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.

Volume 9, Number 1

February, 1986

Supported by the National Science Foundation, Division of Polar Programs, and compiled at Code SN2, Johnson Space Center, NASA, Houston, Texas 77058

!!!!!!!! SAMPLE REQUEST DEADLINE: MARCH 28, 1986 (SEE PAGE 2) !!!!!!!!

SAMPLE-REQUEST GUIDELINES

All sample requests should be made in writing to

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

Questions pertaining to sample requests can be directed in writing to the above address or can be directed by telephone to (713) 483-3274.

Requests for samples are welcomed from research scientists of all countries, regardless of their current state of funding for meteorite studies. All sample requests will be reviewed by the Meteorite Working Group (MWG), a peer-review committee that guides the collection, curation, allocation, and distribution of the U. S. Antarctic meteorites. Issuance of samples does not imply a commitment by any agency to fund the proposed research. Requests for financial support must be submitted separately to the appropriate funding agencies. As a matter of policy, U. S. Antarctic meteorites are the property of the National Science Foundation and all allocations are subject to recall.

Each request should refer to meteorite samples by their respective identification numbers and should provide detailed scientific justification for the proposed research. Specific requirements for samples, such as sizes or weights, particular locations (if applicable) within individual specimens, or special handling or shipping procedures should be explained in each request. All necessary information should probably be condensable into a one- or two-page letter, although informative attachments (reprints of publications that explain rationale, flow diagrams for analyses, etc.) are welcome.

Requests that are received by the MWG Secretary before March 28, 1986 will be reviewed at the MWG meeting of April 3-5, 1986 to be held in Houston. Requests that are received after the March 28 deadline may possibly be delayed for review until the MWG meets again in September or October, 1986.
PLEASE SUBMIT YOUR REQUESTS ON TIME.

Samples can be requested from any meteorite that has been made available through anouncement in any issue of the *Antarctic Meteorite Newsletter* (beginning with 1(1) in June, 1978). Many of the meteorites have also been described in the following catalogs:

Marvin, U. B. and B. Mason (eds.) (1984) Field and Laboratory Investigations of Meteorites from Victoria Land, Antarctica, *Smithsonian Contr. Earth Sci. No. 26*, Smithsonian Institution Press, 134 pp.

Marvin, U. B. and B. Mason (eds.) (1982) Catalog of Meteorites from Victoria Land, Antarctica, 1978-1980, *Smithsonian Contr. Earth Sci. No. 24*, Smithsonian Institution Press, 97 pp.

Marvin, U. B. and B. Mason (eds.) (1980) Catalog of Antarctic Meteorites, 1977-1978, *Smithsonian Contr. Earth Sci. No. 23*, Smithsonian Institution Press, 50 pp.

A Message from John O. Annexstad
Secretary, Meteorite Working Group

On March 4, 1986, I will retire from NASA after 18 years of service at JSC and 28 years of government service. The past three decades have been filled with dramatic scientific advances and I feel privileged to have been a participant. My government career began as a winter-over scientist in Antarctica during the IGY and continued through the Apollo years and the Antarctic Meteorite Program. These events were filled with excitement and accomplishment as the frontiers of science were explored. Also, I have experienced and enjoyed a deep sense of fellowship and kinship with members of the scientific community. The people who participated made these programs successful and continue to provide the impetus for future explorations.

For me, personally, the future is very bright and holds the promise of continued productive years in science. I will join the teaching faculty of a northern Minnesota university in March as a professor of geoscience. Until other arrangements can be made, I will also continue as the Secretary of the Meteorite Working Group. Communications regarding sample requests should still be sent to the Secretary at the JSC address. Other communications can be sent to me at the following address:

Dept. of Science and Mathematics
Bemidji State University
Bemidji, Minnesota 56601

As I close this chapter of my life and proceed to the next, I want to express my heartfelt thanks and gratitude to all the members of our planetary materials community. I feel honored to have worked with you and I look forward to a future filled with new challenges.

NEW METEORITES

Pages 5-19 contain preliminary descriptions and classifications of meteorites that were examined since publication of Antarctic Meteorite Newsletter, 8(2) (August, 1985). Most large (> 150-g) specimen (regardless of petrologic type) and all "pebble"-sized (< 150-g) specimens of special petrologic type (i.e., carbonaceous chondrite, unequilibrated ordinary chondrite, achondrite, stony-iron or iron) are represented by a separate descriptions. However, specimens of non-special petrologic type (i.e., equilibrated ordinary chondrite) are listed only as single-line entries in Table 1. For convenience, new specimens are also grouped by petrologic type in Table 2.

Each "macroscopic" description summarizes features that were visible to the eye (with, at most, the aid of a binocular stereomicroscope) at the time the meteorite was first examined. Macroscopic descriptions of stony meteorites were performed at NASA/JSC whereas macroscopic descriptions of iron meteorites were performed at the Smithsonian Insitution. Each "thin section" or "polished section" description represents features that were found in a survey-level examination of a polished section that was prepared from a small (usually exterior) chip of the meteorite. Classification is based on microscopic petrography and reconnaissance-level electron-probe microanalyses. For each stony meteorite, the sample number assigned to the preliminary examination section (...,1 or ...,3, etc.) is included as an aid to workers who may later wish to intercompare samples from different locations in the meteorite.

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

Mrs. Carol Schwarz, Ms. Roberta Score, and Mr. Rene Martinez
Planetary Materials Laboratory
(NASA/Johnson Space Center)
Northrop Services, Inc.
Houston, Texas

Dr. Brian H. Mason and Dr. Roy S. Clarke, Jr.
Department of Mineral Sciences
U. S. National Museum of Natural History
Smithsonian Institution
Washington, DC

Table 1

List of Newly Classified Antarctic Meteorites

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALHA81316	0.7	LL-4 CHONDRITE	B	B	29	23
ALHA81317	0.4	H-6 CHONDRITE	C	A	18	16
ALH 83007	285.0	L-3 CHONDRITE	B	A	0.5-43	3-37
ALH 83008	272.0	L-3 CHONDRITE	B	A	10-24	5-24
ALH 83011	213.3	L-5 CHONDRITE	C	B	23	19
ALH 83013	246.3	H-6 CHONDRITE	A/B	A	18	16
ALH 83067	95.8	L-6 CHONDRITE	A/B	A	24	20
ALH 83069	78.2	L-5 CHONDRITE	A	A	25	21
ALH 83070	215.7	LL-6 CHONDRITE	A	A	29	23
ALH 83106	22.3	CARBONACEOUS C2	A	A/B	0.2-5	
ALH 83108	1519.4	CARBONACEOUS C3O	A	A	0.9-38	1-17
EET 83216	789.9	L-6 CHONDRITE	B	A	24	20
EET 83217	374.7	L-6 CHONDRITE	B	B	24	20
EET 83218	191.9	L-6 CHONDRITE	B	A	23	20
EET 83219	243.3	L-6 CHONDRITE	B	A	23	20
EET 83220	330.9	L-6 CHONDRITE	B	A	23	20
EET 83221	313.9	H-4,6 CHONDRITE	C	C	17	15
EET 83222	317.0	L-6 CHONDRITE	B	B	24	20
EET 83223	218.6	H-5 CHONDRITE	B	B	18	16
EET 83238	382.1	L-6 CHONDRITE	A	A/B	25	21
EET 83239	282.3	L-6 CHONDRITE	B/C	A/B	24	20
EET 83241	203.3	L-6 CHONDRITE	B	A/B	23	19
EET 83242	282.1	L-5 CHONDRITE	B	B	23	20
EET 83243	288.1	L-6 CHONDRITE	A	A	23	19
EET 83244	384.1	L-6 CHONDRITE	B	A	24	20
EET 83248	39.2	H-3 CHONDRITE	B	A	3-24	3-23
EET 83252	183.7	L-6 CHONDRITE	B/C	A	24	21
EET 83253	44.1	L-6 CHONDRITE	B	A	23	20
EET 83285	3.2	H-5 CHONDRITE	B	B	18	16
EET 83289	7.8	L-6 CHONDRITE	B	B	24	20
EET 83290	1.4	LL-6 CHONDRITE	B	A	29	25
EET 83292	9.3	H-5 CHONDRITE	B/C	B	18	16
EET 83295	27.9	H-6 CHONDRITE	B	A/B	18	16
EET 83303	11.8	H-5 CHONDRITE	B/C	A	18	15
EET 83305	167.0	H-5 CHONDRITE	B	B/C	17	15
EET 83307	4.8	E-4 CHONDRITE	C	B	2-5	0.5-5
EET 83308	136.9	L-5 CHONDRITE	B	A	22	18
EET 83309	60.8	ACHON. (UNIQUE)	C	B	11-21	4-14
EET 83312	93.0	L-6 CHONDRITE	B	B	24	20
EET 83318	54.9	L-4 CHONDRITE	A/B	A	23	19
EET 83322	14.3	E-4 CHONDRITE	A/B	B		0.2-2
EET 83324	142.8	H-5 CHONDRITE	B/C	B	17	15
EET 83329	67.7	L-4 CHONDRITE	B	A	22	5-21
EET 83333	188.6	IRON-OCTAHEDRITE				
EET 83335	226.9	L-6 CHONDRITE	A/B	A	23	20
EET 83348	299.2	L-6 CHONDRITE	A/B	A	23	20
EET 83390	15.2	IRON-OCTAHEDRITE				
EET 83399	203.3	L-3 CHONDRITE	C	A	3-26	6-25
ALH 84005	~12000	L-5 CHONDRITE	A/B	A	21	18
ALH 84055	6900.5	H-5 CHONDRITE	B	B	16	14

