

## An Introduction to Bel Air Bauxite

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### Abstract



Bel Air Mining is a new bauxite mine in the Boffa region of Guinea, West Africa, exploiting a new gibbsitic bauxite resource. The Bel Air mine was developed by Alufer Mining Limited for the seaborne bauxite market and shipped its first bauxite in September 2018. Alufer has constructed its own logistics chain including haul roads, stockpile and material handling infrastructure and port facility, through which it can transport and load (via its deep-water trans-shipment capability) up to Capesize vessels. Bel Air is in many ways a typical Guinea bauxite, being gibbsitic, low in reactive silica, but differs from most Guinea bauxites in having little or no boehmite, and containing andalusite. The Chalco Zhengzhou Light Metals Research Institute has performed characterization and processability studies which indicate product quality and suggest optimum low temperature Bel Air processing conditions for desilication, digestion and settling.

**Keywords:** Bel Air, Guinea, bauxite, mine, gibbsite

### Definitions of terms:

Common Chinese alumina refinery terms were used and reported in the Chalco study. Some translations have been made in this paper to more common North American or European terms.

“A/S”: the concentration ratio of  $\text{Al}_2\text{O}_3$  to  $\text{SiO}_2$  in liquor.

“N/S”: the mass ratio of  $\text{Na}_2\text{O}$  to  $\text{SiO}_2$  in the residue, and indicates both the quantity and soda to silica ratio of the desilication product solid.

“ $\alpha_k$ ”: molar ratio of caustic soda (expressed as  $\text{Na}_2\text{O}$ ) to  $\text{Al}_2\text{O}_3$  in liquor.

“Burden  $\alpha_k$ ”: the digestion charge molar ratio ( $\alpha_k$ ) used to calculate bauxite charge.

“ $N_k$ ”: liquor caustic concentration (as  $\text{Na}_2\text{O}$ ).

“ $N_T$ ”: total liquor soda concentration (as  $\text{Na}_2\text{O}$ ).

“ $\eta_A$ ”: Digestion Efficiency (or alumina extraction efficiency), usually presented as % of total alumina extracted in digestion, but presented here as % of available alumina.

“ $\eta_{\text{SiO}_2}$ ”: or “Predesilication Efficiency” is the Mass % of bauxite total silica converted into desilication product.

“A/F”: is the weight ratio of  $\text{Al}_2\text{O}_3$  to  $\text{Fe}_2\text{O}_3$  in solids (e.g. bauxite, digestion slurry, residue), and utilizes iron as a tie element to indicate alumina extraction.

### 1. Introduction

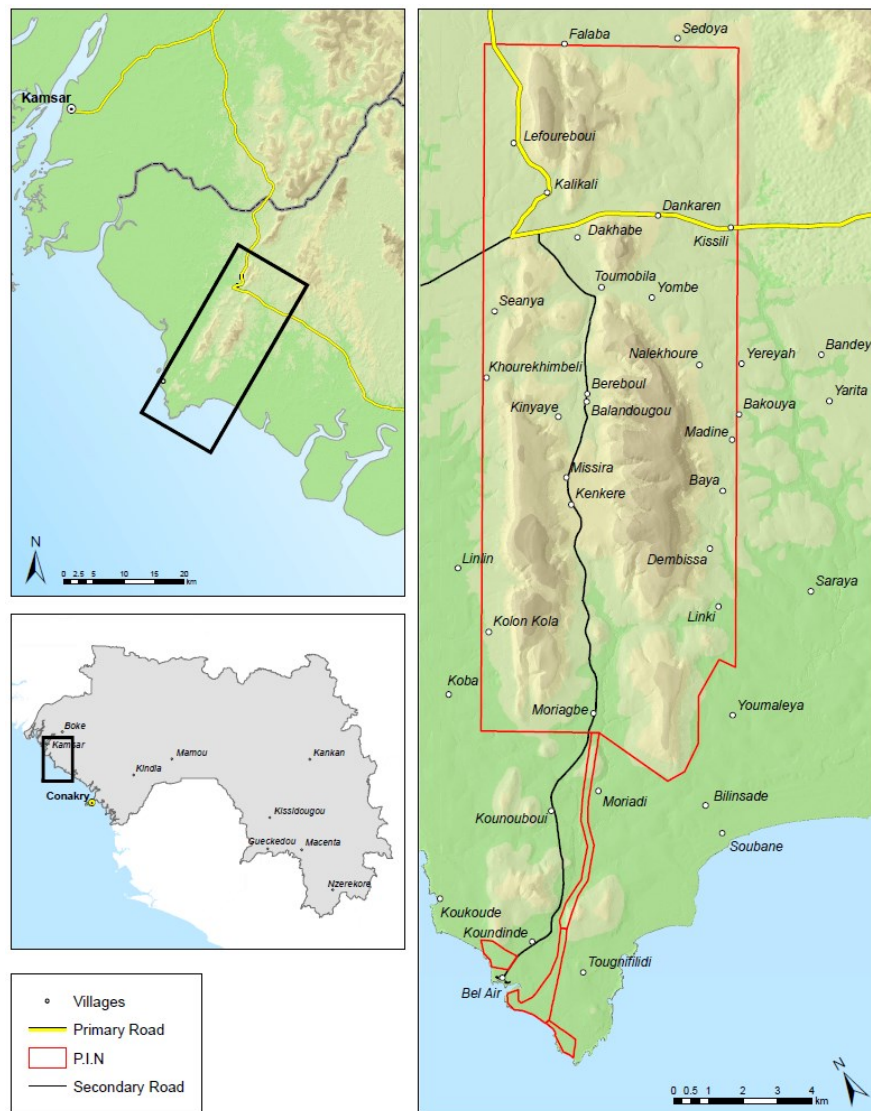
Bel Air Mining is a new bauxite mine in the Boffa region of Guinea, West Africa, exploiting a new gibbsitic bauxite resource [1]. Figure 1 shows the project is located in Western Guinea, approximately 225 km by road, northwest of the capital Conakry. The closest major towns to the Project are Boffa to the southeast and Kamsar 80 km to the northwest.

