Abstract 5313

ALLENDE 3509 HC-2: A COMPACT TYPE A—'F' INCLUSION WITH A SNAKE-LIKE MORPHOLOGY

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Introduction: Calcium-, aluminum-rich inclusions (CAIs) are the first rocks to form in the solar system. Some inclusions are igneous and a very few of these (called F inclusions) experienced significant mass dependant fractionation in oxygen [1], and in some cases, other isotopic systems (FUN inclusions). Increasing the number and types of F inclusions will provide additional constraints on CAI formation and their formation environments. We report here on a Compact Type A (CTA) inclusion from Allende with an overall snake-like morphology, is an F inclusion, and initial $^{26}Al/^{27}Al$ that was canonical.

Analytical Methods: The entire inclusion, HC-2, was recovered from a slab of Allende 3509 (USNM). Major and minor element abundances were determined with the Cameca SX-50 at the LPL UAz. Oxygen isotopes and Al-Mg isotopic systematics were analyzed for on the Cameca 1280 ion microprobe at the Univ. of Hawai'i, Mãnoa [2]. Si isotopes were analyzed by LA-MC-ICPMS at UCLA.

Results: HC-2 has an overall morphology that is snake-like, wrapping throughout a 1.5 cm thick (total width is approximately 0.75 cm) section of the meteorite, inspiring it to be nicknamed The Snake. It has a Wark-Lovering rim on both sides, although the rim is thicker on one side. The inclusion has experienced some brittle deformation. HC-2 is dominated by spinel (Ti = 0.14–0.37; V = 0.44–0.64; Cr = 0.08–0.14; all wt%) and melilite (Ak = approximate 4 to approximate 50). Perovskites are numerous, ranging in size from sub-micron to approximately 0.5 mm. There appear to be two smaller (approximately 400 μm) CAIs that are mineralogically layered included. SIMS analysis on spinel and melilite yield an isochron with an initial $^{26}Al/^{27}Al$ of $(4.9 \pm 0.2) \cdot 10^{-5}$. ^{25}Mg (variations from the standard in stable Mg isotope) range from approximately 5 to 13 ‰.

Oxygen isotopes: Melilites have $\delta^{18}O$- $\delta^{17}O$- values that span approximately 10 ‰ and plot on the CCAM line near the TF line. Two perovskite grains are isotopically different with $\delta^{18}O$, $\delta^{17}O$ of (in ‰) approximately -28, -31 in one and -40, -44 in the other. Overall, the spinels are ^{16}O-rich and show a clear mass fractionation of 4 ‰ amu^{-1}, ($\delta^{18}O$ = -34 to -42 ‰; $\delta^{17}O$ = -41 to –45 ‰) with the overall trend to the right of the CCAM line.

Conclusion: HC-2 is clearly igneous. The reason for its unusual shape is not clear, but it must have formed while plastic. Based on the stable isotope data, HC-2 experienced considerable mass-dependent isotopic fractionation, most likely while molten and while ^{26}Al was present. We will compare our data to other 'F' inclusions to place new constraints on CAI formation and the environment in which they formed.

References: [1] Bullock E. S. et al. 2011. Abstract #2312. 42nd Lunar and Planetary Science Conference. [2] Kentaro et al. 2009. Geochimica et Cosmochimica Acta. [3] Shahara and Young. 2009. Earth and Planetary Science Letters.