

GARNET



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GARNET

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

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23 Garnet

Garnet is the collective name for a group of minerals which crystallise in cubic system with different chemical composition. Garnet is 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 abrasive. The hardness of garnet varies from 6.5 to 7.5 on Mohs' scale.

RESOURCES

In India, garnet deposits suitable for use in abrasive industry occur in Andhra Pradesh, Chhattisgarh, Jharkhand, Kerala, Odisha, Rajasthan and Tamil Nadu. Gem variety of garnet occurs in Ajmer, Jaipur, Kishangarh, Tonk and Udaipur districts, Rajasthan; Krishna, Nellore and Warangal districts, Andhra Pradesh; 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 1.4.2010, as per UNFC system are placed at 56.96 million tonnes of which reserves under proved and probable categories together constitute 19.32 million tonnes. Of the total resources, about 21.56 million tonnes are of abrasive grade, whereas resources of semi-precious grade are mere 5,352 tonnes. Tamil Nadu alone accounts for more than 59% of the total resources followed by Andhra Pradesh 33% and Odisha 6%. The remaining states together shared less than 2% (Table- 1).

EXPLORATION & DEVELOPMENT

During 2013-14, GSI investigated within the territorial waters off north of Bhimunipatnam, Andhra Pradesh. 66 vibrocore seabed sediment samples with an average core length of 2.10 m were collected within the water depths of 22.56 m and 39.47 m. Sedimentological analysis is in progress. Preliminary studies indicate low concentration of heavy minerals such as, ilmenite, sillimanite, garnet, zircon, etc. in the area.

GSI also investigated an area of 78 sq km in the Ajanur- Nileswaram sector in Kasaragod district of Kerala. Forty samples on 1 km X1 km grid from the off shore region and 20 samples from that beach zone were collected. The heavy mineral (HM) analysis showed some promising zones of HM accumulation in the beach and sand dunes of the area with concentration ranging from 1% to 45%. Ilmenite, sillimanite and pyroboles (pyroxenes and amphiboles) form the major HM constituents of the area with considerable amounts of kyanite, garnet, monazite, rutile and zircon.

PRODUCTION, STOCKS AND PRICES

Garnet (Abrasive)

Production of garnet (abrasive) at 458 thousand tonnes during 2013-14 decreased by 40% as compared to that in the preceding year. This decrease is mainly attributed to non issuance of permit by the Government of Tamil Nadu. There were 67 reporting mines during 2013-14 as against 58 in the previous year. Besides, production of garnet (abrasive) was reported as an associated mineral by one sillimanite mine in Odisha. Three principal producers accounted for about 84% of the total output during the period. The share of public sector in the total output was about 6% in 2013-14 and 4% in the previous year.

In 2013-14, 78% of the total production was reported from Tamil Nadu, 18% from Andhra Pradesh and the remaining 4% was from Odisha and Rajasthan. (Tables - 2 to 4).

Mine-head closing stocks of Garnet (Abrasive) for the year 2013-14 were 80 thousand tonnes as against 54 thousand tonnes in the previous year (Table -5).

The average daily employment of labour during 2013-14 was 3,299 as against 3,269 in the previous year.

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

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**Table – 1 : Reserves/Resources of Garnet as on 1.4.2010
(By Grades/States)**

(In tonnes)

Grade/State	Reserves				Remaining resources					Total resources (A+B)		
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332		Inferred STD333	Total (B)
		STD121	STD122			STD221	STD222					
All India : Total	3252107	4712202	11360484	193224793	9270	81901	207041	117887	10226689	26995243	37638032	56962825
By Grades												
Abrasive	3048526	4710071	11091469	18850066	214	39774	114044	102848	15645	2438410	2710935	21561001
Semi-precious	283	481	227	991	5	94	553	39	1293	2378	4361	5352
Others	-	-	5534	5534	9051	6033	-	-	-	215573	230657	236191
Unclassified	203298	1650	263254	468202	-	36000	394	15000	10208995	23951287	34211676	34679878
Not-known	-	-	-	-	-	-	92051	-	756	387596	480403	480403
By States												
Andhra Pradesh	2911387	4500	710000	3625887	9051	42033	-	-	8800000	6587776	15438860	19064747
Chhattisgarh	-	-	-	-	-	-	-	-	-	28800	28800	28800
Jharkhand	-	-	-	-	-	-	88303	-	-	21768	110071	110071
Kerala	-	-	45797	45797	-	-	-	100874	-	52190	153064	198861
Odisha	-	3185605	-	3185605	5	-	-	-	-	348000	348005	3533610
Rajasthan	6251	10700	9299	26250	214	39868	26687	2013	17694	85690	172167	198416
Tamil Nadu	334469	1511397	10595388	12441254	-	-	92051	15000	1408995	19871019	21387065	33828319

Figures rounded off.

