Antarctic Meteorite NEWSLETTER

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

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SAMPLE REQUEST DEADLINE: April 10, 1990 !!!

MWG MEETS APRIL 19-21, 1990

All sample requests should be made in writing to:

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

Requests that are received by the MWG Secretary before April 10, 1990 will be reviewed at the MWG meeting on April 19-21 to be held in Houston, Texas. Requests that are received after the April 10 deadline may possibly be delayed for review until the MWG meets again in the Fall of 1990. **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 telephone at (713) 483-5135.

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 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 and should provide detailed scientific justification for 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. Consortium requests should be initialed or countersigned by a member of each group in the consortium. All necessary information should 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.

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 four Smithsonian Contr. Earth Sci.: Nos. 23, 24, 26 and 28.

Classifications of New Meteorites

This newsletter presents classifications of 175 meteorites from the 1985-1988 collections and completes the classification of the 1985 collection. Descriptions are given for all meteorites of special petrologic type, including five carbonaceous chondrites, three enstatite chondrites, five type 3 ordinary chondrites, eight achondrites and one iron. Of particular interest are MAC88136, MAC88180, and MAC88184, paired unusual chondrites tentatively classed as E3; MAC88177, a ureilite devoid of carbonaceous material; and sulfide-rich iron HOW88403.

Basaltic Lunar Meteorite Identified

Also included in this issue is a reclassification of EET87521. The meteorite was originally classified as a eucrite, but detailed studies by Jeremy Delaney (*Nature 342*, 889-890, 1989) and Paul Warren (*Geochimica Cosmochimica Acta 53*, 3323-3330, 1989) showed it to be a lunar basaltic breccia. Oxygen isotopic measurements by Bob Clayton confirm its lunar origin. This is the first basaltic lunar meteorite and is a very interesting small sample. Requests for allocation of the sample prompted much debate at the Fall MWG meeting. The committee tabled allocations until the reclassification was announced in the newsletter and guidelines for handling such situations were formalized. (See open letter from MWG and guidelines.)

Cancellation of the 1989-1990 Field Season

Most of you are aware that the 1989-1990 ANSMET (Antarctic Search for Meteorites) field season was cancelled at the last moment due to logistical problems in Antarctica. Expedition leader Bill Cassidy and MWG chairman Robert Walker are working with NSF Polar Programs Office to try to avoid similar interruptions in the future. Walker sends his thanks for your support in this effort. Plans for the next field season are proceeding on schedule and we anticipate a successful resumption of the ANSMET collections this year.

POSSIBLE NEW CARBONATES IN SHERGOTTITE EETA79001

James L. Gooding

Recent sawing of the shergottite, EETA79001, has revealed new areas of possible calcium carbonate of the type previously described by Martinez and Gooding (1986) and analyzed as sample EETA79001,239 by Gooding et al. (1988), Clayton and Mayeda (1988), and Wright et al. (1988). If the new druse is the same as that in sample 239, it can be expected to consist of calcite ($CaCO_3$) intergrown with an unusual Mg-phosphate. Current evidence favors pre-terrestrial origin of the carbonate/ phosphate assemblage.

As was the case for the parent material of sample 239, the new occurrences are confined to the interior of the meteorite and are associated with glass veins and pockets (Lithology C) that pervade Lithology A, the principal igneous portion of the meteorite. The most conspicuous new deposits occur as white drusy veins that thinly coat freshly broken surfaces produced by the sawing operations. The largest drusy patches (a few square millimeters in area) occur as wall-rock halos near small veins of black glass. At least one other occurrence, however, consists of apparent veins and scattered small grains in a typical, vuggy inclusion of Lithology C. A third type of occurrence comprises a white patch that superficially resembles a lithic inclusion but is still a wall lining associated with Lithology C.

Experience with the parent deposit of sample 239 showed that only a few micrograms of drusy material could be recovered for each milligram of wall rock that was extracted. The total deposit of white druse in the original (239) deposit was approximately 300 micrograms. Based on the larger areal extent of the newly discovered deposits, the total mass of white druse is estimated to be on the order of 1000 micrograms. Accordingly, only analytical methods than can operate on microgram quantities of sample would be practical for studying the new deposits.

References:

Clayton R. N. and Mayeda T. K. (1988) Isotopic composition of carbonate in EETA79001 and its relation to parent body volatiles. *Geochim. Cosmochim. Acta, 52,* 925-927.

Gooding J. L., Wentworth S. J. and Zolensky M. E. (1988) Calcium carbonate and sulfate of possible extraterrestrial origin in the EETA79001 meteorite. *Geochim. Cosmochim. Acta, 52,* 909-915.

Martinez R. and Gooding J. L. (1986) New saw-cut surfaces of EETA79001. *Antarctic Meteorite Newsletter, 9(1),* 23-29.

Wright I. P., Grady M. M., and Pillinger C. T. (1988) Carbon, oxygen and nitrogen isotopic compositions of possible martian weathering products in EETA79001. *Geochim. Cosmochim. Acta, 52,* 917-924.

February 23, 1990

Dear Colleagues:

A primary role of the MWG is to expedite the provision of meteorite samples to qualified scientists. Although the process generally works smoothly, problems can arise in the allocation process. Some of these result from poorly formulated requests that leave the committee uncertain as to what is required. Part of the purpose of this letter is to detail some of the common problems that arise, in the hopes that they will be minimized in future requests.

The other major allocation problem arises when an especially interesting meteorite is discovered. Many requests are generally received. We do the best that we can in trying to satisfy the desires of the individual scientists, while at the same time developing an allocation plan that optimizes the total scientific yield from the meteorite. The process becomes difficult when only a small amount of material is available for study. It is further complicated by the MWG ground rule that enough material must be retained by the Curator to permit future detailed scientific investigations of rare specimens. Based on its experience, MWG has developed a set of guidelines for future allocation of small, rare specimens. We have appended these guidelines to this letter.

MWG recently developed a further set of guidelines to deal with a new situation, namely, a small specimen that was recognized as being especially interesting (and, hence, subject to the small, rare sample guidelines) only after the original description and allocation. These additional guidelines are also appended to this letter.

We now return to the problem of poorly formulated requests. We receive many proposals where the sample requested clearly does not coincide with the goals of the experimenter e.g.: a number which identifies an ordinary chondrite is requested by someone who is interested only in carbonaceous meteorites. Sometimes it is possible to figure out which numbers got transposed by the requestors; sometimes not - samples that do not even exist are sometimes requested. Of course, we can (and frequently do) contact requestors in real time to find out what they really want, but this is risky for the requestor.

Another situation that crops up is one in which the requestor has failed to do the necessary homework to see whether the request is feasible; for example, it is not possible to give someone a 100 mg sample that is ≥ 1 cm from any external surface, if the total meteorite weight is 5 gms!!

Some experimenters request samples for a series of experiments that they themselves are in no position to do; for example, a mineralogist (experimenter X) who requests a series of samples for isotope measurements. In some cases, the persons who will do the extended measurements are not identified. In other cases the person (experimenter Y) who will do the measurements is identified, but clearly has not been consulted. This is evidenced by the fact that we get independent requests for the same meteorite from both experimenter Y and from experimenter X, but with a different sample size specified. Obviously, a carefully designed request should have the signed agreement of the persons who will actually do the work.

Another difficult problem arises with what we term "blanket requests." For certain rare specimens we sometimes get requests for "samples of all interesting clasts." Such requests stand in stark (and unfavorable) contrast to others which describe either a more focused approach, or which propose to first examine the specimen in Houston in order to formulate a detailed plan of attack.

We will welcome your inputs on any of the issues raised in this letter.

Sincerely yours,

Meteorite Working Group

MWG Guidelines for the Curation of Small, Rare Antarctic Meteorites

October 1988

Allocation of samples from small (e.g. <30g) specimens of Antarctic meteorites, for which a large demand is anticipated, poses special problems. The guiding principle in developing allocation plans for the detailed analyses of such meteorites is to maximize the yield of fundamental scientific information.

A. The MWG shall involve as many qualified and interested scientific investigators as possible in the study of rare Antarctic specimens.

B. The above objectives are to be accomplished in as timely a fashion as possible, and with a minimum of administrative burdens.

C. It shall also be the responsibility of the MWG to conserve enough material for future studies of rare meteorites. Therefore, no more than 50% of the desirable sample remaining after initial thin section preparation should be allocated during the first two MWG meetings following announcement in the Newsletter.

