Reivisiting classical applications with high resolution mass spectrometry

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Classical applications of stable isotope ratio analysis provide important information about atmospheric chemistry and (bio)geochemical processes. In addition they provide powerful tools for reconstructing past environmental conditions. Data are usually measured on mass spectrometers that have a low mass resolving power that cannot separate isobaric interferences from contaminants, adducts or species of the same cardinal masses. The development of high resolution mass spectrometers enables the interference free measurement of stable isotope ratios and isotopologues.

The Thermo Scientific™ 253 Ultra™ high-resolution isotope ratio mass spectrometer (HR-IRMS) has a mass resolving power (M/ΔM) of >30,000 (5, 95% edge definition), combined with a well characterized, high-sensitivity ion source, and low-noise detectors on a versatile multicollector array. Thus precise measurements of rare clumped isotope species and position specific isotope analysis can be made, which will extend scientific research that can enable a better understanding of processes in the geo- and atmospheric sciences. Here, we will revisit classical isotope systems such as H_2, CH_4, CO_2, N_2, N_2O, O_2 and SF_6 using the 253 Ultra. This includes for example the separation of the most abundant clumped isotope species of CH_4 ($^{13}CH_3D$ and $^{12}CH_2D_2$), which provides important information about the origin and the pathways of methane [1]. Besides we present a measurement of the full isotopic composition of CO_2 including bulk, clumped and triple oxygen isotopes measured directly from CO_2. Additionally, high-resolution measurements for O_2 analysis (bulk and clumped isotopes) will be presented.

[1] Stolper et al. (2014), *Science*, **344** (6191), 1500-1503.