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VOLUME I
GENERAL REVIEWS



INDIAN BUREAU OF MINES

Government of India
Ministry of Mines
Indian Bureau of Mines

INDIAN MINERALS YEARBOOK 2021

VOLUME - I
GENERAL REVIEWS



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PREFACE

Indian Minerals Yearbook–2021 (IMYB–2021) is the 60th Edition in its series and comprises three Volumes. This book titled ‘General Reviews’ is the first Volume and it encompasses country-wide & macro-level information on minerals. Attempts have been made to comprehensively depict the Indian Mineral Industry and its contribution to the National Economy, along with concise portrayal of Policy & Legislation, Research & Development and Exploration & Development that have relevance to the year 2020-21. Besides, an extensive chapter on State Reviews that elaborately delves into the Mineral-wealth Status, Production and Industry of each of the States, forms a vital component of this Volume. Topics on Prices, Production, Foreign Trade, Mineral-Based Industries, Port Facilities and Status of Reconnaissance Permits, Prospecting Licences & Mining Leases also form part of the Reviews contained in the General Reviews.

It has been our continuous endeavour to improve upon the coverage and the content of the Yearbook and to present the entire spectrum of Minerals and Metals Sector to the maximum extent possible. Every update and nuances specific to Mineral Sector in terms of policy changes/guidelines issued/laws enacted and amendments made to them are carefully monitored and incorporated at the relevant chapters. The Hon’ble Supreme Court in its judgement directed the Union of India to revisit the National Mineral Policy, 2008 and announce a fresh and more effective and meaningful policy. Accordingly, a new and revised Policy took shape which after the Union Cabinet accorded approval assumed the appellation — the New National Mineral Policy, 2019. The New National Mineral Policy, 2019 has been introduced with an aim to ensure transparency, better regulation and enforcement, balanced social economic growth as well as sustainable mining practices. All information and data materials on the New National Mineral Policy, 2019, have been incorporated under the relevant topics. Besides, legislative changes for Mines and Minerals Sector effected to make the Sector growth oriented and vibrant have been assigned special focus.

Indian Minerals Yearbook is a flagship title of Indian Bureau of Mines and its publication & release is the outcome of collective & coordinated efforts of the Bureau’s Mineral Economics Division and Mining & Mineral Statistics Division. In preparation of the Edition, materials & inputs were resourced 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 inputs from related websites too were drawn and incorporated wherever necessary to impart a sense of holism to the information covered under this Title.

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 the present Edition of Indian Minerals Yearbook, i.e., IMYB–2021 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
December, 2023

(Sanjay Lohiya)
IAS
Additional Secretary &
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Indian Bureau of Mines

CONTENTS

Volume- I

GENERAL REVIEWS

		Page No.
* Explanatory Notes and Sources	(v-vi)
* Abbreviations/Units/Conversion Table	....	(vii-viii)
* UNFC System for Classification of Minerals	....	(ix-x)
1. Indian Mineral Industry and National Economy	....	1
2. Mineral Policy & Legislation	....	20
3. Status of Reconnaissance Permits, Prospecting Licences & Mining Leases in India	....	34
4. Exploration & Development	....	38
5. Research & Development	....	95
6. Port Facilities	....	112
7. Mineral-based Industries	....	129
8. Production	....	145
9. Prices	....	151
10. Foreign Trade	....	155
11. State Reviews	....	181

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
- b) Crude oil and natural gas

Coal Controller, Kolkata and the Coal Directory of India.

- 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 silvicate 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.

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

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

UNITS

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

Conversion Table

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

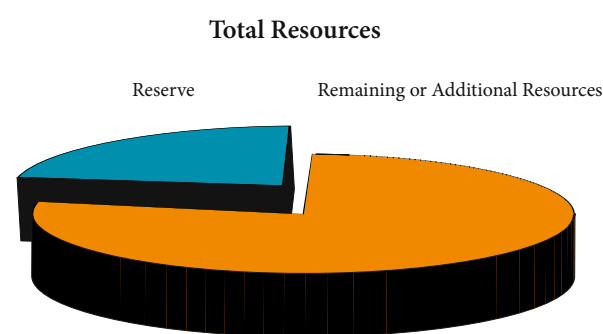
These four stages are, therefore, used as geological assessment categories in the classification. Feasibility assessment studies form an essential part of the process of assessing a mining project. The typical successive stages of feasibility assessment, i.e., geological study as initial stage followed 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.



Diagrammatic 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



9.2

%, Estimated growth of Indian economy in 2021-22

49.7

%, Growth in merchandise exports in 2021-22

68.9

%, Growth in merchandise imports in 2020-21

1.6

%, Share of mining and quarrying industry in the GVA at current prices

NATIONAL ECONOMY

The last two years have been difficult for the world economy on account of the COVID-19 pandemic. Repeated waves of infection, supply-chain disruptions and more recently, inflation have created particularly challenging times for policy-making. Faced with these challenges, the Government of India's immediate response was a bouquet of safety-nets to cushion the impact on vulnerable sections of society and the business sector. It next pushed through a significant increase in capital expenditure on infrastructure to build back medium-term demand as well as aggressively implemented supply-side measures to prepare the economy for a sustained long-term expansion. Advance estimates suggest that the Indian economy is expected to witness real GDP expansion of 9.2 per cent in 2021-22 after contracting in 2020-21. This implies that overall economic activity has recovered past the pre-pandemic levels. Almost all indicators show that the economic impact of the "second wave" in Q1 was much smaller than that experienced during the full lockdown phase in 2020-21 even though the health impact was more

severe. Agriculture and allied sectors have been the least impacted by the pandemic and the sector is expected to grow by 3.9 per cent in 2021-22 after growing 3.6 per cent in the previous year. Advance estimates suggest that the GVA of Industry (including mining and construction) will rise by 11.8 per cent in 2021-22 after contracting by 7 per cent in 2020-21. The Services sector has been the hardest hit by the pandemic, especially segments that involve human contact. This sector is estimated to grow by 8.2 per cent this financial year following last year's 8.4 per cent contraction. Total Consumption is estimated to have grown by 7.0 per cent in 2021-22 with significant contributions from government spending. Similarly, Gross Fixed Capital Formation exceeded pre-pandemic levels on the back of ramped up public expenditure on infrastructure. Exports of both goods and services have been exceptionally strong so far in 2021-22, but imports also recovered strongly with recovery in domestic demand as well as higher international commodity prices. Overall, macro-economic stability indicators suggest that the Indian economy is well placed to take on the challenges of 2022-23. One of the reasons that the Indian economy is in a good position is

its unique response strategy. Rather than pre-commit to a rigid response, Government of India opted to use safety-nets for vulnerable sections on one hand while responding iteratively based on Bayesian-updating of information. Another distinguishing feature of India's response has been an emphasis on supply-side reforms rather than a total reliance on demand management. These supply-side reforms include deregulation of numerous sectors, simplification of processes, removal of legacy issues like 'retrospective tax', privatisation, production-linked incentives and so on. Even the sharp increase in capital spending by the Government can be seen both as demand and supply enhancing response as it creates infrastructure capacity for future growth.

Despite all the disruptions caused by the global pandemic, India's balance of payments remained in surplus throughout the last two years. This allowed the Reserve Bank of India to keep accumulating foreign exchange reserves, which stands at US\$ 634 billion on 31st December 2021. This is equivalent to 13.2 months of imports and higher than the country's external debt. As of end-November 2021, India was the fourth largest foreign exchange reserves holder in the world after China, Japan, and Switzerland. A sizeable accretion in reserves led to an improvement in external vulnerability indicators such as foreign exchange reserves to total external debt, short-term debt to foreign exchange reserves, etc.

India's salient external sector sustainability indicators are strong and much improved as compared to what they were during the global financial crisis or taper episode of 2013. For instance, the import cover and foreign exchange reserves are more than double now. The combination of high foreign exchange reserves, sustained foreign direct investment, and rising export earnings will provide a good buffer against any liquidity tapering/monetary policy normalisation in 2022-23.

The fiscal support given to the economy as well as the health response caused the fiscal deficit and government debt to rise in 2020-21. However, there has been a strong rebound in government revenues in 2021-22 so far. The revenue receipts of the central government during April-November 2021 have gone up by 67.2 per cent (YoY), as against an estimated growth of 9.6 per cent in the 2021-22 Budget Estimates. The tax collections have been buoyant for both direct and indirect taxes. The gross monthly GST collections have crossed ₹1 lakh crore consistently since July 2021.

Inflation has reappeared as a global issue in both advanced and emerging economies. The surge in energy prices, non-food commodities, input prices, disruption of global supply chains, and rising freight costs stoked global inflation during the year. In India, Consumer Price Index (CPI) inflation moderated to 5.2 per cent in 2021-22 (April-December) from 6.6 per cent in the corresponding period of 2020-21. It was 5.6 per cent (YoY) in December 2021, which is within the targeted tolerance band. The decline in retail inflation in 2021-22 was led by easing of food inflation. Wholesale Price Inflation (WPI), however, has been running in double-digits. The inflation in 'fuel

and power' group of WPI was above 20 per cent reflecting higher international petroleum prices. Although the high WPI inflation is partly due to base effects that will even out, India does need to be wary of imported inflation, especially from elevated global energy prices.

Overall, macro-economic stability indicators suggest that the Indian economy is well-placed to take on the challenges of 2022-23.

The Indian economy is estimated to grow by 9.2 per cent in real terms in 2021-22 (as per the First Advance Estimates), after a contraction of 7.3 per cent in 2020-21. Growth in 2022-23 will be supported by widespread vaccine coverage, gains from supply-side reforms and easing of regulations, robust export growth, and availability of fiscal space to ramp up capital spending. The year ahead is also well poised for a pick-up in private sector investment with the financial system in a good position to provide support to the revival of the economy. Thus, India's GDP is projected to grow in real terms by 8.0-8.5 per cent in 2022-23. This projection is based on the assumption that there will be no further debilitating pandemic related economic disruption, monsoon will be normal, withdrawal of global liquidity by major central banks will be broadly orderly, oil prices will be in the range of US\$70-\$75/bbl, and global supply chain disruptions will steadily ease over the course of the year. The above projection is comparable with the World Bank's and Asian Development Bank's latest forecasts of real GDP growth of 8.7 per cent and 7.5 per cent respectively for 2022-23. As per the IMF's latest World Economic Outlook (WEO) growth projections released on 25th January, 2022, India's real GDP is projected to grow at 9 per cent in both 2021-22 and 2022-23 and at 7.1 per cent in 2023-24. This projects India as the fastest growing major economy in the world in all these three years.

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. This shows that India is well on track as far as attaining the export target is concerned. Sharp recovery in key markets; increased consumer spending; pent up savings and disposable income due to announcement of fiscal stimulus by major economies; global commodity price rise and an aggressive export push by the government have bolstered exports in 2021-22. After bottoming out in Q1: FY 21, there was an impressive rebound in merchandise exports, with strong y-o-y and sequential growth, crossing a milestone of US\$ 100 billion in Q2 and Q3 of 2021-22. This is remarkable in view of moderation in global trade growth, elevated shipping rates and persistent problem of container shortages. The rise in exports is contributed by high growth in petroleum, oil and lubricants (POL) exports (constituting about 15 per cent of total exports) as well as non-POL exports, indicating the broad-based nature of expansion. This is reflected in the fact that more than 85 per cent of major export commodity groups recorded positive growth during April-December, 2021 over April-December, 2020. Driven by robust demand for engineering goods, gems & jewellery, and chemicals, the non-POL exports stood at US\$ 257.5 billion during 2021-22 (April-December), registering a growth of 40.1 per cent over corresponding period of last year and 24.9 per cent over 2019-20 (April-December).

United States of America (USA) remained the top export destination in April-November, 2021 followed by United Arab Emirates (UAE) and China. Belgium has replaced Malaysia and entered into the top ten leading export destinations during April-November 2021, with more than a billion dollars' worth of pearls, precious and semi-precious stones, and iron and steel shipped to the country.

Imports

As the pandemic ebbed, India witnessed revival in domestic demand resulting in strong import growth. The merchandise imports grew at the rate of 68.9 per cent to US\$ 443.8 billion in April-December, 2021 over the corresponding period of last year and 21.9 per cent over April-December, 2019, crossing the pre-pandemic levels. Like in the case of merchandise exports, imports also showed secular rise since Q1: FY 21 and reached about US\$ 166 billion in Q3: FY 22, crossing the pre-COVID levels.

The expansion recorded in merchandise imports in April-December, 2021 is accounted by the positive growth in all the three components i.e. gold & silver imports (accounting for 9.1 per cent share in total imports), POL imports (26.6 per cent share) and non-POL, non-Gold & silver imports (64.3 per cent share), with latter

contributing the maximum indicating acceleration in domestic activity. It is observed that more than 93 per cent of major import commodities have registered positive growth in April-December, 2021 compared to last year, indicating a broad-based recovery in the economy. Owing to significant rise in crude oil prices, POL imports rose by 119.2 percent to US\$118.3 billion in April-December, 2021 over corresponding a year earlier and by 22.3 per cent compared to April-December, 2019. The crude oil price (Indian basket) surpassed the pre-COVID level and was as high as US\$ 82.1 per barrel in October 2021. On the other hand, the volume of POL imports rose higher than last year, but remained below the pre-pandemic levels. Gold and silver imports more than doubled to US\$ 40.0 billion, as against US\$ 17.5 billion in corresponding period a year earlier and surpassed the pre-pandemic level of US\$ 25.4 billion recorded in April-December, 2019. Non-POL, non-gold & silver imports were US\$ 285.5 billion in April-December, 2021, witnessing a positive growth of 49.3 percent compared to corresponding period of last year and 17.9 percent over April-December, 2019. Electronic goods; pearls, precious & semi-precious stones; and coal, coke & briquettes, etc., contributed maximum in the non-POL, non-gold & silver import growth in the said period. Among major import commodities, crude petroleum imports more than doubled to US\$ 73.3 billion in April-November, 2021 compared to last year and continues to be the highest imported commodity. Gold imports registered sharp rise to US\$ 33.2 billion (8.7 per cent share), from US\$ 12.3 billion (5.6 per cent share) in corresponding period a year earlier, returning to second position. This is due to significant increase in volume of gold imports that have more than tripled compared to last year and surpassed the pre-pandemic levels, on account of strong festive and export demand, favoured by drop in international gold prices. Industrial machinery for dairy and Iron & Steel do not figure in the list of top ten import commodities in current year, unlike in April-November, 2019.

Among the top ten countries for import origin, China, UAE and USA were the top import sources for India in April-November, 2021, with China's share reducing to 15.5 per cent from 17.7 per cent in corresponding period a year earlier – reflecting increased diversification of India's import sources. Switzerland, which was ousted last year from top ten sources of India's import, bounced back at sixth position with a share of 4.7 per cent in April-November, 2021. Indonesia – second biggest source of crude palm oil – remains to be one of top ten suppliers of India, with a share of 2.9 percent in total imports during same period.

Trade Deficit

Owing to the recovery of global demand with a revival in domestic activity as well as in many trading partners, both the merchandise exports as well as imports rebounded strongly and surpassed pre-pandemic levels leading to an increase in merchandise trade deficit. It stood at US\$ 142.4 billion in April-December, 2021 compared to deficit of US\$

61.4 billion in corresponding period of last year and US\$ 125.9 billion in April-December, 2019. The merchandise trade deficit widened after bottoming out in Q1: FY 21.

India had the most favourable trade balance with USA followed by Bangladesh and Nepal

Trade Related Logistics

An efficient, competitive and resilient logistics ecosystem is pivotal to boost exports. Despite multiple challenges, India has made substantial progress in trade-related logistics, reflected in leading global indices. India scored 90.3 per cent in 2021 in United Nations Economic and Social Commission for Asia Pacific's (UNESCAP) latest Global Survey on Digital and Sustainable Trade Facilitation, a remarkable jump from its score of 78.5 per cent in 2019, on account of improvement in scores of five key indicators. The Survey notes that India is the best performing country when compared to South and South West Asia region (63.1 per cent) and Asia Pacific region (65.9 per cent). India witnessed consistent and significant increase in its overall trade facilitation score since 2015, supported by continuous improvement in each of the five indicators. Transparency index got 100 per cent score in 2021, while paperless trade and formalities got 96 per cent.

India's rank has improved significantly in 'Ease of Doing Business' index at 63 as per the latest data published by the World Bank. The Logistics Performance Index 2023 (LPI), released by the World Bank, assesses relative logistics efficiency of countries. On this index, India was ranked 38 out of 139 countries in 2023 vis-à-vis rank of 44 in 2018.

Pradhan Mantri Gati Shakti National Master Plan (NMP)

Approved in October 2021, PM Gati Shakti NMP aims to provide multimodal connectivity to various economic zones and integrate the infrastructure linkages holistically for seamless movement of people, goods & services to improve logistics efficiency. Gati Shakti will bring 16 Ministries together for integrated planning and coordinated implementation of infrastructure connectivity projects like Bharatmala, Sagarmala, inland waterways, UDAN etc. It will also leverage technology extensively including spatial planning tools with ISRO imagery developed by BiSAG-N (Bhaskaracharya National Institute for Space Applications and Geoinformatics). Economic zones like textile clusters, pharmaceutical clusters, electronic parks, etc. will be covered to make Indian businesses more competitive globally by cutting down the logistics costs and ensure proper linkages for local industry & consumers. This will boost economic growth, attract foreign investment and create multiple employment opportunities.

Other Initiatives to Improve Logistics Ecosystem

Government has taken various steps in last few years to improve logistics efficiency through infrastructure

enhancement and process reforms. Some of them include introduction of FASTag, Turant Customs, mandatory RFID (Radio Frequency Identification) tagging at all EXIM bound containers, E-San chit, Indian Customs Enquiry for Trade Assistance and Knowledge (ICETRAK), ICEDASH (Indian Customs EDI Dashboard), Secured Logistics Document Exchange (SLDE), Import Clearance System, GHG Calculator etc. In order to ease maritime trade, efforts are being undertaken on development of port-specific master plans and a coordination mechanism for implementation of the same, upgradation of select Land Customs Stations (LCS) to Integrated Check Posts (ICPs), promoting Free Trade Warehousing Zones, etc.

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 2020-21 at 101 displayed a decrease of 7.8% as compared to the previous year.

The value of production of metallic minerals in 2020-21 at ₹69,534 crore increased by about 1.8% over that of the previous year mainly due to higher production reported in lead concentrate zinc concentrate, tin concentrate and silver. Among the principal metallic minerals, iron ore contributed ₹49,396 crore or 71%, lead (concentrate) & zinc (concentrate) together ₹8,709 crore or 13%, silver ₹4,266 crore or 6%, chromite ₹2,291 crore or about 3%, manganese ore ₹1,942 crore or about 3%, bauxite ₹1,667 crore or 2.4% and the remaining value was from copper (concentrates), gold, and tin concentrates in the total value of metallic minerals.

The value of production of non-metallic minerals at ₹8,926 crore during 2020-21 decreased by 6% as compared to the previous year (Table-1).

Table-1: Indian Mineral Industry : Value of Production* 2018-19 to 2020-21

(In ₹ crore)

Sector	2018-19 (R)	2019-20 (R)	2020-21 (P)
Total : All Minerals	146126	165877	15757
Metallic minerals	64212	68298	69534
Non-metallic minerals	9740	9503	8926
Minor minerals	72174	88075	79109

* 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 1,323 reporting mines (excluding fuel minerals, atomic fuel and minor minerals) in India located in all States and UTs during 2020-21. Among them, 589 belong to metallic minerals and 734 to Non-metallic minerals. There were 156 mines in Public Sector and the rest of 1,167 mines were in Private Sector (Tables-2).

Table-2: Number of Reporting Mines# 2019-20 and 2020-21

	2019-20	2020-21 (P)
All Minerals	165877	15757
I (i) Public sector	146	156
(ii) Private sector	1157	1167
II (i) Metallic minerals	567	589
(ii) Non-metallic minerals	736	734

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

Role of Public Sector

The Public Sector has played significant role in the overall mineral production in 2020-21.

The entire production of copper ore & conc., among metallic minerals and diamond, fluorite, Salt(rock) & selenite in respect of non-metallic minerals was reported from the Public Sector. By and large, the entire production of gold (primary) and phosphorite came from Public Sector during 2020-21. More than 50% of the production of bauxite and tin concentrate was in the Public Sector during this year.

Gross Value Added from Mining & Quarrying Sector

The Ministry of Statistics & Programme Implementation has released the new series of national accounts, 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 2020-21, Mining and Quarrying Industry accounted for about 1.6 % of the GVA at current prices. The GVA at current and constant prices for the period from 2018-19 to 2020-21 is furnished in Tables-3 & 4.

Table-3: Gross Value Added at Basic Price, 2018-19 to 2020-21

(At 2011-12 prices)

(In ₹ crore)

Industry	2018-19 (NS)	2019-20 (NS)	2020-21 (PE)	% Change in 2020-21 over the previous year
GVA (All)	1,27,44,203	1,32,71,471	1,24,53,430	-6.2
Mining & Quarrying	3,30,521	3,22,116	2,94,644	-8.5

Source: CSO NS : New Series Estimates PE : Provisional Estimates.

Table-4: Gross Value Added at Basic Price, 2018-19 to 2020-21

(At current prices) (31.05.2021)

(In ₹ crore)

Industry	2018-19 (NS)	2019-20 (NS)	2020-21 (PE)	% Change in 2020-21 over the previous year
GVA (All)	1,71,61,213	1,84,61,343	1,79,15,167	-3
Mining & Quarrying	3,77,171	3,55,833	2,92,120	-17.9

Source: CSO NS : New Series Estimates PE : Provisional Estimates.

Employment

The average daily employment of labour engaged in Mining Sector (excluding fuel minerals, atomic and minor minerals) was 99,335 in 2020-21. Out of this, 33,373 or 34% were in Public Sector and 65,962 or 66% in Private Sector. Metallic minerals accounted for 79% and Non-metallic minerals 21% of the total labour force during the year.

As per World Mineral Production, 2016-20, British Geological Survey, India's ranking in 2020 in world

production in term of quantity was 2nd in Steel (crude/liquid) followed by 3rd in Zinc (slabs) and aluminium (primary); 4th in chromite and iron ore; 5th in Manganese ore; 6th in Bauxite; 7th in copper (refined); 15th in apatite & rock phosphate; and 17th in magnesite. 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, 2020

Sector	Unit of Commodity	Production quantity		Contribution (Percentage)	India's rank in World order ⁵
		World	India*		
Metallic Minerals					
Bauxite	'000 tonnes	368600	20368	5.53	6 th
Chromite	'000 tonnes	31000	2863	9.24	4 th
Iron ore	million tonnes	3016	204	6.76	4 th
Manganese ore	'000 tonnes	49600	2688	5.42	5 th
Industrial Minerals**					
Magnesite	'000 tonnes	28300	78	0.28	17 th
Apatite & Rock phosphate	'000 tonnes	221000	1455	0.66	15 th
Metals					
Aluminium (primary)	'000 tonnes	65400	3619	5.53	3 rd
Copper (refined)	'000 tonnes	249001/	364#	1.46	7 th
Steel (crude/liquid)	million tonnes	1857	104	5.6	2 nd
Lead (refined)	'000 tonnes	125002/	214#@	1.71	3 rd
Zinc (slab)	'000 tonnes	13800	715	5.18	3 rd

Source: World Mineral Production, 2016-2020, British Geological Survey for

World mineral production and MCDR returns & individual plants for production with respect to India.

* Figures relate to 2020-21.

** Minerals declared as minor minerals vide Government of India Notification S.O. 423(E)

dated 10th February, 2015 are not included due to non-availability of production with respect to India.

5: India's rank based on production mentioned in World Mineral Production 2016-20, British Geological Survey.

1/ Figures relate to both primary and secondary refined copper, whether electrolytic or fire refined.

Metal recovered from secondary materials by remelting alone is excluded.

2/ Figures relate to both primary and secondary refined lead and include the lead content of antimonial lead.

#: production of copper (refined) and lead refined during 2020 was 697 and 818 thousand tonnes, respectively

, as per World Mineral Production, 2016-2020 which includes both primary and secondary production.

@: Production of lead (primary).w

Note: Data in respect of World Mineral Production is on calendar year basis, however,

the data on India's production is based on financial year.

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 prebedded 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 2020-21, till, a total of 967 online templates for the assessment have been filed by the lessees. Out of these, 491 cases have been validated. After validation 45 leases fall under five star, 212 leases under four star 195 falls under three star and 39 falls under 2 star and below.

LEGISLATIVE FRAMEWORK

A major amendment was carried out in 2021 in the Act through the MMDR (Amendment) Act, 2021. The objectives of the MMDR Amendment Act, 2021 are:

- Fully harnessing the potential of the mineral sector,

- Increasing employment and investment in the mining sector including coal,
- Increasing the revenue to the States,
- Increasing the production and time bound operationalisation of mines,
- Maintaining continuity in mining operations after change of lessee,
- Increasing the pace of exploration and auction of mineral resources, and
- Resolving long pending issues that have slowed the growth of the sector.

Some of the major reforms brought in the MMDR Amendment Act, 2021 are as under:

- Removed the distinction between captive and merchant mines by providing for auction of mines in future without restriction of captive use of minerals and allowing existing captive mines including captive coal mines to sell up to fifty per cent. of the minerals produced after meeting the requirement of linked plants to ensure optimal mining of mineral resources and specify the additional amount to be charged on such sale [Section 8A(7A) and Section 10B(6)].
- Provided for payment of additional amount to the State Government on extension of mining lease of Government companies and specify such amount to create level playing field between the auctioned mines and the mines of a Government company [Section 8A(8)].
- Provided that all the valid rights, approvals, clearances, licences and the like granted to a lessee in respect of a mine shall continue to be valid on expiry or termination of lease and such clearances shall be transferred and vested to the successful bidder of the Mining Lease selected through auction under the Act. This will ensure continuity in mining operations even with change of lessee, conservation of mineral and avoid repetitive and redundant process of obtaining clearances again for the same mine [Section 8B(1)].
- Central Government has been empowered to issue directions regarding composition and utilisation of Fund by the District Mineral Foundations [Section 9B(3)].
- Restrictions on transfer of mineral concessions for non-auctioned mines has been removed to attract fresh investment and new technology in the sector [Omission of Section 12A(6)].
- Pending cases of non-auctioned concession holders which have not resulted in grant of mining leases despite passage of a considerable time of more than five years have been closed/lapsed. The existence of these cases was anachronistic and antagonistic to the auction regime. The closure of the pending cases would facilitate the Government to put to auction a large number of mineral blocks in the interest of nation

resulting in early operationalisation of such blocks and additional revenue to the State Governments [Section 10A(2)(b)].

- (vii) Central Government has been empowered to conduct auction in cases where the State Governments face difficulty in conducting auction or fails to notify the area or conduct auction [Section 10B(3), Section 10B(4) and Section 11(5)].
- (viii) Provision introduced to grant short term mining lease to Government companies in situations where the auction of mines pursuant to sub-section (4) of section 8A has failed [Section 8B(1)].
- (ix) The expression “without any lawful authority” occurring in section 21 of the Act has been clarified to limit its scope to the violations of the said Act and the rules made thereunder [Section 21(6)].
- (x) Simplification of exploration regime - (i) National Mineral Exploration Trust (NMET) shall be an autonomous body; (ii) Private entities may be notified under Section 4(1) of the MMDR Act for conducting exploration; (iii) Enable funding of eligible private exploration agencies from NMET; (iv) Provision for seamless PL-cum-ML (composite licence).[Section 9C(1), Section 4(1), Section 9C(5) and Section 3(a)].

Auction of Mineral Blocks

As per information available on website of Ministry of Mines as on 09.03.2022, a total of 145 mineral blocks have been auctioned successfully across 11 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.

As a part of Pilot Project in Tandur area, Andhra Pradesh, volume changes in a cluster of mines (6) studied for 2007-2015 period, it was observed that overall volume change is 10 to 11% only.

Application of Drone Technology in Mining

Furthering the efforts to utilise new technology, the Ministry of Mines has explored applicability of the unmanned Aerial Vehicles (UAV) Technology or commonly referred to as ‘UAVs’ for the Mining Sector.

Government of India, Ministry of Mines has amended Mineral Conservation and Development Rules (MCDR), 2017 in the year 2021 requiring submission of digital images by the lessee/ preferred bidders to the IBM. The provisions of rule 34A of MCDR are as follows: “Rule 34A —(1) Every lessee having—

- (a) an annual excavation plan of one million tonne or more in a particular year; or
- (b) leased area of fifty hectare or more, shall carry out a drone survey of the leased area and upto hundred metres outside the lease boundary in the month of April or May every year and submit the processed output [digital elevation model (DEM) and Orthomosaic] images obtained from such survey or any other format as may be specified by Indian Bureau of Mines to the Controller General, Indian Bureau of Mines on or before 1st day of July every year: (2) Every lessee, other than those covered under sub-rule (1), shall

submit soft copy of high resolution Georeferenced Orthorectified Satellite images of the leased area and upto hundred metres outside the lease boundary taken in the month of April to June of every year, to the Controller General, Indian Bureau of Mines on or before 1st day of July of the that year in the standards formats such as GEOTIFF along with metadata, or any other format as may be specified by Indian Bureau of Mines in this regard: Provided that the lessee who has submitted images under sub-rule (3) shall not be required to submit the images under this sub-rule for the year in which images are submitted under sub-rule (3). (3) Every lessee shall carry out a drones survey of his leased area and upto hundred metres outside the lease boundary within six months before submission of any mining plan document or modification thereto to the Indian Bureau of Mines for approval and shall submit processed output [digital elevation model (DEM) and Orthomosaic] images obtained from such survey to the concerned Regional Controller of Mines and the Controller General, Indian Bureau of Mines along with the application for approval or modification of mining plan: Provided that the lessee who has submitted the images under sub-rule (1) on or before the 1st day of July falling immediately before submission of mining plan document, shall not be required to submit the same under subrule (3). (4) All preferred bidders who are issued with a letter of intent for grant of a mining lease shall carry out a drone survey of the mining block granted through auction and upto hundred metres outside the block boundary and submit the processed output [digital elevation model (DEM) and Orthomosaic] images obtained from such survey along with the mining plan to the Regional Controller and the Controller General, Indian Bureau of Mines. (5) The standard operating procedure for carrying out the drone survey and form of the data to be submitted shall be specified by Indian Bureau of Mines from time to time: Provided that the Indian Bureau of Mines may prescribe any alternate mechanism for survey and submission of data or images other than the mechanism specified in sub-rules (1) to (4), in case of any restriction on use of drones under any law for the time being in force regulating the use of drones”.

UAV technology can be extensively applied in the Mining Sector, i.e for

- (i) Carrying out overall survey of mine for monitoring the mining and allied activities in and around the mining area.
- (ii) Lease boundary demarcation using the Ground Control Points (GCPs) and geo-referencing of the leases, monitoring of illegal mining activities etc.
- (iii) Volumetric estimation of excavation, reclamation and periodical stock .
- (iv) Piles monitoring change detection analysis over a period of time using previously surveyed data.

- (v) Monitoring of land use and environmental impact in and around mining area.
- (vi) Virtual inspection of mines for regulatory purpose.
- (vii) Preparation of contour survey and survey map for filing to various regulatory agencies as well as internal use of the industry.

The advantages of UAV Survey are

- (i) UAV Survey in mining can improve the overall efficiency of large mine site and quarry management by providing accurate and comprehensive data detailing site conditions in a very short time.
- (ii) The data accuracy and authenticity is better than the traditional survey.
- (iii) High resolution (cm level) data of UAV provides high accuracy and more precise volumetric measurements than traditional surveying methods.
- (iv) Stock piles of irregular shape and exhibiting craters can be easily surveyed with great precision than using traditional methods.
- (v) UAV survey is faster, has less human intervention in mine and facilitates easily repeatable mining surveys at low cost.
- (vi) Changes between two surveys can be tracked and highlighted automatically.
- (vii) UAV aerial images can be used to generate point clouds, digital surface models, digital terrain models and a 3D reconstruction of a mining site, including its stockpiles.
- (viii) Helps in creating a digital data base which can be used and retrieved at ease and compared.
- (ix) Data generated over a period of time can be stored in digital platform and the time series data can be compared. The data can be used for systematic and scientific mine closure planning, monitoring of reclamation, rehabilitation activities in lease area. Keeping the above advantages of UAV Survey in view, it has been proposed that UAV Surveys be carried out periodically for each working mine along with the non-working mines and the data be submitted to IBM for periodic evaluation for the various purposes as mentioned above.

IBM organised several meetings with all stakeholders for finalisation of modalities and guidelines for application of drones in mine regulation. This step is a wayforward initiated by IBM for effective E-governance through satellite and remote sensing applications, as enshrined in NMP, 2019. It was proposed to carry out a POC of drone survey in four mines Status of Survey is as follows:

Dongri Buzurg Manganese ore Mine of M/s MOIL Ltd., Maharashtra: 1st UAV Survey completed during September 2020 and based on the raw and processed output data it was proposed to take-up 2nd UAV

Survey during March 2021. This 2nd Survey got postponed due to Covid and DGPS survey data is awaited.

- (2) Maratha-I Limestone mine of M/s Ambuja Cements Ltd, Maharashtra :Drone survey proposed to be carried out from 25th March 2021 was postponed due to Covid.
- (3) Sonadiah Limestone Mine of M/s NuvacoVisatas Corp. Ltd, Chhattisgarh: The 1st Survey in December 2020 was carried out and received the raw images and processed output data. IBM prepared a draft report on the UAV survey conducted.
- (4) Rawan–Jhipan Limestone Mine of M/s Ultratech Ltd, Chhattisgarh: M/s Ultratech Ltd has informed that they conducted a UAV survey in Rawan Jhipan Limestone Mine in February 2020 through a DGCA approved authorised Drone agency as per the SOP of IBM and submitted the survey data and processed data to IBM based on the assessment of data by IBM and on receipt of affirmation. The data received from M/s Ultratech to be as per the SOP. M/s Ultratech was issued a go-ahead to takeup the second pilot study of UAV Survey Rawan-Jhipan mine during that last week of January 2021. Accordingly, M/s Ultratech has carried out the 2nd pilot study of UAV Survey during 29th January 2021 to 2nd February 2021. The output data was subsequently processed and, IBM prepared a draft report on the UAV survey conducted.

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 initial phase, a total of 296 triggers across the country covering a total area of 3,994.87 hectares wherein, 48 unauthorised mining have been detected after inspection of the triggers by the State Government officials. The training of all the States for its adoption of the MSS for minor minerals has also been done. A total of 164 Officers from States participated in the training.

In the second phase, 52 major mineral triggers have been detected from the 3,280 plotted leases (Working Mines 1,689 plotted out of 1,694 and Non-Working Mines 1,596 plotted out of 2,129) across the country, out of which 45 have been verified by the State Governments and in 5 cases unauthorised mining activities have been identified.

Similarly, in respect of minor mineral, 130 triggers have been generated, out of which 104 have been verified and in 9 cases unauthorised mining activities have been identified.

Regarding setting up of Remote Sensing Laboratories, it is confirmed that two remote sensing labs have been established one at Nagpur and other at Hyderabad and both these are fully operational. Transfer of legacy data of Multi-Mineral Leasehold Map, which was earlier on Auto cad system, is being carried out on GIS platform and all Reconnaissance Permit and Prospecting Licences are being digitised on GIS platform along with Integration of regional geology, forest map and mine lease boundary maps.

An MoU has been signed between IBM and MOIL for pilot study of MOIL leases in Maharashtra state using time

series satellite imageries (for the year 2010, 2014 and 2018) procured from NRSC.

District Mineral Foundation / Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY)

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.

Memorandum of Understanding (MoU) Signed in 2021-22

In the interest of developing bilateral cooperation with countries having rich mineral resources and access to the latest technologies in the exploration and development of minerals, the Central Government has entered into bilateral agreements with the Governments of a number of countries. Moreover, the Ministry of Mines is constantly endeavouring to seek greater engagements overseas in order to ensure mineral security for the Country.

MoU with FIU

MoU between Geological Survey of India, Ministry of Mines, the Government of the Republic of India and the Florida International University Board of Trustees on behalf of its Department of Earth and Environment, College of Arts, Sciences and Education, United States of America on cooperation in the field of Geology under the Research Project Title “Study of Post-collisional Magmatism in the India-Asia Collision Zone (Ladakh Granitoids, Indus Ophiolite Belt) and Integrative Geological and Geochronological studies of the Mishmi Tectonic Belt, North Eastern India (Arunachal Pradesh) was signed on 6th October, 2021.

MoU with ROSGEO

An MoU between Joint stock company Rosgeologia (ROSGEO) a legal entity incorporated under the laws of the Russian Federation and Geological Survey of India (GSI), Ministry of Mines, the Government of the republic of India on cooperation in the field of geoscience was signed on 1st December, 2021.

In addition to the above MoUs, the proposal of signing another two MoUs namely Memorandum of Understanding between Ministry of Mines, the Government of the

Republic of India and the Ministry of Mines & Geology, the Government of the Republic

of Cote D'Ivoire on cooperation in the field of Geology and Mineral Resources; and (ii) Memorandum of Understanding between the Ministry of Mines of the Government of the Republic of India and the Secretariat of Mining Policy of the Ministry of Productive Development of the Argentine Republic for cooperation in the field of Mineral Resources, have been approved by the Cabinet on 07.04.2021 and 03.06.2021 respectively and are in the process of being signed in near future.

Bilateral Meetings

There are a number of bilateral meetings held during the year 2021-22 with various countries to further the cooperation and collaboration in the fields of Mining, Geology and Mineral Resources, including the critical and strategic minerals.

The second meeting of the Joint Committee under the MoU on cooperation in the field of Mining and Geology between India and Morocco was held on 2nd February, 2021 through video conference. Both the sides agreed to cooperate in the area of exchange of information on Geology and Mining. Both the sides also noted that strengthening of India-Morocco cooperation in the fields of Geology, Mining, and Downstream Industry and collaboration would be mutually beneficial.

A meeting with Australian High Commissioner in India was held on the 13th July 2021 with Secretary, Ministry of Mines on virtual platform. The various key issues like India's mining outlook, Impact of COVID-19 on the mining sector, Potential areas of collaboration, and Australia-India critical minerals cooperation and how Australia could assist India in meeting its critical minerals demand etc. were discussed in the meeting.

A delegation led by H.E Mr. Hugo Javier Gobbi, Ambassador, Embassy of the Argentine Republic in India assisted by Ms. Denise Perguica Bozic, Head of Commercial Department, Embassy of the Argentine

Republic, met with Secretary, Ministry of Mines, Government of India on 18/08/2021 to discuss the issues related to critical and strategic minerals.

Pursuant to the aforesaid meeting, a visit of Government of Indian Delegation led by secretary (Mines) to Argentina took place during 29th August to 4th September, 2021 to evaluate the potential lithium projects for acquisition by Khanij Bidesh India Ltd. (KABIL). The delegation visited the province of CATAMARCA. CAMYEN, the state-owned enterprise of CATAMARCA province has assured that they will collaborate with KABIL to ensure preferential allocation of prospective Lithium bearing mineral acreages located within the province.

The visiting delegation also had extensive interaction with M/s YPF. Both YPF and KABIL outlined a broad contour of activities that need to be taken up with utmost priority as the acquisition process entailing

engagement with target companies need to be started expeditiously.

The 2nd meeting of Joint Working Group of India-Australia under the Memorandum of Understanding for cooperation in the field of mining & processing of Critical & Strategic Minerals was held on 10th September 2021 through virtual mode.

It was decided in the meeting that on the basis of the list of Lithium and Cobalt projects submitted by Australian side during 2nd JWG, more discussions will be held between CMFO and KABIL on the possible investment opportunities with more specific details of investment or participating interests of Government of Australia in such projects. Aus Trade is to organise a virtual event for showcasing investment opportunities in Australia to key Indian Industry Representatives.

Mr. Sanjiva Desilva, Counselor, Department of Industry, science, Energy and Resources of Government, Australian High Commission, New Delhi of Australia met with Shri Satendra Singh, JS (SS) and Dr. Ranjit Rath, CEO, KABIL on 16th November, 2021 to review the progress of the draft MoU proposed to be signed between Critical Minerals Facilitation Office (CMFO), Australia and KABIL for an initial investment commitment towards the due diligence process for selection of mineral asset for investment out of the shortlisted projects.

The 3rd meeting of Joint Working Group (JWG) between India and Mozambique under the Memorandum of Understanding on cooperation in the field of Mineral Resources was held on 10.12.2021 through Virtual platform.

Khanij Bidesh India Limited (KABIL)

A Company named 'Khanij Bidesh India Ltd (KABIL)' was formed during the year for exploring overseas mineral assets, particularly, strategic and critical minerals, with an objective of ensuring mineral security of the nation. A Joint Venture Company of NALCO, HCL and MECL with equity participation of 40:30:30 has been created with a mandate to identify, explore, acquire, develop, mine, process, and sale of critical & strategic minerals and other minerals overseas for mineral security and commercial use so as to ensure mineral security of the country through supply side assurance of Energy Minerals.

In this context, engagement of KABIL is underway with select source countries such as Argentina, Bolivia, Chile and Australia etc. which are endowed with the cited critical & strategic minerals. The primary interface has been the respective Embassies & Missions of India in those countries for sharing of information with respect to prospective mineral acreages primarily with state owned organisations for taking up due diligence and investment decisions.

Despite the COVID 19 pandemic, global health crisis and associated constraints, KABIL has been able to secure engagement with Argentina & has signed MoUs for sharing of information with a Non-Disclosure Agreement with the following state-owned organisations of Argentina:

- a. M/s. YPF, an energy major & federal owned enterprise.
- b. M/s. JEMSE, a state-owned enterprise of JUJUY province.
- c. M/s. CAMYEN, a state-owned enterprise of CATAMARCA province.

As of engagement with Australia, during the apex level discussion between the Premier of Australia and Hon'ble Prime Minister of India held on 3rd June 2020, a MoU has been signed between Government of India and the Government of Australia through Ministry of Mines and Critical Minerals Facilitation Office (CMFO) respectively for co-operation in the field of mining and processing of Critical and Strategic Minerals.

The follow up discussions are underway between CMFO & KABIL for signing an MoU to take up due diligence of select projects for possible joint investments. The draft MoU is under exchange between the two participants for an investment commitment of USD 3 Million by each KABIL & CMFO.

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

EXPLORATION & DEVELOPMENT

GSI, DGMs of various States, Public Sector companies like NMDC, MECL, MOIL, etc., continued their efforts in respect of surveying, mapping and exploration of new deposits and re-assessment of old deposits/mines during 2019-20. The ONGC and OIL, the two National Oil Companies (NOC) and a few private and joint venture companies were engaged in exploration and production activities of oil and natural gas, including coal-bed Methane in the country. The details of exploration carried out and discoveries found during the year 2019-20 are described in "General Review" on "Exploration & Development". However, the exploration conducted by various organisations during 2020-21 is highlighted below:

MECL

MECL continued its core activities of regional and detailed mineral exploration involving exploratory drilling along with associated geological activities. During the year 2020-21, a total of 10100 million tonnes of mineral resources have been established. Cumulatively, since inception in 1972, (up to March-21) a total of 185290 million tonnes of resources for various minerals have been added to National Mineral Inventory. The mineral wise break up of resources established during 2020-21 and since inception are given below.

Salient features of mineral resources estimated during 2020-21

- Coal: A total of 8,940.69 million tonnes of coal resources were established during 2020-21 in Balrampur, Korba, Raigarh, Jarekeela & Thanarghat in Chattisgarh and Recherla & Chintalpedi in Andhra Pradesh and Umariya in Madhya Pradesh

- Lignite: 431.22 million tonnes of lignite resources were established in the state of Tamil Nadu.
- Iron Ore : 74.33 million tonnes of iron ore resources were established in Gumla district Jharkhand, Tiffin's Barytes, Dist. Bellari, Karnataka and Sundargarh district Odisha.
- Limestone: 561.29 million tonnes of limestone resources were established in Unjini & Ariyalur districts in Tamil Nadu and Satna in Madhya Pradesh.
- Potash : 87.19 million tonnes of Potash resources were established in Bikaner district, Rajasthan.
- Bauxite : 2.82 million tonnes of bauxite ore resources were established in Kabirdhan district, Chhattisgarh.
- Manganese : 2.68 million tonnes of manganese ore resources were established in Bolangir, Odisha.

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 2020-21, the vectorisation of 134 toposheets and plotting of 869 mining leases were completed.

Mineral beneficiation studies were carried out by IBM to encourage value addition, conservation and development of mineral resources. During 2020-21, 48 Ore dressing investigations, 14,608 chemical analyses, 2290 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. A total of 52 major mineral triggers in second phase have been detected from the 3,280 plotted leases across the country, out of which 45 have been verified by the State Governments and in 5

cases unauthorised mining activities have been identified. Similarly in respect of minor minerals, so far, 130 triggers have been generated, out of which 104 have been verified and in 9 cases unauthorised mining activities have been identified.

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 updating of National Mineral Inventory (NMI) as on 01.04.2020 for 46 major minerals is under progress.

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 20th PERC meeting held on 23-25th Nov. 2020, a total of 383 project proposals, as received under S&T Program Scheme of Ministry of Mines. After screening, 102 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. As per available information, details of some of the R&D work conducted or completed by various organisations during 2020-21 are furnished below. However, the research & development details are covered in the Review on “Research & Development” under “General Review”.

Indian Bureau of Mines (IBM)

Important R&D activities regarding ore dressing carried out by Mineral Processing Division, IBM during the year 2020-21 are summarised below:

A. Mineral Processing Division, IBM

1. COPPER ORE

- 1.1 Bench scale Beneficiation Studies on Copper bearing Sample (G-2 level exploration) from Northern part of Toda Ramliyas block, Sikar, Rajasthan
- 1.2 Bench-scale Beneficiation Studies on Copper bearing Sample (G-2 level exploration) from RJB (Lode I), Bokri North Block of Jhunjhunu, Rajasthan

- 1.3 Bench-scale Beneficiation Studies on Copper bearing Sample (G-2 level exploration) from RJB (Lode II), Bokri North Block of Jhunjhunu, Rajasthan

- 1.4 Bench-scale Beneficiation studies on a Copper Ore Sample (G-2 level exploration) from Lingsurur taluk, Raichur district, Karnataka

2. IRON ORE (BHQ)

- 2.1 Pilot scale Beneficiation Studies on an Iron Ore Banded Hamatite Quartzite (BHQ) Sample (Mine Reject) from Dongarbor iron ore mines, Rajnandgaon, Chhattisgarh for Industry

3. IRON ORE

- 3.1 Beneficiation Studies on a Composite Iron Ore Sample from Belgaum, Karnataka for Industry

- 3.2 Bench-scale Beneficiation Studies on a drill core Iron Ore Sample from Alaghat West Block (G-2 Stage exploration), Sundargarh District, Odisha

4. MANGANESE ORE

- 4.1 Bench-scale Beneficiation Studies on a Manganese Ore sample (G-2 level exploration) from Cheepurupalli, Vizianagaram District, Andhra Pradesh.

5. COPPER - GOLD ORE

- 5.1 Bench-scale Beneficiation Studies on Copper-Gold Ore Sample (G-2 level exploration) from Mundiawas Block, Alwar district, Rajasthan

6. GRAPHITE ORE

- 6.1 Bench-scale Beneficiation Studies on a Low-grade Graphite Ore (G-2 level exploration) Sample from Golihat Block, Betul district, Madhya Pradesh

Jawaharlal Nehru Aluminium Research Development & Design Center (JNARDDC)

1. Completed Projects

- 1.1 To study the fire retardancy of nano-ATH in polymers with CIPET, Bhubaneswar (Central Institute of Plastics & Engineering Technology) (S&T- Mines):
- 1.2 Optimisation of digestion efficiency in Bayer process by ascertaining the ideal size fraction of bauxite feed (S&T- Mines):
- 1.3 Development of a process technology (at lab scale) for low-cost production of 3N (99.9%) pure alumina (Ministry of Science and Technology – DST, New Delhi):

2. Ongoing Projects 2020-21

- 2.1 Fabrication of Advanced Ceramic Nanocoatings for Automotive Applications with Christ University (Sponsored by Ministry of Mines):
- 2.2 Techno-economic Survey of Aluminium Scrap Recycling in India with Metal Recycling Association of India (Sponsored by Ministry of Mines):

- 2.3 Utilisation of Aluminium Dross to Achieve Zero Waste — A Bench-scale Study Project (Sponsored by Ministry of Mines):
- 2.4 Bench-scale study on Extraction of Pure Silica and smelter-grade Aluminium Fluoride from Coal Fly Ash (CFA) (Sponsored by Ministry of Mines):
- 2.5 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):
- 2.6 TPN:59025 Instrument for Real Time Measurement of Anode Current Distribution of Aluminium Electrolysis Cell (Sponsored by Dept of Science and Technology, New Delhi):
- 2.7 Production and Certification of Certified Reference Materials (CRMs) for the Analysis of Aluminium Alloy (Sponsored by Ministry of Mines):
- 2.8 Development of Ceramic Proppant from Low-grade Materials (Partially Lateritised Khondalite -PLK, Fly ash, etc.), Phase-II Scale up Studies (Sponsored by NALCO, Bhubaneswar Odisha):
- 2.9 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, Bhubaneswar, Odisha, Jointly with IIMT, Bhubaneswar & Eesavyasa Tech, Pvt Ltd, Telangana):
- 2.10 TPN:59031 Instrument for Instantaneous and Onsite Measurement of Aluminium Electrolysis Bath Parameters (Sponsored by Dept of Science and Technology, New Delhi):
- 2.11 Technology Development for Holistic Utilisation of Red Mud for Extraction of Metallic Value & Residue Utilisation (Sponsored by NALCO, HINDALCO & VEDANTA and S&T (Mines) under the aegis of NITI Aayog, Jointly with NML, Jamshedpur & IIMT, Bhubaneswar):

National Institute of Rock Mechanics (NIRM)

During the current reporting period, i.e., 2020, the institute received 36 new projects from the industry and completed 41 industry projects.

CSIR–Central Electrochemical Research Institute (CECRI)

1. R&D (Ore Preparation and Processes)
2. R&D in building Materials (Minerals and Mineral-based Products in Construction Activities, Substitution etc.)
3. R&D work on Recovery of Marine Chemicals and By-products, viz, Salt, Potash, Bromine, Iodine, Gypsum and Magnesium Chemicals:

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)
 - 4.2 Electro-hydrolysis of low-grade manganese ore to gamma MnO₂ (Sponsored by Tata Steel Ltd)
 - 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.)

CSIR–National Metallurgical Laboratory (NML)

The R&D work carried out by CSIR–NML in Mineral Processing during 2020-21 is below:

- (i) Mission Mode Project on Strategic Minerals — Production of Lithium Salt from Ores
- (ii) Dry Beneficiation of Limestone Samples for Removal of Iron-bearing and other Magnetic Impurities.
- (iii) Continuous Pilot-Scale Reverse Flotation of Iron Ore
- (iv) Pilot-scale Study on Hydrocyclone
- (v) Advanced Gravity Concentration of Chromite Beneficiation Plant Tailing
- (vi) Processing of Low-Grade Dolomite Ore
- (vii) Studies on Beneficiation of Bauxite Sample for Reduction of Reactive Silica
- (viii) Beneficiation Studies on Low-Grade Manganese Ore Samples:

Hindustan Copper Ltd (HCL)

HCL has undertaken the following R&D projects:

- (i) R&D Project on Study of Bond work index (BWI), flotation optimisation studies, settling & filtration studies and magnetite recovery studies from the plant tailings for selling up of Copper Concentrator plant under Rakha Copper Project at ICC has been done in collaboration with CSIR – Institute of Minerals and Materials Technology, Bhubaneswar.
- (ii) Line study of Mosabani concentrator plant at ICC has been done.
- (iii) Introduction of rice husk for mixing with ANFO (explosives) for Deep Hole Blasting (Production Blasting) at KCC.
- (iv) Study for implementation of advanced technology for SO₂ gas recovery through amine based absorption route in existing SO₂ plant at ICC.

Manganese Ore India Ltd (MOIL)

Significant R&D projects are listed below:

1. Mine Environment
 - 1.1 Ventilation
 - 1.2 Sustainable Development Framework

2. Mines Safety
 - 2.1 Mining subsidence
 - 2.2 Rock Mechanics
3. Mineral Conservation
4. Mining Technology
 - 4.1 Rock Mechanics
 - 4.2 Underground Mechanisation
 - 4.3 Alternative to river sand
 - 4.4 Space technology - Remote Sensing
5. Mineral Beneficiation
6. Modern Radar Technology
7. Metallurgical Studies
8. In house R & D in Cement Concrete

National Mineral Development Corporation Ltd (NMDC)

1. Projects of NMDC Mines/Projects
 - (i) Physical and metallurgical characterisation of iron ore samples received from Bailadila sector.
 - (ii) Physical and metallurgical characterisation of pellet samples of NMDC Pellet Plant.
 - (iii) Various samples received for characterization and chemical analysis from Investigation department.
 - (iv) Characterisation of coking coal sample.

Tata Steel Ltd

1. Projects under Research and Development Project title Benefits
 - A. Projects under Research and Development
 1. Jamshedpur
 - 1.1 Seam Specific Reagent for Lower Seam Coals of West Bokaro:
 - 1.2 Reduction of Alumina in Iron Ore from Wet Processing Plant of Noamundi using Dispersant:
 - 1.3 Smart Lance System for LD vessel:
 - 1.4 Calcium Ferrite for Dephosphorisation of Steel:
 - B. Process Improvements
 1. Raw Materials Division
 - 1.1 Mining
 - 1.2 Ore Beneficiation Technology
 - (i) Stickiness Index to Predict Iron Ore Fines Flowability:
 - (ii) Identification of enablers to reduce Alumina in Dispatch Fines at Noamundi:
 - (iii) Identification of Enablers to Reduce the K₂O and SiO₂ from Gomardih Dolomite:

1.3 Coal Beneficiation Technology

- (ii) Intermediate Size (0.5mm-0.25mm) beneficiation Circuit Reflux Classier Stabilisation at New Jamadoba Coal Preparation Plant

2. Kalinganagar

- 2.1 Raw Material Handling System and Logistics
- 2.2 Sinter Plant
- 2.3 Coke Plant

Hindustan Zinc Ltd (HZL)

Specific areas in which R&D has been carried out by the HZL in 2020-21 are listed below:

- (i) Individual Ore Characterisation at Zawar for improved metallurgical performance.
- (ii) Feasibility study for Derrick Screen to replace existing cyclones to improve classification efficiency.
- (iii) Feasibility study for Lead circuit re-grind and effect of pH on lead flotation to improve Lead Silver Recovery and concentrate grade at RAM which confirms that use of Lead re-grind at RAM and Derrick Screen at Zawar will improve Lead/Silver Recovery by 2-3%.
- (iv) Geo-Metallurgy Study on advance Drill Core samples for Metallurgical characterisation at SKM and RAM which improved Metallurgical performance by Geo-Metallurgical assessment of core samples to predict recovery and grades and optimise circuit parameters. For instance - Dilute Nigrosine for high graphite in SKM, use of SMBS to deal with high pyritic ore, etc.
- (v) RDM Mesh of grind (MOG) study to determine optimum grinding size to improve metal recovery. New grinding circuit designing as per MOG study at Rajpura Mines for recovery enhancement.
- (vi) Grinding circuit audit and Loss Matrix analysis across all Milling sites to optimise circuit performance and improve process control.
- (vii) Automated mill Quality Dashboard for continuous monitoring and analytics for data based actionable.
- (viii) Establishing impact of impurities in copper sulphate on zinc flotation performance at mills. Thus, improved inhouse copper sulphate quality by process control at DSC ancillary.
- (ix) Integration and stabilisation of commercialised project for sodium sulphate crystal generation from DSC smelter effluent.
- (x) Process developed and integrated with existing plant for Raw Zinc oxide inventory dilution at CLZS Hydro-II plant, contributing ~2 500 tonne Zn & ~700 tonne Pb.
- (xi) Cu Matte Plant manganese bearing stream utilisation at Zinc smelter Debari for maintaining Mn level in electrolyte.

- (xii) Process audit and control to manage Cu levels in purification section at Zinc smelter Debari thereby reducing usage of fresh copper sulphate crystals.
- (xiii) Field trials for usage of Jarosite in concrete.
- (xiv) Collaborative project for metal recovery from Zinc smelter residues by chloride and nitric based leaching.
- (xv) Generation of Zn VAP – fertilizer grade Zinc sulphate and Zinc dust from residue & secondaries.
- (xvi) Mapping of minor metals at Mills, Identifying opportunities for minor metal extraction at HZL.
- (xvii) COP reduction initiatives by alternate reagents, process controls and optimisation.

FOREIGN TRADE

India's Trade

India's overall exports in 2020-21 (P) were US\$ 497.90 billion as against US\$ 526.55 billion in 2019-20, registering a negative growth of (-) 5.44 per cent. For the period April-December 2021* exports were estimated at US\$ 479.07 billion as against US\$ 351.47 billion during April-December 2020, registering a positive growth of 36.31 per cent. As compared to April-December 2019, exports during April-December 2021* exhibited a positive growth of 20.25 per cent. Overall (Merchandise and Services combined) exports to GDP ratio showed a declining trend over last few years. In 2020-21 the ratio stood at 18.7 per cent.

Overall imports in 2020-21 (P) were US\$ 511.96 billion, exhibiting a negative growth of (-) 15.09 per cent over the same period last year. For the period April-December 2021* imports were estimated at US\$ 547.12 billion as against US\$ 347.76 billion during April-December 2020, registering a positive growth of 57.33 per cent. As compared to April-December 2019, imports during April-December 2021* exhibited a positive growth of 18.57 per cent.

Overall trade deficit in 2020-21 (P) was US\$ 14.06 billion, which was lower than the deficit of US\$ 76.43 billion in 2019-20.

Overall trade deficit for the period April-December 2021* estimated at US\$ 68.06 billion as against the surplus of US\$ 3.70 billion during April-December 2020. In comparison to April-December 2019, overall trade deficit during April-December 2021* increased by 8.00 per cent.

As per the World Trade Statistics Review 2021, India's ranking amongst the leading exporters in the world merchandise trade improved from 30 in 2004 to 18 in 2020 with a share of 1.60%. Similarly, India's ranking amongst the leading importer in world merchandise trade was 14 in 2020 as compared to 23 in 2004 with a share of 2.1 per cent.

Exports

The total exports (including re-exports) of all merchandise in 2019-20 and 2020-21 was ₹22,19,854 crore and ₹21,59,043 crore, respectively. During the year 2020-21 the value of exports (including re-exports) of ores and minerals is ₹1,96,654 crores. The export value which had

decreased from ₹2,19,168 crore in 2018-19 to ₹1,89,683 crore in 2019-20 increased to ₹1,96,654 crore in 2020-21. The value of mineral exports showed an increase of 3.67% in 2020-21 as compared to that in the previous year.

Diamond continued to be the largest constituent item with a share of 63.98 % in the total value of mineral exports in 2020-21. Next in order of share was iron ore with contribution of 18.44 % followed by granite 5.76%, Limestone 2.18% and Alumina 1.44%.

The value of exports of ores & minerals (including re-exports) showed a mixed trend for most of the minerals in 2020-21 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 iron ore 94.08%, building & monumental stones 54.20%. On the other hand, the exports value recorded significant decline in the cases of Abrasive (Natural) 75.98%, Copper ore 62.04%, bauxite 33.05%, natural gas 70.11%, coal (excl. lignite) 3.25%, chromite 91.71%, alumina 8.4%, emerald (cut & uncut) 69.42% as compared to that in the previous year.

The value of exports (including re-exports) of metals & alloys stands at ₹2,07,222 crore in the year 2020-21. The export value which had decreased from ₹1,74,287 crore in 2018-19 to ₹1,66,099 crore in 2019-20 increased to ₹2,07,222 crore in 2020-21. The value of metal exports showed an increase of 24.76% in 2020-21 as compared to the previous year.

In terms of value of exports, Iron & Steel has the largest share of 59.12%, followed by Aluminum and Alloys Incl. Scrap 20.64%, Ferro Alloys 6.16% and Copper & Alloys (Incl Brass & Bronze) 4.93%.

As compared to previous year, the value of exports for different important metals had shown a mixed trend in 2020-21. The export value of silver registered a huge spike of 4,889.50% similar hike in export value was noticed in gold (Non monetary & monetary) which increased by 229.04%, platinum 110.21%, precious metals 197.17%, copper & alloys 68.63%, pig & cast iron (Incl. speigeliessen) 180.84% and tin & alloys incl. scrap 5.87%. However, the export values showed significant negative growth during 2020-21 as compared to that of the previous year in the cases of cobalt alloys (65.32%), Mo & Scrap (49.20%), Hg- (40.90%), Ni & Alloys (36.51%), Ti & Alloys (18.76%) and W & Alloys (4.03%).

Imports

During the year 2020-21 the value of imports (including re-imports) of ores and minerals is ₹7,91,320 crores. The import value which decreased from ₹12,99,186 crore in 2018-19 to ₹11,51,530 crore in 2019-20 decreased to ₹7,91,320 crores in 2020-21. The value of mineral imports showed a decrease of 31.28% in 2020-21 as compared to that in the previous year.

Petroleum (crude) continued to be the largest constituent item with a share of 55.56 % in the total value of mineral imports in 2020-21. Next in order of share was

Diamond with the contribution of 16.22 % followed by Coal (Except Lignite) 14.67% and Natural Gas 7.37%.

The value of imports (including re-imports) of metals & alloys stands at ₹4,35,611 crores in the year 2020-21. The import value which decreased from ₹4,77,843 crores in 2018-19 to ₹4,16,727 crore in 2019-20 increased to ₹4,35,611 crores in 2020-21. The value of metal imports showed an increase of 4.53% as compared to the previous year.

In terms of value of imports, Gold (Non-monetary & monetary : total) has the largest share of 58.38%, Iron & steel 18.97%, Copper & Alloys (Incl Brass & Bronze) 7.84%, Aluminum and Alloys Incl. Scrap 6.87% , and Silver 1.37%.

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 2020-21 with a share of about 9.10% (i.e., ₹19,66,539 million) in the total value of all merchandise. The contribution of minerals in exports in raw/unprocessed forms was about ₹4,72,525 million and in semi-processed/processed forms was about ₹14,94,014 million. The manufactured mineral-based commodities (final stage of transformation) contributed about ₹36,94,502 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, feldspar (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, inorganic chemicals like lime & 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 2018-19 to 2020-21.

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-term as 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 ₹6.0 lakh crore over 4-year period (5.4 percent of total infrastructure investment envisaged under NIP).

Coal

Coal production (provisional) at 716.083 million tonnes in 2020-21 was decreased by 0.30% from that of 730.87 million tonnes in 2019-20. In 2020-21, out of the total production of coal, 6.25% (44.78 million tonnes) was of coking coal and the remaining 93.75% (671.29 million tonnes) was of non-coking coal. Despatches of raw coal in 2020-21 were lower by around 2.3% as compared to that in the previous year. About 84.1% despatches were to Electricity Sector, 1.3% to the Steel Industry, 1.4% to the Sponge Iron Industry and 0.98% to the Cement Industry. The remaining 6.5% was made for the priority sectors including chemical steel (boilers), textile & rayons, bricks and others.

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. As a result, India has been ranked

at 87th position in the Energy Transition Index, 2021 published by the World Economic Forum (WEF).

The installed capacity has increased from 3,56,100 MW in March 2019 to 3,73,436 MW as on October, 2020. During the year 2020-21 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 2020-21, Indian Railways carried 1230.9 million tonnes of freight and 1250 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 137 million in FY20, a growth of over 14% per annum.

Ports and Shipping

Shipping is essential to both commodity and services trade of any country. Around 95 per cent of India's trade by volume and 68 per cent in terms of value is transported by sea. As on 30th December, 2020, India had a fleet strength of 1,429 ships.

The Major Ports in the country have an installed capacity of 1,534.91 MTPA and handled traffic of 672.68 MT during 2020-21. 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 2020-21 improved to 55.99 hrs as against 62.11 hrs in 2019-20. The Average Output Per Ship Berthday has increased from 12,458 tonnes in 2015-16 to 19,171 tonnes in 2020-21.

Roads

Road transport is one of the most cost effective and convenient modes of transportation in India both for freight and passengers as it has high penetration level with door-to-door delivery. Importance of road infrastructure is widely recognised as a potent means of socio-economic integration and is vital for the economic development of the country. The road network of the country consists of National Highways (NH), State-Highways (SH), District Roads, Rural Roads, Urban Roads and Project Roads of over 63.71(Provisional) lakh km of roads as on 31 March

2019, which is the second-largest in the world, after the United States with 66.45lakh kms of roads. There has been a consistent increase in the construction of National Highways/roads since 2013-14 with 13,327 kms of roads constructed in 2020-21 as compared to 10,237 kms in 2019-20, indicating an increase of 30.2 per cent over the previous year. In 2021-22 (till September), 3,824 kms of road network were constructed. The extent of road construction per day increased substantially in 2020-21 to 36.5 kms per day from 28 kms per day in 2019-20, a rise by 30.4 percent as compared to the previous year. The significant upturn in road construction in 2020-21 is due to the increase in public expenditure by 29.5 percent as compared to the previous year —a reflection of the impetus given by the Government of India to a critical sector that generates employment and supports infrastructure during a pandemic year. In addition to action taken to increase the network of national highways, the govt has taken measures to address village level road network through the Gram Sadak Yojana.

PERFORMANCE OF SELECTED MINERAL-BASED INDUSTRIES

Steel

Globally, India is the second largest producer of crude steel in the world after China. During 2020-21, crude steel production stood at 103.545 million tonnes, witnessing a decline of 5.6 per cent over the corresponding period of 2019-20 at 109.13 million tonnes. India is the third largest consumer of the finished steel after China and USA. The total export of finished steel with highest volume of 10.78 million tonnes during 2020-21 registered a growth of 29.1% over 2019-20.

Cement

As per DIPP Annual Report, production of cement during 2020-21 was 299.94 million tonnes as against 334.37 million tonnes in 2019-20 and registered a decrease of about 1 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 2.80 million tonnes in 2020-21 from 2.84 million tonnes in 2019-20.

Petroleum Oil and Refineries

Crude oil production & condensate in 2020-21 at 30.49 million tonnes registered a nominal decrease of 5.20% as compared to that in 2019-20. The production of natural gas (utilised) was at 28,673 million cubic metres in 2020-21, 8 % lower than 31,184 million cubic metres achieved in 2019-20. The total refining capacity in the country was about 249.36 MMTPA in 2020-21. Production of petroleum products (including LPG production from natural gas) was 233.51 million tonnes in 2020-21 as compared to 262.36 million tonnes in 2019-20.

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, aluminium, cement, various types of refractories, china clay based ceramics, glass. India is self-sufficient or near to self sufficient in bauxite, chromite, iron ore, kyanite, limestone, sillimanite, etc. which are imported mainly for either blending with locally available mineral raw materials and/

or to meet special requirement for manufacturing special qualities of mineral based products. India is deficient in magnesite, manganese ore, rock phosphate, etc. which were imported to meet the domestic demand. 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. The degree of self-sufficiency in respect of various principal minerals and metals in 2020-21 is furnished in Table-7.

Table-6: Contribution of Value-added (Processed) Minerals & Mineral-based Products in India's Export* Trade, 2018-19 to 2020-21

Sl. No.	Commodity group	Value of exports (₹ million)			Contribution (percentage)		
		2018-19	2019-20 (R)	2020-21 (P)	2018-19	2019-20	2020-21 (P)
1	All Merchandise	23077261	22198541	21590432	100	100	100
2	Ores & Minerals	2191682	1896831	1966539	9.5	8.54	9.1
	2.1 Raw/Unprocessed form	223388	292637	472525	0.97	1.32	2.18
	2.2 Semi-processed/ processed forms (preliminary and intermediate stages of processing)	1968294	1604194	1494014	8.53	7.23	6.91
3	Manufactured Mineral-based Commodities (final stage of transformation)	4481240	4251969	3694502	19.42	19.15	17.11
	3.1 Metals/Alloys	1742868	1660988	2072220	7.55	7.48	9.59
	3.2 Others	2738372	2590982	1622282	11.87	11.67	7.51

Figures rounded off.

* Including re-exports.

Table-7: Degree of Self-sufficiency in Principal Minerals & Metals, 2020-21 (P)

Sl. No.	Commodity	Demand/Domestic Consumption ('000 tonnes)	Supply/Domestic supply ('000 tonnes)	Order of self-sufficiency (%)
Minerals*				
1	Bauxite	23162	20369	88
2	Chromite	3017	2864	95
3	Iron ore	147524	204481	100
4	Kyanite	5.9	4.9	83
5	Limestone	368439	349170 ^{1/}	95
6	Magnesite	437	78	18
7	Manganese ore	6664	2688	40
8	Rock phosphate (including apatite)	9236	1456	16
9	Sillimanite	6.7	11.1	100
Metals				
10	Aluminium (primary)	2944	3619	100
11	Copper (refined)	720 ^{2/}	364	50
12	Lead (primary)	284 ^{3/}	214	76
13	Zinc	555 ^{4/}	715	100

Source: MCDR Returns for production and DGCI&S for export & import.

Apparent consumption = production+ import-export

*: Minerals declared as minor mineral vide Government of India Notification S.O. 423(E)

dated 10th February, 2015, are not included due to non-availability of production for the year 2020-21.

1/ Excludes production of limestone as a minor mineral,

calcite & chalk and includes limeshell, limekankar & marl.

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

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

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

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

2. Mineral Policy And 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

LEGISLATION

Notifications

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

Ministry of Mines

A. Notification No. G.S.R. 195(E) dated 11th April, 2022 reads—In exercise of the powers conferred by Section 18 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 Mineral Conservation and Development Rules, 2017, namely —

1. (1) These rules may be called the Mineral Conservation and Development (Amendment) Rules, 2022.

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

2. In the Mineral Conservation and Development Rules, 2017, in Schedule-I,— (a) in Form F1 and Form G1, in the table under the sub-heading “@Grades of ROM ore dispatched:”, for the rows titled “Iron Ore” and the corresponding entries relating thereto, the following shall respectively be substituted, namely—

(b) in Form F1, Form G1, Form L and Form M,—

(i) in the table under the sub-heading “**Grades of minerals to be reported in the above tables are as given below (If separate grades are not mentioned below, report the mineral name against grade):”, for the rows titled “Iron Ore” and the corresponding entries relating thereto, the following shall be substituted, namely —

"MINERAL	GRADES
Iron ore	<ul style="list-style-type: none"> (a) Below 45% Fe ROM (For Magnetite Ore only) (b) 45% to below 51% Fe ROM (c) 51% to below 55% Fe ROM (d) 55% to below 58% Fe ROM (e) 58% to below 60% Fe ROM (f) 60% to below 62% Fe ROM (g) 62% to below 65% Fe ROM (h) 65% and above Fe ROM"; (i) Lumps: <ul style="list-style-type: none"> (a) Below 45% Fe (For Magnetite Ore only) (b) 45% to below 51% Fe (c) 51% to below 55% Fe (d) 55% to below 58% Fe (e) 58% to below 60% Fe (f) 60% to below 62% Fe (g) 62% to below 65% Fe (h) 65% and above Fe (ii) Fines: <ul style="list-style-type: none"> (a) Below 45% Fe (For Magnetite Ore only) (b) 45% to below 51% Fe (c) 51% to below 55% Fe (d) 55% to below 58% Fe (e) 58% to below 60% Fe (f) 60% to below 62% Fe (g) 62% to below 65% Fe (h) 65% and above Fe (iii) Concentrates (iv) Calibrated Lump Ore (CLO) <ul style="list-style-type: none"> (Quantity already reported in Lumps should not be reported against CLO) (a) Below 62% Fe (CLO any size) (b) 62% to below 65% Fe (5–18 mm size CLO) (c) 62% to below 65% Fe (10–40 mm size CLO) (d) 62% to below 65% Fe (CLO others) (e) 65% and above Fe (5–18 mm size CLO) (f) 65% and above Fe (10–40 mm size CLO) (g) 65% and above Fe (CLO others)".

Note : The Mineral Conservation and Development Rules, 2017 were published in the Gazette of India, Part II, Section 3, Sub-section (i) vide number G.S.R. 169(E), dated the 27th February, 2017 and lastly amended vide number G.S.R 780 (E), dated 3rd November, 2021.

B. Notification No. G.S.R. 286(E) dated 7th April, 2022 reads— 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 (QCI-NABET), the Central Government hereby notifies that M/s Geotechnical Mining Solutions under ‘Category B Exploration Agencies’ as specified in the guidelines for notification of accredited private exploration agencies issued by the Government of India in the Ministry of Mines order vide 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.

2. The Agency 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.

C. Notification No. G.S.R. 284(E) dated 7th April, 2022 reads— 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 (QCI-NABET), the Central Government hereby notifies that M/s United Exploration India. Private Limited under ‘Category A Exploration Agencies’ as specified in the guidelines for notification of accredited private exploration agencies issued by the Government of India in the Ministry of Mines order vide 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.

2. The Agency 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.

D. Notification No. G.S.R. 285(E) dated 7th April, 2022 reads— 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 (QCI-NABET), the Central Government hereby notifies that M/s Gemcokati Exploration Private Limited under ‘Category A Exploration Agencies’ as specified in the guidelines for notification of accredited private exploration agencies issued by the Government of India in the Ministry of Mines order vide 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.

2. The Agency 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.

E. Notification No. G.S.R. 273(E) dated 5th April, 2022 reads— 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 (QCI-NABET), the Central Government hereby notifies that M/s Indian Mine Planners and Consultants under ‘Category A Exploration Agencies’ as defined in the guidelines for notification of accredited private exploration agencies issued by the Government of India in the Ministry of Mines order vide no. M.VI-16/15/2021-Mines VI dated the 12th August, 2021 for the purposes of the second proviso to Sub-section (1) of Section 4 of the said Act.

2. The Agency shall carry out prospecting operations in compliance with the conditions specified in the guidelines for notifications of accredited private exploration agencies issued by the Government of India in the Ministry of Mines order vide no. M.VI-16/15/2021-Mines VI dated the 12th August, 2021.

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.

F. Notification No. S.O. 2307(E) dated 18th May 2022 reads— 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 that M/s FCI Aravali Gypsum and Minerals India Limited under ‘Category B Exploration Agencies’ as specified in the guidelines for notification

of accredited private exploration agencies issued by the Government of India in the Ministry of Mines order vide 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.

2. The agency 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.

G. Notification No. S.O. 2050(E) dated 2nd May, 2022 reads— 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 order vide 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:

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.

H. Notification No.G.S.R. 415(E) dated 3rd June, 2022 reads— In exercise of the powers conferred by Section 13 read with the second proviso to Clause (b) of Sub-section (2) of Section 10A of the Mines and Minerals (Development and Regulation) Act,1957 (67 of 1957), the Central Government hereby makes the following rules, namely:—

Reimbursement of Exploration Expenditure Rules, 2022

Preliminary

1. Short title and commencement— (1) These rules may be called the Reimbursement of Exploration Expenditure Rules, 2022.

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

2. Definitions— (1) In these rules, unless the context otherwise requires,—

(a) “Act” means the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957);

(b) “Claim” means application submitted by the applicant for reimbursement of exploration expenditure in the Form set forth in the Schedule I;

(c) “Claimant” means the applicant of the claim who was the holder of reconnaissance permit or prospecting licence and had acquired a right for obtaining a prospecting licence followed by a mining lease or a mining lease, as the case may be, under Clause (b) of Sub-section (2) of Section 10A of the Act and whose said right had lapsed; and includes the legal representatives, lawful assignee, lawful transferee or successor by the order of a competent court, as the case may be, of such holder of reconnaissance permit or prospecting licence;

(d) “date of lapse” means the date of commencement of the Mines and Minerals (Development and Regulation) Amendment Act, 2021 (i.e., 28th March, 2021), when the right of the holder of reconnaissance permit or prospecting licence for obtaining a prospecting licence followed by a mining lease or a mining lease, as the case may be, under Clause (b) of Sub-section (2) of Section 10A of the Act had lapsed under the second proviso to the said clause.

(e) “Form” means Form set forth in the Schedule annexed to these rules.

(2) The words and expressions used in these rules, but not defined, shall have the same meaning as assigned to them in the Act or the rules made thereunder.

3. Applicability— (1) These rules shall be applicable only to such concession holders or applicants who had acquired a right for obtaining a prospecting licence followed by a mining lease or a mining lease, as the case may be, under Clause (b) of Sub-section (2) of Section 10A of the Act and whose said right has lapsed on the date of lapse.

Claim process

4. Claims for exploration expenditure.— (1) A claimant may submit a claim for reimbursement of expenditure incurred towards reconnaissance or prospecting operations to the State Government in the Form set forth in Schedule I to these rules within a period of one year from the date of commencement of these rules with an intimation to the National Mineral Exploration Trust: Provided that in cases where the period of permit or licence had not expired before the date of lapse—

(a) the claimant may submit the claim within a period of one year from the date of expiry of the period of permit or licence or date of commencement of these rules, whichever is later; or

(b) the claimant may submit a claim of the expenses incurred by it till the date of lapse after surrendering such permit or licence to the State Government, within the said period of one year from such surrender or date of commencement of these rules, whichever is later.

(2) The claimant shall enclose with its claim application, the following, namely—

(a) the documents necessary to prove payments or expenditure incurred towards exploration activities undertaken, like bank statements, discharged payment slips, vouchers or invoices with acknowledgement of settlement, or receipts of payment or other such documents; and

(b) certificate of chartered accountant to the effect that the claim has been duly verified by him.

(3) The State Government shall not proceed with the claims submitted after the period specified in sub-rule (1):

Provided that the State Government may allow a further period of one year for filing a claim, if the reasons for delay were beyond the control of the claimant.

5. Verification by the State Government— (1) On receipt of a claim application, the State Government shall verify the following, namely—

(a) claimant was the holder of reconnaissance permit or prospecting licence who had acquired a right for obtaining a prospecting licence followed by a mining lease or a mining lease, as the case may be, under Clause (b) of Sub-section (2) of Section 10A of the Act and whose said right has lapsed on the date of lapse; or is the legal representative, lawful assignee, lawful transferee or successor by the order of a competent court, as the case may be, of such holder of reconnaissance permit or prospecting licence; and

(b) claimant, to the satisfaction of the State Government, has—

i) undertaken reconnaissance operations or prospecting operations, as the case may be, to establish the existence of mineral contents in such land in accordance with the parameters as laid down by the Central Government in this behalf;

ii) not committed any breach of the terms and conditions of the reconnaissance permit or the prospecting licence;

iii) not become ineligible under the provisions of the Act and rules made thereunder; and

iv) not failed to apply for grant of prospecting licence or mining lease, as the case may be, within a period of three months after the expiry of reconnaissance permit or prospecting licence, as the case may be, or within such further period not exceeding six months as may be extended by the State Government:

Provided that in case where the period of permit or licence had not expired before the date of lapse and the claimant has submitted the claim after the expiry of permit or licence under Clause (a) of the proviso to Sub-rule (1) of Rule 4, the condition specified in Clause (iv) shall not be applicable:

Provided further that in case where the period of permit or licence had not expired before the date of lapse and the claimant has submitted claim of the expenses incurred by it till the date of lapse under Clause (b) of the proviso to Sub-rule (1) of Rule 4, the State Government shall verify that the conditions specified in Clauses (i) to (iii) were complied with by the claimant, as far as practical, till the date of lapse and the condition specified in Clause (iv) shall not be applicable.

(2) After due verification in accordance with Sub-rule (1), and on being satisfied that claimant had the right to obtain prospecting licence followed by mining lease or mining lease, as the case may be, before the date of lapse, the State Government may forward the claim to the Reimbursement Assessment Committee along with its annexures and other relevant documents.

6. Reimbursement Assessment Committee— A Reimbursement Assessment Committee shall be formed at the State level comprising of the following members, namely—

(a) Additional Chief Secretary or Principal Secretary or Secretary in-charge of Mining and Geology of the State, as the Chairman;

(b) Deputy Director General (State Unit), Geological Survey of India;

(c) Regional Controller of Mines, Indian Bureau of Mines, of the area concerned;

(d) Representative of Finance Department of the State Government;

(e) Director in the Directorate or Department of Mining and Geology of the State Government (by whatever name called), as Member Secretary; and

(f) Additional Director, Atomic Mineral Directorate for Exploration and Research to be co-opted in case of atomic minerals.

7. Assessment of Claim by the Reimbursement Assessment Committee— (1) On receipt of claim from the State Government under Rule 5, the Reimbursement Assessment Committee shall examine the work done by the permit holder or licensee, as the case may be, in accordance with the rules for the time being in force as on the date of lapse.

(2) The examination shall also include technical evaluation of the work carried out as per the reports submitted by the permit holder or licensee, as the case may be, during the course of reconnaissance or prospecting operations undertaken in accordance with the provisions of the Act and rules framed thereunder; the necessity for carrying out the work so done; reasonability of each item and adherence to applicable extant rules.

(3) The Reimbursement Assessment Committee shall assess the reimbursement amount based on the actual

expenditure incurred by the claimant on the exploration activities and the said reimbursement amount shall not exceed the amount given in the approved schedule of charges of such authorities as specified by the Central Government:

Provided that for special studies not covered under schedule of charges, such as Aero Geophysical Survey or the like, the Reimbursement Assessment Committee may recommend appropriate reimbursement based on similar work undertaken by the Geological Survey of India or the Mineral Exploration Corporation Limited or any other Government agency.

(4) The Reimbursement Assessment Committee may seek clarification or additional information from the claimant regarding its claim, if required and shall give the claimant a reasonable opportunity of being heard in case the amount claimed is reduced or rejected by the Committee in its assessment.

(5) Simple interest shall be added in the amount assessed by the Committee at the rate of six per cent per annum from the date of submission of application for prospecting licence or mining lease, as the case may be, till date of commencement of these rules.

(6) The Reimbursement Assessment Committee shall forward to the State Government its assessment report specifying the reimbursement amount payable to the Claimant as assessed by it including the interest calculated under sub-section (5).

Payment of Reimbursement and Recoupment

8. Reimbursement— (1) On receipt of assessment report from the Reimbursement Assessment Committee, the State Government shall forward the report along with its recommendations on the same to the National Mineral Exploration Trust established under Section 9C of the Act.

(2) The entire process of verification of the claim by State Government under Rule 5, assessment by Reimbursement Assessment Committee under Rule 7 and forwarding of approved assessment report by the State Government to the Trust under Sub-rule (1) shall be completed within a period of three months from the date of receipt of the claim under rule 4.

(3) The Technical-cum-Cost Committee of the National Mineral Exploration Trust shall verify whether reimbursement amount assessed by the Reimbursement Assessment Committee is in accordance with subrule (3) of Rule 7 and finalise the reimbursement amount payable with such modification as may be required: Provided that the eligibility of the claimant as verified by the State Government under rule 5 shall be final.

(4) The National Mineral Exploration Trust may, after such verification, release the finalised amount to be reimbursed along with the interest calculated in accordance with sub-rule (5) of rule 7, in favour of the Director in the

Directorate or Department of Mining and Geology of the State Government (by whatever name called) of the State Government within three months from the receipt of assessment report from the State Government, subject to availability of fund with the Trust.

(5) The Director in the Directorate or Department of Mining and Geology of the State Government (by whatever name called) shall further release the finalised amount to the claimant within one month from the receipt of the amount from the National Mineral Exploration Trust.

9. Recoupment— (1) Notwithstanding the pendency of any claim in respect of any area, the State Government shall process for grant of mineral concessions in respect of such area in accordance with Clause (d) of Sub-section (2) of Section 10A of the Act and the rules framed thereunder.

(2) In case of auction of composite licence or mining lease in respect of the area covered under Clause (b) of Sub-section (2) of Section 10 of the Act where—

(i) notice inviting tender is issued after the date of commencement of these rules; and

(ii) notice inviting tender has been issued but the last date of submission of bids is falling after the date of commencement of these rules, the following conditions shall be considered part of the auction conditions specified in the tender document, namely—

(a) the preferred bidder shall deposit the amount reimbursed or to be reimbursed towards exploration expenditure along with the first instalment of upfront payment or, as the case may be, performance security to the State Government, if the amount has been finalised by the Technical-cum-Cost Committee of the National Mineral Exploration Trust; or

(b) the preferred bidder shall give an undertaking, in writing, to the State Government to deposit the amount to be reimbursed towards exploration expenditure with the State Government within one month of its finalisation by the Technical-cum-Cost Committee of the National Mineral Exploration Trust, if the amount is yet to be finalised;

(c) the preferred bidder shall also give an undertaking, in writing, to furnish such additional amount to be reimbursed towards exploration expenditure, which may be modified or amended by the Revisionary Authority; and

(3) In case of non-compliance of the conditions specified in Sub-rule (2), the State Government shall take action for forfeiture of first instalment of upfront payment or performance security, as the case may be, and any other action in accordance with the Mineral (Auction) Rules, 2015:

Provided that in respect of the atomic minerals where grade of such mineral is equal to or above the threshold value as specified by the Central Government in Schedule A of the Atomic Minerals Concession Rules, 2016, the

conditions mentioned in Sub-rule (2) shall be specified as pre-conditions for grant of mineral concession.

(4) On receipt of the amount reimbursed or to be reimbursed towards exploration expenditure from the preferred bidder as specified in Sub-rule (2), the State Government shall deposit the same in the National Mineral Exploration Trust Fund, before signing the lease deed or within one month of its receipt, whichever is later.

(5) In case where auction has concluded or the last date of submission of bids is over before the date of commencement of these rules, the State Government shall deposit the amount reimbursed or to be reimbursed towards exploration expenditure under these rules in the National Mineral Exploration Trust Fund from the applicable amount (auction premium) deposited by the lessee under Sub-rule (2) of Rule 13 of the Mineral (Auction) Rules, 2015.

(6) The National Mineral Exploration Trust may request for additional grants from the Central Government in the Ministry of Mines for disbursal of reimbursement under these rules.

(7) The State Government shall hand over to the preferred bidder the reports along with other proofs of exploration like preserved core, litho graphs, core photographs, drill log-book and the like, if available or any geological study report of the area and other such documents submitted by the claimant.

10. Revision— Any person aggrieved by an assessment, verification or order made by the State Government or any authority thereunder, or the Reimbursement Assessment Committee or the Technical-cum-Cost Committee of the National Mineral Exploration Trust may apply to the Revisionary Authority of the Central Government for revision of the same under Section 30 of the Act.

SCHEDULE I

Form for Submission of Claim

[See Rule 4(1)]

PART-A		
GENERAL INFORMATION		
Sl. No.	Item Detail	Particulars
(1)	(2)	(3)
1	Type of Mineral Concession: Reconnaissance Permit / Prospecting Licence Name of Holder of the Mineral Concession Legal Status of Claimant (Power of Attorney/Affidavit/Registered Deed)	
2 A	(a) Postal Address: (b) Telephone Number (Office): (c) Fax Number (Office): (d) Mobile No.: (e) Telephone Number (Residence): (f) E-Mail Id:	
	Entity Details Name PAN Number ITR Details (For the period of exploration)	
2 B	Aadhar Number GST/ Service Tax Number TIN Number Address Bank details	

PART-A GENERAL INFORMATION		
Sl. No.	Item Detail	Particulars
(1)	(2)	(3)
	Details of Mineral Concession	
	(a) State:	
	(b) District (s):	
	(c) Taluka (s):	
	(d) Village (s):	
3A	Block Name	
	Area in Ha.	
	Survey of India Toposheet Number (s):	
	Minerals	
	Block Location (Lat Long of all corner points a, b, c, d etc.)	a) Lat. -- Long---; b) Lat. -- Long---; c) Lat. -- Long---; d) Lat. -- Long---; e) Lat. --,Long --
	Administrative Details	
	Date of issue of order for grant or issue of Letter of Intent	
	Date of execution of the Reconnaissance Permit/ Prospecting Licence	
	Period of the Reconnaissance Permit/Prospecting Licence	From: To:
	Date of Renewal of the Reconnaissance Permit / Prospecting Licence, if any, and period	From: To:
	Date of Final Reconnaissance Permit/ Prospecting Licence Report Submission	
	Resource Estimated with Grade & Tonnage	
	Category of Resource (as per UNFC)	
	Recommendation by Agency	
3B	Whether an application for Grant of Prospecting Licence or mining lease to a holder of a Reconnaissance Permit or Prospecting Licence, as the case may be, has been submitted before the 12 th January, 2015 {Compliance of Subclause (i) of Section 10A(2)(b)} Remarks	
	Printed on	
	Printed by	
	Prepared By :	Checked By : Approved By :
		NAME & SIGNATURE

Note: Provide separate Part-A for the reconnaissance operations conducted under reconnaissance permit and prospecting operations conducted under prospecting licence.

PART-B								
DETAILS OF EXPLORATION ACTIVITIES								
Sr. No.	Activity	Unit	Proposed	Achieved	Unit Cost	Actual Expenditure incurred along with documentary proof	Reference/ Page No in RP/PL* Report	Remarks
1	1 Areogeophysical Studies (a) Aero Gravity (b) Aero Magnetic (c) Aero Magnetic (High Resolution) (d) Aero Electromagnetic (AEM)							
2	Remote Sensing Studies (a) (b) (c) (d)							
3	Seismic Surveys							
4	2D Seismic Reflection survey							
5	3D Seismic Reflection Survey							
6	DSRS Surveys							
7	GPR Surveys							
8	Topographical Survey	Scale: Area Covered (Sq km/hectare)						
9	Geological Mapping	Scale: Area Covered (Sq km/hectare)						
10	Surface/ Geochemical Sampling (a) Bedrock (b) Soil (c) Stream Sediment (d) Channel Sample (e) Any Others	Area Covered (sq km/ Hectare)						
11	Pitting	Nos: Excavation: CBM Samples						
12	Trenching	Nos: Excavation: CBM Samples						
13	Surface Geophysical Works Type of Survey (a) Gravity Method (b) Magnetic Method (c) Self-potential Method (d) Induced Polarisation Method (e) Electrical Resistivity v (f) Resistivity Profiling/ Imaging (g) Electro magnetic Survey (h) Magneto-Telluric (MT) (i) Any Other							

Part B (Contd).

PART-B								
DETAILS OF EXPLORATION ACTIVITIES								
Sr. No.	Activity	Unit	Proposed	Achieved	Unit Cost	Actual Expenditure incurred along with documentary proof	Reference/ Page No in RP/PL* Report	Remarks
14	Drilling							
	(a) Core	Mt.						
	(b) Non Core	Mt.						
15	Geophysical Logging							
	(a) Base Log							
	(b) SP							
	(c) Resistivity							
	(d) Dual Density							
	(e) Gamma-Gamma							
	(f) Neutron							
	(g) Caliper							
	(h) Natural Gamma							
	(i) SPR							
	(j) Focused Resistivity							
	(k) Sonic							
	(l) Temperature & Fluid Conductivity							
	(m) Deviation							
	(n) HR Acoustic Televiwer (In Borehole)							
	(o) Spectral Gamma (In Borehole)							
	(p) I.P. (In Borehole)							
	(q) Magnetic Susceptibility (In Borehole)							
	(r) Shallow Hole Temperature							
	(s) Borehole Geophysical Logging							
16	Chemical Analysis							
	(a) Wet Chemical Analysis							
	(b) AAS method							
	(c) ICP-MS/OES method							
	(d) XRF technique							
	(e) Any other method							
17	Petrological Studies							
	(a) Thin section of rock							
	(b) Polished Section							
	(c) Heavy mineral separation by liquid							
	(d) Separation of heavy minerals from stream sediment samples							
	(e) Mineralogical studies of Beach Sand Minerals (BSM) sample							
	(f) Any other							
18	EPMA / SEM Studies							
19	XRD Analysis for Identification of Minerals							
20	Sample for Beneficiation Study	Nos						

Part B (Concl'd).

PART-B								
DETAILS OF EXPLORATION ACTIVITIES								
Sr. No.	Activity	Unit	Proposed	Achieved	Unit Cost	Actual Expenditure incurred along with documentary proof	Reference/ Page No in RP/PL* Report	Remarks
21	Geotechnical Studies							
22	Report Preparation							
23	Resources Established if any with quantity, grade & category							
24	In case application was made for grant of mining lease then resources established under G2 Level and whether a prefeasibility study report establishing reserves have been submitted to the State Government\or not.							
25	Any other that the holder may wish to specify							
Prepared By :			Checked By :			Approved By :		

Note: Provide separate Part-B for the reconnaissance operations conducted under reconnaissance permit and prospecting operations conducted under prospecting licence.

PART-C			
COMPLIANCE DETAILS			
1. Compliance of Sub-clause (ii) of Section 10A (2) (b) (i.e. the permit holder or licensee has not committed any breach of the terms and conditions of the Reconnaissance Permit or the Prospecting Licence)			
(a) Compliance of Provisions of Rule 7 of Mineral Concession Rules, 1960 (Applicable for Reconnaissance Permit Holders)			
Sub-Rule / Clause	Conditions	Compliance	Remarks
7 (i)	Periodic Relinquishment of area after the completion of two years and after the completion of three years		
7 (ii)	Adherence to minimum expenditure commitment and specific physical targets specified in the grant order		
7 (iii)	Making available all data to the State Government, GSI & IBM		
7 (v)	Maintenance of accounts by the Reconnaissance Permit holder		
7 (vi)	Submission of six monthly report to the state Government (within three month of the close of the period to which it relates)		
7 (xi)	Payment of permit fees each year		
7 (2)	Reconnaissance Permit may contain such other conditions as may be imposed by the Central Government		
7 (3)	State Government may with the approval of the Central Government may impose conditions in the permit as it may think necessary in the interest of mineral development		
(b) Compliance of Provisions of Rule 14, 16 & 18 of Mineral Concession Rules, 1960 (Applicable for Prospecting Licence Holders)			
Rule/Sub-Rule/ Clause	Conditions	Compliance	Remarks
14(1)(i)	Payment of Prospecting Fee each year or part of the year		
16(1)	Submission of six monthly report to the State Government (within three month of the close of the period to which it relates)		
16(2)	Submission of full report to the State Government (within three month of the expiry or abandonment or termination of the licence) Maintenance of accounts by the Prospecting Licence holder		

Part C (Concl'd).

(c) Compliance of Provisions MCDR, 1988: Applicable to both Reconnaissance Permit and Prospecting Licence Holders			
Rule/Sub-Rule/ Clause	Due Date of Submission as per Rule	Date of Receipt in IBM	Remark
Rule 3A / 4: Schee of Reconnaissance / Scheme of Prospecting	Within 60 days from the date of execution.		
Rule 3B/5: Modification in Scheme of Reconnaissance / Modification in Scheme of Prospecting	As per requirement		
Rule 3D/7: Notice of Commencement of Reconnaissance Prospecting Operations	Within 15 days from the date of commencement of reconnaissance operations		
Rule 3E/8: First Year Report	Within 30 days after expiry of every year from the date of execution		
Rule 3E/8: Second Year Report	Within 30 days after expiry of every year from the date of execution		
Rule 3E/8: Third Year Report	Within 30 days after expiry of every year from the date of execution		

2. Compliance of Sub-clause (iii) of Section 10A (2)(b) (i.e. the permit holder or licensee has not become ineligible under the provisions of this Act)

To submit an Affidavit in Compliance of Section 5(1) of the Act.

3. Compliance of Sub-clause (iv) of Section 10A (2)(b) (i.e. the permit holder or licensee has not failed to apply for grant of prospecting licence or mining lease, as the case may be, within a period of three months after the expiry of reconnaissance permit or prospecting licence, as the case may be, or within such further period not exceeding six months as may be extended by the State Government)

To submit an affidavit in compliance of Section 5 (1) of the Act.

Approved By :

Checked By :

Prepared By :

PART-D DETAILS OF ANNEXURES			
Sl. No.	Item	Available (Yes/No)	Annexure No
	Reconnaissance Permit Application		
	Allocation Letter / Letter of Intent		
	Reconnaissance Permit Deed / Agreement with State Govt		
	Progressive Half Yearly Reports		
	Final Reconnaissance Permit Report		
	Prospecting Licence Application		
	Prospecting Licence Exploration Scheme		
	Allocation Letter / Letter of Intent		
	Prospecting Licence Deed / Agreement with State Govt		
	Progressive Reports		
	Final Prospecting Licence / Geological Report		
	Application for Mining Lease		
	Application of Converting Reconnaissance Permit to Prospecting Licence / Prospecting Licence to Mining Lease		
	Payment Receipt of Permit Fee each year		
	ITR Details (For the period of exploration)		
	Self-Certification of Claimant for Qualifying under Section 10A (2)(b) of the MMDR Act, 1957		

Prepared By :

Prepared By :

Approved By :

I. Notification No. S.O. 4038(E) dated 29th August 2022 reads 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 (QCI-NABET), the Central Government hereby notifies that M/s Maheshwari Mining Private Limited under 'Category A Exploration Agencies' as specified in the guidelines for notification of accredited private exploration agencies issued by the Government of India in the Ministry of Mines order vide 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.

2. The agency 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.

J. Notification No. S.O. 3722(E) dated 8th August 2022 reads— In pursuance of 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 M/s Karnataka State Minerals Corporation Limited [KSMCL] for the purposes of the second proviso to Sub-section (1) of

Section 4 of the said Act: Provided that the M/s Karnataka State Minerals Corporation Limited [KSMCL] shall make available the data generated by it, 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.

K. Notification No. S.O. 4596(E) dated 29th September 2022 reads— 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 order vide 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.

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	Category of Exploration Agency
1	M/s GeoExpOre Private Limited	A
2	M/s V. M. Salgaocar and Brother Private Limited	B
3	M/s Geovale Services Private Limited	A

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;
- Proposes to make efforts to harmonise taxes, levies & royalty with world benchmarks to help Private Sector.

(2) Setting up of Dedicated Mineral Rail Corridors

Dedicated mineral corridors shall be planned to facilitate transport of minerals from mining areas in hinterland along with encouraging the local evacuation networks to be built in an integrated manner.

Ministry of Railways has sanctioned construction of two dedicated freight corridors (DFC), i.e, Eastern and Western DFCs. Further, MoR has decided to prepare Detailed Project Report (DPR) for the following three new Dedicated Freight Corridors:

(i) East-Coast Corridor (Kharagpur to Vijayawada: 1115 KM)

(ii) East-West Sub-corridor

(a) (Palghar–Bhusawal–Nagpur–Kharagpur–Dankuni : 2,163 km and

(b) Rajkharsawan–Kalipahari–Andal : 195 km)

(iii) North-South Sub-corridor (Vijayawada–Nagpur–Itarsi : 975 km)

(3) Odisha Artisan Grade Stone Policy, 2021

Odisha, being a culturally rich State, has always been appreciated across the world for its rich art, cultural and artistic inheritance. In order to continue the trend, the

State Government, with a vision to ease out the supply of stones to artisans of the State, have decided to formulate Odisha Artisan Grade Stone Policy, 2021. This policy will ensure Demand-Supply Estimation, Identification of Stone source, Extraction and supply of stone to artisan users of different categories like individuals, groups, co-operatives, and will enable monitoring and supervision of stone supply to users & will also ensure actual utilisation by them. Besides, this policy will also prevent illegal artisan grade stone mining and motivate the artisan to continue their tradition in the State.

(4) Policy for long-term ore linkage

With a view to supply raw material to the State based end-user industries, the State Government have promulgated Policy for long-term ore linkage to those industries through OMC Ltd vide Notification No.1462/SM dated 17.09.2014 as amended from time to time.

In order to further streamline the implementation of the said policy, the Government approved the following further amendment to the said policy.

(i) Long-Term Linkage (LTL) buyers of OMC who are willing to invest in mechanised ore evacuation system would be permitted LTL linkage for duration of more than five years. This will facilitate ramp up of production by the OMC.

(ii) Lessees having chrome ore leases will not be allowed to participate in the national e-auction. This will help in discovery of fair market price of chrome ore, a scarce raw material.

Serial No.	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

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



3,314

No. of mining leases are in force in the country in 23 States covering an area of 3,06,398.76 hectares

72

% 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. A “mineral 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 bore holes 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 licence/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) is 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 31.3.2021 (P) indicates that 3,314 mining leases were in force in the country in 23 States covering an area of 3,06,398.76 hectares.

The statewide summary of existing mining leases as on 31st March 2019, 2020 and 2021 is detailed in (Table-1). The mineral-wise summary of existing mining leases as on 31.3.2021 (P) is furnished in Table-2.

Sectorwise distribution of mining leases as on 31.3.2021 (P) is furnished in Table-3. Area wise distribution of Leases (frequency in Hect.) as on 31.03.2021 (P) is furnished in Table-4.

Table-1: Existing Mining Leases*as on 31st March 2019, 2020 and 2021 (P)
(By States)

State	as on 31.03.2019		as on 31.03.2020		as on 31.03.2021 (P)	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
India	3527	315986.03	3437	312645.72	3314	306398.76
Andhra Pradesh	453	27703.12	403	27918.98	400	26743.81
Assam	7	889.5	7	889.5	7	889.5
Bihar	1	53.38	1	53.38	1	53.38
Chhattisgarh	183	24565.95	185	24593.89	181	25062.33
Goa	15	2226.19	15	2378.65	11	528.49
Gujarat	432	25829.83	416	26821.1	415	27535.8
Haryana	4	46.85	4	46.85	4	46.85
Himachal Pradesh	43	2468.44	42	2459.78	42	2459.78
Jammu & Kashmir**	37	2020.4	37	1984.12	37	2020.43***
Jharkhand	146	21980.87	146	21980.61	122	19902.95
Karnataka	376	39349.81	379	39116.01	313	34984.36
Kerala	8	1687.4	5	421.65	5	432.4
Madhya Pradesh	727	38246.75	702	40555.4	714	44342.37
Maharashtra	173	13938.08	169	14106.03	164	14540.58
Manipur	1	132.78	-	-	-	-
Meghalaya	22	849.34	21	789.34	21	789.34
Odisha	268	61152.36	172	55108.72	154	49587.23
Rajasthan	180	32507.4	195	33394.21	163	33561.83
Sikkim	3	96.32	3	96.32	3	96.32
Tamil Nadu	540	10048.76	464	9061.66	463	9170.16
Telangana	90	11170.19	84	10887.16	82	10485.4
Uttar Pradesh	5	3397.8	4	2960.19	4	2960.19
Uttarakhand	7	191.79	7	191.79	7	191.79
West Bengal	4	20.88	1	13.47	1	13.47

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

Source: Data received from various State Governments, Respective State Government (DGMS/DMGS etc).

** formed a new Union Territory to be known as the Union Territory of Jammu & Kashmir vide Notification No. 53, New Delhi, the 9th August, 2019/Shravana 18, Gazette 1941 (Saka)

*** Including mining lease in Ladakh (U/T).

Note:- The data received from respective regional offices of IBM have also been taken into account wherever necessary. (P): Provisional

Table-2: Existing Mining Leases* as on 31.3.2021 (P)
(By Minerals)

Sl. No.	Mineral	No. of Leases	Lease Area (ha)
1	Amethyst	2	5.83
2	Apatite	1	13.47
3	Aquamarine	1	24.29
4	Bauxite	352	26082.24
5	Borax	1	159
6	Chromite	24	7629.79
7	Copper ore	13	4198.05
8	Diamond	2	275.96
9	Emerald	1	46.32
10	Epidote	1	4.05
11	Flint stone	2	11.78
12	Fluorite	10	326.24
13	Garnet	30	176.95
14	Gold	10	6934.25
15	Graphite	38	1557.85
16	Iolite	5	61.79
17	Iron ore	359	56020.35
18	Kyanite	18	635.85
19	Lead & zinc ore	8	7098.2
20	Limeshell	22	1719.69
21	Limestone	1960	171079.05
22	Magnesite	35	2308.65
23	Manganese ore	249	14340.48
24	Marl	5	857.29
25	Moulding sand	5	28.94
26	Perlite	1	144.88
27	Rock phosphate	8	1694.01
28	Rock salt	1	8.12
29	Ruby	1	27.66
30	Sapphire	1	673.4
31	Semi-precious stones	17	276.85
32	Siliceous earth	39	271.57
33	Sillimanite	1	4.64
34	Stibnite	1	40.47
35	Tin	15	319.17
36	Vermiculite	56	892.75
37	White shale	4	146.18
38	Wollastonite	15	302.7
Total		3314	306398.76

* 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 into account wherever necessary. (P): Provisional

Table-3: Existing Mining Leases* as on 31.3.2021 (P)
(By Sectors)

Sector	No. of Leases	Percent (%)	Area (ha)	Percent (%)
Total	3314	100	306398.76	100
Public	263	7.94	85355.41	27.86
Private	3051	92.06	221043.35	72.15

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

Source: Data received from various State Governments

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

(All India)

Frequency In (ha)	No. of Leases	Lease Area (ha)
0 to 2	387	506.08
>2 to 5	888	3446.4
>5 to 10	403	2972.81
>10 to 20	369	5456.64
>20 to 50	440	14331.58
>50 to 100	254	18192.1
>100 to 200	186	26796.84
>200 to 500	212	69744.92
Above 500	175	164951.39
Total	3314	306398.76

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

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

(P): Provisional

The statewise break up of mining leases as on 31.03.2021 as reflected in Table-1 indicates that Madhya Pradesh was leading with 714 mining leases followed by Tamil Nadu (463), Gujarat (415), Andhra Pradesh (400), Karnataka (313), Chhattisgarh (181), Odisha (154), Rajasthan (163), Maharashtra (164), Jharkhand (122) and Telangana (82). These 11 States together accounted for about 96% of the total mining leases in force.

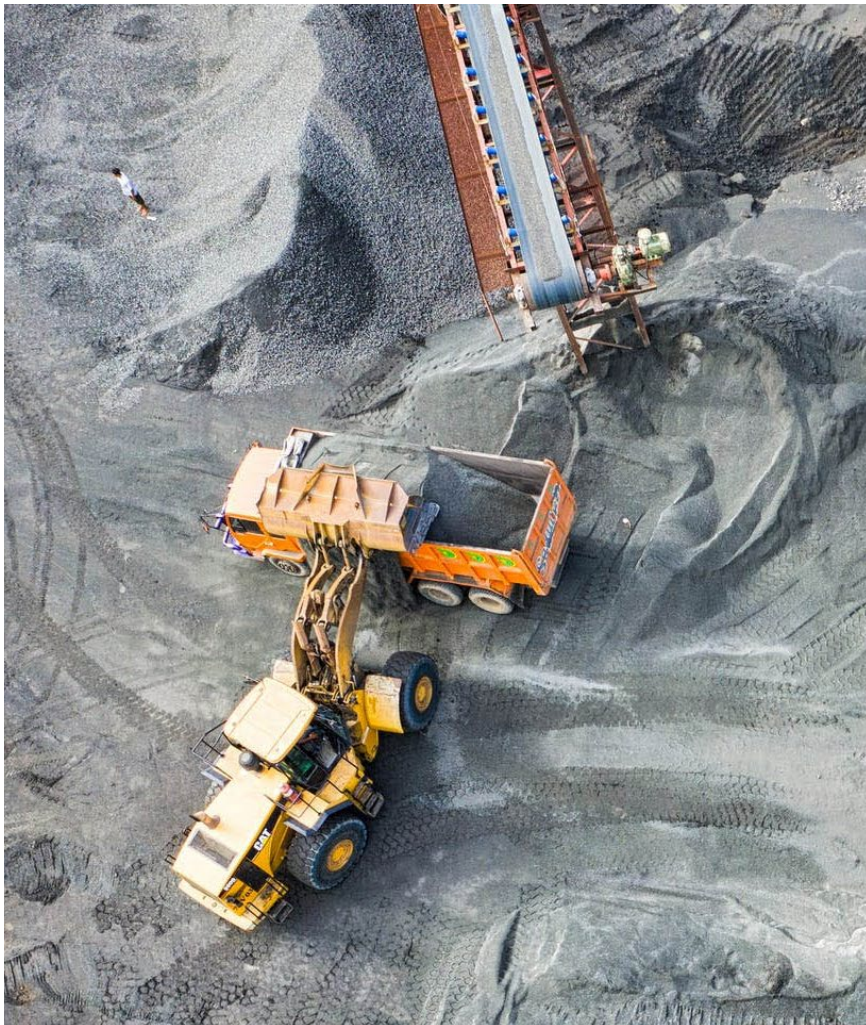
Of the total mining lease area covered by different States, Odisha accounted for 16.18% followed by Karnataka (11.41%), Madhya Pradesh (14.47%), Rajasthan (10.95%), Andhra Pradesh (18.72%), Gujarat (8.98 %), Chhattisgarh (8.17%), Jharkhand (6.49%), Maharashtra (4.74%) and Telangana (3.42%). These Ten States accounted for about 93.53% of the total mining lease area granted and the

remaining 6.47% was accounted for by the rest of the 13 States.

During 2020-21, mining leases in force were in both Private and Public Sectors which included Central and State Government Undertakings. Out of the total 3,314 mining leases in force in the country, 3,051 (92%) mining leases with an area of 2,21,043.35 hectares (72%) are in the Private Sector and the remaining 263 (8%) with an area of 85,355.41 hectares (28%) are in the Public Sector.

In the Metallic Minerals, Ferrous group of minerals includes iron ore, manganese ore, chromite, while the Non-ferrous group of minerals comprises bauxite, copper ore, lead & zinc ores, molybdenum, nickel, tin and the noble metals which include gold, silver and platinum group of metals.

4. Exploration & Development



7911.75

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

98.57

sq.km Detailed mapping were carried out by GSI, 2020-21

138016

m, Drilling were carried out by GSI, 2020-21

31,19,080

sq. km, Area were covered so far for systematic mapping bringing the total coverage to 99.27%

NATIONAL MINERAL POLICY

The Hon'ble Supreme Court in its judgement dated 2.8.2017 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 inter-ministerial body is proposed.
- Endeavours 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.

ORGANISATIONS INVOLVED

GSI, DGMs of various States, Public Sector companies like NMDC, MECL, MOIL, etc., continued their efforts in respect of surveying, mapping and exploration of new deposits and re-assessment of old deposits/mines during 2020-21.

The Oil and Natural Gas Corporation (ONGC) and Oil India Limited (OIL), the two National Oil Companies (NOC) and a few private and joint venture companies were engaged in exploration and production activities of oil and natural gas, including coal-bed methane in the country.

IBM

Indian Bureau of Mines (IBM), as a facilitator to the Mineral Industry, provides technical consultancy services for conducting feasibility studies, etc.; plays the role of National Repository

of mineral data through maintaining a databank of mines and minerals by developing advanced IT-based Mineral Information System; carries out mining research project

on need-based aspects of mining; conducts mineral beneficiation studies, including mineralogical testing and chemical analysis and prepares mineral maps.

Geographic information system and Remote sensing centre is functional in Indian Bureau of Mines since December 2018. Multimineral Lease-hold maps are now updated on Arc GIS platform. During the year 2020-21, vectorisation of 134 toposheets and plotting of 869 mining leases were completed. All maps viz lease boundaries, geology layer and toposheet were integrated for Goa and Maharashtra.

Mineral beneficiation studies were carried out by IBM to encourage value addition, conservation and development of mineral resources. During 2020- 21, 48 ore dressing investigations, 14,608 chemical analyses, and 2,290 mineralogical examinations 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. A total of 52 triggers for major minerals and 130 triggers for minor minerals have been generated in second phase and these were sent to respective State Governments for field verification. So far, unauthorised mining in 5 cases of major minerals and 9 cases of minor minerals were confirmed by the State Governments. In third phase, up to February 2021, 80 triggers were generated for major minerals and uploaded for further transmission to State Governments.

IBM undertakes preparation of National Inventory of mineral resources on a quinquennial basis. Under this programme, implementation of UNFC system was adopted replacing the earlier resource classification based on Indian system. During 2020-21, the preparation and updation of NMI as on 01.04.2020 for 20 major minerals were completed and remaining 26 minerals were in progress.

GSI

GSI pursued its most fundamental and basic mapping programme of systematic geological mapping in 2020-21 and had completed 7,911.75 sq. km of Large-scale Mapping, 98.57 sq.km detailed mapping and 1,38,016 m drilling as against previous year's achievement of 17,467.5 sq. km Large-scale Mapping, 273.4 sq. km detailed mapping and 1,32,805.7 m drilling. Out of the total mappable areas of 3.146 million sq. km of the country, 31,19,080 sq. km was covered so far by systematic mapping bringing the total coverage to 99.27%. During field season 2020-21, an item was taken up in Northern region for systematic geological mapping.

Marine and Costal Survey

During the period, Marine and Costal Survey Division carried out marine survey by R.V. Samudra Ratnakar and covered 12,064 line-km by bathymetry, 18,382 sq.km by swath bathymetry, 15,055 line-km by magnetic, 18,298 line-km by gravity, 14,458 line-km by sub-bottom profiling. An area of 3,314 sq.km was covered by systematic coverage within TW by coastal vessels, namely, R.V. Samudra Kaustubh and R.V. Samira Saudhikama and an area of 11,100 sq.km was covered by systematic coverage within EEZ. Parametric surveys were carried out within TW and covered 4,346 line-km by bathymetry, 1,466 line-km by shallow seismic, 2,755 line-km by magnetic.

The following marine geoscientific surveys were conducted during 2020-21 Field Season.

R. V. Samudra Ratnakar

SR-049: “Close grid geophysical surveys (GM) for studying the characteristics of subsurface geology, structure in the continental shelf/slope off Pondicherry, Tamil Nadu coast, Bay of Bengal.

SR-054: “Preliminary Assessment of Lime Mud in the Continental Shelf off Pentakota–Bavanapadu, Andhra Pradesh”

SR-061: “Regional search of limemud/limesand in the continental shelf off Maharashtra Coast (Gap Area Block -2)”

SR-066: “Regional exploration for Fe-Mn nodules off Lakshadweep Sea”

R. V. Samudra Shaudhikama

Cruise SD-297: “Close grid heavy mineral resource evaluation and study of sub-surface disposition of sand bodies in the inner shelf off Tuticorin in Gulf of Mannar (Area-I), Tamil Nadu coast.

SD-298: “Preliminary resource evaluation of construction grade sand and search for heavy minerals in the contiguous zone off Mangalore, Karnataka”

SD-301: “Preliminary evaluation of heavy mineral resources and sub-surface disposition of sand bodies in the inner shelf sediments off Vizinjam–Poonthura sector, within territorial waters of west coast of India, Kerala coast”

SD-302: “Multi thematic mapping of Contiguous Zone beyond Territorial water in Arabian sea off Mt. Dilli, Kerala”

SD-303: “Multi thematic mapping of Contiguous Zone beyond Territorial Waters off Bekal, Kerala”

R.V. Samudra Kaustubh

ST-282: “Close Grid Mineral Exploration for Placer Minerals within the Territorial Waters off Bavanapadu-Nuvvalarevu, Andhra Pradesh (South Block)”

ST-283: “Preliminary search for Placer Minerals and Sub-Surface Sand Body in the Territorial Waters off Karipeta, Andhra Pradesh”

ST-284: “Preliminary evaluation of placer mineral resource in the shelf area off between Port Novo and Karaikal, Tamil Nadu”

ST-285: “Geophysical (magnetic) survey within continental shelf off Kalingapatnam, Andhra Pradesh coast, Bay of Bengal”

ITEM NO-130: “Preliminary Investigation of Placer Mineral Resource in the Near Shore area off Baruva sector, North Andhra Pradesh Coast”

RP Item

RP-132: “Paleo oceanographic reconstruction using geochemical and mineralogical proxies from sediment core off Lakshadweep Sea”

RP-134: “Reckoning the phases & rate of sedimentation/ deposition of lime mud in the basins on the outer shelf of west coast of India”

RP-135: “Reconstruction of palaeo-climatic and oceanographic conditions by using geochemical and mineralogical proxies from sediment core off south eastern Arabian Sea”

R.V. Samudra Kaustubh

ST-273: “Systematic Magnetic Survey within Territorial Waters in the Shelf Area off Dalhousie Island, West Bengal”

ST-277: “Close Grid Exploration for Placer Mineral Resources in the Territorial Waters off Malud Odisha Coast”

ST-279: “Close grid exploration for placer mineral resources in the territorial waters off Gopalpur-Chatrapur, Odisha coast”

MECL

The highlights of exploration carried out by MECL during 2020-21 are summarised as below:

- 1) The Company has carried out about 6.39 lakh metres of exploratory drilling for various minerals, out of which 5.97 lakh metres were through departmental resources and about 0.43 lakh metres through outsourcing.
- 2) A total of 239 sq.km area have been covered with detailed geological mapping for various minerals in different parts of the country. Besides, 4.05 lakh metres of borehole drilling and geophysical logging also were carried out.
- 3) In laboratories, a total of 1,29,268 samples were analysed for chemical analysis and 619 samples for microscopic and petrographic studies.
- 4) A total of 36 geological reports of mineral exploration, geophysical survey, environmental & remote sensing studies for different minerals were submitted which led to addition of 10,100 million tonnes of mineral resources during the year 2020-21.
- 5) The mineral-wise details of reserves/resources estimated by MECL are as under:

- **Coal:** A total of 8,940.69 million tonnes of coal resources were established during 2020-21 in Balrampur, Korba, Raigarh, Jarekeela & Thanarghat in Chhattisgarh and Recherla & Chintalpedi in Andhra Pradesh and Umaria in Madhya Pradesh.
- **Lignite:** 431.22 million tonnes of lignite resources were established in the state of Tamil Nadu.
- **Iron Ore:** 74.33 million tonnes of iron ore resources were established in Gumla district Jharkhand, Tiffin's Barytes, Dist. Bellari, Karnataka and Sundargarh district Odisha.
- **Limestone:** 561.29 million tonnes of limestone resources were established in Unjini & Ariyalur districts in Tamil Nadu and Satna district in Madhya Pradesh.
- **Potash:** 87.19 million tonnes of Potash resources were established in Bikaner district, Rajasthan.
- **Bauxite:** 2.82 million tonnes of bauxite ore resources were established in Kabirdhan district, Chhattisgarh.
- **Manganese:** 2.68 million tonnes of manganese ore resources were established in Bolangir district, Odisha

MINERAL-WISE EXPLORATION ACTIVITIES

Petroleum and Natural Gas

A number of new initiatives have been taken to promote Exploration and Production activities in the country. A multidimensional approach has been adopted for furthering the objective of enhancing energy security of the country through increased domestic production and improved investment climate in the country. Some of the policy initiatives taken by the Government for exploration and development of oil & gas in the country are as under:

The operator can explore and produce conventional as well as unconventional hydrocarbon, such as, Coal-bed Methane (CBM), Shale, etc. under a single licence.

Opening up of India's sedimentary basins through open acreage policy will provide option for the companies for selection of Exploration blocks. They will also not be required to wait till the formal bid round is launched by the Government as the open acreage area will be available throughout the year for bidding.

Exploration will be allowed through out the contract period. One of the major restrictions under Production Sharing Contract (PSC) was regarding exploration after the completion of exploration phase. The Hydrocarbon Exploration Licencing Policy (HELP) addresses the same and allows exploration throughout the contract period.

Exploration Phase for onshore areas has been increased from 7 years to 8 years and for offshore it has been increased from 8 years to 10 years.

As part of the Government's effort to increase domestic production, Discovered Small Field (DSF) Policy was introduced for fast-tracking the monetisation of un-monetised small fields/ discoveries of National Oil Companies (NOCs) under Nomination regime and relinquished discoveries under the PSC regime. Some of the notable features of DSF bid in addition to HELP features are: (i) the inclusion of the criterion "No prior technical experience required"—this would enable ease of entry for non-E&P players; (ii) No upfront bonus; (iii) Exploration allowed during the entire contract period; and (iv) Ready availability of nearby processing facilities. DSF Bid Round-I was launched in 2016 which was a roaring success. Seeing the success of DSF Round I, DSF Round-II was launched in 2018 with 59 discoveries on offer with an in-place volume of 190 million tonnes of oil and oil equivalent gas.

During the year 2020-21, ONGC has acquired 962.42 LKM of 2D seismic data, 7,138.18 SKM of 3D seismic data and drilled 100 exploratory wells. A total of 353 development wells were drilled by NOC's and Pvt. Ltd / JV to accumulated meterage of 7,40,202 m. Majority of the wells were drilled by ONGC in its nomination areas.

During 2020-21, a cumulative of about 17,051 LKM of 2D seismic and about 9,362 SKM of 3D seismic have been acquired and 115 exploratory wells have been drilled amounting to a drilling meterage of about 344 thousand metres. The focus was on acquisition of data of offshore basins. About 55% of 2D Seismic data and 68% of 3D Seismic data acquisition were carried out in the offshore basin.

Ultimate reserves of oil and oil equivalent of gas (O+OEG) established by ONGC, OIL and Pvt./JVs are placed at 4,374.7 million tonnes. During 2020-21, accretion in ultimate reserve has been 41.61 million tonnes of O+OEG.

The area-wise development of drilling wells & meterage drilled by ONGC, OIL and private/joint ventures/NOCs are furnished in Table-1 and exploratory efforts in nomination & PSC regime by ONGC, OIL and private/joint ventures/NOCs are reflected in Table-2.

As per the Directorate General of Hydrocarbons guidelines dated 08/01/2021, declaration or announcement of discoveries for nominations fields under NOC were discontinued. Hydrocarbon discovery reporting has since been done in accordance with PRMS guidelines approved by Society of Petroleum Engineer's USA (Revised in June 2018). Accordingly, when a new discovery occur within the Contract Area submission of Format A & B would not be required by Licensee/ Lessee for review or acceptance by DGH. During the year DGH has received 13 notification of Oil & Gas discoveries from NOC/PSC/RSC operators. In addition to 3 DGH reviewed discoveries, 10 more O & G discoveries were notified by ONGC/OIL as operator, the details are furnished in Table-3.

Table-1: Area wise Development of Wells & Meterage

Drilled by ONGC, OIL & Private/ Joint Ventures/NOCs, 2020-21

Agency	Onshore		Offshore		Total	
	Wells (Numbers)	Meterage (in '000)	Wells (Numbers)	Meterage (in '000)	Wells (Numbers)	Meterage (in '000)
A. ONGC (Nomination)	252	466.186	29	73.983	281	540.169
B. OIL (Nomination)	24	59.49	-	-	24	59.490
C. Private/JVs/NOCs	40	115.177	8	25.366	48	140.543
Total	316	640.85	37	99.349	353	740.202

Source: Directorate General of Hydrocarbons Annual Report, 2020-21.

Table-2: Exploratory Efforts by ONGC, OIL & Private/Joint Ventures/NOCs, 2020-21

Agency	Onshore		Offshore		Total	
	Wells (Numbers)	Meterage (in '000)	Wells (Numbers)	Meterage (in '000)	Wells (Numbers)	Meterage (in '000)
A. ONGC (Nomination)	61	176.266	31	83.177	92	259.443
B. OIL (Nomination)	10	42.811	-	-	10	42.811
C. Private/JVs/NOCs	5	14.65	8	27.25	13	41.90
Total	76	233.744	39	110.431	115	344.175

Source: Directorate General of Hydrocarbons Annual Report, 2020-21.

Table-3: Oil & Gas Discoveries made by ONGC, OIL & Vedanta during 2020-21

Name of Basin	Well Name	Field/Block	Oil/Gas
A. Discoveries reviewed by DGH.			
Krishna–Godavari Basin	(KGD982NA-CHN-B-1)	KG-DWN-98/2	Gas
Mumbai Offshore Basin	AWEL-A-1	MB-OSN-2005/2	Gas
Rajasthan	KW-2-Updip-1	Rj-ONHP-2017/1	OIL
B. Other notified discoveries reviewed by DGH.			
AAFB–Tripura	Kunjaban-13(KUDD)	Kunjaban/KunjabanPML	Gas
AAFB–Tripura	Sundulbari-16 (SDAP)	Sundulbari/West Tripura PML	Gas
WOFF	WO-5-13	WO-5/BOFF PML	Oil & Gas
WOFF	B-126N-1	B-126N/MUKTA ML	Oil & Gas
WOFF	BS-17-1	WEST OFF BASSEIN/BS-17	Oil & Gas
WOFF	GK-28-14	GK-28/GK-28PML	Gas
Krishna–Godavari Basin	KGD982NA-R1-E-1	KG-DWN-98/2	Gas
Krishna–Godavari Basin	KGD982NA-PDM-SH-1	KG-DWN-98/2	Gas
Assam Shelf	Dinjan-1	Tinsukia PML	Gas
Krishna–Godavari Onland	Kavitam South-1(KTAC)	PML-Kavitam Onland	Gas

Source: Directorate General of Hydrocarbons, (DGH) Annual Report 2020-21.

