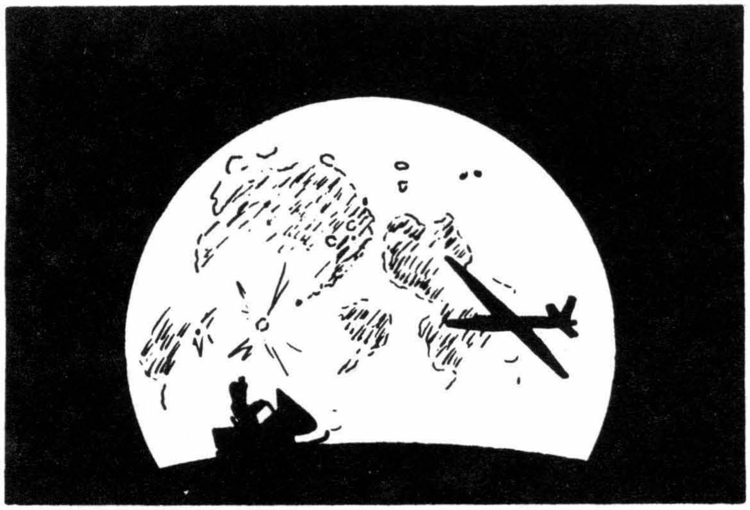

LUNAR SAMPLE NEWSLETTER

NUMBER 42

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OPPORTUNITY FOR A LUNAR SAMPLE FIELD TRIP

The Lunar Sample Curator and his staff will offer a lunar sample field trip to a limited number of attendees during Lunar and Planetary Science Conference XVI. On the field trip you will be able to see new lunar rocks that were exposed on slabs cut from breccia samples in the Apollo 14, 16, and 17 collections and a number of other interesting samples. (See "New Lunar Samples" in this issue.) The slabs will be displayed in nitrogen cabinets in the Lunar Sample Processing Laboratory. Lunar sample processors who are familiar with the slabbing program and the displayed samples will serve as field trip guides.

After the LPSC XVI preliminary program is set, the curatorial staff will determine the number of lunar sample field trips that can be scheduled. The opportunity is limited; only ten people can be accommodated during each trip. We encourage both new and old investigators to take advantage of this chance to see the new surfaces of big lunar samples. We will mail an announcement to recipients of the Lunar Sample Newsletter early in February.

NEXT LAPST MEETING IS FEBRUARY 15-17, 1985

The Lunar and Planetary Sample Team (LAPST) met at the Lunar and Planetary Institute November 16-18, 1984. LAPST reviewed ten lunar sample requests from seven investigators and recommended allocation of 494 lunar samples with a total weight of 300 grams. In response to two requests for cosmic dust, LAPST recommended allocation of one cosmic dust flag and several individual interplanetary dust particles. The team also endorsed the allocation of eleven samples and 60 thin sections with a total weight of about 3.2 grams assigned by the Curator in response to ten lunar sample requests from seven investigators between the June and November meetings of LAPST.

Two requests to form new lunar sample consortia were considered; LAPST recommended approval of both. Dr. D. Stoffler, Münster, and his colleagues (Dr. A. Deutsch, Münster; Dr. H. Wänke, Mainz; and Dr. E. Jessberger, Heidelberg) propose to study the samples from Cone Crater at the Apollo 14 site in a comprehensive manner. Dr. L. Taylor and Dr. P. Salpas (Univ. of Tennessee), Dr. M. Lindstrom (Washington Univ.) and Ms. K. Willis (NSI) will study about thirty clasts from lunar breccia 72275 for the purpose of finding new, important lithologies. LAPST encourages consortium studies such as these.

LAPST has recommended that two new thin sections (of rocks 78235 and 72275) be added to the thirty sets of lunar educational thin section packages. These educational packages are widely distributed to petrology classes in England, Ireland, Germany and Japan as well as within the United States. LAPST has also recommended allocation of a large piece (about 150 grams) of lunar basalt 15555 for long-term public display at the Edmonton Space Science Center.

Studies of lunar cores generated requests from two investigators. Dr. L. Haskin's group requested numerous small sub-samples from previously dis sected Apollo 15 and 16 core tubes to look for the end-member components indicated by their mixing-model calculations. Dr. M. N. Rao (India) requested five small samples from different depths along an Apollo 15 core to study the nuclear track records.

Other requests supported:

- A search for mare basalt fragments in Apollo 14 soils
- A search for zircon crystals suitable for age dating
- Continuing study of an Apollo 14 large glass sphere.

LAPST reconsidered a request from Dr. T. D. Lin of Portland Cement in light of the Headquarters denial of the allocation recommended at the June LAPST meeting. Lin's request is now supported by a more detailed proposal which has been reviewed by JSC staff and LAPST. LAPST again recommends allocation of lunar sample material for the proposed study. LAPST further recommends that the investigator use simulant to demonstrate that the test can be scaled down and to determine the minimum size of sample that will give valid results prior to allocation of the lunar materials.

LAPST will meet again February 15-17, 1985. Your requests are welcome at anytime; some allocations can be made between LAPST meetings. We especially encourage you to submit your requests well ahead of the LAPST meeting.

A LETTER FROM THE CHAIRMAN OF LAPST

The Lunar Sample Analysis Planning Team (LSAPT) has played a major role in lunar sample science commencing with the return of the first Apollo samples. It continues this role as the Lunar and Planetary Sample Team (LAPST), a name change brought about by the incorporation of cosmic dust into its purview. LAPST, as it is presently constituted, is a committee of the Lunar and Planetary Institute with a membership from the scientific community (see listing below). Its role is to advise and recommend to Mike Duke, Chief Solar System Exploration Division, and Doug Blanchard, the Planetary Materials Curator, both at JSC, on matters concerning lunar and cosmic dust samples and their science.

LAPST is the prime advisory team on lunar sample handling and allocations. The major tasks of LAPST are: 1) to ensure the integrity of the lunar samples; 2) to ensure the development of an adequate descriptive data base through sample characterization; and 3) to coordinate, foster, and otherwise promote problem-oriented sample research. It is this last task which has become increasingly important in recent years and is vital to the continued healthy growth of lunar science.

Today, the primary function of LAPST concerns the implementation and focusing of research efforts on major problems in the realm of lunar sample science. Some of this endeavor can be effected by "initiatives," such as the 'Highland Initiative' started by LAPST in 1980. Problem orientation and overall direction is also brought about by means of workshops, topical conferences, and symposia. Although the Lunar and Planetary Institute (LPI) gets credit for sponsoring all such workshops and topical confer ences, e.g., the recent Origin of the Moon Conference, the inspiration and initial promotion for these come from LAPST in all its wisdom. A list of several recent and proposed meetings that are direct outgrowths of LAPST instigated initiatives follows this letter.

LAPST has been spending considerable numbers of "mental calories" in putting together a 5-year plan for lunar sample science. From this brainstorming came the realization that mare basalts may be ripe for re-visiting. These basalts are prominent constitutents of the lunar crust, and they provide valuable information about the nature of the lunar interior. After a period of neglect caused by intense interest in nonmare samples, research on the nature and origin of mare basalts has begun to blossom once again. This re-awakening of interest stems from the realization that numerous questions remain to be answered about mare basalt genesis. Some of these questions are: What are mare basalt source areas in the lunar mantle really like? Are any undifferentiated? How uniform are they laterally and vertically? What happens to magmas after they ooze out of their source areas? How much fractional crystallization takes place? Do these magmas assimilate components from surrounding rocks on the way to the surface or as they flow across the stark lunar landscape? How do mare basalts fit into the evolution of the early crust? Age-wise? Compositionally? Petrogenetically? LAPST would be interested in your feelings concerning this mare basalt initiative mentioned above. Would you like to be an active player? Do you have any suggestions for fruitful avenues of pursuit? In fact, any comments which you wish to make about sample science endeavors, in general, can be made at any time, on an informal basis if you wish, to the various members of LAPST. We on LAPST are trying to serve you in the science community and need your input into our thought processes. Even if you are not an active participant in lunar sample science, please give us the benefit of your wisdom from "outside the forest."

Larry Taylor
LAPST Chairman

LAPST INITIATED MEETINGS

Topic	Dates	Place	Publication(s) *
Conference on Lunar Highlands Crust	11-79	LPI	Abs - LPI-C #394 Proceedings Volume
Workshop on Apollo 16	11-80	LPI	Abs - LPI-TR 81-01
Workshop on Magmatic Processes of Early Planetary Crusts	8-81	Montana	Abstract Volume LPI-TR 82-01
Workshop on Lunar Breccias and Meteorite Analogs	11-81	LPI	Abstract Volume LPI-TR 82-02
Workshop on Pristine Lunar Highlands Rock and the Early History of the Moon	10-82	New Orleans	Abstracts Volume LPI-TR 83-02
Workshop on Past and Present Solar Radiation: Record in Meteoritic and Lunar Regolith Material	9-83	Mainz, F.R.G.	Abstracts Volume Technical Report (in prep)
Conference on the Origin of the Moon	10-84	Hawaii	Abstract Volume Proceedings Volume

Proposed:

Workshop on Geochemical Tests of Models for Lunar Origins

Workshop on Restudy of Mare Basalts

Conference on Mare Basalts

Conference on Evolution of the Moon as a Planetary Object.

