**NANOSIMS O & S-ISOTOPE ANALYSES OF COSMIC SYMPLECTITE IN THE PRIMITIVE CHONDRITE ACFER 094**

L. G. Vacher¹, R. C. Ogliore¹, N. Liu¹ and J. B. Lewis¹; ¹Department of Physics, Washington University in St. Louis, St. Louis, MO, USA (lvacher@wustl.edu).

**Introduction:** Cosmic Symplectite (COS) are anomalous $^{17,18}$O-rich magnetite-sulfide grains ($\Delta^{17}$O = −90‰) found in the ungrouped carbonaceous chondrite Acfer 094 [1, 2]. They are thought to have formed from sulfidation and oxidation of Fe,Ni metal by H$_2$S and isotopically heavy water vapor. This $^{17,18}$O-rich water possibly originated from isotopic mass-independent fractionation (MIF) from CO photochemical self-shielding in the protoplanetary disk [3, 4].

Like for the O-isotopes, S-isotopes ($\Delta^{33}$S) may undergo MIF by UV photodissociation processes [5], but the magnitude of fractionation is smaller than for O-isotopes (only few per mil). Because COS has large O isotope MIF and contains ≈10 wt.% S [2], it is an important phase to investigate S-MIF in the early Solar System. Here we report petrographic and O-isotopic searches for COS in Acfer 094 and present preliminary results of S isotope measurements.

**Methodology:** COS candidates were identified from petrographic observations and SEM-EDS analyses using a Tescan Mira3 FEG-SEM (Fig. 1A). Oxygen isotope measurements on COS candidates were then performed with the Wash U NanoSIMS using a ≈2 pA primary beam focused to ~100 nm. We acquired 10x10 μm scanning ion images of $^{16}$O, $^{17}$O, and $^{18}$O, using EMs. O isotope ratios of COS were normalized to their surrounding matrix, assumed to have the same composition as reported in [1]. 2σ errors were estimated to be ≈10‰ on $\delta^{18}$O, ≈23‰ on $\delta^{17}$O. Finally, we performed S-isotope ($^{32}$S, $^{33}$S and $^{34}$S) on these COS grains under similar analytical conditions as O isotopes. Because sulfide grains in CM-C1 chondrites fall along a mass-dependent fractionation (MDF) line [6], we corrected the $\Delta^{33}$S values of COS with micrometer sulfide grains located in the matrix that show reproducible $\Delta^{33}$S values ($\sigma$ ≈ 2%), assumed to fall along a MDF line (i.e., $\Delta^{33}$S$_{Sulfide} = 0$‰).

2σ errors were estimated to be ≈5‰ on $\Delta^{33}$S.

**Results and discussion:** The O-isotopic compositions of the three COS candidates reveal that these grains have anomalous O-isotopic signature compared to their surrounding matrix ($\delta^{17}$O = $\delta^{18}$O ≈ 130–160‰; Fig. 1B), confirming their nature as cosmic symplectite [1, 7]. The S isotopic compositions of two COS grains are consistent with zero and one COS showed a hint of S-MIF anomaly at the 2σ level: $\Delta^{33}$S$_{COS} = 6 \pm 5$‰ (Fig. 1C). If the COS S-MIF can be confirmed with a higher precision measurement, then this result suggests that a MIF process, e.g. UV photodissociation, for both O & S were recorded for some COS grains. The analytical uncertainties of our S isotope measurements by NanoSIMS ion imaging are too high (and dominated by systematics) to detect small mass-independent fractionation as expected for S-isotopes (only S-MIF > 5‰ can be ruled out). Future S isotope analyses of a selection of identified COS using a Cameca ims 1280 are planned.