Indian Minerals Yearbook 2018

(Part- III : MINERAL REVIEWS)

57th Edition

KYANITE, SILLIMANITE AND ANDALUSITE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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17 Kyanite, Sillimanite and Andalusite

Kyanite, sillimanite and andalusite are unhydrous aluminosilicate minerals that have the same chemical formula Al_2O_3 but differ in crystal structure and physical properties. When calcined at high temperature around 1350 ^{0}C to 1380 ^{0}C for kyanite and slightly higher for andalusite and sillimanite, these minerals are converted to mullite, ($3\ Al_2O_3.2SiO_2$) and silica (SiO_2) which are refractory minerals.

Synthetic mullite is made by heating mixtures of alumina and silica or bauxite and kaolin at around 1550 ^{0}C to 2000 ^{0}C. Refractories are heat resistant materials used in high temperature applications such as furnaces, ladles, kilns, in the metallurgical, glass, chemical, cement and other industries.

RESERVES/RESOURCES

Kyanite

The total reserves/resources of kyanite as per NMI database, based on UNFC system as on 1.4.2015 in the country have been placed at 104.98 million tonnes. Out of these resources, only 0.68 million tonnes are the reserves and 104.29 million tonnes are the remaining resources. Out of total resources, high and medium-grade resources together account for merely 1.74%, low grade 8%, mixed grade 0.73%, quartz kyanite rock, kyanite gneiss rock and kyanite schist 87.1% and granular, others and not-known grades 2.41%. Statewise, share of Telangana is 46% of total resources followed by Andhra Pradesh 30.5%, Karnataka 12.67% and Jharkhand 7.23%. Remaining 3.60% resources are in Kerala, Maharashtra, Rajasthan, Tamil Nadu and West Bengal collectively (Table-1).

Sillimanite

The total reserves/resources of sillimanite as per NMI database, based on UNFC system in the country as on 1.4.2015 have been placed at 70.20 million tonnes. Out of these resources, the reserves are only 6.50 million tonnes, while about 63.70 million tonnes are the remaining resources. Out of total resources, more than 73.33% are granular high-grade, while quartz sillimanite rocks and sillimanite bearing rocks are about 21.64%. Resources of massive sillimanite of all grades are about 4.83%. The resources are located mainly in Odisha (25.15%), Tamil Nadu (24.87%), Uttar Pradesh (16.30%), Andhra Pradesh (12.52%), Kerala (10.17%) and Assam (6.55%). Remaining 4.44% resources are in Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Rajasthan and West Bengal (Table-2).

Andalusite

The total reserves/resources of andalusite in the country as on 1.4.2015 as per NMI database, based on UNFC system have been placed at 28.20 million tonnes. Most of the resources are of reconnaissance category located in Uttar Pradesh (Table-3).

EXPLORATION & DEVELOPMENT

Details of exploration & development if any are shown in the review of "Exploration & Development" in "General Reviews".

Table – 1 : Reserves/Resources of Kyanite as on 1.4.2015
(By Grades/States)

(In tonnes)

