

Effect of CO₂ on the geochemical properties of carbonates

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Carbonates are among the most sensitive minerals in the CO₂-porewater-rock system to detect the geochemical processes, which are induced by either natural or anthropogenic CO₂ flooding.

This paper compares sandstones in the natural CO₂ reservoirs of the Mihályi-Répcelak site with those from Szolnok area derived from the same turbiditic facies, but without CO₂. Both lithologies represent the most potential industrial CO₂ storage reservoir in the Carpathian-Pannonian region.

The main question of this study how the geochemical behavior of carbonates reflects the high flux of CO₂. Thus, the samples were studied for major and minor element compositions, trace element mapping and stable isotope ratios.

As a general feature ankerite rim precipitated around dolomites, and patches of siderite are present in interstitial position. The presence/lack of dawsonite is the most obvious dissimilarity between the two study areas. However clear difference in the textural occurrence of ankerite zoning, related to differences in iron content, are also observed. Furthermore, calcite in the CO₂ barren area is the dominant cement phase, whereas it is missing from the CO₂ reservoir sandstones. Despite differences in iron zoning, the behavior of trace elements is similar. Barium, Ce, Dy, Y, Yb, La, Mn, Sr show positive correlation with iron concentration in the carbonates. The results of stable isotope analyses, carried out only in the CO₂ reservoir samples, indicate that siderite and dawsonite precipitated from different sources of CO₂. The origin of CO₂ related to dawsonite formation is magmatic based on the stable isotope composition of dawsonite and that of the free CO₂ gas. According to the hydrogen isotope composition of dawsonite, the origin of pore water may be meteoric modified due to the water-rock interaction.