Shale Gas

Shale Gas/Oil is a form of natural gas/Oil that remain unexpelled, unmigrated and entrapped within the pore space and fractures of a source rock (commonly, shale). During 2020-21, ONGC has drilled two exclusive shale wells (NJSGA in Cambay Basin and MDSGA in KG Basin) and one dual objective well PGAE. At present, a dual objective well, LKEAA in KG Basin is under drilling. Out of the 30 wells completed so far, across four basins viz. Cambay, KG, Cauvery and A&AA Basins, 11 were exclusive wells and 19 were dual objective wells. Indications of presence of shale oil have been recorded in some wells, i.e, JMSSGA, NSGB and NJSGA in Cambay Basin and WGSSGA

in KG Basin. In the shale well, NGSSGA (Cambay Basin), a zone encountered within the Nawagam Middle Pay (Tight Reservoir) was hydro-fractured and on activation, produced oil.

COAL

The agencies engaged in exploration for coal during 2020-21 were mainly GSI, CMPDI and DGM.

GSI

In Maharashtra, a reconnaissance survey for coal was taken up with scout drilling in Lathi–Kesurli Area Wardha Valley Coalfield, Yavatmal District. Geological mapping of

40 sq. km area on 1:25000 scale revealed brick red coloured oxidised medium grained cross bedded sandstone with vertical burrows filled up with un-oxidised yellowish sand, is exposed in the area. A total of 752.60 m drilling has been carried out. Core-logging revealed Motur Formation is characterised by greenish-grey to a variegated argillaceous dominant unit (mudstone) with interlayer sequence represented by inter-banded sandstone, devoid of economic coal, but at places thin coal/carbonaceous shale bands/streaks/cleats were observed. The Regional Barakar Coal seam has been encountered at BH no. WLK-1 from 680.67m to 701.33m with cumulative thickness of 20.66m. The total 17.25 m regional Barakar coal seam collected from borehole, apart from these, total of 10. REE samples, 05 petrographic samples and 04 coal petrographic samples were collected and sent for analysis.

In Chhattisgarh, a general exploration for coal in Jampali block, Mand-Raigarh coalfield, Raigarh district was taken up with an objective to establish the developmental pattern and continuity of the regional Barakar coal seams intersected in adjacent blocks and to assess coal resource potentiality. Exploration in Jampali block has revealed that the area is covered by sediments of Kamthi Formation and Barren Measures. Thirteen regional Barakar coal seams/ zones (Seam I to XIII, in ascending order) have been intersected in Boreholes MRJL-3, MRJL-04 & MRJL-5. Seams IV and I are the thickest which persistently intersected in all the completed boreholes. Coal exploration programme in Jampali Block, MRCE, C.G., commenced on 30.04.2019 and went on for two years, i.e, FS 2019- 20 & 2020-21. During the 2nd year, i.e, period from 1st April 2020 to 31st March, 2021, a total drilling of 2,661 m were carried out in three boreholes, these are MRJL-3 (final depth 977m), MRJL-4 (final depth 974m) and MRJL-5 (final depth 1,028m). Thirteen regional Barakar coal seams / zones (Seam I, IIL,III, IV, V, VI, VII, VIII, IX, X, XII & XIII in ascending order) were intersected between 182 m (in MRJL-03) and 1,022.61 m depth (in MRJL-05). Cumulative coal thickness of individual coal seam /zone varied from 0.68 m (Seam X, MRJL-4) to 20.24 m (Seam IV, MRJL-5), whereas borehole-wise, cumulative coal thickness of all the seams of Borehole MRJL-3 was 39.38 m, MRJL-4 was 39.68 m and MRJL-5 was 50.18 m. Seam IV was the thickest seam which was persistently intersected in the completed boreholes. Seam-IV developed in multiple splits, was intersected between the depth of 627.36 m and 686.62 m in the boreholes. Seam No I also persistently developed in two splits, which was intersected between the depths of 954.20 m and 1,022.61 m. Large-scale mapping on 1:10000 scale of 2 sq km area was carried out during this period. Coal samples from BH No. MRJL-03, 04 & 05 of 92.46 m were collected and sent for analysis. About 03 samples for Coal Petrography (CPS) and 03 for Petrological Studies (PS) were submitted. Geophysical logging was carried out in BH No. MRJL-03 & 04 with total achieved depth of 1,949.29 m.

In Chhattisgarh during a general exploration for coal in Karmagarh block, Mand-Raigarh coalfield, Raigarh

district, a total of 2,241m was drilled in three boreholes. Seven regional Barakar coal seams/zones (Seam IV to X) were intersected between the depths 555.60 m and 755.60 m. The thickness of individual coal seam/zone varied from 1.25 m (Seam IV, MRKG-6) to 16.74 m (Seam VII, MRKG-6). Besides, one local coal seam was intersected at depth of 812.45m (Seam IIL), with thickness of 0.50 m. Borehole-wise, the cumulative coal thickness of all the seams varies from 39.25 m (MRKG-7) to 52.94 m (MRKG-8). Coal seams were observed to be inter-banded in nature. A total of 823.93m geophysical logging were carried out in this block. Large-scale mapping of 3.00 sq km area on 1:10000 scale was carried out during this period. Subsurface data in the Karmagarh block 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 in Barakar Formation. 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 occurrence of two local coal seams (R-III & R-I) having cumulative thickness ranges from 0.55 m to 1.40 m.

In Madhya Pradesh a general exploration for coal in Devri block, Singrauli coalfield, Singrauli district, was taken up on 01/04/2020. During the period from 01/04/2020 to 31/03/2021, a total of 1,640.1 m were drilled in three boreholes, namely, SDR-01 & 02 (completed) drilling in SDR-03 was in progress. A total of 06 sq.km area were geologically mapped on 1:10000 scale. During the geological mapping two Formations were observed in the area which are Lower Barren measures and Upper Raniganj Formation. Devri Block was seen slightly covered by rocks of Barren measures Formation towards S and SE part and mostly covered by Raniganj Formation towards N. A total of three boreholes (SDR-01— depth: 613 m ; SDR-02— depth: 575.4m; SDR-03— depth: 451.7m) were drilled in the area. The total drilling done was 1,640.1m and a cumulative total of 75.36m coal was encountered in all the three boreholes. All the boreholes have encountered Barakar Formation. Barakar coal seams were observed to be thick and laterally persistent over the entire Devri Block. Seven coal seams (Seam-VII to I) of regional extent were identified in the area. All coal seams were intersected between 267.35 m and 555.40 m depths. The thickest coal seam in all the drilled boreholes was in seam no. VI with thickness ranging from 12.49 m (SDR- 01) to 12.94 m (SDR-03). A preliminary exploration for coal in Shivgarh Sarai (W) Sector, Singrauli coalfield, Singrauli district, Madhya Pradesh, was commenced on 01/04/2020. During Field Season 2020-21, a total of 2,289.40 m were drilled in four boreholes. A total of 24 sq. km area were geologically mapped on 1:10000 scale with objectives to (i) establish the development pattern and strike continuity of the regional Raniganj and Barakar coal seams already established in the Uphradol block and Sarai (W) Sector, and (ii) assess coal resource potentiality. Among the 3 boreholes drilled in Shivgarh Sarai (West) Sector, all boreholes commenced

from Raniganj Formation and closed within Barakar Formation. Raniganj Formation was observed to be mostly devoid of any coal seam while Barakar coal seams were thick and laterally persistent over the entire Shivgarh Sarai (W) Sector. Seven coal seams (Seam- I to VII) of regional extent and one local seam were identified in the area. All coal seams were intersected between 244.01m (SSG-4) and 535.59 m (SSG-4) with individual seam thickness varying from less than a meter to 3.36m (SSG-02). A total of 27.55 m coal core sample were collected and sent for chemical analysis.

A preliminary exploration for coal in Sagoniya Sector, PENCH Valley Coalfield, Chhindwara district M.P. was taken up during FS 2019-21 for two years. A total of 4,054.75m were drilled in eight boreholes. An area of 28 sq km was mapped on 1:10000 scale and geophysical borehole logging of 2,687.77 m was carried out. All boreholes encounter Barakar Formation (29m – 56m) within a depth range from 307.80 m to 644.10 m. Cumulative thickness of coal (I, II, III, IV and V in descending order) varied from 3.89 m to 15.43 m. Sub-surface data depicts that thickness of Lower Gondwana strata, particularly, Barakar Formation, was observed to be increasing towards west and northwestern part of the sector.

In Bihar, during G2 stage Gondwana Coal exploration under thick Gangetic alluvium in Lakshmiपुर North Block, northern extension of Hura Coalfield, Rajmahal Master Basin, Bhagalpur district, a total of 7 sq. km area were covered by LSM with 3,724.50 m of drilling in six boreholes (BRRBLN- 7 to 12). The sub-surface data reveals the presence of thick coal seam-bearing Barakar Formation under strata of Dubrajpur Formation which was seen further overlain by younger Rajmahal Formation and Alluvium at the top. Alluvium ranged in thickness from 66.00 m to 108.10 m. Rajmahal Formation thickness varies from 1.80 m and 21.00 m. Dubrajpur Formation was intersected only in one borehole which had thickness of 51.50 m. It is further overlain by coal-bearing Barakar Formation with thickness ranging from 319.90 m to 675.60 m and comprising sandstone, shale, siltstone, carbonaceous shale and coal. Basement is intersected in one borehole for 8.30 m. The cumulative coal thickness in individual borehole varied from 46.40 m (BRRBLN-8) to 79.15 m (BRRBLN-10) with maximum of 32 coal seam sections (BRRBLN-9) and thickest seam section being 23.05m (BRRBLN-10) at a roof depth of 629.15 m. Four coal seam zones (Zone-A to D in ascending order) of varying thickness from 8.85 m (Zone-A,) to 145.45 m (Zone-B,) were intersected within depth range of 101.75 m to 744.90 m.

A general exploration for Gondwana coal under the cover of younger formations in Hatmarwa Block, Northern Extension of Hura Coalfield, Rajmahal Group of Coalfields, Bhagalpur district, Bihar involved a total cumulative drilling of 3,465 m. in four boreholes along with 4 sq km of Large-scale mapping. The sub-surface data reveals occurrence of Barakar Formation of appreciable

thickness under the cover of younger Infratrappean and Alluvium. The entire area was observed to be covered by the Alluvium resting over the uneven surface of Rajmahal Formation. Alluvium ranged in thickness from 5.30 m to 62.30 m. The underlying Rajmahal trap was with thickness ranging between 58.60 m and 151.10 m. It was further overlain by coal bearing Barakar Formation with thickness ranging from 630.30 m to 824 m and comprising sandstone, shale, carbonaceous shale and coal. The total cumulative coal thickness encountered in four boreholes was 425.45 m which is varied from 98.35 m to 117.50 m with four regionally co-relatable coal seam zones (A to D) in ascending order within the depth range from 206.80 m to 960.40 m. The thickest seam section of 26.40m occurred at roof depth of 673.20 m.

In West Bengal & Jharkhand during general exploration for Gondwana coal in Aturia Block in the trap covered area of Birbhum–Brahmani Basin, Rajmahal group of Coalfields, Birbhum, West Bengal and Dumka district, Jharkhand, a total of 2,210.20m of drilling were completed in five boreholes along with Large Scale Mapping of 5 sq. km area. The sub-surface data revealed the occurrence of coal-bearing Barakar Formation of appreciable thickness under the cover of younger Dubrajpur Formation. The maximum thickness of Alluvium, Rajmahal Formation, Dubrajpur Formation, Barakar Formation, Talchir Formation and Basement intersected in boreholes are 7.00 m, 187.60 m, 7.20 m, 400.05 m, 34.10 m and 4.50 m, respectively. Four regionally co-relatable coal seam zones (I to IV) in ascending order have been recorded in this block. The total cumulative coal thickness of 533.30 m was encountered in 11 boreholes from which 226.60 m were achieved during 2020-21. The coal seam intersected was at a depth range of 97.10 m to 451.60 m. The thickest coal seam section of 23.15 m was intersected at a roof depth of 276.85 m in one borehole. The thickness of individual coal seam zones varied from 4.50 m (Zone-I) to 62.05 m (Zone-II).

In Jharkhand, reconnaissance survey for Gondwana coal in Chandangaria block was taken up in the trap covered area of Brahmani Basin, Rajmahal group of Coalfields, Dumka district. Large-Scale Mapping covering an area of 6 sq km was completed.

In Odisha, during general exploration for coal in Badibahal Block Ib- River Coalfield, Sundargarh District, an area of 3 sq km was covered by Large- scale Mapping with 3,933.90 m drilling in 5 boreholes and geophysical logging of 1,644.80 m. Coal samples of 574.08 m were collected. Badibahal block is occupied by the lithounits of Kamthi and Raniganj Formations. In the boreholes, rocks of Raniganj Formation, Barren Measures, Barakar Formation, Talchir Formation and Basement have been intersected. The exploration work has established the occurrence and continuity of three regional coal seam- zones of Raniganj Formation, i.e, R-III, R-II & R-I and four regional coal seam zones of Barakar Formation, i.e, Parkhani, Lajkura, Rampur and Ib (from top to bottom). The graphic lithologs

of the boreholes depict the occurrence of coal seam zones of Raniganj Formation within the depth ranging from 11.49 m to 102.75 m and that of Barakar Formation between 293.17 m (Parkhani) and 804.28 m (Ib) depth. Cumulative coal thickness of Raniganj coal seam intersected in boreholes varied from 6.15 m to 18.28 m. Cumulative coal thickness of Parkhani, Lajkura, Rampur and Ib seam zone varied from 7.99 m to 10.43 m, 23.62 m to 33.63 m, 45.65 to 65.34 m and 5.14 m to 20.38 m, respectively. Rampur seam zone is the thickest among the Barakar coal seam zones. The extension of Barakar and Raniganj coal seams was established for about 2.8 km along strike and 2 km along down dip direction based on the sub-surface data. During general exploration for coal in Bagbarhi Block, Ib-River Coalfield, Sundargarh District, a total of 3,596.65 m drilling was carried out in 6 boreholes along with Large-Scale Mapping of 4 sq km and geophysical logging of 1,478 m. Coal samples of 364.58 m from six boreholes, 20. REE samples and 5 Coal Petrographic samples were collected. The occurrence and continuity of two regional coal seam zones of Raniganj Formation, i.e. R-II & R-I and four regional coal seam zones of Barakar Formation, i.e. Parkhani, Lajkura, Rampur and Ib (from top to bottom) were established. Sub-surface data revealed the occurrence of coal seam zones of Raniganj Formation within the depth ranging from 6m R-II to 81.67 m R-I) and that of Barakar Formation from 135.60 m (Parkhani) to 834.1m (Ib) depth. Cumulative coal thickness of R-II and R-I intersected in boreholes varied from 2.47m (R-II) to 3.64 m (R-II) and from 1.18 m (R-I) to 4.91 m (R-I), however, cumulative coal thickness of Raniganj coal seam varied from 1.94 m to 5.09 m. Cumulative coal thickness of Parkhani, Lajkura, Rampur and Ib seam zone varied from 3.01 m to 8.62 m, 14.6 m to 27.49 m, 35.86 m to 62.3 m and 1.50 m to 5.74 m respectively. Rampur seam zone was the thickest among the Barakar coal seam zones. The extension of Barakar and Raniganj coal seams was established for about 3 km along strike and 2.5 km along down dip direction. During general exploration for coal in Kuanrkella Block, Ib- River Coalfield, Sundargarh District, Odisha, a total of 2,744.90 m was drilled in 4 boreholes. Coal samples of 263 m were collected from four boreholes. Large-scale mapping of 4 sq km and geophysical logging of 613 m was carried out. Data accrued from mapping and drilling revealed that the study area was occupied by Raniganj Formation on the surface whereas in the boreholes lithounits of Raniganj Formation (Max: 110.00 m), Barren Measures (Max: 233 m), Barakar Formation (Max: 520.50m), Talchir Formation (Max: 15.20m) and basement rock (Max: 2.75 m) were intersected successively from top to bottom. The exploration work has established the occurrence and continuity of three regional coal seam zones of Raniganj Formation, i.e. R-III, R-II & R-I and four regional coal seam zones of Barakar Formation, i.e. Parkhani, Lajkura, Rampur and Ib (from top to bottom). Raniganj coal seams occur within the depth ranging from 8.90 m to 87.65 m. Cumulative thicknesses of Raniganj coal seam intersected in boreholes vary from 0.73m to 7.74. Likewise, Barakar coal seam zones occurred within depth 253.52 m

(Parkhani,) to 823.26 m (Ib). Cumulative coal thickness of Barakar coal seam zones, i.e. Parkhani, Lajkura, Rampur and Ib intersected in different boreholes varied from 79.43 m to 124.65 m. Rampur seam zone was the thickest among the Barakar coal seam zones and hence, is important from coal resource point of view. The extension of Barakar and Raniganj coal seams was established for about 3 km along strike and 2.5 km along down dip direction based on the sub-surface data. A general exploration for coal carried out in Taparaia Block, Ib- River Coalfield, Sundargarh District, Odisha, that comprised a total of 4,334m drilling in 6 boreholes, collection of coal samples of 302.96 m from six boreholes and large- scale mapping of 7 sq km and geophysical logging of 1,615 m. Taparia Block was occupied by Raniganj and Barren Measure Formations on the surface whereas in the borehole lithounits of Kamthi, Raniganj, Barren Measures, Barakar, Talchir and Basement were intersected. Kamthi Formation was observed to be composed of reddish coloured, moderate to highly ferruginous, medium to coarse-grained, trough cross stratified sandstone. Raniganj Formation constituted fine to medium-grained, well- sorted planar to trough cross bedded sandstone, siltstone, shale with regional coal seams. Barren Measures was observed to be devoid of coal seams. Barakar Formation was composed of thick coal seam zones and other rock types. Six boreholes were drilled in Taparia Block. Three regional coal seam zones within Raniganj Formation (R-III, R-II & R-I in ascending order) were intersected within the depth range of 17.83 m (R-III) and 194.87m (R- I). Maximum cumulative thickness of Raniganj coal seam recorded was to 6.16 m. Four regional coal seam zones within Barakar Formation (Ib, Rampur, Lajkura and Parkhani in ascending order) were intersected in this Block within the depth range of 253.05 m (Parkhani, IBTP- 4) to 869.76 m (Ib, IBTP-3). Cumulative thickness of Barakar coal seam zones varied from 59.30 m to 81.67 m. Seam zones, R-I and Lajkura were the most important coal seam zones of Raniganj and Barakar formations respectively for their thickness and regional persistency. Rampur seam zone was the thickest among the Barakar coal seam zones and hence, is important from coal resource point of view. The exploration work established the continuity of regional coal seam zones of Raniganj and Barakar Formations to about 1.6 km along strike and 2.5 km along dip direction.

A general exploration for coal was taken up in Rajanpal Block, Talcher Coalfield, Angul District, Odisha. Rajanpal Block covers an area of about 4 sq.km. One borehole has been completed and one borehole (TRJ-2) is in progress. The lithounits of Kamthi Formation (max thickness 379.10 m), Barren Measures Formation (max thickness: 143.25 m) and Barakar Formation (Max thickness : 375.00 m) were intersected in the borehole.

Seven regional coal seam zones were intersected at depth ranges from 460.35 m to 849.20 m in Barakar Formation. Boreholewise cumulative coal thickness varied from 51.25 m to 63.95 m. Sub-surface data of the block and adjoining area suggests that the cumulative coal thickness gradually increased from south to north direction. Coal

seam zone III was also intersected in four major split section from bottom to top within the depth range from 646.95 m to 741.10 m. Seam zone IIIM was observed to be the thickest within Seam zone III with cumulative coal thickness of 10.00m. Seam zone IIIT was observed to be successively overlain by Seam zone VI & VIII and IX respectively. The Seam zone IX was intersected at the depth range from 524.60 m to 696.60 m and recored the maximum thickest seam within Barakar Formation in Khandanal block. Seam zone IX occurred in three split sections with cumulative coal split thickness of 26.30 m. Seam zone IX was observed to be successively overlain by Seam zone X and Seam zone XI respectively. Cumulative coal thickness of Seam zone X and Seam zone XI varied from 1.55 m to 3.25 m and 3.00 m to 9.00 m respectively. Exploration data in Rajanpal Block revealed that the entire coal horizon was found to be restricted within Barakar Formation with overburden thickness varying from 460.35 m to 566.05 m and continuity of Barakar coal seam zones was established to over 1.1 km along strike direction and 2.00 km along dip direction.

In Telangana, during general exploration for coal in Durgam Gutta Block in the southeastern part of the main basin of Godavari Valley Coalfield, Bhadradi-Kothagudem District, large-scale mapping of 2.85 sq. km on 1: 10000 scale was completed. The Barakar Formation was mainly exposed along the nala sections within the Block area. A total of 1,286 m drilling were completed in 4 boreholes along with Geophysical logging done in three boreholes. All the boreholes were started from Barakar Formation and three Barakar Coal Seams (No. I Seam, Seam C and Thick Seam) were intersected between 20.06 m and 356.29 m. Maximum coal seams were intersected in Borehole TBKD-8 (16.29m). A total of 3,280m drilling was achieved in nine boreholes since commencement of drilling. A general exploration for coal in Durgam Gutta North Block in the southeastern part of the main basin of Godavari Valley Coalfield, Bhadradi-Kothagudem District, Telangana was also carried out during FS 2020-21 (as continuation of FS 2019-20). During the period, a total of 2,238 m drilling were achieved in four boreholes, after intersecting Lower Kamthi and all the Barakar coal seams. Geophysical borehole logging of 1,629.65 m was

done in three boreholes. The mapped areas consisted of Barren Measures and Lower Kamthi Formations of Lower Gondwana sediments. However, the litho-assemblages of Lower Kamthi, Barren Measures, Barakar and Talchir Formations were established from the surface and sub-surface (borehole data of present block and adjacent blocks) data.

CMPDI

During 2020-21, CMPDI continued its coal exploration activities mainly in CIL and Non-CIL/Captive Mining Blocks. Exploration in CIL blocks was taken up to cater to the needs of the project planning/production support needs of subsidiaries of CIL; whereas, exploration in Non-CIL/Captive Mining Blocks was undertaken to facilitate allotment of coal blocks to prospective entrepreneurs. A total of 160 to 180 drills were deployed in 2020-21, out of which 71 drills were departmental drills.

CMPDI deployed its departmental resources for detailed exploration of CIL/Non-CIL blocks, whereas State Government of Odisha deployed resources in CIL blocks only. Besides, eleven other contractual agencies have also deployed resources for detailed drilling/exploration in CIL/Non-CIL blocks.

In 2020-21, CMPDI and its contractual agencies took up exploratory drilling in 133 blocks/mines spread over 23 coalfields in 8 States. Out of 133 blocks/mines, 55 were Non-CIL/Consultancy /R & D blocks and 63 CIL blocks/mines. Departmental drills of CMPDI were employed for exploratory drilling in 72 blocks/mines, whereas, contractual agencies undertook drilling in 61 blocks/mines. CMPDI extended its technical supervision in promotional/NMET exploration work undertaken by MECL in Coal Sector (CIL areas) in 8 blocks. DGM, Nagaland, has also carried out exploration in three blocks for regional drilling in Coal Sector.

A total of about 12.48 lakh metres of exploratory drilling were carried out by CMPDI in 2020-21 of which deployment of departmental resources accounted for 4.85 lakh m while outsourcing involved 7.63 lakh m mainly from State Governments/MECL/Tendering (CIL/Non-CIL blocks). Details of exploratory drilling carried out by CMPDI in 2020-21 are given in Table - 4.

Table-4: Exploratory Drilling by CMPDI (Departmental and Outsourcing) in 2020-21

Sl. No.	Agency	Target (lakh m)	Exploratory drilling achieved (lakh m)	Achieved (%)
1.	Departmental	4.88	4.85	99
2.	Outsourcing			
	i) State Govts.	0.04	0.01	25
	ii) MECL (MoU)	43.77	.99	132
	iii) Tendering (CIL/Non-CIL Blocks)	2.31	2.63	114
	Total	11.00	12.48	113

DGM Odisha

The State Directorate took up a G2 level exploration for coal in IB vally, Jharsuguda district. A total of 3 boreholes

were drilled to a cumulative depth of 1,257.0 m and 261.29 m of coal were intercepted so far.

Lignite

GSI

The investigation details for lignite carried out by GSI during 2020-21 are as below:

In Tamil Nadu, a preliminary exploration for Lignite in Chittarkottai Sector, Ramnad sub-basin, Ramanathapuram district, was continued in 2020-21. During 2020-21, a total of five boreholes were drilled and three boreholes were under progress. Lignite seams were intersected in all the twelve boreholes between 403 m to 451.00 m and individual seam thickness varying from 1.4 to 12 m with cumulative thickness varies from 3.2 to 12.70 m. Since initiation of the project a strike continuity of single regionally persistent lignite seam was established of about 8 km length with thickness varying from 3.2 to 12.70 m. Band by band analysis of 46 lignite samples from 09 boreholes indicated that 7 samples were of in Grade A category with Calorific value ranging from 3,001 cal/kg to 3,166 cal/kg; 22 samples were of Grade B category with Calorific value ranging from 2,010 Kcal/kg to 2,859 cal/kg; and 17 samples were of Grade C category with Calorific value ranging from 1,599 cal/kg to 1,994 cal/kg. A G3 Stage exploration for lignite in Tiruppullani Sector, Ramnad sub-basin, Ramanathapuram district was taken up in field season 2020-21 over an area of about 25 sq. km. Drilling was initiated in the study area with expectations to intersect lignite at a depth of 550–600 m in the borehole.

In Rajasthan, preliminary exploration for lignite was taken up in Punam Singh ki Dhani Sector, Palana basin, Jaisalmer district. A total of 28 boreholes were planned on 800 m grid spacing in the area. During 2020-21, a total of 14 boreholes were drilled to a cumulative depth of 2,585 m. A total of 2,475 m of Geophysical borehole logging were carried out in 14 boreholes. One lignite seam zone was intersected in all the 14 boreholes drilled with thickness ranging from 4.40 m to 0.80 m at a depth range between 107m and 155.50 m.

DGM, Rajasthan (Lignite)

The exploration work to explore new workable deposit of Lignite near village Diyatara, tehsil Kolayat, district Bikaner was started in 2013-14. So far, cumulative drilling of 11,153.50 m in 61 boreholes was completed and an average of 6.07 m thickness lignite/carb clay was established. The progressive lignite reserves of 28.33 million tonnes and progressive carb clay resources of 20.87 million tonnes were estimated in the area.

Gujarat Mineral Development Corp. Ltd

An exploration work in Tadkeshwar lignite mine. Surat district, Gujarat was taken up to prove existence of lignite in the study area. A total of 19 boreholes were drilled.

In Matanomadh lignite mine, Kachchh district, a total of 64 boreholes were drilled to a cumulative depth of 3,152.8 m to know the existence of lignite and estimate the reserves in the mine area. About 3.7 million tonnes of lignite resources were estimated in the study area. During exploration in Surkha(N) lignite mine (3,672Ha), village Tagadi, Malpar post office, Bhavnagar district, a total of 104 boreholes were drilled to a cumulative depth of 1,675.0 m. Drilling was carried out to establish Lignite boundary, etc. The total reserves varying in block-A was estimated at about 114.72 million tonnes.

Rajasthan State Mines & Minerals Limited (RSMML)

In Kasnau–Matasukh lignite mine, Nagaur district, Rajasthan, an additional of 12 boreholes were drilled to a cumulative depth of 1,260 m and 58 samples were collected. Resources re-estimated at about 29.56 million tonnes.

Non-ferrous Metals

Base Metals

GSI and HZL conducted investigations for copper, lead and zinc ores in different parts of the country during 2020-21.

GSI

The details of exploration activities carried out for base metal by GSI during 2020-21 are furnished in Table-5

Hindustan Zinc Limited

A gross resource addition of 61.9 million tonnes with contained metal of 3.1 million tonnes has been reported by the company during exploration programme 2020-21.

Several new target areas having potential to increase reserves & resources (R&R) in the mining leases has been identified. Across all the sites, HZL has successfully completed 107.7 km of surface drilling and 248.7 km of underground drilling during the year to add new resources and for in upgrading resources to reserves.

Hindustan Zinc's Reserves at the end of financial year 2021 were reported to be 150 million tonnes and Resources amounted to 298 million tonnes. The contained metal in ore reserves comprised of 9.2 million tonnes of zinc, 2.6 million tonnes of lead and 295.5 million oz of silver while mineral resources contained 14.9 million tonnes of zinc, 6.3 million tonnes of lead and 618.7 million oz of silver.

Table-5: Exploration for Base Metals (Copper, Lead & Zinc) by GSI, 2020-21

State/District	Name of block	Details of exploration	Results
Maharashtra			
Gondia	Palasgaon–Murdoli	Mapping & Sampling	Reconnaissance survey for base metal mineralisation in Palasgaon–Murdoli area did not show any surface indication of mineralisation within the quartz veins except some ferruginisation of quartz veins. Preliminary data pertaining to geochemical studies indicated that most of the samples from the Palasgaon Murdoli quartz vein showed Cu value from 20 to 350 ppm, Pb from 20 to 520 ppm and Zn from 20 to 460 ppm which in turn indicated low incidence of sporadic base metal mineralisation. None of the samples showed promising values of Cu mineralisation.

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
Chandrapur	Shirpur Motegaon	Mapping & Sampling	Reconnaissance survey for copper and associated mineralisation carried out in Shirpur Motegaon area, Chandrapur District, mainly involved 100 km ² of large-scale mapping on (1:12500 scale), systematic bedrock sampling, soil sampling and pitting, trenching; along with petrographic and minerographic studies. Shirpur Motegaon area falls on the northern most extension of the Thanewasna shear zone. Three major quartz veins have been mapped in the block. The Motegaon quartz vein was exposed intermittently over a length of 1.3 km with width varying from 5m to about 25 m. Reddish-brown iron oxide stains were observed along with malachite stains and specks of chalcopyrite and bornite. Analytical results of bed-rock sampling and trench sampling of Motegaon quartz vein indicated copper values ranging from 10 ppm to 390 ppm. The Shirpur quartz vein extended up to 800 m in length with width varying from 8 m to 30 m. Specks of pyrite were noticed in Shirpur quartz vein in its central part. The Aregaon quartz vein showed profuse secondary sulphide mineralisation over its entire length in the form of malachite, brochantite, covellite and bornite. Analytical results of bedrock and trench samples and trench sampling of Motegaon quartz vein indicated copper values ranging from 10 ppm to 390 ppm.
Amgaon, Nagpur,	Amgaon block	Mapping & Sampling	Reconnaissance survey for base metal mineralisation carried out in Amgaon block area involved large-scale geological mapping (1:12500 scale) of 100 sq. km along with collection of geochemical and petrological samples, and samples for other laboratory studies to ascertain the mineralisation potentiality. Two prominent quartz reefs were observed to be present in the Amgaon block. Near village Amgaon, the quartz reef was intruded along a brittle shear zone and was discontinuously exposed with a cumulative strike length of over 1.1 km along the varying width ranging from 20 to 60 m. The base metal mineralisation is closely associated with the younger intrusive body of quartz reef. Milky white to brown and grey quartz reef was found to be highly oxidised and ferruginous also hydrothermally altered. The box work, gossanisation and limonitic activities were some common features observed over the reef. Another prominent quartz reef was exposed near village Chikhali to a cumulative strike length of 800m and 60-80 m width. The reef was observed to be silicified and brecciated but devoid of any base metal mineralisation. The sampling was done with collection of bedrock samples (n=60), channel samples (n=50) pit and trench samples (n=50), and soil samples (n=28) along with petrological and ore samples. The analytical results of bedrock samples of Amgaon quartz reef showed values of copper from 20 to 270 ppm (avg. =123 ppm); lead values from 60 to 2900 ppm (avg. =583 ppm), zinc values from 10 to 1800 ppm (avg.=273 ppm) and silver values from >1 to 3 ppm. The gold values in BRS were found to be ranging from >50 to 110 ppb. The analytical results of BRS samples from Chikhli quartz reef and quartz vein near Nakshi did not show any significant value of base metal mineralisation. Two samples of banded magnetite grunerite quartzite showed 1ppm silver. The chemical analysis of channel samples from Amgaon quartz reef showed copper values varying from 40 to 500 ppm (avg. =131 ppm); lead from 0.01% to 0.26% (avg. =0.12%), zinc from 10 to 2,000 ppm (avg. =421ppm), and silver from >1 to 4ppm. The soil samples showed copper values ranging from 10 to 320 ppm (avg. =129 ppm); lead from 40 to 520 ppm (avg. =258 ppm), zinc from 40 to 1,000ppm (avg.=232 ppm), and silver from >1 to 3 ppm. The gold values in soil samples were ranging from >50 to 155 ppb. Analytical results pitting and trenching samples (n=40) showed the copper value ranging from 20 to 110 ppm (avg. =53 ppm); lead from 30 to 750 ppm (avg. =205 ppm), zinc from 70 to 360 ppm (avg. =123 ppm), silver from >1 to 1 ppm and gold values >50 ppb. The overall study of quartz reef and the analytical results indicated that the reef was partially mineralised but not significant economically.
Madhya Pradesh			
Dewas	Burara-Khubgaon-Mawasa-Kundgaoni	Sampling	During Reconnaissance Survey for copper mineralisation in the area, occurrence of copper and associated mineralisation was observed within quartz vein in the form of malachite, chalcopyrite, pyrite and galena near Village Burara and Village Nawalgaon. BRS sample collected from bouldary outcrop of quartz vein in Burara area showed copper values up to 3,045 ppm and sample collected from quartz vein in Nawalgaon area showed up to 440 ppm of copper.

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
Chhindwara	Kevlari, Mankughati	Mapping & Drilling	Reconnaissance survey for base metal and associated mineralisation around Kevlari, Village Mankughati was carried out. The mapped area was characterised by small scale discrete shear zone identified by shear sense indicator viz; tensional cracks, etc. The shear zone was observed to be exposed in discrete pockets in and around Kevlari–Mankughati area. Sporadic specks of pyrite, galena and arsenopyrite were observed in quartz veins in a well dump near southeast of Tandri, north of Kamtha, northwest of Malni, north of Mankughati area.
Gwalior	Bhaggeh, Lakhnauti and Ainti	-	During preliminary exploration for copper and associated mineralisation around Bhaggeh, Lakhnauti and Ainti area, detailed mapping of 1.6 sq km area on 1:2000 scale along with drilling of 1,200 m in 14 boreholes, was being carried out with an objective to access the copper and its associated mineralisation. A total of five boreholes were drilled (for intersection of mineralisation at 60 m vertical depth) with the strike spacing of 200 m in Lakhnauti area and 300m in Ainti area covering the unexplored area in central and north-eastern part of the block. A total of 666.00 m drilling meterage were achieved.
Chhattarpur	Mahuajhala- Amrauniya	Mapping, Drilling & Sampling	<p>During reconnaissance survey for base metal and associated mineralisation in Mahuajhala–Amrauniya area, a large-scale mapping of 100 sq km on 1:12500 scale was carried out. Based on the complete analytical results of the core samples received for Borehole no. MPBLK-01, a 5.5 m zone of mineralisation was intersected at 54 m along the borehole having an average value of 2,079.5 ppm Cu. Sulphide mineralisation which is manifested in the form of specks, stringers and disseminations of chalcopyrite and covellite was observed in all 05 boreholes. The area showed evidences for base metal mineralisation especially for copper mineralisation. Speks of molybdenum and arsenopyrite, associated with alterations were found in granite and along the quartz veins. Copper minerals found in the area are mainly chalcopyrite, malachite, azurite, bornite, chrysocolla, chalcocite and covellite along with arsenopyrite, molybdenum and pyrite. Mineralisation in the area was sporadic and in the form of dissemination.</p> <p>The chemical analysis of bedrock samples and PGS samples for base metal analysis indicated copper values ranging from 175 ppm to 1,785 ppm.</p>
Chhattisgarh			
Mahasamund and Raigarh	Chhirrabhara- Potapara	Mapping & Sampling	<p>During reconnaissance survey to search for mineralisation of base metal and associated elements in Chhirrabhara–Potapara area, large-scale mapping was carried out in an area of 100 sq km on 1:12500 scale. The available analytical value indicated presence of anomalous molybdenite and Pb mineralisation within smoky quartz vein. Three mineralised zones were identified, i.e. Zone-I (near village Kotendarha), Zone-II (near village Bichhiya) and Zone-III (near village Kapudih) based on the available chemical analysis data. Sample nos. CP/BRS/4 & CP/BRS/117 showed maximum value of molybdenum (950.41 and 1.210 ppm respectively) from Smoky Quartz vein collected within Dongargarh granite near village Sagarпали. The data statistics showed variation, between the minimum and maximum value as 0.85 ppm to 1,210 ppm.</p> <p>The surface indications of mineralisation were mostly confined within smoky quartz vein within Dongargarh Granite and along the alteration zone within granite. Quartz vein 50-60 m thick fine-grained (occasionally rich in fresh sulphide) has been identified within Dongargarh Granite. Presence of molybdenite was initially confirmed by SEM- EDS study and under Stereozoom microscope. Secondary smoky quartz veinlets in contact with alkali feldspar granite were seen as the carrier of molybdenite. Occurrence of molybdenite was correlated with the Mo anomaly map of the area. Molybdenum value ranged from 145–1,210 ppm. Based on the anomalous values of molybdenum in BRS samples, two blocks were demarcated.</p>

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
Surajpur & Balrampur	Toni-Kadaura block,	Mapping, pitting, Trenching & Sampling	Reconnaissance survey for base metal and associated mineralisation were carried out in Toni-Kadaura block, involved large-scale mapping of 100 sq. km area on 1:12500 scale. The oxidised zone was found to occur in curvilinear pattern extending along NE (3.3 km) and EW (2.9 km) trending ridges in the east-central part of the study area with variable width of 200 m in SW to 470 m in NW part. Sulphide dominantly pyrite of up to 1cm size occurs in oxidised zone along foliation plane. Occurrence of sphalerite, galena and chalcopyrite of sporadic nature also was observed. Pitting/ trenching of 52.6 cu.m was carried out and 50 pit/trench samples were submitted for analysis along with 111 bedrock samples, 22 petrochemical samples and 50 stream sediment samples. Analytical results of stream sediment samples near oxidised zone showed anomalous value of tungsten up to 555.42 ppm. Out of 111 BRS samples, 67 sample data were received so far for base metal and some other elements. The maximum value of Zn of 0.14% and Pb at 0.19% occurred in the study area. The concentration of Ti varied from 591 to 7,343 ppm. Nb with highest value of 209.87 ppm, Zr with highest value of 1,937 ppm, and Nd with highest value of 392.55 ppm, V with a value of 509 ppm were noted in the study area.
Jharkhand			
East Singhbhum District	Jamshol-Kokpara Block	Mapping & Sampling	During reconnaissance survey for copper, gold and associated minerals in Jamshol-Kokpara Block, an area of 100 sq. km was mapped on 1:12500 scale beside collection of bedrock samples, pitting and trenching samples, stream sediment and soil samples for chemical analysis. The indicators of mineralisation were ferruginous alteration, limonite-goethite alteration in weathered metabasic rock in Village Rangamatiya, tiny grains of chalcopyrite dispersed along with pits, vugs and boxworks within quartz-muscovite-biotite schist near Village Gohala. Small specks of dispersed chalcopyrite and bornite stains in quartz-muscovite-biotite schist were observed in Gohala and Garghutu village. Some encouraging values of Cu content in five bedrock samples (1,009 ppm to 6,377ppm) and pit-trench samples (Trench-2) (2,176ppm to 4,602ppm) were observed in quartz-muscovite-biotite schist from Gohala village and surrounding area.
Odisha			
Mayurbhanj	Kesharpur East block	Drilling	During general exploration for copper and associated precious metals in Kesharpur East block, a total of 1,569.65 m of drilling were carried out in 7 boreholes. The surface manifestation of mineralisation in the area was in the form of old workings, malachite and azurite stains. The mineralisation occurred in the form of dissemination, stringers, veinlets, shear parallel and occasionally in a massive form. Chalcopyrite was the chief ore mineral, pyrite and pyrrhotite were the other subordinate sulphide mineral recorded. The host rock for mineralisation was the hornblende-biotite-schist, silicified schist, hornblende gneiss and metabasics. The analytical results of borehole indicated two copper mineralised zones/lodes viz. from 163.50 to 165.50 m = 2.00 m x 0.36 %Cu and from 180.95 to 182.95 m = 2.00 m x 0.4%Cu.

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
Mayurbhanj	Madasahi block	Drilling, Pitting & Trenching	<p>During general exploration for copper and associated precious metals in Madansahi block, a total of 6,173.45 m drilling were carried out in 24 of inclined boreholes. As part of surface investigation, 135 cu.m of trenching/pitting was carried out with 12 trenches across the mineralised zone. Surface evidences of mineralisation were marked by presence of feeble malachite-azurite stains and occasional fine specks and disseminations of pyrite and chalcopyrite. Principal ore mineral was chalcopyrite with association of pyrite, pyrrhotite and pentlandite. Accessory sulphide phases identified were molybdenite, galena and covellite with minor gold. The cumulative thickness of sulphide zone varied from 7.00 m to 84.50 m with an average thickness of 33.00 m considering up to 3rd level of intersection. A borehole drilled in central part intersected a copper lode of 34.00 m with average 0.60%Cu, besides a copper lode of 11 m width with 1.01%Cu. The 3rd level borehole intersected three copper lodes i.e. two shallow zones from depth 49.00 m to 51.00 m (2.00 m x 0.96 %Cu), 59.20 m to 64.20 m (5.00 m x 0.31%Cu) and third one from 260.50 m to 276.00 m (15.50 m x 0.59%Cu). In eastern part of the prospect, one 2nd level borehole intersected five copper lodes from 30.45 m to 34.95 m (4.50 m x 0.70%Cu), 43.20 m to 48.25 m (5.05 m x 0.30%Cu), 54.00 m to 56.05 m (2.05 m x 0.20%Cu), 156.35 m to 171.35 m (15.00 m x 0.59%Cu) and 175.35 m to 181.90 m (6.55 m x 0.67%Cu) with cumulative of 33.15 m with 0.55%Cu. Based on the present available assay, the average copper lode thickness was about 15.00 m with average copper grade of 0.55% Cu to 0.20%Cu, disposing a linear pinch and swell lensoidal ore body behaviour both in strike as well as depth. As per present available exploration details and data correlation, in western part the mineralisation seems to be pinching at depth, however, the central part was found to quite significant in terms of lateral depth continuity and thickness. Similarly in eastern side mineralisation was observed to be significant at depth with respect to grade while for thickness needs further test drilling on hanging zones needs to be carried out.</p>
Mayurbhanj	Nimaidihi block	Mapping, pitting, Trenching & Sampling,	<p>A preliminary exploration for copper and associated precious metals in Nimaidihi block involved detailed mapping of 1.0 sq. km on 1:2000 scale along with ground geophysical survey, pitting/trenching and collection of samples for petrographic and other laboratory studies. The mineralisation in the form of pyrite and chalcopyrite was associated with hornblende biotite schist as well as granite gneiss and their silicified equivalent in the area. The presence of malachite, azurite stains, disseminated fine specks of chalcopyrite & pyrite, fracture filled limonite within quartz veins, box-work structure were the surface evidences of mineralisation.</p> <p>The analytical results of boreholes were recalculated at 0.2% Cu cut-off and two copper lodes in KW-02, four copper lodes in KW-05 and five copper lodes in KW-06 were delineated.</p>
Deogarh	Rampali Block,	Drilling	<p>A general (G2) level exploration was taken up for copper and associated metals in Rampali Block. During G-3 stage, two lodes were established and 0.172 million tonnes resource of 0.66% average grade Cu at 0.4% Cu cut-off up to 210 m vertical depth (30m R.L.) was estimated. Sulphide mineralisation occurred in the form of dissemination, stringers and veinlets. Chalcopyrite was the major ore mineral associated with pyrite and pyrrhotite and occasionally bornite & covellite within silicified pyroxene granulite were observed. The present work included a total of 2,552 m of drilling in nine boreholes. The boreholes were planned at 100m strike interval for each level excluding fourth level borehole. As per the visual estimate, all the boreholes have intersected ore zones. The dusty dissemination/specks/vein type of chalcopyrite which were observed in the boreholes contained 0.2% to 0.8% Cu as per visual estimation.</p>

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
West Bengal			
Darjeeling	Takdah-HamBasti area,	Mapping & Sampling	During reconnaissance Survey for base metal and associated minerals around Takdah–HamBasti area, a total of 50 sq. km area were mapped and 160 samples from different media were collected. Two alteration zones were noticed within mapped area. The first located near Village Chegra Basti in which a metabasic body was altered and contained pyrite and fine grains of chalcopyrite. This alteration zone was 10 meter in length and 1.5 meter wide and no further extension was noticed. The second was located near Tista Valley Tea Garden in which quartzite is altered and limonite and goethite were noticed within this zone. Fine grains of pyrite, chalcopyrite and bornite were observed. This zone was 35 in length and 5 to 6 m in width.
Uttar Pradesh.			
Lalitpur	Neemkhera & Dhaurisagar area	Mapping & Sampling	During reconnaissance survey for base metal and associated mineralisation in Neemkhera and Dhaurisagar area, an area of 100 sq. km on 1:12500 scale was mapped in and around Neemkhera and Dhaurisagar area. The geochemical results of the bed-rock samples showed no significant base metal values. The Cu, Pb & Zn values ranged from <5 ppm to 279 ppm. The Mn values were analysed up to 2,384 ppm. Gold values of selected BRS and channel samples showed <0.05 ppm concentration. The REE & traces of 09 BRS, 11 trench and 02 channel samples showed no significant concentration of metals.
Andhra Pradesh			
Guntur	Vemulurupadu, Peddapalalaluru	Mapping & Sampling	Reconnaissance survey for copper carried out in Vemulurupadu Peddapalalaluru area involved, large- Scale mapping of 50 sq.km area on 1:12500 scale. Mineralisation was observed as pyrite, chalcopyrite and pyrrhotite within garnetiferous quartzofeldspathic biotite gneiss, charnockite and sheared quartz vein. Chemical analyses for 19 bedrock samples showed Cu ranging from 0.0095% to 2.62%. Pb values range from <10 ppm to 35 ppm, and Zn values from 2 ppm to 145 ppm, The highest value recorded for Cu was 2.62% from malachite stained zone associated with pyrite and chalcopyrite grains within quartzofeldspathic biotite gneiss from the wall of abandoned quarry, south of Village Turkapalem.
Nellore	Aayapeta block		This preliminary exploration for copper and associated mineralisation in the area was taken up in Field Season 2019-20 & 2020-21 to delineate the mineralised zone by drilling boreholes, and to estimate resources. The copper mineralisation occurred as disseminated form within the host rock but it is more concentrated in quartz vein. A total of 1,910 m of drilling in 14 boreholes were carried out to intersect/ test geological and geophysical anomaly. Three mineralised bands, i.e, southern, northern and western band were demarcated with cut off of 0.2% Cu. In Southern band (~250m strike length), major copper zones were intersected in three borehole.
YSR Kadapa	Mittapalle block	Mapping, Geophysical survey Drilling & Sampling	A reconnaissance survey for Lead & Zinc and associated mineralisation in Mittapalle block was taken up in Mittapalle block with an objective of resource assessment for Pb, Zn & associated mineralisation. Detailed geological mapping of the Mittapalle block of 1.2 sq. km area was completed on 1:2000 scale. Pb and Zn mineralisation in the area was hosted by dolomite and mineralisation occurred as veins, veinlets, stringers, lenses, vug-fillings and disseminations. A total of 104 channel samples, 10 PCS, 20 pitting & trenching samples were collected. Ground geophysical surveys (IP and resistivity) were also completed. In northern band (~300m strike length), copper zone was intersected in two borehole and in western band (~100m strike length), copper zones were intersected in one borehole. A total of 1.15 million tonnes of Cu ore with 0.53% Cu average grade calculated by cross section method at 0.2% cut-off. In LV section, the resource was 0.98 million tonnes with 0.53% average grade of Cu at 0.2% cut-off. Three potential mineralised dolomite bands (BAND I, BAND II and BAND III) were identified in the area. BAND I with a strike length of 900 m and width varying from 8 to 88 m was established. Surface bedrock sampling showed weighted average of (Pb+Zn) ranging from 2.33% to 2.56%, wt. avg. of Pb ranging from 50 ppm to 3.8% and wt. avg. for Zn ranging from 175 ppm to 1.80%. BAND II with strike length of 930 m and width varying from 10 to 66 m was established Surface bedrock sampling showed weighted average of (Pb+Zn) ranging from 225 ppm to 2.47%, wt. avg. of Pb ranging from 50 ppm to 0.31% and wt. avg. for Zn ranging from 175 ppm to 5.85%, BAND III showed outcrop width varying from 10 to 30 m.

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
YSR Kadapa	Jaukulapalle block	Mapping, Pitting/Trenching, Sampling.	A G-3 stage exploration for Lead & Zinc and associated mineralisation was taken up in Jaukulapalle block with an objective of resource assessment for Pb, Zn & associated mineralisation. Detailed geological mapping of the Jaukulapalle block for 1 sq. km area was completed on 1:2000 scale. A total of 60 channel samples, 44 core samples, 7 PCS, 20 pitting & trenching samples were collected. Ground geophysical surveys (16.5 L.km IP & Resistivity 15 L.km) were also carried out in Jaukulapalle block. Detailed mapping brought out two potential mineralised dolomite bands. BAND I with strike length of about 550 m and width varying from 10 to 12 m was established. In BAND I, Zn value ranged from 25 ppm to 12.37% with a mean value of 2.94% and Pb values ranged from 5 ppm to 0.50% with a mean value of 0.04%. The (Pb+Zn) values ranges from 35 ppm to 12.47% with a mean value of 2.99%. Old working and old pits of small dimension was also noticed. BAND II with a strike length of 290 m and width ranging from 6 to 30 m was established. In BAND II, Zn value ranged from 164 ppm to 25.10% with a mean value of 2.69% and Pb values ranged from 65 ppm to 19.67% with a mean value of 0.74%. The (Pb+Zn) values ranged from 342 ppm to 25.44% with a mean value of 3.43%. A total of 205.45 m of drilling were carried out.
Karnataka			
Raichur	Machanur West block	Pitting/Trenching Drilling & Sampling	A general exploration for copper and gold was initiated in Machanur west block with an objective to delineate the mineralised zone for copper and gold and estimate the resource in the area. The block was of 1 sq km area and was primarily soil covered with extensive agricultural fields. The study area was represented by brecciated and altered pink porphyritic granite and intrusive dolerite dyke. The mineralised zone in Machanur occurred in an ENE-WSW trending brittle fracture system stretching for about 5 km in length and 50–150 m in width within pink porphyritic granite. The linear dolerite dyke was also mineralised when close to breccia zone. Hydrothermal alteration was intense and was represented by quartz–K–feldspar–haematite–chlorite–carbonate–epidote assemblages developed in altered granite and dolerite. Sulphide minerals were observed in the form of dissemination, massive chunks, veins and fracture filling. Ore minerals noted in the zones were chalcopyrite, pyrite, bornite, covellite, native copper, chalcocite and minor cuprite. Chalcopyrite was the main ore of copper in the area followed by bornite, covellite, and native copper. A total of 60 cu.m of trenching was completed and a total 60 pitting/trenching samples were sent for analysis. Analytical results from one trench sample indicated value of 530 ppm Cu over 1 m and second trench sample indicated 0.1% Cu over 1 m within the West block.
Raichur	Yerjanti area,	Mapping, Pitting Trenching, Sampling	During reconnaissance survey for copper, gold and associated minerals around Yerjanti area, an area of 50 sq. km area was mapped on 1:12500 scale along with 50 cu. m pitting & trenching and also 514.50 m scout drilling achieved by drilling three scout boreholes. A total of 409 samples were collected. Copper mineralisation was seen manifested in the form of chalcopyrite, chalcocite and covellite, malachite and azurite staining. Yerajanti block is characterised by altered granite that was traced for a length of 1 km with width of 20 m and was seen associated with covellite, chalcopyrite and good amount malachite staining. Four BRS samples collected from the altered porphyritic granites analysed 0.23 to 1% Cu.
Telangana			
Nalgonda	Mallepalli-Chintakuntla block	Mapping, Sampling & Drilling	During reconnaissance survey in Mallepalli-Chintakuntla block in parts of Nalgonda District, a total of 114 sq. km area was mapped on 1:12500 scale. The major sulphide minerals noticed in the area were chalcopyrite, pyrite and suspected molybdenite. Three scout boreholes achieved a total of 514.5 m drilling. First and second scout boreholes intersected three sulphide-bearing zones. Third Scout borehole intersected one K-feldspar and iron oxide alteration zone and one chlorite, epidote, quartz and carbonate altered mafic rock. Actual mineral potential of the investigation area will be furnished after receiving all the analytical results. BRS samples analysed 0.14 to 1.01% Cu. Multiple old working with dumps and old pits, and gossanised bodies are other indicators of the sulphide mineralisation. The available analytical results of bedrock, soil and pit/-trench samples revealed sporadic anomalous Pb (up to 7.5%), followed by Cu (up to 0.25%) and Mo (up to 0.19%). However, relatively higher values of Zn (up to 235 ppm) were observed in stream sediment samples. Based on the surface indication of mineralisation, two mineralised zones, namely, zone-I and II, separated by ~1 km, were demarcated in the eastern part of the block.

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
Rajasthan			
Sikar	Ravji Ki Dhani area,	Drilling	A preliminary exploration for base metal mineralisation in Ravji Ki Dhani Area, Nim Ka Thana was carried out. The Ravji Ki Dhani area is located about 16 km southeast of Nim Ka Thana. Copper mineralisation was observed in the form of malachite stains and occasional specks or disseminations of pyrite, chalcopyrite, bornite and chalcocite. At some places quartz veins intruded into amphibole marble along and across the strike also carried disseminated bornite and chalcocite. Sub-surface exploration by core drilling was carried out with an aim to assess the strike and the depth continuity of copper and associated precious metals in the study area. Eight boreholes were drilled to a cumulative depth of 1,015 m. Out of these eight boreholes, four were planned in the south western part to target mineralised zone (MZ- III), 3 boreholes in northern part to target mineralised zone (MZ-I) and 1 borehole in the central part to target mineralised zone (MZ-II). The mineralised zones were intersected at a vertical depth of ~50–60 m. The investigation established the occurrence of sub-surface copper mineralisation. Sulphide mineralisation in the drilled boreholes was observed to be 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.
Sikar	Kalamara Block, Bhudoli-Basari area, Nim Ka Thana	Drilling & Sampling	A preliminary exploration was taken up for base metal mineralisation in Kalamara Block, Bhudoli–Basari area. The Kalamara block of Bhudoli–Basari area was located about 4 km south of Nim Ka Thana. The host rock for mineralisation was banded impure marble of the Ajabgarh Group of the Delhi Supergroup, similar to Nim Ka Thana copper belt. Sub-surface investigation by drilling was carried out over a strike length of 1,000m in Kalamara block to establish the base metal potentiality of the area. A cumulative total of 1,02,173 m drilling were carried out with six first level boreholes and one/second level borehole. The boreholes drilled in the Kalamara block intersected sporadic and scanty copper mineralisation in the form of fine disseminations besides, a few specks of chalcocite, bornite, chalcopyrite and covellite were observed visually during core logging. The analytical results of core samples from first level borehole showed mineralised zone of 2m X 0.33% Cu.
Alwar	Bhigota block, Rajgarh teshil	Drilling & Sampling	A preliminary investigation by drilling for copper and gold was carried out in Bhigota block to test the continuity of mineralised zone, delineated on surface during detailed geological mapping carried out in 2019-20. In the study area located 20 km Northwest of Bandikui, drilling was carried out to test the depth persistence and potentiality of copper mineralisation in the area along 800 m strike length of white siliceous dolomitic marble. One mineralised zone (MZ-1) was delineated. The MZ-I, was observed to be lying within white siliceous dolomitic marble of the Kushlagarh Formation. All the boreholes were planned along channels and trench maintaining a strike interval of 200 m towards west and east respectively. A cumulative total of 1,115 m of drilling were carried out in seven boreholes. All boreholes drilled at a strike interval of 200 m intersected sulphides mostly pyrite and chalcopyrite, bornite and chalcocite in the form of fine to coarse disseminations.
Alwar and Dausa	Kaled area,	Mapping, Drilling, & Sampling,	During preliminary exploration for base metal and associated precious metal mineralisation in the study area, a total area of 1.5 sq. km were covered and detailed geological mapping on 1:2000 scale along with surface geophysical survey of 20 L km was carried out during 2019-20. Systematic bedrock sampling was carried out in order to demarcate the zones of possible mineralisation. The surface indication of mineralisation was in the form of malachite staining, small specks of pyrite and chalcopyrite, specular haematite, ferroginitisation and limonitisation were also observed. Apart from this, channel sampling was carried out where surficial indication was observed. During detailed geological mapping, a total of 378 samples were collected. After delineation of the mineralised zones during 2019-20, sub surface exploration was proposed to be carried out in Field Season 2020-21, involving drilling of 1000 m. First level boreholes with 200 m spacing were planned so as to execute the drilling associated with geophysical borehole logging and Mise-a-la-masse to delineate the sub-surface continuity of the mineralised zone. A total of 1,125 m drilling were completed in six boreholes. All the boreholes intersected sulphides mostly pyrite, chalcopyrite, pyrrhotite, arsenopyrite and chalcocite. A total of 148 core samples were submitted for analysis.

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
Alwar	Suratgarh block, Thanagazi teshil,	Mapping,Pitting, Trenching,Sampling & Geophysical Survey	During preliminary exploration for copper and associated precious metals in Suratgarh block, detailed mapping on 1:2000 scale was carried out covering 1.5 sq km area to delineate zones of Cu and associated precious metal mineralisation. Besides, 71.50 cubic m pitting/ trenching were carried out and a total of 368 samples were collected. Ground geophysical survey was also carried out in Suratgarh block to locate the potential zones of mineralisation. The surface indications of mineralisation were in the form of presence of old workings, malachite stains, scapolites and fresh sulphides, i.e. bornite, covellite, chalcopyrite, pyrrhotite, quartz and carbonate veins. On the basis of field observation, interpretation of surface indication of mineralisation and channel sample results, two zones of sulphide mineralisation over a strike length of 700 m and 250 m were delineated in the central and southern part of the block. The chemical analytical results of channel samples showed Cu values ranging from 10 ppm to 0.49%.
Sikar	Dariba block,	Drilling & Sampling	A general exploration was carried out for base metal mineralisation in Dariba block which is located about 20 km southeast of Neem ka Thana. A total of 23 boreholes were drilled to trace depth and strike continuity of these mineralised zone.The analytical results of 21 boreholes were received so far. Out of 21 boreholes, 13 boreholes indicated significant copper lodes.Two second level boreholes were under progress. The resource estimation will be carried out after the receipt of all analytical results.
Sikar	Adharshila- Dariba, Block Neem ka Thana	Drilling & Sampling	A preliminary exploration was taken up for base metal in Adharshila–Dariba, Neem ka Thana, area which is located about 20 km southeast of Neem ka Thana. The area was comprised of rocks of Ajabgarh Group of Delhi Supergroup. The Ajabgarh Group was found to be represented by amphibole quartzite, amphibole bearing impure marble with inter bands of quartzite and schist interlayered with the amphibolite of Kushalgarh Formation. The general trend of the lithounits is NNE-SSW to N-S with westerly dip. During 2019-20, two mineralisation zones MZ-I and MZ-II were delineated.The length of MZ-I was more than 1,600 m and width varied from 5 m to 21 m with grade varying from 0.2% Cu to 0.55 % Cu. The length of MZ-II was 600 m and width varying from 11m to 66 m with grade varies from 0.22% Cu to 0.56 % Cu. During Field Season 2020-21, the sub-surface exploration by 11first level boreholes involved drilling of 1,605 m, with 200 m spacing. Eight boreholes (RJSA-1 to RJSA-6, RJSA- 10 and RJSA-11) and three boreholes (RJSA-7 to 9) were planned in MZ-I and MZ-II, respectively. All the boreholes intersected significant copper mineralisation. The main copper ore minerals identified in the area were chalcocite, bornite and chalcopyrite. The analytical results of nine boreholes were received and all the boreholes intersected significant copper lodes at 0.2% cut-off. Analytical result of borehole samples showed copper value varying from 0.24% to 0.53%.
Sikar	Daudham- Kalakota block, Nim Ka Thana,	Drilling sampling	A preliminary exploration for copper and associated precious metals in Daudham-Kalakota block, Nim Ka Thana, Sikar, Rajasthan (G3): The study block lies east of Nim Ka Thana copper belt and located 2 km east of Village Toda. Earlier during 2019-20, three mineralised zones MZ-I, MZ-II and MZ-III of 550 m, 600 m and 430 m strike length, respectively were delineated. The average grade of mineralised zones varied from 0.10% Cu to 0.20% Cu. Although the mineralised zones showed a restricted width up to 03 m only the reported evidences of fresh sulphides in the form of chalcopyrite and bornite along with intense malachite stains were significant. During 2020-21, the mineralised zones MZ-II and MZ-III were explored involving by drilling up to 1,200 m. The MZ-I could not be tested by drilling as it was under deep forested area. A total of 06 first level boreholes weren planned to test the mineralised zones MZ-II and MZ-III. A total of 4 boreholes were drilled in MZ-III whereas two boreholes were drilled in MZ-II. All the six boreholes drilled intersected sulphide mineralisation in the form of vein filled, fracture filled, foliation parallel specks and disseminations of chalcopyrite, pyrrhotite and pyrite with occasional presence of chalcocite, bornite and few specks of covellite. Apart from this, 239 samples were collected from the drilled boreholes. The analytical results were awaited.

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
Sikar and Jaipur	Beri Bharaj areas,	Mapping & Sampling	During reconnaissance Survey for base metals in Beri Bharaj areas, an area of 102 sq. km was mapped on 1:12500 scale. A total of 242 samples were collected for different types of studies. Malachite staining was recorded in minor amounts in brecciated quartzite of Seriska Formation and majorly in the tremolite marble of Thanagazi Formation in discontinuous patches for about 1.5 km long zone with width of roughly 50 m from Bharaj to Banari ki Dhani. Some specks of pyrite were noted in quartzite bands within quartz-sericite-biotite schist of Thanagazi Formation. Iron mineralisation in the form of haematite/ specularite veins and reefs were recorded near Garnao ki Dhani, south-east of Ladi ka Bas and near Mamtoda villages. There were also intense ferruginisation and iron leaching in the Dantil fault zone, near Dantil and Sudarpura villages. Analytical results of bedrock samples showed Cu values ranging between 10 ppm and 0.4%; while Zn value ranged between 5 and 515 ppm.
Sikar	Chiplata area, Neem-ka-Thana	Mapping, Sampling Pitting & Trenching	A reconnaissance survey for copper and associated precious metals in Chiplata area, Neem-ka-Thana, involved large-scale mapping of 100 sq.km area on 1:12500 scale. Besides, geochemical sampling in the form of 136 bedrock sample, 15 petrochemical samples and 50 cubic metres of pitting/trenching were collected. Based on the surface indications of mineralisation, four zones within the block were demarcated as promising zones for copper mineralisation. Out of the 4 zones demarcated based on the field observations and surface evidence of mineralisation, only MZ 1 seemed promising after chemical analytical data of the BRS and trench samples. BRS value of 0.44%, 0.25%, 0.14% and 0.13% for Cu was reported from a 2.5 square km area between Chiplata and Lambi-Ki-Dhani village. Several other anomalous values of Cu also were reported from the area. BRS from the mineralised zone 4 (MZ 4) to the south of Goli-Ki-Dhani village, did not show anomalous values of Cu. Trench samples collected from this zone showed concentration of total REE up to 3,93.8 ppm. The chemical data of the BRS collected from the area showed erratic and feeble nature of Cu mineralisation in the area. In a few areas like Lambi-Ki-dhani and Goli-Ki-Dhani, value of elemental Cu and total REE showed some promising result and concentration in zones, which could be further explored. Based on the chemical analytical data and surface evidences of mineralisation along with suitable litho-structural set up, MZ-1 and MZ-4 could further be explored in detail to check the presence of base metal and REE mineralisation in the respective areas.
jhunjhun	Fatehpura block	Mapping	During preliminary exploration for copper and associated mineralisation in Fatehpura block, an area of 0.75 sq. km was covered by Detailed Mapping on 1:2000 scale. Evidences of base metal mineralisation were observed in the form of presence of old working, fault breccia and fresh sulphides besides malachite staining, presence of slag pieces and presence of intense ferruginisation and silicification. The main sulphide minerals in the area were pyrite, pyrrhotite and chalcopyrite
Udaipur	Phalet area	Mapping & Sampling	During reconnaissance survey for copper mineralisation in parts of Phalet area, large-scale mapping covering an area of 100 sq. km was carried out on 1:12500 scale. A total of 200 bedrock samples for base metal analysis, 10 petrochemical, 20 petrological and 10 samples for ore microscopy were collected. Surface indication of mineralisation were represented by profuse malachite stains, silicification, boxwork structure, old working slag heaps and fresh specks of chalcopyrite, galena and pyrite in disseminated form and also along fractures. Three mineralised zones were delineated based on the chemical analysis of channel samples viz. (i) 450 m long and 9 m thick Cu mineralised zone lying 1.75 km NW of Gurli with an average Cu value of 0.91% and 5 m thick Cu zone with an average Cu value of 0.76%, (ii) 100 m long and 6 m thick Cu, Pb and Zn mineralised zone with an average Cu value of 713 ppm, avg. Pb value of 0.57% and avg. Zn value of 0.44% [750 m north of Bhainsra Khurd] and (iii) 35m long 7m thick Cu mineralised zone with an average Cu value of 0.73% lying 575 m south of Nauva

Table-5 (Contd.)

State/District	Name of block	Details of exploration	Results
Bhilwara	Lakhola block	Mapping & Sampling	During preliminary exploration for base metal and associated mineralisation in Lakhola block, detailed geological mapping (1:2000 scale) was carried out in the Lakhola block covering an area of 1.52 sq. km. A total of 533 samples (grid/channel/trench) were collected and sent for chemical analysis. Two mineralised zones, i.e, MZ-I and MZ-II were demarcated on the basis of surface manifestations. MZ-I with strike length of about 450 m and width of approximately 65 m and MZ-II with strike length of about 350 m and approximately 55 m width were identified. Analytical results of only 118 samples were received so far and four significant Cu values reported were 0.10 % (two samples) and 0.13% and 0.17%.
Udaipur	Khori Mahuri area	Drilling	A preliminary exploration for copper and gold mineralisation in Khori Mahuri area, to test the sub-surface continuity of mineralised zone delineated on surface during detailed geological mapping of the study area. A total of 1,080 m of drilling were carried out in four boreholes, varying in length from 241 m to 295 m and a total of 335 samples for various types of studies were collected during the study. The first borehole was drilled along geophysical anomalous Zone-I. The second and third borehole were drilled to test the strike continuity of sulphide mineralisation at a strike interval of 200 m. The fourth borehole was drilled to test the depth continuity of copper mineralisation of old workings in the eastern part of the mapped area. The Boreholes RJKM-1 and RJKM-2 intersected significant concentration of sulphides mostly fracture filled pyrrhotite, pyrite and chalcopyrite along with magnetite. The Boreholes RJKM-3 and RJKM-4 intersected sulphides mostly fracture filled pyrrhotite, pyrite and chalcopyrite in the form of disseminations, specks and stringers. Copper sulphides in these boreholes were not significant enough for delineation of zones on the basis of visual estimates. However, the analytical results of samples were awaited.
Udaipur	Ladana North block	Mapping & Sampling	A preliminary exploration for copper and associated mineralisation in Ladana North block, involved detailed mapping of the study area. A total of four boreholes were drilled to a cumulative depth of 608.6 m. All the surface copper anomalies delineated through grid bedrock samples as well as ground geophysical survey during previous investigations were tested but copper mineralisation observed in all these four boreholes were insignificant. Chalcopyrite along with pyrite and pyrrhotite in the form of fine dissemination and thin stringers was observed within altered amphibolite and granite. The copper zones intersected within altered amphibolite showed less than 0.20% Cu (average grade) based on visual estimation. Therefore, drilling was suspended after four boreholes.
Bhilwara	Kesarpura block	Drilling	A preliminary exploration for base metal in Kesarpura, was taken up. Based on the encouraging results of bedrock samples and anomalies delineated through systematic ground geophysical survey, a total of 1,560.0 m of drilling were carried out in eight boreholes with boreholes spacing of 200 m along the strike. Drill core observations revealed that copper mineralisation in the area was mainly hosted in the silicified feldspathic mica schist of Potta Formation, calc-silicate rock and quartz amphibole mica schist of Rewara Formation. Chalcopyrite, pyrite, pyrrhotite and bornite were the major sulphides which occurred as dissemination as well as stringers along the foliation planes. Sulphides also occurred as fracture fillings in the host lithounits.
Bhilwara & Chittorgarh	Chainpuriya- & Lasariyakhera area	Mapping & Sampling	During reconnaissance survey for base metal mineralisation in Chainpuriya-Lasariyakhera area, geological mapping was carried out covering an area of 100 sq. km on 1:12500 scale. Surface manifestation of mineralisation in the area was quite prominent. Presence of malachite stains have been observed in almost all lithounits of the area. The specks and veins of primary sulphides like chalcopyrite, bornite, azuite and pyrite were observed in the calc gneiss, calc schist and calc-silicates of Rewara Formation. Based on the surface indications of mineralisation, favourable lithological and structural set up coupled with the analytical result of the bedrock samples, two potential zones, i.e, Rampuriya & Gujar khera of base metal mineralisation were demarcated.

Table-5 (Concl.)

State/District	Name of block	Details of exploration	Results
Gujarat			
Banaskantha	Dungarpura block & Malana block	Mapping & Sampling	During preliminary exploration for base metals and associated mineralisation in Dungarpura block and Malana block, detailed geological mapping and topographical survey of 1.75 sq. km area (1 sq. km at Dungarpura and 0.75 sq. km at Malana) were completed. Dungarpura area showed incidence of epigenetic hydrothermal base metal mineralisation. Disseminated specks and stringers of galena, sphalerite, pyrite and rare chalcopyrite with surficial encrustation of malachite and covellite were observed in cherty brecciated quartzite and quartz veins. While cherty quartzite of Malana area was found to be highly oxidised, limonitised and brecciated in nature comprising galena and sphalerite mineralisation. At the central part of quartzite, 3-5 m thick and 140 m in length smoky quartz vein hosting chunks of pyrite with disseminated specks of chalcopyrite, sphalerite, galena, covellite was exposed. Greyish cherty quartzite was seen mainly associated with galena and sphalerite, while quartz veins were associated with pyrite, chalcopyrite, galena and sphalerite. The chemical analytical result of BRS samples collected from Dungarpura block showed concentration of Cu ranging from 25 ppm to 0.1%, Pb ranging from 25 ppm to 0.65% and Zn ranging from 25 ppm to 1.1% while in Malana block concentration of Cu ranging from 25 ppm to 0.18% and Zn ranged from 25 ppm to 0.14%. Chemical analytical result of 16 channel samples showed the concentration of Pb and Zn ranging from 0.11% to 0.28% and 0.16 to 0.79% respectively. Analytical result of 17 water samples received so far, indicated value of Cu from 3.71 ppb to 73.96 ppb and Pb from 2.69 ppb to 8.90 ppb while 5 samples showed concentration of Zn from 84 ppb to 4,859.53 ppb.

Bauxite

GSI

In Madhya Pradesh, a reconnaissance survey for aluminous laterite and bauxite around Tulra–Mediyaras–Benibari area, Anuppur and Dindori districts, involved large-scale mapping of 100 sq. km area on 1:12500 scale along with collection and chemical analysis of 50 bedrock samples (BRS), 10 petrochemical samples (PCS), 100 cubic meter pitting – trenching with collection of pit-trench samples (PTS) and study of 10 polished sections (PS). The basaltic flows of Deccan Trap capped by laterite cover accounted for bauxite occurrence in the area. These laterite/bauxite deposits were in the form of impersistent lenses, pockets and as irregular shaped tabular bodies formed by weathering of aluminous rock, i.e, basalt. Laterite/bauxite capping was observed mainly as detached bodies in NE-SW trending high hills viz. north of Tulra, north of Mediyaras and Pharhada. In the north of Tulra and south of Shyamduari villages laterite/bauxite outcrop with pissolitic texture were mapped. The thickness of the laterite/bauxite capping was around 8-10m. Near Bhalwar and Charkumar village, the small mounds and hills covered by laterite/bauxite showed reddish brown colour and was in pissolitic form. At places these were limonitic in nature and rich in iron. The thickness of these beds was 5-10m and was found to be vary from place to place. The lateritic/bauxitic horizons mapped around Kussera–Antariya area were pissolitic, oolitic, reddish brown, pinkish in colour and limonitic at places. The thickness of laterite/bauxite in this area vary from 5–10 m. In the high hills and mounds they were of 8–15 m thick, whereas in flat land they were about 5–8 m thick. The complete analytical results of BRS, PCS, and PTS samples were awaited.

In Maharashtra, reconnaissance survey for bauxite in Kunkeshwar area, Sindhudurg district, involved large-scale mapping of lateritic terrain of Kunkeshwar block on 1:12500 scale with collection of 118 bedrock samples and 50 pit samples. Analytical result of BRS and PTS show Al_2O_3 content in the BRS ranging from 9.59% to 57.73% and in PTS, it ranged from 18.58% to 57.96%. Based on the Al_2O_3 content of BRS, area was classified into bauxite ($Al_2O_3 > 40%$), aluminous laterite (Al_2O_3 30-40 %) and laterite ($Al_2O_3 < 30%$).

The analytical results, statistical analysis of results and ore petrographic study indicated that Kunkeshwar block has the potential for bauxite occurrences. About 2 sq km and 65 sq km cumulative areas were delineated as potential for bauxite and aluminous laterite respectively. Besides, seven zones were also demarcated as anomalous zones which included three zones for Al_2O_3 (585 m² cumulative area), two zones each for gallium (190 m² cumulative area) two and for TiO_2 (199 m² cumulative area). Surface indications of bauxite in the area were manifested in the form of pissolitic/oolitic, massive, nodular, concretionary grains of gibbsite within aluminous/clayey laterite. XRD and ore microscopic studies confirmed that gibbsite was the dominant ore mineral of bauxite present in the area. Ga values ranged from 26 ppm to 90 ppm in the BRS whereas, Ga content in the PTS ranged from 45 ppm to 72 ppm.

In Chhattisgarh, preliminary exploration for bauxite ore in Chichili block, Jashpur district, comprised detailed mapping on 1:4000 scale covering an area of 4 sq km around Village Chichili and drilling in 200 x 200 m grid spacing. The Chichili block forms a part of Pandrapat plateau which forms a marked topographical feature in the Jashpur district for occurrence of bauxite. The study

area comprised laterite, aluminous laterite and bauxite and Deccan basalts at the base of the scarp surface. The bauxite occurred as irregular lenticular bodies within the aluminous laterite /laterite. A total of 197.65 m drilling were completed in 13 boreholes at 400 m X 400 m spacing. During the drilling programme, two bauxite zones were demarcated. The thickness of bauxite zone intersected in boreholes varied from 0.6 m to 2.2 m. A total of 81 core samples, 10 BRS, 10 PCS, 10. XRD, 05 of reactive silica and 05 OM were collected and sent for chemical analysis. The chemical analyses of BRS samples showed Al_2O_3 varying from 48.07% to 59.57%, SiO_2 from 0.87% to 3.85% and MgO from 0.01% to 0.06%. It also showed good concentration of gallium/ (61 ppm to 118 ppm) and vanadium (676 ppm to 1,256 ppm).

In Jharkhand, reconnaissance survey for bauxite and associated minerals (Ti, V, Ga etc.) in and around Dumardih and Tukudih area, Latehar District, involved detailed mapping of 1.30 sq. km area on 1:4000 scale along with collection of 10 XRD samples for laboratory studies. The laterite exposures in and around Tukudih area were mostly covered by yellow to reddish lateritic soil. One such outcrop was exposed at the eastern part of Village Jamdih having a dimension of around 100 m x 5 m. Near Village Bugludih, a recently excavated dug well was studied and no bauxite or bauxite clast was observed this indicates absence of bauxite in the northern part of the block.

The analytical results of BRS indicated Al_2O_3 ranging from 32.26% to 44.44% and the corresponding SiO_2 ranging from 2.19% to 7%. A total of 7.96 MT of bauxite resource were prognosticated over an area of 2.025 sq. km. with an average grade of 41.25% Al_2O_3 and 3.988% SiO_2 (UNFC under 334 category).

In Jammu & Kashmir, a preliminary exploration for bauxite, REE & lithium in Salal-Haimna areas of Reasi district, comprised detailed geological mapping of an area of 3 sq. km on 1:4000 scale. The analytical studies for major oxides and V, Ga etc. by XRF & REE with Be, Ge, Sn, Hf, Ta & U by ICMPS) Li and Cs for different types of samples were carried out. The bauxite samples showed Al_2O_3 (43.51% to 69.69%), SiO_2 (10.39% to 36.44%) with presence of TiO_2 in bauxite in the area. The analytical result of 25 BRS also showed high value of Vanadium in 20 samples which ranges from 1,705 ppm to 3,995 ppm and 10 samples indicated TiO_2 that varied from 5.12% to 12.32%. A large part of the study area was covered by aluminous laterite and the chemical analysis support indicated that 14 BRS samples had $Al_2O_3 = 20\%$. The XRD analysis of 20 samples of the study area indicated major amount (>50%) as gibbsite while small amount (>5-20%) contained of boehmite, anatase, haematite beside goethite, rutile and kaolinite occurring as traces. Total REE (La to Lu) in the bedrock samples of bauxite ranged from 65.57 to 340.14 ppm with average of 155.16 ppm. Li values for 19 core samples indicated concentration between 166 ppm and 497 ppm with an average of 306 ppm in the top layer of the bauxite up to 3.5 to 4m depth.

In Uttar Pradesh, during reconnaissance survey for bauxite and associated mineralisation in Naugarh-Pandri areas of Chandauli district, an area of 100 sq. km was mapped on 1:12500 scale. The analytical results of the geochemical samples suggested that the Al_2O_3 ranged between 16.62% and 52.01% with an average of 40% and contained silica in the range between 2.13% and 10.93%. While in channel samples of CH-1, Al_2O_3 values ranged between 38.20% and 46.28% with wt. avg. 43.10% and silica value ranged between 3.48% and 7.95%. In three trench samples viz. TRB-1, TRB-2 & TRB-3, Al_2O_3 content was 18.61%, 32.66% and 35% respectively while in one pit PTB-1 26.94% Al_2O_3 was recorded. The analytical results of core samples received for Borehole no. UPCNB-1 & UPCNB-2 ranged from 18.20% to 44.36% Al_2O_3 and 24.84% to 38.85% Al_2O_3 respectively in laterite profile, but silica was dominant, especially in lithomarge. Values of vanadium in trench samples (3 trenches) ranged from 943 ppm – 4,551 ppm and Ga values from 23 ppm – 77 ppm. In core samples of UPCNB-1, were V and Ga maximum values of 3,553 ppm and 190 ppm respectively. TiO_2 in core samples showed a wide range between 2% and 13.61% with an average of 7.4%. Σ REE values in Boreholes UPCNB-2, UPCNB-3 (part), trench TRB-5 and Pit-2 ranged between 57.93 ppm and 1,18.87 ppm with the average of 464.02 ppm. Highest Σ REE value of 1,018.87 ppm was noted in massive pisolitic bauxite of UPCNB-2. In lithomarge part, the maximum Σ REE value was 898.74ppm. The Σ REE values in BRS samples were ranging between 40.61 ppm and 893.21 ppm. Lithium content in the samples was insignificant.

In Kerala, during reconnaissance survey for bauxite around Perla area, Kasargod district, large- scale mapping of 100 sq.km was carried out on 1:12500 scale together with collection of 131 bedrock samples, 36 vertical section samples, 50 pit samples, 13 petrographic, 10 XRD and 13 petrochemical samples. Laterite was the major rock unit in the area and bauxite was seen intermixed with laterite as pockets and patches. Analytical results of BRS samples yielded Al_2O_3 content of 5.23 to 52.92% with an average of 34.59%. SiO_2 , Fe_2O_3 and TiO_2 of BRS samples showed average value of 26.50%, 23.23% and 1.33% respectively. About 17 BRS samples yielded Al_2O_3 greater than 40. TREE values of BRS samples ranged from 115.48 to 474.26 ppm. Al_2O_3 content in pit samples ranged from 22.74 to 40.71% with an average of 32.80%. Analytical results of vertical profile samples revealed that the bauxite occurrence was mainly confined to a depth of 2m to 5m from the ground surface with an average of 35.71%. Integration of geological and geochemical data of aluminous laterite/ bauxite samples, demarcated 5 mineralised zones of having total area of 2.73 sq. km, around Yetadka, Ukkinadka, Maniampara and Perla by fixing cut-off grade for bauxite at 40% Al_2O_3 .

Gujarat Mineral Department Corporation (GMDC)

During 2020-21 GMDC, took up exploration in Nana Goniysar bauxite mine and Bothala Balachod bauxite mine. The exploration in nana Goniysar mine, comprised

2 number of pitting admeasuring 1.82 x 1 x 5.15 m, 10.30 m drilling in 2 boreholes and collection of 2 samples; and in Bothala mine exploration comprised 8 number of pitting adeasuring 1.82 x 1 x 4.71 m, 37.70 m drilling in 6 boreholes and collection of 6 samples.

Iron Ore

GSI

In Odisha, general exploration for iron and manganese ore in Jajang Block, Kendujhar district, was taken up for G-2 stage exploration as a part of non-working expiry lease on request of Govt. of Odisha. Detailed mapping of 1.0 sq. km area on 1: 4000 scale along with 25 cu. m of pitting/ trenching was carried out in the block. Hard massive iron ore was exposed on mine face and benches in the western part of the block. Manganese ore occurred within shale and laterite in the northern part. Lateritic iron ore, hard massive iron ore, hard laminated ore, soft laminated and powdery iron ores were intersected in the boreholes. The iron ore was mainly haematite.

In Kendujhar district, general exploration for iron and manganese ore in Jalahuri Block, was taken up for G-2 stage exploration as a part of expiry lease (non-working mines) on request of Government of Odisha. An area of 1.82 sq. km area was covered by detailed mapping on 1: 4000 scale along with 50 cu.m of pitting /trenching. The ore mineral was mainly massive haematite present as pockets within the laterite cappings. Soft laminated ore was also observed in the area. A total of 87.6 m were drilled in one borehole.

In a Sundargarh district, preliminary exploration for iron and manganese ore was taken up in Patamunda East block, which is located in the southern part of the Jamda-Koira valley of Bonai-Kendujhar iron ore belt. The East block comprising an area of 5.1 sq km lies just east of Patmunda west block where active mining was going on for manganese till it was suspended in late 2000. An area of 1 sq. km was mapped on the available topographic map of Lessee. The area was represented by Banded Iron Formation, Ferruginous Shale/Phyllite and manganeseiferous

shale/phyllite. During Field Season 2019-20, an area of 1.50 sq. km was mapped on 1:2000 scale in Morija block along with the collection of channel samples, bedrock samples and 03 haematite bands were delineated. Iron ore was seen very well exposed on the surface. Band-I continued for approx. 1.3km strike length with variable thickness of 7 m to 30 m. Strike length of the band-II was 450 m which varied in thickness from 6 m to 13 m. Kankeria area exposed the shortest band, i.e, Band-III of haematite which continued up to 210 m strike length and was 6-12 m in thickness. During the detailed mapping, a total of 121 channel samples, 25 bedrock samples, 10 petrochemical samples and 15 samples from trenches & pits were collected for analysis. On the basis of detailed mapping on 1:2000 scale, three bands of haematite were demarcated. Band-I hosted haematite quartzite and occurred at the contact of basement and Fe quartzite. Band-II contained brecciated ferruginised quartzite which was separated from Band-I by micaceous quartzite. Band-III was also hosted in haematite quartzite. About 08 channels were put up in Band-I, 03 channels in Band-II and 02 channels in Band-III near Kankeria. Classical wet chemical analysis of Fe in channel samples proved encouraging values. Most prominent values were in the channel near hinge zone in haematite quartzite in Band-I and another in the brecciated ferruginised quartzite in Band-II. Channel no. 26384/MCH/07 near hinge showed 6 m wide zone with 66.08% Fe (weighted average) while Channel no. 26384/MCH/09 exposed 6 m wide zone with 58.24% Fe value (weighted average). Samples from Channel no. 26384/MCH/06 were collected above an abandoned mine in Band-I, which exposed 17 m mineralised zone with 59% Fe value (weighted average).

The detailed mapping revealed prominent occurrence of iron ore mineralisation in the block. As channel samples have yielded encouraging values of iron (>55%), it is likely to be present in sub sur-face.

Exploration work carried by NMDC (:)is refelected in (Table -6).

Table-6: Exploration for Iron Ore by MECL & NMDC 2020-21

Agency/ Mineral/ State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (ha)	Boreholes	Meterage		
MECL	-	-	-	-	-	-	
Chhattisgarh Dantewada (South Bastar)	Bailadila Iron ore Mines Bachel D-5	-	-	43	4901.0 m	-	Processed Ore— Lump+CLO=35.01lakh tonnes. Fines=43.48 lakh tonnes and Slimes=0.97 lakh tonnes. Waste handled:- 3.04 lakh tonnes.
	Bachel D-10	-	-	13	1094 m	-	The ROM capacity of the mine: 6.0 million tonnes. The ROM capacity of processed ore—6.0 million tonnes Lumps: 1.02 million tonnes Fines: 3.90 million tonnes Waste handled: 2.32/16.50 million tonnes

Directorate of Geology and Mining, Rajasthan

During 2020-21, exploration for iron and associated minerals was taken up near village Karoth ki Dhani, Jagdishpura, Pachlange, Papra, tehsil Udaipurwati in Jhunnunu district. A total of 10.50 sq.km area on 1:10000 scale and 2.10 sq.km area on 1:4000 scale were mapped and 10 samples were collected for analysis. During the investigation, exposures of pegmatite, calc silicate gneiss, quartzite, iron band, granite gneiss, etc. rocks were mapped. In Bhilwara district, investigation for iron ore in Dhulkhera & Jeepiya area, Bhilwara tehsil, involved mapping of 20 sq km. area on 1:10000 scale, 25 sq.km area on 1:2000 scale and 4 pitting & 5 trenching in the study area.

Karnataka State Minerals Corporation Ltd (KSMC)

During 2020-21, KSMC has carried out exploration in its Subbarayanahalli iron ore mines (ML-2629) located in Sandur Taluka Bellary district, Karnataka, with an objective to know the depth continuity and lateral extension of iron ore in mining lease area. Two boreholes were drilled to cumulative depth of 142.40 m. Out of the total resources of 74.95 million tonnes were estimated in the area, 68.91 million tonnes estimated under Reserves category. In Thimmappanagudi iron ore mine (ML2605) Village Krishna nagar, Sandur Taluka, Bellary district, a cumulative total of 308.20m drilling were done in 9 boreholes. Besides, an area of 136.94 ha was mapped on 1:2000 scale, 957 samples were collected and trenches were excavated in the lease area to know the depth continuity and laterat extension of iron ore. A total of 3.58 million tonnes of reserves were estimated in the ML area.

Directorate of Geology, Odisha

A G2 level exploration taken up since March 2020 was under progress for iron ore in Mankarnacha iron ore prospects. So far the two boreholes were drilled to a cumulative depth of 72.0 m. A total of 11.0 m thickness iron

were encountered in the boreholes. The Directorate has also taken up a G4 stage investigation for iron ore around Thakurani, Keonjhar district. An area of 3.995 sq.km was mapped on 1:10000 scale. Iron ore mineralisation was confined mostly to the southern part of the block over an area of 0.81 sq.km. Delineation of ore body is in progress through trial excavation and large-scale mapping.

Directorate of Geology and Mining, Nagaland

The Directorate of Geology and Mining under took a G4 stage exploration for Ni-Co-Cr magnetite in Mollen-Jopi-Ziphu Ridge and adjoining area, Naga Hills ophiolite, Phek district. During investigation in Thewati and Reguri, an area of 0.26 sq.km and 0.056 sq.km was mapped on 1:12500 scale and a total of 60 and 42 samples were for chemical analysis, respectively. In Thewati, 2.84 million tonnes magnetite resources of Fe > 45% to 55%, (Avg. % Fe 47.27, Ni 0.64, Co 0.058, Cr 1.246, Ti 0.194 & V 0.017 and 1.68 million tonnes resources of Fe > 30% to < 45% (Avg. % Fe 32.28, Ni 0.865, Co 0.06, Cr 1.01, Ti 0.105, V 0.019) were estimated in the area. In Reguri area, 0.81 million tonnes resources of Fe > 45% to < 55% (Avg. % Fe 47.21, Ni 0.64, Co 0.058, Cr 1.246, Ti 0.194, V 0.017) were estimated. These investigation was sponsored by NMET.

Manganese Ore

GSI

In Jharkhand, during reconnaissance survey for manganese mineralisation around Basedera-Babaida area, East Singhbhum district, a total of 100 sq. km area were covered by large-scale mapping, 60 cu. m. of pitting/trenching and about 50 bedrock samples were collected from potential lithounits. The study area formed a part of North Singhbhum Mobile Belt. Small veinlets of manganese from a few mm to cm width were present near Phuljhor, Amalgora and Ramchandrapur within phyllite and quartzite. Manganese mineralisation in north western part

of field area near Dharagiri fall and Terapani was observed along margins of quartz vein intruded in quartzite, whose thickness was about 10 to 20 cm. Near Maheshduba and Bhaduya, manganese mineralisation was observed within laterite cover developed over phyllite and quartzite. Near Phuljhor, Dainmari and north of Basadera, manganese mineralisation was observed as bedded type of about 1–2 m thickness in the study area. Old working in the form of adit was observed in the field area at 6-7 places. The chief ore minerals in the study area were psilomelane, pyrolusite and subordinate amount of braunite. The value of Mn in the BRS ranged from 0.01 to 1.49 % and Fe ranged from 0.45 to 29.49n%. Chemical analyses result received for PCS sample depicted 2,549 ppm Cr and 1,260 ppm Ni in staurolite mica schist near Basadera.

In Odisha, during general exploration for manganese and iron ore in Chormalda Block, Kendujhar district, an area of 1.41 sq. km was covered by detailed geological mapping along with 57 cu.m of pitting and trenching. Ferruginous shale, manganiferous shale, iron and manganese laterite were the dominant unit exposed in the study area. A part of the block was covered with float haematite ore. Laterite hosts varying proportion of haematite angular fragments, psilomelane nodules/botroids with occasional shale and goethite. Below the laterite/lateritised float ore, manganese occurred as detached lenses, pockets of Wad +Psilomelane+Goethite. Iron and/or manganese float ore were subjected to in situ residual enrichment due to lateralisation.

In Sundargarh district, general exploration for manganese ore was carried out in Orahuri, Kusumdihi and Banjikusum blocks. The exploration work in these three non-working mine blocks were taken up by GSI, on request from Govt. of Odisha. An area of 1 sq. km was mapped on 1: 2000 scale with 1,444.60 m drilling and collection of 624 core samples. The manganese ore in Orahuri Block was generally associated with laterites and Lower Shale Formation of Koira Group. The ore body occurred as irregular tabular type and at places as lensoid/pocket type. A total of 685.30 m drilling was carried out in thirteen boreholes over 0.51476 sq. km. area. All the 13 boreholes intersected manganese ore with more than 10% Mn content. The total manganese resource estimated up to a maximum depth of 79.00 m at 10% and 25% Mn cut-off were 7.18 MT with 21.39% Mn and 2.42 MT with 32.39% Mn, respectively. In Banjikusum block, a total of 380.00 m drilling was carried over an area of 0.08134 sq. km. The total resource estimated at 10% Mn cut-off was 0.097 MT with 11.34% average Mn. In Kusumdihi block, a total of 8 boreholes were drilled with total meterage of 379.30 m and 62 core samples were collected. Three boreholes have intersected manganese ore with more than 10% Mn content and one borehole intersected iron ore zone with above 45% Fe content. The total manganese resource at 10% Mn cut-off was 0.0944 MT with 13.64% Mn over an area of 0.31549 sq. km. The resource was estimated up to a maximum depth of 18.00 m.

During general exploration for manganese in mined out area of Patamunda West Block, Sundargarh district,

detailed mapping of 0.59 sq. km on 1: 4000 scale, was carried out in Patamunda West block along with drilling and collection of petrographic and core samples. Patamunda West Block was found occupied by thin layer of laterite and manganiferous laterite at the top which was underlain by white shale, variegated soft friable manganiferous shale and hard compact, fine-grained purple colour phyllite/shale.

A preliminary exploration for manganese ore in Upardhodshi block, Koraput district, was taken up as 2-year exploration programme, i.e, 2019-2021. During 2019-20, 1.016 sq km detailed mapping, 20.2 L km gravity and magnetic survey were carried out in the block and 115 cu. m pitting and trenching, 61 pit-trench samples and 60 bedrock samples were collected and analysed to evaluate the surface potential of manganese ore. A total of 34 petrological samples including 30 samples for thin polished section and 4 samples for polished section studies were also collected and studied to identify manganese ore minerals in the study area. The block formed part of the Eastern Ghat granulite terrain and was observed to fall within the 32 km long and over 5 km wide Kutinga–Nishikhal manganese ore belt in southern Odisha. The rock types exposed in the block were khondalite, quartzite, calc- silicate and granite gneiss. Manganese ore bodies were confined to the highly weathered khondalite and quartzite in the area and occurred in the form of fine disseminations, streaks, lenses, bands, patches along the foliation planes and fracture filling. Ore microscopic study of manganese ore reveals that the major manganese minerals were cryptomelane, psilomelane, pyrolusite. Cryptomelane and psilomelane occurred in the form of colloform bands sometimes with alternating layers of goethite.

On the basis of surface indication and analytical results of bedrock and trench samples, Mn bands (Band I to V) were delineated in the area. The manganese ore bands of cumulative strike length of 115 m and 10 m average width (Band-I); 230 m cumulative strike length and 35.5 m average width (Band-II); 174 m cumulative strike length and 45.5 m average width (Band-III); 120 m cumulative strike length and 6 m average width (Band-IV); and 110 m cumulative strike length and 8 m average width (Band-V) along with smaller outcrop of siliceous manganese ore in western part of the block and isolated patch of Mn in the southern part of block were delineated. Surface sampling was done at 50 to 100 m interval. Analytical results of channel samples showed Mn content varying from 0.80 to 60.01 % and in PTS samples Mn content varied from 1.46% to 31.20% .

In West Bengal, during reconnaissance survey for manganese and associated sulphide mineralisation in and around Chaukisar-Pahar area, West Medinipur district, an area of 100 sq. km was covered by on 1:12500 scale in and around Chaukisar Pahar, Labani, Pathachakri, Sarisabasa, Odolchua, Mahulbani and Balichua areas in Jhargram district along with collection of 154 BRS, 50 PTS, 10 PCS and 25 petrological samples. The phyllite band that occurred near Chaukisar Pahar was found to be manganiferous. Manganese occurred as thin bands parallel

to the main foliation within the phyllites. At places near Labani, Patharchakri, manganese occurred within laterite cappings over the phyllite. The brecciated quartzite found near Chaukisal Pahar and Labani were also manganiferous. Impersistent lenticular bands of banded iron formation were found in Sarishabasa, south of Balichua area. Sulphide mineralisation in the form of disseminations of chalcopyrite and pyrite is mainly observed within metabasalt. Manganese mineralisation was mainly confined to the phyllites and brecciated quartzites.

In Andhra Pradesh, during preliminary exploration for manganese in Jaggarajupeta block, Vizianagaram district, an area of 1.5 sq. km on 1:2000 scale was mapped along with collection of BRS, PCS, PS samples. A total of 720 m drilling were done in nine boreholes to check the depth continuity and resource estimation of demarcated manganese mineralisation. Out of nine boreholes (AVJ-1, AVJ-2, AVJ-3, AVJE-1, AVJE-2, AVJE-3, AVJE-4, AVJE-5, AVJE-2A), eight boreholes were drilled at first level, while one borehole (AVJE-2A) was drilled at second level. In Borehole AVJE-2, two Mn zones were intersected, from 10.50 to 24.00 m and 33.00 to 51.00 m. In AVJE-1, the Mn was zone recorded at depth from 22.5 to 24.00 m and 36.00 to 39.00 m, in AVJ-1, the Mn zone was intersected from 42.30 to 49.10 m and 58.50 to 85.00 m. In AVJ-2, Mn zone was intersected from 45.10 to 50.10 m and from 63.50 to 64.50 m. In Borehole AVJE-4, the Mn zone was encountered at depth of 50.10 to 58.90m. In AVJE-2A (II level) Mn zone was intersected at a depth of 47.10 to 51.40 m., 110.80 to 118.50 m and 122.40 to 136.00 m with visual estimation of Mn at 15–20%.

In Srikakulam district, during preliminary exploration for manganese in Garraju–Cheepurupalli block, Eastern Ghat Mobile Belt, detailed Mapping of 1 sq. km area was covered in the field season 2020-21. The manganese mineralisation was found to be associated with quartzofeldspathic gneiss and quartzite. Out of 26 bedrock samples, average Mn value of 17 samples was more than 10%. About 10 boreholes were drilled to a cumulative depth of 720 m. Manganese zone intersected in Borehole ASG-5 and in Borehole ASG-3 was about 21.3 m and 27 m thick respectively. In Boreholes ASG-1 and ASG-6, Mn mineralisation encountered was 11 m thick manganese zone. Whereas in ASG-17 and ASG-19, Mn zone intersected was from 39 to 54 m and from 30 to 36 m, respectively.

The ore petrographic studies revealed psilomelanerhodonite, braunite, jacobsonite, pyrolusite and cryptomelane as the major ore minerals in the area. The gangue minerals were goethite, haematite, graphite, quartz, altered sillimanite, apatite, zircon, sphene, garnet, rutile, ilmenite, and biotite etc.

A preliminary exploration for manganese in Vommi block, Vizianagaram district, was taken up with an objective to assess potential of manganese mineralisation. An area of 2 sq km was covered on scale of 1:2000. The Mn mineralisation was seen associated with khondalite and was present at the contact with altered/kaolinised quartzofeldspathic gneiss. The ore occurred in forms of botryoidal small bands and concentric layers. Under microscope,

minerals identified were mainly Psilomelane, Pyrolusite and Manganite, associated with limonite, goethite and quartz as gangues. Disposition of old manganese pits and excavated pits/trenches marked the mineralised zone, which was found extending for a length up to 1,000 m with width varying from 10-20 m. Analytical results of bedrock samples showed MnO ranging from 0.04- 9.66% and in pitting/trenching samples, MnO ranged from 0.11 to 9.37%.

During reconnaissance survey for manganese mineralisation in Tilaru–Nimmada areas, Srikakulam district, an area of 100 sq. km was mapped on 1: 12500 scale along with collection of 100 BRS, 100 PTS, 5 PCS, 20 PS and 10 ore microscopy samples in the block during the field season 2020-2021. The manganese mineralisation was observed in the form of manganiferous dissemination, thin veinlets and stringent associated with kaolinised quartzofeldspathic gneiss and garnet–sillimanitegneiss. Chinna Bommidi showed dimension of 300 m strike length and 25 m width in Chinna Bommidi area (MnO: 0.01% to 0.35%). The observed overburden in this area was 5-10 m. Alteration zone with manganese dissemination and thin veinlets were observed near Kota Bommali having strike length of 300 m and width of 2-10 m with overburden of 5-10 mts (MnO: 0.04% to 2.37%). In Yetturalapadu, Mn occurrence in the form of thin veinlets was observed within the garnet-sillimanite-gneiss. On the hill 130, it was observed that the Mn-dissemination and encrustation in the garnet–sillimanitegneiss having dimension of 10 m thick and 300 m strike.

In Rajasthan, a two year (2019-2021) preliminary exploration for manganese, phosphorite and associated mineralisation in Karoli Ki Dhani block, Rajsamand district, was taken up in the study area. Detailed mapping of 2.0 sq. km area on 1:2000 scale along with bedrock, channel sampling and pitting/ trenching was completed during field season 2019-2020. The lithounits in the study area were manganiferous metachert, ferruginised metachert, quartzite/ metachert, dolomite and phyllite. About 50 trench samples were collected from 5 trenches and sent for chemical analysis. Trench-1 indicated MnO value ranging from 01 to 23.23% with average grade of 13.05% MnO over 4 m width and Trench-3 has indicated one sample with MnO value of 25.32% over 1 m width. On the basis of encouraging result of Mn values in Trenches 1 and 3, Borehole RJKKD-01 was planned in the profile of trench-1 and borehole RJKKD-03 was planned in the profile of Trench-3 at 400 m north east of RJKKD-01.

During preliminary exploration for manganese in Negariya block, Rajsamand district, Rajasthan, detailed mapping on 1:2000 scale was carried out to evaluate the potential of manganese and associated mineralisation in the study area. Lithologies exposed were manganiferous quartzite, ferruginised quartzite, calcareous quartzite, grey quartzite, intercalated phyllite within impure dolomite. Manganese mineralisation was prominently associated with manganiferous brecciated quartzite. Evidences of mineralisation were noticed in the form of pyrolusite, psilomelane and old working in manganiferous quartzite

north of Village Negariya. Thickness of manganiferous bands varied from 25 to 50 m and length from 100 to 600 m and were mainly found as peak of ridges in discontinued manner. Trench-A chemical analysis showed MnO ranging from 0.63 to 16.97 %.

A reconnaissance survey for manganese in Kalinjara–Kasoomba area in Banswara district involved mapping of area on 1:12500 scale. Different types of samples were collected (100 bedrock samples, 50 pitting/trenching samples, 10 petrological samples & ore microscopy samples (each) and 05 electron probe micro-analyser samples) for analysis. Bedrock samples (100 nos.) were collected from the manganese-bearing rocks and channel sampling were carried out for pitting/trenching sample across the strike of mineralisation. Manganese ore was seen associated with the manganiferous phyllite of Kalinjara Formation of Lunawada group. The manganiferous phyllite linear band indicated a total strike length of 14 km with average thickness of 20 meter. indicated a 11 km strike length was exposed while 3 km strike length were noticed to have been covered by thick pile of basalt near Village Bhakhri . It was found along the regional foliation plane in the form of thin bands of manganese ore minerals (both pyrolusite and psilomelane) within phyllite. Out of 20 thick manganiferous phyllite band, main ore-bearing zone was only 3 to 5 meter thick and was exposed as interbedded within manganiferous phyllite. Analytical results of 44 BRS samples revealed MnO value ranging from 12.19 % to 65.83% in 40 BRS samples. Maximum value of MnO was 65.83% found in Sample no. KKL1 collected from Kalakhunta mines. MnO values ranged from 51–58% in 4 samples. Maximum of 58.48% MnO value was found in KKL8 collected from NW of Village Ghatia and MnO value of 51.36% and 51.42% was observed in Sample no. KKB28 and KKL3 respectively which were collected from south of Village Timba Mahuri and NW of Village Kalakhunta.

During reconnaissance survey for manganese in Kanajpara–Kushalgarh area, Banswara district, large scale mapping (1:12500 scale) was carried out covering 100 sq km area around Magarda, Badwas, Kushalgarh, Pali Choti, Rupkhera, Wagaicha, Nisawatect area of Kushalgarh tehsil, with an objective to delineate potential zone of manganese ore. The manganiferous phyllite of Kalinjara Formation was the main potential rock for manganese mineralisation in the study area. It was exposed as a linear band of approximately 5 km in strike length with thickness of 20 meter from Rupkhera in the north-west to Sasakwadi in the south-east. It consisted of thin bands of manganese ore minerals (both pyrolusite and psilomelane) with intercalation of chert and phyllite. Out of 20 meter thick manganiferous phyllite band, main ore-bearing zone was only 2 to 3 meter thick which was exposed in mid part of 20 meter thick band.

During the course of mapping ,50 cu. m trenching work was carried out through 5 numbers of trenches across the manganiferous phyllite and 50 BRS, 10 ore microscopy, 10 petrological and 5 EPMA samples also were collected.

Directorate of Geology, Odisha

In odisha, an exploration in Roida-D area, Keonjhar district, was under progress since 2019-2020 and so far 772.0 m of core drilling in 22 boreholes were completed. cumulative thickness of 91.30 m of manganese mineralisation was encountered. Pyrolusite and psilomelane occurred as irregular pockets with pinching and swelling effects.

Rare-earth Elements (REE)

GSI

In Maharashtra, during preliminary exploration for Rare earth Elements and Rare Metal (RM) mineralisation at Pipra–Mahegaon–Dongarla area, Bhandara district, large-scale mapping of over 50 sq.km area, followed by collection of bedrock sample (BRS) and stream sediment samples, pitting for bulk samples and auger drilling of 500 m were carried out. A few pegmatite veins were mapped to the north and northwest of Village Sakri. REE-bearing mineral phases like zircon, monazite, xenotime and allanite were reported in these pegmatites in accessory amounts. Auger drilling in loose sediment along the depositional sides of the River Ambagarh was completed over 2.56 sq km covering 1.44 sq km area on the right side and 1.12 sq km area on the left side of the River Ambagarh. A total of 52 number of auger boreholes were drilled in grid pattern of 400 m X 200 m. The boreholes were drilled up to a maximum depth of 14 m and a minimum depth of 5 m. The average thickness of loose material was about 10 m, and it contained rare-earth-bearing heavy minerals viz zircon, monazite and xenotime (rare-earth phosphates), as well as magnetite, ilmenite and rutile. A total of 255 auger samples were collected at 2 m intervals of borehole depth. Petrographic and geochemical investigation of the heavy fraction revealed the presence of REE and RM. The principal rare-earth-bearing minerals within the auger samples identified included rare-earth phosphates monazite ($[Ce, La, Y, Th] PO_4$), zircon ($ZrSiO_4$) and xenotime (YPO_4). The geochemical analysis indicated that the REE varied between 0.8 and 2% in the heavy mineral concentrate. The LREE concentration was from 0.1 to 1.6 % and the HREE concentration was up from 0.05 to 0.35 %. The results indicated a potential for low-grade secondary resource of REE in stream placers/ loose material of pegmatite and Tiroda–Biotite-gneiss. The thorium content in the auger samples varied between 12 and 1,512 ppm and the uranium concentration was between 2 and 112 ppm. Zirconium showed concentration between 0.01 and 1.3 %. The rare earth prospect explored in Pipra–Mahegaon–Dongarla block revealed flat laying deposit extending from the surface to a maximum depth of 14 m.

In Bihar, during reconnaissance survey for REE and associated minerals in Barhulia Block, Munger district, an area of 100 sq. km was covered on 1:12500 scale, along with pitting/trenching and collection of BRS, PCS, colluvial, alluvial, stream sediment samples and PS, XRD, SEM & EPMA studies. The analytical result of bedrock samples showed tREE values from 63.86–486.78 ppm.

A preliminary exploration for REE and Rare Metals in Nari Block, Banka district, included detailed geological mapping (1:2000 scale) of 2 sq. km area, pitting & trenching of 50 cu.m and auger drilling of 90 m with collection of 51 pit & trench samples, 90 auger soil samples and 150 bedrock samples. Bulk samples were collected from 05 pits (1 cu. m. each) and the panned heavies were sent for chemical analysis. Auger drilling on 200 m x 200 m grid pattern was carried out over the insitu soil profile. Available analytical data (15 nos.) indicated higher concentration of REE in bedrock samples collected from boudinaged migmatite gneiss and C-horizon developed over it, with values ranging from 410 to 889 ppm.

In Jharkhand, during preliminary exploration for REE and Rare metals in Hupnatola Block, Godda District, an area of 10 sq. km was mapped on 1:4000 scale to access the potentiality of the rare-earth elements (REE) and rare metals. The granite gneisses in the area were intruded by variants of younger granites, pegmatite, and quartz veins. Pegmatites bodies ranging from 20–200 m in length and 5–25 m in width were mapped. A zoned pegmatite was observed north of Khariani. The pegmatite bodies trend in three directions. The pegmatite bodies trending NE-SW and E-W were mostly tourmaline-bearing. Magnetite is observed in pegmatite vein (40x10 m) east of Village Khariani. An Auger drilling of 240 m was completed in 120 boreholes which were drilled for 1–3 m depth at regular interval of 300 m x 300 m in grid pattern. A total of 50 BRS, 330 soil samples by auger drilling, 100 heavy mineral samples, 20PCS, 10 SEM and 20 XRD samples were collected.

In West Bengal, during preliminary exploration for REE & RM mineralisation in Kalapathar–Raghudih Block, Purulia District, a total of 732 m drilling were carried out in 11 boreholes (WBKR-1 to WBKR-11) along with 166 cu. m of pitting & trenching, 103 channel sampling. REE mineralisation was mainly restricted within the pegmatite veins intersecting the host lithology of porphyroclastic granite gneiss. Exposure of this mineralised vein-bearing porphyroclastic granite gneiss was very scanty and showed a wide variation in their trend. The mineralised pegmatite veins showed variation in composition and were identified in four different categories viz. (a) Quartzo feldspathic vein \pm baryte, sulphide, (b) Green coloured epidote and amphibole-bearing veins \pm barite, sulphide, and tourmaline, (c) Course-grained, comparatively thicker pegmatite vein with myrmekite texture at places, and (d) barite vein. The PGG intersected in boreholes showed variation in clast sizes. HBG was mainly intersected in 7 boreholes. The veins intersected in the boreholes occurred in sporadic manner and they were not very thick.

In Assam, during reconnaissance survey for REE in Panbari–Geleki area, Karbi Anglong district, large-scale mapping on 1:12500 scale was carried out with an objective to delineate prospective zones enriched with REE and for resource estimation. The granites of the study area showed both porphyritic and medium-grained nature. Both these granites were highly weathered and had intermittent regolith development (up to 10 meter) with distinct A, B

and C horizons. The REE concentration (10 BRS samples) from granite samples ranged from 300–500 ppm. The presence of REE phases like zircon, monazite, xenotime, apatite grain in the granites (up to 1%) suggested potential REE mineralisation in the study area.

In Arunachal Pradesh, during preliminary exploration for REE and associated precious and base metal in Lodoso East Block, Papum Pare district, detailed geological mapping was carried out on 1:2000 scale with an objective to delineate REE-bearing zones. A mineralised zone of 1,000 m in strike length with 30 m to 40 m outcrop thickness was delineated in the study area. Native copper, magnetite, brochantite and pyrite were some of the ore minerals present and observed in the target zone. The zone was confined within garnetiferous–quartz–biotite schist of Khetabari Formation. The samples collected from the respective zone yielded max. 3.0% REE as a channel sample, 4,808 ppm value of REE with wt. Avg. value of about 2,385 ppm from a 10 m long trench sample, 1.3% max. value of REE with wt. Avg. value of about 0.69% from a 05 m long trench sample. About 23 pit samples out of 40 samples collected from the area yielded TREE values >0.2% with maximum of 2.0% TREE. Apart from REEs, encouraging values of copper up to 2,790 ppm (max.) and Au value of 280 ppb (max.) were also reported. All the samples from mineralised zone yielded high Fe₂O₃ ranging from 32 to 82% along with anomalous P₂O₅ (up to 1.56%). REE-bearing mineral phases like monazite, allanite, xenotime, zircon, thorite, scheelite and euxenite were identified in EPMA analysis. Peaks of elements viz. lanthanum, cerium, neodymium, dysprosium, yttrium, tungsten, tantalum, antimony, lead, silver & tin were also identified during scanning electron microscopy (SEM) studies.

In Meghalaya, a reconnaissance survey for REE and other associated minerals was taken up in parts of East Khasi Hills, West Khasi Hills & Ri-bhoi districts. Based on the outcome of the material maps using ASTER data, a total of 275 sq km regolith cover map was prepared on 1:50000 scale. Heavy mineral separation of soil horizon was done and accessory phases like monazite, zircon and xenotime were identified in microscope for regolith over AMGC but not only minor quantity of zircon, apatite was also obtained from regolith over granite. Some grains of kaolinite had REE adsorbed in its lattice. EPMA analysis of bedrock showed mostly bastnasite (REE carbonate) followed by monazite, xenotime and REE-sphene. Since the REE concentration in the Wallang–Nongspung area were mostly interpreted to be due to ion adsorption in clay, a block has been delineated for further exploration. Sulphide mineralisation in the form of dissemination of pyrite was observed near Village Kyrדם in the homophanous Kyrדם granite.

In Uttarakhand, reconnaissance survey for RM, REE and associated strategic mineralisation was carried out along Chardam route Pauri, Tehri, Chamoli, Rudraprayag and Uttarkashi districts involving mapping of 25 lkm in 1:12500 scale, collection of 75 BedRock samples, 25 channel/chip samples, 15 petrological samples (PS), 20 fixed carbon samples, XRD and EPMA analysis of 05 samples each. The

investigation on a total of 100 bedrock samples (BRS) were collected from all bands of carbonaceous slate/phyllite/schist by chip and channel sampling method. Out of 100 BRS, half of the samples (55 BRS) showed REE values ranging from 24.71 to 415.81 ppm. V value ranged from 15 to 736 ppm. About 20 bedrock Samples (BRS) showed fixed carbon value ranging from 0.16 to 8.49%.

In Telangana, during reconnaissance survey for REE in and around Rachannagudem–Ankampalem area, Bhadradi Kothagudem district, large scale mapping on 1: 12500 scale was carried out in the study area. The petrological and SEM studies revealed that the major heavy mineral phases were monazite, zircon, ilmenite, rutile, garnet, xenotime, thorite and silicates. The study revealed that the HMS sample has high concentration of REE and other trace elements than the other media samples. The REE value of 45 HMS varied from 1.21 to 18.33%, average was 5.71%. A total of 34 regolith sample (clay fraction) showed REE value ranging between 159.63 and 1,603.47 ppm, average was 496.81 ppm. The REE values of BRS (73 nos.) ranged from 111.88 to 3,811.66 ppm. Analysis of all the media showed LREE as higher than HREE. Other than REE, Ti ranged from 482.21 to 34,699.12 ppm, Zr varied from 75.92 to 82,599.68 ppm and Th value varied from 5.19 to 32,593.1 ppm from all the media. The above observations showed that the heavy fractions from stream sediments contained significantly high REE and monazite was the main contributing mineral phase for this high REE incidence.

In Kerala, a reconnaissance survey for REE and other Rare Metals mineralisation around Chittirapuram, Idukki district, involved large-scale mapping of 100 sq. km on 1: 12500 scale with 50 cu.m pitting/trenching and collection of 118 BRS, 50 PTS, 50 regolith, 50 SSS, 30 PCS, 26 PS, 5 EPMA, 10 nos. of XRD and 5HMS samples. Pegmatites, granite and foliated granite were the favourable host rocks for REE. Based on the analytical results of bedrock samples, two potential REE mineralised zones were demarcated viz. MZ-I and MZ-II. MZ-I was located southeast of Pallivasal and covered an area of 1.15 sq. km. In MZ-I, pegmatites were the host rock for REE. Eight pegmatite samples collected from MZ-I showed REE- at 433.9 to 2896.7 ppm with an average of 1,576.1 ppm. MZ-II was located south of Randam Mile and covered an area of 2.86 sq. km. Six foliated granite samples yielded REE- at 418.4 to 2,077.5 with an average of 897.2 ppm, two charnockite show REE- at 2079.7 ppm and 967.5 ppm, two pegmatite showed REE- at 617.8 ppm and 1,089 ppm and one granite showed REE of 1,535.4 ppm. One heavy mineral sample yielded REE of 3,274 ppm and one alkali-feldspar syenite sample from a tunnel section yielded REE of 6,390.3 ppm.

A reconnaissance survey for REE in and around Uppala area, Kasaragod district was taken up which involved large-scale mapping on 1: 12500 scale over an area of 100 sq. km. The field study implied that the gneisses and associated granite, pegmatites, quartz veins were the favourable rock for REE mineralisation. In the study area, a number of non-mappable pegmatites were observed within different lithounits and systematic sampling was carried out from

this pegmatite. The intense laterisation noticed in the area could have contributed to secondary clay associated REE mineralisation. Systematic soil sampling in grid pattern was carried out in the south-western and eastern part of the study area due to non-availability of outcrops. A total of 101 bedrock samples, 51 regolith samples, 50 of trench samples and 28 petrochemical samples were collected and sent for chemical analysis. Based on the available analytical results of bedrock samples (27 nos.), the REE values in pegmatite ranged from 67.42 to 1,254.54 ppm, in hornblende biotite gneiss—the REE value ranged from 55.08 to 611.72 ppm and in granite gneiss, the REE value ranged from 606.81 to 985.19 ppm.

In Rajasthan, during reconnaissance survey for REE and rare metals around Basni–Motipura–Itunda area in pegmatites of Bhilwara district, large-scale mapping covering an area of 100 sq. km on scale of 1:12500 was carried out. Pegmatites of varying dimension were observed as intrusives within the garnetiferous schist. The pegmatites observed in the study area were differentiated based on mineral assemblage and categorised into four groups viz. Garnet-bearing pegmatite, Beryl-bearing pegmatite, Simple pegmatite and Tourmalinite (pegmatites containing >15 vol. % tourmaline). Survey by UV lamp recorded the presence of scheelite in pegmatites. The mineralisation was confined within pegmatite and tourmaline.

During reconnaissance survey of possible Multi-Metal mineralisation in Sewara area, (Block-32), Jalore district, large-scale geological mapping on 1:12500 scale covering an area of 150 km was carried out. A total of 117 litho-geochemical samples were collected along with 52 pedo-geochemical and 10 ground water samples. Pitting of 67m³ was carried out to ascertain depth as well as strike continuity of mineralised zone. Ground magnetic and gravity surveys were carried out in study areas totaling to 15 km. The Sewara block was mostly under sand cover with a few exposures present in the northern part of the block. The dominant lithounit exposed in the area were felsic pyroclastic, basalt ranging from massive to porphyritic, porphyritic andesite and rhyolite, volcanic breccia, and tuff. The surface indication of mineralisation was observed in the form of ferruginisation, limonitisation and botryoidal structure within fractures of brecciated zone as well as joint surfaces of rhyolite. The analytical results of a few samples indicated high REE concentration (>1,000 ppm) in felsic lava flows and volcanic breccia. High Zr concentration of >1,000 ppm was recorded in 16 geochemical samples, with highest concentration of 1,896 ppm. A total of 695 m were drilled during the current field season.

A reconnaissance survey was taken up in search of possible multi-metal mineralisation in Karwara area, Block -32, Jalore district. A potential mineralised block (Block-32 for Fe, Cu, Pb, Zn, Au, REE) was delineated in Dantwara area. Geological mapping of 100 km² area on 1:12500 scale was carried out to locate possible multi-metal mineralisation in the area. A total of 154 surface geochemical samples, 25 pit and trench samples along with 10 ground water samples were collected. Extensive ground sampling was carried out in the Karwara area.

Four vertical to sub-vertical scout boreholes, with depth varying from 250 m to 300 m, were planned to test the geophysical anomalies. The surface indication of sulphide mineralisation in the area was manifested by the presence of fresh chalcopyrite grains at the contact of rhyolitic & basaltic rocks, fluorite and barite occurring along the fractures. Ferruginisation and limonitisation within fractures and joint surfaces of rhyolite and porphyritic andesite were common. Secondary veins of iron- carbonate were recorded at several places.

A reconnaissance survey of possible multi-metal mineralisation in Dantwara area, Jalore district, included large-scale mapping of 100 km² on 1:12500 scale, lithochemical sampling and collection of, petrological samples, water samples, pitting and trenching. Investigation was carried out in and around Dantwara–Lakhawas–Tavedar area. A sampling strategy emphasising the contact zones of lithounits, brecciation, quarry wall, veins/fractures surfaces and ferruginisation was employed to collect 166 lithochemical samples along with 10 water samples. Numerous abandoned linear quarries for fluorite and barytes were located in and around Dantwara–Taveedar–Lakhawas. The felsic volcanic breccia holds the fluorite and baryte mineralisation mainly along the fractures as fracture filling and veins. Maximum Ba concentration recorded was 48%.

A reconnaissance survey of possible multi-metal mineralisation was taken up in Karara area, Jalore district. A potential mineralised block (for W, Fe, Cu, Pb, Zn, Au and REE) was delineated in Karara area. Large-scale geological mapping was carried out over an area of 150 km² on 1:12500 scale. To assess the mineral potential of the study area, 130 lithochemical samples and 10 ground water samples were collected along with 50 m³ of pitting and trenching. Fluorite was present as vein type mineralisation in the hills south of Chatwara within felsic pyroclastics. Analytical results received indicated that alkaline felsic volcanics contained significant amount of rare-earth elements with highest 1,878 ppm concentration of REE+Y. Highest Zr concentration recorded 3,356 ppm, which was also from alkaline felsic volcanics. No significant concentration of base metal, iron, tungsten or gold was recorded. Four to five scout boreholes were planned in the area to test the Aeromagnetic anomalies and so far, 300 m of drilling were complete.

A reconnaissance survey for REE & RM in Selri–Bhadrajun areas, Jalore district, was carried out by large-scale mapping of 100 sq km area on 1:12500 scale around Selri and Bhadrarjun in Rajsamand district. To identify REE-bearing phases, the quantum of sampling done included chemical analysis of 100 BRS, 10 PCS and petrological studies of 10 PS and 15 OM. Major rock types mapped in the area were mainly variants of acid volcanics whereas N-S trending hillocks of granites were exposed in western side (4-5 km) of the study area. Presence of at least three phases of igneous activities was revealed in the area. The Phase-I was extrusive in nature being represented by felsic flows and pyroclastics. Almost all the outcrops present in the mapped area consisted of acid volcanics belonging

to Phase-I. They predominantly were represented by porphyry rhyolite with other felsic flows and pyroclastics. Phase-II was intrusive in nature and was represented by homophonous, massive biotite granite having no exposed contact with the surrounding volcanics (i.e. Phase-I) mapped in the study area. There was a gap of about 4-5 km between rhyolites and granites. The last phase (Phase-III) was intrusive in nature consisting of various felsic and basic dolerite dykes cutting across rocks of both the earlier two phases. Isolated outcrops of the northern half of the area were mainly composed of porphyry rhyolite with the phenocrysts of quartz and K-feldspar. In the southern half of the area, central portion of the largest continuous outcrop was occupied with porphyry rhyolite; whereas, various other felsic flows separated by intermediate pyroclastic beds were present in the flanks. There was no indication of any mineralisation noticed on the surface. Analytical results of various bedrock samples and petrochemical samples were yet to be received. After receiving all the analytical results, interpretations regarding mineralisation and total REE content in the study area would be carried out.