Grade/State	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	**639121**	**-**	**48958**	**688079**	**1505114**	**568205**	**2193427**	**579619**	**3577402**	**95869713**	**-**	**104293480**	**104981559**
By Grades													
High grade	-	-	-	-	-	4317	21867	-	297827	114689	-	438700	438700
Medium grade	212881	-	48958	261839	430490	-	276651	-	34410	381532	-	1123083	1384922
Low grade	426240	-	-	426240	234210	15930	1178813	386247	2214900	3952872	-	7982972	8409212
High & medium mixed	-	-	-	-	-	100550	53103	-	93640	106928	-	354221	354221
Medium & low mixed	-	-	-	-	-	-	-	-	-	48000	-	48000	48000
High, medium & low mixed	-	-	-	-	13097	89650	10606	-	45000	210025	-	368378	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	-	-	-	-	593710	23491	303166	1012	-	12530	-	933909	933909
Not-known	-	-	-	-	233607	334267	349221	192360	-	235620	-	1345075	1345075
By States													
Andhra Pradesh	-	-	-	-	-	-	399	-	-	32003829	-	32004228	32004228
Jharkhand	426240	-	-	426240	824472	524467	881313	-	1754900	3182363	-	7167515	7593755
Karnataka	-	-	-	-	637460	15930	113630	386247	1610502	10531529	-	13295298	13295298
Kerala	-	-	-	-	-	-	-	192360	-	10000	-	202360	202360
Maharashtra	212881	-	48958	261839	30085	27808	1187479	1012	45000	1684113	-	2975497	3237336
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 1.4.2015
(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	**323231**	**5728868**	**450016**	**6502115**	**1020187**	**135278**	**20257525**	**4580083**	**17790664**	**16068690**	**3849600**	**63702027**	**70204142**
By Grades													
Massive high grade	-	-	-	-	-	-	-	-	-	11903	-	11903	11903
Massive medium grade	-	-	-	-	-	4000	-	-	-	29705	-	33705	33705
Massive low grade	44021	-	15000	59021	300	-	519	-	850000	2273786	-	3124605	3183626
Massive high & medium	-	-	-	-	-	-	-	-	-	19800	-	19800	19800
Massive medium & low	136981	-	7274	144255	-	-	-	-	-	-	-	-	144255
Massive high, medium & low	-	-	-	-	-	-	-	-	-	38	-	38	38
Granular high	128789	5728868	427742	6285399	1019887	120208	20257006	2480083	7590600	13732942	-	45200726	51486125
Quartz sillimanite rock	-	-	-	-	-	-	-	-	-	-	3748000	3748000	3748000
Sillimanite bearing rock	-	-	-	-	-	-	-	2100000	9350000	-	-	11450000	11450000
Others	-	-	-	-	-	11070	-	-	-	-	-	11070	11070
Unclassified	13440	-	-	13440	-	-	-	-	-	-	-	-	13440
Not-known	-	-	-	-	-	-	-	-	64	516	101600	102180	102180
By States													
Andhra Pradesh	2045	-	37	2082	15	11278	12	267	7430300	1346988	-	8788861	8790943
Assam	-	-	-	-	-	-	-	-	850000	6700	3748000	4604700	4604700
Jharkhand	-	-	-	-	-	-	-	-	-	83000	-	83000	83000
Karnataka	-	-	-	-	-	-	-	-	-	982725	-	982725	982725
Kerala	-	-	-	-	1015625	120000	-	2479816	160300	3369200	-	7144941	7144941
Madhya Pradesh	-	-	-	-	-	-	-	-	-	-	101600	101600	101600
Maharashtra	181002	-	22274	203276	-	-	-	-	64	15516	-	15580	218856
Meghalaya	-	-	-	-	-	-	-	-	-	55807	-	55807	55807
Odisha	-	5728868	427705	6156573	-	-	6557013	-	-	4943600	-	11500613	17657186
Rajasthan	-	-	-	-	300	-	519	-	-	-	-	819	819
Tamil Nadu	140184	-	-	140184	4246	4000	13699981	-	-	3612154	-	17320381	17460565
Uttar Pradesh	-	-	-	-	-	-	-	2100000	9350000	-	-	11450000	11450000
West Bengal	-	-	-	-	-	-	-	-	-	1653000	-	1653000	1653000

Figures rounded off

Table – 3 : Reserves/ Resources of Andalusite as on 1.4.2015

(In '000 tonnes)

State	Total Reserves	Remaining Resources			Total Resources (A+B)
	Total (A)	Inferred STD333	Reconnaissance STD334	Total (B)	
All India : Total	**–**	**4000**	**24201**	**28201**	**28201**
By Grades					
Unclassified	-	-	24201	24201	24201
Low	-	4000	-	4000	4000
By States					
Jharkhand	–	4000	1	4001	4001
Uttar Pradesh	–	-	24200	24200	24200

Figures rounded off

PRODUCTION & STOCKS

Kyanite

The production of kyanite at 7,818 tonnes in 2017-18, increased by 140% as compared to the previous year. In both the years, there were 5 reporting mines. Two producers contributed the entire production of kyanite during the year.

In 2017-18, 7,818 tonnes i.e. about 100% of total production of kyanite was of grade 40% Al_2O_3, about 30% of the total production was reported by the public sector (Tables - 4 to 6).

Mine-head closing stocks of kyanite for 2017-18 were 12,340 tonnes as against 12,892 tonnes in 2016-17 (Table-7).

The average daily employment of labour was 63 in 2017-18 as against 69 in the preceding year.

