

51 Laterite

Laterite is a residual ferruginous rock, commonly found in tropical regions and has close genetic association with bauxite. The term 'laterite' was originally used for highly ferruginous deposits first observed in Malabar Region of coastal Kerala and Dakshin Kannad and 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) manganiferous laterite (manganese ore), (iv) nickeliferous laterite (nickel ore) and (v) chromiferous laterite (chrome ore). Laterite with $Fe_2O_3:Al_2O_3$ ratio more than 1, and $SiO_2:Fe_2O_3$ ratio less than 1.33 is termed as ferruginous laterite while that having $Fe_2O_3:Al_2O_3$ ratio less than 1 and $SiO_2:Al_2O_3$ 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, nickel and chromium. Furthermore, it is the home for several trace elements like gallium and vanadium which can be extracted as by-products.

RESOURCES

In the peninsular India, laterite deposits are the most important Pleistocene Formations. The 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 varying between 20 and 60 m.

Laterite occurrences are reported from all over the country. Almost all Indian bauxite deposits are associated with laterite except those in Jammu & Kashmir. So far, systematic resource estimation has not been carried out for laterite. Some important laterite deposits are discussed below:

In Andhra Pradesh, occurrences of aluminous laterite have been reported from Dumkonda hill in the East Godavari district and Galikonda, Raktakonda, Katuki, Chittamgundi and Kottavalasa areas in Visakhapatnam district.

In Bihar, occurrences of aluminous laterite have been reported from Mahol and Bhaganda, areas in Rohtas district. These laterites have analysed Al_2O_3 - 46.49%, Fe_2O_3 - 4.61% and TiO_2 -10.30%.

In Chhattisgarh, laterite has been reported from Bastar, Bilaspur and Surguja districts.

In Goa, GSI has reported aluminous laterite in areas near Morgim, Consua, Calangute, Camorlin, etc.

In Gujarat, laterite is found in Jamnagar, Bhavnagar, Kachchh, Sabarkantha, Kheda, Bharuch, Ahmedabad and Surat districts. The laterite belt in Kachchh and Jamnagar districts runs to about 250 km with width varying from a hundred metres to as much as 3 km and thickness ranging from 2 to 5 m.

In Jharkhand, laterite occurrences have been reported in Bagru, Manduapat, Pakharpat, Maidanpat, Birhniapat and Serandag plateaus in Ranchi district and Netrahat plateau areas near Jamirapat in Palamau district.

In Karnataka, the principal deposits of bauxite associated with laterite rocks capping the Deccan lava flows were reported from Sidh Pahar, Jamboti and Betne areas and in Mogalgaad Plateau, Kasar Sada range of hills, Kalanandigarh area and Boknur Navege ridge in Belgaum district. In Sidh

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Pahar, the massive aluminous laterite and bauxite covered an area of 90,000 sq m with thickness varying from 1.6 to 5 m. GSI has located aluminous laterite and bauxite at Mudupina Padavu, Pajir Perna Kuddarka, Kalamanadkuru, Shedde Padaru, Badaga Mijir, Mudabidri, Sampayee, Belmana, Manipal, Baindur, Kellingagudda and other localities in Dakshin Kannad district and near Apsarkond, Honnavar Plateau, Haldipur-Hebbadkeri, Tadri-Gokarn, Swarnagadde, etc. in Uttar Kannad district.

In Kerala, thick beds of laterite rocks are found in the coastal areas.

In Madhya Pradesh, aluminous and ferruginous laterites are found in the Amarkantak area which has the largest deposit of bauxite in the State, extending from Mandla and Shahdol districts in Madhya Pradesh to Bilaspur district in Chhattisgarh. Here, bauxite and laterite occur as tabular & lenticular bodies and in pockets. Similar occurrences are also found in Katni and Jabalpur districts.

In Maharashtra, laterite occurrences are reported from Kolhapur, Satara, Ratnagiri and Raigad districts.

In Orissa, GSI has reported extensive deposits of aluminous laterite, ferruginous laterite and bauxite in Kalahandi and Koraput districts. The thickness of laterite varies from 1 to 5 m.

In Tamil Nadu, laterite is reported from the eastern part of the Nilgiri Hills, Ootacamund; plateau portion of the Palani Hills around Kodaikanal in Madurai district; Shevroy Hills near Yercaud and in parts of the Kollaimalai Hills in Salem district.

In Uttar Pradesh, laterite containing pockets of bauxite has been reported from Mirzapur, Banda and Varanasi districts. Exploratory work in Bareilly area, Mirzapur district, has shown laterite analysing 20.23 to 39.61% Al_2O_3 , 12.8 to 33.2% Fe_2O_3 , 7.56 to 37.03% SiO_2 and 2.01 to 9.3% TiO_2 .