* LPI-C = LPI Contribution
LPI-TR = LPI Technical Report

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NEW LUNAR SAMPLES

Sample scientists will soon have an opportunity to study new suites of lunar rocks. Clasts that were totally enclosed in samples of lunar breccia are now exposed on new, saw-cut surfaces. Several samples have been sawed as part of a search for new rocks, either by a single saw cut or by sawing one or more slabs from the large samples.

Investigators have nominated most of the candidates for sawing to support an ongoing or proposed study. LAPST identified other candidates that promised a good return of new information.

Until recently, the consortium leader or another member of the investigator team studied the new surfaces in the Lunar Sample Preparation Laboratory at JSC to determine the types of clasts exposed and map their distribution. This labor-intensive task, needed to identify clasts that should be sampled for further study, was performed after the investigator team was committed to the study.

We now plan to complete a preliminary study and publish maps of the new surfaces with descriptions of representative clasts in the Lunar Sample Newsletter before allocation of samples. This information will assist the prospective investigator in selecting clasts for detailed study; we hope the preliminary studies will encourage participation by investigators who cannot afford an extended visit to lovely Houston for the purpose of mapping the new surfaces.

Kim Willis, one of the NSI lunar sample processors, prepared maps of the new surfaces on Apollo 17 sample 72275. That sample has been allocated to a consortium for detailed study. Clast descriptions from two surfaces and maps of all five new surfaces (Appendix 1) are extracted from her report as examples of the type of information that will be available.

New surfaces of four other lunar breccias are awaiting mapping. These are: Apollo 14 sample 14304, Apollo 16 samples 60016 and 60019, and Apollo 17 sample 72255. The map(s) and clast descriptions prepared for these samples will be published in future issues of this newsletter. To give you a preview, the NSI lunar sample processor assigned to study each rock has prepared a short summary of data available prior to sawing and has included a picture of one of the new surfaces. These are presented as Appendix 2. The black and white reproductions in the appendixes convey only part of the information that can be seen in the color photographs of the new surfaces. Investigators interested in the study of clasts in the lunar breccias may order 8 x 10 inch color prints of the new surfaces by completing the form on the last page of this newsletter.

CONSORTIUM RESEARCH

The value of consortia has long been recognised for conducting studies of lunar materials with as many techniques as possible applied to the same materials. The consortium approach has been used successfully on a wide variety of samples but has been particularly successful for complicated breccias.

The investment of the leader in a consortium effort (necessary recruitment and coordination of the consortium team) has been protected in the past by granting sole privilege for that rock to the consortium group. This mode is assumed for the guidelines for consortia that were published in this newsletter several issues ago.

The intent of the guidelines was to encourage consortium efforts by protecting the investment of the PI. As consortia have formed to study rocks that had been previously studied and as consortia have formed to study site oriented problems using a variety of rocks, the formal guidelines have been open to various interpretations.

The curator and LAPST will continue to use the consortium guidelines as guidelines, but will make whatever special agreements are needed with the investigators to promote and facilitate the study of the samples. The practical consequences of this policy for prospective consortium leaders is to facilitate their proposals and coordination work and to speed the allocation of samples to their consortium members.

Consortia leaders should be the focus of the understanding of the consortium samples and problems. Investigators interested in those problems and samples are encouraged to go directly to the leaders of the consortia. Collaboration is encouraged and will, no doubt, be welcomed by the consortia leaders.

The active consortia, their leaders and samples and research problems are listed here. If you have an interest in working on any of these problems/ samples and want to collaborate in a group effort please get in touch with the consortium leaders.

ACTIVE CONSORTIUM STUDIES

Topic	Consortium Leader
14304	K. Keil, Univ. New Mexico
14305	L. Taylor, Univ. Tennessee
14321	L. Taylor, Univ. Tennessee
61015	O. James, USGS, Reston, VA
64435	O. James, USGS, Reston, VA
67015	U. Marvin, Smithsonian Astrophysical
67435	K. Keil, Univ. New Mexico
67975	O. James, USGS, Reston, VA
72275	L. Taylor, Univ. Tennessee
A-14 Cone Crater	D. Stöffler, Univ. Münster, F.R.G.
A-16 North Ray Crater	D. Stöffler, Univ. Münster, F.R.G.

UPCOMING DATES OF INTEREST

January 1985	Target date for inventory of lunar samples held by Principal Investigators
January 15, 1985	Deadline for LPSC XVI abstracts
February 15-17, 1985	LAPST meeting, Lunar and Planetary Institute
February 1985	Next issue of Antarctic Meteorite Newsletter
March 11-15, 1985	Lunar and Planetary Science Conference XVI
Mar. 30-Apr. 1, 1985	Spring meeting of Meteorite Working Group
April 26, 1985	Deadline for LPSC XVI papers
May 1985	LAPST Meeting, Lunar and Planetary Institute

APPENDIX 1

MAPPING OF FIVE NEW FACES OF 72275
by Kim Johnson Willis, Northrop Services, Inc.

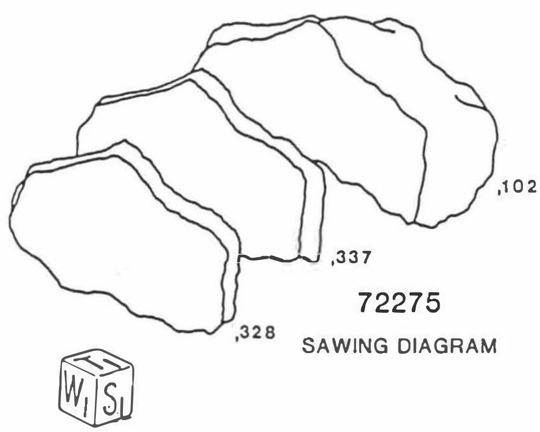
INTRODUCTION

72275 was one of four samples taken from Station 2 Boulder 1 located near the South Massif. The Sawing Diagram displays the five new faces exposed during bandsawing in July, 1984. All of the slabs were mapped and specific clast descriptions were made for each of the new faces. Some clasts have been removed, and these are indicated as being "excavated" or "partially excavated" at the end of each of the clast descriptions. Before slabbing 72275,102 weighed 2093.600 g. Clast descriptions for two slab faces are included in this section because they represent the range of clast and matrix types of 72275,102. The abbreviations used in mapping are as follows:

AC	Anorthosite Clast	G	Gabbro
AN	Anorthosite	GC	Gray Clast
B	Basalt	LA	Light Area
BGM	Blue Gray Matrix	LCMZ	Large Clast Matrix Zone
CG	Cataclastic Gabbro	LGM	Light Gray Matrix
CZ	Crushed Zone	LMA	Light Matrix Area
DA	Dark Area	MCC	Marble Cake Clast
DB	Dark Breccia	PRM	Plagioclase Rich Matrix
DC	Dark Clast	P	Patina
DMA	Dark Matrix Area	WC	White Clast

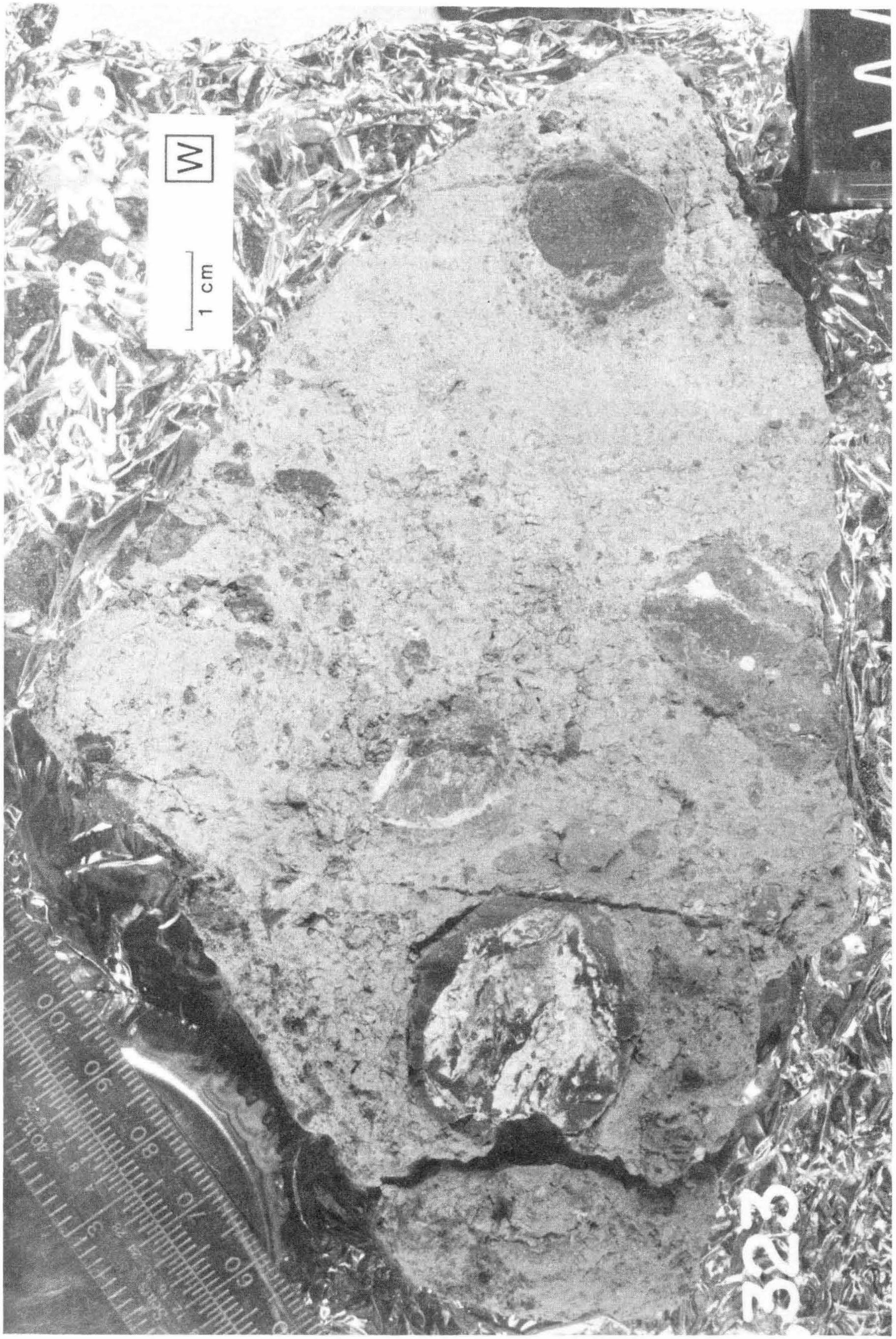
The format used in this section is:

