Sheared Metagranitoids in the Ještěd Range Mts.: the Role in the Westward Propagation of the Variscan Orogenic Wedge in the West Sudetes

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The Ještěd Range Unit (JRU) is situated on the westernmost margin of the Krkonoše-Jizera terrane (KJT) (West Sudetes, N margin of the Bohemian Massif). It forms the KJT boundary with the Lusatian autochthonous domain comprising the Cadomian basement and unconformably overlying Early to Late Paleozoic cover folded during the Variscan orogeny. In the E the JRU is overthrust by the volcano-sedimentary sequence of the South Krkonoše Complex. The JRU is the lowermost part of the W- to WNW-directed complex orogenic wedge of the West Sudetes (e.g., Kachlík and Patočka, 1998). It is the only unit of the KJT where the Palaeozoic sedimentation continued to Early Carboniferous in contrast with the South and East Krkonoše complexes where the Variscan tectonometamorphic processes finished the sedimentation already in the Devonian (Maluski and Patočka, 1997). In the central and eastern parts of the JRU, the paraautochthonous (Early to Late Palaeozoic) and allochthonous (Early Palaeozoic) domains were distinguished from bottom to top of the structural succession; however, relationships of these domains to the autochthonous domain in the W part of the JRU are not satisfactorily understood yet (Kachlík and Patočka, 1998, 2001).

A set of rather small-scale metagranitoid bodies was identified in the JRU during a detailed 1:10,000 mapping survey. Newly found JRU metagranitoids (together with an already known metagranite exposed W of Machnín – e.g., Chaloupský et al., 1989) were subdivided into two groups according to their structural relations. Metagranitoids of the first group show intrusive relation to host rocks and are supposed to be elements of the autochthonous domain. Rocks of the second group form small and strongly sheared bodies and/or tectonic slices intercalated in various lithologies; they are usually closely associated with major thrust planes.

The Machnín metagranite is an example of metagranitoids of the first group. The metagranite body was emplaced into phyllite-greywackes and metagreywackes of the Neoproterozoic Machnín Group (Chaloupský et al., 1989). The primary contacts were obscured by intense Variscan shearing and thermal overprint due to the emplacement of the Variscan Tanvald granite (Marheine et al. 2000, in press). The exact age of the Machnín metagranite is yet unknown but according to field evidence, the composition and porphyritic texture of the pre-Variscan metagranite resembles Cambro-Ordovician metagranitoids straddling the boundary between the KJT and the Lusatian domain.

The Machnín metagranite consists of quartz, albitized microcline, albite to oligoclase, biotite and muscovite. Accessories include apatite, tourmaline and opaque minerals (ilmenite for the most part). Biotite is often completely recrystallized and partly replaced by retrograde chlorite. The primary porphyritic texture is strongly modified by later shearing, which reduced the original grain size (with the exception of some microcline porphyroclasts up to 2 cm in diameter). In some extreme cases, phyllonitized sericite-rich varieties showing only relics of primary magmatic textures can be identified. Deformational banding and deformation mechanisms in quartz and feldspars suggest that the greenschist-facies metamorphic conditions prevailed during the Variscan shearing.

Metagranitoids of the second group are exposed close to overthrust of the South Krkonoše Complex on the paraautochthonous domain of the JRU (1 km to E of the Pláně cottage). They also occur at the tectonic contact between the Devonian of the JRU paraautochthonous domain and Early Palaeozoic Complex of the allochthonous domain (800 m NW of the Kryštofovo údolí church). Metagranitoid bodies are characterized by strong shearing and almost complete replacement of biotite by chlorite. Primary feldspar porphyroclasts (up to 3 cm in diameter) are preserved only in relatively low-strained domains. The metagranitoids are leucocratic and well schistous; the schistosity is conspicuously defined by alternating bands of micas and felsic minerals. Deformational banding is much more pronounced compared to that in the first group of metagranitoids.

The rocks are composed of quartz, relics of microcline and albite porphyroclasts, and sericite-chlorite intergrowths. Primary plagioclase was mostly decomposed to white mica during deformation softening. Quartz grains are usually completely dynamically recrystallized into fine-grained equigranular mosaic (0.01–0.03 mm) with scarce occurrence of larger strained grains of quartz and feldspar. In highly strained samples, the phyllonitized metagranitoids with strong internal anisotropy are intricately folded by mm-scale microfolds.

