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The lherzolite-pyroxenite-horneblendite association from St. Lucia (Corsica): evidence for refertilization of subcontinental mantle

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The St. Lucia nappe from Alpine Corsica includes a lower crustal section exhumed along the European rifted margin of the Ligurian Tethys (Beltrando et al., 2013). The lower crustal rocks consist of a High Grade Mafic Complex and a Granitoid Complex of Early Permian age. The base of the Mafic Complex is associated with up to 50-m thick mantle slices formed by mylonitic spinel-bearing lherzolites and mm- to cm-thick pyroxenite and hornblendite layers elongated concordantly with the foliation of the host rocks. These rocks represent a unique occurrence of subcontinental lithospheric mantle in Corsica.

The mylonite microstructure in the lherzolites is characterized by aligned porphyroclasts of pyroxene + spinel in a fine-grained polyphase matrix composed of olivine + pyroxenes + spinel. Relics of an older low-strain spinel tectonite predating the mylonite deformation are locally preserved as Opx porphyroclasts mantled by neoblastic Cpx + Opx + spinel. Major element compositions of olivine, Cpx and spinel porphyroclasts of the lherzolites attest a fertile geochemical signature. The pyroxenites include (i) Opx-poor websterites with disseminated Cr-poor spinel, kaersutite and accessory Fe-Ni sulphides, (ii) Cr-rich spinel clinopyroxenites. Pyroxenites have fine-grained granoblastic texture with Al-rich Cpx porphyroclasts displaying high TiO_2 in the websterites (~1.0 - 1.5 wt.%) and lower contents (~0.5 wt.%) in the clinopyroxenites. The peridotites show lower Fo values in olivine, increasing TiO_2 contents in Cpx, decreasing Cr# in spinel and crystallization of Ti-rich amphibole over a distance < 2 cm from the websterite contact. Spinel-facies mylonite recrystallization in both lherzolites and websterites occurred at ~850-900 °C. The hornblendites are made up of K_2O-rich kaersutite + Ti-rich phlogopite + ilmenite. The Cpx porphyroclasts from the lherzolites show heterogeneous trace element compositions pointing to four different geochemical signature: Type 1 Cpx is markedly LREE-depleted (CeN/SmN down to 0.05) with nearly flat MREE-HREE at 8-10 times chondrite; Type 2 Cpx is moderately LREE-depleted (CeN/SmN = 0.31-0.49) and Type 3 has nearly flat LREE; Type 4 Cpxs are weakly LREE depleted, peak at MREE and show a slight HREE depletion with respect to MREE (GdN/YbN = 1.1-1.6) and variable HREE (e.g. YbN = 7-12). The websterite Cpxs display convex-upward REE patterns and higher concentrations of incompatible trace element. The Cpx from the clinopyroxenites is very similar to Type 4 Cpx from the lherzolites. Kaersutite from the hornblendites are enriched in Rb, Ba, U, Nb, Ta, LREE and depleted in HREE with respect to the websterite ones.

The peridotite protoliths are interpreted as residua after low degrees of fractional melting of spinel facies DM. Type 4 Cpx from the peridotite reflect equilibrium with infiltrating MORB-type melts, which most likely produced also the clinopyroxenite layers. Computed melts in equilibrium with Cpx and kaersutite from the websterites and the hornblendites suggest transitional to alkaline affinity. This study shows that the St. Lucia mantle slices underwent injections of melts with MORB to alkaline affinity forming different kinds of magmatic layers, which were associated with a metasomatic imprint in the ambient peridotite.

Beltrando M., Zibra I., Montanini A. & Tribuzio R. 2013. Crustal thinning and exhumation along a fossil magma-poor distal margin preserved in Corsica: a hot rift to drift transition. Lithos, 168-169, 99-112.