Antarctic Meteorite Newsletter

Volume 20, Number 1 February 1997

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

Edited by Cecilia Satterwhite and Marilyn Lindstrom, Code SN2, NASA Johnson Space Center, Houston, Texas 77058

New Meteorites

This newsletter announces the availability of 40 new meteorites from the 1994-1995 collections. The number may be small, but the samples are large and from areas not previously sampled. Most notable among the new meteorites are 4 achondrites (ureilite GRA95205, lodranite GRA95209 and two howardites) and 6 special chondrites (EH3 GRO95517, 2 C2s and 3 UOCs). Also included are two terrestrial rocks, EET96400 and 96401, collected as "meteowrongs" on the ice as controls or blanks for studies of organic compounds in martian meteorites.

Collecting Antarctic Meteorites and Terrestrial Rocks

The 1996-1997 ANSMET season is history. The field team members are back at their regular jobs and the meteorites await shipment to California enroute to JSC in March/April. The team of six consisted of Ralph Harvey, John Schutt, Guy Consolmagno, Rene Martinez, Sarah Lawrence and Laurie Leshin. They went to the Elephant Moraine field areas of Meteorite City and Texas Bowl to complete collection. They also did some reconnaissance at the Meteorites Hills site. They had some illnesses, bad weather, and visits from film crews, but still managed to collect 390 meteorites. They tell us that there are some especially nice meteorites in the batch. Stay tuned for the summer newsletter.

The team also collected two deliberate "meteowrongs" - two Antarctic dolerites (basalts) which were found on the ice and collected using the same procedures as meteorites. These terrestrial rocks are available as controls/blanks for studies of organics/life in martian meteorites. (see EET96400 and EET96401 listing). Ralph Harvey will do petrographic documentation for them after they arrive at JSC, but investigators may request them now.

New MWG Secretary and Changes in the MPL

Judy Allton has been appointed the new MWG Secretary, filling the position vacated by Robbie Score last spring. Although new to meteorite curation, Judy is learning the meteorite culture and working her way through the backlog of correspondence that accumulated during the 6 months without an MWG secretary. Judy's long experience on the curation team is mostly with lunar samples and advanced curation for future samples from the Moon and Mars. Her chemistry training will be helpful in the assessment of organic contamination control. The curator apologizes

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for not being able to manage everything herself, but assumes that most investigators don't really mind if their samples arrived before their correspondence.

Cecilia Satterwhite took over management of the MPL last spring. She and Kathleen McBride have been doing an excellent job of keeping allocations and sample descriptions going despite a huge influx of visitors and "meteorites" sent to us by the public. Cecilia is available to answer questions about sample processing, but remember that her bark is worse than her bite.

Claire Dardano is our computer programmer who is responsible for the meteorite database. She keeps us honest with real data and keeps our VAX database running. She is beginning to transition the data to a modern PC database. This task will also include input of balance and imaging data electronically. When the job is done the data should be much more accessible to investigators. Claire and graphic artist Anita Dodson created and maintain the curator's website. They responded overnight in setting up a martian meteorite website from the text of the curator's display. Claire also assembled the Ancient Martian Meteorites Proposal Information Package from text provided by the curator. Anita prepares all our newsletters, exhibits and public handouts. They do a great job of transforming our detailed work into something readable and attractive.

Martian Meteorites

Human life and work in the JSC Meteorite Processing Lab has been crazy since the announcement of possible fossil life in our martian meteorite last summer. First we were inundated by media, then by the public with calls of "I think I have a meteorite", then by the JSC center director's VIP tours. We had already prepared a traveling exhibit and handouts on martian meteorites and they have been in great demand by the public, educators and scientists. We have displayed the exhibit locally, regionally and at national meetings (DPS, GSA, NSTA) and have made copies for several other NASA centers to broaden public access.

Meteorite laboratory at NASA's Johnson Space Center.

We have never forgotten that meteorite science is our first responsibility. Our new work has focused on two areas: 1) documenting what we know about martian meteorites for headquarters, MWG, and investigators. This was presented at two levels, for meteoriticists in the Mars Meteorite Compendium, and for newcomers from other fields of science in the Mars Meteorite Proposal Information Package. 2) evaluating our lab and procedures for possible organic contamination. At our request, headquarters convened a blue ribbon panel chaired by Jeff Bada (UCSD) to help us evaluate organic contamination. We compiled detailed information about our meteorite curation techniques for the committee's reference. They visited JSC in late December and their report is expected soon.

We are supporting NASA headquarters and NSF in martian meteorite research. Both NASA and NSF have announced funding opportunities for studying possible fossil life in martian meteorites. We prepared the Proposal Information Package on the web to support both programs. It tells investigators everything they want to know about martian meteorites, especially the five in our collection. The sample request deadline for martian meteorites is just past, so we are now preparing request summaries for both funding panels and for a special MWG meeting to handle the requests. (All requests for ALH84001 were tabled at the September MWG meeting.) The reviews of proposals and sample requests by the three panels will be an iterative process between NASA, NSF and MWG. Funding proposals will not be approved if they depend on requests for Antarctic meteorites which are unreasonable (too much or non-existent samples). We hope to be able to allocate samples by April.

