Indian Minerals Yearbook 2014

(Part- III : MINERAL REVIEWS)

53rd Edition

KYANITE, SILLIMANITE AND ANDALUSITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

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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 1,350 ^{0}C and 1,500 ^{0}C. 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 (1,810 ^{0}C). 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 Andhra Pradesh alone is more than 78% of total resources followed by 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 22.7%. Resources of massive sillimanite of all grades are about 5.0%. The resources are located mainly in Tamil Nadu (27%), Odisha (20%), Uttar Pradesh (17%), Andhra Pradesh (14%), Kerala (11%) and Assam (7%). Remaining 4% 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 Salaidih-Harwariya area, Mahakoshal Group, in Sonbhadra district of Uttar Pradesh to delineate and assess the andalusite bearing zones. DMG, Rajasthan also carried out exploration in Pisangan tehsil of Ajmer district. 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	-	-	80353829	-	80354228	80354228
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
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 States				
Jharkhand	–	4000	4000	4000
Uttar Pradesh	–	14450	14450	14450

Table – 4 : Details of Exploration Activities for Kyanite, Sillimanite and Andalusite , 2013-14

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	Salaidih	1:25,000		-	-	-	Reconnaissance stage (G-4) investigation was carried out to delineate & assess the andalusite-bearing area.
	Harwaria area (Mahakoshal Group)	1:12,500 LSM 1:12500	200 91				Large Scale Mapping has delineated 65.14 sq km area of andalusite-bearing phyllite schist out of total 91 sq km area mapped. The andalusite content in phyllite/ schist in general varies from 15% to 20% by weight. The chemical analysis viz. residual andalusite crystals collected from surface and streams give average Al_2O_3 content 42% while andalusite crystal separated from bedrock crushing and sieving yield average 30% Al_2O_3. Different andalusite bearing bands were demarcated based on andalusite content. The possible tentative reserve of andalusite were estimated at 25.90 MT approximately per 1 m depth for an area of 67.99 sq km.The possible andalusite placer reserves are 0.16 MT approx. for average bed thickness of 1.75 m and area covered by residual/float deposit is 0.34 sq km.
Kyanite							
DMG							
Rajasthan	Villages-						The investigation have been carried out to lcalize sopstone,magnesite, kyanite, emerald, nickel,cobalt,etc.
Ajmer	Gadi Arjunpura	1:50,000	160	-	-	40	
	Kothaj,Makreda	1:10,000	10	-	-		
	Saradhana etc in tahsil Pisangan and Ajmer	1:2000	1				

PRODUCTION, STOCKS & PRICES

Kyanite

The production of kyanite at 1,922 tonnes in 2013-14, increased by 83% as compared to the previous year due to re-starting of production by one of the mines in Maharashtra. 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 & 6).

In 2013-14, about seventy five percent of the total production of kyanite was of grade 40% Al_2O_3 and above, the rest 25% was of below 40% Al_2O_3 grade .

One public sector mine in the state of Maharashtra (Maharashtra State Mining Corp. Ltd) accounted for about 7 % of the total production . Remaining 93% production was reported by the private sector mine (Table- 7).

Mine-head stocks at the end of the year 2013-14 were 9,864 tonnes as against 8,383 tonnes in the beginning of the year (Table - 8).

The average daily employment of labour was 38 in 2013-14 as against 55 in the preceding year. Prices of kyanite are furnished in the General Review on Prices.

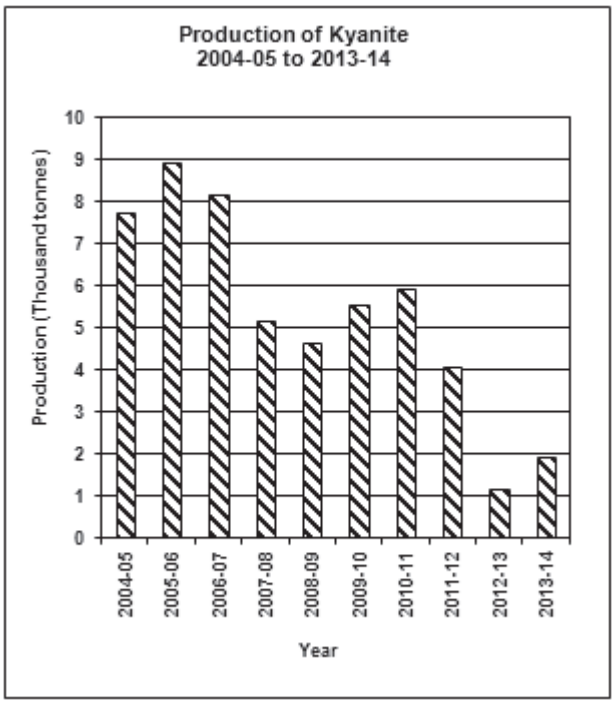

Table – 5 : Producers of Kyanite, 2013-14

Name & address of producer	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
Maharashtra State Mining Corporation Ltd, Plot No. 7, Ajni Chowk, Wardha Road, Nagpur - 440 015, Maharashtra.	Maharashtra	Bhandara

