

PYROPHYLLITE



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**PYROPHYLLITE**

(FINAL RELEASE)

GOVERNMENT OF INDIA  
MINISTRY OF MINES  
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**P**pyrophyllite ( $\text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$ ) is a hydrous silicate of aluminium. It resembles closely with talc in many physical and optical properties but differs in chemical composition with talc which contains magnesia instead of alumina. 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 and Lalitpur districts of Uttar Pradesh and Keonjhar district of Odisha.

## RESOURCES

The total resources of pyrophyllite in India as per UNFC system as on 1.4.2010 are placed at 56.08 million tonnes of which about 41%; i.e., 23.27 million tonnes are in reserves category. Madhya Pradesh accounts for 56% resources, followed by Odisha(22%) and Uttar Pradesh (10%). The remaining (12%)resources are in Andhra Pradesh, Maharashtra and Rajasthan. Gradewise, refractory grade accounts for 24%, followed by insecticide grade and ceramic grade (22% each) and insecticide and ceramic mixed grade 18%. The remaining 14% are others, unclassified and not-known grades (Table - 1).

## EXPLORATION & DEVELOPMENT

In the year 2011-12, DGM Rajasthan, carried out geological survey near villages Dijanwan & Bikarni of Tehsil Mavli of District Udaipur, by RMS- 200 sq. km, RGM-20 sq. km & DGM-3 sq. km. Minor occurrence of Pyrophyllite was observed. Staining occurrence were also reported near village Pal Nimboda.

## PRODUCTION, STOCKS & PRICES

The production of pyrophyllite at 240 thousand tonnes during 2011-12 registered a very nominal decrease as compared to that in the previous year.

There were 33 reporting mines in 2011-12 as against 30 in the preceding year. Besides, the production of pyrophyllite was also reported as an associated mineral by two mines in Maharashtra. Eight principal producers accounted for 93% of total production during the year.

Five mines, each reporting more than 10,000 tonnes accounted for about 73 % of total production and 13 mines each with production between 1000 to 10,000 tonnes contributed about 25% of total output. Remaining 2% of production was from 15 mines including two associated mines.

Madhya Pradesh continued to be the leading producing state which accounted for 87% of output, followed by Uttar Pradesh 12%. Nominal production was also reported from Maharashtra during the year (Table - 2 to 5).

Mine-head stocks of pyrophyllite at the end of 2011-12 were 88 thousand tonnes as against 81 thousand tonnes at the beginning of the year (Table - 6).

The average daily employment of labour in pyrophyllite mines during 2011-12 was 1,243 as against 1,324 in the previous year. Domestic prices of pyrophyllite are furnished in the General Review on "Prices".

**Table – 1: Reserves/Resources of pyrophyllite as on 1.4.2010**  
(By Grades/Stages)

Grade/State	(In tonnes)												
	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)
<b>All India : Total</b>	<b>12146045</b>	<b>6888351</b>	<b>4241055</b>	<b>23275451</b>	<b>3256515</b>	<b>4919285</b>	<b>6595687</b>	<b>3976532</b>	<b>3963980</b>	<b>9786686</b>	<b>308766</b>	<b>32807451</b>	<b>56082902</b>
<b>By Grades</b>													
Refractory	3823529	3102412	907499	7833440	624548	780518	215441	1622096	437442	2155126	17161	5852332	13685772
Ceramic	73495	1718367	1422374	3214236	2084359	585761	860549	1712387	1155394	2416999	43200	8858649	12072885
Insecticide	2530529	1034194	179740	3744463	100714	2061915	1627759	213300	2045592	2357243	-	8406523	12150986
Insecticide &													
Ceramic mixed	4550634	763591	828162	6142387	439128	1292905	606892	327187	139811	998364	-	3804287	9946674
Others	855667	263541	610850	1730058	-	-	3200000	-	60570	60585	-	3321155	5051213
Unclassified	222979	6246	163180	392405	2300	195037	63895	94450	49848	1571161	248405	2225096	2617501
Not-known	89212	-	129250	218462	5466	3150	21150	7112	75323	227209	-	339410	557872
<b>By States</b>													
Andhra Pradesh	245019	41841	171143	458003	121475	33360	-	-	75201	662193	-	892229	1350232
Jharkhand	858	-	328	1186	-	-	-	-	-	-	-	-	1186
Madhya Pradesh	6779943	5239637	2622217	14641797	585596	3451594	2062603	2407790	3753640	4418648	248405	16928276	31570073
Maharashtra	702680	-	281072	983752	-	-	-	958000	-	2185696	-	3143696	4127448
Odisha	3329278	1001802	525100	4856180	1973032	194121	3920129	80	40	1331393	17161	7435956	12292136
Rajasthan	139650	-	187041	326691	54308	38989	110709	232212	68587	277249	-	782054	1108745
Uttar Pradesh	948617	605071	454154	2007842	522104	1201221	502246	378450	66512	911508	43200	3625241	5633083

Figures rounded off.

