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The hydrogeological activity of fault zones: the example of the Talhof-fault-system (Eastern Alps, Austria)

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Fault zones in the upper crust are typically composed of complex fracture networks and discrete zones of altered fault rocks. They generally show a spatio-temporal evolution from the protolith to the fully developed fault with a zoned internal architecture. Distinct domains of fault zones, in particular the damage zone, often represent important areas of essential subsurface water conductivity. Other domains, e.g. the fault core, may act as barriers (Caine et al., 1996). Massive influx of water during subsurface excavation is often related to fault zones. To establish a hydrotechnical quantification of tunnel-sections it is important to define the hydrogeological setting. A detailed collection of the hydraulic effectivity of faults is therefore very important for the hydrogeological prediction during the site investigation in view of geotechnical projects.

For a case study we chose the Talhof-fault-system in the Semmering area (Eastern Alps, Austria). The subvertical, approx. E-W-striking Talhof fault shows predominant left-lateral displacement and crosscuts in parts layered carbonates (Triassic limestones and dolomites) and quartzites of the Lower Austroalpine Unit. These lithological units are characterised by contrasting deformational and rheological behaviour during faulting. Brittle structures within the carbonates are generally characterised by the formation of joints (shear and extensional fractures) and cemented tectonic breccia; within the quartzites the protolith is totally disintegrated up to the formation of cohesionless fault gouges.

Small-scale mapping of the lithology and macroscopic (brittle) structures, and the detailed investigation of representative outcrops (e.g., scan-line-mapping) gives detailed information about the geometry of the joint system, and the properties of distinct joint

sets (e.g., aperture, width, length, roughness, filling,Ě). Based on these data, certain domains were defined, each being characterised by a particular hydraulic effectivity. This work provides the compilation of hydrogeological parameters (e.g., permeability, porosity, etc.) based on a detailed tectonic analysis. This is a major input for numeric-hydraulic modelling.

References: Caine, J.S., Evans, J.P., Forster, C.B., 1996. Fault zone architecture and permeability structure. Geology 24, 1025-1028.