

MSC 03211

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

# LUNAR SAMPLE INFORMATION CATALOG

## APOLLO 17

### LUNAR RECEIVING LABORATORY

LYNDON B. JOHNSON SPACE CENTER  
HOUSTON, TEXAS

APRIL 1973

DOCUMENT APPROVAL SHEET

APOLLO 17 SAMPLE INFORMATION CATALOG

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## CONTENTS

<u>Section</u>	<u>Page</u>
INTRODUCTION . . . . .	1
ACKNOWLEDGEMENTS . . . . .	2
NUMBERING OF APOLLO 17 SAMPLES . . . . .	4
SAMPLE LOCATIONS . . . . .	28
SAMPLE RETURN ENVIRONMENTS AND CONTAINERS. . . . .	37
SAMPLE PROCESSING. . . . .	45
PROCESSING ENVIRONMENT. . . . .	48
CHEMICAL ANALYSIS. . . . .	49
EVOLVED GAS STUDIES. . . . .	51
TOTAL CARBON ANALYSIS. . . . .	56
CORES . . . . .	57
SOIL SAMPLES . . . . .	67
ROCK DESCRIPTIONS . . . . .	105

## FIGURES

<u>Figure</u>		<u>Page</u>
1	Map of EVA Traverses and Sample Collection Stations . . .	29
2a	Planimetric Map of the LM-ALSEP-SEP . . . . .	30
2b	Planimetric Map of Station 1 . . . . .	30
2c	Planimetric Map of Station 2 . . . . .	31
2d	Planimetric Map of Station 3 . . . . .	31
2e	Planimetric Map of Station 4 . . . . .	32
2f	Planimetric Map of Station 5 . . . . .	32
2g	Planimetric Map of Station 6 . . . . .	33
2h	Planimetric Map of Station 7 . . . . .	33
2i	Planimetric Map of Station 8 . . . . .	34
2j	Planimetric Map of Station 9 . . . . .	35
3a	Gas Release Profile and Weight Loss Curve, 74220,5 . . .	52
3b	Gas Release Profile and Weight Loss Curve, 74240,5 . . .	52
3c	Gas Release Profile and Weight Loss Curve, 74260,4 . . .	53
4a	Interpretative Drawings and Descriptions of X-radiographs of Core Samples: Drill Core, Lower Part. . . . .	63
4b	Interpretative Drawings and Descriptions of X-radiographs of Core Samples: Drill Core, Upper Part. . . . .	64
4c	Interpretative Drawings and Descriptions of X-radiographs of Core Samples: One Double and Two Single Drive Tube Cores . . . . .	65
4d	Interpretative Drawings and Descriptions of X-radiographs of Core Samples: One Double and One Single Drive Tube Core . . . . .	66

## TABLES

<u>Table</u>		<u>Page</u>
I	Apollo 17 Sample Inventory . . . . .	6
II	List of Rocks >50 g and Boulder Samples. . . . .	24
III	Contents of Sample Collection and Return Containers. . .	40
IVa	Chemical Analysis of Soils . . . . .	50
IVb	Chemical Analysis of Rocks . . . . .	50
Va	Gamma Ray Analysis of Soils. . . . .	54
Vb	Gamma Ray Analysis of Rocks. . . . .	55
VI	Total Carbon Analysis. . . . .	56
VII	Data on Drill Stem Samples . . . . .	61
VIII	Data on Drive Tube Samples . . . . .	62
IX	Grain Size Parameters of Some Apollo 17 Soils. . . . .	70
Xa	Compositions of Soils in Percent of Grains. . . . .	71
Xb	Compositions of Soils in Percent of Grains . . . . .	72
XI	Some Terms Used for Rock Descriptions. . . . .	106
XII	Abbreviations Used in Thin Section Descriptions. . . . .	108

## INTRODUCTION

This document contains data developed on the Apollo 17 samples in the Lunar Receiving Laboratory during the preliminary examination period, December 21, 1972, to April 6, 1973.

The data consists of a complete inventory, binocular descriptions of the rocks, and photographs of most of the rocks. For representative rocks and fines samples, thin section descriptions and chemical analyses are included.

Further information on the samples including field relations, lunar surface photography, along with summaries and interpretations is contained in the United States Geological Survey's Interagency Reports (69, 71, and 72) to NASA and in the NASA Apollo 17 Preliminary Science Report (in preparation).

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ASU - Arizona State University  
 BELLCOM - Bell Communications  
 BNW - Battelle Pacific Northwestern Laboratory  
 LEC - Lockheed Electronics  
 JSC - Johnson Space Center  
 NSI - Northrop Services, Incorporated  
 ORNL - Oakridge National Laboratory  
 USGS - U.S. Geological Survey  
 SAO - Smithsonian Astrophysical Observatory  
 SUNY - State University of New York  
 KH - Kentron-Hawaii  
 CUCE - Cambridge University, Cambridge, England

## NUMBERING OF APOLLO 17 SAMPLES

As in previous missions, five digit sample numbers are assigned each rock (coherent material greater than about 1 cm), the unsieved portion and each sieve fraction of scooped <1 cm material, the drill bit and each drill stem and drive tube section and each sample of special characteristics.

The first digit (7) is the mission designation for Apollo 17 (missions prior to Apollo 16 used the first two digits). As with Apollo 15 and 16 numbers, the Apollo 17 numbers are grouped by sampling site. Each group of one thousand numbers applies to an area as follows:

<u>Sampling Site</u>	<u>Initial Number</u>
LM, ALSEP, SEP, and samples collected between Station 5 and the LM	70000
Station 1A	71000
Station 2 and between it and the LM	72000
Station 3 and between it and Station 2	73000
Station 4 and between it and Station 3	74000
Station 5 and between it and Station 4	75000
Station 6 and between it and the LM	76000
Station 7 and between it and Station 6	77000
Station 8 and between it and Station 7	78000
Station 9 and between it and Station 8	79000

The first numbers for each area were used for drill stems, drive tubes, and the SESC. Drill stem sections and double drive tubes are numbered from the lowermost section upward.

The last digit is used to code sample type, in conformity with the conventions used for Apollo 15 and Apollo 16. Fines from a given documented bag are ascribed numbers according to:

7WXY0	Unsieved material (usually <1 cm)
7WXY1	<1 mm
7WXY2	1-2 mm
7WXY3	2-4 mm
7WXY4	4-10 mm

Rocks from a documented bag are numbered 7WXY5 - 7WXY9, usually in order of decreasing size.

Sample number decades were reserved for the contents of each documented bag. In the cases where the number of samples overflowed a decade, the next available decade was used for the overflow. For example DB 455 contained soil, numbered 71040-71044, and 6 small rocks numbered 71045-71049 and 71075.

Paired soil and rake samples for each sampling area are assigned by centuries starting with 7W500. The soil sample documented bag has the first decade or decades of the century, in conformity with the last digit coding for rocks and fines (as explained above), and the rake sample documented bag uses the following decades. For example, 71500-71509, 71515 were used for the sieve fractions and six rocks from the soil sample in DB 459. Then for the companion rake sample in DB's 457 and 458, 71520 was used for the soil, which was not sieved, and the 38 >1 cm. rake fragments were numbered 71535-71539, 71545-71549, etc., to 71595-71597.

In as much as possible all samples returned loose in a sample collection bag or an ALSRC were numbered in a decade. In the cases in which rocks from several stations were put into a single collection bag however, the soil and rock fragments were assigned a decade number that conforms to the site for the largest or most friable rock. The other rocks in the same bag have numbers for their own site, generally in the second or third decade of the thousand numbers for that site.

TABLE I - APOLLO 17 SAMPLE INVENTORY

<u>SAMPLE* NUMBER</u>	<u>WEIGHT (g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u> <sup>1</sup>	<u>CONTAINERS OUTER/INNER</u> <sup>2</sup>
0001	29.78	Drill core bit	ALSEP	DSB
0002	207.8	Drill core stem	--do--	--do--
0003	237.8	----do----	--do--	--do--
0004	238.8	----do----	--do--	--do--
0005	240.7	----do----	--do--	--do--
0006	234.2	----do----	--do--	--do--
0007	179.4	----do----	--do--	--do--
0008	261.0	----do----	--do--	--do--
0009	143.3	Drill core stem (top)	--do--	--do--
0010	3.92	Fines outside stem	--do--	--do--
0011	440.7	SESC	LM	SCB 5/
0012	485.0	Drive tube (52)	--do--	BSLSS/
0017	2957.	Coarse basalt	--do--	--do--
0018	51.58	Dark matrix breccia	--do--	SRC 1/SCB 1
0019	159.9	Agglutinate	Between station 5 and LM	SRC 2/469
0030	33.92	SCB residue	EVA 1	SCB 2/
0035	5765.	Coarse basalt	SEP	--do--
0040	2.494	Fragments	All EVA's	Suit pocket
0050	573.4	BSLSS residue (unsieved)	EVA 3	BSLSS/
0051	1438.	BSLSS residue, <1 mm	--do--	--do--
0052	67.76	BSLSS residue, 1-2 mm	--do--	--do--
0053	86.93	BSLSS residue, 2-4 mm	--do--	--do--
0054	94.41	BSLSS residue, 4-10 mm	--do--	--do--
0060	0.24	Dust and sweepings	All EVA's	SCB 7/15E
0061	60.80	<1 mm fines	--do--	--do--
0062	2.12	1-2 mm fines	--do--	--do--
0063	1.24	2-4 mm fines	--do--	--do--
0064	0.86	4-10 mm fines	--do--	--do--
0070	0.11	Dust and sweepings	?	BSLSS/108
0075	5.64	Fine basalt	--do--	--do--
0130	12.18	DB residue	ALSEP	SCB 2/10E
0135	446.3	Coarse basalt	--do--	--do--
0136	10.65	--do--	--do--	--do--
0137	6.16	--do--	--do--	--do--
0138	3.66	--do--	--do--	--do--
0139	3.16	--do--	--do--	--do--
0145	3.07	--do--	--do--	--do--
0146	1.71	--do--	--do--	--do--
0147	1.35	--do--	--do--	--do--
0148	0.92	--do--	--do--	--do--
0149	0.95	--do--	--do--	--do--
0155	0.77	--do--	--do--	--do--
0156	0.63	--do--	--do--	--do--

TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
0157	0.57	Coarse basalt	ALSEP	SCB 2/10E
0160	106.1	Unsieved fines	--do--	SRC 1/SCB 1/474
0161	197.7	<1 mm fines	--do--	--do--
0162	5.14	1-2 mm fines	--do--	--do--
0163	3.43	2-4 mm fines	--do--	--do--
0164	1.66	4-10 mm fines	--do--	--do--
0165	2.143	Coarse basalt	--do--	--do--
0170	42.31	DB residue	--do--	SCB 5/55Y
0175	339.6	Dark matrix breccia	--do--	--do--
0180	93.25	Unsieved fines	ALSEP	SRC 1/SCB 1/475
0181	157.1	<1 mm fines	--do--	--do--
0182	4.63	1-2 mm fines	--do--	--do--
0183	3.12	2-4 mm fines	--do--	--do--
0184	1.68	4-10 mm fines	--do--	--do--
0185	466.6	Coarse basalt	--do--	--do--
0215	8110.	Fine basalt	SEP - LM	BSLSS
0250	62.04	DB residue	SEP	SCB 8/22E
0255	277.2	Fine basalt	--do--	--do--
0270	70.46	Unsieved fines	--do--	SCB 8/23E
0271	116.1	<1 mm fines	--do--	--do--
0272	2.97	1-2 mm fines	--do--	--do--
0273	1.46	2-4 mm fines	--do--	--do--
0274	2.33	4-10 mm fines	--do--	--do--
0275	171.40	Medium basalt	--do--	--do--
0290	56.36	DB residue	--do--	SCB 7/45Y
0295	361.2	Dark matrix breccia	--do--	--do--
0310	6.82	DB residue	LRV 12	SCB 5/54Y
0311	106.5	<1 mm fines	--do--	--do--
0312	4.20	1-2 mm fines	--do--	--do--
0313	3.21	2-4 mm fines	--do--	--do--
0314	5.25	4-10 mm fines	--do--	--do--
0315	148.6	Coarse basalt	--do--	--do--
0320	78.24	Unsieved fines	--do--	SCB 5/53Y
0321	141.6	<1 mm fines	--do--	--do--
0322	5.420	1-2 mm fines	--do--	--do--
0323	4.100	2-4 mm fines	--do--	--do--
0324	4.00	4-10 mm fines	--do--	--do--
1010	32.84	Residue in SRC 1 and SCB 1	EVA 1	SRC 1/
1030	36.28	DB residue	Sta 1A	SRC 1/SCB 1/476
1035	144.8	Medium basalt	--do--	--do--
1036	118.4	--do-- (refrigerated)	--do--	--do--
1037	14.39	--do--	--do--	--do--
1040	94.89	Unsieved fines	--do--	SRC 1/SCB 1/455
1041	137.8	<1 mm fines	--do--	--do--

8 TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
1042	7.21	1-2 mm fines	Sta 1A	--do--
1043	6.19	2-4 mm fines	--do--	--do--
1044	12.84	4-10 mm fines	--do--	--do--
1045	11.92	Medium basalt	--do--	--do--
1046	3.037	Medium basalt	--do--	SRC 1/SCB 1/455
1047	2.780	Coarse basalt	--do--	--do--
1048	2.457	Fine basalt	--do--	--do--
1049	1.860	--do--	--do--	--do--
1050	4.000	DB residue	--do--	SRC 1/SCB 1/454
1055	669.6	Medium basalt	--do--	--do--
1060	199.4	Unsieved fines	--do--	SRC 1/SCB 1/456
1061	229.2	<1 mm fines	--do--	--do--
1062	20.74	1-2 mm fines	--do--	--do--
1063	22.79	2-4 mm fines	--do--	--do--
1064	34.35	4-10 mm fines	--do--	--do--
1065	28.83	Fine basalt	--do--	--do--
1066	19.96	--do--	--do--	--do--
1067	4.245	Medium basalt	--do--	--do--
1068	4.208	--do--	--do--	--do--
1069	4.058	Fine basalt	--do--	--do--
1075	1.563	Medium basalt	--do--	SRC 1/SCB 1/455
1085	3.402	--do--	--do--	SRC 1/SCB 1/456
1086	3.329	Fine basalt	--do--	--do--
1087	2.200	--do--	--do--	--do--
1088	2.064	--do--	--do--	--do--
1089	1.733	Medium basalt	--do--	--do--
1095	1.483	--do--	--do--	--do--
1096	1.368	--do--	--do--	--do--
1097	1.355	--do--	--do--	--do--
1130	49.51	Unsieved fines	--do--	SRC 1/SCB 1/477
1131	86.4	<1 mm fines	--do--	--do--
1132	3.99	1-2 mm fines	--do--	--do--
1133	3.22	2-4 mm fines	--do--	--do--
1134	0.91	4-10 mm fines	--do--	--do--
1135	36.85	Fine basalt	--do--	--do--
1136	25.39	--do--	--do--	--do--
1150	1.565	DB residue	--do--	SRC 1/SCB 1/478
1151	57.6	<1 mm fines	--do--	--do--
1152	2.60	1-2 mm fines	--do--	--do--
1153	2.36	2-4 mm fines	--do--	--do--
1154	1.37	4-10 mm fines	--do--	--do--
1155	26.15	Fine basalt	--do--	--do--
1156	5.420	--do--	--do--	--do--
1157	1.466	--do--	--do--	--do--
1170	16.38	DB residue	--do--	SRC 1/SCB 1/479
1175	207.8	Medium basalt	--do--	--do--
1500	359.5	Unsieved fines	--do--	SRC 1/SCB 1/459 (rake soil)

TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

9

<u>SAMPLE NUMBER</u>	<u>WEIGHT (g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS OUTER/INNER</u>
1501	600.9	<1 mm fines	Sta 1A	SRC 1/SCB 1/459 (rake soil)
1502	22.68	1-2 mm fines	--do--	--do--
1503	17.58	2-4 mm fines	--do--	--do--
1504	13.13	4-10 mm fines	--do--	--do--
1505	29.45	Fine basalt	--do--	--do--
1506	12.11	--do--	--do--	--do--
1507	3.962	Medium basalt	--do--	--do--
1508	3.423	Coarse basalt	--do--	--do--
1509	1.690	--do--	--do--	--do--
1515	1.635	Agglutinate	--do--	--do--
1520	48.16	DB residue	--do--	SRC 1/SCB 1/457 & 458 (rake)
1525	3.900	Fine basalt	--do--	--do--
1526	12.91	--do--	--do--	--do--
1527	2.186	--do--	--do--	--do--
1528	11.25	--do--	--do--	--do--
1529	6.025	Medium basalt	--do--	--do--
1535	17.71	Coarse basalt	--do--	--do--
1536	5.322	--do--	--do--	--do--
1537	12.25	Fine basalt	--do--	--do--
1538	8.038	--do--	--do--	--do--
1539	10.90	--do--	--do--	--do--
1545	17.26	--do--	--do--	--do--
1546	150.7	--do--	--do--	--do--
1547	12.54	Medium basalt	--do--	--do--
1548	25.46	--do--	--do--	--do--
1549	7.903	--do--	--do--	--do--
1555	4.547	--do--	--do--	--do--
1556	29.14	Coarse basalt	--do--	--do--
1557	40.35	--do--	--do--	--do--
1558	15.81	--do--	--do--	--do--
1559	82.16	--do--	--do--	--do--
1565	24.09	--do--	--do--	--do--
1566	415.4	--do--	--do--	--do--
1567	146.0	--do--	--do--	--do--
1568	10.02	--do--	--do--	--do--
1569	289.6	Fine basalt	--do--	--do--
1575	2.113	--do--	--do--	--do--
1576	23.54	--do--	--do--	--do--
1577	234.7	--do--	--do--	--do--
1578	353.9	Medium basalt	--do--	--do--
1579	7.937	--do--	--do--	--do--
1585	13.86	--do--	--do--	--do--
1586	26.92	--do--	--do--	SRC 1/SCB 1/457 & 458 (rake)
1587	41.27	--do--	--do--	--do--
1588	48.98	--do--	--do--	--do--
1589	6.860	--do--	--do--	--do--

10 TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
1595	25.21	Medium basalt	Sta 1A	--do--
1596	61.05	--do--	--do--	--do--
1597	12.35	Coarse basalt	--do--	--do--
2010	76.92	SCB residue	EVA 2	SCB 8/
2130	79.91	Unsieved fines	LRV 1	SCB 8/26E
2131	107.9	<1 mm fines	--do--	--do--
2132	8.53	1-2 mm fines	--do--	--do--
2133	10.95	2-4 mm fines	--do--	--do--
2134	13.18	4-10 mm fines	--do--	--do--
2135	336.9	Dark breccia of basalt fragments	--do--	--do--
2140	115.0	Unsieved fines	LRV 2	SCB 6/27E
2141	225.9	<1 mm fines	--do--	--do--
2142	5.32	1-2 mm fines	--do--	--do--
2143	1.88	2-4 mm fines	--do--	--do--
2144	2.73	4-10 mm fines	--do--	--do--
2145	1.25	Dark matrix breccia	--do--	--do--
2150	53.29	DB residue	LRV 3	SCB 6/28E
2155	238.5	Medium basalt	--do--	--do--
2160	80.0	Unsieved fines	--do--	SCB 8/29E
2161	162.5	<1 mm fines	--do--	--do--
2162	4.018	1-2 mm fines	--do--	--do--
2163	2.538	2-4 mm fines	--do--	--do--
2164	0.946	4-10 mm fines	--do--	--do--
2210	1.83	DB residue	Sta 2	SCB 6/514
2215	379.2	Layered light-gray breccia	--do--	--do--
2220	136.2	Unsieved fines	--do--	SCB 8/496
2221	225.8	<1 mm fines	--do--	--do--
2222	11.13	1-2 mm fines	--do--	--do--
2223	7.92	2-4 mm fines	--do--	--do--
2224	7.51	4-10 mm fines	--do--	--do--
2230	1.66	DB residue	--do--	SCB 6/515
2235	61.91	Layered light-gray breccia	--do--	SCB 6/515
2240	113.3	Unsieved fines	--do--	SCB 8/497
2241	186.0	<1 mm fines	--do--	--do--
2242	11.20	1-2 mm fines	--do--	--do--
2243	7.93	2-4 mm fines	--do--	--do--
2244	3.99	4-10 mm fines	--do--	--do--
2250	7.74	DB residue	--do--	SCB 8/494
2255	461.2	Layered light-gray breccia	--do--	--do--

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
2260	100.60	Unsieved fines	Sta 2	SCB 8/498
2261	161.9	<1 mm fines	--do--	--do--
2262	7.70	1-2 mm fines	--do--	--do--
2263	4.40	2-4 mm fines	--do--	--do--
2264	4.40	4-10 mm fines	--do--	--do--
2270	26.11	DB residue	--do--	SCB 8/495
2275	364.0	Layered light-gray breccia	--do--	--do--
2310	1.09	DB residue	--do--	SCB 6/516
2315	131.4	Vesicular, poikilitic clast	--do--	--do--
2320	26.17	Unsieved fines	--do--	SCB 8/500
2321	77.3	<1 mm fines	--do--	--do--
2322	1.38	1-2 mm fines	--do--	--do--
2323	0.50	2-4 mm fines	--do--	--do--
2324	0.96	4-10 mm fines	--do--	--do--
2330	0.36	DB residue	--do--	SCB 6/517
2335	108.9	Vesicular poikilitic clast	--do--	--do--
2350	1.70	Dust and sweepings	--do--	SRC 2/518
2355	367.4	Green-gray breccia	--do--	--do--
2370	0.02	Dust and sweepings	--do--	SRC 2/519
2375	18.16	Green-gray breccia	--do--	--do--
2390	20.63	DB residue	--do--	SCB 8/499
2395	536.4	Green-gray breccia	--do--	--do--
2410	52.00	DB residue	--do--	SCB 8/503
2415	32.34	Brecciated dunite clast	--do--	--do--
2416	11.53	--do--	--do--	--do--
2417	11.32	--do--	--do--	--do--
2418	3.55	--do--	--do--	--do--
2430	1.45	Dust and sweepings	--do--	SCB 8/504
2431	72.0	<1 mm fines	--do--	--do--
2432	3.62	1-2 mm fines	--do--	--do--
2433	2.33	2-4 mm fines	--do--	--do--
2434	1.47	4-10 mm fines	--do--	SCB 8/504
2435	160.6	Blue-gray breccia	--do--	--do--
2440	161.6	Unsieved fines	--do--	SCB 8/505
2441	267.3	<1 mm fines	--do--	--do--
2442	10.60	1-2 mm fines	--do--	--do--
2443	7.98	2-4 mm fines	--do--	--do--
2444	2.91	4-10 mm fines	--do--	--do--
2460	0.51	Dust and sweepings	--do--	SCB 8/506
2461	113.7	<1 mm fines	--do--	--do--
2462	5.14	1-2 mm fines	--do--	--do--
2463	3.90	2-4 mm fines	--do--	--do--
2464	1.76	4-10 mm fines	--do--	--do--

12 TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
2500	325.5	Unsieved fines	Sta 2	SCB 8/502 (rake soil)
2501	687.2	<1 mm fines	--do--	--do--
2502	24.13	1-2 mm fines	--do--	--do--
2503	12.94	2-4 mm fines	--do--	--do--
2504	7.96	4-10 mm fines	--do--	--do--
2505	3.09	Green-gray breccia	--do--	--do--
2530	18.14	DB residue	--do--	SCB 8/501 (rake)
2535	221.4	Blue-gray breccia	--do--	--do--
2536	52.30	--do--	--do--	--do--
2537	5.192	--do--	--do--	--do--
2538	11.09	--do--	--do--	--do--
2539	11.22	--do--	--do--	--do--
2545	4.055	--do--	--do--	--do--
2546	4.856	--do--	--do--	--do--
2547	5.045	--do--	--do--	--do--
2548	29.29	--do--	--do--	--do--
2549	21.00	Green-gray breccia	--do--	--do--
2555	10.48	--do--	--do--	--do--
2556	3.861	--do--	--do--	--do--
2557	4.559	--do--	--do--	--do--
2558	5.713	--do--	--do--	--do--
2559	27.84	Feldspathic breccia	--do--	--do--
2700	295.2	Unsieved fines	--do--	SCB 8/508 (rake soil)
2701	557.3	<1 mm fines	--do--	--do--
2702	17.70	1-2 mm fines	--do--	--do--
2703	8.05	2-4 mm fines	--do--	--do--
2704	4.76	4-10 mm fines	--do--	--do--
2705	2.39	Anorthosite breccia and glass	--do--	--do--
2730	1.98	DB residue	--do--	SCB 8/507 (rake)
2735	51.11	Green-gray breccia	--do--	--do--
2736	28.73	Tan breccia	--do--	--do--
2737	3.33	--do--	--do--	--do--
2738	23.75	Blue-gray breccia	--do--	--do--
3001	809.0	Drive tube (L46, lower)	Sta 3	SRC 2/CSVC
3002	429.7	Drive tube (U31, upper)	--do--	SRC 2/ SCB 6/
3010	34.56	SCB residue	EVA 2	SCB 6/
3120	100.2	Unsieved fines	Sta 2a	SCB 6/30E
3121	179.7	<1 mm fines	--do--	--do--
3122	5.25	1-2 mm fines	--do--	--do--
3123	2.03	2-4 mm fines	--do--	--do--
3124	0.50	4-10 mm fines	--do--	--do--
3130	77.20	Unsieved fines	--do--	SCB 8/31E
3131	132.3	<1 mm fines	--do--	--do--
3132	10.38	1-2 mm fines	--do--	--do--
3133	8.58	2-4 mm fines	--do--	--do--
3134	9.61	4-10 mm fines	--do--	--do--

TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
3140	121.6	Unsieved fines	Sta 2	SCB 6/40Y
3141	191.4	<1 mm fines	--do--	--do--
3142	11.69	1-2 mm fines	--do--	--do--
3143	7.84	2-4 mm fines	--do--	--do--
3144	4.47	4-10 mm fines	--do--	--do--
3145	5.60	Dark matrix breccia	--do--	--do--
3146	3.01	Brecciated anorthosite	--do--	--do--
3150	52.56	Unsieved fines	--do--	SCB 6/32E
3151	101.2	<1 mm fines	--do--	--do--
3152	3.57	1-2 mm fines	--do--	--do--
3153	1.31	2-4 mm fines	--do--	--do--
3154	0.31	4-10 mm fines	--do--	--do--
3155	79.3	Blue-gray breccia	--do--	--do--
3156	3.15	Fine crystalline	--do--	--do--
3210	37.89	Unsieved fines	Sta 3	SCB 6/527
3211	51.95	<1 mm fines	--do--	--do--
3212	3.47	1-2 mm fines	--do--	--do--
3213	2.80	2-4 mm fines	--do--	--do--
3214	2.47	4-10 mm fines	--do--	--do--
3215	1062.	Light-gray breccia	--do--	--do--
3216	162.2	Green-gray breccia	--do--	--do--
3217	138.8	Blue-gray breccia	--do--	--do--
3218	39.67	--do--	--do--	--do--
3219	2.88	Fine basalt	--do--	--do--
3220	20.8	Unsieved fines	--do--	SCB 6/520
3221	48.11	<1 mm fines	--do--	--do--
3222	2.71	1-2 mm fines	--do--	--do--
3223	2.61	2-4 mm fines	--do--	--do--
3224	1.65	4-10 mm fines	--do--	--do--
3225	3.66	Crystalline (green-gray breccia?)	--do--	SCB 6/520
3230	21.34	DB residue	--do--	SCB 6/524
3235	878.3	Blue gray breccia	--do--	--do--
3240	114.7	Unsieved fines	--do--	SCB 6/521
3241	192.7	<1 mm fines	--do--	--do--
3242	14.94	1-2 mm fines	--do--	--do--
3243	14.38	2-4 mm fines	--do--	--do--
3244	22.25	4-10 mm fines	--do--	--do--
3245	1.60	Brecciated anorthosite clast	--do--	--do--
3250	15.25	DB residue	--do--	SCB 6/525
3255	394.1	Light gray or blue- gray breccia	--do--	--do--
3260	103.5	Unsieved fines	--do--	SCB 6/522
3261	194.8	<1 mm fines	--do--	--do--
3262	12.01	1-2 mm fines	--do--	--do--
3263	9.47	2-4 mm fines	--do--	--do--
3264	6.45	4-10 mm fines	--do--	--do--

14 TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
3270	22.43	DB residue	Sta 3	SCB 6/526
3275	429.6	Green-gray breccia	--do--	--do--
3280	53.54	Unsieved fines	--do--	SCB 6/523
3281	95.75	<1 mm fines	--do--	--do--
3282	5.38	1-2 mm fines	--do--	--do--
3283	4.74	2-4 mm fines	--do--	--do--
3284	7.14	4-10 mm fines	--do--	--do--
3285	2.58	Glass coated gray friable breccia	--do--	--do--
4001	1072.	Drive tube (L44, lower)	Sta 4	SRC 2/
4002	909.6	Drive tube (U35, upper)	--do--	--do--
4010	22.52	SRC residue	EVA 2	SRC 2/
4110	92.12	Unsieved fines	LRV 5	SCB 8/41Y
4111	116.8	<1 mm fines	--do--	--do--
4112	11.12	1-2 mm fines	--do--	--do--
4113	12.11	2-4 mm fines	--do--	--do--
4114	13.26	4-10 mm fines	--do--	--do--
4115	15.36	Extremely friable light gray breccia	--do--	--do--
4116	12.68	--do--	--do--	--do--
4117	3.69	--do--	--do--	--do--
4118	3.59	--do--	--do--	--do--
4119	1.79	--do--	--do--	--do--
4120	124.1	Unsieved fines	LRV 6	SCB 8/42Y
4121	252.0	<1 mm fines	--do--	--do--
4122	6.65	1-2 mm fines	--do--	--do--
4123	2.73	2-4 mm fines	--do--	--do--
4124	0.39	4-10 mm fines	--do--	--do--
4220	1180.	Unsieved fines	Sta 4	SRC 2/509
4230	0.70	DB residue	--do--	SCB 8/12E
4235	59.04	Basalt vitrophyre	--do--	--do--
4240	544.9	Unsieved fines	--do--	SRC 2/510
4241	307.3	<1 mm fines	--do--	--do--
4242	22.50	1-2 mm fines	--do--	--do--
4243	27.67	2-4 mm fines	--do--	--do--
4244	21.95	4-10 mm fines	--do--	--do--
4245	64.34	Fine or devit. basalt	--do--	--do--
4246	28.81	Dark matrix breccia	--do--	--do--
4247	7.761	Fine or devit. basalt	--do--	--do--
4248	5.682	--do--	--do--	--do--
4249	4.183	Fine basalt	--do--	--do--
4250	22.56	DB residue	--do--	SCB 6/512
4255	737.3	Coarse basalt	--do--	--do--
4260	526.7	Unsieved fines	--do--	SRC 2/511
4270	9.61	DB residue	--do--	SCB 4/461
4275	1493.	Fine basalt	--do--	--do--
4285	2.212	Medium basalt	--do--	SRC 2/510
4286	2.102	--do--	--do--	--do--
4287	1.568	Fine basalt	--do--	--do--

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
5010	9.25	DB residue	Sta 5	SCB 6/462
5015	1006.	Coarse basalt	--do--	--do--
5030	2.63	DB residue	--do--	SCB 6/463
5035	1235.	Medium basalt	--do--	--do--
5050	2.5	Dust & sweepings	--do--	SRC 6/464
5055	949.4	Coarse basalt	--do--	--do--
5060	0.527	DB residue	--do--	SRC 2/465
5061	157.9	<1 mm fines	--do--	--do--
5062	8.520	1-2 mm fines	--do--	--do--
5063	6.280	2-4 mm fines	--do--	--do--
5064	11.63	4-10 mm fines	--do--	--do--
5065	1.263	Medium basalt	--do--	--do--
5066	0.980	Dark gray breccia	--do--	--do--
5070	7.260	DB residue	--do--	SRC 2/466
5075	1008.	Medium basalt	--do--	--do--
5080	524.2	Unsieved fines	Sta 5	SRC 2/467
5081	932.4	<1 mm fines	--do--	--do--
5082	38.92	1-2 mm fines	--do--	--do--
5083	30.88	2-4 mm fines	--do--	--do--
5084	23.31	4-10 mm fines	--do--	--do--
5085	4.298	Medium basalt	--do--	--do--
5086	2.323	--do--	--do--	--do--
5087	2.321	--do--	--do--	--do--
5088	1.992	Fine basalt	--do--	--do--
5089	1.718	--do--	--do--	--do--
5110	122.5	Unsieved fines	LRV 7	SCB 8/43Y
5111	235.0	<1 mm fines	--do--	--do--
5112	10.20	1-2 mm fines	--do--	--do--
5113	6.76	2-4 mm fines	--do--	--do--
5114	6.87	4-10 mm fines	--do--	--do--
5115	2.60	Fine basalt	--do--	--do--
5120	126.6	Unsieved fines	--do--	SCB 8/44Y
5121	240.3	<1 mm fines	--do--	--do--
5122	5.208	1-2 mm fines	--do--	--do--
5123	2.147	2-4 mm fines	--do--	--do--
5124	0.956	4-10 mm fines	--do--	--do--
6001	711.6	Drive tube (L48)	Sta 6	SCB 7/
6010	20.31	SCB residue	EVA 3	SCB 4/
6015	2819.	Green-gray breccia	Sta 6	SCB 4/
6030	16.06	DB residue	--do--	SCB 5/49Y, 48Y
6031	152.6	<1 mm fines	--do--	--do--
6032	5.71	1-2 mm fines	--do--	--do--
6033	4.58	2-4 mm fines	--do--	--do--
6034	2.01	4-10 mm fines	--do--	--do--
6035	376.2	Blue gray breccia	--do--	--do--
6036	3.95	--do--	--do--	--do--
6037	2.52	Medium basalt	--do--	--do--
6055	6412.	Green-gray breccia	--do--	--do--

16 TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
6120	107.0	Unsieved fines	LRV 9	SCB 5/46Y
6121	188.1	<1 mm fines	--do--	--do--
6122	4.72	1-2 mm fines	--do--	--do--
6123	2.49	2-4 mm fines	--do--	--do--
6124	1.61	4-10 mm fines	--do--	--do--
6130	19.57	DB residue	LRV 10	SCB 5/47Y
6131	146.1	<1 mm fines	--do--	--do--
6132	6.79	1-2 mm fines	--do--	--do--
6133	5.21	2-4 mm fines	--do--	--do--
6134	3.10	4-10 mm fines	--do--	--do--
6135	133.5	Green-gray breccia	--do--	--do--
6136	86.6	Medium basalt	--do--	--do--
6137	2.46	Fine grained crystalline	--do--	--do--
6210	2.74	DB residue	Sta 6	SCB 4/535
6215	643.9	Green-gray breccia	--do--	--do--
6220	196.7	Unsieved fines	--do--	SCB 7/534
6221	390.4	<1 mm fines	--do--	--do--
6222	13.65	1-2 mm fines	--do--	--do--
6223	8.26	2-4 mm fines	--do--	--do--
6224	3.83	4-10 mm fines	--do--	--do--
6230	6.63	DB residue	--do--	SCB 4/556
6235	26.56	Brecciated olivine norite	--do--	--do--
6236	19.18	--do--	--do--	--do--
6237	10.31	--do--	--do--	--do--
6238	8.21	--do--	--do--	--do--
6239	6.23	--do--	--do--	--do--
6240	450.7	Unsieved fines	--do--	SCB 4/312
6241	21.14	<1 mm fines	--do--	--do--
6242	1.20	1-2 mm fines	--do--	--do--
6243	1.23	2-4 mm fines	--do--	--do--
6244	1.53	4-10 mm fines	--do--	--do--
6245	8.24	Green-gray breccia	--do--	--do--
6246	6.50	--do--	--do--	--do--
6250	4.63	DB residue	--do--	SCB 4/536
6255	406.6	Banded tan and blue - gray breccia	--do--	--do--
6260	96.6	Unsieved fines	--do--	SCB 4/313
6261	170.7	<1 mm fines	--do--	--do--
6262	8.55	1-2 mm fines	--do--	--do--
6263	6.57	2-4 mm fines	--do--	--do--
6264	8.76	4-10 mm fines	--do--	--do--
6265	1.75	Green-gray breccia	--do--	--do--
6270	0.46	DB residue	--do--	SCB 4/537
6275	55.93	Blue-gray fragment breccia	--do--	--do--
6280	153.0	Unsieved fines	--do--	SCB 4/472
6281	251.8	<1 mm fines	--do--	--do--

TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

17

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
6282	14.27	1-2 mm fines	Sta 6	SCB 4/472
6283	12.71	2-4 mm fines	--do--	--do--
6284	10.69	4-10 mm fines	--do--	--do--
6285	2.208	Agglutinate	--do--	--do--
6286	1.704	Brecciated troctolite	--do--	--do--
6290	9.65	DB residue	--do--	SCB 4/538
6295	260.7	Banded tan and blue- gray breccia	--do--	--do--
6305	4.01	Brecciated olivine norite	--do--	SCB 4/556
6306	4.25	--do--	--do--	--do--
6307	2.49	--do--	--do--	--do--
6310	25.39	DB residue	--do--	SCB 7/539
6315	671.1	Blue gray breccia	--do--	--do--
6320	260.3	Unsieved fines	--do--	SCB 7/557
6321	502.7	<1 mm fines	--do--	--do--
6322	23.10	1-2 mm fines	--do--	--do--
6323	15.84	2-4 mm fines	--do--	--do--
6324	11.80	4-10 mm fines	--do--	--do--
6330	418.6	DB residue	--do--	BSLSS/560
6335	352.9	Friable anorthositic breccia	--do--	--do--
6500	345.2	Unsieved fines	--do--	SCB 4/559 (rake soil)
6501	630.7	<1 mm fines	--do--	--do--
6502	22.76	1-2 mm fines	--do--	--do--
6503	10.09	2-4 mm fines	--do--	--do--
6504	10.72	4-10 mm fines	--do--	--do--
6505	4.69	Greenish-gray breccia	--do--	--do--
6506	2.81	Friable dark matrix breccia	--do--	--do--
6530	70.27	DB residue	--do--	SCB 4/558 (rake)
6535	155.5	Coarse norite	--do--	--do--
6536	10.26	Brecciated norite	--do--	--do--
6537	26.48	Fine basalt	--do--	--do--
6538	5.870	Medium basalt	--do--	--do--
6539	14.80	Vitrophyric basalt	--do--	--do--
6545	7.676	Dark vitreous matrix breccia	--do--	--do--
6546	24.31	--do--	--do--	--do--
6547	10.05	--do--	--do--	--do--
6548	2.527	--do--	--do--	--do--
6549	9.175	--do--	--do--	--do--
6555	8.435	Crystalline matrix-rich basalt	--do--	--do--

TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE* NUMBER</u>	<u>WEIGHT (g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS OUTER/INNER</u>
6556	7.396	Crystalline matrix-rich basalt	Sta 6	SCB 4/558 (rake)
6557	5.592	--do--	--do--	--do--
6558	0.683	--do--	--do--	--do--
6559	0.747	--do--	--do--	--do--
6565	11.60	Friable dark matrix breccia	--do--	--do--
6566	2.639	--do--	--do--	--do--
6567	5.490	--do--	--do--	--do--
6568	9.477	Basalt-rich breccia	--do--	--do--
6569	4.207	Crystalline breccia (blue-gray?)	--do--	--do--
6575	16.25	Crystalline breccia, clast rich	--do--	--do--
6576	5.327	Crystalline light- gray breccia	--do--	--do--
6577	13.54	--do--	--do--	--do--
7010	93.65	SCB residue	EVA 3	SCB 7/
7017	1730.	Brecciated olivine gabbro	STA 7	SCB 7/541
7035	5727.	Green-gray breccia	--do--	BSLSS/
7070	9.28	DB residue	--do--	SCB 7/544
7075	172.4	Dark gray dike	--do--	--do--
7076	13.97	--do--	--do--	--do--
7077	5.45	--do--	--do--	--do--
7110	0.15	Dust and sweepings	--do--	SCB 4/561
7115	115.9	Blue-gray breccia	--do--	--do--
7130	1.42	DB residue	--do--	SCB 4/562
7135	337.4	Green-gray breccia	--do--	--do--
7210	111.7	DB residue	--do--	SCB 7/543
7215	846.4	Brecciated norite	--do--	--do--
7510	77.57	Unsieved fines	--do--	SCB 7/540
7511	118.1	<1 mm fines	--do--	--do--
7512	2.45	1-2 mm fines	--do--	--do--
7513	1.19	2-4 mm fines	--do--	--do--
7514	1.24	4-10 mm fines	--do--	--do--
7515	337.6	Green-gray breccia	--do--	--do--
7516	103.7	Medium basalt	--do--	--do--
7517	45.6	Feldspathic breccia	--do--	--do--
7518	42.5	Green-gray breccia	--do--	--do--
7519	27.4	--do--	--do--	--do--
7525	1.19	Feldspathic breccia	--do--	--do--
7526	1.07	--do--	--do--	--do--
7530	82.76	Unsieved fines	--do--	SCB 7/542
7531	126.6	<1 mm fines	--do--	--do--
7532	3.13	1-2 mm fines	--do--	--do--
7533	2.51	2-4 mm fines	--do--	--do--
7534	4.46	4-10 mm fines	--do--	--do--
7535	577.8	Coarse basalt	--do--	--do--
7536	355.3	--do--	--do--	--do--
7537	71.7	Green-gray breccia	--do--	--do--

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
7538	47.2	Light gray breccia	Sta 7	SCB 7/542
7539	39.6	Tan gray breccia	--do--	--do--
7545	29.5	Green-gray breccia	--do--	--do--
8120	75.78	Unsieved fines	LRV 11	SCB 5/50Y
8121	121.6	<1 mm fines	--do--	--do--
8122	4.43	1-2 mm fines	--do--	--do--
8123	2.49	2-4 mm fines	--do--	--do--
8124	5.64	4-10 mm fines	--do--	--do--
8130	3.62	DB residue	STA 8	SCB 4/563
8135	133.9	Medium basalt	--do--	--do--
8150	0.65	Dust and sweepings	--do--	SCB 4/567
8155	401.1	Gabbroic breccia	--do--	--do--
8220	108.3	Unsieved fines	--do--	SCB 7/545
8221	227.1	<1 mm fines	--do--	--do--
8222	5.21	1-2 mm fines	--do--	--do--
8223	2.69	2-4 mm fines	--do--	--do--
8224	1.48	4-10 mm fines	--do--	--do--
8230	82.98	Unsieved fines	--do--	SCB 4/564
8231	122.7	<1 mm fines	--do--	--do--
8232	2.68	1-2 mm fines	--do--	--do--
8233	1.42	2-4 mm fines	--do--	--do--
8234	0.72	4-10 mm fines	--do--	--do--
8235	199.0	Coarse norite	--do--	--do--
8236	93.06	--do--	--do--	--do--
8238	57.58	--do--	--do--	--do--
8250	50.57	Unsieved fines	--do--	SCB 4/546
8255	48.31	Coarse norite	--do--	--do--
8420	97.94	Unsieved fines	--do--	SCB 4/548
8421	186.2	<1 mm fines	--do--	--do--
8422	4.16	1-2 mm fines	--do--	--do--
8423	2.41	2-4 mm fines	--do--	--do--
8424	1.91	4-10 mm fines	--do--	--do--
8440	81.38	Unsieved fines	--do--	SCB 4/551
8441	162.8	<1 mm fines	--do--	--do--
8442	3.78	1-2 mm fines	--do--	--do--
8443	2.44	2-4 mm fines	--do--	--do--
8444	1.19	4-10 mm fines	--do--	--do--
8460	138.1	Unsieved fines	--do--	SCB 7/550
8461	264.5	<1 mm fines	--do--	--do--
8462	5.328	1-2 mm fines	--do--	--do--
8463	2.787	2-4 mm fines	--do--	--do--
8464	1.303	4-10 mm fines	--do--	--do--
8465	1.039	Dark matrix breccia	--do--	--do--
8480	89.33	Unsieved fines	--do--	SCB 4/549

TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE* NUMBER</u>	<u>WEIGHT (g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS OUTER/INNER</u>
8481	173.9	<1 mm fines	Sta 8	SCB 4/549
8482	2.69	1-2 mm fines	---do---	---do---
8483	1.21	2-4 mm fines	---do---	---do---
8484	0.32	4-10 mm fines	---do---	---do---
8500	391.1	Unsieved fines	---do---	SCB 4/566 (rake soil)
8501	718.7	<1 mm fines	---do---	---do---
8502	21.38	1-2 mm fines	---do---	---do---
8503	16.41	2-4 mm fines	---do---	---do---
8504	19.16	4-10 mm fines	---do---	---do---
8505	506.3	Coarse basalt	---do---	---do---
8506	55.97	---do---	---do---	---do---
8507	23.35	---do---	---do---	---do---
8508	10.67	Friable dark matrix breccia	---do---	---do---
8509	8.68	Basalt	---do---	---do---
8515	4.76	Coherent dark matrix breccia	---do---	---do---
8516	3.18	Friable dark matrix breccia	---do---	---do---
8517	1.82	Friable white breccia	---do---	---do---
8518	0.88	Friable dark matrix breccia	---do---	---do---
8525	5.11	Agglutinate	---do---	SCB 4/565 (rake)
8526	8.77	Breccia with green glass vein	---do---	---do---
8527	5.16	Brecciated gabbroic rock	---do---	---do---
8528	7.00	Fine basalt	---do---	---do---
8530	88.92	DB residue	---do---	---do---
8535	103.4	Coherent dark matrix breccia	---do---	---do---
8536	8.67	---do---	---do---	---do---
8537	11.76	---do---	---do---	---do---
8538	5.82	---do---	---do---	---do---
8539	3.73	---do---	---do---	---do---
8545	8.60	---do---	---do---	---do---
8546	42.66	---do---	---do---	---do---
8547	29.91	Friable dark matrix breccia	---do---	---do---
8548	15.95	---do---	---do---	---do---
8549	16.09	---do---	---do---	---do---
8555	6.64	---do---	---do---	---do---
8556	9.50	---do---	---do---	---do---
8557	7.19	---do---	---do---	---do---

<u>SAMPLE* NUMBER</u>	<u>WEIGHT (g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS OUTER/INNER</u>
8558	3.78	Friable dark matrix breccia	Sta 8	SCB 4/565 (rake)
8559	3.05	--do--	--do--	--do--
8565	3.50	--do--	--do--	--do--
8566	0.77	--do--	--do--	--do--
8567	18.88	--do--	--do--	--do--
8568	3.57	--do--	--do--	--do--
8569	14.53	--do--	--do--	--do--
8575	140.0	Coarse basalt	--do--	--do--
8576	11.64	--do--	--do--	--do--
8577	8.84	--do--	--do--	--do--
8578	17.13	--do--	--do--	--do--
8579	6.07	Medium basalt	--do--	--do--
8585	44.60	Fine basalt	--do--	--do--
8586	10.73	--do--	--do--	--do--
8587	11.48	--do--	--do--	--do--
8588	3.77	--do--	--do--	--do--
8589	4.10	--do--	--do--	--do--
8595	4.19	--do--	--do--	--do--
8596	7.55	--do--	--do--	--do--
8597	319.1	--do--	--do--	--do--
8598	224.1	--do--	--do--	--do--
8599	198.6	--do--	--do--	--do--
9001	743.4	Drive tube (50, lower)	STA 9	SCB 7/
9002	409.4	Drive tube (37, upper)	--do--	--do--
9010	87.05	SCB residue	EVA 3	SCB 5/
9035	2806.	Dark matrix breccia	Sta 9	BSLSS/
9110	66.30	DB residue	--do--	SCB 5/568
9115	346.3	Dark matrix breccia	--do--	--do--
9120	116.4	Unsieved fines	--do--	SCB 5/569
9121	214.4	<1 mm fines	--do--	--do--
9122	13.97	1-2 mm fines	--do--	--do--
9123	13.14	2-4 mm fines	--do--	--do--
9124	14.48	4-10 mm fines	--do--	--do--
9125	1.91	Dark matrix breccia	--do--	--do--
9130	3.99	Dust and sweepings	--do--	SCB 5/480
9135	2283.	Dark matrix breccia	--do--	--do--
9150	5.63	DB residue	--do--	SCB 5/571
9155	318.8	Coarse basalt	--do--	--do--
9170	43.42	DB residue	--do--	SCB 7/481
9175	677.7	Agglutinate	--do--	--do--
9190	13.38	DB residue	--do--	SCB 7/482
9195	368.5	Dark matrix breccia	--do--	--do--
9210	5.55	DB residue	--do--	SCB 7/486
9215	553.8	Brecciated troctolite	--do--	--do--

TABLE I - APOLLO 17 SAMPLE INVENTORY (Continued)

<u>SAMPLE*</u> <u>NUMBER</u>	<u>WEIGHT</u> <u>(g)</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>	<u>CONTAINERS</u> <u>OUTER/INNER</u>
9220	93.49	Unsieved fines	Sta 9	SCB 5/483
9221	152.6	<1 mm fines	--do--	--do--
9222	7.22	1-2 mm fines	--do--	--do--
9223	6.24	2-4 mm fines	--do--	--do--
9224	9.75	4-10 mm fines	--do--	--do--
9225	7.42	Friable dark matrix breccia	--do--	--do--
9226	6.73	Friable dark matrix breccia	--do--	SCB 5/483
9227	5.57	Disaggregated clod	--do--	--do--
9228	2.50	--do--	--do--	--do--
9240	113.3	Unsieved fines	--do--	SCB 5/484
9241	174.3	<1 mm fines	--do--	--do--
9242	11.32	1-2 mm fines	--do--	--do--
9243	10.46	2-4 mm fines	--do--	--do--
9244	10.85	4-10 mm fines	--do--	--do--
9245	10.11	Crystalline	--do--	--do--
9260	118.9	Unsieved fines	--do--	SCB 5/485
9261	187.8	<1 mm fines	--do--	--do--
9262	11.74	1-2 mm fines	--do--	--do--
9263	11.46	2-4 mm fines	--do--	--do--
9264	15.85	4-10 mm fines	--do--	--do--
9265	2.6	Basalt	--do--	--do--
9510	107.6	Unsieved fines	--do--	SCB 5/570
9511	179.2	<1 mm fines	--do--	--do--
9512	11.32	1-2 mm fines	--do--	--do--
9513	9.94	2-4 mm fines	--do--	--do--
9514	12.24	4-10 mm fines	--do--	--do--
9515	33.00	Medium basalt	--do--	--do--
9516	23.92	--do--	--do--	--do--
9517	10.23	Dark matrix breccia	--do--	--do--
9518	5.20	--do--	--do--	--do--
9519	3.65	--do--	--do--	--do--
9525	3.03	--do--	--do--	--do--
9526	2.93	--do--	--do--	--do--
9527	2.65	--do--	--do--	--do--
9528	2.38	--do--	--do--	--do--
9529	1.84	--do--	--do--	--do--
9535	1.69	--do--	--do--	--do--
9536	1.66	--do--	--do--	--do--
9537	1.05	--do--	--do--	--do--

## LIST OF ACRONYMS

BSLSS - Buddy Secondary Life Support System (Bag)  
CSVC - Core Sample Vacuum Container  
DB - Documented Bag  
DSB - Drill Stem Bag  
EVA - Extravehicular Activity (3 sampling traverses)  
LRV - Lunar Roving Vehicle (location of samples taken from vehicle)  
SCB - Sample Collection Bag  
SESC - Special Environment Sample Container  
SRC - Sample Return Container ("rock box")

## NOTES:

- \* Last four digits; initial digit "7" omitted.
- 1. Locations are shown on Figures 1 and 2.
- 2. Three digits or two digits plus a letter designate a documented bag (DB).

TABLE II.-- LIST OF ROCKS &gt;50g AND BOULDER SAMPLES

ROCK NUMBER <sup>1</sup>	WEIGHT (g)	LABORATORY <sup>2</sup> ORIENTATION FOR		ROCK TYPE <sup>3</sup>	STUDIES <sup>4</sup>	
		LUNAR TOP	LUNAR NORTH			
0017	2957.		No photo	Coarse basalt		
0018	51.58		No photo	Dark matrix breccia		
0019	159.9		Broken	Agglutinate		
0035 B <sup>5</sup>	5765.		No photo	Coarse basalt	CA, TS	
0135	} 446.3    } 33.60		Insuf photo	Coarse basalt	GR	
0136-						
0139						
0145-						
0149				----do----	----do----	TS (0149)
0155-						
0157						
0175	339.6		No photo	Dark matrix breccia	GR	
0185	466.6	T	E/N	Coarse basalt	GR	
0215	8110.		No photo	Fine basalt	CA, TS	
0255	277.2	N	E/B	----do----	GR	
0275	171.4	T	E	Medium basalt	GR	
0295	361.2		No photo	Dark matrix breccia		
0315	148.6		No photos	Coarse basalt		
1035	144.8	N/T	E/B	Med. basalt	GR	
1036	118.4		Refrigerated	----do----		
1037	14.39		No attempt	----do----		
1055	669.6	S	E/T	----do----		
1135, 1136 } 1155-1157 }	} 95.276		No attempt	Fine basalt	GR	
1175	207.8	N/T	S/W	Med. basalt		
1546	150.7		Rake	Fine basalt		
1559	82.16		Rake	Coarse basalt		
1566	415.4		Rake	----do----		
1567	146.0		Rake	----do----		
1569	289.6		Rake	Fine basalt		
1577	234.7		Rake	----do----		
1578	353.9		Rake	Med. basalt		
1596	61.05		Rake	Med. basalt		
2135	336.9		No photos	Dark breccia of basalt fragments	TS	
2155	238.5	T	N/E(?)	Med. basalt		
2215	379.2	B	S	Layered light gray breccia	TS	
2235	61.91	N	B/W	----do----		
2255	461.2	S/B	W	----do----	GR, TS	
2275	3640.	B	S	----do----	CA, TS	

TABLE II. - LIST OF ROCKS &gt;50g AND BOULDER SAMPLES (Cont.)

ROCK NUMBER	WEIGHT (g)	LABORATORY ORIENTATION FOR		ROCK TYPE	STUDIES
		LUNAR TOP	LUNAR NORTH		
2315	131.4	W/T	N/B	Vesicular, poikilitic clast	TS
2335	108.9	T/N	N/B	----do----	GR
2355	367.4	N/T	S/W	Green-gray breccia	TS
2375	18.16		No attempt	----do----	
2395	536.4	T	S/W	----do----	
2415	32.34		No attempt	Brecciated dunite clast	CA, TS, GR
2416--					
2418	26.40		----do----	----do----	
2435	160.6	B	N/W	Blue-gray breccia	CA, TS
2535	221.4		Rake	----do----	
2536	52.3		Rake	----do----	
2735	51.11		Rake	Green-gray breccia	
3155	79.30	B/N	N/E	Blue-gray breccia	
3215	1062.		No photos	Light gray breccia	TS
3216	162.2		----do----	Green-gray breccia	
3217	138.8		----do----	Blue-gray breccia	
3235	878.3	T	S/E	Blue-gray breccia	TS
3255	394.1	B	N	Light gray or blue-gray breccia	TS
3275	429.6	T	W	Green-gray breccia	
4235	59.04		No photos	Basalt vitrophyre	TS
4245	64.34		----do----	Fine or devit. basalt	
4255	B 737.3	B	N/E	Coarse basalt	TS
4275	1493.	T	S/E	Fine basalt	
5015	B 1006.		Unsuccessful	Coarse basalt	
5035	B 1235.	S/W	B/W	Med. basalt	
5055	B 949.4	T/N/E	S/E	Coarse basalt	CA, GR, TS
5075	B 1008.	B	S/W	Med. basalt	
6015	B <sup>7</sup> 2819.	W	B/S	Green-gray breccia	GR, TS
6035	376.2		No photos	Blue-gray breccia	
6055	6412.		----do----	Green-gray breccia	CA, TS
6135	133.5		----do----	----do----	
6136	86.6		----do----	Med. basalt	TS

TABLE II. - LIST OF ROCKS &gt;50g AND BOULDER SAMPLES (Cont.)

ROCK NUMBER	WEIGHT (g)	LABORATORY ORIENTATION FOR		ROCK TYPE	STUDIES
		LUNAR TOP	LUNAR NORTH		
6215 B	643.9			Green-gray breccia	GR, TS
6235 - 6239	70.49			Brecciated olivine norite	(CA, TS of 6230)
6255	406.6	N	B	Banded tan and blue-gray breccia	(GR, TS of 6250)
6275	55.93	T	W/S	Blue-gray fragment breccia	GR
6295	260.7	B	N/E	Banded tan and blue-gray breccia	GR
6305 - 6307	10.75			Brecciated olivine norite	
6315 B	671.1			Blue-gray breccia	CA, TS
6335	352.9			Friable anorthositic breccia	
6535	155.5			Rake	Coarse norite
7017	1730.			No photos	Brecciated olivine gabbro
7035	5727.			---do---	Green-gray breccia
7075 - 7077	191.82			Broken	Dark gray dike
7115	115.9			Not identified	TS
7135	337.4	S	T/W	Green-gray breccia	CA, TS, GR
7215	846.4			Not identified	Brecciated norite
7515	337.6			Rake	Green-gray breccia
7516	103.7			Rake	Med. basalt
7535	577.8			Rake	Coarse basalt
7536	355.3			Rake	---do---
7537	71.7			Rake	Green-gray breccia
8135	133.9	T	W	Med. basalt	GR
8155	401.1			Not identified	Gabbroic breccia
8235	199.0	T	S/E	Coarse norite	GR
8236	93.06	T	E/N	---do---	
8238	57.58			Not identified	TS
8255	48.31			---do---	
8505	506.3			No attempt	Coarse basalt
8506	55.97			No attempt	---do---
8535	103.4			Rake	Coherent dark matrix breccia
8575	140.0			Rake	Coarse basalt
8597	319.1			Rake	Fine basalt
8598	224.1			Rake	---do---
8599	198.6			Rake	---do---

TABLE II. - LIST OF ROCKS &gt;50g AND BOULDER SAMPLES (Concl.)

27

ROCK NUMBER	WEIGHT (g)	LABORATORY ORIENTATION FOR		ROCK TYPE	STUDIES
		LUNAR TOP	LUNAR NORTH		
9035	2806.		No photos	Dark matrix breccia	TS
9115 ]	346.3		Unsuccessful	----do----	
9135 ]	2283.		----do----	----do----	CA, TS
9155	318.8		No photos	Coarse basalt	GR
9175	677.7	W		Agglutinate	
9195 B	368.5		Broken	Dark matrix breccia	
9215	553.8	N		Brecciated troctolite	TS

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Footnotes:

<sup>1</sup> Last four digits, initial digit (7) omitted.

<sup>2</sup> By R. Sutton, USGS

<sup>3</sup> Compiled by W. C. Phinney, JSC

<sup>4</sup> Studies: CA - Chemical analysis - Table IV  
EG - Evolved gases - Figure 3  
GR - Gamma ray analysis - Table V  
TC - Total carbon analysis - Table VI  
TS - Thin section description - With rock description

<sup>5</sup> B = sample chipped from a boulder

<sup>6</sup> Brackets join samples all chipped from a single boulder

<sup>7</sup> All of the sampled station 6 boulders are interpreted to have been a single boulder that broke up at or near the present location.  
(Field Geology Team and others)

## SAMPLE LOCATIONS

Figure 1 shows the sampling stations and other locations, as designated in the Apollo 17 Sample Inventory, Table I. Figures 2A through 2J are planimetric maps of the sample collecting stations showing sample locations in greater detail. The maps are modified from the USGS Interagency Reports 71 and 72. Only the first number of the decade is shown for predominantly soil samples, and only the number of the largest rock is usually given where several rocks were returned in a documented bag.

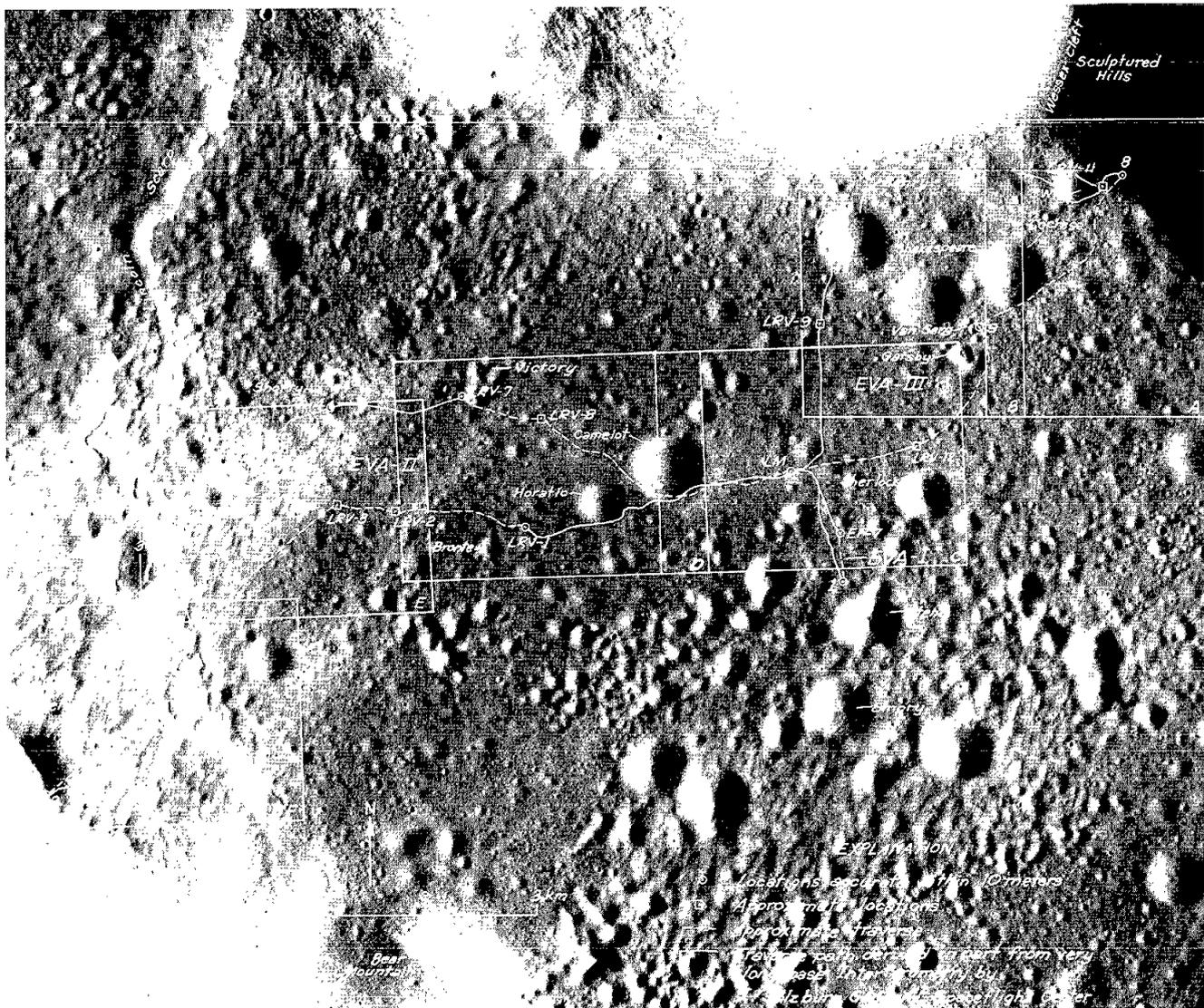


Figure 1. Map of EVA Traverse and Sample Collection Stations. (From USGS IR 72. Lettered boxes show boundaries of the detailed traverse maps that appear in the USGS IR 72 as Figures 4a through 4f).

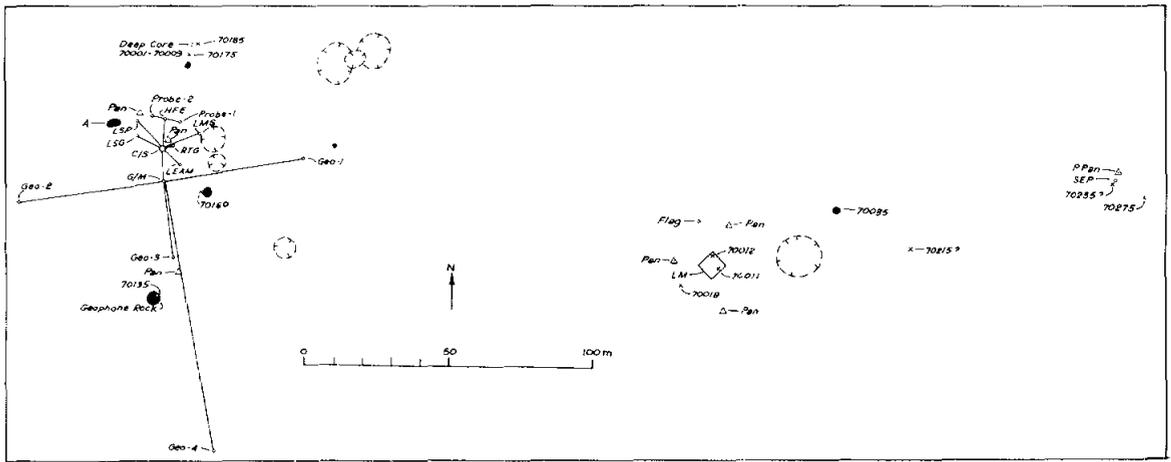


Figure 2a - Planimetric Map of the LM-ALSEP-SEP

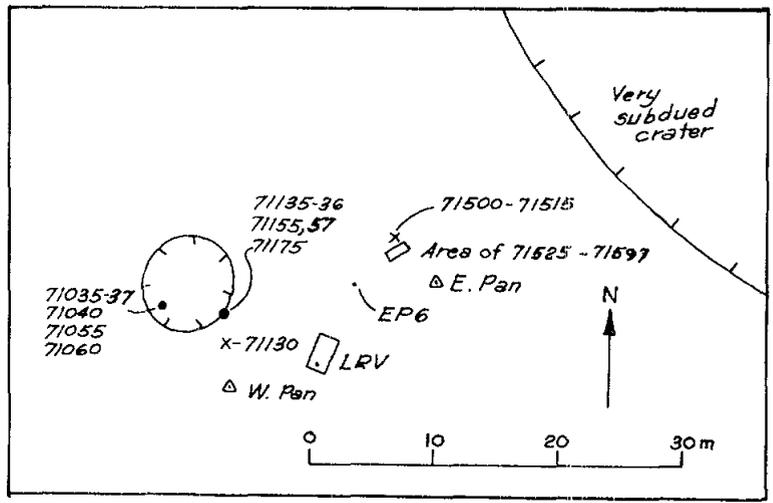


Figure 2b - Planimetric Map of Station 1

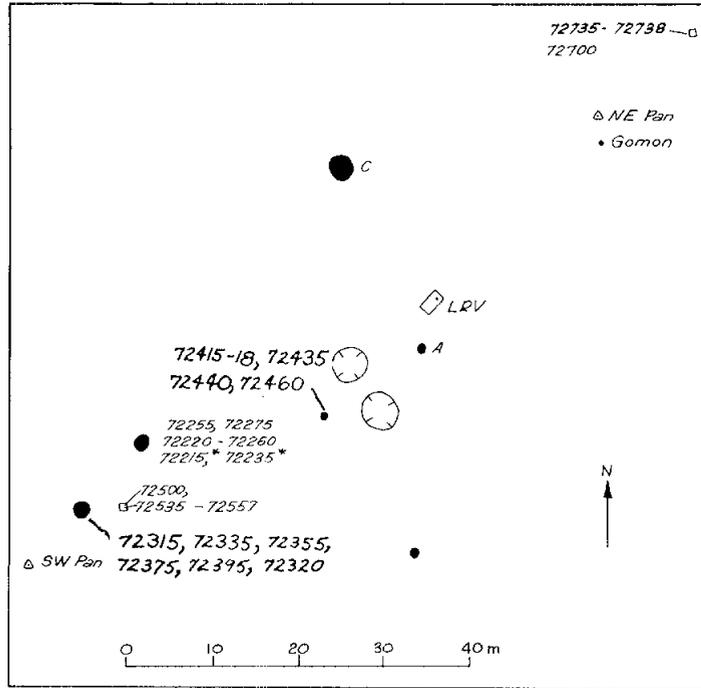


Figure 2c - Planimetric Map of Station 2

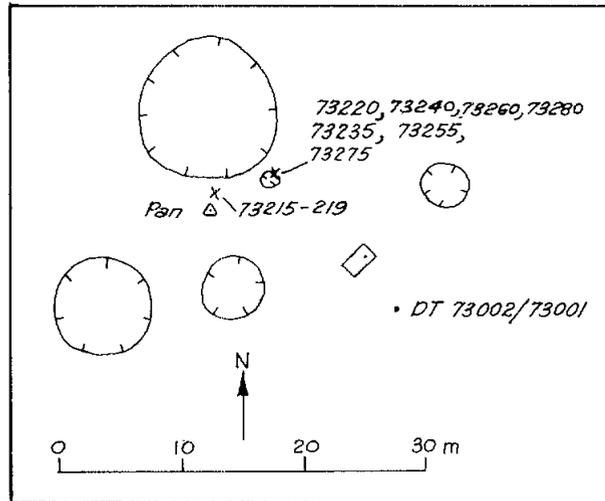


Figure 2d - Planimetric Map of Station 3

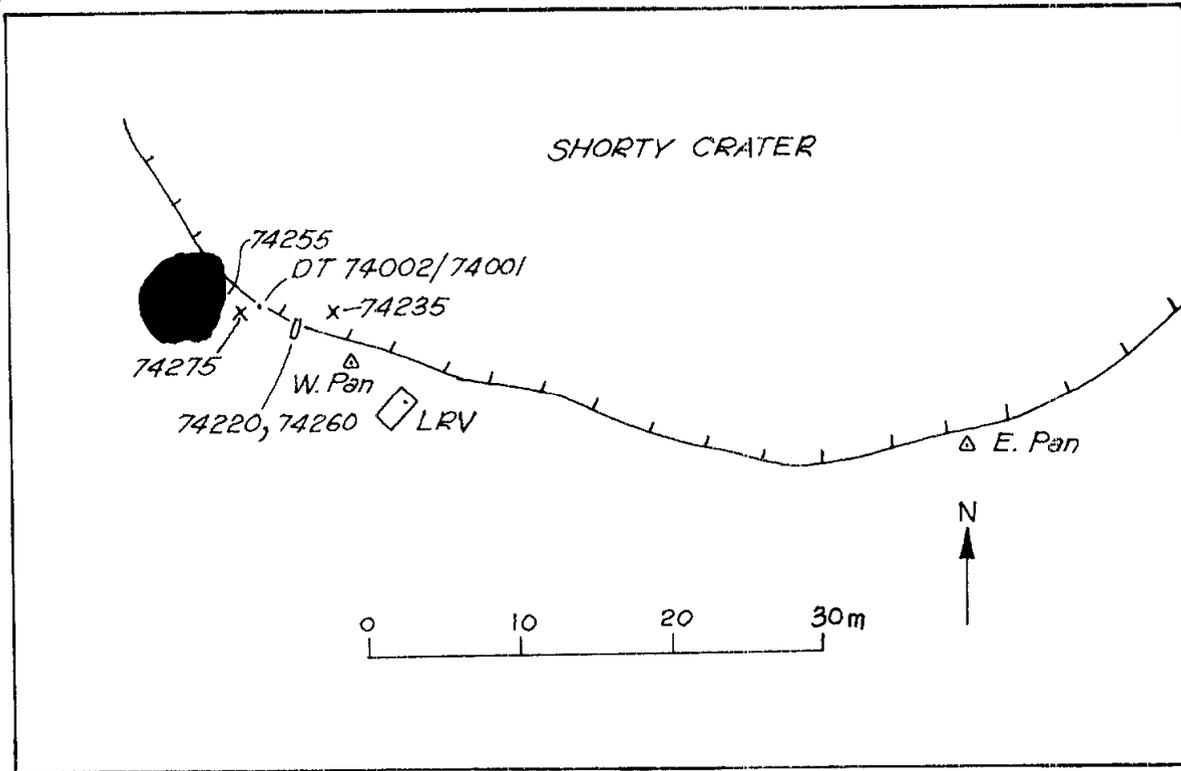


Figure 2e - Planimetric map of Station 4

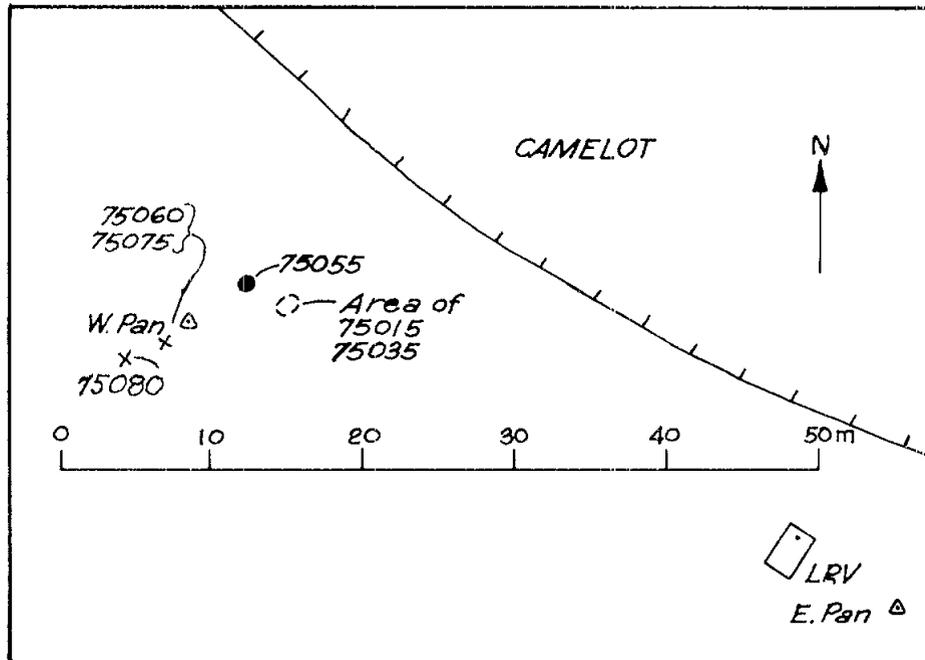


Figure 2f - Planimetric Map of Station 5

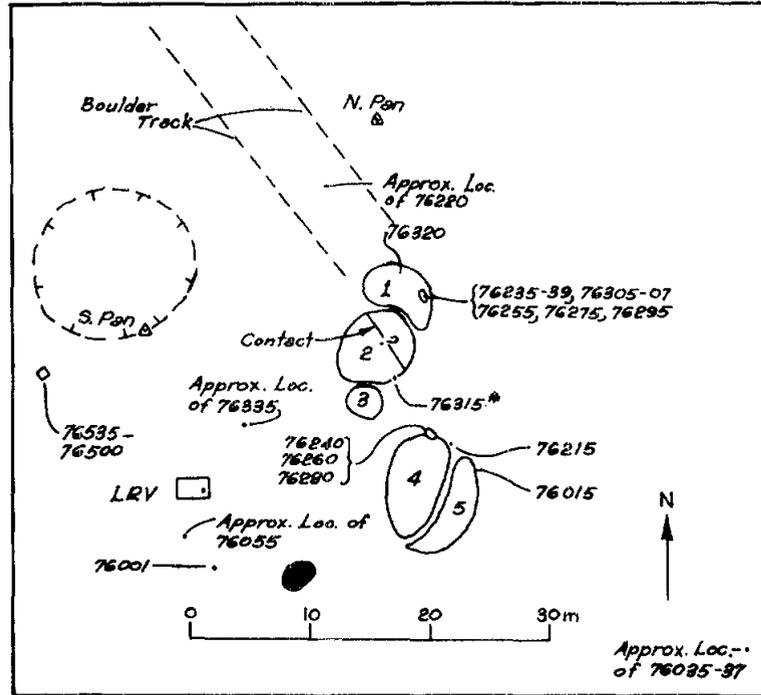


Figure 2g - Planimetric Map of Station 6

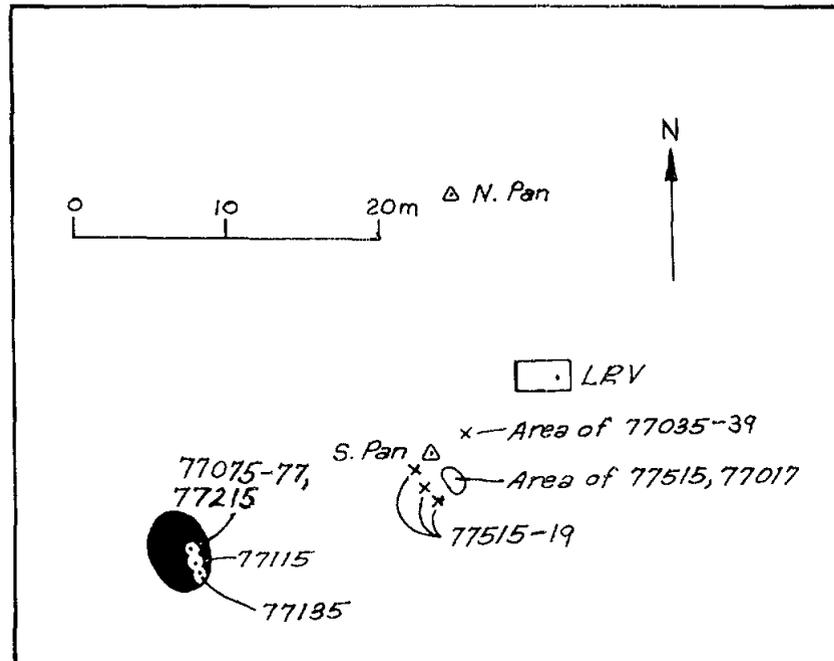


Figure 2h - Planimetric Map of Station 7

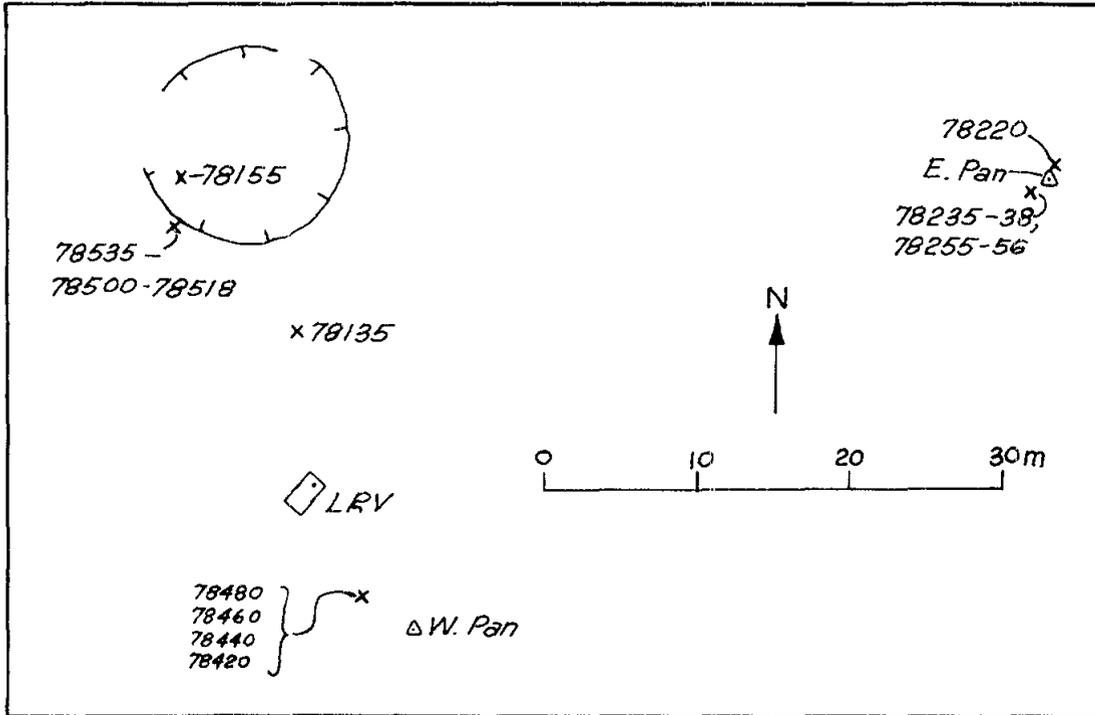


Figure 2i - Planimetric Map of Station 8

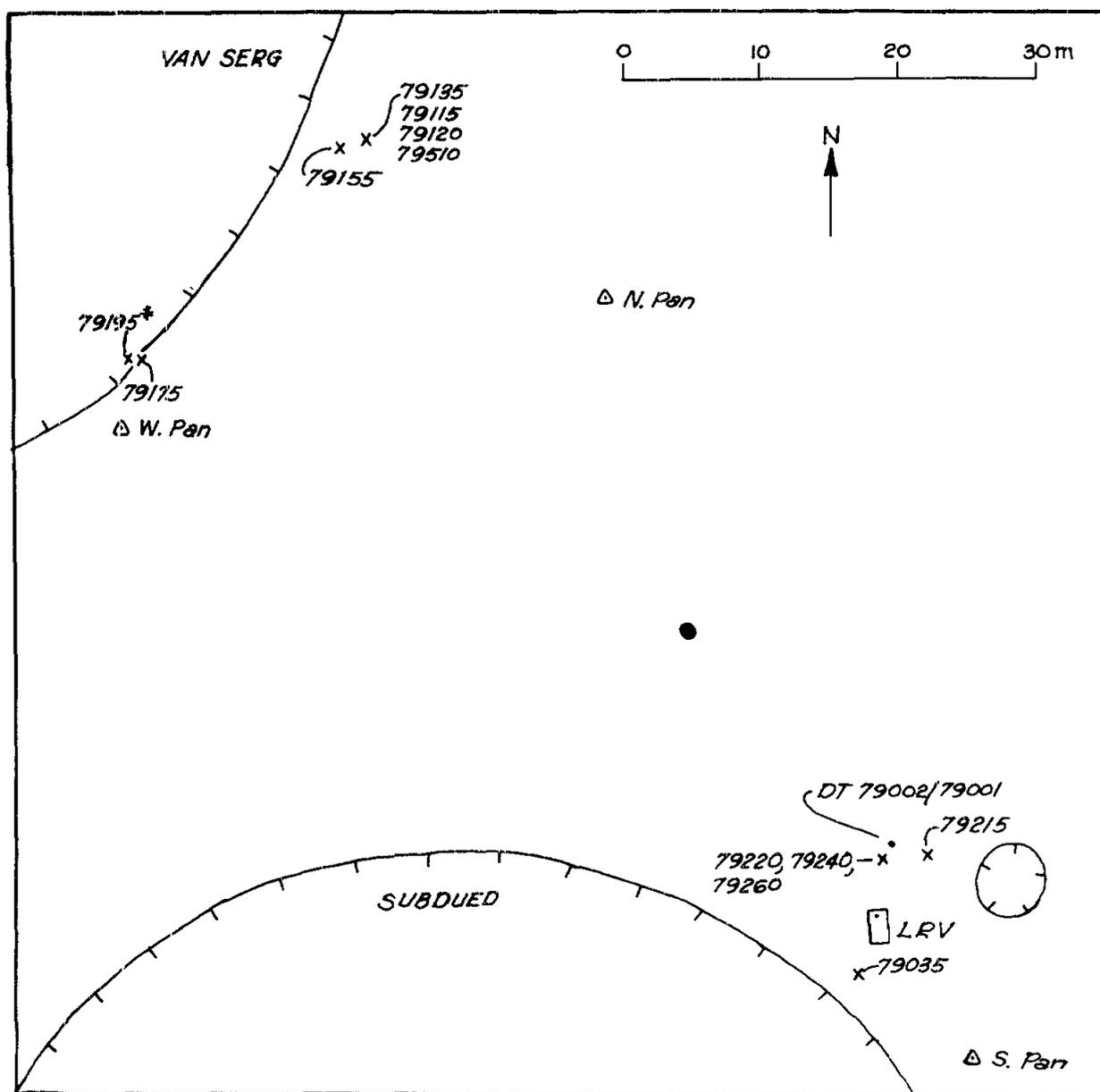


Figure 2j - Planimetric Map of Station 9

70275	Sample number
*	Tentative sample number
x	Sample location
70018?	Sample location uncertain
□	Rake and soil sample location
DT 73002/ 73001	Drive tube, upper/lower tube number
C/S	ALSEP Central Station
G/M	Geophone Module
EP6	Explosive Package Number 6
Geo-2	Geophone Number 2
HFE	Heat Flow Experiment
LEAM	Lunar Ejecta and Meteorites Experiment
LM	Lunar Module
LMS	Lunar Mass Spectrometer Experiment
LSG	Lunar Surface Gravimeter Experiment
LSP	Lunar Seismic Profiling Experiment
PAN Δ	60 mm Hasselblad panorama
RTG	Radioisotope Thermoelectric Generator
SEP	Surface Electrical Properties Experiment Transmitter
LRV □	Lunar Roving Vehicle, dot shows front of vehicle
●	Boulder - letters refer to large blocks on maps and pans
○	Crater

### Explanation

## SAMPLE RETURN ENVIRONMENTS AND CONTAINERS

Table III lists the contents of the sample return containers. This list in conjunction with the information in this section is intended to provide a means for evaluation of possible contamination of specific samples in the period from collection to introduction into nitrogen atmosphere cabinets.

