New insights on the formation of Triassic dolomite platforms derived from clumped isotope analyses

INIGO A. MÜLLER[1], PETER BRACK[2] AND STEFANO M. BERNASCONI[3]

[1,3]ETH Zurich, Geological Institute, Sonneggstrasse 5, 8092 Zurich
[2]ETH Zurich, Institute for Geochemistry and Petrology, Sonneggstrasse 5, 8092 Zurich
[1]inigo.mueller@erdw.ethz.ch
[2]peter.brack@erdw.ethz.ch
[3]stefano.bernasconi@erdw.ethz.ch

The chemistry of seawater during the Triassic has been postulated to have been different than in the modern oceans and to have triggered, especially in the area of the southern Alps, the formation of massive dolomite platforms. Some of these dolomite platforms are thought to consist of primary dolomite that either precipitated directly from seawater at ideal hydrochemical conditions or due to microbial influence. In other cases the dolomite might be a diagenetic replacement of a primary calcite phase. However, the distinction between primary and diagenetic dolomite formation is in most cases very difficult.

We applied the clumped isotope technique to distinguish between the different mechanisms of dolomite formation and provide better constraints on the formation temperature as well as the fluid source. During clumped isotopes analyses we measure the abundance of the doubly substituted $^{13}C^{18}O^{16}O$ isotopologue of CO_2 released during acid digestion of the carbonate. Its abundance is solely temperature-dependent and over geological timescales, dolomite has been shown to preserve the primary temperature signal even upon exposure to temperatures up to 200–250 °C. Until recenly clumped isotope phosphoric acid fractionation and the temperature calibration for dolomite were considered to be identical to calcite, resulting in a large uncertainty. Recent studies however provided new acid fractionation corrections and dolomite-specific temperature calibrations allow more precise measurements.

Our dolomite clumped isotope analyses on different platforms in the southern Alps of Switzerland were processed with a dolomite specific acid fractionation correction and temperature calibration. We obtained surprising results that point rather on a later diagenetic dolomite formation than primary precipitation in shallow seawater.