A SHOCK MELT DIKE IN 3D: SHEAR AND MELT MIGRATION IN THE BUCK MOUNTAINS 005 L6 CHONDRITE.

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Introduction: The Buck Mountains 005 (BM005) chondrite was found as 36 fragments, some of which display a straight dark ridge protruding from their surfaces [1]. Analysis of a thin section from one of the specimens shows that the ridge is the surface expression of an erosionally-resistant, structured shock melt dike. The dike has two distinct zones: a central clast-rich inner dike surrounded on either side by a clast-poor outer dike. Both zones have a crystalline, igneous-textured groundmass enriched in fine-grained low-Ca pyroxene and subequal olivine, and both are depleted in metal, as well as in a feldspathic component. Troilite-rich borders mark the edge of the inner dike. Small (<40 µm) droplets of intergrown metal and troilite are found in the outer dike near the contact with the host meteorite [2].

Results and Discussion: A second small specimen (~1-1.5 cm^3) of BM005 displaying a surface ridge around the center of the sample was studied with micro-tomography (µCT). Following µCT analysis, the sample was cut and examined using a binocular microscope. The dike occurs as a nearly symmetrical, sheet-like structure ~1.5 mm thick that is cut at regular intervals by subparallel fractures perpendicular to the dike. These fractures cut all features in the dike and probably represent cooling joints. The metal/sulfide droplets in the outer dike are not uniformly distributed near the host contact, but rather are concentrated in clumps near the dike margin. The thickness of the inner dike varies, with sulfide-rich borders forming sheets that pinch in and out around entrained silicate clasts, creating boudin-like structures, consistent with a shear process [3]. Tomography reveals the presence of six metal-rich blobs ~0.5-2 mm across outside the dike, all of which contain silicate clasts. Sulfide and/or metal weathering product partially surround some of the metal blobs. Two of the metal blobs, including the largest (~3 mm^3), are in contact with the dike. Some metal-rich areas follow vein-like lines or sheets at high angle to the dike; others parallel it. It appears that during dike formation, metal and sulfide were molten and were mobilized in different ways: troilite was moved into the border of the inner dike and into droplets of the outer dike, and metal was moved outside of the dike into metal blobs and vein-like structures in the chondrite host. Discontinuous sheets of metal occur on the surface of the hand specimen; their presence likely assisted in fragmentation of the sample. Fracturing along metal veins helps explain why BM005 was recovered in so many pieces.

References: [1] M. Hutson, A. Ruzicka, A.J.T. Jull, J.E. Smaller, and R. Brown 2013. *Meteoritics & Planetary Science* **48**: 365-389. [2] M. Hutson, A. Ruzicka, and R. Brown. 2013. Abstract #1186. *44th Lunar & Planetary Science Conference*. [3] C.W. Passchier and R. A.J. Trouw, *Microtectonics,* 2nd Ed., Springer.