

Paper Number: 10

Chemistry of cassiterite, ferberite and columbite-tantalite samples from Rwinkwavu, Bugarura-Kuluti and Musha-Ntunga mineral districts of the South-Eastern Rwanda.



Ngaruye, J.C.¹ and Gauert, C.²

¹Ministry of Natural Resources, Kigali, Rwanda, Email: jclaude.ngaruye@gmail.com or cngaruye@minirena.gov.rw;

²Department of Geology, University of the Free State, Bloemfontein, South Africa

The mines of Eastern Rwanda are historically known to host cassiterite, ferberite and niobo-tantalite (“coltan”) mineralization. The geology of that area is dominated by meta-sedimentary rocks of Mesoproterozoic age. The latter were deformed during the Kibaran Orogeny (1.4 to 1 Ga) and intruded by two generations of granite: G1-3 granites of ca. 1380+/-10 Ma and G4- granites of ca. 986+/-8 Ma (Tack et al., 2010). The mineralization exploited here, are related to the G4 granite which functioned as the heat source for the mineralizing fluids. The SEM-EDX/WDX investigations on cassiterite samples revealed that the dominant substitutions were of the $\text{Sn}^{4+} \leftrightarrow (\text{Ta}, \text{Nb})^{4+}$, $3 \text{Sn}^{4+} \leftrightarrow 2(\text{Ta}, \text{Nb})^{5+} + (\text{Fe}, \text{Mn})^{2+}$ and/or $\text{Fe}^{3+} + \text{OH}^- \leftrightarrow \text{Sn}^{4+} + \text{O}^{2-}$ types (Moller et al., 1988). Laboratory analysis of coltan mineralization from increasingly distal veins showed evolution trends from ferro-columbite to mangano-tantalite compositions indicating the increase of Ta and Mn with advanced differentiation of pegmatites. The fluid inclusion studies showed that the mineralizing fluids were composed by more than one type of cations, salinities below 17.5 wt. % NaCl equiv. and T_h between 103 and 360°C (Ngaruye, 2011). They confirmed that the coltan precipitation closer to the granites was achieved in pneumatolytic conditions whereas the cassiterite and ferberite mineralization precipitated in hydrothermal environments possibly derived from a mixture between magmatic fluids and meteoric to connate waters. A conceptual metallogenetic model was developed and includes a multi-stage hydrothermal circulation induced by progressive granitic magmatism and precipitation of Sn, W, Nb-Ta minerals in pegmatitic veins cross-cutting rocks strata acting as chemical traps.

Reference

1. Möller, P., Dulski, P., Szacki, W, Malow, G. and Riedel, E. (1988). Substitution of tin in cassiterite by tantalum, niobium, tungsten, iron and manganese. *Geochimica et Cosmochimica Acta*, **52**, 1497-1503.
2. Ngaruye, J.C. (2011), Petrographic and geochemical investigation of Sn - W - Nb - Ta - pegmatites and mineralized quartz veins in southeastern Rwanda, Magister Thesis, University of the Free State, Bloemfontein, South Africa, p182.
3. Tack, L., Wingate, M.T.D., De Waele, B., Meert, J., Belousova, E., Griffin, B., Tahon, A. and Fernandez-Alonso, M. (2010). The 1375 Ma “Kibaran event” in Central Africa: Prominent emplacement of bimodal magmatism under extensional regime. *Precambrian research*, **180**, 63-84.

