BAUXITE

GLOBAL OUTLOOK

The global demand for bauxite is primarily driven by aluminium production, which is projected to increase due to higher levels of consumption by the transportation, construction, high-tech and packaging industries. Global bauxite output grew by 1.2% to 359.2 million tonnes (Mt) despite the COVID-19 pandemic in 2020. Bauxite production is expected to further increase to 406.7Mt by 2025, according to GlobalData's estimates (Mining Technology, n.d.). The global bauxite market is expected to reach USD 18.15 billion by 2030, registering a compound annual growth rate CAGR of 1.7% from 2022 to 2030. Bauxite resources are estimated to be between 55 billion and 75 billion tons, distributed in Africa (32%), Oceania (23%), South America and the Caribbean (21%), Asia (18%), and elsewhere (6%). Brazil and Guyana are the two-leading exporters of bauxite in South America. Guyana is ranked 12th as a major exporter of bauxite (Research and Market, 2022) and has produced over 137.4 million tonnes (Mt) of bauxite between the inception of the local industry in 1915 to 2022.

LITERATURE REVIEW

Bauxite is a laterite or residual rock in which alumina monohydrate or trihydrate minerals predominate. The bauxite orebodies take the form of flattened dome-shaped crust capping the higher parts of the pre-Berbice landscape and their shape is compatible with moulding by subaerial agents. The textures of bauxite are typically colloform, brecciated, rhythmic and banded in crypto-crystalline cliachite with subsidiary amounts of crystalline gibbsite filling veins and small vugs (Bleakley, 1960). The bauxite deposits overlie kaolinitic clays, some of which are residual on the basement: others are part of a wedge of Paleocene sediments that thicken seawards.

In 1759, the first geological survey was undertaken by L.L Bercheyck in the area. Bauxite was observed at Christianburg by J.B. Brown during his famous expedition in 1860. In 1910, J.H Harrison released findings of bauxite. These developments eventually led to the establishment of the Demerara Bauxite Company (DEMBA) in 1916 and produced 2137 tons from the Three Friends area deposit (Frank, 2007). The first bauxite reserve estimate was 16 million tons. In 1929, Aluminum Company of Canada took control of the Demerara Bauxite Company (DEMBA). At that point, Guyana became the world's third-largest bauxite producer after the U.S.A. and Suriname and by the end of the 1940s the world's second-largest (Abrams, 2009). The year 1952 saw the Berbice Bauxite Company acquired by Reynolds Metals Company and production

of metallurgical grade bauxite (MAZ) subsequently began at Kwakwani. In 1961, an Alumina refinery was constructed in Linden with a 300,000-ton capacity. Demerara Bauxite Company (DEMBA) was nationalized in 1970 and renamed Guyana Bauxite Company. Six years later, the Guyana Mining Company (GUYMINE) was established as a new corporate body with the merger of the GUYBAU in Linden and the BERMINE in Berbice. In 1982, the alumina plant was decommissioned after twelve years in operation. By 1992, GUYMINE was dissolved and divided into the Linden Mining Enterprise (LINMINE) and the Berbice Mining Enterprise (BERMINE). The Government in 1998 announced privatization plans for both LINMINE and BERMINE; in 2004, the Bauxite Company of Guyana Inc. a subsidiary of RUSAL, Russia's aluminium giant, was established. RUSAL had 90% ownership of this company and the Government retained 10%. Mining operations were turned over to OMAI Bauxite Co., a Canadian company formerly involved in mining the Omai gold deposit. Mining operations of OMAI Bauxite Co. were turned over to IAMGOLD in 2007, who resold their shares to BOSAI Minerals Inc., majority owned by Nanchuan Minerals Group of Chongqing (China), who still operate some of the mines to date.

