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(Part- III : MINERAL REVIEWS)

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KYANITE, SILLIMANITE AND ANDALUSITE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
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30 Kyanite, Sillimanite and Andalusite

Kyanite, sillimanite and andalusite are three aluminium silicate minerals having the same chemical composition ($Al_2O_3.SiO_2$) but differing in physical properties. These minerals are also known as 'super-refractories' in view of their special refractory properties. These minerals have special property of undergoing conversion into mullite ($3Al_2O_3.2SiO_2$) and vitreous silica (cristobalite) on heating between 1350^0C and 1500^0C. The conversion takes place with about 20% increase in volume and hence it is necessary to calcine these minerals before use. Mullite (artificial) is the most important constituent of refractory products as it shows little or no softening below its melting point (1810^0C). After calcination of these minerals, the mullite obtained is characterised by good high temperature insulation of electricity, increase in firing range and temperature, high mechanical strength, low thermal expansion, good resistance to thermal shock of cooling and heating and good resistance to corrosion. It also does not spall. It is not a plastic mineral and is mixed with clay to make refractory products for electrical insulators and spark plugs, glass furnaces, tanks and pots, furnaces for high melting point alloys and pottery kiln linings, saggers and laboratorywares.

RESOURCES

Kyanite

The total resources of kyanite as per UNFC system as on 1.4.2010 in the country are placed at 103.24 million tonnes. Out of these resources, only 1.57 million tonnes are the reserves and 101.67 million tonnes are the remaining resources. Out of total resources, high and medium-grade resources together account for merely 1.5%, low grade 7.6%, mixed grade 0.8%, quartz kyanite gneiss and kyanite schist rock 88.6% and granular, others and not-known grades 1.6%. Statewise, share of Telangana is 47% of total resources followed by Andhra Pradesh 31%, Karnataka 13% and Jharkhand 6%. Remaining 3% resources are in Kerala, Maharashtra, Rajasthan, Tamil Nadu and West Bengal (Table - 1).

Sillimanite

The total resources of sillimanite as per UNFC system in the country as on 1.4.2010 are placed at 66.98 million tonnes. Out of these resources, the reserves are only 4.08 million tonnes, while about 62.90 million tonnes are the remaining resources. Out of total resources, more than 72.1% are granular high-grade, while quartz sillimanite rocks and sillimanite bearing rocks are about 22.69%. Resources of massive sillimanite of all grades are about 5.0%. The resources are located mainly in Tamil Nadu (26%), Odisha (20%), Uttar Pradesh (17%), Andhra Pradesh (14%), Kerala (11%) and Assam (7%). Remaining 5% resources are in Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Rajasthan and West Bengal (Table-2).

Andalusite

The total resources of andalusite in the country as on 1.4.2010 as per UNFC system are placed at 18.5 million tonnes. There are no reserves. The resources are of inferred category located in Uttar Pradesh and Jharkhand (Table-3).

EXPLORATION & DEVELOPMENT

The exploration was carried out by the Geological Survey of India at Banwarjharia-Mairpur area, Mahakoshal Group, in Sonbhadra district of Uttar Pradesh to delineate and assess the andalusite bearing zones. Details of exploration are furnished in Table-4.

