Are CK chondrites really a distinct group or just equilibrated CVs?

Conference or Workshop Item

ARE CK CHONDRITES REALLY A DISTINCT GROUP OR JUST EQUILIBRATED CVs? R C Greenwood[1], A T Kearsley[2] and I A Franchi[1]: [1]PSSRI, Open University, Walton Hall, Milton Keynes, MK7 6AA, U.K. [2]Oxford Brookes University and Dept of Mineralogy, The Natural History Museum, London, SW7 5BD, UK.

Introduction: The CK group, as presently defined [1,2], is dominated by equilibrated meteorites, whereas all other carbonaceous chondrites groups contain only unequilibrated material [3]. This is in marked contrast to ordinary chondrites, in which equilibrated and unequilibrated meteorites form a continuum within each of the main groups (H, L, LL). As part of a classification exercise on newly-recovered CK-like material it became apparent to us that the distinction between the CK and CV groups is far from clear-cut and that the relationship between them may need to be reevaluated.

Experimental Techniques: Backscattered electron imagery, X-ray mapping and mineral analyses were performed on a JEOL 840 scanning electron microscope with an Oxford Instruments exL energy dispersive spectrometer (20kV accelerating voltage, 2 nA probe current): Oxygen isotope analyses were undertaken by infrared laser-assisted fluorination [4]. Samples studied: Karoonda (CK4 fall), Dar al Gani 250 (CK4/5), Dar al Gani 275 (CK4/5), recently-recovered CK6-like chondrite.

Results and Discussion: CK chondrites are highly oxidized meteorites having high modal abundances of magnetite and trace amounts of Fe,Ni-metal [1,2]. The main classification criteria used to define the group are: (i) low chondrule to matrix ratio, (ii) chondrule size intermediate between the CO and CV groups, (iii) absence of coarse-grained rims around chondrules, (iv) low abundance of refractory inclusions compared to CO and CV groups, (v) low C content, (vi) refractory lithophile abundances intermediate between CO and CV groups, (vii) O-isotope compositions overlapping those of the CO and CV groups.

While we do not dispute the validity of most of these features, our own observations suggest that they are mainly a reflection of the higher metamorphic grade of most CKs compared to other carbonaceous chondrites. Thus, the apparently low content of refractory inclusions is most likely a product of alteration and subsequent metamorphism, as shown by the similarity between the bulk refractory lithophile abundances in CKs and the CAI-rich CV group [1]. Chondrule abundance; or perhaps more correctly apparent chondrule abundance, will also decrease with increasing grade. Coarse-grained chondrule rims are present in at least some CKs, (e.g. DAG 250) but due to recrystallisation are far less obvious than in the lower grade CV3 chondrites.

A number of meteorites have been classified as being CK3 (Camel Donga 003, Watson 002, DAG 431, Dhofar 015). It is instructive to note that these meteorites generally do not show typical features of the CK group, often having abundant chondrules and/or refractory inclusions and oxygen isotope compositions that plot away from other equilibrated members of the CK group. In many respects these meteorites resemble CV3 chondrites of the oxidized subgroup.

Conclusions: The distinction between CK and CV3 (oxidized subgroup) chondrites may be more apparent than real and may reflect varying metamorphic conditions rather than more fundamental compositional differences.

References: [1] Kallemeyn G.W. et al (1991) in *GCA 55,* 881-892. [2] Geiger T. and Bischoff A. (1995) *Planet. Space Sci., 43,* 485-495. [3] Brearley A. J and Jones R. H. (1998) in *Planetary Materials,* Papike J.J.(ed). [4] Miller M.F. et al. (1999) *Rapid Commun. Mass Spectrom. 13,* 1211-1217.