

ting of the higher Mesozoic nappes which were emplaced in a relatively short time and in a "thin skinned" tectonic regime. During the time span of 75 Ma to 80 Ma a temperature of about 300°C was sustained in certain parts of the southern Veporicum, as documented by biotite cooling ages. This Late Cretaceous period is characterised by an extensional regime and by local thermal perturbation. A thermal effect of a contact aureole near the Rochovce granite may be regarded as the third episode of the Alpine metamorphic history. We interpret some older age (e.g. a staircase spectra of muscovite - 123 Ma and 134 Ma) as a result of Alpine excess Ar. On the other

hand, amphiboles from metabasics recording 137 Ma and 150 Ma reflect an incomplete Alpine rejuvenation of the Hercynian metamorphism.

The petrographic phenomena as well as geochronological data indicate an increase in Alpine thermal reworking from the southwest to the northeast. The Cretaceous orogenic evolution of the southern Veporic domain had many features in common with the Mittelostalpin unit in the Eastern Alps but a potential pre-Barrovian HP event (of a different provenance than that of the southerly situated Meliaticum) has not been revealed.

## High Pressure – Low Temperature Metamorphism in the West Sudetes: Tectonic Implications

Ryszard KRYZA

*Uniwersytet Wrocławski, Instytut Nauk Geologicznych, Cybulskiego 30, 50-205 Wrocław, Poland*

High pressure – low temperature (HP-LT) metamorphic rocks (blueschist facies) are an important tool in the construction of tectonic models, as they are, commonly, interpreted to delineate major tectonic sutures. In the West Sudetes, blueschist facies metamorphism is recorded in two areas: (a) the E and S metamorphic envelope of the Karkonosze pluton (Cháb and Vrána 1979, Kryza and Mazur 1995, Smulikowski 1995, Patočka et al. 1996) and (b) the Kaczawa complex (Kryza et al. 1990, Muszyński and Kryza 1993).

The southern and eastern envelope of the Karkonosze granite comprises several tectonic units which differ in their lithostratigraphic contents and P-T paths (Kryza and Mazur 1995, Mazur 1995). The blueschist facies mineralogy (e.g. glaucophane, Si-rich phengite) is found in the external and structurally highest tectonic units (Niedamirów, Rýchory and Źelezný Brod areas) and is best preserved in metabasic rocks associated with phyllites of poorly constrained, early- to mid Palaeozoic age (including documented Silurian). The P-T conditions for the HP event are estimated at ca. > 8 kbar and 300-400°C. The P-T paths of these HP units are in marked contrast with the conditions experienced by the structurally underlying tectonic unit (the Kowary/Izera gneisses and their mica schist envelope) which underwent MP regional and, locally, contact metamorphism. The HP rocks are separated from the underlying tectonic unit by a tectonic contact (Mazur 1995).

The Kaczawa complex comprises several tectonic units interpreted as thrust sheets, involving fragments of Palaeozoic succession (Cambrian to Upper Devonian and, locally Lower Carboniferous), and polygenic melange bodies mostly assumed to be Upper Devonian or Lower Carboniferous in age (Baranowski et al. 1990). In spite of deformation and metamorphism, primary sedimentary and volcanic structures are well preserved in the Kaczawa complex rocks. A record of early HP-LT metamorphic event has been found in most of the tectonic units of the area and it includes: (a) zoned amphiboles in mafic rocks (from glaucophane to actinolite); (b) zoned white mica (Si content from 3.55 in cores to 3.05 in rims); and (c) relics of pure jadeite in felsic metavolcanics. The P-T conditions of the HP-LT event can be assessed as > 10 kbar and 300-400°C. The medium pressure overprint generally represents conditions typical of lower part of the greenschist facies.

### Tectonic implications

1. The two described metamorphic complexes in the West Sudetes (E and S Karkonosze and Kaczawa complex) bear record of early HP-LT events typical of the blueschist facies, followed by MP metamorphism, mostly under the greenschist facies. As shown by  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  dating (Maluski and Patočka 1997), which is also supported by geological constraints, the HP event took place at ca. 360 Ma, while the MP overprint can be dated at around 340 Ma ago.
2. The presence of blueschist facies rocks corroborates the hypothesis that this part of the Sudetes may represent fragments of a Variscan accretionary prism (Baranowski et al. 1990). In a broad sense, the area is located at the boundary between major tectonic zones of the Variscan orogen: Saxothuringian to NW, and Barrandian plus Moldanubian to SE.
3. The general metamorphic zonation in the Sudetes allows a subdivision of this area into two domains: (a) WNW domain, with records of HP-LT metamorphism, and (b) ESE domain, with relics of UHP-HT rocks and usually strong LP-HT regional imprint. Following the interpretation based on "extrusive tectonics" models (Thompson et al. 1997), the first domain may comprise fragments of narrow, moderately buried (ca. 30 km) and quickly exhumed external parts of the orogen, while the second domain, could be a fragment of deeply buried (50 or more km) and rather slowly exhumed internal parts of the Variscan belt.
4. Detailed tectonic interpretations remain controversial. The two blueschist facies complexes, apart from their similarities, display important differences.

*E and S Karkonosze:* HP-LT rocks are found only in the upper tectonic units, on the E and S(?) side of the so called Leszczyńiec Shear Zone. Such a position of the blueschist facies rocks confirms that this zone is a major tectonic boundary.

*Kaczawa complex:* in spite of its mosaic tectonic pattern – it seems to represent a roughly coherent stratigraphic sequence which as a whole experienced roughly the same P-T conditions. The recognised close spatial association of the HP rocks and polygenic melange bodies suggests that the model of "imbricated slab" or "subduction channel" could have been the mechanism of exhumation of this rock complex.

These differences seem to be at variance with the new concept of Cymerman et al. (1997) which assumes a continu-

