



DIRECTORATE OF GEOLOGY

DEPARTMENT OF STEEL AND MINES

GOVERNMENT OF ORISSA

BAUXITE RESOURCES OF ORISSA



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BAUXITE RESOURCES OF ORISSA

Bauxite is the only ore of aluminium. It is the hydrate of alumina and mainly composed of gibbsite, diaspore, bohemite. Gibbsite is dominant among other minerals. Besides, the other minerals in bauxite include goethite, lepidocrocite, haematite, rutile, quartz, clay (kaolinite), hallosite, limonite, residual silicates etc. Bauxite is used for manufacture of aluminium metal which is the second abundant metal in the earth next to SiO₂. It is also used in abrasive and chemical industries. Versatile properties of aluminium has varieties of other uses and its demand is increasing day by day. Bauxite is formed from the decay and weathering of aluminium bearing rocks under humid tropical condition by the process of de-silicification.

The discovery of East Coast Bauxite(ECB) in the state is a major breakthrough to augment the bauxite resources of the state as well as the nation resulting India's rapid development in the global scenario. Following the proving of bauxite reserves in Panchpatmali, National Aluminium Company Limited, a company fully owned by Govt. of India has developed a mechanized opencast mine for an annual production of 2.4 million tonnes. Besides the bauxite deposits explored during ECB Project, there are a number of deposits in the state which were subsequently explored by DG(O), GSI, MECL etc. that together add up substantially to the total resources of the state. A very significant feature of the deposits is their low reactive silica content and consequently easy extractability of alumina by Bayer's process.

Bauxite deposits of Orissa are of diverse parentage. More than 95% of the bauxite resources of the state come under East Coast Bauxite (Eastern Ghats Mobile Belt) located in Southern and Western part of the state i.e. Koraput, Raygada, Kalahandi, Bolangir districts. The other deposits, smaller in dimensions are residual products of lateritisation of metavolcanics as in Dholkatapahar (Kuanr) of Keonjhar district and Similipal Complex belonging to Similipal Group, shales of Banded Iron Formations of Nuamundi Group as in Tantra, Kusumdihi of Sundergarh district and shales of Khariar high land Group of Nuapada district equivalent to Vindhyan Group.

Eastern Ghats Mobile Belt (*East Coast Bauxite*) The major bauxite deposits of Orissa are associated with Eastern Ghats Mobile Belt. Most of the deposits owe their origin to *insitu* weathering of khondalites and associated rocks. Bauxite occur as a very gently undulating blanket, capping the parent rocks on plateau tops in this unique

bauxite province and constitute an integral part of the lateritic profile, at elevations of 900m to 1400m above mean sea level. Steep or vertical scarp faces along the periphery of the laterite bauxite caps, barren to sparse vegetation at the hill tops, fairly dense growth of flora along the slopes of the plateaus characterise the ECB deposits. A typical East Coast Bauxite profile is as follows:

Lithounits	Thickness (in metres)
Bauxite with intercalation of laterite	2- 32
Partially lateritised khondalite/ Charnockite or lithomarge	3-25
Kaolinised khondalite /Charnockite	5-8
Unaltered khondalite/Charnockite	Base



Geographical Distribution of East Coast Bauxite

Koraput District

Deposit	T.S No	Capping Area (in sq.km.)	Average Thickness (in mt.)	Resources (in million tonnes)	Category	UNFC Classification	Grade	Exploring Agency
Panchpatmali	65 N/12 & S/13	17.2	3.25 to 31.4	314	proved	G-1	Al ₂ O ₃ -46%, SiO ₂ -2.32	DG&GSI
Pottangi	65 J/14	4.3	10-40	76	probable	G-2	Al ₂ O ₃ -45.98%, SiO ₂ -2.20	DG & GSI
Maliparbat	65 J/14	1	3	9.8	possible	G-3	Al ₂ O ₃ -43.29%, SiO ₂ -2.84	
Ballada	65 J/11	3.35	5	11.5	possible	G-3	Al ₂ O ₃ - 46.69 to 49.50 %, SiO ₂ -2.48 to 2.67	GSI
Kodingamali	65 M/4	6	10	81	probable	G-3	Al ₂ O ₃ -46.48%, SiO ₂ -2.19	GSI
Hatimali	65 J/13	0.41	4	3.3	possible	G-3	Al ₂ O ₃ -40%, SiO ₂ -5	DG
Kakrimali	65 N/1	0.52	5.5	5.2	possible	G-3		DG
Chintamgundi	65 J/15	0.3	20	12	possible	G-3	Al ₂ O ₃ - 41 to 59.98 %, SiO ₂ -1.73	GSI & DG
Karnapodikonda	65 N/1	1.93	5	17	possible	G-3	Al ₂ O ₃ -46.58%,SiO ₂ -1.73	GSI
Gurji	65J/14	0.5	3	2.4	possible	G-3	Al ₂ O ₃ - 39.45,SiO ₂ -5.34	DG
Medamgundi	65J/14	0.27	6	5.18	possible	G-3	Al ₂ O ₃ 43.13,SiO ₂ -1.88	DG
Barhaparhu	65J/14	0.25	4	1.6	possible	G-3	Al ₂ O ₃ 40.14,SiO ₂ -1.41	DG
Phulabandha	65J/14	0.37	5	2.96	possible	G-3	Al ₂ O ₃ 39.58-47.88, SiO ₂ -3.21-3.68	DG
Sarbati	65J/14	0.1	1	0.16	possible	G-3	Al ₂ O ₃ 40.58,SiO ₂ -4.46	DG
Timajhola	65J/14	0.125	6.1	0.78	possible	G-3	Al ₂ O ₃ 39.08-52.02, ReactiveSiO ₂ -0.22-5.84	DG
Nandapur	65J/14	0.28	7.33	2.873	possible	G-3	-	DG
Khilua	65J/14	0.1	6	0.84	possible	G-3	-	DG
Gerupet	65J/14	0.1	5.5	0.77	possible	G-3	-	DG
Sagur	65J/14	0.07	3	0.294	possible	G-3	-	DG
Sargihatimali	65 M/4&N/1	0.125	2-11	0.25	possible	G-3	Al ₂ O ₃ 35.81-56.67, RSiO ₂ -0.36-14.02,NRSiO ₂ -0.2-20.19	DG
Ramgarh	65J/9	1.47		7.47	possible	G-3	Al ₂ O ₃ - 35.14 to 52.6 %, SiO ₂ -1.83-9%	DG

