Microstructures in Halite Veins and their Implication on the Bulk Permeability of Rock

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Veins are localized precipitates grown in dilatational sites. They are of great importance as they emplaced in fractures, which significantly change the bulk permeability of rocks. This study gives an overview of various halite vein microstructures and discusses the process of vein formation. Fibrous and elongate to elongate-blocky halite veins were sampled in sandstone, marly beds and rock salt (Poland, Germany). Their microstructures are visualized with gamma-irradiated halite and polished and etched surfaces, which allows to deduce the deformation mechanism and strain rate, as well as the differential stress. Fibrous halite veins are about 5 to 10 cm wide and the microstructure only locally shows growth subgrains aligned parallel to the grain boundaries and inclusion bands oriented normal to fibre orientation. Earlier fibrous veins implies a more complex evolution with abundant deformation-related subgrains and show growth zonation indicative of deformation, recrystallization and subsequent overgrowth. Elongate blocky veins hosted in sandstone and rock salt are a few cm wide and are filled with cm-sized grains showing growth zonation. Such microstructures require large fracture increments during vein growth, which in turn implies higher bulk permeability of the rock. Syntectonic vein formation suggests the presence of fluid overpressures in our samples. The orientation of veins may be used to infer paleostress directions during vein formation. Plastically deformed halite vein microstructures are used to deduce differential stresses, and fibrous veins track the opening direction of the fracture over time.