

WOLLASTONITE



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(Part- III : Mineral Reviews)



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**WOLLASTONITE**

**(FINAL RELEASE)**

**GOVERNMENT OF INDIA  
MINISTRY OF MINES  
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# 49 Wollastonite

**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.

## RESERVES/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 1.4.2015, the reserves/resources of wollastonite, as per NMI database, based on UNFC system are placed at 16.47 million tonnes of which reserves under proved and probable categories together constitute 2.24 million tonnes (14%) and the remaining

resources constitute for the balance 14.23 million tonnes (86%). Out of the total reserves/resources, about 88% (14.47 million tonnes) including 2.24 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).

## EXPLORATION & DEVELOPMENT

No exploration was carried out by any agency during 2015-16.

## PRODUCTION AND STOCKS

Production of wollastonite at 175 thousand tonnes in 2015-16 decreased by 6 percent as compared to that in the preceding year. There were five reporting mines in 2015-16 as compared to six mines in the previous year. The entire production was reported from Private Sector mines located in Rajasthan (Tables-2 to 4).

Mine-head closing stocks of wollastonite for the year 2015-16 were 13,818 tonnes as against 3,418 tonnes in the previous year (Table- 5).

The average daily employment of labour during 2015-16 was 295 as against 333 in the previous year.

**Table – 2: Principal Producers of Wollastonite, 2015-16**

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	Pali Sirohi Udaipur
Renu Atre 378,C Block, Malviya Nagar, Sanganer, Jaipur- 302 017, Rajasthan.	Rajasthan	Ajmer

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

Grade/State	Reserves		Remaining Resources					Total Resources (A+B)		
	Proved STD111	Probable STD121 STD122	Total (A)	Feasibility STD211 STD222	Pre-feasibility STD221 STD222	Measured STD331	Indicated STD332		Inferred STD333	Reconnaissance STD334
<b>All India : Total</b>	<b>1953384</b>	<b>48075 240003</b>	<b>2241462</b>	<b>3750118 12000</b>	<b>3748191</b>	<b>76088</b>	<b>3325042</b>	<b>3316385</b>	<b>-</b>	<b>14227824 16469286</b>
<b>By Grades</b>										
Marketable	1953384	- 197253	2150637	837864 -	3724191	76088	-	1083475	-	5721618 7872255
Unclassified	-	48075 42750	90825	2912254 12000	24000	-	3325042	2154300	-	8427596 8518421
Not-known	-	-	-	-	-	-	-	78610	-	78610 78610
<b>By States</b>										
Gujarat	-	-	-	-	-	-	-	1990000	-	1990000 1990000
Rajasthan	1953384	48075 240003	2241462	3750118 12000	3748191	76088	3325042	1322852	-	12234291 14475753
Tamil Nadu	-	-	-	-	-	-	-	3533	-	3533 3533

Figures rounded off.

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**Table – 3 : Production of Wollastonite, 2013-14 to 2015-16  
(By State)**

(Qty in tonnes; Value in `'000)

State	2013-14		2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India/Rajasthan</b>	<b>192712</b>	<b>157090</b>	<b>186524</b>	<b>162113</b>	<b>175348</b>	<b>150364</b>

**Table – 4: Production of Wollastonite, 2014-15 & 2015-16  
(By Sector/State/Districts)**

(Qty in tonnes; Value in `'000)

State/District	2014-15			2015-16 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
<b>India/Private sector</b>	<b>6</b>	<b>186524</b>	<b>162113</b>	<b>5</b>	<b>175348</b>	<b>150364</b>
<b>Rajasthan</b>	<b>6</b>	<b>186524</b>	<b>162113</b>	<b>5</b>	<b>175348</b>	<b>150364</b>
Ajmer	3	18768	7507	2	15495	6334
Pali	1	36	13	1	589	324
Sirohi	1	20564	37015	1	14105	25389
Udaipur	1	147156	117578	1	145159	118317

**Table – 5 : Mine-head Closing Stocks of  
Wollastonite, 2014-15 & 2015-16  
(By State)**

(Qty in tonnes)

State	2014-15	2015-16 (P)
<b>India/Rajasthan</b>	<b>3418</b>	<b>13818</b>

## MINING, PROCESSING & MARKETING

Wollastonite is mined by opencast method essentially through manual and semi-mechanised method. In some of the mines viz. Bel ka Pahar mine of M/s Wolkem Industries Ltd in Sirohi district, Rajasthan, manual selection and manual sorting are practised for improving recovery of ore. 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 with a capacity of 80,000 tonnes per year. 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.