Raygada District

Deposit	T.S No	Capping Area (in sq.km.)	Average Thickness (in mt.)	Resources (in million tonnes)	Category	UNFC Classification	Grade	Exploring Agency
Baphimali	65 J/14	9.6	11.98	195	probable	G-2	Al ₂ O ₃ -45.21%, SiO ₂ -2.19	GSI
Sasubohumali-Pasangamali	65 M/3	12.74	9.2	81	possible	G-3	Al ₂ O ₃ -43.29%, SiO ₂ -2.84	GSI
Majhigaonmali	65 M/3	2.3	6	19	possible	G-3	Al ₂ O ₃ -37.5%, SiO ₂ -0.9-6%	DG
Indragiri	65 M/3	1.8	2	6	possible	G-3	Al ₂ O ₃ - 38 to 53 %, SiO ₂ -2.96-5.3	DG
Sijimali	65 M/2 M/3	6.34	5	244.8	probable	G-2	Al ₂ O ₃ -43.17%, SiO ₂ -5	GSI
Tikirimali-Budharajamali	65 M/4	0.3	20	6.9	possible	G-3	Al ₂ O ₃ - 34.72 to 52.71 %, SiO ₂ -1.4 to 5.75	DG
Sunderghati	65 M/3		5	1.6	possible	G-3	Al ₂ O ₃ - 40.93 to 46.79 %, SiO ₂ -1.18-2.7	DG
Tajhiri	65 M/3	0.98	6	2.76	possible	G-3	Al ₂ O ₃ – 42.675	DG
Narayangundimal	65 M/3	0.66	6	2.77	possible	G-3	Al ₂ O ₃ – 41.19	DG
Girimali	65M/4		6	0.82	possible	G-3	Al ₂ O ₃ – 38.18	DG
Tikiriguda	65M/4		6	4.07	possible	G-3		DG
Dabuguda	65M/4		6	1.27	possible	G-3		DG
Balimala	65M/4	0.32	6	1.36	possible	G-3	Al ₂ O ₃ – 42.52	DG
Lakhirishi,Manjimali, Kathakhal	65 M/3	6	3-8	20	possible	G-3		DG
Nunapaimali	65M/4	1.64	6	6.89	possible	G-3	Al ₂ O ₃ – 44.758	DG
Nangalaghatimali	65M/3,4	0.78	6	3.3	possible	G-3	Al ₂ O ₃ – 35.03-38.83,SiO ₂ -1.72-9.35	DG

Malkangiri District

Korkonda	65 J/4,8		10-20	9	probable	G-3	Al ₂ O ₃ -40 to55%, SiO ₂ <4%	DG
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Kalahandi District