D. The process of allocation must be conducted in a scrupulously fair fashion that gives no special advantage to any present or past member of the committee or any part of the community at large. The process must not only be fair, it must be perceived as fair by the community of interested scientists.

Some specific guidelines that follow from these general principles given below:

1. Care should be taken to ensure that minimal material (<5% or 100 mg, whichever is more, of total mass) is consumed in the preparation of polished thin sections for the initial characterization. These sections, and others made from the potted butt, should then be made widely available to qualified investigators who have expressed an interest in these materials.

2. MWG should participate in the categorization of the scientific measurements for a specific meteorite. However, individual members shall not participate in the actual allocations of their own samples or the samples of others with whom they are affiliated institutionally or scientifically.

3. The categories of investigation are as follows:

   a. Absolutely necessary for a basic characterization of the samples. The mass consumed by these measurements should not exceed 20% of the total available.

   b. Of the highest importance scientifically and should be performed if appropriate samples can be made available. The sum of such measurements should not exceed 20% of the total material available.

   c. Scientifically desirable measurements to be made if the results are commensurate with the size of samples to be consumed.

d. Of potential scientific interest, but of a nature where the interest cannot be guaranteed.

4. In general, replicate analyses of certain quantities is desirable and should be encouraged for categories I and II, but not III and IV (although permitted, nonetheless). However, the sum of replicate analyses for a given type of information should not exceed 5% of the total available sample mass.

5. In general, analyses which consume the smallest amounts of material to obtain information are to be preferred. Judgment will have to be used to distinguish between laboratories whose techniques are genuinely better, from those which simply request smaller samples in the hopes of being approved.

6. In general, P.I.s should not be restricted in the types of investigations they pursue provided they do not destroy more sample than specified in their original request and, that they provide the information they originally proposed.

7. The categories I-IV are ranked in order of their deemed scientific importance, but they need not be performed sequentially.

8. In cases where sample weight restrictions, as stated above, do not permit multiple allocations for the same (or highly similar) measurements, priority shall be given based on the following criteria:

   a. An objective assessment of the capabilities of different laboratories.

   b. Where such distinctions cannot be made, priority shall be given to those investigators who have planned to extract the maximum amount of information from their samples by combining complementary investigations.

   c. In cases where the above distinction a) and/or b) cannot be made, priority will be given to investigators based on the date they submitted their requests.

ADDITION TO GUIDELINES - NOVEMBER 1989

The operational definition of "small" is a sample whose size is such that fulfilling <u>all</u> current requests, would severely compromise future studies of the meteorite. The figure ≈ 30 grams is an average number was arrived at from our prior experience. It is clearly arbitrary and subject to interpretation; some samples containing large clasts may be classified by MWG or "small" even if they weigh considerably more than 30 grams; other, more homogeneous samples, may not be classified as small even if they weigh considerably less than 30 grams.

GUIDELINES FOR SMALL SAMPLES DISCOVERED TO BE OF SPECIAL INTEREST AFTER INITIAL ALLOCATION

NOVEMBER 1989

1. PI's recognition does not give absolute priority; the widest dissemination of information, leading to proposals that give the optimum scientific approach, is desirable.

2. However, the PI who discovered the interesting aspects of the specimen will be given strong preference in future allocations; thus the original PI will have precedence when competing proposals to pursue similar lines of research are considered.

3. To facilitate both recognition of the priority of the PI and to give wider dissemination, in the future PIs will have the right (though not the obligation) to publish signed letters in Antarctic Meteorite Newsletter (subject to editorial control).

4. The Curator should inform the meteorite community of the new results, with the permission of the discoverers, in the Antarctic Meteorite Newsletter as soon as is reasonable (judgment call).

5. The processes of dissemination and allocation should be as open and fair as possible, conferring no special advantage to those who are privy to unpublished information.

FROM 1985-1988 COLLECTIONS

Pages 11-24 contain preliminary descriptions and classifications of meteorites that were completed since publication of issue 12(3) (September, 1989). Some large (>150g) specimens (regardless of petrologic type) and all "pebble"-sized (<150g) specimens of special petrologic type (carbonaceous chondrite, unequilibrated ordinary chondrite, achondrite, etc.) are represented by separate descriptions. However, some specimens of non-special petrologic type are listed only as single line entries in Table 1. For convenience, new specimens of special petrologic 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 initial 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:

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ANTARCTIC METEORITE LOCATIONS

ALH	Allan Hills
BOW	Bowden Neve
BTN	Bates Nunataks
DOM	Dominion Range
DRP	Derrick Peak
EET	Elephant Moraine
GEO	Geologists Range
GRO	Grosvenor Mountains
HOW	Mt. Howe
ILD	Inland Forts
LEW	Lewis Cliff
MAC	MacAlpine Hills
MBR	Mount Baldr
MET	Meteorite Hills
MIL	Miller Range
OTT	Outpost Nunatak
QUE	Queen Alexandra Range
PCA	Pecora Escarpment
PGP	Purgatory Peak
RKP	Reckling Peak
TIL	Thiel Mountains
TYR	Taylor Glacier

****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.

List of Newly Classified Antarctic Meteorites **

Sample Number		Weight (g)	Classification		Weathering	Fracturing	%Fa	%Fs
ALH	85065~	9.7	L-6	CHONDRITE	B	A		
LEW	85346~	30.2	L-6	CHONDRITE	B	B		
LEW	85362	14.5	H-6	CHONDRITE	C	A	18	16
LEW	85363	44.0	L-5	CHONDRITE	B	A	23	20
LEW	85364	3.6	H-5	CHONDRITE	C	A	18	16
LEW	85366	3.4	H-4	CHONDRITE	C	B	17	12-18
LEW	85367	5.7	H-5	CHONDRITE	C	A	17	15
LEW	85368	17.8	H-6	CHONDRITE	C	A	18	16
LEW	85370	10.8	H-4	CHONDRITE	B/C	A	17	15
LEW	85372	9.5	H-5	CHONDRITE	C	A	18	16
LEW	85374	10.4	H-6	CHONDRITE	B	A	18	16
LEW	85379	25.8	H-5	CHONDRITE	C	A	17	15
LEW	85382	9.9	H-5	CHONDRITE	B/C	A/B	18	16
LEW	85383	18.5	H-3	CHONDRITE	C	A	6-23	2-18
LEW	85385	12.9	L-5	CHONDRITE	B/C	A	23	20
LEW	85389	3.6	H-5	CHONDRITE	C	A/B	17	15
LEW	85391	9.2	H-6	CHONDRITE	C	A	18	16
LEW	85392	27.9	H-6	CHONDRITE	C	A	18	16
LEW	85394	14.8	L-5	CHONDRITE	C	A	23	19
LEW	85395	17.5	H-5	CHONDRITE	B/C	A	18	16
LEW	85398	37.9	H-4	CHONDRITE	C	A	18	14-18
LEW	85404	34.4	H-5	CHONDRITE	B	B	19	16
LEW	85406	7.0	H-5	CHONDRITE	C	A/B	19	16
LEW	85407	18.6	H-5	CHONDRITE	C	A	18	16
LEW	85409	28.5	H-5	CHONDRITE	B/C	A	17	15
LEW	85414	25.8	H-5	CHONDRITE	C	A	19	17
LEW	85416	6.2	H-5	CHONDRITE	C	A	18	16
LEW	85417	9.3	L-5	CHONDRITE	B/C	A	24	20
LEW	85418	37.5	H-6	CHONDRITE	C	A	18	16
LEW	85419	39.1	L-6	CHONDRITE	C	A	23	20
LEW	85422	26.6	H-5	CHONDRITE	C	A	17	15
LEW	85423	11.0	H-5	CHONDRITE	B/C	A	17	15
LEW	85425	3.0	L-6	CHONDRITE	C	A/B	23	20
LEW	85426	15.7	H-5	CHONDRITE	B/C	A	18	16
LEW	85427	14.8	L-5	CHONDRITE	B	A	25	21
LEW	85430	13.3	L-6	CHONDRITE	C	A	23	20
LEW	85434	19.4	L-3	CHONDRITE	C	A	1-23	2-11
LEW	85437	9.4	L-3	CHONDRITE	C	A	1-23	2-11
LEW	85447	16.2	H-5	CHONDRITE	C	A	18	16
LEW	85448	34.2	H-5	CHONDRITE	C	A	18	16
LEW	85450	27.3	H-5	CHONDRITE	B/C	A	17	15
LEW	85451	14.9	L-5	CHONDRITE	B/C	A	23	20
LEW	85452	9.2	L-3	CHONDRITE	C	A	5-23	2-18
LEW	85453	5.5	H-5	CHONDRITE	C	A	18	16
LEW	85455	8.0	H-5	CHONDRITE	C	A	17	15
LEW	85456	19.4	H-5	CHONDRITE	C	A	18	16
LEW	85458	16.8	H-5	CHONDRITE	B/C	A	18	16
LEW	85459	32.0	H-5	CHONDRITE	B/C	A/B	17	15
LEW	85460	5.5	H-5	CHONDRITE	C	A	18	16
LEW	85462	22.5	H-6	CHONDRITE	C	A	18	16

~ Classified by using refractive indices.

