

VERMICULITE



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(Part- III : Mineral Reviews)

61st Edition

VERMICULITE

(ADVANCE RELEASE)

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

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

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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 1.4.2020 as per NMI data, based on UNFC system has been placed at 2.36 million tonnes of which about 1.60 million tonnes (68%) are placed under Reserves category and balance 0.77 million tonnes (32%) are placed under Remaining Resources category. Reserves/resources are mainly located in Tamil Nadu that reported 1.86 million tonnes (79%) followed by Andhra Pradesh with 0.20 million tonnes (8%), Karnataka 0.16 million tonnes (7%), Rajasthan

0.01 million tonnes (4%) 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 is 3061 tonnes in 2021-22 as compared to 1260 in 2020-21 increased by 143% as compared to that in the previous year. There were 5 reporting mines and one associate mine in 2021-22 as compared to 5 reporting mine in previous year.

Andhra Pradesh was the leading producer of Vermiculite in 2021-22, which accounted for 77% of the total production and remaining 23% was from Tamil Nadu state. (Tables-2 to 4).

Mine-head closing stocks of vermiculite at the end of the year 2021-22 were 16475 tonnes as against 7806 tonnes for the previous year. (Table-5).

The average daily employment of labour during the year was 43 in both current and previous year.

Table – 2: Principal Producers of Vermiculite, 2021-22

Name & address of producer	Location of mine	
	State	District
T. Meenatchi Sundaram, Plot No. 2, Industrial Estate, Gudur P.O., (Mandal), SPSR 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
Sadhana Minerals 1-116, Masthanvli Complex, Anil Nagar, Bye Pass Road, Gudur, Chillakur, Post-Gudur Dist Nellore-524412 Andhra Pradesh.	Andhra Pradesh	Nellore

Table - 1: Reserves/Resources of Vermiculite as on 1.4.2020 (P)
(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	Total (B)
		STD121	STD122			STD221	STD222						
All India: Total	1562108	-	28888	1590996	76900	71397	25956	9800	20179	552279	8716	765227	2356223
By Grades													
Refractory	24514	-	14238	38752	-	-	-	-	-	807	-	807	39559
Unclassified	1537594	-	14650	1552244	76900	71397	25956	9800	20179	551472	8716	764420	2316664
By States													
Andhra Pradesh	45305	-	28888	74193	7349	917	5850	9800	5127	88865	-	117908	192101
Gujarat	-	-	-	-	-	-	-	-	-	1960	-	1960	1960
Jharkhand	-	-	-	-	-	-	-	-	-	30048	-	30048	30048
Karnataka	-	-	-	-	28000	50520	15500	-	1562	66658	-	162240	162240
Madhya Pradesh	-	-	-	-	-	-	66	-	-	66	-	329	329
Rajasthan	-	-	-	-	41354	19960	4540	-	13000	16555	8716	104125	104125
Tamil Nadu	1516803	-	-	1516803	-	-	-	-	-	343051	-	343051	1859854
West Bengal	-	-	-	-	-	-	-	-	490	5076	-	5566	5566

Figures rounded off

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**Table – 3 : Production of Vermiculite, 2019-20 to 2021-22
(By States)**

(Qty in tonnes; Value in ₹'000)

State	2019-20		2020-21		2021-22 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	2774	3347	1260	2157	3061	3768
Andhra Pradesh	2190	1414	750	469	2370	1481
Karnataka	-	-	-	-	-	-
Tamil Nadu	584	1933	510	1688	691	2287

**Table – 4 : Production of Vermiculite, 2020-21 & 2021-22
(By Sectors/States/Districts)**

(Qty in tonnes; Value in ₹'000)

State/District	No. of mines	2020-21		No. of mines	2021-22 (P)	
		Quantity	Value		Quantity	Value
India	5	1260	2157	5(1)	3061	3768
Public sector	1	510	1688	1	691	2287
Private sector	4	750	469	4(1)	2370	4181
Andhra Pradesh	3	750	469	3(1)	2370	4181
Nellore	3	750	469	3(1)	2370	4181
Karnataka (Mysore)	1	-	-	1	-	-
Tamil Nadu	1	510	1688	1	691	2287
Vellore	1	510	1688	1	691	2287

**Table – 5 : Mine-head Closing Stocks of
Vermiculite 2020-21 & 2021-22
(By States)**

(Qty in tonnes)

State	2020-21	2021-22 (P)
India	7650	16475
Andhra Pradesh	2462	11267
Karnataka	-	-
Tamil Nadu	5188	5208

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%, SiO₂ 30.52%, Fe₂O₃ 16.32 % and TiO₂ 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.

MINING AND INDUSTRY

In Andhra Pradesh vermiculite is available in the district of Nellore, where one working mines have been reported during 2020-21. 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.

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

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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. Finesized, 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 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. 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 more than doubled in 2021-22 at 2,867 tonnes as against 1,103 tonnes in 2020-21.

