7.1 ANDALUSITE

Introduction

Andalusite is an aluminium nesosilicate mineral with the chemical formula Al_2SiO_5. Andalusite is trimorphic with kyanite and sillimanite, being the lower pressure mid temperature polymorph. At higher temperatures and pressures, andalusite may convert to sillimanite. Thus, as with its other polymorphs, andalusite is an aluminosilicate index mineral, providing clues to depth and pressures involved in producing the host rock. Andalusite has a chemical composition of Al_2O_3. SiO_2. A clear variety first found in Andalusia, Spain can be cut into a gemstone. It is associated with mica schist which increases alkali content in ultimate product and so it has not been exploited economically so far. It is used in furnances, Kilns and other industrial processes.

Basis of Grade Classification

In the inventory as on 01.04.2020, the end-use grade classification of resources has been adopted based on Al_2O_3 content. The entire estimation is broadly classified under low grade which contains an average of (-) 40% Al_2O_3.

Basis of Categorisation of Resources

As per United Nations Framework Classification (UNFC), resources are broadly classified into 'reserves' and 'remaining resources'. The entire resources of andalusite come under 'Remaining Resource' category.

Further the resources of andalusite have been placed under inferred (333) & Recconaissance (334) category , based on the preliminary exploration carried out by Directorate of Geology & Mining, Uttar Pradesh and Jharkhand. These deposits contain andalusite having (-) 40% Al_2O_3 which is not suitable for refractory industry. Therefore, further detailed exploration in these areas to upgrade the confidence level of resources, may only be justified if the economics of utilisation of such materials are available.

Salient Features of the Inventory

The total resources of andalusite in the country as on 01.04.2020 are estimated in six freehold deposits located in Jharkhand & Uttar Pradesh and have been placed at 126.05 million tonnes in remaining resource category. There is a manifold increase of 97.85 million tonnes in the resources as compared to the inventory as on 01.04.2015. The increase in resources was entirely due to the receipt of 6 new freehold deposits. The Salaidih-Harwariya and four other deposits in Sonbhadra district, Uttar Pradesh constitutes the lion's share of the resources i.e. about 114.25 million tonnes (91 %) and the rest 11.8 milllion tonnes (9 %) are from Nagar-Untari area in Garwah district, Jharkhand. Occurrences of andalusite are also reported from Dantewara & Raipur district, Chhattisgarh, Malakangiri district, Odisha, Jhunjhunu, Nagaur and Tonk district, Rajasthan and Mirzapur & Sonbhadra district, Uttar Pradesh.

All India scenarios of andalusite resources as on 01.04.2020 vis-a-vis 01.04.2015 are given in Tables - 1 to 2. These tables give an idea about the significant changes if any in terms of increase or decrease of resources as per lease status, grade and state. In table 3 district wise resources have been given.

In the inventory as on 01.04.2020, total of resources have been estimated from 6 freehold deposits occuring in Garwah & Sonbhadra district of Jharkhand and Uttar Pradesh states respectively.

Table – 2 : Total Resources of Andalusite 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	**126,050**	**28,201**	**(+)97,849**
Jharkhand	11,800	4,001	(+)7,799
Uttar Pradesh	114,250	24,200	(+)90,050

figures rounded off.

Table - 1 : Reserves/Resources of Andalusite 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	**-**	**-**	**-**	**126,050**	**28,201**	**(+) 97,849**	**126,050**	**28,201**	**(+) 97,849**
Low Grade	-	-	-	126,050	4,000	(+) 122,050	126,050	4,000	(+) 122,050
Unclassified	-	-	-	-	24,201	(-)24,201	-	24,201	(-) 24,201
Freehold	**-**	**-**	**-**	**126,050**	**28,201**	**(+) 97,849**	**126,050**	**28,201**	**(+) 97,849**
Low Grade	-	-	-	126,050	4,000	(+) 122,050	126,050	4,000	(+) 122,050
Unclassified	-	-	-	-	40,201	(-) 24,201	-	24,201	(-) 24,201

figures rounded off.

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

(In '000 Tonnes)

State	District Name	Reserves	Remaining Resources	Total Resources
All India : Total		-	**126,050**	**126,050**
Jharkhand		-	**11,800**	**11,800**
	Garwah	-	11,800	11,800
Uttar Pradesh		-	**114,250**	**114,250**
	Sonbhadra	-	114,250	114,250

figures rounded off.

7.2 GRAPHITE

Introduction

Graphite, basically a refractory mineral is a variety of naturally occurring carbon. It is generally used in industries like dry cell battery, electrode, foundry, crucible, pencil, refractory, paints, lubricants, etc.

Although graphite occurs in a number of states in the country, deposits of economic importance are located in Andhra Pradesh, Jharkhand, Karnataka, Kerala, Odisha, Rajasthan and Tamil Nadu.

Flaky and amorphous graphite of high fixed carbon are imported to meet the domestic demand.

Basis of Grade Classification

Graphite occurs generally admixed with the country rock which often requires beneficiation for obtaining desired grade for various end uses. The end-use grade of graphite is generally based on the Fixed Carbon (F.C.) content.

The following grade classification has been adopted in the inventory as on 01.04.2020.

1. (+) 40% F.C.	This is the highest grade that has been reported to have been used in foundry/refractory.
2. (+) 10% to 40% F.C.	Techno-economic feasibility for beneficiation has been established and this grade is accepted as feed for beneficiation plants
3. Beneficiable	i) 2% F.C. (min) for flaky variety. ii) 10% F.C. (min) for amorphous variety.
4. Others	Estimation for those grades which could not be classified into the above grades.
5. Unclassified	The range of minimum and maximum values of fixed carbon (F.C.) are such that it cannot be classified under any of the above grades
6. Not known	Such estimation about which information/data is not available/ reported to classify it under any of the grades mentioned above

Basis of Categorisation of resources

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

According to the norms of this system, reserves of graphite 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

The total resources of graphite as on 01.04.2020 have been estimated at 212 million tonnes, out of which 9 million tonnes (4%) have been placed under 'reserves' and 203 million tonnes (96%) under 'remaining resources'.

All India scenario of graphite reserves, remaining resources and total resources as on 01.04.2020 vis-à-vis 01.04.2015 have been appended 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, districtwise reserves/ resources as on 01.04.2020 have been given.

Out of the total resources, about 180.66 million tonnes (85%) are in freehold, 24.54 million tonnes (12%) in leasehold private and the balance 6.43 million tonnes (3%) in leasehold public areas.

