

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 1.4.2015 are as follows:

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

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 asbestos 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 reconnaissance (334) categories.

Salient Features of the Inventory

All India total resources of asbestos are estimated at 22.95 million tonnes, of which 0.025 million tonnes have been categorised as reserves and 22.92 million tonnes as remaining resources. As far as the status of deposit wise resources are concerned, it is almost equally divided into freehold (47.9%) and private leasehold (52.1%).

All India scenario of asbestos 'reserves', 'remaining resources' and 'total resources' as on 1.4.2015 vis-a-vis 1.4.2010 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 1.4.2015 have been given.

Out of the total resources as on 1.4.2015, mixed amphibole grade is 53.96%, amosite 19.45%, tremolite 18.30% and the remaining 8.29% constitutes rest of the grades. Almost entire quantity of mixed amphibole grade is reported from Rajasthan and amosite grade from Karnataka. The share of chrysotile asbestos in the total resources is 3.62% only.

Out of the total resources, Rajasthan has a major share of 13.62 million tonnes (59.33%), followed by Karnataka 8.28 million tonnes (36.09%), Andhra Pradesh 0.83 million tonnes (3.65%), Jharkhand 0.15 million tonnes (0.67%) and remaining a meager 0.06 million tonnes are distributed in the states of Odisha and Uttarakhand.

In the inventory as on 1.4.2015, the resources of asbestos has increased by 0.78 million tonnes to 22.95 million tonnes in comparison to the previous inventory. All the increase was reported from Andhra Pradesh owing to reporting of 3 new deposits containing 0.78 million tonnes of resources.

Of the total resources of asbestos, a substantial quantity of 10.63 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.

Table - 1 : Reserves/Resources of Asbestos as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	Reserves			Remaining resources			Total resources			(In tonne)
	Reserves			Remaining resources			Total resources			
	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change	
All India : Total	24633	2510840	(-) 2486208	22922751	19655762	(+) 3266989	22947384	22166602	(+) 780782	
Crysotile	-	14782	(-) 14781	831905	75660	(-) 756245	831905	90442	(+) 741463	
Amosite	-	-	-	4463667	4463667	No Change	4463667	4463667	No Change	
Tremolite	-	-	-	4200109	4200109	No Change	4200109	4200109	No change	
Crysotile mixed with others	-	-	-	22516	22516	No Change	22516	22516	No Change	
Mixed Amphibole	-	2410102	(-) 2410102	12383632	9973530	(+) 2410102	12383632	12383632	No Change	
Actinolite	-	-	-	34311	34311	No change	34311	34311	No change	
Anthophyllite	-	-	-	20000	20000	No Change	20000	20000	No Change	
Others	-	-	-	432134	432134	No Change	432134	432134	No Change	
Not Known	-	85957	(-) 85957	463091	377134	(+) 85957	463091	463091	No Change	
Unclassified	24633	-	(+) 24633	71385	56700	(+)14685	96018	56700	(+) 39318	
Freehold	-	-	-	11001566	11001566	No change	11001566	11001566	No change	
Crysotile	-	-	-	58558	58558	No Change	58558	58558	No change	
Amosite	-	-	-	4463667	4463667	No Change	4463667	4463667	No Change	
Tremolite	-	-	-	3993722	3993722	No Change	3993722	3993722	No change	
Crysotile mixed with others	-	-	-	22516	22516	No Change	22516	22516	No Change	
Mixed Amphibole	-	-	-	2181301	2181301	No Change	2181301	2181301	No Change	
Actinolite	-	-	-	34311	34311	No change	34311	34311	No change	
Anthophyllite	-	-	-	20000	20000	No Change	20000	20000	No Change	
Unclassified	-	-	-	56700	56700	No Change	56700	56700	No Change	
Not Known	-	-	-	170791	170791	No change	170791	170791	No change	
Leasehold (Private)	24633	2510841	(-) 2486208	11921185	8654196	(+) 3266989	11945818	11165036	(+) 780782	
Crysotile	-	14782	(-) 14782	773348	17103	(+) 756245	773348	31884	(+) 741464	
Tremolite	-	-	-	206387	206387	No change	206387	206387	No change	
Mixed Amphibole	-	2410102	(-) 2410102	10202331	7792229	(+) 2410102	10202331	10202331	No change	
Unclassified	24633	-	(+) 24633	14685	-	(+) 14685	39318	-	(+) 39318	
Not Known	-	85957	(-) 85957	292300	206343	(+) 85957	292300	292300	No change	
Others	-	-	-	432134	432134	No change	432134	432134	No change	

figures rounded off

A total of 164 deposits of asbestos have been covered in inventory as on 1.4.2015. Of which 99 deposits are in freehold and 65 deposits in leasehold.

**Table – 2 : Total Resources of Asbestos as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

(In tonne)

State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India : Total	22947384	22166602	(+) 780782
Andhra Pradesh	837312	56531	(+)780782
Jharkhand	154893	154893	No Change
Karnataka	8282457	8282457	No Change
Odisha	56700	56700	No Change
Rajasthan	13615710	13615710	No Change
Uttarakhand	311	311	No Change

figures rounded off

Table - 3 : District wise Reserves/Resources of Asbestos as on 1.4.2015

(In tonne)

State/District	Reserves	Remaining Resources	Total Resources
All India : Total	24633	22922751	22947384
Andhra Pradesh	24633	812679	837312
Anantpur	24633	757282	781915
Cuddapah	-	55397	55397
Jharkhand	-	154893	154893
Singhbhum (East)	-	124059	124059
Singhbhum (West)	-	30834	30834
Karnataka	-	8282457	8282457
Chikmagalur	-	143667	143667
Hassan	-	3696700	3696700
Mandya	-	97250	97250
Mysore	-	24840	24840
Shimoga	-	4320000	4320000
Odisha	-	56700	56700
Keonjhar	-	56700	56700
Rajasthan	-	13615710	13615710
Ajmer	-	3458336	3458336
Bhilwara	-	270	270
Dungarpur	-	4167	4167
Pali	-	3142298	3142298
Rajsamand	-	3172041	3172041
Udaipur	-	3838598	3838598
Uttarakhand	-	311	311
Chamoli	-	311	311

figures rounded off

9.2 BORAX

Introduction

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 1.4.2010. Economically workable deposits of borax have not been established in India. The only deposit of borax is in Puga valley 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 1.4.2015 vis-a-vis 1.4.2010 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 1.4.2015 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 Categories.

