

Compositional variation of apatite from rift-related alkaline igneous rocks of the Gardar Province, South Greenland

**SARA LADENBURGER¹, MICHAEL A.W. MARKS^{1,*}, BRIAN UPTON², PETER HILL^{2,†}, THOMAS WENZEL¹,
AND GREGOR MARKL¹**

¹Eberhard Karls Universität Tübingen, Mathematisch-Naturwissenschaftliche Fakultät, FB Geowissenschaften, Wilhelmstrasse 56, D-72074 Tübingen, Germany

²School of Geosciences, Grant Institute, University of Edinburgh, West Mains Road, Edinburgh EH9 3JW, U.K.

ABSTRACT

Textural and compositional variations of apatite from rift-related gabbros, syenogabbros, syenites, quartz-syenites, and nepheline syenites of the Mid-Proterozoic Gardar Province (South Greenland) are presented and compared to apatite compositions from other rock suites.

The observed zoning textures of apatite are interpreted to represent (1) primary growth zonation (concentric and oscillatory) that formed during magmatic differentiation and (2) secondary irregular overgrowths, patchy zonation, and resorption textures, assigned to metasomatic overprinting due to interaction with fluids/melts and intra-crystalline diffusion. Compositional variation in the apatites is mainly due to coupled substitutions of Ca and P by variable amounts of Si, Na, and REE, which show increasing concentrations during magmatic differentiation. Furthermore, F concentrations in apatites increase from gabbroic through syenogabbroic to syenitic rocks, whereas Cl concentrations show the opposite trend.

Compared to apatite compositions from gabbroic, dioritic, and granitic rocks in general, apatites from alkaline rock suites are characterized by exceptionally high contents of REE and Si and in some alkaline rocks they attain Sr contents comparable to those reported from carbonatites. Typical low Mn and S contents are probably a result of low oxygen fugacity during crystallization at relatively high temperatures.

Keywords: Alkaline rocks, apatite, compositional variation, petrogenetic indicator