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P-T-t evolution of high-pressure, medium-temperature metapelite from the Pohorje Mountains (Eastern Alps, Slovenia) and its geodynamic significance

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The Pohorje Mountains in north-eastern Slovenia comprise a suite of eclogite-facies metamorphic rocks. The investigated metapelite from this suite was collected from a road cut south of the village of Jurišna Vas. This rock is fine-grained, containing quartz, potassic white-mica, chlorite, kyanite, biotite, and garnet, which is rimmed by iron hydroxide as a late retrogression product. Accessories are graphite, apatite, rutile, ilmenite, staurolite, K-feldspar, albite, monazite and zircon. The metamorphic evolution of the metapelite was ascertained using pressure (P)-temperature (T) pseudosections calculated with PERPLE_X. The deduced prograde path is related to isothermal compression from 7-9.5 kbar at 610-650 ºC to the peak P of 18.5-23 kbar at 570-630 ºC. The early conditions of this P-T path are constrained by the inner core composition of garnet ($Grs_{10-13}Py_{20-26}Sps_{1.3-2.5}$). The calculated assemblage phengite, staurolite, garnet, biotite, kyanite, quartz, rutile at this stage fits the observed inclusion assemblage in the garnet core well. The peak P was constrained by the garnet mantle composition ($Grs_{8-10}Py_{12-20}Sps_{2.5-4.0}$) and the highest Si (3.27 pfu) content in phengite. The derived temperatures (570-650 ºC) were also confirmed by Zr-in-rutile, garnet-biotite Fe-Mg exchange, and graphite geothermometry. Due to 8 vol.% biotite and 1.5 vol.% kyanite in the matrix, the retrograde P-T path should have passed through 625-660 ˚C at 6.0-8.5 kbar.

In situ U-Th-Pb dating of monazite with the electron microprobe yielded three major age populations at 284.6 $\pm$ 5.6 (2σ) Ma, 94.1 $\pm$ 3.7 Ma, and 28.4 $\pm$ 2.1 Ma. The old monazite is included in garnet and could represent a detrital age. The Cretaceous monazite is related to the high-P metamorphic event consistent with previously reported ages of 91-93 Ma (Miller et al., 2007; Janák et al., 2009). The youngest monazite occuring exclusively in the matrix is assigned to late exhumation.

We interpret the results in contrast to Hurai et al. (2010) and Janák et al. (2009) as follows: former sediment was metamorphosed at the base of an accretionary wedge and then transported with the tip of the downgoing plate to depths of c. 60 km during Cretaceous collision of the African and Eurasian plates. The metasediment was exhumed together with UHP eclogite in an exhumation channel. At higher crustal levels the metasediment was affected by a late metamorphism in the Oligocene.

Hurai, et al., 2010. Fluid-assisted retrogression of garnet and P-T history of metapelites from HP/UHP metamorphic terrane (Pohorje Mountains, Eastern Alps). CMP, 160, 203-218.

Janák et al., 2009. Eclogite-hosting metapelites from the Pohorje Mountains (Eastern Alps): P-T evolution, zircon geochronology and tectonic implications. EJM, 21, 1191–1212.

Miller et al., 2007. Eclogitisation of gabbroic rocks: redistribution of trace elements and Zr in rutile thermometry in an Eo-Alpine subduction zone (Eastern Alps). Chem. Geol., 239, 96–123.