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QUARTZ AND OTHER SILICA MINERALS

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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42 Quartz & Other Silica Minerals

The term 'quartz' is often referred to as a synonym for silica. Silica (SiO_2) is one of the ubiquitous materials in the earth's crust. Quartz, quartz crystals, quartzite, silica sand, sand (others) and moulding sand are all coined together in one generic name 'silica minerals'. This is because all these commodities are essentially crystalline silicon dioxide (SiO_2) with variations mostly related to their crystalline structure and presence of minor or trace impurities. Silica occurs in several forms giving rise to different varieties.

Crystalline Varieties

The important varieties of crystalline quartz are vein quartz (massive crystalline quartz); milky quartz (white, translucent to opaque); ferruginous quartz (containing brown limonite and red haematite and almost opaque); aventurine quartz (containing glistening flakes of mica or haematite); cat's eye (opalescent greenish quartz with fibrous structure); rock crystal (clear, colourless, well-crystallised transparent quartz); amethyst (clear-purple or violet-blue), transparent quartz; rose quartz; smoky quartz; etc. Occurrences of massive crystalline quartz in veins or pegmatites have been recorded in almost all the states.

Clastic or Granular Varieties

These varieties include sand consisting largely of unconsolidated quartzose grains (0.06 mm to 2 mm diameter), gravel consisting largely of unconsolidated coarse quartzose grains or pebbles (2 mm to 8 mm in diameter), sandstone and quartzite. Quartzite is a granulose metamorphic rock consisting essentially of quartz and sandstone cemented by silica which has grown in optical continuity around each grain. Occurrences are reported from Andhra Pradesh, Bihar, Delhi, Haryana, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh, etc. The silica sand from Naini area in Allahabad district, Uttar Pradesh is of a very high quality.

Cryptocrystalline Varieties

This group includes chalcedony, agate, jasper, onyx, flint and chert. These varieties appear non- crystalline (amorphous) in hand specimens, but under microscope show double refraction which reveals their concealed crystalline nature. These varieties are reported from Gujarat, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, Maharashtra, Madhya Pradesh, Karnataka and Punjab. The most important occurrences of agate are in Ratnapur, Rajpipla area and further west between Tapi

and Narmada rivers in Bharuch district, Gujarat, where it is found as pebbles in varying sizes associated with clay washed down by the river flow. Other occurrences of economic importance are reported from Amravati, Aurangabad, Buldhana, Chandrapur, Nashik and Pune districts in Maharashtra; beds of Krishna and Godavari rivers in Andhra Pradesh; Dumka district in Jharkhand; Dhar, Mandsaur, Sihore and Shahdol districts in Madhya Pradesh; and Kachchh district in Gujarat.

As per Govt. of India Gazette Notification S.O 423 (E) dated 10th February 2015, 31 minerals are declared as minor minerals. Out of these 31 minor minerals, Agate, Fuschite quartzite, Jasper, Quartz, Quartzite, Sand (others) and Silica sand comes under the different variety of silica minerals. Minor minerals come under the purview of respective state governments and the States frame their rules for minor minerals.

RESERVES/RESOURCES

As per the NMI database, based on UNFC system as on 1.4.2015, the total reserves/resources of quartz and silica sand in the country have been estimated at 3,907.95 million tonnes out of which 647.53 million tonnes (17%) are placed under reserves category and 3,260.42 million tonnes (83%) are placed under remaining resources category. Resources by grades reflect foundry & moulding grade at 735.59 million tonnes (19%), glass at 649.77 million tonnes (17%), ceramic & pottery grade at 438.44 million tonnes (11%) and ferro-silicon grade at 183.96 million tonnes (5%). The abrassive, sodium silicate, others, unclassified and not-known grades at 1,900.18 million tonnes (48%) of the total resources. State-wise Haryana alone acounts for 1,653.65 million tonnes (42%) resources, followed by Rajasthan at 740.46 million tonnes (19%), Andhra Pradesh 236.69 million tonnes (6%), Tamil Nadu 201.49 million tonnes (5%), Maharashtra 179.72 million tonnes (4.60%), Jharkhand 151.19 million tonnes (4%), Uttar Pradesh 140.72 million tonnes (3.60%), Gujarat 132.42 million tonnes (3.39%), Kerala 128.48 million tonnes (3.28%), Karnataka 95 million tonnes (2.43%), Telangana 80.07 million tonnes (2.05%) etc. (Table-1).

Similarly, the total reserves/resources of quartzite in the country as per NMI database, based on UNFC system as on 1.4.2015 have been estimated at 1,658.80 million tonnes out of which reserves are placed at 83.47 million tonnes (5%) and the remaining resources at 1,575.32 million tonnes (95%). Statewise bulk resources of about 884.18 million tonnes are located in Haryana (53%) followed by Bihar 277.82 million tonnes (17%), Odisha 140.55 million tonnes (8.47%), Maharashtra 90.70 million tonnes (5.46%), Punjab 81.91 million tonnes (5%) and Jharkhand at 40.70 million tonnes (2.45%). Gradewise resources of refractory grade-I & II are estimated at 579.45 million tonnes (35%), ceramic & pottery grade at 215.91 million tonnes (13%), BF grades at 66.50 million tonnes (4%) and the remaining resources at 796.92 million tonnes (48%) are of ferro-silicon, low, unclassified, others & not-known grades (Table-2).

EXPLORATION & DEVELOPMENT

Exploration for quartz and silica minerals was conducted by Geological Survey of India and Directorate of Mines & Geology, Rajasthan during the year 2015-16. Details of location of investigation/ exploration carried out by GSI & DMG, Rajasthan for quartz and other silica minerals during 2015-16 is given in Table - 3.

Table – 1: Reserves/Resources of Quartz & Silica Sand as on 1.4.2015 (By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	Total resources (A+B)
		STD121	STD122			STD221	STD222						
All India: Total	**433014**	**93339**	**121176**	**647528**	**354625**	**368216**	**362128**	**36872**	**219180**	**1897962**	**21436**	**3260420**	**3907948**
By Grades													
Glass	205934	24780	19173	249886	83708	46000	54870	3268	5506	195025	11505	399883	649769
Ferro-silicon	10385	170	6729	17283	14199	15950	15194	106	65173	55878	179	166679	183963
Sodium silicate	2385	80	1911	4376	840	1422	5313	195	325	30869	11	38976	43351
Ceramic and Pottery	35142	8883	23348	67373	98139	24681	68351	7553	13022	159035	289	371070	438443
Foundry and Moulding	115324	4946	9898	130167	71962	47190	121130	19234	37977	300257	7672	605421	735589
Abrasive	48	-	-	48	2253	256	1984	22	21	3508	-	8043	8091
Others	20911	8067	2026	31004	44667	65197	27456	1185	873	866706	541	1006625	1037629
Unclassified	42010	45825	56377	144211	28533	161250	48346	4747	1976	150383	679	395915	540126
Not-known	875	590	1715	3180	10323	6270	19485	563	94307	136301	560	267808	270988
By States													
Andhra Pradesh	94483	3429	13687	111599	32690	4039	17329	7081	6691	45661	11599	125090	236690
Assam	-	-	-	-	-	-	-	-	-	1790	-	1790	1790
Bihar	-	-	-	-	-	-	-	-	-	25755	-	25755	25755
Chhattisgarh	501	479	800	1780	389	282	789	56	26	642	7672	9856	11636
Goa	-	-	-	-	-	20	1736	-	-	18248	-	20004	20004
Gujarat	27892	5617	15260	48769	26742	6681	17809	2932	3371	26099	21	83656	132425
Haryana	-	-	8294	8294	35553	247695	178181	886	642	1182400	-	1645356	1653650
Himachal Pradesh	1	-	7	8	99	-	-	-	-	2928	-	3027	3035
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	3110	-	3110	3110
Jharkhand	-	-	1070	1070	534	985	4533	137	766	143053	112	150122	151192
Karnataka	8001	417	1807	10225	15878	6695	9448	94	52	52077	525	84768	94993
Kerala	221	33	136	389	179	1985	3588	14611	30241	77489	-	128092	128481
Madhya Pradesh	129	30	1781	1940	516	-	920	791	316	2717	-	5261	7201
Maharashtra	15188	93	9984	25265	33039	15455	48535	-	355	57077	-	154461	179726
Meghalaya	-	-	-	-	-	-	-	-	177	6906	-	7083	7083
Odisha	567	109	725	1401	344	2038	2918	93	63308	3944	179	72824	74225
Punjab	-	-	-	-	-	-	-	-	-	3927	-	3927	3927
Rajasthan	239302	58049	51927	349278	160210	34587	50008	5464	8001	131816	1098	391183	740462
Tamil Nadu	25086	3493	1199	29778	28196	15176	2191	3387	95837	26931	-	171718	201496
Telangana	18541	1367	6916	26824	10334	2414	8365	159	3107	28642	230	53250	80074
Tripura	-	-	-	-	-	-	-	225	-	264	-	490	490
Uttar Pradesh	445	21025	15144	36613	9415	28813	7048	957	6290	51590	-	104114	140727
West Bengal	2853	400	939	4193	310	151	229	-	-	4896	-	5586	9779