Hand tools that contact the samples on the Moon were cleaned to MSC-SPEC-C-8, Class A Equipment at JSC. At Kennedy Space Center, the tools variously undergo fit and function checks before stowage on the spacecraft. Not all of these operations were conducted in clean rooms; furthermore, some of the tools may have been handled without gloves. To obtain an indication of the amounts and type of contaminants on the tools when they were stowed aboard the spacecraft, flush fluid samples were taken from the hammer head, the scoop, and the tines of the tongs using redistilled Freon. The levels of organic material extractable from the Freon were very low. The detailed results are in the JSC report on Contamination Control of Apollo 14 - 17 (in preparation).

The containers that came into contact with samples were cleaned to the same specifications as the cabinets, tools, and storage containers used for processing lunar sample on return. The two Sample Return Containers (SRC's) are sealable boxes machined from blocks of aluminum and lined with woven aluminum as padding (York mesh). The sample collection bags (SCB) were carried by the astronauts and are made of woven Teflon sandwiched between sheets of Teflon with York mesh padding on the lids. The BSLSS bag (Buddy Secondary Life Support System) is made of Beta cloth (woven fiberglass fibers coated with Teflon), and was carried on a rack on the LRV (Lunar Roving Vehicle). It was used to return large rocks and other samples after the third EVA.

Smaller samples were collected in documented bags (DB's), which are made of sheet Teflon. A DB is closed by wrapping it around aluminum strips in its lip and then folding over tabs at the ends of the strips.

Filled containers were moved to the ascent stage of the Lunar Module at the end of each EVA. Following repressurization and other activities, the SRC's and BSLSS were weighed and the SCB's were put into containment bags and weighed. The containment bag is a light duffle bag made of woven Beta cloth with a drawstring mouth. On the basis of the container weights, stowage locations to balance the spacecraft were assigned by Mission Control prior to lunar liftoff.

In the LM after EVA 1, the astronauts reopened SCB 2, removed rock 70035, held it with bare hands, and examined it with a hand lens to check the accuracy of their observations during the EVA. It is believed (but not corroborated) that no other samples from this or the other EVA's were unpacked in the LM and the containers remained closed until they were put into the nitrogen cabinets in the LRL.

Only the samples in sealed containers (two SRC's and the CSVC and the SESC) have not been exposed to spacecraft and terrestrial atmospheres. Most of the non-sealable containers were tightly closed, but circulation of spacecraft atmospheres in them was probably enhanced by depressurization and repressurization on the Moon and in space. There was depressurization at the start of each EVA and repressurization at the end, with an additional cycle prior to lunar liftoff to jettison unneeded equipment (but no samples, fortunately). A final cycle in the Command Module was made in the trans-Earth flight for retrieval of film from the Service Module.

Prior to transfer of the SCB's from the LM to the Command Module, each was put into a Beta cloth bag (decontamination bag) to keep the lunar dust adhering to the outsides of the return container from dirtying the inside of the Command Module.

After splashdown and loading of the command module on the recovery ship, the sample return containers were unstowed. The BSLSS bag, stowed in a Beta cloth bag (pressure garment assembly bag) on the floor of the command module, was wet through as it lay for 10 hours in 1/4 inch of water (either condensation or sea water). In an isolated work area with filtered air, the decontamination bags were removed from the SCB's and all of the return containers were individually bagged in two Teflon bags and one polyethylene bag, all heat sealed. The containers were transported to the LRL in this configuration in padded crates.

On receipt of the containers in Houston, the exterior of SRC 2 was cleaned, the vacuum measured, and then moved into the SNAP nitrogen atmosphere processing line for opening. SCB's 2 and 4 were transferred directly into the NNPL nitrogen atmosphere processing line as outer bagging was stripped off. One at a time, the bare SCB's, with tops swung back, were held isolated in the cabinet next to the entrance of the line and purged with  $N_2$  gas at 300 to 350 cfh until  $O_2$  and  $H_2O$  values were less than 30 ppm and 50 ppm respectively, a process that took about one hour.

SRC 1, the BSLSS bag, and the remaining SCB's were stripped of all bagging applied on the recovery ship and moved into nitrogen cabinets in SSPL for storage until they could be rebagged in nitrogen and transferred to a processing line for unpacking. It appeared to take somewhat longer than normal, using the values for NNPL as a baseline, for the cabinet with the BSLSS bag (and four SCB's) to reach low  $H_2O$  values. At a flow rate about 30 cfh of  $N_2$  (one-tenth that used for a purge in NNPL), four hours after the bags were put into the cabinet the values

were 65 ppm  $O_2$  and 650 ppm  $H_2O$ . Four hours later  $O_2$  was less than 10 ppm, but  $H_2O$  was 350 ppm and did not reach 20 ppm for about four days. The experience with SCB 2 and SCB 4 shows that after an initial predominance in the concentration of  $O_2$  over  $H_2O$ , under the  $N_2$  purge the two values quickly became roughly the same and are reduced together. For the stored bags; however, the  $H_2O$  values were much higher than the  $O_2$  values for several days.

Both SRC 1 and SRC 2 were successfully sealed on the lunar surface and showed vacuums of 175 microns and 28 microns Hg respectively just prior to opening in the nitrogen cabinets in the LRL. The other vacuum sample containers, the SESC and the CSVC (containing samples 70011 and 73001 respectively) appear to have been properly sealed on the lunar surface also. The CSVC was placed unopened into a vacuum container which was pumped down to 50 microns Hg and sealed off; the SESC was sealed in two Teflon bags.

In summary, sample containers SRC 1, SRC 2, SESC and CSVC were sealed in the lunar vacuum; the SRC's were unsealed in the  $N_2$  processing lines; the SESC and CSVC were left sealed. Samples in the BSLSS and SCB's have been subject to spacecraft atmospheres from five to seven days with from two to four depressurization-repressurization cycles, to terrestrial atmosphere nine to thirteen hours on the recovery ship, and sealed in a static terrestrial atmosphere for about one and one-half days until introduction into the LRL  $N_2$  processing and storage atmosphere. The known anomalies are the handling of 70035 with bare hands and the BSLSS resting in one-fourth inch of water for 10 hours before bagging on the recovery ship.

TABLE III - CONTENTS OF SAMPLE COLLECTION AND RETURN CONTAINERS

<u>SRC 1 (EVA 1)</u>	<u>SAMPLE Net wt (g)</u>	<u>SAMPLE NUMBER (Last 4 digits)</u>
<u>SCB 1</u>		
DB 454	673.6	1050, 1055
DB 455	282.547	1040-1049, 1075
DB 456	584.715	1060-1069, 1085-1089, 1095-1097
DB 457}	2268.321	1520, 1525-1529, 1535-1597*
DB 458}		
DB 459	1066.06	1500-1509, 1515
DB 474	316.173	0160-0165
DB 475	726.38	0180-0185
DB 476	313.87	1030, 1035-1037
DB 477	206.27	1130 - 1136
DB 478	98.531	1150-1157
DB 479	224.18	1170, 1175
Loose rock	51.580	0018
SCB residue	32.840	1010
	<u>Total</u>	
	6845.067	
<u>SRC 2 (EVA 2)</u>		
DB 464	951.9	5050, 5055
DB 465	187.1	5060-5066
DB 466	1015.26	5070, 5075
DB 467	1562.362	5080-5089
DB 469	159.9	0019
DB 509	1180.0	4220
DB 510	1040.978	4240-4249, 4285-4287
DB 511	526.7	4260
DB 518	369.1	2350, 2355
DB 519	18.18	2370, 2375
Core tube 31	429.7	3002
Core tube 35	909.6	4002
Core tube 44	1072.0	4001
CSVC (core tube 46)	809.0	3001
ALSRC residue	22.52	4010
	<u>Total</u>	
	10254.300	

TABLE III - CONTENTS OF SAMPLE COLLECTION AND RETURN CONTAINERS (Cont'd)

<u>SCB 2 (EVA 1)</u>	<u>SAMPLE Net wt (g)</u>	<u>SAMPLE NUMBER (Last 4 digits)</u>
DB 10E	492.08	0130, 0135-0157*
Loose rock	5765.0	0035
SCB residue	33.92	0030
	<hr/>	
Total	6291.00	
<u>SCB 4 (EVA 3)</u>		
DB 312	490.54	6240-6246
DB 313	292.93	6260-6265
DB 472	446.382	6280-6286
DB 535	646.64	6210, 6215
DB 536	411.23	6250, 6255
DB 537	56.39	6270, 6275
DB 538	270.35	6290, 6295
DB 546	98.88	8250, 8255
DB 548	292.62	8420-8424
DB 549	267.45	8480-8484
DB 551	251.59	8440-8444
DB 556	87.87	6230, 6235-6239, 6305-6307
DB 558	428.301	6530, 6535-6577*
DB 559	1026.97	6500-6506
DB 561	116.05	7110, 7115
DB 562	338.82	7130, 7135
DB 563	137.52	8130, 8135
DB 564	560.14	8230-8236, 8238
DB 565	1444.86	8525-8528, 8530, 8535-8599*
DB 566	1782.36	8500-8509, 8515-8518
DB 567	401.75	8150, 8155
Loose rock	2819.0	6015
SCB residue	20.31	6010
	<hr/>	
Total	12688.953	
<u>SCB 5 (EVA 3)</u>		
DB 46Y	303.92	6120-6124
DB 47Y	403.33	6130-6137
DB 49Y	563.63	6030-6037
DB 50Y	209.94	8120-8124
DB 53Y	233.360	0320-0324
DB 54Y	274.58	0310-0315
DB 55Y	381.91	0170, 0175
DB 480	2286.99	9130, 9135
DB 483	291.52	9220-9228
DB 484	330.34	9240-9245
DB 485	348.35	9260-9265

TABLE III - CONTENTS OF SAMPLE COLLECTION AND RETURN CONTAINERS (Cont'd)

<u>SCB 5 (EVA 3)</u>	<u>SAMPLE Net wt (g)</u>	<u>SAMPLE NUMBER (Last 4 digits)</u>
DB 568	412.60	9110, 9115
DB 569	374.3	9120-9125
DB 570	413.53	9510-9519, 9525-9537*
DB 571	324.43	9150, 9155
SESC 2	440.7	0011
SCB residue	87.05	9010
	<hr/>	
Total	7680.480	

<u>SCB 6 (EVA 2)</u>		
DB 27E	352.08	2140-2145
DB 28E	291.79	2150, 2155
DB 30E	287.68	3120-3124
DB 32E	241.40	3150-3156
DB 40Y	345.61	3140-3146
DB 462	1015.25	5010, 5015
DB 463	1237.63	5030, 5035
DB 512	759.86	4250, 4255
DB 514	381.03	2210, 2215
DB 515	63.57	2230, 2235
DB 516	132.49	2310, 2315
DB 517	109.26	2330, 2335
DB 520	79.54	3220-3225
DB 521	360.57	3240-3245
DB 522	326.23	3260-3264
DB 523	169.13	3280-3285
DB 524	899.64	3230, 3235
DB 525	409.35	3250, 3255
DB 526	452.03	3270, 3275
DB 527	1504.13	3210-3219
SCB residue	34.56	3010
	<hr/>	
Total	9452.83	

<u>SCB 7 (EVA 3)</u>		
DB 15E	65.26	0060-0064
DB 45Y	417.56	0290, 0295
DB 481	721.12	9170, 9175
DB 482	381.88	9190, 9195
DB 486	559.35	9210, 9215
DB 534	612.84	6220-6224
DB 539	696.49	6310, 6315
DB 540	759.61	7510-7519, 7525-7526
DB 541†	1730.0	7017
DB 542	1340.56	7530-7539, 7545
DB 543	958.10	7210, 7215
DB 544	201.10	7070, 7075-7077

TABLE III - CONTENTS OF SAMPLE COLLECTION AND RETURN CONTAINERS (Cont'd)

<u>SCB 7 (EVA 3)</u>	<u>SAMPLE Net wt (g)</u>	<u>SAMPLE NUMBER (Last 4 digits)</u>
DB 545	344.78	8220-8224
DB 550	413.057	8460-8465
DB 557	813.74	6320-6324
Core tube 37	409.4	9002
Core tube 48	711.6	6001
Core tube 50	743.4	9001
SCB residue	93.65	7010
	<hr/>	
Total	11973.497	
<u>SCB 8 (EVA 2)</u>		
DB 12E	59.74	4230, 4235
DB 22E	339.24	0250, 0255
DB 23E	264.72	0270-0275
DB 26E	557.37	2130-2135
DB 29E	250.002	2160-2164
DB 31E	238.07	3130-3134
DB 41Y	282.52	4110-4119
DB 42Y	385.87	4120-4124
DB 43Y	383.93	5110-5115
DB 44Y	375.211	5120-5124
DB 461	1502.61	4270, 4275
DB 494	468.94	2250, 2255
DB 495	3666.11	2270, 2275
DB 496	388.56	2220-2224
DB 497	322.42	2240-2244
DB 498	279.0	2260-2264
DB 499	557.03	2390, 2395
DB 500	106.31	2320-2324
DB 501	436.041	2530, 2535-2559*
DB 502	1060.82	2500-2505
DB 503	110.74	2410, 2415-2418
DB 504	241.47	2430-2435
DB 505	450.39	2440-2444
DB 506	125.01	2460-2464
DB 507	108.9	2730, 2735-2738
DB 508	885.40	2700-2705
SCB residue	76.92	2010
	<hr/>	
Total	14,023.344	

TABLE III - CONTENTS OF SAMPLE COLLECTION AND RETURN CONTAINERS (Concl)

<u>BSLSS (EVA 3)</u>	<u>SAMPLE Net wt (g)</u>	<u>SAMPLE NUMBER (Last 4 digits)</u>
DB 108	5.75	0070, 0075
DB 560	771.5	6330, 6335
Core tube 52	485.0	0012
Loose rock	2957.0	0017
Loose rock	8110.0	0215
Loose rock	6412.0	6055
Loose rock	5727.0	7035
Loose rock	2806.0	9035
BSLSS residue	2260.5	0050-0054
	<hr/>	
Total	29,534.75	
 <u>Drill Stem Bag</u>		
Drill stems	1772.78	0001-0009
Adhering dust	3.92	0010
	<hr/>	
Total	1776.70	
 <u>Astronauts Suits</u>	 2.494	 0040
 <u>GRAND TOTAL,** Apollo 17 Sample Weight</u> 110,523.415 g (243.7 lb)		

† The rock was only partly within the DB, so the DB residue was combined with the SCB residue.

\* Exclusive of numbers ending in digits 0-4.

\*\* Total does not include sample material that eventually will be recovered by washing the sample collection and return containers with Freon, and that is contained with material vacuumed from the command module. Such sample material remaining to be recovered is expected to total considerably less than 100 g.

The sequence of processing rock samples is as follows:

1. Unpacking from the return container (documented bag or sample collection bag) with photographic record made of the configuration of the containers and samples in them.

2. Attempts are made to rematch any fragments that may have broken from rocks in transit.

3. Assignment of number, weighing and identification photography of rocks.

4. Dusting with a gentle jet of  $N_2$  gas, except for very friable rocks.

5. Orthogonal photography - 4x5 inch color views taken at  $90^\circ$  to one another. The rock is positioned on a rotatable photo stage on a stable face, usually with the longer axis right to left. A laboratory orientation cube, marked  $N_1$ ,  $E_1$ ,  $S_1$ ,  $W_1$ ,  $T_1$  and  $B_1$ , is placed with  $N_1$  facing the camera for the first photograph. The cube is then rotated synchronously with the rock for all other views. Four orthogonal views are made of rocks less than about 12.5 grams and six of all larger rocks. For fragile rocks, where handling would tend to disaggregate them, inclined views are substituted for the  $T_1$  and  $B_1$  views. Individual sets of orthogonal views are taken of the larger pieces of broken rocks. Small rocks from soils samples and rake-sample rocks are photographed in groups.

6. No further processing is done until a set of prints of the orthogonal photography has been returned to the laboratory for reference and marking special features.

7. Rock description - The rocks are described through windows in the nitrogen processing cabinet with the aid of binocular microscopes outside of the cabinets.

8. Rock modeling and measurement - All coherent rocks weighing more than about 50 grams have aluminum foil shells molded around them. At the same time 3 caliper measurements are made (between points photographically documented) for dimensional control of the models. The shells are transferred out of the lines and serve as molds for plaster casts. With the aid of the orthogonal photography, plaster casts are sculptured to the shape of the rocks. Plaster models of fragile rocks are made entirely from photographs. A rubber mold of the plaster cast serves for making the epoxy models that are used as a record of the original rock shape and for the planning and documentation of cutting and chipping operations.

9. Stereophotography - For all coherent rocks greater than about 50 grams. The rock is positioned on the photographic stage with the laboratory orientation cube in conformity with the orthogonal photography orientations. Sixteen stereographic pairs at 45° increments are made with 4x5 or 8x10 inch (depending on rock size) color negatives.

10. Field geology experiment - Coherent rocks are placed on the photographic stage and illuminated with a collimated light. The rocks are maneuvered to reproduce the shadowing and appearance of rocks in lunar surface photographs. The rocks are then photographed with the laboratory orientation cube in view to establish the relationship between laboratory and lunar orientations. Table II gives lunar orientation in terms of the laboratory orientation for each oriented rock.

Soil samples are processed as follows:

1. The documented bags are opened and observations and photographs are made of the condition of the sample.

2. Any large rocks are removed.

3. One-quarter to one-third of the sample is scooped from the bag, placed in a preweighed container, weighed and stored as an unsieved reserve sample. In special cases, larger reserves are maintained, or the entire soil sample remains unsieved.

4. The remaining sample is sieved to produce the size fractions <1 mm, 1-2 mm, 2-4 mm, and 4-10 mm. Each fraction is weighed and numbered with its own five digit sample number (see the section on numbering conventions). Each coherent piece >10 mm is processed as a rock.

On the basis of information developed in the first part of the preliminary examination period, the Lunar Sample Analysis Planning Team (LSAPT) requests that further studies, such as thin section petrography and chemical analyses, be made on selected samples. The preliminary examination period is ended when these studies are completed and all the results are reported to LSAPT, at which time they plan the allocations of samples to Principal Investigators.

A note on the weighing of samples:

All samples are weighed inside the nitrogen atmosphere processing cabinets on Ainsworth electric balances (in aluminum cases with electronic readout outside of the cabinets) with maximum capacities of 10 kg and 2 kg and tolerances of ±5 g and ±0.8 g respectively at these maximum values. The lowest range on the 2 kg balance is  $20 \pm 0.05$  g (the tolerances were set outside of the manufacturer's

specifications because of vibration and gas flow in the cabinets). Although weighings are precise to no more than four significant figures, the expression of some sample weights in this catalog to five or more figures results from summation of subsample weights obtained with greater precision than possible if all were weighed together.

During this mission the lunar sample processing cabinets were kept at positive nitrogen pressure (1-inch water pressure relative to the room), without any sterilization requirements.

Prior to the arrival of the lunar samples, all processing cabinets and equipment were cleaned to specifications in Cleaning Procedures for Contamination Control (MSC 03243). Materials forming the interiors of the cabinets, and the exteriors of tools and equipment used within the cabinets, are limited to stainless steel, aluminum, Teflon, neoprene rubber, Viton gaskets, polysulfide sealant (NNPL only) and Lexan or glass.

Lubrication of screw threads (bolt-top containers, laboratory jacks, etc.) is done sparingly with molybdenum disulfide. Bolt-top containers, used for the reserve fines were lubricated with non-pigmented Xylan 1010. During processing and storage the lunar sample normally comes in contact with only aluminum, stainless steel, and Teflon. Some samples, mainly fines, may on rare occasions come in contact with the Viton gaskets used to seal certain containers.

The nitrogen atmosphere of the cabinets was monitored for oxygen, argon, hydrogen, methane, carbon dioxide and carbon monoxide. The oxygen level varied from cabinet to cabinet with the highest reading being in the inbound transfer cabinets as expected. In static mode, the oxygen was maintained at less than 10 ppm. During the processing the oxygen varied from 10 to 30 ppm. A Varian-Aerograph model 1732-20 trace gas analyzer was used to monitor the volatile gases in the nitrogen glove boxes. The moisture was analyzed using a DuPont moisture analyzer, model 26-303. A Teledyne trace oxygen analyzer model 316-1 was also used to monitor oxygen.

Particulate testing was conducted after the cabinetry was cleaned but prior to introduction of tools and equipment. This was done to obtain an estimate of cabinet cleanliness before each mission. The particle testing consisted of placing fallout coupons in various sections of the cabinets for 4 to 6 days. The cabinets were in the quiescent state during testing. In addition, a vacuum sample was taken for microprobe analysis. The fallout coupons indicated that there was negligible particulate contamination. Those few particles found were identified as viton, stainless steel, Teflon, or molybdenum disulfide, using the electron microprobe.

In samples analyzed by PI's, the Apollo 15 lunar drill cores were shown to contain massive lead contamination. A thorough study of lead contamination was carried out. By refinishing and carefully acid cleaning the Apollo 17 cores, the lead contamination was removed. However, during the investigation it was found that tools and containers cleaned by the White Sands Test Facility carried small amount of contaminant lead. As this was discovered shortly before Apollo 17, it was impossible to reclean all containers, but all tools that came in immediate contact with unsieved fines samples (including all sieves) were acid washed and recleaned. All reserve fines samples (7xxx0) are stored in acid washed containers.

CHEMICAL ANALYSES

Jan - April 1973

By: Rhodes, Rodgers, Bansal

X-ray fluorescence spectrometry was used for measuring major and trace element abundances, with the exception of sodium which was analyzed by atomic absorption spectrography.

The major and minor elements were determined using a fused glass disc prepared by fusing a 280 mg aliquot of the sample with a lanthanum-bearing lithium borate fusing mixture (Norrish and Hutton, 1969). Na was analyzed by atomic absorption analysis on a separate 10-20 mg portion of the sample.

Trace elements (Sr, Rb, Y, Zn, Ni, Nb, Zr, Cr) were determined non-destructively using powdered samples and corrections made for matrix effects either by direct measurement of mass-absorption coefficients or, as in the case of Cr, calculating them from the major element data (Norrish and Chappell, 1967).

Calibrations, for both techniques, were based on primary synthetic standards supplemented by previously analyzed U.S.G.S. and N.B.S. rock and mineral standards.

The analyses are presented in Tables IVa (soils) and IVb (rocks).

## References:

Norrish, K., and Chappell, B. W. (1967). X-ray fluorescence spectrography In "Physical Methods in Determinative Mineralogy" (editor, J. Zussman) pp. 161-214, Academic Press.

Norris, K., and Hutton J. T. (1969). An accurate X-ray spectrographic method for the analysis of a wide range of geological samples. Geochim. Cosmochim. Acta 33, 431-453.



## EVOLVED GAS STUDIES

By: Gibson and G. Moore

DATE: 12/26/72 to 1/25/73

The results of the evolved gas study on Apollo 17 samples are given in Figures 3a to 3c. The procedures used have been described previously by Gibson and Moore, 1972 and Gibson 1972, 1973. The lunar samples were analyzed with a Mettler recording vacuum thermal analyzer interfaced with a Finnigan 1015S/L quadrupole mass spectrometer. The source of the mass spectrometer was placed directly in the reaction chamber. With this arrangement the evolved gases are analyzed without requiring any gas transfer procedures. Soil samples between 150 mg and 300 mg were used in this study. They were placed in a previously outgassed 16 mm diameter platinum crucible and evacuated to  $2 \times 10^{-6}$  torr. The sample weight, temperature, and chamber pressure were continuously recorded. The sensitivity of the thermal balance used for the weight-loss studies is  $\pm 0.05$  mg. The samples were heated from ambient temperature to  $1400^{\circ}\text{C}$  at a heating rate of  $6^{\circ}\text{C}/\text{min}$ . Sample temperatures were measured with calibrated Pt/Pt-10%Rh thermocouples located at the base of the sample crucible. Spectra were obtained every  $5^{\circ}\text{C}$  during the heating cycle by the automatic mass spectrometer-computer control. The small laboratory computer that controls the operation of the mass spectrometer collected analytical data as a function of signal strength. The analytical data were stored on magnetic tape until processing after the programmed heating cycle was completed. Reproducible background spectra were obtained during the bakeout procedure with an empty crucible before sample analysis and were later subtracted from the spectra obtained for the lunar samples.

E. K. Gibson, Jr., *Thermochimica Acta* 4, 49-56 (1972)

E. K. Gibson, Jr., *Thermochimica Acta* 5, 243-255 (1973)

E. K. Gibson, Jr. and G. W. Moore, *Proc. Third Lunar Sci. Conf.*  
Vol. 2, 2029-2040 (1972).

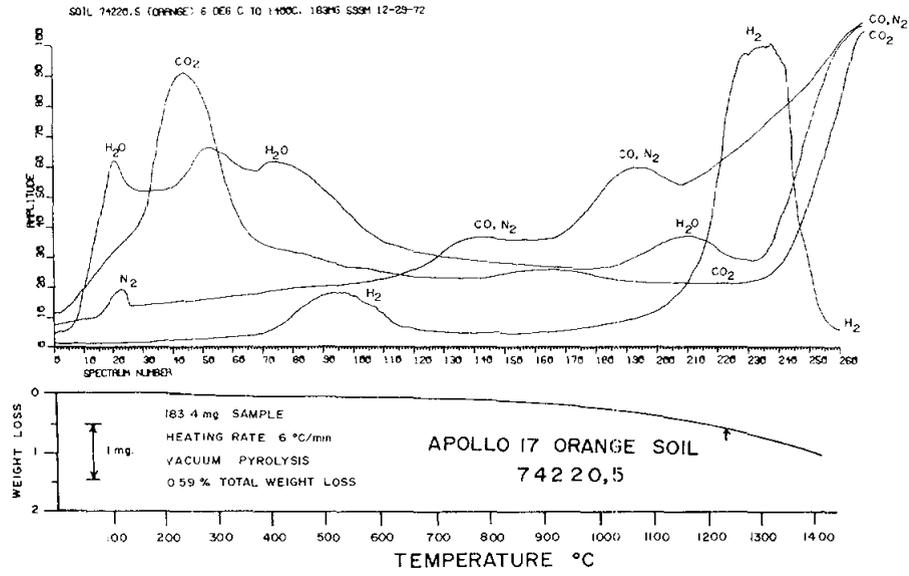


Figure 3a

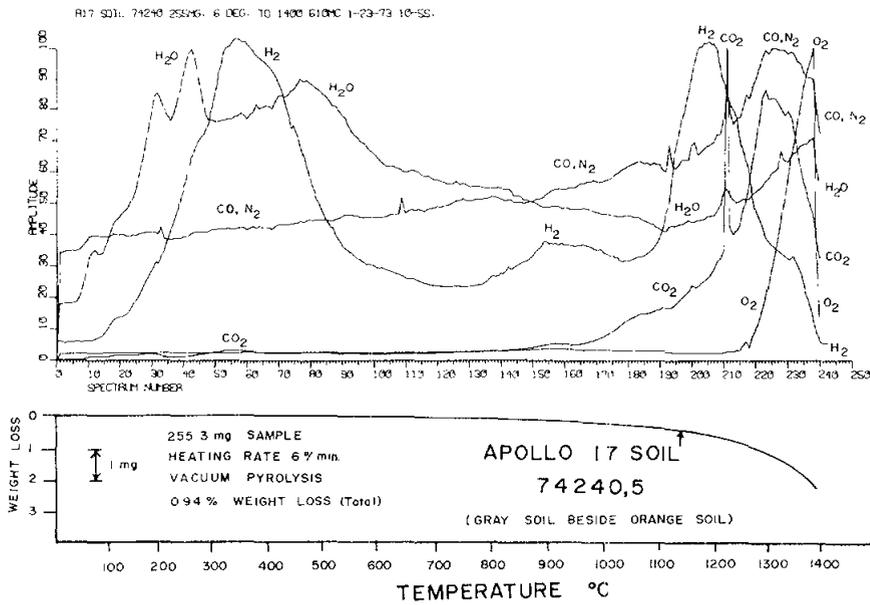


Figure 3b

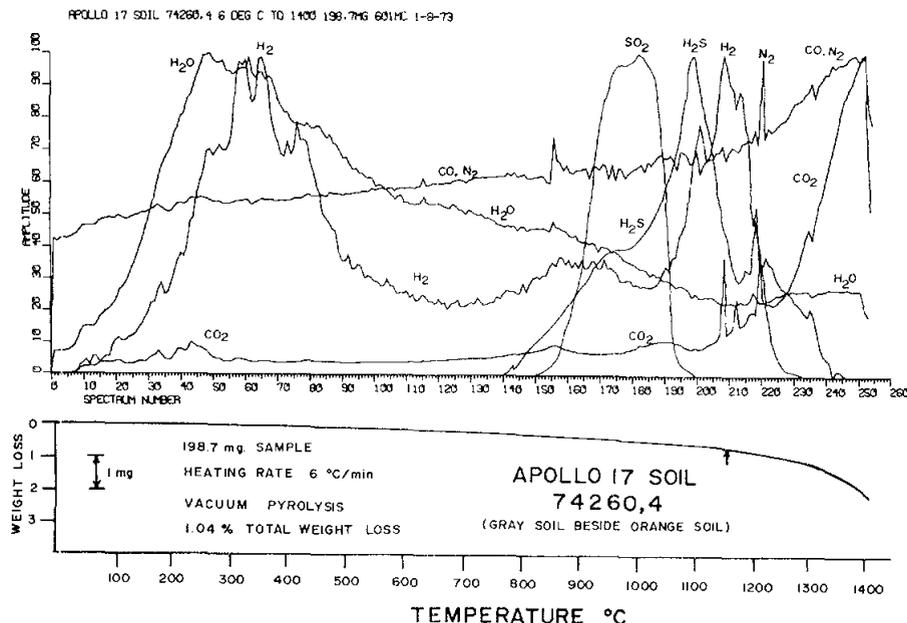


Figure 3c

Figure 3a. Gas release profile and weight-loss curve for Apollo 17 orange soil 74220,5. Sample heated in platinum crucible at 6°C/minute to 1400°C. Each gas shown has been normalized to its greatest release temperature (100% amplitude). Sulfur containing gases (e.g., H<sub>2</sub>S and SO<sub>2</sub>) have not been plotted. Note the low temperature (between 200 and 400°C) carbon dioxide component which is not characteristic of most mature lunar soils. The sample has low solar wind components.

Figure 3b. Gas release profile and weight-loss curve for Apollo 17 soil 74240,5 taken beside the orange soil. Sample heated in platinum crucible at 6°C/minute to 1400°C under vacuum. Each gas shown has been normalized to 100% in the region of its greatest release (100% amplitude). Sulfur containing gases (e.g., H<sub>2</sub>S and SO<sub>2</sub>) have not been plotted. The gas release profile for soil 74240 is typical of most mature lunar soils.

Figure 3c Gas release profile and weight-loss curve for Apollo 17 soil 74260,4 collected beside the orange soil 74220. Sample heated in platinum crucible at 6°C/minute to 1400°C under vacuum. Each gas shown has been normalized to 100% in the region of its greatest release (100% amplitude). Sulfur gases have been plotted. The gas release profile for soil 74260 is typical of most mature lunar soils.

TABLE Va. - GAMMA RAY ANALYSIS OF SOILS

SAMPLE	71011,4	71041,4	71001,5	71131,1	73021,0	73041,1	73061,4	74001,9	74270,9	75061,5	75061,5
WEIGHT (g)	111.1	111.1	100.0	109.18	46.0	100.06	194.34	104.9	743.9	100.0	100.0
LAB*	BNW	BN	BN	ORNL	ORNL	ORNL	ORNL	BN	BN	BNW	BN
Th (ppm)	166 ± 103	3190 ± 1008	1110 ± 2110	2124 ± 111	2113 ± 111	2125 ± 111	2140 ± 110	105 ± 109	610 ± 110	187 ± 103	191 ± 113
U (ppm)	111 ± 101	2120 ± 2100	2120 ± 2120	112 ± 101	111 ± 101	111 ± 101	111 ± 101	111 ± 101	111 ± 101	111 ± 101	111 ± 101
K (%)	100 ± 1004	100 ± 100	100 ± 100	111 ± 1006	111 ± 1006	111 ± 1006	111 ± 1006	111 ± 1006	111 ± 1006	111 ± 1006	111 ± 1006
<sup>26</sup> Al (dpm/kg)	170 ± 4	111 ± 10	45 ± 10	51 ± 3	111 ± 10	111 ± 10	111 ± 10	111 ± 10	111 ± 10	111 ± 10	111 ± 10
<sup>22</sup> Na (dpm/kg)	120 ± 4	135 ± 20	61 ± 10	126 ± 5	230 ± 15	110 ± 5	111 ± 10	111 ± 10	111 ± 10	111 ± 10	111 ± 10
<sup>54</sup> Mn (dpm/kg)	190 ± 10	220 ± 20	114 ± 10	75 ± 10	230 ± 30	80 ± 8	111 ± 10	111 ± 10	111 ± 10	111 ± 10	111 ± 10
<sup>56</sup> Co (dpm/kg)	304 ± 10	400 ± 50	135 ± 30	119 ± 12	810 ± 40	95 ± 10	111 ± 10	111 ± 10	111 ± 10	111 ± 10	111 ± 10
<sup>60</sup> Co (dpm/kg)	72 ± 3	85 ± 30	34 ± 15	15 ± 3	33 ± 6	10 ± 3	8 ± 5	19.1 ± 1.6	46 ± 15	112 ± 7	86 ± 5
<sup>89</sup> Sr (dpm/kg)	27 ± 15							15 ± 11		27 ± 15	47 ± 12
<sup>90</sup> Co (dpm/kg)	<2.2							<5		<2.2	5.7 ± 1.3
<sup>7</sup> Be (dpm/kg)			106 ± 110		450 ± 350				<10	350 ± 120	
<sup>51</sup> Cr (dpm/kg)		14 ± 5							3 ± 2		
<sup>57</sup> Co (dpm/kg)										18 ± 7	
<sup>58</sup> Co										21 ± 4	
Th/U	3.9 ± 1.2	1.6 ± 1.4	3.8 ± 1.6	3.6 ± 1.2	3.4 ± 1.2	3.5 ± 1.2	3.6 ± 1.3	4.0 ± 1.6	1.0 ± 1.7	1.0 ± 1.0	3.1 ± 1.6
K/U	2900 ± 200	3000 ± 1300	2300 ± 700	840 ± 130	1870 ± 130	1900 ± 130	1630 ± 130	4100 ± 280	4100 ± 1100	2700 ± 180	2700 ± 160

SAMPLE	76040,2	76040,2	76261,1	76261,1	76501,4	76421,1	76461,1	76461,4	7650,4	79221,4	79261,4
WEIGHT (g)	104.98	104.98	100.7	100.7	97.89	94.51	101.27	101.27	115.24	100.9	100.2
LAB*	RCL	BNW	RCL	BNW	ORNL	BNW	BNW	BN	ORNL	ORNL	ORNL
Th (ppm)	2.5 ± 1.3	2.40 ± 1.06	2.1 ± 1.3	1.92 ± 1.04	1.39 ± 1.14	1.58 ± 1.01	1.49 ± 1.05	1.4 ± 0.8	1.11 ± 1.11	1.12 ± 1.06	1.08 ± 1.05
U (ppm)	1.61 ± 1.04	1.60 ± 1.00	1.60 ± 1.00	1.51 ± 1.00	1.31 ± 1.04	1.51 ± 1.00	1.50 ± 1.00	1.4 ± 0.8	1.11 ± 1.11	1.12 ± 1.06	1.11 ± 1.05
K (%)	1119 ± 1004	1110 ± 1000	1100 ± 1000	1097 ± 1004	1090 ± 1000	1084 ± 1000	1085 ± 1000	107 ± 100	1119 ± 1004	1070 ± 1004	1070 ± 1004
<sup>26</sup> Al (dpm/kg)	114 ± 11	151 ± 6	182 ± 17	171 ± 5	90 ± 9	111 ± 2	111 ± 2	111 ± 2	111 ± 2	111 ± 2	111 ± 2
<sup>22</sup> Na (dpm/kg)	42 ± 3	42 ± 2	148 ± 8	142 ± 4	90 ± 9	39 ± 2	284 ± 12	290 ± 40	111 ± 10	111 ± 10	111 ± 10
<sup>54</sup> Mn (dpm/kg)	19 ± 6	31 ± 8	93 ± 7	106 ± 8	60 ± 10	12 ± 8	268 ± 10	310 ± 40	111 ± 10	111 ± 10	111 ± 10
<sup>56</sup> Co (dpm/kg)	25 ± 1	27 ± 3	240 ± 20	245 ± 8	120 ± 12	<20	606 ± 30	700 ± 50	111 ± 10	111 ± 10	111 ± 10
<sup>89</sup> Sr (dpm/kg)	7.5 ± 1.9	8 ± 4	24 ± 2	27 ± 3	18 ± 4	111 ± 21	59 ± 2	100 ± 20	111 ± 10	111 ± 10	111 ± 10
<sup>90</sup> Co (dpm/kg)	4.0 ± 1.6	1.8 ± 1.4	12 ± 5	<1.5		1.6 ± 1.8	1.0 ± 1.8		111 ± 10	111 ± 10	111 ± 10
<sup>7</sup> Be (dpm/kg)							370 ± 90	<110			
<sup>51</sup> Cr (dpm/kg)							<340	100 ± 60			
<sup>57</sup> Co (dpm/kg)							18 ± 8	14 ± 4			
<sup>58</sup> Co							18 ± 12	33 ± 10			
Th/U	4.1 ± 1.5	3.8 ± 1.2	4.3 ± 1.6	3.8 ± 1.2	3.7 ± 1.5	3.9 ± 1.3	3.8 ± 1.2	3.5 ± 1.6	4.0 ± 1.6	3.1 ± 1.3	3.5 ± 1.3
K/U	2000 ± 120	1800 ± 100	2100 ± 100	1900 ± 110	2400 ± 300	2000 ± 110	2400 ± 150	1800 ± 600	2500 ± 300	1900 ± 200	2260 ± 190

## \*Key to Laboratories

BNW - L. A. Benoit, B. W. Jenkins,  
W. D. Felix and N. A. Wegman  
Battelle, Pacific Northwest Laboratories

RCL - J. E. Keith and R. S. Clark  
NASA-Johnson Space Center  
W. R. Portenier and M. K. Robbins  
Northrop Services, Incorporated

BN - Ernst Schonfeld  
NASA-Johnson Space Center

ORNL - G. D. O'Keefe, T. S. Eldridge and  
K. J. Northcutt  
Oak Ridge National Laboratory

TABLE Vb. - GAMMA RAY ANALYSIS OF ROCKS

SAM. NO.	70135,0	70175,0	70.85,0	70255,0	70275,0	70285,0	71155,0	71155,0	72255,0	72355,0	72415,0
NETGROSS (%)	14.0	334.6	11.9	224.9	171.4	144.1	25.8	25.8	402.57	367.1	29.47
LAB#	ORNL	POL	JRNL	RCL	RCL	BNW	BNW	RCL	RCL	RCL	RCL
Tn (ppm)	.30 ± .06	.40 ± .04	.30 ± .03	.31 ± .03	.42 ± .04	.34 ± .03	.29 ± .05	.31 ± .03	4.1 ± .4	5.3 ± .3	<.15
U (ppm)	.11 ± .02	.205 ± .007	.10 ± .02	.107 ± .008	.107 ± .008	.11 ± .01	.13 ± .02	.109 ± .018	1.20 ± .15	1.39 ± .04	<.06
K (%)	.046 ± .0010	.055 ± .002	.042 ± .004	.048 ± .008	.0421 ± .0018	.027 ± .003	<.030	.039 ± .003	.184 ± .008	.253 ± .005	.012 ± .007
<sup>26</sup> Al (dpm/kg)	37 ± 8	42 ± 6	70 ± 4	49 ± 6	92 ± 9	90 ± 8	105 ± 4	92 ± 17	75 ± 6	84 ± 6	77 ± 6
<sup>22</sup> Na (dpm/kg)	11 ± 9	76 ± 18	50 ± 4	72 ± 7	90 ± 16	97 ± 8	112 ± 4	112 ± 24	61 ± 5	87 ± 6	290 ± 30
<sup>60</sup> Co (dpm/kg)	47 ± 15	156 ± 9	95 ± 10	137 ± 15	120 ± 10	157 ± 15	227 ± 10	160 ± 80	41 ± 6	66 ± 7	77 ± 16
<sup>137</sup> Cs (dpm/kg)	59 ± 20	330 ± 70	105 ± 10	211 ± 10	200 ± 20	326 ± 30	310 ± 20	180 ± 70	35 ± 15	58 ± 13	150 ± 30
<sup>134</sup> Cs (dpm/kg)	30 ± 10	39 ± 5	47 ± 5	63 ± 6	35 ± 4	84 ± 6	80 ± 2	81 ± 1	6 ± 6	12 ± 3	8 ± 3
<sup>90</sup> Y (dpm/kg)		17 ± 5		<.30	32 ± 10						
<sup>60</sup> Ca (dpm/kg)		1.79 ± .08		<.25	1.17 ± .08		<.1			<.1	
<sup>76</sup> Se (dpm/kg)											
<sup>51</sup> Cr (dpm/kg)											
<sup>54</sup> Co (dpm/kg)											
<sup>58</sup> Co (dpm/kg)											
Th/U	3.9 ± .4	3.4 ± .3	3.9 ± .7	2.9 ± .4	3.9 ± .5	4.0 ± .5		2.6 ± .9	3.7 ± .5	3.8 ± .2	
K/U	1000 ± 1000	1000 ± 100	1200 ± 900	15 ± 500	3900 ± 300	1000 ± 400	112 ± 15	6000 ± 100	1500 ± 200	1820 ± 60	

SAMPLE	75055,0	76015,0	76215,0	76255,0	76275,0	76295,0	76295,0	77135,0	78135,0	78235,0	79155,0
NETGROSS (%)	42.9	2813.0	610.8	393.2	55.93	260.7	260.7	310.7	333.9	128.8	316
LAB#	BNW	RCL	RCL	BNW	BNW	ORNL	BNW	BNW	RCL	RCL	ORNL
Tn (ppm)	.70 ± .02	1 ± 3	1.6 ± .2	2.35 ± .05	5.4 ± .4	2.30 ± .27	5.70 ± .27	3.5 ± .5	1.26 ± .05	.59 ± .08	.31 ± .06
U (ppm)	.10 ± .01	1 ± 3	1.27 ± .02	.98 ± .02	1.32 ± .10	1.20 ± .05	1.55 ± .05	1.42 ± .14	1.07 ± .017	1.96 ± .016	.12 ± .03
K (%)	.065 ± .0035	.30 ± .06	1.15 ± .014	1.071 ± .000	1.022 ± .009	.227 ± .011	.230 ± .009	1.85 ± .015	1.6525 ± .0016	1.0495 ± .0015	.041 ± .004
<sup>26</sup> Al (dpm/kg)	89 ± 7	detected	50 ± 3	72 ± 4	111 ± 9	67 ± 5	71 ± 4	100 ± 11	42 ± 4	77 ± 7	70 ± 10
<sup>22</sup> Na (dpm/kg)	85 ± 5	detected	60 ± 4	71 ± 4	95 ± 6	94 ± 4	64 ± 3	100 ± 10	74 ± 5	111 ± 8	77 ± 10
<sup>60</sup> Co (dpm/kg)	139 ± 15	detected	127 ± 17	32 ± 8	123 ± 20	32 ± 15	70 ± 30	21 ± 15	180 ± 20	55 ± 8	110 ± 20
<sup>137</sup> Cs (dpm/kg)	210 ± 15	detected	45 ± 6	37 ± 4	64 ± 6	41 ± 7	35 ± 1	60 ± 7	240 ± 20	52 ± 9	155 ± 30
<sup>134</sup> Cs (dpm/kg)	62 ± 7	detected	2 ± 1	3.9 ± 1.3	7 ± 2	5 ± 2	5.4 ± 2.6	7.2 ± 2.7	16 ± 5	1.4 ± .9	62 ± 10
<sup>90</sup> Y (dpm/kg)	<.2		<.2	1.7 ± 0.6				3 ± 3	12 ± 5	<.2	
<sup>60</sup> Ca (dpm/kg)	1 ± 0		<.5		<.11		<.12	4 ± 3	<.35	3.4 ± 1.2	
<sup>76</sup> Se (dpm/kg)	1.0 ± .2	detected									
<sup>51</sup> Cr (dpm/kg)	75 ± 40	detected									
<sup>54</sup> Co (dpm/kg)	1.4 ± 1.7										
<sup>58</sup> Co (dpm/kg)	7.0 ± 3.5	detected									
Th/U	1.3 ± .4	1 ± 1.6	3.6 ± .2	4.0 ± .2	3.9 ± .4	3.5 ± .3	3.7 ± .2	3.9 ± .5	2.4 ± .5	3.0 ± .5	2.6 ± .8
K/U	660 ± 600	1500 ± 400	1690 ± 140	5000 ± 200	1600 ± 130	1510 ± 110	1500 ± 80	1300 ± 200	4900 ± 600	2500 ± 200	3800 ± 900

## TOTAL CARBON ANALYSIS

By: Gibson, C. Moore, and Lewis

DATE: 1/8/73 to 3/10/73

The results of the total carbon analyses are in Table VI. The total carbon contents were determined using oxygen combustion followed by gas chromatographic detection of the carbon dioxide produced. Samples weighing from 150 to 300 milligrams were placed with iron chips and a copper-tin accelerator in a preburned refractory crucible. The crucible was then heated to greater than 1600°C in an oxygen atmosphere with an induction furnace. The combustion products were carried by the oxygen through a dust filter to remove the metal oxides and through a manganese oxide trap to remove sulfur gases. Any carbon monoxide (CO) that was formed was converted to CO<sub>2</sub> in a heated catalyst tube. Moisture was removed by an anhydrous trap before the CO<sub>2</sub> was passed into a LECO Low Carbon Analyzer. The CO<sub>2</sub> was carried by the oxygen stream into a collection trap. After a fixed collection time, the trap was heated and the released CO<sub>2</sub> was carried by a helium carrier gas through a silica-gel column into a thermal conductivity detector. The imbalance in the bridge circuit containing the thermal conductivity cell was integrated and read directly on a digital voltmeter.

In order to reduce the background, the crucibles were heated in air at 1000°C for at least 6 hours. Only crucibles heated in a single batch were utilized in a sequence of standards and samples. The system was calibrated using the National Bureau of Standards Steel Standard 55e. Samples of this standard, containing from 4 to 70 µg of carbon were analyzed under the same conditions as the lunar samples. The precision of the method was evaluated by making replicate analyses on sample blanks. A typical standard deviation of a series of ten determinations was 1 µg of total carbon. The results for the standard samples were plotted on linear graph paper and the carbon content in the lunar samples read directly from the standard curve.

TABLE VI  
TOTAL CARBON ANALYSIS

<u>SAMPLE NUMBER</u>	<u>µgC/g</u>	<u>SAMPLE NUMBER</u>	<u>µgC/g</u>
70161	150 ± 8	74220	100 ± 5
70181	165 ± 8	74240	55 ± 5
71041	89 ± 8	74260	44 ± 5
71061	38 ± 8	75081	115 ± 5
71501	74 ± 8	76501	120 ± 8
72501	125 ± 10	78501	170 ± 10
72701	140 ± 11	78155	86 ± 9

CORES

This section contains a description of the return configurations and the processing of the Apollo 17 core samples. Double drive tubes were collected at stations 3, 4, and 9; single drive tubes at stations 6 and at the LM, and a deep drill consisting of eight stem sections and a drill bit was collected at the ALSEP site. Tables VII and VIII give the core parameters and other data. The results of the stereographic radiography of the cores in the drive tubes and drill stems are presented in order of sample number in Figures 4a - 4d at the end of this section. Individual characteristics and circumstances pertaining to cores are discussed separately below.

The inside diameters are 2.04 cm for the drill stems and 4.13 cm for the drive tubes. Sample-containing lengths are 6.5 cm for the drill bit, 37.0 cm for the adjacent drill stem, 39.9 cm for the seven other drill stems, and 34.9 cm for the drive tubes.

After unpacking and inventorying in the LRL, the Apollo 17 cores were triple bagged in Teflon in the nitrogen processing cabinets and were x-rayed in the medical dispensary, JSC. The tubes and drill stems were placed in aluminum holders designed to compensate for differences in x-ray opacity owing to their circular section. Samples were subjected to 50 milliamps of He-Fe radiation for 5 seconds at 90 KVP to produce the great contrast at maximum resolution with minimum exposure time. Stereopairs were made by shifting the x-ray source for each exposure. A second stereopair was made of each core by rotating it 90°.

Information obtained from the weights and x-radiographs enabled preliminary calculation of the density and recovery factors, Tables VII and VIII, and an initial stratigraphic description. The stereopair x-radiographs also serve as a permanent, three-dimensional record of the location and attitude of many of the principal rock fragments. Differences in x-ray matrix opacity and granularity, as well as coarse fraction size, shape, sorting, and packing can be determined from the x-radiographs; likewise, primary depositional structures and sampling artifacts are usually visible. Since particles with a low-x-ray absorption, such as feldspars, tend to be invisible, the data on grain size, sorting, and density may be ambiguous. Furthermore, the exact location of components may be uncertain because of parallax.

The identification of stratigraphic boundaries and assignment of unit designations, done on the basis of x-radiography, will be completely revised after dissection of the cores. The units of this report, therefore, are the x-radiographic units.

A degree of control for the interpretation of x-radiographs has been provided through binocular examination of samples removed from the ends of some of the cores before x-raying, along with the dissection and study of the contents of one drill stem after x-raying. The sampling details are included with the individual descriptions of the cores, which follow.

## 70001 - 70009, DEEP DRILL STRING

Following extraction from the lunar regolith, the drill stem was broken down into three drill-stem strings capped and plugged at the ends: 70001 - 70004, 70005 and 70006, and 70007 - 70009. The strings were further disassembled to the individual stems and bit in the nitrogen cabinets of the LRL. Table VII contains data on recovery, void spaces, etc. Stratal separation took place at the top of 70007; apparently core in the upper two stems (70008 and 70009) moved as a plug into the void space in the upper end of 70009. Since the connection between 70007 and 70008 was loose (the only one) the movement may have been produced by an air pressure difference at either end of the plug of core during repressurization of the spacecraft.

All of the drill stems have been studied by x-ray. The bit has been completely excavated in 0.5 cm intervals, which were examined under a binocular microscope. Similarly, the stem containing 70008 was slit in half longitudinally, opened, and the core dissected in 0.5 cm intervals to a depth of 2/3 its diameter. Material removed was examined under a binocular microscope. In addition, 0.5 to 1.0 cm of soil from the tops of stems 70002 through 70006 were excavated, examined under the binocular microscope, and the coarser than 1 mm fraction picked out, described separately, and photographed as necessary. (Detailed reports of the dissections are being prepared.)

In gross aspect (Figures 4a and 4b), the deep drill string contains three major intervals; an upper massive, coarse-grained interval dominated by basaltic and crystalline rock fragments; a middle, very fine-grained interval dominated by anorthositic fragments, and a distinctly stratified lower interval containing a variety of breccias as well as crystalline fragments.

The upper 107 cm interval is characteristically massive and coarse-grained, and is more poorly stratified than the rest of the core. Principal layering occurs near the top and bottom of the interval. The uppermost 17.5 cm contains five layers, including a basal, fine-grained, thin bed, overlain by 14.5 cm of fining-upward sequence. In contrast, unit 59, the major massive bed, is 61.5 cm thick and is packed with a variety of poorly sorted rock fragments. In 70008, which has been dissected, these fragments show an upward succession from soil-like breccias at the base, through massive to flaky, black devitrified glass in the middle to fresh-appearing, vesicular basalts and gabbroic anorthosites. Glass beads and spattered glass fragments are rare in this part of the core. Units 52 through 58 are more-or-less distinct, and extend the coarse-grained interval to a depth of 107 cm. Judging from examination of fragments at the top of 70006, the basaltic and crystalline component is dominant.

The middle interval, 76 cm thick, is fine-grained and comprises units 36 through 51. What rock fragments there are, appear to be widely scattered, well-sorted, and many are nearly transparent to x-rays. The sample removed from the top of 70005 contains scattered small, well-sorted anorthositic rock fragments plus a few breccias; the x-ray characteristics of the core indicate similar texture and composition through

the remainder of the interval.

The basal interval is 111.5 cm thick and well-stratified, with 35 units distinguishable. Most beds are between 2 and 5 cm in thickness, although some are more than 10 cm thick and a few are less than 0.5 cm thick. Although sorting ranges from very poor to good, and grain size ranges from medium-coarse to very fine, most of the units are well-sorted and fine-grained. Samples removed from the top of 70004, 70003, 70002, and from the bit, 70001, tend to be fine-grained, moderately well sorted, with a small percentage of coarse fraction, dominated by soil- and glass-matrix breccias. The crystalline component (vesicular basalts and gabbros) although still present, is distinctly subordinate to the glasses and breccias.

#### 70012, SINGLE DRIVE TUBE

Core return, Table VIII, was low because the bottom cap came loose in transit and sample was spilling into the BSLSS bag when it was opened for unpacking in the LRL. Forty-seven grams of slumped material was excavated from the base of the core to provide a fresh vertical face, which was then supported by a plug of aluminum foil. The upper keeper was in place, and the x-radiograph indicated no serious cracking or slumping in the remaining portion of the sample.

The material excavated from the lower end of the core tube is mostly fine-grained, with 5 - 10 percent fragments, which are medium to coarse-grained vesicular basalt, up to 11 mm in diameter. No breccia fragments were identified in this sample, which appears to be petrographically similar to the upper beds of 70008, but finer-grained.

#### 73001 and 73002, LOWER AND UPPER DRIVE TUBES

Core return, Table VIII, is somewhat low because about 4 cm of sample was spilled from the bottom of the upper drive tube (73002) before being capped and the keeper rammed into place. In addition, large fragments like the ones now in the core could have obstructed sampling. The lower drive tube (73001) was sealed in the Core Sample Vacuum Container immediately following separation from the upper drive tube, and has not been removed for x-radiography. From the x-radiographs of 73002, the follower was seated approximately 12 cm below the top, and there appears to be 3 cm of partial void immediately below the follower. Much of the 73002 core is permeated by cracks associated with large rock fragments. Two major stratigraphic units were identified, but no sharp stratigraphic breaks are evident.

#### 74001 and 74002, LOWER AND UPPER DRIVE TUBES

Sampling was successful in that both drive tubes were completely filled with soil. However, x-radiography was especially difficult because of the high content of fine-grained opaques. The relatively high densities calculated for these samples, Table VIII, also suggests unusual compositions. Sufficient definition to establish eleven units

within the upper orange-soil drive tube was finally obtained at near maximum x-ray intensity, but little could be seen in the lower, dark-soil drive tube.

About 2 g of material was excavated from the bottom of 74001 and examined under a binocular microscope. The material was unusually cohesive and consists of fine-grained, very dark to opaque and black spheres and conchoidal fragments. Results of microscopic study of grain mounts of this sample appear in the section on soil samples in Table X.

#### 76001, DRIVE TUBE

This is the only core tube well enough photographed on the Moon to establish an unambiguous orientation for the sample.

76001 was subdivided into 4 units on the basis of matrix content and size and type of included rock fragments. The most abundant fragments are semi-transparent to x-rays, are indistinct in outline, and are probably anorthosites. There is a subordinate, but noticeable component of large, distinct-outlined, relatively opaque fragments with transparent, rounded, 1 - 2 mm patches; these fragments are probably vesicular basalts. The matrix resembles that of Apollo 16 cores in being relatively transparent to x-rays, and in having an abundance of diverse opaque fragments up to 2 mm diameter.

#### 79001 and 79002, LOWER AND UPPER DRIVE TUBES

Relatively low core return, Table VIII, was probably in part due to obstruction by large rock fragments. Fracturing and cracking, extensive in all but an interval of 30 - 45 cm depth, is associated with concentrations of rock fragments over 2 cm in diameter. Likewise, the six units recognized in the x-radiographs, were separated on the presence and abundance of rock fragments.

TABLE VII. - DATA ON DRILL STEM SAMPLES

	<u>SAMPLE NO.</u>	<u>RETURNED SAMPLE WEIGHT (g)</u>	<u>RETURNED<sup>a</sup> SAMPLE LENGTH (cm)</u>	<u>BULK DENSITY (g/cm<sup>3</sup>)</u>	<u>ORIGINAL SAMPLE LENGTH (cm)</u>
Top	70009	143.3	24.9 ± 0.1	1.76 ± 0.01	10 ± 2 <sup>e</sup>
	70008	261.0	38 <sup>b</sup>	2.11	39.9
	70007	179.4	30 ± 2 <sup>c</sup>	1.86 ± 0.10	39.9
	70006	234.2	39.9	1.80	39.9
	70005	240.7	39.9	1.85	39.9
	70004	238.8	39.9	1.84	39.9
	70003	237.8	39.9	1.83	39.9
	70002	207.8	42.0 <sup>d</sup>	1.74	42.5
Bottom	70001	29.78			
	TOTAL:	1772.78	294.5		292 ± 2

<sup>a</sup> Determined by x-radiograph

<sup>b</sup> Approximately 2 cm void at top of stem

<sup>c</sup> Approximately 2 cm void at top of stem and the next 16 cm an average of half full, giving a total equivalent void length of 10 cm.

<sup>d</sup> Nominal length is 42.5 cm: 0.5 cm fell out of bottom of drill stem on lunar surface

<sup>e</sup> Core tube rammer-jammer was inserted to a depth of 30 ± 2 cm before drill stem withdrawn from soil

TABLE VIII. - DATA ON DRIVE TUBE SAMPLES

8

SAMPLE NO.	RETURNED SAMPLE WEIGHT (g)	RETURNED SAMPLE LENGTH <sup>a</sup> (cm)	BULK DENSITY <sup>b</sup> (g/cm <sup>3</sup> )	TOTAL DEPTH <sup>c</sup> (PUSHED AND DRIVEN) (cm)	% CORE RETURN (SAMPLE LENGTH TOTAL DEPTH)
70012	434.8 <sup>d</sup>	18.8	1.73	28 ± 3	67
73002	429.7	22.0	1.46	70.6 ± 0.5	81
<del>73001</del>	<del>809</del>	<del>34.9<sup>e</sup></del>	<del>1.73</del>		
74002	909.6	33.5	2.03	71 ± 2	97
<del>74001</del>	<del>1072</del>	<del>35.7<sup>f</sup></del>	<del>2.24</del>		
76001	711.6	35.5 <sup>f</sup>	1.50	37.1 ± 0.5	96
79002	409.4	19.7	1.55	71 ± 2	73
<del>79001</del>	<del>743.4</del>	<del>32.0<sup>g</sup></del>	<del>1.73</del>		

a Equivalent length as adjusted for slumping and voids at the core ends, but uncorrected for fractures and internal voids. Determined from x-radiographs except as noted.

b Sample weight divided by core tube volume over the returned sample length.

c Estimated by D. W. Carrier from kinescopes and other sources.

d Net weight of core sample (as in the x-radiographs) after removal of loose material at bottom (47.23 g) and above the keeper (2.97 g).

e In the core sample vacuum container (CSVC) and not x-rayed; nominal length assumed.

f Exceeds nominal collection length of core (34.9 cm); the follower seated above its normal location.

g Either 3 cm of sample fell out of the top of the tube or the keeper compressed the top of the sample.

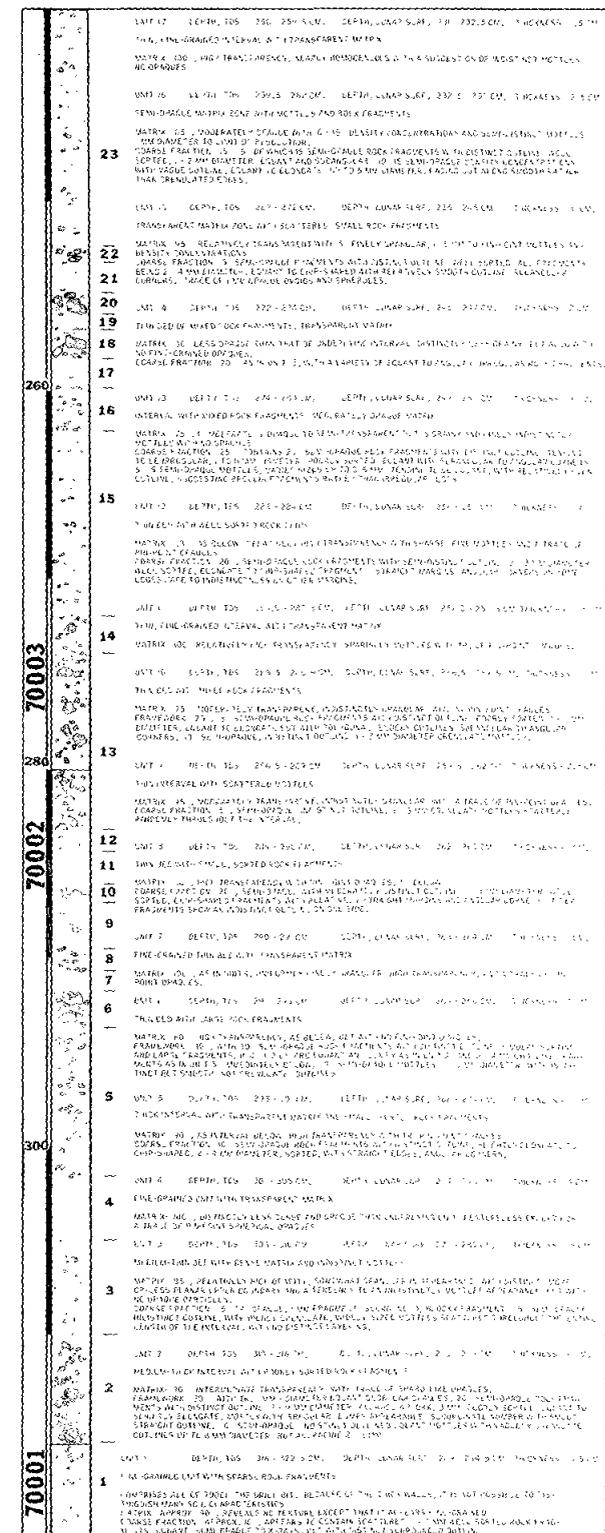
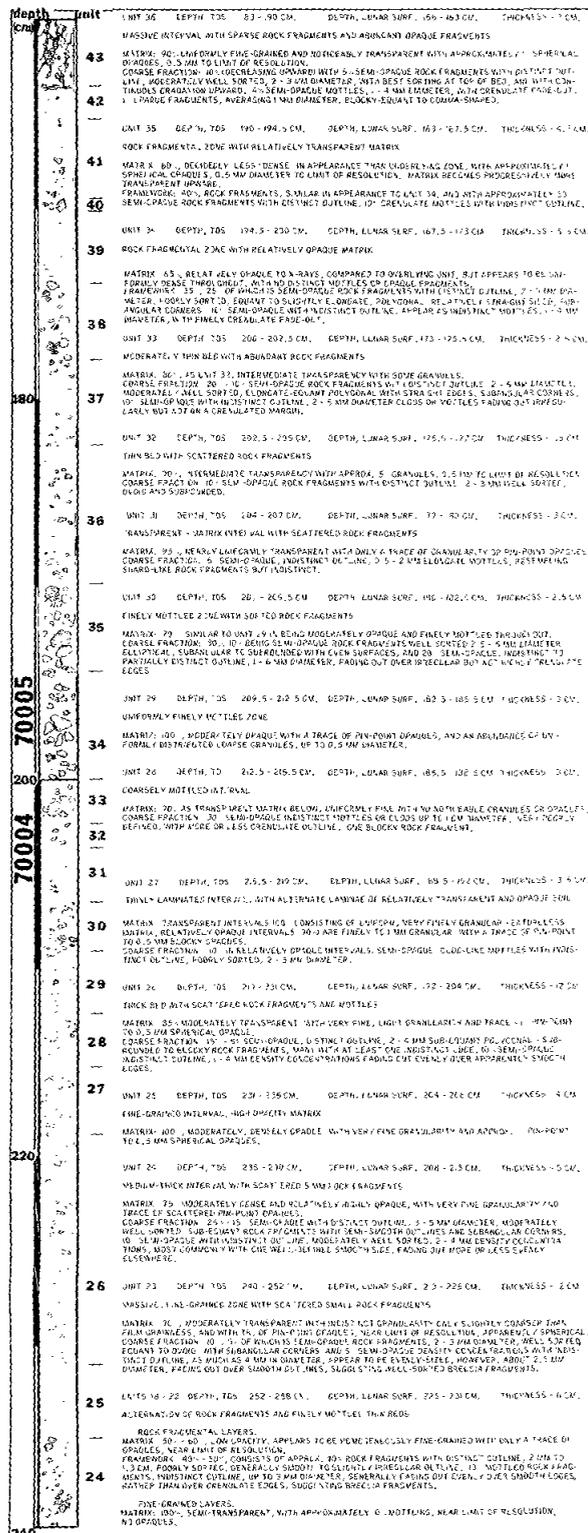


Figure 4a. - Interpretive drawings and descriptions of x-radiographs of core samples: Drill core, lower part. See Figure 4d for x-radiograph symbols. By J. S. Nagle.