**Table – 2 : Total Resources of Borax as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

(In tonne)			
State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India: Total	74204	74204	No Change
Jammu & Kashmir	74204	74204	No Change

figures rounded off

Table - 3 : District wise Reserves/Resources of Borax as on 1.4.2015

State/District	Reserves	Remaining Resources	(In tonne)
			Total Resources
All India : Total	-	74204	74204
Jammu & Kashmir	-	74204	74204
Leh	-	74204	74204

figures rounded off

Table - 1 : Reserves/Resources of Borax as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	(In tonne)							
	Reserves		Remaining resources			Total resources		
	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010
All India	-	-	-	74204	74204	No Change	74204	74204
Unclassified	-	-	-	74204	74204	No Change	74204	74204
Freehold	-	-	-	74204	74204	No Change	74204	74204
Unclassified	-	-	-	74204	74204	No Change	74204	74204

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 is used in filters, as an absorbent and an ultra fine abrasive. It is also called 'Kieselguhr'. It has a chemical composition $\text{SiO}_2 \cdot n\text{H}_2\text{O}$ 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 1.4.2015 have been placed under 'unclassified' grade.

Basis of Categorisation 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 1.4.2015 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 1.4.2015 vis-a-vis 1.4.2010, 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 1.4.2010. Changes are only in lease status i.e. leasehold (Public) to freehold, as lease surrendered due to poor quality & quantity of ore informed by RSMML. District wise resources of diatomite as on 1.4.2015 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 1.4.2015.

Table - 1 : Reserves/Resources of Diatomite as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	(In '000 tonnes)								
	Reserves			Remaining resources			Total resources		
	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change
All India : Total									
Un-classified	-	-	No change	2885	2885	No change	2885	2885	No change
Freehold/Un-classified	-	-	No change	2885	2251	(+)634	2885	2251	(+) 634
Leasehold (Public)/Un-classified	-	-	No change	-	634	(-) 634	-	634	(-) 634

figures rounded off

**Table – 2 : Total Resources of Diatomite as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

(In '000 tonnes)

State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India: Total	2885	2885	No change
Gujarat	811	811	No change
Rajasthan	2074	2074	No change

*figures rounded off***Table - 3 : District wise Reserves/Resources of Diatomite as on 1.4.2015**

(In '000 tonnes)

State/District	Reserves	Remaining Resources	Total Resources
All India : Total	-	2885	2885
Gujarat	-	811	811
Bhavnagar	-	811	811
Rajasthan	-	2074	2074
Barmer	-	1440	1440
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 resources are categorised into 'reserves' and 'remaining resources'.

According to the norms of this system reserves of fluorite have been placed under proved (111) and probable (121) 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 1.4.2015 vis-à-vis 1.4.2010 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 1.4.2015 have been given.

The total resources of fluorite in the country as on 1.4.2015 have been estimated at 18.2 million tonnes. Of this, 0.3 million tonnes (2%) are under reserve category and 17.9 million tonnes (98%) under remaining resource category.

Of the total resources, about 40% are in leasehold (Private 2.4% and Public 37.77%) and the rest 60% are in freehold.

Out of the total resources estimated as on 1.4.2015, about 14.7 million tonnes (81%) constitutes marketable grade, 3.2 million tonnes (17%) low grade and 0.4 million tonnes (2%) unclassified grade.

By states, Gujarat having 12 million tonnes accounted for 66 % of the total resources, followed by Rajasthan 5 million tonnes (29%), Chattisgarh 0.5 million tonnes (3%) and Maharashtra accounted for 0.4 million tonnes (2%) .

A decrease of 0.03 million tonnes resources of fluorite has been recorded in the inventory as on 1.4.2015 as compared to the previous inventory as on 1.4.2010. Out of the total decrease in resources, about 0.03 million tonnes (2%) have been accounted alone by Dongargaon Fluorite Mine of MSMC in Chandrapur

Table - 1 : Reserves/Resources of Fluorite as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	1.4.2015		Net change	1.4.2015		Net change	1.4.2015		Net change
	1.4.2015	1.4.2010		1.4.2015	1.4.2010		1.4.2015	1.4.2010	
All India : Total	288684	4712316	(-)4423632	17893423	13501587	(+)4391836	18182107	18213903	(-)31796
Marketable	288684	4712316	(-)4423632	14368666	9976831	(+)4391836	14689147	14657350	(-)31797
Low	-	-	-	3169481	3169481	No Change	3169481	3169481	No Change
Unclassified	-	-	-	355276	355276	No Change	355276	355276	No Change
Freehold	-	-	-	10874805	9710805	(+) 1164000	10874805	9710805	(+)1164000
Marketable	-	-	-	7704729	7081751	(+) 622987	7704729	7081751	(+)622978
Low	-	-	-	3125841	2584819	(+) 541022	3125841	2584819	(+)541022
Unclassified	-	-	-	44235	44235	No Change	44235	44235	No Change
Leasehold (Private)	-	35280	(-)35280	439641	404361	(+) 35280	439641	439641	No Change
Marketable	-	35280	(-)35280	84961	49681	(+) 35280	84961	84961	No Change
Low	-	-	-	43640	43640	No Change	43640	43640	No Change
Unclassified	-	-	-	311040	311040	No Change	311040	311040	No Change
Leasehold (Public)	288684	4677036	(-)4388352	6578977	3386421	(+)3193556	6867661	8063457	(-)1195796
Marketable	288684	4677036	(-)4388352	6578977	2845399	(+)37333578	6867661	7522435	(-)654774
Low	-	-	-	-	541022	(-)541022	-	541022	(-)541022

figures rounded off

district of Maharashtra. The entire decrease of resources in Chandrapur district is due to downward revision in the resources of existing deposit. A very minor decrease in resources has been reported from Gujarat and Rajasthan States.

Of the total resources of fluorite, about 3.67 million tonnes (20%) 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 29 deposits of fluorite have been covered in the inventory as on 1.4.2015. Out of this, 19 deposits are in freehold, 4 deposits in leasehold private and 6 deposits in leasehold public sector.

