9.1 ASBESTOS

Introduction

Asbestos is a group of fibrous minerals. The properties like fibrous characters, fineness, tensile strength of fibres, low heat conductivity, high resistance to electricity, acid and alkalies, etc. make this mineral commercially important. The commercial varieties are (i) Serpentine group - Chrysotile and (b) amphibole group-amosite, actinolite, anthophyllite, crocidolite and tremolite. The utility of asbestos mostly depends on its physical properties rather than chemical composition. Its industrial use is linked with the type of asbestos. Chrysotile asbestos being more fibrous and possessing good tensile strength than amphibole variety, is used in the manufacture of asbestos fabrics, cement sheets, pipes and allied products. Amphibole asbestos generally finds use in heat insulation and treatment of acids. Anthophyllite and tremolite fibres, although of good length, are too weak and brittle to be spun and used for boiler lagging, hard setting magnesia composition and as a filler in asbestos paints and various asbestos moulded articles.

Basis of Grade Classification

Due to paucity of information on fibre length, tensile strength, etc. from exploration agencies, the resources of asbestos have been classified according to the variety of asbestos and are broadly in line with recommendations of Expert Committee to review the Classification of minerals with regards to their Possible Optimum Industrial Use (September, 2004). The grade classification adopted in the inventory as on 01.04.2020 are as follows:

1. Chrysotile
2. Amosite
3. Tremolite
4. Crysotile mixed with others
5. Mixed Amphibole
6. Actinolite
7. Anthophyllite
8. Others
9. Not known
10 Unclassified

Basis of Categorisatioin of Resources

As per United Nations Framework Classification (UNFC), resources are broadly classified into 'reserves' and 'remaining resources'.

According to the norms of this system, the estimation of asbestos have been placed under (111) feasibility (211), pre-feasibility (221) & (222), measured (331), indicated (332), inferred (333) and reconnaissance (334) categories.

Salient Features of the Inventory

All India total resources of asbestos are estimated at 22.91 million tonnes, entire resources have been categorised as remaining resources. As far as the status of deposit wise resources are concerned, out of the total resources, 22.17 million tonnes (96.76) are in freehold and the balance 0.74 million tonnes (3.24%) are in leasehold (Private) areas.

All India scenario of asbestos 'reserves', 'remaining resources' and 'total resources' as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables 1 and 2. These tables reflect the changes in terms of increase or decrease of resources as per lease status, grades and states. In Table -3 district wise reserves/resources as on 01.04.2020 have been given.

Out of the total resources as on 01.04.2020, mixed amphibole grade is 54.06%, amosite 19.49%, tremolite 18.33% and the remaining 8.12% constitutes rest of the grades. Almost entire quantity of mixed amphibole grade is reported from Rajasthan and amosite grade from Karnataka. The share of crysotile asbestos in the total resources is 3.63% only.

Out of the total resources, Rajasthan has a major share of 13.62 million tonnes (59.44%), followed by Karnataka 8.28 million tonnes (36.16%), Andhra Pradesh 0.79 milion tonnes (3.48%), Jharkhand 0.15 million tonnes (0.68%) and remaining a meager 0.06 million tonnes are distributed in the states of Odisha and Uttarakhand .

In the inventory as on 01.04.2020, the resources of asbestos has decreased by 0.04 million tonnes to 22.91 million tonnes in comparison to the previous inventory. All the decrease was reported from Andhra Pradesh due to re-estimation of resources in one Lease Hold (Private) deposit.

Of the total resources of asbestos, a substantial quantity of 10.61 million tonnes (46%) are under inferred and reconnaissance categories. The detailed exploration in the areas having these estimations may improve the confidence level of resource endowment.

A total of 164 deposits of asbestos have been covered in inventory as on 01.04.2020. Of which 161 deposits are in freehold and 03 deposits in leasehold private category.

Table - 1 : Reserves/Resources of Asbestos as on 01.04.2020 vis-à-vis 01.04.2015 (By Lease Status/Grade)

(In Tonne)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India : Total	**-**	**24,633**	**(-) 24,633**	**22,908,067**	**22,922,751**	**(-) 14,685**	**22,908,067**	**22,947,384**	**(-) 39,318**
Crysotile	-	-	-	831,905	831,905	No change	831,905	831,905	No change
Amosite	-	-	-	4,463,667	4,463,667	No change	4,463,667	4,463,667	No change
Tremolite	-	-	-	4,200,109	4,200,109	No change	4,200,109	4,200,109	No change
Crysotile mixed with others	-	-	-	22,516	22,516	No change	22,516	22,516	No change
Mixed Amphibole	-	-	-	12,383,632	12,383,632	No change	12,383,632	12,383,632	No change
Actinolite	-	-	-	34,311	34,311	No change	34,311	34,311	No change
Anthophyllite	-	-	-	20,000	20,000	No change	20,000	20,000	No change
Others	-	-	-	432,134	432,134	No change	432,134	432,134	No change
Not Known	-	-	-	463,091	463,091	No change	463,091	463,091	No change
Unclassified	-	24,633	(-) 24,633	56,701	71,385	(-) 14684	56,701	96,018	(-) 39,317
Freehold	**-**	**-**	**-**	**22,165,469**	**11,001,566**	**(+)11163903**	**22,165,469**	**11,001,566**	**(+)11,163,903**
Crysotile	-	-	-	89,308	58,558	(+)30,750	89,308	58,558	(+)30,750
Amosite	-	-	-	4,463,667	4,463,667	No change	4,463,667	4,463,667	No change
Tremolite	-	-	-	4,200,109	3,993,722	(+)206,387	4,200,109	3,993,722	(+)206,387
Crysotile mixed with others	-	-	-	22,516	22,516	No change	22,516	22,516	No change
Mixed Amphibole	-	-	-	12,383,632	2,181,301	(+)10,202,331	12,383,632	2,181,301	(+)10,202,331
Actinolite	-	-	-	34,311	34,311	No change	34,311	34,311	No change
Anthophyllite	-	-	-	20,000	20,000	No change	20,000	20,000	No change
Unclassified	-	-	-	56,700	56,700	No change	56,700	56,700	No change
Not Known	-	-	-	463,091	170,791	(+)292,300	463,091	170,791	(+)292,300
Others	-	-	-	432,134	-	(+)432,134	432,134	-	(+)432,134
Leasehold (Private)	**-**	**24,633**	**(-) 24,633**	**742,598**	**11,921,185**	**(-) 11178587**	**742,598**	**11,945,818**	**(-) 11,203,220**
Crysotile	-	-	-	742,597	773,348	(-) 30,751	742,597	773,348	(-) 30,751
Tremolite	-	-	-	-	206,387	(-) 206,387	-	206,387	(-) 206,387
Mixed Amphibole	-	-	-	-	10,202,331	(-) 10,202,331	-	10,202,331	(-) 10,202,331
Unclassified	-	24,633	(-) 24,633	1	14,685	(-) 14,684	1	39,318	(-) 39,317
Not Known	-	-	-	-	292,300	(-) 292,300	-	292,300	(-) 292,300
Others	-	-	-	-	432,134	(-) 432,134	-	432,134	(-) 432,134

figures rounded off

Table – 2 : Total Resources of Asbestos as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In Tonne)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India : Total	**22,908,067**	**22,947,384**	**(-) 39,317**
Andhra Pradesh	797,995	837,312	(-) 39,317
Jharkhand	154,893	154,893	No Change
Karnataka	8,282,457	8,282,457	No Change
Odisha	56,700	56,700	No Change
Rajasthan	13,615,710	13,615,710	No Change
Uttarakhand	311	311	No Change

figures rounded off

Table - 3 : District wise Reserves/Resources of Asbestos as on 01.04.2020

(In Tonne)

State	District	Reserves	Remaining Resources	Total Resources
All India : Total		-	**22,908,067**	**22,908,067**
Andhra Pradesh		-	**797,995**	**797,995**
	Anantpur	-	742,598	742,598
	Cuddapah	-	55,397	55,397
Jharkhand		-	**154,893**	**154,893**
	Singhbhum (East)	-	124,059	124,059
	Singhbhum (West)	-	30,834	30,834
Karnataka		-	**8,282,457**	**8,282,457**
	Chikmagalur	-	143,667	143,667
	Hassan	-	3,696,700	3,696,700
	Mandya	-	97,250	97,250
	Mysore	-	24,840	24,840
	Shimoga	-	4,320,000	4,320,000
Odisha		-	**56,700**	**56,700**
	Keonjhar	-	56,700	56,700
Rajasthan		-	**13,615,710**	**13,615,710**
	Ajmer	-	3,458,336	3,458,336
	Bhilwara	-	270	270
	Dungarpur	-	4,167	4,167
	Pali	-	3,142,298	3,142,298
	Rajsamand	-	3,172,041	3,172,041
	Udaipur	-	3,838,598	3,838,598
Uttarakhand		-	**311**	**311**
	Chamoli	-	311	311

figures rounded off

9.2 BORAX

Introduction

Borax is a salt of hydrated borate of sodium with chemical formula $Na_2H_{20}B_4O_{17}$. Economically viable deposits of Borax have not been established in the country so far. The only deposit of little economic significance is reported from Puga valley in Leh district, Jammu & Kashmir.

Borax is not produced in India. The entire domestic requirement of boron is met solely through imports of crude borate which is refined in the country for producing borax and boric acid (B_2O_3) containing 31% boron. It is extensively used in the manufacture of glass, ceramics, enamels, glazing and in smelting of copper, casting of brass and bronze and refining of gold, silver, etc. It is also used in medicine (boric powder), leather processing, adhesive, corrosion inhibition, ferrous wire manufacture, flame proofing and timber preservation.