Figures rounded off.

Table – 2: Reserves/Resources of Quartzite as on 1.4.2015
(By Grades/States)

(In '000 tonnes)

Grades/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	**47758**	**2016**	**33698**	**83472**	**120723**	**141437**	**160355**	**119953**	**152715**	**868850**	**11293**	**1575325**	**1658798**
By Grades													
Refractory Grade-I	29574	831	19192	49597	50814	10512	31337	1032	1067	293813	2906	391482	441079
Refractory Grade-II	1038	303	42	1384	1666	3220	497	3183	21075	99849	7497	136987	138371
Ceramic / Pottery	112	49	16	177	18499	37356	58442	-	3599	97772	72	215741	215918
Low	249	35	-	284	2139	3764	73	-	23	8791	-	14789	15073
Ferro-silicon	-	-	-	-	169	8392	3034	-	376	461	523	12955	12955
B.F.	-	-	-	-	-	848	2067	197	275	62822	295	66503	66503
Others	9713	68	175	9956	35277	15920	2093	309	251	44895	-	98745	180701
Unclassified	5572	672	12938	19182	12158	55006	60718	94298	94799	226394	-	543373	562555
Not-known	1500	58	1334	2892	-	6418	2094	20935	31250	34053	-	94750	97642
By States													
Andhra Pradesh	16001	-	1389	17390	2103	8357	6418	-	3975	24797	1256	46905	64295
Arunachal Pradesh	-	-	-	-	-	-	-	-	-	5270	-	5270	5270
Bihar	-	282	12260	12542	390	959	8090	5490	22822	227531	-	265282	277824
Chhattisgarh	605	1524	1567	3696	575	7035	1856	-	-	15404	-	24870	28566
Haryana	-	-	-	-	50751	118056	116686	113902	124458	360335	-	884188	884188
Himachal Pradesh	25	-	16	41	16	-	-	-	-	-	-	16	57
Jammu & Kashmir	1500	58	-	1558	-	-	-	-	120	9100	7380	16600	18158
Jharkhand	181	-	-	181	763	49	390	197	275	38854	-	40527	40708
Karnataka	231	-	-	231	69	48	592	-	-	4914	1730	7353	7584
Madhya Pradesh	-	-	-	-	-	-	-	-	-	832	-	832	832
Maharashtra	9026	-	-	9026	49172	-	21156	-	-	11344	-	81671	90697
Odisha	20050	151	18381	38582	16861	6914	5128	364	274	71503	927	101971	140554
Punjab	-	-	-	-	-	-	-	-	116	81796	-	81912	81912
Rajasthan	140	-	86	226	-	18	18	-	-	706	-	742	968
Sikkim	-	-	-	-	-	-	-	-	675	16444	-	17119	17119
West Bengal	-	-	-	-	24	-	21	-	-	21	-	66	66

Figures rounded off.

Table – 3: Details of Exploration Activities for Quartz & Silica sand, 2015-16

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI	Off Ambalappuzha, Kerala	-	-	-	-	-	92 vibrocores were collected from 80 locations and laboratory analysis found that majority of the cores (75) contain clay and sandy clay and few cores (17) contain sand.
DMG, Rajasthan							
Ajmer and Nagaur	Around village Mehgaon, Niiuti, Gingoli, Jajota, Jhak etc.	-	-	-	-	-	Investigation for minerals/ore: Limestone, dolomite, fluorite, barite, soapstone, white quartzite & other economic minerals.
Jodhpur	Thadia, Fatehgarh, Lalsar, Gumanpura, Kumaro Ki Dhani, Ravli Nadi: tehsil- Shergarh.	-	-	-	-	-	Regional mineral survey conducted for sandstone and other economic minerals like Jasper, red ocher.
Bikaner	Motawatan, Kishnayat, Khari-Charnanin: teshil- Kolayat.	-	-	-	-	-	Investigation for minerals/ore: Clay, Silica Sand and other economic minerals.
Bundi	N/V Kathoda, Mani, Bishan Pura, Sodanpura, Kalyani, Karwar, Ariali, Antarda etc.; tehsil- Nainwa and Indergarh	-	-	-	-	-	Investigation for minerals/ore: Limestone, Clay, Silica sand and other economic minerals. Quartzite are found exposed in the form of hills near village Mataji Ka Dera and Jhira. It is pinkish brown in colour, fine to medium grained and hard & compact in nature.
Alwar	N/V Shyampura, Mejorh, Raipura, Ramji ka guda, Balwas etc.; tehsil- Thanagazi.	-	-	-	-	-	Investigation for minerals/ore : Iron ore, Red/yellow ochre, Quartz and other economic minerals.
Barmer	Junejo Ki Dhani, Pusad, Harwecha; tehsil- Sheo	-	-	-	-	-	Investigation for minerals/ore: Bentonite, Siliceous earth, Silica sand, Sandstone. The objective of exploration is to locate and delineate Bentonite and other economic minerals. Regional mapping of sandstone (1 cm=100 m) and siliceous earth (1 cm= 20 m) has been carried out at Bhoja Bhakri area (12 sq. km) and Kumharo Ki Dhani area (3 sq. km), respectively.
Banswara	Near villages Asoda, Oda-Bassi, Bhimgarh, Karna Chota; tehsil- Garhi	-	-	-	-	-	Exploration was carried out for Marble. However, various quartz veins of varying sizes are observed during the process. These quartz veins are occupying top of the hillocks and whitish to off white in colour, hard & compact and fractured.

PRODUCTION & STOCKS

QUARTZ

As per the GOI Notification S.O. 423(E) dated 10th February 2015, 'Quartz' has been declared as 'Minor Mineral', hence the production, stocks & prices beyond January 2015 is not available with IBM. The principal producers of quartz mineral are given in Table-4.

