Carbonate geochemistry of the Mihályi-Répcelak natural CO_2 occurrence

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The study of natural CO_2 occurrences can help to understand the main processes in the CO_2 reservoir on geological time scale. Mihályi-Répcelak area is one of the best known CO_2 occurrence in the Pannonian Basin. The basin is filled by fluvial sediments from deep basin to delta plane facies. The CO_2 was trapped in the turbiditic sandstones about 7-4 million years ago.

Our results on the mineralogy of the natural CO_2 reservoir rocks, show different types of carbonates, that are assumed to be the most sensitive to physco-chemical changes. The first type of carbonates is detrital dolomite, whereas the second type is diagenetic (before the CO_2 flooding) calcite, siderite and ankerite. These minerals are mostly dissolved. The third type of carbonates consists of calcite, ankerite, siderite and dawsonite. The textural position of carbonate minerals show that dawsonite, ankerite, siderite and calcite (3^{th} type) precipitated simultaneusly. Furthermore, the present of dawsonite is the most visible effect of CO_2 flooding.

In this study all types of carbonates (detrital, diagenetic, CO_2 trapping) were analysed by EPMA, LA-ICP-MS, Raman spectroscopy and mass spectrometry for stable isotope composition analyses (C, O, H) to better characterize their geochemical features. The results show that the calcite (2^{nd} and 3^{th} type) and dolomite (1^{st} type) are chemically pure minerals. The composition of ankerite (2^{nd} and 3^{th} type) can be divided into two groups, where the amount of Fe is the controlling factor. The Fe^{2+} concentration in the siderite is variable (~60-90 mol%). According to the result of stable isotope analysis, the source of CO_2 in the carbonates is of magmatic origin. Based on a novel evaporation technique OH^- containing carbonates (dawsonite) were measured for D/H composition. Results show that the porewater present during dawsonite formation had ultimately meteoric origin, which was modified after interaction with the country rock.