

### AN ABUNDANT MIX OF PRESOLAR MATTER IN THE HIGHLY PRIMITIVE CR CHONDRITE QUE 99177.

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**Introduction:** Presolar silicate grains are preserved in interplanetary dust particles and meteorites that have escaped extensive aqueous alteration [1-4]. The primitive natures of the chondrites Acfer 094 (unique) and ALHA77307 (CO3) are exemplified by their large abundance of presolar silicate grains [3]. Here we studied the CR chondrite QUE 99177, which has been shown to be one of the most primitive of its class [4, 5], and compare the presolar grain abundances with those of the aforementioned meteorites.

**Experimental:** A thin section of QUE 99177 was analyzed by raster ion imaging in the Carnegie NanoSIMS 50L. Negative secondary ions of  $^{12}\text{C}$ ,  $^{13}\text{C}$ ,  $^{16}\text{O}$ ,  $^{17}\text{O}$ ,  $^{18}\text{O}$ ,  $^{28}\text{Si}$ , and  $^{30}\text{Si}$  were measured for a total area of  $21100\ \mu\text{m}^2$ . The average isotopic compositions of the matrix material were used as standards. A few regions containing anomalous carbonaceous material were re-measured for  $^{12}\text{C}$ ,  $^{13}\text{C}$ ,  $^{14}\text{N}$ ,  $^{15}\text{N}$ ,  $^{28}\text{Si}$ ,  $^{29}\text{Si}$  and  $^{30}\text{Si}$ .

**Results and Discussion:** We identified 39 anomalous O-rich grains, and all but 7 appear to be silicates according to the NanoSIMS  $^{28}\text{Si}/^{16}\text{O}^-$  ratios. Additional analyses, using Auger spectroscopy for instance, are needed to make unambiguous identifications. Most of these grains have O isotopic compositions consistent with Group 1 presolar oxides [6]. Four grains are enriched in  $^{17}\text{O}$  and  $^{18}\text{O}$  and fall in the Group 4 classification. Grains having similar isotopic compositions have been suggested to originate in SN explosions [7]. The Si isotopic compositions of all the presolar silicate and oxide grains are normal within error. One  $\sim 500\text{nm}$  grain having CAI-like O isotopic composition ( $\delta^{17}\text{O} = -70\text{‰}$ ,  $\delta^{18}\text{O} = -80\text{‰}$ ) was determined by SEM-EDX to be a Cr-bearing spinel.

C isotopic analysis revealed 28 regions with depletions in  $^{13}\text{C}$  (as much as  $-25\text{‰}$ ), and 5 with enrichments in  $^{13}\text{C}$  (up to  $24\text{‰}$ ). One grain with  $\delta^{13}\text{C} > 10000\text{‰}$  is likely a presolar graphite. Preliminary analysis of N isotopes indicates that QUE 99177 contains abundant organic material having  $\delta^{15}\text{N}$  ranging up to  $2000\text{‰}$ . We will continue to characterize the N isotopic composition of the anomalous C-rich material and of other organic material. 12 mainstream SiC grains and one SiC type X were also identified.

The matrix-normalized abundance of presolar silicates in QUE 99177 is 130 ppm (lower than reported by [2]) and of presolar oxides is 40 ppm (higher than reported by [2]). These abundances are comparable to those reported for Acfer 094 and ALHA 77307 [3]. The abundance of presolar SiC is high (50ppm), in agreement with recent data for CR chondrites [8].

**References:** [1] Messenger S. et al. (2003) *Science* 300:105-108. [2] Floss C. et al. (2006) *Geochimica et Cosmochimica Acta* 70:2371-2399. [3] Nguyen A. N. et al. (2007) *Astrophysical Journal* 656 :1223-1240. [4] Floss C. et al. (2008) Abstract #1280. 39th Lunar & Planetary Science Conference. [5] Abreu N. M. & Brearley A. J. (2006) Abstract #2395. 37th Lunar & Planetary Science Conference. [6] Nittler L. R. et al. (1997) *Astrophysical Journal* 483:4715-495. [7] Nittler L. R. et al. (2008) *Astrophysical Journal*, in press. [8] Davidson J. et al. (2008) Abstract #1184. 39th Lunar & Planetary Science Conference.