Abstract, IMA 2010, p. 208

Ultramafic cumulates of oceanic mantle affinity in a continental subduction zone: UHP garnet peridotites from Pohorje (Eastern Alps, Slovenia)

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Rare UHP garnet peridotites have been reported from the Slovenska Bistrica Ultramafic Complex (SBUC) in the Pohorje Mts., NE Slovenia, Eastern Alps [1]. The SBUC is a strongly serpentinised remnant of oceanic mantle entrained within lower Central Austroalpine basement units during Eo-alpine intracontinental subduction in the Cretaceous [1,2]. Peak *P-T* conditions of the garnet peridotites reached up to 4 GPa and 900°C [1].

The UHP metamorphic assemblage of the garnet peridotites consists of olivine (Fo 87-90), Mg-rich (Py 65-67) and low-Cr (Cr_2O_3 <0.2 wt.%) garnet and low-Al orthopyroxene and diopside. Remnants of magmatic minerals include Al and Cr-rich Opx and Cpx, Ti-rich chromian spinel, ilmenite and apatite, but their primary compositions are seldom preserved. Low-TiO_2 (<0.3 wt.%) spinel with Cr# 0.1-0.5 is replaced or rimmed by metamorphic garnet, whereas TiO_2-rich spinel with higher Cr# is not. Two types of magmatic clinopyroxene can be recognised: (a) low-Ti (0.5±0.1 wt.% TiO_2) Cpx with LREE-depleted trace-element patterns that strongly resembles Cpx in primitive olivine-rich gabbros from an oceanic spreading ridge [3], and (b) high-Ti cpx (1.4±0.4 wt.% TiO_2) with strongly negative Eu anomalies and less depleted LREE, which indicates crystallisation from more fractionated melts than low-Ti Cpx. Both types of Cpx show strong HREE depletions towards the crystal rims probably due to partial re-equilibration with garnet during meta-morphism. Fine-grained metamorphic Cpx shows the strongest depletions in HREE (Lu_N<0.3) and has very low TiO_2 (<0.1 wt.%) which indicates equilibrium with TiO_2-poor (<0.1 wt.%) metamorphic garnet.

Bulk rock compositions comprise 28-33 wt.% MgO, 7-10 wt.% Al_2O_3, 3-8 wt.% CaO and 0.3-0.8 wt% Na_2O. They show nearly flat and subparallel REE patterns over a range of HREE contents (Lu_N=0.5-3) and commonly have positive Eu anomalies (Eu*/Eu 1.0-2.3). This suggests that the protoliths were olivine-rich gabbros with ca. 60% olivine, 25% An-rich plagioclase and 10% Cpx, and not refertilised mantle, which is supported by their low but fractionated PGE contents (0.1-0.2 ppb Ir, Pd/Ir=5-15). Trace-element patterns are very similar to those of Pohorje zoisite and kyanite eclogites of predominantly MORB affinity.

The geochemistry of the garnet peridotites and their association with the SBUC and eclogites indicates their oceanic lithosphere origin. This implies that ultramafic plagioclase-bearing cumulates, the protoliths of garnet peridotites, were incorporated into the continental crust during subduction and subsequently experienced UHP metamorphism.

[1] Janak, M. et al. (2006) *J. Metamorph. Geol,*. **24**, 19-31. [2] De Hoog, J.C.M. et al. (2009) *Lithos,* **109**, 209-222. [3] Drouin, M. et al. (2009) *Chem. Geol.*, **264**, 71-88.