

WOLLASTONITE



# Indian Minerals Yearbook 2015

(Part- III : Mineral Reviews)

54<sup>th</sup> Edition

**WOLLASTONITE**  
(FINAL RELEASE)

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July, 2017

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**W**ollastonite, a metasilicate of calcium ( $\text{CaSiO}_3$ ), theoretically contains 48.3% CaO and 51.7%  $\text{SiO}_2$ . It occurs as aggregates of bladed or needle-like crystals with hardness of 4.5 on Mohs' scale. Ceramic Industry substantially uses the domestic production of wollastonite as a filler. The uses of wollastonite in applications other than as filler include marine wallboard, paint, plastic, in refractory liners in Steel Mills and as a partial replacement for short-fibre asbestos in certain applications, such as, brake-lining. Technical improvements in filler properties in plastic and rubber have reportedly been made in recent years. A better compatibility between the polymer and the filler is achieved by chemical surface treatment of the mineral filler. Wollastonite when treated in such a manner, results in improved flexural modules in polypropylene and improved reinforcement in nylon.

## RESOURCES

Major deposits of wollastonite have been found in Dungarpur, Pali, Sirohi and Udaipur districts in Rajasthan. Besides, in Ghoda area, Banaskantha district in Gujarat and in Dharmapuri and Tirunelveli districts in Tamil Nadu, occurrences of a few deposits have been reported. As on 1.4.2010, the resources of wollastonite, as per UNFC system are placed at 16.57 million tonnes. Out of the total resources, about 88% (14.58 million tonnes) including 2.49 million tonnes reserves are located in Rajasthan and the remaining about 12% resources (1.99 million tonnes) in Gujarat. Meagre resources are also located in Tamil Nadu (3,533 tonnes) (Table-1).

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

(In tonnes)

Grade/State	Reserves			Remaining Resources						Total resources (A+B)
	Proved STD111	Probable STD122	Total (A)	Feasibility STD211	Pre- feasibility STD222	Measured STD 331	Indicated STD332	Inferred STD333	Total (B)	
<b>All India (Total)</b>	<b>2289869</b>	<b>197253</b>	<b>2487122</b>	<b>3750545</b>	<b>3724191</b>	<b>76088</b>	<b>3325042</b>	<b>3206885</b>	<b>14082751</b>	<b>16569873</b>
<b>By Grades</b>										
Marketable	2289869	197253	2487122	837864	3724191	76088	–	1083475	5721618	8208740
Unclassified	–	–	–	2912681	–	–	3325042	2044800	8282523	8282523
Not-known	–	–	–	–	–	–	–	78610	78610	78610
<b>By States</b>										
Gujarat	–	–	–	–	–	–	–	1990000	1990000	1990000
Rajasthan	2289869	197253	2487122	3750545	3724191	76088	3325042	1213352	12089218	14576340
Tamil Nadu	–	–	–	–	–	–	–	3533	3533	3533

Figures rounded off.

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**EXPLORATION & DEVELOPMENT**

In 2013-14, GSI conducted exploration for wollastonite in Ghoda-Dhanpura and Ghoda-Bhameriya area within Delhi fold belt in district Banaskantha, Gujarat.

mines in the previous year. The entire production was reported from Private Sector mines located in Rajasthan. Wolkem Industries Ltd is the major contributor of the total production during the year (Tables-2 to 4).

**PRODUCTION, STOCKS &  
PRICES**

Production of wollastonite at 187 thousand tonnes in 2014-15 registered a decrease of 32 percent as compared to that in the preceding year. There were 6 reporting mines as compared to 4

Mine-head closing stocks for the year 2014-15 were 1,498 tonnes as against 10,706 tonnes in the previous year (Table- 5).

The average daily-employment of labour during 2014-15 was 358 as against 416 in the previous year. Prices of wollastonite are furnished in the General Review on 'Prices'.

**Table – 2: Principal Producers of Wollastonite, 2014-15**

Name & address of producer	Location of mine	
	State	District
Wolkem Industries Ltd, P.B.21, E-101, Mewar Industrial Area, Madri, Dist. Udaipur- 313 003, Rajasthan.	Rajasthan	Sirohi Udaipur Pali
Renu Atre 378,C Block, Malviya Nagar, Sanganer, Jaipur- 302 017, Rajasthan.	Rajasthan	Ajmer

**Table – 3 : Production of Wollastonite, 2012-13 to 2014-15  
(By State)**

(Qty in tonnes; Value in ₹'000)

State	2012-13		2013-14		2014-15 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India/Rajasthan</b>	<b>145667</b>	<b>127468</b>	<b>192712</b>	<b>157090</b>	<b>186519</b>	<b>162170</b>

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**Table – 4: Production of Wollastonite, 2013-14 & 2014-15  
(By Sector/State/Districts)**

(Qty in tonnes; Value in ₹'000)

