The contrasting geochemical message from the New Caledonia gabbronorites: insights on depletion and contamination processes of the sub-arc mantle in a nascent arc setting

Secchiari A.*[1], Montanini A.[2], Bosch D.[3], Macera P.[4] & Cluzel D.[5]

[1] Fachbereich Geowissenschaften, Freie Universität Berlin, Germany
[2] Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale, Università di Parma
[3] Géosciences Montpellier, Université de Montpellier, France
[4] Dipartimento di Scienze della Terra, Università di Pisa
[5] Département des Sciences et Techniques, Université de la Nouvelle Caledonie, Nouméa, New Caledonia

* *Corresponding email*: secchiari@zedat.fu-berlin.de

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The New Caledonia ophiolite hosts one of the rare examples of crust-mantle sections formed in a nascent arc setting, thus providing the unique opportunity to improve our understanding of the formation of lower arc roots. This sequence includes ultra-depleted harzburgites that suffered very high melting degrees (□20-25%), overlain by mafic-ultramafic lithologies. The ultramafic rocks (mainly dunites and wehrlites) resulted from melt-peridotite reactions involving primitive arc tholeiites and boninitic melts. The mafic rocks are olivine gabbronorites occurring in the upper part of the sequence as metre-sized sills. In this study a comprehensive geochemical and isotopic (Sr, Nd, Pb) characterization of the New Caledonia olivine gabbronorites has been carried out. The gabbronorites are mainly formed (□50-80 vol%) by subhedral Ca-rich plagioclase (An up to 96 mol%). Mg-rich olivine (5-15 vol%, Fo = 87-89 mol%) occurs as irregularly shaped, resorbed crystals. Clinopyroxene (15-20 vol%) is generally rimmed by interstitial to poikilitic orthopyroxene (5-15 vol%). Fe-Ti oxides and hydrous phases are absent. Clinopyroxene shows high Mg# (88-92), low Al_2O_3 (1.5-2.4 wt%) and negligible TiO_2 and Na_2O contents. Whole rock compositions display high Mg# (86-92) and concentrations of incompatible trace elements lower than arc rocks worldwide. *REE* patterns show *LREE* depletion, nearly flat *HREE* segments ($0.82 \leq Dy_N/Yb_N \leq 1.00$), low *HREE* ($Yb_N = 0.2\text{-}0.9$) and positive Eu anomalies. Cpx trace element chemistry mirrors the extreme depletion shown by the whole rock. In contrast with this depleted nature, positive spikes for the most incompatible, fluid mobile elements (FME), *i.e.*, Pb and Sr, can be observed both for whole rock and Cpx. The calculated compositions of the putative melts in equilibrium with the gabbroic rocks are consistent with melting of a refractory mantle source in the spinel stability field. The inferred melts have high Mg# of 75-76. Trace element contents indicate derivation from ultra-depleted liquids, sharing some affinities with the most primitive boninites of the Bonin Islands, but with lower contents of *LREE* and other highly incompatible trace elements (Ba, Pb, Sr, Zr, Hf). FME enrichments, together with high Pb/Ce, Sr/Nd and Ba/Th ratios, shed light on the involvement of a subduction-related fluid in the magma genesis of these rocks. Nd isotopic data ($+8.2 \leq \varepsilon_{Ndi} \leq +9.2$) coupled with Pb isotopic values trending from DM to Pacific sediments compositions, also support an origin from a homogenous DM reservoir variably re-enriched by slab-derived fluids. We interpret the contrasting geochemical signature of the New Caledonia gabbronorites as reflecting a derivation from a refractory mantle source, which experienced contamination processes by fluids, some of which are related to slab dehydration during the onset of the Eocene subduction.