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Ductile deformation and $^{40}Ar/^{39}Ar$ age of fabrics of Permian polyhalite/anhydrite rocks of Eastern Alps

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The Northern Calcareous Alps (Eastern Alps, Austria) are a fold-and-thrust belt, which was detached in several steps from its basement during Alpine orogeny. The Alpine Haselgebirge Formation represents an evaporitic succession within the rift sequence of the Northern Calcareous Alps. The evaporitic base was used as one of the major detachment levels during Cretaceous and Tertiary shortening. Isolated pieces of anhydrite and polyhalite are placed within a cataclasite of rock salt and shale. The investigated rock salt deposits (Berchtesgaden, Dürrnberg, Altaussee) show the same microstructural fabrics and features for anhydrite and polyhalite rocks. The texture is dominated by grain boundary migration microfabrics. The three major types of sulphate rock – nodular/red anhydrite, dark layered anhydrite and polyhalite – formed in sedimentary-diagenetic respectively metamorphic stages. The metamorphic history starts with an early stage of grain size increase with a polygonal texture in anhydrite. During orogeny, porphyroblasts of polyhalite in anhydrite grew in two stages. For the bulk rock an earlier compressive regime led to twinning, strain shadows, grain boundary migration and subgrain rotation recrystallisation, visible mostly in anhydrite. A later extensive regime led to the breakage of minerals, visible mostly in polyhalite. Finally the ongoing deformation embedded isolated pieces of sulphate rocks in the rock salt matrix.

We applied the $^{40}Ar/^{39}Ar$ dating technique on three distinct types of microfabrics of polyhalite rocks from the Altaussee mine. The preliminary results are as follows: Coarse-grained vein-type polyhalite yielded an age of ca. 232 Ma, when assumed

sediment load was around 850 m (Rantitsch & Russegger, 2005). Our measured temperature peak of 180˚C was reached before 144 Ma, according data from the adjacent gypsum/anhydrite deposit of Moosegg (Hejl & Grundmann, 1998). During Jurassic, a compressional stage of deformation could be related to the closure of the Meliata ocean (Gawlick & Höpfer, 1999). In thin section, we recognised also extensional fabrics. We measured a second stage of deformation of 110 Ma within fine-grained polyhalite, which fits to previous $^{40}Ar/^{39}Ar$ white ages of ca. 105–120 Ma (Frank & Schlager, 2006). Pieces of Tauglboden strata (Upper Jurassic, with a numerical age of 150 Ma) in the rock salt of Berchtesgaden show that incorporation is no older than this age. Rock salt is tectonically juxtaposed over Cretaceous strata in Hallstatt, Dürrnberg, and Bad Ischl. The preliminary polyhalite age of ca. 110 Ma from the Altaussee deposit fits, therefore, well with the age of deformation in surrounding rocks. This allows the conclusion that the $^{40}Ar/^{39}Ar$ technique can be successfully applied for dating of ductile deformation in deformed Alpine polyhalite-bearing rocks.

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