



# **Indian Minerals Yearbook 2019**

**(Part-III: Mineral Reviews)**

**58<sup>th</sup> Edition**

**VERMICULITE**

**(FINAL RELEASE)**

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

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## 27 Vermiculite

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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 has been placed at 2.35 million tonnes of which about 1.63 million tonnes (69%) are placed under Reserves category and balance 0.72 million tonnes (31%) are placed under Remaining Resources category. Reserves/resources are mainly located in Tamil Nadu that reported 1.87 million tonnes (79%) followed by Andhra Pradesh with 0.27 million tonnes (12%), Karnataka 0.13

million tonnes (6%), Rajasthan 0.04 million tonnes (2%) and Jharkhand 0.03 million tonnes (1%). Nominal resources are located in Gujarat, Madhya Pradesh and West Bengal (Table-1).

### PRODUCTION & STOCKS

Production of vermiculite at 3,161 tonnes in 2018-19 decreased drastically by 48% as compared to 6,054 tonnes in 2017-18. There were 5 reporting mines in 2018-19 similar to that in the previous year.

Andhra Pradesh was the leading producer of vermiculite in 2018-19, which accounted for 78% of the total production and the remaining 22% was from Tamil Nadu state (Tables - 2 to 4).

Mine-head closing stocks of vermiculite at the end of the year 2018-19 were 25,693 tonnes as against 26,915 tonnes for the previous year (Table - 5).

The average daily employment of labour during the year was 55 as against 71 in the previous year.

**Table – 2 : Principal Producers of Vermiculite, 2018-19**

Name & address of producer	Location of mine	
	State	District
T. Meenatchi Sundaram, Plot No. 2, Industrial Estate, Gudur P.O., (Mandal), SP SR Nellore - 524 101, Andhra Pradesh.	Andhra Pradesh	Nellore
Tamil Nadu Minerals Ltd, 31, Kamarajar Salaitwad House, Chepauk, Chennai-600 005, Tamil Nadu.	Tamil Nadu	Vellore
B. Koteswara Rao, 558.53-4A, Swarna Bharathi Nagar, Malavya Nagar, Gudur, Nellore-524 101, Andhra Pradesh.	Andhra Pradesh	Nellore

**Table-1: Reserves/Resources of Vermiculite 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	Pre-feasibility STD221 STD222	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334
<b>All India: Total</b>	<b>1582906</b>	<b>19413 30566</b>	<b>1632885</b>	<b>36411</b>	<b>26196 39794</b>	<b>58396</b>	<b>20179</b>	<b>538607</b>	<b>-</b>	<b>719582 2352467</b>
<b>By Grades</b>										
Refractory	28089	- 14238	42327	-	- -	-	-	807	-	807 43134
Unclassified	1554817	19413 16328	1590558	36411	26196 39794	58396	20179	537800	-	718775 2309333
<b>By States</b>										
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

**Table – 3 : Production of Vermiculite, 2016-17 to 2018-19**  
(By States)

(Qty in tonnes; Value in `'000)

State	2016-17		2017-18		2018-19 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>9042</b>	<b>8162</b>	<b>6054</b>	<b>7075</b>	<b>3161</b>	<b>3808</b>
Andhra Pradesh	7225	2441	4790	2891	2456	1474
Rajasthan	127	127	-	-	-	-
Tamil Nadu	1690	5594	1264	4184	705	2334

**Table – 4 : Production of Vermiculite, 2017-18 & 2018-19**  
(By Sectors/States/Districts)

(Qty in tonnes; Value in `'000)