Out of the total resources estimated as on 01.04.2020, (+) 40% F.C. grade comprises 2.9 million tonnes (1%), (+)10 to 40% F.C. grade 43.98 million tonnes (21%), others grade 19.15 million tonnes (9%), unclassified grade 69.5 million tonnes (33%), not known grade 75.3 million tonnes (36 %) and beneficiable 0.79 million tonnes (0.4%).

Of the total resources, Arunachal Pradesh is credited with 76.3 million tonnes (36%) followed by Jammu & Kashmir 62.74 million tonnes (30%), Jharkhand 20.00 million tonnes & Odisha 19.98 million tonnes (9% each), Madhya Pradesh 12.64 million tonnes(6%), Tamil Nadu 9.70 million tonnes (5%) , Gujarat 3.36 million tonnes (2%) and the remaining 6.94 million tonnes (3%) are accounted together by eight states viz. Andhra Pradesh, Chhasttisgarh, Karnataka, Kerala, Maharashtra,Rajasthan,

Table - 1 : Reserves/Resources of Graphite 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	**8,563,411**	**7,960,793**	**(+)602,618**	**203,060,176**	**186,925,987**	**(+)16,134,189**	**211,623,587**	**194,886,779**	**(+)16,736,808**
+ 40% FC	1,387,851	1,802,824	(-)414,973	1,527,904	1,112,931	(+)414,973	2,915,755	2,915,755	No change
10-40% FC	7,175,560	5,437,219	(+)1,738,341	36,808,911	35,220,432	(+)1,588,479	43,984,471	40,657,651	(+)3,326,820
Beneficiable	-	-	-	793,330	-	(+)793,330	793,330	-	(+)793,330
Others	-	315,346	(-)315,346	19,153,359	7,053,188	(+)12,100,171	19,153,359	7,368,534	(+)11,784,825
Unclassified	-	405,404	(-)405,404	69,486,325	68,250,921	(+)1,235,404	69,486,325	68,656,325	(+)830,000
Not Known	-	-	-	75,290,347	75,288,514	(+)1,833	75,290,347	75,288,514	(+)1,833
Freehold	**-**	**-**	**-**	**180,662,578**	**164,592,308**	**(+)16,070,270**	**180,662,578**	**164,592,308**	**(+)16,070,270**
+40% F.C	-	-	-	539,662	94,167	(+)445,495	539,662	94,167	(+)445,495
10-40% F.C	-	-	-	20,545,665	15,896,704	(+)4,648,961	20,545,665	15,896,704	(+)4,648,961
Beneficiable	-	-	-	131,000	-	(+)131,000	131,000	-	(+)131,000
Others	-	-	-	15,709,998	6,598,312	(+)9,111,686	15,709,998	6,598,312	(+)9,111,686
Unclassified	-	-	-	68,613,173	66,880,990	(+)1,732,183	68,613,173	66,880,990	(+)1,732,183
Not Known	-	-	-	75,123,079	75,122,134	(+)945	75,123,079	75,122,134	(+)945
Leasehold (Private)	**5,463,218**	**4,389,352**	**(+)1,073,866**	**19,072,586**	**18,673,867**	**(+)398,719**	**24,535,803**	**23,063,219**	**(+)1,472,584**
+40% F.C	1,387,851	1,802,824	(-)414,973	988,242	1,018,764	(-)30,522	2,376,093	2,821,588	(-)445,495
10-40% F.C	4,075,367	1,865,778	(+)2,209,589	12,938,233	15,663,916	(-)2,725,683	17,013,599	17,529,694	(-)516,095
Beneficiable	-	-	-	662,330	-	(+)662,330	662,330	-	(+)662,330
Others	-	315,346	(-)315,346	3,443,361	454,876	(+)2,988,485	3,443,361	770,222	(+)2,673,139
Unclassified	-	405,404	(-)405,404	873,152	1,369,931	(-)496,779	873,152	1,775,335	(-)902,183
Not Known	-	-	-	167,268	166,380	(+)888	167,268	166,380	(+)888
Leasehold (Public)	**3,100,193**	**3,571,440**	**(-)471,247**	**3,325,013**	**3,659,812**	**(-)334,799**	**6,425,206**	**7,231,252**	**(-)806,046**
10-40% F.C	3,100,193	3,571,440	(-)471,247	3,325,013	3,659,812	(-)334,799	6,425,206	7,231,252	(-)806,046

figures rounded of

Telangana and Uttarakhand .

An increase of about 17 million tonnes of graphite resources has been recorded in the current inventory. The quantity under 'remaining resources' category has been increased by 16 million tonnes while that under 'reserves' category increased marginally by 1 million tonne as compared to 01.04.2015. Total 9 new deposits with 12.75 million tonnes of resources have been reported in the inventory as on 01.04.2020.

The increase in the resources has been reported from Arunachal Pradesh, Andhra Pradesh, Madhya Pradesh, Jharkhand, Karnataka, Odisha and Tamil Nadu. However, resources of Chhattisgarh and Kerala States have been decreased by a small quantity mainly due to production from leasehold deposits.

Of the total increase, about 7 million tonnes (41%) has been reported only from Madhya Pradesh. This increase is due to upward revision in the resources of existing freehold deposits.

About 3.6 million tonnes (21%) increase has been reported from Arunachal Pradesh. This increase is mainly due to addition of 2 new freehold deposits.

In Jharkhand, an increase of about 2.45 million tonnes (15%) and in Tamil Nadu an increase of 1.79 million tonnes (11%) resources have been reported. This increase is due to re-assessment of resources in the existing leasehold (Private) deposits, as well as addition of new freehold deposits.

Table No.2 gives as idea of statewise net increase or decrease of resources as compared to NMI as on 01.04.2015. Increase in resources is either due to addition of new deposits and/or re-estimation of resources while decrease is due to production/ depletion of resources.

About 174 million tonnes (82%) of the total resources have been estimated under inferred and reconnaisance categories. These resources are based on a limited and preliminary exploration. If these areas are explored in detail the confidence level of resource position of graphite in the country may enhance.

Total 312 deposits of graphite have been covered in the inventory as on 01.04.2020, of which 210 deposits are in freehold and 100 deposits in leasehold private and 2 deposits in leasehold public.