Basis of Grade Classification

The entire resources have been placed under unclassified grade. There is no BIS Specification for borax. No information for grade classification is available.

Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), resources are broadly classified into 'reserves' and 'remaining resources'.

According to the norms of this system, the entire remaining resources have been placed under reconnaissance (334) category.

Salient Features of the Inventory

There is no change in the resource position as compared to 01.04.2015. Economically workable deposits of borax have not been established in India. The only deposit of borax is in Puga valley of Leh district, Jammu & Kashmir where resources have been estimated. Few occurrences have also been reported in Jaipur district, Rajasthan , Surendra Nagar district, Gujarat and Leh district, J & K.

All India scenario of borax, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables - 1 and 2. These tables reflect the changes in terms of increase or decrease of resources as per lease status, grades and states. In Table -3 district wise reserves/resources as on 1.4.2020 have been given.

The entire resources, estimated at 74,204 tonnes, are in 04 freehold areas . The entire estimated resources of 74,204 tonnes are of reconnaissance (334) Categories.

Table – 2 : Total Resources of Borax as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In Tonne)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India: Total	**74,204**	**74,204**	**No Change**
Jammu & Kashmir	74,204	74,204	No Change

figures rounded off

Table - 3 : District wise Reserves/Resources of Borax as on 01.04.2020

(In Tonne)

State Name	District Name	Reserves	Remaining Resources	Total Resources
All India : Total		-	**74,204**	**74,204**
Jammu & Kashmir		-	74,204	74,204
	Leh	-	74,204	74,204

figures rounded off

Table - 1 : Reserves/Resources of Borax as on 01.04.2020 vis-à-vis 01.04.2015
(By Lease Status/Grade)

(In Tsonne)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India	-	-	-	**74,204**	**74,204**	**No Change**	**74,204**	**74,204**	**No Change**
Unclassified	-	-	-	74,204	74,204	No Change	74,204	74,204	No Change
Freehold	-	-	-	**74,204**	**74,204**	**No Change**	**74,204**	**74,204**	**No Change**
Unclassified	-	-	-	74,204	74,204	No Change	74,204	74,204	No Change

figures rounded off

9.3 DIATOMITE

Introduction

Siliceous sediments of lower cretaceous age, formed almost entirely of the skeletal remains of microscopic single cell aquatic plants, are called diatoms (bacillariophyta) and are known as diatomite or diatomaceous earth. These microscopic algae have capability of extracting silica from water to produce their skeletal structure. Diatomite is extremely fine grained and highly absorbent. Each particle is porous and has honey-comb like structure. Diatomite consists of nearly 90 percent silica and the remaining part of aluminium and iron oxides. It is used in filters, as an absorbent and an ultra fine abrasive. It is also called 'Kieselguhr'. It has a chemical composition SiO_2nH_2O which is similar to opal or hydrous silica. Workable diatomite deposit of significance has not been established in the country. Almost the entire domestic requirement of diatomite is met through imports.

Basis of Grade Classification

Due to paucity of data on mining and processing and industry wise end uses, the diatomite resources in the National Mineral Inventory as on 01.04.2020 have been placed under 'unclassified' grade.

Basis of Categoristion of Resources

As per United Nations Framework Classification (UNFC), resources are broadly classified into 'reserves' and 'remaining resources'.

According to norms of this system, the entire estimation of diatomite has been made under remaining resources and are placed under feasibility (211) and inferred (333) categories.

Salient Features of the Inventory

The total resources of diatomite in the country as on 01.04.2020 are estimated at 2,885 thousand tonnes. The entire resources are placed under 'remaining resources' category estimated only in freehold areas .

All India scenario of diatomite reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015, have been given in Tables 1 to 2. There is no change in the resources, and grade as compared to the earlier inventory as on 01.04.2015. Distict wise resources of diatomite as on 01.04.2020 have been given in Table - 3.

The entire resources of diatomite are concentrated in two states. About 72% of the total resources (2,074 thousand tonnes) have been estimated in Barmer (50%) and Jaisalmer (22%) districts of Rajasthan. The remaining 811 thousand tonnes (28%), resources have been reported from Bhavnagar district of Gujarat.

A major portion of the resources of diatomite, constituting 2,251 thousand tonnes (78%), have been estimated under inferred (333) category. A detailed exploration in these areas may improve the confidence level of resource endowment of diatomite in the country.

Total 7 freehold deposits have been covered in the inventory as on 01.04.2020.

Table - 1 : Reserves/Resources of Diatomite as on 01.04.2020 vis-à-vis 01.04.2015 (By Lease Status/Grade)

(In '000 Tonnes)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India : Total	-	-	-	2,885	2,885	No change	2,885	2,885	No change
Un-classified	-	-	-	2,885	2,885	No change	2,885	2,885	No change
Freehold/Un-classified	-	-	-	2,885	2,885	No change	2,885	2,885	No change

figures rounded off

Table – 2 : Total Resources of Diatomite as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In '000 Tonnes)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India:Total	**2,885**	**2,885**	**No change**
Gujarat	811	811	No change
Rajasthan	2,074	2,074	No change

figures rounded off

Table - 3 : District wise Reserves/Resources of Borax as on 01.04.2020

(In Tonne)

State Name	District Name	Reserves	Remaining Resources	Total Resources
All India : Total		-	**74,204**	**74,204**
Gujarat		-	811	811
	Bhavnagar	-	811	811
Rajasthan				
	Barmer	-	1,440	1,440
	Jaisalmer	-	634	634

figures rounded off

9.4 FLUORITE

Introduction

Fluorite or Fluorspar is the common name of the mineral having chemical composition, calcium fluoride (CaF_2). It is mainly used in chemical, cement, iron and steel, ferroalloys, foundries and also in aluminium and glass industries. The primary use of fluorspar is for the production of hydrofluoric acid (HF). It is an important commercial source of fluorine. Fluorine in high concentration in drinking water is toxic and causes a disease known as 'Fluorosis'.

Occurrences of commercial deposits of fluorite in India is limited and grades of fluorite produced do not meet the specifications of chemical industry which is a bulk consumer of fluorite. The country depends on imports to meet the internal demand.

Basis of Grade Classification

In nature, fluorite does not occur with such a high concentration of CaF_2 to be used directly in many of the bulk consuming industries. Chemical industry consumes 90-95% CaF_2 for making hydrofluoric acid, synthetic cryolite and aluminium fluoride. Fluorite having 80 to 85% CaF_2 is consumed for making special steel and for production of ordinary steel it should have 70 to 75% CaF_2. Therefore, fluorite produced from the mine are beneficiated and concentrated before it is used in the industries. The mill feed grade for producing concentrate from Ambadongar mine of GMDC is (+)20% CaF_2. The mill feed grade from Chandidongri mine (closed now), Chhattisgarh was (+)15% CaF_2. However, (+)10% CaF_2 grade is considered as beneficiable and mill feed grade. Besides, hand sorted fluorite from Rajasthan and Maharashtra having (+)30% CaF_2 are also being directly marketed.

The End-use grade classification for fluorite as follows :

1. Marketable grade (Useable/Saleable)	Fluorite of (+) 30% CaF_2 (min) by hand sorting and (+) 10% CaF_2 accepted as mill feed for production of concentrates.
2. Low Grade	Fluorite containing below 10% CaF_2.
3. Beneficiable grade	CaF_2 5% (min)
4. Unclassified grade	Fluorite where the ranges of constituents vary widely.

Basis of Categorisation of Resources

As per the United Nations Framework Classification (UNFC), the total resources are categorised into 'reserves' and 'remaining resources' category.

According to the norms of this system reserves of fluorite have been placed under proved (111) and probable (121) and (122) categories. The remaining resources have been placed under feasibility (211), pre-feasibility (221) and (222), measured (331), indicated (332), inferred (333) and reconnaissance (334) categories.

Salient Features of the Inventory

All India scenario of fluorite reserves, remaining resources and total resources as on 01.04.2020 vis-à-vis 01.04.2015 have been given in Tables - 1 and 2. The tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grades and states. In Table-3, district wise reserves/resources as on 01.04.2020 have been given.

The total resources of fluorite in the country as on 01.04.2020 have been estimated at 20.99 million tonnes. Of this, 0.4 million tonnes (2%) are under reserve category and 20.59 million tonnes (98%) under remaining resource category.

Of the total resources, about 45% are in leasehold (Private 2 % and Public 43%) and the rest 55 % are in freehold.

Out of the total resources estimated as on 01.04.2020, about 17.1 million tonnes (82%) constitutes marketable grade, 3.2 million tonnes (15 %) low grade, 0.35 million tonnes (1.7 %) unclassified grade and 0.33 million tonnes (1.6 %) not known grade.

By states, Gujarat with 14 million tonnes accounted for 68.38 % of the total resources, followed by Rajasthan 5.6 million tonnes (26.7 %), Chattisgarh 0.5 million tonnes (2.59 %) and Maharashtra accounted for 0.49 million tonnes (2.32%) .

