Boninite-derived mafic-ultramafic intrusives from Northern Victoria Land (Antarctica): Implications for mantle source metasomatism

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The Cambrian mafic-ultramafic sequence from Niagara Icefalls area in Northern Victoria Land represents a rare case of boninite-derived intrusive complex. The sequence mostly consists of dunites, orthopyroxenites, melanorites and gabbronorites, locally associated with hornblende granitoids that were most likely emplaced at upper levels of the continental crust. The mafic-ultramafic sequence was interpreted to be formed by boninite-type melts according to the fractional crystallization evolution: olivine → orthopyroxene → orthopyroxene + plagioclase ± clinopyroxene. The concentrations of incompatible trace elements in the whole sequence are extremely low (e.g., TiO_2 ≤0.06 wt%, Y <3 ppm). The whole-rock REE chondrite-normalized patterns vary from slightly depleted to enriched in the LREE (La_N/Sm_N = 3.5-0.5), in agreement with the REE variations observed for the included clinopyroxenes. The initial ε_{Nd} of the mafic-ultramafic sequence spans one order of magnitude, which roughly decrease with increasing La_N/Sm_N. The granitoids associated with the mafic-ultramafic sequence have nearly homogeneous trace and Nd-Sr isotopic compositions. In particular, the granitoids have high REE amounts, with LREE-enriched patterns (La_N/Sm_N = 4.3-3.4), and highly radiogenic initial Nd-Sr values. The highest initial ε_{Nd} and the lowest initial $^{87}Sr/^{86}Sr$ (0.7035) of the mafic-ultramafic sequence document the involvement of isotopically depleted asthenospheric sources. The wide Nd isotopic variations in the mafic-ultramafic sequence could be correlated with the boninite-type parental melts experiencing assimilation of crustal material. However, the most enriched isotopic compositions were found for the most primitive rocks: the dunites and the orthopyroxenites. We thus attribute the enriched isotopic compositions to a mantle source metasomatized by components derived from subducted oceanic metasediments.

High temperature alteration of the gabbroic oceanic crust (Ligurian ophiolites, Italy): Evidence for hydrothermal-magmatic interactions

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The gabbroic bodies from the Jurassic Ligurian ophiolites are structurally and compositionally similar to the gabbroic sequences from the oceanic core complexes of the Mid Atlantic Ridge. The high temperature cooling evolution the Ligurian gabbros is locally associated with formation of hornblende-bearing felsic dykes and hornblende vein networks. The hornblende veining is correlated with widespread development of hornblende as coronas/pseudomorphs after the igneous clinopyroxene in the host gabbros. We also found hornblende-rich gabbros as dykes/sills within mantle peridotites.

The hornblendes from the felsic dykes and the hornblende gabbros are characterized by low Mg#, CaO and Al_2O_3, negligible Cl, and high TiO_2, K_2O, REE, Y, Zr and Nb. The whole-rock Sm-Nd isotopic compositions of the felsic dykes and the hornblende gabbros define a Jurassic isochron with a MORB-type initial $^{143}Nd/^{144}Nd$ ratio. The $\delta^{18}O$ of the hornblendes and coexisting zircons from these rocks do not decipher the presence of a seawater component in these melts. We propose that the felsic dykes and the hornblende gabbros formed by SiO_2-rich silicate melts derived from high degree fractional crystallization of MOR-type basalts.

The vein and the coronitic/pseudomorphic hornblendes show high Mg# and CaO, significant Cl and low TiO_2 and K_2O. The coronitic/pseudomorphic hornblendes have trace element compositions similar to those of the clinopyroxenes from the gabbros and $\delta^{18}O$ close to that of seawater, thereby documenting an origin by reaction between migrating seawater-derived fluids and the host gabbros. The vein hornblendes commonly show slight LREE enrichment and relatively high values of Nb and $\delta^{18}O$. The crystallization of these hornblendes most likely required the involvement of both seawater and magmatic components.

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