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**Table – 2 : Principal Producers of Pyrophyllite  
2011-12**

Name and address of producer	Location of mine	
	State	District
Khajuraho Minerals, Post Box No-25, Chhatarpur- 471 001, Madhya Pradesh.	Madhya Pradesh	Chhatarpur
Jindutta Mineral Pvt. Ltd., Post Box No. 27, Chhatarpur – 471 001, Madhya Pradesh.	Madhya Pradesh	Chhatarpur
Eastern Minerals 35, Vivekanand Marg, Cantt. Jhansi- 284 002, Uttar Pradesh.	Madhya Pradesh	Tikamgarh Chhatarpur
Ishwar Mining & Ind. Corpn.(P) Ltd., Charan Kamal 7, Ishwar Nagar, Mathura Road New Delhi – 110 065.	Madhya Pradesh	Shivpuri

(Contd.)

Table - 2 (Concl.)

Name and address of producer	Location of mine	
	State	District
J. K. Minerals C1 & C2 Industrial Estate, Gwalior Road, Jhansi-284 003, Uttar Pradesh.	Uttar Pradesh	Jhansi Lalitpur
Devendradhar Badgaiya 279 Civil Lines, Tikamgarh,472 001 Madhya Pradesh.	Madhya Pradesh	Tikamgarh
Vinod Kumar Trivedi Gandhi Nagar, Charkhari, Mahoba, 210 427 Uttar Pradesh.	Uttar Pradesh	Mahoba
Rajendra Singh Kushwaha 429,O/s Badgaon Gate, Master Colony, Jhansi-284 012 Uttar Pradesh.	Uttar Pradesh	Mahoba

**Table – 3 : Production of Pyrophyllite, 2009-10 to 2011-12  
(By States)**

(Qty in tones; Value in ₹ '000)

State	2009-10		2010-11		2011-12(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>240747</b>	<b>60425</b>	<b>240082</b>	<b>83123</b>	<b>239811</b>	<b>72720</b>
Andhra Pradesh	26	4	-	-	-	-
Jharkhand	1007	614	-	-	-	-
Madhya Pradesh	209127	53123	207521	73945	209421	65384
Maharashtra	1446	461	1485	368	1054	337
Odisha	11926	2748	-	-	-	-
Uttar Pradesh	17215	3475	31076	8810	29336	6999

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**Table – (4) : Production of Pyrophyllite, 2010-11 to 2011-12  
(By Sectors/States/Districts)**

(Qty in tonnes; Value in ₹'000)

State/District	2010-11			2011-12(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
<b>India</b>	<b>30(4)</b>	<b>240082</b>	<b>83123</b>	<b>33(2)</b>	<b>239811</b>	<b>72720</b>
Public sector	1(3)	10477	18611	1(2)	1189	371
Private sector	29(1)	229605	64512	32	238622	72349
<b>Madhya Pradesh</b>	<b>20</b>	<b>207521</b>	<b>73945</b>	<b>20</b>	<b>209421</b>	<b>65384</b>
Chhatarpur	10	153913	37341	10	162643	47260
Shivpuri	1	20716	11394	1	15824	8640
Tikamgarh	9	32892	25210	9	30954	9484
<b>Maharashtra</b>	<b>(4)</b>	<b>1485</b>	<b>368</b>	<b>(2)</b>	<b>1054</b>	<b>337</b>
Bhandara	(4)	1485	368	(2)	1054	337
<b>Uttar Pradesh</b>	<b>10</b>	<b>31076</b>	<b>8810</b>	<b>13</b>	<b>29336</b>	<b>6999</b>
Hamirpur	1	3455	840	1	3209	780
Jhansi	3	3276	799	4	8298	1948
Lalitpur	3	7757	3200	5	7589	2021
Mahoba	3	16588	3971	3	10240	2250

Figures in parentheses indicate number of associated mines with kyanite & sillimanite.

