

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

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Summary

Garnet peridotites from the Slovenska Bistrica Ultramafic Complex (SBUC) in the Pohorje Mts., Eastern Alps, are metamorphosed olivine-rich gabbros that crystallised at low pressures (<5 kbar) within depleted mantle of oceanic affinity. The metamorphic assemblage of the garnet peridotites consists of olivine (Fo 87-90), Mg-rich (Py 65-67) garnet and low-Al pyroxenes which record UHP peak P-T conditions up to 4 GPa and 900°C during Eo-alpine intracontinental subduction in the Cretaceous. Remnants of magmatic minerals include exsolved pyroxenes, Ti-rich chromian spinel, ilmenite, apatite and probably also An-rich plagioclase as found in several samples. Relict igneous textures indicate plagioclase and olivine as cumulus minerals and clinopyroxene as an intercumulus phase. Low-Ti (0.3-0.5 wt.% TiO₂) Cpx has LREE-depleted trace-element patterns that strongly resemble Cpx from olivine-rich gabbros and troctolites from a mid-ocean ridge, whereas high-Ti Cpx (0.6-1.8 wt.% TiO₂) have strongly negative Eu anomalies and less depleted LREE which indicate crystallisation from more fractionated melts than low-Ti Cpx. A cumulate origin is supported by low but fractionated whole rock PGE contents (0.1-0.2 ppb Ir, Pd/Ir=5-15) and trace-element patterns similar to those of associated Pohorje eclogites of predominantly MORB affinity. The shallow level of intrusion of the garnet peridotite precursor indicates that the SBUC mantle rocks were at least partially exhumed at the time of magma emplacement, but its depleted composition argues against formation in a continental rift zone. We propose that the SBUC is derived from overriding mantle during continental subduction, hence oceanic mantle needs to be present at depth, possibly remnants of the Meliata ocean floor.

Keywords: garnet peridotite, ultramafic cumulate, olivine gabbro, continental subduction, ultrahigh-pressure metamorphism, Eastern Alps, Pohorje