

The Bogota pyroxenites (New Caledonia): new insights on mantle heterogeneity in young subduction systems

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This contribution deals with a comprehensive petrological and geochemical investigation of a new set of subduction-related mantle pyroxenites from the New Caledonia ophiolite. We have investigated pyroxenite layers enclosed in refractory mylonitic harzburgites from the Bogota peninsula shear zone, which records HT deformation along a paleotransform fault (Chatzaras et al., 2020 and references therein).

The pyroxenites (~ 5-15 cm-thick) generally cut the peridotite foliation at variable angles, but concordant, locally boudinaged, layers also occur. The samples of this study display textures ranging from cumulitic to porphyroclastic or granoblastic-polygonal. They mostly consist of amphibole-bearing websterites (Amp=5-35 vol%; Opx=40-70 vol%; Cpx ~30 vol%), but minor olivine orthopyroxenites (Opx ~95 vol%; ± 5 vol% Ol and/or Cpx) are also present. Accessory phases include high-Ca (An₈₂₋₈₆) plagioclase, Cr-rich spinel (Cr#=52-73), sulfides and, occasionally, apatite.

Pyroxenes show high Mg# (Mg# Opx=79-85 and ~92; Mg# Cpx=84-88 and ~94 for the websterites and orthopyroxenites, respectively), coupled to low Al₂O₃ contents. Amphibole is a high Mg# (78-85) edenite. Application of conventional pyroxene thermometry yield equilibration T=930-995 °C, comparable to the enclosing harzburgite (~950 °C). By contrast, T calculated with Ol-Sp geothermometer for the mylonitic harzburgite provide notably lower values (710-740 °C), suggesting slow thermal equilibration for the whole sequence.

Bulk rocks exhibit variable Mg# (82-91) coupled to REE concentrations ranging between 0.1-10 times chondritic values, with the orthopyroxenites showing the lowest absolute contents. The pyroxenites display flat to LREE-depleted (La_N/Sm_N=0.28-0.92) patterns, together with weak MREE-HREE fractionation (Gd_N/Yb_N=1.73-1.92) and Eu negative anomalies. As a whole, clinopyroxene REE patterns mirror bulk rocks at higher absolute values.

Putative melts in equilibrium with clinopyroxene of the orthopyroxenites yield high Mg# (~80) and strong boninitic affinity. By contrast, the parental melts in equilibrium with the websterites are characterised by remarkably enriched compositions (REE abundances up to 100 x ch.), variable LREE-HREE fractionation (La_N/Lu_N=3-19) and flat to fractionated HREE (Gd_N/Lu_N=1-2).

Our new results highlight a remarkable heterogeneity of the forearc mantle due to the emplacement of different subduction-related melts during and after the HT shearing deformation of the host peridotite. We propose that the geodynamic setting of the Bogota mantle shear zone needs to be revised in the light of these new results and preliminary ⁴⁰Ar/³⁹Ar dating of amphibole (~56 Ma) from two websterites of this study (Teyssier, personal communication).

Chatzaras V., Tikoff B., Kruckendberg S.C., Titus S.J., Teyssier C. & Drury M.R. (2020) - Stress variations in space and time within the mantle section of an oceanic transform zone: Evidence for the seismic cycle. *Geology*, 48, 569-573.