



# *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 REQUESTS and ALLOCATIONS

The Meteorite Working Group will meet from April 14-17, 1983, for the purpose of reviewing requests for Antarctic Meteorites.

Requests for specific samples (including sample name/number, weight requested, a brief description of the intended meteorite investigation, and pertinent sample specifics) should be sent to:

Secretary, MWG  
Planetary Materials Branch, SN2  
NASA, Johnson Space Center  
Houston, TX 77058

HIGHLIGHTS OF THE 1982-83 FIELD SEASON

1. A major new area of meteorite concentration has been discovered only 325 miles from the South Geographic Pole at the Pecora Escarpment. A reconnaissance team, traveling by snow mobile and sledge, visited the site during late December and January and established the existence of the meteorite concentration but was unable to examine more than a small fraction of the total area of exposed ice. The potential for large-scale future recovery here is considered excellent.
2. Important new concentrations of meteorites were identified by the same team at Davies and Moulton Escarpments in the vicinity of the Thiel Mountains.
3. Another field team established the occurrence of meteorites at the Allan Hills Far Western Ice Field. This was a surprise because during a brief visit some years earlier, none had been found; therefore this very large area of exposed ice had been considered barren of meteorites.
4. This field team also revisited Elephant Moraine and made reconnaissance searches which greatly enlarge the known areas of meteorite occurrence in that region.
5. A chondrite was found apparently weathering out of the ice at the Far Western Ice Field. This specimen was collected in situ in a large block of encasing ice.
6. Total meteorite recoveries for both teams were as follows:

3 carbonaceous chondrites  
7 achondrites  
103 chondrites  
113 Total

This is smaller than in other years, but is considered satisfactory in view of the primarily reconnaissance nature of the total effort this year.

7. Progress was made in extending the Allan Hills triangulation chain further to the west.

ANTARCTIC METEORITES - NEW CLASSIFICATIONS

NAME	WEIGHT	CLASSIFICATION	WEATHERING	FRACTURING	PAGE
ALHA81001	52.9	Eucrite (anomalous)	A	B	1
ALHA81002	14.0	Carbonaceous C2	A	B	1
ALHA81003	10.1	Carbonaceous C3V	A/B	A/B	2
ALHA81004	4.7	Carbonaceous C2	A/B	A	2
ALHA81005	31.4	Anorthositic Breccia	A/B	A	3
ALHA81006	254.9	Eucrite (polymict)	A	A/B	4
ALHA81007	163.5	Eucrite (polymict)	A/B	A	4
ALHA81008	43.8	Eucrite (polymict)	A/B	A/B	5
ALHA81009	229.0	Eucrite	A	A	5
ALHA81010	219.1	Eucrite (polymict)	A	A	6
ALHA81011	405.7	Eucritic Breccia	A/B	A	6
ALHA81012	36.6	Eucrite	A/B	A	7
ALHA81013	17727.0	Iron			7
ALHA81014	188.2	Iron			8
ALHA81015	5489.0	H-5 Chondrite	B	B	9
ALHA81016	3850.2	L-6 Chondrite	B	A	9
ALHA81017	1434.4	L-5 Chondrite	B	A	10
ALHA81018	2236.9	L-5 Chondrite	B	B	10
ALHA81019	1051.2	H-5 Chondrite	B/C	B	11
ALHA81020	1352.5	H-5 Chondrite	B	A	11
ALHA81021	695.1	E-6 Chondrite	C	B	12
ALHA81022	912.5	H-4 Chondrite	B/C	A	12
ALHA81023	418.3	L-5 Chondrite	B	A/B	13
ALHA81024	797.7	L-3 Chondrite	C	B	13
ALHA81025	379.0	LL-3 Chondrite	C	B	14
ALHA81026	515.5	L-6 Chondrite	B	A	15
ALHA81027	3835.3	L-6 Chondrite	C	A/B	15
ALHA81030	1851.6	LL-3 Chondrite	B/C	B/C	16
ALHA81031	1594.9	LL-3 Chondrite	C	B/C	16
ALHA81032	726.8	LL-3 Chondrite	C	A	17
ALHA81033	252.4	H-5 Chondrite	C	C	17
ALHA81034	254.9	H-5 Chondrite	B	B	18
ALHA81035	256.1	H-6 Chondrite	C	A/B	18
ALHA81036	252.1	H-5 Chondrite	C	A	19
ALHA81037	320.3	H-6 Chondrite	B	A	19
ALHA81038	229.0	H-6 Chondrite	C	B	20
ALHA81039	205.9	H-5 Chondrite	A/B	B	20
ALHA81040	194.5	L-4 Chondrite	B/C	A	21
ALHA81042	534.4	H-5 Chondrite	C	C	21
ALHA81044	386.8	H-4 Chondrite	C	C	22
ALHA81048	190.6	H-4 Chondrite	B/C	B/C	22
ALHA81059	539.5	Mesosiderite	C	B/C	23
ALHA81067	227.6	H-5 Chondrite	C	B	23
ALHA81093	271.0	H-6 Chondrite	A/B	A/B	24
ALHA81102	196.0	H-6 Chondrite	B/C	A/B	24
ALHA81111	210.3	H-6 Chondrite	B/C	B	25
ALHA81251	158.0	LL-3 Chondrite	B/C	B	25

Probable pairings of the 1981 Allan Hills Meteorites. \*\*

C2: ALHA77306, 78261, 81002, 81004.

L3: ALHA81024 with the ALHA77011 group.

LL3: ALHA79003, 81025, 81031, 81032.

L5: ALHA81017, 81018, 81023.

H4: ALHA81044, 81048 with the ALHA77004 group.

H4: ALHA77009, 78084, 81022.

H6: ALHA81035, 81038.

Eucrite: ALHA81009, 81012.