In Rajsamand district, reconnaissance survey for REE and associated mineralisation was carried out over an area of 100 sq km around Panri and Kundwa area. The survey work included chemical analysis of 150 BRS, 18 PCS and 50 'C-horizon' soil samples to know the distribution of major and trace elements in different lithounits. Petrological study (15 PS and 10 OM) was done to identify the various mineral phases and their textural relationship. The only REE mineral identified in the field was allanite (silicate phase), which was present in migmatite gneiss intermixed with porphyritic augen gneiss near west of Kawas ka Gurha and Bhurwara and in quartzo-feldspathic veins intrusive into porphyritic augen gneiss near Ran which met granite near Banjarya. The allanite grains were present mainly in quartzo- feldspathic vein. Monazite (phosphate phase of REE) was identified by petrographic study. EPMA study of 05 selected samples was yet to be carried out. Based on the available analytical results of various lithounits, the total REE concentration ranged from 5.06 ppm in pegmatite to 963 ppm in Amet granite. Maximum REE value received from pegmatite was 135 ppm which clearly indicates that REE potential in pegmatite was less as compared to various granite and migmatite rock present in the study area.

In Gujarat, a preliminary exploration for Rare-earth Elements and RM was taken up in Nakhal block of Saidiwasan Carbonatite Complex, Kawant Taluka, Chhota Udaipur district. Based on the work carried out in the previous field—season 2019-20, 5,800 m of drilling work were taken up during the FS 2020-21. A total of 56 boreholes of 100±20 m vertical depth with 200 m spacing were planned. Two boreholes intersected carbonatite breccia along with fenitised phonolite. Carbonatite breccia was the main potential source for REE and RM. Soaked sandstone were also found along with carbonatite breccia. Average thickness of carbonatite breccia was 50–60 m.

In another preliminary exploration for (REE) mineralisation and other RM in Gogadev–Janiyara of

Chhota Udepur district, a total of 90.3 m auger drilling were completed and 100 bulk samples (-35 mesh) were generated from 28 auger boreholes at 400 x 400 m interval. This area comprised plain undulating topography with soil and regolith cover of average thickness of 2-4 m developed over plagioclase-rich biotite granite, micro granite and K-feldspar rich two mica granites. Near Village Janiyara systematic sampling of stream sediments of River Ani in grid pattern was carried out done to assess the REE and RM potentiality of the riverine sediments. About 10 bedrock samples showed TREE value ranging from 364 to 583 ppm. Analysis of 18 samples received so far revealed that the TREE value in B-horizon was greater than C horizon, the total REE value ranged from 518 ppm to 1,300 ppm and 298–1,078 ppm respectively. Element-wise distribution of the REE in all type of samples, which reported > 500 ppm TREE, indicated that La, Ce, Nd and PR in LREE contributed major % of TREE.

STATE DIRECTORATES

Directorate Mines & Geology, Rajasthan

During 2020-21, regional and detailed geological mapping for strategic minerals (REE) and other economic minerals near villages Nosar, Sanpa in Sindhari Tehsil, Barmer district were taken up with an objective to locate REE minerals in the study area. Regional geological mapping of 10 sq.km and detailed geological mapping of 2 sq.km. areas were carried out during the study. The chocolate brown colour carbonatite vein intrusion was found in the maroon colour fine-grained Rhyolite rock exposures in the excavated pit. The dimension of the carbonatite vein was around 40 m in length and 15 cm in thickness. In Carbonatite vein, slight violet colour mineral (REE mineral) was seen in the ground mass. The dimension of the excavated pit was around 200–250m X 50–60— X 2 m. Other rock exposure in the pit was brownish in colour, altered and fractured weathered rock. Pale yellow colour and white/yellow colour veins intruded in the rock in zigzag pattern. The study is under progress.

PLATINUM GROUP OF ELEMENTS (PGE)

In Madhya Pradesh, during reconnaissance survey for PGE, Chromium (Cr) and Nickel (Ni) mineralisation in Padhar mafic-ultramafic complex, in parts of Dolia-Kappa-Gajpur areas of Betul district, a total of 100 sq. km area was covered by large-scale mapping and 130 bedrock samples, 30. petrochemical samples, 30. petrographic samples, 65. pitting and trenching samples, 25 nos. SEM EDS samples and 15. EPMA samples were collected. For systematic geological, geochemical and mineral investigation, six mafic and ultramafic bodies were demarcated within the study area based on their distinct litho-assemblages and mode of occurrence, 1. Naharpur-Bargidhana mafic ultramafic body, 2. Gajpur-Ratamati mafic ultramafic body, 3. Gaulibargi-Pisajhori mafic ultramafic body, 4. Jharkhand-Banjantanda mafic ultramafic body, 5. Mendhapani-Bajarwara mafic ultramafic body, 6. Umarwani-Mardwani mafic ultramafic

body. Disseminated sulphide mineralisation, such pyrite and chalcopyrite was seen mainly in the olivine-websterite, serpentinised and coarse-grained clinopyroxenite and hornblende and anorthositic gabbro. Disseminated pyrite mineralisation were observed in gabbro and pyroxenite in Jharkhand. For identification and to check the potentiality of PGE, Cr and Ni mineralisation in mafic and ultramafic rocks, various types of samples were collected from Ist order drains of selected mafic and ultramafic bodies and pitting and trenching samples from representative rock types were collected and sent for chemical analyses. Based on 35. Cu, Ni, Cr, Co analytical data, the Alaskan type of layered mafic ultramafic complex of Padhar Mafic Ultra mafic Suit recorded copper values ranging up to 435 ppm, cobalt values ranging up to 150 ppm, nickel values ranging up to 945 ppm and vanadium ranging up to 360 mg/kg in Gabbro whereas, pyroxenite recorded copper values ranging up to 315 ppm, cobalt recorded values ranging up to 90 ppm, nickel values ranging up to 615 ppm and vanadium values ranging up to 315 mg/kg. PTS data showed Cu up to 140 ppm, Ni up to 500 ppm and Co up to 50 ppm.

In Karnataka, during preliminary exploration for PGE near Ranganathaswamy Betta, Hassan district, a total of 1.93 sq. km area were covered by ground geophysical surveys viz. magnetic, resistivity and IP methods. A total of 749.49 m drilling were completed in six boreholes in the study block. The first four boreholes were planned on the assay values of trench and bedrock samples collected during G4 stage investigations. Before commencement of drilling, extensive trenching at 100 m spacing was carried out for delineation of continuous zone in the study area. About 268 cu.m trenches were excavated and 305 trench samples were collected keeping the sample interval at 0.5 m and 75 bedrock sampling by chips from outcrop, channel/ groove were also collected for PGE analysis. About 206 trench samples were submitted for PGE analysis. The first three have been drilled on the high surface values of trenches and bedrock. The first borehole was on the mineralised zone in the northern part of the study area. During core logging, sulphides, mainly, chalcopyrite, pyrrhotite and pyrite were seen associated with quartz carbonate. The second borehole was drilled in the southern part of the study area. The sulphides identified were chalcopyrite & pyrite which was comparatively less than first borehole. Third and fourth boreholes were drilled based on the high assay values of bedrock samples on eastern Titaniferous Vanadiferous Magnetite (TVM) reef at 300 m spacing in the northern part. The fifth borehole was planned at 150 m south of third borehole and sixth was planned at 200 m north of second borehole. The magnetic anomaly contour map showed continuous linear feature of TVM showing high magnetic anomaly in Block-1 (North part). Moderate to high chargeability is observed in the block-I represented by Zone-I (N⁷500- S⁹00) and Zone-II (O¹-S⁹00). The amplitude of chargeability decreased while moving from Block-I to Block-II. Moderate low chargeability was observed in the southern part of Ranganathaswamy Betta block which was marked by Zone-III. The high chargeability values in Block-I indicate the possibility of

good disposition of sulphides. Resistivity values varied from 30.1 to 4,484.6 Ohm-m. The high to moderate resistivity values were observed over high chargeability zone. Moderate low chargeability with high resistivity was observed in Zone-III found overlaying the Chromite mine. The strike extent of TVM band observed from geophysical data in Block-I was about 900 m whereas it was 1,300m in Block-II.

Tungsten

GSI

In Maharashtra, during reconnaissance survey for tungsten and associated mineralisation in Chorbaoli–Murda area, Nagpur district, large scale mapping in 1:12500 scale was taken up. The pegmatites in the area were coarse grained and tourmaline-bearing. The contact zones between carbonate rocks of Lohangi Formation and intrusive granite/pegmatite were studied in detail for identification of possible skarn zones. Two skarn zones were noticed in the investigation area, viz

- (1) Skarn zone– I (north of Village Chorbaoli. The skarn rock occurred as low lying outcrops and was well exposed from the western side of National high way 7 to the north of Village Chorbaoli. The width of zone varied from 2 to 3 m and with length of 900 m.
- (2) Skarn zone–II (north of Village Maharajpur). The skarn zone developed at central part of the area, north of Village Maharajpur. The width of zone varied from 2 to 20 m with length extending up to 800 m. The skarn rock was mainly composed of minerals like diopside, actinolite, tremolite, garnet ± wallstonite. Chemical analytical results of bedrock samples collected from skarn and other lithounits indicated that most of the tungsten values were falling below 100 ppm with a maximum 545 ppm in one BRS sample collected from a skarn rock developed North of Village Maharajpur. Similarly, the analytical results of 50 stream sediment samples (panned concentrate) indicated that four values were above 1,000 ppm and maximum value was >1% (11,308 ppm). Though the panned concentrates of a few stream sediment samples analysed higher value of tungsten up to 11,308 ppm, the chemical analytical results of bedrock samples revealed that most of the samples analysed less than 100 ppm W indicating very low incidence of primary tungsten mineralisation in Chorbaoli Murda block.

In Jharkhand, a reconnaissance survey for tungsten and associated minerals in and around Salatua-Kachan area, Palamau district involved large- scale mapping on 1:12500 scale in 100 sq. km area in and around Salatua–In Kachan–Semra areas, bedrock samples (75 nos.), petrochemical samples (10 nos.), stream sediment samples (25 nos.), petrological samples (20 nos.), SEM-EDX (05 nos.) and pitting/trenching samples (50 nos.) were collected and sent for chemical analysis. The surface indications of mineralisation were well developed in skarn zone along with crystalline limestone and amphibolite in the form of azurite, malachite, bornite, pyrite, magnetite, galena and occasionally chalcopyrite. Geochemical analytical results

of bedrock samples showed encouraging value of tungsten ranging from 109.17 ppm to 2,106.45 ppm. Scattered values of Ag ranges from <02 ppm to 52 ppm and Au ranged from <.05 to 0.17 ppm. Isolated value of lead up to 1,608 ppm were also observed around Village Nawadih whereas the values of Zn ranged up to 971 ppm. The analytical result of Au in bedrock samples ranged from >0.5 ppm to 0.17 ppm. The values of U up to 12.48 ppm and Th up to 84.84 ppm were observed from syenite present in the area.

In Jharkhand, during reconnaissance survey for tungsten in and around Nagar Untari, Garhwa District, large-Scale mapping on 1: 12500 scale was carried out in and around Nagar Untari area over 105 sq. km area along with collection of 100 BRS, 100 PTS, 25 PS, and 20 soil samples. Quartz veins and andalusite phyllites were earlier reported to have tungsten mineralisation in adjacent Sonbhadra area. These quartz veins bearing andalusite phyllites were dominantly exposed in and around Village Koraya where a significant intrusive contact between granite and phyllites was observed. Quartz veins of Village Koraya were enriched in tourmaline. A pink porphyritic granite (Phenocryst of K-feldspar surrounded by dark matrix) were found in and around Chechariya and Deikhoh protected forest. These were almost equivalent to pink granite/ biotite granite of Dudhi Granitoid. The analytical results of 20 BRS samples showed that tungsten in phyllite ranged from 3.85 to 6.69 ppm and in quartz vein it ranged from 0.39 to 0.74 ppm.

In West Bengal, during reconnaissance survey for W, Sn and associated mineralisation in Balarampur area, Purulia districts, a total area of 100 sq. km were covered by large-scale mapping in Balarampur–Kana–Pakhi Pahar and 100 soil/ stream sediment samples, 102 BRS, 11 PCS and 25 PS were collected. In the area, mineralisation was indicated by surface metallic stains, specks of sulphides, ferruginisation, brecciation and presence of old workings. Sulphide mineralisation was mainly noticed in ferruginous cherty quartzite (silicified zones), tuffaceous rock. No surface indications of Sn-W mineralisation were noticed during the study. Bedrock samples were collected mostly from cherty quartzite, gneiss, pegmatites and granite on the basis of high specific gravity.

In Meghalaya, reconnaissance survey for tungsten and associated mineralisation was taken up in Nengker block, East Garo Hills district. The pegmatite veins in the area were found intruding the granite gneiss and porphyritic granite. Pegmatite veins varied in length from a few centimetres/ to 10 met and varied in width from 0.5 to 1.5 m. Analytical results from pegmatite veins showed some promising zones of tungsten mineralisation with value ranging up to 500 ppm. Maximum values were recorded around Nengker, Bolsagre, Nengker and Agalgiri area. Lithium value of 116 and 120 ppm were reported from two samples of clay horizons within tertiary sedimentary rocks.

A reconnaissance survey for tungsten mineralisation in Tura area, West Garo Hills and South Garo Hills district was taken up. Precambrian gneisses (biotite gneiss, granite gneiss and augen gneiss) intruded by alkali-feldspar granite, were noticed along with basic intrusive mainly dolerite, pegmatite & quartz veins. A few porphyritic

basic intrusives suspected as a lamprophyre or lamproite at north east and east of Village Nawalgre were observed. Analytical results show tungsten (W) values ranging from 4.44 to 157.81 ppm, with an average of 86.47 ppm; Li values ranged from <5 to 44 ppm and the REE values ranged from 11.26 to 427.77 ppm with an average of 150.85 ppm. Pegmatite veins showed some promising zones of tungsten mineralisation with value ranging up to 500 ppm. Maximum values were recorded around Nengkera Bolsagre, Nengkera Agalgiri area. Lithium value of 116 ppm and 120 ppm were reported from two samples of clay horizons within tertiary sedimentary rocks.

During reconnaissance survey for tungsten mineralisation in Manai–Mairang block, West Khasi Hills district, surface indications of mineralisation were reported in the form of disseminated scheelite grains and greisen veins. Scheelite grains were observed under UV light in a 25 cm thick and 3 m long quartz vein in foliated granite towards northeast of Village Mairang. Another 10 cm thick and 1 m long quartz vein in foliated granite exposed northeast of Village Mairang also contained disseminated scheelite grains. Sulphide mineralisation in the form of pyrite, chalcopyrite and galena were noticed in the quartzite near Village Mawmaram. Maximum tungsten value observed was 1,524 ppm in a 15 cm thick and 3 m long smoky quartz vein near Umthied Bynther village. Three stream sediment samples collected from Umthied Bynther, Wah lakhaw and Mawshut villages also showed tungsten value above 1,000 ppm.

In Uttarakhand, during reconnaissance survey for tungsten, tin and associated mineralisation around Almora, Almora district, large-scale mapping was carried out on 1:12500 scale to delineate the potential zones of W and Sn mineralisation in and around Almora, Petshal, Jakheta, Balta and Phalsima areas. A total of 50 each of bedrock and channel, 77 panned stream sediment samples were collected and sent for chemical analysis. The stream sediment samples were collected from 2nd and 3rd order streams at accessible locations for panning and heavy concentration for chemical analysis. The occurrence of slag and rat hole mines in and around Deora and Alai villages suggested ancient mining and smelting process for metal extraction. These rat hole mines were observed within the graphite schist near the Village Deora along the tributary of Mahadev Gad. These graphite schist bands were highly oxidised altered with full of sulphide minerals. The quartzites were fine-grained micaceous with strong stretching lineation and showed fluorescence under UV light near Village Petshal. The granite gneiss observed to the north of the Village Alai continued NW up to Village Beh. The caught-up lenses of the mica schist were mapped within the granite gneiss that suggested intrusive nature within the mica schist. The lenses of tourmaline rich foliated granite were observed at Binsar to the north of Almora town. The occurrence of tourmaline in this rock indicates hydrothermal alteration.

In Andhra Pradesh, reconnaissance survey for tungsten and associated mineralisation was taken up in Balepalyam- Ramagiri area, Anantapur district involving

large-scale mapping of 100 sq.km area on 1: 12500 scale and detailed mapping of 1.5 sq. km. area on 1:2000 scale. A total of 27 discontinuous quartz–tourmaline veins of 30 to 50 m length and 5 to 30 m width within granodiorite gneiss, have been recorded during detailed mapping. Tiny specks of disseminated scheelite were observed in 8 of these quartz veins. Trenches dug across the strike of these discontinuous veins revealed that these veins continue at depth. Chemical analysis of 76 channel samples collected across the veins, revealed tungsten (W) values varying from 5.04 ppm to 1,868.09 ppm with an average of 55.75 ppm. Among the 27 quartz–tourmaline veins, four veins of 5–30 m thickness and 30–50m length yielded tungsten values of more than 500 ppm. Based on these values, a mineralised zone of 300 m by 150 m was delineated 2.5 km south-east of Balepalyam. Trench samples collected from mineralised zone, across promising tungsten bearing veins, yielded W values between 7.14 and 22.32 ppm. Apart from the tungsten values, promising values of tin (Sn) varying from 5.12 ppm to 442.35 ppm, in soil samples collected from the demarcated mineralised zone were also observed. Additionally, Molybdenum (Mo) and Copper (Cu) values, recorded from different quartz veins throughout the mapped area, varied from 1 to 32.39 ppm and 1 ppm to 0.5%, respectively.

In Rajasthan, during general exploration for tungsten and lithium mineralisation in and around Rewat Hill, Degana, Nagaur district, detailed mapping was carried out at 1:2000 scale covering 0.4 km² area along with collection of 10 BRS, 10 PS, 6 OM, 4 PCS, 3 XRD and 1 EPMA samples. The area of investigation was represented mainly by three hills which stand prominently over the sandy plain and were composed of granite and phyllite. The main hill was entirely made up of granite and the adjoining southwestern hill (Tikli Hill) was of granite and phyllite in which the granite is intrusive. The third hill (Phyllite Hill) was composed entirely of phyllite having stockworks of quartz. These three hills were traversed by a number of quartz veins, pegmatite veins which are wolfram/bearing. Semi consolidated bed of alluvium comprising detrital materials gravel beds were found to lie near foot hill of Rewat, Tikli and Phyllite hills contained erratically distributed wolfram.

A total of 4,111.35 m of drilling were carried out in 19 inclined, deeper level boreholes and 16 shallow level vertical boreholes and 675 CS samples were generated from W-mineralised zones. All the inclined, deeper level boreholes intersected significant W-mineralisation with visible wolframite grains. However, vertical boreholes did not intersect any significant W-mineralisation in gravel beds. Details of mineralisation encountered in the boreholes were as under :-

- i) In inclined first level Borehole RJND-1, fourteen W- mineralised zones were demarcated based on analytical results of 76 CS. The W-mineralised zones varied in thickness from 0.5 m to 5.65 m with average grade of 0.11% to 0.9% W. Li analytical results in 73 CS indicated up to 887.43 ppm Li. In inclined second level Borehole RJND-14, five W-mineralised zones were demarcated based on analytical results of 8 CS.

The W-mineralised zones varied in thickness from 0.5 m to 1.1 m with average grade of 0.25% to 0.88% W. Li analytical results of 37 samples showed Li up to 789.61 ppm.

- ii) In inclined first level Borehole RJND-2, thirty-two W- mineralised zones were demarcated based on analytical results of 199 CS. The W-mineralised zones varied in thickness from 0.4 m to 6.35 m with average grade of 400 ppm to 0.84% W. Li analytical results in 193 CS ranged up to 1,809 ppm. In inclined second level Borehole RJND-11, four W-mineralised zones were demarcated based on analytical results of 48 CS. The W-mineralised zones varied in thickness 0.5 m to 1m with average grade of 600 ppm to 0.61% W. Li analytical results of 6 CS were received and Li value ranged up to 877.90 ppm.
- iii) In inclined first level Borehole RJND-3, seven W- mineralised zones were demarcated based on analytical results of 47 CS. The W-mineralised zones varied in thickness 0.75 m to 3.35 m with average grade of 400 ppm to 0.22% W. Li value ranged up to 905.60 ppm. In inclined second level Borehole RJND-15, three W-mineralised zones were demarcated based on analytical results of 47 CS. The W-mineralised zones varied in thickness 0.5 m to 11m with average grade of 500 ppm to 600 ppm W. Li value ranged up to 3,063.29 ppm.
- iv) In inclined first level Borehole RJND-5, four W-mineralised zones were demarcated based on analytical results of 20 CS. The W-mineralised zones varied in thickness from 0.5 m to 2.0 m with average grade of 410 ppm to 0.18% W. Li value ranged up to 723.38 ppm. In inclined second level Borehole RJND-16, two W-mineralised based on analytical results of 76 CS were demarcated. The W-mineralised zones varied in thickness 0.5 m to 15.15 m with average grade of 400 ppm to 0.54% W. Li analytical results of 11 CS showed Li value up to 857.84 ppm.
- vi) In inclined first level Borehole RJND-8, seven W-mineralised zones were demarcated based on analytical results of 44 CS. The W-mineralised zones varied in thickness from 0.5 m to 2.95 m with average grade of 500 ppm to 0.27% W. Li value ranged up to 645.89 ppm.
- vii) In inclined first level Borehole RJND-9, six W-mineralised zones were demarcated based on analytical results of 47 CS. The W-mineralised zones varied in thickness from 0.6 m to 3.7 m with average grade of 500 ppm to 0.18% W. Li value ranged up to 265.63 ppm in 6 CS.
- viii) In inclined first level Borehole RJND-12, two W- mineralised zones were demarcated based on analytical results of 30 CS. The W-mineralised zones varied in thickness from 6 m to 8.05 m with average grade of 600 ppm W. Li value ranged up to 525.71 ppm in 6 CS. In inclined second level Borehole RJND- 34, six W-mineralised zones were demarcated based on

analytical results of 17 CS. The W-mineralised zones varied in thickness 1.1m to 1.65 m with average grade of 600 ppm to 0.32% W. Li value ranged up to 604.11 ppm.

- ix) In inclined first level Borehole RJND-13, one W-mineralised zone were demarcated based on analytical results of 7 CS. The W-mineralised zone with thickness of 2 m and average grade of 0.55% W was established. Li value ranged up to 721.23 ppm. In inclined second level Borehole RJND-35, three W-mineralised zones were demarcated based on analytical results of 5 CS. The W-mineralised zones varied in thickness from 0.6 m to 1.2 m with average grade of 1,300 ppm to 0.74% W. Li value ranged up to 1,210.91 ppm.
- x) In inclined first level Borehole RJND-22, three W- mineralised zones were demarcated based on analytical results of 52 CS. The W-mineralised zones with thickness ranging from 1.05 m to 12.3 m with average grade of 600 ppm to 0.33% W were established. Li value ranged up to 645.23 ppm.
- xi) In inclined first level Borehole RJND-28, two W-mineralised zones were demarcated based on analytical results of 40 CS. The W-mineralised zones varied in thickness from 2.5 m to 17.15 m with average grade of 900 ppm W. Li value ranged up to 1,406.55 ppm.
- xii) In inclined first level Borehole RJND-32, three W- mineralised zones were demarcated based on analytical results of 10 CS. The W-mineralised zones varied in thickness from 0.5 m to 1.6 m with average grade of 1,300 ppm to 0.46% W. Li value ranged up to 521.49 ppm.
- xiii) In inclined first level Borehole RJND-33, three W- mineralised zones were demarcated based on analytical results of 8 CS. The W-mineralised zones varied in thickness from 0.6 m to 2.6 m with average grade of 1,100 ppm to 0.37% W. Li value ranged up to 524.83 ppm.

Vanadium

GSI

In Himachal Pradesh, reconnaissance survey for vanadium and phosphorite was taken up in Nigalidhar Syncline, Sirmaur district. Detailed mapping of 3 sq. km in Kathwar block and large-scale mapping of 50 sq. km were carried out in western part of Nigalidhar Syncline. About 161 channel samples and 103 trench samples were collected from carbonaceous shale—siltstone and lower intercalated black chert—shale—siltstone to assess the resources of vanadium and phosphorite. Besides, 21 samples for petrographic and 03 samples for XRD were also collected and studied. One borehole in the Kathwar block was completed with a total depth of 133.40 m.

In first borehole in Kathwar block, anomalous vanadium values recorded were as follows:

a) Zone of Vanadium at 0.1% cut off

Sl. No.	Depth	Thickness	Vanadium at 0.1% cut-off
i)	34 m to 52 m	18 m	0.198 %
ii)	54 m to 66 m	12 m	0.196 %
iii)	68 to 86 m	18 m	0.29 %

b) Zone of vanadium at 0.2% cut off —

Sl. No.	Depth	Thickness	Vanadium at 0.1% cut-off
i)	40 m to 46 m	6 m	0.29 %
ii)	58 m to 60 m	2 m	0.23 %
iii)	62 to 66 m	4 m	0.28 %
iv)	70 to 86 m	16 m	0.313

c) Zone of vanadium at 0.4 % cut off at Depth range from —. 80 m to 84 m with thickness 4m and 0.44% cut off

In Kathwar block, 11 channel samples showed P_2O_5 content at less than 1% and in two samples it was 1.30 % and 1.43%. Low grade phosphorite mineralisation was recorded within channel samples. Further, in first borehole, P_2O_5 varied between 0.12 % and 3.63%. In a zone of 10 m thickness, weighted average of P_2O_5 was 2.58%. In Rajana–Chambi section, in the individual phosphorite nodules P_2O_5 was at 23.01% and in mix of phosphorite nodules and chert from same section P_2O_5 was recorded as 9.86%. In one channel sample (mix of phosphorite nodules and chert) with a sample length of 2.5 m along the profile line of borehole, P_2O_5 was at 6.63%.

Molybdenum

GSI

In Assam, during preliminary exploration for molybdenum and associated mineralisation in the area between Helagog and Khaloibari, Kamrup Metropolitan district, detailed geological mapping of 03 sq. km on 1:2000 scale, geophysical survey of 3 sq. km of magnetic and gravity, 25 Lkm of both resistivity and IP surveys were carried out during the course of the study. Molybdenite-bearing pegmatite veins were well exposed in the Helagog and Khaloibari quarry sections. In Helagog quarry, at least four molybdenite-bearing pegmatite veins were observed. The length of the veins ranged from 3 m to 21 m and width from 0.15 m to 12 m. In Khaloibari quarry, in addition to the previously reported two molybdenite-bearing pegmatite veins, six molybdenite bearing pegmatite veins were recorded and distributed over length of 38 m to 40 m wide spacing. The length of the pegmatite veins ranged from 5 m to 15 m with thickness ranging from 0.2 m to 0.7m and a few veins occurred as segregations with random orientations. Chemical analysis showed value of tungsten (W) ranging from 85.264 to 169.301 ppm pyrite–chalcopyrite-bearing pegmatite veins in Helagog quarry and anomalous concentration of fluoride (F) ranging from 104 to 1,200 ppm.

In Andhra Pradesh, a reconnaissance survey was taken up in Bisanattam–Gudipalli–sanganapalli area of Chittoor district, to delineate potential zones and

possible occurrences for molybdenum and associated mineralisation in southern part of Kolar Schist Belt (KSB) and granitoids (PGC II) of Eastern Dharwar Craton. The Mo and Au mineralisation, associated with blue grey quartz veins were seen intruded in metabasalt–mylonitised rhyodacite and controlled by ductile shear zones. Mineralisation was localised at the contact of the mafic and felsic rocks and was recorded in between Salachintanapalli and Avulatippanapalli which was considered as a primary suspected zone. As evidences of mineralisation, a few specks of molybdenum and sulphides were also recorded from those veins. A few old workings were also observed near quartz veins in Avulatippanapalli area. Tourmaline grains, specks of pyrite and chalcopyrite along with malachite staining were evident in quartzo-feldspathic veins. A few specks of molybdenite were recorded from an N-S trending medium grained quartzo-feldspathic vein also. Chemical results of 1 BRS and 2 Trench samples, collected from suspected mineralised zone near Avulatippanapalli showed anomalous Au values of 2.89 ppm, 1.26 ppm and 3.41 ppm respectively. Chemical results of Mo received for 10 soil samples and 40 BRS samples showed mo value ranging from 1.82 ppm to 5.35 ppm for soil samples and maximum value of 188.46 ppm for BRS sample. An anomalous value of Cu of 1,519 ppm was recorded from a blue-grey quartz vein near Athinattam.

In Tamil Nadu, a preliminary exploration for molybdenum and associated mineralisation in Velampatti north A & B blocks of Harur–Uttangarai molybdenum belt, Dharmapuri district, was taken up to delineate the strike continuity and depth persistence of molybdenum mineralisation and to estimate the resource of molybdenum. The investigation block was proposed for nine boreholes in different level—three 1st level at 50 m vertical depth and five 2nd level at 100 m vertical depth with 200 m spacing and one 3rd level drilling at 150 m vertical depth with cumulative of 1,500 m drilling target for analysis of Mo, W, Sn, Co, Ni, Pb, Cu, Zn and Ag. Geophysical survey, i.e, Gravity, Magnetic, IP and SP were carried out, through which moderate sulphide zone was demarcated along the main shear zone. Boreholes were planned based on previous borehole and geophysical data. At the end of field season, four boreholes were completed (1st and 2nd level). The first level boreholes TNDVN-5, TNDVN-6 & TNDVN-7—were completed and one 2nd level borehole (TNDVN-12) was under progress with cumulative drilling target of 488.75 m. Chemical analysis of the core sample of BH –TNDVN-05 indicated 1.7 m Mo lode with average grade of 769 ppm and three lodges of Zn ranging from 3.65 m to 4.55 m with average grade ranging from 154 to 215 ppm along with one lode of Cu of 1.2 m with average grade of 217 ppm. BH: TNDVN-6 intersected shear zone from 66.5 to 78 m depth. The shear zone consisted of 7 m thick milky white quartz vein with thin veinlets and fine specks of sulphide (galena and Mo) mineralisation. The BH: TNDVN-7 at depths shear zone was intersected from 51.0 to 79.0 m. The chemical data revealed good indication of molybdenum in BH: TNDVN-5 (average 750 ppm) and associated sulphide mineralisation, such as, Co up to 217 ppm and Zn up to 215 ppm. One II-level Borehole TNDVN-11 intersected shear zone from 133

to 161m with thick quartz veins showing dissemination of molybdenum and galena, chalcopyrite in the study area.

Nickel

GSI

During reconnaissance survey for Nickel, Chromium and PGE mineralisation in Banda-Tambuli, Sindhudurg district, Maharashtra and Mopa, North Goa district, Goa, an area of 110 sq km was mapped on 1:12500 scale. A total of 110 bed rock samples (BRS) have been collected. Twelve out of sixty-eight BRS from serpentinite, orthopyroxenite and gabbro/gabbro-norite /norite showed Ni values in between 1,025 and 1,542 ppm and twenty-one BRS showed Cr values in between 1,062 and 9,333 ppm. Based on analytical results of BRS, areas were chosen for channel-cum-chip sampling. Fifty channel-cum-chip samples were collected. The analytical data of nineteen out of fifty channel cum-chip-samples from gabbro showed Ni values ranging from 1,014 to 1,557 ppm and Cr values ranging from 3,008 to 3,857 ppm. Based on higher Ni and Cr values, twenty BRS were selected for PGE analysis. Geochemically, gabbro bodies of potential areas were Mg-rich. Four PCS from gabbro showed MgO values from 20.04 to 23.60 wt %. On the basis of overlay studies of analytical results on geological map of LSM block and petrography, two potential areas, i.e, one towards north of Degve having area of 4 sq km (4 km x 1 km) and another towards east of Tambuli having area of 1 sq km (2.5 km x 0.4 km) were delineated.

In Manipur, reconnaissance survey was taken up for Ni, Cu, and PGE in Moreh to Minau areas, Manipur Ophiolite Belt, Tengnoupal and Chandel districts. On the basis of large-scale mapping carried out for 50 sq. km, six dismembered ophiolite units represented by ultramafic, mafic, volcanic units were delineated. These units were found to host disseminated chromite pods in Munnom-Lhangcham areas. Analytical results showed Cr values ranging from 14,220 to 2,511 ppm with a mean value of 8,878 ppm while Ni concentration varied from 7,443 to 1,584 ppm with a mean value of 4,993 ppm. Cobalt values in these samples ranged from 2,691 to 423 ppm with an average of 1,525 ppm.

In Nagaland, during reconnaissance survey for nickeliferous laterite, chromium, PGE and associated base metals around Mollen-Washelo in ultramafic-mafic rocks in part of Ophiolite Belt, Phek District, large-scale geological mapping on 1:12500 scale was carried out for 50 sq km area with an objective to demarcate nickeliferous laterite, chromium, PGE and base metals in ultramafic-mafic rock units. Ultramafic derived lateritic soil over the dunite-peridotite of about 1.6 sq km was delineated as a potential supergene Ni-laterite deposit (SE of Mollen). Sulphide disseminations were also recorded in basalt near Washello.

In Karnataka, during reconnaissance survey for Nickel, Copper, Cobalt and PGE mineralisation between Yaradakere and Patta Devarahalli areas, Antarghatta Mafic-Ultramafic Complex, Chitradurga and Chikmangalur districts, large-scale mapping was carried out in 100 sq. km

area on 1: 12500 scale. The lithounits present in the study area were amphibolite, meta-pyroxenite, talc-tremolite schist, serpentinite, migmatite gneiss, gabbro, dolerite dykes, pegmatite and quartz vein. The migmatite gneiss was the dominant rock type forming low lying area except in the central and southern portion of the study area, which was categorised into grey banded and foliated gneiss and grey granitic gneiss. The scout drilling targets of 500 m were assigned to identify the continuity of mineralisation in the ultramafic sequence. The Borehole KCY-1 intersected talc-tremolite-actinolite schist with magnetite and sulphides with a cumulative thickness of 19.65 m and metapyroxenite with magnetite for a cumulative thickness of 49.36 m. The Borehole KCY-2 intersected metapyroxenite with cumulative thickness of 43.7 m, serpentinite with presence of disseminated chalcopyrite and pyrites for a cumulative thickness of 29.10 m, talc tremolite schist with cumulative thickness of 12.20 m. The Borehole KCY-3 intersected metapyroxenite with disseminated well magnetite for cumulative thickness of 22.40 m, serpentinite with sulphides for cumulative thickness of 121.05 m, Presence of well-developed magnetite was also observed in the metapyroxenite and pyrite, chalcopyrite & magnetite crystal in the carbonate vein were observed within the serpentinite. Based on the surface manifestation of magnetite, sulphide mineralisation and surface alteration, five potential zones for Ni-Cu-Co and PGE mineralisation were delineated.

Zone-1 (1km south of VillageYaradakere) is identified in talc-tremolite schist where presence of well-developed pyrite crystals were observed, having width of 30 m.

Zone-2 (1km southeast of Village Hochihalli) is identified within magnetite crystals and also disseminated sulphides, such as, pyrite and chalcopyrite within the metapyroxenite, having about 30-40 m in width.

Zone-3 (400 northwest of Village Hochihalli) is identified with presence of disseminated sulphides within serpentinite having width of about 50 m.

Zone-4 (700m northwest of Village Sanenahalli) is identified with presence of well-developed magnetite crystals observed within the coarse-grained metapyroxenite varying in size from 0.2 to 0.6 cm having a width of 20-25m approx.

Zone-5 (Udugere forest area) is identified with presence of well-developed magnetite crystals observed within the metapyroxenite having a width of about 15 m. The size of the magnetite crystal varied from 0.2 to 1.2 cm in width.

The base metals analytical results for 82 samples revealed Cr values ranging from 710 ppm to 2.70% and Ni values ranging from 390 to 3,100 ppm.

In Karnataka, preliminary exploration for Komatiite-hosted Ni- PGE-Au mineralisation in the Mafic-ultramafic rocks was carried out around Banasandra, Tumkur district. The geochemical sampling and drilling results of Banasandra block showed the Ni-Co enrichment in the shallow laterite-profile as well as in the deeper altered serpentinite. The eastern and western contact zone of the

komatiite unit was delineated by detailed mapping and tested with drilling and sampling. Nickel mineralisation in laterite and serpentinite was at places associated with silicates like garnierite and oxides like magnetite. A few indications of primary sulphides have been identified in thin section samples of core samples. A few high anomalous chargeability clusters were identified along the western Komatiite contact during the Ground Geophysical survey. The high magnetite contours of south Banasandra blocks represent the magnetite enrichment in weathered serpentinite. Anomalous zones were verified and ground checked for any possible mineralisation. Identified zones with drilled width and nickel-cobalt contents in South Banasandra block were from BH. No. KTBS-1 Zone 1: 10.13 m X (Ni: 0.58% & Co: 242 ppm): Laterite and saprolite; Zone 2: 7.45m X (Ni: 0.62% & Co: 387 ppm) in weathered serpentinite (with magnetite);and Zone 3, 5.6 m X: (Ni: 0.59% & Co: 332 ppm) associated with magnetite in serpentinite. BH. No. KTBS-14 Zone 1: 11.7m X (Ni: 0.94% & Co:288 ppm): Laterite and saprolite and Zone 2: 8.2m X (Ni: 0.45% & Co:144 ppm) in weathered serpentinite (with

magnetite) and KTBS-10A Zone 1: 21.21m X (Ni: 0.44% & Co: 144 ppm): Laterite and saprolite; and Zone 2: 10.29m X (Ni: 0.51% & Co:182 ppm) in weathered serpentinite (with magnetite). Exploration work carried out in the Banasandra block showed possibility of secondary Ni-Co-PGE enrichment in regolith, lateritic profile and altered serpentinites could opens up new possibilities in the block. Three mineralised zones of Nickel- Cobalt enrichment in Banasandra were identified. A sub block of 0.25 sq. km was identified in the South Banasandra block for resource estimation of supergene enriched (Lateritic) Ni-Co zones. Analytical results of 22 soil/ regolith samples showed anomalous PGE values in 3 samples (100 to 232 ppb), indicating the possibility of PGE- enrichment in the weathering profile.

Precious Minerals.

Gold

The GSI, and HGML were engaged in the exploration for gold during 2020-21. An account of exploration work done by GSI is detailed in Table -7

Table-7: Exploration for Gold by GSI, 2020-21

State/District	Location	Details of work done	Results obtained/Remarks
Arunachal Pradesh			
West Siang	Siyom Valley	Mapping	A reconnaissance survey was taken up with an objective to delineate and assess the potentiality of orogenic gold mineralisation in Siyom Valley. The survey involved large-scale mapping (1:12500 scale) over an area of 50 sq. km. Two bands of sulphide mineralisation along quartz veins within the gneisses were delineated in the area. Band-I was about 200–300 m in strike length with a thickness of 20-30 m. Band-II with thickness 10-20 m had strike extension of approximately 100 m. Chemical results showed tungsten value ranging from 303–511 ppm. The values for LREE ranged from 28–136.9 ppm and HREE ranged from 10.5 to 20 ppm. TREE ranged from 39–155 ppm. However, chemical analysis did not show encouraging values for gold –the values ranged from 50–112 ppb.
West Siang	Siyom Valley	Mapping & Sampling	A reconnaissance survey for orogenic gold mineralisation in upper reaches of Siyom valley, West Siang district, was taken up. During Investigation large-scale mapping (1:12500 scale) was carried out for an area of 50 sq. km. The garnetiferous mica schist exposed towards Manigong as well as Village Tadadege was found to be generally oxidised imparting yellowish-orange colour to the surface. A 25–30 m thick banded magnetite quartzite was also recorded in the area. Samples of magnetite band yielded 27.71% to 52.21% of Fe ₂ O ₃ and samples from garnetiferous mica schist yielded tungsten values ranging from 135.26 to 521.21 ppm.
Lower Subansiri	Phop area	Mapping & Drilling	A preliminary exploration for gold, molybdenum, vanadium and associated minerals in Phop area, Lower Subansiri district, was taken up with detailed mapping of 1 sq. km area on 1:2000 scale along with 1000 m drilling. The area was seen covered by meta-sedimentary rocks. Late granitic, quartz and calcite veins intruded the rocks. Limonitisation and ferruginisation were noticed in the area. Sulphides, mainly pyrite and pyrrhotite, in disseminated form were also observed in marble bands and grey quartzite. Banded magnetite quartzite along with bands of carbonaceous phyllite were studied for possible gold and vanadium-molybdenum mineralisation respectively. Banded magnetite quartzite in the study area extended for about 400 m with thickness up to 17 m. Four carbonaceous phyllite bands were delineated in the area.

Table-7 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks
Assam			
Lakhimpur & Dhemaji	Subansiri basin	Mapping	During reconnaissance survey for placer gold in Subansiri basin, large-scale mapping of 100 sq. km on 1: 12500 scale was taken up with an objective to study of gold grains/nuggets in consort with other heavy minerals and for possible source area. Four definite mineralised blocks could be identified that showed terraces (T1 and T4) and pebbly horizon of Kimin Formation (Upper Siwalik) being auriferous. Block-I comprised a total area of 3.4 sq km. It was boulder-pebble horizon of T4 and was the major auriferous zone. It was of an average thickness of 4.7 m and an average of 13 gold flakes/cu.m was recovered from this horizon. Block-II was 2.1 sq km in area with average thickness of 0.62 m of mineralised pebble horizon. Gold flakes of 3 grains/cu.m were recovered. Block-III was of an area of 5.5 sq km with average thickness of 0.56 m of pebble horizon. Average gold flakes of 3 grains/cu.m were recovered. Block-IV also occupied the channel bars and point bar of the River Subansiri. Average gold flakes of 4 grains/cu. m were recovered. The size of the biggest flake recorded was about 1.9 mm in length. Gold flake in heavy mineral concentrations collected from a 8 m-12 m thick Pebble, Cobbles, Boulders Horizon of Corramore Formation (T4 terrace) at right bank of Dirpai River, Dirpai Adigaon.
Andhra Pradesh			
Chittoor and Kadapa	Araveedu-Shivapuram	Mapping, Trenching & Sampling	During reconnaissance survey for gold and associated mineralisation in Araveedu-Shivapuram area, an area of 100 sq km was covered on 1:12500 scale with an additional of 25 sq km area where detailed sampling was carried out on the light of encouraging result reported by previous workers near Shivapuram (0.26 g/t Au). About 101 bedrock samples, 51 soil samples were collected, 50 pit/trench samples. Out of 202 samples analysed for gold, only 12 samples reported Au of more than 50 ppb, and these were reported in and around Shivapuram, Mallayakonda Reserve Forest and Nagireddigaripalle. Highest value of 354 ppb was analysed in one of the trench samples collected near Upparapalle.
Bihar			
Gaya	Ajaynagar	Mapping, Drilling Pitting, Trenching & Sampling	A preliminary exploration for gold around Ajaynagar comprised detailed mapping of 1 sq. km area, drilling of 500 m, pitting & trenching of 110 cu.m with collection of 110 PTS, 63 BRS, petrological and petro-geochemical samples. Surface manifestations of mineralisation were observed in the form of wall-rock alterations like silicification and/or carbonatisation of metabasalt, shearing and occurrence of sulphides within metabasalt, sheared rhyolite and quartz veins, such as, pyrite, pyrrhotite and chalcopyrite. Analytical results of BRS and PTS indicated Au values ranging from 0.06 ppm to 1.27 ppm in quartz vein (n=50) and 0.06 ppm to 0.21 ppm in silicified metabasalt (n=60). Analytical results of 15 BRS yielded Au values ranging from 0.49 ppm to 1.56 ppm in silicified metabasalt (n=6) and from 0.06 ppm to 0.49 ppm in quartz vein (n=9). Sulphide-bearing mineralised zones were intersected from 51 m to 57 m, 70.50 m to 75.4 m in Borehole BRAJ-1 and 18m to 22.05m, 27m to 46.5m in Borehole BRAJ-2.
West Champaran	Foot hills of Siwalik Himalayas	Mapping, Pitting & Sampling	During reconnaissance survey for placer gold in the foothills of Siwalik Himalayas, large scale mapping of 100 sq.km area was carried out along with collection of different geomedia samples. Panning of samples showed presence of fine gold flakes/ grains (5-200 nos.) in the pan concentrates of stream sediment, colluvial and pit samples. Analytical results of 35 stream sediment samples received showed Ag value ranging from <0.01 ppm to 0.26 ppm; 19 pit samples showed Ag value ranging from <0.01 ppm to 0.24 ppm; 3 colluvial samples showed Ag value <0.01 ppm. Analytical results of 4 stream sediment samples and 2 pit samples received showed Scandium (Sc) value ranging from <4 mg/kg to 6 mg/kg and 5-6 mg/kg respectively and Yttrium (Y) value ranging from 208 mg/kg to 1,015 mg/kg and 90-125 mg/kg respectively. Studies of gold grains/flakes collected from various river basins showed size variation ranging from 20 µm to 371 µm, and are flattened with extensive etching and gouging on surface with development of pits and grooves, which indicated considerable fluvial transport and reworking of the gold flakes along with sediment. Heavy mineral study of the pan concentrates showed presence of garnet, sillimanite, kyanite, magnetite, ilmenite, rutile, tourmaline, zircon and monazite.

Table-7 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks
Jharkhand			
West Singhbhum	Chirubera -Gamhariya block	Mapping,Pitting , Trenching & Sampling	A reconnaissance survey for gold and associated minerals in Chirubera– Gamhariya block comprised large-scale mapping of 100 sq. km area along with collection of 50 pitting-trenching samples, 10 BRS, 25 PS, 25 PCS and 25 stream sediment samples. Brecciated chert band having sulphide mineralisation was observed from Baika to Village Loharda. The mineralised zone had width of about 150 m and length of about 2.5 km containing mostly pyrite, arsenopyrite and a few chalcopyrite and bornite. The zone was also characterised by profuse alterations in the form of intense brecciation, limonitisation, goethitisation, box works and pits-vugs. Ore microscopic studies also confirmed the presence of sulphides like pyrite, chalcopyrite, arsenopyrite, bornite and pyrrhotite. Sulphides were also observed in the form of both as stringers and dissemination in brecciated chert, ferruginous quartzite and cherty quartzite near Chargu, Baika, Argundi, Loharda, Robga, Dopai, Ichahatu, Saraid, Lupungbera, Chirubera, Kotsa and Dhangaon villages. Disseminated crystals of pyrite, chalcopyrite and bornite were also present within metabasalt in Khuntpani and Argundi area. Chemical analytical data received showed anomalous values of Zn (928 ppm) and Ni (217 ppm) in the brecciated chert hosted sulphide mineralised zone from Baika to Loharda, whereas, high values of Cu (180 ppm) and V (422 ppm) were observed in metabasalt near Khuntpani area.
Saraikele-Kharsawan	Heben-Raghunathpur Area	Mapping & Sampling	During reconnaissance survey for gold and associated minerals in Heben–Raghunathpur area, large-scale mapping was carried out over 100 sq.km area. The southern part of the area was dominantly occupied by tuffaceous phyllite. Different dimension of map scale quartz veins and network of veinlets were observed intruding into country rocks. Alteration features in the form of ferruginisation, brecciation and secondary silicification, goethitic alteration along with malachite stains and specks of sulphides in quartz vein, presence of cubical pits were the typical surface evidence of mineralisation in the study area. Based on these observations, visible gold grains were observed in pan concentrate of stream sediment samples. A one km long and 50 m wide zone of brecciated quartzite with quartz vein that was found to occurring east of Lawa was considered to be of high potential. The zone occurred in same trend with mineralised quartzite ridge of Lawa gold mine and was characterised by multiple phases of hydrothermal activity in form of smoky/bluish quartz vein and late phase milky quartz vein. Apart from this, near Kushputul, a small zone of intense brecciation and alteration in quartzite characterised by angular clasts of vein quartz in goethitised and limonitised quartzite was also delineated. In terms of Au mineralisation anomalous values in the order 140 ppb and 120 ppb were observed in intensely altered quartzite near Kushputul. Gold values up to 120 ppb observed in trench near Lawa. Cu values were ranging from <1 to 90 ppm. while values of Pb were ranging from <1 to 36 ppm and values of Zn were ranging from <1 to 77 ppm.
Saraikele-Kharsawan	Bachkakocha-Tankocha-Pata-Humid	Mapping Sampling & Trenching	A reconnaissance survey for gold and associated minerals in Bachkakocha–Tankocha–Pata–Humid areas, involved mapping of 100 sq.km. area and collection of bedrock, trench, petrological, ore microscopy, stream sediment and petrochemical samples. Two mineralised zones represented by ferruginised, limonitised, oxidised brecciated quartzite with carbonate and/or smoky quartz veins were demarcated north of Chainpur–Pata–Humid–Katjor–Kadamjhor and south of Bachkakocha–ankocha–Benadih sections. The outcrop studied north of Village Pata showed hydrothermal fluid–wall rock alteration in the form of intense silicification, limonitisation, carbonatisation, chloritisation and suspected albittisation with rich concentration of sulphides Mineralisation is mostly in the form of dissemination along the veins and veinlets. Visible flakes of gold grains were observed from pan concentrate of first order streams draining upstream ferruginised–oxidised quartzite intruded with smoky quartz veins in the east–west mounts north of Danrda–Chainpur village substantiate the enrichment of gold mineralisation in ferruginised–oxidised quartzite.

Table-7 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks
Simdega	Sagjor-Tangratoli -Bagdega area	Sampling	A reconnaissance survey for gold and associated minerals around Sagjor-Tangratoli-Bagdega area was taken up. Gold grains (up to 7-8 grains of gold in panned concentrate of 35 kg of sediments) were observed in naked eye in the panned sediments collected from 1 st and 2 nd order streams flowing through the quartz and quartz-tourmaline veins that have intruded into the sheared granite gneiss. Gold grains were also visible in naked eye in the panned concentrate of sediments collected from the slope wash developed over the quartz veins. The BRS samples as well as the trench samples collected across these quartz veins contained significant concentration of base metals in the form of bornite and chalcopyrite stains and iron oxide stains. Good concentration of gold grains were observed in the panned sediments collected from the streams flowing through the quartz veins in and around of Bandhanatoli, Gamhartoli and Barbeda village.
Karnataka			
Haveri	Sidenur and Aralikatti area		Reconnaissance survey was taken up for Gold in Sidenur and Aralikatti areas. The gold mineralisation was mainly hosted by banded magnetite chert (BMC) and banded magnetite quartzite (BMQ) rocks manifested by presence of oxidised pyrite pits, jasperisation, boxwork, gossan, gash veins and fresh pyrite and other sulphides. Presence of sulphide minerals viz. pyrite, pyrrhotite, sphalerite and bornite was noticed in BMQ and BMC. Field evidences showed both disseminated type—fresh and oxidised pyrites dispersed sporadically within the BIF layers; and vein filling type—sulphide associated with gash and quartz veins intruded during the hydrothermal alteration. The mineralisation was also characterised by wall rock alteration features like limonitisation, silicification, carbonatisation. Analytical results of 23 BRS samples showed Au values ranging from 25 ppb to 382 ppb. Analysis showed Au ranging from 25–60 ppb in Nandihalli, 25–84 ppb in east of Kalgond and 28–382 ppb in BMC, south of Bisalhali area. Analytical results of BRS samples from Kalgond showed copper value of 1,520 ppm.
Haveri	Shiggaon and Konankeri area, Shiggaon taluk	Mapping	Reconnaissance survey was taken up for gold in Shiggaon and Konankeri area, Shiggaon taluk. The BFQ bands showed surficial indication favourable for gold mineralisation like brecciation, silicification, limonitisation etc. whereas the BMQ lacked indications as it was found to be less oxidised and altered. The sulphides were mainly pyrite, arsenopyrite, chalcopyrite and magnetite with/without pyrrhotite; they occurred as disseminations within host rock or as veinlets, streaks, stringers within cherty zones. Five major BIF bands were demarcated during mapping namely; 1) Gangibhavi-Singapura band, 2) Rajivgram-Shivpur band, 3) Mulkeri to Basavankoppa, 4) Shabal-Konankere band and 5) Shiggaon-Kalyan band. The Gangibhavi-Singapura band, Rajivgram-Shivpur band, Mulkeri to Basavankoppa and Shabal-Konankere were basically BFQ in nature whereas Shiggaon-Kalyan band is basically BMQ in nature.
Haveri	Singapura block, Shiggaon Taluka	Geophysical survey, Mapping, Trenching Drilling & sampling	During Preliminary exploration for gold in Singapura block, a total of 2 sq. km area was covered by detailed mapping on 1:1000 scale along with 107 cu. m trenching and collection of 100 trench, 50 bedrock, 20 petrochemical and 20 petrology samples. In all 8 first level (60 m vertical) inclined boreholes were drilled with a spacing of 100–200 m covering a total of 985 m drilling. Singapura block comprised Meta volcano-sedimentary rocks as meta-greywacke argillite, felsic volcanic, Banded Iron Formation (BIF) with presence of sulphides and later intruded by basic dykes and quartz veins. BIF formed linear outcrops trending N20°W-S20°E with 30° to 55° easterly dip over a strike length of 1.5 km. Width of the BIF varied from 5 cm to 1.5 m with average width of 1 m. Outcrops of BIF band showed muscovite mica alteration, limonitisation and sulphide leaching stains. BIF showed presence of disseminated sulphides mainly pyrite within silica and iron-rich layers. Drill core of meta-greywacke argillite showed presence of sedimentary structures as graded bedding, unsorted clast rich patches, clay clasts and soft sediment deformation structure like ball and pillow structure. Sulphide content in the mineralised zone varied from 0.1%. Kalyan band was basically BMQ in nature. Photomicrographs of BFQ with mineralisation were shown in. The Gangibhavi-Singapura BFQ band which was a promising band showed

Table-7 (Contd.)

State/District	Location	Details of work done	Results obtained/Remarks
			encouraging Au values of 265 ppb, 118 ppb, 625 ppb, 500 ppb and 1120 ppb obtained from BRS; 80 ppb, 100 ppb and 140 ppb from SS and 330 ppb and 155 ppb from PTS to 5%. Width of alteration and sulphide mineralisation zone in drill core varied from 0.5 m to 1.5 m. Alteration and sulphide mineralisation was traced by drilling over a strike length of 600 m in block area. Four bedrock samples from sulphidic BIF analysed Au values as 26, 36, 36 and 726 ppb. One trench sample analysed 2.52 ppm Au. Base metal analysis of bedrock/trench sample analysed Cu from 11 to 330 ppm, Zn from 10 to 221 ppm and Pb from 11 to 60 ppm in the study area.
Haveri	Dyamankoppa Block, Shiggaon Taluk,	Mapping, Geophysical survey, Trenching, Drilling & Sampling	A preliminary exploration for gold in Dyamankoppa block, Shiggaon taluk was carried out to assess gold potentiality of the rock. The study involved 2 sq. km detailed mapping, 102 cu. m trenching, 1,000 m drilling, along with collection of 52 bedrock samples, 102 trench samples and 350 core samples. Geophysical survey carried out in the area showed that chargeability in the area varied from 0.5 to 13.1 mv/V. Resistivity in the area ranged from 1 to 5,162 ohm m. BIF was represented by high magnetic value. Adjacent to BIF band towards the northeastern side, high chargeability and moderate to high resistivity linear zone was marked all along the Dyamankoppa Block. A total of 762.5 m drilling were completed in the area. Analytical results of bedrock and trench samples showed gold value ranging from 28 ppb to 1.3 ppm.
Chitradurga	Chikkenahalli-Kasavanahalli	Mapping & Sampling	During reconnaissance survey for gold and associated mineralisation in Chikkenahalli-Kasavanahalli area, a total of 100 sq. km were mapped along with systematic sampling for study of petrography, mineral chemistry and mineralisation. During the mapping work, four hydrothermal alteration zones mapped at southeast of Kasavanahalli (north of JN kote) were extension of alteration zone established during field season 2019-20 and combined dimension was about 1.5 km long and 450 to 800 m wide. Forty bedrock samples (15 during field season 2019-20 and 25 during field season 2020-21) were collected from veins/veinlets/ host granite in this zone was analysed for gold and the report showed gold value as high as 15,100 ppb (Field Season 2019-20). Highest gold value analysed from this zone during Field Season 2020-21 was 13,600 ppb. Hydrothermal alteration zone (approximately 250 m long and 150 m wide) mapped at north of Ennegere, comprised 1m to 2 m thick and up to 30 m long quartz-carbonate veins. These veins were colourless, mild smoky, vughy and stained. Disseminated chalcopyrite was observed and analytical results were awaited. Hydrothermal alteration zone (approximately 50 m x 50 m exposed zone) mapped at east of Chikkenahalli, comprised disseminated galena-sphalerite bearing quartz-carbonate veins (2-10 cm wide, pinched-swelled, 10-15 m long veins). Quartz reef (20 m wide and about 1km long) mapped at north of Pallavagere was brecciated, smoky to colourless, intruded in granitoid and contained up to 10 % pyrite and <1% galena. In association with this reef, there were various horizontal-sub-horizontal veins of pyritiferous quartz.
Madhya Pradesh			
Singrauli	Sonkurwa block & Byodhihar-Bagadha block	Mapping & Sampling	A preliminary exploration of gold mineralisation in Sonkurwa and Byodhihar-Bagadha block, a G3 stage investigation was taken up in Sonkurwa block to delineate the auriferous zone and assessment of gold mineralisation. The investigation comprised 800 m drilling along with detailed mapping of 2.6 sq. km BRS, PS, PCS and XRD sampling. The sulphide mineralisation occurred in quartz veins and metasediments, localised along the axial planes of minor folds which were further cross cut by minor quartz veins. The sulphide mineralisation was mainly associated with quartz veins. Surface mineralised zones can be identified by development of gossans and scorodite minerals in quartz vein. Arsenopyrite, scorodite, galena, pyrite and chalcopyrite were the principal sulphide minerals present in the mineralised zones. In the mineralised zones, sulphide minerals occurred as specks, vugs/cavity filled and crustified banding in quartz veins. The Meta-basics have most probably acted as primary source of mineralisation from which quartz veins and hydrothermal activity have engulfed the sulphides along with gold. Analytical result reported so far showed wt average of 1.16 kg Au in Borehole MPSSK-01 and 1.06 kg in Borehole MPSSK-04.

Table-7 (Concl.)

State/District	Location	Details of work done	Results obtained/Remarks
West Bengal			
Kalimpong	Samthar-Deoralipit	Mapping & Sampling	During reconnaissance survey to search auriferous veins in Samthar–Deoralipit area, an area of 50 sq. km was mapped on 1:12500 scale along with collection of 100 BRS, 10 PCS, 25 PS, 20PS and 50 PTS. The locales of mineralisation were epigenetic quartz veins occurring within the host rocks of chlorite/ chlorite-sericite schists and quartzites. Capping, stains and old workings were noted as surface indication of mineralisation. Sulphide-bearing crystals of pyrite, chalcopyrite, bornite, etc. were also observed within the quartz vein. Six old workings were identified in the mapped area. One mineralised zone of 400 m lateral extension was also demarcated in Yangmakum–Paserbu village area. Malachite, azurite, crystals of pyrite, arsenopyrite, REE (suspected) were also observed in the area. Analytical results of few bedrock samples revealed that one sample collected from Deorali pit area showed gold (Au) value of 1.52 ppm and Copper (Cu) value of 9,278 ppm.
Darjiling	Munsang & adjoining area	Mapping & Sampling	A reconnaissance survey for gold and associated mineralisation in Munsang and adjoining areas involved mapping of a total of 50 sq km area on 1: 12500 scale along with collection of 328 samples from different media. All the lithounits were traversed by two generations of quartz veins. Though mineralisation was noted in both quartz veins, foliation parallel quartz veins/partings contained relatively more incidences than later quartz veins. Disseminated sulphide mineralisation (pyrite and chalcopyrite grains) was noted in foliation parallel quartz veins within grey quartzite-phyllite sequence near Anaconda Kholai, Lower Munsong–Barmek road section, Naksha–Barek road section, Mungerjung Upper Munsong link road, Barek-Kashyong road section, Sukhe Khola and Tumlong Khola sections. Pyrite and arsenopyrite specks are noted in micaceous quartzite near Cross Hill Road section, in Tumlong Khola section and also near Village Kashyong.
Uttar Pradesh			
Sonbhadra	Garda-Bhitri area	Mapping, Geophysical Survey, Drilling	As a spin-off work of field season 2018-20, a preliminary exploration for gold around Garda–Bhitri area involved detailed mapping (1:1000) in two blocks covering 1.5 sq. km area around Jharkharwa and Harsadand near Jogail, from where gold values ranging from 300 ppb to 400 ppb were recorded. Three scout boreholes, two in Jharkharwa block and one in Harsadand block were done, with a cumulative drilling of 612.70 m. Geophysical survey (IP, SP and Magnetic) for 20.25 lkm was carried out in the detailed mapped area, to decipher the sub-surface geology and sulphide mineralisation. In Borehole UPSGB-01 (Jharkharwa), drilling was done up to 321.20 m and the major lithologies intersected were serpentinite, chloritised serpentinite and carbonated olivine basalt. Sulphide disseminations in form of pyrite (>90%), chalcopyrite, pyrrhotite and arsenian pyrite (~10%) were observed in 07 discrete zones through the length of the borehole. The olivine-rich basalt in Harsadand yielded 400 ppb Au value as /was targeted by Borehole UPSGB-02. Drilling was done up to depth of 194.70 m and predominantly olivine-rich basalt and carbonated basalt with varying degrees of brecciation—possibly magmatic breccia was intersected and 04 discrete sulphide-rich zones were demarcated through the length of the borehole. Sulphide dissemination was primarily pyrite (>90%) and chalcopyrite + pyrrhotite (10%). Based on geophysical anomaly (chargeability high) 200 m east and 20 m north of UPSGB-01, recorded from 66 m to 99 m depth, a third vertical Borehole UPSGB-03 was drilled to directly intersect the anticipated anomalous zone. The borehole was drilled up to 96.80 m depth and 4 sulphide mineralised zones were demarcated. The sulphide mineralisation recorded in this borehole was more in comparison to the earlier two boreholes at an average of ~1 to 2.5% by visual estimation. Disseminations of sulphides, dominantly pyrite, chalcopyrite and pyrrhotite were observed at various depths in carbonated olivine basalt, in the drill cores of boreholes. The analytical values indicated presence of <50 ppb Au.

Hutti Gold Mines Company Ltd (HGML)

HGML has taken up exploration in its ML area located in Hutti village, Raichur district, Karnataka. An underground mapping of 868 sq.m area was mapped on a 1:400 scale and about 5,293 samples were collected for analysis. A total of 15.58 million tonnes ores @ 4.10 g/t metal has been estimated in the study area.

DIAMOND

GSI

In Chhattisgarh, during reconnaissance survey in search of source rocks of diamond in Kansabel, Chandarpur and Ludeg areas in Jashpur, Sarguja and Raigarh districts, a total of 96 stream sediment samples, 11 PCS, 11PS samples and 04 PTS from 1 Trench (3x1x1 m dimension) and 1 Pit (1x1x1 m dimension) were collected. The survey of the area revealed that the area is mainly covered by different varieties of granitoids. At places granites were altered into unakite. The different varieties of granitoids included biotite granite, biotite muscovite granite, porphyritic granite and coarse-grained granite. Metasedimentaries were mainly present in the form of small patches and xenoliths. Metasedimentaries included chlorite schist, talc chlorite schist and muscovite schist. Dykes included dolerite dyke, gabbro dyke, amphibolite dyke, ultramafic dyke and metapyroxinite dyke. Epidosite, epidote, quartz-tourmaline and quartz veins were very common in the study area. Veins with most intrusions, traversed all the rock types present in the study area. E-W and WNW-ESE trending Quartz-tourmaline veins were mostly intruded along some weak planes, identified as fault zones. In SSE of

Village Badrabahar within a quarry section accumulation of sulphide mineralisation was identified in quartz veins along the slip planes of gabbro. South-East of Ludeg area, a narrow ridge of Quartzite band containing sulphides was observed. During panning of stream sediments samples from 3rd order streams in Hathgara, Pemla and Pongo village near Kansabel, specks of gold grains were found. During reconnaissance survey for primary source rocks for diamond in Ramagiri-Nutimadugu area of Eastern Dharwar Craton, Anantapur district of Andhra Pradesh and Tumkur district of Karnataka, an area around 740 sq km area was covered under survey and 163 stream sediment samples were collected from favourable trap sites and processed for heavy mineral separation. The study of stream sediment samples revealed that the present area contained heavy minerals like chromites, spinels, ilmenites, garnets, diopsides, epidotes, amphiboles, zircons, apatites, tourmalines and sulphides. Suspected kimberlite indicator minerals were separated and submitted for EPMA studies to confirm their Kimberlitic affinity. Based on EPMA data, the area was further divided into two blocks— Nutimadugu in the northern part of the toposheet, and Gangampalli, in the southeastern part of toposheet. MgO- TiO₂ plot suggested that ilmenites recovered from above two areas are of kimberlitic. The source rock could not be traced due to forest cover in the area. One lamprophyre float was reported from B.K Halli area. In southeastern part, near Village Kanaganakuntla one zone of quartz-tourmaline vein (approximate dimension of 1200 m x 200 m) was reported during the reconnaissance traverse for kimberlite which was intruded into PGC-II which reveal that a potential zone for critical minerals like tin and tungsten could be a possibility.

Table-8: Exploration for Industrial Minerals by GSI, DMG/DGM etc. 2020-21

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Graphite Madhya Pradesh Sidhi	Kunri To Baharia Area,	-	-	-	-	-	A G4 stage exploration was taken in the study area. During large-scale mapping, a total of 09 lensoidal bodies of graphite were demarcated in the area. The discontinuous graphite bands within carbonaceous phyllite were present intermittently along its strike average width of about 15 m. Prominent malachite staining was also noticed along carbonaceous phyllite. Systematic channel sampling was carried out at 25 m channel interval along the strike length of graphite-bearing carbonaceous phyllite with 5 m sampling length for each sample across the strike length. Rock chips were collected from 5 m channel length for each sample. Fixed carbon content of BRS sample was found to be ranging from <1% to 5.85% (average 2.82%). Extensive brecciation silicification, prominent malachite staining and goethite were noticed in some area. Near to Village Goriara, gossan present within carbonaceous phyllite was highly ferruginised and limonitised and showed boxworks, abundant goethite and malachite staining showed presence of.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Graphite Chhattisgarh Balrampur	Ranga-Revatipur area	1:4000	3.6	55	-	-	oxidation zone that indicated encouraging Cu values up to 14%. Ground geophysical survey was carried out along the mineralised zone. Low resistivity and high chargeability anomaly indicated presence of graphite along with base metal mineralisation. The data integration of geophysical anomaly geological map and fixed carbon values of systematic channel sampling suggested potential zone near to Village Baheera. The discovery of this graphite lenses in the area has opened a new vista for detail exploration and genesis study of graphite mineralisation
							During preliminary exploration for graphite 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 trench/ pit samples were sent for fixed carbon analysis. A total of 10 petrochemical samples (PCS) and 20 petrological samples (PS) were also submitted. Geophysical survey has brought out a pronounced high chargeability anomaly coinciding with low resistivity and low self-potential anomaly indicating the presence of graphite mineralisation at depth to a strike length of about 4 km from Oranga village in the NW to Village Revatipur in the SE. In Borehole CBO-2, graphite mica schist of 9.7 m and 0.57 m thick were intersected. Analytical result of four graphite mica schist from Borehole no. CBO-2 revealed the fixed carbon content ranging from 4.47% to 10.33%. In CBO-3 borehole, graphite was found associated with graphite mica schist with thickness varying from 1.99 m to 4.78 m. Analytical results from CBO-3 indicated that out of the 26 graphite mica schist samples, 24 of them had fixed carbon content ranging from 2.3% to 10.19%. In CBO-4 borehole, thickness of graphite mica schist varied from 0.49 m to 6.38 m. Analytical results received for 9 graphite mica schist borehole samples in CBO-4 borehole showed fixed carbon ranging from 2.56% to 9.92%. In boreholes/ CBO-5, CBO-6 and CBO-7 thickness of graphite mica schist varied from 0.68 m to 6.14 m, 0.2 m to 5.47 m and 1.32 m to 6.04 m, respectively. Available chemical result of 18 trench samples revealed that graphite mica schist contained <1 to 14.62 % fixed carbon content, moisture content of 0.04 to 1.78%, volatile matter of 1.50 to 10.40% and ash content of 81.59 to 91.55%.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Graphite and Vanadium Arunachal Pradesh							
West Kameng	Kalaktang- Amatulla area,	1:12500	50	-	-	-	A reconnaissance survey for graphite and vanadium mineralisation in the area was taken up with an objective delineate and assess the economic potentiality of the area for graphite and vanadium. Near Village Paljor, a 50–60 m thick band of carbonaceous shale alternating with siliceous sandstone was mapped with steep dips on either sides. Near 900 chain PWD Camp, a 180–200 m thick band of interbanded dark grey phyllite and carb phyllite was mapped for a strike length of about 1.5 km. The available chemical results did not show promising values of vanadium, graphite and base metals but the silica values obtained from quartzite sample was >90%.
Graphite and Vanadium Arunachal Pradesh							
West Siang	Kalamati area,	1:2000	-	-	-	-	Reconnaissance survey for graphite and vanadium mineralisation in Kalamati area was taken up with an objective to delineate and assess the economic potentiality of the area for graphite and vanadium. On the basis of detailed mapping on 1:2000 scale, a carbonaceous phyllite band was identified and delineated with variable exposure-thickness of 250 to 370 m with strike extension up to 700 m in Kalamati area and one carbonaceous phyllite band with exposure-thickness of about 7 m having 170 m strike length in Yomgam area. Samples from carbonaceous phyllite of Kalamati area showed vanadium values up to 3,105 ppm with Fixed Carbon up to 8.6 %. Analytical results showed Zn values up to 3,017 ppm and Ni up to 788 ppm. The carbonaceous phyllite showed a positive correlation with vanadium, which was found to increases with the increase of Fe ₂ O ₃ . Similarly, Zn also showed a positive correlation in the carbonaceous phyllite
Graphite and Vanadium Arunachal Pradesh							
Lower Subansiri	Radhpur block	-	-	-	-	-	Preliminary exploration for graphite and vanadium mineralisation in Radhpur block, was taken up with an objective to assess the economic potentiality of the area for vanadium, graphite and associated minerals. A cumulative strike length of 3,300 m of carbonaceous phyllite bands was demarcated with thickness ranging from 5 m to 25 m. The western carb. Phyllite extended for 850 m with variable thickness of 8 m to 25 m was delineated. The eastern carb phyllite band, a cumulative strike length of 2,450 m of delineated and whose/variable thickness varied between 5 m and 15 m. Carbonaceous phyllite was characterised by high carbon content ranging from 4.39% to 16.69% and vanadium value ranging from 525 ppm to 2,820 ppm.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
West district Sikkim	Chitre-Dhareli-	1:12500	50.00	-	-	-	During reconnaissance survey for graphite and base metal mineralisation that was carried out in Chitre–Dhareli–Kalijhar areas, four graphite mineralised zones were demarcated in north- east of Chitre, Uttrey, Dentam and Sangkhu areas. Graphite occurred as lumpy to amorphous, flaky and vein type. Base metal mineralisation occurrences were also recorded in ferruginised quartzite at Chitre in stingers and dissemination in the form of pyrite, chalcocopyrite and bornite. Analytical results showed Ni value up to 1,878 ppm and V values up to 1,190 ppm.
Graphite Jammu & Kashmir							
Baramulla,	Boniyar area,	1:12500	50.00	-	-	-	A reconnaissance survey was carried out for graphite and associated mineralisation in Boniyar area, Uri Block. The rock types observed in the area belonged to Salkhala, Dogras, Panjals and Quaternary sediments. The Salkhala Formation was represented by gypsum, graphite schist, milky white quartzite, quartz mica schist, limestone with intercalations of schist and gritty quartzite. Dogra Group was represented by three Formations viz. Trikanjan, Baren and Chananwari formations. Panjal volcanics are usually fine-grained, light to dark green in colour with vesicles filled with secondary quartz and calcite as amygdules. It was observed that the gypsum and graphite bands occurred as two beds parallel to each other. A number of faults and a thrust were observed in the area. The gypsum and graphite were observed in Salkhalas from Maidanan in the west to Ijara in the east. Besides, sulphide mineralisation as weathered sphalerite was observed at Dachina Salamabad within quartz sericite phyllite. About 8 samples showed 10 to 20 % fixed carbon, 7 samples showed FC from 5.40% to 9.18% and 12 samples showed FC between 0.11% and 4.83 %, respectively.
Potash Rajasthan							
Fazilka & Sri Muktsar Sahib districts of Punjab & Sri Ganganagar	-	-	-	-	-	-	A reconnaissance survey for reappraisal of potash was taken up in Fazilka and Sri Muktsar Sahib districts of Punjab and Sri Ganganagar district of Rajasthan. Geologically, the study area falls in the Satluj basin which is a part of Indo-Gangetic Alluvial Plain. The entire area extending in Punjab was covered with thick blanket of Quaternary sediments. The Evaporite Group comprised cyclic deposits of halite containing polyhalite, alternating and separated by a sequence with anhydrite, clay and dolomite. A total 1600 m +10% drilling were planned in south-western part of Punjab to evaluate the potential of potash in part of Fazilka district, Punjab. During the period, one borehole was successfully drilled up to 886 m. The Geophysical logging of the borehole was carried out up to 860 m.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Hanumangarh	Jandawali north block Satipura sub-basin of Nagaur Ganganagar evaporite basin	1:4000	0.75	-	-	-	<p>In borehole a cumulative thickness of potash zone was 16 m, with average grade of 3.02% K at 2% K cut-off and total cumulative thickness of halite (NaCl) was 282.6m with average grade of 88.80% at 80% cut-off. Further sub-surface exploration could possibly lead to delineation of a depocentre of potash/halite and calculation of resource potential of the partially explored Punjab basin.</p> <p>During preliminary exploration for potash in Jandawali north block in Satipura sub-basin of Nagaur-Ganganagar evaporite basin, detailed mapping of 0.75 sq km. on 1:4000 scale was carried out in the study area. During field season 2020-21, the drilling work of previous field season was completed in eight boreholes which were separated by 750 m-800 m spacing. Out of the total 9 boreholes drilled in the Jandawali North block, a total three (03nos) boreholes were of full-coring and rest six (06 nos) were non-coring up to depth of 330.0 m. The depth of non-coring varies from 321 m to 330 m. During detailed lithological borehole logging, it was noticed that the contact between Nagaur and HEG varied from 380.60 m to 405.12 m. The cumulative thickness of HEG varied from 359.88 m to 398.63 m. Visible mineralisation in the form of sylvite and polyhalite was noticed within H2 cycles from 660.6 m to 681.80 m. The main potash-bearing mineral sylvite/sylvinite mainly occurred in H2 halite cycle along with presence of polyhalite. Mineral sylvite is grayish white to pale reddish white in colour, medium to coarse-grained, crystalline, translucent and highly soluble in nature. Upon taste it gives pinching essences. Halite and minor polyhalite were the common association with reddish brown clay and minor grayish white anhydrite stringers were the common impurities. Sylvite is commonly associated with sylvinite (KCl.NaCl). The other potash-bearing minerals identified while lithological borehole logging was polyhalite. Polyhalite $[K_2MgCa_2(SO_4)_{4.2}H_2O]$ was the admixture of different salt composition and was dark reddish brown in colour, medium to coarse grained and clay is the common impurity associated with it. Geophysical borehole logging was carried out after completion of each borehole. Conducted in two phases, first was from ground to 500 m and the second was from 501m to final depth. As received, 175 analytical data from one borehole 2.40 m zone was established from 675.60 m to 678.0 m and the K varied from 2.03% to 7.12%. In XRD analysis sylvite, langbeinite $[Mg_2 K_2(SO_4)_3]$ and polyhalite were identified.</p>

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Hanumangarh	Khunja (NW) block in Satipura sub-basin of Nagaur – Ganganaga evaporite basin,	-	-	-	-	-	During preliminary exploration for potash in Khunja (NW) block in Satipura sub-basin of Nagaur– Ganganagar evaporite basin, a total of 6,181 m drilling in 9 boreholes with depth ranging from 750 m to 777 m were carried out in Khunja North West block. During the investigation, the visible/suspected mineralised zones were sampled. The sample length varied from 0.50 m to 3.5 m. Presence of sylvite was observed mainly in the H2 halite cycles within depth range of 642 m to 690 m.
Hanumangarh	Jorkian south block	1:4000	10.30	10.30	-	-	<p>A preliminary exploration for potash was carried out in Jorkian south block in Satipura sub-basin of Nagaur– Ganganagar Evaporite basin. Mineralised zone in the study area was associated with the Hanseran Evaporite Group. The Hanseran Evaporite Group comprised a cyclic sequence of halite containing potash minerals in the form of Polyhalite (K₂MgCa₂(SO₄)₄·2H₂O), Sylvinite (KCl·NaCl) and Sylvite (KCl). The intervening zone between the halite cycles comprised of anhydrite, clay, dolomite and magnesite. During investigation, a total of 10.30 sq.m of detailed mapping were carried out on 1:4000 scale and total 14 of boreholes were fixed with the interval of 800 m. A total of nine boreholes were completed.</p> <p>The intersected thickness of the total halite sequence ranged from 379.10 m to 384.60 m depth in the area. Mineralisation was mainly associated with the lower two cycles of halite. The mineralisation was discontinuous, lenticular and pocket type. Sylvite/ sylvinite were the main mineral of potash in the area. Apart from sylvite, polyhalite and sulphate phase of potash minerals, langbenite and carnallite were recorded in lower halite cycles. Impurities of clay and anhydrites were the common association. Potash-bearing zones were identified between 640 and 755.0 m depth from the surface. The different mineralised zones identified were on the basis of core litho-logging. Around 934 core samples were sent for potash and associated elements analysis.</p>

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Hanumangarh	Jandawali south block, in Satipura, sub-basin, Ganganagar evaporite basin	1:4000	3 sq.km	-	-	-	A preliminary exploration for potash was carried out in Jandawali south block in Satipura sub-basin of Nagaur-Ganganagar evaporite basin. The geological map was prepared on 1:4000 scale and boreholes were fixed at the interval of 800 m towards south of earlier drilled borehole P-29 (Jandawali). A total of thirteen boreholes were drilled. The evaporite sequence in parts of Satipura sub-basin is in the form of horizontal bedded nature and characteristically cyclic deposits of halite. The intersected thickness of the total halite sequence ranged from 372.27 m to 401.23 m in the area. The whole potash mineralisation is strata bound in nature. In the investigation area, it was noted that the potash-bearing zones were recorded only in lower halite cycles. Sylvite/ sylvinite was the main mineral of potash in the area. Apart from sylvite, polyhalite and sulphate phase of potash minerals viz., langbenite and carnallite were also present in lower halite cycles. Potash-bearing zones were identified between 640 and 680.0 m depth and 740.0 to 755.0 m depth from the surface. Geophysical logging in twelve boreholes was carried out. Maximum potash value of 14.81% was from Borehole RJNGJS-10 at 649.42 to 649.7 m depth. In XRD analysis sylvite and polyhalite were observed.
GSI Glaucconite M.P Satana &							
U.P Chitrakoot	Pindra-Bambiha area	1:12500 1:4000	55.0 1.1	-	-	-	A reconnaissance survey in the area was taken up with an objective to assess the potentiality of potash in glauconite sandstone of lower Rewa Formation. The glauconitic sandstone consisted of quartz, glauconite, muscovite, etc. The majority of glauconite grains were under the process of formation of pellets. K ₂ O values in ten bedrock samples of glauconitic sandstone varied from 4.19% to 5.75% and in 13 bulk samples K ₂ O content varied from 4.95% to 6.26%. The weighted average of K ₂ O of 5 trenches varied from 2.31% to 5.64%.
Directorate of Mines & Geology, Rajasthan							
Limestone Kota	N/V Nimana-, Duniya, Ramganj Mandi	1:4000	2.0 sq.km	9	320	186	A G2 level exploration was carried out in the study area. The depth of boreholes varied from 30 m to 60 m. In the drilled boreholes, one to two zones of limestone with thickness varying from 10 to 35.5 m were intersected. The limestone of the area showed creamish to greyish colour and reddish color variations in nature which was observed at exposed and open well sections. Resources estimated were at about 113 million tonnes.
Baran	N/VAughar, Majhola Tanda & Thana Kasba Shahbad tehsil,	1:10,000 1:4000	10.0 2.0	-	-	20	A G3 level exploration was carried out to assess new limestone deposit in the area.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Ajmer	N/V Shyamgarh, Kanakhera, Pakriyawas, Kesarpura, Sipuraghata etc, Beawar tehsil.		3.0	4	224	-	Geologically the area comprised of calc-silicate, limestone, quartzite & mica-schist of Kumbhalgarh Group of Delhi Supergroup along with intrusive of granite, pegmatite and vein quartz etc.
Dholpur	Near village Molupura Barpura, Karuapura, Basai dang.	1:10,000 1:4000	-	-	8	-	The exploration was taken up with an objective to established and assess concealed limestone along River Chambal passing through Dholpur district. The limestone was fractured, layered fine-grained, yellowish to offwhite and sometimes/grey or chocolate brown in colour. The limestone exposures were mapped and had dimension of approx (1)240mX1.5-2m(2) 70mX1.52m(3) 70 m X 15 m (4) 200 m X 40 - 50 m (5) 50mX20-30m(6)2-2.5km X8-10m. Further limestone exposure was also observed along River Chambal. The limestone was found to be bedded, fractured & at places boundary in nature at top. Various units, such as, sandstone & shale, were also observed in upper Bhandar Group of Vindhayan Supergroup. At places in nalah cutting, small occurrences of lime kankar was also observed during mapping.
Chittorgarh	Sindwari & Charliya tehsil Nimbahera & Chittorgarh	-	2.035	9	482	355	A G2 stage exploration for cement-grade limestone was carried out in unexplored part of the of block area near Sindwari & Charliya village involving drilling and mapping of study area of 2.035 sq.km. A total of 342 m cumulative thickness of grey coloured limestone with thin shale partings were intersected in 8 boreholes. Geological resources estimated at about 156.596 million tonnes with weighted average of CaO -42.03%, SiO2 -17.41%, and MgO-0.66%.
Jodhpur	Borunda, Hariyadhana Digarna, Sinla, Bitan, Kurdaya, Tehsil Bilara	1:250001: 1:4000	20.0 5.0	- -	- -	- -	Limestone was exposed in the form of linear bands near Village Jaton ki Dhani, Gurjaron ki Dhani, Khojon ki Dhani and Ranishigaon, Tehsil Bilara, Limestone was grey in colour, fine-grained and bedded in nature. Jaton ki Dhani—The limestone linear bands were spread over 280 m to 360 m in length with width varying from 110 m to 130 m. In the south-east of Village Jaton ki Dhani, limestone was spread over 750 m to 1,700 in length with width varying from 230 m to 410 m. Gurjaron ki Dhani—Limestone was seen exposed in the form of linear bands having dimension of 1,220 m X 300 m. In the north-east of Village Gurjaron Ki Dhani, limestone bands were spread over 1,900 m X 500 m in dimension. Khojon ki Dhani—Limestone was exposed in the form of linear bands spread over 220 m to 400 m in length with width varing from 150 m to 190 m. Ranishigaon—Limestone was exposed in the form of linear bands spread over 870 m to 2,400 m in length with width varying from 100 m to 680 m.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Pali	N/V Atbara, Rundiya, Bayal; Tehsil— Sojat	1:10,000 1:4000	25.00 5.0	- -	- -	32	Limestone was exposed in the form of linear bands near Village Khariya Neev, Atbara, Rundiya in the study area. KhariyaNeev—The limestone as linear bands were spread over 130 m to 1,300 m in length with width varying from 100 m to 500 m. Atbara—In the west of Village Atbara, limestone was spread over 1,100 m X 550 m and in the south-west of Village Atbara limestone was spread over 600 m X 600 m. Rundiya—In the north-west of Village Rundiya, limestone having dimension of 950 m X 330 m was observed. Boyal:—In the north-east of Village Boyal, limestone spread over a length of 520 m to 1,300 m with width varying from 275 m to 650m.
Udaipur	N/V - Hariyav- Jaspura, Tehsil- Vallabh Nagar	-	-	4	303.0	269	Geologically the area comprised crystalline limestone (marble), gneisses quartzite, schist intruded by amphibolites belonging to Lasariya Formation. Resources estimated were at about 22 million tonnes.
Nagaur	Block no.3 N/V Awad and Khera Tehsil-Jayal	1:1000	155.0	12	596	-	The rocks were horizontally bedded limestone and dolomitic limestones parted with calcareous reddish shales. The boreholes intersected limestone seams of cumulative thickness of 5.14 m to 37.12 m. The limestone of the area was of good quality high-grade limestone with cavernous, grey and pink in colour and at some places laminated cherty bands and was found to be generally crystalline with fine to medium- grained texture. Resources estimated were at about 108.92 million tonnes in the area.
	N/V Tadas and Khorwa, Tehsil-Khinwsar	-	-	10	496.0	-	The investigation was started in 2016-17. The rocks were horizontally bedded limestone and solomitic limestones parted with calcareous redish shales. The boreholes intersected limestone of cumulative thickness of 9.00 m to 33.41 m. The dolomitic limestone of the area was earthy white to grey colour, medium to coarse-grained, crystalline texture and at top surface elephant skin weathering was observed to be present. The limestone of area was of good quality high-grade with cavernous, grey and pink in colour and at some places laminated cherty bands and was generally crystalline with fine to medium-grain texture. About 83.23 million tonnes of limestone resources were estimated in the area.
Nagaur	Bher Village, Tehsil Khinwsar,	1:4000	2.0	-	-	8	The area under investigation bore scanty exposures of fine to medium-grained crystalline grey colour limestone that of found mostly occurring in the quarry at places below the 1m to 3 m soil cover. In the studied area, the existing pits were uneven in shape and size with varying dimensions that the chemical grade limestone was seen at the subsurface lying below the soil cover. Spot/pit samples of grey colour limestone were collected for analysis.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Banswara	N/V Parthipura Nayatalab etc; Tehsil-Garhi,	-	-	2	174.5	91	The area was taken up for further detailed sub-surface exploration for G2 stage with revised borehole planning. Crystalline limestone was mapped for a length of about 3.5 km, with width varying from 100 m to about 1.0 km. Limestone was found as medium to coarse-grained crystalline, pink to white-grey in colour, fractured and multi jointed & compact in nature.
DGM, Rajasthan							
Limestone							
Rajasthan							
Jaisalmer	N/V Sam; Tehsil-Jaisalmer	1:10,00 1:4000	10.0	14	371.0	255	An exploration work was taken up to assess the quality and quantities of SMS and Cement-grade limestone in the study area. As a result of exploratory drilling, 102 million tonnes of SMS grade limestone resources were estimated in the area. Thickness of cement grade and 18.50 million tonnes of SMS grade limestone varied from 5.25 m to 9.75 m in 5 boreholes while that of underlying chalky cement grade limestone varied from 17.25 m to 37.50 m in 9 boreholes. The exploration will continue.
DGM,							
Limestone							
Rajasthan							
Jaisalmer	N/V Badabag; Tehsil-Jaisalmer	1:10,000 1:6336	5.0 2.0	14 -	- -	- -	A regional geological mapping in the area was taken up to assess the quality of yellowish limestone to its suitability for dimension stone/masonry stone. Yellowish limestone with thickness of about 0.50 m to 1.0 m was exposed in an area of about 0.20 sq km.
DGM,							
Rajasthan							
Limestone							
Karauli	N/V Mungepura, & Rodhain; Tehsil-Sapotra	1:10000 1:4000	30.0 5.76	-	-	-	Exploration was taken up to locate cement-grade limestone in the study area. The limestone of the area showed almost horizontal disposition and traced discontinuously for a strike length of 900 m x 300-400 m x 4-10 m N/V Kaser.
Sandstone							
Baran	N/V Chinpura, Khankra (Ganeshpur), Khandela Digoda, Gordhanpura etc; Tehsil-Kishanganj,	1:50,000 1:10,000 1:4000	100.00 10.00 2.00	-	-	9	The sandstone exposed in the area was in the form of horizontal sheets sandstone suitable for making floor and wall tiles and patti-katla in splittable and blockable grade useful in Building Industry.
Sandstone							
Bundi	N/V Thari; Tehsil-Talera,	1:4000	2.72	-	-	7	Around 140-150 plots of one hectare each of mineral sandstone, Masonry stone was delineated in the mapped area. Vindhyan Sandstone of the area showed light brownish to creamish colour, fine to medium-grained partly fractured to jointed and partly massive and was horizontal to sub-horizontal in nature. Sandstone in the area was mapped in nallah cutting sections and as surface exposure.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Sandstone							
Rajasthan Jaisalmer	N/V Purohitar; Tehsil-Pokaran	1:10,000 1:4000	10 2.0	-	-	-	During detailed geological mapping, a bout 2 sq km area sandstone of maroon to reddish colour, medium- grained with thickness varying from 0.5 m to 3.50 m suitable for masonry stone was identified.
Bharatpur	N/V Kakrala; Tehsil- Nagar & N/V Dumariya, Sirrond; Tehsil-Roopwas	1:4000	9.00	-	-	-	(i) In Kakrala Block about 2.0 sq.km. area were covered under detailed geological mapping n/v Kakrala- Rupwas, Tehsil Nagar. The area was represented by quartzite and interlayered phyllite. Quartzite was fine to medium-grained, light to dark grey, reddish brown, hard and compact in nature. On the surface- subsurface, the quartzite was found as weathered and fractured. (ii) Dumariya Block-about 3.0. sq.km area were covered under detailed geological mapping (1:4000 scale) n/v Dumariya, Tehsil Roopwas. Sandstone identified was buff red & red spotted, cream off white coloured. It was fine to medium- grained, equigranular and splittable/ blockable in nature. The thickness of splittable zone varied from 0.33 m up to 1.5 m at place. On the surface, the sandstone was weathered and fractured, (iii) In Dumariya Block about 3.0 sq.km area were covered under detailed geological mapping (1:4000scale) n/v Dumariya were Tehsil Roopwas. The area was represented by sandstone and shale. Sandstone was buff red & spotted red, cream & off white coloured. It was fine to medium-grained, equigranular and splittable/ blockable in nature. The thickness of splittable zone varied from 0.33 m up to 1.5 m at place. On the surface the sandstone was weathered and fractured. (iv) In Kotki Block, about 1.0 sq.km area were covered under detailed geological mapping (1:4000 scale) n/v Kotki, Tehsil Bhusawar. The dominant rock unit was quartzite which was fine to medium-grained off white & brown coloured and ferruginous at places. On the surface the quartzite was weathered and fractured. (v) In Sirrond Block, about 3.0 sq km. area were covered under detailed geological mapping (1:4000 scale) n/v Sirrond, Tehsil Roopwas. Sandstone was the most dominating rock type in the area. Sandstone was buff red and spotted red, cream and off white coloured. It was fine to medium- grained, equigranular and Splittable/blockable in nature.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Garnet							
Bhilwara	Mandapiya, Gundali, Kochariya, Rampuriya, Ruppura; Tehsil– Sundarpura	1:10,000 1:2000	20 2.0	-	-	10	Garnet was scattered in light coloured muscovite mica schist having diameter up to 2 cm to 7 cm at depth. Several small quartz and pegmatite veins intruded the garnet mica schist formation in the study area. Two garnet mica schist bands i.e. eastern having length of 1.8 km. with width varying from 50m to 100m and western having length of 1.6 km with width varying up to 490 m near village Kochariya were noted in the area.
Clay							
Bikaner	N/V Mudh, Chandi, Gurha, Kolayat, etc; Tehsil–Kolayat	1:50000 1:10,000 1:4000	300.0 10.0 5.0	-	-	-	The area comprised the rocks of Tertiary Age in which clay was mainly found in Marh and Palana Formation. Geologically, rocks of the mapped area were mainly covered by calc silicate/ calc gneiss and rest was soil covered and at several places rocks were intruded by a few small quartz veins.
Masonry							
Jhunjhunu & Sikar	N/V Chapoli; Tehsil– Udaipurwati	1:10000 1:4000	10.00 2.0	-	-	-	Bhinmal Block— Exposures of granite of the area were about 850 m X 250 m and 900mX800m in dimensions. It is light grey to creamish in colour, jointed, fractured and medium-grained in texture.
Granite							
Jalore	N/V Lalji ki Dungri, Ropsi, Kori Chopawtan, Charpatiya, Bhinmal; Tehsil– Bhimal	1:10,000 1:4000	25.00 5.0	-	-	-	Lalji Ki Dungri Block—The granite outcrops were about 500 m X 550 m dimension. It was light grey to pinkish in colour, jointed, fractured, medium-grained in texture. About 3 plots (each 1 hect are) were been delineated. Ropsi Block—The dimension of granite outcrops were about 70m–600m in length and about 50 m–150 m. It was light grey to creamish in colour, jointed, fractured, weathered, medium- grained in texture and compact and massive in nature. Kori and Charpatiya Block—The dimension of granite outcrops was about 500 m X 550 m, 350 m X 400 m & 400 m X 300 m. It was light grey to light pinkish in colour, jointed, highly fractured medium-grained in texture and compact and massive in nature.
Mansorry stone & Granite							
Sirohi	N/V Anapur; Tehsil Reodar & N/V Mahab- batnagar & Kunna in Tehsil–Sirohi	1:10000 1:4000	30	-	-	7	-

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Blockble pegmatite, granite, masonry stone etc.							
Rajsmad	N/V Rawat ka Khera, Bali, Talawon, Ruparel, Kundiyan, Pipalwala, Jalpa & Togi; Tehsil– Bhim	1:10,000 1:4000	20.0 2.0	-	-	-	Several white to off white coloured pegmatite bands were observed in the area which seem to be blockable at places. The details is as follows: i) 1100 m X 60 –105 m, 240 m X 8 m –10 m, 130 m X 30 m and 160 m X 25 m bands were mapped N/V Rawat ka Khera and 50 m X 8 m –10 m bands was mapped north of the Village Ruparel. ii) 1400 m X 60 – 90 m mapped n/v Pipalwala, Tehsil–Bhim iii) The siliceous calc gneiss & schist, dark grey to black in colour, massive & hard were mapped near Village Rawat Khera. This band had dimension of 1300 m x 900 m.
Quartzite							
Atwar	N/V Senthalia Odela and KaroliJageer; Tehsil–Ramgarh	1:10,000 1:4000	10 2.08	-	-	-	The area covered parts of village boundaries of Bahadkhokhurd, Antapura, Garhisawairan, Jhalatala Sunari and Jhankra of Tehsil Rajgarh
Marble / Dolomite							
Atwar	N/V Sunari,Jhalatala, Mukundpura, Antapura; Tehsil– Lachhmangarh	1:10,000 1:4000	10.23 1.95	-	-	-	-
Serpentinile, Chlorite Schist bearing ultramafic suite for blockable Marble							
Dungarpur	Chital, Jalap, Dhangaon ,Simalwada ,etc; Tehsil– Sinautuwara	1:10,000 1:4000	10.0 2.0	-	-	-	-
Fluorite							
Dungarpur	N/V Onwadia Bernia, Bokarsel, Masona–Khantri, Sidri–Damri,Khalil; Tehsil–Sagwara	1:10,000 1:4000	10.0 2.0	-	-	-	The exploration was taken up in the area with an objective to identify the fluorite bearing mineral strata and its evaluation. A small mining pit of dimension 30 m x 10 m x 2 m was found during the study.
Limestone							
Balangir	Around Telipadar	-	-	44	1357.0	-	G2 level exploration for crystalline limestone level was cotinued.The project commenced in field season 2018-19. Cumulative thickness of 396.24 m of limestone was intercepted
Graphite							
Dhenkanal	Karabira	-	-	50	3812	-	During G-2 level exploration for graphite around Karabira, drilling meterage of 3,812 m in 50 boreholes was completed. The cumulative thickness of graphite encountered was 715 m. The GR will be submitted for auction.
Graphite							
Raygada	Khalpadar	-	-	27	522.30	-	G-2 level exploration for graphite around Khalpadar was in progress since 2019-20. A cumalative thickness of 235.35 m of graphite was intercepted. The block has potential & drilling will be continued in next field season.

Table-8 (Contd.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Graphite Balangir	Beheramunda	-	-	-	-	-	G-3 level of investigation for graphite around Beheramunda area was carried out through large-scale mapping and scout drilling was under in progress. Graphite veins were mainly exposed in the quarry faces & the block would be taken up for upscaling to G2 level.
China clay Mayurbhanj	Dumaria	-	-	99	1935.35	-	G-2 stage of exploration for china clay was under progress since field season 2018-19. A cumulative thickness of 1,470.59 m of china clay horizons of different hues were intercepted. The GR will be submitted for auction.
Dimension/ Decorative stones Gajapati	Garabandha	1:25,000 1:4000	110.0 1.49	-	-	-	G-3 stage of investigation for dimension/ decorative stone around Garabandha of Gajapati district was completed. Two potential decorative stone blocks were identified of dimension 300 m X 270 m X 40 m and 565 m X 550 m X 260 m at 300 m SW of Village Lingipur and 300 m NE of Village Mettura, respectively.
Decorative stones Ganjam	Mathura	-	-	-	-	-	G-3 stage of investigation for decorative stone of artisan grade around Mathura of Ganjam district was in progress.
Quartz & Quartzite Malkangiri	Maharajpalli	-	-	-	-	-	G-3 level of investigation for quartz and quartzite around Maharajpalli under Tahasil-Kalimela of Malkangiri district was in progress.
Soapstones Sundergarh	Bhaludungri	1:25,000 1:4000	72.0 0.05	-	-	-	Investigation for soapstone at G-3 stage around Bhaludungri was in progress. During scanning of the area, 4 soapstone occurrences were delineated, out of which Rajabasa soapstone occurrence was found to be promising.
Graphite Dhenkanal	Bandhabhuin	1:4000	0.7	-	-	-	G-4 level of investigation for graphite through geophysical prospecting around Bandhabhuin of Dhenkanal district was in progress. So far, self potential survey over an area of 0.735 sq.km |& geological mapping over an area of 0.7 sq km on 1:4000 scale carried out & the results were encouraging. |The block will be taken up for upscaling in the coming field season.
Directorate of Geology & Mining, Nagaland. Limestone Nagaland Kiphre	Salumi village	1:4000	0.79	5	224.75	163	Limestone occurred as rootless, lensoidal deposits/pockets associated with the volcanic of Naga Hill Ophiolite (NHO) suite of rocks. Five limestone pockets of varying dimensions were delineated in the block. Resources estimated showed about 6,650 thousand tonnes of cement-grade limestone and 6683 thousand tonnes of siliceous limestone.

Table-8 (Concl.)

Agency/ Mineral/State/ District	Location	Geological mapping		Drilling		Sampling	Remarks
		Scale	Area (sq. km)	Boreholes	Meterage		
Magnetite ore	bearomg areas, falling within the, Mollen-Jopi- Ziphu ridge.	-	103	-	-	-	The block formed a part of Naga Hills Ophiolite (NHO)—the igneous rocks mostly ultramafic rocks were seen overlain by sedimentary rocks of Jopi Formation.
Karnataka State Mineral Corporation Magnesite and Dunite							
Mysore	Karya village, Madanpura Post, Nanjanagud Taluka	1:2000	86.25 ha	-	-	-	About 204 Th tonnes of magnesite and about 3,004 thousand tonnes of dunite reserves were estimated in the ML area.

5. Research & Development



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

383

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

28

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 mineral resources 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 underlying 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 an 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 evaluation including presentation of shortlisted projects before the Project Evaluation and Review Committee (PERC) and final approval of an inter-ministerial Standing Scientific Advisory Group (SSAG), grants are given to the projects submitted by R&D institutions.

During the year 2020-21, project proposals under the S&T Scheme of Ministry of Mines were invited online through SATYABHAMA portal. As per Minutes of 20th PERC meeting held during 23-25 Nov. 2020, a total number of 383 project proposals were received online on the portal. A two-stage review process was adopted to evaluate the proposals for recommendation to Standing Scientific Advisory Group (SSAG). The first stage comprised of preliminary screening of the proposals done by a team 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, 102 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 review in the second stage. These 102 project proposals were presented by the respective Principal Investigators (PIs) and evaluated by the committee during the VC meeting held on 23-25 Nov 2020. Based on the detailed review and evaluation, 28 new Project Proposals were recommended with or without changes to SSAG while 68 Project Proposals were not recommended. A total of 6 Project Proposals were to be revised and resubmitted in next PERC. In addition to the above, 38 ongoing projects were reviewed by the committee.

Besides, progress reports/final reports, requests for time extension, etc. of ongoing projects under the S&T Programme Scheme of Ministry of Mines were also considered by the committee for review in the 20th PERC

Meeting and Review Meeting of PERC (held on 21-22 January, 2020).

The projects recommended by the PERC were further considered during 52nd meeting of the SSAG held on 24th December 2020 through video conferencing. Chairman/Secretary (Mines) suggested the need to focus on applied R&D projects with outcomes which could be translated into benefits for the society. After detailed deliberation, SSAG approved 28 project proposals (Table-1).

The SSAG also approved foreclosure of the following 3 projects recommended by PERC:

- (i) Geochemical Studies of the Archaean Greenstone Belts of the Aravali Craton, Northwestern Indian Shield: Implications for Crustal Evaluation and Economic Potential— Aligarh Muslim University, Aligarh
- (ii) Development of a Low-cost Portable Optical Reflectance Spectrometer for Mining and Mineralogy— Indian Institute of Technology, Madras
- (iii) Development of capacitive deionisation technology for the extraction of germanium and selenium: Two elements of strategic relevance— IIT, Madras, Chennai

After deliberation, the SSAG accepted the final report and approved the closure of the 18 projects (Table-2) and release of remaining funds, subject to finalisation of accounts and other relevant procedures.

In view of the COVID-19 pandemic, the SSAG has approved, based on recommendations of PERC, time extension for 27 ongoing projects.

Table-1: Details of Projects Approved under S & T Programme, Ministry of Mines during 52nd meeting of SSAG

Sl. No.	Project Title	Implementing Institution	Project Cost & Duration of Project
1	Studying, modelling and evolving new blasting technique for open cast mine excavations near the proximity of structures (beyond 50 m) using the structural response analysis and dynamic FEM	CSIR, Central Institute of Mining and Fuel Research	Cost: ₹38.19 Lakh Duration: 3 year
2	Recovery of copper from water bodies nearby copper mines using microbial electrochemical systems	IIT, ISM Dhanbad (Partner- Hindistan Copper Ltd)	Cost: ₹25 Lakh Duration: 18 month
3	Corrosion and wear resistant advanced coatings based on high entropy alloys for mining equipment	IIT, Delhi	Cost: ₹24 Lakh Duration: 2 year
4	Design, analysis and development of Rheo gravity die cast Al-15Mg2Si-4.5Si composite based light weight Bucket links for Mining Excavators	CSIR Central Mechanical Engineering Research Institute (Partner - LA- CAST Metals & Components Pvt.Ltd Mahalaxmi Auto Industries)	Cost: ₹55 Lakh Duration: 2 year
5	Development of empirical methodology for design of Crown Pillar during transition from opencast to under- ground mining for Indian Mines	CSIR Central Institute of Mining and Fuel Research	Cost: ₹37.8985 Lakh Duration: 3 year
6	Determination of optimum safe distance of toe of dump from crest of open-pit for stability of pit slope under different geo-mining conditions	CSIR Central Institute of (Partner -HZL, Tata Steel and SAIL)	Cost: ₹52 Lakh Duration: 2 years
7	Development of Ready-To-Use Assorted Sand for Construction Activities from Zinc Refining Wastes and Marble Powder	Manipal University Jaipur Mining and Fuel Research (Partner -HZL and Manak Sangemermer Pvt. Ltd)	Cost: ₹30 Lakh Duration: 2 years
8	Preparation of synthetic zircon from zircon minerals of beach sand, its characterisation and value addition as thermal and electrical insulator	C.V. Raman Global University, Bhubaneswar (NGO -Society Raman Education)	Cost: ₹10 Lakh (seed money) Duration: 1 year

Table-1 (Contd.)

Sl. No.	Project Title	Implementing Institution	Project Cost & Duration of Project
9	Geo-technological evaluation of Bauxite and Laterite deposits of Chhattisgarh State by using Geospatial technology under Smart Mining 4.0	JNARDDC, Nagpur (Partner Chhattisgarh Council of Science & Technology, Govt. of Chhattisgarh, Raipur)	Cost: ₹45 Lakh Duration: 2 year
10	Development of low cost filler material utilising Lithomargic clay for Paint Industry as per IS 68 2006 standard	JNARDDC, Nagpur (Partner– Mundle Paint and Chemicals)	Cost: ₹45 Lakh Duration: 2 year
11	Fabrication of Al ₂ O ₃ containing cellulose based Ag NPs encapsulated Collagen dressing and investigation of its Therapeutic Opportunities in Diabetic Wound Healing	Kalinga Institute of Industrial Technology & JNARDDC, Nagpur	Cost: ₹30 Lakhs (₹15 Lakh each) Duration: 2 year
12	Design, synthesis and fabrication of donor-acceptor based fluorescent sensing organic-nanomaterials and devices for detection and quantification of rare-earth elements in minerals	University of Calcutta	Cost: ₹54.935 Lakh Duration: 2 year
13	Extraction and isolation of Al, K, Li, Rb and Cs from Mica	CSIR Institute of Minerals and Materials Technology	Cost: ₹9.975 Lakh Duration: 1 year
14	Development of process for making High Pure Quartz or Silica and Metallic Silicon from low-grade naturally occurring quartz	CSIR Institute of Minerals and Materials Technology	Cost: ₹15 Lakh (seed money) Duration: 1 year
15	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	IIT, BHU Varanasi; IIT, Bombay; NIT, Rourkela; NIT, Surathkal; IIT, Guwahati; IIT, Indore; IIT, Roorkee; IIT ISM Dhanbad; IIT, Kharagpur; IIT, Madras; IIIT, Hyderabad; Nalanda University and IIT, Kanpur and Triveni Earth Movers) (Partner - MOIL, Hindalco	Cost: ₹49.98 Lakh Duration: 2 year
16	Employing metallurgical silicon to develop new class of silicon composites for structural applications	IIT, Bhubaneswar	Cost: ₹37.997 Lakh Duration: 2 years
17	Bioleaching of lithium from minerals and low-grade ores of Indian origin	CSIR Institute of Minerals and Materials Technology	Cost: ₹12.936 Lakh (seed money) Duration: 1 year
18	Production of high pure manganese metal organic frameworks (Mn-MOFs) and their derivatives from low- grade manganese ores for supercapacitor applications	CSIR Institute of Minerals and Materials Technology	Cost: ₹10 Lakh (seed money) Duration: 1 year
19	Development of Alternative flux Material from Red Mud for Steel Dephosphorisation	CSIR Central Electro-chemical Research Institute	Cost: ₹10 Lakh (seed money) Duration: 1 year
20	Development of prototype aluminium seat frame for passenger buses	JNARDDC, Nagpur and Automotive Research Association of India	Cost: ₹100 Lakh (JNARDDC – ₹60 Lakh; ARAI – ₹40 Lakh) Duration: 2 years
21	Sustainable ion exchange resin-based technology for rare earth extraction	IIT, Madras	Cost: ₹52.51 Lakh Duration: 2 years
22	Bio-electrochemical reclamation of titanium and other rare-earth metals from red mud waste using a modified microbial fuel cell approach	PSG Institute of Advanced Studies (NGO – PSG and Sons Charities)	₹9.99 Lakh (seed money) Duration: 1 year
23	Exploring the practicability of extracting platinum and palladium from the mineral beds of Village Sittampudi in Salem District of Tamil Nadu – An Experimental and Molecular Dynamics Approach	NIT, Trichy	Cost: ₹15 lakh (seed money) Duration: 1 year
24	Development of perovskite-based materials using inexpensive RE mixed oxides precursors derived from Indian beach sands for room temperature magnetic refrigeration applications	CSIR Indian Institute of Chemical Technology	Cost: ₹51 Lakhs (MoM – ₹31 Lakh, CSIR – ₹20 Lakh) Duration: 1 year
25	Recovery of galena, sphalerite from lead zinc tailings by integrated energy efficient ultrafine comminution and novel shear flocc-flotation and its impact on downstream Paste fill	IIT, Hyderabad and CSIR Institute of Minerals and Materials Technology (Partner – HZL)	Cost: ₹25 Lakh (MoM - ₹10 lakh seed money; HZL - ₹15 Lakh) Duration: 1 year

Table-1 (Concl'd).

Sl. No.	Project Title	Implementing Institution	Project Cost & Duration of Project
26	Additive manufacturing of Rare-earth based Nd-Fe-B magnets	International Advanced Research Centre for Powder Metallurgy and New Materials	Cost: ₹52 Lakh Duration: 2 years
27	Innovative approach to recover chromite value from low-grade chromite ore, fines and slimes by dry and wet beneficiation technique	CSIR Institute of Minerals and Materials Technology	Cost: ₹10 Lakh (seed money) Duration: 1 year
28	Process development for the recovery of tungsten values from lean grade Indian resources.	CSIR Institute of Minerals and Materials Technology	Cost: ₹10 Lakh Duration: 1 year (seed money)

Source: Minutes of 52nd meeting of SSAG.

Table-2: Details of Acceptance of Final Report and Closure of Completed Projects under S & T Programme, Ministry of Mines during 52nd meeting of SSAG

Sl. No.	Project Title	Implementing Institution
1	Development of super thermal aluminium (STAL) conductor for Indian Power Sector.	JNARDDC, Nagpur & NFTDC, Hyderabad (jointly)
2	Simulation of simultaneous rock fractures at multiple scales.	IIT Delhi
3	Urban Li Battery Mining: Physio-Chemical separation of used Li ion Batteries for Recovery of Li, Co, Ni active materials and Cu, Al Metal.	Nonferrous Materials Technology Development Centre, Hyderabad
4	Production of geopolymer-based construction material from pond ASH: an industrial waste.	Gandhi Institute of Engineering and Technology, Gurnapur, Odisha.
5	Novel synthesis routes for high purity kesterites (CZTS:Cu-Zm-Sn-S; Cu-Zn-Sn-Se) and development of cost kesiterite based solar PV cells and modules.	Non-Ferrous Materials Technology Development Centre, Hyderabad
6	Recyclability strategy or value-added utilisation of iron/manganese ore tailing/low-grade ore: evaluation of energy storage capacities .	Institute of Minerals and Materials Technology, Bhubaneswar
7	Extraction of potash values from silicate rocks.	IIT, Roorkee, Uttarakhand
8	Mineralogical and geochemical characterisation of Indian glauconites for alternative potassium fertilizers.	IIT, Bombay and NGRI, Hyderabad (jointly)
9	Development of low density emulsion explosives for energy efficient blasting in environmentally sensitive areas.	IIT, Dhanbad (Indian School of Mines, Jharkhand)
10	Technology Development (TRL-7) for calico-thermic reduction of rare-earth metal oxides and establishment of pilot plant for extraction and purification of samarium.	Non-ferrous Material Technology Development Centre, Hyderabad
11	Development of Nickel containing steel from chromite overburden.	IIT, Kharagpur and Institute of Minerals and Materials Technology Bhubaneswar (Jointly)
12	Processed Sea sand for construction and other purposes.	Saveetha Engineering College, Saveetha Nagar, Thandlam, Chennai
13	Novel Approach to Recover Individual Valuable Heavy Minerals from Pyriboleferrous Beach and Dune Sand Deposits.	CSIR-Institute of Minerals & Materials Technology, Bhubaneswar
14	Nano Processing of Industrial Rejects for use as additives in Mix designs for improved pozzolanic reaction efficiency.	JNARDDC, Nagpur and VNIT, Nagpur VNIT, Nagpur
15	Study of Alkaline – Carbonatite complexes as potential resources for REEs, Nb-Ta and U-Th.	IIT Roorkee, Uttarakhand
16	Assessment and prediction of land surface deformation due to under-ground metal mining in northern Aravali Range of hills using microvave remote sensing data sets and ground based Observations.	IIT, Dhanbad (Indian School of Mines), Jharkhand
17	Study the feasibility of treatment of seepage water from chromite mine quarries of Odisha.	National Institute of Technology, Rourkela
18	Optimisation of digestion efficiency in Bayer process by ascertaining the ideal size fraction of bauxite feed.	JNARDDC, Nagpur and VNIT, Nagpur

Source: Minutes of 52nd 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 2020-21 are furnished below:

Indian Bureau of Mines (IBM)

Important R&D activities carried out by IBM during the year 2020-21 are summarised below:

A. Mineral Processing Division, IBM

1. COPPER ORE

- 1.1 Bench-scale Beneficiation Studies on Copper bearing Sample (G-2 level exploration) from Northern part of Toda Ramliyas block, Sikar, Rajasthan.

The sample assayed 0.40% Cu, 5.10% Fe(T), 42.98% SiO₂, 9.76% Al₂O₃, 11.51% CaO, 9.55% MgO, 0.18% S(T), 0.63% TiO₂, 2.38% Na₂O, 1.26% K₂O, 12.11% LOI and 58.86% AI (Acid Insolubles).

Beneficiation studies using froth flotation process yielded a composite concentrate (concentrate + second cleaner tails) that assayed 27.18% Cu with Cu recovery of 87.82% (Wt% yield 1.30).

- 1.2 Bench-scale Beneficiation Studies on Copper bearing Sample (G-2 level exploration) from RJBN (Lode I), Bokri North Block of Jhunjhunu, Rajasthan

The sample assayed 0.27% Cu, 3.49% Fe(T), 59.81% SiO₂, 8.99% Al₂O₃, 9.23% CaO, 5.17% MgO, 0.46% S(T), 0.51% TiO₂, 6.71% LOI, 0.03% Mn.

Beneficiation study employing froth flotation process yielded a copper concentrate that assayed 19.69% Cu with 85.60% copper recovery (Wt% yield 1.18).

- 1.3 Bench-scale Beneficiation Studies on Copper bearing Sample (G-2 level exploration) from RJBN (Lode II), Bokri North Block of Jhunjhunu, Rajasthan

The sample assayed 0.25% Cu, 3.39% Fe(T), 70.33% SiO₂, 7.12% Al₂O₃, 7.17% CaO, 5.04% MgO, 0.42% S(T), 0.40% TiO₂, 3.82% LOI, 82.87% AI, 0.02% Mn.

Beneficiation studies using froth flotation process yielded a copper concentrate assaying 19.31% Cu, with 88.75% copper recovery (Wt% yield 1.15).

- 1.4 Bench-scale Beneficiation studies on a Copper Ore Sample (G-2 level exploration) from Lingsurur taluk, Raichur district, Karnataka

The sample assayed 1.06% Cu, 2.90% Fe(T), 78.06% SiO₂ and 85.28% Acid insoluble.

Froth flotation studies on as received sample ground to all -200 mesh size yielded a copper concentrate assaying 29.84% Cu, 15.41% SiO₂, 19.89% Acid insoluble with 75.6% copper recovery (Wt.% yield : 3.0).

2. IRON ORE (BHQ)

- 2.1 Pilot-scale Beneficiation Studies on an Iron Ore Banded Haematite Quartzite (BHQ) Sample (Mine Reject) from Dongarbor iron ore mines, Rajnandgaon, Chhattisgarh for Industry

The sample assayed 33.5% Fe(T), 49.7% SiO₂, 1.1% Al₂O₃, 0.17% CaO, 0.032% MgO, 0.011% TiO₂, 0.03% P, 0.083% Mn and 1.2% LOI.

Pilot-scale beneficiation studies were carried out on the sample employing different techniques like crushing, screening, grinding, gravity separation employing spiral and wet high intensity magnetic separation, etc. The beneficiation process route evolved for the up gradation of Fe (T) and reduction of Silica content yielded a combined concentrate comprising of cleaner spiral concentrate and scavenger spiral concentrate assaying 61.0% Fe (T), 11.1% SiO₂, 0.7% Al₂O₃ and 0.4% LOI with Wt% yield of 26.1% and 47.6% Fe (T) recovery.

3. IRON ORE

- 3.1 Beneficiation Studies on a Composite Iron Ore Sample from Belgaum, Karnataka for Industry

The composite sample assayed 58.15% Fe(T), 82.57% Fe₂O₃, 5.50% SiO₂, 3.36% Al₂O₃, 0.36% FeO, 1.11% Mn, 0.12% CaO, 0.06% MgO, 0.07% P, 0.12% S(T), 0.19% TiO₂, and 6.28% LOI.

Wet High Intensity Magnetic Separation tests were conducted on sample, stage grinding of +65 mesh followed by wet magnetic separation at 2,000 gauss and cleaning of the non-mag at 13,000 gauss yielded a composite magnetic concentrate (Mag-I and II) which assayed 62.95% Fe(T), 1.45% SiO₂, 1.19% Al₂O₃ and 5.84% LOI with Fe(T) recovery of 80.4% (Wt.% yield 74.3).

- 3.2 Bench-scale Beneficiation Studies on a drill core Iron Ore Sample from Alaghat West Block (G-2 Stage exploration), Sundargarh District, Odisha

The sample assayed 57.87% Fe(T), 4.15% Al₂O₃, 7.17% SiO₂, 0.10% CaO, 0.04% P₂O₅, 0.06% K₂O, 0.02% Na₂O, and 5.11% LOI with traces of MgO, TiO₂ & Mn.

Beneficiation studies comprising of crushing and gravity separation techniques employing Jigging, Tabling and Multi-Gravity separation yielded a composite concentrate assaying 63.29% Fe(T), 2.06% Al₂O₃ and 3.27% SiO₂ with a total Fe recovery of 59.1% (Wt% yield 53.6).

4. MANGANESE ORE

- 4.1 Bench-scale Beneficiation Studies on a Manganese Ore sample (G-2 level exploration) from Cheepurupalli, Vizianagaram District, Andhra Pradesh.

The sample assayed 23.66% Mn, 10.41% Fe(T), 22.65% SiO₂, 8% Al₂O₃, 1.27% TiO₂, 0.3% P, 3.84%

CaO, 0.04% MgO, 11.25% LOI and of S(T) in trace amount.

Gravity separation employing tabling at -72 mesh size followed by electrostatic separation of the gravity separation products to refine the Manganese concentrate. Gravity tails were subjected to reverse flotation to recover Mn values from tails.

The concentrate-I was obtained by combining +150# conductor and middling & -150# conductor and middling of table concentrate and table concentrate & table middling which assayed 47.02% Mn with 39.0% Mn recovery (Wt.% yield 21.01).

The concentrate-II was obtained by combining -150# non-conductor of table concentrate, +150# conductor and middling of table middling, -150# conductor of table middling and non-float reverse flotation concentrate of combined table tails and slimes which assayed 33.55% Mn with 44.0% Mn recovery (Wt.% yield 33.18).

The composite concentrate was obtained by combining concentrate-I and concentrate-II which assayed 38.78% Mn with 83.0% Mn recovery (Wt.% yield 54.19).

5. COPPER –GOLD ORE

5.1 Bench-scale Beneficiation Studies on Copper-Gold Ore Sample (G-2 level exploration) from Mundiawas Block, Alwar district, Rajasthan

The sample assayed 0.25% Cu, 44.86% SiO₂, 5.97% Al₂O₃, 1.82% S(T), 5.23% Fe(T), 12.76% CaO, 9.12% MgO, 0.42% Na₂O, 1.76% K₂O, 0.52% TiO₂, 0.04% MnO, 9.22% LOI with 56.89% Acid insoluble. The composite sample assayed 1.24 ppm Au, 7.12 ppm Ag, 0.61% Cu, 8.73% Fe(T) & 10.33 LOI.

By adopting flotation test at optimised conditions yielded a copper concentrate assaying 21.36% Cu with a Cu recovery of 70.6% (Wt.% yield was 0.80). Acid leaching followed by cyanidation resulted in the overall recovery of gold at 97.9%.

6. GRAPHITE ORE

6.1 Bench-scale Beneficiation Studies on a Low- grade Graphite Ore (G-2 level exploration) Sample from Golihat Block, Betul district, Madhya Pradesh

The as received sample assayed 6.25% FC, 4.76% VM, 0.49% moisture and 88.5% ash. The ash analysis of as received sample showed 63.5% SiO₂, 10.45% Al₂O₃, 4.98% Fe₂O₃, 2.09% CaO, 1.61% MgO, 0.93% Na₂O, 3.41% K₂O, 10.76% LOI, and 0.154% V₂O₅ pectively.

Beneficiation studies comprising grinding, screening, magnetic separation, froth flotation, gravity separation, etc. were employed by varying different parameters for concentration of graphite and vanadium-bearing minerals. The beneficiation process route evolved yielded —

- (i) A composite graphite concentrate, i.e., 3rd cleaner concentrate mat assayed 57.93% FC, 39.1% Ash, 2.48 % VM, 0.47% Moisture with FC recovery of 76.4% and wt% yield 8.6.
- (ii) A vanadium-bearing mineral concentrate as a co-product which assayed 0.39% V₂O₅, 1.23% FC, 92.86% Ash, 5.03% VM, 0.88% Moisture with V₂O₅ recovery of 17.7% and wt% yield 6.6.

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 0.15mm) 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 the substantial extent of the total Run-off Mine (ROM) and are often discarded as waste into waste dumps/tailing ponds, containing considerable amounts 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 insitu 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 washing methodology adopted in NMDC, 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 back in main stream using techniques of beneficiation involving gravity, magnetic and flotation 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 fine form assay reasonably high percent of Fe. Therefore if properly beneficiated, these slimes 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% Al₂O₃ 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 To study the fire retardancy of nano-ATH in polymers with CIPET, Bhubaneswar (Central Institute of Plastics & Engineering Technology) (S&T- Mines): The objective of the project was to
 - (i) investigate the effect of nano or micro-ATH particles as a fire-retardant additive in thermoplastic polymers (PP & PVC).
 - (ii) replace/substitute the existing flame retardants used in polymer composites with nano-ATH & evaluate the performance.
 - (iii) examine the mechanical, thermal and flame-retardant properties of thermoplastic polymers (PP & PVC)/ATH composites obtained using ATH fillers of various particle sizes.

- (iv) innovative process utilising aluminum trihydroxide (ATH) and thermoplastic polymer matrix with value addition.

The final report of the findings showed that nanosized ATH with 40–350 nm size has reduced the loading of fire-retardant filler in the polymer (PP) from 40–60% to 2–3%. It has a large surface area and improves the fire retardancy and the mechanical properties of the polymer. PP/nano-ATH nanocomposites can be suitably validated for acoustic panels used in building and construction industries based on their mechanical & flame retardancy where lightweight is a priority. Based on the successful lab-scale findings, the pilot-scale level can be taken up.

- 1.2 Optimisation of digestion efficiency in Bayer process by ascertaining the ideal size fraction of bauxite feed (S&T- Mines): The objective of the project is summarised below:

- (i) Determination of the optimum size of bauxite for digestion by grinding and characterisation of various size fractions.
- (ii) Technological testing and evaluation of various size fractions of bauxite to optimise digestion efficiency.

The project attempted to investigate the chemical, mineralogical, rare earth, trace elements, petrology characteristics of the bauxites used from predominantly two regions in India, namely East Coast and Central India.

The results showed that there is a clear enrichment of SiO₂ and Fe₂O₃ in the finer fractions both for East Coast bauxite and Central India bauxite. Thus, the removal of some of these size fractions can improve the overall grade of these bauxites. However, these reductions are not appreciable to make bauxite suitable for refractory and abrasive industries.

The project findings further revealed that if the finer size fraction get rejected there will be reduction in consumption of both specific bauxite and caustic soda consumption leading to improvement in digestion efficiency. The optimum particle size of the feed bauxite to digestion was also recommended in the report. The final recommendation can be used by primary Aluminium producers utilising East Coast and Central India bauxite.

- 1.3 Development of a process technology (at lab- scale) for low-cost production of 3N (99.9%) pure alumina (Ministry of Science and Technology –DST, New Delhi): The objective of the project is enumerated as below:
 - (i) To develop the process know-how (at lab-scale) for the low-cost production of 3N pure alumina (99.9% purity).
 - (ii) Characterisation and Validation for Sapphire making for LED (Light Emitting Diode) and Semiconductor applications.