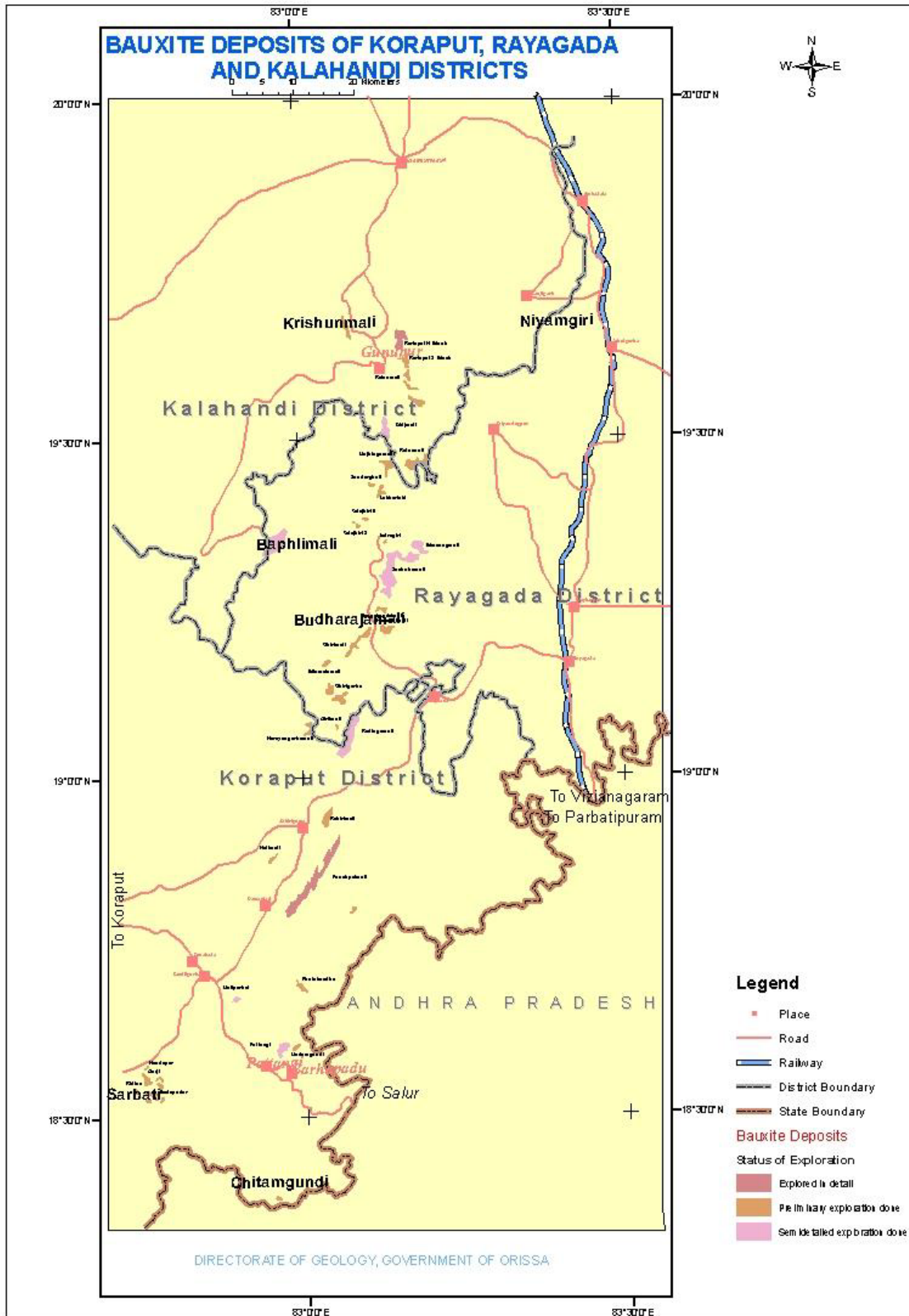
Deposit	T.S No	Capping Area (in sq.km.)	Average Thickness (in mt.)	Resources (in million tonnes)	Category	UNFC Classification	Grade	Exploring Agency
Karlapat-Pollingpadar	65 M/3	9.6	11.98	207(153+54)	proved+ possible	G-2+G-3	Al ₂ O ₃ -45.21%, SiO ₂ -2.19	DG
Kutrumali-Tangridongar	65M/3	4.6	9.2	40	possible	G-3	Al ₂ O ₃ - 41.4 to 58.3 %, SiO ₂ -0.52 to 3.36	GSI
Lanjigarh-Niyangiri	65 M/6	1.6	6	88	probable	G-2	-	GSI & MECL
Krishunmali	65 M/2)	2.36	2	28.30	possible	G-3	Al ₂ O ₃ - 36.44 to 41.915 %, SiO ₂ -1.24-1.84	DG
Keluamali	65 M/2	2.95	5	49	possible	G-3	Al ₂ O ₃ - 35.49 to 47.12 %, SiO ₂ -0.68 to 3.91	DG

Balangir-Bargarh District

Gandhamardan	64L/13		16.75	207	probable	G-2	Al ₂ O ₃ -45.21%, SiO ₂ -2.19	DG
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Kandhamal District

Anamini parbat	65 M/9	9.6	11.98	9.03	possible	G-3	Al ₂ O ₃ - > 40%.	DG
Rukuni cuttack	65 M/9	0.5	4.8	3.2	possible	G-3	Al ₂ O ₃ - 41.4 to 58.3 %, SiO ₂ -0.52 to 3.36	DG
Sindhiguda	64 P/12 & 65 M/9	0.9	10	1.2	possible	G-3	Al ₂ O ₃ -35-40%, SiO ₂ -2.-8%	DG
Demoli	64 P/12 & 65 M/9	3	6	21.5	possible	G-3	Al ₂ O ₃ - 23.05 to 56.06%, SiO ₂ 1-8%.	DG
Ushabali	65M/9	1.81	1-9.4	10.74	possible	G-3	Average Al ₂ O ₃ -40.5,SiO ₂ -5.68	DG



