Isotopic analyses of the Middle Miocene evaporite assemblage and its fluid inclusions (Praid, Transylvanian Basin, Romania)

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The objective of this study is to constrain the formation conditions of deposition of the Middle Miocene marine evaporite in the Transylvanian Basin (TB). The salt rock, formed during the Badenian Salinity Crisis (BSC), consists principally of halite (> 90%). Representative samples were collected from Praid salt diapir.

Detailed petrographic study was carried out in order to distinguish primary features of the salt rock and to exclude secondary movements and their impacts. Two types of salt rock can be distinguished: 1/ massive grey salt with large, elongated halite crystals, containing primary fluid inclusions (FIp), surrounded by submicrometer size halite grains and clay matrix, and 2/ layered salt building up greyish (clay rich) and white (clear halite) layers. This type has quasi mosaic structure and contains very rarely FIp.

The primary fluid inclusions in halite, containing aqueous solutes, are expected to record compositions and isotopic characters of paleo-seawater during the BSC of the Paratethys. Beside halite, authigenic anhydrite and dolomite are also present, which precipitated in marine environment and their compositions also reflect the geochemical conditions of the seawater.

Microthermometry of FIp in both types of halite shows low homogenization temperature (10-24 °C) which is typical for marine environment. Isotopic characteristics of FIp are -15.55 – -7.07 ‰ for δ¹⁸O and -87.9 – -74.17 ‰ for δ²H. Sulfate isotope values measured in anhydrite are ranging δ³⁴S 20.4 – 22.4 ‰ and δ¹⁸O 12.9 – 14.5 ‰ that coincide with the Middle Miocene Outer Carpathians salt deposits (Halas & Krouse, 1981) and support evaporated seawater origin. The geochemical signatures (Fe-zonation) and isotopic characters (δ¹⁸O -7.07 – -4.55 ‰ and δ¹³C -9.03 – -8.31 ‰) of the rombohedral translucent dolomite suggest mainly meteoric origin. They possibly precipitated from an upper level of the seawater. All of these isotopic and geochemical characters of the evaporite reveal a complex restricted hydrogeologic evolution environment.