State/District	2013-14			2014-15 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
<b>India/Private sector</b>	<b>4</b>	<b>192712</b>	<b>157090</b>	<b>6</b>	<b>186519</b>	<b>162170</b>
<b>Rajasthan</b>	<b>4</b>	<b>192712</b>	<b>157090</b>	<b>6</b>	<b>186519</b>	<b>162170</b>
Ajmer	2	10823	4437	3	18763	7543
Pali	-	-	-	1	36	13
Sirohi	1	24660	32058	1	20564	37015
Udaipur	1	157229	120595	1	147156	117599

**Table – 5 : Mine-head Closing Stocks of  
Wollastonite, 2013-14 & 2014-15  
(By State)**

(Qty in tonnes)

State	2013-14	2014-15(P)
<b>India/Rajasthan</b>	<b>10706</b>	<b>1498</b>

## MINING, PROCESSING & MARKETING

Wollastonite is mined by opencast method essentially through manual and semi-mechanised mechanisms. In some of the mines viz. Chaura Nimberi mine in Ajmer district, Rajasthan, manual selection and manual sorting followed by magnetic separation are practised for improving recovery of ore. Workings are mostly along the strike of the mineralised zone with bench height 2 to 6 meters. The run-of-mine is selectively hand-sorted to the size of

30 cm to 50 cm to remove the associated minerals, such as, calcite, diopside, garnet, quartz and iron. Wollastonite, thus separated, is then crushed to various sizes at two crushing plants near Sirohi railway station. Principal commercial grades produced are: White Kemolit (S1 to S5) and off-white Kemolit (H1 to H5 and LG 25) which are milled products in the size range of 100 to 500 mesh. Besides, micronised products are also marketed, i.e. Wolkron (1008, 1010, 1015, 1020, 1025 and 10825) in the low aspect ratio and Kemolit 1025 and 1020 in the high aspect ratio. In addition, speciality products and surface modified products are also marketed as Kemolit and Fillex, respectively. Wolkem's grinding technology and its automated process control system, which is duly supported with the latest instrumentation enables it to achieve a highly acicular wollastonite.

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Processing improvements integral to new product development focus on the following:

(i) High aspect ratio, fine particle size grades used as reinforcements to compete against milled glass fibres, synthetic fibres and whiskers.

(ii) Fine particle size high aspect ratio grades to compete against other mineral reinforcements, such as, talcs and clays, in the thermoplastic compounds.

(iii) Incorporation of new coupling agents to expand the usefulness of wollastonite into emerging markets, such as, wood composites.

Hand-sorted wollastonite has few impurities and is of high aspect ratio.

### USES & SPECIFICATIONS

The use of wollastonite depends on the acicularity or the aspect ratio, i.e., ratio between length and width of a crystal, chemical composition, brightness and fibre length. Wollastonite having aspect ratio in the range from 3:1 to 5:1 has little potential for reinforcing applications. Hence, market is primarily confined to ceramic, metallurgical fluxes and simple filler and coating applications. Wollastonites acicular nature allows it to compete with other acicular materials, such as, ceramic fibre, glass fibre, steel fibre, and several organic fibres such as, aramid and polyethylene, etc. It reduces the volume of the expensive plastic or resin medium and contributes to physical and chemical properties of the finished products. It improves tear strength, dielectric properties and retains mechanical properties at elevated temperatures.

Wollastonite is used primarily in automobile brakes, ceramics, metallurgical processing, paper, paint, plastic, cosmetics, adhesives and as a replacement of asbestos in asbestos cement boards and sheets. Some of the properties that make it so useful are high brightness & whiteness, low moisture & oil absorption, low volatile content, and the acicular nature of some wollastonite. A better compatibility between the polymer and the filler is achieved by chemical surface treatment of the mineral filler. Wollastonite results improved flexural modules in polypropylene and improved reinforcement in nylon.

Bulk demand for wollastonite in the country is from the Ceramic Industry for the manufacture of floor and wall tiles. In ceramics, wollastonite decreases shrinkage and gas evolution during firing. Small quantities are used in asbestos-cement products as a partial replacement for short fibre asbestos, paint, insecticide, marine wallboard and welding rod industries. In metallurgical applications, wollastonite serves as a flux for welding, a source for calcium oxide, as slag conditioners and to protect the source of molten metal during the continuous casting of steel.

A new development with very large potential is the use of wollastonite as a sequestration mineral for carbon dioxide, a major factor in global warming. Unlike other methods, sequestration by wollastonite is permanent and results in a mixture of precipitated calcium carbonate and silica that may have filler applications in paper, plastics & rubber.

**SUBSTITUTE**

The acicular nature of many wollastonite products allow it to compete with other acicular materials, such as, ceramic fibre, glass fibre, steel fibre, and several organic fibres, such as, aramid, polyethylene, polypropylene, and polytetrafluoroethylene in products where improvements in dimensional stability, flexural modulus and heat deflection are sought. Wollastonite also competes with several non-fibrous minerals or rocks, such as, kaolin, mica and talc, which are added to plastics to increase flexural strength and such minerals as baryte, calcium carbonate, gypsum and talc, which impart dimensional stability to plastics. In ceramics, wollastonite competes with carbonates, feldspar, lime and silica as a source of calcium and silica. America Selenite has developed a very high-aspect-ratio synthetic whiskers which can replace the higher-end Wollastonite.

