Antarctic Meteorite NEWSLETTER

A periodical issued by the Antarctic Meteorite Working Group to inform scientists of the basic characteristics of specimens recovered in the Antarctic.

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!!!!!!!! SAMPLE REQUEST DEADLINE: MARCH 27, 1987 (SEE PAGE 2) !!!!!!!!

METEORITE NOTES

In case you haven't already heard, there's a new Associate Curator for Antarctic Meteorites. Last fall Marilyn Lindstrom replaced Jim Gooding in that post. Jim is now working on advanced planning for a Mars Sample Return Mission. Both Jim and Marilyn will continue their research on planetary materials.

NEWS FROM THE 1986-87 ANSMET TEAM

The six member ANSMET team returned this year to Lewis Cliff in the Beardmore Glacier area of Antarctica. Good weather aided their search and approximately 570 specimens were collected. Most of these are small ordinary chondrites, a few are carbonaceous chondrites and achondrites. The majority of the specimens were found in a 200 x 15 meter area that contained many snow drifts. The team affectionately nicknamed this area Meteorite Moraine as they worked on their hands and knees picking up the meteorites.

Al-26 and TL SURVEYS FOR METEORITE TERRESTRIAL AGES

The Meteorite Working Group has recently approved two types of surveys of Antarctic meteorites which will identify meteorites with particularly short or long terrestrial ages or unusual thermal or radiation histories. The first is gamma-ray counting for Al-26. This technique is the standard means of determining terrestrial ages and is applied by several meteorite PIs (Bhandari, Herpers, Heydegger) to analyze small numbers of samples. John Evans (Battelle Northwest) proposes a survey of 150-200 meteorites per year. This study will contribute significantly to our database on terrestrial ages of meteorites. Evans has submitted a list of requested samples but is open to suggestions from other PIs of interesting samples for which no terrestrial age is available.

The second technique involves the natural thermoluminescence (TL) of meteorites. Derek Sears and Fouad Hasan (Univ. Arkansas) conducted a pilot study for MWG which showed that natural TL correlates well with Al-26 for most meteorites. The few samples for which the two measurements do not correlate have unusual thermal or radiation histories. The results are summarized in an article in the 17th LPSC (Hasan F.A., Haq M., and Sears D.W.G. (1986) The Natural Thermoluminescence of Meteorites-I: Twenty-three Antarctic Meteorites of Known Al-26 Content). Sears is setting up a laboratory to measure natural TL in survey mode. MWG has added TL measurement to the initial processing of meteorites beginning with the 1985 collection. We look forward to publishing the results of Evans' Al-26 and Sears' TL surveys in future issues of the Newsletter.

ARTICLE BY LIPSCHUTZ AND CASSIDY

Each copy of this issue is mailed with a companion copy (reprints courtesy of LPI) of the following article:

Lipschutz M.E. and Cassidy W.A. (1986) Antarctic Meteorites: A Progress Report, EOS 67, n47, p.1339-1341.

The article briefly summarizes for the geoscience audience various aspects of the collection, curation and study of Antarctic meteorites. For a different view of the topic aimed at the chemistry audience readers are referred to: Lipschutz M.E. (1986) The Worlds Beyond: Meteorite Studies, Analytical Chemistry, 58, 968A.

A few previous issues of the Newsletter have also been accompanied by other general interest articles on Antarctic meteorites. Authors of similar articles who would like to make general distributions of reprints are invited to contact the editor to discuss details.

NEW METEORITES FROM 1983-1985 COLLECTIONS

Pages 6-17 contain preliminary descriptions and classifications of meteorites that were completed since publication of issue 9(3) (August, 1986). Some large (>150g) specimens (regardless of petrologic type) and all "pebble"-sized (<150g) specimens of special petrologic type (carbonaceous chondrite, unequilibrated ordinary chondrite, achondrite, etc.) are represented by separate descriptions. However, some specimens of non-special petrologic type are listed only as single line entries in Table 1. For convenience, new specimens are also recast by petrologic type in Table 2.