Meanwhile, life goes on and we have a lab full of other meteorites, this newsletter to publish, requests and MWG meetings to support, and allocations and new meteorites to process. That work goes on amidst the chaos of martian meteorites. We thank investigators for their patience if we are slower than usual.

Mars Meteorite Compendium Available

Chuck Meyer, of the curator's office, has recently published a *Mars Meteorite Compendium.* It is currently available on the curator's web site (http://www-curator.jsc.nasa.gov/antmet/mmc/mmc.htm) and will later be available from our office as a limited number of paper copies. It provides a complete review of the curation and research on all 12 martian meteorites. Chuck studied our database and datapacks on our 5 specimens. He also contacted curators and dealers holding large pieces of the other 7 meteorites. He painstakingly collected all the literature on martian meteorites. He thanks everyone who sent him information for their help. The compendium has photos of whole rocks and thin sections and a wealth of data on mineralogy and bulk and isotopic composition. It is an incredibly useful collection of information and references which took over a year to compile.
I recommend it to all scientists interested in studying these fascinating meteorites.

Smithsonian Meteorite Volumes Available

Tim McCoy, the new meteorite curator at the Smithsonian Natural History Museum, reports that he has copies of several meteorite catalogs available. They were published as *Smithsonian Contributions to Earth Sciences*, volumes 23, 24, 26, 28, 30. For copies see the announcement below and contact Tim at the museum.

The following back issues of publications are available at no cost from the Smithsonian Institution

Smithsonian Contributions to the Earth Sciences. These volumes contain descriptions, with photos, of Antarctic meteorites and field recovery programs from 1976-1987. Available volumes are #23 (76,77), #24 (78,79), #26 (80,81), #28 (82,83), and #30(84-86, including ALH 84001).

The Microscopic Properties of Meteorites, by Tschermak (1985). Translated by Wood (1965) and including numerous wonderful photographs of meteorites in thin section.

To request copies contact: Dr. Tim McCoy, Dept. of Mineral Sciences, MRC 119, Smithsonian Institution, Washington, DC 20560, USA
Fax: (202) 357-2476; email: mnhms055@sivm.si.edu

Sample Request Guidelines

All sample requests should be made in writing to:

Secretary, MWG
SN2/Office of the Curator
NASA Johnson Space Center
Houston, TX 77058 USA

Requests that are received by the MWG Secretary before March 7, 1997, will be reviewed at the MWG meeting on March 21-22, 1997, to be held in Houston, TX. Requests that are received after the Mar. 7 deadline may possibly be delayed for review until the MWG meets again in the Fall of 1997. PLEASE SUBMIT YOUR REQUESTS ON TIME. Questions pertaining to sample requests can be directed in writing to the above address or can be directed to the curator by phone, FAX, or e-mail.

Requests for samples are welcomed from research scientists of all countries, regardless of their current state of funding for meteorite studies. Graduate student requests should be initialed or countersigned by a supervising scientist to confirm access to facilities for analysis. All sample requests will be reviewed in a timely manner. Those requests that do not meet the JSC Curatorial Guidelines will be reviewed by the Meteorite Working Group (MWG), a peer-review committee which meets twice a year to guide the collection, curation, allocation, and distribution of the U.S. collection of 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 accurately refer to meteorite samples by their respective identification numbers. Specific requirements for sample types within individual specimens, or special handling or shipping procedures should be explained in each request. Each request should include a brief justification, which should contain: 1) what scientific problem will be addressed; 2) what analytical approach will be used; 3) what sample masses are required; 4) evidence that the proposed analyses can be performed by the requester or collaborators; and 5) why Antarctic meteorites are best suitable for the investigation. For new or innovative investigations, proposers are encouraged to supply additional detailed information in order to assist the MWG. Requests for thin sections which will be used in destructive procedures such as ion probing, etching, or even repolishing, must be stated explicitly. Consortium requests must be initialed or countersigned by a member of each group in the consortium. All necessary information, in most cases, should be condensable into a one-or two-page letter.

Samples can be requested from any meteorite that has been made available through announcement in any issue of the *Antarctic Meteorite Newsletter* (beginning with 1 (1) in June, 1978). Many of the meteorites have also been described in five *Smithsonian Contr. Earth Sci.:* Nos. 23, 24, 26, 28, and 30. A table containing all classifications as of December 1993 is published in *Meteoritics* 29, p. 100-142 and updated as of April 1996 in *Meteoritics and Planetary Science* 31, p. A161-A174.

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New Meteorites

From 1994-1995 Collections

Pages 6-11 contain preliminary descriptions and classifications of meteorites that were completed since publication of issue 19(2), August 1996. Specimens of special petrologic type (carbonaceous chondrite, unequilibrated ordinary chondrite, achondrite, etc.) are represented by separate descriptions unless they are paired with previously described meteorites. However, some specimens of non-special petrologic type are listed only as single line entries in Table 1. For convenience, new specimens of special petrological type are also recast in Table 2.