Table – 2 : Total Resources of Graphite 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	**211,623,587**	**194,886,779**	**(+) 16,736,808**
Andhra Pradesh	1,138,275	701,027	(+)437,248
Arunachal Pradesh	76,318,257	72,758,257	(+)3,560,000
Chattisgarh	6,612	7,341	(-)729
Gujarat	3,355,805	3,355,805	No Change
Jammu & Kashmir	62,740,555	62,740,555	No Change
Jharkhand	20,006,367	17,560,386	(+)2,445,981
Karnataka	992,632	399,406	(+)593,226
Kerala	1,434,975	1,436,050	(-)1,075
Madhya Pradesh	12,640,000	5,736,660	(+)6,903,340
Maharashtra	1,160,000	1,160,000	No Change
Odisha	19,981,121	18,968,239	(+)1,012,882
Rajasthan	1,913,554	1,913,554	No Change
Tamil Nadu	9,705,279	7,919,345	(+)1,785,934
Telangana	219,455	219,455	No Change
Uttarakhand	10,700	10,700	No Change

figures rounded off.

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

(In Tonne)

State	District	Reserves	Remaining Resources	Total Resources
India : Total		**8,563,411**	**203,060,176**	**211,623,587**
Andhra Pradesh		**-**	**1,138,275**	**1,138,275**
	Godavari East	-	1,088,571	1,088,571
	Godavari West	-	3,600	3,600
	Srikakulam	-	2,240	2,240
	Visakhapatnam	-	32,467	32,467
	Vizianagaram	-	11,397	11,397
Arunachal Pradesh		**-**	**76,318,257**	**76,318,257**
	Lohit	-	71,000,000	71,000,000
	East Siang	-	1,735,000	1,735,000
	Upper Subansiri	-	3,223,257	3,223,257
	West Siang	-	360,000	360,000
Chattisgarh		**5,282**	**1,330**	**6,612**
	Balrampur	5,282	1,330	6,612
Gujarat		**-**	**3,355,805**	**3,355,805**
	Panchmahals	-	3,355,805	3,355,805
Jammu & Kashmir		**-**	**62,740,555**	**62,740,555**
	Baramula	-	62,740,555	62,740,555
Jharkhand		**2,604,079**	**17,402,288**	**20,006,367**
	Palamau	2,406,745	15,849,093	18,255,838
	Latehar	197,334	1,553,195	1,750,529
Karnataka		**-**	**992,632**	**992,632**
	Kolar	-	18,200	18,200
	Mysore	-	974,432	974,432
Kerala		**15,443**	**1,419,532**	**1,434,975**
	Ernakulam	15,443	959,362	974,805
	Idukki (Iddiki)	-	357,806	357,806
	Kollam	-	73,000	73,000
	Kottayam	-	16,800	16,800
	Thiruvananthapuram	-	12,564	12,564
Madhya Pradesh		**-**	**12,640,000**	**12,640,000**
	Betul	-	12,496,000	12,496,000
	Sidhi	-	144,000	144,000
Maharashtra		**-**	**1,160,000**	**1,160,000**
	Sindhudurg	-	1,160,000	1,160,000
Odisha		**2,838,414**	**17,142,707**	**19,981,121**
	Bargarh	-	1,557,924	1,557,924
	Boudh	-	20,000	20,000
	Bolangir	-	4,424,919	4,424,919
	Kalahandi	-	1,034,756	1,034,756
	Kandhamal	-	812,030	812,030
	Koraput	-	2,557	2,557
	Nawapara	185,469	284,312	469,781
	Raygada	2,652,945	9,006,209	11,659,154
Rajasthan		**-**	**1,913,554**	**1,913,554**
	Ajmer	-	37,239	37,239
	Alwar	-	945	945
	Banswara	-	1,875,370	1,875,370
Tamil Nadu		**3,100,193**	**6,605,086**	**9,705,279**
	Madurai	-	41,110	41,110
	Ramnathapuram	-	4,973	4,973
	Sivaganga	3,100,193	6,556,403	9,656,596
	Vellore	-	2,600	2,600
Telangana		**-**	**219,455**	**219,455**
	Khammam	-	219,455	219,455
Uttarakhand		**-**	**10,700**	**10,700**
	Almora	-	10,700	10,700

figures rounded off.

7.3 KYANITE

Introduction

Kyanite is an important mineral composed of aluminium silicate (Al_2O_3, SiO_2) used for production of super duty refractory material viz. mullite ($3Al_2O_3$ SiO_2) for application in non-ferrous metallurgical and glass industries. When heated to about 1350°C, it converts into mullite and free silica. It is not a plastic material and is mixed with clay to make refractory products for electrical insulation, spark plugs, glass furnaces, tanks and pots, furnaces for high melting point alloys, pottery, kiln lining and laboratory wares. The advantage of kyanite refractory bricks are due to its lower co-efficient of expansion, higher firing range of temperature, greater durability, negligible change in volume after prolonged heating, more resistance to salt and very low co-efficient of splitting.

Kyanite mineralisation occurs in a number of states but major deposits are located in Jharkhand, Karnataka, Maharashtra, Rajasthan and Andhra Pradesh.

Basis of Grade Classification

Kyanite is used only in refractory industry. However, the resources have been classified, based on the Al_2O_3 content as high, medium, low, mixture of these grades and also as kyanite bearing rock which includes Quartz Kyanite rocks, Kyanite Gneiss rock and Kyanite schist. The resources estimated from beach sand have been placed as 'granular' variety. The specifications for the above terminologies are given below :

i) High Grade : Al_2O_3 (+) 58% ; Fe_2O_3 1% (max)

ii) Medium Grade : Al_2O_3 (+) 50% to 58% ; Fe_2O_3 1.5% (max)

iii) Low Grade : Al_2O_3 (+) 40% to 50%

iv) High & medium mixed : It is a combination of above two grades.

v) Medium & low mixed : It is a combination of two grades.

vi) Granular : Estimation from beach sand.

vii) Kyanite bearing rock : Kyanite containing (-) 40% Al_2O_3

viii) Others : Estimation that could not be classified into the above grades.

ix) Not known : Such estimation about which information / data is not available to classify it under any of the grades.

x) Unclassified : The range of maximum and minimum values 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), total resources are broadly classified into 'reserves' and 'remaining resources' category.

According to the norms of this system, 'reserves' of kyanite 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 kyanite in the country as on 01.04.2020 are estimated at 105,682 thousand tonnes. Of these, 847 thousand tonnes (0.80%) falls under reserves category and 104,835 thousand tonnes (99.20%) are under remaining resource category. About 95.4% of the total resources of kyanite are in freehold, 2.7% in leasehold (Private) and 1.9% in leasehold (Public) areas.

All India scenario of kyanite 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 states. In Table-3, district-wise reserves/ resources as on 01.04.2020 have been given.

