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Antitaxial veins of rock salt in shale associated with slickensides (Permian Haselgebirge Formation, Northern Calcareous Alps, Austria)

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In Alpine salt deposits, extensional veins/gashes filled with fibrous salt minerals are often associated with slickensides along vein walls to shale. In theory, veins and faults (with slickensides) originate from different external stress fields and stress ratio. How to explain the association of veins and slickensides? The observed slickensides generated in a stress field in shale as two mirror-symmetrical slickensides. At this stage, a compressional stress field existed. Recrystallizing salt acts as a very high viscous liquid generating an overall isotropic pressure thus allowing easy cracking of the weak shale (phenomenon of effective pressure). After cracking of the shale, salt crystallized within the growing vein. The growth of the vein fill was antitaxial (Hilgers & Urai, 2002; Oliver & Bons, 2001). Material transport occurred likely along slickensides respectively vein walls and possibly through shale. The first fibrous are oriented oblique to the wall, according to the direction of the minimum principal stress. At the final stage of vein growth, the fibrous filling grew orientated normal to the wall surface. Crystallization was driven by crystallization power, until an isotropic stress field was restored. The crystallization pressure for halite amounts 66 MPa and 380 MPa at 50˚C and supersaturations of 2 and 50 (references in Hilgers & Urai, 2005). The crystallization pressure at elevated temperature likely resulted in short periods of “fluid” overpressure. Consequently, the intermittent change of differential stresses could explain the slickensides parallel to vein walls.

References

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