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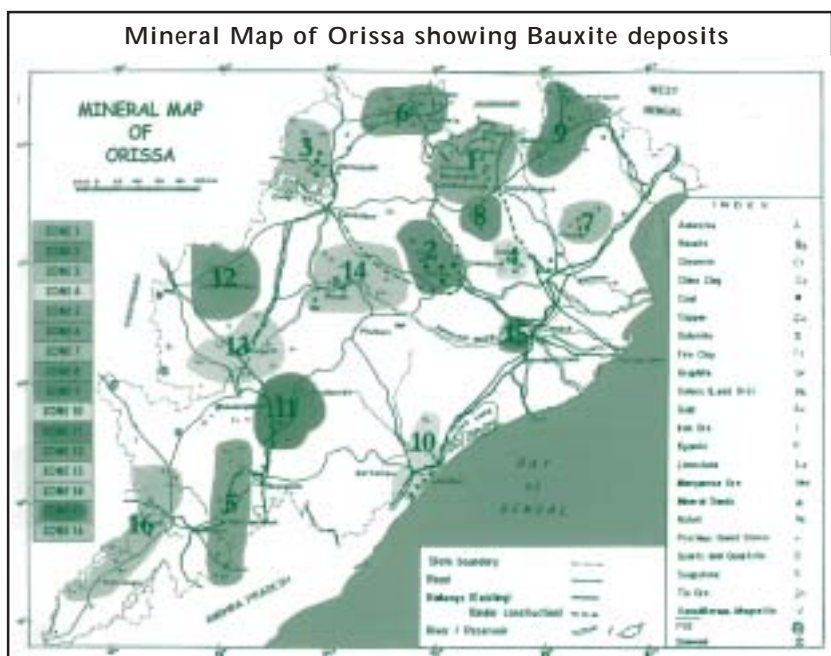
## State of Environment: Bauxite Mining & Alumina

*In the mineral map of India, Orissa occupied an important position both in terms of deposit and production. Orissa is the leading bauxite producing state in India. The main bauxite deposits of Orissa are associated with the Eastern Ghats Super Group of rocks and form the major component of the East Coast Bauxite deposits. Currently having five working mines of bauxite, Orissa is also largest producer of aluminium in India. More bauxite mines are expected to come up along with alumina refinery in Orissa. Thus environmental management will be a matter of concern in future.*

India is rich in mineral resources and has a long history of mining, mineral production, and mineral utilization. India is among the top ten mineral producing nations in the world. The Indian Economy to a great extent depends on the value of the minerals produced, as these represent a major portion of the raw materials for the nation's industrial activities. In the mineral map of India, Orissa occupied an important position both in terms of deposit and production. The mineral deposit of the State is not only vast but also equally diverse. It is one of the largest minerals bearing states in India having 16.92% of the total reserves of the country. Many of the minerals are known to be in abandon supply, while many are least known in this State. Orissa produces enormous minerals including non-metallic, metallic and fuel minerals. Orissa stood one of major producer of chromite, Nickel, Iron, Manganese, Tin, Lead, Graphite, Bauxite and Zinc in India. In terms of geographical distribution of mineral production comes from the state of Orissa.

Bauxite is a heterogeneous ore of Aluminium. It is derived from khondalite and charnockite consists of Gibbsite, Geothite and Kaolinite in varying proportion with some Garnet, Hematite and Ilmenite as accessory minerals. Although Bauxite is the main source of aluminium, it is the second abundant metal element in the Earth's crust after silicon.

In 1808, Sir Humphry Davy (Britain) established the existence of aluminium and named it. In 1821, P. Berthier (France) discovered bauxite, the most common ore of aluminium.