Macroscopic descriptions of stony meteorites were performed at NASA/JSC. These descriptions summarize hand-specimen features observed during inital examination. Classification is based on microscopic petrography and reconnaissance-level electron microprobe 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:

Kathleen McBride, Cecilia Satterwhite
Antarctic Meteorite Laboratory
NASA Johnson Space Center
Houston, Texas

Brian Mason
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U.S. National Museum of Natural History
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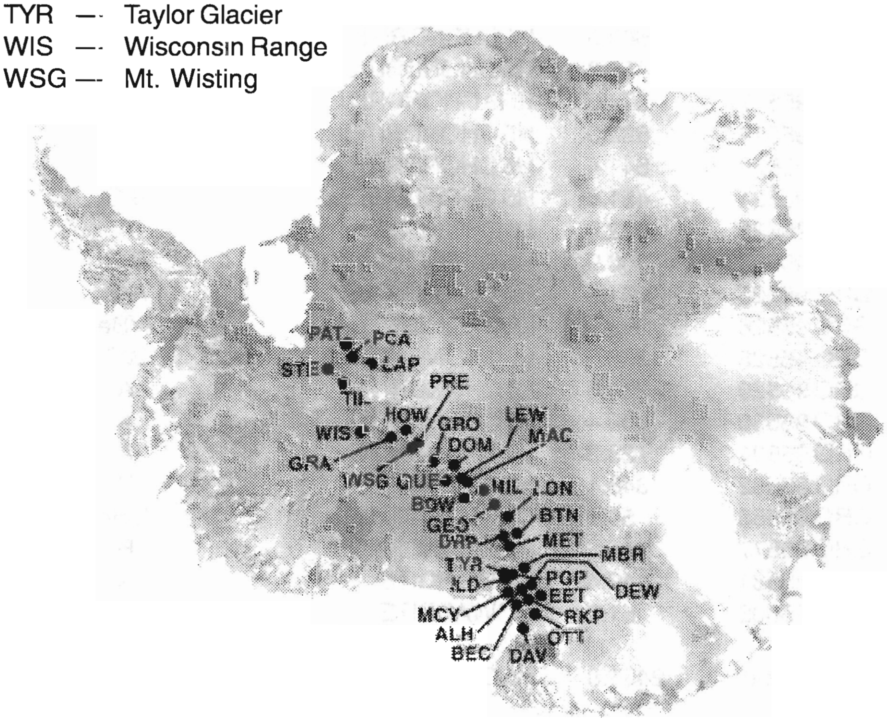
Washington, D.C.

Antarctic Meteorite Locations

ALH — Allan Hills
BEC — Beckett Nunatak
BOW — Bowden Neve
BTN — Bates Nunataks
DAV — David Glacier
DEW — Mt. DeWitt
DOM — Dominion Range
DRP — Derrick Peak
EET — Elephant Moraine
GEO — Geologists Range
GRA — Graves Nunataks
GRO — Grosvenor Mountains
HOW — Mt. Howe
ILD — Inland Forts
LAP — LaPaz Ice Field
LEW — Lewis Cliff
LON — Lonewolf Nunataks
MAC — MacAlpine Hills
MBR — Mount Baldr
MCY — MacKay Glacier
MET — Meteorite Hills
MIL — Miller Range
OTT — Outpost Nunatak
PAT — Patuxent Range
PCA — Pecora Escarpment
PGP — Purgatory Peak
QUE — Queen Alexandria Range
RKP — Reckling Peak
STE — Stewart Hills
TIL — Thiel Mountains
TYR — Taylor Glacier
WIS — Wisconsin Range
WSG — Mt. Wisting