**CONSUMPTION**

The estimated consumption of wollastonite is at 196,700 tonnes in 2014-15. The Ceramic Industry solely consumed the entire quantity of wollastonite (Table-6).

**Table- 6 : Consumption\* of Wollastonite  
2012-13 to 2014-15  
(By Industries)**

(In tonnes)			
Industry	2012-13	2013-14(R)	2014-15(P)
<b>All Industries</b>	<b>140300</b>	<b>187300</b>	<b>196700</b>
Asbestos products	++ (2)	++ (2)	++ (2)
Ceramic	140300(15)	187300(15)	196700(15)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector.

\*Paucity of data, hence consumption may not be complete.

**WORLD REVIEW**

World resources have not been estimated for wollastonite. The large deposits of wollastonite were in China, Finland, India, Mexico and the United States. Smaller but significant deposits were in Canada, Chile, Kenya, Namibia, South Africa, Spain, Sudan, Tajikistan, Turkey and Uzbekistan.

In 2014, the world production of wollastonite was 1.1 million tonnes which decreased by 2% as against previous year. China (69%) India (17%) & USA(6%) were the major producers. Small quantities of wollastonite are produced in many other countries as well.

The Ceramic Industry probably accounts for the major consumption of wollastonite worldwide, followed by polymers (plastic and rubber) and paint. The remaining were used in construction, friction products and metallurgical applications. The countrywise production of wollastonite from 2012 to 2014 is furnished in Table-7.

**Table -7 : World Production of Wollastonite  
(By Principal Countries)**

(In tonnes)			
Country	2012	2013	2014
<b>World Total</b>	<b>1043289</b>	<b>1098182</b>	<b>1081037</b>
China <sup>e</sup>	750000	750000	750000
Finland <sup>e</sup>	11500	11500	11500
India*	145667	192642	179660
Mexico	55204	57302	54579
Spain	10918	16738	15298
USA <sup>e</sup>	70000	70000	70000

**Source:** World Mineral Production, 2010-2014.

\*India's production of wollastonite during 2012-13, 2013-14 and 2014-15 was 0.15 million tonnes, 0.19 million tonnes and 0.19 million tonnes, respectively.

## FOREIGN TRADE

### Exports

In 2014-15, exports of wollastonite decreased by 6.1% to 17864 tonnes from 19033 tonnes in the previous year. Exports were mainly to Belgium (45%), Japan (27%), Germany (10%) and Australia (6%) (Table- 8).

**Table – 8 : Exports of Wollastonite  
(By Countries)**

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>19033</b>	<b>310240</b>	<b>17864</b>	<b>288087</b>
Belgium	7725	126648	7989	133579
Japan	5405	68782	4737	64254
Germany	1404	33093	1787	36565
Australia	2649	54183	1121	19544
Netherlands	492	5613	520	6806
France	--	--	315	6415
Iran	88	1898	260	5726
USA	200	4517	256	4324
Saudi Arabia	460	2884	481	3128
Italy	104	1782	156	2887
Other countries	506	10840	242	4859

## FUTURE OUTLOOK

Presently, India is world's second largest producer of wollastonite after China. The existing mines in the country are in a position to meet the domestic requirements of the Ceramic Industry as well as export demand. There is an increasing demand for wollastonite in the international markets, especially in ceramic, metallurgy, paint, construction and as asbestos substitute. Present consumption is 1,96,700 tonnes and as per Sub-Group Report

### Imports

Imports of wollastonite increased by 49% to 1,948 tonnes in 2014-15 as compared to 1,305 tonnes in the previous year. Imports were mainly from China (84%), Spain (9%) and USA & Mexico (3% each) (Table- 9).

**Table – 9 : Imports of Wollastonite  
(By Countries)**

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>1305</b>	<b>30479</b>	<b>1948</b>	<b>32549</b>
China	734	8409	1641	19672
Spain	110	2733	168	4191
USA	187	7564	58	3740
Mexico	120	6419	50	2046
Germany	14	1947	11	1523
Finland	54	1521	8	964
Korea, Rep. of	50	1352	12	407
Denmark	--	--	++	6
Other countries	36	534	--	--

for 12<sup>th</sup> Plan Period, the apparent domestic demand would be estimated 2,03,000 tonnes by 2016-17 at 9% growth rate.

The Sub-Group Report for 12<sup>th</sup> Plan Period has recommended that the exports of processed wollastonite with high aspect ratio and powdered wollastonite may be encouraged for better unit value realisation. The Sub-Group Report recommended that by augment action of the reserves of wollastonite in the States of Tamil Nadu and Gujarat, India would be in a formidable position to cope with futuristic demands.