

LATERITE



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(Part-III : Mineral Reviews)



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**LATERITE**

**(FINAL 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](mailto:cme@ibm.gov.in)  
Website: [www.ibm.gov.in](http://www.ibm.gov.in)

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# 31 Laterite

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Laterite (from the Latin word later, meaning "brick" or "tile") is a surface formation that is enriched in iron and aluminium. Found mainly in hot, wet tropical areas, it develops by intensive and long-lasting weathering of the underlying parent rock. The mineralogical & chemical composition of laterite depends on their parent rock. Due to the presence of iron oxides, lateritic soils are red in colour ranging from light bright to brown shades. The term 'laterite' was originally used for highly ferruginous deposits first observed in Malabar Region of coastal Kerala and Dakshina Kannada & other parts of Karnataka. It is a highly weathered material, rich in secondary oxides of iron, aluminium or both. It is either hard or capable of hardening on exposure to moisture and drying.

Laterite and bauxite show a tendency to occur together. Aluminous laterites and ferruginous bauxites are quite common. The most common impurity in both is silica. Laterite gradually passes into bauxite with decrease in iron oxide and increase in aluminium oxide. The laterite deposits may be described on the basis of the dominant extractable minerals in it: (i) aluminous laterite (bauxite), (ii) ferruginous laterite (iron ore), (iii) manganese laterite (manganese ore), (iv) nickeliferous laterite (nickel ore) and (v) chromiferous laterite (chrome ore). Laterite with  $\text{Fe}_2\text{O}_3:\text{Al}_2\text{O}_3$  ratio more than one, and  $\text{SiO}_2:\text{Fe}_2\text{O}_3$  ratio less than 1.33 is termed as ferruginous laterite, while that having  $\text{Fe}_2\text{O}_3:\text{Al}_2\text{O}_3$  ratio less than one and  $\text{SiO}_2:\text{Al}_2\text{O}_3$  ratio less than 1.33 is termed as aluminous laterite.

Laterite can be considered as polymetallic ore as it is not only the essential repository for aluminium, but also a source of iron, manganese, cobalt, nickel and chromium. Furthermore, it is the home for several trace elements like gallium and vanadium which can be extracted as by-products.

## RESERVES/RESOURCES

Laterite occurrences are widespread in the country. Almost all Indian bauxite deposits are associated with laterite, except those in Jammu & Kashmir. Laterite generally occurs as capping on the hills and plateaus of Madhya Pradesh and in some states of the Deccan peninsula at altitudes ranging from coastal to 2,000 m with thickness up to 60 m.

As per the NMI database based on UNFC System as on 1.04.2015, the total reserves/resources of laterite

were estimated at 706 million tonnes. Out of these, 124 million tonnes are placed under Reserves category and 581 million tonnes are under Remaining Resources category. Major share of about 74% resources is located in two states, namely, Madhya Pradesh (55%) and Rajasthan (17%). The remaining 28% of resources are spread over in the States of Andhra Pradesh, Kerala, Gujarat, Maharashtra and Jharkhand. Gradewise and Statewise reserves/resources are furnished in Table- 1.

## EXPLORATION & DEVELOPMENT

Details of exploration activities for laterite done by GSI; DMG, Kerala, DMG, Rajasthan & DMG, West Bengal is given in Table- 2.

## PRODUCTION & STOCKS

As per GOI Notification S.O. 423(E) dated 10<sup>th</sup> February 2015, laterite has been declared as 'Minor Mineral', hence, the production beyond January 2015 is not available with IBM. The list of producers of laterite is furnished in Table-3.

## USES & SPECIFICATIONS

Indian Standards code IS 3620-1979 provides specifications and standards for laterite masonry construction in India. Unique material properties and regional variations have rendered laterite stone as subject of controversy. The engineering characteristics of laterite from Malabar region of western India are presented based on the doctoral research conducted by the first author of IITM and several other published studies in the literature.