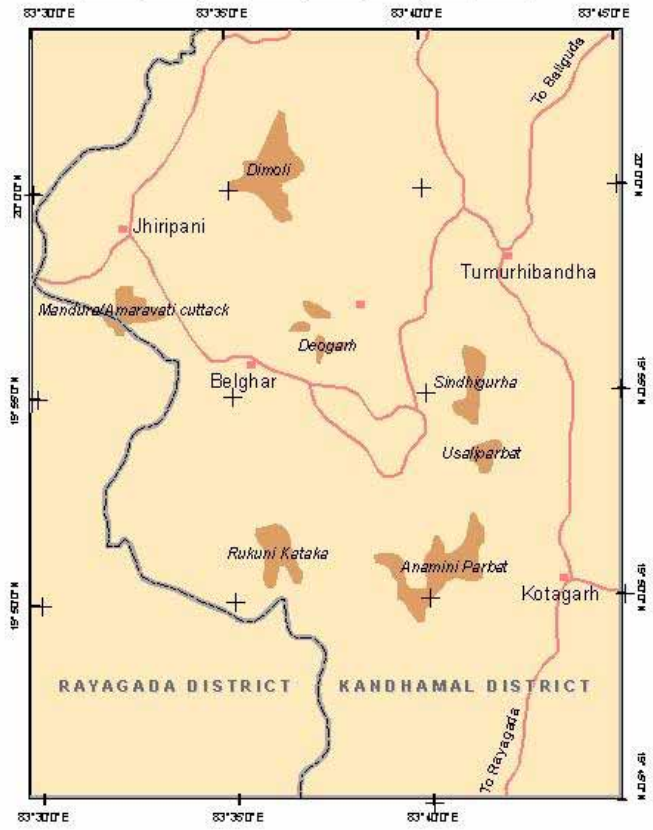
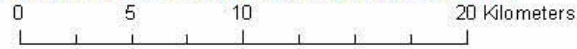


Bauxite Plateau top,
Kodingamali



Bauxite Escarpment at Lakhirishi

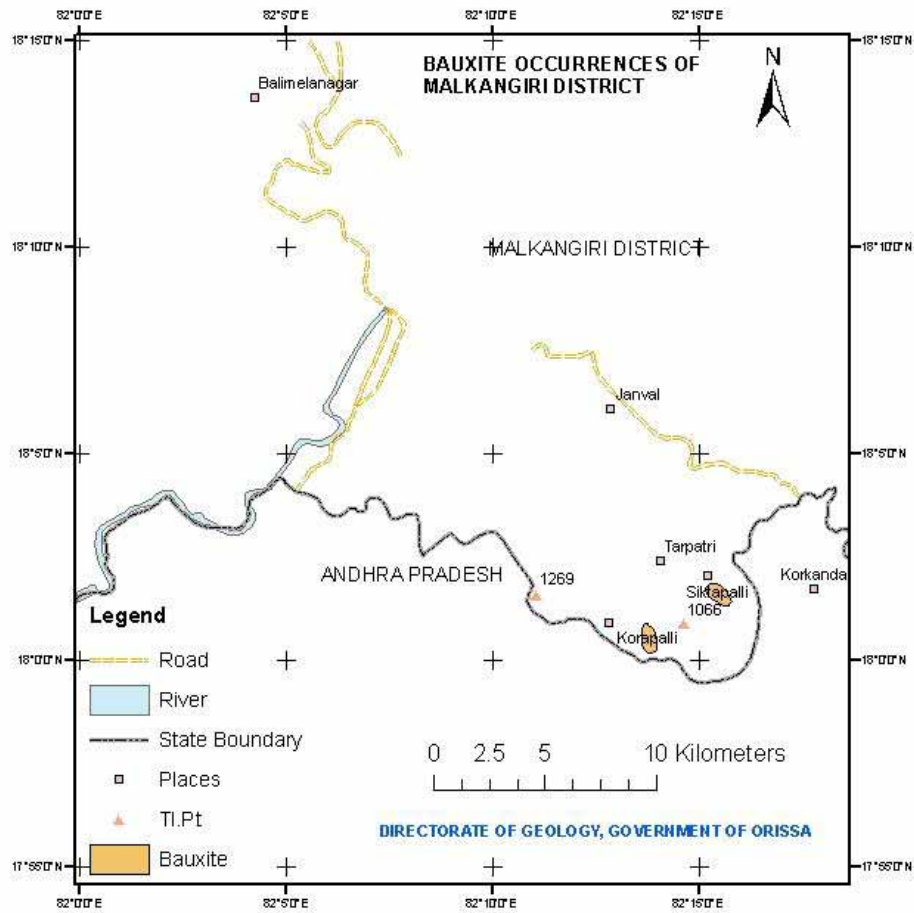
**BAUXITE DEPOSITS AROUND DIMOLI, ANAMINI PARBAT
AND RUKUNI KATAKA IN KANDHAMAL DISTRICT**



