THE EFFECTS OF AQUEOUS ALTERATION ON PRIMARY IRON SULFIDES IN CR AND CM CHONDRITES. S. A. Singerling and A. J. Brearley. Department of Earth and Planetary Sciences, MSC03-2040, 1 University of New Mexico, Albuquerque, NM 87131. E-mail: ssingerling@unm.edu.

Introduction: Sulfides are relatively minor but ubiquitous phases in chondritic meteorites, postulated to have formed from different processes either in the solar nebula or on asteroidal parent bodies. As such, they can be used to determine the characteristics of nebular dust and to understand how later secondary processes may have modified these characteristics.

Iron sulfides, such as pyrrhotite ($Fe_{1-x}S$) and pentlandite ($(Fe,Ni)_9S_8$), in carbonaceous chondrites were largely considered to be secondary phases which formed from aqueous alteration of troilite (FeS) and/or Fe,Ni-metal in a parent body setting [1-4]. Recently, however, a mounting body of evidence has suggested that a population of these grains in CR and CM chondrites is primary and formed in the solar nebula [5-8].

The purpose of this work is to study the effects of aqueous alteration on primary sulfide grains in the more altered CR and CM carbonaceous chondrites. Identification of primary sulfides which have been altered can provide information on conditions of aqueous alteration (i.e., T, P, fO_2, pH, WR ratio, fluid composition).

Results & Discussion: This work has identified two unique groups of primary sulfides which have experienced aqueous alteration. These include porous-pitted pyrrhotite-pentlandite (4P) grains and pyrrhotite-pentlandite composite grains altering to magnetite or phyllosilicates (altered COMP) all of which were found as isolated grains in the matrix or in type IIA chondrules.

The 4P grains are found only in the CM chondrites. They are characterized by the presence of either pyrrhotite with exsolution lamellae/rods/patches of pentlandite or a homogeneous texture lacking exsolution with a composition intermediate between pyrrhotite and pentlandite. There is a range of textures between these two extremes, but in all cases the pyrrhotite (or intermediate composition phase) appears porous and pitted. The pitting usually appears crystallographically controlled being either parallel to or meeting at 60/120° angles to pentlandite lamellae/rods. The altered COMP grains are found in both CR and CM chondrites. They have the same textural features as the COMP grains of [8] with the pyrrhotite altering to magnetite or phyllosilicates.

Both groups of altered primary grains display pyrrhotite-pentlandite exsolution textures which only form by solid-state processes, at moderate temperatures (<610°C, [9]). The 4P grains likely experienced dissolution from aqueous fluids as evidenced by the pitting. In contrast, the altered COMP grains experienced pseudomorphic replacement of pre-existing phases due to interactions with aqueous fluids. Clearly, the mechanisms of alteration of these two groups of grains are distinct, indicating that they experienced alteration under different conditions. Constraining these conditions will be the focus of future work.

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