

41 Garnet

Garnet is the collective name for a group of minerals which form an isomorphous series and crystallise in cubic system. 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 a resistant mineral and detritus grains are commonly found in sediments. It is used both as semi-precious stone and as abrasive. The hardness of garnets 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, Orissa, 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 and Salem districts, Tamil Nadu. Garnet is found to occur in beach sands along with ilmenite, rutile, sillimanite, etc. in the states of Kerala, Orissa and Tamil Nadu.

The total resources of garnet in India, as on 1.4.2005, as per UNFC system is placed at 57.66 million tonnes of which reserves in proved and probable categories together are 20.98 million tonnes. Of the total resources, about 22.27 million tonnes are of abrasive grade whereas resources of semi-precious grade are 9,465 tonnes only. Tamil Nadu alone accounts for more than 49% of the total resources followed by Andhra Pradesh 26% and Orissa 24%. The remaining States together shared less than 1% (Table - 1).

EXPLORATION AND DEVELOPMENT

During the year 2006-07 and 2007-08, the Directorate of Geology, Government of Orissa carried out mapping for heavy minerals including garnet in the Udegiri sector along Puri coast in the scale of 1:2000.

Directorate of Mines and Geology, Government of Rajasthan, conducted exploration for garnet near village Rit, Hatundi, Mabua, etc. tehsil Kotri, Dist. Bhilwara. Reserves were not estimated.

PRODUCTION, STOCKS AND PRICES

Garnet (Abrasive)

Production of garnet (abrasive) at 873 thousand tonnes during 2007-08 increased by 2% as compared to that in the preceding year. There were 49 reporting mines during 2007-08 as against 48 in the previous year. Three principal producers accounted for about 66% of the total output during the period. The share of public sector in the total output was 3% in both the years. More than 99 % of the total production was reported from Tamil Nadu while nominal production was reported from Andhra Pradesh and Orissa (Tables - 2 to 4).

Mine-head stocks at the end of the year was 87 thousand tonnes as against 125 thousand tonnes at the beginning of the year (Table - 5).

The average daily employment of labour during 2007-08 was 2,251 as against 2,982 in the previous year. Prices of garnet are furnished in Table - 6.

**Table - 1: Reserves/Resources of Garnet as on 1.4.2005
(By Grades/States)**

(In tonnes)

State/Grade	Proved STD111	Reserves			Remaining resources				Total Resources (A+B)	
		STD121	Probable STD122	Total (A)	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
All India	6719626	9700	14246279	20975605	119831	10233123	26326391	682	36680027	57655633
By Grades										
Abrasive	6493356	7847	13926171	20427374	102792	22124	1713359	-	1838275	22265649
Semi-precious	316	145	387	847	2039	1249	5330	-	8618	9465
Others	-	-	-	-	-	-	268820	-	268820	268820
Unclassified	36000	1708	628	38336	-	8800000	4070268	682	12870950	12909287
Not known	189954	-	319093	509047	15000	1409751	20268615	-	21693366	22202413
By States										
Andhra Pradesh	36000	600	-	36600	-	8800000	5934423	-	14734423	14771023
Chhattisgarh	-	-	-	-	-	-	28800	-	28800	28800
Jharkhand	-	58	234	292	-	-	-	682	682	975
Kerala	-	-	45797	45797	100874	-	52190	-	153064	198861
Orissa	-	-	13793101	13793101	2000	-	351000	-	353000	14146101
Rajasthan	12964	9041	20054	42059	1957	24128	88959	-	115045	157104
Tamil Nadu	6670662	-	387093	7057755	15000	1408995	19871019	-	21295014	28352769

Figures rounded off.

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Table – 2 : Principal Producers of Garnet (Abrasive), 2007-08

Name & address of producer	Location of mine	
	State	District
Beach Minerals Sands Company, 132, Tiruchendur Road, Kuttam – 627 651, Dist. Tirunelveli, Tamil Nadu.	Tamil Nadu	Tirunelveli
Transworld Garnet India (Pvt.) Ltd. Tuticorin Air Port, Palayamkottai High Road, Village Kuttidankadu, Dist. Tirunelveli - 628 103, Tamil Nadu.	Tamil Nadu	Tirunelveli
Sri M. Ramesh 46, Palayamkottai Rd. PO- 628 003, Dist. Thoothukudi Tamil Nadu.	Tamil Nadu	Tirunelveli

**Table – 3 : Production of Garnet (Abrasive), 2005-06 to 2007-08
(By States)**

(Qty. in tonnes; value in Rs.'000)

State	2005-06		2006-07		2007-08 (p)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	671541	182814	858843	259167	873498	303239
Andhra Pradesh	14100	1066	1919	144	1950	146
Orissa	567	851	3681	5706	8534	13600
Tamil Nadu	656874	180897	853243	253317	863014	289493

**Table – 4 : Production of Garnet (Abrasive), 2006-07 and 2007-08
(By Sectors/States/Districts)**

(Qty. in tonnes; value in Rs.'000)