Polymict Eucrite: ALHA81006, 81007, 81008, 81010 with the  
ALHA76005 group.

\*\* See Vol. 5 No. 1 for complete listing.

ANTARCTIC METEORITE AL26 DATA - John Evans, Battelle Northwest

SITE	SAMPLE	CLASSIFICATION	WEATHERING	AL26 (DPM/KG)	+/-
ALHA	76004	LL3	A	58.	6.
ALHA	76005	EU	A	89.	9.
ALHA	76006	H6	C	51.	5.
ALHA	76007	L6	B	45.	4.
ALHA	76008	H6	B/C	11.	1.
ALHA	77001	L6	B	52.	5.
ALHA	77002	L5	B	30.	3.
ALHA	77003	C03	A	45.	5.
ALHA	77004	H4	C	52.	5.
ALHA	77009	H4	C	32.	2.
ALHA	77010	H4	C	49.	3.
ALHA	77011	L3	C	39.	4.
ALHA	77014	H5	C	55.	3.
ALHA	77015	L3	C	36.	4.
ALHA	77025	H5	C	54.	5.
ALHA	77062	H5	B	47.	5.
ALHA	77071	H5	B	55.	6.
ALHA	77081	H	B	42.	4.
ALHA	77086	H5	C	58.	6.
ALHA	77115			48.	3.
ALHA	77118	H5	C	53.	5.
ALHA	77124	H5	C	70.	7.
ALHA	77140	L3	C	40.	4.
ALHA	77144	H6	B	56.	6.
ALHA	77150	L6	C	43.	4.
ALHA	77164	L3	C	44.	5.
ALHA	77167	L3	C	37.	2.
ALHA	77177	H5	C	54.	3.
ALHA	77182	H5	C	41.	4.
ALHA	77190	H4	C	51.	3.
ALHA	77191	H4	C	56.	4.
ALHA	77192	H4	C	55.	6.
ALHA	77208	H4	C	52.	3.
ALHA	77214	L3	C	56.	6.
ALHA	77215	L3	B	36.	4.
ALHA	77216	L3	A/B	40.	3.
ALHA	77217	L3	B	38.	3.
ALHA	77224	H4	C	51.	3.
ALHA	77225	H4	C	51.	3.
ALHA	77230	L4	C	51.	3.
ALHA	77232	H4	C	54.	3.
ALHA	77233	H4	C	47.	3.
ALHA	77249	L3	C	37.	2.

ALHA 77258	H6	B/C	29.	2.
ALHA 77260	L3	C	37.	2.
ALHA 77261	L6	B	36.	4.
ALHA 77262	H4	B/C	47.	5.
ALHA 77269	L6	B	49.	3.
ALHA 77270	L6	A/B	40.	3.
ALHA 77271	H6	C	39.	2.
ALHA 77272	L6	B/C	35.	4.
ALHA 77273	L6	B	31.	2.
ALHA 77278	LL3	A	28.	3.
ALHA 77282	L6	B	49.	3.
ALHA 77284	L6	A/B	45.	5.
ALHA 77285	H6	C	38.	4.
ALHA 77286	H4	C	54.	4.
ALHA 77288	H6	C	45.	3.
ALHA 77294	H5	A	61.	4.
ALHA 77296	L6	A/B	67.	4.
ALHA 77297	L6	A	70.	7.
ALHA 77299	H3	A	43.	4.
ALHA 77300	H5	C	54.	4.
ALHA 77304	LL3	B	50.	3.
ALHA 78001	PEB		50.	4.
ALHA 78003	PEB		59.	4.
ALHA 78038	L3	C	36.	3.
ALHA 78039	L6	B	42.	3.
ALHA 78041	PEB		38.	3.
ALHA 78042	L6	B	45.	2.
ALHA 78043	L6	B	38.	3.
ALHA 78044	L4	B/C	51.	4.
ALHA 78045	L6	B/C	34.	3.
ALHA 78046	PEB		46.	5.
ALHA 78048	L6	A/B	59.	5.
ALHA 78049	PEB		52.	3.
ALHA 78050	L6	B	44.	3.
ALHA 78051	PEB		38.	3.
ALHA 78052	H5	C	56.	4.
ALHA 78074	L6	B	66.	3.
ALHA 78076	H6	B	52.	4.
ALHA 78077	H4	C	42.	3.
ALHA 78102	H5	B/C	35.	3.
ALHA 78103	L6	B	58.	3.
ALHA 78104	L6	B	53.	3.
ALHA 78105	L6	B	61.	7.
ALHA 78106	L6	A/B	44.	4.
ALHA 78109	LL5	A/B	46.	3.
ALHA 78112	L6	B	42.	3.
ALHA 78114	L6	B/C	38.	2.
ALHA 78115	H6	B	43.	3.
ALHA 78126	L6	B	45.	3.
ALHA 78128	H5	C	34.	2.
ALHA 78130	L6	B/C	51.	4.
ALHA 78131	L6	B/C	40.	3.