Table – 1 : Reserves/Resources of Kyanite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/State	Reserves				Remaining Resources								Total Resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
All India : Total	**551529**	**524485**	**498839**	**1574853**	**322622**	**25917**	**1238407**	**578607**	**3590902**	**95914312**	**-**	**101670767**	**103245620**
By Grades													
High grade	-	-	-	-	-	4317	21867	-	297827	114689	-	438700	438700
Medium grade	266698	-	83851	350549	33295	-	252334	-	34410	430511	-	750550	1101099
Low grade	17609	-	12663	30272	276230	21600	953600	386247	2228400	3948492	-	7814569	7844841
High & medium mixed	-	100550	53103	153653	-	-	-	-	93640	106928	-	200568	354221
Medium & low mixed	-	-	-	-	-	-	-	-	-	48000	-	48000	48000
High, medium & low mixed	-	89650	-	89650	13097	-	10606	-	45000	210025	-	278728	368378
Granular	-	-	-	-	-	-	-	-	167000	81359	-	248359	248359
Quartz kyanite rock	-	-	-	-	-	-	-	-	-	81105358	-	81105358	81105358
Kyanite gneiss rock	-	-	-	-	-	-	-	-	-	5370800	-	5370800	5370800
Kyanite schist	-	-	-	-	-	-	-	-	724625	4250000	-	4974625	4974625
Others	-	-	-	-	-	-	-	-	-	12530	-	12530	12530
Not-known	267222	334285	349222	950729	-	-	-	192360	-	235620	-	427980	1378709
By States													
Andhra Pradesh	-	-	-	-	-	-	399	-	-	32003829	-	32004228	32004228
Jharkhand	267222	524485	402325	1194032	-	-	41384	-	1754900	3040283	-	4836567	6030599
Karnataka	-	-	-	-	309525	21600	18843	386247	1610502	10688721	-	13035438	13035438
Kerala	-	-	-	-	-	-	-	192360	-	10000	-	202360	202360
Maharashtra	284307	-	96514	380821	-	4317	1167175	-	58500	1713600	-	2943592	3324413
Rajasthan	-	-	-	-	13097	-	10606	-	-	-	-	23703	23703
Tamil Nadu	-	-	-	-	-	-	-	-	167000	81359	-	248359	248359
Telangana	-	-	-	-	-	-	-	-	-	48350000	-	48350000	48350000
West Bengal	-	-	-	-	-	-	-	-	-	26520	-	26520	26520

Figures rounded off.

Table – 2 : Reserves/Resources of Sillimanite as on 1.4.2010
(By Grades/States)

(In tonnes)

Grade/States	Reserves				Remaining Resources								Total Resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**1693000**	**1602228**	**789824**	**4085052**	**317869**	**124000**	**20082855**	**4579816**	**17795772**	**16152473**	**3849600**	**62902385**	**66987437**
By Grades													
Massive high grade	-	-	-	-	-	-	-	-	-	11903	-	11903	11903
Massive medium grade	-	-	-	-	-	4000	-	-	-	29705	-	33705	33705
Massive low grade	5139	-	2056	7195	300	-	519	-	850000	2259814	-	3110633	3117828
Massive high & medium	-	-	-	-	-	-	-	-	-	19800	-	19800	19800
Massive medium & low	140005	-	56002	196007	-	-	-	-	-	1120	-	1120	197127
Massive high, medium & low	-	-	-	-	-	-	-	-	-	38	-	38	38
Granular high	1547856	1602228	731766	3881850	317569	120000	20082336	2479816	7595708	13829577	-	44425006	48306856
Quartz sillimanite rock	-	-	-	-	-	-	-	-	-	-	3748000	3748000	3748000
Sillimanite bearing rock	-	-	-	-	-	-	-	2100000	9350000	-	-	11450000	11450000
Not-known	-	-	-	-	-	-	-	-	64	516	101600	102180	102180
By States													
Andhra Pradesh	518000	-	170000	688000	-	-	-	-	7430300	1526200	-	8956500	9644500
Assam	-	-	-	-	-	-	-	-	850000	6700	3748000	4604700	4604700
Jharkhand	-	-	-	-	-	-	-	-	-	83000	-	83000	83000
Karnataka	-	-	-	-	-	-	-	-	-	982725	-	982725	982725
Kerala	698056	-	-	698056	317569	120000	-	2479816	165408	3369200	-	6451993	7150049
Madhya Pradesh	-	-	-	-	-	-	-	-	-	-	101600	101600	101600
Maharashtra	145144	-	58058	203202	-	-	-	-	64	2664	-	2728	205930
Meghalaya	-	-	-	-	-	-	-	-	-	55807	-	55807	55807
Odisha	-	1602228	-	1602228	-	-	6557013	-	-	4943600	-	11500613	13102841
Rajasthan	-	-	-	-	300	-	519	-	-	-	-	819	819
Tamil Nadu	331800	-	561766	893566	-	4000	13525323	-	-	3529577	-	17058900	17952466
Uttar Pradesh	-	-	-	-	-	-	-	2100000	9350000	-	-	11450000	11450000
West Bengal	-	-	-	-	-	-	-	-	-	1653000	-	1653000	1653000

Figures rounded off.