Thick cappings of laterite over 40 sq km are observed in Cuttack and Dhenkanal districts, Orissa. Systematic sampling of the laterite in these districts shows fairly high concentration of nickel in sporadic patches.

Nickeliferous laterite is reported from Orissa, Manipur, Tamil Nadu and Andaman Group of Islands.

EXPLORATION & DEVELOPMENT

In 2006-07 Directorate of Geology & Mining, Andhra Pradesh conducted reconnaissance survey for laterite N/V Pandirimamidikot, Kodavalilanka Vetukuru and Maredipalli villages in East Godavari district.

In 2007-08, State Directorates of Geology & Mining, Government of Maharashtra, Madhya Pradesh and Nagaland, Directorate of Geology, Orissa and Directorate of Mining and Geology, Rajasthan conducted exploration for laterite. DGM, Nagaland conducted traverse mapping of laterite deposit of middle range (Aitepyong to Pyochu) under Wokha district on 1:50,000 scale covering an area of about 200 sq.km. A number of mineable laterite deposits were located. Altogether 16 number of laterite samples were collected.

DGM, Madhya Pradesh conducted geological mapping and sampling for laterite in Shamgarh, Suwasra, etc. areas of Mandasaur district. About 1,599 sq.km area covered on 1:50,000 scale and 2.04 sq.km area on 1:4,000 scale. Laterite bodies of varying dimensions were demarcated and about 80 million tonnes of resources were estimated.

During investigation for bauxite around Ushabali plateau in Kandhamal district, Directorate of Geology, Orissa recorded 0.5-5m thick laterite capping over bauxite deposit.

DGM, Maharashtra conducted exploration for bauxite and laterite in Ghungur area in Kolhapur district and estimated about 4 million tonnes of laterite reserves.

DMG, Rajasthan conducted geological mapping and sampling for laterite deposits N/V Benta, Barara, etc. in Baran district. About 15.9 million tonnes of laterite resources were estimated out of which 12.3 million tonnes are N/V Benta and 3.6 million tonnes N/V Barara.

During exploratory/drilling for bauxite in North & Central block of Panchpatmali bauxite deposit, NALCO recorded <1-50 m thick bauxite bearing laterite cappings.

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PRODUCTION, STOCKS AND PRICES

The production of laterite at 1,431 thousand tonnes in 2007-08 increased by 4% as compared to that of the previous year owing largely to increase in demand of laterite.

There were 22 reporting mines during 2007-08 as against 21 in the previous year. Production of laterite was reported as associated mineral by 17 mines. Seven principal producers accounted for about 83% of the total production. Seventeen mines which include eleven major mines of laterite and six associate mines, each producing more than 10,000 tonnes annually accounted for 94% of the total production during the period under review. About 22% of the total production was reported from captive mines in 2007-08 as against 20% in the preceding year.

Andhra Pradesh was the leading state contributing 48% to the total production, followed

by 17% each in Gujarat and Maharashtra, 9% in Madhya Pradesh, 7% in Karnataka, 1% each in Jharkhand and Kerala.

Gradewise analysis of production in 2007 -08 revealed that the bulk of production was of cement grade, accounting for 83% of the total production during the year. Eight percent of production was reported in below 40% Al₂O₃ grade from Kerala and Maharashtra. And, 8% in 40% to 45% Al₂O₃ grade was reported from Gujarat, Karnataka and Kerala. Nominal production of refractory grade was reported from Jharkhand and chemical grade from Karnataka (Tables - 1 to 4).

Mine-head stocks of laterite at the end of 2007-08 were 150 thousand tonnes as against 181 thousand tonnes in the beginning of the year (Tables - 5A & 5B)

The average daily employment of labour in laterite mines was 295 in 2007-08 as against 310 in the previous year. Prices of laterite are furnished in Table - 6.

Table - 1 : Principal Producers of Laterite 2007-08

Name and address of producer	Location of mine	
	State	District
S. Sohan Babu, Village Sankada, G.K.Veedhi Mandal.	Andhra Pradesh	East Godavari
Sanghi Industries Ltd, P.O. Motiber, Taluka Abdasa, 370 655.	Gujarat	Kachchh
M/s Royal Pottery Ceramics, Kasarsada Mines, P.O. Chandgad - 416 509.	Mahara-shtra	Kolhapur
Hindalco Industries Ltd, Prafulla Chandra Sen Sarani, Kolkatta.	Mahara-shtra	Kolhapur

(Contd.)

Table - 1 (Concl'd.)

