

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 $\text{Fe}_2\text{O}_3:\text{Al}_2\text{O}_3$ 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, 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 m 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 m 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 Navge ridge in Belgaum district. In Sidh Pahar, the massive aluminous laterite and bauxite covered an area of 90,000 sq m with thickness varying from 1.6 m to 5 m. GSI has located aluminous laterite and bauxite at Mudupina Padavu, Pajir Perna Kuddarka, Kalamanadkuru, Shedde Padaru, Badaga Mijir, Mudabidri,

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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 Odisha, GSI has reported extensive deposits of aluminous laterite, ferruginous laterite and bauxite in Kalahandi and Koraput districts. The thickness of laterite varies from 1 m 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, Odisha. Systematic sampling of the laterite in these districts shows fairly high concentration of nickel in sporadic patches.

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

EXPLORATION & DEVELOPMENT

In 2009-10, DMG, Rajasthan conducted geological mapping and sampling for laterite deposits in Jhalawar district. About 42.43 million tonnes of laterite resources were estimated. DGM, Madhya Pradesh carried out exploratory work for iron ore and laterite in Mandsoor and Neemuch districts and 47.25 million tonnes of laterite resources were estimated. Particulars of exploration carried out are furnished in Table-1.

Table – 1 : Details of Exploration Activities for Laterite during 2009-10

Agency/ State/ District	Location	Mapping		Drilling	Sampling	Remarks Reserves/Resources estimated	
		Scale	Area (sq km)	No. of boreholes			Meterage
DMG							
Rajasthan							
Jhalawar	N/v Dag, Girdharpura, Goshala, Chaukri Khurd, Udaipur & Tisai etc. of teh. Gangdhar	-	-	-	-	8	A total of 42.43 million tonnes of resources were estimated.
DGM							
Madhya Pradesh							
Mandsore & Neemuch		2209.00	-	-	-	-	Exploratory work for iron ore & laterite was carried out. 47.25 million tonnes of laterite resources have been estimated from 32 occurrences.

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PRODUCTION, STOCKS AND PRICES

The production of laterite at 1,221 thousand tonnes in 2009-10 decreased by 1 % as compared to that of the previous year owing to less market demand.

There were 24 reporting mines during 2009-10 as against 20 in the previous year. Besides, the production of laterite was reported as associated mineral by 11 mines. Six principal producers accounted for about 80% of the total production. Seventeen mines which include 13 mines of laterite and 4 associate mines; each producing more than 10,000 tonnes annually, accounted for 98% of the total production during the period under review. About 16% of the total production was reported from captive mines in 2009-10 as against 20% in the preceding year.

Andhra Pradesh was the leading state contributing 50% of the total production, followed by 15% in Gujarat, 13% in Karnataka, 9% in Maharashtra, 6% in Madhya Pradesh & remaining 7% covered by Jharkhand & Kerala.

Gradewise analysis of production in 2009-10 revealed that the bulk of production was of cement grade, accounting for 93% of the total production during the year. A production of 3% reported as below 40% Al₂O₃ grade was from Kerala, Karnataka Madhya Pradesh & Jharkhand and 4% of 40% to 45% Al₂O₃ grade was reported from Karnataka. Nominal production of refractory grade and chemical grade were reported from Karnataka (Tables - 2 to 5).

Mine-head stocks of laterite at the end of 2009-10 were 96 thousand tonnes as against 106 thousand tonnes in the beginning of the year (Tables - 6(A) & (B)).

The average daily employment of labour in laterite mines was 263 in 2009-10 as against 242 in the previous year. Domestic prices of laterite are furnished in the General Review on Prices.