Out of the total resources, high and medium grade together are merely 1.44%, low grade 8.18%, mixed grade 0.53%, quartz kyanite, kyanite gneiss and kyanite schist rock 88.21%, granular, others, unclassified and not known grades are 1.64%.

Table - 1 : Reserves/Resources of Kyanite 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	**846,865**	**688,079**	**(+)158,786**	**104,835,455**	**104,293,480**	**(+)541,975**	**105,682,321**	**104,981,559**	**(+)700,762**
High Grade	-	-	-	438,700	438,700	No change	438,700	438,700	No change
Medium Grade	368,562	261,839	(+)106,723	716,745	1,123,083	(-)406,338	1,085,307	1,384,922	(-)299,615
Low Grade	67,554	426,240	(-)358,686	8,577,045	7,982,972	(+)594,073	8,644,599	8,409,212	(+)235,387
High & Medium Mixed	-	-	-	141,390	354,221	(-)212,831	141,390	354,221	(-)212,831
Medium & Low Mixed	-	-	-	48,000	48,000	No change	48,000	48,000	No change
High, Medium & Low Mixed	-	-	-	368,378	368,378	No change	368,378	368,378	No change
Granular	1,620	-	(+)1,620	247,829	248,359	(-)530	249,449	248,359	(+)1,090
Quartz Kyanite Rocks	330,202	-	(+)330,202	82,550,736	81,105,358	(+)1,445,378	82,880,938	81,105,358	(+)1,775,580
Kyanite Gneiss Rock	-	-	-	5,370,800	5,370,800	No change	5,370,800	5,370,800	No change
Kyanite Schist	-	-	-	4,974,625	4,974,625	No change	4,974,625	4,974,625	No change
Others	78,865	-	(+)78,865	990,854	933,909	(+)56,945	1,069,719	933,909	(+)135,810
Not Known	-	-	-	410,353	1,345,075	(-)934,722	410,353	1,345,075	(-)934,722
Unclassified	63	-	(+)63	-	-	-	63	-	(+)63
Freehold	**-**	**-**	**-**	**100,844,927**	**100,669,240**	**(+)175,687**	**100,844,927**	**100,669,240**	**(+)175,687**
High Grade	-	-	-	380,080	380,080	No change	380,080	380,080	No change
Medium Grade	-	-	-	608,073	608,073	No change	608,073	608,073	No change
Low Grade	-	-	-	7,300,739	7,300,739	No change	7,300,739	7,300,739	No change
High & Medium Mixed	-	-	-	141,390	141,390	No change	141,390	141,390	No change
Medium & Low Mixed	-	-	-	48,000	48,000	No change	48,000	48,000	No change
High, Medium & Low Mixed	-	-	-	368,378	255,025	(+)113,353	368,378	255,025	(+)113,353
Granular	-	-	-	246,434	237,000	(+)9,434	246,434	237,000	(+)9,434
Quartz Kyanite Rocks	-	-	-	81,105,358	81,105,358	No change	81,105,358	81,105,358	No change
Kyanite Gneiss Rock	-	-	-	5,370,800	5,370,800	No change	5,370,800	5,370,800	No change
Kyanite Schist	-	-	-	4,974,625	4,974,625	No change	4,974,625	4,974,625	No change
Others	-	-	-	12,530	12,530	No change	12,530	12,530	No change
Not Known	-	-	-	288,520	235,620	(+)52,900	288,520	235,620	(+)52,900
Leasehold (Private)	**447,427**	**586,142**	**(-)138,715**	**2,353,501**	**2,200,945**	**(+)152,556**	**2,800,928**	**2,787,087**	**(+)13,841**
High Grade	-	-	-	58,620	58,620	No change	58,620	58,620	No change
Medium Grade	368,562	159,902	(+)208,660	108,672	515,010	(-)406,338	477,234	674,912	(-)197,678
Low Grade	-	426,240	(-)426,240	1,207,885	682,233	(+)525,652	1,207,885	1,108,473	(+)99,412
High , Medium & Low Mixed	-	-	-	-	23,703	(-)23,703	-	23,703	(-)23,703
Others	78,865	-	(+)78,865	978,324	921,379	(+)56,945	1,057,189	921,379	(+)135,810
Leasehold (Public)	**399,438**	**101,937**	**(+)297,502**	**1,637,027**	**1,423,295**	**(+)213,732**	**2,036,465**	**1,525,232**	**(+)511,233**
Medium Grade	-	101,937	(-)101,937	-	-	-	-	101,937	(-)101,937
Low Grade	67,554	-	(+)67,554	68,421	-	(+)68,421	135,975	-	(+)135,975
High & Medium Mixed	-	-	-	-	212,831	(-)212,831	-	212,831	(-)212,831
High Medium & Low Mixed	-	-	-	-	89,650	(-)89,650	-	89,650	(-)89,650
Granular	1,620	-	(+)1,620	1,395	11,359	(-)9,964	3,015	11,359	(-)8,344
Quartz Kyanite Rocks	330,202	-	(+)330,202	1,445,378	-	(+)1445378	1,775,580	-	(+)1,775,580
Not known	-	-	-	121,833	1,109,455	(-)987,622	121,833	1,109,455	(-)987,622
Unclassified	63	-	(+)63	-	-	-	63	-	(+)63

figures rounded off.

Of the four major states accounting about 96% of the total resources, Telangana is credited with 48,350 thousand tonnes (46%), followed by Andhra Pradesh 32,004 thousand tonnes (30%), Karnataka 13,173 thousand tonnes (12%), Jharkhand 8,275 thousand tonnes (8%) and the rest 4% resources are accounted for by Kerala, Maharashtra, Rajasthan, Tamil Nadu and West Bengal .

A net increase of about 700 thousand tonnes of resources has been recorded in comparison to the earlier inventory as on 01.04.2015. Out of the total increase in resources, about 20% is accounted by granular, low, others, quartz-kyanite rock and unclassified grades of kyanite.

In Jharkhand, an increase of about 681 thousand tonnes of resources has been recorded due to upward estimation of resources in two leasehold deposits in Singhbhum (East) district.

In Karnataka, about 122 thousand tonnes of resources have been decreased due to downward revision in two existing deposits in Mysore district.

In Maharashtra resources have been increased by 159 thousand tonnes due to upward revision of resources in three existing deposits in Bhandara district. In Andhra Pradesh, Rajasthan, Telangana and West Bengal resources were unchanged.

In Tamilnadu, 1.15 thousand tonnes of resources increased due to re-estimation of resources in freehold deposit and addition of two new leasehold deposits.

