USING GRAIN DENSITY AND MAGNETIC SUSCEPTIBILITY TO QUANTIFY WEATHERING IN CHONDRITE FINDS.

R. J. Macke[1], D. T. Britt[1] and G. J. Consolmagno[2]. [1]University of Central Florida. Email: macke@jesuits.net [2]Specola Vaticana.

Introduction: Unlike petrographic type and shock state, weathering states of meteorite finds are not well standardized, difficult to determine, and rely in large part on personal judgment. Few meteorites even have a weathering state in the public record. In addition, different stones from the same meteorite may weather differently due to variations in local environmental conditions or even size of the stone. This makes weathering determinations performed on thin sections only partially informative for other stones.

Chondritic meteorites with moderate to high metal content weather in a predictable manner that is well-understood [1,2]. Iron metal oxidizes, expanding into available pore space until it is mostly filled, at which point weathering slows considerably. In addition, the oxidation of iron metal greatly reduces magnetic susceptibility and grain density [3].

Using techniques developed by Consolmagno and Britt [4] and Gattacceca et al. [5], we have measured grain density and magnetic susceptibility as well as bulk density and porosity of ~1200 stones from ~650 meteorites of all types, including both falls and finds. Using this database, we have created a weathering modulus based on grain density and magnetic susceptibility that is applicable to ordinary chondrites and enstatite chondrites. With this modulus, we can compare degree of weathering of stones within the meteorite type.

Some results: Our ordinary chondrite results are consistent with [1, 2, 3]. All finds are 0-10% porous but porosity alone does not correlate to degree of weathering. We also see a negative correlation of weathering modulus with bulk density; assuming bulk density is not strongly affected by weathering, this indicates that the most weathered finds were originally the most porous.

Enstatite chondrites show a peculiar trend: porosity increases with weathering, and the most weathered finds' porosities exceed those of typical falls. This suggests that either (1) cracks are being introduced into the meteorites during weathering or (2) a significant amount of at least one mineral species is leeched out as a result of weathering.

Work on carbonaceous chondrite weathering is under way.

References: [1] Bland P. A. et al. 1998. *Geochimica et Cosmochimica Acta* 62:3169-3184. [2] Consolmagno G. J. et al. 1998. *Meteoritics & Planetary Science* 33:1221-1230. [3] Consolmagno G. J. et al. 2006. *Meteoritics & Planetary Science* 41:331-342. [4] Consolmagno G. J. and Britt D. T. 1998. *Meteoritics & Planetary Science* 33:1231-1240. [5] Gattacceca J. et al., 2004. *Geophysical Journal International* 158:42-29.