesite)
Nayyar Electrode Pvt. Ltd, Barri Brahmana	4.45

Jharkhand

Coal was the principle mineral item reporting production in the state

The other important minerals produced are Bauxite, Copper Ore and Concentra

46
Reporting mines in case of MCDR of minerals in 2021-22

Mineral Resources

Jharkhand is one of the major mineral producing States. It is the sole producer of flint stone in the country and is one of the leading producers of coal, gold, graphite, bauxite, iron ore & limestone. Uranium ore is mined and processed by Uranium Corporation of India Ltd (UCIL) for supply as fuel to the country's nuclear power reactors through six underground mines, one opencast mine, and two processing plants. Jharkhand has the sole resources of emerald mineral. It accounts for about 31% rock phosphate, 23% iron ore (haematite), 30% apatite, 14% andalusite, 20% cobalt ore, 20% copper ore, 9% each granite (dimension stone) & graphite and 5% silver ore resources of the country.

Important minerals that occur in the State are bauxite in Dumka, Gumla, Latehar, Lohardaga & Palamu districts; china clay in Dumka, Hazaribagh, Lohardaga, East & West Singhbhum, Sahebganj & Ranchi districts; coal in Bokaro, Deoghar, Dhanbad, Giridih, Godda, Hazaribagh, Palamau, Pakur & Ranchi districts; copper in Hazaribagh & East Singhbhum districts; dolomite in Garhwa & Palamu districts; felspar in Deoghar, Dhanbad, Dumka, Giridih, Hazaribagh, Jamtara, Koderma, Latehar, Palamu & Ranchi districts; fireclay in Dhanbad, Dumka, Giridih, Godda, Hazaribagh, Latehar, Palamu, Ranchi & West Singhbhum districts; gold in East Singhbhum district; graphite in Palamu district; iron ore (haematite) in West Singhbhum district; iron ore (magnetite) in Gumla, Hazaribagh, Latehar, Palamu & East Singhbhum districts; kyanite in Saraikela-Kharsawan & West Singhbhum districts; limestone in Bokaro, Dhanbad, Garhwa, Giridih, Hazaribagh, Palamu, Ranchi, East & West Singhbhum districts; manganese ore in East & West Singhbhum districts; mica in Giridih and

Koderma districts; ochre in West Singhbhum district; dunite/pyroxenite in East Singhbhum district; quartz/ silica sand in Deoghar, Dhanbad, Dumka, Giridih, Godda, Hazaribagh, Jamtara, Koderma, Latehar, Palamu, Ranchi, Sahebganj, Saraikela-Kharsawan & West Singhbhum districts; and quartzite in East & West Singhbhum districts.

Other minerals that occur in the State are andalusite and rock phosphate in Palamu district; apatite, chromite, cobalt, nickel, gold & silver in East Singhbhum district; asbestos in East & West Singhbhum districts; barytes in Palamu & East Singhbhum districts; bentonite in Pakur & Sahebganj districts; garnet in Hazaribagh district; granite in Deogarh, Dhanbad, Dumka, Giridih, Godda, Gumla, Hazaribagh, Koderma, Lohardaga, Palamu, Ranchi & East Singhbhum districts; sillimanite in Hazaribagh district; talc/steatite/ soapstone in Giridih, Koderma, Palamu, East & West Singhbhum districts; pyrophyllite in Saraikela-Kharaswan district; titanium minerals in Ranchi and East Singhbhum districts; and vermiculite in Giridih & Hazaribagh districts (Table - 1). The reserve/resources of coal and the various coalfields located in Jharkhand are furnished in Table - 2.

Exploration & Development

The details of exploration activities conducted by GSI for base metals, graphite, vanadium and associate d minera ls , t ungsten, rare earths elements, rare metals, lithium during the year 2021-22 are furnished in Table - 3.

Production

Coal was the principal mineral item for which production was reported in the State. The other important minerals produced are Bauxite, Copper Ore and Concentrate, Iron Ore, Limestone, etc. The value of minor minerals' production was estimated as 40 crore for the year 2021-22. There were 44 reporting mines in 2021-22 in case of MCDR of minerals (Table – 4).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the principal large and medium-scale mineral-based industries in the organised sector in the State are furnished in Table - 5.

Table – 1: Reserves/Resources of Minerals as on 1.4.2020: Himachal Pradesh

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Andalusite	'000 tonnes	-	-	-	-	-	-	-	-	-	-	11800	11800	11800
Apatite	tonne	-	-	-	-	-	-	-	2110000	1620000	3540000	-	7270000	7270000
Asbestos	tonne	-	-	-	-	-	3871	18309	2885	5769	124059	-	154893	154893
Bauxite	'000 tonnes	29524	731	9717	39972	25895	7647	14969	25962	63224	70527	41050	249272	289244
Chromite	'000 tonnes	-	-	-	-	-	-	-	15	98	623	-	736	736
Cobalt	Million tonnes	-	-	-	-	-	-	-	-	2	-	7	9	9
Copper														
Ore	'000 tonnes	6150	-	3000	9150	10445	2804	3988	87330	99890	37855	-	242313	251463
Metal	'000 tonnes	72.08	-	35.37	107.45	115.59	29.98	45.9	1002.92	1023.12	454.7	-	2672.21	2779.66
Emerald	Kilogram	-	-	-	-	-	-	-	-	-	-	55869	55869	55869
Garnet	tonne	-	-	-	-	-	-	88303	-	-	21768	-	110071	110071
Gold														
Ore (Primary)	tonne	-	-	-	-	-	-	9206	-	4710966	4579355	767000	10076527	10076527
Metal (Primary)	tonne	-	-	-	-	-	-	0.08	-	2.24	12.49	0.62	15.43	15.43
Graphite	tonne	2091442	-		2604079	1341224	491883	3020107	60607	5167431	6639828	681208	17402288	20006367
Iron Ore														
(Heamatite)	'000 tonnes	388078	16760		534677	324634	902980	814308	101700	122673	617586	1291588	4175469	4710146
Iron Ore														
(Magnetite)	'000 tonnes	-	-	-	-	-	518	1986	411	3948	3722	82	10667	10667
Kyanite	tonne	-	331193	-	331193	1017105	920088	523589	-	1754900	3727685	-	7943367	8274560
Limestone	'000 tonnes	6780	3512	395	10687	74071	50565	11535	91922	13220	356962	11803	610078	620765
Manganese Ore	'000 tonnes	132	433	493	1059	1394	1046	5198	-	1395	4658	-	13691	14749
Nickel	Million tonnes	-	-	-	-	-	-	-	-	2	7	-	9	9
Potash	Million tonnes	-	-	-	-	-	-	-	-	-	152	-	152	152
Rare-earth														
Elements	tonne	-	-	-	-	-	-	-	-	-	4	-	4	4
Rock														

Table-1 (Concld.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Phosphate	tonne	-	-	-	-	-	-	-	-	-	107370000	-	107370000	107370000
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	83000	-	83000	83000
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	-	23840000	-	23840000	23840000
Metal	tonne	-	-	-	-	-	-	-	-	-	5.22	-	5.22	5.22
Titanium	tonne	-	-	-	-	-	-	-	-	3630000	20635000	2338767	26603767	26603767
Vermiculite	tonne	-	-	-	-	-	-	-	-	-	30048	-	30048	30048

Figures rounded off.

Table – 2 : Reserves/Resources of Coal as on 1.4.2023: Jharkhand

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Coalfield	Proved	Indicated	Inferred	Total
Total	55749	26994	5095	87838
Raniganj	1594	445	-	2039
Jharia	17735	1798	-	19533
East Bokaro	3977	3553	762	8292
West Bokaro	3923	1279	17	5218
Ramgarh	937	912	58	1906
North Karanpura	11774	6173	1865	19812
South Karanpura	6045	1267	1083	8394
Aurangabad	352	2142	503	2997
Hutar	191	27	32	250
Daltonganj	84	60	-	144
Deogarh	326	74	-	400
Rajmahal	8811	9267	774	18852

Source: Coal Directory of India, 2022-23.

Table –3 : Details of Exploration Activities in Jharkhand, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **Base Metal**							
Palamau	Sokra-Chando area	-	-	-	-	-	Hornblende biotite granite gneisses, garnet biotite gneiss, foliated alkali-feldspar granites and its coarse-grained variety were the major rock types found in the area of investigation. Exposures of amphibolite, calcsilicate, and ferrugenous quartzite were found at places in small patches. Small occurrences of Kyanite-magntite schist, dolomite and graphite along with quartz veins were found in the area. Rocks of the area were seen mylonitised at several places inferring there by the presence of shear zone. Garnet biotite gneiss was found to be the most deformed rock overlained by hornblende biotite granite gneiss. Calcsilicate/ Ferrugenous Quartzite/Amphibolite have wavy erosional contact with biotite hornblende granite gneiss. Foliated alkali feldspar granite was seen to have intrusive contact. Kyanite-Magnetite Schist, Dolomite and graphite with quartz veins were seen associated along shear planes and have sheared contact with other rocks. Mineralisation was found in the form of en-echelon hydrothermal veins mostly associated with calc-silicate (magnetite mineralisation) and quartz veins (graphite mineralisation). It is mostly associated with NE shear planes and associated with hydrothermal fluids. Abandoned small magnetites and dolomites quarries are found in the area were exhausted at local level for use in iron industries
REE, Rare Metals and associated strategic minerals							
Palamu	Sildag-Chhatarpur-Tenpa area	-	-	-	-	-	The study area formed a part of CGGC and its regional trend varied from NE-SW to NW-SE. The major lithounits exposed in the study area were migmatites, biotite granite gneiss (± garnet), granite gneiss, porphyritic granite, pink granite, grey granite, pegmatites, amphibolites, dolerite and ultramafics. Migmatites were well exposed in north-west and south-west part of the study area. The area like Sildag, Rudwa, etc. has well developed exposures of migmatites. In the NW part of the study towards south of Village Liwar, a bouldery outcrop of ultramafics has been mapped. This ultramafic body showed NE-SW trend that laid within the migmatites. Grey granite was exposed near Village Kangalidih. In these granites sulphides were observed which occurred as fracture filling and disseminations. Pegmatite vein of dimension (270 x 25) m was also noted in this lithounit. The area suffered four major phases of deformation. Gneissic foliation represents D2 deformation which varied from NE-SW to NW-SE due to the swerving of S2 planes and that which got preserved mostly in granite gneiss and biotite gneiss. During the present study, no significant mineralisation was observed. However, near Village Manea pyrite and chalcopyrite grains were seen alligned along the gneissic plane of the biotite gneiss. Apart from this molybdenite was also observed in amphibolite near Village Liwar. The analytical result of 52 BRS, 20 PTS, 52 stream sediment samples and 26 panned concentrate samples were received. In bedrock samples, maximum concentration of 2,450 ppm of SREE was recorded east of Village Basdihar in migmatites rock. Whereas in panned concentrate sample, maximum value up-to 9,000 ppm is obtained south east of Village Sildag in migmatite terrain
Hazaribagh	Darudih, Jharpo and Banhe areas	-	-	-	-	-	The area exposed rocks of Unclassified Metamorphics, represented by calc-silicate, calc-amphibolite, gneissose amphibolite and amphibolite; and granite gneiss suites of CGC, represented by granite gneiss, migmatite-gneiss, garnet bearing granite gneiss, hornblende gneiss and quartzo-feldspathic gneiss. These rocks were seen invariably intruded by younger intrusives such as pegmatite, aplite and quartz vein. The area was seen with subdued topography and largely peneplain supporting cultivation. The exposures were limited along the major river sections. From NGCM data and field conditions it appears that the REE/RM mineralisation is of secondary origin and is concentrated within the weathered profile. The orientation sampling carried out at seven locations indicated that the 'B' horizon

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							and -120 mesh fraction were more accommodative for REE concentration than the 'C' horizon. In the most promising site at SW part of the study area, a systematic grid-based colluvial sampling was carried out at 500m interval covering 12 sq. km area. In this part a number of weathered pegmatite bodies were present. The area also accommodated many linear pegmatite bodies along and across the Siwane nadi. The analytical results of 30 BRS samples showed that the tREE values in pegmatite ranged from 40 ppm to 1,124 ppm, in migmatite gneiss from 77 ppm to 999 ppm and rest other showed very low values. The tREE values for 44 colluvial samples ranged from 74 ppm to 1,069 ppm and in stream sediment samples collected from Bhandarbar and Hatwe area in the south it ranged from 1,546 ppm to 1,854 ppm. The REE-bearing mineral phases were identified included xenotime, monazite, zircon and a few apatite. A few REE-bearing mineral phases, such as monazite, zircon, allanite and apatite were observed in thin sections of hornblende gneiss, calc silicate, gneissose amphibolite and migmatite gneiss.
Palamu	Chhotanagpur	-	-	-	-	-	The CGGC within the study area containd various gneissic components, different granitoid components along with mappable units of Unclassified Metamorphics. The younger quartz veins, pegmatite veins etc. intruded into CGGC were documented, and these were formed during different tectono-magmatic events/ experiences by the CGGC during its evolution. The gneissic rock included migmatite gneiss along with gneissose granite, gneissose biotite- granite and gneissose hornblende-biotite-granite. The granitoid rock has various components like granite, granodiorite quartz- syenite. The unclassified metamorphic included the enclaves of calc-silicate and hornblende-schist. Evidences of three phases of deformation were observed in various structural fabrics of the mapped area. For REE mineralisation various intrusive like granite and different generation of pegmatite veins were targeted. The pegmatite veins were differentiated based on presence of mica and magnetite. The magnetite-bearing pegmatites were observed mostly at the north-western part of the study area around Kusumahi and Baghmar villages, were quite thick (maximum up to 50 m) and had length (up to 1.5 km). While the mica-bearing pegmatites were found mostly in the central and southern part of the study area, south of Gobardha and Samda villages which were of relatively smaller dimension. The part analytical results received till date of the BRS and PTS samples collected from these pegmatites and younger granitoid intrusion did not show any encouraging values of total REE (SREE). The maximum SREE value for the BRS sample was up to 438 ppm (in the gneissose granite) and for the PTS samples, the maximum SREE value was up to 584 ppm (in the pegmatite vein). In the stream sediment samples only one sample showed SREE value of 1232 ppm. All these values of SREE in the available analytical results of various sample media did not show any anomalous values worthy of any economic significance.
Palamu	Bangasi – Chhotahasa area	-	-	-	-	-	Large-scale mapping revealed that study area is dominated by felsic orthogneisses which contains enclaves of metasedimentary, Felsic granulites, Anorthosite, sillimanite-garnet-schist, mafic rocks and younger intrusive (Pegmatite, syenite and quartz veins). The lithology of the study area has been classified into three major subdivisions viz. (a) Unclassified Metamorphics (b) Chhotanagpur Granite Gneiss Complex and (c) Younger Intrusives; The gneissic component of CGGC encompasses migmatite gneiss, quartzo feldspathic gneiss and hornblende-biotite gneisses. The trend of gneissic foliation of the granitic gneiss varies from WNW-ESE to NE-SW with a moderate to steeply dip towards south. Two different phases of pegmatite unit have been marked based on their disposition and trend pattern. The pegmatite veins were seen mostly occurring as concordant and discordant veins and were sporadically present in the northern part of the study area only. The NE-SW trending Pegmatite-I unit was intruded along S3 foliation.

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							Similarly, the NW-SE trendingPegmatite-II unit was obesrved to be rich in potash feldspar. The concentration of allanite was observed in the central part of unit around Sukri PF. Around Village Paparwaghat magnetite was seen associated with pegmatite unit. Syenite unit was exposed in the southern part of mapped area whereas the northern part was exposed with pegmatite unit. The bedrock samples were concentrated from the younger intrusive only. In the west of Chothasa, an excavated weathered outcrop was exposed where quartz veins and syenite bodies have intruded into the amphibolite unit. The granites were found to be quite variable in character ranging from fine-grained to porphyritic varieties containing feldspar phenocrysts of 1mm to 3cm max. size. The colour of granites varied from greyish to buff white. Two types of granite were observed around Talapara and south of Village Baranw. Mafic intrusive in the form of gabbro/diorite were seen intruded in the gneissic country rock. The study area suffered three phases of deformation. Wall rock alteration in the form of epidotisation, silicification & ferruginisation and kaolinisation was also recorded in the study area. Analytical result of Rb value ranged from 2.85 ppm to 1,236 ppm. The total REE content in BRS samples ranged from 8.05ppm to 623.90 ppm. Analytical results of Rb in pegmatite PTS samples ranged from 6.30 ppm to 1,567 ppm. The total REE content in PTS samples varied from 6.30 ppm to 869 ppm.
Lithium							
Koderma	Pihra area	1:12500	100	-	-	340	An area of 100 sq. km was mapped on 1:12,500 scale and collected 100 bedrock samples, 100 pitting and trenching samples, 100 soil samples for chemical analysis were collected and 15 petrographic studies and 25 heavy mineral studies to assess the potentiality of Rare metal and REE in the study area were undertaken. The area of investigation lies in the southernmost part of the Bihar Mica Belt (BMB). Major part of the study area was covered by the Metamorphic of Bihar Mica Belt whereas the rocks of CGGC were exposed in SE and NE part of toposheet. Central and NW parts of the study area were covered by Quaternary alluvium of Pleistocene to Holocene Age. Mica schist, Quartz mica schist and quartzite form the part of Bihar Mica Belt. Pegmatite, quartz veins and granite were the intrusive bodies. The BMB appears to be a nearly E-W trending anticlinorium with several subsidiary folds. The granite was seen mostly intruded into the cores of the larger anticlines and has parental association with pegmatite which they resemble in composition. In the studied area, numerous pegmatites vein with variable dimensions were emplaced along the joints, fractures, foliation, bedding planes, etc. The pegmatites in the study area of Bihar Mica Belt were oriented along N-S to NW-SE and NE-SW to E-W. These pegmatites were emplaced within all the rock types of the area. The pegmatites appeared very coarse-grained with quartz, feldspar (both orthoclase and plagioclase), muscovite as major constituents with minor amount of biotite, garnet and tourmaline at places. These pegmatites also contained beryl, columbite-tantalite and ilmenite, as accessory. Megascopically, a few of these pegmatites were of zoned type where a well-developed quartz core was found in the middle portion of the lens and was seen surrounded by intergrowth zone of admixture of quartz and feldspar (both k-feldspar and plagioclase).
Tungsten							
Giridih	Kakakudar-Gaganpur area	-	-	-	-	-	Geologically, rocks of the Unclassified Metamorphics (represented by biotite schists, quartzites, tremolite-actinolite-talc schists, dolomitic marble, amphibolite/ hornblende schist and very small pockets of granulitic calc-silicate rocks), Chhotanagpur Granite Gneissic Complex (consisting enclaves of older metamorphics in the form of meta-sedimentary and meta-volcanic rocks within gneissic component) and later intrusive of dolerite, pegmatite and quartz veins form the chief litho-units of the area. Old workings (OW) for copper, lead, zinc etc. at Gaganpur, Jhalakdiha, Kakakuddar and Chandio

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							villages (east to west respectively) occurred within the granite and/ or granite with mica-schist Scheelite specks associated with similar rock types (talc-muscovite schist, tremolite-muscovite schist, impure carbonate rock) in Chandio, Kakakuddar OW areas which were observed under UV light. Mineralisation can be correlated to skarn type in the area wherein previous sedimentary units were intruded by late granite fluxes resulting in contact metasomatism and subsequent formation of skarn minerals. The mineralisation can be inferred to be litho-controlled as primary commodity for investigation, tungsten was observed to be associated with talc-tremolite schist with muscovite, tremolite schist in close vicinity of dolomitic marble etc. From the available chemical analytical data significant values of copper (3,934mg/kg), Zn (2,587mg/kg), Mo (294.31ppm) have been observed near Kakakuddar OW. An elevated Pb value of 5,961mg/kg was analysed from Trench-1 close to Kakakuddar OW. Panned stream sediment samples collected close to Kakakuddar OW gave Th value of 1,229.45 ppm. Pb value amounting to 3,752 mg/kg and Ag value of 3.22 ppm have been reported near Chandio OW besides Au value as high as 0.18 ppm from the soil sample which has been further corroborated by value of 0.80 ppm of Au from Trench-5 sample. Au value of 0.43 ppm has been analysed from tremolite schist towards S of Chandio OW. The lab study is in progress
Graphite, Vanadium and associated minerals							
Palamu and Latehar	Nawadih-Gurha area	-	-	-	-	-	The area can be broadly classified into three subdivisions viz. (i) The Unclassified enclave suite (Unclassified metamorphic) consisting of quartzite, calc-silicates, amphibolite, graphitic quartzite, ultramafite, (ii) granite gneiss, migmatite gneiss and granitoids of CGC and (iii) younger intrusive consisting of pink and grey granite, pegmatite, quartz, and quartzo-feldspathic veins. The dominant foliation plane in the study area was NW-SE. The area had experienced upper amphibolite to granulite facies of metamorphism During the investigation, a total of 15 bands of graphite in form of linear continuous and discontinuous bodies were delineated. The strike length of the band varied from 332m to 1.07km and the width varied from 84m to 375m. The host rocks for graphite mineralisation in the area were granite gneiss, quartzite and granulite. The analytical result of 102 BRS and 100 PTS yielded 13.46% average fixed carbon. About 79 BRS yielded more than 10% FC. So far 61 BRS for vanadium were analysed and showed encouraging concentrations in the range of 73 to 4859 ppm and the average was 782 ppm. Seventeen samples out of 61 yielded more than 1,000 ppm of vanadium which is very close to the present cut- off value.
Palamu	Adhmaniya block	-	-	-	-	-	The area exposed rocks of i) Unclassified Metamorphics, ii) Chhotanagpur Gneissic Complex, and iii) acid and basic intrusive that were intruded in different rock types. The host rocks for mineralisation in the area were graphite-bearing sillimanite schist and granite gneiss. The graphite mineralisation was in the form of lenticular bands disposed of in an enchelon pattern. Two graphite schist bands trending in WNW-ESE were delineated. The southern band was 700 m in length with a moderate dip southwesterly. The northern band was bifurcated into two branches having an approximate strike length of 200m and 650m dipping moderately towards the southwest. The ground geophysical survey (SP) of 29 LKM was carried out in this block. Two anomalous zones were delineated on the SP map. Zone-I in the southern part of the block was approx. 700m in strike direction whereas Zone-II was swerving and branched into two parts. Graphite mineralisation was picked up well by SP anomaly. Out of the total 13 boreholes, boreholes JHPA-01, JHPA-02, JHPA-03 and JHPA-04, and JHPA-05 were drilled in the southern band of the area. Proximate analysis of 55 BRS and 63 core samples were received. Fixed carbon up to 25.23 % and vanadium up to 1,359 ppm were obtained from Bedrock samples (n=55). In Borehole JHPA-01, it was weighted average of 9.57%, FC was for 63m sample length with a maximum FC up to

Table-3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							17.28%. In Borehole JHPA-02, it was weighted average of 9% FC for 30m sample length with a maximum FC up to 15.1%. In Borehole JHPA-11, three enriched zones of vanadium were intersected. Zone-I, Zone-II, and Zone-III were with a weighted average of 887ppm (17 m sample length), 833 ppm (27 m sample length) and 660 ppm (17 m sample length) respectively. In Borehole JHPA-02, it was 28m sample length with a weighted average of 906 ppm of vanadium while in Borehole JHPA-13, a zone of 18m sample length with a weighted average of 645ppm was intersected.

Table – 4 : Mineral Production in Jharkhand, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**54**		**32278813**	**46**		**30845510**	**44**		**58300177**
Coal	'000t	-	131763	-	-	119295	-	-	130105	-
Natural Gas (ut.) +	m c m	-	5	-	-	2	-	-	4	-
Bauxite	t	20	1418793	1400830	19	1497472	1607332	19	1808725	2334128
Copper Ore	t	-	288477	-	-	41772	-	-	25834	-
Copper Conc.	t	2	7660	604135	2	1208	23707	2	-	-
Gold Ore	t	-	4807	-	-	2859	-	-	3682	-
Gold	kg	1	18	64689	1	11	53310	1	12	56268
Iron Ore	'000t	21	25015	29411760	17	21434	28520399	16	24728	55467888
Manganese Ore	t	2	4785	36126	-	-	-	-	-	-
Graphite (r.o.m.)	t	3	21202	20661	3	5962	6069	1	21	23
Kyanite	t	-	-	-	-	-	-	1	2899	5417
Limestone	'000t	5	785	339164	4	324	233245	4	72	35005
Minor Minerals @		-	-	401448	-	-	401448	-	-	401448

Table - 4: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Alumina	
Hindalco Industries Ltd, Muri.	450 KTPA
Asbestos Products	
Hyderabad Industries Ltd, Jasidih, Distt. Deogarh.	NA
Cement	
ACC Ltd, Chaibasa, Distt. Singhbhum.	900
ACC Ltd, Sindri, Distt. Dhanbad (G).	2350
Bokaro Cement Plant (formerly JV of Jaypee Cement & SAIL), Bokaro (G).	2100

Table- 4 (Concld.)

Industry/plant	Capacity ('000 tpy)
Lafarge, Jojobera, Distt. Singhbhum.	4600
Burnpur Cement Patratu Ramgarh	300
Ceramic	
Maithan Ceramics Pvt. Ltd, Dhanbad.	80
Chemicals	
Bihar Caustic & Chemicals Ltd,	92.75
Garhwa Road, Distt. Palamu.	(caustic soda lye)
Copper Smelter	
HCL, ICC, Ghatsila,	19 (refined copper)
Distt. Singhbhum (East).	20.5 (copper smelting)
	18.5 (copper cathode)
	84 (fabricated wire bar)
	54(H_2SO_4), 390 t ($NiSO_4$)
	480 kg ($CuSO_4$)
	14.6 kg (selenium)
	9868 kg (Ag), 698 kg (Au)
Foundry	
Grind chem, Adityapur	15 (Foundry fluxes)
Jharkhand Grid chem Pvt. Ltd,	25 (Foundry fluxes)
Adityapur, Gamharia	
Iron & Steel	
Bokaro Steel Plant, Bokaro	6900 (sinter)
	4585 (pig iron)
	4500 (Crude/liquid steel)
	35.5 (H_2SO_4)
	27.2 (ammonium sulphate)
Tata Steel Ltd, Jamshedpur	6000 (pellets)
	8000 (sinter)
	10550 (Pig Iron)
	13000 (Crude/liquid steel)
Usha Martin Ltd, Jamshedpur.	500 (Sponge iron)
	1200 (pellets)
	715 (sinter)
	1000 (Liquid/ crude Steel)
Pellet	
Orissa Manganese & Minerals Ltd,	1600 (pellets)
Kandra, Sarai Kharsawan.	
Pig Iron	
Atibir Industries Pvt. Ltd,	600
Bhorandiha, Giridih	120 (Sponge iron)
	680 (sinter)
Elcctrosteel Steels Ltd, Siyal Jori,	1500
Chandan Kiyari	
Sponge Iron	
Anindita Steel Ltd,	120
Senegarha Rabodh	
Ashirwad Steel & Industries Ltd, Gamharia,	72
Jamshedpur.	
Bihar Sponge Iron Ltd, Chandil,	210
Distt. Saraikela-Kharsawan.	
Brahmaputra Metallics Limited,	105

Table- 4 (Concld.)

Industry/plant	Capacity ('000 tpy)
Kamta, Gola, Distt. Ramgarh.	148.5 (Semi-finished Steel)
Balmukund Sponge & Iron Pvt. Ltd,	63
Majhaladih, Gadisrirampur	75 (Crude/liquid steel)
	37 ((Pig Iron)
Chintpurni Steel Pvt. Ltd,	90
Indra, Zarba	100 (Semi-finished steel)
Jai Durga Iron Pvt. Ltd, (I &II)	(36+66) =96
Jhumari Tellaiya, Distt. Koderma	
Jai Balaji Industrial Engg. Ltd, Barajamda	120
Rungta Mines Limit Chaliyama Rajnagar	620.4
Saluja Steels & Power Pvt. Ltd, Mahtodih.	60
Satpuria Alloys Pvt. Ltd, Manjhladih	60
Shivam Iron & Steel Co. Ltd,	90
Bandhi, Chandwara	
Zoom Vallabh Steels Ltd, Dugdha,	120
Distt. Saraikela-Kharsawan.	
Ferro-alloys	
Astha Ferrotech Pvt. Ltd,	201
Adityapur, Tatanagar	
Anjaney Ferro Alloys Ltd, Mahijam	12
Bihar Foundary & Ccasting Ltd, Marar	36
Dayal Ferroalloy Ramgarh cantt	10
Gautam Ferro Alloys Ltd,	5.5
Shivam Iron & Steel	37.4 (Si-Mn)
Co. Ltd, Jambad, Udnabad	
Tin Plates	
The Tin Plate Co. of India Ltd,	379
Jamshedpur.	
Glass	
IAG Co. Ltd, Bhandainagar.	360 TPD
Refractory	
SAIL Refractory Unit (formerly Bharat	7.5
Refractories Ltd), Ranchi Road, Ramgarh.	
SAIL Refractory Unit (formerly Bharat	42
Refractories Ltd), IFICO, Ramgarh.	
SAIL Refractory Unit (formerly Bharat	26
Refractories Ltd), Bhandaridah,	
Distt. Bokaro.	
Jharia Firebricks Pottery Works (P) Ltd,	20
Dhansar, Distt. Dhanbad.	
Mineral Trade Corporation	6.6
Khaparsai, Chaibasa	
Raj Refractory (P) Ltd,	6
Hardag, Distt. Ranchi.	
G; Grinding Unit	

Note: *Data, for Cement Industries on respective websites, is taken from Survey of Cement Industry & Directory.*

Karnataka

Gold ore, Iron ore, Manganese ore, Limestone, and Magnesite are the important minerals produced in Karnataka State	H1,916 Crore, value of minor mineral's production was estimated for the year 2021-22	141 Reporting mines in case of MCDR of minerals were reported in 2021-22

Mineral Resources

Karnataka has the distinctio n of b e ing the principal gold producing State in the country. The State is the sole producer of felsite and one of the leading producer of iron ore, chromite, dolomite, dunite, kyanite and shale. Karnataka hosts the country's 79% vanadium ore, 72% iron ore (magnetite), 65% corundum, 42% tungsten ore, 36% asbestos, 27% limestone, 21% gold ore (primary), 20% granite (dimension stone), 20% manganese ore, 17% dunite, 13% kyanite and 10% PGM resources.

The important mineral-occurrence found in the State are bauxite in Belagavi, Chikkamagaluru, Uttara & Dakshina Kannada and Udupi districts; china clay in Bengaluru, Belagavi, Ballari, Bidar, Chikkamagaluru, Dharwad, Gadag, Hassan, Haveri, Kolar, Uttara & Dakshina Kannada, Shivamogga & Tumakuru districts; chromite in Chikkamagaluru, Hassan & Mysuru districts; dolomite in Bagalkot, Belagavi, Vijayapura, Chitradurga, Mysuru, Uttara Kannada and Tumakuru districts; dunite/ pyroxenite in Chikkamagaluru, Hassan and Mysuru districts; felspar in Bengaluru, Belagavi, Chitradurga & Hassan districts; fireclay in Bengaluru, Chitradurga, Dharwad, Hassan, Kolar, Shivamogga & Tumakuru districts; gold in Chitradurga, Dharwad, Gadag, Kalaburagi, Hassan, Haveri, Kolar, Raichur & Tumakuru districts; iron ore (haematite) in Bagalkot, Ballari, Vijayapura, Chikkamagaluru, Chitradurga, Dharwad, Gadag, Uttara Kannada, Shivamogga & Tumakuru districts; iron ore (magnetite) in Chikkamagaluru, Hassan, Uttara & Dakshina Kannada and Shivamogga districts; kyanite in Chikkamagaluru, Chitradurga, Coorg, Mandya, Mysuru, Shivamogga & Dakshina Kannada districts; limestone in Bagalkot, Belagavi, Ballari, Vijayapura, Chikkamagaluru, Chitradurga, Davangere, Gadag, Kalaburagi, Hassan, Mysuru, Uttara & Dakshina Kannada, Shivamogga, Tumakuru & Udupi districts; magnesite in Coorg, Mandya & Mysuru districts; manganese ore in Belaga vi , Ballar i , Chikkamagaluru, Chitradurga, Davangere, Uttara Kannada, Shivamogga & Tumakuru districts; ochre in Ballari and Bidar districts; quartz/silica sand in Bagalkot, Bengaluru, Belagavi, Ballari, Chikka magaluru, Chitr ad ur ga, Dava nger e, Dharwad, Gadag, Kalaburagi, Hassan, Haveri, Kolar, Koppal, Mandya, Mysuru, Uttara & Da kshina Kanna da, Raichur, Shivamo gga, Tumakuru & Udupi districts; Quartzite in Belagavi district; & talc/steatite/soapstone in Ballari, Chikkamagaluru, Chitradurga, Hassan, Mandya, Mysuru, Raichur & Tumakuru districts.

Other minerals that occur in the State are asbestos in Chikkamagaluru, Hassan, Mandya, Mysuru and Shivamogga districts; barytes & pyrite in Chitradurga district; calcite in Belagavi, Vijayapura & Mysuru districts; copper in Chikkamagaluru, Chitradurga, Kalaburagi, Hassan, Uttara Kannada, Raichur & Shivamogga districts; corundum in Bengaluru, Ballari, Chitradurga, kodagu, Hassan, Mandya, Mysuru & Tumakuru districts; fuller's earth in Belagavi & Kalaburagi districts; granite in Bagalkot, Bengaluru, Bellari, Vijayapura, Chamrajanagar, Chikkamagaluru, Chitradurga, kodagu, Dharwad, Gadag, Kalaburagi, Hassan, Kolar, Koppal, Mandya, Mysuru, Uttara & Dakshina Kannada, Raichur, Tumakuru & Udupi districts; graphite in Kolar & Mysuru districts; gypsum in Kalaburagi district; molybdenum in Kolar & Raichur districts; nickel in Uttara Kannada district; Platinum Group of Metals in Davangere district; sillimanite in Hassan, Mysuru & Dakshina Kannada districts; silver in Chitradurga & Raichur districts; titanium minerals in Hassan, Uttara Kannada & Shivamogga districts; tungsten in Gadag, Kolar & Raichur districts; vanadium in Hassan, Uttara Kannada & Shivamogga districts; and vermiculite in Hassan, Mandya & Mysuru distri cts (Table - 1).

Exploration & Development

T he details of explo ra t io n activities conducted by GSI for molybdenum, gold, base metal, platinum group of elements, nickel, rare earth elements & rare metals and cobalt during 2021-22 are furnished in Table - 2.

Production

Gold ore and bullion (metal), Iron Ore, Manganese ore, Limestone, and Magnesite are the important minerals produced in Karnataka State. The value of minor minerals' production is estimated as 2216 crores for the year 2021-22. There were

132 reporting mines in 2021-22 in case of MCDR of minerals.(Table- 3) .

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the important mineral-based industries in organised sector in the State are given in Table - 4.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020: Karnataka

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Asbestos	tonne	-	-	-	-	-	-	-	-	2441037	5841420	-	8282457	8282457
Bauxite	'000 tonnes	126	194	4887	5207	2468	864	88	82	2220	35520	-	41242	46449
Chromite	'000 tonnes	176	-	323	499	474	378	54	-	20	392	-	1317	1817
Copper														
Ore	'000 tonnes	-	-	-	-	867	1301	3114	1750	6833	27634	-	41499	41499
Metal	'000 tonnes	-	-	-	-	-	-	15.28	22	65.77	142.81	-	245.86	245.86
Gold														
Ore														
(Primary)	tonne	17050000	3420000	-	20470000	2013000	1964000	174000	4304968	46495718	21773820	5813000	82538506	103008506
Metal														
(Primary)	tonne	74.02	13.44	-	87.46	5.06	5.12	0.64	14.13	44.17	48.91	45.68	165.71	251.17
Graphite	tonne	-	-	-	-	203673	30600	48821	-	41605	667933	-	992632	992632
Iron Ore														
(Haematite)	'000 tonnes	897256	39779	106177	1043212	330334	46621	84816	592180	62882	504234	171714	1792781	2835992
Iron Ore														
(Magnetite)	'000 tonnes	133	185	-	318	120131	-	18375	1498957	479372	5345018	340000	7801853	7802171
Kyanite	tonne	181600	-	-	181600	230660	15930	119368	386247	1610502	10628753	-	12991460	13173060
Limestone	'000 tonnes	1766001	2013	503208	2271221	584131	522239	778646	1776165	15091800	35135248	11008	53899236	56170457
Magnesite	'000 tonnes	997	30	-	1027	802	247	270	88	10	2834	264	4516	5543
Manganese														
Ore	'000 tonnes	15363	-	101	15464	14723	2373	9604	18700	7306	55471	329	108508	123972
Molybdenum														
ore	tonne	-	-	-	-	-	-	-	-	-	1320900	-	1320900	1320900
Contained MoS2 tonne	-	-	-	-	-	-	-	-	-	1718.7	-	1718.7	1718.7	
Nickel ore	Million tonne	-	-	-	-	-	-	-	-	-	0.23	-	0.23	0.23
Pt.Group of														
Metals	tonne	-	-	-	-	-	-	-	-	-	-	1.5	1.5	1.5
Pyrite	'000 tonnes	-	-	-	-	-	-	-	-	-	3000	-	3000	3000

Table-1 (Concld.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Rare Earth														
Elements	tonne	-	-	-	-	-	-	-	-	-	3350	384	3734	3734
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	982725	-	982725	982725
Silver														
Ore	tonne	17480000	4640000	-	22120000	-	-	69462	-	1490000	2254150	-	3813612	25933612
Metal	tonne	4.43	1	-	5.43	-	-	0.48	-	0.39	3.42	-	4.29	9.72
Titanium	tonne	-	-	-	-	-	-	-	-	-	13862094	-	13862094	13862094
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	15361152	11805499	172921	9338246	36677818	36677818
Contained Wo3tonne	-	-	-	-	-	-	-	2915	1775	142	1403	6235	6235	
Vanadium														

Table –2 : Details of Exploration Activities in Karnataka, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **Gold**							
Haveri	Sidlapur Block, Singgaon Taluk	1:1000	42.51	8	671.20	-	An area of 2 sq. km was mapped in detail on 1:1,000 scale along with 186 cu m. trenching and 671.20 m of drilling. Apart from this, Geophysical Survey involving IP, Resistivity and Magnetic methods of 42.5 l km has been also carried out. The DM Block comprises a long BIF band engulfed within thick pile of greywacke and argillite of Ranebennur Formation of Chitradurga Group. The mapping has brought out presence of two major and three minor banded ferruginous quartzite (BFQ) units within a meta-greywacke/ argillite. The general trend of the bedding (S0) are N10°W to S10°E dipping gently towards east. Two sets of cleavages are observed in argillite/greywacke. Mesoscopic folds of S-asymmetric nature have been observed at many places with 10º to 35º plunge towards north. The bands are characterized by intense limonitisation, silicification, ferruginisation and serecitisation and often noticed with disseminated cubic pyrites and stringers of sulphides. Surface sampling includes soil, bedrock and trench. While the soil sampling is carried out in 200 m x 200 m grid pattern, trench and bedrock sampling are carried out along the profile lines laid at 100 m interval across the BIFs. Au values obtained from the bedrock, trench and soil samples vary from 26 ppb to 952 ppb, 26 ppb to 866 ppb and 31ppb to 302 ppb respectively. The Total Field Magnetic anomaly contour map shows high intensity Magnetic signatures along two prominent trends, one is NNW–SSE to NS trending local geological trend. The detailed magnetic survey, IP and Resistivity survey by gradient array has revealed one prominent anomalous zone in the central part of the study area with a strike length of 2km with depth varies from 10-20m. A total of 671.20 m cumulative drilling has been achieved in 8 boreholes viz. KHSB-1, 2, 3, 4, 5, 6, 7 and KHSB-8. While boreholes KHSB-1 to 5 were drilled along the five profile lines lying in the northern segment, i.e., north of Sidlapur Village, borehole nos. KHSB-6, 7 and 8 are drilled in the southern segment falling south of Sidlapur. Except borehole KHSB-05, all the boreholes were drilled to test the targeted BIF band at 60 m vertical depth. The borehole No. KHSB-5 was drilled to intersect the band at 30 m vertical depth. Majority of the boreholes intersected a silicified zone is characterised with intense carbonitisation along with presence of pyrites in the form of lamination, chunks, smears, stringers and disseminations. This zone is also demarcated with magnetite laminations in rhythmic fashion and some borehole intersected BFQ also. While the silicified zone ranges in thickness from 2.05 to 6.45 m, portion with magnetite layering vary in thickness from 0.1 to 2.14 m. Based on the intersection a possible potential zone of 1500 m strike length has been established in 8 boreholes in the block. Besides, another sympathetic zone (Zone-II) marked with carbonitisation in the form of secondary veins and veinlets have been marked in for about 300 m in KHSB-1 & 2 in the northern segment. The analytical results received till date reveals that the borehole no. KHSB-1 has showed 0.417 g/t/0.5m for Zone-I. The Zone-II in KHSB-1 shows the average Au value of 0.030g/t/0.5m. The Zone-I of borehole no. KHSB-2 showed auriferous lode averaging 2.8 g/t/2m whereas Zone-II is having only 0.037g/t/0.5m. The corresponding trench i.e., STR-4 in the same profile line is showing the indication of Au value of 0.83g/t/1m. KHSB-3 showed 0.628 g/t/0.5m and KHSB-5 showed average assay value of 0.75g/t/0.5m.
Gold, Ni-PGE and associated mineralisation							
Chikamaglur & Davangere	Hanni, Bukkumbudi and adjoining areas	1:12500	-	-	-	30	The study area falls within the eastern margin of the Shimoga Schist Belt in western Dharwar craton. The area comprises metavolcano- sedimentary suite of rocks unconformably lying over the basement granitic gneiss of the Peninsular Gneissic Complex (PGC). The volcano-sedimentary rocks are represented by basal conglomerate, quartzite, quartz-chlorite carbonate schist, quartz sericite schist belonging to Chitradurga Group During the geological traverse observed different lithologies are, Granite gneiss, Titaniferous-

Table-2 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							vanadiferous magnetite (TVM) bands, Meta-pyroxenite, Talc tremolite actinolite schist, Tremolite actinolite schist, Conglomerate, Quartz- Chlorite schist, Quartzite, Quartz sericite schist, Anorthositic gabbro, Serpentinite, gabbro and dolerite dykes. Mineralisation is manifested in the form of presence of pyrite, chalcopyrite, bornite, pyrrhotite/pentlandite, malachite, azurite stains, magnetite and quartz-carbonate veins hosted in the quartz-chlorite schist, quartz chlorite carbonate schist, serpentinite, talc-tremolite schist and meta pyroxenite. Based on the surface manifestation of magnetite, sulphide Mineralisation and surface alteration fifteen feeble narrow anomalous zones are identified. Zone-I: Sulphides such as pyrite and chalcopyrite in the Anorthositic gabbro of about 10m in width associated along with quartz vein. Zone-II: Malachite associated with carbonate vein in talc tremolite actinolite schist of about 10m in width. Zone-III: Malachite azurite in conglomerate associated with secondary quartz vein of about 10m width. Zone-IV: Well developed magnetite observed within the Anorthositic gabbro of about 15m in width. Zone-V: Malachite along with quartz ankerite vein within the quartz chlorite schist of about 10 in width and length of about 25m roughly. Zone-VI: Sulphides minerals and malachite strains observed within quartz chlorite schist. The width of the Mineralisation is about 20m roughly Zone-VII: Sulphides such as pyrite, pyrrhotite and pentlandite observed as disseminated in nature within the serpentinite of about 5m in width Zone-VIII: Sulphides minerals and malachite strains observed in contact between quartzite and tremolite actinolite schist, it is associated with carbonate vein of about 15m in width. Zone-IX: Sulphides such as pyrite, chalcopyrite associated with quartz-ankerite vein in the quartz-chlorite schist of about 15m in width. Zone-X: Well developed pyrite and magnetite within the talc tremolite actinolite schist and meta pyroxenite about 10m in width. Zone-XI: Well developed magnetite associated with quartz-carbonate vein and malachite within the quartz-chlorite schist, about a width of 20m and length of 100m roughly. Zone-XII: Sulphides and malachite along with quartz vein within the quartz chlorite schist of about 5 in width and length of about 15m roughly. Zone-XIII: Sulphides minerals and malachite strains observed within conglomerate. The width of the Mineralisation is about 20m.Zone-XIV: Sulphides such as sulphides and ankerite vein as thin band in nature within the quartz chlorite schist of about 10m in width. Zone-XV: Pyrite and chalcopyrite and ankerite veins within the quartz chlorite schist of about 20m in width and 30m in length. The chemical analysis for Au has been received for 125 samples out of which five samples analysed>100 ppb (Au), ranging from 25 to 435 ppb in conglomerate, Meta pyroxenite and TVM rocks. The base metal analytical results have been received for 89 samples out of which Cu in bed rock samples yielded maximum of 1655 ppm average 0.1% @ 3m in quartz-chlorite schist rock. Mn values ranging from 90 to 6100 ppm and nine samples analysed >24% for Fe in TVM bands.
Base Metals							
Haveri	Yelvatti block, Shiggaon Taluk	1:2000	2	5	738.15	340	A G3 stage exploration was taken up in the Yelvatti area with an objective to estimate the resource of base metals. During this work detailed mapping of 2 sqkm area on 1:2000 scale, 100 Cu.m trenching with 100 trench samples, 150 no soil samples, 50 bedrock, 20 petrochemical and 20 petrology samples were collected. A total of 5 boreholes were drilled (including 3 first level and 2 second level) covering 738.15m and 150 no drill core samples. The area exposes rocks of Ranibennur Formation of Shimoga Schist Belt. The area comprises rocks of meta-argillite, cherty quartzite which are intruded by later quartz veins. Meta-argillite and cherty quartzite show a general trend of N-S with moderate dip due east. Meta-argillite is highly weathered and forms a low-lying area. Cherty quartzite forms a resistant ridge within the meta-argillite extending over the strike length of 750m with varying width of 5-25m. It is highly jointed, fractured. Two prominent sets of joints observed in the area are N-S with moderate easterly dip and E-W with steep dip on either side. Cherty quartzite

