Internal Strain Fabric of the Mohelno Serpentinized Peridotite

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A subcrustal lithosphere below internal orogenic zone of the Bohemian Massif was suggested as a mechanically rigid part of the orogeny during Variscan collision (e.g. Babuška and Plomerová 1992). Current studies using anisotropy of seismic P and SKS waves (Babuška and Plomerová 2001) suggest that planes of high seismic velocities in the recent upper mantle are striking approximately E-W and dipping to the south. This fabric is not coherent to vertical, NE-SW oriented high-temperature foliations of lower crustal rocks. It could indicate mechanical decoupling between mantle and crust during Variscan convergence in the Bohemian Massif (Schulmann et al. 2002). Beside seismic anisotropy studies of the recent mantle below the Bohemian Massif, there are no data concerning internal deformation fabric of the mantle boudins that were incorporated to the surrounding crustal rocks during Variscan orogeny.

In this work we aimed to Mohelno serpentinized peridotite body, as it has strain and metamorphic patterns correlative to surrounded granulites (Medaris et al. 1990) suggesting strain coupling at some stage of orogeny. It occurs in the eastern margin of the Bohemian massif in the Gfőhl unit of the Moldanubian domain. It is surrounded by Náměšť granulite massif and crop out as part of the large-scale fold having steeply oriented limbs and fold axis. In spite of serpentinization, original mineralogy related to mantle conditions is preserved. It is composed of spinel peridotite, with garnet occurring only in the margin of the body. Petrological evolution of the peridotite have been studied by several authors and neglecting serpentinization reveal the following sequence of mineral assemblages: M1) ol+opx+cpx+spl, M2) ol+opx+cpx+grt (marginal part), M3) ol+opx+cpx+spl (marginal part), M4) ol+opx+hbl+spl (marginal part). Evolution from the M1 to M2 assemblages, have been interpreted as a result of isobaric cooling from the near solidus temperature and pressure of 2.5GPa. Stages M3 and M4 they suggested to be correlative with the granulite metamorphism and amphibolite facies retrogression in surrounding granulites, respectively (Medaris et al. 1990).

A correlation of the strain fabric between peridotite and granulite has not been carried out quantitatively up to date. Serpentinization makes measurement of original strain features as mantle related foliation and stretching lineation in the outcrops usually impossible. The original strain fabric in serpentinized peridotite is currently possible to be determined by lattice preferred orientation of olivine as a principal mineral of upper mantle rocks (e.g. Vauchez and Garrido 2001, Christensen et al. 2001, Mizukami et al. 2004). Systematic study of LPO of olivines from mantle rocks using EBSD method clearly shows their strong LPO defining ellipsoid of finite strain even when rock seems to be macroscopically free of any strain features (Ben Ismail and Mainprice 1998). Next method is experimental measurements of anisotropy of magnetic susceptibility (AMS method) that usually indicates finite strain ellipsoid (Hrouda 1993). However, results of this method can be charged by great mistake due to crystallization of magnetite during serpentinization. Hence, influence of magnetite must be filtered in order to enhance pattern related to original mantle minerals.

Twenty samples of serpentinized peridotite have been analyzed using AMS method and fifteen samples using EBSD method. Finally, field measurements carried out in peridotite and surrounding granulites have been compared to the new database, presented in our poster and discussed. A special interest has been aimed to comparison of filtered AMS data with EBSD data.

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Metabasites of the Nove Mesto Group, West Sudetes: a Rift-Related Bimodal Sequence Incorporated in a Variscan Nappe Structure

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The westernmost flank of the Orlica-Śnieżnik Dome (OSD), West Sudetes, is formed by the Nové Město Group (NMG). The NMG is composed of low-grade to mid-grade metamorphosed metapelites and metagreywackes extensively accompanied by bimodal metavolcanic rocks and diorite to granodiorite intrusions (Opletal et al., 1980). Although still no age data are available, the NMG has customarily been assigned to the Late Proterozoic, less commonly to the Cambrian–Silurian interval (see review in Opletal et al., 1980), and interpreted as a mantle to the ca. 500 Ma gneissic core of the OSD.