Table – 4: Principal Producers of Quartz

Name & address of producer	Location of mine	
	State	District
Veejee Mines & Minerals, 1-154, Hanaval (Post), Adoni- 518 344, Andhra Pradesh.	Andhra Pradesh	Kurnool
Adibonia Subbarayadu, 20/1/2, Kondapeta, Rajivnagar, Dhone, Kurnool- 518 222, Andhra Pradesh.	Andhra Pradesh	Anantapur
Sibelco India Minerals Pvt. Ltd, (Formerly Vijaya Gimpex, Mining (P) Ltd), No.8-2-293/k/311-312, Sriman Chambers, Kamalapuri Colony, Phase-3, Hyderabad- 500 073, Andhra Pradesh.	Andhra Pradesh Telangana	Anantapur, Mahabubnagar Nalgonda Rangareddy
Sharana Basaveshwara Mining Co. 124/B, Ward No. 2, Koppal – 583 234, Karnataka.	Karnataka	Koppal
Bijendra Kumar Goyal, 35-36, Shiv Nagar, Murlipura, Jaipur- 302 013, Rajasthan.	Rajasthan	Tonk
Asha Lata Bairwa, R-3, Raghu Vihar, Lal Kothi, Gandhi Nagar, Jaipur- 302 015, Rajasthan.	Rajasthan	Tonk
K. Maheswara Reddy, 5/57, Village & PO. Hussainapuram, Peapully- 518 222, Andhra Pradesh.	Andhra Pradesh	Kurnool
Vidhatri Mines & Minerals, D. No. 40-439-S, Ravi Prakash Complex, R.S. Road, Kurnool – 518 001, Andhra Pradesh.	Andhra Pradesh	Kurnool
L.M. Prashant, 11th Ward, Gadigi Palace Car Street,	Karnataka	Ballari

SILICA SAND

As per the GOI Notification S.O. 423(E) dated 10th February 2015, 'Silica Sand ' has been declared as 'Minor Mineral', hence the production, stocks & prices beyond January 2015 is not available with IBM. The principal producers of silica sand are given in Table-5.

Table – 5: Principal Producers of Silica Sand

Name & address of producer	Location of mine	
	State	District
Bhavani Minerals, P.O.Bhilod-393 135, Distt. Bharuch, Gujarat.	Gujarat	Bharuch
Mohd. Sher Khan Khwaja Bagh, P.O. Sawa- 312 613, Distt. Chittorgarh, Rajasthan.	Rajasthan	Chittorgarh
Sanghi Industries Ltd, 10th Floor, Kataria Arcade, Opp. S. G. Highway, P.O. Makaraba, Distt. Ahmedabad- 380 051, Gujarat.	Gujarat	Kachchh
Alimiya Imam Ali Saiyed, 22/FF-16, Samruddhi Complex, Nyay Mandir, P.O. Himmatnagar- 383 001, Distt. Sabarkantha, Gujarat.	Gujarat	Bharuch
Nishita Mines & Minerals, 6/160, East Street, Gudur, Distt. Nellore, Andhra Pradesh.	Andhra Pradesh	Nellore
D. Sundara Rami Reddy, P.O. Chillakur, Mandal-524 412, Distt. Nellore, Andhra Pradesh	Andhra Pradesh	Nellore
Bhajan Dutta, Vill. & P.O. Panchmura, P.S. Taldangra, Distt. Bankura-722 156, West Bengal.	West Bengal	Bankura

(Contd.)

Table- 5 (Concld.)

Name & address of producer	Location of mine	
	State	District
Bundi Silica Sand Supply Co., B-72, Ballabh Nagar, Kota- 324 007, Rajasthan.	Rajasthan	Bundi
Shanmuga Minerals, 38/3, Siddavaram Village, Vill. & Post. Siddavaram, Kota Mandal, Gudur, Nellore- 524 411, Andhra Pradesh.	Andhra Pradesh	Nellore
Neyveli Lignite Corporation Ltd., No.135, Periyar E.V.R High Road, Kilpauk, Distt. Chennai-600 010, Tamil Nadu.	Tamil Nadu.	Cuddalore

QUARTZITE

As per the GOI Notification S.O. 423(E) dated 10th February 2015, 'Quartzite' has been declared as 'minor mineral', hence the production, stocks & prices beyond January 2015 are not available with IBM. The principal producers of quartzite mineral are given in Table-6.

MOULDING SAND

The production of moulding sand was at 25,852 tonnes in 2015-16 increased by 305% during the year as compared to that in the previous year. There were three reporting mines in both the year 2014-15 and 2015-16. The production of moulding sand was reported only from Chhattisgarh during the year. Three principal producers of moulding sand accounted for the entire production in 2015-16 (Tables- 7 to 9).

Table – 6: Producers of Quartzite

Name & address of producer	Location of mine	
	State	District
Dinesh Das & Son's Mines & Steel Pvt. Ltd, Post- Bahalda, Bahalda Road, Distt.- Mayurbhanj - 757 054, Odisha.	Andhra Pradesh	Vizianagaram
B. Ramesh, Flat No. 201, Supriya Niwas, Sagar Society, Road No. 2, Banjara Hills, Hyderabad-500 034.	Andhra Pradesh	Vizianagaram
*Abdul Gaffar Rangoonwala, Gahra Mineral Habib Nagar,Teka Naka, Nagpur-440 017, Maharashtra.	Maharashtra	Bhandara Chandrapur
R. Suneetha, P.O.: Gadasam, Mandal: Dattirajeru, Vizianagaram-535 580, Andhra Pradesh.	Andhra Pradesh	Vizianagaram
BVRM Vishakha, 6-2-79, Gembali Vari Street, Vill. Parvathipuram, Vizianagaram-535 501, Andhra Pradesh.	Andhra Pradesh	Vizianagaram
S. Tirumala Rao, D. No. 4-117, Main Road, P.O. Cheepurupalli, Vizianagaram-535 128, Andhra Pradesh.	Andhra Pradesh	Vizianagaram
Venkateswara Mines and Minerals, Post.Balagudaba,Parvathipuram- 535 501, Distt. Vizianagaram, Andhra Pradesh.	Andhra Pradesh	Vizianagaram

** Producing as an associated mineral with quartz and pyrophyllite.*

Mine-head closing stocks of moulding sand in the year 2015-16 were 1,148 tonnes as against 411 tonnes in 2014-15 (Table- 10).

The average daily employment of labour in 2015-16 was 35 as against 29 in the preceding year.

SAND (OTHERS)

As per Govt. of India Notification S.O 423 (E) dated 10th February 2015, Sand (others) has been declared as 'Minor Mineral', hence the production, stocks & prices beyond January 2015 is not available with IBM. The producers of Sand (Others) is given in Table-11.

Table - 7: Principal Producers of Moulding Sand, 2015-16

Name and address of producer	Location of Mine	
	State	District
Mahendra Kumar Seksaria, 271, Ramdev Mandir, Ward-35, Ganjpara, Durg-491 001, Chhattisgarh.	Chhattisgarh	Durg
Deepak Kumar Gupta, 97-A, Plot 10-11, Nehru Nagar(East), Bhilai, Durg- 490 020, Chhattisgarh .	Chhattisgarh	Durg
Smt. Archana Das, 44, Vardhaman Nagar, Jain School Road, Rajnandgaon-491 441, Chhattisgarh.	Chhattisgarh	Rajnandgaon

Table –8: Production of Moulding Sand , 2013-14 to 2015-16 (By States)

(Qty in tonnes; Value in ₹'000)

State	2013-14		2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**29963**	**4877**	**6383**	**1671**	**25852**	**6068**
Chhattisgarh	29323	4675	6383	1671	25852	6068
Gujarat	150	68	-	-	-	-
West Bengal	490	134	-	-	-	-

Table – 9: Production of Moulding Sand, 2014-15 & 2015-16 (By Sector/States/Districts)

(Qty in tonnes; Value in ₹'000)

State/District	2014-15			2015-16 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**3**	**6383**	**1671**	**3**	**25852**	**6068**
Private sector	3	6383	1671	3	25852	6068
Chhattisgarh	**3**	**6383**	**1671**	**3**	**25852**	**6068**
Durg	2	5953	1459	2	24992	5638
Rajnandgaon	1	430	212	1	860	430

Table – 10: Mine-head Closing Stocks of Moulding Sand, 2014-15 & 2015-16 (By States)

(In tonnes)

State	2014-15	2015-16 (P)
India	**411**	**1148**
Chhattisgarh	190	1127
Gujarat	200	-
West Bengal	21	21

Table – 11: Principal Producers of Sand (Others)

Name & address of producer	Location of mine	
	State	District
Singareni Collieries Co.Ltd, P.O. Kothagudam, Distt.- Khammam- 507 101, Telangana.	Telangana	Adilabad Karimnagar
Western Coal fields Ltd, Coal Estate, Civil Lines, Nagpur- 440 001, Maharashtra.	Maharashtra	Chandrapur
MOIL Limited, MOIL Bhavan, I-A Katol Road, Nagpur- 440 013, Maharashtra.	Madhya Pradesh	Balaghat

Table – 12: Producers of Flint Stone

Name and address of producer	Location of mine	
	State	District
Sisir Kumar Sarkar, Vill.Taljhari, Taluk-Rajmahal, Distt. Sahibganj-816 129, Jharkhand.	Jharkhand	Sahibganj

AGATE

As per Govt. of India Notification S.O 423 (E) dated 10th February 2015, Agate has been declared as 'Minor Mineral' hence the production, stocks & prices beyond January 2015 is not available with IBM.