Table-2 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							is brecciated limonitised, ferruginised, oxidized and also shows presence of sulphide specs (pyrite ±chalcopyrite ±pyrrhotite ±sphalerite ±galena) and pits after sulphides. It is highly brecciated due to later intruded quart-carbonate veins. Sulphides in cherty quartzite and meta-argillite of footwall side occur as disseminated patches, fracture/ joint filling and along the quartz-carbonate veinlets. The sulphide content varies from 1-3% VE. Bedrock samples of cherty quartzite analysed Au from 30 to 435 ppb and Pb+Zn from 623 to 4865 ppm, Cu from 197 to 1618 ppm. Soil samples collected in the strike extension of cherty-quartzite analysed Cu from 110 to 1115 ppm, Pb from 65 to 30110 ppm, Zn from 150 to 5230 ppm and Au from 25 to 47 ppb. Four cherty quartzite trench samples analysed Pb+Zn from 990 to 4930 ppm, Cu from 310 to 505 ppm and Au from 35-100 ppb. Trench samples from altered meta-argillite in contact with cherty quartzite analysed Pb+Zn from 525 to 4385 ppm, Cu from 120 to 565 ppm and 5 samples analysed Au from 35 to 110 ppb. Trench samples of non-altered meta-argillite analysed Pb+Zn from 95 to 1090 ppm, Cu from 65 to 140 ppm. The drill core samples of KHY-1B shows 3 m Pb+Zn zone with average grade of 1.5%.
REE and RM mineralisation							
Raichur	Kallingsugur and Niralkeri area	-	100	-	-	51	Large Scale mapping was carried out in an area of 100 sq. km. The objective of the investigation was to delineate the potential of REE and RM Mineralisation in the area. The major lithounits exposed in the investigated area are Pink granite, porphyritic granite, hornblende-granite, Syenite/Monzonite and dolerite. Younger intrusives occur in the form of K-feldspar and plagioclase rich pegmatite vein and smoky quartz vein. Syenite plugs also occurs at the contact with Pink granite in the south of Kesaratti Tanda. Massive, hard compact syenite is exposed in the west of Anehosur. K-feldspar rich pegmatite vein intruded into Hornblende-biotite granite in the south of Kesaratti Tanda. Porphyritic granite is grey coloured, coarse grained, hard, compact in nature with development of feldspar porphyroclast within it. S-C fabric alongwith dextral shear sense is commonly observed in Mavinbhavi. Under transmitted light, Presence of twin zircon crystals and Iron oxides in Syenite of Anehosur and development of Sericitization and presence of Quartz, plagioclase and microcline in Pink granite of Anehosur. In quartz veins of Anehosur, Mineralisation is mainly identified by different alterations such as ferruginization, radioactive haloes and localization of fine grained dark minerals. Besides this, in pegmatite veins, bluish coloured minerals and presence of allanite, magnetite is also observed at some places such as Anehosur and Rampur village. REE Mineralisation is associated with the smoky quartz vein in association with Syenite and Pink granite. Wall rock alteration is also observed in the form of limonitisation, silicification and brecciation is in quartz veins and pegmatite veins in the north and west of Anehosur village .REE Mineralisation is associated with syenite, pink granite and younger intrusives such as quartz and pegmatite veins. It is lithologically controlled by the wall rock alteration in the form of limonitisation, ferruginisation, silicification and brecciation in smoky quartz veins and pegmatite veins in Syenite and Pink granite. On the basis of geochemical results, five samples of Syenite and Pink granite of Anehosur and Niralkeri area have shown Total REE value ranging from 309.50 ppm upto 390.53 ppm. Ba values ranges from 506ppm – 2085ppm in 28 samples, Sr value ranges from 384-1400 ppm in 18 samples and Li range from 23-104 ppm.
Chamrajnagar	Gundlupet and Annurkeri areas	1:12500	50	3	469.50	-	Large scale mapping on 1:12500 scale was carried out in parts of toposheet no 58A09 covering an area of 50 sq. km along with systematic sampling, scout drilling of 469.50 m and Geophysical survey. The objective was to delineate the potentiality of REE and RM Mineralisation in carbonatite-syenite and granitoids in the area. The present study area is located at the junction of three major shear zones i.e., NNE-SSW trending Kollegal shear zone(KSZ) to the East, Moyar shear zone (MSZ) to the South

Table-2 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							and Sargur shear zone (SSZ) to the West. Granite gneiss ± Garnet (Peninsulargneissic complex (PGC) is the dominantlithology exposed in the area. Sargur Group ofrocks (Calc gneiss ± graphite, amphibolite, pyroxenite, quartzite ± fuchsite, BMQ and garnetbiotite gneiss) occur as enclaves within PGC. Both the Group of rocks later intruded by younger acidic and basic intrusives. Carbonatite and syenite exposed West of Gundlupet town isintrusive into PGC. Syenite contains enclaves of PGC and amphibolite confirming its later intrusion. Carbonatite occur as linear detached bodies over a strike length of 1.7 km, there are six continuous carbonatite body with length varying from 300-1000 m and variable thickness and numerous small detached discontinuous bodies. The carbonatite is of sovite variety with monazite, allanite and apatite as the visible REE bearing phase. Magnetite occur as oxide and pyrite as sulphide phase. Syenite is medium to coarse grained with amphibole and biotite as mafic minerals and sphene, monazite and allanite occur as accessory elements. The TREE content in carbonatite from surface samples varies between 3295 ppm to 12,735 ppm (n=26). Three scout boreholes have been drilled to check the subsurface continuity of the mineralised body. Borehole KCGA-1 intersected 29.80m REE zones with 0.56% cutoff of total REE. KCGA-2 and KCGA-3 have intersected cumulative TREE zones of 15m and 12m respectively as per visual estimation. Mineralisation can be divided into three parts and the REE content is highest in carbonatite and then in carbonatite with syenite and after that syenite with carbonatite. As per the analytical results of borehole KCGA-1 LREE varies from 3604 ppm to 8529 ppm in carbonatites. Geophysical survey (magnetite and radiometric) has been carried out in Gundlupet block. There is magnetic low over the carbonatite body trending ENE-WSW, thus magnetic anomaly well corroborates with the geology of the area. Magnetic anomaly map has helped in delineating two faults or lineaments bounding the mineralised body. Variation of radiometric concentration could interpretated the presence of REE Mineralisation in Carbonatite and associated syenite body. High concentration of Thorium and Uranium along with Low concentration of Potassium is corresponding to Carbonatite and associated syenite. Carbonatite and syenite from surface and subsurface have similar petrographic characteristics. Carbonatite shows beautiful mosaic texture in the calcite grains. Rounded apatite, irregular monazite and euhedral to anhedral allanite are present as REE phase. Three types of monazite are present; one occurring as dissemination within carbonatite, other at the rim and inclusion in apatite. Breakdown reaction in amphiboles can be seen in carbonatite. Syenite is medium to coarse grained dominantly composed of K-feldspar and amphiboles with rare apatite, allanite and monazite. Fenitization at the contact of carbonatite and syenite can be seen in surface samples, core samples and also in microscopic scale
Molybdenum							
Yadgir	Bowanahalli and Devarapalli areas	1:12500	100	-	-	306	An area of 100 sq. km was covered by LSM on 1:12,500 scale with 50 cu. m of trenching and collected 150 nos. of BRS, 50 nos. of PTS, 56 nos. of SS, 15 nos. of PCS, 25 nos. of TPS and 10 ORM samples. The LSM area comprises dominantly of granitoids and gneisses with lenses of amphibolite, BIF, acid & basic dykes and Deccan Volcanics. The BIF, talc actinolite schist and tremolite schist of Dharwar Supergroup (Archean) are seen as small linear outcrops within PGC-II. Older amphibolites are seen as smaller enclaves and xenoliths within the gneisses and granites. The granitoids include gneisses of PGC-II and variants of Closepet Granite. Linear bodies of basic intrusive like hornblendite, pyroxenite, dolerite/gabbro dykes and acidic intrusive like pegmatite veins and quartz veins belonging to Younger Intrusives (Paleoproterozoic) intrude to all the older rocks in the area. The Deccan basalt and intertrappean belonging to Upper Cretaceous to Palaeocene age overlies the rocks PGC-II and Closepet granite. Dykes of lamprophyres and kimberlites of limited extensions are also reported in several places of the study area.

Table-2 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							The granitoids show extensive chloritisation and epidotisation mainly observed in the western and north-eastern parts of the study area Quartz, epidote, chlorite, titanite and hematite are the main hydrothermal mineral phases observed in the system (propylitic alteration). There is wide spread pervasive potassic alteration along with specularite veinlets were observed in the southern part of the area occupied by granitoids and quartz-pegmatite veins. Hence, these veins are considered to be potential target zones for Mo and associated elements. One such pegmatite vein carries Mo mineralisation in the form of stringer observed in northeast of Kamalanagar. However, no significant Mo occurrences is observed in the area.
Molybdenum-Tungsten and associated mineralisation							
Chitradurga	Doddaularthi area	1:12500	100 500	-	-	-	An area of 100 sq.km area has been mapped on 1:12,500 scale, 500 sq. km Aster studies along with collection of chemical samples. The study area forms the eastern part of the Western Dharwar Craton (WDC), represented by biotite gneiss & migmatite gneiss of Peninsular Gneissic Complex-I (PGC-I), granodiorite, younger intrusives of dolerite, pegmatite and quartz vein. Sargur rocks are represented by Amphibolite, garnet biotite ± sillimanite schist and Banded Magnetite Quartzite (BMQ) occur as enclaves within the biotite gneiss in varies dimensions from few mm to few meters. Two sets of dolerite dykes in mapped area. Earlier one is intruded along NNW-SSE direction and later one intruded along the E-W direction. Pegmatite vein and Quartz veins are intruded in the gneissic rock along the shear plane foliation plane, fracture planes and along the fracture plane of granodiorite. The trend of the gneissic plane varies from N-S to NW-SE dipping moderate to steeply towards NE. At-least three sets of fracture plane are noticed out of which two sets of very prominent, first set of fracture plane is NW-SE dipping moderately towards northeast and second set of fracture plane NNE-SSE dipping very steeply towards northwest. Few specks of fine grained molybdenite identified in the quartz vein associated k-feldspar alteration and iron oxide alteration intruded along the shear plane hosted in the biotite gneiss. Copper Mineralisation noticed in the form of presence of chalcopyrite and malachite staining hosted in K-feldspar altered of Thippareddihalli. A total of 67 nos. of soil samples are collected; 26 nos. soil sample results are available out of which only one reported Mo values of 10.28 ppm. A total of 105 nos. of BRS are collected; 63 nos. of BRS results are available out of which three samples reported Mo values from 10.09 to 27.58 ppm and seven samples analysed W value from 10.90 ppm to 75.30 ppm. A total of 76 nos. of trenching samples have been collected, all the trench samples analytical results are available out of which one sample reported 12.31 ppm of Mo and 16 nos. of samples reported W values from 10.37 to 48.98 ppm.
Cobalt							
Shimoga	Gilalagundi area	1:12500	100	-	-	-	The Gilalagundi investigated block, forms parts of TS. No. 48N/8, Shimoga District, Karnataka was mapped on 1:12,500 scale and covers an area of 100 sq.km. The meta volcano-sedimentaries exhibit gradational contact among each other. The entire study area can be divided into 04 parts, the western, the central, the eastern and the north / north east part. The eastern part is dominated by quartz-chlorite-schist and its variants. The central by ferruginous phyllite, interbanded with brecciated chert / cherty quartzite and banded iron formations. The western domain is mainly characterised by meta-argillite-chert-volcanic suite. Also, development of laterites was observed over this meta-argillite-chert-volcanic suite package. In the north / north east domain acidic volcanics in the form of meta-rhyolite, quartz-sericite-schist, ignimbrite and tuffaceous rocks were observed. The Mineralisation is confined to ferruginous phyllite and brecciated chert / cherty quartzite. Botryoidal, box work, cavity fillings, replacement structures were observed in the investigated block. A total of 19 samples have shown the assay values of Co more than 125 ppm, the maximum being 0.26% reported from sample collected

Table-2 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							from brecciated chert / cherty quartzite, Arasalu RF, falls in central domain of studied block and 03 samples have shown the assay value of manganese more than 10 %. The analytical results of trench samples have shown the assay value of Cobalt in trench no. 04 maximum up to 0.44 % with an average of 772 ppm x 10 m, carried out at Arasalu RF. The XRF analysis of petrochemical samples corroborated with BRS. A total of 11 numbers of pockets of Mn / Fe oxides were identified in the investigated block, making the Arasalu, Gilalagundi and Konehosuru segments.
Nickel, PGE and gold mineralisation							
Mandya	Sindhughatta area	1:12500	-	-	-	-	Large scale mapping was carried out on 1:12500 scale and mapped lithologies in the study area include PGC comprise - migmatites and leucosomal granite gneiss and pegmatites defines marginal rocks; while ultramafic consists of talc tremolite schist ± chlorite- actinolite, Birbiritized Talc tremolite chlorite schist, meta pyroxenite; rafts of hornblendite ± quartz epidote veins/ amphibolite and quartz grunerite garnet schist marks major enclaves within shear zones hosting marginal facies. Basic intrusive, epidosite, chromitiites and tourmaline-rich pegmatite manifests deep crustal fault/ shear zones. Basic intrusion in the form of gabbro/dolerite dyke were noticed with NW-SE trend. In the Mineralisation point of view Birbirite outcrops are seen prominently near Sindugatta, while chromite bearing Talc tremolites were observed near Jaginakere and Marenhalli. Based on systematic sampling and LSM, few areas reported chromite bands (few cm to 1.5m) within talc-tremolite schist near south of Sindhughatta and Jagginakere areas. The chromiferous metapyroxenites occur as discontinuous along major tectonic planes associated with epidosites. Evidence of mylonite development is ubiquitous. Probable areas of Ni enrichment zones near Sindhughatta over birbiritized talc tremolite chlorite schist unit were sampled and sent for analysis. The complete analytical result can only reveal the extension and quality of mineralisation at Sindhughatta block

Table – 3 : Mineral Production in Karnataka, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**148**		**100582716**	**141**		**127485054**	**132**		**197871132**
Bauxite	t	1	-	-	-	-	-	-	-	-
Chromite *	t	2	-	-	2	-	-	2	-	-
Gold Ore	t	-	590704	-	-	434810	-	-	486629	-
Gold	kg	4	1724	6431034	3	1116	5422160	4	1239	5955409
Iron Ore	'000t	61	31392	67326043	65	34500	94390860	56	40332	158769382
Manganese Ore	t	9	336745	2194098	9	371045	2359787	8	380004	3311881
Silver #	kg	-	187	8066	-	120	7244	-	127	8168
Graphite (r.o.m.) *	t	2	-	-	2	-	-	2	-	-
Kyanite	t	1	400	880	1	3780	7397	1	5075	9084
Limestone	'000t	64	34165	6672035	54	33188	6095069	54	39405	7611350
Limeshell	t	1	1017	3051	-	-	-	1	100	220
Magnesite	t	3	7198	48309	4	6611	39237	3	7057	50138
Vermiculite	t	-	-	-	1	-	-	1	-	-
Minor Minerals		-	-	17899200	-	-	19163300	-	-	22155500

Table - 4: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Abrasives	
Grindwell Norton Ltd, Bengaluru.	NA
Alumina	
Hindalco Industries Ltd, Belagavi	350 (alumina)
	40(paste)
	0.090(Vanadium)
Cement	
ACC Ltd, Wadi (Wadi & Wadi New),	5450
Distt. Kalaburagi	
ACC Ltd, Kudithini, Ballari (G).	1100
ACC Ltd, Thondebhavi, Distt. Chikaballapur (G).	1660
Bagalkot Cement Industries Ltd,	600
Distt. Bagalkot.	
Chettinad Cement, Kallur, Distt. Kalaburagi.	2500
Dalmia Cement, Yadwad, Distt. Belagavi	4000
	2600(Clinker)
Heidelberg Cement India Ltd,	510
(Formerly Mysore Cements Ltd)	
Ammasandra, Distt. Tumakuru.	
J. K. Cement Ltd, Muddapur, Distt. Bagalkot	3000
JSW Cement, Vijaynagar, Distt. Ballari.	3200
Kesoram Industries, Vasavadatta Cement,	8565(OPC)
Sedam, Distt. Kalaburagi	8565(PPC)
Kalaburagi Cement Pvt Ltd (formerly Viratsagar)	2750
Gulbargha, Distt. Kalaburagi	
Kalaburagi Cement Pvt Ltd	3500
Karchikhed, Chincholi	2750 (Clinker)
Orient Cement Ltd.Itagi, Chittapur	3000
Ramco Cement Ltd, Mathodu,	290
Distt. Chitradurga.	
Shree Cement Ltd.Benekanahalli, Kodla	3000
Sedam, Kalaburagi	
Ultratech Cement, Raj Shree Cement,	6100
Malkhed, Distt. Kalaburagi.	
Ultratech Cement, Ginigera,	1300
Distt. Koppal (G).	
Orient Cement Chittapur, Kalaburagi	3000
Ceramic	
Ceramic Products Ltd, Khanapur, Distt. Belagavi.	NA
H&R Johnson (India) Ltd, Hubballi.	47.72
Murudeshwar Ceramics Ltd, Dharwad.	8.4 mill.sqm
The Mysore Spongware Pipes Potteries Ltd,	NA
Solandavanahalli, Bengaluru.	
Chemical	
Solaris Chem Tech Industries Ltd,	59.4 (caustic
Bhinga, Distt. Uttara Kannada.	soda), 52.3 (Cl),
	133.7 (HCl)
	24.0 (H_3PO_4)
Magnesium & aallied Product	3 (Magnesium

Industry/plant	Capacity ('000 tpy)
Hurugalavadi , Mandya	Carbonate)
	1.875 (Magnesium Oxide)
Shivam Minerals , Honaga Belgaum	4.6(Magnesium
	Carbonate)
	4.6 (Magnesium Oxide)
Fertilizer	
K. P. R. Fertilizers Ltd Halvarthi, Koppal.	60 (SSP)
Mangalore Chemical & Fertilizers Ltd,	379.5 (Urea)
Panambur, Mangaluru.	260 (DAP)
	40 (Complex)
Tungabhadra Fertilizers & Chemicals Ltd,	45 (SSP)
Munirabad, Koppal.	
Iron & Steel	
JSW Steel Ltd, Tornagallu	9200 (pellets)
Sandur Distt. Ballari	12100 (pig iron)
	12000 (crude/liquid steel)
	12950 (sinter)
	4618(Coke)
Visvesvaraya Iron & Steel Ltd,	205 (pig iron)
Bhadravati, Distt. Shivamogga.	118(crude/liquid steel)
4.8 (refractory bricks)	
Sunvik Steels Pvt. Ltd,	60 (sponge iron)
Jodidevarahally, Distt. Tumakuru.	60 (TMT bar)
	36(-------)
Pellets	
BMM Ispat, Danapur, Distt. Ballari.	2400 (pellets)
KIOCL, Mangaluru	3500 (pellets)
	6700 (conc.)
Minera Steel & Power Pvt. ltd., Sandur	**600**
SLR Metalliks Ltd. Narayan	343.2(Sinter)
Devera Kera Hagari Bommanahalli	
Xindia Steel, Koppal.	800 (pellets)
Pig Iron	
Uni-Metal Ispat Ltd, Ballari.	75
Kalyani Ferrous Ind. Ltd, Koppal	500(Sinter)
	289.6
Kirloskar Ferrous Industries Ltd, Bevinahalli,	500 (Sinter)
Distt. Koppal.	**720**
Mukund limited, Ginigera, Kopopal	500 (Sinter)
	410.3
Sponge Iron	
Agrawal Sponge & Energy (P) Ltd,	90
Kuduthini, Distt. Ballari.	
Balakundi Premium Steels Pvt. Ltd,	34
Halakundi, Distt. Ballari.	
Bellary Ispat (P) Ltd, Halakundi	52.5
Distt. Ballari.	
Ballary Steel & Alloys Ltd, Ballari.	60
Benaka Sponge Iron Pvt. Ltd, Belagal,	84
Distt. Ballari.	
BMM Ispat Ltd., Danapur	600

Table- 4 (Concld.)

Industry/plant	Capacity ('000 tpy)
	2400 (pellet)
BRU Industries, Anekal Taluk	1.2 (cast Iron)
Dhruvdesh Metasteel Pvt. Ltd, Hirebaganal, Distt. Koppal.	72
Divya Jyoti Steel Ltd, Taranagar, Distt. Ballari.	30
Gayatri Metals Pvt Ltd, Belagal, Distt. Ballari.	5000
Hindustan Calcined Metal Pvt. Ltd., Janekunnte Ballari	60
Jairaj Ispat Limited Belagal village	60
Haryana Steel and Power, Shanthigrama, Distt. Hassan.	35
Hare Krishna Metallics Pvt Ltd, Hire Baganal, Distt. Koppal.	144
Hospet Ispat Pvt. Ltd, Allanagar Bagnal Road, Distt. Koppal.	60
Hothur Ispat Pvt. Ltd, Veniveerpur, Distt. Ballari.	300 TPD
Minera Steel & Power Pvt. Ltd, Yerabanahally, Distt. Ballari.	120
M.S.Metals & Steels PVT. Ltd. Hirebagnal	105
Koppal	109.5(TMT Bars)
Noble Distillaries & Powers Ltd, Sirivar, Distt. Ballari.	200 TPD
PGM Ferro Steel Pvt. Ltd, Hariganadani, Distt. Ballari.	60
Popuri Steels Ltd, Halakundi, Distt. Ballari.	30
Padmawati Ferrous Metal, Chikantpur Sandur, Ballari.	150
Rayon Steel Pvt Ltd, Veniverapur, Distt. Ballari.	60
Rengineni Steel Pvt. Ltd, Halakundi, Distt. Ballari.	25.5
Shree Venkteshwara Sponge & Power Ltd, Halakundi, Distt. Ballari.	60
Yashshvi Steel & Alloys Ltd, Halakundi, Distt. Ballari.	30
Ferro Alloys	
Ani Smelters Yaradakatla, Hariyur	1.5
Dandeli Steel & Ferro Alloys Ltd, Dandeli.	6
Padmawati Ferrous Metal, Chikantpur	30
Ballari	5 (Ferro - manganese)
	5 (Silico-manganse)
	2 (Ferro-silicon)
Sandur Manganese & Iron Ore Ltd, Mariyammanahalli Hospet	36 (SiMn)
Refractories	
T. S.Ranganath & Company, Keshavapurahuliyar, Chikkanayakanahalli	1.0 (Clay tiles & Block)

Table- 4 (Concld.)

Industry/plant	Capacity ('000 tpy)
S.R. Chemicals & Ferro Alloys Ltd,	0.3
Honaga, Distt. Belagavi.	
Thermit Alloys Pvt. Ltd, Shivamogga.	1.2
Petroleum Refinery	
MRPL, Mangaluru.	15000
G; Grinding Unit	

Note: *Data for fertilizer and cement industries is taken from Indian Fertilizer Scenario, FAI Statistics, and Survey of Cement Industry & Directory, respectively.*

Kerala

Limestone is the important minerals produced in Kerala State

₹ 3,848 crores
Estomsted value of production of minor minarals in 2021-22

1
Reporting mines in case of MCDR of minerals in 2021-22

Mineral Resources

Kerala is well-known for its deposits of excellent quality china clay and beach sands containing valuable minerals like ilmenite, rutile, sillimanite, zircon, garnet, leucoxene and monazite. The State is the principal producer of limeshell and sillimanite. The State also accounts for 23% china clay and 10% sillimanite of the country's resources. As per AMDER of the Department of Atomic Energy, Kerala state accouts for 144.02 million tonnes of ilmenite, 7.83 million tonnes of rutile and 7.96 million tonnes of zircon resources.

Important mineral occurrences in the State are: bauxite in Kannur, Kasaragod, Kollam & Thiruvananthapuram districts; china clay in Alappuzha, Ernakulam, Kannur, Kasaragod, Kollam, Kottayam, Palakkad, Thiruvananthapuram & Thrissur districts; limestone in Alappuzha, Ernakulam, Kannur, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad & Thrissur districts; quartz/silica sand in Alappuzha, Kasargod, Thiruvananthapuram & Wayanad districts; sillimanite in Kollam & Thiruvananthapuram districts; and titanium minerals in Kasaragod, Kollam, Pathanamthitta & Thiruvananthapuram districts.

Other minerals that occur in the State are fire clay in Alappuzha, Ernakulam, Kannur & Kollam districts; garnet in Kollam & Thiruvananthapuram districts; gold in Malappuram & Palakkad districts; granite in Palakkad & Thiruvananthapuram districts; graphite in Ernakulam, Idukki, Kollam, Kottayam & Thiruvananthapuram districts; iron ore (magnetite) in Kozhikode & Malappuram districts; kyanite in Kollam & Thiruvanantha- puram districts; lignite in Kannur districts; magnesite in Palakkad district; and steatite in Kannur & Wayanad districts (Tables - 1 and 2).

Exploration & Development

Details of exploration carried out by GSI during 2021-2022 are furnished in Table-3.

Table –1: Reserves/Resources of Minerals as on 1.4.2020: Kerala

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Bauxite	'000 tonnes	-	-	-	-	29	-	24	2037	14637	2722	-	19449	19449
Garnet	tonne	-	-	-	-	-	-	45797	100874	-	52190	-	198861	198861
Gold					-									
Ore														
(Primary)	tonne	-	-	-	-	-	-	-	462280	96180	-	-	558460	558460
Metal														
(Primary)	tonne	-	-	-	-	-	-	-	0.17	0.03	-	-	0.2	0.2
Ore														
(Placer)	tonne	-	-	-	-	-	-	-	-	2552000	23569000	-	26121000	26121000
Metal														
(Placer)	tonne	-	-	-	-	-	-	-	-	2.29	3.57	-	5.86	5.86
Graphite	tonne	-	-	15443	15443	-	8376	-	-	1088550	322606	-	1419532	1434975
Iron Ore														
(Magnetite)	'000 tonnes	-	-	-	-	-	-	-	-	59912	23523	-	83435	83435
Kyanite	tonne	-	-	-	-	-	-	-	174733	-	10000	-	184733	184733
Limestone	'000 tonnes	10475	-	65	10540	123286	103	-	21161	2888	36622	-	184059	194599
Magnesite	'000 tonnes	-	-	-	-	-	-	-	2	-	38	-	40	40
Pt.Group														
of Metals	'000 tonnes	-	-	-	-	-	-	-	-	-	0.18	-	0.18	0.18
Sillimanit	tonne	553000	-	-	553000	432713	-	-	2564254	-	3369200	-	6366167	6919167
Titanium	toone	2370712	-	-	2370712		-	-	-	19961000	87048716	-	117607659	119978371
Zircon	'000 tonnes	156509	-	-	156509	400650	-	-	123426	-	716279	-	1240355	1396864

Figures rounded off.

Table –2 : Reserves/Resources of Lignite as on 1.4.2023 : Kerala

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total/Kannur	–	–	9.65	9.65

Source: Coal Directory of India, 2022-23.

Table –3 : Details of Exploration Activities in Kerala, 2020-21

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **Gold**							
Palakkad and Malappuram	Mulliakurssi - Vattathur area	1:12500	100	-	-	256	Large scale mapping of 100 sq.km was carried out on 1:12500 scale in toposheet nos. 58A04, 58A08, 58B01 and 58B05 with collection of 108 bedrock samples, 50 trench samples, 25 regolith samples and 50 stream sediment samples, 13 petrochemical samples, 5 XRD samples and 5EPMA samples. The area exposes rocks viz. include banded magnetite quartzite, pyroxene granulite, amphibolte and metapyroxenite of Wayanad Group, charnockite of Charnockite Group and biotite gneiss and granite gneiss of Peninsular Gneissic Complex. Younger granites and quartz-pegmatite veins are the major acidic intrusive and dolerites are the major mafic intrusive in the area. The rock units in the area underwent insitu weathering and resulted in the formation of laterite. The general trend of the pervasive foliation was NW-SE to ESE-WNW with moderate to steep dip to northerly and southerly. Shear indicators like asymmetric augens/clast, quartz ribbons, tight isoclinals folds, pinch and swell structure and boudiange structure were quite frequent in the high strained zones. Indications of mineralisation in the form of pyrite disseminations, chalcopyrite, pyrrhotite and bornite were observed in quartz veins, gneisses and banded magnetite quartzite. Intense limmonitisation and silicification of BMQ also act as surface indications of mineralisation. 23 old workings in the form of inclines, shafts and narrow trenches were observed near Maruthumppara, Vettathur, Nattukal, Thazhekkod and Telakkad in BMQ bands and associated laterites and the excavations followed the trend of BMQ bands. 2 to 9 m wide and 10 to 40m long NW-SE trending three leached zones were mapped around Pattikkad, Ponniyamkurussi, Vettathur and Mulliakurussi areas within charnockite and gneisses. In this leached/ limonitic zone fresh pyrite, chalcopyrite was noticed and sensed smell of sulphur from this zone. These also indicated the evidence of mineralisation. Available analytical results showed Au values in bedrock samples were below detection level, ie, <0.05ppm and that in stream sediments (2 nos.) analysed 0.2ppm.
Rare Earth							
Elements (REE) Idukki	Chittirapuram	1:12500	100	-	-	344	Reconnaissance Survey (G4)was carried out for REE and other Rare Metals mineralisation.The work involves large scale mapping of 100 sq. km on 1: 12,500 scale with 50 cu.m pitting/trenching and collection of 118 nos. of BRS, 50 nos. of PTS, 50 nos. of regolith, 50 nos. of SSS, 30 nos. of PCS, 26 nos. of PS, 5 nos. of EPMA, 10 nos. of XRD and 5 nos. of HMS samples. Pegmatites, granite and foliated granite are the favourable host rocks for REE. Based on the analytical results of bed rock samples, two potential REE mineralised zones were demarcated viz. MZ-I and MZ-II. MZ-I is located southeast of Pallivasal and covered an area of 1.15 sq. km, which is associated with N-S trending shear zone. In MZ-I, pegmatites are the host rock for REE. Eight pegmatite samples collected from MZ-I show ÓREE-433.9 to 2896.7 ppm with an average of 1576.1 ppm. MZ-II is located south of Randam Mile and covered an area of 2.86 sq. km. Pegmatites, foliated granite, charnockite and granite are the exposed rock types. Six foliated granite samples yielded ÓREE- 418.4 to 2077.5 with an average of 897.2 ppm, two charnockite show ÓREE-2079.7 ppm and 967.5 ppm, two pegmatite show ÓREE-617.8 ppm and 1089 ppm and one granite show ÓREE of 1535.4 ppm. One heavy mineral sample yielded ÓREE of 3274 ppm and one alkali-feldspar syenite sample from a tunnel section yielded ÓREE of 6390.3 ppm.
Rare Earth Elements (REE) and Rare Metals							
Idukki	Devikulam	1:12500	100	-	-	-	To evaluate the REE and rare metal potential in Devikulam area, large scale mapping on 1: 12,500 scale has been carried out and 100 sq. km area was covered. Geologically the area consists of calc-granulite and garnetiferous hornblende-biotite gneiss of Khondalite Group, charnockite of Charnockite

Table-2 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							Group, hornblende-biotite gneiss of Peninsular Gneissic Complex-II with foliated granite, granite and pegmatite. The field study implied that the granite and associated pegmatites were the favorable rock for REE mineralisation. In the study area, number of non-mappable pegmatites was observed within different lithounits. Systematic sampling was carried out to know the concentration of REE along with Augur drilling was also carried out in gridded pattern where soil samples developed over granite. In hornblende biotite gneiss, the SLREE values ranges from 402.97 to 840.42 ppm with mean value of 621.70 ppm, the SHREE values ranges from 9.46 to 20.84 ppm with mean value of 15.15 ppm and the SREE values ranges from 412.44 to 861.26 ppm with mean value of 636.85 ppm. In foliated granite, the SLREE values ranges from 157.18 to 1288.85 ppm with mean value of 592.94 ppm, the SHREE values ranges from 3.07 to 62.31 ppm with mean value of 24.29 ppm and the SREE values ranges from 161.39 to 1351.18 ppm with mean value of 617.24 ppm. In granite, the SLREE values ranges from 39.23 to 5145.41 ppm with mean value of 533.05 ppm, the SHREE values ranges from 0.87 to 33.37 ppm with mean value of 9.31 ppm and the SREE values ranges from 40.19 to 5178.79 ppm with mean value of 542.32 ppm. In pegmatite, the SLREE values ranges from 64.225 to 11136.06 ppm with mean value of 820.72 ppm, the SHREE values ranges from 1.50 to 191.52 ppm with mean value of 16.44 ppm and the SREE values ranges from 66.96 to 11327.59 ppm with mean value of 837.22 ppm. In regolith samples, the SLREE values ranges from 112.45 to 4994.51 ppm with mean value of 784.47 ppm, the SHREE value ranges from 6.12 to 82.89 ppm with mean value of 20.25 ppm and the SREE value ranges from 129.11 to 5077.40 ppm with mean value of 804.73 ppm. In core samples, the SLREE values ranges from 85.80 to 4149.8 ppm with mean value of 777.42 ppm, the SHREE value ranges from 11.11 to 43.50 ppm with mean value of 21.80 ppm and the SREE value ranges from 97.50 to 4169.27 ppm with mean value of 799.23 ppm. In stream sediment samples, the SLREE values ranges from 85.80 to 4149.8 ppm with mean value of 777.42 ppm, the SHREE value ranges from 11.11 to 43.50 ppm with mean value of 21.80 ppm and the SREE value ranges from 97.50 to 4169.27 ppm with mean value of 799.23 ppm.
Molybdenum							
Wayanad	Mandat block	1:1000	-	-	-	-	The detailed mapping on 1:1000 scale along with sampling was carried out in Mandat block as part of G3 stage investigation during FS 2021-22. The study area forms northern part of Southern Granulite Terrain and the rock type exposed in this area was younger acid intrusive known as Kalpatta granite and associated pegmatite/ quartz veins. Pegmatites of three stages were identified, in which the youngest one with NE-SW trend, mainly carried molybdenum mineralisation in association with sulphides. The molybdenite was noticed as bluish grey flaky aggregate, associated with chalcopyrite, pyrite and fluorite in pegmatite and quartz veins. These pegmatites were pinkish coloured, consists mainly orthoclase and 5 cm to 1 m wide. The compositional zoning with quartz at the core and orthoclase at the rim and quartz-orthoclase ladder type pattern also observed. The geophysical survey delineated chargeability zones approximately 180m west of established mineralised zone with trend parallel to established mineralised zone. The chargeability profile shows that the cumulative length of this chargeability zone was 707 m and avg. width was 88 m.The dipole-dipole survey along two traverselines indicates that the depth to top of probable mineralised zone was approx. 27 m on S5 traverse and 20 m on S2 traverse. The negative SP anomaly testified in the area indicated that the area was favourable for mineralisation. The geophysical surveys ascertained that the mineralisation was structurally controlled. Base on the integration of geological, geochemical and geophysical studies four first level boreholes were planned to intersect the mineralisation at 30m vertical depth. The available analytical results yielded Mo in bedrock samples ranged from 0.30 to 4624.61 ppm

Table-2 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							with an average of 175.97 ppm, Cu- 8 to 200 ppm and SREE- 9.27 to 495.03 ppm. From the received analytical results of 30 soil samples it was understood that the Mo varied from 4.62 ppm to 32.59 ppm with an average of 12.13 ppm and the average concentration of Mo, Cu, Pb, Zn in soil samples were very low. Average total REE concentration in soil samples was 265.26 ppm. Thirty-five samples were collected from channel 1 at an interval of 1m, Mo concentration in channel-1 ranged from 6.16 to 16140.37 ppm with an average of 1144.93 ppm analysed in ICPMS and the samples were also analysed in ASS in which Mo varied from 30.00 ppm to 38340 ppm with an average of 2951.98 ppm. The channel-1 delineated 70 m Mo mineralised zone with weighted average of 0.29% Mo (ASS) and 0.11% Mo (ICPMS).

Production

Limestone is only the important minerals produced in Kerala State. The value of minor minerals' production is estimated as 3374 crore for the year 2021-22. There was only one reporting mines in 2021- 22 in case of MCDR of minerals.(Table-4).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the important mineral-based industries in organised sector in the State are given in Table - 5.

Table – 4: Mineral Production in Kerala, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**2**		**31123523**	**1**		**16486191**	**1**		**34086624**
Limestone	'000t	1	398	342144	1	376	331191	1	379	345424
Limeshell	t	1	3583	15679	-	-	-	-	-	-
Sulphur #	t	-	227253	-	-	142166	-	-	182352	-
Minor Minerals		-	-	30765700	-	-	16155000	-	-	33741200

Note: The number of mines excludes Minor minerals.

 # Recovered as by-product from oil refinery.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Abrasives	
Carborandum Universal Ltd, Ernakulam	NA
Carborandum Universal Ltd, Thrissur	NA
Carborandum Universal Ltd, Pattanamthitta	NA
Asbestos Products	
Hyderabad Industries Ltd (formerly, Malabar Building Products Ltd) Mulagunnathukavu, Distt. Thrissur	84
Cement	
J K Tex Coats Nadama, Kanayannur	0.030 (Cerastone) 0.025 (Rock tiles) 0.35 (Others)
Malabar Cements, Walayar, Distt. Palakkad	660
Malabar Cement, Cherthala, Distt. Alappuzha (G)	200
The Travancore Cements Ltd, Nattakom,	81

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Distt. Kottayam	
Ceramic	
Kerala Ceramics Ltd, Kundara, Distt. Kollam	18000
Tata Ceramics, Kozhikode	NA
FACR-RCF Building Product Ltd (FRBL),	NA
Kochi.	
Chemical	
Tecil Chemicals and Hydro	30 (calcium carbide)
Power Ltd, Chingavanam,	2 (acetylene black)
Distt. Kottayam	7.5 (ferrosilicon)
Cochin Minerals and Rutile Ltd,	50 (Synthetic Rutile)
Kadungalloor, Alwaye	82.5 (Ferrous cloride)
	30 (Ferric cloride)
	8 (Recovered Tio2)
	6 (Recovered Upgraded Ilmenite)
Electrode	
Super Electrode, Patlla	0.6
Synthetic Rutile	
CMRL, Edayar, Distt. Ernakulam	50
KMML, Chavara, Distt. Kollam	50
TiO2 Pigment	
TTPL, Kochuveli, Distt. Thiruvananthapuram	1.8
KMML, Chavara, Distt. Kollam	40
Fertilizer	
FACT Ltd, Udyogmandal,	148.5 (Complex)
Distt. Ernakulam	225 (AS)
FACT Ltd, Ambalamedu (Cochin II),	485 (NP/NPKs)
Distt. Ernakulam	
Ferro-alloys	
INDSIL Electrosmelts Ltd, Pallatheri,	14
Distt. Palakkad.	
The Silcal Metallurgic Ltd, Wayalur.	3.6
Foundry	
HMT Machine Tools Ltd, Bengaluru.	1500
Glass	
Excel Glass Ltd, Pathirapally, Distt. Alappuzha.	72
Lead-Zinc	
BZL Zinc Ltd, Binanipuram.	38 (Zn ingot)
(Edayar Zinc Ltd)	0.08 (Cd ingot)
	50 (H2SO4)
Petroleum Refinery	
BPCL, Kochi.	12400
G; Grinding Unit	

Note: *Data for Fertilizer Industries is taken from Indian Fertilizer Scenario, FAI Statistics.*

Madhya Pradesh

Madhya Pradesh was the sole producer of diamond

₹

Crore, value of minor mineral's production were estimated for the

249

Reporting mines in case of MCDR of minerals were reported in

Mineral Resources

Madhya Pradesh is the only diamond producing State in the country and is the leading producer of copper conc., diaspore, pyrophyllite, manganese ore, limestone and clay (others). The State hosts the country's 90% diamond, 74% diaspore, 55% laterite, 48% pyrophyllite, 41% molybdenum, 27% dolomite, 19% copper ore, 18% fireclay, 12% manganese and 8% rock phosphate ore resources.

Important mineral occurrences in the State are: bauxite in Balaghat, Guna, Jabalpur, Katni, Mandla, Rewa, Satna, Shahdol, Shivpuri, Sidhi & Vidisha districts; calcite in Barwani, Jhabua, Khandwa & Khargone districts; china clay in Be tul, Chha t ar pur, Chhindwar a, Gwalior, Hoshangabad, Jabalpur, Khargone, Narsinghpur, Raisen, Satna, Shahdol & Sidhi districts; copper in Balaghat, Betul & Jabalpur districts; coal in Betul, Shahdol & Sidhi districts; diamond in Panna district; diaspore & pyrophyllite in Chhatarpur, Shivpuri & Tikamgarh districts; dolomite in Balaghat, Chhindwara, Damoh, Dewas, Harda, Hoshangabad, Jabalpur, Jhabua, Katni, Mandla, Narsinghpur, Sagar & Seoni districts; fireclay in Betul, Chhindwara, Jabalpur, Katni, Narsinghpur, Panna, Sagar, Shahdol & Sidhi districts; iron ore (haematite) in Betul, Gwalior, Jabalpur & Katni districts; limestone in Balaghat, Chhindwara , Damoh, Dhar, Hosha nga ba d, Jabalpur, Jhabua, Khargone, Katni, Mandsaur, Morena, Narsinghpur, Neemach, Rewa, Sagar, Satna, Sehore , Shahdol & Sidhi districts; manganese ore in Balaghat and Jhabua districts; ochre in Dhar, Gwalior, Jabalpur, Katni, Mandla, Rewa, Satna , Shahdol & Umaria districts; pyrophyllite in Chhatarpur, Sagar, Shivpuri & Tikamgarh districts; quartz/silica sand in Balaghat, Dewas, Dhar, Jabalpur, Khandwa, Khargone, Morena, Rewa & Shahdol districts; talc/steatite/soapstone in Dhar, Jabalpur, Jhabua, Katni, Narsinghpur & Sagar districts and vermiculite in Jhabua district.

Other minerals that occur in the State are: barytes in Dewas, Dhar, Shivpuri, Sidhi & Tikamgarh districts; calcareous shales (used in slate pencil) in Mandsaur district; felspar in Jabalpur & Shahdol districts; fuller's earth in Mandla district; gold in Jabalpur & Sidhi districts; granite in Betul, Chhatarpur, Chhindwara, Datia, Jhabua, Panna, Seoni & Shivpuri districts; graphite in Betul & Sidhi districts; gypsum in Shahdol district; lead- zinc in Betul district; molybdenum in Balaghat district; potash in Panna district; quartzite in Sehore district; rock phosphate in Chhatarpur, Jhabua & Sagar districts; and sillimanite in Sidhi district (Table-1). The reserves/resources of coal along with various coalfields in Madhya Pradesh are furnished in Table - 2.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020: Madhya Pradesh

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Antimony														
Ore	tonne	-	-	7503	7503	-	-	592	-	-	-	-	592	8095
Metal	tonne	-	-	75	75	-	-	5.92	-	-	-	-	5.92	80.92
Bauxite#	'000 tonnes	13584	631	4349	18564	20389	13358	7138	22060	54577	50172	-	167695	186259
Copper														
Ore	'000 tonnes	107773	-	12580	120353	55777	100411	8824	23062	300	77938	-	266312	386665
Metal	'000 tonnes	1422.6	-	148.44	1571.04	686.05	321.31	27.35	207.45	9.78	843.88	-	2095.82	3666.86
Diamond	carat	847400	-	159	847559	-	-	-	104118	-	27645359	-	27749477	28597036
Gold														
Ore														
(Primary)	tonne	-	-	-	-	-	-	-	-	5745934	1947000	-	7692934	7692934
Metal														
(Primary)	tonne	-	-	-	-	-	-	-	-	6.03	2.22	-	8.25	8.25
Graphite	tonne	-	-	-	-	-	-	-	-	-	6254000	6386000	12640000	12640000
Iron Ore														
(Haematite)	'000 tonnes	24363	11326	18440	54129	30076	15080	29885	12613	3993	151523	59700	302870	356999
Lead-Zinc														
Ore	'000 tonnes	-	-	-	-	129	117	-	1510	6396	7765	3150	19067	19067
Lead Metal	'000 tonnes	-	-	-	-	-	-	-	26.12	5.13	5.04	-	36.29	36.29
Zinc Metal	'000 tonnes	-	-	-	-	5.2	4.71	-	114.76	44.67	200.07	101.12	470.53	470.53
Limestone	'000 tonnes	1252455	128972	311004	1692431	772476	342790	1119260	498580	791417	4128019	308205	7960747	9653178
Manganese														
Ore	'000 tonnes	13551	2230	3777	19558	3830	7037	4212	127	23351	1943	-	40499	60057
Molybdenum														
Ore	tonne	-	-	-	-	-	-	-	-	-	8000000	-	8000000	8000000
Contained														
MoS2	tonne	-	-	-	-	-	-	-	-	-	5020	-	5020	5020
Potash	Million tonnes	-	-	-	-	-	-	-	-	1206	36	2	1244	1244

Table-1 (Concld.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Rock														
Phosphate	tonne	5258158	-	3772935	9031093	6460616	15688511	13880230	-	2730000	10615956	50625	49425938	58457031
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	-	101600	101600	101600
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	2096000	1120000	-	3216000	3216000
Metal	tonne	-	-	-	-	-	-	-	-	150.61	9.25	-	159.86	159.86
Vermiculite	tonne	-	-	-	-	197	-	66	-	-	66	-	329	329

Figures rounded off

Table – 2 : Reserves/Resources of Coal as on 1.4.2023 : Madhya Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	15279	12457	4482	32219
Johilla	185	263	33	481
Umaria	178	4	-	181
Pench-Kanhan	2112	923	1903	4938
Pathakhera	291	88	68	447
Gurgunda	-	85	53	138
Mohpani	8	-	-	8
Sohagpur	3484	5071	278	8833
Singrauli	9021	6024	2147	17192

Source: Coal Directory of India, 2022-23

Exploration & Development

The details of exploration activities conducted by GSI during 2021-22 are furnished in Table - 3.

Production

Madhya Pradesh was the sole producer of diamond. Apart from this, Coal, Bauxite, Copper Ore & Concentate, Iron Ore, Manganese Ore, Phosphorite and Limestone are the principle minerals produced in Madhya Pradesh State. The value of minor minerals' production is estimated as 630 crores for the year 2021-22. There were 263 reporting mines in 2021-22 in case of MCDR of minerals (Table - 4).

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the important large and medium-scale mineral-based industries in the Organised Sector in the State are furnished in Table-5.