The compact and ferruginous variety of laterite is used widely as a building stone and road metal. Limited capacity to withstand heavy pressure has limited the use of laterites in construction of light structures, partition walls, boundary walls, etc. Laterite as a building stone possesses one advantage that it is soft when quarried and can be easily cut and dressed into blocks and bricks which on exposure to air become hard.

The industrial use of laterite is in the Cement Industry. It is used as an additive for lowering the clinkerisation temperature and supplementing aluminous and iron contents required in the manufacture of cement. It is also reported that laterite is capable of removal of phosphorus from solutions and percolating columns of laterite remove cadmium, chromium and lead to very low concentrations. Specifications of laterite for Cement Industry are detailed in Table- 4.

**Table – 1: Reserves/Resources of Laterite as on 1.4.2015  
(By Grades/States)**

(In '000' 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						
<b>All India: Total</b>	<b>98598</b>	<b>12527</b>	<b>13608</b>	<b>124733</b>	<b>49655</b>	<b>8960</b>	<b>22724</b>	<b>3532</b>	<b>2626</b>	<b>243535</b>	<b>250787</b>	<b>581819</b>	<b>706552</b>
<b>By Grades</b>													
Unclassified	98598	12527	13608	124733	49655	8960	22724	3532	2626	243535	250787	581819	706552
<b>By States</b>													
Andhra Pradesh	13574	680	1710	15964	23238	5107	2244	24	1107	889	-	32608	48572
Gujarat	36019	-	399	36418	8095	-	1467	-	-	-	-	9562	45981
Jharkhand	-	-	-	-	-	-	-	-	-	570	-	570	570
Kerala	-	-	1156	1156	953	-	-	-	-	-	16717	17670	18826
Madhya Pradesh	12534	3355	7917	23807	8715	1631	16077	3189	1519	167527	169678	368336	392143
Maharashtra	-	278	-	278	2215	1393	400	319	-	7577	-	11903	12181
Odisha	-	-	-	-	-	-	-	-	-	-	1227	1227	1227
Rajasthan	-	-	-	-	-	-	-	-	-	60490	62860	123350	123350
Telangana	36471	8213	2426	47110	6439	828	2536	-	-	6483	305	16591	63701

Figures rounded off.

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**Table – 2: Details of Exploration Activities for Laterite during, 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>							
<b>Chhattisgarh</b>							
Kabirdham	Bamhantara Block	-	-	120	1277.6	395	The area mainly comprises plateau of Deccan lava flows. Laterite in the area is found as overburden of 3 to 5 m over thin and flat lenticular bodies (1-3 m) of bauxite. The maximum thickness of laterite capping is 13 m. Bauxitization has been identified as two aluminous horizons within laterite capping. The upper one generally occurs within the depth range of 1 - 3.5 m and the deeper one extends from 6.5 to 8.5 m. Al <sub>2</sub> O <sub>3</sub> content of deeper horizon varies from 28.05% to 58.6% and the mean value is 5.2%.
Balrampur	Damchuan Block	-	2.00	35	N.A.	7	G-2 stage of investigation on assessment of bauxite ore was taken up in an area of 2 sq km. The area exposes rocks of Deccan volcanics and laterites along the pockets of massive and oolitic bauxite. The laterite is red, yellow and brown in colour. It is pisolitic to massive type, porous and sparsely oolitic. In the east of Damchuan village in a scarp section massive bauxite of 200 m length and 3.5 m thickness is observed. Further field work and drilling activity could not be carried out. The project is discontinued.
<b>Meghalaya</b>							
West Khasi Hills	Rambari area	-	1.55	15	417.65	-	An area of 1.55 sq km has been covered Hills by detailed mapping and drilling. The lateritic bauxite in the area is buff and brick-red in colour. Three main bodies of laterite were identified having dimensions as: 600 m x 100-400 m; 400 m x 100-200 m; and 100 m x 50-100 m. In addition, one small patch was also identified near body-5 of the area. The thickness of ore bodies in boreholes varies from 6.90 m to 14.50 m, the average thickness being 10.61 m to 10 m. Analytical results of the samples collected showed Al <sub>2</sub> O <sub>3</sub> varies from 41.34 wt% to 58.99 wt%. Cr, Sc and Ga also show encouraging values with an average value of 1083 ppm, 83 ppm and 64 ppm, respectively.
West Khasi Hills	South-west of Nongstoin area	1:12500	50.00	N.A.	N.A.	N.A.	Reconnaissance Survey for bauxite in Hills Nongstoin area SW of Nongstoin area has been carried out and revealed potential areas of laterite and lateritic bauxite deposit. Laterisation is extensive over biotite gneiss, while lateritic bauxite capping occurs over garnetiferous sillimanite gneiss and sillimanite gneiss. Al <sub>2</sub> O <sub>3</sub> varies from 51.43% to 30.10% (average 36.20%). Ga content varies from 41 ppm to 93 ppm (average 58 ppm, backward value 15 ppm), which indicates potentiality of this strategic metal in lateritic bauxite capping.

