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(Part- III : Mineral Reviews)

56th Edition

VERMICULITE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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27 Vermiculite

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 6,543 tonnes in 2016-17 decreased drastically by 72% as compared to that in previous year.

There were 6 reporting mines in 2016-17 and 7 reporting mines in the previous year. The share of public sector was 26% as compared to 4% in the previous year.

Andhra Pradesh was the leading producer of vermiculite in 2016-17 which accounted for 72% of the total output and remaining 28% was from Rajasthan and Tamil Nadu states. (Tables - 2 to 4).

Mine-head closing stocks of vermiculite at the end of the year 2016-17 were 27,570 tonnes as against 29,045 tonnes for the previous year (Table - 5).

The average daily employment of labour during the year was 76 as against 106 in the previous year.

Table – 2 : Principal Producers of Vermiculite, 2016-17

Name & address of producer	Location of mine	
	State	District
Dugar Insulation India Pvt. Ltd, 7th Floor 34 (123), Dugar Towers, Marshalls Road, Egmore, Chennai City - 600 008, Andhra Pradesh.	Andhra Pradesh	Nellore
T.Meenatchi Sundaram, Plot No. 2, Industrial Estate, Gudur P.O.), (Mandal), SP SR Nellore - 524 101, Andhra Pradesh.	Andhra Pradesh	Nellore
B.Koteswara Rao, 558.53-4A, Swarna Bharathi Nagar, Malavya Nagar, Gudur, 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

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		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
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

Table – 3 : Production of Vermiculite, 2014-15 to 2016-17

(By States)

(Qty in tonnes; Value in `'000)

State	2014-15		2015-16		2016-17 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**19336**	**12479**	**23279**	**10556**	**6543**	**6122**
Andhra Pradesh	15491	6246	21890	7986	4725	1898
Rajasthan	1623	1251	421	400	127	126
Tamil Nadu	2222	4982	968	2170	1691	4098

Table – 4 : Production of Vermiculite, 2015-16 & 2016-17
(By Sectors/States/Districts)

(Qty in tonnes; Value in `'000)

State/District	2015-16			2016-17 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**7(7)**	**23279**	**10556**	**6(3)**	**6543**	**6122**
Public sector	1	968	2170	1	1691	4098
Private sector	6(7)	22311	8386	5(3)	4852	2024
Andhra Pradesh	**6(5)**	**21890**	**7986**	**5(1)**	**4725**	**1898**
Nellore	6(4)	21675	7283	5(1)	4725	1898
Visakhapatnam	(1)	215	703	-	-	-
Rajasthan	**(2)**	**421**	**400**	**(2)**	**127**	**126**
Ajmer	(2)	421	400	(2)	127	126
Tamil Nadu	**1**	**968**	**2170**	**1**	**1691**	**4098**
Vellore	1	968	2170	1	1691	4098

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

Table – 5 : Mine head Closing Stocks of Vermiculite 2015-16 & 2016-17

(By States)

(Qty in tonnes)

State	2015-16	2016-17 (P)
India	**29045**	**27570**
Andhra Pradesh	23044	21519
Karnataka	400	400
Rajasthan	286	158
Tamil Nadu	5315	5493

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. The 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 compositon 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 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 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 and low temperature industrial equipment.

Vermiculite is also used for refractory and high temperature insulation,can withstand hot face temperature of 1000 ^{o}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. Pure vermiculte 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 screens, 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

The apparent consumption of vermiculite was 6,338 tonnes during 2016-17.

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

The details of World reserves of vermiculite, as per Mineral Commodity Summaries, 2018 are given in Table-6.

In 2016, the World production of vermiculite was estimated at 420 thousand tonnes. South Africa (40%), USA (24%), Brazil (14%), Zimbabwe (7%), Bulgaria (5%) and China (4%) were the principal producers (Table-7).

Table – 6: 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, 2018*

** 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	2014	2015	2016
World Total	**404**	**402**	**420**
Brazil	56	60[e]	60[e]
Bulgaria[e]	19	19	19
China[e]	15	15	15
India	19	23	7
Russia [e]	10[e]	8	12
South Africa	143	138	166
USA[e]	100	100	100
Zimbabwe	30	29	29[e]
Other countries	12	10	12

Source: *World Mineral Production, 2012-16.*

FOREIGN TRADE

Exports

Export of vermiculite increased to 756 tonnes in 2016-17 as compared to 528 tonnes in 2015-16. Exports were mainly to Norway (45%), UAE (33%), Combodia (13%) and Japan (8%) (Table-8).

Imports

Import of vermiculite increased to 551 tonnes in 2016-17 from 439 tonnes in 2015-16. Imports were mainly from Brazil (61%), Zimbabwe (13%), South Africa (12%) and USA (9%) (Table-9).

Table – 8: Exports of Vermiculite
(By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**528**	**6402**	**756**	**8312**
UAE	272	2719	250	3004
Norway	150	1430	342	2926
Cambodia	40	781	100	1599
Japan	63	718	64	774
Nepal	-	-	++	8
Malaysia	-	-	++	1
USA	++	650	-	-
Romania	1	35	-	-
Kenya	1	31	-	-
New Zealand	1	29	-	-
Other Countries	++	9	-	-

Table – 9: Imports of Vermiculite
(By Countries)

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**439**	**15093**	**551**	**14412**
Brazil	232	4421	336	7836
USA	127	6658	51	2913
South Africa	43	1112	65	1648
Zimbabwe	-	-	72	1188
Mozambique	-	-	24	437
UK	31	2771	3	283
Japan	++	14	++	107
China	6	113	-	-
Singapore	++	4	-	-