DIRECTORATE OF GEOLOGY, GOVERNMENT OF ORISSA

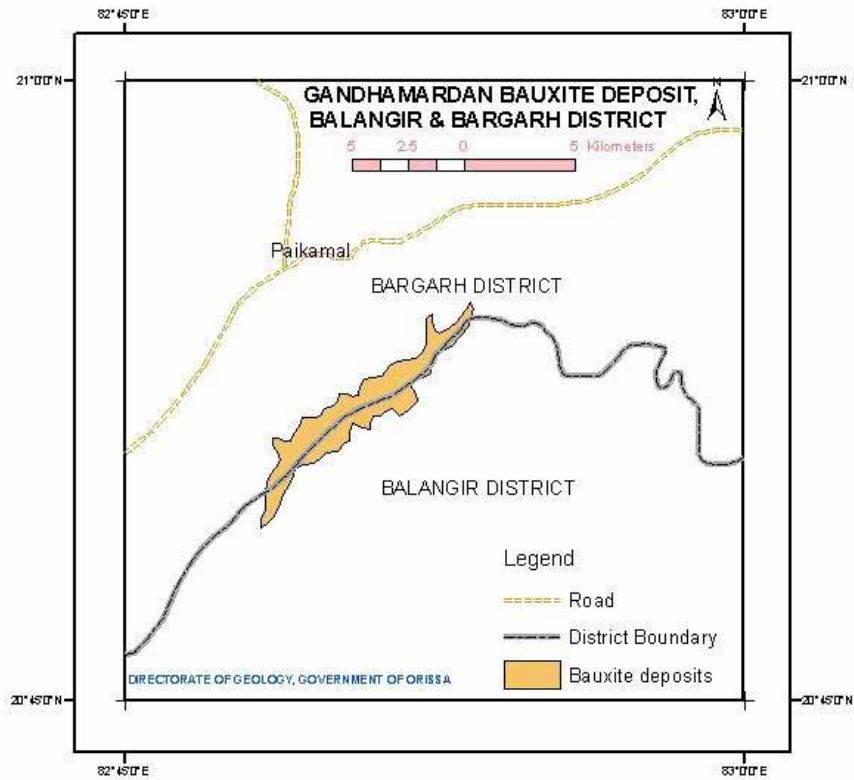
Malkangiri district

Korukonda: (T.S. No.65 J/4, 8): The bauxite bearing plateaus namely Sikatpalli and Korapalli form a part of Korukonda group of plateaux lying along the border of Orissa and Andhra Pradesh in the district of Malkangiri. The thickness of bauxite varies from 10-20 m. A possible resource of 9 million tonnes bauxite with Al_2O_3 40 to 55% and SiO_2 below 4% was estimated.



Bolangir-Bargarh district:

Gandhamardan Bauxite Deposit (T. S. No. 64 L/13): The Directorate of Geology had identified the Gandhamardan deposit occurring on the border of Bargarh and Bolangir district during early sixties. Preliminary investigation continued in the area upto the year 1965. Later during the year 1975-1979 detailed investigation was undertaken in the area and a resources of the order of 207 million tonne of metallurgical grade bauxite with average Al_2O_3 45.75%, SiO_2 2.23% and resumed thickness of bauxite 16.75 m was estimated.



Similipal Group

The Similipal assemblage of rocks are equivalent of Dhanjori Group and lie above the eroded surface of BIF bearing Gorumahisani group and Singbhum granite. These rocks include ultramafics, alternating layers of metavolcanics and sedimentary quartzites, gabbro-anorthosite suite, granite suite intruded by the Amjori sill belonging to Newer dolerites. Both ultramafics and metavolcanics are lateritised giving rise to nickeliferous laterite and aluminous laterite respectively. The bauxite deposits of Dholkatapahar around Kuanr in Keonjhar district lying to the west of main Singbhum granite body are underlain by volcano-sedimentary assemblages similar to those of the Similipal plateau. Residual weathering of metatholeitic basalt has given rise to thick lateritic mantle, within which bauxite is found as segregations and tabular bodies of impersistent lenses and pockets.

Dholkatapahar, Keonjhar District(T.S. No.73 G/6): Investigation for bauxite around Dholkatapahar and its surroundings initiated after discovery of the deposit in 1975 by the Directorate. A probable reserve of 5.09 million tonne of metallurgical grade bauxite was estimated in Dholkatapahar. The bauxite ranges in thickness from 0.2m to 10m, averaging 3m. The content of bauxite ranges from 40 to 58 %, SiO_2 from 2.3-7.9%. Moreover, a possible reserve of 6 million tonne of bauxite has been estimated on Unsir Pahar, Serenda Pahar and Samaraja Pahar.



