Murchison in two different physical forms: solid or chipped fragments and homogenized pressed powders. The powdered samples were splits of much larger (0.1 to 0.2 g) original specimens. Four powdered samples gave results ranging from 59 to 75 ppm, which, as expected, was smaller than the range (53 to 93 ppm) observed from the fragments. Fluorine contents (in ppm) for seven carbonaceous chondrites using only homogenized samples are: Ivuna, 70; Orgueil, 74; Mighei, 66; Allende, 59; Essebi, 80; Haripura, 59; and Murchison, 65. The typical analytical precision is ±5 ppm. Measurements of the F concentrations of both crushed and chipped fluorapatite samples agreed statistically with the 3.53% F obtained by chemical analysis. There is no evidence for any systematic fluorine depletions in C2 relative to C1 chondrites. Our results suggest a solar system F abundance (760 atoms/10^6 atoms Si) which is a factor of 2 to 3 lower than adopted previously, which allows the F data for galactic cosmic rays to be more readily understood.

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AMOEBA-SHAPED OLIVINE AGGREGATES: A NEW TYPE OF INCLUSION IN THE ALLENDE METEORITE

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Amoeba-shaped olivine aggregates amount to ~ 2 percent by volume of the Allende C3 chondrite. They are very ragged in appearance, with rounded and outstretched protuberances. They are greyish-brown porous aggregates about 1 to 10 mm in longest dimension, consisting of rounded polycrystalline lumps ~ 0.1 mm in diameter.

An olivine composition histogram constructed from 463 analyses of randomly selected points in 18 *aggregates* from 10 polished thin sections stretches from Fo99 to Fo64 with a broad peak from Fo92 to Fo73. A similar histogram constructed from 325 analyses of olivine in glass-bearing porphyritic and barred chondrules in 12 sections is strikingly different, peaking sharply at Fo100 and dropping off steeply to a low tail stretching from Fo92 to Fo76.

Laced interstitially between the olivines in the aggregates are abundant grains and stringers of several different inter-grown minerals from 3-120 μ in size. X-ray scanning photographs reveal that these are silicates containing Na, Al, Ca, Cl and S. X-ray powder patterns revealed only olivine in whole aggregates and in the $>$3.08 density fraction separated from a single aggregate. Considerable nepheline and sodalite were found, however, in the $>$3.08 density fraction. Other feldspathoid minerals are also believed to be present on the basis of the scanning photos.

The oxygen isotopic compositions of the two density separates lie on line (b) of Clayton *et al.* (1973), indicating a significant interstellar component. The δO^{18} of the olivine-rich fraction is -14.5 $^{o}/oo$ relative to SMOW and that of the feldspathoid-rich fraction is -7.8 $^{o}/oo$. Thus, homogenization of oxygen isotopic composition did not occur between the different phases within the aggregates, implying that the aggregates were never molten.

The chemistry of the phases suggests that the aggregates could be assemblages of condensates which equilibrated with the solar nebula between 500 and 900° K. If so, they have critical implications for the condensation sequence and are important clues to processes in the early solar systems.

Clayton, R.N., Grossman, L. and Mayeda, T.K.,, 1973. A component of primitive nuclear composition in carbonaceous meteorites. *Science* **182,** 485.

CAN RANDOM IMPACTS CAUSE THE OBSERVED AR 39/40 AGE DISTRIBUTION FOR LUNAR HIGHLAND ROCKS?

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The 4 b.y. peak in the Ar 39/40 age distribution for lunar highland rocks may be caused by: 1. the Imbrium event 2. a sharp decrease in the rate of formation of craters. This latter possibility calls for a cratering rate so high before 4 b.y. that few rock ages survive and a rate so low after 4 b.y. that few rock ages are produced. A model for this hypotesis based on probability theory has been developed. We assume rock ages are produced and destroyed by random impacts which occur at an exponentially decreasing rate. The relative probability of producing a rock age at a given time is proportional to the cratering rate. The probability of survival of that rock is related to the total number of craters formed from that time to the present. The product of these two probabilities yields the probability of a rock age being produced and surviving until the present.

For a crater-production-rate half-life of 0.07 b.y. the resulting model age distribution matches approximately the observed age distribution. The fact that such a fit is possible demonstrated random impacts can cause the observed AR39/40 age distribution for lunar highland rocks. Additionally, the 0.07 b.y. half-life obtained agrees roughly with independent results from other workers. Thus, the credibility of the multi-crater hypotesis, as opposed to the Imbrium-event hypotesis, is further increased.