Table – 2 : Principal Producers of Laterite 2009-10

Name and address of producer	Location of mine	
	State	District
S. Soban Babu, D.No 23-16-25/A, Lalitha Nagar, Rajamundry E. G., Andhra Pradesh.	Andhra Pradesh	East Godavari
Sanghi Industries Ltd, P. O. Motiber, Taluka - Abdasa 370 655, Gujarat,	Gujarat	Kachchh
K. Surya Kumari M/s Belgaum Mines, 91 Ganesh Krupa, Vinayak Nagar, Hinidalga Road, Belgaum - 591 108, Karnataka.	Karnataka	Belgaum
Zarina Begum H. No. 2-1-20/5, Hyderabad Road, Tandur - 501 141, Andhra Pradesh.	Andhra Pradesh	Ranga Reddy
Syed Salauddin, C/o N. Md. Zaheer, H. No. 2-1-50, Opp. William Moon School, Hyderabad Road, Tandur – 501 141, Andhra Pradesh.	Andhra Pradesh	Ranga Reddy

Table – 3 : Production of Laterite, 2007-08 to 2009-10 (By States)

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

State	2007-08		2008-09		2009-10 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	1478590	217425	1237393	162442	1221410	173232
Andhra Pradesh	697003	67612	528692	52571	615953	61445
Gujarat	237312	22680	259767	21104	184840	12773
Jharkhand	7184	1108	4869	752	4316	631
Karnataka	105080	40452	108628	36527	159078	59445
Kerala	51681	9250	77327	21410	69088	18514
Madhya Pradesh	132421	8773	94779	6659	79234	4809
Maharashtra	247894	67550	163331	23419	108901	15615
Rajasthan	15	++	-	-	-	-

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**Table – 4 (A) : Gradewise Production of Laterite, 2008-09
(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
Inida	20(14)	31627	20200	1180011	5017	538	1237393	162442
Public sector	2	–	–	58456	–	–	58456	17930
Private sector	18(14)	31627	20200	1121555	5017	538	1178937	144512
Andhra Pradesh	6(1)	–	–	528692	–	–	528692	52571
East Godavari	2(1)	–	–	412643	–	–	412643	48687
Ranga Reddy	4	–	–	116049	–	–	116049	3884
Gujarat	2	–	–	254767	5000	–	259767	21104
Kachchh	1	–	–	243727	–	–	243727	16817
Porbandar	1	–	–	11040	5000	–	16040	4287
Jharkhand	(2)	–	–	4869	–	–	4869	752
Gumla	(1)	–	–	1932	–	–	1932	299
Lohardaga	(1)	–	–	2937	–	–	2937	453
Karnataka	2	–	20200	87873	17	538	108628	36527
Belgaum	2	–	20200	87873	17	538	108628	36527
Kerala	4(1)	20150	–	57177	–	–	77327	21410
Alapuzha	1	12200	–	–	–	–	12200	2293
Kannur	2	7950	–	3000	–	–	10950	1745
Kasargod	1	–	–	53275	–	–	53275	17101
Thiruvananthapuram	(1)	–	–	902	–	–	902	271
Madhya Pradesh	4(10)	11477	–	83302	–	–	94779	6659
Jabalpur	2(1)	100	–	6215	–	–	6315	632
Katni	1(1)	2463	–	–	–	–	2463	99
Rewa	(1)	–	–	14120	–	–	14120	565
Satna	1(7)	8914	–	62967	–	–	71881	5363
Maharashtra	2	–	–	163331	–	–	163331	23419
Chandrapur	2	–	–	163331	–	–	163331	23419

Figures in parentheses indicate number of associated mines.

