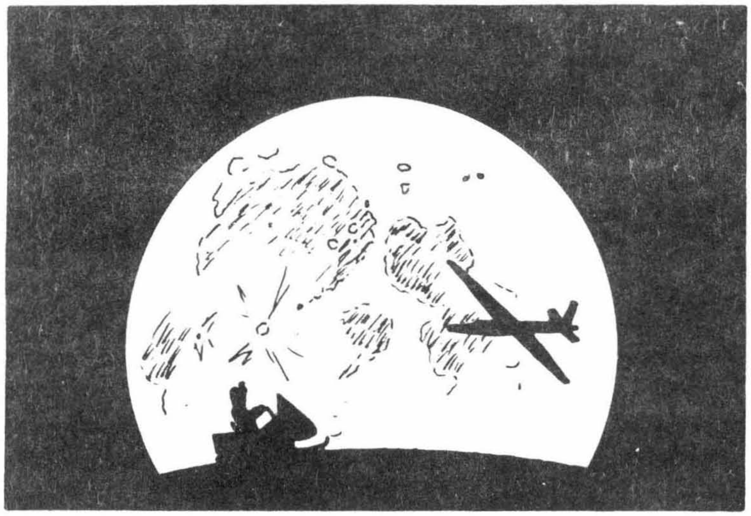

LUNAR SAMPLE NEWSLETTER

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NAME CHANGES

As you may have noticed, the name of this newsletter has changed as has the name of our branch here at JSC. The newsletter is now the LUNAR SAMPLE NEWSLETTER. It will incorporate the contents of the former LUNAR CURATORIAL NEWSLETTER and HIGHLANDS INITIATIVE NEWSLETTER. The LUNAR SAMPLE NEWSLETTER will join the ANTARCTIC METEORITE NEWSLETTER and the COSMIC DUST COURIER as the three newsletters produced by the Planetary Materials Branch. The recent change of our branch name from Curatorial Branch to Planetary Materials Branch does not signal a change in our curatorial responsibilities but does reflect the expanded role of the branch with regard to Antarctic meteorites and cosmic dust.

SPECIAL SESSIONS ON LUNAR EXPLORATION AND UTILIZATION AT THE FOURTEENTH LUNAR AND PLANETARY SCIENCE CONFERENCE

LUNAR EXPLORATION AND UTILIZATION

In the past year, Drs. Wendell Mendell and Michael Duke have been organizing the rationale and supporting information for a renewed program of lunar exploration, leading to a manned lunar base to be first occupied in 2007, the 50th anniversary of space flight. As part of this activity, special sessions will be held at the Fourteenth Lunar and Planetary Science Conference, March 14-18, 1983, on the subject of Lunar Exploration and Utilization. The keynote speaker in a plenary session will be Dr. Hans Mark, NASA Deputy Administrator, who will be joined by several other people prominent in scientific, industrial, and government arenas. A technical session will include contributed papers on a variety of relevant topics.

Drs. Mendell and Duke are interested in gathering ideas, rationale, and facts that support resuming lunar unmanned and manned exploration. You are encouraged to contact them.

NEXT LAPST MEETING IS MARCH 1Ø-12, 1983

The Lunar and Planetary Sample Team (LAPST) met at the Lunar and Planetary Institute November 19-2Ø, 1982. LAPST reviewed ten requests for lunar samples and recommended allocation of 41 samples totalling about 12Ø grams and another 41 thin sections. LAPST also reviewed four requests for cosmic dust and recommended allocation of samples to each of the requestors. Studies related to the Highlands Initiative generated most of the lunar requests.

Members of three investigator teams/consortia visited the JSC Curatorial Facility five times in the past three months to describe and chose samples for their reseach. Several of the visits were related to describing newly exposed slab faces resulting from the recent effort to slab selected breccias. A copy of the report on 14321 written by John Servais and Larry Taylor is a part of this newsletter. The opportunity to come to the lunar curatorial facility at JSC and describe newly slabbed faces is still open. We invite your active participation -- it is an especially useful exercise for researchers who are relatively new to lunar sample work. Generally a visit of less than a week is adequate.