**Table – 2 : Total Resources of Fluorite as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

(In tonne)			
State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India Total	18182107	18213903	(-)31796
Chhattisgarh	545455	545455	No change
Gujarat	1204510	12005280	(-)770
Maharashtra	388684	418949	(-)30265
Rajasthan	5243458	5244219	(-)761

figures rounded off

Table -3 : District wise Reserves/Resources of Fluorite as on 1.4.2015

State/District	(In tonne)		
	Reserves	Remaining Resources	Total Resources
All India : Total	288684	17893423	18182107
Chhattisgarh	-	545455	545455
Rajnandgaon	-	545455	545455
Gujarat	-	12004510	12004510
Bharuch	-	1920	1920
Vadodara	-	12002590	12002590
Maharashtra	288684	100000	388684
Chandrapur	288684	100000	388684
Rajasthan	-	5243458	5243458
Ajmer	-	987	987
Dungarpur	-	3288862	3288862
Jalore	-	510787	510787
Jhunjhunu	-	733626	733626
Sikar	-	350000	350000
Sirohi	-	93917	93917
Udaipur	-	265280	265280

figures rounded off

9.5 LIMESTONE

Introduction

Limestone is a carbonate rock of sedimentary origin formed from solutions carrying calcium and magnesium carbonates. 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 or magnesite mixed with calcite. They are then termed as dolomite limestone and magnesium 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.

Basis of Grade Classification

The following end-use grade classification adopted in the inventory as on 1.4.2015 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/Beneficial)	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 ₂ O ₃	1%(max)
	Fe ₂ O ₃	1%(max)

7. Chemical	CaO	50%(min)
	SiO ₂	2%(max)
	Fe ₂ O ₃	0.25%(max)

8. Blendable	CaO	34%(min)
	MgO	4%(min)

Limestone deposit in Chhattisgarh, Gujarat, Himachal Pradesh, Madhya Pradesh, Maharashtra, Rajasthan, Jharkhand and Uttar Pradesh.

	CaO	35%(min)
	MgO	4%(min)
	SiO ₂	18%(max)
	Alkalies	0.5 (max)

Limestone deposit in Andhra Pradesh, Jharkhand, Kerala, Karnataka, Odisha and Tamil Nadu.

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.	

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 placed 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 1.4.2015 are estimated at 203,225 million tonnes, of which 16,335 million tonnes (8.03%) falls under 'reserve' category and 186,888 million tonnes (91.96%) are under 'remaining resource' category.

All India scenario of limestone 'reserves', 'remaining resources' and 'total resources' as on 1.4.2015 vis-a-vis 1.4.2010, 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 1.4.2015 have been given.

Out of the total resources, the share of freehold areas is 165,477 million tonnes (81.42%), leasehold public sector 5,341 million tonnes (2.63%) and leasehold private sector 32,408 million tonnes (15.95%).

Out of the total resources of limestone, chemical grade constitutes 5,452 million tonnes (2.68%), SMS

(OH) grade 5,065 million tonnes (2.49%), SMS (LD) grade 405 million tonnes (0.19%), SMS (OH & LD mixed) grade 167 million tonnes (0.08%), BF Grade 14,003 million tonnes (6.89%), SMS & BF mixed grade 1,339 million tonnes (0.65%), Cement (portland) grade 141,754 million tonnes (69.75%), Cement (blendable/beneficiable) grade 1475 million tonnes (0.72%), Cement (white) grade 130 million tonnes (0.06%), Cement (portland and white) grade 9,86 million tonnes (0.48%), BF & Cement mixed grade 213 million tonnes (0.10%), SMS, Chemical & paper grade 1,235 million tonnes (0.60%), Paper grade 922 million tonnes (0.45%), others, unclassified and not known grade 30,078 million tonnes (14.80%). Resources not reported under 'blendable' grade.

Karnataka is credited with 26.78% of the total resources estimated in the country, followed by Andhra Pradesh 12.26%, Rajasthan 11.99%, Gujarat 10.45%, Meghalaya 8.71%, Telangana 8.45%, Chhattisgarh 5.31%, Madhya Pradesh 4.59%, Himachal Pradesh 3.06%, Maharashtra 1.40%, Jammu & Kashmir 1.30%, Odisha 1%, Nagaland 0.86%, Tamil Nadu 0.78%, Uttarakhand 0.75% and Assam 0.72%. The balance about 1.41% resources have been accounted together by Arunachal Pradesh, Bihar, Daman & Diu, Haryana, Jharkhand, Kerala, Manipur, Puducherry, Sikkim, Uttar Pradesh and West Bengal.

State	(In million tonnes)						
	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	11797(466)	9024	20821	195(70)	2336	2531	(+)18290
Andhra Pradesh	3516(17)	1420	4936	2(2)	216	218	(+)4718
Arunachal Pradesh	1(1)	-	1	-	-	-	1
Assam	-	22	22	-	1	1	(+)21
Bihar	-	5	5	-	-	-	(-)5
Chhattisgarh	1065(37)	822	1887	2(2)	41	43	(+)1844
Gujarat	1374(29)	156	1530	64(20)	220	284	(+)1246
Himachal Pradesh	-	851	851	-	76	76	(+)775
Jammu & Kashmir	770(39)	497	1267	102 (31)	113	215	(+)1052
Jharkhand	2(4)	112	114	1(1)	23	24	(+)90
Karnataka	1203(8)	1646	2849	7(3)	607	614	(+)2235
Kerala	-	-	-	-	3	3	(-)3
Madhya Pradesh	1618(143)	539	2157	-	357	357	(+)1800
Maharashtra	59(8)	28	87	-	57	57	(+)30
Meghalaya	168(4)	64	232	-	34	34	(+)198
Nagaland	613(3)	106	719	-	5	5	(+)714
Odisha	65(12)	299	364	-	25	25	(+)339
Rajasthan	1112(5)	1657	2769	-	58	58	(+)2711
Tamil Nadu	231(155)	442	673	17(11)	106	123	(+)550
Telangana	-	346	346	-	394	394	(-)48
Uttar Pradesh	-	12	12	-	-	-	(+)12

figures rounded off

Table - 1 : Reserves/Resources of Limestone as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