Table – 6 : Production of Kyanite, 2011-12 to 2013-14 (P)
(By States)

(Qty in tonnes; Value in ₹ '000)

State	2011-12		2012-13		2013-14(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**4064**	**4802**	**1048**	**1248**	**1922**	**5720**
Jharkhand	4011	4757	1015	1204	-	-
Maharashtra	53	45	33	44	1922	5720

Table – 7 : Production of Kyanite, 2012-13 and 2013-14 (P)
(By Sectors/States/Districts/Grades)

(Qty in tonnes; Value in ₹ '000)

State/District	2012-13					2013-14 (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**	**8**	**1040**	**1048**	**1248**	**3**	**1439**	**483**	**1922**	**5720**
Public sector	2	-	1040	1040	1234	1	-	142	142	159
Private sector	2	8	-	8	14	2	1439	341	1780	5561
Jharkhand	**1**	**-**	**1015**	**1015**	**1204**	**-**	**-**	**-**	**-**	**-**
Singhbhum (East)	1	-	1015	1015	1204	-	-	-	-	-
Maharashtra	**3**	**8**	**25**	**33**	**44**	**3**	**1439**	**483**	**1922**	**5720**
Bhandara	3	8	25	33	44	3	1439	483	1922	5720

Table – 8 : Mine-head Stocks of Kyanite, 2013-14 (P)
(By States/Grades)

(Qty in tonnes)

State	At the beginning of the year			At the end of the year		
	40% & above Al_2O_3	Below 40% Al_2O_3	Total	40% & above Al_2O_3	Below 40% Al_2O_3	Total
India	**269**	**8114**	**8383**	**1609**	**8255**	**9864**
Jharkhand	-	1327	1327	-	1327	1327
Karnataka	-	6444	6444	1322	6444	7766
Maharashtra	269	323	592	287	484	771
Rajasthan	-	20	20	-	-	-

Sillimanite

The production of sillimanite at 61,597 tonnes in 2013-14 recorded an increase of 41% as compared to the previous year due to increase in market demand. There were 5 reporting mines in the current year same as in the previous year. Besides, three mines reported production of sillimanite as an associated mineral with garnet and kyanite during 2013-14.

Ninty seven percent of total production during the year was contributed by three producers. About 26 % of total production of sillimanite was reported by public sector, while remaining 74% of production was reported by the private sector. Andhra Pradesh, the main producing state contributed 65% of the total production of sillimanite in 2013-14 followed by Odisha (19%), Maharashtra (10%) and Kerala (6%) (Tables - 9 to 11).

Mine-head stocks at the end of the year 2013-14 were 14,656 tonnes as against 16,939 tonnes at the beginning of the year (Table - 12).

The average daily employment of labour during 2013-14 was 2,026 as against 1,767 in the previous year. Domestic prices of sillimanite are furnished in the General Review on 'Prices'.

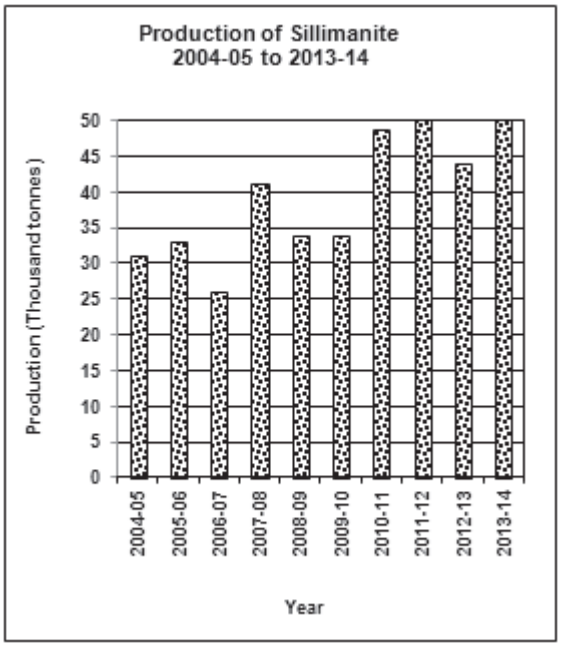

Table – 9 : Producers of Sillimanite, 2013-14

Name & address of producer	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 Cimmco House, A-1 Indrasagar Apartment, Ravindranath Tagore Marg, Civil lines, Nagpur- 440 001 Maharashtra.	Maharashtra	Bhandara

