

GARNET



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GARNET

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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13 Garnet

Garnet is the collective name for a group of minerals which crystallise in cubic system with different chemical composition. The principal members of the Garnet group are Almandine (Fe-Al), Pyrope (Mg-Al), Spessartine (Mn-Al), Grossularite (Ca-Al), Andradite (Ca-Fe) and Uvarovite (Ca-Cr). Almandine is hardest amongst all varieties and is often used for abrasive purpose. Garnet is dense & hard with sharp angular chisel-edged fracture, containing small amounts of free silica and exhibits high resistance to physical and chemical attacks. It is used both as semi-precious stone and as an abrasive. The hardness of garnet varies from 6.5 to 7.5 on Mohs scale. This allows it to be used as an effective abrasive.

RESERVES / RESOURCES

In India, garnet deposits suitable for use in Abrasive Industry occur in Andhra Pradesh, Chhattisgarh, Jharkhand, Kerala, Odisha, Rajasthan, Tamil Nadu and Telangana. Gem variety of garnet occurs in Ajmer, Bhilwara, Jhunjhunu, Sikar and Tonk districts, Rajasthan; Nellore and Srikakulam districts, Andhra Pradesh; Khammam district, Telangana and Coimbatore, Ramanathapuram, Tirunelveli, Kanyakumari, Tiruchirappalli and Tiruvarur districts, Tamil Nadu. Garnet is found to occur in beach sands along with ilmenite, rutile, sillimanite, etc. in the States of Kerala, Odisha and Tamil Nadu.

The total reserves/resources of garnet in India as on 1.4.2015, as per UNFC system has been placed at 56.16 million tonnes of which Reserves under Proved and Probable categories together constituted 12.78 million tonnes. Of the total resources, about 20.90 million tonnes are of Abrasive grade, whereas resources of Semi-precious grade are mere 5,803 tonnes. Tamil Nadu alone accounted for about 48% of the total resources followed by Andhra Pradesh (31%), Odisha (17%) and Telangana (3%). The remaining States together shared less than 1% (Table- 1).

EXPLORATION & DEVELOPMENT

The details about the exploration and development, if any, are covered in the Review on “Exploration and Development” under “General Reviews”.

PRODUCTION AND STOCKS

Garnet (Abrasive)

Production of garnet (abrasive) at only 552 tonnes during 2019-20 decreased sharply by more than two hundred times as compared to that in the preceding year. Similarly, there were only 5 reporting mines during 2019-20 as against 10 mines reported in the year 2018-19. The main reason for decrease in number of mines is classification of some garnet producing mines, such as BSM mines in Andhra Pradesh, Odisha and Tamil Nadu. Earlier these mines were considered under Garnet (Abrasive) as a part of MCDR mineral. Since there was no separate classification of BSM and Non-BSM. This has also resulted in the decrease in production. Only one principal producer accounted for about 97% of the total production during the year.

Unlike previous year the share of Public Sector in the total output was about nil in 2019-20 as opposed to 37% in the previous year. Similarly, the share of Private Sector in the total output was cent per cent in 2019-20 as opposed to 63% in the preceding year.

In 2019-20, unlike that of previous year, production was reported only from the State of Rajasthan, i.e., two principal producers from Rajasthan accounted for about cent per cent of the total output during the current year (Tables-2 to 4).

Mine-head closing stocks of garnet (abrasive) for the year 2019-20 were 45,953 tonnes as against 95,784 tonnes in the previous year (Table -5).

The average daily employment of labour during 2019-20 was 35 as against 1,267 in the previous year.

