POROSITY ADJUSTMENTS OF CARBONACEOUS CHONDRITE ANALOGS. S. N. Congram[1], M. M. Strait[1], and B. A. May[1], [1]Alma College, Alma, MI, USA, congram1sn@alma.edu

Introduction: The most common type of meteorites found on Earth are stony meteorites called ordinary chondrites. These are composed of chondrules in a matrix of different minerals and silicates [1]. Carbonaceous chondrites, another type of meteorite, contain more complex silicates and hydrated minerals. These are rarer than their ordinary chondrite counterparts.

This work looks at disruption experiments, where the sample is shot with a projectile at speeds found in the asteroid belt. To be as complete as possible, carbonaceous chondrites need to be studied. Access to these rare meteorites is difficult due to the nature of this work, therefore this project has embarked on a project to create carbonaceous chondrite analogs [2].

Experimental: To successfully synthesize a carbonaceous chondrite analog, ordinary chondrite pieces were ground down to less than 2 mm in diameter and then put into a pressure bomb in pH 13 water at 150°C for three months. This process allows the individual grains of the chondrite to hydrate and create the more complex silicates and hydrated minerals that are found in carbonaceous chondrites. The resulting hydrated granules of the chondrite were poured into a mold made of 1.5 inch PVC cut into 2.5 inch lengths. Twenty milliliters of 0.5 M NaOH were poured into the mold and mixed with the particles. The resulting slurry was left to dry on a hot plate at 60°C for 6 weeks. A matrix structure from the NaOH is created that locks the granules together while also allowing pores to be created within the sample. Because of the pore space in the samples, the densities come out to be roughly 2.0 g/cm3 [3]. The target density for these samples, to keep them as realistic an analog as possible for their naturally occurring carbonaceous chondrite counterparts, is roughly 1.6 g/cm3 [4]. To decrease the density of the samples, the amount of pore space within them needs to increase.

A series of five experiments were designed to increase the porosity of the product as it sets in its mold. Table 1 outlines the different experiments that were carried out. Two control samples were also used for comparison.

Results and Discussion: The experiments outlined in Table 1 were designed to adjust the density of the analog meteorites without chemically altering the sample, and without dramatically adjusting the process for creating the samples. Once the 6-week period was finished, the samples were removed from their molds. The radius of the molds and the height of the sample in the mold were measured to calculate the volume of the sample. The mass of the entire mold apparatus was measured and then just the mold itself to calculate the mass of the sample. These two values allowed for the density to be calculated.

Table 1: Adjustments Made to the Process of Creating Carbonaceous Chondrites to Alter the Density of the Sample

Sample	Experiment	Density (g/cm^3)
Control 1 (C1)	The sample was placed into its mold in pH 13 and left to sit at 60°C for 6 weeks.	1.88
Control 2 (C2)	The same procedure as C1.	1.96
More Water (MW)	10 mL more pH 13 water was added to this sample.	1.89
Higher Concentration (HC)	2.0 molar pH 13 water was added to this sample.	1.89
Larger Particles (LP)	This rock has larger, unground particles, some exceeding 4 mm in diameter.	1.79
Smaller Particles (SP)	Only composed of particles less than 0.5 mm in diameter.	1.42
Ammonium Carbonate (NH_4CH_3)	A 1:10 granulated ammonium carbonate to granulated meteorite ratio was placed into the mold.	1.96

The average density of the control samples was 1.92 g/cm3 ± 0.04 g/cm3. The experiments where the water was adjusted yielded no significant change to the density of the sample. The sample that used the ammonium carbonate filler also resulted in no change to the density. The experiments where the particle sizes were adjusted both yielded a substantial change to the resulting densities. The sample that used larger particles had a 6.77% decrease from the control average. The sample that used smaller particles ultimately resulted in a 26.04% decrease from the control average (Table 2). Further experiments will be done to validate this result.

References: [1] Smith C. et al. (2009) *Meteorites*¸ Natural History Museum. [2] Strait M. M. et al. (2012) *Met Soc LXXV*, Abstract #5363. [3] Molesky M. J. et al. (2015) *Met Soc LXXVIII*, Abstract #5300. [4] Macke R. J. et al. (2011) *Meteoritics and Planet. Sci., 46*, 1842-1862.