Macroscopic descriptions of stony meteorites were performed at NASA/JSC. These descriptions summarize hand-specimen features observed during initial examination. Classification is based on microscopic petrography and reconnaissance-level electron micro-probe analyses using polished sections prepared from a small chip of each meteorite. For each stony meteorite the sample number assigned to the preliminary examination section is included. In some cases, however, a single microscopic description was based on thin sections of several specimens believed to be members of a single fall.

Meteorite descriptions contained in this issue were contributed by the following individuals:

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Table 1.

List of Newly Classified Antarctic Meteorites **

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 83012	202.7	H-5 CHONDRITE	B/C	B	18	16
EET 83300	115.1	H-5 CHONDRITE	C	B	18	16
EET 83317	119.0	L-6 CHONDRITE	B	A	23	20
EET 83323	140.5	L-6 CHONDRITE	B	B	23	20
EET 83326	112.6	H-5 CHONDRITE	C	B	17	15
EET 83342	148.6	L-6 CHONDRITE	B	B	23	20
EET 83343	125.1	L-6 CHONDRITE	B	A	23	20
ALH 84101	220.9	H-6 CHONDRITE	C	B	19	17
ALH 84102	213.9	L-6 CHONDRITE	B	B	24	21
ALH 84103	137.5	H-4 CHONDRITE	B	A	17	15
ALH 84104	201.1	L-6 CHONDRITE	B	B	24	20
ALH 84105	260.9	H-6 CHONDRITE	C	C	15	14
ALH 84108	214.8	H-6 CHONDRITE	B	B	18	16
ALH 84109	245.9	H-6 CHONDRITE	B/C	A/B	19	16
ALH 84110	318.5	H-6 CHONDRITE	B/C	A	18	16
ALH 84112	145.8	L-6 CHONDRITE	A/B	B	24	21
ALH 84113	212.1	H-6 CHONDRITE	B/C	B	18	16
ALH 84114	119.9	H-6 CHONDRITE	B	B	18	16
ALH 84115	194.5	H-6 CHONDRITE	B/C	B	18	16
ALH 84118	113.7	H-6 CHONDRITE	B	B	18	16
ALH 84120	129.0	L-3 CHONDRITE	A/B	A	22	6-21
ALH 84124	114.5	H-5 CHONDRITE	C	B/C	18	16
ALH 84132	157.8	L-6 CHONDRITE	B	A	23	20
ALH 84134	113.4	L-6 CHONDRITE	B	A	23	20
ALH 84140	164.0	L-6 CHONDRITE	C	B	24	21
ALH 84141	130.3	L-6 CHONDRITE	B	B	24	21
ALH 84148	168.4	H-5 CHONDRITE	C	C	17	15
ALH 84159	100.8	H-6 CHONDRITE	C	A/B	19	17
ALH 84163	134.9	H-5 CHONDRITE	C	A	17	15
ALH 84164	101.4	L-6 CHONDRITE	A/B	A	24	20
ALH 85003	50.1	CARBONACEOUS C3O	A/B	A	1-56	0.5-23
ALH 85004	8.4	CARBONACEOUS C2	B	C		
ALH 85010	3.2	CARBONACEOUS C2	A/B	A	0.7-28	3-20
ALH 85011	10.7	CARBONACEOUS C2	A/B	A	0.6-39	.8-2.5
ALH 85012	3.9	CARBONACEOUS C2	B	B	0.5-18	0.7-46
ALH 85016	1412.0	L-6 CHONDRITE	A/B	A	23	20
ALH 85017	2361.4	L-6 CHONDRITE	A	A	24	20
ALH 85018	811.8	H-6 CHONDRITE	B	A	17	15
ALH 85019	632.8	LL-6 CHONDRITE	A	A	28	23
ALH 85020	744.3	H-6 CHONDRITE	B	B	17	15
ALH 85021	646.8	H-5 CHONDRITE	B	B	17	15
ALH 85022	951.5	L-6 CHONDRITE	B	A	24	20
ALH 85023	438.5	H-6 CHONDRITE	B/C	A	18	16
ALH 85024	387.7	H-5 CHONDRITE	B/C	A/B	18	15

Table 1 (cont.).