Table – 3 : Reserves/ Resources of Andalusite as on 1.4.2010

(In '000 tonnes)

State	Total Reserves (A)	Remaining Resources		Total Resources (A+B)
		Inferred STD333	Total (B)	
All India : Total	**–**	**18450**	**18450**	**18450**
By Grades				
Low	-	18450	18450	18450
By States				
Jharkhand	–	4000	4000	4000
Uttar Pradesh	–	14450	14450	14450

Table – 4 : Details of Exploration Activities for Kyanite, Sillimanite and Andalusite , 2014-15

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Andalusite							
GSI							
Uttar Pradesh							
Sonbhadra	Banwarjharia Mairpur area (Mahakoshal Group)	-	-	-	-	-	G-4 stage investigation was carried out in this area. Investigation area is occupied mainly by meta-sediments of Parsoi Formation and younger acid and basic intrusives as well as granitoids of Dudhi Granitoid Complex. Occurrences of two andalusite deposits were noticed. viz. Rantola-Katauli in west and Banwarjharia-Kurgi in east, which occurs as porphyroblasts within phyllite and schists of Parsoi Formation of Mahakoshal Group. Andalusite is also noted within pegmatite and quartz veins intruding phyllite. The andalusite bearing phyllite and schist forms a linear ridge in ENE-WSW direction covering an area of 33.59 sq km. The andalusite is mainly "chiastolite" variety. The resources were estimated per metre depth for 33.59 sq km is 7.7 million tonnes approximately with grade 8.43% (Wt%) by weighted average method. The resource estimated for placer andalusite is 0.03 million tonnes approximately for average thickness of gravel beds-1.00 m for an area of 0.15 sq km.

PRODUCTION, STOCKS & PRICES

Kyanite

The production of kyanite at 6,260 tonnes in 2014-15, increased by 70% as compared to the previous year due to re-opening of a mine in Karnataka towards the end of previous year. There were 3 reporting mines during the year under review as against 4 mines in the previous year. Two principal producers contributed almost the entire production of kyanite during the year (Tables- 5 to 7).

In 2014-15, the entire production of kyanite was of grade 40% Al_2O_3 and above and the production was reported by the private sector.

Mine-head closing stocks at the end of the year 2014-15 were 15,605 tonnes as against 10,032 tonnes in 2013-14 (Table - 8).

The average daily employment of labour was 52 in 2014-15 as against 64 in the preceding year. Prices of kyanite are furnished in the General Review on 'Prices'.