The second group-type metagranitoids show chondrite-normalized REE distribution patterns with a distinct enrichment in light REE (LREE), negative Eu-anomaly of ca. 0.5, and rather unfractionated and almost flat distribution of heavy REE (HREE). The CeN/YbN values (illustrating LREE/HREE fractionation) are around 5.0. Trace element compositions of the metagranitoids are quite similar to those of post-collisional and extension-related granites after Pearce et al. (1984). In the geochemical features the second group-type metagranitoids closely resemble the Rumburk granite.

The above described strained pre-Variscan metagranitoid (orthogneiss) bodies of the Ještěd Ridge Unit and the South Krkonoše Complex support the allochthonous nappe idea of the KJT architecture (Kachlík and Patočka, 1998, 2001). The “nappistic” concept is also evidenced by stratigraphic and metamorphic inversions in the KJT (Chlupáč, 1988; Kachlík and Patočka, 1998). Relics of HP-LT metamorphic mineral assemblages (typical of the East and South Krkonoše complexes – Patočka et al., 1996; Patočka et al., 2000) are preserved in the Early Palaeozoic roofing phyllites resting as a tectonic outlier on the fossiliferous Devonian succession in the JRU. Additional evidence is also the E-W orientated delay of the onset of flysch sedimentation in the whole West Sudetes (Hladil et al., 1998; Mazur and Kryza, 1999). Pebbles of cherts rich in Early Palaeozoic microfauna (i.e., of cherts abundant in the South Krkonoše Complex –

Konzalová, Vavrdová, pers. comm.) were found in the JRU Lower Carboniferous Jítrava Group syntectonic sediments. The pebbles may indicate that the Complex was a source area for the Tounaisian flysch during the westward migration of the deformation front (Kachlík and Patočka, 1998, 2001; Marheine et al., 2000, in press).

According to the structural position of the Early Palaeozoic metagranitoid bodies (thrust over the JRU Middle to Upper Devonian limestones), the KJT nappe stacking post-dated the Late Devonian and may correspond to Early Carboniferous times (cf. Marheine et al. 2000, in press). Rheological inhomogeneities along boundaries of metagranitoid bodies and greenschist-grade complexes were convenient places ready for initiation and development of the Variscan thrust planes. Access of fluids during the greenschist-facies metamorphism made the deformation of metagranitoids more effective due to deformation softening at higher crustal levels. According to this explanation, the metagranitoids in the KJT acted as important horizons for channelling of strain and played an important role during tectonic stacking of the KJT in a regional scale.

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Petrogenesis of Gneiss Mylonites from the Niemcza Zone – New Evidence Based on Morphology and Morphometry of Zircons

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The Niemcza Shear Zone, extending along the eastern edge of the Góry Sowie Massif, was interpreted by Scheumann (1937) to contain mylonitized gneisses. Based on detailed study, Mazur and Puziewicz (1995) showed that the Niemcza Zone represented a 5 km wide, left-lateral strike-slip ductile shear belt, separating the Góry Sowie Massif from the Kamieniec Metamorphic Belt. The Niemcza mylonites were derived from the Góry Sowie Gneiss (Scheumann, 1937; Mazur and Puziewicz, 1995; but see e.g. Franke and Żelaźniewicz, 2000, for alternative interpretation of the Niemcza Zone rocks as metagreywackes) and include minor lenses of non-mylonitic gneisses, amphibolites and quartzo-graphitic schists. The mylonites occur as high- and low-temperature varieties, formed in amphibolite and greenschist facies conditions, respectively (Mazur and Puziewicz, 1995). The Niemcza Shear Zone contain numerous small bodies of undeformed to little deformed Lower Carboniferous granitoids and syenites/diorites.

The aim of this work is to provide new data concerning the petrogenesis of different mylonite varieties occurring within the Niemcza Zone. Our investigations were based on morphology analysis of zircon crystals found in the study rocks. We made an attempt to evaluate the influence of mylonization intensity on morphology and morphometry of zircon crystals inherited from the protolith. Typological analysis of examined zircons and their comparison with those from the Góry Sowie gneisses are presented in a separate paper (Klimas et al., this volume).

Rocks selected for zircon analysis mainly consists of plagioclase, quartz and micas. They were interpreted by Mazur and Puziewicz (1995) as mylonites derived from the Góry Sowie gneisses. Some of the studied samples represent the high temperature variety of mylonites developed under amphibolite facies conditions (Tab. 1 – localities 1, 6, 8, 9, 11). They contain significant amount of synkinematic fibrolite. Furthermore, in sam-