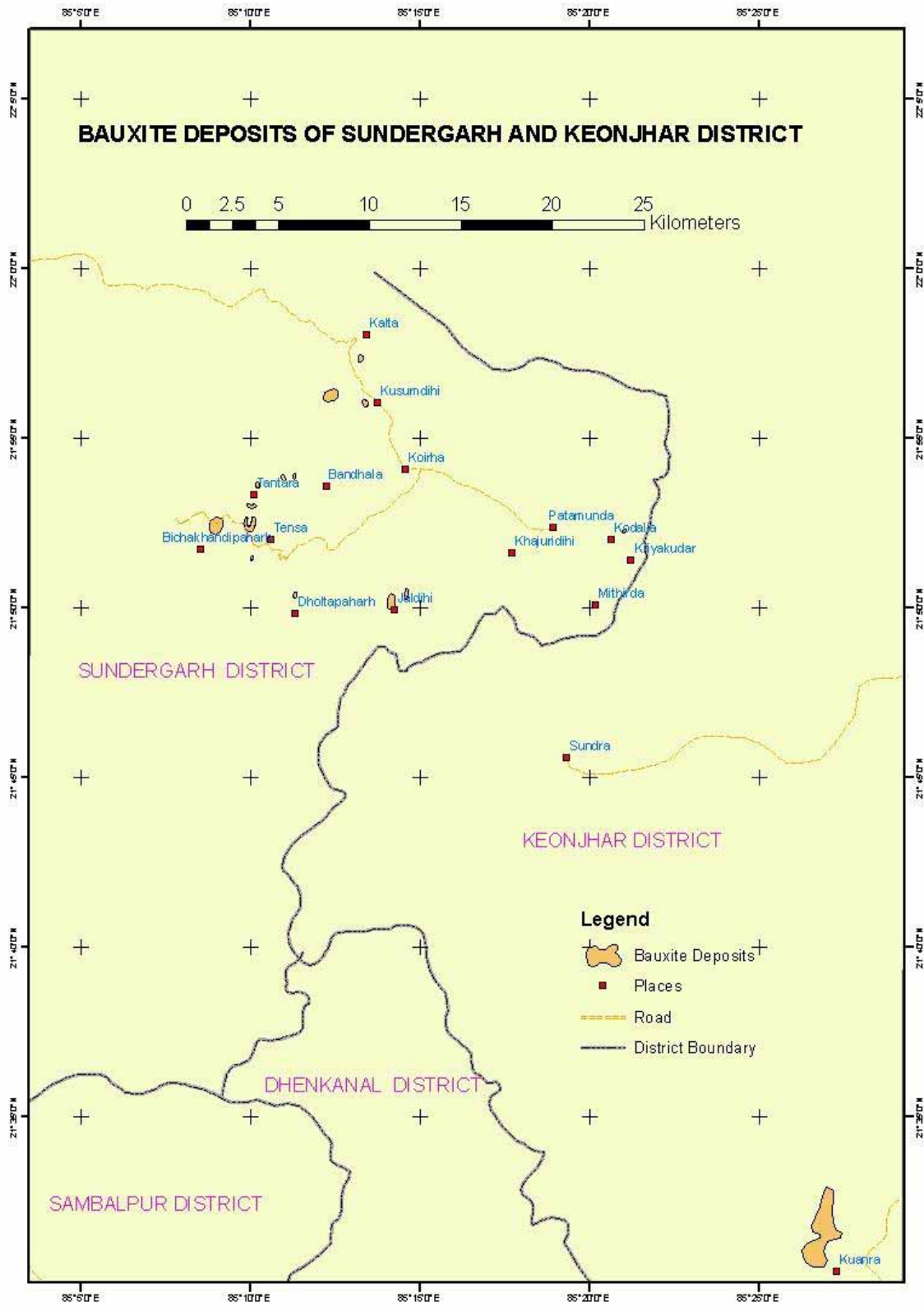
Dholkata Pahar Bauxite exposure

Nuamundi Group

The Nuamundi Group of rocks are constituted of a lower formation of manganiferous shale, shale, phyllite and tuff, middle formation of banded iron silica rocks and upper formation of phyllite, shale and tuff. Iron formations are extensively lateritised. In small exposures around **Kusumdihi, Tantra, Jaldihi Kotalia, etc. of Sundergarh district**, the shales are lateritised which contain bauxites in pockets. Gradation of bauxite-bearing laterite into underlying rocks is not observed here. GSI has brought out high grade plateau bauxite, in form of narrow bands and small patches at an elevation of 800m R.L in Kotalia, Malangtoli and Dunkujori blocks with areal extent 6kmx1km, 1.5kmx1km and 1kmx5km respectively. The plateaus are capped by thick lateritic bauxite crust hosted by upper shale formation of Koira group and belonging to Iron Ore Super Group. Drilling was done in south Kotalia block and Malangtoli block. The thickness of bauxite varies from 0.5m to 10.3m. The bauxite is of yellowish brown to buff in colour with pinkish tint and at places pisolitic in nature. The partial analysis of drill core samples of Kotalia block indicates that Al_2O_3 varies from 40.86% to 48.155, SiO_2 content varies from 1.68% to 10.46%. The tentative resources estimated at the Kotalia block (in part) at 40% Al_2O_3 cut off grade and less than equal to 5% SiO_2 is 1.968 million tonnes.