Other areas of interest represented in the requests were:

a. studies related to the Regolith Initiative;
b. paleomagnetism;
c. volcanic glasses from the Apollo 15 and 17 sites;
d. micrometeorite crater distributions; and
e. isotopic analyses.

LAPST will meet again March 1Ø-12, 1983, immediately prior to the Lunar and Planetary Science Conference. As always we welcome your requests anytime but we especially encourage you to get them in well before the LAPST meeting.

WORKSHOP ON "PRISTINE HIGHLAND ROCKS AND THE EARLY IGNEOUS HISTORY OF THE MOON"

This workshop was held as scheduled October 15-17, 1982, in New Orleans prior to the annual meeting of the Geological Society of America. About 4Ø scientists attended, including petrologists, geochemists, geochronologists, and geophysicists. Having participants from these diverse specialities led to stimulating discussions and much cross fertilization of ideas. Discussions made it clear that we are making significant progress in understanding the early evolution of the Moon.

The discussions also helped focus attention on the many problems that remain to be solved. For example, several suites of nonmare rock types have been identified. How are they related to each other and to the putative magma ocean? Do we have samples of all major nonmare lithologies? Chemical studies of soils and soil breccias suggest that other lithologies exist but have not yet been recovered among existing samples. Discussions of the Moon's bulk composition (a first-order parameter in understanding how the Moon formed) demonstrated the importance of tackling this problem with a variety of disciplines. These discussions also emphasized that much more research is needed to constrain the Moon's bulk composition. There was general agreement that significant progress can be made in solving these and other outstanding problems by additional research on lunar samples.

The success of this workshop was due in part to holding it immediately prior to a major conference. This allowed several scientists not previously involved in lunar science to attend the workshop, and helped attract several former lunar investigators. This scheduling also saved travel money for those who attended both the workshop and the GSA meeting.

A report of the workshop will be published in a few months. It will contain the agenda, summaries of the discussions, invited and contributed abstracts, and a list of attendees.

REGOLITH INITIATIVE NEWS

The Regolith Initiative is beginning to attract the interest of several research groups as is evident from the lunar sample requests received by LAPST. Within the Planetary Materials Branch, work is nearing completion on a compilation of regolith breccias that have been identified in the lunar collection and that can form the nucleus of the sample work associated with this new initiative. The completed catalog will be sent to all of the recipients of this newsletter. A topical mini conference is also contemplated as part of the Regolith Initiative, detailed plans for that conference are not yet available.

SLABBING OF SELECTED LUNAR BRECCIAS CONTINUES

The slabbing of lunar breccias is continuing in the lunar curatorial facility. 14321, 14305, and 14303 have been slabbed to date. 14304 is the next breccia to be slabbed. The saw cabinet will then be thoroughly cleaned and refitted and slabbing will continue with 77215, 76255, 61015, 64455, 73215, and 73255.

In this newsletter you will find the first of the reports of mapping the faces of the newly sawed slabs. John Servais mapped 14321 and 14305; he reports on 14321. Larry Taylor has requested and has been granted consortium status on 14321 and 14305. John Dietrich of the Planetary Materials Branch will be mapping the faces of the 14303 slab. There has been no request for consortium status for 14303 nor for any of the other slabbing candidates. We are open to volunteers for mapping the faces of the slabs to be cut in the near future. The work in the laboratory can be completed within a few days at Houston. The new slabs are all good candidates for consortium investigations and there is no better way to become familiar with the sample than to examine it in person in the curatorial facility.

The queue of samples to be slabbed is reviewed periodically and in particular at the times of the LAPST meetings. If you have interest in one of the samples on the list or if you want to see your candidate added to the list, send us your comments and we will present your request to LAPST. We can also rearrange our sawing schedule to accomodate the schedule of anyone that wants to describe a slab.

REVISED GUIDELINES FOR CONSORTIUM RESEARCH

In their November meeting, LAPST reviewed the guidelines for consortium research. The revised guidelines are presented here for your information. We in the Planetary Materials Branch will be happy to answer your questions about these guidelines and LAPST is always open to your views and comments.