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

(In tonnes)

Grade/State	Reserves			Remaining Resources								Total (B)	Total Resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		
		STD121	STD122			STD221	STD222						
All India : Total	9917936	278493	2587427	12783856	84320	1643412	3287667	121099	10247428	27992906	333	43377166	56161022
By Grades													
Gem	39000	362	34	39396	2	81339	-	-	-	109	-	81450	120846
Abrasive	9804483	276468	2586266	12667217	3062	1489600	3194708	106060	19428	3423374	333	8236565	20903782
Semi-precious	18	13	1128	1159	41	115	514	39	1249	2688	-	4645	5803
Others	-	-	-	-	9051	36358	-	-	-	215573	-	260982	260982
Unclassified	74435	1650	-	76085	72164	36000	394	15000	10225996	23968842	-	34318396	34394481
Not-known	-	-	-	-	-	-	92051	-	756	382321	-	475128	475128
By States													
Andhra Pradesh	1183898	4500	568750	1757148	12189	232525	791238	18	8800000	5674011	-	15509981	17267129
Chhattisgarh	-	-	-	-	-	-	-	-	-	28800	-	28800	28800
Jharkhand	-	-	-	-	-	-	88303	-	-	21768	-	110071	110071
Kerala	-	-	45797	45797	-	-	-	100874	-	52190	-	153064	198861
Odisha	8459821	-	585130	9044951	5	-	-	-	-	348000	-	348005	9392956
Rajasthan	33566	35926	5556	75048	3100	26663	29629	5207	21432	123587	333	209952	285000
Tamil Nadu	225554	238067	1382194	1845815	21936	1342191	2378497	15000	1425996	19888574	-	25072194	26918009
Telangana	15097	-	-	15097	47090	42033	-	-	-	1855976	-	1945099	1960196

Figures rounded off

GARNET

Table – 2 : Principal Producers of Garnet (Abrasive), 2019-20

Name & address of producer	Location of mine	
	State	District
AKD Gem Garnet Mines, F-203, Near Mahapragya Circle, Azad Nagar, Bhilwara - 311 001, Rajasthan.	Rajasthan	Bhilwara
Ansari Brothers, 3142, New Mata Ka Mand, Mohalla Mahavatan, Jaipur - 302 003, Rajasthan.	Rajasthan	Tonk

*Producing as an associated mineral with sillimanite.

**Table – 3 : Production of Garnet (Abrasive) 2017-18 to 2019-20
(By States)**

(Qty in tonnes; Value in ₹'000)

State	2017-18		2018-19		2019-20 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	158277	1618903	123404	1746756	552	4734
Andhra Pradesh	111513	1283793	72521	1068152	-	-
Odisha	34170	242504	38376	545745	-	-
Rajasthan	5781	18717	5166	23662	552	4734
Tamil Nadu	6813	73889	7341	109197	-	-

Note-The main reason for decrease in number of mines is classification of some Garnet producing mines, such as BSM mines in Andhra Pradesh, Odisha and Tamil Nadu. Earlier, these mines were considered under Garnet (Abrasive) as a part of MCDR mineral as there was no separate classification of Beach Sand Minerals (BSM) and Non-Beach Sand Minerals (Non-BSM).

**Table – 4 : Production of Garnet (Abrasive), 2018-19 & 2019-20
(By Sectors/States/Districts)**

(Qty in tonnes; Value in ₹'000)

State/District	2018-19			2019-20 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	10(1)	123404	1746756	5	552	4734
Public sector	2(1)	45717	654942	-	-	-
Private sector	8	77687	1091814	5	552	4734
Andhra Pradesh	2	72521	1068152	-	-	-
Srikakulam	2	72521	1068152	-	-	-
Odisha	(1)	38376	545745	-	-	-
Ganjam	(1)	38376	545745	-	-	-
Rajasthan	4	5166	23662	3	552	4734
Ajmer	1	18	54	-	-	-
Bhilwara	2	5148	23608	2	536	4627
Rajsamand	1	-	-	-	-	-
Tonk	-	-	-	1	16	107
Tamil Nadu	4	7341	109197	2	-	-
Kanyakumari	2	7341	109197	-	-	-
Tiruchirapalli	2	-	-	2	-	-

Note-The main reason for decrease in number of mines is classification of some Garnet producing mines, such as BSM mines in Andhra Pradesh, Odisha and Tamil Nadu. Earlier, these mines were considered under Garnet (Abrasive) as a part of MCDR mineral as there was no separate classification of Beach Sand Minerals (BSM) and Non-Beach Sand Minerals (Non-BSM).

