Ar-Ar dating of polyhalite and langbeinite in evaporite bodies

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Ar-Ar dating of K-sulphates (polyhalite, langbeinite) allows the recognition of a wide variety of geological processes within sulphate-bearing evaporite bodies. Under laboratory conditions, polyhalite can be synthesized by a reaction of gypsum with appropriate solutions in the ternary system K_2SO_4–$MgSO_4$–H_2O at temperatures above 70 °C and starts to dehydrate at 255 °C. Langbeinite likely forms by decomposition of polyhalite to langbeinite + anhydrite during prograde metamorphism. We successfully dated geological processes in the Permian evaporites of Eastern Alps. Of particular interest is the growth of polyhalite with a variety of fabrics in several stages between 235 and 208 Myrs. These ages reflect likely elevated heat and fluid flow during formation of the Austroalpine passive continental margin facing towards Meliata oceanic tract. Some fabrics are overprinted during Early Cretaceous mylonitization (ca. 113 Ma) and partial Ar loss during Eocene recrystallization (ca. 45 Ma).

Fine-grained polyhalite from Zechstein (Morsleben) gave an age of 28.68 ± 0.11 Ma, which may represent the age of crystal growth from a brine. Deformed langbeinite from a mylonite zone from Neuhof gave a slightly scattered age pattern at ca. 150 Ma, implying a major step of ductile flow and crystallization of langbeinite. From analytical point of view, langbeinite is very stable and allows diffusion experiments over a wide range of energies.