Consortium Guidelines

A. Request for Consortium Status

In preparation of a request for consortium status, the prospective consortium leader is expected 1) to do a thorough literature search to determine the results of all previous studies of the sample and 2) to ascertain the amounts and types of materials available for future study. If subsamples are inspected in the Curatorial Facility as a part of this preliminary study, this inspection may involve limited chipping to obtain materials for thin sections and to isolate easily separable lithologies for potential future allocation. At the discretion of the prospective consortium leader, the results of the literature search and assessment of sample availability may be assembled into a guidebook.

The request to form a consortium shall contain the following information:

1. a scientific justification of the study;

2. a research plan, indicating the particular lithologies of the rock to be studied and the types of analyses planned for each; and

3. a list of the members of the consortium and their fields.

LAPST may approve this plan or may require additions or changes before approving it.

B. Consortium Study: Duties, Responsibilities, and Conditions

1. <u>General</u>

a. The consortium leader or a designated representative will design, with the assistance of the Curator, the plan for processing of the rock. This plan will include a listing of where and under what conditions the consortium materials will be subdivided. The plan must be approved by LAPST.

b. The consortium leader may submit to LAPST a list of subsamples to be designated as "consortium subsamples". After these subsamples have been approved by LAPST, plans for their subsequent processing need not be submitted to LAPST prior to execution. Approved consortium subsamples may be subdivided in the laboratories of the consortium members (subject to the restrictions listed below) or subdivided in the Curatorial Facility (either in air or in the nitrogen cabinets) to obtain material for analysis. Alternatively, the consortium leader may propose some other type of guideline for access to the rock, but in no case will any consortium be granted totally unrestricted access to all subsamples of a rock.

c. If the consortium subsamples contain material from exterior surfaces, investigations requiring this material will have high priority, even if they are not connected with the consortium.

d. The consortium will be allocated a total weight of material that may be destroyed in the course of analysis by the various consortium members. Any requests for additional material for destructive analysis must be made in writing through the consortium leader to the Curator. Such requests must include a detailed justification for the additional material.

2. Consortium Leader. The consortium leader has the following responsibilities:

a. To see that the consortium subsamples are handled under clean-room conditions. These subsamples should not be treated under conditions which would compromise the experiments of any consortium member or the remainder of the material for future experiments.

b. To produce high-quality photographs of the surfaces of the subsamples before any material is removed and as required during disaggregation, and to produce overlays documenting the removal of each piece. The complete photographic record will be provided to the Curator when material remaining is returned to the Curator.

c. To keep records of the disaggregation of the sample. A complete sample history will be provided to the Curator. (At the request of the consortium leader, the Curator will provide standard, pre-cleaned vials for storage and transfer of samples.)

d. To ensure that the total weight of material that is consumed in the course of the experiments does not exceed the total permitted for destructive analysis by the consortium members.

e. To select and describe all samples allocated from the rock, including any allocated to PI's who are not members of the consortium.

f. To coordinate all studies of the rock. The experimental design should ensure the maximum scientific return from the material analyzed.

g. To coordinate a petrographic description of the material after the consortium subsamples have been subdivided. A set of representative thin sections will be made during processing and provided to the consortium leader.

h. To follow standard procedures in sample transfer.

i. To see that unused material is maintained in chemically uncontaminated condition and returned to the Curator after the consortium studies have been completed (simultaneous return of all material from the consortium subsamples is preferable).

j. To mediate and, if necessary, decide in cases of a dispute among consortium members wishing to use any given material for mutually incompatible purposes.

3. Consortium Members. Each designated member of the consortium will be provided material that he may consume in destructive operations. From this material he is expected to provide the basic data pertinent to his field of expertise. In addition, he may generate whatever other studies on his portion of the material that he wishes, within the normal bounds stipulated by his approved proposal.

4. Sample Consumption. The consortium should destroy only the minimum amount of material that is consistent with its needs. For individual clasts and distinctive lithologies of masses greater than 1 gram, the consortium may consume up to 70% for destructive analysis. For individual clasts and distinctive lithologies of masses less than 1 gram, the consortium may consume the entire mass.