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 84056	2140.3	L-6 CHONDRITE	B	A/B	24	21
ALH 84057	368.2	L-6 CHONDRITE	B/C	A	23	19
ALH 84058	2002.5	L-6 CHONDRITE	B	A	23	20
ALH 84059	856.9	H-4 CHONDRITE	B/C	B	18	16
ALH 84060	338.9	H-5 CHONDRITE	B	A	17	15
ALH 84061	676.4	L-6 CHONDRITE	B	A	24	21
ALH 84062	958.2	L-6 CHONDRITE	A/B	A	23	19
ALH 84063	759.6	L-5 CHONDRITE	A/B	A	22	19
ALH 84064	1889.1	H-5 CHONDRITE	B	A	17	15
ALH 84066	355.8	L-6 CHONDRITE	B	A	23	19
ALH 84067	391.2	H-5 CHONDRITE	C	B/C	17	15
ALH 84068	1114.1	H-5 CHONDRITE	B	A	17	15
ALH 84070	3951.7	L-6 CHONDRITE	A/B	A	23	19
ALH 84071	797.7	H-6 CHONDRITE	B	B	19	16
ALH 84072	720.9	L-6 CHONDRITE	B	A	24	20
ALH 84165	94.7	IRON-OCTAHEDRITE				
EET 84300	72.2	IRON-OCTAHEDRITE				

Table 2

Achondrites

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
EET 83309	60.8	ACHON. (UNIQUE)	C	B	11-21	4-14

Carbonaceous Chondrites

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 83106	22.3	CARBONACEOUS C2	A	A/B	0.2-5	
ALH 83108	1519.4	CARBONACEOUS C3O	A	A	0.9-38	1-17

E Chondrites

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
EET 83307	4.8	E-4 CHONDRITE	C	B	2-5	0.5-5
EET 83322	14.3	E-4 CHONDRITE	A/B	B		0.2-2

Chondrites - Type 3

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
EET 83248	39.2	H-3 CHONDRITE	B	A	3-24	3-23
ALH 83007	285.0	L-3 CHONDRITE	B	A	0.5-43	3-37
ALH 83008	272.0	L-3 CHONDRITE	B	A	10-24	5-24
EET 83399	203.3	L-3 CHONDRITE	C	A	3-26	6-25

Chondrites - Type 4

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 84059	856.9	H-4 CHONDRITE	B/C	B	18	16
EET 83221	313.9	H-4,6 CHONDRITE	C	C	17	15
EET 83318	54.9	L-4 CHONDRITE	A/B	A	23	19
EET 83329	67.7	L-4 CHONDRITE	B	A	22	5-21
ALHA81316	0.7	LL-4 CHONDRITE	B	B	29	23

Irons

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
ALH 84165	94.7	IRON-OCTAHEDRITE				
EET 83333	188.6	IRON-OCTAHEDRITE				
EET 83390	15.2	IRON-OCTAHEDRITE				
EET 84300	72.2	IRON-OCTAHEDRITE				

Sample No.: ALHA81316
Weight (g): 0.7
Dimensions (cm): 1 x 1 x 0.5
Meteorite Type: LL4 Chondrite

Location: Allan Hills
Field No.: 1647

Macroscopic Description: Carol Schwarz

Stone was originally grouped in the field with seven other fragments that comprise ALHA81047. This individual fragment has a different classification from the other fragment that was classified and has been renumbered ALHA81316. This specimen is gray and contains small chondrules.

Thin Section (,1) Description: Brian Mason

The small section (0.5 x 1.2 cm) shows a few relatively large chondrules (up to 3.6 mm across) in a finely granular groundmass consisting largely of olivine and pyroxene, with a small amount of nickel-iron and sulfide. Some of the pyroxene is polysynthetically twinned clinobronzite. A little brown limonite is present, but otherwise the meteorite appears relatively unweathered. Microprobe analyses give the following compositions: olivine, Fa 29; pyroxene, Fs 23. The meteorite is classified as an LL4 chondrite.

Sample No.: ALH83007
Weight (g): 285.0
Dimensions (cm): 9.5 x 5.5 x 4
Meteorite Type: L3 Chondrite

Location: Allan Hills
Field No.: 2530

Macroscopic Description: Carol Schwarz

Black to slightly brownish fusion crust covers this specimen. One to five sq. mm areas of fusion crust have spalled off revealing several white clasts. The interior has a dark matrix with 1-5 mm sized clasts/chondrules that are gray to yellowish in color and somewhat weathered. One large area (8 x 4 mm) is medium gray and fine grained. This specimen is very coherent.

Thin Section (,4) Description: Brian Mason

The thin section shows a close-packed aggregate of chondrules, chondrule fragments, and irregular inclusions up to 2.5 mm across in a small amount of black matrix. The matrix includes minor subequal amounts of nickel-iron and troilite. A considerable variety of chondrules is present, the most common being granular olivine with or without polysynthetically twinned clinopyroxene, porphyritic olivine, and fine-grained pyroxene. Some chondrules have intergranular, transparent, pale brown glass; in others the glass is turbid and partly devitrified. Microprobe analyses show a wide range in the composition of olivine (Fa 0.5-43) and pyroxene (Fs 3-37). This range of composition, together with the presence of glass and twinned clinopyroxene, indicates type 3, and the small amount of nickel-iron suggests L group; the meteorite is therefore tentatively classified as an L3 chondrite. It resembles closely ALHA79003. (Editor's note: ALHA79003 is presently classified as LL3.)

Sample No.: ALH83008
Weight (g): 272.0
Dimensions (cm): 8.5 x 5 x 3
Meteorite Type: L3 Chondrite

Location: Allan Hills
Field No.: 2516

Macroscopic Description: Carol Schwarz
Shiny black fusion crust with large (<1 cm) oxidation haloes covers nearly all of this specimen. The interior is dark in color and dotted with oxidization. Small (~1 mm) sized clasts/chondrules are barely discernible.