Bel Air Mining was developed by Alufer Mining Limited (Alufer) for the seaborne bauxite market and shipped its first bauxite in September 2018. The Joint Ore Reserves Committee

(JORC) resource of 146 million tonnes (mt) presently supports a mine life of more than 15 years at an initial production target of 5.5 million tonnes per annum (mtpa), with a well-developed mine plan to produce consistent product volume and grade for the life of mine.

Alufer has constructed its own logistics chain including roads, stockpile, port and deep-water trans-shipment facilities, through which it can load up to Capesize vessels. The 18 km average distance between mining activities and port is managed by trucking on dedicated haul roads built by Alufer.

Through its community engagement and cooperation programs, Alufer has developed a good relationship with local communities and will bring significant employment and economic activity into a region that presently lacks substantial economic activity.



**Figure 1. Location map for Bel Air bauxite mine in Guinea.**

## 2. Project History

An exploration permit was granted in 2010. Alufer immediately launched exploration, engineering, social and environment studies and delivered the maiden JORC resource,

When flocculants NALCO 9779 and DX-77 were co-dosed (97 – 130 g/t), settling velocities of 8.9 – 17.6 m/hr were measured. L/S in the settled solids after 30 minutes were 3.00 – 3.26, and supernatant solids were 0.25 – 0.39 g/L.

On the basis of this test work, Bel Air bauxite requires higher flocculant doses if only polyacrylate flocculants are used. Co-dosing achieved acceptable settling rates, underflow solids density and supernatant clarity. Although its relatively high goethite content suggests Bel Air will be a more difficult bauxite to settle [9,10], the study indicates that acceptable results can be achieved.

During the test work, it was observed that the filtration of digestion slurry improved with the addition of 1 % lime, and it is suggested that lime added to digestion or to the settler may improve settling and liquor filtration in operations.

## 7. Conclusions

Bel Air is a new bauxite mine in the coastal Boffa region of Guinea, commencing bauxite exports through its wholly owned and/or controlled mining, transport and ship-loading infrastructure in the second half of 2018. After ramp-up, the Bel Air mine and infrastructure is designed to produce and export bauxite at 5.5 million tonnes/year.

Bel Air is a gibbsitic bauxite with low reactive silica and low or no measurable boehmite. A bauxite sample representative of the first 12 years of mine plan was measured to have a Total Alumina content of ~ 46.5 %, Total Fe<sub>2</sub>O<sub>3</sub> content of 21.6 %, Total SiO<sub>2</sub> of 4.37 % and TiO<sub>2</sub> content of 2.63 %.

The main aluminium mineral is gibbsite (~62 %); the main iron minerals are alumino-goethite (~15 %) and hematite (~10 %); the main silicon minerals are andalusite (~ 5.5 %), kaolinite (~3 %) and quartz (~1 %), the main titanium minerals are anatase (~1 %) and rutile (~1.7 %). Total Available Alumina of the Bel Air bauxite sample was determined as 39.74 %, reactive SiO<sub>2</sub> was 1.47 %, using a typical bomb digestion method.

Although Bel Air is in many ways a typical Guinea bauxite, it is unusual in containing andalusite, an alumino-silicate mineral (Al<sub>2</sub>SiO<sub>5</sub>), which makes a small contribution to reactive silica under low-temperature digestion conditions, but like quartz, is substantially dissolved under high temperature conditions. Bel Air's mineralogy means optimum processing is achieved under typical low temperature conditions (145 °C, 1 hour). Desilication generally requires more attention than higher silica bauxites, as does attention to flocculant selection and dosing regimen for good settling. With attention to its processing specifics (as with many bauxites), Bel Air is an important addition to the alumina industry's low temperature bauxite supply.

## 8. References

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