

PYROPHYLLITE



# Indian Minerals Yearbook 2016

(Part- III : Mineral Reviews)



**55<sup>th</sup> Edition**

**PYROPHYLLITE**

**(FINAL RELEASE)**

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

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# 41 Pyrophyllite

**P**rophyllite ( $\text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$ ) is a hydrous silicate of aluminium. It resembles closely with talc in many physical and optical properties but differs in chemical composition. Pyrophyllite finds application in high-grade ceramics & refractories and also as a filler in pesticide industry. Production of pyrophyllite is mainly reported from Chhatarpur, Tikamgarh and Shivpuri districts of Madhya Pradesh; Mahoba, Hamirpur, Jhansi and Lalitpur districts of Uttar Pradesh; Bhandara district of Maharashtra; Bhilwara and Udaipur districts of Rajasthan; Ananthapur and Cuddapah districts of Andhra Pradesh; and Kendujhar district of Odisha.

## RESERVES/RESOURCES

The total reserves/resources of pyrophyllite in India as per NMI data, based on UNFC system as on 1.4.2015 have been placed at 59.61 million tonnes of which about 42%; i.e., 24.93 million tonnes are in reserves category. Among the states, Madhya Pradesh accounted for 48% resources, followed by Odisha

(23%) and Uttar Pradesh (13%). The remaining (16%) resources are in Andhra Pradesh, Maharashtra, Jharkhand and Rajasthan. Gradewise, Refractory grade accounts for 24%, followed by Insecticide grade 22%, Ceramic grade 18% and Insecticide & Ceramic mixed grade 14%. The remaining 18% belongs to Others, Unclassified and Not-known grades (Table-1).

## EXPLORATION & DEVELOPMENT

Exploration carried out by GSI in Madhya Pradesh is provided in Table-2.

## PRODUCTION & STOCKS

As per the Government of India notification S.O.423(E), dated 10<sup>th</sup> February 2015, Pyrophyllite has been declared a 'minor mineral'. Hence, the production for 2015-16 (beyond January, 2015) is not available with IBM. List of producers of pyrophyllite is given in Table-3.

**Table – 2 : Details of Exploration Activities for Pyrophyllite, 2015-16**

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
<b>GSI</b>							
Madhya Pradesh Chhatarpur	Sarkana Banpura Nandagaon	1:12500	100	-	-	225	Reconnaissance stage (G4) investigation was carried out to delineate & to assess the pyrophyllite/diaspore mineralisation. Pyrophyllite mineralisation observed in the area was closely associated with N20°-35° E plane and at surface its possibility can be inferred on the basis of its association with epidotization. Its association with this plane also indicate its hydrothermal origin. Out of 38 BRS, only 4 BRS indicated encouraging value of $\text{Al}_2\text{O}_3$ which varied from 44.04% to 57.21% and rest of the values are not encouraging.

**Table – 1: Reserves/Resources of Pyrophyllite 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		Inferred STD333		Reconnaissance STD334			
		STD121	STD122			STD221	STD222						
<b>All India</b>	<b>16575493</b>	<b>4322386</b>	<b>4035079</b>	<b>24932958</b>	<b>9539407</b>	<b>8301411</b>	<b>4240016</b>	<b>1118943</b>	<b>3589624</b>	<b>7533340</b>	<b>360006</b>	<b>34682745</b>	<b>59615703</b>
<b>By Grades</b>													
Refractory	5839430	1835057	746404	8420890	1915721	5030576	204467	247568	49730	1084237	17161	8549460	16970350
Ceramic	2323554	1128868	1040329	4492951	2047247	819750	1286251	555850	48114	1803804	43200	6604215	11097166
Insecticide	2495205	644502	415394	3555101	249016	1865059	1990109	176400	3198926	1956786	51240	9487536	13042636
Insecticide & Ceramic Mixed	4960978	4922259	1446327	6899564	52665	231942	260177	37563	77451	934862	0	1594660	8494224
Others	342379	221700	110850	674929	5022557	41841	0	0	60570	60585	0	5185553	5860482
Unclassified	435404	0	129956	565360	210351	309093	427599	94450	134360	1456906	248405	2881163	3446523
Not Known	178544	0	145619	324163	41850	3150	71413	7112	20473	236160	0	380158	704321
<b>By States</b>													
Andhra Pradesh	39376	0	9441	48817	366494	75201	311209	0	108831	737855	0	1599590	1648407
Jharkhand	858	0	328	1185	0	0	0	0	0	0	0	0	1185
Madhya Pradesh	9786485	2242501	1907116	13936102	1860354	2976581	2738198	520801	3294772	2984100	248405	14623211	28559313
Maharashtra	0	0	705169	705169	45532	4780000	0	0	0	407160	0	5232692	5937861
Odisha	2781889	1094902	0	3876791	6978702	216661	766105	80	40	1782070	68401	9812058	13688848
Rajasthan	368774	214870	179514	763158	156136	38989	210982	219612	119469	551225	0	1296413	2059571
Uttar Pradesh	3598112	770113	1233511	5601736	132189	213979	213522	378450	66512	1070930	43200	2118782	7720518