Thin Section (,3) Description: Brian Mason
The section shows a close-packed aggregate of chondrules, chondrule fragments, and irregular inclusions in a dark matrix which contains minor subequal amounts of nickel-iron and troilite. Chondrules range in size from 0.2-3 mm across, and show a variety of types, the commonest being porphyritic or granular olivine with or without polysynthetically twinned clinopyroxene. Considerable weathering is indicated by brown limonitic staining throughout the section. Microprobe analyses give the following compositions: olivine, Fa 10-24, mean Fa 17 (CV FeO 22); pyroxene, Fs 5-24. The variability of olivine and pyroxene compositions indicates type 3, and the amount of nickel-iron suggests L group; hence the meteorite is tentatively classified as an L3 chondrite. It resembles ALHA78046.

Sample No.: ALH83070
Weight (g): 215.7
Dimensions (cm): 6 x 4 x 4.5
Meteorite Type: LL6 Chondrite

Location: Allan Hills
Field No.: 2745

Macroscopic Description: Rene Martinez
Black fusion crust covers most of this meteorite, except for a fracture surface which has weathered to a pale yellow color with reddish-brown oxidation stains. Weathering has caused the more resistent clasts/chondrules to show relief on this exterior surface.

Fresh interior matrix is light gray and fine-grained with no visible oxidation staining. A darker gray weathering rind, discontinuous and thin, was exposed when this specimen was chipped. No metal is visible.

Thin Section (,3) Description: Brian Mason
Chondritic structure is barely discernible, the section showing a rather uniform granular aggregate of olivine and pyroxene, with minor amounts of plagioclase and sulfide, a little nickel-iron, and accessory chromite. Microprobe analyses gave the following compositions: olivine, Fa 29; pyroxene, Fs 23; plagioclase, An 10. The meteorite is an LL6 chondrite. In texture and mineral compositions it resembles ALHA78153 and 81123 and the possibility of pairing should be considered.

Sample No.: ALH83106
Weight (g): 22.3
Dimensions (cm): 4.5 x 2.5 x 1.5
Meteorite Type: C2 Chondrite

Location: Allan Hills
Field No.: 2799

Macroscopic Description: Carol Schwarz

This meteorite has a rectangular shape and is covered with a very black and sometimes polygonally fractured fusion crust on three sides. The other surfaces are olive green and very fine-grained. One or two cracks penetrate the specimen. The interior is black and very fine-grained.

Thin Section (,4) Description: Brian Mason

Chondrules are small and sparse, the section consisting largely of small mineral grains (0.01-0.1 mm across) in a translucent brown to black matrix. Most of the mineral grains are serpentinized. Olivine in the chondrules is mostly close to forsterite in composition, but compositions up to Fa 5 were measured. Troilite and nickel-iron are extremely rare. The meteorite is a C2 chondrite, possibly paired with ALH83100.

Sample No.: ALH83108
Weight (g): 1519.4
Dimensions (cm): 16 x 8 x 6
Meteorite Type: C30 Chondrite

Location: Allan Hills
Field No.: 2120

Macroscopic Description: Carol Schwarz

Approximately 80% of this carbonaceous chondrite is covered with dull, polygonally fractured fusion crust. The exterior matrix exposed on areas devoid of fusion crust has weathered to a greenish-gray color. The interior is medium gray, contains minute metal flecks, and shows no appreciable weathering.

Thin Section (,4) Description: Brian Mason

The section shows numerous chondrules, chondrule fragments, and irregular mineral aggregates in a turbid brown matrix which contains minor subequal amounts of nickel-iron and sulfide. The condrules are small and fairly uniform in size, 0.2-0.6 mm across. Most of the chondrules consist of granular or porphyritic olivine; pyroxene is rare. Microprobe analyses show olivine compositions ranging from Fa 0.9 to Fa 38, with a marked peak at the high-iron end; pyroxene compositions range from almost pure $MgSiO_3$ to Wo 5 Fs 16, with a mean of Wo 2 Fs 6. The meteorite is a C30 chondrite. It resembles the other C30 chondrites from the Allan Hills (77003, 77029, 82101), and the possibility of pairing should be considered.

Sample No.: ALH84005
Weight (g): 12000 (approx.)
Dimensions (cm): 30 x 18 x 15
Meteorite Type: L5 Chondrite

Location: Allan Hills
Field No.: 2061

Macroscopic Description: Carol Schwarz

This chondrite is covered with smooth fusion crust which is polygonally fractured, dotted with oxidation haloes, and has a blistery texture in some areas. Areas devoid of fusion crust are grayish with oxidation scattered throughout. The interior is gray and shows minor oxidation.

Thin Section (,4) Description: Brian Mason

Chondrules and chondrule fragments are fairly abundant, 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. Minor weathering is indicated by rusty haloes around metal grains. Microprobe analyses give the following compositions: olivine, Fa 21; pyroxene, Fs 18. These compositions are intermediate between those characteristic of H and L groups; the amount of metal suggests L group, and the meteorite is tentatively classified as an L5 chondrite.

Sample No.: ALH84165
Weight (g): 94.7
Dimensions (cm): 4.3 x 3.3 x 1.5
Meteorite Type: Octahedrite

Location: Allan Hills
Field No.: 2198

Macroscopic Description: Roy S. Clarke, Jr.

This ablation-shaped individual is essentially oval in outline when viewed along its axis of oriented flight through the atmosphere. Over most of its area the anterior surface has a fairly uniform radius of curvature that is greater than the radius of curvature of the posterior surface. The anterior radius of curvature, however, does decrease markedly toward the edge, and the anterior surface extends beyond the joint of the two surfaces. The result is a 1 mm ablation lip or flange, reminescent of a flanged australite. Both surfaces are covered with reddish brown secondary oxides, the anterior surface being smoother than the posterior. Delicate streamers of fusion crust remain, however, along the anterior surface edge. They record flow of melt away from the stagnation point and parallel to the direction of orientation during flight. A fine crack 1.5 cm long is present on the anterior surface.

Polished Section Description: Roy S. Clarke, Jr.

A median section perpendicular to a flat projection of the anterior surface, and approximately parallel to and including the axis of orientation, provided an area of 3 sq. cm for examination. The anterior edge is free of fusion crust, but α_2 structure in kamacite penetrates 1.5 to 2 mm. The posterior edge has a continuous fusion crust accumulation 0.2 to 0.3 mm thick. The kamacite along this edge has also been penetrated to a depth of 1.5 to 2 mm by α_2 structure. At the flanges, fusion crust accumulation is as thick as 1.5 mm. Taenite lamellae, taenite-plessite areas, and cellular plessite areas are present. The few opportunities for band width measurements suggest a tentative value of about 1 mm. Grain boundary schreibersite is present as is schreibersite associated with taenite. Kamacite is mottled and contains a pronounced ϵ-structure and occasional remnant Neumann bands.

This ablation-shaped and shock-affected octahedrite may prove to be a Group III meteorite.

Sample No.: EET83221
Weight (g): 313.9
Dimensions (cm): 7 x 6 x 4
Meteorite Type: H4,6 Chondrite

Location: Elephant Moraine
Field No.: 1363

Macroscopic Description: Carol Schwarz

Shiny iridescent remnant fusion crust occurs on this extensively weathered and fractured stone.. The interior is reddish brown and no metal is visible.

Thin Section (,4) Description: Brian Mason

Visual examination of the section shows two contrasting lithologies: the larger area black, the smaller pale brown. Under the microscope the black area is seen to be highly chondritic and the pale brown area poorly chondritic with chondrules tending to merge with the granular groundmass. Weathering is extensive with red-brown veinlets of limonite throughout the section. Microprobe analyses show slightly variable compositions: olivine, Fa 16-17; pyroxene, Fs 14-16. The pale brown area contains maskelynite, with CaO content corresponding to An 12, but with low Na_2O, 0.8-4.6%. The black area can be classified as H4; the pale brown area as H6.