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 and production data. The details of world reserves of vermiculite are reflected in Table 6 & 7. 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' 2018 is furnished below:

Brazil

In 2018, Brazil was estimated to have produced 50,000 tonnes of vermiculite, most of which was mined by Brasil Minérios Ltd., by far the leading vermiculite producer in Brazil. The company's largest mine was the Morro Pelado Mine in Sao Luis de Montes Belos municipality near Goiania in the State of Goias in central Brazil, and its primary processing plant was in Sao Luis. The mine had an estimated production capacity of 50,000 metric tonnes per year (tonnes/year) of vermiculite ore with reserves estimated in 2012 of 1.2 million metric tonnes (Mt) of vermiculite ore. With the expansion of its mining operations continuing, Brasil Minérios produced about 48,700 tonnes of vermiculite concentrate in 2017 (most recent year for which data were available). About 60% of Brazil's vermiculite products were exported, with sales in North America (50% of all exports), Europe (35%), and Asia (15%).

Near Brasilia in Catalao, Goias State, Brasil Minérios owned the mining rights to vermiculite deposits containing estimated vermiculite ore reserves of 3.3 million tonnes. Brasil Minérios' total production capacity was expected to increase to 200,000 tonnes/year when the Catalão Mine reached full capacity during the next several years. Brasil Minérios expected to meet Brazil's domestic demand for vermiculite for 50 years while continuing to be a significant exporter of the mineral. The company also expanded capacity by 15,000 tonnes/year of vermiculite at its exfoliation plants in Sanclerlandia, Goias State, and in Cosmopolis, Sao Paulo State.

Bulgaria

In 2018, Wolff & Müller Minerals Bulgaria OOD, a joint venture between companies from Bulgaria and Germany, mined vermiculite ore from its Belitza opencast mine and had limited production at, and continued development of, the nearby Verona vermiculite deposit in southwestern Bulgaria near the capital of Sofia. The company processed the crude vermiculite ore into a

concentrate in superfine- and micron-sized products at its 20,000 tonnes/year vermiculite concentration plant.

China

Production levels of vermiculite in China were not available, but based on a 2016 estimate made by the Vermiculite Association that China annually exports 110,000 tonnes of vermiculite, the country's annual production likely was greater than 110,000 tonnes. Production increases in China continued to be constrained by increased enforcement of environmental regulations.

Xinjiang Yuli Xinlong Vermiculite Co., Ltd. mined vermiculite ore from its Xinlong Mine in the Bazhou area of Xinjiang Uyghur Autonomous Region. The 120,000 tonnes/year vermiculite concentrate Xinlong Mine was the top-producing vermiculite mine in China, from which the company produced 30,000 cubic meters per year of exfoliated vermiculite. The company's leading product was a flake vermiculite concentrate ranging in size from 0.3 to 8.0 millimeters. The company exported most of its products, typically to developed countries and regions such as Europe, Australia, Hong Kong, Japan, the Republic of Korea, Russia, Taiwan, and the United States, but also sold products domestically.

South Africa

In 2018, South Africa continued to be the world's leading producer and exporter of vermiculite, accounting for about 43% of estimated world production. In 2018, 180,000 tonnes was produced, most of which was mined by Palabora Mining Co. Ltd. Under the ownership of a consortium consisting of entities from South Africa and China led by the Industrial Development Corp. of South Africa Ltd. and China's Hebei Iron & Steel.

Group, Palabora Mining increased production in 2018 by more than 8% from that in 2017 from its mine in the Limpopo Province. Nearby, the company was preparing for the opencast mining of ore that was equally rich in high-purity vermiculite. The new mine was designed to produce 1.5 million metric tonnes per year of ore and yield 170,000 tonnes/year of vermiculite concentrate, extending the company's total mine life through 2031. Because of grade constraints and lower recovery rates from portions of the vermiculite ore body, the vermiculite product has continued to shift toward fine and superfine grades. Palabora Mining continued to face increased competition in the global vermiculite market, including from Brazil and Uganda, but it regained

some of its market share lost in the past few years, in part through competitive pricing. Palabora Mining marketed its vermiculite products through the company's Singapore office to its three international subsidiaries in Australia, Europe, and North America.

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)] has completed plant construction and started producing from 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 million tonnes of high-quality vermiculite and 2.5 million tonnes of lower quality vermiculite. The mine had a capacity of 10,000 million/year of vermiculite concentrate, which includes a significant quantity of coarse and medium grades. An unspecified portion of production was further processed by exfoliation. Sales of vermiculite concentrate and of exfoliated vermiculite were planned to go through Imerys' established network.