FLINT STONE

The production of flint stone at 253 tonnes in 2015-16 increased by 4% during the year as compared to that in the previous year.

There was one reporting mine in 2015-16 as against two in the previous year. The entire production of flintstone was reported from Jharkhand (Tables -12 to 14).

There were no mine-head closing stocks of flint stone in 2015-16 as well as in 2014-15 .

The average daily employment of labour in 2015-16 was 2 as against 7 in the preceding year.

Table – 13: Production of Flint Stone, 2013-14 to 2015-16
(By State)

(Qty in tonnes; Value in ₹'000)

State	2013-14		2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India/Jharkhand	**459**	**136**	**244**	**79**	**253**	**76**

Table – 14: Production of Flint Stone, 2014-15 & 2015-16
(By Sector/State/District)

(Qty in tonnes; Value in ₹'000)

State/District	2014-15			2015-16 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India/Private Sector	**2**	**244**	**79**	**1**	**253**	**76**
Jharkhand/ Sahibganj	2	244	79	1	253	76

MINING

Mining for silica minerals is carried out by manual opencast method. Quartz produced in the form of lump along with other associated minerals is invariably hammered to pieces and manually sorted before it is despatched to the consuming industries. It is sometimes crushed and marketed. Glass sand is generally screened and washed to remove all the deleterious constituents for its use in glass industry.

APMDC owns two crushing plants located at Mahabubnagar district in Andhra Pradesh with crushing capacity of 45 tonnes and 1000 tonnes a month, respectively. Besides, Maharashtra Minerals Corp. Ltd is having a 50,000 tonnes per year beneficiation plant at Phondaghat in Sindhudurg district. The plant has advanced technology in washing both by water and chemicals and further grading it in required fractions.

HEALTH HAZARDS

Respirable silica is still a cause of major concern to miners and consumers since many minerals, especially industrial sand and gravel contain crystalline silica. There is a potential threat of workers getting subjected to "silicosis" in quartz, silica sand and gravel mines. Occupational safety measures & regulations to monitor the levels of crystalline silica in these mines are mandatory. In the USA, the Occupational Safety and Health Administration (OSHA) listed "crystalline silica" as one of their top five priorities for formulation of necessary rules. The OSHA, on the basis of significant information put out by International Agency for Research on Evaluation of Cancer has declared that any material containing more than 0.1% crystalline silica should indicate its carcinogenic hazard.

USES

Quartz, quartzite and silica sand are used in various industries like glass, refractory, foundry, ceramic, cosmetic, electrical, abrasives, paints, etc. The primary use of silica is in the manufacture of virtually all types of glasswares, ceramics and ceramic glazes. Other major uses are in metallurgy, (where silica is used as a refractory, foundry mould, fluxes and as a source of silicon for the production of silicon metal and ferro-silicon and other ferro-alloys), silicon carbide manufacture, chemical & construction sectors and as a natural abrasive. Known for its piezoelectric properties, high quality quartz crystal is used in electronic devices, multiple telephone lines, depth-sounding devices, range finders, chronometers, etc.

Sand is also used as a fireproofing material, for sandstowing in mines, soundproofing material and as a filler. Silica sand is also used to maintain or increase the permeability of oil and gas-bearing formations; its application as a filler in acid proof cements, putty, paints, epoxy & polyester resins is inevitable. Besides, it is widely used in horticulture as a filtration medium, and for ornamental purposes as well. Silica flour is used as a filler in plastic and rubber products.

Flint and chert are used in abrasives and tube-mill lining. Besides, chert is used in crushed form as aggregate for concrete and road surfacing. Rounded pebbles of chalcedony are used as balls in ball mill for finer crushing and grinding felspar, calcite and barytes. The different cryptocrystalline varieties of transparent and translucent chalcedony are valued as semiprecious stones and are carved out into a variety of ornaments and used for making different ornamental wares or articles of decoration. Agate pieces after cutting and polishing are sold as semiprecious stones. Big pieces are used in making mortars and pestles for laboratory use. Agate cut into requisite shapes is also used as fulcra of scientific balances and in making edges, planes and bearings of precision instruments.

INDUSTRY & SPECIFICATIONS

In India, quartz, quartzite and silica sand are used mainly in glass, foundry, ferro-alloys and refractory industries and also as building materials. According to its suitability for different purposes, it may be named as building sand, paving sand, moulding or foundry sand, refractory sand or furnace sand, filter sand, glass sand and grinding & polishing sand.

Glass

Main use of silica minerals is in the manufacture of different types of glasses, i.e. glass containers, bottles, amber glass containers, clear flint glass, vacuum bottles and other glasswares. Most of the glass demand in India currently comes from container glass, which accounts for 50% of the country's glass consumption by value. It is reported that a large fraction of the requirement of flat glass, container glass, glass fibre and glass tablewares is being produced by about 100 large-scale producers. Most of them are located in Gujarat, Mumbai, Kolkata, Bengaluru and Hyderabad. There are more than 600 medium and small cottage-scale industries.

The production of glass sheet, toughened glass, fibre glass and glass bottles during 2015-16 were 87,544.08 thousand sq m, 3,117.95 thousand sq m, 49.96 thousand tonnes and 918.67 thousand tonnes, respectively.

The natural silica sand is the preferred material in glass industry, but in some cases where the glass plants are located far away from silica deposits, crushed quartz is also used. For use in glass industry, the silica sand must be uniform in chemical composition, size and shape of grains. Uniform grain size promotes even melting in the glass tank. The sand should not be coarser than 20 or 30 mesh and finer than 100 to 120 mesh. As a general rule, the grains should be angular rather than rounded, because angular grains melt more readily than the rounded ones.

For glass manufacturing, the silica sand should be fairly free from contaminations of clay materials, pebbles, etc. Silica sand usually contains iron oxide, calcium oxide, potassium oxide and sodium oxide in small amounts. Iron is the most objectionable impurity because it imparts colouration to the glass. The common permissible limits of iron oxide in silica sand for use in the manufacture of different types of glass are as follows:

Glass type	Fe_2O_3 %
Optical glass	0.005-0.008
Flint or soda-lime glass	0.02-0.05
Plate glass	0.1-0.2
White bottles or window glass	0.2-0.5
Dark bottle glass	0.5-0.7

BIS has laid down specifications for glass making sands vide IS:488-1980 (Second Revision, Reaffrimed 2008 & 2013).

Chromium compounds, alumina, lime and magnesia are the other deleterious impurities. Chromium compounds are undesirable because these compounds impart more colouration to the glass than iron. Alumina tends to decrease transparency and makes the batch more difficult to melt. The maximum quantity of alumina permissible in sand is 1.5 percent. The maximum permissible limit for lime and magnesia is about 0.05% and for alkalies, it is 0.01% or less.

