PETROGRAPHIC EVIDENCE OF SHOCK METAMORPHISM IN CR2 CHONDRITE GRO 03116.

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Introduction: CR chondrites are primitive meteorites that show a broad range of aqueous alteration features from nearly pristine [1] to fully altered [2]. However, evidence of any thermal metamorphism group is only beginning to emerge [3,4]. To better understand the effects and the source of metamorphism in the CR parent body, an SEM/EPMA/TEM study of GRO 03116 is underway. GRO 03116 was chosen because O-isotopic analyses suggest that it has only suffered limited aqueous alteration [5], while Raman spectra shows that its organic materials have undergone some thermal metamorphism [4]. GRO 03116 is an Antarctic CR2 find of terrestrial weathering type C. Thus, disentangling its record of asteroidal versus terrestrial aqueous alteration merits careful analysis petrologic analysis.

Results and Discussion: GRO 03116 contains porphyritic type I and fewer type II chondrules, abundant opaques, a heterogeneous matrix and CAIs. These components are well defined texturally. Fine-grained layered assemblages and ferryhydrite veins, characteristic of terrestrial aqueous alteration [6], are also present. Chondrule mesostasis is often dendritic. Chondrule forsterites show no systematic enrichment in fayalite content at their edges. However, some chondrules exhibit complex chemical zoning. Opaques range from nearly intact kamacite grains with variable amounts of Ni and Co and terrestrial ferrihydrite haloes to terrestrial alteration assemblages. Matrix is significantly less abundant (~21 vol% - this study, 24.3 vol% - [5]) than in other CR chondrites (>30 vol% [7]) and clastic in texture. Matrix is rich in opaques, particularly magnetite and sulfides. In addition, some matrix regions appear very compact and have a foliation fabric. Some chondrules show signs of plastic deformation along the direction of matrix foliation. These chondrules display substantial textural integration with the surrounding metal and matrix. In addition, porous melt veins (~200µm across) containing angular olivine fragments and abundant, rounded, micron-sized magnetite and pentlandite grains have been identified.

Conclusion: GRO 03116 has undergone pervasive terrestrial weathering that overprinted its original record. However, preservation of some kamacite suggests limited preterrestrial aqueous alteration. TEM studies will be conducted to better establish the extent of alteration. The following petrologic observations also indicate limited thermal metamorphism, certainly lower than in CR GRA 06100 [3]: minor integration of chondrules and matrix, preservation of some mesostasis, low Fe content in type I chondrules, Co heterogeneity in metal, and presence of magnetite. Thus, preterrestrial alteration of GRO 03116 was probably dominated by shock metamorphism, as indicated by its deformed chondrules, comminuted matrix, and melt veins [8].

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