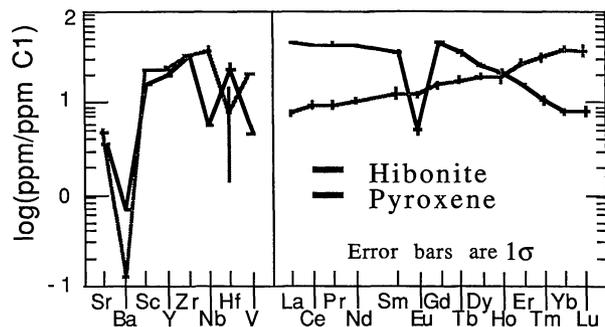


is enriched in Nb and V relative to the hibonite, but is depleted in Ba. The bulk REE pattern for 7-228 would be flat at $\sim 20 \times C1$ with a Eu depletion if the inclusion consisted of equal proportions of hibonite and pyroxene. However the exposed section of 7-228 has only around 10% hibonite.



The similarity in the Ca and Ti isotopic compositions of hibonite and pyroxene indicates that the hibonite and pyroxene are cogenetic. The coexistence of hibonite and pyroxene are not consistent with gas-solid condensation. The morphology of the grain and the complementary nature of the REE fractionations indicate that this inclusion crystallised from a melt. References: 1. Ireland (1988) *GCA* 52, in press. 2. Ireland *et al.* (1988) *GCA* 52, in press.

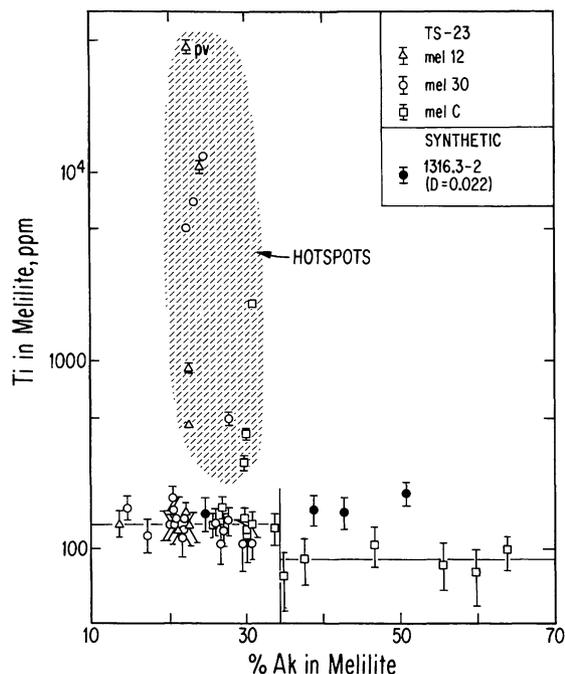
Relict Refractory Element Rich Phases in Type B CAI. M. L. Johnson,¹ D. S. Burnett¹ and D. S. Woolum.² Geol. Planet. Sci., Caltech, Pasadena, CA 91125 USA. ²Physics Dept. Calif. State Univ., Fullerton, CA 92634 USA.

Of the possible processes involved in Type B CAI history, igneous processes are the most tractable for study. Temperature and time scales inferred [1, 2] are commensurate with feasible laboratory simulations. We have previously reported melilite (mel) crystal liquid partition coefficients, D_i [3], for Sm, Yb, Sr (Eu⁺⁺ analog), and Y (Ho analog). Our data for akermanite (Ak) 30 mel compositions is in good agreement with literature data where direct/extrapolated comparisons are possible [4, 5, 6, 7]. Even allowing for significant variations in D_i with progressive crystallization, comparisons of predictions for the initial (0–30%) fractional crystallization of mel with our Sr, Y contents obtained for mel cores in Allende Type B CAI, with comparable Ak contents, indicate that the natural data substantially exceed (factors of 1.5–2.5 \times) those predicted. Similar results are obtained for Y, Zr in fassaite (fass) based on estimates of the D_i from literature data. In this case, excesses of these trace elements are up to factors of about $\times 5$. Thus, while the trace elements observed in natural CAI (Sr in mel and Y, Zr in fass) are in qualitative agreement with igneous partitioning, the trace element abundances are higher than quantitative predictions.