Table –3 : Details of Exploration Activities in Kerala, 2020-21

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI							
Gold							
Singrauli	Mishirgawan area	1:12500	100	-	-	205	Large scale mapping of 100 sq. km. on 1:12500 scale has been carried out in the areas of Misirgawan and Kolhuwa areas of Singrauli district, Madhya Pradesh, with the objective to bring out potential zones of gold mineralisation in Mahakoshal Belt. Aerial reconnaissance survey of 700 sq. km. of the area of interest was carried out using Aster and LANDSAT imagery which was processed using Arc-GIS and ERDAS software. Total of 75 BRS samples 25 PTS, 25 PS, 20 PCS and 10 EPMA samples along with additional 50 channel samples were collected. Mineralisation in the area is observed to be associated with the secondary quartz carbonate activity within the metabasalt and BMQs. Sulphides in the form of chalcopyrite, pyrite, arsenopyrite and galena is observed within the carbonated metabasalt either associated with quartz carbonate veins or in disseminated form. Secondary fillings of quartz or carbonates within vesicular basalt also hold sulphides around its rim part of filled within the vesicles. Malachite stains have been observed within the ultramafic bodies and also within the quartz vein parallel to the S0 planes of BIF. Quartz vein at one place within the BMQ has given a high encouraging value of Au that is up to 7700 ppb
PGE and basemetal							
Shivpuri	Nangali	1:12500	-	-	-	-	The study area under the item is majorly occupied by the rocks of Bundelkhand Granitoid Complex (BGC) along with the rocks of Vindhyan Supergroup towards western margin. Lithologically, the study area is characterised by presence of Tonalite-trondhjemite-granodiorite (TTG) suite of rocks, rhyolite-andesite, variants of granites which are traversed by quartz reefs, mafic-ultramafic dyke system and quartz veins. Western part of the study area is occupied by Kaimur sandstone belonging to Vindhyan Supergroup. The field components under the project included Large Scale Mapping (on 1:12500 scale), trenching, scout drilling, geophysical borehole logging and sampling for bed rock, petrochemical, groundwater, drill core analysis and petrographic & EPMA studies. A significant part of the study area is occupied by gabbro/dolerite bodies which in turn is majorly soil covered and occupies agricultural land. Observation of well section and associated dumps indicates that gabbro considerably extending subsurface also. Few locations expose textural and mineralogical variation with depth (gabbro on top followed by other mafic or ultramafic rocks with increasing depth) based on well section study. These mafic/ultramafic rocks also host sulphide mineralisation at various locations in the study area and have been targeted for basemetals, Ni, Cr & PGE analysis. Copper, molybdenum and tungsten mineralisation hosted within altered syeno-granites has been observed around Kakrauwa Alias Thuni, Umri Khurd and Kanchanpur areas located in southern part of T.S. No.54K/3. Sulphide mineralisation (chalcopyrite, arsenopyrite and pyrite) in basic/ultramafic dykes has been also observed around Umri Khurd, Kanchanpur and Tori areas. Based on analytical results of bed rock samples (mainly altered granites and mafic rocks), anomalous values of Cu, Mo & W have been observed from the localities like Thuni (Cu-755-790 ppm, Mo-1597 ppm & W-1449 ppm), Kanchanpur (Cu-375-390 ppm, Mo-4800 ppm & W-21.9 ppm), Tori (Cu: 520-6000 ppm)

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							Dargwan (Cu: 195-390 ppm) first scout borehole, namely MPBNG-1 (closing depth-99.90 m) was drilled around Tori village. It intersected sulphide mineralisation from 28.00-42.00 m (stringers, blebs and sporadic disseminations of chalcopyrite and pyrite in quartz veins and mafic rocks and from 88-92 m along the borehole (sporadic disseminations of chalcopyrite within altered granite). Based on the analytical results, a mineralised zone of 0.22% Cu was demarcated from 25.60-27.80 m along the borehole MPBNG-1. Second scout borehole, i.e. MPBNG-2 was drilled around Thuni village. It intersected alteration zones in granites hosting pyrite, chalcopyrite, molybdenite and scheelite mineralisation from 25.50 – 31.00 m, 51.50-57.00 m and from 76-82 m along the borehole
Copper							
Jhabua	Balhati- Hiri Chhota-Chotyabarari-Burkui Badi area	1:12500	-	-	-	195	Large Scale Mapping of basalts of Deccan Trap in Balhati-Hiri Chhota-Chotyabarari-Burkui Badi area on 1:12,500 scale has been carried out in parts of Jhabua District, Madhya Pradesh in parts of toposheets 46J/10 during FS 2021-22. The main objective of the work was to search for copper and associated scandium, vanadium mineralisation in the Deccan basalts. The present study area consists of 6 different basalt flows belonging to Malwa Group of Deccan Trap Supergroup. The lava flows are Aa to compound pahoehoe type with well-developed lower and upper vesicular horizons (LVZ and UVZ). The basalt flows exposed in the present study area are massive to friable in texture. The present study area shows presence of some neo-tectonic activities as interpreted from the sudden course-correction (almost 90°) of rivers and often steep slopes exhibited by the flows present in the study area. During this FSP, 100 nos. BRS, 30 nos. PTS, 50 nos. Soil samples and 15 nos. PCS were collected from the study area. The BRS collected from the study area show highest value of 388 ppm of Cu over Flow number 3-4 of Kalisindh Formation (Fig. 3.7) near Dhamoi. Highest value of V as 441 ppm has been reported from the contact zone between Kalisindh Flow 1 and Flow 2 near Hiri Bada. Anomalous values for Cu (270-345 ppm) have been recorded from the soil zones developed over the Flow 1 of Kalisindh Formation near Balhati-Hiri Bada areas.
Alirajpur	Kosduna South Block	1:2000	1.5	4	471.0	-	The study has been carried out with an objective to assess the potentiality of copper and associated mineralisation in the area. The detailed geological mapping of 1.5 sq. km. on RF 1:2000 scale in Kosduna South block reveals presence of Phyllite, Biotite Granite, Sheared Quartz veins and calcareous gritty, pebbly sandstone, and fossiliferous limestone of Bagh group. Biotite granite is exposed as small, isolated outcrops towards eastern part of block which is mostly non-foliated, medium to coarse grained, both grey and pink in colour and composed of mainly quartz, both plagioclase and orthoclase feldspar and mica. Both phyllite and Biotite granite is intruded by sheared quartz veins. These quartz veins show swelling, pinching and discontinuous in nature and occur in en-echelon pattern and the thickness of quartz veins varies from 10 m to 25 m which trends in N20°E-S20°W and at places it shows swerving nature. These quartz veins show evidence of copper mineralisation in the form of malachite stains and at places very fine specks of pyrite and chalcopyrite were also noticed. Both phyllite and Granite are traversed by numerous milky white quartz veins. During FS 2021-22 under G-3 stage exploration, a total of 471.0 m drilling with 4 boreholes of 1st levels were drilled across the mineralised quartz vein at 200m strike spacing to intersect the mineralisation at 60 m vertical depth. All the boreholes have intersected copper mineralisation except borehole no. MPAK-04 even though grade is very poor. Based on the chemical analyses of drilled boreholes data, it is found that the grade of Cu mineralisation is poor in Kosduna South block. Analytical results of core samples show <0.1 % Cu. The Cu values are not significant in core veins along with rare to occasional occurrence of chalcopyrite mineralisation noticed. The mineralisation is very sporadic in nature and irregular in habit. Due to poor mineralisation in the block, the project was prematurely closed as per recommendations/ suggestions from competent authority.

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Tungsten							
Betul	Sonaghati-Chiklar-Rawanpudi-Khandara Areas	1:12500	100	-	-	-	Large-scale geological mapping of about 100 sq. km. area was carried out on 1:12,500 scale in and around Sonaghati- Chiklar- Rawanpudi- Khandara areas, Betul District, Madhya Pradesh with an objective to delineate the Tungsten and associated mineralisation in the area along with pitting and trenching of 30 cu.m., collection of bed rock samples, soil samples and petrological and petrochemical studies. The detailed field investigations through LSM reveals that the rocks exposed in the area are mainly sheared porphyritic granite, phyllite, amphibolite, quartzite, migmatite, calc silicate rock, graphite schist, garnetiferous quartz mica schist, banded iron formation, gabbro etc. For systematic geological, geochemical and mineral investigation, four Calc silicate bodies have been found for possible Tungsten mineralisation based on their distinct litho assemblages and mode of occurrence, viz. Chikhlar Calc silicate, Ampani nala Calc silicate, Dharakhoh Calc silicate and lensoidal Calc Silicate bodies. The Calc silicate rock found in the west of Chikhlar is 5 to 7 m thick and extends for about 25-30 m in its strike direction of ENE-WSW and shows bluish-greenish fluorescence while subjected to UV light indicating presence of Tungsten mineral. The Calc-silicate band of Ampani nala is 80-100 m thick and 350-400 m in its strike direction of ENE-WSW. It is mainly composed of fine-grained silica and thin veins of calcite. The Dharakhoh Calc silicate body is having much higher calcite than Chikhlar body but it is slightly coarser than Calc silicate of Chikhlar. Apart from these, some lensoidal calc silicate bodies having 2-3 m in length were also recorded near Ampani nala area. Chemical analysis results reveal the presence of 150 ppm of Cu, 40 ppm Pb, 155 ppm Zn for, 91 ppm Vin calc silicate rock, whereas sheared porphyritic granite, which is adjacent to calcsilicate body, records 35 ppm Cu, 45 ppm Pb, 105 ppm Zn, <1 ppm Ag and Cd. Calc silicate body records <0.5 ppm Mo, 7.11 ppm Sn, whereas, sheared porphyritic granite records 1.04 ppm Mo and 12.22 ppm Sn as reported from chemical analysis of BRS samples. Values of 1.64 ppm and 2.03 ppm for Tungsten (W) are recorded in calc silicate and sheared porphyritic granite respectively. Samples collected from the contact between calc silicate and granite are showing gold values of <25 ppb and 30 ppb. Chemical analysis of PTS samples shows 55 ppm Cu, 25 ppm Pb, 105 ppm Zn, <1 ppm Ag, Cd. The analytical results of soil samples show 75 ppm Cu, 30 ppm Pb, 90 ppm Zn, <1 ppm Ag and Cd. The XRD study reveals the presence of Wollastonite upto 35 weight percentage in few samples.
Graphite, Base Metal and REE mineralization							
Sidhi	Bahera-Goriara block	1:2000	1	8	-	90	Detail mapping of 1 sq. km area was done on 1:2000 scale. A total of 10 PCS, 10 trace element, 50 channel/ groove samples, 10 PS, 05 BRS and 05 EPMA/Ore microscopy samples were collected. A total of 08 nos. of boreholes in a series pattern were planned from Bahera to Goriara village at a 200 m interval so as to intersect mineralisation at a 30 m vertical depth. Total 03 nos. of boreholes were supported by channel/groove sampling of graphitic bearing lenses carried out during G4 stage of exploration and 50 nos. of channel/groove sampling was carried out in front of section line of remaining 05 nos. of boreholes for borehole planning. Along borehole no. MPSBG-1 detailed Geological and Geophysical logging for 82.70 m has been done. Graphitic carbonaceous phyllite intersected from 19.50 m to 23.50 m and 56.80 m to 81.30 m, totaling to 24.80 m of mineralised zone (true width 21.50m) for which sampling has been completed and samples have been submitted on priority basis. The mineralisation intersected along the borehole suggested for the continuity of graphite bearing lenses till 30 m vertical depth and ~300 m RL. Also, abundant malachite grains/encrustation were encountered during logging which suggest basemetal potentiality of the area.
Bauxite							
Dindori	Khapripani block	1:4000	5.0	28	614.00	599	Detailed geological mapping on 1:4000 scale was carried out by using Total Station over an area of 5.0 square kilometer. During this period a total of 614.00 m was drilled in 28 numbers of boreholes and 599 nos. of core samples have been generated and analysed. Samples

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							were analysed for Al2O3, SiO2, P2O5, Fe2O3, CaO, MgO, Na2O, K2O, TiO2, MnO, Ga, V, REE, Reactive Silica & L.O.I. to assess the degree of laterisation and formation of bauxite and aluminous laterite. A total sum of 6.67 million tonnes (5.26 float & 1.41 insitu) of Bauxite with an average of 39.41% Al2O3, 47.89 million tonnes (24.63 float & 23.26 insitu) of aluminous laterite with an average of 28.61% Al2O3 and 3.04 million tonnes (1.07 float & 1.96 insitu) of Ferruginous laterite with an average of 15.93% Al2O3 resources has been estimated in Khapripani block among which 4.74 million tonnes (4.24 float & 0.50 insitu) of Bauxite, 23.07 million tonnes (15.63 float & 7.44 insitu) of aluminous laterite and 0.66 million tonnes (0.43 float & 0.22 insitu) of Ferruginous laterite having more than 0.1% (cutoff) of Vanadium mineralisation. Those mineralised zones also having some good values of Gallium (up to 129 ppm) both of them may be recovered as by products
Coal							
Chhindwara	Andole Sector, Pench Valley Coalfield	1:10000	25	-	-	-	A total of 25 sq.km area has been geologically mapped on 1:10,000 scale. During the mapping, 4 number of lava flows has been identified in the area. Later intrusion is also observed in the area in the form of dolerite dyke trending N250°(ENE-WSW) with 2.5 to 3 m thickness and about 70-80 m long intruded in compound pahoehoe flow (Flow No-1) in the area. It is medium grained, phenocrystic in nature. Horizontal columnar joints are also observed in the dyke. A total of four boreholes (PAN-1; depth: 466.7 m, PAN-2; depth: 493.9 m, PAN-3; depth: 625.1 m and PAN-4; depth 635.80 m) were drilled in the area. The total drilling is 2221.5 m and total of 17.39 m coal is encountered in all the four boreholes. The four boreholes have encountered Talchir Formation (intersected thickness being 4.93 m+ to 14.8 m+), Barakar Formation (Intersected thickness being 42.87 m to 47.7 m), Motur Formation (220.17 m to 369.13 m thick), Jabalpur Formation (21.6 m to 31.00 m) and Deccan Trap Formation (intersected thickness being 0 m to 195.40 m). PAN-4 have also encountered Talchir Formation (intersected thickness being 0 m to 195.40 m). A complete sequence wherever preserved generally starts from coarse to very coarse-grained sandstone and ends in grey shale or coal in Barakar Formation. Motur Formation constitutes claystone and siltstone cycles separated by very fine to medium grained sandstone. Jabalpur Formation consists of sandstone with jasper pebbles and Deccan trap Formation with 4 number of lava flows. Barakar coal seams are moderate in thickness and fairly persistent over the Andole area. Five coal seams (Seam-I to V) of regional extent have been encountered in the area (PAN-3 & PAN-4), four coal seams (Seam-I to IV) of regional extent have been encountered in the PAN-2. PAN-1 has encountered only one Barakar coal seam which is Seam-IV. All coal seams are intersected between 445.40 m to 618.22 m depths in Barakar Formation. The cumulative thickness of the individual coal seams is varying from less than a meter to 2.24 m. The thickest coal seam in all the drilled boreholes is seam no. IV which is having thickness ranging from 0.85 (PAN-2) to 2.24 m (PAN-3).

Table – 4 : Mineral Production in Madhya Pradesh, 2019-20 to 2021-22

(Excluding Atomic Minerals)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**223**	**-**	**147021686**	**241**	**-**	**63585432**	**263**	**-**	**38688990**
Coal	'000t	-	125726	-	-	132531	-	-	137975	-
Natural										
Gas (ut.) +	m c m	-	345	-	-	334	-	-	290	-
Bauxite	t	20	685929	546953	21	632385	479818	18	608925	493590
Copper Ore	t	-	2544472	-	-	2239152	-	-	2442459	-
Copper Conc.	t	1	65094	4750125	1	64920	5137695	1	65022	5487137
Iron Ore	'000t	19	3343	1729068	21	4094	2146870	23	7399	4667940
Manganese										

Table- 4 (Concld.)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
Ore	t	42	962576	6220812	47	934548	5684482	44	849221	6831964
Phosphorite	t	5	99960	94304	5	97880	92007	6	113730	111398
Diamond	crt	2	28816	352472	2	13917	147696	3	266	18051
Limestone	'000t	134	47118	12332360	144	46099	12879609	168	50140	14782552
Minor Minerals		-	-	120995592	-	-	37017255	-	-	6296358

Note : The number of mines excludes Fuel and Minor minerals.

$ Excludes the value of Fuel minerals.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Hindalco Industries Ltd, Mahan	360 (Aluminium)
Aluminium, Bargwan, Distt Singrauli	
Asbestos Products	
Everest Building Products Ltd, Kymore	NA
Kalani Industries Pvt. Ltd, Pitampur, Dhar	NA
Ramco Industries Ltd, Maksi, Distt Shajapur	NA
Calcined Lime	
Rekha Harlalka, Jukehi, Maihar	11
Padampani Tripathi, Mamalime Industries	9.6
Rajarwara, Katni	
Cement	
ACC Ltd, Kymore, Distt Katni	2720
Bhilai Jaypee Cement Ltd, Babupur, Satna	1300
Birla Corpn. Ltd, (Satna Cement Works &	2200
Birla Vikas Cement), Satna	
Birla Coorporation Ltd, (Erstwhile Reliance	3000
Cement Pvt. Ltd, Maihar, Distt Satna	
Century Textiles & Ind. Ltd, Maihar Cement,	4200
Maihar (unit I & II), Distt Satna	
Heidelberg Cement (I) Ltd, Narsingarh,	2000
Distt Damoh	
Jaiprakash Power Ventures, Singrauli (G)	2000
Jaypee Rewa Cement Plant, Distt Rewa	2500
Jaypee Bela Cement Plant, Distt Rewa	2600
KJS Cement, Rajnagar, Distt Satna	2200
Prism Cement Ltd, (Unit I & II), Satna	6600
Satguru Cement Pvt. Ltd, Ghursal, Gandhawani	95
UltraTech Cement Ltd, Sidhee	2300
UltraTech Cement, Dhar Cement Plant,	3500
Tonki, Temarni sounul, Golpura Manawar	
UltraTech Cement, Vikram Cement Plant,	4500 (OPC)
Khor, Distt Neemuch	4500 (PPC)
UltraTech Cement Ltd, Majhigawan,	3000
Rampur Naikin	
Ceramic	
Roca Bathroom Products Ltd, Dewas	NA
Govind Tiles Pvt. Ltd, Garra, Distt Balaghat	NA
Calcined Lime	

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Som Lime work, Jukehi, Katni	21.6
Jai Mata Lime Industries Pathra, Katni	15.2
Dharampal Industries Pathra, Katni	6
Sampuran Singh Saluja Patra, Katni	6.07
Fertilizer	
Agro Phos. (India) Ltd, Dewas	45 (SSP)
Arihant Ferts. & Chems. India Ltd, Kanawati, Neemuch	66 (SSP)
Basant Agro Tech (India) Ltd, Jawad, Neemuch	45 (SSP)
Coromandel International Ltd, (Formerly, Liberty Urvarak Ltd,), Nirmani Khargone	100 (SSP)
Indra Industries Ltd, (Formerly, Swastik Ferts & Chems Ltd,), Indore, Dhar	66 (SSP)
KMN Chemicals & Fertilizers Ltd, Diwanganj, Raisen	60 (SSP)
Khaitan Chemical & Fertilizers Ltd,	400 (SSP)
Nimrani, Distt Khargone	115.5 (H2SO4)
NFL, Vijaipur (Unit I & II), Distt Guna	2066.1 (Urea)
Krishna Phoschem Ltd, Meghnagar, Jhabua	120 (SSP)
Madhya Bharat Agro Products Ltd, Rajoa, Sagar	60 (SSP)
Madhya Bharat Phosphate Pvt. Ltd, (Unit I), Diwanganj, Sanchi, Raisen	132 (SSP)
Madhya Bharat Phosphate Pvt. Ltd, (Unit II), Meghnagar, Jhabua	165 (SSP)
Mexican Agro Chemical Ltd, (Formerly, Asha Phosphates Ltd,), Jaggakhedi, Mandsaur	60 (SSP)
Mukteswar Fertilizers Ltd, Narayankhedi, Ujjain.	60 (SSP)
Rama Phosphates Ltd, Indore	250 (SSP)
	102 (H2SO4)
Suman Phosphates and Chemicals Ltd, Indore	330 (SSP)
Varun Fertilizers Pvt. Ltd, Dewas	100 (SSP)
Ferroalloys	
Crescent Alloys Pvt. Ltd, Seoni	4.5
Jalan Ispat Castings Ltd, Meghnagar, Distt Jhabua	12
MOIL Ferro Manganese Plant, Bharveli, Distt Balaghat	10
Petroleum Refinery	
Bharat Oman Refineries Ltd, Bina, Distt Sagar	6000
Refractory	
ACC Refractories, Katni	65
Calderys India Refractories Limited	78
Katni Refractory Works, Katni	30 (Binder)
Murwara	9 (Grout)
Mahakoshal Refractories Pvt. Ltd, Katni	61.09
Mahakoshal Refractories Pvt. Ltd, Gudri, Bohariband	31
Premier Refractories India Pvt. Ltd, Katni. G; Grinding Unit	50

Note: Data not readily available for fertilizer and cement industries on respective websites, therefore it has been taken from Indian Fertilizer Scenario, FAI Statistics and Survey of Cement Industry & Directory, respectively.

Maharashtra

Maharashtra was the sole producer of Flourite and Kyanite

₹ 6,282 crore
value of minor mineral's production were estimated for the year 2021-22

71
Mines in case of MCDR of minerals reported production in 2021-22

Mineral Resources

Maharashtra is the sole producer of fluorite (graded) and the principal producer of bauxite, kyanite, manganese ore, quartzite and sand (others). The principal mineral-bearing belts in Maharashtra are Vidarbha area in the east and Konkan area in the west. Important mineral occurrences are: bauxite in Kolhapur, Raigad, Ratnagiri, Satara, Sindhudurg & Thane districts; china clay in Amravati, Bhandara, Chandrapur, Nagpur, Sindhudurg & Thane districts; chromite in Bhandara, Chandrapur, Nagpur & Sindhudurg districts; coal in Nagpur, Chandrapur & Yavatmal districts; dolomite in Chandrapur, Nagpur & Yavatmal districts; fireclay in Amravati, Chandrapur, Nagpur & Ratnagiri districts; fluorite & Shale in Chandrapur district; iron ore (haematite) in Chandrapur, Gadchiroli & Sindhudurg districts; iron ore (magnetite) in Gondia district; kyanite in Bhandara & Nagpur districts; laterite in Kolhapur district; limestone in Ahmednagar, Chandrapur, Dhule, Gadchiroli, Nagpur, Nanded, Pune, Sangli & Yavatmal districts; manganese ore in Bhandara, Nagpur & Ratnagiri districts; corundum & pyrophyllite in Bhandara district; quartz & silica sand in Bhandara, Chandrapur, Gadchiroli, Gondia, Kolhapur, Nagpur, Ratnagiri & Sindhudurg districts; quartzite in Gondia & Nagpur districts; and sillimanite in Chandrapur district.

Other minerals that occur in the State are: barytes in Chandrapur & Gadchiroli districts; copper in Bhandara, Chandrapur, Gadchiroli & Nagpur districts; felspar in Sindhudurg district; gold in Bhandara & Nagpur districts; granite in Bhandara, Chandrapur, Dhule, Gadchiroli, Nagpur, Nanded, Nashik, Sindhudurg & Thane districts; graphite & mica in Sindhudurg district; lead-zinc & tungsten in Nagpur district; marble in Bhandara & Nagpur districts; ochre in Chandrapur & Nagpur districts; silver & vanadium in Bhandara district; steatite in Bhandara, Ratnagiri & Sindhudurg districts; and titanium minerals in Gondia & Ratnagiri districts (Table-1). As per the AMD of the Department of Atomic Energy India, Maharashtra state accounted for 5.50 million tonnes of ilmenite resources and 0.01 million tonnes of rutile resources. The coal reserves and resources along with the various coalfields located in the State are shown in Table - 2.

Table –1: Reserves/Resources of Minerals as on 1.4.2020: Maharashtra

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Bauxite	'000 tonnes	18833	3573	16065	38472	15794	1981	21023	38931	32875	83354	-	193958	232430
Chromite	'000 tonnes	5	-	-	5	5	-	-	43	67	418	-	533	538
Copper														
Ore	'000 tonnes	-	-	-	-	-	-	-	-	5831	11774	150	17755	17755
Metal	'000 tonnes	-	-	-	-	-	-	-	-	58.36	99.18	0.54	158.08	158.08
Fluorite	tonne	222282	163860	-	386142	-	-	-	-	-	100000	-	100000	486142
Gold														
Ore (Primary)	tonne	-	-	-	-	-	-	-	-	-	1627000	-	1627000	1627000
Metal (Primary)	tonne	-	-	-	-	-	-	-	-	-	3.64	-	3.64	3.64
Graphite	tonne	-	-	-	-	-	-	-	-	-	1160000	-	1160000	1160000
Iron ore (Haematite)	'000 tonne	9464	2124	3653	15241	1672	6632	9191	81116	95545	59673	32474	286304	301544
Iron ore (Magnetite)	'000 tonne	481	65	32	578	329	24	267	-	-	590	-	1210	1788
Kyanite	tonne	210075	-	122314	332389	69621	4317	1210436	-	45000	1734241	-	3063615	3396004
Lead-zinc														
Ore	'000 tonnes	-	-	-	-	-	-	-	1967	6305	1000	-	9272	9272
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	133.56	428.11	28	-	589.67	589.67
Limestone	'000 tonne	528636	137773	34940	701349	765567	235543	126780	69286	681879	1220928	7060	3107044	3808392
Manganese ore	'000 tonne	16537	835	361	17733	1891	15354	16304	-	5055	2585	113	41303	59036
Rare Earth Elements	tonne	-	-	-	-	-	-	-	-	-	2090	-	2090	2090
Sillimanite	tonne	174474	3655	3619	181748	15000	-	-	15000	64	516	-	30580	212328
Silver														
Ore	tonne	-	-	-	-	-	-	-	-	-	235000	-	235000	235000
Metal	tonne	-	-	-	-	-	-	-	-	-	0.23	-	0.23	0.23
Titanium	tonne	219623	64860	19068	303551	24172	-	-	1172214	846000	1938400	-	3980786	4284337

Table-1 (Concld.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	4275000	5461250	386000	-	10122250	10122250
Contained	tonne	-	-	-	-	-	-	-	11287.8	7117.92	185	-	18590.72	18590.72
WO3														
Vanadium														
Ore	tonne	-	-	-	-	276530	-	108100	-	-	-	-	384630	384630
Contained	tonne	-	-	-	-	1106.12	-	432.4	-	-	-	-	1538.52	1538.52
V2O5														

Figures rounded off

Table – 2 : Reserves/Resources of Coal as on 1.4.2023 : Maharashtra

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	8065	3425	1847	13336
Wardha Valley	5009	1891	1441	8340
Kamptee	2046	938	107	3091
Umrer Makardhokra	308	–	161	469
Nand Bander	691	596	118	1405
Bokhara	10	–	20	30

Source: Coal Directory of India, 2022-23.

Exploration & Development

The details of exploration activities conducted by GSI during 2021-22 are furnished in Table - 3

Production

Maharashtra was the sole producer of Fluorite and Kyanite. Apart from Coal, Bauxite, Iron Ore, Man- ganese Ore, Sillimanite and Limestone are the principle minerals produced in Maharashtra State. The value of minor minerals' production is estimated as 5,475 crores for the year 2021-22. There were 73 reporting mines in 2021-22 in case of MCDR of minerals.

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the important mineral-based industries in the Organised Sector in the State are given in Table-5.

Table –3 : Details of Exploration Activities in Maharashtra, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **Platinum Group of Elements (PGE)**							
Raigad	Khopoli area	1:12500	100	-	-	202	Reconnaissance survey in parts of toposheet 47F/5 was carried out with an objective to assess the PGE mineralisation in the picritic basalts and dykes present in the area. An area of 100 sq. km was mapped on 1:12,500 scale. The mapped area is a part of the Deccan Volcanic Province and comprises flow units belonging to Lower Ratangarh Formation, Upper Ratangarh Formation, Indrayani Formation and Karla Formation. Two generations of intrusives are present within the basalt wherein olivine gabbro is the oldest and the basaltic dykes are the younger ones. Out of the 101 BRS, 50 BRS showed Cu/Zr ratios of <1. The Cu/ Zr ratios of these samples vary from 0.503 to 0.990. The MgO% in these 50 BRS varies from 3.39 to 26.08 with an average MgO content of 13.67%. The samples yielding high MgO values (greater than 12 %) and having Cu/ Zr ratio less than 1 were targeted for channel cum chip sampling as well as for Pt-Pd analysis. Out of the 51 CS, 45 showed Cu/Zr ratios of <1. The Cu/Zr ratios of these samples vary from 0.592 to 0.953. The MgO% in these 45 CS vary from 6.12 to 25.56 with an average MgO content of 20.46%. To assess the PGE mineralisation in the area, 50 samples were analysed for Pt-Pd. The concentration of Pt varies from 7.6 ppb to 50 ppb while that of Pd varies from 5.0 ppb to 15.6 ppb. Eight samples show anomalous values of Pt, the highest being 50 ppb which is found in olivine gabbro. On the basis of Pt and Pd values in BRS and CS, a clustering of positive values is observed in Vadaval area. Hence an area of 2.36 sq. km. (2.15 km x 1.10 km) in Vadaval, comprising of olivine basalt is demarcated as a potential area for PGE mineralisation.
Copper and associated base metal							
Gadchiroli	Chamorshi, Kurul, Bhiwapur area	1:12500	100	-	-	-	Large scale geological mapping of 100 sq. km area was completed on 1:12,500 scale along with geochemical and petrological samples collection. The investigation area is located in the southwestern part of Bastar Craton (BC). A NNW-SSE trending mineralised quartz reef located about 2 km north of Chamorshi town is approximately 1 km long and 30 to 50 m wide with a dip of 60° to 65° towards west. Mineralisation is visible in the form of pyrite, chalcopyrite and bornite along with secondary ores of malachite and azurite. The chemical analysis results of BRS from the Chamorshi quartz reef (n=45) indicated copper concentration ranging from 50 to 3700 ppm (Avg.= 655 ppm). Channel samples show copper values are ranging from 410 to 3100 ppm (Avg.= 1204 ppm). Overall analytical results indicate a higher concentration of copper in bed rock samples. Owing to the encouraging results of the bed rocks samples, the Chamorshi quartz reef with strike length of 1 km length and 30 to 50 m width is most potential mineralised reef in the area.
Chandrapur	Tambegadi – Pathari area	-	1.5	2	285	-	The Copper investigation (G3-stage) was carried out around Tambegadi and Pathari areas, Chandrapur District, Maharashtra with an objective to establish the copper and associated mineralisation. During FS 2021-22, detailed geological mapping of 1.5 sq. km. was covered around Tambegadi and Pathari blocks. The Bengpal gneiss in the area is feebly mineralised intermittently in the form of pyrite, galena and minor chalcopyrite. Two boreholes (MHCT-1, 2) with cumulative t

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							drilling of 285 m were completed in Tambegadi block. All the boreholes were planned at 60 m vertical depth of intersection and 200 m strike spacing. Boreholes MHCT-1, 2 have not intersected any significant mineralisation. Mineralisation is confined to 250 m x 120 m zone in the Tambegadi block within the ferruginised basement granite gneiss. Mineralisation intermittently occurs with diminishing nature in lateral and also depth extent within this zone. However, it has been observed from drill core analysis that the mineralisation is purely confined to the upper oxidative surficial level of not more than 40 m in both the borehole cores. Mineralisation in the subsurface is insignificant to almost non-existent. This has been confirmed by chemical analytical results of borehole core samples. Demarcation of clear zones was no possible in this case due to lack of proper concentration and lateral continuity along the strike.
Rare Earth Elements (REE) and Rare Metals (RM)							
Nagpur	Ghotitola-Warghat area	-	-	-	-	-	The lithounits mapped in the Ghotitola Warghat area includes basement gneiss (Tirodi biotite gneiss) overlained by rocks of Sausar Group i.e. Calc silicates and marble of Mansar Formation, Mica schist of Mansar Formation, Marble of Bichua Formation and foliated granite, pegmatite and quartz veins as intrusive. Number of simple pegmatite and a few complex zoned pegmatite veins has been mapped in the area. In the North West of Kharpada village complex zone pegmatite has been observed which shows different zones within pegmatite containing quartz with beryl crystal of 1 cm in diameter and 3 cm in length at the core and intermediate zone with pocket of mica books and wall zone with small grains mica and quartz. In the North of Warghat village small pegmatite vein (1 X 30 m dimension) having quartz, K feldspar, muscovite books and big crystals of magnetite (up to 3 X 6 cm dimension) is observed in the contact with foliated granite. Petrological study of rock samples from this area has revealed the presence of allanite, apatite, monazite and zircon which may have contributed towards the relative high concentration of total REE in the rock. The Stream sediment samples collected from 1st order stream were panned and heavy minerals have been segregated from it. SEM studies have confirmed the presence of REE minerals such as monazite, Zircon, etc. Signatures of fluid migration are seen both in field and thin section study. The chemical analytical results of 35 numbers of bed rock samples are showing SREE ranging from 3.68 to 390.08 ppm. The chemical analytical results of 27 stream sediment samples out of 50 samples submitted are showing SREE ranging from 529.33 to 46644.99 ppm. Highest concentration of SREE in the stream sediment sample is observed at the North of Pauni village
Bauxite							
Sindhudurg	Math Budruk area	1:12500	-	-	-	150	A G-4 stage investigation was carried out with an objective to assess the potentiality of bauxite occurrences. The work includes large scale mapping (LSM) on 1:12500 scale with collection of 100 nos. of bed rock samples and 50 nos. of pit samples. The area exposes small patches of metasedimentary rocks (hornblende schist) of Dharwar Supergroup as inlier, sediments of Kaladgi Supergroup (ortho-quartzite, sandstone and shale), basalts of Deccan Trap, laterite and/or aluminous laterite and bauxite. The Al2O3 content in BRS varies from 17.91% to 56.57 % and correspondingly SiO2 content varies from 1.3% to 22.81%. Gallium values range from 31 ppm to 76 ppm. The Al2O3 content in pit samples range from 19.67 % to 59.23% and SiO2values range from 1.72% to 33.50%. Based on the Al2O3, SiO2 and Fe2O3 value of bedrock and pit samples, laterite has been classified into ferruginous laterite, aluminous laterite and bauxite. Cumulative area of 10.36 sq. km and 34.68 sq. km have been delineated as potential for bauxite and aluminous laterite respectively. Bauxite is present as pockets as well as lenses in laterite. XRD and ore microscopic studies of representative samples collected from bauxite show that gibbsite is the dominant ore mineral with minor mineral like anatase, haematite and goethite.

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
	Kudopi block	1:4000	10	31	514	300	A collaborative work between GSI, Pune and DGM, Maharashtra was carried out in Kudopi block by detailed mapping (DM) of 10 sq. km. of lateritic terrain on 1:4000 scale and 514 m of drilling. Total 31 boreholes were drilled (by DGM, Maharashtra) on 400 x 400 m grid interval and 300 nos. of core samples were collected. The DM area exposes laterite/ aluminous laterite and at places bauxite. Laterite is present in the form of capping and most of which lie over the Deccan basalts which are mainly exposed in nala sections. Kaladgi sediments exposed in nala/road cutting sections and comprise quartz arenite/sandstone and shale. Analytical result of CS shows Al2O3 content from 19.93% to 55.67%. The analytical results of core samples indicate that zone/s of bauxite is intersected in 10 no. of boreholes out of 31 bore holes. The resource estimation for bauxite and aluminous laterite is under progress. The resource of aluminous laterite is calculated as 7.32 MT with an average grade of 33.79% Al2O3 and an average thickness of 2.27m. Besides, total 40.47 MT resources of aluminous laterite with an average grade of 29.03% Al2O3 and average thickness as 5.04m is also calculated separately by considering threshold value with minimum 20% Al2O3.
Coal							
Yavatmal	Lathi-Kesurli area Wardha Valley Coalfield	1:25000	80	-	1717.91	-	Large-scale mapping (1:25000) of 80 sq. km. area revealed that the area is covered by Motur Formation overlain by alluvium, river borne material and soil. The regional attitude of the bedding plane of sandstones varies from 110° to 130° with the dip varying between 7° to 10° towards SW. Four boreholes viz, WLK 1, WLK 2B, WLK 3A and WLK 4 have been drilled in the Lathi – Kesurli area, and including borehole geophysical logging of 1717.91 m in three boreholes. The Motur Formation is encountered in all boreholes, represented by greenish grey to variegated argillaceous dominant unit (mudstone) with interlayered sequence of an interbanded sandstone, heterolith (sand/mud dominated), grey shale and carbonaceous shale. The Barakar Formation is represented by fine to coarse grained, white to dark grey sandstone with interlayered sequence of mudstone, sand/ mud dominated heterolith, grey shale, carbonaceous shale and coal. The contact between Motur Formation and Barakar Formation is gradational and considered at last appearance of chocolate brown to brownish grey coloured lithounit. The Regional Barakar coal seam is intersected in borehole number WLK-1 at a depth from 680.67 to 701.33 m with cumulative thickness of 20.66 m, in WLK-2B at a depth from 806.21 m to 826.78 m with cumulative thickness of 20.70 mand in WLK-3A at a depth from 813.48 m to 831.85 m with a cumulative thickness of 18.37 m respectively. As the borehole WLK-4 is located within, the depo-center i.e. zone of -50 m gal as indicated by the Bouguer gravity anomaly, coal seam has not been encountered in this borehole up to final depth of 900 m. Quality wise the coal seam is non-coking ranging grade from G4 to G14. Total 617.02 million tons of inferred coal resources for "Thick seam and thin seam" has been estimated under reconnaissance category with in a depth range of 600 m – 1200 m.

Table – 4 : Mineral Production in Maharashtra, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
Coal	**'000t**	**-**	**54746**	**-**	**-**	**47435**	**-**	**-**	**56528**	**-**
Bauxite	t	15	595562	401196	12	471068	332108	12	640345	390285
Iron Ore	'000t	13	1131	1340244	11	1249	1732866	11	1958	6471874
Manganese Ore	t	20	720518	6096443	27	646513	6485961	26	731730	8445151
Fluorite (graded)	t	1	1315	8844	1	1052	8018	1	1237	8831

Table- 4 (Concld.)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
Kyanite	t	4	3098	11848	3	1145	1854	3	1458	3077
Sillimanite	t	2	13221	37903	1	11110	13987	-	3432	7973
Limestone	'000t	18	14614	3475512	17	13943	3476065	20	15757	3869717
Sulphur#	t	-	55659	-	-	41375	-	-	53165	-
Minor Minerals		-	-	71093300	-	-	62818800	-	-	54751000

Note : The number of mines excludes Fuel and Minor minerals.

$ Excludes the value Fuel minerals.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Abrasives	
Grindwell Norton Ltd, Mora, Uraon, Raigad	NA
Aluminium Products	
Hindalco, Recycling Plant, Taloja	50
Hindalco, Mouda, Distt. Nagpur	30 (rolling mill)
	14 (conductor rod)
Asbestos Products	
Everest Building Products Ltd, Mulund	NA
Hyderabad Industries Ltd, Musarane	60
Newkem Products Corp, Mumbai	9.9
Swastik Industries, Pune	NA
Cement	
ACC Ltd, Ghugus, Distt. Chandrapur	3800
Ambuja Cement Ltd, (Maratha Cement Works), Upparwahi, Chandrapur	4750
India Cement, Vaijnath, Parli, Distt Beed (G)	1100
JSW Cement, Dolvi, Distt. Raigad	1000 (slag cement)
Manikgarh Cement, (I) Korpana, Distt. Chandrapur	2000
Manikgarh Cement, (II) Korpana, Distt. Chandrapur	4000
Murli Industries Ltd, Naranda, Distt. Chandrapur.	3000
Orient Cement, Jalgaon (G)	2000
Birla Corpn. Ltd, Butibori, Distt. Nagpur (G)	500
UltraTech Cement, Hotgi, Distt. Solapur (G)	4000
UltraTech Cement Ltd, Awarpur,	6000
Distt. Chandrapur	4500 (Clinker)
UltraTech Cement Ltd, Ratnagiri Works (G), Distt. Ratnagiri	480
UltraTech Cement Ltd, Nagpur	2000
Zuari Cement, Solapur	1200
Ceramics	
H & R Johnson (India) Ltd, Pen	154.8
Joglekar Refractory & Ceramics Pvt. Ltd, Rabale, Distt. Thane.	**364.8**
Jyoti Ceramic Industries Pvt. Ltd,	0.16 (Ref. coating)
Satpur	**1.0 (Ceramic Product)**

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
NITCO Tiles Ltd, Raigad	66 lakh (sq. m)
Chemicals	
Borax Morarji Ltd, Ambarnath	25 (borax)
	8 (boric acid)
Century Rayon, Shahad, Distt. Thane	**25 (rayon yarn)**
	20 (caustic soda)
Foseco India Ltd, Sanswadi	15 (foundry chemicals)
Gargi Huttenes Albertus Pvt.Ltd, Kukshet,Navi Mumbai	12 (Foundary Chemical)
National Peroxide Ltd, Kalyan, Distt Thane.	1.4 (sodium per borate)
Star Earth Minerals Pvt. Ltd, Tanjola, Panvel	0.6 (zirconium basic carbonet)
Sudarshan Chemical Ind. Ltd, Roha, Distt Raigad	5.2 (pigments)
Tecil Chemical & Hydro Power Ltd, Mumbai.	30 (calcium carbide)
Zirconium Chemicals Pvt. Ltd, Taloja, Distt. Raigad	0.3 (zirconium salt)
Copper Wire Rods	
HCL, Copper project, Taloja	60
Electrode	
GEE Ltd, Thane.	4.02 (Mill. m)
Weldfast Electrode Pvt. Ltd, Nagpur	15.9
Weldstrong Electrode Pvt. Ltd,	0.9
Butibori, Hingna Nagpur	0.15 (Welding flux)
Electrolytic Manganese Dioxide	
MOIL, Dongri Buzurg, Distt. Bhandara	1
Fertilizers	
Balaji Fertilisers Pvt. Ltd, Nanded	20 (SSP)
Basant Agro Tech (India) Ltd, Barshi Takli, Akola	**120 (SSP)**
Basant Agro Tech (India) Ltd, Jalgaon.	132 (SSP)
BEC Fertilizer (Unit of Bhilai Engg. Corpn. Ltd,), Gunjakheda, Wardha	66 (SSP)
Bharat Agri Fert & Realty Ltd, Kharivali, Thane	**132 (SSP)**
Coromandel International Ltd, (Formerly, Liberty Phosphate Ltd,), Pali, Raigad	**66 (SSP)**
Deepak Fertilizers & Petrochemical Corporation Ltd, Taloja	230 (ANP)
Rama Krishi Rasayan (A division of Rama Phosphates Ltd), Loni Kalbhor, Pune	132 (SSP)
Shiva Global Agro Industries Ltd, (Formerly, Shiva Fertilizers Ltd), Nanded	120 (SSP)
Shri Bhavani Mishra Fertilizers Pvt. Ltd, Vazirabad, Nanded	30 (SSP)
Shree Pushkar Chems & Fertiliser Ltd, Lote	100 (SSP)

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Porshuram, Khed, Ratnagiri	
Zuari Fertilizers and Chemicals Ltd, Mahad,	216 (SSP)
Distt. Raigad	
RCF, Trombay	330 (Urea)
	690 (Complex)
RCF, Thal, Distt. Raigad	2000 (Urea)
Pesticides	
Hindustan Insecticides Ltd, Rasaini, Distt. Raigad	13.2
Paint	
Jespco, Irechwara, Miraj	8 (Zircon Paint)
Glass	
Ace Glass Containers Ltd, Pimpri, Distt. Nashik	NA
Empire Industries Ltd, (Vitrum Glass),	37.5
Vikroli, Mumbai	
Hindustan National Glass & Industries Ltd,	320 TPD
Nashik	
Iron & Steel	
JSW Ispat Steel Ltd, Dolvi, Raigad	5400 (Sinter)
	1600 (Sponge iron)
	5040 (Crude/Liquid steel)
	3500 (pig iron)
Lloyds Steel Ltd, Wardha	600 (HRC)
	350 (CRC)
	250 (GPC)
Indian Seamless Steel & Alloys Ltd, 450 (seamless tubes)	
Jejuri, Distt. Pune	350 (alloy &
	carbon steel)
Sunflag Iron & Steel Co. Ltd,	262 (sponge iron)
Warrthy, Mohadi	250 (Pig iron)
	250 (sinter)
	505 (Finished steel)
Uttam Galva Metallics Ltd,	886.95 (Sinter)
Bhugaon,Wardha	525 (pig iron)
Lime	
Hetendra Lime Products, Rajur, Wani	5.5
Swastic Lime Factory, Rajur, Wani	5.5
Swastic Mineral & Lime Industries, Rajur,Wani	5.5
Pellet	
Amba River Coke Ltd, Dolvi, Pen	4000
Pig Iron	
Ispat Metallics India Ltd, Dolvi, Raigad.	2000
Lint Export Pvt. Ltd, Chincholi, Mohol	0.25
Tata Metaliks Ltd, (Usha Ispat Ltd, Redi),	300
Distt Sindhudurg.	
Sona Alloys Pvt. Ltd, Satara.	314

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Usha Ispat Ltd, Redi.	300
Uttam Galva Metallics Ltd,	225
Bhugaon, Wardha	389.95 (Sinter)
Gopani Iron Ore Ltd, Chandrapur.	144
	75 (Semi-Finished Steel)
Lloyds Metals & Engineers, Ghugus, Chandrapur.	300
JSW Steel Salav Ltd,	900
Welspun Max Steel Ltd, (formerly Vikram Ispat),	
Distt. Raigad	
Ferroalloys	
Chandrapur Ferro Alloys Plant (SAIL), (formerly	100
Maharashtra Elektrosmelt Ltd,), Chandrapur.	
Minex Metallurgical Co. Ltd, Nimji,	0.250 (Fe-Ti)
Kalmeshwar	
Natural Sugar & Allied Industries Ltd,	16.5 (Si-Mn)
Sai Nagar, Ranjani, Distt. Osmanabad	16.5 (H. C.Si-Mn)
SRC Chemical Pvt. Ltd, Borieandi, Daund, Pune	6
Welspun Maxsteel Ltd, Salav, Raigad.	90
Refractory	
ACE Refractories, Nagpur.	60
NECO Ceramics	NA
Ceraflux India Pvt. Ltd,	2.7 (Ref. Die releasing Agent)
Gokul Shirgaon, Kolhapur	2.7 (Ref. Coating)
Calderys India Refractories Limited	58 (castable)
Nagpur Refractory Works, Ruikhairi	
Butibori, Nagpur	
Joglekar Refractories Pvt. Ltd,	4.8 (Ramming Mass)
Rabale, Navi Mumbai	0.54 (Chrome Ore +60)
	0.15 (Chrome Ore -60)
	0.15 (DBM Magnetite)
Petroleum Refinery	
BPCL, Mumbai.	12000
HPCL, Mumbai.	7500

(G) : Grinding units.

Note: Data, for fertilizer and cement industries besides their respective websites, have been taken from Indian Fertilizer Scenario, FAI Statistics and Survey of Cement Industry & Directory, respectively.

Manipur

Mineral Resources

Important mineral occurences in Manipur are Chromite and Limestone. Total resources of the Chromite and Limestone in the state are 6.65 million tonnes and 46 million tonnes respectively (Table-1)

Exploration & Development

The details of exploration activities conducted by GSI for Chromite and Nickel during the year 2021-22 are furnished in Table - 2.

