

**PRE-ALPINE ECLOGITES AND GARNET-PYROXENE-BEARING METABASITES IN THE
AUSTROALPINE UNITS OF THE EASTERN ALPS AND WESTERN CARPATHIANS**

by

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The Austroalpine tectonic units in the Eastern Alps and the Western Carpathians basement rocks are indicative of similar metamorphic evolution during Pre-Alpine history. The classical Variscan metamorphism of medium-pressure conditions was followed by Upper Carboniferous granite intrusions. According to petrological and geochronological data, basement rocks from both area record early Variscan or Pre-Variscan high-grade, mostly high-pressure metamorphism. Because of multiply deformation and recrystallization during Variscan and Alpine metamorphic events, evidences of earlier metamorphic processes are only locally preserved. Some metabasites may contain lens-shaped enclaves (1 - xx m in length) of massive eclogites or high-pressure amphibolites that were spared from deformation and hydration.

In the Eastern Alps, amphibolized eclogites occur at Hochgrößen massif, east of the Tauern Window (RICHTER, 1973). Together with host serpentinites, they are part of the Speik Complex in the Austroalpine basement nappes. Fresh eclogites are rare and contain omphacite with a maximum of 39 mol % jadeite content, garnet (Py₁₅₋₁₉) and amphibole. An average temperature of 700°C was obtained for eclogite facies metamorphism using garnet-pyroxene thermometries. A minimum pressure of 1.5 GPa is indicated by the maximum jadeite content in omphacite. Thermobarometric calculations for amphibole with coexisting omphacite and garnet give pressures of 1.8 GPa at 700°C. Retrogression to ca 0.6 - 0.8 GPa at 590 - 640°C is documented by the equilibrium assemblage of Na-poor clinopyroxene, albite, amphibole and zoisite in the symplectites. ⁴⁰Ar/³⁹Ar radiometric dating of edenitic amphibole in textural equilibrium with omphacite gave a plateau age of 397.3 ± 7.8 Ma (FARYAD et al., 2001), and probably indicates retrograde cooling through the closure temperature for amphibole (~ 500°C). The age of the HP metamorphism thus must be pre-Variscan and points to one of the earliest metamorphic events in the Austroalpine nappes known to date.

Several petrological works from the Western Carpathians (HOVORKA & MÉRES, 1990; JANAK et al., 1996) indicated evidences of granulite or eclogite facies metamorphism. Similar rocks were recently found in the eastern part of the western Carpathians from Branisko Mts. (MÉRES et al., 2000). Detail mineralogy of these rocks indicates high-grade metamorphism, appropriate to triple point of amphibolite - eclogite - granulite facies boundaries. The rocks are derived from MORB type basalts and contain Ca- and Mg- rich garnet (Gr_{20-32} , Py_{18-20}), diopsidic clinopyroxene and plagioclase (An_{10-40}). Garnet encloses clinopyroxene, plagioclase, ilmenite and K-feldspar. P-T conditions of 750°C and 13 - 14 kbar were estimated using various exchange thermometries and equilibrium reactions. Such pressure conditions are assumed also by accessory phengite ($Si = 3.38$) with K-feldspar in the matrix. Besides inclusions in garnet, pyroxene forms symplectites with plagioclase and amphibole in the matrix. The high-grade metamorphism was followed by amphibolite facies metamorphism at 650°C and 7 - 8 kbar. Textural relations in metabasites with combination of geochronological data from other basement rocks suggest long-termed and polyphase evolution of the Western Carpathians basement during Pre-Alpine history.

The presented data from the Eastern Alps and Western Carpathians suggest subduction of continental and oceanic elements during Silurian-Devonian and continent-continent collision between Gondwana-derived continental elements and northern portion of Central European Variscan Belt and Fennosarmatia (VON RAUMER, 1998). Really eclogites, derived from ocean-floor basalts, occur in the Eastern Alps, while the high-pressure amphibolites transitioning to eclogites were formed in the Western Carpathians.

References

- FARYAD, S. W., HOINKES, G., MELCHER, F., PUHL, J., MEISEL, T. & FRANK, W. (2001): Eclogites from the Speik Complex at Hochgrößen; middle Austroalpine unit, Eastern Alps. - *Mineralogy and Petrology* (in print).
- HOVORKA, D. & MÉRES, Š. (1990): Clinopyroxene-garnet metabasites from the Tribeč Mts. (Central Slovakia). - *Mineralia Slovacia*, 22, 533-538.
- JANAK, M., O'BRIEN, P. J., HURAI, V & REUTEL, CH. (1996): Metamorphic evolution and fluid composition of garnet-clinopyroxene amphibolites from the Western Tatra Mts., Western Carpathians. - *Lithos*, 39, 57-79.
- MÉRES, Š., IVAN, P. & HOVORKA, D. (2000): Garnet-pyroxene metabasite and antigorite serpentinites – evidence of leptino-amphibolite complex in the Branisko Mts. (Tatric unit, central eastern Carpathians). - *Mineralia Slovaca*, 32, 479-486.
- RICHTER, R. (1973): Vergleichende Untersuchungen an ostalpinen Eklogiten. - *Tschermaks Min Petr Mitt* 19: 1-50.
- VON RAUMER, J. F. (1998): The Palaeozoic evolution of the Alps: from Gondwana to Pangea. - *Geol. Rundschau* 87: 407-435.