ALHA	78132	EU	A	68.	4.
ALHA	78134	H4	B/C	61.	3.
ALHA	78170	PEB		48.	4.
ALHA	78173	PEB		64.	5.
ALHA	78190	PEB		67.	6.
ALHA	78194	PEB		74.	5.
ALHA	78235	PEB		38.	5.
ALHA	78251	L6	B	56.	6.
ALHA	81005	BAC	A/B	46.	3.
RKPA	78001	L6	C	49.	3.
RKPA	78003	L6	C	50.	3.
RKPA	78004	H4	A	39.	2.
RKPA	78005	PEB		65.	5.
RKPA	79001	L6	B	58.	4.
RKPA	79002	L6	B	60.	3.
RKPA	79003	H6	B	59.	4.
RKPA	79004	H5	B/C	45.	3.
RKPA	80201	H6	B	52.	3.
RKPA	80202	L6	B	53.	3.
RKPA	80231	H6	C	62.	4.
RKPA	80233	H5	B/C	67.	4.
RKPA	80234	LL5	B	58.	3.
RKPA	80235	LL6	A/B	55.	3.
META	78001	H4	B/C	53.	3.
META	78002	L6	B	47.	3.
META	78003	L6	B	50.	3.
META	78004	PEB		49.	4.
META	78005	L6	B	44.	3.
META	78006	H6	C	60.	4.
META	78009	PEB		68.	4.
META	78010	H5	B	56.	3.
META	78011	PEB		39.	3.
META	78013	PEB		61.	4.
META	78014	PEB		68.	4.
META	78015	PEB		42.	5.
META	78018	PEB		58.	4.
META	78019	PEB		108.	6.
META	78021	PEB		52.	12.
META	78023	PEB		54.	5.
META	78025	PEB		33.	2.
META	78027	PEB		69.	6.
META	78028	L6	B	56.	3.
BTNA	78001	L6	B	65.	4.
BTNA	78004	LL6	B	49.	3.
BTNA	78005	PEB		40.	2.

YAMA	7301	H4	26.	3.
YAMA	74080	L6	48.	3.
YAMA	74116	CHO	31.	2.
YAMA	74192	H6	69.	4.
YAMA	74193	H5	43.	2.
YAMA	74374	H6	55.	3.
YAMA	74418	H6	42.	3.
YAMA	74640	H6	61.	4.
YAMA	74646	LL6	51.	3.
YAMA	74663	L6	44.	3.
YAMA	75028	H3	51.	3.

USNM	2318	L	50.	5.
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Sample No.: ALHA81010  
Field No.: 1673  
Weight (gms): 219.1  
Meteorite Type: Polymict Eucrite

Location: Allan Hills

Physical Description: Roberta Score

Fusion crust totally covers ALHA81010. This achondrite is probably from the same fall as the other polymict eucrites found in Allan Hills area.

Dimensions: 8 x 5 x 5.5 cm.

Petrographic Description: Brian Mason

The meteorite is a microbreccia consisting largely of angular monomineralic pyroxene and plagioclase clasts up to 4 mm in maximum dimension, and a few lithic clasts, in a matrix of comminuted pyroxene and plagioclase. Transparent brown fusion crust rims part of the section. The pyroxene is light to dark brown pigeonite; a few grains show exsolution lamellae. The lithic clasts have a maximum dimension of 3 mm, and consist of pigeonite and plagioclase with ophitic and gabbroic textures; one clast consists of angular pigeonite and plagioclase grains in a semi-opaque glassy matrix. Microprobe analyses show pigeonite and augite with a wide range of compositions: Wo 5-36, En 26-61, Fs 31-57; plagioclase composition range is An 78-93, mean An 88. The meteorite is classified as a polymict eucrite, and is probably paired with ALHA81006, 81007, and 81008.

Sample No.: ALHA81011  
Field No.: 1435  
Weight (gms): 405.7  
Meteorite Type: Eucritic Breccia (possibly a genomict breccia)

Location: Allan Hills

Physical Description: Roberta Score

Rounded with scattered patches of black fusion crust, this breccia is clast rich. Several types of clasts are present--typical eucritic clasts, pinkish-white clasts and massive gray clasts. These clasts range in shape from rounded, to lens-shaped, to rectangular, and many are larger than 1.5 cm long. The exterior matrix has a light gray color while the fresh interior matrix is very fine-grained and black. Several areas of oxidation are visible.

Dimensions: 8 x 6 x 5 cm.

Petrographic Description: Brian Mason

The meteorite is a breccia of eucritic clasts up to 10 mm in maximum dimension, the clasts sitting in a minor amount of dark glass filled with comminuted grains of pyroxene and plagioclase. The clasts consist of pyroxene and plagioclase and show a variety of textures--finely granular, subophitic, and gabbroic. Microprobe analyses show pyroxene compositions corresponding to pigeonite and augite and clustering around two mean compositions,  $Wo_4En_{36}Fs_{60}$  and  $Wo_{35}En_{32}Fs_{33}$ , with a few intermediate values. Plagioclase has fairly uniform composition, An 87-91, mean An 88. The meteorite is a eucritic breccia; although it appears to be polymict, the uniformity of mineral compositions suggest a considerable degree of equilibration, and it may be a genomict breccia.



Tentative Classification: Roy S. Clarke, Jr.

A median slice was removed perpendicular to the square section of the specimen and parallel to opposite sides. One side of the slice was polished and macroetched, resulting in an area of approximately 140 cm<sup>2</sup> available for examination at low magnification. The matrix appears to be single crystal kamacite that etches to a dull finish, atypical for hexahedrites. Several small troilite-daubreelite inclusions are present, as are a few small schreibersites. Slight variations in kamacite reflectivity appear to be due to tiny schreibersites that are unresolvable at low magnification. The most prominent surface feature is the system of orthogonal cracks mentioned above. They penetrate into the interior of the specimen. Neumann bands are absent. This cursory examination suggests that the meteorite is a hexahedrite of somewhat unusual metallography. It probably represents a separate fall, distinct from the typical hexahedrite ALHA78100.

Sample No.:	ALHA81014	Location:	Allan Hills
Field No.:	1214		
Weight (gms):	188.2		
Meteorite Type:	Fine Octahedrite		

Physical Description: Roy S. Clarke, Jr.

This specimen is an irregularly shaped individual somewhat resembling a fish. It is covered with a uniformly pitted, dark reddish brown, iridescent, secondary iron oxide coating.

Dimensions: 6.5 x 3 x 2 cm.

Tentative Classification: Roy S. Clarke, Jr.

