

## Madagascar bauxite as an alternative source

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### Abstract

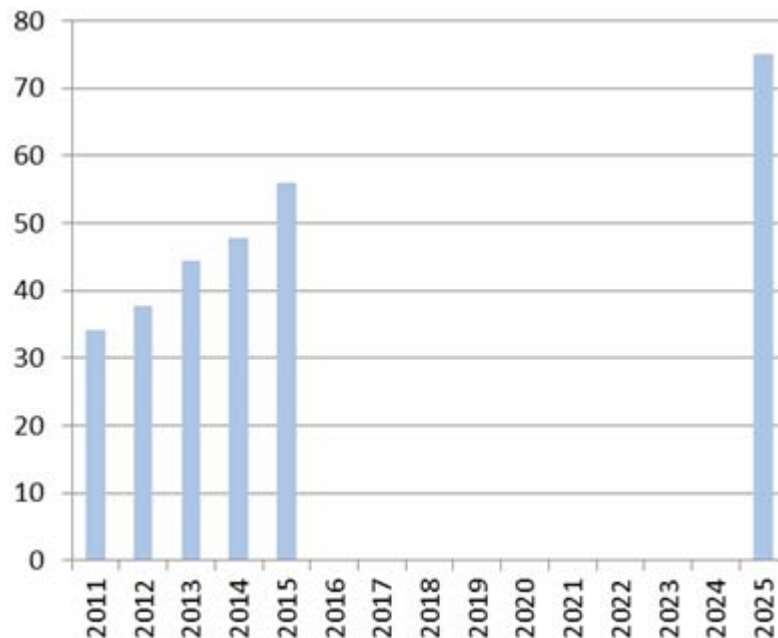


From Farafangana to Manantenina on the east coast of Madagascar Island an extensive exploration was carried out during the 1960's and in the early 1970's. One of the objectives of that campaign was to evaluate the bauxite resources and reserves of the Manantenina area where some extensive exploration, drilling and testing were conducted from 1967 to 1973. This deposit is now covered by exploitation permits and is an interesting option to supply China and eventually the Middle East. Holes and pits totaling 18 350 m. were drilled in such area. The Manantenina deposit is made up of gibbsite nodules within a clay and sand rich matrix. Recent studies undertaken have been based on such previous extensive exploration work and resource evaluations. Different scenarios were evaluated, based on bauxite mining and recovery percentages and on the basis of both crude and washed ore options. The current preferred option is washed bauxite for export. The key numbers are 200 Mt - 41 % available alumina - 1.3 % reactive silica. Location very close to the sea is a significant advantage. Furthermore, it is very easy deposit to mine: No overburden, no forest to clear, and 3 - 6 m thickness on average.

**Keywords:** Madagascar bauxite; % of available alumina in bauxite; washed bauxite.

### 1. Why to look at Madagascar bauxite deposit?

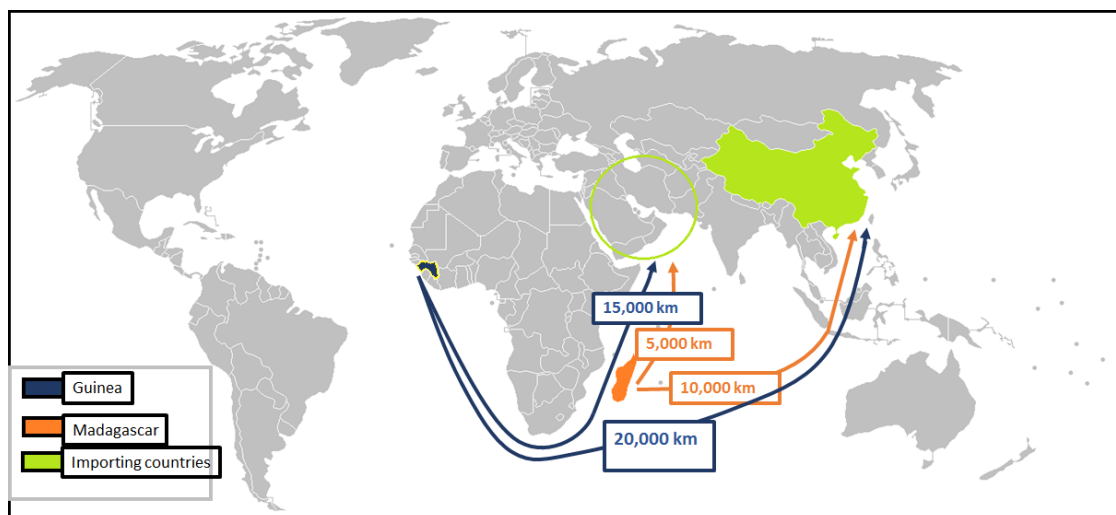
China's fast growing alumina production and its declining availability for bauxite of acceptable quality induce an increasing need of imported bauxite. (Figure 1)