Introduction
Sawing Diagram
Photograph of 72275,328 W
Photograph of 72275,337 E
Slab ,328 W Map, Clast Descriptions
Slab ,328 E, Map*
Slab ,337 W, Map*
Slab ,337 E Map, Clast Descriptions
Slab ,102 W, Map*



72275
SAWING DIAGRAM

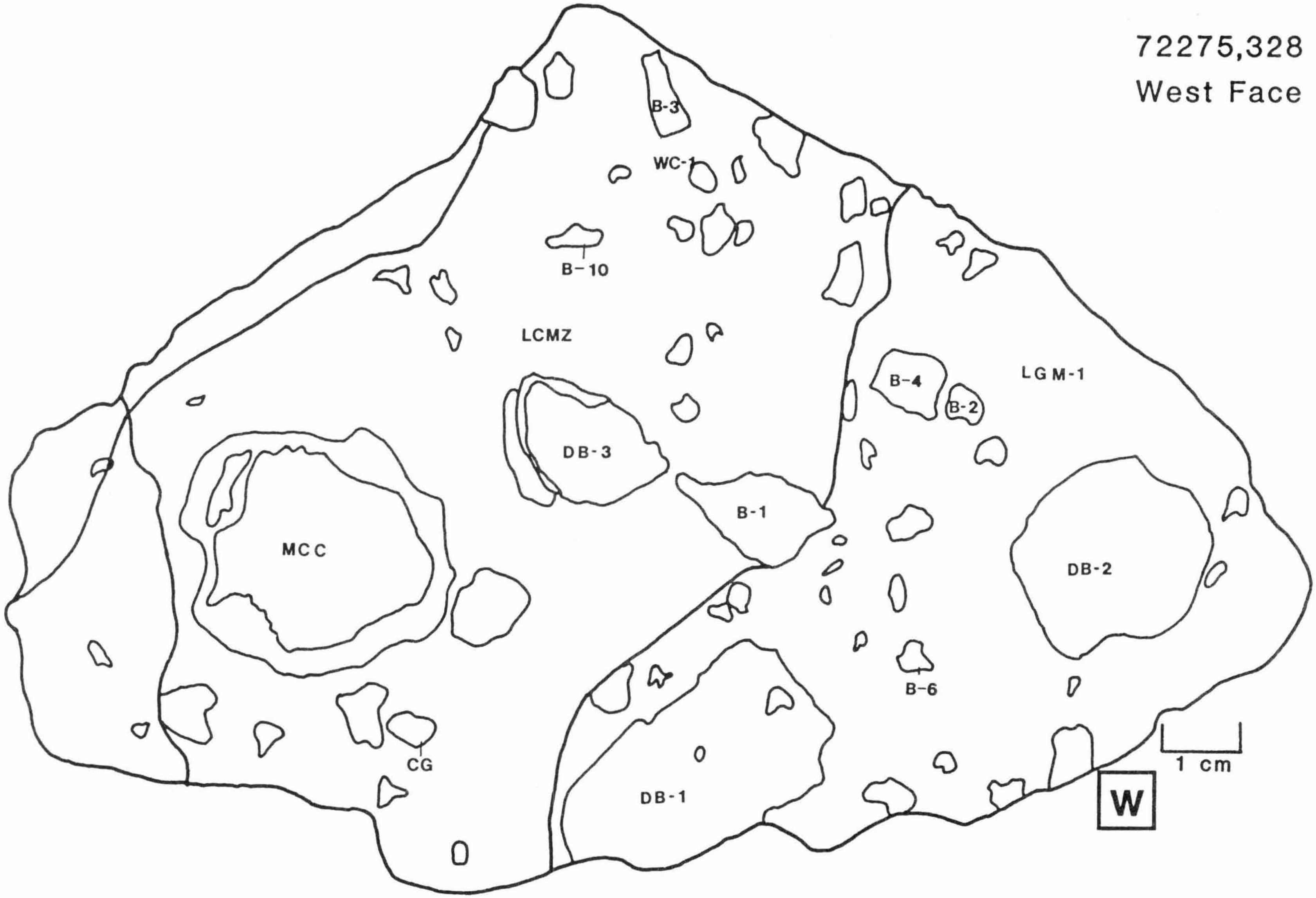
*Clast descriptions available upon request.



72275,328 WEST FACE

72275,337 EAST FACE

72275,328
West Face



B = Basalt
LCMZ = Large Clast Matrix Zone
WC = White Clast
CG = Cataclastic Gabbro
LGM = Light Gray Matrix
DB = Dark Breccia
MCC = Marble Cake Clast

APPENDIX 1

SLAB 72275,328
WEST FACE

SPECIFIC CLAST DESCRIPTIONS

B-1 (19 x 10 mm) Clast is fine-grained, subrounded, and white. The clast itself has an incoherent, crushed, granular appearance. Two coherent smaller pieces within the larger clast show cross-hatching with sugary white, granular plagioclase embedded in it. B-1 also contains a yellow mineral (pyroxene?).

B-2 (6 x 6 mm) Clast is subangular and fine-grained. Needles of a fine-grained sugary white plagioclase criss-cross throughout the sample. These plagioclase needles are less than 0.5 mm in width. On the south side of the clast the plagioclase occurs in larger concentrations that are not needle like. Occurring throughout the basalt are rounded masses (less than 0.5 mm) of yellow pyroxene? grains. These pyroxene? grains are not as fine-grained as the surrounding plagioclase and dark gray inclusions. Excavated.

B-3 (10 x 5 mm) Clast is angular and fine-grained. The lower southern edge of the clast shows the same criss-cross needles that other basalts on the west face show. The southern edge of the clast has a very thin line of gray/black material marking the edge. Yellow pyroxene? can be seen throughout the clast. However, the criss-cross needle zone has the highest concentration of pyroxene?. Sugary white, fine-grained plagioclase constitutes the majority of the clast with the gray/black material being the second most abundant. Excavated.

CG (6 x 4 mm) So named by Marvin and Agrell. Most of the clast was removed during previous processing. Clast is subangular and fine-grained. Center of clast is composed of fine-grained gray/black material. Surrounding gray/black material is a ring of sugary white plagioclase. A portion of the clast still exists on the southern edge of the previous saw cut. At Top, is a thin (less than 1 mm) line of gray/black material. The rest of the clast is composed of a tan, fine-grained mineral. In the center of the remaining clast is a fine-grained sugary white plagioclase clast (about 2 mm in diameter). Two more plagioclase clasts (less than 1 mm) appear on Top edge of the tan mineral clast and below the gray/black line. The two top plagioclase clasts have a more melted appearance than the other larger fine-grained plagioclase clast. All three clasts are rounded.

APPENDIX 1

DB-1 (30 x 20 mm) Clast is angular, fine-grained, and gray in color. Clast consists of mostly dark gray material. One-third of clast on north side is a lighter gray. This area also contains more plagioclase than the darker area. DB-1 contains four large subrounded plagioclase? clasts that range in diameter from 5 to 1 mm. There are also several small rounded plagioclase clasts that have a sugary white, granular texture. Within these plagioclase clasts are larger white to clear grains. Only two of the larger plagioclase clasts were observed to have minor amounts of pyroxene? grains. Also visible are two narrow strings of plagioclase which occur within the DB clast. These narrow strings appear similar to the white plagioclase clasts. The largest plagioclase string goes into and exits from the largest plagioclase clast. The second plagioclase string is narrower and is on the north side of DB-1. This narrow string also intersects a clast. However, the point where clast and plagioclase string intersect is not as definite as with the larger plagioclase string. The plagioclase string looks similar to the clast it intersects with one exception. The plagioclase clast contains pyroxene? while the plagioclase string has no pyroxene? visible. Again, the narrow plagioclase string contains sugary white fine-grained plagioclase. Along the southern edge of DB-1 is a section of plagioclase that runs parallel to the edge of the clast. DB-1 consists of sugary white, fine-grained plagioclase with large clear to white grains.

