A UNIQUE CARBONACEOUS CHONDRITE: LEWIS CLIFF 85332; Alan E. Rubin and Gregory W. Kallemeyn, Institute of Geophysics and Planetary Physics, University of California, Los Angeles, CA 90024, USA.

The vast majority of carbonaceous chondrites belong to four major groups: CI, CM, CO and CV. Eight metamorphosed meteorites may constitute a fifth group [1,2]. Several additional chondrites (notably Al Rais and Renazzo) have been designated as members of a "CR" group [3], but because Al Rais and Renazzo are more compositionally divergent than other carbonaceous chondrite groups [4,5], it is uncertain if all the "CR" chondrites are members of a single group. A few unique carbonaceous chondrites have also been described including B-7904, Adelaide, Kaidun, and ALH85085. New petrologic and chemical data indicate that Lewis Cliff 85332 (hereafter LEW85332) is another unique carbonaceous chondrite.

LEW85332 is one of the least equilibrated chondrites known. It contains sharply defined chondrules (some with transparent colorless glassy mesostases), abundant low-Ca clinopyroxene and abundant fine-grained extremely ferroan matrix material. Olivine (Fa 0.25-37.0; mean Fa = 9.2±9.4) and low-Ca pyroxene (Fs 0.8-29.9) are very heterogeneous. Kamacite with substantial Cr (1.6 mg/g) and relatively low Co (2.5 mg/g) is similar in composition only to the kamacite in Renazzo and ALH85085. One kamacite grain in LEW85332 contains considerable Si (3.5 mg/g). Troilite contains appreciable Ni (7.2 mg/g). The thermoluminescence sensitivity indicates petrologic type 3.0-3.1 (D.W.G. Sears, pers. commun., 1989).

The meteorite is a breccia. There are three types of clasts in the one available thin section: (a) There are at least 10 primitive carbonaceous chondrite clasts that have affinities for both CI and CM. Like CM chondrites, several clasts contain one or two small chondrules and/or chondrule fragments. As in CI chondrites, magnetite occurs as framboids, platelets and massive rounded and angular grains. Metallic Fe-Ni (which is absent from CI) was observed in only one clast. These clasts were probably derived from outside the LEW85332 parent body and incorporated into the regolith as exotic projectiles. (b) Two troilite-rich clasts occur that contain abundant (~30 vol.%) ~10-µm-size clusters of small troilite grains, and minor (1-2 vol.%) mafic silicate grains surrounded by fine-grained matrix material; metallic Fe-Ni and magnetite are absent from these clasts. The origin of these clasts is problematic, but it is possible that they were formed by migrating sulfur-bearing hydrothermal fluids generated by impacts on carbonaceous chondrite parent bodies. (c) One unusual clast contains numerous (~3 vol.%) randomly oriented needles of schreibersite (with ~120 mg/g Ni) surrounded by fine-grained silicate matrix material. It seems possible that the schreibersite needles were initially rhabdites enclosed in metallic Fe-Ni that were preserved during an oxidation event.

Two fluffy type A refractory inclusions were identified. One inclusion is a complex layered structure consisting (from

the core outward) of Al-rich diopside, perovskite, melilite (Ak 22), spinel, Al-rich diopside and spinel. Diopside from the core and rim are connected at one edge of the inclusion. The other inclusion consists of massive melilite (Ak 22), accessory perovskite and rare metallic Fe-Ni with minor Pt, Ru and Ir.

The bulk composition of LEW85332 was determined by INAA. Relative to Mg and CI chondrites, LEW85332 has unfractionated refractory and common lithophiles (0.97-1.06×CI) and unfractionated refractory and common siderophiles (1.00-1.04×CI). However, moderately volatile Mn is low (0.84×CI). With the exception of Au (unfractionated at 1.05×CI), volatile siderophiles have low abundances, ranging from 0.48×CI for Sb to 0.84×CI for As. Selenium (0.40×CI) and Zn (0.25×CI) have very low abundances. The low abundances of Mn, As, Ga, Sb, Se and Zn in LEW85332 show that the meteorite is not closely related to CI chondrites.

LEW85332 is also not closely related to CM, CO, "CR" or ordinary chondrites. Relative to CM and CO chondrites, LEW85332 has low abundances of refractory lithophiles (by 5-10%) and high abundances of common siderophiles (by 5-10% and 12-14%, respectively). Relative to Al Rais and Renazzo, LEW85332 is significantly enriched in Mn and most volatile siderophiles. Relative to ordinary chondrites, LEW85332 has significantly higher abundances of refractory lithophiles, volatile siderophiles and chalcophiles.

It seems probable that LEW85332 is a carbonaceous chondrite: (a) Its matrix/chondrule ratio is higher than that of ordinary and enstatite chondrites and close to that of CO chondrites. (b) Fluffy type A refractory inclusions have been reported only in carbonaceous chondrites. (c) The large proportion of opaque-mineral-rich "spongy" chondrules is characteristic of carbonaceous chondrites. (d) Numerous primitive carbonaceous chondrite clasts are present. (e) Of all the major chondrite groups, CI chondrites are closest in bulk composition to LEW85332.

Besides differing from established carbonaceous chondrite groups in bulk composition, LEW85332 differs in its chondrule characteristics. LEW85332 chondrules (mean size 170 μm) are smaller than those in CM and CV chondrites and larger than those in all CO chondrites except Isna. Even so, the spread of chondrule sizes in Isna is appreciably smaller than that in LEW85332. The relative abundance of nonporphyritic chondrules in LEW85332 (~15%) is much greater than that in CV (0.3%) and CO (3%) chondrites and comparable to that in ordinary chondrites.

LEW85332 is thus another unique carbonaceous chondrite. Its existence serves to demonstrate that the diversity of materials produced in the solar nebula was substantially greater than currently represented in meteorite collections.

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