SPINEL-PYROXENE AGGREGATES IN MURCHISON

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Spinel-pyroxene aggregates were discovered in the Murchison C2 chondrite by Fuchs *et al.* (1973). Here we present petrographic and mineralogical data from a large number of these inclusions collected by freeze-thaw disaggregation and heavy liquid separation. These objects have a botryoidal to irregular external morphology, are creamy-white and have a sugary-textured outer surface. Two textural variants have been observed, distinguished by their internal structures: nodular and banded. The nodular variety consists of several clumps of Fe-free spinel grains, each mantled by Fe-free clinopyroxene that grades outward from fassaite (15-22% Al_2O_3, 5-10% TiO_2) near the spinel to diopside ($Al_2O_3 \lesssim 2.5\%$). Also present in these mantles are minor amounts of a greenish Fe-bearing silicate phase whose composition is similar to the "spinach" phase of Fuchs *et al.* (1973) and occasional troilite. The group of spinel-pyroxene clumps in each inclusion is rimmed as a whole by Fe-free forsterite grains ($<$ 1 to 10 μm) and, on the outermost part of the rim, by much rarer grains of Fe-free aluminous enstatite (Al_2O_3 1-1.5%; grain size $<$ 1 to 10 μm). Perovskite and rare noble-metal nuggets can be present, usually as inclusions within spinel or fassaite. Melilite and hibonite have not been found. The banded variety of these inclusions contains the same phases as above, but spinel forms folded sheets that are mantled on both sides by fassaitic to diopsidic pyroxene. Cavities are common in both varieties, and, in the banded type, the sheets wrap around them. This suggests that either the cavities are original features or that they were initially filled by some unknown material that has been completely removed during thin section preparation. No alkali- or halogen-bearing phases have been found in either variety of inclusions.

We propose that the perovskite and spinel condensed from the solar nebular gas at high temperature. Apparently, some of the spinels had grown or accreted into sheet-like bodies while others had formed more nearly spherical ones prior to condensation of their mantling clinopyroxenes. Accretion of the spherical bodies into the observed botryoidal objects was followed by condensation of forsterite and then enstatite at temperatures still high enough to prevent FeO from entering their structures. INAA data show that these objects are high-temperature condensates that were diluted by addition of lower-temperature materials: they have moderate SiO_2 contents, their MgO is higher and CaO lower than Allende coarse-grained inclusions and their refractory trace elements are uniformly depleted relative to the latter. The absence of FeO from the outermost rim phases argues against extensive *in situ* low-temperature alteration of the materials in C2 chondrites.

No counterpart to this type of inclusion has yet been found in the Allende C3 chondrite. These objects do bear a striking resemblance, however, to some of the micrometeorites recovered from deep sea sediments by Brownlee *et al.* (1980). This similarity lends additional support to the idea that the micrometeorite population contains particles that were derived from the same source as inclusions in C2 chondrites.

Brownlee, D.E., B.A. Bates, L.B. Pilachowski, E. Olszewski and W.A. Siegmund, 1980. *Lunar Planet Sci. XI*, pp. 109-111.

Fuchs, L.H., E. Olsen and K.J. Jensen, 1973. *Smithson. Contrib. Earth Sci.* **10**.

PETROGRAPHY OF THE LOUISVILLE METEORITE

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Fall, recovery, bulk chemical composition (Jarosewich, analyst) and chondrule-matrix relationship of the Louisville meteorite have been reported earlier (Hunt, 1978; Hunt and Boone, 1978). Study of one polished thin section from the largest fragment (1051 g) and macroscopic observations form the basis of this preliminary petrographic report.

The meteorite contains a few extremely brecciated dark bands which do not seem to cut one another. The bands comprise anastomising veins of troilite and recrystallized glass (with numerous disseminated Fe-Ni metal granules) enclosing clasts of the wall-rock material. The bands appear to represent melt pockets of the sinuous form (Dodd and Jarosewich, 1979). Undefined barred olivine-plagioclase chondrules as well as those with radiating and equant crystals of pyroxene occur in the light portion. The margins of all the recognizable chondrules are either blurred or are rimmed by recrystallized maskelynite. Many fragments of the chondrules are also intimately mixed with the