Determination of carbon, hydrogen and oxygen isotopic compositions in pore waters using continuous flow isotope ratio mass spectrometer coupled with GasBench II

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The concentrations and isotopic compositions of carbon isotopes in dissolved inorganic carbon (DIC) and hydrogen and oxygen isotopes of pore waters are useful geochemical tracers that have been applied to constrain the fluid and carbon sources, fluid advection, fluid-rock interaction and AMO process in marine sediments. In our lab, we established an analytical method for measuring both the concentration and stable carbon isotopic compositions of DIC in pore waters. The instrument we used is a Delta Plus XP continuous flow isotope ratio mass spectrometer coupled with an on-line GasBench II device. In general, 0.5 ml of water sample is taken and reacted with pure H_3PO_4 in a glass vial at 40^{o}C, and the produced CO_2 is transferred into the mass spectrometer and $\delta^{13}C$ values are obtained. We carried out experiments in different reaction durations, and the results show that no statistical change in $\delta^{13}C$-DIC after 4 hours reaction time. The analytical precision for pore water samples is <0.1‰. The intensity of produced CO_2 gas shows an excellent linear correlation (r^2=0.998) with the DIC concentration, hence we can use this equation to calculate the DIC concentrations in the water samples. Four in-house water standards are prepared.

The GasBench II can be also used for highly precise measurements of the oxygen and hydrogen isotopic compositions of pore waters. The oxygen isotopes are measured by CO_2-water equilibration method. The water sample (~0.5ml) is isotopically equilibrated with a small volume of reference gas of 0.3% CO_2 filled in the headspace of a sample vial placed in the GasBench II. The analytical precision of $\delta^{18}O$ is <0.1‰. The hydrogen isotopes are measured by H_2-water equilibration method using a platinum catalyst, and the analytical precision for $\delta^{2}H$ is <2‰. This study is financially supported by Ministry of Education (grant no. 306007).