Table – 5 : Mine-head Closing Stocks of Garnet (Abrasive) 2018-19 & 2019-20 (By States)

(In tonnes)		
State	2018-19	2019-20 (P)
India	95784	45953
Andhra Pradesh	22026	326
Odisha	3089	-
Rajasthan	3872	3430
Tamil Nadu	66797	42197

Garnet (Gem)

No production of garnet (gem) was reported since 2018-19.

USES & CONSUMPTION

The most important industrial use of garnet in the form of garnet sand is as an abrasive. About 90% production of abrasive garnet is used for manufacturing of garnet-coated papers, clothes and discs. Garnet-coated abrasives are used in the form of belts, covers for drums, discs or as small sheets. It is used for cleaning spark plugs, paints, polishing and grinding of plate-glass. The remaining 10% output is used in the form of loose grains for surfacing and polishing soft stones (marble, slate, soapstone, etc.). Clear, flawless and rich-coloured crystals of garnet are used as semi-precious stones. The principal variety among them are pyrope, deep-crimson almandine, orange-yellow grossularite, etc. Other uses are in Electronic and Television Industry for polishing glass and TV tubes. Garnet granules are used in 'abrasive blasting' commonly called 'sand blasting' in order to smoothen, clean and remove oxidation products from metals, stone and other material. MMTC's specifications of garnet sand used for sand blasting/jet cutting/other uses for exports to USA, Europe, Middle East and Taiwan are as follows: Al₂O₃: 20.8 to 21.2%, Bulk density; 2.17 kg/m³, Hardness in Mohs scale should be 7.5 to 8.

Water jet cutting machines generally use finely-ground 80-120 mesh size garnet as cutting medium with high pressure water. Owing to its inertness to a wide range of chemicals and relatively high specific gravity, it is used as filter medium for water and other liquids.

SUBSTITUTES

Other natural and manufactured abrasives can substitute to some extent for all major end uses of

garnet. In many cases, however, using the substitutes would entail sacrifices in quality or cost. Fused aluminum oxide and staurolite compete with garnet as a sandblasting material. Ilmenite, magnetite and plastics compete as filtration media. Corundum, diamond and fused aluminum oxide compete for lens grinding and for many lapping operations. Emery is a substitute in nonskid surfaces. Fused aluminum oxide, quartz sand and silicon carbide compete for the finishing of plastics, wood furniture and other products.

WORLD REVIEW

Garnet group of minerals are found throughout the world in metamorphic, igneous and sedimentary rocks.

World resources of garnet are large and occur in a wide variety of rocks, particularly, gneisses and schists. Garnet also occurs in contact-metamorphic deposits in crystalline limestones, pegmatites, serpentinites and in vein deposits. In addition, alluvial garnet is present in many heavy-mineral sand and gravel deposits throughout the world. Large domestic resources of garnet also are concentrated in coarsely-crystalline gneiss near North Creek, NY; other significant domestic resources of garnet occur in Idaho, Maine, Montana, New Hampshire, North Carolina, and Oregon. In addition to those in the United States, major garnet deposits exist in Australia, Canada, China, India and South Africa, where they are mined for foreign and domestic markets; deposits in Russia and Turkey also have been mined in recent years, primarily for internal markets. Additional garnet resources are in Chile, Czechia, Pakistan, Spain, Thailand and Ukraine; small mining operations have been reported in most of these countries.

In 2020, Australia produced about 33% of total global production of garnet (Industrial), followed by China (28%), South Africa (13%), India (12%), USA (10%) and the remaining 4% was contributed by other countries. Russia and Turkey are also mining garnet for domestic markets. Garnet is also mined in Canada, Chile, Czech Republic, Pakistan, South Africa, Spain, Thailand and Ukraine.

Worldwide the end uses of garnet and market shares are: abrasive blasting media 30%, abrasive grains for water jet cutting 35%, water filtration 20%, abrasive powder 10% and other end uses 5 per cent.

The world reserves/resources and production of industrial garnet are furnished in Tables- 6 and 7.

**Table – 6 : World Reserves of Garnet (Industrial)
(By Principal Countries)**

(In 000' tonnes)	
Country	Reserves
World: Total (rounded)	Moderate to Large
Australia	Moderate to large
China	Moderate to large
India*	13000
South Africa	NA
USA	5000
Other countries	6500

Source: USGS Mineral Commodity Summaries, 2021

* In India as per NMI data based on UNFC system the total reserves/resources of garnet as on 1.4.2015 are estimated at 56.16 million tonnes.

