ABSTRACT FOR: Session 25-4 Meteorites, Asteroids and Comets at 31st IGC

Physical Properties of Meteorites: Implications for the Stone Asteroids

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We measured the densities and porosities 19 ordinary chondrite and 5 carbonaceous chondrite meteorites, and found that unweathered ordinary chondrites have porosities ranging from 8 to 23% while carbonaceous chondrites have porosities ranging from 11 to 29% (Flynn et al., Icarus, in press). To determine the degree to which this porosity effects shock propagation, we measured the longitudinal and transverse speed of sound, and the elastic and shear moduli of ordinary and carbonaceous chondrites (Flynn et al., Lunar & Planetary Science, 1999). The longitudinal wave velocity of the most porous ordinary chondrite was only ~1100 m/sec, and this sample had elastic and shear moduli similar to concrete. The meteorites examined exhibit three types of porosity: cracks, vugs, and gaps surrounding chondrules. We are now employing Computed MicroTomography to characterize the porosity of the samples used in the speed of sound measurements to determine if the type of porosity effects the sound speed.

Meteorites are believed to be fragments of asteroids. Thus, the physical properties of the meteorites can be used to constrain the properties of asteroids. Experiments by Love et al. (Icarus, 1993) demonstrate that cratering and collisional disruption are sensitive to target porosity. Our results suggest the stone asteroids are porous. This porosity may have significant effects on the impactor energy required to produce a given crater diameter, the response of the asteroid to cratering, and the energy required for collisional disruption.