Sample No.: EET83248
Weight (g): 39.2
Dimensions (cm): 3.5 x 3 x 2.5
Meteorite Type: H3 Chondrite

Location: Elephant Moraine
Field No.: 1364

Macroscopic Description: Carol Schwarz

Black fusion crust, iridescent on one face, covers all but one side of this smooth specimen. The fracture surface is very dark and iridescent with a few millimeter sized chondrules visible. A few small yellowish-colored chondrules/clasts are visible in the dark matrix that makes up the interior of this meteorite. EET83248 is very coherent.

Thin Section (,3) Description: Brian Mason

The section shows a close-packed aggregate of chondrules (0.1-1.2 mm diameter), chondrule fragments, and irregular crystal aggregates, with interstitial nickel-iron and troilite and a small amount of dark fine-grained matrix. Chondrule types include granular and porphyritic olivine and olivine-pyroxene, barred olivine, and fine-grained and radiating pyroxene. Weathering is extensive, with brown limonitic staining throughout the section. Microprobe analyses show olivine ranging in composition from Fa 3 to Fa 24, with a mean of Fa 14 (CV FeO is 45); the pyroxene is clinobronzite ranging in composition from Fs 3 to Fs 23. These ranges in composition indicate type 3, and the amount of nickel-iron suggests H group; the meteorite is therefore tentatively classed as an H3 chondrite.

Sample No.: EET83307
Weight (g): 4.8
Dimensions (cm): 2 x 1 x 1
Meteorite Type: E4 Chondrite

Location: Elephant Moraine
Field No.: 2833

Macroscopic Description: Roberta Score

Some fusion crust remains on this otherwise extensively weathered stone.

Thin Section (,2) Description: Brian Mason

Chondrules and chondrule fragments are fairly abundant, and are set in a granular matrix of pyroxene, nickel-iron, and sulfides. The condrules range up to 1.3 mm in diameter, and consist of granular pyroxene, sometimes with a little olivine, but a few are made up of nickel-iron and sulfide. Brown limonitic staining is present throughout the section. Microprobe analyses show that the pyroxene is close to $MgSiO_3$ in composition (FeO 0.5-4.5, mean 1.5%; Al_2O_3 0.1-0.8, mean 0.3%; CaO 0.1-0.4, mean 0.2%; TiO_2 0.02-0.11, mean 0.05%; MnO 0.02-0.4, mean 0.18%). Three olivine grains were analyzed, FeO ranging from 4.3 to 5.1%. The nickel-iron contains about 2.4% Si. Since part of the pyroxene is polysynthetically twinned clinoestatite, the meteorite is classified as an E4 chondrite; It is similar to EET83322, and the possibility of pairing should be considered.

Sample No.: EET83309
Weight (g): 60.8
Dimensions (cm): 4 x 4 x 2.5
Meteorite Type: Achondrite

Location: Elephant Moraine
Field No.: 1444

Macroscopic Description: Roberta Score

Some fusion crust remains on this weathered stone. Though the interior is extensively oxidized, a few platy minerals with well-developed crystal faces can be distinguished.

Thin Section (,2) Description: Brian Mason

This meteorite is a microbreccia, consisting largely of olivine clasts (up to 3 mm in maximum dimension), with a lesser amount of pyroxene and a few small plagioclase clasts. Nickel-iron and troilite are present only in traces. One small clast appears to be a fragment of a barred olivine chondrule. Brown limonitic staining pervades the section. Olivine compositions range from Fa 8 to Fa 25, with most between Fa 15 and Fa 23. The olivine has unusually high calcium (CaO 0.2-0.5%) and chromium (Cr_2O_3 0.5-0.9%) contents. Most of the pyroxene is low-Ca, around Wo 5 Fs 18, but a little diopside (Wo 39 Fs 6) is present. Plagioclase compositions show a considerable range, An 10-50. The meteorite is classified as an achondrite, but it does not fit in any of the recognized achondrite classes. The high Ca and Cr contents in the olivine are matched only by olivine in ureilites, but this meteorite is distinctly different from the ureilites in other respects, except for the present of small amounts of graphite (not rimming grains as in the ureilities, but as discrete areas).

Sample No.: EET83322
Weight (g): 14.3
Dimensions (cm): 3 x 2.5 x 2
Meteorite Type: E4 Chondrite

Location: Elephant Moraine
Field No.: 2849

Macroscopic Description: Roberta Score

One small patch of fusion crust is present on the iridescent reddish-brown exterior of this stone. Interior is black and speckled with small (<1 mm) inclusions. Abundant black minerals show well-developed crystal faces. Metal may be present. Minor oxidation haloes are visible. Stone is very cohesive.

Thin Section (,2) Description: Brian Mason

Chondrules and chondrule fragments are fairly abundant, and are set in a granular matrix of pyroxene, nickel-iron, and sulfides. The chondrules range up to 0.9 mm in diameter, and consist of granular pyroxene, except for a few made up of nickel-iron and sulfide. A minor amount of brown limonitic staining is present. Microprobe analyses show that the pyroxene is close to $MgSiO_3$ in composition (FeO 0.2-1.7, mean 0.6%; Al_2O_3 0.04-1.1, mean 0.3%; CaO 0.1-0.5, mean 0.3%; TiO_2 0.04-0.24, mean 0.05%; MnO 0.04-0.24, mean 0.13%). The nickel-iron contains about 2.2% Si. Since part of the pyroxene is polysynthetically twinned clinoestatite, the meteorite is classified as an E4 chondrite. It is similar to EET83307 and the possibility of pairing should be considered.

Sample No.: EET83333
Weight (g): 188.6
Dimensions (cm): 5 x 4 x 2.5
Meteorite Type: Silicate-rich Octahedrite

Location: Elephant Moraine
Field No.: 2797

Macroscopic Description: Roy S. Clarke, Jr.

This specimen is irregularly shaped, weathered and pitted, and mainly covered with a reddish brown coating of secondary oxides. Tiny areas of remnant fusion crust have been preserved in several depressions. Silicates are exposed at the bottoms of other depressions, the largest silicate area measuring 10 x 5 mm. Ablative melting of inclusions appears to have caused other surface depressions.

Polished Section Description: Roy S. Clarke, Jr.

A median section through the specimen provided an area of approximately 8 sq. cm for examination. The surface is silicate- rich, containing a number of silicate regions in the mm-size range, as well as numerous small indi- vidual crystals irregularly distributed in the metal. Silicate associa- tions comprise 5-10% of the surface area, two clusters having maximum dimensions of 5 mm. The metal is polycrystalline kamacite with individual crystals in the mm-size range. Longest dimensions are normally less than 5 mm, and the shortest normally more than 1 mm. Taenite and pearlitic plessite areas are distributed along grain boundaries and at junctions of three or more kamacite grains. A striking feature of the etched surface is a continuous and unusually thick circumferential heat altered zone. The thickness of the α_2 structure averages about 5 mm and ranges from 2 to 7 mm. About half of the area of the slice is heat altered. Although small areas of fusion crust were tentatively identified in surface depressions, none was recognized in polished section. Weathering is most obvious near the surface and has penetrated into the interior along grain boundaries.

Interior kamacite areas contain numerous straight Neumann bands and numerous curved subboundaries. Subboundaries are populated with occasional schreibersites, some of which have distinct rhabdite morphologies. Kamacite areas tend to be mottled, suggesting the presence of unresolvable microrhabdites. Large schreibersites occur along crystal boundaries, and several areas of massive schriebersite occur in association with silicate-troilite areas. Schreibersite also occurs at taenite borders. The plessite has a well developed pearlitic structure and is present in abundance consistent with a medium or coarse octahedrite. A distinct Widmanstatten pattern is not well enough developed to obtain reliable band widths.

