exhibits characteristics of facies b, relatively mild shock. Because of the heterogeneity of shock effects, caution is recommended in assigning a meteorite to a particular shock facies.

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CAVITATION AND HEAT CONDUCTIVITY IN THE ATMOSPHERIC DISRUPTION OF LARGE METEORITES

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The disruption of large meteorites by atmospheric forces has been studied mathematically and conjecturally; directly, through the use of radar and photography; and indirectly, through observation of the shapes and the distribution patterns of the meteorites spawned by these disruptions. However, it is still becoming more and more common for researchers to speak of "thermal disruption" of incoming meteorites, and a recent paper (Nozette, 1979) attributed to atmospheric heating a glassy vein which penetrated deeply into a stony meteorite. It is difficult to find a basis for either of these hypotheses.

Historically, evidence of internal heating from ablation has been notably lacking in meteorites. Heat conduction in stones is too slow to appreciably affect the meteoritic body during ablation and heat penetrates only a few millimeters at best. Melted crustal material has been found to penetrate to a maximum depth of only 6 mm into open fissures during ablation. Rather than filling fissures and cracks with molten material from the exterior of the meteorite, ablation tends to produce cavitation, which assists the disruption of the meteorite.

It is suggested that the lack of a highly oxidized external crustal layer on Collescipoli resulted from the disruption of the Collescipoli parent mass as it progressed below the area of retardation during atmospheric flight. Visual evidence of flow in shock melts is presented.

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A Mg ISOTOPE STUDY OF HIBONITE-BEARING MURCHISON INCLUSIONS

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The Mg isotopic composition of 5 hibonite-bearing inclusions and 3 hibonite single crystals from the Murchison C2 chondrite has been measured with an ion microprobe. Two of the inclusions, BB-1 and BB-4, and all of the hibonite fragments were recovered using a freeze-thaw technique described earlier (MacPherson *et al.*, 1980), while 3 other inclusions, BB-6, MUCH-1 and SH-4, were discovered by optical microscope examination of broken surfaces. All analyses were performed with a primary beam current of $\sim$ 2nA and a beam diameter $<$ 5 μm to ensure that the beam did not overlap the characteristically intergrown phases; isotopic data are summarized in the table below. BB-1, 4 and 6 are blue, spheroidal objects ($\sim$ 100 μm diameter) comprised mostly of intergrown spinel and lath-shaped hibonite, as described in MacPherson *et al.* (1980). Single hibonite crystals DJ-3 and 6 are similar to DJ-1 described in MacPherson *et al.* (1980) and are of similar compositions with only a factor of two range in Mg. MUCH-1 is composed of bladed hibonite crystals (typically $\sim$ 130 μm $\times$ 20 μm) radiating outwards from the inclusion center, surrounded by loosely compacted perovskite and calcite. Unlike other refractory Murchison inclusions, no spinel was observed. MUCH-1 hibonite resembles the DJ fragments in appearance and composition; all are characterized by low Mg (0.5-1.2% MgO) and uniform Sc (0.06-0.10% Sc_2O_3). Furthermore, another hibonite fragment, DJ-2, has a similar REE pattern to MUCH-1: nearly flat except for negative anomalies in Yb (large) and Eu (small). SH-4 is a fine-grained aggregate, $\sim$ 1 mm in diameter, containing diopside, fassaite, spinel, olivine, perovskite, hibonite, calcite, and a blocky, hydrated feldspathoid.

Excess ^{26}Mg was detected only in the hibonites from BB-1 and BB-4. No evidence for mass fractionated Mg like that reported in Macdougall and Phinney (1979) was observed. The ^{26}Mg excesses in three hibonites exhibit the linear correlation with the Al/Mg ratio characteristic of most Allende refractory inclusions and, together with data from spinel, define an Al-Mg isochron of slope $(^{26}Al/^{27}Al)_0 \sim 5 \times 10^{-5}$. These data are the first unambiguous evidence of ^{26}Mg excesses in hibonite which are correlated with the Al/Mg ratio. The slope of the hibonite isochron is identical to