An overall increase of 2.8 million tonnes resources of fluorite has been recorded in the inventory as on 01.04.2020 as compared to the previous inventory as on 01.04.2015. Out of the total increase in resources, about 2.3 million tonnes (11%) have been accounted

Table - 1 : Reserves/Resources of Fluorite as on 01.04.2020 vis-à-vis 01.04.2015
(By Lease Status/Grade)

(In Tonne)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India : Total	**404,241**	**288,684**	**(+)115,557**	**20,588,239**	**17,893,424**	**(+)2,694,815**	**20,992,480**	**18,182,107**	**(+)2,810,373**
Marketable	404,241	288,684	(+)115,557	16,731,425	14,368,666	(+)2,362,759	17,135,666	14,657,350	(+)2,478,316
Low	-	-	-	3,169,481	3,169,481	No change	3,169,481	3,169,481	No change
Not Known	-	-	-	332,057	-	(+)332,057	332,057	-	(+)332,057
Unclassified	-	-	-	355,276	355,276	No change	355,276	355,276	No change
Freehold	**-**	**-**	**-**	**11,514,193**	**10,874,805**	**(+)639,388**	**11,514,193**	**10,874,805**	**(+)639,388**
Marketable	-	-	-	7,989,437	7,704,729	(+)284,708	7,989,437	7,704,729	(+)284,708
Low	-	-	-	3,169,481	3,125,841	(+)43,640	3,169,481	3,125,841	(+)43,640
Unclassified	-	-	-	355,276	44,235	(+)311,041	355,276	44,235	(+)311,040
Leasehold (Private)	**18,099**	**-**	**(+)18,099**	**344,045**	**439,641**	**(-) 95,596**	**362,145**	**439,641**	**(-) 77,496**
Marketable	18,099	-	18,099	11,988	84,961	(-) 72,973	30,088	84,961	(-) 54,873
Low	-	-	-	-	43,640	(-) 43,640	-	43,640	(-) 43,640
Not Known	-	-	-	332,057	-	(+)332,057	332,057	-	(+)332,057
Unclassified	-		-	-	311,040	(-) 311,040	-	311,040	(-) 311,040
Leasehold (Public)	**386,142**	**288,684**	**(+)97,458**	**8,730,000**	**6,578,977**	**(+)2,151,023**	**9,116,142**	**6,867,661**	**(+)2,248,481**
Marketable	386,142	288,684	(+)97,458	8,730,000	6,578,977	(+)2,151,023	9,116,142	6,867,661	(+)2,248,481

figures rounded off

alone by Ambadungar Fluorite Mine of GMDC in Chota Udaipur district of Gujarat followed by 0.4 million tonnes (1.7 %) in leasehold (Pvt.) in Rajasthan and 0.09 million tonnes in Dongargaon Fluorite Mine of MSMC in Chandrapur district of Maharashtra due to re-estimation in leasehold both Public and Private deposits.

Of the total resources of fluorite, about 1.74 million tonnes (8.29%) have been estimated under inferred and reconnaissance categories. These resources have been estimated based on a limited and preliminary exploration. If these areas are examined for further exploration, the confidence level of resource position of fluorite in the country may improve.

A total 32 deposits of fluorite have been covered in the inventory as on 01.04.2020. Out of this, 27 deposits are in freehold, 3 deposits in leasehold private and 2 deposits in leasehold public sector.

Table – 2 : Total Resources of Fluorite as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In Tonne)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India Total	**20,992,480**	**18,182,107**	**(+)2,810,373**
Chhattisgarh	545,455	545,455	No change
Gujarat	14,355,280	12,004,510	(+)2,350,770
Maharashtra	486,142	388,684	(+)97,458
Rajasthan	5,605,603	5,243,458	(+)362,145

figures rounded off

Table -3 : District wise Reserves/Resources of Fluorite as on 01.04.2020

(In Tonne)

State	District	Reserves	Remaining Resources	Total Resources
All India : Total		**404,241**	**20,588,239**	**20,992,480**
Chhattisgarh		-	**545,455**	**545,455**
	Rajnandgaon	-	545,455	545,455
Gujarat		-	**14,355,280**	**14,355,280**
	Bharuch	-	1,920	1,920
	Chhota Udaipur	-	14,353,360	14,353,360
Maharashtra		**386,142**	**100,000**	**486,142**
	Chandrapur	386,142	100,000	486,142
Rajasthan		**18,099**	**5,587,504**	**5,605,603**
	Ajmer	-	987	987
	Dungarpur	18,099	3,300,850	3,318,950
	Jalore	-	584,716	584,716
	Jhalawar	-	258,128	258,128
	Jhunjhunu	-	733,626	733,626
	Sikar	-	350,000	350,000
	Sirohi	-	93,917	93,917
	Udaipur	-	265,280	265,280

figures rounded off

9.5 LIMESTONE

Introduction

Limestone is a carbonate rock of sedimentary origin formed from solutions carrying mainly calcium carbonates $CaCO_3$. Limestone may be formed by three processes - inorganic, organic and chemical. They may be argillaceous (clayey), arenaceous (siliceous), carbonaceous (containing bitumen or coaly matter), ferruginous (containing iron minerals such as limonite, siderite or hematite) and fossiliferous (containing corals and other fossils or their fragments, etc). Limestone often contains some magnesium carbonate either as dolomite [$CaMg(CO_3)_2$] or magnesite ($MgCO_3$) mixed with calcite. They are then termed as 'dolomitic' and magnesiam limestone. Limestone altered by dynamic or contact metamorphism become coarse, crystalline and are called marble and crystalline limestone.

Limestone occurs as regular beds in sedimentary sequences. In metamorphosed terrain they tend to occur as thin narrow bands and show complex structures. Depending on size, shape and deposition, three types of limestone deposits are recognised - simple, complex and intricate.

Other common varieties of limestone are marl stone, an impure variety of limestone containing varying proportions of clay, oolitic limestone composed wholly or partly of small spherical concretions of calcium carbonate built up in concentric layers, also as lime shell, lime kankar, chalk, friable limestone, etc. However, minerals like lime Kankar, Chalk have been notified as minor minerals and not covered in NMI.

Basis of Grade Classification

The following end-use grade classification adopted in the inventory as on 01.04.2020 are based on the recommendations of expert Committee constituted for revision and review the end use grade classification, September, 2004.

1.	Cement (Portland)	CaO	44 to 52%
		MgO	3.5% (max)
2.	Cement (Blendable/ Beneficiable)	CaO	38 to 44%
		MgO	5% (max)
3.	B.F.	CaO	42% (min)
		MgO	6% (max)
		SiO_2	4% (max)
		Total Insoluble	8 to 12%
		Alkalies	0.4% (max)
4.	S.M.S. (O.H)	CaO	48% (min)
		MgO	4% (max)
		SiO_2	4% (max)
5.	S.M.S. (L.D)	CaO	52% (min)
		SiO_2	1% (max)
		MgO	Below 2%
	Decrepitation Index		(-) 15 mm 10%
6.	White Cement	CaO	48% (min)
		Al_2O_3	1% (max)
		Fe_2O_3	1% (max)
7.	Chemical	CaO	50% (min)
		SiO_2	2% (max)
		Fe_2O_3	0.25% (max)
8.	Blendable/ (Threshold)*	CaO	34% (min)
		MgO	5% (max)
9.	Paper	As reported by exploration/ exploitation agencies	
10.	Others	Estimations for those grade which could not be classified into the above grades.	
11.	Unclassified	The range of maximum and minimum value of CaO and other constituents is such that it cannot be classified under any grades.	
12.	Not Known	Such estimation about which information/data is not available/reported to classify it under any of the grade mentioned above.	

** Incorporating as per noification no C-284/3/CMG/2017 dated 25/04/2018.*

Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), resources are broadly classified into 'reserves' and 'remaining resources'.

According to the norms of this system, reserves of limestone have been placed under proved (111) and probable (121) & (122) categories.

The remaining resources have been place under, feasibility (211), pre-feasibility (221) & (222), measured (331), indicated (332), inferred (333) and reconnaissance (334) categories.

Salient Features of the Inventory

The total resources of limestone in the country as on 01.04.2020 are estimated at 227,589 million tonnes, of which 19,028 million tonnes(8%) falls under 'reserve' category and 208,561 million tonnes (92%) are under 'remaining resource' category.

All India scenario of limestone 'reserves', 'remaining resources' and 'total resources' as on 01.04.2020 vis-a-vis 01.04.2015, have been given in Tables - 1 and 2. The tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grade and state. In Table-3 district wise reserves/resources as on 01.04.2020 have been given.

Out of the total resources, the share of freehold areas is 183,513 million tonnes (80.63%), leasehold public sector 4,608 million tonnes (2.02%) and leasehold private sector 39,468 million tonnes (17.34%).

Out of the total resources of limestone, chemical grade constitutes 5,453 million tonnes (2.40%), SMS (OH) grade 4,949 million tonnes (2.17%), SMS (LD) grade 619 million tonnes (0.27%), SMS (OH & LD mixed) grade 381 million tonnes (0.17%), BF Grade 14,173 million tonnes (6.23%), SMS & BF mixed grade 1,263 million tonnes (0.55%), Cement (portland) grade 156,354 mllion tonnes (68.70%), Cement (blendable/beneficiable) grade 7640 million tonnes (3.36%),Cement (white) grade 75 million tonnes (0.03%), Cement (portland and white) grade 1,100 million tonnes (0.48%), BF & Cement mixed grade 637 million tonnes (0.28%), SMS, Chemical & paper grade 1,234 million tonnes (0.54%), Paper grade 897 million tonnes (0.39%), others, unclassified and not known grade 31,931 million tonnes (14.03%). Blendable grade 884 million tonnes (0.39%).

Karnataka is credited with 24.68% of the total resources estimated in the country, followed by Andhra Pradesh 13.11%, Rajasthan 12.73%, Meghalaya 10.47%, Gujarat 10.03%, Telangana 7.76%, Chhattisgarh 5.80%, Madhya Pradesh 4.24%, Himachal Pradesh 2.91%, Maharashtra 1.67%, Jammu & Kashmir 1.07%, Odisha 0.96%,Tamil Nadu 0.93%, Assam 0.82%, Nagaland 0.77% and Uttarakhand 0.69%. The remaining balance of about 1.34% resources have been accounted together by Arunachal Pradesh, Bihar, Daman & Diu, Haryana, Jharkhand, Kerala, Manipur, Puducherry, Sikkim, Uttar Pradesh and West Bengal.