Production

No mineral production (except minor minerals) was reported from Manipur in 2021-22. The value of minor minerals' production was estimated at 29 lakh for the year 2021-22

Table 1: Reserves/Resources of Mineral as on 1.4.2020 : Manipur

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Chromite	000 Tonnes	-	-	-	-	3	21	52	-	504	6077	-	6657	6657
Limestone	000 Tonnes	-	-	-	-	-	-	-	10197	2138	33718	-	46053	46053

Figures rounded off

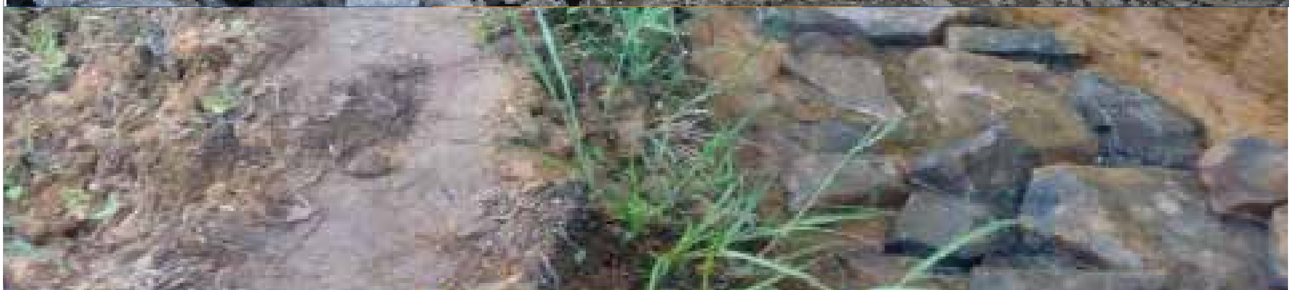
Table –2 : Details of Exploration Activities in Manipur, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Nickel-Ni-Cr-PGE/Cr-Ni-PGE							
	Naga-Manipur Hills Ophiolite around Champhai-Hermon area	1 :2000	3	-	-	-	Detailed geological mapping on 1 :2000 scale covering 3 sq km around Champhai- Hermon- Seivangkho areas in parts of SoI TS 83 L/ 07 was carried out toassess the potential source supergene Ni deposits. Ni- rich laterite deposits of about 1 . 6 sq km with an average thickness of 4 . 5 m around Champhai, Hermon and Seivangkhowere delineated as potential supergene Ni- laterite deposits. Laterites are observed to occupy the crest and slope of gently sloping ridges and flat top plateau, typical of accretionary deposit. The deposit can be classified as both oxide and saprolite type (boulder ore) and the laterite profile have been subdivided into various weathering zones. A total of five horizons have been recognised (bottom to top) that have been described in other Ni laterite deposits of the world: (i) Saprolite, (ii) ferruginous saprolite (yellow limonite) (iii) Oxidised Zone (iv) Plasmic Zone and (v) duricrust. The ore-bearing laterite i s derived from the weathering of the spinel harzburgitic rocks. Lateritic regoliths are confined to peridotite, with varying thicknesses. Trench profile and soil section indicate at least two distinguishable weathering mantles with subdivision in each zone. The upper oxide zone is usually dark brownish- reddish in colour containing granules, pisolite (±secondary silica vein), locally hardened ferruginous granular, porous concretionary aggregate having colloidal or colloform texture. The round to ellipsoidal goethite granules is held together by ferruginous limonitic materials. Goethites are the main host for Ni in the oxide zone. The lower zone called saprolite zone is composed of weathered and decomposed rock which is light yellowish to soft pale greenish in colour. Remnants of protolith are visible. In the saprolite zone, hydrous material of serpentine- like, talc- like and chlorite- like (hydrous Mg-Ni silicate; garnierite) precipitates and occurs as slickenside coating, sigmoidal and fracture filling and veins. This indicates a complex supergene syn- tectonic evolution. The chemical data indicated an encouraging value of Ni in the saprolite zone (Ni – 15,822 ppm), of ultramafic- derived regolith. The concentrations of other trace elements in the saprolite/saprocks are Cr (4472 ppm), Cu (32 ppm), Co (268 ppm), Pb (8 ppm) and Sc (5 ppm).The limonitic layer of the laterite contains high value of Fe_2O_3 (T) (19.95-51.42 %), Al_2O_3 (4 . 22 - 19 . 74 %) and low MgO (1 . 20 - 4 . 98 %). The limonitic laterite analysed Ni (1962 -7992 ppm) with associated Co (110-336 ppm), Cr (3693-12380 ppm), Cu (66-90 ppm), Pb (<2-15 ppm), Sc 23-29 ppm) and V (64-262 ppm). Within the laterite profile, an abrupt decrease in MgO and gradual increases of TiO_2 and a drastic increase in Fe_2O_3 and Al_2O_3 from the protolith towards the oxidized lateritic soil were observed. The high content of i ron in the lateritic soil is attributed to the release of FeO during the process of serpentinisation and weathering of olivine and pyroxene- rich rocks. The high SiO_2 content in the oxide zone may be due to the presence of localized thin silica veins within the oxide zone. Mno is fairly uniform in both limonite and saprolite. CaO and Na_2O are fairly constant. While Cr content gradually increases from bedrock to the limonite, on average, the concentration of Ni is higher in saprock. This pattern is in good agreement with the principle of weathering or lateritisation process during which elements such as Mg and Si become leached and others such Ni, Co, Y and Mn are secondarily enriched, while Fe, Cr, Al and Ti are residually concentrated within the laterite profile.

Table-2 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Tengnoupal	Manipur-Nagaland Ophiolite Belt, Chalwa-Kwatha area	1 :5000	6 . 3	-	-	-	Detailed mapping on 1:5000 scale was carried out in parts of Kamjong District for delineating the mineralised zone within nickeliferous laterite and associated base metal covering 6.3 sq.km area. The study area forms a part of the southern extension of the Manipur-Nagaland Ophiolite Belt and exposes the Ophiolite suite of rocks and Paleogene sediments. Ophiolite suite of rocks is mainly represented by the dunite, pyroxenite, harzburgite and volcanics. The cumulate ultramafic peridotite host massive chromitite as discontinuous lenses and pods of varying dimension along the strike continuity. The lateritic soil capping developed above the mafic-ultramafic peridotite shows varying exposed thickness (1 to 8m). The well-developed lateritic soil capping shows six distinct lateritic soil profile horizons i.e., saprock mixed with saprolite, saprolite, oxidised zone rich in goethite nodules, plasmic and ferric duricrust. The lateritic soil samples in the studied area are characterised by the relative enrichment of Fe_2O_3 (14.60% to 46 . 75 %), Ni (2505 ppm to 14494 ppm), Cr (2466 ppm to 10236 ppm) and Co (92 ppm to 405ppm). The higher values of Ni correspond to the saprolite lateritic soil horizon. The significant depletion of MgO in the top lateritic profile (MgO - 1.15%) and relative enrichment at the base (22 .63 %) indicates the leaching effect induces by the meteoric water. The UMIA values for the lateritic soil range from 27.67 to 69 .46 , which indicates high degree of weathering of the protolith mafic- ultramafic peridotite (UMIA value of fresh bedrock peridotite ranges from 8 . 51 to 36 . 0). The index of laterisation (IoL) values for the lateritic soil mostly range between 30.52 to 65.33 indicating middle stage of advanced leaching, resulting from re-distribution of Ni, Si, and Mg from the limonite towards the saprolite horizon. Ternary plot of SiO_2-Al_2O_3-Fe_2O_3 for lateritic soil shows clustering of plots in the three f ield of medium to low laterisation and kaolinisation, indicating less advanced stage of laterisation.

Meghalaya



Limestone was the important mineral produced in Meghalaya during the year 2021-22

₹ 721lakh
Value of minor minerals' production were estimated for the year 2021-22

19
Mines in the state reported production of limestone in 2021-22

Mineral Resources

Coal and limestone are the only major minerals mined in Meghalaya. Coal occurs in Mikir Hills, Khasi Hills, Jaintia Hills and Garo Hills districts. Resources of limestone occur in West Garo Hills, East Khasi Hills, West Khasi Hills and Jaintia Hills districts. Other mineral occurrences are apatite in Jaintia Hills district; china clay in East Garo Hills & West Garo Hills, Jaintia Hills & East Khasi Hills districts; copper, lead-zinc, silver & titanium minerals in East Khasi Hills district; felspar & rock phosphate in East Garo Hills & Jaintia Hills districts; fireclay in East Khasi Hills & West Garo Hills districts; granite in West Khasi Hills district; iron ore (magnetite) in East Garo Hills district; quartz & silica sand in East Garo Hills, West Garo Hills & East Khasi Hills districts; and sillimanite in West Khasi Hills district (Table -1) The various coalfields and their reserves/resources in the State are furnished in Table-2.

Table – 1 : Reserves/Resources of Minerals as on 01-04-2020: Meghalaya

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Apatite	Tonne	-	-	-	-	-	-	-	-	-	1300000	-	1300000	1300000
Bauxite	000 Tonnes	-	-	-	-	-	-	-	-	-	4300	-	4300	4300
Copper														
Ore	000 Tonnes	-	-	-	-	-	-	-	-	880	-	-	880	880
Metal	000 Tonnes	-	-	-	-	-	-	-	-	9	-	-	9	9
Iron Ore (Heamatite)	000 Tonnes	-	-	-	-	-	-	-	-	-	225	-	225	225
Iron Ore (Magnetite)	000 Tonnes	-	-	-	-	-	-	-	-	-	3380	-	3380	3380
Lead-Zinc Ore														
Ore	000 Tonnes	-	-	-	-	-	-	-	-	880	-	-	880	880
Lead metal	000 Tonnes	-	-	-	-	-	-	-	-	16.5	-	-	16.5	16.5
Zinc metal	000 Tonnes	-	-	-	-	-	-	-	-	14	-	-	14	14
Limestone	000 Tonnes	133298	50979	66766	251043	57639	104791	16452	697286	4167752	17819716	720309	23583945	23834988
Rock Phosphate	Tonne	-	-	-	-	-	-	-	-	-	1311035	-	1311035	1311035
Sillimanite	Tonne	14400	-	68112	82512	-	-	-	-	-	55807	-	55807	138319
Silver														
Ore	Tonne	-	-	-	-	-	-	-	-	880000	-	-	880000	880000
Metal	Tonne	-	-	-	-	-	-	-	-	19.8	-	-	19.8	19.8
Titanium	Tonne	-	-	-	-	-	-	-	-	3345000	-	-	3345000	3345000

Figures rounded off.

Table – 2 : Reserves/Resources of Coal as on 1.4.2023 : Meghalaya

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	89	17	471	576
West Darangiri	65	–	60	125
East Darangiri	–	–	34	34
Balphakram-Pendenguru	–	–	107	107
Siju	–	–	125	125
Langrin	10	17	106	133
Mawlong Shelia	2	–	4	6
Khasi Hills	–	–	10	10
Bapung	11	–	23	34
Jayantia Hills	–	–	2	2

Source: Coal Directory of India, 2022-23.

Exploration & Development

Details of exploration activities conducted by GSI during 2021-22 are furnished in Table - 3.

Production

Limestone was the important mineral pro- duced in Meghalaya during the year 2021-22. The value of minor minerals' production was estimated at Rs. 46 crore for the year 2021-22.There were 16 reporting mines in 2021-22 in the state for lime- stone (Table-4).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the important mineral-based industries in the organised sector in the State are furnished in Table - 5.

Table –3 : Details of Exploration Activities in Meghalaya, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **Base Metals**							
East Khasi Hills	Barapani Shear Zone in and around Mawlyndep – Mawmin - Nongbsap villages	1:12500	50	-	-	168	Large scale mapping of 50 sq. km area on 1:12,500 scale has been carried out along with pitting / trenching of 50 Cubic m, 118 bedrock sampling and 50 soil sampling in the surrounding of Barapani Shear Zone. Bedrock samples from Carbonaceous phyllite, calc-silicate, meta-volcanoclastic and quartz veins have shown >100ppm as values and maximum upto 2954ppm in quartz vein. 7 sample collected from carbonaceous phyllite and calc-silicate rock have shown >250ppm Zn values and maximum upto 3028 ppm Zn in one sample from calc-silicate rock. Two samples from carbonaceous phyllite showing TiO2 concentration 4.47 and 5.06 % whereas two samples from laterite shows 7 and 7.17 % TiO2. 35 samples collected from meta-volcanoclatsic, meta-rhyolite, calc-silicate, quartz vein and carbonaceous phyllite are showing Li content >20 ppm and maximum upto 57 ppm in meta-volcanoclatic, 29 bedrock samples collected from meta-volcanoclastic, carbonaceous phyllite, and calc-silicate shows Cs content >10 ppm and maximum upto 23.31 ppm in metavolcanoclastic and 23.01 ppm in carbonaceous phyllite. Based on petrographic study, sulphide mineralisation has been observed in the form of pyrite, arsenopyrite, pyrrhotite, covellite, chalcocite and chalcopyrite. Scanning electron microscopic (SEM) shows, arsenopyrite, pyrrhotite, pyrite, colevllite, galena, chalcopyrite and LREE bearing carbonate and phosphate phases.
Tungsten							
East Khasi Hills, Rhi-boi and West Jaintia Hills	Kyrdem area	1:12500	50	-	-	-	Large scale mapping (1:12,500) of 50 sq.km was carried out in the Kyrdem area and in and around the contact between Shillong Group of rocks the Kyrdem Pluton. The study area is occupied by lithounits of gneissic rock of AMGC, intercalation of phyllite and micaceous quartzite, tuffaceous phyllite, amphibolite and calc silicate rock of Shillong Group, gabbroic pyroxenite of Khasi Greenstone belt and granitic rocks of Kyrdem Pluton. First time the calc silicate band has

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							been reported in the Lumsyntung area. Three phases of deformation were recorded in the calc silicate rock. Sulphide mineralisation in the area is mainly confined to calc-silicate, micaceous grey quartzite and amphibolite. The mineralisation, manifested by disseminated sulphide occurrences, is predominantly enriched to conformable set of quartz veins that occur along the gently dipping prominent foliation in the calc silicate rocks. The structural control of mineralisation appears to be by the 2nd deformation event that gave rise to the gently dipping foliation-parallel silicification related to the early phase of deformation of the schistosity/ gneissosity. At Mawtari and Klew village scheelite mineralisation which is associated with sulphide minerals has been observed along the fracture plane developed in the ferruginous porphyritic granite. The control of mineralisation may be due to the hydrothermal fluid which has interacted or remobilised the wall rock along the fracture plane and given rise to the formation of tungsten bearing minerals like scheelite and wolframite. These N-S fracture planes may be developed due to the reactivation of the Barapani shear zone or it may be part of Umgot lineament which is passing through the Pluton and even though it is far from N-S Nongcharam fault but sympathetic to it. The Ca, Fe and Mg laden hydrothermal fluid might have given rise to the formation of scheelite and wolframite. The pyrite and chalcopyrite minerals might be formed by hydrothermal activity. The potassic alteration evidences by petrographic studies of granite suggest that the plagioclase is converted to potassic feldspar, also sericitisation of plagioclase feldspar is indicating the alteration feature. The tungsten value in 10 samples is 358ppm, 225ppm, 302 ppm and 152 ppm, 227ppm,132ppm, 48 ppm 31ppm, 30ppm, 13.3ppm respectively in the porphyritic granite at Mawtari and Klew village. Lithium values of 208 ppm, 131ppm, 112 ppm, 83 ppm, 78 ppm has been indicated from amphibolite and pegmatite vein intruded into it.

Table - 4 : Mineral Production in Meghalaya, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**19**	**-**	**3431243**	**19**	**-**	**3148600**	**16**	**-**	**3331595**
Limestone	'000t	19	7248	2988280	19	6029	2689713	16	6399	2872708
Minor Minerals @		-	-	442963	-	-	458887	-	-	458887

Note: The number of mines excludes Minor minerals.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Cement	
Adhunik Cement (Subsidiary of Dalmia Cement), Distt Jaintia Hills	1500
Amrit Cement Industries Ltd, Khleriat, Distt Jaintia Hills	3000
Cement Manufacture Co. Ltd, Lumshnong, Distt Jaintia Hills	792
DCBL Meghalaya Cements Ltd, Thangskai, Narpuh Distt Jaintia Hills	1500
Green Valley Industries, Nongsning, Jowai,Distt Jaintia Hills.	1000
JUD Cement Ltd, Norpuh, Distt Jaintia Hills	500
Mawmluh Cherra Cements Ltd, Cherrapunjee, Distt East Khasi Hills	185

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Meghalaya Cements Ltd, Thangskai,	860
Distt Jaintia Hills	
Megha Technical & Engineering (P) (MTEPL),	700
Lumshnong, Distt Jaintia Hills	
Hills Cement, Jaintia Hills	1000
RNB Cement, East Khasi	400
Ferroalloys	
Jaintia Ferro Alloys Pvt. Ltd, Byrnihat.	6
Maithan Alloys Ltd, Ribhoi	15 MVA
Maithan Alloys Ltd, RajaBagan	28
Nalari Ferro alloys Pvt Ltd, Norbhog	11
Khasi alloys Pvt. Ltd, EPIP Meghalaya	4.1
Iron & Steel	
Jai Kamakhya Alloy Pvt. Ltd	815 tpd

Source: Data from respective websites of cement industries as well as Survey of Cement Industry & Directory.

Mizoram and Nagaland

₹ 18 lakh

estimated value of production of minor minerals in 2021-22.

MIZORAM

Mineral Resources

Occurrences of lignite, sandstone and pyrites are reported from the State. Major deposits of economic importance have not been reported so far in the State.

Exploration & Development

No exploration activities was reported to be carried out by any Central/State Government agency during 2021-22 in the State.

Production

No mine ral pro duction (exc ep t minor minerals) was reported from Mizoram during 2021-22. The value of minor minerals' production was estimated at 165 crore for the year 2021-22.

NAGALAND

Mineral Resources

Important mineral occurrences in the State are: coal in Borjan, Jhanzi-Disai, Tiesang and Tiru Valley Coalfields; iron ore (magnetite), cobalt, dunite and nickeliferous chromite in Tuensang district and limestone in Phek and Tuensang districts (Table-1). The various coalfields and their reserves/resources are furnished in Table-2.

Exploration & Development

Details of exploration activities conducted by GSI during 2021-22 are furnished in Table-3.

Production

No mineral production (except minor minerals) was reported from Nagaland during 2021-22. The value of minor minerals' production was estimated at 18 lakh for the year 2021-22.

Table – 1 : Reserves/Resources of Minerals as on 01-04-2020 : Nagaland

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Chromite	000 Tonnes	-	-	-	-	-	-	-	-	-	3200	-	3200	3200
Cobalt	Million Tonnes	-	-	-	-	-	-	-	-	-	-	5	5	5
Copper														
Ore	000 Tonnes	-	-	-	-	-	-	-	-	-	2000	-	2000	2000
Metal	000 Tonnes	-	-	-	-	-	-	-	-	-	15	-	15	15
Iron Ore	000 Tonnes	-	-	-	-	-	-	-	-	5280	-	-	5280	5280
(Magnetite)														
Limestone	000 Tonnes	-	-	-	-	825	-	-	-	1005500	745875	-	1752200	1752200
Nickel Ore	Million Tonnes	-	-	-	-	-	-	-	-	5	-	-	5	5

Figures rounded off.

Table – 2 : Reserves/Resources of Coal as on 1.4.2023 : Nagaland

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Nagaland	9	22	448	478
Borjan	6	–	5	11
Jhanzi-Disai	2	22	109	133
Tiensang	1	–	2	3
Tiru Valley	–	–	7	7
DGM	–	–	293	293
Changki	-	-	32	32

Source: Coal Directory of India, 2022-23..

Table – 3: Details of Exploration Activities in Nagaland, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Shale Gas							
Kohima	Chedema-Dihoma area	1:12500	100	-	-	-	Reconnaissance survey for shale gas around Chedema-Dihoma area, Kohima District, Nagaland has been undertaken to evaluate hydrocarbon potentiality of shale horizon within Disang Formation in part of T.S. 83K/02. The study area falls within the latitudes 25°40'40"N - 25°45'00"N and longitudes 94°07'20"E - 94°15'00"E. Large-scale mapping on 1:12,500 scale has been carried out covering 100 sq km area. The study area forms a part of the Inner Palaeogene Fold belt of Nagaland-Manipur. The rocks exposed in the area comprise of shales, phyllites, slates, siltstones and minor sandstones. The Disangs (Late Eocene to Upper Cretaceous) is the oldest formation. It is sub-divided into Lower and Upper Disang formations. The rocks of the Lower Disang Formation have undergone low-grade metamorphism as evident by phyllitic shale and slate. Slates are dark grey with ubiquitous crisscrossed quartz veins. It can be easily broken into thin sheets due to well-developed foliations. The lower Disang Formation has a gradational contact with Upper Disang Formation. Exotic coralline limestone is also observed within the dark grey shales, which are exposed on the left bank of Sedzu River. The Upper Disang Formation is argillaceous dominant and comprises alternate layers of monotonous thick sequence of dark grey to, laminated/ splintery grey shale with thin interbands of bedded sandstones and siltstone. Spheroidal weathering is common within the Disang shale. The arenaceous units appreciably increase towards the upper part. To evaluate the unconventional hydrocarbon system, it is indispensable to understand various key geochemical (organic matter abundance, type and maturity) and geological parameters (mineral composition, porosity, permeability and gas content) to determine the potentiality for shale gas generation. Because of high organic matter abundance and stratigraphic continuity in the Disang Group, it is imperative to assess the viability of shale gas prospects in the present study area. The total organic carbon (TOC) of Disang shales ranges from 0.02% to 0.66% mg/g (av. 0.347 mg/g), suggesting poor to fair generating potential. The S1 concentration ranges between 0.01 and 0.04 mg/g (avg. 0.018 mg/g) and S2 concentration ranges between 0.06 to 0.32 mg/g (avg. 0.107 mg/g). The rock-eval parameters reflect that the Disang shales have poor generative potential. The plot of TOC vs. Hydrogen index (HI) of the seven shale samples indicates that one sample of Upper Disang Fm. and one sample from Renji Fm falls under gas and oil field, one sample of Upper Disang Fm. falls under fair oil-prone field, and three samples Upper Disang Fm. and one sample of Renji Fm fall under no source field. TOC vs. S1 indicates that all the samples are characterised by autochthonous hydrocarbon. The TOC vs. S2 diagram indicates that four samples Upper Disang Fm., one sample of Renji Fm falls under the Type-IV field, one sample of Renji Fm falls under Type-III kerogen field and one sample of Upper Disang Fm. falls under Type-II & III suggesting the kerogen of the Disang shale are Type-III & IV dominant which are potential source of gas. The plot of HI vs. Oxygen index (OI) indicates that four samples of Upper Disang Fm. and one sample of Renji Fm fall under Type- IV fields, one sample of Renji Fm falls outside field below Type-I kerogen and one sample of Upper Disang Fm. falls under Type II & III. The Tmax vs. HI diagram indicates that three samples of Upper Disang Fm. and one sample of Renji Fm fall under dry gas window and one sample of Upper Disang Fm., and one sample of Renji Fm falls under immature field. The Tmax vs. PI diagram indicates that five samples of Upper Disang Fm. falls under dry gas zone and two samples of Renji Formation fall under stains or shows. The Tmax value of the study area ranges from 427°C – 506°C and PI ranges between 0.15 -0.22 indicating that the maturity of the organic matter in Disang shale falls within wide limitfrom immature to postmature (gas generation). During the course of large-scale mapping extensive area of shale was delineated which could prove to be a good reserve of shale gas/oil. The low TOC (< 0.5%) can be attributed to oxidation of organic matter during outcrop weathering. Therefore, drilling is warranted to obtain core samples from greater depth to establish the shale gas reserve.

Odisha

The important minerals produced in the state were Coal, Bauxite, Chromite, Iron Ore, Manganese Ore, Graphite and Limestone etc. during 2020-21

₹ 6,282 crore
value of minor minerals' production were estimated for the year 2021-22

71
Mines in case of MCDR Minerals reported production in 2021-22

Mineral Resources

Odisha is the leading producer of chromite, garnet (abrasive), bauxite, manganese ore, iron ore, sillimanite, quartzite and dolomite. The State hosts the country's sole resources of ruby. It accounts for the country's 96% chromite, 93% nickel ore, 90% PGM metal, 69% cobalt ore, 51% bauxite, 44% manganese, 34% iron ore (haematite), 25% sillimanite, 24% fireclay, 23% pyrophyllite, 20% vanadium ore, 17% mica, and 10% dolomite resources. As per AMD of the Department of Atomic Energy, Odisha, accounted for 150.62 million tonnes of rutile resources.

Important minerals that occur in the State are: bauxite in Balangir, Kalahandi, Kandhamal, Keonjhar, Koraput, Malkangiri, Rayagada & Sundargarh districts; china clay in Bargarh, Boudh, Balangir, Keonjhar, Koraput, Mayurbhanj, Sambalpur & Sundargarh districts; and chromite in Balasore, Cuttack, Dhenkanal, Jajpur & Keonjhar districts. Chromite deposits of Sukinda and Nuasahi ultramafic belt constitute 95% of the country's chromite resources. Besides, coal occurs in Ib river valley and Talcher coalfield, Dhenkanal district; dolomite in Bargarh, Keonjhar, Koraput, Sambalpur & Sundargarh districts; dunite/pyroxenite in Keonjhar and Sundargarh districts; fireclay in Angul, Cuttack, Dhenkanal, Jharsuguda, Khurda, Puri, Sambalpur & Sundargarh districts; garnet in Ganjam, Kalahandi & Sambalpur districts; graphite in Bargarh, Boudh, Balangir, Kalahandi, Koraput, Nuapada & Rayagada districts; iron ore (haematite) in Dhenkanal, Jajpur, Keonjhar, Koraput, Mayurbhanj, Sambalpur & Sundargarh districts; iron ore (magnetite) in Mayurbhanj district; limestone in Bargarh, Koraput, Malkangiri, Nuapada, Sambalpur & Sundargarh districts; manganese ore in Balangir, Keonjhar, Koraput, Rayagada, Sambalpur & Sundargarh districts; Pyrophyllite in Keonjhar district; quartz/silica sand in Boudh, Balangir, Kalahandi, Sambalpur & Sundargarh districts; quartzite in Balangir, Dhenkanal, Jajpur, Jharsugada, Keonjhar, Mayurbhanj, Sambalpur & Sundargarh districts; sillimanite in Ganjam & Sambalpur districts; talc/steatite/soapstone in Mayurbhanj, Sundargarh & Sambalpur districts; titanium minerals in Dhenkanal, Ganjam, Jajpur & Mayurbhanj districts; and zircon in Ganjam district.

Other minerals that occur in the State are asbestos in Keonjhar district; cobalt in Cuttack & Jajpur districts; copper in Mayurbhanj & Sambalpur districts; granite in Angul, Boudh, Balangir, Cuttack, Deogarh, Dhenkanal, Ganjam, Keonjhar, Khurda, Koraput, Mayurbhanj, Nuapada, Rayagada & Sambalpur districts; lead in Sargipalli area, Sundargarh district; mica in Sonepur district and nickel in Cuttack, Keonjhar & Mayurbhanj districts. Occurrences of ruby and emerald are reported from Balangir and Kalahandi districts, respectively. Platinum Group of Metals occur in Keonjhar district; silver in Sundargarh district; tin in Koraput & Malkangiri districts; and vanadiferous magnetite occurs in Balasore & Mayurbhanj districts (Table-1). The various coalfields along with their reserves/resources are given in Table - 2.

Table –1: Reserves/Resources of Minerals as on 1.4.2020: Maharashtra

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Asbestos	Tonne	-	-	-	-	-	-	-	10000	37200	9500	-	56700	56700
Bauxite	000' Tonnes	388184	7346	14210	409740	97550	56160	193301	161842	428849	596940	112642	1647284	2057024
Chromite	000' Tonnes	40453	15229	22349	78031	52215	10146	44289	1565	52304	59284	20435	240237	318269
Cobalt	Million Tonnes	-	-	-	-	-	-	-	31	-	-	-	31	31
Copper														
Ore	000' Tonnes	-	-	-	-	-	-	-	1340	2306	8345	-	11991	11991
Metal	000' Tonnes	-	-	-	-	-	-	-	20.63	20.14	56.26	-	97.03	97.03
Garnet	Tonne	8330045	-	1	8330046	5	-	1	-	-	348001	829311	1177318	9507364
Graphite	Tonne	-	-	2838414	2838414	6371790	2889564	2927932	696021	838841	3119932	298628	17142707	19981121
Iron Ore (Haematite)	000' Tonnes	1817247	328296	653206	2798749	1662944	1068654	770861	28824	925717	2019410	134173	6610582	9409331
Iron Ore (Magnetite)	000' Tonnes	-	-	-	-	79	-	120	-	-	43	-	242	242
Lead-Zinc Ore														
Ore	000' Tonnes	-	-	-	-	-	961	119	-	-	670	-	1750	1750
Lead metal	000' Tonnes	-	-	-	-	-	34.32	4.25	-	-	38.39	-	76.96	76.96
Limestone	000' Tonnes	388084	67346	13150	468580	156898	456006	260485	139924	239877	435449	38785	1727424	2196004
Manganese Ore	000' Tonnes	7535	1511	2423	11470	39091	22916	33968	10260	12219	32657	8947	160058	171528
Nickel Ore	Million Tonnes	-	-	-	-	-	21	21	31	51	51	-	175	175
Pt. Group Of Metals	Tonne	-	-	-	-	-	-	-	-	7.7	6.5	-	14.2	14.2
Rare Earth Elements	Tonne	-	-	-	-	-	-	-	-	6353	19140	-	25493	25493
Ruby	Kilogram	-	-	-	-	-	429	3296	-	-	1623	-	5349	5349
Sillimanite	Tonne	5640985	-	-	5640985	-	-	6557013	-	-	4943600	561595	12062208	17703193

Table-1 (Concld.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Silver														
Ore	Tonne	-	-	-	-	-	960500	119000	-	-	670000	-	1749500	1749500
Metal	Tonne	-	-	-	-	-	27.34	3.4	-	-	34.17	-	64.91	64.91
Tin														
Ore	Tonne	-	-	-	-	12749	653	40	-	1166	1010	-	15618	15618
Metal	Tonne	-	-	-	-	73.91	512.47	27.59	-	22.2	16.56	-	652.73	652.73
Titanium	Tonne	12654141	-	-	12654141	-	-	-	950000	2196933	48612331	1259798	53019062	65673202
Vanadium														
Ore	Tonne	-	-	-	-	-	1220000	-	-	232000	3412795	-	4864795	4864795
Metal	Tonne	-	-	-	-	-	2135	-	-	487.2	10935.74	-	13557.94	13557.94
Zircon	Tonne	476672	-	-	476672	-	-	-	-	39300	303491	47456	390247	866919

Figures rounded off.

Table – 2: Reserves/Resources of Coal as on 1.4.2023: Odisha

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	52046	37536	4936	94519
Ib-River	17506	20096	2228	39830
Talcher	34540	17440	2708	54689

Source: Coal Directory of India, 2022-23.

Exploration & Development

The details of exploration activities conducted by GSI for gold, diamond, iron ore, manganese ore, coal & REE and other minerals during 2021-22 are furnished in Table - 3.

Production

MThe important minerals produced in the state during 2021-22 were Coal, Bauxite, Chromite, Iron Ore, Manganese Ore, Graphite and Limestone etc.. The value of minor minerals' production was estimated at 147 crore for the year 2021-22. The number of reporting mines in 2021-22 was 128 in case of MCDR minerals. (Table-4).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the important large and medium mineral- based industries in organised sector in the State are given in Table - 5.

Table –3 : Details of Exploration Activities in Odisha, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI **Manganese Ore**							
Keonjhar	Kendudihi-Parulipada Block	-	-	24	1163.75	-	A total of 1,163.75 m has been drilled from 24 boreholes at 100 m x 100 m grid interval. Analytical results of Borehole OKKP-1, 2, 3, 4, 5, 8, 9, 11, 14, 15, 16, 18, 19, 21, 25 and 26 show, the cumulative Mn ore zone is 1 m, 2.40 m, 5.10 m, 13 m, 6.70 m, 2 m, 2.30 m, 1.50 m, 1.8 m, 3.5 m, 7 m, 0.5 m, 1.60 m, 1 m, 5.2 m, 2.10 m thick having 10.53%, 12.40%, 10.17%, 16.57%, 14.09%, 11.86%, 12.36%, 13.24%, 13.42%, 13.86%, 10.90%, 10.10%, 12.31%, 29.09%, 14.08%, and 15.26% of Mn respectively. Analytical results of core samples from 24 boreholes show that the width of mineralized zone varies from 0.50 m to 13.00 m with an average grade of 13.53% of Mn. Petrography study of ore samples show the Mn ores are psilomelane and pyrolusite. The manganese ore occurs in discrete isolated pockets/lenses in form of powdery and pisolitic ore hosted in shale. No correlation of mineralized zones is observed between adjacent boreholes drilled during FS 2021-22. The mineralized zones are occurred as small isolated pockets. The manganese ore zones are occurring at different depths with different thickness. The exploration was is continued during FS 2022-23 with a total drilling target of 4800 m and detailed geological mapping of 0.6 sq. km.
Balangir	Uchhabapalli-Thakurpalli Block	-	2.05	-	386	-	The major lithounits in the block are khondalite (quartz –feldspar-garnet-sillimanite+graphite schist/ gneiss), calc-silicate rocks (calc gneiss and calc-granulite), quartzite, and late intrusives include pegmatite and quartz-veins. General strike varies from NNE-SSW directions with sub-vertical dip towards east in Thakurpalli block in the south to NW-SE directions in Uchhabapalli area in the north. The area has undergone polyphase deformation. The Mn ore occurs within shallow synformal structure of the calc-silicate rock. A total 2.05 sq. km. detailed geological mapping is carried out in the block alongwith 55 cu. m Pitting / trenching. The average grade of channel sample is 15.95% Mn. A total 386 m drilling has been carried during FS 2021-22. All the boreholes intersected mineralized zone with cumulative thickness 2 m to 15 m except ODUT-3 and the strike length of mineralized zone is approximately 2700 m in Uchhabapalli-Thakurpalli area.
Gold							
Keonjhar	Gopur Block	1:1000	1.5	9	1563.15	-	Preliminary exploration for gold in Gopur Block was carried out with a total drilling of 1563.15 m and 1.5 sqkm detailed mapping in 1:1000 scale. The area belongs to Iron Ore Group exposing meta-volcanics (Pillowed metabasalt & pyroclastic). Exposures of quartz –sericite schist in Sankarkhol hill (In the southern part of the block) also observed. Gold mineralisation in the IOG is associated with zone of intense silicification and hydrothermal alteration within the metabasalt. The IOG rocks are overlain by gritty sandstone and conglomerate containing clasts of quartz, meta-chert, and quartzite and observed as capping on the Sankarkhol hill and in the south-eastern part of Sankarkhol Hill. Palaeoplacer rich in gold and uranium mineralisation is recorded in this siliciclastic sediment in its type area near Mankarchhua. Two NNE-SSW trending subparallel auriferous lodes have been delineated in the exploration area. The NNE-SSW trending central lode has been probed with 9 boreholes with 100 m spacing. Among which sulphide mineralisation zone is encountered in

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling Scale	Mapping Drilling Area (sq.km)	Drilling No. of Boreholes	Drilling Meterage	Sampling No.	Remarks Reserves/Resources estimated
							eight boreholes (OKG-1 to OKG-7 and OKG-9). In the southern part, there is another lode, where four first level boreholes OKG-11, OKG-12, OKG-13, OKG-14 and one second level borehole OKG-16 was drilled with 100 m spacing. Among which sulphide mineralisation zone is encountered in three boreholes (OKG-11, OKG-12 and OKG-16). The sulphide mineralisation zones observed in boreholes drilled for central lode is, 1) OKG-1, 64.25-77.25 2) OKG-2, 59.92-79.29 mts 3) OKG-3, 70.85-73.00 mts & 81.7-84.85 mts 4) OKG-4, 69.41-77.23 mts) OKG-5, 46.7-51.5 mts 6) OKG-6, 70.8-71.63 mts & 77.4-78.35 mts 7) OKG-7, 82.7-85.7 mts 8) OKG-9, 49.1-53.4 mts, 95.00-95.93 mts & 126.90-128.97 mts. The sulphide mineralisation zones observed in boreholes drilled for eastern lode is OKG-11, 80.00-85.40 mts (5-8%), OKG-12, 85.00-92 mts (5-8%) & OKG-16, 149.60-155.60 mts. The sulphide mineralisation such as pyrite, arsenopyrite, very few chalcopyrite and gold (observed from ore petrography study) has been observed within metabasalt with quartz, epidote and carbonate veins The sulphide mineralisation was observed along the foliation planes and in association with quartz and epidote veins.
Diamond							
Bargarh	Padampur-Paikamal-Jharbandh area	-	675	-	-	-	An integrated approach to find out primary source rock for diamond was adopted encompassing aerial reconnaissance and remote sensing studies over 675 sq. km area, study of lineament tectonics and aero-magnetic map of the area with delineation of anomalous zones, geological traverses along the suspected zones such as Craton- Mobile Belt boundary followed by stream sediment sampling from the suspected drainage networks with good trap sites. The investigation block around Padampur-Paikamal area exposes lithounits of Bastar Craton, western margin of Eastern Ghat Mobile Belt (EGMB) and parts of Chhattisgarh sedimentaries. The cratonic lithounits include granite gneisses of different varieties mostly banded gneisses with minor migmatitic and porphyritic varieties, quartz mica schist and minor unmappable units of low-grade metasedimentary schists. The litho- units of EGMB occupy major parts of the study area which include garnetiferous granite gneiss, khondlite and quartzite. The Chhattisgarh Supergroup exposes ferruginous and khaki green shale, arenite and limestone mostly confined to the central portion of the area in contact with both the cratonic and EGMB blocks. Digital image processing using ASTER imagery along with study of NGLM data was carried out to prepare the lineament map of the area. ALOS PALSAR DEM (12.5 resolution) was used to prepare drainage basin and watershed map of the area. The lineaments prepared were superimposed on the geological map as well as drainage map of the area to mark some important blocks for detailed study and sample collection. Heavy minerals such as garnet, ilmenite, spinel, zircon, amphiboles, pyroxenes and epidote were recovered after separation from the stream sediment samples. A total of 110 such suspected heavy mineral grains were selected for further analysis by EPMA and SEM, of which 67 grains were selected for EMPA and 43 grains were selected for SEM studies. These heavy minerals include 52 of suspected garnets, 16 of suspected ilmenites, 06 of suspected spinel, 31 of suspected diopside grains and 05 of suspected grains which could not be identified by microscopic observation.
Copper and associated precious metals							
Mayurbhanj	Kesharpur East block	-	-	15	2243.55	385	A total of 2243.55 m drilling, 10 cu m pitting and trenching was carried out with collection of 335 CS, PS, 10 OM, 10 XRD, 10 EPMA, 10 sulphur isotope and 10 fluid inclusion samples for petrographic and other laboratory studies. The study area belongs to part of the SOI toposheet no. 73 J/12 located in the eastern fringe of Singhbhum shear zone (SSZ). Regionally, the area exposes rocks belonging to the Singhbhum Group intruded by different phases of Mayurbhanj granitoids and dolerite. Different rock types exposed in the area are quartzite, hornblende biotite schist, augen gneiss, hornblende granite gneiss, leuco granite and dolerite with numerous quartz veins. The general strike of the

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							lithologies vary from WNW-ESE in western part to ENE-WSW in eastern part with moderate to steep dips towards north forming a synformal structure. The surface manifestation of mineralisation in the area is in the form of old workings, malachite and azurite stains. Surface investigation trenching has been carried out along the borehole profile lines perpendicular to the strike to expose the host rock across the mineralised zone. The analytical results of trench vary from 79 ppm to 9230 ppm. During FS 2020-22, A total of 15 boreholes have been drilled and the average thickness of sulphide zone is 40 m which varies from 15 m to 80 m. The cumulative thickness of copper lode intersected is 26.20 m. The average grade of Cu varied from 0.25% to 1.26% and thickness varied from 2.20 m to 22.65 m. The work is in progress and resource estimation will be done after receiving complete analytical results and interpretation.
Basemetal, Graphite and REE							
Bolangir	Ampali-Badipura-Saintala area	1:12500	60	6	446.0	-	During FS 2021-22, an area of 60 sq. km has been mapped by arge scale mapping (1:12,500 scale) followed by 446.0 m of drilling in 06 of scout boreholes (ODBD-1 to ODBD-6) with collection of 46 channel samples, 53Pit/Trench samples, 21 Regolith samples and 37 core samples. The occurrence of lead ore as stringers and specks of galena in a brecciated quartz vein at Badipura and Jalorpadar area have been observed. The old workings near Badipura and Jalorpdar area for galena observed well within the brecciated quartz veins, on surface old working pits are of roughly 15 m X 20 m and 25 m X 20 m in dimension respectively. The allanite-fluorite outcrop of about 8 m thick and about 45 m of strike length, near Bibina area has been observed, which is a potential rock hosting REEs. Channel sampling has been carried out on the brecciated quartz veins and allanite-fluorite rock and sent for chemical analysis to test its potential for basemetal and REE mineralisation respectively. The analytical results of channel samples (7 nos) of allanite rich rock shows total REE ranges from 12.60% to 14.29% and it shows an enrichment of LREE mostly La and Ce up to a value of 5.15% and 6.10% respectively while it is remarkably low in HREE ranges from 398.71 ppm to 437.32 ppm. In almost all the boreholes the brecciated zone has been intersected showing specks of sulphides mostly pyrite and few chalcopyrite. In borehole ODBD-5 a 4.75 m thick zone of allanite-fluorite-calcite has been intersected, which also shows cluster of sulphides and along fracture planes chalcopyrite and pyrite are most commonly observed. In borehole ODBD-6, a 4.0 m thick sulphide zone consists of pyrite and chalcopyrite in khondalite has been observed.
REE & RM mineralization							
Nayagarh	Khuntapada-Purushottam pura area	1:12500	-	-	-	-	Reconnaissance survey for REE & RM mineralisation around Khuntapada- Purushottampura area, Nayagarh district, Odisha was taken up for LSM on 1:12500 scale along with pitting/ trenching, regolith sampling, stream sediment sampling and laboratory studies. The area of investigation being part of the EGMB, lithounits exposed in the area are khondalite, granite gneiss, leptynite, pyroxene granulite, leptynite and pegmatite. Large scale as well as detail mapping revealed that granite gneissic country rock is intruded by several leucocratic coarse grained to pegmatoidal syenite veins. A dark coloured pyroxenite dyke was delineated near Khuntapada whose intrusive nature in to the granite gneiss country rock is evident from straight and sharp contact between pyroxenite and country rock, cross cutting the foliation in the Granite gneiss. Xenoliths of syenite with irregular outline are found floating in the pyroxenite dykes. Titanite crystals are also found associated with the pyroxenite bodies which could be the source of REE. The petrographic studies of syenite, pyroxenite and their contact reveal that heavy minerals like alanite and titanite are present in pyroxenite and along the contact between pyroxenite and syenite which could be the possible source of REE. Analytical results for regolith samples indicate that tREE

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							content in regolith varies from 184.90 ppm to 3847.48 ppm with an average of 782.83 ppm. Whereas, in BRS total REE varies from 84.409 ppm to 7436.458 ppm. and in stream sediment samples it varies from 214.87 to 1118.19 ppm. Rubidium concentration in regoliths vary from 30.46 ppm to 314.23 ppm with an average of 166.18 ppm. which is more than the average crustal abundance of 150 ppm in granitic rocks. After XRD and EPMA study, the mineral phases contributing for REE & RM content can be identified
Graphite							
Nayagarh	Daspalla Block	-	2.3	23	1733.5	69	As a part of G-3 exploration programme, detailed mapping of 2.3 sq. km., drilling of 1733.5 m and 50 cubic metre of pitting and trenching work have been completed so far. The ore body (graphite) is hosted within khondalite and migmatised khondalite and graphite occurs as disseminations. The graphite is flaky in nature with greasy lustre. There are five occurrences of graphite mineralisation, near Tumandi-Narajipara area as observed in the quarry and pond. All the quarry sections are aligned in N-S direction. Apart from that 33 BRS samples and 36 of trench and pit samples are collected in study area as well as in the periphery of the study area. All the 69 samples are showing high values of fixed carbon (FC%). The FC value varies from 3.6% to 21.56% in trench samples and 2.13% to 25.02% in BRS in the study area. As the graphite body is mostly concealed beneath the surface, 1st level boreholes are planned on the N-S aligned quarry sections based on results oftrenches. Out of 23 of borehole drilled so far,20 are 1st level boreholes and 03 are 2ndlevel boreholes. 410 of core samples havebeen collected so far from 23 boreholes. As per the visual estimation of all the drilled boreholes, 26 m of graphite occurrences are delineated in borehole no. ODT-6 from 26.5 m to 52.5 m and as per the chemical analysis, three graphite zones are delineated having 3.47% FC from 28 m to 38.5 m depth, 3.13% of FC from 41 m to 46 m and 3.04% of FC from 47.5 m to 53.5 m depth. All the boreholes have intersected graphite zones except borehole ODT-9 & ODT-14. The thickest graphite zone is delineated in borehole no. ODT-22 i.e. 29.5 m graphite zone from 24.5 m to 54 m depth. As per the visual estimation of graphite zones in all the 20 of 1st level boreholes, geological profile lines of 8 boreholes i.e. ODT-5, 6, 7, 8, 15, 16, 17 & 22 are selected for 2nd level drilling.
Coal							
Angul	Kanaloi Area, Talcher Coalfield	1:10000	-	-	-	-	The detailed geological map (1:10,000 scale) of the Kanaloi area have been prepared with the help of available surface as well as projected sub-surface data. Kamthi Formation, Barren Measures and Barakar Formation are exposed in the study area from south to north direction. Outcrops of the Barakar Formation are well preserved in nala cutting section in the area whereas rocks of the Kamthi Formation are exposed in the hillocks of the Kanaloi Reserve Forest area. Kamthi Formation occurs as an overlapping sequence above either Barakar Formation or Barren Measures. The lithounits of Barren Measures (36.80 m-38.09 m), Barakar Formation (202.39 m to 309.10 m), Karharbari Formation (119.80 m to 170.11m) and Talchir Formation (11.30 m to 33.30 m) have been intersected downward sequentially in the boreholes. In Kanaloi area three regional coal seam zones (II, II and Combine VI-VIII in ascending order) of the Barakar Formation and one regional coal seams zone (I) of Karhabari Formation were intersected between the depth ranges from 30.25 m to 372.40 m in the boreholes. Borehole-wise cumulative coal thickness was varying from 55.20 m to 95.77 m. Seam zone II and III are the most important seam in Barakar Formation in their regional continuity and thickness and seam zone thickness of II and III in borehole was varying from 36.60 m to 47.25 m and 36.85 m to 50.10 m respectively. The parting thickness between seam zone II and III are varying from 11.90 m to 18.95 m. Seam zone combine VI-VIII is degenerated in TKNL-3. Coal splits section in Karharbari Formation are varying from 5nos to 9nos and thickness of the individual coal split

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							section ranges from 0.50 m to 3.96 m. Exploration data in Kanaloi area has established the regional continuity of thick coal seam zone at shallow (<300m) depth along 8km along strike direction and 2 km along dip direction which further enhance the prospect of open cast mining in the area. Coal samples of boreholes have been submitted to CIMFR, Bilaspur for band-by-band as well as GCV analysis.

