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Supra-subduction mantle pyroxenites in an infant subduction system: the New Caledonia ophiolite record.

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Pyroxenites constitute the major form of heterogeneity in the upper mantle. Their occurrence in supra-subduction zone settings is mostly testified by veins and layers in refractory ophiolitic peridotites, where they represent a crucial witness of melt migration in the forearc/subarc environment [1,2]. The New Caledonia ophiolite hosts one of the largest forearc mantle section worldwide, providing a unique perspective into upper mantle processes. The sequence is dominated by ultra-depleted harzburgites [3], locally overlain by mafic-ultramafic cumulates [4,5,6]. The harzburgites are highly refractory residues that register a multi-phase evolution, including fluid-assisted melting in a forearc environment and contamination by fluid- and melt inputs triggered by Eocene subduction [1]. Pyroxenitic rocks intruding the harzburgites are only known in the Bogota peninsula shear zone, which records HT deformation along a paleotransform fault [7]. In this contribution, we report a comprehensive petrological and geochemical characterization on a new set of pyroxenites from this locality. The pyroxenites (~5-15 cm-thick) generally cut the peridotite foliation at variable angles, but concordant, locally boudinaged, layers also occur. Pyroxenite textures range from cumulitic to porphyroclastic or granoblastic-polygonal. The studied samples mostly consist of amphibole-bearing (5-44 vol.%) websterites, with variable amounts of orthopyroxene (27-67 vol.%) and almost constant clinopyroxene contents (~ 25-29 vol.%). Minor olivine-bearing orthopyroxenites are also present. Accessory phases include high-Ca (An= 82-86 mol%) plagioclase, Cr-rich spinel (Cr# = 50-61), sulfides and, occasionally, apatite. Pyroxenes displays high Mg# (Mg# Opx= 91-92; Mg# Cpx= 84-93), coupled with low Al2O3 contents (0.97-1.92 wt% and 1-2.42 wt% for orthopyroxene and clinopyroxene, respectively). Amphibole is high Mg# edenite. Application of conventional pyroxene thermometry yield equilibration temperatures ranging between 930-1040°C, comparable to the enclosing harzburgites (~ 950°C), whereas amphibole-plagioclase geothermometer provides lower temperatures (~ 800°C). Bulk rock composition of the websterites show variable Mg# (82-91) and REE concentrations ranging between 1 to 10 times chondritic values. They are characterized by flat to LREE-depleted (LaN/SmN 0.28-0.92) patterns, coupled to weak MREE-HREE fractionation (GdN/YbN = 1.73-1.92) and Eu negative anomalies. By contrast, orthopyroxenites display notably lower concentrations (0.1≤REE≤1 chondrite abundances). As a whole, clinopyroxene REE patterns of the websterites mirror bulk rocks at higher absolute values. Putative melts in equilibrium with clinopyroxene indicate strongly enriched compositions (up to 300 times chondritic values) coupled to variable LREE-HREE fractionation (LaN/LuN = 3-19) and flat to fractionated HREE (GdN/LuN 1-2).

Such enriched liquids, which show some analogies with pre-obduction adakite-like dikes [8], have never been recorded in the MTZ cumulitic sequence of the New Caledonia ophiolite and shed new light on the magmatic activity in the early stage of subduction.

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