- (iii) Theoretical study of cost economics for 3N pure alumina synthesis process and further recommendation.

The project activities involved production of high purity alumina powder (3N pure) by two different methods which later was used for the fabrication of sapphire crystal for LED applications.

The Centre has successfully developed the lab scale process know-how for low-cost production of 3N pure alumina at much low temperature suitable for LED (Light Emitting Diode) and Semiconductor applications. The cost economics for 3N pure alumina synthesis process was also evolved. Presently, 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 process does look to have commercial potential to add to the vision of Make in India program after being suitably scaled up.

2. Ongoing Projects

- 2.1 Fabrication of Advanced Ceramic Nanocoatings for Automotive Applications with Christ University (Sponsored by Ministry of Mines): The project aims to develop 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 import substitution in the field of Automotive Sector applications.
- 2.2 Techno-economic Survey of Aluminium Scrap Recycling in India with Metal Recycling Association of India (Sponsored by Ministry of Mines): Indian Aluminium Recycling Industry is currently considered as un-organised, represented by around 5,000 Micro, Small and Medium Enterprises. Scrap collection is largely unorganised coupled with insufficient awareness, leading to a major proportion of scrap going to landfill rather than recycling. Current recycling rate in India is only 25% compared to the world average of 45%. The country has a long way to go before it can become a major aluminium recycler and feed the secondary metal market which is dependent on imports. Presently key concern areas of aluminium recycling are lack of structure for aluminium scrap handling and secondary metal recovery.
- On this background the survey report will assist the Ministry of Mines in establishing the techno-economic status of the Aluminium Recycling Industry in the country and in due course help in formulation of policies pertaining to this Industry.
- 2.3 Bench-scale study on Extraction of Pure Silica and smelter-grade Aluminium Fluoride from Coal Fly Ash (CFA) (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 that get generated from all coal-based thermal power plants accumulating over the years and this 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 to study the bench-scale (0.5–1 kg CFA) extraction of pure silica and aluminium fluoride by treating CFA with appropriate mineral acid were carried out.

- 2.4 Utilisation of Aluminium Dross to Achieve Zero Waste — A Bench-scale Study Project (Sponsored by Ministry of Mines): The main objective of the project was 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 that it provides alternative source to primary material and it helps in reduction of waste disposed to landfills.
- 2.5 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 alloys at JNARDDC for the benefit of 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.
- 2.6 Development of Ceramic Proppant from Low-grade Materials (Partially Lateritised Khondalite -PLK, Fly ash, etc.), Phase-II Scale up Studies (Sponsored by NALCO, Bhubaneswar Odisha): Based on the successful lab-scale process already developed by JNARDDC, the scale-up project for developing ceramic proppant from low-grade materials (Partially Lateritised Khondalite -PLK, Fly ash, etc.) under Phase-II was undertaken.
- In general, ceramic proppants is manufactured from high-grade bauxite. An attempt has been made for converting unutilised materials into value added product (proppants). This is a part of the efforts made under 'Make in India' and 'Swachh Bharat' zeal.
- 2.7 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, Bhubaneswar Odisha, Jointly with IIMT, Bhubaneswar & Eesavyasa Tech, Pvt Ltd. Telangana): The Project was aimed at developing an innovative and viable process for recovery of iron values from red mud and processing of non-iron part for its application as an insulating product with an aim for complete utilisation of red mud. JNARDDC was to be the nodal agency and the deliverables included mass and energy balance of the developed process.

- 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 at developing an indigenous process to prepare 4N (99.99%) pure grade alumina (HPA) that has potential for use in LED applications.
- 2.9 TPN:59025 Instrument for Real Time Measurement of Anode Current Distribution of Aluminium Electrolysis Cell (Sponsored by Dept of Science and Technology, 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 at developing 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.
- 2.10 TPN:59031 Instrument for Instantaneous and Onsite Measurement of Aluminium Electrolysis Bath Parameters (Sponsored by Dept of Science and Technology, New Delhi): JNARDDC has already developed the methodology to establish the relationship of cooling curve with bath parameters on the basis of plant and lab experiments and has successfully developed the basic instrument for instantaneous measurement of important bath parameters. The project aims at developing the instrument which can be used in plants for regular measurements of bath parameters by addition/changes in the basic instrument in the terms of software & hardware for its commercialisation.
- 2.11 Technology Development for Holistic Utilisation of Red Mud for Extraction of Metallic Value & Residue Utilization (Sponsored by NALCO, HINDALCO & VEDANTA and S&T (Mines) under the aegis of NITI Aayog, Jointly with NML, Jamshedpur & IMMT, Bhubaneswar): 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 from red mud and for further

research, development and commercialisation to other industries.

3. Collaborative work

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

1. Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India: JNARDDC has successfully carried out technical evaluation under PAT-1 & 2 to support the BEE in reducing energy consumption of Aluminium Sector. Presently PAT-3 scheme is being evaluated. The recommendation will help BEE in generation and trade of e-certificates under PAT scheme. It will also be useful in setting up energy reduction targets for PAT-3 scheme.
2. NITI AAYOG: In 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. 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.
4. Central Pollution Control Board (CPCB): The Institute has submitted recommendations of Aluminium Industry for supporting CPCB in formulating guidelines for safe disposal & utilisation of waste (red mud) generated by the Aluminium Industry.
5. Russian Union of Producers, Suppliers and Consumers of Aluminium: Russian Aluminium Association, Moscow and JNARDDC, Nagpur signed an MOU on 3rd August 2020 for long-term cooperation between Russian and Indian companies related to aluminium production and transformation; knowledge and experience sharing to increase aluminium production; promoting direct partnerships between aluminium processing facilities as well as between R&D institutes; development of techno-parks (clusters) for the Aluminium Industry; setting up joint ventures between Russian and Indian enterprises including facilities producing high-level aluminium products; etc.

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 involves 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.

During the current reporting period, many innovative techniques were used to solve the industry problems. Some of the important contributions are listed below:

- (i) Geophysical investigations were carried out to analyse the likely impact of the enhanced induced vibrations due to landing and take-off of the heavier and more frequent aircrafts after the proposed expansion of the runway by 260 m towards the Dumas end at Surat Airport.
- (ii) World's 2nd largest lift irrigation project: The Palamuru Ranga Reddy Lift Irrigation Scheme (PRLIS), Telangana, would facilitate irrigating drought prone regions of the State, and the engineering geological investigations and the subsequent technical inputs of NIRM along with recommendations for suitable engineering measures would ensure the life of this project for next 100 years.
- (iii) Critical Angle Excavation of Draft Tube: The strategic engineering design of excavation in the choked tunnels of the Punatsang Chu Hydroelectric Power Project, Bhutan, under adverse geological conditions enabled progress of the hydel project.

During the reporting period between 1st January to 31st December 2020, the Institute received 36 new projects from the industry during the pandemic and completed 41 industry projects.

Some of the major ongoing projects that are being executed by the Institute during Jan.–Dec. 2020 include:

- (i) Engineering geological investigations of cut slopes for intake pool, upstream and downstream hillock above pressure tunnels and powerhouse area and tailrace pool of Indra Sagar Polavaram Hydro Electric Project;
- (ii) Geophysical investigation to study the rock mass condition around the sinkholes and abandoned coal working in the Umariya District, MP;
- (iii) MASW survey and measurement of vibration parameters around tailing dam of Bailadila mines;
- (iv) Scientific Study for assessing the stability of pit & dumps and design for strengthening of benches for opencast;
- (v) BPM & benches above proposed decline portal of Kaliapani Chromite Mine, Balasore Alloys Ltd.

- (vi) Scientific Study for stability assessment and monitoring of Pit and Dump at 3 nos. Budgauna, Hinauti and Majhgawan Limestone mines at Sidhi Cement works;
- (vii) Determination of Insitu stress parameters (Magnitude, Direction & Gradient) of the overlying roof strata for orientation of Longwall panel at Muraidih Colliery, Barora Area, BCCL, Dhanbad;
- (viii) Analysis of Geotechnical & Geodetic Instrumentation Data at C-3 Package of Punatsangchhu-II Hydroelectric Project, Bhutan; Cap Rock Stability at Central Baroi Mine, HZL vis-a-vis Depillaring of Remnant Pillars – A Critical Appraisal;
- (ix) Blast Design for Graded Material to Construct Break Water for Vizhinjam, Thiruvananthapuram, HOWE Engineering Projects (India) Pvt Ltd.
- (x) Monitoring of ground vibration and air overpressure due to blasting carried out for construction of Hydro-Technical Structure of unit 3 and 4 at Kudankulam Nuclear Power Plant, Kudankulam, L&T, Tamil Nadu;
- (xi) Procedure for controlled blasting and monitoring of ground vibration for rock excavation at Kaiga 5&6 site, Kaiga, NPCIL;
- (xii) QA support for the On-going Geological/ Geotechnical investigations at Mahi Banswara Rajasthan Atomic power project.

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 potentiodynamic 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 Salt Electrolysis sponsored 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 densities and bath 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 MnO₂ (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 and analysed 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-MnO₂ 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 Compact and Crystalline 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 focusing on Fine particle processing, Dry beneficiation, Mathematical modeling & simulation, Plant performance auditing & improvement, and Equipment development. During 2020-21, the following were some important R&D programmes and projects that were under execution:

(i) Mission Mode Mroject on Strategic Minerals — Production of Lithium Salt from Ores

NML laboratory is working on the development of indigenous technology for production of lithium from hardrock ores under a CSIR—Mission Mode Project on Bulk Chemicals. The objective of the research was to develop process flow sheet for beneficiation and extraction of lithium salts from ore. Three lots of lepidolite- bearing rocks and one spodumene-bearing rock were sourced for the research. The Li₂O content in sourced lepidolite samples varied from 1.9% to 2.8% whereas that in spodumene sample it was 3.1%. Mineralogical study revealed that albite, quartz and muscovite-were the major gangue minerals in both lepidolite- bearing and spodumene-bearing rock/pegmatite. Preliminary beneficiation study revealed that Li₂O content in lepidolite concentrate was 4% and in spodumene concentrate weas 5.1% and the work is in progress. Preliminary hydrometallurgical processing revealed that roasting of lepidolite- bearing rock followed by mineral acid leaching resulted in recovery of 99% Li in the leach liquor.

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

The objective of the present study was to beneficiate limestone samples through dry magnetic separation

and Air table for reducing of iron from 1.5% to 0.08% Fe₂O₃ for rejected limestone and from 0.2% to 0.08% for regular limestone. To prepare clinker for white cement, it is pertinent to minimise the iron and other transition elements (titanium, chromium, manganese, nickel and zinc) in the raw mix composition. High-grade limestone containing less than 0.068% Fe₂O₃ and less than 0.015% MnO is generally used for such purpose. Limestone deposits in BWC mines is highly associated with lateritic coating. The iron in laterite adversely affects the white cement quality. The current project was aimed at exploring the possibility of removal of iron and other transition elements from limestone of BWC to improve the clinker quality. Based on characterisation and liberation studies, it was proposed to beneficiate limestone through dry magnetic separation and Air table for the separation of contaminants from limestone. In addition, it was also proposed to develop beneficiation process for reduction of impurities present in rejected limestone sample at the mining site for its ultimate utilisation.

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

The objective of the present study was to validate the results of continuous operation of pilot-scale flotation studies that were done earlier by treating 15 tonnes of iron ore through reverse flotation. Extensive iron and steel production has resulted in depletion of high-grade iron ores. As a result, the thrust is on beneficiation of low-grade ores. Moreover, decrease in threshold value of tailings/reject Fe (< 45%) as per statutory norms demands beneficiation of inferior grade iron ore. These ores comprise haematite, goethite (iron minerals) along with kaolinite and quartz (gangue minerals). Reverse flotation method was used for beneficiation of iron ores wherein silica gangue could be 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 encouraging results of batch-scale studies (20-25 kg) in an earlier project carried out at CSIR NML, continuous pilot-scale flotation of 15 tonnes of iron ore will be experimented for the validation of the bench-scale results.

(iv) Pilot-scale Study on Hydrocyclone

Weir EnSci has developed a new Cavex Hydrocyclone with a double effect overflow (DEO) system for a high capacity performance with an efficient classification performance. M/s Weir Mineral EnSci, Bengaluru approached CSIR-NML for conducting pilot-scale testing with their newly developed Cavex 100 cyclone. With mutual consultation pilot scale testing was conducted by using iron ore slime at different operating conditions. The products were analyzed for particle size distribution in Malvern Laser Particle Size Analyzer. The mass balancing as well as size wise data recovery was obtained for all experiments

to predict the performance of this newly designed hydrocyclone. A much finer cut size can be achieved with this DEO system compared to conventional hydrocyclone. With the help of this DEO system, final loss to overflow can be minimised.

(v) Advanced Gravity Concentration of Chromite Beneficiation Plant Tailing

NML undertook bench-scale beneficiation studies to recover chromite values from plant tailing sample to produce preferably 40% Cr₂O₃ using water only cyclone and Falcon concentrator. Detailed characterisation of the tailing sample was carried out which revealed the presence of chromite, goethite, haematite and clay silicates in the sample. Goethite was the major constituent of the tailing sample. Chromite was seen interlocked in silicate minerals or the goethite haematite matrix. The separation performance of Falcon concentrator and Water-only cyclone for recovery of chromite value from plant tailing was investigated. The experimental scheme was designed and the process parameters were optimised by the design of experiment software. It was observed that around 32% of chromite value was recovered from plant tailing by Falcon concentrator with 4 chromite content of 40% in a single-stage operation. Results also indicated that it is difficult to enhance the chromite content of the product to 40% using water-only cyclone. It can enhance the chromite content to a maximum of 25.3% with 25.8% of mass yield in a single-stage operation with the present granulometry. Experimental investigation revealed that the separation performance of the Shaking table was better than the Falcon concentrator with the present granulometry of the sample. However, the throughput rate of the Falcon concentrator was much higher than the Wilfley Shaking table.

(vi) Processing of Low-grade Dolomite Ore

A collaborative project was undertaken for characterization and beneficiation studies of three different types of dolomite samples from Gomardih mines near Rourkela, Odisha, for reduction of alkali and silica content for iron and steel making applications. The objective was to develop a process for reduction of K₂O to < 0.2% and SiO₂ to 0.5% for ROM sample containing 5% silica and to 3% silica for low-grade samples containing around 12% silica. Mineralogical characterisation of the samples was carried out by optical microscope and XRD studies were carried out to identify the mineral phases in the as received samples, their textural relationship, optical characteristics, mode of occurrence and distribution. The valuable mineral in all the samples was dolomite with gangue minerals, like, calcite (CaCO₃), plagioclase feldspar (Na, Ca (Al, Si)₃O₈), muscovite (KAl₂(AlSi₃O₁₀) (OH)₂), biotite (K(Mg,Fe)₃ AlSi₃O₁₀ (OH)₂), orthoclase feldspar (KAlSi₃O₈) and quartz (SiO₂) in different proportions. Due to the interlocking of the gangue

minerals within the carbonate matrix, beneficiation studies were carried out with the fine feed material for all the three dolomite samples. As the density of the dolomite and gangue minerals are very close to each other, and as the minerals lack magnetic susceptibility & gravity, magnetic separation could not be performed. Therefore, froth flotation was the only method for reduction of SiO₂ and K₂O content. It was found that suitable dosage of sodium silicate used as depressant and collector dosage together was effective for reducing the K₂O and silica content to the desired level.

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

In 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 - 11.5%. Characterisation of the bauxite ore revealed that the sample exhibits various types of textures, like, oolitic, colloform and replacement. The sample contained abundant gibbsite and boehmite, followed by clay, altered/translucent silicate and opaque minerals (Feoxides/hydroxides) and anatase. The beneficiation study included scrubbing and washing, gravity separation, magnetic separation and froth flotation studies. Scrubbing and washing studies demonstrated that there was significant reduction in reactive silica content (~2%) with increase in total available alumina content in the washed product. The project is in progress.

(viii) Beneficiation Studies on Low-grade Manganese Ore Samples: In the present investigation was aimed at designing beneficiation process flowsheet for upgradation of the low - grade manganese ores for use in ferromanganese/silicomanganese with the reject containing < 10% Mn. For this purpose, three different low grade manganese samples were sourced and characterised. The samples were ferruginous in nature. Mineralogical studies showed that the manganese ore samples had predominantly pyrolusite, goethite/limonite and manganomelane with minor amounts of cryptomelane, clay, lithiophorite and haematite. Todorokite, manganite, quartz, mica (muscovite, biotite), feldspar (orthoclase) and gibbsite were noticed in very minor to trace amounts. Different beneficiation schemes were studied on these samples and their responses were observed. It was possible to produce desirable concentrate for ferromanganese/silico chrome application maintaining 10% Mn in reject using combination of physical beneficiation followed by low intensity magnetic separation on pretreated sample.

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. For

many R&D projects, MOIL has engaged and was associated with several institutions, viz. (i) CSIR- Central Institute of Mining & Fuel Research, Nagpur and Dhanbad; (ii) CSIR- National Metallurgical Laboratory, Jamshedpur; (iii) CSIR- National Geophysical Research Institution, Hyderabad; (iv) CSIR- National Environmental and Engineering Research Institute, Nagpur; (v) Indian Institute of Technology, Kharagpur; (vi) Indian Institute of Technology, (Formerly Indian School of Mines), Dhanbad; (vii) National Institute of Technology, Rourkela; (viii) Visvesvaraya National Institute of Technology, Nagpur; (ix) National Institute of Technology (NIT), Raipur; (x) National Institute of Rock Mechanics, Kolar Gold Fields; (xi) Indian Institute of Engineering Science and Technology, Shibpur; and (xii) IMT Bhubneshwar. Significant R & D projects undertaken are listed below:

1. Mine Environment

1.1 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. The studies are going on at Chikla and Ukwa Mine. Moreover, Ventilation reorganisation studies for deeper levels have been conducted by Indian Institute of Technology (IIT), (formerly ISM), Dhanbad for Balaghat Mine and accordingly the ventilation drifts have been re-located at Balaghat Mine and sinking has been completed for 5m diameter ventilation drifts. The above operations have helped in improving the face ventilation and productivity of underground sections of mine.

1.2 Sustainable Development Framework: Collaborative scientific research for evaluation of environmental parameters in and around Kandri and Munsar mine has been completed for online continuous monitoring of air, water and noise parameters on experimental basis by Indian Institute of Engineering Science and Technology (IIEST), Shibpur. A patent application has been filed jointly by MOIL and IIEST, Shibpur, for the Real-time zero waste water quality observing system in February, 2020 for publication and the project was completed in March, 2021.

2. Mines Safety- Mining Subsidence: In-house 3-D analysis of subsidence parameters were carried out by MOIL and it was found that there are no noticeable movements in any orthogonal direction above the ground at Munsar mine. Accordingly, MOIL has filed for patent for the method used to determine the subsidence at mining site, which was published in October, 2019. This in-house prepared subsidence parameter scientific report was vetted by IIT, Kharagpur. The subsidence monitoring by in-house developed seven pillars for micro-analysis and these were designed for better safety.

3. Mineral Conservation: R&D studies conducted by National Institute of Rock Mechanics (NIRM), KGF for stope design have been implemented at Chikla and Munsar mine. The modified stope

design has increased the quantity of manganese ore in underground for exploitation by around 20%. Further, long hole drill and blast method for semi-mechanised operation is in experimental stage at the mine for safety and productivity improvement at Munsar underground mine.

4. In-house Mining Technology

4.1 **Rock Mechanics:** MOIL has designed in-house rock mechanics software MOIL-RMR for rock mass characterisation and support design. Patent has been filed for a system and a method for rock mass characterization and rock support system in mining for publication in January, 2020. It indicates RMR&Q and putting the values directly in graph without any human machine interference (HMI) and indicates roof span, stand-up time and designated support for method of workings for better safety. Preparation of final examination report is in progress.

4.2 **Alternative to River Sand:** R&D wing of MOIL has used old refuse overburden material with crushing, screening and heat treatment of material at Munsar mine for hydraulic transportation in underground for stowing. Bench-scale studies and field trials confirm that the treated old refuse overburden material can be used for hydraulic transportation for stowing in underground with or without river sand. MOIL has filed and got a patent for a composition useful as an alternative material for hydraulic stowing in an underground mine and method thereof. The same was published in April, 2018 with final examination report submitted in March, 2021. Any waste material which is excavated from the earth can be utilised for this process and processed material could transfer its geo-engineering strength up to 80% from the in situ to the product —These have been confirmed from the field trials. The invention, a Made in India Technology, has for reaching potential as any waste material lying in the mine could be put to use saving the river sands which is scarce natural resource.

5. **Space technology** – Remote sensing: MOIL has identified manganese-bearing areas in terms of an MoU with National Remote Sensing Centre (NRSC), Hyderabad, for remote sensing studies of four districts of Madhya Pradesh, namely Balaghat, Chhindwada, Jabalpur and Jhabua. On the basis of the report, MOIL has carried out field survey and applied for permission for core drilling from Govt. of Madhya Pradesh in potential zones of these four districts. Recently, Govt. of Madhya Pradesh has reserved 850 km² and 487 km² areas in Balaghat and Chhindwara districts respectively, to carry out exploration work. This will enable MOIL to take up exploration project in the reserved areas of Balaghat and Chhindwara districts. Applications for other two districts, i.e., Jabalpur and Jhabua, are in process is rather high.

6. **Pani Project (Mining outside the State of Maharashtra and Madhya Pradesh):** In a move to spread its operations in other States, MOIL has entered into an MoU with Gujarat Mineral Development Corporation (GMDC) to explore possibilities of manganese mining. To start with, Pani area of Chhota Udepur district has been identified and, a tripartite MoU among MOIL, GMDC and Mineral Exploration Corporation Limited (MECL), has been entered into for carrying out exploration. MECL has carried out exploration and proved reserves and resources of ~ 7.00 Million MT so far have been established. Preparation of feasibility report for mining of manganese ore in the area is in progress at MOIL.

7. **R&D Labs:** Mine planning department of the Company has established a Remote Sensing and Petrological Laboratory to study petrological and mineralogical characteristics of samples collected in field from different areas. This would help knowing the genesis of ore and to make use in geological reports for onward submission to various statutory authorities in DGMS, IBM, DGM, etc. The planning department is also procuring hand held XRF, XRD and DGPS instruments for analysis of field samples and also to do DGPS survey in new areas.

MOIL has also established a Geographic Information System (GIS) and Remote Sensing laboratory with ERDAS, ARC GIS and Surpac software along with petrological microscope for capacity building of R&D works and for study of all operating and future mine leases for mine planning and design.

Besides, Work on Rock Mechanics Laboratory with modern rock testing machines as per ISRM standards is in progress and it will have rock mechanics numerical modelling softwares for core testing.

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 but 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 studies, material handling & storage, metallurgical studies of iron ore and coal, chemical analysis etc. Various research projects completed by the R&D Centre are enumerated below:

1. Projects of NMDC Mines/Projects

(i) Development of vision enhancement system for foggy weather at Bachel (In collaboration with CSIR-CIMFR).

- (ii) Testing with VSI and HPGR for comparative crushing data of iron ore fines from Donimalai/Kumaraswamy for beneficiation plant, Donimalai.
- (iii) Evaluation of indigenous wear liner to be used in NMDC mines- —An import substitution initiative for ATMANIRBHAR BHARAT.
- (iv) Study on physical, metallurgical & flowability properties of coking coal sample received from NISP, Nagarnar.
- (v) Physical and metallurgical characterisation of iron ore samples received from Bailadila sector.
- (vi) Various samples received for characterisation and chemical analysis from Investigation department.

2. In-house Developmental Research Projects

2.1 Conservation of Energy

- (i) Development of iron ore pellet from Kumaraswamy fines suitable for gas-based DRI process.
- (ii) Utilisation of microwave heating in iron ore pellet making.
- (iii) Utilisation of mining waste (Slime) to produce Bricks/Tiles.
- (iv) Investigation on the effect of temperature on the rheological properties of iron ore slurry.

2.2 Technology Absorption

- (i) Beneficiation studies with high ash coal sample
- (ii) Study on SMS slag and exploring its prospect in agriculture
- (iii) Study on making of value- added product from slimes/tailings

2.3 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 beneficiation technology for processing of hydrated iron ore.
(ii).	IIT, Bhubaneswar	Optimisation of Silos, Bins and Hoppers design through modeling, primarily intended for iron ore storage (Completed in Oct 2020).
(iii)	CSIR-IMMT, Bhubaneswar	a) Modeling & Optimisation of high concentration Iron ore fines/concentrate slurry pipeline for Indian Iron Ore Processing Industry (Completed in Mar 2021). b) Development of application of Nano iron oxide obtained from blue dust in energy & sensors devises. c) Dry beneficiation of Iron ore and coal using VSK Separator
(iv)	NIT, Raipur	Study on improvement of potability of ground water in surrounding area of mines
(v)	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 Electrolytic 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 mineral based products are given below:

A. Projects under Research and Development

1. Jamshedpur

- 1.1 Seam Specific Reagent for Lower Seam Coals of West Bokaro: Tata Steel R&D in collaboration with a foreign university has developed a new reagent which increases floatability of lower seam coals by (i) increasing their C-C/C-H content on the surface making it more hydrophobic; and (ii) aggregating finer coal particles to minimise porosity and improving surface properties. An increase in fine

clean coal yield of 7.5% for lower seam coals was observed as compared along with a decrease of 1% product ash content. The overall increase on ROM basis is 1% with the new reagent. Pilot-scale trials (capacity 400 kg/hr) are under progress with different seam coals.

- 1.2 Reduction of Alumina in Iron Ore from Wet Processing Plant of Noamundi using Dispersant: The alumina reduction is about 1.2% in wet lumps and 0.2 to 0.4% in the classifier fines through present practice of the washing process. Addition of surface active reagents help to increase the washing efficiency of iron ore. Test work with different dispersants showed that alumina could be reduced by 0.2 to 0.3% in addition to the reduction achieved by washing with water alone. Two dispersants were selected for plant-scale trials based on lab-scale experimentation. First phase of plant trials has been conducted for two weeks in February 2021.
- 1.3 Smart Lance System for LD vessel: To improve blowing operation in LD vessel and avoid subjective assessment of the onset of slop by operating

personnel, a lance positioning and control system, known as Smart Lance was developed for LD vessel using an audiometer to measure the process noise generated by oxygen jet impinging in the steel bath. The hardware, signal processing software and smart lance algorithm were designed and developed in-house. The technology has reduced the number of slopping incidents and severity by 70%.

- 1.4 Calcium Ferrite for Dephosphorisation of Steel: Synthetic calcium ferrite flux was developed to decrease the phosphorous content of liquid steel. Plant trials at LD shop of TSL Jamshedpur successfully decreased the turndown phosphorous by 20 ppm and reduced the lump iron ore and calcined lime consumption by 1,000 kg and 500 kg per ton of crude steel, respectively.

B. Process Improvements

1. Raw Materials Division

1.1 Mining

- (i) Concept developed for paste backfilling in Highwall mining face at West Bokaro (first in the world) in collaboration with XCUMT backfill, China to increase the coal extraction ratio to more than 65% as compared to existing 30%. Lab test work at XCUMT & CIMFR is in progress to finalise material proportioning for paste backfilling and prerequisites for subsequent approval from regulatory authority (DGMS) for field trial respectively.
- (ii) Novel mining approach proposed for extraction of friable chrome ore (~30 million tonne) below ultimate pit limit at Sukinda. Technical feasibility study is under progress.

1.2 Ore Beneficiation Technology

- (i) **Stickiness Index to Predict Iron Ore Fines Flowability:** A project was formulated to minimise the rake unloading issue by developing a Statistical Index to provide prior information about the flowability characteristics of fines. The collective effect of factors such as granulometry, mineralogy and ratio of wet & dry fines create the stickiness issue. Methods like principle component analysis and multiple regression were used to develop the stickiness index.
- (ii) **Identification of enablers to reduce Alumina in Dispatch Fines at Noamundi:** Several initiatives (short-term and medium-term) were identified to reduce alumina in fines. Short-term initiatives are (a) Jig utilisation 100% and (b) hydrocyclones bypass) and medium-term initiative are (a) 100% classifier fine processed through jig; (b) slime beneficiation; and (c) jigging in upcoming low grade plant. These initiatives have a potential to reduce alumina by 0.37% (from 2.95% to 2.58%).
- (iii) **Identification of Enablers to Reduce the K₂O and SiO₂ from Gomardih Dolomite:** Beneficiation

studies to reduce K₂O and SiO₂ from dolomite were carried out and it was observed that by flotation it was possible to reduce the SiO₂ from 12.2% to 1.31% and K₂O from 0.8% to 0.14% which is very promising from an end -usage view point.

1.3 Coal Beneficiation Technology

- (i) West Bokaro Washery#3 Flotation Circuit Performance Improvement by (a) ~0.5% clean coal yield improvement (on raw coal basis) by replacement of conventional rotorstator with FloatForce (a new generation mixing mechanism developed by Outotec). 3 units of FloatForce were introduced in FY 2017-18 and based on the encouraging results, 3 more units were integrated in FY 2020-21.
- (b) Approximately ~10% reduction in flotation cell level fluctuation achieved by replacement of conventional actuators with advanced FESTO actuators.
- (ii) Intermediate Size (0.5mm-0.25mm) beneficiation Circuit—Reflux Classifier Stabilisation at New Jamadoba Coal Preparation Plant

2. Kalinganagar

2.1 Raw Material Handling System and Logistics

- (i) Elimination of man-machine interface through adoption of Robotic application in in-haul and out-haul operation of Wagon Tippler 2.
- (ii) Installation of smart fencing system in Wagon Tippler 4 to prevent unauthorised entry during unloading operation of wagons.
- (iii) Integrated Power Supply installation of Cabin A and B for increase of reliability of signaling operation.
- (iv) Integration of Road weigh-bridge weightment Screen with VTS.
- (v) Installation of Change over Visual Indicator at BF Critical Points.
- (vi) Started the dosing of chemical powder in PCI that enhanced the flowability and increased the PCI rate to 200 Kg/thm even during monsoon period.
- (vii) Successfully commissioned the S&T system in upline between Jakhapura & Cabin-B that will increase the flowability of inward and outward rakes in parallel mode.
- (viii) Electronic interlocking system ensures safe and optimum rake movement with all interlocks in place.
- (ix) In-house mechanical modification done in the reach stacker which enabled it to handle slabs along with HR Coil.
- (x) Signal and Hooter installation at Outside LC's during Rake movement.
- ### 2.2 Sinter Plant
- (i) Maintaining Sinter bin level >60% to improve Sinter yield and lower specific energy consumption.

- (ii) Number of interruptions reduced from 1.31 per day to 0.54 per day.
- 2.3 Coke Plant**
- (i) PHCC in the coal blend was reduced from the previous lowest of 18.68% during FY 2019-20 to 14.75%.
 - (ii) OHCC in the coal blend was reduced from the previous lowest of 28.21% during FY 2019-20 to 19.63%.

Hindustan Zinc Ltd (HZL)

Specific areas in which R&D has been carried out by Hindustan Zinc Ltd in 2020-21 are summarised below:

- (i) Individual Ore Characterization at Zawar for improved metallurgical performance.
- (ii) Feasibility study for Derrick Screen to replace existing cyclones to improve classification efficiency.
- (iii) Feasibility study for Lead circuit re-grind and effect of pH on lead flotation to improve Lead Silver Recovery and concentrate grade at RAM which confirms that use of Lead re-grind at RAM and Derrick Screen at Zawar will improve Lead/Silver Recovery by 2–3%.
- (iv) Geo-Metallurgy Study on advance Drill Core samples for Metallurgical characterisation at SKM and RAM which improved Metallurgical performance by Geo-Metallurgical assessment of core samples to predict recovery and grades and optimise circuit parameters. For instance - Dilute Nigrosine for high graphite in SKM, use of SMBS to deal with high pyritic ore, etc.
- (v) RDM Mesh of grind (MOG) study to determine optimum grinding size to improve metal recovery. New grinding circuit designing as per MOG study at Rajpura Mines for recovery enhancement.
- (vi) Grinding circuit audit and Loss Matrix analysis across all Milling sites to optimise circuit performance and improve process control.
- (vii) Automated mill Quality Dashboard for continuous monitoring and analytics for data based actionable.
- (viii) Establishing impact of impurities in copper sulphate on zinc flotation performance at mills Thus, improved inhouse copper sulphate quality by process control at DSC ancillary.
- (ix) Integration and stabilisation of commercialised project for sodium sulphate crystal generation from DSC smelter effluent.
- (x) Process developed and integrated with existing plant for Raw Zinc oxide inventory dilution at CLZS Hydro-II plant, contributing ~2,500 tonne Zn & ~700 tonne Pb.
- (xi) Cu Matte Plant manganese bearing stream utilisation at Zinc smelter Debari for maintaining Mn level in electrolyte.
- (xii) Process audit and control to manage Cu levels in purification section at Zinc smelter Debari thereby reducing usage of fresh copper sulphate crystals.
- (xiii) Field trials for usage of Jarosite in concrete.
- (xiv) Collaborative project for metal recovery from Zinc smelter residues by chloride and nitric based leaching.
- (xv) Generation of Zn VAP – fertilizer grade Zinc sulphate and Zinc dust from residue & secondaries.
- (xvi) Mapping of minor metals at Mills, Identifying opportunities for minor metal extraction at HZL.
- (xvii) COP reduction initiatives by alternate reagents, process controls and optimisation.

Hindustan Copper Ltd (HCL)

HCL has undertaken the following R&D projects:

- (i) R&D Project on Study of Bond work index (BWI), flotation optimisation studies, settling & filtration studies and magnetite recovery studies from the plant tailings for setting up of Copper Concentrator plant under Rakha Copper Project at ICC has been done in collaboration with CSIR – Institute of Minerals and Materials Technology, Bhubaneswar.
- (ii) Line study of Mosabani concentrator plant at ICC has been done.
- (iii) Introduction of rice husk for mixing with ANFO (explosives) for Deep Hole Blasting (Production Blasting) at KCC.
- (iv) Study for implementation of advanced technology for SO₂ gas recovery through amine based absorption route in existing SO₂ plant at ICC.

6. Port Facilities



1,249.99

million tonnes, Total cargo handled at Indian Ports (Major and Non-major) in 2020-21

53.81

%, Share of the maritime cargo traffic of the country was handled by the twelve Major ports in India in 2020-21

672.68

million tonnes, the total traffic handled by the major ports in 2020-21

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 212 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) decreased to 1,249.99 million tonnes in 2020-21 from 1,319.97 million tonnes in 2019-20 reflecting a negative growth of 5.3% during 2020-21. The total cargo handled at Indian ports. India's major ports handled around 53.8% the growth profile of cargo throughput at India's Major and Non-major ports in terms of their coastal and overseas trade during 2018-19 to 2020-21 is reflected in Table - 2.

Table-1: Number of Major and Non-major Ports in the Maritime States

(As on 31.03.2021)

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	12	13
Kerala	1	17	18
Lakshadweep Islands	-	10	10
EAST COAST			
Tamil Nadu	3	15	18
Puducherry	-	3	3
Andhra Pradesh	1	13	14
Odisha	1	14	15
West Bengal	1	1	2
Andaman & Nicobar Islands	-	24	24
TOTAL	12	212	224

Source: Basic Port Statistics of India, 2020-21.

Table-2: Growth in Cargo Traffic at Indian Ports (In%)

Port	2018-19			2019-20			2020-21		
	OT	CT	TT	OT	CT	TT	OT	CT	TT
Major	1.54	7.51	2.9	2.32	-3.96	0.82	-3.64	-7.77	-4.57
Non-major	7.87	23.05	10.12	7.15	-2.44	5.57	-4.71	-14.06	-6.14
All Ports	4.47	12.73	6.06	4.63	-3.41	2.98	-4.16	-10.1	-5.3

Note: OT- Overseas Cargo Traffic; CT- Coastal Cargo Traffic; TT- Total Cargo Traffic

Source: Basic Port Statistics of India, 2020-21.

The period 2001-02 to 2020-21 saw compound annual growth rate (CAGR) of 6.42% in total cargo throughput at Indian ports. The compound annual growth in Cargo handled at Non-major ports during 2001-02 to 2020-21 was 9.9%. The overall cargo handled by Major ports and

Non-major ports during 2020-21 registered decline of 4.6% and 6.1% respectively. Commodity-wise traffic handled, in respect of principal commodities, by all the ports (Major & Non-major) in India from the year 2018-19 to 2020-21 are presented in Table - 3.

Table-3: Commodity-wise Traffic handled by All Ports

(In million tonnes)

Sl.No.	Commodity-wise Traffic	2018-19	2019-20	2020-21
1	P.O.L (Crude & Products)	412.69	418.79	348.69
2	Iron ore	83.64	95.65	107.32
3	Building Material	16.16	15	13.89
4	Coal	308.58	297.4	256.77
5	Fertiliser raw material	31.64	32.11	31.36
6	Other/cargo	429.07	461.01	491.96
	Total	1281.78	1319.97	1249.99

Source: Ministry of Shipping, Annual Report, 2020-21.

The commodity composition of the total traffic at Indian Ports has shown marginal changes over the years. POL & its products continue to be the single largest commodity handled by the ports, constituting 27.90% of the total seaborne traffic followed by coal (20.54%), iron ore (8.59%) and FRM (2.51%) in 2020-21.

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 40.4% of the total cargo handled at Indian ports. It is also noteworthy that about 67.1% of the cargo handled by Non-major ports is from the State of Gujarat. In terms of India's total seaborne traffic, Gujarat is followed by Andhra

Pradesh (12.8%), Maharashtra & Odisha (12.6% each), and Tamil Nadu with share of (8.7%). The twelve Major ports in India handled about 53.81% of the maritime cargo traffic of the country in 2020-21. Traffic handled at the Major ports during last one decade has been increasing over the years except in 2011-12 & 2012-13 in tandem with the economic activity and volume of trade turnover. The total traffic handled by the Major ports has recorded around 1.2 times increase from 561.1 million tonnes in 2009-10 to 672.68 million tonnes in 2020-21.

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 2020-21

(In million tonnes)

State	Major Ports	Non-major ports	Total
1 Gujarat	117.57	387.57	505.14
2 Maharashtra	118.13	39.84	157.98
3 Goa	21.99	0.04	22.02
4 Karnataka	36.5	0.79	37.29
5 Kerala	31.5	0.11	31.62
6 Tamil Nadu	101.23	7.41	108.64
7 Andhra Pradesh	69.84	89.64	159.48
8 Odisha	114.55	43.03	157.58
9 West Bengal	61.37	0	61.37
10 Others ^(a)	0	8.88	8.88
11 Total	672.68	577.3	1249.99

Note: (a) Includes Puducherry, A&N Islands and Lakshadweep Port

Source: Ministry of Shipping, Annual Report, 2020-21.

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

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 (4 th 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

Table-5 (Contd.)

Projects/Development	Estimated Cost (In ₹ crore)	Capacity (MMTPA)
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
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	65.37	2

Table-5 (Contd.)

Projects/Development	Estimated Cost (In ₹ crore)	Capacity (MMTPA)
Berth on PPP mode for handling construction materials		
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 2 nd Container Terminal (M/s CITPL)	783.32	29.5
Cochin Port Trust		
3 Vallarpadam Container Terminal ICTT	2118	40
4 LNG Terminal	4182	5
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 9BPCL 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 15. Coal Berth-1 for TANGEDCO (Captive)	80.38	8
Deendayal Port Trust		
16 Development of 13 th Berth other than liquid and container cargo berth	188.87	1.5
17 Development of 15 th 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	159.81	7.2

Table-5 (Contd.)

Projects/Development	Estimated Cost (In ₹ crore)	Capacity (MMTPA)
(Berth 11 & 12) on BOT		
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 Jetty at Old Kandla (IFFCO)	27	1.5
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
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 2 nd SPM Captive Berth	746.17	11
40 Construction of 3 rd SPM Captive Berth	746.17	11
41 Development of South Oil Jetty (Captive)	222.29	10
Visakhapatnam Port Trust		
42 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

Table-5 (Concl'd)

Projects/Development	Estimated Cost (In ₹ crore)	Capacity (MMTPA)
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 50. Development of 7 th 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 strategically 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 4,800 m in Tribeni-Rajmahal (399 km) stretch and 16,110 m 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 thalwas 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 advantages 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 associated 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. Studies under Sagarmala have identified opportunities for reducing overall logistics costs, thereby improving the overall efficiency 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 to the tune of ₹1,545 crore already released by December, 2021.

In the 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 crore were completed at Major ports and 4 projects amounting to ₹40 crore were executed by State Maritime Boards. Three projects focusing on Port Modernisation, 10 projects of port connectivity, 1 project of SEZ at JNPT and 5 projects under the pillar of coastal shipping and IWT are under progress.

Out of all completed projects, 7 projects worth ₹341.52 crore have been supported financially to the tune of ₹84.86 crore under the Sagarmala scheme. Major projects that were completed in 2021 include 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 overseas and coastal cargo handled during 2020-21 by Major ports was of the order of 525.33 million tonnes

and 147.35 million tonnes respectively. The Overseas Cargo traffic handled at Major Port recorded decline of 3.6% in 2020-21 as compared to 2019-20 and the Coastal cargo traffic declined by 7.8% in 2020-21. However, the total cargo traffic handled in 2020-21 decreased by 4.6% as compared to that of 2019-20. The Cargo traffic in terms of coastal and overseas categories at Major Ports during 2019-20 & 2020-21 are furnished in Table 6.

Table-6: Traffic Handled (cargo) at Major Ports 2019-20 & 2020-21

(In million tonnes)			
Sl. No.	Ports	2019-20	2020-21
1A.	Kolkata	17.3	15.9
1B.	Haldia	46.68	45.47
2	Paradip	112.69	114.55
3	Visakhapatnam	72.72	69.84
4	Ennore (Kamarajar)	46.76	43.55
5	Chennai	31.75	25.89
6	V.O. Chidambaranar (formerly Tuticorin)	36.08	31.79
7	Cochin	34.04	31.5
8	New Mangalore	39.15	36.5
9	Mormugao	16.01	21.99
10	Mumbai	68.45	64.81
11	JNPT	60.7	53.32
12	Deendayal (kandla)	122.61	117.57
Total		704.92	672.68

Figures rounded off

Source: Basic Port Statistics of India, 2020-21.

Amongst the major ports, Deendayal Port (erstwhile Kandla port) accounted for the highest share of 17.5% in the total cargo traffic at all Major ports during 2020-21 followed by Paradip (17.0%), Vishakhapatnam (10.4%), Mumbai (9.6%), J.L. Nehru (7.9%), SMP (Haldia Dock Complex) (6.8%), Kamarajar Port (6.5%), NMPT (5.4%) and V.O. Chidambaranar Port & Cochin Port (4.7%). The cargo traffic at Chennai Port, Mormugao Port, and SMP Kolkata Dock System (KDS) had a share of less than 4% each during the same period of 2020-21. The Cargo traffic at all the ports was overwhelmingly outward oriented with overseas cargo accounting for the larger share in the total cargo handled at the port. Port-wise analysis of the traffic growth indicates that Mormugao recorded highest growth of 37.4% during 2020-21 followed by Paradip (1.6%). Other Major ports like Chennai recorded highest negative growth (18.4%) followed by JNPT (12.1%), V.O. Chidambaranar Port (11.9%), SMP (KDS) (8.1%), Cochin Port (7.5%), Kamarajar Port (6.9%), NMPT (6.8%), Mumbai (5.3%), Deendayal Port (4.1%), Vishakhapatnam Port (4.0%) and SMP Haldia (2.6%) respectively. Commodity-wise break-up of traffic handled at the Major ports in India during 2018-19 & 2020-21 is furnished in Table - 7

Table-7: Commodity-wise Cargo Traffic Handled at Major Ports

(In million tonnes)			
Sl. No.	Ports	2019-20	2020-21
1	P.O.L (Crude & Products)	221.64	191.06
3	Fertilizer	9.53	10.38
4	Fertilizer Raw material	6.6	7.57
2	Iron ore	55.46	64.33
5	Coal*	118.88	102.93
6	Food grain	0.4	1.56
7	Other/cargo	292.42	294.86
	Total	704.93	672.68

Source: Basic Port Statistics of India, 2020-21.

* Thermal Coal & coking coal.

Cargo Handling Capacity and Cargo Handled

Cargo handling capacity at Major ports has also risen with traffic. Over the years, cargo handling capacity of Major ports has steadily increased to cater to the growing volume of internal and external trade. The capacity of the ports which was 172.59 million tonnes at the end of 1993-94 increased to a level of 1,514.1 million tonnes at the end of 2018-19 and further increased to 1,534.91 million tonnes during 2020-21. The capacity addition and the productivity improvements achieved by the Major ports coupled with growing participation of Private Sector in cargo handling have had a favourable impact on efficiency of cargo handling operations at India's Major ports. The capacity utilisation which was 91.0 % in 2009-10, reduced to 45.9% in 2019-20. The port-wise capacity and capacity utilisation for the year 2020-21 is provided in Table - 8.

Table-8: Major-Port-wise Capacity Utilisation during 2020-21

(In million tonnes)		
Name of the Port	Capacity	Capacity Utilisation (%)
SMP Kolkata Dock System	31.57	50.36
SMP Haldia Dock Complex	51	89.15
Paradip	249	46
Visakhapatnam	134.18	52.05
Kamarajar	91	28.45
Chennai	135	32.26
V.O.Chidambaranar	111.46	28.52
Cochin	78.6	40.08
New Mangalore	104.73	34.85
Mormugao	63.4	34.68
J.L. Nehru	138.87	46.67
Mumbai	79	67.5
Deendayal	267.1	44.02
ALL PORTS	1534.91	43.83

Source: Basic Port Statistics of India, 2020-21.

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 Pradesh, Madhya Pradesh, Assam, North East Hill States and the two land locked 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. SMPK, Kolkata, handled 61.368 million metric tonnes (MMT) of cargo traffic during 2020-21 as compare to 63.983 MMT during 2019-20, registering a nominal decline of 4.09%, despite the outbreak of Pandemic COVID-19 and that catastrophic effect of J.L. Nehru (7.9%), 'Amphan' cyclone that caused widespread damage in the eastern coast region in May 2020. SMPK ranked 5th in traffic handling in 2020-21, among other Major Ports of India.

SMPK is the first Major Port to adopt ROIP System (Radio over Internet Protocol) as Effective Long Range Marine communication, covering the River Hooghly estuary [with 4 base stations at Kolkata, Hooghly Point, Haldia & Sagar Pilot Station] from Kolkata to Sandheads. This system was inaugurated on 25.10.2021. Vessels at Sandheads can 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. The Port handled 114.55 MMT of traffic in 2020-21. The port has Seventeen berths/jetties + 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. Presently, Paradip 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. The highest number of 2,051 vessels were handled at the port during 2020-21, which is 38 more than the vessels handled during 2019-20. The highest number of 14,371 railway rakes were handled during 2020-21 as compared to 13,216 rakes in 2019-2020, i.e., an increase of 8.73%. The port handled the highest ever Average Rakes per day, i.e., 51.82 of in February, 2021— wherein, the Average of Incoming & Outgoing Rakes were 29.93 & 21.89 respectively.

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 traffic 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.

The 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

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). Further the port handled new chemical cargo – 2 Ethylhexyl Acrylic for IMC from 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 cross roads 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 growth of 16.11% over the corresponding period of 2020-21.

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 & laid foundation stone for reconstruction of South Coal Berth (SCB) at Wellington Island on 14.02.2021.

Jawaharlal Nehru Port

Constructed in the mid 1980's 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 (upto December, 2021) of which containerised cargo account for 51.01 MMT which is 90.98% of 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 Moller 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 -I (2.4 million TEUs) on 18th February 2018. Phase-II (2.4 million TEUs) is expected to start in 2025. During the calendar year 2021 (Jan.-Dec., 2021), JN Port handled a 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 therefore commissioned BMCT for the first time crossed 1 million TEUs mark in a year (12 months period). NSIGT handled 1.17 Million TEUs (1,166,019) and BMCT handled 1.17 Million TEUs (1,170,502) during calendar year 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 the Hon'ble Union Minister of Ports, Shipping, Waterways & Ayush. The cargo moved in the first lot of 20 dwarf containers consisting of PVC Resin suspension (Grade TC 1000) 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).

Financial Year 2020-21, was the year of the "COVID-19" Pandemic that 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 and by hiring private labour by arranging bus services for essential staff. This was done by scrupulously following the instructions from the Central and State Governments in relation to the lockdown, following COVID protocols and with precautionary measures to curb the spread of COVID-19.

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 the 8th International Samudra Manthan Awards 2021, held on 16.12.2021, Mumbai Port was awarded Terminal of the year (Non-specific) 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). 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 2021) 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 with a parcel size of 1,37,989 MT of Steam Coal imported from Australia for M/s. OPG Power Generation Pvt. Ltd was handled of the port. The ghest DWT 1,82,567 MT vessel with a draft of 15 m and the length & beam of 292 m & 45m respectively with the ofore mentioned parcel size the highest 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. 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 operationalisation 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 of Construction of Automobile Export/ Import Terminal - II to M/s L & T Geosturcture 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 2020-2021. During 2021-22, tonnage handled up to December 2021 was 35.62 MMT which comprises of 21.80 MMT of Import and 13.82 MMT of exports. During 2020-2021, 1,386,926 TEUs of containers were handled, whereas in the previous year 13,83,971 TEUs were handled. 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 8,819 TEUS comprising of Import 4,645 TEUs and Export 4,174 TEUs and sailed on 22.05.2021. The above noteworthy achievement surpassing the previous record of 8,397 TEUS per vessel 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 year old port. It has modern infrastructure capable of handling a wide variety of cargo. It is a natural harbour protected by a breakwater and also by a mole. The Port has an approach channel of depth 14.4 meters. The existing rail and road connectivity provides seamless logistic network to the rest of the Country. There is a modern Vessel Traffic 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. Shri Sarbananda Sonowal, Hon'ble Union Minister, of Ports, Shipping and Waterways (MoPSW) along with Shri Shripad Naik, Hon'ble Union Minister of State for Ports, Shipping & Waterways and Tourism, visited Mormugao Port on 11th December, 2021 and in the presence Shri Rajiv Jalota, IAS, Chairman – MPT and Shri Guruprasad Rai, Dy. Chairman – MPT inaugurated The "River Cruise Services", operated by M/s Vijai Marine Services Pvt. Ltd at Mormugao Port, which is first in South Goa. In order to contain dust pollution due to handling of dusty cargo, Port has commissioned two. Automatic Truck Wheel Washing units at a cost of ` . 38,56,761/-. Thus this initiative will 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 kms. 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 Containers— 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 78 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). On 14.05.2021, V.O. Chidambaranar Port created a new record for handling a coal vessel with highest parcel size. The Panama flagged 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 Thoothukud. 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 of handling the vessel with highest parcel size of 92,935 tonnes, (Coal) by the vessel Bastions on 14.05.2021.

Deendayal Port (Kandla)

Deendayal Port (erstwhile Kandla Port) was established in the year 1950 as a Central Government Project, Subsequently 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 comprises POL, Iron Ore, Fertilizers, Coal (Thermal/coking) etc.

Port retains Numero Uno position for handling 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 for Health & Family Welfare, Chemicals & Fertilizers virtually inaugurated Oxygen Plant, set up by the port at Rambaug Hospital Adipur. 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.

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. The capacity of the port as on 31.12.2021 was 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 Supercapex 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). MoU signed during the month of May 2021 with M/s HPCL (exclusive Capital user) for up-gradation of Fire Fighting system at OSTT berth was commissioned at a cost of ₹.37 crore. 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 officials. The Hon'ble Vice-President of India appreciated the fact of operating the entire port activities with Solar Energy. The Hon'ble Minister for port, Shipping & Waterways inaugurated "Grade Separator from H-7 to Convent Junction". A supplementary agreement was reached on 29th October 2021 between M/s VGCBPL and port for utilisation of the facility for other compatible cargoes by the port when the VGCBPL berth is free from handling operations as obligated under the main agreement.

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 finalized 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 South East 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 supporting waterway transportation.

NON-MAJOR PORTS

There are 212 non-major ports situated along the peninsula coast-line and sea-islands. These ports are located in Gujarat (48), Maharashtra (48), Goa (5), Daman & Diu (2), Karnataka (12), Kerala (17), Lakshadweep (10), Tamil Nadu (15), Puducherry (3), Andhra Pradesh (13), Orissa (14), West Bengal (1) and Andaman & Nicobar Islands (24). Out of these 212 Non-major ports, only some ports are well developed and provide all-weather berthing facilities for cargo handling. In 2020-21, 68 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 577.31 million tonnes of traffic during the year 2020-21 as compared to 615.05 million tonnes of cargo handled in 2019-20. The cargo handled at Indian ports declined by 6.1% in 2020-21 as compared to 5.6% growth registered in 2019-20. At a disaggregated level, the overseas cargo traffic decreased by 4.7% in 2020-21 as compared to the growth of 7.2% recorded in 2019-20. Coastal cargo traffic decreased by 14.1% in 2020-21 compared to an decrease of 2.4 % in 2019-20. Commodity composition of traffic handled by Non-major ports during the year 2019-20 and 2020-21 is furnished in Table-9.

Table-9: Traffic Handled at Non-major Ports 2019-20 and 2020-21

Commodity	(In million tonnes)	
	2019-20	2020-21
POL & its Products	197.16	157.63
Iron Ore	39.97	42.99
Building Material	15	13.89
Coal*	178.52	153.84
Fertiliser & FRM	15.96	13.41
Others	168.43	195.55
Total	615.05	577.3

Source: Basic Port Statistics 2020-21

Note: Figures in parenthesis indicate growth over the previous year.

*Thermal Coal & Coking Coal.

POL & its products (27.3%) was the single largest commodity handled at Non-major ports in 2020-21. The share of POL has decreased from 32.1% in 2019-20 to 27.30% in 2020-21. During 2020-21, the share of other cargo in the total traffic was 33.9% followed by coal (26.7%), Iron ore (7.5%), building material (2.4%) and fertilizer & FRM (2.3%).

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	2018-19	2019-20	2020-21
Gujarat	399.2	411.79	387.57
Maharashtra	45.79	43.66	39.84
Andhra Pradesh	103.33	99.91	89.64
Tamil Nadu	0.96	11.37	7.41
Karnataka	1.04	0.94	0.79
Odisha	22.19	35.27	43.03
Others	10.11	12.12	9.03
Total	582.61	615.05	577.3

Source: - Basic Port Statistics 2020-21

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 coast line). 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 18 Non-major ports. The remaining 30 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 2020-21 was of the order of 387.57 million tonnes as against 411.79 million tonnes in 2019-20, reflecting a decrease of 5.9% as compared to an increase of 3.2% in 2019-20. Non-major ports of Gujarat account for around 67.1% of the total cargo handled by Non-major ports in India during 2020-21. Overseas traffic in 2020-21 was 348.06 million tonnes with the remaining 39.51 million tonnes being coastal traffic. GAPL port handled the highest cargo tonnage of 137.65 million tonnes (35.5%) of the total cargo handled by non-major ports in Gujarat in 2020-21. Main commodities handled by GAPL port is Container cargo that contributes to 54.7 % of the traffic handled at the port. Sikka Port handled the cargo tonnage of 121.42 million tonnes in 2020-21 as compared to 134.14 million tonnes handled in 2019-20. This port accounted for 31.3% of the total cargo handled by the non-major ports in Gujarat in 2020-21, 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. Dahej port accounted for 29.52 million tonnes (7.6%) of

the cargo traffic in 2020-21. Major commodities handled by the port are coal & Iron ore. Magdalla Port handled 28.7 million tonnes of cargo in 2020-21 with a share of 7.4% in total traffic. Major commodities handled by the port are 'POL & its products'. The important ports which showed increase in the cargo handled during 2020-21 were Bedi and GAPL; while Sikka, Magdalla, Jafarabad, Bedi, Mul-Dwarka, GAPL, Dahej and Pipavav ports witnessed a decrease in cargo traffic in 2020-21.

ANDHRA PRADESH

Andhra Pradesh is another important maritime State with a coast line of around 975 km. There are 13 Non-major ports in Andhra Pradesh, of these, 5 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 2020-21 was 15.5%. Non-major ports in Andhra Pradesh collectively handled 89.64 million tonnes of cargo during 2020-21 as compared with 99.90 million tonnes in 2019-20, registering a decline of 10.3% in traffic. The overseas traffic during 2020-21 was 77.64 million tonnes (86.6%) of the total cargo traffic in Non-major ports of Andhra Pradesh and coastal traffic was of the order of 12.0 million tonnes (13.4%) of total cargo traffic. Commodity-wise analysis of the total cargo handled by the non-major ports in Andhra Pradesh indicates that Coal (51.9%), Other Cargo (34.5%), Iron ore (8.6%), Fertilizer & FRM (2.6%) and Building material (0.9%) were the principal items of cargo handled during 2020-21 by the Non-major Ports of Andhra Pradesh.

MAHARASHTRA

Maharashtra has a coast line of around 653 km with 48 notified Non-major ports. Out of these only 16 ports handled cargo traffic during 2020-21. The total cargo traffic

handled at the Non-major ports of Maharashtra during 2020-21 was 39.84 million tonnes as compared to 43.66 million tonnes in 2019-20. This shows a decline of 8.7%. Out of 39.84 million tonnes of total cargo handled by Non-major ports in Maharashtra, 21.02 million tonnes (52.8%) was overseas cargo and the remaining 18.84 million tonnes (47.2%) were coastal cargo. Overseas traffic declined by 9.9% to 21.02 million tonnes in 2020-21 from 23.35 million tonnes in 2019-20. Coastal traffic also decreased by 7.2% to 18.84 million tonnes from 20.31 million tonnes in 2019-20. Commodity-wise break-up of the cargo handled by the Non-major ports of Maharashtra indicated that Coal traffic of 18.99 million tonnes constituted (47.7%) of the total cargo handled in 2020-21 followed by Iron ore (23.94%), Other commodities (23.48%), Building Material (4.5%) and POL & Products (0.4%).

GOA

Goa has a coastline of about 118 km. There are 5 Non-major ports in Goa. Out of this only one port, Panaji handle cargo traffic. Panaji port handled cargo traffic of 0.04 million tonnes during 2020-21 as compared with 0.008 million tonnes handled in the previous year. Iron ore has 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. Handling of Coal decreased from 0.41 million tonnes in 2014-15 to zero during 2020-21.

KARNATAKA

Karnataka has a coastline of around 280 km. with 12 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 2020-21 as compared to 0.94 million tonnes in 2019-20 reflecting a decrease of 16.0% over the previous year. The contribution of the Karwar Port was 0.75 million tonnes cargo which constitutes 95.5% of total cargo handled by Non-major ports in Karnataka in 2020-21.

TAMIL NADU

Tamil Nadu has a coastline of around 906 km. The State has 15 Non-major ports, out of which only 6 ports handled cargo traffic. During 2020-21, the Non-major ports in Tamil Nadu collectively handled 7.41 million tonnes of cargo traffic as compared to 11.37 million tonnes in the previous year. Kattupalli port handled the maximum traffic of 7.05 million tonnes during 2020-21 accounting for 95.1% followed by Cuddalore port (0.26 million tonnes)

accounting for 3.6% and Other Ports (0.10 million tonnes) accounted for 2.3% of the total traffic handled by all the Non-major ports in the State.

ODISHA

Odisha is the only State which recorded positive growth of 22% in the year 2020-21. Odisha has a coastline of 480 km 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. The advantages for development of sea ports in Odisha include 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 2020-21 the Non-major ports in Odisha collectively handled 43.03 million tonnes of cargo traffic as compared to 35.27 million tonnes in the previous year showing an increase of 22%.

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 capacities are significant for economic vibrancy and growth.

7. Mineral-based Industries



300

million tonnes, Targeted domestic steel production by 2030

3.61

million tonnes, Production of aluminium in 2020-21

3.38

million tonnes, Production of copper ore in 2020-21

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, with an aim towards long-term national goals. In tune with the Economic Liberalisation Policy adopted in July 1991, the National Mineral Policy announced in March 1993 has opened the Mineral Sector for private entrepreneurs, both domestic and foreign. 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, 2019-20 to 2020-21

Mineral-based product	Unit of quantity	Annual Installed capacity	Production	
			2019-20	2020-21 (P)
Ferrous Metals				
Sponge iron	million tonnes	47.85	37.10	34.38
Crude/liquid steel	"	142.3	109.14	103.54
Ferroalloys				
Ferrosilicon	'000 tonnes	1690	NA	NA
Ferromanganese	"	3160	NA	NA
Silicomanganese	"	-	320	329
Ferrosilicon	"	250	NA	NA
Ferromolybdenum	tonnes	-	527	428
Ferrotitanium	"	-	121	249
Ferrovandium	"	-	665	664
Ferroaluminium	"	-	1461	1119
Non-ferrous Metals				
Aluminium	million tonnes	4.16	3.63	3.61
Copper (Cathode)	'000 tonnes	1001.5	408	363
Lead (primary)	"	201	181	214
Zinc Ingots	"	881	688	715
Silver	tonnes	600	609	705
Cement	million tonnes	537	334	300
Fertilizers[§]				
Complex Fertilizer	lakh tonnes	75.65	92.38	93.2
SSP	"	123.37	42.66	
DAP	"	82.52	44.88	37.7

Figures rounded off.

Sources:

1. Ministry of Steel, Annual Report, 2020-21 and JPC Bulletins.
 2. Ministry of Commerce & Industry, Department of Industrial Policy & Promotion and Annual Report, 2020-21.
 3. Ministry of Chemicals & Fertilizers, Department of Chemicals & Petrochemicals, Annual Report, 2020-21.
 4. Ministry of Petroleum and Natural Gas, PNG Statistics 2020-21.
 5. Fertilizer statistics, Fertilizer association of India.
 6. MSMP - March, 2021.
- § Source: Department of fertilizer.

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 stood at 96.204 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. In 2021, about 4.87 million tonnes of pig iron was produced in the country as compared to 5.421 million tonnes in the previous 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

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

(In lakh tonnes)

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 34.38 million tonnes in the year 2020-21 as compared to 37.10 million tonnes in the previous year. Plant-wise capacity details as available in respect of major sponge iron units are furnished in Table-3.

Table-3: Capacities of Principal Sponge Iron (DRI) Plants

(In lakh tonnes)

Unit	Location	Capacity
Gas-based		
Essar Steel Ltd	Hazira, Gujarat	68
JSW Steel Ltd (Salav) (formerly Welspun Maxsteel Ltd)	Salav, Raigad, Maharashtra	9
JSW Steel (formerly Ispat Industries Ltd)	Geetapuram, Dolvi, Raigad, Maharashtra	16
Coal-based		
Alliance Integrated Metallics Ltd	Bemta, Raipur, Chhattisgarh	5
Godawari Power & Ispat Ltd	IGC Siltara, Raipur, Chhattisgarh	4.95
Ind Synergy Ltd	Kotmar, Raigarh, Chhattisgarh	3
Monnet Ispat Energy Ltd	Chandkhuri Marg, Hasaud, Raipur, Chhattisgarh	3
Monnet Ispat & Energy Ltd	Naharpalli, Raigarh, Chhattisgarh	5
Prakash Industries Ltd	Champa, Janj-gir-Champa, Chhattisgarh	4.5
Rungta Mines Ltd	Karakola and Kamando, Sundargarh, Odisha	4.2
Rashmi Cement Ltd	Barbil, Kendujhar, Odisha	3.6
Tata Sponge Iron Ltd (Ipitata Sponge)	Joda, Kendujhar, Odisha	3.9
Visa Steels Ltd	KIC, Jajpur Road, Odisha	3

I.G.C.: Industrial Growth Centre.

Source: Sponge Iron Manufacturers' Association (SIMA) and individual plants.

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. The total exports of finished steel (Non Alloy + alloy) increased to 10.87 million tonnes in 2019 from 8.98 million tonnes in 2018 and the imports decreased to 7.95 million tonnes in 2019 from 8.29 million tonnes in 2018.

Details about capacity and production of crude liquid steel & hot metal by main producers are furnished in Table-4.

Table-4: Capacity and Production of Hot Metal and Crude/Liquid Steel, 2020 and 2021, (By Principal Producers)

(In '000 tonnes)

Unit	Annual installed capacity Crude/Liquid steel	Production of Hot metal		Production of Crude/ Liquid steel		
		2019-20	2020-21	2019-20	2020-21	
Public Sector						
Steel Authority of India Ltd (SAIL)	19632	17437	16581	16181	14969	
Rashtriya Ispat Nigam Ltd (Andhra Pradesh)	6300	5161	4681	4833	3979	
Private Sector						
JSW Steel Ltd	18000	15220	14389	16156	14780	
Tata Steel Ltd Group	19400	19019	17775	18525	17204	
Essar Steel Ltd (Gujarat)	10000	3632	3331	7121	6696	
Jindal Steel & Power Ltd (Chhattisgarh)	8600	5262	5862	5861	6859	
Others	60367	7281	6647	40755	38491	

Source: JPC Bulletin on Iron & Steel, April, 2020-21

BF/BOF/ & EAF/IF INDUSTRY

Performance of the BF/BOF & EAF/IF Industry is summarised below:

Basic Oxygen Furnace (BOF)

Presently, there are around 17 Basic Oxygen Furnace units with an installed capacity of 57.29 million tonnes. The production of steel through this route was around 45.08 million tonnes (44%).

Electric Arc Furnace (including corex & MBF/EOF)

Steel produced in the Electric Arc Furnace (including corex & MBF/EOF) is mostly by recycling of steel scrap using Electric Arc Furnace (EAF). Presently, there are more than 38 EAF-based steel plants that are operational in the country with an aggregate working capacity of around 40.35 million tonnes per annum. The production of steel through EAF route and IF route was around 29.47 million tonnes (28%) and 29.05 million tonnes (28%), respectively. 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 generated 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 around 823 ground induction furnaces with an aggregate working capacity of about 46.26 million tonnes. In the year 2020-21, the production of steel through induction furnace route was 29.05 million tonnes.

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 ferrovandium, 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. About 25% to 30% production is usually exported. 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.

Table-5: Capacity of Ferroalloys Industry

Ferroalloys	(In tonnes per annum) Installed capacity
Total	5150000
Bulk Ferroalloys :	5100000
Manganese alloys	3160000
Chrome alloys	1690000
Ferrosilicon	250000
Noble Ferroalloys :	50000

Source: Indian Ferroalloys Producer's Association (IFPA), Mumbai.

Bulk Ferroalloys

Ferromanganese and Silicomanganese

The country's total installed capacity for ferromanganese is around 42 lakh tonnes. The total consumption for bulk ferroalloys accounts for over 98% of all ferroalloys. Also about 80% of total ferroalloys production is used in steel making, while the balance is used for the manufacture of casting, superalloys, aerospace and other special application.

The total production of silicomanganese was 3,29,295 tonnes in the year 2020-21, as compared to 3,20,594 tonnes in the previous year. The production ferromanganese reported by MOIL was at 8851 tonnes as against the 10,421 tonnes in the previous year. MOIL has plans to set up a

ferroalloy plant of total 75,000 MT capacity at Balaghat and Gumgaon mines. The project is expected to be completed between 2022 and 2023.

Ferrochrome and Charge chrome

The total combined capacity of ferrochrome and charge chrome is around 16 lakh tpy. Stainless and Alloy-steel Industry are the chief consumers of ferrochrome.

The total production of ferrochrome in 2020-21 was about 8,68,000 tonnes, as compared to 9,44,000 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 50,000 tpy and they majorly include ferromolybdenum, ferro-vanadium, ferrotungsten, ferrotitanium, ferro-silico-magnesium, ferroaluminium, ferroboration, etc. Mishra Dhatu Nigam (A Govt. of India Undertaking), with a capacity of 2,729 tpy produced different types of super-alloy, chiefly, cobalt, molybdenum, titanium and tungsten-based super-alloys and products. The production of various noble ferroalloys is furnished in Table-6.

Table-6: Production of Noble Ferroalloys

(in '000 tonnes)	
Ferroalloys	Quantity
Ferromolybdenum	428
Ferrotitanium	249
Ferrovandium	664
Ferroaluminium	1119

Source: MSMP-March, 2021.

Electrolytic Manganese Dioxide (EMD)

EMD is consumed along with natural manganese dioxide for the manufacture of dry battery cells. There are two units, one owned by MOIL in Bhandara district of

Maharashtra, having a capacity of 1,000 tpy and the other by the then Union Carbide Ltd (now Eveready Ltd) at Thane, Maharashtra, having a capacity of 2,500 tpy. MOIL has undertaken capacity expansion of the existing EMD plant to 2,000 tpy in view of the good demand for EMD in the domestic market. The capacity of the plant was 1,000 tpy. The production of EMD by MOIL was 1,070 tonnes in 2020-21 as against 925 tonnes in 2019-20.

NON-FERROUS METALS

Aluminium

There were four companies with a total installed capacity of 4.165 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. BALCO has an installed capacity of 0.57 million tpy at Korba. The three companies with six plants in the Private Sector have a total capacity of 3.135 million tpy in operation. The production of aluminium in 2020-21 was 3.61 million tonnes as compared to 3.63 million tonnes in the previous year. The installed capacity and production of aluminium in 2019-20 and 2020-21 are enumerated in Table-7.

Table-7: Capacity and Production of Aluminium, 2019-20 and 2020-21

Producer	Annual Capacity	Production	
		2019-20	2020-21 (P)
Total	4.16	3.63	3.61
Public Sector			
National Aluminium Co. Ltd (Angul)	0.46	0.4	0.41
Private Sector			
Bharat Aluminium Co. Ltd (Korba)	0.57	0.56	0.57
Hindalco Industries Ltd	1.34	1.33	1.23
Vedanta Aluminium Ltd (Jharsuguda)	1.75	1.34	1.4

Figures rounded off.

Source: Information received from individual plants/Annual reports

MALCO Plant is closed since December 2008, hence it is removed from the table.

Alumina

The production of alumina was 6.52 million tonnes in 2020-21 as compared to 6.67 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, 2019-20 and 2020-21

Producer	Annual Capacity	Production	
		2019-20	2020-21 (P)
Total	7.56	6.67	6.52
Public Sector			
National Aluminium Co. Ltd (Damanjodi)	2.28	2.1	2.2
Private Sector			
Bharat Aluminium Co. Ltd	0.200#	-	-
Hindalco Industries Ltd	3	2.76	2.64
Vedanta Aluminium Ltd (Lanjigarh)	2	1.81	1.68

Figures rounded off.

Source: Information received from individual plants/Annual Reports.

Plants remained non-operational during the year.

MALCO Plant is closed since December 2008, hence it is removed from the table.

Hindalco's Renukoot Integrated Smelter uses alumina produced in their plant for producing aluminium.

National Aluminium Co. Ltd

The Company has a 22.80 lakh tpa Alumina Refinery located at Damanjodi in Koraput district of Odisha and 4.60 lakh tpa Aluminium Smelter & 1200 MW 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 2.275 million tonnes per year. The Company also plans to develop a 42 lakh tpy bauxite mine and 14 lakh tpy alumina refinery complex in Andhra Pradesh. The Company has port facilities at Visakhapatnam to export alumina at the rate of 1.4 million tpy. 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

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 1.7 million tpy, with total smelter capacity of 23.20 lakh tpy, respectively. 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 a total aluminium production capacity of around 1.34 million tonnes.

Hindalco's plans to expand alumina refinery capacity at Belagavi from 3.5 lakh tpy to 6.5 lakh tpy, but this plan has been kept on hold, awaiting Government approval related to bauxite mines.

Hindalco Aluminium smelting operations are located at Renukoot (Uttar Pradesh), Aditya Aluminium (Odisha), Mahan Aluminium (Madhya Pradesh) and Hirakud (Odisha). Aditya and Mahan Aluminium smelters are operating on state-of-the-art AP36 technology. In addition to aluminium, Renukoot (Uttar Pradesh), Integrated Aluminium Complex also produces semi-fabricated products viz. conductor redraw rods, sheet, extrusion, etc. Hindalco's plants are equipped with sophisticated rolling mills and finishing equipment. The plants are located at Hirakud (Odisha), Belur (West Bengal), Mouda (Maharashtra), Renukoot (Uttar Pradesh) and Taloja (Maharashtra). 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. Hindalco has a conductor redraw capacity of 56,400 tpy at Renukoot plant and sheet rolling capacity of 2,05,000 tpy spread over at Renukoot (80,000 tpy), Belur (45,000 tpy), Taloja (50,000 tpy) and Mouda (30,000 tpy) plants. The Company also has two plants for aluminium extrusion with capacity of 31,000 tpy [comprising units at Renukoot with 23,000 tpy capacity and Alupurum (Kerala) with 8,000 tpy capacity].

Hindalco's foil unit located at Silvassa (Dadra & Nagar Haveli) has an installed capacity of 30,000 tpy and produces foils with thickness varying from 9 microns to 200 microns. Kollur plant in district Medak (Andhra Pradesh) has capacity of 4,000 tpy and produces an array of high-quality foils, from cigarette and blister foil to lidding foil of thickness ranging from 50 to 7 microns.

Utkal Alumina (Odisha) with an installed capacity of 1.5 million tpy alumina refining, continues to be the most economical and efficient alumina producing plant globally. Utkal alumina sources bauxite from Baphlimali Bauxite Deposit in Odisha. The Company has set up 3.60 lakh tpy aluminium smelter at Bargawan. The other integrated aluminium project, namely, Aditya Alumina & Aluminium Project, alumina refinery at Koraput, 3.60 lakh tpy aluminium smelter was set-up at Lapanga, Odisha. A joint venture agreement on bauxite mines was signed with OMC. Another greenfield project, viz. Jharkhand Aluminium Project at Sonahatu, entails setting up of a 7.20 lakh tpy aluminium smelter.

Recycling: Aluminium is recyclable without any loss of properties and consumes only 5% of the total energy requirement compared with primary metal production. At present, in the Organised Sector, only Hindalco operates 25,000 tpy capacity recycling plant at Taloja in Maharashtra.

Cadmium

Cadmium (99.95 min.) 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. 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 2019-20, however the last reported production of cadmium was 47 tonnes in 2017-18.

Copper

The production of copper ore at 3.38 million tonnes in 2020-21 decreased by 4% as compared to that in the previous year. The metal content in the ore produced in 2020-21 works out to 26,462 tonnes as against 29,502 tonnes in 2019-20.

Hindustan Copper Ltd produces copper metal from the ore produced at their captive mines. 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	State	Annual Capacity	Production	
			2019-20	2020-21 (P)
Total		1001.5	408	363
Hindustan Copper Ltd	Jharkhand	51.5	4.94	-
Vedanta Ltd	Dadra & Nagar	400	77	101
Hindalco Industries Ltd	Gujarat	500	325	262
Jhagadia Copper Ltd (formerly SWIL)	Gujarat	50	-	-

Figures rounded off.

Production of refined copper (cathodes) in 2019-20 and 2020-21 was 408 thousand tonnes and 363 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. Copper is produced at two smelters of HCL at Indian Copper Complex (ICC), Ghatsila, East Singhbhum district in Jharkhand and Khetri Copper Complex (KCC), Khetrinagar, district Jhunjhunu, Rajasthan. The aggregate capacity of the two smelters for copper cathode production is 51,500 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.

Continuous Cast Copper Wire Rods Project, (TCP) Taloja, Maharashtra:

This project has a capacity of 60,000 tpy continuous cast copper wire rods (CCWR). The plant is based on the Southwire SCR-2000 technology of the USA, which uses natural gas as fuel and imported copper cathodes.

Vedanta Ltd (Sterlite copper)

Vedanta Ltd is India's largest Mining Company with interests and operations in iron ore, aluminium, copper, zinc, lead

and power. The smelter and refinery of Sterlite Industries (India) Ltd are located at Thoothukudi in coastal belt of Tamil Nadu and Silvassa, Dadra & Nagar Haveli and has a total installed capacity of 4 lakh tpy each. The Unit is based on 'ISASMELT' technology from MIM, Australia, using imported concentrates. A Cathode Refinery of 2,05,000 tpy capacity and 90,000 tpy Copper Rod Plant have been built at Thoothukudi to undertake export operations from the nearby port. Sterlite closed its operations at Thoothukudi plant w.e.f May, 2018 as per order issued by the State Government. The 1,80,000 tpy copper cathode refinery of Sterlite is located in Chinchpada at Silvassa in the Union Territory of Dadra & Nagar Haveli which predominantly caters to the domestic market and also has a 1,50,000 tpy rod mill. The copper anodes at Sterlite were refined into cathodes at Silvassa for domestic markets, while anodes were refined to cathodes at Thoothukudi itself for exports. The technology for refineries and Continuous Cast Copper Rod Plant is of MIM, Australia and Continuous Properzi, Italy, respectively. The imported copper concentrates for smelters are obtained from captive mines in Australia through long-term contracts with producers in Chile and Indonesia, as also through spot purchases. The Company is the largest producer of Continuous Cast Copper Rods (CCR) in India. The CCR plants have total annual capacity of 2,68,000 tpy. The Company has sulphuric acid plant of 1.3 million tpy and phosphoric acid plant of 2,30,000 tpy. The copper smelter plant at Thoothukudi was under shutdown for the whole of the financial year 2019-20 in accordance with the order issued by Tamil Nadu Pollution Control Board (TNPCB) and Govt. of Tamil Nadu.

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 are recovered and include sulphuric acid (1.67 million tpy), phosphoric acid (1,80,000 tpy), di-ammonium phosphate (DAP) & complex fertilisers (4,00,000 tpy), gold (15 tpy) and silver (150 tpy). The

entire requirement of copper concentrates is met through imports.

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 technical collaboration with Outokumpu Technology (formerly Boliden 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.

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. The production of lead acid batteries by the Units in the Organised Sector in 2019-20 was 1,49,583.81 thousand tonnes.

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 2019-20 and 2020-21 are furnished in Table-10.

Table-10: Capacity and Production of Primary Lead and Zinc Ingots

(In tonnes)

Producer	Lead capacity	Production		Zinc capacity	Production	
	(tpy)	2019-20	2020-21 (P)	(tpy)	2019-20	2020-21 (P)
Hindustan Zinc Ltd	210000	181365	214399	913000	688282	715445
Edayar Zinc Ltd. (formerly, Binani Zinc Ltd.)	-	-	-	38000	-	-
Total	210000	181365	214399	951000	688282	715445

Figures rounded off.

ABRASIVES

Natural abrasives, which include calcite, emery, diamond, zircon, corundum, novaculite, pumice, etc. are generally sold as dressed stones. Synthetic abrasives include borazon, ceramic, dryice, 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 Archeon process in electrical resistance furnaces. SiC does not occur naturally except in some types of pre-solar meteorites, 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 delicensing of the Industry and Policy Reforms initiated in 1991.

As per DIPP, the total installed capacity of Indian Cement Industry is about 537 million tonnes. At present the capacity utilisation is low and idle capacity of the cement is around 200 million tonnes. The Cement Industry comprises around 240 large cement plants and more than 350 mini cement plants manufacturing all types of cement in the country. Cement consumption in India is around 195 kg per capita against global average of 500 kg per capita, which shows significant growth potential for the Industry. The total production of cement (all kinds) in 2020-2021 was about 300 million tonnes as compared to 334 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. India's cement demand is expected to reach 550–600 million tonnes per annum by 2025.

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 manufacture 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 Ballabgarh 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 was 1,264.06 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 (P)
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. India ranks 8th in world in terms of production of ceramics, which is around 2.5 % of global output (as per Morbi Ceramic Association). As per ICCTAS, 750 million sq. metres of ceramic tiles were estimated to be produced as against the global production of about 11,913 million sq.m. The main product segments are the Wall tile, Floor tile, Vitrified tile and Industrial tile segments. The market shares (in value terms) are 20%, 23%, 50% and 7% for Wall, Floor, Vitrified and Industrial tiles, respectively. 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, etc. The per capita consumption of ceramic tiles in the country was about 0.50 sq.m which is comparatively lower as compared to 2.6 sq. m in China and 5-6 sq. m in Europe. 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 development and growth of the Building Industry, ceramic glazed tiles producing industries too flourished considerably during the last decade. As per ICCTAS, there were 14 units in the National Sector,

which accounted for 40% of production of ceramic tiles. Besides, there are about 200 units in Regional Sector, which accounted for 60% of production of ceramic tiles. The domestic Ceramic Tile Industry has been growing at about 15% per annum. 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

India's sanitarywares installed capacity is already in excess of 40 million pieces/year, India is the world's second largest sanitaryware producer after China. Around 75% of the country's entire production comes from Gujarat. The basic raw materials for sanitaryware are felspar, ball clay, kaolin and quartz. There were 7 units with installed capacity of 143 thousand tpy in the Organised Sector, while around 210 plants with a capacity of 53,000 tpy exist in the Small-scale Sector. Some units have either been closed or merged with the other existing ones. This Industry has been reporting a growth rate of about 10% per annum. The major manufacturers of sanitaryware include Hindustan Sanitaryware Industries Ltd, Parryware Roca Bathroom Products, 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.

Glass Industry

The Glass Industry includes manufacturing unit that makes glass products, such as, glass containers and hollow-ware, 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.

The production in terms of quantity/value of Sheet Glass, Fibre Glass, Glass Bangles and Glassware during 2019-20 was 93,538.33 thousand square metres, 1,30,901.05 tonnes, 35.53 crore, 4,150.50 crore respectively.

The per capita consumption of glass in India is about 1.1 kg, which is on the lower side when compared to 15 kg in China. Indian Glass market is estimated to increase at a CAGR of 6–7% in future. Most of the glass demand in India comes from container glass which accounts for 50% of country's glass consumption by value. The market share of Indian Glass Industry consists of Container Glass (45%), Flat Glass (16%), Speciality Glass (33%) and Fibre Glass (6%).

Glass Containers and Hollow-wares

About 43 units in the Organised Sector are engaged in the manufacture of glass containers and hollow-wares with an in-stalled capacity of around 9,305 tonnes per day. Glass containers are ideal packaging medium, but are increasingly being replaced by other packaging materials like plastic, PET, aluminium and tetrapack. The per capita consumption of container glass in India is 2.5 kg as compared to 27.5 kg in USA and 9 kg in China. 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. The major consumers of flat glass are Non-automotive (95%) and Automotive (15%). The per capita consumption of glass in India is 1.90 kg, whereas in developed countries per capita consumption is very high ranging between 6 and 10 kg. Imported glass contribution is approx. 21% in total Indian flat glass market. There has been growing acceptability of the Indian flat glass products in the global market.

Vacuum Flasks and Refills

There were eight units in the Organised Sector that manufacture vacuum flasks and refills, with an installed capacity of 36 million numbers per annum.

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. In the year 2019-20, production of fibre glass hovered around 130.90 thousand tonnes. Presently, India exports about 80% of its glass fibre production.

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. The production of caustic soda during 2019-20 was 31.37 lakh tonnes against the total installed capacity of 37 lakh tonnes as in 2019-20 which as compared to 29.25 lakh tonnes in the previous year is significantly higher. The major Indian producers are Gujarat Alkalies & Chemicals, Grasim Industries, Nirma, Shriram Alkali & Chemicals, Reliance Industries, Aditya Birla Chemicals (India), etc. Aditya Birla Management Corp. Pvt Ltd, Gujarat Alkalies & Chemicals Ltd, DCM Shriram Ltd, Nirma Ltd and Reliance Industries Ltd together accounted for 57.6% of the total Caustic Soda capacity in India in 2017. India's Caustic Soda Plant capacity was expected to grow at a compounded annual growth rate (CAGR) of 6.1% from 2017 to 2022, according to Global Data, a leading Data and Analytics company.

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.

RSPL Jamnagar Greenfield Soda Ash Plant, Gujarat, is a project that involves construction of a greenfield soda ash plant with a production capacity of 1,500 tonnes per day of light soda ash and 770 tonnes per day of dense soda ash at Village Kuranga in Dwarka, district Jamnagar.

The installed capacity of soda ash was 34.64 lakh tonnes. The production of soda ash during the year 2019-20 was 30.69 lakh tonnes as compared to 30.48 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.

The installed capacity of calcium carbide was 1.12 lakh mtpa. The production of calcium carbide during the year 2019-20 was 0.81 lakh tonnes as compared to 0.83 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 500 tpd fluorite 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

The important units that produce aluminium fluoride include Navin Fluorine Industries, Maya Rasayan Ltd, Mumbai, Tanfac Industries Ltd, SPIC and Aegis Chemical Industries Ltd. The installed capacity of aluminium fluoride was about 1,500 tpd. The production of aluminium fluoride during the year 2019-20 was 5,050 tonnes as compared to 5,700 tonnes in the previous year.

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 TiO_2 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. According to the recently published Tech Sci Research report "India Titanium dioxide Market Study, 2011-2025", the Titanium di-oxide Market in India is projected to exhibit a CAGR of 3.98% during 2016-2025, owing to broad growing applications of titanium dioxide in paints, rubbers, plastics, textiles, cosmetics, pare & printings, etc. As per Ministry of Chemicals & Fertilizers, the production of titanium dioxide was 49.49 thousand tonnes in 2019-20 as compared to 57.06 thousand tonnes in the previous year against the installed capacity of 82.50 thousand tonnes.

Sulphuric Acid

There were 140 (130 sulphur-based and 10 smelter gas-based) units with an annual capacity of more than 12 million tonnes that manufacture sulphuric acid in the Organised Sector based on sulphur as a raw material. In addition, sulphuric acid is also recovered at HCL, Hindalco & Sterlite and at HZL during lead-zinc smelting.

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 Company, Vadodara, Gujarat; Fertilizers and Chemicals Travancore Ltd (FACT), Udyogmandal, Kochi, Kerala; Sterlite Industries India Ltd (Vedanta); HCL, Khetri, Rajasthan; HZL, Udaipur, Rajasthan; Southern Petrochemical Industries Corp. Ltd, Thoothukudi, Tamil Nadu; EID Parry (India) Ltd, Ennore, Tamil Nadu; Star Chemical Ltd, Mumbai, Haldia, West Bengal; Ballarpur Industries Ltd, Karwar, Karnataka; Hindalco Industries Ltd, Dahej, Gujarat; and Paradeep Phosphates Ltd, Paradeep, Odisha. 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. According to Tech Sci Research report, "India Phosphoric Acid Market by Type, by application, competition forecast and opportunities, 2011-2021", Phosphoric acid (H_3PO_4) market in India was projected to grow at a CAGR of 7.2% during 2016-2021, on account of increasing demand for phosphoric acid in various applications including fertiliser, sugar, oil, detergent, food & beverage, etc.

Ferro-phosphorus (FeP)

Ferro-phosphorus is obtained as a by-product during steel manufacturing, during the production of yellow phosphorus or is smelted 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 drying 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. The installed capacity of red phosphorus was 1.68 thousand tpy. The production of red phosphorus during the year 2019-20 was constant at 1.03 thousand tpy in line with 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.

Besides the above listed chemicals, activated bleaching earth, fluorochemicals, alumina ferric and sodium silicofluoride were the other mineral-based products.

CHEMICAL FERTILIZERS

In India, the Agricultural Sector plays a vital role in the economic development of the country as securing food for 1.3 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 has been well known over a hundred years, but the use of chemical fertilizer started in the beginning of this century. The first phosphate fertilizer plant in India went on stream 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.

Presently, there are around 32 units manufacturing urea, 19 units for DAP & Complex fertilizers and 110 units for SSP in India.

As per Fertilizer Association of India, the total installed capacity of Urea, DAP & complex fertilizer and SSP stands at 247.65, 158.17 and 123.37, respectively. In the year 2020-21, the production of total nutrients was 18.47 million tonnes, imports were 9.93 million tonnes and consumption was 28.97 million tonnes.

Different types of straight and complex fertilizers are manufactured from rock phosphate, such as, SSP, DAP, nitrophosphate, urea ammonium phosphate etc. In the year 2019-20, the consumption of straight fertilizer and complex fertilizer contributed about 8% and 92% of total P_2O_5 , 82.5% & 17.5 % of total N and 65.1% & 34.9% of total K_2O , respectively, in the country.

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 01.04.2018)	Production	
			2019-20	2020-21 (E)
Urea	39	247.65	249.25	246
DAP & Complex Fertilizers	19	82.52	44.88	37.7
		75.65	92.48	93.2
SSP	110	123.37	42.46*	42.46*

Source: Annual Report 2019-20 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- I & II and Bhatinda (Punjab), Panipat (Haryana), Vijaipur, Vijaipur Expansion (Madhya Pradesh)
2	Brahmaputra Valley Fertilizer Corp. Ltd	Namrup- II and III (Assam)
3	Fertilizers & Chemicals Travancore Ltd	Udyogmandal and Cochin-II (Kerala)
4	Rashtriya Chemicals & Fertilizers Ltd	Trombay and Trombay IV, V and Thal (Maharashtra)
5	Madras Fertilizers Ltd	Chennai (Tamil Nadu)
6	Steel Authority of India Ltd	Rourkela (Odisha)
7	Hindustan Fertilizer Corp. Ltd	Khetrinagar (Rajasthan)
Private Sector Large Units		
8	Gujarat State Fertilizers Co. Ltd	Vadodara and Sikka I & II (Gujarat)
9	Shriram Fertilizers & Chemicals	Kota (Rajasthan)
10	DIL (Duncan Industries Ltd)	Kanpur (Uttar Pradesh)
11	Zuari Agro Chemicals Ltd	Zuari Nagar (Goa)
12	Coromandal Fertilizers Ltd	Visakhapatnam and Kakinada (Andhra Pradesh), Ennore (Tamil Nadu)
13	Mangalore Chemicals & Fertilizers Ltd	Mangaluru (Karnataka)
14	Gujarat Narmada Valley Fertilizers Company Ltd	Bharuch (Gujarat)
15	Southern Petrochemicals Industrial Corp.	Thoothukudi (Tamil Nadu)
16	Tata Chemicals Ltd	Haldia (West Bengal), Babrala (Uttar Pradesh)
17	Punjab National Fertilizers and Chemicals Ltd	Nangal (Punjab)
18	Deepak Fertilizers & Petrochemicals Corporation	Taloja (Maharashtra)
19	Tuticorin Alkali	Thoothukudi (Tamil Nadu)
20	Indo-Gulf Fertilizers & Chemicals Corp. Ltd	Jagdishpur (Uttar Pradesh)
21	Nagarjuna Fertilizers & Chemicals Ltd	Kakinada I & II (Andhra Pradesh)
22	Godavari Fertilizers & Chemicals Ltd	Kakinada (Andhra Pradesh)
23	Hindalco Industries Ltd	Dahej (Gujarat)
24	Chambal Fertilizers & Chemicals Ltd	Gadepan I & II Kota (Rajasthan)
25	KSF Ltd	Shahjahanpur (Uttar Pradesh)
26	Paradeep Phosphates Ltd	Paradeep (Odisha)
Co-operative Sector		
27	Indian Farmers' Fertilizers Co-operative Ltd	Kalol and Kandla (Gujarat), Aonla I & II, Phulpur I & II (Uttar Pradesh), Paradeep (Odisha)
28	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

Source: Department of fertilizer.

PAPER & PAPER BOARD INDUSTRY

The Indian Paper Industry accounts for about 5% of the world's total production of paper. There are around 861 units which are manufacturing pulp, paper, paper board and newsprint with an installed capacity of nearly 27.15 million tonnes out of which 4.72 million tonnes are lying idle. As on date around 526 mills are in operation with a total operating capacity of around 23.64 million tonnes. In the year 2019-20, the total capacity utilisation stood at around 87% and the total consumption of paper, paperboard, and newsprint stood at 22.05 million tonnes. The total production for the year of 2019-20, stood at 20.61 million tonnes exhibiting an increase of 6.4% on YoY basis. The Indian Paper Industry is in a fragmented structure, consisting of small, medium and large paper mills having capacity ranging from 5 to 2,000 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 20%, 8% and 72%, respectively. Domestic paper and paperboard segment produces all the main varieties of paper that are in demand in the market viz. writing and printing (35%), packaging grade paper (55%), newsprint (5%) and others/

specialty paper (<5 %). The production of paper and paper board (excluding newsprint) was about 19.57 million tonnes in the year 2019-20. During the year 2019-20, 2.192 million tonnes of paper and paper board were imported and about 2.081 million tonnes of paper and paper board were exported. 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. The domestic production of newsprint dropped from 1.05 million tonnes in 2018-19 to 1.03 million tonnes in 2019-20. The per capita consumption of paper in India is 15.75 kg, which is far behind the global average of 57 kg in 2019. 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.

The production of paints (all types), printing ink and varnish (all types) during 2019-20 was 7,21,176 tonnes 1,98,509 tonnes and 30,597 tonnes, respectively.

PETROLEUM REFINERIES

There were 23 refineries operating in the country (20 in Public/Joint Sector and 3 in Private Sector). India has emerged as second largest refiner in Asia after China.

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	Refinery Crude throughput			
	Annual installed capacity (as on 1.4.2021)	2018-19	2019-20	2020-21 (P)
Total	249200	257205	254386	221773
Public/Private Sector & Subsidiaries	141920	150976	144715	127504
IOCL, Digboi, Assam	650	676	664	605
IOCL, Guwahati, Assam	1000	863	892	849
IOCL, Barauni, Bihar	6000	6661	6516	5469

Table-14 (Concl'd)

(In '000 tonnes)

Refinery	Refinery Crude throughput			
	Annual installed capacity (as on 1.4.2021)	2018-19	2019-20	2020-21 (P)
IOCL, Koyali, Gujarat	13700	13505	13075	11603
IOCL, Haldia, West Bengal	8000	7965	6463	6759
IOCL, Mathura, Uttar Pradesh	8000	9737	8948	8926
IOCL, Bongaigaon, Assam	2350	2513	2045	2450
IOCL, Panipat, Haryana	15000	15281	15038	13181
IOCL, Paradeep, Odisha	15000	14616	15778	12508
BPCL, Mumbai, Maharashtra	12000	14773	15017	12941
BPCL (formerly KRL), Kochi, Kerala	15500	16051	16515	13282
HPCL, Mumbai, Maharashtra	7500	8671	8065	7374
HPCL, Visakhapatnam, Andhra Pradesh	8300	9773	9115	9050
CPCL, Manali, Tamil Nadu	10500	10271	10161	8243
CPCL, Narimanam, Tamil Nadu	1000	423	-	-
Numaligarh Refinery Ltd, Numaligarh, Assam	3000	2900	2383	2707
MRPL, Mangaluru, Karnataka	15000	16231	13953	11475
ONGC, Tatipaka, Andhra Pradesh	70	66	87	81
Joint Venture	19100	18189	20155	16262
Bharat Oman Refineries Ltd, Bina [@]	7800	5716	7913	6190
HPCL Mittal energy Ltd (HMEI), Bathinda [#]	11300	12473	12242	10072
Private Sector	88200	88041	89515	78008
RIL, Jamnagar, Gujarat	33000	31752	33019	34100
RIL, Jamnagar (SEZ), Gujarat	35200	37393	35876	26841
Nyara Energy Ltd (NEL), Vadinar, Gujarat	20000	18896	20620	17067

Source: Indian Petroleum and Natural Gas Statistics, 2020-21, 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 01.04.2021 is around 249.37 million tpy. The total crude throughput decreased to 221.77 million tonnes in 2020-21 from 254.39 million tonnes in 2019-20. Production of petroleum products from crude oil was 233.57 million tonnes in 2020-21 as against 262.94 million tonnes in 2019-20. Import of petroleum crude was 188.182 million tonnes in 2020-21 as against 220.870 million tonnes in 2019-20. During 2020-21, crude oil and condensate production in the country was at 30.49 million tonnes, while the natural gas production was at 28.67 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, 2021.

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 production of cast iron castings in 2018-19 and 2019-20 was 1,291.73 thousand tonnes and 684.79 thousand tonnes, respectively.

8. Production



7.8 %

Reduction in mineral production (excluding atomic minerals and minor minerals) in India (as per index of mineral production base year 2011-12) during 2020-21

Rs.69,535 crore

Value of production of metallic minerals in 2020-21

Rs.8,926 crore

Value of production of non-metallic minerals in 2020-21

MINERALS

The mineral production (excluding Atomic Minerals and Minor Minerals) in India decreased by 7.8% (as per index of mineral production base year 2011-12) during 2020-21 as compared to the previous year due to decrease in the production of coal, lignite, natural gas and petroleum among Fuel minerals; bauxite, chromite, gold, iron ore and manganese ore among Metallic minerals; and diamond fluorite, limestone, magnesite, vermiculite and wollastonite among Non-metallic minerals. The decrease in production could be attributed to the countrywide lockdown during the first quarter of the financial year.

Fuel Minerals

The production of coal at 716 million tonnes during 2020-21 decreased slightly by about 2% as compared to 731 million tonnes in the previous year. The production of lignite at 38 million tonnes during 2020-21 decreased by about 10% as compared to that of the previous year.

The production of petroleum (crude) at 30 million tonnes decreased by 5% whereas production of natural gas at 28,673 m.cu.m decreased by 8% as compared to that of the previous year.

Offshore regions remain the largest producing area and contributed 49.63% of total production of petroleum (crude) followed by Rajasthan (20%), Gujarat (15%) and Assam (13%). The remaining 2.4% was contributed by a few other States. Offshore region, the largest source for natural gas in the country accounted for 66% of the total production, while Assam contributed 10 per cent. The remaining was contributed by a few other States.

Metallic Minerals

The value of production of metallic minerals in 2020-21 at ₹69,535 crore increased by about 1.8% over that of the previous year mainly due to higher production reported in lead concentrate zinc concentrate, tin concentrate and silver. Among the principal metallic minerals, iron ore contributed

₹49,396 crore or 71%, lead (concentrate) & zinc (concentrate) together ₹8,709 crore or 13%, silver ₹4,266 crore or 6%, chromite ₹2,291 crore or about 3%, manganese ore ₹1,942 crore or about 3%, bauxite ₹1,667 crore or 2.4% 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 204 million tonnes in 2020-21 decreased by 16% over that of the previous year. Production of iron ore was mainly from Odisha (54.44%), Chhattisgarh (22%), Karnataka (13%), and Jharkhand (9%) during the year. The remaining 4.56% production was reported from Andhra Pradesh, Goa, Madhya Pradesh, Maharashtra, Telangana and Rajasthan.

The production of chromite at 2.86 million tonnes in 2020-21 decreased by 27% as compared to the previous year. Odisha reported almost entire output of chromite in the country. The production of copper ore at 3.37 million tonnes was 15% lower, while that of copper concentrate at 109 thousand tonnes in 2020-21 decreased by 13% as compared to the previous year. The average metal content in copper conc. was 23.2% Cu. The production of manganese ore at 2.69 million tonnes in 2020-21 decreased by 7.6% as compared to that in the previous year. Of the total production of manganese ore in 2020-21, Madhya Pradesh continued to be the largest producer by contributing 34%, followed by Maharashtra (24%) and Odisha (18%). The remaining production was reported by Andhra Pradesh, Karnataka, Jharkhand, Rajasthan, Gujarat and Telangana.

The production of gold at 1,126 kg (excluding gold recovery from imported concentrates) in 2019-20 decreased by 35% as compared to the previous year. Karnataka was the leading producer of gold accounting for almost 99% output followed by Jharkhand (1%). The production of bauxite at 20.37 million tonnes in 2020-21 decreased by 7% as compared to the previous year. During the year under review, Odisha accounted for 76% of the total output followed by Gujarat and Jharkhand (7% each). The remaining production was reported from Chhattisgarh, Maharashtra, Madhya Pradesh and Tamil Nadu. During 2020-21, the production of lead concentrate at 377 thousand tonnes increased by 7% and that of zinc concentrate at 1,514 thousand tonnes increased by 5% over the previous year. Average metal content produced in lead concentrate was 57.38% Pb and in zinc concentrate it was 49.94% Zn. Rajasthan was the only State reporting production of lead concentrate and zinc concentrate during 2020-21.

Non-Metallic Minerals

The value of production of non-metallic minerals at ₹8,926 crore during 2020-21 decreased by 6% as compared to the previous year (Tables 1 & 2).

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, winzings, sinking work, exploration by pitting, trenching or drilling as evident from the MCDR returns”.

There were 1,323 reporting mines (excluding fuel minerals, atomic fuel and minor minerals) in India located in all States and UTs during 2020-21. Among them, 589 belong to metallic minerals and 734 to Non-metallic minerals. There were 156 mines in Public Sector and the rest of 1,167 mines were in Private Sector.

Employment

The average daily employment of labour engaged in Mining Sector (excluding fuel minerals, atomic and minor minerals) was 99,335 in 2020-21. Out of this, 33,373 or 34% were in Public Sector and 65,962 or 66% in Private Sector. Metallic minerals accounted for 79% and Non-metallic minerals 21% of the total labour force during the year.

Role of Public Sector

The Public Sector has played significant role in the overall mineral production in 2020-21.

The entire production of copper ore & conc., among metallic minerals and diamond, fluorite, Salt (rock) & selenite in respect of non-metallic minerals was reported from the Public Sector. By and large, the entire production of gold (primary) and phosphorite came from Public Sector during 2020-21. More than 50% of the production of bauxite and tin concentrate was in the Public Sector during this year.

Index of Mineral Production

The index of mineral production (excluding atomic and minor minerals) (with base year 2011-12=100) for 2020-21 at 101 displayed a decrease of 7.8% as compared to the previous year (Table-3).

Gross Value Added from Mining & Quarrying Sector

The Ministry of Statistics & Programme Implementation has released the new series of national accounts, 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 2020-21, Mining and Quarrying Industry accounted for about 1.6 % of the GVA at current prices. The GVA at current and constant prices for the period from 2018-19 to 2020-21 is furnished in Tables-4 & 5.

Table-1: Mineral* Production in India, 2018-19 to 2020-21
(By Mineral Groups & Minerals)

(Value ₹ '000)

Minerals	Unit	2018-19		2019-20		2020-21P	
		Quantity	Value [§]	Quantity	Value [§]	Quantity	Value [§]
All Minerals			1491139500		1658778489		157570772
Fuel Minerals							
Coal	'000t	728718	NA	730874	NA	716083	NA
Lignite	'000t	44283	NA	42096	NA	37895	NA
Natural Gas (utilised)	m.cu.m	32873	NA	31184	NA	28673	NA
Petroleum (crude)	'000t	34203	NA	32170	NA	30494	NA
Metallic Minerals			642146745		682983311		695348920
Bauxite	t	23689619	17836033	21825227	16299333	20368665	16667101
Chromite	t	3970691	36850747	3929260	32134395	2863869	22910242
Copper conc.	t	143668	8846151	124586	8448405	108719	8633968
Copper ore	t	4134702	-	3952472	-	3377850	-
Gold	kg	1672	5267696	1742	6495723	1126	5475950
Gold ore	t	567291	-	595511	-	450611	-
Iron ore	'000t	206494	453465829	244083	496430578	204481	493959913
Lead & Zinc ore	t	13452295	-	14479032	-	15455343	-
Lead conc.	t	358369	16316914	351746	18260832	376924	20416324
Manganese ore	t	2832315	21640165	2910186	18849100	2688038	17942596
Silver	kg	679386	25824756	609340	25616104	705796	42664424
Tin conc.	kg	21212	14627	15530	10337	16865	9413
Zinc conc.	t	1456804	56083827	1446824	60438504	1513996	66668989
Non-Metallic Minerals			97400700		95038914		89262540
Diamond	ct	38437	539062	28816	352472	13917	220304
Fluorite (graded)	t	1079	8117	1315	8844	1052	7897
Garnet (abrasive)	t	1234040	746756	568	1775	9307	33585
Graphite (r.o.m.)	t	39030	36233	34674	55908	30168	60054
Iolite	kg	73	684	90	579	16	73
Kyanite	t	4889	15757	3498	12728	4925	10837
Limeshell	t	7534	27780	4600	18730	-	-
Limestone	'000t	379974	89584491	359464	88890081	349170	82659807
Magnesite	t	146875	408287	102554	351947	78144	292653
Marl	t	1890308	349420	2148854	412463	2202331	379778
Moulding sand	t	1421086	3883571	1400189	4731313	1455627	5441988
Phosphorite	t	1421086	3883571	1400189	4731313	1455627	5441988
Salt (rock)	t	17	160	130	1447	486	14239
Selenite	t	2906	5812	2154	4206	202	402
Siliceous earth	t	80237	50205	19367	11710	18429	12184
Sillimanite	t	69919	564498	13221	37903	11110	26611
Sulphur**	t	890400	-	900942	-	737337	-
Vermiculite	t	2992	3709	2774	3347	1260	2157
Wollastonite	t	184063	172013	124757	139695	103902	96552
Minor Minerals@			- 751592055		- 880756264		- 791096242

* 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

Other than BSM (Beach Sand Minerals).

@ Figures for earlier years have been repeated as estimates, wherever necessary, because of non-receipt of data from respective State Governments.

Table-2: Mineral* Production in India, 2019-20 to 2020-21
(By Sectors)

Mineral	Unit	All India		Public Sector		Private Sector		Share of Public Sector in Total Production		Overall increase or decrease in production in 2020-21 over 2019-20
		2019-20	2020-21 (P)	2019-20	2020-21 (P)	2019-20	2020-21 (P)	2019-20	2020-21 (P)	
Metallic Minerals										
Bauxite	tonne	21825227	20368665	10859654	10674620	10965573	9694045	49.76	52.41	-6.67
Chromite	tonne	3929260	2863869	809723	1123742	3119537	1740127	20.61	39.24	-27.11
Copper conc.	tonne	124586	108719	124586	108719	-	-	100	100	-12.74
Copper ore	tonne	3952472	3377850	3952472	3377850	-	-	100	100	-14.54
Gold (Total)	kg	1742	1126	1724	1115	18	11	98.97	99.02	-35.36
Gold ore	tonne	595511	450611	590704	447752	4807	2859	99.19	99.37	-24.33
Iron ore (Total)	'000 t	244083	204481	70879	76058	173204	128423	29.04	37.2	-16.22
Lead & Zinc ore	tonne	14479032	15455343	-	-	14479032	15455343	0	0	6.74
Lead conc.	tonne	351746	376924	-	-	351746	376924	0	0	7.16
Manganese ore	tonne	2910186	2688038	1295916	1152549	1614270	1535489	44.53	42.88	-7.63
Silver	kg	609340	705796	187	120	609153	705676	0.03	0.02	15.83
Tin conc.	kg	15530	16865	1603	13859	3927	3006	74.71	82.18	8.6
Zinc conc.	tonne	1446824	1513996	-	-	1446824	1513996	-	-	4.64
Non-Metallic Minerals*										
Diamond	carat	28816	13917	28816	13917	-	-	100	100	-51.7
Flourite Graded	tonne	1315	1052	1315	1052	-	-	100	100	-20
Garnet (Abrasive)	tonne	568	9307	-	-	568	9307	-	-	1538.56
Graphite R.O.M.	tonne	34674	30168	-	10026	34674	20142	-	33.23	-13
Iolite	kg	90	16	-	-	90	16	-	-	-82.22
Kyanite	tonne	3498	4925	863	540	2635	4385	24.67	10.96	40.79
Limeshell	tonne	4600	-	-	-	4600	-	-	-	-100
Limestone	'000 t	359464	349170	10144	8641	349320	340529	2.82	2.47	-2.86
Magnesite	tonne	102554	78144	34956	30620	67598	47524	34.09	39.18	-23.8
Marl	tonne	2148854	2202331	-	-	2148854	2202331	-	-	2.49
Moulding sand	tonne	12905	11737	-	-	12905	11737	-	-	-9.05
Phosphorite	tonne	1400189	1455627	1300229	1357747	99960	97880	92.86	93.28	3.96
Salt (rock)	tonne	130	486	130	486	-	-	100	100	273.85
Selenite	tonne	2154	202	2154	202	-	-	100	100	-90.62
Siliceous earth	tonne	19367	18429	-	-	19367	18429	-	-	-4.84
Sillimanite	tonne	13221	11110	-	-	13221	11110	-	-	-15.97
Sulphur**	tonne	900942	737337	900942	737337	-	-	100	100	-18.16
Vermiculite	tonne	2774	1260	584	510	2190	750	21.05	40.48	-54.58
Wollastonite	tonne	124757	103902	-	-	124757	103902	-	-	-16.72

* Excluding Atomic, Fuel and minor minerals

Other than BSM (Beach Sand Minerals)

Table-3: Index of Mineral Production, 2018-19 to 2020-21
(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)
2018-19	107.9	135.2	80.1	123.5	128.1
2019-20	109.6	134.6	75.4	141.3	120.9
2020-21(p)	101	131.4	70.7	117.7	117.4

Note: Figures in parentheses indicate the weights attached to respective groups

Table-4: Gross Value Added at Basic Price, 2018-19 to 2020-21
(At current prices) (31.05.2021)

(In ₹ crore)

Industry	2018-19 (NS)	2019-20 (NS)	2020-21 (PE)	% Change in 2020-21 over the previous year
GVA (All)	1,71,61,213	1,84,61,343	1,79,15,167	-3
Mining & Quarrying	3,77,171	3,55,833	2,92,120	-17.9

Source : CSO NS : New Series Estimates PE : Provisional Estimates.

Table-5: Gross Value Added at Basic Price, 2018-19 to 2020-21
(At 2011-12 prices)

(In ₹ crore)

Industry	2018-19 (NS)	2019-20 (NS)	2020-21 (PE)	% Change in 2020-21 over the previous year
GVA (All)	1,27,44,203	1,32,71,471	1,24,53,430	-6.2
Mining & Quarrying	3,30,521	3,22,116	2,94,644	-8.5

Source : CSO NS : New Series Estimates PE : Provisional Estimates.

METALS

Ferrous Metals

As per the provisional data received from the office of Joint Plant Committee, Kolkata, India produced 95 million tonnes of Finished Steel, 103 million tonnes of Semi-

finished Steel, 4.8 million tonnes of Pig iron and 34 million tonnes of Sponge Iron in 2020-21.

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, 2018-19 to 2020-21

(In '000 tonnes)

Ferrous Metal	2018-19	2019-20	2020-21 (P)
Finished steel (including C.R. sheets)	131573	102058	95122
Semi-finished steel (including steel ingots)	106565	109216	103045
Pig iron	6055	5508	4840
Sponge iron	27131	37141	34155

Source: Office of Joint Plant Committee, Kolkata
Mining & Mineral Statistics Division, 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 21 operating plants in 2020-21. The production in respect of ferrochrome, ferromanganese

and ferrosilicon was collected from Joint Plant Committee, Kolkata. 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 2018-19 to 2020-21, to the extent received (including partly estimated due to non-receipt of data), is presented in Table - 7.

Table-7: Production of Ferroalloys, 2018-19 to 2020-21

Ferroalloys	Unit	2018-19	2019-20	2020-21 (P)
Ferrocchrome	tonne	944000	921000	868000
Ferromanganese	tonne	518000	NA	NA
Ferrosilicon	tonne	90000	NA	NA
Ferroboration	kg	NA	NA	NA
Ferromolybdenum	kg	1003265	527359	428210
Ferriobium	kg	NA	NA	NA
Ferrotitanium	kg	118137	120762	249162
Ferrovandium	kg	1013000	664541	634160
Ferroaluminium	kg	2751827	1461388	1119259
Magnesium Ferrosilicon	tonne	19180	13930	10220
Silicomanganese	tonne	345290	320593	329295

Note: 1. Figures for the latest available month have been repeated as estimates, wherever necessary, due to non receipt of data.
2. Figures in respect Iron & Steel items as well as Ferrocchrome, Ferromanganese and Ferrosilicon have been received from JPC Kolkata
NA : Not available

Non-Ferrous Metals

The production of aluminium at 3,619 thousand tonnes in 2020-21 registered a slight decrease of 0.4% 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 which decreased by 100% as compared to that in the previous year. The

production of copper cathodes at 3,63,609 tonnes in 2020-21 decreased by 11% as compared to that in the previous year. The production of copper continuous cast wire rods at 3,41,563 tonnes in 2020-21 decreased by 2% as compared to that in the previous year.

The production of lead (primary) at 2,14,399 tonnes in 2020-21 increased by 18% 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 2020-21 was 7,15,445 tonnes which showed an increase of 4% from that of previous year (Table-8).

Table-8: Production and Value of Non-Ferrous Metals, 2018-19 to 2020-21

(Quantity in tonnes; Value in ₹'000)

Metal/Grade	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Aluminium	tonnes	3696181	528227924	3635089	45960160	3619237	415967702
Cadmium	tonnes	-	-	-	-	-	-
Copper (blister)	tonnes	13293	NA	3997	NA	-	NA
Copper (cathode)	tonnes	454337	207019308	408003	176011710	363609	190616200
Copper (continuous cast wire rod)	tonnes	354146	165324812	349475	155090811	341563	188445400
Gold	kg	12623	39663595	8364	31283423	7387	35814249
Lead (primary)	tonnes	197839	33814419	181365	29111241	214399	34531700
Silver	kg	750928	28558056	672380	28267504	746377	45207924
Tin	kg	7436	8918	6063	7361	4337	5400
Zinc ingot	tonnes	696283	153894301	688282	137840297	715445	147976396

Source: Data for metals and alloys are obtained from individual producers/Units

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 2020-21 at 7,387 kg decreased by 12% as compared to 8,364 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 7,46,377 kg (746.377 tonnes) registered a decrease of 11% 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 2020-21.

9. Prices



In the Mumbai and Delhi domestic market, mostly upward trend was observed in 2020-21 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 2020-21.

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	2018-19	2019-20	2020-21
SEMI-COKING & WEAKLY COKING COAL (run-of-mine)			
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			

Table-1 Concl'd.

(In ₹ per tonne)

Grade	2018-19	2019-20	2020-21
Washery grade I	3450	3450	3450
Washery grade II	3210	3210	3210
Washery grade III	2750	2750	2750
Washery grade IV	2300	2300	2300
CRUDE OIL			
Basic Price Offshore	36494	31604	24187
Basic Price Onshore	34579	30488	23081
Basic Price Offshore & onshore	35886	31237	23832

Sources : 1. Coal directory of India 2020-21, Ministry of Coal, for prices of coal.
2. Indian Petroleum & Natural Gas Statistics, 2020-21, Ministry of Petroleum & Natural Gas, for basic prices of crude oil.

METALS

Domestic Markets

In the Mumbai and Delhi domestic markets mostly upward trend was 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&B).

Prices of most of the items of steel have registered a positive growth during 2020-21. Prices of steel in domestic markets are listed in Table-3.

Foreign Markets

The prices of metals have mostly shown an upward trend. They are listed in Table-4.

Table-2(A): Prices of Metals (Non-ferrous), 2018-19 to 2020-21 (Domestic Markets)

(In ₹ per quintal)

Grade	Market	2018-19	2019-20	2020-21
Aluminium				
Utensil Scrap	Mumbai	-	10547	14700
Ingot	Mumbai	-	14168	19340
Wire Scrap	Mumbai	-	12668	18175
Sheets (Scrap)	Delhi	-	12721	17885
Utensil Scrap	Delhi	-	11173	14445
Wire Scrap	Delhi	-	13173	18710
Brass				
Honey	Mumbai	-	28957	41605
Utensil Scrap	Mumbai	-	30547	42425
Sheet Cutting	Mumbai	-	30715	45620
Gun Metal Scrap	Delhi	-	32473	44675
Copper				
Wire Scrap	Mumbai	-	42850	68920
Utensil Scrap	Mumbai	-	39010	61665
Wire Rod	Mumbai	-	43668	59910
Wire Bar	Mumbai	-	42515	69340
Cathode	Mumbai	-	43045	71675
Wire Scrap	Delhi	-	42984	62595
Wire	Delhi	-	47394	66305
Mixed Scrap	Delhi	-	41494	66910
Lead				
Ingot	Mumbai	-	14926	17025
Soft	Delhi	-	14421	16830
Hard (4%)	Delhi	-	14578	18135
Nickel				
Ingot	Mumbai	-	96889	126900
Ingot (4x4)	Delhi	-	105552	126810
Tin				
Ingot	Mumbai	-	125394	221275
Ingot	Delhi	-	128121	220630
Zinc				
Ingot	Mumbai	-	17242	23205
Ingot	Delhi	-	22847	25190
Dross	Delhi	-	17331	22605

Source: Minerals and Metals Review.

Table-2(B): Prices of Metals (Non-ferrous), 2018-19 to 2020-21 (Domestic Markets)

Grade	Market	2018-19	2019-20	2020-21
Gold*				
24 ct	Mumbai	30976	33567	NA
Standard	Delhi	32080	35372	NA
Biscuits	Delhi	31984	35276	NA
Sovereign#	Delhi	31339	34440	NA
24 ct	Chennai	32521	35393	NA
Silver**				
0.999 (Finesse)	Mumbai	38610	42598	NA
0.999 (Finesse)	Delhi	38832	41318	NA
Ready	Chennai	41470	45063	NA

Source: Minerals and Metals Review.

Note : Prices of gold and silver have not been reported during the year 2020-21 due to non-availability of data

: per piece

* : Prices in ₹/10 g.

** : Prices in ₹/kg.

Table-3: Prices of Steel, 2018-19 to 2020-21 & March'21# (Domestic Markets)

(In ₹ per tonne)

Grade	Market	2018-19	2019-20	2020-21
TMT Bars (ISI, 8 mm)	Delhi	46180	45044	46646
MS Squares (8 mm)	"	45044	50525	45305
MS Angles (25 x 3 mm)	"	45135	50265	46383
Channels (75 x 40 mm)	"	44827	49560	46740
Joists (150 x 75 mm)	"	44546	51325	48065
Melting Scrap	"	26217	39775	32675
Induction Ingots	"	35698	33517	39638
TMT Bars (local 8 mm)	Mumbai	44998	43838	45665
MS Rounds (8 mm)	"	43658	42258	43776
MS Angles (40 x 6 mm)	"	40671	44619	45891
Joists (150 x 75 mm)	"	44538	42977	44865
Melting Scrap	"	-	-	-
Induction ingots	"	36119	33170	41350
Arc Ingots	"	36238	33835	40950
Concast Billet ingots	"	36529	34148	41350
TMT Bars (ISI, 8 mm)	Kolkata	46447	45398	48168
MS Squares (8 mm)	"	45726	44944	46803
MS Angles (25 x 3 mm)	"	45242	44773	46566
Channels (75 x 40 mm)	"	47124	44898	46727
Joists (150 x 75 mm)	"	44633	43079	46220
Induction Ingots	"	36190	33982	41450
Arc Ingots	"	36329	34257	41550
Concast Billet Ingots	"	36433	34444	41750
Induction ingots (round)	Gobind	35970	31693	40300
Blooms (SAIL, 150 mm)	"	36016	31660	40500
Old Ship Breaking Scrap	"	29510	29126	34250
Melting Scrap (rolling)	"	33271	28166	33775
MS Rounds (10 mm)	"	45075	43367	47775
MS Squares (8 mm)	"	47033	46018	49275
MS Angles (25 x 3 mm)	"	45313	44051	45650
MS Sponge Iron	"	26529	24566	32025
MS Flat (3 x 20 mm)	"	45300	43339	48575
Pig Iron (Foundry Grade) ^{B^}	Punjab	-	-	-

Source: Minerals & Metals Review.

#: Data for the period 2020-21 is not available, hence, the prices during the month of March 2021 is reported.

B^ : High Sulphur/Phosphorus i.e. above 0.09% which is used in Non-critical castings.

Table-4: Prices of Metals, 2018-19 to 2020-21 (Foreign Markets)

Metal/Grade	Unit	Currency	2018-19	2019-20	2020-21 [#]
Aluminium HG [@]	Tonne	\$	1931.45	1791.13	1835.89
Antimony (min. 99.65 %)	Tonne	\$	7733.33	6100	NA
Bismuth (min. 99.99 %)	Pound	\$	3.89	2.7	NA
Cadmium (min. 99.95%)	Pound	Cents	143	123	NA
Cadmium (min. 99.99%)	Pound	Cents	146	124	NA
Chromium (min. 99%)	Tonne	\$	8900	6300	NA
Cobalt (99.80%)	Pound	\$	15.07	16.55	NA
Copper Grade A [@]	Tonne	\$	6094.21	5999.73	5947.91
Germanium Dioxide	kg	\$	1150	1100	NA
Gold (London)	tr oz	\$	1303	1556.9	NA
Indium	kg	\$	215	165	NA
Iridium (min. 99.9 %)	tr oz	\$	1510	1550	NA
Lead [@]	Tonne	\$	1965.47	1999.68	2051.63
Magnesium (min. 99.9 %)	Tonne	\$	2740	2200	NA
Manganese (min. 99.7%)	Tonne	\$	2100	1620	NA
Mercury	Flask	\$	2700	2400	NA
Molybdenum Molybdic Oxide	Pound	\$	12.25	9.5	NA
Nickel [@]	Tonne	\$	10836.84	13935.7	12178.96
Palladium (min. 99.9%)	tr oz	\$	1378	2087	NA
Platinum (min. 99.9%)	tr oz	\$	905	978	NA
Rhodium (min. 99.9%)	tr oz	\$	3050	8200	NA
Ruthenium (min. 99.9%)	tr oz	\$	275	260	NA
Selenium	Pound	\$	11	7	NA
Silver (London)	tr oz	\$	15.25	17.77	NA
Silicon	Tonne	\$	1920	1840	NA
Tungsten	mtu	\$	282	245	NA
Tin HG [@]	Tonne	\$	19242.63	18613.99	18802.74
Vanadium Pentoxide, min. 98%V	mtu	\$	-	5.85	NA
Zinc SHG [@]	Tonne	\$	2625.61	2546.34	2545.65

Source : Minerals and Metals Review.

[#]: Price data is not available for the period 2020-21 except for Aluminium, copper, lead, nickel, tin and zinc.

tr oz: Troy Ounce

[@] Annual average LME settlement prices of Sett for the years 2018, 2019 and 2020 respectively.

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 2020-21, the value of exports (including re-exports) of ores and minerals at ₹1,96,654 crore accounted for about 9.1% of the total value of all merchandise exported from India. The value of exports of ores & minerals which declined from ₹2,19,168 crore in 2018-19 to ₹1,89,683 crore in 2019-20 increased to ₹1,96,654 crore in 2020-21. The value of mineral exports showed an increase of 3.67% in 2020-21 as compare to that of the previous year.

Diamond (total) continued to be the largest constituent item with a share of 63.98% in the total value of mineral exports in 2020-21. Next in the order of share were iron ore with the contribution of 18.44% followed by granite 5.76%, limestone 2.18% and alumina 1.44%. 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 2020-21 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 Iron ore (94.8%) and building & monumental stones (54.2%). On the other hand, the exports value recorded significant decline in the cases of abrasives (natural) (75.98%), copper ores & conc. (62.4%), bauxite (33.05%), natural gas (70.11%), coal (excl. lignite) (3.25%), chromite (91.71%), alumina (8.4%) and emerald (Cut & Uncut) (69.42%), as compared to that in the previous year.

Ores and minerals were exported to various countries in 2020-21. About 89.3% per cent of the total value of exports of ores and minerals was confined to only ten countries. During 2020-21, USA occupied the top position in terms of value accounting for 25.09% of the total value of mineral exports, Hong Kong was in the second place and contributed 22.78% followed by China (19.33%), UAE

(5.31%), Belgium (4.91%), Israel (3.12%), Bangladesh (2.83%), Thailand (2.42%), Japan (2.14%) and UK (1.36%). 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 Brazil (229.23%), Bangladesh (223.90%), Bahrain (202.67%), Indonesia (111.10%), Oman (103.01%), China (73.21%),

Netherlands (45.30%), Morocco (33.54%), Qatar (32.4%), Algeria (26.8%), Poland (25.74%), and Vietnam (23.24%).

However, value of export of ores & minerals declined significantly in respect of Singapore (58.76%), Turkey (55.24%), Libya (46%), Switzerland (45.71%), Taiwan (41.9%), Spain (33.13%), Malaysia (19.4%) and Kuwait (17.8%) when compared to that of the previous year (Tables -1 to 3).

