INVESTIGATION OF CRYSTAL STRUCTURE END-MEMBERS IN FRAGMENTATION PATTERNS OF DISRUPTED METEORITES. M. D. Lipman[1], M. M. Strait[1], G. J. Flynn[2], and D. D. Durda[3] [1]Dept. Of Chemistry, Alma College, 614 W. Superior St., Alma MI 48801 (lipman1md@alma.edu), [2]Dept. Of Physics, State University of New York-Plattsburgh, Plattsburgh NY 12901, [3]Southwest Research Institute, 1050 Walnut Street Suite 3400, Boulder CO 80302.

Introduction: Collisions are believed to be the dominant mechanism for dust production, surface erosion, and catastrophic disruption in the main-belt. In order to understand the collisional evolution of asteroids and interplanetary dust and to accurately model the infrared signature of small particles in our own Solar System and in other planetary systems, it is critical to address the fundamental problem of dust production from primary impact disruption events over a wide range of fragment sizes. Of particular interest is the possibility that differences in the size-frequency distribution of dust produced by hydrous and by anhydrous asteroids might result in different populations of particles in the interplanetary dust size range (5 to 50 micrometers) and the micrometeorite size range (50 micrometers to millimeters) [1].

To determine the size-frequency distribution of the fragments produced by hypervelocity impacts on asteroids we have disrupted both anhydrous and hydrous asteroid targets at the NASA Ames Vertical Gun Range (AVGR) and determined the mass-frequency distribution of the resulting debris by: 1) weighing all fragments >0.01 grams collected from the floor of the AVGR chamber, and 2) measuring the diameters of puncture holes in passive Aluminum foil detectors placed around the target [2].

To be able to understand the evolution of collisions in asteroids and interplanetary dust, it is necessary to experiment on dust production from primary impact disruption over a range of sizes [1].

Experimental: In this work, meteorites and meteoritic analogs are disrupted at the NASA Ames Vertical Gun Range (AVGR) in Moffett Field, California. A meteorite is suspended in the middle of a chamber in the AVGR. Four detectors are placed around the meteorite. The detectors are comprised of foil held in 35 mm slide mounts, utilizing three different thicknesses. The meteorite is shot with a quarter inch aluminum projectile having a speed of ~5 km/sec, simulating the collisions that occur in the main belt. The slides are then scanned under back-lit conditions to determine hole frequency and size. Production of dust from the targets is monitored by the foil penetrations and by the larger fragments, which are retrieved from the floor of the chamber and weighed [1]. The mass-frequency distribution of the debris can then be determined. The data are used to understand the way that the meteorite shattered.

In previous studies, a 30.09g sample of the Murchison CM2 carbonaceous chondrite meteorite was disrupted at the AVGR using a 1/8 inch aluminum sphere at 4.45 km/s [3]. Data were collected from the foil and analyzed (Figure 1). The mass-frequency distribution of fragments from the Murchison disruption differed significantly from that of previous disruption experiments on nine anhydrous meteorites. To test the idea that layered, hydrous silicates might disrupt differently, because of their layered, sheet structure, than anhydrous minerals, we disrupted a 84.6g quartz target and a 54.0g mica target, under similar conditions at the AVGR.

Quartz (Figure 2) and mica (Figure 3) samples were disrupted as anhydrous and hydrous end-member analogs respectively. Their respective slopes were calculated to compare the cumulative mass-frequency distributions of the disrupted particles with the goal of determining if hydrous and anhydrous silicates fracture differently.

As observed in the individual graphs and the composite graph (Figure 4), the slopes the cumulative mass-frequency distributions for mica and Murchion aresteeper than the slope for the quartz sample.

The slopes of the cumulative mass-frequency distributions are -.421, -.590, and -.515 for quartz, mica, and Murchison respectively. This indicates that hydrous samples, both terrestrial and extraterrestrial, disrupt differently than anhydrous samples.

To determine if this distribution is entirely unique to hydrous samples, coal and charcoal analogs, along with NWA 869 ordinary chondrite samples, have also been shot at the AVGR but analysis of the samples have not yet been completed for comparison. The Murchison data will also be completed through sieve analysis of the disrupted particles to see if a different distribution curve is produced.

Acknowledgements: This work was supported by a NASA Planetary Geology and Geophysics Program grant. Support is also provided by Alma College.

