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Nature and evolution of Northern Victoria Land subcontinental lithospheric mantle (Antarctica)

Barbara Faccini, Massimiliano Melchiorre, Massimo Coltorti, and Costanza Bonadiman
Department of Earth Science, University of Ferrara, Italy (mlcmsm1@unife.it)

The nature of subcontinental lithospheric mantle (SCLM) from Northern Victoria Land (NVL, Antarctica) was highlighted by the study of two spinel-bearing mantle xenolith suites: Baker Rocks (BR) and Greene Point (GP). BR xenoliths are mainly amph-bearing lherzolites, with minor harzburgites and pyroxenites, whereas those from GP are anhydrous lherzolites and harzburgites. In both suites pyrometamorphic textures are superimposed on protogranular to porphyroclastic textures. BR primary clinopyroxene (cpx1) sometime show spongy or reaction rims made up of secondary cpx, olivine, spinel and glass. Cpx1 changes in composition (cpx-A) before being transformed into amphibole. In GP, orthopyroxene (opx) is the most reactive phase, often rimmed by secondary cpx and glass.
GP cpx1 show variable enrichments in LILE, Th and U, with REE patterns varying from slightly depleted [(La/Yb)N, 0.16-0.34] to moderately enriched [(La/Yb)N 0.65-1.45]. Some cpx1 have very low Yb values (YbN, 1.97-2.32), probably recording a previous melting episode in the garnet stability field (Perinelli et al., 2006). BR cpx1 show high and more variable degrees of LREE enrichment [(La/Yb)N, 1.16-9.08], while Cpx-A is the most enriched in both LREE and HREE.
BR glasses have low and highly variable SiO2 contents with TiO2 increasing from amph-free to amph-bearing samples. They are enriched in LILE, LREE [(La/Yb)N, 11.8-21.2)], Nb and Ta, and depleted in K. On other hand GP glasses have very high SiO2 and alkali contents, but TiO2 is low. They show similar enrichment in all incompatible elements but for K, Zr (and Hf), that display positive anomalies, whereas Nb and Ta show flat to negative anomalies.
Water contents of cpx and opx were determined by FTIR (Bonadiman et al., 2009). Both pyroxenes in GP collection are very dry, with water content ranging from 9 to 16 ppm in opx and from 5 to 16 ppm in cpx. In BR pyroxene water content is higher and much more variable (opx: 39-166 ppm; cpx: 82-399 ppm), but the differences are not related to the presence of amphibole that is also characterized by a low water content (Nazzareni et al., 2010).
Sr, Nd and Hf isotopic ratios have been measured for the two suites on separated cpx crystals. In BR cpx 87Sr/86Sr varies between 0.70296 and 0.70488, 143Nd/144Nd lies within a narrow range (0.51271–0.51296), and 176Hf/177Hf ranges from 0.28300 to 0.28337. Cpx from GP have similar 87Sr/86Sr (0.70277 to 0.70434), whereas 143Nd/144Nd goes from 0.51261 to 0.51347, and 176Hf/177Hf from 0.28332 to 0.28519. The higher Hf isotopic values of GP xenoliths can be reconciled with a melting episode in the garnet facies, re-equilibrated in the spinel stability field.
The presence of an ancient eclogite in the NVL SCLM was invoked by Melchiorre et al. (2010) to take into account for the high Os isotopic values of sulphides related to metasomatic reactions at BR. GP sulphides (much less abundant) do not record similar values.
Two different metasomatizing agents percolating the BR and GP lithospheric mantle sections were identified. In BR a TiO2-rich nephelinitic melt interacted mainly with cpx1 increasing TiO2, Al2O3 and REE and decreasing SiO2 contents toward the composition of amphiboles. At GP a hotter mantle records metasomatism induced by a melt richer in K2O and poorer in TiO2, probably undersaturated, that reacted mainly with opx to generate secondary cpx and SiO2-rich glasses.

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