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.

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. Wollastonite 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. It is also used as performance additive in a wide range of construction material (concrete, stucco and adhesives).

Bulk of the demand for wollastonite in the country is in 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 nonfibrous 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 151,200 tonnes in 2015-16. The Ceramic Industry solely consumed the entire quantity of wollastonite (Table-6). In addition to this, as per the annual returns, about 13,000 tonnes of wollastonite was dispatched to various end use consumers.

**Table- 6 : Estimated Consumption\* of Wollastonite  
2013-14 to 2015-16  
(By Industries)**

	(In tonnes)		
Industry	2013-14	2014-15 (R)	2015-16 (P)
<b>All Industries</b>	<b>187300</b>	<b>177900</b>	<b>151200</b>
Ceramic	187300	177900**	151200 **
Others	++	++	++

*Figures rounded off.*

*(\*Includes reported consumption and/or estimates wherever required and paucity of data, hence coverage 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 2015, the world production of wollastonite was 1.34 million tonnes which decreased by 7% as against previous year. China (75%), India (13%) & USA (5%) were the major producers. Small quantities of wollastonite were 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 by principal countries from 2013 to 2015 is furnished in Table-7.

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

(In tonnes)			
Country	2013	2014	2015
<b>World Total</b>	<b>1098252</b>	<b>1439401</b>	<b>1338427</b>
China <sup>c</sup>	750000	1100000	1000000
Finland <sup>c</sup>	11500	10000	10000
India <sup>*</sup>	192712	186524	175348
Mexico	57302	54579	57451
Spain	16738	15298	17700
USA <sup>c</sup>	70000	70000	70000
Other countries	-	3000	7928

*Source: World Mineral Production, 2011-2015.*

*\* India's production of wollastonite during 2013-14, 2014-15 and 2015-16 was 193 thousand tonnes, 187 thousand tonnes and 175 thousand tonnes respectively.*

## FOREIGN TRADE

### Exports

In 2015-16, exports of wollastonite decreased by 7% to 16,616 tonnes from 17,864 tonnes in the

previous year. Exports were mainly to Belgium (54%), Japan (27%), Germany (7%) and Saudi Arabia (3%) (Table-8).

### Imports

Imports of wollastonite increased by 45% to 2,818 tonnes in 2015-16 as compared to 1,948 tonnes in the previous year. Imports were mainly from China (90%), USA(7%), Mexico (2%) and Germany (1%) (Table-9).

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value ('000)	Qty (t)	Value ('000)
<b>All Countries</b>	<b>17864</b>	<b>288087</b>	<b>16616</b>	<b>279263</b>
Belgium	7989	133579	8899	160416
Japan	4737	64254	4420	65394
Germany	1787	36565	1217	24186
Netherlands	520	6806	521	6208
France	315	6415	294	5968
Saudi Arabia	481	3128	562	3842
USA	256	4324	217	3429
UK	1	28	81	1638
Turkey	5	78	83	1407
Singapore	23	1064	35	1098
Other countries	1750	31846	287	5677

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value ('000)	Qty (t)	Value ('000)
<b>All Countries</b>	<b>1948</b>	<b>32549</b>	<b>2818</b>	<b>53216</b>
China	1641	19672	2525	35972
USA	58	3740	189	11870
Germany	11	1523	37	2661
Mexico	50	2046	43	1684
Netherlands	-	-	15	478
Belgium	-	-	1	163
Finland	8	964	2	144
Spain	168	4191	6	137
Japan	-	-	++	89
Denmark	++	6	++	13
Other countries	12	407	++	5

## **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 151,200 tonnes and as per Sub-Group Report

for 12<sup>th</sup> Plan Period, the apparent domestic demand is estimated at 203,000 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 augmenting the reserves of wollastonite in the States of Tamil Nadu and Gujarat, India would be in a formidable position to cope with futuristic demands.