Of the total resources of kyanite, about 96,560 thousand tonnes (91%) resources have been estimated under inferred (333) category. These resources are based on very limited preliminary exploration. A detailed exploration in these areas may improve the confidence level of resources.

A total of 108 deposits of kyanite have been covered in inventory as on 01.04.2020 of which 82 deposits are in freehold and 26 deposits in leasehold (8 leasehold public and 18 leasehold private).

Table – 2 : Total Resources of Kyanite as on 01.04.2020 vis-a-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	**105,682,321**	**104,981,559**	**(+)700,762**
Andhra Pradesh	32,004,228	32,004,228	No Change
Jharkhand	8,274,560	7,593,755	(+)680,805
Karnataka	13,173,060	13,295,298	(-)122,238
Kerala	184,733	202,360	(-)17,627
Maharashtra	3,396,004	3,237,336	(+)158,668
Rajasthan	23,703	23,703	No Change
Tamil Nadu	249,512	248,359	(+)1,153
Telangana	48,350,000	48,350,000	No Change
West Bengal	26,520	26,520	No Change

figures rounded off.

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

(In Tonnes)

State	District	Reserves	Remaining Resources	Total Resources
All India : Total		**846,865**	**104,835,455**	**105,682,321**
Andhra Pradesh		**-**	**32,004,228**	**32,004,228**
	Nellore	-	3,430	3,430
	Prakasam (Ongole H.Q)	-	32,000,798	32,000,798
Jharkhand		**331,193**	**7,943,367**	**8,274,560**
	Saraikela-Kharaswan	-	975,184	975,184
	Singhbhum (East)	331,193	6,257,783	6,588,976
	Singhbhum(West)	-	710,400	710,400
Karnataka		**181,600**	**12,991,460**	**13,173,060**
	Chikmagalur	-	745,336	745,336
	Chitradurga	-	540,000	540,000
	Coorg	-	4,407,800	4,407,800
	Mandya	-	74,630	74,630
	Mysore	181,600	6,272,894	6,454,494
	Shimoga	-	107,800	107,800
	South Kanara	-	843,000	843,000
Kerala		**-**	**184,733**	**184,733**
	Kollam	-	174,733	174,733
	Thiruvananthapuram	-	10,000	10,000
Maharashtra		**332,389**	**3,063,615**	**3,396,004**
	Bhandara	332,389	3,063,615	3,396,004
Rajasthan		**-**	**23,703**	**23,703**
	Udaipur	-	23,703	23,703
Tamil Nadu		**1,683**	**247,829**	**249,512**
	Kanyakumari	1,683	10,829	12,512
	Tirunelveli	-	237,000	237,000
Telangana		**-**	**48,350,000**	**48,350,000**
	Khammam	-	48,350,000	48,350,000
West Bengal		**-**	**26,520**	**26,520**
	Purulia	-	26,520	26,520

figures rounded off.

7.4 MAGNESITE

Introduction

Magnesite, a magnesium carbonate ($MgCO_3$), usually occurs as a secondary deposit as veins and in an alteration product of ultrabasic rocks, serpentinite and other magnesium rich rock types. In India, deposits of commercial significance are located in Uttarakhand, Tamil Nadu, Karnataka & Rajasthan. Other states where resource estimates have been made are Jammu & Kashmir and Himachal Pradesh, with meagre amount in Andhra Pradesh & Kerala.

Magnesite in Uttarakhand and Tamil Nadu occurs as an alteration product of ultra basic rocks. Tamil Nadu Magnesite is characterised by high silica content and Uttarakhand magnesite by calcium, which are deleterious constituents.

The primary use of raw magnesite is in the calcination industry in which about 98% of raw magnesite is consumed. The dead-burnt magnesite (DBM) and fused magnesite are used in refractory industry for manufacturing various refractory products. The low calcined magnesite (caustic magnesia) is used in non-refractory uses and in the manufacture of sorel cement (magnesium oxychloride).

Basis of Grade Classification

The following end-use grade classification of magnesite has been adopted in the NMI as on 01.04.2020.

1. High Grade : Directly useable for making high grade DBM.
   - MgO - 45.5% min
   - SiO_2 - 2.5% max
   - CaO - 1.5% max

2. Medium Grade : Directly useable for making ordinary DBM.
   - MgO - 42.5% min
   - SiO_2 - 2.5% to 4% max
   - CaO - 1.5% max

3. Beneficiable/Low grade :

   a) MgO - 38 to below 42.5%
   Magnesite amenable to reduce silica content by simple dressing and sorting.

   b) MgO -35%,
   CaO-3% (max),
   Fe_2O_3-3% (max)
   This is beneficiated by flotation or other methods.

4. Others : Estimation of such grade through useable/marketable but cannot be classified into above grades.

5. Unclassified : Range of minimum and maximum values of the constituents are too wide to classify under above grades.

6. Not Known : Such estimation about which information/data is not available/ reported to be classified it under any of the grades.

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, the reserves of magnesite 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 magnesite in the country as on 01.04.2020 are estimated at about 459 million tonnes with 66 million tonnes (14%) under reserve category and the balance 393 million tonnes (86%) under remaining resources category. Out of the total resources, about 277 million tonnes (60%) are in freehold and 182 million tonnes (40%) in leasehold areas.

All India scenario of magnesite 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 changes in terms of increase or decrease of resources as per lease status, grade and state. In Table -3, district-wise reserves/resources have been given.

Of the total resources of magnesite, about 3.3 million tonnes (0.7%) constitutes high grade, 170.8 million tonnes (37.2%) medium grade, 155.7 million tonnes (33.9%) beneficiable/low grade, 118.2 million tonnes (25.8%) in mixed grade constituting high, medium & low grades. The balance 11 million tonnes (2.4%) are in others, unclassified and not known grades.

