The Presolar Grain Inventories of Adelaide and Kakangari

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Introduction

Presolar silicates are, apart from nanodiamonds, the most abundant type of stardust and have been found in several primitive meteorites [e.g., 1, 2]. Together with Acfer 094 and ALHA77307, the ungrouped C3 chondrite Adelaide and the K chondrite Kakangari have been characterized as primitive with pristine matrix material [3, 4]. We are investigating the latter two meteorites in order to evaluate their presolar grain inventories and the degree to which these have been affected by nebular and/or parent body processing.

Experimental and Results

We used the NanoSIMS to carry out ion imaging searches ($^{12}C^-$, $^{13}C^-$, $^{16}O^-$, $^{17}O^-$, $^{18}O^-$) [e.g., 2] in matrix material from both Adelaide (18,400 μm^2) and Kakangari (10,000 μm^2).

In Kakangari, we found one ^{13}C-rich grain (~9 ppm abundance). No O-anomalous grains were found (≤ 5 ppm abundance). In contrast, we found 22 O-anomalous grains (55 ppm abundance) in Adelaide. All but one belong to O isotope group 1; the remaining grain belongs to group 3 [e.g., 5]. Of ten C-anomalous grains in Adelaide (50 ppm abundance) seven are ^{13}C-rich and three are ^{12}C-rich.

Discussion

Both Kakangari and Adelaide have lower presolar silicate and oxide abundances than Acfer 094 and ALHA77307 (125–145 ppm) [1]. Kakangari, unlike the other three meteorites, contains no amorphous silicates in its matrix [6]. Amorphous silicates are common in two CR chondrites which also have high presolar silicate abundances [2], suggesting that secondary processing, leading to the recrystallization of matrix silicates, also destroys fragile presolar silicate/oxide grains. The intermediate presolar silicate/oxide abundances in Adelaide suggest that it experienced more processing than Acfer 094 and ALHA77307. Moreover, the distribution of presolar grains in this meteorite is highly variable between different matrix areas, possibly due to heterogeneous alteration on a mm-scale.

[1] Nguyen *et al*. (2007) *Astrophys. J.* **656**, 1223-1240. [2] Floss and Stadermann (2009) GCA, in press. [3] Scott and Krot (2005) *LPSC XXXVI*, #2007. [4] Nuth *et al*. (2005) In *Chondrites and the Protoplanetary Disk*, 675-700. [5] Nittler *et al*. (1997) *Astrophys. J.* **483**, 475-495. [6] Brearley (1989) *GCA* **53**, 2395-2411.