State	2006-07			2007-08 (p)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	48(1)	858843	259167	49(1)	873498	303239
Public sector	1(1)	18860	38659	1(1)	23254	54080
Private sector	47	840183	220508	48	850244	249159
Andhra Pradesh	1	1919	144	1	1950	146
Srikakulam	1	1919	144	1	1950	146
Orissa	(1)	3681	5706	(1)	8534	13600
Ganjam	(1)	3681	5706	(1)	8534	13600
Tamil Nadu	47	853243	253317	48	863014	289493
Kanyakumari	4	18859	35282	4	19436	43310
Tiruchirapalli	1	3325	998	1	1950	585
Tirunelveli	41	830309	216812	42	837078	244233
Tuticorin	1	750	225	1	4550	1365

Figures in parentheses indicate associated mine of sillimanite.

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Table – 5 : Mine-head stocks of Garnet (Abrasive), 2007-08 (p)
(By States)

(Qty. In tonnes)

State	At the beginning of the year	At the end of the year
India	124741	87446
Andhra Pradesh	74142	76401
Orissa	8927	4024
Tamil Nadu	41692	7021

Table – 6 : Prices of Garnet, 2005-06 To 2007-08
(Domestic Markets)

(In Rs. per tonne)

Grade	Market	2005-06	2006-07	2007-08 (p)
Common grade	Ex-factory Kuttam (Tamil Nadu)	680-720	690-720	690-720
OR Grade (NAW)	Ex-works Chatrapur (Orissa)	1500	1650	1650
MK Grade Normal (bagged)	Ex- works Manavalakurichi (Tamil Nadu)	2175	2325	2325
MK Grade Normal (NAW)	Ex- works Manavalakurichi (Tamil Nadu)	1850	2000	2000
MK Grade Coarse (bagged)	Ex- works Manavalakurichi (Tamil Nadu)	2525	2825	2825
MK Grade Coarse (NAW)	Ex- works Manavalakurichi (Tamil Nadu)	2200	2500	2500

NAW - Naked at Works

Garnet (Gem)

No production of garnet (gem) has been recorded during 2007-08 due to non availability of ore. Mine-head stocks remained unchanged at 63 kg at the beginning and end of the year.

MINING & MARKETING

Garnet is obtained generally by digging small shallow pits barring a couple of places in Tamil Nadu where it is recovered from seashore. 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 output from mines is graded into two varieties - abrasive and gem, depending upon the clarity of crystals. Clear, flawless and rich-colour crystals of garnet are sold as precious and semi-precious stones after cutting and polishing.

USES & CONSUMPTION

Clear flawless and rich-colour crystals of garnet are used as semi-precious stones, the principal variety among them are ruby, pyrope, deep-crimson almandine, orange-yellow grossularite, etc.

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.). 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 marketing plater 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.

The apparent consumption of garnet (abrasive) during 2005-06, 2006-07 and 2007-08 was about 434 thousand, 573 thousand and 612 thousand tonnes, respectively.

WORLD REVIEW

World resources of garnet are 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. The world resources and production of industrial garnet are furnished in Tables -7 and 8.

**Table - 7 : World Resources of Garnet (Industrial)
(By Principal Countries)**

(In tonnes of garnet)	
Country	Reserve base
World : Total	Large
Australia	7000000
China	Moderate to large
India	5400000
USA	25000000
Other countries	20000000

Source: Mineral Commodity Summaries, 2008.

**Table - 8 : World Production of Garnet (Industrial)
(By Principal Countries)**

(In tonnes)			
Country	2005	2006	2007
World : Total	324000	325000	325000
Australia	155000	160000	160000
China	29000	30000	30000
India	65000	65000	65000
USA	40100	34100	34000
Other Countries	34900	35500	36000

Figures are rounded off.

Source: Mineral Commodity Summaries, 2008.

FOREIGN TRADE

Exports

Exports of abrasive garnet decreased to 261,433 tonnes in 2007-08 from 285,440 tonnes in 2006-07. Exports were mainly to UAE (19%), Saudi Arabia (15%), Qatar (11%), USA (9%), Germany (7%) and Italy (4%). Exports value of garnet (cut & uncut) decreased sharply in 2007-08 to Rs.15.6 lakh from Rs. 1.8 crore in the previous year. Out of total exports earnings from cut and uncut garnet, more than 89% were from cut garnet. Exports of cut variety were mainly to Thailand and Switzerland (Tables - 9 to 12).

Imports

In 2007-08, imports of abrasive garnet decreased to 35 tonnes from 94 tonnes in the previous year. Imports value of cut and uncut garnet also decreased in 2007-08 to 4.13 crore from Rs. 5.2 crore in 2006-07. Imports were mainly from USA (58%) and Russia (24%). Out of the total imports in 2007-08, cut garnet accounted for 96% value and the remaining 4% was accounted for by uncut garnet (Tables - 13 to 16).

