# Brine inclusion migration in single salt crystals under thermal gradient

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**Introduction**

The behaviour of water contained in rock salt at elevated temperatures is critical to the performance of that medium for the disposal of nuclear waste. Water content in halite ranges from 0.1 wt. % (pure), up to several wt. % water (clay rich). Previous investigations indicate brine inclusions move towards the heat source involving dissolution of salt at the hot side of the inclusion and precipitation at the cold side [1].

**Preliminary Results**

We ran controlled thermal gradients studies for brine movement in WIPP salt single crystals and found the behaviour of the brine inclusions subjected to heat dependent on the thermal gradient magnitude and the nature of the inclusion. Single phase inclusions (liquid only) migrate towards the heat source as described above [1]. The composition of the salt deposited along the migration channels changes along the pathway. At the start of the pathway the deposited salt is composed of a mixture of NaCl, $MgCl_2$, and $CaCl_2$. As the brine migrates towards the heat source its composition changes and it gets enriched in NaCl. SEM analysis shows that brine migrates through a created network of square shaped hollow channels of about 10 $\mu$.

The behaviour of two phase inclusions (liquid and gas) in temperature gradients is different from single phase inclusions [2]. The liquid in the inclusion still migrates towards the heat source, while the vapor moves away from the heat source through single narrow (square shaped) channels. The resulting salt crystals are more fractured than salt crystals with liquid inclusions.

[1] Roedder, E. and Bassett, R. L. (1981) *Geology* **9**, 525-350
[2] Anthony, T.R. & Cline, H.E. (1972) *Acta Metall* **20**, 247-255