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Meteorite Search in the Deflation Basins in Lea County, New Mexico and Winkler County, Texas, USA: Discovery of Lea County 003 (H4)

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METEORITE SEARCH IN THE DEFLATION BASINS IN LEA COUNTY, NEW MEXICO AND WINKLER COUNTY, TEXAS, USA: DISCOVERY OF LEA COUNTY 003 (H4). T. Mikouchi[1,2], K. C. Welten[3], P. C. Buchanan[1], M. W. Caffee[4], R. Hutchison[5], M. Hutchison[5], and M. E. Zolensky[1], [1]Mail Code SN2, NASA Johnson Space Center, Houston, TX77058, USA, [2]Mineralogical Institute, Graduate School of Science, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, JAPAN, [3]Space Science Laboratory, University of California, Berkeley, CA94720-7450, USA, [4]CAMS, Lawrence Livermore National Laboratory, Livermore, CA94551, USA, [5]Department of Mineralogy, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK (E-mail: TMikochi@ems.jsc.nasa.gov or mikouchi@min.s.u-tokyo.ac.jp).

Introduction: During the past few decades great numbers of meteorites have been recovered from the ice accumulation zones of Antarctica and from the vast Sahara.. Although these two great deserts are the two most productive areas, the Southern High Plains in USA (New Mexico and Texas) and Nullarbor Plain, Western Australia have great potential for meteorite recovery [e.g., 1-6]. The number of meteorite finds from Roosevelt County, New Mexico alone exceeds 100 in only approximately 11 km^2 area [e.g., 4,5]. Most meteorites from this area have been found on the floors of active deflation basins (blowouts) that have been excavated from a mantle of sand dunes. This area has no apparent fluival or permafrost activity within the last 50,000 years [e.g., 4,5], suggesting that only prevailing winds and natural aridity aid in the concentration and preservation of meteorites.

We investigated these deflation surfaces in Lea County (the SE corner of New Mexico) and neighboring Winkler County, Texas following a prior search in this area which found two chondrites [4]. We found a tiny H4 chondrite in this search and here we report its mineralogy and petrology along with preliminary data on its exposure history.

Meteorite search and recovery: We (T.M., K.W., P.B., R.H., and M.H.) spent three days searching by foot these deflation basins. The basins are located between sand dunes and are generally a few tens of meters wide and 100-200 meters long (Fig. 1). Because these basins contain few large stones exceeding 10 cm in size and vegetation, it is easy to look for "black" meteorite-like objects even if they are very small. We found the Lea County 003 H4 chondrite (hereafter, LC3) at 103° 9' 12", 32° 2 '4" (about 7 km south of *downtown* Jal) on Oct. 26, 1999. It is a tiny single stone (2 x 1.5 x 1 cm) weighing only 4.59 g. Thin black fusion-crust-like material covers one side of the stone. The meteorite is heavily weathered and is brownish in color except for the side with the fusion crust. Although there is no exposed metallic Fe,Ni on the surface, the meteorite is attracted to a magnet. Chondrules or inclusions are not obvious on the surface and the meteorite appears to represent one complete stone, rather than a fragment of a larger rock.

Petrology and Mineralogy of Lea County 003: The thin sections of LC3 show brown color due to the presence of weathering products. The thin sections include many chondrules, fragments of chondrules, and lithic fragments scattered within a dark brown matrix. Chondrules are generally 0.1-1 mm in diameter. Several types of chondrules are observed including porphyritic olivine or/and pyroxene, radial pyroxene, cryptocrystalline, barred-olivine, and other types.

Most Fe,Ni and troilite are weathered to goethite (limonite). They are present as massive grains reaching 1 mm and as vein fillings. The weathering degree is W3 according to the presence of small amounts of fresh metal and sulfide that survived alteration [7]. Most olivine and pyroxene grains show little evidence of undulatory extinction and mosaicism, suggesting very weak shock metamorphism (S1) [8]. Because the matrix minerals are contaminated by terrestrial weathering products, it is difficult to obtain accurate analysis of this part of the meteorite.

Random analyses of olivine and low-Ca pyroxene gave $Fa_{1\text{-}32}$ (average Fa_{19}, PMD=1.5%) for olivine and $Fs_{10\text{-}40}Wo_{0.5\text{-}4}$ (average $Fs_{16}Wo_{1.5}$, PMD=2.7%) for low-Ca pyroxene, respectively (Fig. 2). Augite compositions have ranges of $Fs_{4\text{-}17}Wo_{37\text{-}48}$. The calcium content of olivine is 0.01-0.3 wt%. Plagioclase is microcrystalline (there is one plagioclase analysis of $An_{37}Ab_{61}Or_2$ from over 300 random point analyses) and most chondrules still contain a glassy groundmass. Combining these results, we conclude that LC3 is an H4 chondrite [e.g., 9].

Comparison with Lea County 001 and 002: Because LC3 was found in close proximity (only a few hundreds of meters apart) to the recovery site of Lea County 001 and 002 (hereafter LC1 and LC2, respectively) [4], it is necessary to consider pairing of LC3 with these two previously found chondrites. LC1 and LC2 are H5 and ungrouped type 3 chondrites, respectively [4]. It is evident from Fig. 3 that LC3 is not paired with LC2, containing abundant mafic silicates consistent with type 3. Although olivine and low-Ca pyroxene compositions of LC3 are generally similar to those of LC1, LC3 shows wider compositional variations, suggesting that these two stones are different

meteorites. Furthermore, most metal and troilite in LC1 are not as weathered as those of LC3 and the chondrule outlines of LC1 are more ambiguous than those of LC3. Shock stages are also different for these two meteorites. Some grains of silicates in LC1 show undulatory extinction suggesting a shock stage greater than S2 [8].

In order to further compare LC1 and LC3, we measured the concentration of cosmogenic ^{10}Be in the stony fraction of LC1 and LC3 as well as in the metal phase of LC1. Unfortunately we could not separate any clean metal from LC3, since it is more weathered than LC1. The concentrations of ^{10}Be in the stony fraction of LC1 and LC3 are 20.3 ± 0.4 and 20.6 ± 0.4 dpm/kg, respectively, typical for ordinary chondrites with exposure ages >5 My and terrestrial ages <100 ky. The fact that these concentrations are identical within the experimental errors does not mean these two meteorites are paired, because concentrations of 20-25 dpm/kg are quite common. Therefore, additional measurements of cosmogenic ^{26}Al and ^{36}Cl are in progress to further constrain the exposure and terrestrial histories of LC1 and LC3.

Concluding remarks: The deflation basins near Jal, New Mexico have yielded three individual meteorite finds from only about 1 km^2 area. The number of meteorites here is probably as great as that in Roosevelt County. Therefore, the Jal area promises further meteorite finds by a systematic search. We are planning additional searchs in February, 2000.

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Fig. 1. Typical deflation basins (blowouts) located between sand dunes. The basins show exposed brown surfaces nearly free from vegetation and large stones.

Fig. 2. Photomicrograph of Lea County 003 (Open nicol). Chondrules are partly weathered and replaced by brown alteration materials along cracks. The field of view is 1.3 mm.

Fig. 3. Histograms of random analyses of olivine and low-Ca pyroxenes in Lea County 001, 002 and 003 chondrites. Lea County 003 is different from both Lea County 001 (H5) and Lea County 002 (ungrouped type3 chondrite). The total number of analyses for olivine and pyroxene in Lea County 003 are 169 and 80, respectively. Data for Lea County 001 and 002 are from Zolensky et al. [4].