Silicate areas contain coarse (0.1 to 0.5 mm), colorless, and trans- parent crystals associated with abundant troilite and traces of included kamacite and taenite. Graphite is irregularly associated with silicates, generally at silicate/metal interfaces. It is coarse-grained when present. All the troilite in this section occurs with silicates. Survey electron microprobe examination of the silicates identified plagioclase (An 9), olivine (Fa 5), and pyroxene (Fs 7).

This individual is a silicate-rich octahedrite, probably a Group I meteorite. The unusually thick heat-altered zone suggests an atypical passage through the atmosphere. It is distinct from EET84300, another silicate-rich iron.

Sample No.: EET83390
Weight (g): 15.2
Dimensions (cm): 2 x 1.8 x 1
Meteorite Type: Atmospherically heat-affected coarse or medium Octahedrite

Location: Elephant Moraine
Field No.: 2964

Macroscopic Description: Roy S. Clarke, Jr.

The specimen is irregular in shape and deeply weathered. The surface is covered with reddish brown secondary oxides, and it contains several small depressions that may have resulted from atmospheric melting.

Polished Section Description: Roy S. Clarke, Jr.

A median section provided an area of 1 sq. cm for examination. The structure revealed is that of a heat-affected medium or coarse octahedrite. The few structures available for band width measurements indicate a 1 to 1.5 mm range. Throughout the section kamacite has been transformed to α_2 by atmospheric heating. Most of the rim of the section is coated with layered secondary oxides 0.1 to 1 mm thick.

Taenite and comb plessite areas appear to have been somewhat heat-affected. Microrhabdites are present, and several remnant Neumann bands are suggested by linear arrays of microrhabdites. Major grain boundaries are populated over much of their lengths by either grain boundary schreibersite or secondary iron oxides that have invaded into the interior. Some schreibersite is associated with taenite-plessite areas.

This specimen appears to be a small individual that was severely heated upon passage through the atmosphere. It is an octahedrite and may prove on further study to be a Group III meteorite.

Sample No.: EET83399
Weight (g): 203.3
Dimensions (cm): 5 x 5 x 4
Meteorite Type: L3 Chondrite

Location: Elephant Moraine
Field No.: 2774

Macroscopic Description: Rene Martinez

Small patches of black, shiny fusion crust remain on this otherwise extensively weathered meteorite.

Thin Section (,3) Description: Brian Mason

The section shows numerous chondrules, up to 1.8 mm across. A variety of types is present, including granular and porphyritic olivine and olivine-pyroxene, barred olivine, and cryptocrystalline pyroxene. The matrix consists largely of fine-grained silicates with minor subequal amounts of nickel-iron and troilite. The meteorite is considerably weathered, with brown limonitic staining throughout the section. Microprobe analyses show olivine ranging in composition, Fa 3-26, with a mean of Fa 17 (CV FeO is 34); the pyroxene is clinobronzite ranging in composition from Fs 6 to Fs 25. This range in composition indicates type 3, and the amount of nickel-iron suggests L group. The meteorite is tentatively classified as an L3 chondrite.

Sample No.: EET84300
Weight (g): 72.2
Dimensions (cm): 3.5 x 3 x 2
Meteorite Type: Silicate-rich finest Octahedrite

Location: Elephant Moraine
Field No.: 2489

Macroscopic Description: Roy S. Clarke, Jr.

This specimen is irregularly shaped, pitted, weathered, and covered with a reddish brown coating of secondary oxides.

Polished Section Description: Roy S. Clarke, Jr.

An off-center section through the specimen provided an area of 4 sq. cm for examination. About one-third of this surface area contains silicate clusters and individual silicate crystals dispersed in metal. These Orsilicate association comprise about 5% of the total area. The metal is. polycrystalline, containing three cm-size areas of finest octahedrite structure with band widths around 0.1 mm. These three large areas are separated by two comparatively wide bands of kamacite containing median grain boundary schreibersite. The silicate-rich area is more complex and contains smaller areas of finest octahedrite structure. The slice is rimmed with essentially continuous secondary oxides about 0.2 mm thick. A few small metal areas near the rim contain α_2 structure, its deepest penetration being less than 0.5 mm.

Dominant features within the metal areas are a Widmanstatten pattern of taenite, cellular plessite, and kamacite lamellae. Schreibersite is found at junctions of kamacite lamellae, at centers of kamacite lamellae, and within plessite areas. A number of graphite inclusions are present, ranging in size from a few hundredths of a mm to 0.5 mm. Tiny inclusions of daubreelite were tentatively identified.

Silicates occur as clusters and as individual grains within metal. They range from transparent to translucent, and from water-clear to slightly colored. Some of the coloring is probably due to weathering. A 0.5 mm transparent and slightly green crystal proved on electron microprobe examination to be diopside. Other silicates identified were plagioclase (An 12), olivine (Fa 0.8), and pyroxene (Fs 6). The cluster silicates are coarsely crystalline, and associated with polycrystalline troilite, small amounts of metal, and schreibersite and/or carbide.

This specimen is a silicate- and graphite-rich polycrystalline finest octahedrite. It is distinct from EET83333.

METEORITE POWDERS PREPARED BY EUGENE JAROSEWICH

It is well known that, because many meteorites are compositionally heterogeneous at the millimeter to centimeter scale, representative sampling can be a significant problem in studies of the bulk compositions of meteorites. Especially for chemical and elemental measurements, it is advantageous to have all analyses performed on equivalent splits from a representative, homogenized powder so that meaningful intercomparison of data can be achieved.

Thanks to the generous cooperation and hard work of Eugene Jarosewich (Department of Mineral Sciences, U. S. National Museum of Natural History, Smithsonian Institution, Washington, DC), homogeneous-powder samples are available for many of the more interesting specimens from the U. S. Antarctic collection. A complete list of those powders is given in Table 3. For each specimen, the weight of the sample that was committed to homogenization is listed. The amount of material that remains from each sample varies from one specimen to the next because some material has been consumed in analysis. However, these powders probably comprise the most representative bulk samples of the respective meteorites that can be obtained, especially for analyses that require only a few tens to a few hundreds of milligrams of material.

For each meteorite that contained a significant amount of metal, quantitative separations were made to produce metal and silicate (+ sulfide) portions by crushing and sieving. Large grains of metal were concentrated into the ">100-mesh" fraction. The "<100-mesh" fraction was predominantly silicate (+ sulfide and minor metal) material. For each meteorite that did not contain appreciable metal, though, no such splitting was attempted (e.g., eucrites, C2 chondrites).

Further details of sample preparation can be obtained directly from Eugene Jarosewich (details are provided along with allocated samples). However, requests for samples should be made through the Secretary/MWG at the address given on page 2 of this newsletter.