Table – 4 : Producers of Kyanite, 2017-18

Name & address of producer	Location of mine	
	State	District
Pavri Kyanite Mines, A-1, Indra Sagar Apartment, Ravindranath Tagore Marg, Civil Lines, Nagpur- 440 001, Maharashtra.	Maharashtra	Bhandara
Maharashtra State Mining Corporation Ltd Plot No. 7, Ajani Chowk, Wardha Road, Nagpur - 440 015, Maharashtra.	Maharashtra	Bhandara

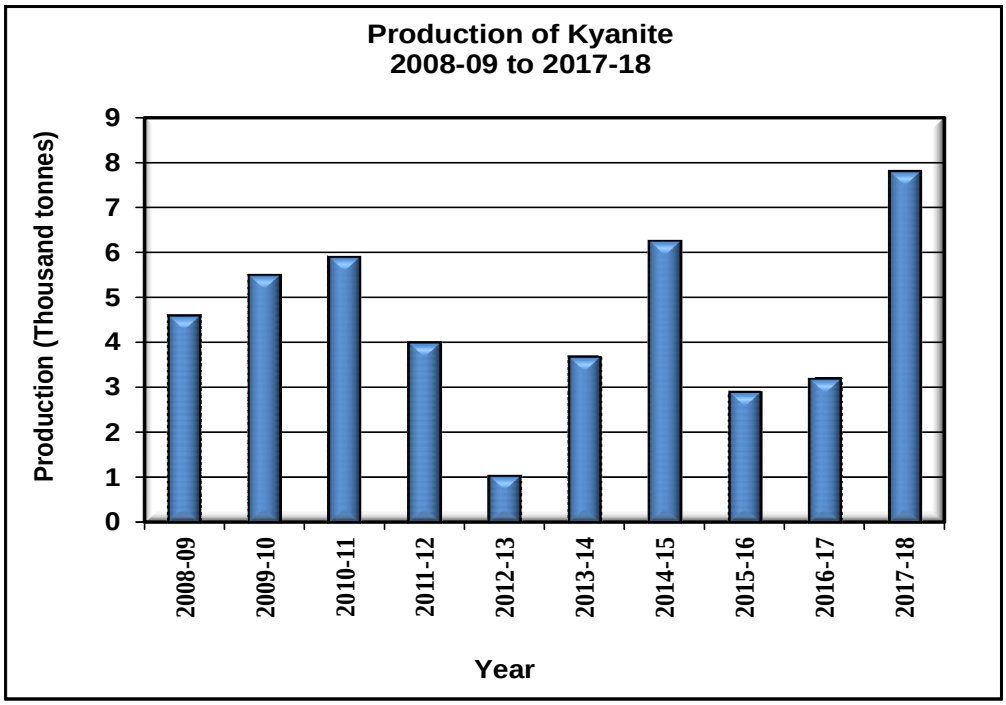

Table – 5 : Production of Kyanite, 2015-16 to 2017-18
(By States)

(Qty in tonnes; Value in `'000)

State	2015-16		2016-17		2017-18 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**2901**	**14180**	**3253**	**13458**	**7818**	**23002**
Karnataka	-	-	-	-	-	-
Maharashtra	2901	14180	3253	13458	7818	23002

Table – 6 : Production of Kyanite, 2016-17 and 2017-18 (P)
(By Sectors/States/Districts/Grades)

(Qty in tonnes; Value in ` '000)

State/District	2016-17					2017-18 (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	**5**	**3253**	-	**3253**	**13458**	**5**	**7818**	-	**7818**	**23002**
Public sector	1	976	-	976	1736	1	2318	-	2318	4013
Private sector	4	2277	-	2277	11722	4	5500	-	5500	18989
Karnataka	**1***	-	-	-	-	**1***	-	-	-	-
Mysuru	1*	-	-	-	-	1*	-	-	-	-
Maharashtra	**4**	**3253**	-	**3253**	**13458**	**4**	**7818**	-	**7818**	**23002**
Bhandara	4	3253	-	3253	13458	4	7818	-	7818	23002

Only labour reported

Table – 7 : Mine-head Closing Stocks of Kyanite, 2016-17 and 2017-18 (By States/Grades)

(Qty in tonnes)

State	2016-17			2017-18 (P)		
	40% Al_2O_3 & above	Below 40% Al_2O_3	Total	40% Al_2O_3 & above	Below 40% Al_2O_3	Total
India	**810**	**12082**	**12892**	**953**	**11387**	**12340**
Jharkhand	-	1327	1327	-	1327	1327
Karnataka	-	10430	10430	-	10033	10033
Maharashtra	810	325	1135	953	27	980

Sillimanite

The production of sillimanite at 81,638 tonnes in 2017-18 increased by 20% as compared to that in the previous year. There were 5 reporting mines in 2017-18. Besides, four mines reported production of sillimanite as an associated mineral with garnet and kyanite during the year.

