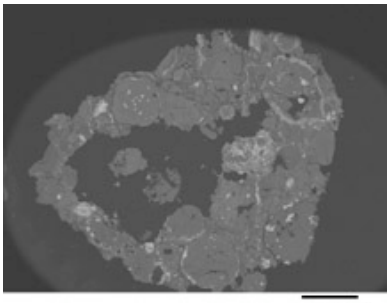
VISUALIZING POROSITY IN METEORITES. M. M. Strait[1] and G. J. Consolmagno SJ[2], [1]Alma College, 614 W. Superior St., Alma, MI 48801, USA (straitm@alma.edu), [2]Vatican Observatory, V-00120, Vatican City State (gjc@specola.va).

Introduction: We have been measuring the porosity in meteorites for a number of years using two methods that seem to correlate well for ordinary chondrites [1], but seem to show discrepancies in other types of meteorites [2]. It has been proposed that the problem in carbonaceous chondrites may lie in the nature of the fabric of the material. We have suggested that the missing porosity in the image work may lie at a fine scale too small to be seen. However, the work presented herein points to the fact that we may be looking at the wrong end of the scale and that the missing porosity may be macroscale in nature. This shows that actually looking at the fabric of these samples may be as important in interpreting the porosities as what we measure.

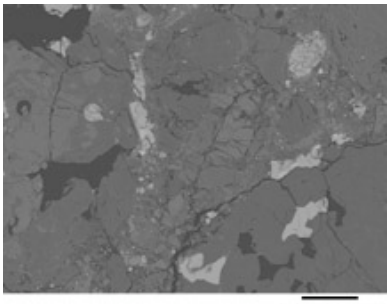
Recently, we reported on the porosity in two H4 chondrites, Beaver Creek and Menow, and found a larger than normal discrepancy between the two methods [3]. In going back and re-examining the data, it was observed that two sets of measurement were taken, one of which was significantly higher in porosity than the other. Typically, the porosity is measured in images that are at a magnification of x250, but other images are taken at x90 to provide a better map of the sample. In most cases for meteorites measured to this point, the two sets of measurements agree within about 1% [4]. The measurements for Beaver Creek are 11.8% at x250 and 24.60% at x90. The pycnometry value for Beaver Creek was 15.3%. It was thought at the time that the primary cause of the discrepancy was due to the poor quality of the images and the lower value was reported. However, recently we collected images for Chainpur (LL3). We had access to five thin sections. The samples were very small and so we were able to image the entire thin section at several magnification levels. The first thing noticed was that the samples were highly porous in a way that might have been taken for damage at higher magnifications. In addition, one section clearly had porosity that was not damage as there was a ring of sample with a lake of epoxy including islands (Figure 1A).

Discussion: Figure 1 shows four images of a single thin section of Chainpur taken at a variety of magnifications. As can be seen, the higher magnifications (Figure 1C and 1D) agree fairly well at 9.7% and 9.8%, (although in the former, the upper left corner might be deleted because of suspected damage and the right center might be deleted because of the potential of in-filling from a crack at the edge of the sample, which would reduce the porosity to 7.5%). This is most likely not the case when the lower magnification image is inspected. As can be seen in the image used to map the image (Figure 1A), there is clearly a large hole in the middle, as well as a fair amount of porosity in the bulk sample that may or may not be counted when measuring at higher magnifications because of concern for counting as porosity damage done to the sample. This image shows a porosity almost four times that of the higher magnifications. Even the sample at the moderate magnification (Figure 1B) is statistically different from the highest magnifications, although only half of that in the map image.

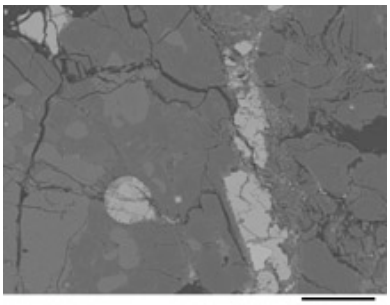
This work points out that continued caution needs to be taken when reporting porosity measurements using imaging methods. In the past, we have not found the magnification to



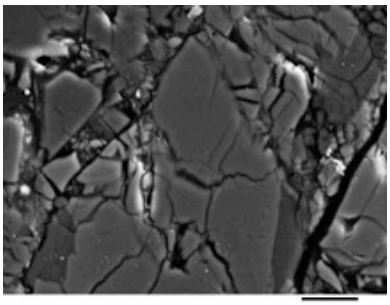
A. 27.2%



B. 13.3%



C. 9.7%



D. 9.8%

Figure 1. One thin section of Chainpur (LL3) imaged at several magnifications. Measurements of porosity give the following: A. 27.2% at x20; B. 13.3% at x100; C. 9.7% at x260 and D. 9.8% at x1000.

be a significant factor, but as we move into new classes and different petrographic grades of meteorites, more care needs to be taken to evaluate the porosity based on a visualization of the fabric of the sample.

These recent observations point out the importance of evaluating the porosity not only from a measurement point of view, but also from a visual aspect. We will present a pictorial view of the porosity in the meteorites we have measured to this point. In addition, we will present new data that has been collected at a variety of magnifications in our quest to determine the location of the porosity in all types of meteorites.

References: [1] Britt D. T. and Consolmagno G. J. (2003) *Meteoritics & Planet. Sci., 38*, 1161-1180. [2] Strait M. M. and Consolmagno G. J. (2004) *Meteoritics. & Planet. Sci., 39,* A100. [3] Strait M. M. and Consolmagno G. J. (2008) *Meteoritics. & Planetary Science, 43,* A148.[4] Strait M. M. and Consolmagno G. J. (2002) *LPSC XXXIII*, Abstract #1711.

Acknowledgements: Alma College for a GIP Grant to support microscope time; Portland State University for use of samples and the scanning electron microscope.