POROSITY, MAGNETIC SUSCEPTIBILITY AND DENSITY OF LUNAR METEORITES.

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Introduction: The interpretation of gravimetric and topographical data from lunar missions to model the Moon's interior requires a comprehensive database of lunar rock densities and porosities. To date we have measured porosity, density and magnetic susceptibility for five Apollo lunar samples and 50 stones from 44 of the 74 known lunar meteorites, representing a wide range of lithologies and lunar regions. Our measurement methods as outlined in [1] are fast, non-destructive and non-contaminating. Grain density is measured by helium ideal-gas pycnometry, bulk density by the glass bead method developed by [2]. Porosity is calculated directly from bulk and grain densities. We also measure magnetic susceptibility, using an SM-30 magnetic susceptibility meter [3].

Basalts: The low-Ti (1-5 wt% TiO_2) basalts measured here group tightly in grain density (avg. 3.30 ± 0.06 g cm^{-3}) and magnetic susceptibility ($\log \chi = 2.86 \pm 0.11$). Porosities range from zero to 10%, averaging 5.6%. There is no discernible difference between the two Apollo basalts (12051 and 15555) and the six basaltic meteorites taken as a whole.

Feldspathic Breccias: Grain densities averaged 2.85 ± 0.11 g cm^{-3}. Magnetic susceptibilities varied over a wide range, from $\log \chi = 2.1$ to 4.5. Two distinct populations are visible in porosity, with most below 8% porous, but a few (most notably all stones of the pairing NWA 2995/2996/4503/5151/6252) have a porosity in excess of 10%. These samples represent a mix of regolith breccias, fragmental breccias, and impact-melt breccias.

Other Breccias: Diverse lithologies (including KREEP-rich breccias) occupy a different range of density and magnetic susceptibility than the other two groups. The meteorites in this group have low porosities (like the felsdpathic breccias and basalts), but in contrast Apollo breccias have porosities above ~15%.

Discussion: The data presented here are early results of an ongoing study. Much work still remains to be done, including further measurements already in progress of both meteorites and Apollo samples. Expanding the database of Apollo samples will help address issues about the porosity of in-situ breccias as opposed to meteorite breccias. It will also fill in missing data with the inclusion of thus-far unrepresented high-Ti (9-14 wt% TiO_2) basalts as well as expanding the representation of low-Ti basalts. In addition, the Apollo samples have known geologic contexts and include lithologies that have not been recognized in the lunar meteorite collection.

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