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 85025	713.0	H-5 CHONDRITE	C	A/B	18	16
ALH 85026	817.1	L-6 CHONDRITE	A	A	24	21
ALH 85027	370.4	L-6 CHONDRITE	B	A	24	20
ALH 85028	325.7	H-6 CHONDRITE	C	B	19	17
ALH 85029	388.8	L-6 CHONDRITE	A/B	A	24	21
ALH 85030	619.7	H-6 CHONDRITE	B/C	A	17	15
ALH 85031	200.6	H-6 CHONDRITE	B/C	A	17	15
ALH 85032	424.2	H-6 CHONDRITE	C	A	17	15
ALH 85033	249.8	L-4 CHONDRITE	A	A	23	6-24
ALH 85034	343.9	L-6 CHONDRITE	A	A/B	24	21
ALH 85035	420.1	LL-6 CHONDRITE	C	B	27	23
ALH 85036	231.5	H-6 CHONDRITE	C	A	19	16
DOM 85501	126.2	H-5 CHONDRITE	C	A	17	15
DOM 85502	302.2	L-6 CHONDRITE	B	B	24	21
DOM 85503	719.7	L-6 CHONDRITE	A	B	25	21
DOM 85504	120.6	L-4 CHONDRITE	B/C	A	24	18-21
GEO 85700	2409.0	L-6 CHONDRITE	B	A	24	20
GEO 85701	438.6	L-6 CHONDRITE	A	A	23	20
GRO 85203	1450.4	H-5 CHONDRITE	B	B	18	16
GRO 85204	1754.7	L-6 CHONDRITE	A	A/B	24	21
GRO 85205	999.9	L-6 CHONDRITE	A/B	A	25	20
GRO 85206	2420.1	H-5 CHONDRITE	B/C	B	17	15
GRO 85207	2372.1	L-6 CHONDRITE	A/B	A	24	20
GRO 85208	1356.9	L-6 CHONDRITE	A	A	23	20
GRO 85209	1126.1	L-6 CHONDRITE	A	A	25	21
GRO 85210	246.8	H-5 CHONDRITE	B	A	18	16
GRO 85211	355.3	H-5 CHONDRITE	B	A	19	17
GRO 85212	342.2	L-4 CHONDRITE	B	A/B	23	16-20
GRO 85213	4364.4	L-6 CHONDRITE	B	A	23	20
LEW 85307	1.7	CARBONACEOUS C2	A	A	0.6-46	
LEW 85314	14.0	H-5 CHONDRITE	C	A/B	18	16
LEW 85315	10.2	H-6 CHONDRITE	C	A	18	16
LEW 85316	34.3	H-5 CHONDRITE	C	B/C	17	15
LEW 85318	152.2	H-5 CHONDRITE	C	B	17	15
LEW 85319	11000.0	H-5 CHONDRITE	B/C	B	18	16
LEW 85321	527.0	L-6 CHONDRITE	B/C	A	24	20
LEW 85322	582.0	H-6 CHONDRITE	C	A	19	17
LEW 85323	874.4	L-6 CHONDRITE	B	A	23	20
LEW 85324	514.1	H-5 CHONDRITE	B	B	18	16
LEW 85325	536.9	L-6 CHONDRITE	B/C	A	25	21
LEW 85326	224.7	H-5 CHONDRITE	C	A	19	17
LEW 85328	106.8	UREILITE	B/C	A	20	17
LEW 85329	169.6	H-6 CHONDRITE	A/B	A	19	16
LEW 85332	113.7	CARBONACEOUS C3O	B/C	B	1-20	1-16
LEW 85333	47.9	L-4 CHONDRITE	B	A	25	21
LEW 85345	32.2	H-5 CHONDRITE	B/C	A	17	16
LEW 85353	24.5	EUCRITE	B	A/B		22-62
LEW 85361	4.2	L-6 CHONDRITE	C	B	23	20

Table 1 (cont.).

