Lifetimes of interstellar dust from new exposure ages of large presolar SiC grains

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The cosmic ray (CR) exposure ages of presolar grains can provide direct chronological information on the interstellar dust life cycle. We previously reported CR exposure ages of large presolar SiC grains based on cosmogenic Li, He, and Ne [1-4]; most grains had presolar He and Ne ages <300 Ma and only a few had higher ages (up to ~1 Ga). The He and Ne ages of individual grains agree with one another [2,3] but Li ages are systematically higher than He and Ne ages of the same grains [3,4]. The reason for this discrepancy is unknown but might be due to insufficient knowledge of the cosmogenic production rate of Li [4]. The knowledge of the production rates in the interstellar medium is one of the most critical elements in the calculation of presolar exposure ages. Since our last report more realistic cosmogenic production rates have become available [5]. For the first time, these rates use the galactic CR spectrum as observed outside the heliosphere by Voyager [6]. Here, we report 19 new He and Ne ages for large presolar SiC grains from Murchison that were calculated using these improved production rates. This includes seven ^{21}Ne-based recoil-corrected ages ranging from 294 Ma to ~2 Ga and 12 upper limits ranging from 44 Ma to 2.4 Ga. The Ne age (460±230 Ma) of one of the grains is lower than its previously reported Li age (1.3±0.7 Ga [3]), in line with the trend of consistently higher Li than Ne ages [4]. We use our new data to test the hypothesis [7] that the dominance of comparably young presolar ages is a consequence of a presolar starburst event [2,8] and to explore the presolar history of the Galaxy.

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