Standard Isotope Methodology

Carbonate samples were drilled with a small dental drill using a 0.5 mm carbide bit to avoid fracturing and veining. Depending on the size of the phase of interest, 2-10 mg of powder was drilled. Carbon and oxygen isotope analyses were performed on carbonate powders using a Nu Perspective IRMS at the MIT Carbonate Research Laboratory. Procedures followed those outlined in Anderson et al. (2021). Samples were heated to remove water and volatiles before acidification in a NuCarb automated sample preparation unit held at 70°C. Carbonate samples (including dolomite) weighing 50–100 μg reacted for 25 minutes in individual glass vials with 150 μl orthophosphoric acid (ρ = 1.93 g/cm³). Evolved CO₂ gas was purified cryogenically. Purified sample gas and reference gas of known composition were alternately measured on six Faraday collectors (m/z 44–49) in 6 cycles, each with 30 seconds integration time (3 minutes total integration time). Each session of approximately 50 individual analyses began with two ETH anchors, then alternated between blocks of six to eight unknowns and two ETH anchors, totaling eight anchors per run.

Data were processed using the “D47crunch” Python package (Daëron, 2023) with IUPAC 17O parameters and 70°C 18O acid fractionation factors of 1.00871 for calcite (Kim et al., 2007) and 1.009926 for dolomite (Rosenbaum and Shepard, 1986). Raw measurements were converted to Vienna Pee Dee Belemnite using a pooled regression approach (Daëron, 2021) that used the ETH anchor values from Bernasconi et al. (2021). Nominal anchor values for d13C and d18O are ('ETH-1': 2.02, 'ETH-2': -10.17, 'ETH-3': 1.71, 'ETH-4': -10.2, 'IAEA-C1': 2.42, 'IAEA-C2': -8.25, 'CIT': 2.05). The long-term average external repeatability (1SD) for standards is 0.06‰ for δ¹³C and 0.25‰ for δ¹⁸O. The dataset contains 2434 analyses of 1893 unique samples and anchors conducted over 70 sessions.