 # Producing as an associated mineral with garnet.
** Producing as an associated mineral with kyanite.*

Table – 10 : Production of Sillimanite, 2011-12 to 2013-14 (P)
(By States)

(Qty in tonnes; Value in ₹'000)

State	2011-12		2012-13		2013-14 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**59206**	**522737**	**43736**	**352062**	**61597**	**373488**
Andhra Pradesh	31992	304402	23896	205289	39723	252757
Kerala	7205	79255	4936	44424	3946	34376
Maharashtra	2520	4135	2590	3923	6206	9225
Odisha	17489	134945	12314	98426	11722	77130

Table – 11 : Production of Sillimanite, 2012-13 and 2013-14 (P)
(By Sectors/States/Districts)

(Qty in tonnes; Value in ₹'000)

State/District	2012-13			2013-14 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**5(2)**	**43736**	**352062**	**5(3)**	**61597**	**373488**
Public sector	5	17490	143248	5	15750	111622
Private sector	(2)	26246	208814	(3)	45847	261866
Andhra Pradesh	**(1)**	**23896**	**205289**	**(1)**	**39723**	**252757**
Srikakulam	(1)	23896	205289	(1)	39723	252757
Kerala	**2**	**4936**	**44424**	**2**	**3946**	**34376**
Kollam	2	4936	44424	2	3946	34376
Maharashtra	**2(1)**	**2590**	**3923**	**2(2)**	**6206**	**9225**
Bhandara	2(1)	2590	3923	2(2)	6206	9225
Odisha	**1**	**12314**	**98426**	**1**	**11722**	**77130**
Ganjam	1	12314	98426	1	11722	77130

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

Table – 12 : Mine-head Stocks of Sillimanite 2013-14 (P)
(By States)

(In tonnes)

State	At the beginning of the year	At the end of the year
India	**16939**	**14656**
Andhra Pradesh	1108	3894
Kerala	2433	652
Maharashtra	2813	9693
Odisha	10103	100
Rajasthan	317	317
Tamil Nadu	165	-

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 of 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 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 3,000 tonnes in 2013-14 which is same as the previous year. Entire consumption of kyanite was accounted for by the refractory industry (Table-13).

Sillimanite

The consumption of sillimanite was 21,100 tonnes in 2013-14 which increased by about 8% over the previous year. Refractory industry alone accounted for about 91% consumption (Table-13).

Table – 13 : Consumption* of Kyanite and Sillimanite 2011-12 to 2013-14 (By Industries)

(In tonnes)

Industry	2011-12	2012-13(R)	2013-14(P)
Kyanite			
All Industries	**2900**	**3000**	**3000**
Refractory	2900(20)	3000(21)	3000(21)
Sillimanite			
All Industries	**14000**	**19600**	**21100**
Abrasive	100(1)	100(1)	100(1)
Ceramic	1600(4)	1600(4)	1600(4)
Chemical	200(1)	200(1)	200(1)
Foundry	++(1)	++(1)	++(1)
Refractory	12100(26)	17700(27)	19200(28)

Figures rounded off.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
(includes reported consumption and/or estimates made wherever required).*

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. Kyanite Mining Corp. in the USA is, by far, the largest producer of kyanite, with an estimated production of about 95 ,000 tpy. 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	2011	2012	2013
Brazil[(b)]			
Kyanite[(e)]	200	200	200
France			
Andalusite[(e)]	65000	68000	68000
India*			
Kyanite	4064	1048	1922
Sillimanite	59206	43736	61597
South Africa			
Andalusite[e]	295000	265000	270000
USA			
Kyanite[(a)]	98000	99000	95000[e]

Source: *World Mineral Production, 2009-2013.*
(a). Including related minerals.
(b). Including beneficiated & directly shipped material.
** India's production of kyanite during 2011-12, 2012-13 and 2013-14 was 4,064 tonnes,1,048 tonnes,and 1,922 tonnes respectively, while that of sillimanite was 59,206 tonnes , 43,736 tonnes and 61,597 tonnes, respectively.*

A steady increase in the world's steel industry and less availability of refractory grade bauxite increased the demand of andalusite. Significant deposites of kyanite and sillimanite were reported from Vietnam.