Jaldihi Bauxite Exposure



Bauxite Deposits of Sundergarh District

Deposit	T.S. No	Area (m x m)	Dimension (m x mx m)	Resource in million tonnes	Category	Grade	Exploring agency
Kodalia	73G/5		60x12x4	1.968	Probable	Al ₂ O ₃ -40.86% to 48.155 SiO ₂ -1.68%to 10.46%.	GSI
Tantra	73G/1	800x500. 600x250, 200x125	-	3.6	Possible	Al ₂ O ₃ -50.7% to 68.7 SiO ₂ -0.1%to 3.92%.	DG
Phuljhari	73G/1	-	200x25x2, 60x30x2	0.064	Possible	Al ₂ O ₃ -67.15% to 67.7 SiO ₂ -1.15%to 1.86%.	DG
Bahamba	73G/1	1000	-	0.0025	Possible	-	DG
Kamando	73G/1			1.15	Possible	Al ₂ O ₃ -+40%	DG
Tensa	73G/1	-	125x60x2	0.019	Possible	Al ₂ O ₃ -69.35% SiO ₂ -4.28%to 4.98%.	DG
Jaldihi	73G/1		460x240x5	0.63	Possible	Al ₂ O ₃ -40.86% to 48.155 SiO ₂ -1.68%to 10.46%.	DG
Kusumdihi	73G/1	-	500x250x15	0.85	Possible	Al ₂ O ₃ -40.86% to 48.155 SiO ₂ -1.68%to 10.46%.	DG



Jaldihi Bauxite Sample



Tantra Bauxite sample

Kharihar Highland Group (Nuapada Basin)

The lithoassemblages of this group comprise of argillaceous, arenaceous and calcareous members. They are exposed between Ampani in south and Nuapada in North. Bauxite occurs as thin blankets and lenses on the argillaceous member Kharihar Highland Group (shale). The bauxite is localised along a narrow E-W trending fault zone and is apparently derived from the topmost (horizon) shale overlying the quartzite by insitu weathering.

Bauxite deposits of Orissa (31.12.2009)

District	Deposits	Reserve (Million Tonnes)				Exploring Agency	
		Proved	Probable	Possible	Total		
Koraput	Panchpatmali	314			314	DG & GSI	
	Pottangi		76		76	GSI	
	Maliparbat		9.8		9.8	GSI	
	Ballada		11.5		11.5	GSI	
	Kodiagamali		81		81	GSI	
	Hatimali			3.3	3.3	DG	
	Kakrimali			5.2	5.2	DG	
	Chintamgundi			12	12	DG	
	Karnapodikonda			17	17	GSI	
	Nangalmarhimali			3.3	3.3	DG	
	Gurji			2.4	2.4	DG	
	Medamgundi			5.18	5.18	DG	
	Barhaparhu			1.6	1.6	DG	
	Phulabandha			2.96	2.96	DG	
	Sarbati			0.16	0.16	DG	
	Timajhola			0.78	0.78	DG	
	Sagrgighatimali			0.25	0.25	DG	
	Nandapur			2.873	2.873	DG	
	Raygada	Khilua			0.84	0.84	DG
		Gerupet			0.77	0.77	DG
Sagur				0.294	0.294	DG	
Ramgarh					7.47	DG	
Manjhingamali				19	19	DG	
Indragiri				6	6	DG	
Baphilimali			195		195	GSI	
Sasubohumali-Pasangamali			81		81	DG	
Sijimali			245		245	GSI	
Tikirmali				3.5	3.5	DG	
Budharajamali				3.4	3.4	DG	
Sunderaghathi				1.6	1.6	DG	
Taljhiri				2.75	2.75	DG	
Narayangudamali				2.77	2.77	DG	
Girmali				0.82	0.82	DG	
Tikiiguda				4.07	4.07	DG	
Dabuguda				1.27	1.27	DG	
Balimala				1.36	1.36	DG	
Kathakhal, Manjimali, Lakhirishi				20	20	DG	
Nunapaimali				6.89	6.89	DG	
Malkangiri	Korkanda			9	9	DG	
Kalahandi	Karlapat-Pollingpadar	153		54	207	DG	
	Kutrumali-Tangridongar			40	40	DG	
	Lanjigarh-Niyangiri		88		88	GSI	
	Krishunmali			28	28	DG	
	Keluamali			49	49	DG	

