AGES OF LARGE SiC GRAINS FROM MURCHISON

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Introduction: Estimating the presolar residence time of SiC grains in the interstellar medium (ISM) has been a longstanding problem. Previous studies, on bulk samples, have focused on cosmogenic production of ^{21}Ne [1, 2] and ^{126}Xe [3] in estimating cosmic ray exposure ages. Ott *et al*. [3] found no clear evidence for cosmogenic ^{126}Xe, implying very short cosmic ray exposure histories, while ages inferred from ^{21}Ne production have largely been invalidated because of spallation recoil loss [4]. We measured Li isotopes in large presolar grains and found ^{6}Li enrichments of up to ~300‰ [5]. Assuming that these excesses are from cosmic ray spallation in the ISM, we can infer lower limits on the length of time *individual* presolar SiC grains spent in the ISM.

Experimental: Grains from Murchison separates LS and LU [6] were placed on a clean gold foil with a micromanipulator and pressed with a quartz disk. SEM-EDX analysis identified forty grains as SiC, ranging in size from 5 μm to 60 μm. With the Washington University NanoSIMS, Li, B, C, Si, and S isotopic ratios were determined on nine of the largest grains.

Results: Eight out of 9 grains show ^{6}Li enrichments, likely due to spallation from C by cosmic rays. Using Li production rates calculated for grains with radii less than 1 cm by Reedy [7], we infer cosmic ray exposure ages of the eight grains with ^{6}Li excesses from 24 My to 1.2 Gy. Two grains have irradiation ages less than 40 My, four grains are between 100 and 500 My, and two grains have ages greater than 500 My. The dominant source of error in these age determinations is uncertainty in the production rate, as it depends critically on the cross sections of the responsible spallation reactions for realistic targets, and in the interstellar flux of galactic cosmic rays, both poorly constrained quantities. Resulting errors are ~30 – 40%. These age determinations do not account for any spallation recoil loss or self-shielding; however, these effects would only increase the ages reported here.

Long interstellar exposure ages are not necessarily inconsistent with previous results indicating young SiC exposure ages [3], as the large L-series SiC measured here are morphologically and isotopically distinct from other presolar SiC [5]. Jones *et al.* [8] estimated SiC grain lifetimes in the ISM to range up to 1.5 Gy, consistent with the ages we have calculated. These results may suggest that some large LS+LU SiC grains come from stars that ejected grains into the ISM before the parent stars of most smaller SiC grains found in meteorites. The large size of these LS+LU grains likely allows them to better survive destruction by SN shock waves and nebular processing in the ISM.

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