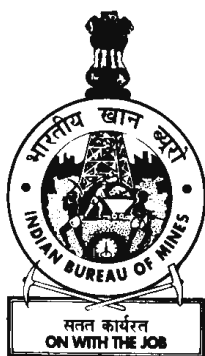


GARNET



# Indian Minerals Yearbook 2017

(Part- III : Mineral Reviews)

**56<sup>th</sup> Edition**

**GARNET**

**(FINAL RELEASE)**

**GOVERNMENT OF INDIA  
MINISTRY OF MINES  
INDIAN BUREAU OF MINES**

Indira Bhavan, Civil Lines,  
NAGPUR – 440 001

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

**March, 2018**

# 13 Garnet

---

**G**arnet 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), Spessartite (Mn-Al), Grossularite (Ca-Al), Andradite (Ca-Fe), and Uvarovite (Ca-Cr). Almandine is harder 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, Jaipur, Kishangarh, Tonk and Udaipur districts, Rajasthan; Krishna and Nellore, Andhra Pradesh; Warangal district, Telangana and Coimbatore, Nilgiri, Tirunelveli, Kanyakumari, Madurai, Tiruchirappalli, Thoothukudi and Salem 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 resources of garnet in India as on 1.4.2015, as per UNFC system are placed at 56.16 million tonnes of which reserves under proved and probable categories together constitute 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 only. Tamil Nadu alone accounts 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 given in the review on "Exploration and Development" in "General Reviews".

## PRODUCTION, STOCKS AND PRICES

### Garnet (Abrasive)

Production of garnet (abrasive) at 85,411 tonnes during 2016-17 increased by 4% as compared to that in the preceding year. There were 7 reporting mines during 2016-17 as well as in the year 2015-16. Besides, production of garnet (abrasive) was reported as an associated mineral by one sillimanite mine in Odisha. Three principal producers accounted for about 99% of the total output during the year. The share of public sector in the total output was about 38% in 2016-17 and 31% in the previous year.

In 2016-17, 60% of the total production was reported from Andhra Pradesh, 26% from Odisha and 12% from Tamil Nadu and 2% from Rajasthan (Tables-2 to 4).

Mine-head closing stocks of garnet (abrasive) for the year 2016-17 were 68 thousand tonnes as against 63 thousand tonnes in the previous year (Table-5).

The average daily employment of labour during 2016-17 was 1,478 as against 1,890 in the previous year.

Prices of garnet are furnished in the General Review on 'Prices'.

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

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						
<b>All India : Total</b>	<b>9917936</b>	<b>278493</b>	<b>2587427</b>	<b>12783856</b>	<b>84320</b>	<b>1643412</b>	<b>3287667</b>	<b>121099</b>	<b>10247428</b>	<b>27992906</b>	<b>333</b>	<b>43377166</b>	<b>56161022</b>
<b>By Grades</b>													
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
<b>By States</b>													
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), 2016-17**

Name & address of producer	Location of mine	
	State	District
Indian Rare Earths Ltd, Plot No. 1207, Veer Savarkar Marg, Near Siddhivinayak Temple, Prabhadevi, Dadar- 400 028, Mumbai, Maharashtra.	Tamil Nadu Odisha	Kanyakumari Ganjam*
Trimex Sands Pvt. Ltd, Trimex Towers, No. 1, Subbraya Avenue, C. P. Ramaswamy Road, Alwarpet, Chennai-600 018, Tamil Nadu.	Andhra Pradesh	Srikakulam
Transworld Garnet India Pvt. Ltd, New No. 34, Old No. 46, M. G. R. Road, Kalakshetra Colony, Besant Nagar, Chennai- 600 090, Tamil Nadu.	Andhra Pradesh	Srikakulam
AKD Gem Garnet Mines, F-203, Near Mahapraygya Circle, Azad Nagar, Bhilwara-311 001, Rajasthan.	Rajasthan	Bhilwara

\*Producing as an associated mineral with Sillimanite.

**Table – 3 : Production of Garnet (Abrasive) 2014-15 to 2016-17  
(By States)**

(Qty in tonnes; Value in ₹'000)

State	2014-15		2015-16 (R)		2016-17 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>91394</b>	<b>800998</b>	<b>82001</b>	<b>648124</b>	<b>85411</b>	<b>758300</b>
Andhra Pradesh	68275	645124	55583	471079	51243	534082
Odisha	11999	73218	14767	93564	22076	134365
Rajasthan	725	993	958	1744	1481	3624
Tamil Nadu	10395	81663	10693	81737	10611	86229

**Table – 4 : Production of Garnet (Abrasive), 2015-16 & 2016-17  
(By Sectors/States/Districts)**

(Qty in tonnes; Value in ₹'000)

