LIDI 2 – New Evaluation Strategy for Accurate and Precise Clumped Isotope CO2 Analysis on Carbonate Samples

CHRISTOPHER BRODIE[1], NILS STOEBENER[1], JENS RADKE[1], JOHANNES SCHWIETERS[1]

[1]Thermo Fisher Scientific, Hanna Kunath Str. 11, Bremen, 28199, Germany. christopher.brodie@thermofisher.com

Long Integration Dual Inlet (LIDI) is an established technology which enabled improved accuracy and precision of Δ47 analysis from carbonate samples by utilizing sequential measurement of the full sample and reference, rather than alternating between sample and reference on shorter time periods, as it is done in the classical Dual Inlet method. As of today, there are two key challenges that were limiting further improvements to Δ47 determination: the IRMS must be in a stable temperature environment during long measurement of sample and reference gas, and the crimping of the sample and reference capillaries must be precisely matched, otherwise the produced data will be inaccurate and have reduced precision.

Here we present the improvements made on the sample gas measurement and data evaluation, which we define as LIDI 2.

By applying the LIDI 2 method, sample bracketing is possible following a four-step approach, resulting in fully corrected temperature drift (i.e. eliminated from the data), decreasing the standard deviation by factor of 2. This is a substantial improvement for acquiring clumped isotope data as reaching a very stable temperature of ±0.1°C/h is a challenge for most laboratories.

Alongside eliminating variation in the Δ47 data caused by unstable laboratory air temperature, LIDI 2 also improves the overlap of sample and reference gas signals due to non-perfect crimping of the capillaries. The crimping procedure is laborious and rarely delivers perfect results. Additionally, the pressure adjustment before reference measurement must ensure there is no

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significant offset between sample and reference intensities. LIDI 2 delivers perfect sample versus reference intensity matching, which results in significantly higher precision on each sample gas analyzed. Standard error of a single sample measurement is improved by up to factor of 2.
The LIDI 2 method delivers improved accuracy and precision on Δ47 measurement from small Carbonate samples, which in combination with the latest advancements in inert capillaries coating and automated contaminant trapping contributes to enhanced clumped isotopes data quality.