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Table: 2 (concl.)

Agency/ State/District	Location/ Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (Sq km)	No. of boreholes	Meterage		
<b>DMG</b>							
<b>Kerala</b>							
Kannur	Kannadipoyil area, Perinthatta village Taliparamba Taluk	-	48.00 ha.	8	168.0	67	The rock types of the area are mainly laterite at the top followed by variegated clays overlying Archean gneissic charnockite. China clay occurs as sedimentary as well as residual deposits. Bauxite/aluminous laterite/ laterite occurs in the form of massive flat sheets or blankets capping plateaus. Resources of china clay and aluminous laterite have been estimated at 9.6 and 3 million tonnes, respectively.
Kannur	Karinthadam area, Peringome village, Taliparamba Taluk	-	72.00	18	397.5	149	The general geological formations of the area are mainly laterite at the top followed by variegated clays overlying charnockite. China clay occurs as sedimentary as well as residual deposits. Bauxite aluminous laterite/ laterite occurs in the form of massive flat sheets or blankets capping plateaus. The tentative resources of low grade china clay and aluminous laterite have been estimated at 21.0 and 11.0 million tonnes, respectively.
Kasargod	Narayanamangalam area, Kumbla village,	-	20.00 ha.	5	30.0	30	The rock types of the area are mainly aluminous laterite. Reserves and resources of the area have not been assessed. Further details of the exploration are not available.
<b>Maharashtra</b>							
Ratnagiri	Area in Guhaghar taluk	1:25000	40.00	N.A.	N.A.	50	The area is covered by Deccan Trap basalt, bauxite and aluminous laterite. The samples have been collected and sent for analysis. Analysis results from villages Asore, Nivatyachiwadi, Teliwadi, Katalwadi, Bhatwadi, Dhargarwadi, Mohitewadi, Zarewadi, Murtawadi-Buddhawadi, Madhliwadi, Kutalwadi, Danewadi, Vareli, Sutarwadi, Tondali-Buddhawadi, Kalbawadi, Sadewadi, etc. have shown encouraging results, i.e. +40% Al <sub>2</sub> O <sub>3</sub> . Further work of exploration by way of drilling is proposed after further sampling by excavating pits and trenches in the area.
<b>DGM</b>							
<b>Rajasthan</b>							
Pratapgarh	Rathajna, Gadola, Khariya, Bhuwasiya, Panmori, etc.	1:50000 1:10000 1:2000	100.0 10.0 1.5	-	-	-	The area is occupied by basaltic flows. Weathering of basalt at places has resulted in formation of laterite cappings of varying thickness ranging from 0.5 to 3 m. Laterite is covered by red ochre and red soil formed due to weathering and erosion. Laterite is pisolitic, porous, red and brown in colour. No further exploration work was proposed.
Baran	Shahbad	(RMS) 150 (RGM) 15 (DGM) 1.5	-	-	-	-	Two small mounds of laterite are also found in the southeast of Majhola falling in forest land.