A microetched surface area of approximately 4.5 cm<sup>3</sup> was examined. The section was taken perpendicular to the long axis of the specimen near the more massive end. The edge of the section contains an intermittent thin border of oxide. Below this is a heat-altered zone up to 1 mm thick that is present, with the exception of a few small gaps, around the complete section. Remnant fusion crust was not observed. Kamacite has a rather uniform matte surface at low magnification that can be resolved with higher magnification to a fine epsilon-decomposition structure. A system of wider than average kamacite lamellae, containing frequent centered schreibersites in the 100 x 200 micron size range, is a prominent feature. Kamacite lamellae free of centered schreibersites have widths in the 0.3 mm range. Plessite fields occupy approximately two-thirds of the surface. Interiors of larger fields contain cellular plessite framed in martensite with taenite borders. Narrow plessite fields have only martensitic areas with taenite borders. Schreibersite is also occasionally present at taenite borders, and as grain boundary schreibersite bridging between adjoining plessite areas. Occasional 5 to 10 micron schreibersites are present within plessite fields. Other inclusions were not observed. The specimen is a fine octahedrite with structural similarities to the high phosphorus IVA meteorite Chinautla. It appears, however, to be even richer in phosphorus and to be distinct from ALHA78252. Chemical data will be required for definitive classification.





Sample No.: ALHA81017  
Field No.: 1494  
Weight (gms): 1434.4  
Meteorite Type: L5 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This specimen consists of two pieces that cannot be fit together, but are obviously the same stone. Each piece has several small patches of dark fusion crust. The samples have a rough texture and are reddish-brown. The matrix is gray with small white and gray inclusions or chondrules. A gray weathering rind was exposed where chips were broken off. Oxidation haloes are also present.

Dimensions: 13.5 x 8 x 7 cm and 10 x 9 x 5.5 cm.

Petrographic Description: Brian Mason

Chondrules are moderately abundant, ranging up to 1.8 mm across, but their margins tend to merge with the granular groundmass, which consists largely of olivine and pyroxene, with minor amounts of nickel-iron and troilite. Microprobe analyses give the following compositions: olivine,  $Fa_{25}$ ; orthopyroxene,  $Fs_{21}$ ; one grain of diopside,  $Wo_{41}Fs_8$ , was noted. The meteorite is classified as an L5 chondrite.

Sample No.: ALHA81018  
Field No.: 1421  
Weight (gms): 2236.9  
Meteorite Type: L5 Chondrite

Location: Allan Hills

Physical Description: Roberta Score

ALHA81018, an angular shaped stone, is entirely covered with dull black fusion crust. Several cracks penetrate the stone.

The chip obtained for thin section has an approximately one centimeter thick continuous weathering rind. The center of the area exposed is light gray in color with several darker gray colored rounded inclusions.

Dimensions: 13.5 x 11 x 10 cm.

Petrographic Description: Brian Mason

This section closely resembles that of ALHA81017, which suggests that these two specimens may be paired. Microprobe analyses give the following compositions: olivine,  $Fa_{24}$ ; orthopyroxene,  $Fs_{21}$ ; a little diopside  $Wo_{42}Fs_9$ , is present. The meteorite is classified as an L5 chondrite.

Sample No.: ALHA81019  
Field No.: 1428  
Weight (gms): 1051.2  
Meteorite Type: H5 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This specimen is rectangular shaped with thin patchy black fusion crust covering about 65% of its surface. Where the fusion crust is absent the surface is smooth and reddish-brown in color with no features distinguishable. There is a deep fracture penetrating the stone, dividing it into two halves. A small amount of white deposit has formed on the top surface.

The interior is dark reddish-brown with several small areas which are not completely weathered.

Dimensions: 9 x 7 x 6.5 cm.

Petrographic Description: Brian Mason

Chondrules are present but are poorly defined, their margins merging with the granular groundmass, which consists largely of olivine and pyroxene with minor amounts of nickel-iron and troilite. Patchy brown limonitic staining is present throughout the section. Microprobe analyses give the following compositions: olivine,  $Fa_{19}$ ; orthopyroxene,  $Fs_{16}$ . The meteorite is classified as an H5 chondrite.

Sample No.: ALHA81020  
Field No.: 1492  
Weight (gms): 1352.5  
Meteorite Type: H5 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

ALHA81020 is almost totally covered by a thin, black, polygonally fractured fusion crust. White deposits have formed on one surface.

The interior is light gray in color with numerous oxidation haloes. Some fresh metal is obvious. Small white clasts, 1-2 mm, occur in the matrix.

Dimensions: 11 x 8 x 7 cm.

Petrographic Description: Brian Mason

Chondrules are present, ranging up to 2.2 mm across, but most of the section shows a granular aggregate of olivine and pyroxene with minor amounts of nickel-iron and troilite. Weathering is moderate, being limited to brown limonitic staining around metal grains. A little fusion crust is present on one edge. Microprobe analyses give the following compositions: olivine,  $Fa_{19}$ ; orthopyroxene,  $Fs_{16}$ . The meteorite is classified as an H5 chondrite.

Sample No.: ALHA81021  
Field No.: 1424  
Weight (gms): 695.1  
Meteorite Type: E6 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

Flow lines mark the broad top surface of this otherwise smooth and flat specimen. The bottom surface has weathered more extensively than the top.

The interior that was exposed is extremely weathered.

Dimensions: 12 x 9 x 3 cm.

