

VERMICULITE



Indian Minerals Yearbook 2016

(Part-III : Mineral Reviews)



55th Edition

VERMICULITE

(FINAL RELEASE)

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

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Vermiculite is a term applied commercially to micaceous minerals (essentially hydrated silicates of Al, Mg and Fe), usually alteration products of biotite or phlogopite micas, formed by the removal of much alkalies and addition of water. Vermiculite differs from mica in its characteristic property, i.e., exfoliation. Crude vermiculite is always exfoliated before use.

RESERVES/RESOURCES

The total reserves/resources of vermiculite as on 1.4.2015 as per NMI data, based on UNFC system have been placed at 2.35 million tonnes of which about 69% are placed under reserves category and balance 31% are placed under Remaining Resources category. Reserves/resources are located in Tamil Nadu (79%), Andhra Pradesh (12%), Karnataka (6%), Rajasthan (2%) and Jharkhand (1%). Nominal resources are located in Gujarat, Madhya Pradesh and West Bengal (Table-1).

PRODUCTION & STOCKS

Production of vermiculite at 23,267 tonnes in 2015-16 increased by 20% as compared to that in the previous year. There were 7 reporting mines in 2015-16 and 8 reporting mines in the previous year. Besides, production of vermiculite was reported as associated mineral by seven mines in both the years. About 81% of the total production was reported as an associated mineral of mica and quartz mines in Andhra Pradesh and felspar mines in Rajasthan. The share of public sector was 4% as compared to 11% in the preceding year.

Andhra Pradesh was the leading producer of vermiculite in 2015-16 which accounted for 94% of the total output and remaining 6% was from Rajasthan and Tamil Nadu states (Tables - 2 to 4).

Mine-head closing stocks of vermiculite for the year 2015-16 were 30,410 tonnes as against 17,899 tonnes for the previous year (Table - 5).

The average daily employment of labour during the year was 89 as against 107 in the preceding year.

Table – 2 : Principal Producers of Vermiculite, 2015-16

Name & address of producer	Location of mine	
	State	District
Sree Sravana Minerals,* S.No. 209/A.B.210/A, Mangalapur, Distt. Nellore-524 406 Andhra Pradesh.	Andhra Pradesh	Nellore
Laxmi Narayana Mining Company,* East Street, Gudur, Distt.Nellore - 524 101 Andhra Pradesh.	Andhra Pradesh	Nellore
B.Koteswara Rao, 558.53-4A, Swarandhra Bharathi Nagar, Malavya Nagar, Gudur, Distt. Nellore-524 101 Andhra Pradesh.	Andhra Pradesh	Nellore
Tamil Nadu Minerals Ltd, 31, Kamarajar Salai, Chepauk, Chennai-600 005, Tamil Nadu.	Tamil Nadu	Vellore

* Associated with mica and quartz.

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

(In tonnes)

Grade/State	Reserves				Remaining resources				Total resources (A+B)	
	Proved STD111	Probable STD121 STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221 STD222	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334
All India: Total	1582906	19413 30566	1632885	36411	26196 39794	58396	20179	538607	-	719582 2352467
By Grades										
Refractory	28089	- 14238	42327	-	- -	-	-	807	-	807 43134
Unclassified	1554817	19413 16328	1590558	36411	26196 39794	58396	20179	537800	-	718775 2309333
By States										
Andhra Pradesh	60892	19413 30566	110871	2040	917 5850	58396	5127	88865	-	161195 272066
Gujarat	-	- -	-	-	- -	-	-	1960	-	1960 1960
Jharkhand	-	- -	-	-	- -	-	-	30048	-	30048 30048
Karnataka	-	- -	-	13550	22520 29450	-	1562	66658	-	133740 133740
Madhya Pradesh	-	- -	-	197	- 66	-	-	66	-	329 329
Rajasthan	-	- -	-	20623	2759 4428	-	13000	2883	-	43693 43693
Tamil Nadu	1522014	- -	1522014	-	- -	-	-	343051	-	343051 1865065
West Bengal	-	- -	-	-	- -	-	490	5076	-	5566 5566

Figures rounded off.