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**Table- 3: Principal Producers of Laterite**

Name and address of producer	Location of mine	
	State	District
Putta Ramakrishna, 8-2-268/1/2, Flat-101, Uma Park Side Apartments, Road no. 5, Banjara Hills, Hyderabad-500 034, Telangana.	Andhra Pradesh	East Godavari
Maheswari Minerals, 1-1-37/1, Kondaihpalem, Gangeyuluvari Street, Kakinada-533 033, East Godavari, Andhra Pradesh.	Andhra Pradesh	East Godavari
Andru Srinivas, D. No. 3-15, Raja Street, Gowripatnam, Devarpalli Mandal-534 313. Andhra Pradesh.	Andhra Pradesh	East Godavari
V. Prabhakar Rao, H. No. 7-1-469, Mankammathota, Karimnagar, Andhra Pradesh.	Telangana	Warangal
Donkena Pandari, House No. 4-71, UK road, Sedam, Kalaburagi-585 222, Karnataka.	Telangana	Rangareddy
Maa Sharda Mining & Chemical Works, 72, 1 <sup>st</sup> Floor, Aditya Avenue, Zone II, Bhopal-462 011, Madhya Pradesh.	Madhya Pradesh	Jabalpur
Aziz Khan, H.No. 8-3-66, Old Tandur, Tandur- 501 141, Andhra Pradesh.	Telangana	Rangareddy
S. Chandra Mohan, 17-76/2, Sri Raghavendra Nagar, Uppal-500 039, Rangareddy, Telangana.	Telangana	Rangareddy
G. Rajendranath Goud, 1-8-497/3, Chickadapally, Musheerabad-500 020, Hyderabad, Telangana.	Telangana	Rangareddy
S. S. Enterprises, 40-APR Colony, Katanga-482 001, Jabalpur,	Madhya Pradesh	Jabalpur

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**Table - 4: Specificatins of Laterite  
Consumed in Different Cement Plants**

(In Percentage)

Plant	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>
ACC Ltd, Wadi Cement Works, Distt. Kalaburagi, Karnataka.	36-45	-	-
Anjani Portland Cement Ltd, Anjanipuram, Distt. Nalgonda, Telangana.	20-40	-	-
Birla Cement Works, Chandera, Distt. Chittorgarh, Rajasthan.	17	50	18
Birla Corporation Ltd, P.O. Birla Vikas, Distt. Satna, Madhya Pradesh.	26	37	17
Cement Corporation of India, Tandur, Distt. Rangareddy, Telangana.	> 22	> 40	-
The India Cements Ltd, Chilamkur, Distt. Cuddapah, Andhra Pradesh.	22-37	22-36	21-30
The India Cements Ltd, Vishnupuram, Wadapally, Distt. Nalgonda, Telangana.	12-18	45-50	12-18
The India Cements Ltd, Malkapur, Distt. Rangareddy, Telangana.	12-15	40-43	-
Heidelberg Cements (Diamond Cements) P.O. Narsingarh, Distt. Damoh, Madhya Pradesh.	5-8	42-47	-
Jaypee Rewa Cement, Jaypee Nagar, Distt. Rewa, Madhya Pradesh.	15(min.)	30(min.)	10-12
J.K. Cement Works, Nimbahera and Mangrol, Distt. Chittorgarh, Rajasthan.	10-15	40-55	12-27
Kakatiya Cement & Sugar Industries, Distt. Krishna, Andhra Pradesh.	40-45	9	10
J.K.Cement Works, P.O. Gotan, Distt. Nagaur, Rajasthan.	-	>50	-
Keerthi Industries Ltd, Mellacheruvu, Distt. Nalgonda, Telangana.	25.52	31.05	30.54
Kesoram Cement, P.O. Basantnagar, Distt. Karimnagar, Telangana.	35-38	-	-

(Contd.)

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Table - 4 (Contd.)

