WHAT'S IN A HISTOGRAM? DECONSTRUCTING AND RECONSTRUCTING INITIAL $^{26}Al/^{27}Al$.

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Our 1995 review [1] of initial $^{26}Al/^{27}Al$ abundances in early solar system objects demonstrated a bimodal distribution: (a) most materials have ratios of ~0 (rare isotopically anomalous grains plus everything formed more than 2–3 My after "time zero"; and (b) CAIs with ratios of $(4–5)\times10^{-5}$. We now know [2] that there also is a chondrule component at $\sim1\times10^{-6}$, but basically the story remains the same. The histogram peak at $(4–5)\times10^{-5}$ has become the focus of much recent attention, because it defines the so-called canonical value for initial $^{26}Al/^{27}Al$. But what *really* is canonical? And, by extension: What is supracanonical?

The 1995 histogram summarized all available data at that time, mainly SIMS data collected on older generation machines such as the Cameca ims-3f. As we carefully explained in the review, the histogram did not include whole-CAI isochron values. Rather, every individual analysis datum was used to construct a 2-point isochron with an intercept of $\delta^{26}Mg=0$. The resulting CAI peak was fairly broad, extending from $\sim3\times10^{-5}$ to $\sim6\times10^{-5}$, with a maximum at $\sim4.5\times10^{-5}$. The latter value has been adopted by many [e.g., 3] as *the* canonical value. However, this approach may not be justified and certainly is not what we advocated [1]. The width of the CAI peak may well be due entirely to analytical uncertainty of the data. Our recommendation therefore was to use a *reasonable upper limit* for initial $^{26}Al/^{27}Al$ rather than the peak center, hence our preferred value of $\sim5\times10^{-5}$. This value was based on our summary isochron diagram and not the histogram: above $^{27}Al/^{24}Mg > 200$, many data have initial ratios close to 5×10^{-5} but none have significantly larger ratios. And, this is an *approximate* value; indeed, some recent high-precision data [4,5] suggest that the upper limit may be somewhat higher, $\sim5.2\times10^{-5}$.

Thus, defining any particular measurement as being "supracanonical" is entirely relative. For example, the CAI Leoville 144A was defined by Young et al. [3] as having a supracanonical ratio relative to 4.5×10^{-5}, but a careful regression of their data shows that the isochron for that object is not supracanonical relative to 5.2×10^{-5}. The essential task that now must be addressed by all labs working on this problem is to define precisely what the real width of the histogram peak is. If, for example, all CAIs formed within a very short time period, the histogram peak will turn out to be very narrow. Alternatively, different varieties of CAIs may record different crystallization ages and the histogram peak will consist of multiple resolved components. Until these data exist, any discussion of canonical vs. supracanonical initial ratios is premature and largely speculative.

References: [1] MacPherson G. J., Davis A. M. & Zinner E. K. 1995. *Meteoritics & Planetary Science* 30:365–386. [2] Kita N. T. et al. 2000. *Geochimica et Cosmochimica Acta* 64:3913–3922. [3] Young E. D. et al. 2005. *Science* 308:223–227. [4] Kita N. T. et al. 2008. *Geochimica et Cosmochimica Acta* 72:A477. [5] Jacobsen B. et al. 2008. *Earth and Planetary Science Letters* 272:353–364.