**Figure 1. China alumina output (Mtpa) – 2025 average forecasts.**

This is why a significant production capacity of low temperature refineries has been developed in Shandong province on gibbsitic bauxite. Supplying sources exist: Australia, India, Malaysia,

etc. However, some of those sources could be only temporary. Others, as Guinea, Vietnam, Laos, etc., are promising, but there are infrastructure problems, inducing a certain period of time to be implemented. Madagascar bauxite has some advantages. It is located at a reasonable distance from China. It can also supply the Atlantic zone with its gibbsitic bauxite for the non-integrated refineries. (Figure 2)



**Figure 2. Guinea – Madagascar comparison.**

Furthermore, the deposit is very close to the coast and the quality of the washed bauxite (see paragraph 3.1.4) can compete with the other mentioned bauxites. This deposit can rapidly be exploited, so it must be considered.

## 2. History

Bauxite was first discovered in Madagascar in the late 1940s. It was identified four generic types of bauxite deposits in the island (Figure 3). Bauxite exploration took place, in Madagascar, in the mid-1950s to early 1970s. It was quickly focused on the south-east coast, which was found to contain the most significant resources on the island. This area was considered by various state agencies and mineral companies, including P echiney and Alusuisse. Between 1967 and 1973, P echiney carried out an in-depth investigation of the Manantenina deposit, including washing tests on 25 large representative batches (each weighing between 1000 and 1 500 tonnes); Several industrial projects were defined, including (i) the production and export of up to 5 Mt/y of bauxite from a new wharf on the Manantenina coast and, alternatively (ii) the production of up to 1.5 Mt/y of alumina from a new plant in the Fort-Dauphin area. No industrial partner was found and this and other bauxite/alumina projects were definitively abandoned by P echiney in 1973.

## 3. Bauxite potential

Typical plateau-type deposits are found along the strongly eroded remnants of the high peneplain in the northern half of the island (1 500 m and higher). Bauxite occurrences are often ferruginous, and the resources of individual plateaux – known as Tampoketsa – are generally small, with the exception of the Ankaizina group of deposits, which were explored by P echiney in the early 1970s. They are estimated to contain a total of ca. 55 Mt washed bauxite at about 41 % average  $Al_2O_3$ . The other Tampoketsa typically contain no more than a few hundreds of thousands of tonnes of low-quality, iron-rich according to an exploration made in 1966. Significant bauxite resources occur along the south-east coast, between Fort-Dauphin (now

**Table 5: Alumina quality produced by pilot plant.**

Cycle #	Composition (%)		
	Si	Fe	Na <sub>2</sub> O
16	0.0122	0.0117	0.4
17	0.011	0.0093	0.368
18	0.0098	0.0045	0.372
19	0.0064	0.009	0.296
20	0.0091	0.0045	0.332
21	0.01	0.0054	0.348
22	0.0083	0.0036	0.34
23	0.0082	0.0059	0.36

A refinery was designed based on washed bauxite with the washed bauxite in Table 6:

**Table 6. Bauxite for refinery project.**

Available Alumina	40 %
Reactive Silica	1.8 0%
Quartz	24 %
Moisture	12 %

The power station design includes backpressure turbines for power production, (Table 7).

**Table 7. Refinery main parameters.**

Refinery Production	1.65 Mtpa
Wet Bauxite (feed to Bayer Plant)	2.9 t/t
Bauxite Moisture	12 %
Availabilty factor	97 %
Caustic Soda (NaOH)	55 kg/t
Burnt Lime (100%CaO)	13 kg/t
Steam 5 bar	1.1 t/
Steam 12 bar	0.5 t/t

## 5. Conclusion

The Manantenina deposit has been extensively studied. Its bauxite does not present any particular difficulty in its treatment by the Bayer process. The construction of a alumina refinery on the island looks unlikely in the medium term. However, the washed bauxite can be an interesting source of gibbsitic bauxite for Shandong refineries or non-integrated plants in the Atlantic area.

## 6. References

1. Roullier, J.P. (1970 - 1973)
2. Bárdossy, G. & Aleva, G. J. J., 1990. Lateritic bauxites. Developments in Economic Geology, 27.Elsevier.
3. Komlóssy, G 2013. Global Bauxite Resources. Metal Bulletin 2013.
4. Carboni, V. 2005 Bauxite Potential of Madagascar.