5. Destructive and Non-Destructive Operations. It is not possible to define simply or unambiguously destructive and non-destructive operations on the consortium subsamples. The following examples may help. Undocumented removal of material from the slab is forbidden. Disaggregation of the slab into individual fragments that are documented and stored in clean individual polystyrene, stainless steel, or aluminum containers is not considered a destructive operation. Pulverization and sieving of material are considered destructive operations. Chemical contamination or neutron irradiation are considered destructive.

6. Publication of Results. Each member of the consortium may publish at his discretion the results obtained from his work on the consortium rock. Simultaneous publication of a series of papers on the consortium rock in a single journal is encouraged because of the coherent body of information on the rock what will result.

7. Requests for Samples by Non-Members of the Consortium. Investigators who would like to analyze material from a consortium rock but who are not consortium members will be referred to the consortium leader. Such investigators may be added to the consortium if this solution is agreeable to all concerned.

8. Termination of Consortia. The consortium may be asked at any time by the Curator to provide a report of studies in progress, future plans, and a timetable for completion of the research. If satisfactory progress cannot be demonstrated by a consortium, its rights to first priority on material from a rock may be terminated by the Curator and the sample may be made available for more general allocation.

14321: CLAST MAPS OF A NEWLY SAWN FACE

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INTRODUCTION

14321, affectionately known as "Big Bertha", is one of the largest samples of breccia returned from the Moon, and has been the object of intensive study in the past (e.g. 1-4). More recently, Warren and others (5,6) have reported on three troctolite clasts from 14321, and taylor and others have discovered a large granitic clast. In hope of finding further goodies such as these, the largest remaining piece of 14321 (,37) was slabbed in October 1982. The resulting slab broke into three pieces which have been numbered ,1082; ,1083; ,1084. Additional chips comprising chips of various recognizable clast types and matrix fines (sawdust) were also numbered. Both the new face of ,37 (S_1) and the face of the reconstructed slab (N_1) were mapped. Six mappablevarieties of lithic clasts were recognized, along with several small clasts that appear to consist of single, highly shocked plagioclase grains. We will first give general descriptions of the lithic clast types, and then more detailed descriptions of specific numbered clasts. The numbering system is consistent for both faces; that is clasts which have the same number on both faces are the same clast.

GENERAL DESCRIPTION OF CLAST TYPES

DA = Dark Aphanitic: Dark greenish-brown or 'olive-drab' clasts without discernable crystallinity or texture, and with rare to absent crystals or lithic fragments. May be clast-free melt rocks or volcanic; probably the former.

DB = Dark Breccia: Dark greenish-brown or 'olive drab' to almost black. Very fine grained crystalline matrix with no discernable texture; common (≈5-8%) crystal fragments, plag>>> mafics. Most DB clasts have distinct contacts with the adjacent, lighter-colored matrix, but some have gradational contacts and may represent a dark-matrix variety of the 14321 breccia.

DV = Dark Volcanic: Dark olive drab to brownish clasts with discernable "volcanic" texture to the matrix. Textured areas vary in distribution from patchy to homogenous, and in grain size from very fine grained to medium grained. The most common textures observed are ophitic to subophitic or intergranular; granular textures are rare. Two clasts contain large "phenocrysts" (0.3-0.8 mm) of a mafic mineral, probably olivine. The DV clasts may represent true volcanic rocks, but amelt rock origin seems more likely.

MB = Mare Basalt: The mare basalt clasts are much lighter in color than those described above, and do not stand out distinctly from the matrix. They can be recognized by their coarse grain size (≈0.3 mm), ophitic to granular texture and distinctive mineralogy: 35-50% plg, 25-40% pale green cpx/ol, 20-40% red-brown to dark brown opx, and trace oxides. Larger clasts show an irregular distribution of mafic- and plagioclase-rich areas, which is reflected in the variable modes of the smaller clasts.

MN = MicroNorite: Very fine grained, granular textured clasts (grain size $\leq$ 0.1 mm); composed of 50-60% feldspar, with subequal proportions of red-brown to grey-brown pyroxene. The feldspar is commonly milky white and probably shocked.

W = White clasts: Anorthositic clasts comprising 80-90% clear to milky white plagioclase of indeterminate grain size; the remainder consists of darker grey-brown areas that may be pyroxene.