Ninety five percent of total production during the year was contributed by three producers. About 30% of total production of sillimanite was reported by the public sector mines, while the remaining 70% of production was reported by the private sector mines. Andhra Pradesh, the main producing state contributed 66% of the total output in 2017-18 followed by Odisha, Kerala, Maharashtra and Meghalaya (Tables - 8 to 10).

Mine-head closing stocks for the year 2017-18 were 21,653 tonnes as against 28,555 tonnes in the previous year (Table - 11).

The average daily employment of labour during 2017-18 was 1,589 as against 1,776 in the previous year.

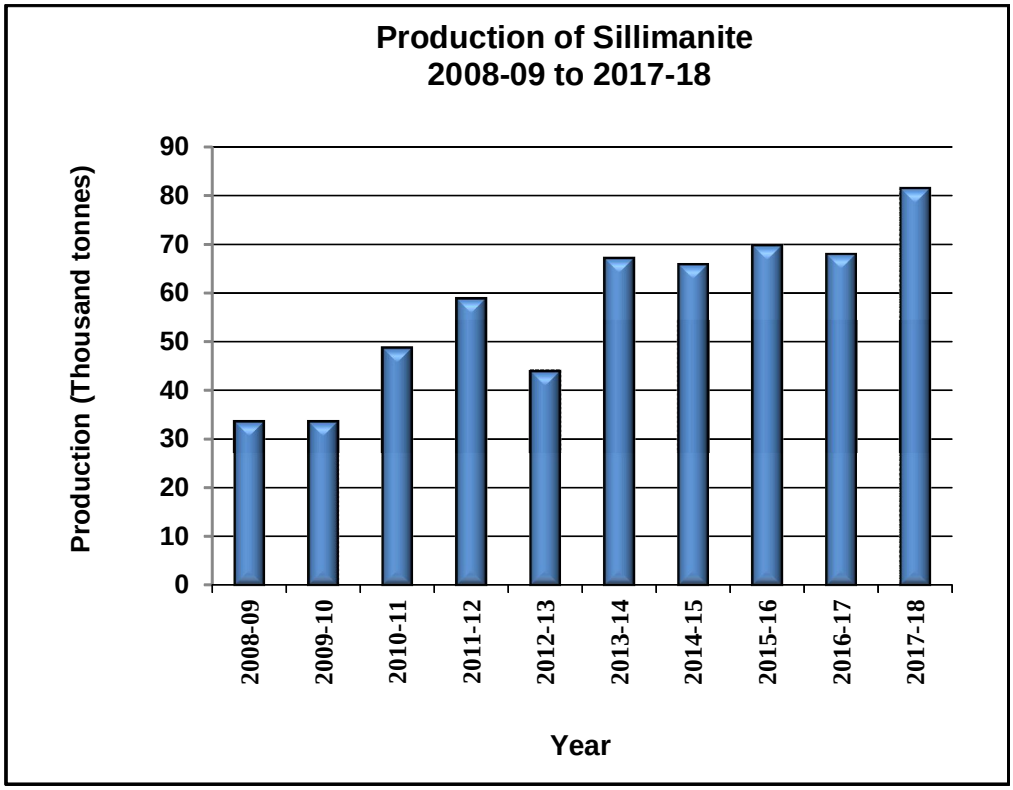

Table – 8 : Principal Producers of Sillimanite, 2017-18

Name & address of producer	Location of mine	
	State	District
#Trimex Sands Private Limited, Trimex Towers, No.-1, Subbraya Avenue, C.P. Ramaswamy Road, Alwarpet, Chennai - 600 018. Tamil Nadu.	Andhra Pradesh	Srikakulam
Indian Rare Earths Ltd, Plot No. 1207, V. S Marg, Prabhadevi, Mumbai-400 028, Maharashtra.	Kerala Odisha	Kollam Ganjam
*Pavri Kyanite Mines, A/1, Indrasagar Apartments, Ravindranath Tagore Road, Civil Lines, Nagpur- 440 001 Maharashtra.	Maharashtra	Bhandara

