MULGA WEST, A C6 CARBONACEOUS CHONDRITE ?

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Carbonaceous chondrites of different types (C1, C2, C3) have in contrast to different types of ordinary chondrites (e.g. H3, H4, H5, H6) strong variations in their chemical composition. The concentrations of all non-refractory elements decrease from type C1 to C4, leading to a corresponding increase of refractory elements. The degree of those depletions together with the respective enrichments can be used for a simple compositional classification of carbonaceous chondrites. This classification is in general in good agreement with that based on petrographic variations.

The meteorite Mulga West, recovered in 1971 from the Nullabor Plain of Western Australia, is the strongest recrystallized carbonaceous chondrite known so far, classified as C5 or C6 (Binns *et al.*, 1977). We have been interested to determine, whether the chemical composition of Mulga West shows a parallel variation. A sample of Mulga West was analysed by INAA and X-ray techniques. We consider three groups of elements:

The first group consisting of highly incompatible elements (Ba, K, Rb, Cs, Ta, U etc.) shows abnormally high abundances. Terrestrial contamination from weathering should be responsible for their enrichments. Additionally we find Ca and C contamination from a calcite phase, which was also described by Binns *et al.* (1977).

A second group of elements including chalcophiles (S, Se, Ni, Au, Co, Cu) is strongly depleted. A similar depletion of these elements was observed in the meteorite Brachina (Dreibus *et al.*, 1983). It may imply a loss of sulfide. In contrast to Brachina such a lost sulfide phase from Mulga West should have been Ni-rich (> 30%). Microprobe studies show that small amounts of sulfide with a high Ni-content (30%-33%) is still present in the sample.

The third group includes all elements, which are not affected by weathering or loss of sulfide. Their concentrations are similar to those of C3V-chondrites. The weight-ratios between two of these elements are significantly closer to C1-ratios than to ratios in Coolidge, contrasting the higher metamorphism of Mulga West. Like Binns *et al.* (1977) we suppose, that C3V-chondrites underwent an isochemical metamorphism on their parent body, which was similar to that among the group 3 to 6 sequence in ordinary chondrites. Beside Mulga West also Karoonda, Yamato 69003 and two new Antarctic meteorites (ALH 82135, PCA 82500) may belong to the same metamorphic sequence (Kallemeyn, 1985). To distinguish this almost isochemical process on the parent body, from that among the C1 to C3 sequence, it seems to be necessary to project a new classification of carbonaceous chondrites, using independently petrographic and chemical trends.

Binns, R.A. *et al.*, 1977. *Meteoritics* **12**, 179.
Dreibus, G. *et al.*, 1983. *Proc. Lunar Planet. Sci.* **14**, B237.
Kallemeyn, G.W., 1985. *Abstracts 10th Symp. of Antarctic Meteorites,* 45.

SIDEROPHILE ELEMENTS AND THE RELATIONSHIP BETWEEN TYPE 3 AND EQUILIBRATED ORDINARY CHONDRITES

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It is not clear whether the metamorphism of ordinary chondrites occurred subsequent to aggregation, so that closed system metamorphism alone would have converted a type 3.0 to a type 6 chondrite or whether each meteorite is an aggregation of components which were metamorphosed to diverse degrees prior to, or during, aggregation in the nebula (Scott *et al.*, 1985). Oxygen isotope data seem difficult to reconcile with the former (Sears and Weeks, 1983), as do bulk Fe (Dodd, 1976) and certain trace siderophile elements in Tieschitz and Bremervorde (Morgan *et al.*, 1985).

We have performed INAA on 38 type 3 ordinary chondrites (27 Antarctic, 10 possibly paired) and 15 equilibrated ordinary chondrites. Here we discuss six siderophile elements and the relationship between petrologic type 3 and type 4-6 ordinary chondrites. Since many of our samples are Antarctic finds we compared our results to literature data, although the latter are sparse and in several instances may be subject to systematic error. There is some uncertainty in the assignment of type 3 chondrites to the L or LL classes as there is no hiatus in bulk composition to separate the classes, and silicates or metal compositions are unreliable because of the more reduced nature of the type 3 chondrites.

Data are plotted in Figure 1. Type 3 chondrites of the H and L classes plot consistently lower in their siderophile element content than types 4-6. For the LL class Ir, Co, and Fe in type 3 ordinary chondrites also are 5-10% depleted, but the Ni and Au data make the situation unclear. The siderophile element depletion in type 3 chondrites is comparable with analytical accuracy, but is present in 11 cases out of 15 in our data and 11 cases out of 13 in the literature data. We therefore conclude that it is real and that a metal-silicate fractionation occurred within the H, L, and possibly LL classes and that closed system metamorphism alone could not have converted a type 3 chondrite into a type 6.

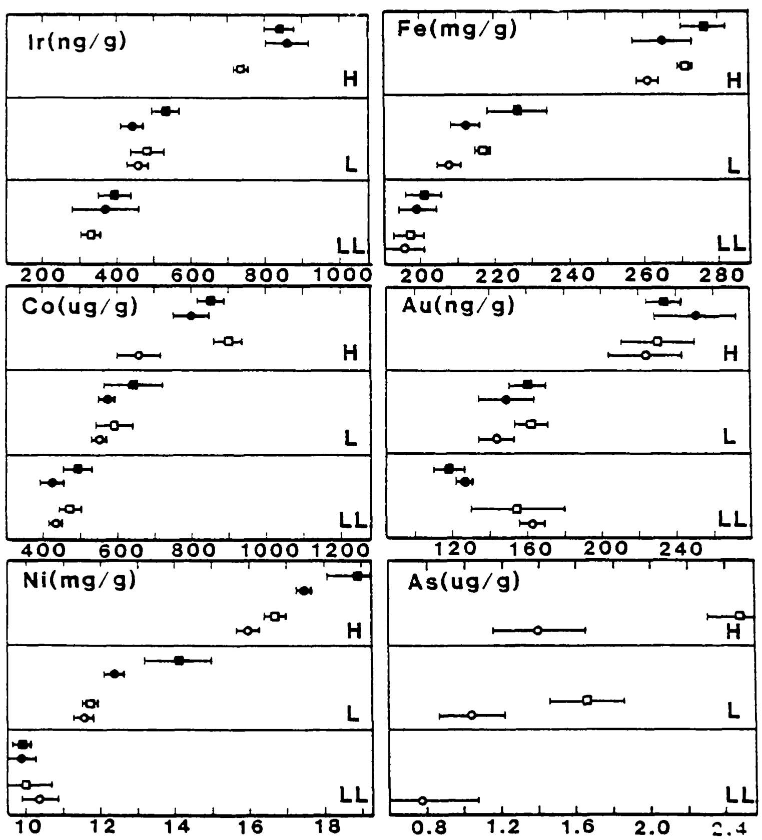

Fig. 1 Siderophile element concentrations in type 3 (circles) and type 4-6 (squares) ordinary chondrites for present data (filled symbols) and literature data (open symbols).

Dodd, 1976. *EPSL* **28**, 479.
Morgan *et al.*, 1985. *GCA* **49**, 247.
Scott *et al.*, 1985. *LPS* **16**, 751-752.
Sears and Weeks, 1983. *LPSC* **14**, B301.