

Bauxite Mining in the Boké Region (Western Guinea): Method Used and Impacts on Physical Environment

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ABSTRACT

This study assesses the environmental impact of bauxite mining and the attempts at managing those impacts around the three different bauxite mining communities “zones” (Sangarédi, Boké, Fria) in the western Guinea. Mining sector is important to the country’s economy; it represents 75 to 85% of resources exports by year, especially bauxite and figures prominently in the government's development priorities, evidenced by the broad movement of reforms undertaken by the authorities since 2010. In this context, these reforms aim both to minimize the risks while maximizing the benefits of the mining activity. This implies among other things, a better distribution of income from the mine, strict compliance with environmental standards, to record activity in a sustainable development perspective. To better understand these reforms and scope, this research evaluates the existing framework and innovations of the new reforms in the context of sustainable development. The researcher conducted a data collection, a series of interviews with resource persons (The local communities, the Ministry of Mines, mining companies and NGOs working in the mining sector), to analyze the Environmental and Socio-economic impact of mine. The results showed that the mining code of 1995 was both inadequate and very rarely applied in the field. In contrast, the 2011 code contains advanced Transparency important for equitable sharing of benefits and stringent measures for environmental protection. Thus, this 2011 mining code is more attractive and oriented towards sustainable development.

Keywords: bauxite, mining, blasting, impact, environment, management

INTRODUCTION

The West African basement complex contains large bauxite reserve. Guinea is the first bauxite exporter in Africa and second in the world after Australia (US Geological Survey, 2015).

The classification of Guinea on the chessboard of bauxite producers does not seem threatened in the short term because with CBG (Guinean Bauxite Company), extension mine project, Simandou mine project and Dian-Dian project, the country hopes to become the largest bauxite producer in the world in 2020 (Ministry of Mine and Geology of Guinea, 2016).

The joint venture bauxite mining companies and alumina operations in Northwest Guinea, historically provides about 80% of Guinea's foreign exchange. Bauxite is refined into alumina, which is later smelted into aluminum. The CBG (Guinea’s bauxite company), which exports about 14 million tons of high-grade bauxite annually, is the main player in the bauxite industry. CBG is a joint venture, 49% owned by the Guinean Government and 51% by an international consortium known as Halco Mining Inc., itself a joint venture controlled by aluminum producer Alcoa (AA), global miner Rio Tinto and Dadco Investments. The past few years have been characterized by an