(In million tonnes)											
Lease status/Grade	Reserves			Remaining resources			Total resources				
	1.4.2015		Net change	1.4.2015		Net change	1.4.2015		Net change		
All India : Total	16336	14926	(+)1409	186888	170009	(+)16879	203225	184935	(+)18290		
Chemical	378	237	(+)141	5073	4843	(+230)	5452	5080	(+372)		
SMS (OH)	999	1015	(-)16	4066	3998	(+)68	5065	5014	(+51)		
SMS(LD)	3	100	(-)97	402	197	(+205)	405	297	(+108)		
SMS(OH & LD Mixed)	-	23	(-)23	167	170	(-)3	167	193	(-)26		
BF	343	931	(-)588	13660	12771	(+889)	14003	13701	(+302)		
SMS & BF Mixed	170	219	(-)49	1169	1231	(-)62	1339	1450	(-)111		
Cement (Portland)	13616	11216	(+)2400	128138	113688	(+114450)	141754	124904	(+16850)		
Cement (Blendable/Beneficial)	300	315	(-)15	1175	596	(+579)	1475	911	(+564)		
Cement (white)	-	2	(-)2	130	128	(+2)	130	130	No Change		
Cement (Portland & White)	3	86	(-)83	983	976	(+7)	986	1062	(-)76		
BF & Cement Mixed	85	54	(+)31	128	110	(+18)	213	164	(+49)		
SMS, Chemical & paper	2	1	(+)1	1233	1232	(+1)	1235	1233	(+)2		
Paper	26	29	(-)3	897	897	No Change	922	926	(-)4		
Others	94	107	(-)13	3427	3861	(-)434	3521	3968	(-)447		
Unclassified	284	180	(+)104	24831	24238	(+593)	25114	24418	(+696)		
Not Known	32	411	(-)379	1411	1073	(+338)	1443	1484	(-)41		
Freehold	-	135	(-)135	165475	160713	(+)4762	165476	160848	(+)4628		
Chemical	-	-	-	3934	3965	(-)31	3934	3965	(-)31		
SMS (OH)	-	-	-	3966	3963	(+3)	3966	3963	(+3)		
SMS (LD)	-	-	-	291	191	(+100)	291	191	(+100)		
SMS (OH & LD Mixed)	-	-	-	167	167	No Change	167	167	No Change		
BF	-	-	-	12416	12414	(+2)	12416	12414	(+2)		
SMS & BF Mixed	-	-	-	1100	1170	(-)70	1100	1170	(-)70		
Cement (Portland)	-	135	(-)135	111231	107562	(+3669)	111231	107697	(+3534)		
Cement (Blendable/Beneficial)	-	-	-	368	315	(+)53	368	315	(+53)		
Cemet (White)	-	-	-	117	117	No Change	117	117	No Change		
Cement (Portland & White)	-	-	-	953	953	No Change	953	953	No Change		
BF & Cement Mixed	-	-	-	38	38	No Change	38	38	No Change		
SMS, Chemical & Paper	-	-	-	1232	1232	No Change	1232	1232	No Change		
Paper	-	-	-	788	788	No Change	788	788	No Change		
Others	-	-	-	3000	3029	(-)29	3000	3029	(-)29		
Unclassified	-	-	-	24527	24074	(+453)	24527	24074	(+453)		
Not Known	-	-	-	1349	735	(+614)	1349	735	(+614)		
(Contd.)											

(Contd.)

National Mineral Inventory - An Overview

Table-1 (Concl.)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change
Leasehold Public	2149	2816	(-)667	3191	1561	(+)1630	5341	4377	(+)964
Chemical	125	-	(+)125	58	4	(+)54	183	4	(+)179
SMS (OH)	144	180	(-)36	21	7	(+)14	165	187	(-)22
SMS (LD)	-	98	(-)98	106	-	(+)106	106	98	(+)8
BF	258	889	(-)631	1169	287	(+)882	1427	1176	(+)251
SMS & BF Mixed	92	184	(-)92	-	-	-	92	184	(-)92
Cement (Portland)	1486	1451	(+)35	1611	820	(+)791	3098	2271	(+)827
Cement (Blendable/Beneficiable)	23	2	(+)21	127	-	(+)127	150	2	(+)148
Cement (white)	-	-	No Change	1	1	No Change	1	1	No Change
BF & Cement Mixed	15	9	(+)6	50	7	(+)43	65	16	(+)49
Others	7	-	(+)7	44	435	(-)391	51	435	(-)384
Not Known	-	3	(-)3	3	-	(+)3	3	3	No Change
Leasehold Private	14187	11975	(+)2212	18222	7735	(+)10487	32408	19710	(+)12698
Chemical	254	236	(+)18	1081	874	(+)207	1335	1111	(+)224
SMS (OH)	855	835	(+)20	78	29	(+)49	934	864	(+)70
SMS (LD)	3	2	(+)1	5	6	(-)1	8	8	No Change
SMS (OH & LD Mixed)	-	23	(-)23	-	3	(-)3	-	26	(-)26
BF	86	42	(+)44	75	69	(+)6	161	111	(+)50
SMS & BF Mixed	78	36	(+)42	69	61	(+)8	147	97	(+)50
Cement (Portland)	12130	9629	(+)2501	15296	5307	(+)9989	27425	14936	(+)12489
Cement (Blendable/Beneficiable)	277	314	(-)37	680	281	(+)399	957	594	(+)363
Cement (white)	-	2	(-)2	12	10	(+)2	12	12	No Change
Cement (Portland & White)	3	86	(-)83	30	23	(+)7	33	109	(-)76
BF & Cement Mixed	71	45	(+)26	40	65	(-)25	111	110	(+)1
SMS, Chemical & Paper	2	1	(+)1	1	-	(+)1	3	1	(+)2
Paper	26	29	(-)3	109	109	No Change	134	138	(-)4
Others	87	107	(-)20	383	397	(-)14	470	504	(-)34
Unclassified	284	180	(+)104	304	163	(+)141	588	343	(+)245
Not Known	32	408	(-)376	59	338	(-)279	91	746	(-)655

figures rounded off

National Mineral Inventory - An Overview

A net increase of 18,290 million tonnes resources have been recorded in the inventory as on 1.4.2015 in comparison to the earlier inventory as on 1.4.2010. An account of these changes is illustrated in the following table :

About 130,788 million tonnes and 8,015 million tonnes resources have been estimated under inferred and reconnaissance categories respectively. These together constitute about 68% 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 1.4.2015, total 3,494 deposits have been covered. Of these 1,622 deposits are in freehold areas and the balance 1,872 deposits in leasehold areas (leasehold (public) - 83 deposits and leasehold (private) - 1,789 deposits).