(In Million Tonnes)

State	Increase of Resources due to			Decrease of Resources due to			Net changes (A)-(B)
	Addition of new deposits (Numbers in parenthesis)	Upward revision in the existing deposits	Total increase (A)	Deletion of deposits (Numbers in parenthesis)	Downward revision in the existing deposits	Total decrease (B)	
All India : Total	**21,395(159)**	**10,618**	**32,013**	**1,302(92)**	**6,351**	**7,653**	**(+)24,364**
Andhra Pradesh	3,296(16)	2,229	5,526	504(31)	105	609	(+)4,917
Assam	-	645	645	239(1)	2	241	(+)404
Bihar	-	146	146	-	1	1	(+)145
Chhattisgarh	1,777(25)	1,334	3,110	*(1)	704	704	(+)2,406
Gujarat	1,584(7)	317	1,901	1(41)	325	326	(+)1,575
Himachal Pradesh	14(5)	603	617	-	222	222	(+)395
Jammu & Kashmir	1(1)	192	193	-	408	408	(-)215
Jharkhand	1(2)	9	11	-	114	114	(-)103
Karnataka	2,221(19)	419	2,640	1(1)	905	906	(+)1,735
Kerala	-	1	1	-	-	-	(+)1
Madhya Pradesh	545(19)	1,112	1,657	1(2)	1,345	1,346	(+)311
Maharashtra	223(2)	827	1,050	15(1)	80	95	(+)955
Meghalaya	6,348(23)	21	6,369	81(2)	157	238	(+)6,131
Odisha	-	104	104	-	30	30	(+)74
Rajasthan	4,893(26)	1,624	6,517	155(3)	1,769	1,923	(+)4,594
Tamil Nadu	337(10)	373	711	3(10)	184	187	(+)524
Telangana	122(3)	645	767	-	301	301	(+)466
Uttar Pradesh	-	15	15	-	-	-	(+)15
Uttarakhand	(33)1	-	33	-	-	-	(+)33

figures rounded off **negligible quantity*

Table - 1 : Reserves/Resources of Limestone as on 01.04.2020 vis-à-vis 01.04.2015
(By Lease Status/Grade)

(In Million Tonnes)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India : Total	**19,028**	**16,336**	**(+)2,692**	**208,561**	**186,888**	**(+)21,672**	**227,589**	**203,225**	**(+)24,364**
Chemical	255	378	(-)124	5,198	5,073	(+)124	5,453	5,452	(+)1
SMS (OH)	104	999	(-)896	4,845	4,066	(+)780	4,949	5,065	(-)116
SMS(LD)	27	3	(+)24	591	402	(+)189	619	405	(+)213
SMS(OH & LD Mixed)	144	-	(+)144	237	167	(+)69	381	167	(+)213
BF	747	343	(+)404	13,426	13,660	(-)234	14,173	14,003	(+)170
SMS & BF Mixed	22	170	(-)148	1,241	1,169	(+)72	1,263	1,339	(-)76
Cement (Portland)	16,713	13,616	(+)3,097	139,641	128,138	(+)11,503	156,354	141,754	(+)14,600
Blendable (Cao 34 - 38%)	-	-	-	884	-	(+)884	884	-	(+)884
Cement (Blendable/Beneficiable)	589	300	(+)289	7,051	1,175	(+)5,876	7,640	1,475	(+)6,165
Cement (white)	28	-	(+)28	47	130	(-)83	75	130	(-)55
Cement (Portland & White)	55	3	(+)53	1,044	983	(+)61	1,100	986	(+)114
BF & Cement Mixed	20	85	(-)66	617	128	(+)490	637	213	(+)424
SMS, Chemical & paper	-	2	(-)2	1,234	1,233	(+)1	1,234	1,235	(-)1
Paper	56	26	(+)30	841	897	(-)56	897	922	(-)25
Others	49	94	(-)45	3,440	3,427	(+)13	3,489	3,521	(-)32
Unclassified	165	284	(-)119	26,383	24,831	(+)1,552	26,548	25,114	(+)1,434
Not Known	56	32	(+)23	1,839	1,411	(+)428	1,895	1,443	(+)451
Freehold	**-**	**-**	**-**	**183,513**	**165,475**	**(+)18,038**	**183,513**	**165,476**	**(+)18,037**
Chemical	-	-	-	3,996	3,934	(+)62	3,996	3,934	(+)62
SMS (OH)	-	-	-	4,632	3,966	(+)666	4,632	3,966	(+)666
SMS (LD)	-	-	-	475	291	(+)184	475	291	(+)184
SMS (OH & LD Mixed)	-	-	-	237	167	(+)69	237	167	(+)69
BF	-	-	-	12,301	12,416	(-)115	12,301	12,416	(-)115
SMS & BF Mixed	-	-	-	1,118	1,100	(+)17	1,118	1,100	(+)17
Cement (Portland)	-	-	-	119,332	111,231	(+)8,102	119,332	111,231	(+)8,102
Blendable (Cao 34 - 38%)	-	-	-	865	-	(+)865	865	-	(+)865
Cement (Blendable/Beneficiable)	-	-	-	6,126	368	(+)5,759	6,126	368	(+)5,759
Cemet (White)	-	-	-	27	117	(-)90	27	117	(-)90
Cement (Portland & White)	-	-	-	953	953	No Change	953	953	No Change
BF & Cement Mixed	-	-	-	550	38	(+)512	550	38	(+)512
SMS, Chemical & Paper	-	-	-	1,232	1,232	No Change	1,232	1,232	No Change
Paper	-	-	-	788	788	No Change	788	788	No Change
Others	-	-	-	3,214	3,000	(+)214	3,214	3,000	(+)214
Unclassified	-	-	-	26,096	24,527	(+)1,569	26,096	24,527	(+)1,569
Not Known	-	-	-	1,572	1,348	(+)224	1,572	1,349	(+)223

(Contd.)

Table-1 (Concld.)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	1.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
Leasehold Public	**2,015**	**2,149**	**(-)135**	**2,594**	**3,191**	**(-)598**	**4,608**	**5,341**	**(-)732**
Chemical	80	125	(-)45	7	58	(-)51	87	183	(-)96
SMS (OH)	80	144	(-)64	149	21	(+)128	230	165	(+)64
SMS (LD)	27	-	(+)27	112	106	(+)6	139	106	(+)33
SMS (OH & LD Mixed)	144	-	(+)144	-	-	-	144	-	(+)144
BF	453	258	(+)195	1,015	1,169	(-)155	1,468	1,427	(+)41
SMS & BF Mixed	-	92	(-)92	-	-	-	-	92	(-)92
Cement (Portland)	1,228	1,486	(-)259	1,107	1,611	(-)505	2,334	3,098	(-)764
Blendable (Cao 34 - 38%)	-	-	-	19	-	(+)19	19	-	(+)19
Cement (Blendable/Beneficiable)	3	23	(-)20	165	127	(+)38	168	150	(+)18
Cement (white)	-	-	-	1	1	No change	1	1	No change
BF & Cement Mixed	-	15	(-)15	-	50	(-)50	-	65	(-)65
Others	-	7	(-)7	9	44	(-)35	9	51	(-)42
Unclassified	-	-	-	7	-	(+)7	7	-	(+)7
Not Known	-	-	-	3	3	No Change	3	3	No Change
Leasehold Private	**17,014**	**14,187**	**(+)2,827**	**22,454**	**18,222**	**(+)4,232**	**39,468**	**32,408**	**(+)7,059**
Chemical	175	254	(-)79	1,195	1,081	(+)114	1,370	1,335	(+)35
SMS (OH)	23	855	(-)832	64	78	(-)14	88	934	(-)846
SMS (LD)	-	3	(-)3	5	5	No change	5	8	(-)3
BF	294	86	(+)208	111	75	(+)36	405	161	(+)244
SMS & BF Mixed	22	78	(-)56	123	69	55	145	147	(-)2
Cement (Portland)	15,485	12,130	(+)3,356	19,202	15,296	(+)3,906	34,688	27,425	(+)7,262
Cement (Blendable/Beneficiable)	585	277	(+)309	760	680	(+)80	1,345	957	(+)389
Cement (white)	28	-	(+)28	19	12	(+)7	47	12	(+)35
Cement (Portland & White)	55	3	(+)53	91	30	(+)61	147	33	(+)114
BF & Cement Mixed	20	71	(-)51	68	40	(+)27	87	111	(-)23
SMS, Chemical & Paper	-	2	(-)2	2	-	(+)1	3	3	(-)1
Paper	56	26	(+)31	53	109	(-)56	109	134	(-)25
Others	49	87	(-)38	217	383	(-)166	266	470	(-)204
Unclassified	165	284	(-)119	280	304	(-)24	445	588	(-)143
Not Known	56	32	(+)23	264	59	(+)205	320	91	(+)228

figures rounded off

A net increase of 24,364 million tonnes limestone resources have been recorded in the inventory as on 01.04.2020 in comparison to the earlier inventory as on 01.04.2015. An account of these changes is illustrated in the table at page No.155.

Limestone resoures of about 135,833 million tonnes and 9,580 million tonnes resources have been estimated under inferred and reconnaissance categories respectively. These together constitute about 64% of the total resources. These resources have been estimated based on a limited and preliminary exploration. If these areas are examined for further detailed exploration, the confidence level of resource position of limestone in the country may improve.

