253 Plus Applications to improve datasets for higher resolution – Clumped and light stable isotopes

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The isotopes of carbon, nitrogen, sulfur, oxygen and hydrogen isotopes are used for numerous applications in the geosciences. For various paleoclimatology studies, the sample material that can be extracted from a given time interval is limited, which in turn limits the precision of isotopic data points. Alternatively the sample is pooled from a wider time interval and the time resolution is blurred. Applications affected come from all fields in the earth sciences, including Paleoclimatology, Paleoceanography, Atmospheric Sciences, Paleobiology and Archeology.

The Thermo Scientific™ 253 Plus™ 10kV IRMS, together with its inlet systems, addresses the needs of achieving precision from smaller sample amounts, and is especially suited to the measurements of clumped isotope signatures. Thermo Scientific™ 10^{13} Ohm Amplifier Technology™ together with new data acquisition workflows achieves higher precision for low abundant isotopologues. High precisions and accuracies are achieved for $\Delta^{17}O$ from water and carbonates, Δ^{47} & Δ^{48} from carbonates, and noble gas isotope ratios from ice cores. Studies with bulk organic/inorganic, elemental and compound specific isotope analyses also benefit from the stability and linearity of the instrument.

The 253 Plus with Thermo Scientific™ Kiel IV™ carbonate device efficiently produces robust clumped isotope data from both smaller and larger sample amounts. Ion energy shielding ensures accuracy of measurements, without influence of baseline effects. Smaller ion beams can be measured with precisions at the limits of counting statistics by using the low noise 10^{13} Ohm Amplifier Technology. Using this set up we obtain results that are in consistent agreement with the Δ^{47} values of isotopically distinct δ^{47} gases and heated gases.

In combination with a static Porapak™ sample clean up device, a wide range of natural carbonaceous samples are measured using an enhanced LIDI methodology, which further improves the quality of small-sample clumped isotope datasets from carbonates. The combination of new features is pushing the boundaries of clumped isotope ratio measurements.