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

Table – 9 : Production of Sillimanite, 2015-16 to 2017-18 (By States)

(Qty in tonnes; Value in `'000)

State	2015-16		2016-17		2017-18(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**669942**	**509314**	**68131**	**535949**	**81638**	**669340**
Andhra Pradesh	42409	340841	37109	321945	53749	472572
Kerala	5121	49585	9254	87400	7548	71193
Maharashtra	9019	27133	6196	22739	3184	10741
Meghalaya	-	-	-	-	459	3335
Odisha	13393	91755	15572	103865	16698	111499

Table – 10 : Production of Sillimanite, 2016-17 and 2017-18 (By Sectors/States/Districts)

(Qty in tonnes; Value in `'000)

State/District	2016-17			2017-18 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**4(4)**	**68131**	**535949**	**5(4)**	**81638**	**669340**
Public sector	4	24936	191571	4	24336	183012
Private sector	(4)	43195	344378	1(4)	57302	486328
Andhra Pradesh	**(1)**	**37109**	**321945**	**(1)**	**53749**	**472572**
Srikakulam	(1)	37109	321945	(1)	53749	472572
Kerala	**2**	**9254**	**87400**	**2**	**7548**	**71193**
Kollam	2	9254	87400	2	7548	71193
Maharashtra	**1(3)**	**6196**	**22739**	**1(3)**	**3184**	**10741**
Bhandara	1(3)	6196	22739	1(3)	3184	10741
Meghalaya	**1**	**-**	**-**	**1**	**459**	**3335**
Khasi Hills West	1	-	-	1	459	3335
Odisha	**1**	**15572**	**103865**	**1**	**16698**	**111499**
Ganjam	1	15572	103865	1	16698	111499

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

Table – 11: Mine-head Closing Stocks of Sillimanite, 2016-17 and 2017-18 (By States)

(In tonnes)

State	2016-17	2017-18 (P)
India	**28555**	**21635**
Andhra Pradesh	3435	2428
Kerala	2387	1470
Meghalaya	25	244
Maharashtra	18908	16830
Odisha	3800	663

Andalusite

There was no production of andalusite reported 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. Presently IREL's Chavara plant in Kollam district, Kerala, 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 and ceramic products because of their ability to form mullite phase at high temperature. Mullite is an essential component of high-alumina refractories forming the inner lining of furnaces and high temperature vessels widely used in the production of metals,ceramics, glass and cement.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 Pyrometric Cone Equivalent (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 6,600 tonnes in 2017-18 which is about 94% more than previous year. Maximum consumption of kyanite was accounted for by the Refractory Industry and negligible amount of consumption is reported by other industries (Table-12).

Sillimanite

The consumption of sillimanite was 75,900 tonnes in 2017-18, reported a huge leap of about three folds over the previous year. Refractory Industry alone accounted for about 78% of consumption, Ceramic Industry (11%), Foundry Industry (5%) and rest by Other Industries (Table-12).

Table – 12 : Consumption# of Kyanite and Sillimanite 2015-16 to 2017-18 (P)
(By Industries)

(In tonnes)

Industry	2015-16	2016-17(R)	2017-18(P)
Kyanite			
All Industries	**3100**	**3400**	**6600**
Refractory	3000	3100*	6600*
Others	100	300*	++
Sillimanite			
All Industries	**38100**	**24200**	**75900***
Ceramic	2500	2400	8700
Foundry	1100	1300	4000
Refractory	33000	19300	59000
Others (abrasives, cement, chemicals, etc.)	1500	1200	4200

Figures rounded off.
 # Includes actual reported consumption and/or estimates made wherever required and paucity of data, hence coverage may not be complete.
**Consumption estimated from the despatches, as reported in Form-H under Rule-45 of MCDR, 2017.*

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 indicated in Table-13.