Sample Number	Weight (g)	Classification	Weathering	Fracturing	%Fa	%Fs
LEW 85464	23.7	H-5 CHONDRITE	C	A	19	16
LEW 85466	14.1	H-5 CHONDRITE	C	A	18	16
LEW 85468	15.4	H-4 CHONDRITE	B/C	A	18	16
LEW 85470	18.8	H-6 CHONDRITE	C	B	18	16
LEW 86052	2.4	H-6 CHONDRITE	B/C	A	18	16
LEW 86053	4.2	H-5 CHONDRITE	B/C	A	19	17
LEW 86055	41.3	H-5 CHONDRITE	B/C	A	19	17
LEW 86058	22.3	H-5 CHONDRITE	B/C	A	19	17
LEW 86059	1.8	H-5 CHONDRITE	B/C	A	19	16
LEW 86060	23.0	H-5 CHONDRITE	C	A	17	15
LEW 86061	8.8	L-4 CHONDRITE	B	A	24	20
LEW 86062	13.2	H-5 CHONDRITE	C	A	19	16
LEW 86063	7.0	H-5 CHONDRITE	C	A	18	16
LEW 86065	9.2	L-5 CHONDRITE	C	A	25	21
LEW 86067	8.9	H-4 CHONDRITE	C	A	19	8-20
LEW 86068	6.3	H-5 CHONDRITE	C	A	18	16
LEW 86071	6.3	H-5 CHONDRITE	B/C	A	19	16
LEW 86072	11.9	H-5 CHONDRITE	C	A	18	16
LEW 86074	19.3	H-5 CHONDRITE	B/C	A/B	19	16
LEW 86076	23.7	H-5 CHONDRITE	B/C	A	19	16
LEW 86077	8.6	H-5 CHONDRITE	B/C	A	19	17
LEW 86078	37.1	H-5 CHONDRITE	B/C	A	19	16
LEW 86079	6.6	H-5 CHONDRITE	B/C	A	18	16
LEW 86080	13.5	H-5 CHONDRITE	C	A	18	16
LEW 86081	28.4	H-5 CHONDRITE	C	A	18	16
LEW 86087	10.9	H-5 CHONDRITE	C	A	18	16
LEW 86088	38.0	H-5 CHONDRITE	C	A	19	17
LEW 86092	20.6	H-5 CHONDRITE	B	A	19	17
LEW 86093	14.6	H-5 CHONDRITE	C	A	19	17
LEW 86094	15.4	H-5 CHONDRITE	C	A	19	17
LEW 86095	14.1	H-5 CHONDRITE	C	A/B	19	17
LEW 86099	28.2	H-5 CHONDRITE	C	A	18	16
LEW 86100	23.6	H-5 CHONDRITE	C	A	18	16
EET 87521	30.7	LUNAR-BASALTIC BRECCIA	A	A	35-95	25-65
HOW 88403	2480.7	IRON-ATAXITE (ANOM)				
LEW 88001	44.9	CARBONACEOUS C2	Ce	B	1-44	1-7
LEW 88002	7.2	CARBONACEOUS C2	Be	B	1-29	1-3
LEW 88003	1.7	CARBONACEOUS C2	A	A	1-31	1-8
LEW 88006	27.0	UREILITE	B	A/B	18	16
LEW 88007	8.4	EUCRITE	A/B	A	25-60	
LEW 88008	17.9	DIOGENITE	A/B	A	30	
LEW 88009	11.7	EUCRITE (UNBRECCIATED)	A	A	25-58	
LEW 88010	7.1	EUCRITE (UNBRECCIATED)	A	B	33-55	
LEW 88011	2.0	DIOGENITE	A	A	24	
LEW 88012	3.8	UREILITE	B	A	9	8
LEW 88016~	308.0	L-6 CHONDRITE	Be	B/C		
LEW 88017~	263.9	L-6 CHONDRITE	B	B		
LEW 88018~	215.1	L-6 CHONDRITE	A/Be	A		
LEW 88019	238.0	H-4 CHONDRITE	B/C	A	18	16
LEW 88020	107.3	H-4 CHONDRITE	Ce	B	18	16
LEW 88024	23.1	H-5 CHONDRITE	C	A	18	16
LEW 88025	31.4	H-5 CHONDRITE	B/C	B	18	16

~ Classified by using refractive indices.

Sample Number	Weight (g)	Classification	Weathering	Fracturing	%Fa	%Fs
LEW 88026	9.0	H-5 CHONDRITE	B/C	A	19	17
LEW 88027	10.9	H-5 CHONDRITE	C	A	18	16
LEW 88029	10.6	H-5 CHONDRITE	C	A	18	16
LEW 88031~	6.1	L-6 CHONDRITE	C	A		
LEW 88038~	4.2	L-6 CHONDRITE	B	A		
LEW 88039~	14.9	L-6 CHONDRITE	B	A		
LEW 88042~	7.0	H-6 CHONDRITE	B	A		
LEW 88043~	8.3	L-6 CHONDRITE	B/C	A		
LEW 88045~	3.6	H-6 CHONDRITE	B/C	A		
LEW 88048~	3.9	H-6 CHONDRITE	B/C	A		
LEW 88049~	1.9	L-6 CHONDRITE	B	A		
LEW 88050~	6.2	H-6 CHONDRITE	B/C	B		
LEW 88056~	3.0	L-6 CHONDRITE	B/C	A		
LEW 88058~	66.7	L-6 CHONDRITE	B/C	B		
LEW 88060~	24.6	L-6 CHONDRITE	B	A		
LEW 88061~	2.3	L-6 CHONDRITE	B/C	A		
LEW 88063~	22.8	L-6 CHONDRITE	B/C	A		
LEW 88066~	7.5	L-6 CHONDRITE	B/C	A		
LEW 88067~	11.5	L-6 CHONDRITE	B/C	A		
LEW 88069~	3.5	L-6 CHONDRITE	B/C	A		
MAC 88101	20.9	CARBONACEOUS C2	Be	A	1-25	1-5
MAC 88106	26.7	LL-6 CHONDRITE	A/B	A	28	24
MAC 88112~	1288.0	L-6 CHONDRITE	B	A		
MAC 88113~	752.2	LL-6 CHONDRITE	A/B	A		
MAC 88114	844.4	H-5 CHONDRITE	B/C	B	18	16
MAC 88117~	1103.8	L-6 CHONDRITE	A/B	A		
MAC 88120	718.7	H-5 CHONDRITE	C	A	17	15
MAC 88121~	318.7	L-6 CHONDRITE	A/B	A		
MAC 88122	345.3	LL-5 CHONDRITE	B	A	27	23
MAC 88123	180.3	H-6 CHONDRITE	Ce	B	18	16
MAC 88124	201.1	H-4 CHONDRITE	B/C	A	17	15
MAC 88125	213.5	H-6 CHONDRITE	C	A	18	16
MAC 88126~	293.9	L-6 CHONDRITE	A	A		
MAC 88127	204.1	L-5 CHONDRITE	Be	B/C	23	20
MAC 88128	233.7	H-5 CHONDRITE	B/Ce	A/B	18	16
MAC 88129	200.5	H-5 CHONDRITE	B	C	18	16
MAC 88130	223.7	H-6 CHONDRITE	B/C	A	19	17
MAC 88131	175.6	H-6 CHONDRITE	B/C	B/C	19	17
MAC 88132	151.5	H-6 CHONDRITE	B/C	B	19	17
MAC 88133	137.6	H-6 CHONDRITE	B/C	B	19	17
MAC 88136	74.4	E-3 CHONDRITE	A	B	0-3	
MAC 88137~	105.1	L-6 CHONDRITE	Be	A		
MAC 88141	61.1	H-4 CHONDRITE	B	A	18	16
MAC 88144	10.4	H-6 CHONDRITE	B	A	18	16
MAC 88145	11.7	H-4 CHONDRITE	B	A	17	15
MAC 88146	10.6	H-4 CHONDRITE	B/C	A	17	15
MAC 88148~	76.9	L-6 CHONDRITE	B	B		
MAC 88150~	41.2	H-6 CHONDRITE	B/Ce	A		
MAC 88151	41.3	H-4 CHONDRITE	A/B	A	18	12-16
MAC 88152	80.0	H-5 CHONDRITE	A/Be	A	19	17
MAC 88156~	69.2	L-6 CHONDRITE	A/B	A		
MAC 88157~	88.2	H-6 CHONDRITE	C	C		
MAC 88159~	147.5	L-6 CHONDRITE	A	A		
MAC 88162~	112.9	L-6 CHONDRITE	Be	A		
MAC 88167	38.1	H-5 CHONDRITE	Ce	B/C	17	15
MAC 88168~	31.3	L-6 CHONDRITE	B	A		

~ Classified by using refractive indices.