**Table – 7 : World Production of Garnet (Industrial)
(By Principal Countries)**

(In tonnes)			
Country	2018	2019	2020(e)
World: Total (rounded)	974000	1120000	1100000
Australia	364000	352000	360000
China	100000	310000	310000
South Africa	211000	179000	140000
India*	142000	120000	130000
USA	107000	104000	110000
Other countries	50000	60000	60000

Source: USGS, Mineral Commodity Summaries 2021,

Note : Figures are rounded off

* India's production of garnet (abrasive) during 2017-18, 2018-19 and 2019-20 was at 158 thousand tonnes, 123 thousand tonnes and 552 tonnes, respectively.

FOREIGN TRADE

Exports

In 2019-20, exports of abrasive garnet decreased drastically by 28% to 74,697 tonnes from 1,04,343 tonnes in the previous year. Exports were mainly to USA (58%), UAE (11%), Malaysia (8%), Saudi Arabia (5%), Canada (4%) and Kuwait & Italy (3% each). Exports in terms of value in respect of cut & uncut garnet variety decreased drastically by 26% to 36.68 crore in 2019-20 from 49.48 crore in the previous year. In terms of value, exports were mainly to Thailand (32%), Hong Kong (31%), USA (17%), Japan (4%) and Italy, UAE, UK & Germany (2% each).

Out of the total exports in terms of value of cut & uncut garnet in 2019-20, cut variety of garnet accounted for 91% share and the remaining 9% was contributed by the uncut garnet. In terms of value Exports of cut variety were mainly to Thailand (34%),

Hong Kong (27%), USA (18%), Japan (5%) and UAE & UK (3% each). Similarly, exports of uncut garnet were mainly to Hong Kong (73%), Thailand (11%), USA (10%) and the remaining 6% share was contributed by the other countries (Tables- 8 to 11).

**Table -8 : Exports of Garnet (Abrasive)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	104343	1783920	74697	1254542
USA	40772	666775	42965	712791
UAE	14554	253700	8344	155561
Malaysia	3094	49410	5692	84781
Saudi Arabia	4680	82106	3696	67251
Canada	4245	70614	2718	43360
Kuwait	1530	27102	2156	36960
Italy	4340	74647	2100	34965
Oman	1508	29242	1232	23534
Japan	881	17948	740	14087
Spain	1483	25726	745	12232
Other countries	27257	486649	4309	69019

Figures rounded off

**Table -9 : Exports of Garnet (Cut & Uncut)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (**)	Value (₹'000)	Qty (**)	Value (₹'000)
All Countries	**	494842	**	366807
Thailand	**	182991	**	116128
Hong Kong	**	172459	**	114741
USA	**	56186	**	63982
Japan	**	27813	**	15624
UAE	**	3029	**	9008
UK	**	8152	**	8603
Italy	**	8270	**	7580
Germany	**	8174	**	6216
Armenia	**	-	**	5450
Czech Republic	**	7262	**	4016
Other countries	**	20506	**	15459

Note : ** - Not additive. The total may not tally.
Figures rounded off

GARNET

**Table – 10 : Exports of Garnet (Cut)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty ('000crt)	Value (₹'000)	Qty ('000crt)	Value (₹'000)
All Countries	14428	473034	42178	333072
Thailand	5104	181999	4095	112291
Hong Kong	4130	152754	2236	90241
USA	2804	56143	11499	60578
Japan	570	27808	291	15624
UAE	14	3029	224	9008
UK	412	8147	473	8340
Italy	340	8268	170	7580
Armenia	-	-	113	5450
Germany	316	7703	693	5447
Czech Republic	67	7262	79	4016
Other countries	670	19920	22304	14496

Figures rounded off

**Table – 11 : Exports of Garnet (Uncut)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	116	21808	136	33735
Hong Kong	113	19705	134	24500
Thailand	++	992	++	3837
USA	++	43	++	3404
Germany	++	471	++	768
Austria	-	-	++	319
Canada	++	18	++	303
UK	++	5	++	263
France	++	383	++	160
Israel	-	-	++	82
China	3	131	++	37
Other countries	++	60	++	62

