

BONANZA: ISOTOPIC ANATOMY OF A LARGE PRE-SOLAR SiC GRAIN OF TYPE X.

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Introduction: Among presolar SiC grains from the LU fraction of the Murchison L separation series [1, 2], we identified an unusually large (30 μ m, see Fig. 1a) type X grain [3]. Because of its enormous size, this grain, named Bonanza, offers the possibility of analyzing a large number of elements for their isotopic ratios. By isotopic imaging we can determine the distribution of isotopic ratios in the grain and check for isotopic heterogeneities.

Results: With the NanoSIMS, we measured C, Si, N, S, Li, B, Al-Mg, ^{40,44}Ca and ⁴⁸Ti. The first four elements were measured as negative (N as CN), the others as positive secondary ions. The average C, N, and Si isotopic ratios of the whole grain are ¹²C/¹³C = 190, ¹⁴N/¹⁵N = 28, $\delta^{29}\text{Si} = -282\%$, $\delta^{30}\text{Si} = -442\%$. In the isotopic images we observed variations in the C and Si isotopic ratios over the grain. The variations in the Si ratios can be explained by contamination with small mainstream grains [3], but not those of the C ratios when combined with the Si ratios. Magnesium in the grain is completely dominated by radiogenic ²⁶Mg ($\delta^{26}\text{Mg}$ up to $4.5 \times 10^6 \%$). Aluminum is heterogeneous over the grain and so is the inferred ²⁶Al/²⁷Al ratio, which ranges from 0.4 to 0.9 (Fig. 1b).

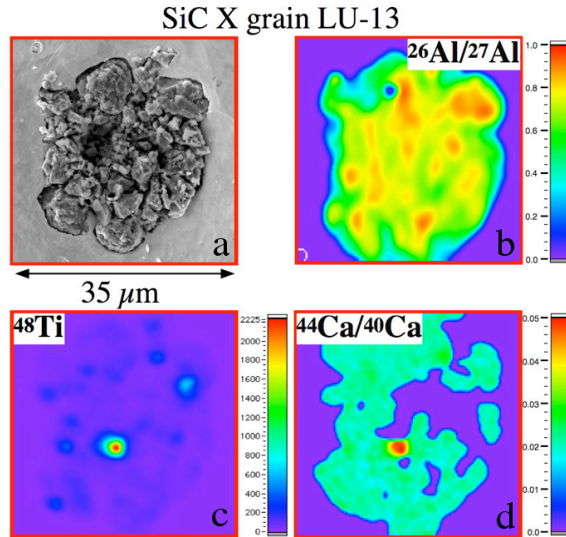


Figure 1. a) SEM image. b) Inferred ²⁶Al/²⁷Al ratio. c) NanoSIMS ion image of ⁴⁸Ti. d) ⁴⁴Ca/⁴⁰Ca ratio. The color bar indicates counts/px in panel c and ratios in panels b and d.

Titanium in Bonanza is concentrated in a few subgrains (Fig. 1c). Calcium is apparently dominated by contamination and ^{42,44}Ca/⁴⁰Ca ratios are normal except for a large ⁴⁴Ca excess associated with the large Ti-rich subgrain (Fig. 1c,d). This association is clear evidence for the initial presence of ⁴⁴Ti, with an inferred ⁴⁴Ti/⁴⁸Ti ratio of 5×10^{-3} .

Lithium, B, and S show heterogeneous distributions but the isotopic ratios are normal, indicating that these elements are mostly present as contamination.

References: [1] Amari, S. et al. 1994. *GCA* 58: 459.
[2] Virag, A. et al. 1992. *GCA* 56: 1715. [3] Wopenka B. et al. 2010 *LPS XLI*, Abstract #1390.