Sample Number	Weight (g)	Classification	Weathering	Fracturing	%Fa	%Fs
MAC 88170~	58.1	L-6 CHONDRITE	A/B	A		
MAC 88172~	37.0	L-6 CHONDRITE	A/B	A/B		
MAC 88173~	126.4	L-6 CHONDRITE	A/B	B		
MAC 88174	98.4	H-3 CHONDRITE	Be	A/B	3-19	6-13
MAC 88175~	128.1	LL-6 CHONDRITE	A/Be	A		
MAC 88176	37.9	CARBONACEOUS C2	Be	A	1-34	1-8
MAC 88177	35.3	UREILITE	B/C	A	13	12
MAC 88178~	28.1	L-6 CHONDRITE	A/B	A		
MAC 88180	26.6	E-3 CHONDRITE	C	C	3-1.2	
MAC 88181~	84.4	L-6 CHONDRITE	A/B	A		
MAC 88182~	31.5	L-6 CHONDRITE	B	A/B		
MAC 88184	20.6	E-3 CHONDRITE	C	C	6-2.5	
MAC 88187~	94.7	L-6 CHONDRITE	A/B	B		
MAC 88191~	73.6	H-6 CHONDRITE	B/C	A		
MAC 88193~	137.5	L-6 CHONDRITE	A/B	A		
MAC 88194~	17.2	L-6 CHONDRITE	A/B	A		
MAC 88197~	66.0	L-6 CHONDRITE	A/B	A		
MAC 88201~	40.4	H-6 CHONDRITE	B/C	A		

~ Classified by using refractive indices.

TABLE 2

Newly Classified Specimens Listed By Type **

Sample Number	Weight (g)	Classification	Weathering	Fracturing	%Fa	%Fs
		Achondrites				
LEW 88008	17.9	DIOGENITE	A/B	A	30	
LEW 88011	2.0	DIOGENITE	A	A	24	
LEW 88007	8.4	EUCRITE	A/B	A	25-60	
LEW 88009	11.7	EUCRITE (UNBRECCIATED)	A	A	25-58	
LEW 88010	7.1	EUCRITE (UNBRECCIATED)	A	B	33-55	
EET 87521	30.7	LUNAR-BASALTIC BRECCIA	A	A	35-95	25-65
LEW 88006	27.0	UREILITE	B	A/B	18	16
LEW 88012	3.8	UREILITE	B	A	9	8
MAC 88177	35.3	UREILITE	B/C	A	13	12
		Carbonaceous Chondrites				
LEW 88001	44.9	CARBONACEOUS C2	Ce	B	1-44	1-7
LEW 88002	7.2	CARBONACEOUS C2	Be	B	1-29	1-3
LEW 88003	1.7	CARBONACEOUS C2	A	A	1-31	1-8
MAC 88101	20.9	CARBONACEOUS C2	Be	A	1-25	1-5
MAC 88176	37.9	CARBONACEOUS C2	Be	A	1-34	1-8
		Chondrites - Type 3				
LEW 85383	18.5	H-3 CHONDRITE	C	A	6-23	2-18
MAC 88174	98.4	H-3 CHONDRITE	Be	A/B	3-19	6-13
LEW 85434	19.4	L-3 CHONDRITE	C	A	1-23	2-11
LEW 85437	9.4	L-3 CHONDRITE	C	A	1-23	2-11
LEW 85452	9.2	L-3 CHONDRITE	C	A	5-23	2-18
		E Chondrites				
MAC 88136	74.4	E-3 CHONDRITE	A	B	0-3	
MAC 88180	26.6	E-3 CHONDRITE	C	C	3-1.2	
MAC 88184	20.6	E-3 CHONDRITE	C	C	6-2.5	
		Irons				
HOW 88403	2480.7	IRON-ATAXITE (ANOM)				

~ Classified by using refractive indices.

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).

C2 CHONDRITE:
LEW88001, LEW88002, LEW88003.

E3 CHONDRITE:
MAC88136, MAC88180, MAC88184.

H4 CHONDRITE:
LEW88019, LEW88020.

MAC88145, MAC88146.

H6 CHONDRITE:
MAC88130, MAC88131, MAC88132, MAC88133.

L3 CHONDRITE:
LEW85434, LEW85437.

UREILITE:
LEW88012 with LEW85440.

RECLASSIFICATION

Sample No: **EET87521**
Weight (g): 30.7
Dimensions(cm): 3.7 x 2.5 x 2
Meteorite Type: Lunar Basaltic Breccia

Location: Elephant Moraine
Field No: 4452

Macroscopic Description: Carol Schwarz and Marilyn Lindstrom

About 30% of this smooth rounded specimen is covered with black to brown shiny fusion crust. The interior of this coherent breccia is dark and fine-grained and contains numerous small white and yellow inclusions. Two 2-3 mm clasts are visible on the surface: One is a white clast consisting of plagioclase with 10-15% yellow and black mafic minerals; the other is a buff-colored clast made up of plagioclase and 35-50% yellow and black mafic minerals.

Thin Section (EET87521,8 & ,9) and Bulk Composition (EET87521,6) Description: Jeremy Delaney and Paul Warren

EET87521 was originally classified as a eucrite. However, more detailed investigations indicate that it is a very-low-titanium (VLT) basaltic breccia of lunar derivation. The modal mineralogy is 5-10% olivine, 45-50% pyroxene, 35-40% plagioclase and 1-2% ilmenite, chromite, ulvospinel/magnetite, sulfide, silica minerals, and FeNi-metal. The matrix of the meteorite also contains several percent of glass similar in composition to the bulk meteorite. The olivine ranges in composition from Fo_{65} to Fo_5, a range typical of VLT mare basalts, and shows a strong bimodality with clusters centered at Fo_{57-65} and Fo_{5-15}. Intermediate olivine compositions are uncommon. Molar Fe/Mn ratios of the olivine are 90-100. The pyroxene is pigeonite/subcalcic augite/augite with a composition range of $En_{65}Wo_{5-10}$ to $En_{20}Wo_{15-40}$. Most pyroxene is iron-rich and comparable to eucritic pyroxene, but is generally more calcic than eucritic pyroxene. The pyroxene does not show the bimodal distribution of the olivine. Pyroxene Fe/Mn ratios are 50-75. These ratios are typical of mare basalts, and much higher than those of basaltic achondrites (30-40). The feldspar is mostly An_{93-97} with a few more sodic grains present. Several clasts within the thin sections have survived with textures little altered by brecciation. These clasts tend to be relatively coarse-grained, by mare basalt standards.

Thin section [,9] contains a small (1 mm) clast of what is probably a highlands impact melt breccia. This extremely fine-grained clast contains at least 70% plagioclase. It also contains the only observed grains of FeNi-metal, with compositions (average 94.1% Fe, 4.53% Ni, 0.37% Co) typical of metals derived as "contamination" from metal-rich meteorites.

The bulk composition of EET87521 has been studied by INAA, using two adjacent chips, 278-290 mg in mass. The TiO_2 concentration is 0.8-1.1%, and results for ratios such as Fe/Mn, Ga/Al, Na/Ca, and Co/Cr indicate that this sample is lunar, and certainly not a eucrite. In general, the bulk composition shows a striking resemblance to VLT mare basalts from Luna 24. Perhaps the most significant difference is that EET87521 has higher concentrations of incompatible elements, especially light REE. This difference might be caused by the highlands component associated with the FeNi-bearing clast. However, the bulk-rock Ni content (29-43 µg/g) indicates that the total proportion of non-VLT "contaminant" is probably small.