DB-2 (25 x 25 mm) Clast consists of a dark gray core that has a section swirling into a lighter gray area that contains fragments of the dark gray core. These fragments are angular to subangular. The lighter area that contains the dark fragments is fine-grained and is grayer in appearance than the surrounding matrix. This light gray area also contains more sugary white fine-grained plagioclase than the matrix. Included within the plagioclase is less than five percent pyroxene?. Within DB-2 is a gray/black core (6 x 8 mm) surrounded by dark gray material. Both areas are fine-grained. The gray/black core reflects more light than the dark gray area of the clast. Both gray and gray/black areas of clast include numerous white, granular inclusions less than 1 mm in diameter. Included in the dark area of the clast are several small (less than 1 mm) inclusions of plagioclase and narrow strings of plagioclase. These are also fine-grained.

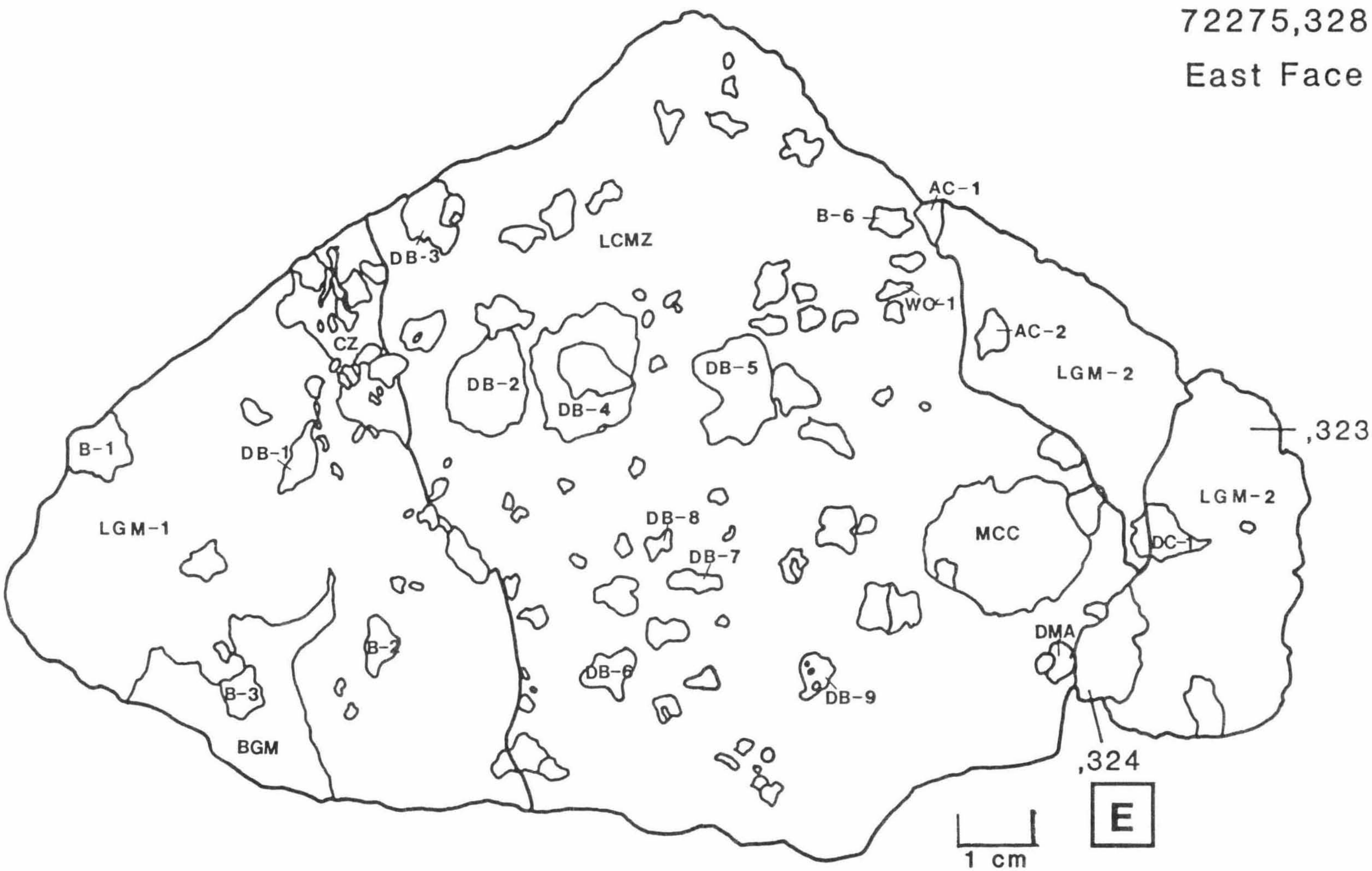
DB-3 (16 x 19 mm) Clast is fine-grained and subrounded. The clast is similar to other breccias of the west face in that it is dark gray with white plagioclase narrow strings running through it. One plagioclase string on the north side of the clast is 2 mm in width and about 18 mm in length. The plagioclase string also contains large clear to white grains. The north side of the clast also contains a crushed breccia zone similar to DB-2, although not as extensive. These clasts are less than or equal to 1 mm in diameter, dark gray, and angular to subangular. The top portion of the clast also contains a plagioclase string similar in appearance to the one on the north side. There is little or no pyroxene? visible in the plagioclase strings. The center of DB-3 is gray with plagioclase and dark gray inclusions. These inclusions are generally less than 1 mm. Both light and dark inclusions are angular to subangular and fine-grained. Plagioclase strings less than or equal to 0.5 mm in width extend throughout the dark gray breccia. The appearance of the plagioclase string is the same as the other plagioclase strings.

LCMZ — For description see ,337 W face.

LGM-1 — Area has a high concentration of basalts. Plagioclase and pyroxene? are also more abundant in this matrix than in the LCMZ. LGM-1 contains two large dark gray/black clasts (DB-1 and DB-2). However, most dark clasts in this region are less than 2 mm in diameter. LGM-1 is more fine-grained than the matrix in the rest of ,328. LGM-1 contains an abundance of crushed basalts.

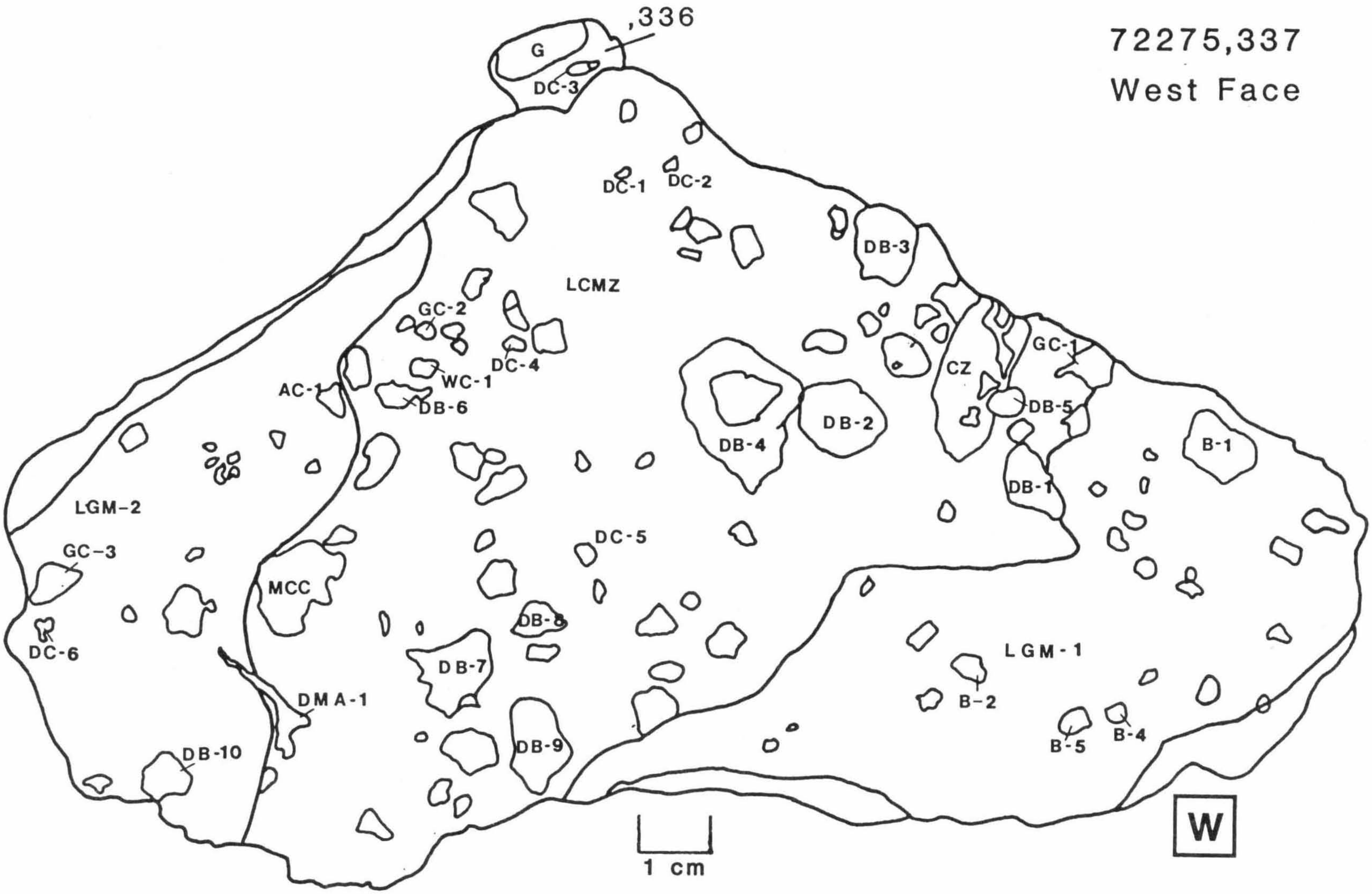
MCC — (30 x 30 mm) Clast is rounded. Colors are dark gray/black, gray, and white. The north side of the MCC is now the edge of the slab ,328. The clast consists of a dark rim with spirals of a white plagioclase. The plagioclase is sugary white, has a granular texture with large clear to white grains embedded in it. Widely dispersed throughout the plagioclase are pyroxene? grains (less than 5%). The dark rim is fine-grained. Within the dark rim are several inclusions of plagioclase. These inclusions are generally less than 1 mm in diameter. Partially excavated.

