Eudialyte-group minerals as monitors of magmatic and hydrothermal processes in peralkaline rocks

M. A. W. MARKS[1*], M. J. LINDHUBER[2], B. C. RATSCHBACHER[3], C. GIEHL[4], M. NOWAK[1] AND G. MARKL[1]

[1]Universität Tübingen, 72074 Tübingen, Germany (*correspondance: michael.marks@uni-tuebingen.de)
[2]Adamera Minerals Corp., Vancouver, BC V6E3V6, Canada
[3]University of Southern California, Department of Earth Sciences, Los Angeles, California 90089, USA
[4]Universität Kiel, Institut für Geowissenschaften, 24118 Kiel, Germany

Eudialyte-group minerals (EGM) occur in a special group of peralkaline nepheline syenites and granites, the so-called agpaites. They comprise a number of Cl-bearing Na-Ca-Zr-cyclosilicates with variable amounts of Fe, Mn, Sr, REE, and Nb, forming extensive solid solution series. The textural occurrence of EGM can be highly variable, from orthocumulates (less common, e.g., Ilímaussaq and Lovozero), to late magmatic or hydrothermal occurences (more common, e.g., Pilansberg, Tamazeght, Langesundfjord). As the structure of EGM contains several different structural sites, a large number of minor and trace elements can be accomodated. Accordingly, compositional and textural variations of EGM are promising monitors of various magmatic and hydrothermal processes.

The stability of EGM depends on a number of factors, such as melt composition (especially peralkalinity and Zr content), redox conditions, and the availability of volatile components (such as F, Cl and H_2O). If any of these factors are not met, other Zr-phases such as zircon, catapleite and others are stabilized. These parameters have a major impact on enrichment processes during the differentiation of a magmatic system, e.g. for REE and Zr.

The type locality for eudialyte$_{s.s.}$ is the Ilímaussaq complex in South Greenland. Some of its agpaitic rocks contain economically very attractive levels of REE, Zr, Nb and others. The complex has therefore a long prospecting and exploration history and recent developments on the REE market as well as political changes in Greenland have led to increased exploration activity in the complex. Using the Ilímaussaq complex as a type example, we show, that EGM are reliable monitors of processes such as fractional crystallization, formation of layering, magma replenishment, late-magmatic to hydrothermal overprint and supergene alteration.