Table - 1 : Reserves/Resources of Magnesite 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	010.4.2015	Net change
All India : Total	**66,070**	**82,277**	**(-) 16,207**	**393,047**	**311,711**	**(+) 81,337**	**459,118**	**393,988**	**(+) 65,130**
High	-	-	-	3,336	3,249	(+) 87	3,336	3,249	(+) 87
Medium	63,849	79,174	(-) 5,325	106,968	27,318	(+) 79,650	170,818	106,492	(+) 64,326
Beneficial/Low	2,154	2,949	(-) 795	153,537	151,850	(+) 1,687	155,691	154,799	(+) 892
High & Medium mixed	-	-	-	2,339	2,339	No Change	2,339	2,339	-
Medium & Low mixed	-	-	-	115,910	115,910	No Change	115,910	115,910	-
Others	6	146	(-) 140	7,258	7,480	(-) 222	7,264	7,626	(-) 362
Unclassified	-	-	-	83	83	No Change	83	83	-
Not Known	60	8	(+) 52	3,617	3,482	(+) 135	3,677	3,491	(+) 186
Freehold	**-**	**-**	**-**	**276,746**	**274,646**	**(+) 2,100**	**276,746**	**274,646**	**(+) 2,100**
High	-	-	-	2	2	-	2	2	-
Medium	-	-	-	4,362	4,362	No Change	4,362	4,362	No Change
Beneficiable/Low	-	-	-	148,543	148,543	No Change	148,543	148,543	No Change
High & Medium mixed	-	-	-	2,313	2,313	-	2,313	2,313	-
Medium & Low mixed	-	-	-	115,910	115,910	-	115,910	115,910	-
Others	-		-	2,100	-	(+) 2,100	2,100	-	(+) 2,100
Unclassified	-	-	-	83	83	-	83	83	-
Not Known	-	-	-	3,433	3,433	-	3,433	3,433	-
Leasehold (Private)	**11,466**	**4,975**	**(+) 6,490**	**16,958**	**23,248**	**(-) 6,290**	**28,424**	**28,224**	**(+) 200**
High	-	-	No Change	124	36	(+) 88	124	36	(+) 88
Medium	9,245	2,049	(+) 7,196	7,113	12,965	(-) 5,852	16,358	15,015	(+) 1,343
Beneficial/Low	2,154	2,772	(-) 618	4,382	2,720	(+) 1,662	6,536	5,492	(+) 1,044
High & Medium mixed	-	-	-	26	26	No change	26	26	No change
Medium & Low mixed	-	-	-	-	-	No change	-	-	No change
Others	6	146	(-) 140	5,129	7,452	(-) 2,323	5,136	7,598	(-) 2,462
Not Known	60	8	(+) 52	184	49	(+) 135	244	58	(+) 186
Leasehold (Public)	**54,604**	**77,301**	**(-) 22,697**	**99,344**	**13,816**	**(+) 85,528**	**153,947**	**91,118**	**(+) 62,830**
High	-	-	-	3,210	3,210	-	3,210	3,210	-
Medium	54,604	77,124	(-) 22,520	95,494	9,991	(+) 85,503	150,097	87,116	(+) 62,981
Beneficial/Low	-	177	(-) 177	612	587	(+) 25	612	763	(-) 151
Others	-	-	-	28	28	No Change	28	28	-

figures rounded off.

The major resources of magnesite have been estimated in Uttarakhand,Rajasthan and Tamil Nadu . Out of these, Uttarakhand is credited with 239 million tonnes (52%) resources, followed by Tamil Nadu 155 million tonnes (34%), Rajasthan 54 million tonnes(12 %) and rest (2 %) is accounted for by other states viz. Andhra Pradesh, Himachal Pradesh, Jammu & Kashmir, Karnataka and Kerala.

A net increase of about 65 million tonnes resources of magnesite have been recorded in the inventory as on 01.04.2020 in comparison to 01.04.2015. This has resulted due to increase of 63 million tonnes resources in leasehold (public) areas and 2 million tonnes resources in freehold areas.

One new leasehold private deposit with estimated resources of 98 thousand tonnes has been reported in NMI as on 01.04.2020.

In Tamil Nadu, an overall sharp increase of 57 million tonnes of resources have been recorded due to upward revision in one leasehold public deposit and seven leasehold private deposits in Salem district, one leasehold private deposit in Tiruppur district and addition of one new leasehold private deposit in Karur district. However, downward revision mainly recorded in four leasehold deposits located in Karur,Namakkal,Salem & Tiruppur districts.

In Karnataka, there is nominal decrease of 0.44 million tonnes of resources due to downward revision of resources in 3 leasehold deposits in Mysore district. In Uttarakhand, 8 million tonnes of resources increased mainly due to upward estimation of resources of one leasehold public deposit in Bageshwar district. However, a minor change due to downward revision in resources of two leasehold private deposits in Pithorgarh district was also noticed. In Rajasthan, minor increase of 0.29 million tonne due to re-estimation of resources in two leasehold private deposits in Ajmer and Udaipur districts.

About 28% of the total resources of magnesite estimated in the country are under inferred (333) and reconnaissance (334) categories. These estimates are based on a very limited preliminary exploration. If these areas are examined for further detailed exploration, the confidence level of the magnesite resources may improve.

A total 133 deposits of magnesite have been covered in the NMI as on 1.4.2020; out of which 93 deposits are in freehold and 40 deposits in leasehold areas (leaseshold public-11 and leasehold private-29) including 1 new freehold deposit.

Table – 2 : Total Resources of Magnesite 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	**459,118**	**393,988**	**(+) 65,130**
Andhra Pradesh	80	80	No Change
Himachal Pradesh	298	298	No Change
Jammu & Kashmir	4,145	4,145	No Change
Karnataka	5,543	5,981	(-) 438
Kerala	40	40	No Change
Rajasthan	54,091	53,804	(+) 287
Tamil Nadu	155,486	98,226	(+) 57,260
Uttarakhand	239,434	231,413	(+) 8,021

Figures rounded off

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

(In '000 Tonnes)

State	District	Reserves	Remaining Resources	Total Resources
All India : Total		**66,070**	**393,047**	**459,118**
Andhra Pradesh		**-**	**80**	**80**
	Cuddapah	-	80	80
Himachal Pradesh		**-**	**298**	**298**
	Chamba	-	298	298
Jammu & Kashmir		**-**	**4,145**	**4,145**
	Kargil	-	-	-
	Leh	-	45	45
	Reasi	-	3,950	3,950
	Udhampur	-	149	149
Karnataka		**1,027**	**4,516**	**5,543**
	Coorg	-	75	75
	Mandya	-	820	820
	Mysore	1,027	3,621	4,648
Kerala		**-**	**40**	**40**
	Pallakad	-	40	40
Rajasthan		**-**	**54,091**	**54,091**
	Ajmer	-	6,460	6,460
	Dungarpur	-	45,000	45,000
	Pali	-	2,626	2,626
	Udaipur	-	5	5
Tamil Nadu		**55,084**	**100,402**	**155,486**
	Coimbatore	-	387	387
	Dharmapuri	-	8	8
	Karur	23	104	127
	Namakkal	4	376	380
	Nilgiris	-	161	161
	Salem	54,091	98,048	152,139
	Tiruchirapalli	-	27	27
	Tirunelveli	-	7	7
	Tiruppur	966	854	1,820
	Vellore	-	430	430
Uttarakhand		**9,959**	**229,476**	**239,434**
	Almora	-	2,500	2,500
	Bageshwar	8,790	76,528	85,318
	Chamoli	132	8,120	8,253
	Pithoragarh	1,037	142,327	143,364

figures rounded off.

