DEMERS-ROBERGE Alexandra (2016): Peridotite Xenoliths from Sierra Baguales (Patagonia): Insights into melting and refertilisation processes in the mantle wedge

Abstract

Mantle xenoliths are abundant in many different localities throughout Patagonia. They are found in plateau and post plateau alkaline volcanics (Miocene to Pleistocene) from the Patagonian back-arc region. The latter is due to the subduction of the Chile triple junction, where the Nazca and the Antarctica plates subduct under the South American plates, leading to the opening of a slab window. Mantle xenoliths from these localities are important because they provide information about the Andean mantle wedge. In the present study, mantle xenoliths, which include spinel bearing dunites, harzburgites, lherzolites and ol-websterite, were collected in Sierra Baguales, Austral Patagonia, around 300 km east of the subduction trench in Chile. We use petrographic analyses, thermometry as well as major and trace element geochemistry in order to identify the different processes which have affected the lithospheric mantle under Sierra Baguales. Harzburgites and lherzolites yield equilibration temperatures between 850°C to 940°C and 860°C to 910°C, respectively, using various thermometers. Olivine, clinopyroxene and orthopyroxene Mg# range from 90 to 92.3, 89 to 94.7 and 90.5 to 92.6 respectively. Spinel is magnesiochromite and has Cr# between 25 to 50 from the most fertile to the most depleted peridotite. There are 4 distinct groups of REE patterns in clinopyroxenes : convex shaped (group 1), convex shaped with LREE enrichment (group 2), flat (group 3) and higher LREE than HREE (group 4). We estimate, based on the best fit of MREE to HREE content in these cpx, that the initial fractional melting process which depleted these peridotites start melting in the garnet stability field (0 to 7%) following by moderate melt extraction in the spinel stability field (6 to 9%). Secondary melt enrichment associated to chromatic effects related to melt circulation explain the enrichment observed in cpx from group 2 and 3. The metasomatic melt is an alkaline melt which is cogenetic with the host basalt. A slab-derived component is noticeable in the trace element melt patterns (positive Th, U and Pb anomalies). The studied samples show a lithological continuity in correlation with the degree of refertilization. The alkaline metasomatic liquids are likely to have percolated through a dunite channel, in which sample EC_09 was formed, as a replacive dunite. The melt percolated through the channel walls and enriched strongly the dunites EC_03 and EC_14 which were directly in contact with the dunite channel, and then the harzburgites and lherzolite. Dunites are then the product of melt rock reactions with an undersaturated silica melt. The presence of Ol-websterite EC_07 may have been favored by the circulation of adakitic melts. The influence of adakitic melts in the re-enrichment patterns from the peridotites of Cerro del Fraile (50 to 80 km west of Sierra Baguales) is suggested by Faccini et al. (2013) and Killian and Stern (2002) and can be related to the geographical position of the locality, implying the potential evolution of the nature of the mantle wedge and upper mantle from West to East in Austral Patagonia.