Table-1 : Exports of Ores and Minerals (including re-exports), 2018-19 to 2020-21

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Minerals		**	2191682036	**	1896831578	**	1966539540
Abrasives (natural)	tonne	80436	1380074	92241	1568206	23411	376713
Alabaster	tonne	12	129	27	256	4	184
Alumina	tonne	1389105	46982487	1330038	30900409	1265941	28280781
Andalusite	tonne	100	2659	19	1240	9	476
Antimony ores & conc.	tonne	++	6	--	--	--	--
Arsenic sulphide (Natural)	tonne	25	212	++	69	277	1697
Asbestos: Total	tonne	1112	33914	1001	31011	299	11991
Asbestos (chrysotile)	tonne	1090	33647	997	30994	275	11895
Asbestos (others)	tonne	22	267	4	17	24	96
Ball clay	tonne	213999	497944	153658	398714	170915	410109
Barytes	tonne	2114610	11781173	2221693	12896670	1010894	6261470
Bauxite	tonne	1509738	3045300	524229	1421269	240841	951442
Bentonite	tonne	1693046	5846662	1647485	5674970	1557484	5215656
Borax: Total	tonne	2353	238103	2977	359860	2996	414601
Natural borate	tonne	105	1887	214	6806	55	5633
Sodium borate	tonne	1240	61645	773	54235	741	56265
Other borates	tonne	1008	174571	1990	298819	2200	352703
Building and monumental stones NES	tonne	9137308	10806105	12612479	15692854	13134116	24200968
Calcite	tonne	39251	303449	36433	273950	23867	155049
Chalk	tonne	1199	7736	1317	8022	1104	6155
Chromite: Total	tonne	39273	1337693	33898	867910	2872	71979
Chrome ore (others)	tonne	2788	116528	3433	132477	2668	68875
Chrome ore conc.	tonne	34985	1167942	30465	735433	204	3104
Chrome ore lumps	tonne	1500	53223	--	--	--	--
Clay (others)	tonne	44195	428742	50365	476744	45346	402787
Coal (Ex. Lignite)	'000t	1305	9500065	1045	5929549	2943	5736794
Coal : Lignite	'000t	2	254653	3	319838	2	234709
Coke	tonne	101863	2205464	111507	2383337	207412	4771075
Coal gas	tonne	++	100	--	--	--	--
Cobalt Ores & Conc.	tonne	1	4496	2	9478	--	--
Copper Ores & Conc.	tonne	181642	16627621	212659	20450948	82463	7689376
Corundum (natural)	tonne	101	2149	--	--	62	137
Diamond: Total		**	1758167200	**	1400336074	**	1258209200
Diamond (mostly cut)		**	1757329008	**	1399742298	**	1257345848
Diamond (industrial)	ct	7730667	545530	7410678	387188	7015880	688082

Table-1 (Contd.)

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Diamond (powder)	'000 ct	10554	292662	8650	206588	10628	175270
Diatomite	tonne	27893	273001	4302	72842	3240	69439
Dolomite	tonne	78010	308053	91431	349684	95892	349090
Earth clay	tonne	3650	38825	2652	18037	3881	22220
Emerald (Cut & Uncut): Total		**	23026249	**	17387875	**	5316603
Emerald (uncut)	tonne	2	495684	34	60040	++	45741
Emerald (cut)	'000 ct	31790	22530565	21960	17327835	4076	5270862
Felspar (Natural)	tonne	655913	3310611	640709	3225696	705280	3931135
Felspar (cut & uncut): Total		**	338518	**	203185	10863	198059
Felspar (uncut)	tonne	215	42112	76	20001	24	30923
Felspar (cut)	'000 ct	29953	296406	25483	183184	10839	167136
Fire clay	tonne	4665	40928	5172	41898	5324	43606
Flint	tonne	790	10393	1195	8014	406	2953
Fluorite/Fluorspar	tonne	533	23410	1368	51562	474	22436
Garnet (arasive)	tonne	104344	1783920	74697	1254539	76799	1265586
Garnet (cut and uncut): Total		**	494842	**	366806	**	280824
Garnet (uncut)	tonne	116	21808	134	33736	111	20194
Garnet (cut)	'000 ct	14429	473034	42177	333070	76049	260630
Granite : Total	tonne	6811728	102014060	6678131	102248504	7522159	113279766
Granite (crude or roughly trimmed)	tonne	4040010	30037431	4015876	30475234	4705266	32700873
Granite (cut blocks/ slabs)	tonne	794155	9079569	698624	8397611	674353	8810152
Granite (polished blocks/ tiles)	tonne	213464	4844864	190023	4577912	240445	5969769
Granite (others)	tonne	1764099	58052196	1773608	58797747	1902095	65798972
Graphite (natural)	tonne	402	22960	607	32629	716	42994
Gypsum	tonne	175269	684490	151722	578922	213061	723888
Iron ore: Total	'000 ct	16149	92626090	36625	186092710	57723	362556021
Iron ore conc: Non-Agglomerated	'000 ct	49	167775	153	559743	363	1781069
Iron ore: Fines	'000 ct	5905	16112898	22374	83422738	40661	215190641
Iron ore: Lumps	'000 ct	831	3138922	1480	8779976	2239	13118637
Iron ore Pellates	'000 ct	9364	73177864	12618	93305204	14460	132419634
Iron ore Pyrites	'000 ct	++	28631	++	25049	++	46040
Kaolin	tonne	446358	1709970	431536	1929478	287260	1610489
Kieselguhr	tonne	61	1341	113	2399	27	917
Kyanite	tonne	283	4872	143	2627	252	9033
Lead Ores & Conc.	tonne	37	2007	3	202	9	1076
Limestone	tonne	3883757	4947503	3760402	4656567	3528973	42939083
Magnesite : Total	tonne	6268	204287	5453	147073	5477	171020
Magnesia (fused)	tonne	31	1798	55	2691	41	863
Magnesite (not Calcined)	tonne	355	7843	75	1632	220	5202
Magnesite (calcined)	tonne	62	1671	35	1111	100	2102
Magnesite:Dead-Burnt Magnesia	tonne	508	13946	684	10665	2	93

Table-1 (Contd.)

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Magnesium Oxide	tonne	3193	139427	2152	103450	1646	119899
Magnesite (other)	tonne	2119	39602	2452	27524	3468	42861
Manganese ore : Total	tonne	55845	138120	58198	254643	82363	974940
Manganese ore (46% or more Mn)	tonne	2	55	5	299	10	330
Manganese ore (35% or more but below 46% Mn)	tonne	--	--	8987	137409	40108	698245
Manganese ore (30% or more but below 35% Mn)	tonne	--	--	--	--	20200	214707
Manganese ore (Ferruginous 10% or more but below 30%)	tonne	++	2	--	--	--	--
Manganese ore (others)	tonne	55843	138063	49206	116935	22045	61658
Marble : Total	tonne	385241	8757384	310613	9010909	295085	10082272
Marble (dressed)	tonne	236740	3240387	182976	2969818	148619	2115113
Marble (others)	tonne	148501	5516997	127637	6041091	146466	7967159
Mica: Total	tonne	152494	6200102	116854	4909143	144121	5733785
Mica (unmanufactured): Total	tonne	151444	4981247	115652	3719906	143291	4724093
Mica (blocks)	tonne	2157	365067	2754	359574	1870	354192
Mica (splittings)	tonne	20798	513854	20037	474627	28810	753109
Mica (powder)	tonne	97998	3258399	73525	2295741	84031	2811539
Mica (condenser films)	tonne	++	777	120	6098	13	239
Mica (waste & scrap)	tonne	30491	843150	19216	583866	28567	805014
Mica (Worked): Total	tonne	1050	1218855	1202	1189237	830	1009692
Mica (bricks)	tonne	--	--	++	227	1	115
Mica (cond. films, plates, cut nes)	tonne	8	26301	59	11326	32	18288
Mica (washers & discs)	tonne	5	25493	9	19564	7	14057
Mica (sheets & strips)	tonne	8	80197	18	98173	19	115884
Micanite & other	tonne	10	6050	47	6399	13	3452
Built-Up Mica							
Mica Worked (others)	tonne	1019	1080814	1069	1053548	758	857896
Molybdenum ores & conc.	tonne	6	81	3	3023	45	43181
Niobium or tantalum ores & conc.	tonne	++	790	361	943	++	217
Natural gas	tonne	73574	3802681	52408	2202387	17992	658242
Nickel ores & conc.	tonne	50	1619	++	++	--	--
Ochre: Total	tonne	3491	65042	2934	72045	4126	71626
Ochre: (earth colours)	tonne	2559	30466	1964	23594	3276	44387
Ochre (persian red)	tonne	--	--	++	1	13	1666
Ochre (red oxide)	tonne	694	25187	707	37111	625	16573
Ochre: (yellow ochre)	tonne	238	9389	263	11339	212	9000
Precious & Semi-precious Stones		**	14493857	**	12083066	**	23463605
(Cut & Uncut): Total							
Precious & Semi-precious stones (uncut)	tonne	3173	1261704	2194	822702	2250	1300940

Table-1 (Concl.)

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Precious & Semi-precious stones (cut)	'000 ct	1823853	13232153	2617919	11260364	1300016	22162665
Precious metal	kg	50001	484	--	--	260175	5435
ores & concentrates							
Quartz and Quartzite: Total	tonne	793394	5702081	944041	6087293	772127	6213690
Quartz (natural)	tonne	672764	4035108	768686	4685362	692520	5289217
Quartzite (natural)	tonne	120630	1666973	175355	1401931	79607	924473
Rock phosphorite	tonne	1651	46794	257	2015	825	5602
Salt (other than common salt)	tonne	12755381	14627311	11681705	13681149	8260913	10571743
Sand (excl. metal bearing)	tonne	3390	24451	1894	32610	1178	13630
Sandstone	tonne	1032376	13570942	795763	10434171	794445	11220825
Silica sand	tonne	3152	27793	2391	14934	43061	63008
Sillimanite	tonne	9984	111874	1025	14961	4998	94359
Slate : Total	tonne	80536	2180250	61143	1983349	66335	2453970
Slate (worked)	tonne	16080	942249	10751	922884	13975	1250220
Slate (others)	tonne	64456	1238001	50392	1060465	52360	1203750
Talc/steatite/soapstone : Total	tonne	259520	3764807	250649	3583316	283303	4364076
Steatite blocks	tonne	903	9509	180	4393	468	8525
Steatite lumps	tonne	66129	951471	71309	978177	107566	1744449
Steatite powder & others	tonne	192488	2803827	179160	2600746	175269	2611102
Sulphur (excl. sublimed precipitated & colloidal)	tonne	479650	4332470	802175	3872834	802713	4328627
Tin ores & conc.	tonne	++	54	++	1	--	--
Titanium ores & conc.: Total	tonne	359971	6566847	246203	4995763	246534	5348323
Titanium ores & conc. (ilmenite)	tonne	358027	6438828	246179	4992946	246534	5348321
Titanium ores & conc. (rutile)	tonne	98	7760	8	817	--	--
Titanium ores & conc. (others)	tonne	1846	120259	16	2000	++	2
Tungsten ores & conc.	tonne	34	43180	--	--	--	--
Vanadium ores & conc.	tonne	10	2320	10	10801	--	--
Vermiculite	tonne	583	7251	634	7902	853	11573
Witherite	tonne	++	87	++	156	++	104
Wollastonite	tonne	13786	279115	14582	298591	13716	311809
Zinc ores & conc.	tonne	2078	71169	317	15828	399	20716
Zirconium ores & conc.	tonne	89	4469	1	78	++	21
Other minerals NES	tonne	3817136	5538145	3643829	4587040	3842874	4244574

Source: DGCI & S, Kolkata

** : Quantity not additive

Table-2: Value of Exports of Ores & Minerals (including re-exports), 2018-19 to 2020-21
(By Principal Ores & Minerals)

Ores & Minerals	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
All Minerals	2191682036	100	1896831578	100	1966539540	100	3.67
Diamond	1758167200	80.22	1400336074	73.83	1258209200	63.98	-10.15
Iron ore	92626090	4.23	186092710	9.81	362556021	18.44	94.83
Granite	102014060	4.65	102248504	5.39	113279766	5.76	10.79
Alumina	46982487	2.14	30900409	1.63	28280781	1.44	-8.48
Copper ores & conc.	16627621	0.76	20450948	1.08	7689376	0.39	-62.4
Emerald (cut & uncut)	23026249	1.05	17387875	0.92	5316603	0.27	-69.42
Precious & semi-precious stones (cut & uncut): Total	14493857	0.66	12083066	0.64	23463605	1.19	94.19
Sandstone	13570942	0.62	10434171	0.55	11220825	0.57	7.54
Building and monumental Stones NES	10806105	0.49	15692854	0.83	24200968	1.23	54.22
Barytes	11781173	0.54	12896670	0.68	6261470	0.32	-51.45
Salt (other than common salt)	14627311	0.67	13681149	0.72	10571743	0.54	-22.73
Coal (excl. lignite)	9500065	0.43	5929549	0.31	5736794	0.29	-3.25
Marble	8757384	0.4	9010909	0.48	10082272	0.51	11.89
Mica	6200102	0.28	4909143	0.26	5733785	0.29	16.8
Titanium ores & conc.	6566847	0.3	4995763	0.26	5348323	0.27	7.06
Bentonite	5846662	0.27	5674970	0.3	5215656	0.27	-8.09
Quartz and Quartzite	5702081	0.26	6087293	0.32	6213690	0.32	2.08
Sulphur (exc. sublimed precipitated & colloidal)	4332470	0.2	3872834	0.2	4328627	0.22	11.77
Steatite	3764807	0.17	3583316	0.19	4364076	0.22	21.79
Limestone	4947503	0.23	4656567	0.25	42939083	2.18	822.12
Talc/soapstone/steatite	37648070.17	0.17	3583316	0.19	4364076	0.22	21.79
Natural gas	3802681	0.17	2202387	0.12	658242	0.03	-70.11
Bauxite	3045300	0.14	1421269	0.07	951442	0.05	-33.06
Felspar (natural)	3310611	0.15	3225696	0.17	3931135	0.2	21.87
Garnet (abrasive)	1783920	0.08	1254539	0.07	1265586	0.06	0.88
Slate	2180250	0.1	1983349	0.1	2453970	0.12	23.73
Manganese ore	138120	0.01	254643	0.01	974940	0.05	282.87
Kaolin	1709970	0.08	1929478	0.1	1610489	0.08	-16.53
Borax	238103	0.01	359860	0.02	414601	0.02	15.21
Coke	2205464	0.1	2383337	0.13	4771075	0.24	100.18
Gypsum	684490	0.03	578922	0.03	723888	0.04	25.04
Other minerals	12242111	0.56	10313324	0.54	7771508	0.4	-19.36

Source: DGCI&S, Kolkata

Table-3 : Value of Exports of Ores & Minerals (including re-exports), 2018-19 to 2020-21
(By Principal countries)

Ores & Minerals	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
All Countries	2191682036	100	1896831578	100	1966539540	100	3.67
USA	616559576	28.13	528711991	27.87	493499087	25.09	-6.66
Hong Kong	680993516	31.07	470206976	24.79	447951892	22.78	-4.73
China	151497875	6.91	219411030	11.57	380077162	19.33	73.23
UAE	135516440	6.18	114164809	6.02	104335194	5.31	-8.61
Belgium	169764411	7.75	151255522	7.97	96560613	4.91	-36.16
Israel	70675334	3.22	64807168	3.42	61431650	3.12	-5.21
Bangladesh	14999853	0.68	17208196	0.91	55737626	2.83	223.9
Thailand	43675034	1.99	45600085	2.4	47659389	2.42	4.52
Japan	40002022	1.83	44424844	2.34	42054415	2.14	-5.34
UK	25176931	1.15	22863008	1.21	26731073	1.36	16.92
Vietnam	13045408	0.6	13629494	0.72	16797196	0.85	23.24
Korea, Rep. of	17037009	0.78	16181300	0.85	14650431	0.74	-9.46
Oman	3983975	0.18	6063245	0.32	12308820	0.63	103.01
Malaysia	8682524	0.4	14263474	0.75	11498522	0.58	-19.38
Australia	11993011	0.55	10290892	0.54	10907001	0.55	5.99
Nepal	13384221	0.61	11736648	0.62	10092486	0.51	-14.01
Botswana	8585684	0.39	8709480	0.46	9889759	0.5	13.55
Indonesia	5186368	0.24	4663874	0.25	9845335	0.5	111.1
Saudi Arabia	9086586	0.41	8755015	0.46	8618105	0.44	-1.56
Germany	9275453	0.42	8388465	0.44	8452053	0.43	0.76
Italy	9133026	0.42	8155826	0.43	6717453	0.34	-17.64
Canada	6006389	0.27	5942188	0.31	6324114	0.32	6.43
Singapore	19159080	0.87	15283658	0.81	6303074	0.32	-58.76
France	8453951	0.39	7464099	0.39	6279841	0.32	-15.87
Brazil	1570934	0.07	1581689	0.08	5207377	0.26	229.23
Switzerland	14786961	0.67	9128473	0.48	4955789	0.25	-45.71
Turkey	6420711	0.29	9766260	0.51	4371213	0.22	-55.24
Poland	3701166	0.17	3323492	0.18	4179084	0.21	25.74
Egypt	12386737	0.57	4753153	0.25	4161003	0.21	-12.46
Qatar	4786187	0.22	3057265	0.16	4047316	0.21	32.38
South Africa	4598990	0.21	3266621	0.17	3680561	0.19	12.67
Taiwan	5338103	0.24	6259954	0.33	3637479	0.18	-41.89
Netherlands	6003586	0.27	2248225	0.12	3266707	0.17	45.3
Bahrain	1344199	0.06	947010	0.05	2866324	0.15	202.67
Bhutan	1892788	0.09	2140556	0.11	2389754	0.12	11.64
Algeria	1540116	0.07	1434302	0.08	1818974	0.09	26.82
Spain	2105151	0.1	2662435	0.14	1780286	0.09	-33.13
Kuwait	2114538	0.1	2055959	0.11	1690266	0.09	-17.79
Russia	1091199	0.05	1523221	0.08	1470036	0.07	-3.49
Sri Lanka	1775665	0.08	1537180	0.08	1269968	0.06	-17.38
Ireland	1143447	0.05	1034946	0.05	1224230	0.06	18.29
New Zealand	1079022	0.05	1004005	0.05	1075570	0.05	7.13
Morocco	618469	0.03	757120	0.04	1011060	0.05	33.54
Iraq	1009190	0.05	881792	0.05	986723	0.05	11.9
Libya	1346450	0.06	1736427	0.09	938054	0.05	-45.98
Other countries	23154750	1.06	17550206	0.93	15789475	0.8	-10.03

Source: DGCI&S, Kolkata

Metals & Alloys

The value of exports of metals & alloys at ₹2,07,222 crore in the year 2020-21 registered an increase of 24.76% as compared to that of ₹1,66,098 crore in the previous year. The contribution of metals & alloys in the total value of India's exports was only 7.48% during the year under review.

Iron & steel with a share of 59.12% continued to hold the top position in the value of metals/alloys exported from India in 2020-21. Aluminium and alloys including scrap is in the second place and accounted for 20.64% value. Ferroalloys and copper & alloys (including brass & bronze) occupied the third & fourth place with a contribution of 6.16% and 4.93%, respectively. The contributions of zinc & alloys including scrap and silver were 2.66% and 1.64% pig & cast iron (incl speigeliesen) and lead & alloy including scrap were 1.46% & 1.25% 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 2020-21. The export value of silver registered a huge spike of 4889.50% similar hike in export value was noticed in gold (Non monetary & monetary) which increased by 229.04%, platinum 110.21%, precious metals 197.17%, copper & alloys 68.63%, pig & cast iron (Incl. speigeliesen) 180.84% and tin & alloys incl. scrap 5.87%. However, the export values showed significant negative growth during 2020-21 as compared to that of the previous year in the cases of cobalt alloys (65.32%), Mo & Scrap (49.20%), Hg- (40.90%), Ni & Alloys (36.51%), Ti & Alloys (18.76%) and W & Alloys (4.03%).

India exported metals & alloys to various countries in 2020-21. Bulk of the metals and alloys having share

of more than 1% to the total value were exported to 27 countries. These countries together accounted for 95.88% of the total value of exports during 2020-21. China led the group with a share of 13.62% followed by USA (8.74%), Malaysia (6.07%), Republic of Korea (5.68%), UAE (4.57%), Vietnam (4.34%), Italy (4.20%), Nepal (4.17%), UK (3.24%), Belgium (2.46%), Taiwan (2.23%), Germany (2.07%), Thailand (2.06%), Bangladesh (2.01%), Saudi Arabia (1.65%), Indonesia (1.67%), Spain (1.59%), Canada (1.51%), Japan (1.45%), Netherlands (1.42%), Sri Lanka & Brazil (1.08% each), Mexico (1.11%), Oman (1.25%), Singapore 1.83%, Turkey 1.3%, and Australia 1.02%. The individual share is less than one 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 2020-21 are China more than 3 fold of (278.19%), Greece (182.17%), Switzerland (174.68%), Singapore (142.34%), Kenya (119.75%), Hong Kong (115.66%), UK (95.31%), Turkey (77.84%), Romania (63.58%) Tanzania Rep (54.51%), Australia (50.28%), Philippines (44.11%) and Indonesia (42.42%).

On the other hand, decline in the value of exports of metals & alloys was observed among Nigeria (26.28%), Ethiopia (12.26%), Bangladesh (10.46%), UAE (4.83%), France (2.85%), Nepal (2.45%), Germany (1.50%) and USA (1.18%) during the year under review (Tables - 4 to 6).

Value of exports of selected Mineral- based products at ₹1,63,070 crore in the year 2020-21 registered a decrease of 37.32% as compared to that of ₹2,60,158 crore in the previous year. Exports of selected mineral-based products during 2018-19 to 2020-21 are furnished in Table -7.

Table-4 : Exports of Metals and Alloys, 2018-19 to 2020-21

(Value in ₹'000)

Metals & Alloys	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Metals & Alloys		**	1742867821	**	1660987438	**	2072220863
Aluminium and Alloys Incl. Scrap	tonne	2337737	398756249	2371062	361046684	2735588	427759670
Antimony Alloys and Scrap	tonne	2283	1242871	2217	927375	2134	932922
Bismuth & Scrap	tonne	++	924	++	1053	++	2528
Boron	tonne	++	1971	++	91	5	525
Cadmium (incl. waste & scrap)	tonne	145	20128	268	35680	208	24971
Cement (copper precipitated)	tonne	42	1961	++	367	4	1066
Chromium & Alloys	tonne	45	60582	157	112563	168	119489
Cobalt & Alloys (incl. waste and scrap): Total	tonne	95	425191	105	220380	340	364327
Cobalt & Alloys	tonne	81	411877	87	199965	340	364006
Cobalt & Scrap	tonne	14	13314	18	20415	++	321

Table-4 (Contd.)

(Value in ₹'000)

Metals & Alloys	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Copper & Alloys							
(incl. brass & bronze): Total	tonne	134452	70029611	140857	60527102	209332	102064524
Brass & Bronze	tonne	28627	20698053	50669	21447989	61018	30956169
Brass & Bronze (scrap)	tonne	1596	481298	1064	312010	1484	511456
Copper & Alloys	tonne	99154	46846423	81388	35989492	139540	67619065
Copper (scrap)	tonne	5075	2003837	7736	2777611	7290	2977834
Ferroalloys : Total	tonne	1942120	149622729	1715919	118100709	1843322	127735114
Ferro-boron	tonne	46	9922	51	11143	39	9728
Ferro-chrome	tonne	860179	66563282	732431	48794984	720539	49939983
Ferro-Charge-Chrome	tonne	++	63	--	--	--	--
Ferro-cobalt	tonne	++	398	++	75	++	29
Ferrocolumbium	tonne	++	1088	1	2901	++	1522
Ferromanganese	tonne	271431	22752478	262265	19796179	335229	23997006
Ferromolybdenum	tonne	328	444659	129	146529	279	324540
Ferronickel	tonne	++	55	++	197	77	65052
Ferroniobium	tonne	45	99699	26	52730	14	25114
Ferrophosphorous	tonne	149	17076	80	10878	77	11038
Ferroselenium	tonne	++	917	++	1365	++	979
Ferrosilicon	tonne	25752	2580246	18754	1601611	11236	1194260
Ferrotitanium	tonne	1199	284737	3227	678896	2553	567131
Ferrotungsten	tonne	2	6444	++	1223	++	1150
Ferrovandium	tonne	472	1832963	531	883571	240	346840
Ferrozirconium	tonne	2	1546	5	2914	3	1644
Ferro-silico-chrome	tonne	++	31	3	638	32	12095
Ferro-silico-magnesium	tonne	8610	951635	7153	770985	4192	483234
Ferro-silico-manganese	tonne	766932	53296563	682846	44374533	764747	50326047
Ferroalloys (Others)	tonne	6973	778927	8417	969357	4065	427722
Gold (non-monetary & monetary): Total	kg	507	1441335	1730	5742699	4191	18895717
Gold-Non-monetary: Total	kg	507	1441326	1730	5742699	4191	18895692
Gold, non-Monetary,							
Other Unwrought Forms	kg	505	143628	1575	5300969	4191	18894458
Gold-Non-monetary, Powder	kg	++	35	--	--	++	16
Gold-Non-monetary:							
Other Semi-manufactured forms	kg	2	4963	155	441730	++	1218
Gold-clad Metals/Base Metals Nes	tonne	++	1084	++	19	++	306
Iron & Steel : Total		**	1022758437	**	1019955563	**	1225105321
Iron & Steel							
(finished steel incl. Cr sheet)	tonne	4523205	326115980	4631222	309262120	6108963	358432755
Iron & Steel							
(semi-finished steel incl. stl ingo)	tonne	5979694	29365342	795707	320684584	12577510	480956813
Iron & Steel (steel wire)	tonne	152589	25449307	159597	23911264	169631	25750975
Iron & Steel (sponge iron)	tonne	686150	15725355	898475	17286760	524566	11248671
Iron & Steel (scrap)	tonne	8487	648538	11876	688320	25613	649151
Iron & Steel: Alloy Steel (granules)	tonne	309	21811	484	29004	422	29056

Table-4 (Contd.)

(Value in ₹'000)

Metals & Alloys	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Iron & Steel: Alloy Steel (powder)	tonne	128	36775	68	9067	4	1760
Iron & Steel (other finished steel, nes)	tonne	**	351532787	**	339926285	**	340587784
Iron & Steel Material	tonne	88150	5217272	84891	4478671	70062	4250996
Iron & Steel (stainless steel)	tonne	12139	4356970	8181	3679488	12889	3197360
Lead and Alloys Incl. Scrap: Total	tonne	176836	28199782	174939	26422498	176601	25845466
Lead & Alloys	tonne	176774	28192398	174936	26421811	176569	25841849
Lead & Scrap	tonne	62	7384	3	687	32	3617
Magnesium & Scrap	tonne	993	116661	2373	294359	1266	143710
Manganese & Alloys (Incl. waste & scrap): Total	tonne	454	312175	418	343896	469	375616
Manganese Waste & Scrap	tonne	41	11326	24	5916	32	9094
Manganese & Alloys: (wrought & unwrought)	tonne	413	300767	136	119131	188	106409
	tonne	++	82	258	218849	249	260113
Mercury	tonne	35	237152	58	312409	42	184648
Molybdenum & Scrap	tonne	514	281063	82	122342	119	182537
Nickel And Alloys Incl. scrap: Total	tonne	3738	4648645	16890	6532327	2937	4147078
Nickel & Alloys	tonne	2455	3935390	15634	5830642	2269	3763280
Nickel Scrap	tonne	1283	713255	1256	701685	668	383798
Other Rare Metals Nes	tonne	++	617	++	20064	++	366
Pig & Cast Iron (Incl. Speigeliessen)	tonne	346759	10053234	440432	10737676	1123792	30155194
Platinum Alloys & Related Metals: Total	kg	937	2197416	604	1681684	616	3535012
Platinum (powder, unwrought & others)	kg	395	739052	259	524194	507	552422
Other Metals of Platinum Group	kg	542	1458364	345	1157490	109	2982590
Platinum-clad Base metal/							
Precious Metal	kg	++	254	--	--	700	50
Precious Metals / Metals Clad							
With Precious Metals	tonne	3354	7297957	1054	4499703	3827	13371985
Selenium	tonne	27	58603	18	46422	40	43423
Silicon	tonne	203	29967	175	19030	159	23239
Silver	tonne	32	818436	30	680127	615	33934966
Silver clad Base Metals	kg	1354	4637	3898	12268	6026	23892
Tantalum & Scrap: Total	tonne	6	83897	3	40266	5	55163
Tantalum Alloys Unwrought	tonne	6	81959	3	37811	5	54121
Tantalum & Scrap	tonne	++	1938	++	2455	++	1042
Tellurium	tonne	++	419	++	122	++	37
Tin & Alloys Incl. Scrap: Total	tonne	853	718271	944	740863	750	784385
Tin & Alloys	tonne	534	688881	681	694813	570	731861
Tin & Alloys : Worked	tonne	317	28782	263	46041	178	51368

Table-4 (Concl'd)

(Value in ₹'000)

Metals & Alloys	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Tin (scrap)	tonne	2	608	++	9	2	1156
Titanium & Alloys (incl. waste & scrap)	tonne	315	272934	486	546039	253	443579
Tungsten Alloys & Scrap	kg	466667	1254344	313499	870314	292331	835275
Zinc and Alloys Incl. Scrap: Total	tonne	195880	41899904	212702	40372945	300018	55103971
Zinc & Alloys	tonne	195761	41882283	212592	40361623	299936	55094321
Zinc (scrap)	tonne	119	17621	110	11322	82	9650
Zirconium & Scrap	tonne	3	18425	++	21799	++	24791

Source: DGCIS, Kolkata

++: Negligible

**: Quantity not additive

Table-5 : Value of Exports of Metals and Alloys, 2018-19 to 2020-21

(By Principal Metals & Alloys)

Metals & Alloys	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
All Metals & Alloys	1742867821	100	1660987438	100	2072220863	100	24.76
Iron & Steel	1022758437	58.68	1019955563	61.41	1225105321	59.12	20.11
Aluminium and Alloys							
Incl. Scrap	398756249	22.88	361046684	21.74	427759670	20.64	18.48
Ferroalloys	149622729	8.58	118100709	7.11	127735114	6.16	8.16
Copper & Alloys (Incl. Brass & Bronze)	70029611	4.02	60527102	3.64	102064524	4.93	68.63
Zinc and Alloys Incl. Scrap	41899904	2.4	40372945	2.43	55103971	2.66	36.49
Silver	818436	0.05	680127	0.04	33934966	1.64	4889.5
Pig & Cast Iron (incl. speigeliesen)	10053234	0.58	10737676	0.65	30155194	1.46	180.84
Lead and Alloys Incl. Scrap	28199782	1.62	26422498	1.59	25845466	1.25	-2.18
Gold (non-monetary & monetary):Total	1441335	0.08	5742699	0.35	18895717	0.91	229.04
Precious Metals / Metals Clad with Precious Metals	7297957	0.42	4499703	0.27	13371985	0.65	197.17
Nickel and Alloys Incl. Scrap	4648645	0.27	6532327	0.39	4147078	0.2	-36.51
Platinum Alloys & Related Metals	2197416	0.13	1681684	0.1	3535012	0.17	110.21
Antimony Alloys and Scrap	1242871	0.07	927375	0.06	932922	0.05	0.6
Tungsten and Alloys Incl. Scrap	1254344	0.07	870314	0.05	835275	0.04	-4.03
Tin and Alloys Incl. Scrap	718271	0.04	740863	0.04	784385	0.04	5.87
Titanium & Alloys (Incl.Waste & Scrap	272934	0.02	546039	0.03	443579	0.02	-18.76
Manganese & Alloys (Incl Waste &	312175	0.02	343896	0.02	375616	0.02	9.22
Cobalt & Alloys (Incl Waste and Scrap	425191	0.02	220380	0.01	364327	0.02	65.32
Mercury	237152	0.01	312409	0.02	184648	0.01	-40.9
Molybdenum & Scrap	281063	0.02	122342	0.01	182537	0.01	49.2
Other Metals and Alloys	400085	0.02	604103	0.04	463556	0.02	-23.27

Source: DGCI & S, Kolkata

Table-6 : Value of Exports of Metals and Alloys, 2018-19 to 2020-21
(By Principal Countries)

Country	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
All Countries	1742867821	100	1660987438	100	2072220863	100	24.76
China	50858257	2.92	74601591	4.49	282137796	13.62	278.19
USA	204501005	11.73	183309784	11.04	181147665	8.74	-1.18
Malaysia	87285937	5.01	113572297	6.84	125849163	6.07	10.81
Korea, Rep. of	95671262	5.49	104730742	6.31	117726820	5.68	12.41
UAE	98180488	5.63	99533217	5.99	94721649	4.57	-4.83
Vietnam	42944571	2.46	87603977	5.27	89994420	4.34	2.73
Italy	93754961	5.38	74776642	4.5	88655244	4.28	18.56
Nepal	98029669	5.62	88483203	5.33	86311070	4.17	-2.45
UK	40610536	2.33	34404603	2.07	67194772	3.24	95.31
Belgium	54687323	3.14	41428319	2.49	50892573	2.46	22.84
Taiwan	40101093	2.3	36440572	2.19	46133098	2.23	26.6
Germany	47721830	2.74	43590629	2.62	42938548	2.07	-1.5
Thailand	36161132	2.07	33538503	2.02	42712830	2.06	27.35
Bangladesh	45970820	2.64	46545576	2.8	41676869	2.01	-10.46
Singapore	20434570	1.17	15657027	0.94	37943474	1.83	142.34
Indonesia	28580338	1.64	24313402	1.46	34626189	1.67	42.42
Saudi Arabia	28495676	1.63	28852422	1.74	34252627	1.65	18.72
Spain	43789125	2.51	28551673	1.72	32978681	1.59	15.51
Canada	23383598	1.34	30498069	1.84	31322349	1.51	2.7
Japan	35124228	2.02	28381267	1.71	29959601	1.45	5.56
Netherlands	38288315	2.2	28229925	1.7	29377804	1.42	4.07
Turkey	48998670	2.81	15187741	0.91	27009450	1.3	77.84
Oman	14163958	0.81	19834532	1.19	25806700	1.25	30.11
Brazil	20841849	1.2	20356436	1.23	24931404	1.2	22.47
Mexico	35476001	2.04	20240203	1.22	22986274	1.11	13.57
Sri Lanka	19607774	1.13	20424545	1.23	22297606	1.08	9.17
Australia	13932818	0.8	14102349	0.85	21192418	1.02	50.28
Switzerland	1549102	0.09	5839518	0.35	16039870	0.77	174.68
Poland	16085142	0.92	14585426	0.88	15982508	0.77	9.58
Kenya	9620489	0.55	7106422	0.43	15616109	0.75	119.75
Qatar	19983081	1.15	13081294	0.79	15262845	0.74	16.68
France	14346022	0.82	15438443	0.93	14999110	0.72	-2.85
Russia	8054201	0.46	11073961	0.67	13891831	0.67	25.45
Greece	7394768	0.42	4773947	0.29	13470442	0.65	182.17
Hong Kong	5323812	0.31	5977392	0.36	12890895	0.62	115.66
Egypt	11673591	0.67	10833409	0.65	12579893	0.61	16.12
Philippines	11883453	0.68	8697510	0.52	12534275	0.6	44.11
South Africa	10621781	0.61	9251850	0.56	11756736	0.57	27.07
Nigeria	13252634	0.76	12649001	0.76	9324379	0.45	-26.28
Ethiopia	8734445	0.5	9280316	0.56	8142745	0.39	-12.26
Portugal	5049104	0.29	5936076	0.36	8071537	0.39	35.97
Tanzania, United Rep. of	7613513	0.44	4939038	0.3	7631409	0.37	54.51
Romania	3660198	0.21	4065640	0.24	6650468	0.32	63.58
Israel	5360101	0.31	6397412	0.39	6434422	0.31	0.58
Ghana	4822993	0.28	4772362	0.29	5905126	0.28	23.74
Other countries	170243587	9.77	149099175	8.98	132259169	6.38	-11.29

Source: DGCI & S, Kolkata

Table-7 : Exports of Selected Mineral-based Products, 2018-19 to 2020-21

(Value in ₹'000)

Mineral-based Product	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Item		**	2746887418	**	2601579579	**	1630698738
Aluminium Fluoride	tonne	442	36259	1362	120976	2045	187158
Asbestos Cement Products	tonne	67352	970411	91101	1447617	89833	1444464
Asbestos Fibre Products	tonne	41641	5252131	43298	5071610	41739	5548536
Bleaching Powder	tonne	21327	592187	23948	677278	21509	734237
Boric Acid	tonne	1319	107103	1520	121969	1952	160749
Briquets of Coke, Semi-coke of Coal	tonne	80	605	210	1722	51	728
Calcium Carbide	tonne	325	20383	370	24367	129	11213
Caustic Soda	tonne	172157	7166280	187484	5453186	275516	6028001
Cement : Total	tonne	5824303	20293763	2840277	9539871	2806874	8761533
Cement (others)	tonne	209898	763211	129760	480668	166359	642298
Cement (portland grey)	tonne	2014672	6837612	1892277	6173135	1528080	4528743
Cement (portland white)	tonne	29183	215183	18164	176655	18384	179863
Cement Clinker	tonne	3570550	12477757	800076	2709413	1094051	3410629
Cryolite and Chiolite	tonne	71	9001	52	4296	149	8467
Graphite (artificial)	tonne	31586	3745540	24745	3555899	21744	2820004
Graphite Bricks & Shapes	tonne	597	5708	95	5141	515	8408
Graphite Crucibles	tonne	56	6888	20	2256	416	28081
Hydrofluoric Acid	tonne	2198	211814	2474	237996	1931	164258
Manganese Oxide: Total	tonne	18034	928686	28485	1382052	29116	1357914
Manganese Dioxide	tonne	2528	118444	11412	549640	4476	227849
Manganese Oxides (other than Mn Dioxide)	tonne	15506	810242	17073	832412	24640	1130065
Petroleum Products: Total*	'000 tonne	61096	2676970000	65685	2540180000	56769	1571680000
Non-Ferrous Ash & Residues	tonne	168329	618622	417955	1739634	319494	514364
Non-Ferrous Ash & Residues	tonne	167197	613243	415378	1707211	317963	491875
Non-Ferrous Base Metals Scrap	tonne	1132	5379	2577	32423	1531	22489
Other Refractory Manufactures	tonne	56851	5484462	37658	5065199	64780	6895845
Phosphotic Fertilizers	tonne	6947	94621	172	13729	385	15631
Phosphoric Acid	tonne	359	30928	2630	196837	460	50475
Phosphorus (elemental)	tonne	610	224679	650	256687	583	246040
Potash Fertilizer	tonne	41323	1223815	29565	1014818	26583	673799
Potassium Nitrate	tonne	805	154987	985	168082	827	165914
Refractory Bricks	tonne	253457	13895206	226260	14825818	291949	13735641
Silicon Carbide Crucibles	tonne	3128	671351	3023	690399	3728	624851
Slag (dross etc. from iron & steel exc. granules)	tonne	148858	507380	131880	702416	152818	951045
Soda Ash	tonne	62453	1520232	137747	2713657	149930	1376038
Sodium Nitrate	tonne	7	1222	149	7890	272	10289
Sodium Nitrite	tonne	15180	759377	14465	661146	15629	727353
Sulphur (sublimed precipitated & colloidal): Total	tonne	18077	2128393	16811	1917964	15756	1777105
Sulphur (colloidal)	tonne	3	211	++	24	++	9
Sulphur Precipitated	tonne	++	92	1	155	2	543
Sulphur Sublimed	tonne	18074	2128090	16810	1917785	15754	1776553

Table-7 (Concl'd)

Mineral-based Product	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Titanium Oxide&Dioxide: Total	tonne	37084	3255384	38506	3779067	28419	2990597
Titanium Dioxide	tonne	7340	1274277	6231	1065352	6481	1152120
Titanium Oxide (Other than	tonne	29744	1981107	32275	2713715	21938	1838477

Source: 1) DGCI & S, Kolkata

*Source: Ministry of Petroleum & Natural Gas Basic Statistics

**: Quantity not additive

IMPORTS

Ores and Minerals

The value of imports of ores & minerals in 2020-21 accounted for 34.26% of the total value of all merchandise imported into India. During 2020-21, the total value of imports of ores and minerals at ₹7,91,320 crore registered a decrease of 31.28% as compared to ₹11,51,530 crore in the year 2019-20.

Petroleum (crude) continued to be the largest constituent item with a share of 55.56% in the total value of minerals imported in 2020-21. Next in order of importance were diamond with a share of 16.22%, coal (ex.lignite) with 14.67% and natural gas with 7.37%. The combined share of these four minerals was 93.82% in 2020-21 as against 95.36% in the previous year.

The value of imports of some ores & minerals in 2020-21 has increased as in the cases of manganese ore (33.82%), sulphur (ex.sublimed ppt & colloidal) (32.82%), bauxite (26.73%), Precipitated & semi-precious stone (cut & uncut) (16.37%), alumina (15.38%), zirconium ores & conc. (15.15%), kaolin (12.66%), borax (12.28%) and chromite (9.33%) as compared to that in the previous year. However, the value of imports in some cases significantly declined as in emerald (cut & uncut) (67.23%), petroleum (crude) (39.62%), marble (32.87%), copper ores & conc. (31.85%), granite (28.53%), coke (26.60%), coal (ex lignite) (24.02%), dolomite (22.58%), magnesite (19.12%), fluorspar (15.71%), natural gas (14.81%) and diamond (13.71%) during the year under review over the previous year.

During 2020-21, ores and minerals were imported from various countries. Bulk of ores & minerals having share more than 1% to total value were imported from 16 countries. These 16 countries, accounted for about 85.36% of the total value of ores & minerals imported in 2020-21. UAE occupied the top position in 2020-21 in terms of imports value and accounted for 12.86% of the total mineral imports. Next in the order was Iraq with 12.03% share followed by USA (10.58%), Saudi Arabia (10.09%), Australia (6.21%), Nigeria (5.17%), Indonesia (5%), Qatar (3.91%), Belgium (3.34%), South Africa (3.05%), Kuwait (2.93%), Hong Kong (2.75%), Russia (2.23%), Mexico (1.85%), Angola (1.74%) and Oman (1.62%). The individual share of remaining countries was less than one per cent.

Countrywise analysis of value of imports of ores and minerals in 2020-21 revealed that imports value from Gabon reported increase of about eight times (695.50%); Colombia by over three times (236.51%). The other countries which recorded significant increase in the value of imports of ores and minerals during the year were France (68.91%), Oman (25.27%), Sudan (10.35%), Israel (8.76%) and USA (3.74%). However, imports value showed a decline in respect of Venezuela (88.83%), Algeria (78.16%), Kazakhstan (61.26%), Equatorial Guinea (70.01%), Congo (58.93%), Malaysia (41.81%), Mozambique (40.83%), Mexico (37.79%), Botswana (37.78%), China (36.83%), Belgium (27.12%) and Australia (15.15%). (Tables - 8 to 10).

Table-8 : Imports of Ores & Minerals, 2018-19 to 2020-21

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Minerals		**	12991864206	**	11515303006	**	7913202918
Abrasives (Natural)	tonne	4941	74317	4234	59872	3221	55212
Alabaster	tonne	1378	39474	1040	32801	826	27872
Alumina	tonne	2856524	102946453	1844483	49829384	2334786	57491719
Andalusite	tonne	14263	355232	17618	425962	15217	428831
Antimony Ores and Concs.	tonne	7496	1609649	7656	1265983	5977	1072406
Arsenic Sulphide (natural)	tonne	7	557	7	995	4	570
Asbestos: Total	tonne	364107	12253121	361163	12432333	308506	11851124
Asbestos (chrysotile)	tonne	363903	12246919	360839	12422164	308100	11840174
Asbestos (others)	tonne	204	6202	324	10169	406	10950

Table-8 (Contd.)

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Ballclay	tonne	175253	1579468	126794	1115239	65828	765439
Barytes	tonne	11498	266740	15436	427967	11691	313860
Bauxite	tonne	2254595	13364136	2246681	10817757	3034041	13709540
Bentonite	tonne	57232	868080	72618	882272	90933	1019395
Borax: Total	tonne	181625	5886234	176421	5644322	194448	6337254
Natural Borate	tonne	85217	2206203	84699	2157324	83207	2113660
Sodium Borate	tonne	86687	3101905	81531	2776165	101477	3557620
Other Borates	tonne	9721	578126	10191	710833	9764	665974
Building & Monumental Stones Nes	tonne	201754	850408	47971	523956	16327	360034
Calcite	tonne	71713	346401	63458	302799	67643	374975
Chalk	tonne	254	6143	105	4131	66	2661
Chromite: Total	tonne	162663	3154448	124693	2065047	156211	2257733
Chrome Ore Others	tonne	31290	630140	42983	739986	73353	1015587
Chrome Ore Conc.	tonne	2970	104952	891	24896	4013	93937
Chrome Ore Lumps	tonne	128403	2419356	80819	1300165	78845	1148209
Clay (Others)	tonne	17482	319967	20961	317309	12562	241521
Coal (Ex lignite)	'000 tonnes	235355	1709323903	248545	1527478152	215260	1160506410
Coal:lignite	'000 tonnes	1	8171	1	5170	1	5746
Cobalt Ores & Conc.	tonne	1	4476	2	9253	++	325
Coke	tonne	4933340	120756969	2912775	61067396	2463036	44821773
Copper Ores & Conc.	tonne	823938	121462018	821555	86675247	415136	59071579
Corundum (Natural)	tonne	--	--	--	--	1	79
Diamond: Total		**	1779709897	**	1487354319	**	1283511854
Diamond (Industrial)	Carat	5120796	3864006	10427197	6024784	8725537	4362112
Diamond (mostly cut)	Carat	**	1773772349	**	1479515995	**	1277251339
Diamond Powder	'000 Carat	763772	2073542	816431	1813540	839962	1898403
Diatomite	tonne	3647	139462	4950	152229	7099	212766
Dolomite	tonne	5869534	6743265	5539814	6555288	3505151	5075300
Earth Clay	tonne	18	4254	2	343	3	450
Emerald (cut & uncut)		**	36592287	**	24403510	**	7997796
Emerald (uncut)	tonne	45	14833395	136	13871900	49	6640030
Emerald (cut)	'000 Carat	51013	21758892	90367	10531610	9842	1357766
Felspar (natural)	tonne	9490	100613	8198	101216	13187	78978
Felspar (cut & uncut)		**	96750	**	83631	**	8094
Felspar (uncut)	tonne	1	75191	14	67870	1	3741
Felspar (cut)	'000 Carat	3612	21559	2142	15761	883	4353
Fireclay	tonne	1293	88521	1896	100241	2326	100595
Flint	tonne	6886	76018	6279	62362	9209	85170
Fluorspar	tonne	265443	7281833	239589	7225937	220573	6090596
Garnet (abrasive)	tonne	422	6410	391	6189	345	14712
Garnet(cut and uncut)		**	169836	**	184466	**	97335
Garnet (uncut)	tonne	26	124214	56	129065	11	64770
Garnet (cut)	'000 ct	6143	45622	4969	55401	1437	32565
Granite : Total	tonne	61960	1940629	56169	1846960	37304	1320021
Granite(crude or roughly trimmed)	tonne	41224	1085462	38755	1011671	25874	829212

Table-8 (Contd.)

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Granite (cut blocks/ slabs)	tonne	14444	353100	11265	270578	7071	175377
Granite (polished blocks/ tiles)	tonne	757	36138	674	24389	1501	51776
Granite (others)	tonne	5535	465929	5475	540322	2858	263656
Graphite (natural)	tonne	47057	2328880	41405	1863220	40153	1808218
Gypsum & Plaster	tonne	6186253	9473416	5460746	8415195	4762012	7372934
Iron Ore: Total	'000 tonnes	12807	59136708	1245	9409772	766	8445221
Iron Ore Conc:Non-agglomerated	'000 tonnes	532	3533497	420	3063619	154	1484523
Iron Ore Fines	'000 tonnes	8436	28976776	223	1291301	++	852
Iron Ore Lumps	'000 tonnes	3196	19735797	543	4530382	166	1800782
Iron Ore pelletes	'000 tonnes	640	6832112	54	438140	379	4612581
Iron Ore Pyrites	'000 tonnes	3	58526	5	86330	67	546483
Kaolin	tonne	229733	3581700	231662	3933899	237144	4431804
Kieselgurh	tonne	42	3994	66	9247	10	1543
Kyanite	tonne	997	27590	1112	33476	1238	42080
Lead Ores & Concs.	tonne	1499	85468	3283	166725	5473	325104
Limestone	tonne	24397169	36665171	25639508	37429909	22797801	32911759
Magnesite : Total	tonne	464365	11120844	365053	9468163	364577	7657838
Magnesia (fused)	tonne	21129	1630684	16325	823312	25215	1135547
Magnesite (not calcined)	tonne	115539	390376	63874	185153	57993	159537
Magnesite (calcined)	tonne	36157	1542204	50567	1645695	59514	919930
Magnesite:Dead-Burnt Magnesia	tonne	144069	4911912	160465	5018483	133034	3360002
Magnesium Oxide	tonne	48882	1436253	55765	1208334	63442	1402374
Magnesite (other)	tonne	98589	1208815	18057	587186	25379	680448
Manganese Ore: Total	tonne	2784473	48484512	4316572	41282100	4058590	55242138
Manganese Ore (46% or more Mn)	tonne	219963	5275364	191766	3997776	182048	3156903
Manganese Ore (35% or more but below 46% Mn)	tonne	1641886	29972597	1871739	26995931	2942210	39070738
Manganese Ore (30% or more but below 35% Mn)	tonne	395736	4809679	432072	4049808	449497	3789163
Manganese Ore (Ferruginous,10 % or more but below 30% Mn)	tonne	98443	881294	47639	394579	168371	1218726
Manganese Ore (others)	tonne	428445	7545578	1773356	5844006	316464	8006608
Marble : Total	tonne	997194	20190596	951361	17923694	645253	12032307
Marble (dressed)	tonne	916566	14896711	900860	14764327	623229	10660272
Marble (others)	tonne	80628	5293885	50501	3159367	22024	1372035
Mica: Total	tonne	3684	1172720	3645	1280925	2987	1252020
Mica (unmanufactured)	tonne	1951	133078	1626	135689	1273	140981
Mica (blocks)	tonne	116	6825	218	11184	56	15557
Mica (powder)	tonne	870	70520	535	63928	542	75765
Mica (splittings)	tonne	503	35978	461	43169	515	43414
Mica (waste & scrap)	tonne	462	19755	412	17408	160	6245
Mica (worked)	tonne	1733	1039642	2019	1145236	1714	1111039

Table-8 (Contd.)

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Mica (cond. films, plates, cuts Nes)	tonne	11	15521	33	33469	53	55589
Mica (washers & discs)	tonne	++	343	++	2	++	55
Mica (sheets & strips)	tonne	269	44738	156	32761	101	20939
Micanite & Other built-up mica	tonne	--	--	--	--	--	--
Mica (Bricks)	tonne	--	--	--	--	++	406
Mica Worked (others)	tonne	1453	979040	1830	1079004	1560	1034050
Molybdenum Ores & Conc.	tonne	11028	13606784	7901	9809780	9177	8848441
Natural Gas	tonne	21544664	738878610	24416607	684667281	25054872	583289424
Nickel Ores & Concs.	tonne	++	169	++	204	37	6404
Niobium or Tantalum ores and concs.	tonne	156	264455	16	21764	2	489
Ochre: Total	tonne	38	11796	188	35754	391	82224
Ochre: Earth Colours	tonne	7	2857	152	14871	228	18018
Ochre: Yellow Ochre	tonne	2	1582	7	6286	7	6308
Ochre: Persian Red	tonne	++	50	++	147	--	--
Ochre: Red Oxide	tonne	29	7307	29	14450	156	57898
Petroleum (crude)	'000 tonnes	226452	7981583190	220869	7281122511	188182	4396561618
Precious & Semi-precious Stones (Cut & uncut): Total		**	48292001	**	41191154	**	47935435
Precious & Semi-precious Stones (uncut)	tonne	2493	24610115	2435	6169055	2024	6847282
Precious & Semi-precious Stones Cut	'000 ct	726883	23681886	623818	35022099	432603	41088153
Precious Metal Ores & Concentrates	kg	201	159	273	736	10743	48509
Quartz & Quartzite: Total	tonne	1662	54632	1155	40682	1098	50333
Quartz (Natural)	tonne	223	6568	718	9960	206	6940
Quartzite (Natural)	tonne	1439	48064	437	30722	892	43393
Rock Phosphate/ Phosphorite	tonne	7519155	56379205	7654867	54205952	7781423	53709109
Salt (other than common salt)	tonne	78712	472879	65263	466170	98042	645494
Sand, Excl. Metal Bearing	tonne	390328	843983	198862	502131	57812	400291
Sandstone	tonne	48	973	28	693	16	480
Silica Sand	tonne	60896	400142	21392	218841	21356	238740
Sillimanite	tonne	99	2403	609	10781	606	11571
Slate	tonne	225	6867	111	3818	49	3784
Steatite : Total	tonne	7028	324573	5809	325939	5332	344649
Steatite Blocks	tonne	201	2619	170	1744	--	--
Steatite Lumps	tonne	1254	7027	724	2205	156	501
Steatite Powder & Others	tonne	5573	314927	4915	321990	5176	344148
Sulphur (excl. sublimed, ppt. & colloidal)	tonne	1346775	15219696	1235102	8239656	1463291	10948268
Tin Ores & Concs.	tonne	6	1259	++	206	2	889
Titanium Ores & Conc.: Total	tonne	97307	3013231	138042	3965292	78747	3440562
Titanium Ores and Conc. (ileminite)	tonne	70275	1250833	109771	1963147	43894	907344
Titanium Ores and Conc. (rutile)	tonne	20825	1500943	20589	1689194	29562	2224774

Table-8 (Concl'd)

(Value in ₹'000)

Ores & Minerals	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Titanium Ores and Conc. (others)	tonne	6207	261455	7682	312951	5291	308444
Tripoli Earth	tonne	8	238	19	1116	--	--
Tungsten Ores & Concs.	tonne	461	64520	447	69234	121	9104
Vanadium Ores & Others	tonne	2658	451825	7006	349104	999	77967
Vermiculite (raw)	tonne	610	16154	416	11024	696	17234
Witherite	tonne	++	96	7	263	++	10
Wollastonite	tonne	26483	331612	22616	294800	24049	370375
Zinc Ores & Concs.	tonne	1422	38776	101	2667	804	9530
Zirconium Ores & Conc.	tonne	76077	8084381	56166	6073420	68675	6993378
Other Minerals Nes	tonne	683347	2821858	641544	2995670	544580	2325905

Source: DGCI & S, Kolkata

**: Quantity not additive

Table-9 : Value of Imports of Ores & Minerals (including Re-import), 2018-19 to 2020-21
(By Principal Minerals)

Metals & Alloys	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
All Minerals	12991864206	100	11515303006	100	7913202918	100	-31.28
Petroleum (crude)	7981583190	61.44	7281122511	63.23	4396561618	55.56	-39.62
Diamond	1779709897	13.7	1487354319	12.92	1283511854	16.22	-13.71
Coal (ex lignite)	1709323903	13.16	1527478152	13.26	1160506410	14.67	-24.02
Natural Gas	738878610	5.69	684667281	5.95	583289424	7.37	-14.81
Copper Ores & Conc.	121462018	0.93	86675247	0.75	59071579	0.75	-31.85
Alumina	102946453	0.79	49829384	0.43	57491719	0.73	15.38
Manganese Ore	48484512	0.37	41282100	0.36	55242138	0.7	33.82
Rock Phosphate	56379205	0.43	54205952	0.47	53709109	0.68	-0.92
Precious & Semi-precious Stones (cut & uncut):Total	48292001	0.37	41191154	0.36	47935435	0.61	16.37
Coke	120756969	0.93	61067396	0.53	44821773	0.57	-26.6
Limestone	36665171	0.28	37429909	0.33	32911759	0.42	-12.07
Bauxite	13364136	0.1	10817757	0.09	13709540	0.17	26.73
Marble	20190596	0.16	17923694	0.16	12032307	0.15	-32.87
Asbestos	12253121	0.09	12432333	0.11	11851124	0.15	-4.67
Sulphur (exc. sublimed precipitated & colloidal)	15219696	0.12	8239656	0.07	10948268	0.14	32.87
Molybdenum Ores & Conc.	13606784	0.1	9809780	0.09	8848441	0.11	-9.8
Iron Ore	59136708	0.46	9409772	0.08	8445221	0.11	-10.25
Emerald (cut & uncut)	36592287	0.28	24403510	0.21	7997796	0.1	-67.23
Magnesite	11120844	0.09	9468163	0.08	7657838	0.1	-19.12
Gypsum	9473416	0.07	8415195	0.07	7372934	0.09	-12.39
Zirconium Ores & Conc.	8084381	0.06	6073420	0.05	6993378	0.09	15.15
Borax	5886234	0.05	5644322	0.05	6337254	0.08	12.28
Fluorspar	7281833	0.06	7225937	0.06	6090596	0.08	-15.71
Dolomite	6743265	0.05	6555288	0.06	5075300	0.06	-22.58
Kaolin	3581700	0.03	3933899	0.03	4431804	0.06	12.66
Titanium ores & conc.	3013231	0.02	3965292	0.03	3440562	0.04	-13.23
Chromite	3154448	0.02	2065047	0.02	2257733	0.03	9.33

Table-9 (Concl'd)

Metals & Alloys	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
Graphite (Natural)	2328880	0.02	1863220	0.02	1808218	0.02	-2.95
Granite	1940629	0.01	1846960	0.02	1320021	0.02	-28.53
Mica	1172720	0.01	1280925	0.01	1252020	0.02	-2.26
Other Minerals	13237368	0.1	11625431	0.1	10279745	0.13	-11.58

Source: DGCI&S, Kolkata

Table- 10 : Value of Imports of Ores & Minerals (including Re-import), 2018-19 to 2020-21
(By Principal Countries)

Country	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
All Countries	12991864206	100	11515303006	100	7913202918	100	-31.28
UAE	1149114932	8.84	1242431153	10.79	1017894598	12.86	-18.07
Iraq	1558441339	12	1613786345	14.01	951898110	12.03	-41.01
USA	822173562	6.33	806756883	7.01	836948848	10.58	3.74
Saudi Arabia	1503843212	11.58	1446490894	12.56	798697210	10.09	-44.78
Australia	772386316	5.95	579300065	5.03	491512945	6.21	-15.15
Nigeria	744982826	5.73	711621877	6.18	409344897	5.17	-42.48
Indonesia	546544894	4.21	485969389	4.22	395918292	5	-18.53
Qatar	465533600	3.58	414677870	3.6	309014143	3.91	-25.48
Belgium	463567548	3.57	362970553	3.15	264518200	3.34	-27.12
South Africa	264851178	2.04	285908142	2.48	241002978	3.05	-15.71
Kuwait	380661266	2.93	342816907	2.98	231464773	2.93	-32.48
Hong Kong	286504030	2.21	234382027	2.04	217688153	2.75	-7.12
Russia	182165009	1.4	242618163	2.11	176807689	2.23	-27.13
Mexico	299027481	2.3	235589576	2.05	146551950	1.85	-37.79
Angola	279398905	2.15	257426729	2.24	137782628	1.74	-46.48
Oman	110253274	0.85	102239806	0.89	128077798	1.62	25.27
Egypt	77403889	0.6	95506536	0.83	78132837	0.99	-18.19
Brazil	136281783	1.05	84781547	0.74	74961113	0.95	-11.58
Malaysia	186249655	1.43	127928663	1.11	74447498	0.94	-41.81
Colombia	40190756	0.31	20760739	0.18	69861350	0.88	236.51
Kazakhstan	37017910	0.28	152715241	1.33	59168048	0.75	-61.26
Canada	101946334	0.78	108498295	0.94	55949686	0.71	-48.43
Israel	62716249	0.48	45985748	0.4	50015508	0.63	8.76
Venezuela	507311111	3.9	427605020	3.71	47784806	0.6	-88.83
Singapore	75807151	0.58	67570524	0.59	39441256	0.5	-41.63
Turkey	83538064	0.64	68803213	0.6	38261935	0.48	-44.39
Botswana	68085363	0.52	52770671	0.46	32833354	0.41	-37.78
Chile	61098272	0.47	59936479	0.52	32458431	0.41	-45.85
Gabon	27626635	0.21	3284695	0.03	26129785	0.33	695.5
Algeria	93014542	0.72	118040691	1.03	25776167	0.33	-78.16
Mozambique	61661953	0.47	42250357	0.37	25000891	0.32	-40.83
Thailand	23855789	0.18	28395961	0.25	24462173	0.31	-13.85
Brunei	41031826	0.32	41534342	0.36	24057370	0.3	-42.08
Jordan	21974768	0.17	23545576	0.2	21341424	0.27	-9.36
Equatl Guinea	43959177	0.34	67957388	0.59	20383646	0.26	-70.01
China	83538506	0.64	31195013	0.27	19704470	0.25	-36.83
Poland	22273936	0.17	19767781	0.17	18748083	0.24	-5.16

Table-10 (Concl'd)

Country	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
Japan	20832896	0.16	22063842	0.19	18012309	0.23	-18.36
Ecuador	8997367	0.07	17953281	0.16	17501977	0.22	-2.51
Switzerland	28358256	0.22	17365858	0.15	17499548	0.22	0.77
Morocco	18771919	0.14	18282211	0.16	17442769	0.22	-4.59
Azerbaijan	10143298	0.08	19296611	0.17	16747001	0.21	-13.21
Congo P. Rep.	24307910	0.19	39805443	0.35	16347508	0.21	-58.93
France	7484945	0.06	9169172	0.08	15487655	0.2	68.91
Sudan	38311626	0.29	13775715	0.12	15201154	0.19	10.35
Other countries	1148622948	8.84	303770014	2.64	164919954	2.08	-45.71

Source: DGCI&S, Kolkata

Metals & Alloys

The value of imports of metals & alloys at ₹4,35,611 crore showed an increase of 4.53% in 2020-21 as compared to ₹4,16,727 crore in the previous year. The share of metals & alloys in the total value of all merchandise imported to India was about 12.39 % in 2020-21.

Gold, non-monetary & monetary (total), with a share of 58.38% continued to occupy the top position in the total value of imports of metals and alloys in 2020-21. Iron & steel is placed in the second position and accounted for share of 18.97%, copper & alloys including brass & bronze occupied the third place with a share of 7.84% and aluminium & alloys including scrap occupied the fourth place with a share of 6.87%. Next in the order were silver with 1.37% followed by ferro- alloys, Nickel & Alloys incl. scrap and Lead & alloys incl. scrap, with 1.27%, 1.27% and 1.05%. 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 platinum alloys & related metals with 48.52%; precious metals/metalclad with precious metals 992.10%; silicon 35.61%; and gold 27.62% in 2020-21 as compared to that in the previous year. On the other hand, during 2020-21, 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 cobalt alloys & scrap (31.26%), zinc & alloys incl. scrap (25.66%), titanium & alloys (incl waste & Scrap) (26.43%), cadmium (25.12%), (incl.waste & scrap), iron & steel (18.49%), silver (68.89%) and manganese & alloys (incl. waste & scrap) (20.28%).

India imported metals & alloys from various countries in 2020-21. Bulk of the metals and alloys having share of more than 1% of the total value were imported from 19 countries which accounted for 84.9% of the total value of

metals & alloys imported in 2020-21. Switzerland occupied the top position with a share of 27.59% of the total value of metal imports in 2020-21 followed by UAE in second place with a share of 9.44%. The countries next in order were China in third place with a share of 5.81%, South Africa 5.66% followed by USA at the 5th place with share of 4.59% and Republic of Korea at 6th place with 4.4%. The other countries with share more than 2% included Japan (3.72%), Singapore (3.36%), Peru (2.55%), UK (2.54%), Guinea (2.43%) and Hong Kong (2%). The contribution of countries with share less than 2% but more than 1% included Bolivia (1.95%), Australia (1.67%), Malaysia (1.63%), Ghana (1.54%), Germany (1.5%), Thailand (1.34%), and Vietnam (1.18%). The remaining countries are those with a share less than one per cent.

During the year under review, imports in terms of value from Armenia increased manifold by 14577.62% and for many other countries imports value rose up more than 100%, for instance, Guinea (489.73%), Mozambique (141.56%), Singapore (132.40%) and Philippines (131.83%). The other countries which recorded significant positive growth in imports included South Africa (83.43%), Argentina (53.22%), Bolivia (42.30%), Australia (39.61%), Bahrain (38.84%), and Mexico (36.45%), 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 Indonesia (50.10%), UK (33.25%), Saudi Arabia (33.20%), Malaysia (30.71%), Burkina Faso (30.63%), Ghana (27.44%), Dominican Republic (27.38%), Qatar (21.33%), Rep. of Korea (21.56%) and Bhutan (19.19%) Table-11 to 13.

Imports of selected mineral-based products during 2018-19 to 2020-21 are furnished in Table-14. Value of imports of selected mineral-based products at H1,39,200 crore in the year 2020-21 registered an decrease of 9.7% as compared to that of H1,54,150 crore in the previous year.

Table-11: Imports of Metals and Alloys 2018-19 to 2020-21

(Value in ₹'000)

Metals & Alloys	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Metals & Alloys		**	4778433063	**	4167271075	**	4356107118
Aluminium & Alloys Incl. Scrap	tonne	2317632	381662645	2152419	310945506	2060227	299126164
Antimony Alloys & Scrap	tonne	1176	673154	1465	660699	1319	591363
Bismuth & Scrap	tonne	262	192642	192	107726	277	135511
Boron	tonne	++	3316	++	2193	++	1899
Cadmium & Scrap	tonne	8898	1742742	9640	1787948	8249	1338734
Chromium Alloys & Scrap	tonne	1268	1031627	1514	923957	1329	786755
Cobalt Alloys & Scrap: Total	tonne	835	4763695	1294	4216990	802	2898721
Cobalt & Alloys	tonne	832	4760385	1294	4216990	802	2898714
Cobalt & Scrap	tonne	3	3310	--	--	++	7
Copper & Alloys (incl. brass& bronze): Total	tonne	839462	368963437	896848	361304774	744819	341717156
Brass & Bronze	tonne	29944	16093229	23552	12369100	19468	11486251
Brass & Bronze (scrap)	tonne	132409	41057177	144126	39170225	138389	40285631
Copper & Alloys	tonne	597899	287265269	616456	280500278	496358	261483027
Copper (scrap)	tonne	79210	24547762	112714	29265171	90604	28462247
Copper (cement copper precipitated)	tonne	++	5	++	763	39	5489
Ferroalloys : Total	tonne	508006	75734231	483127	63432050	421980	55319083
Ferroboron	tonne	1025	181136	1166	190257	1238	197093
Ferrochrome	tonne	30816	5594082	29999	3893862	39002	4897369
Ferroalloys: charge chrome	tonne	22081	1446124	5654	328099	14004	741433
Ferrocobalt	tonne	--	--	++	1746	++	1402
Ferromanganese	tonne	123110	9695114	95706	6607464	66089	4785976
Ferromolybdenum	tonne	2371	3109993	2531	3120808	2883	3115738
Ferronickel	tonne	88320	24319791	113151	25036565	79737	16875880
Ferroniobium	tonne	3177	6022084	2778	5483410	3026	5857814
Ferrophosphorous	tonne	3589	102217	2577	71363	2006	55172
Ferrosilicon	tonne	221509	20909224	215181	16171706	194439	16370102
Ferrotitanium	tonne	1378	408958	1157	299792	462	109565
Ferrotungsten	tonne	27	65195	4	9250	13	23282
Ferrovanadium	tonne	713	2881355	595	1143397	480	613762
Ferrozirconium	tonne	297	39969	342	41178	374	51237
Ferro-silico-chrome	tonne	29	5221	37	14448	--	--
Ferro-silico-magnesium	tonne	2271	243875	3128	294705	2765	289625
Ferro-silico-manganese	tonne	3135	204718	6172	344396	10497	546336
Ferro alloys (Others)	tonne	4158	505175	2949	379604	4965	787297
Gold (non-monetary & Monetary):Total	kg	982697	2295364965	719905	1992494952	651238	2542884698
Gold-Monetary	kg	--	--	--	--	--	--
Gold-Non-monetary: Total	kg	982697	2295364965	719905	1992494952	651238	2542884698
Gold,non-monetary, Powder	kg	6	17098	++	471	++	51
Semi-manufactured forms	kg	2756	7387110	1981	6047059	1864	7902576
Gold, non-monetary, Other							
Unwrought Forms	kg	979935	2287960757	717924	1986447422	649374	2534982071
Gold-Clad Metal/Base							

Table-11 (Contd.)

(Value in ₹'000)

Metals & Alloys	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Metals Nes	tonne	--	--	++	270	++	1694
Iron & Steel : Total		**	1147881273	**	1013874204	**	826381853
Iron & Steel (finished steel Inc. Cr sheet)	tonne	4246565	377203678	4024286	358688033	3123084	281364644
Iron & Steel (semi-finished steel incl. stl ingo)	tonne	4130608	205456004	3008429	146062138	1848059	97340310
Iron & Steel (steel wire)	tonne	267797	25937468	185193	17301064	151105	15473255
Iron & Steel (sponge iron)	tonne	49063	1000242	65244	1263296	68343	1315159
Iron & Steel (scrap)	tonne	6883781	256694747	6776675	241791670	5393385	213404783
Iron & Steel: alloy Steel (granules)	tonne	23478	1268099	20530	1083770	17284	1015659
Iron & Steel: alloy Steel (powder)	tonne	4664	840713	3661	579712	2596	590464
Iron & Steel (other finished Steel, Nes): Total	tonne	**	226803135	**	202485991	**	187149323
Iron & Steel material	tonne	639652	37058231	527392	31485891	385727	21247947
Iron & Steel (stainless steel)	tonne	97277	15618956	71949	13132633	39876	7480309
Lead and alloys & scrap: Total	tonne	360254	54754915	348747	49923441	314954	45882809
Lead & alloys	tonne	252587	40998160	256132	37990315	245841	36498550
Lead (scrap)	tonne	107667	13756755	92615	11933126	69113	9384259
Magnesium & scrap	tonne	27884	5141748	24680	4508647	25841	4604195
Manganese & Alloys (incl. waste& scrap): Total	tonne	45867	7676642	45195	6188389	37247	4933243
Manganese & Alloys:(wrought & unwrought)	tonne	45839	7674480	44580	5882186	36890	4838565
Manganese & Alloys Nes	tonne	++	993	598	303087	357	94678
Manganese Waste & Scrap	tonne	28	1169	17	3116	--	--
Mercury	tonne	157	704063	130	472838	112	456185
Molybdenum & Scrap	tonne	490	1698725	429	1545908	430	1540722
Nickel & Alloys Incl.	tonne	47223	51678356	48425	55491356	56536	55125443
Scrap: Total							
Nickel & Alloys	tonne	45125	50672255	45294	53854179	53248	53022663
Nickel (scrap)	tonne	2098	1006101	3131	1637177	3288	2102780
Other Rare Metals Nes	tonne	299	1469539	150	464961	212	520361
Pig & Cast Iron Incl. Spiegelisen	tonne	73258	5175323	47749	3618533	36920	3368526
Platinum Alloys & Related Metals	kg	8876	18334593	9299	25809821	10719	38332024
Platinum (Powder, Unwrought& Others)	kg	4859	9548460	4705	10157862	5184	11561645
Other Metals of Platinum Group	kg	4017	8786133	4594	15651959	5535	26770379
Platinum-clad base / Precious Metal	kg	5	14392	6	14483	73	42046
Precious Metals / Metals Clad with Precious Metals	tonne	214	900853	114	482326	328	5267483
Selenium	tonne	374	936735	574	708675	701	681519
Silicon	tonne	64285	8653014	55221	6137456	64800	8323238
Silver	tonne	7472	261886337	5421	191617874	1484	59602766
Silver-clad Base Metal	kg	7503	112775	574	5565	500	7518

Table-11 (Concl'd)

(Value in ₹'000)

Metals & Alloys	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Tantalum & Scrap: Total	tonne	2	139944	1	83353	1	92405
Tantalum Alloys Unwrought	tonne	2	139366	1	83353	1	92405
Tantalum & Scrap	tonne	++	578	--	--	--	--
Tellurium	tonne	5	31337	3	23332	2	21250
Tin & Alloys (Incl. scrap): Total	tonne	11260	15780746	11746	15254405	10797	14848133
Tin Alloys	tonne	10908	15550616	11225	14998805	10382	14585191
Tin & Alloys Worked	tonne	352	229740	521	255514	415	262942
Tin (Scrap)	tonne	++	390	++	86	--	--
Titanium & Alloys (incl. waste & scrap)	tonne	7654	7031701	8347	7448533	8875	5480218
Tungsten and Alloys (incl. scrap)	kg	399205	1726270	385732	1467498	326673	1451447
Zinc and Alloys (incl. scrap)	tonne	278088	56463013	249502	46153989	189197	34313169
Zinc & Alloys	tonne	184251	40200055	173997	34384910	139769	27338160
Zinc (scrap)	tonne	93837	16262958	75505	11769079	49428	6975009
Zirconium & Scrap	tonne	61	108310	40	97660	3	23298

Source: DGCI & S, Kolkata

** Quantity not additive

Table-12: Value of Imports of Metals and Alloys, 2018-19 to 2020-21
(By Principal Metals & Alloys)

Metals & Alloys	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
Grand Total	4778433063	100	4167271075	100	4356107118	100	4.53
Gold (non-monetary & monetary): Total	2295364965	48.04	1992494952	47.81	2542884698	58.38	27.62
Iron & Steel	1147881273	24.02	1013874204	24.33	826381853	18.97	-18.49
Copper & Alloys (incl. brass & bronze)	368963437	7.72	361304774	8.67	341717156	7.84	-5.42
Aluminium and Alloys Incl. Scrap	381662645	7.99	310945506	7.46	299126164	6.87	-3.8
Silver	261886337	5.48	191617874	4.6	59602766	1.37	-68.89
Ferroalloys	75734231	1.58	63432050	1.52	55319083	1.27	-12.79
Nickel and Alloys Incl. Scrap	51678356	1.08	55491356	1.33	55125443	1.27	-0.66
Lead and Alloys Incl. Scrap	54754915	1.15	49923441	1.2	45882809	1.05	-8.09
Zinc and Alloys Incl. Scrap	56463013	1.18	46153989	1.11	34313169	0.79	-25.66
Platinum Alloys & Related Metals	18334593	0.38	25809821	0.62	38332024	0.88	48.52
Tin and Alloys Incl. Scrap	15780746	0.33	15254405	0.37	14848133	0.34	-2.66
Titanium & Alloys (incl. waste & scrap)	7031701	0.15	7448533	0.18	5480218	0.13	-26.43
Manganese & Alloys (incl. waste & scrap)	7676642	0.16	6188389	0.15	4933243	0.11	-20.28
Silicon	8653014	0.18	6137456	0.15	8323238	0.19	35.61
Magnesium & Scrap	5141748	0.11	4508647	0.11	4604195	0.11	2.12
Cobalt & Alloys (incl. waste and scrap)	4763695	0.1	4216990	0.1	2898721	0.07	-31.26

Table-12 (Concl'd)

Metals & Alloys	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
Pig & Cast Iron							
(incl. speigeliessen)	5175323	0.11	3618533	0.09	3368526	0.08	-6.91
Cadmium							
(incl. waste & scrap)	1742742	0.04	1787948	0.04	1338734	0.03	-25.12
Precious Metals / Metals Clad Waste	900853	0.02	482326	0.01	5267483	0.12	992.1
Molybdenum & Scrap	1698725	0.04	1545908	0.04	1540722	0.04	-0.34
Tungsten & Alloys Incl. Scrap	1726270	0.04	1467498	0.04	1451447	0.03	-1.09
Chromium & Alloys	1031627	0.02	923957	0.02	786755	0.02	-14.85
Selenium	936735	0.02	708675	0.02	681519	0.02	-3.83
Other Metals & Alloys	3449477	0.07	1933843	0.05	1899019	0.04	-1.8

Source: DGCI&S, Kolkata.

Table-13: Value of Imports of Metals and Alloys, 2018-19 to 2020-21
(By Principal Countries)

Country	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
All Countries	4778433063	100	4167271075	100	4356107118	100	4.53
Switzerland	1090727139	22.83	1039728485	24.95	1201797774	27.59	15.59
UAE	342508388	7.17	310559135	7.45	411090037	9.44	32.37
China	366989188	7.68	298228269	7.16	253099822	5.81	-15.13
South Africa	128046778	2.68	134464819	3.23	246653484	5.66	83.43
USA	288016621	6.03	234443282	5.63	199853317	4.59	-14.75
Korea, Rep of.	279781273	5.86	244310288	5.86	191626385	4.4	-21.56
Japan	166052260	3.48	177505748	4.26	162204785	3.72	-8.62
Singapore	84318116	1.76	62990591	1.51	146390033	3.36	132.4
Peru	154326614	3.23	101475207	2.44	111217188	2.55	9.6
UK	215555187	4.51	165877334	3.98	110728782	2.54	-33.25
Guinea	21179473	0.44	17919211	0.43	105674630	2.43	489.73
Hong Kong	138065294	2.89	99480092	2.39	87314320	2	-12.23
Bolivia	59668343	1.25	59810123	1.44	85111551	1.95	42.3
Australia	75820391	1.59	52218415	1.25	72900094	1.67	39.61
Malaysia	115338852	2.41	102730921	20.47	71177450	1.63	-30.71
Ghana	213179652	4.46	92620018	2.22	67204084	1.54	-27.44
Germany	74836632	1.57	62665932	1.5	65525774	1.5	4.56
Thailand	69552067	1.46	59629957	1.43	58326516	1.34	-2.19
Vietnam	70683740	1.48	59711979	1.43	51232884	1.18	-14.2
Tanzania	50476251	1.06	44347948	1.06	42337240	0.97	-4.53
Indonesia	57631637	1.21	81912364	1.97	40875240	0.94	-50.1
Russia	40707030	0.85	28529347	0.68	35261589	0.81	23.6
Saudi Arabia	34973760	0.73	49037679	1.18	32755487	0.75	-33.2
Belgium	29391728	0.62	30976136	0.74	32504807	0.75	4.93
Netherlands	47653368	1	38247049	0.92	31735149	0.73	-17.03
Brazil	47147057	0.99	34749039	0.83	29317748	0.67	-15.63
Colombia	27590657	0.58	30839214	0.74	28940987	0.66	-6.16
Italy	31991080	0.67	33425420	0.8	27524684	0.63	-17.65
Burkina Faso	56342242	1.18	35007113	0.84	24285988	0.56	-30.63
Argentina	429646	0.01	15651645	0.38	23981232	0.55	53.22
France	20372206	0.43	19939367	0.48	20627600	0.47	3.45

Table-13 (Concl'd)

Country	2018-19		2019-20		2020-21 (P)		% increase (+) or decrease (-) in 2020-21 over 2019-20
	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	Value (₹'000)	% share in total value	
Taiwan	28076446	0.59	19057272	0.46	19372549	0.44	1.65
Mexico	5782995	0.12	13911135	0.33	18982225	0.44	36.45
Dominican Republic	39177620	0.82	24973191	0.6	18134943	0.42	-27.38
Canada	16741191	0.35	18375709	0.44	17870630	0.41	-2.75
Philippines	8515426	0.18	6076592	0.15	14087147	0.32	131.83
Sweden	16144252	0.34	14422660	0.35	13913307	0.32	-3.53
Norway	8793980	0.18	9349399	0.22	11517093	0.26	23.19
Bahrain	11597364	0.24	8291276	0.2	11511478	0.26	38.84
Kuwait	10578161	0.22	9173989	0.22	9608378	0.22	4.74
Bhutan	11068698	0.23	11487853	0.28	9282769	0.21	-19.19
Spain	9735267	0.2	10644554	0.26	8791657	0.2	-17.41
Mozambique	3126789	0.07	3595268	0.09	8684725	0.2	141.56
Armenia	36077	0	47718	0	7003866	0.16	14577.62
Qatar	13979085	0.29	8805053	0.21	6927078	0.16	-21.33
Other countries	195727042	4.1	190027279	4.56	111142612	2.55	-41.51

Source: DGCI & S, Kolkata

Table-14 : Imports of Selected Mineral-based Products, 2018-19 to 2020-21

(Value in ₹'000)

Mineral-based Product	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
All Item		**	1458643218	**	1541499125	**	1392000442
Aluminium Fluoride	tonne	62374	5607483	40362	3791019	61225	4805867
Asbestos Cement Products	tonne	29358	592294	25008	570692	19306	466845
Asbestos Fibre Products	tonne	4421	3605944	3577	2740754	2309	2750723
Bleaching Powder	tonne	29	4574	17	2780	34	5524
Boric Acid	tonne	6535	284858	4826	210517	6897	313194
Briquets of Coke, Semi-coke of Coal	tonne	1	1440	++	2236	++	222
Calcium Carbide	tonne	45321	2155384	31217	1450665	32665	1774852
Caustic Soda	tonne	208267	7992693	309346	8798197	248057	5549454
Cement : Total	tonne	2261591	9834412	2214478	9003784	2350442	9302473
Cement (others)	tonne	226890	1812971	230950	1922703	291131	2067663
Cement (portland grey)	tonne	1195645	4882591	372431	1757397	393659	1851543
Cement (portland white)	tonne	62643	500255	148098	1115330	174241	1321486
Cement Clinker	tonne	776413	2638595	1462999	4208354	1491411	4061781
Cryolite And Chiolite	tonne	1899	117503	2763	12329	6338	174382
Graphite (artificial)	tonne	68289	6739304	47511	4870675	54327	5422418
Graphite Bricks & Shapes	tonne	9	10434	9408	16170	5430	21390
Graphite Crucibles	tonne	79	10195	1	2573	906	50672
Hydrofluoric Acid	tonne	391	42197	969	89459	2095	177923
Manganese Oxide: Total	tonne	23977	1445934	18239	1325712	25687	1565080
Manganese Dioxide	tonne	9163	892944	10607	963139	12996	1016479
Manganese Oxides (other than Mn Dioxide)	tonne	14814	552990	7632	362573	12691	548601
Petroleum Products: Total*	'000 tonne	33348	1136650000	43788	1257420000	43248	1094300000
Non-Ferrous Ash & Residues	tonne	63481	3951390	24946	2566897	66023	7976670
Other Refractory Manufactures	tonne	19065	4846555	24682	4682877	131311	4122283
Phosphotic Fertilizers	tonne	2559	99988	16	2324	++	51

Table-14 (Concl.)

Mineral-based Product	Unit	2018-19		2019-20		2020-21 (P)	
		Quantity	Value	Quantity	Value	Quantity	Value
Phosphoric Acid	tonne	2773554	147391853	2501094	119766817	2514246	124688967
Phosphorus (elemental)	tonne	40081	7954160	33751	6552640	42551	8199312
Potash Fertilizer	tonne	4576730	86989505	4040268	83239621	5250814	94059271
Potassium Nitrate	tonne	92	11722	208	34447	58	7553
Refractory Bricks	tonne	191664	12911025	409154	14567881	265070	10879704
Silicon Carbide Crucibles	tonne	48	8628	63	20742	386	70638
Slag (dross etc. from iron & steel exc. granu)	tonne	136421	1131820	64674	527863	84962	592855
Soda Ash	tonne	840588	14490003	847704	15251459	719730	11480417
Sodium Nitrate	tonne	350	17376	677	22798	1281	36525
Sodium Nitrite	tonne	18572	812044	16616	631340	11053	434032
Sulphur (sublimed ppt. & collodial): Total	tonne	160	25155	752	42667	862	191861
Sulphur (colloidal)	tonne	60	10960	54	8729	39	8477
Sulphur Precipitated	tonne	27	3908	528	9533	9	1568
Sulphur Sublimed	tonne	73	10287	170	24405	814	181816
Titanium Oxide & Dioxide: Total		14648	2907345	16591	3164130	13514	2579284
Titanium Oxides	tonne	14544	2868634	16416	3082535	13389	2510726
Titanium Oxide (Other than Titanium Dioxides)	tonne	104	38711	175	81655	125	68558

Source: 1) DGCI & S, Kolkata

*Indian Petroleum & Natural Gas Statistics published by Ministry of Petroleum & Natural Gas

** : Quantity not additive

State Reviews

Summary

The mineral production (excluding atomic minerals and minor minerals) in India decreased by 7.8% (as per index of mineral production base year 2011-12) during 2020-21 as compared to the previous year. The complete decrease in production may be attributed to country wide lock-down during the first quarter of the financial year.

Mineral production (Fuel, Metelic, Non-metelic and Minor minerals) was reported from 30 States Union Territories and offshore regions during the year 2020-21. From the State the value of MCDR mineral production was reported at ₹1,57,571 crore. The major part of the value

of MCDR mineral production was confined to six States, namely, Odisha, Rajasthan, Telangana, Chhattisgarh, Andhra Pradesh and Karnataka (Table-1).

The total number of reporting mines (excluding fuel, atomic and minor minerals) at all India level were 1,323 in 2020-21. Out of these, 249 were from Madhya Pradesh, 149 from Odisha, 143 from Gujarat, 141 from Karnataka, 104 from Andhra Pradesh, 100 from Chhattisgarh, 92 from Tamil Nadu and 82 from Rajasthan. Remaining mines were reported from other States (Table-2).

Mineral wise reserves/ resources in the country as on 01.04.2020 are furnished in Table-3.

Table-1: Value* of Mineral Production, 2018-19 to 2020-21
(By States & Union Territories)

(In ₹'000)

State/Union Territory	2018-19	2019-20	2020-21 (P)
India	1491139500	1658778489	1575707702
Andaman & Nicobar Islands	234221	184682	221700
Andhra Pradesh	119550100	166218264	131228966
Arunachal Pradesh	464903	455845	397944
Assam	845538	814755	782482
Bihar	42858862	42983377	42912978
Chhattisgarh	117345916	118108145	154776623
Goa	545679	398896	441540
Gujarat	74901900	76880978	54368018
Haryana	1718901	1718901	1718901
Himachal Pradesh	3224807	3453620	3325467
Jammu & Kashmir	3845383	3710260	1960163
Jharkhand	31593780	32278813	27922626
Karnataka	100319538	100582716	118382249
Kerala	38807569	38835180	38792470
Madhya Pradesh	82555134	147021686	62890259
Maharashtra	59045818	82465290	74737545
Manipur	2866	2866	2866
Meghalaya	3022550	3060355	2748747
Mizoram	16793	16793	16793
Nagaland	1774	1774	1774
Odisha	306536247	343507062	283343864
Punjab	90153	28701	28701
Rajasthan	229732298	257025185	311919094
Sikkim	18787	18787	18787
Tamil Nadu	9821068	9771097	8175780
Telangana	1842645230	149069086	177166582
Tripura	47953	50577	46688
Uttar Pradesh	56988986	57073325	56865787
Uttarakhand	2023524	1649607	2201339
West Bengal	20714222	21391866	18310969

* Excluding the minerals declared as prescribed substances under the Atomic Energy Act, 1962 and Fuel minerals & contribution from Ladakh U.T. for 2019-20 & 2020-21.

Table-2: Number of Reporting Mines*, 2018-19 to 2020-21
(By States)

State	2018-19	2019-20	2020-21 (P)
India	1428	1370	1323
Andhra Pradesh	133	122	104
Assam	3	3	3
Bihar	1	1	1
Chhattisgarh	105	102	100
Goa	48	48	39
Gujarat	200	184	143
Himachal Pradesh	25	26	24
Jammu & Kashmir	22	17	19
Jharkhand	62	54	46
Karnataka	141	148	141
Kerala	8	2	1
Madhya Pradesh	223	223	249
Maharashtra	72	73	71
Meghalaya	21	19	19
Odisha	134	130	149
Rajasthan	84	85	82
Tamil Nadu	104	92	92
Telangana	36	36	36
Uttar Pradesh	2	2	2
Uttarakhand	3	3	2
West Bengal	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 STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total Resources (A+B)				
			STD121	STD122			STD221	STD222							STD331	STD332	STD333	STD334
Andalusite	000 tonnes	0	0	0	0	0	0	0	58040	56210	11800	126050	126050					
Antimony																		
Ore	tonne	0	7503	7503	0	0	0	0	0	10588	0	11180	18683					
Metal	tonne	0	75	75	0	0	0	0	0	174	0	179.92	254.92					
Apatite	tonne	27715	1680	29395	499149	0	0	2281521	11481250	5801338	1017646	21080904	21110299					
Asbestos	tonne	0	0	0	2488022	3113446	4062376.4	100687	2527959	10557777	57800	22908067	22908067					
Bauxite	000 tonnes	560865	70076	646493	268398	128409	316835	526286	843058	2044653	184116	4311754	4958248					
Borax	tonne	0	0	0	0	0	0	0	0	0	74204	74204	74204					
Chromite	000 tonnes	40635	22672	78535	52696	10545	44395	1630	53008	70440	20435	253150	331685					
Cobalt (Ore)	million tonnes	0	0	0	0	0	0	30.63	2	0.28	12	44.91	44.91					
Copper																		
Ore	000 tonnes	128267	20045	15580	83102	111376	41368	135884	340902	778987	5360	1496979	1660870					
Metal	000 tonnes	1664.12	313.64	183.81	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	304601	1524317	29047514	0	30876432	31723991					
Diatomite	000 tonnes	0	0	0	634	0	0	0	0	2251	0	2885	2885					
Emerald	kilogram	0	0	0	0	0	0	0	0	0	55869	55869	55869					
Fluorite	tonne	228393	163860	11988	9340556	771934	768573	1727945	6239589	1578067	161575	20588239	20992480					
Garnet	tonne	8539520.7	50946	5	1835546	1624128	4622014	138905	10226601	28066885	902574	47416654	56007126					
Gold																		
Ore	tonnes	20271400	3420000	36700	4498133	3821500	1741321.2	9658248	109446798	238863938	126476333	494506270	518234370					
Metal	tonnes	79.26	13.44	0.06	16.93	9.11	5.64	22.05	159.41	236.26	65.1	514.5	607.26					
(Placer)	tonnes	0	0	0	0	0	0	0	2552000	23569000	0	26121000	26121000					
Metal	tonnes	0	0	0	0	0	0	0	2.29	3.57	0	5.86	5.86					
(Placer)	tonne	4386467	0	4176944	7964326	3461288	6166401	796464	10679490	31827080	142165128	203060176	211623587					
Graphite	tonne	0	0	0	0	0	0	0	0	0	0	0	0					
Iron Ore	000 tonnes	4559856.5	508158	1141019.5	3181005	2404790.4	2005363.1	1010483.61	1805532	4827512	2614185	17848870	24057905					
(Haematite)	000 tonnes	71930	385	130508	307652	16082	72127	1513168	2036982	6383274	695507	11024791	11227614					
Iron Ore	tonne	393358	331193	122314	1331061	940452.02	1864398.3	561680	3577402	96560462	0	104835455	105682321					
(Magnetite)	000 tonnes	28791	63331	11153	4627	23663	13784	51613	196911	368094	4530	663222	766497					
Lead Metal	000 tonnes	503.7	1188.47	208.02	140.42	534.83	286.02	1117.33	2283.43	660777	0	10969.8	12869.99					
Zinc Metal	000 tonnes	2356.56	4592.03	489.46	448.15	1121.12	599.62	3540.38	5840.74	14080.66	101.65	25732.32	33170.37					

Table-3 (Contd.)

Mineral	Unit	Reserves					Remaining Resources										Total Resources (A+B)
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance		Total (B)			
			STD121	STD122			STD221	STD222				STD334	STD335				
Lead+Zinc Metal	000 tonnes	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	135833401	9579524	208560789	227589259				
Magnesite	000 tonnes	57934	6354	1782	66070	80983	24858	40132	59010	128104	309	393047	459118				
Manganese Ore	000 tonnes	61510	6081	7450	75041	76106	51162	80580	29600	117986	11944	428583	503624				
Marl	tonne	50825000	17210000	110000	68145000	26474477.33	4189000	0	0	390000	0	31053477	99198477				
Molybdenum Ore	tonnes	0	0	0	0	0	1500000	0	2382000	19884394	167800	27203398	27203398				
Contained MoS ₂	tonne	0	0	0	0	0	1050	0	1599.54	12457.39	50.34	16890.56	16890.56				
Nickel Ore	million tonnes	0	0	0	0	0	21	21	31	53	63	0	189				
Perlite	000 tonnes	0	0	0	0	140	683	595	0	0	988	2406	2406				
Platinum Group of Metals	tonnes of metal	0	0	0	0	0	0	0	0	11.66	74	1.86	20.92				
(PGM) contained	million tonnes	0	0	0	0	0	0	0	0	18151	4125	814	23091				
Potash	000 tonnes	0	0	0	0	27129	0	32597	9590	1527356	0	1674401	1674401				
Rare-Earth Elements (REE)	tonne	0	0	0	0	0	0	0	0	430353	26042.49	3332	459727.49				
Rock Phosphate	tonne	27103158	0	3772935	30876093	13669080	29796846	34526541	2879833	186657066	9308275	280377392	311253485				
Rock Salt	000 tonnes	0	3860	0	3860	3360	940	4620	0	0	0	8920	12780				
Ruby	kilogram	0	0	0	0	0	429	3296	0	1623	0	5349	5349				
Sapphire	kilogram	0	0	0	0	0	0	0	0	450	0	450	450				
Sillimanite	tonne	7968444.8	3655	290200	8262300	503301	23406	20549508	4771654	16115664	4411195	64005091	72267391				
Silver Ore	tonne	61604192	67971000	40870828	170446020	2330000	18445543	53914460	41320000	211261729	0	398197732	568643752				
Metal Sulphur (Native)	tonne	2155.3	4981.73	570.04	7707.07	172.2	824.44	663.67	3881.88	12442.92	0	22560.84	30267.91				
Tin	000 tonnes	0	0	0	0	0	0	0	0	210	0	210	210				
Ore	tonne	2075	0	25	2101	22594540	3213	31330134	168457	29063370	0	83720794	83722895				
Metal	tonne	963.19	0	10.8	973.99	33384.66	1116.41	5408946	813.29	13147.46	0	102782.91	103756.9				
Titanium	tonne	15914697	64860	19068	15998625	10928991	91828	0	2610618	344212444	3598565	411108526	427107150				

Table-3 (Concl.)

Mineral	Unit	Reserves			Remaining Resources							Total Resources (A+B)		
		Proved STD111	Probable STD121	STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total (A+B)
Tungsten														
Ore	tonne	0	0	0	0	2230000	0	173063	23276152	23259954	23912049	16581246	89432464	89432464
Contained														
WO ₃	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														
V ₂ O ₅	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

Figures rounded off.

Note: The Proved and Indicated balance recoverable reserves of crude oil and natural gas as on 1.4.2020 in India are 603.36 million tonnes and 1.371.89 billion cu. m, respectively.

Declared as minor mineral vide Gazette Notification dated 10.02.2015.

Minor mineral before Gazette Notification dated 10.02.2015.

Andhra Pradesh



Andhra Pradesh is the sole producer of apatite. The State is the leading producer of barytes, ball clay, dolomite, garnet (abrasive), laterite, limestone, uartz, quartzite, silica sand and vermiculite

The principal minerals produced in the State were Natural Gas (ut.), Petroleum (crude), Manganese Ore, Limestone, Vermiculite etc

104

Mines in the case of MCDR minerals reported production in 2020-21

Mineral Resources

Andhra Pradesh is the sole producer of apatite. The State is the leading producer of barytes, ball clay, dolomite, garnet (abrasive), laterite, limestone, quartz, quartzite, silica sand and vermiculite. It accounts for 92% barytes, 40% calcite, 41% mica, 31% each kyanite & garnet, 19% titanium minerals, 16% bauxite, 15% dolomite, 13% sillimanite and 12% each vermiculite & limestone resources of the country. Andhra Pradesh is endowed with the internationally known black, pink, blue and multicoloured varieties of granites. Krishna-Godavari basin areas in this State have emerged as new promising areas for hydrocarbons, especially natural gas.

Important minerals occurring in Andhra Pradesh are: **apatite** in Visakhapatnam district; **asbestos** in Cuddapah district; **ball clay** in West Godavari district; **barytes** in Anantapur, Cuddapah, Krishna, Kurnool, Nellore & Prakasam districts; **calcite** in Anantapur, Cuddapah, Kurnool & Visakhapatnam districts; **china clay** in

Anantapur, Chittoor, Cuddapah, East Godavari, West Godavari, Guntur, Kurnool, Nellore & Visakhapatnam districts; **coal** in Godavari Valley Coalfield; **corundum** in Anantapur districts; **dolomite** in Anantapur & Kurnool districts; **felspar** in Anantapur, Cuddapah, West Godavari, Nellore & Vizianagaram districts; **fireclay** in Chittoor, Cuddapah, East Godavari, West Godavari, Kurnool & Srikakulam districts; **garnet** in East Godavari, Nellore & Srikakulam districts; **granite** in Anantapur, Chittoor, Cuddapah, Guntur, Krishna, Nellore, Prakasam, Srikakulam & Vizianagaram districts; **iron ore (haematite)** in Anantapur, Cuddapah, Guntur, Krishna, Kurnool & Nellore districts; **iron ore (magnetite)** in Prakasam district; **lead-zinc** in Cuddapah, Guntur & Prakasam districts; **limestone** in Anantapur, Cuddapah, East Godavari, West Godavari, Guntur, Krishna, Kurnool, Nellore, Srikakulam, Visakhapatnam & Vizianagaram districts; **manganese ore** in Srikakulam & Vizianagaram districts; **mica** in Nellore & Visakhapatnam district; **ochre** in Anantapur & Cuddapah, West Godavari, Guntur, Kurnool & Visakhapatnam

districts; **pyrophyllite** in Anantapur, Chittoor & Cuddapah districts; **quartz/silica sand** in Anantapur, Chittoor, Cuddapah, West Godavari, Guntur, Krishna, Kurnool, Nellore, Prakasam, Srikakulam, Visakhapatnam & Vizianagaram districts; **quartzite** in Kurnool, Srikakulam, Visakhapatnam & Vizianagaram districts; **talc/soapstone/steatite** in Anantapur, Chittoor, Cuddapah & Kurnool districts & **vermiculite** in Nellore & Visakhapatnam districts. **Petroleum & natural gas** deposits of importance are located in the onshore and offshore areas of Krishna-Godavari basin of the State.

Other minerals that occur in the State are **bauxite** in East Godavari & Visakhapatnam districts; **chromite** in Krishna district; copper in Guntur, Kurnool & Prakasam districts; **diamond** in Anantapur, Krishna & Kurnool districts; **gold** in Anantapur, Chittoor & Kurnool districts; **graphite** in East Godavari, West Godavari, Srikakulam, Visakhapatnam & Vizianagaram districts; **gypsum** in Guntur, Nellore & Prakasam districts; **kyanite** in Nellore & Prakasam districts; **magnetite** in Cuddapah district; **pyrite** in Kurnool district; **sillimanite** in West Godavari & Srikakulam district; **silver** in Guntur district; **titanium minerals** in East Godavari, Krishna, Nellore, Srikakulam & Visakhapatnam districts; and **tungsten** in East Godavari district (Tables-1 & 2).

Exploration & Development

The details of exploration activities conducted by various agencies for minerals during 2020-21 are furnished in Table - 3.

During 2020-21, National Oil Companies (NOC) continued their operations for exploration of oil and gas in the State.

Production

Many important minerals are produced in Andhra Pradesh. The principal minerals produced in the state were Natural Gas (ut.), Petroleum (crude), Manganese Ore, Limestone, Vermiculite etc. The value of minor minerals' production was estimated at ₹12,120 crore for the year 2020-21. The number of reporting mines in the State was 104 in 2020-21 in case of MCDR minerals (Table-4)

Table-1: Reserves/Resources of Minerals as on 01.04.2020: Andhra Pradesh

Mineral	Unit	Reserves					Remaining Resources					Total Resources (A+B)		
		Proved STD111	Probable STD121	STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	STD222	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334	Total (B)
Apatite	Tonne	27715	-	1680	29395	-	-	-	-	-	200163	-	200163	229558
Asbestos	Tonne	-	-	-	-	684839	39126	16553	-	1541	55936	-	797995	797995
Bauxite	000' Tonnes	-	-	-	-	-	-	-	188971	138120	288176	-	615267	615267
Chromite	000' Tonnes	-	-	-	-	-	-	-	-	-	#	-	#	#
Copper														
Ore	000' Tonnes	-	-	-	-	686	-	105	-	5791	1000	-	7582	7582
Metal	000' Tonnes	-	-	-	-	6.88	-	1.05	-	9745	8.32	-	113.7	113.7
Diamond	Carat	-	-	-	-	-	-	-	200483	1524317	98155	-	1822955	1822955
Garnet	Tonne	-	-	-	-	1196087	237025	1359988	18	8800000	5674011	-	17267129	17267129
Gold														
Ore (Primary)	Tonne	3221400	-	36700	3258100	2485133	1857500	1548115	291000	55000	6236150	-	12472898	15730998
Metal	Tonne	5.24	-	0.06	5.3	11.87	3.99	4.92	1.08	0.17	19.84	-	41.87	47.17
(Primary)														
Graphite	Tonne	-	-	-	-	-	-	1135	0	1122	1136018	-	1138275	1138275
Iron Ore	000' Tonnes	32893	-	11851	44744	42461	68382	66330	377	5863	144374	23085	350872	395616

Table - 1 Contd.

Mineral	Unit	Reserves				Remaining Resources						Total Resources (A+B)		
		Proved STD111	Probable STD121	STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total (A+B)
(Haematite)														
Iron Ore	000' Tonnes	-	-	-	-	114210	-	-	13800	1266666	68527	9180	1472383	1472383
(Magnetite)														
Kyanite	Tonne	-	-	-	-	-	-	399	-	-	32003829	-	32004228	32004228
Lead-Zinc Ore														
Ore	000' Tonnes	-	-	-	-	-	-	-	1000	4159	17530	-	22689	22689
Lead metal	000' Tonnes	-	-	-	-	-	-	-	28.7	119.53	688.65	-	836.88	836.88
Zinc metal	000' Tonnes	-	-	-	-	-	-	-	12.4	43.57	7.19	-	63.16	63.16
Limestone	000' Tonnes	2815170	2133	439387	3256690	1302360	404217	1164592	115264	2129536	18066740	3399422	26582132	29838822
Magnesite	000' Tonnes	-	-	-	-	-	-	-	-	-	80	-	80	80
Manganese Ore	000' Tonnes	6848	1006	234	8088	1000	718	1990	465	10730	6838	15	21756	29844
Pyrite	000' Tonnes	-	-	-	-	-	-	-	-	-	880	-	880	880
Sillimanite	Tonne	1451556	0	218469	1670025	-	11070	462830	-	7430300	1491539	-	9395739	11065764
Silver														
Ore	Tonne	-	-	-	-	-	-	16950000	-	-	-	-	16950000	16950000
Metal	Tonne	-	-	-	-	-	-	128.13	-	-	-	-	128.13	128.13
Titanium	Tonne	-	-	-	-	-	31365	-	-	-	76702509	-	76733874	76733874
Tungsten														
Ore	Tonne	-	-	-	-	-	-	-	3640000	4700800	5952500	509000	14802300	14802300
Contained	Tonne	-	-	-	-	-	-	-	5096	6574.64	8273.65	318.28	20262.57	20262.57
WO ₃														
Vermiculite	Tonne	45305	-	28888	74193	7349	917	5850	9800	5127	88865	-	117908	192101

Figures rounded off

Negligible

Table-2: Reserves/Resources of Coal as on 1.4.2021: Andhra Pradesh

Coalfield	Proved			Indicated			Inferred			Total
	921	901	425	921	901	425	921	901	425	
Total/Godavari Valley	921	901	425	921	901	425	921	901	425	2247

(in million tonnes)

Source: Coal Directory of India, 2010-21.

Table-3: Details of Exploration Activities in Andhra Pradesh, 2020-21

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Manganese Vizianagaram	Jaggarajupeta	1:2000	1.5	9	720	-	Block Preliminary Exploration (G3) for manganese in Jaggarajupeta Block, Vizianagaram District, Andhra Pradesh : Detailed mapping (DM) in an area of 1.5 sq. km on 1:2,000 scale was mapped along with collection of BRS, PCS, PS samples. Geologically, block area is occupied by the garnet-sillimanite gneiss, quartzo feldspathic gneiss and calc-granulite of Khondalite suite later traversed by pegmatite and quartz veins. The kaolinisation, feldspathisation with surface encrustation of manganese along with iron oxides. The trend of the mineralisation varies from N80°W to N60°W in the western part, whereas in eastern part of the block is almost E-W with a dip of 45°-55° towards north. A total of 720 m drilling were done in nine boreholes to check the depth continuity and resource estimation of demarcated manganese mineralisation. Out of nine boreholes (AVJ-1, AVJ-2, AVJ-3, AVJE-1, AVJE-2, AVJE-3, AVJE-4, AVJE-5, AVJE-2A), eight boreholes were drilled at first level, while one borehole (AVJE-2A) was drilled at second level. In borehole AVJE-2, two Mn zones were intersected, from 10.50 to 24.00 m and 33.00 to 51.00 m. In AVJE-1, the Mn zone was recorded at depth from 22.5 to 24.00 m and 36.00 to 39.00 m, in AVJ-1, the Mn zone was intersected from 42.30 to 49.10 m and 58.50 to 85.00 m. In AVJ-2 Mn zone was intersected from 45.10 to 50.10 m and from 63.50 to 64.50 m. In Borehole AVJE-4, the Mn zone was encountered at depth of 50.10 to 58.90m. In AVJE-2A (II level), Mn zone was intersected at a depth of 47.10 to 51.40 m., 110.80 to 118.50 m and 122.40 to 136.00 m with visual estimation of Mn 15-20%.
Srikakulam	Garraju- Cheepurupalli Block	-	1:00	10	720	26	Preliminary exploration for Manganese in Garraju-Cheepurupalli Block, Eastern Ghat Mobile Belt, Srikakulam District, Andhra Pradesh (G3). Detailed Mapping of 1 sq. km area was covered in the FS 2020-21. The area comprises of Khondalite Suite of rocks. The manganese mineralisation is associated with quartzo-feldspathic gneiss and quartzite. Out of 26 bedrock samples, average Mn value of 17 samples more than 10%. About 10 boreholes was were completed with 720 m drilling. A total of 21.3 m thick in ASG-5 and 27 m in ASG-3 manganese zone were observed. In boreholes ASG-1 and ASG-6 Mn mineralisation encountered 11m thick manganese zone. Whereas in ASG-17 and ASG-19 Mn zone was intersected from 39 to 54m and from 30 to 36m respectively.
Vizianagaram	Vommi block,	1:2000	2.00	-	-	-	Preliminary exploration for manganese in Vommi block, Vizianagaram district, Andhra Pradesh (G3): The item was taken up with an objective to assess potential of manganese mineralisation. An area of 2 sq km was covered as a part of detailed mapping on scale of 1:2000. Garnet-sillimanite gneiss is the main lithology exposed in the area whereas calc granulite was also seen as thin bands and as unmappable patches within the khondalite. Dominant foliation trending in NE-SW direction with a variable dip of 45°-55° towards SE was observed. The Mn mineralisation was associated with khondalite and was present at the contact with altered/kaolinised quartzo-feldspathic gneiss. The ore occurred in forms of botryoidal small bands and concentric layers. Under microscope, minerals identified were mainly Psilomelane, Pyrolusite and Manganite, associated with limonite, goethite and quartz as gangues. Disposition of old manganese pits and excavated pits/trenches marked the mineralised zone, which extended for a length up to 1000 m and width, varied from 10-20m. Analytical results of bedrock samples ranged from 0.04- 9.66% MnO and pitting/trenching samples showed MnO range from 0.11 to 9.37%.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Srikakulam	Tilaru-Nimmada	1:12,500	100.00	-	-	235	Reconnaissance survey for manganese mineralisation in Tilaru–Nimmada areas, Srikakulam district, Andhra Pradesh (G4): Large-scale Mapping (LSM) of 100 sq. km area on 1: 12,500 scale was carried out along with collection of 100 BRS, 100 PTS, 5 PCS, 20 PS and 10 ore microscopy samples in the block during the field season 2020-2021. The manganese mineralisation was observed in the form of manganiferous dissemination as thin veinlets and stringent which were associated with kaolinised quartzo–feldspathic gneiss and garnet–sillimanite gneiss. Chinna Bommidi having dimension of 300 m of strike length and 25 m of width in Chinna Bommidi area (MnO: 0.01% to 0.35%) was observed. The observed overburden in this area was 5-10 m. Alteration zone with manganese dissemination and thin veinlets along S1 plane were observed near Kota Bommali having strike length of 300 m and width of 2-10m with overburden of 5-10 m (MnO: 0.04% to 2.37%). In Yetturalapadu, Mn occurrence in the form of thin veinlets along S1 foliation was observed within the garnet– sillimanite gneiss. On the hill 130, observed that the Mn-dissemination and encrustation in the garnet-sillimanite gneiss having dimension of 10 m thick and 300m strike were observed.
Gold							
Chittoor and Kadapa	Araveedu- Shivapuram area	1:12,500	125	-	-	202	Reconnaissance survey for gold and associated mineralization in Araveedu-Shivapuram area, Chittoor and Kadapa districts, Andhra Pradesh (G4): An area of 100 sq km was covered by LSM on 1:12,500 scales with an additional of 25 sq km area where detailed sampling was carried out on the light of encouraging result reported by previous workers near Shivapuram (0.26 g/t Au). Collected 101 bedrock samples, 51 soil samples, 50 nos. of pit/trench samples were collected. Major lithounits exposed in the study area are granite gneiss/migmatite gneiss, amphibolite, quartz-mica schist, BIF, meta-acid volcanics, meta-basalt, monzo/syeno granite, granodiorite and dolerite. Meta-basalt, amphibolite, quartz-mica schist, Banded Iron Formation and meta-acid volcanics represent the Veligallu Schist Belt. Sulphides like pyrite, arsenopyrite and chalcopyrite, oxides and hydroxides like haematite, goethite and magnetite observed within the BIF band, amphibolite, quartz-mica schist and meta-acid volcanics. Out of 202 samples analysed for gold, only 12 were samples with Au more than 50 ppb were reported in and around Shivapuram, Mallayakonda Reserve Forest and Nagireddigaripalle. Highest value of 354 ppb was analysed in one of the trench samples collected near Upparapalle.
Diamond (including area of Tumkur district of Karnataka)*							
Anantapur	Ramagiri- Nutimadugu area	-	740	-	-	163	Reconnaissance survey for primary source rocks for diamond in Ramagiri- Nutimadugu area of Eastern Dharwar Craton, Anantapur district of Andhra Pradesh and Tumkur district of Karnataka (G4): Around 740 sq km area was covered under reconnaissance survey and 163 stream sediment samples were collected from favourable trap sites and processed for heavy mineral separation. The study of stream sediment sample revealed that the present area contains heavy minerals like chromites, spinels, ilmenites, garnets, diopsides, epidotes, amphiboles, zircons, apatites, tourmalines and sulphides. Suspected Kimberlite indicator minerals were separated under stereo-zoom microscope and submitted for EPMA studies to confirm their Kimberlitic affinity. Based on EPMA data and the help of end member recalculation, the area was further divided into two blocks. One area was Nutimadugu in the northern part of the toposheet where magnesian ilmenites were recovered, and another area was Gangampalli, southeastern part of toposheet where both chrome spinel and magnesian ilmenites were recovered. MgO-TiO2 plot suggests that ilmenites recovered from the above two area were of kimberlitic.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Base metal							
Guntur	Vemulurupadu Peddapalalaluru area	1:12500	50	-	-	19	Reconnaissance survey for copper in Vemulurupadu Peddapalalaluru area, Guntur District, Andhra Pradesh (G4): Large-Scale Mapping of 50 sq.km area on 1:12,500 scale was carried out. The main litho-units were garnet sillimanite gneiss and leptynite of Khondalite Suite, pyroxene granulite and charnockite of Charnockite Suite and garnetiferous quartzofeldspathic biotite gneiss (GQFB) of Migmatite Suite belonging to the EGMB. Mineralisation observed as pyrite, chalcopyrite and pyrrhotite within garnetiferous quartzo-feldspathic biotite gneiss, charnockite and sheared quartz vein. Chemical analyses for 19 bedrock samples showed Cu ranging from 0.0095% to 2.62%. Pb values ranged from <10 ppm to 35 ppm, Zn values ranging from 25 ppm to 145 ppm. The highest value recorded for Cu was 2.62% from malachite stained zone associated with pyrite and chalcopyrite grains within quartzofeldspathic biotite gneiss from the wall of abandoned quarry, south of Village Turkapalem.
Nellore	Masayapeta Block	-	-	14	1910	-	Preliminary exploration for copper and associated mineralisation in Masayapeta block, Nellore district, Andhra Pradesh (G3): This Preliminary exploration was taken up in FS 2019-20 & 2020-21, to delineate the mineralised zone by drilling boreholes, and to estimate resources. A total of 1910 m of drilling in 14 boreholes were carried out to intersect/test geological and geophysical anomaly. Three mineralised bands such as, southern, northern and western band have been demarcated with cut off of 0.2% Cu. In Southern band (~250m strike length) major copper zones were intersected in boreholes APMAS-1, APMAS-10, APMAS-19 (2 nd level) and APMAS-16. In northern band (~300m strike length), copper zone was intersected in boreholes APMAS- 4 and APMAS-9 and western band (~100m strike length) copper zones were intersected in Borehole APMAS-11. Ore resource was calculated by cross section method. Total 1.15 million tonnes of Cu ore with 0.53% Cu average grade had been calculated by cross section method at 0.2% cut-off. In LV section, the resource was 0.98 million tonnes with 0.53% average grade of Cu at 0.2% cut-off.
YSR Kadapa	Mittapalle Block	1:2000	1.2	-	-	134	Reconnaissance survey for Lead & Zinc and associated mineralisation in Mittapalle block, YSR Kadapa district, Andhra Pradesh (G3): During FS: 2020-21, G4 stage exploration was taken up in Mittapalle block, Kadapa district, Andhra Pradesh with an objective of resource assessment for Pb, Zn & associated mineralisation. Detailed geological mapping of the Mittapalle block with 1.2 sq. km area was completed on 1:2000 scale. Pb and Zn mineralisation in the area was hosted by dolomite and mineralisation occur as veins, veinlets, stringers, lenses, vug-fillings and disseminations. A total 104 channel samples, 10 PCS, 20 pitting & trenching samples were collected. Ground geophysical surveys (IP and resistivity) were also completed. Three potential mineralised dolomite bands (BAND I, BAND II and BAND III) have been identified in the area. BAND I with a strike length of 900 m had width varying from 8 to 88 m. Strike trending in NNW to SSE had its dip (20°- 55°) towards east. Surface bedrock sampling show weighted average of (Pb+Zn) ranging from 2.33% to 2.56%, wt. avg. of Pb ranging from 50 ppm to 3.8% and wt. avg. for Zn ranging from 175 ppm to 1.80%. BAND II with strike length of 930 m had width varying from 10 to 66m was seen trending in NNW to SSE direction with high to moderate dip (34° to 67°) towards west. Surface bedrock sampling showed weighted average of (Pb+Zn) ranging from 225 ppm to 2.47%, wt. avg. of Pb ranging from 50 ppm to 0.31% and wt. avg. for Zn ranging from 175 ppm to 5.85%. BAND III with an outcrop width varying between 10 and 30 m and trending NNW to SSE direction showed moderate dip (40°-60°) towards west.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
YSR Kadapa	Jaukulapalle block	1:2000	1.0	-	205.45	131	Preliminary exploration for Lead & Zinc and associated mineralisation in Jaukulapalle block, YSR Kadapa district, Andhra Pradesh (G3): A G-3 stage exploration was taken up in Jaukulapalle block, Kadapa district, Andhra Pradesh with an objective of resource assessment for Pb, Zn & associated mineralisation. Detailed geological mapping of the Jaukulapalle block for 1 sq. km area was completed on 1:2000 scale. A total of 60 channel samples, 44 core samples, 7 PCS, 20 pitting & trenching samples were collected. Ground geophysical surveys (16.5 L. km IP & Resistivity 15 L. km) were also carried out in Jaukulapalle block. Detailed mapping brought out two potential mineralised dolomite bands. BAND I with strike length of about 550 m had width varying between 10 and 12 m. Dolomite band was seen trending NNW to SSE and showed low to moderate dip (22° - 40°) towards west. In BAND I, Zn value ranged from 25 ppm to 12.37% with a mean value of 2.94% and Pb values ranges from 5 ppm to 0.50% with a mean value of 0.04%. The (Pb+Zn) values ranged from 35 ppm to 12.47% with a mean value of 2.99%. Old working and old pits of small dimension was also noticed. BAND II trending NNW to SSE showed low to moderate dip (20° - 27°) towards east. It had strike length of 290 m with width ranging from 6 to 30 m. In BAND II, Zn value ranged from 164 ppm to 25.10% with a mean value of 2.69% and Pb values ranged from 65 ppm to 19.67% with a mean value of 0.74%. The (Pb+Zn) values ranged from 342 ppm to 25.44% with a mean value of 3.43%. A total of 205.45 m of drilling target were achieved by 31 st March 2021.
Tungsten							
Anantapur	Balepalyam- Ramagiri area	1:12500 1:2000	100 1.5	- -	- -	75	Reconnaissance survey for tungsten and associated mineralisation in Balepalyam–Ramagiri area, Anantapur district, Andhra Pradesh (G4): Large-scale mapping of 100 sq.km area on 1: 12500 scale and detailed mapping of 1.5 sq. km area on 1:2000 scale, were carried out in Balepalyam–Ramagiri area of Ramagiri–Penakacherla Schist Belt, Anantapur District, Andhra Pradesh. A total of 27 discontinuous quartz–tourmaline veins of 30 to 50 m length and 5 to 30m width within granodiorite gneiss were recorded during detailed mapping. Tiny specks of disseminated scheelite were observed in 8 of these quartz veins. Trenches dug across the strike of these discontinuous veins revealed that these veins seen to continue at depth. Chemical analysis of 76 channel samples collected across the veins revealed tungsten (W) values varying from 5.04 ppm to 1,868.09 ppm with an average of 155.75 ppm. Among the 27 quartz–tourmaline veins, four veins of 5–30 m thickness and 30–50m length, yielded tungsten values of more than 500 ppm. Based on these values, a mineralised zone of 300 m by 150 m was delineated 2.5 km south-east of Balepalyam. Trench samples collected from this mineralised zone showed across promising tungsten, bearing veins and yielded W values between 7.14 and 22.32 ppm. Apart from the tungsten values, promising values of tin (Sn) was also observed, varying from 5.12 ppm to 442.35 ppm, in soil samples collected from the demarcated mineralised zone. Additionally, Molybdenum (Mo) and Copper (Cu) values, recorded from different quartz veins throughout the LSM area, were observed to be varying from 1 to 32.39 ppm and 1 ppm to 0.5% respectively.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Chittoor	Bisanattam- Gudipalli- Sanganapalli	-	-	-	-	53	Reconnaissance survey for molybdenum and associated mineralisation in Bisanattam–Gudipalli–Sanganapalli area of Chittoor district, Andhra Pradesh (G4): Delineation potential zones and possible occurrences for molybdenum and associated mineralisation in southern part of Kolar Schist Belt (KSB) and granitoids (PGC II) of Eastern Dharwar Craton is to be carried out. Chemical results (received so far) of 1 BRS and 2 Trench samples, collected from suspected mineralised zone near Avulatippanapalli showed anomalous Au values of 2.89 ppm, 1.26 ppm and 3.41 ppm respectively. Chemical results of Mo received for 10 soil samples and 40 BRS samples till date had values ranging from 1.82 ppm to 5.35 ppm for soil samples and a maximum of 188.46 ppm for BRS sample. An anomalous value of Cu of 1,519 ppm was recorded from a blue–grey quartz vein near Athinattam.
Kadapa	Mangampeta	-	100	-	-	-	Reconnaissance Survey for Barytes in the southern extension of the Mangampeta Baryte Deposit, Kadapa District, Andhra Pradesh (G4): Large- scale Mapping of an area of 100 sq. km was carried out for baryte investigation in the southern extension of Mangampeta baryte mine, Kadapa district, Andhra Pradesh. The area comprised rocks of Cumbum Formation of Nallamalai Group. Outcrop of sulphide (pyrite and chalcopyrite) bearing quartzite of about 500 m strike length and 15-20m width was exposed near eastern flank of Ballireddypalli hill. Analytical result of bedrock samples showed Ba value ranging from 95 to 5,485 ppm with an average of 903.85 ppm. Trenches dug near Ballireddypalli showed Ba values ranging from 377 ppm to 662 ppm with an average of 529 ppm.
Manganese Ore							
Department of Mines & Geology, Andhra Pradesh							
Vizianagaram	Sadanandapuram, Gurla mandal & Chinnabantupalli, Merakamudim mandal	-	-	-	-	-	In Vizianagaram district, G3 level exploration was carried out in Sadanandapuram village, Gurla mandal and Chinnabantupalli village, Merakamudim mandal covering an area of 36 hect ares and 45 hect ares respectively by geological mapping, gravity and magnetic surveys. In Sadanandapuram area, 10 boreholes were drilled to a depth of 677.00 m whereas in Chinnabantupalli area, 12 boreholes were drilled to a depth of 831.00 m. The sampling in both areas were in progress. Reconnaissance survey for manganese was taken up in villages of Batuva, Mandiravalasa (Garividi mandal), Nimmalavalasa (Cheepurupalli Mandal) and Peddalingalavasala (Laveru Mandal) and magnetic and gravity survey covered 243 ha, 300 ha, 445 ha and 472 ha, respectively. In Batuva area, 243 ha, were covered by magnetic & gravity survey and 8 boreholes were drilled to a depth of 542 m; in Mandiravalasa area, 300 ha were covered by magnetic & gravity survey and 8 boreholes were drilled to a depth of 540 m; in Nimmalavalasa area, 445 ha was covered by magnetic and gravity survey and 10 boreholes were drilled to a depth of 309 m; in Peddalingalavasala area, 472 ha were covered by magnetic & gravity survey.

Table-3 (Concl.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
MECL Diamond							In Andhra Pradesh, a G4 stage survey for Kimberlite Clan of Rocks (KCR) was carried out with an objective to demarcate the Kimberlite clan diamond-bearing formation, collect stream sediments samples, estimate resources, etc. in Kalyandurg–Timmasumudram block, Anantpur district. An area of 1,172.00 sq.km was mapped on of 1:12500 scale and a total of 44 samples including 40 stream sediments samples were collected.
Anantpur	Kalyandurg- Timmasumudram block	1:12500	1172	-	-	-	
Department of Mines & Geology, Andhra Pradesh							-
Limestone							-
YSR Kadapa	Bhima- gundam block Peddamudium	-	6.979	34	749.00	505	-
	Gundlakunta	-	12.58	68	2825.00	2713	-
	Dommar- nandhyala block, Mylavaram	-	20.1	101	5409.00	5070	-
	Devaudi block, Jammalamadugu	-	17.19	100	4085.50	3491	-
Guntur	Madinapadu block. Dachepalli	-	6.60	38	2328.00	2355	-
	Mutyalampad- utangeda block, Dachepalli	-	4.80	28	2034.00	2015	-
	Tageda block, Dachepalli	-	7.16	39	2850.00	2993	-
	Ramapuram block, Dachepalli	-	4.07	23	1693.00	1758	-

Table-4: Mineral Production in Andhra Pradesh, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value\$	No. of mines	Quantity	Value\$	No. of mines	Quantity	Value\$
All Minerals		133		119550100	122		166218264	104		131228966
Natural Gas (ut.)	m c m	-	1081	-	-	912	-	-	827	-
Petroleum (crude)	'000t	-	296	-	-	243	-	-	195	-
Gold *	kg	1	-	-	1	-	-	1	-	-
Iron Ore	'000t	16	654	402616	18	825	613393	12	360	275300
Manganese Ore	t	28	293679	1039486	27	330530	1059109	22	250255	987075
Garnet (abrasive)	t	2	72521	1068152	-	-	-	-	-	-
Sillimanite %	t	-	31243	288810	-	-	-	-	-	-
Limestone	'000t	82	48295	10227864	72	42532	9267248	68	41148	8766490
Vermiculite	t	4	2286	1372	4	2190	1414	1	750	469
Minor Minerals		-	-	106521800	-	-	155277100	-	-	121199632

Note : The number of mines excludes Fuel and Minor minerals.