Homogenized Powders of Antarctic Meteorites

Meteorite		Original Aliquot (g)	Type	
ALHA	76004,10	2.015	LL3	
ALHA	77003,20	4.700	C30	*
ALHA	77005,38	2.310	SH	*
ALHA	77011,11	3.360	L3	*
ALHA	77015,17	3.110	L3	*
ALHA	77155,12	20.190	L6	
ALHA	77167,19	3.100	L3	*
ALHA	77214,18	10.700	L3	*
ALHA	77216,00	19.770	L3	
ALHA	77219,27	2.000	M	
ALHA	77231,25	20.080	L6	
ALHA	77249,16	3.000	L3	*
ALHA	77256,33	2.210	DI	*
ALHA	77257,44	2.210	U	*
ALHA	77260,17	3.100	L3	*
ALHA	77270,18	20.060	L6	
ALHA	77271,20	20.230	H6	
ALHA	77278,23	5.152	LL3	*
ALHA	77284,12	21.130	L6	
ALHA	77294,26	20.040	H5	
ALHA	77296,12	20.850	L6	
ALHA	77297,23	20.200	L6	
ALHA	77299,17	5.122	H3	*
ALHA	77304,23	3.520	L4	*
ALHA	77307,55	3.513	C3	
ALHA	78078,09	20.060	L6	
ALHA	78106,23	20.150	L6	
EETA	79001,00	9.437	SH	
EETA	79001,00	15.236	SH	
EETA	79004,76	4.090	EU	
EETA	79005,69	4.075	EU	
EETA	79011,33	2.099	EU	
ALHA	80102,68	4.350	EU	
RKPA	80256,07	3.010	L3	
ALHA	81001,12	2.001	EU	
ALHA	81006,22	4.010	EU	
ALHA	81007,09	2.002	EU	
ALHA	81009,27	4.059	EU	
ALHA	81010,18	4.040	EU	
ALHA	81011,00	4.195	EU	
ALHA	81027,17	10.260	L6	
ALH	82101,16	2.530	C30	
TIL	82402,05	20.300	LL6	
TIL	82403,15	2.000	EU	
PCA	82502,32	4.128	EU	
PCA	82506,07	20.096	U	
PCA	82507,05	20.200	LL6	
EET	82600,13	4.092	HO	
ALH	83100,74	20.227	C2	
EET	83232,05	10.030	EU	

Eugene Jarosewich
Smithsonian Institution

All meteorites were prepared in agate mortar,except for those marked with asterisk "*", which were prepared in tungsten carbide mortar.

POLICY ON CONSORTIUM STUDIES

Recognizing the scientific advantages in cooperative, multidisciplinary investigations of documented samples, researchers have successfully studied several important meteorites by the "consortium" approach. In its typical manifestation, a consortium study is organized by an individual scientist who accepts responsibility for identifying the key measurements that are to be made, selecting appropriate samples from the meteorite, and coordinating the analyses and reports of the participating research groups. To date, consortium studies have been made, at various levels of detail, for 18 different specimens from the U. S. Antarctic meteorite collection.

At its meeting of September, 1985, the Meteorite Working Group discussed consortium studies and reaffirmed its general support of that approach to meteorite research. The following policy statement was issued as Appendix 7 of the meeting minutes:

> Proposals for consortium study of Antarctic meteorites are encouraged, but in most cases such consortia will no longer have exclusive access to a given specimen. Allocations to two or more investigators for competing research may be approved, even though one investigator may be a consortium member.

NEW SAW-CUT SURFACES OF EETA79001

Rene Martinez and James L. Gooding

A recent saw cut of the highly interesting shergottite, Elephant Moraine A79001, produced additional exposures of the meteorite's two most rare lithologic units, a coarsely crystalline feldspathic pyroxenite (Lithology B, below) and a microvitrophyric vug- and vein-forming material (Lithology C). The latter glassy material is well known as the carrier of trapped gases that resemble those in the atmosphere of Mars, both in terms of elemental and isotopic abundances (Bogard and Johnson, 1983; Becker and Pepin, 1984).

As shown in Fig. 1, EETA79001 was first sawed in December 1980 to produce a 1-cm-thick slab (consisting of fragments ...,21 and ...,22), from which most research samples were taken. The new saw cut was made on parent, ...,1, in a direction perpendicular to the original saw cuts (i.e., in the plane of Fig. 1). The principal fragments that were generated by the new saw cut were ...,1 (parent) and ...,216, as well as 37.25 g of saw dust (...,219). As in 1980, the sawing was performed with an unlubricated stainless steel band inside a dry-nitrogen cabinet. Photographs and lithologic maps of the new saw-cut faces are shown in Figs. 2-5. Please note that the black stripes on the cut face in Fig. 2 are artifacts of sawing. The lithologic units are as follows:

Lithology A

This unit consists principally of a medium-grained, feldspathic pyroxenite with abundant megacrysts of olivine and some megacrysts of pyroxene. All plagioclase has been converted to maskelynite by shock metamorphism, as is characteristic of shergottites. Detailed petrographic descriptions were provided by McSween and Jarosewich (1983).

Lithology B

This unit is a coarse-grained equivalent of Lithology A but without megacrysts. Detailed petrographic descriptions were provided by McSween and Jarosewich (1983).

Lithology C

Although this unit has been commonly described as "glass," it actually consists of finely intermingled vitreous and cryptocrystalline materials. The true glassy component is dark brown to black whereas the microcrystalline components include both dark gray-brown phases and colorless to white phases. Both large vugs and small vesicles are common features. Some dark-colored phases (probably pyroxenes) display quench textures that suggest origins by incomplete crystallization of the parental melt(s) of this unit. In contrast, the light-colored phases might be a mixture of incompletely melted relict grains and post-melting reaction products. In at least one case, a nearly spheroidal, light-colored phase is clearly attached to the wall of a vug. Other occurrences of light-colored phases include translucent fillings of microvesicles. Additional descriptions have been given by McSween and Jarosewich (1983) and Gooding and Muenow (1986).

Glass Veins

These vitreous dark brown to black veins fill major fractures to various degrees. However, only the most prominent veins are represented on the lithologic maps and there exist many small fractures that might not be filled by glass. Large pockets of Lithology C appear to be the centers of most large vein systems, suggesting that pockets of Lithology C were the source regions for the veins. However, the veins are noticeably more vitreous than the large pockets.

White Druse

This unit consists of thin saccharoidal coatings and veins of a colorless to white, translucent phase of dull to resinous luster. Although most grains are too small to reveal characteristic crystal forms under the binocular light microscope, a few occurrences consist of radiating acicular to prismatic, euhedral crystals with monoclinic terminations. Microforms of other grains range from massive to mammillary and botryoidal. Small rust-like, yellow-red stains are associated with the white druse.

The occurrence of white-druse material in or on some small vesicles in Lithology C clearly implies that the white material grew in place. The white material might consist of gypsum and/or other salt or aluminosilicate minerals of the types described by Gooding (1984) and Gooding and Muenow (1986) but in much larger quantities than previously discovered. The terrestrial (vs. pre-terrestrial) origin of the white-druse material remains problematical, though. Gypsum and clay mineraloids of Antarctic origin occur on and in the exterior portions of the meteorite (Gooding, 1984). However, the white druse described here is associated with large pockets of Lithology C that are clearly within the interior of the meteorite and which do not display obvious connections with the exterior of the specimen.

References Cited:

Becker R. H. and Pepin R. O. (1984) The case for a martian origin of the shergottites: nitrogen and noble gases in EETA79001. Earth Planet. Sci. Lett., 69, 225-242.

Bogard D. D. and Johnson P. (1983) Martian gases in an Antarctic meteorite? Science, 221, 651-654.

Gooding J. L. (1984) Search for "Martian (?) weathering" effects in achondrites EETA79001 and ALHA77005: complications from Antarctic weathering (abstract). Lunar Planet. Sci. XV, Lunar and Planetary Institute, Houston, 310-311.

Gooding J. L. and Muenow D. W. (1986) Martian volatiles in shergottite EETA79001: new evidence from oxidized sulfur and sulfur-rich aluminosilicates. Geochim. Cosmochim. Acta, 50, in press.

McSween H. Y. Jr. and Jarosewich E. (1983) Petrogenesis of the Elephant Moraine A79001 meteorite: multiple magma pulses on the shergottite parent body. Geochim. Cosmochim. Acta, 47, 1501-1513.