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
LEW 85365	7.5	L-4 CHONDRITE	C	A	24	20
LEW 85387	3.8	H-5 CHONDRITE	C	A	17	15
LEW 85390	1.5	L-4 CHONDRITE	C	A/B	24	12-24
LEW 85396	60.2	L-3 CHONDRITE	C	A	2-26	3-25
LEW 85401	3.9	L-3 CHONDRITE	B/C	A	1-28	1-20
LEW 85440	43.8	UREILITE	B	A/B	9	8
LEW 85441	10.9	HOWARDITE	B	A/B		25-48
LEW 85471	239.2	L-6 CHONDRITE	C	A	25	22
MIL 85600	496.9	H-5 CHONDRITE	C	A	18	15

Table 2.

Newly Classified Specimens Listed By Type **

Achondrites

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
LEW 85353	24.5	EUCRITE	B	A/B		22-62
LEW 85441	10.9	HOWARDITE	B	A/B		25-48
LEW 85328	106.8	UREILITE	B/C	A	20	17
LEW 85440	43.8	UREILITE	B	A/B	9	8

Carbonaceous Chondrites

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 85004	8.4	CARBONACEOUS C2	B	C		
ALH 85010	3.2	CARBONACEOUS C2	A/B	A	0.7-28	3-20
ALH 85011	10.7	CARBONACEOUS C2	A/B	A	0.6-39	.8-2.5
ALH 85012	3.9	CARBONACEOUS C2	B	B	0.5-18	0.7-46
LEW 85307	1.7	CARBONACEOUS C2	A	A	0.6-46	
ALH 85003	50.1	CARBONACEOUS C3O	A/B	A	1-56	0.5-23
LEW 85332	113.7	CARBONACEOUS C3O	B/C	B	1-20	1-16

Chondrites - Type 3

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 84120	129.0	L-3 CHONDRITE	A/B	A	22	6-21
LEW 85396	60.2	L-3 CHONDRITE	C	A	2-26	3-25
LEW 85401	3.9	L-3 CHONDRITE	B/C	A	1-28	1-20

Table 2 (cont.).

Chondrites - Type 4

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 84103	137.5	H-4 CHONDRITE	B	A	17	15
ALH 85033	249.8	L-4 CHONDRITE	A	A	23	6-24
DOM 85504	120.6	L-4 CHONDRITE	B/C	A	24	18-21
GRO 85212	342.2	L-4 CHONDRITE	B	A/B	23	16-20
LEW 85333	47.9	L-4 CHONDRITE	B	A	25	21
LEW 85365	7.5	L-4 CHONDRITE	C	A	24	20
LEW 85390	1.5	L-4 CHONDRITE	C	A/B	24	12-24

** NOTES TO TABLES 1 and 2:

"Weathering" categories:

A: Minor rustiness; rust haloes on metal particles and rust stains along fractures are minor.
B: Moderate rustiness; large rust haloes occur on metal particles and rust stains on internal fractures are extensive.
C: Severe rustiness; metal particles have been mostly stained by rust throughout.

"Fracturing" categories:

A: Minor cracks; few or no cracks are conspicuous to the naked eye and no cracks penetrate the entire specimen.
B: Moderate cracks; several cracks extend across exterior surfaces and the specimen can be readily broken along the cracks.
c: Severe cracks; specimen readily crumbles along cracks that are both extensive and abundant.

Table 3 summarizes possible pairings of the new specimens with each other and with previously classified specimens, based on descriptive data in this newsletter issue. Readers who desire a more comprehensive review of the meteorite pairings in the U. S. Antarctic collection should refer to the compilation provided by Dr. E. R. D. Scott, as published in issue 9(2) (June, 1986).

TABLE 3.

TENTATIVE PAIRINGS FOR NEW SPECIMENS

Carbonaceous C2:

ALH85004 with ALH83100.

ALH85010, 85011, 85012 with ALH85005.

LEW85307 with LEW85306.

Carbonaceous C3O:

ALH85003 with ALH82101.

L-3 Chondrite:

LEW85396, 85401.

L-6 Chondrite:

EET83317, 83323, 83342, 83343.

H-6 Chondrite:

ALH85030, 85031, 85032.

