PHYLLOSILICATES IN THE YAMATO 82042 CARBONACEOUS CHONDRITE - PRIMITIVE OR NOT?

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Yamato 82042 is a CM chondrite consisting of rare olivines set in a matrix of phyllosilicates with minor carbonates, sulphides, oxides and metal. Some chondrule-like objects contain a complex intergrowth of phyllosilicate and carbonate. The olivines range in composition from almost pure forsterite to Fa35 with very little zoning within crystals (1). It has been argued that those forsterites with comparatively high minor element contents are of nebular origin (2,3). Clearly the possibility of a variety of sources for the olivines in CM chondrites is widely accepted. It is less widely accepted that the phyllosilicates may have both nebular and parent body origins.

In Yamato 82042 the phyllosilicates are predominately serpentine-type minerals with basal spacings of 7.17 - 7.30 Å. Minor amounts of chlorite-montmorillonite have been identified in the groundmass matrix but the iron-rich serpentine (cronstedtite) common in many CM meteorites was not found. Very minor amounts of PCP (tochilinite), giving a poorly developed 10.8 Å basal spacing, are present (1).

The serpentine-type material occurs as distinct aggregates generally with broad, dark-brown rims set within a matrix consisting of light brown-yellow material. The chemical compositions of the matrix and aggregates overlap but there is a tendency for the dark-brown rims to be relatively depleted in Fe and Mg. Traverses across rimmed aggregates show a distinct trend in chemical composition with Mg decreasing as Fe increases. The dark rims show no such trend. There seems to be two populations of phyllosilicate-rich aggregates which may have had differing histories. Recent papers on the matrices in CM chondrites (4,5,6) have discussed the relationship between the anhydrous silicates and phyllosilicates. One scenario places the origin of the phyllosilicates on the surface of a parent body by alteration of prexisting material, generally olivine. A second suggests, from textural evidence, that some features of the CM chondrites cannot be solely parent-body derived (7). It may be that some of the complexities of the phyllosilicates in CM chondrites could be explained by postulating a pre-accretion source for part of this material. In particular some of this may have formed in a nebular environment with only limited reprocessing on a parent body.

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