

Bauxite Mining In Bagru, Lohardaga.

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ABSTRACT

The metals and minerals we rely on in our everyday life are staggering. Bauxite is one such mineral of great economic importance. Almost all of the aluminum that has been ever produced has been extracted from bauxite. The area under investigation is sustained by Chotanagpur Granite Gneiss associated with intrusions of quartzite, older rocks and Deccan Traps. Under suitable chemical condition and leaching through geological time period, the rocks have been transformed into laterite and bauxite remnants. Reclamation plans in Bagru Pat include many of the following concerns: drainage control, preservation of top soil, segregation of waste material, erosion and sediment control, solid waste disposal, control of fugitive dust, and restoration of waste and mine areas. Thus, mining is an important activity which provides employment to many and even adds to the economy of the country.

KEY WORDS: Open pit mining, laterite of Cretaceous Period, excavation, RNR Process, bauxite.

I. INTRODUCTION

“A mineral is a natural substance of inorganic origin with definite chemical and physical properties”.

Since the beginning of copper age mining has become an important economic activity. This form of economic activity still contributes a sizable amount to the economic development of the countries.

Minerals sometimes occur on the earth's crust but most of the time are buried below the surface. Minerals vary a great deal in their structure, composition use etc.

ABOUT JHARKHAND

Jharkhand is a blessed land with the natural gift of immense mineral potential and other natural resources. Jharkhand state enjoys a strong position on the mineral map of the country. No region in the world is gifted with such a vast mineralization in such a close vicinity as is there in Jharkhand. The

state has potential deposits of energy, ferrous, non-ferrous, fertilizer, industrial, refractory, atomic, strategic, precious and semi-precious groups of minerals. The state stretches over 79,714 square kilometer geographical areas with 29.61% forest area and owns about 40% of total mineral resources of India. The State Occupies 1st position in coal reserves, 2nd position in Iron, 3rd position in Copper ore reserve, 7th position in Bauxite reserve and is the sole producer of prime coking coal. Presently Jharkhand state is annually producing about 160 million tones of various types of minerals worth Rs 15,000 crore and generating mineral revenue to the tune of about Rs 3,500 crore. The state of Jharkhand having geological formation of different geological period and varied landscapes is not only rich in forest resource but is rather more important in terms of minerals. The state is not only notable for minerals in the country but it also gets position on the world map and so it is known as “Storehouse of minerals” of the country accounting for nearly 40% of its mineral production.

Huge reserves of different minerals in the state has close relationship with different geological period . The Dharwarian sedimentation enabled the state to have good reserve of superior quality iron ore in south eastern portion of state .The Gondwana deposits in the rough basin of Damodar Valley facilitated the formation of thick coal seams of bituminous and other types of coal . The formation of Vindhyan deposits in the north –west and south – west margins have provided the occurrence of limestone. Lava cappings during cretaceous period have enriched this state with laterite containing bauxite. Besides these important minerals containing formation of igneous intrusion, eruption, etc. have also played important role in the occurrence of number of minerals.

The minerals of this region can be categorized into three groups:-

- Metallic minerals containing iron ore, copper, bauxite, manganese, chromite, tungsten, gold, silver, etc.

- Non –metallic minerals consisting of mica, dolomite, limestone, asbestos, fireclay, china clay, feldspar, etc.
- Atomic and power generating minerals comprising of uranium, thorium and graphite, vanadium, coal, etc.