Information on the U.S. Collection of Antarctic Meteorites

Number of meteorites:	7857
Number of meteorites classified:	7532

Table 1: List of Newly Classified Antarctic Meteorites**

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
QUE 94777	18.3	H5 CHONDRITE	B/C	A/B	19	17
GRA 95200	25066.1	L5 CHONDRITE	A/B	A/B	25	21
GRA 95201	2990.5	H5 CHONDRITE	Be	B	19	17
GRA 95202	2006.4	H5 CHONDRITE	A/B	A	18	16
GRA 95203	1205.9	L5 CHONDRITE	B	B	25	21
GRA 95204	1173.7	H5 CHONDRITE	A/B	A	18	16
GRA 95205	1459.8	UREILITE	B	B	20-22	18-20
GRA 95206	933.2	L6 CHONDRITE	B	B	25	21
GRA 95207	914.2	H5 CHONDRITE	A/B	A/B	18	16
GRA 95208	778.3	H3.7 CHONDRITE	B	A/B	19-27	7-23
GRA 95209	948.8	LODRANITE	B	A/B	7	7
GRA 95210	550.4	H5 CHONDRITE	A/B	A	18	16
GRA 95211	518.8	H6 CHONDRITE	B/C	A	19	17
GRA 95212	444.1	H5 CHONDRITE	B	A/B	18	16
GRO 95505	2031.0	L3.6 CHONDRITE	B	A	11-26	15-24
GRO 95506	1194.5	H5 CHONDRITE	B/Ce	B/C	19	17
GRO 95508	1271.6	L6 CHONDRITE	A/B	A	24	20
GRO 95509	1014.0	H5 CHONDRITE	B	B	19	17
GRO 95510	1097.3	L6 CHONDRITE	A/Be	A/B	24	20
GRO 95513	851.7	L6 CHONDRITE	B	B	25	21
GRO 95515	663.6	L4 CHONDRITE	A/Be	A/B	24	15-21
GRO 95516	456.8	H6 CHONDRITE	B	B	19	17
GRO 95517	574.0	EH3 CHONDRITE	C	B/C		1-5
GRO 95519	682.3	H5 CHONDRITE	B/C	B/C	18	16
GRO 95520	641.4	H5 CHONDRITE	B/C	B	18	16
GRO 95521	451.5	H5 CHONDRITE	B/C	B	19	17
GRO 95523	402.0	L6 CHONDRITE	A	A	24	20
GRO 95524	360.9	H5 CHONDRITE	B/C	B	18	16
GRO 95525	291.6	H6 CHONDRITE	A/B	A	19	17
GRO 95526	299.9	L6 CHONDRITE	A/Be	B	26	22
GRO 95528	358.6	L6 CHONDRITE	B/C	A/B	24	20
GRO 95529	250.6	L5 CHONDRITE	A	A	24	20
GRO 95530	603.4	L5 CHONDRITE	A	A/B	24	20
GRO 95531	723.3	L6 CHONDRITE	A	A	25	21
GRO 95532	348.4	H6 CHONDRITE	B	A/B	19	17
GRO 95566	50.7	C2 CHONDRITE	A/Be	A/B	1-35	2-4
GRO 95577	106.2	C2 CHONDRITE	B	B		
GRO 95581	49.4	HOWARDITE	A	A		21-54
GRO 95602	51.5	HOWARDITE	A/B	A	25	17-49
PRE 95400	2431.8	H5 CHONDRITE	A	A	19	17
WSG 95300	2733.0	H3.4 CHONDRITE	A/B	A	1-21	2-17
EET 96400	*	TER-DOLERITE	*	*	*	*
EET 96401	*	TER-DOLERITE	*	*	*	*

* Terrestrial dolerites collected by ANSMET. Detailed descriptions will be available in next newsletter.

Table 2: Newly Classified Specimens Listed By Type **

Sample Number	Weight (g)	Classification	Weathering	Fracturing	% Fa	% Fs
		Achondrites				
GRO 95581	49.4	HOWARDITE	A	A		21-54
GRO 95602	51.5	HOWARDITE	A/B	A	25	17-49
GRA 95205	1459.8	UREILITE	B	B	20-22	18-20
		Carbonaceous Chondrites				
GRO 95566	50.7	C2 CHONDRITE	A/Be	A/B	1-35	2-4
GRO 95577	106.2	C2 CHONDRITE	B	B		
		Chondrites - Type 3				
WSG 95300	2733.0	H3.4 CHONDRITE	A/B	A	1-21	2-17
GRA 95208	778.3	H3.7 CHONDRITE	B	A/B	19-27	7-23
GRO 95505	2031.0	L3.6 CHONDRITE	B	A	11-26	15-24
		E Chondrites				
GRO 95517	574.0	EH3 CHONDRITE	C	B/C		1-5
		Stony-Irons				
GRA 95209	948.8	LODRANITE	B	A/B	7	7
		Terrestrial Rocks				
EET96400	*	TER-DOLERITE	*	*	*	*
EET96401	*	TER-DOLERITE	*	*	*	*

* Terrestrial dolerites collected by ANSMET. Detailed descriptions will be available in next newsletter.

Table 3: Tentative Pairings for New Specimens

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). Possible pairings were updated in Meteoritical Bulletin No. 76, Meteoritics 29, 100-143 (1994), and Meteoritics and Planetary Science, A161-A174.

HOWARDITE

GRO 95581 and GRO 95602 with GRO 95534

**Notes to Tables 1 and 2:

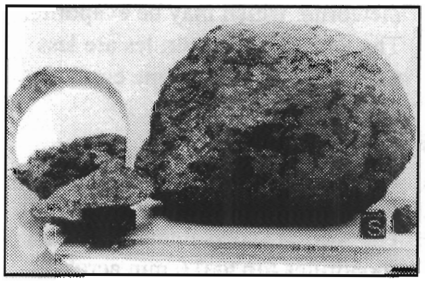
"Weathering" Categories:

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.
e: Evaporite minerals visible to the naked eye.

"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.

