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**MICROSTRUCTURAL STUDY OF BROUSEK QUARTZITES  
(SUDETES, SW POLAND)– CHARACTER AND CONDITIONS  
OF DEFORMATION**

The Stare Město Belt is located westwards the Ramzova thrust, which separates West and East Sudetes (NE Bohemian Massif). The so-called Brousek quartzites crop out directly eastwards of the northern part of the Stare Město Belt, at the Polish-Czech border, in the vicinity of Bielice village. The quartzites crop out as a small lens, few kilometers long, and several hundreds meters wide.

Quartzites are creamy or light gray, usually fine-grained, strongly foliated. The foliation dips to NNW at low angles, bearing almost horizontal stretching lineation dipping under very low angles to NNE. Quartzites contain subordinate white mica, opaques and graphite. Accessories are zircon, titanite.

Quartzites are usually strongly layered due to alternation of fine-grained and medium grained quartzose layers. Moreover, quartzites commonly display compositional banding. Their main constituents are segregated into sharply contacting pure quartzose layers and quartz-mica layers. The quartz-mica layers are locally strongly enriched in graphite and opaques, leading to the occurrence of types transitional between typical light quartzite and dark quartzo-graphitic schist. The layering is parallel to the foliation.

Anhedral quartz forms usually elongated grains, oriented parallel to the layering, up to 1.0 mm in long. Part of them are dynamically recrystallized (Paschier, Trouw 1996). The shape of those subgrains defines weak second foliation, subparallel to the primary one (op. cit.). Some quartz crystals exhibit undulose extinction and sutured boundaries. Sparse quartz ribbons occur. Those microstructures imply that quartz was deformed mainly due to subgrain rotation (SGR) with minor influence of grain boundary rotation (GBM, Stipp et. al. 2002, Paschier, Trouw 1996). The subgrain rotation is dominant within the temperatures of ~400-500 ° C (Stipp et. al. 2002). This suggests that quartzites were most likely deformed within this temperature range close to SGR/GBM transition boundary. In part of quartz grains prism-plane parallel subgrain boundaries are present and no evidence for “chessboard” quartz (i.e. prism- and basal-plane parallel subgrain boundaries) was found. Since the occurrence of “chessboard” quartz is strictly limited to the stability field of high-quartz (Kruhl 1996), the Brousek quartzite

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tes recorded deformation and metamorphism below the temperature marking  $\alpha$ - $\beta$  transformation of quartz (i.e.  $T \approx 630^\circ \text{C}$  at  $P \approx 2.5\text{-}3.0 \text{ kb}$ ).

Quartz lattice preferred orientation (LPO) study shows the occurrence of two main types of scatter. They are: (1) I-type of crossed girdle (Fig.1 A) and (2) single girdle inclined to the foliation (Fig. 1B). The girdles observed on diagrams are unequally populated with well developed submaxims, some of them are even discontinuous (Fig. 1 A). Strong Z (basal  $\langle a \rangle$ ) and Y-submaxims (prism  $\langle a \rangle$ ) occur in all diagrams, whereas submaxims intermediate between Z and Y (rhomb  $\langle a \rangle$ ) are less common.

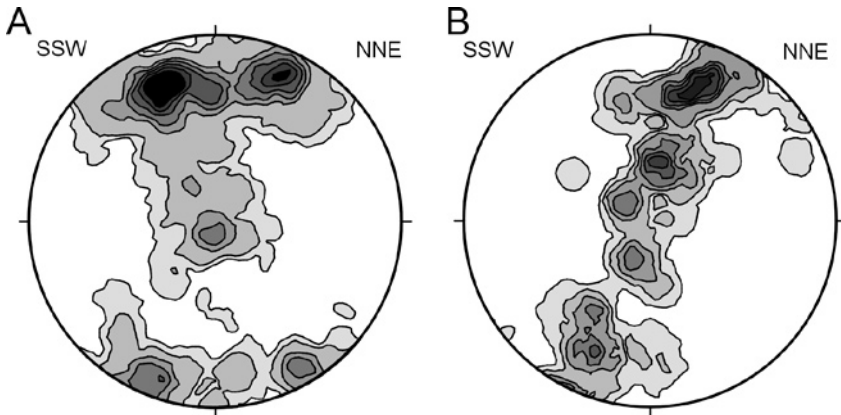


Fig. 1. Representative examples of quartz  $\langle c \rangle$  axes patterns in the Brousek quartzites. Equal-area net, lower hemisphere. Density contours at 1% intervals. Projection plane is XZ plane of strain ellipsoid. Attitude of foliation corresponds to a plane perpendicular to the figure. L – lineation.

The internal symmetry of obtained quartz  $\langle c \rangle$  axes scatters suggests that quartz LPO developed as a result of simple shear deformation (single girdle scatter) prevailing over coaxial deformation at plain strain (I-type of crossed girdles scatter; Schmid, Casey 1986, Passchier, Trouw 1996). However, the I-type of crossed girdle scatter may also be interpreted as a result of simple shear deformation too, but at very low strain (Etchecopar, Vasseur 1987, Dell'Angelo, Tullis 1989).

The external asymmetry of single girdle scatters implies a top-to-the-NNE shearing. The presence of Y-submaxim indicates the deformation under amphibolite facies conditions (Schmid, Casey 1996). Observed submaxims allow to infer that only  $\langle a \rangle$  slips were active in quartz during deformation. This conclusion and total lack of evidence for  $\langle c \rangle$  slips suggests that the temperature of deformation did not exceed  $650^\circ \text{C}$  (Passchier, Trouw 1996) or  $500^\circ \text{C}$  (Okudaira et al. 1995), which stays in good agreement with observed quartz microstructures.

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