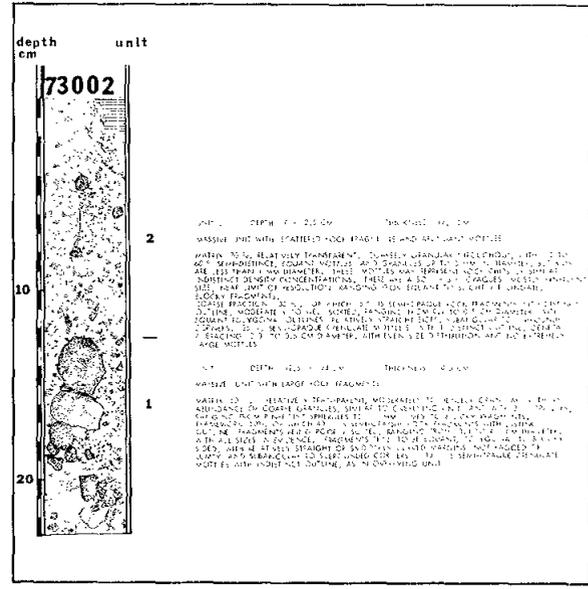
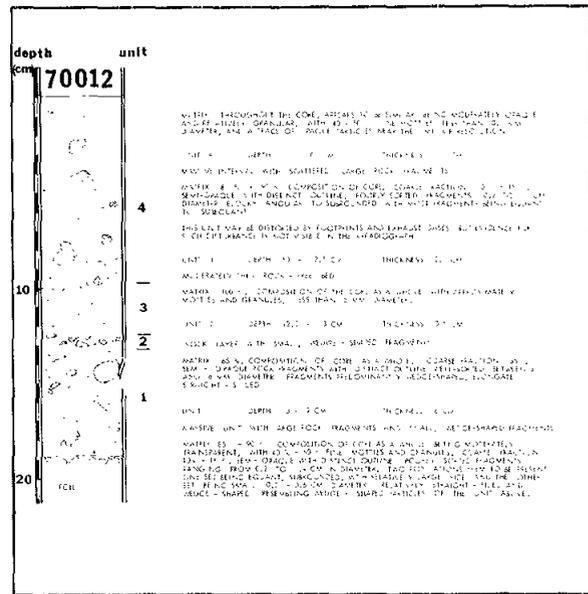
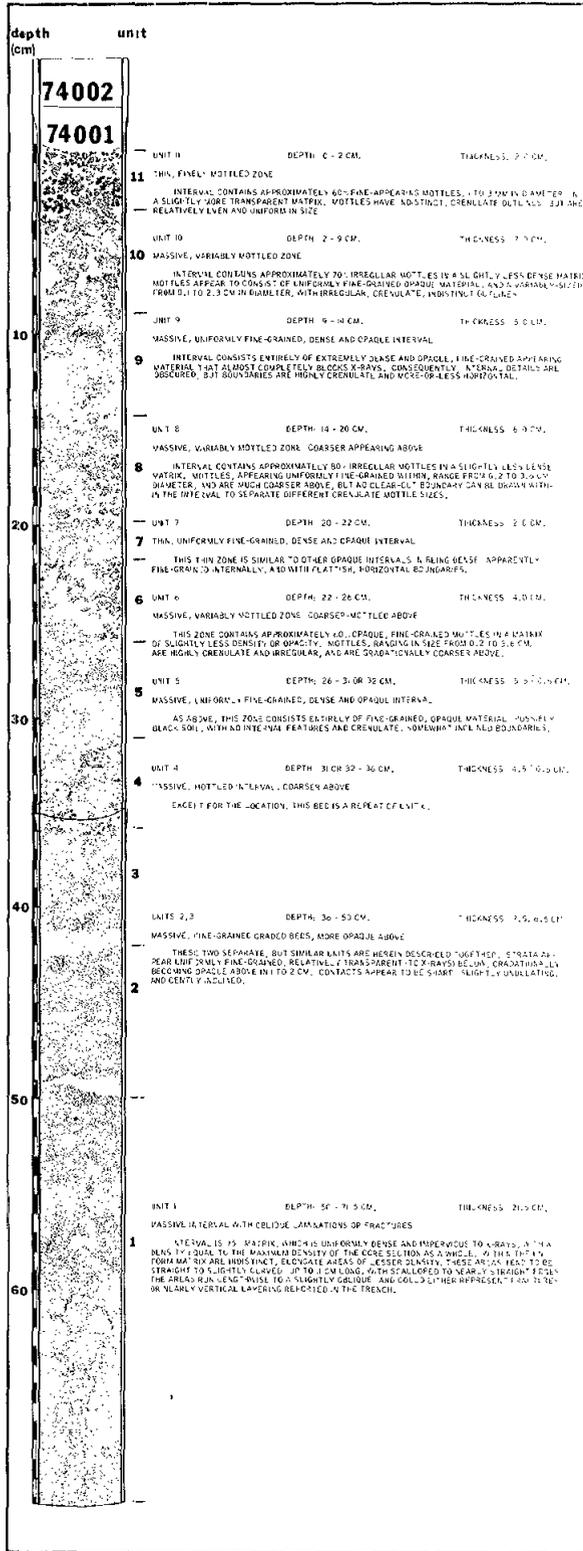
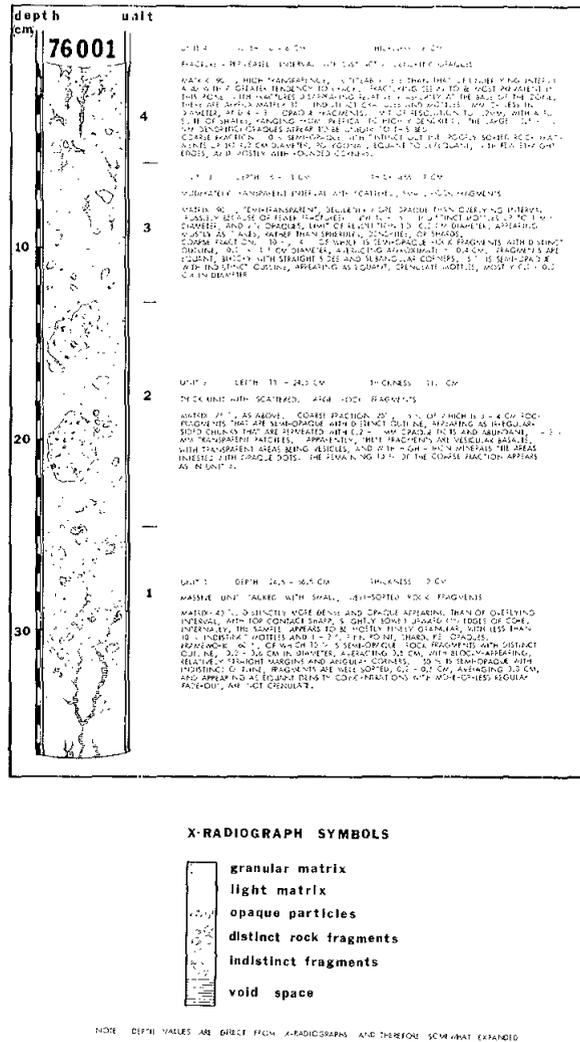
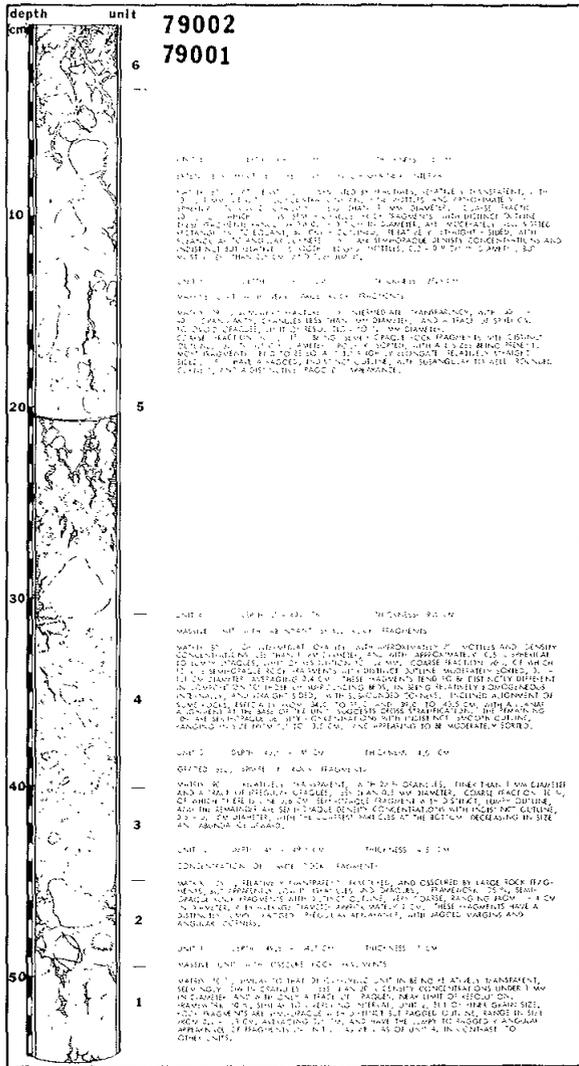


Figure 4c. - Interpretive drawings and descriptions of x-radiographs of core samples: One double and two single drive tube cores. (73001 was not x-rayed.) See Figure 4d for x-radiograph symbols. By J. S. Nagle.



**X-RADIOGRAPH SYMBOLS**

- granular matrix
- light matrix
- opaque particles
- distinct rock fragments
- indistinct fragments
- void space

NOTE: DEPTH VALUES ARE DIRECT FROM X-RADIOGRAPHS AND THEREFORE SOMEWHAT EXPANDED

Figure 4d. - Interpretive drawings and descriptions of x-radiographs of core samples: One double and one single drive tube cores. See above for x-radiograph symbols. By J. S. Nagle.

## Introduction

Seventy-three samples of lunar soil were collected by the Apollo 17 crew. The descriptions of these samples, made with unaided eye while they were being unpacked and sieved in the processing cabinets, are given in order of sample number at the end of this section. Those soils on which further studies were made are indicated for each. (For the methods of sieving, sorting, and numbering of soils samples, see the sections on Sample Processing and on Numbering of Apollo 17 Samples.)

The results of size analyses and microscopic grain mount studies are presented in Tables IX and X respectively. The grain size analyses combines the sieve data obtained in the course of sorting soil samples in the processing lines with the sieving data on the small aliquots allocated to the PET. The PET aliquots were wet sieved with freon at 500 $\mu$ , 250 $\mu$ , 150 $\mu$ , 90 $\mu$ , 75 $\mu$ , 45 $\mu$ , and 20 $\mu$ . A particle measurement computer was used for the 1 to 20 $\mu$  fraction.

Thin sections were made of the 90 - 150 $\mu$  and 250 - 500 $\mu$  fractions of the PET aliquots. Three finer fractions of a core sample from core 74001 were also studied. The compositions of the grain size fractions are given in Table Xb .

## Components of the Soils

Agglutinates are present in nearly all of the samples, although in smaller proportions than in soils from the other mare sites. Agglutinates in soils from the valley floor have a dull, nearly metallic luster in contrast to the vitreous luster of those from the massif areas. In thin section, agglutinates consist of bonded, dark brown to black glass droplets containing finely comminuted glass, plagioclase, clinopyroxene, ilmenite, and lithic fragments. There is also a trace of metallic iron and troilite. There are traces of orange glass in agglutinate grains at nearly every station. Finer-grained agglutinates are generally non-vesicular, but may have some vesicles. Coarser grained agglutinates (250 - 500  $\mu$ ) are very vesicular, containing irregular, coalescing cavities 5 to 150 $\mu$  long.

Basalt fragments exhibit a wide range of textures and compositions, although two are most common: (1) equigranular to subophitic, medium crystalline basalt with about 50 percent clinopyroxene (augite, titan-augite, pigeonite), 25 percent plagioclase, 25 percent ilmenite, and a minor amount of cristobalite and other opaque phases; (2) finely

crystalline, variolitic basalt with about equal proportions of titan-augite and ilmenite, and lesser amounts of plagioclase. There are rare grains of basalt with clinopyroxene phenocrysts in brown glass ground-mass.

Vitric breccias of low metamorphic grade (1 to 3 of Warner, 1972\*), contain 1 $\mu$  to 200 $\mu$  long clasts of mineral and lithic detritus in matrices of colorless, brown or banded (brown and colorless) glass. Most of the clasts are feldspar grains, with a trace of clinopyroxene or orthopyroxene, but some grains contain a myriad of clast types. Vitric breccia textures range from homogeneous to banded and sometimes contain clasts with accretionary bands of smaller clasts.

Breccias of medium metamorphic grade (4 to 6 of Warner, 1972), have mostly fine to coarse grained, equigranular textures, and are composed chiefly of feldspar and orthopyroxene, with traces of ilmenite and olivine. Some fragments exhibit very irregular, poikiloblastic textures, with bleb-like orthopyroxenes in larger feldspar grains.

Both anorthosite and cataclastic anorthosite are present. The anorthosite grains are generally equigranular, with 20 $\mu$  diameter plagioclase crystals. The cataclastic anorthosites are highly sheared grains with a mylonitic texture.

Clinopyroxenes mineral fragments include augite, titanaugite and pigeonite; many are zoned, with pale purple cores and colorless rims. Fragments of unshocked plagioclase include euhedral to subhedral clear grains and larger grains containing chains of fluid(?) inclusions. Shocked plagioclase grains range from fractured grains with undulose extinction to angular, colorless glass fragments, which may be maskelynite. There is a trace of olivine and rare to abundant ilmenite grains in the soils.

Orange ( $\sim$ 5YR 6/8) glasses have a refractive index of about 1.72. The glass spheres and broken spheres are homogeneous, with no trace of debris or phenocrysts. Many of the spheres are partly or completely devitrified; textures range from small, sheaf-like bundles to parallel bars of ilmenite and olivine. None of the orange glass spheres studied is vesicular.

The sample from the bottom of the core at Station 4 (74001) is composed mostly of black, ovoid or spherical droplets, which are made of phenocrysts of olivine and orthopyroxene(?) in a very small amount of brown glass. The droplets contain also about 25 percent ragged, subparallel ilmenite crystals. Also present in lesser amounts are spinel (and possibly some armalcolite) and a trace of metal. In addition,

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\*Warner, Jeffrey, 1972, Metamorphism of Apollo 14 breccias, Proc. of Third Lunar Sci. Conf., Geochim. et Cosmochim. Acta, Suppl. 3, Vol. 1, pp. 623-643. MIT Press.

to the black droplets, 74001 also contains 10 - 20% brown and orange glass spheres.

Also at Station 4, the "gray" soils (74240 and 74260) on both sides of the orange soil band contain a significant amount of "ropy" glasses, which are light gray, spindle or teardrop-shaped droplets. These are characterized by abundant angular detritus welded to grain surfaces; this detritus penetrates 10 to 15% of the droplet diameters. Some of the droplets are folded into pretzel shapes, giving the appearance of a grain with well-developed schlieren. Some of the glass droplets contain 10 to 30 $\mu$  long vesicles.

Glasses present in lesser amounts are colorless to pale gray, yellow-brown to brown, and nearly opaque (tachylite). The pale yellow-brown and gray glass fragments are characterized by faint schlieren consisting of dispersed inclusions which are generally less than 1 $\mu$  in diameter.

#### Binocular Descriptions

The descriptions are listed in order of sample number. The studies on aliquots of some of the samples are indicated by abbreviations and may be found in tables as follows:

CA - chemical analysis	Table IV
EG - evolved gases	Figure 3
GR - gamma ray analysis	Table V
TC - total carbon analysis	Table VI
TS - thin section - grain mount	Table X
SA - size analysis - sieving at less than 1 mm	Table IX

TABLE IX. GRAIN SIZE PARAMETERS\* OF SOME APOLLO 17 SOILS

Sample #	Median Grain Size		Inclusive Graphic Mean		Inclusive Standard Graphic Deviation	Inclusive Skewness	Kurtosis
	$\phi$	$\mu$	$\phi$	$\mu$			
70161	3.95	64.0	3.88	68.0	2.08	-.12	1.08
70181	4.10	58.3	3.98	63.3	2.02	-.17	1.01
71061	3.20	108.2	2.62	163.0	3.30	-.24	.79
74240	3.22	108.0	2.64	160.0	3.32	-.26	.86
75061	3.16	112.0	3.17	112.0	2.62	-.25	1.19
75081	3.65	79.9	3.48	89.0	2.42	-.17	1.07
76501	4.22	53.4	3.92	66.0	2.58	-.28	1.09
78421	4.61	40.0	4.47	44.8	2.02	-.18	1.02
78501	4.70	37.5	3.97	64.0	2.94	-.33	1.15
79261	3.60	82.0	3.0	125.0	2.94	-.29	.84
Without >1 mm data							
74001	4.60	40.0	4.52	43.0	1.70	-.06	.99
74220	4.61	40.0	4.60	40.0	1.59		
74260	4.36	48.0	4.14	56.4	2.03		

\*Folk, Robert L., 1968, Petrology of Sedimentary Rocks, Hemphills, Austin, Texas, 170 pp.

TABLE Xa. - COMPOSITIONS OF SOILS IN PERCENT OF GRAINS

COMPONENTS	70161 FILLET NEAR ALSEP		70181 REF. FOR CORE		71061 AT -5 TO 6 cm DEPTH		71501 RAKE SOIL		73201 SKIM SAMPLE AT TRENCH		73261 MED. GRAY IN TRENCH		73281 WHITE IN TRENCH		74001 BOTTOM OF CORE		74220 ORANGE SOIL			
	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-		
	150u	500u	150u	500u	152u	500u	150u	500u	150u	500u	150u	500u	150u	500u	150u	500u	150u	500u		
Agglutinates	34.0	36.5	56.0	45.8	9.3	10.0	35.0	23.8	26.3	9.7	34.3	34.1	24.6	11.1	---	---	---	---	1.3	4.0
Basalt	15.0	22.4	14.0	29.4	19.6	51.5	24.6	69.0	3.0	2.2	2.0	10.4	3.7	7.8	---	---	---	---	1.6	4.0
Breccia	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Low grade-brown	5.0	4.7	4.6	7.1	3.6	6.9	2.3	---	18.3	28.0	19.7	17.7	23.7	35.6	---	---	---	---	0.3	---
Low grade-colorless	---	---	Tr	0.3	0.6	1.5	0.6	---	10.3	17.2	4.7	6.3	2.3	8.9	---	---	---	---	---	---
Med. grade	2.0	2.4	2.6	3.5	1.6	---	2.3	---	18.0	16.1	15.7	17.7	20.6	23.3	---	---	---	---	---	---
High grade	---	---	---	---	---	---	---	---	---	2.2	---	---	---	---	---	---	---	---	---	4.0
Anorthosite	---	---	---	---	0.3	---	---	---	0.3	1.1	0.3	---	0.3	---	---	---	---	---	---	---
Cataclastic anorthosite	---	---	0.3	1.2	---	---	---	---	0.3	2.2	1.6	2.1	1.6	---	---	---	---	---	---	---
Plagioclase	9.0	5.9	4.3	4.7	17.3	8.5	5.0	---	11.3	12.9	9.7	4.2	9.3	5.6	1.6	2.0	---	---	---	---
Clinopyroxene	21.6	15.3	10.3	3.5	21.0	10.7	17.3	---	8.0	2.2	7.0	1.0	7.3	2.2	2.1	---	---	---	0.3	---
Orthopyroxene	---	---	0.3	---	---	---	0.6	---	Tr	---	---	---	Tr	1.2	---	1.0	---	---	---	---
Olivine	0.3	---	---	---	---	---	---	---	2.3	---	---	---	0.3	---	---	---	---	---	---	---
Opauques (mostly ilm)	5.0	2.4	2.3	4.7	4.6	2.3	2.0	2.1	---	2.2	0.6	---	1.3	---	---	---	---	---	---	---
Glass: Orange	2.0	1.2	3.0	---	6.3	0.8	1.6	2.4	Tr	---	1.7	---	1.2	2.2	8.0	7.0	95.6	85.0	---	---
Colorless	0.3	1.2	0.3	---	1.3	1.5	0.6	---	0.3	2.2	0.6	2.1	0.6	---	---	---	---	---	0.3	---
Brown	0.6	5.9	0.6	---	4.6	---	0.3	---	0.6	2.2	1.3	2.1	2.0	1.1	---	---	---	---	---	---
Ropy	---	---	---	---	---	---	---	---	---	---	1.0	---	---	---	---	---	---	---	---	---
Tachylite	2.6	1.2	0.6	---	5.6	2.3	0.3	---	---	---	---	---	---	---	16.6	2.0	---	---	---	---
Gray	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Metal spherules	2.6	---	Tr	---	4.0	3.8	1.0	---	---	---	---	1.0	0.3	1.1	---	---	---	---	---	---
"Barred" spherules	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Norite	---	1.2	---	---	---	---	---	---	2.6	---	0.6	1.0	0.3	---	73.3	80.0	---	---	---	---
Number of Grains	300	85	300	85	300	130	300	42	300	93	300	96	300	90	300	100	300	25	---	---

COMPONENTS	74240 GRAY SOIL		74260 GRAY SOIL		75061 SKIM-TOP OF FLAT BLDM		75081 INTER- BOULDER		76501 RAKE SOIL		78421 BOTTOM OF 25 cm DEEP TRENCH		78501 RAKE SOIL		79221 TOP 2 cm OF TRENCH		79261 LOWEST LAYER IN 17 cm		
	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	90-	250-	
	150u	500u	150u	500u	150u	500u	150u	500u	150u	500u	150u	500u	150u	500u	150u	500u	150u	500u	
Agglutinates	8.0	8.2	7.7	17.4	24.0	35.3	21.0	31.6	47.2	26.3	62.5	47.1	35.3	23.0	44.4	53.0	22.3	28.0	
Basalt	30.0	34.2	23.7	26.1	26.6	41.2	22.0	30.2	1.7	4.9	5.7	8.5	11.0	46.2	14.4	13.6	15.3	23.6	
Breccia	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Low grade-brown	1.6	16.5	7.4	---	2.6	11.8	6.3	6.6	3.8	10.5	7.0	3.9	2.3	---	8.5	14.8	1.3	15.7	
Low grade-colorless	13.3	5.5	5.4	26.1	2.0	---	---	---	---	5.9	1.3	13.7	0.3	---	1.0	1.2	0.3	4.5	
Med. grade	2.0	2.7	3.3	---	0.3	---	2.6	3.9	8.3	19.7	2.6	8.8	8.0	---	1.0	2.5	8.0	9.0	
High grade	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.3	2.2
Anorthosite	---	---	---	---	---	---	---	---	---	---	0.3	---	Tr	---	---	---	---	0.6	3.4
Cataclastic anorthosite	0.6	---	---	---	---	---	---	1.3	1.4	2.6	0.6	2.0	2.0	---	0.3	---	0.6	2.2	
Plagioclase	4.6	1.4	2.7	4.3	4.6	5.9	17.0	6.6	7.2	28.9	7.3	6.9	13.3	---	6.9	3.7	12.7	4.5	
Clinopyroxene	11.3	8.2	13.7	9.6	29.6	5.9	26.3	18.4	7.6	---	9.0	2.9	6.0	---	6.5	3.7	16.6	4.5	
Orthopyroxene	---	---	---	---	---	---	---	---	7.9	---	---	---	7.3	---	---	---	---	1.6	2.2
Olivine	---	---	0.3	---	0.3	---	---	---	0.7	---	0.6	---	---	---	---	---	---	---	---
Opauques (mostly ilm)	1.3	---	2.3	---	5.3	---	7.6	1.3	1.7	---	---	---	3.7	---	1.3	---	7.0	1.1	
Glass: Orange	4.0	1.4	7.7	---	1.0	---	0.6	---	0.7	---	0.6	1.0	2.0	---	---	---	4.0	2.2	
Colorless	1.6	2.7	3.7	---	1.6	---	0.6	---	1.4	---	1.3	2.9	1.0	---	2.3	1.2	3.2	---	
Brown	1.6	---	1.7	---	1.6	---	1.6	---	---	1.3	0.6	1.0	2.3	---	2.3	---	3.6	3.3	
Ropy	14.3	17.8	18.1	---	---	---	---	---	---	---	---	---	0.3	---	3.6	2.5	---	---	
Tachylite	---	1.4	1.7	13.0	---	---	---	---	0.3	2.6	---	---	---	---	---	---	0.6	4.5	
Gray	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.3	---	
Green	---	---	0.3	4.3	---	---	---	---	---	---	---	---	2.0	23.0	---	---	---	---	
Metal spherules	---	---	0.3	---	---	---	---	---	---	---	0.3	1.0	3.0	---	Tr	---	2.0	---	
"Barred" spherules	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3.3	1.2	---	---	
Norite	---	---	---	---	---	---	---	---	---	---	---	---	Tr	---	---	---	0.3	---	
Number of Grains	300	73	300	23	300	17	300	70	300	70	300	103	300	15	300	81	300	89	

TABLE Xb - COMPOSITIONS OF SOILS IN PERCENT OF GRAINS

Soil 74001 (Bottom of Core)

<u>COMPONENTS</u>	<u>20-45<math>\mu</math></u>	<u>45-75<math>\mu</math></u>	<u>75-90<math>\mu</math></u>	<u>90-150<math>\mu</math></u>	<u>250-500<math>\mu</math></u>
Barred spheres and frags.	71.6	62.0	59.0	73.3	88.0
Brown glass spheres	6.6	1.0	0.6	0.6	----
Devitrified brn. glass spheres	21.0	23.6	24.3	16.0	2.0
Orange glass spheres	----	9.3	14.3	8.0	7.0
Plagioclase	0.6	0.6	0.6	1.6	2.0
Clinopyroxene	----	0.3	----	0.3	----
Orthopyroxene	----	0.3	0.3	----	1.0
Opaque spheres	----	2.3	0.3	----	----
<hr/> Number of grains	<hr/> 300	<hr/> 300	<hr/> 300	<hr/> 300	<hr/> 100

## 70160 - 70165

WEIGHT: 316.173 g    COLOR: Brownish gray (5YR 4/1)    BY: Heiken  
 COMMENTS: Fillet near the AISEP. Fine sand size soil. Forms very few clods.

UNSIEVED: 106.1 g (70160)    STUDIES: (70161) CA, TC, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	2.143	(70165) Angular fragment with ragged edges, dark gray basalt with a few vugs. On one face, there is a line of vugs along a fracture. The vugs are lined with 0.2 - 0.5 mm long pyrox (?) and cristobalite (?) crystals.
4-10	1.66	(70164) 8 fragments: 12.5% agglutinate; 25% flat, angular, light gray basalt; 12.5% flat, elongate, moderately friable white breccia or anorthosite fragments; 50% tabular or pyramidal, smooth-surfaced, dark gray, fine-grained breccia.
2-4	3.43	5% agglutinates; 25% medium gray basalt, equant, angular fragments; 35% medium gray, fine-grained breccias, smooth surfaces, tabular grains; 35% dark gray, fine-grained breccias, with trace of 0.5 mm diameter white clasts.
1-2	5.14	Ditto; percentages for 2-4 mm fraction
<1	197.7	None

## 70180 - 70184

WEIGHT: 259.78 g    COLOR: Dark olive gray (5Y 3/1)    BY: Clanton  
 COMMENTS: 3 m from deep drill core. Soil plus 1 rock (70185, 466.6 g), which is vuggy basalt.

UNSIEVED: 93.25 g (70180)    STUDIES: (70185) CA, TC, SA, TS  
 20.02 g is refrigerated)

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		None
4-10	1.68	(70184) 5 fragments: 60% angular basalt; 40% vesicular glass agglutinates, or cinders (?), smallest grain is ropy and twisted.
2-4	3.12	(70183) 1% typical agglutinates; 2% light gray breccia; 97% basalt.
1-2	4.63	(70182) 2% light gray breccia; 98% basalt.
1	157.1	(70181) 100% basalt fragments.

71060 - 71069, 71085 - 71089, 71095 - 71097

WEIGHT: 584.715 g      COLOR: Medium dark gray to brownish gray (N4 to 5YR 4/1)      BY: Heiken

COMMENTS: Near "Tombstone" rock, at depth of 5-6 cm. No cohesive aggregates, but a few ephemeral clods 1-2 mm in diameter. Dust clings to the larger fragments and is very difficult to remove.

UNSIEVED: 199.4 g (71060)      STUDIES: (71061) CA, GR, TC, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	78.235	(71065-71069) 13 fragments: 16% subrounded, medium, gray very dusty; 50% angular to subrounded coarse-grained basalt, 5-10% of surface is vuggy; 17% subangular, aphanitic, medium gray basalt; a few vugs; 33% aphanitic, dark gray basalt, whose surfaces appear fresh and free of zap pits.
4-10	34.35	(71064) 25% equant, subrounded, coarsely crystalline basalt, with fragments have 20% vugs; 5% extremely vesicular, glassy (?), equant, subrounded fragments; 70% dust-covered, aphanitic, tabular, gray, subangular basalt fragments or less likely fine-grained metamorphosed.
2-4	22.79	(71063) like 4-10 mm fraction.
1-2	20.74	(71062) very dusty fragments, but like 4-10 mm fraction.
<1	229.2	(71061)

71130 - 71134

WEIGHT: 144.03 g      COLOR: Olive gray to olive black      BY: Fruland  
(5Y 2/1 - 5Y 4/1)

COMMENTS: Soil collected with 2 chips (71135, 71136, 62.24 g total) off of boulder. Soil is poorly sorted and has no clods 1 cm.

UNSIEVED: 49.51 g (71130)      STUDIES: None

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		None
4-10	0.91	(71134) 4 fragments: 1 basalt, 3 others which are too heavily coated with dust for identification.
2-4	3.22	(71133) angular to subangular fragments which are mostly basalts, with minor amounts of agglutinates and dark gray, fine-grained breccias.
1-2	3.99	(71132) mostly dust-covered fragments, which may be either aphanitic basalt or breccia, most are angular to subrounded, several % agglutinates.
<1	86.4	(71131) poorly sorted soil.

71150 - 71154, 71156, 71157

WEIGHT: 70.816 g    COLOR: Dark olive gray (5Y 3/1)    BY: Fruland  
 COMMENTS: Soil scooped up with chip (71155, 26.15 g) off of boulder.  
 The soil is poorly sorted and cohesive.

UNSIEVED: None    STUDIES: None

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
> 10	6.886	(71156, 71157) 2 fragments angular, finely vesicular, possibly breccias.
4-10	1.37	(71154) 9 fragments: 5 have heavy soil cover; 4 are basalt fragments.
2-4	2.36	(71153) 50% aphanitic basalts; 45% fine-grained, gray breccias; 5% agglutinates.
1-2	2.60	(71152) 50% basalt; 50% fine-grained breccia; trace of agglutinates.
< 1	57.6	(71151) traces of powdery white fragments in soil.

71500 - 71509, 71515

WEIGHT: 1066.06 g    COLOR: Olive gray to olive black    BY: Fruland  
 (5Y 4/1 to 5Y 2/1)

COMMENTS: Soil to go with rake sample (71520-71597); contains several <1 cm clods.

UNSIEVED: 359.5 g (71500)    STUDIES: (71501) CA, TC, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	52.27	(71505-71509, 71515) 6 fragments: 1 agglutinate; 3 tabular, aphanitic basalt fragments (some with "zap" pits); 2 vuggy basalts.
4-10	13.13	(71504) vuggy basalt fragments, which are angular to subangular; aphanitic basalt fragments, some of which are partly coated with glass.
2-4	17.58	(71503) 10% dark gray, fine-grained breccias with dusty coatings; 40% agglutinates; 50% vuggy basalt fragments; trace of plagioclase grains.
1-2	22.68	(71502) similar to 2-4 mm fraction; 15% dark, fine-grained breccias.
<1	600.9	(71501) cohesive soil which forms clods easily; pyroxene and plagioclase grains can be distinguished.

## 72130 - 72134

78

WEIGHT: 220.47 g COLOR: Dark olive gray (5Y 3/1) BY: Clanton  
 COMMENTS: LRV sample collected with a large basalt piece (72135,  
 336.9 g).

UNSIEVED: 79.91 g (72130) STUDIES: None

SIZE (mm)	WT (g)	CONSTITUENTS
>10		None
4-10	13.18	(72134) about 50 fragments: 10% which may be chips from rock 72135, are dark gray, glassy breccia; 10% salt-and-pepper breccias with 0.25-0.5 mm clasts (up to 40% clasts in these rocks); 80% angular, gray breccia fragments with 5-15% white clasts.
2-4	10.95	(72133) 10% dark colored glassy fragments similar to rock 72135; 10% salt-and-pepper appearing breccia, high white clast content; 80% angular gray breccia fragments, containing 25% white clasts (clasts about 0.5 mm angular).
1-2	8.53	(72132) 5% breccia with salt-and-pepper appearance (half light and half dark clasts); 95% angular, dark gray breccia with 5% white clasts.
<1	107.9	(72131) like the 1-2 mm fraction except that there may be 5-7% glass.

## 72140 - 72145

WEIGHT: 352.08 g COLOR: Dark olive gray (5Y 3/1) BY: Fruland  
 COMMENTS: LRV sample between station 1 and station 2 on "prong" of white mantle. Ground surface has a "raindrop" texture. Very cohesive soil.

UNSIEVED: 115.0 g (72140) STUDIES: (72141) CA, TC, SA, TS

SIZE (mm)	WT (g)	CONSTITUENTS
>10	1.25	(72145) 1 very dusty breccia fragment.
4-10	2.73	(72144) 9 fragments: 33% glass fragments, very vesicular, with smooth-walled vesicles; 11% breccia (?); 56% basalt fragments.
2-4	1.83	(72143) 50% dark glass fragments and agglutinates (some of the fragmental material is vesicular); 45% basalt fragments (?); 5% breccia fragments.
1-2	5.32	(72142) 50% glass fragments and agglutinate; 10% light gray breccias (?); 30% basalt fragments; 10% breccia fragments.
<1	225.9	(72141) very cohesive.

72150

WEIGHT: 53.29 g    COLOR: Dark brownish gray (5YR 3/1)    BY: Heiken  
 COMMENTS: LRV sample collected 4.3 km from IM on the way to station 2  
 in dark mantle between the "prongs" of the white mantle.  
 Rock and soil. The rock (72155, 238.5 g) is a wuggy, medium  
 crystalline basalt. The soil is fine sand to silt size,  
 poorly sorted. There are no visible clods (if there had been  
 any, the rock would have broken them up).  
 UNSIEVED: 53.29 (72150)    STUDIES: 72150 CA, TC, SA, TS

72160 - 72164

WEIGHT: 250.002 g    COLOR: Olive gray (5Y 4/1)    BY: Clanton  
 COMMENTS: Very cohesive and fine-grained on dark mantle between SEP  
 and Station 2.  
 UNSIEVED: 80.0 g (72160)    STUDIES: none

SIZE (mm)	WT (g)	CONSTITUENTS
>10		none
4-10	0.946	(72164) 5 angular to subangular fragments: 3 are dark (5Y 4/1) breccia; 2 are gray breccia with white clasts; largest fragments have 75-80% light gray to white clasts.
2-4	2.538	(72163) 30% agglutinates; 10% light gray breccia; 60% dark gray breccia. The light gray (N6) breccia has 5-10% (N7) clasts about 0.25 to 1.0 mm in diameter. The dark gray breccias are more rounded than the light gray breccia fragments.
1-2	4.018	(72162) 35% agglutinates; 5% light gray breccia, 60% dark gray breccia. Agglutinates are vesicular. The light gray fragments appear to be clasts from the dark gray breccia.
<1	162.5	(72161) Like the 1-2 mm fraction.

72220 - 72224

WEIGHT: 388.56 g    COLOR: Olive gray (5Y 4/1)    BY: Fruland  
 COMMENTS: Cohesive soil from "fillet underneath overhang" of the  
 2 meter boulder.

UNSIEVED: 136.2 g (72220)    STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	7.51	(72224) 15% plagioclase crystals or anorthosite; 50% gray breccias; 35% unidentified.
2-4	7.92	(72223) 5% agglutinates; 40% gray breccia; 10% anorthositic (?); 45% indeterminate; one black glass sphere.
1-2	11.13	(72222) 5% agglutinates; 5% cindery black glass; 15-20% light gray breccia; 1% plagioclase grains; 40% medium gray breccia; 20% indeterminate.
<1	225.8	(72221) like the 1-2 mm fraction.

72240 - 72244

WEIGHT: 322.42 g    COLOR: Olive gray (5Y 4/1)    BY: Fruland  
 COMMENTS: Sample of fillet on 2 meter boulder.

UNSIEVED: 113.3 g (72240)    STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	3.99	(72244) 22 fragments: nearly all with heavy dust coating, one obvious agglutinate, and two dust-free gray breccia fragments.
2-4	7.93	(72243) 2-3% agglutinates; 10-15% light gray breccias; 80% dust-covered and unidentified.
1-2	11.20	(72242) 30% agglutinates; 25% light gray breccia; 45% medium gray breccias; dust covered in part.
<1	186.0	(72241) loosely cohesive. White lithic and black glass fragments are visible.

72440 - 72444

WEIGHT: 450.39 g COLOR: Olive gray (5Y 4/1) BY: Fruland

COMMENTS: From under a 2/3 meter diameter rolled boulder.

UNSIEVED: 161.6 g (72440) STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	2.91	(72444) very dusty: 25% agglutinates; 75% medium gray breccias.
2-4	7.98	(72443) 25% agglutinates; 1% white anorthosites (?); 74% medium gray breccia.
1-2	10.60	(72442) 10% black cindery glass; 10% agglutinates; 10-15% white or light gray matrix breccia; 70% medium gray matrix breccia.
<1	267.3	(72441) like the 1-2 mm fraction.

72320 - 72324

WEIGHT: 106.31 g COLOR: Medium gray (N5) BY: McKay

COMMENTS: Shadowed soil under boulder.

UNSIEVED: 26.17 g (72320, 25.84 g STUDIES: None is refrigerated).

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
> 10		None
4-10	0.96	(72324) 1 fragment is cindery glass; 1 is medium gray breccia with white clasts; 2 are dusty, irregular fragments with vesicles (breccia or basalt or glass).
2-4	0.50	(72323) 37% agglutinates; 37% medium gray fragmental rocks (some with light clasts); 26% irregular glass (?) fragments.
1-2	1.38	(72322) 20% agglutinates; 15% glass but no spheres; 5% light colored breccias; 60% dark and medium gray breccias and dusty basalts.
< 1	77.3	(72321) cohesive, forming clods easily.

## 73120 - 73124

WEIGHT: 287.68 g COLOR: Olive gray (5Y 4/1) BY: Clarton

COMMENTS: Collect station 2A on light mantle.

UNSIIEVED: 100.2 g (73120) STUDIES: (73121) GR

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
> 10		none
4-10	0.50	(73124) 3 fragments: one is 6 x 5 x 5 mm, angular light gray breccia with 5% lighter gray clasts; the other two are vesicular agglutinates.
2-4	2.03	(73123) 15% agglutinates; 35% light gray breccias; 50% dark gray breccias. The agglutinates are vesicular, with debris stuck to the surface. The lighter gray breccias (N7) are more rounded than the angular dark gray breccia fragments.
1-2	5.25	(73122) 20% agglutinates; 40% light gray breccias, 40% dark gray breccias. The light gray fragments may be clasts from the dark gray breccias.
<1	179.7	(73121) 25% agglutinates; 45% light gray breccias; 30% dark gray breccias.

## 73130 - 73134

WEIGHT: 238.07 g COLOR: Medium light gray (N6) BY: Fruland

COMMENTS: Moderately cohesive soil in bag with a friable breccia.

UNSIIEVED: 77.20 g (73130) STUDIES: (73131) GR

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	9.61	(73134) lithic fragments heavily dust-coated and some glass.
2-4	8.58	(73133) most fragments dust covered; some white breccias are present.
1-2	10.38	(73132) mostly light gray breccias, but some white breccia fragments.
<1	132.3	(73131)

73140 - 73146

WEIGHT: 345.61 g    COLOR: Olive gray (5Y 4/1)    BY: Heiken  
 COMMENTS: LRV sample from station 2 to station 3; light colored  
 soil from about 15 cm below the surface. Fine sand to  
 silt size soil; forms ephemeral clods 0.2 to 1 cm long.  
 Has a patchey, "mixed" appearance.

UNSIEVED: 121.6 g (73140)    STUDIES: (73141) CA, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
> 10	8.61	(73145, 73146) 2 fragments: one is tabular, angular, fine-grained brownish gray breccia; one side with a thin coating of black glass. The other is an equant, subrounded, powdery white fragment (cataclastic anorthosite?).
4-10	4.47	(73144) 7 fragments: 4% agglutinate, spinose, dark brown glass; 68% equant to slightly elongate, medium gray, subrounded to sub-angular, fine-grained breccia; < 5% white clasts; 28% medium brown-gray breccia, angular, fine-grained fragments, some with dark brown clasts.
2-4	7.84	(73143) 60% medium gray, fine-grained breccia; 30% medium gray-brown breccia; 10% black to brown agglutinates.
1-2	11.69	(73142) 50% medium gray, fine-grained breccia; 10% powdery white anorthositic fragments (friable); 30% medium brown breccia fragments; 10% agglutinates.
< 1	191.4	(73141)

WEIGHT: 162.1 g    COLOR: Olive gray (5Y 4/1)    BY: Heiken  
 COMMENTS: LRV sample between stations 2 and 3. Soil collected with a rock (73155, 79.3 g) which is medium gray breccia with black and white clasts. The soil is medium sand-bearing silt-size and forms only 0.2 to 1 cm, irregular ephemeral clods.

UNSIEVED: 52.56 g (73150)		STUDIES: None
SIZE (mm)	WT (g)	CONSTITUENTS
> 10	3.15	(73156) 1 subrounded, crystalline breccia fragment
4-10	0.31	(73154) 3 fragments: all are equant to subangular and crystalline, which may be breccias, they are too dusty for a good description.
2-4	1.31	(73153) 10% agglutinates; 15% pale gray to white, equant to slightly elongate breccia (?) fragments; 5% black and white breccia; 70% equant, angular to subrounded, medium dark gray fine-grained fragments, which may be breccias.
1-2	3.57	(73152) same as 2-4 mm fraction except for increase to 5% agglutinates.
< 1	101.2	(73151) very cohesive and forms clods easily.

## 73210 - 73214, 73219

WEIGHT: 101.14 g    COLOR: Medium light gray (N5,5)    BY: McKay  
 COMMENTS: Soil in bag with 4 rock fragments (73215-73218, 1402.67 g) at rim crest of a 10 m crater in the light mantle. The soil is very cohesive and adheres to the bag.

UNSIEVED: 37.57 g (73210)		STUDIES: None
SIZE (mm)	WT (g)	CONSTITUENTS
> 10	2.88	(73219) 1 fragment, which is coated with dust.
4-10	2.47	(73214) 12 fragments: 42% breccia with white clasts; 8% vesicular glass spatter; 8% fine-grained, glassy fragments; 42% are too dusty for description.
2-4	2.80	(73213) 11% glass fragments, possibly spatter; 11% breccia with light clasts; 1% aphanitic, dark gray breccia; 77% medium gray, angular, dust-covered fragments.
1-2	3.47	(73212) mainly angular, dust-covered grains; the few visible grains consist of light gray and glass fragments.
< 1	51.95	(73211) no glass is apparent; a few light gray fragments are visible.

## 73220 - 73225

WEIGHT: 79.54 g COLOR: Medium olive gray (5Y 5/1) BY: Fruland  
 COMMENTS: Skim sample of upper light gray soil; part of trench  
 sequence. Very cohesive.

UNSIEVED: 20.8 g (73220) STUDIES: (73221) CA, GR, TC, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	3.66	(73225) 1 fragment of light gray breccia.
4-10	1.65	(73224) 7 fragments, 100% light gray breccia.
2-4	2.61	(73223) 94% gray breccias (dust-coated); 3% glass fragments; 3% basalt (?) fragments.
1-2	2.71	(73222) 85% light gray breccia fragments; 8% glass fragments plus a sphere; 4% powdery white breccia fragments; 3% basalt fragments.
<1	48.11	(73221)

## 73240 - 73245

WEIGHT: 360.57 g COLOR: Light medium gray (N5 to N6) BY: Fruland  
 COMMENTS: Upper 5 cm of a trench sample.

UNSIEVED: 114.7 g (73240) STUDIES: (73241) GR

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	1.60	(73245) 1 light gray, angular, flat breccia fragment.
4-10	22.25	(73244) 50 fragments: 8% dark glass; 2% white breccia; 15-20% dark to medium gray fine-grained breccia; 60% too dusty for identification.
2-4	14.38	(73243) 10% agglutinates; 2% light gray breccia; 85% too dusty for identification.
1-2	14.94	(73242) 20% agglutinates; 7% light gray breccias; 60% gray breccias; 15% unidentified.
<1	192.7	(73241)

## 73260 - 73264

WEIGHT: 326.23 g    COLOR: Olive gray (5Y 4/1)    BY: Fruiland  
 COMMENTS: Trench medium gray portion of "marbled" zone.  
 UNSIEVED: 103.5 g (73260)    STUDIES: (73261) CA, GR, TC, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		None
4-10	6.45	(73264) 3% agglutinates; 97% light to medium gray breccias.
2-4	9.47	(73263) 20% glass fragments; 80% medium gray breccias with white clasts, some with thick glass coatings.
1-2	12.01	(73262) 10-13% glass (including agglutinates); 1% light gray breccia; 85% medium gray breccia.
<1	194.8	(73261)

## 73280 - 73285

WEIGHT: 169.13 g    COLOR: Medium gray (N5)    BY: Heiken  
 COMMENTS: Trench at Station 3. White fraction of marbled zone. Forms ephemeral, 1-3 mm diameter clods.

UNSIEVED: 53.54 g (73280)    STUDIES: (73281) SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	2.58	(73285) 1 large agglutinate (1.2 x 1.5 x 2.0 cm) which bonds together slightly elongate fragments of fine-grained light gray breccia.
4-10	7.14	(73284) all fragments are dust-coated: 20% dark gray, subrounded fragments with irregular grain surfaces (breccia?); 30% medium gray, subrounded fragments with smooth, planar surfaces (breccia?); 45% light gray, equant to elongate breccia fragments; 5% agglutinates.
2-4	4.74	(73283) like the 4-10 mm fraction.
1-2	5.38	(73282) like the 4-10 mm fraction, except increase agglutinates to 10% and decrease medium gray breccia fragments to 3%.
<1	95.75	(73281) some powdery white fragments scattered through this sample.

74110 - 74119

WEIGHT: 282.52 g    COLOR: Light olive gray (5Y 6/1)    BY: Heiken  
 COMMENTS: LRV sample of darker surface soil between station 3 and station 4. The soil formed small 1-3 mm, equant clods when the bag was handled.

UNSIIEVED: 92.12 g (74110)    STUDIES: None

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	37.11	(74115-74119) 5 fragments with extremely friable light gray breccia, 10% white clasts and a trace of dark gray clasts in light gray matrix.
4-10	13.26	(74114) 90% are equant, rounded fragments with thick cake of dust clinging tightly to the surface; 10% are fragments with some of dust removed. The two types are: medium light gray, friable breccias; black glass with spherical vesicles.
2-4	12.11	(74113) most of the fragments are dust-covered. Those identified are: agglutinates; black, vesicular glass; powdery white crystalline fragments; medium gray breccia.
1-2	11.12	(74112) resembles 2-4 mm fraction.
<1	116.8	(74111)

74120 - 74124

WEIGHT: 385.87 g    COLOR: Olive gray (5Y 4/1)    BY: Fruland  
 COMMENTS: LRV sample between Stations 3 and 4; quite cohesive.

UNSIIEVED: 124.1 (74120)    STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	0.39	(74124) 3 fragments of gray breccia with white clasts, one has a glass coating over its surface.
2-4	2.73	(74123) 20-30% agglutinates; 70% medium gray breccia; 5% basalt (?). Dust coating on most of the lithic fragments.
1-2	6.65	(74122) 25-35% medium gray breccia; 15% light gray breccia; 20-25% agglutinate; 30% indeterminate.
<1	252.0	(74121)



WEIGHT: 1039.978 g    COLOR: Gray to medium brownish gray    BY: Heiken  
(N5.5 to 5YR 5/1)

COMMENTS: 1-4 cm diameter ephemeral  
          clods.

UNSIEVED: 543.9 g (74240)                    STUDIES: (74241) CA, EG, TC, SA, TS

SIZE (mm)	WT (g)	CONSTITUENTS
>10	116.658	(74245-74249, 74285-74287) 8 fragments: 15% dark gray (N3), hyalocrystalline basalt composed of 23% olivine and 22% plagioclase phenocrysts. One rock surface is glassy. 10% vugs up to 1 cm lined with felted ilmenite crystals; 15% basalt composed of 50% feldspar, 30% red-brown pyroxene and 20% ilmenite; 70% vuggy, coarsely crystalline basalt in angular, elongate fragments.
4-10	21.95	(74244) 60% equant to elongate, angular, to subangular, medium gray, basalt (no vugs); 20% elongate, tabular, angular, vuggy basalt fragments which contain vugs with crystal lining; 10% powdery white, crystalline fragments (dusty); 10% equant to elongate, highly vesicular black glass fragments (40% vesicles), <0.1 to 2 mm diameter vesicles, with smooth walls. These fragments have a "cindery" appearance.
2-4	27.67	(74243) nearly the same proportions as the 4-10 mm fraction, with a slight increase in the "cindery" glasses.
1-2	22.50	(74242) like the 2-4 mm fraction.
<1	307.3	(74241)

## 75061 - 75066

WEIGHT: 186.573 g    COLOR: Brownish gray (5YR 4/1)    BY: Fruland

COMMENTS: 1 cm deep skim soil from the top (0.5 m from the edge) of a boulder 3 m wide by 0.3 m high. The soil is very poorly sorted and sand-sized with some rounded, ephemeral clods.

UNSIEVED: None                                    STUDIES: (75061) CA, EG, GR, TC, SA, TS

SIZE (mm)	WT (g)	CONSTITUENTS
>10	2.243	(75065, 75066) 2 fragments of vuggy basalt.
4-10	11.63	(75064) 90% basalt; 10% dark gray, fine-grained breccias.
2-4	6.28	(75063) 95% basalt fragments; 5% vesicular basalt or glass (?) (dusty), 1 glass sphere.
1-2	8.52	(75062) 80% basalt in angular to subrounded fragments; 20% dusty and difficult to identify, trace of dumbbell-shaped glass droplets.
<1	157.9	(75061) plagioclase grains are visible.



## 75120 - 75124

WEIGHT: 375.211 g    COLOR: Dark olive gray (5Y 3/1)    BY: Fruland  
 COMMENTS: Collected between Victory and Horatio Craters in an area  
 of dark mantle.

UNSIEVED: 126.6 (75120)    STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	0.956	(75124) 100% basalt in flat, elongate, sub-angular to subrounded fragments.
2-4	2.147	(75123) 15-20% black glass; 2-3% light gray basalt; 60% basalt; 20% dark gray breccias.
1-2	5.20	(75122) 10-15% agglutinates plus black cindery glass; 5-10% light gray crystalline fragments; 80% indeterminate because of dust, but probably basalt.
<1	240.3	(75121)

## 76120 - 76124

WEIGHT: 303.92 g    COLOR: Dark olive gray    BY: Fruland  
 (5Y 3/1)

COMMENTS: LRV sample halfway between SEP and Station 6. Very  
 cohesive soil.

UNSIEVED: 107.0 g (76120)    STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	1.61	(76124) 3 agglutinate fragments; 9 dusty dark gray breccias (?).
2-4	2.49	(76123) 5% agglutinates; 15-20% light gray breccia (?); 75% dark gray breccia (?). All fragments are very dusty.
1-2	4.72	(76122) 10% agglutinates; 30% "cindery" glass; 20% light gray breccia (?); 40% indeterminate (breccia?).
<1	188.1	(76121)

76240 - 76246

WEIGHT: 490.54 g COLOR: Olive gray (5Y 4/1) BY: Heiken  
 COMMENTS: Shadowed soil from beneath overhang in boulder. Fine sand to silt size soil, poorly sorted. No agglutinates or glass in coarser fractions. Basalt is the most common constituent. Density calculated of the volume of 105 g (76240) is 1.44 g/cc.

UNSIEVED: 450.7 g (76240) STUDIES: (76240) GR

SIZE (mm)	WT (g)	CONSTITUENTS
> 10	14.74	(76245, 76246) 2 fragments.
4-10	1.53	(76244) 66% vesicular (0.5-1.0 mm vesicles), angular basalt fragments; 16% angular, non-vesicular basalt fragments; 17% dust-coated, aphanitic basalt (?).
2-4	1.23	(76243) about 30 fragments: 20% white crystalline (anorthosite?) fragments, which are equant and blocky; 20% flat, angular, finely vesicular basalt; 60% dust-covered fragments, which may be basalt or breccia.
1-2	1.20	(76242) like the 2-4 mm fraction.
<1	21.14	(76241) forms clods easily.

76260 - 76265

WEIGHT: 292.93 g COLOR: 5Y 3/1 BY: Clanton  
 COMMENTS: Skim of upper 2 cm of soil outside of boulder overhang as a reference for the shadowed soil (76240-76246).

UNSIEVED: 96.6 g STUDIES: (76261) GR

SIZE (mm)	WT (g)	CONSTITUENTS
> 10	1.75	(76265) 1 fragment: angular and vuggy breccia with a fresh surface and a zap-pitted surface; some vugs go through the fragment; has two 5-6 mm diameter clasts; the matrix is dark.
4-10	8.76	(76264) 34 fragments: 100% dark gray breccia fragments; overall color is 5Y 3/1 with N8 (?) clasts; fragments are all angular.
2-4	6.57	(76263) 1% agglutinate; 5-7% dark gray breccias (as above), with vesicular glass splashed on the surface; 92-94% dark gray breccia, vuggy as described above; trace of white clasts from breccias.
1-2	8.55	(76262) 95% breccia components, both matrix and clast fragments; 2-3% glass spheres; 1-2% breccia coated with glass.
<1	170.7	(76261) all gray, very uniform.

76280 - 76286

WEIGHT: 446.382 g    COLOR: Olive gray (5Y 4/1)    BY: Fruland

COMMENTS: 5 cm deep scoop beyond boulder overhang.

UNSIIEVED: 153.0 g (76280)

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	3.912	(76285), 76286) 1 elongate dark gray vitric breccia and 1 equant breccia (?); both are dusty.
4-10	10.69	(76284) 35-40 subangular to subrounded fragments: 3% black glass spheres; 6% light gray crystalline fragments; 3% pale green breccia; 85% dark gray breccias.
2-4	12.71	(76283) subangular to rounded dusty fragments: 5% agglutinates; 10% light gray crystalline fragments; 85% unidentified.
1-2	14.27	(76282) 5% dark brown glass; 20% light gray breccia (?); 10% medium gray breccia, friable; 65% unidentified.
<1	251.8	(76281)

76320 - 76324

WEIGHT: 813.74 g    COLOR: Olive gray (5Y 4/1)    BY: Fruland

COMMENTS: On flat surface of boulder #1.

UNSIIEVED: 260.3 g (76320)

STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	11.8	(76324) 50 fragments: 98% angular to subrounded gray breccia, some with white clasts and some with glass coating; 2% white fragments.
2-4	15.84	(76323) 2% agglutinates; 10% light gray to white breccia; 5% basalt (?); 83% angular gray breccia, some with white clasts.
1-2	23.10	(76322) 10% agglutinates; 15% white to light gray breccia; 55% gray breccia; 5% basalt (?); 15% unidentified.
<1	502.7	(76321) cohesive; forms clods easily.

96 WEIGHT: 1026.97 g COLOR: Medium gray (N4 to N5) BY: McKay  
 COMMENTS: Soil accompanying rake sample (76530); poorly sorted.  
 UNSIEVED: 345.2 g (76500) STUDIES: (76501) CA, TC,  
 SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
> 10	7.50	(76505, 76506) 2 fragments: 1 is black and white breccia, in which black matrix contains white clasts and penetrating veins; 1 is dusty, may be similar to the first fragment.
4-10	10.72	(76504) 50 fragments: 10% agglutinates and vesicular glass; 4% light gray, finely crystalline and possibly shocked, with some reddish-brown spots on surface; 4% black and white breccias; 82% dark gray lithic fragments probably fine-grained breccia.
2-4	10.09	(76503) 20% agglutinates and vesicular, frothy glass; 1% plagioclase crystals; about 80% dark gray breccias, some with white clasts.
1-2	22.76	(76502) 15-20% light gray fragments that are mostly breccias (?); 10-15% glass as agglutinates, spheres, and frothy glass; 70% dark gray, aphanitic breccia (?) fragments.
< 1	630.7	(76501)

77510 - 77514, 77525, 77526,

WEIGHT: 202.81 g COLOR: Olive gray (5Y 4/1) BY: Heiken  
 - COMMENTS: Blue gray breccia and soil. Silt to fine sand-size soil; moderately poorly sorted. Loose; forms only small ephemeral clods. The soil was in the bag with 5 rocks (77515 - 77519, total 556.8 g).

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
> 10	77.57 g (77510)	STUDIES: (77525, 77526) two fragments, which may be chips from the rocks: 1) 1.5 x 2.0 cm; very angular elongate breccia fragment; medium gray, 1 to 2 mm long clasts in a light gray matrix. Clasts >matrix. One surface is dark brown, with a thin coat of glass (?). Surfaces are irregular and differentially eroded. 2) 1.5 x 1.1 cm partly gray, angular breccia (?).
4-10	1.24	(77514) 3 fragments which may have broken off rock fragments in the bag: one is dark gray, subrounded fine-grained gray breccia; two are angular, patchy gray fragments of blue-gray breccia (?).
2-4	1.19	(77513) 60% angular, elongate, patchy gray breccia; 35% dark gray, fine-grained, friable vitric breccia; 5% agglutinates.
1-2	2.45	(77512) 30% light to medium gray, patchy, angular breccia fragments; 40% dark gray, fine-grained vitric breccia, subrounded, equant fragments; 30% agglutinates.
< 1	118.1	(77511) like 1-2 mm fraction with a trace of dark brown glass spheres.

77530 - 77534

WEIGHT: 219.46 g COLOR: Olive gray (5Y 4/1) BY: Fruland

COMMENTS: Cohesive, poorly sorted soil, in a bag with 6 rocks  
(77535 - 77539, 77545; total 1121.1 g).

UNSIEVED: 82.76 g (77530)

STUDIES: CA, SA, TS, TC (77531)

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	4.46	(77534) 12 fragments of which all appear to be crystalline breccias (?) and are angular to subrounded.
2-4	2.51	(77533) 2-3% agglutinates; 30% vesicular basalts (?); 67% blocky, angular dust-covered breccias (?).
1-2	3.13	(77532) 1-2% glass fragments; 10% agglutinates; 88% breccia (??) fragments.
<1	126.6	(77531)

78120 - 78124

WEIGHT: 209.94 g COLOR: Olive gray (5Y 4/1) BY: Fruland

COMMENTS: LRV Sample from Sta. 7 to Sta. 8. Fragmented clods from the SE rim of SWP crater, but no clods observed in this soil when processed in the LRL.

UNSIEVED: 75.78 g (78120)

STUDIES: None.

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	0	NONE
4-10	5.64	(78124) about 17 fragments, all to heavily coated with dust for identification.
2-4	2.49	(78123) Most are dust-covered but a few agglutinates are visible.
1-2	4.43	(78122) Dust covered; about 12% are glass fragments or glass-coated fragments.
<1	121.6	(78121)

78220 - 78224

WEIGHT: 344.78 g    COLOR: Dark olive gray (5Y 3/1)    BY: Fruland  
 COMMENTS: Soil from beneath 2/3 m diameter gabbroic boulder.  
 UNSIEVED: 108.3 g (78220)    STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	1.48	(78224) 3 agglutinates; 8 gray breccias.
2-4	2.69	(78223) 20% agglutinates; 1% brown glass spheres; 7% light gray breccias; 70% medium gray crystalline breccias.
1-2	5.21	(78222) 30% agglutinates and black cindery glass; 5% light gray breccia; 65% medium dark gray crystalline (?) breccia.
<1	227.1	(78221)

78250

WEIGHT: 50.57 g    COLOR: Medium gray (N5)    BY: McKay  
 COMMENTS: Soil near the boulder rolled over by the astronauts and includes two chips from the boulder (78255, 48.31 g). Very fine grained and poorly sorted soil.  
 UNSIEVED: 50.57 g (78250)    STUDIES: None

78420 - 78424

WEIGHT: 292.62 g    COLOR: Medium-gray (N5)    BY: McKay  
 COMMENTS: Bottom layer (10 cm thick) of a 25 cm deep trench. The soils is generally very fine grained; but contains coarser fragments. Described as cloddy when collected, but none were observed during processing.

<u>Size (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	0	None
4-10	1.91	(78424) 6 fragments; all are fine grained dark gray breccias; composed of a dark gray (N3) matrix with 0.1 - 1 mm white clasts.
2-4	2.41	(78423) about 50 fragments: trace of agglutinates; 10-15%; a vesicular, frothy glass; 80% dark gray breccia and medium to light gray breccia.
1-2	4.16	(78422) 10-15% frothy glass fragments with vesiclesize about 0.1 mm; 5% agglutinates; 80% breccias representing a range of gray shades.
<1	186.2	(78421)

78440 - 78444

WEIGHT: 251.59 g      COLOR: Olive gray (5Y 4/1)      BY: Fruland

COMMENTS: Very cohesive soil from walls of trench above 78420.

UNSIEVED: 81.38 (78440)      STUDIES: (78441) GR

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10		none
4-10	1.19	(78444) 5 dust-coated breccias (?).
2-4	2.44	(78443) 40% agglutinates; 58% gray breccias; 2% light gray breccias.
1-2	3.78	(78442) 35% gray breccia; 15% light to white breccia; 25% agglutinates; 10% black "cindery" glass; 15% unidentified.
<1	162.8	(78441)

78460 - 78465

WEIGHT: 413.057 g      COLOR: Olive black (5Y 2/1)      BY: Fruland

COMMENTS: Cohesive soil from wall of trench, 5 cm below skim sample.

UNSIEVED: 138.1 g (78460)

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	1.039	(78465) 1 vesicular black glass fragment.
4-10	1.303	(78464) 2 "cindery" black glass fragments; 6 dark gray breccia fragments with white clasts.
2-4	2.787	(78463) very dusty surfaces: 30% agglutinates plus black "cindery" glass fragments; 5% light gray breccias with white clasts.
1-2	5.328	(78462) like the 2-4 mm fraction.
<1	264.5	(78461)

WEIGHT: 267.45 g    COLOR: Olive gray (5Y 4/1)    BY: Heiken

COMMENTS: Skim of upper 1/2 to 1 cm of soil.

UNSIIEVED: 89.33 g (78480)    STUDIES: None

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	0	None
4-10	0.32	(78484) 2 fragments: one is angular, 6 mm long, blocky, with a "salt and pepper" appearance; the other is a smooth, dark gray fragment which may be a clod or vitric breccia.
2-4	1.21	(78483); 20% black vesicular glass droplets with rough grain surface, including several broken droplets and one teardrop shaped grain; 20% agglutinates; crystalline 10% angular, white crystalline fragments (anorthositic); 50% dark gray, dust-covered angular fragments.
1-2	2.69	(78482) 10% white lithic fragments; 60% agglutinates; 10% black glass droplets and broken droplets; 20% unidentified because of dust cover.
<1	173.9	(78481)

78500 - 78504, 78506 - 78509, 78515 - 78518

WEIGHT: 1276.06 g    COLOR: Medium brownish gray (5YR 5/1)    BY: Heiken  
 COMMENTS: Soil sample accompanying rake sample (78530 ).

Structure disturbed by the rock (78505, 506.3 g) placed  
 in the bag with the sample. After the rock was removed,  
 ephemeral clods 0.5-2 cm in diameter were visible.

UNSIEVED: 391.1 g(78500)    STUDIES: (78501) CA, TC, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	109.31	(78506 - 78509, 78515 - 78515) 8 fragments; 38% irregular, nearly equant, medium gray, ruggy basalts; 25% flat, tabular, vuggy basalt fragments, whose vugs are lined with dark brown pyroxene; 37% brownish gray breccia fragments with about 5% 1 mm diameter white clasts.
4-10	19.16	(78504) 60% dust covered angular, tabular fragments from which dust is nearly impossible to blow off; 20% equant the elongate white crystalline rocks with powdered white surfaces; 20% irregular, lumpy, black glass fragments, which show mostly elongate, tabular grain shapes.
2-4	16.41	(78503) nearly same composition as the 4-10 mm fraction; Some of the black glass has smooth, fluid surface which may be broken droplets; most of the dust-covered fragments appear to be breccias.
1-2	21.38	(78502) 75% angular, blacky, smooth surfaced dark gray breccias; 5-10% powdery white, crystalline fragments; 5-10% black glass fragments.
<1	718.7	(78501)

## 79120 - 79125

WEIGHT: 374.3 g COLOR: Olive gray (5Y 4/1) BY: Fruland

COMMENTS: Surface at the southeast rim of Van Serg Crater.

UNSIEVED: 116.4 g (79120) STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	1.91	(79125) 1 fragment which is a flat, angular, dark gray fine-grained breccia, containing a few white clasts.
4-10	14.48	(79124) 30 fragments: 7% black, vesicular glass; 3% white and gray breccia; 90% angular, dark gray, fine-grained breccia, with a small percentage of white clasts.
2-4	13.14	(79123) 5% black, vesicular glass; 3% is light gray breccia with white clasts; 92% dark gray breccia.
1-2	13.97	(79122) 10% is black glass; 8% is light gray breccia; 82% dark gray, fine-grained breccia.
<1	214.4	(79121)

## 79220 - 79228

WEIGHT: 291.52 g COLOR: Olive gray (5Y 4/1) BY: Heiken

COMMENTS: Top 2 cm in the trench at Sta. 9. The soil is fine sand to silt size and very poorly sorted. Forms only ephemeral clods 0.5 - 1.0 cm in diameter.

UNSIEVED: 93.49 g (79220) STUDIES: CA, GR, TC, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	22.22	(79225 - 79228) 4 fragments; all are dark gray, fine-grained, friable breccias.
4-10	9.75	(79224) 10% angular to well-rounded black glass fragments, some are vesicular and appear to be broken droplets; 10% light gray, equant to elongate, subrounded crystalline fragments, which are probably basalt; 80% tabular, angular to subrounded, fine-grained dark gray breccias.
2-4	6.24	(79223) 15% gray to light gray, equant, angular crystalline rocks (basalt); 5% Black vesicular glass; 80% subangular to subrounded equant to elongate dark gray fine grained breccia.
1-2	7.22	(79222) like the 2-4 mm fraction
< 1	152.6	(79221)

79240 - 79245

WEIGHT: 330.34 g      COLOR: Medium dark gray (N4)      BY: Heiken  
 COMMENTS: The soil is loose and forms only very small clods (<1 mm).  
 UNSIEVED: 113.3 g (79240)      STUDIES: none

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	10.11	(79245) 1 fragment: 2 x 3 x 2 cm, angular and tabular, consisting of medium gray, very fine-grained aphanitic basalt (?).
4-10	10.85	(79244) all fragments are very dusty: 60% subrounded, medium gray, fine-grained breccia; 10% light gray to white, subrounded breccia fragments; 2% black glass fragments (broken spheres); 28% equant, subrounded, vuggy basalt.
2-4	10.46	(79243) similar to 4-10 mm fraction, except for an increase in glass fragments to 5%, and the presence of 5% agglutinates.
1-2	11.32	(79242) like 2-4 mm fraction.
<1	174.3	(79241) still loose even after sieving and forms no clods.

79260 - 79265

WEIGHT: 348.35 g      COLOR: Olive gray to olive black (5Y 4/1 to 5Y 2/1)  
 BY: Fruiland      COMMENTS: From lowest 10 cm in a 17 cm deep trench  
    Cohesive soil.

UNSIEVED: 118.9 g (79260)      STUDIES: (79261) CA, GR, TC, SA, TS

<u>SIZE (mm)</u>	<u>WT (g)</u>	<u>CONSTITUENTS</u>
>10	2.60	(79265) one dust-covered angular fragment.
4-10	15.85	(79264) about 30 fragments, which are dust covered and appear to be basalt or breccia.
2-4	11.46	(79263) 1.5% glass fragments; 3.5% light gray breccias; 95% dust-covered breccias (?) and basalts (?).
1-2	11.74	(79262) dust-covered fragments the visible types of which include dark gray breccia, glass-coated basalt, light gray breccia, and a glass droplet.
<1	187.8	(79261)

79510 - 79519, 79525 - 79529, 79535 - 79537

WEIGHT: 413.53 g    COLOR: Olive gray (5Y 3/1)    BY: Clanton  
 COMMENTS: Cohesive soil from the surface at the rim of Van Serg Crater.  
 UNSIEVED: 107.6 g (79510)    STUDIES: none

SIZE (mm)	WT (g)	CONSTITUENTS
>10	93.23	(79515 - 79519, 79525 - 79529, 79535 - 79537) 13 rock fragments: 1 somewhat rounded fragment (4 x 3 x 3 cm) of coarse-grained, vuggy basalt, with plagioclase and pyrox crystals up to 3 mm long. The vugs are up to 4 mm in diameter, and make up 10-15% of the rock; 1 fragment of aphanitic basalt with abundant zap pits; 11 very angular fragments of dark gray breccia with about 5% lighter gray clasts. Most clasts are <2mm in diameter.
4-10	12.24	(79514) 35 fragments: 3% are black vesicular glass; 97% are dark gray (5Y 3/1) breccias with 3-5% light gray (N6) clasts. Most clasts are <1mm in diameter and angular.
2-4	9.94	(79513) 15% agglutinates; 10% white fragments (clasts); 75% dark gray breccia with 3-5% light gray clasts. All fragments are angular.
1-2	11.32	(79512) like the 2-4 mm fraction.
<1	179.2	(79511)

All hand specimen, binocular and petrographic microscope descriptions of Apollo 17 rocks are contained in this section in the general order of sample number. Rocks from rake samples are classified and described by lithologic type. The same classification is applied to all of the rocks in Tables I and II, but the rock names used in the following descriptions are those applied by the individual describers when the descriptions were made.

All of the rocks were examined through the windows of nitrogen atmosphere processing cabinets with the aid of binocular microscopes. Conventions used for the descriptions are given in Table XI.

Somewhat different formats are used in the thin section descriptions of igneous rocks and breccias. In the breccia descriptions the components are placed in four groups: lithic clasts, mineral clasts, glass clasts, and matrix. In igneous rocks the only distinction made between components is the usual one of phenocryst and groundmass for rocks with a bimodal grain size distribution. Table XII lists the abbreviations used in the thin section descriptions.

In the descriptions, as well as in Table II, N, E, S, W, T, and B refer to laboratory orientations. The subscript 1, shown on the photo cubes, is omitted in the text.

TABLE XI - SOME TERMS USED FOR ROCK DESCRIPTIONS

<u>CHARACTERISTIC</u>	<u>TERM</u>	<u>DEFINITION AND COMMENT</u>
Cavities		Not to include merely surface-related features such as clast molds.
	vugs	
	vesicles crystals	projecting or lining minerals
Coherence		
	Intergranular:	Grain-to-grain coherence
	very friable	crumbles under touch
	friable	crumbles under manual pressure
	coherent	must be struck to disaggregate grains
	tough	breaks across grains rather than around them
Fracturing		Terms combined as needed for a full description.
	absent	
	few	
	numerous	
	nonpenetrative	
	penetrative	visible on opposing sides
Component		Igneous rocks, breccias, and fines as applicable.
	mafic silicate	all colored translucent minerals; mainly pyroxenes and olivines.
	plagioclase	light gray and white (if shocked)
	opaque	further defined by color and shape
	matrix	aphanitic material (under binocular microscope) <0.1 mm
	lithic clasts	general term
	basalt clasts	see rock types for other specific lithic terms
	glass	
	agglutinates	
	fragments of glass	
	basalt/vesicular glass	example for a compound grain; use two lines on form for the color, etc.

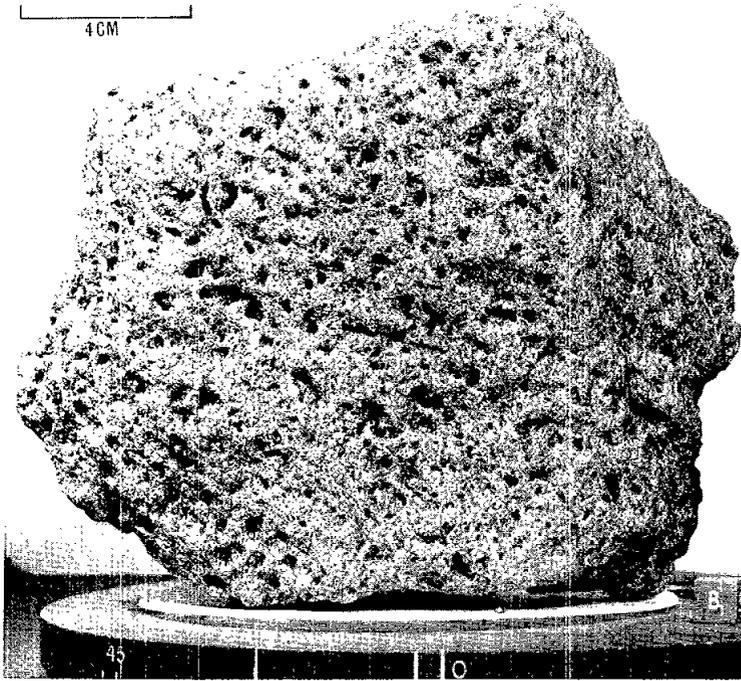
TABLE XI - SOME TERMS USED FOR ROCK DESCRIPTIONS (conc.)

<u>CHARACTERISTIC</u>	<u>TERM</u>	<u>DEFINITION AND COMMENT</u>
Fabric		To include texture
	isotropic	
	laminated	
	inequigranular	
	porphyritic	
	seriate	
	microbreccia	<1 mm average clast size
	fine breccia	1-5 mm average clast size
	breccia	>5 mm average clast size
Surface		Specific faces may be referenced by the laboratory orientation cube face designation.
	irregular	
	granulated	
	smooth	
	hackly	generally a freshly broken surface
	glass covered (%)	e.g., glass 30% of E and 10% of T
	grooved	for slickenside-like surfaces
Variability		Any difference in any characteristic from one part to another, e.g., grain size, lithology, mineralogy
Zap Pit	none	none seen in quick scan
	few	<10/cm <sup>2</sup>
	many	>10/cm <sup>2</sup>

TABLE XII - ABBREVIATIONS USED IN THIN SECTION DESCRIPTIONS

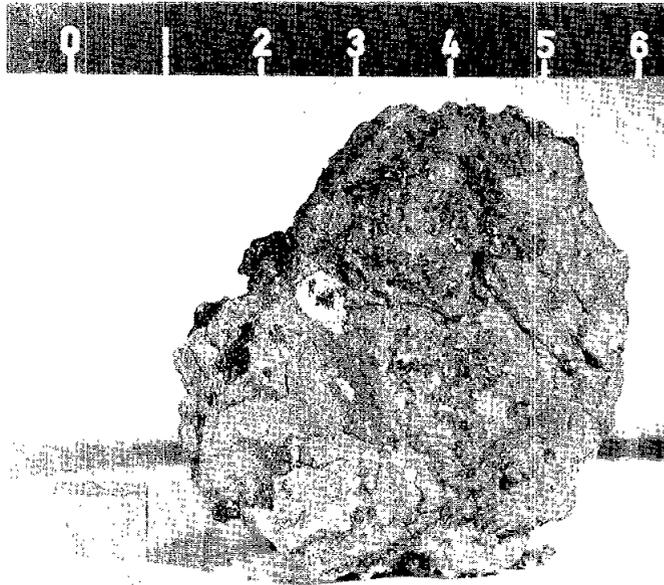
<u>ABBREVIATION</u>	<u>TERM</u>
aggl	agglutinates
ang	angular
anorth	anorthosite
apa	apatite
aug	augite
brn	brown
cpx	clinopyroxene
crist	cristobalite
Cr-spin	chrome spinel
devit	devitrified
Fe-Ni	Fe-Ni metal
fsp-pyrox	feldspathic pyroxenite
gab-an	gabbroic anorthosite
gl	glass
ilm	ilmenite
int bas	intersertal basalt
mask	maskelynite
meso	mesostasis, too fine grained for mineral identification by microscope
oliv	olivine
opaq	opaque
opx	orthopyroxene
pig	pigeonite
plag	plagioclase
pyrox	pyroxenite
pyroxf	pyroxferroite
pyx	pyroxene
sev	several
sph	spherical
subang	subangular
subrd	subrounded
trid	tridymite
troil	troilite
ulvo	ulvospinel
unident	unidentified
vitro	vitrophyre





Sample 70017

S-73-15720



Sample 70018

S-73-15330

ROCK TYPE: Clastic matrix breccia,  
 glass coated  
 WEIGHT: 51.58 g  
 DIMENSIONS: 1.8 x 4.5 x 5.5 cm  
 COLOR: Medium dark gray with brownish  
 tinge (5YR)  
 SHAPE: Irregular - slabby  
 COHERENCE: Intergranular - Moderately coherent  
 Fracturing - Extensive, penetrative

BINOCULAR DESCRIPTION BY: Gooley and Horz DATE: 1/17/73

SURFACE: B is about 90% glass coated; W, S, N, E, T are partially glass coated (40%, 10%, 30%, 10%, 10% respectively). All glass-free areas are irregular hackly.

ZAP PTS: None on B; few on N, W, E, and S; many on the glass-covered portion of T; few on the breccia surfaces.

CAVITIES: Rare (<1%)

SPECIAL FEATURES: Glass coating; highly vesicular, 0.1-0.5 mm thick, some areas (SW face) with metallic sheen, color is 5YR 3/1. At edge of T towards N occur three thin and extremely delicate glass fibers protruding from brown glass coating. They look like ribbons twisted into bow.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	5YR	80		< 0.1	< 0.1 - 0.2	1
Plag and anorthosite	White	10-15	Ang, sugary	0.3	0.1 - 2	
Oliv	5GY	2	Ang	0.3	0.1 - 0.5	2
Glass clast	Black	2-5	Subrnd	0.3	0.1 - 0.5	3
Glass clast	Orange	2	Subrnd	0.3	0.1 - 2	4
Pyrox(?)	5YR	Tr	Ang	0.2	0.1 - 0.3	
Lithic		2-5	Subrnd	0.4	0.2 - 8	5

NOTES:

1. Fine-grained, clastic-sugary, no mode.
2. Fractured and sugary.
3. Vitreous luster, homogeneous.
4. On T face fractured, translucent, homogeneous.
5. Lithic fragments, holo-crystalline rocks composed of plagioclase, pyroxene, and olivine.

