Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.3264

Analytical methods for determination of $\delta^{26}Mg$ and $\delta^{88/86}Sr$ in evaporites

YANA KIRICHENKO[1] AND NETTA SHALEV[2]

[1]ETH Zürich
[2]ETH Zurich
Presenting Author: yana.kirichenko@erdw.ethz.ch

Marine evaporites (such as gypsum and halite) precipitate directly from evaporating seawater, and thus are considered to be good recorders of ocean chemistry. Magnesium and strontium are found in gypsum as trace elements in the crystal lattice. In halite, they are present in fluid inclusions captured during crystallization. Thus, ancient marine evaporites may potentially serve as an archive for seawater isotope compositions of Mg ($\delta^{26}Mg$) and stable Sr ($\delta^{88/86}Sr$). Such use of marine evaporites requires accurate and precise $\delta^{26}Mg$ and $\delta^{88/86}Sr$ measurements of these minerals. However, due to low concentrations and their chemical properties (such as solubility), new sample preparation procedures are needed to enable such measurements.

In this study, we develop practical procedures for:

1. Leaching of gypsum to remove fluid inclusions that can contribute Sr and Mg to bulk compositions. The method involves three leaching steps with ethanol and three leaching steps with Milli-Q water, before the full dissolution of the solids in a large volume of Milli-Q water. The procedure has been tested on a natural sample of marine gypsum.
2. Purification of Mg from extremely high Ca or Na matrix, applying routinely-used cation-exchange resin column chromatography. A new procedure takes into account the column volume requirements of low concentrations of Mg in gypsum and halite.

Preliminary results show that using the ethanol-Milli-Q leaching procedure, only <4% of calcium is lost during the six leaching steps, while 40% of sodium and 7% of magnesium are removed. This suggests that the vast majority of the gypsum crystals remained undissolved, while most of the fluid inclusions were leached. The adjusted Mg purification technique allows loading of the sample onto columns dissolved in up to 2 ml of solution. This enables the treatment of halite with a Mg/Na molar ratio ≥0.0001, which encompasses the range of most marine halites, and of gypsum with a Mg/Ca ratio ≥0.001. A procedure for gypsum with lower Mg concentrations will be further investigated.