Structural control on mineralization of joints: case study from Paleogene flysch, Outer Carpathians (Poland)

Anna Świerczewska[1], Vratislav Hurai[2] & Antoni K. Tokarski[1]

[1]*Institute of Geological Sciences, Polish Academy of Sciences, Senacka 1, 31-002 Kraków, Poland*
[2]*Geological Survey of Slovak Republic, Mlynska Dolina 1, 81-704 Bratislava, Slovakia*

In the Dunajec River valley, Paleogene flysch in the innermost part of the Magura nappe is affected by advanced diagenesis. Mineralization of joints in sandstone beds has been studied there. The sandstone is cut by joints of four sets comprising two

sets of cross-fold joints striking NNE (I) and NNW (II) and two sets of fold-parallel joints striking ENE (III) and ESE (IV). Joints of sets I and II occurred before folding, whereas joints of sets III and IV occurred during and/or after folding.

Numerous set I and set II joints are filled by mineral veins, up to 2 cm thick. These are simple veins comprising: (1) columnar calcite, (2) blocky calcite and blocky quartz and, (3) drusy calcite, as well as composite veins (4) comprising columnar calcite at the margins and blocky calcite and blocky quartz in central part. No fluid inclusions are preserved in calcite crystals, whereas numerous inclusions were observed in quartz crystals. Some quartz crystals show zonal texture. Inclusions within different zones show that during growth of the crystals P/T conditions changed from 1.1–2.0 kb and 200–210°C to 0.8–1.8 kb and 160–175°C. Mineral veins (less than 1 cm thick) filling set III and set IV joints are less common. These veins contain exclusively columnar calcite (1).

Mineralization formed in four successive stages (i-iv). In the first stage (i) columnar calcite (in veins 1 and 4) filled set I and set II joints. This took place during a period of strike-parallel extension, when the host strata were still in horizontal position. In the second stage (ii) columnar calcite veins (1) filled set III and set IV joints. This occurred due to cross-fold extension during and/or after folding. In the third stage (iii) blocky calcite and blocky quartz mineralization (in veins 2 and 4) occurred. The last stage (iv) resulted in drusy calcite veins (3). Stages (iii) and (iv) occurred due to fold-parallel extension after completing of folding.

Cathodoluminescence indicates that composition and/or temperature of fluids during formation of the columnar calcite veins (1) were different for the phases (i) and (ii). It appears that the high T blocky quartz mineralization (in veins 2 and 4) as well as advanced diagenesis of the host strata may be related to Miocene andesite intrusions cutting the discussed part of the Magura nappe.