**Table – 2 : Total Resources of Limestone as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

(In million tonnes)

State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India : Total	203225	184936	(+)18290
Andhra Pradesh	24922	20203	(+)4719
Arunachal Pradesh	483	483	No Change
Assam	1468	1447	(+)21
Bihar	861	856	(+)5
Chhattisgarh	10805	8959	(+)1846
Daman & Diu	129	129	No Change
Gujarat	21257	20011	(+)1246
Haryana	75	75	No Change
Himachal Pradesh	6224	5449	(+)775
Jammu & Kashmir	2643	1591	(+)1052
Jharkhand	724	634	(+)90
Karnataka	54435	52200	(+)2235
Kerala	194	197	(-)3
Madhya Pradesh	9342	7542	(+)1800
Maharashtra	2853	2822	(+)31
Manipur	46	46	No Change
Meghalaya	17704	17506	(+)198
Nagaland	1752	1038	(+)714
Odisha	2122	1783	(+)339
Puducherry	16	16	No Change
Rajasthan	24367	21660	(+)2707
Sikkim	2	2	No Change
Tamil Nadu	1600	1050	(+)550
Telangana	17186	17233	(-)47
Uttar Pradesh	428	416	(+)12
Uttarakhand	1543	1543	No Change
West Bengal	45	45	No Change

figures rounded off

Table - 3 : District wise Reserves/Resources of Limestone as on 1.4.2015

(In '000 tonnes)

State/District	Reserves	Remaining Resources	Total Resources
All India : Total	16335753	186888898	203224752
Andhra Pradesh	1408329	23513499	24921828
Anantapur	77654	269278	346932
Cuddapah	619634	3855629	4475263
Godavari (East)	-	780	780
Godavari (West)	-	3510	3510
Guntur	159673	4777161	4936834
Krishna	100065	428048	528113
Kurnool	450900	14147801	14598701
Nellore	-	11284	11284
Srikakulam	-	928	928
Visakhapatnam	137	16788	16925
Vizianagaram	267	2292	2558
Arunachal Pradesh	-	482796	482796
Dibang Valley	-	99510	99510
East Siang	-	1500	1500
Lohit	-	150000	150000
West Siang	-	225001	225001
Upper Subansiri	-	6785	6785
Assam	178088	1290258	1468346
Karbi Anglong	20680	93270	113950
North Cachar Hills	157408	1042988	1200396
Nowgong	-	154000	154000
Bihar	12715	847872	860587
Bhabua	-	101511	101511
Monghyr	-	13510	13510
Rohtas	12715	732851	745567
Chhattisgarh	1177885	9627377	10805262
Baloda Bazar	600083	1413319	2013402
Bastar	14485	1980264	1994749
Bemetara	6998	4352	11349
Bilaspur	-	2135037	2135037
Durg	348896	914290	1263186
Janjgir-Champa	61944	42798	104742
Kabirdham	2469	74617	77086
Raigarh	1081	85884	86966
Raipur	141291	2896554	3037846
Rajnandgaon	639	80261	80900
Daman & Diu	-	128670	128670
Daman	-	128670	128670
Gujarat	999804	20257514	21257318
Amreli	104863	357667	462530
Banaskantha	-	716066	716066
Bharuch	-	15850	15850
Bhavnagar	-	302465	302465
Gir Somnath	31343	8455	39798
Jamnagar	151054	137824	288877
Junagarh	100543	963185	1063728
Kheda	-	6310	6310
Kutch	418102	16422989	16841091

(Contd.)

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Table-3 (Contd.)

State/District	Reserves	Remaining Resources	Total Resources
Panchmahals	-	161810	161810
Porbandar	182635	646734	829369
Rajkot	-	22043	22043
Sabarkantha	-	482222	482222
Surat	11264	3511	14776
Vadodara	-	718	718
Valsad	-	9665	9665
Haryana	-	74677	74677
Ambala	-	16561	16561
Bhiwani	-	1929	1929
Mahendragarh	-	55331	55331
Panchkula	-	856	856
Himachal Pradesh	834938	5389231	6224169
Bilaspur	207810	504473	712283
Chamba	-	1285500	1285500
Kangra	-	180000	180000
Kulu	-	4060	4060
Mandi	-	549240	549240
Simla	-	805283	805283
Sirmur	137538	582947	720485
Solan	489590	1477728	1967318
Jammu & Kashmir	554404	2088214	2642618
Anantnag	114034	1286207	1400241
Baramula	-	27972	27972
Gandharbal	-	2730	2730
Kargil	-	11480	11480
Kathua	-	45411	45411
Kupwara	-	24520	24520
Leh	-	46091	46091
Poonch	-	9375	9375
Pulwama	128383	353027	481410
Rajauri	-	123621	123621
Srinagar	311987	124569	436556
Udhampur	-	33211	33211
Jharkhand	117288	606715	724003
Bokaro	123	1522	1644
Dhanbad	-	44	44
Garwah	82070	64153	146223
Giridih	-	1500	1500
Hazaribagh	1341	177554	178895
Palamau	8294	143551	151845
Ramgarh	-	28598	28598
Ranchi	-	68485	68485
Singhbhum (East)	-	32	32
Singhbhum (West)	25460	121276	146736
Karnataka	1576998	52858420	54435418
Bagalkot	168397	1607673	1776070
Belgaum	17699	2259844	2277543
Bellary	-	234	234
Bijapur	-	1232039	1232039
Chikmagalur	-	115	115
Chitradurga	9098	354262	363360
Dawangere	-	55560	55560
Gadag	-	263	263
Gulbarga	1354546	46845423	48199969
Hassan	-	1200	1200
Mysore	1683	3377	5060
North Kanara	990	139133	140123
Shimoga	10264	47893	58157
South Kanara	-	500	500

(Contd.)

National Mineral Inventory - An Overview

Table-3 (Contd.)

State/District	Reserves	Remaining Resources	Total Resources
Tumkur	14320	309042	323363
Udupi	-	1666	1666
Yadgir	-	197	197
Kerala	11472	182459	193931
Alapuzha (Alleppy)	1528	124232	125760
Ernakulam	-	130	130
Kannur	-	1450	1450
Kollam	-	3570	3570
Kottayam	30	6674	6704
Kozhikode	-	811	811
Malappuram	-	662	662
Palakkad	9914	44181	54095
Trissur	-	750	750
Madhya Pradesh	2455103	6886754	9341857
Balaghat	-	93992	93992
Chhindwara	-	1120	1120
Damoh	127009	1857432	1984441
Dhar	2213	272313	274526
Hoshangabad	-	142114	142114
Jabalpur	1686	55352	57038
Jhabua	-	19859	19859
Katni	404710	1044074	1448784
Khargaon (W Nimar)	-	250265	250265
Mandsaur	30706	141392	172098
Morena	-	352548	352548
Narasinhapur	702	8585	9287
Nimach	139324	118020	257344
Rewa	182422	51010	233432
Sagar	475	74715	75190
Satna	1517514	1822742	3340256
Sehore	-	23599	23599
Shahdol	-	400	400
Shyampur	-	51085	51085
Sidhi	48342	506138	554480
Maharashtra	607055	2246255	2853310
Ahmednagar	-	1132	1132
Chandrapur	517141	1659137	2176278
Dhulia	-	32070	32070
Gadchiroli	-	40000	40000
Nagpur	-	65370	65370
Nanded	-	3020	3020
Poona (Pune)	-	150	150
Sangli	-	1500	1500
Yeotmal	89914	443877	533791
Manipur	-	46053	46053
Chandel	-	4487	4487
Ukhrul	-	41566	41566
Meghalaya	225562	17478553	17704115
Garo Hills West	-	397698	397698
Jaintia Hills	55019	12725286	12780305
Khasi Hills (East)	147143	4151069	4298212
Khasi Hills (West)	23400	204500	227900
Nagaland	-	1752200	1752200
Kiphire	-	712125	712125
Phek	-	35075	35075
Tuensang	-	1005000	1005000

(Contd.)