## Occurrences of Bauxite:

Bauxite is the product of weathering of different aluminium rocks and is mined in many countries the world over near 98% bauxite is mined in tropical regions and those with Mediterranean climate. Bauxite is formed though leaching of soluble minerals, so it is not surprising that mines are generally situated in the area of high rainfall (average 1487 mm per year). Bauxite deposits mostly occur associated with laterite capping on the hill plateaus at elevations varying from 700 to 2100m. The major bauxite producing states in India are

List of Mining Leases for Bauxite subsisting in the State				
District	Mineral	Location	Name of the Lessee	Lease area in Ha
Sundergarh	Iron & Bauxite	Sanindupur	M/s Rungta Sons (P) Ltd.	137.100
Sundergarh	-do-	Jaldihi	S. N. Mohanty	333.063
Koraput	Bauxite	Panchapatmali North Block	M/s NALCO Ltd.	3403.183
Koraput	-do-	Panchapatmali South Block	-do-	1243.943
Rayagada	-do-	Baphilimali	M/s Utkal Alumina Int. Ltd.	1388.740
Sundergarh	-do-	Kushumdihi	M/s ORIND Ltd.	102.700
Sundergarh	-do-	Kamando	M/s Rungta Sons (P) Ltd.	43.067
Sundergarh	-do-	Tantra	M/s SAIL	117.440
Sundergarh	-do-	Tantra	P. D. Agrawal	106.138
Sundergarh	Manganese Ore & Bauxite	Kusumdihi	M/s B.I. Co. Ltd.	52.176

*Source: Directorate of Mines*

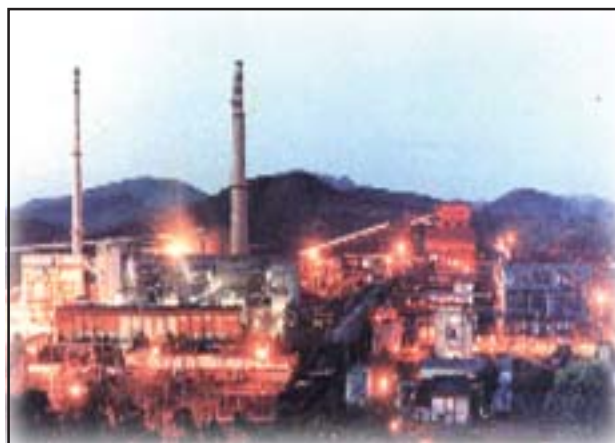
namely Orissa, Andhra Pradesh, Madhya Pradesh, Gujarat, Maharastra and Bihar. Orissa is the leading bauxite producing state amongst all. The main Bauxite deposits of Orissa are associated with the Eastern Ghats Super Group of rocks and form the major component of the East Coast Bauxite deposits. The total reserves of Bauxite in the State are estimated at 1530 million tones at +40% Al<sub>2</sub>O<sub>3</sub> and 5% SiO<sub>2</sub> cut-off. Excepting 20 million tones distributed in Keonjhar, Sundergarh and Phulbani districts, the balance reserve occur as thick blankets below a thin capping of soil and laterite in the districts of Bolangir-Bargarh, Kalahandi, Rayagada and Koraput. Ten number of bauxite leases are in Orissa. Out of them five are working.

During the last financial year 4870604 MT of Bauxite

Production and despatch of Bauxite in the State during last five years (unit-MT)		
Year	Production	Despatch
2001-02	3605703	3602733
2002-03	4932447	4924018
2003-04	4938071	4930663
2004-05	4911739	4914654
2005-06	4870604	4875402

has been exploited and 4875402 MT has been dispatched. The State Government have decided in principle, to lease the bauxite mines to the prospecting entrepreneurs through Orissa Mining Corporation with the condition that they will set up Alumina / Aluminium industries in the State. The total forest area occupied by bauxite mining leases in Orissa is 3792.28 ha.

