



Status report of the new carbonate clumped laboratory of Isotope Climatology and Environmental Research Center (ICER), Debrecen, Hungary

Marianna Túri, László Palcsu, and László Rinyu

MTA ATOMKI, IKER, Isotope Climatology and Environmental Research Center (ICER), Debrecen, Hungary
(turi.marianna@atomki.mta.hu)

In April 2018, a MAT253 Plus mass spectrometer using a KIEL IV carbonate device system (Thermo Scientific) were installed in Isotope Climatology and Environmental Research Center (ICER), Debrecen, Hungary, to improve analytical methods and capabilities. This poster briefly presents the instrumental setup and the experience of our analytical and standardization procedures and demonstrates the occurred barriers that had to be solved.

The first carbonate measurements have been performed on a Kiel IV carbonate device connected to the MAT253 Plus mass spectrometer with the new 1013 ohm amplifier technology following the methodology of Bernasconi et al. (2018)*1. Carbonate samples (120-150 μg) are loaded in the Kiel IV carbonate device, and then the samples are digested by three drops of phosphoric acid of 107 %, and the evolved CO_2 is passed through two LN₂ trap with a Porapak trap in between. The Porapak Type Q 50–80 mesh trap is held at -20 °C by Peltier cooling elements and embedded with silver wool on both ends. The sample gas is released at 30 °C from the second LN₂ trap to the MAT253 Plus through a silica coated capillary (crimped 10 mbar CO_2 to 1.5 V at m/z 44). Ion beams at m/z of 44, 45, 46, 47, (47.5) 48, 49 are measured with low extraction energy in micro volume mode using the LIDI (long-integration dual-inlet) protocol during 8-15-40-60 cycles with 10 sec integration time against our reference gas. For the evaluation of the measurements, the detected ion intensities are carried out with the Easotope software using the following: Brand parameter*2, carbon dioxide equilibrium scale (CDES)*3.

The newly developed sample off-line preparation system in ICER can handle the samples as gas sample and various types of carbonates creating a similar environment to Kiel IV carbonate device.

The first $\Delta 47$ results of measurements of intercomparison samples (ETH 1-4, IAEA C1-C2, NBS-18, NBS-19) provide evidence of the reliability of the sample preparation system at ICER Lab and also the good performance of the MAT253 Plus-Kiel IV system.

In the future our aims with carbonate clumped thermometry are to studying travertines, cave carbonates, carbonate layer, CO_2 volcanic gases.

This work was supported by the European Union and the State of Hungary, co-financed by the European Regional Development Fund in the project of GINOP-2.3.2-15-2016-00009 'ICER'.

1: Bernasconi, S. M., Müller, I. A., Bergmann, K. D., Breitenbach, S. F., Fernandez, A., Hodell, D. A., ... & Ziegler, M. (2018). Reducing Uncertainties in Carbonate Clumped Isotope Analysis Through Consistent Carbonate-Based Standardization. *Geochemistry, Geophysics, Geosystems*, 19(9), 2895-2914.

2: Brand, W. A., Assonov, S. S., & Coplen, T. B. (2010). Correction for the 17O interference in δ (¹³C) measurements when analyzing CO_2 with stable isotope mass spectrometry (IUPAC Technical Report). *Pure and Applied Chemistry*, 82(8), 1719-1733.

3: Dennis, K. J., Affek, H. P., Passey, B. H., Schrag, D. P., & Eiler, J. M. (2011). Defining an absolute reference frame for 'clumped' isotope studies of CO_2 . *Geochimica et Cosmochimica Acta*, 75(22), 7117-7131.