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

(Qty in tonnes; Value in `'000)

State	2013-14		2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	11851	9470	19336	12479	23267	10573
Andhra Pradesh	9650	4542	15491	6246	21900	7985
Rajasthan	-	-	1623	1251	378	370
Tamil Nadu	2201	4928	2222	4982	989	2218

**Table – 4 : Production of Vermiculite, 2014-15 & 2015-16
(By Sectors/States/Districts)**

(Qty in tonnes; Value in `'000)

State/District	No. of mines	2014-15		No. of mines	2015-16 (P)	
		Quantity	Value		Quantity	Value
India	8(7)	19336	12479	7(7)	23267	10573
Public sector	1	2222	4982	1	989	2218
Private sector	7(7)	17114	7497	6(7)	22278	8355
Andhra Pradesh	6(6)	15491	6246	6(5)	21900	7985
Nellore	6(5)	14821	5710	6(4)	21685	7796
Visakhapatnam	(1)	670	536	(1)	215	189
Karnataka	1*	-	-	-	-	-
Mysuru	1*	-	-	-	-	-
Rajasthan	(1)	1623	1251	(2)	378	370
Ajmer	(1)	1623	1251	(2)	378	370
Tamil Nadu	1	2222	4982	1	989	2218
Vellore	1	2222	4982	1	989	2218

Figures in parentheses indicate no. of associated mines with apatite, felspar, mica and quartz.

* only labour reported

**Table – 5 : Mine-head Closing Stocks of Vermiculite 2014-15 & 2015-16
(By States)**

(Qty in tonnes)

State	2014-15	2015-16 (P)
India	17899	30410
Andhra Pradesh	11557	24411
Karnataka	400	400
Rajasthan	1	285
Tamil Nadu	5941	5314

MINING AND INDUSTRY

The reserves of vermiculite are limited. In Andhra Pradesh, vermiculite is available in the district of Nellore, where there are 4 working (private) mines. DGS Minerals, with 30 acres of mining land as approved by the State Government of Andhra Pradesh for a period of 20 years, with vermiculite mines are engaged in mining, quarrying and processing of vermiculite. Vermiculite is mined and refined using a variety of techniques and supplied commercially in a range of particle size grades of vermiculite concentrate. In Tamil Nadu good quality deposits of vermiculite are mostly found in the North Arcot district, where there are a few working mines. In Karnataka vermiculite is found in the districts of Hassan, Mandya and Mysuru. In West Bengal vermiculite occurs in the district of Bankura.

Vermiculite, when heated to a high degree of temperature exfoliates and expands 8 to 14 times in volume and yields exfoliated vermiculite by loss of water molecules. The chemical composition shows Average Moisture 7.89%, Loss on Ignition 11.05%, SiO_2 30.52%, Fe_2O_3 16.32 % and TiO_2 2.63%. Exfoliation, observed at right angles to the strong basal cleavage. This property is the basis for its commercial use. There is change in the colour during heating process depending upon the composition of the vermiculite and furnace temperature.

USES

Vermiculite is known for its horticultural applications. It is a common component in potting soils. Unfoliated (unexpanded) vermiculite has only minor uses, such as for circulation in drilling muds and in the annealing of steel. In order to convert raw vermiculite into a product suitable for industrial use, it must be exfoliated or expanded by heating, a process termed as 'exfoliation'. Vermiculite is chemically inert, fireproof, non-conductor of electricity and a good insulator against heat (both radiant and conducted), cold and sound. Unlike cork and other organic light weight insulating material, it neither rot, nor attacked by vermin and has a fair mechanical strength.

Vermiculite added to soil for conditioning and lightening either alone or in conjunction with peat or compost. This will accelerate the growth by enabling

the plant to absorb the NPK nutrients and promote anchorage for tender young root systems.

It is also used as a carrier in fertilizers, herbicides and insecticides. Cementing mixtures of exfoliated vermiculite and binding agents, such as gypsum and plaster, have been important products and are applied to structural steel members in commercial buildings.

The mineral is used in various types of building boards and in pollution control applications. Fine-sized, untreated vermiculite concentrates are included in the preparation of fireproof plaster boards. The exfoliated product forms the basis of some light weight plaster board, whilst ground, exfoliated vermiculite is used in various refractory board products.

The principal uses of expanded vermiculite are based on its thermal insulating quality (due to presence of innumerable air cells), low-density, fireproof nature and granular form. Larger vermiculite granules are used as a loose fill for thermal insulation for homes, industrial structures, cold storage, refrigeration and high temperature and low temperature industrial equipment.

Vermiculite is also used for refractory and high temperature insulation as it can withstand hot face temperature up to 1000 °C.

The high absorbency and chemical inertness of exfoliated vermiculite has made it suitable for a wide range of absorbent packing materials as well as for packaged units for the containment of oil and similar liquids.

Like perlite, vermiculite is a mined mineral that is heated to yield a soilless ingredient of potting mixes. Unlike perlite, vermiculite absorbs and retains water and nutrients. This quality is desirable especially in container gardens because of their quicker evaporation rates compared to in-ground plantings. On heating, vermiculite swells up and exfoliates into thin sheets; the swellings may be twenty times or more. The swelled-up vermiculite is very light and thus may be used as an ingredient for the making of light cement or plaster. Vermiculite is also used in the Packing Industry and the making of insulator against heat and sound. Its colour may be yellow, brown or blue. It is very soft and slippery like soap.