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Table – 4 (B) : Gradewise Production of Laterite, 2009-10 (P)
(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	Other	Quantity	Value
India	24(11)	41439	43000	1136023	748	100	100	1221410	173232
Public sector	2	–	–	52765	–	–	–	52765	15424
Private sector	22(11)	41439	43000	1083258	748	100	100	1168645	157808
Andhra Pradesh	6(1)	–	–	615953	–	–	–	615953	61445
East Godavari	2(1)	–	–	471697	–	–	–	471697	55641
RangaReddy	4	–	–	144256	–	–	–	144256	5804
Gujarat	2	–	–	184740	–	–	100	184840	12773
Kachchh	1	–	–	184740	–	–	–	184740	12747
Porbandar	1	–	–	–	–	–	100	100	26
Jharkhand	(2)	2862	–	1454	–	–	–	4316	631
Gumla	(1)	–	–	1036	–	–	–	1036	161
Lohardaga	(1)	2862	–	418	–	–	–	3280	470
Karnataka	3	9200	43000	106078	700	100	–	159078	59445
Belgaum	3	9200	43000	106078	700	100	–	159078	59445
Kerala	5(1)	23800	–	45240	48	–	–	69088	18514
Alapuzha	2	15650	–	–	–	–	–	15650	2943
Kannur	2	8150	–	992	–	–	–	9142	1372
Kasargod	1	–	–	43364	–	–	–	43364	13920
Thiruvananthapuram	(1)	–	–	884	48	–	–	932	279
Madhya Pradesh	5(7)	5577	–	73657	–	–	–	79234	4809
Jabalpur	2	–	–	213	–	–	–	213	30
Katni*	1	–	–	–	–	–	–	–	–
Satna	2(7)	5577	–	73444	–	–	–	79021	4779
Maharashtra	2	–	–	108901	–	–	–	108901	15615
Chandrapur	2	–	–	108901	–	–	–	108901	15615
Rajasthan	1	–	–	–	–	–	–	–	–
Chittorgarh*	1	–	–	–	–	–	–	–	–

* Production not reported, only labour employment reported.
Figures in parenthesis indicate number of associated mines.

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Table – 5 : Production of Laterite, 2008-09 & 2009-10(P)
(By Frequency Groups)

(Quantity in tonnes)

Production Group	No. of Mines		Production		Percentage in Total Production		Cumulative Percentage	
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
Total	20(14)	24(11)	1237393	1221410	100.00	100.00	–	–
Up to 1000	2(3)	7(3)	1487	3504	0.11	0.29	0.11	0.29
1001-2000	(3)	(2)	5084	2114	0.42	0.17	0.53	0.46
2001-5000	4(3)	1(1)	24094	6050	1.95	0.50	2.48	0.96
5001-10000	3(1)	3(1)	27831	31928	2.25	2.61	4.73	3.57
10001-50000	4(4)	7(4)	156388	241621	12.64	19.78	17.37	23.35
50001 & above	7	6	1022509	936193	82.63	76.65	100.00	100.00

Figures in parentheses indicate number of associated mines.

Table – 6 (A) : Mine-head Stocks of Laterite at the beginning of the year 2009-10
(By States/Grades)

(In tonnes)

State	For use in alumina & aluminium extraction Al_2O_3		For use other than alumina, aluminium metal extraction			Total Quantity
	Below -40%	40-45%	Chemical	Cement	Refractory	
India	5120	718	14580	85094	126	105638
Andhra Pradesh	–	–	–	1097	–	1097
Gujarat	–	–	10908	–	–	10908
Jharkhand	–	–	–	87	–	87
Karnataka	–	718	3672	11648	126	16164
Kerala	1572	–	–	5678	–	7250
Madhya Pradesh	3548	–	–	66499	–	70047
Tamil Nadu	–	–	–	85	–	85

Table – 6 (B) : Mine-head Stocks of Laterite at the end of the year 2009-10(P)
(By States/Grades)

(In tonnes)

State	For use in alumina & aluminium extraction Al_2O_3		For use other than alumina, aluminium metal extraction			Total Quantity
	Below -40%	40-45%	Chemical	Cement	Refractory	
India	2271	1386	11092	81204	18	95971
Andhra Pradesh	–	–	–	5068	–	5068
Gujarat	–	–	11008	–	–	11008
Jharkhand	–	–	–	121	–	121
Karnataka	–	1386	84	13427	18	14915
Kerala	1477	–	–	81	–	1558
Madhya Pradesh	794	–	–	62176	–	62970
Maharashtra	–	–	–	246	–	246
Tamil Nadu	–	–	–	85	–	85

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. R & D on use of laterite for removal of fluoride from contaminated drinking water is being investigated. 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
ACC Ltd, Wadi Cement Works, District Gulbarga, Karnataka.	36-45	–	–
Anjani Portland Cement Ltd, Anjanipuram, District Nalgonda, Andhra Pradesh.	20-40	–	–
Birla Cement Works, Chandera, District Chittorgarh, Rajasthan.	17	50	18
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	> 40	–
The India Cements Ltd, Chilamkur, District Cuddapah, Andhra Pradesh.	21-37	22-37	21-30
The India Cements Ltd, Vishnupuram, Wadapally District Nalgonda, Andhra Pradesh.	12-18	45-50	12-18
The India Cements Ltd, Malkapur, District Ranga Reddy, Andhra Pradesh.	12-15	40-42	–
Heidelberg Cements (Diamond Cements) P.O. Narsingarh District Damoh Madhya Pradesh	5-8	42-47	–
Jaypee Rewa Cement, Jaypee Nagar, District Rewa, Madhya Pradesh.	15(min.)	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

(Contd.)

