INVESTIGATION OF THE HYDRATION OF ANHYDROUS CHONDRITE METEORITES. M. J. Molesky[1], S. J. Jack[1], A. N. Clayton[1], M. M. Strait[1], D. D. Durda[2], and G. J. Flynn[3]; [1]Dept. Of Chemistry, Alma College, Alma MI 48801. E-mail: masonmolesky@gmail.com. [2]Southwest Research Institute. [3]Dept. of Physics, State University of New York – Plattsburgh.

Introduction: Our lab disrupts meteorite samples as analogs for asteroid impacts. Our previous work found ordinary chondrites to have different disruption patterns than carbonaceous chondrites [1,2]. Understanding the fragmentation of an asteroid is crucial to studying the origin of interplanetary dust particles. In the main belt it has been predicted that nearly 50% of the material is of a hydrated nature [3]. Since carbonaceous chondrites and other hydrated meteorites are rare, and our testing is therefore limited, attempts have been made to hydrate ordinary chondrites to produce the mineralogy and texture of carbonaceous chondrites [4].

Analysis of the size distribution of particles after fragmentation has proven a successful methodology in modeling such disruptions [5]. Meteorites have been impacted using the NASA Ames Vertical Gun [6].

Experimental: For hydration, we used samples of Northwest Africa 869, an L3 – L6 ordinary chondrite. Samples were crushed to less than 2 mm, size sorted in an eight layer sieve and weighed. The recombined samples were put into a Teflon container with pH ~ 13 solution. This container was put into a Parr pressure bomb at 150°C for ~14 weeks. The extent of hydration was measured using FTIR analysis [4]. Once samples were hydrated, they were removed and placed in a 1.5-inch, plastic-lined metal cylinder. Three samples were prepared for the study. The first sample was allowed to settle by gravity. A hydraulic pump was used to apply pressure to the remaining samples. The second sample received one pump on the handle, applying ~1400 psig. The third sample received two pumps on the handle, applying ~2800 psig. The samples sat in the cylinder, with pressure applied, for 2 weeks to dry and harden.

We removed these reconstructed meteorites from the cylinder. Each of the samples were hung in the gun chamber at the NASA Ames Vertical Gun with fishing line and a small amount of epoxy. The samples were shot with a $\frac{1}{16}$ inch projectile at a speed of ~5 km/sec. The resulting fragments were collected and the largest pieces were individually weighed.

During shots, we used a set up foam core detectors with foils of three thicknesses (Figure 2). These were strategically placed around the sample to measure particle sizes. We collected the foils after the disruption for analysis.

The foils were scanned into a computer using a PrimeFilm 7250 Pro[3] scanner at 7200 dpi using the program CyberViewX. The images was then analyzed using ImageJ to count and measure the holes produced from the disruption. Excel was used to calculate the masses from the size of holes we got from the foils.

In addition, collected particles were put through an eight layer sieve and weighed according to their size range (Figure 1). The particle and foil data were combined to produce a size frequency distribution graph.

Results and Discussion: The sieved shots confirmed previous results demonstrating we are in fact artificially creating a new material since we had some particles larger after disruption than what was used to make the meteorite. 1.5% of the fragments after disruption were larger than the fragments used to make the meteorite. Weighing the five largest particles before and after transportation to Michigan shows a large reduction in size of 24.53%, 38.08%, and 9.33%, for the first second and third samples, respectively. This is due to the fragile nature of the meteorite. Thus the mass distribution in figure should have a larger percentage of fragments of 2 mm and 4 mm sizes after initial disruption. This fragile nature is characteristic of carbonaceous chondrites.