In addition to these clasts there are distinct color differences in the matrix, which can be seen in the photos. The most obvious is a zone of light-colored matrix that can be seen in the central part of the "N_1" face; less obvious are zones of darker colored matrix that occur on both faces.

LMZ = Light Matrix Zone: The lighter color of this zone is due to a much lower proportion of very small, dark lithic clasts than is found in the 'normal' matrix. This difference is only apparent, however, and does not persist into the slab. The LMZ is visible only where clasts DA3 or DV4 have been plucked from the matrix, leaving their molds behind. The LMZ represents the 'surface' of these large clasts, where the smaller lithic clasts were in 'point' contact with the large clasts. The situation is analogous to a pile of marbles sitting on a table: a section made at the surface of the table will show a much lower apparent volume of marbles than one made randomly through the pile.

DMZ = Dark Matrix Zone: In contrast, the darker color of the DMZ reflects a true higher than normal proportion of dark lithic clasts in parts of the breccia matrix. These dark zones occur adjacent to some large dark clasts and may be due to partial dissaggregation of the larger clasts by turbulent mixing during emplacement.

Clasts which are thought to represent single plagioclase crystals are labelled either "P" or "Ps", depending on whether they are clear (unshocked) or milky (shocked).

DESCRIPTIONS OF SPECIFIC CLASTS

Face 'N_1' : ,1082 ,1083 ,1084 Face 'S_1' : ,37

Clasts that are found on only one of the faces are labelled in parentheses with the face that they are found on, i.e. (N_1) or (S_1). Clasts which have been mapped on both faces are unlabelled in this fashion. Because "T_1' is oriented towards the top in both photos, the images are perverse and clasts which occur on the right in one photo will appear on the left in the other photo.

Dark Aphanitic

DA1 : About 4 x 2 cm max.; Olive drab, with no apparent texture.

DA2 : About .5 x .5 cm; Darker than DA1, almost black. Tiny plg lathes visible (barely).

DA3 : 6.5 x 3.5 max; Very dark olive drab, mostly aphanitic but with some areas of very fine-grained subophitic texture. Contains sparse plg clasts. The S_1 face contains a small anorthositic clast (W6). This is probably a clast-poor melt rock.

DA4 : 6.0 x 2.5 cm max; Similar to DA3 but with no visible texture at all, and no mineral or lithic clasts. Mostly on S_1.

Dark Breccia

DB1 : About 4 x 3 cm max; typical DB, with 5% mineral clasts (plg,px,ol?). Gradational contact with matrix and DB10; may even be part of DB10.

DB4 : 2 x 1 cm max; Very dark olive drab , finely crystalline matrix; with subhedral to rounded plag and px clasts.

DB5 : 2 x 1 cm; Same as DB4 but with tiny (1.5 mm) lithic clast of norite (?) .

DB7 : 2 x 2 cm (N_1); Similar to DB1, may be part of DB10. Its position on S_1 is occupied by a DMZ.

Dark Volcanic

DV1 : Olive drab ophitic basalt, much darker than the 'mare basalts' as mapped here. Grain size about 0.05-0.2 mm, with rare equant ol (?) to 0.3 mm. (N_1).

DV2 : Similar to DV1 but darker in color. 0.7 x 0.5 cm about.

DV3 : About 1 x 1 cm; very fine grained, texture is barely perceptible (could be 'DA').

DV4 : About 1.5 x 1 cm; Dark olive drab, with tiny plag lathes in 'diabasic' texture; Contains several large (0.5-0.8 mm) yellow-orange phenocrysts, probably olivine.

DV5 : About 5 x 3 cm; Unusual texture of aphanitic, olive drab matrix with irregular to ovoid areas of medium to caorse-grained ophitic basalt, very similar in appearance to 'mare basalt', as mapped here.

Mare Basalt

MB1 : Small clast (0.5 cm) of light colored, subophitic to intergranular basalt; grain size about 0.1-0.3 mm. About 50% plg, 30% pale green cpx (?), 20% dark drown opx.

MB4 : Less than 0.3 cm; Granular textured mafic-rich basalt; grain size 0.3 mm; about 35-40% plg, 40% pale green cpx/ol, 20-25% red-brown opx. Partly ophitic, with some plag lathes included in larger, blocky pyroxenes.

