

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, 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 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 1.4.2005, 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 Odisha 24%. The remaining states together shared less than 1% (Table - 1).

EXPLORATION & DEVELOPMENT

During 2009-10, Directorate of Geology, Odisha carried out following exploration activities for heavy minerals (rutile, monazite, illeminite, sillimanite, garnet, zircon, etc.): (1) 3 to 6 km to the NE of Puri town district. Puri with 5.2 sq. km. mapping on 1:2,000 scale and 2,013 m in 253 boreholes auger drillings. (2) SW of Konark along Puri Coast, district. Puri with 7.95 sq. km. mapping on 1: 2,000 scale and 3,045 m in 402 boreholes in auger drillings, and (3) Nabha Northeast section along Puri Coast, district. Puri with 1.9 sq. km. mapping on 1: 2,000 scale and 3,328 m in 416 boreholes auger drilling.

PRODUCTION, STOCKS AND PRICES

Garnet (Abrasive)

Production of garnet (abrasive) at 1,566 thousand tonnes during 2009-10 increased by 36% as compared to that in the preceding year due to sustained demand. There were 65 reporting mines during 2009-10 as against 63 in the previous year. Three principal producers accounted for about 85% of the total output during the period. The share of public sector in the total output was 2% in both the years.

About 92% of the total production was reported from Tamil Nadu, 7% from Andhra Pradesh and the remaining 1% production was reported from Odisha (Tables - 2 to 4).

Mine-head stocks at the end of the year was 269 thousand tonnes as against 361 thousand tonnes at the beginning of the year (Table - 5).

The average daily employment of labour during 2009-10 was 3,251 as against 3,102 in the previous year. The domestic prices of garnet are furnished in the General Review on 'Prices'.

Table - 2 : Principal Producers of Garnet (Abrasive), 2009-10

Name & address of producer	Location of mine	
	State	District
V. V. Mineral Keeraikaranthattu, Tisaiyanvilai - 627 657, Thirunelveli, Tamil Nadu.	Tamil Nadu	Thirunelveli
Transworld Garnet India (P) Ltd, New No. 34, M. G. T. Road, Kalashetra Colony, Besant Nagar, Chennai - 600 090 Tamil Nadu.	Tamil Nadu	Thirunelveli
Beach Minerals Sands Company, 132, Tiruchendur Road, Kuttam - 627 651, Thirunelveli, Tamil Nadu.	Tamil Nadu	Thirunelveli

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

State/Grade	Proved STD111	Reserves			Remaining resources				Total Resources (A+B)	
		Probable	Total (A)	Measured STD331	Indicated STD332	Inferred STD333	Recomnaissance STD334	Total (B)		
										STD121
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
Odisha	-	-	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.

GARNET

**Table – 3 : Production of Garnet (Abrasive) 2007-08 to 2009-10
(By State)**

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

State	2007-08		2008-09		2009-10(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	1275919	523688	1151241	565937	1565579	740870
Andhra Pradesh	1950	166	74988	7981	107602	9978
Odisha	8533	13678	11455	22360	11081	33667
Tamil Nadu	1265436	509844	1064798	535596	1446896	697225

**Table – 4 : Production of Garnet (Abrasive), 2008-09 & 2009-10
(By Sectors/States/Districts)**

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

State	2008-09			2009-10 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	63(1)	1151241	565937	65(1)	1565579	740870
Public sector	1(1)	25982	84158	1(1)	24224	96918
Private sector	62	1125259	481779	64	1541355	643952
Andhra Pradesh	2	74988	7981	2	107602	9978
Nellore	1	15	34	1	7	11
Srikakulam	1	74973	7947	1	107595	9967
Odisha	(1)	11455	22360	(1)	11081	33667
Ganjam	(1)	11455	22360	(1)	11081	33667
Tamil Nadu	61	1064798	535596	63	1446896	697225
Kanyakumari	4	57057	87316	6	67820	96057
Thiruchirapalli	6	46000	14260	6	98168	30432
Thirunelveli	49	905441	403840	49	1191318	519082
Tuticorin	2	56300	30180	2	89590	51654

*Figures in parentheses indicate associated mine of sillimanite.***Table – 5 : Mine-head stocks of Garnet (Abrasive), 2009-10 (P)
(By States)**

(In tonnes)

State	At the beginning of the year	At the end of the year
India	360597	268890
Andhra Pradesh	324	331
Odisha	4024	3609
Tamil Nadu	356249	264950

Garnet (Gem)

No production of garnet (gem) has been recorded during 2009-10 due to non availability of ore.

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 2007-08, 2008-09 and 2009-10 was about 1,014 thousand tonnes, 899 thousand tonnes and 1,394 thousand tonnes, respectively.