Table - 4 : Mineral Production in Odisha, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**130**		**343507062**	**154**		**303806246**	**128**		**586973477**
Coal	'000t	-	143016	-	-	154151	-	-	185068	-
Bauxite	t	5	15483307	10901088	5	15565611	12424241	6	16449396	18779569
Chromite	t	20	3929260	32134395	22	2830413	21862796	18	3785625	47298073
Iron Ore	'000t	64	146637	293179734	82	104485	262035370	68	136696	514531737
Manganese Ore	t	27	537325	3161505	29	482915	1948077	20	512591	2421292
Graphite (r.o.m.)	t	5	12564	34838	6	17697	46633	6	21029	63519
Iolite	kg	2	90	579	3	16	73	3	27	191
Limestone	'000t	7	5627	1848621	7	7186	2118507	7	7059	2410646
Sulphur#	t	-	253697	-	-	209387	-	-	207831	-
Minor Minerals		-	-	2246302	-	-	3370549	-	-	1468450

Note: The number of mines excludes Fuel and Minor minerals.

$ Excludes the value of Fuel minerals.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Aluminium/Alumina	
Hindalco Industries Ltd, Hirakud	215 (aluminium)
Hindalco Industries Ltd, Aditya	360 (aluminium)
Aluminium, Lapanga, Distt. Sambalpur	
NALCO, Damanjodi, Distt. Koraput	2275 (alumina)
NALCO, Angul	460 (aluminium)
Utkal Aluma, Rayagada	1500 (alumina)
Vedanta Aluminium Ltd, Lanjigarh,	2000 (alumina)
Distt. Kalahandi	1500(Venadium)
Vedanta Aluminium Ltd, Jharsuguda,	1750 (aluminium)
Distt. Sambalpur	
Asbestos Products	
UAL Industries Ltd, Korian, Distt. Dhenkanal	NA
Konark Cement & Asbestos Industries Ltd,	NA
Bhubaneswar	
Cement	
ACC Ltd,Bargarh Cement Ltd, Bargarh	2140
Ultra-Tech Cement Ltd, Jharsuguda (G)	2600
OCL India Ltd, Rajgangpur, Distt. Sundargarh	4000
	1064(Refractory)
	2900(Clinker)
OCL India Ltd, Kapilas (G). Cuttack	1350

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Toshali Cements Pvt Ltd, Ampavalli, Distt. Koraput	200
Ceramics	
Prabhu Ceramics & Minerals Pvt Ltd, Majhipali, Rengali, Sambalpur	24(Acidic Ramming Mass)
Chemical	9.6(EBT Filling Mass)
Arrow Minerals & Metals Pvt. Ltd,Vejidihi, Banspal	1.8(Manganese Oxide) 2.25(Manganese dioxide powder)
Chrome Concentrate	
K L Resources PVT. Ltd,	74.7

Sundaria, Dharmsala

Offshore Regions

Petroleum (Crude) and Natural Gas (utilised) are also produced from Offshore region

The Government of India notified the Offshore Areas Minerals (Development & Regulation) Act, 2002 (OAMDR Act), No. 17 of 2003 in the Gazette of India, Extraordinary, Part-II, Section-1, dated 31.1.2003. The purpose of the Act is to provide for development and regulation of mineral resources in the territorial waters, continental shelf, exclusive economic zone and other maritime zones of India and to provide for matters connected therewith or incidental thereto. The Act is applicable to all minerals in offshore areas including minerals prescribed under Atomic Energy Act, 1962, but excludes oils and related hydrocarbons as there is separate legislation in force. The Act came into effect from 15.1.2010 vide S.O. 338 (E), dated 11.2.2010 as notified by the Central Government.

The Act makes it mandatory to undertake reconnaissance, exploration or production operation in the offshore areas in accordance with the prescribed terms and conditions for Reconnaissance Permit (RP), Exploration Licence (EL) or Production Lease (PL) granted under the Act and the rules made thereunder. The Act further states that availability of the areas for grant of RP, EL or PL shall be notified within six months from the commencement of the Act, and subsequently at such times as considered necessary. The Act empowers the Central Government to make rules for the purpose of the Act including terms and conditions under the RP, EL, PL, etc. The Rules, namely, the Offshore Areas Mineral Concession Rules, 2006 have been framed and notified on 3.11.2006 by G.S.R.691(E) published in the Gazette of India, Extraordinary, Part II, Section 3 (i), No. 539, dated 4.11.2006. The Rules came into effect on the date on which the Offshore Areas Mineral (Development and Regulation) Act, 2002 came into force, i.e, 15.1.2010.

As per S.O.1341(E) dated 7.6.2010, the Controller General, Indian Bureau of Mines had notified the mineral-bearing offshore blocks available for grant of Exploration Licence. As per the attached Schedule to the said Notification, there were 26 offshore areas available in offshore waters of Bay of Bengal and 37 offshore areas in the offshore waters of Arabian Sea for grant of Exploration Licence.

The orders for grant of exploration licences were issued by the Administering Authority on 05.04.2011 for the 62 exploration blocks (the bounding latitude and longitude of Block Nos. 3 & 32 falling in the Arabian Sea were same and therefore these were considered as a single block and granted as Block No. 3). Before execution of deed granting such licence, the grant of exploration licences in 62 blocks was challenged through the writ petition in the judicature of various High Courts. Due to interim orders passed by various Hon'ble High Courts on the writ petition and non- disposal of the said petition, the offshore exploration licences granted have not been executed. Besides, it was brought to the notice of the Administering Authority that some of the exploration blocks notified for grant of offshore exploration licences vide Notification dated 07.06.2010 overlapped with areas other than offshore area, to which the OAMDR Act did not apply.

The Central Government vide S.O.19 (E) dated 06.01.2011, published in the Official Gazette, declared the extent of the Coastal Regulation Zone (CRZ) and also imposed certain restrictions on the setting up and expansion of industries, operations or processes and the like in the CRZ. The said statutory order also did state that CRZ shall apply to the water and the bed area between the Low Tide Line to the territorial water limit (12 Nm) in case of seas and has prohibited in the area so identified as CRZ, inter alia, the mining of sand, rocks and other sub-strata materials except those rare minerals not available outside the CRZ area. In the context of the said notification, all the 62 offshore blocks lie within the area identified as CRZ which attracts the prohibition of mining (operation undertaken for the purpose of winning any mineral).

The OAMDR Act provides that the holder of an exploration licence for offshore area shall have the exclusive right to a production lease for winning of a mineral. In view of the effect of the CRZ Notification dated 06.01.2011, the purpose of executing the 62 offshore exploration licences could not be realised as the applicants could not undertake operations for winning of minerals in spite of grant of Production Lease after successful completion of exploration operations.

Therefore, taking into consideration all the above stated facts, the Controller General, IBM and administering authority Offshore Areas Minerals (Development & Regulation) vide S.O.19 (E) dated 6th January, 2011, published in the Official Gazette, annulled the Notification issued vide S.O.1341(E) dated 7th June 2010 with effect that all subsequent actions undertaken for grant of the 62 exploration licences hereby would stand rescinded.

As per S.O. 1523(E) dated 06.04.2018, the Additional Director General, National Mission Head-II, Geological Survey of India, has been notified as the "Administering Authority" for the purpose of the said Act by Clause (a) of Section (4) of the Offshore Area Mineral Development and Regulation Act, 2002 ,17 of 2003 and in supersession of the notification published in Gazette of India, Extraordinary Part II, Section 3, Sub-section (ii) vide S.O. 339(E) dated 11th February 2010.

The Government of India further signed 360 contracts under NELP (New Exploration and Licensing Policy) regime with National Oil Companies and Private (both Indian and foreign)/ Joint Venture companies. At present, 186 contracts are operational out of the total 541contracts [(360 NELP, 110 (OALP), 71 (DSF Round) signed so far under various bidding rounds.

The awarded 254 blocks under NELP regime are at locations in inland (114), offshore shallow water (59) and deepwater (81) areas. As a result of exploratory activities, several unexplored and poorly explored areas, in particular, offshore and deepwater areas, have been appraised through geophysical surveys and exploratory drilling. Details of exploration block awarded/ relinquished/operational are provided in Table -1.

Table - 1: Details of Exploration Block Awarded (as on 01.04.2021)

(In million tonnes)

Round	No. of blocks awarded	No. of blocks relinquished	No. of blocks active	Present Area (Sq. Km)
NELP-I	24	21	3	231527
NELP-II	23	22	1	267883
NELP-III	23	19	4	204596
NELP-IV	20	17	3	192810
NELP-V	20	16	4	115180
NELP-VI	52	44	8	306426
NELP-VII	41	33	8	112950
NELP-VIII	32	29	3	52573
NELP-IX	19	10	9	26431
Total	254	211	43	1510376
OALP-I	55	-	55	59283
OALP-II	14	-	14	29233
OALP-III	18	-	18	29765
OAPL-IV	7	-	7	18510
OAPL-V	11	-	11	19789
Total OALP	105	-	105	156580
DSF-I	30	11	19	777
DSF-II	24	5	19	3000
Total DSF	54	16	38	3777

Source: IPNG Statistics 2021-22, Minstry of petroleum and Natural Gas.

In order to explore and produce new sources of natural gas from coal-bearing areas, the Government had formulated a CBM Policy in 1997, wherein CBM being Natural Gas is explored and exploited under the provisions of OIL Fields (Regulation & Development) Act, 1948 (ORD Act 1948) and Petroleum & Natural Gas Rules, 1959 (P&NG Rules 1959) administered by Ministry of Petroleum & Natural Gas (MOP&NG). CBM policy was aimed to provide attractive fiscal and contractual framework for exploration and production of CBM which is an environment-friendly clean gas fuel similar to conventional natural gas. In order to harness CBM (Coal-bed Methane) potential in the country, CBM blocks were offered through international competitive bidding for exploration and production for the first time in the year 2001. Under the CBM policy till date, four rounds of CBM bidding have been implemented by MoP&NG, resulting in award of 33 CBM blocks [including 2 blocks on Nomination and 1 block through Foreign Investment Promotion Board (FIPB) route]. Till date, most CBM exploration and production activities in India are pursued by domestic Indian companies. These CBM blocks are in the States of Andhra Pradesh, Assam, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu and West Bengal.

RESERVES/RESOURCES

As on 1.4.2022, balance recoverable reserves of crude oil were estimated at 651.8 million tonnes, out of which 255.8 million tonnes (39.2%) are in onshore and 396 million tonnes (60.8%) in offshore areas. ONGC (nomination) contributed with the largest share of 63.5% in reserves of crude oil followed by Pvt' JVs in production sharing contract (PSC)/Revenue sharing contract (RSC)regime(26.01%) and oil (nommination)(10.4%).

The balance recoverable reserves of natural gas as on 01.04.2022 were placed at 1138.7 billion cu. m, out of which 606.3 billion cu. m (53.2%) are in offshore and 532.3 billion cu. m (46.8%) in onshore areas. ONGC(Nomination) contributed with the largest share of 49.2% in natural gas reserves followed by PSC/RSC/ CBM regime and OIL (nomination) at 39.9% and 10.9%, respectively.

Table – 2: Balance Recoverable Reserves of Crude Oil & Natural Gas in India including Offshore Areas (As on 1.4.2022)

(Crude oil in million tonnes; Natural gas in billion cu. m)

Area	Crude oil*	Natural gas*
India	651.8	1138.7
Onshore	396.1	532.4
Offshore	255.8	606.3
Western offshore	216.6	337.3
Eastern offshore	39.2	269

Source: Indian Petroleum and Natural Gas Statistics, 2021-22, Ministry of Petroleum and Natural Gas, Govt. of India.

EXPLORATION ACTIVITIES

Conventional Hydrocarbon

ONGC, GSI and other Public & Private Sector companies continued their efforts in respect of exploration for hydrocarbon in offshore region, both shallow and deep water, during 2021-22.

Private Companies/Joint Ventures

In FY 2021-22, about 7,780.5 LKM 2D seismic data was acquired. However, majority of the 2D Data acquisition was carried out under RSC regime (in OALP Blocks) which was approximately 7,481 LKM. 3D seismic data acquired in FY 2021-22 was 6,575.7 SKM out of which approximately 4,659 SKM data was acquired by NOCs/JVs/Pvt. companies under OALP. This year, 86% of 2D seismic and 50% of 3D Seismic data acquisition has been carried out in the onshore basins. In addition, 101 exploratory wells (including Onland and offshore) amounting to a drilling meterage of 279,867 m has been drilled too during the FY 2021-22 in Table-3.

Table – 3 : Exploratory Efforts in Nomination, PSC and RSC Regime during 2021-22

Subject	Parameter	ONGC (Nomination)	OIL (Nomination)	PSC (Pre-NELP & NELP)	RSC (OALP & DSF)	Total
2D Seismic Data acquired	Onland (GLKM)	287.8	0	11.5	6,420.30	6719.5
	Offshore (GLKM)	0	0	0	1,061.00	1,061.00
Total 2D Seismic		287.8	0	11.5	7,481.30	7,780.50
3D Seismic Data acquired	Onland (SKM)	492.2	219	568.3	2,007.70	3287.2
	Offshore (SKM)	636.90	0	0	2,651.60	3288.5
Total 3D Seismic		1,129.10	219	568.3	4,659.30	6,575.70
Exploratory well drilled	Onland	46	7	11	12	76
	Offshore	25	0	0	0	25
Total Exploratory wells		71	7	11	12	101
Exploratory Meterage drilled	Onland (1000 m)	119,112	30.238	27.037	35,637	212,024
	Offshore (1000 m)	67.843	0	0	0	67.843
Total Exploratory Meterage drilled	(1000 m)	186,995	30,238	27,037	35,637	279,867

Source: India's Hydrocarbon Outlook, 2020-21, Directorate General of Hydrocarbons

Marine and Costal Survey

Geological Survey of India

The Annual Programme for FS 2021 – 2022(April 2021 – March, 2022) of Marine &Coastal Survey (MCS) Division under the Mission-IA (Baseline Geoscience Data Generation) of Geological Survey of India included multidisciplinary offshore survey and exploration within the Exclusive Economic Zone (EEZ) of India including Territorial Waters (TW) and International Waters.

Economic placer minerals resources have been delineated besides identifying encouraging occurrence of vanadium rich magnetite placers, phosphate bearing sediments,occurrence of metalliferous mud and Fe-Mn crusts /Nodules within the EEZ of India.

In view of the geoscientific studies carried out over decades with the specialised laboratory backup, the Marine and Coastal Survey Division has developed adequate expertise in the fields of seabed mapping with geological, geophysical, geotechnical and geochemical parameters, resource evaluation for placer minerals, geochemical scan for hydrocarbons,etc. Till March 2022, M&CSD has completed the seabed mapping of 1,43,386 sq km out of 1,58,005 sq km in 5 km x 2 km grid within

Territorial Waters (TW) and 18,98,312 sq km in the Exclusive Economic Zone (EEZ) beyond Territorial Waters on reconnaissance scale with collection of preliminary baseline data on bathymetry (Single beam & Multibeam), sediment (both surface and subsurface) since last few decades and gravity, magnetic, seismic (shallow /deep) data since inception of R.V. Samudra Ratnakar in FS 2013-14. The total EEZ coverage including TW is 20,41,698 sq km out of a total EEZ area of 21,59,620 sq km.

During the cruises of R.V. Samudra Ratnakar, RV Samudra Shaudhikama and RV Samudra Kaustubh of FS: 2021-22, baseline geoscience data collection on systematic seabed mapping were carried out over an area of 23,911 sq. km. Preliminary mineral investigation over an area of 4500 sq km and close grid mineral investigation to the tune of 450 sq. km were also carried out in TW and EEZ of India for augmentation of offshore mineral potentials in Indian EEZ. Along with these, a total of 6,612 lkm of multichannel and shallow seismic surveys have also been taken up as a part of generation of Baseline Geoscientific Data and to study the sub-surface disposition of sediment sequences in TW and contiguous zone and to identify the possible locales of offshore minerals through advance processing techniques. Marine geoscientific programme taken up during the period under review comprises of 7 complete and 1 spill over cruises onboard RV Samudra Ratnakar in deep waters, out of 9 proposed. In shallow water domain seven cruises each onboard RV Samudra Kaustubh and RV Samudra Shaudhikama were taken up. Besides these, one coastal item using mechanised boat was also taken up during the period. The programmes were undertaken under Eastern and Southern Regions and highlights of the work completed are given under the heads of the Regions. The list of cruises and coastal programmes taken up by M&CSD during FS: 2021-22 is given below.

Close grid geophysical surveys for studying the characteristics of shallow sediment layer, subsurface geological structure and thermal gradient within the submarine plateau and search for phosphorite off Quilon-Alleppey sector, Kerala coast, Arabian Sea (Cruise: SR067) (FSP ID: M1AMCSSMM/NC/SR/ MCSD-WC-1/ 2021/ 38444).

The sensor surveys are carried out with gravity, magnetic, bathymetric, and sub-bottom profiling at 5lkm line intervals, and the heat-flow probe was deployed at 11 locations over the Quilon-Alleppey platform (encompassing an area of 19,395 sq.km, bounded by the co-ordinates (a) 74°49’12"E, 09°32’47.04"N (b) 75°48’32.9796"E, 10°0’4.608"N (c) 76°16’47.1756"E, 08°36’55.818"N (d) 75°16’43.0464"E, 08°9’9.4212"N), which is a typical marginal plateau constrained by the crustal-scale fracture Vishnu Fracture Zone (VFZ), off Kerala, India. The sediment sampling has been done along the platform covering an area of 2223 sq.km on engaging the grab sampler and spade corer at 5 x 5 km and 10 x10 km grid intervals respectively. Rock samples and a drill core sample were collected with the manipulator of a Remotely Operated Vehicle (ROV) within the submarine plateau. Sound Velocity Probe data along with Conductivity-Temperature-Depth (CTD) has been collected at one location.

Swath bathymetry data indicates that part of the Quilon plateau, having a relief of nearly 1200m has been demarcated with a flat-topped area along the eastern part of the area. The linear free air anomaly pattern derived from gravity contour map (Fig.2.74) may be attributed to the presence of the Vishnu Fracture Zone (VFZ). The eastern part of VFZ shows a high gravity anomaly that may correspond to the Alleppey Trivandrum Terrace Complex (ATTC). The VFZ constraints the ATTC which is considered an extension of the South West Indian shield. Total Field (TF) magnetic anomaly of the area with trend of the anomaly NW-SE. The highest values over north and north-eastern side of the platform whereas the lowest values have been noticed towards south (Fig.2.75). The marine magnetic data have continued upward for 120 meters and knitted with the aeromagnetic data of southwest India and the high-altitude magnetic data of south India and the initial analyses clearly establishes the offshore extension of the major shear zones and fracture zones including the Achankovil Shear Zone and Thenmala fault. The sub-bottom records over the plateau indicated a thin sediment layer of a few centimetres to meters in thickness.

Based on reported occurrences of phophorite nodules and phosphatic sediments in various cruises, close grid (at 5x5 and 10x10 grid intervals) grab and core sampling was carried out in the southern part of Quilon Plateau over an area of 2223 sq.km to evaluate phosphorite occurrences.

Study reveals that the plateau area is covered by sandy sediments composed mainly of bioclasts, including foraminifers, gastropods and bivalves. Geochemical analyses indicate no P2O5 enrichment in the sediments. Petrographic study of these rocks reveal that they contain bioclasts of large benthic foraminifers and planktic foraminers bound together by micrite matrix. These rocks can be classified as bioclastic packstones.

Tectonic evolution study of Lakshadweep ridge and basin morphology with integrated multichannel seismic, gravity and magnetic survey (Cruise-SR- 069). (FSP ID: M1AMCS-SMM/NC/SR/MCSD-WC-1/ 2021/ 35177).

Cruise SR-069 was taken up with an objective to study the geological characteristics of the Lakshadweep ridge and basin, their formation and seismic signatures. The area covered under cruise SR- 069 is bounded by coordinates a) 11°4'37.2" N, 69°54'0" E b) 12°6'0" N, 73°27'36" E c) 15°9'36" N, 72°54'36" E d) 13°59'24" N, 69°21'36" E off Marmagao, Karwar and Mangalore coast.

The Seismic, Gravity and bathymetry surveys have been conducted along 4 coast perpendicular traverses at an interval of ~ 110 km in almost E-W direction and 1 coast parallel transect in almost NNW-SSE direction. The basic observation is that FAA (Free air Anomaly) and Bathymetry follow similar trends in conformity with each other. However, slight to noticeable deviations may be observed due to the subsurface inhomogeneity, lateral density contrast and structural control etc. in the subsurface geology. The preliminary interpretation of two seismic lines indicated that the major physiographic divisions observed along the sections from east to west are continental shelf, shelf break, continental slope, laccadive basin/trough, laccadive ridge, west laccadive slope and abyssal plain. Thick accumulation of sediments of about 700m to 1000m are observed in the Laccadive basin area. Submerged Pratap Ridge was identified in the Laccadive basin. A fault scarp is the boundary between Laccadive Ridge and the abyssal plain also noticed. In Profile L-4, a fault observed in the boundary of continental slope and Laccadive basin which may be an extension of onshore lineament/shear zone.

High resolution seabed mapping and exploration in Cherbaniani Block, Lakshadweep Trough (Cruise-SR-070) (FSP-ID-: M1AMCS- SMM/NC/SR/MCSD-WC-2/ 2021/ 35572).

The cruise SR-070 was taken with the objective to understand the geological and geophysical characteristics of the ocean floor, to study the morpho- tectonic elements and to understand the economic potential of phosphorites, metalliferous mud and ferromanganese crust and nodules in the northern part of Laccadive Ridge. Brownish black coloured, with characteristic knotty surface (botryoidal texture having larger knot like protrusions ferro-manganese crusts pieces were recovered from the flanks of sea mounts located north western part of Byramgore Reef during three dredge operations (D2, D3 and D4) from a water depth of 1600 m. Spheroidal to near spheroidal shaped having botryoidal/gritty textured brownish black ferromanganese nodules were recovered from western part of Cherbaniani Reef near the periphery of seamount flanks during spade core operation (SC-15) at a water depth of 1546 m. The crusts and nodules contain ΣREE concentrations ranging from 179 ppm to 2041ppm (average 1305 ppm) with high Ce contents.

High resolution seabed mapping and exploration in Peremul Par Block, Lakshadweep Trough (Cruise- SR-071). FSP ID: M1AMCSSMM/NC/SR/MCSD- WC-2/ 2021/ 35413).

An area of 5100 sq. km has been surveyed to understand the geological and geophysical characteristics of the surface and sub-surface of the ocean floor along with studies of the morpho-tectonic elements, and search for Fe-Mn encrustations, phosphorite and metalliferous mud occurrences in Lakshadweep area. In the survey area, two NNE-SSW trending reefs, namely Bitra par reef in the NE and Peremul Par reef in the SE part of the surveyed area. Prominent terrace on either side of east and west flanks of the Peremul Par reef have been noticed. Pock marks, Valley, sea mounts and crescent shaped seamounts and guyots, sshaped ridges, dissected structures, step faults and regional faults and scour marks are also observed in the survey area.

Free air gravity anomaly map with 5 mGal contour interval shows anomalies of shorter and longer wavelength and exhibits NESW and N-S contours trends and clearly reflects the bathymetric and morphological characteristic of the area. Magnetic analytic signal map shows that, the high analytic signal amplitude that trending in approximately NNW-SSE and E-W direction in the study area.

Fe-Mn crust and nodules were collected by deploying dredge sampler, spade corer and ROV within a depth range of 800 to 1700 m. A large composite nodule of 41cm x 29 cm x 22 cm and weighing 17.5 kg, was also recovered from spade core at water depth of 1220 m. Study of subsurface sediments from cores revealed presence of clayey sediments with varying proportion of fine to medium sand.

The Fe-Mn crusts /encrustations are jet black coloured, hard, massive with or without botryoidal and knotty structures and are exposed as slabs/ layer/ boulders/ fragments of varying sizes or as thin coating over coral reef. At many locations the Fe-Mn crusts / encrustations are partially buried by thick sediment cover. The nodules observed are black colored, spheroidal or ellipsoidal (well rounded, sub rounded, elongated, heart shaped), with smooth or mixed morphology, with well-developed botryoidal structures. Analysis of Fe-Mn samples shows high concentration of Co, Ni and Pb with average concentration 3965 ppm, 4469 ppm and 1440 ppm respectively. Concentration of Total REE concentration varies from 1130 to 1710 ppm with an average of 1499 ppm.

Multi thematic mapping of contiguous zone beyond territorial waters off Kasaragod, Kerala (Cruise-SD-304)

(FSP ID: MIAMCSSCWTEEZ/NC/ SR/MCSD-WC-2/ 2021/ 36214).

During the cruise SD-304, a total of 750 sq. km area was covered with systematic survey in the Territorial Water of West Coast During the cruise SD-304, a total of 750 sq. km area was covered with systematic survey in the Territorial Water of West Coast of Kasaragod, Kerala to bring out the bathymetry, surface and subsurface geology of the area through geological and geophysical studies and generation of baseline data.

The survey area is bounded by coordinates (a) 74° 31' 08.82"E, 12° 31' 31.80" N(b) 74° 42' 45.60" E, 12° 37' 13.44" N (c) 74° 49' 17.82" E, 12° 21' 43.02" N and (d) 74° 38' 45.48" E, 12° 14' 41.28" N (Fig.2.81). Study of 73 nos. of grab samples (collected at 2 x 5 km interval within water depth range 42 to 64.5 m) revealed that seabed is mainly carpeted by fine sand as well as medium sand. A hard compact cemented shelly bottom / substratum (13 cm x 11 cm) had also been recovered at location G24. Study of 19 Vibro Core samples revealed presence of thick sediment column with rich carbonaceous components, indicative of a swampy, back water system where burial/sudden sedimentation is possible. The vibrocores VC-03 and VC-14, collected beyond 54.3m are rich in sand, having very coarse sand to coarse sand with minimal clayey components.

The thick column of sand may be indicative of palaeo strandline. Palaeontological studies indicated that Foraminifera is predominant followed by bivalves, microgastropods, Pteropods, ostracods. Foraminifer is further subdivided in to planktic and benthic forms. The observed planktic genus are like Globigerinoides sp. and Globigerina sp. and the dominant benthic genus like Ammonia sp., Cancris sp., Cibicidoides sp., Nonion sp., Brizalina sp., Bolivina sp., Fursenkoina sp., Elphidium sp., Amphicoryna sp., Bulimina sp., Amphistegina sp., Cassudilina sp., Lagena sp., Lenticulina sp., Operculina sp., Quinqueloculina sp., Spiroloculina sp., Textularia sp., Triloculina sp., Uvigerina sp.

Multi thematic mapping of contiguous zone beyond territorial waters off Muttam Point, Kerala- western Tamil Nadu coast **(Cruise-SD-305) (FSP ID: MIAMCS-SCWTEEZ/NC/SR/MCSDWC-2/2021/ 35321).**

Cruise SD-305, was taken up with an objective to bring out the bathymetry, surface and subsurface geology of the survey area through geology and geophysical studies and to generate the baseline data bounded by coordinates (a) 76° 50' 58"E, 07° 59' 30"N (b) 77° 00' 56"E, 08° 08' 12"N (c) 77° 07' 28"E, 08° 03' 21"N (d) 77° 13' 41"E, 07° 57' 16"N(e) 77° 04' 11"E, 07° 48' 36" N. Geophysical surveys (magnetic and shallow seismic) were also conducted concurrently with bathymetric survey. The total magnetic field anomaly profiles along transect L1 shows that the magnetic anomaly values are increasing towards the sea whereas low magnetic anomalies are observed in the western part. It was found that higher amplitude anomalies are recorded near to the coast. Geological studies indicated that seabed is carpeted mainly by fine to medium sand, with presence of coarse sand in the northern and eastern parts.

Parametric shallow seismic survey in the gap area off Karwar- Devgarh sector, West Coast, Arabian Sea. (Cruise-SD308) FSP ID No. M1AMCSAPS/NC/SR/ MCSD-WC-1/2021/38446.

Systematic coverage of shallow seismic data gap along West Coast has been initiated from southern most gap area. Seismic data gap from off Karwar, Karnataka coast to off Devgarh, Maharashtra coast has been proposed for compilation and collective interpretation. Cruise SD-308 has been taken up as a part of generation of Baseline Geoscientific Data and to study the sub-surface disposition of sediment sequences in TW and contiguous zone. Study reveals that the bathymetric contours are aligned near parallel to the coast configuration and is gently sloping towards the southwest. The processed and interpreted seismic records reveals that the depth to the seafloor is from 7.6 to 49.8 m. Regarding sub-sea bed, 5 to 6 prominent subsurface reflectors with good reflectivity contrast, are deciphered. The reflector R1 occurs below the sea floor. In the seismic record the reflection character for the material lying above the reflector R1 indicates soft sediments of unconsolidated nature. The three sequence boundaries (erosional surface (ES), transgressive surface (TS) and maximum flooding surface (MFS) are recognized in the seismic Line -3 and 21 (Fig.2.82) off Karwar- Devgarh sector, West Coast, Arabian Sea. The undulating erosional surface cutting through late Pleistocene sediments represents an incised valley and may be attributed to emergence of the shelf during the last glacial maxima. The TS mark the post glacial rise of the sea level and represents the initial flooding surface. The transgressive system tract (TST) overlying TS shows strong reflections suggesting a possible sandy nature of the sediment package. TS is overlain by the MFS which marks the time of maximum flooding or transgression of the shelf and it separate the transgressive and high stand system tracts.

SCWTEEZ/NC/SR/MCSD-WC1/2021/35180).

Cruise-SD-310 with the objective of to fill up the shallow seismic gap areas between Ponnani-Karwar off West Coast, Arabian Sea under Baseline Geoscientific Data Generation and to study the subsurface disposition of sediment sequences & sediment thickness in TW & Contiguous Zone.

Block1: Single beam bathymetric survey reveal gradual slope of 0.03° to 0.09° away from shore (SW) with minor undulations. The seismic two-way-time sections of all transects show a smooth and slightly undulating seafloor gently increasing depth towards southwest without any significant geomorphic feature.

Block 2: The seismic survey has delineated 4 acoustic reflectors designated as Seafloor (R0), R1, R2 and R3. The reflector R1 strong, continuous and more or less subparallel to the seafloor and dipping towards sea.The reflectors R2 R3, R4, R5 are dipping towards sea and characterized by erosion and top lap features. A buried river channel, U and V shaped streams are noticed in western parts of the survey area.

Block 3: The isochron (TWT) map of Seafloor also depicts a smooth and gently dipping seafloor to southwest of the surveyed area in agreement with the bathymetry. All the contours are trending parallel to the present day coast with minor undulations and they are oriented generally along NW-SE. Block-4: The seismic section show a wedge shaped sediment package characterized by low amplitude continuous parallel reflectors extending seaward up to a water depth of 48 m. The weak reflectors below the wedge shaped sediment layer against a planar surface referred to here as maximum flooding surface. The acoustic blankings observed in high resolution seismic data suggest that the late Holocene sediment wedge is amenable for accumulation of gas. The observed acoustic masking is attributed to the presence of gas bubbles (predominantly free methane gas) in the sediments.

R.V. SAMUDRAKAUSTUBH

Geophysical (shallow seismic and magnetic) surveys within continental shelf off Baruva, Andhra Pradesh coast, Bay of Bengal **(Cruise ST-287). (FSP ID: M1AMCSAPS/NC/SR/MCSD-EC-2/2021/35430**

Geophysical surveys (magnetic and shallow seismic) and bathymetric survey was taken up within the continental shelf off Baruva, Andhra Pradesh Coast, Bay of Bengal during the Cruise ST-287 with an objective to identify seabed morphology, sub-surface structural features and tectonic fabric of the area. The water depth in the surveyed area varies from 10m to 480m. Based on the contour pattern, it can be inferred that the shelf area is wider in the southern part when compared to the northern part. The undulatory nature in bathymetry contours between 50 m to 70 m appears to be due to a ridge in NE–SW direction which is also confirmed by seismic surveys. The magnetic anomaly map can be broadly classified into a) low anomaly zone is prominent over the Shelf-Break zone, b) bipolar magnetic anomaly zone was observed over intra basement intrusive within the continental crust and c) moderate anomaly zone was observed over the area where placer deposits have been reported. The stacked profile of observed magnetic (TF) and bathymetry responses over transects L-1, L-3, L-5 and L-6 has been prepared. As observed over the qualitative variation, the moderate magnetic zone is having southward continuation and is limited by a high anomalous zone present towards the deep sea. The disposition of the liner high frequency anomaly zone extending in the NNE-SSW direction may be attributed to the intra basement intrusive within the continental crust. This zone seems to act as a limiting margin for the aforementioned moderate anomalous zone

Moreover, high frequency anomalies have been noticed almost over all the profiles.

The significant observation over the FAA map is the high gravity anomaly zone where the bipolar magnetic anomaly is noticed (Fig. 2.84). This indicates the presence of terrace like feature and acts as a restricting boundary to the seaward flow of placer minerals from hinterland. The occurrence of HM is most likely to be concentrated in the western part of this terrace like feature.

The shallow seismic survey has brought out the morphological and stratigraphic distinction in terms of several reflectors. Broadly, three to four acoustically strong reflectors have been identified within a probing depth of 480 m. There are some seafloor undulations and significant ridges are observed at 56 m and 96 m water depths (Fig. 2.85; Box-I). The occurrences of such ridges from the coastline can be attributed to the postglacial strandlines formed during the standstill positions of recent Holocene transgression

Gas Hydrates

Gas hydrates are formed when gas and water mixtures are subjected to high pressure and low temperature conditions in the sea, usually in water depths of more than 800 m, within sediments just below the sea bottom. They are also formed in some permafrost region of the world. The gas hydrates also act as a cap under which natural gas can get accumulated. Gas hydrates can be an unconventional energy source of the future.

In India, gas hydrate research and exploratory activities are being steered under National Gas Hydrate Programme (NGHP). Under NGHP, technically coordinated by Directorate General of Hydrocarbons (DGH), various R&D studies are in progress to develop vast resources of gas hydrates in western and eastern offshore and Andaman offshore areas.

NGHP Expedition-01 exploration programme was carried out in 2006 for mapping gas hydrate zones in Krishna-Godavari, Kerala, Konkan, Mahanadi and Andaman offshore areas. A total of 39 holes were drilled at 21 sites and the physical presence of gas hydrate was established predominantly in Krishna- Godavari, Mahanadi and Andaman Basin in clay dominated complex geological settings.

NGHP-02 was conducted successfully in Eastern offshore from 09.03.2015 to 31.07.2015. A total of 42 wells were drilled at 25 sites in Krishna-Godavari and Mahanadi areas in sand reservoirs for gas hydrates. NGHP-02 has discovered two world class gas hydrate reservoirs, namely, Block KG-DWN-98/5 and Block KG-DWN-98/3. Based on the post-expedition studies and review by international experts, the site located in KG-DWN-98/5 has been found suitable for pilot production test during NGHP-03 expedition for which various studies like sand control measures, well design, reservoir and production simulation modelling as prerequisite for the pilot production have been completed.

Punjab

The State reported production of only minor minerals

₹ 287

Lakh, value of minor minerals' production were estimated in the year2021-22

Mineral Resources

Minerals reported to occur in the State are quartz and silica sand in Hoshiarpur district; and quartzite in Hoshiarpur & Ropar (Rupnagar) districts (Table - 1).

Exploration & Development

No exploration activities were carried out during the year 2021-22 .

Production

Production of minor minerals was only reported in the state. The value of minor minerals' production was estimated at Rs. 175 crore for the year 2021-22.

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the important Mineral-based Industries in the Organised Sector in the State are furnished in Table - 2.

Table –1: Reserves/Resources of Minerals as on 1.4.2020: Maharashtra

Mineral	Unit	Reserves	Remaining Resources				Total Resources (A+B)
		Total	Feasibility	Indicated	Inferred	Total	
		(A)	STD211	STD332	STD333	(B)	
Quartz/silica sand#	'000 tonnes	-	-	3927	3927	3927	
Quartzite#	'000 tonnes	-	116	81796	81912	81912	
Figures rounded off							

 # Declared as Minor mineral vide Gazette notification dated 10.02.2015

Table – 3: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Alloy Steel	
Antarctic Industries Ltd, Ludhiana	120
Cement	
Ambuja Cement, Ropar (Rupnagar) (G)	2500
Asian FCPL, Patiala	1500
Ambuja Cement, Bathinda (G)	1200
UltraTech Cement, Bathinda (G)	1750
Chemical	
Siel Chemical Complex, Charatrampur	74.3 (NaOH) 65.8 (Cl) 18 (bleaching powder) 66.0 (HCl)
VTPL (Vardhaman Industries Ltd), Distt Patiala	60
Fertilizer	
NFL, Nangal, Distt. Ropar (Rupnagar)	478.5 (Urea) 22 (methanol)
NFL, Sibian Road, Distt. Bathinda	511.5 (Urea) 8.7 (S)
Petroleum Refinery	
HPCL Mittal energy Ltd, Bathinda	9000
Sponge Iron	
Vallabh Steels Ltd, Sahnewal, Ludhiana	120

Rajasthan

Production of different type of minerals have been reported from the state of Rajasthan

82
Reporting mines in Rajasthan in case of MCDR minerals in 2021-22

₹ 00,000 crore
Estimated value of production of minor minerals in 2021-22

Mineral Resources

RRajasthan is the richest state in terms of availability and variety of minerals in the country and produces about 50 different minerals along with minor minerals during 2020-21. Rajasthan is the sole producer of lead & zinc ores, selenite and wollastonite. Rajasthan was the sole producer of garnet (gem) t ill 2004 - 05 . Almost entire production of silver in the country comes from Rajasthan. The State is a major producer of copper ore/conc., limestone, ochre, phosphorite/rock phosphate and talc/soapstone/steatite. The State is also an important producer of marble of various shades. Makrana area is the world famous centre for marble mining.

The State possesses substantial share of the total resources of potash (94%), lead & zinc ore (89%), wollastonite (88%), silver ore (88%),

gypsum (82%), ochre (81%), bentonite (75%),

fuller's earth (74%), diatomite (72%), felspar (66%),

marble (63%), asbestos (61%), copper ore (54%),

calcite (50%), talc/steatite/soapstone (49%), ball

clay (38%), rock phosphate (31%), fluorite (29%),

and tungsten (27%).

Important minerals that are found to occur in the State are: asbestos (amphibole) in Ajmer, Bhilwara, Dungarpur, Pali, Rajsamand & Udaipur districts; ball clay in Bikaner, Nagaur & Pali districts; barytes in Alwar, Bharatpur, Bhilwara, Bundi, Chittorgarh, Jalore, Pali, Rajsamand, Sikar & Udaipur districts; calcite in Ajmer, Alwar, Bhilwara, Jaipur, Jhunjhunu, Pali, Sikar, Sirohi & Udaipur districts; china clay in Ajmer, Barmer, Bharatpur, Bhilwara, Bikaner, Bundi, Chittorgarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Kota, Nagaur, Pali, Sawai Madhopur & Udaipur districts; and copper in Khetri belt in Jhunjhunu district & Dariba in Alwar district. Deposits of copper are also reported at Ajmer, Bharatpur, Bhilwara, Bundi, Chittorgarh, Dausa, Dungarpur, Jaipur, Jhunjhunu, Pali, Rajsamand, Sikar, Sirohi and Udaipur districts. Occurrence of other minerals, namely, Dolomite in Ajmer, Alwar, Bhilwara, Chittorgarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Jodhpur, Sikar &

Udaipur districts; felspar in Ajmer, Alwar, Bhilwara, Jaipur, Pali, Rajsamand, Sikar, Tonk & Udaipur districts; fireclay in Alwar, Barmer, Bharatpur, Bhilwara, Bikaner, Dausa, Jaisalmer, Jhunjhunu & Sawai Madhopur districts; fluorspar in Ajmer, Dungarpur, Jalore, Jhunjhunu, Sikar, Sirohi & Udaipur districts; garnet in Ajmer, Bhilwara, Jhunjhunu, Sikar & Tonk districts; gypsum in Barmer, Bikaner, Churu, Sri Ganganagar, Hanumangarh, Jaisalmer, Jalore, Nagaur & Pali districts; iron ore (haematite) in Alwar, Dausa, Jaipur, Jhunjhunu, Sikar & Udaipur districts; iron ore (magnetite) in Bhilwara, Jhunjhunu & Sikar districts; and lead- zinc in Zawar in Udaipur distric t , Ba mnia Kala n, Rajpura- Da r iba in Rajsamand & Rampura/ Agucha in Bhilwara district. Lead-zinc occurrences have also been reported from Ajmer, Chittorgarh, Pali and Sirohi districts. Lignite deposits are found to occur in Barmer, Bikaner, Jaisalmer, Jalore, Nagaur and Pali districts. Flux grade limestone occurs in Jodhpur and Nagaur districts and Chemical-grade limestone in Jodhpur, Nagaur and Alwar districts. Cement grade deposits of limestone are widespread in Ajmer, Alwar, Banswara, Bhilwara, Bikaner, Bundi, Chittorgarh, Churu, Dungarpur, Jaipur, Jaisalmer, Jodhpur, Jhunjhunu, Kota, Nagaur, Pali, Sawai Madhopur, Sikar, Sirohi and Udaipur districts. Magnesite in Ajmer, Dungarpur, Pali & Udaipur districts; marble in Ajmer, Alwar, Banswara, Bhilwara, Bundi, Chittorgarh, Dungarpur, Jaipur, Nagaur, Sikar, Sirohi & Udaipur districts; mica in Ajmer & Bhilwara districts; ochre in Baran, Bharatpur, Bhilwara, Bikaner, Chittorgarh, Jaipur, Sawai Madhopur & Udaipur districts; pyrite in Sikar district; pyrophyllite in Alwar, Bhilwara, Jhunjhunu, Rajsamand & Udaipur districts; quartz/silica sand in Ajmer, Alwar, Bharatpur, Bhilwara, Bikaner, Bundi, Chittorgarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Jodhpur, Kota, Pali, Rajsamand, Sawai Madhopur, Sikar, Sirohi, Tonk & Udaipur districts; quartzite in Ajmer, Alwar, Jhunjhunu & Sawai Madhopur districts; rock phosphate in Alwar, Banswara, Jaipur, Jaisalmer & Udaipur districts; talc/ steatite/soapstone in Ajmer, Alwa r, Banswara , Bhara tpur, Bhilwar a, Chittorgarh, Dausa, Dungarpur, Jaipur, Jhunjhunu,

Table –1: Reserves/Resources of Minerals as on 1.4.2020: Maharashtra

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Apatite	tonne	-	-	-	-	-	-	-	51521	1016000	-	-	1067521	1067521
Asbestos	tonne	-	-	-	-	1803183	3070449	4027514	87802	42101	4526861	57800	13615710	13615710
Bauxite	'000 tonnes	-	-	-	-	-	-	-	-	-	528	-	528	528
Copper														
Ore	'000 tonnes	14344	20045	-	34388	13314	1148	24304	18603	197078	573814	5200	833461	867849
Metal	'000 tonnes	169.44	313.64	-	483.08	33.87	12.2	136.32	338.66	1385.88	2214.46	31.13	4152.52	4635.6
Diatomite#	'000 tonnes	-	-	-	-	634	-	-	-	-	1440	-	2074	2074
Fluorite	tonne	6111	-	11988	18099	644667	618802	759285	1542460	510656	1350059	161575	5587504	5605603
Garnet	tonne	156938	50946	4	207888	310712	191094	33115	2013	17606	215120	73263	842923	1050811
Gold														
Ore														
(Primary)	tonne	-	-	-	-	-	-	-	4600000	51743000	69507720	63000	125913720	125913720
Metal														
(Primary)	tonne	-	-	-	-	-	-	-	6.67	104.97	122.85	0.07	234.56	234.56
Graphite	tonne	-	-	-	-	47600	-	165920	-	250000	1450034	-	1913554	1913554
Iron ore														
(Haematite)	'000 tonnes	4555	2280	479	7314	3775	3962	1132	-	11510	7776	13	28166	35480
Iron ore														

Table-1 (Concld.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
(Magnetite)	'000 tonnes	37631	136	83294	121060	1131	1023	85	-	3566	588463	79598	673866	794926
Kyanite	tonne	-	-	-	-	13097	-	10606	-	-	-	-	23703	23703
Lead-Zinc														
Ore	'000 tonnes	28791	63331	11153	103275	2485	19779	12632	43337	172985	328784	1380	581381	684656
Lead metal	'000 tonnes	503.7	1188.47	208.02	1900.19	58.48	405041	245.68	917.5	1972.47	5832.19	-	9431.73	11331.92
Zinc metal	'000 tonnes	2356.56	4592.03	489.46	7438.05	331.22	992.09	559.35	3112.59	5052.47	1377.72	0.53	23827.97	31266.02
Lead-Zinc														
metal	'000 tonnes	-	-	-	-	-	-	-	-	-	119.86	22.37	142.23	142.23
Limestone	'000 tonnes	3299838	220062	1284254	4804154	454148	1838217	4541298	441902	2261727	12946106	1673697	24157095	28961249
Magnesite	'000 tonnes	-	-	-	-	1030	1574	2045	-	149	49293	-	54091	54091
Manganese														
ore	'000 tonnes	568	-	-	568	-	100	-	-	-	1690	-	1790	2359
Potash	million tonnes	-	-	-	-	-	-	-	-	16936	3509	127	20572	20572
Pyrite	'000 tonnes	-	-	-	-	13667	-	22917	9590	26310	18392	-	90876	90876
Rock														
Phosphate	tonne	21845000	-	-	21845000	4144961	13675437		119833	69750	28942783	9257650	72003769	93848769
Sillimanite	tonne	-	-	-	-	300	-	519	-	-	-	-	819	819
Silver														
Ore	tonne	44124192				2330000	17049200	36712218	39420000	64730000		-	342383997	490710017
Metal	tonne	2150.87	4980.73	570.04	7701.64	172.2	781.85	531.62	3720.28	4384.86	12349.76	-	21940.57	29642.21
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	-	963666	17000628	5964000	23928294	23928294
Contained														
WO3	tonne	-	-	-	-	-	-	-	-	1421.44	90171.5	2115	93707.94	93707.94
Vermiculite	tonne	-	-	-	-	41354	19960	4540	-	13000	16555	8716	104125	104125
Wollastonite	tonne	2388641	190739	101598	2680978	4563016	1245009	8559760	-	3325042	2603667	137461	20433955	23114933

Figures rounded off

Karauli, Pali, Rajsamand, Sawai Madhopur, Sirohi, Tonk & Udaipur districts; vermiculite in Ajmer & Barmer districts; and wollastonite in Ajmer, Dungarpur, Pali, Sirohi & Udaipur districts. Other important minerals that occur in the State are: apatite in Udaipur & Sikar districts; bauxite in Kota district; bentonite in Barmer, Jaisalmer & Jhalawar districts; corundum in Tonk district; diatomite in Barmer & Jaisalmer districts; emerald in Ajmer & Rajsamand districts; fuller's earth in Barmer, Bikaner & Jodhpur districts; gold in Banswara, Bhilwara, Dausa, Sirohi & Udaipur districts; granite in Ajmer, Alwar, Banswara, Barmer, Bhilwara, Chittorgarh, Jaipur, Jaisalmer, Jalore, Jhunjhunu, Jodhpur, Pali, Rajsamand, Sawai Madhopur, Sikar, Sirohi, Tonk & Udaipur districts; graphite in Ajmer, Alwar & Banswara districts; kyanite & si l l imanite in Udaipur district; manganese ore in Banswara, Jaipur & Pali distric ts ; po ta sh in J aisalme r & Na ga ur districts; silver in Ajmer, Bhilwara, Jhunjhunu, Rajsamand, Sikar & Udaipur districts; and tungsten in Nagaur & Sirohi districts (Table -1). District-wise reserves/resources of lignite in the State are provided in Table-2.