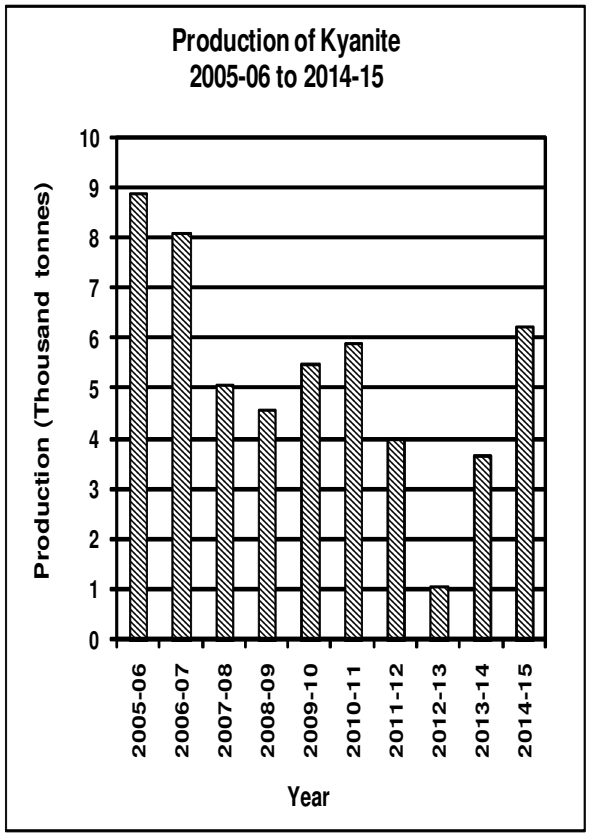

Table – 5 : Producers of Kyanite, 2014-15

Name & address of producers	Location of mine	
	State	District
Pavri Kyanite Mines, Cimmco House, A-1 Indrasagar Apartment, Ravindranath Tagore Marg, Civil Lines, Nagpur- 440 001, Maharashtra.	Maharashtra	Bhandara
Mr.Mohammad Akram Rasheed 3, Marcha Halli, H.D. Kote, Mysuru- 571 125, Karnataka.	Karnataka	Mysuru

Table – 6 : Production of Kyanite, 2012-13 to 2014-15 (By States)

(Qty in tonnes; Value in ₹ '000)

State	2012-13		2013-14		2014-15 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1048**	**1248**	**3679**	**8071**	**6260**	**10716**
Jharkhand	1015	1204	-	-	-	-
Karnataka	-	-	1416	708	4400	3520
Maharashtra	33	44	2263	7363	1860	7196

Table – 7 : Production of Kyanite, 2013-14 and 2014-15 (By Sectors/States/Districts/Grades)

(Qty in tonnes; Value in ₹ '000)

State/District	2013-14					2014-15 (P)				
	No. of mines	Quantity			Value	No. of mines	Quantity			Value
		40% & above Al_2O_3	Below 40% Al_2O_3	Total			40% & above Al_2O_3	Below 40% Al_2O_3	Total	
India	**4**	**3196**	**483**	**3679**	**8071**	**3**	**6260**	**-**	**6260**	**10716**
Public sector	1	-	142	142	159	-	-	-	-	-
Private sector	3	3196	341	3537	7912	3	6260	-	6260	10716
Karnataka	**1**	**1416**	**-**	**1416**	**708**	**1**	**4400**	**-**	**4400**	**3520**
Mysuru	1	1416	-	1416	708	1	4400	-	4400	3520
Maharashtra	**3**	**1780**	**483**	**2263**	**7363**	**2**	**1860**	**-**	**1860**	**7196**
Bhandara	3	1780	483	2263	7363	2	1860	-	1860	7196

Table – 8 : Mine-head Closing Stocks of Kyanite, 2013-14 and 2014-15 (By States/Grades)

(Qty in tonnes)

State	2013-14			2014-15 (P)		
	40% & above Al_2O_3	Below 40% Al_2O_3	Total	40% & above Al_2O_3	Below 40% Al_2O_3	Total
India	**1778**	**8254**	**10032**	**6025**	**9580**	**15605**
Jharkhand	-	1327	1327	-	2652	2652
Karnataka	1500	6444	7944	5738	6444	12182
Maharashtra	278	483	761	287	484	771

Sillimanite

The production of sillimanite at 66,025 tonnes in 2014-15 recorded a decrease of 2% as compared to the previous year. There were 4 reporting mines in the current as against 5 reporting mines in the previous year. Besides, three mines reported production of sillimanite as an associated mineral with garnet and kyanite during 2014-15.

Ninety eight percent of total production during the year was contributed by three producers. About 40 % of total production of sillimanite was reported by the public sector, while remaining 60 % of production was reported by the private sector. Andhra Pradesh, the main producing state contributed 51% of the total production of sillimanite in 2014-15 followed by Odisha(28%), Kerala (12%) and Maharashtra (9%) (Tables - 9 to 11).

Mine-head closing stocks for the year 2014-15 were 17,932 tonnes as against 15,103 tonnes in the previous year (Table - 12).