WC-1 — (4 x 4 mm) Clast is angular and fine-grained. WC consists of white sugary, fine-grained plagioclase, dark gray/black material, and grains of a reddish-brown mineral (spinel?). Two-thirds of the clast is white plagioclase. One-third is dark gray/black material. The reddish-brown spinel? occurs in the plagioclase concentrations and in the gray/black area. The upper northern edge of the clast has a concentration of plagioclase. Within the plagioclase several grains of the reddish-brown spinel? can be seen. In the upper portion of this plagioclase concentration are pale tan grains (maskelynite?) with a grain of a reddish-brown spinel? in it. On the lower middle to southern half of the clast is the largest concentration of plagioclase. The top portion of this concentration of plagioclase has an area about 1 mm in diameter that is pale tan (maskelynite?). Within the pale tan area are several grains of the reddish-brown spinel?. The reddish-brown mineral is more concentrated in the pale tan zone than in the whiter plagioclase areas. This clast shows the highest concentration of spinel? in 72275,328. Excavated.



AC =	Anorthosite Clast	B =	Basalt	BGM =	Blue Gray Matrix
CZ =	Crushed Zone	DB =	Dark Breccia	DC =	Dark Clast
DMA =	Dark Matrix Area	LCMZ =	Large Clast Matrix Zone	LGM =	Light Gray Matrix
MCC =	Marble Cake Clast	WC =	White Clast		

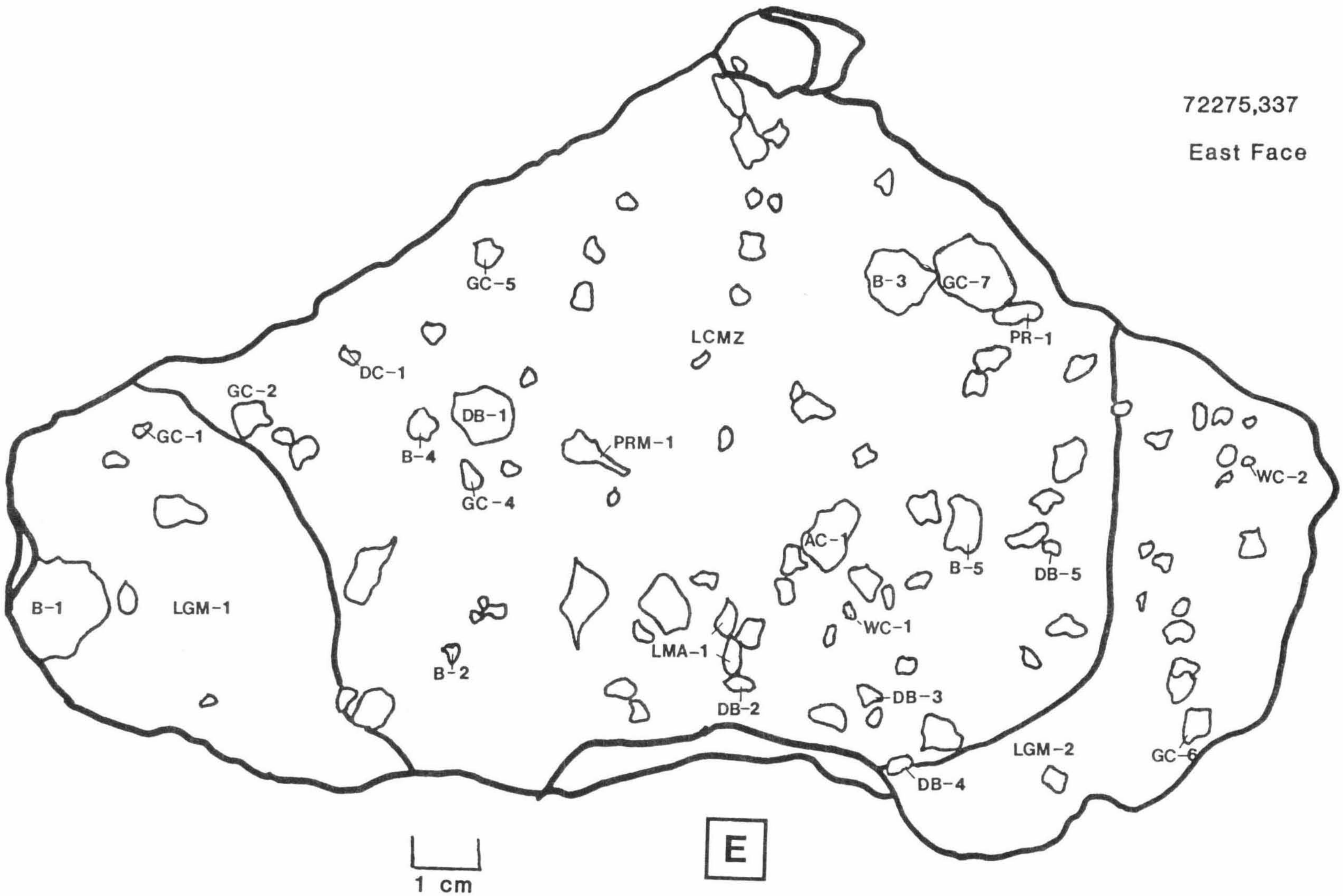
72275,337
West Face



AC	=	Anorthosite Clast	B	=	Basalt	CZ	=	Crushed Zone
DB	=	Dark Breccia	DC	=	Dark Clast	DMA	=	Dark Matrix Breccia
G	=	Gabbro	GC	=	Gray Clast	LCMZ	=	Large Clast Matrix Zone
LGM	=	Light Gray Matrix	MCC	=	Marble Cake Clast	WC	=	White Clast

72275,337

East Face



AC	= Anorthosite Clast	B	= Basalt	DB	= Dark Breccia		
DC	= Dark Clast	GC	= Gray Clast	LCMZ	= Large Clast Matrix Zone		
LGM	= Light Gray Matrix	LMA	= Light Matrix Area	PRM	= Plagioclase Rich Matrix		
				WC	= White Clast		

APPENDIX 1

SLAB 72275,337
EAST FACE

SPECIFIC CLAST DESCRIPTIONS

AC-1 (7 x 9 mm) Clast is fine-grained, angular, and chalky white. Small black grains (ilmenite?) can be seen along the edges. Partially excavated.

B-1 (14 x 12 mm) Clast is rounded, fine-grained, and gray. B-1 differs from previous basalt clasts in the LGM in that there is a greater amount of dark gray/black material in the clast. Sugary white, fine-grained, plagioclase is the main component of B-1. Within the plagioclase are small black grains (ilmenite?) and yellow pyroxene? grains. Partially excavated.

B-2 (3 x 3 mm) Clast is subangular, fine-grained, and grayish-white. B-2 consists of a dark gray/black, fine-grained material. Also present is sugary white, fine-grained plagioclase. Within the plagioclase are small black grains (ilmenite?). The plagioclase contains concentrations of fine-grained, yellow pyroxene? grains. on bottom south edge of b-2 is an angular, black clast (glass?) that is very reflective.

B-3 (10 x 8 mm) Clast is subrounded, fine-grained, and gray/white. Sugary white, fine-grained plagioclase and gray material constitute the majority of B-3. Embedded within the plagioclase are small black ilmenite? grains and pale yellow pyroxene? grains. Cross hatching filled with plagioclase is not as clear as in basalts in other 72275 slabs but is still evident in B-3. Partially excavated.

B-4 (4 x 3 mm) Clast is gray, fine-grained, and subangular. B-4 consists of sugary white, fine-gained, plagioclase. Embedded within the plagioclase are yellow grains of (pyroxene?). B-4 has a higher concentration of plagioclase and pyroxene? than most clasts. Plagioclase and dark gray material seem to be equal in abundance. Pyroxene? is the other mineral present.

DB-1 (10 x 9 mm) Clast is gray/white, fine-grained, and subrounded. DB-1 resembles a miniture Marble Cake Clast. White bands of sugary white, fine-grained plagioclase with black ilmenite? grains swirl within the clast. DB-1 has a dark gray rim with a white interior. With the white plagioclase interior are sub-rounded, fine-grained inclusions which resemble the dark gray rim. These inclusions are about 1 mm in diameter. Partially excavated.

DB-2 (2 x 2 mm) Clast is subrounded, fine-grained, and dark gary/black. In the center of DB-2 is a concentration of light gray matrix. Visible within the light gray matrix is a large concentration of tan (maskelynite?) grains with one orange/red grain visible (spinel?). A concentration of sugary white, fine-grained plagioclase is visible at Bottom North edge.