Petrographic Description: Brian Mason

Only traces of chondritic structure are visible in the section, which consists largely of granular enstatite, with considerable nickel-iron (~20%), minor troilite and plagioclase, and accessory sinoite ( $\text{Si}_2\text{N}_2\text{O}$ , identified by its high birefringence). Weathering is extensive, with brown limonitic staining throughout the section. Remnants of fusion crust are present. Microprobe analyses show the enstatite is almost pure  $\text{MgSiO}_3$  (CaO 0.8%, FeO 0.2%,  $\text{Al}_2\text{O}_3$  0.2%); plagioclase is  $\text{An}_{15}\text{Or}_4$ ; the metal contains about 2% Si. The meteorite is an E6 chondrite.

Sample No.: ALHA81022  
Field No.: 1482  
Weight (gms): 912.5  
Meteorite Type: H4 Chondrite

Location: Allan Hills

Physical Description: Roberta Score

The bottom surface shows relief with many chondrules apparent. All other surfaces are covered with a thin dull black fusion crust.

This stone was extremely hard to chip. The small piece that fell off revealed an evenly weathered interior with several inclusions visible.

Dimensions: 11.5 x 10 x 5.5 cm.

Petrographic Description: Brian Mason

The section shows a close-packed aggregate of chondrules and chondrule fragments, up to 2.5 mm across, with interstitial fine-grained matrix. A wide variety of chondrule types is present, the commonest being porphyritic olivine, granular olivine and olivine-pyroxene, barred olivine, and fine-grained radiating pyroxene. Some intergranular glass within the chondrules is pale brown and transparent, but is usually turbid and partly devitrified. Much of the pyroxene is polysynthetically twinned clinobronzite. Small areas of brown limonite are concentrated around the margins of the section. Microprobe analyses show olivine ( $\text{Fa}_{19}$ ) and pyroxene ( $\text{Fs}_{17}$ ) of essentially uniform composition (% mean deviation FeO 2-3). The texture is similar to that of type 3 chondrites, but the homogeneous nature of the olivine and pyroxene indicates type 4; the meteorite is classified as an H4 chondrite. It closely resembles ALHA78084 (recently reclassified from H3 to H4), with which it is tentatively paired.

Sample No.: ALHA81023  
Field No.: 1427  
Weight (gms): 418.3  
Meteorite Type: L5 Chondrite

Location: Allan Hills

Physical Description: Roberta Score

ALHA81023 was found on the ice in Antarctica as 2 large pieces, 2 small pieces and many tiny chips. None of the pieces fit together, but are obviously related.

The matrix is light gray with many dark colored chondrules, irregular shaped inclusions and troilite(?) grains that show relief from the exterior surface. Some fusion crust is present on each piece. Weathering is moderate. A minute amount of white deposit is present on one piece.

Petrographic Description: Brian Mason

Chondrules are abundant and well developed, ranging up to 2.3 mm across; a variety of types is present, including porphyritic olivine, granular olivine and olivine-pyroxene, and radiating pyroxene. They are set in a granular groundmass consisting largely of olivine and pyroxene with minor amounts of nickel-iron and troilite. Weathering is limited to brown limonitic staining around metal grains. Microprobe analyses give the following compositions: olivine, Fa<sub>25</sub>; orthopyroxene, Fs<sub>21</sub>. The meteorite is classified as an L5 chondrite; it is very similar to ALHA81017, 81018, and the possibility of pairing with these meteorites should be considered.

Sample No.: ALHA81024  
Field No.: 1510  
Weight (gms): 797.7  
Meteorite Type: L3 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This angular specimen is covered by black blistery fusion crust; some areas are reddish-brown. Several deep fractures penetrate the specimen.

The interior exposed in chipping is reddish-brown and appears to be extremely weathered.

Dimensions: 10 x 8 x 6.5 cm.

Petrographic Description: Brian Mason

The section shows a close-packed aggregate of chondrules, up to 1.5 mm across; a variety of types is present, including porphyritic olivine, barred olivine, granular olivine and olivine-pyroxene, and fine-grained pyroxene. Much of the pyroxene is polysynthetically twinned clinobronzite. Some intergranular glass within the chondrules is pale brown and transparent, but commonly is turbid and partly devitrified. Minor amounts of nickel-iron (largely altered to brown limonite) and troilite are present in the matrix. Olivine and pyroxene have variable composition. Olivine composition ranges from  $Fa_3$  to  $Fa_{28}$ , with a mean of  $Fa_{19}$  (% mean deviation FeO is 34). Pyroxene composition ranges from  $Fs_2$  to  $Fs_{24}$ , with a mean of  $Fs_{10}$  (% mean deviation FeO is 79). Transparent chondrule glass has the following mean composition (weight per cent):  $SiO_2$  63.3,  $Al_2O_3$  22.5, FeO 0.9, MgO 0.2, CaO 0.2,  $K_2O$  3.3,  $Na_2O$  8.8,  $TiO_2$  0.8, MnO 0.03; this composition is close to anorthoclase. The texture and the variable mineral compositions are that of type 3, and the amount of metal suggests L group, hence the meteorite is tentatively classified L3. It is possibly paired with ALHA77011 and many other L3 chondrites from the Allan Hills.

Sample No.: ALHA81025 Location: Allan Hills  
Field No.: 1598  
Weight (gms): 379.0  
Meteorite Type: LL3 Chondrite

Physical Description: Roberta Score

Although ALHA81025 is extremely weathered, many clasts, both rounded and irregular, are apparent on the exterior. One notable exterior clast is 7 x 5 mm in diameter. The bottom surface is iridescent brown and covered with squall-like marks. The interior is extensively weathered.

Dimensions: 9.5 x 8 x 4.5 cm.