7.5 SILLIMANITE

Introduction

Sillimanite is an aluminium silicate mineral similar in chemical composition to kyanite i.e. Al_2O_3 SiO_2. Theoretically it contains 62.93% Al_2O_3 and 37.07% SiO_2. The mode of occurrence, physical and optical properties are however different for these minerals. The decomposition of sillimanite occurs at a range of 1550^{0}C to 1650^{0}C. It is this property to withstand high temperature makes it suitable as a refractory in the form of high alumina refractory bricks. Its application in ceramics is, however, limited. Massive sillimanite is at present being mined in Bhandara district, Maharashtra. Granular variety is recovered as by-product of mining of beach sands from Kerala, Tamil Nadu and Odisha.

Basis of Grade Classification

In the inventory as on 01.04.2020 resources of sillimanite has been classified into the following grades:

I. Massive		
1. High Grade	Al_2O_3 (+)58% Fe_2O_3 1% (max)
2. Medium Grade	Al_2O_3 50% to 58% Fe_2O_3 1.5% (max)
3. Low Grade	Al_2O_3 40% to 50%
4. High & Medium Grade	
5. Medium & low Grade	
6. High, Medium & low Grade	
II. Granular	Sillimanite in beach sand has been classified as granular type Al_2O_3 58% (min) Fe_2O_3 0.75% (max)
III. Sillimanite Bearing Rock	The rock containing sillimanite with (-) 40% Al_2O_3
IV. Quartz Sillimanite Rock	
V. Others	Estimation of such grade though usable/ marketable but cannot be classified into the above grade.
VI. Unclassified	The minimum and maximum ranges of chemical constituents are too wide to be classified into any of the above grades.
VII. Not known	The information on chemical constituents is not available or potential/ actual use is not reported.

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 sillimanite 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 sillimanite in the country as on 01.04.2020 are estimated at 72,267 thousand tonnes. Of these 8,262 thousand tonnes (11.4%) fall under 'reserve' category and 64,005 thousand tonnes (88.6%) are under 'remaining resource' category.

All India scenario of sillimanite 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 states. In Table-3 district-wise reserves/ resources as on 01.04.2020 have been given.

Out of the total resources, about 59,875 thousand tonnes (83%) have been placed in freehold, 10,021 thousand tonnes (14%) in leasehold public areas and a negligible quantity of 2,372 thousand tonnes (3%) in leasehold private sector.

Sillimanite resources in the inventory have been broadly placed into three groups of grades namely Massive Sillimanite, Granular Sillimanite, Quartz sillimanite and Sillimanite bearing rocks. These are based on their natural occurrences. The largest share of Sillimanite in the total resources is held by granular variety 53,399 thousand tonnes (73.89%), followed by sillimanite bearing rocks

Table - 1 : Reserves/Resources of Sillimanite as on 01.04.2020 vis-à-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	**8,262,300**	**6,502,115**	**(+)1,760,185**	**64,005,091**	**63,702,027**	**(+)303,065**	**72,267,391**	**70,204,142**	**(+)2,063,250**
Massive High Grade	163,557	-	(+)163,557	11,903	11,903	-	175,460	11,903	(+)163,557
Massive Medium Grade	62,703	-	(+)62,703	33,705	33,705	-	96,408	33,705	(+)62,703
Massive Low Grade	38,000	59,021	(-)21,021	3,139,605	3,124,605	(+)15,000	3,177,605	3,183,626	(-)6,021
Massive High & Medium	-	-	-	19,800	19,800	-	19,800	19,800	No change
Massive Medium & Low	-	144,255	(-)144,255	-	-	-	-	144,255	(-)144,255
Massive High, Medium & low	-	-	-	38	38	-	38	38	No change
Granular High	7,994,582	6,285,399	(+)1,709,183	45,404,791	45,200,726	(+)204,065	53,399,373	51,486,125	(+)1,913,248
Quartz Sillimanite Rock	-	-	-	3,748,000	3,748,000	-	3,748,000	3,748,000	No change
Sillimanite Bearing Rock	-	-	-	11,450,000	11,450,000	-	11,450,000	11,450,000	No change
Others	-	-	-	11,070	11,070	-	11,070	11,070	No change
Unclassified	3,458	13,440	(-)9,982	84,000	-	(+)84,000	87,458	13,440	(+)74,018
Not Known	-	-	-	102,180	102,180	No change	102,180	102,180	No change
Freehold	-	-	-	**59,874,752**	**59,848,894**	**(+)25,858**	**59,874,752**	**59,848,894**	**(+)25,858**
Massive High Grade	-		-	11,903	-	(+)11,903	11,903		(+)11,903
Massive Medium Grade	-	-	-	33,705	20,569	(+)13,136	33,705	20,569	(+)13,136
Massive Low Grade	-	-	-	3,109,605	3,108,786	(+)819	3,109,605	3,108,786	(+)819
Massive High & Medium	-	-	-	19,800	19,800	No change	19,800	19,800	No change
Massive High, Medium & low	-	-	-	38	38	No change	38	38	No change
Granular High	-	-	-	41,399,521	41,399,521	No change	41,399,521	41,399,521	No change
Quartz Sillimanite Rock	-	-	-	3,748,000	3,748,000	No change	3,748,000	3,748,000	No change
Sillimanite Bearing Rock	-	-	-	11,450,000	11,450,000	No change	11,450,000	11,450,000	No change
Not Known	-	-	-	102,180	102,180	No change	102,180	102,180	No change
Leasehold (Private)	**1,752,537**	**2,082**	**(+)1,750,455**	**619,239**	**21,723**	**(+)597,516**	**2,371,776**	**23,805**	**(+)2,347,971**
Massive High Grade	82,512	-	(+)82,512	-	8,543	(-)8,543	82,512	8,543	(+)73,969
Massive Low Grade	-	-	-	-	819	(-)819	-	819	(-)819
Granular High	1,670,025	2,082	(+)1,667,943	608,169	1291	(+)606,878	2,278,194	3,373	(+)2274821
Others	-	-	-	11,070	11,070	-	11,070	11,070	No change
Leasehold (Public)	**6,509,763**	**6,500,033**	**(+)9,730**	**3,511,101**	**3,831,410**	**(-)320,309**	**10,020,864**	**10,331,443**	**(-)310,579**
Massive High Grade	81,045	-	(+)81,045	-	3,360	(-)3,360	81,045	3,360	(+)77,685
Massive Medium Grade	62,703	-	(+)62,703	-	13,136	(-)13,136	62,703	13,136	(+)49,567
Massive Low Grade	38,000	59,021	(-)21,021	30,000	15,000	(+)15,000	68,000	74,021	(-)6,021
Massive Medium & Low	-	144,255	(-)144,255	-	-	-	-	144,255	(-)144,255
Granular High	6,324,557	6,283,317	(+)41,240	3,397,101	3,799,914	(-)402,813	9,721,658	10,083,231	(-)361,573
Unclassified	3,458	13,440	(-)9,982	84,000	-	(+)84,000	87,458	13,440	(+)74,018

figures rounded off.

