First evidence for omphacite and eclogite facies metamorphism in the Veporic unit of the Western Carpathians

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The first evidence for omphacite and eclogite facies metamorphism is reported from metabasites in the Veporic unit of the Western Carpathians. These rocks have been found in the eastern part of the Nízke Tatry Mountains, in the Koleso valley, ca. 8–9 km northwards of Heľpa. The omphacite-bearing rocks are retrogressed eclogites closely associated with amphibolites and metagabbros. The metagabbros have partly well preserved their primary cumulate texture and minerals (Ivan et al., 1996). Relicts of eclogites form lenses and boudins in amphibolites. Reddish garnet and pale green clinopyroxene form the cores of such boudins, whereas amphiboles are abundant at their margins. The country rocks of these metabasites are kyanite–bearing gneisses comprising the Ordovician (c. 470 Ma) age of the protolith, and Variscan (c. 340 Ma) age of recrystallization (Janák et al., 2002). All these rocks belong to the pre-Mesozoic metamorphic sequences of the Veporic crystalline basement – the Hron complex.

Omphacite occurs as inclusions in garnet, attaining the size of less than 10 microns. Omphacite has up to 40–41 mol % of jadeite content with 50–52 mol % of diopside-hedenbergite and 2 % of Ca-Tschermak component. Garnet is poikiloblastic with inclusions of quartz, zoisite, clinopyroxene, amphibole, rutile/ilmenite and K-feldspar. The composition of garnet is almandine (54–58 mol %), pyrope (7–8 mol %), grossular (34–39 mol %) and spessartine (1–2 mol %): no pronounced zoning has been observed.

The amphibole inclusions are classified as ferrohornblende and ferropargasite. Minor white mica is phengite with up to 3.3 Si p.f.u. It is associated with biotite and biotite + plagioclase symplectites. Secondary phases occur in coronas, symplectites and fractures. The most typical is clinopyroxene (diopside) with 10–20% of jadeite content, forming the symplectites with plagioclase and amphibole after primary clinopyroxene (omphacite).

Peak metamorphic conditions have been calculated from geothermobarometry on the mineral assemblage garnet + omphacite + quartz + phengite. Microprobe analyses of omphacite with the highest jadeite content, garnet with the maximum grossular and pyrope contents, and phengite with the highest Si content have been selected. A combination of the garnet-clinopyroxene Fe^{2+}-Mg exchange geothermometers (Powell 1985; Krogh-Ravna 2000) with the geobarometer utilizing the net-transfer reaction equilibrium (1): 3 celadonite + 2 grossular + pyrope = 6 diopside + 3 muscovite (Waters – Martin 1993; Carswell et al., 1987) has been used. The ferric Fe was calculated from stoichiometry.

A combination of garnet-clinopyroxene thermometry and equilibrium (1) defines a maximum pressure of 1.8–2.0 GPa at temperatures ranging from 670–740 °C, well within the eclogite facies stability field.

The age of eclogite metamorphism in the investigated rocks is unknown. Based on monazite dating in the surrounding kyanite gneiss (Janák et al., 2002), we suppose that high-pressure metamorphism was Variscan and related to subduction.

This discovery of omphacite definitely confirms the eclogite facies metamorphism in the crystalline basement of the Western Carpathians, as has been discussed for several years (e.g. Hovorka – Méres 1990; Janák et al., 1996; 1997; Korikovsky – Hovorka 2001).

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