Ceramic

The Indian ceramic tiles industry, despite an overall slowdown of the economy, continues to grow at a healthy rate of about 15% per annum. India ranks in top 3 countries in terms of tiles production in the world. The ceramic tiles industry have been characterised by excess capacities and falling margins. As per Indian Council of Ceramic Tiles & Sanitaryware report, the per capita consumption in India is as low as 0.5 m^2 per person compared to China (2.6 m^2 per person), Europe (5 to 6 m^2 per person) or Brazil (3.4 m^2 per person). Considering the shortage of 40 million units of housing and rising income of growing middle class, the industry has a great potential.

Ceramic industry comprises ceramic tiles, sanitaryware and crockeryware items. These products are manufactured both in large and small-scale sectors. In organised sector, there were approximately 14 units for ceramic tiles which accounted 40% of total production. The current size of the organised sector is about Rs. 7,200 crores. The unorganised sector accounts nearly 60% of the total industry.

In the regional sector, approximately 200 (70% based in Gujarat) no. of units of ceramic tiles industry is based in the country.

Ceramic whiteware contains about 40% silica, besides other constituents except for bone china in which it is not used at all. The silica serves to provide whiteness and renders the ceramic body to dry easily and provides compatability between the body and the glass to prevent crazing or peeling. Main source of silica for this

application is silica sand. In addition, silica flour is used in formulation of ceramic body for enamels and frits. Silica flour produced by fine grinding of quartzite, sandstone or lump quartz is used in enamels. The silica flour normally contains more than 97.5% SiO_2, less than 0.55% Al_2O_3 and less than 0.2% Fe_2O_3. Purity and small particle size (BS mesh-200) are fundamentally important for silica in manufacture of ceramics. BIS has prescribed the specifications of quartz for ceramic industry vide IS: 11464-2011 (First Revision).

Foundry

The Indian foundry industry is the largest in the world. This industry is well established in the country and is spread across a wide spectrum consisting of large, medium, small and tiny sector. A special feature of domestic foundry industry is its geographical clustering, i.e., Coimbatore cluster is famous for pump sets castings, Kolhapur and Belgaum cluster for automotive castings, Rajkot cluster for diesel engine castings and Batala and Jalandhar cluster for machinery parts and agriculture implements.

A large number of foundries in both ferrous and non-ferrous sectors are functioning in the organised sector in the country. Most of the foundry units use moulding sand having 40 to 65 A.F.S. (American Foundrymen's Society) numbers.

Silica sand is used in both foundry cores and moulds because of its resistance to thermal shock. Silica content of 85% is used in iron casting. In steel foundries, silica content should be at least 95%. BIS has laid down specifications of high silica sand for use in foundries vide IS: 1987-2002 (Second Revision, Reaffirmed 2007).

Natural moulding sand contains variable amount of clay which acts as a bond between the sand grains. These sands, therefore, possess strength, plasticity and refractoriness to varying extent depending upon the clay minerals present. When it contains more clay, it is blended with river sand, which is relatively clay-free so as to get the optimum properties desired in the sand mixture.

Washed grains shall be mostly sub-angular to rounded shape. As far as possible, the sand shall be free from gravel. As per IS:3343-1965 (Reaffrimed 2008), natural moulding sand for use in foundries shall be of three main grades, namely, A, B and C with respect to clay content.

Grade	Clay (%)
A	5 to 10
B	10 to 15
C	15 to 20

Refractoriness of the natural moulding sand based on sintering temperature range should be as follows:

Grade A - 1350 to 1450 °C

Grade B - 1200 to 1350 °C

Grade C - 1100 to 1200 °C

Washed sand grains are required to be sub-angular to rounded shape.

Silica flour is particularly used in the steel foundry in dressing for moulds & cores and also as essential ingredient in the moulding sand mixtures. It is also used to obtain elevated temperature strength, high density and resistance to metal penetration in cores. Silica flour is produced by crushing, washing and grading high-grade quartz/quartzite rocks or white silica sand or other deposits sufficiently pure to get the desired material. BIS has laid down specifications of silica flour for use in foundries vide IS: 3339-1975 (Reaffirmed 2008 & 2014).

Refractory

Quartz and quartzite are used in the manufacture of refractory silica bricks. However, recently these bricks are being replaced by basic linings of magnesite, dolomite or natural types such as bauxite, etc. in LD basic oxygen and electric furnaces. Silica reacts readily with basic slag and is, therefore, unsuitable in the basic steel making process. Nevertheless, silica bricks continue to be used in coke ovens, ceramic kilns, glass tank crowns and as blast furnace chequers in some steel mills. Silica bricks have excellent load resistance capacity at high temperature. For the manufacture of refractory bricks, silica mineral should be free from aluminosilicates (felspar, mica, etc.) as they adversely affect refractoriness of the bricks. Silica rock (raw material) should be hard, having high bulk density and low porosity.

Fluxes

Massive quartz, quartzite, sandstone and unconsolidated sands are the main sources of silica that get used as flux in smelting base metal ores where iron and basic oxides are slagged as silicates. Silica is also used to balance the lime and silica ratio of the blast furnace mix. The silica content for this purpose must be as high as 90% with minor amounts of impurities like iron and alumina up to 1.5% maximum. BIS has laid down IS: 13676-1993 (Reaffirmed 2008 & 2014) for quartzite for iron making in blast furnace.

Ferro-silicon and Other Alloys

Ferro-silicon contains about 75-90% silicon and minor amounts of iron, carbon, etc. It is estimated that for the manufacture of one tonne ferro-silicon of 70-75% grade, about 1.78 tonnes quartz is required besides other raw materials like coke, iron scrap, etc. Quartz is the major source of silica in the manufacture of ferro-silicon. Occasionally, quartzite is also used. However, use of quartzite is restricted as it contains higher alumina and iron and more likely that it would break down in the furnace. Lump silica in the size range from 3/4 to 5 inches are generally preferred. Ferro-silicon is produced by smelting a mixture of quartz, metallic iron (steel scrap and turnings) and a reducing agent like coke, charcoal or wood chips.

Quartz, suitable for ferro-silicon production should have more than 98% SiO_2, less than 0.4% Al_2O_3 and not more than 0.2% each of Fe_2O_3, CaO and MgO. Phosphorus or arsenic should not be present in quartz. If Al_2O_3 is more than the prescribed limit, it affects reduction in the electric furnace. Alkali has a tendency to promote a sticky slag which contaminates the products. If higher iron (more than 0.3%) is present in quartz, the fusion in the furnace takes place at lower temperature and affects reduction process. Another important factor is that quartz should have good thermal stability at 1200°C or more. BIS has laid down IS: 13054-1991 (Reaffirmed 2008) for use of quartz/ quartzite for production of ferro-alloys.

The production of ferro-silicon was estimated at around 90 thousand tonnes each in 2014-15 and 2015-2016. List of principal producers of ferro-silicon is furnished in Table - 15.

Silico-manganese, a combination of 60-70% manganese, 16-28% silicon and 1.5 to 2.5% carbon is used as a more effective deoxidizing agent than high carbon ferromanganese in the production of various types of steels. The production of silico-manganese (including medium carbon & low carbon silico-manganese) which was about 249.69 thousand tonnes in 2014-15 increased to 269.92 thousand tonnes in 2015-16. The details of silicon ferro-alloys are also discussed in the review on 'Ferro-Alloys'. In 2015-16, the total consumption is reported at 258.20 thousand tonnes.

Table – 15: Principal Producers of Ferro-silicon

Name of the plant	Installed capacity (tpy)
Ferro Alloys Corp. Ltd, (Ferro Alloys Division), Vizianagaram, Andhra Pradesh.	72500 (Total)
Navbharat Ferro Alloys Ltd, Paloncha, Distt.- Khammam, Andhra Pradesh.	9300
VBC Ferro Alloys Ltd, Medak, Andhra Pradesh.	19000
GMR Technologies & Ind. Ltd, Ravivalasa, Distt.- Srikakulam, Andhra Pradesh.	25000 (Total)
Akshay Ispat & Ferro Alloys Ltd, Namchi Distt.- South Sikkim, Sikkim.	6000
Hindustan Malleables & Forgings Ltd, Dhanbad, Jharkhand.	1800
Anjaney Ferro Alloys Ltd, Mihijam, Distt.- Dumka, Jharkhand.	NA

(Contd.)