ABOUT LOHARDAGA DISTRICT

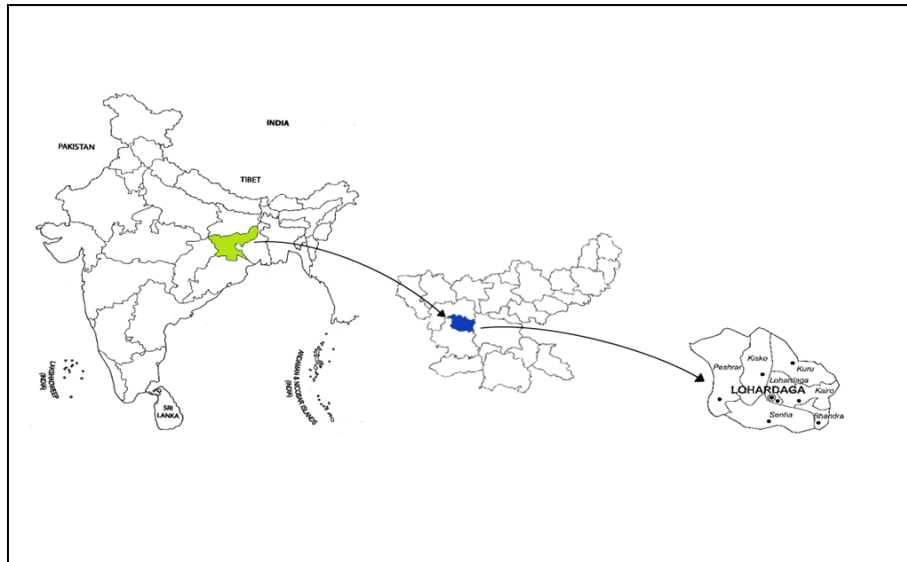


Figure- Lohardaga district on the map of Jharkhand.

Lohardaga is one of the twenty- four districts of the Indian state of Jharkhand. The district of Lohardaga is located in western part of the Ranchi plateau .It is bounded by the district of Palamu in the north, Gumla in the west and south and Ranchi in the east .The district has also clear cut demarcation in the west by Pat region.

Latitudinal extent - $23^{\circ}16'45''N$ to $23^{\circ}40'30''N$.

Longitudinal extent - $84^{\circ}23'50''N$ to $84^{\circ}56'50''E$.

As the district is located in the higher Ranchi plateau it has more undulation .The western part of the district is hilly known as Pat and the eastern part comparatively flat plateau known as Lohardaga plateau .The above two topographical area get separated by the contour of 400 meter. This region has several hills and Tongri Bagru Pat, Rudani Pat, Pakhar Pat, etc.The land slopes from west to east and consists of igneous and metamorphic rocks. Important rivers are the Auranga, the North Koel, the South Koel, etc.

Since the area consists of higher plateaus and considerable forest cover it has suitable climatic

conditions for natural vegetation, human habitation, wild life, etc.

TEMPERATURE AND RAINFALL – Summer temperature remains comfortable and winter remains cold. Average temperature of the area is $23^{\circ}C$. The highest temperature goes up to $36^{\circ}C$ and the lowest temperature comes down to $1^{\circ}C$. The rainfall is about 100 cm in the lower area and 200 cm in the higher areas.

It has dominance of laterite soil .Nearly one fourth area of this region has forest cover where trees of Sal, Mahua, Jamun, Neem etc are mostly found .The region is rich in resources .Nearly $\frac{1}{4}$ of the area is covered with forest and vegetation .Less than half area is under cultivation .The remaining area is under other categories of land use like habitation, pastures, orchards, playground, cultural waste, etc .Paddy, Ragi and Maize are the important crops in the district .



Figure: An Overview from Bagru Hills

BAUXITE IN JHARKHAND



Figure: Bauxite Mining in Bagru, Lohardaga.

Bauxite is found in association with laterites. The Pat region having thick deposits of laterites is a store of this minerals. Geological formation of this region is complex. Forming parts of ancient landmass it is supposed to have rock formation of early geological period like gneiss, schist in the basement. Apart from the pat region the adjoining higher plateaus of Lohardaga and Gumla also have extensive laterite cover because of the presence of lava cappings. Laterites of this region have bauxite minerals containing 51% -55% alumina. Important mines are Serendag, Bagru, Dudha, Katcha, Khamar, Banjar, etc. Besides there are bauxite mines at Pakhar, Pakri, Oranga, Banda etc. The Rajmahal hills have also bauxite. The state has estimated reserve of 63.5 million tones, out of which known reserve is 21.4 million tones. Annual production is about 7.7lakh tones. This mineral is important for aluminum industries at Muri, Asansol, Hirakud, Alwe, Rihand.

