boron rich interior sample contains less of the element than 80% of the previously analyzed meteorites of this type. It is probable that many of the previously reported results from carbonaceous chondrites reflect the analysis of boron contaminated samples.

The distinction between boron abundances in interiors and those in samples from unspecified regions of ordinary chondrites is not as well defined as it is in the carbonaceous types. The median abundance of boron in interior pieces is 30% less than it is in all other samples of ordinary chondrites. If meteorites are susceptible to contamination by boron, ordinary chondrites are less adversely affected than the carbonaceous types.

The median silicon normalized boron abundance in interior pieces of ordinary chondrites is 22% less than it is in similar portions of carbonaceous chondrites. However, the ranges of values obtained from the analysis of eight interior specimens of each type of chondrite are very similar. No chondritic type offers an obvious choice for estimating a meteorite based value of the cosmic abundance of boron. Consequently, this value has been calculated from the simple average of the boron concentration as determined from the analysis of interior samples of ten chondrites of different types. This meteorite based cosmic abundance of boron is 8 ± 5 atoms of born per 10^6 atoms of silicon. The uncertainty represents one standard deviation of the ten results. Assuming $(Si/H)_{meteorites} = (Si/H)_{solar} = 4.5 \times 10^{-5}$ (Ross and Aller, 1976), the newly measured value corresponds to 3.6 ± 2.3 atoms of boron per 10^{10} atoms of hydrogen. This is in excellent agreement with spectroscopic determinations of (B/H) in the solar photosphere (Kohl *et al.*, 1977; Engvöld, 1970).

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A SINUOUS INCLUSION FROM ALLENDE: TRACE ELEMENT ANALYSIS OF A RIM

A.M. Davis, T. Tanaka, L. Grossman and **G.J. MacPherson,** *University of Chicago, Chicago, IL 60637*
J.M. Allen, *University of Toronto, Toronto, Ontario, Canada M5S 1A1*

Wark and Lovering (1977) published the first detailed description of narrow, multi-layered rims that surround most coarse-grained Allende inclusions. They also found fine-grained inclusions to be aggregates of tiny spheres, each of which has the same sequence of layers as the rims. Those interested in the chemistry of primitive objects in carbonaceous chondrites have dreamed of extracting rim material from a coarse-grained inclusion for trace element analysis, but sampling techniques have not yet achieved the required sophistication. We describe here a sample of rim that nature has "extracted" for us.

It was the shape of this so-called sinuous inclusion on two facing slabs of Allende that first attracted our attention. A thin section was prepared from the portion of the inclusion in one slab and a sample was extracted with a tungsten needle from the other slab for trace element analysis. The inclusion consists of a ribbon of spinel within whose center is a chain of perovskites and on either side of which is a sequence of mineralogically distinct layers. On one side is a sequence identical to that around Type A inclusions: AI, a zone 18-30 μm thick with voids and fine-grained anorthite, nepheline and an unknown Ca-Al-silicate; AII, a zone 4-18 μm thick of diopside, with 5% Al_2O_3 and 1% TiO_2 where it abuts AI and decreasing amounts of these elements outwards; and AIII, a zone 0-15 μm thick of pure hedenbergite outside of which are porous masses of andradite, nepheline and diopsidic to hedenbergitic pyroxene. On the other side of the spinel ribbon is a single layer that bears a resemblance to rims found around Type B inclusions. It consists of porous nepheline and sodalite within which are embedded clinopyroxene and olivine.

Two samples were taken for chemical analysis by INAA: a bulk sample (#1) and dark grains from an aliquot of the bulk (#2). The major element composition of the sinuous inclusion resembles that of fine-grained Group II inclusions, except that it has a higher TiO_2 content, like that of coarse-grained Groups I and II inclusions. This is in accord with the small amount of perovskite in fine-grained inclusions and the prominent perovskite chain in the sinuous inclusion. The samples have typical Group II REE patterns and, when modelled according to Davis and Grossman (1979), give perovskite removal temperatures of 1666.5 and 1665.8 K. These temperatures are at the low

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end of the range for fine-grained inclusions. Sample #1 contains a smaller amount of the component with the flat REE pattern than sample #2. The sinuous inclusion differs from fine-grained inclusions in its relatively high refractory siderophile content, $\sim$ 2 times C1 chondrite levels. All volatile elements determined in the sinuous inclusion fall within the concentration ranges for fine-grained inclusions.

If it is assumed on the basis of mineralogy and texture that the sinuous inclusion is indeed a rim, then rims must have Group II REE patterns. Since rims have different REE patterns from interiors of coarse-grained inclusions, the former did not form by simple reaction of volatiles with the latter. Furthermore, because the interiors do not have a complementary pattern to that of rims, the rims did not condense from the gas remaining after formation of the interiors. Rather, our work indicates that rims formed by introduction of volatiles *and* refractories from a reservoir that was chemically distinct from that which gave rise to the interiors.

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HIGHLY DIFFERENTIATED EUCRITIC CLASTS IN POLYMICT BRECCIAS ALLAN HILLS A78040 AND A77302

J.S. Delaney, R. Bedell, S. Frishman, R. Klimentidis, G.E. Harlow, and M. Prinz, *Dept. Mineral Sciences, Amer. Mus. Nat. Hist., New York, NY 10024*

Modal analysis by automated electron microprobe, of lithic clasts from these eucrite polymict breccias, reveal dramatic variations of modal silica and cpx/opx. Bulk compositions of lithic clasts in A78040, define a new trend in the eucrite pseudoternary diagram (ol-qtz-an), away from the peritectic on which most basaltic eucrites plot (Fig. 1). This trend is the result of crystal-liquid separation and liquid evolution toward the minimum in the system. If eucritic magma differentiated down the cotectic B'' of Stolper (1977) it would produce the illustrated compositions. Eruption of these liquids produces rapid cooling which is indicated by the presence, in both A78040 and A78302, of 'Pasamonte-type' basaltic clasts with Fe-Mg zoned, uninverted pigeonites (Takeda *et al.*, 1979), while liquid trapped at shallow depth would equilibrate to the more uniform compositioned, granular textured clasts found. The increase in modal silica reflects the trend of magma evolution. This silica occurs petrographically either as dark interstitial devitrified glass containing the assemblage silica $\pm$ Ca-rich pyroxene $\pm$ fluorapatite or as large, often slightly altered, tridymite laths ($\sim$ 2 mm long) which crystallized simultaneously with the pyx and plag. The more evolved liquids also have higher modal cpx ($>$ cpx/opx) indicating that Ca-enrichment occurs in the later liquids. Two clasts in A78040 contain over 50% silica. These are very fine grained and have compositions like the devitrified glass in A76005 (Olsen *et al.*, 1978). They are also compositionally similar to the interstitial, silica rich areas of some clasts. These clasts therefore probably represent late-stage liquids remaining after much fractionation. Some of these evolved clasts cooled very rapidly (indicated by Pasamonte-type pyroxenes, 'feathery' pyx/plag intergrowths and devitrified glass) but some cooled more slowly or were later equilibrated by a thermal event.

These polymict breccias are therefore considered to have formed by impact brecciation of a series of near surface intrusions or lavas which are the result of internal evolution of a eucritic parent magma. Impact melting may be responsible for the textures of some of the clasts and perhaps is responsible for the production of some of the high-SiO_2 clasts. It seems unlikely that the regular variation of bulk chemistry (Fig. 1) could be produced by impact melting. The eucrite polymict breccias contain relics of rock types derived from differentiated eucritic melts which have not been recognized in monomict basaltic eucrites, except perhaps Pasamonte which is currently under investigation.

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