In the inventory as on 01.04.2020, total 3,559 deposits have been covered. Of these 1,793 deposits are in freehold areas and the balance 1,766 deposits in leasehold areas (leasehold public - 70 deposits and leasehold private - 1,696 deposits).

Table – 2 : Total Resources of Limestone as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In Million Tonnes)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India : Total	**227,589**	**203,225**	**(+)24,364**
Andhra Pradesh	29,839	24,922	(+)4,917
Arunachal Pradesh	483	483	No Change
Assam	1,872	1,468	(+)404
Bihar	1,006	861	(+)145
Chhattisgarh	13,211	10,805	(+)2,406
Daman & Diu	129	129	No Change
Gujarat	22,832	21,257	(+)1,575
Haryana	75	75	No Change
Himachal Pradesh	6,619	6,224	(+)395
Jammu & Kashmir	2,428	2,643	(-)215
Jharkhand	621	724	(-)103
Karnataka	56,170	54,435	(+)1,735
Kerala	195	194	(+)1
Madhya Pradesh	9,653	9,342	(+)311
Maharashtra	3,808	2,853	(+)955
Manipur	46	46	No Change
Meghalaya	23,835	17,704	(+)6,131
Nagaland	1,752	1,752	No Change
Odisha	2,196	2,122	(+)74
Puducherry	16	16	No Change
Rajasthan	28,961	24,367	(+)4,594
Sikkim	2	2	No Change
Tamil Nadu	2,124	1,600	(+)524
Telangana	17,652	17,186	(+)466
Uttar Pradesh	443	428	(+)15
Uttarakhand	1,576	1,543	(+)33
West Bengal	45	45	No Change

figures rounded off

Table - 3 : District wise Reserves/Resources of Limestone as on 01.04.2020

(In '000 Tonnes)

State/District	Reserves	Remaining Resources	Total Resources
All India : Total	**19,028,470**	**208,560,789**	**227,589,259**
Andhra Pradesh	**3,256,690**	**26,582,132**	**29,838,822**
Anantapur	114,547	241,059	355,606
Cuddapah	858,222	5,442,601	6,300,823
Godavari (East)	-	780	780
Godavari (West)	-	3,510	3,510
Guntur	890,904	5,819,013	6,709,917
Krishna	459,665	1,136,984	1,596,648
Kurnool	933,353	13,909,923	14,843,275
Nellore	-	11,284	11,284
Visakhapatnam	-	16,925	16,925
Vizianagaram	-	53	53
Arunachal Pradesh	**-**	**482,796**	**482,796**
Dibang Valley	-	99,510	99,510
East Siang	-	1,500	1,500
Lohit	-	150,000	150,000
Upper Subansiri	-	6,785	6,785
West Siang	-	225,001	225,001
Assam	**188,130**	**1,683,540**	**1,871,670**
Karbi Anglong	12,899	103,653	116,552
North Cachar Hills	175,231	1,425,887	1,601,118
Nowgong	-	154,000	154,000
Bihar	**11,807**	**994,188**	**1,005,995**
Bhabua	-	101,511	101,511
Monghyr	-	13,510	13,510
Rohtas	11,807	879,167	890,974
Chhattisgarh	**1,486,351**	**11,724,867**	**13,211,218**
Baloda Bazar	873,701	1,899,425	2,773,126
Bastar	4,185	2,307,303	2,311,489
Bemetara	3,721	7,278	10,999
Bilaspur	35,750	2,159,337	2,195,087
Durg	424,282	987,237	1,411,519
Janjgir-Champa	61,076	111,578	172,654
Kabirdham	1,457	80,114	81,571
Raigarh	-	298,577	298,577
Raipur	81,540	3,740,381	3,821,921
Rajnandgaon	639	133,637	134,276
Daman & Diu	**-**	**128,670**	**128,670**
Daman	-	128,670	128,670
Gujarat	**903,115**	**21,929,169**	**22,832,284**
Amreli	91,758	443,977	535,735
Banaskantha	-	716,066	716,066
Bharuch	-	15,850	15,850
Bhavnagar	-	302,465	302,465
Devbhoomi Dwarka	847	159,779	160,625
Gir Somnath	66,364	167,333	233,697
Jamnagar	14,978	113,053	128,031
Junagarh	23,309	1,868,346	1,891,655
Kheda	-	6,310	6,310
Kutch	576,170	16,825,239	17,401,409

(Contd.)

Table-3 (Contd.)

State/District	Reserves	Remaining Resources	Total Resources
Panchmahals	-	161,810	161,810
Porbandar	121,843	630,045	751,888
Rajkot	-	21,758	21,758
Sabarkantha	-	482,222	482,222
Surat	7,847	4,533	12,380
Vadodara	-	718	718
Valsad	-	9,665	9,665
Haryana	**-**	**74,677**	**74,677**
Ambala	-	16,561	16,561
Bhiwani	-	1,929	1,929
Mahendragarh	-	55,331	55,331
Panchkula	-	856	856
Himachal Pradesh	**1,022,012**	**5,597,134**	**6,619,146**
Bilaspur	376,730	792,583	1,169,313
Chamba	-	1,285,500	1,285,500
Kangra	-	180,000	180,000
Kulu	-	4,060	4,060
Mandi	-	549,240	549,240
Simla	-	805,283	805,283
Sirmur	70,609	518,208	588,817
Solan	574,673	1,462,259	2,036,932
Jammu & Kashmir	**185,490**	**2,242,071**	**2,427,561**
Anantnag	66,008	1,319,977	1,385,985
Baramula	-	27,972	27,972
Gandharbal	-	2,730	2,730
Kargil	-	11,480	11,480
Kathua	-	45,411	45,411
Kupwara	-	24,520	24,520
Leh	-	46,091	46,091
Poonch	-	9,375	9,375
Pulwama	78,214	362,545	440,759
Rajauri	-	123,621	123,621
Srinagar	41,268	234,368	275,636
Udhampur	-	33,982	33,982
Jharkhand	**10,687**	**610,078**	**620,765**
Bokaro	-	1,644	1,644
Dhanbad	-	44	44
Garwah	-	48,150	48,150
Giridih	-	1,500	1,500
Hazaribagh	-	178,896	178,896
Palamau	-	151,845	151,845
Ramgarh	-	29,693	29,693
Ranchi	-	63,903	63,903
Singhbhum (East)	-	32	32
Singhbhum (West)	10,687	134,372	145,059
Karnataka	**2,271,221**	**53,899,236**	**56,170,457**
Bagalkot	185,684	1,588,760	1,774,444
Belgaum	121,221	2,308,981	2,430,202
Bellary	-	234	234
Bijapur	-	1,232,039	1,232,039
Chikmagalur	-	115	115
Chitradurga	20,884	363,878	384,762
Dawangere	-	55,560	55,560
Gadag	-	263	263
Gulbarga	1,913,302	47,827,157	49,740,459
Hassan	-	1,200	1,200
Mysore	-	5,060	5,060
North Kanara	917	142,472	143,389
Shimoga	10,136	47,893	58,029
South Kanara	-	500	500

(Contd.)

Table-3 (Contd.)

State/District	Reserves	Remaining Resources	Total Resources
Tumkur	19,077	323,261	342,338
Udupi	-	1,666	1,666
Yadgir	-	197	197
Kerala	**10,540**	**184,059**	**194,599**
Alapuzha (Alleppy)	1,525	124,232	125,757
Ernakulam	-	130	130
Kannur	-	1,450	1,450
Kollam	-	3,570	3,570
Kottayam	65	6,699	6,764
Kozhikode	-	811	811
Malappuram	-	662	662
Palakkad	8,950	45,755	54,705
Trissur	-	750	750
Madhya Pradesh	**1,692,431**	**7,960,747**	**9,653,178**
Balaghat	-	93,992	93,992
Chhindwara	-	1,120	1,120
Damoh	185,036	1,877,859	2,062,895
Dhar	129,134	393,446	522,580
Hoshangabad	-	142,114	142,114
Jabalpur	1,583	53,213	54,796
Jhabua	-	19,859	19,859
Katni	415,469	1,160,632	1,576,101
Khargaon (W Nimar)	-	250,265	250,265
Mandsaur	30,706	141,392	172,098
Morena	-	353,759	353,759
Narasinhapur	663	8,586	9,248
Nimach	6,210	260,673	266,883
Rewa	85,668	78,666	164,334
Sagar	-	75,190	75,190
Satna	752,460	2,456,700	3,209,161
Sehore	-	23,599	23,599
Shahdol	-	400	400
Shyopur	-	51,085	51,085
Sidhi	85,502	518,199	603,700
Maharashtra	**701,349**	**3,107,044**	**3,808,392**
Ahmednagar	-	1,132	1,132
Chandrapur	634,652	2,151,314	2,785,967
Dhulia	-	32,070	32,070
Gadchiroli	-	149,500	149,500
Nagpur	-	62,675	62,675
Nanded	-	3,020	3,020
Poona (Pune)	-	150	150
Sangli	-	1,500	1,500
Yeotmal	66,696	705,682	772,379
Manipur	**-**	**46,053**	**46,053**
Chandel	-	4,487	4,487
Ukhrul	-	41,566	41,566
Meghalaya	**251,043**	**23,583,945**	**23,834,988**
Garo Hills West	-	397,698	397,698
Jaintia Hills	134,271	18,940,299	19,074,570
Khasi Hills (East)	116,772	4,042,232	4,159,004
Khasi Hills (West)	-	203,716	203,716
Nagaland	**-**	**1,752,200**	**1,752,200**
Kiphire	-	712,125	712,125
Phek	-	35,075	35,075
Tuensang	-	1,005,000	1,005,000

(Contd.)

