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**CHARACTER OF DEFORMATION WITHIN SHEAR ZONES ON  
THE GALERIA CUBRYŃSKA RIDGE AND MIĘGUSZOWIECKA  
PRZEŁĘCZ POD CHŁOPKIEM PASS, HIGH TATRA MTS., POLAND**

INTRODUCTION

The High Tatra Mts. granitoid massif intruded ca. 300 Ma (Burchart 1968, Janák 1994, Poller & Todt 2000), and after the Permian was situated at depths not exceeding 12 km (ca 250°C). The uplift of the Tatra Mts. started from depths of approx. 10-11 km about 70-50 Ma ago and reached the 5 km (100°C) depth level 30-15 Ma ago (Kováč et al. 1994).

The granitoid core of the Tatra Mts. is cut by numerous dislocations of different types. Some of them display slickensided flat and smooth planes, others are several meters wide tectonic zones, showing evidences of repeated activity. Mylonitic textures are observed within some zones. In order to distinguish the different types of dislocations the geometrical criterion was applied, which allows to describe the following groups:

- a) flat dipping faults, mineralised with quartz, epidote or chlorite (connected with Alpine thrust-napping processes)
- b) steep dislocations comprising singular planes or systems of several parallel planes
- c) steep dislocations associated with mylonite or cataclasite zones, several tens of centimetres to approximately 2-3 m wide.

RESULTS

**Galeria Cubryńska Ridge shear zone**, with the orientation 205/80, belongs to the third group of dislocations and shows evidences of repeated activation. It is one of the three parallel mylonitic zones cutting the Cubryna Massif. This zone, approx. 1.5 – 2 m wide, represents a several tens of meters deep fissure cutting into the massif, with a distinct rock-fall fan at its base. Within this zone the following deformation and mineralization stages took place, in chronological order:

- 1) development of S-C mylonites, indicating the south-ward down-dip displacement,

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- 2) milky quartz vein development,
- 3) greenish quartz mineralization, colour is connected with dispersed chlorite,
- 4) dip-slip movement along the shear zone boundary, leading to the development of tectonic striation 292/35 on mylonitic epidote-coated wallrocks,
- 5) quartz in druse character growing within extensional fractures,
- 6) carbonate mineralization filling spaces between euhedral quartz crystals; carbonate minerals with the following sequence: Fe-dolomite – ankerite – calcite are observed.

In order to establish the deformation conditions during the oldest stage when S-C mylonites were developed, the microtectonic analysis was applied. Brittle fracturing and undulose extinction within porphyroclasts of magmatic quartz, kink-band folding of twin lamellae within plagioclase porphyroclasts, undulose extinction within neomorphic quartz crystallised along S-C surfaces, mica fish-like structures, ductile deformation of biotite, and quartz porphyroclasts accompanied by asymmetric pressure shadows filled with fine grained calcite were observed. The coexistence of the presented structures allows estimation of the deformation temperature at approximately 300<sup>o</sup>C.

As new phases crystallized: quartz, chlorite, sericite/muscovite, albite, K-feldspar, epidote, calcite, apatite and titanite.

**Mięguszowiecka Przełęcz Pod Chłopciami Pass shear zone** with the orientation 160/60, is ca 1-2 m wide and can be recognised along the distance of ca. 300 m. In the lower eastern part microfolds of mylonitic foliation can be observed, whereas in its western part – closer to the Pass – a tectonic gouge. Similarly to that of Galeria Cubryńska, is accompanied by ca 5-20 cm quartz veins, in some cases of druse character, in which the spaces between euhedral quartz crystals are filled with carbonates in the following sequence: from ferrous dolomite through ankerite to calcite. The carbonates are susceptible to weathering resulting the frequent occurrence of Fe-hydroxides in quartz druses.

Investigations of fluid inclusions from the postdeformational vein of milky quartz (Kozłowski & Jurewicz 2001) indicated the temperature 264<sup>o</sup>C and pressure of 1.6 kbar (1.6x10<sup>8</sup> PA). Pressure and temperature were also determined for neomorphic quartz from C shear surfaces in S-C mylonites, which yielded slightly lower P-T conditions: t=216<sup>o</sup>C and P=1.3 kbar (1.3x10<sup>8</sup> PA). Temperature was also determined based on the chemical content analysis of chlorites in microprobe, using the geological thermometer Cathelineau & Nieva (1985) and Cathelineau (1988). Temperatures calculated in three samples yielded the following results: 200, 225 and 255<sup>o</sup>C. Heterogeneity of chlorite composition led to considerable difference in obtained results that seem to indicate slightly too low temperatures.

## CONCLUSIONS

Application of the chlorite thermometer - Cathelineau (1988) allowed determination of a wide range (caused by uncertainty of the thermometer) of chlorite forma-

tion temperatures (200-255°C). The obtained results are close to the temperatures measured by Kozłowski (in: Kornatowski 2002) for fluid inclusions in quartz on S-C surfaces in the mylonites (216°C) and slightly lower than the temperature of crystallization in the postdeformation milky quartz vein (264°C in: Kozłowski & Jurewicz 2001). Petrotectonic observations point to higher temperature condition during the formation of the shear zone (above 300°C).

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