Bauxite deposits of Orissa are of diverse percentage. It is the main source of aluminium which is the second most abundant metal element in the earth crust after silica. The deposits are of lateritic type and owe their origin to in situ chemical weathering of Khondalites and Charnockites, and more specifically Khondalites.

Bauxite is a naturally occurring, heterogeneous ore composed chiefly of aluminous oxide minerals as gibbsite ($\text{Al}_2\text{O}_3\cdot3\text{H}_2\text{O}$), the trihydrate, bohemite, diasporite ($\text{Al}_2\text{O}_3\cdot\text{H}_2\text{O}$) and monohydrates etc. Major impurities in bauxite are iron oxide, silica, aluminium silicates and titanium oxides. Free moisture in crude bauxite as mined, may range from 5 to 30%. Other aluminium resources for future include kaolinitic clays, nepheline syenite, anorthosite and alunite. Bauxites are typically classified according to their intended commercial application: abrasive, cement, chemical, metallurgical, refractory, etc. The bulk of world bauxite production (approximately 85%) is used as feed for the manufacture of alumina via a wet chemical caustic leach method commonly known as the Bayer process. Bauxite is mainly mined for production of alumina by the Bayer's process which has remained practically unchanged since its discovery in 1888.

**Occurrence:**

The important deposits of bauxite are associated with the Eastern Ghat Super group of rocks which form the major component of the East Coast Bauxite deposits. The deposits are of lateritic type and owe their origin to in situ chemical weathering of khondalites and charnockites, and more specifically khondalites, the garnet-sillimanite-graphite gneisses and schists and their variants. The other deposits smaller in dimensions are residual products of lateritisation of metavolcanics as in Dholkata pahar of Keonjhar district and simlipal complex.

The major bauxite deposits of Orissa occur as a very gently undulating blanket, capping the parent rocks on plateau tops in this unique bauxite province and constitute as integral part of lateritic profile, at elevations of 900m to 1400m above MSL. Bauxitisation is more pronounced in the case of Khondalites. A generalized profile of the ECB deposit is as follows:

- Soil
- Laterite
- Aluminium laterite/ bauxite
- Lithomarge/kaolinite
- Unaltered khondalite
The similipal assemblage of rocks are equivalent of Dhanjori group and lie above the eroded surface of BIF bearing Gorumarhisani group and Singhbhum granite. These rocks include ultramafics, alternating layers of metavolcanics and sedimentary quartzites, gabbro-anorthosite suite, granitic suite intruded by the Amjori sill belonging to newer dolerite suite. Both ultramafics and metavolcanics are lateritised giving rise to nickeliferous laterite and aluminous laterite respectively.

The Dholkata bauxite deposit of Keonjhar district, Orissa, has developed on the metavolcanics of tholeiitic basalt composition. The weathered profile reveals five distinct altered zones, such as topsoil, laterite, bauxite, lithomarge and altered metavolcanics. The mineralogy of different zones studied in a representative pit shows the association of major mineral constituents like gibbsite, goethite, hematite, kaolinite, limonite and quartz. Gibbsite is the most dominant one followed by goethite and hematite in the bauxite zone. The geochemical study of all weathering zones indicates the geochemical affinity of the elements Ni, Th and U for laterites and Cr, Zr and Hf for bauxites to occur in high quantities. Trend surface maps predict the bauxite zones in the different levels of the deposit. If the zones having Al$_2$O$_3$ 35-40 % are blended with high grade ores, the deposit may prove to be a potential one.

**Ore Characteristics:**

The bauxite ore is very hard and massive in the top and moderately hard and spongy below. The pale buff to creamy white coloured bauxite is mostly of high grade and is recorded mostly on surface. Bauxite, pale pink in colour and with a clayey appearance, has been found to occur towards the lower part of the bauxite zone. Crystalline, cryptocrystalline and dense gibbsite occur in varying proportions. The porosity and moisture contents are highly variable. Specific gravity ranges from 2.1 and 2.5. Bauxite derived from khondalite retains the continuity of the structural features like foliation and schistosity of the bedrock whereas those from the charnockite are massive with irregular surfaces and relatively dull earthy look. Further, there is a distinct morphological contrast between the two types. The bauxite overlying charnockite are relatively flat whereas those on the khondalite are highly jointed with several sets of intersecting joints often resulting in filling of lateritic materials. Bauxite over khondalites and charnockites exhibit massive of spongy and vermicular textures. Outlines of relict silimanite and garnet are discernible even to the naked eye in bauxite derived from the khondalite gneisses. Bauxite derived from shale show crude sub-horizontal stratification produced by the alternate layering of the ferruginous and aluminous minerals probably due to compaction of the weathered mass. The bauxite zone also contains small lateritic patches and cavities filled with ferruginous materials. Bauxites of different types like massive and disintegrated, spongy, cellular and oolitic are seen over metavolcanics.