Sample	$\delta^{26}Mg$ (‰)	$^{27}Al/^{24}Mg$
BB-1 spinel	0 ± 2	2.5
hibonite	6 ± 2	25
BB-4 spinel	− 1 ± 2	2.5
hibonite #1	15 ± 2	30
hibonite #2	25 ± 3	75
BB-6 hibonite #1	2 ± 2	27
hibonite #2	3 ± 3	34
MUCH-1 hibonite	− 1 ± 3	196
DJ-1 #2	1 ± 2	190
#3	0 ± 2	181
DJ-3	0 ± 3	113
DJ-6	0 ± 2	123
SH-4 hibonite	− 1 ± 2	14

that defined by data from melilite in Murchison inclusions MUM-1 and MUM-2 (Tanaka *et al.*, 1980) and to the slope of the standard Allende isochron (Lee, 1979), suggesting that some Murchison BB and MUM inclusions are contemporaneous with Allende Type B1 inclusions. In contrast, the DJ, BB-6, MUCH-1, and SH-4 hibonites contain no excess ^{26}Mg with $^{27}Al/^{24}Mg$ up to $\sim$ 200. $^{26}Al/^{27}Al$ was $< 2 \times 10^{-6}$ when these hibonites formed. If the lack of ^{26}Al is due to decay, then these hibonites formed $\gtrsim$ 3 My after BB-1 and 4. The similarity in physical appearance and chemical and isotopic composition of the DJ hibonites and those in MUCH-1 suggests that of the inclusions thus far observed, MUCH's are the most likely source of DJ hibonite fragments.

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Sm-Nd ISOTOPIC SYSTEMATICS OF CHONDRITES AND ACHONDRITES

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The $^{143}Nd/^{144}Nd$ and $^{147}Sm/^{144}Nd$ ratios have been measured in five chondrites and the Juvinas achondrite. The range in $^{143}Nd/^{144}Nd$ for the analyzed meteorite samples is 5.3 ε-units (0.511673 to 0.511944) normalized to $^{150}Nd/^{142}Nd$ = 0.2096. This is correlated with the variation of 4.2% in $^{147}Sm/^{144}Nd$ (0.1920 to 0.2000). Much of this spread is due to small scale chemical heterogeneities in the chondrites and does not appear to reflect the large scale volumetric averages. It is shown that all samples lie within 0.5 ε-units of a 4.6 AE reference isochron and define an initial $^{143}Nd/^{144}Nd$ ratio at 4.6 AE of 0.505828 ± 9 (Fig. 1). As there is a range of $^{147}Sm/^{144}Nd$ in chondrites there is no unique way of picking solar or average chondritic values for $^{143}Nd/^{144}Nd$ and $^{147}Sm/^{144}Nd$. From these data we have selected a new set of selfconsistent present-day reference values for CHUR (''chondritic uniform reservoir'') of $(^{143}Nd/^{144}Nd)_{CHUR}$ = 0.511836 and $(^{147}Sm/^{144}Nd)_{CHUR}$ = 0.1967. The new $^{147}Sm/^{144}Nd$ value is 1.6% higher than the previous value assigned to CHUR using the Juvinas data of Lugmair. This results in a small but significant change in the CHUR evolution curve. At 4.6 AE ago the new CHUR curve is 1.8 ε-units lower than the old CHUR curve. Some terrestrial samples of Archean age show clear deviations from the new CHUR curve (Fig. 2). If the new CHUR curve is representative of undifferentiated mantle then it demonstrates that depleted sources were also tapped early in the Archean. Such a depleted layer may represent the early evolution of the source of present-day mid-ocean ridge basalts. There exists a variety of discrepancies with most earlier meteorite data which includes determination of all Nd isotopes and Sm/Nd ratios. These discrepancies require clarification in order to permit reliable interlaboratory comparisons. The new CHUR curve implies substantial changes in model ages for lunar rocks and thus also in the interpretation of early lunar chronology. In addition to the total chondrite data isochrons will be presented for St. Severin and Angra dos Reis.

Division Contrib. No. 3464 (358).