(Table -15 Concld.)

Name of the plant	Installed capacity (tpy)
Sandur Manganese & Iron Ore Ltd, Vyasankere, Ballari, Karnataka (closed).	24000
Sri Laxmi Electro Smelters (Pvt.) Ltd, Erumathala, Aluva, Kerala.	NA
Indsil Electrosmelts Ltd, Pallabhari, Distt.- Palakkad, Kerala.	NA
Indian Metals & Ferro Alloys Ltd, Therubali, Distt.- Cuttack, Odisha.	53000
The Silical Metallurgic Ltd, Puducherry.	10560
Snam Alloys Ltd, Village Kariamanickam, Puducherry.	12000
V.S.K. Ferro Alloys Ltd, Thuthipet, Puducherry.	3000
Hindustan Ferro Alloys & Industries Ltd, Hamirpur, Uttar Pradesh.	3200

Silicon Metal

A high purity quartz containing about 99.80% SiO_2, without any other contaminant, is used in the production of silicon metal. The production of silicon metal is similar to that for ferro-silicon except that no iron is added. The alumina and iron contents are specified to be below 0.1% each with calcium and phosphorus contents each restricted to 0.005 percent. For production of one tonne of silicon metal, about 2.6 tonnes silica is consumed. Specifications of silica minerals to be used in different industries are given in Table- 16.

Table – 16: BIS Specifications of Silica Minerals for various Industries

Industry	Mineral consumed	BIS No.	Physical specifications	Grade	Chemical Specifications							Remarks
					SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	CaO (%)	MgO (%)	TiO_2 (%)	P (%)	
Glass	Silica sand	IS: 488 1980 (Second Revision; Reaffirmed 2008 & 2013)	–	Special Gr.	99	0.020 (min)	-	-	-	0.10		For manufacturing high-grade colourless glass, viz, crystal glass, tableware and decoratedware.
				Gr. I	98.0 (min)	0.04 (max)	-	-	–	0.10 (max)	-	For manufacturing decolourised glassware, viz, containerware, lampware, etc.
				Gr. II	97.5 (min)	0.07 (max)	-	-	-	0.10 (max)	-	For manufacturing glassware where slight tint is permissible.
				Gr. III	97 (max)	0.2 (max)	-	-	-	-	-	For manufacturing of decolourised and some coloured glasses.
Foundry	Silica flour	IS:3339 1975 (First Revision; Reaffirmed 2008 & 2014)	-	-	98.0 (min)	-	-	-	-	-	-	100% silica flour should pass through 150-micron I.S. sieve and atleast 95% through 75-micron sieve. The fusion temperature should be >1700 °C.
Iron (BF)	Quartzite	IS:13676 -1993 (Reaffirmed 2008 &) 2014	Lumpy, Hard, Non-friable of size -150 to +10 mm	-	96-98	2.4	-	-	-	-	-	After prescribed thermal stability test on -25+19 mm material, +19 mm fraction should be more than 55% and -5 mm fraction should be less than 5%.
Banded Hematite Quartzite		-do-	-do-	-	48-50	1.0 (max)	50-52 (Fe)	-	-	-	-	After prescribed tumbling test on +5 mm material, +5 mm fraction should be more than 90%.

Note: *In addition, BIS has prescribed following specifications: - silica for paint industry (IS : 67 - 1998; Second Revision; Reaffirmed 2002), High-silica sand for use in foundries (IS : 1987-2002; Second Revision), Quartz, quartzite for production of ferro-alloys (IS : 13054-1991; Reaffirmed 2003).*

CONSUMPTION

The consumption of quartz and silica sand was estimated at 2.79 million tonnes in 2015-16. Major consuming industries were glass (41%), cement (28%), ferro-alloys (10%), Iron & Steel (6%), foundry (5%) and fertilizer (4%). Other industries such as ceramic, alloy steel, insecticide, refractory, abrasive, etc. consumed the remaining 6% .

The consumption of quartzite was estimated around 526 thousand tonnes out of which iron and steel industry consumed about 67%, followed by ferro-alloys (13%), refractory (10%) and sponge iron (9%).

The total ferro-silicon consumed by various industries in 2015-16 was estimated at 52,400 tonnes. Major consuming industries were iron & steel (81%), alloy steel (14%) and foundry (4%). Besides, reported consumption of ferro-silico-magnesium was 13 tonnes in foundry industry in 2015-16 (Tables 17 to 20).

POLICY

Foreign Trade Policy (FTP) for 2015-2020, the imports of silica sands (processed (white), processed (brown) & other) will subject to Plant quarantine (Regulation of imports into India) Order, 2003. Quartz (lump & powder), quartzite (lump & powder) & flint are free as per import policy 2015-20. The export of silica sand processed (white), processed (brown) & other) permitted under licence. However, the exports of river sand to Maldives under bilateral agreements between Government of India and Government of the Republic of Maldives is permitted, subject to 'No Objection Certificate' by CAPEXIL within the annual ceiling of 2, 2.5 & 3 lakh metric tonnes for the year 2014-15, 2015-16 and 2016-17, respectively.

SUBSTITUTION

In order to reduce the potential threat of "silicosis", a variety of materials are used as substitutes for silica. Basic and neutral refractories (including magnesite, mag-chrome, dolomite and high alumina bricks) have replaced silica in a large number of applications. Chromite, olivine and zircon are alternatives to foundry sands. Garnet and to a lesser extent, olivine are used in sand blasting to avoid the risk of silicosis. Wollastonite is more favoured than free silicon for use in the ceramic industry, again due to the risk of silicosis. In electronic industry, replacement of natural quartz crystal by cultured quartz crystal is increasing steadily. It has been estimated that about 10 billion quartz crystals and oscillators per year are manufactured and installed worldwide in all types of electronic devices.

Table – 17: Consumption* of Quartz/Silica Sand, 2013-14 to 2015-16 (By Industries)

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	**2123400**	**2707100**	**2793100**
Alloy steel	2900	2900	2900
Cement	334200	878700	780300
Ceramic	88200	96600	96600
Ferro-alloys	272700	285100	282000
Fertilizer	105800	105800	105800
Foundry	141400	140700	140800
Glass	1036100	957900	1143800
Iron & Steel	83700	182300	183500
Others (Abrasive, asbestos, chemical, dry cell battery, electrode, paint, pesticide, refractory and rubber)	58400	57100	57400

Figures rounded off.
**Includes actual reported consumption and/or estimates made, wherever required. Due to paucity of data, the coverage may not be complete.*

Table – 18: Estimated Consumption* of Quartzite, 2013-14 to 2015-16 (By Industries)

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	**418000**	**478200**	**525900**
Cement	++	++	++
Ferro-alloys	43100	64600	68400
Foundry	100	100	100
Iron & steel	279400	310600	355000
Pelletisation (Iron & steel)	++	++	++
Refractory	50500	55800	54000
Sponge iron	44900	47100	48400

Figures rounded off.
**Includes actual reported consumption and/or estimates made, wherever required. Due to paucity of data, the coverage may not be complete.*

Table –19: Estimated Consumption* of Ferro-Silicon 2013-14 to 2015-16 (By Industries)

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	**42000**	**42500**	**52400**
Alloy steel	3300	3200	7600
Foundry	2200	2200	2200
Iron & steel	36200	36800	42300
Others (Electrode & Ferro-alloys)	300	300	300

Figures rounded off.
**Includes actual reported consumption and/or estimates made, wherever required. Due to paucity of data, the coverage may not be complete.*

Table – 20: Estimated Consumption* of Ferro - Silicon-Magnesium, 2013-14 to 2015-16 (By Industries)

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	**13**	**13**	**13**
Foundry	13	13	13

**Includes actual reported consumption and/or estimates made, wherever required. Due to paucity of data, the coverage may not be complete.*

WORLD REVIEW

Basically, silica is abundant in the earth's crust. Sand and gravel reserves of the world are large. Quartz-rich sand and sandstone are the main sources of industrial silica sand which occurs throughout the world. Reserves of natural quartz crystal suitable for electronics or optical use in the world are limited. The world's dependence on these reserves will continue to decline because of the increased usage of cultured quartz crystal as an alternate material. Electronic applications accounted for the most industrial uses of quartz crystal, followed by optical application.