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 Damrec SA (a subsidiary of Imerys) at its Yilong Andalusite Mineral Co. facilities in the Xinjiang Uyghur Autonomous Region of north-western China.

Peru

Andalusita S.A. continued development and production from its mine in north-western Peru, 20 km from the deep seas port Pita.A primary andalusite poduct grading 59% to 60% Al_2O_3 and maximum 0.85% iron oxide was prouduced for refractory consumers. Plant capacity has been increased to 42,000 tonnes.

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

Latin rescources received unrestricted and exclusive surface rights to the land overlying the estimated 1.1 billion tonnes heavy mineral sand Los Conchales resoures.The Los Conchales mineral sands deposit, which covers 1,350 hectares of the Guadalupito project, is mostly andalusite (21% to 24%) and magnetite (22% to 25%). The Los Conchales resource is more than 90% below the water table, making it amenable to dredging.

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.

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

Vietnam

Significant kyanite and sillimanite deposits were reported in Vietnam. Thanh son kyanite deposits in Phu Tho Province in northern Vietnam had reserves of 60,000 tonnes. Another deposit, the Hung Nhuong sillimanite deposit in Quang Nagi Province had reserves slightly more than 1,00,000 tonnes. No production of kyanite or sillimanite was reported.

FOREIGN TRADE

Exports

Exports of kyanite during 2013-14 were 52 tonnes, 2% less than the previous year. Exports were mainly to Greece (44%) and China (38%).Exports of sillimanite increased by 52% to 28,152 tonnes in 2013-14 from 11,151 tonnes in the previous year. Sillimanite was exported mainly to China (87%) and Nepal (9%). Exports of andalusite were 5 tonnes in 2013-14 (Tables - 15 to 17).

Imports

In 2013-14, imports of kyanite were 394 tonnes as against 623 tonnes in the previous year. Imports of sillimanite were 110 tonnes in 2013-14 as compared to 74 tonnes in the previous year. Imports of andalusite decreased substantially to 8,738 tonnes in 2013-14 from 13,767 tonnes in the previous year. USA (93%) was the main supplier of kyanite and Nepal (43%) that of sillimanite, while South Africa (91%) was the main supplier of andalusite in 2013-14 (Tables - 18 to 20).

Table – 15 : Exports of Kyanite (By Countries)

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**53**	**784**	**52**	**1174**
Greece	-	-	23	478
Ethiopia	-	-	1	323
China	-	-	20	291
Nepal	1	12	8	81
Other countries	52	772	++	1

Table – 16 : Exports of Sillimanite (By Countries)

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**11151**	**133322**	**28152**	**148779**
China	8461	102138	24435	121431
Nepal	427	2820	2571	12483
Singapore	391	4091	292	3257
Thailand	141	1967	145	2527
Oman	621	1518	144	2106
Iran	216	7244	48	1560
Belgium	-	-	104	1431
Greece	99	1686	69	1355
Germany	-	-	80	958
Kenya	-	-	53	638
Other countries	795	11858	211	1033

Table – 17 : Exports of Andalusite (By Countries)

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**-**	**-**	**5**	**244**
Nepal	-	-	2	96
Korea, Rep. of	-	-	2	78
UAE	-	-	1	70

Table – 18 : Imports of Kyanite
(By Countries)

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**623**	**20765**	**394**	**13711**
USA	589	15503	368	10252
Nepal	18	4872	6	2899
Bolivia	-	-	20	560
Other countries	15	390	-	-

Table – 19 : Imports of Sillimanite
(By Countries)

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**74**	**7401**	**110**	**14307**
Nepal	42	4796	47	10372
Japan	1	863	19	2594
France	22	714	24	843
USA	-	-	20	384
South Africa	-	-	++	77
UK	-	-	++	29
Germany	-	-	++	8
Other countries	9	1028	-	-

Table – 20 : Imports of Andalusite
(By Countries)

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**13767**	**262633**	**8738**	**187621**
South Africa	12613	236704	7968	163030
France	1024	22672	716	23335
Peru	104	2391	54	1256
Other countries	26	866	-	-

FUTURE OUTLOOK

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.