Table – 2 : Reserves/resources of Lignite as on 1.4.2023 : Rajasthan

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	1203.85	3108.55	2273.84	6586.24
Bikaner	560.3	230.33	309.19	1099.82
Barmer	495.23	2509.46	1555	4559.69
Jaisalmer & Bikaner	–	–	11.47	11.47
Jaisalmer	–	–	70.44	70.44
Jaisalmer & Barmer	–	–	13.8	13.8
Jalore	–	–	76.08	76.08
Nagaur	148.32	368.26	219.17	735.75
Nagaur & Pali	–	0.5	18.69	19.19

Source: Coal Directory of India, 2022-23.

Exploration & Development

T he details of explo ra t io n activities conducted by GSI for Gold, Emerald, Limestone, Manganese ore, base metals (Cu,Pb & Zn), Rare Earth Elements, Tungsten, Rare Metal and other minerals during the year 2021-22 are furnished in Table - 3.

Production

Production of different type of of minerals have been reported from the state of Rajasthan. The value of minor minerals' production was estimated at 11780 crore for the year 2021-22. The number of reporting mines in Rajasthan was 91 in the year 2021-22 in case of MCDR minerals (Table-4).

Table –3 : Details of Exploration Activities in Rajasthan, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Manganese							
Rajsamand	Negariya block	-	-	19	710.54	-	Negariya block is located in Survey of India T.S. nos. 45H/9&13 Rajsamand district, Rajasthan. The study area comprises rocks of Delwara Group of Aravalli Supergroup of Palaeoproterozoic age and Granite Gneiss of Bhilwara Supergroup of Archean age. Lithologies exposed are brecciated ferruginised quartzite with or without manganese, quartzite, calcareous quartzite and intercalated phyllite with minor dolomite and granite gneiss exposed as basement rock. The rocks of this area have undergone at least four phases of deformation as evident by the formation of cleavage planes in different lithounits and later affected by ductile and brittle deformation in the form of shearing and fault. Dome and basin structure have been developed in the study area due to intersection of third and fourth phase of deformation. In the mapped area, manganese bearing horizons are exposed in 3 linear hills trending NS to N10°E in western, central and NE part. Manganese is associated with brecciated ferruginised quartzite. The manganese exposure on western hill extends discontinuously for a strike length of 900m, on central hill for a strike length of 650m and northeasterly hill for a strike length of 650m. Total 7 nos. of trench were excavated in all the three bands. Chemical analysis of trench -T1 has analysed 13.82 % MnO over 4m, trench T2 indicated 30.34 % MnO over 9 m, trench no. T3 indicated 20.8 % MnO over 10 m, trench no. T4 indicated 12.51 % MnO over 6 m and trench T 7 indicated MnO values of 13.95

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							% and 10. 17 % MnO over 4m width. Total 19 boreholes (2 inclined and 17 vertical) have been drilled with total meterage of 710.54 m and the exploration has been completed in this block. Maximum width of manganese mineralised zone exposed on the surface is 35 m with average width of around 20m. The maximum thickness of manganiferous horizon intersected in the borehole is 17m in borehole RJRN-04 and average thickness of manganiferous horizon is abou 10 m. The maximum depth of manganiferous horizon is up to 28.5 m in borehole RJRJ-09. The analytical results of borehole samples are yet to be received
Manganese Rajsamand	Karoli Ki Dhani	1:2000	2.0	2	-	50	Preliminary exploration was taken up to carry out preliminary exploration in Karoli Ki Dhani block. Detailed mapping of 2.0 sq. km area on 1:2000 scale along with bedrock, channel sampling and pitting trenching was completed during FS 2019-20. The rock exposed in Karoli Ki Dhani block formed a part of Debari Group of Aravalli Supergroup. The litho units in the study area were manganiferous metachert, ferrugenised metachert, quartzite/ metachert, dolomite and phyllite. All the litho units were disposed in N25°E to N30° E direction dipping 60° to 80° towards west 50 trench samples were collected from 5 trenches for chemical analysis. Trench 1 had indicated MnO value ranging from 01 to 23.23% with average grade of 13.05% MnO over 4 m width and trench-3 had indicated one sample with MnO value 25.32% over 1m width. Trench 2 had not analysed any significant Mn value.
Gold							
Udaipur	Rathri-Harmatiya Khurd area	1:12500	50	-	-	175	During FS 2021-2022, reconnaissance survey for gold and basemetal mineralisation in Rathri- HarmatiyaKhurd area of Udaipur district, Rajasthan (G-4 Stage) was taken up in parts of toposheet no. 46I/1 and 46 I/5. It is covered by large scale geological mapping of 50sq km area on 1:12,500 scale and sampling. The main objective was to assess the nature and potentiality of gold and base metal mineralisation. Bedrock and pit & trench sampling have been done. Geologically, the study area exposes the rocks of Mangalwar complex and Aravalli Supergroup. Different rock types observed during mapping are granite gneiss of Mangalwar complex and the rocks belong to Aravalli Supergroup include dolomitic marble, garnet-biotite-schist, calc-silicate, amphibolite, metavolcanics intruded by quartzo-feldspathic veins. The general trend of the rocks in this area is NNE-SSW to NW-SE with moderate dips on NNW and SW. The basement rocks have undergone four phases and Aravalli rocks have undergone three phases of deformation. The rocks have undergone up to amphibolite facies of metamorphism. Evidences of mineralisation in the area occur in the form of small old workings/ pits, gossanisation, ferruginisation, malachite staining, silicification, dissemination of pyrite grains. 100 nos. of Bedrock samples, 25 nos. of petrochemical samples and 50 nos. of trench samples were submitted in the chemical division for Au, basemetal, REE and trace elemental analysis. Chemical analysis of samples is yet to be received for further studies and to conclude the presence of any valuable mineralisation in the study area for further course of action.
daipur and Dungarpur	Bara Talav-Jharap-Bori area	1:12500	50	-	-	190	A large scale mapping (1:12500 scales) was carried out and covered 50 sq km area around Bara-Talav, Jharap, Bori, Manpur, Matasula, HarmatiyaKhurd, Bhabharanaetc area of Salumber tehsil of Udaipur and Aspur tehsil of Dungarpur district in parts of T.S. No. 45L/04. LSM work along with sampling was carried out with an objective to assess the nature and potentiality of gold and basemetal mineralisation. Geologically, study area is occupied by the rocks of Mangalwar complex of Archaean age and Aravalli Supergroup of paleo-proterozoic age. Mangalwar complex is represented by the banded biotite granite gneiss. The banded biotite granite gneiss is medium to coarse grains, dark greyish to white gray in colour. The banding in the gneisses is marked by dark bands rich in ferromagnesian minerals mainly biotite and light-coloured band rich in quartzo-f

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							elspathic material. Aravalli Supergroup is represented by the garnetiferous mica schist of Delwara group and dolomitic marble of Debari group. Garnetiferous mica schist is fine to medium grain, greenish grey to dark grey colour rock with well-developed schistosity planes. Porphyroclast of garnet crystal are well developed in this rock. Dolomitic marble of Debari group is light to dark brown coloured, medium to coarse grained rock. It is crystalline in nature at number of places. During mapping a gossan zone is also identified. It is associated near to the contact of dolomitic marble and garnetiferous mica schist around Bara-Talav area. The zone has a dimension of approximately 400 m length and 40-50m in thickness. Gossanised material is exposed along the NW-SE trending shear zone developed at the contact of dolomitic marble and garnetiferous mica schist around Bara-Talav area. During the course of mapping 50 cu m trenching work has been carried out through 6 numbers of trenches. During field work 100 Nos. of BRS, 30 trench samples, 25 Nos. Of PCS, 30 No. of petrological and 5 number of XRD sample also has been collected.
Banswara	Ghatiyana Block	-	-	11	1249.00	242	Ghatiyana block is located in Survey of India T.S. 46 I/05 in Banswara District, Rajasthan. The main objective was to assess the nature and potentiality of gold and base metal mineralisation. The rock types exposed in the study area belongs to Delwara Group of Aravalli Supergroup. The main lithounits are phyllite, quartz albite epidote rock, impure marble and quartz veins. Phyllite is the most dominant lithounits having well-developed foliation. Central part of the area is occupied by thin impure marble bands and quartz albite epidote rock. All the lithounits are disposed in the form of NNW – SSE trending linear bands with steep to sub vertical dips towards WSW. The most penetrative and pervasive foliation is S1 oriented parallel to litho-contacts represents the planar fabric formed during the first phase of deformation. The surface mineralisation in the area is manifested by malachite / azurite stain, hydrothermal alterations, gossans, ore grinding implements and presence of fresh sulphides like pyrite, pyrrhotite, chalcopyrite and bornite. A number of small old workings and dump sites are present in the area. During FS 2021-22, based on the detail geological mapping and channel sampling at a regular interval of nearly 100 m along strike, trench sampling and bed rock sampling of one surface mineralisation zone (MZ-I) has been delineated having the dimension of nearly 1.3 km strike length and 6- 10 m width. Total thirteen channels of the various lengths were laid along the strike and a total of 161 channel samples, 31 trench samples and 50 bed rock samples were also collected. Channels are showing encouraging value of copper. Chemical result of channels shows copper (Cu) in the range of 170 ppm to 2.00 % with an average value of 0.23 %, while gold (Au) varies from <0.05 ppm to 0.23 ppm with an average of 0.07 ppm. A total of eleven first level boreholes (RJBGN-01 to RJBGN-11) were planned at about 100m spacing to intersect mineralised zones at 60 m vertical depth. All boreholes were planned at 45°- 50° dip and S 70°W azimuth. To avoid the forest issues, borehole has been planned along the dip from the footwall. Total 1249.00 m drilling has been completed in eleven nos. of boreholes. All boreholes are intersected significant sulphide mineralisation in the form of chalcopyrite, bornite, and covellite (VE= 1% to 2%). Few native copper grains are also present in core samples. The thickness of the zones in various boreholes varies from 6 m to 12 m. Sulphide minerals are mainly noticed in the core samples of quartz albite epidote and dolomitic marble rock and mineralisation is mainly structurally controlled.
Emerald							
Rajsamand	Kalaguman-Dhaneen-Nathela areas	1:12500	100 100	- -	- -	312 255	During FS 2021-2022, reconnaissance survey for Emerald was taken up in Kalaguman-Dhaneen-Nathelaarea of Rajsamand district, Rajasthan (G4 Stage) and in parts of toposheetno. 46H/12. As per the objective of the item, large-scale geological mapping (LSM) on a 1:12,500 scale was carried out in 100 sq.km. area along with pitting and trenching and collection of bedrock samples (BRS) and soil samples. A total of 200 numbers of bedrock samples, 37 numbers of

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							petrographic samples (PS), 20 petrochemical samples (PCS), and 55 numbers of pitting/trenching samples (PTS) have been collected to evaluate the emerald mineralisation potentiality of the area. Besides these, an area of 700 sq km was studied by Photogeology & Remote Sensing (PGRS) studies which include ASTER data processing and alteration zone mapping. The study area encompasses Archaean (BGC) to Proterozoic (Aravalli and Delhi fold belts) rocks covered at places by recent soil and alluvium sediments. The Kalaguman prospect is situated near the eastern margin of the South Delhi Fold Belt within the basement rocks belonging to the banded gneissic complex (BGC) of Heron (1953). However, Naha, Gupta, et al. (1980, 1997) included these rocks within the Aravalli Supergroup. The Bhilwara Supergroup in the study area is represented by the Sandmata Group, Sambhugarh Formation constituting the sequence of the high-grade rock, defined by Augen gneiss & migmatite gneiss followed by the amphibolites of the Badnor Formation having Archaean age. Aravalli Supergroup in the area is represented by Devathri Formation of Dovda Group constituting of calc-silicate rocks of Paleoproterozoic age. Delhi Supergroup in the area is represented by quartzites of Antalia Formation, Gogund Group having Paleoproterozoic to Mesoproterozoic age. Mafic dykes/Meta basics, pegmatites, and leucogranites are classified as later intrusive having Mesoproterozoic to Paleoproterozoic age. Major rock types exposed in the area are Augen gneiss/migmatite/banded gneiss and mica schist. Apart from these many small bodies of altered mafic/ ultramafic (tremolite-actinolite schist, biotite-actinolite schist) and hornblende schist/amphibolite are also observed in the area. All these rocks are profusely injected by pegmatite veins. The emerald deposits in Rajasthan, northwest India, are situated in a narrow NE–SW belt in the Aravalli Mountains. The studied deposits were formed by the metasomatic reaction between muscovite (± garnet ± tourmaline) pegmatites and lenticular bodies of altered ultramafic rocks that are hosted by the Bhilwara Supergroup gneisses (BGC). This reaction produced phlogopite schists containing the exometasomatic emeralds, as in all other granite-related emerald deposits. The concentration and distribution of chromium in the host rock and beryllium content of the hydrothermal fluids, derived from the pegmatites, seem to be the most significant factor for the development of emeralds. Field studies confirmed that a lithological association i.e., schistose, mafic/ultramafic intruded by beryllium bearing pegmatites is a must for the mineralisation of emerald, apart from the lithological control and structural control. So far, 200 BRS samples and 55 P/T samples have been submitted and 100 sq. km. mapping has been successfully completed.
Basemetal							
Sikar	SE Block of Ravji Ki Dhani, Nim Ka Thana Belt	1:2000	-	-	-	-	A G3 stage exploration in SE Ravji Ki Dhani area was taken up to delineate the zones of basemetal mineralisation. The area is located about 16 km southeast of Nim Ka Thana, Sikar district, Rajasthan. Detailed geological mapping has been completed on 1: 2,000 scale along with different types of sampling. The dominant lithologies are meta-sediments belonging to the Kushalgarh Formation of the Ajabgarh Group and the Pratapgarh Formation of the Alwar Group of the Delhi Supergroup. The Kushalgarh Formation is represented by impure marble, mica schist and quartzite. There are two variants of impure marble, namely micaceous marble and amphibole marble. The rocks have undergone three phases of deformation. Copper mineralisation is observed in the form of malachite stains and disseminations of chalcopyrite, bornite and chalcocite. At some places quartz veins intruded into amphibole marble along and across the strike also carry disseminated bornite and chalcocite. The lithologies intersected along the boreholes are amphibole + biotite marble, biotite + amphibole marble, mica schist and amphibolite. The investigation has established occurrence of subsurface copper mineralisation, hosted by amphibole marble and quartz biotite schist of the Kushalgarh Formation of the Ajabgarh Group. Sulphide

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							mineralisation in the drilled boreholes is manifested in the form of fine disseminations, specks with occasional stringers, vein fillings and fracture fillings of the copper ore minerals, namely chalcocite, bornite, chalcopyrite and occasionally covellite associated with pyrite. Mineralisation shows either foliation parallel or cross cutting relationship with the host rock.
Alwar	Raipur-Mundawar area	1:12500	50	-	-	150	Reconnaissance survey for base metal and gold mineralisation in Raipur-Mundawar area, Alwar district, Rajasthan was carried out covering an area 50 Sq. Km. in toposheet no 54A/09. The area exposes the rocks belonging to Delhi Supergroup and located in North Delhi Fold Belt (NDFB) of Proterozoic age which hosts many occurrences of base metal mineralisation. Large scale geological mapping of 50.0 sq. km area was carried out on 1:12,500 scale. The lithounits exposed in the study area belongs to the Delhi Supergroup of rocks comprising of Alwar and Ajabgarh Groups. Major lithounits observed are micaceous quartzite with amphibolite band, mica schist, calc-biotite quartzite of Kankwari formation and orthoquartzite and biotite sericite schist of Pratapgrah Formation of Alwar Group. The other major lithounits observed are mainly of impure marble of Kushalgarh Formation and tremolite marble of Thanagazi Formation of Ajabgarh Group. During the course of large-scale geological mapping, copper mineralisation was recorded in the tremolite marble of the Thanagazi Formation and Impure Marble of Kushalgarh formation in the form sulphides mainly chalcopyrite, bornite with malachite staining occurring as disseminations and occasionally as thin stringers. The copper mineralisation in the area is litho controlled. Towards south of Pehal, an old working pit (strike length: 30 m, width: 20 m and depth: 10 m) is demarcated in tremolite marble. It shows malachite staining and oxidised specks of chalcopyrite. A total of 150 nos. of samples (BRS and Channel samples) were collected from 6 channels and 2 Trench lay in area. The analytical result of the bed rock samples indicates the occurrences of different mineral are in the range of Cu (<10 to 33000 ppm), Co (<15 to 40 ppm), Ni (<15 to 70 ppm), Pb (<25 to 30 ppm), Zn (<5 to 10 ppm), Ag (<5 ppm) Cd (<5 ppm) and Au (<0.05 to 0.17 ppm). Two mineralised zones (MZ-I and MZ-II) have been delineated on the basis of surface indications. The mineralisation in these z ones is observed as zones of malachite staining with minor occurrence of specks of chalcopyrite, pyrite, bornite and old working. MZ-I is observed just south of Pahel area. It is demarcated in impure marble and tremolite marble. This zone has an approximate length of 500 m and a width of 25 m. Total 2 channels were laid in the Impure marble and tremolite marble namely RM/CH/01 and RM/CH/02 of 10 m each. MZ-II is observed in the eastern side of Kali Pahadi area, near Ranoth village marked by malachite staining in calc-biotite quartzite. This zone has an approximate length of 650 m and a width of 15 m. Total 4 Channel were laid in the calc-biotite quartzite namely RM/CH/3 to RM/CH/6 of 15m,10m,10m and 10m respectively. The analytical results of the channel RM/CH1 and RM/CH/2 from MZ-I are encouraging. The Channel RM/CH/1, analysed a maximum of 0.45% and minimum of 20 ppm Cu. and the Channel RM/CH/2, analysed a maximum of 2% and minimum of 20 ppm Cu. The analytical results of the channel RM/CH4 and RM/CH/5 from MZ-II are encouraging. The Channel RM/CH/4, analysed a maximum of 1.10% and minimum of 30 ppm Cu. and the Channel RM/CH/5, analysed a maximum of 0.10% and minimum of 165 ppm Cu.
Sikar	West of Narda	1:2000	1.5	6	1000	-	The west of Narda block is located about 25 km east of Neem Ka Thana tehsil, Sikar district, Rajasthan. The area falls in toposheet No. 45M/14. Geologically, the area exposes rocks of the Ajabgarh Group of the Delhi Supergroup. The exposed lithounits are scapolite-bearing banded impure marble of the Thanaghazi Formation with tremolite and actinolite and the sheared quartzite of the Serisk Formation along with interbanded garnetiferous quart biotite schist. Apart from this, numerous intrusive Formation along with interbanded garnetiferous quart biotite schist. Apart from this, numerous intrusive

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							pegmatite, quartz and calcite veins are also present in the block area. Structurally, the area has undergone three phases of ductile deformation with the second phase of deformation controlling the regional topography of the area. During the FS: 2021-22, an area of 1.50 sq. km. area was mapped on 1:2000 scale. A total of 06 nos. of channels have been laid across the scapolite-bearing banded impure marble over 1000m strike length and 11m to 20 m width based on the presence of malachite stains and fresh specks of pyrite and chalcopyrite. On the basis of surface anomalous values for Cu, a total 06 nos. of first level boreholes RJSWN-01 to RJSWN-06 and 01 no. second level borehole RJSWN-07 were drilled to evaluate the subsurface potentiality of basemetal and other precious metals in west of Narda block. All the boreholes intersected scapolite-bearing banded impure marble along with partings of biotite and amphibole rich marble along with quartz and calcite veins. In borehole no. RJSWN-07, apart from scapolite-bearing banded impure marble, quartzite with bands of garnetiferous quartz biotite schist has also been intersected at a deeper level (approx. 193m to 230m). Fine disseminated pyrite, pyrrohtite, chalcopyrite and bornite along with fracture and vein filled pyrite and chalcopyrite have been reported in the boreholes. The analytical results of channels WNRDCH-1 (1m x 0.35% Cu), WNRDCH-2 (2m x 0.10% Cu) and WNRDCH-4 (7m x 0.85% Cu) indicated anomalous values for Cu. The analytical results of channel nos. WNRDCH-3, WNRDCH-5, WNRDCH-6, WNRDCH-7 and WNRDCH-8 didn't show any encouraging basemetal values. The complete analytical results of the core samples are awaited.
Jhunjhunu	Pratappura block	1:2000	-	-	-	-	During FS 2021-22, detailed mapping on 1:2000 scale along with surface sampling work and ground geophysical survey was carried out at East of Pratappura block. The block exposes thick pile of meta-sediments of Delhi Supergroup and intrusive rocks. The garnet-biotite schist, dolomite, quartzite of Kushalgarh Formation of Ajabgarh Group of Delhi Supergroup are the dominant litho-units. The Ajabgarh Group is represented by combination of alternating arenaceous, argillaceous and calcareous facies rocks, among which argillaceous and calcareous components are dominant. Garnet biotite schist exposes in the maximum part of the study area and comprising of large garnet (diameter ~4.2cm to 1cm) with biotite, plagioclase, and quartz. Dolomite is impure in nature, consists of quartz, dolomite, calcite and ankerite, exposes eastern margin of the study area, shows elephant skin weathering. Quartzite mainly occurs at higher elevation in the study area and characteristics of yellowish white in colour, medium grain, shows well developed foliation planes. Amphibolite and granite occur as intrusive rocks in the area. Amphibolite dyke is melanocratic in nature, consists of mainly plagioclase and pyroxene, and shows typical salt-pepper texture. Evidences of at least three generations of deformations are observed within the lithounits. The surface evidences of mineralisation are well preserved in the form of malachite stain, box-work structure, gaussan zone, slag, old workings, and occurrences of Ocimum centraliafricanum as copper plant. Occurrence of old working is present mainly in the contact of quartzite and garnet-biotite-schist along F2 fold hinges. The ground Geophysical survey was also carried out, covering 10L Km. in which magnetic anomaly, self-potential, IP chargeability and IP resistivity were measured. Four low SP zones were marked mostly concentrated on the east and north part of the block, magnetic high on the east and west part of the block, four zones having high IP chargeability mainly on the east and central part of the block and low IP resistivity at the eastern part of the block were noticed. A total 10 nos. of channel laid mainly targeting the garnet-biotite schist and impure dolomite, on which EPCH-1, 2 and 9 on garnet- biotite schist and EPCH-4, 6 and 8 on impure dolomite have indicated positive results. The maximum copper zone identified on the channel at EPCH-2 having 0.56% Cu with a. thickness of 15.0m. The maximum Pb concentration delineated at EPCH-4 having 5.0m thick with an average grade of 0.44%. The Maximum Zn observed at EPCH-4 having 7.0m thickness with an average grade of 0.47%1

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Alwar	Suratgarh block, Thanagazi tehsil	1:2000	-	-	1251.30	310	The field work includes detailed geological mapping of an area of 1.00 sq km on 1:2000 scale followed by 1251.30m drilling in ten boreholes during FS 2021-22. A total of 180 nos. of core samples have been prepared and submitted in the Chemical laboratory, WR for analysis. Apart from this, in order to assess the potentiality of mineralised zones in respect of copper and associated precious metals, 33 cubic m pitting/ trenching were carried out and a total of 20 nos. of PTS samples, 90 BRS/ channel samples, 10 nos. of petrological samples and 10 nos. of ore mineral samples have been collected and submitted in the respective laboratory of GSI, WR. The lithologies intersected in the boreholes drilled in Suratgarh block are brecciated quartzite, dolomitic marble intercalated with thin bands of quartzite, banded dolomitic marble and thin veins and veinlets of quartz and carbonate. Sulphide mineralisation has been intersected in the form of specks, dissemination, vein and fracture filled bornite, chalcopyrite and pyrrhotite. Borehole RJAS-1 has intersected 1m thick lean mineralised zone of 0.12% Cu. Borehole RJAS-2 has intersected two lean mineralised zone of 1m thick with 0.11% and 0.13% Cu. The analytical results are awaited to estimate the resource of the block.
	Around the Baraud-Dooghera	1:12500	100	-	-	284	Exploration for copper and associated precious metals in Dooghera-Baraud block, Alwar, Rajasthan has been taken up involving large scale geological mapping. An area of 100 sq. km was mapped on 1:12,500 scale, 700 sq. km ASTER image processing and a total of 150 bed rock/channel samples and 50 trench samples were collected. Apart from this, 20 samples for petrography, 10 samples for ore microscopy, 10 samples for petrochemical analysis and 25 nos. of water samples have been collected from the study area. The main rocks exposed in the area includes impure dolomitic marble of Kushalgarh Formation, brecciated quartzite of Seriska Formation, graphite bearing mica schist, garnet bearing mica schist, chlorite mica schist and carbon phyllite/pyritiferous quartzite of Bharkol Formation. Apart from this numerous intrusive bodies are present in the study area as, quartz reef, quartz veins and calcite veins. Alterations occurs in the form of limonitisation and chloritisation. The rocks of the study area had undergone three stages of deformation and the general trend of rocks is NNE to SSW and moderately dipping towards NW or SE. The surface indications of base metal mineralisation are present in the form of malachite stains and fresh sulphides i.e., chalcopyrite, covellite, bornite, pyrrhotite and pyrite within impure dolomitic marble, carbon phyllite and brecciated quartzite as well as in quartz veins. A mineralisation zone MZ-I has been delineated on the basis of surface indications of mineralisation within impure dolomitic marbles of Kushalgarh Formation. Apart from this, surface indication of graphite mineralisation was also observed. Graphite present in the study area is thinly laminated/bedded and having flaky to crystalline in morphology. It is hosted by graphite bearing mica schist, carbon phyllite and garnet bearing mica schist. Copper mineralisation is in the study area were manifested by presence of gossan zone in ferruginous brecciated quartzite of Sariska Fm. Based on these surface indications for copper mineralisation, one mineralised zone (MZ-I) has been demarcated. The MZ-I, is lying within impure dolomitic marble of the Kushlagarh Formation and situated east of Baraud village. The strike length of mineralised zone was trending in NNE-SSW direction having strike extension of 350 m and width varying from 3m to 6m. Channel samples from copper mineralised zone were collected and submitted for analysis. The chemical result of 03 number of channel samples (DBCH-2, 3 and 4) shows Cu, Mn, and Fe content from 10 ppm to 0.72%, 80 ppm to 0.17% and 0.70% ppm to 12.50% respectively. The channel samples (DBCH-4) analysed amaximum of 0.72% Cu, with 6m x 0.28% Cu, 2m x 0.21%, 4m x 0.1% and 3m x 0.1%. The chemical result of 50 nos of pitting trenching cum channel samples indicates insignificant amount of copper content (10 ppm to 160

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							. ppm). Petrochemical sampling was carried out in the study area to know the whole rock geochemistry of all the litho-units present in the study area. Most of the analytical results are awaited with Chemical Division, GSI, WR. Graphite mineralisation was also observed within graphite mica schist, carbonaceous phyllite and garnet bearing mica schist of Bharkol Formation of Ajabgarh group. A mineralised zone (MZ-II) is delineated over a strike length of 5.25 Km and width up to 20m. 02 nos. of channel and 17 nos. grab bed rock samples were collected to check the fixed carbon analysis and vanadium, Mo and REE.
REE & RM							
Sirohi	Mungthala-Mawal-Bhaisasing area	1:12500	100	-	-	-	The work includes large scale mapping of an area of 100 sqkm on 1:12,500 scale. A total of 167 bedrock samples, 30 pit/trench samples, 26 petro-chemical samples, 40 soil samples, 40 stream sediment samples and 20 heavy mineral samples were collected during field work. All the samples have been submitted to Chemical Division, GSI, WR for chemical analysis. Apart from this, 24 petrological samples, 20 ore microscopy samples, 5 XRD and 5 EPMA samples were also submitted in the respective laboratories of GSI. The litho-units observed during mapping were calc-silicate rock, impure marble, skarn, biotite granitoid, medium and coarse grained granitoid, gabbro, and sheared/brecciated cherty quartzo-feldspathic rock. Several skarn zones were observed in the area by presence of garnet and pyroxene. The granitoid are brecciated and sheared at places. Most of the area is covered by Quaternary sediments of Holocene age comprising of Thar Desert Formation. Structural features recorded in the area are represented by bedding, lineation, foliation, joint, fold and shear zone. Granites are jointed and sheared. The surface indication of mineralisation in the area is manifested by the presence of chalcopyrite within quartz vein, malachite staining, limonitic vein, sulfides within skarn and brecciated/sheared quartzo-feldspathic rock/ silicified breccia, pyrrhotite, epidote vein, iron staining on skarn rock.Veinlets of magnetite in gabbroic rock/mafic rock, magnetite associated with quartz veins intruding granite and sediments near skarn zone has been recorded at several places. Rutile, Ilmenite, and sulphide bearing quartz vein, tourmaline bearing micro-pegmatite, epidotisation, goethite development at fracture and joint surfaces of brecciated quartz vein and veins of iron-carbonate, iron box-work, ferrugenisation and limonitisation inbrecciated/sheared quartzo-feldspathic rock/silicified breccias is also present in the area. The samples collected from the study area were submitted in the respective laboratories of GSI WR, Jaipur for Chemical analysis. The analytical results of submitted samples are awaited.
Barmer	Sainji Ki Beri-Meli area	1:12500	108	-	-	-	A G4 stage exploration in Sainji Ki Beri-Meli area in toposheet no. 45C/06 was taken up to delineate zones of REE & associated RM mineralisation and to demarcate younger intrusive phases. Large scale geological mapping has been carried out over an area of 108 sq. km on 1:12,500 scale along with collection of various sample media. During mapping, a total of 29 nos. of different flows of rhyolites were marked on the basis of the characteristics of groundmass colour, mineral composition of phenocrysts (viz. globular quartz, K-feldspar, Na-feldspar etc.), size and shape of the phenocrysts (viz. tabular, lath etc.) the ratio between ground mass and phenocrysts as well as presence of vesicles. The rhyolitic flows are well jointed and the joint planes are intruded by basic and felsic dykes. Felsic dykes are comparatively thicker than basic ones. Felsic dykes are showing coarse grained texture primarily composed of K-feldspar, Na-feldspar and quartz. Often K-feldspars are rimmed by Na-feldspar. All basicdykes are fine grained and highly weathered. Complete analysis of submitted samples is awaited.

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Sikar	South East of Nanagwas	1:1000	1	9	-	-	The Southeast of Nanagwas area is located about 20 kms east of Neem ka Thana tehsil, Sikar district, Rajasthan. The area falls in toposheet No. 45M/14. Geologically, the area exposes the rocks of the Ajabgarh Group of the Delhi Supergroup. The exposed lithounits are quartz biotite schist with magnetite band and banded impure marble of the Kushalgarh Formation, quartzite of the Seriska Formation and Jaitpura granite. Apart from this, numerous intrusive bodies' viz. pegmatite veins, quartz veins, calcite veins, albitite veins are present in the study area. General strike of rocks is NE to SW and dip varies from 55° to 85° towards west. The area has undergone three phases of deformation. The second-generation deformation is more prominent which controls the topography of the area. During the period, an area of 1.00 sq km was mapped on 1:1000 scale along with delineation of host of REE mineralisation (quartz biotite schist with magnetite band/ partings). A total of 09 nos. of geochemical profiles has been led across the quartz biotite schist with magnetite band/partings over 1500m strike length and 0.50 to 03 m width. Occurrence of base metal mineralisation was also demarcated over 250 m strike length with very restricted width of about 1m in the form of fresh copper sulphides i.e. chalcocite, bornite and chalcopyrite along with pyrite and malachite stains. The analytical results of channels SENCH-01 (2m x 0.26% tREE), SENCH-02 (0.50m x 0.24% tREE), SENCH-03 (0.50m x 0.11% tREE), SENCH-04 (1.5m x 0.17% tREE), SENCH-05 (3.0m x 0.68% tREE), SENCH-06 (1m x 0.19% total REE and 2m x 0.24% tREE), SENCH-07 (3m x 0.21% tREE) and SENCH-08 (2.5m x 0.14% tREE) indicated anomalous values of tREE on surface. On the basis of surface anomalous values of tREE, a total 09 nos. of first level boreholes RJSSN-01 to RJSSN-09 were drilled to evaluate the subsurface potentiality of REE and Rare Metals in SE of Nanagwas area. All the borehole intersected quartzite, quartz biotite schist with magnetite band/partings (host lithology of REE mineralisation in the area), amphibole bearing dolomitic marble and albitite-quartz-calcite veins. The subsurface feeble and sporadic occurrence of copper mineralisation was also reported in the form of vein filled bornite and chalcopyrite in few boreholes. All the boreholes RJSSN-01 to RJSSN-09 intersected iron (magnetite-hematite) in the form of thick bands, thin partings, small laths and crystals hosted within quartz biotite schist and are mostly associated with calcite and albitite veins. Chemical analytical results of core samples are awaited
Tungsten, Lithium and associated mineralisation							
Pali	Mohangarh	1:2000	2	-	-	-	During field season 2021-22, the area around Mohangarh (Motiya) is taken up for G3-investigation with an objective 1) To assess the potentiality of tungsten, lithium and associated mineralisation. 2) Genetic and metallogenic correlation with Degana Tungsten prospect, if any. During FS 2021-22, detailed geological mapping on 1:2000 scale of 2 sq. km area was carried out and two major litho units were identified and demarcated viz. mica schist/phyllite and granite gneiss. Mica schist is fine grained rock with quartz, mica as essential mineral composition. Granite Gneiss is coarse to medium grained leucocratic rock with Quartz (55-60%), feldspar (35-40%), mica (3-4%), tourmaline (1-2%) as major mineral phases. Contact of mica schist and Granite Gneiss is sheared which is evident by development of mineral lineation and s-c fabric and sub-grain formation in granite gneiss near the contact. Two sets of foliations are well developed and preserved in mica schist and granite gneiss (near the contact). Disseminated wolframite grains are observed in quartz and quartz-tourmaline veins intruded in granite gneiss near the contact. Total five numbers of major mineralised quartz and quartz tourmaline veins with visible wolfram grains of varying size from 1 mm to 6 cm are identified and recorded. These veins are varying in thickness from 5 cm to 2m and exposed strike length is about 700m. The general trend of quartz and quartz tourmaline veins is NS, NNE-SSW with sub vertical dip. These veins are branched, swirling in nature and dipping either side at

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							places. Total 50 nos. of Channel samples, 100 nos. of bed rock samples, 50nos of polished sections, 30 nos. of petrochemical samples and 25 nos. of soil samples had been collected and submitted to respective laboratories. The analytical results 21 bed rock samples have been received from the Chemical laboratory on which 1 sample is having 28000 ppm and one more sample having upto 6000 ppm tungsten, 50 channel sample result also received from the Chemical laboratory out of which 1 sample of MCH-7 is showing 3273 ppm W value, 6 PCS samples result also received on which 2 samples
Limestone							
Sikar	Maonda area	1:2000	1.63	8	434.20	7	The item comprised of detailed geological mapping of 1.63 sq km area on 1:2000 scale and a total core drilling of 400 m involving 08 nos. of boreholes each having a depth of 50m with having borehole spacing of 400m. A total of 8 boreholes (RJNN-1 to RJNN-8) were drilled in the area, which involved 434.20 m of drilling. The rock types exposed in the block are micaceous quartzite, dolomitic marble, mica schist, quartz-feldspar vein and impure marble of the Kushalgarh Formation of the Ajabgarh group. During the investigation, 07 nos. bed rock samples were collected and analysed. The chemical analysis of 07 nos. of bed rock samples from impure marble indicated weighted average grade of CaO-48.97%, SiO2-5.71%, MgO-4.32%, Al2O3-0.56% and Fe2O3-0.57%. 03 nos. of samples out of 07 nos. have more the 5% MgO. Analytical results of bed rock samples indicate that impure marble unit (high CaO and low SiO2 except high MgO) is suitable for cement grade. Impure marble has been intersected in 05 nos. boreholes out of 08nos. of boreholes. Borehole nos. RJNN-2, RJNN-6 and RJNN-7 has been intersected thick micaceous quartzite.

Table – 4 : Mineral Production in Rajasthan, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
Lignite	**'000t**	**-**	**8223**	**-**	**-**	**9056**	**-**	**-**	**10526**	**-**
Natural Gas (ut.)	m c	-	1883	-	-	2040	-	-	2619	-
Petroleum(crude)	'000t	-	6653	-	-	5891	-	-	5887	-
Copper Ore	t	-	1119523	-	-	991991	-	-	1101339	-
Copper Conc.	t	2	51832	3094145	2	42590	3371952	2	49399	5463975
Iron Ore	'000t	10	1012	3677013	9	1088	5106818	10	1235	5574588
Lead & Zinc Ore	t	-	14479032	-	-	15455342	-	-	16338461	-
Lead Conc.	t	10	351746	18260832	10	376923	18810483	10	368040	22366174
Zinc Conc.	t	*	1446824	60438504	*	1513996	63127101	*	1594086	81815818
Manganese Ore	t	1	9937	29811	1	6940	20820	1	8008	25626
Silver **	kg	-	609153	25608038	-	705676	42657180	-	647013	42115418
Phosphorite	t	1	1300229	4637009	1	1357949	4602518	1	1281349	7505078
Garnet (abrasive)	t	5	568	1775	7	7114	26378	5	8182	29880
Limestone	'000t	38	72390	19094468	39	74266	19449722	41	87679	22220563
Magnesite	t	-	-	-	-	-	-	1	-	-
Selenite	t	2	2154	4206	3	402	602	4	756	1022
Siliceous Earth	y	12	19367	11710	12	23823	14686	13	31783	21209
Wollastonite	t	4	124757	139695	4	103902	122210	3	108383	99265
Minor Minerals		-	-	122027979	-	-	150950900	-	-	117797586

Note : The number of mines excludes Fuel and Minor minerals.

$ Excludes the value of Fuel minerals.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Cement	
ACC Ltd, Lakheri, Distt. Bundi	1500
Ambuja Cements Ltd, Rabriyawas, Distt. Pali	3600
Binani Cement, Binanipuram, Distt. Sirohi	4850
Binani Cement, Neem Ka Thana, Distt. Sikar (G)	1400
Birla Corporation Ltd, (Birla Cement Works & Chanderia Cement Works), Distt. Chittorgarh	4000
India Cements Ltd, Jhalo ka garha Garhi	1800
J.K. Cement, Nimbahera, Distt. Chittorgarh	3250
J.K. Cement, Mangrol, Distt. Chittorgarh	2500
J.K. Cement, Gotan, Distt. Nagaur	500
J.K. White Cement Works, Gotan, Merta, Distt. Nagaur	610 (white Cement) 500 (white Putty)
J.K. Laxmi Cement, Banas, Distt. Sirohi	8700
NUVOCO Vistas(Lafarge) India Ltd, Nimbahera, Distt. Chittorgarh	2600
Mangalam Cement (Mangalam Cement & Neer Shree Cement), Morak, Distt. Kota	3250
Nirma Limited, Nimbol, Jaitaran	2280
Shree Cement Ltd, Beawar, Distt. Ajmer	3000
Shree Cement Ltd, Andherideori, , Masuda, Ajmer	3600
Shree Cement Ltd, Ras, Distt. Pali	3000
Shree Cement Ltd, Ras ,Jaitaran, Distt. Pali	4000
Shree Cement Ltd, Kushkhera, Distt. Alwar (G)	3500
Shree Cement Ltd, Suratgarh, Distt. Sri Ganganagar (G)	1800
Shree Cement Ltd, Suratgarh, Rohi, Udaipur-Udasar Distt. Sri Ganganagar (G)	3600
Shree Cement Ltd, Jobner, Distt. Jaipur (G)	1500
Shriram Cement Works, Kota	400
Trinetra Cement (Subsidiary of India Cement), Nokhala, Distt. Banswara	1800
Udaipur Cement Works (Subsidiary of JKCL), Udyog Ltd,), Distt. Udaipur	1240
Ultra Tech Cement (Birla White Cement Division), Kharia Khangar, Bhopalgarh	680 (white cement) 400 (putty)
Ultra Tech Cement Nathdwara 4850 (cement)	
Binnani Cement Ltd,Amli,Pindwara	
UltraTech Cement (Aditya I & II), Shambhupura, Distt. Chittorgarh	8000
UltraTech Cement, Kotputali, Distt. Jaipur	4000
Wonder Cement, Nimbahera, Distt. Chittorgarh	8000
Chemical	
DCM Shriram Industries Ltd, Distt.Kota	9 (rayon/yarn) 7.7 (sodium sulphate)
Modi Alkalies & Chemicals Ltd, Distt. Alwar	84.2 (caustic soda) 50.3 (Cl), 39.6 (HCl)
Ceramics/Chemicals	
Bikaner Ceramics Pvt. Ltd, Distt. Bikaner	9 (insulators)

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Kajaria Ceramics Ltd, Gailpur	6.5 (mill. sq m)
Kajaria Ceramics Ltd, Malootana	24.5 (mill. sq m)
Bhalla Chemical Works Pvt Ltd	10 (zirconium oxychloride & special zirconia)
Roca Bathroom Product Pvt Ltd, Distt. Alwar	12.9
Roca Bathroom Product Pvt Ltd, Distt. Alwar	2 mill. pc.
Fertilizer	
Adheeshaa Phosphate, Umarada, Distt. Udaipur	132 (SSP)
Arawali Phosphate Ltd, Umra, Distt. Udaipur	40 (SSP)
Arihant Phosphate & Fertlizers Ltd, Nimbaheda, Distt. Chittorgarh	66 (SSP)
Bohra Industries Ltd, Umra, Distt. Udaipur	200 (SSP)
Chambal Fertilizers & Chemicals Ltd, Gadepan, Distt. Kota	180 (SSP)
Coromandel International Ltd, (Formerly) Liberty Phosphate Ltd), Jagpura, Distt. Kota	132 (SSP)
Devyani Phosphate Pvt. Ltd, Distt. Udaipur	60 (SSP)
Dharamsi Morarji Chemical Co. Ltd, Khemli, Distt. Udaipur	66 (SSP)
Gayatri Spinners Ltd, Hamirgarh, Distt. Bhilwara	30 (SSP)
Indian Phosphate Ltd, Umrada, Distt. Udaipur	130 (SSP)
Jagdamba Phosphate,Distt. Kota	132 (SSP)
Jubilant Agri and Consumer Products Ltd, Singhpur, Kapasan, Distt. Chittorgarh	264 (SSP)
Khaitan Chemical & Fertilizers Ltd, Dhinwa, Distt. Chittorgarh	198 (SSP)
Mangalam Phosphates Ltd, Hamirgarh, Distt. Bhilwara	72 (SSP)
Ostwal Phoschem (India) Ltd, Hamirgarh, Distt. Bhilwara	132 (SSP)
Patel Phoschem (P) Ltd, Umarda, Distt. Udaipur	100 (SSP)
Prem Sakhi Fertx. Ltd, Lakadwas, Distt. Udaipur	66 (SSP)
Rama Phosphates Ltd, Umra, Distt. Udaipur	181 (SSP)
Sadhana Phosphates & Chems Ltd, Gudli, Distt. Udaipur	120 (SSP)
Shriram Fertilizers & Chemicals Ltd, Shriramnagar, Distt. Kota	379.5 (Urea) 113.8 (caustic soda) 13.2 (bleaching powder) 61.2 (HCl) 61.2 (Cl)
Shri Ganapati Fertilizers Ltd, Kapasan, Distt. Chittorgarh	99 (SSP)
Shurvi Colour Chem Ltd, Madri, Distt. Udaipur	12 (SSP)
Plaster of Paris	
Abhishek Plaster Industries, Baramsar, Distt. Hanumangarh	6.1
Agrawal Industries, Nohar, Distt. Hanumangarh	6.3
Balaji Plaster Industries, Taranagar, Distt. Churu	6
Balaji Industries, Taranagar, Distt. Churu	6.5
Ganesh Plaster Industries, Taranagar, Distt. Churu	6

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Gil Brothers, Taranagar, Distt. Churu	7.1
Hind Plaster Industries, Taranagar, Distt. Churu	6
Jaishri Plaster Industries, Taranagar, Distt. Churu	6.3
Jagdamba Plaster Industries, Rawatsav, Distt. Hanumangarh	7
Coromandel International Ltd, (Formerly Liberty Phosphate Ltd), Jagpura, Distt. Kota	132 (SSP)
Devyani Phosphate Pvt. Ltd, Distt. Udaipur	60 (SSP)
Dharamsi Morarji Chemical Co. Ltd, Khemli, Distt. Udaipur	66 (SSP)
Jai Bhavani Plaster Industries, Baramsar, Distt. Hanumangarh	6
Jai Sriram Plaster Industries, Taranagar, Distt. Churu	7.1
M.G. Plaster Pvt Ltd, Taranagar, Distt. Churu	6.2
Mahabir Plaster Industries, Taranagar, Distt. Churu	6
Multani Industries, Nohar, Distt. Hanumangarh	8.4
R.D. Plaster Industries, Nohar, Distt. Hanumangarh.	8.4
R.N. Industries, Bikaner, Distt. Bikaner	18
Shalimar Plaster & Chemical Industries, Sardarshahar, Distt. Churu	14
Shri Lakshmi Gypsum, Chak, Distt. Hanumangarh	6
Shriram Plaster, Taranagar, Distt. Churu	6.3
SS Plaster Industries, Taranagar, Distt. Churu	6
Shiv Bhakti Industries, Nohar, Distt.. Hanumangarh	8.4
Tiger Plaster, Sardarshahar, Distt. Churu	11
The Sardarshahar Plaster & Minerals, Sardarshahar, Distt. Churu	19.4
Updesh Industries Ltd, Chak, Distt. Hanumangarh	9
Pellet	
Jindal Saw Limited, Pur, Bilwara	1500
Power generation	
JSW Energy Barmer Ltd, Bhadresh.	1080 MW
Copper Smelters	
HCL, KCC, Distt. Jhunjhunu.	31 (Cu cathode)
Rajpura Dariba Lead & Zinc Mine	76.827(Zinc Conc.)
Dariba, Distt. Rajsamand	17.506(lead Conc.)
Lead & Zinc Smelters	
HZL Zinc Smelter, Debari, Distt. Udaipur.	88 (Zn)
HZL Lead-zinc Smelter, Chanderiya, Distt. Chittorgarh.	85 (Pb) 525 (Zn) 0.833 (Cd)* 168 tonnes (Ag)
HZL, Dariba Smelting Complex, Dariba Distt. Rajsamand.	100 (Pb) 210 (Zn)
* Total for all smelters of HZL	

(G); Grinding Units

Note: Data sourced from Indian Fertilizer Scenario, FAI Statistics and Survey of Cement Industry & Directory respectively.