Aluminium exists in very stable combinations with other materials such as silicates and oxides. The main application areas of aluminium are aviation industry, road transport, building & constructions, rail & sea



Production & Export of Alumina by NALCO during last five years					
Particulars	2001-02	2002-03	2003-04	2004-05	2005-06
<b>Production</b>					
Alumina Hydrate	1114000	1496600	1556100	1575500	1590000
Aluminium	231674	244708	298207	338483	358954
<b>Export</b>					
Alumina	670120	1037287	934874	909081	862616
Aluminium	106282	107302	129718	132730	95747
					<i>Source: NALCO</i>

transport, cooking, packaging and water treatment plants. Bauxite is mined for production of aluminium by Bayer's method.

Orissa is largest producer of aluminium in India. In 2003-04, it produced over 365000 tonnes of India's total aluminium, representing around half of India's total aluminium production.

Orissa's key advantage for aluminium industry is the fact that the State accounts for half of India's bauxite reserves. It's location makes it close to the Chinese and South East Asian markets and the presence of large ports makes it easier to access large export markets. During the financial year 2002-03 Orissa has explored 1515.84 crore rupees of aluminium / alumina to Georgia, Russia, China, Japan, Singapore, Indonesia, Malaysia, Taiwan, Vietnam, U.A.E., Thailand and Bahrain.

Prominent players in the aluminium industry in Orissa are NALCO and HINDALCO having production capacity of 480,000 and 100,000 T/annum of aluminium respectively. NALCO is mining bauxite ore in the Panchpatmali Hills of Koraput district. The mining is being carried out by open cast mechanized method. The production capacity has been expanded from 24,00,000 to 48,00,000 tonnes per annum. This mine has served as feed back to Alumina Refinery. The estimated reserved is 310 million tones. An Alumina Refinery has been set up by NALCO at Damanjodi of Koraput district with 3 production streams each of 5.25 lakh tones per annum. The production capacity has been expanded form 8,00,000 to 15,75,000 tones per annum.

Another Bauxite mines is located in Maliparbat which is to be mined by Hindalco having 268.11 ha of lease area. Besides Alumina Refinery at Damanjodi of NALCO another plant has been set up by Vedanta at Lanjigarh with a projected production capacity of 1 million tones per annum.

#### Annual Production of Primary aluminium by Hindalco

Year	Production in tones
2003-04	60868
2004-05	65620
2005-06	66347



HSS Pot Line at Hiralud Smelter, Hindalco

#### Environmental Problems and its management:

Improper mining operation such as drilling, blasting, loading, hauling, dumping, crushing and conveying results in harmful impacts on environment in shape of noise pollution, air pollution, water pollution, vibration, soil erosion and land degradation. It ultimately causes hearing loss, lung diseases, aesthetic effect and damage to flora and fauna. The general practices to check environmental pollution being implemented in the bauxite mines are:

- i) Water sprinkling on haul roads for dust suppression and provision of water supply points & sprinkling system at stockpile, ROM hopper, crusher house etc.

- ii) Drilling with efficient dust extractors and wet drilling.
- iii) Provision of dust extractors and hoods at transfer points in crushing and conveying system.
- iv) Frequent check of heavy earth moving machineries.
- v) Provision of dust protection equipment to employees like nose masks and ear protective equipment like earplug and earmuff.
- vi) Use of non-electric detonator for reducing the noise and vibration.
- vii) Periodical health check-up of employees.
- viii) Provision of adequate sewage systems to check water pollution from mines drainage, workshop and equipment washing points.
- ix) Provision of settling tank, garland and catch drains.