References:

J. Delaney (1989) *Nature 342*, 889-890.
P. Warren and G. Kallemeyn (1989) *Geochim. Cosmochim. Acta 53*, 3323-3330.

Oxygen Isotopic Composition: Robert Clayton

The oxygen isotopic composition is $\delta^{18}O = +5.39$, $\delta^{17}O = +2.79$. These analyses are comparable to those of previously analyzed lunar meteorites and Apollo lunar samples and distinct from those of eucrites.

Sample No: **HOW88403**
Dimensions (cm): 11.5x7.0x7.0
Weight (g): 2470
Meteorite Type: Anomalous Ataxite

Location: Mt. Howe
Field Number: none

Macroscopic Description: V.F. Buchwald and R.S. Clarke, Jr.
The meteorite was found by a research group under the direction of Dr. Charles Swithinbank on the blue ice field at Mt. Howe, Antarctica. It is blocky in shape with smoothly rounded edges, and its surfaces are dark brown in color with a slightly reddish tinge. The surface is unusual in appearance, having a texture of densely spaced pin holes due to selective corrosion and interior structure. Flow structure is present in the fusion crust suggesting that the domed or most rounded surface was the anterior surface during atmospheric entry.

Polished Section Description: V.F. Buchwald and R.S. Clarke, Jr.
A polished section of 20 cm^2 was prepared from a slice that was taken perpendicular to the long axis of the specimen and ~15 mm from its smaller end. The appearance of this surface suggests a metal-sulfide eutectic, with ~2/3 metal and ~1/3 sulfide. It is a fine grained structure with individual sulfide cells ranging around 0.3 mm across. A thin fusion crust is present, underlain by a 2-3 mm heat-altered zone. The metal matrix is ataxitic, decomposing into a very fine grained mixture of taenite and kamacite with abundant small schreibersites. Troilite is surrounded by discontinuous rims of schreibersite, and an occasional chromite was observed in the sulfide. The specimen is an anomalous sulfide-rich ataxite.

Sample No: **LEW85383**
Dimensions (cm): 3x2.5x2
Weight (g): 18.5
Meteorite Type: H3 chondrite

Location: Lewis Cliff
Field Number: 2453

Macroscopic Description: Roberta Score
This angular stone is completely covered with polished black fusion crust. The interior is heavily oxidized, masking any structure present.

Thin Section (.3) Description: Brian Mason
The section shows abundant chondrules and chondrule fragments, up to 1.5 mm across, in a minor amount of finely granular matrix containing considerable nickel-iron and lesser troilite. A variety of chondrule types is present, mostly porphyritic and granular olivine and olivine-pyroxene, but some cryptocrystalline and radiating pyroxene chondrules were seen. Weathering is extensive, with brown limonitic staining throughout the section. Microprobe analyses show olivine and pyroxene of variable composition: olivine, Fa_{6-23}, mean Fa_{17} (CV FeO is 26); pyroxene, Fs_{2-18}. The meteorite is classified as an H3 chondrite, estimated H3.7.

Sample No: **LEW85434; LEW85437**
Dimensions (cm): 2.5x2x1.5; 2x1.5x1
Weight (g): 19.4; 9.4
Meteorite Type: L3 chondrite

Location: Lewis Cliff
Field Number: 2431; 2427

Macroscopic Description: Cecilia Satterwhite
Both specimens are covered with weathered fusion crust. The interior of both fragments is red-brown. Light colored chondrules are visible in LEW85437.

Thin Section (LEW85434.5; LEW85437.3) Description: Brian Mason
These sections are very similar, and the same description applies to both; they are probably paired. They show a close-packed aggregate of chondrules and chondrule fragments, up to 1.8 mm across, in a small amount of dark matrix containing a little troilite and nickel-iron. Chondrule types include granular and porphyritic olivine and olivine-pyroxene, barred olivine, and fine-grained radiating pyroxene. Weathering is extensive, with brown limonitic staining pervading the

sections. Olivine and pyroxene show a wide range in composition: olivine, Fa_{1-23}, mean Fa_{10} (CV FeO is 76); pyroxene, Fs_{2-11}. This range of compositions indicates type 3, and the small amount of nickel-iron suggests L group; the meteorite is therefore classed as an L3 chondrite (estimated L3.4).

Sample No: **LEW85452**
Dimensions (cm): 2x1.5x0.5
Weight (g): 9.2
Meteorite Type: L3 chondrite
Location: Lewis Cliff
Field Number: 3140

Macroscopic Description: Cecilia Satterwhite
Black fusion crust completely covers LEW85452. The interior structure has been obliterated by oxidation.

Thin Section (,3) Description: Brian Mason
The section shows a close-packed aggregate of chondrules and chondrule fragments, up to 2.4 mm across, in a finely granular matrix containing some troilite and nickel-iron. Chondrule types include granular and porphyritic olivine and olivine-pyroxene, and fine-grained to cryptocrystalline pyroxene. Olivine and pyroxene show a wide range in composition: olivine, Fa_{5-23}, mean Fa_{15} (CV FeO is 35); pyroxene, Fs_{2-18}. This range of compositions indicates type 3, and the small amount of nickel-iron suggests L group; the meteorite is therefore classed as an L3 chondrite (estimated L3.6).

Sample No: **LEW88001; LEW88002; LEW88003**
Dimensions (cm): 4.7x3.5x2.5; 2.7x1.5x1.3; 1.5x1.2x1.4
Weight (g): 44.9; 7.2; 1.7
Meteorite Type: C2 chondrite
Location: Lewis Cliff
Field Number: 4481; 5698; 5665

Macroscopic Description: Robbie Marlow
Dull black and brown fusion crust covers 95% of these 3 carbonaceous chondrites. Evaporite deposit was noted on the exteriors of LEW88001 and 88002. The interior of LEW88001 is dark gray and contains numerous "rusty" inclusions. Evaporites prevaid this specimen. LEW88002 and 88003 are less weathered and contain numerous submillimeter sized white inclusions.

Thin Section (LEW88001,4; LEW88002,3; LEW88003,3) Description: Brian Mason
These meteorites are C2 carbonaceous chondrites, and are so similar that a single description will suffice. The sections show numerous small (up to 0.6 mm across) chondrules and mineral grains in a black matrix. Chondrules consist largely of olivine, with minor pyroxene; mineral grains are olivine, pyroxene, and a little calcite. Microprobe analyses show that most of the olivine has composition close to Mg_2SiO_4, but with a few more iron-rich grains; pyroxene is clinoenstatite, with composition range Fs_{1-7}.

Sample No: **LEW88006**
Dimensions (cm): 3x2.5x2
Weight (g): 27.0
Meteorite Type: Ureilite
Location: Lewis Cliff
Field Number: 5262

Macroscopic Description: Roberta Score
LEW88006 is semi-rounded with fusion crust covering 95% of the exterior surfaces. Fusion crust is generally shiny black, but is frothy and pitted on the bottom surface. Breaking this specimen revealed an interior typical of ureilites that is brownish in color and crystalline with many grains showing crystal faces.

Thin Section (.4) Description: Brian Mason

The section shows an aggregate of olivine and pyroxene, as rounded to subhedral grains 0.1-3.0 mm in maximum dimension. The grains are rimmed with black carbonaceous material, which contains trace amounts of nickel-iron and troilite. Microprobe analyses show olivine and pyroxene of uniform composition: olivine, Fa_{18} (CaO 0.35%, Cr_2O_3 0.70%); pyroxene, Wo_8Fs_{16} (Cr_2O_3 1.2%). The meteorite is a ureilite; it appears to be essentially unshocked.

Sample No: **LEW88007**
Dimensions (cm): 2.6x2x1.5
Weight (g): 8.4
Meteorite Type: Monomict Eucrite
Location: Lewis Cliff
Field Number: 4610

Macroscopic Description: Robbie Marlow

Seventy-five percent of the exterior of this achondrite is covered with shiny and dull fusion crust. The interior shows an even distribution of mafic and nonmafic minerals. No individual clasts were noted. Small areas of oxidation are present.

Thin Section (.5) Description: Brian Mason

The section shows an ophitic intergrowth of pigeonite and plagioclase, with trace amounts of opaque minerals. The grain size and texture vary considerably within the section, suggesting a recrystallized breccia. Microprobe analyses show pyroxene ranging in compostion from Wo_2Fs_{60} to $Wo_{40}Fs_{26}$, with relatively uniform En content. Plagioclase ranges in composition from An_{85} to An_{91}, with a mean of An_{90}. The meteorite is a monomict eucrite.