Actinide data are also available for individual mel grains from Type B CAI [8, 9, 10]. For mel, U- D_i values near 1 are needed to explain the U abundances of early-crystallizing mel. This seems unreasonable for such a highly incompatible element like U, and we have demonstrated this for Th. Mel Th- D_i values for the synthetic samples previously described were obtained using Th-alpha-track radiography. $D_i(\text{Th}) = 8.4 \times 10^{-3}$. Comparisons of predictions for Th with Th in natural samples [8] indicate enhancement factors (natural/predicted) of about 100!

Excesses of lithophile trace elements thus suggest that relict unmelted phases were incorporated in CAI. There is general agreement that some spinel is relict. But spinel can't account for the refractory lithophile enrichments observed. [8] suggested perovskite (pv) as a likely candidate. We have searched for surviving relict grains in 3, mm-sized Allende mel. All inclusions were characterized, but most were metals. There were two submicron pv grains. Pv are rare, but they must be relict, since pv is soluble in Type B CAI melts. We have searched for evidence of resorbed pv by looking for Ti hot spots in Allende mel. As shown in the figure, there is a general decrease in Ti with Ak, which is contrary to predictions based on our Ti D_i value (0.020). There are also three distinct Ti hot spots evident. Subsequent high resolution SEM

observations of the spots analyzed revealed a submicron pv inclusion for one of the hot spots, but there was no visible inclusion at the other two, in the SEM or with high magnification transmitted light optical observation. Detailed profiles show hot spot sizes of 10–20 microns. These might be sites of resorbed pv. However, actinide data indicate that relict pv is unlikely to account for the observed trace element data. TS23 mel data show [8] a CI normalized U/Ti ratio of about 10, but the corresponding pv ratio is approximately 1. This requires another trace element carrier(s), or an igneous pre-history for relict pv. High resolution SEM and optical observations also were made of anorthite that had yielded U stars in the [8] study. These too showed no evidence for visible inclusions to which the actinide-rich sources could be attributed. References: [1] Stolper E. (1982) *GCA* 46, 2159. [2] Stolper E. and Paque J. M. (1986) *GCA* 50, 1785. [3] Woolum D. S. *et al.* (1988) *LPS* 19, 1295. [4] Beckett J. *et al.* (1988) *LPS* 19, 49. [5] Ringwood (1975) *The Moon* 12, 12. [6] Nagasawa *et al.* (1980) *EPSL* 46, 431. [7] Kuehner S. M. *et al.* (1988) *LPS* 19, 653. [8] Murrell M. & Burnett D. (1987) *GCA* 51, 985. [9] Schirck J. (1975) Thesis. Washington University, St. Louis. [10] Wark D. (1984) Thesis. University of Melbourne.



Core Formation on the Eucrite Parent Body, the Moon and the AdoR Parent Body. J. H. Jones,¹ A. H. Treiman,² M.-J. Janssens,³ R. Wolf³ and M. Ebihara.³ ¹NASA Johnson Space Center, SN21, Houston, TX 77058 USA. ²Dept. of Geology, Boston U., Boston, MA 02215 USA. ³Enrico Fermi Institute, U. of Chicago, Chicago, IL 60637 USA.

The Moon, the Eucrite Parent Body (EPB) and the AdoR Parent Body (APB) are all small bodies within the inner solar system. In samples from these bodies, refractory elements which are more siderophile than P show good correlations between depletions and degree of siderophily. Depletions are also relatively consistent, for a given element, between different bodies. These observations appear to imply that depletions of siderophiles in the silicate portions of these bodies was mainly caused by the separation of solid Fe-Ni metal under similar redox conditions. For some elements (*e.g.*, P and Ag), depletions due to volatility may be more important than those attributed to core formation. Detailed models (after Newson [1]) indicate possible variations in styles of core formation. Unfortunately, systematic differences between experimentally-determined partition coefficients (D) [2, 3, 4, 5] preclude strong conclusions.

EPB. All models are sensitive to elemental depletions and to redox conditions. Estimates of the redox conditions during core formation on