Based on geochemical studies, Domečka and Opletal (1980) and Opletal et al. (1990) identified in the NMG subalkalic tholeiites interpreted as ocean floor basalts and co-magmatic calc-alkaline felsic volcanites, apparently different from (meta)basites of the Stronie Group at the OSD core (Domečka and Opletal 1980, Opletal et al. 1990). Floyd et al. (1996, 2000) classified the NMG mafic rocks to MORB-like tholeiites and included to the West Sudetes Main Series metabasites of Early Palaeozoic age. They paid no attention to the NMG felsic members and considered the mafites as astenosphere-derived basalts modified by mixing of depleted (MORB-like) and enriched (OIB-like) plume sources.

Our studies show that the NMG metabasites, conforming in general to the main series tholeiites of Floyd et al. (1996, 2000), are diversified enough to be subdivided into 3 different types: dominant within-plate tholeiites (WPT), less common MORB-like tholeiites, and scarce Ti-tholeiites. The distinguishing element ratios are: Zr/Y, Ti/Y, Ti/V, Zr/Nb, (La/Yb)N, (La/Sm)N and abundances of HFSE and REE. Although the three types display some overlaps, they are persistently discriminated on various diagrams. In the field, the WP-tholeiites (Zr/Y ca. 3.57–5.70; Ti/Y ca. 290–450) and MORB-like tholeiites (Zr/Y $<$ 3.5; Ti/Y $<$ 320) form roughly parallel belts concordant with the regional meridional strike of the main lithological boundaries and that type of their distribution continues E-ward to the Stronie Group. Both the WPT and MORB-like metabasites, irrespective of their position in the observed belts, display fairly uniform isotopic signature εNd(500) ~5–7 suggestive of similar mantle source and possibly weak contamination with crustal material. (La/Yb)N, (La/Sm)N and Zr/Nb ratios indicate that the WPT might come from an enriched mantle source as compared with a N-MORB source, whereas the MORB-like tholeiites might originate from a MORB source transitional between N-MORB and E-MORB. A N-MORB-like source might possibly be mixed with an enriched OIB-like source (plume). For the WPT, both the isotopic and characteristic elemental ratios may also point to mild contamination due to some crustal admixtures.

The Ti-tholeiites (Ti/Y ca. 600–860; Ti/V ca. 50–100) differ from the two previous types. They are uniquely characterized by positive Eu and Sr anomalies which might be due to plagioclase cumulation in a depleted yet Ti-rich magma source (cumulated Ti-phases). These cumulate-like basites on most discriminant diagrams plot in the WPT area.

Field evidence shows that only the WP tholeiites and Ti-tholeiites are accompanied by the NMG felsic volcanites which injected the former. Also the MORB-like tholeiites intruded other mafites. These observations make a crude template of evolving magmatism in the NMG.

The observed field relationships of the cumulate-type mafic and the felsic to intermediate volcanites (rhyolites to trachyandesites) suggest their origin from the same magma chamber, which is corroborated by Eu-anomalies shown by the two lithologies. This suggestion is consistent with the results of geochemical studies conducted by Opletal et al. (1990), who concluded that the NMG bimodal magmatic rocks were derived from the same magma source.

The bimodal magmatism recorded in the NMG likely developed in a rift-related (probably back-arc) setting which reached the stage of new oceanic crust production. Palaeogeographic assignment of the rift basin needs dating of its sedimentary-volcanogenic infilling. U-Pb dating of the NMG rocks is under way.

The NMG metabasites originated form dolerites and gabbros that underwent polymetamorphic transformations when practically all primary magmatic minerals have been replaced by metamorphic ones. The oldest recognizable and most distinct foliation of the metabasites dipping to SW/W/NW is defined by the assemblage tschermakite–plagioclase (An_{28-36}). It developed syntectonically in a contractional regime with E/SE directed tectonic transport under the metamorphic peak conditions at T= 615–680 °C and P ~ 6 kbar (geothermometer of Holland