Sample No: **LEW88008**
Dimensions (cm): 2.8x2.5x2
Weight (g): 17.9
Meteorite Type: Diogenite
Location: Lewis Cliff
Field Number: 5336

Macroscopic Description: Robbie Marlow

This meteorite fragment has a greenish-yellow color whose exterior surface is partially covered with patchy dull black fusion crust. Clasts ranging from 1 to 4 mm were revealed when this achondrite was broken.

Thin Section (.4) Description: Brian Mason

The section shows a cataclastic texture, with pyroxene clasts up to 4 mm across in a matrix consisting of comminuted pyroxene with a little plagioclase and chromite. Microprobe analyses show pyroxene of uniform composition, Wo_4Fs_{30}; plagioclase composition is An_{96}. The meteorite is a diogenite.

Sample No: **LEW88009**
Dimensions (cm): 2.5x2.5x1.5
Weight (g): 11.7
Meteorite Type: Unbrecciated Eucrite
Location: Lewis Cliff
Field Number: 6182

Macroscopic Description: Robbie Marlow

Three-quarters of the exterior of this angular stone has fusion crust. The interior is light gray and has a massive texture. Oxidation is very light.

Thin Section (.2) Description: Brian Mason

This meteorite is a fine-grained aggregate of pyroxene and plagioclase (average grain size 0.1 mm). Microprobe analyses show pyroxene composition ranging from Wo_2Fs_{58} to $Wo_{42}Fs_{25}$; plagioclase composition ranges from An_{82} to An_{94}. The meteorite is an unbrecciated eucrite.

Sample No: **LEW88010**
Dimensions (cm): 3x1.5x1.3
Weight (g): 7.1
Meteorite Type: Unbrecciated Eucrite

Location: Lewis Cliff
Field Number: 6019

Macroscopic Description: Robbie Marlow
Flowlines are visible in the fusion crust which covers this oblong eucrite. The interior shows an even distribution of mafic and non-mafic minerals. No individual clasts were revealed.

Thin Section (.3) Description: Brian Mason
The section shows an ophitic intergrowth of pyroxene and plagioclase, with grain size 0.6-1.2 mm. Microprobe analyses show pyroxene compositions ranging from Wo_1Fs_{55} to $Wo_{30}Fs_{33}$, with relatively uniform En content. Plagioclase composition ranges from An_{76} to An_{86}, with a mean of An_{82}. The meteorite is an unbrecciated eucrite.

Sample No: **LEW88011**
Dimensions (cm): 1.5x1.5x6
Weight (g): 2.0
Meteorite Type: Diogenite

Location: Lewis Cliff
Field Number: 5677

Macroscopic Description: Roberta Score
Thin shiny fusion crust covers 40% of the exterior of LEW88011. Flow lines are present on the bottom surface. The interior of LEW88011 contains black and white inclusions that are ~0.5 mm in length. No oxidation is visible.

Thin Section (.3) Description: Brian Mason
The section has a cataclastic texture, and consists almost entirely of pyroxene, in grains up to 0.9 mm in maximum dimension; a little plagioclase and chromite are also present. Microprobe analyses show pyroxene of uniform composition, Wo_3Fs_{24}; plagioclase composition is An_{90}. The meteorite is a diogenite.

Sample No: **LEW88012**
Dimensions (cm): 1.9x1.5x1
Weight (g): 3.8
Meteorite Type: Ureilite

Location: Lewis Cliff
Field Number: 6180

Macroscopic Description: Robbie Marlow
LEW88012 has dull brownish-black fusion crust covering 75% of the exterior. Heavy oxidation and abundant mineral grains showing crystal faces are characteristic of this ureilite.

Thin Section (.3) Description: Brian Mason
The section shows an aggregate of olivine and pyroxene, as rounded to subhedral grains 0.3-1.5 mm in maximum dimension. The grains are rimmed with black carbonaceous material, which contains trace amounts of nickel-iron and troilite. Microprobe analyses show olivine and pyroxene of uniform composition: olivine, Fa_9 (CaO 0.35%, Cr_2O_3 0.55%); pyroxene, Wo_5Fs_8. One grain of augite, $Wo_{36}Fs_5$, was analysed. The meteorite is a ureilite, and is relatively unshocked. It is very similar in texture and mineral compositions to LEW 85440, and the possibility of pairing should be considered.

Sample No: **MAC88101**
Dimensions (cm): 4.2x3x2
Weight (g): 20.9
Meteorite Type: C2 chondrite

Location: MacAlpine Hills
Field Number: 5483

Macroscopic Description: Robbie Marlow
Eighty percent of the fusion crust on this carbonaceous chondrite has been plucked off. The fusion crust remaining is thick and dull black. Areas devoid of fusion crust are greenish in color. The interior matrix is black with a greenish-tinge and has no obvious inclusions. Traces of evaporite deposit were noted immediately underneath the fusion crust.

Thin Section (,3) Description: Brian Mason
The section shows a few small chondrules and numerous mineral grains in a dark brown to black semi-translucent matrix. The chondrules and mineral grains consist largely of olivine, with minor pyroxene; a few calcite grains were noted. Microprobe analyses show that most of the olivine is near Mg_2SiO_4 in composition, with a few more iron-rich grains; pyroxene is clinoenstatite, with composition range Fs_{1-5}. The meteorite is a C2 carbonaceous chondrite.

Sample No: **MAC88136**
Dimensions (cm): 4x4x2.5
Weight (g): 74.4
Meteorite Type: E3 chondrite

Location: MacAlpine Hills
Field Number: 5726

Macroscopic Description: Carol Schwarz
Rusty, smooth, unfractured fusion crust covers 70% of this chondrite. The interior is black and fine-grained with abundant metal evenly disseminated throughout. One 1 mm chondrule was exposed on the freshly broken surface. Except for one small corner, oxidation appears to be minimal.

Thin Section (,3) Description: Brian Mason
Chondrules and chondrule fragments are abundant, ranging up to 2.4 mm across; they consist of granular or cryptocrystalline pyroxene. The matrix consists largely of small pyroxene grains, with some nickel-iron and minor sulfides. One ellipsoid (chondrule?) of metal, 1.1 x 1.5 mm, is present in the section. Microprobe analyses show that the pyroxene is clinoenstatite, with variable but low iron content (FeO 0.1-2.1%); the metal grains show a low and variable silicon content, ranging up to 0.5%. The meteorite is tentatively classified as an E3 enstatite chondrite, but the metal has a lower Si content than is usual for these meteorites. MAC88136 resembles MAC88180 and MAC88184; the possibility of pairing should be considered.

Sample No: **MAC88176**
Dimensions (cm): 4.5x3x2.5
Weight (g): 37.9
Meteorite Type: C2 chondrite

Location: MacAlpine Hills
Field Number: 5555

Macroscopic Description: Robbie Marlow
Black, polygonally fractured fusion crust covers 75% of this oblong carbonaceous chondrite. The fusion crust is frothy on one surface. Evaporite deposit was exposed when this friable specimen was dissected. Oxidation is light and sub-millimeter sized white inclusions are evenly distributed throughout this meteorite.

Thin Section (,3) Description: Brian Mason
The section shows a few small chondrules and numerous mineral grains in a black matrix. Chondrules and mineral grains consist largely of olivine, with a minor amount of pyroxene. Microprobe analyses show that most of the olivine has a composition close to Mg_2SiO_4, with a few more iron-rich grains; pyroxene is clinoenstatite, composition range Fs_{1-8}. The meteorite is a C2 carbonaceous chondrite.

Sample No: **MAC88174**
Dimensions (cm): 6x4x3.2
Weight (g): 98.4
Meteorite Type: H3 chondrite

Location: MacAlpine Hills
Field Number: 6156

Macroscopic Description: Roberta Score
Smooth brown fusion crust covers 90% of this unequilibrated chondrite. Large areas of oxidation are present in the clast-rich, dark-gray matrix. Evaporite deposit was noted.

Thin Section (.4) Description: Brian Mason
The section shows a close-packed aggregate of chondrules and chondrule fragments, up to 1.8 mm across; most of the chondrules are granular or porphyritic olivine and olivine-pyroxene, but a few radiating and cryptocrystalline pyroxene chondrules are present. They are set in a small amount of dark matrix which contains some nickel-iron and troilite, often concentrated as rims to the chondrules. Microprobe analyses show olivine and pyroxene of variable composition: olivine, Fa_{3-19} (CV FeO is 38); pyroxene, Fs_{6-13}. The variability of olivine and pyroxene compositions indicates type 3, and the amount of metal suggests H group; hence the meteorite is tentatively classified as an H3 chondrite (estimated H3.6).