DB-3 (4 x 3.5 mm) Clast is dark gray/black, subrounded, and fine-grained. Along the North and South sides of DB-3 are narrow strings of sugary white, fine-grained plagioclase. Plagioclase and dark gray/black material are the only two materials visible in DB-3.

DB-4 (4 x 3 mm) Clast is dark gray, subrounded, and fine-grained. On Top and South sides of clast are concentrations of fine-grained, sugary white plagioclase. Also on the South side is a rounded concentration of deep red/black grains (spinel??).

DB-5 (2 x 5 mm) Clast is subangular, fine-grained, and dark gray. Sugary white, fine-grained plagioclase with black ilmenite? grains and gray material appear to be the most abundant. In the major crack at Top part of DB-5 numerous yellow pyroxene? grains can be seen. Yellow pyroxene? grains can also be seen lining the edges of DB-5.

DC-1 (2 x 2 mm) Clast is subangular, fine-grained, and dark gray/black. Sugary white, fine-grained, plagioclase coats the Bottom edge of DC-1. Within the plagioclase are small black ilmenite? grains. On the North Bottom edge of DC-1 is a concentration of yellow pyroxene? grains.

GC-1 (3 x 3 mm) Clast is subrounded, fine-grained, and gray. GC-1 looks similar to basalts in LGM-1. However, GC-1 appears to contain a greater amount of dark gray/black material than other basalts in LGM-1. Criss-cross hatching appears throughout the clast with sugary white, fine-grained plagioclase (filling in the hatching). In the center of GC-1 is a high concentration of sugary white, fine-grained plagioclase. In the center of the plagioclase is a concentration of yellow pyroxene? grains. On the Bottom edge of GC-1 is another concentration of yellow pyroxene? grains. The grains in this pyroxene? concentration are larger and easier to see than the pyroxene? grains in the center of the clast. Materials present in decreasing order of abundance are dark gray/black material, plagioclase, and (pyroxene?).

GC-2 (5 x 5 mm) Clast is subangular, fine-grained, and gray. GC-2 has a basaltic texture similar to GC-1. Both GC's appear similar to basalts in ,328 except that there is a greater amount of dark gray/black material present. The upper northern edge of GC-2 contains a concentration of almost pure, sugary white, fine-grained plagioclase. Within the plagioclase are small black grains (ilmenite?). Pyroxene? is also present in concentrations on the South and North side of the clast.

APPENDIX 1

GC-4 (3 x 4 mm) Clast is light gray, fine-grained, and subangular. GC-4 differs from other GC's in that it does not appear basaltic. Coating the southern edge from Top to Bottom is a thin line of sugary white, fine-grained, plagioclase. Within the plagioclase are small black grains (ilmenite?). The rest of GC-4 is milky-white, fine-grained, with a few dark inclusions (diameters less than 0.5 mm). Excavated.

GC-5 (4 x 4 mm) Clast is gray, subrounded, and fine-grained. Sugary white, fine-grained plagioclase constitutes the majority of the clast. A gray material, also fine-grained, is the second most abundant material. Along the edges of the clast pale yellow pyroxene? grains can be seen.

GC-6 (5 x 4 mm) Clast is light gray, fine-grained, and subrounded. Sugary white, fine-grained plagioclase constitutes the majority of the clast. GC-6 appears to be basaltic. Pale yellow pyroxene? can be seen embedded within the plagioclase. On the southern edge of GC-6 black crystals are visible that are very reflective (ilmenite?).

GC-7 (10 x 7 mm) Clast is subangular, fine-grained, and gray. Sugary white, fine-grained plagioclase and gray material are the two most abundant components of GC-7. On the Bottom South side of GC-7 is a sugary white plagioclase inclusion (about 0.5 mm in diameter). Within the center of this inclusion pale yellow (pyroxene?) grains can be seen.

LCMZ (about 100 x 90 mm) The size of the large clasts in LCMZ has decreased in size from ,328 East and West face and ,337 West face. The Crushed Zone in ,328 East face and ,337 West face does not exist in ,337 East face. There is also no eroded area marking the boundary of ,337 East face as there was in ,328 East and West face and ,337 West face. LCMZ still contains a greater number of clasts than LGM-1 or LGM-2. White clast diameters also appear to be decreasing. The number of basalt clasts and crushed basalts has increased. The crushed basalts are more concentrated in the Top portion of the LCMZ. The basalt clasts appear to contain a greater amount of dark gray/black material than basalts in ,328 East and West face.

LGM-1 (35 x 53 mm) Is part of LGM-1 on ,328 East and West face and ,337 West face. LGM-1 is fine-grained, and light gray. Basalt clasts and crushed basalts are also present in LGM-1. However, the basalt clasts seem to contain a greater amount of dark gray/black material than basalts in lgm-1 in ,328 east and west face and ,337 west face. the number of basalt clasts seems to have decreased from previous lgm-1's. plagioclase and yellow pyroxene? grains are present throughtout the matrix. also present are a few grains of a reddish-orange mineral (spinel?).

APPENDIX 1

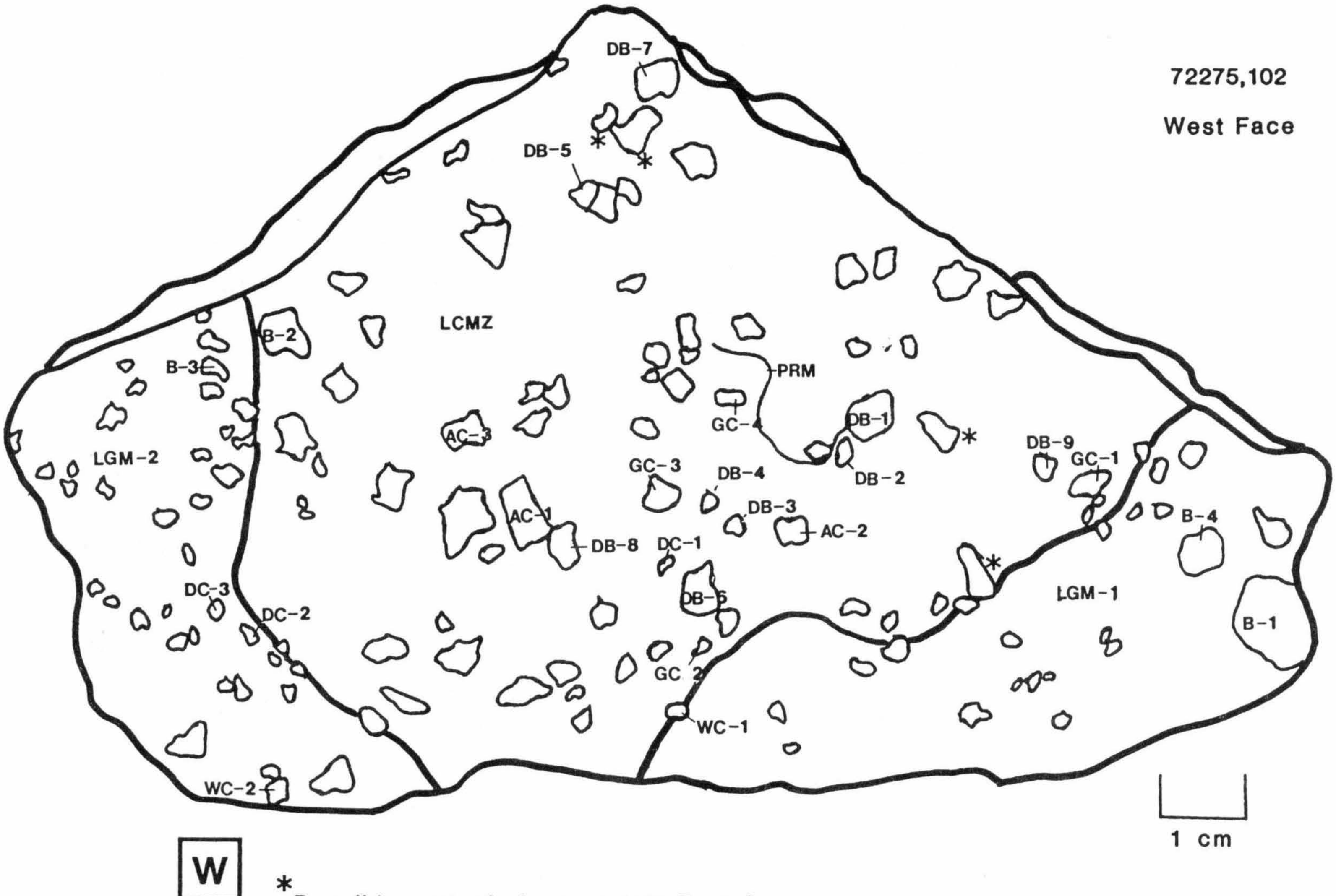
LGM-2 (about 20 x 60 mm) Number of clasts has increased in LGM-2 ,337 East face when compared to ,328 East and West face and ,338 West face. Also present are basalt clasts. Matrix is fine-grained.

LMA-1 (5 x 10 mm) Appears whiter than surrounding matrix due to a higher concentration of plagioclase. At Top of LMA-1 is a rounded inclusion of sugary white, fine-grained, plagioclase with small black grains (ilmenite?) embedded in it. LMA-1 contains numerous yellow grains of (pyroxene?). Also in Top and Bottom of LMA-1 are a few grains of red to reddish/orange grains (spinel?).