BAUXITE MINING IN BAGRU PAHAR

ORIGIN – Bagru Pat originated during the tertiary period when Himalayan Organic Movements were taking active consequently the western part of Jharkhand was uplifted upto 900-1000 mts due to faulting and due to volcanic eruption the western

part is covered with consolidated volcanic lava, which due to intense conditions and pressure the surface lava has changed into laterites.

Location – Bagru Pahar is located 16 km away from Lohardaga. It is also termed as Ghera Pahar in local terms as it stretches in western part of Lohardaga transportation of bauxite by ropeway is the landmark of this not only Jharkhand but also in India. The height of Bagru Pat above mean sea level is 1035-1100 meters. Bauxite is mainly entreated by open pit mining and mining operations are carried out by HINDALCO. The lease hold area of HINDALCO measures 214.57 ha. area on the plateau top with elevations ranging between 1035-1100 MSL.



Figure: Bagru Hills from a distance.

PROCESS OF BAUXITE MINING – Basically bauxite in mining Lohardaga can be done by 4 major mining operations:-

1. Drilling.
2. Blasting.
3. Excavation.
4. Crusher.

1. **Drilling** – First method for bauxite mining is drilling A 115mm hole is drilled for the sampling of bauxite. All the process is done in a highly mechanized form. A special German machine i.e. cello machine is used for drilling.



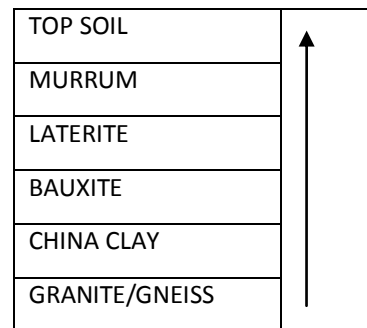
Figure: Drilling for sampling of Bauxite.

2. **Blasting** – After drilling the second process is blasting. Nearly 50-100 holes are made and connected with elective wires for the blasting of bauxite. Ammonium Nitrate mixed with Kerosene oil acts as explosives for the blasting.

3. **Excavation** – There are different layers of soil found in the lithosphere. In their orderly form is firstly the Top soil, Murrum, Laterite, Bauxite and lastly China Clay.



Figure: Excavation done by heavy machineries.



So in this process firstly the top soil is removed or excavated then murrum then laterite & bauxite are blasted to be excavated.

4. **Crusher** – Finally, the bauxite boulders are transported to the crusher where these bauxite

boulders are crushed into nearly smaller parts nearly 6-12 inches There are 2 types of crusher:-

- i. Crusher large – which works with 120 TPH i.e. tones per hour.
- ii. Crusher Small – Which worker with 60 TPH (Tonnes per hour).



Figure: Crusher Large



Figure: Crusher Small

After this process it moves into the bunker from where the trolley is filled up with bauxite and transported to the loading point near Lohardaga station.



Figure: Ropeway carrying Bauxite to Lohardaga Station.

The total area of bauxite mining is nearly 134 hectares out of which 74 hectares are engaged in mining. The annual production of bauxite in this region is 4 lakh tones. Only 1 lakh tones could be extracted. The bauxite from this region is transported to Muri plant where alumina is extracted from bauxite.

PUBLIC WELFARE PROGRAMME DONE BY (HINDALCO INDUSTRIES LIMITED):-

Hindalco Industries which is located on the Bagru Hill mines runs various public welfare programmes and social activities. It is run by Aditya Birla Centre for Community Initiative and Rural Development programmes. It mainly deals on following points :-

- I. Employment generating programmes.
- II. Providing free Medical facility.
- III. Providing free Ration & Electricity.
- IV. Free Transport facility.



Figure: Hindalco Industries operating Mining Operations.

I. Employment generating facility- Hindalco provides employment facilities for nearly 50-60% of people of nearby areas.

II. Providing free Medical facility – A small dispensary is setup which provides free medical facilities for the people nearby. It also provides free medical checkup weekly and monthly to the workers.

