ON THE QUESTION OF INTRINSIC ISOTOPIC HETEROGENEITY WITHIN PRESOLAR GRAINS.

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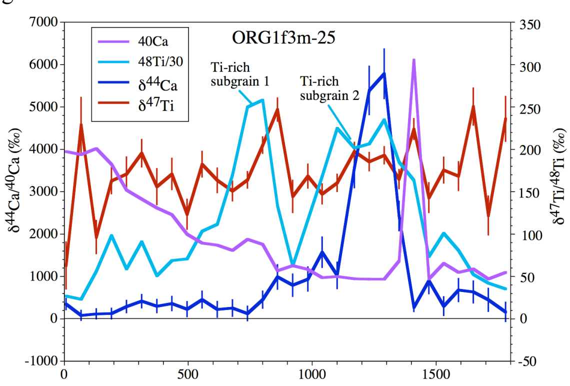
Introduction: Detection of isotopic heterogeneity at the time of grain formation could provide information on the astrophysical environment where presolar grains formed. Isotopic heterogeneity has been found in many cases but has been generally attributed to contamination [1, Fig. 8] or isotopic equilibration [2]. Strictly speaking, isotopic contamination or equilibration is always a possibility if only two isotopes have been measured and the resulting ratios in a given grain are not both larger and smaller than solar. But even measurements of 3-isotope system cannot unequivocally identify isotopic heterogeneity. An example are the O-isotopic measurements inside of a TEM slice of a low-density graphite grain from Murchison [2]. Because the $^{17}O/^{16}O$ ratios are close to solar, the large variations in $^{18}O/^{16}O$ can still be explained by isotopic equilibration. The situation is similar for Fe-rich subgrains within a SiC X grain that show differences in the $^{57}Fe/^{56}Fe$ ratios but solar $^{54}Fe/^{56}Fe$ ratios [3]. These considerations can be extended to apparent variations in inferred $^{26}Al/^{27}Al$ ratios in X grains that can be explained by contamination with Al [4, 5].

Results: The best candidate for a grain with intrinsic isotopic heterogeneity is ORG1f3m-25 from the high density graphite fraction (2.02-2.04 g cm^{-3}) from Orgueil [6]. This 5 µm large grain has $^{12}C/^{13}C$=486, $\delta^{29}Si$=–55‰, $\delta^{30}Si$=–30‰, normal N, O, and Mg, but large anomalies in Ca ($\delta^{42}Ca$=–69‰, $\delta^{43}Ca$=487‰, $\delta^{44}Ca$=1193‰) and Ti ($\delta^{46}Ti$=–792‰, $\delta^{47}Ti$=–122‰, $\delta^{49}Ti$=1802‰, $\delta^{50}Ti$=5300‰). Large variations in the Ti signal during grain analysis indicate the presence of Ti-rich subgrains (TiC). However, while the $^{49}Ti/^{48}Ti$ and $^{50}Ti/^{48}Ti$ ratios are fairly uniform throughout the graphite grain, the $^{47}Ti/^{48}Ti$ ratio shows large variations (Fig. 1). While the fact that $\delta^{44}Ca > \delta^{43}Ca$ and the association of the largest ^{44}Ca excesses with the highest $^{48}Ti/^{40}Ca$ ratios (in the middle of Ti-rich subgrain 2) indicate that some ^{44}Ca is from ^{44}Ti decay, Ti-rich subgrain 1 seems to have no or only little radiogenic ^{44}Ca, but a ^{47}Ti excess comparable to that in subgrain 2.



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