EXPERIMENTAL PARTIAL MELTING OF THE LAPAZ ICE FIELD 03639 R4 CHONDRITE.

K. G. Gardner-Vandy and D. S. Lauretta. Lunar and Planetary Laboratory, University of Arizona. kgardner@lpl.arizona.edu.

Introduction: As part of an ongoing study of the petrology, geochemistry and formation conditions of the FeO-rich primitive achondrites [1-3], we perform partial melting experiments of FeO-rich chondritic meteorites. We recently reported that melting experiments of a CK5 chondrite yield compositions similar to those in several ungrouped primitive achondrites, but we also concluded that a more FeO-rich chondritic precursor is needed to yield brachinite compositions [3]. From this, we have begun similar experiments on R4 chondrite LaPaz Ice Field (LAP) 03639.

Methods: We obtained a thin section and chip (2.7 g) of LAP 03639 from the Meteorite Working Group. We used an ~250 mg chip in each experiment to capture textural changes across the experimental conditions. Experiments were run in a Deltech gas-mixing furnace with an oxygen sensor and type R thermocouple. Thus far, we have completed and analyzed two experiments, R1 and R2. Temperature for both was 1250 °C, and each ran for 4 days. The oxygen fugacity for R1 was IW-1 and R2 was IW+1, controlled with a 1-bar $CO+CO_2$ gas mixture. We choose fO_2 values based on our previous analyses of the thermodynamic environment of FeO-rich primitive achondrite meteorites [2]. No attempt was made to retain volatiles.

Starting Material: LAP 03639 is an R4 chondrite [4-5]. It has chondrules and chondrule fragments ≤ 1.1 mm across. The matrix is made of olivine, pyroxene and plagioclase with sulfides containing 0-30 wt% Ni. Olivine is $Fa_{38.8\pm0.2}$, low-Ca pyroxene is Fs_{6-26}, high-Ca pyroxene is Fs_{10-12}, and plagioclase is An_{5-13}.

Experimental Results: Both the R1 and R2 experiments resulted in significant silicate melting to the extent that homogeneous ($Fa_{33.5\pm0.8}$ and $Fa_{39.8\pm0.9}$, respectively) anhedral to subhedral olivine is the only silicate mineral remaining. These grains are surrounded by silicate melt with Mg# 28.0±1.1 and 20.8±0.8, respectively. Significant S loss occurred, but there are several rounded Ni-rich sulfides in each charge; R1 sulfides have 8.5-40 wt% Ni, and R2 sulfides have 63-70 wt% Ni. R1 contains taenite with up to 39 wt% Ni. R2 has a few grains of Fe,Ni-metal with 60-79 wt% Ni. The original chondritic texture remains only in small regions with relict barred olivine grains.

Discussion: Olivine compositions generated in the R1 experiment resulted in olivine with compositions matching those of brachinites (Fa_{32-35}) [1]. Those for the R2 experiment, however, resulted in compositions more oxidized than the starting material. This is likely due to the wide range of intrinsic oxygen fugacities (fO_2) calculated for the R chondrites (FMQ-1 to FMQ-3.5) [5], and proves that LAP 03639 formed at more reducing conditions than IW+1. These initial results indicate that brachinites could form from the partial melting of an R-chondrite at IW-1.

References: [1] Gardner K. G. et al. 2007. Abstract #2086. 38th Lunar & Planetary Science Conference. [2] Gardner-Vandy K. G. et al. 2009. Abstract #2520. 40th Lunar & Planetary Science Conference. [3] Gardner-Vandy et al. 2011. Abstract #1935. 42nd Lunar & Planetary Science Conference. [4] Kallemeyn G. W. et al. 1996. *Geochimica et Cosmochimica Acta* 60:2243-2256. [5] Righter K. and Neff K. E. 2007. *Polar Science* 1:25-44.

Acknowledgments: Research supported by NASA grants NNX09AQ88H and NNX10AH50G (DSL) and UA/Sloan Foundation Indigenous Graduate Partnership Fellowship (KGGV).