National Mineral Inventory - An Overview

Table-3 (Contd.)

State/District	Reserves	Remaining Resources	Total Resources
Odisha	394442	1727264	2121706
Bargarh	15714	67769	83483
Jharsuguda	-	840	840
Koraput	87156	272058	359214
Malkangiri	-	430145	430145
Nawapara	1118	22281	23399
Sambalpur	-	3100	3100
Sundergarh	290453	931072	1221525
Puducherry	-	15732	15732
Puducherry	-	15732	15732
Rajasthan	4268382	20098465	24366847
Ajmer	39330	715330	754660
Alwar	-	27254	27254
Banswara	-	785071	785071
Baran	-	6300	6300
Bhilwara	-	403399	403399
Bikaner	-	4495	4495
Bundi	117787	1076400	1194187
Chittorgarh	1080612	2484663	3565275
Churu	-	128	128
Dungarpur	-	568	568
Jaipur	194041	106668	300709
Jaisalmer	1129035	8911385	10040420
Jhunjhunu	-	656215	656215
Jodhpur	-	71621	71621
Kota	107140	254998	362138
Nagaur	97230	1387191	1484422
Pali	959010	1224458	2183468
Sawai Madhopur	-	52494	52494
Sikar	47229	213377	260606
Sirohi	371905	666971	1038876
Udaipur	125063	1049481	1174544
Sikkim	-	2380	2380
Sikkim North	-	2380	2380
Tamil Nadu	473909	1126088	1599997
Ariyalur	145280	179534	324814
Coimbatore	14413	39867	54281
Cuddalore	-	39216	39216
Dindigul	87892	25396	113288
Kanchipuram	-	133	133
Karur	27804	210016	237820
Krishnagiri	62	120	182
Madurai	801	18629	19431
Nagapattinam	-	521	521
Namakkal	16825	9504	26329
Perambalur	60036	185331	245366
Ramnathapuram	-	12122	12122
Salem	12363	69785	82148
Sivaganga	384	-	384
Theni (Madurai)	-	7300	7300
Thiruvallur	-	71	71
Thiruvannamalai	-	1733	1733
Tiruchirapalli	28514	56642	85156
Tirunelveli	43967	176738	220704
Turicorin	17835	8203	26038
Vellore	-	4900	4900
Villupuram	-	2940	2940
Virudhunagar	17733	77386	95120

(Contd.)

National Mineral Inventory - An Overview

Table-3 (Concl.d.)

State/District	Reserves	Remaining Resources	Total Resources
Telangana	1026529	16159207	17185736
Adilabad	48167	799618	847785
Hyderabad	-	103810	103810
Karimnagar	22173	2593	24765
Mahbubnagar	-	181000	181000
Nalgonda	766459	14755767	15522225
Rangareddy	189730	316420	506150
Uttar Pradesh	12849	414878	427727
Sonbhadra	12849	414878	427727
Uttarakhand	-	1542760	1542760
Almora	-	135890	135890
Bageshwar	-	1051	1051
Dehradun	-	1228051	1228051
Nainital	-	10400	10400
Pauri Garhwal	-	65500	65500
Pithoragarh	-	76500	76500
Tehri Garhwal	-	25369	25369
West Bengal	-	44706	44706
Bankura	-	2154	2154
Purulia	-	42552	42552

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 1.4.2015 have been passed under unclassified grade.

Basis of Categorisation of Resources

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

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 pre-feasibility (211) category.

Salient Features of the Inventory

The total resources of marl in the country as on 1.4.2015 have been estimated at about 136 million tonnes. Out of these, about 124 million tonnes (91%) have been placed under 'reserves' category and the balance 12 million tonnes (9%) under 'remaining resources' category.

All India scenarios of marl reserves, remaining resources and total resources as on 1.4.2015 vis-a-vis 1.4.2010 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 1.4.2015 have been given.

The entire resources of marl have been reported from the state of Gujarat. Out of the total resources, about 78% have been estimated in Amreli district, 15% resources in Porbandar district, and remaining 7% in Junagarh and Jamnagar district. The entire resources of marl is under private leasehold.

A total of 8 deposits have been covered in National Mineral Inventory as on 1.4.2015 and all are in leasehold private areas.

Table - 1 : Reserves/Resources of Marl as on 1.4.2015 vis-a-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	1.4.2015	1.4.2010	Net Change	1.4.2015	1.4.2010	Net Change	1.4.2015	1.4.2010	Net Change
All India : Total	123855856	139976150	(-)16120294	11704870	11704870	-	135560726	151681020	(-)16120294
Unclassified	123855856	139976150	(-)16120294	11704870	11704870	-	135560726	151681020	(-)16120294
Leasehold / Private	123855856	139976150	(-)16120294	11704870	11704870	-	135560726	151681020	(-)16120294
Unclassified	123855856	139976150	(-)16120294	11704870	11704870	-	135560726	151681020	(-)16120294

figures rounded off

**Table – 2 : Total Resources of Marl as on 1.4.2015 vis-a-vis 1.4.2010
(By States)**

State			(In tonnes)
	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India : Total	135560726	151681020	(-) 16120294
Gujarat	135560726	151681020	(-) 16120294

*figures rounded off***Table - 3 : District wise Reserves/Resources of Marl as on 1.4.2015**

State/District			(In tonnes)
	Reserves	Remaining Resources	Total Resources
All India : Total	123855856	11704870	135560726
Gujarat	123855856	11704870	135560726
Amreli	93474260	11704870	105179130
Jamnagar	277	-	277
Junagarh	9486615	-	9486615
Porbandar	20894704	-	20894704

figures rounded off

9.7 PERLITE

Introduction

Perlite is a glassy rock of rhyolitic composition displaying typical perlite texture and contain generally higher water content than obsidian. It is a glassy mass of volcanic origin. 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°C to 1150°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 1.4.2015.

- | | |
|-----------------|--|
| 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 1.4.2015 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 1.4.2015 vis-a-vis 1.4.2010 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 1.4.2015 have been given.