All quartz crystals used for electronics were cultured. The world production of industrial silica sand and gravel by principal countries is given in Table - 21.

Table – 21: World Production of Sand and Gravel (Industrial), 2013 to 2015 (By Principal Countries)

(In '000 tonnes)

Country	2013	2014	2015
World: Total	**152000**	**196000**	**189000**
Australia	5500	5500	6000
Canada	1690	1690	1700
Chile	1360	1360	1250
Czech Republic	1340	1270	1270
Finland	2400	2400	2400
France	6290	8750	8750
Germany	7500	7500	7500
India	1210	3430	3400
Italy	16400	13900	13900
Japan	3000	3000	3000
Malaysia	1000	1240	1200
Mexico	3590	3590	3600
Moldova	3000	3500	3800
Norway	1000	1000	1000
Poland	2300	2300	2300
Saudi Arabia	1400	1400	1260
South Africa	2110	2110	2300
Spain	3400	3400	3400
Turkey	15000	7970	8000
UK	3760	4000	4000
USA	62100	110000	103000
Other countries	6690	6030	6000

***Source:** Mineral Commodity Summaries, 2016 & 2017.*

FOREIGN TRADE

Exports

Exports of quartz and quartzite (natural) decreased to 388,192 tonnes in 2015-16 from 410,497 tonnes in the previous year. Out of total exports, quartz comprised 301,226 tonnes (78%) and quartzite 86,966 tonnes (22%). Exports were mainly to Bhutan(12%), Vietnam(11%), Korea, Rep. of (10%), Malaysia (9%), Japan (8%), UAE

& Bangladesh(6% each) and China (5%). Exports of silica sand decreased considerably to 709 tonnes in 2015-16 from 1,216 tonnes in the previous year. Exports were mainly to Bangladesh(39%), Nigeria (15%), Oman (11%), Korea (8%) and Nepal (7%). Exports of sand (excluding metal bearing) increased to 14,476 tonnes in 2015-16 from 10,751 tonnes in the previous year. Exports were mainly to Bhutan (32%), Saudi Arabia (27%), Iran (20%), Bangladesh (7%) and Sri Lanka (5%). Exports of agate (uncut) increased to 800 tonnes in 2015-16 from 557 tonnes in the previous year. China (96%) was the main buyer followed by HongKong (3%) and USA (1%). Exports of agate (cut) registered a sharp increase of 26,70,054 thousand carat in 2015-16 from 8,38,669 thousand carat in the previous year. China (75%) USA (10%), UK (5%) and Ireland (4%) were the main buyers of agate (cut) in 2015-16. Exports of silicon decreased drastically to 36 tonnes in 2015-16 from 260 tonnes in the previous year. Sri Lanka (50%) Ghana (28%), Turkey (8%) and Nepal (5%) were the main buyers of silicon in 2015-16. Exports of flint increased drastically to 867 tonnes in 2015-16 from 484 tonnes in the previous year. Djibouti (35%), Japan (28%) and Saudi Arabia (22%) were the main buyers in 2015-16. (Tables- 22 to 30).

Imports

Imports of quartz and quartzite (natural) sharply increased to 1,224 tonnes in 2015-16 as compared to 215 tonnes in 2014-15. Out of the total imports in 2015-16, those of quartz (natural) were 1,027 tonnes and mainly from Vietnam (97%) and China (1%) while quartzite imports were 197 tonnes mainly from Mauritania (35%), Italy (17%), China (16%) and Germany (12%). Imports of silica sand drastically decreased to 18,788 tonnes in 2015-16 from 76,529 tonnes in the previous year. Egypt (32%), Saudi Arabia (18%), China (16%), Italy (13%) and Belgium (9%) were the main suppliers. Imports of sand (excluding metal bearing) was increased considerably to 1,65,150 tonnes in 2015-16 from 58,237 tonnes in the previous year and imports were mainly from Cambodia (69%) and Philippines (29%). Imports of agate (uncut) decreased drastically to 8 tonnes in 2015-16 from 98 tonnes in the previous year. Imports were mainly from USA, Germany & South Africa (25% each) and China & Brazil (12% each). Imports of agate (cut) also increased manifold to 1,777 thousand carat in 2015-16 from 767 thousand carat in 2014-15. China & Hong Kong (49% each) were the main suppliers of agate (cut). Imports of silicon increased marginally to 46,252 tonnes in 2015-16 from 42,296 tonnes in previous year. Imports were mainly from China (93%) and Bhutan & Australia(2% each). Imports of flint recorded at 1,279 tonnes in 2015-16 and were mainly from France (59%) and Egypt (40%) (Tables - 31 to 39).

Table – 22: Exports of Quartz And Quartzite (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**410497**	**2938736**	**388192**	**3025916**
Japan	33730	449364	29501	436941
Vietnam	47888	432739	41086	381826
Korea, Rep. of	31915	175839	38673	235336
China	8603	74537	20990	216076
Malaysia	28011	175087	34329	207724
Bangladesh	46370	184807	23130	171525
Bhutan	49610	193343	47778	151274
Israel	12124	159045	9206	124579
Italy	7726	93739	10631	120755
UAE	28885	135860	25503	118332
Other countries	115635	864376	107365	861548

Table – 23: Exports of Quartzite (Natural) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**73266**	**848532**	**86966**	**1002267**
Japan	13011	221323	18443	300922
Israel	8375	104793	7782	106213
Italy	5294	67038	8591	96611
Bangladesh	11174	53562	12858	76199
USA	557	20970	3157	52084
Canada	373	5364	4877	51035
Bhutan	7466	50800	12334	43923
Spain	371	10196	3113	42851
Singapore	2475	49116	1554	32934
Czech Republic	1410	17222	2808	32742
Other countries	22760	248148	11449	166753

Table – 24: Exports of Quartz (Natural) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**337231**	**2090204**	**301226**	**2023649**
Vietnam	42794	384154	40333	375388
Korea, Rep. of	31342	171006	37985	229615
China	8461	73351	20621	212812
Malaysia	24402	152771	31851	178589
Japan	20719	228041	11058	136019
Oman	28527	125634	29946	113120
UAE	27327	126696	24356	111314
Bhutan	42144	142543	35444	107351
Bangladesh	35196	131245	10272	95326
Kenya	2961	37401	3462	55752
Other countries	73358	517362	55898	408363

Table –25: Exports of Silica Sand (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1216**	**9802**	**709**	**6727**
Indonesia	-	-	40	1411
UAE	284	1499	37	1294
Bangladesh	16	353	280	952
Korea, Rep. of	-	-	60	777
Nigeria	216	1379	108	732
Nepal	49	840	53	489
Oman	257	955	79	387
Maldives	-	-	10	207
UK	3	105	3	117
Baharain Is	-	-	9	103
Other countries	391	4671	30	258

Table – 26: Exports of Sand (Excl. Metal Bearing) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**10751**	**342836**	**14476**	**491908**
Saudi Arabia	2999	205129	3922	290359
Iran	898	81775	2883	147715
Bhutan	-	-	4712	16140
Sri Lanka	8	524	791	14406
Bangladesh	366	4814	1070	9900
UAE	93	2435	364	3875
Afghanistan	11	20	11	2022
Kuwait	142	1857	122	1915
Angola	326	1877	297	1827
Nigeria	-	-	133	820
Other countries	5908	44405	171	2929

