ones, produced by deformations of opposite kinematics. Moreover, it is impossible to assess the amount of strain accomplished by particular deformational processes: dynamic recrystallisation and recovery, pressure - solution, microboudinage, slip on {001} phyllosilicates crystallographic planes and grain-boundary sliding. This variety of deformation mechanisms could be responsible for ambiguous and unreadable quartz c-axes microfabrics.

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Thermal State of the Bohemian Massif

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Terrestrial heat flow (HF), defined as a product of temperature gradient and thermal conductivity, is a measure of the amount of heat transferred from deeper portions of the earth's crust to the surface. 136 HF values determined in the Bohemian Massif (BM) form a basis for description of main thermal characteristics of this tectonic unit: the mean HF 67±24 $mW \cdot m^{-2}$ is consistent with Variscan age of the Bohemian Massif. Low HF (40±14 $mW \cdot m^{-2}$) has been recorded in the stable central-southern part (Moldanubian block), HF maxima (> 80 $mW.m^{-2}$) are situated in tectonically active zones at the north and west (Ohře graben and Bohemian Cretaceous Basin). Surface HF together with information on heat production and thermal conductivity distribution in the crust (both derived from seismic data) were used for modelling a temperature field in the crust and upper mantle. Temperature at MOHO ranges from less then 400°C in the Moldanubian segment to about 650°C in the two mobile zones. Depth to the base of the lithosphere inferred from thermal data is biggest bellow the Moldanubian zone (120-140 km) and attains only ~ 80 km below the northern and western part of BM. All models of crustal temperatures were based on the assumption of a steady state thermal regime. However, this needs not to be valid in the surroundings of the Ohře graben which is affected by Tertiary volcanism. A broad variety of models were compiled from geological data and used to asses the effect of volcanic activity on the present thermal state. Most of them suggest that the transient component of temperature field degraded below noise level by now.

Geochemistry and Petrology of the Early Palaeozoic Železný Brod Volcanic Complex (W Sudetes, Bohemian Massif): Geodynamic Interpretations

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The crystalline rock sequence of the Železný Brod region is situated in the SE margin of the Krkonoše-Jizera crystalline unit, constituting the W part of the W Sudetes (NE Bohemian Massif). The low-grade metamorphosed metavolcanics are present in abundance there, dominated by mafic rocks (subaquatic lavas, tuffs and tuffites); felsic metavolcanics as well as their pyroclastic equivalents are rather subordinate. The metavolcanic rocks are associated with small bodies of metadiabases-metagabbros and metagranitoids. Several thin intrusive bodies of the serpentinised ultrabasites are also known there.

The metavolcanics, exposed in the large area around the Železný Brod town, are accordingly termed the Železný Brod volcanic complex (ZBVC) (e.g. Fediuk 1962).

The ZBVC is a part of the system of volcano-sedimentary low- to medium-grade metamorphosed complexes occurring along the E and S margins of the Krkonoše-Jizera crystalline unit. This unit is a suspected terrane in the W Sudetes amalgamated during the Variscan collision of Baltica and Armorica (± eastern Avalonia) (e.g. Cymerman et al. 1997).

The age of the ZBVC has not been palaeontologically and/or geochronologically determined with enough accuracy yet. The Železný Brod sequence is intricately folded into a perianticlinorial structure. The metavolcanic (±tuffaceous phyllite) pile occupy the bottom part which is probably of the Cambro-Ordovician age. It is conformably overlain by mostly metapelitic (±metavolcanic) part of the sequence, paleontologically dated to Late Ordovician to Silurian (and possibly Devonian?) (e.g. Chlupáč 1993, 1997), consisting of phyllites with intercalations of quartzites, marbles, graphitic rocks and metacherts. The volcanic rocks are successively waning out in the younger sequence.

The ZBVC rocks together with the surrounding metapelites experienced complicated metamorphic history. Primary magmatic mineral associations (documented by relics of augitic to pigeonitic pyroxenes, kearsutitic amphiboles and ilmenites) were destroyed during ocean-floor burial metamorphism by secondary alterations.