70019

ROCK TYPE: Soil breccia - shock  
 fragmented  
 WEIGHT: 159.9 g  
 DIMENSIONS: 13 x 6 x 6 cm  
 COLOR: Dark gray, brown tint (N3-5YR 2/1)  
 SHAPE: Irregular  
 COHERENCE: Intergranular - Weak  
 Fracturing - Many, penetrative

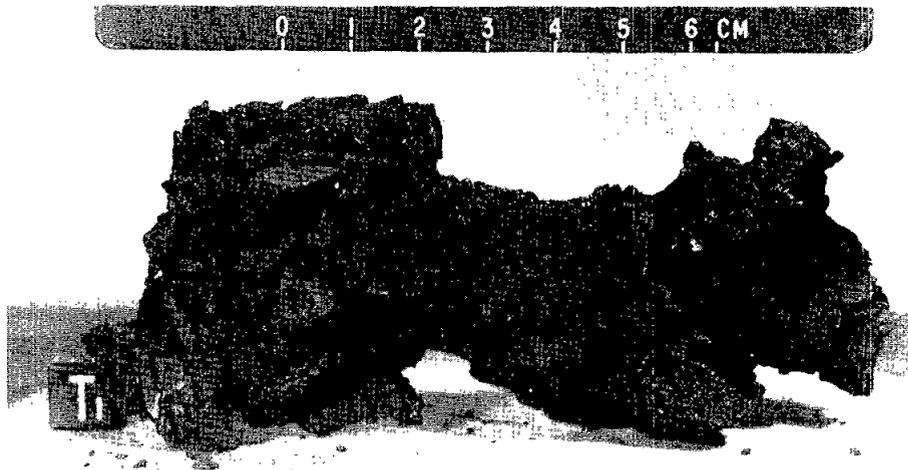
BINOCULAR DESCRIPTION BY: Horz and Agrell DATE: 1/18/73

FABRIC: Variable brecciated  
 VARIABILITY: Homogeneous, fine soil breccia  
 SURFACE: T is finely hackly with 20% glass coating broken by rhomboidal jointing; S has 70% glass coating over partially rounded fragments. Small amounts of fine dark dust may adhere to other smooth surfaces of the glass.  
 ZAP PITS: None on T, S, E, W, and N. The B face was not studied (to protect the sample) but no pits show in the B photos.  
 CAVITIES: Surface glass skin has 10% vesicles of 0.5 mm diameter on surface, 20-30% angular voids in glass cemented between fragments of soil breccia at W end of sample.  
 SPECIAL FEATURES: The appearance of the rock is controlled by a flattened rhomboidal fracture pattern in the fine soil breccia. The fragments developed are closely packed and little disrupted at the E end of the sample. The W end is disrupted into a loosely packed aggregate of soil breccia fragments. Here they are more commonly glass coated, the glass coating being restricted to the external faces at the fragments, which may show uncoated internal fractures. On the T face is the appearance of wedging in of the fractures from E to W on the E half of the surface. The surfaces of the microbreccia fragments (where free from glass) may show a common set of striations trending ESE on the T face.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Dark gray brown tint	90		<0.1	<0.1	1
Basalt	Dark	8	Ang to rnd	1.5	0.5 - 3	2
Basalt	Pale	<1	Rnd	1		3
Plag		<1	Ang	1		4
Lithic		<1	Vague	1-3		5
Glass	Vitreous black to dark gray brown	1				6

## NOTES:

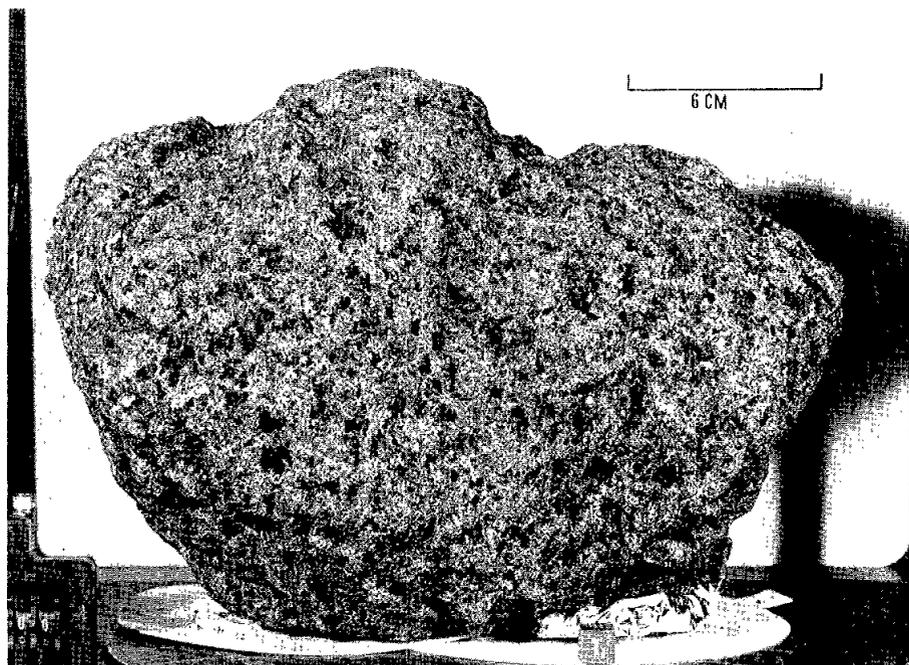
1. 60% dark glass, 15% brown pyroxene, 15% colorless plagioclase, 5% oxides, grain size uniform on all areas examined. The mineral fragments are rounded(?)
2. Plagioclase, brown pyroxene, and opaque. Texture is granular.
3. Plagioclase, green-gray mafic silicate (oliv(?)). Has less opaques than the dark basalt.
4. Shows cleavage.
5. Smearly patches of polycrystalline material; outlines obscured by dust.
6. The dark glass which partially coats surfaces and penetrates between the fracture controlled fragments is vitreous black to dark gray brown under low magnification; it's surface may be mammillary or relatively smooth, in both cases many small vesicles can be seen.



Sample 70019

S-73-15333





Sample 70035

S-72-56385

THIN SECTION DESCRIPTION

BY: Morrison

DATE: 3/2/73

SECTION: 70035,14

SUMMARY: Inequigranular basalt with crystallization order: (a) Opaques, (b) augite and plagioclase, (c) plagioclase and olivine, and (d) mesostasis.

TEXTURE: Inequigranularity results from roughly equidimensional areas that show reduced grain size of all components. Augites in these areas are equant and 0.5 - 1 mm, olivines are equant and 0.5 mm, and opaques are equant and slightly layered. All of these minerals are poikilitically enclosed by a few large plagioclase crystals. Both augite and plagioclase show some incipient deformation expressed by imperfect extinction.

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	25	Subhed to prism	<1 - 3	Plag, which is progressively zoned, occurs as (a) 2 - 3 mm laths poikilitically enclosing all other components, and (b) <1 to 1 mm crystals, surrounded by larger augites, and (c) acicular crystals in the mesostasis.
Augite	60-70	Subhed & prism to equant	<1 - 3	
Opaq	10-15	Euhed to subhed	<1 - 2	
Oliv	1-2	Equant	0.5 - 1	
Crist	Tr	Ovoid mass	<1	
Meso-stasis	<1	Inequi	1 - 2	Augite is titaniferous and occurs as: (a) 2 - 3 mm crystals, blocky, frequently twinned, and with

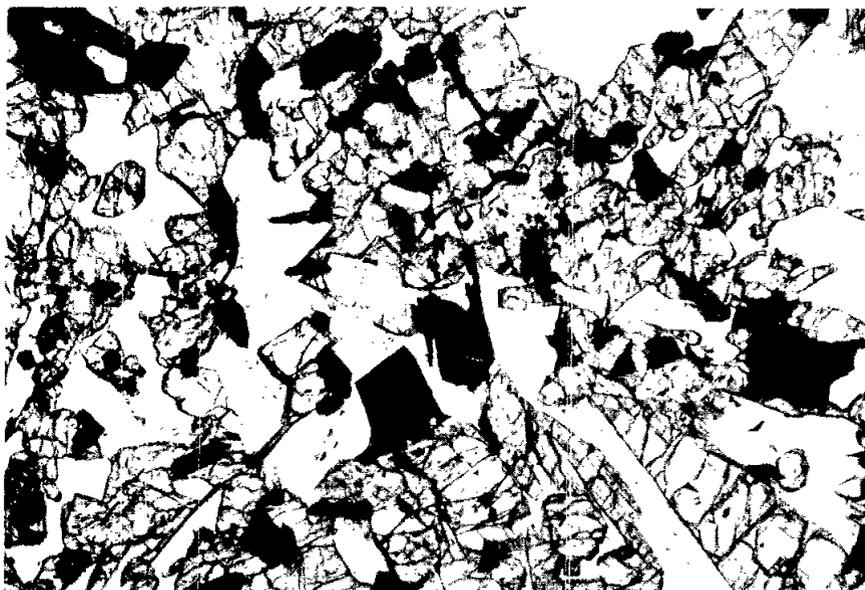
numerous ilmenite inclusions

(b) <1 - 2 mm crystals, as discrete grains and also as inclusions in plagioclase.

Olivine occurs as: 0.5 - 1 mm equant crystals, typically enclosed by plagioclase.

Mesostasis consists of pyroxene, plagioclase, glass spheres and has spherical bodies of suspended opaque(?).

Some ilmenite growths have lenticular inclusions which appear to be trapped early liquid which is now crystallized.



Section 70035,14 S-73-19849  
Width of field 3.16 mm, plane light

<u>OPAQUES DESCRIPTION</u>		BY: Brett	DATE: 2/1/73	
SECTION: 70035,15				
<u>PHASE</u>	<u>SECTION</u>	<u>SHAPE</u>	<u>SIZE</u>	<u>COMMENTS</u>
Ilm	15	Blocky	0.001-0.05	Ilmenite in subhedral blocky crystals, laths and rectangles. Strongly pleochroic and anisotropic like all Apollo 17 mare ilmenite.
Rut	<0.5	Lamel	0.1	
Spin	<0.5	Lamel & irreg	0.2 - 0.02	
Troil	<0.2	Blebs	To 0.3	Lamellae of rutile in rhombohedral directions are common in ilmenite, lamellae of a spinel phase occur along the basal plane of ilmenite. The spinel phase also rims ilmenite locally. Metal blebs in troilite are rare. Grains of chromian ulvospinel are rare; these commonly contain exsolution lamellae of ilmenite; armalcolite in ilmenite occurs rarely.
Fe-Ni	<0.2	Blebs	To 0.6	
Cr-Ulvo	Tr	Subhed	To 0.05	

ROCK TYPE: Fine-grained olivine-  
ilmenite basalt

WEIGHT: 5.64 g

DIMENSIONS: 3 x 1.7 x 1 cm

COLOR: Grayish black (N2)

SHAPE: Subangular slabby

COHERENCE: Intergranular - Tough  
Fracturing - None

BINOCULAR DESCRIPTION

BY: Agrell and Agrell

DATE: 3/30/73

FABRIC: Microporphyritic

VARIABILITY: Homogeneous

SURFACE: All fresh and hackly. One end of sample has surface  
iridescent surface

ZAP PITS: None

CAVITIES: <1%, narrow slit-like cavities 1 - 4 mm in length, <0.2 mm  
in width lined with prismatic crystals of plag, pyrox, ilm(?) occur  
throughout the rock; they run more or less at right angles to the  
length. Two areas on the surface of the rock probably represent  
the lining of a large bubble-like vesicle. Plates of ilmenite  
with minor plag or pyrox coat these surfaces. The strip-like  
vesicular zones are replaced by little randomly oriented vugs  
in the vicinity of these larger vesicles.

SPECIAL FEATURES: A quench rock with ilmenite and olivine on the  
liquidus.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Oliv	Greenish	5	Equant	0.2		1
Plag	Vitreous	35	Interst	<0.05		
Cpx	Brownish	45	Interst	<0.05		
Opaq oxide	Black	15	Thin plates	2	0.05 - 2	2

NOTES:

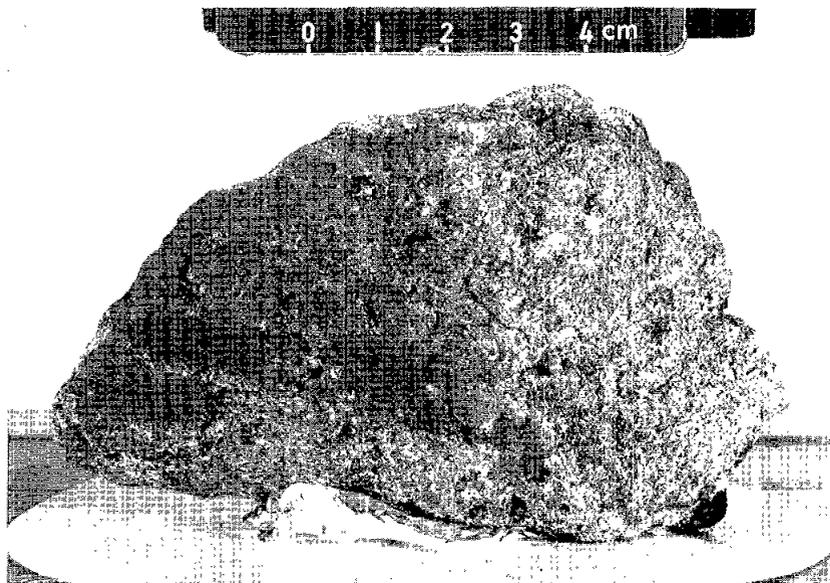
- Olivine and ilmenite appear as microphenocrysts in a rock which has a groundmass of fine-grained plag, pyrox and ilm.
- Randomly oriented; probably ilmenite.



<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clots	Brown	5-10	Blocky, rounded corners		2x3	1
Plag	White	35	Blocky to lath- like	1.0	2x1.5 to 0.1x3	2
Pyrox	Deep honey brown	35-40	Blocky	0.7		3
Ilm	Black high luster	15-20	Lath	1.0	0.1x1.5	

## NOTES:

1. 60% brownish gray pyroxene with inclusions of opaque minerals. Rarely contain small bits of plagioclase.
2. The blocky grains are bigger than the laths.
3. Interstitial to plagioclase.



Sample 70135

S-72-56379



BINOCULAR DESCRIPTION

BY: Butler

DATE: 3/28/73

FABRIC: Granular

VARIABILITY: None

SURFACE: All faces are irregular and hackly. Two faces are discolored from exposure.

ZAP PITS: None

CAVITIES: 5% as vugs

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox	Cinnamon brown	45	Anhed equant	0.3	Up to 1	
Plag	White	35	Subhed colum	1	Up to 1.5	
Ilm	Black	20	Equant	0.5	Up to 1	
Oliv	Pale green	1	Equant	0.5		

70138

ROCK TYPE: Medium basalt

WEIGHT: 3.66 g

COLOR: Brownish gray (5YR 5/1)

DIMENSIONS: 2 x 1.3 x 1 cm

SHAPE: Angular

COHERENCE: Intergranular - Coherent

Fracturing - Few, non-penetrative

BINOCULAR DESCRIPTION

BY: Butler

DATE: 3/29/73

SURFACE: One surface is slickensided with smeared-out and pulverized ilmenite.

ZAP PITS: None

CAVITIES: 5% as vugs

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox	Cinnamon brown	50	Equant	0.5	Up to 1	
Plag	White c'less	35	Colum	1	Up to 2	
Ilm	Black	15	Tab	0.3		
Oliv	Pale green	1	Equant	0.3		

70139

ROCK TYPE: Medium basalt  
 COLOR: Brownish gray (5YR 5/1)  
 SHAPE: Angular  
 COHERENCE: Intergranular - Coherent  
 Fracturing - None

WEIGHT: 3.16 g  
 DIMENSIONS: 2 x 1.4 x 0.8 cm

BINOCULAR DESCRIPTION

BY: Butler

DATE: 3/29/73

VARIABILITY: None

SURFACE: One face is darkened and seems to have had ilmenite smeared over it; probably slickensided, but may have been exposed surface.

ZAP PITS: None

CAVITIES: 2% as vugs

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox	Cinnamon brown	45	Colum	0.5		
Plag	C'less, white	35	Colum to lath	0.8	Up to 0.1	
Ilm	Black	20	Platy	0.3		

70145

ROCK TYPE: Basalt  
 COLOR: Medium gray (N4)  
 SHAPE: Subrounded  
 COHERENCE: Intergranular - Tough  
 Fracturing - Small

WEIGHT: 3.07 g  
 DIMENSIONS: 2 x 1 x 1 cm

BINOCULAR DESCRIPTION

BY: Agrell and Agrell

DATE: 3/29/73

FABRIC: Equigranular

VARIABILITY: Homogeneous

SURFACE: All except B fresh fracture surfaces; B possible exterior surface in part, feldspar slightly chalky, pyroxene dull.

ZAP PITS: None

CAVITIES: 5% miarolitic cavities lined with plag, pyrox or ilm.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	C'less	43	Equant laths & interst	0.8	0.2 - 1.2	

## 70145 (Continued)

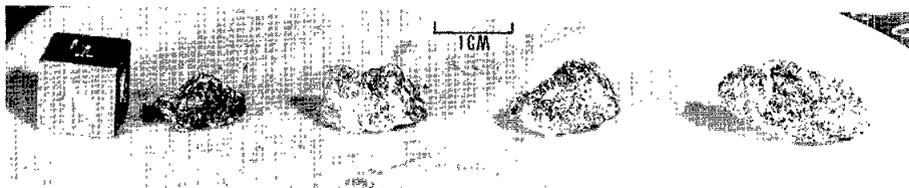
123

Cpx	Cinnamon	43	Blocky & interst	0.8	0.2 - 1.5
Ilm	Black	14	Blocky tablets	0.4	0.3 - 0.7
Maf sil	Pale green			0.15	

1

## NOTES:

- Trace only, only seen as a few sporadic crystals enclosed in plagioclase - possibly olivine.



Sample	70148	70147	70146	70145
		S-73-17974		

70146

ROCK TYPE: Basalt  
 COLOR: Medium gray (N4)  
 SHAPE: Subangular  
 COHERENCE: Intergranular - Tough  
 Fracturing - Two non-penetrative

WEIGHT: 1.71 g  
 DIMENSIONS: 1.3 x 1.3 x 0.8 cm

BINOCULAR DESCRIPTION

BY: Agrell

DATE: 3/29/73

FABRIC: Equigranular  
 VARIABILITY: Homogeneous  
 SURFACE: N, S, and T are fracture surfaces; B was exposed surface with some chalky plag and crazed pyroxene.  
 ZAP PITS: B none  
 CAVITIES: 5%, miarolitic lined with plag, pyrox or ilm.  
 SPECIAL FEATURES: The crazed surface of the pyroxene is dark and finely hackly; it is possible that there is a thin skin of dark glass coating part of the surface. Mode is identical to 70145.

70147

ROCK TYPE: Basalt  
 COLOR: Medium gray (N4)  
 SHAPE: Subangular  
 COHERENCE: Intergranular - Tough  
                   Fracturing - None

WEIGHT: 1.35 g  
 DIMENSIONS: 1.3 x 0.8 x 0.8 cm

BINOCULAR DESCRIPTION

BY: Agrell

DATE: 3/29/73

FABRIC: Equigranular  
 VARIABILITY: Homogeneous  
 SURFACE: S fracture; T fracture; N fracture; E exterior; B fracture;  
           W fracture  
 ZAP PITS: None on E  
 CAVITIES: None  
 SPECIAL FEATURES: Mode identical with 70145, and 70146.

70148

ROCK TYPE: Basalt  
 COLOR: Medium gray (N4)  
 SHAPE: Subangular  
 COHERENCE: Intergranular - Tough  
                   Fracturing - Small, non-penetrative

WEIGHT: 0.92 g  
 DIMENSIONS: 1 x 1 x 0.7 cm

BINOCULAR DESCRIPTION

BY: Agrell and Agrell

DATE: 3/29/73

FABRIC: Equigranular  
 VARIABILITY: Homogeneous  
 SURFACE: S fracture; E exposed surface, dull; B fresh  
 ZAP PITS: None  
 CAVITIES: None  
 SPECIAL FEATURES: Components are as in 70145, 70146, 70148. With  
                   reference to series 70145 through 70148, it is very difficult  
                   to judge overall color in small specimens where the white plagioclase,  
                   cinnamon pyroxene and black ilmenite present a composite appearance.

70149

ROCK TYPE: Basalt  
 COLOR: Brownish gray  
 SHAPE: Angular, broken piece  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 0.95 g  
 DIMENSIONS: 0.6 x 0.6 x 0.4 cm

BLINOCULAR DESCRIPTION BY: Jackson

DATE: 1/10/73

FABRIC: Inequigranular  
 SURFACE: Freshly broken all surfaces.  
 CAVITIES: 0.1 mm vugs.  
 SPECIAL FEATURES: This is representative of end portions of 70135,  
 as seen on W, not of foliated central part.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTE</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clots	Brown	10	Blocky		2x3	1
Plagio- clase	White	35	Lath to inter- stitial	1.0	0.4x2	
Pyroxene	Brown	35-40	Blocky to inter- stitial	0.7		
Ilmenite	Black	15-20	Blocky to lath- like	0.7	0.3x1	

NOTES:

1. Honey brown (dark) pyroxene with ilmenite inclusions.

THIN SECTION DESCRIPTION BY: Wilshire

DATE: 1/20/73

SECTION: 70149,1  
 SUMMARY: Coarse-grained poikilitic basalt rich in ilmenite.  
 TEXTURE: Poikilitic texture with large plagioclase plates enclosing  
 pyroxene and opaque minerals. Two large clots of intergrown  
 pyroxene-ilmenite. Prismatic clinopyroxenes have normal zoning;  
 other forms show complex, irregular zoning. Opaques are inhomog-  
 eously distributed. Olivine occurs in clusters of tiny anhedral  
 grains in clinopyroxene.

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	27	Irreg plates	0.15 - 6	
Pyrox	49	Anhedral-euhedral	0.1 - 2.7	All clinopyroxene
Opaque	23	Equant	<0.1 - 1.1	
Cristobalite	1	Interstitial	0.2 - 0.5	
Oliv	Tr	Anhedral	<0.1 - 0.15	
Mesos	Tr			

ADDITIONAL COMMENTS: Narrow crush zone 2.5 mm long, <0.1 mm thick. Mode on basis of 700 pt. counts. Minute cavities in glassy mesostasis.



Section 70149,1 S-73-19855  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 2/8/73

SECTION: 70149,1

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	20	Rnd, equant	To 1	Ilmenite is Mg-rich with relatively abundant rutile and spinel lamellae and inclusions. Some Cr-spinel grains by themselves are associated with ilmenite. Troilite contains typical metal blebs.
Rut	<0.2	Lamel, irreg	To 0.2	
Spin	<0.2	Lamel, irreg	To 0.2	
Fe-Ni	<0.2	Rnd	To 0.075	
Troil	<0.2	Rnd	To 0.075	

70155

ROCK TYPE: Basalt

WEIGHT: 0.77 g

COLOR: Medium gray (N5)

DIMENSIONS: 1 x 0.8 x 0.8 cm

SHAPE: Subangular block

COHERENCE: Intergranular - Tough  
Fracturing - NilBINOCULAR DESCRIPTION

BY: Agrell and Agrell

DATE: 3/29/73

FABRIC: Equigranular

VARIABILITY: Homogeneous

SURFACE: T fresh; S fresh; B fresh; N fresh (possibly part external surface)

ZAP PITS: None

CAVITIES: 1% miarolitic (0.5 mm diameter) with pyrox, plag, and ilm in linings.

SPECIAL FEATURES: Slight heterogeneity on scale of samples as the largest blocky crystal of pyroxene are separated by 0.3 - 0.5 mm.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	C'less	40	Lathy & interst	1	0.5 - 2	
Pyrox	Deep brown to cinnamon	49	Blocky & interst	1	0.5 - 2.5	1
Ilm	Black	10	Tab	0.5	0.3 - 1.5	
Oliv	Yellow gray	1	Equant	0.5		

## NOTES:

1. Blocky pyroxenes are deep brown; those interstitial to feldspar are cinnamon colored.



70165

ROCK TYPE: Basalt  
 COLOR: Brownish gray (5YR 4/1 to 5YR 6/1)  
 SHAPE: Angular  
 COHERENCE: Intergranular - Coherent  
 Fracturing - Minor, non-penetrative

WEIGHT: 2.143 g  
 DIMENSIONS: 1.7 x 1.5 x 0.8 cm

BINOCULAR DESCRIPTION

BY: Marvin

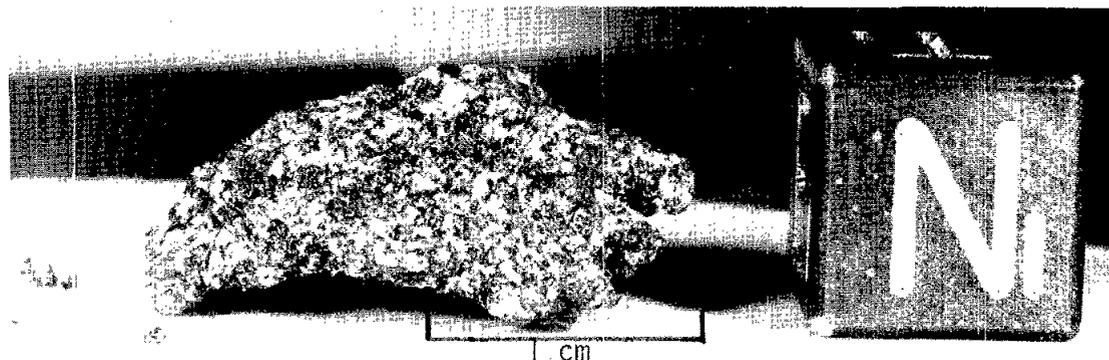
DATE: 2/16/73

FABRIC: Medium, coarse-grained, glomeroporphyritic  
 VARIABILITY: Homogeneous  
 SURFACE: Granular; one area dust-covered  
 ZAP PITS: None observed  
 CAVITIES: <10%; small, irregular  
 SPECIAL FEATURES: No olivine observed

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Vitreous white to gray	35	Anhed	1		1
Pyrox	Cinnamon	45	Anhed	1		
Ilm	Black	20	Anhed	0.5	0.2 - 1.0	

## NOTE:

1. Texture is granular with some clots of pyrox and ilmenite up to 3 mm in size.



Sample 70165

S-73-18159

ROCK TYPE: Glass-rich microbreccia                      WEIGHT: 339.6 g  
 COLOR: Brownish black (5YR 2/1)                      DIMENSIONS: 9 x 6 x 6 cm  
 SHAPE: Pyramidal block  
 COHERENCE: Intergranular - Just coherent  
                   Fracturing - Many non-penetrative; few penetrative

BINOCULAR DESCRIPTION                      BY: Agrell                      DATE: 4/2/73

FABRIC: Microbreccia

VARIABILITY: Homogeneous

SURFACE: T is hackly, with many small sealed fractures. N is cut by many open fractures perpendicular to B, occasional coating with films of mammillated glass. W is very uneven surface controlled by fractures. S is broken by many small fractures, an area about 2x3 cm is a distinctly more feldspathic microbreccia. E is an apex and shows intersecting fractures. T is broken by many fractures; 1 cm glass splash on W.

ZAP PITS: Many on B (1 - 2 mm diameter with dark glass lining), W (towards B), S; few on N, T; none on E (except on portions that are passing into S and N).

CAVITIES: <5%; see Lithic Clast.

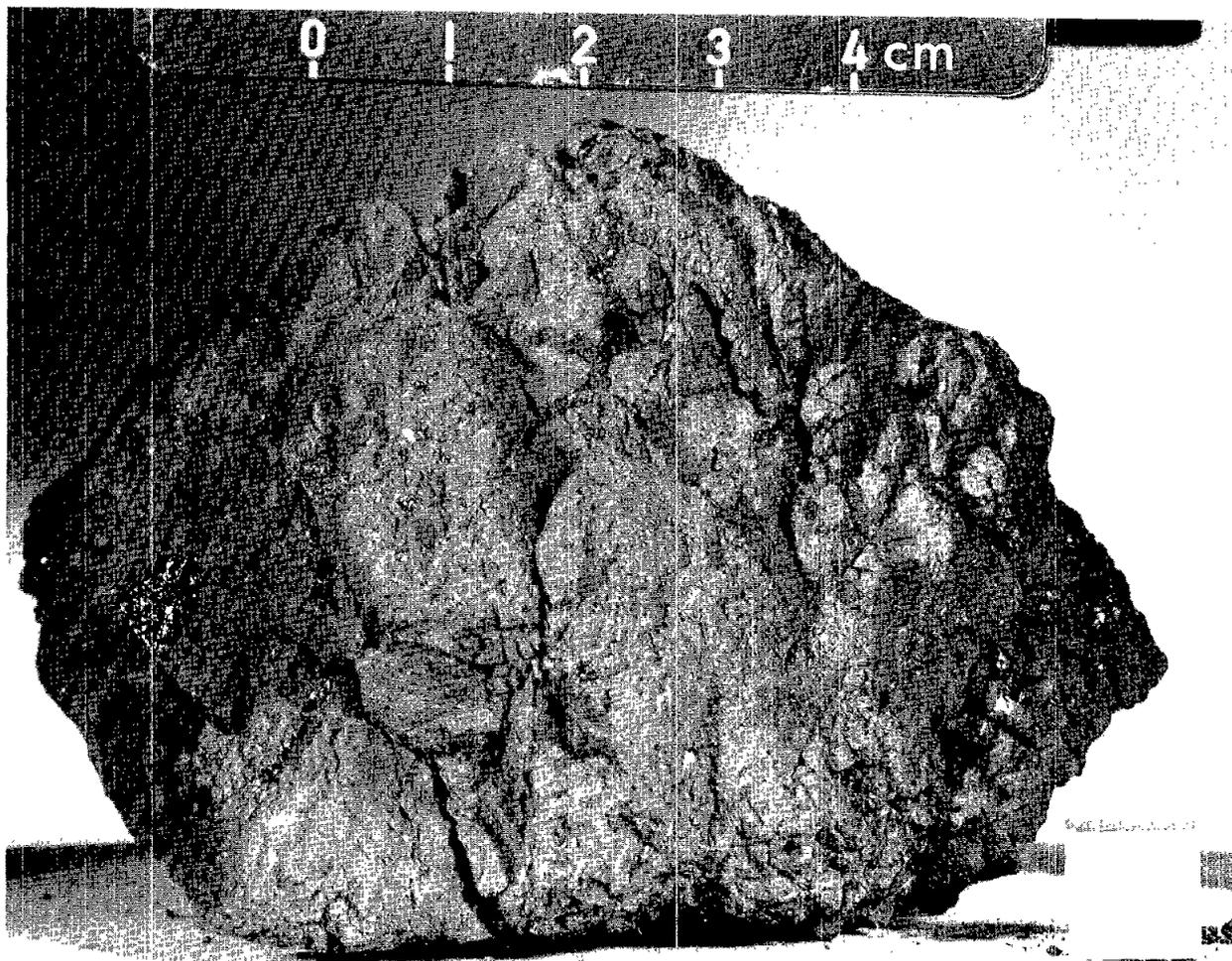
SPECIAL FEATURES: Many beams of orange colored glass. Beautiful glass splash on W face, rim features droplets, rays, etc.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Browny black	75			<0.01 - 0.5	1
Mineral clasts	Variable	5	Ang	0.2	0.5 - 1.0	2
Glass clasts	Orange brown to black	15	Spheres or fragments	0.1	0.02 - 1	3
Lithic clasts	Speckled gray	5	Irreg	20x20		4

NOTES:

1. Dominantly glass, both black and orange brown colors can be seen and minute feldspar chips. This may be traversed by curving orange brown glass seams 0.1 mm thick and up to 1 cm or more in length.
2. Angular white plagioclase fragments dominant; subordinate dark ferro-magnesian (pyroxene?).
3. Glass occurs in small dots, spheres and angular fragment; black on exterior surfaces. Glass seams occur on broken surfaces and are orange brown in color. The unbroken surface of these seams is black. It is difficult to decide whether these are glass splashes or veining glass.

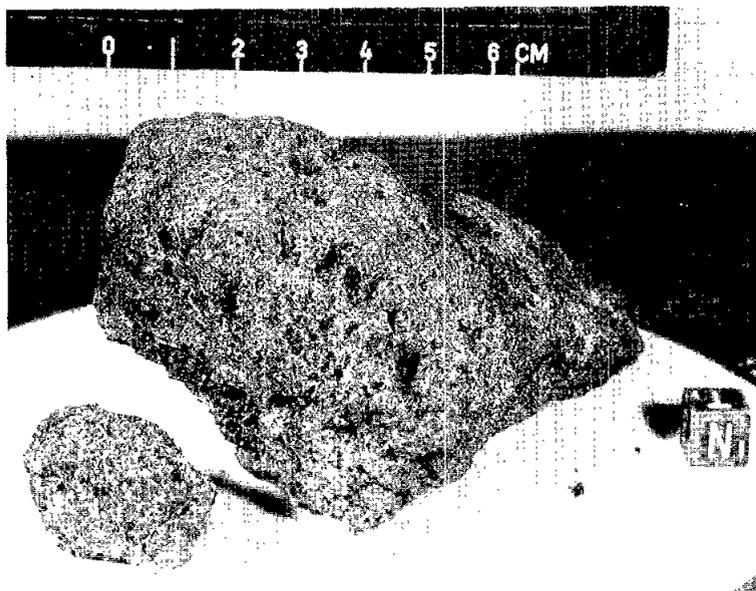
4. The clast is a fine-grained microbreccia slightly paler in color than the host rock. About 80% matrix, 20% clasts of chalky and sugary feldspar with sporadic dark pyroxene. The matrix contains small flattened cavities <0.1 mm in length, whose alignment gives a weak foliation to the sample.



Sample 70175

S-73-15348





Sample 70185

S-73-15872

70215

ROCK TYPE: Fine-grained basalt                      WEIGHT: 8110 g  
 COLOR: Medium dark gray with faint                      DIMENSIONS: 23x13x10.5 cm  
           brownish tint (N4)  
 SHAPE: Blocky, subangular; one flat surface  
 COHERENCE: Intergranular - Tough  
                   Fracturing        - Several penetrative

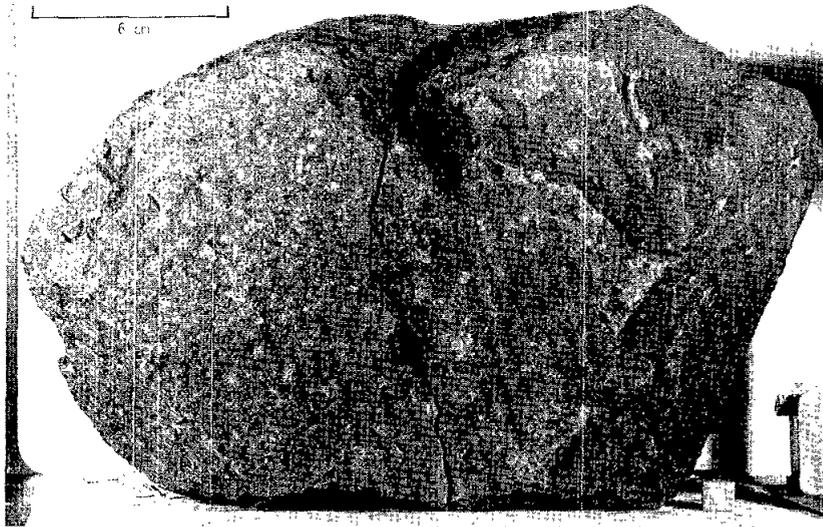
BINOCULAR DESCRIPTION    BY: Wilshire/Ridley                      DATE: 1/22/73

FABRIC: Intersertal-intergranular  
 VARIABILITY: Possibly in grain size from aphanitic to very fine-grained  
 SURFACE: T has thin 5x3 mm crusts with slickensides, whole surface of  
           B lighter colored than body of rock due to zaps. All surfaces finely  
           hackly.  
 ZAP PITS: Many on all faces except a patch on N (see photo) which has  
           few.  
 CAVITIES: Trace of 0.5 - 3 mm diameter vugs with projecting pyroxene  
           and ilmenite prisms and plates.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Olivine	Yellow green	<1	Equant subhedral	1	1-2	1
Plagioclase	Light gray		Laths		0.2-1	2
Pyroxene	Brown		Equant			2
Opaque	Black					2
Metal	Silver	Tr				3

## NOTES:

1. Phenocrysts. Possible also in groundmass.
2. Grain size and components too fine to estimate. Portions estimated on small zap spalls are 30% plagioclase, 40 - 45% pyroxene, 25% ilmenite(?), we do not feel these percentages are reliable however.
3. On T



Sample 70215

S-73-15708

## 70215 (Continued)

THIN SECTION DESCRIPTION

BY: Wilshire

DATE: 2/23/73

SECTION: 70215,7

SUMMARY: Fine-grained, subvariolithic basalt with microphenocrysts of ilmenite, olivine, and clinopyroxene.

## GROUNDMASS, 48% OF ROCK

<u>PHASE</u>	<u>% OF GROUNDMASS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm(?)	100			
Pyrox				
Plag				

## PHENOCRYSTS, 52% OF ROCK

<u>PHASE</u>	<u>% OF PHENOCRYSTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm(?)	48	Prism	To 1	
Oliv	13	Stubby, prisms	To 0.2	
Pyrox	38	Stubby, prisms	To 0.5	

TEXTURE: Microporphyrictic with opaque prisms and small olivine and pyroxene prisms in a subvariolithic groundmass with locally developed sheafs of plagioclase laths.

ADDITIONAL COMMENTS: Olivine commonly mantled by pyroxene. Percentages based on 500 point counts.

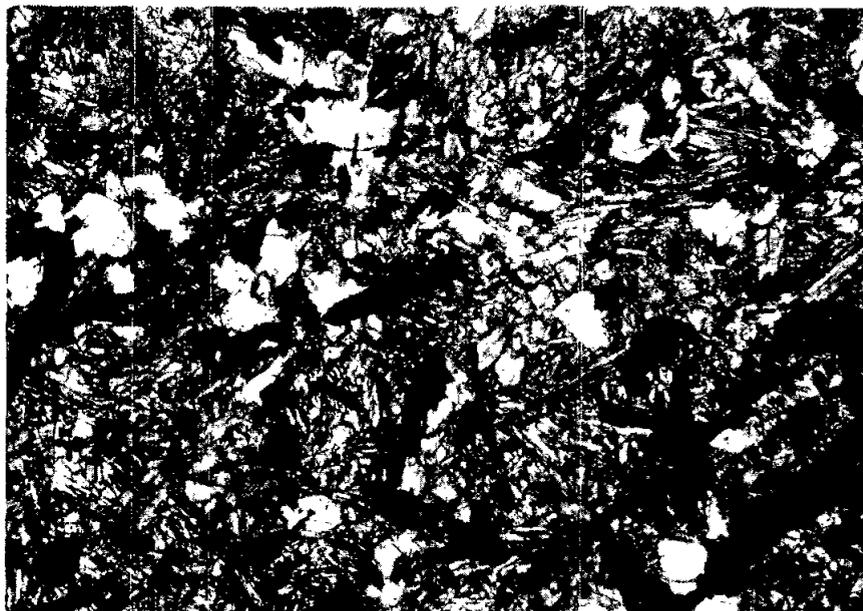
OPAQUES DESCRIPTION

BY: Brett

DATE: 2/8/73

SECTION: 70215,7

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	20	Laths, blocky crystals	To 1	Most ilmenite is Mg-rich, some show abundant rutile lamellae and segregations, but most is poor in this compared to other sub-floor rocks. Ilmenite lamellae occur in ulvospinel; ilmenite occurs also as rims on ulvospinel. Troilite and metal in characteristic occurrence.
Fe-Ni	< 0.2	Blebs	To 0.05	
Troil	< 0.2	Blebs	To 0.05	
Rut	< 0.2	Laths, irreg	To 0.15	
Ulvo	Tr	Anhed	To 0.2	
Cr-Sp	Tr	Anhed	To 0.05	



Section 70215,7 S-73-19859  
Width of field 3.16 mm, plane light

70255

ROCK TYPE: Basalt	WEIGHT: 277.2 g
COLOR: Medium dark gray (N4)	DIMENSIONS: Two mated pieces:
SHAPE: Blocky, subangular	5.5 x 3.5 x 3 cm
COHERENCE: Intergranular - Tough	7.5 x 5.5 x 4.5 cm
Fracturing - One penetrative	

BINOCULAR DESCRIPTION

BY: Stuart-Alexander

DATE: 2/1/73

FABRIC: Intergranular, possible vitrophyric.

VARIABILITY: Homogeneous

SURFACE: Finely hackly

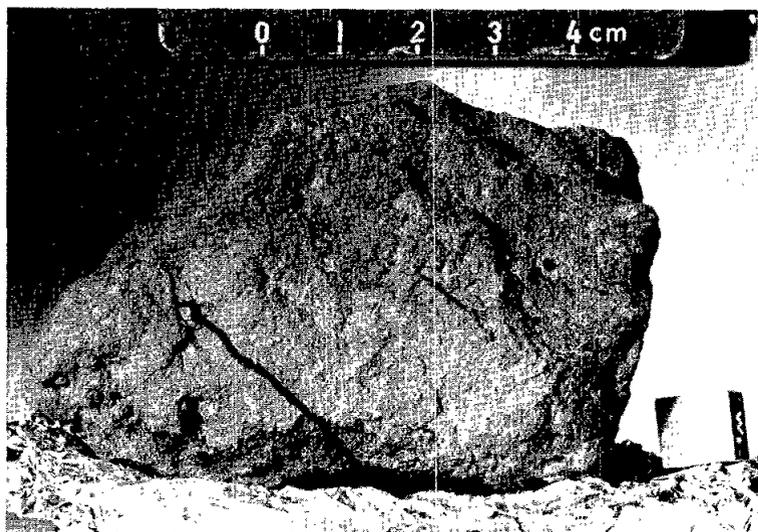
ZAP PITS: Few on B and E; many on T, S, W, and N.

CAVITIES: 1-2%, up to 9 mm, vugs. Lined by irregular masses of ilmenite needles (to 1 mm), plagioclase (scarce), pale yellowish mineral, and brown pyroxene.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox	Reddish brown			0.1		1
Plag	White- colorless		Some laths	0.1	<0.1 - 0.7	1
Opaque Possible glass	Black Dark gray to black			0.1		1 2
Olivine	Yellow- ish green	Tr	Anhed		0.5	

## NOTES:

1. Too fine-grained to get proportions. Coarser grained near vugs.
2. Too fine-grained to get proportions. Vitreous luster.



Sample 70255

S-73-16044

ROCK TYPE: Basalt  
 COLOR: Between medium gray (N5)  
 and light brownish gray (5YR 6/1)  
 SHAPE: Blocky, subrounded  
 COHERENCE: Intergranular - Tough  
 Fracturing - One, penetrative

WEIGHT: 171.4 g  
 DIMENSIONS: 6.5 x 5.0 x 3.5 cm

BINOCULAR DESCRIPTION

BY: Stuart-Alexander

DATE: 2/2/73

FABRIC: Intergranular to plumose; olivine microphenocrysts and  
 glomeroporphyritic clots.

VARIABILITY: Texture variable.

SURFACE: All surfaces weathered and finely lumpy.

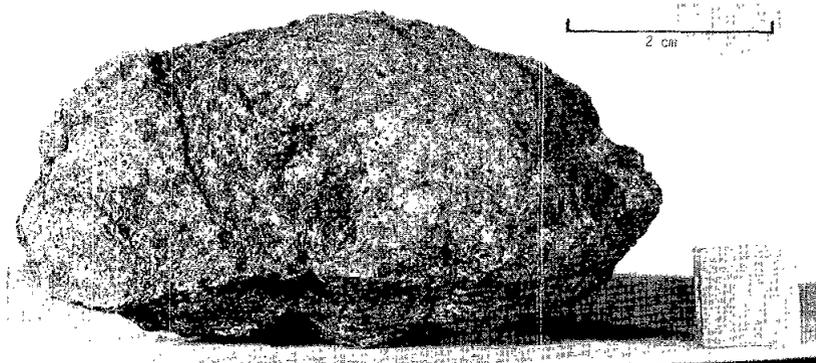
ZAP PITTS: All faces have many.

CAVITIES: 2-3%, vugs up to 2-3 mm, most <1 mm.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox(?)	Yellow- ish brown	50	Anhed	0.2	<0.1 - 5	
Plag	White, minor colorless	30	Thin laths, some anhed	0.4	<0.1 - 3	
Ilm(?)	Black	15 - 20	Anhed to blades	0.2	<0.1 - 4	
Maf sil	Yellow- ish green	3	Anhed to subhed	0.7	2	1

## NOTES:

- Probably olivine; concentrated in clots.



Sample 70275

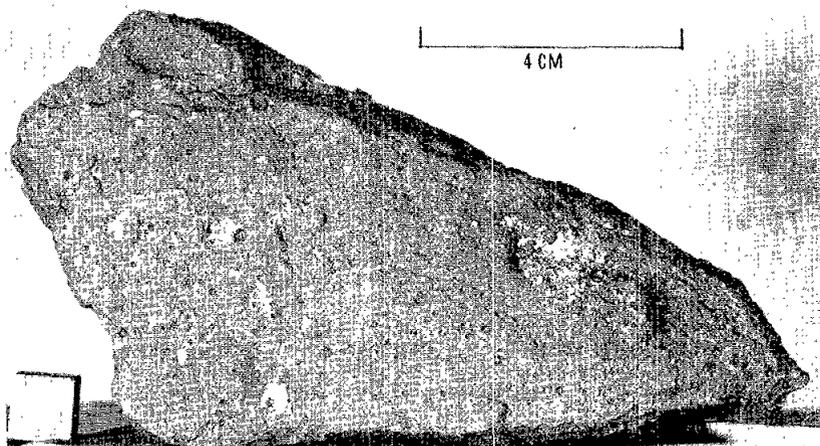
S-73-16208



<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Med gray (N5)	90			<<0.1	1
Lithic I	Mottled white & brown	5	Ang to rnd	1	<0.1 - 5	2
Lithic II		<1	Rnd to subang	1	<0.1 - 3	3
Lithic III	Orange	Tr			Up to 2	4
Lithic IV		Unique		14x12		5
Lithic V		<1			0.1 - 3	6
Plag	White	2	Ang	0.5	<0.1 - 0.2	7
Mafic	Yellow green	<1	Rnd	0.5	<1	8
Mafic	Bottle green	Tr	Rnd		<1	9
Mafic	Brown	<1			<0.5	10

## NOTES:

1. All mineral debris of types listed below matrix in the Table; has a clastic silty texture mostly homogeneous with darker patches, with a few cavities.
2. Basaltic textures with grains up to 1 mm. Many appear crushed or shocked.
3. Mottled on sub 0.1 mm scale. Mottles of white to dark gray. Ratio of light to dark varies. Mottling is mixed with patches of white.
4. Very fine-grained.
5. Large unique clast on N made up of mixture of fine-grained dark gray vitreous to aphanitic material and white porcelain-like material.
6. Plag and yellow green mafic apparently pulverized. The largest mineral grains are 0.3 mm.
7. Clear crystals to maskelynite(?).
8. Milky to sugary (shocked(?)).
9. Clear on inside, milky on outside.
10. Resinous luster with a variety of shades.



Sample 70295

S-73-17194

70315

ROCK TYPE: Basalt  
 COLOR: White, black, and brown,  
 average color 5YR 4/1  
 SHAPE: Subrounded, irregularly surfaced cube  
 COHERENCE: Intergranular - Weakly coherent  
 Fracturing - One penetrative

WEIGHT: 148.6 g  
 DIMENSIONS: 5x4.5x4.5 cm

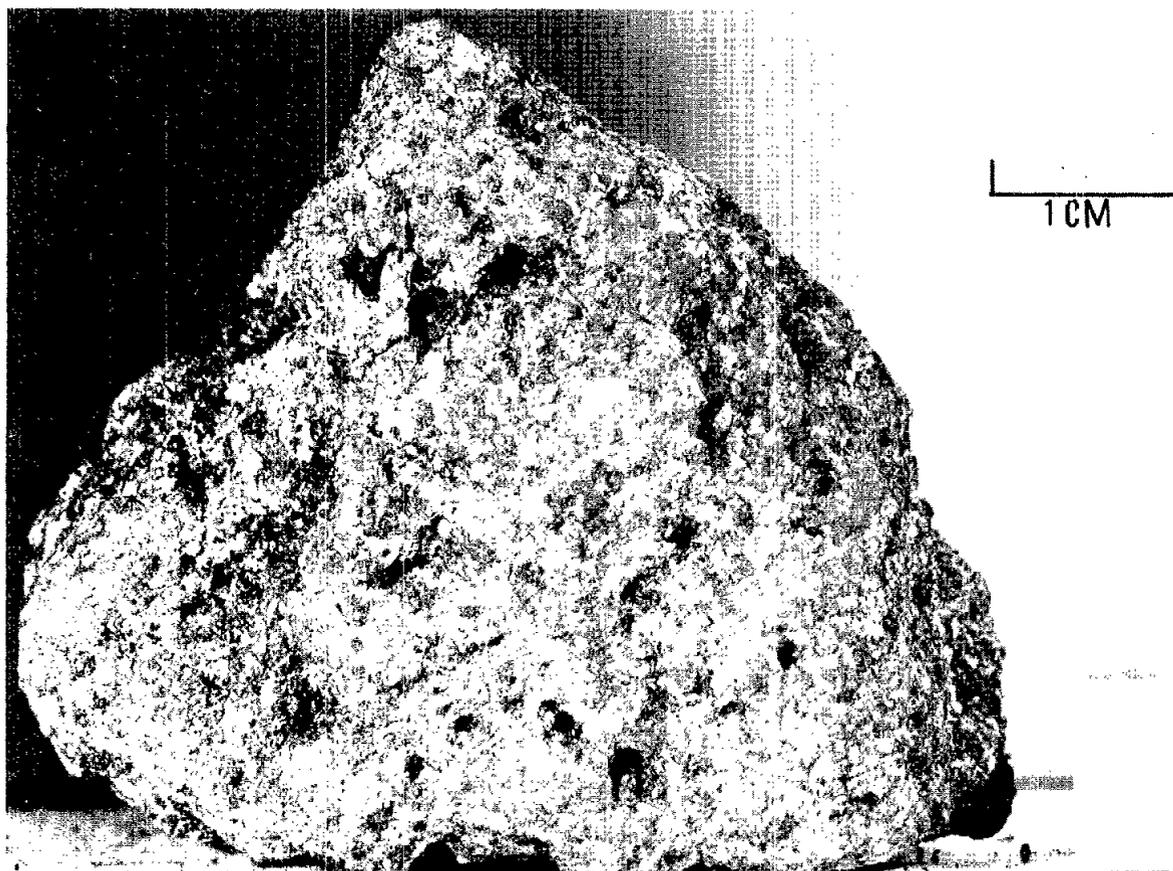
BINOCULAR DESCRIPTION BY: Stuart-Alexander and Ridley DATE: 1/18/73

FABRIC: Primarily intergranular  
 VARIABILITY: Vugs inhomogeneously distributed  
 SURFACE: All equally weathered, no obvious soil line  
 ZAP POINTS: Few on all except none on N. However, density may be low due to friable nature of rock surface  
 CAVITIES: Vugs, 5-10%, a few vesicles, maximum size 1 cm. Where vugs are almost filled, there is a high proportion of ilmenite and pyroxene euhedral crystals; where only lined, there is a normal rock distribution of minerals.  
 SPECIAL FEATURES: Local glomeroporphyritic clots of pyroxene and ilmenite, largest is 3 mm.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White to trans- lucent	35	Equant and laths	0.7	0.2 - 10	1
Pyrox	Resinous brown to lemon yellow	50	Anhed to euhed	0.5	0.1 - 1.0	2
Ilm(?)	Black	15	Anhed to prismatic	0.5	0.1 - 3	
Oliv(?)	Pale yellowish green	Tr		0.1		

## NOTES:

1. Largest grain, located on W face, is an oikocryst, but laths predominate and largest is 3 mm - local plumose texture. A small percentage of these show conchoidal fracturing, and thus may be a silica mineral.
2. A few percent of grains appear zoned with darker brown interiors, lighter exteriors.



Sample 70315

S-73-15451

71035

ROCK TYPE: Basalt  
 COLOR: Medium dark gray (N4)  
 SHAPE: One-half of a hemisphere  
 COHERENCE: Intergranular - Coherent  
 Fracturing - Non -penetrative

WEIGHT: 144.8 g  
 DIMENSIONS: 8x5x2.5 cm

BINOCULAR DESCRIPTION BY: Williams/Marvin DATE: 1/22/73

FABRIC: Medium grained porphyritic  
 VARIABILITY: Homogeneous  
 SURFACE: B and S are fresh; T, N, E and W are rounded and dusty.  
 ZAP PITS: Very sparse pits on T and N and E and W.  
 CAVITIES: 40% are subround to irregular vugs; conc entrated on T and S faces. Their size ranges from 0.2 mm up to 1 cm but averages 3 mm. Lined with euhedral crystals that are larger than groundmass.  
 SPECIAL FEATURES: Crystals in vugs are ilmenite (predominante), pyroxene cinnamon and plagioclase. Vugs coarser toward SW corner. Sparse yellow crystals (oliv or pyrox) are also present in vugs. Pyroferroite(?) present in some vugs.

<u>COMPONENT</u> <sup>1</sup>	<u>COLOR</u>	<u>% OF</u> <u>ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	35	Anhed	0.7	0.2 - 2	2
Pyrox	Brownish	40	Anhed	0.7	0.2 - 1	
Ilm	Black specular	20	Anhed	0.7	0.1 - 1	3
Oliv or pyrox	Dull yellow	<1	Anhed - euhed	0.2		

## NOTES:

1. Components exclude materials in vugs.
2. In some areas up to 4-5 mm.
3. Become blades and laths in vugs.

71036

ROCK TYPE: Basalt  
 COLOR: Medium dark gray (N4)  
 SHAPE: Half of a hemisphere  
 COHERENCE: Intergranular - Coherent

WEIGHT: 118.4 g  
 DIMENSIONS: 8.5x3x4 cm

BINOCULAR DESCRIPTION BY: Williams/Marvin DATE: 1/22/73

FABRIC: Medium grained porphyritic  
 VARIABILITY: Homogeneous  
 SURFACE: S, T, and E are fresh fractures, W is partly exposed surface and partly chipped; B is exposed.

ZAP PITTS: Few on all surfaces

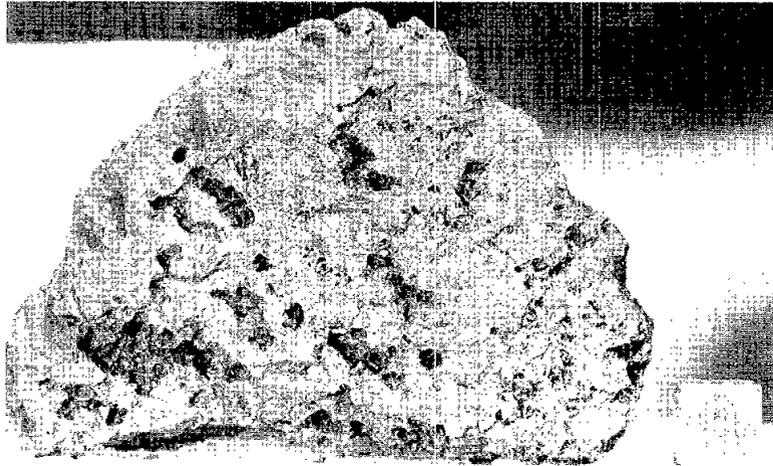
CAVITIES: 30% vugs with a marked concentration on B. They are irregular 0.5 - 5 mm long and average 2 mm. They contain euhedral crystals of ilmenite pyroxene, plagioclase, and rare olivine up to 1 mm long.

SPECIAL FEATURES: Sample 71036 was probably located on the same boulder near 71035, which has the same components. None of the fresh surfaces of 71035 and 71036 fit together, but B of 71035 and T of 71036 are about the same dimensions. The nature of the vugs on these two surfaces are distinctly different (compare photos).

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	35	Anhed to lath shaped	0.7	0.2 - 5	1
Pyrox	Brown	45	Anhed	0.7	0.2 - 1	
Ilm	Black-	20	Anhed	00.7	0.1 - 1	
Ol or pyx	Yellow- green	<1	Anhed- euhed	0.2		

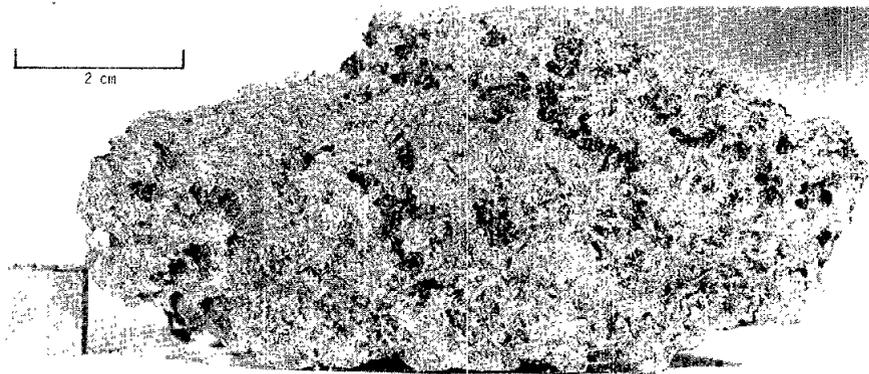
NOTES:

1. Occurs in some areas as ophitic 4-5 mm laths.



Sample 71035

S-73-15672



Sample 71036

S-73-15675

ROCK TYPE: Basalt  
 COLOR: Medium dark gray (M4)  
 SHAPE: Irregular, triangular pyramid  
 COHERENCE: Intergranular - Coherent  
 Fracturing - Few, non-penetrative

WEIGHT: 14.39 g  
 DIMENSIONS: 2.5x2x2 cm

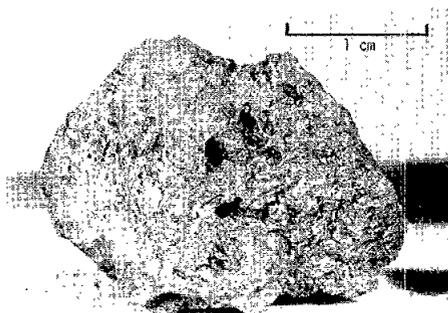
BINOCULAR DESCRIPTION BY: Williams/Marvin DATE: 1/22/73

FABRIC: Medium grained porphyritic  
 VARIABILITY: Homogeneous  
 SURFACE: Fairly dusty, but the greater proportion of all surfaces appear to have been exposed on the lunar surface  
 ZAP PITS: A few on all surfaces except in small chipped areas  
 CAVITIES: 30%; size range (see 71036); large vugs concentrated in one zone  
 SPECIAL FEATURES: Components are like those in 71035 and 71036, except that there may be more yellow mineral in this rock.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	35	Anhed to lath- like	0.7	0.2 - 5	
Pyrox	Brown	45	Anhed	0.7	0.2 - 1	
Ilm	Black	20	Anhed to lath	0.7	0.1 - 1	1
Ol or pyx	Yellow green	<1	Euhed to anhed	0.2		

NOTES:

1. Laths in vugs



Sample 71037 S<sub>1</sub> S-73-15689

ROCK TYPE: Basalt  
 COLOR: Medium dark gray with brownish tint (N4)  
 SHAPE: Blocky, subangular  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 11.92 g  
 DIMENSIONS: 2.5x2x1.5 cm

BINOCULAR DESCRIPTION BY: Wilshire DATE: 1/23/73

FABRIC: Poikilitic  
 VARIABILITY: Irregular vug distribution  
 SURFACE: All finely hackly  
 ZAP PITS: None seen  
 CAVITIES: 5% vugs, 2 - 7 mm in diameter, scarce projecting ilmenite, pyroxene, and possibly a silica mineral.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plagioclase	Light gray	30 - 35	Small rectangular sections of plates		0.5 - 3x7	1
Clots	Brown	5 - 10	Blocky, regular		1x2 - 2x3	2
Pyroxene	Brown	40 -	Stubby prisms	0.5	0.2 - 1	
Opaque	Black	15 - 20	Equant to platy	0.5	0.1 - 1	
Olivine	Yellow green	<1	Equant, anhedral	0.3	0.2 - 0.5	3
Silica	White	1	Interstitial			4

NOTES:

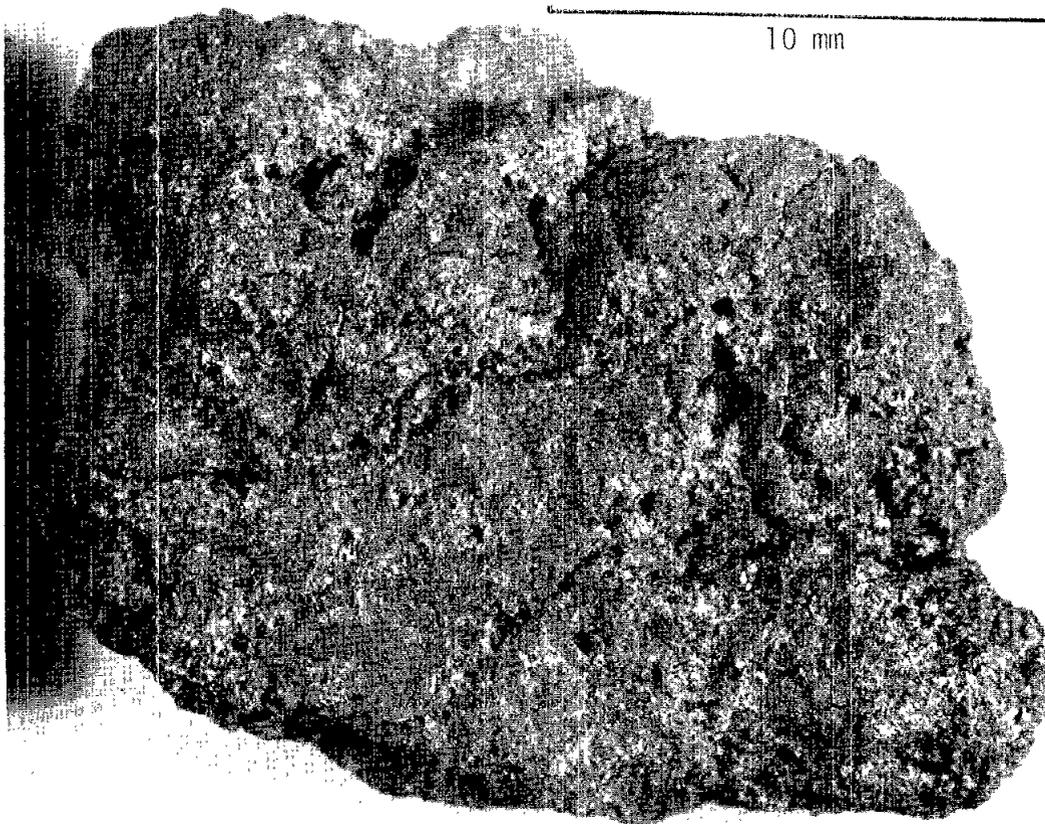
1. Large plates to at least 3 x 7 mm, poikilitically enclose pyroxene and opaque minerals.
2. Subhedral intergrowths of ilmenite and pyroxene.
3. In locally occurring cluster.
4. Cavity lining.



Pyroxene	Brown	45 - 50	Equant	0.5	0.2 - 1	
Opaque	Black	10 - 15	Equant	0.3	0.1 - 0.5	
Silica (?)	Very light gray	Tr				3
Clots	Brown	<5			1x2	4

## NOTES:

1. Clusters; have small black inclusions.
2. Larger grains are intergrown with pyroxene.
3. Cavity filling.
4. Scarce regular-shaped intergrowths of pyroxene and ilmenite.



Sample 71046

S-73-17070

71047

ROCK TYPE: Basalt  
 COLOR: Light brownish gray (5YR 6/1)  
 SHAPE: Blocky, subangular  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few penetrative

WEIGHT: 2.780 g  
 DIMENSIONS: 1.75x1x0.75 cm

BINOCULAR DESCRIPTION BY: Wilshire DATE: 1/23/73

FABRIC: Equigranular, poikilitic  
 SURFACE: Hackly  
 ZAP PITTS: None  
 CAVITIES: None

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clots	Brown	15	Blocky prismatic	2x3	1x2 to 2x3	1
Pyroxene	Light to dark brown	35	Pris- matic	0.7	0.5x1	2
Plagioclase	Light gray	35	Irre- platy	1	To 2x3	3
Opaque	Black	15	Platy	1	0.5x2	4
Yellow- green		Tr	Equant	0.5		5

## NOTES:

1. Intergrowths of brown pyroxene - ilmenite.
2. Irregularly zoned, darker brown toward rims.
3. Larger plates poikilitically enclose pyroxene, opaques.
4. Well developed plates.
5. Possible core zones of pyroxene or olivine.



Sample 71047

S-73-17071

71048

ROCK TYPE: Fine-grained basalt (?)

WEIGHT: 2.457 g

COLOR: Medium dark gray (N4)

DIMENSIONS: 1.25x1x0.5 cm

SHAPE: Blocky, angular

COHERENCE: Intergranular - Tough

Fracturing - None

BINOCULAR DESCRIPTION BY: Wilshire

DATE: 1/23/73

FABRIC: Equigranular

SURFACE: Very finely hackly

ZAP PITS: None

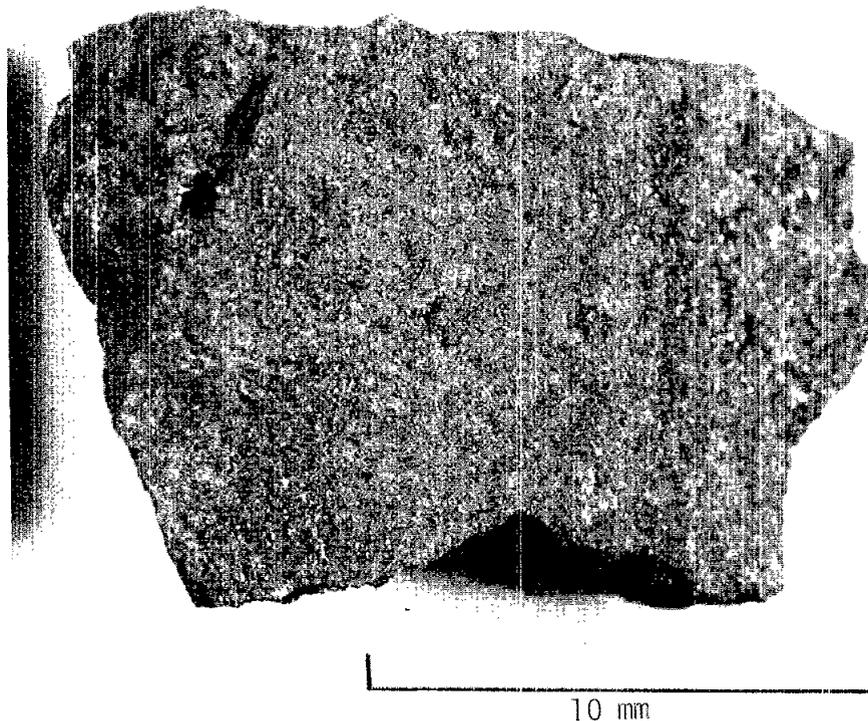
CAVITIES: 1 - 2%, 1 - 2 mm in diameter, lined by ilmenite prisms or plates

SPECIAL FEATURES: Texture very uncertain, igneous name given because the minerals are like those of coarser basalts. Probably the same rock type as 70215.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Olivine	Yellow green	<1	Equant	0.5	0.3 - 0.75	1
Brown pyroxene	Deep reddish brown					2
Opaque	Black					2
Plagioclase (?)						2
Glass	Dark	Tr (?)	Bead		0.5	3

## NOTES:

1. Microphenocrysts.
2. Too fine-grained to estimate proportions.
3. Scarce glass beads in or on rock. Possible groundmass glass.



Sample 71048

S-73-17069

71049

ROCK TYPE: Basalt

WEIGHT: 1.860 g

COLOR: Medium dark gray with brownish  
tint (N4)

DIMENSIONS: 1x1x1 cm

SHAPE: Blocky, angular

COHERENCE: Intergranular - Tough

Fracturing - Few, irregular penetrative

BINOCULAR DESCRIPTION

BY: Wilshire

DATE: 1/23/73

FABRIC: Equigranular

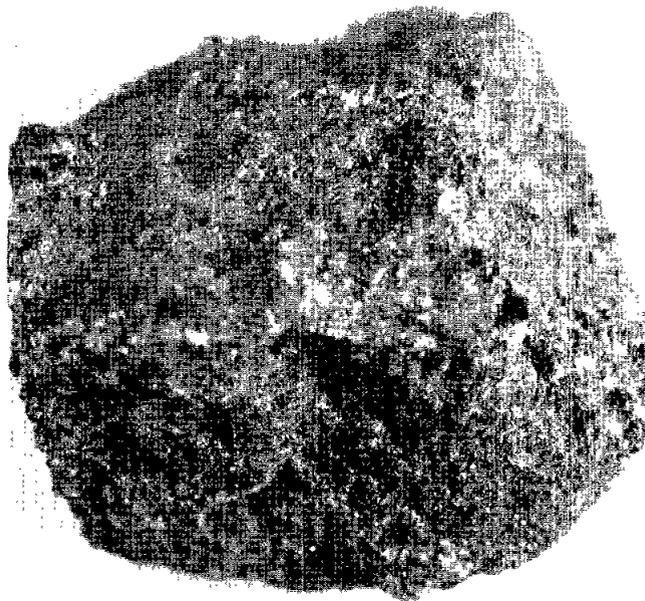
SURFACE: Hackly

ZAP PITS: None seen

CAVITIES: 1-2% of irregular vugs with diameter up to 0.5 mm

SPECIAL FEATURES: Possible scarce 1 mm clots of pyroxene and ilmenite.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	
				<u>DOM.</u>	<u>RANGE</u>
Pyroxene	Brown	50	Equant	0.3	< 0.1 - 0.5
Olivine	Yellow green	< 1	Equant		To 0.5
Plagioclase	Light gray	30	Laths - irreg	0.5	0.2 - 1
Opagues	Black	15 - 20	Equant	0.4	0.1 - 0.5



10 mm

Sample 71049

S-73-17067

ROCK TYPE: Basalt WEIGHT: 669.6 g  
 COLOR: Light brownish gray (N4-IR5 Y/R 4/1) DIMENSIONS: 19.5 x 9.5 x 2.5 cm  
 SHAPE: Angular broken rock, natural surface rounded  
 COHERENCE: Tough and no fractures

BINOCULAR DESCRIPTION BY: Wilshire and Meyer DATE: 1/16/73

FABRIC: Intergranular

VARIABILITY: Homogeneous mineralogy, heterogeneous vug distribution

SURFACE: Finely hackly on both sides. B-S has thin dark gray film and is rounded.

ZAP PITS: B is rounded but has few zap pits. S - few to many.

CAVITIES: Vugs 20-25% (<1-12 mm), 1% smooth-walled vesicles (1 mm), vugs lined with euhedral crystals of ilmenite, pyroxene, plagioclase and yellow-green mineral.

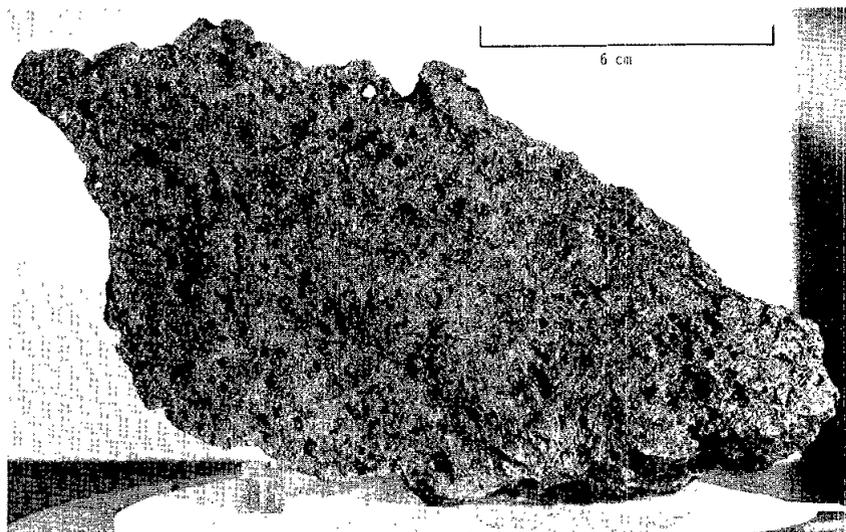
SPECIAL FEATURES: Vugs do not appear to be layered in distribution.

Pyroxene projecting into cavities are thin and needlelike. Yellow-green mineral may be either olivine or pyroxferroite.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Trans-lucent gray	30	Platy to laths	2	0.1x1 to 0.5x4	1
Pyrox	Light to dark root-beer brown	50 - 55	Equant	0.5	0.75 to 0.1	
Oliv(?)		<1	Equant	0.75	0.5 - 1	
Mafic sil	Trans-parent to yellowish green	1	Prismatic	1.0	0.5 - 2	2
Opaque	Shiny black	15 - 20	Platy to equant	0.5	0.5 - 1	
SiO <sub>2</sub> (?)	White	<1			<0.1	3

NOTES:

1. Polysynthetic twinning.
2. On cavity walls.
3. Thin crusts on walls of smooth cavities.



Sample 71055

S-73-15317

71065

ROCK TYPE: Basalt

COLOR: Gray to brownish gray (N4 to  
5YR 4/1)

SHAPE: Rectangular block, angular

COHERENCE: Intergranular - Tough

Fracturing - One penetrative fracture, near edge

WEIGHT: 28.83 g

DIMENSIONS: 4.5 x 2.5 x 2.5 cm

BINOCULAR DESCRIPTION

BY: Marvin

DATE: 1/23/73

FABRIC: Fine-grained, equigranular

VARIABILITY: Homogeneous

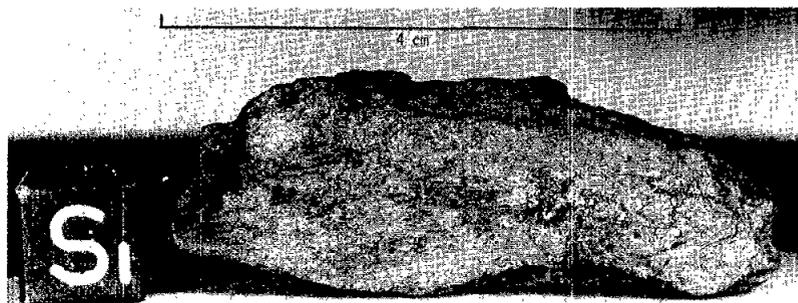
SURFACE: Despite two dustings all surfaces are coated with fine-grained dust and soil, except for one small chipped area next to the vug

ZAP PITS: None

CAVITIES: Only one conspicuous vug which is irregular, 2 mm across, and lined with euhedral ilmenite and pyroxene crystals up to 1 mm long.

