Fe-Ni sulphides in Tagish Lake and CI1 and CM2 carbonaceous chondrites

Conference or Workshop Item

FE-NI SULPHIDES IN TAGISH LAKE AND CI1 AND CM2 CARBONACEOUS CHONDRITES E. S. Bullock, M. Gounelle, M. M. Grady, and S. S. Russell, Department of Mineralogy, The Natural History Museum, Cromwell Road, London SW7 5BD, UK

Introduction: Tagish Lake is an anomalous C2 chondrite that has features similar to both CI1 and CM2 [1] chondrites, though it is not similar enough to be readily incorporated into either of these groups [2,3]. Four main Fe-Ni sulphide phases are found in CI and CM chondrites: troilite, pyrrhotite, pentlandite and intermediate sulphides [4]. This fourth group is found only in meteorites and is more Ni-rich than pyrrhotite but poorer in Ni than pentlandite. The origin of the sulphides is poorly understood - studying the occurrence, texture and composition of them may provide clues to the primordial composition and subsequent aqueous alteration of CI and CM chondrites. In this study, data from two CI1 and two CM2 chondrites are compared with data from the carbonate-rich and carbonate-poor lithologies of Tagish Lake to assess if a common link exists.

Observations: All of the sulphides found in the CI1 chondrites (Alais and Orgueil) are pyrrhotite, with a low (~1.0 wt%) Ni content. The grains are lath-shaped, in the order of 30μm to 50μm in length. They are corroded, with phyllosilicate matrix penetrating the spaces. No whole hexagonal fragments were found in Orgueil, though one was found in Alais. Pyrrhotite makes up approximately 1 vol.% of the CI chondrites.

The CM2 chondrites (Murchison and Mighei), in contrast, contain a broad range of sulphides. Most of the sulphides are Ni-poor pyrrhotite (0.5-2 wt%), although pentlandite and intermediate sulphide grains are also present. The sulphides occur as irregular fragments or blobs within the matrix, and comprise less than 1 vol.% of each sample.

Pyrrhotite is the most common sulphide in the carbonate-poor lithology of Tagish Lake, though minor pentlandite and intermediate sulphides are also seen. No troilite is found. This lithology contains several sulphide morphologies, including: 1) corroded "rosette" pyrrhotites, 2) isolated fragments within the matrix and 3) discontinuous rims around matrix lumps. Both corroded and uncorroded fragments are present, although the former are more common. Sulphides in total make approximately 1 vol.% of this lithology.

The carbonate-rich lithology of Tagish Lake, like the carbonate-poor lithology, displays a range of sulphide compositions, from pyrrhotite to minor pentlandite and intermediate sulphide. No troilite is seen. The major morphology is (<20 μm), uncorroded fragments of sulphide in the matrix. Less than 1 vol.% of the carbonate-rich lithology is sulphide.

Summary: The range of sulphide compositions present in both Tagish Lake lithologies is more reminiscent of CM2s: only pyrrhotite was found in the CI1s, although pentlandite has been reported in Alais by [5]. The morphology of the sulphides in the carbonate-poor lithology of Tagish Lake is very unusual - though fragments and rims of sulphide are not uncommon in CM2s, in no other sample are the rosettes found. The fragments of sulphide in the carbonate-rich lithology are smaller than those found in other samples. On the basis of sulphide data, it appears that Tagish Lakes' unique classification is justified.

References: [1] Brown P. G. et al. (2000) *Science 290* 320-325 [2] Gounelle M. et al (2001) *LPSC XXXII 1616* [3] Zolensky M. E. et al *MAPS In Press* [4] Zolensky M. E. et al (1995) *GCA 59 4707-4712* [5] Kerridge J. F. et al (1979) *EPSL 43 p359-367*