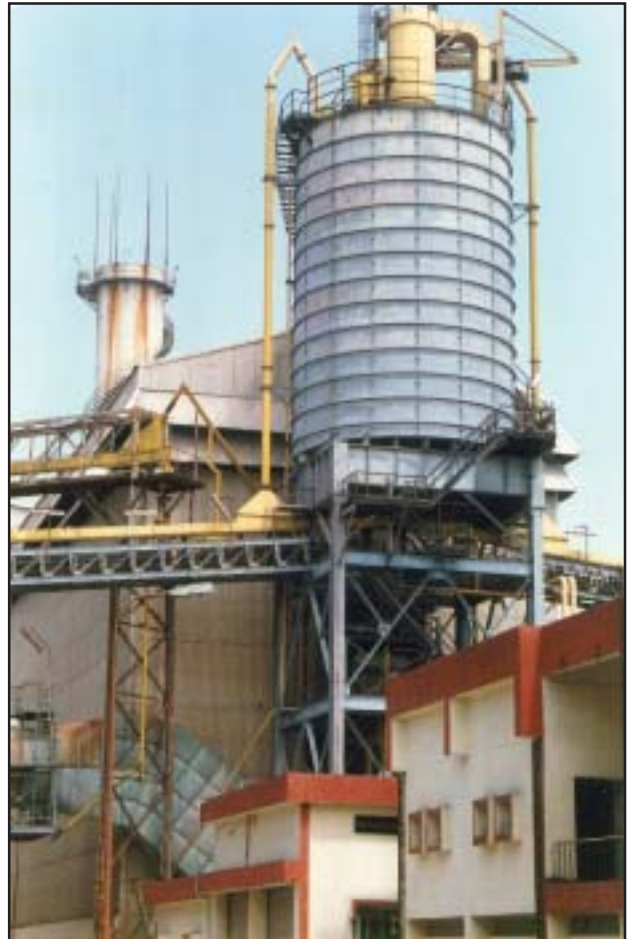


Water Sprinkler at Mine, NALCO

- x) Peripheral barrier with green belt around mining area.
- xi) Backfilling of overburden waste and application of topsoil in land reclamation.

Only large-scale mine operating in Panchapatmali hill, has excellent environmental management system. Air pollution is much below the standard and there is zero discharge (State of Environment Report, Orissa). The bauxite areas devoid of any vegetation after mining, the areas can be developed into well grown

forests. More bauxite mines are coming up in Koraput-Rayagada-Kalahandi Bauxite area. Available bauxite resources in this zone are more than 1 billion tones. Besides, only Bauxite mine at panchpatmali, this area has scope for development of number of large mechanized alumina plants.



Fume- Treatment Plant, NALCO

As per the information collected from State Pollution Control Board the present status of Ambient Air Quality and Water Quality in all bauxite mines & Refinery plants in Orissa is within the norms.

World's primary Aluminium Production consumes mainly Hydropower which is clean, Non-Polluting and Renewable. The Aluminium industry apart from being a major Energy consumer is also a pollution contributor. Fugitive emissions during the drilling,

blasting, sizing, sorting, stacking, loading and transportation of Bauxite from the mining site to the



Bund to Arrest Soil Erosion, NALCO

refinery poses a great problem due to the fact that the major activity is manual and involves minimum or no mechanization. In order to control the fugitive emissions apart from safe mining



Plantation at Refinery Unit, NALCO

practices, pollution suppression measures need to be employed. With the help of Vertical draft flash

Calciners and use of low ash coals in steam generation, emission reductions have been ensured. The major pollution in an integrated Aluminium Industry comes from the smelter with the Cell Houses contributing to the maximum extent. The Cell Houses are the sources of Per Fluoro Carbon (PFC) emissions, which contribute heavily to global warming. They are produced during occurrences of Anode Effect (AE) in pots when the pots are starving for Alumina. All Aluminium industry in the world are involved in reduction of PFC emissions. With the concerted efforts from the industry and the research institutes the PFC emission levels have seen a reduction to <20% of what existed from the industry during the early 1990s and the efforts are on for bringing in further reductions. Sulphur dioxide emissions are generated from the sulphur content at fossil-fueled power stations and other parts of the Aluminium production process like steam generation in Alumina plants, ovens in anode plants and anode consumption in the pots. Use of low sulphur fuel and coke and wet scrubbers can help in removing the particles from

the stack. Carbon dioxide is a feature of all metal processes, which produce metal from ores containing oxides. The gas forms when the carbon in the anode combines with the oxygen in Aluminium oxide

during the smelting process. It is an unavoidable byproduct of the Aluminium smelting process. Over

the last ten years the Aluminium industry has reduced its carbon dioxide output by around 10 percent through better production techniques.

