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The new approach to determine the stable isotope composition different carbonate minerals in CO_2-bearing sandstones

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Most of the stable isotope studies on dawsonite-bearing sandstones of natural CO_2 occurrences are carried out by investigating the whole rock stable carbon and oxygen isotopic composition. According to the studied literature, the most accepted method is described by [1], [2] and [3]. The whole rock sample, containing several different carbonates, is reacted with 100 % orthophosphoric acid at 25 °C for 6, 24 and 48 hours to extract sequentially the different carbonate minerals (i.e. calcite, dawsonite, ankerite) and analyze their carbon and oxygen isotopic compositions. However, it is unclear if the isotope composition obtained by this method is representative for only one phase or the whole rock.
In the present study, we used pure mineral phases (calcite, dolomite, ankerite, dawsonite, siderite) to react them with 100 % orthophosphoric acid at 25 °C for 1, 6, 24 and 48 hours and determined the amount of CO_2, which is the result of the acid reaction and analyzed their carbon and oxygen isotopic composition. The amount and isotopic composition of CO_2 gas developed during the dissolution of calcite and dawsonite have not been changed significantly after one hour, suggesting that these carbonates cannot be separated by using different reaction times. Majority of ankerite and dolomite was reacted in the first 24 hours, thus these minerals also cannot be separated from each other only by using distinct reaction times. In addition, the isotopic composition of ankerite and dolomite does not show significant variation after 24 hours.
Our work proved that this widely used method is inappropriate to separate properly the carbonate minerals as the CO_2, produced during the acid reaction, represents a mixture, which is originated from the carbonate minerals in different proportions. Instead, we suggest to separate the carbonate minerals from the dawsonite-bearing sandstones and to analyze them separately.
Based on these results, we carried out stable isotope analysis in dawsonite-bearing sandstones of natural CO_2 occurrence, which located in Mihályi-Répcelak area (W-Hungary).

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