Bolangir-Bargarh	Gandhamardan		207		207	DG&MECL
Kandhamal	Anaminiparbat			9	9	DG
	Rukunicuttack			3.2	3.2	DG
	Dimoliplateau			21.5	21.5	DG
	Sindhiguda			1.2	1.2	DG
	Ushabali				10.74	
Sundergarh	Tantra, Kusumdihi, Jaldihi, Kamando, Phuljhari			6.3155	6.3155	DG & GSI
	Kotalia		1.97		1.97	
Keonjhar	Dholkatapahar		5	6	11	DG
Total						1846.0325

Total Bauxite resources of Orissa state = 1846.0325 Million Tonnes

The bauxite deposits explored by the Directorate, GSI, MECL etc. together add up substantially to the total resources of the State which amounts to **1846 million tonnes** of all category. From 2003-04 up to 31.3.2009 the **28.8** million tonnes of bauxite ore has been produced from different bauxite mines of Orissa mostly from Panchpatmali mines of NALCO. So the present available resource of bauxite in Orissa stands at **1817.2**million tonnes.

Future Exploration Programme

Bauxite deposits occurring in different parts of the state have been explored by government agencies mostly. According to the status of exploration either in detailed, semi-detailed or preliminary, the resources have been categorized as Proved, Probable or Possible respectively. The transformation of possible and probable category of reserve to proved category can also augment the bauxite resources of the state. The Directorate of Geology, Orissa has identified about 100 small plateaus in Koraput, Kalahandi and Raygada districts which are suspected to be Bauxite bearing. These small plateaus have more than 0.5 sq.km area with total plateau area of around 135 sq.km. The assessment of these small occurrences can augment the Bauxite resources of the state to a great extent.

Production, Bauxite based Industries and Prospects.

Bauxite production in the state is expected to rise significantly in the coming ten years with number of MNCs are signing MOUs with Govt. of Orissa for exploration and exploitation of Bauxite for setting up Alumina plants. There are total 11 bauxite mining leases in Koraput, Raygada, Sundergarh districts producing annually about 4.8 million tonnes bauxite. Panchpatmali is the largest mechanised mines of the state. NALCO a scheduled A Central PSU is the largest integrated alumina and aluminium complex in the country has its Bauxite mines at Panchpatmali, Alumina refinery at the foothills of Panchpatmali hills and alumina smelter and captive power plant at Angul. The present mining capacity of Panchpatmali mines is 4.8 MTPA which is being further augmented to 6.3 MTPA under second phase of expansion. The alumina refinery at Anugul has capacity of 1.575 MTPA, which is being expanded to 2.1 MTPA. The aluminium smelter at Anugul has the capacity of 0.345 MTPA and is in the process of expansion to enhance its capacity 0.46 MTPA. In the year 2008-09 NALCO has produced 4.7 Mt of Bauxite, 1.58 Mt of Alumina and 0.36 Mt of Aluminium.



Conveyor Belt of Nalco plant



Nalco plant at Damanjori



Vedanta plant at Lanjigarh

All the major deposits of bauxite have now been tied up with various industries for production of bauxite as follows:

SI No	Name of the Company	Deposits	Resource In Mt	Status
1	Hindalco	Maliparbat	9.8	Started operation, but temporarily closed
2	OMC-Hindalco (Aditya Aluminium) JV	Kodingamali	81	Not yet started operation
3	Utkal Alumina International Ltd	Baphilimali	195	Do
4	L&T	Sijimali	245	Do
5	L&T	Kutrumali-Tangridongar	40	Do
6	Sterlite-OMC JV	Niyamgiri	88	Do

The companies which have signed MOUs with Government of Orissa for the development in aluminium sector are as follows :

SI	Name of the Company	Location	MoU signed on	Capacity (in MTPA)	Project Cost (Rs. in cr.)
*1	Vedanta Alumina Ltd.(Refinery)	Lanjigarh, Kalahandi	07.06.03	1.00 Alumina	4000.00
	Vedanta Alumina Ltd.(Smelter and CPP)	Jharsugura	04.04.07	0.25 Aluminium 675MW CPP	8400.00
2	Aditya Aluminium	Raygada,	08.04.05	1.00 Alumina	10725.50
		Jharsugura		0.26 Al. Sml.	
3	RSB Metaltech Pvt. Ltd	Raygada (Refinery)	19.12.2008	0.70 Alumina Refinery 0.20 Spl.grade Alumina	6800.00
		Dhenkanal (Smelter & CPP)		0.175 Al. Smelter 450 MW CPP	
Total:					29925.50

Orissa is endowed with huge reserves of metallurgical grade bauxite with low content of reactive silica. With an well co-ordinated planning among explorers, producers, ambitious industrial houses and execution by the visionary state government the production in the state will rise manifold in coming years. The two major deposits Gandhamardan and Karlapat-Pollingpadar and some small deposits in Kandhamal, Koraput and Raygada districts which are not yet tied up with any entrepreneurs can provide resource for setting up of at least two major alumina plants in the state.