MB5 : Larger clast 2 x 0.6 cm max; subophitic to granular basalt with grains 0.2-0.3 mm 35-40% plg, 35-40% red-brown opx, 25-30% pale green cpx/ol.

MB6 : About 1.5 x 1.5 cm; similar in texture, grain size and mode to MB5. Clast is less than 2 or 3 mm deep on the N_1 face, but appears to be much deeper on the S_1 face (although the clast is smaller). The distribution of feldspar and mafics is very irregular in this clast.

MB7 : Small clast less than 1 cm; similar to MB6, but finer grained ophitic texture (N_1).

MB9 : About 1 x 0.5 cm; granular textured, 0.2-0.3 mm grain size. About 45% plg, 30% dark brown opx, 25% pale grey-green to yellow-green mafics (cpx/ol); (S_1).

Micronorite

MN1,2,3 : Three small clasts in DB10, all less than about 5mm in diameter; rounded. Very fine grained (0.1 mm) with granular mosaic (?) texture. About 50-60% plg, rest red-brown to grey-brown mafics; (S_1).

MN4 : About 0.7 x 0.5 cm; very fine grained granular texture, similar in mode to MN1. Distinguished from the breccia matrix by a higher mafic content; (S_1).

White clasts

W1 : About 0.3 x 0.2 cm; mostly milky white plag, with some darker grey areas that may be unshocked plag, pyroxene or quartz (???); (N_1).

W2 : About 1.5 mm across; mostly milky white plag, very fine grained; sparse grey-brown mafics; (S_1)

W3 : About 4 x 3 mm; 70-80% plag, much of it milky white, and grey-green mafics; (S_1).

W4 : About 5 x 3 mm; 80-90% plag, mostly milky white, with sparse grey-green/brown mafics. Very Shallow; (S_1).

W5 : About 3 x 1 mm: Troctolitic? 70-80% milky white plag, 20-30% grey-green mafics; olivine? (S_1).

W6 : Rounded clast about 2 mm across in DA3; 80-90% plag, rest grey-green mafics.