Emission of fluoride from the aluminium smelter is the major air pollution concern. Both NALCO smelter and Hindalco-Hirakud have installed dry scrubbing system where fluoride bearing gases get adsorbed to make aluminium fluoride which is reused in the process. NALCO has provided a defluoridation to treat the fluoride bearing wastewater. Currently the treated wastewater is stored in a pond and used in construction of expansion project. In case of Hindalco, the wastewater is treated and used in the plant. The solid waste from the aluminium smelter plants are also mostly fluoride bearing. NALCO stores them in a concrete lined pit. In case of Hindalco, the spent pot linings are stored under shed to be subsequently disposed off in a lined pit or sold to authorized agency. The possibility of these waste to be used in the boiler along with coal are also being explored.

Alumina is produced from Bauxite using the Bayer process. After digestion, Bauxite residue (also known as red mud), is separated, washed and disposed off. Bauxite residue is highly alkaline in nature and contains oxides and salts of six major oxides of Fe, Al, Ti, Na, Ca, and a variety of minor trace elements. Around 1.50 – 2.50 tons of red mud is generated per ton of alumina produced, depending on the bauxite source and alumina extraction efficiencies. The main environmental risks associated with bauxite residue are related to pH and alkalinity, and minor and trace amounts of heavy metals and radionuclides. The Alumina plant discharges red mud in a slurry of 25-30% solids, and also presents an opportunity to reduce disposal volumes. Today's technology, in the

form of high-efficiency deep thickeners, and large-diameter conventional thickeners, can produce a mud of 50-60% solids concentration.

#### Possible utilization of Red Mud:

- i) The red mud building / constructional materials such as constructional bricks, stabilized blocks, light weight aggregates and low density foamed products.
- ii) In the cement industry as cements and special cements, additive to cements, mortars and concretes construction and repair of roads, pavements and dykes.
- iii) Reinforced red mud polymer products, ceramic / refractory products.
- iv) In the metallurgical industries red mud can be used as raw material in Iron and Steel Industry as sinter aid (binder) for iron ores, flux in steel making etc.



#### What some dailies report

##### 1. Conclave to force Centre act on demands

In an attempt to put pressure on the Centre, which is indifferent to State's demand for timely revision of royalty on major minerals like coal and iron, the Chief Minister of Orissa has convened a conclave of Chief Ministers of mineral-rich Jharkhand and Chattisgarh.

Source: The New Indian Express, 27<sup>th</sup> December 2006

## 2. State bags rural tourism project award

The union Government has conferred on Orissa the 'Best rural tourism project award' for the year 2005-06. The award is in recognition of the Tourism Department's role in transforming Raghurajpur village in Puri district into a tourist hotspot. The State shared the award jointly with Kerala.

Source: The New Indian Express, 29<sup>th</sup> December 2006

## 3. India to catch up with advanced countries

Extraction of minerals through the leaching process, to check pollution, has made the industry more conscious of mineral processing biotechnology. The technology is being exploited by advanced countries. Indian industry would adopt this technology which will not only check environmental pollution but also proper management of waste, produced through the process of extraction. A two day seminar on Mineral Biotechnology has been conducted by Regional Research Laboratory, Bhubaneswar.

Source: The New Indian Express, 30<sup>th</sup> January 2007

## 4. CMC decentralization

In a major step towards decentralization of the system, Cuttack Municipal Corporation (CMC) is working for setting up facilities at the doorsteps of the people. Called Citizen Service Centres, these facilities are expected to become operational from April 2007 which would provide facilities such as dealing with all services, problems, issues and concerns of the people of a particular ward and serve as counters for receiving all kinds of taxes.