Table-3 (Contd.)

State/District	Reserves	Remaining Resources	Total Resources
Odisha	**468,580**	**1,727,424**	**2,196,004**
Bargarh	19,667	59,272	78,939
Jharsuguda	-	840	840
Koraput	66,399	293,760	360,160
Malkangiri	-	429,589	429,589
Nawapara	1,118	22,281	23,399
Sambalpur	-	3,100	3,100
Sundergarh	381,395	918,582	1,299,977
Puducherry	**-**	**15,732**	**15,732**
Puducherry	-	15,732	15,732
Rajasthan	**4,804,154**	**24,157,095**	**28,961,249**
Ajmer	66,661	779,320	845,981
Alwar	-	27,254	27,254
Banswara	41,645	830,416	872,061
Baran	-	6,300	6,300
Bhilwara	-	403,399	403,399
Bikaner	-	4,495	4,495
Bundi	229,450	1,070,520	1,299,970
Chittorgarh	1,332,053	3,077,135	4,409,188
Churu	-	128	128
Dungarpur	-	568	568
Jaipur	171,660	106,668	278,328
Jaisalmer	738,890	11,392,728	12,131,618
Jhunjhunu	-	590,217	590,217
Jodhpur	-	71,621	71,621
Kota	107,226	277,838	385,064
Nagaur	147,899	2,403,033	2,550,932
Pali	1,115,806	1,108,805	2,224,611
Sawai Madhopur	-	52,494	52,494
Sikar	2,238	259,747	261,985
Sirohi	588,118	788,039	1,376,157
Udaipur	262,508	906,372	1,168,880
Sikkim	**-**	**2,380**	**2,380**
Sikkim North	-	2,380	2,380
Tamil Nadu	**547,024**	**1,577,025**	**2,124,049**
Ariyalur	138,747	227,159	365,906
Coimbatore	23,111	90,312	113,423
Cuddalore	-	148,956	148,956
Dindigul	214,679	82,402	297,082
Kanchipuram	-	133	133
Karur	49,119	179,108	228,227
Krishnagiri	-	297	297
Madurai	-	18,673	18,673
Nagapattinam	-	556	556
Namakkal	37	16,629	16,666
Perambalur	392	207,023	207,414
Ramnathapuram	-	12,122	12,122
Salem	4,371	89,370	93,741
Theni (Madurai)	-	7,300	7,300
Thiruvallur	-	71	71
Thiruvannamalai	-	1,300	1,300
Tiruchirapalli	74,462	122,465	196,928
Tirunelveli	17,013	275,952	292,966
Turicorin	12,434	9,942	22,376
Vellore	-	4,900	4,900
Villupuram	-	2,940	2,940
Virudhunagar	12,658	79,415	92,073

(Contd.)

Table-3 (Concld.)

State/District	Reserves	Remaining Resources	Total Resources
Telangana	**1,214,127**	**16,438,327**	**17,652,454**
Adilabad	16,228	798,947	815,175
Hyderabad	-	103,810	103,810
Karimnagar	12,464	9,709	22,173
Mahbubnagar	-	181,000	181,000
Nalgonda	833,476	15,021,332	15,854,808
Rangareddy	351,959	323,530	675,489
Uttar Pradesh	**3,720**	**439,723**	**443,443**
Sonbhadra	3,720	439,723	443,443
Uttarakhand	**-**	**1,575,771**	**1,575,771**
Almora	-	135,890	135,890
Bageshwar	-	1,051	1,051
Dehradun	-	1,228,051	1,228,051
Nainital	-	10,400	10,400
Pauri Garhwal	-	65,500	65,500
Pithoragarh	-	109,511	109,511
Tehri Garhwal	-	25,369	25,369
West Bengal	**-**	**44,706**	**44,706**
Bankura	-	2,154	2,154
Purulia	-	42,552	42,552

figures rounded off

9.6 MARL

Introduction

The term marl is applied to earthy deposits consisting chiefly of an intimate mixture of clay and calcium carbonate formed under fresh water condition, specifically an earthy substance containing 35 - 65% of clay and 65 -35% carbonate.

Marl or marlstone is a calcium carbonate or lime rich mud or mudstone which contains variable amount of clays and silt. The dominant carbonate mineral in most marl is calcite but other carbonate minerals such as dolomite, aragonite and siderite may be present.

In India, marl is found associated with limestone. Resources of marl are spread over in Amreli, Junagarh,Jamnagar and Porbandar districts in Gujarat state.

The marl is mainly consumed by cement industry for the production of cement. It is also used as a soil conditioner and acid neutralizing agent.

Basis of Grade Classification

The information on end use grade have not been suitably reported by exploration and exploitation agencies. Therefore, the resources of marl in the inventory as on 01.04.2020 have been placed under unclassified grade.

Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), the total resources are broadly classified into 'reserves and 'remaining resources' category.

According to the norms of this system, the 'reserves' of marl have been placed under proved (111) and probable (121) & (122) categories.The 'remaining resources' have been placed under feasibility (211), pre-feasibility (221) and inferred (333) categories.

Salient Features of the Inventory

The total resources of marl in the country as on 01.04.2020 have been estimated at about 99 million tonnes. Out of these, about 68 million tonnes (69%) have been placed under 'reserves' category and the balance 31 million tonnes (31%) under 'remaining resources' category.

All India scenarios of marl reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 has been given in Tables-1& 2. These tables provide resource information as per lease status, grade and state. In Table-3, district wise reserves/resources as on 01.04.2020 have been given.

The entire resources of marl have been reported from the state of Gujarat. Out of the total resources, about 43% have been estimated in Amreli district, 38% in Porbandar district, and remaining 19% in Gir -Somnath district & a negligible quantity of resource are reported from Jamnagar district. The entire resources of marl is reported in private leasehold deposits. Of the total resources of marl, a meagre quantity of about 0.39 million tonnes (0.39%) of resources has been estimated under inferred (333) category.

A total of 8 deposits have been covered in National Mineral Inventory as on 01.04.2020 and all are in leasehold private areas.

Table - 1 : Reserves/Resources of Marl as on 01.04.2020 vis-a-vis 01.04.2015
(By Lease Status/Grade)

(In Tonnes)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net Change	01.04.2020	01.04.2015	Net Change	01.04.2020	01.04.2015	Net Change
All India : Total	**68,145,000**	**123,855,856**	**(-)55,710,856**	**31,053,477**	**11,704,870**	(+)**19,348,607**	**99,198,477**	**135,560,726**	**(-)36,362,249**
Unclassified	68,145,000	123,855,856	(-)55,710,856	31,053,477	11,704,870	(+)19,348,607	99,198,477	135,560,726	(-)36,362,249
Leasehold / Private	**68,145,000**	**123,855,856**	**(-)55,710,856**	**31,053,477**	**1,170,487**	(+)**19,348,607**	**99,198,477**	**135,560,726**	**(-)36,362,249**
Unclassified	68,145,000	123,855,856	(-)55,710,856	31,053,477	11,704,870	(+)19,348,607	99,198,477	135,560,726	(-)36,362,249

figures rounded off

Table – 2 : Total Resources of Marl as on 01.04.2020 vis-a-vis 01.04.2015 (By States)

(In Tonnes)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India : Total	**99,198,477**	**135,560,726**	**(-)36,362,249**
Gujarat	99,198,477	135,560,726	(-)36,362,249

figures rounded off

Table - 3 : District wise Reserves/Resources of Marl as on 01.04.2020

(In Tonnes)

State	District	Reserves	Remaining Resources	Total Resources
All India : Total		**68,145,000**	**31,053,477**	**99,198,477**
Gujarat		**68,145,000**	**31,053,477**	**99,198,477**
	Amreli	16,200,000	26,186,200	42,386,200
	Gir Somnath	17,345,000	1,918,000	19,263,000
	Jamnagar	-	277	277
	Porbandar	34,600,000	2,949,000	37,549,000

figures rounded off

9.7 PERLITE

Introduction

Perlite is an amorphous volcanic glassy rock of rhyolitic composition displaying typical perlite texture and contain generally higher water content than obsidian. It shows a pearly luster exhibiting numerous concentric cracks giving an appearance of an onion skin. Perlite can expand upto 20 times of its original volume at a temperature between 850^{0}C to 1150^{0}C.

The principal end-user are building construction products, horticulture, aggregate, filter, fillers, etc. Expanded perlite has excellent thermal and sound insulation properties. It is used most commonly as ultra light weight aggregate, in concrete and plaster, loose insulating material, insulating boards and ceiling tiles. It is found as a substitute for filter aid. From perlite, high, medium and low density filter aids are prepared for regulating flow rate. High density filter aid is employed for slower flow rate. It is also used for filtration of sulphuric acid, citric acid, oils, pharmaceuticals, etc. Low density filter aids are utilised for the filtration of beers, glucose, fruit juices, oils, resins etc.

Basis of Grade Classification

Depending upon the colour, luster and expansion values, the grade of perlite has been continued to classify as high, medium and low grade in the National Mineral Inventory as on 01.04.2020.

1. High Grade	Perlite which is jet black in colour with glassy luster and having expansion values more than 15 to 20 times, is termed as high grade.
2. Medium Grade	Perlite having black colour, dull luster with mixture of rhyolitic material is termed as medium grade.
3. Low Grade	Perlite which is black in colour and have vitrified, greyish patches and mixture of rhyolitic material is termed as low grade.