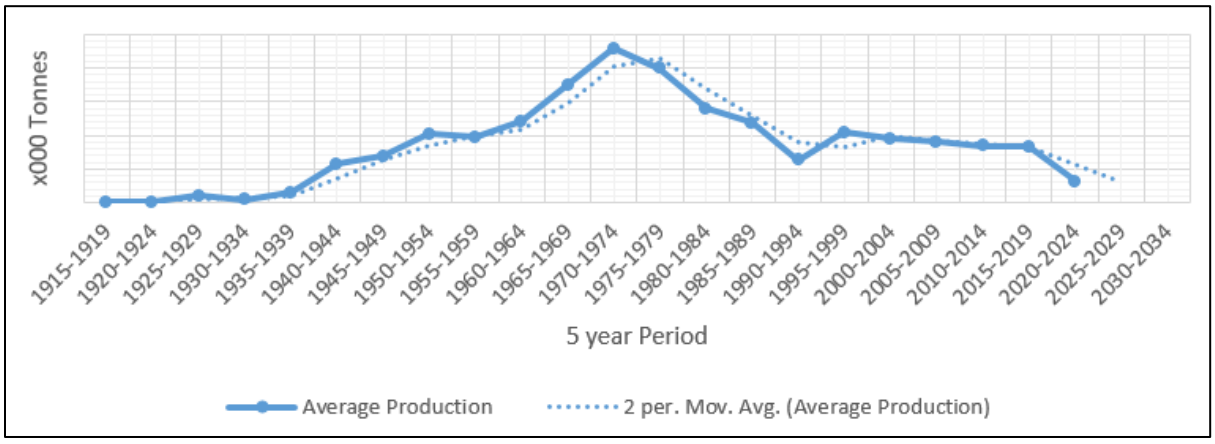

Figure 1. Bauxite average (5-year) production from 1915-2022

In 2013, First Bauxite Corporation a Canadian natural resource company, engaged in the exploration and development of bauxite deposits in Guyana, reported that initial testing conducted on material mined at Bonasika confirms the mineral is of high quality (Butty et al., 2011). RUSAL commenced mining operations in 2015 as it completed the $25 million Kurubuka-22 project at Aroaima. In 2019, Guyana Industrial Minerals (GINMIN) a subsidiary of First Bauxite Company commenced mining operations at its Bonasika site. In 2020, RUSAL was forced to close its operations due to the Covid-19 pandemic and ever-increasing operating costs. To date, BOSAI Minerals Inc. is currently producing calcined bauxite whereas GINMIN is producing washed bauxite. Guyana has been producing bauxite for over 100 years and has seen a production decline in recent years due to factors out of Guyana's control (Figure 1).

The Major Grades of Bauxite produced in Guyana (MNR, 2019) are:

i) Metallurgical-grade or metal-grade bauxite ("MAZ")

The specifications for metal-grade bauxites have changed over the decades with the requirements for Al_2O_3 dropping from over 50% to 30%. The preferred specifications require a pure gibbsitic ore with high Al_2O_3, low SiO_2 and high Fe_2O_3

ii) Refractory-grade calcined bauxite ("RASC")

Bauxite suitable for refractory applications must meet very stringent requirements, such as high alumina (59% to 61%) low iron oxide (> 2.5%) and low titanium content (no higher than 4%). Silica can range between 7% and 10%. This grade specification rules out bauxite from the majority of bauxite producing countries.

iii) Cement-grade bauxite ("CeGB")

The typical industry requirement for high alumina/low iron cement is for a minimum $A1_2O_3$:SiO_2 of 10:1 (which normally excludes bauxite having a silica content of more than 6%) and a minimum $A1_2O_3$:Fe_2O_3 ratio of 20:1. For high-iron cement, this latter ratio is set at 2.5:1. In cement products, the higher the alumina content, the more rapid the hardening rate and the better the refractory properties.

iv) Chemical-grade bauxite ("CGB")

Chemical-grade bauxite accounts for less than 0.3% of bauxite production. The most significant requirement for chemical-grade bauxite is that its acid-soluble iron oxide content must be low. The preferred market specification is for gibbsitic bauxite with a maximum Fe_2O_3 content of 2.5% or an $A1_2O_3$:Fe_2O_3 ratio of 23:1 or higher.

v) Abrasive-grade bauxite ("AAC" or "AGB")

Producing calcined abrasive-grade bauxite is equivalent to producing refractory-grade material (such as RASC), except that abrasives are calcined (fired) at a lower temperature. The main bauxite used in abrasive-grade bauxite is gibbsite, though mineralogy is not of major significance.

