JUNGO 001, JUNGO 002, JUNGO 003, AND BIG HORN MOUNTAINS: FOUR NEW CHONDRITES FROM NEVADA AND ARIZONA WHICH CONTAIN A VARIETY OF UNUSUAL PETROGRAPHIC FEATURES.

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Introduction: Four new chondrites from Nevada and Arizona were recently classified by the Cascadia Meteorite Laboratory. Initially, each uncut hand specimen appeared to be an unremarkable, fairly weathered chondrite. Upon closer examination, each had one or more unusual petrographic features. We briefly describe these four meteorites below.

Jungo 001 – Conjugate Fractures and a Complexly-Textured Ollvine-Rich Clast: This 70.7 g meteorite was found in Humboldt County Nevada by Roger Dyer in October 2007. Two thin sections were prepared. This is an L6 chondrite based on fayalite content (24.3±0.2), the paucity of well-defined chondrules, and the integration of chondrules and matrix [1]. Olivine displays undulose to mosaic extinction, with the latter predominant, only one shock vein and no melt pockets were observed, and feldspar is deformed but not isotropic, indicating a shock stage of S4 [2]. Approximately 40% of the opaques have been replaced, consistent with a weathering grade of W2 [3]. Of note, both thin sections are crosscut by numerous fractures which meet at angles of approximately 60° and 120°. The fractures appear dark in transmitted light (Fig. 1), but for the most part do not contain opaques or significant weathering veins. Similar, but far less pervasive fractures were described in CAI rim layers in the Leoville (CV3) chondrite and attributed to shock [4].

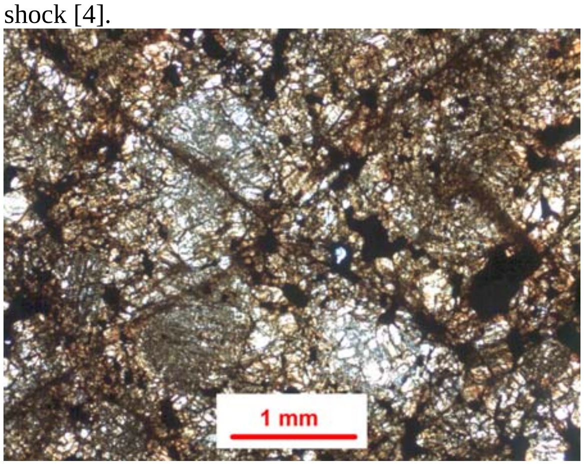

Fig. 1. Transmitted light photomicrograph showing two sets of fractures which meet in the center of the image. Additional subparallel fractures are visible in the lower left, upper left, and middle right edges of the photograph.

This meteorite is clearly a breccia with a number of coarse-grained clasts. One clast (~8-9 mm across) consists almost entirely of olivine and contains one extremely large olivine grain (~3-4 mm across—see Fig. 2). In one thin section, the clast appears to consist entirely of variably-sized, but coarse olivine grains. In the other section, it is clear that the clast includes two barred olivine chondrules (Fig. 2).

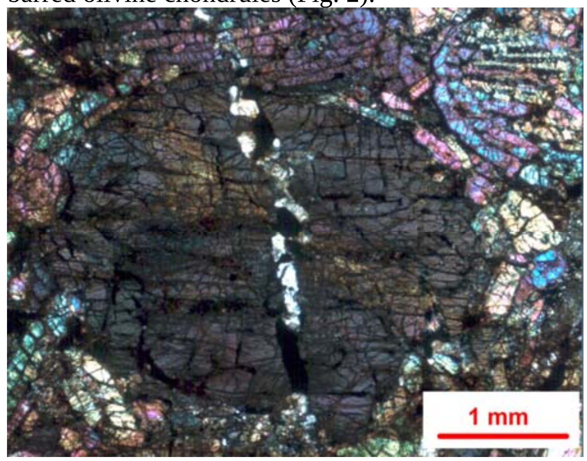

Fig. 2. Photomicrograph in cross-polarized light of a single large olivine grain (~3mm across), with a portion of a barred olivine grain in the upper right hand corner of the image.

Jungo 002 and Jungo 003 – Silicate-bearing Troilite: Both of these meteorites were found by Roger Dyer in October 2007. Both were single stones, with Jungo 002 weighing 27.8g and Jungo 003 weighing 29.1g. Both chondrites are weathering grade W3 [3], with about 70% of the opaques in Jungo 002 and about 90% of the opaques in Jungo 003 having been replaced. Extensive weathering veins crosscut thin sections of both meteorites. Fayalite contents (19.3±0.4 for Jungo 002 and 19.1±0.5 for Jungo 003) indicate that both are H chondrites [1]. Chondrules are not well-defined and matrix is coarse-grained, with some feldspar grains exceeding 50µm in size, indicating that both meteorites are petrographic type 6 [1]. Olivine grains in both meteorites show undulose to mosaic extinction, with the latter predominant. The few large feldspar grains in each meteorite that were examined are heavily deformed, but not isotropic, indicating a shock stage of S4 [2]. Two small (<50µm across) melt pockets were seen in Jungo 002. None were observed in Jungo 003. Both meteorites contain distinctively-textured troilite grains, which is the main reason for believing these two stones to be paired. In both meteorites, troilite grains contain angular silicates, mostly concentrated near the edges of the grains (Fig. 3 and 4). A few of the trolite grains in Jungo 002 also contain irregularly-shaped metal grains (Fig. 3). It is possible that troilite in Jungo 003 might also have contained metal, but most of the opaques in that meteorite were completely replaced by terrestrial weathering. Many of the troilite grains have irregular margins, suggesting that the troilite was fluid and molded itself around adjacent silicate grains.