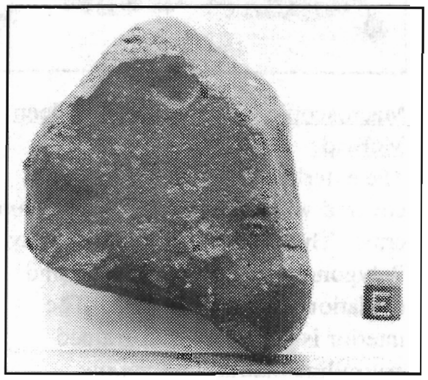
Sample No.: GRA95205
Location: Graves Nunataks
Dimensions (cm): 10.5 x 7.5 x 7.5
Weight (g): 1459.8
Meteorite Type: Ureilite



Macroscopic Description: Kathleen McBride
The exterior of this achondrite has patches of dull black fusion crust with polygonal fractures. Most of the fusion crust has weathered away. The resulting surface is a rusty green-brown color with numerous areas or patches of shiny melted-appearing minerals. Several fractures are visible. This meteorite is very hard and extremely difficult to break. The interior revealed white to yellow minerals; pyroxene, plagioclase and oxides are present. Some areas are completely rusty. Cleavage planes were visible on some of the larger mineral grains. This achondrite has an igneous texture.

Thin Section (,5) Description: Brian Mason
The section shows an aggregate of anhedral to subhedral grains, up to 6 mm across, of olivine and pyroxene. Individual grains are rimmed by carbonaceous material which contains trace amounts of nickel-iron and troilite. The olivine crystals have been converted into a mosaic of tiny grains, presumably by shock; the pyroxene crystals appear to be unaffected, and show polysynthetic twinning. Mineral compositions are slightly variable; mean values are olivine, Fa_{21}; pyroxene, $Wo_4Fs_{19.}$ The meteorite is a ureilite.

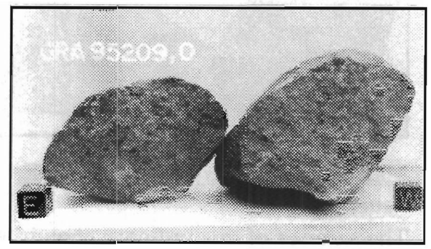
Sample No.: GRA95208
Location: Graves Nunataks
Dimensions (cm): 8.0 x 6.0 x 5.0
Weight (g): 778.3
Meteorite Type: H3 Chondrite (estimated H3.7)



Macroscopic Description: Kathleen McBride
The exterior of this meteorite is covered by dull, thin, black fusion crust. Chondrules are visible through the fusion crust which covers 90% of this meteorite. The interior is a dark gray matrix with some light gray patches visible. This meteorite is loaded with chondrules, several mm in diameter, the largest seen is 7 mm. The meteorite has a high metal content and has rusty patches with metal veins. This ordinary chondrite was very heavy and difficult to break.

Thin Section (,2) Description: Brian Mason
The section shows a close-packed aggregate of chondrules (up to 1.8 mm across), chondrule fragments, and mineral grains in a dark matrix containing a moderate amount of nickel-iron and troilite. The meteorite is considerably weathered, with limonitic staining throughout the section. Microprobe analyses show olivine and pyroxene of variable composition: olivine, Fa_{19-27}, mean Fa_{21}; pyroxene, $Fs_{7-23.}$ The meteorite is classified as an H3 chondrite (estimated H3.7).

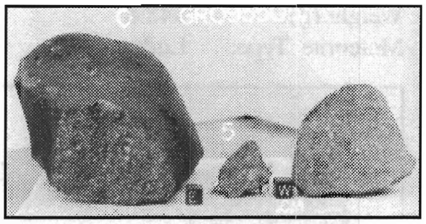
Sample No.: GRA95209
Location: Graves Nunataks
Dimensions (cm): 10.5 x 8.0 x 5.0
Weight (g): 948.8
Meteorite Type: Lodranite



Macroscopic Description: Kathleen McBride
The exterior of this meteorite has a thin, dark brown, melted-appearing fusion crust. One fracture runs across one surface and evaporite deposits are visible on the edge of another surface. Chondrules on the surface appear lighter than the matrix. The interior of the meteorite is very rusty. This meteorite was very coherent and had to be pried apart along complete fractures during chipping. Metal grains are numerous including areas of concentrated metals and metal sulfides, the largest of this being 1 cm in diameter. Clasts are present as well including some as large as 1 cm.

Thin Section (,7) Description: Brian Mason
The section shows an equigranular aggregate (grains averaging 0.3 mm) of subequal amounts of nickel-iron, olivine, and pyroxene, with a little plagioclase. A minor amount of brown limonitic staining pervades the section. Microprobe analyses give the following mineral compositions; olivine, Fa_7; orthopyroxene, Wo_3Fs_7; clinopyroxene, $Wo_{41}Fs_5$; plagioclase, An_{19}. The meteorite is classified as a lodranite.