The average daily employment of labour during 2014-15 was 2,017 as against 2,166 in the previous year. Domestic prices of sillimanite are furnished in the General Review on 'Prices'.

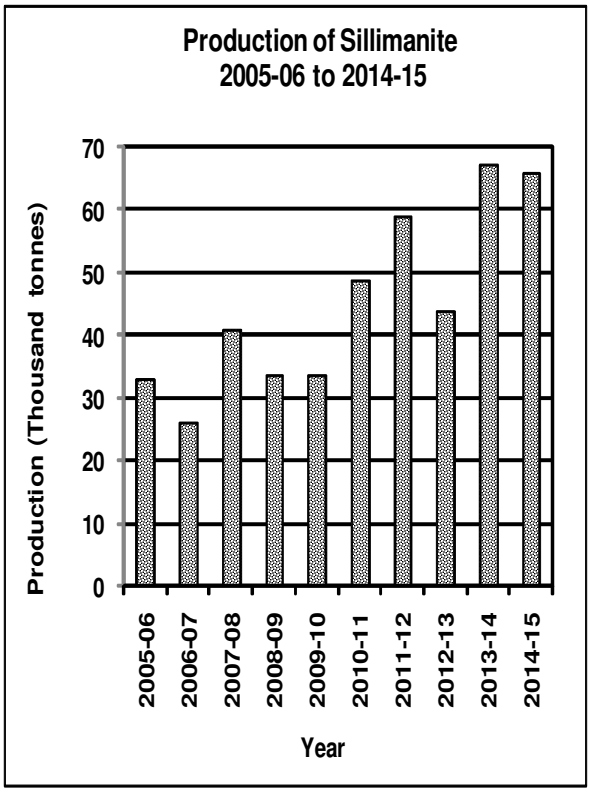

Table – 9 : Producers of Sillimanite, 2014-15

Name & address of producers	Location of mine	
	State	District
Indian Rare Earths Ltd, Plot No. 1207, Veer Sawarkar Marg, Near Siddhi Vinayak Temple, Prabhadevi, Mumbai-400 028, Maharashtra.	Odisha Kerala	Ganjam Kollam
#Trimex Sands Private Limited, 3rd Floor, Serene Tower, Banjara Hills, Hyderabad, Andhra Pradesh.	Andhra Pradesh	Srikakulam
*Pavri Kyanite Mines, Salpekar Building, Rani Jhansi Square Sitabuldi, Nagpur- 440 012 Maharashtra.	Maharashtra	Bhandara

 # Producing as an associated mineral with garnet.

** Producing as an associated mineral with kyanite.*

Table 10– : Production of Sillimanite, 2012-13 to 2014-15 (By States)

(Qty in tonnes; Value in ₹'000)

State	2012-13		2013-14		2014-15 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**43736**	**352062**	**67265**	**408247**	**66025**	**470599**
Andhra Pradesh	23896	205289	43705	277396	33801	265716
Kerala	4936	44424	5109	44635	7690	69271
Maharashtra	2590	3923	6729	9964	6223	9538
Odisha	12314	98426	11722	76252	18311	126074

Table 11– : Production of Sillimanite, 2013-14 and 2014-15 (By Sectors/States/Districts)

(Qty in tonnes; Value in ₹'000)

State/District	2013-14			2014-15 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**5(3)**	**67265**	**408247**	**4(3)**	**66025**	**470599**
Public sector	5	16914	121017	4	26276	195967
Private sector	(3)	50351	287230	(3)	39749	274632
Andhra Pradesh	**(1)**	**43705**	**277396**	**(1)**	**33801**	**265716**
Srikakulam	(1)	43705	277396	(1)	33801	265716
Kerala	**2**	**5109**	**44635**	**2**	**7690**	**69271**
Kollam	2	5109	44635	2	7690	69271
Maharashtra	**2(2)**	**6729**	**9964**	**1(2)**	**6223**	**9538**
Bhandara	2(2)	6729	9964	1(2)	6223	9538
Odisha	**1**	**11722**	**76252**	**1**	**18311**	**126074**
Ganjam	1	11722	76252	1	18311	126074

Figures in parentheses indicate the number of associated mines with garnet and kyanite

Table 12 – : Mine-head Closing Stocks of Sillimanite 2013-14 & 2014-15 (By States)

(In tonnes)

State	2013-14	2014-15 (P)
India	**15103**	**17932**
Andhra Pradesh	3894	1168
Kerala	1106	3562
Maharashtra	9686	9940
Odisha	100	2945
Rajasthan	317	317
Tamil Nadu	-	-

Andalusite

There was no production of andalusite in the country since 1988.

