Determination of the stable isotope composition of dawsonite and its application to trace its origin

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Dawsonite is often mentioned as an indicator for CO_2 infiltration in geological reservoirs. Stable isotope characteristics of carbonates in CO_2-bearing fluid reservoirs can help us to better understand the chemical and physical processes, which control carbonate dissolution and precipitation during infiltration of CO_2–rich fluids. In addition, stable isotope characteristics of carbonates can be used to trace the origin of the CO_2-rich fluids precipitating these minerals. Therefore, stable isotope compositions of dawsonite have been widely investigated. However, determination of stable isotope compositions of dawsonite is not straightforward as CO_2-bearing fluid reservoirs generally contain multiple carbonate phases such as calcite, dolomite, siderite and ankerite. Most of stable isotope studies on CO_2-bearing reservoirs follow the approach analyzing bulk samples, containing several different carbonates. These minerals are reacted with 100 % orthophosphoric acid at 25 °C for 6, 24 and 48 hours to extract different carbonate minerals sequentially (calcite, dawsonite, ankerite) and to analyze their carbon and oxygen isotopic compositions.

Based on our experiments, it is evident that this method is not suitable for separating carbonate minerals (calcite, dawsonite, ankerite, dolomite) from bulk samples to determine their stable isotopic composition. Instead, we suggest a different methodology.

In addition, we present preliminary data for the dawsonite-CO_2 and dawsonite-H_2O isotope fractionation that can help to estimate the composition and origin of the former fluid equilibrated with dawsonite in a CO_2-bearing fluid reservoirs.