POLSKIE TOWARZYSTWO MINERALOGICZNE – PRACE SPECJALNE
MINERALOGICAL SOCIETY OF POLAND – SPECIAL PAPERS
Zeszyt 24, 2004; Volume 24, 2004

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PRELIMINARY DATA ON PETROLOGY AND DEFORMATION OF BROUSEK QUARTZITES (NÝZNEROV THRUST ZONE, SUDETES)

Abstract: The Brousek quartzites crop out in the Bielice vicinity, along Nýznerov thrust (NE part of Bohemian Masiff). Quartzites form a large-scale flat fold, superimposed over the older tight recumbent fold. They are strongly mylonitized and consist of light, medium-grained quartz layers, alternating with dark ones, enriched in low seladonitic muscovite, iron hydroxides and ilmenite. Quartz from light layers recrystallized dynamically (subgrain rotation) under the temperature 400-500 ^{0}C, whereas quartz form dark layers was deformed due to grain boundary sliding. Quartz [c] axes fabric suggests simple shear deformation, with “top-to-NE” sense of shear prevailing over pure shear deformation.

Keywords: quartzites, Nýznerov thrust zone, mezo- and microstructures, dynamic recrystallization, quartz crystal preferred orientation.

INTRODUCTION

The eastern margin of the Bohemian Massif is formed of a collisional structure - the Moravo-Silesian Zone - developed due to Variscan thrusting of Moldanubicum + Lugicum over the Bruno-Vistulicum, along the Moldanubian thrust. Its northern part - the Nýznerov thrust (Fig. 1) – separates West (Lugicum) and East Sudetes (Moravo-Silesicum). The West Sudetes side of the Nýznerov thrust is the Staré Město Zone, the East Sudetes side is the Velké Vrbno Dome. The Brousek quartzites crop out directly eastwards the East Nýznerov thrust in the Bielice vicinity, belonging to Velké Vrbno Dome (East Sudetes, Don et. al. 2003), as an elongated, NE-SW trending body along top-hills Travná Hora-Postawna-Brousek (Fig. 1).

STRUCTURES

Brousek quartzites are characterized by NE-SW trending foliation. It plunges at low angles to NW westwards the line Travná Hora-Brousek, and at very low angles to SE eastwards that line (Fig. 2, c.f. Fig. 1). These difference results from large-scale flat fold with sub-horizontal, NE-SW trending axis. It is superimposed over the older tight recumbent fold, with hinge trending towards SE. Meso-scale equivalents of the large-scale recumbent folding are present in quartzite exposures (Brousek and Travná Hora). Minor folds, younger from large-scale flat dome are common. They have intrafolial character with poorly defined vergence and shear surfaces parallel to axial plane. The transition from asymmetric folds to small-scale

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overthrusts are common in quartzites. The axes of the folds plunge gently towards NW, suggesting “top-to-the-NE” sense of shearing.

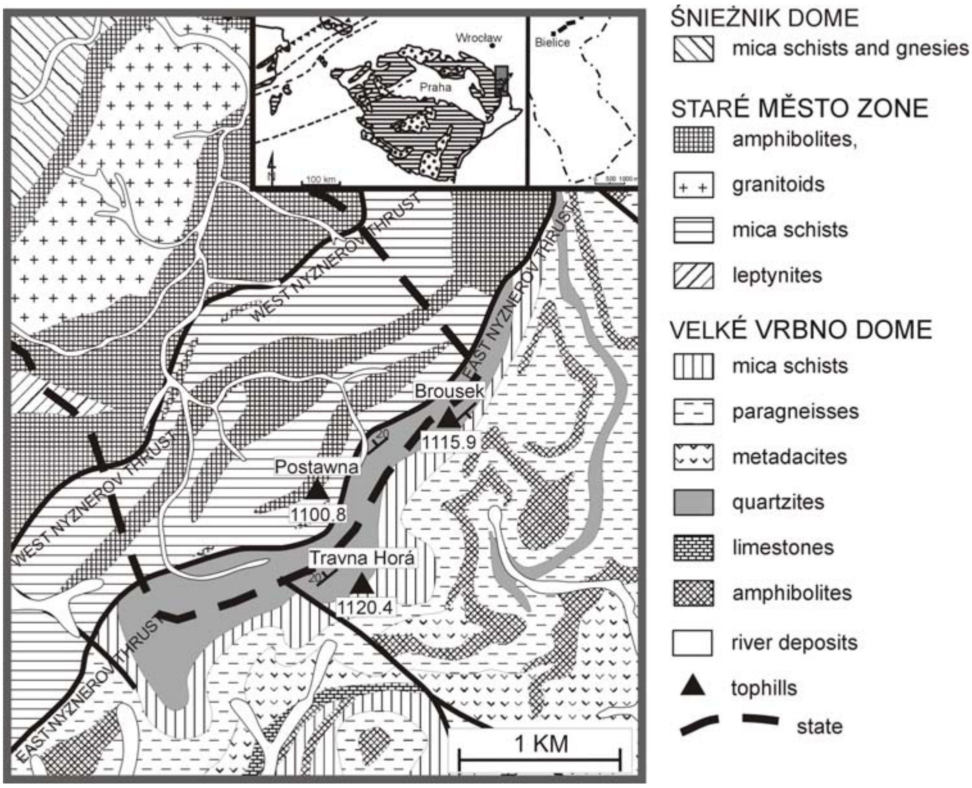

Fig. 1. Geological sketch-map of the vicinity of Bielice, after Don et. al. (2003).