Table – 13 : World Production of Sillimanite Minerals
(By Principal Countries)

(In tonnes)

Country	2015	2016	2017
Brazil			
Kyanite[c]	200	200	200
France			
Andalusite[a]	68000	58000	68000
India*			
Kyanite[d]	2901	3253	7818
Sillimanite[d]	69942	68131	81638
Madagascar			
Andalusite	1900	1800	4200
Nepal			
Kyanite[e]	7	1	2
South Africa			
Andalusite	190000	190000	190000
USA			
Kyanite[b]	109000	79700	90000[e]

Source: *World Mineral Production, 2013-2017,BGS.*

(a) May Include other sillimanite minerals.

(b) Including related minerals.

(c) Including beneficiated and directly shipped material.

(d) Years ended 31st March following the stated.

(e) Years ending 15th July of the stated.

*India's production during 2015-16, 2016-17 and 2017-18 in respect of Kyanite is *2,901 tonnes, 3,253 tonnes & 7,818 tonnes respectively and in respect of Sillimanite is 69,942 tonnes, 68,131 tonnes & 81,638 tonnes respectively.*

The availability of inexpensive refractory-grade bauxite from China served to increase demand for refractories from

alternative raw material such as andalusite. Demand for refractories in iron and steel production is expected to have larger increases in countries with higher growth rates in steel production. Increased demand also is anticipated for refractories used to produce other metals and in the industrial mineral market because of increasing production of cement, ceramics, glass, and other mineral products.

FOREIGN TRADE

Exports

Exports of kyanite during 2017-18 were at 166 tonnes which increased marginally by 8% than the previous year. Exports were mainly to Greece (84%), UAE (10%), Nepal (4%) and Kenya (2%). Exports of sillimanite also increased by 15% to 16,193 tonnes in 2017-18 from 14,064 tonnes in the previous year. Sillimanite was exported mainly to China (78%), Germany and Nepal (7% each). Exports of andalusite during 2017-18 were 6 tonnes which decreased sharply by 88% than the previous year, registered entire exports were to UAE (Tables - 14 to 16).

Imports

In 2017-18, imports of kyanite were at 620 tonnes as against 748 tonnes in the previous year registering a decrease of 17%. Imports of sillimanite were at 18 tonnes which declined by 25% during 2017-18 as compared to the previous year. Imports of andalusite were 14,375 tonnes increased by 32% during 2017-18 than the previous year. The imports of kyanite were from USA (87%) & China (13%). Japan (50%), USA (28%) and Chinese Taipei/Taiwan (22%) were the main supplier of sillimanite, while South Africa (94%) was the main supplier of andalusite followed by France (46%) in 2017-18 (Tables - 17 to 19).

Table – 14: Exports of Kyanite
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (``'000)	Qty (t)	Value (``'000)
All Countries	**153**	**3052**	**166**	**3404**
Greece	139	2675	140	2598
UAE	5	163	16	498
Nepal	5	35	6	144
Kenya	4	179	3	119
Bangladesh	-	-	1	30
USA	-	-	0	15

Table – 15: Exports of Sillimanite
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (``'000)	Qty (t)	Value (``'000)
All Countries	**14064**	**114678**	**16193**	**171835**
China	6507	69404	12616	127570
Germany	125	1838	1062	12336
Nepal	6384	25355	1189	8519
Japan	480	9347	452	7886
Iran	80	1834	238	5498
Thailand	120	2052	235	3927
Malaysia	51	672	87	1405
Belgium	234	2853	75	1382
Vietnam	-	-	50	901
Saudi Arabia	27	367	50	842
Other countries	56	956	139	1569

Table – 16: Exports of Andalusite
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**150**	**2063**	**6**	**327**
UAE	-	-	6	327
Germany	150	2063	-	-

Table – 17: Imports of Kyanite
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**748**	**16619**	**620**	**17807**
USA	478	14607	538	17104
China	270	2012	82	703

Table – 18 : Imports of Sillimanite
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**24**	**3029**	**18**	**1028**
Japan	22	2143	9	729
USA	2	886	5	231
Chinese Taipei/ Taiwan	-	-	4	46
Italy	-	-	++	12
Belgium	-	-	++	10

Table – 19 : Imports of Andalusite
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**10909**	**222534**	**14375**	**318253**
South Africa	10368	205494	13495	287655
France	454	14614	879	30566
China	++	86	1	24
USA	-	-	++	8
Japan	8	656	-	-
Peru	79	1684	-	-

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. 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. Demand for refractory minerals is likely to scale up as the steel production is increasing in India.