State/District	No. of mines	2017-18		No. of mines	2018-19 (P)	
		Quantity	Value		Quantity	Value
<b>India</b>	<b>5</b>	<b>6054</b>	<b>7075</b>	<b>5</b>	<b>3161</b>	<b>3808</b>
Public sector	1	1264	4184	1	705	2334
Private sector	4	4790	2891	4	2456	1474
<b>Andhra Pradesh</b>	<b>4</b>	<b>4790</b>	<b>2891</b>	<b>4</b>	<b>2456</b>	<b>1474</b>
Nellore	4	4790	2891	4	2456	1474
<b>Tamil Nadu</b>	<b>1</b>	<b>1264</b>	<b>4184</b>	<b>1</b>	<b>705</b>	<b>2334</b>
Vellore	1	1264	4184	1	705	2334

**Table – 5 : Mine-head Closing Stocks of Vermiculite 2017-18 & 2018-19**  
(By States)

(Qty in tonnes)

State	2017-18	2018-19 (P)
<b>India</b>	<b>26915</b>	<b>25693</b>
Andhra Pradesh	20765	19965
Karnataka	400	400
Rajasthan	159	*
Tamil Nadu	5591	5328

\*Return not received

## MINING AND INDUSTRY

In Andhra Pradesh vermiculite is available in the district of Nellore, where there are 4 working (private) mines during 2018-19. 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.

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 as 7.89%, loss on ignition 11.05%, SiO<sub>2</sub> 30.52%, Fe<sub>2</sub>O<sub>3</sub> 16.32 % and TiO<sub>2</sub> 2.63%. Exfoliation is observed at right angles to the strong basal cleavage. This property is the basis for its commercial use. Change in colour is observed during heating process and this depends 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 '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 lightweight insulating material, it neither rots nor is attacked by vermin and has a fair mechanical strength.

Vermiculite is 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 lightweight plasterboard, 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 & low temperature industrial equipment.

Vermiculite is also used for refractory and high temperature insulation as it can withstand hot face temperature of 1,000 °C, i.e., it can act as a thermal insulator.

The high absorbency and chemical inertness of exfoliated vermiculite have 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 Packaging 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. Pure vermiculite is also used for plaster aggregates as fireproof 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 screens, acoustic insulation, etc.

## **SUBSTITUTES**

Expanded perlite is a substitute for exfoliated vermiculite in lightweight concrete and plaster. Other denser but less costly substitutes in these applications are expanded clay, shale, slag and slate. Alternate materials for loose-fill fire-proofing insulation include fibreglass, perlite and slag wool. In agriculture, substitutes include bark and other plant materials, peat, perlite, sawdust 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 has 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 finish product of ground coconut husks. The University of Arkansas Co-operative Extension Service Reports that coir can retain up to nine times its weight in water.

## **CONSUMPTION**

The apparent consumption of vermiculite was 3,189 tonnes during 2018-19.

## **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'.

## WORLD REVIEW

Significant deposits have been reported in Australia, China, Russia, Uganda and some other countries, but reserves and resources information come from many sources and in most cases, it is not clear whether the numbers refer to vermiculite alone or vermiculite plus other minerals and host rock and overburden. The details of world reserves of vermiculite are reflected in Table-6. Global vermiculite production increased by about 6.6% in 2016, mostly owing to an increase in production from the world's leading producer, Palabora Mining Co. Ltd [a subsidiary of Palabora Copper (Pty) Ltd] in South Africa. Data for vermiculite production in China, which may have produced significant quantities of vermiculite, were largely unavailable. Although mines and prospects in Brazil, Peru and South Africa had the potential to increase the production of medium to coarse grades, expected production increased in 2015 and 2016, especially of coarser grades, which for others it remaining more or less plain to materialise. To provide a generalised view of the development in various countries, the countrywise description as sourced from the latest available publication of Minerals Yearbook 'USGS' 2017 is furnished below:

### Brazil

Brasil Minerios Ltd was by far the leading vermiculite producer in Brazil. The Company's largest mine was the Sao Luis De Montes Belos Mine near Goiania in the State of Goias in Central Brazil and its main processing plant was in Sao Luis. The mine had an estimated production capacity of 60,000 tonnes per year (t/yr) of vermiculite ore with estimated reserves of 1.2 million tonnes (Mt) of vermiculite ore. With expansion of its mining operations continuing, Brasil Minerios produced about 51,600 tonnes of vermiculite concentrate in 2017.

