



Exploring the hydrochemical evolution of brines leading to sylvite precipitation in ancient evaporite basins

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Sylvite is a very common mineral in ancient evaporite deposits. Due to the absence of current deposits, the natural geochemical mechanism/s for synsedimentary sylvite precipitation and accumulation are not well understood. Numerous sylvite deposits or portions of them have been described as a result of diagenesis (i.e. Sergipe subbasin, Brasil). However, a number of deposits have been described as syndimentary or being formed during primary evaporite deposition. It is the last group of deposits that can be studied to better understand the hydrochemical processes taking place in the brine at the onset of sylvite precipitation.

The Salt IV sylvite beds from the Mulhouse potash basin, Alsace (France) have been described as synsedimentary in origin (LOWENSTEIN and SPENCER, 1990; CENDÓN et al., 2008). While sylvite in itself does not contain fluid inclusions viable for micro analysis, primary textures in neighboring halite are used as a proxy to understand brine evolution. Two halite-sylvite cycles from the B1 and B2 layers of the potash lower seam were selected. These exhibited clear primary halite crystal textures with sylvite adapting to an irregular halite sedimentary surface and finishing with a flat surface. The nine halite samples, selected at centimeter scale, provided close to 100 single fluid inclusion analyses, representing both the transition towards sylvite precipitation and the post sylvite precipitation.

The fluid inclusion analyses revealed strong fluctuations in K concentration, well over the analytical error (<10%). These variations, in the same halite crystal, seem aligned in growth bands, with fluid inclusions within a certain growth band showing practically identical K concentrations, while neighboring bands exhibit a different concentration. Overall, the closer we are from a sylvite layer the higher K concentrations are. However, strong fluctuations continue when growth bands are compared. This pattern shows cycles of increasing K concentration along parallel growth bands with sharp falls followed by the initiation of a new increasing trend. The small "growth band" scale of the K concentration variations, suggests very sensitive processes within the brine with potential environmental changes (i.e. seasonal variations, day-night temperature fluctuations cycles) leading towards the final mass precipitation of a sylvite layer.

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