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Table – 2 : Principal Producers of Garnet (Abrasive), 2013-14

Name & address of producer	Location of mine	
	State	District
V. V. Mineral Keeraikaranthattu, Tisaiyanvilai Radhapuram- 627 657, Tamil Nadu.	Tamil Nadu	Tirunelveli
Beach Minerals Company Pvt. Ltd, BMC House, 32-2, Halls Road, Egmore, Chennai- 600 008, Tamil Nadu.	Tamil Nadu	Tirunelveli
Trimex Industries Pvt. Ltd, Vill. Govindam Palli, Mandal: Obuavari Palli, Kodur- 516 101, Hyderabad, Andhra Pradesh.	Andhra Pradesh	Srikakulam
Transworld Garnet India Pvt. Ltd, New No. 34, M. G. R. Road, Kalakshetra Colony, Besant Nagar, Chennai- 600 090, Tamil Nadu.	Tamil Nadu	Tirunelveli

**Table – 3 : Production of Garnet (Abrasive) 2011-12 to 2013-14(P)
(By States)**

(Qty in tonnes; value in ₹'000)

State	2011-12		2012-13		2013-14(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	1717904	981625	768248	924683	457626	958821
Andhra Pradesh	54213	262194	83683	497499	82804	699850
Odisha	19889	88208	23898	128022	19092	108030
Rajasthan	-	-	614	565	605	622
Tamil Nadu	1643802	631223	660053	298597	355125	150319

**Table – 4 : Production of Garnet (Abrasive), 2012-13 & 2013-14 (P)
(By Sectors/States/Districts)**

(Qty in tonnes; value in ₹'000)

State	2012-13			2013-14(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	58(1)	768248	924683	67(1)	457626	958821
Public sector	2(1)	34138	185141	2(1)	25270	142019
Private sector	56	734110	739542	65	432356	816802
Andhra Pradesh	2	83683	497499	2	82804	699850
Srikakulam	2	83683	497499	2	82804	699850
Odisha	(1)	23898	128022	(1)	19092	108030
Ganjam	(1)	23898	128022	(1)	19092	108030
Rajasthan	1	614	565	1	605	622
Bhilwara	1	614	565	1	605	622
Tamil Nadu	55	660053	298597	64	355125	150319
Kanyakumari	7	44240	67319	8	26178	39988
Madurai	1	25	8	2*	-	-
Thoothukudi	2	17750	6000	2	6350	1940
Tiruchirappalli	3	1250	900	2	2000	875
Tirunelveli	42	596788	224370	50	320597	107516

Figures in parentheses indicate associated mine of sillimanite.

* Only Labour Reported.

**Table – 5 : Mine-head stocks of Garnet (Abrasive)
2012-13 & 2013-14(P)
(By States)**

State	(In tonnes)	
	2012-13	2013-14(P)
India	53609	80463
Andhra Pradesh	9229	8167
Odisha	8085	10742
Rajasthan	488	475
Tamil Nadu	35807	61079

Garnet (Gem)

No production of garnet (gem) was reported during 2013-14.

MINING & MARKETING

Garnet is obtained generally by digging small shallow pits barring a couple of places in Tamil Nadu where it is recovered from sea shore. Mining is done manually with the help of pickaxes and spades. Drilling and blasting are not required as garnet is found in soft 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. The production from mines is graded into two varieties- abrasive and gem, depending upon 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 is as an abrasive. About 90% production of abrasive garnet is used for manufacturing of garnet-coated papers, clothes and discs. 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. 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, ceramic and wood. Other uses are in electronic and television industry for polishing glass and TV tubes. Garnet also finds its use in sand blasting where generally garnet of mesh size 16-24 is used.

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, it is used as filter medium for water and other liquids.

WORLD REVIEW

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 2013, India produced about 48% of total global production, followed by China 31% and Australia 16% and remaining 5% 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 tonnes)	
Country	Reserves
World: Total (rounded)	Moderate to Large
Australia	Moderate to large
China	Moderate to large
India*	6700000
USA	5000000
Other countries	6500000

Source: Mineral Commodity Summaries, 2015.

* India's total UNFC resources of garnet as on 1.4.2010 are estimated at 56.96 million tonnes.