III. Providing free Ration & Electricity – It also provides free monthly Ration to the employees. It also provides settlement and free electricity.

IV. Free transport facility – It has also provided free bus services for the villagers and employees.

USES OF BAUXITE –

Bauxite cannot be used directly. Bauxite after smelting by Hall- Herault Process is converted into alumina. Alumina can be used and converted into casts or sheets. Bauxite is a prime important raw material for the primary aluminium industry.

The uses of aluminium in various fields are:

1. **Conductor**- Apart from gold, silver and copper, no other metal has such conductivity like aluminium. It is lighter and cheaper than copper, so more economical. It is none being used more and more in electrical industries.
2. **Construction Material**- Aluminium is cheap, light, weight, yet touch. So it is more used as construction material.
 - a. **Transport Sector** – In this sector, due to its light weight, bodies of ships, aircraft, automobiles, steamers, rail wagons are now built with aluminium.
 - b. **Building Construction** – As aluminium is very cheap & non corrosive, it is now used in roof, door and window frame making, replacing costly wooden material.
 - c. **Household Material** – The different household materials, particularly utensils like beetles and pans, are built with aluminium, replacing iron.
3. **As Alloy** – Aluminium is widely used as alloy. Combined with manganese and magnesium, it produces duralumin. Cooper and silicon is also used as alloy metal. These alloy metals are very popular in specialized uses in electrical industry & constructional purpose.
4. **Paint Industry** – Aluminium is used in paint industry as raw materials. Aluminium paints is used as anti-corrosive protection for iron structure like bridges.



Figure: Plantation on areas which are already mined.

3. **Development of local communities** - Mining operations support the maintenance and development of local communities through

5. **Packaging Industry** – Very thin aluminium foils are used as food, wrappers and packaging of delicate foods. Foils protect from dust and contamination.

6. **Industrial Raw Material** – It is used in cement, chemical and various other industries as raw material.

MERITS OF MINING:-

1. **Provides Employment**- Bauxite mining operations are actively engaged with local communities and working to ensure that the benefits of mining are shared locally, regionally and globally with present and future generation. It is also important generation. It is also important to note that most of the mine workforce is recruited locally (66%) and a further 20% at the national level.
2. **RNR Process (Rehabilitation and Reclamation)** - Rehabilitation aims at returning the original ecosystem as close as possible, in terms of structure, function & dynamics. The soil rich in organic matter is stored and used for the reforestation afterwards. Mine rehabilitation process leads to a steady state environment in which newly mined areas are balanced by rehabilitation of existing mines area. Reclamation plans include many of the following concerns: drainage control, preservation of top soil, segregation of waste material, erosion and sediment control, solid waste disposal, control of fugitive dust, regrading, and restoration of waste and mine areas. The plan must also consider the effects of mine subsidence, vibration (induced by mining, processing, transport, or subsidence), and impact on surface water and groundwater. These environmental items often dictate the economics of a planned mining operation and determine its viability.



Figure: Rehabilitated land turned into Fruit orchard.

employment infrastructure, training & social programme and compensatory packages.

4. **Social and Economic benefits** – Provision of education and training programme. Mining area also

operations also provide health and sanitation programmes. Various community development programmes like provision of safe water supply and managed waterways systems, cultural development and arts.

PROBLEMS OF MINING:-

1. **Deforestation** - Deforestation is clearing Earth's forest on a massive scale, often resulting in damage to the quality of land. The most dramatic impact is a loss of habitat for millions of species.
2. **Loss of wildlife & flora and fauna** - Due to deforestation there is loss of wildlife and flora and fauna because if their natural habitat is cleared they will become extinct.
3. **Infertility of Soil** - Forest soil is moist, but without protection from sun blocking trees, cover they quickly dry out. Deforestation also drives climatic changes trees also help to perpetuate the water cycle by returning water vapor back into the atmosphere. Without trees to fill these roles, many former forest lands can quickly become barren lands.
4. **Lack of highly mechanized equipment and infrastructure** - In spite of much reserves of bauxite there are not highly mechanized equipment some of the trolley are in rusted position and there's fear of breakdown. Also there is lack of good network of roadways for transportation of bauxite.
5. **Lack of awareness of people** - Since the area near Bagru Hills, is not highly urbanized, so still people are not aware of their rights and duties. This is also because of lack of education as the area is mainly inhabited by rural people.
6. **Naxalism** - Naxalism is also one of the problems which have affected bauxite mining.

