A petrological study of REE-rich carbonatite intrusions from the Lofdal Farm area, Namibia

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Carbonatite dykes in the Lofdal Farm area near the town of Khorixas in Damaraland, Namibia, contain elevated concentrations of rare-earth elements (REE) and in some cases unusually high ratios of heavy REE to light REE. Most dykes have widths between 0.5 cm and 5 m but some are up to 25 m wide and extend over several kilometres. Carbonatite also occurs in plugs with diameters up to several hundred meters, although these bodies outlined to date appear to lack highly elevated REE values. The carbonatite dykes and plugs occur in association with syenite and nepheline syenite intrusions that combined form an alkaline intrusive complex in an area of over 125 km². The complex is hosted by 1.7 Ga metasedimentary rocks, including gneiss and schist, of the Huab Basement Complex.

This study is based on 18 samples from 6 carbonatite dykes and their host rocks and two carbonatite plugs. The carbonatite samples consist of equigranular twinned calcite with varying abundance of Fe-carbonates, Fe-oxides, and magnetite. Other minerals include biotite, K-feldspar and very fine-grained apatite. Some samples are highly altered ferrocarbonatite and consist of Fe-carbonate with inclusions of calcite, K-feldspar and biotite. Based on electron microprobe analyses, the Fe-carbonate mineral is ankerite. Preliminary microprobe data indicate that REE appear to occur in fine-grained opaque minerals as well as in REE-mineral inclusions in calcite. Analyses of eight whole-rock samples showed varying total REE abundances, with a high of 50820 ppm. Four samples from one dyke show an increasing amount of silicon from the center of the dyke to the edge, accompanied by a decrease in total REE. Ratios of total light REE (La to Sm) to total heavy REE (Eu to Lu) range from 0.71 up to 59.63 in the analyzed samples. A regional geochemistry database of 1400 REE analysis shows total REE concentrations up to 86184 ppm in some dykes.