## SPECIAL FEATURES:

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyx	Brown	45-50	Anhed		0.05 - 0.1	
Plag	Grayish	35-40	Anhed		0.05 - 0.1	
Clb	Black	15	Anhed		0.05 - 0.1	
Oliv	Yellow	1	Anhed		0.05 - 0.1	



Sample 71065

S-73-16932

71066

ROCK TYPE: Basalt  
COLOR: Medium dark gray (N<sup>4</sup>)  
SHAPE: Very angular, wedge-shaped  
COHERENCE: Intergranular - Tough  
Fracturing - None penetrative

WEIGHT: 19.96 g  
DIMENSIONS: 3.5 x 1.5 x 2.2 cm

BINOCULAR DESCRIPTION BY: Marvin DATE: 1/23/73

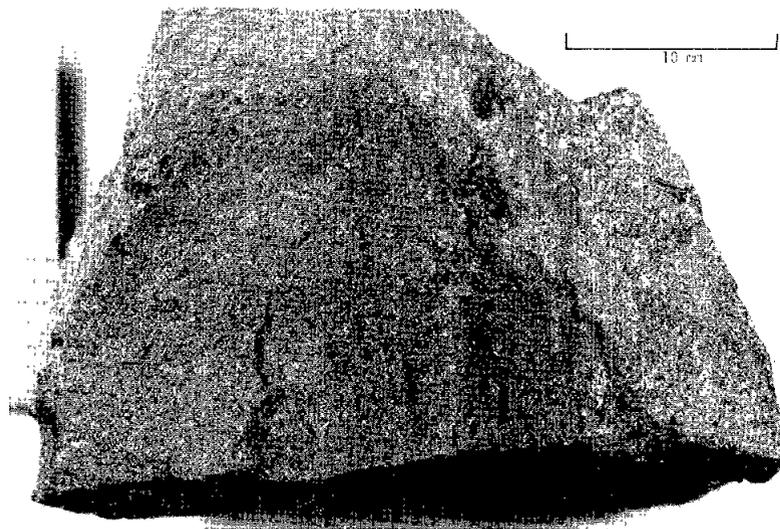
FABRIC: Very fine-grained (0.05 mm) microporphyritic; some plagioclase needles, 0.7 mm long, as seen by reflections from cleavage planes.

VARIABILITY: Very fine

ZAP PITS: None

CAVITIES: There is a line of small (0.1 mm) vugs on one side, and a 2 mm vug on other side lined with a felty intergrowth of ilmenite needles which parallel the cavity walls.

SPECIAL FEATURES: The rock is too dense and fine-grained to judge the mode, but the minerals recognized are pyroxene, plagioclase, ilmenite and olivine which is only present as a trace. There is a trace of a glassy coat in isolated spots on the rock.



Sample 71066

S-73-17066

ROCK TYPE: Basalt  
 COLOR: Medium dark gray (N4) with brown tint  
 SHAPE: Subrounded  
 COHERENCE: Intergranular - Friable  
 Fracturing - Minor, penetrative

WEIGHT: 4.245 g  
 DIMENSIONS: 2 x 1.7 x 1 cm

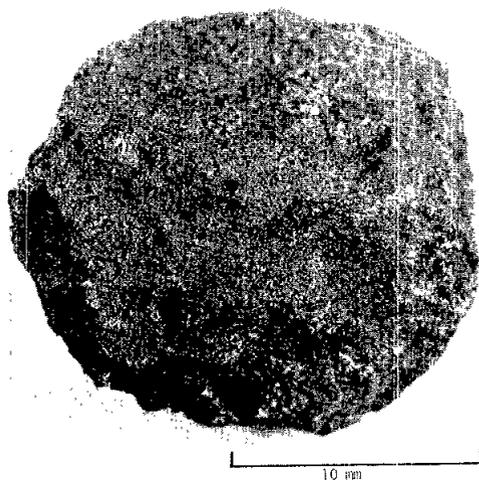
BINOCULAR DESCRIPTION BY: Marvin DATE: 1/23/73

FABRIC: Medium-grained microdiabasic  
 VARIABILITY: Homogeneous  
 SURFACE: Thin coat of dust on most surfaces  
 ZAP PTES: None  
 CAVITIES: Abundant small irregular vugs ( $\leq 0.5$  mm) lined with euhedral needles and plates of groundmass minerals.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	40		0.5	0.05 - 1	1
Pyx	Cinnamon	50		0.5	0.07 - 0.5	1
Ilm	Black	10		0.1	0.05 - 0.5	1

NOTE:

1. Groundmass in general has grain size of about 0.1 mm.



Sample 71067

S-73-17079

71068

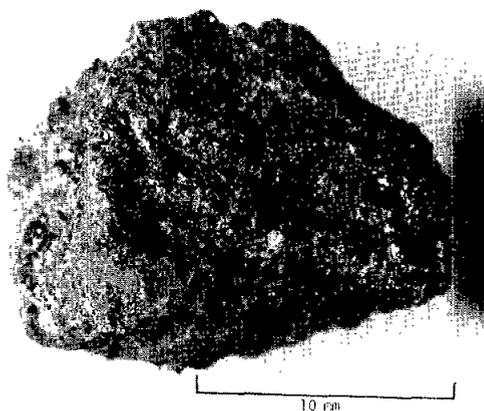
ROCK TYPE: Basalt  
 COLOR: Medium brownish gray (N4 to 5YR 4/1)  
 SHAPE: Angular, blocky  
 COHERENCE: Intergranular - Coherent  
 Fracturing - One small, penetrative

WEIGHT: 4.208 g  
 DIMENSIONS: 2 x 1 x 0.7 cm

BINOCULAR DESCRIPTION BY: Marvin DATE: 1/23/73

FABRIC: Medium grained, average 0.7 mm  
 VARIABILITY: Homogeneous  
 SURFACE: Coated with fine dust and soils; some glass spherules adhering; one side looks slickensided.  
 ZAP PTIS: None  
 CAVITIES: One end of rock is a cavity wall, broken, lined with euhedral ilmenite needles and plates, and coated with dust.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	35-40	Anhed-subhed	0.7	0.5 - 2.0	
Pyx	Pale brown	45	Anhed-subhed	0.7	0.5 - 2.0	
Ilm	Black	15-20	Anhed-subhed		0.3 - 1	
Oliv		<1		1		



Sample 71068

S-73-17081

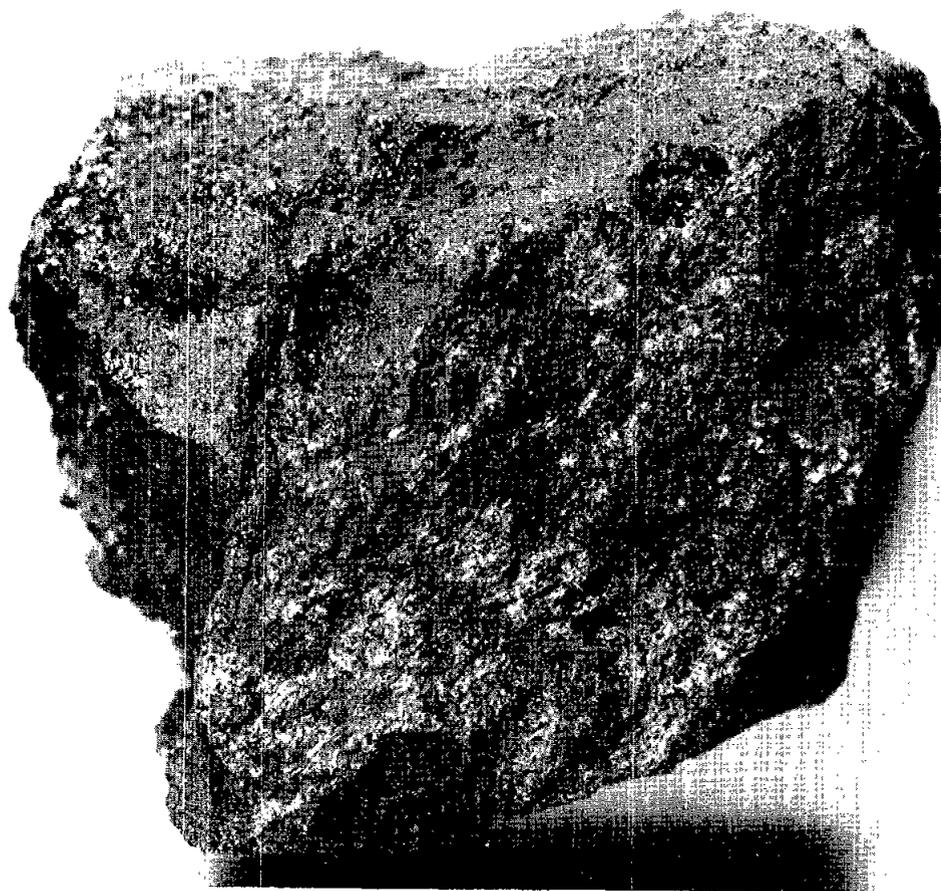
ROCK TYPE: Basalt  
COLOR: Medium dark gray (N4)  
SHAPE: Angular, blocky  
COHERENCE: Intergranular - Tough  
Fracturing - Minor penetrative on one end

WEIGHT: 4.058 g  
DIMENSIONS: 2 x 1.7 x 1 cm

BINOCULAR DESCRIPTION BY: Marvin DATE: 1/23/73

FABRIC: Fine-grained equigranular  
VARIABILITY: Homogeneous  
SURFACE: Dust adhering to most surfaces  
ZAP PITS: None fresh; few spalls  
CAVITIES: Three small vugs ( $\leq 0.1$  mm), with contain minute euhedral needles and plates of ilmenite.  
SPECIAL FEATURES: About 1% olivine is present. Rock is too fine-grained to estimate a mode; rock resembles 71065 and 71066.

10 mm



Sample 71069

S-73-17080

ROCK TYPE: Basalt  
 COLOR: Dark gray, faint brownish  
 tint (N3-N4)  
 SHAPE: Slabby, angular  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few, penetrative

WEIGHT: 1.563 g  
 DIMENSIONS: 1.5 x 1 x 0.5 cm

BINOCULAR DESCRIPTION BY: Wilshire

DATE: 1/23/73

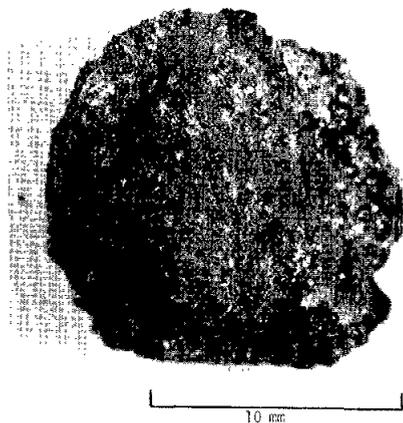
FABRIC: Equigranular  
 VARIABILITY: Irregular vug distribution  
 SURFACE: Finely hackly.  
 ZAP PITTS: None  
 CAVITIES: 5-10%, 0.1-5 mm diameter vugs with projecting ilmenite plates, pyroxene prisms, and a trace of yellow-green crystals; some have a white crust and some of those have ilmenite plates tangential to cavity walls.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Olivine (?)	Yellow green	1	Equant	0.7	0.5 - 1	1
Yellow green		Tr	Euhedral		0.5	2
Silica (?)	White	Tr				3
Plagioclase	Light gray		Irreg-lath	<0.5	0.2 - 1.0	4
Pyroxene	Brown		Equant	<0.5		4
Opaque	Black		Equant to platy	<0.5	0.1 - 1	4

NOTES:

1. Microphenocrysts commonly surrounded by pyroxene.
2. Cavity lining.
3. Thin crusts on cavities.
4. Too fine-grained to estimate proportions.





Sample 71085 S-73-17076

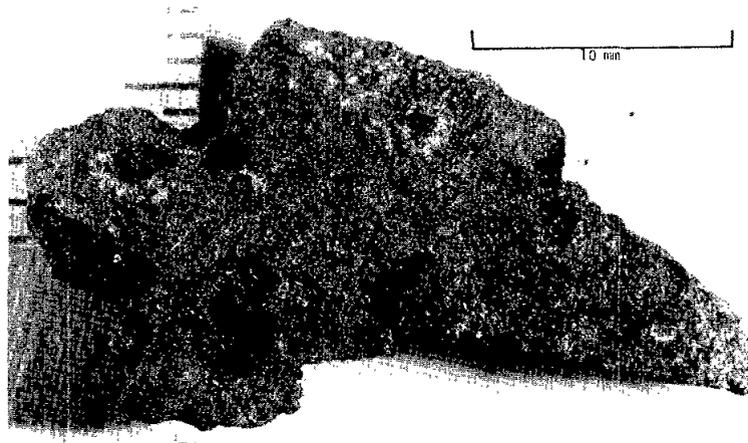
71086

ROCK TYPE: Basalt  
 COLOR: Medium dark gray (N4)  
 SHAPE: Angular, irregular  
 COHERENCE: Intergranular - Coherent

WEIGHT: 3.329 g  
 DIMENSIONS: 3 x 2 x 0.7 cm

BINOCULAR DESCRIPTION BY: Marvin DATE: 1/23/73

FABRIC: Groundmass is fine-grained ( $\leq 0.1$  mm) and equigranular  
 VARIABILITY: Homogeneous  
 ZAP PITS: None with glass linings; one or two possible relict pits.  
 CAVITIES: 50%, on both main surfaces; lined with ilmenite needles,  
 most of which lie parallel to cavity walls.  
 SPECIAL FEATURES: Groundmass is too fine to estimate mode, but is  
 ilmenite-rich, about 20%. Olivine is sparse but present.



Sample 71086 S-73-17065

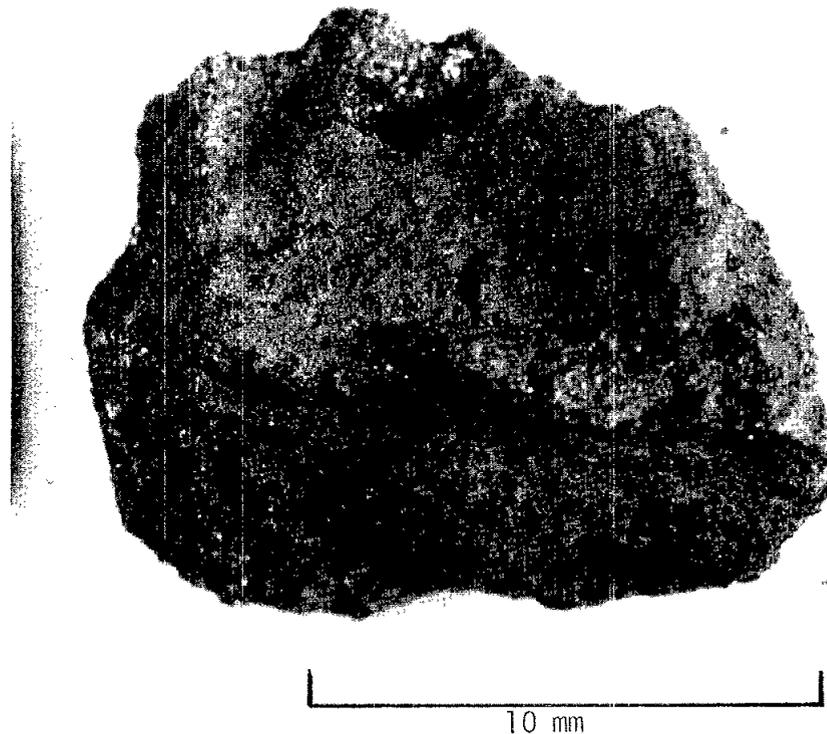
ROCK TYPE: Basalt  
COLOR: Medium dark gray (N4), with brownish tint  
SHAPE: Angular, blocky  
COHERENCE: Intergranular - Friable to coherent  
Fracturing - Non-penetrative

WEIGHT: 2.200 g  
DIMENSIONS: 1.5 x 1.5 x 1 cm

BINOCULAR DESCRIPTION BY: Marvin

DATE: 1/23/73

FABRIC: Fine-grained equigranular  
VARIABILITY: Homogeneous  
SURFACE: Thickly dust coated with two dustings  
ZAP PITTS: None  
CAVITIES: One surface is probably a broken cavity; lined with ilmenite crystals.  
SPECIAL FEATURES: Too dusty and fine-grained to estimate mode. See description of 71086.



Sample 71087

S-73-17078

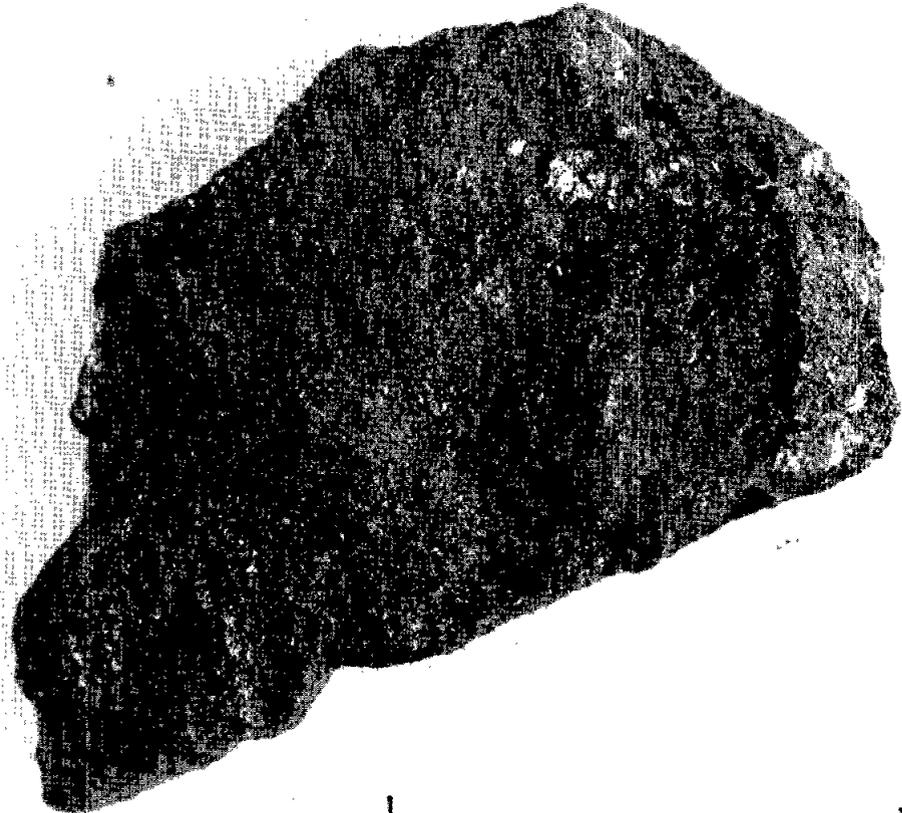
ROCK TYPE: Basalt  
COLOR: Medium dark gray (M4)  
SHAPE: Angular wedge shaped  
COHERENCE: Intergranular - Tough  
Fracturing - None

WEIGHT: 2.064 g  
DIMENSIONS: 2 x 1 x 0.5 cm

BINOCULAR DESCRIPTION BY: Marvin

DATE: 1/24/73

FABRIC: Fine grained equigranular  
VARIABILITY: Homogeneous  
SURFACE: Thinly coated with dust and, on one surface, small white patches  
CAVITIES: Three small, 1 mm vugs on one surface; lined with ilmenite  
needles lying parallel to walls.  
SPECIAL FEATURES: Grain size too small to estimate mode, but the rock  
is ilmenite-rich, has 1% or less olivine and is similar to 71065  
and 71066.



10 mm

Sample 71088

S-73-17074

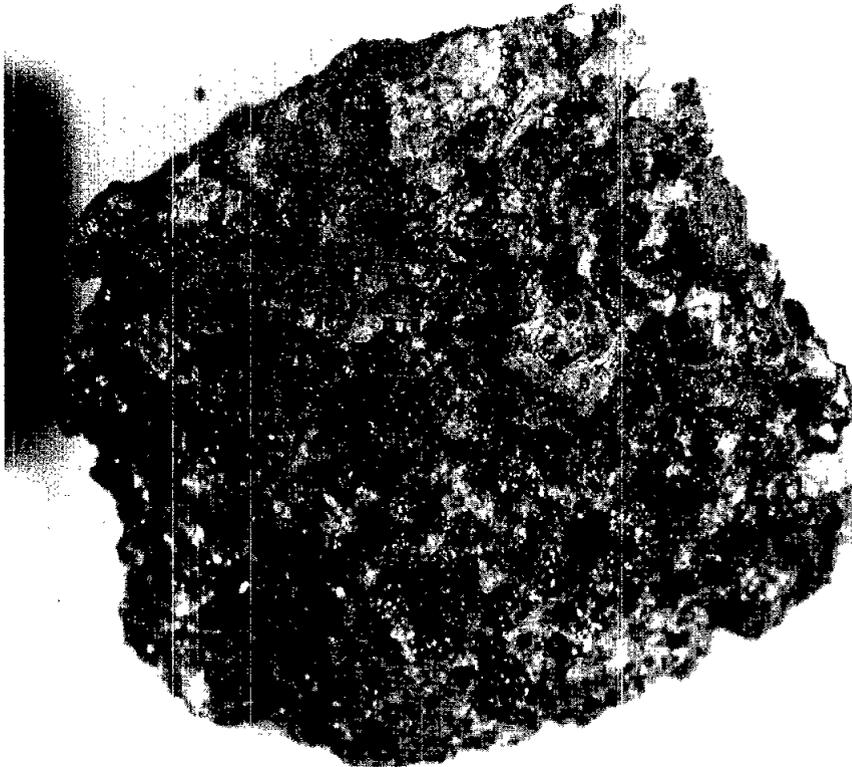
ROCK TYPE: Basalt  
COLOR: Brownish-gray (N4)  
SHAPE: Angular chip  
COHERENCE: Intergranular - Friable

WEIGHT: 1.733 g  
DIMENSIONS: 1 x 1 x 0.5 cm

BINOCULAR DESCRIPTION BY: Marvin

DATE: 1/23/73

FABRIC: Medium-coarse grained  
VARIABILITY: Homogeneous  
SURFACE: Dust adhering to one surface  
ZAP PITS: None  
CAVITIES: Vugs riddle one surface; nearly absent from other  
SPECIAL FEATURES: For description of mode see 71096, which is the same type of basalt.



10 mm

Sample 71089

S-73-17077

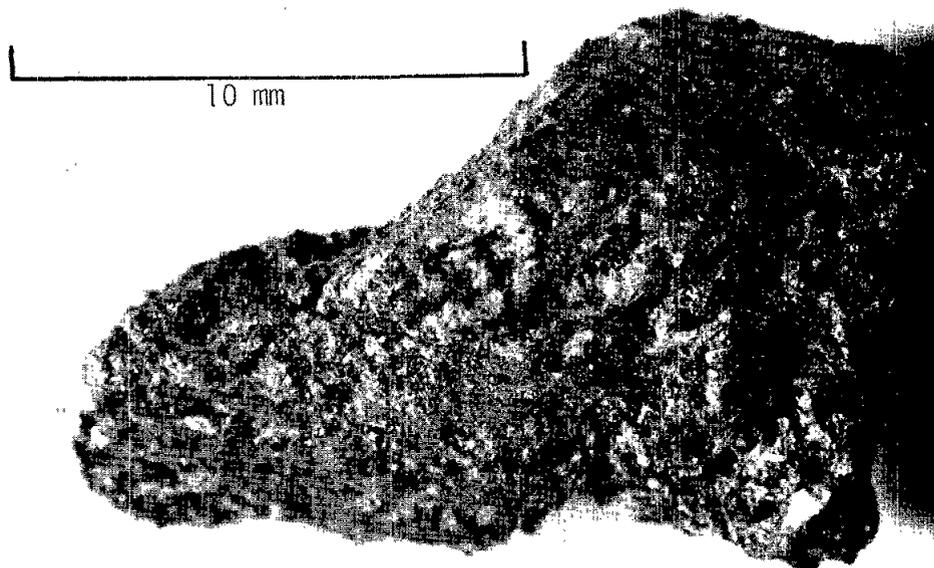
71095

ROCK TYPE: Basalt  
COLOR: Brownish gray  
SHAPE: Narrow wedge  
COHERENCE: Intergranular - Friable  
Fracturing - Non-penetrative

WEIGHT: 1.483 g  
DIMENSIONS: 1.5 x 1 x 1 cm

BINOCULAR DESCRIPTION BY: Marvin DATE: 1/23/73

FABRIC:  
VARIABILITY: Medium grained homogeneous  
SURFACE: Dust coated on three surfaces (after two dustings).  
ZAP PITS: None  
CAVITIES: None  
SPECIAL FEATURES: This rock resembles the groundmass of 71096.



Sample 71095

S-73-17075

ROCK TYPE: Basalt  
 COLOR: Brownish gray  
 SHAPE: Angular, blocky  
 COHERENCE: Intergranular - Friable  
 Fracturing - Penetrative

WEIGHT: 1.368 g  
 DIMENSIONS: 1 x 1 x 1.7 cm

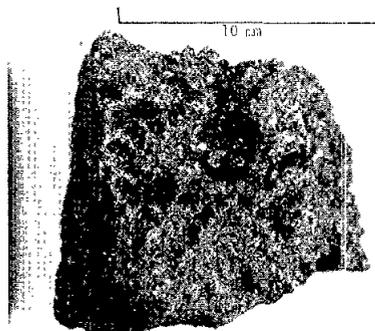
BINOCULAR DESCRIPTION BY: Marvin DATE: 1/23/73

FABRIC: Medium to coarse grained  
 VARIABILITY: Homogeneous rock; variable in grain size  
 ZAP PITS: None  
 CAVITIES: >50%; riddled with microlitic cavities rich in euhedral needles and plates of ilmenite, pyroxene, and plagioclase. One large almost perfectly smooth-surfaced cavity in one face.  
 SPECIAL FEATURES: Groundmass difficult to tell from vugs.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	40	Laths	0.7	0.5-1.5	
Pyrox	Cinnamon	45	Subhed	0.7		1
Ilm	Black	15	Grains & plates	0.5		2
Oliv	Yellow	<1	Subhed	0.2		
Troil	Brassy	Tr				

NOTES:

1. Clots up to 2 mm
2. Needles up to 2 mm



Sample 71096

S-73-17073

71097

ROCK TYPE: Basalt  
 COLOR: Medium dark gray (N4)  
 SHAPE: Irregular, angular  
 COHERENCE: Intergranular - Friable  
 Fracturing - Some; penetrative

WEIGHT: 1.355 g  
 DIMENSIONS: 1.5 x 1 x 0.7 cm

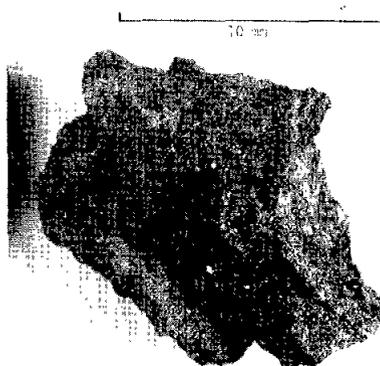
BINOCULAR DESCRIPTION BY: Marvin DATE: 1/23/73

FABRIC: Medium grained microporphyritic  
 ZAP PITS: None  
 CAVITIES: Several small vugs; one end of specimen is a large rounded cavity surface, lined with ilmenite needles and coated with smooth colorless glass, which forms a thin crust over part of cavity.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTE</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	35	Laths		0.1-1.0	
Pyrox	Cinnamon	50				
Ilm	Black	15	Grains & needles		0.1-1.0	
Oliv	Yellow	< 5	Subhed			1
Troil		Tr	Euhed		Up to 1	

## NOTE:

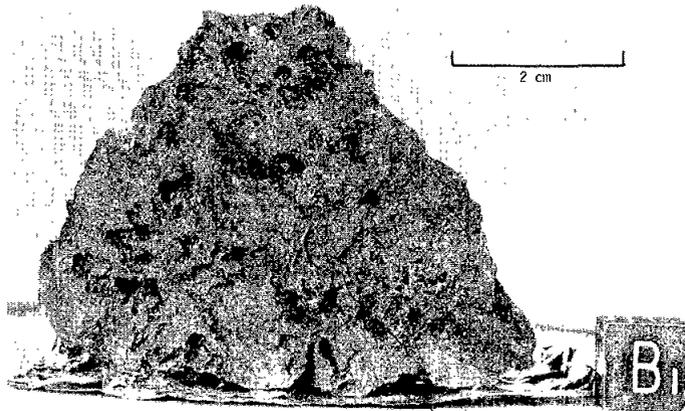
1. A few large grains and clusters of grains.



Sample 71097

S-73-17072





Sample 71135

S-73-15686

71136

ROCK TYPE: Basalt

WEIGHT: 25.39 g

COLOR: Gray (N4)

DIMENSIONS: 4 x 2 x 2 cm

SHAPE: Angular

COHERENCE: Intergranular - Tough

Fracturing - Penetrative

BINOCULAR DESCRIPTION

BY: Meyer

DATE: 2/6/73

VARIABILITY: Homogeneous

SURFACE: B is freshly broken; N, E, W, and T are dust covered.

ZAP PITS: Photos show many on all surfaces except B.

CAVITIES: 20%, vugs filled and lined with crystals; 1% rounded vesicles open into vugs; vugs are 20 - 1 mm.

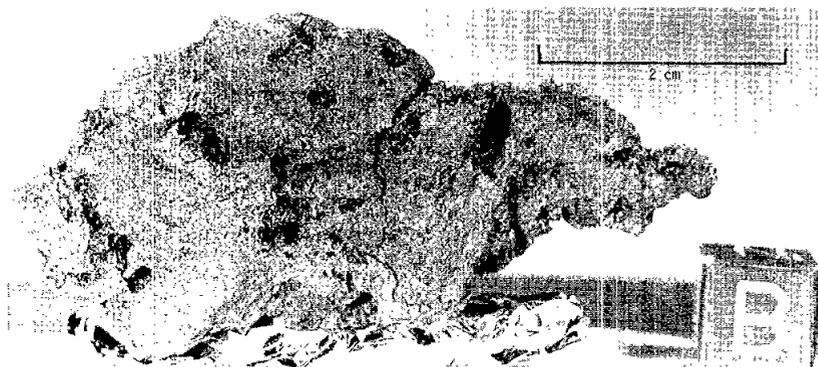
SPECIAL FEATURES: Vugs are filled with delicate crystals of plagioclase, ilmenite, pyroxene, and olivine. Plagioclase in places makes long columnar needles with their stubby ends in the vugs. Such plagioclases are 0.1 mm in cross section and up to 10 mm long. They are transparent and probably vapor grown. Small percentage (<1%) of blood red mineral (0.1 mm), probably spinel.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Chalky white to translucent	35	Lathy to tabular	0.2	0.1 - 2	

Ilm	Shiny black	15	Tabular	0.2	0.1 - 2	
Pyrox	Cinnamon brown	40		0.2	0.1 - 0.5	
Olivine	Yellow green	10		0.3	0.1 - 10	1

## NOTE:

1. Occurs in clusters and as microphenocrysts.



Sample 71136

S-73-16424

71155

ROCK TYPE: Basalt

WEIGHT: 26.15 g

COLOR: Dark gray (N3)

DIMENSIONS: 5 x 2.5 x 2.5 cm

SHAPE: Irregular

COHERENCE: Intergranular - Moderately coherent

Fracturing - None

BINOCULAR DESCRIPTION

BY: Stuart-Alexander

DATE: 1/24/73

FABRIC: Intergranular

VARIABILITY: Vug to vesicle ratio variable.

SURFACE: T 1/3 of N and all of T and S show discoloration and rounding of the edges of cavities; other surfaces are freshly broken.

ZAP PITS: None on N or B; few on S, E, W and T.

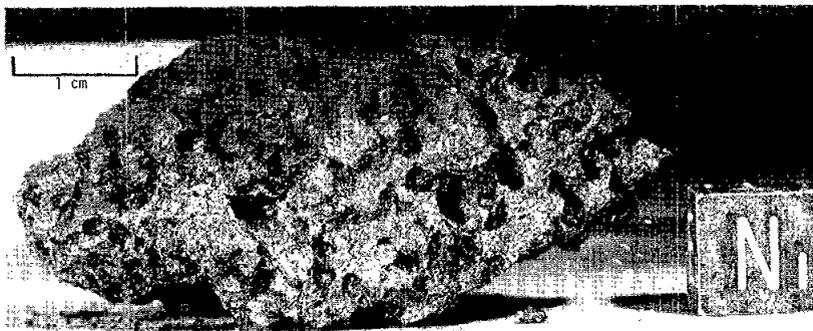
CAVITIES: About 30% cavities of which about 55% are vugs and 45% are vesicles. Vesicles are particularly abundant on B and W. The maximum sizes are 5 mm for vugs and 3 mm for vesicles.

SPECIAL FEATURES: Some vesicles are lined with ilmenite and some with all minerals of this rock. Metal spherules are in a few vesicles.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White to colorless	30 - 34	Anhed to laths	0.15	<0.1 - 0.5	1
Maf sil.	Resinous brown	50	Anhed	0.1	<0.1 - 0.3	2
Opaque	Black	15 - 20	Anhed to plates	0.1	<0.1 - 0.8	3
Maf sil.	Yellow- ish green	1	Anhed	0.5		4
Metal	Silvery	Tr	Spherical	0.1		

## NOTES:

1. Only a few are in laths. Local concentrations of grains.
2. Pyroxene.
3. Ilmenite occurs as plates and needles in and near vugs and vesicles where the maximum size is obtained.
4. Olivine(?).



Sample 71155

S-73-15866

71156

ROCK TYPE: Basalt

COLOR: Medium dark gray (N4 to N5)

SHAPE: Blocky, subrounded

COHERENCE: Intergranular - Weakly coherent  
Fracturing - Few, penetrative

WEIGHT: 5.42 g

DIMENSIONS: 2.2 x 1.5 x 1 cm

BINOCULAR DESCRIPTION

BY: Stuart-Alexander

DATE: 1/24/73

FABRIC: Intergranular

VARIABILITY: Homogeneous

SURFACE: S is smooth, others lumpy.

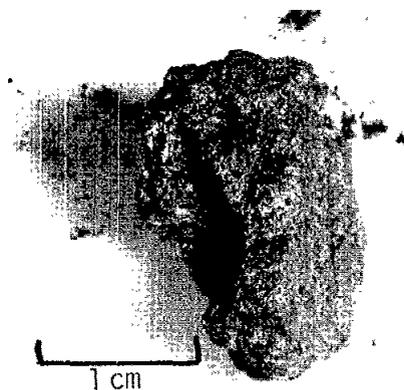
ZAP PITS: None on T; many on all others.

CAVITIES: 1-2% as vugs, which are about 1 mm in size.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Maf sil	Pale to resinous brown	50	Anhed	0.1		1
Plag	White to colorless	30	Anhed to tabular to plates	0.15	<0.1 - 0.4	2
Opaque	Black	20	Anhed to cubic	0.1	0.1 - 0.5	3
Maf sil	Yellowish Tr green		Subhed	0.6		4

## NOTES:

1. Pyroxene.
2. Plates in vugs only, maximum size reached there.
3. Ilmenite plates in vugs.
4. Olivine(?).

Sample 71156 W<sub>1</sub> S-73-15865

ROCK TYPE: Vitrophyric basalt                      WEIGHT: 1.466 g  
 COLOR: Dark gray (N3)                                DIMENSIONS: 1.2 x 1.0 x 0.8 cm  
 SHAPE: Blocky, subangular  
 COHERENCE: Intergranular - Coherent  
                   Fracturing - Few, penetrative

BINOCULAR DESCRIPTION

BY: Stuart-Alexander

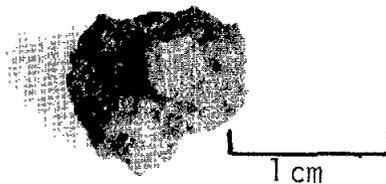
DATE: 1/24/73

FABRIC: Aphanitic to vitrophyric  
 VARIABILITY: Homogeneous  
 SURFACE: Irregular  
 ZAP PITTS: Few  
 CAVITIES: 2-5% vugs, <1 mm

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Glass	Dark gray to black	50?				
Opaque	Black		Some blades	<0.1		1
Plag	Colorless to white			<0.1		
Maf sil	Reddish brown			<0.1	Up to 0.2	2

## NOTES:

1. Ilmenite.
2. Pyroxene(?).

Sample 71157 W<sub>1</sub> S-73-15865

ROCK TYPE: Basalt  
 COLOR: Medium gray (N5)  
 SHAPE: Subangular  
 COHERENCE: Intergranular - Coherent  
 Fracturing - Few, penetrative and non-penetrative

WEIGHT: 207.8 g  
 DIMENSIONS: 8 x 5 x 4 cm

BINOCULAR DESCRIPTION

BY: Lofgren and Agrell

DATE: 1/26/73

FABRIC: Isotropic equigranular

VARIABILITY: Uniform

SURFACE: Irregular to granular all faces. All surfaces dusty which obscures 60% of the rock surface, except on B and T faces where a fragment broke off.

ZAP PITS: None on B, E, S, W and N; few on T.

CAVITIES: 5-10%, 1 - 8 mm diameter miarolitic cavities with irregular distribution and shapes. They rarely contain euhedral minerals. The surfaces of cavities are like the surface of rock. Some cavities are tabular.

SPECIAL FEATURES: Suggestion of some crystal growth along fractures emanating from pipe-like cavities. Two small fragments can be remated to the largest piece and have typical outer and fresh surfaces and mineral percentages.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White trans- lucent	35 - 30	Tabular	0.7	0.2 - 1.5	
Pyrox	Honey brown	50 - 45	Equant	0.5	0.1 - 1	
Opaque	Black	15 - 20	Equant to platy	1.5	0.5 - 3	
Oliv	Pale green- yellow	Tr	Equant	0.75		1

## NOTE:

1. Conchoidal fracture features. Variable proportions from one area to another.



Sample 71175

S-73-15726

71505 - 71509, 71515, 71525 - 71597  
 (exclusive of numbers ending in digits 0-4)

SAMPLE TYPE: Rocks (fragments >1 cm from the Station 1 rake (38 fragments)  
 and associated soil (6 fragments) samples).

BINOCULAR DESCRIPTION: BY: Warner DATE: 1/73

Individual characteristics of the fragments are given in the following table. All but one of the 44 fragments are basalts, which consist of colorless calcic plagioclase, cinnamon-brown augite, black ilmenite, and, in most fragments, yellow-green olivine. The olivine content ranges from zero to two percent for most samples; two samples contain more olivine (about 7 and 25 percent). Modes of plagioclase, pyroxene, and ilmenite were not estimated for the samples. The samples range from 1x1x1 cm to 4x7x12 cm. The size of the fragments may be estimated from the accompanying photos. The single non-basalt fragment (sample 71515 from the rake soil), is a glass bonded agglutinate.

Pyroxene occurs in prismatic crystals. Plagioclase occurs in lath-shaped crystals. Ilmenite occurs in blocky crystals. Olivine occurs in subhedral to euhedral 1 to 2 mm crystals. Thus, in the fine and medium grained basalts, the olivine crystals are phenocrysts. In those rocks that contain less than 1 percent olivine, the olivine phenocrysts tend to occur in groups of two or three crystals. In the olivine-poor rocks, it is common for the olivine to be scattered, i.e., in a sample with a 10 cm<sup>2</sup> surface area, there will be less than 10 olivine phenocrysts. Therefore, every thin section will not have an olivine crystal (as is the case with sample 10022). In addition, the olivine phenocrysts tend to define "layers" that are about 1 cm long and contain three to five olivine crystals or groups of crystals.

Most of the basalts have pores which are present as spherical vesicles, equant vugs, and/or irregular vugs. Most vesicles are lined with tangential ilmenite laths. Most vugs contain projecting, columnar crystals of pyroxene and plagioclase. Olivine is not common in vugs. The finer-grained basalts tend to contain more spherical or equant pores. The volume of pores space ranges from zero to about 50 percent. This space is not uniformly distributed and many rocks show pore-rich and pore-poor regions. Where the boundary between regions is well defined, layers of pore-rich rock intercalated with layers of pore-poor rock is suggested, as described by Schmitt on the lunar surface. These layers are greater than 1 cm in thickness.

For the purpose of numbering them, the rake fragments were grouped by olivine content, and arranged in order of increasing grain size within these groups. The five basalt fragments (71505 - 71509) from the rake soil are arranged in the following table of descriptions in the appropriate places according to the same sorting scheme. Also in the table grain size is used as a relative term between the extremes: coarse-grained samples contain crystals 1 - 2 mm across and very fine-grained

samples contain crystals less than 0.02 mm across. (71515, a glass bonded agglutinate, is omitted from the table, which is devoted to characteristics of the basalt samples.)

<u>SAMPLE NUMBER</u>	<u>OLIVINE CONTENT</u>	<u>GRAIN SIZE</u>	<u>NATURE OF PORE SPACE (COMMENTS)</u>
71525	None	Dust covered	Spherical vesicles
71526	None	Very fine	Filled vugs (ilm rich rock)
71527	None	Fine	Spherical vesicles
71528	None	Fine	1-2 mm, ilm lined, spherical vesicles
71529	None	Med	1-2 mm, ilm lined, spherical vesicles
71508	None	Med coarse	1-2 mm vugs
71535	None	Med coarse	1-5 mm vugs
71536	None	Coarse	None
71537	<1%	Very fine	Few, 3-4 mm, spherical vesicals
71538	<1%	Fine	Few, 2 mm, ilm lined, spherical vesicles
71539	<1%	Fine	One 3 mm irregular vug
71545	<1%	Fine	None
71505	<1%	Fine	None (ilm rich rock)
71506	<1%	Fine	1-2 mm vugs (ilm rich rock)
71546	<1%	Med fine	Few, 3-10 mm, spherical vesicles plus 1 mm vugs
71547	<1%	Med	2-4 mm vugs
71548	<1%	Med	Layers of 3-4 mm vugs
71549	<1%	Med	Few 1 mm vugs
71555	<1%	Med	Layers of 2-8 mm, ilm lined, spherical vesicles
71507	<1%	Med	1-3 mm spherical vesicles
71556	<1%	Med coarse	Layers of 1-4 mm vugs
71557	<1%	Med coarse	Few 2 mm vugs
71558	<1%	Med coarse	Layers of 1-3 mm vugs
71559	<1%	Coarse	Few 2 mm vugs
71565	<1%	Coarse	Few 1-4 mm vugs
71566	<1%	Coarse	Layers of 1-20 mm vugs
71567	<1%	Coarse	Layers of 1-8 mm vugs
71568	<1%	Coarse	None
71509	<1%	Coarse	None
71569	1-2%	Very fine	Few, 1-8 mm, ilm lined, spherical vesicles (ilm rich rock)
71575	1-2%	Fine	Small, ilm lined, spherical vesicles
71576	1-2%	Fine	1-4 mm spherical vugs
71577	1-2%	Fine	2-15 mm, ilm lined, spherical vesicles
71578	1-2%	Med	Layers of 2-6 mm, ilm lined, spherical vugs
71579	1-2%	Med	1-3 mm spherical vugs
71585	1-2%	Med	Layers of 1 mm vugs
71586	1-2%	Med	1-15 mm, ilm lined, vesicles
71587	1-2%	Med	Layers of abundant 2-4 mm vugs
71588	1-2%	Med	None
71589	1-2%	Med	Few, 4 mm, ilm lined, vugs
71595	1-2%	Med	None
71596	5-10%	Med	One, 12 mm, ilm lined, vesicle
71597	20-30%	Coarse	2 mm spherical vesicles, plus abundant 5 mm vugs



ROCK TYPE: Basalt; microphyritic  
 COLOR: Medium gray  
 SHAPE: Rounded exposed surface; one  
 flat fresh fracture  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 12.11 g  
 DIMENSIONS: 3x2x1.5 cm

BINOCULAR DESCRIPTION BY: Marvin

DATE: 1/18/73

FABRIC: Porphyritic; large tabular and acicular plagioclase crystals  
 in fine-grained groundmass.  
 VARIABILITY: Homogeneous  
 SURFACE: Fresh fracture face is in part a shallow vuggy depression  
 ZAP PITTS: Many; glass lined on all surfaces except B, which is a fresh  
 fracture.  
 CAVITIES: 1% small, irregular cavities; some with small groundmass  
 crystal terminations; no good euhedral crystals.  
 SPECIAL FEATURES: A few very thin veinlets of light yellow to  
 greenish glass cut across the fresh surface.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plagioclase	White	30	Equi- granular	0.8		
Pyroxene	Cinnamon	45	Anhed	0.8		
Ilmenite	Black	10	Anhed	0.8		
Olivine	Yellow	5	Subhed	1.0	0.5 - 1.5	1
Plag phenocrysts	White	5		2	1 - 3	2
Pyroxene phenocrysts	Yellow	5		2	1 - 3	3

NOTES:

1. Olivines are coarser than groundmass and tend to occur in clusters;  
 a few grains have emerald green cores; area circled in B ortho.
2. Very thin, long needles randomly oriented. Seen only in light  
 reflected at long angles.
3. A relatively few larger crystals, but hard to identify.

71507

ROCK TYPE: Basalt  
 COLOR: Light reddish gray  
 SHAPE: Irregular  
 COHERENCE: Intergranular - Friable  
 Fracturing - 1 or 2 penetrative

WEIGHT: 3.962 g  
 DIMENSIONS: 3.5 x 1.7 x 1.5 cm

BINOCULAR DESCRIPTION BY: Marvin DATE: 1/18/73

FABRIC: Medium-grained microdiabasic  
 VARIABILITY: Homogeneous  
 SURFACE: Specimen is partially dust coated on all surfaces; truly fresh fractures on a small area of N face.  
 ZAP PITS: A few on all surfaces.  
 CAVITIES: Small smooth vesicles and irregular vugs 1 - 3 mm

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	40-45	Laths and anhedral grains	1.0	0.5 - 1.5	
Pyroxene	Cinnamon	45-50		0.8	0.5 - 1.5	
Ilmenite	Black	10		0.7		
Olivine	Yellow	<1		1	1 - 1.5	

71508

ROCK TYPE: Basalt  
 COLOR: Light reddish gray  
 SHAPE: Rhombic, with rounded edges  
 COHERENCE: Intergranular - Friable  
 Fracturing - Shedding clots of grains

WEIGHT: 3.423 g  
 DIMENSIONS: 2 x 1.5 x 1.5 cm

BINOCULAR DESCRIPTION BY: Marvin DATE: 1/18/73

FABRIC: Medium coarse microdiabasic.  
 VARIABILITY: Homogeneous  
 SURFACE: Partially soil coated on most surfaces; no fresh exposures except for broken areas around vugs.  
 ZAP PITS: Present on most surfaces, but rock too friable to preserve many pits.

CAVITIES: 50% small irregular vugs riddle N surface and appear to occur in interior layers parallel to this surface. Also found in less abundance on all other surfaces.

SPECIAL FEATURES: Rock similar to 71507.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	40-45	Tabular to acicular	1.0	0.5 - 2.0	
Pyroxene	Cinnamon	45-50	Equant to acicular	0.7		
Ilmenite	Black	10	Equant; needles around vugs	0.2	0.1 - 0.5	

## 71509

ROCK TYPE: Basalt

WEIGHT: 1.690 g

COLOR: Variegated white to light brown

DIMENSIONS: 2 x 1.5 x 0.5 cm

SHAPE: Flat fragment before handling

COHERENCE: Intergranular - Very friable

Fracturing - Fell into two parts during photography and is now shedding particles

BINOCULAR DESCRIPTION BY: Marvin

DATE: 1/18/73

FABRIC: Glomerophyric aggregates of pyroxene and ilmenite in white plagioclase matrix.

VARIABILITY: Homogeneous coarse grained.

ZAP PITS: Rock too friable

CAVITIES: 1% vesicles are exposed on fresh fracture surface; none are on original top or bottom.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	45	Anhed	0.5	0.2 - 2.0	1
Pyroxene	Cinnamon	50	Anhed	0.5	0.2 - 2.0	2
Ilmenite	Black	1	Anhed	0.5	0.1 - 0.7	

## NOTES:

1. Mainly as a groundmass.
2. In isolated grains and in clots with ilmenite.

71515

ROCK TYPE: Glass bonded agglutinate      WEIGHT: 1.635 g  
 COLOR: Clasts are gray-brown; glass      DIMENSIONS: 2 cm at longest  
       is light brown and vitreous  
 SHAPE: Irregular  
 COHERENCE: Intergranular - Friable

BINOCULAR DESCRIPTION

BY: Marvin

DATE: 1/18/73

SPECIAL FEATURES: About eight fragments of fine-grained coherent annealed breccia with brown fine-grained matrices and small white clasts of shocked plagioclase are welded into an aggregate by glass crusts and filaments. Basalt fragments also present in the aggregate. Some fragment surfaces show microslickensides.

72135

ROCK TYPE: Microbreccia      WEIGHT: 336.9 g  
 COLOR: Medium gray (N5-N4)      DIMENSIONS: 8 x 6 x 5.5 cm  
 SHAPE: Blocky, subangular  
 COHERENCE: Intergranular - Friable  
               Fracturing - Irregular, penetrative

BINOCULAR DESCRIPTION

BY: Wilshire and Stuart-Alexander

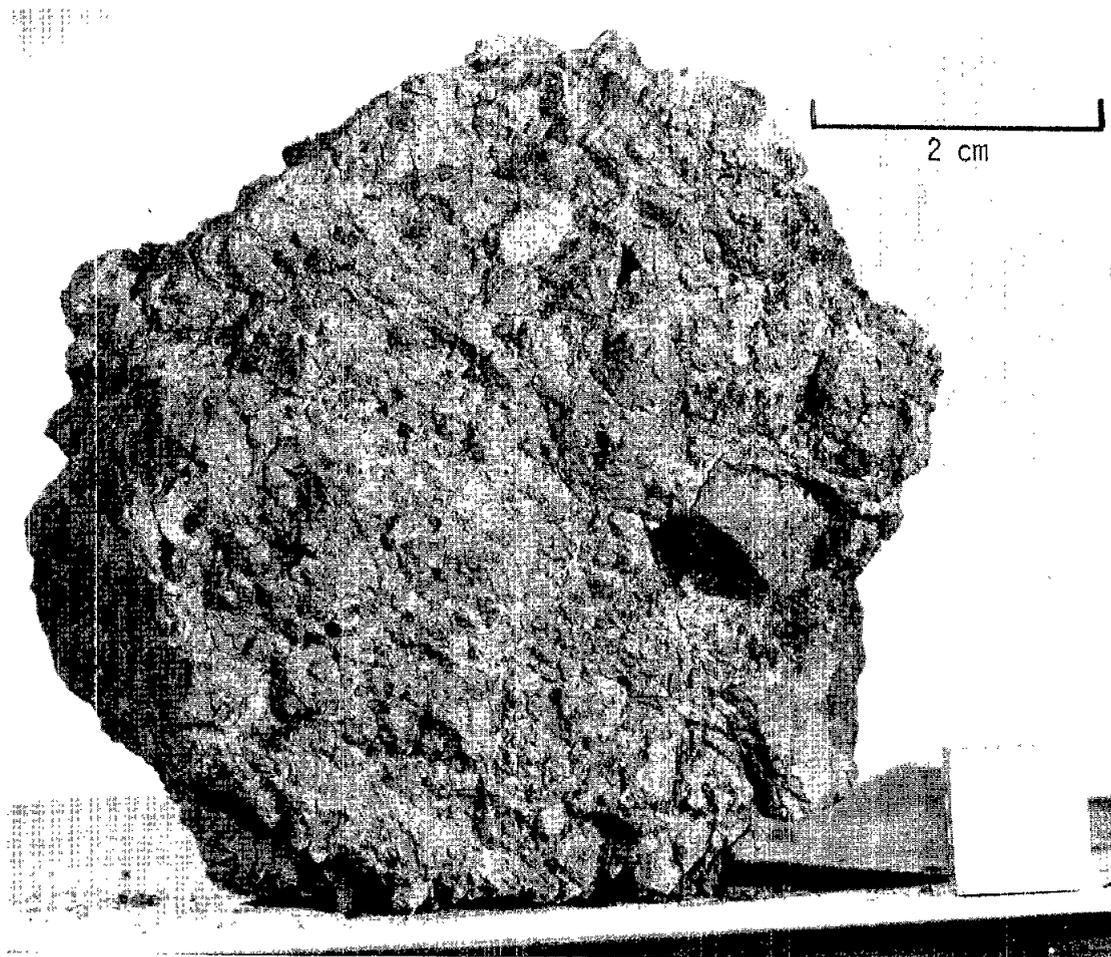
DATE: 2/1/73

FABRIC: Microbreccia  
 VARIABILITY: "Glass" on one surface  
 SURFACE: Very hackly  
 ZAP PITS: Few on S and W; many on B; none on N, E, and T.  
 CAVITIES: <1%, very irregular, unlined  
 SPECIAL FEATURES: Rock is surprisingly heavy for its friable character

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	N4-5	90-95		<<0.1	Up to 1	1
Glass	?	5 -10				2
Clasts		<5	rnd- irreg		To 2	3

## NOTES:

1. Composed of plagioclase, ilmenite, brown pyroxene, dark glass (no spheres), trace of olivine, trace of red translucent mineral, trace of chalky white material. Matrix is fragmented into irregular, blocky fragments bounded by shear surfaces.
2. Partly cements clods of matrix on one side of rock; filled with soil.
3. One clast of basalt with olivine phenocrysts. Others appear to be very vaguely bounded, shocked, friable fragments. Scarce ilmenite, rare olivine to 1 mm.



Sample 72135

S-73-16206

THIN SECTION DESCRIPTION

BY: Wilshire

DATE: 2/23/73

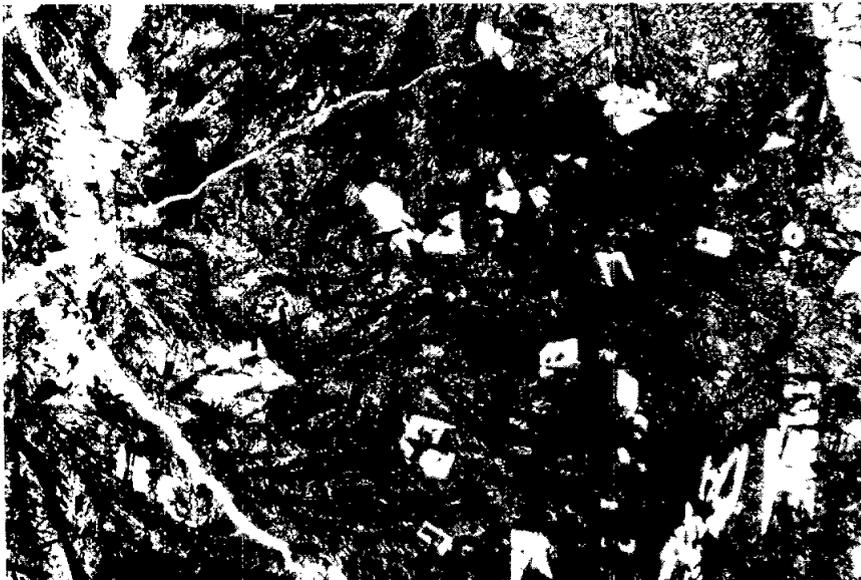
SECTION: 72135,11

SUMMARY: Monomict breccia of fine-grained variolitic olivine-ilmenite basalt.

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
Pyrox	75		
Ilm			
Plag			
Micro-phenocrysts			
Ilm	19	Prism	<0.1 - 0.75
Oliv	6		<0.1 - 0.5

TEXTURE: Variolitic groundmass with quench pyroxene, ilmenite, plagioclase. Patches to 3.5 mm in diameter containing coarser pyroxene are scattered through the rock. Ilmenite and skeletal olivine form microphenocrysts. The rock is broken and irregularly seamed by thin stringers of brecciated basalt, locally glass.

ADDITIONAL COMMENTS: This thin section is probably not representative of rock because it is predominantly in a clast, and does not show much of the brecciated part of the rock. Percentages are based on 500 point counts.



Section 72135,11                      S-73-19890  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 2/15/73

SECTION: 72135,11

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	15	Laths, irreg, feathers	To 0.5	Size distribution of ilmenite is bimodal, large blocky laths commonly greater than several tenths of a millimeter and feathery laths in the aphanitic groundmass commonly smaller than 0.02 mm. The ilmenite enclosed in phenocrysts and elsewhere may have blocky, rectangular or lozenge shapes reminiscent of armalcolite replacement. Several areas (one along a fracture) of diffuse ilmenitic staining, and apparently unrelated to presence of metal grains.
Fe-Ni	Tr	Blebs	<0.01	
Troil	Tr	Blebs	<0.01	

72145

ROCK TYPE: Polymict microbreccia

WEIGHT: 1.25 g

COLOR: Between medium gray (N5) and dark greenish gray (5G 4/1)

DIMENSIONS: 1.3 x 1 x 1.3 cm

SHAPE: Subangular

COHERENCE: Intergranular - Just coherent  
Fracturing - PenetrativeBINOCULAR DESCRIPTION

BY: Agrell

DATE: 3/28/73

FABRIC: Microbreccia

VARIABILITY: Uniform matrix; uniform clast distribution

SURFACE: N and part of B were lunar exterior.

ZAP PITS: Many on N; few on B; none on T, S. Glass lined pits are present but not haloes.

CAVITIES: None

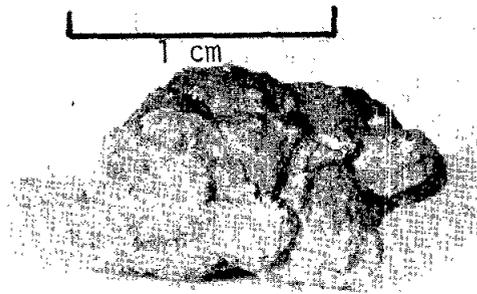
SPECIAL FEATURES: Polymict microbreccia, barely lithified, and containing both Highland- and Mare-type clasts.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix						1
Plag	Very pale gray	20	Ang	0.05		
Pyrox	Brownish	14	Ang	0.05		
Oliv	Yellow green	2	Ang	0.05		
Opaq	Black	4	Rnd	0.05		

Clasts					
Glass	Black	1	Spheres	0.1	0.05 - 0.15
Plag	C'less	26	Subang	0.2	0.1 - 0.5
Pyrox	Cinnamon	5	Ang	0.2	0.1 - 0.4 2
Oliv	Yellow	2	Subang	0.2	0.1 - 0.5
	green				
Oxide	Black	6	Equant	0.15	0.1 - 3 3
Metal	Silvery	<0.5	Rnd	0.15	
Basalt	Gray	3	Subang		1 - 1.2 4
Feldspathic granulite		7	Rnd		1 - 2.5 5
Anorth	Chalky	10			1 - 1.5 6

## NOTES:

1. Matrix mineral chips down to limit of resolution, no glass recognized.
2. Probably cpx.
3. Amount may be overestimated at expense of "black" glass.
4. 30% plagioclase, 60% cinnamon pyrox, and 10% ilmenite.
5. 70% plagioclase, 28% pale pyrox, 2% olivine, <1% oxides; sugary texture.
6. Shocked and chalky with sugary texture; greater than 70% plagioclase, <1% oxide, mafic silicates are pale.

Sample 72145 N<sub>1</sub> S-73-17868

72155

ROCK TYPE: Basalt	WEIGHT: 238.5 g
COLOR: Brownish gray (5YR 4/1)	DIMENSIONS: 7 x 5 x 4
SHAPE: Blocky-angular	
COHERENCE: Intergranular - Tough	
Fracturing - No penetrative	

BINOCULAR DESCRIPTION BY: Morrison and Wilshire DATE: 2/8/73

FABRIC: Porphyritic, scarce olivine phenocrysts.

VARIABILITY: Homogeneous.

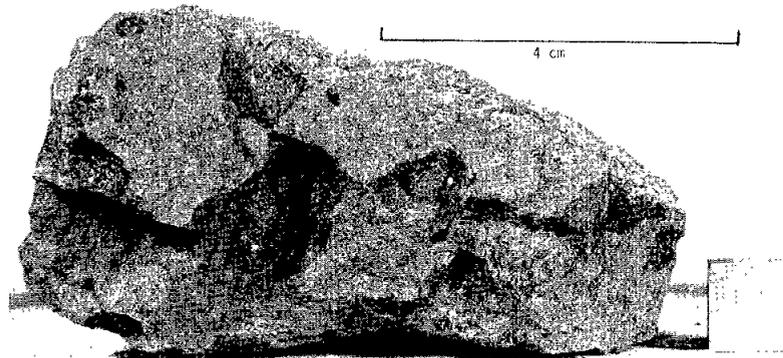
SURFACE: Hackly

ZAP PITS: Few on E, W, B. Many on S, T.

CAVITIES: 10%, as 1x2 cm to <1 mm vugs and vesicles. Vesicles have projecting crystals and linings of pyroxene and ilmenite.

SPECIAL FEATURES: Extremely well developed flat black and gold hexagonal plates occur in larger cavities. Some are up to 1 mm in diameter and have grown parallel to wall.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox	Dark reddish brown	60-65	prismatic		0.1 - 0.5	
Oliv	Yellow green	≤1		0.2		
Opaque	Black	15-20				
Plag	Gray	20				

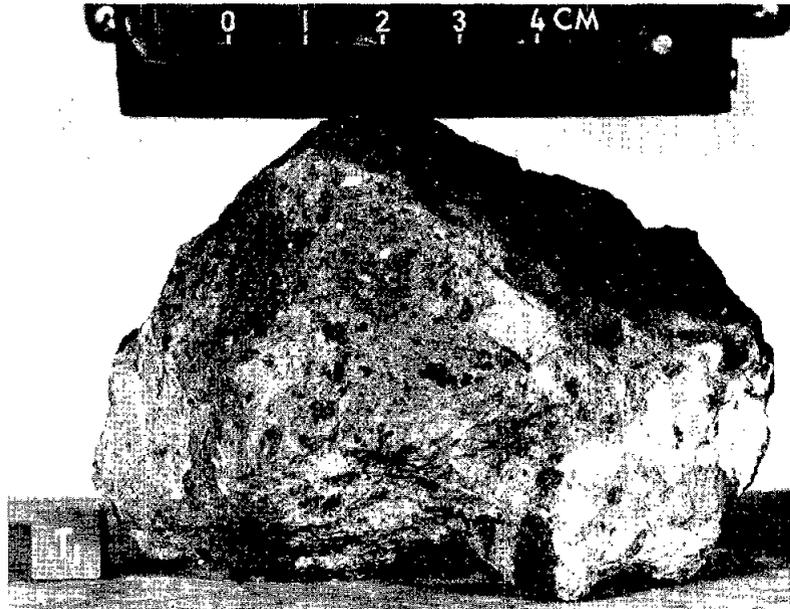


Sample 72155

S-73-16917



4. Average grain size  $\leq 0.1$  mm. Contains 10% mafic green silicate, 5% dark mineral or rock clasts, 80% plagioclase, 5% tan mafic and trace of black specks. The white clast contains a round greenish clast, which is 5 mm in diameter and appears to contain half and half olivine and pyroxene with accessory opaques.



Sample 72215

S-73-16661

THIN SECTION DESCRIPTION

BY: Simonds

DATE: 3/1/73

SECTION: 72215,7

SUMMARY: The rock is a devitrified glassy matrix polymict breccia with mineral, breccia and igneous clasts. The lighter-colored variety of matrix cuts the thin section as either a vein or a depositional inhomogeneity.

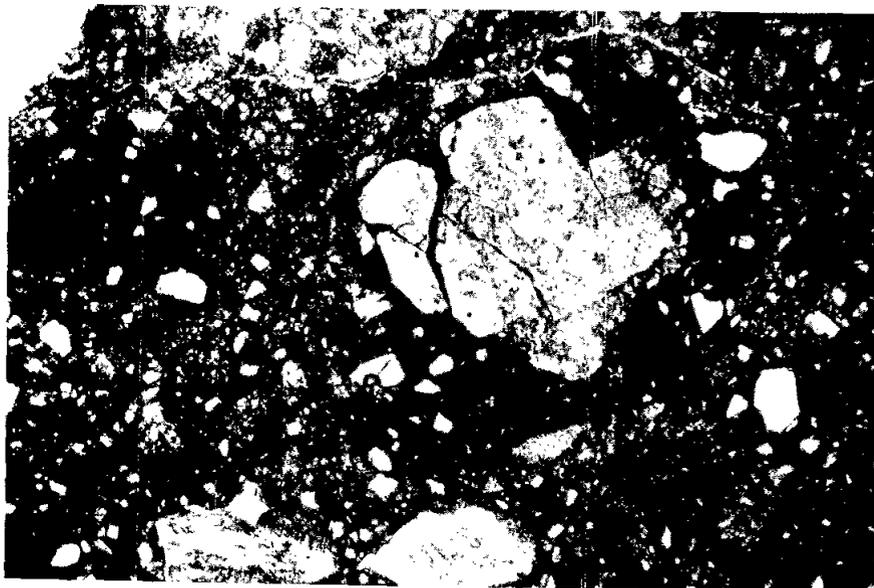
## MATRIX, 54% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	55	Equant irreg	0.2	
Oliv	10	Equant irreg	0.01	
Pyrox	30	Equant irreg	0.01	
Ilm	5	Plates	0.08	

COMMENTS: Two types of matrix: the darker variety is now holocrystalline with numerous fine equant grains of feldspar and other minerals as a few percent sub 0.005 mm grains. The porosity of this matrix is 20%. Its dark color probably indicates that it is partially devitrified glass. The lighter-colored matrix is composed of 80% feldspar, mostly 0.05 - 0.08 mm. Between the large feldspars is a matrix to the matrix of equant 20% feldspar and 75% mafics with about 5% ilmenite in plates. This type of a matrix has almost no porosity.

## MINERAL CLASTS, 25% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	84	Subang subrnd	0.01 - 0.2	Plagioclase occurs mainly either as devitrified maskelynite or shows abundant shock features.
Oliv	10	Subang subrnd	0.01 - 0.16	Olivine is unshocked. Pyroxene shows abundant twins, one grain seems shocked.
Pyrox	5	Subang subrnd	0.01 - 0.2	Spinel is pink.
Spinel	1	Ang	<0.08	



Section 72215,7 S-73-19896  
Width of field ~3 mm, plane light

## LITHIC CLASTS, 20% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Breccia	70	Rnd	Up to 1.0	Breccia is made up of mineral clasts and a matrix similar to the darker type of matrix on rock as a whole. This type of breccia is similar to the rind around other lithic clasts.
Anorth	10	Subrnd subang	Up to 0.7	
Poik	10	Rnd	Up to 0.8	
Troct	10	Subrnd	Up to 0.7	

Anorthosite shows annealed texture with <10% poikilitic pyroxene. Grain size is 0.03 mm.

Poikilitic clasts have sub 0.01 mm grain size, and are composed of olivine, ilmenite, and plagioclase.

Troctolite shows annealed texture, and has a grain size less than 0.015 mm.

A few of the lithic clasts are surrounded by a rind of fine generally clast free matrix of the darker variety.

## GLASS CLASTS, 1% OF ROCK

<u>COLOR</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Orange	100	Ang	0.04	Undevitrified

OPAQUES DESCRIPTION

BY: Brett

DATE: 3/14/73

SECTION: 72215,7

SUMMARY: Opaque minerals similar to 72255,7 except average grain size is somewhat larger, has no discernible limonite and less spinel and rutile in ilm, its groundmass ilmenites are more lath-like; There is a greater degree of recrystallization. One Mg-Ilm is about 300 $\mu$  long.

72235

ROCK TYPE: Breccia dominated by two large black knobs

WEIGHT: 61.91 g

DIMENSIONS: 7 x 4 x 3 cm

COLOR: Matrix - medium light gray

(N6-N7); clasts - dark gray (N3) and very light gray (N8).

SHAPE: Angular, T is subrounded.

COHERENCE: Intergranular - Matrix is coherent; clasts are tough  
Fracturing - One penetrative (N-S)

BINOCULAR DESCRIPTION

BY: Reid and Marvin

DATE: 2/8/73

FABRIC: Breccia with subrounded to angular clasts

VARIABILITY: Heterogeneous

SURFACE: B, W, and S are fresh; others were exposed, are weathered brownish gray and are knobby with dark clasts raised.

ZAP PITS: Few on T (glass lined)

CAVITIES: None observed

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Light gray	70		<0.1		1
Clasts						
I	White & light gray	25	Subrnd	4x2.5x3		2
II	Gray	<5	Dish-shaped	1.5x1x0.8		3
III	Black		Ang		2 - 7	4
IV			Ang to subrnd		2 - 5	5
V	White		Ang		Up to 3	6
VI				1x2		7
Mineral	Roseate pink	Tr		0.1		

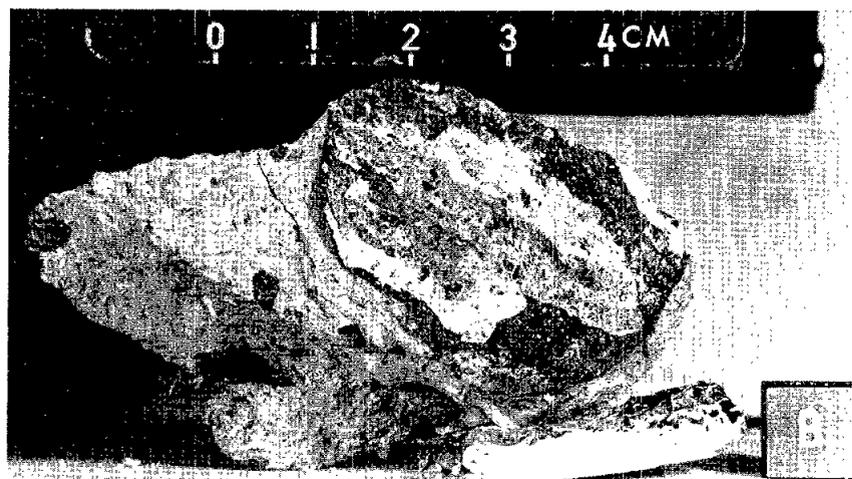
## NOTES:

1. 60% small white grains, 35% translucent pale greenish gray mafics, <5% opaques.
2. Clast I. A large banded breccia clast with a continuous aphanitic, dark gray to black rind from 1 - 8 mm thick. The rind contains 5% angular aggregates of 1 mm white clasts; 5% brownish gray clasts (probably mafic mineral), angular, up to 1 mm. The clast boundary is sharp in some regions but is gradational and poorly defined in others and the black rind becomes lighter gray, streaky and grades into the matrix. The inner edge of the black rind has a very sharp contact with white to light gray interior.

Interior of the clast is crudely banded in white and light gray. The white material has grain size of about 0.3 mm and consists mainly of chalky ground-up plagioclase, and a lot of angular fragments of minerals (gray and translucent, yellowish green, and cinnamon brown) and angular dark lithic fragments. The white band also includes 0.1 mm grains of metal or troilite and a holocrystalline lithic fragment (2.5 x 2 mm; visible on B) with average grain size 0.5 mm, consisting of 45% light gray feldspar, 50% yellow-brown pyroxene, and 5% dark lustrous opaques (some spherules). The gray bands are also breccias whose matrices are medium gray, fine-grained (0.1 mm), and contain a large variety of clasts. The mineral fragments of the

gray matrix are: 10% angular, 1 - 3 mm, gray-white, translucent, plag(?); 5% yellow-green angular mafics 0.1 - 1 mm and cinnamon brown fragments up to 0.5 mm; 1% angular platy lustrous black opaques. Lithic clasts in the gray bands are: 1 mm bluish white and fine-grained, with dark aphanitic rims, black aphanitic angular to subrounded to elongate, up to 3 mm long (compose 40% of gray bands) angular clasts of chalky white material up to 2 mm in size; one 2.5 x 1.5 mm clast, which is tough, fine-grained, 95% light gray sugary material (plag?); plus one metallic grain and one equant grain (0.2 mm) of dark, lustrous spinel(?) and one equant grain of unknown gray mineral.

3. Clast II. Single clast, visible on B, with a black aphanitic rind 2 - 3 mm thick and not quite continuous; this rind is similar to that on Clast I, and contains chalky white angular clasts up to 1 mm. Inside the rind is a lighter colored gray material, fine-grained (<0.1 mm), which is itself a breccia with mineral fragments up to 0.5 mm. It is mottled with white clasts and brownish component, is more or less homogeneous and resembles rock matrix. The few mineral fragments in the gray are angular gray feldspars, yellow-green mafics, and black opaques. The broken surface is irregular with tiny irregular cavities (unlike the light portions of Clast I).
4. Clast type III, aphanitic with angular white inclusions like rind of clast I.
5. Clast type IV; some with white rims, others with no rims, and still others with aphanitic black rims. Look like fine-grained quartzite with resinous luster.
6. Clast type V, feldspathic, fine-grained, chalky white.
7. One clast of type VI on T face has a thin 0.5 mm black rim and consists of 50% white plag; 50% brownish mafic, both with grain size of about 0.2 cm.



Sample 72235

S-73-16772

ROCK TYPE: Light gray breccia                      WEIGHT: 461.2 g  
 COLOR: Whole rock: medium light                  DIMENSIONS: 2.5 x 9 x 10.5 cm  
           gray (N6). Matrix is lighter  
           gray (N6-N7)  
 SHAPE: Subrounded on all faces except T and N.  
 COHERENCE: Intergranular - Moderately coherent  
             Fracturing - Local; non-penetrative, small chips 72255,2  
                           and 3 probably cracked off when rock broke  
                           from boulder.

BINOCULAR DESCRIPTION              BY: Jackson and Marvin              DATE: 2/7/73

VARIABILITY: Heterogeneous

SURFACE: N and T are freshly broken and hackly; E, S and B are discolored and knobby. Type I (see table below) clasts form angular projections on B and S surfaces. Type II clasts are differentially weathered to form shallow depressions.

ZAP PITS: Few on B and S. The pits average 1.5 mm diameter and the largest is 3 mm, glass lined; some pits probably destroyed by spalling of surface.

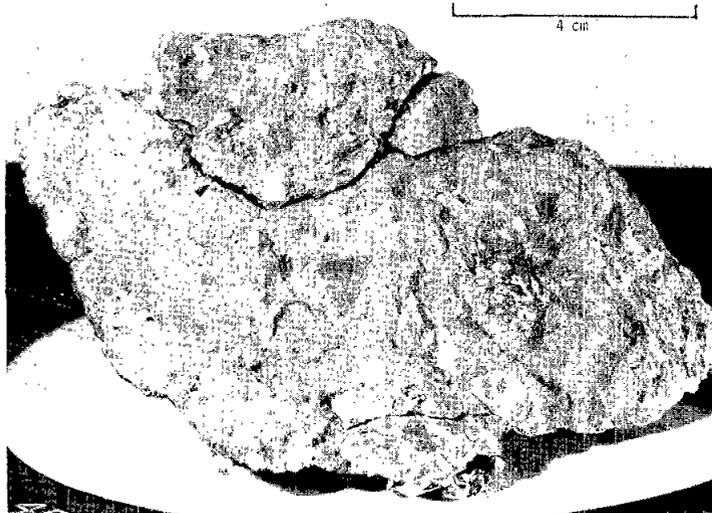
CAVITIES: 1 - 2% in matrix; flattened and elongated in a curved pattern as exemplified on T; size is 0.2 x 2 mm. A few small cavities occur in Type II clasts.

SPECIAL FEATURES: Rough foliation visible on T surface; see photos.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Gray (N6-N7)	60				1
Clast I	Medium dark gray (N4-N5)	20	Subang to ang	3x4	1 to 10	2
Clast II	Light gray (N7-N8)	15	Irreg		To 35x45	3
Clast III	Dark gray	<5			14x26	4
Clast IV		<2			5x6	5
Clast V	Very light gray	<2	Rnd		4	6
Clast VI	White to bluish white	<2			0.5x1.5	7

## NOTES:

1. Consists of fine-grained lithic debris and mineral grains, a few plagioclase grains, mafic silicates and metal or troilite but matrix owes color to being pulverized materials, probably pulverized once since last annealing.
2. Very fine grained (<0.1 mm) crystalline. In general have sharp boundaries, but in places, boundaries grade into the light gray matrix (see T face).
3. These clasts are fragmental rocks with contacts that are intricate and fuzzy. Some contain dark gray Type I clasts and patchy areas looking like matrix material of lighter color than typical matrix. Type II clasts are relatively friable. The largest dark clasts in the white clasts measure about 3 cm. Type II look like pulverized light colored breccias (see N face).
4. Only one Type III clast, which is very fine-grained dark gray matrix with white feldspar in tabular grains. These make up 40% of the clast. In places the clast shows relict cleavage. The dark gray may once have been a mafic mineral with poikilitically included feldspar (see N and T faces).
5. Holocrystalline; 1 mm yellowish-tan and dark gray minerals ~50:50; a mafic rock with granoblastic texture (see T face).
6. Only one Type V clast, which is crystalline fragmental rock with a few mm-size dark clasts: the inside rim is circular with a black coating which, if ever it was glass, is now devitrified (see T face).
7. Dense crystalline material, average about 0.5 x 1.5 mm. Some of these are associated with grains or masses of yellow olivine.



Sample 72255

S-73-16003

THIN SECTION DESCRIPTION

BY: Jackson

DATE: 3/1/73

SECTION: 72255,7

SUMMARY: This section is crudely banded: one band is dark matrix breccia with darker clasts and a heterogeneous matrix containing darker microclasts as well as several other lithic types; the other band is a lighter, mineral-rich zone which consists of broken fragments of the dark breccia mixed with a much higher percentage of mineral fragments.