PRM-1 PRM consists of a bent narrow string containing sugary white, fine-grained plagioclase with black grains (ilmenite?), small yellow pyroxene? grains and a few small reddish/orange grains (spinel?). Dimensions are 8 x 1 mm. The narrow string is attached to a subangular area where the matrix and plagioclase are mixed. Both sugary white plagioclase and matrix are fine-grained. Embedded within the matrix and plagioclase are small black ilmenite grains and larger black inclusions.

WC-1 (2 x 2.5 mm) Clast is subrounded, fine-grained, and contains sugary white plagioclase with small black grains (ilmenite?) embedded within it. On the North side of WC-1 are two concentrations of yellow pyroxene? grains.

WC-2 (1 x 1 mm) Clast is subrounded, sugary white, and fine-grained. Yellow pyroxene? grains are visible along the edges of the clast and in a concentration on the Bottom North side. Also along the Bottom North side is a concentration of gray/black material.



*Possibly part of clast on ,337 East face

AC	=	Anorthosite Clast	B	=	Basalt	DB	=	Dark Breccia
DC	=	Dark Clast	GC	=	Gray Clast	LCMZ	=	Large Clast Matrix Zone
LGM	=	Light Gray Matrix	PRM	=	Plagioclase Rich Matrix	WC	=	White Clast

APPENDIX 2

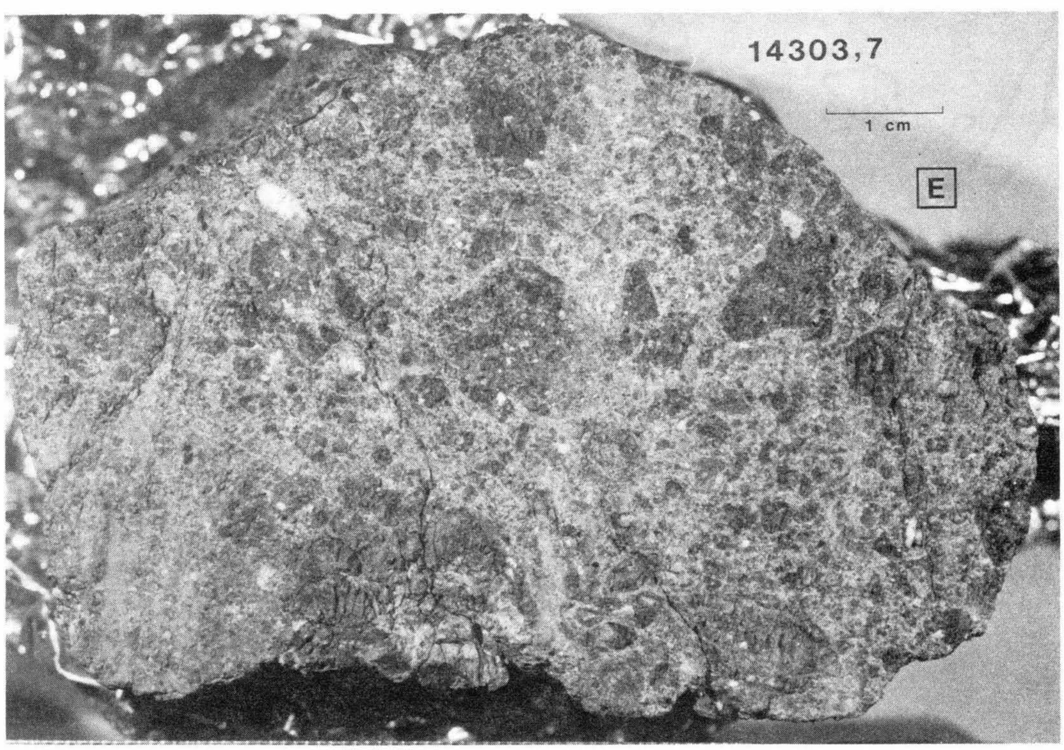
NEW FACES OF 14303 AVAILABLE FOR STUDY
by Linda DeCorte Watts, Northrop Services, Inc.

14303 is part of a football-sized rock collected 80m NNW of the LM during Apollo 14 EVA 1. The rock broke into two pieces before it was first examined at the LRL. The other part of the rock, 14304, is under study by a consortium headed by K. Keil.

14303 was originally 16 x 9 x 7 cm and weighed 898.4 g. The rock is a coherent, gray, blocky to subrounded breccia. The crystalline matrix is shocked and strongly annealed. The rock is fractured, but the clasts are firmly imbedded in the matrix.

PETROGRAPHIC DESCRIPTION AND INFORMATION FROM LITERATURE: This polymict breccia has a holocrystalline matrix which is approximately 40% white, turbid plagioclase. The average grain size of the matrix is 0.2 mm. This rock contains lithic (basalt, breccia, devitrified glass, shocked rock) and mineral (plagioclase, clinopyroxene, orthopyroxene, olivine) clasts. 14303 has a complex thermal history as shown by its melt inclusions. Warren and Wasson described a "very probably" pristine anorthositic troctoline clast from 14303,7.

NEW FACES FROM 14303,7 (470 g): This is the LRL West end of the rock. The new cut was made parallel to the previous saw cut which is normal to the South and Top faces (LRL orientation). The new slab is approximately 1.5 cm thick and broke into three pieces. The pieces are ,221 (107.28 g) ,222 (13.33 g) and ,223 (1.53 g). 14303,7 now weighs 327.50 g. Preliminary examination suggests that most of the clasts exposed on the two new faces were not exposed on the previous sawed face.



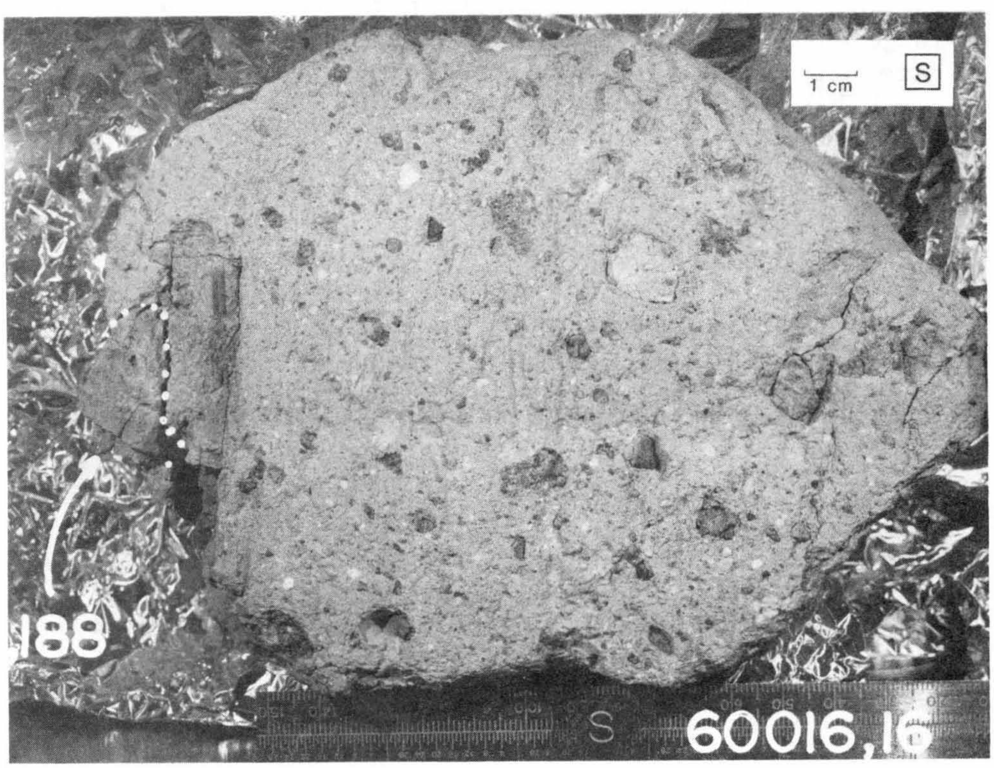
APPENDIX 2

CUTTING OF FRAGMENTAL POLYMICT BRECCIA 60016,16
by Rene Martinez, Northrop Services, Inc.

60016 is a subrounded, friable polymict breccia collected near the Apollo 16 lunar module. The matrix is medium-grey, porous crushed mineral and lithic fragments with a grain size of up to 2 mm. It resembles a loosely indurated soil containing abundant dark glass spherules, some oxidized metallic grains and rare agglutinates.

THIN SECTION OBSERVATIONS: Lithic clasts include cataclastic and recrystallized anorthosite, coarse and fine-grained poikilitic impact melt, granoblastic material, noritic anorthosite, dark matrix and vitric matrix breccias and clast-bearing basaltic impact melt.

RESULTS OF SLABBING: The weight of ,16 before slabbing was 3088.777 g. Two slabs were cut parallel to the S plane of ,16. The photo shows the newly exposed face of ,16. Clasts are mineral and rock fragments from 2 mm to >60 mm loosely set, with sharp clast/matrix boundaries and small oxidized metallic grains and glass shards. What appears to be a large single mineral (pyroxene) grain is shown in the lower right of the photo. One large clast approximately 6 x 3 x 3 mm has almost entirely separated from ,16. This clast has a fine grained, light grey poikilitic texture. Small vugs in this clast exhibit a druzy lining and one contains small metallic crystals resembling troilite crystals lining vugs in some of the Apollo 17 rocks such as 76015. There are also large coarse grained anorthositic clasts up to 10 mm in diameter such as the one visible in the photograph. Other interesting clasts that were "plucked" from the rock in sawing have been sieved out of the bandsaw sweepings and will also be categorized and described.