Ore Deposit Location	Quantity	Composition	Description
Kwakwani (RUSAL)	Proven resource: 2.38 Mt Probable resource: 2.59 Mt Inferred resource: 14.57 Mt	Ore composed of 59% Al_2O_3, 1.1% Fe_2O_3, 2.2% SiO_2 and 3.25% TiO_2	The ore lies between 12 and 18 metres (40 to 60 feet) below the surface. Before mining activities commence, bulldozers remove the trees to expose the first layer of white sand
Linden Deposits (BOSAI)	Proven resource: 49 Mt Total Reserve: 177 Mt (RASC) and 77 Mt (MAZ)	Ore composed of 60.81% Al_2O_3, 1.17% Fe_2O_3, 5.15% SiO_2 and 2.53% TiO_2	Ore usually 10 to 16 feet thick overlain by 100 feet of overburden. High stripping ratio 10:1
Bonasika (GINMIN)	Proven resource: 1.72 Mt Probable resource: 9.37 Mt Inferred resource: 0.542 Mt Total Reserve: 11 Mt	Ore composed of 60.81% Al_2O_3, 1.17% Fe_2O_3, 5.15% SiO_2 and 2.53% TiO_2	The Bonasika deposits exhibit a simple geometry of sub-horizontal strata, tapering at the extremities. The bauxite thickness can attain almost 30ft, but all deposits display an average thickness of some 12ft.
Kopinang Basin	Estimated 5000 Mt	Ore composed of 40% Al_2O_3, 28% Fe_2O_3 and 6% SiO_2	Typical thickness of 10 feet
Kamarang area	Estimated 9000 Mt	Ore composed of 33% Al_2O_3, 20% Fe_2O_3 and 20% SiO_2	Typical thickness of 14 feet
Sukabi Basin	Estimated 4200 Mt	Ore composed of 34% Al_2O_3, 26% Fe_2O_3 and 17% SiO_2	Typical thickness of 16 feet

Table 1. Table showing the Bauxite Potential of Major deposits and occurrences (Bleakley, 1959; Bateson, 1961; Pollard, 1955; Butty et al., 2011)

LOGISTICS

The main deposits of bauxite and associated laterites are found within an arcuate strip of country nearly four hundred miles long extending from the Pomeroon district of Guyana to near the Maroni River in French Guiana, between the latitudes of 5° and 7° 30' north and the meridians of 59° and 51° 40' west longitude (Emory, 1925). About 200 miles of this strip occurs in Guyana, (Figure 2) where it is subparallel with the present coastline ranging from about 20 miles, in the Pomeroon area, to about 70 miles, at Kwakwani, inland from the present shore. It is 15-20 miles wide and contains about 100 separate occurrences of bauxite which have been tested by drilling and a probably greater number of laterite bodies. The bauxite occurrences fall into six groups; Pomeroon, Essequibo, Mackenzie (Linden), Ituni, Kwakwani and Canje, although isolated bodies have been found between them. Immediately flanking it on the landward side are several isolated laterite plateaus some of which, e.g., Blue Mountains, Tiger Hill and Iron Mountain, have been examined in the field. Between the bauxite belt and the Pakaraima Mountains, bauxitic laterite occurs extensively as flat or gently undulating hill cappings representing remnants of formerly much more extensive sheets which formed on previous planation surfaces (Bleakley & Phil, 1964). The former are characteristically present as broad benches or selvedges flanking higher elements of the topography; they are particularly well displayed in the areas of rugged country flanking the Pakaraimas, from the Mazaruni area across the Potaro to the Essequibo River.

SCOPE & POTENTIAL

The known occurrences of high grade bauxite within a narrow belt 15-20 miles wide coincides with the emergence of the basement on the landward side of the coastal down warp. The bauxite consists essentially of gibbsite, silica in the form of kaolinite and quartz, together with minor amounts of ferric oxide and titanium (Cameron, 1971). The deposits of Guyana fall roughly into six groups although bauxite is not limited to these localities and isolated bodies are scattered between the main groups. Table 1 shows that Guyana has a modest reserve of 250 Mt of bauxite after extracting over 137 Mt for the past 107 years.