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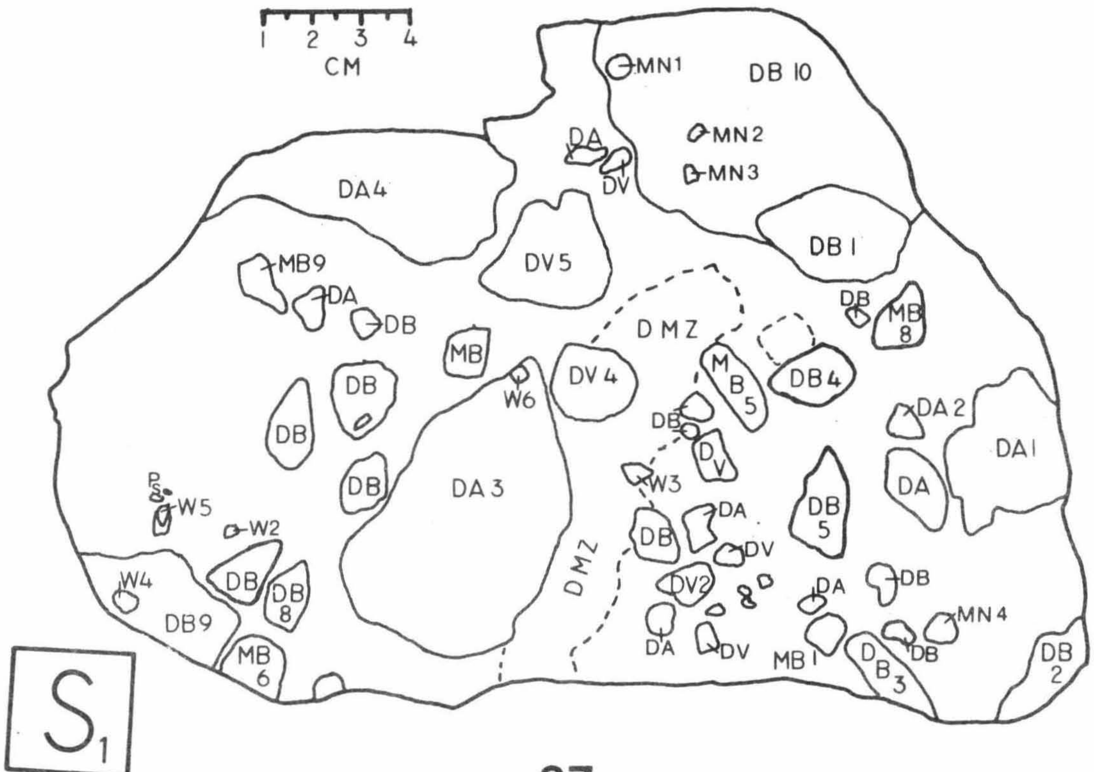
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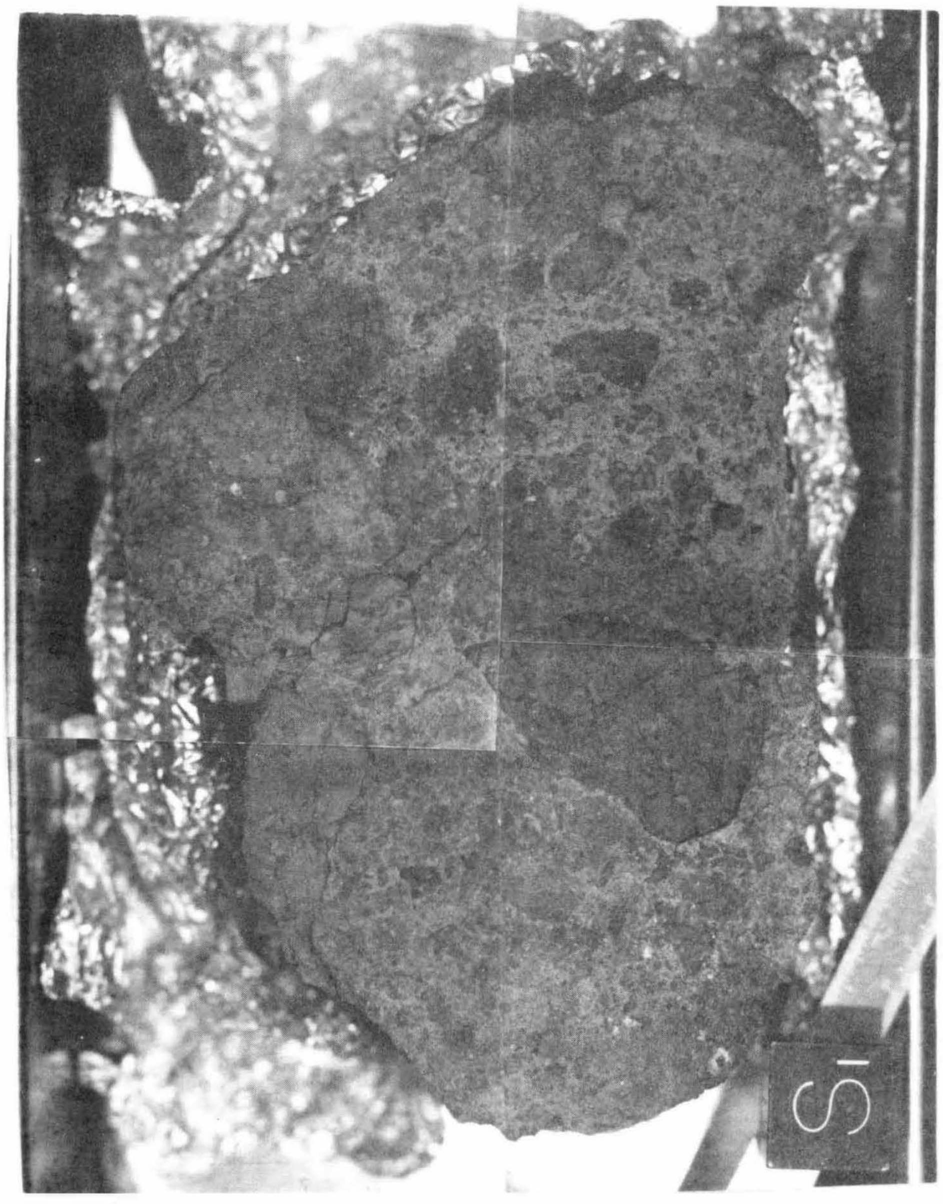

