**FALL OF THE MIFFLIN L5 CHONDRITE.** N. T. Kita[1], J. W. Valley[1], M. J. Spicuzza[1], G. J. MacPherson[2], L. Welzenbach[2], A. M. Davis[3], P. R. Heck[4], D. Nakashima[1], T. J. Tenner[1], and T. Ushikubo[1], [1]Department of Geoscience, University of Wisconsin-Madison, Madison, WI 53706 (noriko@geology.wisc.edu), [2]Department of Mineral Sciences, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, [3]Department of the Geophysical Sciences and Enrico Fermi Institute, The University of Chicago, Chicago, IL 60637, [4]Robert A. Pritzker Center for Meteoritics and Polar Studies, Department of Geology, The Field Museum, 1400 South Lake Shore Drive, Chicago, IL 60605.

**Fall of Meteorite:** A bright fireball was seen by numerous observers in parts of Wisconsin, Iowa, and Illinois at night on April 14, 2010. A camera on the roof of Atmospheric and Oceanic Sciences Building of University of Wisconsin-Madison, over 80 km from the center of the strewnfield, captured two images of the fireball at 10:07PM (Fig. 1). The track was recorded by Doppler radar [1]. Residents in Mifflin Township, WI heard large explosions at the same time. The first stone recovered (7.4 g) hit the metal roof of a shed, was found the following day, and was identified as a meteorite at the University of Wisconsin-Madison. Several more stones were found within a few days. Numerous stones fell in an elliptical strewnfield 20 km long centered in Mifflin Township. More than 70 stones and fragments were recovered in the area within a few weeks of the fall. The total recovered mass is more than 3.5 kg; the largest stone (332 g) is owned by the finder and private collectors. Most pieces are fully enclosed in fusion crust. The meteorite was named "Mifflin" as the strewn field was predominantly within Mifflin Township.

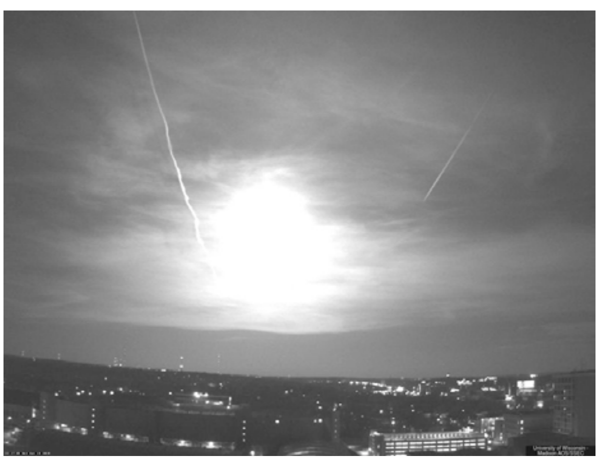

*Fig.1. A bright fireball in the sky over southwestern Wisconsin (April 14, 2010, 10:07PM). Photo courtesy of Atmospheric and Oceanic Sciences and Space Science and Engineering Center, UW-Madison.*

**Petrography:** Most stones are partly to fully coated with fusion crust. Some broken surfaces show a brecciated texture with a dark matrix and light clasts. Black colored shock veins up to a few mm long are observed. Chondrules are not obvious in hand specimen, but are visible in thin section.

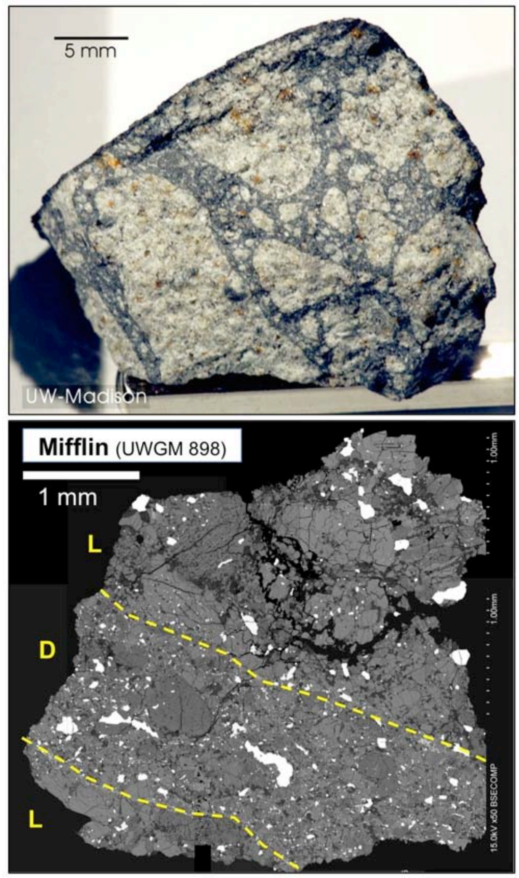


*Fig. 2. Top: Mifflin meteorite, showing light clasts/ dark matrix brecciated textures. Bottom: BSE image of a fragment of the meteorite, which shows a dark matrix (D) between two light clasts (L). Two dashed lines indicate the boundaries between two lithologies.*

The meteorite consists of olivine, pyroxene, plagioclase, FeNi metal, troilite, chromite, and phosphates (whitlockite and apatite). The size of secondary minerals (albite, phosphates, and chromite) is typically less than 50 µm. The shock stage is S1.