Petrographic Description: Brian Mason

The section shows a close-packed aggregate of chondrules and chondrule fragments up to 3.5 mm across; in a fine-grained matrix of olivine, pyroxene, troilite, and a little nickel-iron. Chondrule types include porphyritic olivine, granular olivine and olivine-pyroxene, barred olivine, and radiating pyroxene. Much of the pyroxene is polysynthetically twinned clinobronzite. Intergranular glass is present in the chondrules, usually turbid but sometimes transparent and purple-brown. Weathering is extensive, with small areas of brown limonite throughout the section. Microprobe analyses show that olivine and pyroxene have variable composition. Olivine composition ranges from  $Fa_1$  to  $Fa_{41}$ , with a mean of  $Fa_{18}$  (per cent mean deviation FeO is 76). Pyroxene composition ranges from  $Fs_3$  to  $Fs_{40}$ , with a mean of  $Fs_{15}$  (per cent mean deviation FeO is 75). Purple glass in a chondrule has the following mean composition (weight per cent):  $SiO_2$  56.8,  $Al_2O_3$  24.1, FeO 3.7, MgO 2.4, CaO 0.4,  $K_2O$  4.1,  $Na_2O$  8.8,  $TiO_2$  1.2, MnO 0.09. The texture and the variable mineral compositions indicate type 3, and the low metal content suggests LL group, hence the meteorite is tentatively classified LL3. It is possibly paired with ALHA79003 (Scott et al., Meteoritics, 17, 65-75, 1982), 81030, 81031, and 81032.



Sample No.: ALHA81030 Location: Allan Hills  
Field No.: 1685  
Weight (gms): 1851.6  
Meteorite Type: LL3 Chondrite

Physical Description: Roberta Score

This angular stone is covered with patchy black fusion crust. Several large fractures penetrate the interior. A few inclusions are visible on the exterior. The bottom contains squall-like marks.

Chipping exposed an interior of dark gray matrix material with small inclusions visible.

Dimensions: 18 x 7.5 x 9 cm.

Petrographic Description: Brian Mason

This specimen closely resembles ALHA81025 in texture, range of mineral compositions, and degree of weathering. It is therefore classified as an LL3 chondrite and tentatively paired with that meteorite.

Sample No.: ALHA81031 Location: Allan Hills  
Field No.: 1675  
Weight (gms): 1594.9  
Meteorite Type: LL3 Chondrite

Physical Description: Carol Schwarz

This angular specimen has only small patches of fusion crust remaining on its weathered surface. Many large fractures penetrate the stone. A piece fell off in handling to reveal a totally weathered interior.

Dimensions: 13 x 9 x 9 cm.

Petrographic Description: Brian Mason

This specimen closely resembles ALHA81025 in texture, range of mineral compositions, and degree of weathering. It is therefore classified as an LL3 chondrite and tentatively paired with that meteorite.



Sample No.: ALHA81032  
Field No.: 1686  
Weight (gms): 726.8  
Meteorite Type: LL3 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This angular specimen has thin patchy fusion crust. Where devoid of fusion crust clasts or chondrules up to 0.5 cm are visible in the weathered matrix.

Chipping revealed no fresh material.

Dimensions: 9 x 9 x 6 cm.

Petrographic Description: Brian Mason

This specimen closely resembles ALHA81025 in texture, range of mineral compositions, and degree of weathering. The mean compositions of olivine ( $Fa_{15}$ ) and pyroxene ( $Fs_{11}$ ) are somewhat lower, but this is probably due to the inclusion of several grains of almost iron-free forsterite and enstatite. It is therefore classified as an LL3 chondrite and tentatively paired with that meteorite.

Sample No.: ALHA81033  
Field No.: 1318  
Weight (gms): 252.4  
Meteorite Type: H5 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This sample consists of six similar fragments. They have only small areas of remnant fusion crust and are mostly weathered. One of the smaller pieces was selected for thin section.

Dimensions: 7 x 4.5 x 3 cm (largest piece)

Petrographic Description: Brian Mason

Chondritic structure is well developed, but the chondrules tend to merge with the granular groundmass, which consists largely of olivine and pyroxene with minor amounts of nickel-iron and troilite. Weathering is extensive, with brown limonitic staining and small areas of limonite throughout the section. Microprobe analyses give the following compositions: olivine,  $Fa_{18}$ ; orthopyroxene,  $Fs_{16}$ . The meteorite is classified as an H5 chondrite.



Sample No.: ALHA81036  
Field No.: 1633  
Weight (gms): 252.1  
Meteorite Type: H5 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This specimen has thin (<1 mm) black fusion crust that is slightly weathered in some areas. Regmaglypts occur on several faces. The interior is totally weathered.

Dimensions: 7 x 4.5 x 4.5 cm.

Petrographic Description: Brian Mason

The section consists largely of a granular aggregates of olivine and pyroxene, with relatively few chondrules; nickel-iron and troilite are present in minor amounts. Remnants of fusion crust rim the section. Brown limonitic staining and limonite veinlets are present. Microprobe analyses give the following compositions: olivine, Fa<sub>19</sub>; orthopyroxene, Fs<sub>17</sub>. The meteorite is classified as an H5 chondrite.

Sample No.: ALHA81037  
Field No.: 1489  
Weight (gms): 320.3  
Meteorite Type: H6 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This angular specimen has fusion crust on all but two sides. The fusion crust is black with rust haloes and is polygonally fractured.

The interior is moderately weathered with oxidation haloes in a light yellowish-gray matrix.

Dimensions: 7.5 x 6 x 4 cm.

Petrographic Description: Brian Mason

Chondrules are sparse and poorly defined, merging with the granular ground-mass, which consists largely of olivine and pyroxene, with minor amounts of nickel-iron, troilite, and plagioclase. Well preserved fusion crust is present along one edge. Areas of brown limonitic staining occur throughout the section. Microprobe analyses give the following compositions: olivine, Fa<sub>20</sub>; orthopyroxene, Fs<sub>17</sub>; plagioclase, An<sub>12</sub>. The meteorite is an H6 chondrite.