\$ Excludes the value of Fuel minerals.

* Only labour reported.

% Associated with Garnet (abrasive).

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 provided in Table-5.

Table-5: Principal Mineral-based Industries

Industry/plant	Capacity (‘000 tpy)
Asbestos/Cement sheets	
Hyderabad Industries Ltd, Ibrahimpatnam, Distt Krishna	3000
Ramco Industries, Ibrahimpatnam, Distt Krishna	NA
Cement	
ACC Ltd, (formerly, Encore cement), Vishakhapatnam (G)	300
Andhra Cements Ltd, (Visaka Cement Works), Durga Nagar, Distt Visakhapatnam (G)	540
Andhra Cements Ltd, Durga Cement Works, Dachepalli, Distt Guntur	2310
Anjani Portland Cement Ltd, Chintalapalem, Mellacheruvu	1925
Bharthi Cement Corp. Pvt. Ltd, Nallingayapalli, Distt Cuddapha	5000
Bhavya Cement, Thangeda, Distt Guntur	1400
BMM Cement Ltd, Gudipadu, Yediki	950
Dalmia Cement (Bharat) Ltd, Cuddapha	4060
Deccan Cement Ltd, Ravipahad, Nareducherla	1800
Deccan Cement Ltd, Ravipahad, Palakeedu Nalgonda	1800
Greygold Cement Ltd, Hyderabad	91
Himadri Cement Ltd, Vedadri, Jaggyapet	247.5
India Cements Ltd, Chilamkur, Distt Cuddapha	1460
India Cements Ltd, Malkapur, Tandur	2900
India Cements Ltd, Vishnupuram Work, Wadapally, Mariyalaguda	3500
India Cements Ltd, Yeraguntla, Distt Cuddapha	1000
My home Industries Pvt. Ltd, Mellacheruvu, Nalgonda	3200
UltraTech Cements Ltd, Jaypee Balaji Cement, Budawada, Distt Krishna	5000
JSW Cement Ltd, Nandyal, Distt Kurnool	4800
JSW Cement Ltd, Bilakalagudur, Gadivemula	4800
KCP Ltd, Macherla, Distt Guntur	825
KCP Ltd, Muktyala, Distt Krishna	1860
KCP Ltd, Muktyala, Jaggayyapeta Unit II	3520
Kakatiya Cement Sugar and Industries Ltd, Dondapadu, Melacheruvu	297
My Home Cement Industries Ltd, Mulakapalli, Distt Visakhapatnam (G).	2000
NCL Industries Ltd, Kondapalli, Distt Krishna (G).	990

Contd.

Table-5 (Contd.)

Industry/plant	Capacity (’000 tpy)
Orient Cement Ltd,Devapur, Kasipet.	5000
Panyam Cements & Mineral Industries Ltd, Cement Nagar, Distt Kurnool.	1000
Parashakti Cement, Jettipalem, Distt Guntur.,	1260
Penna Cement Industries Ltd, Talaricheruvu,, Tadipatri, Distt Anantapur.	2200
Penna Cement Industries Ltd, Boyareddypalli, Distt Anantapur.	2000
Penna Cement Industries Ltd, Ganeshpahad Damarcherla	1200
Prism Cement Ltd, Kotapadu, Kolimigundla.	4800
Rain Commodities Ltd, (Rain Cements), Boincheruvupalli, Peapully, Distt Kurnool	2770
Rain Cements, Ltd, Ramapuram, Mellacheruvu	1500
Ramco Cement Ltd, (formerly, Madras Cements), Jayantipuram, K.S. Rajanagar, Distt Krishna.	3650
Ramco Cement Ltd, Vizag Grinding Unit, Distt Visakhapatnam.	950
Shree Jayajothi (Subs. of Myhome Cement Ind.) Yanakandala, Distt Kurnool.	3200
Shri Chakra Cements Ltd, Alamada, Distt Vizianagaram (G).	260
Shri Chakra Cements Ltd, Narsimhapuri, Distt Guntur.	310
Sagar Cements Bayyavaram, Distt Visakhapatnam (G)	200
Sagar Cements, Mattampally	2350
Sagar Cement Ltd, BMM Cement Anantapur, UltraTech Cements Ltd, (APCW), Tadipatri, Distt Anantapur.	1000 9000
Zuari Cement, Krishnanagar, Yerranguntala, Distt Cuddapha.	3800
Zuari Cement, Ltd, Sitapuram Dondapadu Mellacheruvu	1200
Chemical	
Andhra Sugars Ltd, Saggonda, Distt West Godavari.	400 TPD (caustic soda) 99 (H ₂ SO ₄)
Shree Rayalseema Alkalies & Allied Chem. Ltd, Gondiparla,	156.95 (Total) 24.7 (HCl) 23.1 (KOH)
Shree Rayalseema High Distt Kurnool.	14.85 (bleaching powder) 15 (Oleum)
Ceramic	
Sentini Ceramica Pvt. Ltd, Kanukollu, Distt Krishna (JV with H R Johnson (I) Ltd)	58 mill. sq.m
Spartek Ceramics India Ltd, Narsingapuram, Distt Chittoor.	NA
Kajaria Ceramics Ltd, Vijayawada.	2.9 (mill. sq m)
Electrode	
Indus Elctrode Gundlapalli,	0.9

Contd.

Table-5 (Contd.)

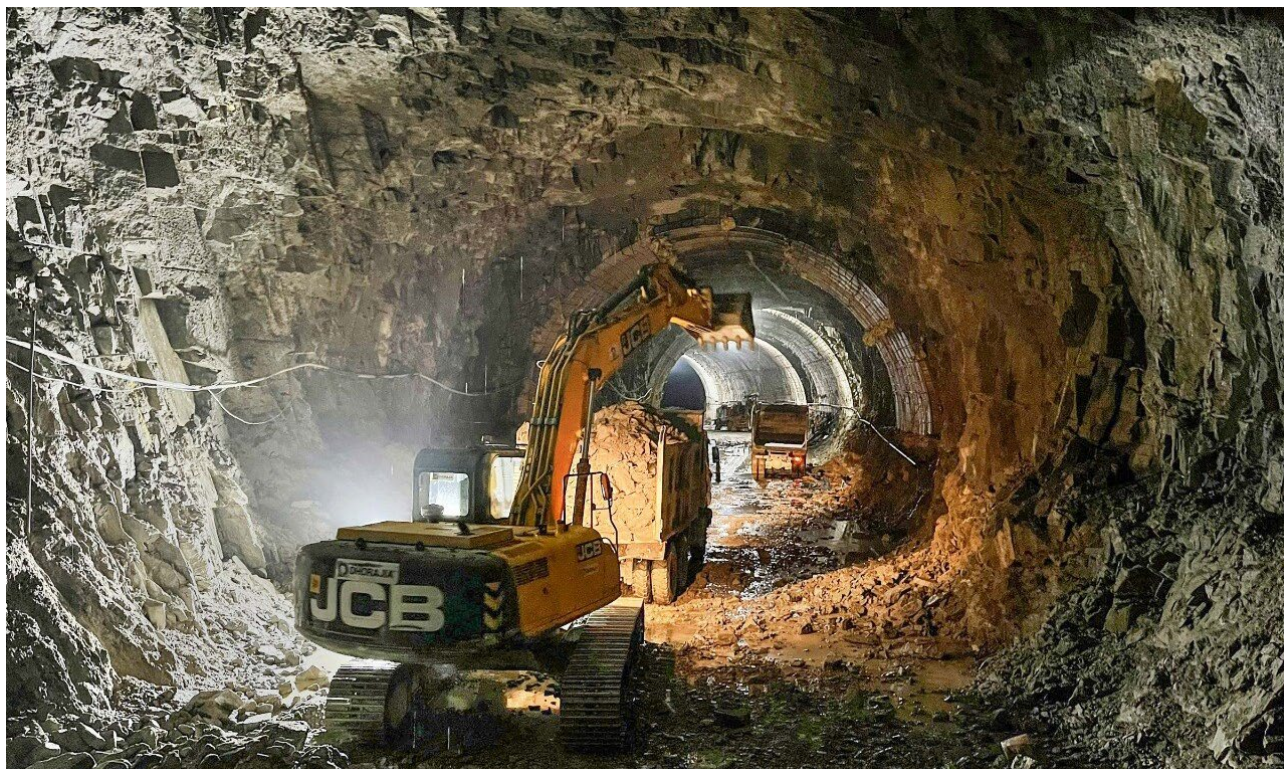
Industry/plant	Capacity ('000 tpy)
Maddiapdumandal.	
Magnarc Elcetrodes Pvt. Ltd, Pendurthy.	1.8
Fertilizer	
Agri Green Fertilizers & Chemicals Pvt. Ltd, Cuddapah.	30 (SSP)
Bhaskar Fertiliser (P) Ltd, Anantapur	45 (SSP)
Coromandel International Ltd, Visakhapatnam.	1300 (NP/NPKs)
Coromandel International Ltd, Kakinada, Distt East Godavari.	1925 (DAP)
GDS Chemicals & Fert. Pvt. Ltd, Anakapalli, Visakhapatnam	36 (SSP)
K. P. R. Fertilizers Ltd, Biccavolu, E. Godavari	11300 (SSP)
Krishna Industrial Corpn. Ltd, Nidadavole, Distt West Godavari.	45 (SSP) 33.5 (H ₂ SO ₄)
Nagarjuna Fertilizers & Chemicals Ltd, Kakinada, Distt East Godavari (Unit I & II)	1500 (Urea)
NG Fertilizers & Chemicals Pvt. Ltd, Kodurupadu, Distt Krishna	200 (SSP)
Prathyusha Chems and Fertilisers Ltd, Parwada, Visakhapatnam	100 (SSP)
Subhodaya Chemicals Ltd, Gauripatnam, Distt West Godavari	42.9 (SSP)
Pesticides	
Jayalakshmi Fertilizers, Tanuku, Distt West Godavari	2000
Glass	
Triveni Glass Ltd, Kondagudem, Distt West Godavari	10 (mill. sq. m)
Iron & Steel	
Visakhapatnam Steel Plant, Visakhapatnam	8856 (sinter) 3400 (pig iron)
Sponge Iron	
Amoda Iron and Steel Pvt. Ltd, Jayanthipuram, Jaggayyapet Mandal, Aggayyapet	60
Apple Industries Ltd, Dhiral, Anantapur	150
Maa Mahamaya Industries Ltd, Vizianagaram	112
Pushpit Steel Pvt. Ltd, Merlapaka, Yerpandu, Chittoor	86.4
SLV Steels and alloys Pvt. Ltd, Anantapur	60
Sri Sai Sindhu Industries Ltd, Tadpatri	52.5
Steel exchange India Ltd,	250

Table-5 (Concl.)

Industry/plant	Capacity (’000 tpy)
Srirampuram,Visakhapatnam	
Sree Rayalseema Green Steloy Ltd,	36
Gooty, Distt Anantapur	
Pig Iron	
Rishrtriya Ispat Nigam Ltd, Vishakhapatanam,	6300
Andhra Pradesh	
Sathavahana Ispat Ltd, Haresamudram,	210
Distt Anantapur	
Pellets	
Essar Steel Ltd, Visakhapatnam	8000
Ferroalloys	
Berry Alloys Ltd, Kothavalasa,	40 (Fe-Mn)
Distt Vizianagaram	32 (Si-Mn)
Deccan Ferro alloys (P) Ltd, Pendurthi,	30 (Si-Mn)
Visakhapatnam	10(Fe-Mn)
facor Alloys Ltd, Shreeramnagar,	90.3
Distt Vizianagaram	
Jindal Stainless (Hisar) Ltd,	40
Kothavalasa, Distt Vizianagaram	
Maithan Alloy Ltd,	120
Atchutapuram	
Hira Elector Smelters Ltd,	NA
Bobbili, Distt Vizianagaram	
Nava Bharat Ventures Ltd,	125
Paloncha	
Rhodium Ferro-alloy Pvt. Ltd,	8
Gollapuram	
Siri Smelters & Energy Pvt. Ltd,	8.5
Bobbili	
Petroleum Refinery	
HPCL, Vizag	8300
ONGC, Tatipaka, Distt East Godavari	66

Note: Data, not readily available for fertilizer and cement Industries on respective website, is taken from Indian Fertilizer Scenario, FAI Statistics, and Survey of Cement Industry & Directory, respectively.

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

Creore, 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 REE, copper, gold and vanadium during the year 2020-21 are furnished in Table-3.

Production

Petroleum (crude) and Natural gas (ut.) were the important minerals produced in Arunachal Pradesh. The value of minor minerals' production was estimated at ₹40 crore for the year 2020-21 (Table - 4).

Table-1: Reserves/Resources of Minerals as on 1.4.2020: Arunachal Pradesh

Mineral	Unit	Total Reserves (A)	Remaining resources				Total resources (A+B)
			Indicated	Inferred	Reconnaissance	Total	
			STD332	STD333	STD334	(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 1.4.2021: 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, 2020-21.

Table-3: Details of Exploration Activities in Arunachal Pradesh, 2020-21

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Rare Earth Element (REE) and rare metal							
Papum Pare	Lodoso East block,	1:2000	-	-	-	40	Preliminary Exploration for REE and associated precious and base metal in Lodoso East Block, Papum Pare District, Arunachal Pradesh (G3): Detailed geological mapping was carried out on 1:2000 scale with an objective to delineate REE-bearing zones. A mineralised zone 1000 m in strike length with 30m to 40m outcrop thickness was delineated. The zone was confined within Garnetiferous-quartz-biotite schist of Khetabari Formation. The samples collected from the respective zone yielded max 3.0% REE as a channel sample, 4,808 ppm value of REE with wt. Avg. value of about 2,385 ppm from a 10 m long trench sample, 1.3% max. value of REE with wt. Avg. value of about 0.69% from a 05 m long trench sample. About 23 pit samples out of 40 samples collected from the area yielded TREE values >0.2% with maximum of 2.0% TREE. Apart from REEs, encouraging values of Copper up to 2,790 ppm (max.) and Au value of 280 ppb (max.) were also reported. All the samples from mineralised zone yielded high Fe2O3% ranging from 32 to 82% along with anomalous P2O5% (up to 1.56%). REE-bearing mineral phases like monazite, allanite, xenotime, zircon, thorite, scheelite and euxenite were identified in EPMA analysis. Peaks of elements viz. lanthanum, cerium, neodymium, dysprosium, yttrium, tungsten, tantalum, antimony, lead, silver & tin were also identified during scanning electron microscopy (SEM) studies.
Graphite							
West Kameng	Kalaktang- Amatulla	1:12500	50	-	-	-	Reconnaissance survey for graphite and vanadium mineralisation in Kalaktang-Amatulla area, West Kameng district, Arunachal Pradesh (G4) was carried out. A total of 50 sq. km were covered by large-scale mapping on 1:12500 scale. Near Village Paljor, a 50-60 m thick band of carbonaceous shale alternating with siliceous sandstone was mapped with steep dips on either sides. Near 900 chain PWD Camp, a 180-200 m thick band of interbanded dark grey phyllite and carb phyllite was mapped for a strike length of about 1.5 km. The available chemical results did not show promising values of vanadium, graphite and base metals but the silica values obtained from quartzite sample were >90%.

Table-3 (Contd.)

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
West Siang	Kalamati area	1:2000	-	-	-	-	Reconnaissance survey for graphite and vanadium mineralisation in Kalamati area, West Siang district, Arunachal Pradesh (G4) was taken up. On the basis of detailed mapping on 1:2000 scale, a carbonaceous phyllite band was identified and delineated with variable exposure thickness of 250 to 370 m having strike extension up to 700 m in Kalamati area and one carbonaceous phyllite band with exposure thickness of about 7 m having 170 m strike length in Yomgam area. Samples from carbonaceous phyllite of Kalamati area showed vanadium values up to 3,105 ppm with Fixed Carbon up to 8.6 %. Analytical results showed Zn values up to 3,017 ppm and Ni up to 788 ppm. The carbonaceous phyllite showed a positive correlation with vanadium, which increased with the increase of Fe ₂ O ₃ . Similarly, Zn also showed a positive correlation in the carbonaceous phyllite.
Subansiri	Radhpu block	-	-	-	-	-	Preliminary exploration for graphite and vanadium mineralisation in Radhpu block, Lower Subansiri district, Arunachal Pradesh (G3) was taken up. A cumulative strike length of 3,300 m of carbonaceous phyllite bands was demarcated having a variable thickness ranging between 5 m and 25 m. The western carb phyllite extending for 850 m was delineated having variable thickness of 8 m to 25 m. The eastern carb phyllite band with a cumulative strike length of 2,450 m was delineated having variable thickness between 5 m and 15 m. Carbonaceous phyllite was characterised by high carbon content ranging from 4.39% to 16.69% and vanadium value ranging from 525 ppm to 2,820 ppm. The vanadium mineralisation in the area was considered as strata bound bedded deposit.
Gold							
West Siang	Siyom Valley	1:12500	50	-	-	-	Reconnaissance survey for Orogenic Gold mineralisation in Siyom Valley, West Siang District, Arunachal Pradesh, with aid of large-scale mapping (1:12500 scale) over an area of 50 sq. km. Two bands of sulphide mineralisation along quartz veins within the gneisses was delineated in the area. Band-I was about 200–300 meters in strike length with a thickness of 20-30 meters. Band-II was 10-20 m with strike extension of approximately 100 m. The quartz veins running parallel to the S1foliation were sulphide enriched with mineralisation in the form of pyrite, chalcopyrite and arsenopyrite. Chemical results showed tungsten value ranging from 303–511 ppm. The values for LREE ranged from 28–136.9 ppm and HREE ranged from 10.5–20 ppm. TREE ranged from 39–155 ppm. However, chemical analysis did not show encouraging values for gold as values were in range from 50– 112 ppb.
West Siang	Siyom Valley	1:12500	50	-	-	-	Reconnaissance survey for orogenic Gold mineralisation in upper reaches of Siyom valley, West Siang district, Arunachal Pradesh: A Large-scale Mapping (1:12500) was carried out for an area of 50 sq. km. The garnetiferous mica schist exposed towards Manigong as well as Village Tadadege was generally oxidised imparting yellowish-orange colour to the surface. Marble was recorded with unmappable unit of graphitic schist body towards South of village Shiet which was found to be oxidised. A 25–30m thick banded magnetite quartzite was also recorded in the area. Samples of magnetite band yielded 27.71% to 52.21% of Fe ₂ O ₃ and samples from garnetiferous mica schist yielded tungsten values ranging from 135.26 to 521.21 ppm.

Table-3 (Contd.)

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Lower Subansiri	Phop area	1:2000	1	-	1000	-	Preliminary exploration for gold, molybdenum, vanadium and associated minerals in Phop area, Lower Subansiri district, Arunachal Pradesh was taken up with detailed mapping of 1 sq. km area on 1:2000 scale along with 1000 m drilling. The area was seen covered by meta-sedimentary rocks of Khetabari Formation of Bomdila Group. Late granitic, quartz and calcite veins were observed to have intruded in the rocks. Limonitisation and ferruginisation have commonly occurred along these veins, developed as a result of weathering of sulphides. Sulphides, mainly pyrite and pyrrhotite, in disseminated form were also observed in marble bands and grey quartzite. Banded magnetite quartzite along with bands of carbonaceous phyllite were studied for possible gold and vanadium-molybdenum mineralisation respectively. Banded magnetite quartzite in the study area extended for about 400 m along NE-SW strike with thickness up to 17 m. Four carbonaceous phyllite bands were also delineated in the area.
Copper, Molybdenum, and associated minerals							
Dibang Valley	Angolin- Etalin area	1:12500	-	-	-	-	Reconnaissance Survey for copper, molybdenum and associated minerals was carried out in Angolin-Etalin area, Dibang Valley district, Arunachal Pradesh (G4): LSM of a 50 sq km block on 1:12500 scale was carried out. Direct surface manifestation of copper, molybdenum mineralisation was evidenced from the malachite staining and direct visual perception of molybdenite crystals in the form of veins within the pegmatites, quartz veins within the calc-silicate rock found at contact of granodiorite and amphibolite. Presence of sulphides was also seen in some parts of the amphibolites also. Chemical analyses of samples were awaited for the detailed geochemical study. One out of the received sample results had value of copper of 7,722 ppm.
Copper, Gold, Silver, and associated minerals							
Papum Pare	Khyate- Parang area	1:12500	50	-	-	-	Reconnaissance survey for copper, gold, silver and associated minerals was carried out in the meta-sedimentary sequence of Bomdila Group in Khyate-Parang Area, Papum Pare District, Arunachal Pradesh (G4): LSM of 50 sq km on 1:12500 scale along with pitting/trenching and other sampling was carried out. Two sulphide-bearing mineralised zones were delineated in the area. These zones were located south of Khyate, along the Gotopu-Khyate section. The zones extended for about 20-50 m each along the strike continuity and were discontinuous in nature. Sulphide mineralised zone, SZ-I strikes NE-SW over a width of about 30 m. The host rock in this zone was siliceous phyllite with bands of chlorite-amphibole schist. One 3 m thick band of chlorite-amphibole schist on the southern end of the zone host the main mineralisation. SZ-II had a strike of NE-SW and appeared as lensoidal body with a width of 5 m. The outcrop was highly limonitised and ferruginised. Mineralisation was seen hosted within the amphibole schist and quartz vein. The quartz vein 1-1.5 m wide. In the SZI, 2 trenches and channel each were made. Cu values ranged from 10 ppm to 445 ppm in Trench no. 1 and 30 ppm to 150 ppm in Trench no. 2. Channel no.1A yielded 35 to 275 ppm Cu. In SZ-II, one trench and channel each were made which sampled 25 to 175 ppm Cu from the trench samples and 2,500 to 1,1000 ppm Cu, 170 to 1,300 ppm Zn from the channel samples. One BRS sample from the sulphide-rich quartz vein from this zone also yielded 15,000 ppm Cu. The amphibolite rocks sampled from channel samples yielded 16.04 % to 49.01% of Fe ₂ O ₃ .

Table-3 (Contd.)

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Base metal, Graphite and associated minerals							
Dibang valley	Anelih- Endolin area	1:12500	50	-	-	-	Reconnaissance survey for base metal, graphite and associated minerals in Isholin–Anelih–Endolin area, Dibang Valley District, Arunachal Pradesh (G4): LSM on 1:12500 scale was carried out for 50 sq km in the study area. The litho-package in the mapped area consisted mainly Tiding Formation and Lohit Granitoids complex. The chemical analysis of bedrock samples of graphitic marble showed presence of CaO ranging from 50.5 to 55.04 % and fixed carbon up to 27.62%. The chemical analysis of bedrock samples of hornblende schist showed presence of Cr, ranging up to 1,699 ppm. The samples from a channel cut across the litho-package of carbonaceous phyllite, amphibole-bearing chlorite schist and graphitic marble has showed Cr value at 2,864 ppm and Ni values at 1,285 ppm. The Au concentration for the samples in the area ranged from 100 –180 ppb. Also, one PCS sample yielded Cu value of 12,985 ppm. The chemical analysis of stream sediment samples showed presence of Au ranging from 50–220 ppb. The chemical analysis of trench samples showed presence of Cr ranging from 1,317–2,027 ppm, Zn value of 900 ppm and Cu values up to 740 ppm with an anomalous value of 11,439 ppm for Cu in Bedrock samples.
REE and associated precious and base metals							
Papum Pare	Lodoso East Block	1:2000	01	-	-	-	Preliminary Exploration for REE and associated precious and base metal in Lodoso East Block, Papum Pare District, Arunachal Pradesh (G3): The work component included detail mapping of 01 sq km area on 1:2000 scale with 1000 m of drilling, 100 cu. m of pitting/trenching, collection of 50 BTS, 10 OM, 30 SS and 10 A samples for EMPA analysis to evaluate the occurrences and potential of REE and associated base metal mineralisation in the area. Gossanous zone was the first indication of major mineralised body present in heavily forested areas of the block. Prominent sponge style iron dominant limonitic gossan was a part of surface expression of high sulphidation system present within the garnetiferous biotite quartz schist of Bomdila Group. The particular mineralised zone, approximately 1,000 m in strike length with outcrop thickness of about 30 m to 40 m was observed and mapped accordingly. It was composed of mixture of goethite, magnetite and haematite along with different oxides. Dendritic-shaped native copper, magnetite, brochantite and pyrite were some of the ore minerals present and observed in the respective zone of interest. The samples collected from the respective mineralised zone yielded max. 3% tREE as a channel sample, 4,808 ppm value of tREE with avg. value of about 2,385 ppm from trench sample, Cu value of 1,620 ppm, Au value of 120 ppb from spot samples.

Table-3 (Concl.)

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Vandium and associated minerals Subansiri	Saiya area	1:2000	01	-	-	-	Preliminary exploration for vanadium and associated minerals around Saiya area, Lower Subansiri District, Arunachal Pradesh (G3): The work component under the investigation included detailed mapping of 1 sq km area on 1:2000 scale with 50 m ³ of pitting/trenching. In the DM block, vanadium mineralisation and fixed carbon values were seen hosted in carbonaceous phyllite/schist bands, and accordingly, they were mapped and sampled. A cumulative strike length of 2,650 m of carbonaceous phyllite bands was confirmed having a variable thickness ranging from 20–200 m. The individual thickness for each inter bands of carbonaceous phyllite count for more than 40–50 m and inferred cumulative thickness based on pitting in black soil and discrete outcrops, is more than 200 m. The vanadium mineralisation in the area was considered as strata bound bedded deposit with tabular geometry. Initial chemical results indicated vanadium values ranging from 978 ppm to 5,851 ppm and Fixed Carbon values from 10.96% to 11.48%.
Vandium, Graphite, Gold and associated minerals Dibang Valley	Pyunli, Yachambra & Kano	1:12500	50	-	-	-	Reconnaissance Survey for Vanadium, Graphite, Gold and associated minerals in Pyunli, Yachambra and Kano villages, Lower, Dibang Valley district, Arunachal Pradesh (G4): LSM on 1:12500 scale was carried out of an area of 50 sq km in Pyunli, Yachambra and Kano area. The area comprised mainly of chlorite schist, carbonaceous phyllite, magnesite, marble, mica schist, garnetiferous amphibolite schist of Tidding Formation and biotite gneiss, orthoquartzite and amphibolite of Ithun Formation. Peridotite which belonged to the Mayudia Ultramafic Complex was also observed in the area of investigation. Greenish coloured, medium to coarse-grained peridotite body was encountered which gave soapy feeling on rubbing. Two samples of peridotite body yielded a value of 46.59% and 44.93% of MgO; 1,118 ppm and 2,469 ppm of Cr and 2,191 ppm and 2,235 ppm of Ni. A band of garnetiferous amphibolite schist was also recorded which was grayish-black, medium-grained foliated rock consisting of biotite, hornblende, muscovite, garnet and quartz. Garnet grains varied in size from <5 to 10 mm.

Table-4: Mineral Production in Arunachal Pradesh, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19		2019-20		2020-21 (P)	
		No. of mines	Quantity	No. of mines	Quantity	No. of mines	Quantity
All Minerals			464903		455845		397944
Natural Gas (ut.)	m cu. m		28		45		56
Petroleum (crude)	'000t		43		56		54
Minor Minerals			-		455845		397944

\$ 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

₹31 crore

estimated Value of production minor minerals in 2020-21

3

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. **Limestone** occurs in Karbi 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 carried out exploration for REE and Tungsten in Assam during 2020-21. Details of the activities are furnished in Table-3.

Table-1: Reserves/Resources of Coal as on 1.4.2021: Assam

Coalfield	(In million tonnes)			
	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 2020-21.

Table-2: Reserves/Resources of Minerals as on 1.4.2020: Assam

Mineral	Unit	Reserves			Remaining Resources							Total Resources (A+B)		
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334	Total (B)
			STD121	STD122			STD221	STD222						
Iron Ore (Hematite)	'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, 2020-21

Agency/ Mineral/ State/District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Molybdenum Kamrup Metropolitan	Helagog Khaloibari	1:2000	3	-	-	-	Preliminary exploration for molybdenum and associated mineralisation in the area between Helagog–Khaloibari, Kamrup Metropolitan district, Assam (G3): Detailed geological mapping of 03 sq. km on 1:2000 scale, geophysical survey of 3 sq. km of magnetic and gravity, 25 Lkm of both resistivity and IP surveys were carried out during the course of the work. Molybdenite- bearing pegmatite veins were well exposed in the Helagog and Khaloibari quarry sections. 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 ranges from 3 m to 21 m with width ranging from 0.15 m to 12 m in anastomosing pattern. In Khaloibari quarry, in addition to the previously reported two molybdenite-bearing pegmatite veins, six molybdenite-bearing pegmatite veins were recorded that which were seen distributed over the length of 38 m to 40 m with wide spacing. The length of the pegmatite veins range from 5m to 15 m with thickness from 0.2 m to 0.7 m with a few veins occurring as segregations with random orientations. Chemical analysis showed value of tungsten (W) ranging from 85.264 to 169.301 ppm from samples collected from pyrite–chalcopyrite bearing pegmatite veins in Helagog quarry and anomalous concentration of fluoride (F) from 104 to 1,200 ppm.
Gold Lakhimpur & Dhemaji	Subansiri basin	1:12500	100	-	-	-	Reconnaissance survey for placer gold in Subansiri basin, Lakhimpur and Dhemaji districts, Assam aided with large-scale mapping of 100 sq. km on 1: 12500 scale for the detailed study of gold grains/nuggets in consort with other heavy minerals and possible source area. Four definite mineralised blocks were identified that had terraces (T1 and T4) and pebbly horizon of Kimin Formation (Upper Siwalik) that was reported by auriferous. Block-I comprised a total area of 3.4 sq km. It was boulder-pebble horizon of T4 and was the major auriferous zone. It had an average thickness of 4.7m and an average of 13 gold flakes/cu.m were recovered from this horizon. Block-II was 2.1 sq km in area with average thickness of 0.62 m of mineralised pebble horizon. Gold flakes of 3 grains/cu.m were recovered. Block-III had an area of 5.5 sq km with average thickness of 0.56 m of pebble horizon. Average gold flakes of 3 grains/cu.m were recovered. Block-IV also occupied the channel bars and point bar of River Subansiri . Average gold flakes of 4 grains/cu. m were recovered. The size of the biggest flake recorded was about 1.9 mm in length. Gold flake in heavy mineral concentrations collected from a 8 m–12 m thick Pebble,Cobbles, Boulders Horizon of Corramore Formation (T4 terrace) at right bank of River Dirpai, Dirpai Adigaon. Gold nuggets of ~1.5mm, 0.1mm and ~0.4mm from PTS sample were also reported.
REE Assam Karbi Anglong	Panbari Geleki	1:12500	-	11	-	10	Reconnaissance survey for REE in Panbari–Geleki area, Karbi Anglong district, Assam (G4): Large-scale mapping (in 1:12500 scale) was carried out with an objective to delineate prospective zones enriched with REE and resource estimation. The granites of the study area showed both porphyritic and medium grained nature. Both these granites were highly weathered and had intermittent regolith development (up to 10 m.) having distinct A, B and C horizons. The highly leached B horizon thickness varied from 0.2 to 0.5 m and least weathered C horizons extended up to 4 meters in thickness. The preliminary geochemical classification of granitoids suggested that they A-type within plate granites with meta-aluminous nature. The REE concentration (10 BRS samples) from granite samples ranged from 300–500 ppm. The presence of REE phases like zircon, monazite, xenotime, apatite grain in the granites (up to 1%) suggests that the study area has potential REE mineralisation.

Production

Petroleum (crude), Natural gas (ut.), Coal and Limestone were the principal minerals produced in Assam in 2020-21. The value of minor minerals' production was estimated at ₹31 crore for the year 2020-21. There were 3 reporting mines in 2020-21 in Assam in case of MCDR minerals (Table - 4)

Table-4: Mineral Production in Assam, 2018-19 to 2020-21
(Excluding Atomic Minerals)

Mineral	Unit	2018-19		2019-20		2020-21 (P)	
		No. of mines	Quantity	No. of mines	Quantity	No. of mines	Quantity
All Minerals		3	845538	3	814755	3	782482
Coal	'000t	-	784	-	517	-	36
Natural Gas (ut.)	m cu m	-	3289	-	3141	-	2995
Petroleum (crude)	'000t	-	4309	-	4093	-	3902
Limestone	'000t	3	1652	3	1552	3	1552
Sulphur [#]	t	-	7100	-	5955	-	6447
Minor Minerals [@]		-	-	-	313805	-	313805

(Value in ₹000)

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, Badarpurghat, Distt. Karimganj.	330
Calcom Cement (Dalmia Subsidiary), Distt. Nagaon.	1720
CCI Ltd, Bokajan, Distt. Karbi Anglong.	200
Cement Manufacturing Co. Ltd, Chamata Pathar, P. O. Sonapur, Distt. Kamrup (G).	2000
Purbanchal Cement, Vill. Sarutari, Distt. Kamrup	360
Topcem Cement Gauripur Kamrup	660
Fertilizer	
Assam State Fertilizer & Chemicals Ltd, Chandrapur, Distt. Kamrup	33 (SSP)
(H ₂ SO ₄)	16.5
Brahmaputra Valley Fertilizers Corpn. Ltd, (Urea)	510
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. As per Rule-45 of MCDR, 2017, a total of 36 companies are registered with IBM as given in <https://ibm.gov.in/writereaddata/files/05102020114426ASSAMALL.pdf>

Bihar



94%

Pyrite resources is located in Bihar

₹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; feldspar 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 are reported (Tables - 1 & 2).

Exploration & Development

GSI carried out exploration for coal, REE, limestone and chromite in Bhagalpur, Kaimur, Rohtas and Gaya districts. Details of exploration activities conducted by GSI during 2020-21 are furnished in Table-3.

Production

Limestone is the only major mineral produced in Bihar. The value of minor mineral's production is estimated as ₹4,272 crores for the year 2020-21. There was a single reporting mine and that of limestone in Bihar in 2020-21.

Table-1: Reserves/Resources of Coal as on 1.4.2021: Bihar

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total/Rajmahal	310	3143	11	3464

Source: Coal Directory of India, 2020-21

Table-2: Reserves/Resources of Mineral as on 1.4.2020: Bihar

Mineral	Unit	Reserves				Remaining Resources							Total Resources (A+B)			
		Proved STD111	Probable STD121	Total (A)	Feasibility STD211	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)					
Bauxite	'000 tonnes	-	-	-	-	-	-	-	-	-	-	-	-	-	4114	4114
Gold																
Ore	tonne	-	-	-	-	-	-	-	-	-	-	-	-	-	128884860	222884860
Metal	tonne	-	-	-	-	-	-	-	-	-	-	-	-	16	37.6	37.6
Iron Ore (Haematite)	'000 tonnes	-	-	-	-	-	-	-	-	-	-	-	-	-	55	55
Iron Ore (Magnetite)	'000 tonnes	-	-	-	-	-	-	-	-	-	-	-	-	-	589	49439
Lead-Zinc Ore																
Ore	'000 tonnes	-	-	-	-	-	-	-	-	-	-	-	-	-	435	11435
Lead metal	'000 tonnes	-	-	-	-	-	-	-	-	-	-	-	-	-	24	24
Zinc metal	'000 tonnes	-	-	-	-	-	-	-	-	-	-	-	-	-	14.75	38.75
Limestone	'000 tonnes	11807	-	11807	3388	2558	1675	67926	135740	772343	10558	-	-	-	994188	1005995
Potash	Million tonnes	-	-	-	-	-	-	-	-	-	-	-	-	-	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, 2020-21

Agency/ Mineral/State/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Gold Gaya	Ajaynagar	-	1	2	500	173	Preliminary exploration for gold around Ajaynagar, Gaya District, Bihar (G3): Exploration for gold in Ajaynagar block was taken up by means of DM of 1 sq. km, drilling of 500m, pitting & trenching of 110 cu.m with collection of 110 PTS, 63 BRS, petrological and petro-geochemical samples. The block comprised metabasalt, meta-acid volcanic (rhyolite), banded carbonate-chert, meta-tuff and quartz veins forming linear ridges trending NE-SW. Surface manifestations of mineralisation were observed in the form of wall-rock alterations like silicification and/or carbonatisation of metabasalt, shearing and occurrence of sulphides within metabasalt, sheared rhyolite and quartz veins, such as, pyrite, pyrrhotite and chalcopyrite. Analytical results of BRS and PTS indicates Au values ranging from 0.06 ppm to 1.27 ppm in quartz vein (n=50) and 0.06 ppm to 0.21 ppm in silicified metabasalt (n=60). Analytical results of 15 BRS yielded Au values ranging from 0.49 ppm to 1.56 ppm in silicified metabasalt (n=6) and from 0.06 ppm to 0.49 ppm in quartz vein (n=9). Sulphide bearing mineralised zone were intersected from 51m to 57 m, 70.50 m to 75.4m in Borehole BRAJ-1 and 18m to 22.05m, 27m to 46.5m in Borehole BRAJ-2.
Champaran	Siwalik Himalayas	-	100	-	-	57	Reconnaissance survey for placer gold in the foothills of Siwalik Himalayas, West Champaran District, Bihar (G4): Investigation for placer gold was carried out by LSM of 100 sq. km area, in the Siwalik Himalayas of Don Valley, West Champaran district, Bihar, along with collection of different geomeedia samples. Panning of samples showed presence of fine gold flakes/ grains (5-200 nos.) in the pan concentrates of stream sediment, colluvial, and pit samples. Analytical results of 35 stream sediment samples received shows Ag value ranging from <0.01 ppm to 0.26 ppm; 19 nos. of pit samples showing Ag value ranging from <0.01 ppm to 0.24 ppm; 3 colluvial samples showed Ag value <0.01 ppm. Analytical results of 4 stream sediment samples and 2 pit samples received showed Scandium (Sc) value ranging from <4 mg/kg to 6 mg/kg and 5-6 mg/kg respectively and Yttrium (Y) value ranging from 208 mg/kg to 1,015 mg/kg and 90-125 mg/kg respectively. Heavy mineral study of the pan concentrates showed presence of garnet, sillimanite, kyanite, magnetite, ilmenite, rutile, tourmaline, zircon, and monazite.
REE & RM Munger	Barhulia Block	1:12500	100	-	-	-	Reconnaissance survey for REE and associated minerals in Barhulia Block, Munger District, Bihar (G4): Study was carried out at an area of 100 sq. km covered by LSM (1:12500 scale), in Barhulia block along with pitting/trenching and collection of BRS, PCS, colluvial, alluvial, stream sediment samples and PS, XRD, SEM & EPMA studies. The arenaceous as well as argillaceous metasediment of Munger Group were exposed in the area along with laterite, hard compact, sand, silt and clay of Jamui Formation and lateritised sand and clay of Lalgah Formation. The arenaceous metasediment comprised massive quartzite, gritty quartzite and foliated quartz while argillaceous metasediment comprised mainly slates and phyllites. The lithounits of Munger Group were also occasionally intruded by hard compact white quartz veins. The analytical result of bedrock samples received showed TREE values from 63.86- 486.78 ppm.

Table-3 (Concl.d.)

Agency/ Mineral/State/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Banka	Nari Block	1:2000	2	-	90	291	Preliminary exploration for REE and Rare Metals in Nari Block, Banka District, Bihar (G3): The exploration work included detailed geological mapping (1:2000 scale) of 2 sq. km. area, pitting & trenching of 50 cu.m and auger drilling of 90 m with collection of 51 pit & trench samples, 90 auger soil samples and 150 bedrock samples. The block formed a part of Chhotanagpur Gneissic Complex and was represented by migmatite gneiss, boudinaged migmatite gneiss, granite gneiss, pegmatite and laterite. Bulk samples were collected from 05 pits (1 cu. m. each) and the panned heavies were sent for chemical analysis. Auger drilling on 200 m x 200 m grid pattern was carried out over the insitu soil profile. Available analytical data (15 nos.) indicated higher concentration of REE in bedrock samples collected from boudinaged migmatite gneiss and C-horizon developed over it, with values ranging from 410 to 889 ppm.
Lithium Jamui	Harni– Kalwadih– Charkapthal area	-	-	-	-	320	Reconnaissance survey for lithium and associated strategic minerals (REE, Rare Metals) in and around Harni–Kalwadih– Charkapthal area, Jamui District, Bihar (G4): The area falls in eastern part of the Chhotanagpur Gneissic Complex and comprised calc granulite, amphibolite and tremolite actinolite schist of Unclassified Metamorphics; Migmatitic granite gneiss of Chhotanagpur Gneiss; mica schist and quartzite of Bihar Mica Belt; and Younger granite, quartz vein, pegmatite & dolerite of Later Intrusives. A discontinuous body of pegmatite (3.5 km strike) was delineated in Janakpura, Khalari, Aharadih and north of Sakdari area in contact zone of mica schist and younger granite. The pegmatite was mined by locals up to depth of 20–30ft in the form of pits and trenches. Columbite pebble up to 2 cm diameter was observed in stream sediment in Village Jathar. A total of 100 BRS, 100 PTS, 80 stream sediment samples and 40 nos. panned concentrate were submitted for analysis.
Jamui	Parmania- Tetariya Area	-	-	-	-	-	Reconnaissance Survey for Lithium and associated Strategic Minerals (REE, Rare Metals) in and around Parmania–Tetariya Area, Jamui District, Bihar (G4): The area lies in the southern margin of Bihar Mica Belt within Chhotanagpur Gneissic Complex (CGC). The lithounits in the area fall under three different domains, which were Unclassified Metamorphic Group, Chhotanagpur Gneissic Complex and Bihar Mica Belt. The Unclassified Metamorphic Group include amphibolite, granulite and these occurred in the form of enclaves within gneissic complex. Migmatite gneiss, amphibole-bearing gneiss, porphyritic granite gneiss and granite gneiss belong to Chhotanagpur Gneissic Complex and garnet mica schist, mica schist and quartzite belonged to Bihar Mica Belt. Thirty pegmatite bodies were mapped and more than 10 pegmatite bodies were reported for the first time. Pegmatite bodies ranged in size from a few meters to 370 m in length and 15m to 65m in width. Fluorite-bearing zoned pegmatite was mapped near Village Ashurya with 400 m strike length and 40 to 70 m width intruded into sheared granitic gneiss. The XRF analysis of the BRS showed maximum concentration of TiO ₂ is 0.79%, Ga 32 ppm, Nb 54 ppm, Sc 14 ppm, Sr 135 ppm, Y 31 ppm) and Zr 324 ppm. In stream sediment samples, maximum concentration of TiO ₂ was 1.10%, Ga 22 ppm, Nb 23 ppm, Sc 17 ppm, Sr 85 ppm, Y 35 ppm and Zr 362 ppm.

Table-4: Mineral Production in Bihar, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19		2019-20		2020-21 (P)			
		No. of mines	Quantity	Value [§]	No. of mines	Quantity	Value [§]	No. of mines	Quantity	Value^{§}
All Minerals		1		42858862	1	42983377	1		42912978
Limestone	'000t	1	240	138931	1	556	1	1000	193047
Sulphur #	t	-	7050	-	-	6843	-	7135	-
Minor Minerals @		-	-	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	20% Iron ore (haematite)	18% Coal
11% Dolomite	4% Diamond & Marble	

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 Korea, Korba, Raigarh & Sarguja districts; **dolomite** in Bastar, Bilaspur, Durg, Janjgir-Champa, 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), Raigarh, Raipur & Rajnandgaon districts; **quartzite** in Durg, Raipur, Rajnandgaon & Raigarh districts; and **talcs/soapstone/steatite** in Durg & Kanker districts.

Other minerals found in the State are **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, NMDC and State DGM during 2019-20 are furnished in Table - 3.

Production

Coal, Bauxite, Iron Ore, Tin Conc., Graphite (r.o.m.), Limestone and Moulding Sand are the major minerals produced in Chhattisgarh. The value of minor mineral's production is estimated as ₹1,037 crore for the year 2020-21. There was 100 reporting mines in 2020-21 in case of MCDR minerals (Table - 4).

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 - 5.

Table-1: Reserves/Resources of Minerals as on 1.4.2020: Chhattisgarh

Mineral	Total Unit	Reserves										Remaining Resources					Total Resources (A+B)
		Proved		Probable		Total		Feasibility		Pre-feasibility		Measured	Indicated	Inferred	Reconnaissance	Total	
		STD111	STD121	STD122	STD122	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(A)	(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	97399	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 1.4.2021: Chhattisgarh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	31562	40425	1437	73424
Sohagpur	94	10	-	104
Sonhat	365	2304	2	2671
Jhilimili	228	39	-	267
Chirimiri	320.33	11	31	362
Bisrampur	1735	696	5	2436
East Bisrampur	-	165	-	165
Lakhanpur	456	3	-	459
Panchbahini	-	11	-	11
Hasdeo-Arand	2032	3273	223	5529
Sendurgarh	153	126	-	279
Korba	7055	5763	159	12976
Mand-Raigarh	17978	24859	924	43761
Tatapani-Ramkola	1145	3165	93	4403

Source: Coal Directory of India, 2020-21.

Table-3: Details of Exploration Activities in Chhattisgarh, 2020-21

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Diamond							
Jashpur, Sarguja & Raigarh	Kansabel, Chandarpur &Raigarh	-	-	-	-	124	Reconnaissance survey (G4) was taken up for search of source rocks of diamond around Kansabel, Chandarpur and Ludeg areas. The study area falls in the Chhotanagpur Gneissic Complex (CGC) in the proximity of the Raigarh Metamorphic Belt in Toposheet no 64N/10. Incidences of diamond and indicator minerals were reported from Ib and Mand Rivers by previous studies. The study area comprised of granite gneiss and other granitoids along with quartzite, quartz-mica schist, chlorite schist, metagabbro and metadolerite. A total of 96 stream sediment samples, 11, PCS, 11, PS samples and 04PTS from 1 Trench (3x1x1 m dimension) and 1 Pit (1x1x1 m dimension) were collected. Reconnaissance survey of the area revealed that the area was mainly covered by different varieties of granitoids. At places granites were altered into unakite. During panning of stream sediments samples from 3 rd order streams in Hathgara, Pemla and Village Pongo near Kansabel found specks of gold grains.

Table-3 (Contd.)

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Base metal							
Mahasamund & Raigarh	Chhrrabhara- Potapara area	1:12500	100	-	-	-	Reconnaissance survey to search for mineralisation of base metal and associated elements in Chhrrabhara–Potapara area, involved large-scale mapping. LSM carried out in an area of 100 sq km on 1:12500 scale in Chhrrabhara–Potapara block. Different lithounits observed in the area were granite gneiss of Bengpal Group followed by quartz-chlorite schist, talc-actinolite schist, massive amygdular metabasalt, pyroxenite and amphibolite of Baghmara Formation and metarhyolite of Laghdabri Formation within Sonakhan Group followed by porphyritic granite and quartz vein of Dongargarh Formation followed by quartz vein as post orogenic intrusive within Dongargarh Granite followed by Glauconitic gritty sandstone of Kansapathar Formation and Shale of Chapordih Formation within Chandarpur Group. The available analytical value indicated presence of anomalous molybdenite and Pb mineralisation within smoky quartz vein hosted in Dongargarh Granite and within Dongargarh Granite along the contact zones. Three zones have been identified, i.e, Zone-I (near Village Kotendarha), Zone-II (near Village Bichhiya) and Zone-III (near Village Kapudih) based on the available chemical analysis data. Sample nos. CP/BRS/4 & CP/BRS/117 showed maximum value of molybdenum (950.41 and 1,210 ppm respectively) was from Smoky Quartz vein collected within Dongargarh granite near Village Sagarpali. The data statistics show variation with the minimum and maximum value of 0.85 ppm to 1,210 ppm. Molybdenum value ranges from 145–1,210 ppm in 6 samples with highest value observed in CP/BRS/04 (950.41 ppm) and CP/BRS/117 (1,210ppm) respectively. Mo value ranged 179–632 ppm in 4 samples with highest value observed in CP/BRS/116 (632 ppm).
Surajpur & Balarampur	Toni-Kadaura block	1:12500	100	-	-	265	Reconnaissance survey for base metal and associated mineralisation were carried out in Toni-Kadaura block, Surajpur and Balrampur districts of Chhattisgarh as part of regular project during FSP: 2020-21. Geologically, the area is located in western part of Chhotanagpur Gneissic Complex (CGC) and bounded by regional Balrampur–Tatapani Shear Zone (BTSZ) in north. The area is mainly occupied by CGC with older metasedimentary enclaves. Large-scale mapping of 100 sq. km area covered on 1:12500 scale which showed that the dominant lithounits were foliated monzogranite with less deformed patches of syenite. Pitting/ trenching of 52.6 cu.m was carried out and 50 pit/trench sample submitted for analysis along with 111 bedrock samples, 22 petrochemical samples and 50 stream sediment samples. Also, 32 petrological samples were collected for petrographic studies. Analytical results of stream sediments samples (from vicinity of oxidised zone) received so far showed anomalous value of tungsten up to 555.42 ppm. Out of 111 BRS samples, data of 67 samples were received so far for base metal and some other elements. The maximum value of Zn is 0.14% and Pb is 0.19% in the study area. The concentration of Ti varied from 591 to 7,343 ppm. Nb with highest value of 209.87 ppm, Zr with highest value of 1,937 ppm, Nd with highest value of 392.55 ppm and V with a value of 509 ppm, were reported from the analytical results received so far.

Table-3 (Contd.)

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
Graphite Balrampur	Oranga – Revatipur area	1:4000	3.6	-	-	85	Preliminary exploration (G3) for graphite was carried out in Oranga–Revatipur area. The study area falls in the northern part of Chhattisgarh, in Toposheet no. 64M/5 and belonged to Bilaspur–Raigarh–Surguja (BRS) metamorphic belt. The area mainly comprises of meta-sedimentary sequences of the Older Metamorphic Group and consisted of 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 were carried out and 55 trench/pit samples were submitted for fixed carbon analysis. A total of 10 petrochemical samples (PCS) and 20 petrological samples (PS) were also submitted. In Borehole CBO-2, graphite mica schist of 9.7 m and 0.57 m thick were intersected. Analytical result of four graphite mica schist from Borehole no. CBO-2 revealed the fixed carbon content that ranged from 4.47% to 10.33%. In Borehole CBO-3, graphite was found associated with graphite mica schist with thickness varying from 1.99 m to 4.78 m and as intercalations within talc± chlorite schist with a thickness of a few cm to 2.03 m. Analytical results received for Borehole CBO- 3 indicated that out of the 26 graphite mica schist samples, 24 of them had fixed carbon content ranging from 2.3% to 10.19%. Two of the samples had values less than 2% due to intercalations. In Borehole CBO-4, graphite mica schist had thickness varying from 0.49m to 6.38m. Analytical results received for 9 graphite mica schist samples in CBO- 4 indicated fixed carbon ranging from 2.56% to 9.92%. In Borehole CBO-5, graphite mica schist had thickness varying from 0.68 m to 6.14 m. In Borehole CBO-6, graphite mica schist had thickness varying from 0.2 m to 5.47 m. In Borehole CBO-7 the thickness of the ore body was 1.32 to 6.04 m. Fixed carbon analytical results of CBO-5, 6 & 7 have not been received. Available chemical result of 18 trench samples revealed that graphite mica schist contained <1 to 14.62 % fixed carbon content, moisture content of 0.04 to 1.78%, volatile matter of 1.50 to 10.40% and ash content of 81.59 to 91.55%.
Bauxite Jashpur	Chichili block Kandai block	1:4000	4	13	197.65	-	The G3 preliminary exploration of bauxite was carried out with DM on 1:4000 scale covering an area of 4 sq km around Village Chichili in TS. 64M/12 along with drilling in 200x200 m grid spacing. The Chichili block is a part of Pandrapat plateau which forms a marked topographical feature in the Jashpur district where occurrence of bauxite was reported. Geologically the study area comprised laterite, aluminous laterite and bauxite and Deccan basalts at the base of the scarp surface. The bauxite occurred as irregular lenticular bodies within the aluminous laterite/laterite. A total of 197.65 m drilling were completed in 13 boreholes at 400 m X 400 m spacing. During the drilling programme, two bauxite zones were demarcated in the 13 boreholes at a spacing of 200 X 200 m. The thickness of bauxite zone intersected in boreholes varied from 0.6 m to 2.2 m and bauxite was mainly located between RL from 1,091.62 m to 1,076.389. A total of 81 core samples, 10 BRS, 10 PCS, 10. XRD, 05. of reactive silica. 05 nos. OM were collected and submitted for chemical analysis. The chemical analyses of BRS samples received showed Al ₂ O ₃ varying from 48.07% to 59.57%, SiO ₂ from 0.87% to 3.85% and MgO from 0.01% to 0.06%. It also showed good concentration of Ga (61 ppm to 118 ppm) and vanadium (676 ppm to 1,256 ppm).

Table-3 (Concl.)

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
CMDC Bauxite							CMDC carried out exploration in four mines, i.e, Kudaridih, Narmadapur, Sukjhar and Kamleshwarpur in Surguja district in Kabirdham district respectively. Objective of exploration was to meet the entire raw material demand of the present & proposed industries.
Surguja & Kabirdhan	Kudaridih,	1:1000	3.7	255	2934	-	In Kudaridih mine, exploration comprised geological & geophysical mapping of 3.70 sq. km area on 1:1000 scale & 3.70 sq. km area, respectively. A total of 255 boreholes were drilled to a cumulative depth of 2,934.0 m.
	Narmadapur,	1:1000	1.49	95	1061	-	In Narmadapur/Kunia mine, geophysical mapping along with geological mapping of 1.49 sq.km area on 1:1000 scale was completed. A total of 95 boreholes were drilled to a cumulative depth of 1,061.0 m.
	Sukjhar	1:1000	2.94	109	1283	-	In Sukjhar mine, geophysical mapping along with geological mapping of 2.94 sq.km area on 1:1000 scale was completed. A total of 109 boreholes were drilled to a cumulative depth of 1,283 m.
	Kamleshwarpur,	1:1000	1.47	197	2758	-	In Kamleshwarpur mine, geophysical mapping along with geological mapping of 1.47 sq. km area on 1:1000 scale was completed and a total of 197 boreholes were drilled to a cumulative depth of 2,758 m. During the exploration, a total 3,603 samples were collected. So far in this mine, a total of 384 boreholes were drilled to a cumulative depth of 5,588 m. The total reserves/ resources in Kamleshwarpur block (147.62 hectare) was estimated at about 4.46 million tonnes under Measured category and 0.70 million tonnes under indicated category.

Table-4: Mineral Production in Chhattisgarh, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19		2019-20		2020-21 (P)	
		No. of mines	Quantity	No. of mines	Quantity	No. of mines	Quantity
All Minerals		105	117345916	102	118108145	100	154776623
Coal	'000t	-	161893	-	157745	-	158410
Bauxite	t	16	1502350	15	1565307	14	715296
Iron Ore	'000t	18	34893	20	34728	21	36989
Tin Conc.	kg	6	21212	6	15530	6	16865
Graphite (r.o.m.)	t	-	-	1	908	1	1701
Limestone	'000t	62	42398	57	42699	54	40378
Moulding Sand	t	3	14805	3	12905	4	11737
Minor Minerals		-	-	-	7130270	-	-
			9070555				10370741

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	200# (Alumina)
Bharat Aluminium Co. Ltd (Unit I & II), Korba.	570 (Aluminium)
Cement	
ACC Ltd, Jamul, Distt Durg.	2400
Ambuja Cements Ltd, Bhatapara, Distt. Raipur.	3500
Bhilai Jaypee Cement Ltd,	2200
Century Cement, Baikunth, Distt Raipur.	2100
Century Textile & Industires Ltd,	2400
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
Lafarge India Pvt. Ltd, Arasmeta, Distt Janjgir-Champa.	1.8
Lafarge India Pvt. Ltd, Sonadih, Distt Raipur	550
NUVOCO Vistas Co. Ltd Rasedi, Baloda Bazar	1000
Shree Cement, Baloda Bazar, Distt Raipur	3000
Shree Cement Ltd, Khapradih Simga, Balrampur.	3000
UltraTech Cement Ltd, Hirmi, Distt Raipur.	1900
UltraTech Cement Ltd, Rawan, Distt Raipur.	2500
Chemical	
Indu Ragukul Food & Chemical Pvt. Ltd,	1.5 (Sodium Dicromate) 2.7 (Sodium chromate)
Rajghatta, Kharsia	1.35 (Sodium sulphate)
Calcutta Electrode Pvt. Ltd,	7.4
Fertilizer	
BEC Fertilizers, Sirgitti, Distt Bilaspur	850000
Dharamsi Morarji Chemical Co. Ltd, Kumhari, Distt. Durg.	183 (SSP & (H ₂ SO ₄))
Khaitan Chemicals & Fertilizers Ltd, Distt Rajnandgaon.	66 (SSP) 49.5 (H ₂ SO 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 650 (Pig iron) 255 (Sponge iron) 1200 (pellets) 1200 (Steel)
Jayaswal NECO Industries Ltd, Siltara, Distt Raipur.	962.3 (Sinters) 612.5 (Pig iron) 750 (MS billet) 450 (TMT Bar) 600 (Pellets)
Monnet Ispat & Energy Ltd, Naharpalli, Raigarh.	

Table-5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Sarda Energy & Minerals Ltd, (formerly Raipur Alloys & Steel Ltd), IGC, Shri Bajrang Power & Ispat Ltd, Borjhara, Distt Raipur.	210 (Sponge iron)
	130 (Steel)
	1200 (pellets)
Sponge Iron	
A.P.I. Ispat & Power Tech. Pvt. Ltd, Siltara Billets, Raipur	210
Alliance Integrated Metallics Ltd, Bemta, Distt Raipur.	500
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, Siltara, Distt Raipur	60
B.S. Sponge Pvt Ltd, Taraimal, Raigarh	90
Crest Steel & Power Pvt. Ltd, IGC Borai, Distt Durg	231
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, Distt Raipur	495
	2100 (pellets)
Gopal Sponge & Power Pvt Ltd, Siltara, Distt Raipur	30
Gitanjali Ispat & Power Pvt Ltd,	10
Sirgititi, Distt Bilaspur	
GR Sponge & Power Ltd, Siltara, Distt Raipur	72
Shree Hare Krishna Sponge Iron Ltd, Siltara, Distt Raipur	12000
Jai Shree Balaji Steel Pvt Ltd (HEG Ltd), Borai, Distt Durg	120 (Sponge iron)
Hi-Tech Power & Steel Ltd, Parsada, Distt Raipur	60
Khetan Sponge & Infrastructure Pvt. Ltd, Sarora, Distt Raipur	30
Maa Kali Alloys (Ind.) Pvt Ltd, Pali, Distt Raigarh	60
MSP Steel & Power Ltd, Raigarh	192
	900 (pellets)
Monnet Ispat & Energy Ltd, Hasaud, Raipur	300
	250 (Semi-finished Steel)
	150 (Finished Steel)
Monnet Ispat & Energy Ltd, Naharpalli, Raigarh	500
NR Sponge Pvt. Ltd, Raipur	90
Nalwa Steel & Power Ltd, Taraimal, Raigarh	198
Nakoda Ispat Ltd, Siltara, Raipur	171
Niros Ispat Pvt. Ltd, Hathkhoj, Bhilai	97.5
Nova Iron & Steel Ltd, Dagori, Bilaspur	150
Nutan Ispat & Power Ltd, Jaroda, Raipur	60
PD Industries Pvt. Ltd, Siltara, Raipur	60
Prakash Industries Ltd, Hathenewra, Janjgir-Champa	1000
Raigarh Ispat & Power Ltd, Delari, Distt Raigarh	60
Rameswaram Steel & Power Ltd, Gharghoda, Distt Raigarh	72
Real Ispat and Power Ltd, Borjhara, Raipur.	60
	460 (Finished Steel)
Sarda Energy & Minerals Ltd, Mandhar, Raipur	150
Hanumant Alloys (India) Pvt. Ltd, Hardikala, Distt Bilaspur	16.5
Shivalaya Ispat & Power Pvt Ltd, Guma, Distt Raipur	90
Shivshakti Steel Pvt. Ltd, Chakradharpur, Distt Raigarh	97.5

Table-5 (Concl.)

Industry/plant	Capacity ('000 tpy)
Shree Shyam Ispat (India) Pvt. Ltd, Taraimal, Raigarh	120
Singhal Enterprises Pvt Ltd, Taraimal, Distt Raigarh	253.5
Singhal Energy Pvt. Ltd, Taraimal, Raigarh	60
Sree Nakoda Ispat Ltd, Siltara, Distt Raipur	66
Sunil Sponge Iron Ltd, Chiraipani, Distt Raigarh	60
Sunil Sponge Pvt. Ltd, Munrethi, Dharsiwa	60
Topworth Steel Pvt Ltd, Rasmada, Distt Durg	165
Trimula Sponge Iron Pvt Ltd, Siltara, Raipur	30
Vandana Global Ltd, Siltara, Distt Raipur	216
Vasvani Industries Ltd, Siltara, Distt Raipur	90
Vidhyan Minerals India Pvt. Ltd, Bilaspur	30
Ferroalloys	
Alok Ferro Alloys Ltd, Urla, Raipur	18
Deepak Ferro Alloys Ltd, Urla, Distt Raipur	5
Indsil Energy & Electro Chemical Ltd, Urla, Distt Raipur	19.2
Hira Ferro alloys Ltd, Urla, Distt Raipur	61.5
Jindal Steel & Power Ltd, Kharsia, Distt Raigarh	36
Sarda Energy & Minerals Ltd, (merged Chhattisgarh Electricity Co. Ltd) Siltara, Distt Raipur	600 (Pellets) 360 (Sponge Iron) 410 (Finished Steel) 150 (Silico & Ferro–manganese)
Nav-chrome Ltd, Urla, Distt Raipur	50
Orion Ferroalloy Pvt. Ltd Punjipathra, Gharghora	8
V.A. Power & Steel Pvt. Ltd Punjipathra, Gharghoda	8.1(Fe-Si)
Manganese Oxide	
Vandana Allied Minerals and alloy Bodegaon, Durg	3.6
Refractory	
SAIL Refractory Unit (formerly Bharat Refractories Ltd), Bhilai, Distt Durg	60
Vishva Vishal Engineering Ltd, Bhilai, Distt Durg	8.2

(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.

Plant remained unoperational during the year.

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 principal Mineral-based Industries in the 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	Probable	Total	Measured	Indicated	Inferred	Total	
		STD111	STD122	(A)	STD331	STD332	STD333	(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

Creore, 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

Exploration activity was reported by GSI during 2020-21 (Table -3).

Production

No mineral production except minor mineral was reported from Goa. The value of minor mineral's production is estimated as ₹26 crores for the year 2020-21. There was 39 reporting mines in 2020-21 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 the Organised Sector in the state are provided in Table - 4.

Table-1: Reserves/Resources of Minerals as on 1.4.2020: Goa

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)	
		Proved		Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
		STD111	STD121	STD122	STD122			STD221	STD222						
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, 2018-19 to 2020-21
(Excluding Atomic Minerals)

Mineral	Unit	2018-19		2019-20		2020-21 (P)	
		No. of mines	Quantity	No. of mines	Quantity	No. of mines	Quantity
All Minerals		48	545679	48	398896	39	441540
Bauxite	t	1	518	-	-	-	0
Iron Ore	'000t	45**	-	45**	-	38	94
Manganese Ore *	t	2	-	3	-	1	-
Minor Minerals		-	545575	-	398896	-	260121

(Value in ₹'000)

Note :The number of mines excludes Minor minerals.

** Only labour reported, production activity stopped by S.C. Order.

* Only labour reported.

Table-3: Details of Exploration Activities in Chhattisgarh, 2020-21

Agency/ Mineral/State/ District	Location	Mapping		Drilling		Sampling	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI North Goa District	Mopa	1:12500	100	-	-	-	Reconnaissance Survey (G4) for Nickel, Chromium and PGE mineralisation in Banda-Tambuli, Sindhudurg District, Maharashtra and Mopa, North Goa District, Goa: An area of 110 sq km was mapped on 1:12500 scale. The mapped area comprised TTG gneiss belonging to Peninsular Gneissic Complex, dolomite, BMQ, quartzite, metabasic (hornblende schist and amphibolite) of Chitradurga Group and ultramafic (orthopyroxenite) and gabbro/gabbro-norite as intrusives. About half of the area has laterite cover. A total of 110 bedrock samples (BRS) were collected. Twelve out of sixty-eight BRS from serpentinite, orthopyroxenite and gabbro/gabbro-norite /norite showed Ni values in between 1,025 and 1,542 ppm and twenty-one BRS showed Cr values in between 1,062 and 9,333 ppm. Based on analytical results of BRS, areas were chosen for channel-cum-chip sampling. Fifty channel-cum-chip samples were collected. The analytical data of nineteen out of fifty channel cum chip samples from gabbro showed Ni values ranging from 1,014 to 1,557 ppm and Cr values ranging from 3,008 to 3,857 ppm. Based on higher Ni and Cr values, twenty BRS were selected for PGE analysis. Geochemically, gabbro bodies of potential areas were Mg-rich. Four PCS from gabbro showed MgO values from 20.04 to 23.60 wt %. In ore microscopic study, chromite, magnetite, ilmenite and pyrite were seen as ore phases. They occurred as fine to medium-sized irregular grains associated with olivine and orthopyroxene of mafic- ultramafic rocks. On the basis of overlay studies of analytical results on geological map of LSM block and petrography, two potential areas, i.e, one towards north of Degve having area of 4 sq km (4 km x 1 km) and another towards east of Tambuli having area of 1 sq km (2.5 km x 0.4 km) were delineated.

Table-4: Principal Mineral-based Industries

Industry/plant	Capacity (’000 tpy)
Counterweight	
Asavari Vishwanath Parulekar, Convale Bardez	15
Fertilizer	
Zuari Industries Ltd, Zuarinagar, Distt South Goa.	495000 (Urea) 500000 (NP/NPKs) 330 (DAP)
Pellets	
Mandovi Pellets Ltd, Mandovi, Shiroda. Chowgule & Co. Ltd	NA NA
Pig Iron	
Sesa Goa Ltd, Bicholim. Aparant Iron & Steel Pvt. Ltd, Sanguem Vedanta Ltd, Amona, Bicholim	625 160 832 1000 (Sinter)
Sponge Iron	
Ambey Metallic Ltd, Pissurlem, Sattari. Goa Sponge & Power Ltd, Santona. Shraddha Ispat Pvt. Ltd, Santona, Sanguem.	36 90 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, Mehsana, Rajkot,

Sabarkantha, Surat & Surendranagar districts; **fluorite** in Vadodara & Bharuch districts; **gypsum** in Bhavnagar, Jamnagar, Junagadh, Kachchh and Surendranagar districts; **lignite** 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 district; **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 **talcs/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 and various agencies during 2020-21 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 ₹4,794 crore for the year 2020-21. There was 143 reporting mines in 2020-21 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

Grade/State	Unit	Reserves				Remaining Resources							Total Resources (A+B)	
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total Resources (A+B)
			STD121	STD122			STD221	STD222						
Apatite	tonne	-	-	-	-	-	-	-	-	-	351000	351000	351000	
Bauxite	'000 tonnes	83448	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	507311	254583	176439	79919	2593098	18317659	160	21929169	22832284	
Manganese Ore	'000 tonnes	695	0	695	-	-	-	-	-	2180	-	2180	2875	
Marl	tonne	50825000	17210000	110000	26474477	4189000	-	-	-	390000	-	31053477	99198477	
Perlite	'000 tonnes	-	-	-	140	683	595	-	-	-	988	2406	2406	
Rare Earth Elements	tonne	-	-	-	-	-	-	-	424000	-	-	424000	424000	
Rock	tonne	-	-	-	-	-	-	-	-	314820	-	314820	314820	
Phosphate														
Vermiculite	tonne	-	-	-	-	-	-	-	-	1960	-	1960	1960	
Wollastonite	tonne	-	-	-	-	-	-	-	-	1990000	-	1990000	1990000	

Figures rounded off.

Table-2: Reserves/Resources of Lignite as on 1.4.2021: 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 2020-21.

Table-3: Details of Exploration Activities in Gujarat, 2020-21

Agency/ Mineral/District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI REE & RM							
Chhota Udepur	Nakhal Block	-	-	56	5800	-	Preliminary Exploration (G3) for Rare-Earth Elements (REE) and Rare Metals (RM) was carried out in Nakhal Block of Saidiwasan Carbonatite Complex. Based on the work carried out in the F.S.2019-20,5,800 m of drilling work were taken up in Nakhal block of Saidiwasan area during the FS 2020-21. A total of 56 boreholes of 100±20 m vertical depth with 200 m spacing were planned. BH GJNB 01 and 04 showed carbonatite breccia along with fenitized phonolite. Carbonatite breccia was the main potential source for REE and RM. Soaked sandstone was also found along with carbonatite breccia. Average thickness of carbonatite breccia was 50–60 m.
Chhota Udepur	Gogadev- Janiyara	-	-	-	-	-	Preliminary exploration (G3) for Rare-Earth Elements (REE) mineralisation and other Rare Metals (RM) in Gogadev–Janiyara. Geologically the area comprised metasediments of the Champaner Group of Palaeoproterozoic Age represented by calc-silicate rocks. These metasediments were intruded by Godhra granite of Neo-Proterozoic Age and dykes of Deccan Volcanics of Upper Cretaceous to Eocene Age. Thin bands of calc-silicate rocks which occurred as enclave within Godhra granite were exposed in the south and southwestern part of the area. A total of 90.3 meter auger drilling were completed and 100 bulk samples (-35 mesh) were generated from 28 auger borehole at 400 x 400 m interval. Near Village Janiyara in River Ani, panning of stream sediment resulted in 212 of non-magnetic heavies from 20 kg of samples. Samples of the 1 st order streams draining from the granitoids and its late derivatives were collected. Systematic sampling of stream sediments of River Ani in grid pattern was also done to assess the REE and RM potentiality of the riverine sediments. About 10 bedrock sample (BRS) results received so far showed TREE value ranging from 364 to 583 ppm. Analysis of 18 samples received so far revealed that the TREE value in B-horizon was greater than C horizon. The total REE value ranged from 518 ppm to 1,300 ppm and 298–1,078 ppm respectively. Element wise distribution of the REE in all type of samples, which showed presence of > 500 ppm TREE, indicated that La, Ce, Nd and PR in LREE contributed the major % of TREE.

Table-3 (Contd.)

Agency/ Mineral/District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Tin							
Sabarkantha	Nadri block	1:2000	1	-	-	-	Preliminary exploration (G3) for strategic minerals / rare metals (Sn-W-Ta-Nb) in Nadri granite and pegmatites intrusive into Delhi Supergroup of rocks. To know the extension of mineralised lithounits in the eastern part of the Nadri block, in Sabarkantha district of Gujarat an area of 1 sq. km dimension adjacent to it was chosen for detailed mapping (1:2000) and mineral exploration in FS 2020-21. Quartz-fluorite veins were NE-SW, NW-SE and E-W trending but majority of veins were following the E-W direction which were displaced by N-S and NW-SE strike slip faults. Later silicification resulted in the brecciation of quartz- fluorite veins and epidotised granite, and giving rise to stock- work like feature. Cassiterite, chalcopyrite, pyrite, sphalerite and minor tungsten were the constituting phases of the fine mineralised disseminations in granite and quartz-fluorite veins. The partially available geochemical data of bedrock samples (BRS) suggested the tin-mineralised nature of Ms-granite (399–434 ppm) and NE-SW (252–309 ppm) and E-W (552 ppm) trending quartz fluorite veins. Chemical data of samples of three trenches attests the tin-bearing nature of granitic bedrock (Sn 159–181 ppm), quartz veins (Sn 135–231ppm) and loose sediments lying over the bedrock (Sn 136–244ppm) in the trenches.
Base Metal							
Banaskantha	Dungarpura block & Malana block	-	1.75	-	-	33	Preliminary exploration (G3) for base metals and associated mineralisation in Dungarpura block and Malana block, Kui-Chitrasani fault zone. Detailed geological mapping and topographical survey of 1.75 sq. km area (1 sq. km at Dungarpura and 0.75 sq. km at Malana) were completed with the help of DGPS and all type of samples as per NQT were collected. During detailed geological mapping of Dungarpura area it was observed that cherty brecciated quartzite showed incidence of epigenetic hydrothermal base metal mineralisation. Cherty quartzite was highly oxidised, limonitised, siliceous and gritty in nature. Disseminated specks and stringers of galena, sphalerite, pyrite and rare chalcopyrite with surficial encrustation of malachite and covellite were observed in cherty brecciated quartzite and quartz veins. While cherty quartzite of Malana area was highly oxidised, limonitised and brecciated in nature contained galena and sphalerite mineralisation. The chemical analytical result of BRS samples collected from Dungarpura block showed concentration of Cu ranged from 25ppm to 0.1%. Pb ranged from 25ppm to 0.65% and Zn ranged from 25ppm to 1.1% while in Malana block concentration of Cu ranged from 25ppm to 0.18% and Zn ranged from 25ppm to 0.14%. Chemical analytical result of 16 channel samples showed the concentration of Pb and Zn ranging from 0.11% to 0.28% and 0.16 to 0.79% respectively. Analytical result of 17 water samples received so far, indicated value of Cu from 3.71 ppb to 73.96 ppb and Pb from 2.69 ppb to 8.90 ppb while 5 samples showed concentration of Zn from 84 ppb to 4,859.53 ppb.
Commissioner of Geology & Mining, Gujarat Limestone							
Gir Somnath	Barevala Singhar,	-	-	90	3723	1339	The exploration was taken up with an objective to establish auctionable mineral reserves/resources. Exploration was under progress.
Devbhumi Dwarka	Pachtar	-	-	5	109	424	The exploration was taken up with an objective to establish auctionable mineral resources. About 7.49 million tonnes of reserves/resources were estimated during the year
Amreli	Jafrabad	-	-	27	1350	621	The exploration was taken up with an objective to establish auctionable mineral reserves/resources. Exploration was under progress.

Table-3 (Concl.)

Agency/ Mineral/District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Bentonite							
Kachchh	Khirsara/Miyani,	-	-	604	23779.7	3139	The exploration was taken up with an objective to establish auctionable mineral reserves/resources. Exploration was under progress.
Chinaclay							
Kachchh	Nadapa, Kali Talavadi	-	-	383	24139	4090	The exploration was taken up with an objective to establish auctionable mineral reserves/resources. Exploration was under progress.
Commissioner of Geology & Mining, Gujarat Bauxite							
Devbhumi Dwarka	Virpur Lusri, Mevasa, Lamba, Magadevia, Satapara & Nandana	-	-	234	495.00	1457	During 2019-20, an exploration in Virpur Lusri, Mevasa, Lamba, Mahadevia, Satapara & Nandana Mevasa villages of Devbhumi Dwarka district, Gujarat, was taken up with an objective to establish auctionable bauxite mineral resources in the area. During study, a total of 234 boreholes were drilled to a cumulative depth of 1,313 m and 1,457 samples were collected for chemical analysis. About 66.845 million tonnes resources were established in the area.
Commissioner of Geology & Mining, Gujarat Limestone							
Dwarka	Devbhumi	-	-	12	495.00	104	-
Junagadh	Junagadh	-	-	18	905.00	91	-
Gir Somnath	Gir Somnath	-	-	85	2879.50	393	-
China clay							
Kachchh	Kachchh	-	-	37	3071.00	-	-
Bentonite							
Kachchh	Kachchh	-	-	11	574.60	-	-

Table-4: Mineral Production in Gujarat, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value ^{\$}	No. of mines	Quantity	Value ^{\$}	No. of mines	Quantity	Value ^{\$}
All Minerals		200	74901900	184	76880978	143	54368018			
Lignite	'000t	-	12565	-	10357	-	10813			
Natural Gas (ut.)	m cu.m	-	1402	-	1342	-	1138			
Petroleum (crude)	'000t	-	4626	-	4707	-	4651			
Bauxite	t	78	2185325	68	2076329	60	1497712			1196637
Manganese Ore	t	1*	-	1*	-	-	-			-
Limestone	'000t	121	26651	115	22868	83	5204303			5017115
Marl [%]	t	-	1794940	-	1646104	-	318711			219191
Sulphur [#]	t	-	91962	-	97107	-	82450			-
Minor Minerals		-	67502645	-	69918075	-	47935075			

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 Jam Khambhalia	86.4 (Abrasive Grain)
Carborandum Universal Ltd, Okha, Distt Jamnagar.	NA
Carborandum Universal Ltd, Bhatia, Distt Jamnagar	NA
Flexo-Plast Abrasives, Ahmedabad	
Orient Abrasive Ltd, Porbandar	NA
	75 (Abrasive Grain)
	150 (Calcined Bauxite)
	30 (Castable Refractory)
Asbestos Products	
Ramco Industries Ltd, Singura, Distt Kachchh.	72
Sanghi Industries Ltd, Sanghipuram, Distt Kachchh.	36
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, Sutrapada Distt Junagadh.	1200
Mehta Group Saurashtra Cement Ltd, Porbandar, 1500 Distt Junagadh.	3063
Saurashtra Cement Ltd, Ranavav Porbandar.	1200
Hi Bond Cement, Gondal.	1000
J.K. Laxmi, Kalol, Distt Ganghinagar (G).	1350
J.K. Laxmi, Surat	4000
Sanghi Industries Ltd, Sanghipuram, Distt Kachchh.	1200 (53. Gr.)
Shree Digvijay Cement Co. Ltd, Digvijaygram, Sikka Distt Jamnagar.	1200 (43 Gr.)
	1200 (PPC)
	1200 (Oil well cement)
Tata Chemicals Ltd, Mithapur, Distt Jamnagar.	1200 (Sulphate Resisting P.C.)
UltraTech Cement Co. Ltd, Pipavav, Distt Amreli.	500
UltraTech Cement Ltd, (Narmada Cement), Jafrabad, Distt Amreli.	6400
UltraTech Cement Ltd, (Gujarat Cement), Kovaya, Babarkot, Rajula Jafrabad,	1450
UltraTech Cement (formerly a unit of JCCL), Sewagram, Abdasa, Distt Kachchh.	6400
UltraTech Cement (formerly a unit of JCCL), Wanakbori, Distt Kheda (G).	2400
UltraTech Cement Ltd, Magdalla (G).	2400
Sparta Cements & Infra Ltd. Bhuj	750
Vadraj Cement, Mora, Surat	1000
Ceramic	
Unifrax India, Lakhtar	7.5 (Ceramic fiber product)
Orient Glazes Ltd, OGPL Kheda Unit Radhu	35.53
Chemical	
Baroda Rayon Corpn. Ltd, Surat.	15000 (yarn)
	21600 (H ₂ SO ₄)
	2.2 (sodium sulphate)
	108 (refined salt)
Century Chemicals, Nava Nanga, Distt Jamnagar.	14.9 (caustic soda)
Gujarat Alkalies & Chemicals Ltd, Baroda.	242.6 (caustic Soda)
Gujarat Alkalies & Chemicals Ltd, Dahej, Distt. Bharuch.	151.4 (Cl)
	33.408 (phosphoric acid)
	1100 (Soda Ash)
	71 (Sodium bicarbonate)
Indian Rayon Industries Ltd,	21 (yarn)
Veraval, Distt Junagadh.	35.7 (H ₂ SO ₄)
	10 (carbon disulphide)
	9.3 (sodium sulphate)
	91.3 (caustic soda)
Kamadhenu Nutrients Pvt.ltd. Panoli, Ankleshwar	10.8 (Dicalcium phosphate)
Kohler India Corp. Pvt. Ltd, Jhagadia, Talodara	15.02 (2Pc B)
	8.29 (lav)
	2.25 (Pedestal)
	4.73 (tank)
Navin Fluorine Industries Ltd, Surat.	22 (HF)
Nirma Cement Ltd, Ranavav	421.2 (Soda ash)

Table-5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Nirma Soda Ash Plant Kalatalav, Bhavnagar	1008 (Soda Ash Light) 648 (Soda Dense)
	144 (Refined Sodium Bicarbonate)
	Vaccun Salt (864)
Saurashtra Chemicals Ltd, Porbandar, Distt Porbandar	365 (soda ash) 20.4 (caustic soda) 26.4 (refined bicarbonate)
Shree Sulphurics Pvt. Ltd, Ankleshwar, Distt Bharuch.	58 (H ₂ SO ₄)
Tata Chemicals Ltd, Mithapur, Distt Jamnagar.	12 (chloro-sulphuric acid) 875 (soda ash)
Copper Smelter	
Hindalco Industries Ltd,	500 (copper smelting)
Birla Copper, Dahej, Distt Bharuch.	1670 (H ₂ SO ₄) 15 tonnes (Au) 150 tonnes (Ag)
HCL, Gujarat Copper Project, Jhagadia, Distt. Bharuch.	50 (electrolytic copper) 20 (copper anodes)
Electrode	
Power Electrode Varaval Shapar Kotda Sangani	0.6
Fertilizer	
Aarti Fertilizers, Vapi, Valsad	132 (SSP)
Coromandel International Ltd (Formerly Liberty Phosphate Ltd), Nandesari, Vadodara	100 (SSP) 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, Distt Bharuch	400 (DAP/ complex) 2420
IFFCO Ltd, Kandla, Distt. Kachchh	602 (urea)
IFFCO Ltd, Kalol, Distt. Gandhinagar	200 (SSP)
Khaitan Chemicals & Fertilizers Ltd, Dahej, Bharuch	2195 (urea)
KRIBHCO Ltd, Hazira, Distt. Surat	33000 (SSP)
Narmada Agro Chemicals Pvt. Ltd, Mangrol, Junagadh	196000 (SSP)
Narmada Bio-chem Pvt. Ltd, Kalyangadh, Ahmedabad	100 (SSP)
Nirma Ltd, Moraiya, Ahmedabad	15 (SSP)
Sona Phosphates Ltd, Sarigam, Valsad	22 (SSP)
T J Agro Fertilizers Pvt. Ltd, Navsari	
Foundry	
Steelcast Ltd, Ruvapuri Road, Bhavnagar	30
Intolcast Pvt. Ltd, 16, 17 & 19 Ankur	2.4 (steel casting)
Industrial Complex, Rajkot Gundal Road Shaper, Rajkot	
Intricast Pvt. Ltd, 25/28 Galaxy	1.08 (steel casting)
Industrial Estate, Rajkot Gundal Road Shaper, Rajkot	2.4 (steel casting)
Invac Cast Pvt. Ltd, 444, 453 & 455 Nana Fofadia Road Bamangam, Vadodara Gujarat	
Intuxt Ltd.184/P, Rajkot Gundal Road Shaper, Rajkot	1.8 (steel casting)
Iron & Steel	
Essar Steel Ltd, Hazira, Distt Surat	6700 (sponge iron) 10000 (crude/liquid steel)
Jindal Saw Ltd, Samaghogha, Mundra	900 (Sinter) 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, Distt Kachchh	75
Gallant Metal Ltd, Samakhialli, Distt Kachchh	225000
Global Hi-Tech Industries Ltd, Bhuj, Distt Kachchh	105
Welspun Steel Ltd, Versamedi, Anjar	144
Glass	

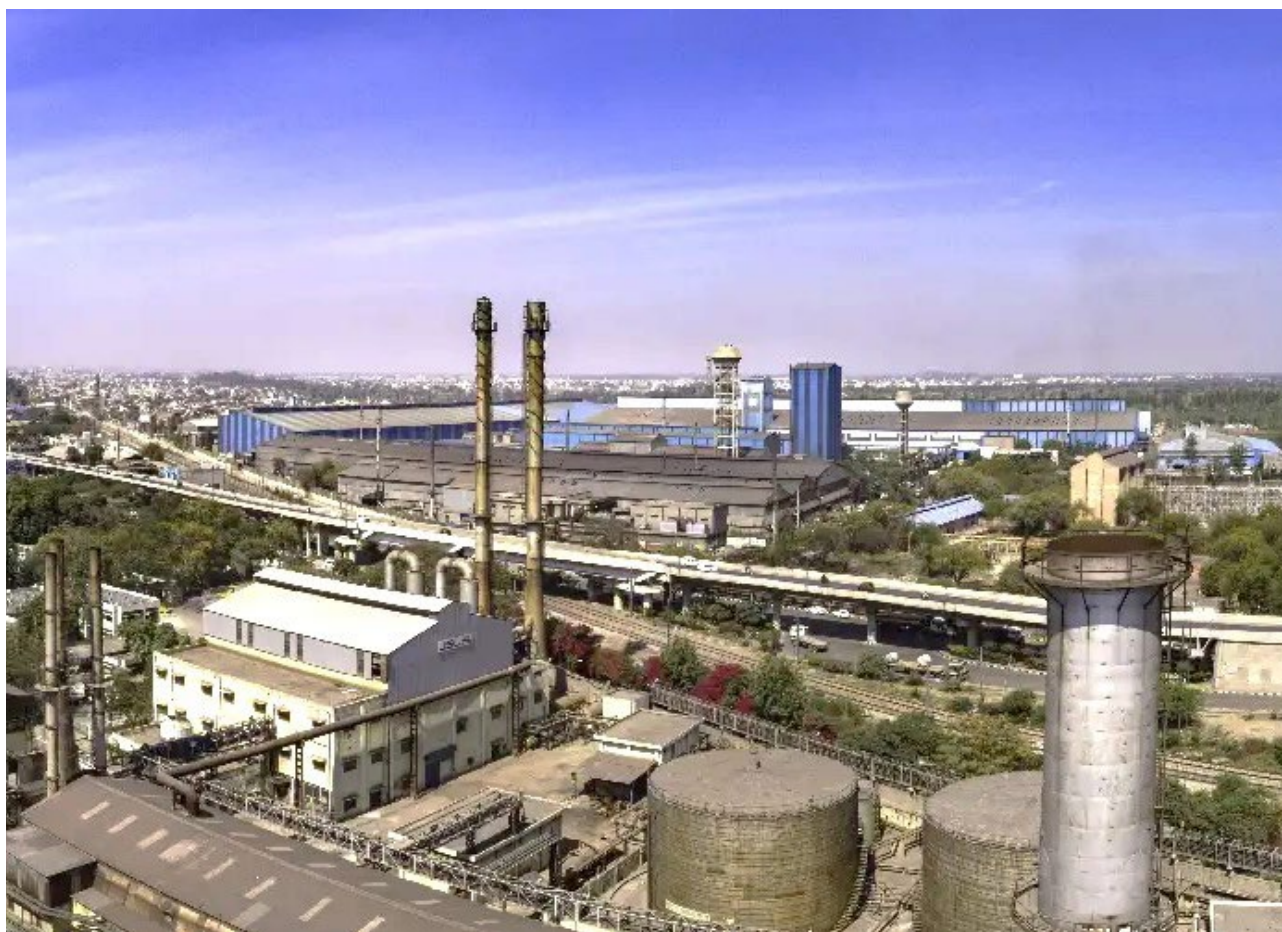
Table-5 (Concl.)

Industry/plant	Capacity ('000 tpy)
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, Distt Mehsana.	40.6
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, Bhayati Jambudiya, Wankaner	42
Lilanand Magnesite Pvt. Ltd, Dharpur, Ranavav	10.8
Synthetic Gas	
Reliance Industries Ltd, JG-DTA Gasification Area, Kunalus Lalpur	13122.48
Calcined Bauxite	
Birla VXL Ltd, Porbandar	36
Bombay Minerals Ltd, Jamkhambhaliya	96
Gujarat Credo Mineral Industries Ltd, Naredi, Abdasa	500 (dry beneficiated)
	10 (processed bauxite)
Saurashtra Calcine Bauxite & Allied Industries Ltd, Bhatia	39
Shri Natraj Ceramics & Chemical Industries Ltd, Khambhaliya	24

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; **limestone** 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, feldspar & 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

No Exploration activity was reported by the GSI in the State of Haryana during the year 2020-21.

Production

Sulphur was the main mineral item reporting production in the State. The value of minor mineral's production is estimated as ₹172 crore for the year 2020-21. (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 - 3.

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	Total			
		STD111	STD121	STD122	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+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 WO ₃	tonne	-	-	-	3568	-	-	-	-	-	-	-	-	3568	3568

Figures rounded off.

Table-2: Mineral Production in Haryana, 2018-19 to 2020-21
(Excluding Atomic Minerals)

Mineral	Unit	2018-19		2019-20		2020-21 (P)	
		No. of mines	Quantity	No. of mines	Quantity	No. of mines	Quantity
All Minerals		-	1718901	-	1718901	-	1718901
Sulphur [#]	t	-	176755	-	170907	-	138025
Minor Minerals [@]		-	1718901	-	1718901	-	1718901

(Value in ₹'000)

[#] Recovered as by-product from fertilizer plant.

[@] Figures for earlier years have been repeated as estimates because of non-receipt of data.

Table-3: 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, Ballabgarh.	10 (Zirconium derivatives) 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) 8.70 (S)
Kisan Phosphates Pvt. Ltd, Gawar, Hisar.	132 (SSP)
Nitin Chemicals & Fertilizers Ltd, Rukri, Ambala.	20 (SSP)
Iron & Steel	
Jindal Stainless Ltd, Hisar.	780 (stainless steel)
Ferroalloys	
Haryana Ferro Alloys Ltd,	2.5
Glass	
Haryana Sheet Glass Ltd, Sevli, Distt Sonipat.	89.5
Hindustan National Glass & Industries Ltd, Ballabgarh.	690 TPD
Petroleum Refinery	
IOCL, Panipat.	15000
Refractory	
Bhaskar Refractories & SW Pipes (P) Ltd, Amar Nagar.	12

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

₹70 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

No mineral exploration activities were reported by any State Government agency during 2020-21. However, GSI carried

out exploration activity for base metal & phosphate in Kullu & Sirmaur districts. Details are furnished in Table-2.

Production

Limestone and Salt (rock) were the principal minerals reporting production in the state. The value of minor mineral's production is estimated as ₹70 crore for the year 2020-21. There were 24 reporting mines in Himachal Pradesh in 2020-21 (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 STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
			STD121	STD122			STD221	STD222						
Antimony														
Ore	tonne	-	-	-	-	-	-	-	-	10588	-	-	10588	
Metal	tonne	-	-	-	-	-	-	-	-	174	-	-	174	
Limestone	'000 tonnes	696165	249863	75984	1022012	78403	653158	21105	1529950	5079	3295168	14271	5597134	
Magnesite	'000 tonnes	-	-	-	-	-	-	-	-	-	298	-	298	
Pyrite	'000 tonnes	-	-	-	-	-	-	-	-	-	2560	-	2560	
Rocksalt	'000 tonnes	-	3860	-	3860	3360	940	4620	-	-	-	-	8920	

Figures rounded off.

Table-2: Details of Exploration Activities in Himachal Pradesh, 2020-21

Agency/ Mineral/District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Vanadium Sirmaur	Nigalidhar Syncline	-	-	-	-	-	Reconnaissance survey (G4) for Vanadium and phosphorite was carried out in Nigalidhar Syncline area. The rocks exposed in the area belonged to the Krol Group and Tal Group of terminal Proterozoic to Cambrian Age. The Tal Group was disposed in the centre of synclinal basin, surrounded by rocks of the Krol Group from all sides. In Nigalidhar Syncline, the Kauriyala Formation of Krol Group was directly overlain by chert–shale association of Lower Tal (Shaliyan Formation). The Kauriyala Formation (Upper Krol) of the Krol Group comprised mainly dolomite and earthy dolomite. Detailed mapping of 3 sq. km in Kathwar block and LSM of 50 sq. km was done in western part of Nigalidhar Syncline. About 161 channel samples and 103 trench samples were collected from carbonaceous shale–siltstone and lower intercalated black chert–shale–siltstone to assess the resources of vanadium and phosphorite. Besides, 21 samples for petrographic and 03. samples for XRD were also collected and studied. One borehole in the Kathwar block was completed with a total depth of 133.40 m. In Kathwar block, in 11 channel samples out of 13 (each sample length: 2.5 m) along the profile line of proposed boreholes HPSKBH-02, the P ₂ O ₅ content was found to be less than 1%, only in two samples it was 1.30 % and 1.43%. Low-grade phosphorite mineralisation was recorded within channel samples, along the profile line of proposed boreholes HPSKBH-02 and 03. Further, in first borehole P ₂ O ₅ varied between 0.12 % and 3.63%. In a zone of 10 m thickness (Depth: 88 m – 98 m), weighted average of a P ₂ O ₅ was 2.58%. In Rajana–Chambi section, in the individual phosphorite nodules P ₂ O ₅ is 23.01% and in mix of phosphorite nodules and chert from the same section, P ₂ O ₅ was 9.86%. In one channel sample (mix of phosphorite nodules and chert) with a sample length of 2.5 m along the profile line of borehole, P ₂ O ₅ was 6.63%.

Table-3: Mineral Production in Himachal Pradesh, 2018-19 to 2020-21
(Excluding Atomic Minerals)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value\$	No. of mines	Quantity	Value\$	No. of mines	Quantity	Value\$
All Minerals		25		3224807	26		3453620	24		3325467
Limestone	'000t	24	12034	2519275	25	12527	2746801	23	11987	2605856
Salt (rock)	t	1	17	160	1	130	1447	1	486	14239
Minor Minerals ^e	-	-	705372	-	-	705372	-	-	705372	-

(Value in ₹'000)

Note : The number of mines excludes Minor minerals.

^e Figures for earlier years have been repeated as estimates because of non-receipt of data.

Table-4: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Cement	
ACC Ltd, Gagga (Gaggal I & II), Distt Bilaspur.	4400
Ambuja Cement, Suli, P.O. Darlaghat, Distt Solan.	2870 (Clinker)
Ambuja Cement, Nalagarh, Distt Solan	1600
Asian Concretes and Cements Pvt Ltd, Bir Palsi, Distt Solan.	1500
CCI Ltd, Rajban, Distt Sirmaur	1300
Ultra Tech Cement Ltd, Bagga, Distt Solan.	250
UltraTech Cement Ltd, (Blending & Grinding), Bagheri Solan	2540
	2000

(In million tonnes)

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

₹164

Crore, value of minor mineral's production were reported in 2020-21

19

Reporting mines in case of MCDR of minerals in 2020-21

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 Anantnag, 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 2020-21 are furnished in Table - 3.

Production

Coal and Limestone were the principle mineral items reporting production in the state. The value of minor mineral's production is estimated as ₹164 crore for the year 2020-21. There were 19 reporting mines in 2020-21 in case of MCDR of 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 Indus. (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: Jammu & Kashmir

Mineral	Unit	Reserves			Remaining Resources								Total Resources (A+B)	
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
			STD121	STD122			STD221	STD222						
Bauxite	'000 tonnes	-	-	-	-	-	-	1323	182	1220	-	2725	2725	
Borax	tonne	-	-	-	-	-	-	-	-	-	74204	74204	74204	
Graphite	tonne	-	-	-	-	-	-	-	-	1059520	61681035	62740555	62740555	
Limestone	'000 tonnes	156757	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.

Table-2: Reserve/Resource of Lignite as on 1.4.2021: Jammu & Kashmir

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total/Kupwara	–	20.25	7.3	27.55

Source: Coal Directory of India, 2020-21.

Table-3: Details of Exploration Activities in Jammu & Kashmir, 2020-21

Agency/ Mineral/District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of Boreholes	Meterage		
GSI Graphite							
Baramulla	Boniyar area Uri Block	1:12500	50	-	-	165	Reconnaissance survey (G4) was carried for graphite and associated mineralisation in Boniyar area, Uri Block. The rock types observed in the area belonged to Salkhala, Dogras, Panjals and Quaternary sediments. The Salkhala Formation was observed to be represented by gypsum, graphite schist, milky white quartzite, quartz mica schist, limestone with intercalations of schist and gritty quartzite. Dogra Group was represented by three formations viz. Trikanjan, Baren and Chananwari formations of Mesoproterozoic Age. Panjal volcanics were usually fine-grained, light to dark green in colour with vesicles filled with secondary quartz and calcite as amygdules. Primary bedding S0 was seen to be well developed in phyllite and quartzite of Baren and Chananwari formations. The gypsum and graphite were observed in Salkhalas from Maidanan in the west to Ijara in the east. These gypsum and graphite bands were found to be displaced by the N-S strike slip faults in the area. Besides, sulphide mineralisation as weathered sphalerite was observed at Dachina Salamabad within quartz sericite phyllite (Baren Formation). LSM on 1:12500 scale was completed covering 50 sq.km of area along with samples collection (BRS-100 nos.), PT-(50 cu.m), PTS-(50 nos.), XRD-(5 nos.), SEM-(5 nos.) and Raman Spectroscopy-(5 nos.) for detailed analysis. About 8 samples showed 10 to 20 % fixed carbon, 7 samples showed FC from 5.40% to 9.18% and 12 samples showed FC between 0.11% and 4.83 %, respectively.
Bauxite							
Reasi	Salal- Haimna area	1:4000	3	-	-	19	Preliminary exploration (G3) for bauxite, REE & lithium in Salal-Haimna areas was carried out by Detail geological mapping of an area of 03 sq. km on 1:4000 scale. The study area exposed limestone and dolomite of Trikuta Formation, Quartzite and chert-brecciated quartzite of Khairikot Formation of Sirban Group of Mesoproterozoic Age. It is unconformably overlain by bauxite column comprised of pisolitic bauxite, non-pisolitic bauxite, clay, variegated clay/shale of Jangalgali Formation of Upper Cretaceous Age. The rocks of Jangalgali Formation were overlain by rocks of Subathu Formation (Carbonaceous shale with coal lenses and Fe-nodules, khaki shale with impersistent bands of Nummulitic limestone) of Palaeocene–Eocene Age. The analytical results of Major oxides and V, Ga etc. by XRF & REE with Be, Ge, Sn, Hf, Ta & U by ICMPs) Li and Cs for different types of samples was received. The bauxite samples were showing Al O 43.51% to 69.69%, SiO 10.39% to 36.44% with TiO -1.56% to 4.8%, V- 140 ppm to 785 ppm and Ga-58ppm to 140ppm. The total REE (La to Lu) in the bedrock samples of bauxite ranged from 65.57 to 340.14 ppm with average of 155.16 ppm. Li values for 19 core samples indicated concentration between 166 ppm and 497 ppm with an average of 306 ppm in the top layer of the bauxite up to 3.5 to 4m depth.

Table-4: Mineral Production in Jammu & Kashmir, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value [§]	No. of mines	Quantity	Value [§]	No. of mines	Quantity	Value [§]
All Minerals		22		3845383	17		3710260	19		1960163
Coal	'000t	-	13	-	-	14	-	-	10	-
Limestone	'000t	22	1228	359423	17	959	280284	18	1173	322897
Magnesite	t	-	-	-	-	-	-	1	-	-
Minor Minerals [@]	-	-	3485960	3485960	-	-	3429976	-	-	1637266

Note : The number of mines excludes Fuels and Minor minerals.

§ Excludes the value of Fuel minerals.

@ Excludes data for Ladakh for 2019-20 & 2020-21 as information is not available.

Table-5: 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 Indus (P) Ltd	330
Ceramic & Refractory Product, Kathua.	1.8
Calcium Carbide Plant, Pulwama	3
J. K. Mineral Ltd, Chipprian, Panthal, Udhampur	30 (DBM)
Nayyar Electrode Pvt. Ltd, Barri Brahmana	75 (Magnesite)
	4.45

Jharkhand



Coal was the principle mineral item reporting production in the state

The other important minerals produced are Bauxite, Copper Ore and Concentrate, Iron Ore, Limestone, etc

46

Reporting mines in case of MCDR of minerals in 2020-21

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 manganese, base metals, iron ore, gold, bauxite, nickel, tungsten, rare earths elements, rare metals, lithium and other agencies (MECL) for bauxite etc. during the year 2020-21 are furnished in Table - 3.

Production

Coal was the principle mineral item reporting production in the state. The other important minerals produced are Bauxite, Copper Ore and Concentrate, Iron Ore, Limestone, etc. The value of minor mineral's production is estimated as ₹40 crores for the year 2020-21. There were 46 reporting mines in 2020-21 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 given in Table - 5.

Table-1: Reserves/Resources of Minerals as on 1.4.2020: Jharkhand

Mineral	Unit	Reserves				Remaining Resources							Total Resources (A+B)	
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
			STD121	STD122			STD221	STD222						
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	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	
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	512637	2604079	1341224	491883	3020107	60607	5167431	6639828	681208	17402288	20006367	
Iron Ore														
(Haematite)	'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	1017105	920088	523589	-	1754900	3727685	-	7943367	8274560	
Limestone	'000 Tonnes	6780	3512	10687	74071	50565	11535	91922	13220	356962	11803	610078	620765	
Manganese Ore	'000 Tonnes	132	433	1059	1394	1046	5198	-	1395	4658	-	13691	14749	

Table-1 (Concl'd.)

Mineral	Unit	Reserves				Remaining Resources								Total Resources (A+B)
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
Nickel	Million Tonnes	-	-	-	-	-	-	-	2	7	-	-	9	
Potash	Million Tonnes	-	-	-	-	-	-	-	-	152	-	-	152	
Rare Earth Elements	Tonne	-	-	-	-	-	-	-	-	4	-	-	4	
Rock														
Phosphate	Tonne	-	-	-	-	-	-	-	-	107370000	-	-	107370000	
Sillimanite	Tonne	-	-	-	-	-	-	-	-	83000	-	-	83000	
Silver														
Ore	Tonne	-	-	-	-	-	-	-	-	23840000	-	-	23840000	
Metal	Tonne	-	-	-	-	-	-	-	-	5.22	-	-	5.22	
Titanium	Tonne	-	-	-	-	-	-	-	3630000	20635000	-	2338767	26603767	
Vermiculite	Tonne	-	-	-	-	-	-	-	-	30048	-	-	30048	

Figures rounded off.

Table-2: Reserves/Resources of Coal as on 1.4.2021: Jharkhand

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	52046	28882	5288	86217
Raniganj	1538	467	32	2036
Jharia	16282	3248	-	19531
East Bokaro	3497	3923	863	8284
West Bokaro	3923	1279	17	5218
Ramgarh	937	912	58	1906
North Karanpura	10929	6173	1865	18967
South Karanpura	5176	1312	1143	7632
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, 2020-21.

Table-3: Details of Exploration Activities in Jharkhand, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI							
Manganese							
Singhbhum	Basedera-	-	100	-	-	50	Reconnaissance survey (G4) was carried out for manganese mineralisation around this Area. A total 100 sq. km area was covered by LSM involving 60 cu. m. of pitting/trenching and collection of 50 nos. of bed rock samples from potential lithounits. The study area forms a part of North Singhbhum Mobile Belt (NSMB) where NW-SE trending Dalma Volcanic/ Group is bounded in northern and southern part by mica schist and hornblende schist of Singhbhum Group. The southern part of the study area is dominantly occupied by meta-argillaceous rocks with Phyllite, Staurolite schist, Hornblende schist and Quartz Mica Schist being the dominant lithology while the northwestern part is essentially mafic meta-volcanic of Dalma Volcanic Group depicting a typical volcano-sedimentary assemblage. In the study area, manganese mineralisation is deposited at the contact of quartzite and phyllite. The chief ore minerals are psilomelane, Pyrolusite and subordinate amount of braunite. The value of Mn in the BRS ranges from 0.01 to 1.49% and Feranges from 0.45 to 29.49%. Chemical analyses result received for PCS sample depicts 2549 ppm Cr and 1260 ppm Ni in staurolite mica schist near Basadera.
Gold							
Singhbhum	Chirubera-Gamhariya Block	-	100	-	-	227	Reconnaissance survey (G4) was carried out for gold and associated minerals in this area. Large Scale Mapping was carried out over 100 sq. km area alongwith collection of 50 nos. of pitting- trenching samples, 102 nos. of BRS, 25 nos. of PS, 25 nos. of PCS and 25 nos. of stream sediment samples. Different rock types observed are phyllite, tuffaceous phyllite, slaty phyllite, brecciated chert, quartzite, cherty quartzite, brecciated / ferruginized quartzite, quartz chlorite schist, schistose and massive metabasalt, felsic tuff, gneissose granite, dolerite and quartz veins (milky white and smoky) cross cutting the phyllites and quartzites.
Saraikela-Kharsawan	Heben-Raghunathpur Area	-	100	-	-	227	Reconnaissance survey (G4) for gold and associated minerals in was carried out in this area. The area belongs to domain V of North Singhbhum Mobile Belt (NSMB) constituting rocks of Singhbhum Group. Large scale mapping was carried out over 100 sq.km area. The area is occupied by varieties of acid volcanic rocks and muscovite-biotite schist, hornblende schist, quartzite, calc-silicate rock, younger gabbroic intrusive and quartz veins. The southern part of the area is dominantly occupied by tuffaceous phyllite. In terms of Au mineralisation anomalous values in the order 140 ppb and 120 ppb is observed in intensely altered quartzite near Kushputul. Gold values up to 120 ppb observed in trench near Lawa. Cu values are ranging from <1 to 90 ppm while values of Pb are ranging from <1 to 36 ppm and values of Zn are ranging from <1 to 77 ppm.

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Saraikela- Kharsawan	Bachkakocha- Tankocha- Pata- Humid areas	-	100	-	-	-	Reconnaissance survey (G4) was carried out in this area for gold and associated minerals. An area of 100 sq. km area was mapped involving the collection of bed rock, trench, petrological, ore microscopy, stream sediment and petrochemical samples. The area forms a part of Palaeo- proterozoic Singhbhum volcano-sedimentary supracrustal rocks constituting the North Singhbhum Mobile Belt preserving metamorphosed pelitic-psammitic-tuffaceous sequence of Dhalbhum, Lower Dalma and Chandil formations capped by rock units of mafic Dalma volcanics(Upper Dalma Formation); constituting chlorite phyllite (with thin layers of carbonaceous phyllite), carbonaceous phyllite, carbonaceous chert, quartzite/ cherty quartzite, ferruginised-oxidized quartzite (brecciated), carbonaceous algal chert (stromatolitic), metabasalt, agglomerate, pillowed metabasalt, talc chlorite schist, quartz veins, cherty dolomite, acid volcanic and mafic intrusives along with multiple tuff bands. Two mineralised zones represented by ferruginised, limonitised, oxidised brecciated quartzite with carbonate and/or smoky quartz veins were demarcated north of Chainpur-Pata-Humid-Katjor-Kadamjhor and south of Bachkakocha-Tankocha-Benadih sections.
Simdega	Sagjor- Tangratoli- Bagdega area	-	-	-	-	-	Reconnaissance survey (G4) for gold and associated minerals was carried out around this area. The mapped area comprises rocks of Chhotanagpur Granite Gneissic Complex (CGGC) and Gangpur Group (GG). The CGGC of the area contain various components including older metamorphic and supracrustal enclave suite within the gneissic country rock which had been intruded by the different phase of felsic and mafic magmatic rocks. The supracrustal units mostly consist of hornblende schist as enclaves (not mappable) within the granodioritic rock. The younger quartz veins, pegmatite veins, syenite vein and lamprophyre dykes etc. intruded into CGGC and GG were documented, which have been formed during different tectono-magmatic events experiences by the CGGC during its evolution. The porphyritic gneiss and sheared granite gneiss occur in small patches within the granite gneiss. The granitoids of granitic composition occur as intrusive into the granite gneiss rock in the central part of the study area. Gold grains (up to 7-8 grains of gold in panned concentrate of 35 kg of sediments) were observed in naked eye in the panned sediments collected from 1 st and 2 nd order streams flowing through the quartz and quartz-tourmaline veins that have intruded into the sheared granite gneiss. Gold grains were also visible in naked eye in the panned concentrate of sediments collected from the slope wash developed over the quartz veins. The BRS samples as well as the trench samples collected across these quartz veins contains significant concentration of base metals in the form of bornite and chalcopyrite stains and iron oxide stains. Good concentration of gold grains were observed in the panned sediments collected from the streams flowing through the quartz veins and around of Bandhanatoli, Gamhartoli and Barbeda village.
Bauxite							
Latehar	Dumardih - Tukudih area	1:4000	1.30	-	-	35	Reconnaissance Survey (G4) was carried out for bauxite and associated minerals (Ti, V, Ga etc.) in and around this area. Detailed mapping of 1.30 sq. km area on 1:4000 scale has been carried out along with the collection of 10 nos. of XRD samples for laboratory studies. The laterite exposures in and around Tukudih area are mostly covered by yellow to reddish lateritic soil. The analytical results of 25 nos. of BRS received indicate Al ₂ O ₃ = 30% and SiO ₂ = 7% in 10 nos. of samples ranging from 32.26% to 44.44% Al ₂ O ₃ and the corresponding SiO ₂ ranging from 2.19% to 7% of SiO ₂ also shows high value of Vanadium in 20 nos. of samples which ranges from 1705 ppm to 3995 ppm and 10 nos. of samples indicates percentage of TiO ₂ from 5.12 %to 12.32%. A large part of the study area is covered by aluminous laterite and the chemical analysis support and indicate that 14 nos. of BRS samples have Al ₂ O ₃ = 20%. The XRD analysis of 20 nos. of samples of the study area indicate major amount (>50%) as gibbsite while small amount (>5-20%) contains of boehmite, anatase, hematite beside goethite, rutile and kaolinite occurring as traces. As per IBM present threshold cut off values of bauxite (Al ₂ O ₃ = 30% and SiO ₂ = 7% total), a total of 7.96 MT of bauxite resource has been prognosticated over an area of 2.025 sq. km. with an average grade of 41.25% Al ₂ O ₃ and 3.988% SiO ₂ which is categorized as 334 as per UNFC classification.

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Base Metal							
East Singhbhum	Jamshol- Kokpara Block	1:12500	100	-	-	-	Reconnaissance survey (G4) was carried out in this area for copper, gold and associated minerals. An area of 100 sq. km was mapped on 1:12500 scale beside collection of bedrock samples, pitting and trenching samples, stream sediment and soil samples for chemical analysis. The study area comprises rocks of upper Dhanjori Formation at the base and Singhbhum Group (Chaibasa Formation). The upper Dhanjori Formation consists of metabasic rocks and Chaibasa Formation of Singhbhum Group contains psammopellitic sequence. The indicators of mineralisation are ferruginous alteration, limonite-goethite alteration in weathered metabasic rock in Rangamatiya village, tiny grains of chalcopryrite dispersed along with pits, vugs and boxworks within quartz-muscovite- biotite schist near Gohala village. Small specks of dispersed chalcopryrite and bornite stains in quartz-muscovite-biotite schist observed in Gohala and Garghutu village. Reddish brown, buff brown coloured soil with sparse tiny grains of chalcopryrite, bornite etc. in weathered muscovite-biotite schist and quartz rubbles is observed at the trench section of Gohala. Pyrite grains are observed in the form of cubical pits in quartz-muscovite-biotite schist and chalcopryrite grains are visible in dissipated manner. Some encouraging values of Cu content in five nos. of bedrock samples (1009 ppm to 6377ppm) and pit-trench samples (Trench-2) (2176ppm to 4602ppm) have been yielded in quartz-muscovite-biotite schist from Gohala village and surrounding area.
Tungsten							
Palamau	Salatua- Kachan area	1:12500	100	-	-	-	Reconnaissance Survey (G4) by Large scale mapping on 1:12500 scale was carried out in 100 sq. km area in and around Salatua- Kachan-Semra areas alongwith collection of bed rock samples (75 nos.), petrochemical samples (10 nos.), stream sediment samples (25 nos.), petrological samples (20 nos.), SEM-EDX (05 nos.) and pitting/trenching samples (50 nos). The samples collected were sent for chemical analysis. The surface indications of mineralisation are well developed in skarn zone along with crystalline limestone and amphibolite in the form of azurite, malachite, bornite, pyrite, magnetite, galena and occasionally chalcopryrite. Geochemical analytical results of bed rock samples show encouraging value of tungsten ranging from 109.17 ppm to 2106.45 ppm. Scattered values of Ag ranges from <02 ppm to 52 ppm and Au ranges from <.05 to 0.17 ppm. Isolated value of lead up to 1608 ppm has also been observed in tremolite actinolite schist around Nawadih village whereas the values of Zn ranges up to 971 ppm. The analytical result of Au in bed rock samples ranges from >0.5 ppm to 0.17 ppm. The values of U up to 12.48 ppm and Th up to 84.84 ppm has been observed from syenite present in the area.
Garhwa	Nagar Untari area	1:12500		105	-	-	Reconnaissance survey (G4) by Large Scale Mapping (LSM), on 1: 12500 scale has been carried out in and around Nagar Untari area over 105 sq. km area with collection of 100 nos. BRS, 100 nos. PTS, 25 nos. PS, and 20 nos. soil sample. The area comprises a thick succession of unmetamorphosed moderately deformed Lower Vindhyan (Semari Group) rocks including sandstones, quartzitic sandstones, siltstones, variants of shale (grey, splintery), dolomitic limestone, cherty limestone and fawn limestone and metasedimentary rocks of Parsoi Formation (Mahakaushal Group) resting unconformably over granitic rocks of Chotanagpur Granite Gneiss Complex (CGGC). In central part of study area near Korya village contacts between phyllite and biotite granite are found. Due to contact metamorphism, randomly oriented andalusite minerals have been developed within phyllites. These contact zones are associated with numerous pegmatitic and quartz veins. The general trend of phyllite/ andalusite phyllite varies from E- W to ENE-WSW. Quartz veins are 1.00 to 10.00 cm thick and less than 1.00 m in length. The depth continuation of these quartz veins are not observed while trenching. Quartz veins and andalusite phyllites were reported to have tungsten mineralisation by previous workers in adjacent Sonbhadra area. The analytical results of 20 nos. of BRS samples shows that Tungsten in phyllite ranges from 3.85 to 6.69 ppm and in quartz vein it ranges from 0.39 to 0.74 ppm.

Table-3 (Concl.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
REE and Rare metals							
Godda	Hupnatola Block	1:4000	10	-	-	530	Preliminary exploration (G3) was carried out for REE and Rare metals in this area. An area of 10 sq. km. was mapped on 1:4000 scale to access the potentiality of the rare earth elements (REE) and rare metals. The area can broadly be classified into unclassified metamorphics as the oldest rocks, gneissic rocks of CGC and intrusive. The older metamorphic consists of quartz-mica-schist, metagabbro, pyroxene granulite and amphibolite/hornblende schist and occur as enclaves and form small mounds. The major part of study area is covered by porphyritic granite gneiss and granite gneiss of Chhotanagpur Gneissic Complex. These granite gneisses are intruded by variants of younger granites, pegmatite, and quartz veins. Pegmatites bodies ranging between 20-200 m in length and 5-25 m in width were mapped. +A zoned pegmatite trending E-W is observed north of Khariani. The pegmatite bodies trend in three directions i.e. NE-SW, NW-SE and E-W. The pegmatite bodies trending NE-SW and E-W are mostly tourmaline bearing. Magnetite is observed in pegmatite vein (40x10 m) east of Khariani village. An Auger drilling of 240 m was completed in 120 nos. of boreholes which were drilled for 1-3 m depth at regular interval of 300m x300 m in grid pattern. A total of 50 nos. of BRS, 330 nos. of soil samples by auger drilling, 100 nos. of heavy mineral samples, 20 nos. of PCS, 10 nos. of SEM and 20 nos. of XRD samples were collected.
Lithium							
Koderma	Dhorakola- Kusahna area	-	-	-	-	-	Reconnaissance Survey (G4) was carried out for Lithium and Caesium in Bihar Mica Belt and Chhotanagpur Granite Gneiss Complex in and around Dhorakola- Kusahna area. LSM was carried out and major lithounits observed in the area are granite gneiss, hornblende gneiss, granite, mica schist, garnetiferous quartz mica schist, pegmatite, quartz reef and amphibolite. A small, linear amphibolite body trending parallel to the major foliation in granite gneiss is observed near Dhorakola village. A pegmatite body having 20-25 m width and 230 m length is found to be intruded along the foliation plane of garnetiferous quartz mica schist in Koderma R.F area. Another pegmatite body striking N40°E- S40°W and having 10-15 m width and 200 m length is found to be intruded in garnetiferous quartz mica schist. A composite type pegmatite intruded within mica schist near Madhuban P.F. Columbite-tantalite are observed within pegmatite intruded within granite gneiss near Dhubba village. Heavy mineral samples were collected from channel bars and meander bars. Analytical results are awaited.
MECL Bauxite							
Gumla	Mahuapattoli- Harduba block	1:2000	0.604	17	-	478	A G2 level exploration in Mahuapattoli-Harduba block, Serandag plateau, Gumla district was carried out with the objectives to i) prove the occurrences of bauxite zones, assess the bauxite resources both quantitatively and qualitatively etc. The exploration comprised mapping of 0.604 sq.km on 1:2000 scale, 206.50 m core drilling in 8 boreholes, 193.80 m vacuum suction drilling in 9 boreholes. A total of 478 samples were collected for various studies/analysis. The total resources estimated in the block was (i) 0.2354 million tonnes of 42.14% Al ₂ O ₃ and 8.39% SiO ₂ , ii) 1.1223 million tonnes of 44.63% Al ₂ O ₃ and 2.89% SiO ₂ , iii) 2.5245 million tonnes of >39.95% Al ₂ O ₃ and 4.34% SiO ₂ under indicated category.
Lohadaga	Maduapat, Kisko block	1:2000	0.363	38	-	952	A G2 level exploration in Maduapat, village, Kisko block was carried out with the objectives to i) prove the occurrences of bauxite zones, assess the bauxite resources both quantitatively and qualitatively etc. The exploration comprised mapping of 0.363 sq.km on 1:2000 scale, 403.80 m core drilling in 21 boreholes, 299.20 m vacuum suction drilling in 17 boreholes. A total of 952 samples were collected for various studies/analysis. The total resources estimated in the area was (i) 2.88 million tonnes of >37.26% Al ₂ O ₃ and 3.34% SiO ₂ , ii) 0.82 million tonnes of >38% Al ₂ O ₃ and <5% SiO ₂ , iii) 0.44 million tonnes of 44.22% Al ₂ O ₃ and 2.78% SiO ₂ , iv) 8.89 million tonnes of >31.72% Al ₂ O ₃ and 21.11% SiO ₂ for aluminous laterite under indicated category.

Table-4: Mineral Production in Jharkhand, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value ^{\$}	No. of mines	Quantity	Value ^{\$}	No. of mines	Quantity	Value ^{\$}
All Minerals		62	-	31593780	54	-	32278813	46	-	27922626
Coal	'000t	-	134666	-	-	131763	-	-	119295	-
Natural Gas (ut.) ⁺	m c m	-	4	-	-	5	-	-	2	-
Bauxite	t	13	2412486	2479551	20	1418793	1400830	19	1497473	1586192
Copper Ore	t	-	242977	-	-	288477	-	-	41772	-
Copper Conc.	t	2	6594	529620	2	7660	604135	2	1209	23707
Gold Ore	t	-	3772	-	-	4807	-	-	2859	-
Gold	kg	2	11	33888	1	18	64689	1	11	53790
Iron Ore	'000t	20	23433	27673520	21	25015	29411760	16	21434	256694610
Manganese Ore	t	4	4785	39839	2	4785	36126	-	-	-
Graphite (r.o.m.)	t	4	15831	17974	3	21202	20661	3	5674	5795
Limestone	'000t	7	1248	417940	5	785	339164	5	324	157084
Minor Minerals [@]		-	-	401448	-	-	401448	-	-	401448

Note: The number of mines excludes Fuel and Minor minerals.

^{\$} Excludes the value of Fuel minerals.

#NAME?

[@] Figures for earlier years have been repeated as estimates because of non-receipt of data.

Table-5: 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
Lafarge, Jojobera, Distt. Singhbhum.	4600
Burnpur Cement Patratu Ramgarh	300
Ceramic	
Maithan Ceramics Pvt. Ltd, Dhanbad.	80
Chemicals	
Bihar Caustic & Chemicals Ltd, Garhwa Road, Distt. Palamu.	92.75 (caustic soda lye)
Copper Smelter	
HCL, ICC, Ghatsila, Distt. Singhbhum (East).	19 (refined copper) 20.5 (copper smelting) 18.5 (copper cathode) 84 (fabricated wire bar) 54(H ₂ SO 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, Adityapur, Gamharia	25 (Foundry fluxes)
Bokaro Steel Plant, Bokaro	6900 (sinter) 4585 (pig iron) 4500 (Crude/liquid steel) 35.5 (H ₂ SO 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, Kandra, Sarai Kharsawan.	1600 (pellets)
Pig Iron	
Atibir Industries Pvt. Ltd, Bhorandiha, Giridih	600 120 (Sponge iron) 680 (sinter)
Elcctrosteel Steels Ltd, Siyal Jori, Chandan Kiyari	1500
Sponge Iron	
Anindita Steel Ltd, Senegarha Rabodh	120
Ashirwad Steel & Industries Ltd, Gamharia, Jamshedpur.	72
Bihar Sponge Iron Ltd, Chandil, Distt. Saraikela-Kharsawan.	210
Brahmaputra Metallics Limited, Kamta, Gola, Distt. Ramgarh.	105 148.5 (Semi-finished Steel)
Balmukund Sponge & Iron Pvt. Ltd, Majhaladih, Gadisrirampur	63 75 (Crude/liquid steel) 37 (Pig Iron)

Table-3 (Concl.)

Industry/plant	Capacity ('000 tpy)
Chintpurni Steel Pvt. Ltd, Indra, Zarba	90
Jai Durga Iron Pvt. Ltd, (I &II) Jhumari Tellaiya, Distt. Koderma	100 (Semi-finished steel)
Jai Balaji Industrial Engg. Ltd, Barajamda	(36+66) =96
Rungta Mines Limit Chaliyama Rajnagar	120
Saluja Steels & Power Pvt. Ltd, Mahtodih.	620.4
Satpuria Alloys Pvt. Ltd, Manjhladih	60
Shivam Iron & Steel Co. Ltd, Bandhi, Chandwara	60
Zoom Vallabh Steels Ltd, Dugdha, Distt. Saraikela-Kharsawan.	90
	120
Ferro Alloys	
Astha Ferrotech Pvt. Ltd, Adityapur, Tatanagar	201
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 Co. Ltd, Jambad, Udnabad	37.4 (Si-Mn)
Tin Plates	
The Tin Plate Co. of India Ltd, Jamshedpur.	379
Glass	
IAG Co. Ltd, Bhandainagar.	360 TPD
Refractory	
SAIL Refractory Unit (formerly Bharat Refractories Ltd.), Ranchi Road, Ramgarh.	7.5
SAIL Refractory Unit (formerly Bharat Refractories Ltd.), IFICO, Ramgarh.	42
SAIL Refractory Unit (formerly Bharat Refractories Ltd.), Bhandaridah, Distt. Bokaro.	26
Jharia Firebricks Pottery Works (P) Ltd, Dhansar, Distt. Dhanbad.	20
Mineral Trade Corporation Khaparsai, Chaibasa	6.6
Raj Refractory (P) Ltd, Hardag, Distt. Ranchi.	6

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

₹1,916

Crore, value of minor mineral's production was estimated for the year 2020-21

141

Reporting mines in case of MCDR of minerals were reported in 2020-21

Mineral Resources

Karnataka has the distinction of being 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 Belagavi, Ballari, Chikkamagaluru, Chitradurga, Davangere, Uttara Kannada, Shivamogga & Tumakuru districts;

ochre in Ballari and Bidar districts; **quartz/silica sand** in Bagalkot, Bengaluru, Belagavi, Ballari, Chikkamagaluru, Chitradurga, Davangere, Dharwad, Gadag, Kalaburagi, Hassan, Haveri, Kolar, Koppal, Mandya, Mysuru, Uttara & Dakshina Kannada, Raichur, Shivamogga, Tumakuru & Udupi districts; **Quartzite** in Belagavi district; & **talcs/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 districts (Table - 1).