The older metamorphic event (Variscan subduction metamorphism?) was characterised by a substantial pressure growth and a less significant rise of temperature; in the East Krkonoše mafic blueschists (of the Early Palaeozoic protolith age) the HP-LT metamorphic episode was dated to ca. 360 Ma (Maluski and Patočka 1997). In the ZBVC metadiabases-metagabbros the mineral association Na-amphibole+epidote+albite+chlorite+leucoxene+stilpnomelane±quartz was a product of this metamorphic phase.

The impingement of the subsequent metamorphic event corresponded to a higher grade of greenschist facies (T = 450°C to 500°C) as documented by very fine-grained (dynamically recrystallised) albite porphyroclasts in steeply dipping shear zones in some metagabbros (cf. Hammer 1982; Tullis 1983). The metamorphic peak was followed by retrogression in low-grade greenschist facies PT conditions. Na-amphiboles and pyroxenes were substituted by actinolite and chlorite+calcite, respectively. The growth of secondary minerals was associated with the dominant foliation origin.

On the basis of petrography and geochemistry from the ZBVC studied sample set the following rock-types were distinguished:

- greenschists and greenstones,
- metadiabases and metagabbros
- felsic metavolcanics (metakeratophyres, porphyroids),
- metagranitoids,
- serpentinites and associated metagabbros.

The dominant ZBVC mafic rocks, i.e. the greenschists-greenstones and metadiabases-metagabbros, in chemical compositions mostly correspond to P-MORBs and transitional to alkaline WPBs, respectively. The felsic (intermediate to acid) metavolcanics are geochemical counterparts of continental intraplate granitic rocks; some of them may be interpreted as attenuated continental lithosphere related types. The serpentinites and associated metagabbros seem to be a specific group of metamorphosed (±serpentinised) upper mantle derived intrusive ultrabasites. These rock bodies mostly cut the older flat-lying foliation planes which are usually following the original sedimentary bedding (Chlupáč 1997). In rare cases they display relict contact aureoles, mostly obliterated during the younger foliation origin.

The Early Palaeozoic protolith history of the ZBVC may be well compared to an evolution of intracontinental rift magmatic suite according to the geochemical features of the distinguished rock-types (cf. Hawkesworth and Gallagher 1993 etc.). The rift was probably developed above the rising upper mantle diapir undergoing progressive partial melting. The succession of the individual geochemical types of the ZBVC rocks was possibly as follows: transitional to alkaline WPBs + continental intraplate felsic rocks » P-MORBs + attenuated continental lithosphere related felsic rocks » picritic ultrabasites.

In the nearby Eastern Krkonoše, the Early Palaeozoic metamorphosed volcano-sedimentary sequences are considered to be the ZBVC equivalents (e.g. Teisseyre 1973; Chaloupský et al. 1989). However, they are metamorphosed to higher grades of greenschist facies and albite-epidote amphibolite facies subsequent to earlier blueschist facies metamorphism (Smulikowski 1995 etc.). The protolith formation of these sequences is dated identically with regards to the ZBVC presumed age of origin - i.e. to the period between Cambrian/Ordovician and Silurian (Oliver et al. 1993; Bendl and Patočka 1995; Konzalová and Patočka in print). The Eastern Krkonoše volcano-sedimentary sequences differ from the ZBVC in a substantial content of N-MORB-like mafic rocks. Patočka et al. (1996) and Patočka and Smulikowski (1997) due to this particular feature concluded that in the history of the Eastern Krkonoše sequences the intracontinental rift stage, characterised by abundant bimodal volcanism (Patočka et al. 1997), was rapidly substituted by generation of lithosphere of an incipient oceanic basin (e.g. of the Red Sea type). The tectonic setting and magmatic development of the ZBVC never reached such an advanced stage.

The common major geochemical traits of the East Krkonoše sequences and the ZBVC as well as the above mentioned abundance of N-MORB-like metabasites in the former may be interpreted as magmatic development features of (a) laterally extending and (b) linearly (in the recent geographical situation from E to W) propagating rift arm (cf. Burke and Whiteman 1973). This extensional tectonics was possibly related to the Early Palaeozoic northern Gondwana fragmentation which preceded the origin of the pre-Variscan European microplates (e.g. McKerrow et al. 1991; Tait et al. 1996; Żelazniewicz 1997).

*For the **references** cited see the Excursion quide on p. 79 of this GEOLINES volume.*