# Influence of hydrothemral activity on the final REE minerlisation at the Okorusu carbonatite complex, Namibia

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Carbonatites are the primary source of LREE worldwide. Here we describe evidence from the Okorusu mine in North-Central Namibia, based on results from a suite of techniques including SEM-EDS and SEM-CL imaging, EPMA, LA-ICP-MS on minerals and fluid inclusions, bulk rock chemistry and microthermometry. This provides indications of hydrothermal reworking in a carbonatite-related REE deposit.

The Okorusu deposit is part of a ring complex consisting of syenites, nepheline syenites, and carbonatite with hydrothermal fluorite ore mineralisation formed principally by replacing carbonatite bodies. The primary carbonatites show a typical LREE enriched pattern. Primary REE mineralisation is contained in the magmatic phases apatite, pyrochlore and calcite. These phases have been partially broken down by hydrothermal activity. Most of the REE in the carbonatite samples now occur in secondary hydrothermal phases, mainly synchysite-(Ce). The REE occur also as synchysite-(Ce) in the hydrothermal fluorite but additionally they are incorporated into the fluorite structure resulting in cathodoluminescence zoning. Fluid inclusions are observed in both magmatic phases (apatite, calcite and clinopyroxene) and in hydrothermal phases (fluorite, calcite and quartz). The fluid inclusions associated with secondary REE mineralisation in fluorite consist of liquid-vapour inclusion with a constant liquid/bubble ratio and often a small daughter mineral. This suggests that the REE were transported by a relatively concentrated aqueous fluid. Fluid and melt inclusions hosted in the magmatic phases show a wider range in composition.

The Okorusu carbonatite deposit shows primary and secondary features common to carbonatite deposits worldwide, and so the results reported here may be of wider significance.