## MATRIX, 100% OF DARKER BAND

<u>PHASE</u>	<u>% OF BAND</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
A	20	Subrnd	<0.1 - 0.5	A - Dark lithic fragments of darker part, re-brecciated
B	5	Subrnd	<0.1 - 0.5	
C	30	Subrnd	<0.1 - 0.5	B - Brown lithic fragments of darker part.
Oliv	10	Subang	<0.1 - 0.5	
Opx	10	Subang	<0.1 - 0.5	C - Matrix of darker part.
Plag	25	Subang	<0.1 - 0.5	
Red spinel	<1	Subang	<0.1	

## MATRIX, 75% OF LIGHTER BAND

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
A	10	Subrnd	<0.1 - 1	A - Same as the larger lithic clasts described below.
B	5	Subrnd	<0.1 - 1	
C	5	Subrnd	<0.1 - 1	B - Brown fine-grained annealed breccia.
D	1	Subrnd	<0.1 - 1	
Oliv	20	Subrnd	<0.1 - 1	C - Fine-grained oliv-pyrox-plag rocks with hornfels texture.
Opx	10	Subang	<0.1 - 1	
Cpx	10	Subang	<0.1 - 1	D - Fine-grained basaltic material, a vug filling.
Plag	40	Subang	<0.1 - 1	
Red spinel	<1	Subang	0.1	

## LITHIC CLASTS, 25% OF LIGHTER BAND

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Breccia	100	Subrnd	1 - 1.5	All are dark gray fine-grained breccias which consist mostly of mineral clasts, but in a few cases contain lithic clasts, themselves very fine-grained. The clasts appear to be annealed.

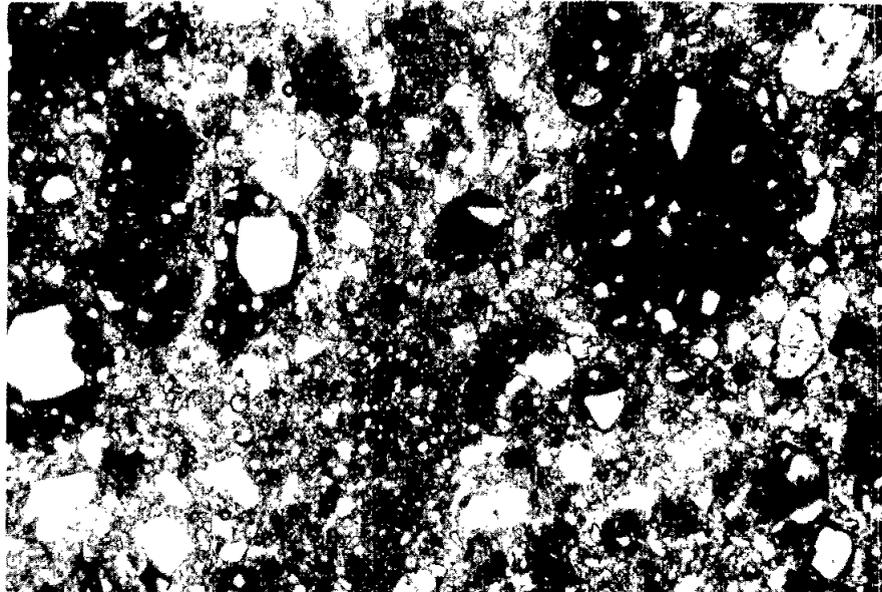
OPAQUES DESCRIPTION

BY: Brett

DATE: 3/14/73

SECTION: 72255,7

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	<1	Ang, rnd laths	0.003	Average grain size is in micron to sub-micron range but larger rounded oxide grains and ragged metal grains occur.
Spinel	Tr	Laths	To 0.02	
Cr-spinel	Tr	Rnd	To 0.03	Large ilm shows rare spinel and rutile laths.
Ulvo	Tr	Rnd	To 0.04	
Arm	Tr	Rnd, ang	To 0.04	At least one large Cr-spinel grain with thick margin of rounded ulvospinel. One small diffuse limonite stain around a metal grain. Some possible armalcolite-ilmenite intergrowths occur.
Fe-Ni	<1	Irreg, blebs	To 0.03	
Troil	<0.5	Irreg, blebs	To 0.03	
Limonite	Tr	Diffuse stain	To 0.04	
Rutile	Tr	Laths	To 0.03	



Section 72255,7 S-73-20076  
Width of field 3.16 mm, plane light





Sample 72275

S-73-16077

THIN SECTION DESCRIPTION

BY: Agrell

DATE: 2/19/73

SECTION: 72275,11

SUMMARY: The rock is composed of a dark fine-grained polymict metaclastic which has been disaggregated and incorporated in a highly feldspathic microbreccia.

## MATRIX, 55% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
Glass	20	Interstit	
Lithic	30	Rnd	0.15
Plag	42	Ang - subrnd	<0.3
Oliv	3	Ang	<0.1
Hyp	5	Ang	<0.1
Cpx	0.5	Ang	<0.1
Opa	<0.2	Subrnd	
Spinel	<0.1	Ang	

COMMENTS: The matrix consists of a sintered and partially fused feldspathic microbreccia. It is composed of mineral clasts and lithic clasts in the size range 0.02 - 0.3 mm bonded by interstitial glass. The lithic clasts have a diffuse outline and are derived from the fragmentation of the dark fine-grained polymict metaclastic which forms about 45% of the rock in

clasts 0.5 - 2.0 mm in size. The high proportion of feldspar and the presence of amber spinel in the mineral clasts of the matrix indicates that an additional component is present.

Plagioclase shows partial maskelynitization, bubble inclusions, occasional needles of rutile(?), most is only slightly shocked.

Hypersthene is nearly colorless; exsolution of small dull brown green plates of spinel(?) is common.

Clinopyroxene has a pale lilac tint; some narrow (100) exsolution lamellae. Spinel occurs as pale amber fragments. Many of the mineral clasts are surrounded by a film of dark material which corresponds to the matrix of the dark fine-grained metaclastic from which they were disaggregated. Spinel is the only mineral never to have this coating.

LITHIC CLASTS, 45% OF ROCK			
TYPE	% OF		SIZE (mm)
	LITHIC	SHAPE	
I	85	Rnd	1 - 2
II	3	Subrnd	0.5
III	1	Rnd	0.5
IV	10	Rnd	0.5

COMMENTS:

- I. Dark fine-grained polymict metaclastic with about 10% angular feldspar, 2% ferromagnesian clasts, 5% lithic clasts in a matrix of devitrified glass and rounded with micron-sized mineral chips. The matrix appears dark due to submicron-sized dust of disseminated troilite, and granules of opaque oxides. The 5% lithic clasts include representatives of all group 4 types of granulitic metaclastics of noritic-anorthositic type.
- II. Maskelynitized anorthosite that consists of partially maskelynitized clots of 3 - 5 plagioclase crystals.
- III. Feldspathic olivine basalt comprising 20% olivine microphenocrysts ( $\pm 60\mu$ ) in a base of lathy plagioclase (60%) and interstitial pale sandy-colored pyroxene.
- IV. Fine-grained feldspathic granulitic metaclastics which show a wide range of types that have approximately the same composition: 70% plagioclase and 30% olivine and hypersthene. One or two are nearly pure anorthite granulites. They vary in grain size from  $20\mu$  to  $50\mu$ , and from even grained to porphyroclastic (plagioclase) types. Thin hairline cracks marked by submicron-sized droplets of troilite and FeNi metal occur in some clasts. Types II, III, IV lithic clasts often have partial coating dark material corresponding to the matrix of the dominant clast type - the fine-grained dark metaclastic, Type I.

ADDITIONAL COMMENTS: Section 72275,12 is similar but single lithic clasts of two additional types were seen: (1) shocked norite, (2) pale pyroxene (pigeonite?) rich basalt with interstitial plagioclase. Ilmenite, and opaque spinel ( $\pm 6\%$ ). FeNi metal and troilite present <1%.

OPAQUES DESCRIPTION

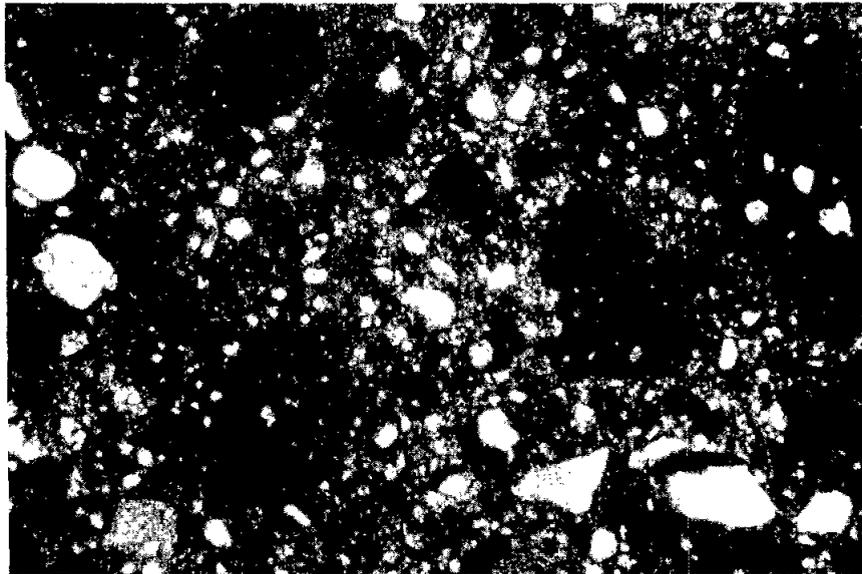
BY: Brett

DATE: 3/14/73

SECTION: 72275,11

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	<1	Irreg	To 0.04	Ilmenite is irregular rounded and angular and lath-like grains with little development of spinel and rutile. Some ilmenite in some clasts is in euhedral 10 $\mu$ laths. Average grain size of all opaque minerals in section is less than 5 $\mu$ . One rusty stain. One 5 $\mu$ grain with appearance of brass. Phase X is light gray, reflectively lower than ilm, and white internal reflection.
Fe-Ni	<0.2	Irreg & rnd	To 0.04	
Tr	<0.2	Irreg & rnd	To 0.03	
Arm	Tr	Ang, rnd	To 0.03	
X				
Limonite	Tr	Diffuse stain		

One shocked plag grain has Fe needles included in it reminiscent of those reported by Brett et. al. in the Lunar 20 sample. Several pyroxenes show ilm(?), Fe, and troilite needles and blebs in one preferred orientation.

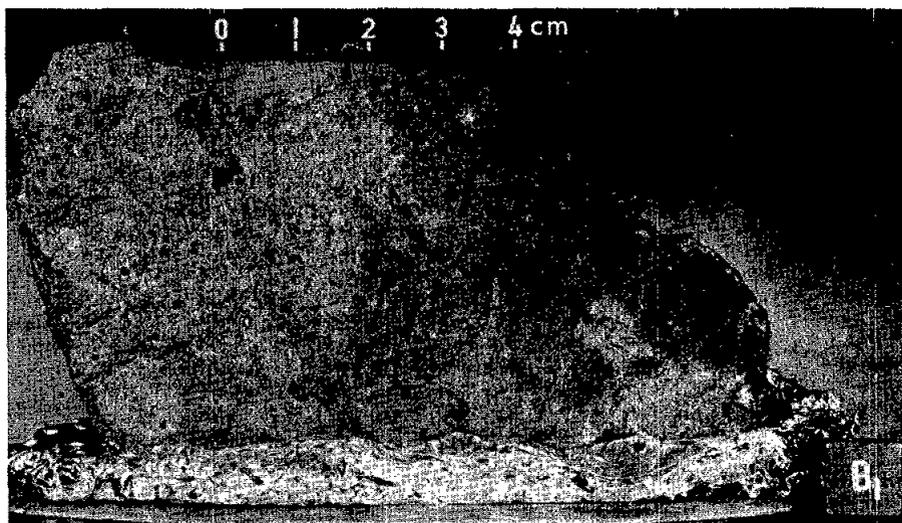


Section 72275,11

S-73-20085

Width of field 3.16 mm, plane light





Sample 72315

S-73-16657

THIN SECTION DESCRIPTION

BY: Wilshire

DATE: 3/1/73

SECTION: 72315,7

SUMMARY: Metaclastic rock, irregularly annealed. Locally vuggy with distinctive crystal growth around vug walls.

## MATRIX, 80% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opa	1 - 2	Short prisms	To 0.4	Granoblastic to poikiloblastic; poikiloblastic pyroxene to 0.3 mm. Probably both opx and cpx in matrix. Much angular plagioclase, olivine; tiny plagioclase laths are common.
Opx }			To 0.3	
Cpx }				
Plag				
Oliv				

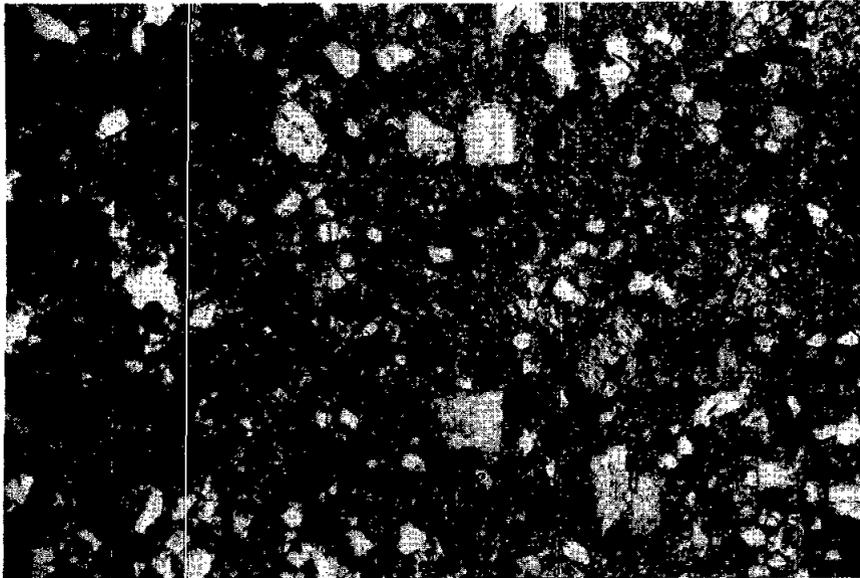
## MINERAL CLASTS, 10 - 15% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	95	Ang	To 0.8	Plagioclase and olivine have normal zoning symmetrical to angular grain shapes.
Oliv	5	Ang	To 0.5	
Pyrox	Tr	Ang	To 0.3	

## LITHIC CLASTS, 5 - 10% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I	65		2	I - "medium grained" hornfels with poikiloblastic orthopyroxene to 0.7 mm enclosing plagioclase and irregular olivine.
II	30		2	II - fine-grained hornfels-nearly "identical" to matrix.
III	5		0.8	III - recrystallized plagioclase aggregates.

ADDITIONAL COMMENTS: Vuggy patches to 2 mm across in matrix. Contain light brown clinopyroxene, plagioclase and minor opaques. Percentages visual estimates.



Section 72315,7 S-73-19932  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 3/14/73

SECTION: 72315,7

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	<1	Irreg	To 0.4	Ilmenite occurs in irregular embayed grains with sieve
Fe-Ni	<0.2	Irreg	To 0.4	

Troil	<0.1	Irreg, rnd	To 0.1	structure. Most ilm is Mg-rich. Appears to be bimodal size distribution in ilm, with smaller size (to 20 $\mu$ ) having a greater abundance of laths. Metal and troilite is both rounded and ragged and irreg.
X	Tr	Irreg	To 0.02	
Spinel	Tr	Lamellae	To 0.02	
Rutile	Tr	Lamellae	To 0.02	

Phase X is light gray, reflectively less than ilm, semi-opaque with white internal reflection; is associated with ilmenite, characteristic spinel and rutile lamellae in ilmenite.

## 72335

ROCK TYPE: Metaclastic	WEIGHT: 108.9 g
COLOR: Greenish gray (5GY 6/1)	DIMENSIONS: 8 x 1.5 x 1.5 cm
SHAPE: Angular on fresh fractures; exposed surface rounded	
COHERENCE: Intergranular - Tough Fracturing - None penetrative	

BINOCULAR DESCRIPTION BY: Marvin and Stuart-Alexander DATE: 2/2/73

FABRIC: Fine-grained; sugary  
 VARIABILITY: Homogeneous groundmass with variety of recrystallized clasts  
 SURFACE: Exposed surfaces (N, T and part of E) are thinly coated with dark yellowish brown (10YR 4/2) material. S, W, and B are freshly broken.  
 ZAP PITS: Many on N, T, and part of E surfaces; none on others.  
 CAVITIES: 30% of surface; irregular with drusy crystals; size of cavities 0.1 to 1.0 mm, dominant size 0.2 mm.  
 SPECIAL FEATURES: Drusy vugs are lined with euhedral ilmenite, rare troilite crystals, and sugary minerals. Most lithic clasts are recrystallized with fine-grained, sugary textures.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Pale greenish gray (5GY 6/1)	80			<0.2	1

Maf sil clast	Vitreous pale yellow	} 12		7		2
Maf sil clast	Yellowish green		0.5	0.5 - 2		3
Plag clast	White to c'less		0.5	0.5 - 3		4
Opaque clast	Black		1.5x1	<1.5		5
Pyrox(?) clast	Brown					
Lithic I	Faint bluish	} 8	Irreg			6
Lithic II	Brown		Subang	5x7		7
Lithic III	Greenish		Rnd	5		8
Lithic IV	Pale grayish brown		Subang	2 - 4	5x7	9

## NOTES:

1. Too fine-grained to estimate mode but contains 0.05 mm black flakes of disseminated ilmenite, often in clumps and stringers, 0.2 mm.
2. Anhedral yellowish translucent and grayish white mafic silicate and probably plagioclase and anhedral, reddish mineral debris.
2. Grayish white core with yellow rim; olivine(?).
3. Olivine grains common.
4. Plagioclase, cleavage conspicuous.
5. Ilmenite(?), very shiny crystal, partly hollow from skeletal growth.
6. Aphanitic, merges with groundmass.
7. Basaltic; brown pyroxene and pale gray plagioclase, 60:40 ratio, trace of ilmenite. High vuggy, 50% cluster of troilite. Both are euhedral.
8. Granular, medium grained, olivine; recrystallized to polycrystal aggregate.
9. Aphanitic. Colors vary slightly. Boundaries can be gradational with groundmass.



Sample 72335      S-73-16246

72355

ROCK TYPE: Vesicular holocrystalline      WEIGHT: 367.4 g  
           tan breccia      DIMENSIONS: 10 x 6.5 x 5.5 cm  
 COLOR: Light olive gray (5Y 6/1)  
 SHAPE: Blocky  
 COHERENCE: Intergranular - Tough  
               Fracturing      - Few non-penetrative fractures

BINOCULAR DESCRIPTION      BY: Jackson and Morrison      DATE: 1/16/73

FABRIC: Holocrystalline and sugary with some lath-shaped plagioclases

VARIABILITY: Heterogeneous in grain size and in distribution of minerals and cavities.

ZAP PITS: Many on N (average 2 mm halo, 0.5 mm pit, 4 mm spall); few on the exposed parts of E, W, B, and T; none on S.

SURFACE: E, S, and T are hackly and fresh; others are knobby and discolored.

CAVITIES: Vugs are 3 - 4% of rock, range in size from 1 mm to 4 x 6 mm.

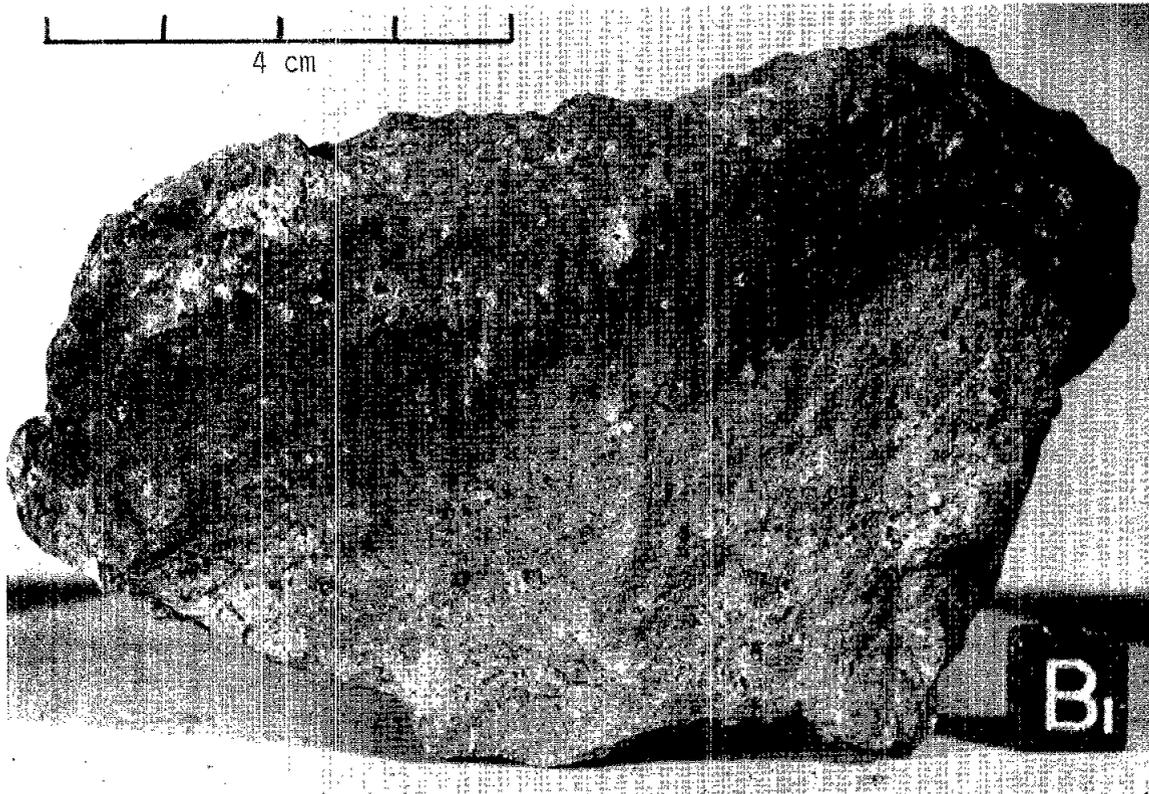
All vugs have crystal linings, the larger vugs having the larger crystals. The largest vug has plagioclase crystals which average 1 mm projecting variolitically into cavity, plus honey yellow pyroxene about 0.5 mm in diameter.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Lithic	Gray	10	Rnd		2 - 12	1
Lithic		<5	Rnd		4x4	2
Plag clasts		5			Up to 3	
Oliv(?) clasts		1-2			Up to 1.5	

Pyrox clasts	Honey brown	1	Up to 1.5	
Troil clasts		<1		3
Matrix		77	<0.1 - 0.3	4

## NOTES:

1. Very fine-grained holocrystalline clasts. Grain size is 0.2 mm, mode is olivine 2%, equant mafics 2%, plagioclase 50%, and 40% gray pyroxene(?). This clast type is finer grained than the matrix.
2. Whether or not these rounded aggregates of pyroxene, olivine, or plagioclase are clasts or vug fillings is unknown. They have open structures. Mineral proportions of the most mafic of this type: root beer pyroxene, 50%; plagioclase, 20%; olivine, 10%; rest is porosity. Mineral proportions of the most plagioclase-rich of this type of clast (mode estimated from a single 6 x 6 mm clast with 0.3 mm grain size): 40% root beer pyroxene, 45% plagioclase; the rest is porosity.
3. In a vug; only one seen.
4. Holocrystalline but heterogeneous in mineralogy and grain size. Minerals present seem to be: plagioclase, olivine, brown pyroxene, gray pyroxene (or plagioclase), opaques (disseminated). Plagioclase is the dominant mineral, but small grain size prevents estimation of a mode.



Sample 72355

S-73-15354

THIN SECTION DESCRIPTION

BY: Jackson

DATE: 2/10/73

SECTION: 72355,4

SUMMARY: Vuggy, holocrystalline breccia. Only four clasts in section; three are metaclastic rock fragments and the fourth is a large single undeformed opx crystal. Two of the rock fragments are finer grained than the matrix, one is slightly coarser. All are rich in plagioclase and orthopyroxene, with plagioclase dominant. The matrix is annealed fragmental material, consisting largely of crystal debris with an unusually high ratio of mafic silicates to plagioclase.

## MATRIX, 85% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	35	Subang	0.05	Lithic fragments are mostly
Opx	40	Subang	0.05	feldspar-rich. Vesicles
Cpx	5	Subang	0.05	are unlined. Matrix does
Oliv	5	Subang	0.05	not change size or mineralogy
Lithic	10	Subrnd	0.3x1.0	near vesicles. Size range
Vesicles	5	Flattened	0.5x1.0	for all mineral fragments is
Opauques	<5	Subang to vermicular	0.02	0.01 - 1.0 mm.

## MINERAL CLASTS, &lt;1% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opx	100	Ang	1.0	

## LITHIC CLASTS, 15% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I	35	Subang	3.0	I. Orthopyroxene plagioclase
II	50	Subrnd	2.5 x 4.0	hornfels. Original grain size
III	15	Subrnd	1.0 x 1.0	may have been about 1 mm; now
				polygonally recrystallized to
				an aggregate about 0.01 mm.
				75% plagioclase; 25% pyroxene.
II.				Cryptocrystalline aggregate of tiny, feathery plagioclase laths studded
				with somewhat larger (0.01 mm) cpx and opaque minerals. Plagioclase 80%;
				cpx 10%; ilmenite 10%.
III.				Plagioclase rich hornfels 0.15 mm polygonal plagioclase grains surrounded
				by necklaces of 0.05 mm orthopyroxene grains. Very few opaque minerals.

ADDITIONAL COMMENTS: All percentages are visual estimates only.

THIN SECTION DESCRIPTION

BY: Morrison

DATE: 3/1/73

SECTION: 72355,4

SUMMARY: Metaclastic rock with all components recrystallized.

Poikiloblasts are small and rare.

MATRIX, 80% OF ROCK				
<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	30(?)	Blocky and laths	0.5 - <0.1	Small poikiloblasts of pyroxene and plagioclase compose about 1% of matrix. Opaques are
Pyrox	40 - 50	Anhed	6.5 - <0.1	complex, showing four types:
Oliv	10(?)	Anhed	0.5 - <0.1	yellow-white, gray-white, yellow,
Opa	5	Irreg	0.5 - <0.1	and dark gray.

MINERAL CLASTS, 15-20% OF ROCK				
<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opx	1	Rnd	≤1	Opx with exsolution lamellae.
Plag	60	Ang to rnd	≤1	Crystals are zoned, and have reaction rims with matrix.
Maf sil	40	Ang to rnd	0.5 - 1	Plag crystals are blocky and sub-rounded. Most are zoned. Inclusion trains near rims may be coincident with zoning. Olivine plus clinopyroxene.

LITHIC CLASTS, 2-3% OF ROCK				
<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I		Ang	6x3	I - one clast, feathery intergrowth of plag (60%) and mafic silicate (10-15%), opaques (5-10%) and very fine-grained mafic silicate(?) 20%. Resembles devitrified glass.
II		Rnd	3x3	II - one clast, rock formed of 0.5 mm plag poikiloblasts (80%) plus finer grained interstitial mafic (20%), very fine-grained mafic (1-2%), and accessory opaques.
III		Rnd	1.5x1.5	III - several clasts composed of plag (60-70%), olivine (20-30%), and accessory opaques. Some plag is poikiloblastic with olivine inclusions. Plag is bimodal in grain size.
IV		Rnd	1.5	IV - one clast with polygonal olivine (90%), polygonal plag (10%).

OPAQUES DESCRIPTION

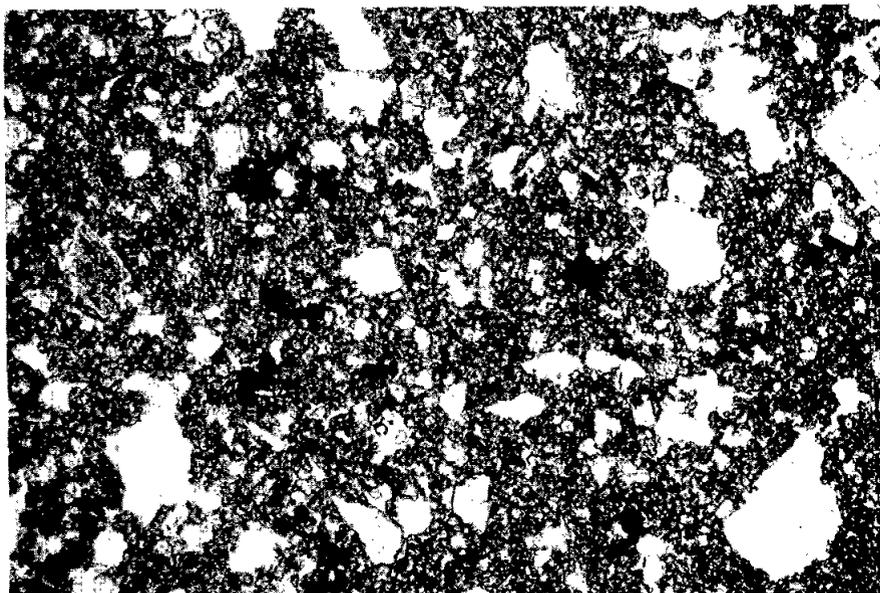
BY: Brett

DATE: 2/1/73

213

SECTION: 72355,4

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	<1.5	Irreg	To 0.7	Ilmenite is largely the pleochroic Mg-rich type; some grains show the typical Apollo 17 rutile lamellae and spinel lamellae and inclusions. Much ilmenite shows sieve structure and has rounded outlines - not as recrystallized as 76015.
Rut	Tr	Lamel	To 0.1	
Cr-Sp	Tr	Laths & irreg	To 0.05	
Fe-Ni	< 0.1	Blebs	To 0.05	
Troil	< 0.1	Blebs	To 0.02	



Section 72355,4

S-73-19937

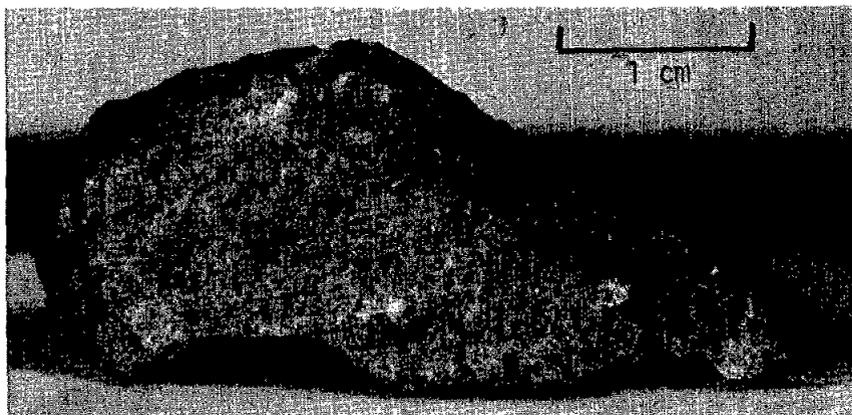
Width of field 3.16 mm, plane light

72375

ROCK TYPE: Green-gray breccia

WEIGHT: 18.16 g

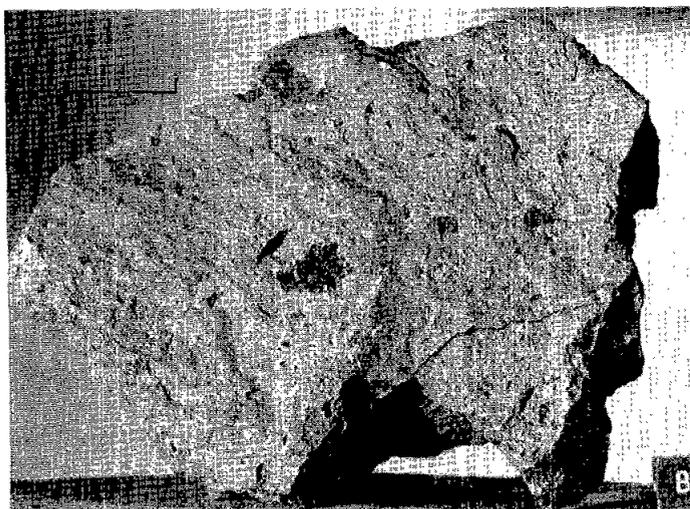
NOTE: This sample was stored as a refrigerated reserve after photography and was not studied under binocular microscope. It resembles two other samples from the same boulder, 72355 and 72395.

Sample 72375 S<sub>1</sub>

S-73-15356



5. Cleavage shows grain size.
6. Only one, which is on the S surface; vuggy.
7. Only one, which is on the S surface.



Sample 72395

S-73-16052

72415

ROCK TYPE: Metaclastic  
 COLOR: Pale yellowish, greenish gray  
 (5Y 8/1 to 5GY 8/1)  
 SHAPE: Slabby chip  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few penetrative

WEIGHT: 32.34 g  
 DIMENSIONS: Two pieces both  
 4 x 2 x 0.8 cm

BINOCULAR DESCRIPTION

BY: Wilshire/Horz

DATE: 2/1/73

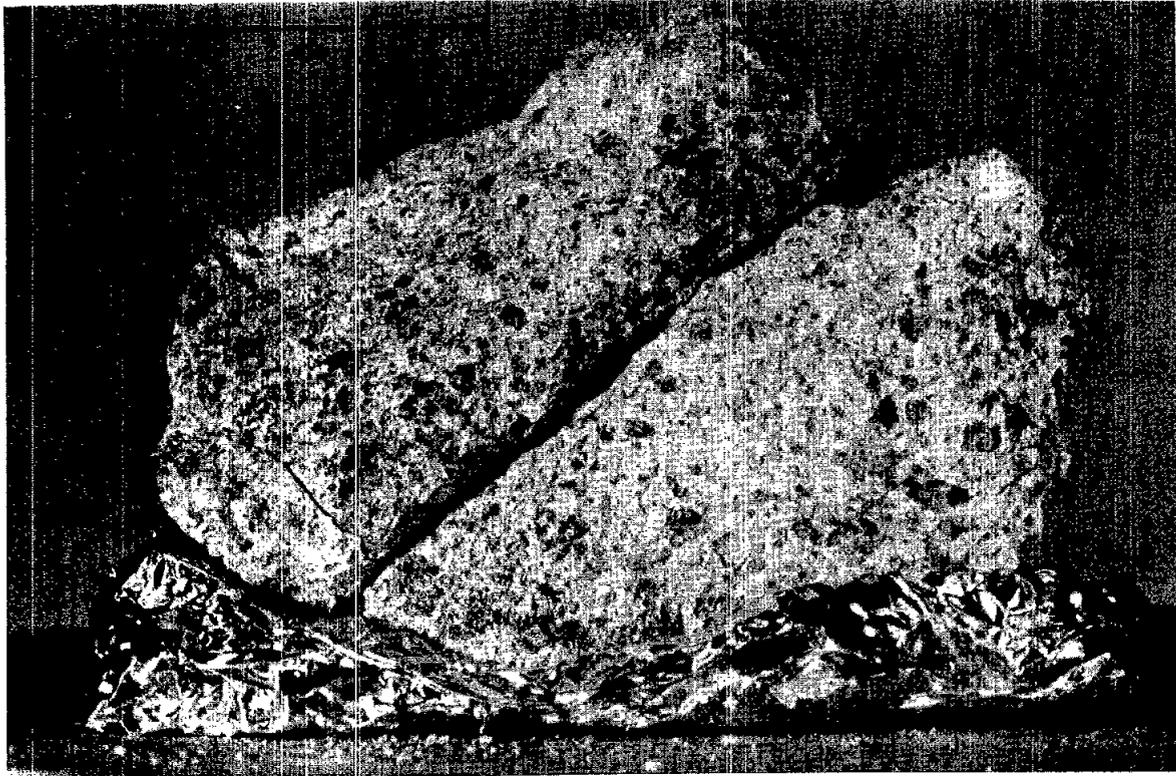
FABRIC: Microbreccia  
 VARIABILITY: Homogeneous  
 SURFACE: Finely hackly  
 ZAP PITS: Many on B and adjacent parts of N, E, W, and S; none on T.  
 CAVITIES: None

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Mineral clasts						
I	Pale yellow green	30	Irreg to prismatic	1.5	1 - 3	1

II	Dark brownish red	<1	Equant		1 - 2	2
III	Light bluish gray	1-2	Irreg		1 - 2	3
Lithic clasts						
I	Gray	} 1-3	Subang	2	2 - 3	4
II	Yellowish gray		Subang		2 - 3	5
Matrix		65		<0.1	<0.1 - 1	6

## NOTES:

1. Olivine or possibly orthopyroxene, resinous. A few grains are tan.
2. More reddish where broken; spinel(?).
3. Plagioclase, which looks sugary.
4. Sugary plagioclase-mafic silicate aggregates.
5. Resinous yellow-green mineral and plagioclase.
6. Consists of 35% resinous yellow-green mineral, seriate from clast size to resolution, trace to 1% reddish spinel(?), trace to 1% opaque mineral, 1 - 2% recognizable sugary gray plagioclase. Remainder is too fine-grained to identify.



THIN SECTION DESCRIPTION

BY: Wilshire

DATE: 2/28/73

SECTION: 72415,11

SUMMARY: Olivine-rich metaclastic rock. Percentages based on 500 point counts.

## MATRIX, 44% OF ROCK

Matrix is all material <0.1 mm, but is composed of the same constituents as the clasts.

## MINERAL CLASTS, 55% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Oliv	99	Ang		Olivines commonly partly recrystallized to small polygonal grains, especially along strain bands. May be a small proportion of pyroxene counted as olivine.
Plag	1	Ang		

## LITHIC CLASTS, 1% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Spinel- plag - maf sil	60	Subang		Wormy and rod shaped intergrowths of brown spinel and plagioclase. A mafic silicate also occurs as small grains in the intergrowth. The same type of intergrowths occur as thin, discontinuous bands in some large olivine grains.
Grano- blastic oliv(?) and plag	40	Subang		

OPAQUES DESCRIPTION

BY: Brett

DATE: 2/14/73

SECTION: 72415,11

Metal is the only readily discernable opaque phase present and it occurs in trace amounts (<0.05%) in grains up to 0.01 mm in diameter.



72417

ROCK TYPE: Metaclastic  
 COLOR: 5Y 8/1 to 5GY 8/1  
 SHAPE: Irregular, slabby chip  
 COHERENCE: Intergranular - Tough  
             Fracturing - Few, non-penetrative

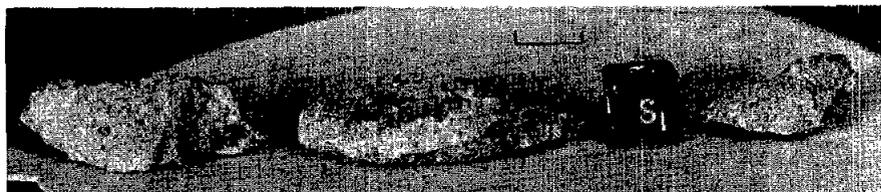
WEIGHT: 11.32 g  
 DIMENSIONS: 1.2 x 2.1 x 3.2 cm

BINOCULAR DESCRIPTION

BY: Horz

DATE: 3/16/73

SURFACE: Hackly  
 ZAP PITS: Many on T; none on other faces  
 CAVITIES: None  
 SPECIAL FEATURES: Same as 72415 (dunite).



Sample 72417

72416  
S-73-17968

72418

72418

ROCK TYPE: Metaclastic  
 COLOR: 5Y 8/1 to 5GY 8/1  
 SHAPE: Slabby  
 COHERENCE: Intergranular - Tough  
             Fracturing - None

WEIGHT: 3.55 g  
 DIMENSIONS: 1 x 2.5 x 4 cm

BINOCULAR DESCRIPTION

BY: Horz

DATE: 3/16/73

SURFACE: Many on T; none on all other surfaces  
 CAVITIES: None  
 SPECIAL FEATURES: Same as 72415 (dunite). A few exceptionally large spinels (up to 1.5 mm). Chips 72418, 72417 and 72416 are identical to 72415 and should be treated as one rock.





Sample 72435

S-73-16187

THIN SECTION DESCRIPTION

BY: Morrison

DATE: 3/1/73

SECTION: 72435,7

SUMMARY: Metaclastic breccia which has totally recrystallized. It contains an earlier generation of a similar breccia type plus rock fragments which have been recrystallized to polygonal textures.

## MATRIX, 85% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Mafic	50-60	Anhed to euhed	<0.1	Matrix is annealed. Primary matrix mineral is clinopyroxene with some orthopyroxene and olivine. No poikiloblasts.
Plag	30	Anhed and laths	<0.1	
Opaque	<1	Irreg	1	
Dissem opaque	2-3	Irreg	≤0.1	

## MINERAL CLASTS, 10-15% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	40(?)	Subrnd to subang	<1-1	Plagioclase clasts typically show slight progressive zoning generally free of inclusions.

Cpx	<1	Ang	1.5 and 0.5	Only 2 grains of this cpx, which has broad lamellae and included extinction. One is zoned and may be clinopyroxene rimmed by orthopyroxene.
Oliv	10	Ang	<1-1	Olivine is clear of inclusions
Cpx	50	Ang	<1-1	Clinopyroxene without broad lamellae.

## LITHIC CLASTS, 1% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I		Ang	1	Metaclastic breccia fragment with fine grained mafic matrix. Grain size slightly larger than host.
II			2	Clast largely stripped from edge of slide by polishing. Remainder has 0.5 - 1 mm grain size and consists of 50% plagioclase and 50% olivine(?). Texture shows annealing.
III		Relict	1	Rock fragment with poikilitic orthopyroxene enclosing plagioclase plus discrete plagioclase grains. Texture is annealed.
IV		Relict	1	Devitrified plagioclase with glass.

OPAQUE DESCRIPTION

BY: Brett

DATE: 2/15/73

SECTION: 72435,7

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	3	Subhed lamel, irreg	Av about 0.03	Ilmenite is partially recrystallized so that subhedral laths are locally developed. Some clasts contain no opaques other than finely disseminated metal.
Arm	Tr	Ang	To 0.02	
Spinel	Tr	Ang	To 0.02	
Fe-Ni	0.5	Blebs, irreg	To 0.04	
Troil	Tr	Blebs, irreg	To 0.1	





Mineral clasts						
Oliv	Yellow green	3	Subang	0.3	0.1 - 0.4	
Pyrox	Gray brown	1	Subang	0.3	0.1 - 1.0	5
Plag	C'less	1	Ang	0.3	0.3	

## NOTES:

1. Uniform grain size and sugary texture.
2. Opx(?)
3. In little irregular patches - ilmenite(?)
4. Cpx(?)
5. Opx(?)

Sample 72505 N<sub>1</sub> S-73-17872

72535 - 72548

(exclusive of numbers ending in digits 0 - 4)

ROCK TYPE: Blue-gray breccias	WEIGHT: 72535 - 221.4 g
COLOR: Matrix is dark bluish-gray (about 5B 4/1 to 5B 3/1)	72536 - 52.30 g
SHAPE: Angular to subangular with 72537 and 72548 subrounded	72537 - 5.192 g
COHERENCE: Intergranular - Tough	72538 - 11.09 g
Fracturing - None except one penetrative in 72539	72539 - 11.22 g
	72545 - 4.055 g
	72546 - 4.856 g
	72547 - 5.045 g
	72548 - 29.29 g

BINOCULAR DESCRIPTION

BY: Phinney

DATE: 3/1/73

FABRIC: Breccia

VARIABILITY: See "Special Features"

SURFACE: Fresh and hackly to eroded

ZAP PITS: Range from none (72545) through few (72539) to many on one surface, none on others (72547) to many on one surface and few on others (72535, 72548) to many on most or all surfaces (72536, 72537, 72538, and 72546).

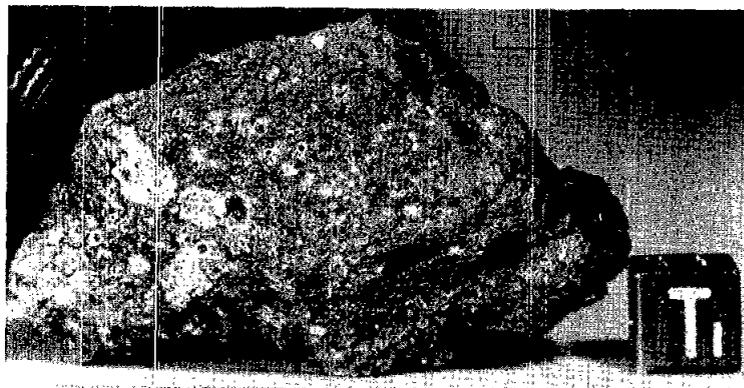
CAVITIES: Range from no cavities (72536) to several percent <1 mm spherical vesicles (best example is 72538) to vuggy to elongate open fractures and combinations of these.

- SPECIAL FEATURES: Maximum clast population with largest fragments occurs in 72536. There is a higher proportion of plagioclase clasts in 72539 than in others. In 72546, 72547, and 72548 there are irregular patches up to 1 cm across of coarser (0.1 - 0.5 mm), tan, less coherent material containing about 20% brown mafic silicate (probably pyroxene).

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Bluish gray	>90			<0.1	1
Clasts						
Anorth	Very light gray	5 - 10	Subrnd to subang		2 - 10	2
Maf sil	Brown	1	Subang		To 1	3
Maf sil	Green	1	Subrnd		To 1	4

NOTES:

1. Very fine-grained, sugary
2. Range from single plag grains to gabbroic anorth compositions, generally brecciated
3. Probably pyroxene
4. Probably olivine



Sample 72536

S-73-19462



Sample 72548      S-73-19730

72549 - 72558

(exclusive of digits ending in 0 - 4)

ROCK TYPE: Green-gray breccias	WEIGHT: 72549 - 21.00 g
COLOR: Matrix is light olive gray	72555 - 10.48 g
(5Y 6/1) to greenish gray (5GY 6/1)	72556 - 3.861 g
SHAPE: Subangular	72557 - 4.559 g
COHERENCE: Intergranular - Tough	72558 - 5.713 g
Fracturing - None	

BINOCULAR DESCRIPTION

BY: Phinney

DATE: 3/1/73

FABRIC: Breccia

ZAP PITS: From few on some faces (72555, 72556) to some on most faces (72549, 72557, and 72558)

CAVITIES: From a few percent small elongate fracture-like openings to a combination of these with small round vesicles. Some vesicles contain relatively coarse basalt-like mineral assemblages.

SPECIAL FEATURES: Maximum clast population occurs in 72549. 72557 and 72558 are somewhat finer-grained than the others.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF</u> <u>ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Light gray	95			<0.3	1
Clast						
Maf sil	Green	<5	Rnd		0.5 - 1	2
Maf sil	Brown	<1	Subang		0.5	3
Plag(?)	Gray	<1	Subang		0.5 - 1	4

## NOTES:

- Made up of equigranular grains of about 90% light gray, 5% black opaque, <5% light brown, and 1-2% green.
- Olivine, on one face there is a cluster of these grains.
- Probably pyroxene
- Light gray granular material, may be brecciated plagioclase.

72559

ROCK TYPE: Feldspathic rock  
COLOR: Light olive gray (5Y 6/1) on  
eroded surface  
SHAPE: Subangular  
COHERENCE: Intergranular - Tough  
Fracturing - None

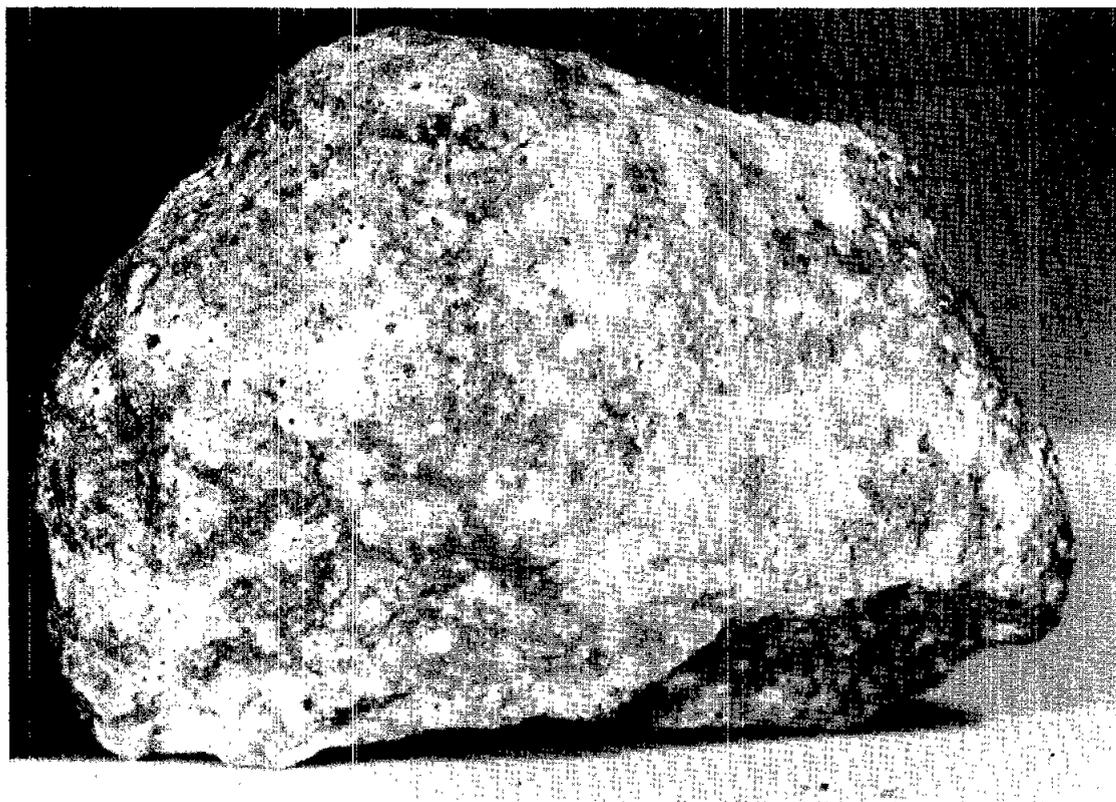
WEIGHT: 27.84 g  
DIMENSIONS: 4 x 3 x 2 cm

BINOCULAR DESCRIPTION

BY: Phinney

DATE: 3/1/73

VARIABILITY: Homogeneous  
ZAP PITS: Many on all surfaces  
CAVITIES: None  
SPECIAL FEATURES: Sugary textured rock containing about 98% translucent light gray grains (<0.3 mm in size) with a few very tiny specks (<0.1 mm) of black opaque minerals and orange-brown grains (spinel?). A few light green grains are sparsely scattered.

Sample 72559 T<sub>1</sub> S-73-19737

72705, 72735-72738

SAMPLE TYPE: Rocks (fragments >1 cm) from the second Station 2 rake sample (4 fragments) and associated soil (1 fragment).

CLASSIFICATION

BY: Morrison

DATE: 3/2/73

## BLUE-GRAY BRECCIA

72738

Angular, very coherent, dark bluish-gray, matrix-rich breccia containing a few rounded light colored clasts.

## GREEN-GRAY BRECCIA

72735

Rounded, very coherent, greenish-gray, vesicular, matrix-rich breccia containing less than 1% olivine and plagioclase clasts. Matrix is coarser than for blue-gray breccias 72705 and 72738.

## TAN BRECCIA

72736 and 72737

Angular, coherent, tannish-gray, slightly vesicular, matrix-rich breccia containing a few mineral clasts and very few lithic clasts. Coarser grained than greenish-gray breccia 72735.

## MISCELLANEOUS

72705

One-half crushed anorthosite and one-half black glass containing a few fragments of white anorthosite. Glass is highly dust-coated.

72705

ROCK TYPE: Black glass and crushed  
anorthosite

WEIGHT: 2.39 g

DIMENSIONS: 1.3 x 1 x 1 cm

COLOR: Black and white

SHAPE: Equant, irregular

COHERENCE: Intergranular - Tough

Fracturing - Abundant, many penetrative

BINOCULAR DESCRIPTION

BY: Simonds

FABRIC: Glass is isotropic; anorthosite is granular

VARIABILITY: Two dissimilar materials

SURFACE: T, N, S, E, and W are covered with tightly adhering dust, especially to the black glass as if it was hot and dust welded to molten glass; B is partially fresh and not covered.

ZAP PITS: Many on T, N, S, W, and E; few on B.

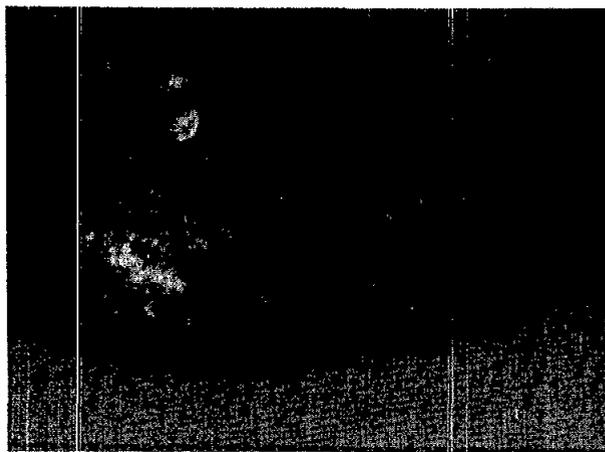
CAVITIES: Abundant spherical and irregularly-shaped pores in the black glass.

SPECIAL FEATURES: Contact between glass and anorthositic material is sharp but the anorthosite has an abundance of the larger milky-lustered grains; or the contact may be marked by a highly fractured layer of feldspathic glass which appears as separate grains.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Black glass	Black	50				1
Anorth	White	50				2

## NOTES:

1. Shiny luster as if not devitrified. Contains bits of feldspar, which have milky resinous luster (maskelynite?). Parts of the glass have smoothly undulating surfaces indicating that they were original free surfaces, while the glass fractures glimmer as if they were feldspar cleavage faces.
2. Made of pulverized white minerals with large milky-lustered colorless and pale green grains. The lusters are probably mafic silicates. One 0.5 mm long opaque grain (ilmenite?). Zap pits in this material have a white glass.

Sample 72705 S<sub>1</sub> S-73-17876

72735

ROCK TYPE: Metaclastic (greenish  
gray breccia)  
COLOR: Gray  
SHAPE: Rounded  
COHERENCE: Intergranular - Tough  
Fracturing - None

WEIGHT: 51.11 g  
DIMENSIONS: 5 x 3.5 x 2 cm

BINOCULAR DESCRIPTION

BY: Morrison

DATE: 3/2/73

ZAP PITS: Zapped on all sides

CAVITIES: 10%, vugs have poorly developed druse

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Gray	99				1
Clasts						
Maf sil	Yellow green	<1	Ang	1		
Plag		<1	Ang	1		

## NOTES:

1. Granular and fine-grained, but coarser than 72738.

72736

ROCK TYPE: Metaclastic (non-breccia)  
COLOR: Tannish gray  
SHAPE: Angular, prismatic  
COHERENCE: Fracturing - One fracture

WEIGHT: 28.73 g  
DIMENSIONS: 5.5 x 2.5 x 2 cm

BINOCULAR DESCRIPTION

BY: Morrison

DATE: 3/2/73

ZAP PITS: Zapped on all sides

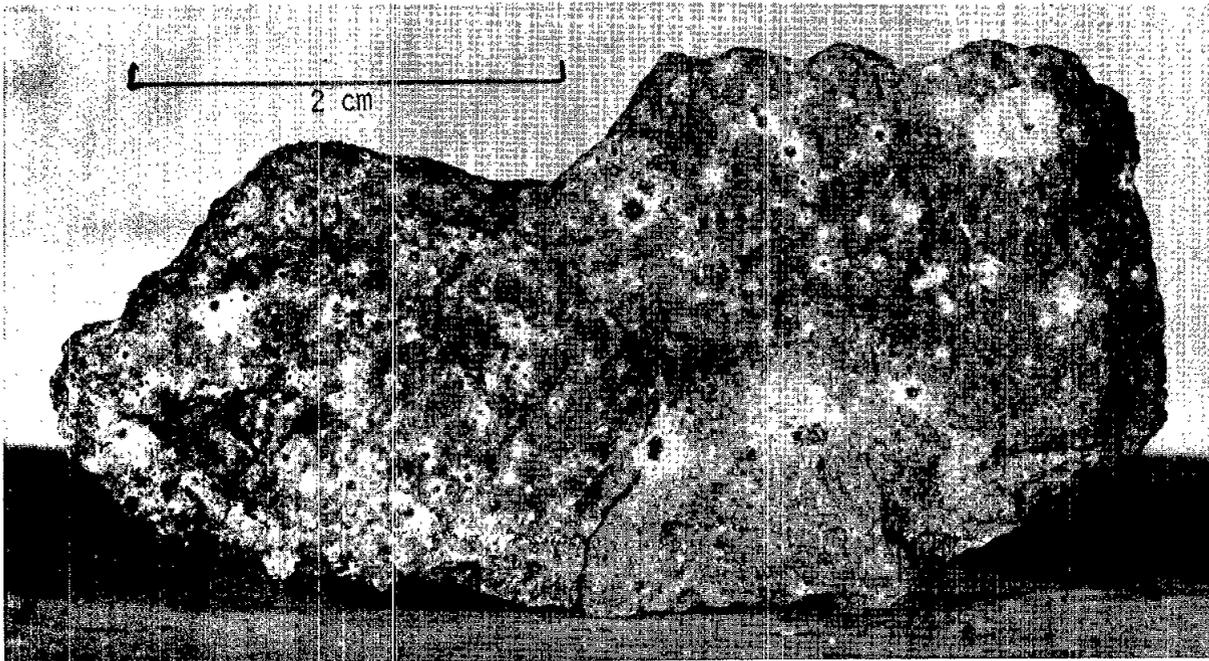
CAVITIES: 1%, normal to long axis; rock will break readily along  
this line.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix		95				1
Clasts						
Norite(?)		Two seen	Rnd		To 4	2

Maf sil	Yellow green	1 - 2	1	
Plag		1 - 2	1	
Opag		2		3

## NOTES:

1. Granular intergrowth of mafic silicate, plag, and disseminated opaques. Coarser-grained than greenish-gray breccia 72735.
2. Intergrowths of yellow-green mafic (opx?) and plag in 40:60 ratio. Appears to have interlocking textures.
3. Disseminated homogeneous.

Sample 72736 B<sub>1</sub> S-73-19438

72737

ROCK TYPE: Metaclastic (tan breccia)

WEIGHT: 3.33 g

BINOCULAR DESCRIPTION

BY: Morrison

DATE: 3/2/73

SPECIAL FEATURES: Rock is identical to 72736.

72738

ROCK TYPE: Blue-gray breccia

WEIGHT: 23.75 g

COLOR: Gray

DIMENSIONS: 4 x 2.5 x 2.5 cm

SHAPE: Angular

COHERENCE: Intergranular - Tough

Fracturing - Non-penetrative

BINOCULAR DESCRIPTION

BY: Morrison

DATE: 3/2/73

SURFACE: One surface shows evidence of shattering

ZAP PITS: Zapped on all sides

CAVITIES: None

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Lithic clasts						
I		One seen	Rnd		2	1
II		9	Rnd	1.5	<1 - 3	2
Mineral clasts						
Yellow- green mafic Plag		1	Ang- rnd	1		
Matrix	Dark gray	90				3

## NOTES:

1. I is 60% plag and 40% brown pyroxene. Some plag may have gone to maskelynite.
2. II is a sugary aggregate of plagioclase. Forms most of lithic clasts.
3. Cryptocrystalline, granular.

73145

ROCK TYPE: Breccia  
 COLOR: Medium dark gray (N4)  
 SHAPE: Slabby, angular  
 COHERENCE: Intergranular - Tough

WEIGHT: 5.60 g  
 DIMENSIONS: 2.5 x 2 x 1 cm

BINOCULAR DESCRIPTION

BY: Bence

DATE: 3/28/73

FABRIC: Microbreccia  
 VARIABILITY: Isotropic  
 SURFACE: Smooth to hackly  
 ZAP PITS: None  
 CAVITIES: None  
 SPECIAL FEATURES: (1) Irregular fractures; (2) Matrix is probably ferromagnesian-rich; and (3) Euhedral cinnamon brown pyroxene crystal on smooth fracture surface.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Light gray	20-25	Subequant ang	0.5	0.25 - 2	1
Matrix	Medium dark gray	75				2
Pyrox	Cinnamon	<1	Euhed prisms			3

## NOTES:

1. Clasts or relicts.
2. Possibly diabasic.
3. On fracture surface.



Sample

73145

S-73-21776

73146

73146

ROCK TYPE: Anorthosite  
 COLOR: Very light gray (N8)  
 SHAPE: Subangular, blocky  
 COHERENCE: Intergranular - Tough

WEIGHT: 3.01 g

BINOCULAR DESCRIPTION

BY: Bence

DATE: 3/28/73

FABRIC: Inequigranular, clastic  
 VARIABILITY: Isotropic  
 SURFACE: Granulated

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	White	50		0.1		
Plag clasts	White to lt gray	50	Equant to irreg		Up to 2	1
Maf sil	Pale green	2	Equant	0.25	0.1 - 1	2
Opa	Black	<1				

## NOTES:

1. Shocked to varying degrees.
2. Probably opx.

73155

ROCK TYPE: Metaclastic  
 COLOR: Medium dark gray (N4)  
 SHAPE: Blocky, subrounded  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few, penetrative

WEIGHT: 79.3 g  
 DIMENSIONS: 5.5 x 4.2 x 3.8 cm

BINOCULAR DESCRIPTION

BY: Stuart-Alexander

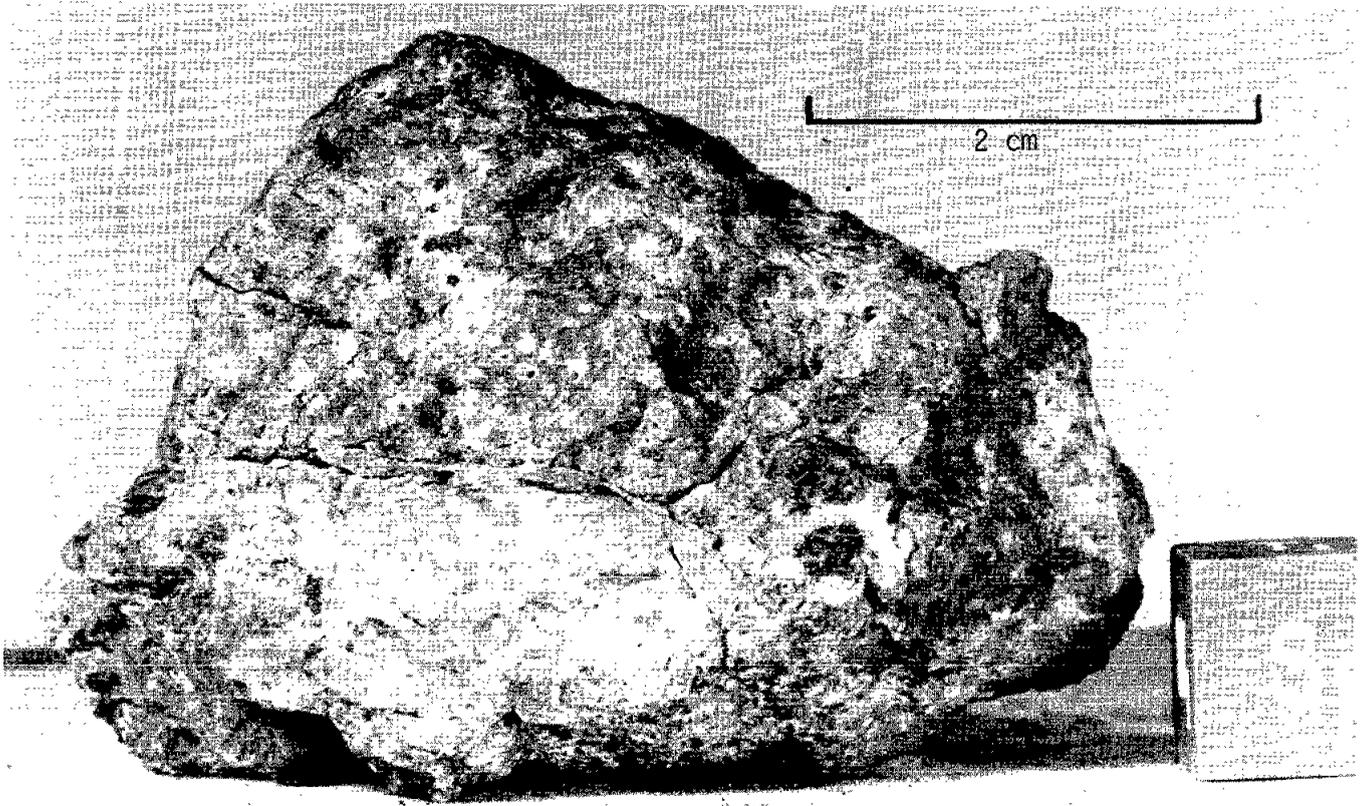
DATE: 2/12/73

FABRIC: Recrystallized fine breccia  
 VARIABILITY: Breccia  
 SURFACE: Smooth to irregular  
 ZAP PITS: Few on W, E, and S; many on N, B and T.  
 CAVITIES: <1%, mostly irregular slits, some vugs, maximum 2 mm,  
 unevenly distributed.  
 SPECIAL FEATURES: Clast percents difficult to estimate because of  
 zapping on all surfaces and indistinct borders of many clasts.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Medium dark gray	85		<0.1		1
Lithic clasts						
I	Yellowish gray	1	Rnd		12x7	2
II	White	5(?)	Subrnd- to rnd	2	<1 - 4	3
III	Medium to lt. gray	2 - 3	Rnd(?)	2	<1 - 4	4
IV	Light brownish	<1	Subang to subrnd	1		5
V	Gray and white	Tr	Elong	6		6
VI	Yellowish gray	1	Irreg	10		7
Mineral clasts						
Maf sil	Yellow			0.5	<0.1 - 1	
Plag	White to colorless	1 - 2		0.5	<0.1 - 3	8
Pyrox(?)	Various shades of brown	1			<0.1 - 0.5	
Maf sil	Greenish	Tr		0.5		
Opakes	Black	<1		0.1	<0.1 - 1	

## NOTES:

1. Very fine-grained, sugary salt and pepper texture with mineral debris of types listed below.
2. Equigranular 0.1 - 0.2 mm, yellow gray and white minerals 50:25:25 plus 1% opaques.
3. Fine-grained, sugary texture, white to colorless with minor yellow mineral.
4. Aphanitic, borders mostly gradational with matrix.
5. Sugary texture, very fine-grained, mainly mafic silicate.
6. Ring of fractured white in fractured gray; partially shocked plagioclase(?).
7. "Zone" of yellow-green and brown mafic silicates and grayish to colorless plagioclase. Individual grain outlines indistinct, but >0.2 mm. One vug with metal ball. Brown and yellow-green minerals in layers; mafic to plagioclase = 70:30, brown dominant over yellow green.
8. Largest grain has 0.2 - 0.3 mm "selvage" of aphanitic gray material around it.



Sample 73155

S-73-17059

73155 (Continued)

ROCK TYPE: Crystalline  
 COLOR: Light gray  
 SHAPE: Wedge shaped  
 COHERENCE: Intergranular - Moderately tough  
 Fracturing - Few penetrative

WEIGHT: 3.15 g  
 DIMENSIONS: 1.5 x 1 x 1 cm

BINOCULAR DESCRIPTION

BY: Simonds

DATE: 3/28/73

FABRIC: Crystalline, isotropic  
 VARIABILITY: Homogeneous as a whole  
 SURFACE: All hackly  
 ZAP PITS: Few on all surfaces, white, pale green, and dark glass linings.  
 CAVITIES: Few at one end with projecting crystals of plagioclase.  
 SPECIAL FEATURES: No indications of poikilitic texture.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Light gray	99			<0.2	1
Opaq	Black	Tr			<0.1	

## NOTES:

1. Mostly light colored granoblastic minerals (plagioclase and a mafic silicate?). The variability of color of zap pit glass suggests small variations in compositions. A few percent of surface has dark areas which may be dark clasts, but have a granoblastic texture similar to the rest of the matrix.

Sample 73156 S<sub>1</sub> S-73-17878





Sample 73215

S-73-16663

THIN SECTION DESCRIPTION

BY: Horz

DATE: 3/1/73

SECTION: 73215,7

SUMMARY: Complex (high grade) metamorphic breccia.

## MATRIX, 50% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Glass				No flow-structures in the matrix, homogeneous distribution of clasts; clasts are occasionally aligned at the dark contact-zone around large lithic clasts. For fine-grained monomineralic components it is difficult to establish whether they are devitrification products or original detritus; probably both, the first one being dominant.
Plag	50		Aphan	
Pyrox			devit	
Plag	10	Ang	<0.1	
Pyrox	40	Ang	<0.1	
Oliv	Tr	Ang	<0.1	

For fine-grained monomineralic components it is difficult to establish whether they are devitrification products or original detritus; probably both, the first one being dominant.

## MINERAL CLASTS, 20% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	55	Ang	0.1 - 3	Plag displays a wide variety of annealing and recrystallization structures; suggestive of different thermal regimes and histories. Olivine and pyroxene are relatively intact, but a few display patchy extinction and mosaicism.
Pyrox	25	Ang	0.1 - 1	
Oliv	15	Ang	0.1 - 0.1	
Spinel	Tr	Ang	0.1 - 0.5	
Ilm	Tr	Ang	0.1 - 0.5	

pyroxene are relatively intact, but a few display patchy extinction and mosaicism.

## LITHIC CLASTS, 30% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Breccia	70	Rnd	0.5 - 3	A variety of breccias are present which, however, have close affinities in their matrix and clast-content and which are also similar to general matrix of the entire rock. The main difference is, however, grain sizes of the matrix may vary. Clasts are in various stages of resorption by matrix. Some have dark, very aphanitic reaction rims. In one case, a breccia within a breccia-clast was observed, an indication of a three generation breccia. The anorthosites are a variety of highly annealed feldspathic aggregates, some of which could be monomineralic plagioclase clasts. In general, they are optically discontinuous, indicating an anorthositic parent rock. "Basaltic" clasts have variable amounts of plagioclase, olivine, and pyroxene, and also different grain sizes and textures (ophitic and poikilitic, for example). One nice troctolitic clast.
Anorth	25	Ang	0.5 - 2	
Basalt	2-5	Rnd-ang	0.5 - 2	
Troct	Tr	Rnd-ang	1	

are also similar to general matrix of the entire rock. The main difference is, however, grain sizes of the matrix may vary. Clasts are in various stages of resorption by matrix. Some have dark, very aphanitic reaction rims. In one case, a breccia within a breccia-clast was observed, an indication of a three generation breccia.

The anorthosites are a variety of highly annealed feldspathic aggregates, some of which could be monomineralic plagioclase clasts. In general, they are optically discontinuous, indicating an anorthositic parent rock.

"Basaltic" clasts have variable amounts of plagioclase, olivine, and pyroxene, and also different grain sizes and textures (ophitic and poikilitic, for example).

One nice troctolitic clast.

OPAQUES DESCRIPTION

BY: Brett

DATE: 3/14/73

SECTION: 73215,7

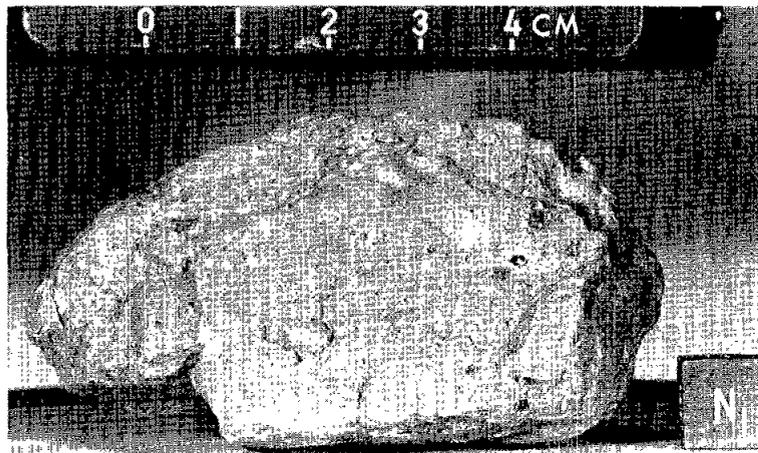
<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Fe-Ni	<1	Irreg,		The bulk of all opaque mineral grains lies in the micron to sub-micron size range. Rare ragged metal grains and rounded to angular ilmenite grains occur up to 40μ in diameter. One blood-red spinel in a crystalline troctolitic clast.
Tr	<0.3	Irreg,	0.001	
Ilm	<0.4	Irreg,	0.001	
Mg-Al spinel	Tr	Ang	0.015	



<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	5Y5/1	85			Up to 0.5	1
Clasts						
Norite	Gray		Ang	1.5	0.5 - 2	2
Anorth	White		Rnd		0.5 - 1	3
Lithic I	Brown	5	Subrnd		0.5 - 1	4
Lithic II	Gray		Subrnd			5
Plag	White	7	Ang	0.5	Up to 2	6
Maf sil	Pale green	2	Ang	0.5	Up to 1	7
Maf sil	Brown	1		0.5	Up to 2	8
Metal	Silvery					9

## NOTES:

1. Faintly brown pyroxene (40%), plagioclase (50%), opaques (5%), metal (tr).
2. Norite (60% pyrox, 40% plag); 0.25 mm grain size
3. Anorthositic (95% plag).
4. Brownish pyrox (50%), plag (50%), cavernous.
5. Pyrox (50%), plag (50%), sugary texture, microbreccia
6. Clear, gray, milky
7. Olivine(?).
8. Pyroxene.
9. Metallic (traces).



Sample 73216

S-73-16775

73217

ROCK TYPE: High grade metaclastic                      WEIGHT: 138.8 g  
 COLOR: Medium gray (N5)                                      DIMENSIONS: 6.5 x 4.5 x 3.0 cm  
 SHAPE: Subangular, blocky  
 COHERENCE: Intergranular - Tough  
                   Fracturing        - Few, only one is penetrative

BINOCULAR DESCRIPTION                      BY: Agrell and Horz                      DATE: 3/22/73

FABRIC: Microbreccia  
 VARIABILITY: Clast distribution variable; a different lithology on S  
 SURFACE: N relatively smooth; E rubbly towards S half; S rubbly and  
                   breccia structure well seen, but less coherent rubbly zone runs  
                   across face; W relatively smooth; B slightly rough outer surface;  
                   T fracture surface.  
 ZAP PITS: Many on B and on the adjacent part of N; few on S (towards  
                   B); none on T, E, W. White to colorless glass liners to zaps.  
 CAVITIES: <0.2%; a few circular vesicles on T; many 5 mm irregular  
                   cavities associated with gray clasts on the rubbly surface of S.  
 SPECIAL FEATURES: The different lithology on S forms 15 - 20% of the  
                   whole rock and is described as a separate section in the table  
                   following.

