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Salt rock of the Alpine Haselgebirge Formation - ages, temperatures and structures

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The Upper Permian salt bearing Haselgebirge Formation (257–251 Ma) of the Northern Calcareous Alps (NCA) shows unusual features different from other evaporite successions: (1) extreme tectonic deformation, (2) a large proportion of mudrock and anhydrite rock, and (3) the absence of K-bearing evaporite minerals other than polyhalite.

Intact mudrock and anhydrite rocks allow the reconstruction of early diagenetic events. Migrating mineralized hydrous fluids, released from mudrock and gypsum, led to the extensive growth of polyhalite, which forms massive rocks with various fabrics. This growth happened during the ongoing opening of the Meliata Ocean. Polyhalite age dating shows a maximum of measured ages ca. 233–234 Ma (40Ar/39Ar age).

The investigated rock salt deposits (Altaussee, Berchtesgaden-Bad Dürrnberg) show a thermal overprint during Alpine orogeny. Polyhalite age data scatter broadly with maxima during Jurassic (closure of Meliata Ocean) and Cretaceous (eo-Alpine thrusting event). Our fluid inclusions and vitrinite reflexion measurements yield a peak temperature of 180°C for Berchtesgaden and >240°C for Altaussee. Rock salt and mudrock form a two-component tectonite (“haselgebirge”, Schauberger, 1986). Halite deformed and recrystallized, and also crystallized in veins within mudrocks. We interpret high overpressure of the pore fluid to have significantly contributed to fracturing of the mudrock. By use of the temperature-independent subgrain-size piezometer for halite, the paleo-differential stress was calculated at ca. 2.5 MPa in Altaussee and ca. 4.5 MPa in Berchtesgaden. These paleo-stresses allow estimate temperatures at ca. 150°C and ca. 110°C, also implying very high strain rates (10-9 to 10-10 s-1; Leitner et al., 2011).

The orientation of the foliation, the halite mineral lineation and other structures of rock salt are consistent within each deposit. The mapped mesoscale structures relate to the surroundings of the salt bodies. White fibers within extensional veins represent the last increment of salt deformation. It is supposed that the salt was squeezed from the décollement level to the surface. All Alpine salt bodies got their final shape and internal structure during Cenozoic deformation stages (Leitner and Neubauer, 2011).

References:

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