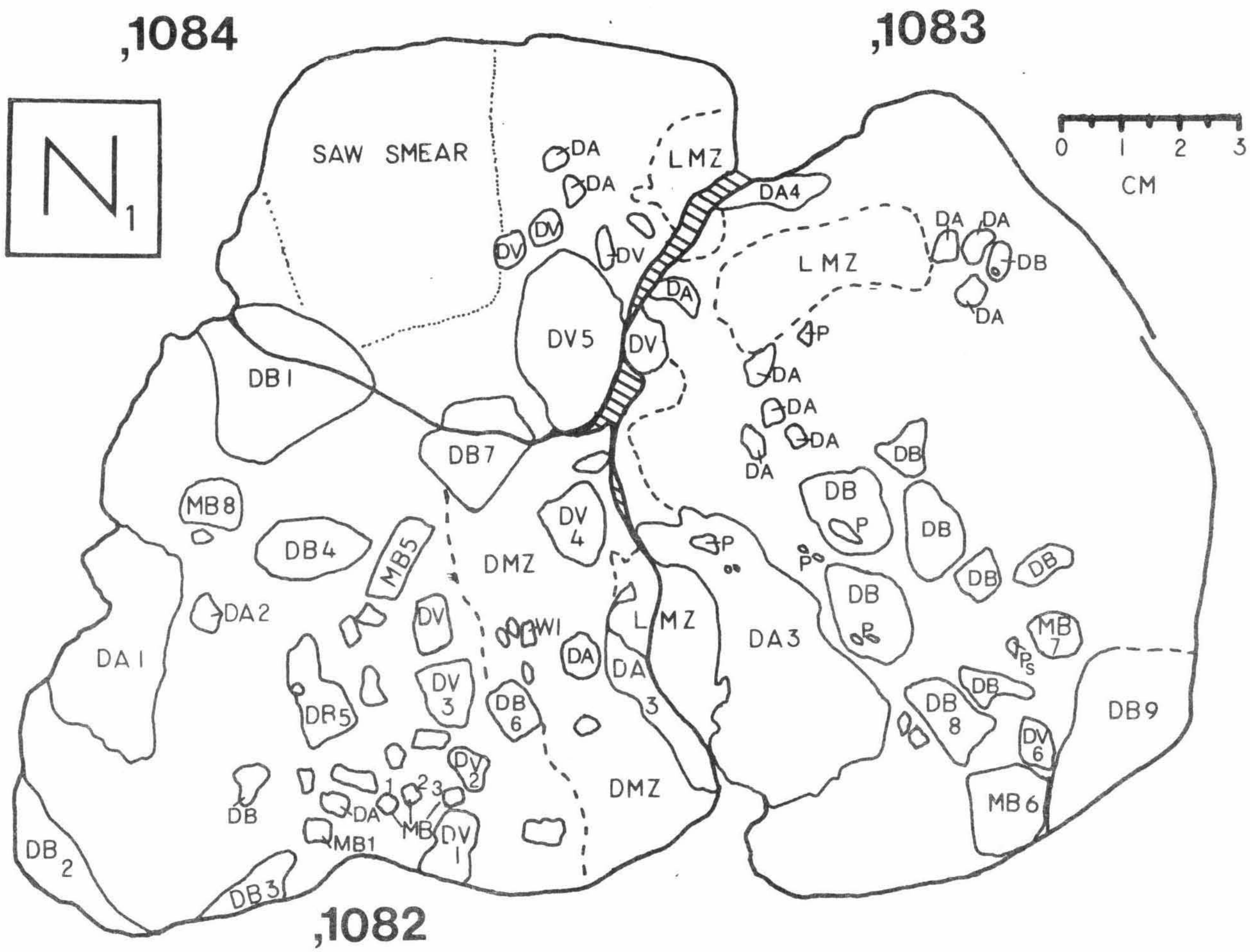
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