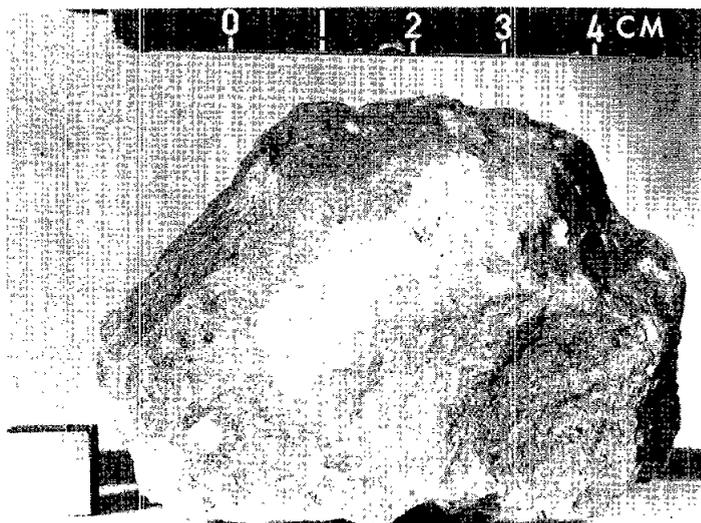
<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix						
Pyrox	Pale brown	40-25	Laths or interst plates	0.2	0.1 - 0.3	1
Plag	C'less	40-60	Lathy or interst	0.5	0.1 - 0.4	
Opaq	Black	<0.5				2
Mineral clasts						
Pyrox	Pale brown	2	Blocky	0.3	0.2 - 0.4	
Plag	Gray white	4	Blocky	0.5	0.4 - 1.0	
Metal	Silvery	<0.5				
Lithic clasts						
Cata- clastic	White	4	Sausage	3x1		3

S FACE					
Matrix	Creamy white	4		<0.05	4
Mineral clasts				<1	5
Plag		3			
Pyrox(?)	Pale yellow brown	0.3			
Oliv(?)	Yellow green	0.3			

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Lithic clasts		10				6
I	Med gray		Rnd, ang		1 - 5	7
II	White				1 - 5	8

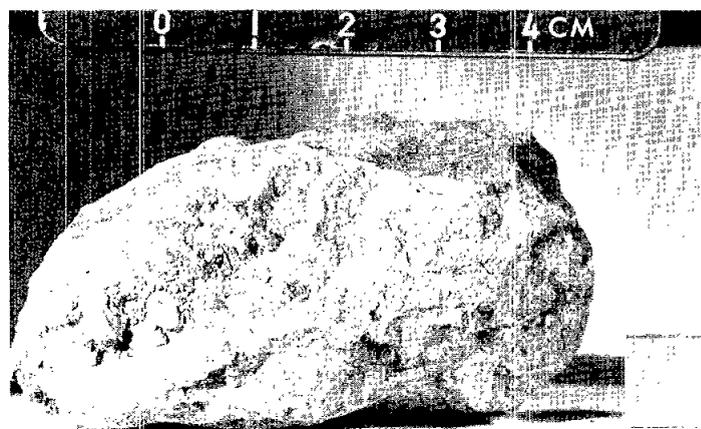
## NOTES:

1. Possibly hypersthene - the grain size and proportions of the matrix pyroxene and plag vary over the surfaces of the rock.
2. Probably ilmenite.
3. Cataclastic anorthosite composed of about 0.1 mm fragments of feldspar set in a 0.01 mm matrix with <1% brown pyroxene, <1% opaques, and a sugary texture. Several smaller clasts, in 1 - 5 mm range, have similar mineralogy although possibly richer in pyroxene and are sometimes surrounded by a dark fine-grained halo.
4. Highly porous with irregular cavities, forms about 20% of the S face lithology, and comprises about 80% clasts and 20% matrix.
5. 20% of S face lithology.
6. 60% of S face lithology.
7. Type I is fine-grained microbreccia containing 20% single crystal plagioclase clasts.
8. Type II with three subtypes: porcellanous plagioclase aggregates; grayish sugary (80% plag, 20% pyrox); yellowish white with gray pyrox, white plagioclase, and olivine (? , pale yellow green).



Sample 73217

S-73-16786



Sample 73217

S-73-16785

73218

ROCK TYPE: Anorthositic impact melt  
 COLOR: Greenish gray (5GY 6/1)  
 SHAPE: Angular  
 COHERENCE: Intergranular - Tough  
             Fracturing - One penetrative

WEIGHT: 39.67 g  
 DIMENSIONS: 4 x 3 x 2.5 cm

BINOCULAR DESCRIPTION

BY: Agrell

DATE: 3/2/73

FABRIC: Holocrystalline, vuggy

VARIABILITY: Homogeneous

SURFACE: B and the parts of E, S, and W toward B are fresh fractures;  
T and the adjacent parts of the other surface are rounded.ZAP PITS: None on B and the adjacent parts of other faces; many on T  
and the adjacent parts of other faces. Zap glass is pale gray;  
the pits have chalky halos.CAVITIES: Drusy cavities 0.1 - 1 mm form 1% of rock. They occur both  
as isolated individuals and as concentrations of cavities in a  
narrow zone. Cavities have sugary linings of plag, and no visible  
metal or troilite.SPECIAL FEATURES: Drusy cavities suggest remelted rock. Probably  
highly feldspathic breccia now with residual clasts of plag or  
hypersthene.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOY.</u>	<u>RANGE</u>	
Matrix						
Plag	C'less	70	Equant	0.04	0.03 - 3	1
Maf sil	Gray	9	Equant	0.03	0.03 - 0.1	2
Oliv	Yellow green	5	Rnd	0.05	0.03 - 2	
Maf sil	Pale brown	1	Subrnd	0.05	0.1	3
Opagues		1	Rnd			
Clasts						
Lithic	Pale gray	3	Ang		1 - 4	4
Plag	C'less	9	Ang		1 - 1.5	5
Oliv	Pale green	2	Subrnd		0.5	
Maf sil	Brown	<1	Subrnd		0.3	6

## NOTES:

1. Granular, sugary.
2. Opx(?) interstitial to plag(?)
3. Clinopyroxene(?), possibly a clast.
4. Anorthositic and sugary, with some olivine plus pyroxene reaching 20% of the clasts.
5. Single crystals, sugary with good cleavage.
6. Hypersthene



<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Oliv(?)	Perido- tite green	5	Pris- matic	0.5	0.3 - 1.0	
Plag	White	35	laths	<0.3	0.5	
Maf sil	Pale brown	55	equant			1
Opaque	Black	5				2

## NOTES:

1. Pyroxene grains <0.3 mm diameter in clots up to 1 mm, intergrown with plagioclase, in other areas subordinate pyroxene interstitial to plagioclase.
2. Associated with pyroxene phase are dark laths, probably ilmenite.

Sample 73219 N<sub>1</sub> S-73-16963

73225

ROCK TYPE: Crystalline (meta-polymict  
breccia)

WEIGHT: 3.66 g

COLOR: Light gray (N5)

DIMENSIONS: 1.7 x 1.3 x 1.5 cm

SHAPE: Equant

COHERENCE: Intergranular - Tough  
Fracturing - NoneBINOCULAR DESCRIPTION

BY: Simonds

DATE: 3/28/73

FABRIC: Clastic, seriate

VARIABILITY: Homogeneous

SURFACE: All fractured; few zaps

ZAP PITS: Dark glass lined pits on some or all surfaces

CAVITIES: Abundant vugs with projecting crystals of plagioclase.

Cavities are up to 1 mm across and very irregular in shape.



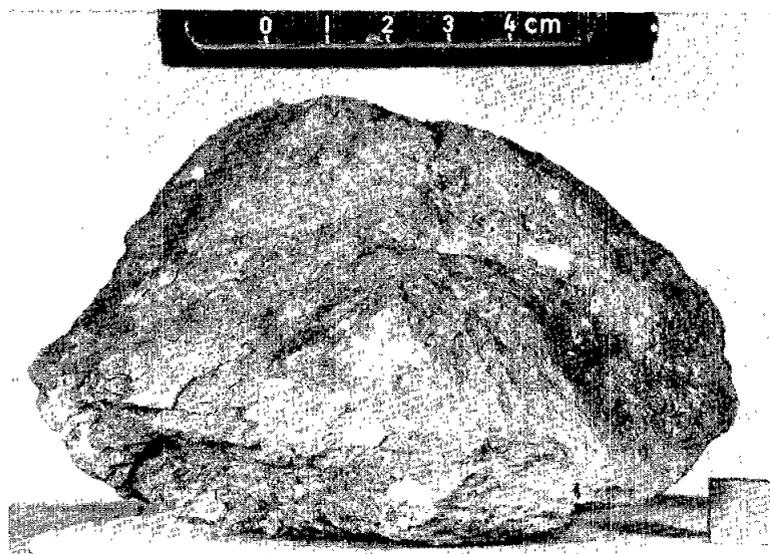
irregular in outline, no visible linings but angular protuberances of wall rock.

SPECIAL FEATURES: Local thin coatings of yellowish brown glass in highly irregular patches up to 3 mm. On the T face there are microveinlets, branching, 8 mm long and 0.1 mm wide, with tan filling.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	N6	75				1
Lithic I	White	} 10	Lenti- cular	8x4		2
Lithic II	White		Amoeboid	5-20		3
Lithic III	Very pale gray		Rnd	5		4
Plag clast	Pale gray to white		Ang	0.3 - 2		5
Spinel clast	Cherry red	} 15	Rnd	0.5		
Maf sil clast	Yellow- green		Ang	1.5		

NOTES:

1. Dense, very fine-grained aphanitic.
2. Boundaries sharp to gradational; very fine-grained, dense white.
3. Single clast of crushed-appearing, plag-rich, with angular fragments of gray plag in finer-grained crushed white matrix. One bright red, angular spinel grain. Boundaries gradational and interfingering with groundmass.
4. Sugary, plag-rich, very fine-grained. Fairly sharp boundaries.
5. Single cleaved grains, with sparse opaques (0.05 mm). These are by far the most common mineral clasts.



Sample 73235

S-73-16957

THIN SECTION DESCRIPTION

BY: Marvin

DATE: 3/2/73

SECTION: 73235,7

SUMMARY: One or two rounded clasts show relict structure, but are shocked to a semi-glassy state. Rock is a recrystallized (annealed) breccia of materials from multiple sources; many clasts have a long history of being reworked.

## MATRIX, 73% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Dark glassy	75	Vermi- cular	<0.01	Very fine-grained, vermicular material: 75% of matrix in section is dark brown including light gray areas; 25% is the reverse.
Light glassy?	25	Vermi- cular	<0.01	

## MINERAL CLASTS, 16% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	60	Ang	0.02 - 0.5	Mineral clasts nearly all have ragged margins on a fine scale showing reaction with the matrix. The most interesting mineral clasts are purplish spinel, some of which are angular, but at least one of which is rounded and rimmed with dark opaque material, which is rimmed in turn by a light halo of devitrified glass(?).
Pyx	14	Ang- rnd	0.3	
Oliv	15	Ang - rnd	0.3	
Spinel	<1	Ang - rnd	0.1	
Opag	<1	Rnd	0.05	
Metal	<1	Rnd -	0.05	
ilmen		irreg		

## LITHIC CLASTS, 9% OF ROCK

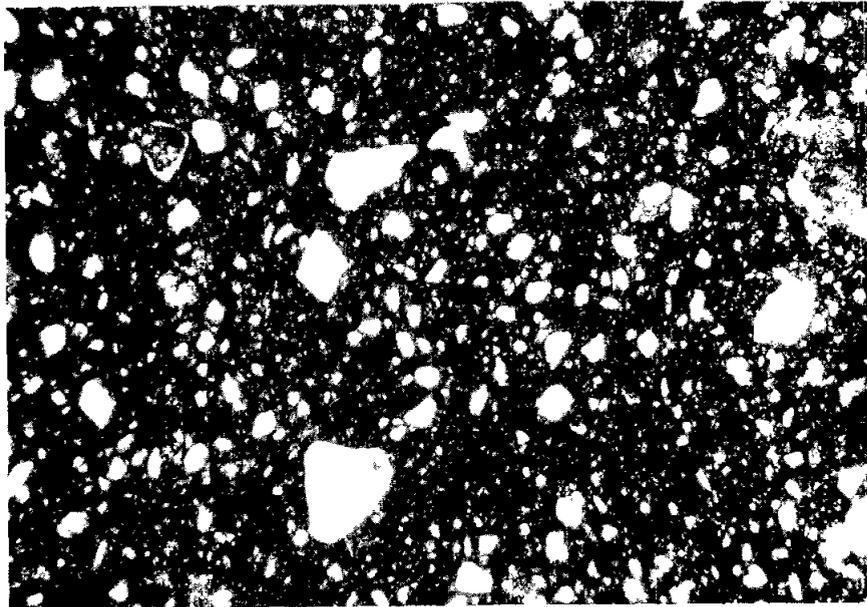
<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Anorth	85	Ang	2	Most are recrystallized anorthositic or troctolitic materials; a few are fresh
Basalt	15	Ang	2	

basalts: most have sharp boundaries with matrix; some are crushed and gradational with matrix.

Relict clasts that are almost wholly recrystallized occur as lighter rounded or streaky areas of matrix, which are generally irregular in shape and up to 2 mm in size.

## GLASS CLASTS, 2% OF ROCK

<u>COLOR</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Light brown	15	Rnd	0.75 - 1.2	Glassy clasts are mainly devitrified; one common type is a leafy intergrowth of feldspathic devitrified product. Others have a feathery texture and are light brown to gray.
C'less	85	Subhed		



Section 73235,7 S-73-20029  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 3/15/73

SECTION: 73235,7

COMMENTS: Opaque mineral content less than 2 percent, consisting entirely of grains 5 $\mu$  to submicron in size of metal troilite and ilmenite. A few angular ilmenite clasts to 50 $\mu$ , a couple of possible chrome spinel grains. A large Mg-Al spinel grain, several hundred microns across has plag-rich alteration zone around it, 10 $\mu$  ilmenite grains also surround it. Spinel contains lamellae 5 - 10 $\mu$  long of what appear to be white and metal.

73245

ROCK TYPE: Granulitic anorthosite  
 COLOR: Medium gray (N6)  
 SHAPE: Cuboidal  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 1.60 g  
 DIMENSIONS: 1 x 0.8 x 1.0 cm

BINOCULAR DESCRIPTION

BY: Agrell and Agrell

DATE: 3/28/73

FABRIC: Even-grained

VARIABILITY: Homogeneous

SURFACE: All surfaces dust covered, or more probably adherent material  
 is feldspathic microbreccia base, light brownish gray (5YR 6/1),  
 in which 73245 is a clast.

ZAP PITS: None

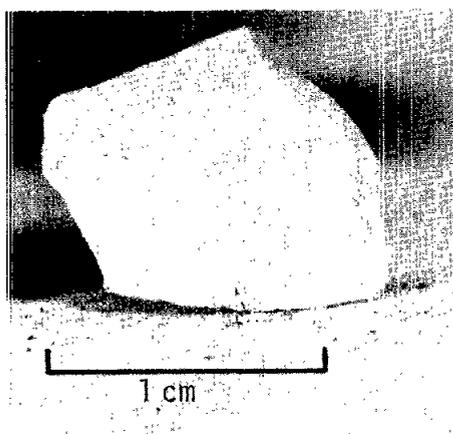
CAVITIES: None

SPECIAL FEATURES: Highly recrystallized anorthositic clast from weakly  
 lithified microbreccia.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix micro- breccia	Pale gray	2		0.05		1
Lithic clast	Gray	98				2

## NOTES:

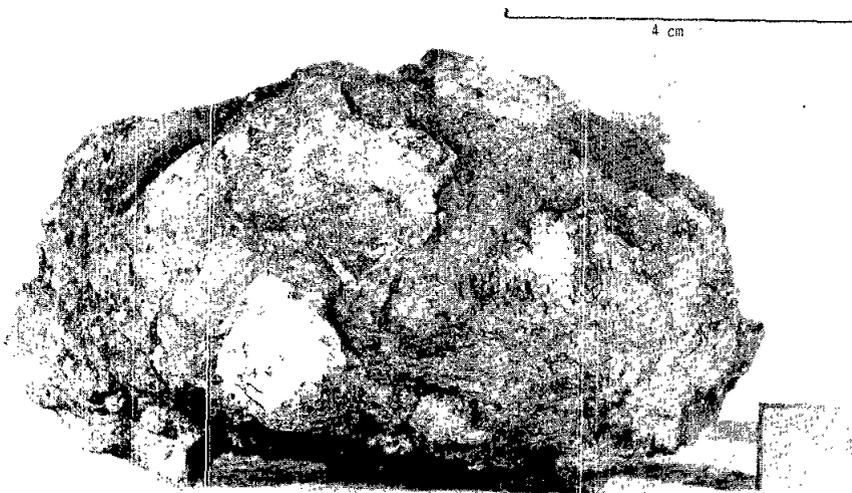
1. 70% plagioclase and 30% mafics.
2. Has a sugary texture, average grain size of 0.05 mm, and is composed of about 90% plagioclase, and 10% mafics.

Sample 73245 S<sub>1</sub> S-73-21774



## NOTES:

1. Very fine-grained, possibly originally glassy.
2. Anorthositic, may have 10-15% pale gray brown mafic silicate. Texture and grain are size variable. May have 0.2 mm halo which is fine-grained and darker than matrix.
3. Occasional white vitreous crystals(?) of fresh plagioclase. Contact is sharp with matrix, but irregular on submillimeter scale.
4. Plagioclase 50%, gray brown pyroxene 50%.
5. Partial fusion of components suspected.
6. Probably pyroxene.



Sample 73255

S-73-16951

THIN SECTION DESCRIPTION

BY: Agrell

DATE: 2/24/73

SECTION: 73255,7

SUMMARY: Dark matrix microbreccia whose matrix is probably devitrified glass. Lithic clasts are granulitic noritic metaclastics, but the mineral clasts are coarser in grain size and from different source.

## MATRIX, 75% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Pyrox	40	Ang - subrnd	<0.005	Very fine-grained, probably devitrified glass. May contain 5 - 10 $\mu$ mineral clasts. 1% vesicles in one fragment sectioned.
Plag	60	Interst	<0.005	
Opa	1	Drops	<0.005	

## MINERAL CLASTS, 15% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	60	Ang - subrnd	0.01 - 0.2	Plagioclase may show crushing, maskelynitization, small
Oliv	20	Ang - subrnd	0.01 - 0.2	bubble-like inclusions. Occasional drop-like in-
Opx	15	Subrnd	0.01 - 0.2	clusions of olivine.
Metal	<1	Rnd	0.04	One olivine has metal in-
Troil	<1	Rnd	0.02	clusions.
Oxides	<1		0.02	Hypersthene shows schiller, some exsolved plates which may be spinel (olive green), others ilmenite (sienna brown).

## LITHIC CLASTS, 10% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Noritic meta-clastics	95	Ang - rnd	1	Noritic metaclastics form a continuous series of finer-grained 10 $\mu$ rocks to coarser-grained 80 $\mu$ rocks, with gran-
Basalt	5	Rnd	0.1	ulitic and porphyroclastic texture, and range from
Gabbro	0.5		0.4	plagioclase 90-60%, pyroxene and olivine 10-40%, with less than 2% opaque oxides.
				Basalt contains 60% pale yellowish pyroxene, 35% lathy plagioclase, and 5% opaques.

ADDITIONAL COMMENTS: 15 $\mu$  carmine red fragment in one part of section may be a foreign particle(?).

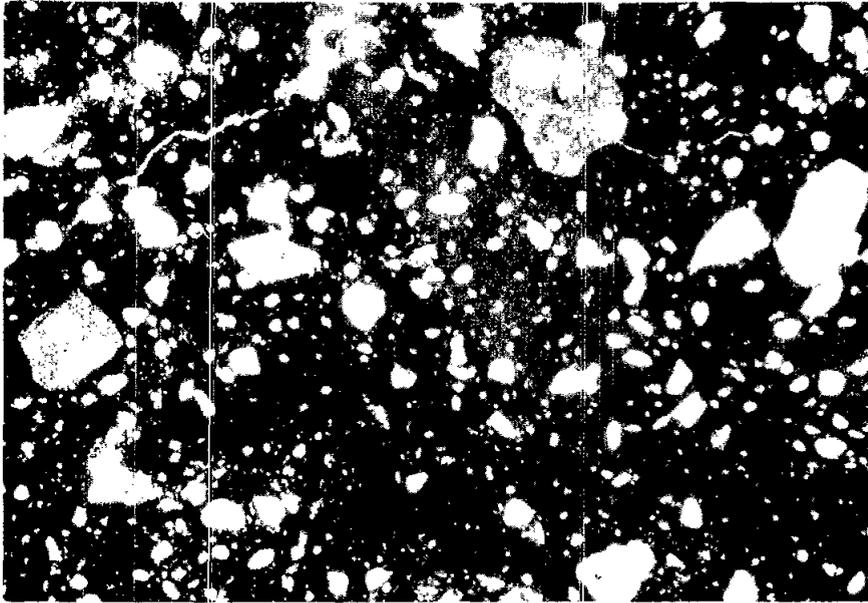
OPAQUES DESCRIPTION

BY: Brett

DATE: 3/15/73

SECTION: 73255,7

COMMENTS: The rock contains less than 1% total opaque minerals - angular clasts of ilmenite up to 20 $\mu$ , Fe-Ni and troilite in ragged grains and blebs from 20 $\mu$  down to less than a micron in size.



Section 73255,7 S-73-20038  
Width of field 3.16 mm, plane light

73275

ROCK TYPE: Metaclastic	WEIGHT: 429.6 g
COLOR: Light gray	DIMENSIONS: 10 x 7 x 7 cm
SHAPE: Blocky, subangular	
COHERENCE: Intergranular - Tough	
Fracturing - None penetrative	

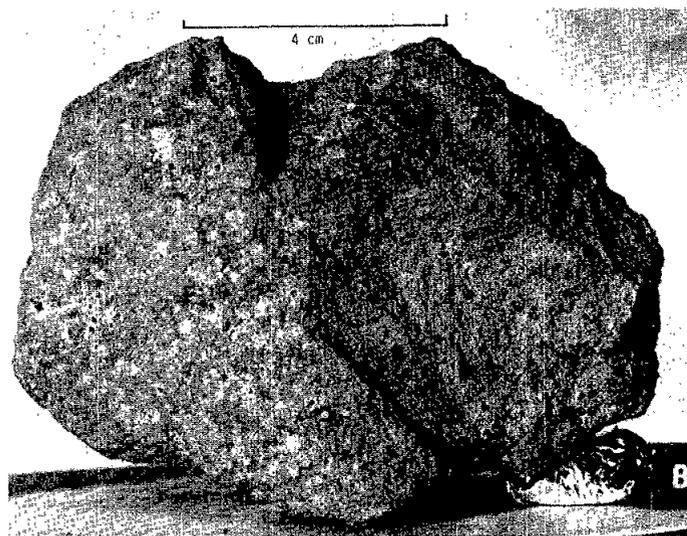
BINOCULAR DESCRIPTION BY: Morrison and Wilshire DATE: 2/8/73

FABRIC: Annealed breccia  
 VARIABILITY: Homogeneous  
 SURFACE: Uneven  
 ZAP PITS: Many on N, E, S, W, T and half of B; none on other half of B.  
 CAVITIES: 2-3% vugs 6 mm to <1 mm; irregular hemispheres to slits.  
           Drusy linings, scarce iron spheres. One cavity is lined with clear  
           glass, which could be a big zap.  
 SPECIAL FEATURES: Rock has been tumbled, fresh surface is a fracture  
                     surface.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
Plag	Med gray sub- vitreous		Blocky ang		1 - 2	1
Maf sil	Yellow green		Ang		1 - 2	2
I	Black vitreous			1		3
Lithic	Yellow gray			1		4
Matrix	Tan	95		<0.1		5

## NOTES:

1. Some aggregates of plagioclase-green mineral.
2. Olivine or orthopyroxene.
3. Glass(?) or opaque(?).
4. 50:50 yellow green mineral and plagioclase.
5. Composed of 50% black opaques, 80% plagioclase, 5% brown pyroxene, and 1-2% mineral fragments, which are larger than average matrix grain size, and a very pale yellow green mineral which may be sufficiently abundant to reduce the plagioclase abundance to  $\leq 50\%$ .



Sample 73275

S-73-16929

ROCK TYPE: Glass coated friable breccia                      WEIGHT: 2.58 g  
 COLOR: Medium light gray (N6)                                  DIMENSIONS: 2.5 x 1 x 1 cm  
 SHAPE: Irregular  
 COHERENCE: Intergranular - Just coherent  
                   Fracturing - Many, glass coated and glass free

BINOCULAR DESCRIPTION                      BY: Agrell and Agrell                      DATE: 3/28/73

FABRIC: Glass coated fragmented, microbreccia  
 VARIABILITY: W end highly fragmented and net-veined with glass. E end solid, N face extensive glass coating.  
 SURFACE: N largely glass coated; W end of sample highly fragmented and penetrated by thin glass veins. Glass is black at distance, but translucent yellow gray when thin (can see breccia through it).  
 ZAP PITS: Few on E end of S.  
 CAVITIES: 20% in the fragmented end of sample where they are voids between shatter fragments.  
 SPECIAL FEATURES: Beautiful glass coating and penetration of fragmented part of rock. Locally, little glass drops occur as "outliers" to the main area of surface.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Glass	Dark	15				1
Microbreccia						2
Plag	White	55			<0.1	
Opx	Gray	20			<0.1	
Oliv	Yellow green	5			<0.1	
Anorth clasts	Chalky	5			2 - 3	3

NOTES:

1. Coating and veins smooth vesicular surface.
2. Fine-grained aggregate intensely shattered locally with 20% isolated mineral clasts in the same proportion as in the table.
3. Crushed anorthositic rocks, sugary texture, and composed of more than 70% plagioclase and less than 30% pale mafic silicates.



Sample 73285 S<sub>1</sub> S-73-19446.

74115-74119

ROCK TYPE: Light gray breccia  
 COHERENCE: Extremely friable

WEIGHT: 74115 - 15.36 g  
 74116 - 12.68 g  
 74117 - 3.69 g  
 74118 - 3.59 g  
 74119 - 1.79 g

NOTES: No binocular study was made of these samples because of their fragility. During the sorting of them from the soil, Heiken identified the rock type and observed the fragments to have 10% white clasts and a trace of dark gray clasts in a light gray matrix.

74235

ROCK TYPE: Aphanite  
 COLOR: Grayish black (N2) with metallic  
 SHAPE: Angular, blocky luster  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few, penetrative

WEIGHT: 59.04 g  
 DIMENSIONS: 4.3 x 3.4 x 3.3 cm

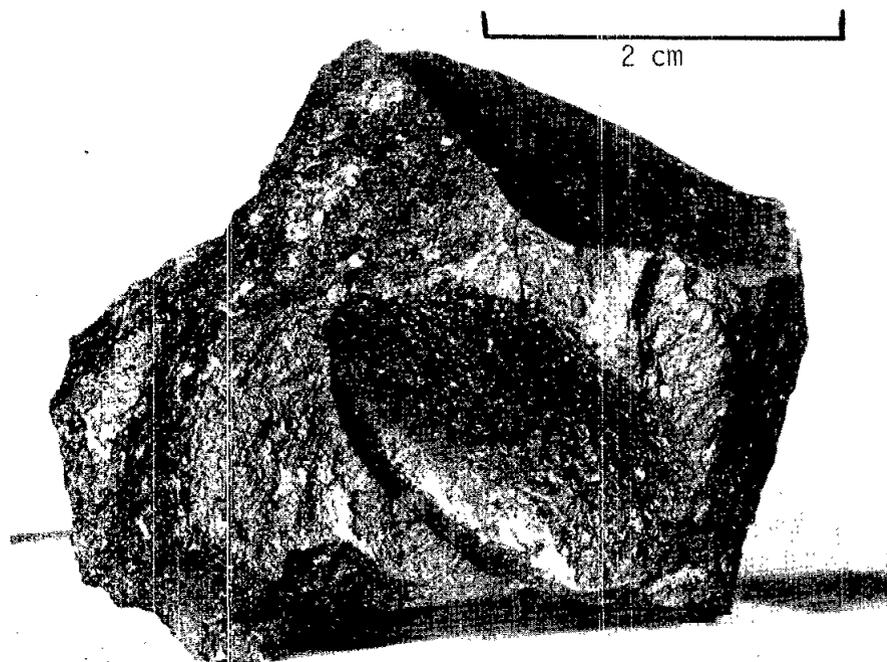
BINOCULAR DESCRIPTION BY: Stuart-Alexander and Horz DATE: 1/29/73

FABRIC: Aphanitic  
 VARIABILITY: Homogeneous  
 SURFACE: Smooth to gently lumpy inside vesicles; hackly on rest of rock.  
 ZAP PITS: None  
 CAVITIES: Vesicles and minor small vugs. Vesicles 0.5 mm to 3 cm, dominantly 1 cm range.  
 SPECIAL FEATURES: Large size of the vesicles (see photo), and lining of them with felted mats of thin ilmenite needles up to 2 mm long.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Ilmenite	Black		Needles	2x0.2		1
Maf sil	Very pale green	<1	Tabular	0.3		2
Groundmass	N2					3

## NOTES:

1. Thin needles line vesicles and also some in groundmass near vesicles.
2. Olivine or pyroxene.
3. Aphanitic. Probably crystalline because no vitreous luster and no conchoidal fractures. Appears slightly grainy under highest power.

Sample 74235 T<sub>1</sub> S-73-16013THIN SECTION DESCRIPTION

BY: Horz

DATE: 3/2/73

SECTION: 74235,11 and ,12

SUMMARY: Basaltic vitrophyr. The rock is very similar to 12009, but is more crystalline.

## GROUNDMASS, 70% OF ROCK

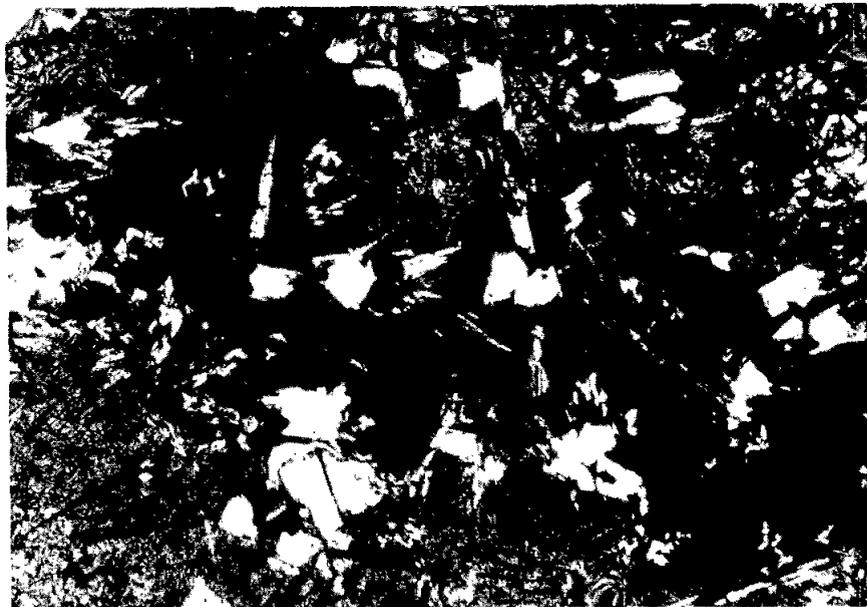
<u>PHASE</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Glass	20		<0.02 - 0.05	Very fine-grained and almost completely crystalline groundmass shows either devitrification or crystallization structures.
Oliv				
Pyrox	80		<0.02 - 0.05	
Plag(?)				

Dominant structures are dendritic and spherulitic (complexly intergrown) aggregates of olivine and pyroxene, possibly even feldspar crystallites. These structures are exceptionally well-developed. Some dendrites and spherulites are optically continuous; however, the majority of spherulites is not and displays wavy extinction. The sections studied were made one after the other from a single mount of two small chips, which were 2 cm apart on the rock. Among the four areas thus available for study in section, there are

subtle differences in grain size, degree of crystallization and amount of spherulites. A precise mode is difficult to establish because of grain size, but all of the larger grains are olivine.

## PHENOCRYSTS, 30% OF ROCK

<u>PHASE</u>	<u>%</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Oliv	30	Laths, equigran	0.1 - 1	Olivine shows (a) normal continuous idiomorphic crystals, and (b) dendritic skeletal crystals, optically continuous. Ilmenite forms idiomorphic, lath-shaped crystals, extremely long laths, occasionally with width to length ratios exceeding 20.
Ilm	70	Laths	Up to 2	
Oliv opaq	Few	Equigran	0.1 - 0.5	



Section 74235,11 S-73-19963  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 2/14/73

SECTION: 74235,12

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Arm	5	Euhed to subhed	To 0.7	Opaques in this rapidly cooled rock are unique in texture. Early prisms and lozenges of armalcolite are partly replaced by ilmenite which also occur as laths and skeletal crystals. Fe-Ni and troilite in tiny blebs. Spinel appears to be of mixed Ti, Cr, Mg, Al, Fe type.
Ilm	10	Euhed to skeletal	To 0.7	
Fe-Ni	<0.1	Blebs	<0.01	
Troil	<0.1	Blebs	<0.01	
Spin	<0.1	Euhed	To 0.5	

ROCK TYPE: Basalt  
 COLOR: Dark gray (N3); grayish black (N2) with a semi-metallic luster on surfaces of former cavities  
 SHAPE: Angular, wedge-shaped  
 COHERENCE: Intergranular - Very tough  
 Fracturing - Minor fractures could yield thin chips near large cavities  
 WEIGHT: 64.34 g  
 DIMENSIONS: 5.5 x 3.5 x 2 cm

BINOCULAR DESCRIPTION

BY: Marvin

DATE: 2/15/73

FABRIC: Very fine-grained to aphanitic  
 VARIABILITY: Homogeneous  
 SURFACE: Both of the broadest surfaces are fresh fractures. The thicker edge of the wedge and the blunt end are remnants of former interior cavity walls. They are irregular and somewhat intricately patterned but smoothed over with a black surface layer having semi-metallic luster and numerous felty ilmenite needles.  
 ZAP PITS: None observed  
 CAVITIES: About 20% of fractured surfaces; 0.3 mm to 1 cm; rounded to somewhat irregular; lined with felty intergrowths of lustrous ilmenite needles.  
 SPECIAL FEATURES: The rock is too fine-grained to estimate a mode. It is a dense, ilmenite-rich basalt with a grain size of <0.1 mm. The groundmass includes fine needles visible only in reflected light. Yellow grains of a mafic silicate (olivine?), averaging 0.7, and totaling <5%, are sparsely disseminated through the groundmass.

74246

ROCK TYPE: Soil breccia  
 COLOR: Medium dark gray with a touch of brown (N4)  
 SHAPE: Rounded  
 COHERENCE: Intergranular - Very friable  
 Fracturing - Fell into three clods plus fine soil when moved for photograph; shedding further  
 WEIGHT: 28.81 g  
 DIMENSIONS: Largest of 3 pieces: 3.5 x 3 x 3 cm

BINOCULAR DESCRIPTION

BY: Marvin

DATE: 2/15/73

FABRIC: Breccia  
 VARIABILITY: Homogeneous breccia  
 SURFACE: Smooth and dusty  
 ZAP PITS: None observed; would not be preserved in any case  
 CAVITIES: None  
 SPECIAL FEATURES: This "rock" is so friable it is hardly legitimate as a specimen. When next packaged, it may dissociate to dust and clasts. The constituents are: 80% matrix (fine gray soil); 20% clasts, mainly fine-grained glomeroporphyritic basalt which is light colored, feldspar-rich with cinnamon pyroxene and ilmenite.

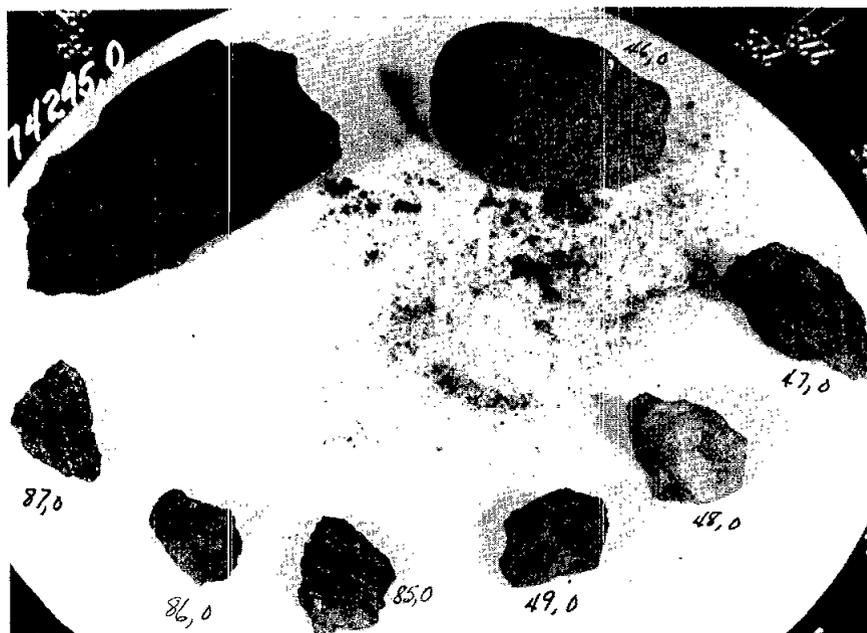


SURFACE: Covered by adhering soil (despite dusting), except one end  
 ZAP PITS: None  
 CAVITIES: 5%, small (1 mm) groups of vugs filled with crystals.  
 SPECIAL FEATURES: One side of this fragment is defined by a large (2 cm diameter) vesicle wall.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Ilm	Black	~20	Needles	1	0.1 - 1	1

## NOTE:

1. In vugs



Sample 74245-49, 74285-87 S-73-17967  
 74249

ROCK TYPE: Basalt  
 COLOR: Very dark gray (N2 to N3)  
 SHAPE: Subangular  
 COHERENCE: Intergranular - Coherent to tough  
 Fracturing - One penetrative at one end  
 WEIGHT: 4.183 g  
 DIMENSIONS: 1.5 x 1.2 x 0.7 cm

BINOCULAR DESCRIPTION

BY: Marvin

DATE: 2/15/73

FABRIC: Very fine-grained  
 VARIABILITY: Homogeneous  
 SURFACE: Coated with dust  
 ZAP PITS: None observed  
 CAVITIES: A few, small, <5%

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Ilm	Black				0.1 - 0.2	1
Pyrox	Cinnamon				0.1 - 0.2	1
Plag	White				0.1 - 0.2	1
Oliv	Yellow	<5		0.5		

## NOTE:

1. Too fine-grained to estimate percentages (grain size 0.1 - 0.2 mm); rock very dark and ilmenite-rich.

74255

ROCK TYPE: Basalt  
 COLOR: Medium dark gray (N5 to N4)  
 SHAPE: Angular, irregular  
 COHERENCE: Intergranular - Coherent  
 Fracturing - One major penetrative parallel to N,  
 with many smaller fractures parallel  
 to it.

WEIGHT: 737.3 g  
 DIMENSIONS: 13 x 7 x 6 cm

BINOCULAR DESCRIPTION

BY: Agrell/Lofgren

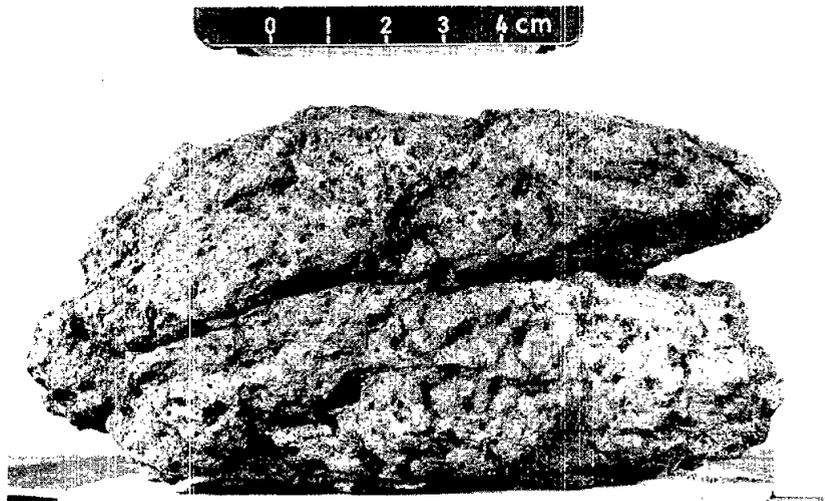
DATE: 2/9/73

FABRIC: Equigranular  
 VARIABILITY: Homogeneous  
 SURFACE: T, N, S, E, and W are hackly; B is rounded.  
 ZAP PITS: None on T, N, S, E, and W; many on B.  
 CAVITIES: 10% vugs; average size 2 - 3 mm; lined with crystals of  
 pyroxene, plagioclase, ilmenite, and very rare olivine (one  
 observed).  
 SPECIAL FEATURES: Large number of vugs. Possibly more plagioclase  
 than average.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Olivine	Yellow green	2	Equant	0.8	0.3 - 1.2	1
Pyroxene	Brown	40	Equant	1.0	0.2 - 2.0	2
Plagioclase	White	40	Lathy	1.0	0.2 - 1.7	3
Ilmenite	Black	18	Tabular	0.8	0.2 - 2.0	4

## NOTES:

1. Usually single crystals but occasional clots of 3 or 4 crystals.
2. More yellow brown where as small crystals in plagioclase.
3. Habit variable, some blocky crystals among lathy ones.
4. Two generations: blocky where large, but small laths in plagioclase.



Sample 74255

S-73-16905

THIN SECTION DESCRIPTION

BY: Agrell

DATE: 2/28/73

SECTION: 74255,7

SUMMARY: Coarse grained olivine basalt or diabase.

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
Oliv	5	Rnd	0.1 - 0.8
Plag	33	Platy	1 - 2
Pyrox	46	Blocky to skel	0.1 - 2
Armal	5	Prism	0.1 - 0.3
Ilm	10	Tab	0.1 - 0.6
Spinel	<0.5	Equant	0.1
FeNi Met	<0.5	Drop-like	<0.05
Troil	<0.5	Interstit	<0.06
Matrix	<1	Interstit	<0.1

COMMENTS:

Olivine occurs as rounded (resorbed) crystals, where it is in pyroxene.

Some is not included in pyroxene. No inclusions in the olivine except possibly one brown spinel.

Plagioclase forms lathy crystals, some in coarse sheaves intergrown with pyroxene or with hypidiomorphic pyroxene between crystals.

Pyroxene - a few larger allotriomorphic crystals with coarsely skeletal outgrowths. These may show a jagged mosaic of blocks with slightly varying extinction, and simulate sector structure in some orientations. The pyroxene is faintly pink with strong dispersion, birefringence increasing at margins and +2V in core of about 20°. It is probably calcic

pigeonite zoned to ferroaugite. The bulk of the pyroxene is in hypidiomorphic crystals, often in groups of three or four having a nearly common orientation. These are intergrown with or interstitial to the plates of plagioclase.

Armalcclite is confined to the central portions of larger pyroxene crystals.

Ilmenite is largely in skeletal embayed plates. It shows spinel and rutile exsolution in thin lamellae or discs. Rounded drop-like areas,  $\sim 30\mu$ , occur in the larger ilmenites; these may be accidental due to cutting embayments or true inclusions of weakly reflecting silicate or possibly glass as isolated metal droplets are present in some.

Residual mesostasis in small amounts occurs locally; it is composed of acid glass with dark droplets ( $\sim 1\mu$ ). Small patches of orthoclase and tridymite may also occur in the interstices between the major minerals.

**TEXTURE:** Texturally inhomogeneous. A few large allotriomorphic pyroxene plates occur with coarse skeletal outgrowth with plagioclase tablets. The major portion is composed of tabular plagioclase, in which pyroxene crystals may be included or occur interstitially. These pyroxenes are hypidiomorphic and may occur in groups of 4 or 5 crystals in sub-parallel orientation.

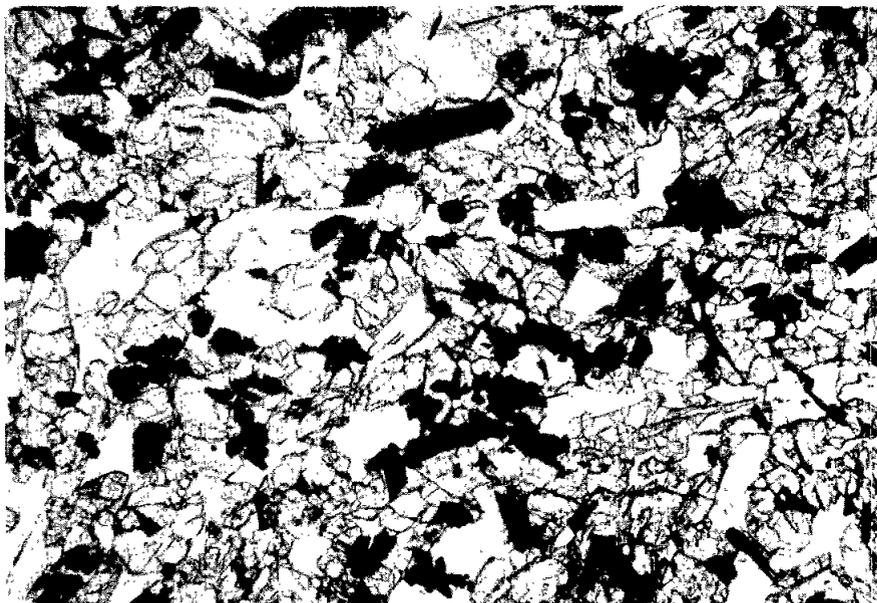
OPAQUES DESCRIPTION

BY: Brett

DATE: 3/15/73

SECTION: 74255,7

COMMENTS: Opaque minerals in size, abundance, and shape and mineralogy are virtually identical to 70035.



Section 74255,7

S-73-20052

Width of field 3.16 mm, plane light

ROCK TYPE: Basalt  
 COLOR: Medium dark gray (N4)  
 SHAPE: Slabby subangular  
 COHERENCE: Intergranular - Tough  
 Fracturing - Several penetrative

WEIGHT: 1493 g  
 DIMENSIONS: 17 x 12 x 4 cm

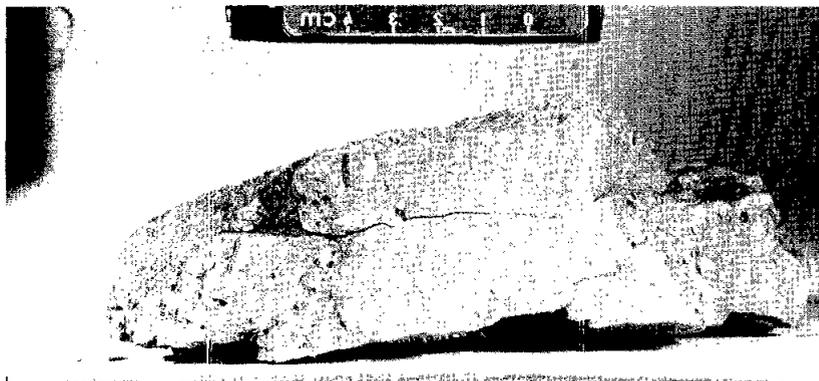
BINOCULAR DESCRIPTION BY: Lofgren and Wilshire DATE: 2/7/73

FABRIC: Porphyritic  
 VARIABILITY: Irregular distribution of cavities  
 SURFACE: B is fluted, from fracturing most likely, and is a very fresh surface  
 ZAP PITS: Many on T, E, N, and W; few on S; none on B.  
 CAVITIES: 5% vugs and vesicles. Vesicles are smooth-walled, crystal lined (with ilmenite), 2 mm; vugs up to 2 cm, projecting plag, pyroxene, and opaque mineral.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Oliv	Yellow green	5	Prism equant		1 - 6	
Opaque Plag	Black Trans- lucent gray		Equant Laths	0.25	0.5	1 1
Vitreous dark			Equant		0.1 - 0.5	2

NOTES:

1. Too fine-grained to estimate percentages.
2. Pyroxene(?)



Sample 74275

S-73-16021

74285

271

ROCK TYPE: Basalt  
 COLOR: Medium gray with brownish tinge  
 (N5 to 5YR 4/1)  
 SHAPE: Angular rhombic fragment  
 COHERENCE: Intergranular - Coherent  
 Fracturing - A few minor fractures, penetrative between  
 vuggy areas

WEIGHT: 2.212 g  
 DIMENSIONS: 2 x 1.5 x 0.5 cm

BINOCULAR DESCRIPTION

BY: Marvin

DATE: 2/16/73

FABRIC: Microdiabasic  
 VARIABILITY: Homogeneous texture; cavities occur in layers.  
 SURFACE: Dust coat on one surface.  
 ZAP PITS: None observed.  
 CAVITIES: ~40% on two broadest surfaces; small, irregular; up to 2 mm  
 in size; with drusy crystal terminations and euhedral prisms of  
 plag and pyrox.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	35	Laths	0.5	(long)	
Pyrox	Cinnamon	40	Anhed	0.3		1
Ilm	Black	20	Anhed	0.1		2
Oliv	Yellow	<5	Subhed	0.8		3

## NOTES:

1. Interstitial
2. Show some tendency to concentrate with pyroxene in irregular patches.
3. Relatively large grains and aggregates of 2 or 3 grains disseminated through rock.

74286

ROCK TYPE: Basalt  
 COLOR: Mottled reddish gray and white  
 (N6 to 5YR 6/1)  
 SHAPE: Angular blocky wedge  
 COHERENCE: Intergranular - Coherent  
 Fracturing - One penetrative

WEIGHT: 2.102 g  
 DIMENSIONS: 1.7 x 1 x 0.7 cm

BINOCULAR DESCRIPTION

BY: Marvin

DATE: 2/16/73

FABRIC: Microdiabasic  
 VARIABILITY: Homogeneous  
 SURFACE: All surfaces coated with fine layer of dust, fresh fractures  
 only along edges.  
 ZAP PITS: None observed  
 CAVITIES: <5%, one small cavity in one face; dust coat (after being  
 dusted) may obscure other small cavities but not many.  
 SPECIAL FEATURES: No olivine observed but may be obscured by dust.



75015

ROCK TYPE: Basalt  
 COLOR: Brownish gray (a little lighter than 5YR 4/1)  
 SHAPE: Blocky, angular  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few, penetrative

WEIGHT: 1006 g  
 DIMENSIONS: 10 x 9 x 6 cm

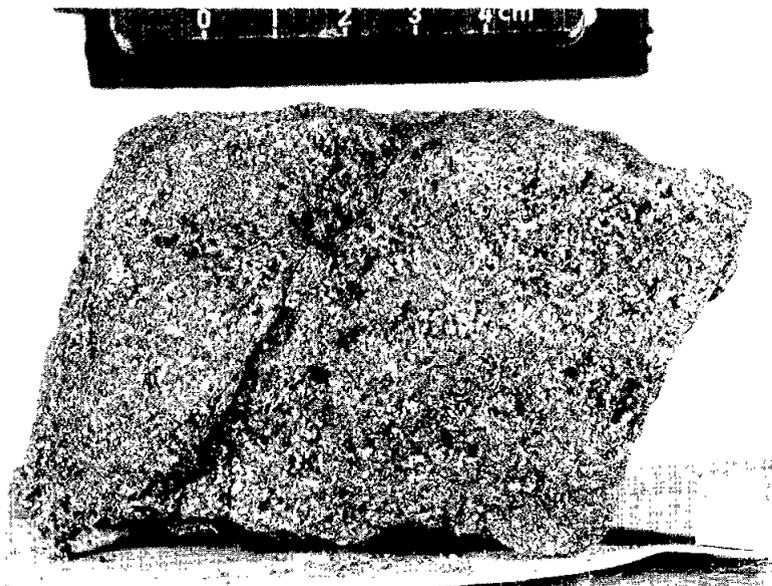
BINOCULAR DESCRIPTION

BY: Wilshire

DATE: 2/5/73

FABRIC: Ophitic-intergranular  
 VARIABILITY: Irregular vug distribution  
 SURFACE: Moderately hackly  
 ZAP PITS: Few on T, W, and S; none on others.  
 CAVITIES: 10% vugs (<1 - 3 mm) in clusters which reach 4 x 6 cm. The vugs are lined by projecting plagioclase, opaque, and pyroxene.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Light gray	35-40	Plates	1 - 1.5	0.5 - 4	
Pyrox	Rich root beer brown	50	Equant	0.5	<0.5 - 1.5	
Opaque	Black	10-15	Equant-platy	0.5 - 0.75	0.1 - 2	
Oliv	Yellow green	Tr	Equant	0.5		



Sample 75015

S-73-16666

ROCK TYPE: Basalt  
 COLOR: Between medium gray (N5)  
 and brownish gray (5YR4/1)  
 SHAPE: Subangular, triangular  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 1235 g  
 DIMENSIONS: 16 x 14 x 7 cm

BINOCULAR DESCRIPTION

BY: Stuart-Alexander

DATE: 2/2/73

FABRIC: Plumose texture within planar fabric; minor oikocrysts.  
 VARIABILITY: Planar fabric apparent on some faces only.  
 SURFACE: Hackly on fresh surfaces.  
 ZAP PITS: None on fresh surfaces (E and N); few on S, E, and W; many on B.  
 CAVITIES: 2-3%, vugs up to 5 mm. Euhedral crystals of average rock mineralogy project into vugs.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Maf sil	Deep reddish brown	50	Anhed to subhed	0.3-0.4	<0.1 - 0.7	1
Plag	Colorless to white	35	Equant to laths	0.5	0.1 - 2	2
Ilm(?)	Black	15	Anhed to plates	0.3	<0.1 - 2	
Maf sil	Yellowish	Tr		0.4		3

## NOTES:

1. Pyroxene; some are zoned with darker cores and lighter yellowish brown rims.
2. Scattered oikocrysts to 1 - 2 mm.
3. Olivine or pyroxene.



Sample 75035

S-73-16253

ROCK TYPE: Basalt  
 COLOR: White and medium brownish gray  
 SHAPE: Flat slab  
 COHERENCE: Intergranular - Coherent  
 Fracturing - Few, penetrative planar

WEIGHT: 949.4 g 275  
 DIMENSIONS: 21x14x1.8 cm

BINOCULAR DESCRIPTION BY: Stuart-Alexander/Marvin

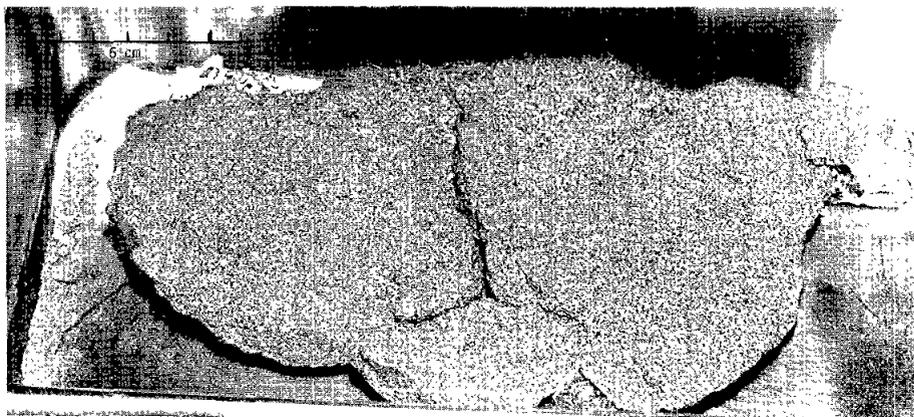
DATE: 1/10/73

FABRIC: Equigranular  
 VARIABILITY: Homogeneous except vugs unevenly distributed  
 SURFACE: Fresh surface is platy; exposed surface gently lumpy.  
 ZAP PITTS: Few on all exposed surfaces.  
 CAVITIES: <5% vugs, maximum size is 8 mm; filled with euhedral crystals of plagioclase, pyroxene and ilmenite.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTE</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plagioclase	White	30	Anhedra1 to plates	1	Max 6	1
Mafic silicate	Brown, locally yellow	50	Anhedra1 to prismatic	0.7	2	2
Opaque	Shiny black	20	Anhedra1 to needles	1	3	3

NOTES:

1. On fresh surface most crystals appear equant; on exposed surfaces most appear to be laths. No discernible preferred orientation.
2. Pyroxene seems zoned. Yellowish brown is <1% of pyroxene.
3. Ilmenite; irregular to equant grains dominant.



Sample 75055

S-73-15093

B<sub>1</sub> face is up.

THIN SECTION DESCRIPTION

BY: Marvin

DATE: 3/2/73

SECTION: 75055,8 ,16 and ,17

SUMMARY: Olivine basalt

## GROUNDMASS

<u>PHASE</u>	<u>%</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	29	Laths	Up to 3.2	Plagioclase laths show random orientation with interstitial olivine (zoned), and clinopyroxene, which shows hour-glass structure. A very small trace of residual glass occurs in interstices. Ilmenite has some "swiss cheese" texture with glassy melt inclusions. Troilite with metal globule inclusions associated with glassy mesostasis.
Cpx	19	Anhed	Up to 0.8	
Oliv	33	Anhed	Up to 0.8	
Cristob	3	Subhed	Up to 1.2	
Ilm	14	Euhed-subhed	Up to 1.8	
Troil	<1	Anhed	0.2 - 0.7	
Metal	<1	Globules	Up to 0.1	
Glass	<1	Interstit	0.2	

TEXTURE: Microdiabasic.



Section 75055,8 S-73-20058  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 2/9/73

SECTION: 75055,8

<u>PHASE</u>	<u>SECTION</u>	<u>SHAPE</u>	<u>SIZE</u> (mm)	<u>COMMENTS</u>
Ilm	15	Laths, anhed, equant	To 1.5	An interesting rock since it shows no inclusions of rutile or spinel, which is rare for an Apollo 17 mare basalt. Rock is coarse-grained, suggesting phenomenon is not a function of cooling; ilmenite may be Mg-poor. Metal not included in troilite is rare. Rare ulvospinel grains are rich in Fe <sub>2</sub> TiO <sub>4</sub> and show pronounced sub-solidus reduction to Fe + ilmenite.
Troil	< 0.5	Blebs	To 0.1	
Fe-Ni	< 0.2	Blebs	To 0.05	
Ulvoc	Tr	Anhed	To 0.05	

75065

ROCK TYPE: Basalt

COLOR: Gray (N4)

SHAPE: Angular

COHERENCE: Intergranular - Tough

Fracturing - Non-penetrative

WEIGHT: 1.263 g

DIMENSIONS: 1 x 1 x 1 cm

BINOCULAR DESCRIPTION

BY: Meyer

DATE: 2/16/73

VARIABILITY: Homogeneous

SURFACE: Extremely soil covered (rock was not dusted because equipment was unavailable).

ZAP PITS: None

CAVITIES: 10% vugs

SPECIAL FEATURES: Because of the soil coating, I am not certain that this rock is not a soil breccia.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF</u> <u>ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White trans	40		0.5		
Pyrox	Brown	45		0.2		
Ilm		15		0.2		

ROCK TYPE: Glassy breccia  
 COLOR: Dark gray  
 SHAPE: Irregular  
 COHERENCE: Intergranular - Friable  
 Fracturing - Penetrative

WEIGHT: 0.98 g  
 DIMENSIONS: 0.5 x 1.2 x 1 cm

BINOCULAR DESCRIPTION

BY: Meyer

DATE: 2/16/73

FABRIC: Marbled

VARIABILITY: Mixture of dirt and glass

SURFACE: Welded dust on all sides (rock was not dusted because equipment was unavailable).

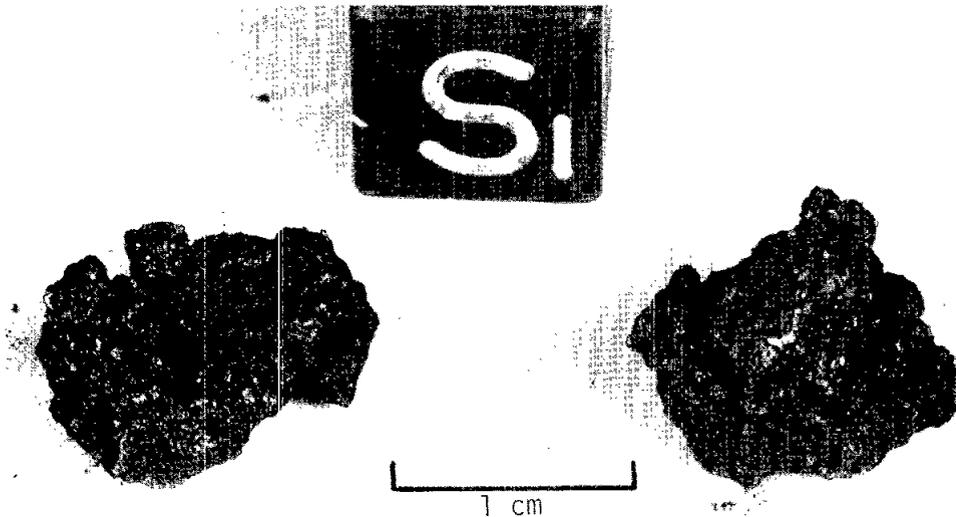
ZAP PITS: None

CAVITIES: 10% irregular cavities, which are neither vugs nor vesicles.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Glass	Black	50				
Soil	Gray	50				1

## NOTE:

1. Includes pyroxene and plagioclase crystals.



Sample 75066

75065

S-73-15337

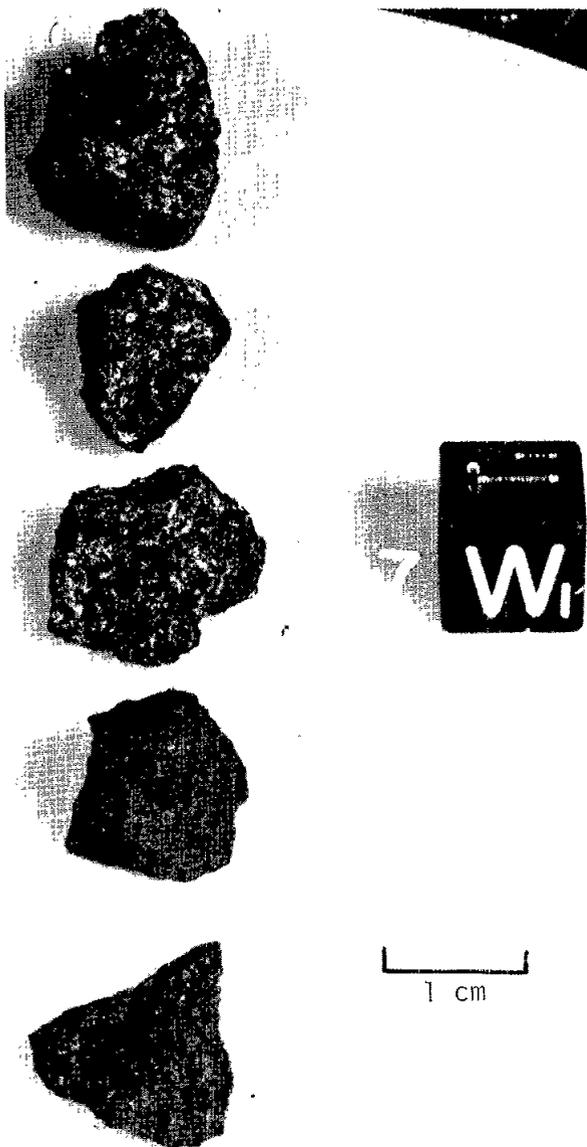




<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	40	Equant to lathy	0.4	0.1 - 1	
Pyrox	Light brown to dark brown	45	Equant	0.4	0.1 - 0.8	
Ilm	Black	15	Equant	0.2	0.1 - 0.5	1

## NOTE:

1. Ilmenite intergrown with pyroxene.



Sample 75085-89

S-71-19403

75086

ROCK TYPE: Basalt

WEIGHT: 2.323 g

COLOR: Gray (N4)

DIMENSIONS: 1 x 1 x 2 cm

SHAPE: Angular

COHERENCE: Intergranular - Tough  
Fracturing - Non-penetrativeBINOCULAR DESCRIPTION

BY: Meyer

DATE: 2/20/73

FABRIC: Equigranular

VARIABILITY: Homogeneous

SURFACE: 30% surface covered with welded dirt

ZAP PITS: None

CAVITIES: 20% vugs (2 mm)

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	40	Equant	0.3	0.1 - 2	
Pyrox	Brown	45	Equant	0.4	0.1 - 0.6	
Ilm	Black	14	Equant	0.2	0.1 - 0.5	
Oliv	Green	1	Equant	0.4		

75087

ROCK TYPE: Basalt

WEIGHT: 2.321 g

COLOR: Gray (N4)

DIMENSIONS: 2 x 2 x 1 cm

SHAPE: Angular

COHERENCE: Intergranular - Tough  
Fracturing - Six, non-penetrativeBINOCULAR DESCRIPTION

BY: Meyer

DATE: 2/20/73

FABRIC: Equigranular

VARIABILITY: Homogeneous

SURFACE: 30% coated with glass-welded dirt

ZAP PITS: None

CAVITIES: 20% vugs, interconnecting

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	40	Equant	0.4	0.1 - 1.0	
Pyrox	Brown	45	Equant	0.3	0.1 - 0.5	
Ilm	Black	15	Equant	0.3	0.1 - 0.5	

75088

ROCK TYPE: Basalt  
 COLOR: Gray (N3)  
 SHAPE: Angular  
 COHERENCE: Intergranular - Tough  
                   Fracturing - None

WEIGHT: 1.992 g  
 DIMENSIONS: 1.5 x 1 x 1 cm

BINOCULAR DESCRIPTION

BY: Meyer

DATE: 2/20/73

FABRIC: Aphanitic to subophitic  
 VARIABILITY: Homogeneous  
 SURFACE: Freshly broken, some dust (despite dusting).  
 ZAP PITS: None  
 CAVITIES: None

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	45	Laths	0.2	0.1 - 1	
Pyrox	Gray	45	Equant	0.1		
Ilm	Black	9	Equant	0.1		
Oliv	Green	1	Equant	0.1		

75089

ROCK TYPE: Basalt  
 COLOR: Gray (N4)  
 SHAPE: Angular  
 COHERENCE: Intergranular - Tough  
                   Fracturing - One, non-penetrative

WEIGHT: 1.718 g  
 DIMENSIONS: 1 x 1 x 1 cm

BINOCULAR DESCRIPTION

BY: Meyer

DATE: 2/20/73

FABRIC: Equigranular  
 VARIABILITY: Homogeneous  
 SURFACE: Dirty (despite dusting), no glass  
 ZAP PITS: None  
 CAVITIES: 5% vugs (0.5 mm)

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	45	Equant	0.2	0.1 - 0.5	
Pyrox	Light brown	45	Equant	0.2	0.1 - 0.5	
Ilm	Black	10	Equant	0.2	0.1 - 0.5	
Oliv	Green	1	Equant	0.1		

75115

ROCK TYPE: Basalt (fine-grained)                      WEIGHT: 2.60 g  
 COLOR: Medium dark gray (N4)                      DIMENSIONS: 2 x 1.3 x 1 cm  
 SHAPE: Subrounded fragment  
 COHERENCE: Intergranular - Coherent  
                   Fracturing - Several penetrative

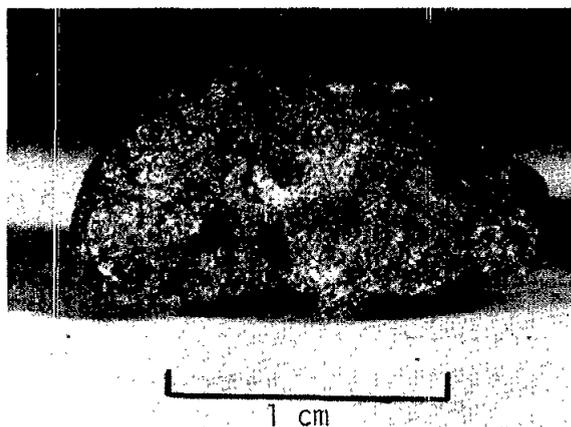
BINOCULAR DESCRIPTION

BY: Agrell and Agrell

DATE: 3/30/73

FABRIC: Equigranular  
 VARIABILITY: Homogeneous  
 SURFACE: T and N are hackly exterior; others are hackly fracture surfaces.  
 ZAP PITS: Few on N, T, S (towards T); none on E, W, B.  
 CAVITIES: <5%, 0.5 - 0.2 mm, rounded crystal-lined vugs (plag, pyrox, ilm)

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	C'less	40	Lath, interst	0.2	0.1 - 0.4	
Pyrox	Cinnamon	45	Blocky, interst	0.2	0.1 - 0.4	
Ilm	Black	15	Tab, interst	0.2	0.1 - 0.4	



Sample 75115

S-73-19744

76015

ROCK TYPE: Metaclastic breccia                      WEIGHT: 2819 g  
 COLOR: Light olive gray (5Y 6/1)                      DIMENSIONS: 20 x 16 x 14 cm  
 SHAPE: Blocky, subangular; broken  
 COHERENCE: Intergranular - Coherent  
                   Fracturing     - Few, irregular, non-penetrative

BINOCULAR DESCRIPTION     BY: Morrison and Wilshire                      DATE: 1/11/73

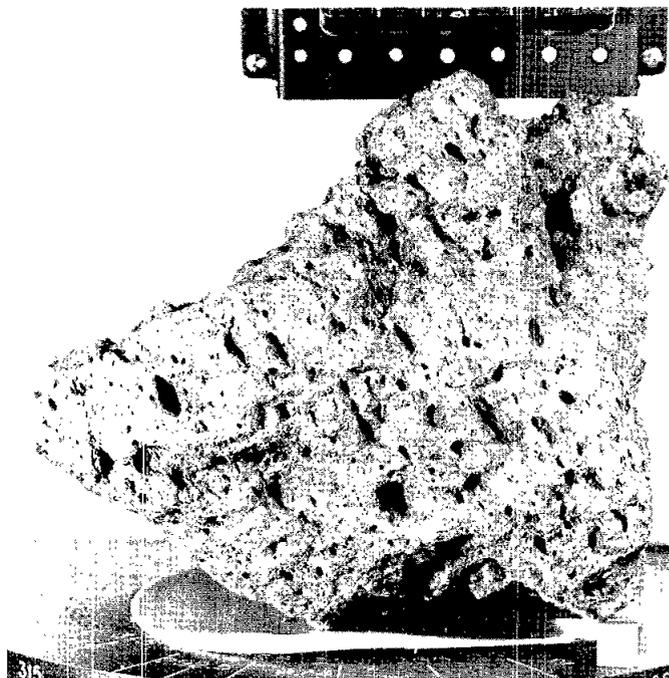
FABRIC: Equigranular with a small percentage of clasts  
 VARIABILITY: Very irregular size distribution of cavities  
 SURFACE: All surfaces are hackly. T is a freshly broken surface with sharp-edged cavities; the edges of cavities on all other surfaces are rounded. T has a small patch of slickenside.  
 ZAP PITS: Many on all surfaces except T, which is fresh and unpitted.  
 CAVITIES: 10 - 15% in main body of rock plus one large cavity; irregular to smooth-walled vugs; 1 cm or less in diameter; thin druses on smooth walled vugs; tendency to elongation, prominently aligned on W, B. Some metal grains attached, occasional yellow mineral projecting into cavity. Another type is ovoid, irregular; walls have complex shapes, many projecting crystals with metal, pyroxferroite(?), and other minerals. A third type is <1. cm, with very well developed projecting crystals of translucent tan mineral.  
 SPECIAL FEATURES: Excellent cavity alignment. Unusually well formed pyroxferroite(?) crystals; clast I is unique in presumed mineralogy and possible mylonitization or "serpenitization" of green waxy mafic mineral. Minute transparent crystals not individually resolvable form rinds on cavities.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
Type I	Waxy green	<1	Rnd	15x10		1
Type II	Gray	<1	Ovoid	5x4		2
Type III	Vitreous gray	<1	Rectangular	5		3
Vuggy matrix	Medium light gray	1-2	Rnd disc	40x30x10		4
Matrix	Light olive gray	97			0.2-0.25	5

## NOTES:

1. Waxy green vitreous appearing mineral with 1-2 mm intergrown brownish gray pyroxene(?) and greenish-white, resinous serpentine-like material. Two fragments.
2. Granoblastic plagioclase(?).
3. Vitreous-appearing plagioclase(?).

4. Possible fragment; spongy intergrowth of pyroxene and plagioclase loosely held by matrix material. Pyroxferroite(?) crystals (1-2%), brown pyroxene (2-5%), gray vitreous pyroxene(?) (30 - 50%), fine sugary matrix (30-40%), possibly mainly plagioclase; 1% opaque minerals. Brown pyroxene 1 x 6 mm, pyroxferroite crystals <1 mm. This "fragment" is isolated from main body of the rocks; pull apart spikes occur on one side where "fragment" is separated from matrix by irregular cavity. "Fragment" may be an unusual vug formation but pull-aparts suggest that it is an altered and recrystallized fragment.
5. Interlocking, granular texture. Uniformly distributed tabular opaques, 0.1 mm, 1-3% gray, vitreous mineral, round to prismatic (plagioclase or pyroxene) may be 15-20%; light tan mineral (pyroxene(?)) 40-50%; 20% whitish plagioclase(?). Trace of yellow olivine(?) or pyroxene(?) - either phenocrystal or xenocrystal. Metal, irregular.



Sample 76015

S-73-15015

THIN SECTION DESCRIPTION

BY: Morrison

DATE: 3/1/73

SECTION: 76015,8

SUMMARY: Metaclastic rock with poikiloblastic texture.

## MATRIX, 95% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opx	60	Irreg poik	1	Matrix is dominated by poikiloblasts of opx and cpx.
Oliv } Pyrox }	10	Ang	<1	About half of the plag is included in the poikiloblasts. The plag that is free of the poikiloblasts is in somewhat larger, blocky grains. Opaques are homogeneously distributed.
Plag	20	Blocky	<1	
Opa	5		0.5	

## MINERAL CLASTS, 5% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	One seen	Subang	1x1.5	One large plag (1x1.5 mm) is present; it is mortared and cataclastically deformed. All of the plag is generally free of inclusions.
Cpx } Oliv }	70-60	Subang	<1	
Plag	30-40	Subang	<1	

## LITHIC CLASTS, &lt;1% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Dunite	100	Rnd	1	Only one clast, which is a polygonal intergrowth of olivine.

## GLASS CLASTS, TRACE IN ROCK

<u>COLOR</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Colorless		Subrnd	0.7	One piece of maskelinite(?), which could have high negative relief - identification very uncertain.

ADDITIONAL COMMENTS: Percentages visual estimates.

THIN SECTION DESCRIPTION

BY: Wilshire

DATE: 3/1/73

SECTION: 76015,9

SUMMARY: Metaclastic rock with well developed coarse poikiloblastic matrix enclosing mineral and lithic debris and newly crystallized plagioclase laths.

## MATRIX, 80-85% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Pyrox		Crude prism	To 0.7	Mostly coarsely poikiloblastic; host mineral mostly clinopyroxene, may be some orthopyroxene. These enclose plagioclase laths and fine mineral debris.
Plag				
Oliv				
Opa		Irreg pods	To 0.5	

## MINERAL CLASTS, 10% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	85-90	Ang	To 2	Normal zoning related to irregular grain shapes.
Oliv	10-15	Ang	To 0.8	

## LITHIC CLASTS, 5-10% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I	90	Elong	To 7.5	Metaclastic with abundant angular plagioclase debris in granoblastic plagioclase and poikiloblastic (to 0.7 mm) pyroxene matrix. Small % opaque prisms.
II	10	Subrnd	To 1.5	Spherulitically crystallized plagioclase.
III	Tr	Ang	To 0.9	Plagioclase with round mafic inclusions.
IV	Tr			Recrystallized plagioclase and olivine aggregates.



ROCK TYPE: Breccia  
 COLOR: Medium gray with bluish tint  
 (N5-5B 5/1)  
 SHAPE: Angular, irregular  
 COHERENCE: Intergranular - Tough  
 Fracturing - One penetrative

WEIGHT: 376.2 g  
 DIMENSIONS: 12 x 5.5 x 5 cm

BINOCULAR DESCRIPTION BY: Wilshire and Stuart-Alexander DATE: 1/18/73

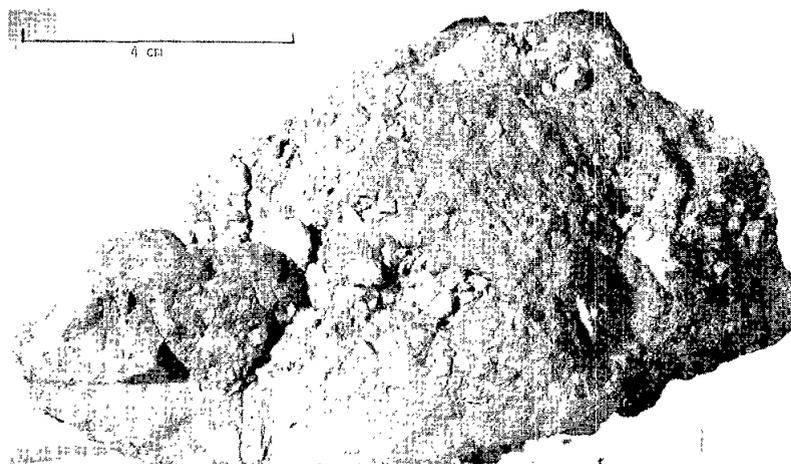
FABRIC: Breccia  
 VARIABILITY: Clast concentration  
 SURFACE: Moderately to very hackly. N most hackly, B least.  
 ZAP PITS: None on B; few on W, E, T, and N; many on S.  
 CAVITIES: 1-5%, only in blue gray, mostly vugs; scattered vesicles with regular shapes and smooth walls; 0.1 - 7 mm. Vugs to 4 cm across in sharply defined concentrations.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Lithic clast 1	Light gray	30 - 35	Blocky ang	5	0.1 - 10	1
Lithic clast 2	White to lt. gray	2	Subang-blocky		1 - 4	2
Lithic clast 3	Pale yellow gray	Tr	Subang-blocky		1 - 2	3
Lithic clast 4	Light brownish gray	Tr	Subang-blocky		8x6 to 2x5	4
Plag	Clear to milky	1 - 2	Irreg-ang		0.5 - 3	
Mafic sil	Yellow green	1	Irreg-ang		0.5 - 1.5	5
Mafic sil	Orange-brown	Tr	Irreg-ang		1	6
Metal	Yellow silver	<1	Frag-ments & spheres		0.1 - 1	
Matrix	Blue-gray	60 - 65			<0.1	7

NOTES:

1. Shattered fragment of fine hornfels; near original edge, all pieces are completely enclosed in blue-gray matrix, in interior the fragments are incompletely cemented by the blue gray matrix, forming a loose knit aggregate. The hornfels clasts have average grain sizes of 0.1 mm, a few mineral fragments to 1 mm.
2. Coarse to fine recrystallized plagioclase. Grain sizes 0.1 - 5.