Sample No: **MAC88177**
Dimensions (cm): 4.2x3x1.5
Weight (g): 35.3
Meteorite Type: Ureilite

Location: MacAlpine Hills
Field Number: 5740

Macroscopic Description: Roberta Score
MAC88177 is a dome-shaped stone covered with flow-marked black and gray fusion crust on the top and frothy fusion crust on the bottom. The interior of the stone is heavily oxidized and much of it is orange. The less weathered matrix is buff colored. Several thin black veins criss-cross the interior.

Thin Section (.3) Description: Brian Mason
The section shows an equigranular aggregate of anhedral to subhedral olivine and pyroxene (grains 0.3-0.6 mm across), with minor troilite and accessory amounts of nickel-iron and chromite. Shock effects include undulose extinction in the silicate grains, mosaic structure in troilite, and minor veining. Some weathering is indicated by small areas of brown limonite and limonitic staining along veins. Microprobe analyses show olivine and pyroxene of uniform composition: olivine, Fa_{13}; pyroxene, Wo_4Fs_{12}. The meteorite is classified as a ureilite, but it lacks the carbonaceous material characteristic of ureilites, and the olivine contains less than 0.1% Ca and Cr.

Sample No: **MAC88180**
Dimensions (cm): 3.8x2.5x2.5
Weight (g): 26.6
Meteorite Type: E3 chondrite

Location: MacAlpine Hills
Field Number: 5547

Macroscopic Description: Robbie Marlow
Fusion crust totally covers this extremely weathered and fractured meteorite. The interior structure has been obliterated by oxidation. Only large orange-brown rust spots are visible.

Thin Section (.3) Description: Brian Mason

Much of the section is occupied by a single large chondrule, 5 mm across; the remainder of the section consists of small chondrules and chondrule fragments in matrix consisting largely of small pyroxene grains, with some nickel-iron and sulfides. The silicate material appears to be entirely clinoenstatite. Microprobe analyses show the clinoenstatite of slightly variable compostions, with FeO 0.2-0.8% and CaO 0.1-0.4%; the metal grains have a variable Si content, 0.2-2.0%. The meteorite is tentatively identified as an E3 chondrite. It resembles MAC88136 and 88184, and the possibility of pairing should be considered.

Sample No:	**MAC88184**	Location:	MacAlpine Hills
Dimensions (cm):	4x2.5x1.5	Field Number:	6670
Weight (g):	20.6		
Meteorite Type:	E3 chondrite		

Macroscopic Description: Robbie Marlow

Brown and black frothy fusion crust covers 95% of MAC88184. Deep cracks penetrate the interior. Oxidation is heavy and has masked any interior structure present.

Thin Section (.3) Description: Brian Mason

Chondrules and chondrule fragments are abundant, ranging up to 1.5 mm across; they consist of granular or cryptocrystalline pyroxene. The matrix consists largely of small pyroxene grains, with some nickel-iron and minor sulfides. Microprobe analyses show that the pyroxene is clinoenstatite, with variable but low iron content (FeO 0.4-1.8%); the metal grains show a low and variable silicon content, ranging up to 0.6%. The meteorite is tentativley classified as an E3 enstatite chondrite, probably paired with MAC88136 and 88180.

NATURAL THERMOLUMINESCENCE DATA FOR ANTARCTIC METEORITES

Natural Thermoluminescence (NTL) data obtained by Ben Myers, Hazel Sears, Fouad Hasan, Roberta Score and Derek Sears at the University of Arkansas. The measurements and data reduction methods were described by Hasan et al. (1987, Proc. 17th LPSC E703-E709; 1989, LPS XX, 383-384). Also included are data for the 23 meteorites discussed by Hasan et al. (1987), reduced using our current methods, and some preliminary notes on pairing and other observations. (February 1990 data set).

Sample	Class	NTL [krad at 250 deg. C]	Sample	Class	NTL [krad at 250 deg. C]
HOW 88401	Euc	6.9 +/- 1.3	EET 87601	L6	11.8 +/- 0.1
LEW 85303	Euc	24 +/- 2	EET 87603	L6	12.1 +/- 0.1
LEW 88005	Euc	23 +/- 2	EET 87607	L6	42.8 +/- 0.7
			EET 87613	L6	12.2 +/- 0.1
EET 87512	How	16 +/- 1	EET 87615	L6	0.8 +/- 0.1
			EET 87616	L6	12.9 +/- 0.1
MAC 88102	Mes	1.1 +/- 0.3	EET 87622	L6	22.1 +/- 0.7
			EET 87623	L6	15.4 +/- 0.2
LEW 85309	C2	<1	EET 87626	L6	7.9 +/- 0.1
MAC 88100	C2	<1	EET 87635	L6	8.7 +/- 0.1
MAC 88107	C2	13.9 +/- 0.4	EET 87639	L6	20.3 +/- 0.1
			EET 87644	L6	27 +/- 1
ALH 85003	C3O	66 +/- 9	EET 87652	L6	9.9 +/- 0.2
LEW 85332	C3O	55 +/- 28	EET 87655	L6	66 +/- 2
			EET 87660	L6	11.3 +/- 0.3
EET 87851	LL5	78 +/- 2	EET 87661	L6	20.7 +/- 0.7
			EET 87744	L6	103 +/- 2
LEW 87049	L4	40 +/- 2	EET 87756	L6	17.9 +/- 0.3
ALHA77002	L5	17.2 +/- 0.4	EET 87758	L6	25.6 +/- 0.5
EET 87570	L5	22.0 +/- 0.4	EET 87759	L6	53 +/- 1
EET 87774	L5	18.0 +/- 0.4	EET 87768	L6	58 +/- 1
ALHA77261	L6	14.0 +/- 0.3	EET 87788	L6	14.6 +/- 0.5
ALHA77296	L6	1.54 +/- 0.08	EET 87789	L6	9.6 +/- 0.1
ALHA77297	L6	2.5 +/- 0.2	EET 87794	L6	15.2 +/- 0.1
ALHA78043	L6	11.0 +/- 0.1	EET 87796	L6	33.5 +/- 0.5
ALHA78105	L6	45.3 +/- 0.5	EET 87804	L6	33 +/- 1
ALHA78112	L6	27.9 +/- 0.7	EET 87807	L6	20.6 +/- 0.2
ALHA78114	L6	14.9 +/- 0.8	EET 87817	L6	19.3 +/- 0.4
ALHA78251	L6	49.6 +/- 0.5	EET 87818	L6	135 +/- 4
ALH 85014	L6	2.0 +/- 0.2	EET 87827	L6	21.1 +/- 0.4
ALH 85095	L6	1.0 +/- 0.2	EET 87829	L6	10.9 +/- 0.9
ALH 85157	L6	8.9 +/- 0.1	EET 87830	L6	12.7 +/- 0.1
EET 87555	L6	44 +/- 1	EET 87843	L6	47.7 +/- 0.3
EET 87569	L6	23.8 +/- 0.2	EET 87855	L6	10.5 +/- 0.1
EET 87583	L6	2.4 +/- 0.5	EET 87857	L6	23 +/- 7
EET 87586	L6	21.6 +/- 0.6	EET 87858	L6	8.9 +/- 0.4
EET 87587	L6	8.4 +/- 0.1	META78003	L6	38.6 +/- 0.6
EET 87589	L6	7.6 +/- 0.1	META78028	L6	22.7 +/- 0.7
EET 87594	L6	28.4 +/- 0.7	RKPA79001	L6	6.5 +/- 0.1
EET 87596	L6	9.5 +/- 0.1	RKPA80202	L6	0.46 +/- 0.01

Sample	Class	NTL [krad at 250 deg. C]	Sample	Class	NTL [krad at 250 deg. C]
EET 87805	H3	6.4 +/- 0.1	EET 87790	H5	3.2 +/- 0.4
ALHA77004	H4	35.5 +/- 0.3	EET 87798	H5	8.7 +/- 0.1
ALHA77191	H4	34.5 +/- 0.3	EET 87821	H5	81 +/- 2
ALHA77262	H4	65 +/- 3	EET 87822	H5	15.2 +/- 0.2
ALHA77294	H5	4.8 +/- 0.1	EET 87840	H5	65.4 +/- 0.9
ALHA78102	H5	23.4 +/- 0.4	ALHA76008	H6	10.3 +/- 0.1
ALH 85021	H5	0.13 +/- 0.01	ALHA77258	H6	48 +/- 1
ALH 85145	H5	0.24 +/- 0.04	ALHA78076	H6	58 +/- 2
EET 87571	H5	29.0 +/- 0.1	ALHA78115	H6	48 +/- 2
EET 87577	H5	51.6 +/- 0.2	ALH 85032	H6	70 +/- 2
EET 87581	H5	69 +/- 2	ALH 85130	H6	0.5 +/- 0.1
EET 87754	H5	0.92 +/- 0.05	EET 87592	H6	48.3 +/- 0.8
EET 87755	H5	98 +/- 4	EET 87820	H6	44.3 +/- 0.5
			META78006	H6	1.6 +/- 0.2

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

NOTES

General comments: We suggest meteorites with NTL >100 krad are candidates for an unusual history involving high radiation doses and/or low temperatures. 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 (close solar passage, shock heating, atmospheric entry), exacerbated, in the case of certain achondrite classes, by "anomalous fading". For samples whose NTL lies between 5 and 100 krad the natural TL is related, primarily, to terrestrial age.

