A NON-NEBULAR ORIGIN FOR THE ALLAN HILLS 85085 SUBCHONDRITIC METEORITE

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The anomalous meteorite Allan Hills 85085 is described by Grossman et al. [1]. With the exception of some personal observations obtained by thin section examination, my information regarding ALH 85085 comes from that abstract and from A. E. Rubin (private communication).

Chondritic meteorites certainly formed in the solar nebula, and ALH 85085 shares numerous properties (presence of chondrules and refractory inclusions and a composition inconsistent with planetary igneous formation) with the chondrites. However, there are serious reasons to doubt that ALH 85085 formed in the nebula. It has an Fe/Si ratio 1.6x CI and a S/Si ratio 0.03x CI [1], well outside the range known in chondrites. It has very low contents of the alkalis Na and K, probably <0.1x CI (Rubin, priv. comm.). It has a texture that is marked by the small (typically 20 µm) dimensions of the high-temperature constituents [1], about 5-10x smaller than typical of chondrites. The metal is remarkably uniform in size, ragged in shape, and uniformly dispersed. Chondrules are rare (Grossman et al. [1] state ≥10 vol. %, but this estimate includes some polymineralic grains that, in my opinion, may not be chondrules) and an appreciable fraction of these rounded objects are smaller than observed to be common in any chondrite having a mass >20 g.

I suggest that ALH 85085 is a product of impact processes on the surface of a chondritic body. Much but not all of the constituents were produced by impact-vaporization followed by recondensation as droplets having typical dimensions of 20 µm. This process accounts for most of the metal and the so-called microchondrules. Some of the more volatile vaporized material (S, Na, K) did not recondense locally and may have escaped from the parent body. During the vaporization-recondensation the mean degree of oxidation may have decreased as a result of the loss of O dissociated from Fe; this could partly account for the remarkably low Ni content of the metal. The larger chondrules and refractory inclusions and the CI-like clasts may be survivors that were originally outside the region where the impact-vaporization occurred. Perhaps ALH 85085 is related to Bencubbin, another impact-produced subchondritic meteorite which also has carbonaceous chondritic affinities [2].

References

[1] Grossman J.N., Rubin A.E. and MacPherson G.J., Lunar Planet Sci. **19**, in press.

[2] Kallemeyn G.W., Boynton W.V., Willis J. and Wasson J.T. Geochim. Cosmochim Acta **42**, 507-515 (1978).

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