Table – 27: Exports of Agate (Uncut) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**557**	**112149**	**800**	**59868**
China	504	17338	765	20369
USA	19	50296	6	15798
UK	5	7984	1	5661
Australia	3	5243	2	2652
Spain	1	2100	1	2471
Germany	2	2403	1	2303
Japan	1	2384	1	1793
Chinese Taipei/ Taiwan	++	528	++	1496
Hong Kong	1	2585	21	1109
France	1	2957	++	757
Other countries	20	18331	2	5459

Table – 28: Exports of Agate: (Cut) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty ('000 carats)	Value (₹'000)	Qty ('000 carats)	Value (₹'000)
All Countries	**838669**	**44513**	**2670054**	**78804**
USA	16852	19722	267835	47944
China	720002	6541	2009650	9448
UK	1910	5431	137066	3530
Turkey	2	262	2610	2958
Australia	62161	4580	41072	2736
Germany	17	139	30260	2451
Ireland	-	-	116816	1868
Spain	++	10	7539	1837
Saudi Arabia	2	146	52	1475
Japan	7345	1009	15885	1100
Other countries	30378	6673	41269	3457

Table – 29: Exports of Flint (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**484**	**3991**	**867**	**7660**
Japan	220	2409	240	3294
Djibouti	38	215	303	1880
Saudi Arabia	-	-	190	1658
Ethiopia	222	1305	134	655
Lebanon	-	-	++	173
Egypt	4	61	-	-
Italy	++	1	-	-

Table – 30: Exports of Silicon (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**260**	**34175**	**36**	**9426**
Turkey	-	-	3	3731
Sri Lanka	17	3076	18	2675
Ghana	-	-	10	2294
Nepal	40	2589	2	248
Italy	1	101	1	207
Thailand	-	-	++	83
Saudi Arabia	1	59	1	61
Spain	-	-	++	39
Bangladesh	++	46	1	38
Uganda	-	-	++	22
Other countries	201	28304	++	28

Table – 31: Imports of Quartz and Quartzite (Natural): Total (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**215**	**10403**	**1224**	**43801**
Bangladesh	-	-	7	21300
Germany	25	1813	31	7089
Vietnam	-	-	1001	7028
Israel	++	906	++	1984
France	++	22	1	1594
China	4	160	39	1438
Italy	51	2475	34	1391
USA	++	7	++	984
Mauritania	-	-	70	567
Belgium	10	1481	5	379
Other countries	125	3539	36	47

Table – 32: Imports of Quartzite(Natural) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**184**	**8393**	**197**	**10144**
Israel	++	253	++	1984
Germany	23	1675	24	1597
France	++	5	1	1557
Italy	51	2475	34	1391
China	4	160	31	1116
USA	++	7	++	958
Bangladesh	-	-	1	904
Mauritania	-	-	70	567
Belgium	1	342	++	24
UK	-	-	++	16
Other countries	105	3476	36	30

Table – 33: Imports of Quartz (Natural) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**31**	**2010**	**1027**	**33657**
Bangladesh	-	-	6	20397
Vietnam	-	-	1001	7028
Germany	2	138	7	5492
Belgium	9	1139	5	355
China	-	-	8	322
France	++	17	++	37
USA	-	-	++	26
Israel	++	653	-	-
Brazil	++	39	-	-
UAE	++	19	-	-
Other countries	20	5	-	-

Table –34: Imports of Silica Sand (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**76529**	**556336**	**18788**	**226225**
China	3978	127493	3062	60380
Italy	1140	21288	2521	39125
Belgium	656	12809	1639	29948
Egypt	51098	151829	6079	29807
Saudi Arabia	15700	112706	3387	19650
USA	873	25563	245	14162
Germany	635	7289	786	6988
Poland	-	-	456	5522
Chinese Taipei/ Taiwan	424	36382	66	5245
UK	152	9246	72	4326
Other countries	1873	51731	475	11072

Table – 35: Imports of Sand (Excl. Metal Bearing) (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**58237**	**98437**	**165150**	**375079**
Cambodia	57150	79757	114204	176527
Philippines	-	-	47226	74633
China	147	5218	1868	62200
Chinese Taipei/Taiwan	59	4736	239	25053
Germany	56	1682	557	8528
UK	27	1714	155	7342
USA	-	-	154	5264
Belgium	-	-	176	3673
Turkey	++	41	176	3190
Italy	20	774	72	2349
Other countries	778	4515	323	6320

Table – 36: Imports of Flint (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**141**	**2257**	**1279**	**17412**
France	-	-	751	10721
Egypt	139	2201	523	6637
UK	-	-	5	44
USA	-	-	++	9
Turkey	-	-	++	1
Denmark	2	56	-	-
Other countries	-	-	-	-

Table – 37: Imports of Agate: Uncut (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**98**	**24688**	**8**	**19268**
Hong Kong	++	232	++	5178
USA	8	1435	2	3816
Germany	++	61	2	3705
Brazil	++	746	1	3180
China	36	13382	1	1845
South Africa	1	113	2	786
Indonesia	4	850	++	748
Mexico	-	-	++	10
Turkey	38	7247	-	-
Madagascar	10	357	-	-
Other countries	1	265	-	-

Table – 38: Imports of Agate: Cut (By Countries)

Country	2014-15		2015-16 (P)	
	Qty ('000 Carats)	Value (₹'000)	Qty ('000 Carats)	Value (₹'000)
All Countries	**767**	**8977**	**1777**	**11345**
Hong Kong	109	1915	872	8496
China	512	4671	868	2324
Italy	1	1134	1	292
USA	4	203	36	233
Australia	140	662	-	-
Thailand	1	392	-	-
Other countries	-	-	-	-

Table – 39: Imports of Silicon (By Countries)

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**42296**	**5689328**	**46252**	**5651589**
China	38964	5190246	43263	5174100
Australia	1152	180569	980	179195
Bhutan	1503	149760	1063	101266
Korea, Rep. of	93	13288	201	47986
UK	307	49714	257	44405
USA	5	11783	35	20679
Singapore	39	13115	36	17751
Norway	92	26494	62	16373
HongKong	++	94	121	15806
Belgium	60	7651	80	9988
Other countries	81	46614	154	24040

FUTURE OUTLOOK

According to its suitability for different purposes, quartz & silica minerals are named as building sand, paving sand, moulding or foundry sand, refractory sand or furnace sand and glass sand, etc. The future market demand of quartz and silica minerals will depend on its application. However, the main use of silica minerals is in manufacture of different types of glasses, natural silica sand being the preferred material in the glass industry. In India, quartz, quartzite and silica sand are used mainly in glass, foundry, ferro-alloys, refractory industries and also as building materials. Silica sand is used in the oil industry for the hydraulic fracturing process as it helps in the extraction of gases. The market demand for silica minerals may be very high due to horizontal well drilling by oil companies.

The demand for quartz, silica sand, moulding sand and quartzite is increasing over the years to cater to the requirement of ferro-silicon, silico-manganese, silico-chrome, silica refractories, glass and for moulding and casting purposes. The requirements of these products are linked up directly with iron and steel industry including alloy steel production. Further, setting up foundries and enhancing their capacities are also linked with metallurgical industry.

The consumption of ferro-silicon, quartzite, quartz/ silica sand showed increased trend from 2013-14 to 2015-16. It may continue in future due to rise in production in steel sector, infrastructure development, foundry etc.

As per the report of the Sub-Group on 12th Plan, Planning Commission of India, the domestic demand of quartz and silica minerals was estimated at 3.15 million tonnes by 2011-12 and at 4.85 million tonnes by 2016-17 at 9% growth rate.

As on 01.04.2015, the total resources of quartz-silica sand is 3,908 million tonnes and quartzite is 1,659 million tonnes. There are very good prospects of increasing the production and also the export of quartz and silica minerals to the neighbouring countries.