Sample No.: ALHA81038  
Field No.: 1578  
Weight (gms): 229.0  
Meteorite Type: H6 Chondrite

Location: Allan Hills

Physical Description: Roberta Score

Several millimeter-sized patches of fusion crust remain on the exterior of this weathered meteorite. There are several fractures which penetrate the interior.

Chipping exposed only weathered material.

Dimensions: 7 x 4 x 4 cm.

Petrographic Description: Brian Mason

This section appears to be identical in texture, mineral compositions, and degree of weathering with that of ALHA81035, and is therefore paired with that meteorite. It is an H6 chondrite.

Sample No.: ALHA81039  
Field No.: 1495  
Weight (gms): 205.9  
Meteorite Type: H5 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This specimen consists of two pieces which fit together plus a small (~1.5 cm) piece. The two larger pieces have black pitted fusion crust on all sides but one. The small piece is nearly totally covered with fusion crust.

Chipping revealed a light gray matrix with oxidation haloes. A weathering rind has formed along the face where fusion crust is absent.

Dimensions: 10 x 4.5 x 4 cm.

Petrographic Description: Brian Mason

Chondrules are present, but are poorly defined, their margins tending to merge with the granular groundmass, which consists largely of olivine and pyroxene, with minor amounts of nickel-iron and troilite. Minor weathering is indicated by brown limonitic staining concentrated around metal grains. Microprobe analyses give the following compositions: olivine, Fa<sub>19</sub>; orthopyroxene, Fs<sub>17</sub>. The meteorite is classified as an H5 chondrite.

Sample No.: ALHA81040  
Field No.: 1571  
Weight (gms): 194.5  
Meteorite Type: L4 Chondrite

Location: Allan Hills

Physical Description: Roberta Score

Dull black fusion crust covers approximately 3/4 of this rounded stone. Areas with no fusion crust have weathered to a deep reddish-brown. A small interior area of mostly weathered material with very dark matrix and some metal flecks was revealed by chipping.

Dimensions: 5.5 x 5 x 5 cm.

Petrographic Description: Brian Mason

The section shows numerous well-defined chondrules in a granular groundmass consisting largely of olivine and pyroxene with minor amounts of nickel-iron and troilite. Chondrule types include porphyritic olivine and olivine-pyroxene, and fine-grained radiating pyroxenes. Much of the pyroxene is polysynthetically twinned clinobronzite. Brown limonitic staining is extensive throughout the section. Microprobe analyses give the following compositions: olivine, Fa<sub>25</sub>; pyroxene, Fs<sub>21</sub>. The meteorite is classified as an L4 chondrite.

Sample No.: ALHA81042  
Field No.: 1640  
Weight (gms): 534.4  
Meteorite Type: H5 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This specimen has patchy fusion crust on its shiny red-brown exterior. It is extensively fractured. The interior appears to be totally weathered.

Dimensions: 10 x 7 x 5 cm.

Petrographic Description: Brian Mason

Chondrules are fairly abundant, but their margins are diffuse, tending to merge with the granular groundmass, which consists largely of olivine and pyroxene with minor amounts of nickel-iron and troilite. Weathering is extensive, with brown limonitic staining and veinlets throughout the section. Microprobe analyses give the following compositions: olivine, Fa<sub>19</sub>; orthopyroxene, Fs<sub>17</sub>. The meteorite is classified as an H5 chondrite.

Sample No.: ALHA81044  
Field No.: 1125  
Weight (gms): 386.8  
Meteorite Type: H4 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This meteorite is extremely weathered and fractured. No fresh material was exposed by chipping.

Dimensions: 8.5 x 6 x 5 cm.

Petrographic Description: Brian Mason

Chondrules are abundant, and are set in a granular groundmass of olivine and pyroxene, with minor amounts of nickel-iron and troilite. Some of the pyroxene in chondrules is polysynthetically twinned clinobronzite. Brown limonitic staining pervades the section. Microprobe analyses give the following compositions: olivine, Fa<sub>18</sub>; pyroxene, Fs<sub>16</sub>. The meteorite is classified as an H4 chondrite.

Sample No.: ALHA81048  
Field No.: 1121  
Weight (gms): 190.6  
Meteorite Type: H4 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This specimen has no fusion crust except for a small amount of remnant crust on one face. It is extremely weathered and fractured. Chipping exposed a thick weathering rind and only small areas of less weathered material.

Dimensions: 8.5 x 4.5 x 3 cm.

Petrographic Description: Brian Mason

This section is essentially identical with that of ALHA81044 in texture, mineral compositions, and degree of weathering. It is classified as an H4 chondrite and tentatively paired with that meteorite.

Sample No.: ALHA81059  
Field No.: 1282  
Weight (gms): 539.5  
Meteorite Type: Mesosiderite

Location: Allan Hills

Physical Description: Roberta Score

The exterior of this mesosiderite has many greenish pyroxene grains, which all show cleavage faces. Several of the larger ones (up to 1.5 x 1 cm) can easily be removed. The stone appears to be fairly weathered with many fractures criss-crossing the exterior. A few small patches of fusion crust remain.

Weathering of the interior is extensive.

Dimensions: 9.5 x 5 x 5.5 cm.

Petrographic Description: Brian Mason

The section consists largely of orthopyroxene clasts ranging up to 10 mm in maximum dimensions, together with about 30% of nickel-iron in grains up to 0.6 mm; a little troilite is present. The meteorite is extremely weathered and seamed with brown limonite. Microprobe analyses shows that the orthopyroxene is somewhat variable in composition, ranging from  $Fs_{25}$  to  $Fs_{32}$ , with a mean of  $Fs_{28}$ ; mean weight per cent CaO is 1.2, MnO 0.7,  $Al_2O_3$  0.6,  $TiO_2$  0.2. Small amounts of olivine ( $Fa_{28}$ ), plagioclase ( $An_{93}$ ), merrillite, and an  $SiO_2$  phase (probably tridymite) were detected with the microprobe. The meteorite is a mesosiderite, the second from the Allan Hills. It appears to be different from the previous one, ALHA77219.

