An Improved Dual-Inlet Measurement Procedure For Traditional And Clumped Isotopes

BIN HU[1,2] JENS RADKE[3], HANS-JÜRGEN SCHLÜTER[3], FRANK-THORSTEN HEINE[3], LIPING ZHOU[1,4] AND STEFANO M. BERNASCONI[1]*

[1]Department of Geography, Peking University, 100871 Beijing, China
[2]Geological Institute, ETH Zürich, 8092 Zürich, Switzerland (*correspondence:stefano.bernasconi@erdw.ethz.ch)
[3]Thermo Fisher Scientific, 28199 Bremen, Germany
[4]Centre for Ocean Research, Peking University, 100871 Beijing, China

High-precision stable isotope measurements in gas-source isotope ratio mass spectrometry are carried out by repeated comparison of the composition of an unknown sample with a working gas, with a so-called dual-inlet (DI). Due to the design and established protocols used in dual inlet mas spectrometers, however, only 30 to 40% of the available sample gas can be measured, which is a major problem when sample size is limited. Here we present a new protocol allowing the measurement of a much larger portion of the gas sample. Our method is based on a single measurement of the sample for 150 to 600 seconds immediately after the gas is released from the microvolume or the bellow, followed by a single measurement of the working gas for the same amount of time (WG). The isotope ratio calculation is carried out by comparison of the beam ratios of WG and sample at equivalent intensity of the major ion beam.

Using three isotopically very different CO_2 gases we show that the new protocol give results that are indistinguishable from the standard DI measurements for both large samples (50 to 100 μmol of CO_2) measured at quasi-constant beam sizes and for small samples (1.5 to 2 μmol of CO_2) measured in micro-volume mode.

Due to the greatly increased integration time and reduced idle time, this procedure allows for the measurement of smaller samples and/or for greater sample throughput while preserving precision. We suggest that other gases commonly used for stable isotope measurements with gas-source mass spectrometry would also benefit from this new protocol.