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Pure vermiculite also used for plaster aggregates as fire proof insulating material in steel/concrete structures. It is widely used in lightweight insulating material for roof/floor deck system, insulation fill for homes and commercial building, packaging material, bitumen coated vermiculite screeds, acoustic insulation, etc.

SUBSTITUTES

Expanded perlite is a substitute for vermiculite in lightweight concrete and plaster. Other more dense but less costly material substitutes in these applications are expanded clay, shale, slag and slate. In agriculture, substitutes include peat, perlite, sawdust, bark and other plant materials and synthetic soil conditioners. Finely ground pine bark, also called "pine fines," is a principal ingredient of most potting mixes. As an alternative to vermiculite, pine fines also offer water retentive qualities, especially with smaller particle sizes. Cotton gin waste includes gin leavings, such as stems, leaves and hulls. Cotton gin compost renders these waste products into a viable alternative to vermiculite, also because of its ability to increase water-holding qualities in mixes. Resembling sphagnum peat moss, coir is the finished product of ground coconut husks. The University of Arkansas Cooperative Extension Service reports that coir can retain up to nine times its weight in water.

CONSUMPTION

In 2015-16, the consumption of vermiculite was estimated at 1,600 tonnes. The asbestos-products, & insulation product (44% each) and Refractory Industries (12%) were the major three consumers of vermiculite (Table - 6).

POLICY

As per foreign trade policy 2015-20, the imports and exports of vermiculite (unexpanded) (ITC (HS) Code 25301010), and vermiculite insulation bricks (ITC (HS) Code 69029030) are allowed 'free'.

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

	(In tonnes)		
Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	900	900	1600
Asbestos products	700	700	700
Refractory	200	200	200
Insulation product	-	-	700

Figures rounded off.

** Includes actual reported consumption and / or estimates made wherever required. Paucity of data, hence consumption may not be complete..*

WORLD REVIEW

The World reserves of vermiculite at the end of the year 2017 were estimated as per Mineral Commodity Summaries, 2017. The details are given in (Table-7).

In 2015, the World production of vermiculite was estimated at 433 thousand tonnes. South Africa (32%), USA (23%), Brazil (14%), Zimbabwe (9%), Bulgaria (4%) and China (3%) were the principal producers (Table-8).

**Table – 7: World Reserves of Vermiculite
(By Principal Countries)**

	(In '000 tonnes)
Country	Reserves
World: Total (Rounded off)	NA
Brazil	6300
India*	1700
South Africa	14000
USA ^e	25000
Other countries	NA

Source: Mineral Commodity Summaries, 2017

** India's total reserves/resources as per UNFC system as on 1.4.2015 were estimated at 2.35 million tonnes.*

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**Table – 8: World Production of Vermiculite
(By Principal Countries)**

(In '000 tonnes)

Country	2013	2014	2015
Brazil	60	56	60 ^e
Bulgaria ^e	19	18	18
China ^e	15	15	15
India*	12	19	23
Russia ^e	30	30	30
South Africa	128	143	138
USA ^e	100	100	100
Zimbabwe	2.9	30 ^e	40 ^e
Other countries	22	9	9

Source: World Mineral Production, 2011-2015.

* India's production of vermiculite in 2013-14, 2014-15 and 2015-16 was 11,851 tonnes, 19,336 tonnes and 23,267 tonnes respectively.

**Table – 9: Exports of Vermiculite
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	1044	9906	528	6402
UAE	550	4912	272	2719
Norway	323	2270	150	1430
Cambodia	40	693	40	781
Japan	85	953	63	718
USA	-	-	++	650
Romania	-	-	1	35
Kenya	-	-	1	31
New Zealand	-	-	1	29
Saudi Arabia	++	5	++	9
Singapore	32	740	-	-
Other countries	14	333	-	-

FOREIGN TRADE

Exports

Export of vermiculite was decreased drastically by 49% to 528 tonnes in 2015-16 as compared to 1,044 tonnes in 2014-15. Exports were mainly to UAE (52%), Norway (28%), Japan (12%) and Cambodia (8%) (Table-9).

Imports

Import of vermiculite was increased by 12% to 439 tonnes in 2015-16 from 391 tonnes in 2014-15. Imports were mainly from Brazil (53%), USA (29%) and South Africa by (10%) (Table - 10).

**Table – 10: Imports of Vermiculite
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	396	11928	439	15092
USA	85	3245	127	6657
Brazil	252	5754	232	4421
UK	1	115	31	2771
South Africa	43	1005	43	1112
China, P. Rep.	++	7	6	113
Japan	2	625	++	14
Singapore	-	-	++	4
Germany	5	426	-	-
Korea, Rep. of	3	309	-	-
Other countries	5	442	++	2