PETROGRAPHY OF A CORUNDUM-BEARING COMPOUND ALLENDE INCLUSION

S.M. Kuehner and L. Grossman*, *Dept. of the Geophysical Sciences, University of Chicago, Chicago, IL 60637*
**Also Enrico Fermi Institute*

Sample TS63F1 is the less convoluted of two sections made from a melilite-poor, hibonite- and spinel-rich Allende inclusion. It is bulb-shaped, ≈ 13 mm long and ≈ 6 mm wide at the base, and can be subdivided into three major mineralogical-textural regions: a hibonite-, spinel-rich region (H-S; ≈ 1/3 of section); a vermicular-textured, spinel-anorthite-diopside region (VSAD; ≈ 2/3); and an ≈ 500 μm wide spinel-, diopside-rich mantle along the perimeter of the entire inclusion.

The H-S region contains 500 μm sections of two hibonite crystals, one of which grades into a zone of randomly oriented, 70-90 μm long, hibonite laths that have undulose boundaries with intersertal spinel (≈ 2% FeO). This zone grades into another dominated by spinel which encloses sprays of 30 μm long hibonite laths and minor rounded perovskite grains. All hibonite in this region contains < 3% MgO and < 4% TiO_2. In both zones, relict grains of primary corundum (5-25 μm) are commonly found in the cores of highly irregular, ragged patches (30-50 μm) of platy material, possibly hibonite + gehlenite + sodalite. Introduction of Fe may have accompanied corundum alteration, as spinel becomes progressively richer in FeO (up to 20%) adjacent to some corundumn occurrences. The platy material was, in turn, replaced by anorthite + grossular. The hibonite-rich zone contains numerous angular voids partially filled with anorthite, grossular and sodalite. Amoeboid voids in the spinel-rich zone are fewer, but larger (≈ 50 μm), and commonly have a rim of gehlenite and a central region partially filled with anorthite, grossular and whiskers of wollastonite. Parallel lamellae of gehlenite, 1 × 10 μm, are found inside one of the large, single hibonite crystals, suggesting exsolution of gehlenite from hibonite, presumably during slow cooling. Angular voids between the hibonite laths suggest that the primary phases in the H-S region are nebular condensates. The mineralogy and texture of the H-S region are reminiscent of those in hibonite- and corundum-bearing inclusions in the Murchison C2 chondrite.

The VSAD region is composed of angular clasts containing islands and curving, branching ribbons (5-10 μm wide) of spinel (≈ 3% FeO). The spinel has scalloped margins and is bound by successive, narrow bands of anorthite and diopside of varying Al and Ti contents, which together form concentric zones about irregularly-shaped voids. This suggests that the primary assemblage in these clasts was a spongy spinel aggregate whose voids allowed access to nebular gas, resulting in replacement of spinel by anorthite, followed by diopside deposition *via* direct condensation or partial reaction with anorthite. Sodalite, grossular and hedenbergite may partially fill the remaining void space. Hibonite in rare, perovskite-rich nodules contains 4-6% MgO and 7-9% TiO_2. The mineralogy and texture of the VSAD region are similar to those of pink and purple, fine-grained Allende inclusions.

The mantle consists of flame-shaped, Fe-poor spinel grains (< 1% FeO) elongated normal to the margin of the inner regions. Spinel-enclosed perovskite chains, up to 100 μm long, occur along only a small section of the mantle's inner contact and are also oriented normal to it. Spinel flames have narrow anorthite rims. Inter-spinel regions contain porous aggregates of columnar diopside. The flame-shaped spinel may have been derived from a massive spinel layer which underwent later alteration along channelways.

The contrast in mineralogy, texture and hibonite composition between the VSAD and H-S regions suggests that these regions may have existed as independent objects that evolved in distinct nebular localities. Between these two regions is a distinct, 100-200 μm wide band of spinel which is embayed by fine-grained anorthite and diopside. It is very similar to the mantle, suggesting that the two different types of nebular material present in this inclusion were cemented together by deposition of the mantle. Occasionally, inclusions with different nebular histories coexisted in the same nebular locale while the gas was still hot enough for condensation of mantles.

BACHMUT (L6) CHONDRULE J 2689: METAMORPHISM VERSUS METASOMATISM

G. Kurat and F. Brandstätter, *Naturhistorisches Museum, Postfach 417, A-1014 Vienna, Austria*
E. Pernicka, *Max-Planck-Institut für Kernphysik, Postfach 103980, D-6900 Heidelberg, FRG*
A. Kracher, *Iowa State University, Dept. Earth Sciences, Amese, IA 50011*

Chondrule J 2689 is a large (8 mm) RP chondrule found by F. Berwerth in 1911 in one of our major Bachmut (L6) specimens (A 915). It has a very fine-grained hornfelsic texture and consists of orthopyroxene, olivine, clinopyroxene, plagioclase, chromite, troilite, and metal. The silicate minerals are "equilibrated" and very similar in composition to those of the host meteorite. Metals and troilite are finely dispersed throughout the chondrule but at very low abundances. The metal forms small anhedral grains and is dominantly taenite with a peculiar composition (average of 20 grains: Ni = 13.7 ± 1.6, Co = 0.82 ± 0.09 weight %) very different from metal of the host (Fig. 1). One 20 μm metal grain consists of a kamacite lamella in high Ni taenite. Host chondrite metal is monotonous except for one kamacite grain with very low Co content (Fig. 1). The bulk composition of the chondrule as determined by INAA and broad beam electron microprobe analysis is fractionated with respect to CI composition (Table 1). The refractory lithophile elements Sc, Al, Ca, and Sm and the moderately volatile elements Mn, Na, and K are enriched up to 3 × CI. Chromium is depleted. All siderophile elements are depleted in the sequence Ir (0.1 × CI)-Ni, Co-Au (0.27 × CI). Oxygen isotopic compositions of the chondrule and the adjacent host are not equilibrated (R.N. Clayton, pers. comm., 1985).

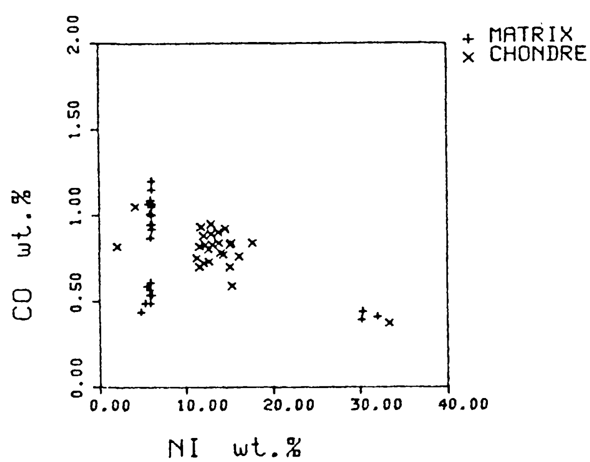

Fig. 1 Metal composition in Bachmut chondrule and bulk.