Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16546

Presolar sources of bulk chondrite variability in titanium isotopes: evidence from *in-situ* measurements.

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Bulk meteorites in the Solar System exhibit mass-independent isotopic variability in Ti[1]. These isotopic differences are considered inherited from heterogeneity in the presolar dust from which meteorite parent bodies formed. The origin of such heterogeneity remains unclear but of major importance to understanding processes operating in the protoplanetary disk[1-4]. Correlated mass-independent variations between ^{46}Ti and ^{50}Ti (i.e., $\Delta'^{46/47}$Ti-$\Delta'^{50/47}$Ti) in bulk meteorites are suggestive of a presolar carrier with abundance anomalies on both isotopes. However, no current presolar grain compositions have been able to replicate bulk observations. The identification of the governing Ti presolar carrier(s) is thus a key step in helping to unravel dust processing in the early Solar System.

To ensure the detection of a full presolar grain inventory, an *in-situ* analysis is required, but is made difficult by potentially uncorrectable presolar isobaric interferences on Ti from Ca, V and Cr. We use a prototype collision cell MC-ICPMS with mass prefilter, 'Proteus', to address this problem. The prefilter is set to allow a narrow range of masses (e.g., 43–53) into the collision cell where Ti ion species are reacted with O_2 gas to form their oxide adducts, e.g. TiO^+, and measured in a region of the mass spectrum cleared by the mass pre-filter. By virtue of the differential reactivity of ion species with O_2, isobaric interferences on Ti are greatly reduced; Ca/Ti by >99 %, V/Ti by >70 %, and Cr/Ti by >95 %. Coupling Proteus with laser ablation thus provides a novel way of identifying presolar Ti compositions *in-situ,* with greatly reduced isobaric interferences.

We have identified a population of grains which only exhibit presolar enrichment on $\Delta^{50/48}$Ti and seemingly lack a correlated $\Delta^{46/48}$Ti. This suggests that Solar System dust processing sorted two distinct Ti carriers concomitantly, advocating for an un-mixing process such as thermal or size susceptibility. Analysis of both ordinary and carbonaceous chondrites showed contrasting concentrations of these "high-50" grains, with more anomalies detected in the latter.

[1]Trinquier et al., *Science*, (2009), 324, 374-376.

[2]Dauphas, et al., *ApJ*, (2010), 720, 1577-1591.

[3]Akram et al., *GCA*, (2015), 165, 484-500.

[4]Poole et al., *EPSL*, (2017), 473, 215-226.