State/District	2015-16			2016-17 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
<b>India</b>	<b>7(1)</b>	<b>82001</b>	<b>648124</b>	<b>7(1)</b>	<b>85411</b>	<b>758300</b>
Public sector	2(1)	25460	175301	3(1)	32687	220594
Private sector	5	56541	472823	4	52724	537706
<b>Andhra Pradesh</b>	<b>2</b>	<b>55583</b>	<b>471079</b>	<b>2</b>	<b>51243</b>	<b>534083</b>
Srikakulam	2	55583	471079	2	51243	534083
<b>Odisha</b>	<b>(1)</b>	<b>14767</b>	<b>93564</b>	<b>(1)</b>	<b>22076</b>	<b>134365</b>
Ganjam	(1)	14767	93564	(1)	22076	134365
<b>Rajasthan</b>	<b>3</b>	<b>958</b>	<b>1744</b>	<b>2</b>	<b>1481</b>	<b>3624</b>
Ajmer	1*	-	-	1*	-	-
Bhilwara	2	958	1744	1	1481	3624
<b>Tamil Nadu</b>	<b>2</b>	<b>10693</b>	<b>81737</b>	<b>3</b>	<b>10611</b>	<b>86229</b>
Kanyakumari	2	10693	81737	3	10611	86229

Figures in parentheses indicate associated mine of sillimanite.

\* Only Labour Reported.

**Table – 5 : Mine-head Closing Stocks of Garnet (Abrasive) 2015-16 & 2016-17 (By States)**

State	(In tonnes)	
	2015-16	2016-17 (P)
<b>India</b>	<b>62908</b>	<b>67955</b>
Andhra Pradesh	7783	6145
Odisha	1037	3226
Rajasthan	480	1332
Tamil Nadu	53608	57252

### Garnet (Gem)

No production of garnet (gem) was reported during 2015-16.

## MINING & MARKETING

Garnet is obtained generally by digging small shallow pits barring a few places in Tamil Nadu where it is recovered from sea shore. Mining is done manually with the help of pick axes and spades. Drilling and blasting are not required as garnet is excavated from soft weathered rocks. Fine abrasive garnet is recovered from processing of beach sands. The mining of beach sand is done by dry and wet dredging. In Heavy Upgradation Plant and Mineral Separation Plant, individual minerals including garnet are separated. Sands with 26% of contained garnet is upgraded to 80-88% garnet rich concentrate at TGI Plan, which is further upgraded to 98-99% pure product. The combined installed capacity of garnet at IREL plants situated in Odisha and Tamil Nadu is 30,000 tonnes. The production from mines is graded into two varieties- abrasive and gem, depending on the clarity of crystals. After cutting and polishing, clear, flawless and rich-colour crystals of garnet are sold as semi-precious stones.

## 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 laid down specifications of garnet sand used for sand blasting/jet cutting/other uses are as follows:  $Al_2O_3$ ; 20.8 to 21.2%, Bulk density; 2.17 kg/m<sup>3</sup>, Hardness in Moh's 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.

## WORLD REVIEW

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

World reserves of garnet are moderate to large and occur in a wide variety of rocks like gneisses, schists in crystalline limestone, pegmatites, serpentinites, vein deposits, etc. In addition, alluvial garnet also occurs in heavy minerals sand deposits throughout the world.

Major garnet deposits are found in USA, Australia, China and India. Deposits of garnets are also located in Canada, Chile, Czech Republic, Pakistan, South Africa, Spain, Thailand and Ukraine.

In 2017, Australia produced about 36% of total global production, followed by South Africa 27%, India 18%, China 9% and remaining 10% was contributed by USA and 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 waterjet cutting 35%, water filtration 20%, abrasive powder 10% and other end uses 5 per cent.

The world reserves 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
<b>World: Total (rounded)</b>	<b>Moderate to Large</b>
Australia	Moderate to large
China	Moderate to large
India	19000
USA	5000
Other countries	6500

*Source: Mineral Commodity Summaries, January 2018.*

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

(In tonnes)			
Country	2015	2016	2017
<b>World: Total</b>	<b>1690000</b>	<b>1540000</b>	<b>1100000</b>
Australia	260000	575000	400000
China	520000	88900	100000
India	800000	500000	200000
South Africa	-	271000	300000
USA	55600	56400	63000
Other countries	50000	50000	50000

*Source: Mineral Commodity Summaries- 2017 & 2018,  
Note : Figures are rounded off.*

## FOREIGN TRADE

### Exports

Exports of abrasive garnet decreased by 24% to 3,87,276 tonnes in 2016-17 from 4,80,408 tonnes in 2015-16. Exports were mainly to USA (18%), UAE (13%), Kuwait (7%), Korea, Rep. of, Saudi Arabia and Germany (5% each). Exports value of garnet (cut & uncut) decreased in 2016-17 to ₹ 24.17 crore from ₹ 25.41 crore in the previous year. Out of total cut and uncut garnet, about 95% exports earnings were from cut garnet. Exports of cut variety were mainly to Hong Kong (28%), Thailand (27%), USA (18%), UK (13%), Italy (7%) and Japan (3%) (Tables- 8 to 11).

