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Trace element composition of sodalite from the peralkaline Ilímaussaq complex, South Greenland, as an indicator of melt composition changes

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The Mesoproterozoic Ilímaussaq intrusion, a member of the Gardar igneous province, South Greenland, comprises an extraordinary diversity of alkaline to agpaitic (i.e. (Na+K)/Al $>$ 1.2) rocks. Its development is characterised by the successive intrusion of three pulses of magma to 3-4 km depth [1]. The first one produced an augite syenite, which is now found as the outer shell of the intrusion. Subsequently, a sheet of alkali granite intruded the augite syenite. In a third stage, various agpaitic nepheline syenites (pulaskite, sodalite foyaite, naujaite, kakortokite, and lujavrite) were formed containing nepheline, eudialyte, sodalite, alkali feldspar, aegirine and arfvedsonite in various proportions.

One of the nepheline syenites, the naujaite, is an up to 600m thick and slightly layered body that represents approximately 40% of the volume of the complex [2]. The naujaite is a roof cumulate formed by flotation of minerals less dense than the melt, mainly sodalite. The sodalite crystals are euhedral and show oriented inclusions of aegirine. Interstitial minerals are aegirine, arfvedsonite, eudialyte, and alkali feldspar.

In the cathodoluminescence microscope, the sodalite grains show zonation with up to three generations expressed by light orange to brownish colours. Some grains are concentrically zoned, others seem to have old cores. These cores have darker orange luminesence colours than the overgrowths, whereas the concentric zonation starts with a light orange zone in the middle changing to brownish colours at the rim. In some samples, the euhedral crystals are overgrown by young and irregular rims of a younger sodalite generation with brightly orange colours, which may be related to hydrothermal activity.

The details of melt compositional changes during sodalite growth reflected by the zonation will be investigated by using microprobe and LA-ICP-MS analyses focussing especially on the halogens Cl, Br and I.

[1] Larsen & Sørensen (1987): Geol. Soc. Sp. Publ. 30, 473-488.

[2] Andersen et al. (1981): Grønl. Geol. Unders. Rapp. 103, 39.