EGU21-15287, updated on 29 Nov 2022
https://doi.org/10.5194/egusphere-egu21-15287
EGU General Assembly 2021

Insight into a salt diapir: microstructural study of Praid (Transylvanian Basin, Romania) salt rocks

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Middle Miocene salinity crisis in the Central Paratethys resulted in significant amounts of marine evaporite deposits in the Transylvanian Basin (TB), Romania. The thickness of salt at Praid area is potentially suitable for underground storage of radioactive waste or gases. One of the main factors that determines the potential usage of this voluminous salt body for storage or disposal of various materials is the microstructural characteristics of the salt rock.

Praid is located at the eastern margin of the TB as part of the eastern diapir alignment. The underground salt mine at Praid has been operating there continuously for centuries. It is an ideal place for sampling the internal part of a salt diapir body, where 20 representative samples were collected. The aim of this study is to extend our understanding of the deformation mechanism in the Praid salt rock.

Primary and secondary structural features were observed and distinguished through detailed petrographic observation. Two types of salt rock were identified: 1/ massive grey salt with large, elongated halite crystals, containing primary fluid inclusions (FI_p), accompanied by submicrometer sized grains of halite and clay matrix, and 2/ layered salt with more uniform grainsize distribution showing alternation of greyish (clay rich) and white (clear halite) layers. The layered rock type has mosaic-like structure with a large number of secondary fluid inclusions (FI_s). Beside halite, authigenic anhydrite and dolomite are present subordinately (~ 1 vol. %). Secondary fluid inclusions, composed of nitrogen and methane, are indicators of fluid migration pathways throughout the salt body.

Electron Backscatter Diffraction (EBSD) mapping was performed both in the massive and layered salt samples to shed light on the microstructure of the salt rocks. Gamma irradiation was carried as a complementary method of EBSD mapping. Comparing the subgrain diameters obtained from the two techniques, the values are fairly overlapping. The detailed microstructural observations

allowed to recognize both dislocation creep and pressure solution processes, which acted concurrently in the Praid salt rock. The differential stress calculations on the salt rock samples indicate a maximum differential stress less than 2 MPa for the massive salt and less than 1.8 MPa for the layered salt. The strain rate calculations (total strain rate between 7.3*e-11 s^{-1} and 1.8*e-10 s^{-1}) are in good agreement with the observed features in the salt mine, where one of the ~260-year-old salt extraction chambers suffered at least 10 % compressional deformation.

The microstructural characters of the salt body reveal a complex deformation history where fluids have played an important role. The results of this project will be useful and comparable with the regional geological knowledge, to better understand the evolution of this Middle Miocene salt body.

The project is supported by the Cooperative Doctoral Programme of the Ministry for Innovation and Technology (ITM).