**Table – (5) : Production of Pyrophyllite, 2009-10 and 2010-11 (p)  
(By Frequency Groups)**

(Qty. in tonnes)

Production group	No. of mines		Production for the group		Percentage in total Production		Cumulative Percentage	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
<b>All Groups</b>	<b>30(4)</b>	<b>33(2)</b>	<b>240082</b>	<b>239811</b>	<b>100.00</b>	<b>100.00</b>	-	-
Up to 500	8(4)	12(1)	3397	2829	1.41	1.18	1.41	1.18
501 –1000	2	3(1)	1258	3876	0.53	1.62	1.94	2.80
1001 –2000	5	1	7716	1886	3.21	0.79	5.15	3.59
2001 –5000	4	7	13119	20963	5.46	8.74	10.61	12.33
5001 –10000	7	5	51432	36185	21.43	15.08	32.04	27.41
10001-15000	-	1	-	11958	-	4.99	-	32.40
15001 & above	4	4	163160	162114	67.96	67.60	100.00	100.00

Figures in parentheses indicate number of associated mines.

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**Table – (6) : Mine-head Stocks of Pyrophyllite  
2011-12(P)  
(By States)**

State	(In tonnes)	
	At the beginning of the year	At the end of the year
<b>India</b>	<b>81014</b>	<b>88027</b>
Andhra Pradesh	41	41
Jharkhand	104	104
Madhya Pradesh	37360	44639
Maharashtra	923	150
Odisha	877	877
Uttar Pradesh	41709	42216

## MINING, MARKETING AND TRANSPORT

All pyrophyllite mines in the country are being operated manually, except 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 10m have been developed in overburden. For ensuring qualitative improvement in the mine environment and ecology, some mine owners have planted trees like Acacia, Shishum, Eucalyptus, Jamun and Mango. Pyrophyllite is sorted out by experienced workers on visual assessment and then transported to grinding units to obtain 70 to 300 mesh powder as per the requirement of consumers.

## CONSUMPTION

The reported domestic consumption of pyrophyllite was at 12,400 tonnes in 2011-12. Refractory was the main consuming industry accounting for about 79% and the ceramic industry consumed the remaining 21% (Table -7).

**Table – 7 : Consumption of Pyrophyllite  
2009-10 to 2011 12  
(By Industries)**

Industry	(In tonnes)		
	2009-10	2010-11(R)	2011-12(P)
<b>All Industries</b>	<b>7400</b>	<b>8400</b>	<b>12400</b>
Ceramic	1800(4)	2000(6)	2500(6)
Refractory	5600(9)	6400(9)	9900(1)

*Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting\* consumption . (\*Includes actual reported consumption and/or estimates made where ever required).*

## USES AND SPECIFICATIONS

Pyrophyllite is harder than talc and unlike talc, pyrophyllite does not flux when fired. 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 felspar. 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 make 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 & hence, pyrophyllite is consumed in refractory as well as in wall tiles, sanitaryware, electrical porcelain and other ceramic and vitreous china products.

The BIS has prescribed the following specifications for pyrophyllite for ceramic industry (IS:11477-2011).

The consumers in refractory industry generally prefer pyrophyllite, containing 26 to 28% Al<sub>2</sub>O<sub>3</sub> 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.

## 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 given in (Table - 8). Reserves of pyrophyllite are not available separately.

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The world production of pyrophyllite in 2011 decreased to 1.39 million tonnes from 1.51 million tonnes in the previous year. The Republic of Korea was the leading producer accounting for 36%, followed by India 27%, Japan 25%, South Africa 8% and Vietnam 1% . (Table - 9).

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

**Table – 8 : World Reserves of Talc and Pyrophyllite (By Principal Countries)**

(In '000 tonnes)

Country	Reserve base
<b>World : Total (rounded)</b>	<b>Large</b>
Brazil	230000
China	Large
Finland	Large
France	Large
India*	75000
Japan	100000
Korea, Republic of	14000
USA **	140000
Other countries	Large

*Source: Mineral Commodity Summaries, 2013.*

\* India's resources of pyrophyllite as per UNFC System as on 1.4.2010 are estimated at 56.08 million tonnes.

\*\* Excludes pyrophyllite.

**Table – 9: World Production of Pyrophyllite**

(In '000 tonnes)

Country	2009	2010	2011
<b>Total</b>	<b>1492</b>	<b>1513</b>	<b>1395</b>
Argentina	10 <sup>e</sup>	10 <sup>e</sup>	- <sup>e</sup>
India*	241	234	387
Japan <sup>e</sup>	340	340	350
Korea, Rep. of	617	674	511
Morocco	33	27	4
Peru	19	19	-
South Africa	115	123	121
Thailand	124	2	5
Vietnam	16	16	16

*Source: World Mineral Production, 2007-2011.*

\*India production of pyrophyllite in 2009-10, 2010-11 and 2011-12 was 241 thousand tonnes, 240 thousand tonnes and 240 thousand tonnes respectively.

## FUTURE OUTLOOK

The consumption of pyrophyllite in ceramic industry seems to be static. 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 of 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 12th Five Year Plan of Planning Commission of India.