NEW INSIGHTS ON HYDROUS PHASES IN R CHONDRITES NWA 6491 AND 6492.

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Introduction: R chondrites are among the most oxidized meteorites and show evidence of hydrous alteration represented by phases such as biotite and hornblende [1-3]. We recently reported two hydrous phases (HP1 and HP2) that were believed to be related to laihunite and cronstedtite in the NWA 6491 and 6492 R chondrites, genomict breccias containing type 3-5 and 3-6 material [4]. In this abstract we summarize new results from both meteorites that provide additional information about these hydrous and other phases.

Results: Additional study of electron microprobe (EMPA) and SEM data from both meteorites, and Raman spectroscopy data from NWA 6492, show that the HP2 phase, believed to be related to laihunite [4], is indeed an intermixture of laihunite and olivine. Two-component mixing models based on EMPA data imply olivine with ~Fa_{60-70}, whereas preliminary Raman data suggest olivine with ~Fa_{88}. Both Fa values are significantly higher than typical for equilibrated R chondrites (Fa_{37-41}) [5]. EMPA data also imply that the olivine and laihunite intermixture may contain water.

Additional analysis of EMPA data suggests that the HP1 phase, earlier suggested to be cronstedtite [4], is in fact goethite that is intermixed with one or more other phases. Raman microscopy conducted on an atypical goethite-bearing assemblage in NWA 6492 suggests a complex intermixture of jarosite and anhydrite in the core, and goethite and hematite in a rim and in veins that cross-cut the core.

Conclusions: We infer that laihunite, goethite, anhydrite and jarosite are of pre-terrestrial origin. We base our conclusion on: (1) the overall low weathering grade of NWA 6491 and 6492; (2) the lack of terrestrial cross-cutting weathering veins; (3) the systematic change of goethite texture and grain size from petrographic type 3 to type 5 and 6 clasts, which implies that it was present at the time of metamorphism in the R chondrite parent body; (4) the apparent broken edges of certain laihunite grains in mineral and lithic clasts which implies that laihunite was present prior to brecciation; and (5) veining structures, which imply formation of sulfate prior to goethite.

Laihunite, goethite, and jarosite probably formed by aqueous alteration under hydrous and oxidizing conditions during open system processes. Laihunite likely formed by the breakdown of ferrous olivine.

References: [1] McCanta M. C. et al. 2008. *Geochimica et Cosmochimica Acta* 72:5757-5780. [2] McCanta M. C. et al. 2007. Abstract #2149. 38th Lunar & Planetary Science Conference. [3] Mikouchi T. et al. 2007. Abstract #1928. 38th Lunar & Planetary Science Conference. [4] Jamsja N. and Ruzicka A. 2011. Abstract #2324. 42nd Lunar & Planetary Science Conference. [5] Hutchison R. (2004) *Meteorites: A petrologic, chemical and isotopic synthesis.*