Quartz [c] axes, measured by universal stage in 11 thin sections, cut perpendicular to the foliation and parallel to the stretching lineation, represent the two main types of scatter: (1) asymmetric, kinked single-girdle (simple shear) and (2) I-type of crossed girdle (pure shear, plain strain) or less common transitional types between them (Schmid, Casey 1986, Passchier, Trouw 1996). The asymmetry of single girdle scatter suggests a “top-to-NE” shearing. All the patterns are characterized by basal <a> submaxims, prevailing over less common prism <a> ones. Moreover, no evidence for [c] submaxims were found, thus quartz underwent dynamic recrystallization below 500 ^{0}C (Passchier, Trouw 1996, Okudira et. al. 1995).

PETROGRAPHY

Quartzites are fine- to medium-grained, strongly mylonitized. They contain subordinate muscovite and opaques, accessories are zircon, titanite and turmaline. The main constituents are segregated into light, pure quartzose layers and dark ones, enriched in muscovite and opaques plus accesories. The banding reflects probably primary sedimentary bedding.

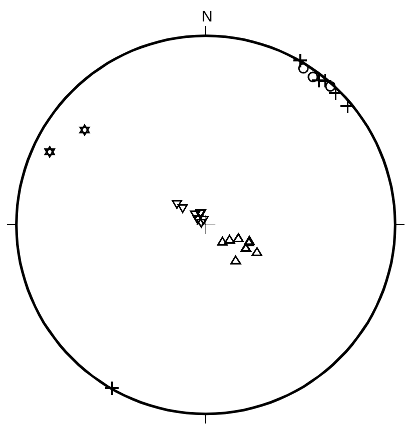

Fig. 2. Attitude of: foliation (triangles), lineation (crosses), and fold axes (circles and asterisks) in Brousek quartzites. Equal-area net, lower hemisphere.

The light layers are characterized by relatively large quartz grains up to 1.0 mm. They are strongly recrystallized, commonly exhibit subgrains, undulose extinction and lobate grain-boundaries, being a record of subgrain rotation and grain boundary migration under the temperature of 400-500 ^{0}C (Stipp et. al. 2002). Locally elongated quartz subgrains define second foliation, oriented oblique to the primary one, suggesting "top-to-NE" sense of shearing.

The dark layers are characterized by equant quartz grains up to 0.1 mm. Single muscovite plates and anhedral titanite grains are located between quartz grains or form thin and discontinuous layers. Their presence supposedly inhibited grain boundary migration and grain growth of quartz, leading to its small grain size (Krabbendamm et. al. 2003). Quartz was thus deformed due to grain boundary sliding (intercrystalline deformation), contrasting to intracrystalline deformation of quartz from light layers (op. cit.).

White mica is low seladonite (Si^{4+} = 6.00-6.22 p.f.u. O^{2-}=22, Fe+Mg=0.07-0.35 p.f.u.) and characterized by Ti^{4+} content ranging from 0.00 to 0.08 cations p.f.u. It s composition documents crystallization at relatively low pressure (Massone, Schreyer 1987, Guidotti 1984). Individual plates are zoned, their rims are enriched in Si^{4+} and depleted in $Al_{tot.}$ relative to the cores, suggesting crystallization under increasing pressure. Muscovite contains only low paragonite substitution (Na/(Na+K=0.03-0.05 p.f.u.). The linear correlation between Ti^{4+} and Al^{VI} suggests that Ti(Fe, Mg)Al^{VI}_{-2} substitution played an important role in muscovite, together with the tschermak one (Guidotti 1984, Holdaway et al 1988).

FINAL REMARKS

Brousek quartzites, registered two contrasting deformation mechanisms of quartz, leading to formation of its different shapes and microstructures. Quartz was subjected to grain boundary sliding (intercrystalline deformation) due to presence of muscovite and opaques in dark layers, and simultaneously to dynamic recrystallization (intracrystalline deformation) in light ones. Quartz preferred orientation, kinematic indicators of micro- and mezo-scale document dominant rotational component of strain with "top-to-NE" sense of shear, prevailing over non-rotational, pure shear. Mylonityzation of quartzites took place at temperatures equal to stability field of low-quartz, ranging from 400 to 500 ^{0}C.

Acknowledgements: this study was supported by grant no 2022/W/ING/04. The authors are grateful to prof. J. Puziewicz (University of Wrocław) for his comments on the earlier version of this paper.

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