Figures rounded off.

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**Table – 3 : Producers of Pyrophyllite**

Name and address of producer	Location of mine	
	State	District
Khajuraho Minerals, Post Box No-25, Chhatarpur- 471 001, Madhya Pradesh.	Madhya Pradesh	Chhatarpur
Eastern Minerals, 35, Vivekanand Marg, Cantt. Jhansi- 284 001, Uttar Pradesh.	Madhya Pradesh	Tikamgarh Chhatarpur
Jindutta Mineral Pvt. Ltd, Post Box No. 27, Chhatarpur – 471 001, Madhya Pradesh.	Madhya Pradesh	Chhatarpur
The Ishwar Mining & Industrial Corp.(P) Ltd, 7, Ishwar Nagar, Mathura Road, New Delhi – 110 065.	Madhya Pradesh	Shivpuri
J. K. Minerals, C-1 & C-2 Industrial Estate, Gwalior Road, Jhansi-284 003, Uttar Pradesh.	Uttar Pradesh	Jhansi Lalitpur
Diwakar Sharma, Flat No.-707, Leela Place, 7/85 Tilak Nagar, Kanpur-208 002, Uttar Pradesh.	Uttar Pradesh	Hamirpur
Devendra Minerals, 279, Civil Lines, Tikamgarh- 472 001, Madhya Pradesh.	Madhya Pradesh	Tikamgarh

**MINING, MARKETING AND TRANSPORT**

Most of the pyrophyllite mines in the country are operated manually with exception of a few semi-mechanised opencast mines in Madhya Pradesh which deploy excavators and payloaders. In some mines, benches of height varying from 1.5 to 3.5 m and width varying from 4 to 10 m have been developed in overburden. Pyrophyllite is sorted out by experienced workers on visual assessment and then transported to grinding units. The ore as mined is crushed with suitable jaw crusher down to 20 mm size and then is ground to 250 mesh size using ceramic balls as grinding media or the requirement as specified by the consumers. For ensuring qualitative improvement in the mine environment and

ecology, some mine owners have planted trees like Acacia, Shisham, Eucalyptus, Jamun and Mango.

**CONSUMPTION**

The domestic consumption of pyrophyllite was at 19,500 tonnes in 2015-16. Refractory was the main consuming industry that accounted for about 86% followed by Ceramic Industry (13%) and remaining 1% by the calcination (Table -4).

**USES AND SPECIFICATIONS**

Pyrophyllite is harder than talc. Unlike talc, pyrophyllite does not flux when subjected to fire and maintains its strength after heating. It is, therefore, used in high-grade ceramic products, electric insulators and refractories. Pyrophyllite imparts thermal shock resistance to ceramic bodies. It is also used as filler and dusting powder in various industries. In Glass Industry, pyrophyllite is used as a source of aluminium instead of feldspar. Owing to its softness and mode of occurrence in lumps, it is used extensively in handicraft industries for making various articles.

Low thermal expansion and shrinkage characteristics of pyrophyllite makes it a useful ingredient in ceramic blends and may substitute either pitcher (grog) or silica. Pyrophyllite allows faster firing cycles in the manufacture of whiteware. In production of stoneware and chinaware, more mechanical strength as well as improved whiteness can be achieved at lower firing temperature. Pyrophyllite is quite stable up to 800 °C and hence, it is consumed in refractory as well as in wall tiles, sanitaryware, electrical porcelain and other ceramic and vitreous china products. Pyrophyllite is non-abrasive, inert with a neutral pH, as well as absorbant providing good flowability which allows it to be used as a diluent, extender, vehicle and carrier for liquids such as fungicide, insecticide, herbicide and fertilizer.

