Fault-related dawsonite veins from the Fore-Dukla thrust sheet (Outer Carpathians, Poland)

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Dawsonite ($NaAlCO_3(OH)_2$) veins have been investigated in the Tertiary flysch rocks of the Silesian nappe in the eastern part of the Polish Outer Carpathians. The veins have been observed in minor thrusts and faults associated with thrust zones in the Fore-Dukla thrust sheet (Opolski, 1930; Świdziński, 1958). The aim of the study is to present the characteristics of the dawsonite veins, establish the origin of dawsonite and draw conclusions on the process of vein formation. The origin of dawsonite was investigated using petrographic, microstructural and geochemical analyses.

Vein samples were taken from natural outcrops along the Jabłonka and Solinka streams. They were found in the Hierglyphic, Menilite, and Transition beds. Dawsonite veins occur on fault surfaces as single objects or in the form of a multilayered structure, and are arranged parallel to each other. In few places the dawsonite veins form thin fibrous covers on calcite. The observed dawsonite is fibrous, white in colour and with a silky gloss. All dawsonite fibres are subparallel to the vein boundaries. Cross-sections normal to the fibres show slightly curved or straight fibres in undeformed veins, or deformed dawsonite fibres and folded dawsonite veins.

X-ray diffraction study clearly identified the presence of dawsonite with small admixture of calcite and quartz. In the majority of the samples the dawsonite content is about 95 %.

Isotopic analysis of dawsonite shows high variability in the $\delta^{18}O$ values, from –7.06 to +4.15 ‰, and low variability in the $\delta^{13}C$ values, from –6.77 to –4.40 ‰. The $\delta^{18}O$ values reflect complex sources and/or processes responsible for the stable oxygen isotope ratios. In turn, the uniform range of $\delta^{13}C$ values suggests the same source of carbon: mantle-magmatic CO_2. Such $\delta^{13}C$ values are observed in the majority of Carpathian CO_2-rich mineral waters.

Deformed and folded dawsonite veins point to the early origin of dawsonite, prior to thrusting in the study area. The $\delta^{18}O$ composition shows that dawsonite could have crystallized from waters with isotopic characteristics of marine waters and provides further support for the early vein formation.

Veins with lack of deformation of the dawsonite fibres and the specific $\delta^{18}O$ composition allow to conclude that this generation of dawsonite was a late authigenic mineral and crystallized after thrusting of sediments in the study area.

References

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