Sources: The New Indian Express, 30<sup>th</sup> January 2007

## 5. New Agenda – Mines Act

According to this new agenda, Government is bound to provide mining lease within a stipulated period failing which the Central

Government can take the power to provide license. As per the cabinet note, the lessee can get reconance permit within four months from the date of application. The lessee can avail prospecting license and final mining lease within 10 months and 13 months respectively from the date of lease application.

Source: The Sambad, 3<sup>rd</sup> February 2007

## 6. Bio-fuel holds hope

The first Bio-diesel plant of the State has been inaugurated at Satyanagar in the city of Bhubaneswar. The plant has been jointly developed by OFDC, OUAT and IIT, New Delhi. The plant will require non-edible seeds such as seeds of Jatropha, Polanga, Karanja and linseed as raw materials and it will produce 1000 KL of bio-diesel per batch.

Source: The New Indian Express, 6<sup>th</sup> February 2007

## 7. Revenue from minerals up by 70 pc

Collection of revenue from coal and minerals by January end has registered a growth of 70 percent against the corresponding period of 2005-06. The mineral revenue collection stands at Rs.718 crore against Rs.612 crore in 2005-06.

Source: The New Indian Express, 7<sup>th</sup> February 2007

## 8. Corridor to boost fishing

In order to boost marine fishing activities, a fishing corridor will be developed on the Orissa coast. The Fisheries Department has identified 63 locations as fish landing centers on the 480 Km coastline from Gopalpur to Digha in West Bengal.

Source: The New Indian Express, 7<sup>th</sup> February 2007

**9. The World Environment Day slogan for 2007**

The World Environment Day slogan selected for 2007 is **Melting Ice – a Hot Topic?** In support of International Polar Year, the WED theme selected for 2007 focuses on the effects that climate change is having on polar ecosystems and communities, and the ensuing consequences around the world. The main international celebrations of the World Environment Day 2007 will be held in **Norway**. World Environment Day, commemorated each year on 5th June, is one of the principal vehicles through which the United Nations stimulates worldwide awareness of the environment and enhances political attention and action.

Source: UNEP

**10. Elaborate Census methodology for Similipal Tiger Reserve**

Census is being carried out in Similipal Tiger Reserve by Wildlife Institute of India (WII) through elaborate census methodology devised by the Centre post – Sariska. Temperature sensitive cameras are fitted in specific areas to capture movement of large cats. As per the WII methodology one camera is used to survey four sq. km.

Source: The New Indian Express, 21<sup>st</sup> April 2007

**11. Action plan for utilization of fly ash**

The State Government would be drawing up an action plan shortly for effective utilization of fly ash and Blast Furnace Slag (BFS). All departments would have to utilize fly ash in construction activities. As per a study, about 10 million tones of fly ash and 1.4 million tones of Blast Furnace Slag (BFS) are generated in the state every year which accounts for 10 percent fly ash produced in the country.

Source: The New Indian Express, 16<sup>th</sup> May 2007.

**12. Centre allots coal blocks to Orissa**

The Centre has sanctioned coal linkages and allotted coal blocks to Orissa to support generation of additional power to the tune of 10,200 mw. The Coal Ministry has sanctioned long-term linkages for new capacity of 3000 mw. These include 500 mw plant of Navbharat Power Pvt. Ltd. and Jindal Photo Ltd. In addition, one block has been allotted for Darlipalli thermal plant of NTPC (3,200 mw).

Source: The New Indian Express, 16<sup>th</sup> May 2007

## Feedback

*We would appreciate if you send us comments and suggestions.*

B. K. Patnaik, IFS  
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Sri G.K.Pujari, Programme Officer (CES) and P. M. Dash, Programme Officer (ENVIS) have prepared this newsletter

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