### Bulgaria

In 2016, Wolff & Muller Minerals Bulgaria OOD, a German-Bulgarian joint-venture company, mined vermiculite ore from its Belitza opencast mine. The Company had limited production at, and continued development of, the nearby Verona vermiculite deposit in southwestern Bulgaria near the capital of Sofia. It processed the crude vermiculite ore into a concentrate in superfine and micron-sized products at a plant capable of producing 20,000 t/yr.

### China

Production levels of vermiculite in China were not available, but the vermiculite Association estimated annual Chinese exports of vermiculite to be 1,10,000 tonnes in 2016, suggesting that annual production must be at least that much. Xinjiang Yuli Xinlong Vermiculite Co. Ltd mined vermiculite ore from its 14.8 Mt deposit at its Xinlong Mine in the No.2 sector of the Qeganbulake ring complex in the Bazhou area of Zinjiang Uyghur Autonomous Region.

### South Africa

In 2017, South Africa continued to be the world's leading producer and exporter of vermiculite accounting for about 44% of estimated world production. From 2000 through 2016, on an average, nearly 90% of the vermiculite produced in South Africa was exported. In 2017, about 1,76,000 tonnes were produced most of which was mined by Palabora Mining Co. Ltd. Under the ownership of a consortium consisting of South African and Chinese entities led by the Industrial Development Corporation of South Africa Ltd and China's Hebei Iron & Steel Group, the Palabora Mining Co. Ltd increased production in 2017 by more than 5% from that of 2016 from its mine in Limpopo Province. In near by areas, the Company was preparing for the opencast mining of ore that was equally rich in high-purity vermiculite. The new mine would have a production capacity of 1.5 Mt/yr of ore and yield capacity of 1,70,000 t/yr of vermiculite concentrate, extending the Company's total mine life through 2033. Grade constraints and lower recovery rates from portions of the vermiculite ore body have led to a shift in the vermiculite product—towards fine and superfine grades.

### Turkey

Organik Madencilik A.S., a 50-50 joint venture of Turkey's Yildirim Group and the Greek mining group S&B [a subsidiary of Imerys SA (Paris,France)] proceeded with plans to develop the country's first vermiculite mine at the Karakoc vermiculite deposit in Sivas in central Turkey. The deposit, discovered by Turkey's Government Exploration Co. in the 1990s is thought to hold resources of about 2.8 Mt of high-quality vermiculite and 2.5 Mt of lower-quality vermiculite. The mine reported has a capacity of 10,000 tonnes per year of vermiculite concentrate, a significant quantity of which reportedly consists of coarse and medium grades.

## Uganda

Australian developer Black Mountain Resources Ltd initiated its purchase of the Namekara Vermiculite Mine in the Manafwa district of eastern Uganda reported an increased estimate of nearly 62 tonnes of inferred resources with a grade of 18.2% vermiculite and containing 11 tonnes of vermiculite. The vermiculite resources include significant quantities of coarse and medium grades.

## Zimbabwe

Samrec Vermiculite (Pvt) Ltd, is a subsidiary of Imerys SA (Paris, France) and is the leading vermiculite producer in the country. Samrec conducted intermittent mining at the Shawa Mine which is about 300 kilometers southeast of the capital of Harare. With surface mining operation of the ore to a depth of 40 meters and a capacity of 40,000 tonnes per year of vermiculite concentrate, the mine's expected life is anticipated to be more than 30 years thereby making it one of the largest vermiculite deposits in the world. The ore which included a significant portion of large flake vermiculite is processed into concentrates, the majority of which gets exported to Europe, the Middle East, Japan and the United States. The Minerals Marketing Corp. of Zimbabwe, which is responsible for marketing and selling the country's industrial minerals, reported exports of 29,300 tonnes of vermiculite concentrate at a value of \$ 3.43 million in 2016 (most recent year available), representing a 5% decrease from about 30,900 tonnes at a value of \$ 4.15 million in 2015.