SOLUTIONS:

- 1) **Sustainable development** - A sustainable mining operation maintains the natural capital of the area in which it operates via a sound environmental management system in order to reduce the environmental impact of the mining activities. Successful rehabilitation and environmental management ensures that bauxite mining is a temporary land-use that does not compromise other land uses in the long-term.
- 2) **Mining software** - (ROCSIENCE SOFTWARE) *Phase*² 8.0 is a powerful 2D elastoplastic finite element stress analysis program for underground or surface excavations in rock or soil. It can be used for a wide range of engineering projects and includes support design, finite element slope stability, groundwater seepage and probabilistic analysis.

3) **Soil management** - Sustainable mining operations protect and restore the biodiversity of the areas they affect. Restoring pre-mining biodiversity requires areas to be protected from erosion and for the original topsoil to be managed to retain its value as a seed source and growing medium. Therefore operations separate the topsoil from the remaining overburden and retain it for use in rehabilitation.

4) **Excellent network of roadways and railways** - Excellent network of roadways and railways should be made so that access of easy transportation could be made, which will again foster in bringing economic changes in country's economy.

5) **Acts and regulations of government** - According to the FOURTH SUSTAINABLE BAUXITE MINING REPORT 2008 there are different legislation regarding environmental protection, protection of biodiversity, social and local context, etc. Following are some of the provisions given by this report :

- Noise mitigation measures by monitoring and modeling noise levels, provision of buffer zones, timing of operations, and modification of equipment, change of mining and blasting methods.
- Control of dust levels by watering, road maintenance and speed limits.
- Limited blasting times to reduce frequency.
- Provision of education and training programmes.
- Development of local industries and businesses.

The rehabilitation objectives can be summarized as follows:

"The bauxite mining operations aim to restore premising environment and the respective conditions; this can be a self-sustaining ecosystem consisting of native flora and fauna or any other land-use to the benefit of the local community".

6) **Protection of Biodiversity**

Other measures that are taken by companies to protect areas of native flora & fauna include:

- Pre and post mining flora and fauna surveys.
- Use of native plant species for rehabilitation.
- Operation of plant nurseries to propagate and grow Native plant species.
- Relocation of plants growing in cleared areas.
- Compensation measures: establishment of flora reserves on other company-owned land.
- Leaving strips or islands of native vegetation within mining areas.
- Provision of financial and other aid to groups with an interest in conservation.
- Minimizing unnecessary clearance.

- Measures to retain wildlife habitat as wildlife reserves and wildlife corridors.
- Reconstructing fauna habitats using rocks and logs taken from areas being cleared for mining.
- Providing fauna nesting boxes in rehabilitated areas.
- Fauna recolonisation (birds, invertebrates).
- Wildlife monitoring programmes (vertebrates, invertebrates).

V. CONCLUSION

“A mine cannot be imagined without land .Yes ...land is the asset that makes us think to begin the journey of mines.”

So, we can now conclude that land resources and mineral resources are linked together .So it becomes very important to study about the problems and solution of both these resources. Sustainable development is an important point which should be kept in mind so that there is no excessive exploitation of minerals and be kept for future use.

In running an open –cast mining some greeneries have been sacrificed, however numerous efforts have been implemented to maintain the ecological balance with plantation of trees with barren land, growing green vegetation and here, also the local villagers were involved. So, during mining 2 points must be focused that there is no over-use or excessive exploitation of resources and secondly there is no excessive loss to our biodiversity and the ecological balance should be maintained.

So, on a concluding note it can be said that mining is an important activity which provides employment to many and even adds to the economy of the country.

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