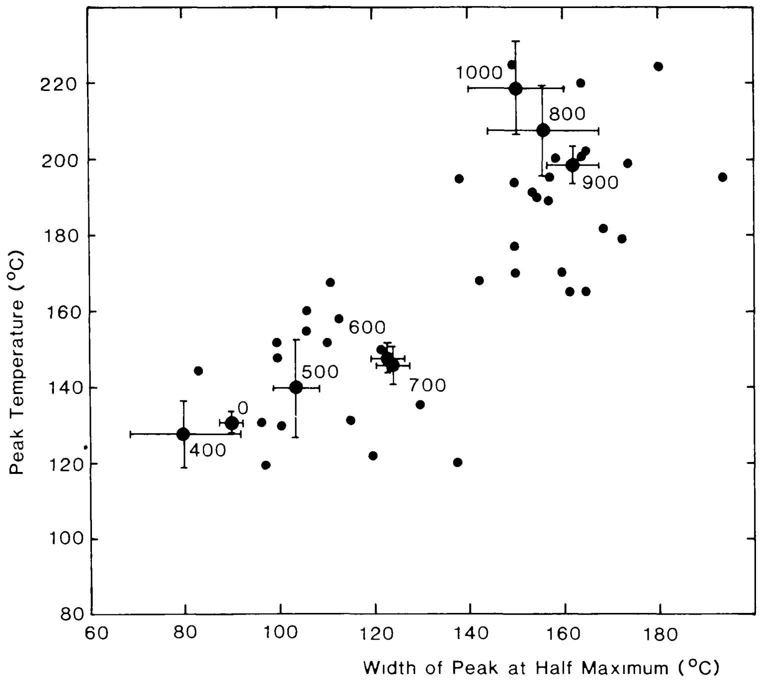

Fig. 1 TL peak temperature vs. peak width for samples of Allan Hills A77011 annealed to various temperatures (large points, temperatures in C) and type 3 ordinary chondrites (small points).

These data suggest that the TL phosphor is feldspar and also that TL may be used to estimate paleotemperatures for little-metamorphosed, unequilibrated meteorites.

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REFRACTORY INCLUSIONS IN AMOEBOID OLIVINE AGGREGATES IN ALLENDE

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Amoeboid olivine aggregates (AOA) are irregularly-shaped objects made mostly of olivine (Ol) with lesser pyroxene (Cpx) and feldspathoids (Fsp) (Grossman and Steele, 1976). SEM studies (Bar-Matthews *et al.*, 1979) show aggregate textures: equant Ol crystals and clumps of crystals are enclosed by finer-grained, loosely-packed matrices of Ol plates, Cpx crystals and Fsp. Rare perovskite (Pv) + spinel (Sp) (Grossman and Steele, 1976) were found in cores of Ol clumps (Bar-Matthews *et al.*, 1979) and were suggested (Grossman and Steele, 1976; Bar-Matthews *et al.*, 1979) as refractory trace element carriers (Grossman *et al.*, 1979). We present more detailed SEM work on these refractory inclusions *within* AOA.

Although systematic searches were not conducted, ~ 30 refractory inclusions were examined in one AOA, TS55F1 (13 mm in length), and ~ 10 in another, TS51F1 (7 mm). The former is of special interest, as it contains the two largest inclusions seen to date. One of these, 102, is ~ 300 μm in diameter and contains an elliptical core (~ 200 μm in length) consisting mostly of Sp which encloses wormy melilite (Mel; Ge ~ 90; ≤ 30 μm) and minor Pv. Cavities tend to be associated with Mel. The Mel texture resembles that in blue spherules in Murchison (MacPherson *et al.*, 1983) but the latter contain hibonite and less Mel. Surrounding the core is a 20 μm-thick zone consisting of a cavity-riddled, fine-grained mixture of anorthite (An97), Sp (5% FeO), nepheline (Nep), ilmenite (Ilm) and grossular (Gr), which embays and veins the core, preferentially attacking Mel. Outside this zone is a 2 μm-thick band of Fas, then a 15 μm-thick band of aluminous diopside (Di). Around the entire structure and attached to it is a 30 μm-thick mantle of Ol grains (≤ 15 μm) which are zoned from Fo96 outward to Fo84. Outside of this is a narrow (5 μm), discontinuous rind of hedenbergite (Hd) which separates the inclusion from the matrix.

The other large (300 μm) inclusion, 101, has a core made mostly of Mel (Ge ~ 90) enclosing odd skeletal Sp crystals (≤ 20 μm) and rare Pv. The core is rimmed by a spherically concentric set of cavity-riddled layers that is almost identical to that in 102. Sp crystals in the first layer have the peculiar, elongated shape of those in the core but contain FeO, are rimmed by Fas and separated by Nep, An and Gr, suggesting that this layer is an alteration product of the core in which Mel was preferentially replaced by the latter phases.

Almost all other refractory inclusions studied in both AOA are much smaller than these, 50-150 μm. Mel is absent from all of these, cavities tend to be more abundant and Sp more FeO-rich (≤ 12%) than in the cores of 101 and 102. Those with the least volume of cavities in the core have Fas ± Nep associated with the cavities. As the proportion of cavities in the core increases, amounts of Sp, Fas, Gr, An and Pv decrease and amounts of Ol, Nep ± Ilm increase. In the most cavity-rich, the only remaining features reminiscent of those in 101 and 102 are the outer layers of Di, Ol and Hd. In these, the cores are porous, fine-grained mixtures of Nep, Ol (Fo ~ 90) and Ilm.

The sequence of rim layers around cores of refractory inclusions in AOA is very similar, but for the Ol layer, to that on many Allende coarse-grained inclusions. In MacPherson *et al.* (1981), the latter were attributed to reaction of primary Melin inclusion interiors with the nebular gas. In large refractory inclusions in AOA, we see clear evidence for formation of the first rim layer by replacement of interior Mel. Small refractory inclusions in AOA are more altered than large ones and record a range of alteration intensity. Rim layers occur on inclusions lacking Mel in their cores, but textural similarity of remaining phases to those in Mel-bearing inclusions and the presence of cavities suggest its former presence.

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SPECTRAL REFLECTANCE STUDIES OF THE ORIENTALE REGION OF THE MOON

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The Orientale impact occurred in rugged highlands on the southwestern limb of the Moon and was the last of the major basin-forming events. Valuable insight concerning lateral and vertical changes in the composition of the lunar crust can be provided by studies of material exposed by lunar impact basins. These impacts have excavated material from a variety of depths and deposited this ejecta in a systematic manner. In order to investigate the composition of materials exposed on the interior of Orientale basin, we have collected near-infrared reflectance spectra for units within the Cordillera ring.

Twelve near-infrared spectra (0.6-2.5 μm) were recently (October, 1983) obtained at the Mauna Kea Observatory 2.2-m telescope using the Planetary Geosciences Division indium antimonide spectrometer. These include spectra obtained for two fresh surfaces on the inner Rook ring, two fresh craters in or adjacent to the outer Rook Mts. (Eichstadt K, 13-km. in diameter and an unnamed 15-km. crater), and two fresh 11-km. craters (Eichstadt G and H) which are located between the outer Rook ring and the Cordillera ring and expose material from within the knobby facies of the Montes Rock Formation. In addition, spectra were collected for portions of the Maunder Formation.

Analyses of the spectra obtained for the mare units on the interior of Orientale (Lacus Veris and Lacus Autumni) indicate that these surfaces are contaminated by variable amounts of local highland debris. This is not surprising in light of the limited areal extent of the mare units and