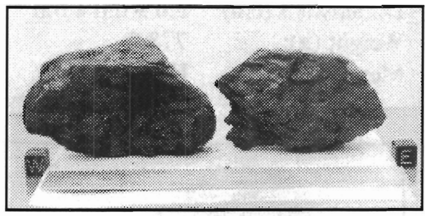
Sample No.: GRO95505
Location: Grosvenor Mountains
Dimensions (cm): 14 x 10.5 x 9.5
Weight (g): 2031
Meteorite Type: L3 Chondrite (estimated L3.6)



Macroscopic Description: Cecilia E. Satterwhite
The exterior of this ordinary chondrite is covered with black fractured fusion crust on most of its surfaces. Areas without fusion crust are yellow brown and oxidation is heavy in areas. Many inclusions and chondrules are visible. The interior reveals a gray brown matrix with abundant light and dark inclusions ranging in size from 1 - 5 mm. Minor metal and weathering are present.

Thin Section (,2) Description: Brian Mason
The section shows a close-packed aggregate of chondrules (up to 2.4 mm across), chondrule fragments, and mineral grains in a dark matrix containing small amounts of nickel-iron and troilite. The meteorite is considerably weathered, with brown limonitic staining throughout the section. Microprobe analyses show olivine and pyroxene of variable compositions; olivine, Fa_{11-26}; pyroxene, Fs_{15-24} The meteorite is classified as an L3 chondrite (estimated L3.6).

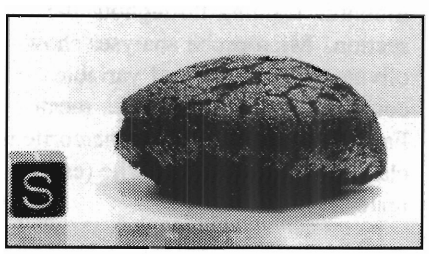
Sample No.: GRO95517
Location: Grosvenor Mountains
Dimensions (cm): 7.5 x 7.5 x 6.0
Weight (g): 574
Meteorite Type: EH3 Chondrite



Macroscopic Description: Kathleen McBride
The exterior of this meteorite is covered with dull brown/black fusion crust. The surface is rough and flaky. Polygonal fractures are present and oxidation is visible in areas. The interior is dark gray fine grained crystalline matrix with yellow chondrules and metal. It is rusty and very weathered.

Thin Section (,2) Description: Brian Mason
The section shows an aggregate of small chondrules (up to 0.6 mm), chondrule fragments, and pyroxene grains in a matrix of about 30% of nickel-iron and sulfides. Weathering is extensive, with brown limonitic staining throughout the section. Microprobe analyses show that the pyroxene is enstatite of somewhat variable composition (Fs_{1-5}); the nickel-iron contains 2.2-2.4% Si. The meteorite is an enstatite chondrite, tentatively classified as EH3

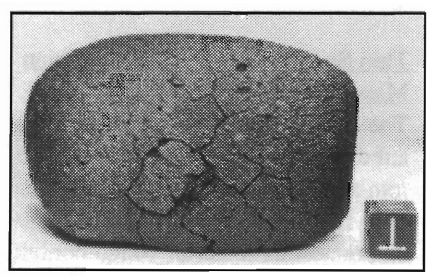
Sample No.: GRO95566
Location: Grosvernor Mountains
Dimensions (cm): 4.0 x 3.5 x 2.5
Weight (g): 50.7
Meteorite Type: C2 Chondrite



Macroscopic Description: Kathleen McBride
The exterior of this carbonaceous chondrite is covered with black fusion crust. The surface is vesicular and displays polygonal fractures. It has a rough texture and is friable. One surface lacks fusion crust. The black interior reveals white material between the fusion crust and the meteorite, which may be evaporite. The numerous chondrules are less than 1 mm in size. Some condrules appear to be rusty.

Thin Section (,5) Description: Brian Mason
The section shows numerous small chondrules (up to 0.6 mm across), some irregular aggregates, and many small silicate grains in a black matrix; trace amounts of nickel-iron and troilite are present as minute grains. The silicate grains are almost entirely olivine near $Mg_2 SiO_4$ in composition, with a few more iron-rich grains. A little pyroxene near $MgSiO_3$ in composition is present. The matrix appears to consist largely of iron-rich serpentine. The meteorite is a C2 chondrite.

Sample No.: GRO95577
Location: Grosvenor Mountains
Dimensions (cm): 6.4 x 3.6 x 3.3 cm
Weight (g): 106.2 g
Meteorite Type: C2 Chondrite

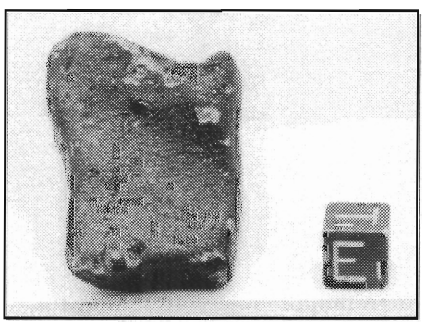


Macroscopic Description: Cecilia E. Satterwhite
The exterior of this carbonaceous chondrite is covered with black fusion crust and is frothy in some areas. Flow lines are present on some surfaces. Areas devoid of fusion crust are brown, pitted and weathered. Fractures are numerous and penetrate the surface. The interior of the sample

reveals a grayish-black matrix, weathered brown in areas. Minor white evaporite deposits are visible and small inclusions/chondrules are present but weathered.

