INTERNAL STRUCTURAL CHANGES RESULTING FROM IMPACT EXPERIMENTS.

M. M. Strait[1], R. J. Macke[2], M. J. Molesky[1], B. A. May[1], G. J. Flynn[3] and D. D. Durda[4], [1]Alma College, 614 W. Superior Street, Alma, MI 48801 (straitm@alma.edu), [2]Vatican Observatory, V-00120 Vatican City,[3]SUNY-Plattsburgh, 101 Broad St, Plattsburgh, NY 12901, [4]Southwest Research Institute, 1050 Walnut Street, Suite 300, Boulder CO 80302.

Introduction: Our lab has been involved in simulations of asteroid impact. It has been found that meteorites require more energy than terrestrial rocks [1] and that porosity is a factor in how rocks disrupt [2]. We are also interested in looking at changes in the fabric of the sample during the impact process. There does not appear to be a change when using highly porous targets, such as pumice [3]. Here we present work we have done to look at less porous samples, as well as look at actual meteorite samples.

Experimental: Whole rock samples were imaged using a GE eXplore specCZT scanner at an X-ray voltage of 90 kV and a current of 40 mA. Larger samples were scanned using a LocusUltra at an X-ray voltage of 120 kV and a current of 20 mA. The images were acquired and reconstructed at an isotropic voxel size of 0.05 mm and 0.100 mm on the specCZT and 0.154 mm on the Ultra. The resulting data sets were viewed using GE MicroView and NIH Image. Several of these samples were then sent to the Vatican Observatory for measurements of density and porosity.

Results: The measurements for the bulk density agree between the two methods. It is observed that there may be slight increase in density when the nonporous meteorite (Northwest Africa 4502) is disrupted (before: 3.41 $\pm$ 0.01 g/cm^3; after: 3.51 $\pm$ 0.02 g/cm^3), as well as a slight decrease in porosity (before: ~2%; after: ~1%). Because of the weathered nature of this sample, the meteorite broke into chunks when impacted. Two of the samples showed differences in density and porosity between the piece of the sample that where the impact occurred (3.53 g/cm^3 and 0.1% porosity) and the part that dropped off (3.49 g/cm^3 and 0.9% porosity). The separation occurred within 5 ms of the impact, apparently inhibiting the passage of the impact shock throughout the sample.

There is clearly an increase in the amount of internal damage after the shot (Figure 1), unlike what had been observed in the more highly porous pumice, which exhibited almost no change in structure [3, 4]. This latter observation is backed up by the measurements on the more porous Saratov, which also showed no change in bulk density before and after impact: 3.05 $\pm$ 0.01 g/cm^3.

It should be noted that in one sample of NWA 4502 there are two clear lithologies observed, with the top half of the sample showing the typical smoother appearance and the bottom being slightly darker with a blotchier appearance to the fabric.

Further work will be done to confirm these observations as we continue to study the effect of impact on the physical fabric of these sample.

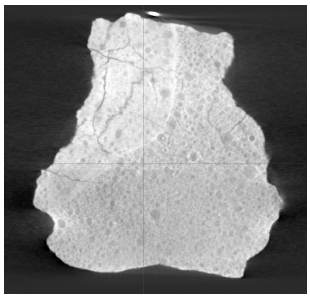

Figure 1: Slice from CT scan of NWA 4502 after impact. Notice the difference in texture between the lower right and the upper left. This is only evident in this one sample; the others appear as the material in the upper left. The lighter material tends to crack more extensively. Notice the distinct dark cracks, implanted during impact versus the fuzzier, grayer cracks which are the original texture of the sample.

Sample	Density (g/cm^3)
Impacted Northwest Africa 4502	3.51 (0.02)
	3.41 (0.01)
Unimpacted Northwest Africa	3.05
Impacted Saratov	3.05 (0.01)
Unimpacted Saratov	

References: [1] Flynn G. J. et al. (2009) *Planetary and Space Science,* 57:119-126. [2] Flynn G. J. et al. (2015) *Planetary and Space Science,* 107:64-76. [3] Strait, M. M. et al. (2013) *Meteoritics & Planetary Science,* 76:5106. [4] Strait, M. M. (2013) *Meteoritics & Planetary Science,* 74:5439.