Plant	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>
The KCP Ltd, Macherla, Distt. Guntur, Andhra Pradesh.	-	45-55	-
Madras Cements Ltd, Kumarasamy, Raja Nagar Distt. Krishna, Andhra Pradesh.	-	-	12 (max.)
Maihar Cement,(Unit -2) P.O. Sarla Nagar, Maihar, Distt. Satna, Madhya Pradesh.	-	>45	< 18
Malabar Cements Ltd, Walayar, Distt. Palakkad, Kerala.	38	30	10
Manikgarh Cement, Gadchandur, Distt. Chandrapur, Maharashtra.	>25	>30	-
Mancherial Cement Company (P) Ltd, Mancherial, Distt. Adilabad, Telangana.	-	32-40	16-22
Orient Cement, Devapur Cement Works, Distt. Adilabad, Telangana.	22-35	27-45	-
Panyam Cements & Mineral Industries Ltd, Cement Nagar, Distt. Kurnool, Andhra Pradesh.	-	24-42	10-14
Penna Cement Ind. Ltd, Ganeshpahad, Distt.Nalgonda, Telangana.	35	30	14
Penna Cement Ind. Ltd, Boyareddypalli Distt. Anantapur, Andhra Pradesh.	-	38	-
Penna Cement Ind. Ltd, Vill. Talaricheruvu, Distt. Anantapur, Andhra Pradesh.	42	25	14
Rajashree Cements, Malkhed Road, Distt. Kalaburagi Karnataka.	20	44	19
Rain Commodities Ltd, Ramapuram, Distt. Nalgonda, Telangana.	-	35(min.)	-
Sanghi Cement Sanghipuram, Kachchh, Gujarat.	15-20	18-25	25-30

(Contd.)

Table - 4 (Concl.)

Plant	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>
Satna Cement Works, Ghurdang, Distt. Satna, Madhya Pradesh.	26	37	17
Shree Cements, Beawar, Distt. Ajmer, Rajasthan.	-	70-94	-
Shri Durga Cement Company Ltd, Hesla, Ramgarh Cantt; Ramgarh, Jharkhand.	36	34	6
Ultra Tech Cement Ltd, Adityanagar, Malkhed Road, Gulbarga, Karnataka.	21	42	19
Ultra Tech Cement Ltd, (Unit-Vikram Cement Works) Vill. Khor, Kheda Rathore, etc. Teh. Jawad, Neemuch, Madhya Pradesh.	68	58	12-14
Sri Vishnu Cement Ltd, Dondapadu, Distt. Nalgonda, Telangana.	36-42	-	18-22
Toshali Cements Pvt. Ltd, Distt. Koraput, Ampavalli, Odisha.	10	8	10
Vasavadatta Cement, Sedam, Distt. Gulbarga, Karnataka.	-	55	< 30
Vikram Cement, Vikram Nagar, Khor, Distt. Neemuch, Madhya Pradesh.	-	58 (min)	12-14
Zuari Cement, Krishna Nagar Distt. Cuddapah, Andhra Pradesh.	16-24	24-39	28-35
Zuari Cement Ltd, Sitapuram, P.O. Dondapadu Distt. Nalgonda. Telangana.	35-42	-	20-22

*Source: Individual plants.*

*Note: All references in respect of Andhra Pradesh are as per its undivided Statehood position (prior to its bifurcation).*



## **CONSUMPTION**

Laterite is used as an additive in Cement Industry in addition to its traditional use as a building material and road metal. The industrial end-use consumption of laterite in Alumina and Cement Industry in 2013-14, 2014-15 & 2015-16 was approximately 4.33 million tonnes, 5.74 million tonnes & 5.94 million tonnes, respectively.

## **FUTURE OUTLOOK**

In India, though the resources of laterite are vast and are available in abundance, the work in respect of systematic exploration and estimation of resources have been restricted. There seems

to be no major change in the end-use pattern of laterite.

Laterite is widely used as a building stone and road metal. Laterite is a weak stone, but can be used for masonry construction. The property of laterite can be enhanced by suitable water proofing treatments. Long term study is required to find an optimum size for its varied masonry applications.

The consumption of laterite in cement has scaled up due to increased demand of cement in the country. The plausibility of diverse application of laterite in future could well become a viable source for metallic minerals like iron, aluminium, chromite and of trace elements like gallium and vanadium.