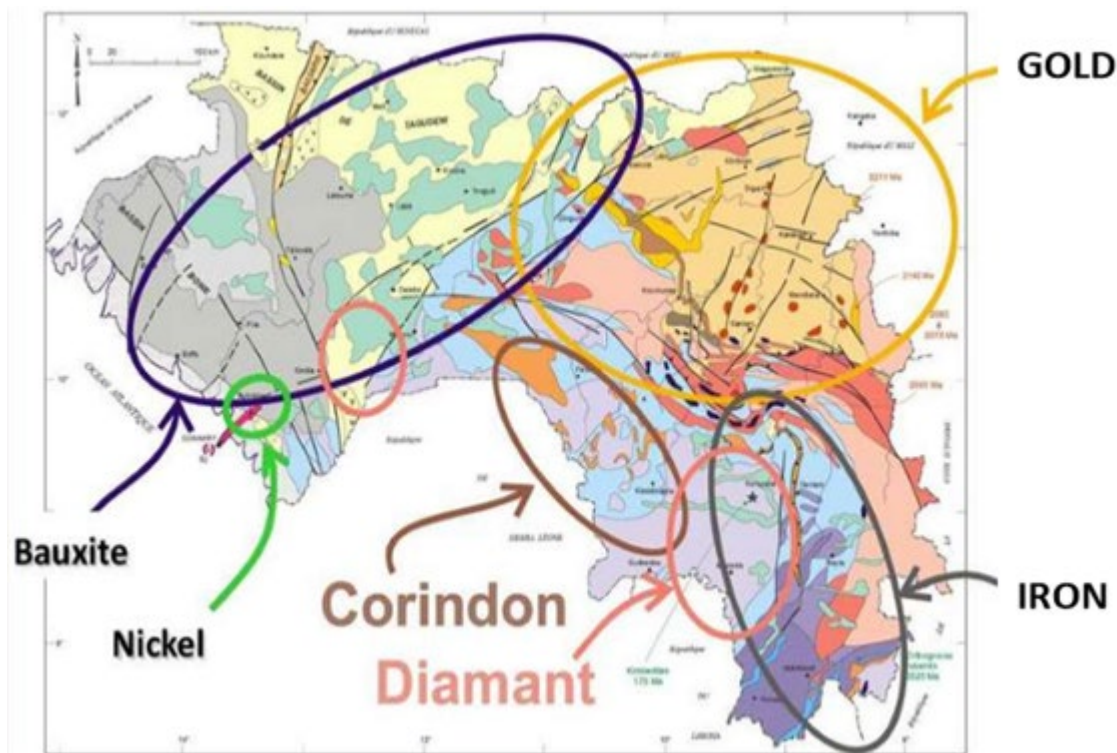


Figure 1. Guinea's principles minerals and their location map

ongoing programme to modernize and re-structure the aluminum industry to make it efficient and profitable, and to increase production. Three companies, CBG (Guinean bauxite Company), SMB (Boké mining Company) and RUSAL (United Company of Rusal) operate several opencast mines across the western part of the country, 'In the Boké region'.

Production in 2013 totaled 16 Million tons compared to 15.7 Million tons in 2009 (Ministry of Mine and Geology of Guinea, 2016).

Among the issues emanating consequences of the mining boom in Guinea, are; the matter of hyper-polluting extraction techniques associated with open cast, surface mining blasting mine, processing sludge mud, untreated waste water and tailing storage. Improper disposal of bauxite residues, toxic wastes that spill directly into the rivers, and the proliferation of open pits are the source of environmental degradation, with all the dangers that these represent for resident community. In addition, mining companies still used methods that have been bound like 'blasting' used by SMB (Boke mining company) in Katougouma mine, 'deep drilling mine' used by CBG (Guinea's bauxite company); which is seriously affecting Sangarédi rivers and water table. Those techniques have huge direct and indirect impacts environment, some are very common and visible on the ground like land cover change, rivers water pollution, water table diminution...

THE PRINCIPLES MINERALS LOCATION MAP OF GUINEA

Guinea, officially the Republic of Guinea, is also called "Guinea-Conakry" the name of its capital to differentiate from Guinea-Bissau and Equatorial Guinea, is a West African country. It became independent from France on 2 October 1958. Based on geology, geomorphology and ecology, Guinea has many natural resources. That abundance of natural resources across country made it appellation of "geological scandal". Guinea is the world's leading country in its proven reserves of bauxite and the second behind Australia, in terms of bauxite production. Its very rich deposits of bauxite in Boké region, precisely at Sangarédi, its gold deposits in (Upper Guinea) precisely in Siguiri, iron, diamonds, uranium in the forest region (N'zérékoré) and also the unexploited iron reserve of Simandou, in the South-east. The agreements were signed by the Guinean government and Rio tinto company in 2014 but the project was abandoned in 2016. In 2017, news negotiations were undertaken between Guinea government and Chinese company "Chinalco".

Table 1. Contribution of the mining sector in the gross domestic product (GDP) of Guinea 2010-2014

| | 2010 | 2011 | 2012 | 2013 | 2014 |
|---------------------------------|----------|----------|----------|----------|----------|
| 1-GROWTH | | | | | |
| GDP (in %) | 1.9 | 3.9 | 3.9 | 2.3 | 1.3 |
| GDP per capita (in %) | -1.2 | 0.6 | 0.7 | -0.9 | -1.8 |
| GDP per capita (in USD) | 382.5 | 406.9 | 508.7 | 508.7 | 502.4 |
| GDP per capita (in USD) | 412.9 | 450.7 | 538.3 | 538.3 | 530.6 |
| 2-CONSTANT PRICES TO GDP | | | | | |
| Total (in billions FNG) | 8022.47 | 8333.32 | 8658.80 | 8856.91 | 8975.09 |
| Mining sector (in billions FNG) | 1166.05 | 1216.03 | 1191.08 | 1110.12 | 1153.81 |
| Mining sector (in %) | 14.5 | 14.6 | 13.8 | 12.5 | 12.9 |
| 3-CURRENT PRICES GDP | | | | | |
| Total (in billions FNG) | 27081.62 | 34320.47 | 40082.58 | 44783.05 | 46180.92 |
| Mining sector (in billions FNG) | 6322.87 | 7761.23 | 7476.23 | 7248.27 | 6876.17 |
| Mining sector (in %) | 23.3 | 22.6 | 18.7 | 16.2 | 14.6 |