India's production of vermiculite during 2016-17, 2017-18 and 2018-19 was 9,042 tonnes, 6,054 tonnes and 3,161 tonnes respectively. South Africa is the largest producer of vermiculite (141 thousand tonnes) in the world during 2018, followed by USA (100 thousand tonnes) and Brazil (70 thousand tonnes) (Table-7).

**Table – 6: World Reserves of Vermiculite (By Principal Countries)**

(In '000 tonnes)	
Country	Reserves
<b>World: Total (Rounded off)</b>	<b>NA</b>
Brazil	6200
India*	1600
South Africa	14000
USA <sup>e</sup>	25000
Other countries	NA

*Source: USGS, Mineral Commodity Summaries, 2020*

*\* India's total reserves/resources as per UNFC system as on 01.04.2015 were estimated at 2.35 million tonnes.*

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

(In '000 tonnes)			
Country	2016	2017	2018
South Africa	166	166	141
USA <sup>(a)</sup>	100*	100*	100*
Brazil <sup>(b)</sup>	72	70*	70*
Zimbabwe <sup>(a)</sup>	29	23	33
Russia	12	9	26
China	15*	15*	15*
Bulgaria	10*	10*	10*
Uganda	3	4	7
India <sup>(d)</sup>	9	6	3
Turkey	1	2	2
Other countries	0.8	0.9	0.7

*Source: BGS, World Mineral Production, 2014-2018*

*\*India's production of vermiculite during 2016-17, 2017-18 and 2018-19 was 9,042 tonnes, 6,054 tonnes and 3,161 tonnes respectively.*

*(a): Sold or used by producers.*

*(b): Including beneficiated and directly shipped material.*

*(d): Years ended 31 March following that stated.*

## FOREIGN TRADE

### Exports

Exports of vermiculite increased drastically by 29% to 583 tonnes in 2018-19 as compared to 453 tonnes in 2017-18. Exports were mainly to UAE (30%), Japan & Norway (25% each) and Nepal & Saudi Arabia (4% each) (Table-8).

### Imports

Imports of vermiculite also increased drastically by 90% to 611 tonnes in 2018-19 from 321 tonnes in 2017-18. Imports were mainly from Brazil (76%) and Mozambique (17%) (Table-9).

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

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
<b>All Countries</b>	<b>454</b>	<b>5093</b>	<b>583</b>	<b>7252</b>
UAE	96	1594	175	2139
Japan	74	902	145	2131
Norway	264	2043	144	1360
Saudi Arabia	1	6	25	360
China	-	++	20	330
Bahrain	-	-	20	329
Sudan	-	-	22	206
Bangladesh	-	-	++	172
Nepal	5	43	26	127
Bhutan	-	-	6	95
Other countries	14	505	++	3

*Figures rounded off***Table – 9: Imports of Vermiculite  
(By Countries)**

Country	2017-18 (R)		2018-19 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
<b>All Countries</b>	<b>321</b>	<b>7415</b>	<b>611</b>	<b>16154</b>
Brazil	189	4473	462	11968
Mozambique	-	-	105	2900
South Africa	86	2114	20	605
China	22	376	22	403
Japan	++	7	2	266
Spain	-	-	++	12
Zimbabwe	24	445	-	-

*Figures rounded off*



## **FUTURE OUTLOOK**

Exploration and development of vermiculite deposits containing medium, large and premium (coarser) grades (mostly in China and South Africa) are likely to continue because of the higher demand for these larger grades. During the next several years, operations in Brazil and the United

States are expected to help maintain regional and global supplies of fine, superfine, and micron grades. Innovative applications continue to emerge including the use of fine-sized to micron-sized grades of vermiculite to combat air pollution and absorb water in mines, replacing zeolites in ion-exchange columns, purifying waste water and containing or removing nuclear waste.