Sikkim

Only minor minerals of production was reported in

XXXX

Value of minor minerals' production were estimated for the year 2020-21 2021-22

Mineral Resources

The important mineral resources of the State are copper-lead-zinc and silver, reported in Bhotang, Rangpo and Dikchu in East Sikkim districts. Occurrences of other minerals reported in the State include dolomite, quartzite and talc/steatite/soapstone in West Sikkim district; limestone in North Sikkim district and marble in East Sikkim & North Sikkim districts (Table -1). The reserves/ resources of coal and the coalfield located in Sikkim are reflected in Table - 2.

Exploration & Development

No exploration work was reported by GSI during the year 2021-22.

Production

No mineral production (except minor miner- als) was reported in 2021-22. The value of minor minerals' production was estimated at Rs.188 lakh for the year 2021-22.

Mineral-based Industry

SMC, a joint venture of Government of Sikkim and Government of India was established for the purpose of development of Bhotang polymetallic ore deposit at Rangpo. Sikkim's Mines & Geology Department had set up a pilot dimension rock cutting unit and pilot lime making unit to ascertain the feasibility of setting up of commercial lime plant and dimension rock cutting plant in the State. A ferro alloys plant, namely, Akshay Ispat & Ferro Alloys Ltd with an installed capacity of 6,000 tpy is located at Mamring, South Sikkim district. The present status of these industries is not available.

Table – 1: Reserves/Resources of Minerals as on 1-04-2020 : Sikkim

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Copper														
Ore	'000 tonnes	-	-	-	-	-	445	63	300	-	150	-	958	958
Metal	'000 tonnes	-	-	-	-	-	7.86	0.91	8.47	-	4.23	-	21.47	21.47
Lead-Zinc					-								-	-
Ore	'000 tonnes	-	-	-	-	-	436	64	300	-	150	-	950	950
Lead metal	'000 tonnes	-	-	-	-	-	6.9	1.68	-	-	-	-	8.58	8.58
Zinc metal	'000 tonnes	-	-	-	-	-	12.88	3.14	3	-	1.05	-	20.07	20.07
Limestone	'000 tonnes	-	-	-	-	-	-	-	-	-	2380	-	2380	2380
Silver														
Ore	tonnes	-	-	-	-	-	435843	63780	300000	-	150000	-	949623	949623
Metal	tonnes	-	-	-	-	-	15.25	0.04	27.6	-	13.8	-	56.69	56.69

Figures rounded off

Table – 2 : Reserves/Resources of Coal as on 1.4.2023 : Sikkim

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Coalfield	Proved	Indicated	Inferred	Total
Total/Rangit Valley	-	58	43	101

Source: Coal Directory of India, 2022-23.

Tamil Nadu

The principal minerals produced in the state were Lignite, Natural Gas (utilised), Petroleum (crude), Limestone, Magnesite and Vermiculite in 2021-22

XXXX
Estimated value of production of minor minerals 2021-22

XX
Mines in case of MCDR minerals reported production in2021-22

Mineral Resources

Tamil Nadu is the leading holder of country's resources of vermiculite, molybdenum, dunite, rutile, garnet and ilmenite. The State accounts for the country's 79% vermiculite, 65% dunite, 48% garnet, 52% molybdenum, 25% sillimanite and 16% fire clay resources. As per AMD of the Department of Atomic Energy, Tamil Nadu accounted for 167.70 million tonnes of ilmenite resources and 7.85 million tonnes of rutile resources.

Important minerals that are found to occur in the State are: bauxite in Dindigul, Namakkal, Nilgiris & Salem districts; dunite/pyroxenite in Salem district; felspar in Coimbatore, Dindigul, Erode, Kanchipuram, Karur, Namakkal, Salem & Tiruchirapalli districts; fireclay in Cuddalore, Kanchipuram, Perambalur, Pudukottai, Sivaganga, Thiruvallur, Tiruchirapalli, Vellore & Villupuram districts; garnet in Ramanatha- puram, Tiruchirapalli, Tiruvarur, Kanyakumari, Thanjavur & Tirunelveli districts; granite in Dharmapuri, Erode, Kanchipuram, Madurai, Salem, Thiruvannamalai, Tiruchirapalli, Tirunel- veli, Vellore & Villupuram districts; graphite in Madurai, Ramnathapuram, Sivaganga & Vellore districts; and gypsum in Coimbatore, Perambalur, Ramnathapuram, Tiruchirapalli, Tirunelveli, Thoothukudi & Virudhunagar districts. Similarly, occurrences of minerals, such as, lignite deposits are located in Cuddalore, Ariyalur, Thanjavur, Thiruvarur, Nagapattinam, Ramnad, Shivganga & Ramana thapuram districts ; lime stone in Coimbatore, Cuddalore, Dindigul, Kanchipuram, Karur, Madurai, Nagapattinam, Namakkal, Perambalur, Ramnathapuram, Salem, Thiruvallur, Tiruchirapalli, Tirunelveli, Vellore, Villupuram & Virudhunagar districts; magnesite in Coimbatore, Dharmapuri, Karur, Namakkal, Nilgiri, Salem, Tiruchirapalli, Tirunelveli & Vellore districts; quartz/ silica sand in Chennai, Coimbatore, Cuddalore, Dharmap uri, Dindigul, Erode, Kanchipuram, Karur, Madurai, Namakkal, Periyar, Perambalur, Salem, Thiruvallur, Thiruvarur, Nagapattinam, Tiruchirapalli, Villupuram, Virudhunagar & Vellore districts; talc/steatite/ soapstone in Coimbatore, Salem, Tiruchirapalli & Vellore districts; titanium minerals in Kanyakumari, Nagapattinam, Ramanathapuram, Thiruvallur, Tirunelveli & Thoothukudi districts; vermiculite in Dharmapuri, Tiruchirapalli & Vellore districts; and zircon in Kanyakumari district have been established.

Other minera ls that occur in the State are: apatite in Dharmapuri & Vellore districts; barytes in Erode, Madurai, Perambalur, Tirunelveli & Vellore districts; bentonite in Chengai-Anna district; calcite in Salem district; china clay in Cuddalore, Dharmapuri, Kanchipuram, Nilgiris, Sivaganga , Thiruvallur, Tiruvanna malai , Tiruchirapalli & Villupuram districts; chromite in Coimbatore & Salem districts; copper, lead-zinc & silver in Villupuram district; corundum & gold in Dharmapuri district; dolomite in Salem & Tirunelveli districts; emerald in Coimbatore district; iron ore (magnetite) in Dharmapuri, Erode, Nilgiris, Salem, Thiruv- annamalai, Tiruchirapalli & Villupuram districts; kyanite in Kanyakumari & Tirunelveli districts; molybdenum in Dharmapuri, Dindigul & Vellore districts; pyrite in Vellore district; sillimanite in Kanyakumari, Karur & Tirunelveli districts; tungsten in Madurai & Dindigul districts; and wollastonite in Dharmapuri & Tirunelveli districts (Table-1). District-wise reserves/resources of lignite are provided in Table-2.

In addition to the above, petroleum and natural gas deposits are found to be located in Cauvery basin area.

Exploration & Development

The details of exploration activities conducted by GSI for Gold, PGE, REE & RM, Graphite and Lignite during 2021-22 are furnished in Table - 3.

Production

The principal minerals produced in the state were Lignite, Natural Gas (utilised), Petroleum (crude), Lime- stone, Magnesite and Vermiculite in 2021-22.

The value of minor minerals' production was estimated at 226 crore for the year 2021-22.

The number of reporting mines was 86 in 2021-22 in case of MCDR minerals.(Table-4).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the important mineral-based industries in organised sector in the State are given in Table -5.

Table –1: Reserves/Resources of Minerals as on 1.4.2020: Tamil Nadu

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Apatite	Tonne	-	-	-	-	-	-	-	-	-	240000	-	240000	240000
Bauxite	000 Tonnes	-	-	-	-	-	1141	3564	960	10084	8363	-	24112	24112
Chromite	000 Tonnes	-	-	-	-	-	-	-	7	-	276	-	282	282
Copper														
Ore	000 Tonnes	-	-	-	-	-	-	-	200	590	-	-	790	790
Metal	000 Tonnes	-	-	-	-	-	-	-	1.08	2.73	-	-	3.81	3.81
Garnet	Tonne	52538	-	-	52538	266555	1153976	3094811	36000	1408995	19871019	-	25831356	25883894
Gold														
Ore	Tonne	-	-	-	-	-	-	-	-	-	67000	-	67000	67000
(Primary)														
Metal	Tonne	-	-	-	-	-	-	-	-	-	1	-	1	1
(Primary)														
Graphite	Tonne	2289743	-	810450	3100193	39	39535	2486	29136	647500	5886390	-	6605086	9705279
Iron Ore	000 Tonnes	-	-	-	-	-	-	-	-	169388	110728	248785	528901	528901
(Magnetite)														
Kyanite	Tonne	1683	-	-	1683	578	117	-	700	167000	79434	-	247829	249512
Lead-Zinc Ore														
Ore	000 Tonnes	-	-	-	-	-	-	-	200	590	-	-	790	790
Lead metal	000 Tonnes	-	-	-	-	-	-	-	2.26	5.48	-	-	7.74	7.74
Zinc metal	000 Tonnes	-	-	-	-	-	-	-	11.76	24.76	-	-	36.52	36.52
Limestone	000 Tonnes	537272	3836	5915	547024	317801	239742	120594	95885	114647	687457	900	1577025	2124049
Magnesite	000 Tonnes	48760	6324	-	55084	71885	21695	3944	17	737	2124	-	100402	155486
Molybdenum														
Ore	Tonne	-	-	-	-	-	1500000	-	2382000	3269204	10563494	167800	17882498	17882498
Contained	Tonne	-	-	-	-	-	1050	-	1599.54	1733.29	5718.69	50.34	10151.86	10151.86
MOS2														
Pt. Group	Tonne	-	-	-	-	-	-	-	-	0.61	0.72	0.36	1.69	1.69
of Metals														
Pyrite	000 Tonnes	-	-	-	-	-	-	-	-	-	24	-	24	24
Sillimanite	Tonne	134030	-	-	134030	55288	12336	13529146	92400	-	3529577	-	17218747	17352777

Table-1 (Concld.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Silver														
Ore	Tonne	-	-	-	-	-	-	-	-	330000	460000	-	790000	790000
Metal	Tonne	-	-	-	-	-	-	-	-	15.87	26.68	-	42.55	42.55
Titanium	Tonne	670221	-	-	670221	306876	60463	-	488404	19687147	93134394	-	113677284	114347505
Tungsten														
Ore	Tonne	-	-	-	-	-	-	-	-	-	-	250000	250000	250000
Contained WO3	Tonne	-	-	-	-	-	-	-	-	-	-	50	50	50
Vermiculite	Tonne	1516803	-	-	1516803	-	-	-	-	-	343051	-	343051	1859854
Wollastonite	Tonne	-	-	-	-	-	-	-	-	-	3533	-	3533	3533
Zircon	Tonne	36285	-	-	36285	22108	4225	-	17500	-	-	-	43833	80118

Fgure rounded off.

Table – 2 : Reserves/Resources of Lignite as on 1.4.2023 : Tamil Nadu

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	5023	21910.06	9652.62	36489.6
Cuddalore	4119	1419	1302	6840
Ariyalur	904	303	512	1719
Thanjavur & Thiruvarur	–	17203	3058	20261
Thanjavur	–	2351	222	2573
Thanjavur & Nagapattinam	–	359	927	1286
Thiruvarur & Nagapattinam	–	–	574	574
Ramanathapuram	–	169	3108	3277
Ramnad	–	71	965	1036
Ramand & Sivaganga	–	–	20	20

Source: Coal Directory of India, 2022-23

Table –3 : Details of Exploration Activities in Tamil Nadu, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Gold							
Tiruvannamalai	Chengam-Uchimalai-kuppam area	1:12500	100	-	-	-	Reconnaissance survey was carried out in Chengam and Uchimalaikuppam areas to delineate potential zones for gold and associated mineralisation with large scale mapping (LSM) on 1:12500 scale covering 100sq km and collection of bedrock, groove as well as stream sediment samples. LSM has brought out seven lithologies in the investigated area. They are charnockite, pyroxene granulite, banded magnetite quartzite (BMQ), granite gneiss, quartzo-feldspathic rock, dolerite dyke and milky white quartz vein. Charnockite is the major litho-unit. Pyroxene granulite is associated with BMQ as inter-bands. Three nos of parallel linear BMQ bands were demarcated from north to south occurring in close association with pyroxene granulite and charnockite. Out of three BMQ bands, only two are persistent and extending for cumulative distance of 10-15 kms from west to east; while the third one occurred as floats. Yellowish quartz vein occurring within the silicified BMQ in Seeranthangal village showed broad folding as well as pinch and swell structure. Highly modified boxwork structure (comb and crustification i.e., caries texture) are also observed showing dental cavities type appearance; from where sulphides are leach out forming the cavities. Ore microscopic study revealed that the sulphide phases like chalcopyrite and pyrite occur as disseminations in association with oxides and silicates. Sulphides also occurred along the fracture planes of garnet grains. The oxide phases include magnetite, hematite and ilmenite. Magnetite crystal retained its idiomorphic form but totally replaced by haematite giving rise to martitisation texture. 50 nos samples were collected from higher to lower order streams covering the whole investigated area to delineate source of gold. Out of 50, 42 nos of stream sediment samples were collected from 2nd/3rd order stream which were cutting across the BMQ bands. Out of 50, 9 nos of stream yielded gold specks along with heavies during panning. The gold grains showed spherical, elliptical, dumble and ameboid shape and size varies from 252.17µm to 1610.65µm. However, analytical results of 50 nos of stream sediment did not yield any gold value. 100 nos BRS were collected from BMQ and associated litho-units. Out of 40 nos of BRS, 3 samples showed Au values ranging from 48ppb to 102 ppb. Maximum values of Arsenic (As), Bismuth (Bi), Molybdenum (Mo) and Tungsten (W) are 14.74 ppm, 0.18 ppm, 44.45 ppm and 11.53 ppm respectively. Out of 10 prioritised samples collected from silicified BMQ, 2 samples showed Au value ranging from 0.08 ppm to 0.18 ppm. Cu values varies from 130 ppm to 1160 ppm. Cobalt (Co) values vary from 30 ppm to100 ppm, Nickel (Ni) values vary from 40 ppm to 390 ppm and FeO (%) is analysed up to 31.38% in silicified BMQ. Out of 100 nos of groove samples, 7 nos of samples are showing gold values varying from 26 ppb to 340 ppb. These 7 nos of groove samples were collected from silicified and gossanised BMQ bands in the south-western part of Uchimalaikuppam RF and northeast of Pudur.
PGE							
Erode	Mettupp alaiyam Mafic-Ultramafic Belt	1:12500	-	-	-	-	Large Scale Mapping on 1:12,500 scale was carried out to delineate PGE mineralisation. The major lithologies exposed in the area are hornblende-biotite gneiss, biotite gneiss gabbro + garnet, meta-pyroxenite, anthophyllite schist and pegmatite. Based on the mineralogy and reaction textures, it can be inferred that the rocks of the study area have undergone granulite facies to amphibolites facies metamorphism. A total of ten pyroxenite bands of various dimensions were delineated. Groove sampling were done on pyroxenite bodies, whereas grab samples were collected from pyroxenite, gabbro and anthophyllite schist. From the analysis of bed rock groove samples, the highest chromium value of 3037 ppm is noted in groove KTP-2 at Kuttipalaiyam village and the highest Ni value of 574 ppm is noted in groove CVP-1 at Chinna Vadamalapalaiyam village. Maximum Cr value of 3301 ppm and Ni value of 763 ppm for BRS grab samples were noted in anthophyllite schist sample from Oricheripudur. From

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							the BRS samples, twenty samples which showed higher Cr and Ni content and sulphide mineralisation were prioritised for PGE analysis and submitted for analysis. Trenching was made to confirm the strike continuity of pyroxenite bodies near Periya Vadamalapalaiyam, Siraimittanpalaiyam, Karattupalaiyam and Jambai villages.
REE and RM							
Vellore	Rasimalai Syenite Complex	1:12500	104	-	-	-	Large-scale mapping on 1: 12,500 scale was carried out in an area of 104 sq. km along with Pitting / Trenching to delineate the REE and RM mineralisation. The dominant lithology mapped during the investigation are charnockite, epidote-hornblende-biotite gneiss, syenite (pink syenite and grey syenite), dolerite dyke, metagabbro, pyroxene-granulite, pegmatite veins, quartzo-feldspathic vein, quartz vein and quartz-baryte vein. The Sannankuppam RF (western part) area is dominated by garnetiferous charnockite with or without garnet. Garnetiferous charnockite are intruded by several criss-cross quartz veins which contain molybdenum mineralisation. Molybdenum occurs in the form of flakes as well as in the form of dissemination. From the analytical result of bed rock samples (BRS), it is observed that pegmatite exposed in the upstream direction of unit cell (63-C) has yielded SREE of 498 ppm and the pink syenite in the Rasimalaiarea shows SREE up to 566ppm and grey syenite has shown a maximum of 178 ppm SREE. Apart from REE, Baoccurrence in syenite ranges from 814 ppm to 2010 ppm and Srvaries from 374 ppm to 1375 ppm. In south western part of Rasimalai area, quartz-baryte vein (~20m width and ~200m length) contains Ba value of 16.23%, Sr of 2704 ppm and SREE of 575 ppm and Mo 104 ppm.In regolith samples, SREE (La to Lu) ranges from 64.17 ppm to 3014.83 ppm with mean value of 283.80 ppm. In colluvial samples, SREE (La to Lu) is obtained up to 400 ppm. Ba value ranges up to 6.67% in colluvial sample of quartz barite vein.
Graphite							
Sivaganga	Sivaganga Block	1:12500	100	-	-	142	Large Scale Geological mapping was carried out in an area of 100 sq.km on 1:12,500 scale and mapped various litho-units quartzite, dolomite, biotite gneiss, quartz biotite gneiss ± epidote, graphite gneiss ± carbonate vein, quartzofeldspathic gneiss/epidotised quartzofeldspathic gneiss ± graphite, charnockite, laterite and calcrete and studied its potentiality of having graphite mineralisation if any. The general trend of the rock type noticed in the study area is N80°E-S80°W with dipping towards south direction but in some of the trenches dipping towards northernly. Based on LSM mapping graphite mineralisation associated with epidotised quartzo-feldspathic rock and carbonate vein reported in north of Ulaganathapuram village. The strike continuity extends 500 m long and trends in WSW-ENE direction. Flake nature of graphite mineralisation concentrated in sheared portion of host rock. Analytical results of 142 trench samples collected from 7 graphite occurring trenches and it indicates that the FC varies from 0.01 % to 31.63 %, VM varies from 2.03 % to 28.03 %, Moisture varies from 0.07 to 4.82 % and Ash varies from 60.88 to 92.61 %. However, 34 trench samples showing >20 % FC, 66 trench samples showing >10 and <20 % FC, 20 trench samples showing> 5 and <10 % FC value.
Lignite							
Ramanatha-puram	Tiruppullani West Sector, basin	-	22	2	1200	13	Lignite investigation was taken up in Tiruppullani West Sector, over an area of about 22 Sq. Km. A total of about 1200 m drilling by two (02) number of boreholes, covering an area of 11 Sq. Km each and a depth range of 550–600 m (+20%) to assess the regional continuity of lignite seams towards east of already explored Kalari East Sector. The boreholeTRTW-01 was closed at the depth of 603 after intersection of lignite seams. The first seam was intersected from 543 m to 561 m and second seam was intersected from 570 m to 570.90 m. Carbonaceous clay and sandstone (at places sand horizons) were encountered down from 570.90 m. Geophysical logging was carried out down to a depth

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							of 602 m and delineated two lignite seams (as mentioned above) and also delineated one thinner seam (third seam) from 598 m to 599m. 13 number of lignite samples were submitted and results were received. All the samples are having re calculated Calorific value between 2372 Kcal/Kg and 2990 Kcal/Kg and belongs to Lignite – "B" grade.

Table – 4 : Mineral Production in Tamil Nadu, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**92**		**9771097**	**98**		**8511562**	**86**		**9106493**
Lignite	'000t	-	23516	-	-	18026	-	-	23635	-
Natural Gas (ut.)	m c	-	1097	-	-	911	-	-	1067	-
Petroleum(crude)	'000t	-	415	-	-	410	-	-	367	-
Garnet (abrasive)	t	2*	-	-	2*	-	-	1*	-	-
Graphite (r.o.m.)	t	1*	-	-	1	10026	32404	1	36214	31650
Limestone	'000t	82	24461	7151088	89	21144	5813723	78	21334	6265788
Magnesite	t	6	51147	222293	5	43613	227494	5	81012	350856
Marl%	t	-	502750	93752	-	916081	173628	-	952921	193287
Vermiculite	t	1	584	1933	1	510	1688	1	691	2287
Minor Minerals@		-	-	2302031	-	-	2262625	-	-	2262625

Note: The number of mines excludes Fuel and Minor minerals.

$ Excludes the value of Fuel minerals.

** Only labour reported.*

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Abrasives	
Carborandum Universal Ltd, Chennai	NA
Cutfast Abrasives Tools Pvt. Ltd, Chennai	NA
Asbestos Products	
Hyderabad Industries Ltd, Kannigaiper	100
Ramco Industries Ltd, Arakkonam,	NA
Distt. Vellore	
Southern Asbestos Cement Ltd, Arrakonam	NA
Distt. Vellore	
Tamil Nadu Asbestos, Alangulam,	28.5
Distt. Virudhunagar	
Cement	
ACC Ltd, Madukkarai, Distt. Coimbatore	1000
Chettinad Cement Corpn. Ltd, Puliyar,	1700
Distt. Karur	
Chettinad Cement Corpn. Ltd, Karikalli	4500
Distt. Dindigul	
Chettinad Cement Corpn. Ltd, Ariyalur	5500
Dalmia Cements, Dalmiapuram,	3400

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Distt. Tiruchirapalli	
Dalmia Cements, Ariyalur	3000
Dhandhapani Cement Pvt. Ltd	225
Thathamangalam,Manachanallur	
India Cements Ltd, Sankarnagar,	2050
Distt. Tirunelveli	
India Cements Ltd, Sankaridurg, Distt. Salem (G)	860
India Cements Ltd, Dalavoi, Distt. Ariyalur	2160
India Cements Ltd, Vallur, Distt. Chennai (G)	1100
India Cements Ltd, Panaiveedu, Thiruchengodu	1400
My Home Industries Ltd. Tuticor	1500
Ultra-Tech Cement Ltd, Reddipalayam,	1400
Distt. Ariyalur	
Ultra-Tech Cement Works (ARCW),	1100
Arakkonam (G)	
Ramco Cement (formerly Madras Cement),	2000
R.S. Raja Nagar, Distt. Virudhunagar	
Ramco Cement (formerly Madras Cement),	3050
Alathiyur Works, Distt. Ariyalur	
Ramco Cement (formerly Madras Cement),	3500
Ariyalur Plant, Govindpuram, Distt. Ariyalur	
Ramco Cement (formerly Madras Cement),	500
Chengalpet Grinding Unit, Uthiramerur,	
Distt. Kanchipuram (G)	
Ramco Cement (formerly Madras Cement),	1600
Valapady, Distt. Salem (G)	
Tamil Nadu Cements, Alangulam,	290
Distt. Virudhunagar	
Tamil Nadu Cements, Ariyalur,	500
Distt. Ariyalur	
Tamil Nadu News -print & Paper Ltd.	328.5
Kagithapuram, Manmangalam	
Vijay Cements Trichy	75
Zuari Cements Ltd, Chennai Grinding Unit,	900
Attipattu, Tiruvallur (G)	
Ceramics	
Carborandum Universal Ltd, Hosur	NA
Murugappa Morgan Thermal	5.44
Ceramics Ltd, Ranipet, Distt. Vellore	
Neycer India Ltd, Vadalur, Distt. Cuddalore	9
Roca Bathroom Product Pvt Ltd, Ranipet,	12.6
Distt. Erode	
Roca Bathroom Product Pvt Ltd, Perundurai,	24
Distt. Vellore	
Spartek Ltd, Chennai	NA
Copper Smelter	
Sterlite Industries (I) Ltd,	400 (Cu smelting)
Thoothukudi	205 (Cu cathode)
	90 (wire rods)
	1050 (H2SO4)
Chemicals	

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Tanfac Industries Ltd, Cuddalore	16.5 (anhydrous HF),
	16.5 (AlF3)
	67.5 (H_2SO_4)
	14 (Hydrofluoric acid)
	3.4 (speciality fluorides)
Tuticorin Alkali Chemicals &	115 (soda ash)
Fertilizers Ltd, Thoothukudi	105 (A/Cl)
Vaiyapuri Shanthi Ferric alum	3.4(Ferric alum)
Sellipalayam, Namakal	
Electrode	
AVR Electrodes, No1, SIDCO,Indl.Estate,	250
Rajapalyam, Virudhnagar	
Fertilizer	
Coimbatore Pioneer Fertilizer Ltd,	66 (SSP)
Muthugoundanpudur, Distt. Coimbatore.	30 (H_2SO_4)
	3 (oleum)
Coramandal International Ltd, (Formerly	132 (SSP)
EID Parry), Ranipet, Distt. N. Arcot	33 (H_2SO_4)
Coramandal International Ltd,	330 (Complex)
Ennore, Distt. Thiruvallur.	
Kothari Industrial Corp. Ltd, Ennore.	66 (SSP)
Madras Fertilizer Ltd, Manali,	486.8 (Urea)
Distt. Thiruvallur.	840 (NP/NPKs)
Greenstar Fertilizers Ltd, Guindy.	115 (SSP)
Southern Petrochemical Industries	620 (Urea)
Corpn. Ltd), Thoothukudi.	
Ferroalloy	
Electralloy Special	1.0 (alloy , Stainless steel casting)
Steel Casting Pvt. ltd.	
Synthetic Rutile	
DCW Ltd, Sahupuram, Distt. Thoothukudi.	48
TiO_2 Pigment	
VVTi Pigments (P) Ltd,	18
(formerly, Kilburn	36 (Ferrous Sulphate
Chemicals) Distt. Thoothukudi	Heptahydrate)
Iron & Steel	
Salem Steel Plant (SAIL), Salem.	180 (Crude/
	Liquid steel)
JSW Steel Plant (acquired Southern Iron	1180 (sinter)
& Steel Co. Ltd), Salem.	1000 (pig iron)
	1000 (specialised
	alloy steel)
	18000 (Crude/Liquid steel)
Sponge Iron	
Akshara Industries Ltd, Eguvarpalayam,	100
Distt. Thiruvallur.	
Kaushik Steel Industries Ltd, Pappen Kuppam	60
Distt. Thiruvallur.	
Agni Steels Pvt Ltd, Olappalayam Road,	36
Ingur, Distt. Erode.	
Refractory	

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
ABREF Pvt. Ltd, Gummidipoondi,	1.3
Distt. Thiruvallur.	
Sharda Ceramics Pvt. Ltd, Ambattur, Chennai.	9.9
Shri Natraj Ceramic & Chemical Industries Ltd,	42
Dalmiapuram, Distt. Tiruchirapalli.	
VRW Refractories, Vanagaram.	21.6
Zirconium Complex, Pazhakayal,	0.5 (Zr-Oxide)
Thoothukudi.	0.25 (Zr sponge)
DBM & Calcined Magnesite	
SAIL Refractory Co. Ltd (formerly Burn	13(calcined
Standard Co. Ltd), Salem	magnesite)
	61 (DBM)
	15 (refractory bricks)
	45(Dunite fracton)
Dalmia Magnesite Corpn., Chettichavadi	72 (DBM)
Distt. Salem.	
Ramkrishna Magnesite Mines, Salem.	3 (calcined)
Tamil Nadu Magnesite Ltd,	19.5(calcined
Kurumbapatty, Distt. Salem.	magnesite)
	30(DBM)
Sri Pon Kumar Magnesite Ltd, Salem.	26.5 (DBM)
Silicon Carbide	
Carborandum Universal Ltd, Tiruvottiyur.	NA
Petroleum Refinery	
CPCL, Manali, Distt. Thiruvallur.	10500
CPCL, Narimanam.	1000
(G): Grinding unit.	

Note: Data sourced from Indian Fertilizer Scenario, FAI Statistics, and Survey of Cement Industry & Directory, respectively.

Telangana

Production of minerals like Coal, Manganese ore, Limestone etc. were reported from Telangana

XXXX
Value of minor minerals' production were estimated for the year 2021-22

XX
Mines in the case of MCDR minerals Reported production in 2021-22

Telangana is the 29th State of India, formed on the 2nd of June 2014 with ten districts, namely; Hyderabad, Adilabad, Khammam, Karimnagar, Mahbubnagar, Medak, Nalgonda, Nizamabad, Rangareddy and Warangal. Telangana is surrounded by Maharashtra and Chhattisgarh in the North, Karnataka in the West and Andhra Pradesh in the South and East directions.

Mineral Resources

Telangana is the leading producer of barytes, dolomite, feldspar, laterite, limestone, Quartz and Sand (others). It accounts for 47% kyanite, 29% corundum, 10% fuller's earth and 9% limestone resources of the country. Telangana is endowed with the internationally known black, pink, blue and multicoloured varieties of granites.

Important minerals occurring in Telangana are: barytes in Khammam, district; china clay in Adilabad, Mahabubnagar, Nalgonda, Rangareddi and Warangal districts; coal in Adilabad, Karimnagar, Khammam and Warangal districts; corundum in Khammam district; dolomite in Khammam and Warangal districts; felspar in Hyderabad, Khammam, Mahabubnagar, Medak and Rangareddy districts; fireclay in Adilabad and Nalgonda districts; garnet in Khammam district; granite in Karimnagar, Khammam, Mahabubnagar, Medak, Nalgonda, Rangareddy and Warangal districts; iron ore (haematite) in Khammam district; iron ore (magnetite) in Adilabad and Warangal districts;

limestone in Adilabad, Hyderabad, Karimnagar, Mahabub-nagar, Nalgonda, Rangareddy, districts; manganese ore in Adilabad district; mica in Khammam districts; quartz/silica sand in Hyderabad, Khammam, Mahabubnagar, Medak, Nalgonda, Rangareddy and Warangal districts; and talc/ soapstone/steatite in Khammam district Other minerals that occur in the State are chromite, copper, graphite and kyanite in Khammam district; fuller's earth in Medak and Rangareddy districts; and marble in Khammam district (Tables - 1 and 2).

Table –1: Reserves/Resources of Minerals as on 01.04.2020: Telangana

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Chromite	'000 tonnes	-	-	-	-	-	-	-	-	15	171	-	186	186
Copper														
Ore	'000 tonnes	-	-	-	-	-	666	-	-	-	-	-	666	666
Metal	'000 tonnes	-	-	-	-	-	9.12	-	-	-	-	-	9.12	9.12
Garnet	tonne	-	-	-	-	62187	42033	-	-	-	1855976	-	1960196	1960196
Graphite	tonne	-	-	-	-	-	-	-	-	123636	95818	-	219455	219455
Iron ore														
(Haematite)	'000 tonnes	-	-	-	-	1162	102	-	-	3370	73754	27240	105627	105627
Iron ore														
(Magnetite)	'000 tonnes	-	-	-	-	-	-	-	-	-	71500	15866	87366	87366
Kyanite	tonne	-	-	-	-	-	-	-	-	-	48350000	-	48350000	48350000
Limestone	'000 tonnes	984751	1450	227926	1214127	509737	142386	299243	118735	893077	11342869	3132280	16438327	17652454
Manganese														
ore	'000 tonnes	250	66	26	342	150	139	126	-	886	320	2540	4162	4503

Figures rounded off.

Table – 2: Reserves/Resources of Coal as on 1.4.2023 : Telangana

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total/Godavari Valley	11257	8497	3433	23186

Source: Coal Directory of India, 2022-23.

Exploration & Development

The details of exploration activities conducted by GSI, base metal and REE during 2021-22 are furnished in Table - 3.

Production

Production of minerals like Coal, Manganese ore, Limestone etc. were reported from Telangana. The value of minor minerals' production was estimated at Rs. 10728 crore for the year 2021-22. The number of reporting mines was 39 in 2021-22 in case of MCDR minerals. (Table-4).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the important mineral based industries in the organised sector in the State are given in Table - 5.

Table –3 : Details of Exploration Activities in Tamil Nadu, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Basemetals							
Nalgonda	Pedda Adisarlapalli block	1:12500	125	3	-	149	A total 125 sq. km area was mapped on 1:12,500 scale with collection of BRS (75), soil (23) Pitting/trenching (51) samples. Multiple fracture/shear zones are present in the area. Quartz veins and pegmatites are emplaced along theses shear zones within granite of PGC-II. The surface indication of mineralisation in the form of malachite staining and dissemination of sulphide minerals within quartz vein, pegmatite and associated granites. The major sulphide minerals are chalcopyrite, pyrite, galena with minor amount of azurites besides sporadic occurrence of allanite and fluorite are observed in quartz-feldspathic vein and calcite vein. The analytical results of BRS, PT and soil samples does not show any significant mineralisation in the area.
REE							
Mancherial	Jaipuram area	1:12500	100	-	-	-	The Jaipuram area is a part of the NW-SE trending Pranhita-Godavari (PG) Basin, located in the Godavari Basin, and hosting arenaceous sediments of Kamthi Formation of Lower Gondwana Group. The REE search included LSM (1:12500) in 100 sq.km area and, collection of different sample media. The dominant lithounits of the Jaipuram area are feldspathic sandstone (Middle Kamthi Fm) and ferruginous sandstone belongs (Upper Kamthi Fm) and have gradational contact. Multiple deformation episodes viz., NNW-SSE, ENE-WNW and WNW-ESE observed in the area, which exhibited by joints and faults and, controls distribution of outcrops, shifting of rock, repetition of beds and, development of steps like cliff sections and erosional landforms. The REE mineralisation found as REE bearing minerals associated with heavy minerals. Ilmenite, magnetite, monazite and zircon are the major heavies. The heavies are concentrated as thin laminations in pockets/patches within stream course. The visible high concentration of heavy minerals observed to be associated with Fe-soil areas, which dominantly developed from weathering of ferruginous sandstone. The available chemical analyses indicated that, in all media, Ti is the dominant element followed by Zr and TREE. The heavy minerals samples have 1.18-8.3% TREE (avg. 3.47%), 3.3-27.35% Ti (avg. 11.17%), 0.99-13.64% Zr (avg. 4.22%) and 0.18-1.16% Th (avg. 0.51%), especially in +85mesh size fraction. In bedrock samples, feldspathic sandstone contains average 0.05% TREE, 1% Ti and, 0.09% Zr, while the Fe-laminated feldspathic sandstone shown average values of 0.05% TREE, 0.66% Ti and, 0.06% Zr. The average 0.05% TREE, 0.75% Ti and 0.1% Zr are observed in ferruginous sandstone, which are comparable with analytical values of soil samples (wt. avg. 0.04% TREE, 0.9% Ti and, 0.2% Zr). Based on geological and geochemical parameters, two potential Fe-soil zones are identified namely Zone-1 and Zone-2.
Bhadradri-Kothagudem	Kamala puram-Jagannadha puram area	1:12500	135	-	-	-	G4-stage REE investigation item was carried out in an area of about 135 sq.km. The area forms part of the Chintalapudi sub-basin, southeast extension of Pranhita – Godavari Gondwana main basin and is situated northeastern side of Telangana state. Study reveals that ?REE value of HMS (heavy minerals) from stream sediment varies from 0.003 to 2.24 % with an average of 0.26% whereas SSS showing 0.248% to 3.118% with an average of 1.41%. On the other hand, ?REE value ranges between 126.88 and 3411.58 ppm (average 1214.0 ppm) in the heavy fraction separated from soil regolith sample

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							and whereas it varies between 318.84 and 2602.19 ppm with an average of 893.27 ppm in clay fraction. However, it ranges between 126.88 and 13249.96 (average 2102.91 ppm) in soil regolith (raw). The ?REE values of BRS sample vary between 105.79 and 10216.57 ppm with an average of 787.07 ppm as well. In all the cases, ?LREE dominates over ?HREE. Study also reveals that Monazite is the main contributing mineral phase for high REE incidence. The analytical results signify that the REE bearing mineral phase is present in all the three mediums (bedrock, soil regolith and stream sediment) but the level of concentration varies significantly. The high values of REE in the stream sediments (HMS) are recorded in the peripheral zone particularly towards the south-eastern and southern part of the block.

Table – 4: Mineral Production in Telangana, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**36**		**149069086**	**36**		**177329636**	**39**		**112966932**
Coal	'000t	-	65703	-	-	52603	-	-	67233	-
Manganese Ore	t	5	7770	51196	6	11097	67713	8	10435	62701
Limestone	'000t	31	26161	5249950	30	24493	4904676	31	28502	5620487
Minor Minerals		-	-	143767940	-	-	172357247	-	-	107283744

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Aluminium Foil	
Hindalco, Kollur, Medak	4
Asbestos Products	
Bhagyanagar Wood Plast Ltd,	60
Nandikandi, Distt. Medak	
Hyderabad Industries Ltd, Sanathnagar,	160
Distt. Rangareddy	
Hyderabad Industries Ltd, Thimmapur	230
J.J. Spun Pipe Industries, Arsapalli, Distt. Nizamabad	4.5
Visaka Industries Ltd, Medak	36
Bleaching Clay	
Ashapura Clay Tech. Ltd,	20 (Fuller's earth granules)
Dharur, Distt. Rangareddy	15 (Bentonite granules)
Cement	
Anjani Portland Cements Ltd (Subs. of Chettinad	1200
Cement), Anjanipuram, Distt.. Nalgonda	
CCI Ltd, Tandur, Distt. Rangareddy	1000
Bheema Cement Nalgonda	900
Greygold Cement Nalgonda	90
Deccan Cements Ltd, Bhavanipuram,	2300
Distt. Nalgonda	
India Cement Ltd, Malkapur Distt. Rangareddy	2400
India Cement (Raasi Cements), Vishnupuram	3500
Distt. Nalgonda	
Keerthi Industries Ltd, Mellacheruvu,	590
Distt. Nalgonda	
Kesoram Cement, Basantnagar, Distt. Karimnagar	6000

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Mancherial Cement Co. (P) Ltd, Mancherial, Distt. Adilabad	330
My Home Cement Industries Ltd, Mellacheruruvu, Distt. Nalgonda	3300
NCL Industries Ltd, Simhapuri, DisttSuryapet	2000
Orient Cement, Devapur, Distt. Adilabad	3000
Penna Cement Industries Ltd, Tandur, Distt. Rangareddy	2000
Penna Cement Industries Ltd, Ganeshpahad, Distt. Nalgonda	1200
Rain Commodities Ltd (Rain Cements), Ramapuram, Distt. Nalgonda	4000
Sagar Cements Ltd, Mattampally, Distt. Nalgonda	2650
Sri Lalita Cement, Mattampally, Distt. Nalgonda	1000
Zuari Cements Ltd (Sri Vishnu Cements Works), Dondapadu, Sitapuram, Distt. Nalgonda	1200
Ceramic/Sanitaryware	
Hindustan Sanitaryware & Industries Ltd, Bibinagar, Distt. Nalgonda	1.8
Montana International Ltd, Faralwadi, Distt. Medak	3.6
Restile Ceramics Ltd, Malkapur. Distt. Medak	1.4 (mill. sq m)
Fertilizer	
Chemtech Fertilizers Ltd, Kazipalli, Medak	33 (SSP)
Sponge Iron	
Ashirwad Steels & Ind. Ltd, Veliminedu, Distt. Nalgonda	60
Anand Metallics & Power Pvt. Ltd, Kodi Cherla, Distt. Mahabubnagar	24
Binjusaria Sponge & Power Pvt. Ltd, Farooq Nagar, Distt. Mahabubnagar	30
Lakshmi Gayatri Iron & Steel, Kethepally Distt. Nalgonda	60
NMDC (Sponge Iron Division), Paloncha, Khammam.	60
Reactive Metals of India Ltd, Appajipally Distt. Mahabubnagar.	36.5
Sunder Steels Ltd, S.D. Road, Secunderabad.	36
Ferro-alloys	
Nav Bharat Ferro Ventures Ltd, Paloncha, Distt. Khammam.	125
Shree Raghvendra Ferro alloys Pvt Ltd, Nalgonda.	15
VBC Ferro Alloys Ltd, Rudraram, Distt. Medak.	48 (silico-manganese) 32.4 (ferro manganese)
Refractory	
MPR Refractories Ltd, Medak.	9.5
Raasi Refractories, Narketapally, Distt. Nalgonda.	35

Note: Data, not readily available for fertilizer and cement Industries on respective websites. Therefore, data sourced from FAI Statistics and Survey of Cement Industry & Directory, respectively.

Tripura

Natural gas (utilised) was the only important mineral item produced in Tripura during 2020-21

XXXX
Lakh, value of minor minerals' production was estimated for the year

Mineral Resources

Natural gas is the most important mineral resource in Tripura located in the Assam Arakan Fold Belt (AAFB) basin. Other minerals of significance found to occur in the State are glass sands, limestone, fireclay, plastic clay, shale and quartz-silica sand used particularly for building/ construction purposes (Table-1).

Exploration & Development

No exploration work was reported by any Central/State agencies during the year 2021-22.

Production

Natural gas (utilised) was important mineral item produced in Tripura during 2021-22. The value of minor minerals' production was estimated at Rs. 431 lakh for the year 2021-22. (Table-2).

Mineral-based Industry

A 3,000 tpy lime-pozzolana mixture factory has been in operation at Kumarghat in North Tripura district. A 150 tpy glazed pottery unit of Tripura Khadi and Village Industrial Board is also in operation at Anandnagar in Tripura (West) district. M/S DP Group has set up a cold Steel Rolling Pla nt a t Bodhjungna gar Industrial Complex. The State Government is actively wo oing Private Sector investment for establishment of gas-based industries. Besides, Private Sector's involvement in setting up of Ceramic tiles units and other mineral- based industries are also being actively pursued. Private participation in setting up plastic clay and glass sand industries too, is under consideration by the State Government.

Table – 1: Reserves/Resources of Minerals as on 1.4.2015: Tripura

Mineral	Unit	Reserves	Remaining resources				Total Resources (A+B)
		Total	Measured	Indicated	Inferred	Total	
		(A)	STD331	STD332	STD333	(B)	
Fireclay#	'000 tonnes	-	1	369	370	370	
Quartz-silica sand#	'000 tonnes	-	225	264	490	490	

Table –2 : Mineral Production in Tripura, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**-**		**50577**	**-**		**46688**	**-**		**43089**
Natural Gas (ut.)	m c m	-	1473	-	-	1634	-	-	1531	-
Petroleum (crude)	'000t	-	-	-	-	-	-	-	3	
Minor Minerals		-	-	50577	-	-	46688	-	-	43089

$ Excludes the value of Fuel minerals.

Union Territories

No mineral production (except minor minerals) was reported from Andaman & Nicobar Islands during 2020-21

XXXX
Crore, value of minor minerals production were estimated for the year

ANDAMAN & NICOBAR ISLANDS

No mine r al p r o duc t ion (excep t mino r minerals) was reported from Andaman & Nicobar Islands during 2021-22. The value of minor mineral's production was estimated at crore for the year 2021-22.

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. The principal mineral-based industries in the Organised Sector in Andaman & Nicobar Islands are furnished in Table - 1 .

Table-1 : Principal Mineral-based Industries at Andaman & Nicobar Islands

Industry/plant	Capacity ('000 tpy)
Cement	
India Cement Ltd Andaman & Nicobar Islands	1650
Sponge Iron	
Gallantt Metal Limited Andaman & Nicobar Islands	225

CHANDIGARH

No production of major or minor mineral was reported from Chandigarh during 2021-22.

DADRA & NAGAR HAVELI

No production of major or minor mineral was reported from Dadra & Nagar Haveli during 2021-22.

The present status of each Mineral-based Industry is not readily available. However, princip al mine ral- b ase d ind ustries in the Organised Sector located in Dadra & Nagar Haveli are furnished in Table - 1.

Table – 1 : Principal Mineral-based Industries in Dadra & Nagar Haveli

Industry/plant	Capacity ('000 tpy)
Aluminium	
Hindalco Industries Ltd, Silvasa	30 (Al foil)
Asbestos Products	
Ramco Industries Ltd, Golanda, Silvasa	NA
Copper	
Sterlite Industries (India) Ltd,	180 (copper cathode)
Chinchpada, Silvasa	150 (CC copper rod)
Alloy	
Hindustan Alloys Mfg. Co Ltd, (HAMCO), Silvasa	3 (tin ingot)
	38 (Al alloy ingot)
	2.8 (Sn-Pb solder wire)

DAMAN & DIU

No production of major or minor mineral was reported from Daman & Diu during 2021-22. Reserves/ Resources of mineral as on 1.04.2020 are furnished in Table-2

Table – 2 : Reserve/Resource of Mineral as on 1.4.2020 : Daman & Diu

Mineral	Unit	Reserves	Remaining resources				Total Resources (A+B)
		Total	Measured	Indicated	Inferred	Total	
		(A)	STD331	STD332	STD333	(B)	
Limestone	'000 tonnes	-	-	-	128670	128670	128670

Figures rounded off

LAKSHADWEEP

No production of major or minor mineral was reported from Lakshadweep during 2021-22.