Conclusion and Future Work: To more accurately represent carbonaceous chondrites, we are modifying our method to produce larger samples. The meteorites are now reformed in a 2-inch PVC pipe where they are allowed to solidify and dry over 12 weeks. The PVC is removed revealing an artificially constructed meteorite. We have estimated the density of the material to be about 2.00 g /cm^3 in comparison to 1.6 g /cm^3 of actual carbonaceous chondrites [7]. Currently the density of our artificially constructed meteorites is too high, however, the structure is similar to carbonaceous chondrites. We will be focusing on methods of density reduction to better model carbonaceous chondrites. Aeration may be used while the meteorite is settling in the PVC pipe to create small pockets of air in the sample to reduce the overall density.

References: [1] Durda D. D. And Flynn G. J. (1999) *Icarus*, 142, 46-55. [2] Flynn G. J. et al. (2009) *Planetary and Space Science*, 57, 119-126. [3] Howell E. S. et al. (2011) *EPSC-DPS Joint Meeting*, EPSC-DPS2011-637-1 [4] Clayton, A. N. et al. (2014) Lunar and Planet Sci. Conf. XXXXV #2419 [5] Flynn G.J., et al. (2007) LPS XXIX, Abstract #1744. [6] Flynn G. J. and Klock W. (1998) LPS XXIX, Abstract #1112. [7] Britt D. T. and Consolmagno G. J. (2003) *MAPS*, 38, 116-1180.

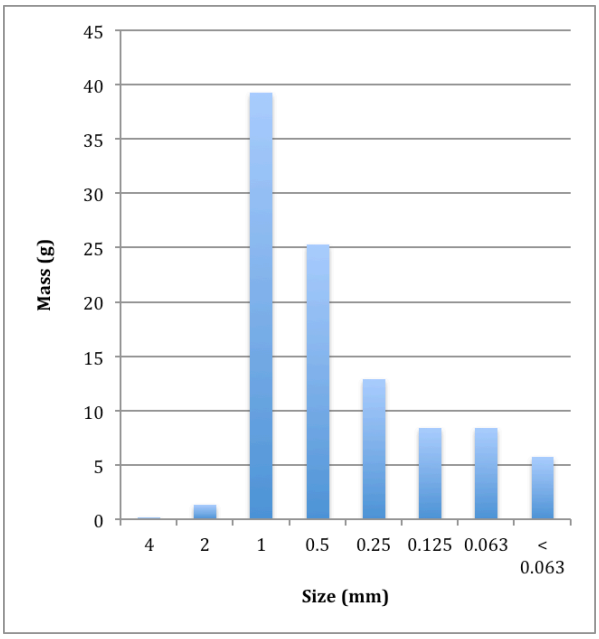

Figure 1. Mass distribution of sieved shots after disruption and travel from California to Michigan where particles may have broken up during the journey due to their very fragile nature. This confirms we artifically reconstructed a meteorite since a significant amount of fragments, 1.5%, after disruption were larger than the fragments used to construct the meteorite.

Figure 2. Gun chamber after a disruption. The foam core detectors are visible around the center of the chamber. The meteorites was suspended in the center of the detectors about half a foot off the white cloth. The white cloth was used to collect particles after disruption.

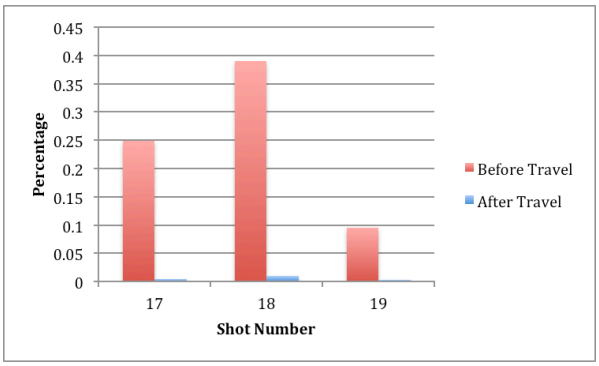

Figure 3. The mass of the five largest remaining particles after disruption as a percentage of the whole before and after travel. This provides an indication that many pieces did not survive and that the mass distribution seen in Figure 1 should contain more fragments greater than 2 mm.