Basis of categorisation of Resources

As per United Nations Framework Classification (UNFC), resources are broadly classified into 'reserves' and 'remaining resources'.

According to the norms of this system, remaining resources of perlite have been placed under feasibility (211), pre-feasibility (221) & (222) and reconnaissance (334) categories.

Salient Features of Inventory

The total resources of perlite as on 01.04.2020 in the country are estimated at 2,406 thousand tonnes. Entire resources of perlite are placed under 'remaining resources' category.

All India scenario of perlite reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables -1 and 2. It is observed from Table-1 and Table-2 that there is no change of reserves/remaining resources with respect to earlier NMI as on 01.04.2015. In Table-3, District wise reserves/resources as on 01.04.2020 have been given.

The entire resources of perlite reported in one non-working leasehold private mine in Rajkot district, Gujarat.

Table -1 : Reserves/Resources of Perlite as on 01.04.2020 vis-à-vis 01.04.2015
(By Lease Status/Grade)

(In '000 Tonnes)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India : Total	-	-	-	**2,406**	**2,406**	**No Change**	**2,406**	**2,406**	**No Change**
High	-	-	-	283	283	No Change	283	283	No Change
Medium	-	-	-	300	300	No Change	300	300	No Change
Low	-	-	-	152	152	No Change	152	152	No Change
Unclassified	-	-	-	1,671	1,671	No Change	1,671	1,671	No Change
Leasehold (Private)	-	-	-	**2,406**	**2,406**	**No Change**	**2,406**	**2,406**	**No Change**
High	-	-	-	283	283	No Change	283	283	No Change
Medium	-	-	-	300	300	No Change	300	300	No Change
Low	-	-	-	152	152	No Change	152	152	No Change
Unclassified	-	-	-	1,671	1,671	No Change	1,671	1,671	No Change

figures rounded off

Table –2 : Total Resources of Perlite as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In '000 Tonnes)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India :Total	**2,406**	**2,406**	**No Change**
Gujarat	2,406	2,406	No Change

figures rounded off

Table - 3 : District wise Reserves/Resources of Perlite as on 01.04.2020

(In '000 Tonnes)

State Name	District Name	Reserves	Remaining Resources	Total Resources
All India : Total		-	**2,406**	**2,406**
Gujarat		-	**2,406**	**2,406**
	Rajkot	-	2,406	2,406

figures rounded off

9.8 ROCK SALT

Introduction

Common salt, when pure, is the mineral halite (NaCl). It is an essential need of human and is being produced from the beginning of human history. Halite is mainly an evaporite deposit and found in two forms namely bedded salt and salt domes. The occurrences of rock salt are limited in the country. In India, the deposits of rock salt is reported from Mandi district, Himachal Pradesh. It is dark purple, opaque and contains many impurities.

Basis of Grade Classification

As per End Use Grade Classification, it is recommended that the practice of classifying the resources of rock salt under unclassified grade has been revised as on NMI 01.04.2010 and the same classification in the National Mineral Inventory as on 01.04.2020 has been adopted based on the NaCl content in the rock salt.

1. Grade I : (+) 60% NaCl
2. Grade II : (-) 60% NaCl

The rock salt from Mandi district is placed under 'Grade-I' category.

Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), resources are broadly been classified into 'reserves' and 'remaining resources'.

According to the norms of this system, reserves of rock salt have been placed under probable (121) category. The remaining resources have been placed under feasibility (211) and pre-feasibility (221) & (222) categories.

Salient Features of the Inventory

The total resources of rock salt in the country as on 01.04.2020 are estimated at 12.78 million tonnes. Of these, 3.86 million tonnes (30.20%) fall under reserve category and balance 8.92 million tonnes (69.80%) fall under remaining resources. There are two deposits namely Mandi Salt Drang Section and Drang Salt Mine in Mandi district of Himachal Pradesh in the country. They are under public sector and owned by M/s. Hindustan Salt Ltd.

All India resources of rock salt with break-up into reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables - 1 and 2. The tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grades and state. In Table - 3, district wise reserves/resources as on 01.04.2020 have been given.

The total resources of rock salt decreased by about 3 million tonnes (20.25%) in comparision to previous inventory as on 01.04.2015. As per information received from Hindustan Salt limited, downward revision in resources was due to production of rock salt from the Drang Salt mine.

In the National Mineral Inventory as on 01.04.2020, total 02 leasehold (Public Sector) deposits have been covered .

Table – 2 : Total Resources of Rock Salt as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In '000 Tonnes)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India :Total	**12,780**	**16,025**	**(-)3,245**
Himachal Pradesh	12,780	16,025	(-)3,245

figures rounded off

Table - 1 : Reserves/Resources of Rock Salt as on 01.04.2020 vis-à-vis 01.04.2015
(By Lease Status/Grade)

(In '000 Tonnes)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India :Total	**3,860**	-	**(+)3,860**	**8,920**	**16,025**	**(-)7,105**	**12,780**	**16,025**	**(-)3,245**
Graade I : (+) 60% NaCl	3,860	-	(+)3,860	8,920	16,025	(-)7,105	12,780	16,025	(-)3,245
Leasehold/Public	**3,860**	-	**(+)3,860**	**8,920**	**16,025**	**(-)7,105**	**12,780**	**16,025**	**(-)3,245**
Graade I : (+) 60% NaCl	3,860	-	(+)3,860	8,920	16,025	(-)7,105	12,780	16,025	(-)3,245

figures rounded off

Table - 3 : District wise Reserves/Resources of Rock Salt as on 01.04.2020

(In '000 Tonnes)

State Name	District Name	Reserves	Remaining Resources	Total Resources
All India : Total		**3,860**	**8,920**	**12,780**
Himachal Pradesh		**3,860**	**8,920**	**12,780**
	Mandi	3,860	8,920	12,780

figures rounded off

9.9 VERMICULITE

Introduction

Vermiculite is a complex hydrated aluminum and magnesium silicate. Its average composition is represented by the formula 22MgO. $5Al_2O_3$. 22 SiO_2 . 4 H_2O. When heated, it exfoliates many times. Expansion below 8 times is considered as low. Large commercial mines currently exist in the USA,Russia,South Africa,China and Brazil. It shows typical micaceous structure with basal cleavage not as perfect as mica and occurs as soft, pliable elastic laminae. The property of exfoliation together with development of golden bronze or silvery luster on heating is the outstanding characteristic of vermiculite. It is used mainly in the manufacture of light weight bricks for insulation purposes. Other uses are in paint and lubricants, as packing material, as filler in plastic and application in horticulture. Unexfoliated vermiculite has few minor uses such as in drilling muds, in the annealing of steel, etc. Vermiculite is also used for refractory and high temperature insulation which can withstand hot face temperature of up 1000°C.

Basis of Grade Classification

Vermiculite has an important use in refractory industry. The following BIS specification for this purpose is also available :

1. Refractory :

SiO_2	36 to 37%
Al_2O_3	14 to 16%
Fe_2O_3	10 to 14%
TiO_2	3 to 4%
LOI	6 to 8%
CaO	2 to 2.5%
$K_2O + Na_2O$	3 to 5%
Moisture	17 to 19%

2. Unclassified :

The range of maximum and minimum value of the constituents are such that it does not enable to classify under any grades.

Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), the resources are classified into 'reserves' and 'remaining resources'.

According to the norms of this system, reserves of vermiculite have been placed under proved (111) and probable (122) categories.

The remaining resources have been placed under feasibility (211), pre-feasibility (221) & (222), measured (331), indicated (332),inferred (333) and reconaissance (334) categories.

Salient Features of the Inventory

The total resources of vermiculite in the country as on 01.04.2020 are estimated at 2,356,223 tonnes. Out of this, 1,590,996 tonnes (68%) fall under reserves category and 765,227 tonnes (32%) under remaining resources.

All India scenario of vermiculite reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables - 1 and 2. The tables give an idea about the significant changes in terms of increase or decrease of resources as per lease status, grade, and state. In Table- 3, district wise reserves/resources as on 01.04.2020 have been given.

Of the total resources, 618,372 tonnes (26%) have been estimated under freehold areas, 1,524,790 tonnes (65%) under leasehold public sector and remaining 213,061 tonnes (9%) under leasehold private sector areas .

Of total resources estimated in India, Tamil Nadu alone is credited with 1,859,854 tonnes (78.93%), of the all India total resources, about 78% resources of Vermiculite is reported from Vellore district, Tamil Nadu. Besides, resources have been estimated in Andhra Pradesh 192,101 tonnes (8.15%), Karnataka 162,240 tonnes (6.89%), Rajasthan 104,125 tonnes (4.42%), Jharkhand 30,048 tonnes (1.28%) and balance 7,855 tonnes (0.3%) is accounted together by other states namely Gujarat, Madhya Pradesh, and West Bengal .

A net increase of 3,756 tonnes of resources has been recorded in the inventory as on 01.04.2020 in comparison to the earlier inventory as on 01.04.2015.

The overall resources of of Andhra Pradesh and Tamil Nadu decrease by 79,965 tonnes and 5,211 tonnes, respectively. Whereas resources of Rajasthan and Karnataka increased by 60,432 tonnes and 28,500 tonnes, respectively. The revision in resources of these states were mainly in leasehold deposits except in Rajasthan where resources of freehold areas was also increased in NMI 2020.

