Mineralogical and Geochemical Characterization of the Paranas Karst Bauxite Deposit, Samar Island, Philippines

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Abstract

Bauxite is a residual soil resulting from intense tropical weathering of rocks rich in aluminium oxide. It is the most important source of aluminium and is recently tapped as potential source of rare earth elements (REEs). The Philippines holds substantial bauxite deposits on Samar Island, which were declared as bauxite mining reservation sites by Presidential Proclamation in 1977. Of these reservation sites, the Paranas bauxite deposit being developed by Alumina Mining Philippines Inc., is in the most advanced stage of exploration, with numerous test pit and drill core data available. This study aims to describe the mineralogical and geochemical characteristics of the Paranas bauxites.

The bauxites in Paranas are recognized by their orange-brown clayey soil, with minor disseminations coarse black manganese particles. X-ray diffraction analysis have shown the major mineral components to be gibbsite, boehmite, goethite, lepidocrocite, cristobalite, and anatase. This study identified two types of bauxite within the area: lateritic bauxite and karst bauxite. The former arising from in situ weathering of mafic sedimentary rocks, and the latter originating from the weathering of basalts and their subsequent deposition in limestone cavities in karst landscapes. The karst bauxites, found in the southwestern area, contain higher aluminium content (>35 wt %) than the lateritic bauxites located in the northwest. The Paranas bauxites are characterized by high levels of Fe_2O_3, SiO_2, and P_2O_5. Furthermore, REE concentrations reach up to 700 ppm in the karst bauxites. The ongoing study on mineral chemistry intends to map out the elemental distribution across different soil and mineral phases within these deposits, further advancing our knowledge of this essential geological resource.

Keywords: Paranas Bauxite, Mineralogy, Geochemical characteristics, Philippines

1. Introduction

Bauxites are clay-like sediments formed due to the weathering of rocks rich in alumino-silicate minerals. They are the major ore of aluminum, consisting primarily of the crystalline alumina minerals gibbsite, boehmite and diaspore [1]. Recent studies have also identified the potential of bauxite for extracting rare earth elements (REE) and other minor elements like vanadium, scandium, gallium, lithium, and molybdenum [2,3]. In selected countries, producing REE as a by-product of large-scale aluminum production from bauxite is seen as a cost-effective solution that results in a smaller environmental footprint [4].

In the Philippines, the majority of bauxite deposits are located on Samar Island (Figure 1), which was designated as a bauxite mining reservation by a 1977 Presidential Proclamation. Among the

areas identified for bauxite extraction on Samar, the deposit in Paranas managed by Alumina Mining Philippines Inc. is the most advanced in terms of exploration with numerous historical drill data available. This study focuses on the mineralogical and geochemical characteristics of the Paranas bauxite deposit. The results of this study will hopefully contribute to the evaluation of its potential for REE by-product extraction.

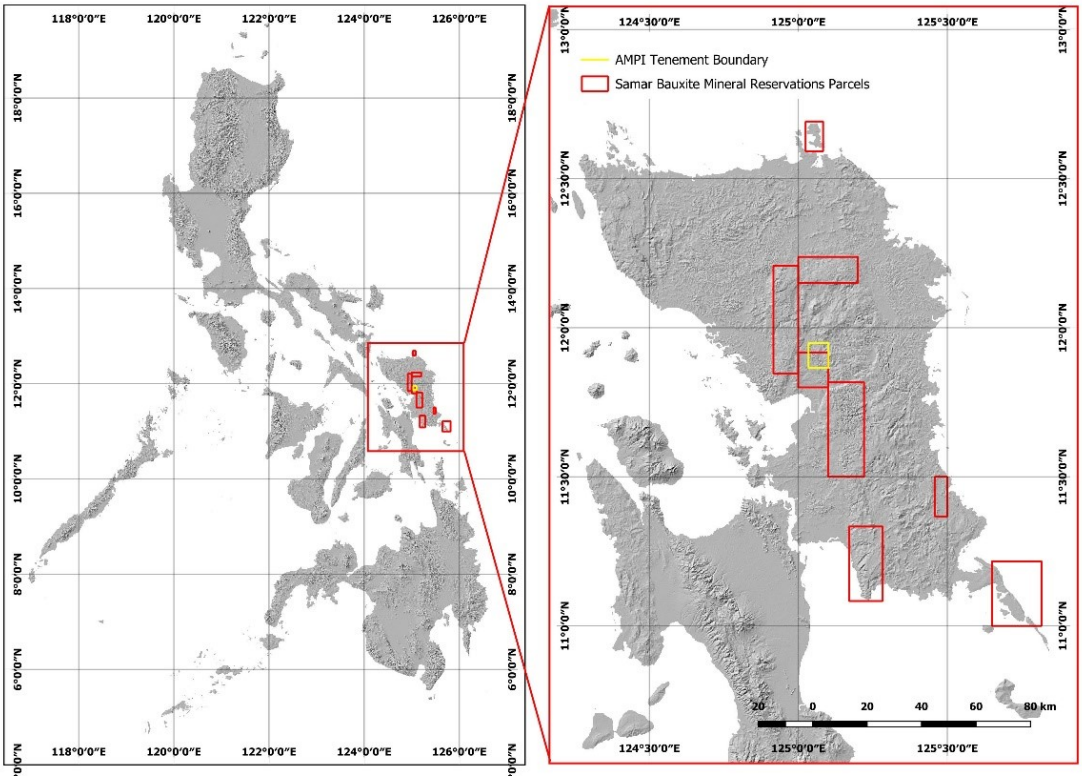

Figure 1. Map showing the tenement boundary of Alumina Mining Philippines Inc. (yellow) in Samar Island, Philippines where the Paranas bauxite deposit is located.

2. Geologic Setting

Samar Island is located in the central portion of the Philippines, bounded by the west-dipping subduction of the Philippine Sea Plate (PSP) beneath the Philippine Mobile Belt (PMB). In the western portion of Samar Island, the sinistral Philippine Fault Zone (PFZ) can be seen transecting the island of Leyte [5]. The basement rocks in the island are the Jurassic to Paleogene ophiolitic rocks that originated from the subduction of the proto-Philippine Sea Plate along the eastern margin of the Philippines [6]. Overlying the ophiolitic units are arc-derived clastic rocks and carbonates [7].

In the study area of Paranas, the oldest rocks consist of Late Cretaceous basaltic pillow lavas as well as blocky and amygdaloidal lava flows. Overlying these igneous rocks are Late Cretaceous interbedded sandstones, calcareous mudstones, and orthoconglomerates. These gently dipping clastic units are primarily composed of volcanic and mineral fragments, along with an abundance of shell fragments. Middle Miocene limestone units overlie the Late Cretaceous sedimentary rocks. The limestone is marly and contains abundant fossils of bivalve shell fragments, benthic foraminifera and other bioclasts cemented by sparry calcite. The limestone served as an ideal depositional site for the weathered products of the nearby aluminium-rich volcanic and clastic units [8].

boehmite, while analytical studies will assess the total organic content of the deposit. These efforts aim to further characterize the Paranas bauxite and confirm its commercial potential.

5. References

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