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Table - 7 (Contd.)

Plant	Al ₂ O ₃	Fe ₂ O ₃	SiO ₂
Keerthi Industries Ltd, Mellacheruvu, District Nalgonda, Andhra Pradesh.	25.52	31.05	30.54
Kesoram Cement, P.O. Basantnagar, District Karimnagar, Andhra Pradesh.	35-38	-	-
The KCP Ltd, Macherla, District Guntur, Andhra Pradesh.	-	45-55	-
Madras Cements Ltd, Kumarasamy, Raja Nagar District Krishna, Andhra Pradesh.	-	-	9(max)
Maihar Cement,(Unit - 2) P.O. Sarla Nagar, Maihar District Satna, Madhya Pradesh.	-	>45	< 18
Malabar Cements Ltd, Walayar, District Palakkad, Kerala.	-	23.25	-
Manikgarh Cement, Gadchandur, District Chandrapur, Maharashtra.	>25	>30	-
Mancherial Cement Company (P) Ltd, Mancherial, District Adilabad, Andhra Pradesh.	-	32-40	16-22
Orient Cement, Devapur Cement Works, District Adilabad, Andhra Pradesh.	25-35	32-45	-
Panyam Cements & Mineral Industries Ltd, Cement Nagar, District Kurnool, Andhra Pradesh.	-	38-42	10-14
Penna Cement Ind. Ltd, Ganeshpahad, Dist. Nalgonda, Andhra Pradesh.	40	27	10-12
Penna Cement Ind. Ltd, Boyareddypalli District Anantpur Andhra Pradesh.	-	38	-

(Contd.)

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Table - 8 (Concl.d.)

Plant	Al ₂ O ₃	Fe ₂ O ₃	SiO ₂
Penna Cement Ind. Ltd, Vill. Talaricheruvu, Distt. Anantpur, Andhra Pradesh.	42	25	14
Rajashree Cements, Malkhaid Road, District Gulbarga Karnataka.	20	44	19
Rain Commodities Ltd, District Nalgonda,Ramapuram, Andhra Pradesh.	–	35(min.)	–
Sanghi Cement Sanghipuram, Kachchh, Gujarat.	15-20	18-25	25-30
Satna Cement Works, Ghurdang, District Satna, Madhya Pradesh.	26	37	17
Shree Cements, Beawar, District Ajmer, Rajasthan.	–	70-94	–
Shri Durga Cement Company Ltd, Hesla, Ramgarh Cantt; Ramgarh, Jharkhand.	36	34	6
Sri Vishnu Cement Ltd, Dondapadu, District Nalgonda, Andhra Pradesh	36-42	–	18-22
Toshali Cements Pvt. Ltd, District Koraput, Ampavalli, Orissa.	10	8	10
Vasavadatta Cement, Sedam, District Gulbarga, Karnataka.	–	55	< 30
Vikram Cement, Vikram Nagar, Khor, District Neemuch, Madhya Pradesh.	–	58 (min)	12-14
Zuari Cement, Krishna Nagar District Cuddapah, Andhra Pradesh.	16-25	25-39	28-35
Zuari Cement Ltd, Sitapuram, P.O. Dondapadu District Nalgonda. Andhra Pradesh	35-42	–	20-22

Source: Individual plants.

CONSUMPTION

Laterite is used as an additive in cement industry. The estimated industrial end-use consumption of laterite in 2007-08, 2008-09 and 2009-10 was approximately 2.231 million tonnes, 3.012 million tonnes and 3.099 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 of cement has increased due to its increased demand 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.