EETA 79001

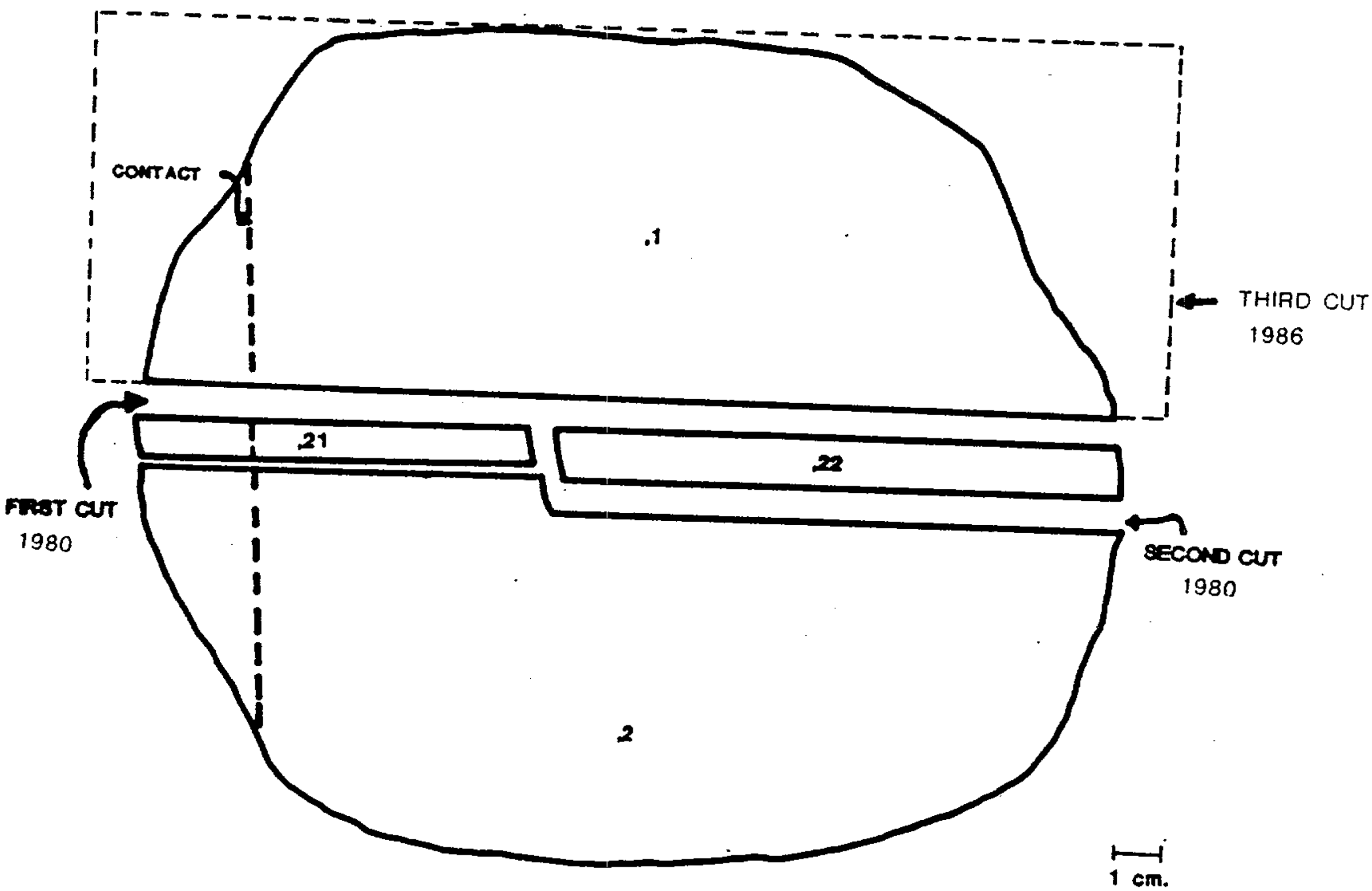

Figure 1. Saw cuts

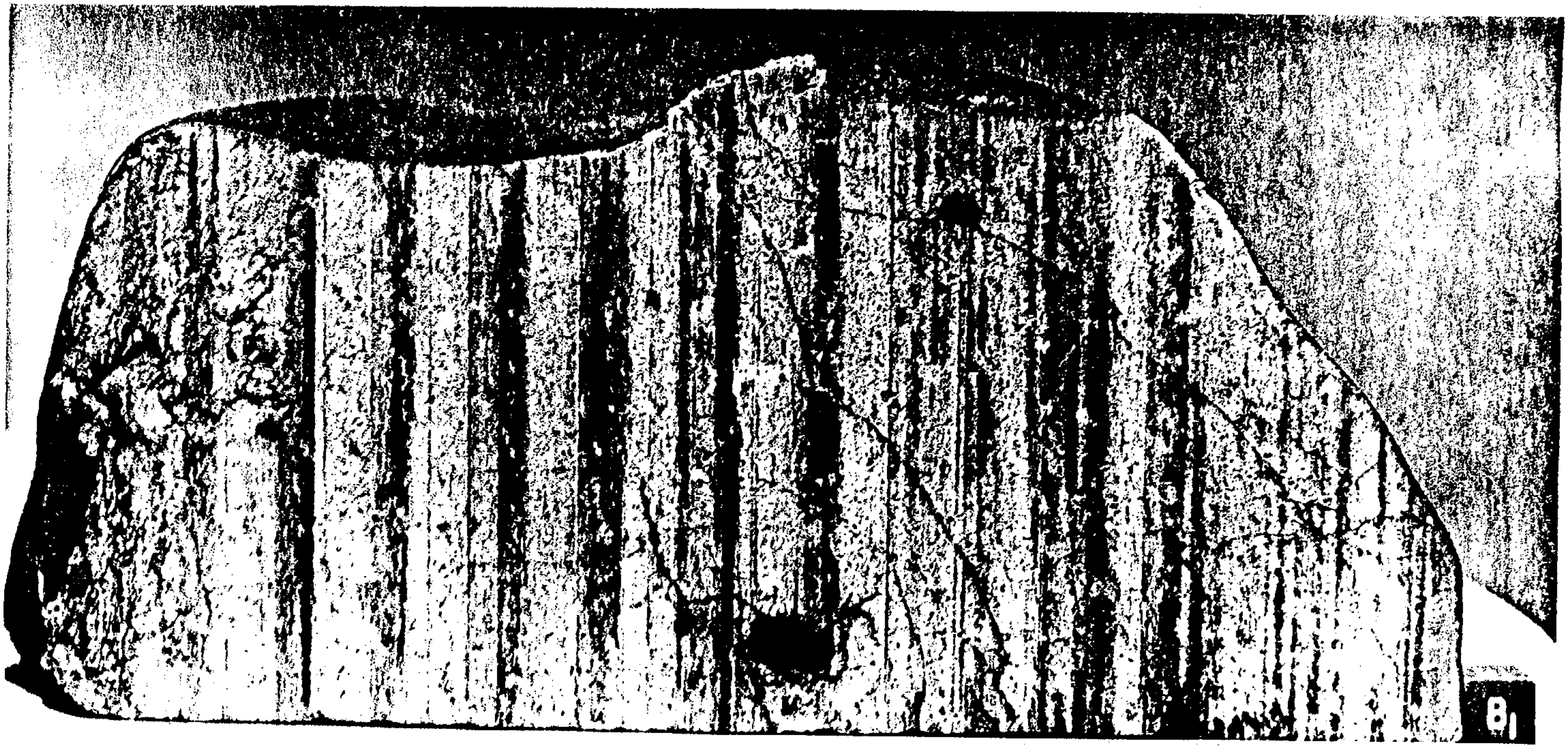

Figure 2. Photo of EETA79001,1

EETA 79001,1

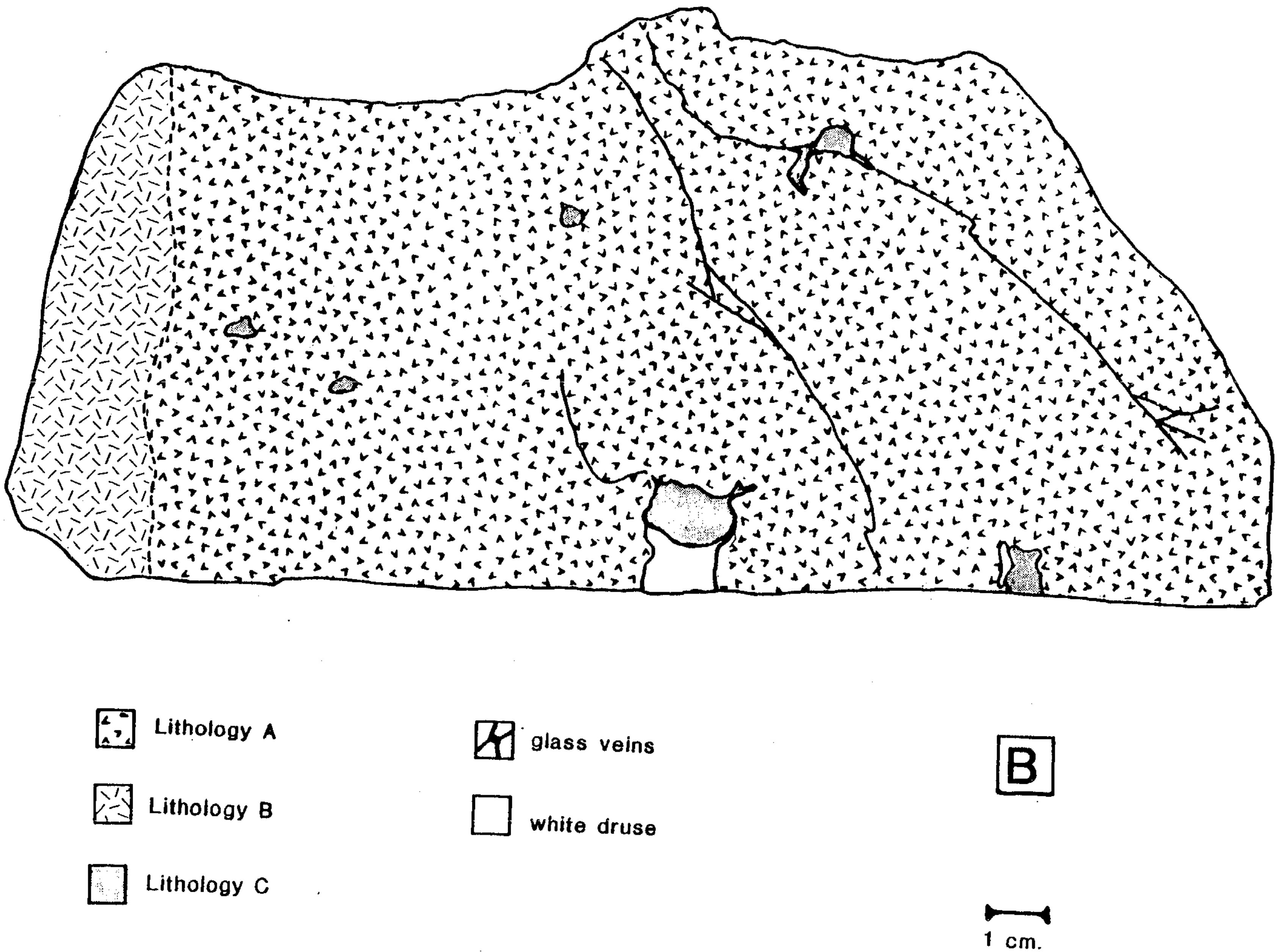

