Barium and strontium in supernova silicon carbide grains

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Presolar silicon carbide grains of type X account for 1% of presolar SiC and, in all likelihood, formed in the ejecta of core-collapse supernovae. This is indicated by, e.g., large overabundances of the (primary) ^{28}Si isotope relative to the (secondary) ^{29}Si and ^{30}Si isotopes, as well as a large abundance of ^{44}Ti at the time of formation, now showing up as the decay product ^{44}Ca (e.g., [1]). More recently, subtypes X0, X1, and X2 have been defined, depending on the detailed position in a Si three-isotope diagram [2]. Here we review available literature data for barium and strontium in X1 and X2 grains [3-5]. Grains of type X2, to first order, are enriched in s-process Ba compared to Solar System Ba. X1 grains contain, in addition, a variable admixture of a component low in ^{135}Ba and ^{136}Ba (relative to solar and ^{137}Ba), but high in ^{138}Ba. This component may represent r-process Ba or Ba produced by a neutron burst like the one proposed by [6]. The delayed appearance of ^{137}Ba due to the 30 a half-life of its precursor ^{137}Cs may allow to date condensation of X1 grains from supernova ejecta, suggesting 5 a for the case of r-process Ba and 8 a in case of the neutron burst of [6]. The value from the r-process depends sensitively on the r-process production of ^{138}Ba, which is, however, highly uncertain because of the predominance of s-process ^{138}Ba in the Solar System abundance distribution. Data for Sr are scarcer and more enigmatic, but, to first order, compatible with the inferences from Ba. X1 grains are rich in ^{88}Sr, while the signature in X2 grains is characterized by uniquely low ^{87}Sr/^{86}Sr ratios (down to 0.4 vs. the normal value of 0.7), possibly indicative of contributions from an s-process that was extremely weak.

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