Pairings: The following are comments on pairings based on the natural TL data above, TL sensitivity, the shape of the induced TL glow curve, classifications, and JSC curatorial staff and Arkansas group unpublished and published sample descriptions. Unless otherwise noted, suggested pairings are considered "probable" as opposed to "possible" or "tentative" by Hazel Sears and Derek Sears.

1. TL data confirm pairings suggested in the Newsletter.

   Euc: LEW85303, LEW88005 (and presumably LEW85300 and LEW85302).

2. TL data do not confirm pairings suggested in the Newsletter.

   How: EET87512 has significantly higher natural TL and may not be paired with the EET87503 group.

3. Additional pairings suggested by the TL data.

   C2: MAC88107 paired with MAC87300/301.

   L5: EET87570, EET87774 (tentative).

   L6: EET87583, EET87536 (tentative).

L6: EET87587, EET87858 and possibly EET87589.
L6: EET87596, EET87635, EET87789.
(The above two groups are tentatively paired with each other).
L6: EET87626, EET87652 (possible).
L6: EET87601, EET87603, EET87613, EET87616, EET87830, EET87855.
L6: EET87569, EET87586, EET87661, EET87807, EET87857.
L6: EET87622, EET87639.
(The above two groups are tentatively paired with each other).
L6: EET87756,.EET87817.
L6: EET87594,.EET87644.
L6: EET87796,.EET87804.

H5: ALH85021, ALH85145 (tentative).
H5: EET87581, EET87840 (possible).

The following pairing was omitted from the September 1989 Newsletter.

L6: EET87502, EET87535, EET87567.

4. The following notes relate to pairings discussed by Scott (1989, *Smith. Cont. to Earth Sci* 28,103) for the 1977-80 samples run by Hasan et al, (1987).

   a). The TL data confirm the following pairings.

   L6: ALHA77296, ALHA77297.
   L6: ALHA78105, ALHA78251 (tentative).

   H4: ALHA77004, ALHA77191.

   b). The TL data confirm that ALHA78112 is not paired with ALHA78114, and that RKPA79001 is probably not paired with RKPA80202.

TABLE 5

^{26}Al ACTIVITY DATA FOR ANTARCTIC METEORITES

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SPECIMEN NUMBER	CLASS	^{26}Al Activity (dpm/kg)
ALHA 80127	H5	63.9 ±6.3
ALHA 81028	L6	40.1 ±3.7
ALHA 81045	H4	47.3 ±3.0
ALHA 81047	H4	57.5 ±4.1
ALHA 81050	H4	57.4 ±3.2
ALHA 81051	H4	52.2 ±3.4
ALHA 81052	H4	59.1 ±3.6
ALHA 81058	H4	64.8 ±5.0
ALHA 81060	L3	40.2 ±8.1
ALHA 81061	L3	58.3 ±8.2
ALHA 81068	H4	55.0 ±4.9
ALHA 81095	H4	52.8 ±4.5
ALHA 81108	H5	45.6 ±3.7
ALHA 81114	H4	50.8 ±3.8
ALHA 81117	H4	38.6 ±3.9
ALHA 81118	H5	37.6 ±1.8
ALHA 81121	L3	55.3 ±2.5
ALHA 81129	H5	65.7 ±5.1
ALHA 81130	H5	50.0 ±5.4
ALHA 81146	H6	57.2 ±7.7
ALHA 81163	H5	71.3 ±4.3
ALHA 81164	H5	64.8 ±5.4
ALHA 81166	H5	68.2 ±7.9
ALHA 81167	L6	59.3 ±5.3
ALHA 81170	H5	80.5 ±5.0
ALHA 81171	H5	80.4 ±7.1
ALHA 81172	L6	58.3 ±6.3
ALHA 81173	H5	67.2 ±4.9
ALHA 81174	H5	66.9 ±4.7
ALHA 81176	H5	45.6 ±2.5
ALHA 81178	H5	60.7 ±5.2
ALHA 81185	LL6	47.4 ±3.8
ALHA 81186	H5	42.3 ±5.9
ALHA 81190	L3	46.2 ±3.4
ALHA 81191	L3	50.1 ±3.1
ALHA 81197	H5	73.6 ±4.0
ALHA 81219	H5	63.7 ±8.1
ALHA 81229	L3	43.8 ±3.4
ALHA 81233	H5	45.4 ±5.9
ALHA 81236	H5	80.5 ±5.1
ALHA 81256	H5	50.1 ±5.3
ALHA 81257	L6	51.4 ±6.0
ALHA 81262	L6	66.3 ±4.3
ALHA 81267	H4	51.8 ±6.0
ALHA 81271	H6	71.3 ±5.2
MAC 88105	lunar	19.5 ±2.6
META 78008	URE	56.1 ±4.2

Uncertainties are calculated from counting statistics. All data have been corrected for background effects, counting geometry, and specimen geometry. For more information or to request a copy of all the Battelle ^{26}Al data (for over 500 specimens), please contact John Wacker [telephone: (509) 376-1076; FAX: (509) 376-5021].

PAIRING OF ANTARCTIC METEORITES BASED ON ^{26}AL ACTIVITIES

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The Battelle ^{26}Al data set contains results for two or more specimens from the following pairings (Antarctic Meteorite Newsletter, 9, no. 2, June, 1986). Starred specimens have ^{26}Al activities that are > ±10 dpm/kg different from other samples in pairing group, which is inconsistent with these samples belonging to the pairing group. Unstarred samples have similar ^{26}Al activities, which is consistent with pairing.

2.1	(euc)	ALHA76005, 78040, 78132*, 78165, 79017
3.5	(ure)	ALHA82106, 82130
8.1	(H4)	ALHA 77004, 77190, 77191, 77192, 77208, 77223, 77224, 77225, 77232, 77233, 77221
8.2	(H4)	ALHA 77009*, 81022*
8.4	(H4)	ALHA 80106, 80121, 80128
8.5	(H4)	ALHA 81041, 81043, 81044, 81045, 81047, 81048, 81050, 81051, 81052
9.2	(H5)	ALHA 77021, 77025, 77062, 77071, 77086, 77088
9.3	(H5)	ALHA77118*, 77124*
10.2	(H6)	ALHA 77271, 77288
10.5	(H6)	ALHA 81038, 81103*, 81112
11.1	(L3)	ALHA 77011, 77015, 77047, 77050, 77052, 77115, 77140, 77160, 77163, 77164, 77165*, 77166, 77167, 77175*, 77185, 77211, 77214*, 77241, 77244, 77249, 77260, 77303, 78015, 78038, 78041, 78162, 78170, 78235, 79001, 79045, 81025, 81032, 81060, 81061*
11.2	(L3)	ALHA 77215, 77216, 77217, 77252
11.4	(L3)	ALHA 78046, 83008
14.2	(L6)	ALHA 77001, 77293, 77296, 77297*, 77150*, 77180
14.3	(L6)	ALHA 77272*, 77273, 77280, 77282, 77269, 77270, 77277*, 77281, 77284
14.4	(L6)	ALHA 78043, 78045
14.5	(L6)	ALHA 78103, 78105, 78104, 78251
14.6	(L6)	ALHA 78112, 78114
14.7	(L6)	ALHA 78126, 78130, 78131
14.8	(L6)	ALHA 80103, 80105, 80107, 80108, 80110, 80112, 80113, 80114, 80115, 80116, 80117, 80125*, 81017, 81107*
14.9	(L6)	ALHA 81028, 81029
14.12	(L6)	RKPA 78001, 78003, 79001, 79002, 80219, 80264*
15.1	(LL3)	ALHA 76004, 81251