Sample No.: ALHA81067  
Field No.: 1597, 1599  
Weight (gms): 227.6  
Meteorite Type: H5 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

This specimen consists of two pieces which fit together perfectly. The "exterior" surfaces have a thin patchy fusion crust while the "interior" surfaces are a dark iridescent brown. The interior exposed by chipping is totally weathered.

Dimensions: 7 x 5.5 x 4 cm.

Petrographic Description: Brian Mason

Chondrules are abundant, but for many of them their margins are diffuse, merging with the granular groundmass, which consists of olivine and pyroxene with minor amounts of nickel-iron and troilite. Weathering is extensive, with limonite veinlets throughout the section. Microprobe analyses give the following compositions: olivine,  $Fa_{19}$ ; orthopyroxene,  $Fs_{17}$ . The meteorite is classified as an H5 chondrite.

Sample No.: ALHA81093  
Field No.: 1488  
Weight (gms): 271.0  
Meteorite Type: H6 Chondrite

Location: Allan Hills

Physical Description: Roberta Score

Dull black fusion crust totally covers this meteorite. The interior has a discontinuous weathering rind with oxidation evenly distributed throughout. Small light and dark inclusions are visible in the gray-white matrix.

Dimensions: 6 x 5.5 x 4 cm.

Petrographic Description: Brian Mason

Chondritic structure is barely perceptible, the few chondrules being extensively integrated with the granular groundmass, which consists largely of olivine and pyroxene, with minor amounts of nickel-iron, troilite, and plagioclase. Limonitic staining and small areas of limonite are present throughout the section. Microprobe analyses give the following compositions: olivine,  $Fa_{20}$ ; orthopyroxene,  $Fs_{17}$ ; plagioclase,  $An_{12}$ . The meteorite is an H6 chondrite.

Sample No.: ALHA81102  
Field No.: 1610  
Weight (gms): 196.0  
Meteorite Type: H6 Chondrite

Location: Allan Hills

Physical Description: Carol Schwarz

The specimen has only a thin remnant fusion crust in patches with most of the surface being a dark red-brown color. A few <1 mm chondrules are visible. The interior exposed in chipping is dark red-brown in color.

Dimensions: 7.5 x 5 x 3 cm.

Petrographic Description: Brian Mason

Chondrules are present, but are extensively integrated with the granular groundmass, which consists largely of olivine and pyroxene with minor amounts of nickel-iron, troilite, and plagioclase. Weathering is extensive, with limonitic staining and small areas of limonite throughout the section. Microprobe analyses give the following compositions: olivine,  $Fa_{19}$ ; orthopyroxene,  $Fs_{17}$ ; plagioclase,  $An_{12}$ . The meteorite is an H6 chondrite.



Sample No.: ALHA81111                      Location: Allan Hills  
Field No.: 1431  
Weight (gms): 210.3  
Meteorite Type: H6 Chondrite

Physical Description: Roberta Score

The top half of ALHA81111 is covered with frothy black fusion crust while the remainder of the specimen is iridescent reddish-brown. Several cracks penetrate the interior.

Chipping exposed only a small area of relatively unweathered material which is a very dark gray color.

Dimensions: 8 x 4 x 6 cm.

Petrographic Description: Brian Mason

Chondrules are moderately abundant but their margins are diffuse, tending to merge with the granular groundmass, which consists of olivine and pyroxene with minor amounts of nickel-iron, troilite, and plagioclase. Limonitic staining and small areas of limonite are present, mainly in association with metal grains. Microprobe analyses give the following compositions: olivine, Fa<sub>19</sub>; orthopyroxene, Fs<sub>17</sub>; plagioclase, An<sub>13</sub>. The meteorite is an H6 chondrite.

Sample No.: ALHA81251                      Location: Allan Hills  
Field No.: 1248  
Weight (gms): 158.0  
Meteorite Type: LL3 Chondrite

Physical Description: Roberta Score

Thin, black, shiny fusion crust covers half of this flat sample. The exterior appears to have been polished, and the broken surfaces show abundant chondrules as large as 0.5 cm in diameter.

The interior exposed by chipping has weathered to a deep reddish-brown, obliterating any structure present.

Dimensions: 6.5 x 6 x 2.5 cm.

Petrographic Description: Brian Mason

The section shows a close-packed aggregate of chondrules and chondrule fragments, up to 3 mm in maximum dimension. Most of the matrix is black and opaque, with small grains of olivine and pyroxene; the black matrix appears to be carbonaceous, with small amounts of troilite and nickel-iron (largely weathered to limonite). A wide variety of chondrule types is present, including barred olivine, granular olivine and olivine-pyroxene, and fine-grained pyroxene. Clear glass is present in barred olivine chondrules. Microprobe analyses show olivine and pyroxene with variable compositions: olivine,  $Fa_1$ - $Fa_{29}$ , mean  $Fa_{14}$  (per cent mean deviation FeO is 64); pyroxene,  $Fs_2$ - $Fs_{28}$ , mean  $Fs_{13}$  (per cent mean deviation FeO is 72). Clear glass in a barred olivine chondrule has the following composition (weight per cent):  $SiO_2$  61.4,  $Al_2O_3$  23.5, FeO 1.7, MgO 2.0, CaO 0.4,  $Na_2O$  4.8,  $K_2O$  1.6,  $TiO_2$  1.1,  $MnO$  0.01. The highly variable composition of olivine and pyroxene and the texture indicate Type 3. The small amount of nickel-iron suggests LL group. Hence the meteorite is tentatively classified as an LL3 chondrite.