Thin Section (,3) Description: Brian Mason
The section shows numerous chondrules (up to 1.8 mm across), irregular aggregates, and small mineral grains in a dark brown to black matrix; accessory nickel-iron and troilite are present, mainly rimming chondrules. The chondrules, aggregates, and mineral grains consist almost entirely of an isotropic to weakly birefringent serpentine; a little calcite is present. The meteorite is a C2 chondrite.

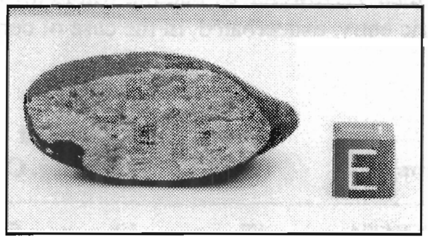
Sample No.:	GRO95581
Location:	Grosvenor Mountains
Dimensions (cm):	4.0 x 2.0 x 2.5
Weight (g):	49.39
Meteorite Type:	Howardite



Macroscopic Description: Kathleen McBride
Ninety percent of this achondrite's exterior surface is covered with shiny, glassy brown/black fusion crust. The interior is light gray with clasts up to 3 cm in diameter. Plagioclase and pyroxene grains are numerous. Minor amount of weathering is visible.

Thin Section (,4 & ,6) Description: Brian Mason
The sections show a groundmass of comminuted pyroxene (orthopyroxene and pigeonite) and plagioclase (grains up to 0.3 mm) with a few larger plagioclase clasts (up to 3 mm). Microprobe analyses show a wide composition range in low - calcium pyroxene, from Wo_2Fs_{21} to Wo_7Fs_{54}; one grain of augite, $Wo_{28}Fs_{25}$ was analyzed. Plagioclase composition is An_{89-93}. The meteorite is a howardite; it is very similar to GRO95534, and 95535, with which it is probably paired.

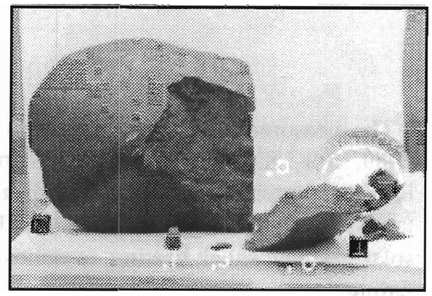
Sample No.:	GRO95602
Location:	Grosvenor Mountains
Dimensions (cm):	4.3 x 3.6 x 1.0
Weight (g):	51.5
Meteorite Type:	Howardite



Macroscopic Description: Cecilia E. Satterwhite
The exterior of this achondrite is covered with black fusion crust. The fusion crust is shiny on some surfaces, dull on others. A large black clast (1.2 cm) is present on the exterior. Smaller clasts are visible (0.5 cm). Areas devoid of fusion crust are gray with light and dark inclusions. Chipping revealed a fine grained gray interior, with abundant light and dark inclusions, ranging in size from 1 to 3 mm. Minor oxidation is visible in some areas.

Thin Section (,3) Description: Brian Mason
The section shows a groundmass of comminuted pyroxene and plagioclase (grains up to 0.3 mm) with a few larger plagioclase clasts (up to 2 mm). Microprobe analyses show that most of the pyroxene is hypersthene ($Wo_{1-5,}$ Fs_{22-36}); one grain of augite, $Wo_{42}Fs_{32,}$ was analyzed, and several grains of intermediate composition. Plagioclase composition is An_{86-91}. One grain of olivine, $Fa_{25,}$ and one of an SiO_2 polymorph were analyzed. The meteorite is a howardite, very similar to GRO95534, and 95535, and 95581, with which it is probably paired.

Sample No.:	WSG95300
Location:	Mount Wisting
Dimensions (cm):	14.0 x 10.0 x 9.0
Weight (g):	2733
Meteorite Type:	H3 Chondrite (estimated H3.4)



Macroscopic Description: Kathleen McBride
This ordinary chondrite has brown/black fusion crust with lighter brown circular splotches with an iridescent sheen. Polygonal fractures are present. The entire exterior surface is smooth. The interior is dark gray to black with numerous white to cream colored chondrules less than 1 mm sized and smaller. Some areas are rusty and there are some glassy clasts/chondrules that are translucent to opaque.

Thin Section (,2) Description: Brian Mason
The section shows numerous chondrules (up to 1.8 mm across), chondrule fragments, and mineral grains in a dark matrix containing a moderate amount of nickel-iron and troilite. The meteorite is essentially unweathered. Microprobe analyses show olivine and pyroxene of variable composition: olivine, Fa_{1-21}; pyroxene, Fs_{2-17}. The meteorite is classified as an H3 chondrite (estimated H3.4).