sillimanite bearing rocks 11,450 thousand tonnes (15.84 %), Quartz Sillimanite Rock 3,748 thousand tonnes (5.19%) and massive low grade 3,177 thousand tonnes(4.40%).

The state of Odisha has been endowed with the largest share of about 17,703 thousand tonnes (24.50%) of sillimanite in the country followed by Tamil Nadu 17,353 thousand tonnes (24.01%), Uttar Pradesh 11,450 thousand tonnes (15.84%), Andhra Pradesh 11,066 thousand tonnes (15.31%), and Kerala 6,919 thousand tonnes (9.57%). The balance 10.77% resources are accounted together by other states namely Assam, Jharkhand, Karnataka, Madhya Pradesh, Maharasthra, Meghalaya, Rajasthan and West Bengal.

In the inventory as on 01.04.2020, total resources of sillimanite inecreased by 2,063 thousand tonnes as compared to earlier inventory as on 01.04.2015. Total 2 new deposits with estimated resources of 166.51 thousand tonnes included in current inventory.

Maharashtra recorded a decrease of 6.5 thousand tonnes resources due to downward revision of resources of lease hold (Pvt.) deposits. In Odisha state, an increase of 46 thousand tonnes of resources has been recorded owing to revised upward estimation. Andhra Pradesh recorded a considerable increase of 2,275 thousand tonnes of sillimanite resources due to re-estimation of resources in leasehold private deposit in Srikakulam district.Tamil Nadu state reported a decline of 108 thousand tonnes resources due to downward revision in estimates of leasehold deposits of Kanyakumari district. A downward revision of resources in Chavara lease of KMML was also recorded. This has resulted in decline of resources in current inventory of Kerala state by 226 thousand tonnes as compared to earlier inventory as on 01-04-2015. In Meghalaya, an increase of 83 thousand tonne of resources was recorded due to addition of one new deposit. Resources quantity of Sillimanite have not been changed in the states of Assam, Jharkhand, Karnataka, Madhya Pradesh, Rajasthan, Uttar Pradesh and West Bengal.

A sizeable quantity of 20,527 thousand tonnes (28%) of sillimanite resources has been estimated under inferred and reconnaissance categories which are based on a limited preliminary exploration. Out of this, about 53,399 thousand tonnes resources are granular variety estimated in beach sand.

A total of 47 deposits have been covered in the inventory as on 01.04.2020. Out of this, 31 deposits are in freehold and 16 deposits are in leasehold areas (03 leasehold private and 13 leasehold public).

Table – 2 : Total Resources of Sillimanite 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	**72,267,391**	**70,204,142**	**(+)2,063,250**
Andhra Pradesh	11,065,764	8,790,943	(+)2,274,821
Assam	4,604,700	4,604,700	No change
Jharkhand	83,000	83,000	No change
Karnataka	982,725	982,725	No change
Kerala	6,919,167	7,144,941	(-)225,774
Madhya Pradesh	101,600	101,600	No change
Maharashtra	212,328	218,856	(-)6,528
Meghalaya	138,319	55,807	(+)82,512
Odisha	17,703,193	17,657,186	(+)46,007
Rajasthan	819	819	No change
Tamil Nadu	17,352,777	17,460,565	(-)107,788
Uttar Pradesh	11,450,000	11,450,000	No change
West Bengal	1,653,000	1,653,000	No change

figures rounded off.

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

(InTonne)

State	District	Reserves	Remaining Resources	Total Resources
All India : Total		**8,262,300**	**64,005,091**	**72,267,391**
Andhra Pradesh		**1,670,025**	**9,395,739**	**11,065,764**
	Godavari (West)	-	8,776,500	8,776,500
	Srikakulam	1,670,025	608,169	2,278,194
	Visakhapatnam	-	11,070	11,070
Assam		**-**	**4,604,700**	**4,604,700**
	Karbi Anglong	-	2,054,700	2,054,700
	Nowgong	-	2,550,000	2,550,000
Jharkhand		**-**	**83,000**	**83,000**
	Hazaribagh	-	83,000	83,000
Karnataka		**-**	**982,725**	**982,725**
	Hassan	-	12,000	12,000
	Mysore	-	965,925	965,925
	South Kanara	-	4,800	4,800
Kerala		**553,000**	**6,366,167**	**6,919,167**
	Alapuzha (Alleppy)	-	32,814	32,814
	Kollam	553,000	2,964,153	3,517,153
	Thiruvananthapuram	-	3,369,200	3,369,200
Madhya Pradesh		**-**	**101,600**	**101,600**
	Sidhi	-	101,600	101,600
Maharashtra		**181,748**	**30,580**	**212,328**
	Bhandara	181,748	30,000	211,748
	Chandrapur	-	580	580
Meghalaya		**82,512**	**55,807**	**138,319**
	Khasi Hills West	82,512	55,807	138,319
Odisha		**5,640,985**	**12,062,208**	**17,703,193**
	Deogarh	-	1,275,000	1,275,000
	Ganjam	5,640,985	10,787,208	16,428,193
Rajasthan		**-**	**819**	**819**
	Udaipur	-	819	819
Tamil Nadu		**134,030**	**17,218,747**	**17,352,777**
	Kanyakumari	134,030	159,847	293,877
	Karur	-	4,000	4,000
	Tirunelveli	-	17,054,900	17,054,900
Uttar Pradesh		**-**	**11,450,000**	**11,450,000**
	Sonbhadra	-	11,450,000	11,450,000
West Bengal		**-**	**1,653,000**	**1,653,000**
	Midnapur	-	1,653,000	1,653,000

figures rounded off.