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# On the stellar sources of presolar graphite in primitive meteorites

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Primitive meteorites contain graphite spherules whose anomalous isotopic compositions indicate a stellar origin [1]. Because the isolation of presolar graphite grains is difficult, they have been less well studied than presolar SiC and presolar oxide grains. It has been known that the isotopic compositions of presolar graphite grains depends on their density, but detailed isotopic measurements have been made only on low-density (<2 g.cm-3) individual grains [2]. The NanoSIMS ion microprobe has enabled us to measure O and Si isotopic ratios in graphite grains with a range of densities from the carbonaceous chondrites Murchison and Orgueil [3-5]. These measurements confirm that low-density grains originated from supernovae and indicate that most high-density (>2 g.cm-3) grains come from C-rich AGB stars of low metallicity. Low-density grains and a few grains of higher density are characterized by large 18O and 28Si excesses that are signatures of Type II supernovae. Many high-density grains have high 12C/13C ratios (>300) and large excesses in 30Si and smaller ones in 29Si. These are best explained by low-metallicity AGB stars. In these stars the enrichments of the envelope in the heavy Si isotopes and in 12C, products of nucleosynthesis in the He shell, are much larger than those expected for solar-metallicity parent stars. The high 12C/13C ratios imply also high C/O ratios, which cause the preferential condensation of graphite grains over SiC grains. The Ne-E(L) component, almost pure 22Ne, which is characteristic of presolar graphite and led to its discovery [6], apparently has two sources [7]. In SN grains it is due to the decay of short-lived (T1/2 = 2.6 yr) 22Na, which condenses into the grains, whereas in AGB grains it is due to the abundant 22Ne in the He shell, produced by α-captures on 14N, the result of previous H burning in the CNO cycle.

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