IDENTIFICATION OF AN EXTREMELY ^{18}O-RICH PRESOLAR SILICATE GRAIN IN ACFER 094.

A. N. Nguyen[1,2] and S. Messenger[1]. [1]Robert M Walker Laboratory for Space Sciences, NASA/JSC. [2]ESCG/Jacobs Technology, Houston, TX. lan-anh.n.nguyen@nasa.gov.

Introduction: Presolar silicate grains have been abundantly identified since their first discovery less than a decade ago [1,2,3]. The O isotopic compositions of both silicate and oxide stardust indicate the vast majority (>90%) condensed around O-rich asymptotic giant branch (AGB) stars. Though both presolar phases have average sizes of ~300 nm, grains larger than 1 μm are extremely uncommon for presolar silicates. Thus, while numerous isotopic systems have been measured in presolar oxide grains [4], very few isotopic analyses for presolar silicates exist outside of O and Si [2,5]. And still, these measurements suffer from isotopic dilution with surrounding matrix material [6]. We conduct a search for presolar silicates in the primitive carbonaceous chondrite Acfer 094 and in some cases obtain high spatial resolution, high precision isotopic ratios.

Experimental: A grain-size separate of Acfer 094 containing matrix silicate grains of diameters ~100-500 nm was analyzed by raster ion imaging in the JSC NanoSIMS 50L ion microprobe. Raster fields of 20×20 μm^2 were first scanned for all O and Si isotopes, and ^{24}Mg^{16}O was also measured for the majority of these regions. The primary beam size (spatial resolution) was ~120 nm. Eleven anomalous grains were subsequently analyzed for O and Si isotopes with higher spatial resolution (~70 nm) to reduce contributing signal from surrounding grains.

Results: A total of 47 presolar silicate grains were identified. As expected, all of them likely condensed in AGB stars save for 6 grains that are enhanced in one or both of the heavy O isotopes. Supernova are favored over high metallicity stars as the parent sources of these rare grains [4,7], as in the case for three presolar silicates that have extreme ^{18}O enrichments but solar or sub-solar ^{17}O/^{16}O [4,5,8,9]. We identified one grain with one of the highest enhancements of ^{18}O (^{18}O/^{16}O = 0.013) found in a presolar silicate to date and normal ^{17}O/^{16}O. A SN origin for this grain is highly probable, but unfortunately its Si isotopic composition is not diagnostic. The NanoSIMS images show the grain contains Mg and we plan to measure Mg/Al isotopes in this unusual grain to better constrain its source. We note that two SN oxide grains were observed to be depleted in ^{25}Mg and enhanced in ^{26}Mg [4].

The O isotopic anomalies of grains re-measured under high spatial resolution are larger than in the original measurements, indicating the reduced contribution from surrounding grains. For many grains, too little material remained for acquisition of higher precision Si isotopic ratios. However, two of three ^{18}O-rich silicate grains with relatively low measurement errors show slight enhancements in ^{30}Si, though this does not necessarily require a high metallicity source [4].

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