APPENDIX 2

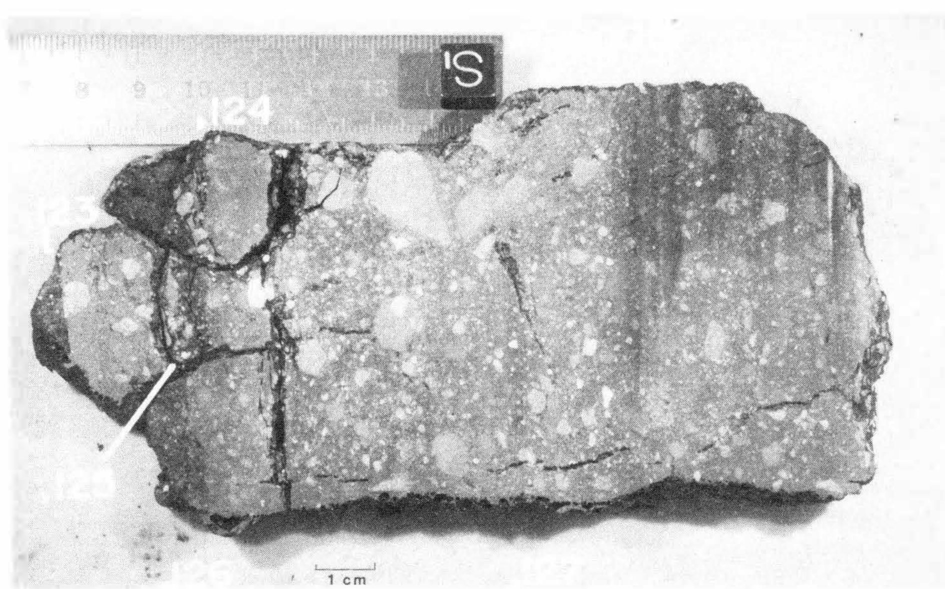
CUTTING OF REGOLITH BRECCIA 60019,4
by Charles Galindo, Northrop Services, Inc.

Rock 60019 is a medium-grey glassy breccia which the Lunar Sample Preliminary Examination Team classified as a Type 1 polymict breccia (light color and cataclastic, nearly glass-free matrix). It was found partially buried approximately 115 m west southwest of the Lunar Module with a poorly developed fillet and few zap pits. 60019 originally weighed 1887 grams.

60019 is a clast-rich regolith breccia consisting of a dark apanitic matrix containing glass-lined cracks and glassy veins. Some rusty patches have been observed in both the matrix and the clasts. Clasts vary from fine-grained, crystalline lithic fragments to glass and mineral fragments. In thin section the matrix is brown, glassy, partly vesicular containing some glass fragments. The large clasts seem to be mostly poikilitic with abundant fragments, and in some areas the poikilitic texture grades into a basaltic type texture.

The largest remaining piece (60019,4), weighing 1171 g, was the south end (lunar orientation) of the rock with a saw cut north face. Two cuts parallel to the north face produced two new slabs approximately 1.5 cm thick. The cuts have exposed many new clasts ranging from 0.5 to 1.0 cm in size with 0.1 to 0.2 cm plagioclase phenocrysts, ilmenite stringers, and a conspicuously abundant amount of red spinel(?) grains. Small dark aphanitic clasts examined show metallic blebs, sometimes rust colored, and traces of minute inclusions, honey to black in color, exhibiting conchoidal fracturing.

This sample and the Allan Hills 81005 (lunar) meteorite have similar textures. Both rocks have a dark brown to black, glassy matrix with abundant large white (anorthositic ?) clasts. The fine-grained crystalline lithic fragments noted in 60019 are closely related to the gabbroic, diabasic, and basaltic textures described in the Allan Hills's (lunar) meteorite by Mason.



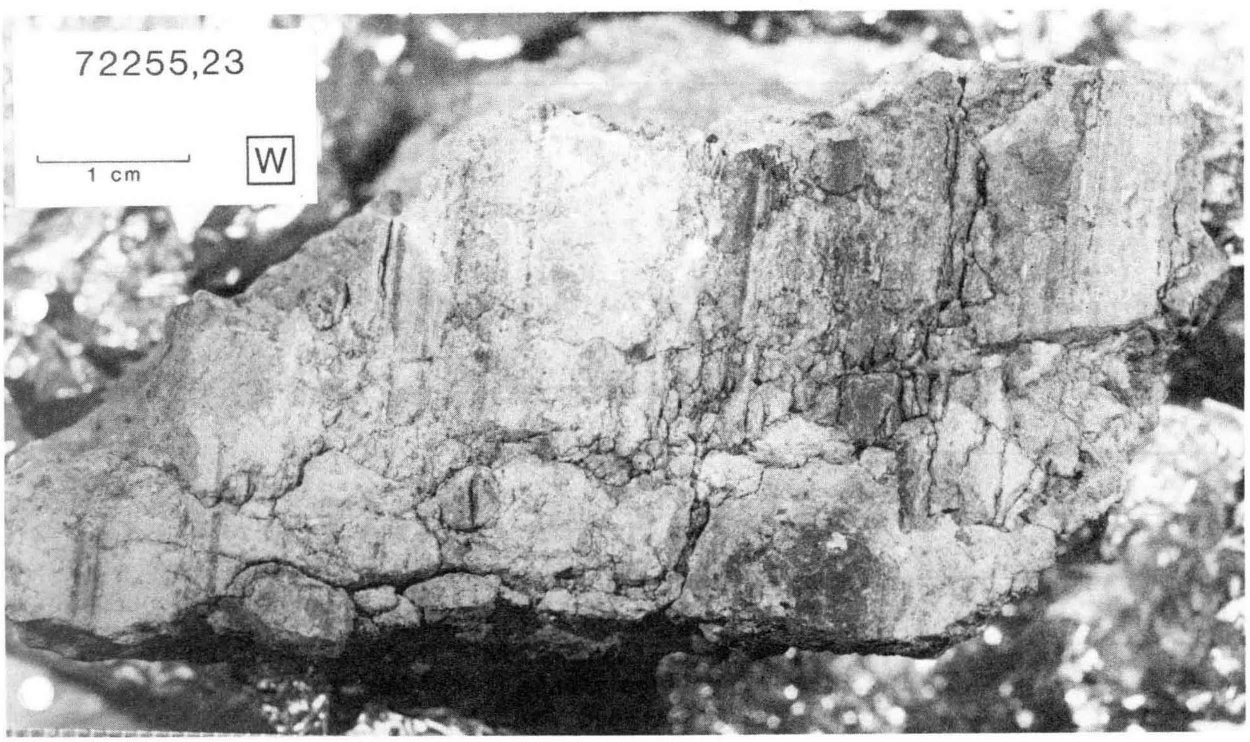
APPENDIX 2

PRELIMINARY EXAMINATION OF NEW FACES OF 72255
by Andrea B. Mosie, Northrop Services, Inc.

72255 is a light gray, moderately coherent, but fractured, breccia broken from a Station 2 Boulder. This specimen resembles 72275 (from the same boulder) in texture and some clast types. This specimen is called the sister rock of 72275. The original specimen was approximately 2.5x9x10.5 cm and weighed 461.20 g.

Previous binocular examination describes rock 72255 as heterogeneous with a few zap pits on the B and S surfaces. These pits average about 1.5 mm in diameter and a large, well-formed pit is 3 mm. The clasts consist of fine-grained lithic debris and mineral grains, a few plagioclase grains, mafic silicates and metal or troilite grains. Some of the clasts are fragmental rocks, and are relatively friable.

A newly cut slab of 72255 is presently being mapped. This 1.5 cm slab broke into five pieces during sawing. Few mafic silicates or metal grains were observed during examination of this new slab. Some dark clasts in 72255 contain anorthite grains. A large amount of crushed, powdery white material is exposed on the "N/T" face of ,226 (41.014 g) after the breaking off of ,223 (9.779 g) during sawing. Although these rocks were collected from the same boulder, the new faces of 72255 are different from the new 72275 slabs in two ways: 1) no clasts of crushed basalt were observed, and 2) more very dark gray, sugary textured clasts (microbreccias?) are present.



WHAT'S A PPM?

Definitions of ppm such as "the abbreviation for parts per million, a convenient means of expressing very low concentractions of a substance in a mixture or of a contaminant in a pure product" are accurate but difficult to relate to life outside the laboratory. The equivalents to "1 ppm" are defined below in various measures for comparison purposes.

A minute in 1.9 years

A cent in 10,000 dollars

An inch in 16 miles

An ounce of salt in 62,500 pounds of sugar

An ounce of dye in 7,812 gallons of water

An ounce of sand in 31 tons of concrete

Or, for those involved in lunar sample analysis:

0.38 gram of lunar sample from the Apollo collection.

PRINT REQUEST FORM

Lunar Sample Curator
Mail Code SN2
NASA Johnson Space Center
Houston, TX 77058

Yes, I am interested in the study of clasts in lunar breccias. Please send color prints of new surfaces on the following samples:

___14303 ___60016 ___60019 ___72255 ___72275

________________________________ name

________________________________ address

________________________________ including

________________________________ zip code

PLEASE PRINT
