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Exploration Tools for Tantalum-Bearing Pegmatites along Kibara Belt, Central and Southwestern Uganda

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Abstract : Tantalum metal is used in addressing capacitance challenge in the 21st-century technology growth. Tantalum is rarely found in its elemental form. Hence it's often found with niobium and the radioactive elements of thorium and uranium. Industrial processes are required to extract pure tantalum. Its deposits are mainly oxide associated and exist in Ta-Nb oxides such as tapiolite, wodginite, ixiolite, rutile and pyrochlore-supergroup minerals are of minor importance. The stability and chemical inertness of tantalum makes it a valuable substance for laboratory equipment and a substitute for platinum. Each period of Tantalum ore formation is characterized by specific mineralogical and geochemical features. Compositions of Columbite-Group Minerals (CGM) are variable: Fe-rich types predominate in the Man Shield (Sierra Leone), the Congo Craton (DR Congo), the Kamativi Belt (Zimbabwe) and the Jos Plateau (Nigeria). Mn-rich columbite-tantalite is typical of the Alto Ligonha Province (Mozambique), the Arabian-Nubian Shield (Egypt, Ethiopia) and the Tantalite Valley pegmatites (southern Namibia). There are large compositional variations through Fe-Mn fractionation, followed by Nb-Ta fractionation. These are typical for pegmatites usually associated with very coarse quartz-feldspar-mica granites. They are young granitic systems of the Kibara Belt of Central Africa and the Older Granites of Nigeria. Unlike 'simple' Be-pegmatites, most Ta-Nb rich pegmatites have the most complex zoning. Hence we need systematic exploration tools to find and rapidly assess the potential of different pegmatites. The pegmatites exist as known deposits (e.g., abandoned mines) and the exposed or buried pegmatites. We investigate rocks and minerals to trace for the possibility of the effect of hydrothermal alteration mainly for exposed pegmatites, do mineralogical study to prove evidence of gradual replacement and geochemistry to report the availability of trace elements which are good indicators of mineralisation. Pegmatites are not good geophysical responders resulting to the exclusion of the geophysics option. As for more advanced prospecting, we bulk samples from different zones first to establish their grades and characteristics, then make a pilot test plant because of big samples to aid in the quantitative characterization of zones, and then drill to reveal distribution and extent of different zones but not necessarily grade due to nugget effect. Rapid assessment tools are needed to assess grade and degree of fractionation in order to 'rule in' or 'rule out' a given pegmatite for future work. Pegmatite exploration is also unique, high risk and expensive hence right traceability system and certification for 3Ts are highly needed.

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