Mineralogical study of a uranium-niobium-rich alteration zone at the Lofdal Carbonatite-Silicate Complex, Namibia

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The Lofdal Farm area, located in NW Namibia, is host to a mid Neoproterozoic (ca. 750 Ma) rift-related silicate-carbonatite intrusive suite. The intrusive core of the complex is characterized by nepheline syenite and carbonatite plugs, and diatreme breccia, surrounded by a wide area (200 km^2) of carbonatite and phonolite dyking accompanied by hydrothermal alteration. The carbonatite dykes are strongly mineralized with rare earth elements, showing particularly strong enrichment in heavy REE, believed to be associated with late stage hydrothermal alteration. The core of the complex, referred to as the "Main Intrusion", outcrops as a large carapace of nepheline syenite (1.5 km^2 exposure area) intruded by a calciocarbonatite (sovite) plug. Airborne radiometric surveys identified a large uranium anomaly along the western and NE extremities of the Main Intrusion. Reverse Circulation drilling and analysis of 5 m-composite chip samples proximal to the main geophysical anomaly has identified a zone of uranium and niobium enrichment averaging 110 ppm U and 3200 ppm Nb. A grab sampling program over the main U anomaly identified enrichment averaging 500 ppm U and 5000 ppm (0.5%) Nb. Detailed field mapping of the Main Intrusion identified two alteration styles, mafic and felsic fenitization, affecting syenite and breccia marginal to their contacts with the intruding carbonatite body. They are interpreted to be a result of alkali metasomatism of host rocks during the carbonatite intrusion. Mafic fenitization is strongly radioactive and consists of coarse-grained aegerine intergrown with calcite and microcline. It is not very extensive and appears to be constrained to the contact margins with thicknesses of approximately 2 m. Felsic fenitization is much more widespread and is characterized by nearly complete replacement of the rock by potassium feldspar. Felsic fenites also show anomalous radioactivity, although not as intense as mafic fenites. Uranium and niobium mineralization in the Main Intrusion is currently of significant interest, although much uncertainty remains about the nature of the mineralization. RC chip analysis has proven that significant mineralization is present at depth, although it is not clear how this mineralization relates to what is seen at surface. This study will focus on describing the mineralization and alteration styles of the syenite, fenite and carbonatite within the main uranium anomaly of the Main Intrusion. This information should provide some insight into the nature of mineralization at depth, helping to constrain targets for a future diamond drilling program.

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