The BIS has prescribed the specifications for pyrophyllite for Ceramic Industry (IS:11477-2011 first revision) reaffirmed on March 2012.

The consumers in Refractory Industry generally prefer pyrophyllite containing 26 to 28% Al<sub>2</sub>O<sub>3</sub>, 3 to 4% alkali and having 23 to 25 Pyrometric Cone Equivalent (PCE). For Insecticide Industry, the specifications of talc/steatite can also be applicable to pyrophyllite as given below:

Loss on Ignition	: 7% max.
Matter soluble in HCl	: 3% max.
Fe <sub>2</sub> O <sub>3</sub>	: 1.5% max.

**Table – 4 : Consumption\* of Pyrophyllite 2013-14 to 2015-16 (By Industries)**

Industry	(In tonnes)		
	2013-14	2014-15 (R)	2015-16 (P)
<b>All Industries</b>	<b>15500</b>	<b>16800</b>	<b>19500</b>
Calcination	1500	1300	100
Ceramic	2400	2600	2600
Refractory	11600	12900	16800

Figures rounded off,

\*Includes actual reported consumption and /or estimates made wherever required. Due to paucity of data, coverage may not be complete.

## WORLD REVIEW

The world reserves of pyrophyllite are quite large and sufficient to meet the world demand. The world reserves of talc and pyrophyllite are provided in Table - 5. Reserves of pyrophyllite are not available separately.

The world production of pyrophyllite in 2015 increased marginally to 1.36 million tonnes from 1.32 million tonnes in the previous year. The Republic of Korea was the leading producer accounting for 45% followed by Japan 25%, India 15% and Turkey 7% (Table-6).

The prices of pyrophyllite are normally influenced by alumina content, levels of iron and other impurities, colour, abrasiveness, absorbency, etc.

**Table – 5 : World Reserves of Talc and Pyrophyllite (By Principal Countries)**

(In '000 tonnes)	
Country	Reserves
<b>World : Total (rounded)</b>	<b>Large</b>
Brazil (crude)	44000
China (Unspecified Mineral)	Large
Finland	Large
France (Crude)	Large
India*	4300000
Japan	100000
Korea, Rep. of	11000
USA	140000
Other countries	Large

*Source: Mineral Commodity Summaries, 2017.*

*\*India's resources of pyrophyllite as per NMI as on 1.04.2015 have been placed at 59.61 million tonnes.*

**Table –6: World Production of Pyrophyllite (By Principal Countries)**

(In '000 tonnes)			
Country	2013	2014	2015
<b>World : Total</b>	<b>1290</b>	<b>1328</b>	<b>1368</b>
India*	225	147	140 <sup>e</sup>
Japan <sup>e</sup>	340 <sup>e</sup>	340 <sup>e</sup>	345
Korea, Rep. of	525	623	597
Peru	32	18	26
Saudi Arabia	6	7	8
South Africa	17	19	17
Thailand	27	49	46
Turkey	102	109	173
Vietnam <sup>e</sup>	16	16	16

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

*\*India's production of pyrophyllite in 2012-13, 2013-14 and 2014-15 was 248 thousand tonnes, 225 thousand tonnes and 147 thousand tonnes respectively.*

## FUTURE OUTLOOK

Globally, market demand for pyrophyllite is expected to increase on account of growing ceramic industry and other refractory applications over the next few years. Increasing number of applications of pyrophyllite in various end-use industries including paints, electrical, porcelain, insecticides, machinery, rubbers and plastics are likely to aid market growth over the next few

years. Pyrophyllite will continue to face competition from bentonite and attapulgite in carrier applications. However, use in filler applications appears to be stable.

The apparent demand for pyrophyllite is estimated at 442 thousand tonnes by 2016-17 at 9% growth rate, as per the report of the Sub-Group-II of Working Group for 12<sup>th</sup> Five Year Plan of erstwhile Planning Commission of India.