Sample No.: ALH84120
Weight (g): 129.0
Dimensions (cm): 4x4.5x3
Meteorite Type: L3 Chondrite

Location: Allan Hills
Field No.: 1545

Macroscopic Description: Roberta Score

Thirty percent of ALH84120 is covered with fusion crust. Areas devoid of fusion crust have a brownish-gray color. The interior of this unequilibrated chondrite is medium-gray in color and contains numerous light and dark gray rounded and irregular shaped inclusions. Oxidation is light and mainly appears as haloes around metal grains.

Thin Section (,3) Description: Brian Mason

The section shows an aggregate of chondrules (0.3-1.8 mm across) and chondrule fragments in a fine-grained matrix of olivine and pyroxene with minor amounts of nickel-iron and troilite. A variety of chondrule types is present; a barred chondrule has transparent pale brown glass between the olivine bars. Most of the pyroxene is polysynthetically twinned clinobronzite. Minor weathering is indicated by brown limonitic staining around metal grains. Microprobe analyses show most olivine of fairly uniform composition, averaging Fa_{22}, but with a few more magnesian grains (CV FeO is 8). Pyroxene composition is more variable, Fs_{6-21}. The meteorite is classified as an L3 chondrite, probably L3.8-3.9.

Sample No.: ALH85003
Weight (g): 50.1
Dimensions (cm): 4x3.5x2.5
Meteorite Type: C3O Chondrite

Location: Allan Hills
Field No.: 2259

Macroscopic Description: Rene Martinez

Thick patchy fusion crust covers approximately 70% of this carbonaceous chondrite. The interior is light gray and chondrules/clasts are not distinguishable in the granular matrix. A 1 mm thick weathering rind and small patches of rust are present.

Thin Section (,4) Description: Brian Mason

The thin section shows an aggregate of small chondrules (up to 0.9 mm diameter, but most are less than 0.6 mm), chondrule fragments, and irregular aggregates set in a translucent yellow-brown matrix. Chondrules are mainly granular or porphyritic olivine. Minor amounts of nickel-iron and sulfide are present, as small grains scattered throughout the section. Microprobe analyses of olivine show a wide composition range, Fa_{1-56}, mean Fa_{17}; only a few grains of pyroxene were found, having a composition range of $Fs_{0.5-23}$. The meteorite is classified as a C3 chondrite of the Ornans subtype; it is so similar to ALH82101 that the possibility of pairing should be considered.

Sample No.:	ALH85004	Location:	Allan Hills
Weight (g):	8.4	Field No.:	2298
Dimensions (cm):	ten pieces		
Meteorite Type:	C2 Chondrite		

Macroscopic Description: Rene Martinez

ALH85004 consists of ten fragments plus many fines. All fragments are black and fine-grained.

Thin Section (,3) Description: Brian Mason

The thin section shows small chondrules, irregular aggregates, and mineral grains in a dark brown to black matrix. Practically all the chondrules, aggregates, and mineral grains consist of pale green isotropic serpentinous material; a few grains of calcite were identified. The meteorite is a C2 chondrite; the extreme degree of serpentinization is reminiscent of ALH83100.

Sample No.:	ALH85010, 85011, 85012	Location:	Allan Hills
Weight (g):	3.2; 10.7; 3.9	Field Nos.:	2294; 2653; 2221
Dimensions (cm):	2x1x0.5; 2.5x2.5x3; many small pieces		
Meteorite Type:	C2 Chondrite		

Macroscopic Description: Rene Martinez

Thick fusion crust is present on some of these carbonaceous chondrite fragments and not on others. All specimens have small (<1 mm) white rounded and irregular inclusions set in a fine-grained black matrix. Each fragment of ALH85012 has small amounts of evaporite deposit present. Visible oxidation is minor.

Thin Section (ALH85005,4) Description: Brian Mason

The section consists largely of black opaque matrix, through which are scattered small mineral grains (up to 0.2 mm) and sparse chondrules and chondrule fragments. The condrules and most of the mineral grains consist of olivine, usually close to Mg_2SiO_4 in composition but with some more iron-rich. Pyroxene is less common, and is close to $MgSiO_3$ in composition. A few grains of calcite were noted. The meteorite is a C2 chondrite; ALH85010, 85011, and 85012 as well as ALH85007, 85008, 85009, and 85013 are very similar to ALH85005 and the possibility of pairing should be considered.