Uganda

In 2018, Black Mountain Resources Ltd. of Australia completed a company restructuring that included selling its interest in the Namekara Vermiculite Mine in the Manafwa district of eastern Uganda in exchange for debt relief. Black Mountain withdrew from the joint venture developing the Namekara Vermiculite Mine citing inconsistent vermiculite sales that resulted in reduced cash flow and the company's inability to service its debt obligations. Namekara Mining Co. Ltd. became the 100% owner of the Namekara Vermiculite Mine and continued mining operations. The large vermiculite deposit had almost 62 million tonnes of inferred resources with a grade of 18.2% vermiculite and containing 11 million tonnes of vermiculite. The mine had an estimated production capacity of 30,000 tonnes/year of vermiculite concentrate, which includes significant quantities of coarse and medium grades, and enough resources to operate for more than 50 years at previously announced rates of production. Black Mountain had considered a production expansion up to 80,000 tonnes/year, but Namekara Mining has not announced plans for expansion.

Zimbabwe

Samrec Vermiculite (Pvt.) Ltd. [a subsidiary of Imerys SA (Paris, France)], the leading vermiculite producer in the country, produced vermiculite concentrate at the Shawa Mine, which is about 300 kilometers southeast of the capital of Harare. The surface mining operation with ore to a depth of 40 meters had a capacity of 40,000 tonnes/year of vermiculite concentrate and an expected mine life of more than 30 years in one of the largest vermiculite deposits in the world. The ore, which included a significant portion of large flake vermiculite, was processed into concentrates, the majority of which was exported to Asia, Europe, the Middle East, and the United States.

The Minerals Marketing Corp. of Zimbabwe, which was responsible for marketing and selling the country's industrial minerals, reported exports of 33,200 tonnes of vermiculite concentrate at a value of \$3.79 million in 2018, representing a 42% increase in quantity with a 12% increase in value from about 23,300 tonnes at a value of \$3.38 million in 2017. The company cited that the strong U.S. dollar and increased inland costs to sea ports had made the local product prices uncompetitive on the international market.

In 2018, the Government of Zimbabwe launched a Transitional Stabilisation Programme, set to run from October 2018 to December 2020, for economic recovery. The Zimbabwe-based Wickbury Investments (Pvt.) Ltd.'s Dinhidza Vermiculite Mine in Buhera was listed with a nonoperational status and as available for investors. Wickbury Investments, which in 2015 had invested in its production facilities at the mine, marketed its product mainly to Zimbabwe's farming industry as a soil amendment to slow the leaching of fertilizers from soil after excessive rainfall while also promoting the mineral's slow release of fertilizer to the soils. In drier areas, farmers would benefit from the mineral's ability to swell and store water, increase soil aeration, and transport and store nutrients. In both instances, use of vermiculite would improve the long-term fertility of soils.

South Africa is the largest producer of vermiculite (118 thousand tonnes) in the world during 2020, followed by USA (100 thousand tonnes) and Brazil (50 thousand tonnes).

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

(In '000 tonnes)	
Country	Reserves
World: Total (rounded off)^a	26,000
China	9,500
Australia	127,400
Russia	5,000
South Africa	3,500
Other countries	165

*Source: USGS, Mineral Commodity Summaries, 2023
a- Excludes China Production.*

** India's total reserves/resources as per UNFC system as on 01.04.2020 were estimated at 2.36 million tonnes.*

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

(In '000 tonnes)			
Country	2019	2020	2021
USA ^(a) *	100	100	100
South Africa	158	118	217
Brazil	50	50	50
Zimbabwe ^(a)	30*	30*	30
Russia	29	29	30
Turkey	1	19	3
China*	15	15	15
Bulgaria*	10	10	10
Uganda	10	14	14
Other countries	3	2	1

Source: BGS, World Mineral Production, 2017-21

***India's production of vermiculite during 2018-19, 2019-20 and 2020-21 was 3,636 tonnes, 3,322 tonnes and 1,808 tonnes, respectively. * Estimated*

(a): Sold or used by producers

(b): Including beneficiated and directly shipped material

(c) : Years ended 31 March following that stated

FOREIGN TRADE

Exports

Exports of vermiculite increased marginally by 48% to 1263 tonnes in 2021-22 as compared to 853 tonnes in 2020-21. Exports were mainly to Japan (48%), UAE and Norway (20% each), Angola (4%), Nepal (3%) and Taiwan (2%) (Table-8).

Imports

The imports of vermiculite also increased drastically by 36% to 1096 tonnes in 2021-22 from 696 tonnes in 2020-21. Imports were mainly from Kenya (82%), Mozambique (7%), South Africa (5%) and Saudi Arab (4%). (Table-9).

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	853	11573	1263	21780
Japan	300	4216	616	9435
UAE	250	2975	252	4900
Norway	120	1261	242	4467
Angola	-	-	59	1357
Taiwan	-	-	28	720
Greece	-	-	24	602
Nepal	5	187	39	217
Tanzania Rep	-	-	3	55
Nigeria	-	-	++	23
Bangladesh Pr	-	-	++	4
Other countries	178	2934	-	-

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	696	17234	1096	25520
Kenya	440	9627	902	20626
South Africa	120	3638	60	2093
Mozambique	20	613	80	2604
Saudi Arab	-	-	54	197
Brazil	84	2232	-	-
Japan	5	905	-	-
Turkey	27	211	-	-
Oman	++	8	-	-

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.