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Structural evolution of Alpine salt deposits, Austria and Bavaria

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Alpine salt deposits consist of a tectonic melange of rocksalt and shale called haselgebirge representing the Haselgebirge Formation of Permian to Early Triassic age and mainly exposed within the central and eastern Northern Calcareous Alps. The initial evaporitic sediments were transformed into a breccia (protocataclasite, mylonite) during Alpine orogeny. Residual rocks of shale, anhydrite, polyhalite, sandstone and limestone float as isolated bodies in the haselgebirge matrix. Field investigations of foliation, halite mineral lineation, fold axis, veins and the overall present slickensides in shale revealed an individual history for all investigated mines (Dürrnberg, Berchtesgaden, Altaussee, in part Hallstatt).
Ar-Ar dating of various micostructural types of polyhalite yield several preliminary age groups: 235 Ma, 180 Ma, and 110 Ma. Fluid inclusion measurements on anhydrite together with vitrinite reflectance data showed that temperatures of 140-180 °C were reached in Berchtesgaden and around 250° C in Altaussee. Microstructural analysis of anhydrite reveals strong stretching structures with lobate grain boundaries and the fomation of large anhydrite crystals in polyhalite (locally called muriazite).
Rock salt and Haselgebirge samples were gamma-irradiated to intensify contrasts in thin section analysis. No primary structures like fluid inclusion bands or chevrons were found. The oldest visible parts are innner cores of large residual grains. All other types of grains suffered grain size reduction during the subsequent deformation. Using subgrain piezometry, high differential stresses of around 5 MPa formed the present microstructure.
The Alpine rock salt deposits suffered a complex deformation history. A first peak was the formation of polyhalite veins, 235 Ma ago. The overburden was around 800 m (Rantitsch & Russegger, 2005) and first differentiation of the sea floor occurred (Mandl, 1984). The Hallstatt Meliata ocean was subducted in the Upper Jurassic (Spötl & Hasenhüttl, 1998). The strong brecciation of shale might come from this event, at least one of the ages measured fits this time, 180 Ma. The present halite structures are younger. The orientation of foliation and mineral lineation in Berchtesgaden and Dürrnberg happened when the lower Cretaceous Roßfeld syncline moved north. In the salt mines of Bad Ischl and Hallstatt, Lower Cretaceous rocks were found beneath the deposit, indicating large-scale displacement movement consistent with polyhalite dating. The salt body of Hallstatt was interpreted to have formed as pre-Gosau body, prior to the Lower/Upper Cretaceous boundary, as intruding into a strike-slip, transtensional zone (Arnberger, 2006). Fine-grained polyhalite recrystallized completely during the Cretaceous, at 110 Ma years. The present macro- and microstructures are no older than that, but may have suffered regional severe overprint like in Berchtesgaden.

References

Arnberger, K. (2006) Detachement folding above the Permian Haselgebige: Palinspastic reconstruction of alpine west-directed thrusting (Plassen, Hallstatt, Upper Austria). Diplomarbeit an der Universität Wien, pp. 100.
Mandl, G. W. (1984) Zur Trias des Hallstätter Faziesraumes – ein Modell am Beispiel Salzkammergut (Nördliche Kalkalpen, Österreich). Mitt. Ges. Geol. Bergbaustud. Österr. 30/31, 133-176.
Rantitsch G. & Russegger, B. (2005) Organic maturation within the Central Northern Calcareous Alps (Eastern Alps). Austrian Journal of Earth Sciences, 98, 68-76.
Spötl, C. & Hasenhüttl, C. (1998) Thermal History of an evaporitic Mélange in the Northern Calcareous Alps (Austria): a Reconnaissance Illite ‘crystallinity’ and Reflectance Study. Geologische Rundschau, 87, 449-460.