The Isotopic Character of Early Solar System Events

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Calcium–aluminum-rich inclusions, or CAIs, were the first solids to condense in the cooling protoplanetary disk and thus represent a snapshot of the isotopic character of the reservoir in which they formed. A marked difference between the isotopic composition of the CAI-forming reservoir and the reservoir represented by inner Solar System rocks has been known for decades in elements near the Fe-peak of nucleosynthesis [e.g., 1-2]. However, recent work by multiple groups has shown subtle isotopic differences extend to elements at much higher masses, up to at least A≈185 [3-7]. With the possible exception of certain siderophile elements that may show variability between fine- and coarse-grained samples [3, 7], the isotopic compositions of most elements measured in normal CAIs (non-FUN) appear to be homogeneous, regardless of the classification of the host meteorite [4-6]. This apparent homogeneity in the CAI-forming region suggests that the reservoir from which CAIs were derived was isolated from later-formed solids by space and/or time [4].

In this work, we present updated results of numerous ongoing and integrated studies determining the isotopic character of the CAI-forming region, as well as discuss recent results from bulk meteoritic materials. From these studies, it is concluded that the isotopic character of the CAI-forming region was unambiguously and systematically different from the isotopic character of later-formed solids. Such isotopic differences can, in most cases, be ascribed to variable amounts of material derived from *p*-, *s*-, or *r*-process nucleosynthesis, with the specific amount and process depending on the material and element investigated [3-10].

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