Name and address of producer	Location of mine	
	State	District
K. Surya Kumari M/s. Belgaum Mines, 91, Ganesh Krupa Vinayak Nagar Hinidalg Road, Belgaum - 591 108.	Karnataka	Belgaum
Syed Salauddin, C/o N. Md. Zaheer, H.No. 2-1-50, Opp. William Moon School, Hyderabad Road, Tandur - 501 141.	Andhra Pradesh	Ranga Reddy
Saurashtra Minerals Ltd, East Kadia Plots Porbander - 360 575 Gujarat.	Gujarat	Porbandar

Producing laterite as an associated mineral with bauxite.

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**Table - 2 : Production of Laterite, 2005-06 to 2007-08
(By States)**

(Quantity in tonnes; value in Rs. '000)

State	2005-06		2006-07		2007-08(p)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	1040816	98124	1373325	157624	1430578	197794
Andhra Pradesh	405752	25350	734629	53320	690213	67568
Gujarat	226552	9590	261962	14670	237310	21648
Jharkhand	777	120	4419	681	7184	1108
Karnataka	125567	27042	173501	60621	99290	37485
Kerala	27781	3210	43319	7497	27702	4417
Madhya Pradesh	141728	10448	83042	5173	123642	7030
Maharashtra	112659	22364	72453	15662	245237	58538

**Table - 3 (A) : Gradewise Production of Laterite, 2006-07
(By Sectors, States and Districts)**

(Quantity in tonnes / Value in Rs. '000)

State / District	No. of mines	For use in Alumina, Aluminium extraction, Production by Grades : Al ₂ O ₃ content		For use other than Alumina Aluminium extraction			Total	
		Below 40%	40-45%	Cement	Chemical	Refractory	Quantity	Value
		India	21(20)	52020	129134	1183022	9149	-
Public sector	1	-	-	5386	-	-	5386	180
Private sector	20(20)	52020	129134	1177636	9149	-	1367939	157444
Andhra Pradesh	8(1)	-	-	734629	-	-	734629	53320
East Godavari	3(1)	-	-	621043	-	-	621043	49947
Ranga Reddy	5	-	-	113586	-	-	113586	3373
Gujarat	2	-	5000	256962	-	-	261962	14670
Kachchh	1	-	-	256962	-	-	256962	13670
Porbandar	1	-	5000	-	-	-	5000	1000
Jharkhand	(2)	-	-	4419	-	-	4419	681
Gumla	(1)	-	-	71	-	-	71	11
Lohardaga	(1)	-	-	4348	-	-	4348	670
Karnataka	3	-	111240	53112	9149	-	173501	60621
Belgaum	3	-	111240	53112	9149	-	173501	60621
Kerala	2(1)	30425	12894	-	-	-	43319	7497
Alapuzha	1	28650	-	-	-	-	28650	4727
Kannur	1	1775	-	-	-	-	1775	256
Thiruvananthapuram	(1)	-	12894	-	-	-	12894	2514
Madhya Pradesh	3(15)	5030	-	78012	-	-	83042	5173
Jabalpur	2(2)	-	-	4998	-	-	4998	388
Katni	(3)	-	-	17488	-	-	17488	929
Rewa	(1)	-	-	6920	-	-	6920	277
Satna	1(9)	5030	-	48606	-	-	53636	3579
Maharashtra	2(1)	16565	-	55888	-	-	72453	15662
Chandrapur	2	-	-	55888	-	-	55888	8208
Kolhapur	(1)	16565	-	-	-	-	16565	7454
Rajasthan	1	-	-	-	-	-	-	-
Chittorgarh	1	-	-	-	-	-	-	-

Figures in parentheses indicate number of associated mines.

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Table – 3 (B) : Gradewise Production of Laterite, 2007-08 (p)
(By Sectors, States and Districts)