Source: MP/DNP, Cadrage novembre 2014

Adapted by the Author, 2016

THE IMPORTANCE OF BAUXITE MINING IN GUINEA ECONOMIC SECTOR

The Guinean economy relies on mining (26% of GDP, including the alumina bauxite processing) and agriculture (20%), Mining is the foremost providing 85% of export revenues (ITIE, 2016) and the second at national level. The share of exports in GDP has increased from 34% in 2005 to 41% in 2009, reflecting strong global demand for bauxite, diamonds and gold, and the weakness of the rest of the Guinean economy. In 2011, significant foreign direct investments were envisaged in the alumina and iron production, and two harbor extensions (FDI, 2015). These investments were in the amount comparable to the country's annual GDP. It is therefore essential to implement macroeconomic policies, including trade, tailored to avoid high inflationary trends that these investments could cost. Contribution of mining in Guinean gross domestic production over the period of 2010-2014 (FNG, billions) (Ministry of Finance, 2016).

The Major Environmental Impacts of Bauxite Mining in (Sangarédi, Noké, Fria) Mine Zones

Environmental impacts of both water pollution and land degradation due to bauxite mining were pronounced in the communities where respondents' views were sampled, these impacts are discussed in the below section.

Bauxite mining does not require tunnels as digging gold mining or other mineral ores. However, it still requires heavy digging equipment and generates tremendous dust that pollutes the surrounding areas air. Diagram of bauxite mining and its impact on the study area environment is presented in this section, and also images shows the impacts of bauxite mining on air, stream water, and environment taken during the field work are however presented in the same body of stream pollution in the Sangarédi's mining zone.

Stream Pollution in Sangarédi's Mining Zone

In Sangarédi bauxite mining zone, the first major environmental problems affecting communities of Sossou, peulhs, maliké living around the mine zone in general, dust, blasting mine and particularly for the farmers, is water pollution, this includes, upstream and downstream water pollution, surface and table water quality degradation, stream water depletion due to mining activities. Almost 84% of the respondents identified water pollution as the major environmental and social impacts of mining. Farmers and others respondents claimed that water for drinking, cooking, laundry, agriculture and other irrigation needs, livestock survival have been affected by mining activities. The second largest percentage, 76% of respondents in the same zone indicated that their water bodies have been polluted by mining in the area. Drinkable water and water for laundry become difficult by mining. The research revealed that mining activities, particularly bauxite surface mining which is ongoing in Sangarédi, was a major source of surface and table water depletion and pollution. They however noted that, the occurrence of flooding was also caused by bauxite mining. It has been noted that, water pollution has increased the risk of using stream and traditional well waters for drinking, laundry and farming purposes despite the existence of amenities as water pumps and some wells provided by mining companies operating in the locality. According to them, the amenities are not enough to satisfy their water demands.