PUDUCHERRY

No production of major or minor mineral was reported from Puducherry during 2021-22. Reserves/ Resources of mineral as on 01.04.2020 are furnished in Table-3. Reserves/ Resources of lignite as on 01.04.2021 are furnished in Table-4.

Table – 3 : Reserves/Resources of Minerals as on 1.4.2020: Puducherry

Mineral	Unit	Reserves	Remaining resources				Total Resources (A+B)
		Total	Measured	Indicated	Inferred	Total	
		(A)	STD331	STD332	STD333	(B)	
Limestone	'000 tonnes	-	4433	4333	6966	15732	15732

Figures rounded off

Table – 4 : Reserves/Resources of Lignite as on 1.4.2023: Puducherry

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total/ Bahur & West of Bahur of Neyveli Lignite Field	–	405.61	11	416.61

Source: Coal Directory of India, 2022-23.

The present status of each Mineral-based Industry is not readily available. However principal mineral-based industries in the Organised Sector located in Puducherry are furnished in Table-5.

Table – 5 : Principal Mineral-based Industries in Pudducherry

Industry/plant	Capacity ('000 tpy)
Ceramics	
Regency Ceramics Ltd, Yanam.	150
H&R Johnson (India) Ltd, Karaikal.	24.2
Ferroalloys	
The Silcal Metallurgic Ltd.	12.4
VSK Ferro Alloys Ltd, Tuthipet.	3
Snam Alloys Pvt. Ltd, Kariamanikam.	12
Iron & Steel	
Sumangala Steel (P) Ltd.	NA
Glass	
Hindustan National Glass & Industries Ltd, Puducherry.	350 TPD

Uttar Pradesh

Coal, Limestone and Sulphur were the mineral items produced in Uttar Pradesh during 2021-22

XXX
Value of minor minerals' production were estimated for the year 2021-22

000
Mines in Uttar Pradesh in case of MCDR Minerals reported production in2021-22

Mineral Resources

The State is the principal holder of country'sandalusite & diaspore resources and possesses 78% andalusite, 37% diaspore, 17% sillimanite and 10% pyrophyllite. Important minerals occurring in the State are: coal in Singrauli coalfields, Sonbhadra district; and diaspore & pyrophyllite in Hamirpur, Jhansi, Lalitpur and Mahoba districts. Naini area of Allahabad district has good resources of high quality silica sand, an important source of glass sand, that contains 98% SiO2 and a very low Fe2O3. It is found at Shankargarh and Lohargarh in Allahabad district and also Bargarh in Banda district. Silica sand is also found in Aligarh and Chitrakoot districts.

Other minerals that occur in the State are andalusite & calcite in Mirzapur district; bauxite in Banda, Varanasi & Lalitpur districts; china clay & dolomite in Banda and Sonbhadra districts; felspar in Jhansi district; fireclay, limestone, potash & sillimanite in Sonbhadra district; ochre in Banda district; granite in Banda, Hamirpur, Lalitpur & Mahoba districts; iron ore (haematite) and rock phosphate in Lalitpur district (Table -1). The reserves/resources of coal along with details of coalfield are provided in Table-2.

Exploration & Development

During 2021-22 the details of exploration carried out by GSI in the State are furnished in Table-3.

Production

Coal, Limestone and Sulphur were the ineral tems produced in Uttar Pradesh during 2021-22.

The value of minor minerals' production was estimated at 5,614 crore for the year 2021-22.

The number of reporting mines in Uttar Pradesh was 2 in 2021-22 in case of MCDR miner-

als (Table-4).

Mineral-based Industry

The present status of each mineral-based industry is not readily available. However, the impo r ta nt mine ral- b ase d ind ustries in t he Organised Sector in the State are furnished in Table - 5.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020: Uttar Pradesh

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Andalusite	'000 tonnes	-	-	-	-	-	-	-	-	58040	56210	-	114250	114250
Bauxite	'000 tonnes	-	-	-	-	-	-	-	10390	500	8018	-	18908	18908
Gold														
Ore (Primary)	Tonne	-	-	-	-	-	-	-	-	-	-	13000000	13000000	13000000
Metal (Primary)	'000 cu. m	-	-	-	-	-	-	-	-	-	-	2.08	2.08	2.08
Iron ore (Haematite)	'000 tonnes	-	-	-	-	-	20000	-	-	-	66330	-	86330	86330
Limestone	'000 tonnes	3720	-	-	3720	-	111910	101510	142763	40000	43540	-	439723	443443
Potash	million tonnes	-	-	-	-	-	-	-	-	10	198	685	893	893
Platinum Group of	tonne	-	-	-	-	-	-	-	-	3.35	-	-	3.35	3.35
Rare Earth-Elements	'000 tonnes	-	-	-	-	-	-	-	-	-	-	2948	2948	2948
Rock Phosphate	tonne	-	-	-	-	-	432898	3118586	-	740000	21481960	-	25773444	25773444
Sillimanite	tonne	-	-	-	-	-	-	-	2100000	9350000	-	-	11450000	11450000

Figures rounded off.

Table –2 : Reserves/Resources of Coal as on 1.4.2023 : Uttar Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total/Singrauli	884	178	–	1062

Source: Coal Directory of India, 2022-23.

Table –3 : Details of Exploration Activities in Uttar Pradesh, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI							
Gold							
Sonbhadra	Hasra - Raigarh - Kurkuti area	1:12500	105	-	-	100	An area of 105 sq. km has been mapped on 1:12500 scale in Hasra -Raigarh-Kurkuti area. The mapped area was seen covered by rocks of Parsoi Formation and Agori Formation of Mahakoshal Group. The study area has been thoroughly sampled to assess the potential zones for gold and associated base metal mineralisation. Au values above 0.05 ppm obtained in seven bedrock samples varied from 0.05 to 0.21 ppm. Cu varied from 5 ppm to 67 ppm with an average of 26.3 ppm, Pb varied from 20 ppm to 206 ppm with an average of 63.60 ppm, Zn varied from 5 ppm to 124 ppm with an average of 89.5 ppm. Co varied from 11 ppm to 39 ppm with an average of 29.7 ppm. Au concentration in 50 channel and 50 trench samples obtained values below 0.05 ppm.
Diamond							
Lalitpur	Barayatha block	-	-	-	-	-	The investigated area falls in the Toposheet number 54L/15. Geologically, the Barayatha block comprises Bundelkhand Granite Massif in the northern part whereas the southern part was occupied by Bijawar, Vindhyan, and Deccan Trap. An integrated litho-structural lineament map was prepared by the processing of various data sets including ASTER images, ETM, LISS-III, RSAS data, NGLM data, aero geophysical and ground geophysical maps, and also topographic/tonal differences defined by linearity from Google images. During the fieldwork, delineated PGRS lineaments in the map were checked in-ground as structural lineaments, intersections that seemed favorable for the emplacement of kimberlite/lamproite. Besides field traverses, systematic stream sediment sampling was carried out with the help of a drainage map. Sample processing was done for recovering heavy mineral concentrate (HMC) which were examined for kimberlite indicator minerals under the stereo-microscope. During field traverses a few ultramafic rock units were been identified. Based on petrographic study two dykes were confirmed as hornblendite. Soil sampling was also carried out on the yellow and green-toned soil around Barayatha, Mandawra, Hanumatgarh, Lahar and other areas for getting KIMs as well as to know their affinity towards kimberlite/lamproite. At present, most of the lab results are awaited
Molybdenum							
Banda	patauda	-	-	-	-	-	The main stratigraphy units of the study area are Bundelkhand Granitoid Complex (BGC), Vindhyan Supergroup and Banda Alluvium. The area comprised wide extent of rocks i.e. older supracrustals and metamorphics, gneiss, migmatites, granitoids, rhyolite, mafic dykes, quartz reefs which are mainly part of BGC and different sedimentary rocks of Semri and Kaimur Group of Vindhyan Supergroup which represents both carbonaceous and arenaceous lithounits. Occurrences of molybdenite as specks were observed mainly within the quartz and quartzo-feldspathic veins near Korari, Gonda, Gonda ka Pahar, Karin Pathar ka Pahar area which were exposed mainly at the rock quarry. At places molybdenite was associated with other sulphides i.e. pyrite, chalcopyrite which were been confirmed during ore microscopy study. The quartz veins were mainly ENE-WSW to E-W trending. These quartz veins were seen intruded in the migmatite. Sulphide mineralisation in the form of pyrite, chalcopyrite and few a bornite specks were observed along the E-W to NE-SW trending slip plane which are parallel to the joint sets. As per the received analytical results, in seven samples including BRS, pit sample, Cu value ranged from 550 ppm to 1,140 ppm. The occurrences of all the sulphides present in the study area were exposed at or near the surface. These were mostly observed at an average depth of 15-20 m from the surface and mostly observed in the quarry sections. The sulphide minerals mainly occurred as disseminated forms. Three bands of banded iron formation (BHQ) were observed near south of village Nardaha having 100m length and 0.5m width with total Fe content analysed up to 37%.

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Tin							
Mahoba	Bilkhi and Bara areas	1:12500	100	-	-	104	A G4 stage investigation involving large scale mapping of 100 sq. km on 1:12500 scale was carried out along with collection of 54 bedrock samples and 50 trench samples. Night survey with the help of UV lamp was carried out in Gopalpur, Bilkhi, Murani and Bara areas. Bright fluorescent green minerals which may be REE phase/radioactive minerals and Powellite (Ca (MoO4)) in pegmatite veins with bluish white fluorescence were observed. Molybdenite (MoS2) and sulphide phases do not show any fluorescence. In BRS samples, the Cu value ranged from <5 ppm to 2,084 ppm (maximum in quartz vein intruded in medium-grained granite). Mn values ranged from 13ppm to 1,326 ppm and Pb values ranges from <20 ppm to 1,320 ppm (maximum in quartz reef of Bilrahi RF). Chemical results for Zn, Sn, Mo and W have not shown any encouraging values. Only one BRS sample showed 247.41 ppm Mo. Out of 50 trench samples, chemical results for base metal viz. Cu value ranged from <5 ppm to 2,478 ppm, Pb value ranged from <20 ppm to 129 ppm and Zn value ranged from 17 ppm to 109 ppm. In Trench-1 from Medium grained K- feldspar granite Mn of 1132 ppm was obtained. four samples from Trench-3 excavated in Tola Shyam quartz reef showed Cu values as 1,194, 1,316, 2,478 and 2,472 ppm respectively. Analytical results for Sn, W and Mo values were not very encouraging.

Table – 4: Mineral Production in Uttar Pradesh, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals		**2**		**57073325**	**2**		**57036657**	**2**		**56816008**
Coal	'000t	-	18030	-	-	17016	-	-	18073	-
Limestone	'000t	2	2804	932764	2	2574	896096	2	2809	675447
Sulphur #	t	-	47955	-	-	54234	-	-	60307	-
Minor Minerals @		-	-	56140561	-	-	56140561	-	-	56140561

Note: The number of mines excludes Fuel and Minor minerals.

$ Excluding the value of Fuel minerals.

Table – 5 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Abrasives	
John Oakey and Mohan Ltd, Ghaziabad	NA
Micro Lapping Abrasive, Near Munni Devi Temple, Seohra, Dhampur	0.08 (Abrasive powder)
Aluminium	
Hindalco Industries Ltd, Renukoot	700 (alumina)
	345 (aluminium)
Asbestos Product	
Asbestos Cement Ltd, Raibareli	NA
Uttar Pradesh Asbestos Product Ltd, Mohanlalganj, Lucknow	NA
Cement	
ACC Ltd, Tikaria, Distt Sultanpur (G)	3000
Ambuja Cement, Dadri, Gautam Budh Nagar (G)	1800
Raebareli Cement Works, Birla Corporation (G)	1300
Heidelberg Cement (Diamond Cement), Madora Jhansi (G)	2700

Table- 5 (Concld.)

Industry/plant	Capacity ('000 tpy)
Jaypee Cement, Sadvakhurd (Blending Unit)	600
Kanodia Cement, Bulandsahar	330
Shree Cement, Sikandarabad (G), Bulandsahar	2000
The KCP Ltd., Dalla Cement Factory, Dalla Distt Sonebhadra	500
Jaypee Cement, Chunar Cement Factory, Chunar, Distt Mirzapur (G)	2500
Jaypee Cement, Tanda, Ayodhya, Distt Faizabad (G)	1000
Jaypee Cement, Churk Mirzapur (G)	1500
Birla Corp. Ltd.(Erstwhile Reliance Cement,) Kundanganj, Distt Raebareli	2000
UltraTech Cement, Dadri (G)	1300
UltraTech Cement, Aligarh (G)	1300
UltraTech Cement Ltd. Ayodhya, Ambekar Nagar	1000
UltraTech Cement Ltd. Bara , Allahabad	4000
UltraTech Cement Ltd. Dallakolta, Robertsonganj	500
Mangalam Cement, Aligarh (G)	750
Electrode	
Ankit Sangal, Sujroo, Muzaffernagar	0.85(electrode no 10)
	0.15(electrode no 8)
Fertilizer	
Asian Fertilizers Ltd, Deokahia, Gorakhpur	66 (SSP)
Coromandel International Ltd (Formerly Liberty Phosphate Ltd), Raebareli	132 (SSP)
Jubilant Agri and Consumer Products Ltd (Formerly Vam Organic Chemicsls Ltd), Bhartiagram, Gajraula	165 (SSP)
IFFCO, Phulpur (Unit I & II), Distt Allahabad	1697.8 (Urea)
IFFCO, Aonla (Unit I & II)	1999.8 (Urea)
Indo Gulf Fertilizer Ltd (a unit of Aditya Birla Nuva Ltd), Jagdishpur	1105.5 (Urea)
Kanpur Fertilizer & Cement, (formerly Duncan India Ltd), Kanpur	722 (Urea)
Khaitan Chemicals & Fertilizers Ltd, Goramachhia, Jhansi.	132 (SSP)
Khaitan Chemicals & Fertilizers Ltd, Malwan, Fatehpur.	115 (SSP)
KRIBHCO Shyam Fertilizer, Piprola Shahajahanpur.	864.6 (Urea)
Madan Madhav Fertilizers & Chems Pvt. Ltd, Fetehgarh.	24 (SSP)
Natraj Organics Ltd, Muzaffarnagar.	60 (SSP)
Tata Chemicals Ltd, Babrala, Distt Badaun.	1155 (Urea)
V. K. Phosphates Ltd, Bartara , Shahjahanpur	33 (SSP)
Natraj Organics Ltd, Muzaffarnagar.	60 (SSP)
Tata Chemicals Ltd, Babrala, Distt Badaun.	1155 (Urea)
V. K. Phosphates Ltd, Bartara , Shahjahanpur	33 (SSP)
Ferroalloys	
Hindustan Ferro Alloys, Hamirpur.	3.2
The India Thermit Corpn. Ltd, Kanpur.	0.3
Iron & Steel	
Malvika Steel Ltd, Jagdishpur.	511 (pig iron)
	600 (saleable steel)
Sponge Iron	
RLJ Concast Pvt. Ltd, Baragaon Chunar	60
S. A. Iron & Alloy Pvt. Ltd. Jeewanthpur, Mughalsarai	90
Petroleum Refinery	
IOCL, Mathura.	8000

(G); Grinding Unit

Note: Data, not readily available for fertilizer and cement Industries on respective websites, is taken from Indian Fertilizer Scenario, FAI Statistics, and Survey of Cement Industry & Directory, respectively.

Uttarakhand

Magnesite was the only important mineral item produced in Uttarakhand during 2021-22

XXX
Crore, value of production of minor minerals was estimated for the yea 2021-22

000
Mines of magnesite in Uttarakhand were reported in 2021-22

Mineral Resources

Important minerals that are found to occur in the State are high-grade limestone in Almora, Bageshwar, Dehradun, Nainital, Pauri-Garhwal, Pithoragarh & Tehri-Garhwal districts; magnesite & steatite in Almora, Bageshwar, Chamoli & Pithoragarh districts; and tungsten in Almora district.

Other minerals that occur in the State are: asbestos in Chamoli district; barytes & marble in Dehradun district; copper in Almora, Dehradun & Pithoragarh districts; dolomite in Dehradun, Nainital & Tehri-Garhwal districts; graphite in Almora district; gypsum in Dehradun, Pauri-Garhwal & Tehri- Garhwal districts; lead-zinc & silver in Dehradun & Pithoragarh districts; and rock phosphate in Dehradun & Tehri-Garhwal districts (Table - 1).

Exploration & Development

GSI carried out exploration for Tungsten , Base metal, Rare metal, Tin and REE in the State of Uttarakhand during 2021 - 22 . Details of exploration are furnished in Table-2.

Production

Magnesite was the only important mineral produced in Uttarakhand during 2021-22. The value of production of minor minerals' was esti- mated at 173 crore for the year 2021-22. There was only one reporting mines in Uttarakhand and that of magnesite only. (Table-3).

Mineral-based Industry

The present status of each Mineral-based Industry is not readily available. However, the important medium and large-scale mineral-based industries in the Organised Sector in the State are furnished in Table - 4.

Table –1: Reserves/Resources of Minerals as on 1.4.2020: Uttarakhand

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Asbestos	tonne	-	-	-	-	-	-	-	-	311	-	-	311	
Copper														
Ore	'000 tonnes	-	-	-	-	-	-	-	3170	390	660	-	4220	
Metal	'000 tonnes	-	-	-	-	-	-	-	53.45	1.44	5.15	-	60.04	
Graphite	tonne	-	-	-		-	-	-	10700	-	-	-	10700	
Lead-Zinc														
Ore	'000 tonnes	-	-	-	-	-	-	-	3170	1790	660	-	5620	
Lead metal	'000 tonnes	-	-	-	-	-	-	-	138.85	34.25	9.5	-	182.6	
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	151.21	87.99	27.63	-	266.83	
Limestone	'000 tonnes	-	-	-	-	5035	91872	60429	29486	164879	1191059	33011	1575771	
Magnesite	'000 tonnes	8177	-	1782	9959	4056	602	33873	58902	58756	73287	-	229476	
Rock Phosphate	tonne	-	-	-	-	3063503	-	1734370	2760000	-	16620513	-	24178386	
Silver														
Ore	tonne	-	-	-	-	-	-	-	1600000	1400000	390000	-	3390000	
Metal	tonne	-	-	-	-	-	-	-	134	4.2	0.39	-	138.59	
Tungsten														
Ore	tonne	-	-	-	-	-	-	-	-	138000	-	520000	658000	
Contained WO3	tonne	-	-	-	-	-	-	-	-	25	-	680	705	

Figures rounded off.

Table –2 : Details of Exploration Activities in Uttarakhand, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Base Metal							
Pithoragarh	Askot-Thal area	1:12500	50	-	-	281	A total of 50 sq km area were mapped in large scale (1:12500) in parts of Survey of India Toposheet no 62C/01, 05 & 06 in and around Thal and Askot area of Pithoragarh district, Uttarakhand to assess the base metal and gold mineralisation potentiality of the study area. The area comprised the rocks of Paleoproterozoic Age belonging to Lesser Himalayan Crystalline and Mesoproterozoic Age of Garhwal Group of rocks. Lithounits included gneissic rocks of granitic composition and quartzite, amphibolites, phyllite, schist, impure dolomite and limestone of Berinag and Pithoragarh Formation. Geophysical studies (IP, Resistivity, SP survey and Magnetic survey) indicated carbonaceous phyllite and its contact with schist in the central east part of the block showed significant potential for mineralisation. Systematic bedrock and pitting-trenching sampling were carried out. A total of 150 bed rock samples (BRS), 50 pitting / trenching samples, 20 heavy mineral samples, 13 petrochemical samples, 38 petrographic samples and 10 ore microscopic samples were collected. Analytical results of Cu, Pb, Zn and Au varied from <5 to 597ppm, <20 to 198ppm, <5 to 711ppm & <0.05 to 1ppm respectively. The total 10-line km of surface induced potential (IP), self-potential (SP), resistivity and magnetic geophysical survey were carried out to identify areas of interest that stands out with the surficial mineral lisation evidence and chemical results. Signature of high chargeability and low resistivity with prominent low negative SP anomaly was recorded in western part of the mapped area.
Dehradun	Tons Valley	1:12500	50	-	-	173	A total of 50 sq km area were mapped in large scale (1:12500) in parts of Survey of India toposheet nos. 53F/13 and 14 in and around Tiuni and Chakrata area of Dehradun district, Uttarakhand to assess the potentiality of base metal and gold mineralisation. Geologically, the area comprises rocks of Lesser Himalaya of Mesoproterozoic Age. A total of 100 bedrock samples (including channel sample), 50 stream sediment samples were systematically collected to interpret the nature and extension of mineralisation. In addition, 20 petrographic samples, 3 ore microscopic samples were collected to identify lithologies, ore mineral present in the study area. The analytical value of Pb, Zn, Cu and Au of bedrock samples ranged from 20 ppm to 151 ppm, 5 ppm to 241 ppm, 2.5 ppm to 2,731 ppm and < 5 ppm respectively. Similarly, the analytical value of Pb, Zn, Cu and Au of stream sediment samples ranged from 20 ppm to 47 ppm, 28ppm to 192 ppm, 6 ppm to 123 ppm and <5 ppm respectively.
Pithoragarh	Nachani roadsection, Dhari road section	1:12500	-	-	-	-	Reconnaissance survey for polymetallic mineralisation in carbonaceous phyllite/ metamorphosed black shales and associated rocks along Nachani road section, Dhari road section, Askote road section and Pithoragarh road section, Pithoragarh district Uttarakhand (G4)¬ — A total of 115 L km traverse mapping were carried out on 1:12500 scale along four road sections — Nachani, Dhari, Pithoragarh and Askot of Pithoragarah district, Uttarakhand to delineate carbonaceous slate/phyllite and to look for potential mineral zone in carbonaceous slate/phyllite and associated rocks. The study area which is part of Lesser Himalaya, comprised lithounits, viz, Central Crystallines of Dharmagarh & Askot of undifferentiated Protereozoic Age, meta-sedimentaries of Rautgara Formation, Pithoragarh Formation and Berinag Formation of Garhwal Group of Proterozoic Age. Carbonaceous slate/phyllite was seen mainly associated with quartzite and phyllite and occurred within Pithoragarh Formation. Four prominent bands were delineated near Maspati, Bhunigaon, Pankholi and Ghatigad. Width of these bands varied from 30cm to 30m. A total of 121 samples for analytical studies, 34 samples for petrographic study, 08 samples for ore microscopy study, 32 samples for fixed carbon and sulphur content analysis, 10 samples for EPMA study and 04 samples for XRD study were collected. Total carbon content of 17 samples analysed varied from 0.54% to 6.38%. A few samples of carbonaceous phyllite

Table- 3 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							did show element concentration (Rb-158ppm, Sr-62.67 ppm, Th-16.97 ppm, U-5.35 ppm and Mo-5.06ppm).
REE & Rare Metals							
Uttarkashi	Gangotri Granite	1:12500	20	-	-	180	Mineral Investigation item (G-4 stage) was carried out to assess REE, Sn, W, Mo and Rare Metals mineralization, in and around Gangotri area, Uttarkashi district, Uttarakhand. The geological mapping of 20 sq. km area on 1:12500 scale and traverse mapping of 65 L. km on 1: 25000 scale was accomplished. A total of 110 bedrock samples, 30 stream sediment/slope wash samples and 40 XRD samples were collected. The Tethyan Sequence and Central Crystalline metasedimentary rocks constituted the Nelong and Gangotri region. In Block II, around Harshil, Dharali, and Jhala area, garnetiferous quartz mica schist, kyanite-sillimanite schist, graphite schist belonging to Central Crystalline were seen intruded by two mica granite, and dikes/sills of layered aplite-pegmatite/pegmatite. The Block-I in Nelong valley comprised low-grade metamorphic rocks of the Tethyan Sequence intruded by two mica granite. The presence of chlorite, epidote, magnetite and sulphides, as well as crustiform multiple injections of quartz veins, suggests hydrothermal activity and alteration. Bedrock samples from Block-I contained value of lead (Pb) from 10 ppm to 23%, Zinc (Zn) concentrations in these samples ranged from 10 ppm to 5,242 ppm. Copper (Cu) value varied from 2.5 ppm to 1,498 ppm and silver (Ag) concentration ranged from 2.5 ppm to 168 ppm
Tungsten, Tin and REE Mineralisation							
Bageshwar andPithor agarh	Chaukori area	1:12500	70	-	-	369	A total of 70 L km traverse mapping were carried out on 1:12500 scale to assess potentiality of W, Sn and REE mineralisation around Chaukori area, Bageshwar and Pithoragarh Districts of Uttarakhand in parts of toposheet nos 53O/13 and 62C/01. A total of 300 stream sediment samples (SSS), 30 bed rock samples (BRS), 24 petrological samples, 10 XRD samples and 05 EPMA samples were collected. The Study area grouped into two categories viz, Central Crystalline rocks (Dharamgarh Crystalline) of undifferentiated Protereozoic Age consisting of lithounits viz, amphibolite, granite/mylonite gneiss, foliated granite, leuco granite and Garhwal group of Meso Proterozoic Age of Rautaraga Formation consisting of slate, Pithoragarh Formation consisting of limestone/dolomitic limestone, carbonaceous slate/ phyllite and Berinag Formation consisting of quartzite, quartz chlorite schist and quartz chlorite mica schist. Out of 300 SSS, 190 REE, W and Sn values ranged from 44.40 ppm to 435.49 ppm, <0.51 ppm to 16.78 ppm and 1.03 ppm to 39.26 ppm respectively. About 11 BRS samples showed REE, W and Sn ranging from 68.92 ppm to 344.54 ppm, 0.62 ppm to 6.78 ppm and 2.83 ppm to 14.96 ppm respectively.

Table – 4: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Abrasives	
Tirupati Microns, Bhagwantpur, Kashipur, Udham Singh Nagar	0.15 (Abrasives Powder)
Cement	
The KCP Ltd, Distt Haridwar (G)	1100
Ambuja Cement, Roorkee, Distt Haridwar (G)	1000
Shree Cement, Roorkee, Distt Haridwar (G)	1800
Shree Cement, Laskar Grinding unit Akbarpur-OUD, Laskar	1800
DBM	
Almora Magnesite Ltd, Village-Matela Distt. Bageshwar	24 (DBM, calcined & semi calcined magnesite)
Minerals & Refractories. Haldwani Pithoragarh	3 (DBM)
Ramesh Chandra Binjola, Kumaon Refractories, Narsingh Talla, Haldwani	8 (DBM, calcined magnesite)
Glass	
Hindustan National Glass & Industries Ltd, Rishikesh	4395 TPD

G: Grinding Unit

West Bengal

During the year 2020-21 production of Coal, Natural Gas (ut.) and Sulphur was reported from West Bengal.

XXXX
Estimated value of production of minor minerals in 2021-22

Mineral Resources

West Bengal is the principal holder of country's apatite resources. It is said to possess 57% apatite and 14% china clay resources of the country. Important minerals that occur in the State are: apatite in Purulia district; coal in Bardhaman, Bankura, Birbhum, Darjeeling, Jalpaiguri & Purulia districts; china clay in 24-Parganas, Bankura, Birbhum, Bardhaman, Hoogly, Midnapur & Purulia districts; and fireclay in Bankura, Birbhum, Bardhaman & Purulia districts.

Other minerals that occur in the State are barytes, copper, gold, kyanite, pyrite & titanium minerals in Purulia district; dolomite in Jalpaiguri district; felspar in Bankura & Purulia districts; granite in Bankura, Birbhum & Purulia districts; lead- zinc in Darjeeling district; limestone in Bankura & Purulia districts; manganese ore & sillimanite in Midnapur district; quartz/silica sand in Bankura, Hoogly & Purulia districts; and tungsten & vermiculite in Bankura district (Table-1). Reserves/resources of coal and lignite along with details of coalfields/ districts are provided in Table-2 & Table -3.

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020: West Bengal

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD 111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	
Apatite	tonne	-	-	-	-	499149	-	-	120000	8845250	521175	666646	10652220	10652220
Copper														
Ore	'000 tonnes	-	-	-	-	-	-	-	-	113	-	-	113	113
Metal	'000 tonnes	-	-	-	-	-	-	-	-	2.09	-	-	2.09	2.09
Gold														
Ore (Primary)	tonne	-	-	-	-	-	-	-	-	-	-	12833333	12833333	12833333
Metal (Primary)	tonne	-	-	-	-	-	-	-	-	-	-	0.65	0.65	0.65
Kyanite	tonne	-	-	-	-	-	-	-	-	-	26520	-	26520	26520
Lead-Zinc					-									
Ore	'000 tonnes	-	-	-	-	-	-	-	-	3371	335	-	3706	3706
Lead metal	'000 tonnes	-	-	-	-	-	-	-	-	130.07	10	-	140.07	140.07
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	-	130.42	13	-	143.42	143.42
Limestone	'000 tonnes	-	-	-	-	-	-	-	7104	15482	22120	-	44706	44706
Manganese ore	'000 tonnes	-	-	-	-	-	-	-	-	-	200	-	200	200
Pyrite	'000 tonnes	-	-	-	-	-	-	-	-	-	2500	-	2500	2500
Sillimanite	tonne	-	-	-	-	-	-	-	-	-	1653000	-	1653000	1653000
Titanium	tonne	-	-	-	-	-	-	-	-	-	2279000	-	2279000	2279000
Tungsten														
Ore	tonne	-	-	-	-	-	-	173063	-	190739	400000	-	763802	763802
Contained WO3	tonne	-	-	-	-	-	-	450	-	80.84	1000	-	1530.84	1530.84
Vermiculite	tonne	-	-	-	-	-	-	-	-	490	5076	-	5566	5566

Figures rounded off.

Table – 2 : Reserves/Resources of Coal as on 1.4.2023: West Bengal

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	17459	12699	3775	33933
Raniganj	17041	6519	2859	26419
Barjora	201	–	–	201
Birbhum	218	6179	901	7298
Darjeeling	–	–	15	15

Source: Coal Directory of India, 2022-23

Table –3 : Reserves/Resources of Lignite as on 1.4.2023: West Bengal

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total	–	1.13	2.8	3.93
Bardhaman Rakshitpur, Gaurangapur-Bankati	–	0.29	1.82	2.11
Birbhum Mahalla, Dhobbanpur & Djara	–	0.84	0.98	1.82

Source: Coal Directory of India, 2022-23

Exploration & Development

Exploration activities were reported by GSI during the year 2021-22 and are provided in Table-4.

Table – 4 : Details of Exploration Activities in West Bengal, 2021-22

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Gold							
Purulia	Berasi-Hurrupat-	-	-	-	-	101	The study area is occupied by different varieties of acid volcanic rocks (namely acid tuff, tuffaceous phyllite etc.) along with different other lithologies like granite gneiss, mica schist, amphibolite, ferruginous cherty quartzite, cherty quartz reef, black shale, younger sheared granitic intrusive, gabbro/ultrmafic rock, and quartz veins. The southern part of the study area is dominantly occupied by acid tuff/tuffaceous phyllite with lenses of mica schist. Topographically high ridges of the area are mainly quartzite and cherty quartzite occurring in the northern and eastern part of the area. Quartzite is highly altered and intruded by quartz veins at places. North-western part of the study area is occupied by mica schist and further to the north by granite gneiss. Granite gneiss is intruded by numerous pegmatite and quartz-tourmaline veins. Occurrence of mica schist and granite gneiss in the northern part indicates higher grade of metamorphism towards north. Different dimension of map scale quartz veins and veinlets were observed intruding into country rocks. Goethitization, limonitization along with vug fillings, dissemination and specks of sulphides in quartz vein are the typical surface evidence of mineralization in the study area. Based on these observations a band of intensely brecciated ferruginized banded quartzite trending WNW-ESE observed near Matkangara and cherty quartz reef with multiple phases of silicification near Suraidih are considered to be potential. In terms of Au mineralization, visible gold grains have been observed in pan concentrate of stream sediment samples near Jugilang, Muru and in the slopes of cherty quartz reef. Out of 101 BRS, six samples show positive anomalous values ranging 60 ppb to 300 ppb. Two samples show anomalous value of 180ppb and 300ppb in cherty quartz reef extending from Suraidih to Sindurpur. 03nos. of native gold grains are observed in the cherty variant in EPMA studies. Au value in the order of 250-300 ppb was also obtained in trace elementanalyses of pyrites from the cherty quartz reef. Around 230ppb gold has also been noted withingalena structure during EPMA studies inMatkangara area. Gold thus occurs in twodifferent forms, as native gold (nuggets) and asnano size refractory gold (invisible gold). Instream sediment sample, gold values upto

Table- 4 (Concld.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping Drilling		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
							310ppb is noted. In ferruginized cherty quartzite nearMatkangara Cu upto 730 ppm, Pb upto 5.45%, Znupto 2552 ppm is recorded. Based on analyticalresults as well as field mineralization evidences,two potential mineralized blocks have been identified.
REE and RM							
Purulia	Chhotan agpur Gneissic Complex (CGC) and Nawadih-Uparbarga-Brajapur area	-	-	-	-	-	The study area forms the part of the Chhotanagpur Granite Gneissic Complex, exposing migmatitic gneisses, biotite granite gneiss, hornblende biotite granite gneiss, porphyry biotite granite gneiss/Augen gneiss with undigested enclaves of metapelites such as quartz mica (muscovite) schist, garnetiferous quartz muscovite schist (graphitic) and, garnetiferous sericite quartz muscovite schist and metapsammites of quartzite and calc-silicate/crystalline limestone, dissected by later mafic-felsic intrusives such as amphibolite, pegmatite, quartzo-feldspathic veins, and gabbro. Several linear outcrops of pegmatites (a few meters to several km in length and a few cms to ~ 150 m in width) are identified. The surface manifestation of mineralization in pegmatite is indicated by different features like the presence of radioactive halos, localization of fine-grained dark minerals, presence of RM or REE mineral phases, and sometimes rare ferruginization. Although the rock is mostly constituted of muscovite, in many portions, it contains well-developed brownish-black (zinnwaldite?) and greenish-colored mica books along with prominent rounded to sub-rounded, deep red to brownish red mineral phases. Occasionally, it contains brownish-black colored, non-magnetic mineral phases which are suspected as columbite-tantalite. The XRD study of one pegmatite sample with reddish-brown mineral phases reported the occurrence of ferro-columbite in a trace amount. Hence, the presence of these mineral phases possibly points to the fertile nature of the pegmatites. Out of various pegmatite bodies demarcated, the pegmatite bodies north of Sondimra-Ulladaka-Sargadih-west of Ambadih and north of Digardih area is found to be the prominent one reaching several km (~5 km) in length and ~ 150 m in width and it very closely falls in the strike extension of pegmatites of Belamu Pahar, West Bengal.
Darjeeling	Senada & Panchang area	1:12500	50	-	-	177	An area of 50 sq. km. on 1:12,500 scale has been mapped and 102 nos. BRS, 50 nos. PTS, 10 nos. PCS and 15 nos of PS samples have been collected. The study area is covered pre-dominantly by Darjeeling Gneiss which comprises of banded migmatite gneiss and garnet biotite gneiss. Regional trend observed in Darjeeling gneiss is NE-SW with two major joint sets (NE-SW and E-W). Chungthang Formation comprising of garnet mica schist (± staurolite) and muscovite biotite schist and Daling Group represented by Chl-sericite schist with quartzite bands are exposed in the eastern part. Evidences for three phases of deformation observed during the course of field work. Gneissic foliation (S1) marks D1 and tight folds of gneissic foliation and migmatite bands represents D2. While the presence of open folds and broad warping of gneissic foliation represents D3. REE bearing mineral phases like allanite, zircon, apatite, sphene, tourmaline and monazite with pleochroic halos are identified from Darjeeling gneiss and garnet mica schist during thin section studies. Sulphides i.e. pyrite and chalcopyrite observed in thin section slides of Darjeeling Gneiss. Chemical analysis results received till date show that 17 BRS samples over garnetiferous biotite gneiss of Darjeeling Gneiss have average TREE concentration with range from 329.14ppm - 827.01ppm with an average of TREE- 578.39ppm; HREE-33.88ppm and LREE- 544.51ppm. Four PCS samples (received till date) show TREE concentration ranging from 473.25ppm - 652.39ppm. The samples show LREE enrichment in comparison to HREE.

Production

During the year 2021-22 production of Coal, Natural Gas (ut.) and Sulphur was reported from West Bengal.

The value of minor minerals' production was estimated at Rs. 5776 crore for the year 2021-22. Table -5

Mineral-based Industry

The present status of each mineral-based industry i s not readily available. However, important mineral-based industries located in the State with their total installed capacities are furnished in Table - 6.

Table – 5 : Mineral Production in West Bengal, 2019-20 to 2021-22

(Excluding Atomic Minerals)

(Value in ₹ '000)

Mineral	Unit	2019-20			2020-21			2021-22 (P)		
		No. of mines	Quantity	Value$	No. of mines	Quantity	Value$	No. of mines	Quantity	Value$
All Minerals				**21391866**	**-**		**18310969**	**-**		**57763181**
Coal	'000t	'000t	33614	-	-	34596	-	-	29069	-
Natural Gas (ut.) +	m c	m c m	306	-	-	307	-	-	389	-
Sulphur #	t	t	35566	-	-	56118	-	-	66170	-
Minor Minerals @			-	21391866	-	-	18310969	-	-	57763181

Note: The number of mines excludes fuel and minor minerals.

$ Excluding the value of Fuel minerals. + Coal Bed Methane

Table – 6 : Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Asbestos Products	
Everest Building Products Ltd, Kolkata	NA
Ramco Industries Ltd, Haratara, Distt Paschim Medinipur	NA
UAL Industries Ltd, Tungadhowa, Distt Paschim Medinipur	150
Abrasives	
Carborandum Universal Ltd, Gopalpur	NA
K.L.Thirani & Co. Ltd, Kolkata	NA
Satya Narayan Roller Floor Mill Pvt. Ltd, Chandur Tarkeshwar	MOG-303 0.35
	MOG-302 0.40
	MOG-M2 0.40
	MOG-220 0.20
	Fine-0.15
Cement	
ACC Ltd (Damodar Cement), Purulia (G)	750
Ambuja Cement Ltd, Sankrail, Distt Howrah (G)	2400
Ambuja Cement Ltd, Farakka, Distt Murshidabad (G)	1250
Birla Corporation Ltd (Durgapur Cement Works & Durga Hitech Cement), Durgapur (G)	2300
Burnpur Cement, Asansol, Distt Burdwan (G)	300
Century Textiles, Sonar Bangala Grinding Unit, Distt Murshidabad	1500
Emami Cement Ltd, Panagarh Burdwan	2000
Emami Cement Ltd, Kotagram, Ausgram-II	2000
JSW Cement, Salboni, P Medinipur	2400
Lafarge Cement Pvt. Ltd, Mejia (G)	1650
Maa Chandi Cement Bamunara Burdwan,	330
NUVOCO Vistas Corp. Ltd, Amdang, Bakura	1650
OCL India Ltd, , Bengal Work Mednapore	1350
Ramco Cement (formerly Madras Cement), Kolaghat, Distt Purba Medinipur (G)	950
Shristi Cement Mangalpur	360
Swasata Cement Ltd, Purulia	1500
Ultra-Tech Cement Works, Dhankuri Hoogly, West Bengal	1600

Table- 6 (Concld.)

Industry/plant	Capacity ('000 tpy)
Ultra-Tech Cement Ltd, WBCW (G) Burdwan	1400
Ceramics	
WBCDC Ltd, Kolkata	0.18
Chemical	
Hindustan Heavy Chemicals Ltd, Khardah, Distt 24-Parganas	14.8 (caustic soda)
	6 (Cl), 9.8 (HCl)
	4.5 (ferric alum)
	18.7 (H_2SO_4)
Alchrome Chemical	1.2(sodium bicarbonate)
Industries Kalyani, Kalyani Industrial Estate	0.6(sodium sulphate)
Electrodes	
GEE Ltd, Kandua	18
Graphite India Ltd, Kolkata	NA
Radix Arc Pvt. Ltd, Dangadighila	4
Shield Arc Equipment Pvt. Ltd, Raspunja	2.5
Fertilizer	
Tata Chemicals Ltd, Haldia	675 (DAP)
Tata Chemicals Ltd (Phosphatic Division), Haldia, Medinipur	160 (SSP)
Teesta Agro Industries Ltd, Rajganj, Jalpaiguri	165 (SSP)
Jay Shree Chemicals & Fertilizers, Khardah, 24 Parganas	132 (SSP)
	62.70 (H_2SO_4)
The Phosphate Company Ltd, Rishra, Hoogly	112.8 (SSP)
Sai Fertilizers Pvt. Ltd, Dewanmara, W. Medinipur	132 (SSP)
Flux	
Priyanka Tradelink Pvt. Ltd	0.6
Glass	
Hindustan National Glass & Industries Ltd, Rishra	680 TPD
Iron & Steel	
Durgapur Steel Plant, SAIL, Durgapur	3009 (sinter)
	2400 (pig iron)
	2200 (crude/liquid steel)
	13.0NH_4SO_4
IISCO Steel Plant, SAIL, Burnpur, Distt Bardhaman	2695(pig iron)
	2500 (crude/liquid steel)
	3800 (sinter)
Alloy Steel Plant, SAIL, Durgapur	234 (crude/liquid steel)
Rohit Ferrotech Ltd, Bishnupur	100 (stainless steel)
	71.4 (ferroalloys)
Rashmi Metaliks Ltd, Gokulpur, West Midnipore	1800 (pellets)
	580 (sinter)
Pig Iron	
Electrosteel Castings Ltd, Khardah	250
	365 (sinter)
Jai Balaji Industries Ltd, Banskopa Distt Bardhaman	428.7
	608 (sinter)
Kajaria Iron Castings Ltd, Durgapur.	110
	326 (sinter)
KIC Metallics Ltd, Raturia Angadpur, Durgapur	336 (sinter)
	165(pig iron)
Orissa Metallic Pvt. Ltd, Mathurakismat, Gokulpur	1370 (pellets)
	300 (pig iron)

Table- 6 (Concld.)

Industry/plant	Capacity ('000 tpy)
Shyamraipur Pachmi medinipur Unit -I & Dhekia & Chaksonadhar Pachmi Medinipur Unit II	329.72 (sponge Iron)
Rashmi Metallics Ltd, Shyamraipur, Gokulpur, Medinipur	600 (sinter)
	900 (pellets)
	180 (pig iron)
Tata Metaliks Ltd, Kharagpur.	345
	528 (sinter)
Tata Metaliks Ltd, Gokulpur, Maheshpur	600
Neo Metalliks Ltd, Gopalpur, Durgapur	300 (Sinter)
	187.9
Sponge Iron	
Adhunik Corporation Ltd, Angadpur, Durgapur.	72
Ankit Metal & Power Limited Jorehira Chhatna	210
	600 (pellet)
Aryavrata Steel Pvt. Ltd, Lohamelya Distt West Medinipur.	36
C. P Sponge Iron Pvt. Ltd, Raturia Angadpur, Industrial Area Durgapur	60
C. P. Ispat Pvt. Ltd, G.T. Road Bhirigee	60
Divya Jyoti Sponge Pvt. Ltd, Nandanpur	60
Electrosteel Castings Limited, Haldia	60
Howrah Gasses Ltd, Raniganj, Distt Bardhaman.	60
Jai Balaji Sponge Ltd, Raniganj, Mangalpur Distt Bardhaman. I	105
Jai Balaji Sponge Ltd, Banskopa Distt Bardhaman. IV	120
Kunj Bihari Steel Pvt. Ltd, Jamuria Nandi	30
M. B. Sponge & Power Limited, Hijalgola Jamuria	60
Maithan Steel & Power Ltd, Bora, Bonra	60
Rashmi Ispat (Pvt.) Ltd, Jhargram Distt W. Medinipur	150
Rashmi Cement Ltd, Jetusole Jhargram Distt W. Medinipur	492.7
	33 (Ferroalloys)
Ravindra Enterprise Pvt. Ltd, Digha, Purulia	30
Rishabh Sponge Ltd, Barjora, Bankura	90
SRS Sponge Pvt. Ltd, Dantia Balrampur	15
Satyam Iron & Steel co. Pvt. Ltd, Asansol	60
Sen Ferro-alloys Pvt. Ltd, Dejudi	15
Shyam Sel Ltd, Dewabdighi, Burdwan	100
Shyam Steel Industries Ltd, Anandpur, Durgappur	79
Sunil Sponge Iron Ltd, Kolkata	115
Ferroalloys	
Kartik Alloys Ltd, Durgapur	10.7
Bhaskar Shrachi Alloys Ltd, Durgapur	40
Corporate Ispat Alloys Ltd (Abhijit Group), Durgapur	74
Dimension Steel and Alloys Pvt. Ltd, Bakura	38
Gagan Ferro Tech. Ltd, Jamuria	138.6
Jai Balaji Industries Ltd, Durgapur (JBIL Group)	106
Jai Balaji Industries Ltd, Unit IV, Banskopa	76.5
Jai Balaji Industries Ltd, Mangalpur	30.1
Maithan Alloys Ltd, Kulti Bardhaman	94.6
Modern India Con-Cast Ltd, Bishnupur, Distt Bankura	75
Modern India Cone-Cost Ltd, Haldia	100
Nilkanth Ferro Ltd, Radhamadhavpur	39.9 (silico -manganese)
Rohit Ferro-Tech Ltd, Haldia	100.6
Shyam Ferro Alloys Ltd, Burdwan	100 (50 MVA)
Shyam Ferro Alloys Ltd, Durgapur	100 (50 MVA)

Table- 6 (Concld.)

Industry/plant	Capacity ('000 tpy)
Shri Vasavi Industries Ltd, Bishnupur, Distt Bankura	45
Srinivasa Ferro Alloys Ltd, Durgapur, Distt Bardhaman	84.2
Shri Goyatri Minerals Pvt. Ltd, Bishnupur, Distt Bankura	24
Refractory	
Alcoa-ACC Industrial Chemicals Ltd, Kalatalahat	10
Barakar Refractories (P) Ltd, Barakar, Distt Bardhaman	3.6
Kero Rajendra Monolithics Ltd, Banjora	NA
National Refractories Prop. Snowtex Udyog Ltd, Salanpur	43.2
Saswat International Ltd, Kulti, Distt Bardhaman	NA
Vesuvius India Ltd, Kolkata	96.5
Coke Oven Batteries	
IISCO Burnpur Works, Burnpur, Distt Bardhaman	1084
Petroleum Refinery	
IOCL, Haldia	7500
TiO2 Pigment	
Kolmak Chemicals Ltd, Kalyani, Distt Nadia	4.8

(G): Grinding units.

Note: Data, not readily available for fertilizer and cement Industries on respective websites, is taken from Indian Fertilizer Scenario, FAI Statistics, and Survey of Cement Industry & Directory.

INDIAN BUREAU OF MINES

www.ibm.gov.in