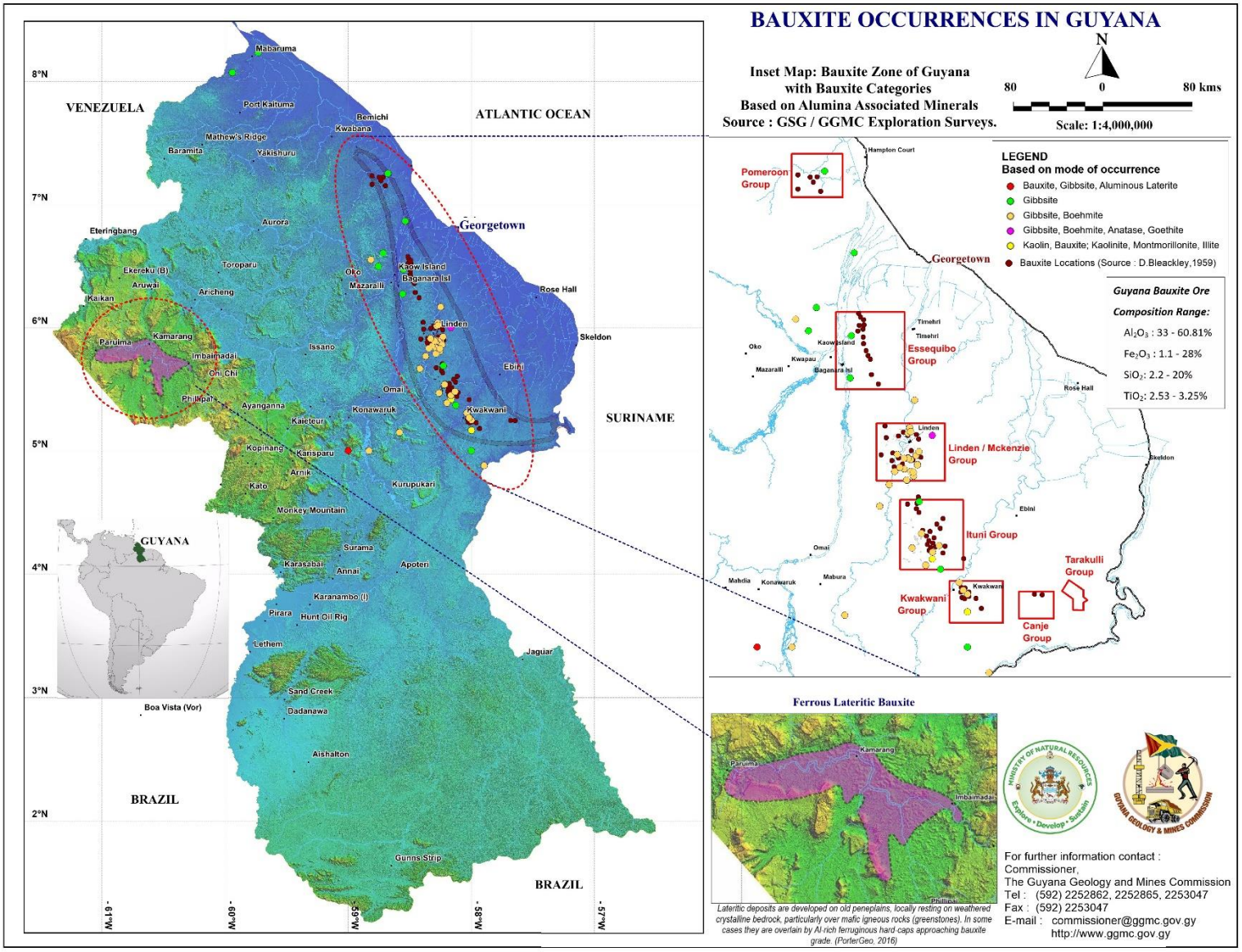

Figure 2: Bauxite Occurrences in Guyana

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