Stump Spring: Classification of 28 Ordinary Chondrites from a New Dense Collection Area in Nevada

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Introduction:

Since its inception, the Lunar & Planetary Laboratory has received hundreds of rocks and artificial materials from around the world with the owners' hope that they might be meteorites. While very few of them have been found to be meteorites, we have been privileged to have classified or analyzed almost every type of meteorite known, including some interesting falls. This report of a new dense collection area in Nevada is the exception to our normal experience. Some time around 2003, Mr. Sonny Clary began finding tens of meteorites in dry areas with sparse vegetation and light-colored soil in Nevada. This work represents the initial reconnaissance and classification of those samples.

Description:

Forty-four stones and fragments were recovered from Stump Spring "area 1" totaling over 2688g. The meteorites were documented and sorted in the laboratory according to similarities in physical appearance of exposed broken interiors based on presence, size, and preservation of chondrules and also proximity of the recovery locations. One specimen from *each group* was selected for analysis for the first investigation. This resulted in 28 samples expected to be ordinary chondrites. Previous research on the Gold Basin strewnfield by Kring et al. (2001) indicated that it was likely many were paired.

Sample Preparation and Experimental Methods:

The specimens were cut into 1-2 mm thick slices with the low-speed Isomet saw and ethanol. Double-polished, 30 micron thick thin sections were prepared by David Mann of High Mesa Petrographics. They were examined by petrographic microscope and analyzed with LPL's electron microprobe. Optical microscopy alone revealed obvious different meteorite textures and petrologic grades (figure 1, for example). Mineral distributions, modes, and compositions were acquired from elemental x-ray maps for the entire thin section and elemental analyses for major and minor elements of individual silicates. Analyses of metals, sulfides, chromites, and plagioclase were conducted when time permitted.

Analysis:

Classification of chondrites is typically conducted according to guidelines originally developed by Van Schmus and Wood (1967) and Dodd & Van Schmus (1965), with additional shock stage and weathering assessment developed by Stoffler et al (1991) and Wlotzka (1993), respectively. The chemical group assignment (H-L-LL) for ordinary chondrites (OC) is based primarily on the distribution of Fe in olivine and low-Ca pyroxene. In addition, our laboratory often analyzes Co in kamacite and % fayalite (Fe) in olivine to confirm chemical groups (Kallemeyn et al. 1989). The petrologic type (3-4-5-6) is based on a combination of delineation of chondrule boundaries and Percent Mean Deviation (PMD), a measure of the spread in mineral compositions throughout the meteorite.

Results:

The analyses indicate the Stump Spring meteorites (provisional name) contain at least 5 H chondrites, 11 L chondrites, and 12 LL chondrites from a small 3 x 10 km area (see figure 2). The petrologic grades are mostly type 5 and 6 with several less equilibrated type 4s, and 2 breccias with interesting impact melt veins. Additional mineral and shock comparisons along with terrestrial residence age dating may be required to ascertain which meteorites of the same classifications are actually paired in the same fall event. We saw that weathering grade for desert falls can be quite variable depending on local conditions. So it is a less significant indicator of pairing. A study of Stump Spring (prov.) meteorite pairings may reveal geological concentration mechanisms and/or overlapping meteorite falls over a long time period. Far from ordinary, these OCs will add to our understanding of parent body collisions in the asteroid belt and rates of delivery to the earth.

References

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