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Authigenic K-feldspar in salt rock (Haselgebirge Formation, Eastern Alps)

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The crystallisation of authigenic quartz under low temperature, saline conditions is well known (Grimm, 1962). Also the growth of low temperature authigenic feldspar in sediments is a long known phenomenon (Kastner & Siever, 1979; Sandler et al., 2004). In this study we intend to show that halite (NaCl) is a major catalyser for authigenic mineral growth.

During late Permian (c. 255–250 Ma), when the later Eastern Alps were located around north of the equator, the evaporites of the Haselgebirge Formation were deposited (Piller et al., 2004). The Haselgebirge Fm. consists in salt mines of a two-component tectonite of c. 50 % halite and 50 % sedimentary clastic and other evaporite rocks (Spötl 1998). Most of the clastic rocks are mud- to siltstones ("mudrock"). During this study, we investigated rare sandstones embedded in salt rock form four Alpine salt mines. Around 40 polished thin sections were prepared by dry grinding for thin section analysis and scanning electron microscopy. The sandstones consist mainly of quartz, K-feldspar, rock fragments, micas, accessory minerals and halite in the pore space. They are fine grained and well sorted. Mudrock clasts in sandstone were observed locally, and also coal was observed repeatedly. Asymmetric ripples were found only in the dimension of millimeters to centimeters. Euhedral halite crystals in pores indicate an early presence of halite. During early diagenesis, authigenic minerals crystallized in the following chronological order. (1) Where carbonate (mainly magnesite) occurred, it first filled the pore space. Plant remains were impregnated with carbonate. (2) Halite precipitated between the detritic sandstone grains. Carbonate grains can be completely embedded in halite. (3) K-feldspar and quartz grains usually expose a detritic core and a later grown euhedral inclusion free rim. Euhedral rims of K-feldspar often also enclose a halite core. K-feldspar replaced the pre-existing halite along former grain boundaries of halite. Fluid reaction rims with many tiny minerals (hematite, acicular crystals, fluid inclusions etc.) around quartz, K-feldspar and rock fragments probably belong to this stage. (4) Authigenic anhydrite grew over carbonate, halite (halite inclusions in anhydrite), euhedral quartz and euhedral K-feldspar. (5). The sulfate polyhalite [K2Ca2Mg(SO4)4•2H_2O] needs three major cation ingredients: potassium, calcium and magnesium. The large granoblastic polyhalite crystals enclose halite, euhedral quartz and euhedral K-feldspar. It formed coevally with the authigenic anhydrite, which proves by their intermediate intergrowth. The age of granoblastic polyhalite was measured between 235–210 Ma on samples from the salt mines of Altaussee, Berchtesgaden and Bad Dürrnberg with 39Ar/40Ar dating (Leitner et al., 2014). Since deposition of the Haselgebirge Fm. was at c. 250 Ma, the primary diagenetic crystallization was completed c. 15–30 Ma after deposition. The overburden at this time was 1000–2000 m at maximum (formation of the large carbonate platforms; Tollmann, 1985) and therefore very low p-T conditions can be assumed for the formation of authigenic quartz and authigenic K-feldspar.