WORLD REVIEW

World reserves 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 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 of garnet)

Country	Reserve
World: Total (rounded)	Moderate to Large
Australia	1000
China	Moderate to large
India	6500
USA	5000
Other countries	6500

Source: Mineral Commodity Summaries, 2010.

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

(In tonnes)

Country	2007	2008 ^(e)	2009
World : Total (rounded)	352000	1310000	1400000
Australia	160000	160000	160000
China	30000	400000	450000
India	65000	650000	700000
USA	61400	62900	56500
Other countries	35500	35500	36000

Source: Mineral Commodity Summaries, 2009 & 2010.

FOREIGN TRADE

Exports

Exports of abrasive garnet decreased to 171,420 tonnes in 2009-10 from 252,478 tonnes in 2008-09. Exports were mainly to UAE (23%), Qatar (14%), Saudi Arabia (7%) and Italy (6%). Exports value of garnet (cut & uncut) increased in 2009-10 to Rs. 13.7 crore from Rs. 7.7 crore in the previous year. Out of total exports earnings from cut and uncut garnet, more than 99% were from cut garnet. Exports of cut variety were mainly to Singapore, USA, Thailand and Hong Kong (Tables - 8 to 11).

Imports

In 2009-10, imports of abrasive garnet decreased to 20 tonnes from 332 tonnes in the previous year. Imports value of cut and uncut garnet also decreased in 2009-10 to Rs. 238 lakh from Rs. 431 lakh in 2008-09. Imports were mainly from USA (61%), Hong Kong (14%) and Thailand (11%) in terms of value. Out of the total imports in 2009-10, cut garnet accounted for 84% value and the remaining 16% was accounted for by uncut garnet (Tables - 12 to 15).

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	252478	1939894	171420	1470702
UAE	51830	385371	39281	339833
Qatar	33922	291839	23239	199199
Italy	16200	133414	10931	100412
Saudi Arabia	18617	108508	11376	83296
USA	22459	179934	8742	78868
Kuwait	6962	57704	9130	77418
UK	9291	83570	7840	68029
Germany	21400	170351	7893	62552
Australia	8462	66042	6465	58495
Malaysia	8141	58292	4930	40140
Other countries	55194	404869	41593	362460

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

Country	2008-09	2009-10
	Value (Rs. '000)	Value (Rs. '000)
All Countries	76503	137014
Singapore	52261	117750
USA	21858	12468
Thailand	24	2186
Hong Kong	2107	1948
Japan	–	1426
China	24	417
UK	76	313
Netherlands	38	241
Canada	–	193
Germany	91	53
Other countries	24	19

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

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

Country	2008-09		2009-10	
	Qty ('000 carats)	Value (Rs. '000)	Qty ('000 carats)	Value (Rs. '000)
All Countries	101	76461	103	135988
Singapore	50	52261	64	117750
USA	32	21858	12	12467
Thailand	–	–	22	2186
Hong Kong	19	2107	2	1948
Japan	–	–	2	1426
Canada	–	–	1	193
China	++	24	–	–
Germany	++	73	–	–
Netherlands	++	38	–	–
UK	++	76	–	–
Other countries	++	24	++	18

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	++	42	++	1026
China	-	-	++	417
UK	-	-	++	313
Netherlands	-	-	++	241
Germany	++	18	++	53
USA	-	-	++	1
Thailand	++	24	-	-
Other countries	-	-	++	1

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	332	6483	20	42
UAE	-	-	20	42
China	332	6483	-	-

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

Country	2008-09	2009-10
	Value (Rs. '000)	Value (Rs. '000)
All Countries	43092	23848
USA	22697	14555
Hong Kong	2310	3239
Thailand	13103	2505
Nigeria	1694	1105
Zambia	318	1061
Mozambique	-	797
Sri Lanka	478	308
Germany	418	-
Madagascar	709	-
Niger	675	-
Other countries	690	278

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

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

Country	2008-09		2009-10	
	Qty ('000 crt)	Value (Rs. '000)	Qty ('000 crt)	Value (Rs. '000)
All Countries	242	39104	102	20065
USA	117	22661	86	14555
Hong Kong	14	2310	10	3239
Thailand	106	13073	6	1747
Sri Lanka	-	-	++	300
Belgium	-	-	++	66
UK	1	101	++	58
Germany	2	418	-	-
Tanzania Rep	1	236	-	-
Turkey	1	191	-	-
UAE	++	79	-	-
Other countries	++	35	++	100

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	++	3988	++	3783
Nigeria	++	1694	++	1105
Zambia	++	318	++	1061
Mozambique	-	-	++	797
Thailand	++	30	++	758
South Africa	-	-	++	54
Sri Lanka	++	478	++	8
Madagascar	++	709	-	-
Niger	++	675	-	-
Tanzania Rep	++	48	-	-
USA	++	36	-	-

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. 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.