MINING & MARKETING

Kyanite

Kyanite mines are worked by opencast manual as well as semi-mechanised methods. Generally, the mineral is marketed under three grades: 60% Al_2O_3 and above, 50-60% Al_2O_3 and less than 50% Al_2O_3. These three grades are used in the manufacture of refractories.

Sillimanite

Sillimanite mines are also worked by opencast method. Pohra mine of Maharashtra State Mining Corporation Ltd is semi-mechanised.

Granular sillimanite is obtained from beach sands in Kerala, Odisha and Tamil Nadu as a by-product along with ilmenite, rutile, zircon, garnet, etc. while recovering monazite. The Odisha Sands Complex of IREL in the coastal region of Chatrapur in Ganjam district, Odisha, has the capacity to recover 10,000 tpy granular sillimanite at present. At Chatrapur, mining is carried out by suction dredging with gravel pump. IREL's Chavara plant in Kollam district, Kerala, presently has an installed capacity of 10,000 tpy granular sillimanite.

At Chavara in Kerala, beach sand mining operations are carried out by IREL in two stages: (i) by means of bulldozers and wheel loaders, and subsequently

loading by front-end loaders, wheel loaders and belt conveyors; and (ii) upgrading it to around 93% heavy minerals at Dredge & Wet Concentration Plant and concentrate upgrading unit. The Mineral Recovery Plant (MRP) essentially consists of a dredging system to mine the deposit and a pre-concentration system to separate the valuable minerals and dispose off the waste at the same place from where it was mined. The two systems are mounted on a combined floating platform which keeps moving with the progress of mining. For details regarding mining and processing, etc. of beach sand minerals, review on 'Ilmenite and Rutile' may be referred.

USES

Kyanite, sillimanite and andalusite are mainly used in refractories and ceramic products because of their ability to form mullite phase at high temperature. These are used to manufacture refractory products like dense bricks, insulating bricks, monolithic & castables. Sillimanite refractory bricks are extensively used in steel and glass industries and also in ceramics, cement kilns, heat treatment furnaces and petrochemical industries.

SPECIFICATIONS

BIS has prescribed IS:14301-1995 (reaffirmed in 2011) for kyanite used in refractory industry. There are two grades i.e. Grade-1 and Grade-2. Composition of kyanite under this specification is Al_2O_3 58% min for Grade-1 and 54% min for Grade-2; Fe_2O_3 1.50% max, $K_2O + Na_2O$ 1% max; other constituents as agreed between the supplier and purchaser and PCE not less than 36 (for Grade-1) and 35 (for Grade-2). Size of the material is 50 to 150 mm or 10 to 50 mm.

BIS has laid down IS:14302-1995 (reaffirmed in 2011) in respect of beach sand sillimanite for use in refractory industry, while IS:2045-1962 in respect of natural sillimanite blocks for glass melting tanks furnaces has been withdrawn.

CONSUMPTION

Kyanite

The consumption of kyanite in various industries was 2,900 tonnes in 2014-15 which is about 3% less than previous year. Entire consumption of kyanite was accounted for by the refractory industry (Table-13).

Sillimanite

The consumption of sillimanite was 21,900 tonnes in 2014-15 increased by about 5% over the previous year. Refractory industry alone accounted for about 91% consumption (Table-13).