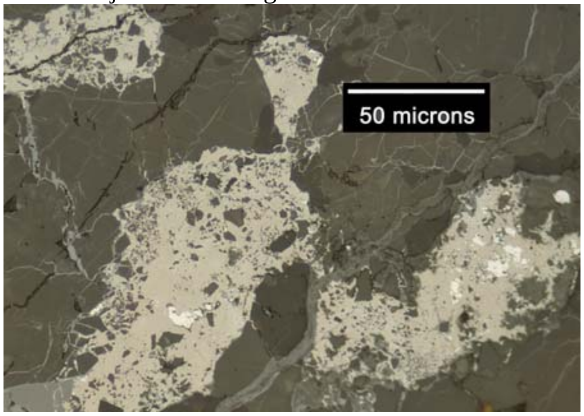

Fig. 3 Reflected light photomicrograph of trolite (pale yellow) in Jungo 002 containing both angular silicate grains and irregularly-shaped metal grains. Light gray veins are weathering.

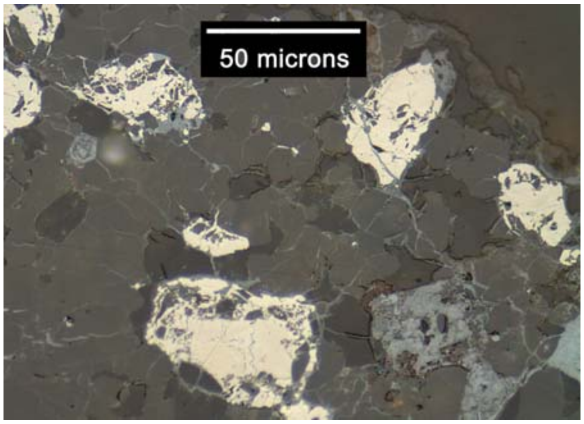

Fig. 4. Reflected light photomicrograph of troilite grains in Jungo 003, containing angular silicate grains. The blue-gray material in the lower right is an opaque that has been replaced by terrestrial weathering. The dark gray grains outside of the troilite are feldspars.

Big Horn Mountains – Bimodal Weathering: This 91.9 g chondrite was found by Larry Sloan in Maricopa County, Arizona in March 2006. It was immediately apparent upon cutting open the stone that one portion of the stone was significantly more weathered than the rest (see Fig. 5).

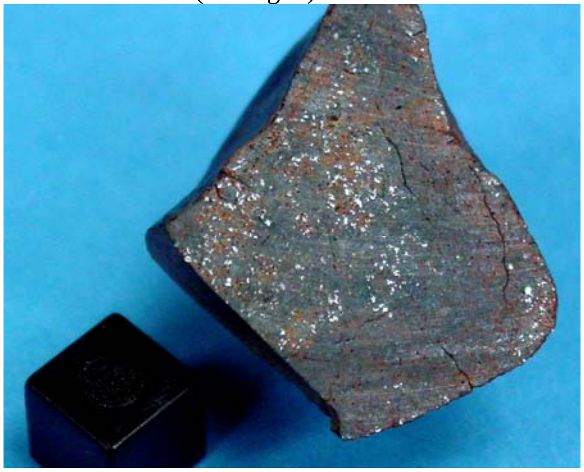

Fig. 5. Photograph showing the cut face of a portion of the Big Horn Mountains chondrite. A cut surface is at lower left; all other edges are original exterior surface. The black cube is a cm across.

An extremely weathered zone completely devoid of opaques-- weathering grade W4 [3]-- occurs between two fractures that are subparallel to one exterior surface (see Fig. 5). In other areas, approximately 40% of the opaques have been replaced, indicating a weathering grade of W2 [3]. The contact between the two regions is sharp in thin section. No region in thin section was observed that could be considered weathering grade W3. Olivine and pyroxene analyses (Fa = 18.5±0.3; Fs = 16.3±0.4) indicate this is an H chondrite [1]. Textural relationships are difficult to see in the heavily weathered area, but in the less weathered portion, fairly well defined chondrules containing devitrified glass suggest this is a type 4 chondrite [1]. Olivine grains show sharp to slight undulatory extinction, with the latter predominant, consistent with a shock stage of S2 [2].

Conclusions: All four of these chondrites show interesting petrographic features. Additionally, variable weathering of two obviously paired meteorites (Jungo 002 and Jungo 003) and of differing portions of Big Horn Mountains makes it clear that the amount of weathering visible in a meteorite thin section may not be a reliable means for pairing meteorites.

References: [1] Sears D. W. G. and Dodd R. T. (1998). In Kerridge J. F. and Matthews M. S. eds., *Meteorites and the Early Solar System*, 3-31. [2] Stöffler D. et al. (1991) *GCA*, *55*, 3845-3867. [3] Wlotzka F. (1993) *Meteoritics*, *28*, 460. [4] Ruzicka A. and Boynton W. V. (1992) *LPS XXIII*, 1191–1192.