

Optical spectroscopic techniques for *in situ* measurements of isotopic composition of trace atmospheric gases

E.J. MOYER¹, C. MORONG¹, D.S. SAYRES²,
T.F. HANISCO² AND M. WITINSKI²

¹University of Chicago, Dept. of the Geophysical Sciences,
Chicago IL 60637, (moyer@uchicago.edu)

²Harvard University, Dept. of Earth and Planetary Sciences,
Cambridge MA 02139

We report on development of optical spectroscopic methods for isotopic measurements in gas-phase atmospheric samples. Recent developments in both light sources and spectroscopic techniques allow science-useful data from lightweight, high-data rate, and remotely operated optical spectrometers suitable for field usage, either for surface or airborne platforms. We report in particular on measurements of water vapor isotopic composition, both from the Harvard ICOS Isotopic Instrument, which has made multiple research flights on NASA's WB-57 high-altitude research aircraft to probe the upper troposphere and lower stratosphere, and from new lightweight instrumentation under development.

Zn isotope variations in Ediacaran carbonates

FREDERIC MOYNIER¹, DAVID FIKE¹
AND SYLVAIN PICHAT²

¹Department of Earth and Planetary Sciences and McDonnell
Center for the Space Sciences, Washington University, St.
Louis, 63130 MO, USA (moynier@levee.wustl.edu)

²LST, Ecole Normale Supérieure de Lyon, 63007, France

The first metazoa appear in the geologic record during the Ediacaran Period (~635 – 542 Ma), amid evidence for increasing oxygenation of the Earth surface and unparalleled reorganization in the carbon and sulfur biogeochemical cycles [1,2]. The timing and magnitude of an Ediacaran rise in oxygen remain hotly debated. Validation of these interpretations requires new geochemical proxies.

Here, we present the Zn isotope composition in carbonate strata from the Ediacaran-age Huqf Supergroup Sultanate of Oman (from ~ 635 – 540 Ma), previously characterized for their C and S isotope composition. Zn isotopic composition has been measured by MC-ICP-MS following the technique described in [3-4]. Zn shows little or no fractionation in most terrestrial rocks and is present in nature almost exclusively in its +II oxidation state. Thus, no Zn isotopic fractionations are expected due to direct changes in the redox state of the marine Zn reservoir. However, changing redox in the ocean may impact the isotopic composition of marine Zn through changes in Zn sequestration during carbonate burial, sedimentary sulfide formation and/or biological activity – all of which are believed to fractionate Zn isotopes.

Preliminary results show stratigraphic trends in the Zn isotopic composition, with a range of variation in $\delta^{66}\text{Zn}$ between -0.5 to 0.3‰. The trends in $\delta^{66}\text{Zn}$ are correlated with changing $\delta^{13}\text{C}$ and $\delta^{34}\text{S}$ patterns through these strata, and suggest a link between the marine zinc cycle and the carbon/sulfur biogeochemical cycling in the Ediacaran Period.

[1] Fike, D. A. and Grotzinger, J. P., (2008). *GCA*, **72**, 2636 – 2648. [2] Fike, D. A., *et al.*, (2006). *Nature* **444**, 744 - 747. [3] Moynier, F., *et al.* (2006). *GCA*, **70**, 6103-6117. [4] Moynier, F., *et al.* (2009). *EPSL*, **277**, 482-489