Table - 1 : Reserves/Resources of Vermiculite as on 01.04.2020 vis-à-vis 01.04.2015
(By Lease Status/Grade)

(In Tonne)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India : Total	**1,590,996**	**1,632,885**	**(-)41,889**	**765,227**	**719,582**	**(+)45,645**	**2,356,223**	**2,352,467**	**(+)3,756**
Refractory	38,752	42,327	(-)3,575	807	807	**No change**	39,559	43,134	(-)3,575
Unclassified	15,52,244	1,590,558	(-)38,314	764,420	718,775	(+)45,645	2,316,664	2,309,333	(+)7,331
Freehold	**-**	**-**	**-**	**618,372**	**588,179**	**(+)30,193**	**618,372**	**588,179**	**(+)30,193**
Unclassified	-	-	-	618,372	588,179	(+)30,193	618,372	588,179	(+)30,193
Leasehold (Public)	**1,523,983**	**1,529,194**	**(-)5,211**	**807**	**807**	**No change**	**1,524,790**	**1,530,001**	**(-)5,211**
Refractory	7,180	7,180	No change	807	807	No change	7,987	7,987	No change
Unclassified	1,516,803	1,522,014	(-)5,211	-	-	-	1,516,803	15,22,014	(-)5,211
Leasehold (Private)	**67,013**	**103,691**	**(-)36,678**	**146,048**	**130,596**	**(+)15,452**	**213,061**	**234,287**	**(-)21,226**
Refractory	31,572	35,147	(-)3,575	-	-	-	31,572	35,147	(-)3,575
Unclassified	35,441	68,544	(-)33,103	146,048	130,596	(+)15,452	181,489	199,140	(-)17,651

figures rounded off

About 560,995 tonnes (24%) of the total resources of vermiculite is under inferred (333) and reconaissance (334) categories. These resources have been estimated based on a limited and preliminary exploration. If these areas are examined for further detailed exploration, the confidence level of resources position of vermiculite in the country may improve.

A total of 58 deposits have been covered in the inventory as on 1.4.2020, of these 38 deposits are in freehold areas and the balance 20 deposits in leasehold areas (18 LH private and 2 LH public).

Table – 2 : Total Resources of Vermiculite as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In Tonne)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India : Total	**2,356,223**	**2,352,467**	**(+)3,756**
Andhra Pradesh	192,101	272,066	(-)79,965
Gujarat	1,960	1,960	No change
Jharkhand	30,048	30,048	No change
Karnataka	162,240	133,740	(+)28,500
Madhya Pradesh	329	329	No change
Rajasthan	104,125	43,693	(+)60,432
Tamil Nadu	1,859,854	1,865,065	(-)5,211
West Bengal	5,566	5,566	No change

figures rounded off

Table -3 : District-wise Reserves/Resources of Vermiculite as on 01.04.2020

(In Tonne)

State/	District	Reserves	Remaining Resources	Total Resources
All India : Total		**1,590,996**	**765,227**	**2,356,223**
Andhra Pradesh		**74,193**	**117,908**	**192,101**
	Nellore	67,013	101,861	168,874
	Visakhapatnam	7,180	16,047	23,227
Gujarat		-	**1,960**	**1,960**
	Vadodara	-	1,960	1,960
Jharkhand		-	**30,048**	**30,048**
	Giridih	-	28,000	28,000
	Hazaribagh	-	2,048	2,048
Karnataka		-	**162,240**	**162,240**
	Hassan	-	64,580	64,580
	Mandya	-	1,562	1,562
	Mysore	-	96,098	96,098
Madhya Pradesh		-	**329**	**329**
	Jhabua	-	329	329
Rajasthan		-	**104,125**	**104,125**
	Ajmer	-	91,125	91,125
	Barmer	-	13,000	13,000
Tamil Nadu		**1,516,803**	**343,051**	**1,859,854**
	Dharmapuri	-	20,000	20,000
	Tiruchirapalli	-	51	51
	Vellore	1,516,803	323,000	1,839,803
West Bengal				
	Bankura	-	**5,566**	**5,566**
		-	5,566	5,566

figures rounded off

9.10 ZIRCON

Introduction

Economically workable concentration of zircon ($ZrSiO_4$) associated with ilmenite, rutile, monazite and sillimanite occur in the beach sands of the coast of Kerala, Odisha and Tamil Nadu. Indian Rare Earth Ltd., and Kerala Minerals and Metals Limited are engaged in mining and processing of beach sand. Its concentration in the deposits is about 0.6-18.7% of total heavy minerals. Indian Zircons analyse 63-66% ZrO_2

Owing to its properties like chemical inertness, good heat conductivity, high specific gravity, good resistance to abrasion, high melting point and no shrinkage after being heated up to 1750^0C, zircon is found to be an outstanding refractory raw material. It is also used in ceramics, foundry and abrasive industry. Gem variety of zircon is used in jewellery.

Beach sand rich in minerals are found extending over three important coastal belts.

1. A 22 km long stretch between Neendakara and Kayamkulam in Kollam district, Kerala.

2. A 6 km long belt stretching from the mouth of Valliyar river to Manavelakurichi and Colachel villages along the west coast in Kanyakumari district, Tamil Nadu.

3. A 20 km long stretch of Chhatrapur coast along Gopalpur village in Ganjam district, Orissa.

Basis of Grade Classification

Exploration agencies or the lessee do not report the resources of zircon as per its end-use grade. However, zircon is mainly consumed in the refractory industry followed by foundry. It is used only after beneficiation of the unclassified zircon. There are no BIS specifications of zircon. Therefore, resources in the inventory as on 01.04.2020 have been placed as 'unclassified grade'.

Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), total resources are broadly classified into 'reserves' and 'remaining resources' category.

According to the norms of this system, reserves of zircon have been placed under proved (111) category. The remaining resources have been placed under feasibility (211), prefeasibility (222), measured (331), indicated (332), inferred (333) and reconaissance (334) categories.

Salient Features of Inventory

The total resources as on 01.04.2020 of zircon in the country are estimated at 2,343,901 tonnes. These resources include 669,466 tonnes (29%) of reserves and 1,674,435 tonnes (71%) of remaining resources.

All India scenario of zircon reserves, remaining resources and total resources as on 01.04.2020 vis-a-vis 01.04.2015 have been given in Tables - 1 and 2. The tables give an idea about the changes in terms of increase or decrease of resources as per lease status, grade and state. In Table-3, district wise reserves/resources as on 01.04.2020 have been given.

Out of the total 2,343,901 tonnes of total resources, 500,848 tonnes have been estimated in freehold and remaining 1,843,053 tonnes have been estimated in the leasehold (public) category. Of the total resources, Kerala is credited with 1,396,864 tonnes (60 %), followed by Odisha 866,919 tonnes (37%) and Tamil Nadu 80,118 tonnes (3 %)

The resources of zircon have been declined by 1,079,302 tonnes (32%) as compared to the earlier inventory as on 01.04.2015. These changes have occured mainly due to re-estimation/revision of resources as reported by M/s Indian Rare Earths Ltd. and KMML. However, resources from Odisha state increased slightly.

Of the total resources of zircon, about 1,067,226 tonnes (46%) have been estimated under inferred (333) and recconaissance (334) categories. These resources are based on a limited preliminary exploration. More over, the beach sand mineral deposit is replenishable & its availability is not fixed. Resources are estimated by exploration/expoitation agencies on the basis of past experience.

A total 24 deposits of zircon have been covered in NMI as on 01.04.2020, and out of these 24 deposits, 8 are in freehold and 16 deposits are in leasehold (public) categories.

Table - 1 : Reserves/Resources of Zircon as on 01.04.2020 vis-à-vis 01.04.2015
(By Lease Status/Grade)

(In Tonne)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change	01.04.2020	01.04.2015	Net change
All India : Total	**669,466**	**1,158,290**	**(-)488,824**	**1,674,435**	**2,264,913**	**(-)590,478**	**2,343,901**	**3,423,203**	**(-)1,079,302**
Unclassified	**669,466**	**1,158,290**	**(-)488,824**	**1,674,435**	**2,264,913**	**(-)590,478**	**2,343,901**	**3,423,203**	**(-)1,079,302**
Freehold	-	-	-	**500,848**	**346,598**	**(+)154,250**	**500,848**	**346,598**	**(+)154,250**
Unclassified	-	-	-	500,848	346,598	(+)154,250	500,848	346,598	(+)154,250
Leasehold (Public)	**669,466**	**1,158,290**	**(-)488,824**	**1,173,587**	**1,918,315**	**(-)744,728**	**1,843,053**	**3,076,605**	**(-)1,233,552**
Unclassified	669,466	1,158,290	(-)488,824	1,173,587	1,918,315	(-)744,728	1,843,053	3,076,605	(-)1,233,552

figures rounded off

Table – 2 : Total Resources of Zircon as on 01.04.2020 vis-à-vis 01.04.2015 (By States)

(In Tonne)

State	Total Resources		Net Change
	As on 01.04.2020	As on 01.04.2015	
All India : Total	**2,343,901**	**3,423,203**	**(-)1,079,302**
Kerala	1,396,864	2,759,107	(-)1,362,243
Odisha	866,919	488,876	(+)378,043
Tamil Nadu	80,118	175,220	(-)95,102

figures rounded off

Table - 3 : District wise Reserves/Resources of Zircon as on 01.04.2020

(In Tonne)

State/	District	Reserves	Remaining Resources	Total Resources
All India : Total		**669,466**	**1,674,435**	**2,343,901**
Kerala		**156,509**	**1,240,355**	**1,396,864**
	Alapuzha	-	67,157	67,157
	Kollam	156,509	1,173,198	1,329,707
Odisha		**476,672**	**390,247**	**866,919**
	Ganjam	476,672	350,947	827,619
	Puri	-	39,300	39,300
Tamil Nadu		**36,285**	**43,833**	**80,118**
	Kanyakumari	36,285	43,833	80,118

figures rounded off