State / District	No. of mines	For use in Alumina, Aluminium extraction, Production by Grades : Al ₂ O ₃ content		For use other than Alumina Aluminium extraction			Total	
		Below 40%	40-45%	Cement	Chemical	Refractory	Quantity	Value
India	22(17)	119960	119817	1185451	5000	350	1430578	197794
Public sector	1	=	=	7947	=	=	7947	278
Private sector	21(17)	119960	119817	1177504	5000	350	1422631	197516
Andhra Pradesh	7(1)	=	=	690213	=	=	690213	67568
East Godavari	3(1)	=	=	596156	=	=	596156	64958
Ranga Reddy	4	=	=	94057	=	=	94057	2610
Gujarat	2	=	36065	201245	=	=	237310	21648
Kachchh	1	=	=	201245	=	=	201245	12477
Porbandar	1	=	36065	=	=	=	36065	9171
Jharkhand	(2)	=	=	7184	=	=	7184	1108
Gumla	(1)	=	=	1821	=	=	1821	282
Lohardaga	(1)	=	=	5363	=	=	5363	826
Karnataka	3	=	72500	21440	5000	350	99290	37485
Belgaum	3	=	72500	21440	5000	350	99290	37485
Kerala	3(1)	16450	11252	=	=	=	27702	4417
Alapuzha	2	5900	=	=	=	=	5900	933
Thiruvananthapuram	(1)	=	11252	=	=	=	11252	2218
Kannur	1	10550	=	=	=	=	10550	1266
Madhya Pradesh	4(12)	=	=	123642	=	=	123642	7030
Jabalpur	2(1)	=	=	28888	=	=	28888	1894
Katni	(3)	=	=	19950	=	=	19950	1128
Rewa	(1)	=	=	8415	=	=	8415	386
Satna	2(7)	=	=	66389	=	=	66389	3622
Maharashtra	2(1)	103510	=	141727	=	=	245237	58538
Chandrapur	2	=	=	141727	=	=	141727	20962
Kolhapur	(1)	103510	=	=	=	=	103510	37576
Rajasthan	1	=	=	=	=	=	=	=
Chittorgarh	1	=	=	=	=	=	=	=

Figures in parentheses indicate number of associated mines.

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Table - 4 : Production of Laterite, 2006-07 and 2007-08 (p)
(By Frequency Groups)

(Quantity in tonnes)

Production Group	No. of mines		Production		Percentage in total production		Cumulative percentage	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Total	21(20)	22(17)	1373325	1430578	100.00	100.00	-	-
Up to 1000	2(5)	5(3)	2092	1634	0.15	0.11	0.15	0.11
1001-2000	3(4)	(2)	10957	3761	0.80	0.26	0.95	0.37
2001-5000	2(4)	3	25315	11012	1.84	0.77	2.79	1.14
5001-10000	3(3)	3(6)	41268	61468	3.01	4.30	5.80	5.44
10001-50000	6(4)	7(5)	193810	245037	14.10	17.13	19.90	22.57
50001 & above	5	4(1)	1099883	1107666	80.10	77.43	100.00	100.00

Figures in parentheses indicate number of associated mines.

Table – 5 (A) : Mine-head Stocks of Laterite at the Beginning of the Year 2007-08
(By States / Grade - wise)

(In tonnes)

State	For use in alumina & aluminium extraction, Al ₂ O ₃		For use other than alumina, aluminium metal extraction		Total quantity
	Below 40%	40 – 45%	Chemical	Cement	
India	44848	27023	-	108965	180836
Andhra Pradesh	-	-	-	78503	78503
Gujarat	-	-	-	-	267
Jharkhand	-	-	-	117	117
Karnataka	-	26756	-	4438	31194
Kerala	1262	-	-	-	1262
Madhya Pradesh	2478	-	-	22644	25122
Maharashtra	41108	-	-	3178	44286
Tamil Nadu	-	-	-	85	85

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Table – 5 (B) : Mine-head Stocks of Laterite at the End of the Year 2007-08 (p)
(By States / Grade - wise)

(In tonnes)

State	For use in alumina & aluminium extraction, Al ₂ O ₃		For use other than alumina, aluminium metal extraction		Total quantity
	Below 40%	40 – 45%	Chemical	Cement	
India	3194	25145	5557	115755	149651
Andhra Pradesh	–	–	–	34660	34660
Jharkhand	–	–	–	117	117
Gujarat	–	20370	–	–	20370
Karnataka	–	425	5557	477	6459
Kerala	1411	4350	–	–	5761
Madhya Pradesh	–	–	–	79880	79880
Maharashtra	1783	–	–	536	2319
Tamil Nadu	–	–	–	85	85

Table - 6 : Prices of Laterite, 2005-06 to 2007-08
(Domestic Markets)

(In Rs. per tonne)

Grade	Market	2005-06	2006-07	2007-08(p)
Lumps 2" and above	Ex-mine Katni (Madhya Pradesh)	56	69	69
Run-of-mine	Ex-mine Katni (Madhya Pradesh)	30	35	35
Non-metallurgical (below 40% Al ₂ O ₃)	Ex-mine Margao (Goa)	75	75	75
Cement grade	Ex-mine Peddemul (M) (Andhra Pradesh)	40	40	40

USES & SPECIFICATIONS

The compact and ferruginous variety of laterite is used widely as a road metal and as a local stone for culverts and buildings. It cannot withstand heavy pressure and as such it is used for construction of light structures. 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 clinkerization temperature and supplementing aluminous and iron contents required in the manufacture of cement. Specifications of laterite for cement industry are given in Table - 7.

