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Strain localization associated with brittle faulting in a natural clinoptilolite-tuff (open-pit mine Nižný Hrabovec, Slovak Republic)

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Clinoptilolite, a micro-porous natural zeolite comprising tetrahedra of silica and alumina that commonly occurs in volcanic tuffs through devitrification of natural glasses, has numerous uses in the manufacturing, agriculture and building industries; it also has applications in veterinary and human medicines. Field observations and microstructural investigations in the natural clinoptilolite-tuff from Nižný Hrabovec (Slovak Republic) – one of the world's economically most important high-quality clinoptilolite deposits – show evidence of strain localization. Brittle faults formed along pre-existing joints with plumose structures that had acted as a pathway for local infiltration of iron-, manganese- and potassium-rich fluids. Fault displacement formed structures that are indicative of both velocity hardening, with dissolution precipitation creep (SC/SCC' foliation), and velocity weakening, with several phases of ultra-cataclasites forming along principal slip surfaces. Rock-fluid interaction is characterized by a high-mobility of K, with K-feldspar decorating SC/SCC' foliations, infiltrating fractures in fault damage zones and precipitating as idiomorphic crystals in open cavities and along fault surfaces. Microstructures such as polished slickensides, injection of fluidized cataclasites, clast cortex grains in cataclasites and truncated grains along principal slip surfaces suggest that seismic slip probably occurred along some of the faults.