Quantifying shear strain of a potential halite detachment below the Swiss Eastern Tabular Jura

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Middle Triassic evaporite successions encompassing anhydrite and halite of the so-called Zeglinge Formation (“Salzlager”) are known to form a major detachment along the floor thrust of the Jura fold-and-thrust belt in northern Switzerland (e.g., Jordan, 1990, Eclogae geologicae Helvetiae, 83, 525–542). The spatial distribution of these evaporites also extends north of the Jura Main Thrust that forms the northern limit of the range. This observation and the occurrence of regional folds north of the Jura Main Thrust guided the tectonic interpretation that a major detachment with some hundreds of meters thrust displacement also underlies the so-called `Vorfaltenzone`, a narrow zone between the autochthonous Tabular Jura in the Northwest and the allochtonous Folded Jura to the South (“thin-skinned model”). A competing, yet unpublished interpretation of the folds north of the Jura Main Thrust, however, infers a thick-skinned origin of these structures, i.e., resulting from the re-activation Paleozoic basement faults of the Constance-Frick Trough (“thick-skinned model”; see Madritsch et al., 2018, Tectonics 10.1029/2017TC004945 for a discussion of regional tectonics). The National Cooperative for the Disposal of Radioactive Waste (NAGRA) recently has drilled through the salt succession of the Zeglingen Formation at four locations within the “Vorfaltenzone”. To test the competing deformation models for this tectonic domain, cores from these Zeglingen evaporites are analyzed with regards of structures which can be used for quantifying the shear strain of the drilled anhydrite and halite. Cores are oriented allowing to determine the true orientation of structures and provide continuous sections through the potential evaporitic detachment. Both macroscopic and microscopic observations are used to develop a strain profile through the evaporites. Results show that large parts of the up to about 30 m thick halite sections and most of the anhydrite units are virtually undeformed showing up to 10 cm sized crystals of rock salt and stylolithic bedding. Sheared and mylonitic halite is limited to several up to about 1 m thick intervals. Orientations of foliation, stretching lineation, elongated (sigmoidal) grains, shear bands and winged inclusions prove polyphase kinematics with different transport directions arguing against a continuous high-strain detachment. The preliminary assessment will be completed by quantifications of the shear strain in mylonitic halite layers using winged inclusions (Grasemann et al., 2015, Journal of Structural Geology, 70, 78–94).