VARIATIONS IN MICROCRACK POROSITY ACROSS METEORITE TYPES.

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Introduction: We have been studying microcrack porosity in meteorites [1] using a computerized point-counting system [2] to learn about the formation and evolution of meteorites and their parent bodies. Previous studies evaluated various stages of weathering (using ordinary chondrites for consistency) to see if observations were consistent with models [3] and concluded that the porosity tends to be constrained to a relatively narrow field, whether the samples are relatively fresh and unweathered, or have been extensively weathered (as can be determined from the bright phase materials filling in microcracks). We also looked at a suite of samples centered around a common mineralogy [4] using basalts as representative of most types of bodies, to evaluate if microcrack porosity varies with planet of origin. In this work we extend the types of meteorites examined to ask: Can one see a different kind of porosity in unequilibrated versus equilibrated chondrites? Do non-chondritic meteorites look less or more cracked than ordinary chondrites? What do non-chondritic breccias like mesosiderites or howardites look like?

Results: Ordinary chondrites range from porosities of 2% to 20% [1]; carbonaceous chondrites and enstatite chondrites fall in this same range (Orgueil 6.7%, Nogoya 1.8% and Abee 4.9%); and similarly achondrites, lunar meteorites and martian meteorites exhibit porosities from 3 to 11%. By contrast, terrestrial samples all fall at the low end of the range (0.7% to 3.9%). As we continue to expand the number and variety of samples we examine, the range does not change significantly.

There does not seem to be any consistent pattern to the values of the porosities and the type of meteorite. Values at the low end cross types (McKinney L4: 2.6%, Nogoya CM2: 1.8%, Dar al Gani Lunite: 2.9%), as do those at the high end (Durala L6: 9.8%, Bishopville Aubrite: 8.2%, Chassigny Chassignite: 10.9%).

Conclusions: Microcrack porosity in meteorites, though greater than that seen in terrestrial samples, does not appear to be correlated with meteorite type, and thus it may have its origin in a process common to all meteoritic material. One such process is the impact environment that has shaped the bodies on which they formed, and from which they were ejected. The subsequent decompression following passing of a shock wave through the material [5] is a very likely source of this porosity.

A further test of this hypothesis would be to examine Apollo samples that have been exposed to an impact environment on their parent body without having been ejected from that body or decelerated upon impact with the Earth.

References: [1] Consolmagno G. J. et al. 1999. Abstract #1158. 30th Lunar and Planetary Science Conference; Consolmagno G. J. et al. 1999. *Meteoritics & Planetary Science* 34:A28-A29; Strait M. M. and Consolmagno G. J. 2001. *Meteoritics & Planetary Science* 34:A199. [2] Strait M. M. et al. 1996. 27th Lunar and Planetary Science Conference. pp. 1285-1286. [3] Bland P. A. et al. 1996. *Geochimica et Cosmochimica Acta* 60:2053-2059; Consolmagno G. J. et al. 1998. *Meteoritics & Planetary Science* 33:1221-1229; Consolmagno G. J. et al. 1998. *Meteoritics & Planetary Science* 33:1231-1241. [4] Strait M. M. and Consolmagno G. J. 2003. *Meteoritics & Planetary Science* 38:A106. [5] Decarli P. S. et al. 2001. *Meteoritics & Planetary Science* 36:A47.