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Table - 7: Specifications of Laterite Consumed in Different Cement Plants

(In Percentage)			
Plant	Al ₂ O ₃	Fe ₂ O ₃	SiO ₂
Anjani Portland Cement Ltd., Anjanipuram, District Nalgonda, Andhra Pradesh.	20-25	–	–
Birla Cement Works, District Chittorgarh, Chanderia, Rajasthan.	15	54	15
Birla Corporation Ltd, P.O. Birla Vikas, District Satna, Madhya Pradesh.	26	37	17
Cement Corporation of India, Tandur, District Ranga Reddy, Andhra Pradesh.	> 22	> 38	–
Jaypee Rewa Cement, Jaypee Nagar, District Rewa, Madhya Pradesh.	15(max.)	30(min.)	10-12
J.K. Cement Works, Nimbahera and Mangrol, District Chittorgarh, Rajasthan.	10-15	40-55	12-27
Kakatiya Cement & Sugar Industries, District Krishna, Andhra Pradesh.	40-45	9	10
Keerthi Industries Ltd, District Nalgonda, Mellacheruvu, Andhra Pradesh.	–	<35	–
Kesoram Cement, P.O. Basanthnagar, District Karimnagar, Andhra Pradesh.	37-38	–	–
Madras Cements Ltd, Kumarasamy, Raja Nagar, District Krishna, Andhra Pradesh.	–	–	8(max)
Maihar Cement, District Satna, Madhya Pradesh.	–	45	< 18
Malabar Cements Ltd, Walayar, District Palakkad, Kerala.	–	23-25	–

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Table - 7 (Contd.)

Plant	Al ₂ O ₃	Fe ₂ O ₃	SiO ₂
Manikgarh Cement, Gadchandur, District Chandrapur, Maharashtra.	30	35	10-15
Mancherial Cement Company (P) Ltd, District Adilabad, Mancherial, Andhra Pradesh.	–	40	18++
Orient Cement, Devapur Cement Works, District Adilabad, Andhra Pradesh.	22-35	27-45	–
Penna Cement Ind. Ltd, Ganeshpahad, Dist. Nalgonda, Andhra Pradesh.	40-45	23	9
Rain Commodities Ltd, District Nalgonda, Ramapuram, Andhra Pradesh.	–	35(min.)	–
Sanghi Cement Sanghipuram, Kachchh, Gujarat.	15-20	18-25	25-30
Satna Cement Works, District Satna, Ghurdang, Madhya Pradesh.	26	37	17
Shree Cements, District Ajmer, Beawar, Rajasthan.	–	70	–
Shri Durga Cement Company Ltd, Hesla, Ramgarh Cantt; Ramgarh, Jharkhand.	36	34	6
Sri Vishnu Cement Ltd, District Nalgonda, Dondapadu, Andhra Pradesh	36-42	–	18-22
The India Cements Ltd, District Cuddapah, Chilamkur, Andhra Pradesh.	21-26	31-36	26-31
The India Cements Ltd, District Nalgonda, Vishnupuram, Andhra Pradesh.	12-18	45-50	12-18
The India Cements Ltd, District Rangareddy, Malkapur, Andhra Pradesh.	12-15	40-42	–

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Table - 7 (Concl'd.)

Plant	Al_2O_3	Fe_2O_3	SiO_2
The KCP Ltd, Macherla, District Guntur, Andhra Pradesh.	-	45-55	-
Toshali Cements Pvt., Ltd, District Koraput, Ampavalli, Orissa.	10	8	60
Vasavadatta Cement, District Gulbarga, Sedam, Karnataka.	-	>55	<18 < 30
Vikram Cement, District Neemuch, Khor, Madhya Pradesh.	-	55 min	6-18
Zuari Cement, District Cuddapah, Yerraguntla, Andhra Pradesh.	22-25	30-35	30-33

Source : Individual plants.

CONSUMPTION

Laterite is used as an additive in cement industry. The estimated industrial end-use consumption of laterite in 2005-06, 2006-07 and 2007-08 were approximately 1.98 million tonnes, 2.18 million tonnes and 2.43 million tonnes, respectively. Other consuming sectors are building construction and road metal.

FUTURE OUTLOOK

Though vast resources of laterite are available in India, systematic exploration and estimation of resources need to be taken up. There seems to be no major change in the end-use pattern of laterite. The consumption in cement has increased due to increased cement production in the country. In future, laterite could be used as a source of metallic minerals like iron, aluminium chromite and of trace elements like gallium and vanadium.