Figure 3. Lithologic map of figure 2

Figure 4. Photo of EETA79001,216

EETA 79001,216

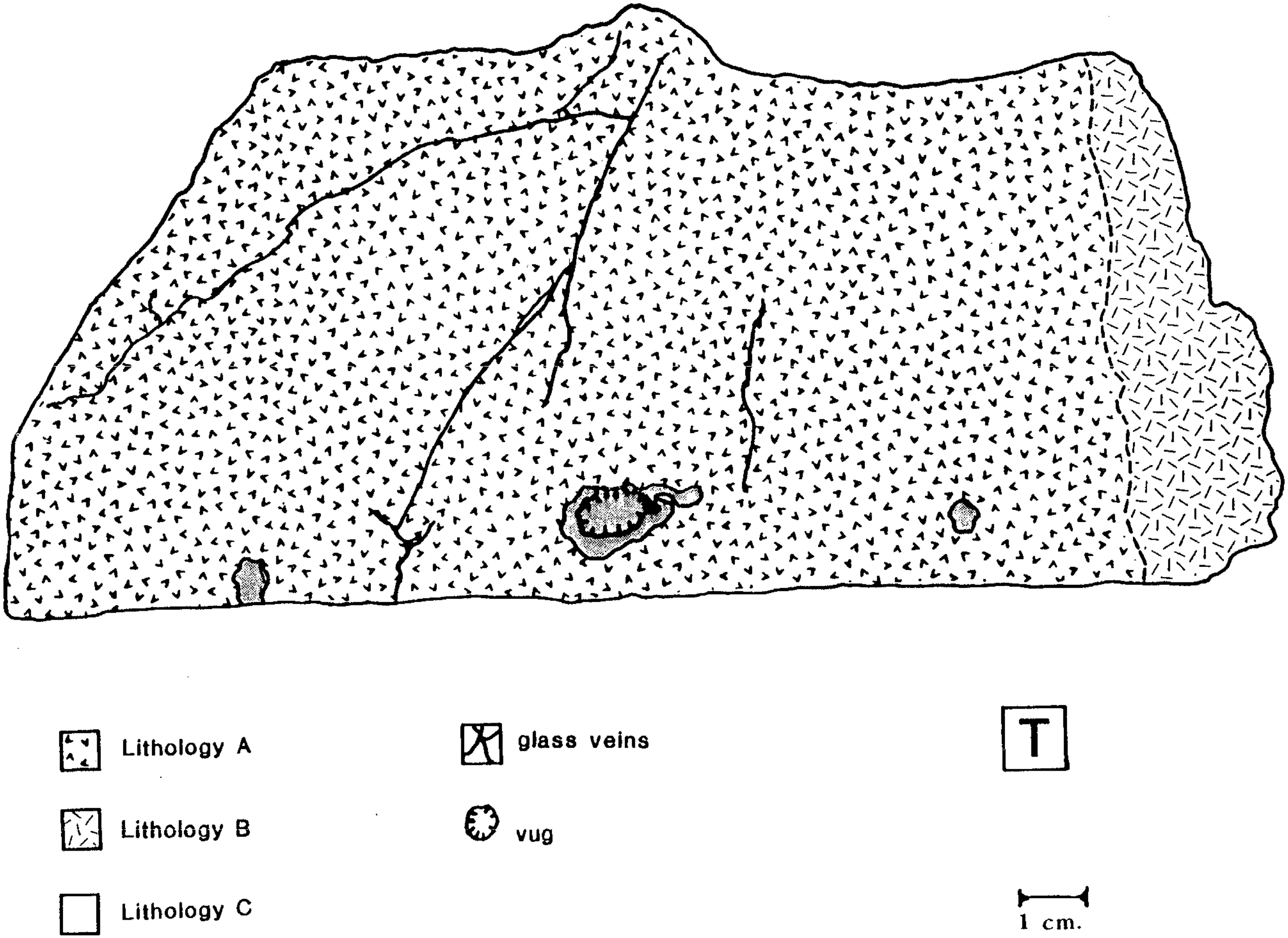

Figure 5. Lithologic map of figure 4

☆ U.S. GOVERNMENT PRINTING OFFICE: 1986—659-014/40017