Exploration & Development

The details of exploration activities conducted by GSI for chromium, gold, base metal, platinum group of elements, nickel and diamond also by KSMCL (Karnataka State Minerals Corporation Limited) during 2020-21 are furnished in Table - 2.

Production

Gold ore, Iron Ore, Manganese ore, Limestone, and Magnesite are the important minerals produced in Karnataka State. The value of minor mineral's production is estimated as ₹1916 crores for the year 2020-21. There were 141 reporting mines in 2020-21 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	Reserves					Remaining resources									
	Total Unit	Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	resources (A+B)	
			STD121	STD122			STD221	STD222							
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	464495718	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 MoS ₂	tonne	-	-	-	-	-	-	-	-	-	1718.7	-	1718.7	1717.7	
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 (Concltd.)

Mineral	Reserves						Remaining resources						resources (A+B)
	Total Unit	Proved STD 111	Probable		Total (A)	Feasibility STD211	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)		
			STD121	STD122									
Rare Earth Elements	tonne	-	-	-	-	-	-	-	3350	384	3734	3734	
Sillimanite	tonne	-	-	-	-	-	-	-	982725	-	982725	982725	
Silver													
Ore	tonne	17480000	4640000	-	22120000	-	-	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	-	-	-	-	-	-	11805499	172921	9338246	36677818	36677818	
Contained WO ₃	tonne	-	-	-	-	-	2915	1775	142	1403	6235	6235	
Vanadium													
Ore	tonne	-	-	-	-	-	-	-	14884430	-	19384430	19384430	
Contained V ₂ O ₅	tonne	-	-	-	-	-	700	-	43197.55	-	49497.55	49497.55	
Vermiculite	tonne	-	-	-	-	28000	50520	1562	66658	-	162240	162240	

Figures rounded off.

Table-2 : Details of Exploration Activities in Karnataka, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
GSI							
Chromium							
Mandya	Anuksapura Kallenahalli	1:12500	-	-	-	30	Reconnaissance Survey (GH) was carried out for Cr-Ni-Cu with associated PGE and gold in this area. Large scale geological mapping (LSM) on 1:12500 scale was carried out to identify the zones of mineralisation for Cr-Ni-Cu with associated PGE and gold mineralisation in the investigated area. The exposed litho assemblages in the study area belong to Sargur group (Nagamangala Group) of rocks. It is mainly represented by meta-ultramafites with rock exposures of talc-tremolite- actinolite schist, peridotite and metapyroxenite and amphibolites. Chemical analytical results of 30 bedrock samples collected from Peridotite in Ichchalagatta area have shown the highest Cu values upto 369 ppm. In this area no high anomalous Cu values have been revealed. Ni values range from 10 ppm to 1477 ppm. Amphibolite Showed highest Ni values. Six samples have yielded the Ni values above 1000 ppm. Similarly, the bedrock samples have shown anomalous Cr values ranging from 10 to 2963 ppm. Peridotite and Ultramafic rocks of Ichchalaghatta area have yielded Cr values more than 2000 ppm. Petrographic studies of ultramafic rocks in the study area have shown plagioclase, hornblende, tremolite, chlorite, magnetite, pyrotite and pentlandite ore minerals.
Gold							
Haveri	Sidenur &	-	-	-	-	23	Reconnaissance survey (G4) was carried out for Gold in these areas. Geologically, the area represent northern extension of Dharwar- Shimoga schist belt. The lithounits constitute intercalated sequences of meta-argillite/ greywacke with BIF, quartzite with felsic volcanic of Ranebennur Formation of Chitradurga Group. It is later intruded by acidic and basic intrusives. Meta-argillite/ greywacke forms the host rock for the other lithounits. Quartzite is the oldest litho-unit. It is light coloured, fine grained, hard, massive, often cherty in nature, foliated with iron staining. Meta-greywacke/ argillite show gradational contact relationship and often grades in shale or phyllite. BIF is represented by banded magnetite chert (BMC), banded ferruginous quartzite (BFQ) and banded magnetite quartzite (BMQ). It is exposed as linear, discontinuous bands characterised by alternate rhythmic layers of fine- grained quartzite, chert, magnetite or haematite and often traversed by several parallel or criss-cross quartz veins. Analytical results of 23 BRS samples shows Au values ranging from 25 ppb to 382 ppb. Analysis shows Au ranging from 25-60 ppb in Nandihalli, 25-84 ppb in east of Kalgond and 28- 382ppb in BMC, south of Bisalhalli area. Analytical results of BRS samples from Kalgond show copper value of 1520 ppm.

Table-2 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Haveri	Shiggaon & Konankeri area	-	-	-	-	-	Reconnaissance survey (G4) was carried out for gold in these area. The investigated area is comprises of rocks of Archaean to Proterozoic ages. The Ranibennur Formation belonging to Archean age comprises by metagreywacke/chlorite-sericite schist sequence, Fe bearing muscovite quartz schist/tuff sequence and banded iron formation; while the rocks of Proterozoic age consist of younger intrusive like gabbro/dolerite dyke and quartz vein. The contacts between metagreywacke, chlorite-sericite muscovite schist and Fe bearing muscovite quartz schist are gradational. However, the contact between metagreywacke and BMQ is sharp. The Gangibhavi -Singapura BFQ band which is promising band shows encouraging Au values 265 ppb, 118 ppb, 625 ppb, 500 ppb and 1120 ppb obtained from BRS; 80 ppb, 100 ppb and 140 ppb from SS and 330ppb and 155ppb from PTS.
Haveri	Singapura block	1:1000	2	8	985	190	Preliminary exploration (G3) was carried out for gold in this area. A total of 2 sq. km area was covered by detailed mapping on 1:1000 scale with 107 cu. m trenching, 100 trench, 50 bedrock, 20 petrochemical and 20 petrology samples. In all 8 first level (60m vertical) inclined boreholes were drilled with a spacing of 100-200 m covering a total of 985 m drilling. Singapura block comprises Meta volcano-sedimentary rocks as meta- greywacke argillite, felsic volcanic, Banded Iron Formation (BIF) with presence of sulphides and later intruded by basic dykes and quartz veins. Outcrops of BIF band shows muscovite mica alteration, limonitisation and sulphide leaching stains. BIF shows presence of disseminated sulphides mainly pyrite within silica and iron rich layers. Drill core of meta-greywacke argillite shows presence of sedimentary structures as graded bedding, unsorted clast rich patches, clay clasts and soft sediment deformation structure like ball and pillow structure. Sulphide content in the mineralised zone varies from 0.1 %to 5%. Width of alteration and sulphide mineralisation zone in drill core varies from 0.5m to 1.5m. Alteration and sulphide mineralisation is traced by drilling over a strike length of 600m in block area. Chargeability value in the area varies from 2 to 11 mV/V, resistivity survey shows total variation from 100 to 2000 Ohm-mand total field magnetic value varies from 111 to 180nT. High Chargeability and low resistivity corroborates with linear BIF bands. Magnetic data of the block area shows discontinuous magnetic zones along strike of BIF bands. Magnetic anomalous zone is well corroborated with the resistivity and chargeability. The area shows a prominent D1 deformation event which is represented by N20°W-S20°E trending foliation. in meta-greywacke

Table-2 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
							argillite and it is parallel to bedding in BIF. 4 bedrock samples from sulphidic BIF analyzed Au value as 26, 36, 36 and 726 ppb. 1 trench sample analyzed 2.52 ppm Au. Base metal analysis of bedrock/ trench sample analyzed Cu from 11 to 330 ppm, Zn from 10 to 221 ppm and Pb from 11 to 60 ppm in Singapura block
Haveri	Dyamankoppa Block	-	2	-	1000	504	Preliminary exploration (G3) was carried out for gold in this block. Gold exploration is carried out in the Dyamankoppa block to assess the of gold potentiality of the rock along with the 2 sq. km detailed mapping, 102 cu. m trenching, 1000 m drilling, collection of 52 bedrock samples, 102 trench samples and 350 core samples. Dyamankoppa Block forms the part of Shimoga Schist Belt and exposes rocks of Ranibennur Formation of Chitradurga Group which includes metagreywacke-argillite, felsic volcanic, Banded Iron Formation, basic dykes and quartz vein. Width of the BIF in the area varies from 20 cm to 1 m. Sulphide specs are seen along the banding.
Chitradurga	Chikkenahalli-Kasavanahalli area	-	100	-	-	40	Reconnaissance survey (G4) was carried out for gold and associated mineralisation in this area. A total of 100 sq. km was mapped along with systematic sampling for study of petrography, mineral chemistry and mineralisation. Sheared granite gneiss (PGC-I), amphibolites (Javanahalli Group), metabasalt (Ingaldhalu and Hiriyur Formation of Chitradurga Group), diorite, meta-gabbro/meta-pyroxenite, granodiorite- granite (JN Kote granitoid), argillite (chlorite-quartz phyllite/schist), strongly sheared Medikeripura granite, BIF, Chitradurga granite and younger intrusive (micro-gabbro, dolerite dykes, quartz reef/veins) are exposed in the study area. During the mapping work, four hydrothermal alteration zones i.e. South-east of Kasavanahalli (North of JN Kote), North of Ennegere, East of Chikkenahalli and North of Pallavere were mapped in study area. Hydrothermal alteration zone mapped at southeast of Kasavanahalli (north of JN kote) is extension of alteration zone established during FS 2019-20 and combined dimension is about 1.5 km long (NNW-SSE) and 450 to 800 m wide. Forty bedrock samples (15 during FS 2019-20 and 25 during FS 2020-21) collected from veins/veins and host granite in this zone has been analysed for gold and has yielded gold value as high as 15100 ppb (FS 2019-20). Highest gold value analysed from this zone during FS 2020-21 is 13600 ppb.

Table-2 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Base Metal							
Raichur	Machanur west block	-	-	-	-	60	General exploration (G2) was carried out for Copper and Gold mineralisation in block. The objective is to delineate the mineralised zone for copper and gold and estimate the resource in Machanur West block. The block is of 1 sq km area and is primarily soil covered with extensive agricultural fields. Regionally, the Machanur block forms part of the granitoid terrain belonging to the Closepet Granite suite of intrusive granites and granodiorites. These granodiorites are intrusive in Hutti Schist Belt. The study area is represented by brecciated and altered pink porphyritic granite and intrusive dolerite dyke. The mineralised zone in Machanur occurs in an ENE-WSW trending brittle fracture system stretching for about 5 km in length and 50-150 m in width within pink porphyritic granite. The linear dolerite dyke is also mineralised when it is close to breccia zone. Hydrothermal alteration is intense and is represented by quartz-K-feldspar-hematite-chlorite-carbonate-epidote assemblages developed in altered granite and dolerite. Sulphide minerals are noted in the form of dissemination, massive chunks, veins and fracture filling. Ore minerals noted in the zones are chalcopyrite, pyrite, bornite, covellite, native copper, chalcocite and minor cuprite. Chalcopyrite is the main ore of copper in the area followed by bornite, covellite, and native copper. A total of 60 cu.m of trenching was completed and a total of 60 pitting/trenching samples were submitted. Out of the 60 samples results of 40 samples were received. Analytical results from one trench MCT-36 indicates value of 530 ppm Cu over 1m and trench MCT 32 indicates 0.1% Cu over 1m within the West block.
Raichur	Yerjanti area	1:12500	50	3	514.50	409	Reconnaissance survey (G4) was carried out for copper, gold and associated minerals. An area of 50 sq. km area has been mapped on 1:12500 scale along with 50 cu. m pitting & trenching and also 514.50m, scout drilling has also been achieved by drilling three scout boreholes. A total of 132 nos. of BRS, 61nos. of pitting & trenching samples, 50 nos. of soil samples and 166 nos. of core samples are collected. Three scout boreholes have achieved a total of 514.5m drilling. First and second scout boreholes (KRY-01& KRY-02) intersected three sulphide-bearing zones. Third Scout borehole (KRY-03) intersected one K-feldspar and iron oxide alteration zone and one chlorite, epidote, quartz and carbonate altered mafic rock. Actual mineral potential of the investigation area will be furnished after receiving all the analytical results. 132 nos. BRS are collected out of which 61 nos. of sample results are available and analysed 0.14 to 1.01% Cu.

Table-2 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Platinum Group Elements (PGE)							
Hassan	Ranganathas- wamy Betta	-	-	6	749.49	380	Preliminary exploration (G3) was carried out for PGE in this area. The study area exposes lithounits belonging to the older greenstone remnants, and comprises of ultramafic and mafic rocks engulfed by migmatitised Peninsular Gneisses (PGC). The various lithounits exposed in the study area includes Chlorite Serpentine, Talc serpentine schist, Meta- gabbro, Titaniferous vanadiferous magnetite rock, Tremolite chlorite schist, Granite gneiss, Hornblendite (Amphibolite), Anorthosite, Gabbro /Pyroxenitic gabbro and quartz veins. During the course of work, a total of 1.93 sq. km area was covered by ground geophysical surveys viz. magnetic, resistivity and IP methods. Total of 749.49m drilling has been completed in six boreholes viz. KHNR-1, 2, 3 4, 5 & 6 in Ranganathaswamy Betta block. Before commencement of drilling, extensive trenching at 100m spacing is being carried out for delineation of continuous zone in the study area. 268 cu.m trenches were excavated and 305 trench samples were collected keeping the sample interval at 0.5m and 75 Nos. of bed rock sampling by chips from outcrop, channel/ groove were also collected for the PGE anlysis. 206 trench samples were submitted for PGE analysis at SR, Chemical lab and the results are awaited. The first three Borehole KHNR-1, 2 & 3 have been drilled as scout borehole based on the high surface values of trenches.
Nickel							
Chitradurga & Chikmangalur	Yaradakere and Patta Devarahalli	1: 12500	100	3	500	82	Reconnaissance survey (G4) was carried out for Nickel, Copper, Cobalt and PGE mineralisation between Yaradakere and Patta Devarahalli areas, Antarghatta Mafic-Ultramafic Complex, Chitradurga and Chikmangalur districts. The area of investigation forms the southeastern margin of Shimoga Schist Belt in Western Dharwar Craton (WDC) of Archaean age. Large Scale Mapping was carried out in 100 sq. km area on 1: 12500 scale in part of Toposheet No. 57C/2. The lithounits present in the study area are amphibolite, meta-pyroxenite, talc-tremolite schist, serpentinite, migmatite gneiss, gabbro, dolerite dykes, pegmatite and quartz vein. The scout drilling targets of 500m have been assigned to identify the continuity of mineralisation in the ultramafic sequence in the subsurface. The base metals analytical results have been received for 82 samples and the highest value for Cr values ranging from 710 ppm to 2.70% and Ni values ranging from 390 to 3100 ppm respectively.

Table-2 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Tumkur	Banasandra	-	-	-	-	22	Preliminary Exploration (G3) was carried out for Komatiite-Hosted Ni- PGE-Au Mineralisation in the Mafic-ultramafic rocks around Banasandra. The area under investigation comprises mainly ultramafic rocks of Bababudhan Group of Chitradurga Supergroup. The geochemical sampling and drilling results of Banasandra block have shown the Ni-Co enrichment in the shallow laterite-profile as well as in the deeper altered serpentinite. A few indications of primary sulphides have been identified in thin section samples of core samples. Few high anomalous chargeability clusters were identified along the western Komatiite contact during the Ground Geophysical survey. Anomalous zones have been verified and ground checked for any possible mineralisation. Identified zones with drilled width and nickel-cobalt contents in South Banasandra block are from BH. No. KTBS-1 Zone 1: 10.13m X (Ni: 0.58% & Co: 242 ppm): Laterite and saprolite, Zone 2: 7.45m X (Ni: 0.62% & Co: 387 ppm) in weathered serpentinite (with magnetite) and Zone 3, 5.6m X: (Ni: 0.59% & Co: 332ppm) associated with magnetite in showing rarely preserved spinifex and pillowed structures located NE and SE of Banasandra village. Identified zones with drilled width and nickel-cobalt contents in South Banasandra block are from BH. No. KTBS-1 Zone 1: 10.13m X (Ni: 0.58% & Co: 242 ppm): Laterite and saprolite, Zone 2: 7.45m X (Ni: 0.62% & Co: 387 ppm) in weathered serpentinite (with magnetite) and Zone 3, 5.6m X: (Ni: 0.59% & Co: 332ppm) associated with magnetite in A sub block of 0.25 sq. km is identified in the South Banasandra block for resource estimation of supergene enriched (Lateritic) Ni-Co zones. Analytical results of 22 Soil/ Regolith samples show anomalous PGE values in 3 samples (100 to 232 ppb), indicating the possibility of PGE- enrichment in the weathering profile.
Diamond							
Tumkur	Ramagiri Nutimadugu area	-	740	-	-	163	Reconnaissance survey (G4) was carried out for primary source rocks for diamond in Ramagiri- Nutimadugu area of Eastern Dharwar Craton, Anantapur district of Andhra Pradesh and Tumkur district of Karnataka. Around 740 sq km area was covered under reconnaissance survey and 163 stream sediment samples were collected from favourable trap sites and processed for heavy mineral separation. The study of stream sediment sample revealed that the present area contains the heavy minerals like chromites, spinels, ilmenites, garnets, diopsides, epidotes, amphiboles, zircons, apatites, tourmalines, and sulphides. In southeastern part, near Kanaganakuntla village one zone of quartz tourmaline vein (approximate dimension of 1200 m x 200 m) is reported during the reconnaissance traverse for kimberlite which is intruded into PGC-II may be a potential zone for critical minerals like Tin and Tungsten.

Table-2 (Concl.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Karnataka State Mineral Corporation Magnesite and Dunite							
Mysore	Karya village, Madanpura Post, Nanjanagud Taluka	1:2000	86.25 Hect	-	-	-	About 204 Th tonnes of magnesite and about 3004 thousand tonnes of dunite reserves has been estimated in the ML area.

Table-3: Mineral Production in Karnataka, 2018-19 to 2020-21

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		141		100319538	148		100582716	141		118382249
Bauxite	t	-	-	-	1	-	-	-	-	-
Chromite *	t	3	-	-	2	-	-	2	-	-
Gold Ore	t	-	563519	-	-	590704	-	-	447752	-
Gold	kg	4	1661	5233808	4	1724	6431034	4	1115	5422160
Iron Ore	'000t	54	29823	71114250	61	31392	67326043	65	34542	85430466
Manganese										
Ore	t	11	332162	2276289	9	336745	2194098	9	371046	2347159
Silver #	kg	-	214	7785	-	187	8066	-	120	7244
Graphite										
(r.o.m.) *	t	2	-	-	2	-	-	2	-	-
Kyanite	t	-	-	-	1	400	880	1	3780	7414
Limestone	'000t	62	34378	6103939	64	34165	6672035	54	33189	5965087
Limeshell	t	2	3538	10699	1	1017	3051	-	-	-
Magnesite	t	3	9108	56368	3	7198	48309	3	6061	39419
Vermiculite	t	-	-	-	-	-	-	1	-	-
Minor										
Minerals		-	-	15516400	-	-	17899200	-	-	19163300

Note: The number of mines excludes Minor minerals.

Recovered at Raichur and Tumkur during refining of gold.

* Only labour reported.

Table-4: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)	Industry/plant	Capacity ('000 tpy)
Abrasives			
Grindwell Norton Ltd, Bengaluru.	NA	Bhinga, Distt. Uttara Kannada.	soda), 52.3 (Cl), 133.7 (HCl) 24.0 (H3PO4)
Alumina			
Hindalco Industries Ltd, Belagavi	350 (alumina) 40(paste) 0.090(Vanadium)	Magnesium & allied Product Hurugalavadi , Mandya	3 (Magnesium Carbonate) 1.875 (Magnesium Oxide)
Cement			
ACC Ltd, Wadi (Wadi & Wadi New), Distt. Kalaburagi	5450	Shivam Minerals , Honaga Belgaum	4.6(Magnesium Carbonate) 4.6 (Magnesium Oxide)
ACC Ltd, Kudithini, Ballari (G).	1100		
ACC Ltd, Thondebhavi, Distt. Chikaballapur (G).	1660	Fertilizer	
Bagalkot Cement Industries Ltd, Distt. Bagalkot.	600	K. P. R. Fertilizers Ltd Halvarthi, Koppal.	60 (SSP)
Chettinad Cement, Kallur, Distt. Kalaburagi.	2500	Mangalore Chemical & Fertilizers Ltd, Panambur, Mangaluru.	379.5 (Urea) 260 (DAP) 40 (Complex)
Dalmia Cement, Yadwad, Distt. Belagavi	4000 2600(Clinker)	Tungabhadra Fertilizers & Chemicals Ltd, Munirabad, Koppal.	45 (SSP)
Heidelberg Cement India Ltd, (Formerly Mysore Cements Ltd) Ammasandra, Distt. Tumakuru.	510	Iron & Steel	
J. K. Cement Ltd, Muddapur, Distt. Bagalkot	3000	JSW Steel Ltd, Tornagallu	9200 (pellets)
JSW Cement, Vijaynagar, Distt. Ballari.	3200	Sandur Distt. Ballari	12000 (crude/liquid steel) 12950 (sinter) 4618(Coke)
Kesoram Industries, Vasavadatta Cement,	8565(OPC)	Visvesvaraya Iron & Steel Ltd, Bhadravati, Distt. Shivamogga.	205 (pig iron) 118(crude/liquid steel)
Sedam, Distt. Kalaburagi	8565(PPC)		4.8 (refractory bricks)
Kalaburagi Cement Pvt Ltd (formerly Viratsagar)	2750	Sunvik Steels Pvt. Ltd, Jodidevarahally, Distt. Tumakuru.	60 (sponge iron) 60 (TMT bar) 36(-----)
Gulbarga, Distt. Kalaburagi		Pellets	
Kalaburagi Cement Pvt Ltd	3500	BMM Ispat, Danapur, Distt. Ballari.	2400 (pellets)
Karchikhed, Chincholi	2750 (Clinker)	KIOCL, Mangaluru	3500 (pellets) 6700 (conc.)
Orient Cement Ltd.Itagi, Chittapur	3000	Minera Steel & Power Pvt. ltd., Sandur	600
Ramco Cement Ltd, Mathodu, Distt. Chitradurga.	290	SLR Metalliks Ltd. Narayan	343.2(Sinter)
Shree Cement Ltd.Benekanahalli, Kodla	3000	Devera Kera Hagari Bommanahalli	
Sedam, Kalaburagi		Xindia Steel, Koppal.	800 (pellets)
Ultratech Cement, Raj Shree Cement, Malkhed, Distt. Kalaburagi.	6100	Pig Iron	
Ultratech Cement, Ginigera, Distt. Koppal (G).	1300	Uni-Metal Ispat Ltd, Ballari.	75
Orient Cement Chittapur, Kalaburagi	3000	Kalyani Ferrous Ind. Ltd, Koppal	500(Sinter) 289.6
Ceramic			
Ceramic Products Ltd, Khanapur, Distt. Belagavi.	NA	Kirloskar Ferrous Industries Ltd, Bevinahalli, Distt. Koppal. 720	500 (Sinter)
H&R Johnson (India) Ltd, Hubballi.	47.72	Mukund limited, Ginigera, Kopopal	500 (Sinter)
Murudeshwar Ceramics Ltd, Dharwad.	8.4 mill.sqm	Sponge Iron	410.3
The Mysore Spongware Pipes Potteries Ltd, Solandavanahalli, Bengaluru.	NA	Agrawal Sponge & Energy (P) Ltd, Kuduthini, Distt. Ballari.	90
Chemical			
Solaris Chem Tech Industries Ltd,	59.4 (caustic	Balakundi Premium Steels Pvt. Ltd, Halakundi, Distt. Ballari.	34
		Bellary Ispat (P) Ltd, Halakundi	52.5

Table-4 (Concl.)

Industry/plant	Capacity ('000 tpy)	Industry/plant	Capacity ('000 tpy)
Distt. Ballari.		Padmawati Ferrous Metal, Chikantpur Sandur, Ballari.	150
Ballary Steel & Alloys Ltd, Ballari.	60	Rayon Steel Pvt Ltd, Veniverapur, Distt. Ballari.	60
Benaka Sponge Iron Pvt. Ltd, Belagal, Distt. Ballari.	84	Rengineni Steel Pvt. Ltd, Halakundi, Distt. Ballari.	25.5
BMM Ispat Ltd., Danapur	600	Shree Venkateshwara Sponge & Power Ltd,	60
	2400 (pellet)	Halakundi, Distt. Ballari.	
BRU Industries, Anekal Taluk	1.2 (cast Iron)	Yashshvi Steel & Alloys Ltd, Halakundi, Distt. Ballari.	30
Dhruvdesht Metasteel Pvt. Ltd,	72	Ferroalloys	
Hirebaganal, Distt. Koppal.		Ani Smelters Yaradakatta, Hariyur	1.5
Divya Jyoti Steel Ltd, Taranagar, Distt. Ballari.	30	Dandeli Steel & Ferro Alloys Ltd, Dandeli.	6
Gayatri Metals Pvt Ltd, Belagal, Distt. Ballari.	5000	Padmawati Ferrous Metal, Chikantpur Ballari	30
Hindustan Calcined Metal Pvt. Ltd., Janekunte Ballari	60		5 (Ferro - manganese)
Jairaj Ispat Limited Belagal village	60		5 (Silico-manganese)
Haryana Steel and Power, Shanthigrama, Distt. Hassan.	35		2 (Ferro-silicon)
Hare Krishna Metalics Pvt Ltd, Hire Baganal, Distt. Koppal.	144	Sandur Manganese & Iron Ore Ltd,	36 (SiMn)
Hospet Ispat Pvt. Ltd,	60	Mariyammanahalli Hospet Refractories	
Allanagar Bagnal Road, Distt. Koppal.		T. S.Ranganath & Company,	1.0 (Clay tiles & Block)
Hothur Ispat Pvt. Ltd, Veniveerapur, Distt. Ballari.	300 TPD	Keshavapurahuliyar,	
Minera Steel & Power Pvt. Ltd, Yerabanahally, Distt. Ballari.	120	Chikkanayakanahalli	
M.S.Metals & Steels PVT. Ltd. Hirebagnal	105	S.R. Chemicals & Ferro Alloys Ltd,	0.3
Koppal	109.5(TMT Bars)	Honaga, Distt. Belagavi.	
Noble Distillaries & Powers Ltd, Sirivar, Distt. Ballari.	200 TPD	Thermit Alloys Pvt. Ltd, Shivamogga.	1.2
PGM Ferro Steel Pvt. Ltd, Hariganadani, Distt. Ballari.	60	Petroleum Refinery	
Popuri Steels Ltd, Halakundi, Distt. Ballari.	30	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

Estimated value of production of minor minerals in 2020-21

1

Reporting mines in case of MCDR of minerals in 2020-21

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, leucosene 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 accounts 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 & Thiruvananthapuram districts; lignite in Kannur districts; magnesite in Palakkad district; and steatite in Kannur & Wayanad districts (Tables - 1 and 2).

Exploration & Development

GSI carried out exploration for bauxite and rare earth elements in Kasargod and Idukki Districts during 2020-21. Details of exploration carried out by GSI and other agencies are furnished in (Table - 3).

Table-1: Reserves/Resources of Minerals as on 1.4.2020: Kerala

Mineral	Reserves						Remaining resources							
	Total Unit	Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	resources (A+B)
			STD121	STD122			STD221	STD222						
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
PtGroup														
of Metals	'000 tonnes	-	-	-	-	-	-	-	-	-	0.18	-	0.18	0.18
Sillimanite	tonne	553000	-	-	553000	432713	-	-	2564254	-	3369200	-	6366167	6919167
Titanium	toone	2370712	-	-	2370712	10597943	-	-	-	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 1.4.2021 : Kerala

(In million tonnes)

District	Proved	Indicated	Inferred	Total
Total/Kannur	-	-	9.65	9.65

Source: Coal Directory of India, 2020-21.

Table -3 : Details of Exploration Activities in Kerala, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
GSI Bauxite							
Kasargod	Perla area	1:12500	100	-	-	253	Reconnaissance survey (G4) was carried out in this area for bauxite. Large scale mapping of 100 sq km was carried out on 1:12500 scale in toposheet no.48P/2 with collection of 131 bed rock samples, 36 vertical section samples, 50 pit samples, 13 petrographic, 10 XRD and 13 petro chemical samples. Laterite is the major rock unit in the area and bauxite is seen as intermixed with laterite as pockets and patches. Analytical results of BRS samples yielded Al ₂ O ₃ content of 5.23 to 52.92% with an average of 34.59%. SiO ₂ , Fe ₂ O ₃ and TiO ₂ of BRS samples gives an average value of 26.50%, 23.23% and 1.33%. About 17 BRS samples yield Al ₂ O ₃ greater than 40. TREE values of BRS samples ranges from 115.48 to 474.26 ppm. Al ₂ O ₃ content in pit samples ranges from 22.74 to 40.71% with an average of 32.80%. Analytical results of vertical profile samples reveal that the bauxite occurrence is mainly confined to a depth of 2m to 5m from the ground surface with an average of 35.71%. Intergration of geological and geochemical data of aluminous laterite/bauxite samples, demarcated 5 mineralised zones of having total area of 2.73 sq. km, around Yetadka, Ukkinadka, Maniampara and Perla by fixing cut-off grade for bauxite at 40% Al ₂ O ₃ .
Rare Earth Elements (REE)							
Idukki	Chittira- puram	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.

Table-3 (Concl.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Rare Earth Elements (REE)							
Kasaragod	Uppala area	1:12500	100	-	-	230	Reconnaissance survey (G4) was carried out in this area for REE. Large scale mapping on 1:12,500 scale has been carried out and 100 sq. km area was covered. The field study implies that the gneisses and associated granite, pegmatites, quartz veins are the favourable rock for REE mineralisation. In the study area, number of non-mappable pegmatites observed within different lithounits, systematic sampling was carried out from this pegmatite. The intense laterisation noticed in the area may contribute to secondary clay associated REE mineralisation. Systematic sampling representative of different horizons viz. parent rock (protolith), saprolite zone, oxidized zone, and clay rich zones were done. Systematic soil sampling in grid pattern was carried out in the south-western and eastern part of the study area due to non-availability of outcrops. A total of 101 nos. of bed rock samples, 51 nos. of regolith samples, 50 nos. of trench samples and 28 nos. of petrochemical samples were collected and submitted for chemical analysis. Based on the available analytical results of bed rock samples (27 nos.), the REE values in pegmatite ranges from 67.42 to 1254.54 ppm, in hornblende biotite gneiss the REE value ranges from 55.08 to 611.72 ppm and in granite gneiss, the REE value ranges from 606.81 to 985.19 ppm.

Production

Limestone is the important minerals produced in Kerala State. The value of minor mineral's production is estimated as ₹3,848 crores for the year 2020-21. There were 1 reporting mines in 2020-21 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 finalised in (Table - 5).

Table-4: Mineral Production in Kerala, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		8	-	38807569	2	-	38835180	1	-	38792470
Graphite										
(r.o.m.)	t	1	-	-	-	-	-	-	-	-
Sillimanite	t	3	7318	82173	-	-	-	-	-	-
Limestone	'000t	1	325	230958	1	398	342144	1	376	315113
Limeshell	t	3	3996	17081	1	3583	15679	-	-	-
Sulphur #	t	-	225857	-	-	227253	-	-	142166	-
Minor Minerals @		-	-	38477357	-	-	38477357	-	-	38477357

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 for 2019-20.

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, Distt. Kottayam	81
Ceramic	
Kerala Ceramics Ltd, Kundara, Distt. Kollam	18000
Tata Ceramics, Kozhikode	NA
FACR-RCF Building Product Ltd (FRBL), Kochi.	NA
Chemical	
Tecil Chemicals and Hydro Power Ltd, Chingavanam, Distt. Kottayam	30 (calcium carbide) 2 (acetylene black) 7.5 (ferrosilicon)
Cochin Minerals and Rutile Ltd, Kadungalloor, Alwaye	50 (Synthetic Rutile) 82.5 (Ferrous chloride) 30 (Ferric chloride) 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
TiO ² Pigment	
TTPL, Kochuveli, Distt. Thiruvananthapuram	1.8
KMML, Chavara, Distt. Kollam	40
Fertilizer	
FACT Ltd, Udyogmandal, Distt. Ernakulam	148.5 (Complex) 225 (AS)
FACT Ltd, Ambalamedu (Cochin II), Distt. Ernakulam	485 (NP/NPKs)
Ferroalloys	
INDSIL Electrosmelts Ltd, Pallatheri, Distt. Palakkad.	14
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. (Edayar Zinc Ltd)	38 (Zn ingot) 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

₹3,702

Crore, value of minor mineral's production were estimated for the year 2020-21

249

Reporting mines in case of MCDR of minerals were reported in 2020-21

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 Betul, Chhatarpur, Chhindwara, 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, Hoshangabad,

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	Reserves				Remaining resources										resources (A+B)
	Unit	Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)		
			STD121	STD122			STD221	STD222							
Antimony															
Ore	tonne	-	7503	7503	-	-	-	592	-	-	-	-	592	8095	
Metal	tonne	-	75	75	-	-	-	5.92	-	-	-	-	5.92	80.92	
Bauxite#	'000 tonnes	13584	631	18564	20389	13358	7138	22060	54577	50172	-	-	167695	186259	
Copper															
Ore	'000 tonnes	107773	-	12580	55777	100411	8824	23062	300	77938	-	-	266312	386665	
Metal	'000 tonnes	1422.6	-	148.44	686.05	321.31	27.35	207.45	9.78	843.88	-	-	2095.82	3666.86	
Diamond	carat	847400	-	159	847559	-	-	104118	-	27645359	-	-	2749477	28597036	
Gold															
Ore	tonne	-	-	-	-	-	-	-	5745934	1947000	-	-	7692934	7692934	
(Primary) Metal	tonne	-	-	-	-	-	-	-	6.03	2.22	-	-	8.25	8.25	
Graphite	tonne	-	-	-	-	-	-	-	-	6254000	6386000	12640000	12640000	12640000	
Iron Ore															
(Haematite)	'000 tonnes	24363	11326	18440	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	3111004	772476	342790	1119260	498580	791417	4128019	308205	7960747	9653178		
Manganese															
Ore	'000 tonnes	13551	2230	3777	3830	7037	4212	127	23351	1943	-	40499	60057		
Molybdenum															
Ore	tonne	-	-	-	-	-	-	-	-	8000000	-	8000000	8000000		
Contained															
MoS ₂	tonne	-	-	-	-	-	-	-	-	5020	-	5020	5020		
Potash	Million tonnes	-	-	-	-	-	-	-	1206	36	2	1244	1244		
Rock															
Phosphate	tonne	5258158	-	3772935	6460616	15688511	13880230	-	2730000	10615956	50625	49425938	58457031		
Sillimanite	tonne	-	-	-	-	-	-	-	-	0	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 1.4.2021 : Madhya Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	13479	13060	3678	30217
Johilla	185	263	33	481
Umaria	178	4	-	181
Pench-Kanhan	1967	923	1166	4056
Pathakhera	291	88	68	447
Gurgunda	-	85	53	138
Mohpani	8	-	-	8
Sohagpur	2129	5659	293	8082
Singrauli	8722	6039	2064	16824

Source: Coal Directory of India, 2021

Exploration & Development

The details of exploration activities conducted by GSI and other various agencies during 2020-21 are furnished in (Table - 3).

Production

Madhya Pradesh was the sole producer of diamond. Apart from this, Coal, Bauxite, Copper Ore & Concentrate, Iron Ore, Manganese Ore, Phosphorite and Limestone are the

principal minerals produced in Madhya Pradesh State. The value of minor mineral's production is estimated as ₹3,702 crore for the year 2020-21. There were 249 reporting mines in 2020-21 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 Madhya Pradesh, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
GSI Base Metals							
Dewas	Burara- Khubgaon- Mawasa- Kundgaon areas	-	-	-	-	-	Reconnaissance Survey (G4) was carried out for Copper Mineralisation in Burara-Khubgaon-Mawasa-Kundgaon Area, Dewas District. The study area is a part of Harda-Barwah Inlier which lies in the northern fringe of ENE-WSW trending Narmada-Son lineament. The area comprises rocks of Harda Granitoids which includes gabbro, granite, porphyritic monzogranite, basalt, quartz veins and dolerite dyke. Occurrence of copper and associated mineralisation is observed within quartz vein in the form of malachite, chalcopyrite, pyrite and galena near Burara village and Nawalgaon village. The quartz vein occurs as bouldary exposures due to thick residual soil cover. BRS sample collected from bouldary outcrop of quartz vein in Burara area shows copper values upto 3045 ppm and sample collected from quartz vein in Nawalgaon area shows up to 440 ppm of copper.
Chhindwara	Kevlari- Mankughati	-	-	-	-	-	Reconnaissance survey (G4) for Base metal and associated mineralisation around Kevlari, Mankughati Village, Chhindwara district. The area exposes a sequence of Felsic volcanic suite of rocks in the eastern, central, western and south western part of mapped area which comprise of quartz-sericite-muscovite-schist, tuffaceous foliated rhyolite, tuffaceous phyllite interbanded with volcanic tuff, massive rhyolite, graphite/ carbonaceous phyllite and calc silicate. Occurrences of Steel grey chunk of graphite in tuffaceous phyllite in scout borehole MPBKM-01.

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Gwalior	Bhaggeh- Lakhnauti & Ainti	1:2000	1.6	14	1200	-	Preliminary exploration (G3) was carried out for Copper and associated mineralisation around Bhaggeh, Lakhnauti and Ainti. Detailed mapping of 1.6 sq km area on 1:2000 scale along with drilling of 1200m in 14 nos. borehole (1 st level), was carried out in and around Lakhnauti, Ainti and Bhaggeh villages, with an objective to access the copper and its associated mineralisation. Regionally, the area comprises rocks of Archaean Bundelkhand granitoids, Lower Proterozoic Gwalior Group of rocks and Upper Proterozoic Kaimur Group belonging to Vindhyan Supergroup of rocks. However, the area around Lakhnauti, Bhaggeh, Ainti mainly comprises rocks of Bundelkhand granitoids represented by highly weathered granodiorite intruded by silicified quartz reefs. A total of five boreholes were drilled (for intersection of mineralisation at 60m vertical depth) with the strike spacing of 200m in Lakhnauti area and 300m in Ainti area covering the unexplored area in central and north-eastern part of the block. A total of 666.00m drilling meterage was achieved in all the above-mentioned borehole. Based on the complete analytical results of the core samples received for borehole no. MPBLK-01, a 5.5 m zone of mineralisation (Cu< 02%) was intersected at 54 m along the borehole having an average value of 2079.5 ppm Cu. Sulphide mineralisation which is manifested in the form of specks, stringers and disseminations of chalcopyrite and Covellite was observed in all 05 boreholes. Stringers of chalcopyrite in quartz veins hosted by alkali feldspar syenite in core sample of borehole no. MPBLK-01 is shown in and disseminated chalcopyrite in quartz veins in core sample of borehole no. MPBLK-02.
Chhattarpur	Mahuajhala- Amrauniya area	1:12500	100	2	-	48	Reconnaissance survey (G4) was carried out for Base metal and associated mineralisation in Mahuajhala-Amrauniya area. Large scale mapping of 100 sq km on 1:12500 scale was mapped in Bundelkhand granitoid complex (BGC) and rocks of Bijawar Group. BGC was represented by various granitoids like syenogranite, porphyry syenogranite, medium grained quartz syenite, grey diorite, quartzo-feldspathic vein, aplite vein, giant quartz vein/quartz reef and quartz veins within granitoids. Bijawar Group of rocks is represented by chert breccias, buff quartzite and ferruginous sandstone. Pyrophyllite is found associated with giant quartz vein with specs of pyrite- chalcopyrite. The altered part of granite is also having malachite stains. The chemical analysis of 15 bed rock samples for base metal analysis from Nagpur Laboratory, 30 bed rock samples from Bhopal Laboratory for base metal analysis and 03 PCS samples received so far is showing copper values ranging from 175 ppm to 1785 ppm.

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Gold							
Singrauli	Sonkurwa & Byodhihar- Bagadha block	-	2.6	-	800	-	Preliminary exploration (G3) stage investigation was taken up in part of toposheet 63L/11 at Sonkurwa block to delineate the auriferous zone and assessment of gold mineralisation. The investigation comprising 800m drilling along with DM of 2.6 sq. km along with Core, BRS, PS, PCS and XRD sampling. Geologically, the area is occupied by Parsoi formation (volcano sedimentary sequence) of Mahakoshal Group which is represented by variegated phyllites, intrusive quartz veins and lensoidal bodies of metabasics parallel to phyllites. During DM it was observed the area indicates lateral change in sedimentary facies as well as along dip having fining upward sequence indicating turbidity type deposition setting with volcanics input in between in sink with back arc model of Mahakoshal belt. The Sulphide mineralisation occurs in Quartz Veins and metasediments, localised along the axial planes of minor folds which have been further cross cut by minor Qtz veins (cm scale). Analytical result reported so far shows wt average 1.16 ig/kg Au in borehole MPSSK-01 and 1.06 ig/kg in borehole MPSSK-04.
Bauxite							
Anuppur & Dindori	Tulra- Mediyaras- Benibari area	1:12500	100	-	-	60	Reconnaissance Survey (G4) was carried out for aluminous laterite and Bauxite in the area, large scale mapping (LSM) of 100 sq. km area on 1:12500 scale was carried out along with collection and chemical analysis of 50 nos. of bed rock samples (BRS), 10 nos. of petrochemical samples (PCS), 100 cubic meter pitting – trenching with collection of pit- trench samples (PTS) and study of 10 nos. polished section (PS). Geomorphologically, the area is mainly traversed by NE-SW trending moderate ridges. The large plateaus was not observed in the area, therefore, the laterite/bauxite in the area is occurring as detached isolated bodies and doesn't have large aerial extension. It has varied thickness from 8- 10 m from the top of the ridge to 2-3m at the flank of the ridges. The complete analytical results of BRS, PCS, and PTS samples are awaited.
Base Metals & PGE							
Betul	Dolia-Kappa -Gajpur areas	1:12500	100	-	-	295	Reconnaissance survey (G4) for PGE, Chromium (Cr) and Nickel (Ni) mineralisation in Padhar mafic-ultramafic complex, was carried out. A 100 sq. km area was covered by LSM and 130 nos. bed rock samples, 30 nos. petrochemical samples, 30 nos. petrographic samples, 65 nos. pitting and trenching samples, 25 nos. SEM EDS samples and 15 nos. EPMA samples were collected. The study area falls in the western part of E-W trending Proterozoic Betul Belt and is a part of north-western fringes of Central Indian Tectonic Zone (CITZ) in Central India. The detailed field investigations through Large-scale mapping reveals that the rocks exposed in the study area are Precambrian granite gneiss (TTG), Olivine websterite, serpentinised pyroxenite, clinopyroxenite,

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
<p>gabbro (part of Padhar mafic ultra mafic complex), intrusive porphyritic and non-porphyritic alkali feldspar granite with enclaves of metasedimentary rocks. Further, these rocks are intruded by post magmatic phases of quartz and pegmatite veins of various dimensions. Gondwana sediments unconformably overlie the Precambrian granite gneiss and the Padhar mafic and ultramafic rocks. For systematic geological, geochemical and mineral investigation, six mafic and ultramafic bodies have been demarcated within the study area based on their distinct litho assemblages and mode of occurrence, 1. Naharpur-Bargidhana mafic ultra-mafic body, 2. Gajpur-Ratamati mafic ultra-mafic body, 3. Gaulibargi-Pisajhori mafic ultra-mafic body, 4. Jharkund-Banjantanda mafic ultra-mafic body, 5. Mendhapani- Bajarwara mafic ultra-mafic body, 6. Umarwani-Mardwani mafic ultra-mafic body.</p>							
Lithium							
Betul	Kesmar- Mendakheda Kanjitalav, Kota, Kajli,	1:12500	100	-	-	305	Reconnaissance Survey (G4) was carried out on an area of 100 sq. km mapped in 1:12500 scale in and around the area, with an objective to establish zones of scandium and other REE mineralisation. Field work involved collection of 100 nos. BRS, 50 nos. PTS, 15 nos. PCS along with 25 nos. PS, 25 nos. Soil/Regolith, 50 nos. Stream sediments, 10 nos. XRD, 15 nos. SEM-EDX and 15 nos. EPMA samples. So far REE, Sc, Li analysis results of 30 nos. BRS are received. Total REE value in quartz syenite and syenite is ranging from 900 ppm to 2250 ppm in 9 nos. of samples. Soil samples are collected from these lithounits. Presence of aegirine, monazite, zircon was observed in these alkaline rocks i.e syenite, quartz syenite. At the north of Kanjitalav village galena was observed in quartz vein which was intruded in garnet bearing quartz mica schist. So far analysis result of one sample is received from this quartz vein and 1.15 % value of Pb is observed.
Glaucoune (*G4 survey carried out with Chitrakoot district of Uttar Pradesh)							
Satna	Pindra- Bambiha	1:12500	55	-	-	-	Reconnaissance survey (GH) was carried out for glaucoune in this area. An area of 55 sq. km was mapped on 1:12500 scale. The glaucoune sandstone is medium grained, bluish-green to reddish-brown colour, bedded and cross-bedded sandstone. The thickness of individual beds varies from 2cm to 30cm. Thin intercalations of shale/chert is observed with thickness varying from 0.4cm to 2.5cm. K ₂ O values in ten bedrock samples of glaucoune sandstone varies from 4.19% to 5.75%. K ₂ O in thirteen bulk channel samples from glaucoune sandstone varies from 4.95% to 6.26%. One pit sample from an iron-rich glaucoune sandstone layer yielded 3.8% K ₂ O. The weighted average K ₂ O of five trenches varies from 2.31% to 5.64%.

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Graphite Sidhi	Kunri-Baharia area	-	-	-	-	-	Reconnaissance Survey (G4) was carried out on Large scale geological mapping in the area. The study reports the occurrence of the graphite within Palaeoproterozoic carbonaceous phyllite, Agori Formation, Mahakoshal Group. During large scale mapping, total 09 lensoidal bodies of graphite have been demarcated in the study area. Systematic channel sampling has been carried out at 25 m channel interval along the strike length of graphite bearing carbonaceous phyllite with 5m sampling length for each sample across the strike length. Rock chips were collected from 5m channel length for each sample. Fixed carbon content of BRS sample ranging from <1% to 5.85% (average 2.82%). Extensive brecciation silicification, prominent malachite staining and goethite have been noticed in some area. Near to Goriara village (N24°21'27.6", E81°54'27.8"), gossan present within carbonaceous phyllite is highly ferruginised and limonitized and shows boxworks, abundant goethite and malachite staining showing presence of oxidation zone and gives encouraging Cu values upto 1.4%.
Phosphoprite							
Jhabua	Jher-Jhabua	1:12500	100	-	-	260	Reconnaissance Survey (G4) for Phosphorite and associated mineralisation around Jher-Jhabua Area, Jhabua District. Rocks exposed in Jhabua-Alirajpur area represents the southern and south eastern extension of Aravalli fold belt, in Madhya Pradesh and represented by Lunawada Group. The lithologies exposed are variegated phyllite, quartzite, dolomite, chert and quartz veins. The Lunawada Group is unconformably overlain by Deccan traps, while it is underlain by Udaipur group of rocks represented by granite gneisse, amphibolite and hybridized granitised amphibolite and intruded by Godhra Granite. Intrusive granite and amphibolite are also observed. They are intruded by mafic and ultramafic suite of rocks known as Jobat Mafic/Ultramafic Complex. Godhra Granite further intrudes the Aravalli's. Bagh Group of rocks, which are in turn overlain by Deccan trap basalt, unconformably overlies these older sequences. During field work, 100 nos. BRS, 70 nos. Soil, 50 nos. PTS, 15 nos. PCS, 20 nos. PS and 5 nos. OM samples were collected. The analysed values of 10 bed rock and 10 soil samples received yield P ₂ O ₅ from 0.06% to 0.16%.

Table-3 (Concl.d.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Chhatarpur	Bineda- Darguwan - Pipariya Kalan area	1:12500	100	-	-	260	Reconnaissance survey (G4) was carried out for extent of Phosphorite bearing horizon in the area in Bijawar Group of rocks. Total 100 sq km area covered by large scale mapping on: 1,12,500. Some lensoids phosphorite bodies marked in study area on the basis of visual estimation with the help of Shapiro test kit. P ₂ O ₅ ranges from 2 to 8% (VE). Phosphorite Mineralisation is seen in area in form of matrix filling and veins type observed in brecciated chert in dolomite and ferruginous sandstone. The phosphorite mineralisation is not encouraging (on basis of partial chemical data received). During the course of mapping, 100 Bed Rock Sample (BRS) and 50 pitting/ trenching samples (PTS) were collected from all mineralised lithounits and analysed for P ₂ O ₅ , SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , CaO, MgO, Na ₂ O, K ₂ O, TiO ₂ and MnO. Analytical results of 50 Nos. BRS and 10 Nos. PTS samples has been received, but it not showing encouraging values. Results of rest of the samples are awaited.
Baryte							
Dewas	Pipalkota, Garari	1:12500	-	-	-	215	Reconnaissance survey (G4) was carried out for Baryte and base metal mineralisation. The rocks exposed in the study area mainly comprise of quartzofeldspathic gneiss of Archaean's, meta volcano- sedimentary sequence of the Mahakoshal Group, Harda Granitoids, Gondwana sandstone and the Deccan traps. These are intruded by numerous basic and felsic dykes and quartz veins. Small outcrops of Gondwana sandstone has been recorded as capping over Harda granitoids. The Deccan flows overlie all these sequences. During large scale geological mapping on 1:12500 scale, baryte hosted quartz reefs are demarcated in the west of Kaulasa village, south east of Piplani and near to Garari village. In the west of Kaulasa, baryte hosted quartz reef is nearly 150m in length and 30m in width and trends in E-W direction where as in the southeast of Piplani, baryte hosted quartz reef is nearly 200m in length and 30m in width and trends in NE- SW direction. These two quartz reefs are exposed as small mounds in agricultural land with some scree of barite hosted quartz boulders. Baryte mineralisation is found to the east of Garari village in a quartz vein. Besides LSM, 100 nos. of BRS sample, 50 nos. of soil sample, 50 nos. of PTS and 15 nos. of petrochemical samples are collected and submitted for chemical analysis. The assay value of BRS samples ranges from 27.35% to 47.96% Ba and assay value of PTS samples varies from 20.13% to 55.29% Ba.

Table – 4 : Mineral Production in Madhya Pradesh, 2018-19 to 2020-21

(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		223		82555134	223		147021686	249		62890259
Coal	'000t	-	118661	-	-	125726	-	-	132531	-
Natural										
Gas (ut.) ⁺	m c m	-	357	-	-	345	-	-	334	-
Bauxite	t	20	750433	599967	20	685929	546953	21	621505	472602
Copper Ore	t	-	2542159	-	-	2544472	-	-	2344087	-
Copper Conc.	t	1	70999	4000290	1	65094	4750125	1	64920	5238309
Iron Ore	'000t	18	2802	1448203	19	3343	1729068	21	4094	2165967
Manganese										
Ore	t	41	942738	7147719	42	962576	6220812	43	921147	5859476
Phosphorite	t	5	98600	88543	5	99960	94304	5	97880	92007
Diamond	ct	2	38437	539062	2	28816	352472	2	13917	220304
Limestone	'000t	136	50102	12271100	134	47118	12332360	156	45978	11824339
Minor										
Minerals		-	-	56460250	-	-	120995592	-	-	37017255

Note : The number of mines excludes Fuel and Minor minerals.

\$ Excludes the value Fuel minerals.

#NAME?

Table-5: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Aluminium/Alumina	
Hindalco Industries Ltd, Mahan Aluminium, Bargwan, Distt Singrauli	360 (Aluminium)
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 Rajarwara, Katni	9.6
Cement	
ACC Ltd, Kymore, Distt Katni	2720
Bhilai Jaypee Cement Ltd, Babupur, Satna	1300
Birla Corpn. Ltd, (Satna Cement Works & Birla Vikas Cement), Satna	2200
Birla Cooperation Ltd, (Erstwhile Reliance Cement Pvt. Ltd, Maihar, Distt Satna	3000
Century Textiles & Ind. Ltd, Maihar Cement, Maihar (unit I&II), Distt Satna	4200
Heidelberg Cement (I) Ltd, Narsingarh, Distt Damoh	2000
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, Tonki, Temarni sounul, Golpura Manawar	3500

Table-5 Contd.

Industry/plant	Capacity ('000 tpy)
UltraTech Cement, Vikram Cement Plant, Khor, Distt Neemuch	4500 (OPC) 4500 (PPC)
UltraTech Cement Ltd, Majhigawan, Rampur Naikin	3000
Ceramic	
Roca Bathroom Products Ltd, Dewas	NA
Govind Tiles Pvt. Ltd, Garra, Distt Balaghat	NA
Calcined lime	
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, Nimrani, Distt Khargone	400 (SSP) 115.5 (H ₂ SO ₄)
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, Mandasaur	60 (SSP)
Mukteswar Fertilizers Ltd, Narayankhedi, Ujjain.	60 (SSP)
Rama Phosphates Ltd, Indore	250 (SSP) 102 (H ₂ SO ₄)
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.	50

G; Grinding Unit

Note: Data not readily available for fertilizer and cement industries & Directory, respectively. on respective websites, is therefore taken from Indian Fertilizer Scenario, FAI Statistics and Survey of Cement Industry

Maharashtra



Maharashtra was the sole producer of Fluorite and Kyanite

₹6,282 crore

value of minor mineral's production were estimated for the year 2020-21

71

Mines in case of MCDR of minerals reported production in 2020-21

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	Reserves					Remaining resources									
	Unit	Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total resources (A+B)	
			STD121	STD122			STD221	STD222							
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	0	386142	-	-	-	-	-	100000	-	100000	486142	
Gold															
Ore	tonne	-	-	-	-	-	-	-	-	-	1627000	-	1627000	1627000	
(Primary)															
Metal	tonne	-	-	-	-	-	-	-	-	-	3.64	-	3.64	3.64	
(Primary)															
Graphite	tonne	-	-	-	-	-	-	-	-	-	1160000	-	1160000	1160000	
Iron ore	000 tonne	9464	2124	3653	15241	1672	6632	9191	81116	95545	59673	32474	286304	301544	
(Haematite)															
Iron ore	000 tonne	481	65	32	578	329	24	267	-	-	590	-	1210	1788	
(Magnetite)															
Kyanite	tonne	210075	0	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	tonne	-	-	-	-	-	-	-	-	-	2090	-	2090	2090	
Elements															
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	
Tungsten															
Ore	tonne	-	-	-	-	-	-	-	4275000	5461250	386000	-	10122250	10122250	
Contained	tonne	-	-	-	-	-	-	-	11287.8	7117.92	185	-	18590.72	18590.72	
WO ₃															
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 1.4.2021 : Maharashtra

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	7770	3320	1847	12936
Wardha Valley	4713	1785	1441	7940
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, 2020-21.

Exploration & Development

The details of exploration activities conducted by GSI and other agencies (DGM) during 2020-21 are furnished in (Table - 3).

Production

Maharashtra was the sole producer of Fluorite and Kyanite. Apart from Coal, Bauxite, Manganese Ore, Sillimanite and Limestone are the principal minerals produced in

Maharashtra State. The value of minor mineral's production is estimated as Rs. 6282 crores for the year 2020-21. There were 71 reporting mines in 2020-21 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, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
GSI Bauxite							
Sidhudurg	Kunkeshwar	1:12500	100.0	-	-	168	Reconnaissance survey (G4) work carried out includes large scale mapping (LSM) of lateritic terrain of Kunkeshwar block on 1:12500 scale with collection of 118 nos. of bed rock samples (BRS) and 50 nos. of pit samples (PTS). The LSM area exposes the Kaladgi sediments, basalts of Deccan Trap and laterite. Laterite is present in the form of cappings and most of which lie over the Deccan lavas. Kaladgi sediments comprise sandstone, quartz arenite, quartzite and shale/slate. Analytical result of BRS and PTS show Al ₂ O ₃ content in the BRS range from 9.59% to 57.73% and in PTS, it is 18.58%-57.96%. Based on the Al ₂ O ₃ content of BRS, lateritic terrain of LSM area has been classified into bauxite (Al ₂ O ₃ > 40%), aluminous laterite (Al ₂ O ₃ 30-40 %) and laterite (Al ₂ O ₃ <30 %). The analytical results, statistical analysis of results and ore petrographic study indicate that Kunkeshwar block appears to be potential for bauxite occurrences. About 2 sq km and 65 sq km cumulative areas have been delineated as potential for bauxite and aluminous laterite, respectively. In addition, seven zones were also demarcated as anomalous zones which include three zones for Al ₂ O ₃ (585 m ² cumulative area), two zones each for gallium (190 m ² cumulative area) and for TiO ₂ (199 m ² cumulative area). Surface indications of bauxite in the area are manifested in form of pisolitic/oolitic, massive, nodular, concretionary grains of gibbsite within aluminous/clayey laterite. XRD and ore microscopic studies confirmed that gibbsite is the dominant ore mineral of bauxite present in the area. Ga values range from 26 ppm to 90 ppm in the BRS whereas, Ga content in the PTS range from 45 ppm to 72 ppm.

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
Base Metals							
Gondia	Palasgaon- Murdoli	-	-	-	-	-	Reconnaissance survey (G4) was carried out for basemetal mineralisation in this area. Geologically, the area falls within the Bastar craton which is known to host the numerous sulphide occurrences. Though minor amounts of fine sulphide disseminations are noticed, preliminary data pertaining to geochemical studies indicate that most of the samples from the Palasgaon Murdoli quartz vein showed Cu value from 20 to 350 ppm, Pb from 20 to 520 ppm and Zn from 20 to 460 ppm indicating low incidence of sporadic basemetal mineralisation. None of the samples showed promising values of Cu mineralisation.
Gondia	Shirpur Motegaon area	1:12500	100	-	-	-	Reconnaissance survey (G4) was carried out for copper and associated mineralization around this area. The work component mainly involves 100 km ² large scale mapping on (1:12500 scale), systematic bed rock sampling, soil sampling, and pitting and trenching; along with petrographic and minerographic studies. Shirpur Motegaon area falls on the northern most extension of the Thanewasna shear zone. Three major quartz veins have been mapped in the LSM block i.e. the NNW-SSE trending Motegaon quartz vein, the NE-SW trending Shirpur quartz vein and the N-S trending Aregaon quartz vein.
Nagpur Bhandara & Chandrapur	Shirpur Motegaon area Amgaon Motegaon area	1:12500	100	-	-	188	Reconnaissance survey (G4) for base metal mineralisation was carried out in Amgaon block area falling in parts of Bhandara, Nagpur and Chandrapur districts. Large-scale geological mapping (1:12500 scale) of 100 sq. km was carried out along with the collection of geochemical and petrological samples, and other laboratory studies to ascertain the mineralisation potentiality. The investigation area is a part of western Bastar Craton (BC) of Central India and geologically exposes the rocks such as enclaves of Banded Magnetite Grunerite Quartzite (BMGQ) belong to the Sukma Group; granite gneiss of Bengal Group; quartz muscovite schist and meta-acid volcanics/tuffs of Sakoli Group; intrusives such as pegmatite and quartz reef. The sampling was done with collection of bed rock samples (n=60), channels sample (n=50), pit and trench samples (n=50), and soil samples (n=28) along with petrological and ore samples. The analytical results of bed rock samples of Amgaon quartz reef (n=38) gave values of copper from 20 to 270ppm (avg. =123ppm); lead values from 60 to 2900ppm (avg. =583ppm), zinc values from 10 to 1800ppm (avg.=273ppm) and silver values from >1 to 3ppm. The gold values in BRS are ranging from >50 to 110ppb. The analytical results of BRS samples from Chikhli quartz reef (n=10). Two samples of banded magnetite grunerite quartzite (n=7) show 1ppm silver. The chemical analysis of channel samples (n=50) from Amgaon quartz reef shows copper values vary from 40 to 500ppm (avg. =131ppm); lead from 0.01% to 0.26% (avg. =0.12%), zinc from 10 to 2000ppm (avg. =421ppm), and silver

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
							from >1 to 4ppm. The soil samples (n=28) gave the copper value ranging from 10 to 320ppm (avg. =129ppm); lead from 40 to 520ppm (avg. =258ppm), zinc from 40 to 1000ppm (avg.=232ppm), and silver from >1 to 3ppm. The gold values in soil samples are ranging from >50 to 155ppb. The pitting and trenching sample (n=40) analytical results show the copper value ranging from 20 to 110ppm (avg. =53ppm); lead from 30 to 750ppm (avg. =205ppm), zinc from 70 to 360ppm (avg. =123ppm), silver from >1 to 1ppm and gold values >50ppb.
Chromium							
Gondia	Shirpur Motegaon area	1:12500	100	-	-	155	Reconnaissance Survey (G4) was carried out for Nickel, Chromium & PGE mineralisation in this area. An area of 100 sq km was mapped on 1:12500 scale. The mapped area forms the northern continuation of the Western Dharwar Craton wherein the TTG gneiss forms the country rock. Banded Iron Formation, talc tremolite schist and amphibolite (Older Supracrustals) occur as enclaves within the TTG gneiss. Granitoid, metagabbro, gabbro and dolerite are the intrusives. The western part of the area is extensively lateritized. Bed rock sampling was done mostly in the target lithologies i.e. talc tremolite schist, gabbro, metagabbro and dolerite and laterite adjacent to these lithologies. A total of 100 bed rock samples (BRS) and 55 groove/channel samples (CS) were collected. In the mafic intrusives, the values of Ni range from 15 ppm to 1012 ppm while that of Cr is between 05 ppm and 3750 ppm. The analytical data of the BRS suggests the talc tremolite schist and associated laterite as the most promising rock types for Ni and Cr mineralisation. The BRS collected from talc tremolite schist yielded nickel values ranging from 294 ppm to 2073 ppm and chromium values between 849 ppm and 7066 ppm. The laterite adjacent to the talc tremolite schist show the value of Cr in range from 514 ppm to 39684 ppm and the Ni values in between 103 ppm and 933 ppm. On the basis of the encouraging values of Cr and Ni in BRS, groove/channel sampling was carried out in these lithologies. The analytical data of groove/channel samples of talc tremolite schist show Ni values ranging from 146 ppm to 3272 ppm and Cr values between 423 ppm and 18731 ppm. The analytical data of groove samples from laterites adjacent to talc tremolite schist to shows encouraging values of Ni (63 ppm to 1646 ppm) and Cr (ranging from 637 ppm to 24179 ppm). The ore microscopic studies and EPMA studies of talc tremolite schist shows the presence chrome spinel and nickel sulphide. The encouraging analytical values of Cr and Ni in BRS from talc tremolite schist is attributed to the presence of these minerals. On the basis of the field studies and encouraging analytical results supported by EPMA studies, an area of 1.35 sq km (2 km x 0.67 km) is delineated NE of Sonurli as potential area for Cr and Ni mineralisation.

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
REE-RM Bhandara	Pipra- Mahegaon Dongarla area	-	50	52	500	255	Preliminary exploration (G3) was carried out in this area for Rare Earth Elements and Rare Metal mineralisation in this area. Large scale mapping (LSM) over 50 sq km area, followed by collection of bed rock sample (BRS) and stream sediment samples, pitting for bulk samples and auger drilling of 500 m was carried out. The Pipra – Mehegaon block covers the southern and southwestern part of the Sausar Mobile Belt and composed of basement Tirodi biotite gneiss (TBG) and meta-sedimentary rocks of Sausar Group. Basement Tirodi biotite gneiss (TBG), calc silicates of Lohangi Formation, quartz mica schist (QMS) of Mansar Formation and quartzite of Chorbaoli Formation of Sausar Group are the major lithological units mapped in the area. The gneisses and meta-sedimentary rocks have been intruded by two phases of pegmatite and quartz veins. A few pegmatite veins have been mapped to the north and northwest of Sakri village. REE bearing mineral phases like zircon, monazite, xenotime and allanite have been reported in these pegmatites in accessory amounts.
REE-RM Nagpur	Chorbaoli- Murda area	1:12500	-	-	-	185	Reconnaissance survey (G4) was carried out for tungsten and associated mineralisation in this area. Large scale mapping in 1:12500 scale revealed that the TBG is the basement rock to the Sausar Group and is exposed mostly in the central and northern parts of the investigation block. The TBG is overlain by the calc- silicate rock and marble of Lohangi Formation, which overlies the mica schist of Mansar Formation and quartzite/quartz mica schist of Chorbaoli Formation. Calc silicate and marble are intruded by a number of granites and pegmatites of variable dimensions. The pegmatites are coarse grained and tourmaline bearing. The contact zones between carbonate rocks of Lohangi Formation and intrusive granite/pegmatite were studied in detail for identification of possible skarn zones. Chemical analytical results of bedrock samples collected from skarn and other lithounits indicate most of the tungsten values are falling below 100 ppm with a maximum 545 ppm in one BRS sample collected from a skarn rock developed North of Maharajpur village. Similarly, the analytical results of 50 nos. of stream sediment samples (panned concentrate) indicated four values are falling above 1000 ppm and maximum value is >1% (11308 ppm). Though the panned concentrates of few stream sediment samples analyses higher value of tungsten upto 11308 ppm, the chemical analytical results of bedrock samples reveal that most of the samples analysed less than 100 ppm W indicating very low incidence of primary tungsten mineralisation in Chorbaoli Murda block.

Table-3 (Concl.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No. of boreholes	Meterage		
REE-RM (*Recon- naissance Survey include North Goa district)							
Sindhudurg	Banda- Tambuli	1:12500	110	-	-	110	Reconnaissance Survey (G4) was carried out for Nickel, Chromium and PGE mineralisation in Banda-Tambuli, Sindhudurg District, Maharashtra and Mopa, North Goa District, Goa. An area of 110 sq km was mapped on 1:12,500 scale. The mapped area comprises TTG gneiss belonging to Peninsular Gneissic Complex, dolomite, BMQ, quartzite, metabasic (hornblende schist and amphibolite) of Chitradurga Group and ultramafic (orthopyroxenite) and gabbro/gabbro-norite as intrusives. About half of the area has laterite cover. A total of 110 bed rock samples (BRS) have been collected. Twelve out of sixty-eight BRS from serpentinite, orthopyroxenite and gabbro/gabbro-norite /norite show Ni values in between 1025 and 1542 ppm and twenty-one BRS show Cr values in between 1062 and 9333 ppm. Based on analytical results of BRS, areas have been chosen for channel cum chip sampling. Fifty channel cum chip samples have been collected. The analytical data of nineteen out of fifty channel cum chip samples from gabbro show Ni values ranging from 1014 to 1557 ppm and Cr values ranging from 3008 to 3857 ppm. Geochemically gabbro bodies of potential areas are Mg rich. Four PCS from gabbro show MgO values from 20.04 to 23.60 wt %. In ore microscopic study, chromite, magnetite, ilmenite and pyrite are seen as ore phases. They occur as fine to medium-sized irregular grains associated with olivine and orthopyroxene of mafic- ultramafic rocks. On the basis of overlay studies of analytical results on geological map of LSM block and petrography, two potential areas i.e. one towards north of Degve having area of 4 sq km (4 km x 1 km) and another towards east of Tambuli having area of 1 sq km (2.5 km x 0.4 km) have been delineated.
MECL Tungsten							
Nagpur	Kuhi- Khobna-	-	-	-	-	-	A G4 stage exploration for tungsten mineralisation was carried out with an objective to prove the occurrence of ore body in the intervening area in the Kuhi-Khobna-Agargaon gap area block and to establish the consistency and reliability of the grade zone over a promising strike length and up to 50 m verticle depth. Exploration involved mapping of 57.0 sq. km. on 1:12,500 scale along with collected 449 samples for chemical analysis of different elements and 52 samples for petrographic/ mineragraphic/etc studies. Besides, a total of 5 borholes were drilled to a cumulative of 945.0 m.

Table-4: Mineral Production in Maharashtra, 2018-19 to 2020-21

(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		72		59045818	73		82465290	71		74737545
Coal	'000t	-	49818	-	-	54746	-	-	47435	-
Bauxite	t	14	1424865	736127	15	595562	401196	12	471068	335740
Chromite *	t	1	-	-	-	-	-	-	-	-
Iron Ore	'000t	12	660	836022	13	1131	1340244	11	1249	1680086
Manganese Ore	t	23	761985	7999939	20	720518	6096443	26	644484	6523574
Fluorite (graded)	t	1	1079	8117	1	1315	8844	1	1052	7897
Kyanite	t	4	4889	15757	4	3098	11848	3	1145	3423
Sillimanite	t	1	13404	49477	2	13221	37903	1	11110	26611
Limestone	'000t	16	14991	3459779	18	14614	3475512	17	13939	3341414
Sulphur #	t	-	46967	-	-	55659	-	-	41375	-
Minor Minerals		-	-	45940600	-	-	71093300	-	-	62818800

Note : The number of mines excludes Fuel and Minor minerals.

\$ Excludes the value Fuel minerals.

* Only labour reported.

Recovered as by-product from oil refinery.

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, Vajinath, 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, Distt. Chandrapur	6000 4500 (Clinker)
UltraTech Cement Ltd, Ratnagiri Works (G), Distt. Ratnagiri	480
UltraTech Cement Ltd, Nagpur	2000
Zuari Cement, Solapur	1200

Table-5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Ceramics	
H & R Johnson (India) Ltd, Pen	154.8
Joglekar Refractory & Ceramics Pvt. Ltd, Rabale, Distt. Thane.	364.8
Jyoti Ceramic Industries Pvt. Ltd, Satpur	0.16 (Ref. coating) 1.0 (Ceramic Product)
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 (foundry chemicals)
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, Higna 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 Porshuram, Khed, Ratnagri	100 (SSP)
Zuari Fertilizers and Chemicals Ltd, Mahad, Distt. Raigad	216 (SSP)
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), Vikroli, Mumbai	37.5
Hindustan National Glass & Industries Ltd, Nashik	320 TPD
Iron & Steel	
JSW Ispat Steel Ltd, Dolvi, Raigad	5400 (Sinter) 1600 (Sponge iron) 5040 (Crude/Liquid steel) 3500 (pig iron)

Table-5 (Concl.)

Industry/plant	Capacity ('000 tpy)
Lloyds Steel Ltd, Wardha	600 (HRC) 350 (CRC) 250 (GPC)
Indian Seamless Steel & Alloys Ltd, Jejuri, Distt. Pune	450 (seamless tubes) 350 (alloy & carbon steel)
Sunflag Iron & Steel Co. Ltd, Warrthy, Mohadi	262 (sponge iron) 250 (Pig iron) 250 (sinter) 505 (Finished steel)
Uttam Galva Metallics Ltd, Bhugaon, Wardha	886.95 (Sinter) 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), Distt Sindhudurg.	300
Sona Alloys Pvt. Ltd, Satara.	314
Usha Ispat Ltd, Redi.	300
Uttam Galva Metallics Ltd, Bhugaon, Wardha	225
	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 Maharashtra Elektros melt Ltd.), Chandrapur.	100
Minex Metallurgical Co. Ltd, Nimji, Kalmeshwar	0.250 (Fe-Ti)
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, Kholapur	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)
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 occurrences in the state 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 2020-21 are furnished in Table - 2.

PRODUCTION

No mineral production (except minor minerals) was reported from Manipur in 2020-21. The value of minor minerals' production was estimated at ₹29 lakh for the year 2020-21.

Table 1: Reserves/Resources of Mineral as on 1.4.2020 : Manipur

Mineral	Unit	Reserves			Remaining Resources							Total Resources		
		Proved STD111	Probable STD121	STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total (A+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, 2020-21

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Nickel (Ni) & Chromite (Cr) Tengnoupal & Chandel	Moreh-Mimau area, Manipur Ophiolite Belt	-	50	-	-	-	Reconnaissance survey (G4) was carried out in this area for Ni, Cu, and PGE. On the basis of large scale mapping carried out for 50 sq. km, six dismembered ophiolite units represented by ultramafic, mafic, volcanic units were delineated. These units have been categorised into cumulate, tectonised peridotite, volcanic and mafic units and were found to host disseminated chromite pods in Munnom-Lhangcham areas. Analytical results show Cr values ranging from 14220 to 2511 ppm with a mean value of 8878 ppm while Ni concentration varies from 7443 to 1584 ppm with a mean value of 4993 ppm. Cobalt values in these samples range from 2691 to 423 ppm with an average of 1525 ppm.

Meghalaya



Limestone was the important mineral produced in Meghalaya during the year 2020-21

₹721lakh

Value of minor minerals' production were estimated for the year 2020-21

19

Mines in the state reported production of limestone in 2020-21

MINERAL RESOURCES

Coal and limestone are the only major minerals mined in the State. **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).

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	Total	
		STD111	STD121	STD122	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+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	000 Tonnes	-	-	-	-	-	-	-	225	-	-	225	225
(Haematite)													
Iron Ore	000 Tonnes	-	-	-	-	-	-	-	3380	-	-	3380	3380
(Magnetite)													
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	57639	104791	16452	4167752	17819716	720309	23583945	23834988	
Rock	Tonne	-	-	-	-	-	-	-	1311035	-	-	1311035	1311035
Phosphate													
Sillimanite	Tonne	14400	-	68112	82512	-	-	-	55807	-	-	55807	138319
Silver													
Ore	Tonne	-	-	-	-	-	-	880000	-	-	-	880000	880000
Metal	Tonne	-	-	-	-	-	-	198	-	-	-	198	198
Titanium	Tonne	-	-	-	-	-	-	3345000	-	-	-	3345000	3345000

Figures rounded off.

The various coalfields and their reserves/resources in the State are furnished in Table-2.

Table – 2 : Reserves/Resources of Coal as on 1.4.2021 : Meghalaya

Coalfield	Proved				Indicated			Inferred		Total
	Proved	Indicated	Inferred	Total	Indicated	Inferred	Total			
Total	89	17	471	576	17	471	576	125	125	34
West Darangiri	65	-	60	125	-	60	125	34	34	107
East Darangiri	-	-	34	34	-	107	107	125	125	133
Balphakram - Pendenguru	-	-	-	-	-	-	-	106	106	6
Siju	-	-	-	-	-	-	-	4	4	10
Langrin	10	17	106	133	-	-	-	10	10	34
Mawlong Shelia	2	-	4	6	-	-	-	23	23	2
Khasi Hills	-	-	10	10	-	-	-	-	-	-
Bapung	11	-	23	34	-	-	-	-	-	-
Jayantia Hills	-	-	2	2	-	-	-	-	-	-

(In million tonnes)

Source: Coal Directory of India, 2020-21.

EXPLORATION & DEVELOPMENT

Details of exploration activities conducted by GSI and various agencies during 2020-21 are furnished in Table - 3.

Table-3: Details of Exploration Activities in Meghalaya, 2020-21

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Tungsten East Garo Hills	Nengkera block	1:50000	275	-	-	-	Reconnaissance Survey (G4) was carried out for Tungsten and associated mineralisation in this area. The study area comprises the rocks of Archean to Proterozoic gneisses and older supracrustals belong to Assam Meghalaya Gneissic Complex (AMGC), younger granitoids and Tertiary cover sediments. The pegmatite veins have been found intruding the granite gneiss and porphyritic granite. Pegmatite veins vary in length from 1 cm to 10 meters and varies in width from 0.5 to 1.5m. Younger granitoids are found as porphyritic as well as non-porphyritic. Analytical results from pegmatite veins are showing some promising zone for tungsten mineralisation with value ranging up to 500 ppm. Maximum values were recorded around Nengkera, Bolsagre, Nengkera, Agalgiri area. Lithium value of 116 and 120 ppm are reported from two samples of clay horizons within Tertiary sedimentary rocks.
West Garo Hills & South Garo Hills	Tura area	-	-	-	-	-	Reconnaissance survey (G4) was carried out in this area. The study area falls at the SW fringe of Shillong plateau and comprises Assam Meghalaya Gneissic Complex (AMGC) or Basement Gneissic Complex, traversed by dolerite dykes. Precambrian gneisses (biotite gneiss, granite gneiss and augen gneiss) intruded by alkali-feldspar granite, basic intrusive mainly dolerite, pegmatite & quartz veins. Few porphyritic basic intrusive suspected as a lamprophyre or lamproite at Northeast and east of Nawalgre village. Analytical results shows Tungsten (W) values ranging from 4.44 to 157.81 ppm of W, with an average of 86.47 ppm of W; Li values ranges from <5 to 44 ppm and the REE values ranges from 11.26 to 427.77 ppm with an average of 150.85 ppm. Pegmatite veins are showing some promising zone for tungsten mineralisation with value ranging up to 500 ppm. Maximum values were recorded around Nengkera Bolsagre, Nengkera Agalgiri area. Lithium value of 116 ppm and 120 ppm are reported from two samples of clay horizons within tertiary sedimentary rocks.

Table-3 Contd.

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
West Khasi Hills	Manai- Mairang Block	-	-	-	-	3	Reconnaissance Survey (G4) was carried out in this area for Tungsten Mineralisation. Surface indications of mineralization are in the form of disseminated scheelite grains and greisen veins. Scheelite grains are observed under UV light in a 25 cm thick and 3 m long quartz vein in foliated granite towards northeast of Mairang village. Another 10 cm thick and 1 m long quartz vein in foliated granite exposed northeast of Mairang village also contains disseminated scheelite grains. Greisen veins are occurring as intrusions within foliated granite and quartz mica schist of AMGC. Sulphide mineralisation in the form of pyrite, chalcopyrite and galena are noticed in the quartzite near Mawmaram village. Maximum tungsten value observed is 1524 ppm in a 15 cm thick and 3 m long smoky quartz vein near Umthied Bynther village. Three stream sediment samples collected from Umthied Bynther, Wahlakhaw and Mawshut villages also shows tungsten value above 1000 ppm.
REE							
East Khasi Hills, West Khasi hills & Ri-bhoi	-	1:50000	275	-	-	-	Reconnaissance survey (G4) for REE and other associated minerals in parts of East Khasi Hills, West Khasi Hills & Ri-bhoi districts. Regolith characterisation by generating material maps using remotely sensed data was used for identification and classification of regolith which was followed by field validation. Based on the outcome of the material maps using ASTER data, a total of 275 sq km regolith cover map was prepared on 1:50,000 scale. Heavy mineral separation of soil horizon was done and accessory phases like monazite, zircon and xenotime were identified in microscope for regolith over AMGC but no heavies, only minor quantity zircon, apatite was obtained from regolith over granite. Some grains of kaolinite have REE adsorbed in its lattice. EPMA analysis of bedrock showed mostly bastnasite (REE carbonate) followed by monazite, xenotime and REE-sphene. Since the REE concentration in the Wallang-Nongspung area are mostly interpreted to be due to ion adsorption in clay, a block has been delineated for further exploration. Sulphide mineralisation in the form of dissemination of pyrite was observed near Kyrдем village in the homophanous Kyrдем granite.

PRODUCTION

Limestone was the important mineral produced in Meghalaya during the year 2020-21. The value of minor minerals' production was estimated at ₹ 721 lakh for the year 2020-21. There were 19 reporting mines in 2020-21 in the State for limestone (Table-4).

Table - 4 : Mineral Production in Meghalaya, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		21		3022550	19		3060355	19		2748747
Sillimanite	t	1	24	168	-	-	-	-	-	-
Limestone	'000t	20	7195	2950307	19	7248	2988280	19	6028	2676672
Minor Minerals [@]		-	-	72075	-	-	72075	-	-	72075

Note: The number of mines excludes Minor minerals.

@ 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 important 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)
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
Meghalaya Cements Ltd, Thangskai, Distt Jaintia Hills.	860
Megha Technical & Engineering (P) (MTEPL), Lumshnong, Distt Jaintia Hills.	700
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 2020-21.

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 2020-21 in the State.

PRODUCTION

No mineral production (except minor minerals) was reported from Mizoram during 2020-21. The value of minor minerals' production was estimated at ₹168 lakh for the year 2020-21.

NAGALAND

MINERAL RESOURCES

Important mineral occurrences in the State are: coal in Borjan, Jhanzi-Disai, Tiensang and Tiru Valley Coalfields; iron ore (magnetite), cobalt, dunite and nickeliferous chromite in Tuensang district and limestone in Phek and Tuensang districts (Table-1).

Table – 1 : Reserves/Resources of Minerals as on 01-04-2020 : Nagaland

Mineral	Unit	Reserves				Remaining Resources							Total Re-sources (A+B)		
		Proved	Probable		Total (A)	Feasi-bility	Pre-feasibility		Mea-sured	Indicated	Inferred	Recon-naissance		Total (B)	
		STD111	STD121	STD122			STD211	STD221							STD222	STD331	STD332	STD333	STD334
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 (Magnetite)	'000 Tonnes	-	-	-	-	-	-	-	-	5280	-	-	-	5280	5280
Limestone	'000 Tonnes	-	-	-	-	825	-	-	-	1005500	745875	-	-	1752200	1752200
Nickel Ore	Million Tonnes	-	-	-	-	-	-	-	-	-	5	-	5	-	5

Figures rounded off

The various coalfields and their reserves/resources are furnished in Table-2.

Table – 2 : Reserves/Resources of Coal as on 1.4.2021 : Nagaland

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Nagaland	8.76	21.83	415.83	446.42
Borjan	6	-	5	11
Jhanzi-Disai	2	22	109	133
Tiensang	1	-	2	3
Tiru Valley	-	-	7	7
DGM	-	-	293	293

Source: Coal Directory of India, 2020-21.

EXPLORATION & DEVELOPMENT

Details of exploration activities conducted by GSI and DGM, Nagaland during 2020-21 for Nickel, Limestone and Magnetite ore are furnished in Table-3.

Table – 3: Details of Exploration Activities in Nagaland

Agency/ Mineral/District	Location	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No of. Boreholes	Meterage		
GSI Nickel Phek	Mollen-Washelo	1:12500	50	-	-	-	Reconnaissance survey (G4) was carried out for nickeliferous laterite, chromium, PGE and associated base metals in ultramafic-mafic rocks in part of Ophiolite Belt. Large scale geological mapping on 1:12500 scale has been carried out for 50 sq km area with an objective to demarcate nickeliferous laterite, chromium, PGE and base metals. The ophiolite unit comprises dominantly peridotite and its altered derivatives serpentinite, dunite, minor pyroxenite, gabbro, volcanic (basalt/andesite). The pelagic sediment is represented by cherts and limestone. The ultramafics are dominated by cumulate peridotite with minor dunite and pyroxenite. Cumulate peridotite exhibits primary magmatic layering defined by the alignment of pyroxene minerals. Ultramafic derived lateritic soil over the dunite- peridotite of about 1.6 sq km was delineated as a potential supergene Ni-laterite deposit (SE of Mollen). Sulphide disseminations were also recorded in basalt near Washello.
Directorate of Geology & Mining, Nagaland							
Limestone Kiphre	Salumi village	1:4000	0.79	5	224.75	163	Limestone occurs as rootless, lensoidal deposits/pockets associated with the volcanic of Naga Hill Ophiolite (NHO) suite of rocks. Five limestone pockets of varying dimensions have been delineated in the block. Resource estimated at about 6650 thousand tonnes of cement grade limestone and 6683 thousand tonnes of siliceous Limestone.
Magnetite ore							
Phek	Bearomg areas, falling within the, Mollen-Jopi-Ziphu ridge.	-	103	-	-	-	The block forms a part of Naga Hills Ophiolite (NHO), the igneous rocks mostly ultramafic rocks are overlain by sedimentary rocks of Jopi-Formation.

PRODUCTION

No mineral production (except minor minerals) was reported from Nagaland during 2020-21. The value of minor minerals' production was estimated at ₹18 lakh for the year 2020-21.

Odisha



The important minerals produced in the state were Coal, Bauxite, Chromite, Iron Ore, Manganese Ore, Graphite and Limestone etc. during 2020-21

₹337

Crore, value of minor minerals' production were estimated for the year 2020-21

149

Mines in case of MCDR Minerals reported production in 2020-21

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, Kendujhar, Koraput, Malkangiri, Rayagada & Sundargarh districts; **china clay** in Bargarh, Boudh, Balangir, Kendujhar, Koraput, Mayurbhanj, Sambalpur & Sundargarh districts; and **chromite** in Balasore, Cuttack, Dhenkanal, Jajpur & Kendujhar 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, Kendujhar, Koraput, Sambalpur & Sundargarh districts; **dunite/pyroxenite** in Kendujhar 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, Kendujhar, Koraput, Mayurbhanj, Sambalpur & Sundargarh districts; **iron ore (magnetite)** in Mayurbhanj district; **limestone** in Bargarh, Koraput, Malkangiri, Nuapada, Sambalpur & Sundargarh districts; **manganese ore** in Balangir, Kendujhar, Koraput, Rayagada, Sambalpur & Sundargarh districts; **Pyrophyllite** in Kendujhar district; **quartz/silica sand** in Boudh, Balangir, Kalahandi, Sambalpur & Sundargarh districts; **quartzite** in Balangir, Dhenkanal, Jajpur, Jharsuguda, Kendujhar, 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 Kendujhar district; **cobalt** in Cuttack & Jajpur districts; **copper** in Mayurbhanj & Sambalpur districts; **granite** in Angul, Boudh, Balangir, Cuttack, Deogarh, Dhenkanal, Ganjam, Kendujhar, Khurda, Koraput, Mayurbhanj, Nuapada, Rayagada & Sambalpur districts; **lead** in Sargipalli area, Sundargarh district; **mica** in Sonepur district and **nickel** in Cuttack, Kendujhar & Mayurbhanj districts. Occurrences of **ruby** and **emerald** are reported from Balangir and Kalahandi districts, respectively. **Platinum Group of Metals** occur in Kendujhar district; **silver** in Sundargarh district; **tin** in Koraput & Malkangiri districts; and **vanadiferous magnetite** occurs in Balasore & Mayurbhanj districts (Table-1).

Table – 1: Reserves/Resources of Minerals as on 1.4.2020: Odisha

Mineral	Unit	Reserves				Remaining Resources						Total Resources (A+B)				
		Proved		Probable		Total (A)	Feasibility	Pre-feasibility		Measured	Indicated		Inferred	Reconnaissance		Total (B)
		STD111		STD121	STD122			STD221	STD222		STD331	STD332		STD333	STD334	
Asbestos	Tonne	-	-	-	-	-	-	-	10000	37200	9500	-	56700	56700		
Bauxite	000 Tonnes	388184	7346	14210	409740	97550	193301	56160	161842	428849	596940	112642	1647284	2057024		
Chromite	000 Tonnes	40453	15229	22349	78031	52215	44289	10146	1565	52304	59284	20435	240237	318269		
Cobalt	Million Tonnes	-	-	-	-	-	-	-	31	-	-	-	31	31		
Copper																
Ore	000 Tonnes	-	-	-	-	-	-	-	1340	2306	8345	-	11991	11991		
Metal	000 Tonnes	-	-	-	-	-	-	-	2063	20.14	56.26	-	97.03	97.03		
Garnet	Tonne	8330045	-	1	8330046	5	1	-	-	-	348001	829311	1177318	9507364		
Graphite	Tonne	-	-	2838414	2838414	6371790	2927932	2889564	696021	838841	3119932	298628	17142707	19981121		
Iron Ore	000 Tonnes	1817247	328296	653206	2798749	1662944	770861	1068654	28824	925717	2019410	134173	6610582	9409331		
(Haematite)																
Iron Ore	000 Tonnes	-	-	-	-	79	120	-	-	-	43	-	242	242		
(Magnetite)																
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	260485	456006	139924	239877	435449	38785	1727424	2196004		
Manganese	000 Tonnes	7535	1511	2423	11470	39091	33968	22916	10260	12219	32657	8947	160058	171528		
Ore																
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		
Silver																
Ore	Tonne	-	-	-	-	-	960500	119000	-	-	670000	-	1749500	1749500		
Metal	Tonne	-	-	-	-	-	2734	3.4	-	-	34.17	-	64.91	64.91		
Tin																
Ore	Tonne	-	-	-	-	12749	653	40	1166	1010	1010	-	15618	15618		
Metal	Tonne	-	-	-	-	73.91	512.47	27.59	-	22.2	16.56	-	652.73	652.73		
Titanium	Tonne	12654141	-	0	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

The various coalfields along with their reserves/resources are given in Table - 2.

Table – 2: Reserves/Resources of Coal as on 1.4.2021: Odisha

Coalfield	Proved	Indicated	Inferred	Total
Total	43326	35222	6330	84787
Ib-River	16365	13509	2228	32102
Talcher	26961	21713	4130	52776

Source: Coal Directory of India, 2020-21.

EXPLORATION & DEVELOPMENT

The details of exploration activities conducted by GSI for iron ore, manganese ore, coal & REE and other agencies during 2020-21 are furnished in Table - 3.

Table – 3 : Details of Exploration Activities in Odisha, 2020-21

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Iron							
Kendujhar	Jajang Block	1: 4000	1.0	-	-	-	General exploration (G2) was carried out for iron and manganese ore in Jajang Block, Kendujhar district. The block belongs to the eastern limb part of the horse shoe shaped Bonai-Keonjhar iron ore belt. Detailed mapping of 1.0 sq. km area on 1: 4000 scale along with 25 cu. m of pitting/trenching has been carried out in the block. The major rock types in the area include banded hematite quartzite, banded hematite jasper, banded hematite chert, cherty quartzite, ferruginous shale / tuffaceous shale and laterite. Hard massive iron ore is exposed on mine face and benches in the western part of the block. Manganese ore occurs within shale and laterite in the northern part. Lateritic iron ore, hard massive iron ore, hard laminated ore, soft laminated and powdery iron ores have been intersected in the boreholes. The iron ore is mainly hematite.
Kendujhar	Jalahuri Block	1: 4000	1.82	-	876	-	General exploration (G2) was carried out for iron and manganese ore in Jalahuri Block, Kendujhar district. The block belongs to the eastern limb part of the horse shoe shaped Bonai-Keonjhar iron ore belt. An area of 1.82 sq. km area has been covered by DM on 1: 4000 scale along with 50 cu.m of pitting /trenching. The litho-sequence belongs to the Iron Ore group and it comprises banded iron formation (BIF), shale, chert, quartzite and iron ore (soft laminated ore, hard massive ore, lateritised ore, powdery ore). The ore mineral is mainly hematite. Massive ore is present as pockets within the laterite cappings. Soft laminated ore was also observed to be inter-bedded with the ferruginous shale. A total of 876m has been drilled in one borehole (OKJL-2) which has intersected mainly shale and BHC with thin bands of iron ore.
Sundargarh	Patamunda East block	-	1	-	-	-	Preliminary exploration was carried out for iron and manganese ore this block. Patamunda Block is located in the southern part of the Jamda-Koira valley of Bonai-Kendujhar iron ore belt. The East block comprising an area of 5.1 sq km lies just east of Patmunda west block where active mining was going on for manganese till it was suspended in late 2000. An area 1 sq. km was mapped on the available topographic map of Lessee. The area is represented by Banded Iron Formation, Ferruginous Shale/Phyllite and manganese shale/phylite. BIF is exposed in the northeastern part of Patmunda East block where as a major part of the block is occupied by ferruginous shale. The western fringe of the East block has few exposures of manganese shale which continues to the West block where old mines are located. Drilling is being planned across several profiles, to ascertain the extension of manganese shale horizon in the East Block. Prima facie the block does not hold much potential for manganese mineralisation except the western fringe part. The BIF exposed in the north eastern part is likely to have low grade iron ore in addition to float ore. This area too will be probed by systematic drilling.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Kendujhar	Roida-I Block	1:4000	1	11	1005.9	-	General exploration (G2) for iron ore was carried out in Roida-I Block. Detailed mapping on 1:4000 scale was carried out over an area of 1.0 sq. km area. The lithounits exposed in the area are ferruginous laterite, hard and soft laminated iron ore, blue dust, BHQ/ BHJ/ BHC and shale of the Koira Group of rocks. The iron ore is capped by ferruginous and aluminous laterite. Considerable thickness of high grade ore band has been exposed in the quarry section. The ore zone consists of mainly powdery ore, soft and hard laminated ore, blue dust and occasionally hard lateritized ore. The average strike length of the mineralised zone is around 500m. A total of 1005.90 m of drilling meterage has been achieved by 11 boreholes. All the boreholes drilled during this investigation have intersected considerable thickness of ore zone. The borehole ODKR-1 has intersected High grade iron ore comprising of powdery iron ore, blue dust, SLO, HLO between 00-50.00 m (63.08%Fe) and 58.00m to 94.00m and low grade iron ore comprising of powdery iron, soft laminated ore and ferruginous shale between 50.00 to 53.00 m (50% Fe). The borehole ODKR-2 has intersected High grade iron ore comprising of powdery iron ore, blue dust, SLO, HLO between 00-22.00 m (63.25%Fe), 30.00m to 55.00 m (61.11% Fe) and low grade iron ore comprising of powdery iron, soft laminated ore and ferruginous shale between 22.00 to 30.00m (47.79% Fe), 55.00 to 85.00 m (47.01% Fe) and 88.00 to 94.00 m (45.75% Fe). The borehole ODKR-3 has intersected low grade iron ore comprising of powdery iron, soft laminated ore and ferruginous shale between 0 m to 34.00m with average grade of 47.88% Fe and 42.60 to 44.90 m with average grade of 53.60% Fe. The borehole ODKR-4 has intersected low grade iron ore comprising of lateritic ore with powdery ore and Ferruginous shale from 0.00 to 13.35 m (47.63% Fe) and 52.40 to 54.40 m (49.87% Fe) and High grade iron ore comprising of powdery iron, blue dust, SLO, HLO between 56.40 to 127.40 m (65.26% Fe). The borehole ODKR-5 has intersected High grade iron ore comprising of powdery iron ore, blue dust, SLO, HLO between 00-149.25 m. The borehole ODKR-6 has intersected powdery ore and SLO iron ore between 0.00-88.05 m. The borehole ODKR-7 has intersected powdery ore with Fe shale between 0.00-20.00 m, powdery ore and SLO between 38.00-173.00 m.
Kendujhar	Balita & Inganjiharan Blocks	-	0.36	-	-	-	General exploration (G2) was carried out for iron and manganese ore in Balita and Inganjiharan Blocks. Detailed mapping in an area of 0.36 sq. km was carried out in Balita block along with 15 cu. m. of pitting and trenching. Banded hematite quartzite (BHQ), banded hematite jasper (BHJ) and ferruginous shale are exposed in the old quarry of the block. The iron ore is restricted to the central part of the quarry and the general trend of the iron ore is N-S, with moderately westerly dipping. The total thickness of the iron ore varies from 50 m to 180 m and it is extended up to about 400m in the strike direction. The thickness of the individual jasper/quartzite bands in the BHJ/BHQ bands varies from 0.1 cm to 3 cm. At places, pockets of powdery ore and soft laminated ore are observed in the old quarry. In the mine section, the depth of the lateritic soil is extended up to 4m. In the northern corner of the block, another band of iron ore is exposed, which is hard and massive in nature for about 20 m of length and 10 m of width.
Base Metal							
Mayurbhanj	Kesharpur East	-	-	7	1569.65	-	General exploration (G2) was carried out for copper and associated precious metals in this block. A total of 1569.65 m of drilling was carried out in 7 nos. of which includes 01 no. of first level, 05 nos. of second level and 01 no. third level boreholes. The surface manifestation of mineralisation in the area is in the form of old workings, malachite and azurite stains. The sulphide phases identified are chalcocopyrite, pyrrhotite and pyrite. The mineralisation occurs in the form of dissemination, stringers, veinlets, shear parallel and occasionally in a massive form. Chalcocopyrite is the chief ore mineral, pyrite and pyrrhotite being other sub-ordinate sulphide minerals. The host rock for mineralisation is the hornblende-biotite-schist, silicified schist, hornblende gneiss and metabasics. The sulphides are concentrated along shear and fracture planes and are more or less concordant with the foliation planes of the host rocks. Massive chalcocopyrite mineralisation (15 cm) in silicified schist in borehole ODKE-29. The analytical results of Borehole ODKE-25 indicate two copper mineralised zones/lodes viz. from 163.50 to 165.50 m = 2.00 m x 0.36%Cu and from 180.95 to 182.95 m = 2.00 m x 0.4%Cu.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Mayurbhanj	Madansahi block	-	-	24	6173.45	-	General exploration (G2) was carried out for copper and associated precious metals in this block. A total of 6173.45 m drilling had been done in 24 nos. of inclined boreholes. As part of surface investigation, 135 cu.m of trenching/pitting was carried out with 12 trenches across the ineralizat zone. The block exposes patchy outcrops of granitoids and intrusive dolerite. Surface evidences of ineralization are marked by presence of feeble malachite-azurite stains and occasional fine specks and disseminations of pyrite and chalcopyrite. Principle ore mineral is chalcopyrite with association of pyrite, pyrrhotite and pentlandite. Accessory sulphide phases identified are molybdenite, galena and covellite with minor gold. The ineralization is hosted within the hornblende biotite schist, silicified metabasics and gneiss restricted to foliation, shear fabrics, fracture and secondary quartz-calcite-chlorite vein and veinlets in form of streaks, disseminations, stringers, and at places breccias filling. The cumulative sulphide zone thickness varies from 7.00 m to 84.50 m with an average thickness of 33.00 m considering up to 3 rd level of intersection. The borehole ODMS-20 drilled in central part intersects a copper lode of 34.00 m with average 0.60% Cu, which includes a copper lode of 11 m width with 1.01%Cu. The 3 rd level borehole ODMS-30 intersects three copper lodes i.e. two shallow zones from depth 49.00 m to 51.00 m (2.00 m x 0.96 % Cu), 59.20 m to 64.20 m (5.00 m x 0.31%Cu) and third one is from 260.50 m to 276.00 m (15.50 m x 0.59% Cu). In eastern part of the prospect, one 2 nd level borehole ODMS-37 intersects five copper lodes from 30.45 m to 34.95 m (4.50 m x 0.70%Cu), 43.20 m to 48.25 m (5.05 m x 0.30%Cu), 54.00 m to 56.05 m (2.05 m x 0.20%Cu), 156.35 m to 171.35 m (15.00 m x 0.59%Cu) and 175.35 m to 181.90 m (6.55 m x 0.67%Cu) with cumulative of 33.15 m with 0.55%Cu, which remains open in further east. Based on the present available assay, the average copper lode thickness is about 15.00 m with average copper grade of 0.55% Cu at 0.20% Cu, disposing a linear pinch and swell lensoidal body behaviour both in strike as well as depth.
Mayurbhanj	Nimaidih block	1:2000	1.0	-	-	-	Preliminary exploration (G3) was carried out for copper and associated precious metals in Nimaidih block. The exploration work included DM of 1.0 sq. km on 1:2000 scale along with ground geophysical survey, pitting/trenching and collection of samples for petrographic and other laboratory studies. The rocks exposed in the area include quartzite and hornblende biotite schist which are later intruded by granites and granite gneisses which are traversed by series of newer dolerite sills/dykes. The mineralisation in the form pyrite and chalcopyrite is associated with hornblende biotite schist as well as granite gneiss and their silicified equivalent in the area. The presence of malachite, azurite stains, disseminated fine specks of chalcopyrite and pyrite, fracture filled limonite within quartz veins, box-work structure are the surface evidences of mineralisation, besides old prospecting pits and slag heaps near northern part of the area. Self -Potential anomaly along with moderate resistivity and high chargeability has been identified in the central part which may indicate presence of sulphide mineralisation. The analytical results of boreholes have been recalculated at 0.2% Cu cut-off and two copper lodes in KW-02, four copper lodes in KW-05 and five copper lodes in KW-06 have been delineated.
Deogarh	Rampali Block	-	-	9	2552	-	General exploration (G2) was carried out for copper and associated metals this Block. Deogarh district. The area forms a part of the East ern Ghats Mobile Belt and exposes mainly ferruginous oxidised quartzite, garnet biotite gneiss/schist and pyroxene granulite, granite. Quartzites in the area are capped by laterite, goethite and devoid of gossans. The surface manifestation of mineralisation in Rampali Block is in the form of oxidation, ferruginisation and limonitisation within the pyroxene granulite and brecciated quartzite. Pyroxene-granulite is the main host rock for the copper mineralisation as observed from the borehole intersections. Disseminations of sulphides are also seen in the garnet biotite schist and quartzite on either side of the mineralised zones in the boreholes. During G-3 stage, two lodes were established and 0.172 million tonnes resource of 0.66% average grade Cu at 0.4% Cu cut-off up to 210 m vertical depth (30m R.L.) was estimated. Sulphide mineralisation occurs in the form of dissemination, stringers and veinlets. Chalcopyrite is the major ore mineral associated with pyrite and pyrrhotite and occasionally observed Bornite & covellite within silicified pyroxene granulite. The present work includes a total of 2552m drilling carried out in nine boreholes (ODR-01 to ODR-09). The boreholes were planned at 100m strike interval for each level excluding fourth level borehole (ODR-1). As per the visual estimate, all the boreholes have intersected ore zones. The dusty dissemination/specks/vein type of chalcopyrite which is observed in the boreholes contains 0.2%-0.8% Cu as per visual estimation.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		Sampling No.
Manganese Ore						
Kendujhar	Chormalda Block	-	1.41	-	-	General exploration (G2) was carried out for manganese and iron ore in Chormalda Block, Kendujhar District. An area of 1.41 sq. km were covered by detailed geological mapping along with 57 cu.m of pitting and trenching. The area forms part of the Iron Ore Group (IOG) sequence of Bonai-Kendujhar Belt in Kendujhar district of Odisha. The litho units are feebly metamorphosed Precambrian volcano- sedimentary sequence laid between Singhbhum granite on east, Bonal granite on west and are classified as Iron ore Group. Ferruginous shale, manganiferous shale, iron and manganese laterite are the dominant unit exposed in the study area. A part of the block is covered with float hematite ore. Laterite hosts varying proportion of hematite angular fragments, psilomelane nodules/botroids with occasional shale and goethite. Below the laterite/lateritised float ore manganese occurs as detached lenses, pockets of Wad +Psilomelane+Goethite. Iron and/or manganese float ore were subjected to in situ residual enrichment due to lateralisation.
Sundargarh	Orahuri, Kusumdihi & Banjikusum	1:2000	1.41	21	1444.60	624 General exploration (G2) was carried out for manganese ore in Orahuri, block. The exploration work in these three non- working mine blocks were taken up by GSI, on request from Govt. of Odisha. An area of 1 sq. km was mapped on 1: 2,000 scale with 1444.60 m drilling and collection of 624 nos. of core samples. The manganese ore in Orahuri Block is generally associated with laterites and Lower Shale Formation of Koira Group. A total of 685.30 m drilling has been carried out in thirteen boreholes over 0.51476 sq. km. area. All the 13 boreholes have intersected manganese ore with more than 10% Mn content. The total manganese resource estimated up to a maximum depth of 79.00 m at 10% and 25% Mn cut-off are 7.18 MT with 21.39% Mn and 2.42 MT with 32.39% Mn respectively. In Banjikusum block, a total of 380.00 m drilling has been carried in 0.08134 sq. km area. The total resource estimated at 10% Mn cut-off is 0.097 MT with 11.34% average Mn. In Kusumdihi block, a total of 8 boreholes were drilled with total meterage of 379.30 m and collection of 62 nos. core samples. Three boreholes have intersected manganese ore with more than 10% Mn content and one bore hole has intersected iron ore zone with above 45% Fe content. The total manganese resource at 10% Mn cut-off is 0.0944 MT with 13.64% Mn over an area of 0.31549 sq. km. The resource has been estimated up to a maximum depth of 18.00 m.
Sundargarh	Patamunda West Block	1: 4000	0.59	-	-	5 General exploration (G2) was carried out for manganese detailed mapping in Patamunda West block along with drilling and collection of petrographic and core samples. Patamunda West Block is occupied by thin layer of laterite and manganiferous laterite at the top which is underlain by white shale, variegated soft friable manganiferous shale and hard compact, fine-grained purple colour phyllite / shale. During the FS 2020-21, detailed mapping of 0.59 sq. km on 1: 4000 scale, 5 nos. of PS and OM samples has been completed.
Koraput	Upardhodshi Block	-	1.016	-	-	155 Preliminary exploration (G3) for Manganese Ore was carried out in Upardhodshi block. The 1.016 sq km area were mapped by DM, 20.2 L km gravity and magnetic survey were carried out in the block and 115 cu m pitting and trenching, 61 nos. of pit- trench samples and 60 nos. of bedrock samples were collected and analysed to evaluate the surface potential of manganese ore. A total of 34 nos. of petrological samples including 30 samples for thin polished section and 4 samples for polished section studies, were also collected and studied to identify manganese ore minerals in Upardhodshi block. The block forms part of the Eastern Ghat granulite terrain and falls within the 32 km long and over 5 km wide Kutinga- Nishikhal manganese ore belt in southern Odisha. The rock types exposed in the block are khondalite, quartzite, calc- silicate and granite gneiss. Manganese ore bodies are confined to the highly weathered khondalite and quartzite in the area and occurs in the form of fine disseminations, streaks, lenses, bands, patches along the foliation planes and fracture filling. On the basis of surface indication and analytical results of bedrock and trench samples Mn bands (Band I to V) are delineated in the area. The manganese ore bands have a cumulative strike length of 115 m and 10 m average width (Band-I); 230 m cumulative strike length and 35.5 m average width (Band-II); 174 m cumulative strike length and 45.5 m average width (Band-III); 120 m cumulative strike length and 6 m average width (Band-IV) and 110 m cumulative strike length and 8 m average width (Band-V) with smaller outcrop of siliceous manganese ore in western part of the block and isolated patch of Mn in the southern part of block. Surface sampling i.e., channel sampling and trenching was done at 50 to 100 m interval. Analytical results of channel samples show Mn content varies from 0.80 to 60.01 % and in PTS samples varies from 1.46% to 31.20%.

Table-3 (Concltd.)

Agency/ Mineral/ District	Location/ Area/ Block	Mapping		Drilling		Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		Sampling No.
Directorate of Geology, Odisha Manganese Ore						
Keonjhar	Roida-D	1:12500	-	10	-	143 In Odisha, a exploration in Roida-D area was carried out with the objectives to assess manganese ore resources with its grade. Two irregular sporadic outcrops were delineated. The manganese exposure at the central part has the maximum length of 10 m and average width of 4 m. The cumulative thickness of ore body encountered in boreholes is about 47.55 m. The study involved drilling of 10 boreholes, at grid spacing of 100 m * 50 m, to a total depth of 354 m and collection 143 samples. Exploration is continuing in the area.
Keonjhar	Tentuliguda area	1:12500	121	-	-	37 Tentuliguda area, Keonjhar district, exploration was taken up to assess manganese ore resources in the area. One manganese ore body admeasuring 15 m * 30 m has been located at west of Bagchuan village. The study involved geological mapping of 121 sq.km area on 1:12500 scale and collection of 37 samples. Exploration suspended due to local problems in the area.
MECL Manganese Ore						
Bolangir	Tamiya	1:4000	8.05	-	-	893 In Odisha, a G2 stage exploration in Tamiya village, Patangarh tehsil, was carried out with the broad objectives to carry out detailed geological mapping and estimate indicated category resources of manganese ore in the area. The study involved mapping of 8.05 sq.km area on 1:4000 scale with collection of about 893 samples along with a trenching and 5 pittings of dimension 1m x 1m x 1m. Resources in the area has been estimated at about 633 thousand tonnes of manganese ore with 23.04% Mn under indicated category.
Bolangir	Rengali block	1:12500	1.83	-	-	1556 A G2 stage exploration was carried out over an area of 1.831 sq.km in Rengali block with the broad objectives to carry out detailed geological mapping and estimate indicated category resources of manganese ore in the area. The study involved mapping of 1.83 sq.km area on 1:12,500 scale with collection of different types of 1,556 samples along with a trenching and 5 nos of pittings admeasuring 1m x 1m x 1m. Resources in the area has been estimated at 328 thousand tonnes of manganese ore with 21.37% Mn, 15.82% Fe and 0.28% P under indicated category.

PRODUCTION

The important minerals produced in the state were Coal, Bauxite, Chromite, Iron Ore, Manganese Ore, Graphite and Limestone etc. during 2020-21. The value of minor minerals' production was estimated at Rs. 337 crore for the year 2020-21. The number of reporting mines in 2020-21 was 149 in case of MCDR minerals (Table-4).

Table - 4 : Mineral Production in Odisha, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value [§]	No. of mines	Quantity	Value [§]	No. of mines	Quantity	Value [§]
All Minerals		134		306536247	130		343507062	149		283343864
Coal	'000t	-	144312	-	-	143016	-	-	154151	-
Bauxite	t	5	15413642	11000292	5	15483307	10901088	5-	15565611	12324450
Chromite	t	22	3970691	36850747	20	3929260	32134395	21	2863869	22910242
Iron Ore	'000t	62	113119	251111210	64	146637	293179734	80	104631	240326857
Manganese Ore	t	31	476821	3048997	27	537325	3161505	28	483069	2135372
Garnet (abrasive) [%]	t	-	38376	545745	-	-	-	-	-	-
Graphite (r.o.m.)	t	3	23199	18259	5	12564	34838	5	12767	41633
Iolite	kg	3	73	684	2	90	579	3	16	73
Sillimanite	t	1	17930	143870	-	-	-	-	-	-
Limestone	'000t	7	5289	1728521	7	5627	1848621	7	7187	2234688
Sulphur [#]	t	-	239344	-	-	253697	-	-	209387	-
Minor Minerals		-	-	2087922	-	-	2246302	-	-	3370549

Note: The number of mines excludes Fuel and Minor minerals.

§ Excludes the value of Fuel minerals.

% Associated with Sillimanite.

Recovered as by-product from oil refinery.

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 – 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, Distt. Kalahandi	2000 (alumina)
	1500(Venadium)
Vedanta Aluminium Ltd, Jharsuguda, Distt. Sambalpur	1750 (aluminium)
Asbestos Products	
UAL Industries Ltd, Korian, Distt. Dhenkanal	NA
Konark Cement & Asbestos Industries Ltd, Bhubaneswar	NA
Cement	
ACC Ltd, Bargarh Cement Ltd, Bargarh	2140
Ultra-Tech Cement Ltd, Jharsuguda (G)	2600

Table-5 (Contd.)

Industry/plant	Capacity ('000 tpy)
OCL India Ltd, Rajgangpur, Distt. Sundargarh	4000
	1064 (Refractory)
	2900 (Clinker)
OCL India Ltd, Kapilas (G). Cuttack	1350
Toshali Cements Pvt Ltd, Ampavalli, Distt. Koraput	200
Ceramics	
Prabhu Ceramics & Minerals Pvt Ltd, Majhipali, Rengali, Sambalpur	24 (Acidic 9.6 (EBT Filling Mass)
Chemical	
Arrow Minerals & Metals Pvt. Ltd, Vejdihi, Banspal	1.8 (Manganese Oxide) 2.25 (Manganese dioxide powder)
Chrome Concentrate	
K L Resources PVT. Ltd, Sundaria, Dharmasala	74.7
Maharaja Minerals Pvt. Ltd, Soso Hatadidi	60
Anand Exports, Nimmapali, Sukinda	60
Fertilizer	
IFFCO, Paradeep	NA
Paradeep Phosphates Ltd, Paradeep	NA
SAIL Fertilizer Plant, Rourkela, Distt. Sundargarh	NA
Graphite Concentrate	
Pradhan Industries , Katra, Kana Laxmipur	2.88
Iron & Steel	
SAIL, Rourkela Steel Plant, Rourkela, Distt. Sundargarh	5300 (sinter) 3470 (pig iron) 4400 (crude/liquid steel) 85 (tin plates)
Bhushan Power & Steel, Sambalpur	1000 (sinter) 2420 (crude steel)
Bhushan Steel Ltd, Dhenkanal	5625 (crude Steel) 6680 (Sinter) 3200 (Finished steel)
Jindal Stainless Steel Ltd, Kalinganagar, Gadapur,	1000 (Stainless steel) 250 (ferroalloys)
Neelachal Ispat Nigam Ltd, Khurunti, Godigotha, Sarangapur	1710 (sinter) 855 (pellets) 1100 (Pig Iron) 920 (crude/liquid steel) 900 (Semifinised Steel)
	13 (A/S) 35 (Crude Tar)
OCL India Ltd, Lamloi, Distt. Sundargarh	120 (sponge iron) 85 (billets)
Orissa Sponge Iron Ltd, Palaspanga, Distt. Keonjhar	250 (Ssponge iron) 100 (steel ingot)
Shree Jagannath Steel & Power Ltd Uliburu Barbil	115.5 (Sponge iron) 112.86 (M S billets)
Visa Steel Ltd, Kalinganagar, Distt. Jajpur	225 (pig iron) 300 (sponge iron) 500 (special steel)
Tata Steel Ltd Duburi Sukinda	3200 (pig iron) 3000 (crude/liquid steel) 5750 (sinter)

Table-5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Manhole Cover Utkal Modular, Cover) Kaurmundu	10.752 (Gl. 2.73 (DI. Manhole Cover)
Pellet	
Arya Iron & Steel Co. Pvt Ltd, Barbil.	1200 (pellets)
Essar Steel Ltd, Paradip	6000 (pellets)
Jindal Steel & Power Ltd, Barbil.	9000 (pellets)
Pro Minerals Pvt. Ltd, Basantpur, Jhumpara	1000 (pellets)
Rexon Strips Ltd, Kumakela, Distt. Sundargarh	300 (pellets)
	60 (sponge iron)
	25 (M. S. ingots)
Shivom Mineral Limited Kusumdih, Koira	120 (Lump CLO)
Tata Steel Ltd, Kalinga nagar works, Kalinganagar, Odisha	2800
Pig Iron	
IDCOL Kalinga Iron Works Ltd, Barbil, Distt Keonjhar	180
IKIW. Ltd, Matkambeda Barbil	170
Sponge Iron	
Action Ispat & Power (P) Ltd, Pandripathar, Distt. Jharsuguda	250
Adhunik Metaliks Ltd, Chandrihariharpur, Distt. Sundargarh	270
Aarti Steel limited, Ghantikhal, Athagarh, Cuttack	320
Bhaskar Steel & Ferroalloys Pvt. Ltd, Badtumkela Rajamunda	120
Beekay Steel & Power Ltd, Uliburu, Distt Barbil.	115.5
Bhusan Steels Ltd, Meramandali, Distt. Dhenkanal	900
Brand Steel & Power Pvt. Ltd, Murusuan, Keonjhar	60
Crackers India (Alloy) Ltd, Gobardhanpur, Distt. Keonjhar	73
Dinabandhu Steel & Power Ltd, Kalinganagar, Distt Jajpur.	60
Ganesh Sponge Pvt Ltd, Krushnachandrapur, Distt. Angul	90
Jay Iron & Steel Ltd, Balanda, Rourkela, Distt. Sundargarh	60
Jindal Steel & Power Ltd, Nisha, Dist. Angul	1800
Kamaljit Singh Alluwalia Steel & Power Div. Barpada, Barbil	300
L. N. Metalics Ltd, Sripura Jharsuguda	60
MGM Minerals Ltd, Forest Park, Bhubaneswar	105
Rungta Mines Ltd,	
Unit-I, Karakola, Barbil, Distt. Kendujhar	180
Unit-II, Kamand, Koira Distt Sundargarh	556.5
	277.2 (Semi Fin. Steel)
SMC Power Generation Ltd, Jharsuguda	200
	350(Billet)
Scaw Industries Pvt. Ltd, Gundichapara, Distt. Dhenkanal	100
Sponge Udyog Pvt. Ltd, Jai Bahal, Lathikata	60
Sree Metallic Ltd, Loidapada, Distt. Kendujhar	300
Suraj Products Ltd, Barpalli, Distt. Sundargarh	36
Swastik Ispat pvt. Ltd	45
Tata Sponge Iron Ltd, Joda, Distt. Kendujhar	465
Vikram Pvt Ltd, Tumkela, Distt. Sundargarh	60
Viraj Steel & Energy Ltd, Gurupali, Rengali	220
Vishal Metalics Pvt. Ltd, Barahamusa, Bonai	60
Yedani Steel & Power Ltd, Manitra Donagadi	60

Table-5 (Concl.)

Industry/plant	Capacity ('000 tpy)
Ferroalloys	
Aarti Steel limited, Ghantikhal,	50 (Ferrochrome)
Athagarh, Cuttak	200 (Finished Steel)
Balasore Alloys Ltd, Balgopalpur, Distt. Balasore	145 (H. C. Ferro chrome)
FACOR, Charge Chrome Plant, Randia, Distt. Bhadrak	65
Ferro alloy Corporation Ltd, Bhadrak	75
IDCOL Ferro Chrome & Alloys Ltd, Distt. Jajpur	18
Indian Metal & Ferro alloys Ltd	168
(Indian Charge Chrome Ltd, Choudwar	
Indian Metals & Ferro Alloys Ltd, Therubali, Distt. Cuttack	116.4
Jeypore Sugar Co. Ltd, Rayagada	22.5
Jindal Stainless Ltd, Kalingnagar, Jajpur	250
Nav Bharat Ventures Ltd, Ferro Alloys Plant, Khargprasad, Distt. Dhenkanal	75
Rohit Ferro-Tech Ltd, Kalinganagar, Distt. Jajpur	110
Sagar Mining & Metal Industries Pvt. Ltd,	3.6 (L.C. Fe/mn)
Nayagarh, Barbil	6.0 (M. C Fe/mn)
Stork Ferro& Mineral Industries Pvt. Ltd, Somanthpur, Remuna	25 (Ferro chrome)
Tata Steel Ltd (Ferroalloys and Minerals Div.), Joda, Distt. Kendujhar	50.4
Tata Steel Ltd (Ferroalloys and Minerals Div.), Bamnipal, Distt. Kendujhar, Jhumpura	65
Tata Steel Ltd (Ferroalloys and Minerals Div.), Distt. Cuttack	50
Tata Steel Ltd (Ferro Chrome plant Chamakhandi.), Chatrapur	55
T.S.Alloys Ltd, Anantpur,	52
(Rawmet Ferrous Industries Ltd), Cuttack	
Visa Steel, Kalinganagar	180
(Manganese oxide)	
Refractory	
IFGL Refractory Ltd, Kalunga,	80000 pc
Distt. Sundargarh	(continuous casting refractories)
Khemka Refractories (P) Ltd, Khatukhura, Dhenkanal	35.4
Orissa Industries Ltd, Lakhikata, Distt. Sundargarh	125
Kalinga Refractories, Brundammal, Badmal, Jharsuguda	7.2 (Fire Bricks)
	1.2 (F. C. Mortar)
Maruti Monolithics Pvt. Ltd, Gopalpur, Tangi Choudwar	2.0(Basic fettling Mass)
	2.75(Basic mortar)
Total solution, Piplimal, Lakhanpur	10 (Mag- chrome Powder)
	10 (Mag- chr. Powder, normal)
	10 (Mill scale Powder)
Orissa Industries Ltd, Barang, Distt. Cuttack	19
	5 (DBM)
TRL Krosaki Refractories Ltd, Belpahar, Distt. Jharsuguda.	247.89
	18 (Taphole clay)
Silicon Carbide	
Indian Metals & Carbide Ltd, Therubali	NA
Synthetic Rutile	
IREL, Orissa Sands Complex, Ganjam	100
Petroleum Refinery	
IOCL Paradeep Odisha	15000

(G): Grinding units.

Note: Data, not readily available for fertilizer and cement industries on respective websites.

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 541 contracts [(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)

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 2020-21, Ministry 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 1.4.2021, balance recoverable reserves of crude oil were estimated at 587.33 million tonnes, out of which 325.73 million tonnes (55%) are in onshore and 261.61 million tonnes (45%) in offshore areas. ONGC (nomination) has the largest share of 71% in reserves of crude oil with OIL (nomination) and PSC regime contributing 13% and 16%, respectively.

The balance recoverable reserves of natural gas as on 01.04.2021 were placed at 1,372.64 billion cu. m, out of which 882.72 billion cu. m (64%) are in offshore and 492.91 billion cu. m (36%) in onshore areas. PSC regime has the largest share of 50% in natural gas reserves followed by ONGC (nomination) and OIL (nomination) at 40% and 10%, respectively (Table-2).

Table-2: Balance Recoverable Reserves of Crude Oil & Natural Gas in India including Offshore Areas (As on 1.4.2021)

(Crude oil in million tonnes; Natural gas in billion cu. m)

Area	Crude oil*	Natural gas*
India	1372.64	587.33
Onshore	325.73	492.91
Offshore	261.61	882.72
Western offshore	219.27	325.65
Eastern offshore	42.34	557.07

Source: Indian Petroleum and Natural Gas Statistics, 2020-21, Ministry of Petroleum and Natural Gas, Govt. of India.

Note: * Proved and indicated balance recoverable reserves. In case of Natural Gas, reserves includes Coal -bed Methane.

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 2020-21.

Private Companies/Joint Ventures

During 2020-21, cumulative 17,051.24 LKM 2D and 1,47,107 SKM 3D seismic data was acquired. Out of which approximately 16,806.42 LKM 2D and 7,281.69 SKM 3D data were acquired. This year 55% of 2D seismic and 68% of 3D seismic data acquisition have been carried out in the offshore basins. A total of 115 exploratory wells (including inland and offshore) amounting to a drilling meterage of 3,44,175 m were drilled. Details of exploratory activities in Nomination, PSC regime & RSC regime in the year 2020-21 are furnished in Table-3.

Table-3: Exploratory Efforts in Nomination, PSC and RSC Regime during 2020-21

Subject	Parameter	ONGC	OIL	PSC	RSC	Total
		(Nomination)	(Nomination)	(Pre-NELP & NELP)	(OALP & DSF)	
2D Seismic Data acquired	Onland (GLKM)	244.82	-	-	7502.89	7747.71
	Offshore (GLKM)		-	-	9303.53	9303.53
	Total	244.82	-	-	16806.415	17051.24
3D Seismic Data acquired	Onland (SKM)	433.05	124.61	250.05	2321.99	3129.71
	Offshore (SKM)	1,272.26			4959.69	6231.95
	Total	1,705.31	124.61	250.05	7281.69	9361.66
Exploratory well drilled	Onland	61	10	4	1	76
	Offshore	31		8		39
	Total	92	10	12	1	115
Exploratory Meterage drilled	Onland (1000 m)	176.266	42.811	13.25	1.4	233.744
	Offshore (1000 m)	83.177		27.25		110.31
	Total (1000 m)	259.443	42.811	40.5	1.4	344.175

Source: India's Hydrocarbon Outlook, 2020-21, Directorate General of Hydrocarbons

Marine and Coastal Survey

Geological Survey of India

During, 2020-21, 27 no. of items were taken up by GSI under Marine & Coastal Survey.

SR-049 “Close grid geophysical surveys (GM) for studying the characteristics of subsurface geology, structure in the continental shelf/slope off Pondicherry, Tamil Nadu coast, Bay of Bengal”. Magnetic (5,000 lkm) and Gravity data (2,304 lkm) along with bathymetry are collected. Study of magnetic anomaly map revealed a ENE-WSW broad magnetic trend associated with a long wavelength between 11° 30'N and 12° 20'N in the central part of the study area. The significant change in the magnetic anomaly pattern at 12° 20'N gives a clear indication of the basin boundary. This zone may be spatially correlated to the E-W trending Moyar-Bhavani-Attur (MBA) lineament on land. The bathymetric data indicates continental shelf (77 to 1,266 m), continental slope (1,555 m and 2,500 m), continental rise (2,966 to 3,200 m) and abyssal plain (3,200 m to 3,550 m). The SBP survey depicts the terrace/ridge-like features related to hard bottom are recorded around 900 to 1,000 m water depth. Sub-bottom record shows very thin or no sediment deposition resulting in the exposure of basement rock. This indicates a high energy condition in the area.