Table – 13 : Consumption* of Kyanite and Sillimanite 2012-13 to 2014-15* (By Industries)

(In tonnes)

Industry	2012-13	2013-14(R)	2014-15(P)
Kyanite			
All Industries	**3000**	**3000**	**2900**
Refractory	3000(21)	3000(21)	2900(22)
Sillimanite			
All Industries	**19600**	**20900**	**21900**
Abrasive	100(1)	100(1)	100(1)
Ceramic	1600(4)	1600(4)	1600(4)
Chemical	200(1)	200(1)	200(1)
Refractory	17700(27)	19000(28)	20000(28)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector.

(Paucity of data, hence consumption may not be complete).*

WORLD REVIEW

World reserve of kyanite and related minerals is large in the USA. Andalusite is limited to only a few countries. The main producer and exporter of andalusite is South Africa. USA and India are the main producers of kyanite. India is the leading producer of sillimanite. World production of kyanite and related minerals is given in Table-14.

Table – 14 : World Production of Kyanite and Related Minerals (By Principal Countries)

(In tonnes)

Country	2012	2013	2014
Brazil			
Kyanite[(e)]	200	200	200
France			
Andalusite[(e)]	68000	68000	68000
India*			
Kyanite	1048	1922	2000[e]
Sillimanite	43736	61597	76480
South Africa			
Andalusite[e]	265000	270000	270000
USA			
Kyanite[(a)]	99000	110000	100000[e]

Source: *World Mineral Production, 2010-2014.*
(a). Including related minerals.
(b). Including beneficiated & directly shipped material.
** India's production of kyanite during 2012-13, 2013-14 and 2014-15 was 1,048 tonnes, 3,679 tonnes,and 6,260 tonnes respectively, while that of sillimanite was 43,736 tonnes,67,265 tonnes and 66,025 tonnes, respectively.*

A steady increase in the world's steel industry and less availability of refractory grade bauxite increased the demand of andalusite.

China

China is supposed to produce kyanite, but its production data is not available since 2003. A production capacity of 40,000 tonnes per year was reported for Yilong Andalusite Mineral Co. (a subsidiary of Imerys SA, Paris, France) in the Xinjiang Uyghur Autonomous Region of north-western China.

France

Imerys Refractory Minerals (a member of Imerys Group), which produces andalusite under the trade name Kerphalite[T] opened a new andalusite mine pit at its Glomel Mine, in Brittany (Imerys Refractory SA, 2014).

Peru

Andalusita S.A. continued development and production from its mine in north-western Peru, 20 km from the deep seas port Paita in unconsolidated sand and gravel of the Tablazo Mancora flood plain .A primary andalusite poduct graded 59% to 60% Al_2O_3 with a maximum 0.85% iron oxide was prouduced for refractory consumers. Plant capacity is planned to increase between 48,000 and 60,000 tonnes per year.

Latin Resources Ltd (Perth,Western Australia) continued exploration and development at the Guadalupito iron and mineral sands project, near the port town of Chimbote.

The Los Conchales resource mineral sands deposit, which covers 1,350 hectares of the Guadalupito project was estimated to contain 1.1 billion tonnes heavy mineral sand containing mostly andalusite (21% to 24%) and magnetite (22% to 25%) and small quantities of ilmenite, rutile and zircon. The andalusite is found mostly as highly liberated particles which is more than 90% below the water table, making it amenable to dredging based on testing performed in 2014, the deposit was expected to produce an andalusite product grade of greater than 60% Al_2O_3 with less than 0.2% for refractory and technical ceramic markets .

South Africa

Andalusite Resources (Pty.) Ltd mined andalusite at its Maroeloesfontein Mine in Thabazimbi, Limpopo Province. The company planned to expand its annual production capacity to 120,000 tonnes per year from 70,000 tonnes per year by 2015.

Denain-Anzin Mineraux Refractarie Ceramique (Damrec) (a subsidiary of Imerys SA) produced about 70% of the andalusite production in South Africa. Rhino Minerals (Pty.) Ltd operated three of Damrec's four South African mines. Samrec (Pty.) Ltd operated the fourth mine in Mpumalanga region near Lydenburgh.