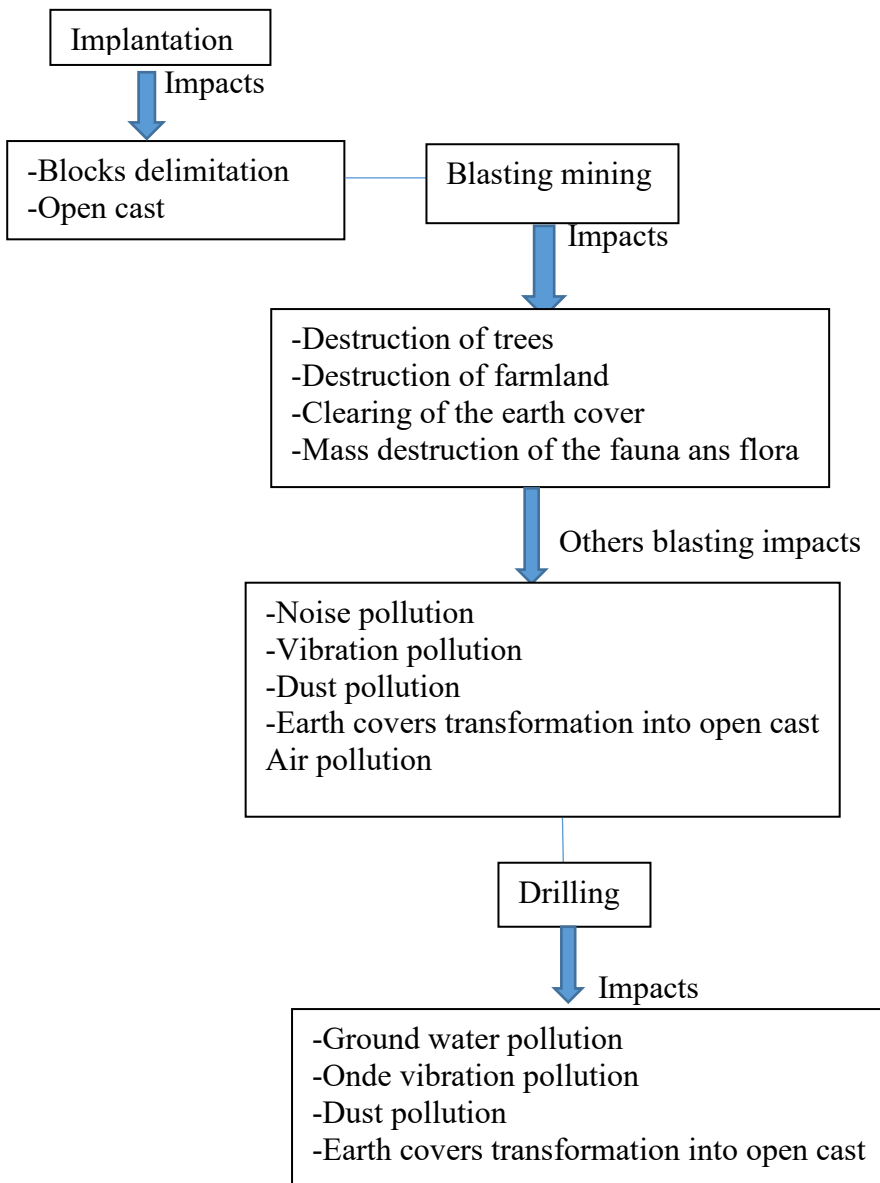


Figure 2. Stream pollution in Sangaredi’s mining zone

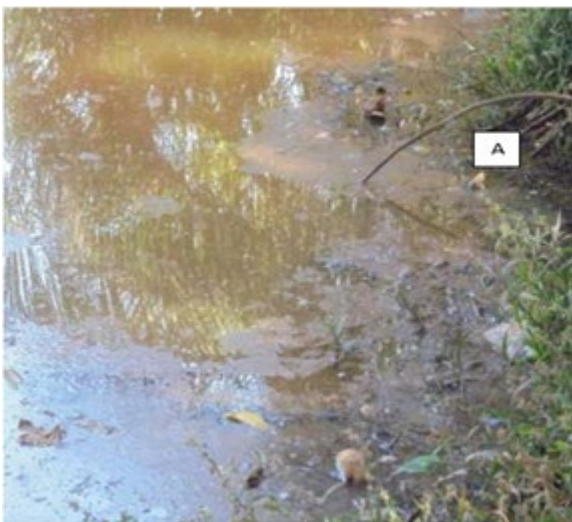


Figure 3A. Polluted stream at Sildara district



Figure 3B. Polluted River at Hamdalaye quarter



Figure 4. Air pollution related to blasting bauxite mining (Source: Author's field work, 2016)

Sludge Mud in Boké at Katougouma

In addition to these environmental impacts highlighted above, mine tailing is also another environmental impact caused by bauxite mining. Tailings also called mine dumps, Culm dumps, slimes, tails, refuse, leach residue, red sludge or slickens, are the materials left over after the process of separating the valuable fraction from the uneconomic fraction (Gangue, 2013) Basically, bauxite tailings or red mud is the insoluble product generated as a result of the Bayer process; an alkaline leaching process which extract alumina from the bauxite ore (Rai et al., 2012). Its contains vast quantities of slurry having a high solid concentration of 30 - 60% of iron oxides, titanium oxides, silicon oxides and un-dissolved alumina together with a wide range of other oxides (Snars et al., 2002).