Figures rounded off

Imports

In 2019-20, imports of abrasive garnet decreased marginally by 7% to 391 tonnes from 422 tonnes in the previous year. Imports were solely from UAE (100%). Imports in terms of value in respect of cut & uncut garnet variety increased marginally by 9% to 18.45 crore

in 2019-20 from 16.98 crore in the previous year. In terms of value, imports were mainly from Thailand (28%), Kenya (20%), Hong Kong (14%), USA & Sri Lanka (7% each), South Africa & Br Virgin Is (5% each) and Mozambique & Tanzania (4% each).

Out of the total imports in terms of value of cut & uncut garnet in 2019-20, uncut variety of garnet

GARNET

accounted for 70% share and the remaining 30% was contributed by the cut garnet. In terms of quantity, imports of uncut variety were mainly from Madagascar (43%), Mozambique (19%), Hong Kong (14%) and

Tanzania (12%). Similarly, imports of cut garnet were mainly from Hong Kong (41%), Sri Lanka (26%), Thailand (15%), USA (11%) and China (4%) (Tables-12 to 15).

**Table – 12 : Imports of Garnet (Abrasive)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	422	6410	391	6188
UAE	384	5843	391	6130
New Zealand	-	-	++	59
China	12	428	-	-
Australia	26	102	-	-
Madagascar	++	37	-	-

Figures rounded off

**Table- 13: Imports of Garnet (Cut & Uncut)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (**)	Value (₹'000)	Qty (**)	Value (₹'000)
All Countries	**	169836	**	184468
Thailand	**	36026	**	52000
Kenya	**	40317	**	37665
Hong Kong	**	45485	**	26024
USA	**	10347	**	12869
Sri Lanka	**	13825	**	12119
South Africa	**	7244	**	9329
Virginia	**	-	**	8386
Mozambique	**	2149	**	7610
Tanzania	**	2484	**	7138
Madagascar	**	3487	**	4698
Other countries	**	8472	**	6629

Note : ** - Not additive. The total may not tally.

Figures rounded off

GARNET

**Table – 14 : Imports of Garnet (Cut)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (‘000 crt)	Value (₹‘000)	Qty (‘000 crt)	Value (₹‘000)
All Countries	6144	45623	4970	55402
Thailand	678	8340	761	15419
Hong Kong	1573	12035	2024	14278
Sri Lanka	1947	13815	1313	12119
USA	274	8295	539	11273
Switzerland	2	615	1	221
Canada	-	-	3	206
China	1599	972	213	148
Japan	2	90	9	103
Germany	66	284	13	83
UK	++	62	++	18
Other countries	2	1114	93	1534

Figures rounded off

**Table – 15 : Imports of Garnet (Uncut)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	27	124213	58	129066
Kenya	4	40317	1	37665
Thailand	1	27686	3	36581
Hong Kong	10	33450	8	11747
South Africa	++	7244	++	9329
Virginia	-	-	++	8386
Mozambique	6	2149	11	7610
Tanzania	++	2484	7	7138
Madagascar	2	3487	25	4698
USA	++	2052	++	1596
Germany	1	602	++	1358
Other countries	3	4742	2	2958

Figures rounded off

FUTURE OUTLOOK

Garnet has a wide range of applications, such as, in production of abrasives, sand blasting, water filtration materials, abrasive blasting media and water-jet cutting. Garnet is expected to continue replacing silica sand blasting media, owing to latter's associated occupational health risks. Moreover, garnet is safer for the environment and cheaper to dispose of after recycling. Hence, the worldwide demand for garnet is expected to increase, especially

for waterjet cutting and for abrasive blasting media. China and India are expected to steadily increase garnet production and will become significant garnet sources for other countries. The garnet market is very competitive. To increase profitability and remain competitive with imported material, production may be restricted to only high-grade garnet ores as a by-product of other saleable mineral products that occur with garnet, such as, kyanite, marble, metallic ores, mica minerals, sillimanite, staurolite or wollastonite.

