THE APPEARANCE OF POROSITY IN METEORITES

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Introduction: Porosity is an important physical parameter of meteorites that is used in modeling the behavior of materials as they are exposed to a variety of processes in the Solar System. Porosity of meteorites is currently being measured three ways: X-ray microtomography [1], He pycnometry [2] and imaging thin sections using backscatter scanning electron microscopy and subsequent processing of the images with a computer program [3]. Each method provides important information about the nature of porosity in samples.

In recent work, we have found that magnification is an important consideration in making porosity measurements using imaging methods, as macroporosity is often missed or ignored [4]. In an attempt to explore the appearance of porosity we have broadened our work to include a variety of other classes and types of meteorites.

Results: The porosity for DAG 056 (C3) is similar to other carbonaceous chondrites we have measured, with a porosity of 2.25 $\pm$ 1.42%. Qingzhen (EH3) has a porosity of 4.9 $\pm$ 2.11% but does not exhibit the variety in porosity observed at different magnification levels in other Group 3 meteorites we have measured. Steinbach (IVA) is the first iron we have measured. The average porosity is 2.4%, but varies from 0% in an image that is pure metal to 3.56% in an image that was primarily stony inclusion. The two ordinary chondrites measured on the low end of the range for porosity we have observed: Franconia (H5) 1.44 $\pm$ 0.97% and Portales Valley (H6) 1.12 $\pm$ 0.58%.

Discussion: All of these meteorites have appearances similar to samples we have investigated in the past. Franconia exhibits normal microcrack porosity and the lower porosity value matches the texture seen. Portales Valley had large, distinct grains with most of the porosity in the spaces between grains, again agreeing with the lower measured value for porosity. DAG 056 exhibited the typical macerated appearance we have seen in carbonaceous chondrites with an over-texture of microcracking. Qingzhen showed a similar macerated texture to the carbonaceous chondrites, although there was obvious microcracking, especially around grains. Steinbach had a huge disparity in porosity between the smooth, uncracked metals grains and the highly porous silicate inclusions. None of the samples exhibited the macroholes observed at low magnification that has recently been reported [5].

References: [1] Friedrich, J. M. et al. 2008. *Planetary and Space Science* 56:895-900. [2] Consolmagno G. J. and Britt D. T. 1998. *Meteoritics and Planetary Science* 33:1231–1242. [3] Strait M. M. et al. 1996. *27th Lunar & Planetary Science Conference* pp. 1285-1286. [4] Strait, M. M. and Consolmagno, G. J. 2004. Abstract 5143. *Meteoritics & Planetary Science* 39. [5] Strait M. M. and Consolmagno G. J. 2010. Abstract #2258. *41st Lunar & Planetary Science Conference.*