Table 4: Natural Thermoluminescence (NTL) Data for Antarctic Meteorites

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Cosmochemistry Group
Dept. Chemistry and Biochemistry
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The measurement and data reduction methods were described by Hasan et al. (1987, Proc. 17th LPSC E703-E709); 1989, LPSC XX, 383-384). For meteorites whose TL lies between 5 and 100 krad the natural TL is related primarily to terrestrial history. Samples with NTL <5 krad have TL below that which can reasonably be ascribed to long terrestrial ages. Such meteorites have had their TL lowered by heating within the last million years or so by close solar passage, shock heating, or atmospheric entry, exacerbated, in the case of certain achondrite classes by "anomalous fading."

Sample	**Class**	**NTL [krad at 250 deg. C]**
QUE94204	E7	22 +- 5
GRO95535	HOW	11 +- 1
QUE94500	H5	36.0 +- 0.3
GRO95544	L3	<1
GRO95545	L3	<1
QUE94473	L5	16.0 +- 0.1
QUE94477	L5	1.9 +- 0.2
QUE94714	L5	64.8 +- 0.1
QUE94716	L5	4.2 +- 0.2
QUE94623	L6	4.4 +- 0.1
QUE94719	L6	21.4 +- 0.1

The quoted uncertainties are the standard deviations shown by replicate measurements on a single aliquot.

COMMENTS: The following comments are based on natural TL data, TL sensitivity, the shape of the induced glow curve, classifications, and JSC and Arkansas group sample descriptions.

GRO 95544 and GRO 95545 (L3) have very low induced TL sensitivities (0.003 and 0.006 relative to Dhajala H3.8, respectively) and are either type 3.1 or are highly shocked.

GRO 95535 (HOW) has low induced TL sensitivity (0.17+-0.02 relative to Dhajala H3.8) compared to most howardites, perhaps indicative that it is rich in diogenitic material (GCA 55, 3831-3844).

1. Pairings (Confirmations of Pairings):
   L3: GRO95544 and GRO95545 (AMN 19:2).

2. Pairings suggested by TL data:
   H5: QUE94500 with the QUE94217 group (AMN 19:2).
   L5: QUE94473 with the QUE90207 group (AMN 15:2, 19:2).
   L5: QUE94716 with the QUE 90205 group (AMN 15:2, 19:2).

Meteorites On-Line

Several meteorite web site are available to provide information on meteorites from Antarctica and elsewhere in the world. Some specialize in information on martian meteorites and on possible life on Mars. Here is a general listing of ones we have found. We have not included sites focused on selling meteorites even though some of them have general information. Please contribute information on other sites so we can update the list.

JSC Curator, Antarctic meteorites	http://curator.jsc.nasa.gov/antmet/antmet.htm
JSC Curator, martian meteorites	http://curator.jsc.nasa.gov/antmet/marsmet/contents.htm
JSC Curator, mars meteorite PIP	http://sn-charon.jsc.nasa.gov
Antarctic collection, martian meteorites	http://www.cwru.edu/CWRU/Dept/Artsci/geol/ANSMET
LPI martian meteorites	http://cass.jsc.nasa.gov/pub/lpi/meteorites/mars-meteorites.html
NIPR Antarctic meteorites	http://www.nipr.ac.jp/
BMNH general meteorites	http://www.nhm.ac.uk/mineral/project4/index.html
UHI planetary science discoveries	http://www.soest.hawaii.edu/PSRdiscoveries
Meteoritical Society	http://www.uark.edu/studorg/metsoc
Meteorite! Magazine	http://www.meteor.co.nz
Geochemical Society	http://www.ciw.edu/geochemical_society/BROCH.html

The curatorial databases may be accessed as follows:

Via INTERNET	1) Type **TELNET 139.169.126.35** or **TELNET CURATE.JSC.NASA.GOV**. 2) Type **PMPUBLIC** at the USERNAME: prompt.
Via WWW	1) Using a Web browser, such as Mosaic, open URL **http://www-sn.jsc.nasa.gov/curator/curator.htm**. 2) Activate the ***Curatorial Databases*** link.
Via modem	The modem may be between 1200 and 19200 baud; no parity; 8 data bits; and 1 stop bit. If you are calling long distance, the area code is 713. 1) Dial 483-2500 for 1200-9600 bps, V.32bis/V.42bis, or 483-9498 for 1200-19200 bps, V.32bis/V.42bis. 2) Once the connection is made, press <CR>. Type **INS** in response to the Enter Number: prompt. 3) Press <CR> twice quickly until the XYPLEX#> prompt displays. 4) Type **C CURATE.JSC.NASA.GOV** at the XYPLEX#> prompt. 5) Type **PMPUBLIC** at the USERNAME: prompt.

For problems or additional information, you may contact: Claire Dardano, Lockheed Martin Engineering & Sciences Company, (713) 483-5329, cdardano@ems.jsc.nasa.gov.