IRON-, MAGNESIUM-, AND MANGANESE-BEARING PHOSPHATES IN THE LODRANITE GRAVES NUNATAKS 95209. C. Floss, McDonnell Center for the Space Sciences and Department of Earth and Planetary Sciences, Washington University, St. Louis MO 63130, USA (floss@howdy.wustl.edu).

Introduction: As part of an in-depth trace element study of the acapulcoite – lodranite suite of meteorites [1,2], ion microprobe measurements were made on the recently classified lodranite, GRA 95209 [3]. Examination of thin section ,39 revealed the presence of two large Fe,Mg,Mn-bearing phosphate grains. These grains were examined optically and by secondary electron microscopy, and the rare earth element (REE) compositions were measured by ion microprobe.

Results and Discussion: Graves Nunataks 95209 appears to consist of three lithologies, described by [4]: relatively metal-rich matrix, metal-poor regions, and a metal-rich sheet on the surface of the meteorite that extends into the interior [5]. Section ,39 consists of equigranular olivine and orthopyroxene grains, with abundant metal and minor clinopyroxene, plagioclase, and troilite. Rare chromite grains are present, but Ca-phosphates (merrillite and apatite) and schreibersite are not observed in this section, although they have been reported by others [4]. However, two large regions of Fe,Mg,Mn-bearing phosphates, one (area B) about 500 by 700 µm, the other (area D) 600 by 1100 µm, were found associated with the metal in section ,39. The areas were examined by secondary electron microscopy and major element compositions were measured by quantitative energy-dispersive X-ray analysis. Each region appears to contain two distinct phosphates, Ca-free and Ca-bearing; small metal grains are interspersed throughout.

The Ca-free phosphates have average compositions of $(Fe_{1.07}Mg_{1.70}Mn_{0.18})_{?=2.95}P_{2.00}O_8$ and $(Fe_{1.53}Mg_{1.06}Mn_{0.33})_{?=2.92}P_{2.02}O_8$ for areas B and D, respectively, corresponding to an ideal formula of $(Fe,Mg,Mn)_3(PO_4)_2$. Some analyses show minor amounts of Ni, which are probably due to contamination from adjacent metal grains. These phosphates are more Fe- and Mn-rich than previously reported farringtonites [e.g., 6,7], but contain significantly more Mg than graftonite [8]. Partially surrounding individual Ca-free grains, and lining adjacent metal grains, are thin rims of what appears to be chladniite. Average compositions are $Na_{1.93}Ca_{0.55}(Fe_{1.69}Mg_{4.46}Mn_{1.03})_{?=7.18}P_{6.08}O_{24}$ for area B and $Na_{1.98}Ca_{0.49}(Fe_{2.36}Mg_{3.50}Mn_{1.48})_{?=7.34}P_{6.06}O_{24}$ for area D. These are distinctly more Fe- and Mn-rich than the chladniite found in the Carlton (IIICD) iron meteorite [9], and approach the composition of johnsomervilleite, which has an ideal formula of $Na_2Ca(Fe,Mg,Mn)_7(PO_4)_6$ [10,11]. The presence of chladniite in GRA 95209 was noted by [4], but no analyses were reported.

Trace elements (e.g., the REE) were measured by ion microprobe in the phosphates. REE abundances are below detection limits in the Ca-free phosphates, but show a wide variety in three chladniite analyses. One grain is HREE-enriched with Lu ~ 100 x CI and has a negative Eu anomaly, another has a flat pattern at about 1× CI, and a third grain is LREE-enriched with a positive Eu anomaly.

Textures in the phosphates are suggestive of growth by reaction and replacement: Chladniite occurs primarily as thin rims around Ca-free grains or adjacent to larger metal grains, and small, corroded metal grains are present throughout both phosphates. The variable REE patterns noted in chladniite probably result from this replacement process. REE may have been imported together with Ca from surrounding phases such as plagioclase or pyroxene.

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