Blasting Mining Dust and Air Pollution in Boké at Katougouma Plateau 1

Bauxite is a rock that is mainly composed of various minerals. Most importantly, bauxite is the primary ore for aluminum. Aluminum is a very crucial element as its uses are varied and diverse such as in transportation, household items, packaging, power lines, and construction.

In Boké region, the active bauxite mine in Sangarédi started since 1963. However, the mining sector while the improving the economy of the country, as well as serving as a lucrative source of income for many people, is also causing intense suffering to the locals communities.

Bauxite mining has indeed caused pollution around Sangarédi, Kamsar and kolabougny mine zones for years. Certain areas in the district, particularly in Kamsar, Bintoumodia have suffered serious air pollution from bauxite dust and residue that were released by the processing plants or leaked during transportation to the Kamsar port.

This pollution has damaged roads, river and more recently; the bauxite residue has been flowing out to the stream water due to heavy rain showers. It was previously reported that local citizens had been alarmed at the color of the stream turning red. Dust pollution caused by 'blasting mining' in Katougouma, has been mentioned by 85% of local communities. In addition, dust emanating from Lorries traffic, smoke from heavy machines, and bad smell from waste oil, are as well the challenges facing by local communities.

In Katougouma bauxite mine site, several fatal accidents were also caused by Lorries transporting bauxite. These Lorries caused further traffic congestion as the drivers parked their Lorries indiscriminately on the roads. Katougouma, village located 30Km in Boké's chief town)

Deforestation and Land Degradation due to Bauxite Mining in Fria Mine Zone

Bauxite mining is considered to be one of the most significant reasons behind deforestation in Fria. During the last decades, large areas of forest have been cleared on the Timbo due to open pit mining for bauxite. Fria bauxite exploitation factory started 62 years ago; the first Alumina factory in African was built in Fria in 1954 by the Guinea-Russian cooperation. According to the Regional directorate of forest environment in Boké, in 62 years of operation, the industry has stripped 5,099 hectares land of trees, including some 3,218 hectares of forest. It has also caused the destruction of an undetermined number of hectares by opening access roads into forests.

Bauxite mining may also have additional consequences for the Fria's forests long-term survival. A Geologist/Mining engineer met in Fria mining zone speculated that the large scale removal of vegetation, as required by the open cast method, may be causing abnormal rainfall patterns and prolonged droughts in some areas.

In recent years Fria, Timbo, three of the parishes with severely degraded mining areas, have experienced abnormal weather patterns including prolonged droughts and changes in the rainy season. The zone rainfall has



Figure 5. Parked arable land after clearing operation (Source: Author's field work, 2016)



Figure 6. Eroded soil due to bauxite mining in Fria at Timbo village (Source: Author's field work, 2016)

decreased by 20 percent over the last 30 years, dry spells are longer and harsher and the temperature has risen by one percent (Directorate of meteorology, 2016).

The Regional Directorate of Environmental (RDE) says bauxite mining may have done some environmental damage to the region given the range of interlocking activities. The agency listed dust, which causes health and property damage, and noise pollution as possible environmental problems.

“Denudation of hillsides and displacement and destruction of flora and fauna also impact negatively on the environment. These changes have not been significant enough to impact on the climate, water or food balance, but if efforts are not made to control the tree loss, there could be serious localized disorders says the Agency. See images showing bulldozer machines clearing forests in Sangarédi mine.

Erosion of Reclaimed Soil in Fria Mine at 500m to Fria's Town.

Soil is vulnerable to bauxite mining; the huge soil cover is removed at the beginning of the activity which exposes it to water erosion. On most reclaimed sites, management controls such as deep ripping, contour mounding and landscaped sub-catchments limit erosion. Despite these measures, severe gully erosion that is anecdotally associated with steep slopes were damaged the areas and affect downstream drinking water resources. A review of erosion dynamics in Fria (Timbo mined site) reveals that gullies develop episodically and in a non-linear manner, a villager interviewed at that mining site reveals that gully erosion caused by bauxite mining. She

mentioned that environmental problems were huge these days in the areas which were not previously. Soil erosion, flood, wild fires were among those problems she mentioned. A frequent erosion and run off from the mined area affect the landscape and during the raining season these gully erosion affects our farms areas.

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