GEOCHEMICAL TRENDS IN MAGNETITE DURING METAMORPHISM OF TYPE 3 CK CHONDRITES

T.L. Dunn[1] and J. Gross[2]. [1]Department of Geology, Colby College, Waterville, ME 04901 (tldunn@colby.edu). [2]American Museum of Natural History, Department of Earth and Planetary Sciences, NY, NY 10024.

Introduction: The CK chondrites are a highly-oxidized group of carbonaceous chondrites characterized in part by the presence of nickel-rich olivine and Cr_2O_3-rich magnetite [1-3]. Similarities between the CK and the CV chondrites, such as oxygen isotopes, mineral compositions, and bulk rock compositions, led [4] to suggest that both groups are derived from the same parent asteroid. The CV and CK chondrites do have one significant difference however, and that is the degree of metamorphism that they have experienced. All CV chondrites are classified as petrologic type 3 [5, 6], while CK chondrites exhibit the complete range of thermal metamorphism, from type 3 to type 6 [1]. Although most CK chondrites are equilibrated, twenty-two unequilibrated (type 3) CK chondrites have been identified. If the CV and CK chondrites are derived from the same parent body, we would expect them to have a shared thermal history. In that case, the CV and CK chondrites should be of similar petrologic subtypes or share a common metamorphic sequence. Though the CV chondrites are thought to be less metamorphosed than the type 3 CK chondrites [e.g.4-7], very little work has been done to characterize the thermal histories of the unequilibrated CK and CV chondrites.

Here we continue an ongoing study to characterize the petrologic subtypes of the type 3 CK chondrites. Our previous work [8-10] has demonstrated that NiO and Cr_2O_3 content of olivine in type II chondrules can be used as a geochemical indicator of metamorphism. Because oxides diffuse between chondrules and matrix material during metamorphism, we would expect there to be parallel trends in NiO and Cr_2O_3 content in magnetite during metamorphism.

Results: Here we present EMPA analyses of magnetite in four progressively metamorphosed CK chondrites (in order of progressive metamorphism): Hart, Northwest Africa 1559, Dar al Gani 431, and Dhofar 015. Analyses show that Cr_2O_3 and NiO content increases during metamorphism (from NWA 1559 to Dhofar 015). Hart, which does contain the lowest abundances of Cr_2O_3 and NiO (as predicted by the metamorphic sequence), does not follow the trend due its FeO content (~90 wt%), which is higher than even the equilibrated CK chondrites [11]. These trends, along with those in olivine [10], suggest that $C_{r2}O_3$ may diffuse from olivine to magnetite during metamorphism. However, because NiO increases during metamorphism in both olivine and magnetite, it seems unlikely that NiO diffuses from magnetite into olivine, as suggested by [3].

References: [1] Kallemeyn G.W. et al. 1991. *GCA* 55:881-892. [2] Nogouchi T. 1993. *Proceed. NIPR Ant. Met.* 2:204-233. [3] Geiger T, and Bischoff. A. 1995. *Planet. Space Sci.* 43:485-498. [4] Greenwood R.C. et al. 2010. *GCA* 74:1684-1705. [5] McSween H.Y. et al. 1977b. *GCA*, 41:479-491. [6] McSween H.Y. et al. 1977a. GCA, 41:1777-1790. [7] Guimon R.K. et al. 1995. *Meteoritics* 30:704-714. [8] Dunn, T.L. 2013. *GSA Abstracts and Programs* 45, 7: 140. [9] Dunn T.L. 2013. *MAPS* 74:5291. [10] Dunn T.L. 2014. Abstract #1038, 45th LPSC. [11] Runyon S.E. and Dunn T.L. 2011. Abstract #2114. 42nd LPSC.