Sample No.: LEW85307
Weight (g): 1.7
Dimensions (cm): 2x1x1
Meteorite Type: C2 Chondrite

Location: Lewis Cliff
Field No.: 3178

Macroscopic Description: Rene Martinez

LEW85307 is rounded and is totally covered with smooth fusion crust. Numerous <1 mm-sized white inclusions are present in the black matrix.

Thin Section (LEW85306,3) Description: Brian Mason

The section shows numerous mineral grains and aggregates and a few small (maximum diameter 0.6 mm) chondrules in a brown to black matrix. Most of the mineral grains are olivine, usually near Mg_2SiO_4 in composition, but some are more iron-rich. Pyroxene is less abundant, and is near $MgSiO_3$ in composition. The meteorite is a C2 chondrite. LEW85307 as well as 85009, 85011, and 85012 are very similar to LEW85306 and probably paired with it.

Sample No.: LEW85328
Weight (g): 106.8
Dimensions (cm): 5x4x2
Meteorite Type: Ureilite

Location: Lewis Cliff
Field No.: 2035

Macroscopic Description: Cecilia Satterwhite

LEW85328 is covered by black fusion crust which has well defined ablation marks and is frothy in some areas. An ablation flange is present. Two mm-sized brown crystals make up the interior of this achondrite.

Thin Section (,5) Description: Brian Mason

The section shows an aggregate of anhedral to subhedral grains (0.3-2.4 mm across) of olivine and pyroxene, in the approximate proportions of 2:1. Individual grains are rimmed by carbonaceous material. Trace amounts of finely-divided nickel-iron and troilite are present, mainly along grain boundaries. Microprobe analyses show olivine of uniform composition (Fa_{20}) with notably high CaO content (0.3%); the pyroxene is pigeonite with composition Wo_9Fs_{17}. The meteorite is a ureilite; it is notably unshocked compared to most ureilites.

Sample No.: LEW85332
Weight (g): 113.7
Dimensions (cm): 5.5x4x3.5
Meteorite Type: C3O Chondrite

Location: Lewis Cliff
Field No.: 2425

Macroscopic Description: Rene Martinez
Dark fusion crust covers all but one exterior surface. Fine-grained dark gray matrix with a few <1 mm-sized light color inclusions make up the interior of this carbonaceous chondrite.

Thin Section (,4) Description: Brian Mason
The section shows an aggregate of small chondrules (up to 1.2 mm across, but most are less than 0.5 mm), chondrule fragments, and irregular granular masses set in a translucent yellow-brown matrix. Chondrules are mainly granular or porphyritic olivine. Minor amounts of nickel-iron and sulfide are present, as small grains scattered through the matrix, sometimes concentrated around chondrule rims. Olivine shows a wide composition range, Fa_{1-20}, mean Fa_9; pyroxene is less abundant, and has composition range Fs_{1-16}. The meteorite is classified as a C3 chondrite of the Ornans subtype.

Sample No.: LEW85353
Weight (g): 24.5
Dimensions (cm): 4x2x2
Meteorite Type: Eucrite

Location: Lewis Cliff
Field No.: 3188

Macroscopic Description: Rene Martinez
This pebble retains most of its thin fusion crust. Weathering of the stone has removed some fusion crust and left a pitted surface. The interior is light gray and has a basaltic texture.

Thin Section (,3) Description: Brian Mason
The section shows a fine-grained aggregate (grains 0.1-0.4 mm) of pale brown pyroxene and colorless plagioclase, with a few opaque grains. Minor weathering is indicated by brown limonitic staining around opaque grains. Plagioclase is fairly uniform in composition, mean An_{88}. Pyroxene is largely hypersthene of mean composition Wo_2Fs_{60}, together with some augite, $Wo_{48}Fs_{22}$; the augite shows exsolution lamellae of hypersthene. The meteorite is an unbrecciated eucrite.