Formula,

Typical Available chemical composition,

\[ \text{Al}_2\text{O}_3 + \text{SiO}_2 + \text{TiO}_2 + \text{Fe}_2\text{O}_3 \]

Purities available from 98% (industrial grade) to 99.999% (high purity grade). The suitability of bauxite for alumina production depends upon the mineralogical form, the quantity of reactive silica and extractability by the Bayer's process. The East Coast Bauxite deposits are predominantly gibbsitic and 90-95% of total alumina is extractable at low temperature and pressure thereby entailing lower consumption of caustic soda for digestion. The alumina content vary from 45% to 48% and silica ranges from...
less than 2-3%. The other constituents of East Coast Bauxite deposit of Orissa include 20-25% haematite include goethite, 3-5% kaoline and 2-3% anatase including rutile.¹

**Reserve :**

The total reserves of bauxite in the world are estimated at 23.2 billion tones. The total recoverable Indian reserves as on year 2004-05 are placed at 3076 million tones and total reserves in Orissa are estimated to be 1,530 million tones (source: Directorate of Mines & Directorate of Geology, Bhubaneswar).

Among all the districts of Orissa, Koraput which occupies two mining leases with an area of 4,647.17 Ha of mining area is the major bauxite bearing district in Orissa and produces 98.82 % of the state's total production followed by Rayagada (one mining lease occupying 1,388.7 Ha of mining area) and Sundergarh (Four mining leases occupying 419.4 Ha of mining area). Major Bauxite reserves are concentrated in the East Coast Bauxite deposits of Orissa are shown in Fig.1.

**Mining :**

Out of all the Bauxite mineralization areas in Orissa, Panchapatmali deposit of Koraput district bears the largest single deposit of world. National Aluminium Company (NALCO) a company fully owned by Government of India has developed a mechanized open cast mine for annual production of more than 4.5 million tonnes. The Rs.2400-crore National Aluminium Company Limited (NALCO) was born on January 7, 1981 with technical collaboration agreement with Aluminium Pechiney of France. The multi-unit, multi-locational company, NALCO came up with bauxite mining capacity of 24 lakh tonnes per year, an alumina refinery to produce 8 lakh tonnes of calcinated alumina per year and a 2.3 lakh tonnes per year smelter plant. NALCO holds a mining lease of Panchpatmali deposit covering an area of 7,204.74 hectares. Along with the other mining Companies HINDALCO, INDAL, Larsen and Tourbo, Sterlite Industries etc².

**Industrial uses and Specifications :**

The mineral bauxite constitutes the most important ore of aluminium, which is used widely in the modern industry. Bauxite is used in the manufacture of alum, aluminous sulphates and other chemicals. It is also used in the preparation of artificial abrasives. Bauxite is widely used in the manufacture of refractory bricks, which are utilized as lining materials in furnaces and kilns. By virtue of its containing a number of colloidal constituents, the mineral bauxite finds extensive use in the purification of petroleum. About 1 tonne of Alumina is produced from 3 tonnes of Bauxite and about 1 tonne Aluminium is produced from 2 tonnes of Alumina. More than 90% of the bauxite produced in the world is consumed for production of alumina. Other applications are as refractories and abrasives where bauxite is used in calcinated
form. Minor quantities of bauxite are utilized in production of iron and steel, cement, ceramics, chemicals and ferroalloys.

India was dependent upon imports of Aluminium metal till 1988. With the commissioning of NALCO's plant in 1988 a sea change took place and the country which was a net importer of Aluminium became self-sufficient. Consequently, the Aluminium Control Order which regulated supplies and prices of indigenous Aluminium were withdrawn on 1 March, 1989.

**Conclusion:**

In the mineral map of India, Orissa occupies an important position both in terms of deposit and production. The mineral deposit of the state is not only vast but also equally diverse. With the given natural resource endowment, growing demand for Aluminium and its alloys, economic opportunities and scope for exports, Orissa can produce Alumina at internationally competitive prices. Aluminium has significant industrial and economic importance for Orissa, as this is the one metal for which the state has abundant raw material. Aluminium metal can also be produced competitively with the latest technology coupled with cheaper energy arrangements in Orissa. The greatest scope for value addition and employment lies in the development of down-stream Aluminium end-products like extrusions, rolled products, fabrication and finished items. Orissa can reap more benefit by this value addition given the low energy requirements and labour intensity of down-stream industries.

**References:**


Er. Suryanshu Choudhury is the Technical Support Engineer, Surpac Software India Pvt Ltd, Bhubaneswar

**Shri Debasish Nayak, Minister Information & Public Relations, Sports and Youth Services** inaugurating the 18th Annual Conference of Orissa Working Journalists Union on 28.12.2007. Sri Devi Prasad Mishra, Minister, Excise and Tourism is also present.