The entire resources of perlite have been estimated in leasehold (private) in the state of Gujarat.

There is only one non-working leasehold private deposit in Rajkot district, Gujarat covered in National Mineral Inventory as on 1.4.2015. Hence the reserves of 428 thousand tonnes as per NMI as on 1.4.2010 has been shifted to 'remaining resources' category.

Table-1 : Reserves/Resources of Perlite as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	Reserves				Remaining resources				Total resources			
	1.4.2015		1.4.2010		1.4.2015		1.4.2010		1.4.2015		1.4.2010	
				Net change				Net change				Net change
All India : Total	-	428		(-) 428	2406	1978		(+) 428	2406	2406	2406	No Change
High	-	151		(-) 151	283	132		(+)151	283	283	283	No Change
Medium	-	182		(-)182	300	118		(+)182	300	300	300	No Change
Low	-	95		(-)95	152	57		(+)95	152	152	152	No Change
Unclassified	-	-		No Change	1671	1671		No Change	1671	1671	1671	No Change
Leasehold (Private)	-	428		(-) 428	2406	1978		(+) 428	2406	2406	2406	No Change
High	-	151		(-)151	283	132		(+)151	283	283	283	No Change
Medium	-	182		(-)182	300	118		(+)182	300	300	300	No Change
Low	-	95		(-) 95	152	57		(+)95	152	152	152	No Change
Unclassified	-	-		No Change	1671	1671		No Change	1671	1671	1671	No Change

figures rounded off

**Table –2 : Total Resources of Perlite as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

(In '000 tonnes)

State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India : Total	2406	2406	No Change
Gujarat	2406	2406	No Change

figures rounded off

Table -3 : District wise Reserves/Resources of Perlite as on 1.4.2015

(In '000 tonnes)

State/District	Reserves	Remaining Resources	Total Resources
All India : Total	-	2406	2406
Gujarat	-	2406	2406
Rajkot	-	2406	2406

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 only deposit 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 and the following classification in the National Mineral Inventory as on 1.4.2015 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 feasibility (211) and pre-feasibility (222) categories.

Salient Features of the Inventory

The total resources of rock salt in the country as on 1.4.2015 are estimated at 16.02 million tonnes. The entire resources are under remaining resource category. 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 1.4.2015 vis-a-vis 1.4.2010 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 1.4.2015 have been given.

Slightly decrease of about one thousand tonnes of rock salt resources has been recorded in comparison to earlier inventory as on 1.4.2010. This was due to downward revision in resources of Drang Salt Mine considering the production.

In the National Mineral Inventory as on 1.4.2015, total 02 leasehold (Public Sector) deposits have been covered.

**Table – 2 : Total Resources of Rock Salt as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

			(In '000 tonnes)
State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India :Total	16025	16026	(-)1
Himachal Pradesh	16025	16026	(-)1
figures rounded off			

figures rounded off

Table - 1 : Reserves/Resources of Rock Salt as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	(In '000 tonnes)					
	Reserves		Remaining resources		Total resources	
	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change
All India :Total	-	16026	(-)16026	16025	-	(+)16025
Graade I : (+) 60% NaCl	-	16026	(-)16026	16025	-	(+)16025
Leasehold/Public	-	16026	(-)16026	16025	-	(+)16025
Graade I : (+) 60% NaCl	-	16026	(-)16026	16025	-	(+)16025

figures rounded off

Table - 3 : District wise Reserves/Resources of Rock Salt as on 1.4.2015

State/District	(In '000 tonnes)		
	Reserves	Remaining Resources	Total Resources
All India : Total	-	16025	16025
Himachal Pradesh	-	16025	16025
Mandi	-	16025	16025

figures rounded off

9.9 VERMICULITE

Introduction

Vermiculite is a complex hydrated aluminum and magnesium silicate. Its average composition is represented by the formula $22\text{MgO} \cdot 5\text{Al}_2\text{O}_3 \cdot 22\text{SiO}_2 \cdot 4\text{H}_2\text{O}$. When heated, it exfoliates many times. Expansion below 8 times is considered as low. 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 to 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%
$\text{K}_2\text{O} + \text{Na}_2\text{O}$	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 (121) & (122) categories.

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

Salient Features of the Inventory

The total resources of vermiculite in the country as on 1.4.2015 are estimated at 2,352,467 tonnes. Out of this, 1,632,885 tonnes (69%) fall under reserves category and 719,582 tonnes (31%) under remaining resources.

All India scenario of vermiculite reserves, remaining resources and total resources as on 1.4.2015 vis-a-vis 1.4.2010 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 1.4.2015 have been given.

Of the total resources, 588,179 tonnes (25%) have been estimated under freehold areas, 1,530,001 tonnes (65%) under leasehold public sector and 234,287 tonnes (10%) under leasehold private sector areas .

Tamil Nadu alone is credited with 1,865,065 tonnes (79.3%) of total resources estimated in India. About 99% resources of vermiculite in Tamil Nadu are in Vellore district. Besides, resources have been estimated in Andhra Pradesh 272,066 tonnes (11.5%), Karnataka 133,740 tonnes (5.7%), Rajasthan 43,693 tonnes (1.9%), Jharkhand 30,048 tonnes (1.3%) and balance 7,855 tonnes (0.3%) is accounted together by other states namely Gujarat, Madhya Pradesh, and West Bengal .

A net decrease of 154,543 tonnes has been recorded in the inventory as on 1.4.2015 in comparison to the earlier inventory as on 1.4.2010.

Overall 180,545 tonnes decrease in resources as on 1.4.2015 has been recorded due to downward revision of estimates in the existing deposits. This decrease has been distributed at 83,082 tonnes in Nellore and Visakhapatnam districts of Andhra Pradesh, 93,060 tonnes in Mysore district, Karnataka and 4,403 tonnes in Vellore district Tamil Nadu.

Similarly about 26,002 tonnes resources have been increased due to upward revision of estimates and addition of one new deposit . This change has a share of 25,030 tonnes in Mysore district, Karnataka and 972 tonnes (new deposit) in Nellore district, Andhra Pradesh.

