



Mantle xenoliths from South Auckland Volcanic Provinces (New Zealand)

B. Faccini (1), C. Bonadiman (1), M. Coltorti (1), and R. Briggs (2)

(1) Department of Earth Sciences, University of Ferrara, Italy, (2) Department of Earth Sciences, The University of Waikato, Hamilton, New Zealand

Two suites of mantle xenoliths have been collected from the basaltic outcrops of Ngatutura and Okete Beaches. These alkaline volcanics are located in the western part of the North Island (New Zealand) and belong to the South Auckland Volcanic Province. They are situated in an intraplate tectonic setting behind the currently active Taupo Volcanic Zone, and 300 km above the subducting slab. The host lavas show restricted compositions, ranging from hawaiites to nepheline hawaiites, and are enriched in LIL, LRE, and HFS elements.

The Ngatutura samples (NG) are equigranular and protogranular dunites; only NG1 have modally detectable amount of opx and cpx. Dunite NG6 is crosscut by a network of orthopyroxene veins and NG4 is the sole composite lherzolite/dunite sample. In dunites olivine (ol) can be found as medium/coarse grained (average 2.5 mm) crystals; kink-banding is visible in some cases. Orthopyroxene (opx), is smaller (up to 1 mm) and interstitial. Spinel (sp) is very small, black, euhedral and often enclosed within olivine.

The majority of Alexandra samples (OK) is constituted by protogranular and porphyroclastic cpx-poor lherzolites, with minor porphyroclastic harzburgites and rare dunites. Cumulitic clinopyroxenites have also been found. Ol in lherzolites and harzburgites is coarse grained (up to 9 mm), with the characteristic kink-banding. Opx can be found as medium-coarse grained (up to 5.5 mm in porphyroclastic samples), and shows exsolution lamellae. Cpx is small (up to 1.5 mm) and exhibits spongy textures. In clinopyroxenites ol is characterized by a medium grained (up to 2 mm) kink-banded crystals. Cpx is arranged in big individuals (up to 3.5 mm across) with exsolution lamellae. Sp can be found both as primary, bigger crystals (sometimes with reaction rims) or as secondary idiomorphic and smaller crystals. Amphibole occurs only in the OK8 ol-websterite.

Both xenolith suites have sp as the only aluminum phase. Metasomatic reactions occur in both mantle and cumulitic lithotypes. Two kind of reaction textures are found. The first one consists of a complete recrystallization of previous unrecognizable phases into a mingling of small secondary iso-oriented minerals in an altered glassy matrix. The second mainly involves opx, which is partially destabilized and forms thick, interconnected areas made up of secondary phases and glass.

Ol in NG samples have mg# [$\text{MgO}/(\text{MgO}+\text{FeO})$ mol%] in the range of 0.84-0.90 sensibly lower than those of OK peridotites (mg# = 0.89-0.92). The highest NiO content is recorded in the OK lherzolites (NiO up to 0.44 wt%). Major element compositions of opx are clearly distinct in the two xenolith suites. In NG dunites, opx have lower mg# and extremely low aluminum contents, whereas OK harzburgites and lherzolites have opx with mg# and Al_2O_3 typical of mantle enstatites (NG opx: mg# = 0.88-0.90; Al_2O_3 = 0.56-1.23 wt%; OK opx: mg# = 0.89-0.93; Al_2O_3 = 3.42-5.03 wt%). The opx in the vein of sample NG6 has variable mg values (mg# = 0.86-0.90), but Al_2O_3 and TiO_2 almost absent (< 0.19 wt% and < 0.04 wt% respectively).

In both populations cpx show similar mg# (NG = 0.88-0.93; OK = 0.89-0.92). Al_2O_3 content range from 8.33 wt% in cpx from OK6 lherzolite to <0.89 wt% in cpx from NG4 dunite, close to the diopside end-member ideal composition. Spinel in NG dunites are very relict in composition with cr# up to 0.80, whereas those from the OK peridotites have lower cr#, clustering around 0.20, except for spinels in dunite OK11 (average cr# = 48).

The extreme heterogeneity in the chemical composition of these peridotitic assemblages point toward a complex petrological evolution of the lithospheric mantle beneath the north-western part of the North Island characterized by various depletion events, followed by enrichment process/es also related SiO_2 -saturated magmas.