References: [1] Lipman M. D., Strait M. M., Flynn G. J., Durda D. D. (2010) Lunar and Planet. Sci.Conf. **XXXXI** # 2442

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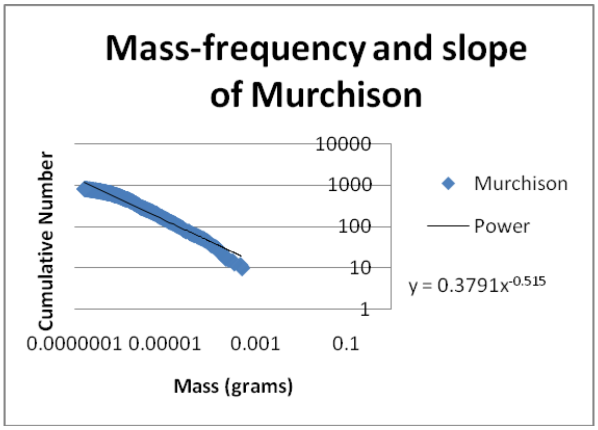

Figure 1. Cumulative mass-frequency distribution determined from foil penetrations for a sample of disrupted Murchison with slope calculated.

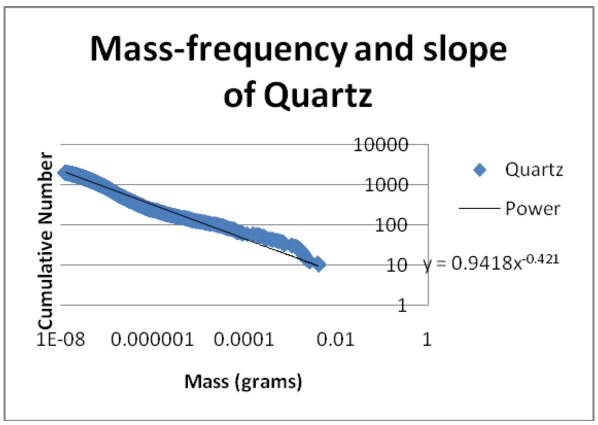

Figure 2. Cumulative mass-frequency distribution determined from foil penetrations for a sample of disrupted quartz with slope calculated.

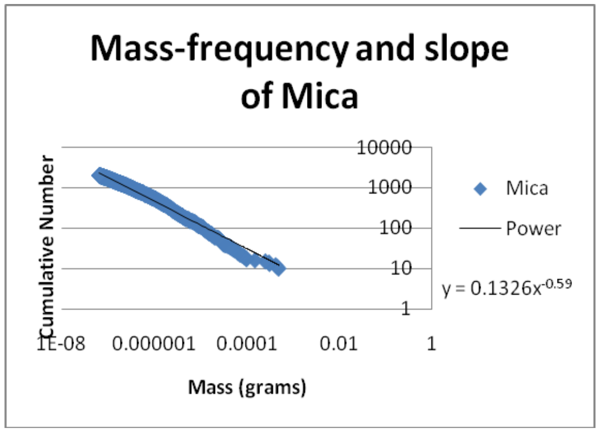

Figure 3. Cumulativfe mass-frequency distribution determined from foil penetrations for a sample of disrupted mica with slope calculated.

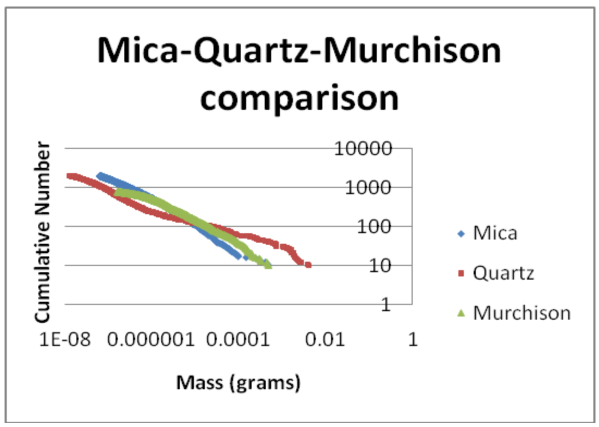

Figure 4. Cumulative mass-frequency distributions from the mica, quartz, and Murchison shots.