The light clasts consist of coarse-grained ordinary chondritic texture, which includes ≤1 mm chondrules. The dark matrix is made of fragments of finer grained silicates that are often rimmed with FeS grains. Submm fragments with light clasts are found within the dark matrix. Melt-clasts up to several 100 µm across are also observed, often located near the boundary of light/dark lithologies. They consist mainly of olivine, low-Ca pyroxene and glass.

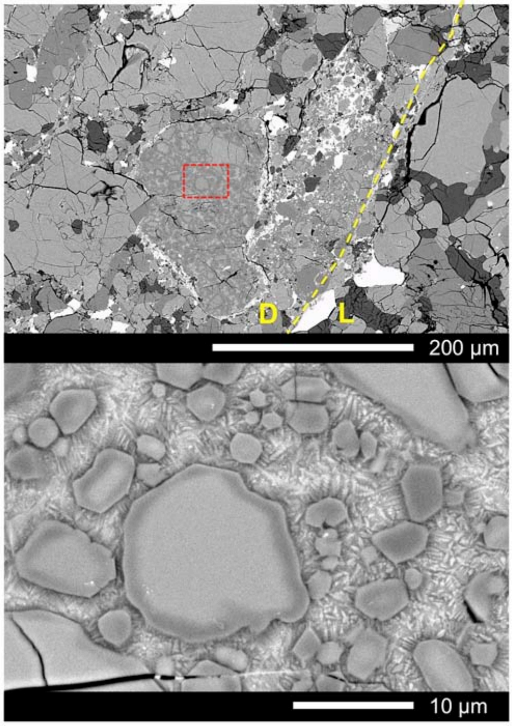


*Fig. 3. Top: Boundary between a light clast (L) and a dark matrix (D), shown as a dashed line. The dark matrix contains melt clasts. The red square indicates the area shown in the bottom view. Bottom: Expanded image of a melt clast containing zoned olivine grains. Dark zones correspond to Mg-rich olivine (~$Fo_{82}$). The mesostasis of the melt clast contains sub-µm dendritic microcrystallites possibly with pyroxene composition.*

EPMA analyses of olivine and low-Ca pyroxene show $Fo_{74.5\pm0.4}$ (n=18) and $En_{76.9\pm0.4}$ $Wo_{1.4\pm0.2}$ (n=26), respectively. These compositions are within the range found in L chondrites [2]. Plagioclase is albitic ($An_{11}Or_6$). Fo contents in one melt clast were heterogeneous and range between $Fo_{75}$-$Fo_{82}$. The EPMA analyses of metal show 5.8 wt% Ni in kamacite and 48.5 wt% Ni in taenite.

**Oxygen Isotopes:** Four different aliquots each weighing ~3 mg were analyzed for high precision oxygen isotope ratios by using Laser Fluorination/ Gas Mass Spectrometer at University of Wisconsin-Madison [3-4]. The precision of analyses are ~0.1‰ for $\delta^{18}O$ and $\delta^{17}O$ and ~0.03‰ for $\Delta^{17}O$ ($=\delta^{17}O-0.52\times\delta^{18}O$). Four aliquots were analyzed, two each from the light clasts and dark matrix. The four analyses are indistinguishable within analytical error and show the average value of $\delta^{18}O$=4.84‰, $\delta^{17}O$ =3.65‰, and $\Delta^{17}O$ = 1.13‰ VSMOW. As shown in Fig. 4, the result from Mifflin is within the range observed for types 4-6 L chondrites [5].

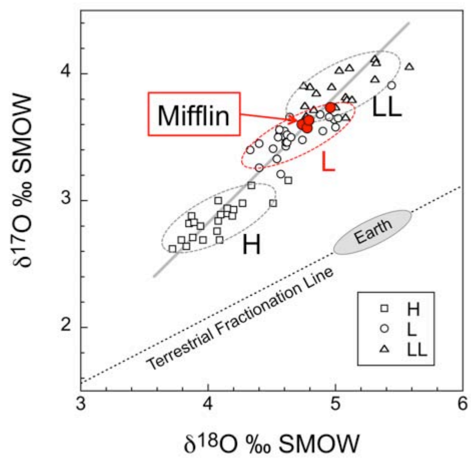


*Fig. 4. Oxygen three isotope ratios of Mifflin meteorites. Ordinary chondrite data are from [5].*

**Classification:** Olivine and low-Ca pyroxene compositions are consistent with L chondrites, as are the oxygen isotope ratios. The distinct chondrule margins and sizes of secondary minerals (≤50 µm) indicate that the Mifflin meteorite is a type 5 chondrite. The brecciated light-dark structure is relatively common in L5 chondrites (e.g. Park Forest [6]). Cosmogenic nuclide data, the preatmospheric size, and a cosmic-ray exposure age of Mifflin are reported at this meeting by [7].

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**References:** [1] Fries M. D. and Fries J. A. (2010) *Meteorit. Planet. Sci., 45,* A58. [2] Brearley A. J. and Jones R. H. (1998) *Rev. Min., 36*, pp.3-1-3-398. [3] Valley J. W. et al. (1995) *GCA, 59*, 5223–5231. [4] Spicuzza M. J. et al. (2007) *EPSL, 253*, 254-265. [5] Clayton R. N. et al. (1991) *GCA, 55*, 2317-2337. [6] Simon S. B. et al. (2004) *Meteorit. Planet. Sci.*, *39*, 625–634. [7] Welten K. C. et al. (2011) *LPS XLII*, *this volume*.