SEG 2024 Conference: Sustainable Mineral Exploration and Development

Unveiling the Geological Potential of Bauxite Deposits in the Democratic Republic of Congo (DRC) for Sustainable Aluminium Production and the Green Transition

Derick U. Ramazani, Dominique W. Osomba
University of Kinshasa, Kinshasa, Democratic Republic of the Congo (Kinshasa)

Among the global shift towards a greener economy, the demand for sustainable raw materials has surged, with bauxite emerging as one of the cornerstones due to its integral role in renewable energy infrastructure and green technologies. The Democratic Republic of Congo (DRC) holds one of the world-class bauxite provinces (100 to 150 million tonnes with 42.6% of Al associated with gibbsite mineral), but it is not exploited, with deposits such as Sumbi, Mayedo, Kinzoki, and Kimvela strategically located near vital facilities like the largest Inga hydropower and the Atlantic Ocean. This study aims to delineate and characterize the geological features of these deposits through comprehensive petrographic analyses, X-ray diffraction (XRD), and geochemical investigations. Petrographic and mineralogical examinations unveil a progression of supergene alterations within dolerite and basaltic rocks, culminating in bauxite formation. These formations exhibit an evolving mineralogical assemblage made up of kaolinite, gibbsite, quartz, anatase, and goethite. The main Al oxide mineral, gibbsite, peaks at 47.06%, observed at the Mayedo deposit. The geochemistry across deposits shows wide variability in different profiles with SiO_2 (3.51-48.37%), Al_2O_3 (8.68-44.60%), Fe_2O_3 (17.17-57.39%), and TiO_2 (1.96-12.48%). Comparative analysis of the major oxides with other worldwide bauxite deposits reveals the predominance of the classification typical of the kaolinic and bauxitic zones, with significant variations in the alteration indices (33.32-100%). Geochemical analyses further underscore the unique characteristics of these deposits, emphasizing the extensive supergene fluid flow and complex leaching processes that have transformed the protolith into gibbsite-rich minerals. These findings not only underline the vast untapped potential of the DRC's bauxite resources but also highlight their pivotal role in catalyzing sustainable aluminum production and fostering the global transition towards a greener future.