



## **Complexity of metasomatic and magmatic processes on crust-mantle boundary beneath the Hebridean terrane - mysterious origin of ultramafic and felsic xenoliths and megacrysts from Loch Roag monchiquite (Lewis Island, Outer Hebrides, UK).**

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The xenolith suite in from Loch Roag (Lewis Island, N Scotland) Eocene (Faithfull et al. 2012, JGS) monchiquite dyke comprises ultramafic, mafic and felsic rocks. The peridotitic xenoliths represent samples of Archean mantle underlying marginal parts of North Atlantic Craton, while the origin of non-peridotitic xenoliths is not clear.

The studied xenoliths are anhydrous diorites (plagioclase, clinopyroxene formed after replacing of orthopyroxene, apatite, opaques), syenite (dominating K-feldspar, clinopyroxene, biotite, apatite, spinel) and biotite clinopyroxenites (+apatite), megacrysts are represented by clinopyroxene and K-feldspar, both enclosing inclusions of clinopyroxene, biotite and apatite. Megacrysts of alkaline, Na-rich feldspar associated with corundum and HFSE-bearing minerals have been also described from this locality (Menzies et al., 1986).

Clinopyroxene in anhydrous diorites and biotite clinopyroxenites is Al-augite/Al-diopside with Mg#=56-75 and 64-85 (Al=0.2-0.4 a.pfu), respectively, and negative Nb-Ta, Zr-Hf, Sr and Ti anomalies. Plagioclase (An40-25) in diorites is characterized by negative Nb-Ta, Zr-Hf and Ti anomalies. Composition of clinopyroxene (Al, Ti diopside) from syenites, K-feldspar megacrysts and clinopyroxene megacrysts are similar in terms of major elements (Mg#=45-72; Al=0.2-0.5 a.pfu), but the trace element concentration in clinopyroxene from syenite is lower than in other rocks from this group. K-feldspar forming megacrysts and syenite exhibit wide range of compositions (>Or55, An0-10), but the latter one is significantly poorer in trace elements. Composition of apatite in clinopyroxene megacryst imply magmatic origin of the suite (O'Reilly and Griffin, 2000, Lithos).

Our study shows that the anhydrous diorites and biotite clinopyroxenites from Loch Roag may be genetically related. Rocks similar to anhydrous diorite occurring in Western Redhills igneous complex from Isle of Skye (Scotland) have been interpreted as late fractionates from deep-seated mafic intrusion (Wager & Vincent, 1961, MinMag). We therefore suggest that also in Loch Roag diorite and clinopyroxenite may represent fractionates from mafic melt(s), possibly at different stages of evolution.

Origin of syenite as well as K-feldspar and clinopyroxene megacrysts is not certain, but we suggest that they may have crystallized from K-rich silicate magmas formed by small-scale melting of K-enriched mantle peridotites. Albite-rich megacrysts were interpreted by Upton et al. (2009, MinMag) as precipitates from Na-rich melts formed by melting of mantle peridotites previously metasomatized by Na-carbonatite. Our results, together with those of Upton et al. (2009, MinMag) points to extremely complex metasomatic history of lithospheric mantle underlying Hebridean terrane.

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