Position Specific Isotope Effects in Alanine Produced by Strecker Synthesis

LAURA CHIMIAK[1*], CARL BLUMENFELD[1], BROOKE DALLAS[1], JOHN EILER[1], ALEX SESSIONS[1]

[1]Caltech, USA, *Corresponding author: lchimiak@caltech.edu

Meteorites may have seeded the early Earth with organic compounds such as amino acids that contributed to the origin of life. These amino acids could have been synthesized by a variety of mechanisms, differing in their reactants and physiochemical conditions. These differences could impart distinct isotopic signatures in the products' position-specific and multiply-substituted ('clumped') isotopic structures.

We present measurements of the carbon isotope structures of alanine formed in controlled conditions by known abiotic mechanisms. We combined established analytical techniques and novel methods involving direct isotopic analysis of alanine and its derivatives with the Q-Exactive GC, an Orbitrap-based Fourier transform mass spectrometer with the resolution and sensitivity required for position-specific isotope measurements of organic compounds on meteorites.

We focus on alanine made via Strecker synthesis. Normal kinetic isotope effects dominate fractionation affecting the carboxyl carbon and inverse isotope effects dominate fractionations affecting the amine carbon and nitrogen. We intend to compare this isotopic structure to that of alanine recovered from chondritic meteorites. Alanine concentrations range from 4 to 450 ppm in CM2 and CR2 meteorites [1][2], so the Q-Exactive will require ~0.1-1 gram of a meteorite sample for our measurements.

[1] Cronin & Pizzarello (1983) *Adv. Space Res.* **3**, 5-18. [2] Pizzarello & Holmes (2009) *Geochim. Cosmochim. Acta* **73**, 2150-2162