

IN SITU STUDY OF THE SULPHUR ISOTOPIC COMPOSITIONS OF FE-NI SULPHIDES IN CI1, CM1, AND TAGISH LAKE CARBONACEOUS CHONDRITES: PRELIMINARY RESULTS. E. S. Bullock¹, K. D. McKeegan², M. Gounelle^{1,3}, M. M. Grady¹, S. S. Russell¹, ¹Department of Mineralogy, The Natural History Museum, Cromwell Road, London, SW7 5BD UK; ²Department of Earth and Space Sciences, UCLA, Los Angeles, CA 90095; ³CSNSM, Université de Paris, Bâtiment 104, 91 405 Orsay Campus, France.

Introduction: CI1, CM1 and the anomalous C2 [1] Tagish Lake chondrites have endured variable degrees of aqueous alteration. The sulphides present in carbonaceous chondrites may form in both nebula and parent body environments. Sulphur isotope distributions between the sulphides and other S-bearing phases may reflect the degree of aqueous alteration and/or their primitive nebula composition. A detailed study of the petrology and mineralogy of the sulphides, combined with sulphur isotope data measured *in situ* can provide clues as to whether differences within and between each group are due to the different degrees of aqueous alteration, or whether they are the result of nebula heterogeneity.

Previous studies: Carbonaceous chondrites exhibit ~7‰ variation in $\delta^{34}\text{S}$, and previous $\delta^{34}\text{S}$ values for Orgueil sulphides have been inconsistent. [2] reported values for $\delta^{34}\text{S}$ of +6.5‰ in the sulphides, whereas [3] reported lower values of around +2.6‰. Sulphur isotopes have been studied in only one CM1 sample, the CM1 lithology sulphides in the brecciated meteorite Kaidun [4, 5]. The data obtained by [5] shows a range of $\delta^{34}\text{S}$ values from -5.7‰ to +1.1‰

Method: Two thin sections of Alais and one of Orgueil were taken to represent the range of CI1s. One section of the CM1 chondrite ALH88045, and two sections of Tagish Lake were also studied. The isotopes ^{32}S , ^{33}S and ^{34}S were measured with the UCLA Cameca IMS 1270 in multicollector mode following the method outlined in [6].

Observations and Discussion: The majority of the sulphides in the CI1 chondrites are pyrrhotite [7], although ~10µm grains of pentlandite are found in Alais. By contrast, Tagish Lake and ALH88045 contain a variety of Fe-Ni sulphide compositions, from pyrrhotite through intermediate sulphides to pentlandite. In the CI1 and Tagish Lake samples, the sulphides are surrounded by matrix phyllosilicates, whereas in CM1 ALH88045 the sulphides occur as rims around remnant chondrules, as well as discreet grains in the matrix. The sulphide grains in the CM1 chondrite are significantly larger than those in either of the CI1s or Tagish Lake. Data obtained thus far for $\delta^{34}\text{S}$ fall within previously observed ranges, and $\delta^{33}\text{S}$ values are consistent with the modern terrestrial mass-dependent fractionation line.

References: [1] Zolensky, M. E. et al. (2002) *MAPS*, 37, 737-761 [2] Gao, X. & Thiemans, M. H. (1993) *GCA*, 57, 3159-3169. [3] Monster, J. et al. (1965) *GCA*, 29, 773-779. [4] McSween, H. Y. et al. (1996) *LPI*, 27, 855. [5] McSween, H. Y. et al. (1997) *MAPS*, 32, 51-54. [6] Farquhar J. et al. (2002) *Science* 298, 2369-2372. [7] Bullock, E. S. et al. (2002) *MAPS*, 37, A27.