GARNET

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

Country	2015-16 (R)		2016-17 (P)	
	Qty	Value	Qty	Value
	(t)	(₹'000)	(t)	(₹'000)
<b>All Countries</b>	<b>480408</b>	<b>5950862</b>	<b>387276</b>	<b>4691843</b>
USA	102722	1181674	69306	750331
UAE	72322	994253	48865	665396
Kuwait	18368	231852	27185	351210
Korea, Rep. of	15265	194197	20292	275208
Saudi Arabia	26709	351755	18929	240727
Germany	22305	256067	18404	196493
Malaysia	17094	195244	16232	193775
Italy	17305	200529	14448	173233
Canada	11422	153155	10829	133316
Russia	14290	125670	13890	131958
Other countries	162606	2066466	128896	1580196

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

Country	2015-16 (R)		2016-17 (P)	
	Qty	Value	Qty	Value
	(**)	(₹'000)	(**)	(₹'000)
<b>All Countries</b>	<b>**</b>	<b>25405</b>	<b>**</b>	<b>241716</b>
Hong Kong	**	5981	**	106066
Thailand	**	3250	**	83942
USA	**	5605	**	30145
Japan	**	347	**	7809
Czech Republic	**	6788	**	6321
UK	**	1436	**	2983
Germany	**	38	**	2369
Italy	**	1855	**	856
China	**	--	**	797
Israel	**	--	**	191
Other countries	**	105	**	237

Note : \*\* - Quantity in diffrenet units

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

Country	2015-16 (R)		2016-17 (P)	
	Qty	Value	Qty	Value
	('000 crt)	(₹'000)	('000 crt)	(₹'000)
<b>All Countries</b>	<b>1062</b>	<b>25131</b>	<b>4442</b>	<b>229781</b>
Hong Kong	112	5754	1260	94950
Thailand	94	3241	1180	83825
USA	325	5605	818	30145
Japan	125	347	119	7809
Czech Republic	53	6788	52	6321
UK	343	1436	597	2983
Germany	-	-	88	2369
Italy	6	1855	313	832
Israel	-	-	8	191
China	-	-	2	121
Other countries	4	105	5	235

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

Country	2015-16 (R)		2016-17 (P)	
	Qty	Value	Qty	Value
	(t)	(₹'000)	(t)	(₹'000)
<b>All Countries</b>	<b>++</b>	<b>274</b>	<b>10</b>	<b>11935</b>
Hong Kong	++	227	5	11116
China	-	-	5	676
Thailand	++	9	++	117
Italy	-	-	++	24
France	-	-	++	2
Germany	++	38	-	-

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

Country	2015-16 (R)		2016-17 (P)	
	Qty	Value	Qty	Value
	(t)	(₹'000)	(t)	(₹'000)
<b>All Countries</b>	<b>883</b>	<b>11053</b>	<b>2286</b>	<b>22193</b>
UAE	769	9385	2238	21213
China	22	292	18	369
Baharain	-	-	26	311
USA	-	-	4	300
Australia	78	1232	-	-
Norway	14	144	-	-

## GARNET

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	**	<b>62630</b>	**	<b>222296</b>
Hong Kong	**	19664	**	164101
South Africa	**	9637	**	13068
Thailand	**	5176	**	12725
Sri Lanka	**	1253	**	10676
Kenya	**	12607	**	8674
Mozambique	**	2819	**	7035
Tanzania	**	4551	**	2963
USA	**	495	**	1767
China	**	1807	**	807
Unspecified	**	-	**	401
Other countries	**	4621	**	79

Note : \*\* - Quantity in different units

**Imports**

In 2016-17, imports of abrasive garnet increased by 159% to 2,286 tonnes from 883 tonnes in the previous year. Imports value of cut and uncut garnet also increased in 2016-17 to ₹ 2,223 lakh from ₹ 626 lakh in 2015-16. In terms of value, imports were mainly from Hong Kong (74%), South Africa & Thailand

(6% each) and Sri Lanka (5%). Out of the total imports in terms of value in 2016-17, uncut garnet accounted for 92% and the remaining 8% was accounted for by cut garnet (Tables-12 to 15).

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

Country	2015-16 (R)		2016-17 (P)	
	Qty ('000 crt)	Value (₹'000)	Qty ('000 crt)	Value (₹'000)
<b>All Countries</b>	<b>26</b>	<b>2852</b>	<b>1571</b>	<b>17472</b>
Sri Lanka	-	-	1437	10676
Thailand	3	1367	25	3401
Hong Kong	9	925	88	2376
USA	13	495	21	1019
Japan	1	65	-	-

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>7</b>	<b>59778</b>	<b>4</b>	<b>204824</b>
Hong Kong	1	18739	1	161725
South Africa	1	9637	++	13068
Thailand	++	3809	1	9324
Kenya	1	12607	1	8674
Mozambique	1	2819	1	7035
Tanzania	1	4551	++	2963
China	1	1807	++	807
USA	-	-	++	748
Zambia	++	461	++	79
Morocco	++	1783	-	-
Other countries	1	3565	++	401



## **FUTURE OUTLOOK**

Garnet has 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 displacing silica sand blasting media, owing to its 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.