Table - 1 : Reserves/Resources of Vermiculite as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	Reserves				Remaining resources				Total resources				(In tonne)
	1.4.2015		1.4.2010		1.4.2015		1.4.2010		1.4.2015		1.4.2010		
				Net change				Net change				Net change	
All India : Total	1632885	1704007	(-)71122	719582	803003	(-)83421	2352467	2507010	(-)154543				
Refractory	42327	46455	(-)4128	807	807	No change	43134	47262	(-)4128				
Unclassified	1590558	1657552	(-)66994	718775	802196	(-)83421	2309333	2459748	(-)150415				
Freehold	-	-	-	588179	588179	No change	588179	588179	No change				
Unclassified	-	-	-	588179	588179	No change	588179	588179	No change				
Leasehold (Public)	1529194	1535844	(-)6650	807	807	No change	1530001	1536651	(-)6650				
Refractory	7180	19427	(-)12247	807	807	No change	7987	10234	(-)2247				
Unclassified	1522014	1526417	(-)4403	-	-	-	1522014	1526417	(-)4403				
Leasehold (Private)	103691	168163	(-)64472	130596	214017	(-)83421	234287	382180	(-)147893				
Refractory	35147	37028	(-)1881	-	-	-	35147	37028	(-)1881				
Unclassified	68544	131135	(-)62591	130596	214017	(-) 83421	199140	345152	(-)146012				

figures rounded off

National Mineral Inventory - An Overview

About 538,607 tonnes (23%) of the total resources of vermiculite is under inferred (333) category. 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 56 deposits have been covered in the inventory as on 1.4.2015, of these 35 deposits are in freehold areas and the balance 21 deposits in leasehold areas.

**Table – 2 : Total Resources of Vermiculite as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

(In tonne)

State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India : Total	2352467	2507010	(-)154543
Andhra Pradesh	272066	354176	(-)82110
Gujarat	1960	1960	No change
Jharkhand	30048	30048	No change
Karnataka	133740	201770	(-)68030
Madhya Pradesh	329	329	No change
Rajasthan	43693	43693	No change
Tamil Nadu	1865065	1869468	(-)4403
West Bengal	5566	5566	No change

figures rounded off

Table - 3 : District wise Reserves/Resources of Vermiculite as on 1.4.2015

(In tonne)

State/District	Reserves	Remaining Resources	Total Resources
All India : Total	1632885	719582	2352467
Andhra Pradesh	110871	161195	272066
Nellore	103691	145148	248839
Visakhapatnam	7180	16047	23227
Gujarat	-	1960	1960
Vadodara	-	1960	1960
Jharkhand	-	30048	30048
Giridih	-	28000	28000
Hazaribagh	-	2048	2048
Karnataka	-	133740	133740
Hassan	-	64580	64580
Mandya	-	1562	1562
Mysore	-	67598	67598
Madhya Pradesh	-	329	329
Jhabua	-	329	329
Rajasthan	-	43693	43693
Ajmer	-	30693	30693
Barmer	-	13000	13000
Tamil Nadu	1522014	343051	1865065
Dharmapuri	-	20000	20000
Tiruchirapalli	-	51	51
Vellore	1522014	323000	1845014
West Bengal	-	5566	5566
Bankura	-	5566	5566

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°C , 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 1.4.2015 have been placed as 'unclassified 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, reserves of zircon have been placed under proved (111) and probable (121) & (122) categories. The remaining resources have been placed under feasibility (211), prefeasibility (222), measured (331), indicated (332) & inferred (333) categories.

Salient Features of Inventory

The total resources as on 1.4.2015 of zircon in the country are estimated at 3,423,203 tonnes. These resources include 1,158,290 tonnes (34%) of reserves and 2,264,913 tonnes (66%) of remaining resources.

All India scenario of zircon reserves, remaining resources and total resources as on 1.4.2015 vis-a-vis 1.4.2010 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 1.4.2015 have been given.

Out of the total 3,423,203 tonnes of total resources, 346,598 tonnes have been estimated in freehold and remaining 3,076,605 tonnes have been estimated in the leasehold (public) category. Of the total resources, Kerala is credited with 2,759,107 tonnes (80.6%), followed by Odisha 488,876 tonnes (14.3%) and Tamil Nadu 175,220 tonnes (5.1%).

The resources of zircon have been increased by 289,250 tonnes (9.23%) as compared to the earlier inventory as on 1.4.2010. These changes have occurred due to reporting of 4 new freehold deposits in Ganjam & 1 new freehold deposit in Puri district of Odisha by Director of Geology, Govt. of Odisha and 1 new L/H public deposit in Kanyakumari district of Tamil Nadu was also reported by M/s Indian Rare Earths Ltd. However, no change in the resources was recorded in Kerala.

Of the total resources of zircon, about 1,044,554 tonnes (30.5%) have been estimated under inferred (333) category. These resources are based on a limited preliminary exploration. If these resources are explored further, the confidence level of resource estimation may improve.

A total 24 deposits of zircon have been covered in NMI as on 1.4.2015, and out of these 24 deposits, 6 are in freehold and 18 deposits are in leasehold (public) category.

Table - 1 : Reserves/Resources of Zircon as on 1.4.2015 vis-à-vis 1.4.2010
(By Lease Status/Grade)

Lease status/Grade	Reserves			Remaining resources			Total resources		
	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change	1.4.2015	1.4.2010	Net change
All India : Total	1158290	1347470	(-)189180	2264913	1786483	(+)478430	3423203	3133953	(+) 289250
Unclassified	1158290	1347470	(-)189180	2264913	1786483	(+)478430	3423203	3133953	(+) 289250
Freehold	-	-	-	346598	-	(+)346598	346598	-	(+)346598
Unclassified	-	-	-	346598	-	(+)346598	346598	-	(+)346598
Leasehold (Public)	1158290	1347470	(-)189180	1918315	1786483	(+)131832	3076605	3133953	(+)57398
Unclassified	1158290	1347470	(-)189180	1918315	1786483	(+)131832	3076605	3133953	(+)57398

figures rounded off

**Table – 2 : Total Resources of Zircon as on 1.4.2015 vis-à-vis 1.4.2010
(By States)**

(In tonne)

State	Total Resources		Net Change
	As on 1.4.2015	As on 1.4.2010	
All India : Total	3423203	3133953	(+)289250
Kerala	2759107	2759107	-
Odisha	488876	146085	(+)342791
Tamil Nadu	175220	228761	(-)53541

figures rounded off

Table - 3 : District wise Reserves/Resources of Zircon as on 1.4.2015

(In tonnes)

State/District	Reserves	Remaining Resources	Total Resources
All India : Total	1158290	2264913	3423203
Kerala	972624	1786483	2759107
Alapuzha	-	67157	67157
Kollam	972624	1719326	2691950
Odisha	146085	342791	488876
Ganjam	146085	303491	449576
Puri	0	39300	39300
Tamil Nadu	39581	135639	175220
Kanyakumari	39581	135639	175220

figures rounded off