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

(In tonnes)			
Country	2012	2013	2014
World: Total	1670000	1660000	1660000
Australia	263000	263000	260000
China	510000	510000	520000
India*	800000	800000	800000
USA	46900	33900	32200
Other countries	50000	50000	50000

*Source: Mineral Commodity Summaries, 2013, 2014 & 2015
Note : Figures are rounded off.*

* India's production of garnet during 2011-12, 2012-13 and 2013-14 was 1.72 million tonnes, 0.77 million tonnes and 0.46 million tonnes, respectively.

FOREIGN TRADE

Exports

Exports of abrasive garnet decreased by 5% to 480,774 tonnes in 2013-14 from 505,281 tonnes in 2012-13. Exports were mainly to UAE (22%), USA (15%), Saudi Arabia (6%), Germany and Kuwait (5% each). Exports value of garnet (cut & uncut) also decreased in 2013-14 to 3.94 crore from 4.98 crore in the previous year. Out of total of cut and uncut garnet, about 93% exports earnings were from cut garnet. Exports of cut variety were mainly to Thailand, Czech Republic, USA and UK (Tables- 8 to 11).

Imports

In 2013-14, imports of abrasive garnet decreased drastically to 626 tonnes from 1,115 tonnes in the previous year. Import value of cut and uncut garnet also decreased in 2013-14 to ₹469 lakh from ₹1,179 lakh in 2012-13. Imports were mainly from Thailand (30%), Mozambique (25%) and Tanzania (17%) in terms of value. Out of the total imports in 2013-14, uncut garnet accounted for 97% value and the remaining 3% was accounted for by cut garnet (Tables- 12 to 15).

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

Country	2012-13		2013-2014	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	505281	5108666	480774	6060269
UAE	114734	1169913	106077	1372415
USA	86352	862215	73289	845380
Saudi Arabia	20974	208864	28473	357837
Kuwait	24483	257209	24987	316159
Germany	23582	236516	24047	301088
Qatar	23228	256385	20209	289302
Italy	17729	189699	19522	239868
UK	12041	121029	14877	188554
Australia	16913	188412	13412	181978
Malaysia	20144	207890	13138	152209
Other countries	145101	1410534	142743	1815479

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

Country	2012-13	2013-14
	Value (₹'000)	Value (₹'000)
All Countries	49812	39395
Thailand	17893	20234
Czech Republic	5166	10538
USA	4363	6126
Japan	++	1507
Hong Kong	5774	627
UK	185	336
Italy	114	19
Greece	++	7
Other countries	16317	1

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

Country	2012-13		2013-14	
	Qty (‘000 Carats)	Value (₹'000)	Qty (‘000 Carats)	Value (₹'000)
All Countries	701	42619	1373	36673
Thailand	362	17893	982	20183
Czech Republic	69	5166	116	10538
USA	69	4324	151	3688
Japan	-	-	23	1507
Hong Kong	72	5667	5	395
UK	2	185	96	336
Italy	++	59	++	19
Greece	-	-	++	7
Other countries	127	9325	-	-

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

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1	7193	3	2722
USA	++	39	++	2438
Hong Kong	++	107	2	232
Thailand	-	-	1	51
China	-	-	++	1
Other countries	1	7047	-	-

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

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1115	19800	626	10542
UAE	752	12057	348	6446
China	-	-	217	3660
Australia	-	-	52	351
Kuwait	-	-	9	85
Other countries	363	7743	-	-

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

Country	2012-13		2013-14	
	Qty (^{'000} crt)	Value (₹'000)	Qty (^{'000} crt)	Value (₹'000)
All Countries	5	7108	2	1585
Thailand	++	71	++	762
USA	-	-	1	603
Sri Lanka	1	1103	1	109
Hong Kong	2	5301	++	56
Japan	-	-	++	49
China	-	-	++	5
Other countries	2	633	++	1

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

Country	2012-13	2013-14
	Value (₹'000)	Value (₹'000)
All Countries	117864	46894
Thailand	76077	14109
Mozambique	1414	11513
Tanzania	3867	7975
Italy	622	3791
Hong Kong	20542	2939
Kenya	44	2026
Zambia	127	1795
Madagascar	269	977
Nigeria	2706	605
USA	2830	603
Other countries	9366	561

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

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	44	110756	58	45309
Thailand	2	76006	++	13347
Mozambique	16	1414	15	11513
Tanzania	15	3867	39	7975
Italy	-	-	1	3791
Hong Kong	11	15241	2	2883
Kenya	++	44	++	2026
Zambia	++	127	1	1795
Madagascar	++	269	++	977
Nigeria	++	2706	++	605
UAE	-	-	++	141
Other countries	++	11082	++	256

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. Worldwide demand for garnet is expected to continue 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. Domestic production of garnet is very high while the current domestic demand is limited and the major chunk is exported.