Sample No.: LEW85396
Weight (g): 60.2
Dimensions (cm): 4.5x3.0x2.0
Meteorite Type: L3 Chondrite

Location: Lewis Cliff
Field No.: 3102

Macroscopic Description: Cecilia Satterwhite
Some exterior surfaces retain the black fusion crust. Areas without fusion crust are dark brown and show some light colored chondrules/inclusions. The interior is extensively weathered, though a few small inclusions/chondrules are visible.

Thin Section (,3) Description: Brian Mason
The section shows a closely packed mass of chondrules (0.3-1.8 mm across), chondrule fragments, and irregular granular aggregates, set in a small amount of dark matrix which includes minor amounts of nickel-iron and troilite. Most chondrules consist of granular or porphyritic olivine, some with polysynthetically twinned clinopyroxene. Some weathering is indicated by the presence of a moderate amount of brown limonite as veinlets and patches. Both olivine and pyroxene show a wide range in composition: olivine, Fa_{2-26}, mean Fa_{13}; pyroxene, Fs_{3-25}. This range of compositions indicates type 3, and the small amount of nickel-iron suggests L group; the meteorite is therefore classed as an L3 chondrite.

Sample No.: LEW85401
Weight (g): 3.9
Dimensions (cm): 2x1.5x1
Meteorite Type: L3 Chondrite

Location: Lewis Cliff
Field No.: 3124

Macroscopic Description: Roberta Score
Entire angular stone is covered with dull black and brown fusion crust. Interior is heavily oxidized but the clastic nature of LEW85401 is still visible.

Thin Section (,2) Description: Brian Mason
The section is very similar to that of LEW85396, and the same description applies to both. Olivine and pyroxene show similar ranges in composition, although the mean Fa of olivine is lower in LEW85401: olivine, Fa_{1-28}, mean Fa_7; pyroxene, Fs_{1-20}. This meteorite is therefore classified as an L3 chondrite, and the possibility of pairing with LEW85396 should be considered.

Sample No.: LEW85440
Weight (g): 43.8
Dimensions (cm): 4.5x2.5x2
Meteorite Type: Ureilite

Location: Lewis Cliff
Field No.: 2023

Macroscopic Description: Roberta Score
Thin black fusion crust covers sixty percent of LEW85440. Greenish-gray streaks appear on all fusion crusted surfaces. Abundant minerals all showing crystal faces and areas of heavy oxidation make up the black interior.

Thin Section (,4) Description: Brian Mason
The section shows an equigranular aggregate of olivine and pyroxene, as rounded to subhedral grains 0.3-0.6 mm across. The grains are rimmed with black carbonaceous material, which contains trace amounts of nickel-iron (partly weathered to brown limonite) and troilite. Microprobe analyses show olivine and pyroxene of uniform composition: olivine, Fa_9 (CaO 0.3%); pyroxene Wo_5Fs_8. The meteorite is a ureilite; it appears to be relatively unshocked.

Sample No.: LEW85441
Weight (g): 10.9
Dimensions (cm): 3x2x1.5
Meteorite Type: Howardite

Location: Lewis Cliff
Field No.: 3125

Macroscopic Description: Roberta Score
Fifty percent of the exterior of this achondrite is covered with dull, frothy fusion crust. Areas devoid of fusion crust are brownish-gray and contain numerous clasts. The exposed interior is lighter and grayer in color than the exterior. Abundant clasts, polymict and monomict, are present. Concentrated areas of oxidation do exist.

Thin Section (,3) Description: Brian Mason
The section has a cataclastic texture, with angular fragments of pyroxene and plagioclase up to 2 mm across in a comminuted groundmass of these minerals. The pyroxene is mainly hypersthene, but ranges widely in composition: Wo_{1-10}, Fs_{25-48}, with a mean of Wo_4Fs_{28}. Plagioclase is fairly uniform in composition, mean An_{93}. The presence of a significant amount of pyroxene of diogenitic composition indicates that this meteorite can be classified as a howardite.