Russia

The mining company JSC Central Kola Expedition announced the discovery of about 950 million tonnes of kyanite resources in the Murmansk region of the Kola Peninsula of northwestern Russia. The deposit, lying up to 100 m depth was amenable to economical open pit mining and may reduce dependence on bauxite by the alumina producers. According to the Kola Scientific Centre of the Russian Academy of Sciences, about 90% of Russian kyanite was concentrated in the Large Keivy Massif in the Murmansk region. However, owing to the location and type of material, development of the deposit was likely to be delayed by as much as 20 years because the deposit was far away from large industrial centers and power plants with no potential consumer anticipated in the near future.

FOREIGN TRADE

Exports

Exports of kyanite during 2014-15 were only 39 tonnes, 25% less than the previos year. Exports were mainly to Nepal (56%) and Kenya (31%). Similarly exports of sillimanite also decreased by 39% to 17,304 tonnes in 2014-15 from 28,152 tonnes in the previous year. Sillimanite was exported mainly to China (75%) and Nepal (19%). Exports of andalusite were only 4 tonnes in 2014-15 (Table - 15 to 17).

Table – 15 : Exports of Kyanite (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**52**	**1174**	**39**	**505**
Nepal	8	81	22	203
Iran	-	-	5	164
Kenya	-	-	12	126
UK	-	-	++	7
USA	-	-	++	2
China	20	291	++	2
Other countries	24	802	++	1

Table – 16 : Exports of Sillimanite (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**28152**	**148779**	**17304**	**141262**
China	24435	121431	12958	105524
Nepal	2571	12483	3262	19413
Japan	10	157	261	5027
Belgium	104	1431	312	3518
Greece	69	1355	138	2518
Oman	144	2106	145	2124
Thailand	145	2527	75	1674
Canada	++	5	104	1151
Malaysia	-	-	40	123
Indonesia	++	5	2	76
Other countries	674	7279	7	114

Imports

In 2014-15, imports of kyanite were at 508 tonnes as against 394 tonnes in the previous year. Imports of sillimanite were 116 tonnes in 2014-15 as compared to 110 tonnes in the previous year. Imports of andalusite increased to 9,350 tonnes in 2014-15 from 8,738 tonnes in the previous year. USA (99%) was the main supplier of kyanite and Peru (70%) that of sillimanite, while South Africa (91%) was the main supplier of andalusite in 2014-15 (Tables - 18 to 20)

Table – 17 : Exports of Andalusite (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**5**	**244**	**4**	**127**
UAE	1	70	2	74
Nepal	2	96	1	35
China	-	-	1	18
Other countries	2	78	-	-

Table – 18 : Imports of Kyanite (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**394**	**13711**	**508**	**17006**
USA	368	10252	503	15988
Nepal	6	2899	2	932
China	-	-	3	86
Other countries	20	560	-	-

Table – 19 : Imports of Sillimanite (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**110**	**14307**	**116**	**10754**
Nepal	47	10373	24	7271
Peru	-	-	81	1893
Japan	19	2594	11	1551
Thailand	-	-	++	33
Jordan	-	-	++	6
Other countries	44	1340	-	-

Table – 20 : Imports of Andalusite (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**8738**	**187621**	**9350**	**201731**
South Africa	7968	163030	8488	179375
France	716	23335	815	21192
Peru	54	1256	27	666
USA	-	-	20	498

FUTURE OUTLOOK

The demand for high quality raw and calcined sillimanite minerals is closely linked to the need for high performance refractories with increased operational lifespans. As the predominant consumer of refractory products, the steel manufacturing industry provides a reliable market indicator of the demand for sillimanite minerals. The Asia-Pacific region remains the largest market for refractories. Above average growth in India is expected to continue. As per the Report of the Working Group for 12th Plan (2012-17), the current demand of sillimanite is 32,000 tpy. Projected demand for next five years is 35,000 to 40,000 tpy at GDP growth rate of 8%, 9% and 10%. The production of sillimanite is likely to be increased in coming years to meet the demand. China will remain the leading market on global front.