A LARGE PRESOLAR OXIDE GRAIN IDENTIFIED IN ALLENDE CV3 CHONDRITE. M. Bose[1], T. J. Zega[2], A. Andronokov[2], and P. Williams[1], [1]Arizona State University, Department of Chemistry and Biochemistry, Physical Sciences Building, Room D-57, PO Box 871604, Tempe AZ 85287. [2]Lunar and Planetary Laboratory, University of Arizona, 1629 East University Blvd., Tucson AZ 85721. (maitrayee.bose@asu.edu)

Introduction: Abundant presolar oxide grains of different chemical compositions have been identified in acid-residues of ordinary and carbonaceous chondrites [e.g., 1−5]. Most of these grains have formed in the winds of Red Giant or Asymptotic Giant branch stars [5]. A smaller fraction of the grains are of supernova origin or nova origin [5, 6].

Here we report searches for presolar oxide grains in acid residues of CV3 carbonaceous chondrite Allende. The primary goal of this study is to search for large grains with exotic isotopic compositions, such as those with large ^{16}O or ^{18}O excesses. The stellar source of these grains is still under considerable debate, and is often assessed based on their composition in multiple isotopic systems [e.g., 6, 7]. Such studies often also reveal the problems or uncertainties in stellar models. Therefore, we aim to search for large grains, and acquire isotopic compositions in multiple isotopic systems to uniquely pin down their stellar source.

Information about the chemical composition and crystallinity of the presolar grains can elucidate their formation conditions in the stellar environment. Microstructural studies of very few presolar oxide grains (<15) have been done [8−10]. Thus another motive of this study is to extract the presolar grains by focussed ion beam (FIB) milling and study them using transmission electron microscopy (TEM), which will help constrain circumstellar condensation conditions.

Experimental: A piece of the Allende CV3 chondrite was treated with a procedure that did not require the use of perchloric acid. Mechanically separated fragments of matrix were dissolved in concentrated HF and a few drops of concentrated HNO_3. They were dried down on a hot plate. Subsequently, the residues were treated with HCl, and dried down further. The residue was repeatedly dissolved in concentrated HNO_3 to remove soluble organics, and dried. Finally, the residue was reconstituted in liquid form with isopropanol. The grains were deposited onto a glass slide coated with indium-tin-oxide for SIMS analysis.

We manually searched for presolar grains with the Cameca Ametek NanoSIMS 50L at Arizona State University. The NanoSIMS was tuned on San Carlos olivine and augite for O isotopes. Suitable areas on the glass slide were measured either in the isotope mode or in the imaging mode. In the isotope mode, a few pA primary Cs^+ beam (<100nm) was used to acquire $^{16,17,18}O^-$ ion images from $1\times1\mu m^2$ to $5\times5\mu m^2$ analysis areas centered on the grains. The areas were measured for <15 min with a 5ms/pixel dwell time for 64^2 pixels. Large fields (typically $10\times10\mu m^2$ or $30\times30\mu m^2$) containing well-separated grains (Figure 1) were imaged overnight for 256^2 or 512^2 pixels. Adequate mass resolving powers were used to eliminate the isobaric interference $^{16}O^1H$ from ^{17}O. Prior to any measurement, a larger area was presputtered with a high-current primary Cs^+ beam to remove surface contamination and to implant Cs in the grains present, which enhances the negative secondary ion yield. Before and after any measurement on the Allende grains, standards were measured under typical "standard bracketing" conditions.

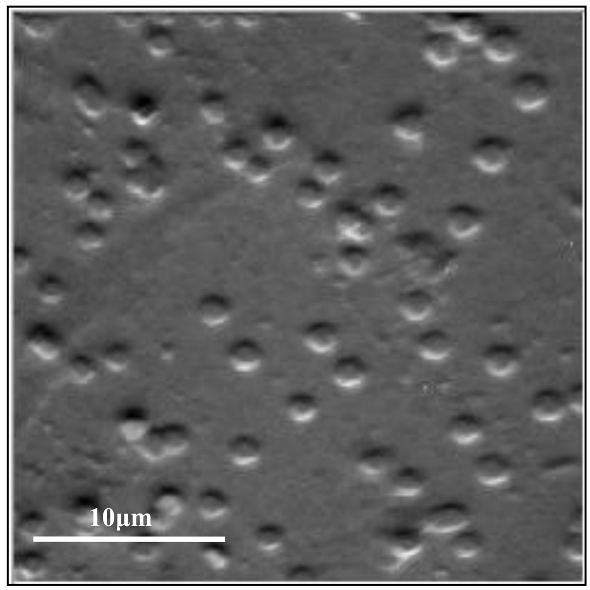

Figure 1: *Secondary electron image of well-separated Allende grains from the non-pulverized fraction acquired in the NanoSIMS.*

Results and Discussion: Five O-anomalous grains were identified (Figure 2) in the non-pulverized fraction of Allende. Grain A-23 exhibits ^{17}O excesses and normal $^{18}O/^{16}O$ ratios [5]. This Group 1 grain arguably condensed in the winds of low-mass Red Giant or Asymptotic Giant branch star that experienced a first dredge-up episode [5]. Another grain A-15 shows ^{18}O excesses and isotopically normal ^{17}O, while the third grain A-19 shows enrichments in both the heavier isotopes of O. Both are classified as Group 4 grains [5]. The ^{18}O excesses in A-15 may have come from the He/C zone in a Type II supernova (SN). Grain A-19 with ^{17}O and ^{18}O enrichments may have condensed either in a high-metallicity star or during a SN explosion.

Two grains (A-1 and A-17) show depletions in ^{17}O, and are classified as Group 3 grains [5]. Stellar source of these grains is still debated, but other oxide grains with similar O isotopic compositions are argued to have a SN origin because they fall under the Galactic Chemical Evolution (GCE) line (Figure 2; [5]). Note that grains that fall above the GCE line can possibly form in low-mass and low-metallicity stars. Isotopic studies in major and trace elements of very few grains of this type (e.g., A-1 and A-17) have been done to date. Except for the A-1 that is ~10×6μm in size, the remaining oxide grains are <1μm in size. In fact, A-1 is possibly the largest presolar oxide grain identified to date [11], and structural data is unavailable for Group 3 oxide grains. Grain A-1 is an ideal candidate for measurements on multiple isotopic systems, and for microstructural analysis via TEM. These measurements are planned and results will be presented at the meeting.

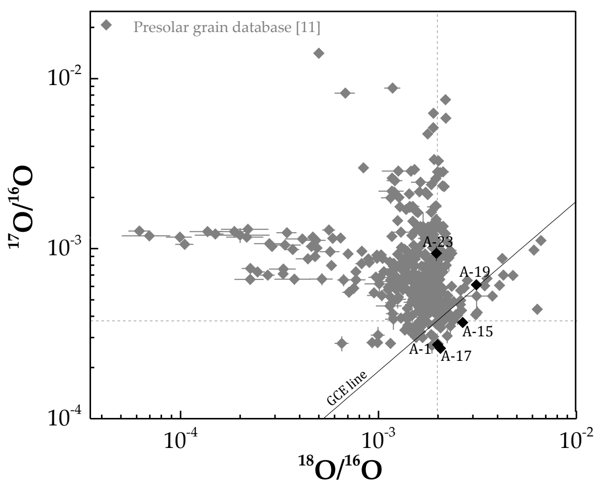

Figure 1: *Presolar oxide grains, shown in black, were identified in Allende. Presolar grain data from [11].*

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