SR-054: “Preliminary Assessment of Lime Mud in the Continental Shelf off Pentakota-Bavanapadu, Andhra Pradesh”. Preliminary assessment of lime mud over an area of 5000 sq km was taken up. The continental shelf in the study area is having a maximum width of 15 km in the central part and a minimum width of 1 km in the northern most part. In the northern part, shelf is very narrow beyond margin followed by deep submarine channels and gullies. The thickness of the lime mud in the recovered cores varies between 0.11m and 5.8 m. Two zones of lime mud deposition is noticed in the 11.31m piston core collected from a depth of 151m. Lime sand/mud occurs in an area of 1,440 sq km over a length of more than 170 km and a maximum width of 16 km in the study area.

SR-061: “Regional search of limemud/limesand in the continental shelf off Maharashtra Coast (Gap Area Block-2)”. The mid-shelf is characterised by uneven, rugged erosional topography with ripple marks and pinnacles/buried coral reefs with a relief of 1 to 3 m. Sub-bottom profiles reveals the variation of sediment thickness between 20 m and 5 m. Major part of the survey area is covered by sand and silty sand. Silty clay occurs as a small patch in the survey area. Accordingly, three zones could be demarcated viz., high grade limesand zone, low grade limesand zone and impure limesand zone. The high grade limesand zone comprises of grey limesand with CaO content ranging from 50 to 52%. Low grade limesand zone is located in central part with CaO content varying from 44% to 50%. The impure limesand with intercalations of clay and limesand and carbonaceous clay zone is identified in the eastern part having less than 44% of CaO.

SR-066 “Regional exploration for Fe-Mn nodules off Lakshadweep Sea”. An area of 6050 sq. km, within a depth

range from 1649 to 3716 m off west of the Laccadive Ridge, in the Lakshadweep Sea, was surveyed by backscatter imaging/multi beam echo sounder system along with bathymetric, sub-bottom profiling, magnetic and gravity surveys. Thirty surface sediment samples (grab) in 10 km x10 km grid and one gravity core (GC) were collected from the area. The major sedimentary units is sandy silt followed by silty sand and sand silt clay. Coarse fraction study reveals presence of frequent microfaunal remains with occasional detrital mineral grains and encrustations of Fe-Mn and Mn micronodules. The major microfauna noticed are foraminifera, followed by radiolaria, ostracods and broken shells of pteropods and foraminifera.

SD-297: “Close grid heavy mineral resource evaluation and study of sub-surface disposition of sand bodies in the inner shelf off Tuticorin in Gulf of Mannar (Area-I), Tamil Nadu coast”. This program was taken up over an area of 50 sq km. Higher absorption of the seismic energy suggests the possibility of sand layer. The vertical extension of sand bodies varies from 2.2 m to 15.6 m. Total Heavy Mineral (THM) content in the seabed sediment varies from 1.33 wt.% to 21.95 wt.% with an average of 6.54 wt.%. The heavy minerals present in the samples are Garnet, Ilmenite, Sillimanite, Rutile, Zircon, Monazite, etc. in the decreasing order of abundance. The heavy mineral content is more in the medium sand than the fine/coarse sand unit. Further studies are in progress.

SD-298: “Preliminary resource evaluation of construction grade sand and search for heavy minerals in the contiguous zone off Mangalore, Karnataka”. A total of 59 vibrocore samples were also collected in 2km X 2km grid. Sedimentological studies revealed that the area is mainly carpeted with clayey sediments. Sand sediments seen as patches are found to be associated either with the oxidised clay or the clay rich in organic materials (may be an indication of the presence of palaeo-strandline). Total Heavy Mineral (THM) content in sediment for 34 samples is not encouraging.

SD-299: “Close grid heavy mineral resource evaluation and subsurface disposition of sand bodies in the inner shelf off Vembar in Gulf of Mannar (Area-II), Tamil Nadu coast”. The program was mounted over an area of 50 sq. km along with bathymetry, shallow seismic surveys and seabed sampling. Two channels are observed in the central part and north-eastern part of the survey area which are separated by a prominent ridge. The channel in the central part is one km wide and four km in length and shows a trend of N 10° W to S10°E. These channels may be the extensions of river Vembar and Mukaiyur respectively joining the gulf. Based on visual observation, surface sediments mainly consist of medium, coarse and fine sand. Coarse sand mainly occurs all along the channels. Medium and fine grained sediments occurs on the ridges. Heavy minerals are more concentrated in medium sand and fine sand. Total Heavy Mineral (THM) content in sediment varies between 0.8184 wt.% and 20.0674wt.% which averages to 5.8575 wt.%.

SD-300: “Preliminary resource evaluation of heavy mineral and sub-surface disposition of sand bodies in the inner shelf off Kuttapuli to Uvari sector in Gulf of Mannar,

Tamil Nadu coast". Preliminary resource evaluation of heavy mineral over an area of 196 sq. km was carried out along with sensor surveys and sediment sampling at 2kmX2km grid interval. The total heavy mineral content in representative sample varies from 0.31 to 3.78 % in the bulk sample. Further studies are in progress.

SD-301: "Preliminary evaluation of heavy mineral resources and sub-surface disposition of sand bodies in the inner shelf sediments off Vizinjam-Poonthura sector, within territorial waters of west coast of India, Kerala coast". Preliminary evaluation of heavy minerals over an area of 183 sq. km. was carried out by vibrocoreing at 2 X 2 grid pattern. The total heavy mineral percentage in the area varies from 0.34 wt.% to 4.62 wt.%. Concentration of heavies are higher in sediments having proximity to river mouths i.e, along the eastern side of the area. The major economic heavy minerals identified include ilmenite, garnet, sillimanite, zircon, monazite and rutile in the order of abundance.

SD-302: "Multi thematic mapping of Contiguous Zone beyond Territorial water in Arabian sea off Mt. Dilli, Kerala". A total area of 750 sq.km was covered within a depth range of 46.6 m and 76.8 m. A total of 71 grab samples were collected at 2 km x5 km interval. The seabed is mainly carpeted by fine to medium sand except along the eastern part where silty sand, sandy clay and clayey sand are present in shallow part of the area. The concentration of heavies in seabed sediment is not significant.

SD-303 "Multi thematic mapping of Contiguous Zone beyond Territorial Waters off Bekal, Kerala". Bathymetry data reveals that the depth increases progressively from east to west. A total of 75 surface sediment samples were collected at a 2x5 km grid and 3 core samples at a 5x10 km grid to generate 15 core samples. The THM content varies from 0.6 to 2.4% in the surface sediments and the carbonate content in the surface sample ranges from 6.8% to 31.7%.

ST-282: "Close Grid Mineral Exploration for Placer Minerals within the Territorial Waters off Bavanapadu-Nuvvalarevu, Andhra Pradesh (South Block)". Cruise: was taken-up over an area of 45 sq.km and the bathymetric survey reveals that the sea bottom is gently sloping in general from east to west within the water depth varying from 28.56m to 46.41m. The total non-magnetic heavy mineral wt% in the area varies from 1.92 to 10.73wt% with an average of 5.66wt% in 0-1 m level.

ST-283: Preliminary search for Placer Minerals and Sub-Surface Sand Body in the Territorial Waters off Karipeta, Andhra Pradesh". A total of 45 vibrocore sediment samples were collected in 2km x 2 km grid by covering an area of 128 sq.km within water depths of 11.9 m to 40.7 m. A few concretions (carbonaceous?) of 3cm x 2cm and wood pieces were observed in few samples. Total Heavy Mineral (THM) content in sediment varies between 0.83 wt.% and 8.23 wt.% with an average of 3.93 wt.%.

ST-284: "Preliminary evaluation of placer mineral resource in the shelf area off between Port Novo and

Karaikal, Tamil Nadu". The survey has been taken-up over an area of 70 sq.km, within the water depths of 28.8 to 59.7 m. Bathymetric survey carried out for 80 lkm reveals that the sea bottom is exhibiting gentle slope from west to east. Total Heavy Mineral (THM) content in sediment calculated for 34 samples varies between 2.3 wt.% and 6.5 wt.% with an average of 4.5 wt.%.

ST-285: "Geophysical (magnetic) survey within continental shelf off Kalingapatnam, Andhra Pradesh coast, Bay of Bengal". During the cruise, 905 lkm of magnetic and bathymetric surveys were carried out in an area of 3780 sq.km. A minor NE-SW trending negative anomaly has been observed in the northeastern part of the area. This low may be interpreted as southwestern continuity of the hinge zone passing through the Bengal basin. It extends up to the Kalingapatnam and further southwest falls in line with the main deep fault. This magnetic low is flanked by short-wavelength anomalies on the landward side. The elliptical closures having high frequency and high amplitude magnetic anomalies trending along NE-SW and ENE-WSW direction observed at the central, north-eastern and south-western part of the study area respectively, may be due to the presence of intrusive bodies within the continental crust. These intrusive bodies might have originated during the initial stage of rifting of the Eastern Continental Margin of India (ECMI).

ITEM NO.-127: "Preliminary search for placer mineral occurrence in the nearshore area between Taruvaikkulam and Chippikulam, Thoothukkudi District, Tamil Nadu". An area of 100 sq. km had been covered with systematic bathymetric survey and collection of seabed sediments in 2 km x 2 km grid. The concentration of CaCO₃ and P₂O₅ in the sediment from near shore domain is higher than the upper crustal continental values may be due to higher biological productivity in the study area. The average concentration of TiO₂ & Fe₂O₃ in the near shore seabed sediment samples are higher than the upper continental crustal values may be due to abundance of heavy minerals such as garnet and ilmenite. Trace elements such as Zirconium and Strontium are higher than its upper continental crustal values attributing towards abundance of heavy minerals such as Garnet, Ilmenite and Zircon. Total Heavy Mineral (THM) content in sediment calculated for 18 samples varies between 3.2 wt % and 11.2 wt % with an average of 6.2 wt %.

ITEM NO-130 "Preliminary Investigation of Placer Mineral Resource in the Near Shore area off Baruva sector, North Andhra Pradesh Coast". An area of 35 sq. km from the low water line (LWL) to 10 m isobath was surveyed towards carrying out bathymetry by portable single beam echo sounder and sediment sampling with portable grab, manual auger core and vibrococorer Total heavy mineral (THM) concentration (Magnetite free) in the grab samples ranges from 2.39 wt% to 24.98wt% with an average of 10.57wt%. The vibro core samples ranges from 5.08 wt% (VC/2/1) to 10.38 wt% (VC/3/1) with an average of 7.93 wt%. The sediment wise THM wt% reveals that, the

concentration of HM is more in the very fine sand followed by sandy clay, fine sand and medium sand.

SR-059: “ Preliminary assessment for polymetals in the Fe-Mn crust/nodules in the southern part of West Sewell Ridge with close grid sampling and Preliminary search for Fe-Mn crust/nodules in the northern Part of the Sewell Rise, Andaman Sea”. The survey was carried out over an area of 1510 sq km. Most Fe-Mn crusts and nodules were recovered from the near flat seamounts and ridges of the study area. The surface of the nodules having either a combination of botryoidal and gritty texture or a completely botryoidal texture, although some nodules have smooth surface. Recovered crusts are usually tabular and mainly pebble size fragments. They are usually laminated or layered having thickness of 2-3 cm.

ST-277: “Close Grid Exploration for Placer Mineral Resources in the Territorial Waters off Malud Odisha Coast”. The programme was taken up over an area of 48 sq.km and total of 64 nos. of vibrocore samples and 3 water samples were collected from water depth of 19.60 to 32.15m. Heavy minerals are mostly concentrated in the fine to medium grained sand. The bulk economic Heavy Mineral content in the study area varies from 1.78 to 13.47 wt%. The heavy mineral suite with ilmenite, garnet and sillimanite as major constituents followed by zircon, pyroxenes, epidote, monazite and kyanite.

ST-279: “Close grid exploration for placer mineral resources in the territorial waters off Gopalpur-Chatrapur, Odisha coast”. Cruise was mounted over an area of 45 sq.km. Geostatistical studies show an area of 42.98 sq.km consist of potential heavy mineral bearing sand for the top 1.0 sediment column. Preliminary study indicates heavy mineral suite with garnet, ilmenite and sillimanite as major constituents followed by zircon, pyroxenes, epidote, monazite and kyanite.

ITEM 129: “Study of Shoreline changes, coastal zone management and bathymetry study in the inner shelf (0-10m water depth) of Rasulpur River mouth to Subarnarekha River mouth”. This study was taken up along 60 km long coastal stretch located between Rasulpur and Subarnarekha estuarine complex and the study reveals prograde and retrograde shoreline changes due to erosion and accretion of sediments by tides and waves. The study shows dynamic behaviour of erosion and accretion processes which are resulting both by natural and anthropogenic activities. The bathymetric survey was carried out in 64 sq. km area of nearshore domain falling within 0 to 10m isobaths. The bathymetric contour map reveals that the depth of the nearshore seabed varies from -0.7m to -9.5m isobaths. The predominant sediment type is grey-brown, fine to very fine sand rich in shell fragments, mica and heavy minerals with mud, loose clay with sticky sandy clay balls. Very fine sand with admixture of mud etc.

Production

Petroleum (Crude) and Natural Gas (utilised) are also produced from Offshore region (Table - 4).

Table-4: Mineral Production in Offshore Regions, 2018-19 to 2020-21
(Excluding Atomic Minerals)

Mineral	Unit	2018-19	2019-20	2020-21 (P)
		Quantity	Quantity	Quantity
Natural Gas (ut.)	m cu m	22117	20635	18429
Petroleum (crude)	'000t	16867	16003	15391

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.

The challenges faced for commercial exploitation of gas from gas hydrates are more or less similar all over the world. Extracting methane from gas hydrate in marine environments is relatively a new path. Japan has taken a lead in this direction. From the progress being made by the Indian NGHP, steps are underway to mitigate anticipated challenges in the Indian context. The NGHP expeditions are an appropriate line of research investigation which could help the country move forward by harnessing this yet elusive resource.

Punjab



The State reported production of only minor minerals

₹287

Lakh, value of minor minerals' production were estimated in the year 2020-21

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).

Table – 1: Reserves/Resources of Minerals as on 1.4.2015 : Punjab

Mineral	Unit	Reserves		Remaining Resources			Total Resources
		Total	Indicated	Inferred	Total	(A+B)	
		(A)	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

EXPLORATION & DEVELOPMENT

Exploration activities carried out for Potash during the year 2020-21 are furnished in Table-2.

Table –2 : Details of Exploration Activities in Punjab, 2020-21

Agency/ Mineral/ District	Location Area /Block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Potash Fazilka & Sri Muktsar Sahib and SriGanganagar *(Rajasthan)	Satluj basin	-	-	1	-	182	Reconnaissance survey (G4) was carried out for reappraisal of potash in this area. Exploration for potash was carried out in parts of Fazilka district of Punjab. Geologically, the study area falls in the Satluj basin which is a part of Indo-Gangetic Alluvial Plain. The entire area extending in Punjab is covered with thick blanket of Quaternary sediments. They comprise older alluvium and aeolian sediments of Middle Pleistocene to Holocene age. In the sub-surface, the area comprises geological formations from the Neoproterozoic through Early Cambrian and continues through Tertiary to Quaternary sequences. The Evaporite Group comprises cyclic deposits of halite (most dominant constituent) containing polyhalite, alternating and separated by a sequence with anhydrite, clay and dolomite. Total 1600m +10% drilling was planned in south-western part of Punjab to evaluate the potential of potash in part of Fazilka District, Punjab. During the period, one borehole (PFSBH-02) was successfully drilled up to 886m by the outsourced drilling. The Geophysical logging of the borehole (PFSBH-02) was carried out up to 860m by Geophysical team, GSI, NR, Lucknow. In borehole PFSBH-02, cumulative thickness of potash zone is 16 m, with average grade of 3.02% K at 2% K cut-off and total cumulative thickness of halite (NaCl) is 123.3m with average grade of 92.31% at 90% cut-off. Further, total cumulative thickness of halite (NaCl) is 282.6m with average grade of 88.80% at 80% cut-off. Further subsurface exploration can possibly lead to delineation of a depocentre of potash/halite and calculation of resource potential of the partially explored Punjab basin.

PRODUCTION

The State reported production of only minor minerals. The value of minor minerals' production was estimated at ₹287 lakh for the year 2020-21.

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 - 3.

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, Charatrapur	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)
NFL, Sibian Road, Distt. Bathinda	22 (methanol)
	511.5 (Urea)
	8.7 (S)
Petroleum Refinery	
HPCL Mittal energy Ltd, Bathinda	9000
Sponge Iron	
Vallabh Steels Ltd, Sahnewal, Ludhiana	120

(G): Grinding units.

Note: Data, not readily available for Fertilizer and Cement Industries on their respective websites is taken from Indian Fertilizer Scenario, FAI Statistics and Survey of Cement Industry & Directory, respectively.

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 2020-21

₹15,095 crore

Estimated value of production of minor minerals in 2020-21

MINERAL RESOURCES

Rajasthan 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) till 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%), feldspar (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; **feldspar** 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 district, Bannia Kalan, Rajpura-Dariba 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, Alwar, Banswara, Bharatpur, Bhilwara, Chittorgarh, Dausa, Dungarpur, Jaipur, Jhunjhunu, 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 & sillimanite in Udaipur district; **manganese ore** in Banswara, Jaipur & Pali districts; **potash** in Jaisalmer & Nagaur districts; **silver** in Ajmer, Bhilwara, Jhunjhunu, Rajsamand, Sikar & Udaipur districts; and **tungsten** in Nagaur & Sirohi districts (Table -1).

Table – 1 : Reserves/Resources of Minerals as on 1.4.2020: Rajasthan

Mineral	Unit	Reserves										Remaining Resources				Total Resources (A+B)
		Proved STD111	Probable STD121	STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total			
														STD122	STD211		STD221	STD331	STD332	STD333	STD334
Apatite	tonne	-	-	-	-	-	-	51521	1016000	-	-	-	-	1067521	1067521	
Asbestos	tonne	-	-	-	-	1803183	3070449	87802	42101	4526861	57800	-	-	13615710	13615710	
Bauxite	'000 tonnes	-	-	-	-	-	-	-	-	528	-	-	-	528	528	
Copper																
Ore	'000 tonnes	14344	20045	-	34388	13314	1148	18603	197078	573814	5200	-	-	833461	867849	
Metal	'000 tonnes	169.44	313.64	-	483.08	33.87	12.2	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	1542460	510656	1350059	161575	-	-	5587504	5605603	
Garnet	tonne	156938	50946	4	207888	310712	191094	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																

Table-1 Contd.

Mineral	Unit	Reserves					Remaining Resources							Total Resources (A+B)
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
(Haematite)	'000 tonnes	4555	2280	479	7314	3775	3962	1132	-	11510	7776	13	28166	35480
Iron ore														
(Haematite)	'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	4050.41	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	13777.2	0.53	23827.97	31266.02
Lead-Zinc metal														
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	157933355	119833	69750	28942783	9257650	72003769	93848769
Sillimanite	tonne	-	-	-	-	300	-	519	-	-	-	-	819	819
Silver														
Ore	onne	44124192	63331000	40870828	148326020	2330000	17049200	36712218	39420000	64730000	182142579	-	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														
WO ₃	tonne	-	-	-	-	-	-	-	-	142144	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

Note: The proved and indicated balance recoverable reserves of crude oil and natural gas as on 1.4.2016 are 31.72 million tonnes and 35.66 billion cum. respectively.

District-wise reserves/resources of lignite in the State are provided in Table-2.

Table – 2: Reserves/Resources of Lignite as on 1.4.2021: Rajasthan

District	Proved	Indicated	Inferred	Total
Total	1168.53	3029.77	2150.77	6349.07
Bikaner	560.3	230.33	309.19	1099.82
Barmer	495.23	2509.46	1496.77	4501.46
Jaisalmer & Bikaner	-	-	11.47	11.47
Jaisalmer	-	-	70.44	70.44
Jaisalmer & Barmer	-	-	13.8	13.8
Jalore	-	-	76.08	76.08
Nagaur	113	289.49	154.33	556.82
Nagaur & Pali	-	0.5	18.69	19.19

(In million tonnes)

Source: Coal Directory of India, 2020-21

Deposits of petroleum are located in the Bikaner-Nagaur and Barmer-Sanchore basin and those of natural gas in Jodhpur and Jaisalmer basins in the State.

EXPLORATION & DEVELOPMENT

National Oil Companies (NOC) continued their seismic survey for petroleum and natural gas during 2020-21.

The details of exploration activities conducted by various agencies GSI and State DMG for Iron ore, Manganese ore, base metals (Cu, Pb & Zn), Rare Earth Elements, Tungsten, Potash and other minerals including minor minerals during the year 2020-21 are furnished in Table - 3.

Table – 3 : Details of Exploration Activities in Rajasthan, 2020-21

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Iron ore							
Jaipur	Morjia block	1:2000	1.5	-	-	-	Preliminary exploration (G3) for iron was carried out in Morjia block, Jaipur district, Rajasthan in part of survey of India toposheet No. 45M/16. A total of 1.5 sq. km of detailed geological mapping on 1:2000 scale in the block was completed in F.S. 2019-20. Drilling component of FS. 2020-21 had been dropped as mining lease of the area had been renewed and mining for hematite had already started in the area. During the detailed mapping, a total of 121 nos. of channel samples, 25 nos. of bedrock samples, 10 nos. of petrochemical samples and 15 nos. of samples from trenches and pits had been collected for analysis. Classical wet chemical analysis of Fe in channel samples gave encouraging values. Channel no. 26384/MCH/07 near hinge gave 6m wide zone with 66.08% Fe (weighted average) while channel no. 26384/MCH/09 exposed 6m wide zone with 58.24% Fe value (weighted average). Samples from channel no. 26384/MCH/06 were collected above an abandoned mine in band-I, which gave 17m mineralised zone having 59% Fe value (weighted average). The detailed mapping revealed prominent occurrence of iron ore mineralisation in the block. As channel samples had yield encouraging values of iron (>55%), it was likely to be present in sub surface.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		Sampling No.
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 mangiferous metachert, ferruginised 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.
Rajsamand	Negariya Block	1:2000	-	-	-	- Preliminary Exploration (G3) for Manganese in Negariya Block, Rajsamand district, Rajasthan. Detailed Mapping on 1:2000 scale had been carried out during FSP 2020-21, to evaluate the potential of Manganese and associated mineralisation in Negariya Block. The study area comprised the rocks of Deiwara Group of Aravalli Supergroup Palaeoproterozoic age (2.5 to 1.6 Ga) and Granite Gneiss of Bhilwara Supergroup of Archean.Lithologies exposed were mangiferous quartzite, ferruginised quartzite, calcareous quartzite, grey quartzite, intercalated phyllite within impure dolomite, sheared granite gneiss exposed as basement rock of Archean age. General strike of the study area varied from N20°E to N35°E with very steep 70° to 80° dipping towards NW and at place to quaquaversal dip. Manganese mineralisation is prominently associated with mangiferous brecciated quartzite. Evidences of mineralisation had been found in the form of pyrolusite, psilomelane, old working was found in mangiferous quartzite north of Negariya village. Mangiferous quartzite is black colour, metallic lustre, black streak, soils to hand. Thickness of Mangiferous bands varied from 25 to 50m and length 100 to 600m mainly occurred peak of ridges in discontinued manner. Trench-A chemical analysis of MnO ranging from 0.63 to 16.97 %.
Banswara	Kalinjara- Kasoomba area	1:2000	-	-	-	- Reconnaissance survey for manganese in Kalinjara-Kasoomba area by large scale mapping on a scale of 1:12500 in parts of Toposheet nos. 46I/07 in Banswara District was carried out. The different types of samples were collected (100 nos. of bed rock samples, 50 nos. of pitting/trenching samples, 10 nos. of petrological sample & ore microscopy sample (each) and 05 nos. of electron probe micro- analyser samples for analysis. Bed rock samples (100 nos.) were collected from the manganese bearing rocks and channel sampling were carried out for pitting/trenching sample across the strike of mineralisation. Geologically, the area forms the part of Aravali Supergroup of rocks that include Udaipur and Lunavada Group of rock which belonging to Palaeo Proterozoic age and the Deccan traps of Cretaceous to Palaeocene age. The Dominant lithologies exposed in the area were paragneisses, feldspathised schist and para-amphibolite with interbands of dolomite and quartzite belong to Banswara Formation, Udaipur Group; phyllite, meta-subgraywacke and feldspathised mica schist with bands of quartzite, meta-conglomerate, dolomite and mangiferousphyllite of Kalinjara Formation and meta- subgraywacke, mica schist of Wagidora Formation, Lunavada Groups, Aravalli Supergroup age. Analytical results of 44 BRS samples had been received. The MnO value ranges from 65.83 % to 12.19% in 40 BRS samples. Maximum value of MnO was 65.83% found in sample no. KKL1 collected from Kalakhunta mines. MnO value ranges from 51- 58% found in 4 samples. Maximum 58.48% MnO value found in KKL8 collected from NW of Ghatia village and MnO value 51.36% and 51.42% found in sample no. KKB28 and KKL3 respectively which were collected from south of Timba Mahuri village and NW of Kalakhunta village.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		Sampling No.
Banswara	Kanajpara- Kushalgarh area	1:12000	100	-	-	75 Reconnaissance survey (G4) for manganese in Kanajpara-Kushalgarh area, Banswara district, Rajasthan Large scale mapping (1:12500 scales) had been carried out and covered 100 sq km area around Magarda, Badwas, Kushalgarh, Pali Choti, Rupkhera, Wagaicha, Nisnawatect area of Kushalgarh tehsil of Banswara district in parts of T.S. No 46I/08. LSM work was carried out with an objective to delineate potential zone of manganese ore. Geologically, study area was having rocks of Aravalli supergroup of palaeoproterozoic age and Deccan trap complex of upper cretaceous to palaeocene age. Aravalli supergroup of rocks are represented by Banswara Formation of Udaipur group and Kalinjara Formation of Lunawada Group. In the mapped area the oldest rock exposed was para-gneiss of Banswara Formation. Para-gneiss is grey-white in colour, foliated, and consists of alternate bands of felsic and mafic minerals. Para gneiss is unconformably overlain by rocks of Kalinjara Formation of Lunawada Group. Kalinjara Formation mainly comprised of mica schist, meta-subgreywacke, phyllite, chlorite schist, quartzite, and dolomite and manganeseiferous phyllite. During the course of mapping 50 cu m trenching work had been carried out through 5 numbers of trenches across the manganeseiferous phyllite. During field work 50 Nos. of BRS, 10 Nos. of ore microscopy 10 No. of petrological and 5 number of EPMA sample also had been collected.
Basemetal						
Banswara	Rayji Ki Dhani Area	1:12000	100	-	-	75 Preliminary Exploration (G3) for Basemetal Mineralisation in Rayji Ki Dhani Area, Nim Ka Thana, Sikar District, Rajasthan. The Rayji Ki Dhani area is located about 16 km southeast of Nim Ka Thana, Sikar district, Rajasthan. The area is part of Nim Ka Thana copper belt. The Alwar and Ajabgarh Group of rocks belonging to the Delhi Supergroup of Palaeo-Meso-Proterozoic age represent the mineral belt. The quartzite and schist of the Pratapgarh Formation represent the Alwar Group. The Ajabgarh Group is a combination of calcareous, argillaceous and minor arenaceous rocks of which the host rock for mineralisation is banded impure marble of the Kushalgarh Formation of the Ajabgarh Group of the Delhi Supergroup. Subsurface exploration by core drilling had been carried out with an aim to assess the strike and the depth continuity of copper and associated precious metals in the study area. Eight boreholes were drilled including a total drilling of 1015m. Out of these eight boreholes, four had been planned in the south western part to target mineralised zone (MZ - III), 3 boreholes in northern part to target mineralised zone (MZ-I) and 1 borehole in the central part to target mineralised zone (MZ-II). The mineralised zones had been intersected at a vertical depth of ~50-60m.
Banswara	Kalamara Block Bhudoli-Basari area Nim Ka Thana	-	-	6	1021.7	- Preliminary exploration (G3) for basemetal mineralisation in Kalamara Block, Bhudoli-Basari area, Nim Ka Thana, Sikar dist., Rajasthan. The host rock for mineralisation is banded impure marble of the Ajabgarh Group of the Delhi Supergroup, similar to Nim Ka Thana copper belt. The dominant lithologies exposed in the area were metasediments belonging to the Kushalgarh of the Ajabgarh Group and Pratapgarh Formation of the Alwar Group. Besides these, acidic and basic intrusives of post-Delhi age were also exposed. Subsurface investigation by drilling had been carried out over a strike length of 1000m in Kalamara block to establish the basemetal potentiality of the area. Total 1021.73m drilling had been carried out with six first level boreholes and a second level borehole had been drilled which intersected impure marble. The boreholes drilled in the Kalamara block intersected sporadic and scanty copper mineralisation in the form of fine disseminations and few specks of chalcocite, bornite, chalcopyrite and covellite. Disseminations of pyrite and specularite also had been observed in the drilled boreholes. The analytical results of core samples received so far from first level borehole showed mineralised zone of 2m X 0.33% Cu.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Alwar	Bhigota block Rajgarh	-	-	7	1115	-	Preliminary exploration (G3) investigation by drilling for copper and gold was carried out in Bhigota block, Rajgarh teshil, Alwar district, Rajasthan to test the continuity of mineralised zone, delineated on surface during detailed geological mapping carried out in FS: 2019-20. The study area is located 20 km Northwest of Bandikui. Drilling was carried out to test the depth persistence and potential of copper mineralisation in the area along 800 m strike length of white siliceous dolomitic marble. On the basis of field observations and integration of geological, geochemical and geophysical data, one mineralised zones (MZ-1) had been delineated. All the boreholes had been planned along channels and trench maintaining a strike interval of 200 m towards west and east respectively. A total of 1115 m of drilling had been carried out in seven boreholes. The boreholes RJBHG-1, 2, 3, 4, 5, 6 and RJBHG-7 (Second level) had intersected sulphides mostly pyrite and chalcopyrite, Bornite and Chalcocite in form of fine to coarse disseminations along the foliation plane, specks and stringers in white silicified dolomitic marble but unfortunately copper sulphides in these boreholes were not significant enough for delineation of zones on the basis of visual estimates.
Alwar and Dausa	Kaled area	1:12000	1.5	6	1125	378	Preliminary exploration (G3) for basemetal and associated precious metal mineralisation in Kaled area, Alwar and Dausa districts, Rajasthan. A total of 1.5 sq. km area had been covered on during the detailed geological mapping on 1:2000 scale along with the surface geophysical survey of 20 L km during FS 2019-20. Systematic bed rock sampling had been carried out in order to demarcate the zones of possible mineralisation. The surface indication of mineralisation was in the form of malachite staining, small specks of pyrite and chalcopyrite, specular haematite, ferrogonisation and limonitisation were observed. Apart from this channel sampling had been carried out where surficial indication was observed. During detailed geological mapping a total of 323 nos. of bed rocks samples, 10 nos. of petrochemical samples, 20 nos. of petrological samples, 15 nos. of ore microscopic samples, 05 nos. fluid inclusion study samples and 05 nos. XRD samples had been collected. A total of 1125 m drilling had been completed against the assigned target of 1000 m along the six boreholes. The boreholes RJKLD-01, 02, 03, 04, 05 and RJKLD-06 had intersected sulphides mostly pyrite, chalcopyrite, pyrrhotite, arsenopyrite and Chalcocite in form of fine to coarse disseminations along the foliation plane, specks and stringers in impure marble. And total 148 core samples had been submitted to Chemical lab GSI, Jaipur for analysis.
Alwar	Suratgarh block Thanagazi teshil	1:2000	1.5	-	-	368	Preliminary exploration (G3) for copper and associated precious metals by detailed mapping on 1:2000 scale was carried out covering 1.5 sq km area in Suratgarh block, Thanagazi teshil, Alwar district, Rajasthan to delineate zones of Cu and associated precious metal mineralisation. Apart from this, 71.50 cubic m pitting/ trenching were carried out and a total of 50 nos. of PTS samples, 286 BRS/ channel samples, 10 petrochemical samples, 10 nos. of petrological samples and 12 nos. of ore mineral samples had been collected. Ground geophysical survey was also carried out in Suratgarh block to locate the potential zones of mineralisation. The surface indications of mineralisation were in the form of presence of old workings, malachite stains, scapolites and fresh sulphides i.e. bornite, covellite, chalcopyrite, pyrrhotite, quartz and carbonate veins. Chalcopyrite, bornite and pyrrhotite were present in the form of dissemination, minor specks, filled within veins as well as along the fracture and foliation planes within the dolomitic marble. On the basis of field observation, interpretation of surface indication of mineralisation and channel sample results, two zones of sulphide mineralisation over a strike length of 700m and 250m had been delineated in the central and southern part of the block. The chemical analytical results of channel samples showed Cu values ranging from 20 ppm to 0.30% (RJAS/CH-1), 20 ppm to 0.15% (RJAS/CH-2), 15 ppm to 0.49% (RJAS/CH-3), 10ppm to 0.12% (RJAS/CH-4) and 20 ppm to 0.40% (RJAS/CH- 5) respectively.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Sikar	Dariba block	-	-	23	-	-	General exploration (G2) for basemetal mineralisation in Dariba block, Sikar district, Rajasthan. Geologically, the area comprised, the rocks of Ajabgarh Group and arenaceous rocks of Pratapgarh Formation of the Alwar Group belonging to Delhi Supergroup. In order to test the mineralised lodes intersected in the previously drilled boreholes (DBB-1 & DBB-4), the boreholes were planned to trace depth and strike continuity of these mineralised zone. A total of 23 boreholes had been drilled so far, which included 11 first, 7 second and 5 third level boreholes. Two second level boreholes were under progress. The analytical results of 21 nos. of boreholes were received so far. Out of 21 boreholes, 13 boreholes had indicated significant copper lodes. The analytical results of the borehole RJSD-1 had indicated three significant copper lodes of 2.05m, 4.10m & 2.05m thickness with an average grade of 0.43%, 0.21% and 1.38% Cu, respectively. The analytical results of the borehole RJSD-2 had indicated a copper lode of 2.15m thickness with an average grade of 0.25% Cu. The analytical results of the borehole RJSD-4 have indicated two copper lodes of 4.80m & 3.00m thickness with an average grade of 0.52% & 0.23% Cu, respectively. The analytical results of the borehole RJSD-5 had indicated three significant copper lodes of 7.00m, 4.00m & 6.00m thickness with an average grade of 0.46%, 0.35% & 0.40 % Cu, respectively. The analytical results of the borehole RJSD-7 had indicated a copper lode of 4.00m thickness with an average grade of 0.57% Cu. The analytical results of the borehole RJSD-8 had indicated a copper lode of 4.60m thickness with an average grade of 0.37% Cu. The analytical results of the borehole RJSD-12 had indicated two copper lodes of 4.60m & 2.10m thickness with an average grade of 0.37% & 0.20% Cu, respectively. The analytical results of the borehole RJSD- 14 had indicated two copper lodes of 3.00m & 13.10m thickness with an average grade of 0.21% & 0.27% Cu, respectively. The analytical results of the borehole RJSD-15 had shown two significant copper lodes of 3.00m & 4.00m thickness with an average grade of 0.26% & 0.25% Cu, respectively. The analytical results of the borehole RJSD-16 had indicated three significant copper lodes of 6.10m, 4.15m & 2.00m thickness with an average grade of 0.25%, 0.33% & 0.26% Cu, respectively. The analytical results of the borehole RJSD-19 had indicated four significant copper lodes of 2.60m, 2m, 4m and 4m with an average grade of 1.11%, 0.24%, 0.22% and 0.21% Cu, respectively. The analytical results of the borehole RJSD-20 had indicated two significant copper lodes of 2.10m and 6.60m with an average grade of 0.21% and 0.25% Cu, respectively. The analytical results of the borehole RJSD-21 had indicated one copper lodes of 2.20m with 0.26% Cu. The resource estimation will be attempted after the receipt of all analytical results.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		Sampling No.
Sikar	Adharshila - Dariba	-	-	11	1605	- Preliminary Exploration for basemetal in Adharshila-Dariba, Neem ka Thana, Sikar district, Rajasthan. Geologically, the area comprised the rocks of Ajabgarh Group of Delhi Supergroup. The Ajabgarh Group was represented by amphibole quartzite, amphibole bearing impure marble with inter bands of quartzite and schist interlayered with the amphibolite of Kushalgarh Formation. The general trend of the lithounits was NNE-SSW to N-S with westerly dip. The length of MZ-I was more than 1600m and width varied from 5m to 21m with grade varied from 0.2% Cu to 0.55 % Cu. The length of MZ-II was 600m and width varied from 11m to 66m with grade varied from 0.22% Cu to 0.56 % Cu. The subsurface exploration by 11 nos. of first level boreholes, involving drilling of 1605m, with 200m spacing had been carried out. Eight boreholes (RJSA-1 to RJSA-6, RJSA- 10 and RJSA-11) and three boreholes (RJSA-7 to 9) were planned in MZ-I and MZ-II, respectively. The analytical results of nine boreholes had been received and all the boreholes had intersected significant copper lodes at 0.2% cut-off.
Sikar	Daudham- Kalakota block	-	-	6	1200	231 Preliminary exploration (G3) for copper and associated precious metals in Daudham-Kalakota block, Nim Ka Thana, Sikar, Rajasthan. Geologically, the area comprised the rocks of Alwar and Ajabgarh Groups. The Alwar Group was mainly represented by massive quartzite of Pratapgarh Formation; schist and phyllite of Kankarwahi Formation. The Ajabgarh Group was represented by calc gneiss, amphibole bearing impure marble with interbands of quartzite and schist of Kushalgarh Formation. Amphibolites and pegmatites are also present as intrusive in the area. The general trend of the litho-units is NNE-SSW with steep westerly dip. Three mineralised zones (MZ-I, MZ-II and MZ-III) of 550m, 600m and 430m strike length, respectively were delineated. The average grade of mineralised zones varies from 0.10% Cu to 0.20% Cu. Although the mineralised zones have a restricted width up to 03m only but were having evidences of fresh sulphides in the form of chalcopyrite and bornite along with intense malachite stains. During FS: 2020-21, the mineralised zone MZ-II and MZ- III being explored sub-surface, involving 1200m drilling. The MZ-I could not be tested by drilling as it fell in deep forested area. All the six boreholes drilled so far had intersected sulphide mineralisation in the form of vein filled, fracture filled, foliation parallel specks and disseminations of chalcopyrite, pyrrhotite and pyrite with occasional presence of chalcocite, bornite and few specks of covellite hosted by amphibole bearing quartz biotite schist and quartz veins. Apart from this, 206 nos. of core samples, 08 nos. of polished/ thin-polished sections for OM, 04 nos. of petrochemical samples, 04 nos. of XRD samples, 04 nos. of EPMA and 05 nos. of geotechnical samples had been collected from the drilled boreholes. The analytical results were awaited.
Sikar & Jaipur	Beri Bharaj areas	1:12500	102	-	-	242 Reconnaissance Survey for Basemetals in Beri Bharaj areas, Sikar and Jaipur Districts, Rajasthan (G4): An area of 102 sq. km had been mapped on 1:12, 500 scale, to bring out a large-scale geological map. 81 BRS, 75 Channel samples and 50 PTS (samples collected from trenches at 1 m intervals) collected from different potential lithounits for basemetal analysis, 10 OM for ore microscopy and 15 PS for petrographic studies, 10 PCS for major oxides, trace elements and REE analyses and 01 XRD samples for mineral had been collected. The bed rock sample results received till date (n=44), the Cu value ranged between 10 ppm to 0.4%; while the Zn value showed a range of 5-515 ppm and channel results (n=52) showed Cu value ranged between 10ppm to 0.13%. The channel samples derived from the tremolite marble horizon of Thanagazi formation.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Sikar	Chiplata Neem- ka-Thana	1:12500	-	-	-	151	Reconnaissance Survey (G4) for Copper and associated precious metals in Chiplatea area, Neem-ka-Thana, Sikar, Rajasthan. The exploration work in the item included large scale mapping of 100 sq.km. area on 1:12500 scale, geochemical sampling in the form of 136 bedrock samples and 15 petrochemical samples to check the basemetal potential and extent of the ore zone, with 50 cubic metres of pitting/ trenching. Based on the surface indications of mineralisation, favourable litho-structural set up, four zones within the block had been demarcated as promising zone for copper mineralisation 4 zones demarcated based on the field observations and surface evidence of mineralisation only the MZ 1 seemed promising after consultation of chemical analytical data of the BRS and trench samples. BRS value of 0.44%, 0.25%, 0.14% and 0.13% for Cu had been reported from a 2.5 square km area between Chiplatea and Lambi-Ki-Dhani village. Several other anomalous values of Cu had been reported from the area. BRS from the mineralised zone 4 (MZ 4) to the south of Goli-Ki-Dhani village, did not show anomalous values of Cu as expected, though two samples from two different channel and a random BRS showed 1900, 1500 and 890 ppm of Cu respectively. Trench samples collected from this zone showed concentration of total REE up to 3093.8 ppm. The chemical data of the BRS collected from the area showed erratic and feeble nature of Cu mineralisation in the area, with the mean Cu value was 134.40 ppm with standard deviation of 470.72. As per the chemical data only the Kushalgarh metasediments seemed to be mineralised and the basement rocks were devoid of any mineralisation, despite having strong surface evidences and hydrothermal alteration packages suitable for Cu mineralisation.
Jhunjhunu	Fatehpura block	1:2000	0.75	-	-	-	Preliminary exploration (G3) for copper and associated mineralisation in Fatehpura block, Jhunjhunu district, Rajasthan. An area of 0.75 sq. km was covered by Detailed Mapping (DM) on 1:2000 scale. The Lithounits present in the study area belonged to Alwar and Ajabgarh groups of the Delhi Supergroup of rocks. The litho units present in the area were represented by grey quartzite, micaceous quartzite, amphibole quartzite, amphibolites, quartz-biotite- schist and minor albitite emplaced along weak zones.
Udaipur	Phalet	1:12500	100	-	-	240	Reconnaissance survey (G4) for copper mineralisation in parts of Phalet area, Udaipur district, Rajasthan. During the present study, large scale mapping covering an area of 100 sq. km had been done on 1:12500 scale. A total of 200 bedrock samples for basemetal analysis, 10 petrochemical, 20 petrological and 10 samples for ore microscopy were collected. The mineralisation is structurally controlled along the contact between the ferruginous quartzite of the Gurali Formation of the Debari Group and the migmatite gneiss of the Sawadri Group. Surface manifestations of mineralisation are represented by profuse malachite stains, silicification, boxwork structure, old workings/located along the Aravalli-Mangalwar contact, slag heaps and fresh specks of chalcopyrite, galena and pyrite in disseminated form and also along fractures. Three mineralised zones had been delineated based on the chemical analysis of channel samples viz. i) 450 m long and 9m thick Cu mineralised zone lying 1.75 km NW of Gurlith with an average Cu value of 0.91% and 5 m thick Cu zone with an average Cu value of 0.76%. ii) 100 m long and 6 m thick Cu, Pb and Zn mineralised zone with an average Cu value of 713 ppm, avg. Pb value of 0.57% and avg. Zn value of 0.44% [750 m north of Bhainsra Khurd] and iii) 35m long 7m thick Cumineralsed zone with an average Cu value of 0.73% lying 575 m south of Nauva.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Remarks Reserves/Resources estimated	
		Scale	Area (sq.km)	No of. Boreholes	Meterage		Sampling No.
Bhilwara	Lakhola block	1:2000	1.52	-	-	533	Preliminary exploration (G3) Detailed geological mapping (1:2000 scale) had been carried out in the Lakhola block covering an area of 1.52 sq. km. A total of 533 samples (grid/channel/trench) were collected and submitted for chemical analysis. Two mineralised zones (MZ-I and MZ-II) were demarcated on the basis of surface manifestations. MZ-I had a strike length of about 450 m with approximately 65m width. MZ-II had a strike length of about 350 m with approximately 55 m width. Analytical results of only 118 samples had been received so far and four significant Cu values reported are 0.10 % (two samples) and 0.13% and 0.17 %.
Udaipur	Khori Mahuri	-	-	4	1080	338	Preliminary exploration (G3) for copper and gold mineralisation in Khori Mahuri area, Udaipur district, Rajasthan. A total of 1080 m of drilling had been carried out in four boreholes, varying in length from 241 m to 295 m and 200 core samples, 100 channel samples, 30 petrographic, 5 samples for EPMA, Fluid Inclusion study, Stable Isotope study and XRD each had been collected. The first borehole had been drilled along channel no. 3 and geophysical anomalous zone – I. The second and third borehole had been drilled to test the strike continuity of sulphide mineralisation in RJKM-1, maintaining a strike interval of 200 m towards west and east respectively. The fourth borehole had been drilled to test the depth continuity of copper mineralisation of old workings in the eastern part of the mapped area. The boreholes RJKM-1 and RJKM-2 had intersected significant concentration of sulphides mostly fracture filled pyrrhotite, pyrite and chalcocopyrite along with magnetite in the form of specks, stringers and veins in dolomitic marble. The boreholes RJKM-3 and RJKM-4 had intersected sulphides mostly fracture filled pyrrhotite, pyrite and chalcocopyrite in the form of disseminations, specks and stringers in dolomitic marble but unfortunately copper sulphides in these boreholes were not significant enough for delineation of zones on the basis of visual estimates. However, the analytical results of the core samples were yet to be received.
Udaipur	Ladana North Block	1:2000	-	4	608.6	-	Preliminary exploration (G3) for copper and associated mineralisation in Ladana North Block, Udaipur district, Rajasthan. Detailed mapping on 1:2000 scale had revealed exposures of Untala Granite, quartz veins and the rocks of the Mangalwar Complex such as amphibolite and brecciated chert bands. A few bed rock samples collected on grid pattern and channel samples during the F.S. 2019-20 had analysed anomalous copper values. Ground geophysical survey had brought out a few anomalies trending NS. The drilling investigation under G-3 stage had been carried out during the F.S. 2020-21. For planning of boreholes, geophysical SP, IP and Magnetic anomalies, bed rocks samples and channel samples collected had been taken into consideration. A total of four boreholes namely RJLN-1 to RJLN-4 had been drilled (608.6m of drilling) out of the total envisaged target of 1000m. All the surface copper anomalies delineated through grid bed rock samples as well as ground geophysical survey had been tested but copper mineralisation observed in all these four boreholes were insignificant. Chalcocopyrite along with pyrite and pyrrhotite in the form of fine dissemination and thin stringers had been observed within altered amphibolite and granite. The copper zones intersected within altered amphibolite showed less than 0.20% Cu average grade based on visual estimation.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Bhilwara	Kesarpura	-	-	8	1560	-	Preliminary exploration (G3) for basemetal in Kesarpura, Bhilwara District, Rajasthan. Based on the encouraging results of bedrock samples and anomalous axes of SP and IP delineated through systematic ground geophysical survey, a total of 1560.0m of drilling had been carried out in eight boreholes. The spacing of boreholes was kept 200 m along the strike for G-3 stage exploration. The block was located in the central part of the Pur-Banera Belt. The contact of Pur-Banera Group and the underlying Potta Formation of Bhilwara Supergroup lay in the Kesarpura block. The metasedimentaries lithounits of both the groups were exposed and intersected in the boreholes in the block.
Bhilwara & Chittorgarh	Chainpuriya- Lasariyakhera	1:12500	100	-	-	-	Reconnaissance survey (G4) for basemetal mineralisation in Chainpuriya-Lasariyakhera area, Bhilwara and Chittorgarh districts, Rajasthan. Geological mapping was carried out covering an area of 100 sq. km on 1:12500 scale. Surface manifestation of mineralisation in the area was quite prominent. Presence of malachite stains had been observed in almost all lithologies of the area. The specks and veins of primary sulphides like chalcopyrite, bornite, azuite and pyrite had been observed in the calc gneiss, calc schist and calc-silicates of Rewara Formation. The shear zone is major structural control of mineralisation in the area. Based on the surface indications of mineralisation, favourable lithological and structural set up coupled with the analytical result of the bed rock samples two potential zones of basemetal mineralisation had been demarcated. The two potential zones are Rampuriya mineralised zone and Gujjar khera mineralised zone associated with profuse malachite staining. The mineralisation was controlled by shear zone.
REE(Rare Earth Elements) Bhilwara	Basni-Motipura- Itunda area	1:12500	100	-	-	-	Reconnaissance survey for a rare metals around Basni-Motipura-Itunda area in pegmatites of Bhilwara district, Rajasthan: Large Scale Mapping covering an area of 100 sq. km was carried out on scale of 1:12500. Geologically, the study area was occupied by the rocks of Bhilwara Supergroup represented by Mangalwar complex and Hindoli Group and Jawal formation of Jahazpur group of rocks. Mangalwar Complex in the north eastern part of the study area was represented by garnet bearing mica schist of Potta Formation and migmatite gneiss of Kekri Formation. The rocks of Mangalwar Group were mostly soil covered in the western part of the study area. Mapping in northern, eastern and southern eastern part was carried out based on the exposures and isolated hillocks. The Hindoli Group of rocks was exposed in south eastern part; they were represented by metagraywacke and phyllites of Sujanpur Formation. The rocks of Bhilwara Supergroup were intruded by pegmatites. The Jahazpur Group of rocks was represented by conglomerate, gritty quartzite, grey phyllites and dolomite of Jawal Formation. The pegmatites present in the study area formed the eastern fringe of Ajmer Bhilwara pegmatite belt.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Jalore	Sewara block	1:12500	150	2	695	186	<p>Reconnaissance Survey (G4) exploration was taken up in Sewara block during FS: 2020-21. Large scale Geological mapping on 1:12500 scale covering an area of 150 km² was carried out in Sewara block. A total of 117 litho-geochemical samples were collected along with 52 pedo-geochemical and 10 groundwater samples. Pitting of 67m³ had been carried out to ascertain depth as well as strike continuity of mineralised zone. Ground magnetic and gravity surveys were carried out in select areas totaling to 15km². High Zr concentration of >1000 ppm had been recorded in 16 litho-geochemical samples, with highest concentration of 1896 ppm. Out of total 1000m drilling target, 695m had been achieved. Borehole no. RJJ5-1 (260m) and RJJ5-2 (250m) had been completed and logging and sampling were ongoing. In BH no. RJJ5-1 rocks observed range from biotite rich granite to granodiorite and gabbro. The lithotypes observed in RJJ5- 2 were pyroclastic andesite and basalt.</p>
Jalore	Karwara block	1:12500	100	4	-	189	<p>Reconnaissance Survey (G4) of Possible Multi-Metal Mineralisation in Karwara area, Jalore District. As an outcome of NAGMP, a potential mineralised block (Block-32, for W, Fe, Cu, Pb, Zn, Au, REE) was delineated in Dantwara area. Geological mapping of 100 km² area on 1:12,500 scale was carried out to locate possible multi-metal mineralisation in the area. A total of 154 surface litho-geochemical samples, 25 pit and trench samples along with 10 ground water samples were collected. The litho-units mapped in the area include granite, porphyritic basalt, trachy-basalt, trachyte, andesite, trachy-andesite, rhyolite, and chert beds. Most of the area was covered by the Quaternary blown sands of Thar Desert Formation. Extensive ground sampling had been carried out in the Karwara area. Four vertical to sub-vertical scout boreholes, with depth varying from 250m to 300m, were planned to test the geophysical anomalies. The surface indication of sulphide mineralisation in the area was manifested by the presence of fresh chalcopyrite grains at the contact of rhyolitic and basaltic rocks, fluorite and barite occurring along the fractures. Ferruginisation and limonitisation within fractures and joint surfaces of rhyolite and porphyritic andesite was common. Secondary veins of iron-carbonate were recorded at several places.</p>
Jalore	Dantwara block	1:12500	100.0	-	-	176	<p>Reconnaissance Survey (G4) of Possible Multi-Metal Mineralisation in Dantwara area, Jalore District, Rajasthan. The work carried out included large scale mapping of 100 km² on 1: 12,500 scale, litho-geochemical sampling, petrological samples, water samples, pitting and trenching. A sampling strategy emphasising the contact zones of lithounits, brecciation, quarry wall, veins/fractures surfaces and ferruginisation was employed to collect 166 litho-geochemical samples along with 10 water samples. Numerous abandoned linear quarries for fluorite and barytes were located in and around Dantwara-Taveedar-Lakhawas. The felsic volcanic breccia held the fluorite and baryte mineralisation mainly along the fractures as fracture filling and veins. Maximum Ba concentration recorded is 48%.</p>

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Jalore	Karara	1:12500	100	5	-	140	Reconnaissance Survey (G4) of Possible Multi-Metal Mineralisation in Karara area, Jalore District, Rajasthan. As an outcome of NAGMP, a potential mineralised block (for W, Fe, Cu, Pb, Zn, Au and REE) was delineated in Karara area. The area falls in parts of toposheet 45 D/01 of Jalore district in Rajasthan. Large scale geological mapping was carried out for an area of 150 km ² on 1:12,500 scale. To assess the mineral potential of the study area, 130 lithochemical samples and 10 ground water samples had been collected along with 50 m ³ of pitting and trenching. Fluorite was present as vein type mineralisation with NE-SW trend in the hills south of Chatwara within felsic pyroclastics. Analytical results received so far indicated that alkaline felsic volcanics contained significant amount of rare earth elements with highest 1878 ppm concentration of ÓREE+Y. Highest Zr concentration recorded was 3356 ppm, which was also from alkaline felsic volcanics. Aeromagnetic 300m of drilling was complete, intersecting mostly trachyte and basalt, with minor volcanic breccia.
Jalore	Selri- Bhadrajun	1:12500	100	-	-	135	Reconnaissance Survey (G4) for REE & RM in Selri-Bhadrajun areas, Jalore District, Rajasthan. A G4 stage exploration was carried out by large scale mapping over an area of 100 sq km on 1:12500 scale around Selri and Bhadrajun in Rajsamand district. To identify REE bearing phases, the quantum of sampling done includes chemical analysis of 100 nos. of BRS, 10 nos. of PCS and petrological studies of 10 nos. of PS and 15 nos. of OM.
Rajsamand	Panri and Kundwa	-	100	-	-	243	Reconnaissance Survey (G4) for REE and associated mineralisation in Panri and Kundwa area, Rajsamand District. A G4 stage exploration was carried out over an area of 100 sq km around Panri and Kundwa in Rajsamand district. The quantum of work included chemical analysis of 150 nos. of BRS, 18 nos. of PCS and 50 nos. of 'C-horizon' soil sample to know the distribution of major and trace elements in different lithounits. Petrological study (15 nos. of PS and 10 nos. of OM) had been done to identify the various mineral phases and their textural relationship. The only REE mineral identified in the field was allanite (silicate phase), which was present in migmatite gneiss intermixed with porphyritic augen gneiss near west of Kawas ka Gurha and Bhurwara and in quartzo-feldspathic veins intrusive into porphyritic augen gneiss near Ran and Amet granite near Banjara. The allanite grains present mainly in quartzo-feldspathic vein showed pleochroic halos whereas in other rocks they occurred as cluster of prismatic, brown to black grains. Monazite (phosphate phase of REE) was identified by petrographic study. EPMA study of 05 selected samples was yet to be carried out. Analytical results of various litho-units received till date indicated total REE concentration ranges from 5.06 ppm in pegmatite to 963 ppm in Amet granite. Maximum REE value received from pegmatite was 135 ppm which clearly indicated that REE potential in pegmatite was less compared to various granite and migmatite rock present in the study area.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Tungsten Nagaur	Rewat Hill Degana	1:2000	0.4	3	411.3	709	General Exploration (G2) detailed mapping was carried out at 1:2000 scale covering 0.4 km ² area in and around Rewat Hill, Degana along with collection of 10 nos. BRS, 10 PS, 6 nos. OM, 4 nos. PCS, 3 nos. XRD and 1 no. EPMA samples. The area of investigation was represented mainly by three hills which stand prominently over the sandy plain and were composed of granite and phyllite. The main hill (Rewat Hill, Ä470) was entirely made up of granite and the adjoining south-western hill (Tikli Hill) was of granite and phyllite in which the granite was intrusive. The third hill (Phyllite Hill) was composed entirely of phyllite having stockworks of quartz. Rest of the area was covered by barren lands, Quaternary sediments and alluvium (low lying areas) and settlements. These three hills were traversed by a number of NW-SE, NNW-SSE, N-S trending quartz veins, pegmatite veins which are wolfram bearing. Semi consolidated bed of alluvium comprising detrital materials (gravel beds) lies near foot hill of Rewat, Tikli and Phyllite hills contains erratically distributed wolfram. A total of 411.35 m of drilling was carried out in 19 nos. of inclined, deeper level boreholes (RJND-1, 2, 3, 5, 7, 8, 9, 11, 12, 13, 14, 15, 16, 22, 28, 32, 33, 34 and 35) and 16 nos. of shallow level vertical boreholes and 675 nos. of CS samples were generated from W-mineralised zones. All the inclined, deeper level boreholes had intersected significant W- mineralisation with visible wolframite grains which size ranges from 1 mm to 9 cm. However, vertical boreholes did not intersect any significant W-mineralisation in gravel beds.
Potash Sri Ganganagar	-	1:2000	-	-	-	-	Reconnaissance survey for reappraisal of potash in Fazilka and Sri Muktsar Sahib districts of Punjab and Sri Ganganagar district of Rajasthan (G4) Exploration for potash was carried out in parts of Fazilka district of Punjab. Geologically, the study area falls in the Satluj basin which is a part of Indo-Gangetic Alluvial Plain. The entire area extending in Punjab was covered with thick blanket of Quaternary sediments.
Nagaur - Ganganagar	Jandawali north block	1:4000	-	-	-	-	Preliminary exploration (G3) detailed mapping of 0.75 sq km. on 1:4000 scale and contouring works carried out at Jandawali North block, falls under survey of India toposheet 44K/02, using DGPS survey equipment. Out of total 9 borehole drilled in the Jandawali North block total three (03nos) were of full-coring (corner boreholes) viz. RJNGJN-01, 05 and 09, rest six (06 nos) were non-coring up to depth of 330.0m. The depth of non-coring varied from 321m at borehole RJNGJN-02 to 330m at rest of the boreholes, depending upon the depositional variability. During detailed lithological borehole logging it was noticed that the contact between Nagaur and HEG varied from 380.60m at borehole RJNGJN-02 to 405.12m at RJNGJN-04. The cumulative thickness of HEG varied from 359.88m at RJNGJN-04 (from 405.12m to 765.0m) to 398.63m at borehole RJNGJN-02 (from 380.60m to 779.23m). Halite from RJNGJN-01; Cluster of sylvite+polyhalite and impurities of clay from RJNGJN-01; Fracture/breccia filled with anhydrite from RJNGJN-04; halite minerals from RJNGJN-07. Geophysical borehole logging was carried out after completion of each boreholes. As per received 175 nos of analytical data from RJNGJN-01, 2.40m zone was established from 675.60m to 678.0m and the K varied from 2.03% to 7.12%. In XRD analysis sylvite, langbeinite (Mg ₂ K ₂ (SO ₄) ₃) and polyhalite were identified.

Table-3 (Contd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		Sampling No.
Nagaur - Ganganagar	Khunja (NW) block	-	-	-	6181	- Preliminary exploration (G3) for potash in Satipura sub-basin of Nagaur - Ganganagar evaporite basin, Hanumangarh district, Rajasthan. A total of 6181m drilling in 9 boreholes with depth ranging from 750m to 777m had been carried out in Khunja North West block. During the investigation, the visible/suspected mineralised zones were sampled. The sample length varied from 0.50m to 3.5m depending on the lithological variations. Presence of sylvite was observed mainly in the H2 halite cycles within depth range of 642m to 690m.
Nagaur - Ganganagar	Jorkian south block	1:4000	-	-	-	- Preliminary exploration (G3) for potash in Satipura south block in Satipura sub-basin of Nagaur - Ganganagar Evaporite basin, Hanumangarh district, Rajasthan. The area was a part of Satipurasub-basin in Nagaur Ganganagar Evaporite basin (NGEB). Mineralised zone was associated with the Hanseran Evaporite Group. The Hanseran Evaporite Group comprised a cyclic sequence of halite containing potash minerals in the form of Polyhalite (K2MgCa2(SO4)4.2H2O), Sylvinite (KCl.NaCl) and Sylvite (KCl). The intervening zone between the halite cycles comprised of anhydrite, clay, dolomite and magnesite. Total 10.30 sq.m. Detailed Mapping had been done on 1:4000 scale and total 14 nos. of boreholes had been fixed with the interval of 800m. Total nine boreholes have been completed i.e. RJNGJK-1 to 9. Around 934 no. of core samples have been submitted to the Chemical Laboratory, Western Region, Jaipur for potash and associated elements analysis.
Nagaur - Ganganagar	andawali south block in Satipura sub-basin	1:4000	-	-	-	- Preliminary exploration (G3) for potash in Jandawali south block in Satipura sub-basin of Nagaur - Ganganagar evaporite basin, Hanumangarh district, Rajasthan. The study area was flat/ plain and consisted of Quaternary sediments. The potash mineralisation was not related to surface exposures, as Hanseran Evaporite Group (HEG) was concealed under Quaternary sediments and Nagaur Group of rocks. The geological map prepared on 1:4,000 scale and boreholes fixed towards at the interval of 800 m towards south of earlier drilled borehole P-29 (Jandawali), RJNGS-1 to 4. Total thirteen boreholes were drilled. Total 2237 no. of core samples were submitted to the Chemical Laboratory, Western Region, Jaipur for potash and associated elements analysis. Anion analysis of boreholes RJNGJS- 6 was received. Maximum potash value 14.81% was from borehole RJNGJS-10 at 649.42 to 649.7 m depth. In XRD analysis sylvite and polyhalite were observed.
Directorate Mines & Geology, Rajasthan RARE EARTH ELEMENT (REE)						
Barmer	village Dandali and Goyna Bhakar area in Sindhari tehsil	12:				Regional and geological mapping for strategic minerals (REE) near village Dandali and Goyna Bhakar area in Sindhari tehsil, Barmer district was taken up with an objective to locate Rare-earth Elements minerals. An area of 15.0 sq.km on 1:10,000 scale and 1.0 sq.km on 1:4,000 scale was covered. Calcio carbonatite vein had been marked east of the nepheline syenite hills near Rebariyo ki dhani school. It was intrusive in syenite rock. Exposures of syenite were noticed over 1.25 km x 0.45 km and 550 m x 250 m area towards east of Gangli.

Table-3 (Concl'd.)

Agency/ Mineral/ District	Location/Area/ block	Mapping		Drilling		Sampling No.	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
Limestone							
Ajmer	Village Kanakheda Beawar	-	-	-	-	224	- During 2020-21, 224 m drilling had been carried out near kanakheda village of Beawar Tehsil, District Ajmer. Light gray to white Limestone deposit was identified.
Kota	Village Nimana-Dunia Ramgarjmandi	-	-	-	-	320	- During 2020-21, 320 m drilling had been carried out near Nimana-Dunia village of Ramgarjmandi Tehsil, Kota District. 158.44 million tonnes cement grade limestone was estimated.
Udaipur	Village Hariyav Vallabh Nagar	-	-	-	-	303	- During 2020-21, 303 m drilling had been carried out near Hariyav village of Vallabh Nagar Tehsil, District Udaipur. Cement grade Limestone deposit was identified.
Jaisalmer	Dadavala village Sam Tehsil	-	-	-	-	371	- During 2020-21, 371 m drilling had been carried out near Dadavala village of Sam Tehsil, District Jaisalmer. Limestone deposit was identified.
Nagaur	Tadas & Khorva village- Khivisar Tehsil	-	-	496	-	-	- During 2020-21, 496 m drilling had been carried out near Tadas and Khorva village of Khivisar Tehsil, District Nagaur. Cement grade Limestone deposit was identified.
Nagaur	Aavad and Kheda village- Jayal Tehsil	-	-	596	-	-	- During 2020-21, 596 m drilling had been carried out near Aavad and Kheda village of Jayal Tehsil, District Nagaur. Cement grade Limestone deposit was identified.
Banswara	Parthipura village Gadhi Tehsil	-	-	-	-	174.5	- During 2020-21, 174.5 m drilling had been carried out near Parthipura village of Gadhi Tehsil, District Banswara. Light white coloured crystalline Limestone deposit was identified.
Pali	Khariyaniv village Sojat Tehsil	-	-	-	-	-	- During 2020-21, near Khariyaniv village of Sojat Tehsil, District Pali Limestone deposit of about 130 - 280 m length X 100-180 m breadth was marked.
Dholpur	Baasae village Badi Tehsil	-	6	-	-	-	- During 2020-21, near Baasae village of Badi Tehsil, District Dholpur, mapping of various outcrops of chocolate and yellow coloured Limestone were carried out in six sq. km.
Granite							
Jalore	Chharpatiya village Ranivada Tehsil	-	-	-	-	-	- During 2020-21, near Chharpatiya-Sillasan village of Ranivada Tehsil, District Jalore, medium grained yellow coloured Granite deposit of about 350-400 m length X 300-400 m breadth was marked.
Bhilwara	Kaatar village Aasind Tehsil	-	0.1	-	-	-	- During 2020-21, near Kaatar village of Aasind Tehsil, District Bhilwara, mapping of Granite plots were carried out in 0.1 sq. km.
Quartzite							
Sirohi	Mohabbatnagar village	-	0.7	-	-	-	- During 2020-21, near Mohabbatnagar village of Sirohi Tehsil, District Sirohi, minerlas Schist, Filite and Quartzite of about 20-150 m length X 40-100 m breadth was marked. The deposit could be utilised in masonry stone.

PRODUCTION

Production of different type of minerals have been reported from the state of Rajasthan. The value of minor minerals' production was estimated at ₹15095 crore for the year 2020-21. The number of reporting mines in Rajasthan was 82 in the year 2020-21 in case of MCDR minerals.(Table-4).

Table - 4 : Mineral Production in Rajasthan, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value₹	No. of mines	Quantity	Value₹	No. of mines	Quantity	Value₹
All Minerals		84		229732298	85		257025185	82		311919094
Lignite	'000t	-	8676	-	-	8223	-	-	9056	-
Natural Gas (ut.)	m c m	-	1483	-	-	1883	-	-	2040	-
Petroleum(crude)	'000t	-	7667	-	-	6653	-	-	5891	-
Copper Ore	t	-	1349566	-	-	1119523	-	-	991991	-
Copper Conc.	t	2	66075	4316241	2	51832	3094145	2	42590	3371952
Iron Ore	'000t	7	1108	3893253	10	1012	3677013	9	1088	3982372
Lead & Zinc Ore	t	-	13752295	-	-	14479032	-	-	15455343	-
Lead Conc.	t	10	358369	16316914	10	351746	18260832	10	376924	20416324
Zinc Conc.	t	*	1456804	56083827	*	1446824	60438504	*	1513996	66668989
Manganese Ore	t	1	9410	28230	1	9937	29811	1	6940	20820
Silver **	kg	-	679172	25816971	-	609153	25608038	-	705676	42657180
Phosphorite	t	2	1322486	3795028	1	1300229	4637009	1	1357747	5349981
Garnet (abrasive)	t	4	5166	23662	5	568	1775	4	9307	33585
Limestone	'000t	36	76567	19496173	38	72390	19094468	38	74450	18357853
Selenite	t	3	2906	5812	2	2154	4206	3	202	402
Siliceous Earth	y	16	80237	50205	12	19367	11710	11	18429	12184
Wollastonite	t	3	184063	172013	4	124757	139695	3	103902	96552
Minor Minerals		-	-	99733969	-	-	122027979	-	-	150950900

Note : The number of mines excludes Fuel and Minor minerals.

* Number of mines covered under lead concentrates.

** Recovered at Chanderiya Lead-Zinc Smelter of HZL (as by product) from lead concentrates produced in Rajasthan.

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 – 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, Sikar (G)	1400
Birla Corporation Ltd, (Birla Cement Works & Chanderia Cement Works), 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,	610 (white Cement)
Merta, Distt Nagaur	500(white putty)

Table-5 (Contd.)

Industry/plant	Capacity ('000 tpy)
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.), Udaipur	1240
Ultra Tech Cement (Birla White Cement Division), Kharia Khangar, Bhopalgarh	680 (white cement)
	400 (putty)
Ultra Tech Cement Nathdwara Binnani Cement Ltd,AmlI,Pindwara	4850 (cement)
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, Kota	9 (rayon/yarn)
	7.7 (sodium sulphate)
Modi Alkalies & Chemicals Ltd, Alwar	84.2 (caustic soda)
	50.3 (Cl), 39.6 (HCl)
Ceramics/Chemicals	
Bikaner Ceramics Pvt. Ltd, Bikaner	9 (insulators)
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, Alwar	12.9
Roca Bathroom Product Pvt Ltd, Alwar	2 mill. pc.
Fertilizer	
Adheeshaa Phosphate, Umarada, Udaipur	132 (SSP)
Arawali Phosphate Ltd, Umra, Udaipur	40 (SSP)
Arihant Phosphate & Fertilizers Ltd, Nimbaheda, Chittorgarh	66 (SSP)
Bohra Industries Ltd, Umra, Udaipur	200 (SSP)
Chambal Fertilizers & Chemicals Ltd, Gadepan, Kota	180 (SSP)
Coromandel International Ltd, (Formerly Liberty Phosphate Ltd), Jagpura, Kota	132 (SSP)
Devyani Phosphate Pvt. Ltd, Udaipur	60 (SSP)
Dharamsi Morarji Chemical Co. Ltd, Khemli, Udaipur	66 (SSP)
Gayatri Spinners Ltd, Hamirgarh, Bhilwara	30 (SSP)
Indian Phosphate Ltd, Umrada, Udaipur	130 (SSP)
Jagdamba Phosphate, Kota	132 (SSP)
Jubilant Agri and Consumer Products Ltd, Singhpur, Kapasan, Chittorgarh	264 (SSP)
Khaitan Chemical & Fertilizers Ltd, Dhinwa, Distt Chittorgarh	198 (SSP)

Table-5 (Contd.)

Industry/plant	Capacity ('000 tpy)
Mangalam Phosphates Ltd, Hamirgarh, Bhilwara	72 (SSP)
Ostwal Phoschem (India) Ltd, Hamirgarh, Bhilwara	132 (SSP)
Patel Phoschem (P) Ltd, Umarda, Udaipur	100 (SSP)
Prem Sakhi Fertx. Ltd, Lakadwas, Udaipur	66 (SSP)
Rama Phosphates Ltd, Umra, Udaipur	181 (SSP)
Sadhana Phosphates & Chems Ltd, Gudli, 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, Chittorgarh	99 (SSP)
Shurvi Colour Chem Ltd, Madri, 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
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, Kota	132 (SSP)
Devyani Phosphate Pvt. Ltd, Udaipur	60 (SSP)
Dharamsi Morarji Chemical Co. Ltd, Khemli, 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, Jhunjhunu.	31 (Cu cathode)
Rajpura Dariba Lead & Zinc Mine	76.827(Zinc Conc.)

Table-5 (Concl.)

Industry/plant	Capacity ('000 tpy)
Dariba, 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, 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.

Sikkim



Only minor minerals of production was reported in 2020-21

₹188 lakh

Value of minor minerals' production were estimated for the year 2020-21

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

The details of exploration work was conducted out by GSI during the year 2020-21 for the graphite mineral are furnished in Table-3.

Production

No mineral production (except minor minerals) was reported in 2020-21. The value of minor minerals' production was estimated at ₹188 lakh for the year 2020-21.

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	Total
		STD111	STD121	STD122	STD121	STD122	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)	
Copper																
Ore	'000 tonnes	-	-	-	-	-	445	63	300	-	150	-	-	958	958	
Metal	'000 tonnes	-	-	-	-	-	786	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																
Coalfield									Proved	Indicated	Inferred	Total				
Total/Rangit Valley									-	58	43	101				

(In million tonnes)

Source: Coal Directory of India, 2020-21.

Table-2 : Details of exploration activities in Sikkim

Coalfield	Proved	Indicated	Inferred	Total
Total/Rangit Valley	-	58	43	101

Table-3: Details of Exploration Activities in Sikkim 2019-20

Agency/Mineral/District	Location Area/Block	Mapping		Drilling		Sampling (No.)	Remarks
		Scale	Area (sq.km)	No of Boreholes	Meterage		
GSI Graphite							
West district Sikkim	Chitre-Dhareli-Kalijhar areas	-	50	-	-	-	Reconnaissance survey (G4) for graphite and base metal mineralisation was carried out. Four graphite mineralised zones had been demarcated in north east of Chitre, Uttrey, Dentam, and Sangkhu areas. Graphite occurred as lumpy to amorphous, flaky and vein type. Base metal mineralisation occurrences were also recorded in ferruginised quartzite at Chitre in stringers and dissemination in the form of pyrite, chalcopyrite and bornite. Analytical results showed Ni value up to 1878 ppm and V values upto 1190 ppm.

Tamil Nadu



The principal minerals produced in the state were Lignite, Natural Gas (utilised), Petroleum (crude), Limestone, Magnesite and Vermiculite in 2020-21

₹226 crore

Estimated value of production of minor minerals in 2020-21

92

Mines in case of MCDR minerals reported production in 2020-21

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 & Ramanathapuram districts; **limestone** 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, Dharmapuri, 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 minerals 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, Tiruvannamalai, 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 molybdenum during 2020-21 are furnished in (Table - 3).

Production

The principal minerals produced in the state were Lignite, Natural Gas (utilised), Petroleum (crude), Limestone, Magnesite and Vermiculite in 2020-21.

The value of minor minerals' production was estimated at ₹226 crore for the year 2020-21.

The number of reporting mines was 92 in 2020-21 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 STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
			STD121	STD122			STD221	STD222						
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	25833894	
Gold														
Ore	Tonne	-	-	-	-	-	-	-	-	67000	-	67000	67000	
(Primary)														
Metal	Tonne	-	-	-	-	-	-	-	-	1	-	1	1	
(Primary)														
Graphite	Tonne	2289743	-	810450	3100193	39	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	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	
MOS ₂														
Pt. Group of Metals	Tonne	-	-	-	-	-	-	-	0.61	0.72	0.36	1.69	1.69	
Pyrite	000 Tonnes	-	-	-	-	-	-	-	-	24	-	24	24	
Sillimanite	Tonne	134030	-	134030	55288	12336	13529146	92400	-	3529577	-	17218747	17352777	
Silver														
Ore	Tonne	-	-	-	-	-	-	-	330000	460000	-	790000	790000	
Metal	Tonne	-	-	-	-	-	-	-	15.87	26.68	-	42.55	42.55	

Table-1 (Concltd.)

Mineral	Unit	Reserves			Remaining Resources						Total Resources (A+B)		
		Proved STD111	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total (A+B)
Titanium	Tonne	670221	-	670221	306876	60463	-	488404	19687147	93134394	-	113677284	114347505
Tungsten													
Ore	Tonne	-	-	-	-	-	-	-	-	-	250000	250000	250000
Contained	Tonne	-	-	-	-	-	-	-	-	-	50	50	50
WO ₃													
Vermiculite	Tonne	1516803	-	1516803	-	-	-	-	-	343051	-	343051	1859854
Wollastonite	Tonne	-	-	-	-	-	-	-	-	3533	-	3533	3533
Zircon	Tonne	36285	-	36285	22108	4225	-	17500	-	-	-	43833	80118

Figures rounded off

Table-2: Reserves/Resources of Lignite as on 1.4.2021 : Tamil Nadu

District	Proved		Indicated		Inferred		Total
	Proved	Indicated	Inferred	Total			
Total	4926.92	21910.06	9652.62	36489.6			
Cuddalore	4022.69	1525.29	1302.23	6850.21			
Ariyalur	904.23	302.5	512.37	1719.1			
Thanjavur & Thiruvarur	-	17248.06	3123.46	20371.52			
Thanjavur	-	2306.17	156.33	2462.5			
Thanjavur & Nagapattinam	-	359.21	926.62	1285.83			
Thiruvarur & Nagapattinam	-	-	574.05	574.05			
Ramanathapuram	-	-	2072.35	2241.18			
Ramnad	-	-	964.97	964.97			
Ramanathapuram & Sivaganga	-	168.83	20.24	20.24			

(In million tonnes)

Source: Coal Directory of India, 2019-20.

Table-3: Details of Exploration Activities in Tamil Nadu, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq. km)	No of. Boreholes	Meterage		
GSI							
Molybdenum							
Dharmapuri	Velampatti north A & B blocks of Harur-Uttangara molybdenum belt	-	-	4	488.75	-	Preliminary exploration (G3) for molybdenum and associated mineralisation in Velampatti north A & B blocks of Harur-Uttangarai molybdenum belt, Dharmapuri District. The investigation block was proposed for nine boreholes in different level as follows three 1 st level at 50m vertical depth and five 2 nd level at 100m vertical depth in 200m spacing one 3 rd level drilling at 150m vertical depth with cumulative of 1500m drilling target and for analysis of such as Mo, W, Sn, Co, Ni, Pb, Cu, Zn and Ag. Geophysical survey methods (Gravity, Magnetic, IP and SP) were carried out, through which moderate sulphide zone had demarcated along the main shear zone. Till 31-3-2021, four boreholes were completed (1 st and 2 nd level). The first level boreholes TNDVN-5, TNDVN-6 & TNDVN-7 completed and one 2 nd level borehole TNDVN-12 was under progress with cumulative drilling target of 488.75m as on 31-03-2021. Chemical analysis of the core sample of BH: TNDVN-05 had indicated 1.7m Mo lode with average grade of 769 ppm. Three lodes of Zn ranging from 3.65m to 4.55 with average grade ranging from 154 to 215 ppm. One lode of Cu: 1.2m with average grade of 217 ppm. BH: TNDVN-6 had intersected shear zone from 66.5 to 78 m depth. The shear zone consisted of 7m thick milky white quartz vein with thin veinlets and fine specks of sulphide (Galena and Mo) mineralisation. The BH: TNDVN-7 had intersected shear zone from 51.0 to 79.0 m. The chemical data has given good indication of molybdenum in BH: TNDVN-5 (average 750 ppm) and associated sulphide mineralisation such as Co upto 217 ppm, and Zn up to 215 ppm. One II level borehole TNDVN-11 intersected shear zone started from 133 to 161m with thick quartz veins showing dissemination of molybdenum and galena, chalcopyrite. The drilling of 488.75 m was completed till 31-03-2021 out of 1500 m.

Table-4: Mineral Production in Tamil Nadu, 2018-19 to 2020-21

Minerals	Unit	(Value in ₹'000)								
		2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value [§]	No. of mines	Quantity	Value [§]	No. of mines	Quantity	Value [§]
All Minerals		104		9821068	92		9771097	92	18026	1966539540
Lignite	'000 tonne	-	23041	-	-	23516	-	-	911	8175780
Natural Gas (ut.)	m c m	-	1208	-	-	1097	-	-	410	-
Petroleum (crude)	'000 tonne	-	395	-	-	415	-	-	-	-
Garnet (abrasive)	tonne	4	7341	109197	2	-	-	2	10026	-
Graphite (r.o.m.)	tonne	1*	-	-	1*	-	-	1	21144	10861
Limestone	'000 tonne	93	23864	6895558	82	24461	7151088	83	47646	5531065
Magnesite	tonne	5	50644	198355	6	51147	222293	5	916083	208954
Marl [%]	tonne	-	95368	24700	-	502750	93752	-	510	1605587
Vermiculite	tonne	1	706	2337	1	584	1933	1	-	1688
Minor Minerals		-	-	2590921	-	-	2302031	-	-	2262625

Note: The number of mines excludes Fuel and Minor minerals.

§ Excludes the value of Fuel minerals.

* Only labour reported.

% Associated with Limestone.

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, Distt Vellore	NA
Southern Asbestos Cement Ltd, Arakkonam Distt Vellore	NA
Tamil Nadu Asbestos, Alangulam, Distt Virudhunagar	28.5
Cement	
ACC Ltd, Madukkarai, Distt Coimbatore	1000
Chettinad Cement Corpn. Ltd, Puliya, Distt Karur	1700
Chettinad Cement Corpn. Ltd, Karikalli Distt Dindigul	4500
Chettinad Cement Corpn. Ltd, Ariyalur	5500
Dalmia Cements, Dalmiapuram, Distt Tiruchirapalli	3400
Dalmia Cements, Ariyalur	3000
Dhandhapani Cement Pvt. Ltd Thathamangalam, Manachanallur	225
India Cements Ltd, Sankarnagar, Distt Tirunelveli	2050
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, Distt Ariyalur	1400
Ultra Tech Cement Works (ARCW), Arakkonam (G)	1100
Ramco Cement (formerly Madras Cement), R.S. Raja Nagar, Distt Virudhunagar	2000
Ramco Cement (formerly Madras Cement), Alathiyur Works, Distt Ariyalur	3050
Ramco Cement (formerly Madras Cement), Ariyalur Plant, Govindpuram, Distt Ariyalur	3500
Ramco Cement (formerly Madras Cement), Chengalpet Grinding Unit, Uthiramerur, Distt Kanchipuram (G)	500
Ramco Cement (formerly Madras Cement), Valapady, Distt Salem (G)	1600
Tamil Nadu Cements, Alangulam, Distt Virudhunagar	290
Tamil Nadu Cements, Ariyalur, Distt Ariyalur	500
Tamil Nadu News -print & Paper Ltd. Kagithapuram, Manmangalam	328.5
Vijay Cements Trichy	75
Zuari Cements Ltd, Chennai Grinding Unit, Attipattu, Tiruvallur (G)	900
Ceramics	
Carborandum Universal Ltd, Hosur	NA
Murugappa Morgan Thermal Ceramics Ltd, Ranipet, Distt Vellore	5.44
Neycer India Ltd, Vadalur, Distt Cuddalore	9
Roca Bathroom Product Pvt Ltd, Ranipet, Distt Erode	12.6
Roca Bathroom Product Pvt Ltd, Perundurai, Distt Vellore	24
Spartek Ltd, Chennai	NA
Copper Smelter	
Sterlite Industries (I) Ltd, Thoothukudi	400 (Cu smelting) 205 (Cu cathode) 90 (wire rods) 1050 (H ₂ SO ₄)
Chemicals	
Tanfac Industries Ltd, Cuddalore	16.5 (anhydrous HF),

Table-5 (Contd.)

Industry/plant	Capacity ('000 Tpy)
	16.5 (AlF ₃)
	67.5 (H ₂ SO ₄)
	14 (Hydrofluoric acid)
	3.4 (speciality fluorides)
Tuticorin Alkali Chemicals & Fertilizers Ltd, Thoothukudi	115 (soda ash)
	105 (A/Cl)
Vaiyapuri Shanthi Ferric alum Sellipalayam, Namakal	3.4(Ferric alum)
Electrode	
AVR Electrodes, No1, SIDCO,Indl.Estate, Rajapalyam, Virudhnagar	250
Fertilizer	
Coimbatore Pioneer Fertilizer Ltd, Muthugoundanpudur, Distt Coimbatore.	66 (SSP)
	30 (H ₂ SO ₄)
	3 (oleum)
Coramandal International Ltd, (Formerly EID Parry), Ranipet, Distt N. Arcot	132 (SSP)
	33 (H ₂ SO ₄)
Coramandal International Ltd, Ennore, Distt Thiruvallur.	330 (Complex)
Kothari Industrial Corp. Ltd, Ennore.	66 (SSP)
Madras Fertilizer Ltd, Manali, Distt Thiruvallur.	486.8 (Urea)
	840 (NP/NPKs)
Greenstar Fertilizers Ltd, Guindy.	115 (SSP)
Southern Petrochemical Industries Corpn. Ltd), Thoothukudi.	620 (Urea)
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, (formerly, Kilburn Chemicals) Distt Thoothukudi	18
	36 (Ferrous Sulphate Heptahydrate)
Iron & Steel	
Salem Steel Plant (SAIL), Salem.	180 (Crude/Liquid steel)
JSW Steel Plant (acquired Southern Iron & Steel Co. Ltd), Salem.	1180 (sinter)
	1000 (pig iron)
	1000 (specialised alloy steel)
	18000 (Crude/Liquid steel)
Sponge Iron	
Akshara Industries Ltd, Eguvarpalayam, Distt Thiruvallur.	100
Kaushik Steel Industries Ltd, Pappen Kuppam Distt Thiruvallur.	60
Agni Steels Pvt Ltd, Olappalayam Road, Ingur, Distt Erode.	36
Refractory	
ABREF Pvt. Ltd, Gummidipoondi, Distt Thiruvallur.	1.3
Sharda Ceramics Pvt. Ltd, Ambattur, Chennai.	9.9
Shri Natraj Ceramic & Chemical Industries Ltd, Dalmiapuram, Distt Tiruchirapalli.	42
VRW Refractories, Vanagaram.	21.6
Zirconium Complex, Pazhakayal, Thoothukudi.	0.5 (Zr-Oxide)
	0.25 (Zr sponge)

Table-5 (Concl.)

Industry/plant	Capacity (’000 Tpy)
DBM & Calcined Magnesite	
SAIL Refractory Co. Ltd (formerly Burn	13(calcined 61 (DBM) 15 (refractory bricks) 45(Dunite fracton)
Dalmia Magnesite Corpn., Chettichavadi Distt Salem.	72 (DBM)
Ramkrishna Magnesite Mines, Salem.	3 (calcined)
Tamil Nadu Magnesite Ltd, Kurumbapatty, Distt Salem.	19.5(calcined magnesite) 30(DBM)
Sri Pon Kumar Magnesite Ltd, Salem.	26.5 (DBM)
Silicon Carbide	
Carborandum Universal Ltd, Tiruvottiyur.	NA
Petroleum Refinery	
CPCL, Manali, Dist. Thiruvallur.	10500
CPCL, Narimanam.	1000

(G): Grinding unit.

Note: Data, not available for fertilizer and cement Industries on respective website, is taken 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

₹17,236 crore

Value of minor minerals' production were estimated for the year 2020-21

36

Mines in the case of MCDR minerals Reported production in 2020-21

Telangana is the 29th State of India, formed on the 2nd of June 2014 with ten districts, namely; Hyderabad, Adilabad, Khammam, Karimnagar, Mahabubnagar, 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, Rangareddy 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 (hematite)** in Khammam district; **iron ore (magnetite)** in Adilabad and Warangal districts; **limestone** in Adilabad, Hyderabad, Karimnagar, Mahabubnagar, 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 **talcs/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 1.4.2020: Telangana

Mineral	Unit	Reserves				Remaining Resources							Total Resources (A+B)	
		Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total (A+B)
			STD141	STD122			STD221	STD222						
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	509737	142386	299243	118735	893077	11342869	3132280	16438327	17652454	
Manganese ore	'000 tonnes	250	66	26	150	139	126	-	886	320	2540	4162	4503	

Figures rounded off.

Table-2: Reserves/Resources of Coal as on 1.4.2021 : Telangana

Coalfield	Proved			Indicated		Inferred		Total	
	Proved	Indicated	Inferred	Proved	Inferred	Proved	Inferred	Proved	Total
Total/Godavari Valley	11089	8328	3433	11089	8328	3433	22851	22851	22851

(In million tonnes)

Source: Coal Directory of India, 2020-21.

Exploration & Development

The details of exploration activities conducted by GSI, DMG Telangana and Telangan State Mineral Development Corporation Ltd. for Iron Ore, Chromite, REE and Limestone during 2020-21 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 ₹17236 crore for the year 2020-21. The number of reporting mines was 36 in 2020-21 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 Telangana, 2020-21

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Iron Ore							
Nalgonda	Mallepalli	1:12500	114	3	-	-	Reconnaissance survey (G4) in Mallepalli-Chintakuntla block, in parts of Nalgonda District. A total of 114 sq. km. area was mapped on 1:12500 scale and involved collection of different sample media. The block area was covered by granitoids of Peninsular Gneissic Complex (PGC)-II and younger acid and basic intrusives. The visible sulphide mineralisation was dominantly disseminated in nature, confined to second-generation quartz and pegmatite veins. In addition, fracture/cavity filling and interstitial growth of sulphide was also observed. The major sulphide minerals were chalcopyrite, pyrite and suspected molybdenite with minor azurite and malachite. Multiple old working with dumps and old pits, and gossanised bodies were other indicators of the sulphide mineralisation. The available analytical results of bedrock, soil and pit/-trench samples revealed sporadic anomalous Pb (up to 7.5%), followed by Cu (up to 0.25%) and Mo (up to 0.19%). However, relatively higher values of Zn (up to 235ppm) were observed in stream sediment samples. Based on the surface indication of mineralisation, two mineralised zone namely zone-I and II, separated by ~1km, were demarcated in the eastern part of the block.
Chromite							
Bhadradi Kothagudem & Khammam	Himmamnagar- Vinobhanagar blocks of the Chimalpahad mafic-ultramafic complex	-	-	3	605.2	-	Preliminary exploration (G3) for Chromite and PGE mineralisation, in Himmamnagar-Vinobhanagar block of the Chimalpahad mafic-ultramafic complex, in parts of Khammam and Bhadradi Kothagudem districts. Northern part of the block (Trench-1, 5 & 6) showed Cr values range from 424 ppm to 5690 ppm, Ni values ranges from 187 ppm to 2940 ppm and in the southern part of the block (Trench-3) records Cr values range from 128 ppm to 7888 ppm and Ni values range from 160 ppm to 855 ppm whereas the central part of the block (Trench-2) showed less values of Cr ranges from 245 ppm to 1474 ppm and Ni values range from 90 to 461 ppm. Among these, only northern part of the area records (Trench-1) PGE values upto 104.21 ppb wherein serpentinised dunite and pyroxenite is exposed. A total 6 borehole had been drilled in the block, in which 3 (TGNHV-1, 2 and 6) boreholes were drilled in the northern part of the block and rest 3 (TGNHV-3, 4 and 5) drilled in the north-central and central part of the block where chromite and titanovanadiferous magnetite float ore is abundant. Petrographic study reveals spatial distribution of chromite layers in respect of pyroxenite.

Table-3 (Concl.d.)

Agency/ Mineral/District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
REE							
Bhadradi Kothagudem	Rachannagudem- Ankampalem block	1:12500	-	-	-	191	Reconnaissance survey (G4 stage) for REE in and around Rachannagudem-Ankampalem area, Bhadradi Kothagudem District. Large scale mapping (LSM) on 1: 12500 scale was carried out. The area comprises Upper Kamthi, Kota and Maleri formation of Upper Gondwana Supergroup of rocks. Analytical results of 191 samples have received of different media [HMS, BRS & regolith (clay fraction)]. The HMS sample has high concentration of REE and other trace elements than the other media samples. The REE value of 45 of HMS varies from 1.21 to 18.33%, average is 5.71%. A total of 34 of regolith sample (clay fraction) showing the REE value ranges between 159.63 to 1603.47 ppm, average is 496.81 ppm. The REE values of BRS (73) sample ranges from 111.88 to 3811.66 ppm. Analysis of all the media showing LREE was higher than the HREE. Other than REE, Ti ranges from 482.21 to 34699.12 ppm, Zr varies between 75.92 to 82599.68 ppm and Th value varies from 5.19 to 32593.1 ppm from all the media. The above observations attest to the fact that the heavy fractions from stream sediments contain significantly high REE and monazite was the main contributing mineral phase for this high REE incidence.
Directorate of Mines & Geology /Telangana State Mineral Development Corporation Ltd. Telangana Limestone							
Suryapet,	Mellacheruvu village & Manda (Mellacheruvu cluster-1)	1:12,500	57.77	6	314.00	417	G4 stage exploration led to estimation of about 367.72 million tonnes of cement grade limestone resources with an average CaO 48.01%. During reconnaissance survey, potential area of 41.45 sq.km of cement grade limestone had been identified within cluster for further G3/G2 stage exploration.
	Mattampally village & Mandal (Mattampally cluster-2)	1:12,500	14.65	4	200.00	226	G4 stage exploration led to estimation of about 59.50 million tonnes of cement grade limestone resources with an average CaO 46.97%. During reconnaissance survey, potential area of 8.38 sq.km of cement grade limestone had been identified within cluster for further G3/G2 stage exploration.
	Raghunathapalem village, Mattampally Mandal, (Mattampally cluster-3)	1:12,500	46.58	4	200.00	327	G4 stage exploration led to estimation of about 158.21 million tonnes of cement grade limestone resources with an average CaO 47.55%. During reconnaissance survey, potential area of 31.73 sq.km of cement grade limestone had been identified within cluster for further G3/G2 stage exploration.
	Ramapuram village, Mellacheruvu Mandal (Ramapuram Cluster-5)	1:12,500	55.87	2	100.00	111	G4 stage exploration led to estimation of about 45.58 million tonnes of cement grade limestone resources with an average CaO 46.87%. During reconnaissance survey, potential area of 12.19 sq.km of cement grade limestone had been identified within cluster for further G3/G2 stage exploration.
	Dondapadu village, Mellacheruvu Mandal (Dondapadu Cluster-6)	1:12,500	46.82	4	197.00	241	G4 stage exploration led to estimation of about 45.20 million tonnes of cement grade limestone resources with an average CaO 44.89%. Further, a G3/G2 level exploration work will be taken up in the delineated cement grade limestone block.

Table-4: Mineral Production in Telangana, 2018-19 to 2020-21

Minerals	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value ^{\$}	No. of mines	Quantity	Value ^{\$}	No. of mines	Quantity	Value ^{\$}
All Minerals		36		184264230	36		149069086	36		177166582
Coal	'000 tonne	-	65160	-	-	65703	-	-	52603	-
Iron Ore %	'000 tonne	-	2	1290	-	-	-	-	-	-
Manganese Ore	tonne	6	10735	59666	5	7770	51196	5	11097	69120
Limestone	'000 tonne	30	30895	6078898	31	26161	5249950	31	24498	4740215
Minor Minerals		-	-	178124376	-	-	143767940	-	-	172357247

Note: The number of mines excludes Fuel and Minor minerals.

^{\$} Excluding the value of Fuel minerals.

% Associated mines.

Table-5: Principal Mineral-based Industries

Industry/plant	Capacity ('000 TPY)
Aluminium Foil	
Hindalco, Kollur, Medak	4
Asbestos Products	
Bhagyanagar Wood Plast Ltd, Nandikandi, Distt Medak	60
Hyderabad Industries Ltd, Sanathnagar, Distt Rangareddy	160
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, Dharur, Distt Rangareddy	20 (Fuller's earth granules) 15 (Bentonite granules)
Cement	
Anjani Portland Cements Ltd (Subs. of Chettinad Cement), Anjanipuram, Distt Nalgonda	1200
CCI Ltd, Tandur, Distt Rangareddy	1000
Bheema Cement Nalgonda	900
Greygold Cement Nalgonda	90
Deccan Cements Ltd, Bhavanipuram, Distt Nalgonda	2300
India Cement Ltd, Malkapur Distt Rangareddy	2400
India Cement (Raasi Cements), Vishnupuram Distt Nalgonda	3500
Keerthi Industries Ltd, Mellacheruvu, Distt Nalgonda	590
Kesoram Cement, Basantnagar, Distt Karimnagar	6000
Mancherial Cement Co. (P) Ltd, Mancherial, Distt Adilabad	330
My Home Cement Industries Ltd, Mellacheruvu, 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)

Table-5 (Concl.)

Industry/plant	Capacity (‘000 TPY)
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, is therefore taken 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

₹467

Lakh, value of minor minerals' production was estimated for the year 2020-21

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 2020-21.

Production

Natural gas (utilised) was the only important mineral item produced in Tripura during 2020-21. The value of minor

minerals' production was estimated at ₹467 lakh for the year 2020-21 (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 Plant at Bodhjungnagar Industrial Complex. The State Government is actively wooing 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	Total Reserves (A)	Remaining resources			Total resources (A+B)
			Measured	Inferred	Total	
			STD331	STD333	(B)	
Fireclay [#]	'000 tonnes	-	1	369	370	370
Quartz-silica sand [#]	'000 tonnes	-	225	264	490	490

Figures rounded off.

Note: The proved and indicated balance recoverable reserve of Petroleum crude and Natural gas in the State as on 01.04.2021 are 0.07 million tonnes and 29.18 billion cu.m, respectively.

Declared as Minor Mineral vide Gazette Notification dated 10.02.2015.

Table-2: Mineral Production in Tripura, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Minerals	Unit	2018-19			No. of mines	2019-20			2020-21 (P)		
		No. of mines	Quantity	Value [§]		Quantity	Value [§]	No. of mines	Quantity	Value [§]	
All Minerals		-	-	47953	-	-	50577	-	-	46688	
Natural Gas (ut.)	m c m	-	1554	-	-	1473	-	-	1634	-	
Minor Minerals		-	-	47953	-	-	50577	-	-	46688	

§ Excludes the value of Fuel minerals.

Union Territories



No mineral production (except minor minerals) was reported from Andaman & Nicobar Islands during 2020-21

₹22

Crore, value of minor minerals production were estimated for the year 2020-21

ANDAMAN & NICOBAR ISLANDS

No mineral production (except minor minerals) was reported from Andaman & Nicobar Islands during 2020-21. The value of minor mineral's production was estimated at ₹22 crore for the year 2020-21.

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 .

CHANDIGARH

No production of major or minor mineral was reported from Chandigarh during 2020-21.

DADRA & NAGAR HAVELI

No production of major or minor mineral was reported from Dadra & Nagar Haveli during 2020-21.

The present status of each Mineral-based Industry is not readily available. However, principal mineral-based industries in the Organised Sector located in Dadra & Nagar Haveli are furnished in Table - 2.

DAMAN & DIU

No production of major or minor mineral was reported from Daman & Diu during 2020-21. Reserves/ Resources of mineral as on 1.04.2020 are furnished in Table-3.

LAKSHADWEEP

No production of major or minor mineral was reported from Lakshadweep during 2020-21.

PUDUCHERRY

No production of major or minor mineral was reported from Puducherry during 2020-21. Reserves/ Resources of mineral as on 01.04.2020 are furnished in Table-4. Reserves/ Resources of lignite as on 01.04.2021 are furnished in Table-5.

Table-1: 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	225 282 (MSbillet)

Table-2: Principal Mineral-based Industries in Dadra & Nagar Haveli

Industry/plant	Capacity ('000 tpy)
Aluminium	
Hindalco Industries Ltd, Silvassa	30 (Al foil)
Asbestos Products	
Ramco Industries Ltd, Golanda, Silvassa	NA
Copper	
Sterlite Industries (India) Ltd, Chinchpada, Silvassa	180 (copper cathode) 150 (CC copper rod)
Alloy	
Hindustan Alloys Mfg. Co Ltd, (HAMCO), Silvassa	3 (tin ingot) 38 (Al alloy ingot) 2.8 (Sn-Pb solder wire)

Table-3: Reserve/Resource of Mineral as on 1.4.2020 : Daman & Diu

Mineral	Unit	Total	Remaining Resources				Total Resources (A+B)
		Reserves	Measured	Indicated	Inferred	Total	
		(A)	STD331	STD332	STD333	(B)	
Limestone	'000 tonnes	-	-	-	128670	128670	128670

Figures rounded off

Table-4: Reserves/Resources of Minerals as on 1.4.2020: Puducherry

Mineral	Unit	Total	Remaining Resources				Total Resources (A+B)
		Reserves	Measured	Indicated	Inferred	Total	
		(A)	STD331	STD332	STD333	(B)	
Limestone	'000 tonnes	-	4433	4333	6966	15732	15732

Figures rounded off

Table-5: Reserves/Resources of Lignite as on 1.4.2021: 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, 2019-20.

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-6.

Table-6: 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 2020-21

₹5,614 crore

Value of minor minerals' production were estimated for the year 2020-21

2

Mines in Uttar Pradesh in case of MCDR Minerals reported production in 2020-21

Mineral Resources

The State is the principal holder of country's andalusite & 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 2020-21, GSI carried out exploration for bauxite, base metal, gold and gluconite in Chadauli, Sonbhadra, Lalitpur and Chitrakoot districts. The details of exploration carried out by GSI in the State are furnished in Table-3.

Production

Coal, Limestone and Sulphur were the mineral items produced in Uttar Pradesh during 2020-21.

The value of minor minerals' production was estimated at ₹5,614 crore for the year 2020-21.

The number of reporting mines in Uttar Pradesh was 2 in 2020-21 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: Uttar Pradesh

Mineral	Unit	Reserves				Remaining Resources							Total Resources (A+B)	
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
			STD121	STD122			STD221	STD222						
Andalusite	'000 tonnes	-	-	-	-	-	-	-	58040	56210	-	114250		
Bauxite	'000 tonnes	-	-	-	-	-	-	10390	500	8018	-	18908		
Gold														
Ore														
(Primary)	Tonne	-	-	-	-	-	-	-	-	-	13000000	13000000		
Metal														
(Primary)	'000 cu. m	-	-	-	-	-	-	-	-	-	2.08	2.08		
Iron ore														
(Haematite)	'000 tonnes	-	-	-	-	20000	-	-	-	66330	-	86330		
Limestone	'000 tonnes	3720	-	3720	-	111910	101510	142763	40000	43540	-	439723		
Potash	million tonnes	-	-	-	-	-	-	-	10	198	685	893		
Platinum Group of metals	tonne	-	-	-	-	-	-	-	3.35	-	-	3.35		
Rare Earth-Elements#	'000 tonnes	-	-	-	-	-	-	-	-	-	2948	2948		
Rock														
Phosphate	tonne	-	-	-	-	432898	3118586	-	740000	21481960	-	25773444		
Sillimanite	tonne	-	-	-	-	-	-	2100000	9350000	-	-	11450000		

Figures rounded off

Table-2: Reserves/Resources of Coal as on 1.4.2021 : Uttar Pradesh

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total/Singrauli	884	178	-	1062

Source: Coal Directory of India, 2020-21.

Table-3: Details of Exploration Activities in Uttar Pradesh, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Bauxite							
Chandauli	Naugarh- Pandri areas	1:12500	100	2	-	4	Reconnaissance survey (G4) for bauxite and associated mineralisation in Naugarh - Pandri areas of Chandauli District. An area of 100 sq. km was mapped on 1:12500 scale. The analytical results of the geochemical samples, suggests that the Al ₂ O ₃ ranges between 16.62%-52.01% with an average of 40% and having silica ranging between 2.13%-10.93%. The analytical results of core samples received for borehole no. UPCNB-1 & UPCNB-2 range from 18.20% to 44.36% Al ₂ O ₃ and 24.84% to 38.85% Al ₂ O ₃ respectively in laterite profile, but silica is dominant, especially in lithomarge. Values of vanadium in trench samples (3 trenches) ranges between 943 ppm – 4551 ppm and Ga values between 23 ppm – 77 ppm. In core samples of UPCNB-1, V and Ga maximum values are 3553 ppm and 190 ppm respectively. TiO ₂ in core samples have a wide range between 2% – 13.61% with an average of 7.4%. ÓREE values in boreholes UPCNB-2, UPCNB-3 (part), trench TRB-5 and Pit-2 ranging between 57.93 ppm – 1018.87 ppm with the average of 464.02 ppm. Highest ÓREE value of 1018.87 ppm is noted in massive pisolitic bauxite of UPCNB-2. In lithomarge part maximum ÓREE value is 898.74ppm. The ÓREE values in BRS samples are ranging between 40.61 ppm – 893.21 ppm. Lithium content in the samples is insignificant.
Base metal							
Lalitpur	Neemkhera & Dhaurisagar area	1:12500	100	-	-	22	Reconnaissance survey (G4) for basemetal and associated mineralisation in Neemkhera and Dhaurisagar area, Lalitpur district. An area of 100 sq. km on 1:12,500 scale was mapped in and around Neemkhera and Dhaurisagar area of Lalitpur District, Uttar Pradesh. The study area represents rocks of the Bundelkhand Gneissic Complex, Bijawar Group and Vindhyan Supergroup. The Cu, Pb & Zn values range from <5 ppm to 279 ppm. The Mn values are analysed up to 2384 ppm. Gold values of selected BRS and channel samples shows <0.05 ppm concentration. The REE & traces of 09 BRS, 11 trench and 02 channel samples also reflects no significant concentration of metals.

Table-3 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Gold							
Sonbhadra	Garda-Bhitri area	1:1000	1.5	3	612.7	-	Preliminary exploration (G3) for gold around Garda-Bhitri area, Sonbhadra District. Detailed Mapping was carried on 1:1000 scale in two blocks covered 1.5 sq. km area around Jharkharwa and Harsadand near Jogail, from where gold values ranging from 300 ppb to 400 ppb were recorded. Three scout boreholes, two in Jharkharwa block and one in Harsadand block were done, with a cumulative drilling of 612.70m. Geophysical survey (IP, SP and Magnetic) for 20.25 lkm was done in the Detailed Mapped area, to decipher the sub-surface geology and sulphide mineralisation. The area exposes rocks of Agori Formation of Mahakoshal Group, Jungel Group and post - Mahakoshal intrusives. In borehole no. UPSGB-01 (Jharkharwa), drilling was done up to 321.20 m and the major lithologies intersected are serpentinite, chloritized serpentinite and carbonated olivine basalt. Sulphide disseminations in the form of pyrite (>90%), chalcopyrite, pyrrhotite and arsenian pyrite (~10%) were observed in 07 discrete zones through the length of the borehole. The olivine rich basalt in Harsadand, which yielded 400ppb Au value, was targeted by borehole UPSGB-02. Drilling was done up to depth of 194.70 m and predominantly olivine rich basalt and carbonated basalt with varying degrees of brecciation, possibly magmatic breccia was intersected and 04 discrete sulphide rich zones were demarcated through the length of the borehole. Sulphide dissemination was primarily pyrite (>90%) and chalcopyrite + pyrrhotite (10%). Based on geophysical anomaly (chargeability high) 200m east and 20 m north of UPSGB- 01, recorded from 66m to 99m depth, a third vertical borehole UPSGB-03 was drilled to directly intersect the anticipated anomalous zone. The borehole was drilled up to 96.80m depth and 4 sulphide mineralised zones were demarcated. The sulphide mineralisation recorded in this borehole was more in comparison to the earlier two boreholes at an average of ~1 to 2.5% by visual estimation. Disseminations of sulphides, dominantly pyrite, chalcopyrite and pyrrhotite were observed at various depths in carbonated olivine basalt, in the drill cores of boreholes. The analytical values indicate presence of <50 ppb Au.

Table-3 (Concl.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Glaucanite							
Chitrakoot	Itwa Dudan Doda Mafi blocks	1:4000	1.10	-	-	-	Reconnaissance survey (G4) for glaucanite in the Chitrakoot District of Uttar Pradesh. An area 1.10 sq. km was mapped by detailed mapping in 1:4000 scale in the Itwa Dudan-Doda Mafi blocks of the Chitrakoot District, Uttar Pradesh. The rock sequence indicates ENE-WSW strike and an average southerly dip of 7°. The glaucanitic sandstone consists of quartz, glaucanite, muscovite with minor presence of microcline, plagioclase and opaques. The subangular to subrounded quartz is a major mineral in sandstone generally enclosed in a matrix of iron-rich glaucanite. The glaucanite occurs as pellets as well as matrix. The majority of glaucanite grains are under the process of formation of pellets i.e., not fully matured. K2O values in ten bedrock samples of glaucanitic sandstone varies from 4.19% to 5.75%. K2O in thirteen bulk channel samples from glaucanitic sandstone varies from 4.95% to 6.26%. One pit sample from an iron-rich glaucanitic sandstone layer yielded 3.8% K2O. The weighted average K2O of five trenches varies from 2.31% to 5.64%.

Table-4: Mineral Production in Uttar Pradesh, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Qty	Value ^{\$}	No. of mines	Qty	Value ^{\$}	No. of mines	Qty	Value ^{\$}
All Minerals	-	2	-	56988986	2	-	57073325	2	-	5686587
Coal	'000t	-	20275	-	-	18030	-	-	17016	-
Limestone	'000t	2	2622	848425	2	2804	932764	2	2574	725226
Sulphur #	t	-	51738	-	-	47955	-	-	54234	-
Minor Minerals @		-	-	56140561	-	-	56140561	-	-	56140561

Note: The number of mines excludes Fuel and Minor minerals.

\$ Excluding 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.

Table-5: Principal Mineral-based Industries

Industry/plant	Capacity ('000 tpy)
Abrasives	
John Oakey and Mohan Ltd, Ghaziabad	NA
Micro Lapping Abrasive, Near Munni	0.08
Devi Temple, Seohra, Dhampur	(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
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,	0.85(electrode no 10)
Muzaffernagar	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 Chemicsts 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,	132 (SSP)
Goramachhia, Jhansi.	52.8 (H2SO4)
Khaitan Chemicals & Fertilizers Ltd, Malwan,	115 (SSP)
Fatehpur.	52.8 (H2SO4)
KRIBHCO Shyam Fertilizer, Piprola Shahajahanpur.	864.6 (Urea)
Madan Madhav Fertilizers & Chems Pvt. Ltd, Fatehgarh.	24 (SSP)

Table-5 (Concl.)

Industry/plant	Capacity ('000 tpy)
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 2020-21

₹216

Creore, value of production of minor minerals was estimated for the year 2020-21

2

Mines of magnesite in Uttarakhand were reported in 2020-21

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 and Development

GSI carried out exploration for Tungsten and REE in the State of Uttarakhand during 2020-21. Details of exploration are furnished in (Table-2).

Production

Magnesite was the only important mineral item produced in Uttarakhand during 2020-21. The value of production of minor minerals was estimated at ₹216 crore for the year 2020-21. There were only two 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 STD111	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)		
						STD221	STD222							
Asbestos	tonne	-	-	-	-	-	-	-	311	-	-	-	311	311
Copper														
Ore	'000 tonnes	-	-	-	-	-	3170	390	660	660	-	-	4220	4220
Metal	'000 tonnes	-	-	-	-	-	53.45	1.44	5.15	5.15	-	-	60.04	60.04
Graphite	tonne	-	-	-	-	-	10700	-	-	-	-	-	10700	10700
Lead-Zinc														
Ore	'000 tonnes	-	-	-	-	-	3170	1790	660	660	-	-	5620	5620
Lead metal	'000 tonnes	-	-	-	-	-	138.85	34.25	9.5	9.5	-	-	182.6	182.6
Zinc metal	'000 tonnes	-	-	-	-	-	151.21	87.99	27.63	27.63	-	-	266.83	266.83
Limestone	'000 tonnes	-	-	-	5035	91872	29486	164879	1191059	1191059	33011	-	1575771	1575771
Magnesite	'000 tonnes	8177	1782	9959	4056	602	58902	58756	73287	73287	-	-	229476	239434
Rock Phosphate	tonne	-	-	-	3063503	-	2760000	-	16620513	16620513	-	-	24178386	24178386
Silver														
Ore	tonne	-	-	-	-	-	1600000	1400000	390000	390000	-	-	3390000	3390000
Metal	tonne	-	-	-	-	-	134	4.2	0.39	0.39	-	-	138.59	138.59
Tungsten														
Ore	tonne	-	-	-	-	-	-	138000	-	-	520000	-	658000	658000
Contained														
WO ₃	tonne	-	-	-	-	-	-	25	-	-	680	-	705	705

Figures rounded off.

Table –2 : Details of Exploration Activities in Uttarakhand, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq.km)	No of. Boreholes	Meterage		
GSI Tungsten							
Almora	Almora	1:12500	-	-	-	177	Reconnaissance survey (G4) for tungsten, tin and associated mineralisation around Almora, Almora District. Large Scale mapping was carried out on 1:12,500 scale during this mapping programme to delineate the potential zones of W and Sn mineralisation in and around the Almora, Petshal, Jakheta, Balta and Phalsima areas. Total 50 bed rock samples, 50 nos. of channel samples and 77 nos. of panned stream sediment samples were collected and submitted for chemical analysis in respective laboratories. The stream sediment samples were collected from 2 nd and 3 rd order streams at accessible locations for panning and heavy concentration for chemical analysis.
REE (Rare earth Metal)							
Chamoli, Rudraprayag and Uttarkashi	Chardam route Pauri, Tehri	1:25000	-	-	-	145	Reconnaissance survey (G4) for RM, REE and associated strategic mineralisation along Chardam route Pauri, Tehri, Chamoli, Rudraprayag and Uttarkashi districts. The work carried includes Traverse Mapping of 25 lkm in 1:12,500 scale, collection of 75 nos. of Bed Rock Samples (BRS), 25 nos. of channel/chip samples, 15 nos. of Petrological Samples (PS), 20 nos. of Fixed Carbon samples, XRD and EPMA analysis of 05 nos. of samples each. A total of 100 Bed Rock Samples (BRS) were collected from all bands of carbanaceous slate/phyllite/schist by chip and channel sampling method. Out of 100 BRS half of the samples (55 BRS) show REE values ranging from 24.71 to 415.81 ppm. V value ranges from 15 to 736 ppm. 20 Bed Rock Samples (BRS) show fixed carbon value ranging from 0.16 to 8.49%, moisture content from 0.01 to 1.14 %, volatile matter from 2.64 to 16.53 % and ash content from and 82.97 to 95.76%.

Table-3 : Mineral Production in Uttarakhand, 2018-19 to 2020-21
(Excluding Atomic Minerals)

(Value in ₹'000)

Minerals	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Quantity	Value	No. of mines	Quantity	Value	No. of mines	Quantity	Value
All Minerals		3		2023524	3		1649607	2		2201339
Magnesite	t	3	87123	153564	3	44209	81345	2	24437	44280
Minor Minerals [@]		-	-	1869960	-	-	1568262	-	-	2157059

Note: The number of mines excludes Minor minerals.

@ Figures for earlier years have been repeated as estimates because of non-receipt of data.

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-ODU, 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.

₹1,813 crore

Estimated value of production of minor minerals in 2020-21

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 STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334	Total (B)
			STD121	STD122			STD221	STD222						
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 (Primary)	tonne	-	-	-	-	-	-	-	-	-	12833333	12833333	12833333	
Ore (Primary)	tonne	-	-	-	-	-	-	-	-	-	0.65	0.65	0.65	
Metal														
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														
WO ₃	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 1.4.2021: West Bengal

(In million tonnes)

Coalfield	Proved	Indicated	Inferred	Total
Total	15199	13296	4597	33092
Raniganj	14781	7117	3680	25578
Barjora	201	-	-	201
Birbhum	218	6179	901	7298
Darjeeling	-	-	15	15

Source: Coal Directory of India, 2020-21.

Table-3: Reserves/Resources of Lignite as on 1.4.2021: 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, 2020-21.

Exploration & Development

Exploration activities were reported by GSI during the year 2020-21 and are provided in Table-4.

Table-4: Details of Exploration Activities in West Bengal, 2020-21

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Manganese							
West Medinipur	Chaukisar- PaharLabani, Pathatchakri, Sarisabasa, Odolchua, Mahulbani & Balichua	1:12500	100	-	-	239	Reconnaissance survey (G4) for manganese and associated sulphide mineralisation in and around Chaukisar-Pahar area, West Medinipur district. An area of 100 sq. km was covered by LSM on 1:12500 scale in and around Chaukisar Pahar, Labani, Pathatchakri, Sarisabasa, Odolchua, Mahulbani and Balichua areas in Jhargram District along with collection of 154 nos. of BRS, 50 nos. of PTS, 10 nos. of PCS and 25 nos. of petrological samples.
Gold							
Kalimpong	Samthar -Deoralipit area	1:12500	100	-	-	205	Reconnaissance survey (G4) to search auriferous veins in Samthar-Deoralipit area Kalimpong District. An area of 50 sq. km were mapped on 1:12500 scale alongwith collection of 100 nos. of BRS, 10 nos. of PCS, 25 nos. of PS, 20 nos. of PS and 50 nos. of PTS. The attitude of schistosity plane varies broadly from 290° to 310° with an average northerly dips of 40° to 50°. Sulphides present in the mapped area are mainly poly-metallic and shows complex mineralogy with both primary (symmetrically and rhythmically crucified veins both of quartz and tourmaline) and replacement textures (comb and vug structures). Six old workings was identified in the mapped area. One mineralised zone of 400 m lateral extension has also been demarcated in Yangmakum-Paserbu village area. Malachite, azurite, crystals of pyrite, arsenopyrite, REE (suspected) has also been observed. Analytical results of very few bed rock samples revealed that one sample collected from Deorali pitarea showed gold (Au) value of 1.52 ppm and Copper (Cu) value of 9278 ppm.

Table-4 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Darjeeling	Munsang & adjoining areas	1:12000	50	-	-	328	Reconnaissance survey (G4) for gold and associated mineralisation in Munsang and adjoining areas, Darjeeling District. A total of 50 sq km area had been covered by LSM (1:12500 scale) along with collection of 328 nos. of samples from different media. Quartzite, phyllite and mica schist are the major lithounits of Gorubathan subgroup and variations of these lithounits are also studied. Thin bands of amphibolite are noted within the quartz mica schist in few places. All the lithounits are traversed by two generations of quartz veins. Though mineralisation is noted in both quartz veins, foliation parallel quartz veins/partings contain relatively more incidences than later quartz veins. Disseminated sulfide mineralisation (pyrite and chalcopyrite grains) are noted in foliation parallel quartz veins within grey quartzite-phyllite sequence near Anaconda Kholai, Lower Munsong-Barmek road section, Naksha-Barek road section, Mungerjung Upper Munsong link road, Barek-Kashyong road section, Sukhe Khola and Tumlong Khola sections. Pyrite and areseno-pyrite specks are noted in micaceous quartzite near Cross Hill Road section, in Tumlong Khola section and also near Kashyong village.
Base Metal							
Darjeeling	Takdah-HamBasti area	-	50	-	-	160	Reconnaissance Survey (G4) for base metal and associated minerals around Takdah-HamBasti area, Darjeeling District, West Bengal. A total of 50 sq. km area has been mapped and 160 samples from different media have been collected. Two alteration zones have been noticed within mapped area. One is located near village Chegra Basti in which a meta basic body is altered and contains pyrite and fine grains of chalcopyrite. This alteration zone is 10 meter in length and 1.5 meter wide. Another one is located near Tista Valley Tea Garden in which quartzite is altered and limonite and goethite has been noticed within this zone. Fine grains of pyrite, chalcopyrite and bornite have been observed. This zone is 35 meter in length and 5 to 6 meters width.

Table-4 (Contd.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
REE & RM							
Purulia	Kalapathar- Raghudih Block	-	-	11	732	160	Preliminary exploration (G3) for REE & RM mineralisation in Kalapathar-Raghudih Block, Purulia District. A total of 732m drilling were out in 11 nos of boreholes (WBKR-1 to WBKR-11) along with 166 cu. m of pitting & trenching, 103 nos of channel sampling. The block exposes biotite granite gneiss, porphyroclastic granite gneiss (PGG), hornblende biotite granite gneiss (HBG), calc silicate, khondalite, quartz and pegmatite veins. REE mineralisation is mainly restricted within the pegmatite veins intersecting the host lithology of porphyroclastic granite gneiss. Exposure of this mineralised vein bearing porphyroclastic granite gneiss is very scanty and the mineralised veins are mainly oriented in NW-SE to NE-SW direction showing a wide variation in their trend. The mineralised pegmatite veins show variation in composition. Overall, they can be identified in four different categories, viz. (a) Quartzo feldspathic vein \pm baryte, sulphide, (b) Green coloured epidote and amphibole bearing veins \pm barite, sulphide, and tourmaline, (c) Course grained, comparatively thicker pegmatite vein with myrmekite texture at places, and (d) barite vein. The PGG intersected in boreholes show variation in clast sizes. The REE bearing veins have been intersected from 16.4m - 28m, 37.63m - 62.3m, 69.32m - 87.9m in borehole WBKR-3 and 14.63m-14.8m, 18.00m -18.18m, 30.5-38.38, 44.30m in borehole WBKR-4. Borehole WBKR-5 intersected the veins from 9.35m - 61.30m. In borehole WBKR-6, the veins occur from 18.15m -23.95m, 27m - 33.08m and 43m - 44.95m. Borehole WBKR-7 intersected the veins from 16.2m - 18m, 38.2m and 40.2m - 44.5m. WBKR-8 shows occurrences of the veins from 16.15m - 21m and 35.5m - 36m. In case of borehole WBKR-9, they occur at 17.90m and 53.40m. Good concentration of veins has been intersected in boreholes WBKR-10 and WBKR-11. WBKR-10 intersected the veins from 13.5m- 15.86m and 18.09m - 51.5m and the borehole WBKR-11 intersected them from 13.10m - 60m. No vein has been intersected in borehole WBKR-2.

Table-4 (Concl.)

Agency/ Mineral/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Tungsten							
Purulia	Balarampur- Kana- Pakhi area	-	100	-	-	238	Reconnaissance survey (G4) for W, Sn and associated mineralisation was carried out in Balarampur-in Balarampur-Kana-Pakhi Pahar-Pakhi Pahar area. A total area of 100 sq. km was covered by LSM and 100 nos. soil/ stream sediment samples, 102 nos. BRS, 11 nos. PCS and 25 nos. PS were collected. The area forms the part of the North Singhbhum Mobile Belt (NSMB). The major lithounits are granitic gneiss, quartzite, tuff, garnetiferous mica schist, granite, amphibolite. In the area, mineralisation is indicated by surface metallic stains, specks of sulphides, ferruginisation, brecciation, presence of old workings. Sulphide mineralisation is mainly noticed in ferruginous cherty quartzite (silicified zones), tuffaceous rock. No surface indications of Sn-W mineralisation have been noticed so far. Bed rock samples are collected mostly from cherty quartzite, gneiss, pegmatites and granite on the basis of high specific gravity.

Production

During the year 2020-21 production of Coal, Natural Gas (ut.) and Sulphur was reported from West Bengal.

The value of minor mineral's production was estimated at ₹1831 crore for the year 2020-21. Mineral production in West Bengal from 2018-19 to 2020-21 is furnished in Table -5

Table-5: Mineral Production in West Bengal, 2018-19 to 2020-21
(Excluding Atomic Minerals)

Mineral	Unit	2018-19			2019-20			2020-21 (P)		
		No. of mines	Qty	Value ^{\$}	No. of mines	Qty	Value ^{\$}	No. of mines	Qty	Value ^{\$}
All Minerals		1	-	20714222	-	-	21391866	-	-	18310969
Coal	'000t	-	33136	-	-	33136	-	-	34596	-
Natural Gas (ut.) ⁺	m c m	-	350	-	-	306	-	-	307	-
Apatite	t	1	-	-	-	-	-	-	-	-
Sulphur [#]	t	-	43627	-	-	35566	-	-	56118	-
Minor Minerals [@]		-	-	20714222	-	-	21391866	-	-	18310969

Note: The number of mines excludes fuel and minor minerals.

^{\$} Excluding the value of Fuel minerals.

⁺ Coal Bed Methane

[#] 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, important mineral-based industries located in the State with their total installed capacities are furnished in Table - 6.

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	MOG-303 0.35
Pvt. Ltd, Chandur Tarkeshwar	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
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 ₂ SO ₄)
Alchrome Chemical	
Industries Kalyani, Kalyani	1.2(sodium bicarbonate)
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, Raspuja	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)

Table-6 (Contd.)

Industry/plant	Capacity (‘000 tpy)
Jay Shree Chemicals & Fertilizers, Khardah, 24 Parganas	132 (SSP) 62.70 (H2SO4)
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) 13.0NH4So4
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 Metaliks Ltd, Raturia Angadpur, Durgapur	336 (sinter) 165(pig iron)
Orissa Metallic Pvt. Ltd, Mathurakismat, Gokulpur	1370 (pellets) 300 (pig iron)
Shyamraipur Pachmi medinipur Unit -I & Dhekia & Chaksonadhar Pachmi Medinipur Unit II	329.72 (sponge Iron)
Rashmi Metaliks 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

Table-6 (Concl.)

Industry/plant	Capacity (‘000 tpy)
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	492.7
Distt W. Medinipur	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, Durgapur	79
Sunil Sponge Iron Ltd, Kolkata	115
Ferroalloys	
Kartik Alloys Ltd, Durgapur	10.7
Bhaskar Shracchi 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)
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
TiO ₂ 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.



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