**Table - 9 : Exports of Garnet (Abrasive)
(By Countries)**

Country	2006-07		2007-08	
	Qty. (t)	Value (Rs. '000)	Qty. (t)	Value (Rs. '000)
All Countries	285440	1321213	261433	1277595
UAE	70543	339130	50520	256459
Qatar	27333	117285	29820	168053
Saudi Arabia	36628	146972	38776	164584
USA	21341	89779	22703	94533
Germany	16701	71237	18482	93610
Italy	11999	54734	11461	52526
UK	7782	41876	9293	49112
Malaysia	9545	49008	9100	46754
Australia	10211	49989	5859	29150
Singapore	15294	80251	3997	24842
Other countries	58063	280952	61422	297972

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**Table - 10 : Exports Value of Garnet (Cut and Uncut) : Total
(By Countries)**

Country	2006-07	2007-08
	Value (Rs. '000)	Value (Rs. '000)
All Countries	18278	1560
Thailand	2235	1053
Switzerland	-	295
Hong Kong	5903	138
USA	7539	54
Chinese Taipei/Taiwan	282	-
France	111	-
Germany	830	-
Italy	920	-
Japan	124	-
Spain	154	-
Other countries	180	20

Note : Quantity not given due to partial coverage; value figures however have full coverage.

**Table - 11: Exports of Garnet (Cut)
(By Countries)**

Country	2006-07		2007-08	
	Qty. ('000 Crt)	Value (Rs.'000)	Qty. ('000 Crt)	Value (Rs.'000)
All Countries	28	14524	4	1398
Thailand	3	2151	3	1053
Switzerland	-	-	1	295
USA	14	7354	++	47
Chinese Taipei/Taiwan	++	282	-	-
France	++	111	-	-
Germany	1	719	-	-
Hong Kong	7	2547	-	-
Italy	2	920	-	-
Japan	1	124	-	-
Spain	++	154	-	-
Other countries	++	162	++	3

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**Table - 12 : Exports of Garnet (Uncut)
(By Countries)**

Country	2006-07		2007-08	
	Qty. (t)	Value (Rs. '000)	Qty. (t)	Value (Rs. '000)
All Countries	++	3754	++	162
Germany	++	111	-	-
Hong Kong	++	3356	++	138
Nepal	-	-	++	17
Singapore	++	18	-	-
Thailand	++	84	-	-
USA	++	185	++	7

**Table - 13 : Imports of Garnet (Abrasive)
(By Countries)**

Country	2006-07		2007-08	
	Qty. (t)	Value (Rs. '000)	Qty. (t)	Value (Rs. '000)
All Countries	94	1193	35	238
Australia	26	181	26	157
UAE	-	-	4	45
China	5	45	5	36
Netherlands	44	762	-	-
UK	18	192	-	-
USA	1	13	-	-

**Table - 14 : Imports Value of Garnet (Cut and Uncut) : Total
(By Countries)**

Country	2006-07	2007-08
	Value (Rs. '000)	Value (Rs. '000)
All Countries	52452	41253
USA	26658	23796
Russia	-	9806
Yemen Republic	-	2568
Hong Kong	4059	1515
Germany	7051	1144
Thailand	5689	912
Brazil	138	644
UAE	794	25
Madagascar	2094	-
Tanzania	3212	-
Other countries	2757	843

Note: Quantity not given due to partial coverage; value figures however have full coverage.

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**Table - 15 : Imports of Garnet (Cut)
(By Countries)**

Country	2006-07		2007-08	
	Qty. (^{'000} Crt)	Value (Rs. ^{'000})	Qty. (^{'000} Crt)	Value (Rs. ^{'000})
All Countries	203	47600	132	39746
USA	118	26279	109	23796
Russia	-	-	++	9806
Yemen Republic	-	-	10	2568
Hong Kong	16	3561	2	1515
Germany	37	7051	7	1144
Thailand	17	5689	4	912
Israel	2	346	-	-
Singapore	2	374	-	-
Tanzania	3	2706	-	-
UAE	6	794	-	-
Other countries	2	800	++	5

**Table - 16 : Imports of Garnet (Uncut)
(By Countries)**

Country	2006-07		2007-08	
	Qty. (t)	Value (Rs. ^{'000})	Qty. (t)	Value (Rs. ^{'000})
All Countries	21	4852	++	1507
Brazil	1	138	++	644
Guinea	-	-	++	131
Hong Kong	++	498	-	-
Madagascar	18	2094	-	-
Mozambique	1	744	-	-
Nigeria	++	493	-	-
Tanzania	1	506	-	-
UAE	-	-	++	25
USA	++	379	-	-
Zambia	-	-	++	703
Other countries	-	-	++	4

FUTURE OUTLOOK

The demand for garnet has been increasing rapidly because of its wide range of applications, such as in production of abrasives, sand blasting, water filtration materials and water-jet cutting. The USA is the prime producer and consumer of garnet in the world. India's production of garnet

is witnessing an upward trend and is in a position to cater to its domestic requirements. India is likely to play a decisive role in the world market in future. The waste material and fine slurry generated during processing of khondalites and other garnetiferous rocks as building stones could be treated for recovery of garnets which again can be utilised as abrasives.