3. Fine recrystallized mafic silicate, plagioclase rock.
4. Two rock fragments composed of 20% light brown pyroxene molded on plagioclase, some of which is euhedral - crystals 0.5 x 2 mm - 1 x 2 mm.
5. Some is olivine.
6. Pyroxene.
7. Holocrystalline. Very fine-grained. Scattered mineral debris as above is seriate to resolution. Scarce plagioclase laths. Uniform color. A little coarser away from clast concentration.



Sample 76035

S-73-15457

76036

ROCK TYPE: Annealed breccia                      WEIGHT: 3.95 g  
 COLOR: Medium dark gray (N4 to N5)              DIMENSIONS: 2.5 x 2 x 0.6  
 SHAPE: Flat, chip freshly broken  
 COHERENCE: Intergranular - Tough  
                   Fracturing        - None

BINOCULAR DESCRIPTION

BY: Wilshire

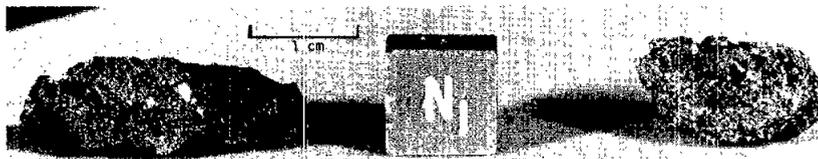
DATE: 2/28/73

FABRIC: Fine breccia.  
 VARIABILITY: Irregular cavity distribution.  
 SURFACE: Finely hackly.  
 ZAP PITS: Many on original surface.  
 CAVITIES: 3%, 0.1 - 2 mm, smooth-walled, spherical to ellipsoidal, the largest is flat on one side. Walls have fine drusy lining with rare yellowish metal grains.  
 SPECIAL FEATURES: - -

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts		3				
Lithic I	White		Ang		1 - 2	1
Lithic II	Light gray		Ang		1 - 3	2
Maf sil	Very pale greenish		Ang		3	3
Maf sil	Pale yellowish green		Ang		2	4
Plag	Light gray		Ang		1	
Matrix	Dark	97				5

## NOTES:

1. Broken plagioclase aggregates and possibly some maskelynite.
2. Fine grained metaclastic(?) rocks with plagioclase and gray and brown minerals.
3. Very waxy luster.
4. Well developed prismatic cleavage.
5. Aphanitic with scattered mineral debris <1 mm, including the clasts described above plus bright yellow-green olivine(?), rare orange-red spinel, much plagioclase, and possible rare dark aphanitic lithic fragments. Scarce tiny plagioclase(?) laths.



Sample

76036

76037

S-73-17959

76037

ROCK TYPE: Basalt

WEIGHT: 2.52 g

COLOR: Brownish gray (N4 to N5)

DIMENSIONS: 1.7 x 1.2 x 0.8

SHAPE: Blocky, subangular

COHERENCE: Intergranular - Tough

Fracturing - Few, non-penetrative

BINOCULAR DESCRIPTION

BY: Wilshire

DATE: 2/28/73

FABRIC: Possibly poikilitic  
 VARIABILITY: One edge looks pulverized.  
 SURFACE: Hackly  
 ZAP PITS: None  
 CAVITIES: 10% as 1-2 mm vugs with projecting ilmenite, pyroxenes, and scarce plagioclase.  
 SPECIAL FEATURES: 5% of the rock is formed of 1x2 - 3 mm clots of pyroxene-opaque minerals.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Light green	35-40	Tabular	1	<0.1 - 2	1
Pyrox	Reddish brown	50	Equant	0.25	<0.1 - 1	
Opaques	Black	10-15	Equant	0.35	<0.2 - 1	

## NOTES:

1. Poikilitically encloses pyroxenes and opaques.

## 76055

ROCK TYPE: Impact melt rock, vesicular      WEIGHT: 6412 g  
 COLOR: Greenish-gray (5G 6/1)      DIMENSIONS: 23 x 13 x 13 cm  
 SHAPE: Irregular, subangular  
 COHERENCE: Intergranular - Tough  
                   Fracturing - Few irregular, penetrative

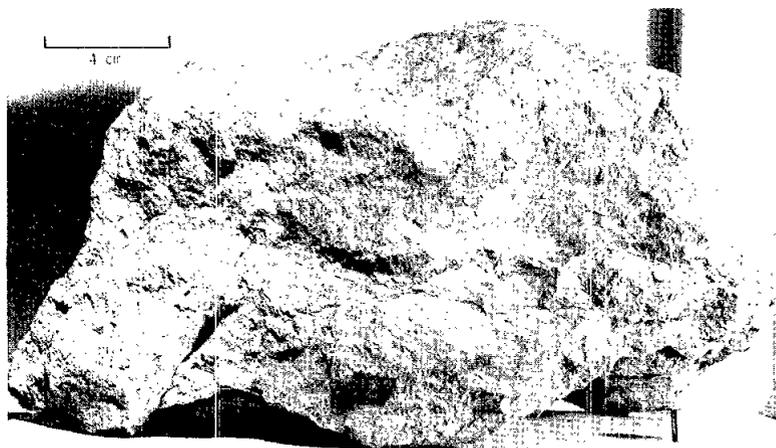
BINOCULAR DESCRIPTION      BY: Agre and Williams      DATE: 1/22/73

FABRIC: Breccia  
 VARIABILITY: Homogeneous on scale of 5 cm but clast and texture variable at small scale.  
 SURFACE: B is hackly; the B half of N is hackly but T half is exterior; E, S, W, and T are exterior, T has 1 cm circular glass splash.  
 ZAP PITS: None on B and B half of N; many on E, S, W, and T. Pits have gray glass linings with white haloes, and range in diameter from 0.3 to 3 mm. White haloed with gray glass 0.3 to 3.0 mm.  
 CAVITIES: <5%. Slit-like undulating gash cavities with drusy lining (plag>>pyx>>opaque, metal, and sulfide), average 7 mm long by 1 mm thick and range from 1 mm to 20 mm long. They are enechelon and appear to be in two sets: one subparallel to B, the other roughly perpendicular to B.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Fine-grained metaclastic pods	Medium dark gray	10	Irreg - lens- like		35x30x30 to 10x10x2	1
Coarser- grained metaclastic matrix	Greenish gray	90				2

## NOTES:

1. Only about 6 pods in the sample. Made up of about 30% plag(?), 50% dark gray, and 20% brownish mafic silicates. Most grains are about 0.1 mm, but also contain 5% clasts of olivine, brown pyroxene and plagioclase. The open gashes are not as abundant in this material as in the second component of this rock.
2. Forms a matrix that encloses the pods of the other component, from which it is distinguished by a greater abundance of subparallel crystal-lined gashes. Composed of 55% plag (<0.1 mm), 35% grayish mineral (Pyroxene?), 0.1 - 0.4 mm diameter, and about 1% greenish mineral (olivine?) about 0.2 mm in size. All of these are equant. Also contains traces of black equant opaque (spinel?) and 0.1 mm troilite. Contains 5% clasts of which 5% are 2 mm greenish angular polycrystalline olivine(?). Polycrystalline olivine occurs in a single zone with opaque rim, 30% are angular to subrounded, plagioclase single crystals up to 3 mm diameter but most smaller, 15% angular, olivine single crystals, and 5% of dense dark gray aphanitic angular to round fragments 2 - 7 mm diameter (one contains white aphanitic clast in it). One 10 mm clast is angular and composed of 20% plagioclase, 50% dark resinous pyroxene, and 30% brown pyroxene, all with grain sizes 0.5 - 1 mm.



Sample 76055

S-73-15714

THIN SECTION DESCRIPTION

BY: Agrell

DATE: 2/5/73

SECTION: 76055,10

SUMMARY: Impact-generated melt, with polymict inclusions of highland type rocks. Largest inclusion is a more slowly cooled impact melt. Vesicles are gas bubbles, formed at time of solidification of original melt, flattened by flow or weight of overlying material. Some cover allowed slow dissipation of heat, crystallization of the matrix (which was possibly originally glassy) and volatile transfer of metal, sulphide, and silicates now lining the vesicles.

## MATRIX, 45% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
Hyp	50	Prismatic	0.03
Plag	40	Interstitial	0.03
Oliv	4	Equant	0.01 - 0.1
Cpx	2	Equant	0.01 - 0.1
Armal	3	Acicular prismatic	
Ilm	0.5	Tabular	0.1
Met	0.5	Interstitial	0.01 - 0.2
Troil	<0.5	Interstitial	0.01 - 0.02

COMMENTS: The matrix of the rock is vesicular and crowded with clasts of both mineral and lithic types; where the former are below 30  $\mu$ m, their clastic origin is impossible to assess. The ultimate matrix is composed of <30 $\mu$  prisms of hypersthene closely packed in a feldspathic base with minor olivine, clinopyroxene and accessory Fe-Ni metal and troilite. The principle opaque mineral is armalcolite in prisms and needles often including micron-sized silicate droplets. Their rectangular cross-section, amphibole-like where cut obliquely, serves to distinguish them from tabular ilmenite, which is present in subordinate amount.

The crystal-charged matrix is vesicular, the voids composing 10% of the rock. The vesicles are flattened and twisted and subparallel to the contact with the centimeter-sized lithic clast. The vesicles do not cut the smaller lithic clasts. Their size ranges from 0.25 mm x 0.01 mm to 8.0 mm x 1 mm, they are lined in the stubby crystals of hypersthene with well developed crystal faces. Minor plagioclase, acicular hypersthene, troilite and iron metal also occur. One or two vesicles are charged with soil derived fragments, about 25 $\mu$  in size; these include amber glass, pyroxene and plagioclase fragments, soil sinter and one glass sphere.

## MINERAL CLASTS, 40% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
Plag A	36	Ang	0.1 - 1
Plag B	7	Blocky	0.2 - 0.3

Plag C	2	Blocky	0.1 - 0.3
Oliv	33	Equant	0.1 - 0.5
Opx	10	to	0.1 - 0.2
Cpx	9	Ang	0.1 - 0.2
Met	2	Rnd	0.1 - 0.3
Troil	<0.5	Rnd	0.2
Spinel	<0.5	Rnd	0.05

COMMENTS: Clasts are evenly distributed in matrix, and grade down in size. Below 0.05 mm are indistinguishable from matrix.

Plagioclase A - angular broken crystals little sign of shock, occasional slight normal zoning of immediate margin.

Plagioclase B - equant, necklace of pyroxene or olivine droplets (about 10 $\mu$ ) just inside outer margin, possibly clasts from disruption of oikocrystal lithic type A.

Plagioclase C - possibly pseudomorphs after maskelynite, replaced by a fine felt of plagioclase crystals showing some preferred orientation.

Olivine - a variety of types all with high Mg/Fe ratio: inclusion free, glass inclusions, exsolved chromite rosettes (2 $\mu$ ). Latter type is also seen in lithic clast type A.

Fe-Ni Metal - probably kamacite; schreibersite inclusions present but rare, peripheral troilite present, form rounded.

Spinel - one 50 $\mu$  clast of magenta-colored spinel present. 2 $\mu$  outer zone brown in color passes into a radial kelyphitic rim of acicular gray brown armalcolite intergrown with a radial growth of fibrous plagioclase. This is probably a reaction product with the matrix liquid as independent matrix armalcolite crystals transect the outer margin of the kelyphitic rim and the matrix of the rock.

#### LITHIC CLASTS, 15% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
A	70	Rnd	0.2 - 12
B	10	Rnd	1.5
C	3	Irreg	2
D	5	Ang	2
E	1	Subang	0.5
F	9	Ang	2
G	2	Rnd	0.5
H			0.3

COMMENTS: A. Oikocrystal melt rock (opx, oliv, plag, armal, many mineral clasts). Mafic fallback melt, forms a cm-size rounded inclusion with a welded contact with the vesicular host. No lithic clasts are recognizable but 10% mineral clasts are present. These include olivine (0.1 - 0.4 mm) and plagioclase (0.1 - 0.5 mm) in

angular to subrounded fragments. In larger fragments plagioclase predominates over olivine and in the smaller sizes the reverse holds. Olivine clasts may show glass inclusions, gas bubbles, and micron-sized chromite exsolution rosettes. Plagioclase shows no zoning but commonly a necklace of pyroxene or olivine droplets inside the edge. One clast of magenta spinel with a brown rim and kelyphitic border of fibrous plagioclase was observed. The matrix consists of 0.6 mm diameter rounded oikocrysts of hypersthene which include about 40% of twinned plagioclase ( $\pm 0.02$  mm) and minor olivine and clinopyroxene. The rounded oikocrysts may be isolated or packed together in groups of five or six and are separated by hypersthene-free zones in which a matrix (25%) composed 25 $\mu$  olivine (40%) clinopyroxene (5%) armalcolite (3%); plagioclase (50%). The latter is tabular and with marked lamellar twinning and shows a marked fluidal alignment. Set in this matrix are clasts of olivine, minor pyroxene and plagioclase. The dominant opaque is armalcolite in acicular crystals up to 0.1 mm. It occurs in swarms in the olivine-rich matrix and is generally absent from the hypersthene oikocrysts. One case exsolved rutile was observed. One plagioclase clast of type interpreted as devitrified maskelynite, has inclusions of armalcolite continuous with those of the groundmass!

Fe-Ni Metal and its associated troilite are more abundant than in vesicular host rock. The former occurs in rounded slightly flattened 0.08 - 0.03 mm pools. Some metal occurs in interstices between the silicates. The troilite is predominantly interstitial.

B. Very high aluminum basalt (70%) plagioclase in 80 $\mu$  laths, with 30% interstitial colorless pyroxene. The plagioclase contacts many small 5 $\mu$  inclusions of colorless spinel. Opaque minerals <1%.

C. Dunite - coarse irregular group of olivine crystals. No sign of crushing. Polygonal crystal outlines. Perhaps 15% orthopyroxene and 3% acicular armalcolite.

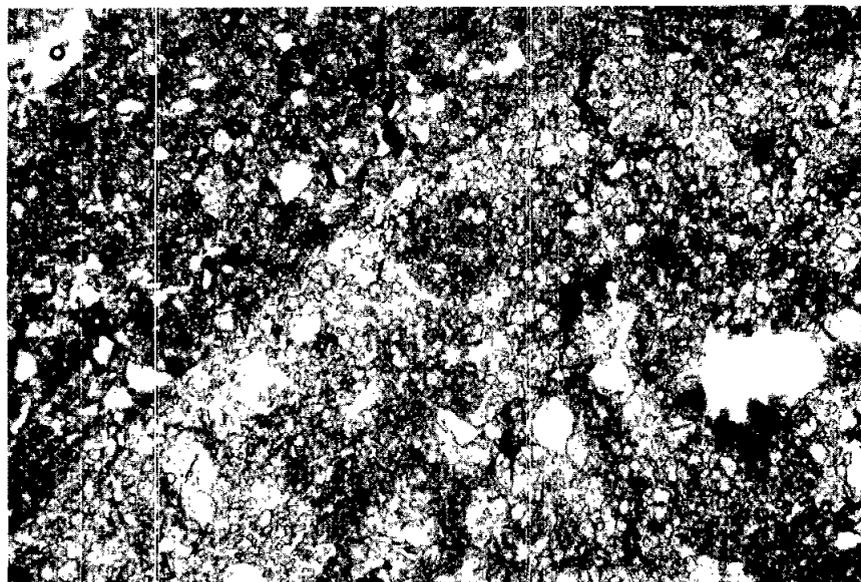
D. Cataclastic dunite - polycrystalline olivine aggregate from 0.5 mm - 0.01 mm, probably crushed single crystals.

E. Anorthositic granulite - 95% anorthosite, 120° grain boundaries.

F. Crushed anorthosite - lens-like crush zones associated with microgranular pyroxene, separating relatively uncrushed areas.

G. Olivine basalt - 50% lathy highly twinned plagioclase (0.1 mm); 50% intersertal ferromagnesian minerals, which are colorless olivine and pyroxene; <0.5% opaque minerals.

H. Hornfelsed basalt - 60% lathy plagioclase (1 mm) including 10 - 5 $\mu$  granules of pyroxene between and within plagioclase.



Section 76055,11 S-73-19868  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 2/1/73

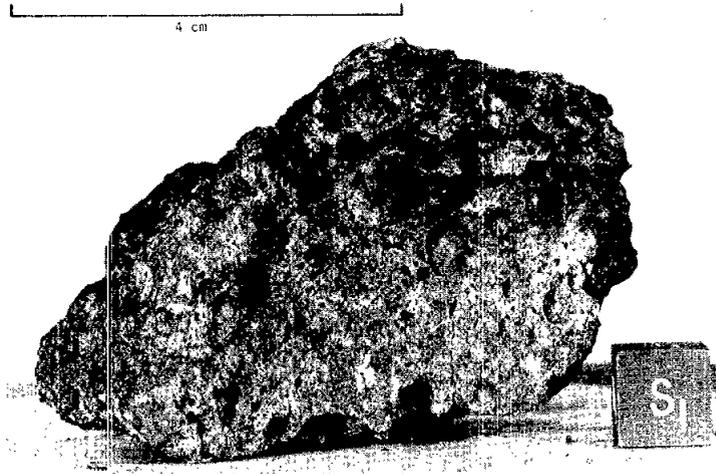
SECTION: 76055,8

<u>PHASE</u>	<u>SECTION</u>	<u>SHAPE</u>	<u>SIZE</u>	<u>COMMENTS</u>
	% OF		(mm)	
Arm	<2	Irreg	0.1	Most abundant opaque is gray armalcolite. Rutile exsolution is very rare in ilmenite. Metal grains are abundant and large; some contain irregular schreibersite.
Fe-Ni	<0.5	Blebs	To 1	
Troil	<0.3	Blebs	To 0.2	
Rut	Tr	Lamel	To 0.02	
Ilm	<1	Irreg	0.1	
Schr	Tr	Irreg	0.02	



## NOTES:

1. Possibly pigeonite oikocrysts.
2. Sugary, polycrystalline in irregular areas.
3. Associated with plagioclase.
4. Sporadic in vesicles, more in matrix.
5. Sporadic in vesicles and matrix, troilite.
6. Both glassy and slightly porcellaneous.



Sample 76135

S-73-15401

76136

ROCK TYPE: Olivine basalt

WEIGHT: 86.60 g

COLOR: Medium gray (N5)

DIMENSIONS: 6x4x3 cm

SHAPE: Subrounded

COHERENCE: Intergranular - Coherent, tough

Fracturing - None, non-penetrative spalls on T

BINOCULAR DESCRIPTION BY: Agrell & Reid

DATE: 1/22/73

FABRIC: Subophitic to intergranular, fine-grained

VARIABILITY: Homogeneous except for few scattered cavities

SURFACE: B is dusty and 3/4 coated with one 5 x 3 mm very thin transparent glass coating. E end of N has miarolitic cavities up to 6 mm long which contain pyroxene, plagioclase, olivine with a glazed surface appearance.

ZAP PITS: None on E; many 0.5 mm diameter lined by gray glass on T; many on S; few on E, W, and N.

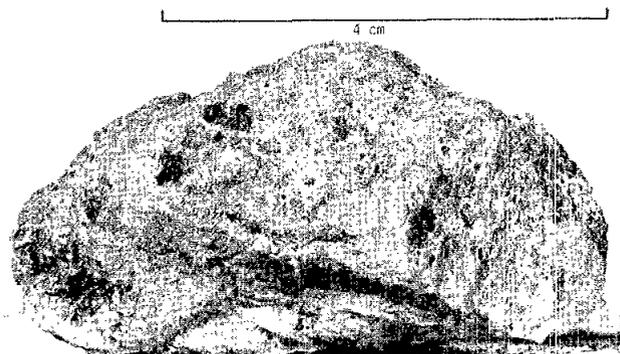
CAVITIES: B has one 3 mm diameter miarolitic cavity. T has &lt;1% small (&lt;1 mm) miarolitic cavities. N, E, several larger (4 - 6 mm) miarolitic cavities.

**SPECIAL FEATURES:** Larger pyroxenes are darker brown, lighter brown pyroxenes are smaller and intergrown with feldspar. Olivine abundance apparently higher at E end of N near cavities, and grain size coarser. Possible "glazed" surface in vugs.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Mafic sil	Very pale green	5	Equant	0.3	0.3	1
Mafic sil	Pale gray-brown	45	Equant to	0.3	0.1 - 0.8	2
Plag	White	40	Interstitial to platy	0.3	0.1 - 0.8	3
Opaque		8			0.1 - 1	4

**NOTES:**

1. Olivine
2. Pyroxene, tends to occur in clots, laths extend into the plagioclase.
3. Chalky white on B.
4. Long thin plates up to 1 mm long. Ilmenite.

Sample 76136 N<sub>1</sub>

S-73-15685

THIN SECTION DESCRIPTION

BY: Agrell

DATE: 2/9/73

SECTION: 76136,7

SUMMARY: Holocrystalline olivine-titan basalt. Order of crystallization: spinel (chromite?) olivine, ilmenite, pyroxene, plagioclase, spinel (ulvospinel?) sulphides. Olivine ceases crystallization as pyroxene commences. Ilmenite ceases crystallization before plagioclase and pyroxene.

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Oliv	6	Equant	0.2 - 0.5	Olivine - equant to rounded colorless crystals. Sporadic inclusions of octahedral opaque spinel. Very rare inclusions of rounded melt drops which have crystallized to ilmenite, feldspar with included pyroxene crystallites (1 - 2 $\mu$ m), outlines of latter not inconsistent with amphibole. Also included in
Cpx	46	Blocky-irreg	0.1 - 1.3	
Ilm	26	Tabular	0.1 - 2.0	inclusions of rounded melt drops which have crystallized to ilmenite, feldspar with included pyroxene crystallites (1 - 2 $\mu$ m), outlines of latter not inconsistent with amphibole. Also included in
Plag	22	Lathy	0.1 - 1.5	
Spinel	<0.01	Equant	0.1	inclusions of rounded melt drops which have crystallized to ilmenite, feldspar with included pyroxene crystallites (1 - 2 $\mu$ m), outlines of latter not inconsistent with amphibole. Also included in
Troil	0.1	Inters	<0.05	
Fe-Ni metal	<0.01	Droplets	<0.01	inclusions of rounded melt drops which have crystallized to ilmenite, feldspar with included pyroxene crystallites (1 - 2 $\mu$ m), outlines of latter not inconsistent with amphibole. Also included in
Crist	<0.01	Inters	<0.03	

olivine are one or two hair-like crystals of armalcolite (rhomboidal cross section). Olivine is mantled by closely packed crystals of clinopyroxene, of same color as groundmass. Plagioclase is seldom if ever in contact with olivine.

Clinopyroxene - early crystallized occurs in blocky hypidiomorphic crystals which include large plates of ilmenite. A few are relatively large, 1 mm, and show undulose extinction and curved boundaries which separate scimitar-shaped areas whose optic orientation differs by 2 - 3°. The color of the pyroxene is cinnamon with a deeper hue in the center of the crystals and paler at the margins. The bulk of the pyroxene is intergrown with plagioclase in crudely variolitic, sheaf-like aggregates which pass outwards into allotriomorphic pyroxene interstitial to tablets of plagioclase. All but the smallest pyroxene crystals show paler margins and a strong increase in birefringence at their margins.

Plagioclase - A >85%, interstitial to pyroxene, in sheaf-like areas, hypidiomorphic tablets in rest of rock, may show slight normal zoning.

Ilmenite - wide size range, large crystals as 1 - 1.5 mm curved tablets with a saw-tooth outline. They occur as skeletal groups. These pass down in size into later crystallizing planar tablets about 0.2 mm. The latter are included in the latest crystallizing plagioclase and pyroxene. The only mineral which does not include ilmenite is olivine. Ilmenite shows sporadic exsolution of micron-wide strips of rutile and flat lenses of a dark weakly reflecting spinel. Exsolution nucleates randomly and at cracks or at margin of crystals.

Spinel - a few octahedra of opaque spinel in olivine, a few 0.01 mm octahedra (ulvospinel?) in pyroxene-plagioclase groundmass, some marginal alteration to ilmenite(?).

Troilite - about 10% is associated with Fe-Ni metal droplets, the rest occurs between silicate or oxide minerals, and is molded on them.  
 Fe-Ni metal - very few interstitial grains, not associated with troilite.  
 Cristobalite - as films between late-crystallizing silicates.

TEXTURE: Randomly orientated ilmenite plates in a holocrystalline matrix with 6% equant olivine rimmed by blocky pyroxene all set in a pyroxene-plagioclase base which varies from crudely variolitic (or sheaf-like) to intersertal in texture.



Section 76136,7 S-73-19880  
 Width of field 3.16 mm, plane light

<u>OPAQUES DESCRIPTION</u>		BY: Brett		DATE: 2/9/73
<u>SECTION:</u>	<u>% OF</u>	<u>SHAPE</u>	<u>SIZE</u>	<u>COMMENTS</u>
76136,7				
<u>PHASE</u>	<u>SECTION</u>	<u>SHAPE</u>	<u>SIZE</u>	
Ilm	25	Lamel equant	(mm) To 1.5	Ilmenite more lath-like than in other Apollo 17 mare rocks and are apparently less magnesian on basis of lack of pleochroism. Rutile lamellae in ilmenite are quite well-pronounced, spinel lamellae are rare compared to other rocks. One isolated Cr-spinel grain is present.
Rut	< 0.2	Lamel	To 0.15	
Fe-Ni	< 0.2	Blebs	To 0.075	
Troil	< 0.2	Blebs	To 0.075	
Spin	Tr	Anhed	To 0.05	

ROCK TYPE: Norite  
 COLOR: Medium gray (N5)  
 SHAPE: Irregular chip  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 2.46 g  
 DIMENSIONS: 1 x 1.5 x 1.8 cm

BINOCULAR DESCRIPTION

BY: Horz

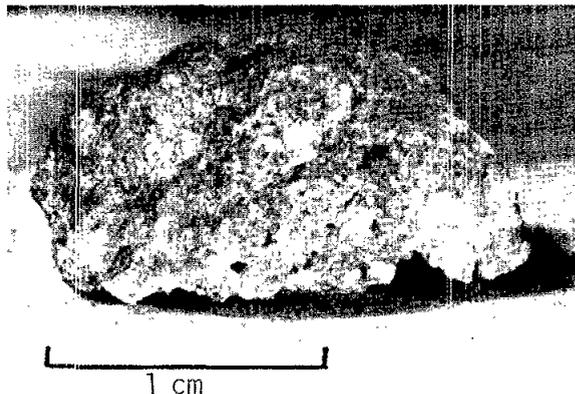
DATE: 3/26/73

FABRIC: Isotropic  
 VARIABILITY: Homogeneous  
 SURFACE: Most are rounded, dusty; one is a fresh fracture,  
 irregular, and hackly.  
 ZAP PITS: Many on most; none on one.  
 CAVITIES: 1 - 5% as vugs and vesicles.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF</u> <u>ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	N8	50	Irreg.	0.2	0.1 - 0.5	1
Pyrox	5GY	30	Irreg	0.1	0.1 - 0.3	1
Maf sil	Greenish- yellow	20	Irreg	0.2	0.1 - 1	2
Metal	Silvery	Tr	Rnd, spherules	0.5	0.5	
Ilm	Black	1-2	Lath	0.2	0.1 - 0.5	

## NOTES:

1. Sugary texture
2. Olivine; various degrees of fracturing; occasionally sugary texture.

Sample 76137 N<sub>1</sub>

S-73-21762

ROCK TYPE: Metaclastic  
 COLOR: Light gray with faint  
 greenish tint (N7)  
 SHAPE: Blocky, angular  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 643.9 g  
 DIMENSIONS: 10.5 x 8 x 6 cm

BINOCULAR DESCRIPTION

BY: Wilshire/Reid

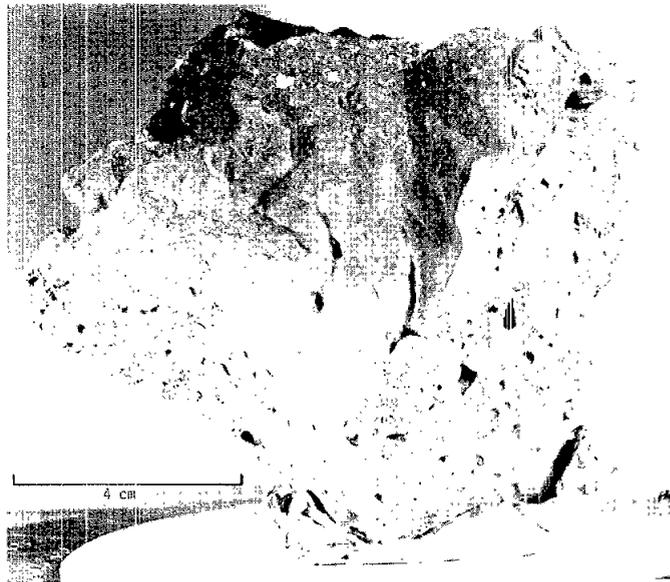
DATE: 1/9/73

**FABRIC:** Roughly equigranular  
**VARIABILITY:** Irregular distribution of cavities; grain size increases toward the cavities.  
**SURFACE:** T is mostly a single vug, 7 x 6.5 cm, coarsely ropy texture, N has deep vugs, others broken surfaces.  
**ZAP PITS:** Few on T and N, few to many on E, none on others which are freshly broken.  
**CAVITIES:** Vugs and vesicles from <1 mm to 7 cm in diameter comprise 15% of the rock.  
**SPECIAL FEATURES:** Vugs on T and N were exposed on lunar surface. Sections should include vuggy and non-vuggy areas.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
1	Pale green	<1	Subrnd		5	1
2	Gray	<1	Irreg		1 - 8	2
3	Yellow green	<1	Ang		1 - 3	3
Metals						
1	Bronze	<1	Euhed		0.1 - 1	4
2	Silver	<1	Euhed		0.1 - 1	5
3	Yellow	<<1	to irreg spherical		1	6
Matrix	Salt & pepper	90 - 95	Spherical	0.1 - 0.2	0.1 - 3	7
	Very pale brown	5 - 10		1		8
	Very light gray			0.2		9
	Black			0.2		10
Fracture coating	Pale milky green white					11

## NOTES:

1. Sugary texture; recrystallized lithic or mineral clast. This could be cavity filling, appears botryoidal, but more likely a broken rock fragment; has a trace of red spinel(?).
2. Sugary; recrystallized plagioclase.
3. Single mineral fragments, some olivine, some pyroxene.
4. Troilite crystals on vug walls. One has a tiny, deep-green inclusion.
5. On vug walls, some later than bronze, and in body of the rock.
6. In body of the rock.
7. About 60% gray, 35% light gray, 5% opaques (equant) plus reddish brown mineral. Grain size increases in vicinity of vugs (distinct increase as far as 1 cm from big vugs) but texture remains granoblastic or poikiloblastic; color of minerals in matrix become distinct near vugs (near the vugs, the matrix becomes yellow green and the grain size increases to 1 mm. The crystals are generally randomly oriented prisms with well developed crystal faces and no inclusions. In other areas, the matrix is sugary and may have inclusions). One angular, tiny emerald green fragment - may be foreign but a similar grain is embedded in troilite.
8. Loose knit patches of pyroxene - locally forms rims on yellow green mineral.
9. Fine, sugary plagioclase.
10. Opaque minerals, tendency to tabular form. Some small vugs have drusy coatings.
11. Coats irregular fracture exposed on freshly broken surface B.



Sample 76215

S-72-56373

THIN SECTION DESCRIPTION

BY: Wilshire

DATE: 1/24/73

SECTION: 76215,7,8

SUMMARY: Metaclastic rock with substantial plagioclase and olivine debris in poikiloblastic matrix of orthopyroxene and clinopyroxene. Tiny euhedral plagioclase is enclosed in poikiloblastic. Opaque minerals are interstitial to poikiloblasts.

## MATRIX, 75-80% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opx/ plag	50-60	Elong	0.1 - 0.8	Dominant poikiloblastic phase is orthopyroxene, but there may be some pigeonite.
Cpx	15-20	Elong	0.1 -	
±Oliv			0.4	All appear to be compositionally zoned, irregularly for mafics, concentrically for plag.
Opa	2-3	Elong	<0.1 -	
			0.2	
Plag	20-30	Square short laths	<0.01 - 0.1	

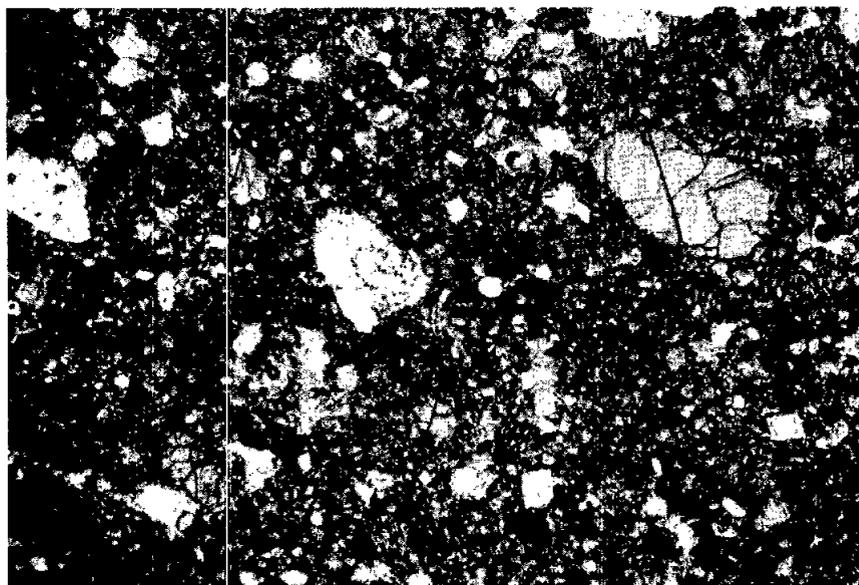
## MINERAL CLASTS, 20-25% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	60 - 70	Anhed	<0.05 - 0.2	Oliv and plag are normally zoned, concentric to irregular grain boundaries. Zones are broad on oliv, thin on plag.
Oliv + minor pyx	30 - 40	Anhed	<0.05 - 0.2	

## LITHIC CLASTS, 1-2% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Hornfels	Most	Ang	0.2 - 0.3	Plag aggregates, with or without minor mafic inclusions.
?	1 clast	Ang	0.3	

ADDITIONAL COMMENTS: Thin sections are restricted to matrix of the rock. Subdivisions above refer to recrystallized material ("matrix") angular debris ("clasts"). All proportions are visual estimates, which are very difficult to make.



Section 76215,7 S-73-19884  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 2/1/73

SECTION: 76215,7

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	< 2	Irreg	To 0.2	Ilmenite outlines determined by adjoining phase, rare rutile and spinel.
Fe-Ni	< 0.1	Blebs	0.01	lamellae in ilmenite. Fe-Ni and troilite have small grain size and are low in abundance.
Troil	< 0.1	Blebs	0.01	
Spin	< 0.1	Lamel.	To 0.05	
Rut	< 0.1	Lamel.	To 0.03	

THIN SECTION DESCRIPTION

BY: Marvin

DATE: 2/22/73

SECTION: 76230,11

NOTE: This section was made from one of the small chips removed from the same documented bag as eight similar large chips (76235 - 76239, 76305 - 76307; their binocular description follows this description) and is typical of all of these chips, which were all collected from a large boulder.

SUMMARY: The original rock, perhaps an anorthositic gabbro, has been crushed and recrystallized with no apparent displacement. The large relict plagioclase and pyroxenes (opx) are separated by streaks and wisps of largely feldspathic cryptocrystalline material and by irregular masses of the pale yellow mafic silicates which, in reflected light, have the texture of swiss cheese. Some 25% of the bulk rock appears to have melted and crystallized at a late stage to interstitial pyroxene enclosing plagioclase.

## MATRIX, 70% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	85	Subhed-euhed	0.03x0.05	Plag is enclosed in late stage, poikilitic pyrox.
Oliv	15	Anhed-subhed	0.1	Oliv is associated with pyrox, and also as minute inclusion in the large plag clasts.
Opa	0.2	Irreg	0.05	Mostly metal

## MINERAL CLASTS, 30% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	95		0.5x0.5	Plag as large, relict clasts.
Pyrox	5		0.2x0.3	Pyroxene occurs as large relict clasts (only 2 or 3 in section), and as late grains poikilitically enclosing plag clasts.

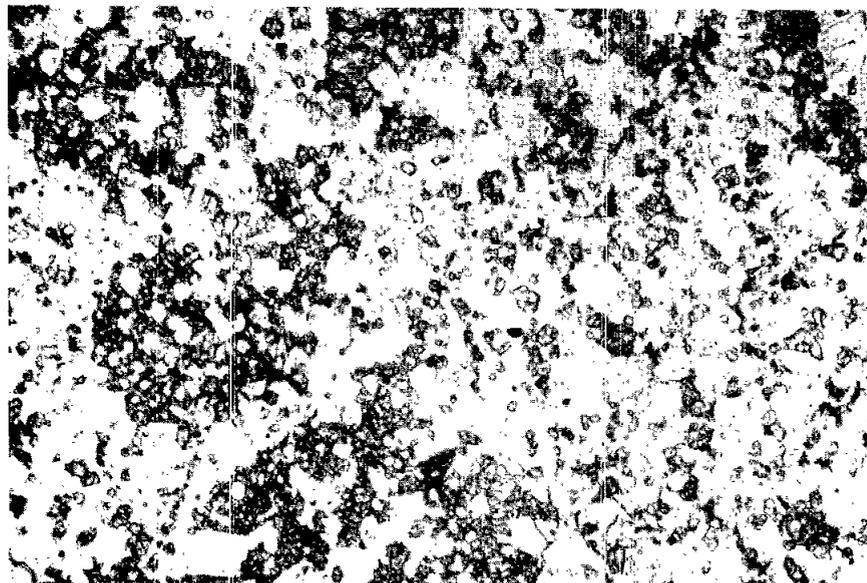
OPAQUES DESCRIPTION

BY: Brett

DATE: 2/8/73

SECTION: 76230,11

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Fe-Ni	< 0.2	Blebs & ang	To 0.05	Oxide content as low as in any Apollo 17 rock. Metal as rounded to irregular blebs.
Troil	< 0.1	Blebs	To 0.05	Troilite as irregular blebs which contain rare metal.
Ilm	Tr	Irreg	To 0.15	Ilmenite is Mg-rich in somewhat rounded irregular grains, some of which are intergrown with Cr-spinel also rare grains of Cr-spinel by itself.
Cr-Sp	Tr	Irreg	To 0.05	



Section 76230,11 S-73-19990  
Width of field 3.16 mm, plane light

76235 - 76239, 76305 - 76307

ROCK TYPE: Metaclastic	WEIGHT: 81.24 g total for 8
COLOR: 76305 is chalky white, other	chips of similar lithology,
seven are very pale gray (N8)	all from a restricted area
SHAPE: Fresh fractures are angular,	on a boulder.
exposed surfaces are rounded.	DIMENSIONS: 5 x 3 x 2 cm to
COHERENCE: Intergranular - Coherent	1.5 x 1.5 x 0.5 cm
to tough, except 76305 which is	
more friable.	
Fracturing - Penetrative fractures common	
NOTE: Thin section descriptions that apply to these samples are given	
under 76230,11.	
<u>BINOCULAR DESCRIPTION</u>	BY: Marvin DATE: 1/26/73

FABRIC: Fine-grained rock; appears crushed and annealed.  
 VARIABILITY: Nearly homogeneous, but minor variations in grain size.  
 SURFACE: Exposed surfaces rounded to hummocky and thinly coated with brownish to olive-gray material.

ZAP PITS: Many on exposed surfaces; pits in brownish-gray coating are lined with greenish gray glass (5GY 7/2 - 5Y 6/1); pits in patches of uncoated surface have linings of colorless glass. Both varieties present on 76236 and 76305. There are no exposed or pitted surfaces on 76235 or 76306.

CAVITIES: Small (<1 mm) irregular vugs common; all "fresh" fracturing has occurred along joint planes; many of these are micromiarolitic surfaces with small drusy crystals, mainly plagioclase and metal, exposed in shallow recesses. Other surfaces are thinly coated with white powder and show microslickensides. Thin veinlets of black glass were observed in 76235, 76237, 76305, 76306.

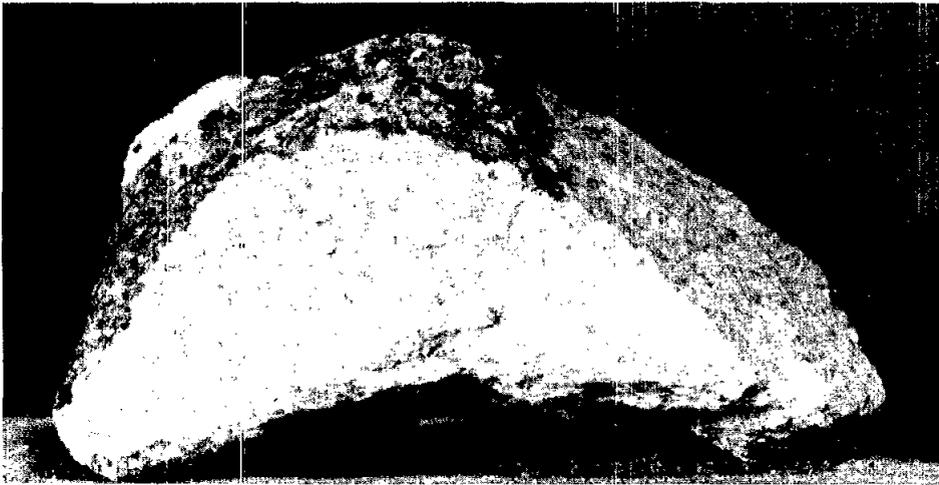
GENERAL DESCRIPTION: The parent clast of these eight chips has been crushed, recrystallized, and shot through with miarolitic fractures and glassy veinlets. It has also been cataclastically deformed after recrystallization so that some fracture planes are coated with "mylonitic" white powder and slickensided. On the Moon, Schmitt called the texture aplitic. The reason is obvious; the rock has a mottled appearance with small (0.5 - 1 mm) white plagioclases in a webby grayer groundmass. Pale yellow-green mafic silicates are also disseminated throughout the rock. The mode is difficult to estimate because the mafic silicates are so pale as to be easily confused with crushed plagioclase. Black opaques occur as minute, disseminated specks; metal occurs as sparse subhedral grains.

SPECIAL FEATURES: 76238 has one very large (5 mm) porphyroblast of a pale yellow-green silicate with a fine-grained sugary texture and minute opaque inclusions. 76236 has one large (1 mm) tabular crystal of metal in a vuggy area of a fractured surface.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White to vitreous gray	50-55	Lenti- cular	1		
Maf sil	Very pale yellow green	35-40		<1		1
Maf sil	Tawny yellow	5		1		2
Opagues	Black	<2		0.5		
Metal		<1		0.1		
Glass	Black					3
	Colorless					4

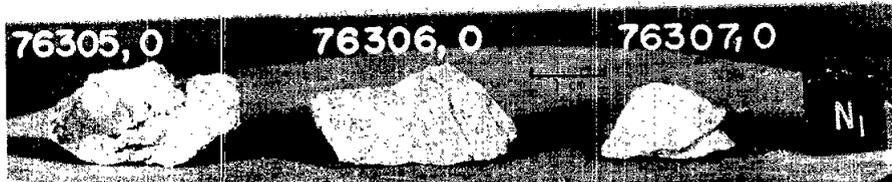
NOTES:

1. Orthopyroxene(?)
2. Olivine(?)
3. Very thin veinlets.
4. Very thin veinlets and stringers.



Sample 76239 N<sub>1</sub>

S-73-16712



Sample

76305

76306

76307

S-73-16711

ROCK TYPE: Tan breccia  
 COLOR: Gray (N5 to N6)  
 SHAPE: Subhedral  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 8.24 g  
 DIMENSIONS: Two pieces:  
 2 x 2 x 1 cm  
 1 x 1 x 0.5 cm

BINOCULAR DESCRIPTION

BY: Morrison

DATE: 3/23/73

FABRIC: Annealed  
 VARIABILITY: Homogeneous  
 SURFACE: Hackly  
 ZAP PITS: All surfaces appear to be pitted  
 CAVITIES: 15 - 20% as spherical vesicles, 2 - 3 mm.  
 SPECIAL FEATURES: Similar to 76246, except it appears to have less well-developed mafic porphyroblasts.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Mineral	Pale green	Tr	Rnd	1.5		1
Metal	Silver	Tr	Rnd		Up to 1	
Matrix						
Plag	Gray	40	Irreg	<1		
Maf sil	Pale green	20-30	Rnd	<1		2
Maf sil	Yellow					
Opaq	Black	5	Irreg	<<1		3
Plag	White	20-25	Irreg	<<1		

## NOTES:

1. Spheroidal with waxy luster.
2. Pyroxene, incipiently porphyroblastic.
3. Homogeneously distributed.



Sample

76245

N<sub>1</sub>

76245

S-73-17977

ROCK TYPE: Tan breccia  
 COLOR: Gray (N5-N6)  
 SHAPE: Angular, blocky  
 COHERENCE: Intergranular - Tough  
             Fracturing - None

WEIGHT: 6.50 g  
 DIMENSIONS: 3 x 2 x 2 cm

BINOCULAR DESCRIPTION

BY: Morrison

DATE: 3/23/73

FABRIC: Annealed, appears porphyroblastic  
 VARIABILITY: Homogeneous matrix  
 SURFACE: Hackly  
 ZAP PITS: Dust impedes observation, but some on W; none on S.  
 CAVITIES: 15 - 20% as spherical vesicles, 1 - 6 mm.  
 SPECIAL FEATURES: This rock identical to 76245 except for some  
 variation in the matrix modes.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
Mineral	Waxy pale green	Tr	Ang	4x6		1
Lithic? Mineral	Black	Tr 5	Rnd	2		2
Metal			Sphere		Up to 1	
Matrix						
Maf sil	Pale green	30	Rnd	≤1		3
Dark mineral	Black to dark gray	20-30	Elong irreg	<1		4
Plag	Gray white	30-40	Irreg	<1		

## NOTES:

1. Appears to be a polycrystalline mafic aggregate; two of these seen.
2. May have reaction rim.
3. Forms porphyroblasts.
4. Forms angular grains and patches, pyroxene(?).

THIN SECTION DESCRIPTION

BY: Simonds

DATE: 1/26/73

SECTION: 76250,5

NOTE: This thin section shows two separate chips that were removed from the residue of the bag that contained rock 76255 (binocular description follows this one). The chips almost certainly came from the rock: one was chosen to represent the granular matrix of 76255 and the other the dark gray clasts.

SUMMARY: Breccia with unusually coarse, granular matrix containing very fine-grained, dark gray clasts. The light colored, granular matrix part has 23% porosity and is remarkable in the complete lack of grains less than 10  $\mu$ m across. It's matrix consists of an open framework of crystalline grains. The dark gray clast, on the other hand, has only a few percent porosity in the form of sub 10 $\mu$  spherical holes and it's matrix consists of devitrified glass with an almost cherty texture. This matrix, which almost certainly was a liquid, is about 50% feldspar and 50% mafic minerals, all less than 10 $\mu$  across. The porous, light-colored, granular breccia is described below. Mineral and porosity proportions were determined by 200 point counts.

## MINERAL CLASTS, 96% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	56	Subang	0.05	There is no true fine-grained matrix to the rock so all is considered mineral clasts. Plagioclase in some of the larger grains have planar zones of red tinted fluid inclusions, and few if any shock features.
Opx	44	Subang	0.05	
Metal	Tr	Spheres	<0.01	
Troil	<1	Irreg		
Ilm	<1	Thick plates	<0.1	

Orthopyroxene - some are exsolved pigeonite or Bushveldt type with coarse augite blebs, a second type of exsolved pigeonite has simple parallel lamellae of augite.

Ilmenite has exsolution lamellae of rutile, spinel, and small amounts of Fe-Ni, best seen in light colored portion of rock.

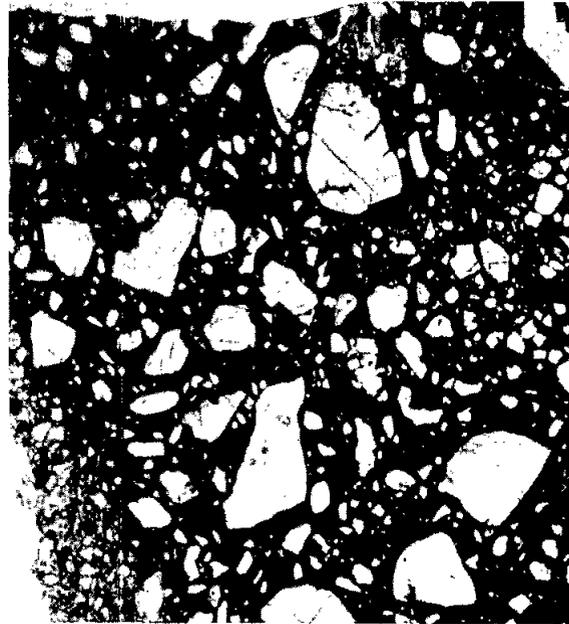
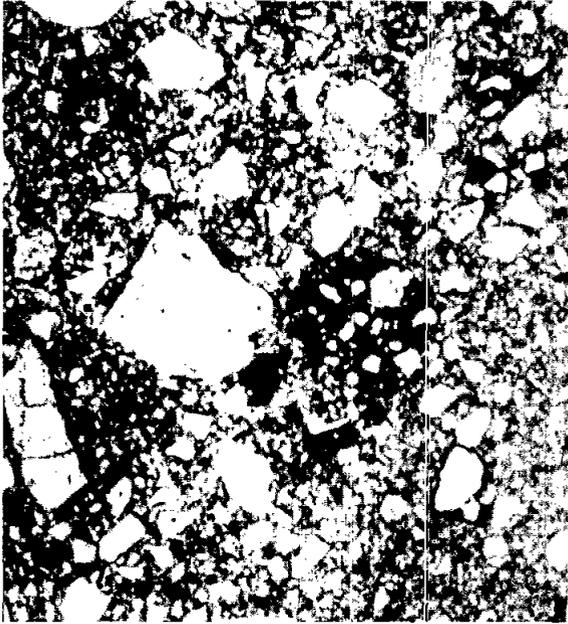
Troilite - irregular patches. Fe-Ni - some show blebs of troilite inside.

## LITHIC CLASTS, 4% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Dark matrix breccia	100		0.5 - 1	This clast type is characterized by a fine chert-like matrix of irregular <10 $\mu$ plagioclase and pyroxene with fine plates of ilmenite.

The feldspar clasts in the lithic breccia clast are almost all shocked and

some show recrystallization to single feldspar crystals at the margins of large relict feldspar clasts. The fraction of large mafic mineral clasts is smaller than in the light colored, granular matrix of the rock as a whole.



Matrix chip

Dark gray clast chip

Section 76250,5 Width of field of each view, 2.7 mm, plane light

OPAQUES DESCRIPTION

SECTION: 76250,5

BY: Brett

DATE: 2/9/73

<u>PHASE</u>	<u>SECTION</u>	<u>SHAPE</u>	<u>SIZE</u> (mm)	<u>COMMENTS</u>
Ilm	2 - 3	Rnd	To 0.25	Some rutile and spinel lamellae in ilmenite, but apart from that a dull section for opaque minerals. Noteworthy that nearly all opaques are rounded clasts rather than recrystallized.
Ulvo	Tr	Rnd	To 0.05	
Fe-Ni	Tr	Rnd	To 0.05	
Troil	Tr	Rnd	To 0.05	
Spin	Tr	Rnd	To 0.05	
Rut	Tr	Rnd	To 0.05	

ROCK TYPE: Bedded polymict breccia      WEIGHT: 406.6 g  
 COLOR: Variable from N8 to N3, all      DIMENSIONS: 6 x 8 x 11 cm  
       shades of gray with an olive hue  
       in places.

SHAPE: Irregular

COHERENCE: Intergranular - Variable, tough to coherent  
           Fracturing - Penetrative, perpendicular to B

NOTE: Thin section descriptions that apply to this sample are given in 76250,5.

BINOCULAR DESCRIPTION      BY: Horz and Simonds      DATE: 1/16/73

SURFACE: B is freshly broken and hackly; S is crushed, smeared white material; N, E, W, and T are rounded and covered with brown adhering coating. Black clasts are more resistant and stick out of matrix which is selectively eroded.

ZAP PITS: None on B and S; many on N, E, W and T.

CAVITIES: None

SPECIAL FEATURES:

(1) Clastic breccia. Sugary matrix with obvious foliation of alternating layers of different grain size and modal composition, dominated by the presence or absence of dark, aphanitic clasts.

(2) S face: finely powdered white material is densely packed against the rock surface resembles slickenside. Definitely coating and not clast. Too fine grained to determine composition, but it has occasionally greenish hue. The thickness of this coating is about 0.1 to 0.5 mm.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White- gray	55	Ang	0.3	0.1 - 1	1
Pyrox and oliv(?)	Green- yellow	20	Ang	0.3	0.1 - 1	1
Ilm	Black	1	Ang	0.2	0.1 - 0.5	1
Metal	Silver, bluish tarnish	Tr	Ang	0.1	?	1
Lithic	Medium to dark gray	20	Ang	0.4	0.1 - 1	2
Breccia	Medium gray	5	Irreg		2x3x4	3

NOTES:

1. Components of matrix: the matrix seems to have bimodal grain size distribution, the "cement" is sugary and too fine-grained for description, the modal estimates are based on coarser components of matrix.

2. Vitreous to aphanitic; variety of recrystallized breccias, melts, multiple breccias.
3. It has two main parts. On the W side of the B surface, the clast mostly dark flinty material with white sugary clasts which are aligned giving the appearance of a rind of dark finely-ground material especially as seen on the weathered top surface. Examination of the bottom shows that this rind is not continuous. The E half of the clast is made of powdery medium gray clastic breccia. Most of the clasts in this part are a medium dark gray flinty-lustered material, with a few mineral clasts of brown and green mafic silicate. Lithic clasts up to 5 mm are present and consist of granular vuggy "basalt" with an average grain size of 0.3 mm. These lithic clasts made up of plagioclase, ilmenite and brown mafic silicate. The W end of the clast appears to be intruded by the granular matrix of the bulk of the rock.



Sample 76255

S-72-56415

ROCK TYPE: Impact melt  
 COLOR: Greenish gray (5GY 6/1)  
 SHAPE: Triangular slabby chip  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few non-penetrative

WEIGHT: 1.75 g

DIMENSIONS: 2 x 1.5 x 0.7 cm

BINOCULAR DESCRIPTION

BY: Agrell and Agrell

DATE: 3/30/73

FABRIC: Equigranular

VARIABILITY: Uniform

SURFACE: One surface has a few glass lined zaps, otherwise fresh, hackly. Other surface has many small zaps with chalky haloes; vugs on this surface contain zaps, one Fe metal crystal in vug has a zap pit with rim.

ZAP PITS: Few on one face (size 1 mm), many on the other main face (size <0.2 mm, see above).

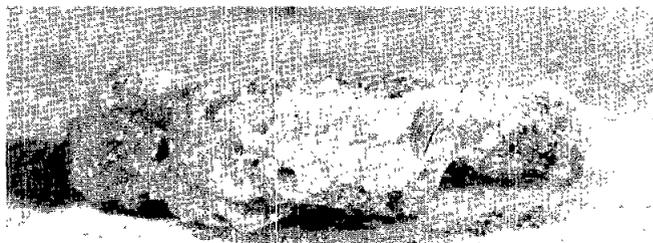
CAVITIES: 10% - 15%: 0.5 - 2.0 mm, rounded and irregular cavities with sugary crystal lining. Both iron metal and troilite may occur as isolated single crystals in some of the vugs.

SPECIAL FEATURES: Two exterior surfaces: one with more extensive impact history than the other.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix						
Plag	Pale gray	47	Interstit	0.1		
Pyrox	Very pale fawn	47	Rnd	0.2		1
Opaq	Black	1-2	Gran	0.05		
Oliv	Pale green	<0.5		0.1		
Mineral clasts						
Plag	C'less	4.5	Subang	<0.5		
Oliv	Pale green	<0.5		<0.2		

## NOTE:

1. Opx cikocrysts?



1 cm

Sample 76265 S<sub>1</sub>

S-73-21767

ROCK TYPE: Blue-gray dense polymict breccia  
 WEIGHT: 55.93 g  
 DIMENSIONS: 6.8x4x3 cm  
 COLOR: Medium bluish-gray (5B 5/1)  
 SHAPE: Disc-shape with tapered N, E, W edges  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

BINOCULAR DESCRIPTION BY: Agrell and Simonds DATE: 1/5/73

FABRIC: Microbreccia, veined  
 VARIABILITY: Marked  
 SURFACE: T is irregular, B and S are hackly fresh. N, E, and W are feather edges. Part of T is a broken face (hammer mark).  
 ZAP PITS: Many with dark glass lining on T; others none.  
 CAVITIES: <1% spherical vesicles in blue-gray material. One highly vesicular fragment with 20% pores lined with felted crystals.  
 SPECIAL FEATURES: Blue-gray hornfelsed microbreccia is shattered and not veined in two stages: first, gray veins and second, very light gray veins. Both contain blue-gray hornfels fragments and its associated clasts in all stages of disruption. The veins contain minute clasts which are dominantly plagioclase and subordinate mafic silicates. The veins, particular the very light gray type, appear as introduced liquid rather than crush material generated in situ.

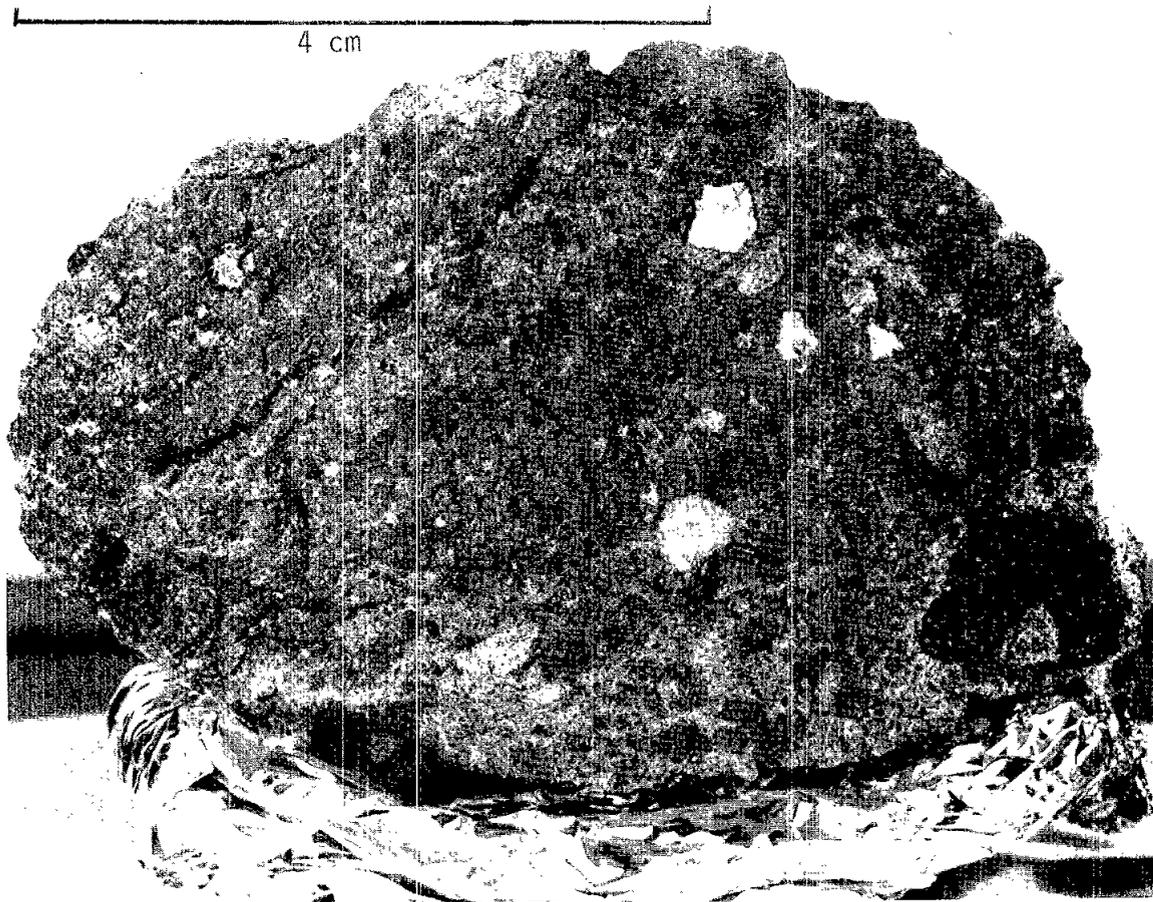
<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Body of Rock						
Matrix	Blue-gray	30		0.1		1
Plagioclase	White	8	Ang	0.1-0.25	0.1-2.0	2
Pyroxene	Brown-gray	2	Ang	0.1-0.25		3
Olivine	Pale green	< .5	Ang	0.1-0.25		
Opaque	Black	Tr	Rnd	0.1		4
Lithic IV	Glassy	< 1	Rnd		< 4	5
Lithic V	White	< 1	Rnd		2 - 4	6
Lithic VI	Pale	< 1	Irreg		10	7
Lithic VII	Medium	< 1	Subrnd		3x2	8

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Veins	Pale gray	10	Veins		< 0.15	9
Veins	Very light gray	20	Veins		< 0.2	10
Clasts in Veined Area						
Lithic I	Blue- gray	20	Subang- equant	4	2-5	11
Lithic II	Dark gray	Unique clast			1x0.75	12
Lithic III	Brownish gray	Unique clast	Subang		3	13

## NOTES:

1. Fine-grained hornfels microbreccia.
2. 2 mm pale gray feldspar.
3. Also in veins with more in the S end veins.
4. No metallic luster.
5. Sugary recrystallized feldspar.
6. Anorthositic granulite with <5% mafic silicates, waxy luster, 4 large clasts have dark "reaction rim." Microgranulitic anorthositic hornfels contain from 5 - 10% mafic silicates. The feldspar is somewhat waxy in luster, a thin skin of "black" glass on some form of reaction rim is common.
7. Anorthositic gabbro is unique clast on NE edge of bottom face, grain size 0.25 mm. 50% vitreous gray ferromags, 50% white plagioclase.
8. Unique clast, vesicular microcrystalline "gabbroic anorthosite." This clast is vesicular and represents a quenched melt product same composition as Lithic Group V.
9. Net veins of dominantly feldspar as 0.1 mm equant grains with minute mineral clasts. The N end of rock has 40% of these.
10. Slightly coarser than N end, feldspathic net veins with equant grains. The fragments surrounded by veins are more clearly defined than at N end. The S end of rock has 50% of this.
11. Clast identical with body of rock. Blue-gray fragment in veins shows some sign of recrystallization against the vein material - all contacts being tightly welded.

12. Vesicular fine-grained, dark gray. Composes 5% of B face. Fine-grained aphanitic vesicular basalt with 20% vesicles with smooth lining. Some flow alignment of feldspar. This basaltic fragment contains a 1.5 mm angular fragment of microgranular recrystallized anorthositic gabbro.
13. Crystalline basalt, miarolitic. Brown basaltic fragment with tabular plagioclase with a small amount of interstitial pyroxene. The plagioclase crystals project into voids, may be partially glass coated. Appearance is as if interstitial liquid had drained away.

Sample 76275 B<sub>1</sub>

S-73-15081

76285

ROCK TYPE: Agglutinate of dark matrix  
breccia fragments  
WEIGHT: 2.208 g  
DIMENSIONS: 3 x 1.5 x 1.5 cm  
COLOR: Medium gray (N5)  
SHAPE: Irregular  
COHERENCE: Intergranular - Friable

BINOCULAR DESCRIPTION

BY: Butler

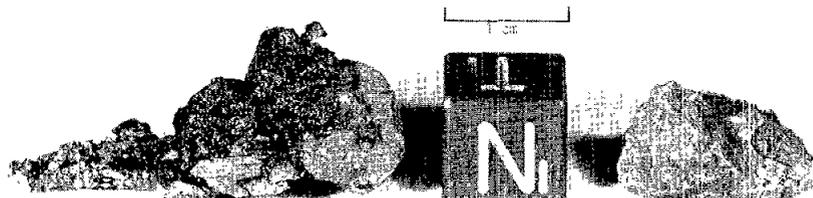
DATE: 4/6/73

VARIABILITY: The breccia fragments are all of the same type  
SURFACE: The glass is shiny  
ZAP PITS: None  
CAVITIES: The glass is bubbly

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Glass	Gray, brown	10	Coating, interfrag- mental			1
Plag clasts	White	10	Ang to irreg	0.2	Up to 2	2
Matrix	Brownish gray	80		<0.1		3

## NOTES:

1. The glass shows two colors - reddish brown and medium dark gray - complexly mixed on a mm scale.
2. Most are chalky white, a few are pale gray and vitreous. A few appear to have specks of colored minerals and so may be lithic clasts.
3. About 20% is recognizable black and brown glass; 30% is plagioclase and light lithic fragments; the remaining 50% is unresolvable, but the color suggests a high content of brown glass.



Sample 76285

76286

S-73-20182



BINOCULAR DESCRIPTION

BY: Marvin and Ridley

DATE: 1/5/73

FABRIC: "Igneous"-looking light brown, fairly fine-grained and uniform matrix but contains some noticeably coarser areas. Blue-gray breccia occurs in angular clasts, lenticular masses and irregular stringers.

VARIABILITY: Extreme

SURFACE: N and part of T - fresh; S smeared with fine-grained, buff-colored material which is probably result of abrasion of rock along fracture.

ZAP PITS: B has 20 - 25/cm<sup>2</sup> large pits and even more small pits. E has similar density of pits in one small area of exposed surface; other surfaces are interior fractures.

SPECIAL FEATURES: The coarse "basaltic" matrix, although clearly pervasive as irregular stringers, in places forms rounded "clots" that show a diktytaxitic texture, with euhedral crystals of deep brown pyroxene, white plagioclase, and thin leaves of black, lustrous ilmenite. Rarely the clots grade into complicated mixture of matrix and gray-blue breccia. The blue-gray breccia is fine-grained, recrystallized, with subangular clasts of anorthosite, troctolite, and abundant mineral fragments (yellowish olivine, fox-brown pyroxene, white and glassy feldspars) and rare chrome-green glass(?). Structure in the breccia is particularly well seen on the fresh south face. Complex relationship between blue-gray and light brown parts of the rock. Some areas show blue-gray with sharp boundaries included in light brown matrix; other areas show complicated interfingering of blue-gray and brown materials without any obvious age relationships. On balance, the blue-gray breccia is considered to be older than the light brown "basalt" that appears to have engulfed the blue-gray breccia and begun to assimilate it, resulting in complex, "fuzzy" boundaries between the two rock types. The rock as a whole consists of at least three generations of material: (1) "foreign" clasts in (2) blue-gray breccia invaded by (3) light brown "basalt."

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Light brown "basaltic"	65				See "Special Features"
Breccia clasts	Blue gray	35				See "Special Features"

Clasts of the following types occur within the blue-gray material

Anorthosite	White		Ang to whorl- shaped (T)	2-10	1	
-------------	-------	--	--------------------------------------	------	---	--

Dark lithic	Dark bluish gray		Ang to subrnd	2-10	2
Troctolite	White	Rare		5	3

## NOTES:

1. Variable grain size and luster. One clast grades into a coarser part composed of 70% plagioclase, 30% brown pyroxene, and minor ilmenite.
2. Very fine-grained, homogeneous. Numerous tiny vesicles (well seen on N face). Some clasts have dark reaction rims.
3. Fine-grained white feldspar, rather coarser pale yellow olivine.



Sample 76295

S-72-56409

76305-76307

These samples were described as a group with 76235-76239.

76315

ROCK TYPE: Metaclastic rock

WEIGHT: 671.1 g

COLOR: Gray greenish gray (2GY 6/1)  
and medium dark gray (N4)

DIMENSIONS: 10 x 12 x 4.5 cm

SHAPE: Flat disc

COHERENCE: Intergranular - Dark tough, light slightly friable  
Fracturing - Few, non-penetrative

BINOCULAR DESCRIPTION

BY: Gooley and Simonds

DATE: 1/19/73

## FABRIC:

VARIABILITY: Made of two parts: one light greenish gray (20%), and the other a dark neutral gray (80%).

SURFACE: E and B are fresh; T, N, S, and W are subrounded.

ZAP PITS: Many (lined with lighter colored glass) on T, N, S, and W; none on E and B.

CAVITIES: Abundant, <0.1 mm, round and a few elongate vugs in darker part of rock.

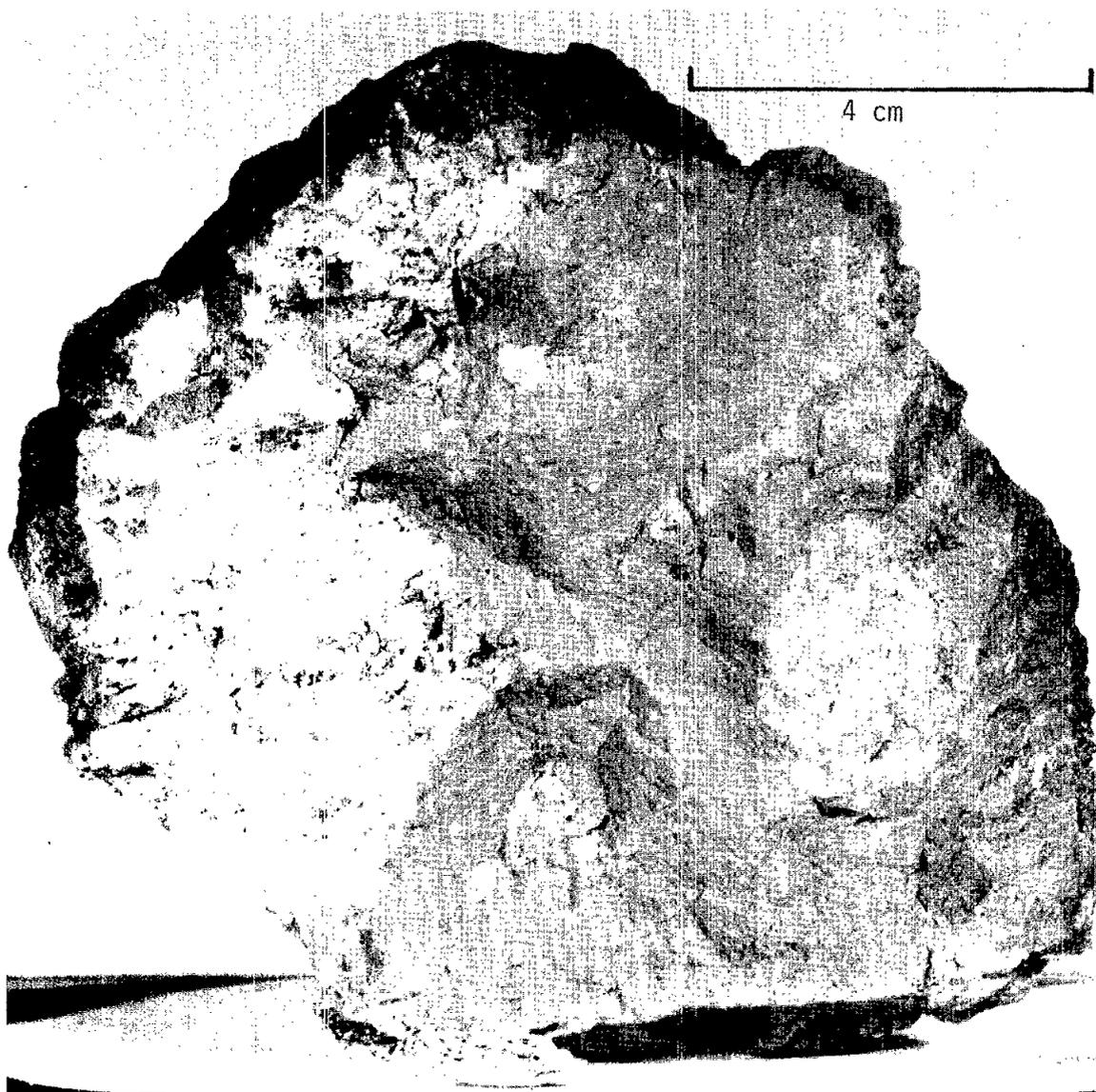
SPECIAL FEATURES: The dark colored portion may or may not intrude the lighter part, the relations are not clear from fresh surface.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Dark gray part						
Matrix	Medium dark gray	80		< 0.1		1
Mineral clasts						2
Lithic clast I	About same as matrix		Ang		About 20x20	3
Lithic clast II						4
Light greenish gray part						
Matrix		15				5
Lithic clast III	Medium dark gray (N4)	4	Ang	1	1 - 5	6
Lithic clast IV	Light gray (N7)	1	Subang	0.7	0.1 - 2	7

## NOTES:

- Has mottled appearance, possibly poikilitic, porosity is about 5% owing to <0.5 mm holes. Matrix is very fine-grained, probably feldspar and pyroxene with about 0.5% opaques (metal and troilite). The size and contrast of light and dark patches (oikocrysts(?)) in the matrix varies unsystematically across the fresh surfaces.
- Traces of olivine (green) in grains up to 1 mm, which are angular in shape. Also clear plagioclase, about same size and shape as olivine.
- One clast, coarser grained, more feldspathic than matrix, patches up to 2 mm long of sugary light-colored silicate. These patches may be oikocrysts or broken single crystal grains.
- Appears the same as the large light greenish gray inclusion, the description of which follows.

5. Composed of about 80% feldspar and 20% green olivine. The olivine ranges from 0.1 - 1.0 mm. The feldspar <0.1 mm - 0.5 mm, mostly <0.1 mm. Metal is absent.
6. The same material as the dark gray part of the rock.
7. Flinty luster to more sugary texture.

Sample 76315 B<sub>1</sub>

S-73-17109

THIN SECTION DESCRIPTION

BY: Simonds

DATE: 3/1/73

SECTION: 76315,11

SUMMARY: Most of the section is a fine-grained diabase with lathy plagioclase and a generally subophitic texture. 10% of this portion of the rock comprises unshocked clasts of feldspar, olivine, pyroxene plus lithic clasts of anorthosite and troctolite. One edge of the section has an annealed breccia with plagioclase, pigeonite, and a pink transparent spinel.

## GROUNDMASS, 90% OF ROCK

<u>PHASE</u>	<u>% OF GROUNDMASS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
Plag	50	Laths	0.02
Oliv	25	Irreg patches	0.01
Pyrox	25	Irreg patches	0.01
Ilm	1	Plates	0.01
Fe-Ni	<1	Equant blobs	0.004
FeS	<1	Equant blobs	0.004

## XENOLITHS--RELICS, 10% OF ROCK

<u>PHASE</u>	<u>% OF XENOLITHS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
Plag	50	Equant, ang - subang	0.02 - 0.5
Oliv	40	Equant, ang - subang	0.02 - 0.15
Pyrox	5	Equant, ang - subang	0.02 - 0.15
Lithic	5	Equant, ang - subang	0.6
Breccia			

COMMENTS: Plag is in unshocked grains or with just a small number of planar features, about half of which are complexly twinned. Lithic clasts are two troctolites with lathy plagioclase and equant olivine, and an anorthosite clast with stubby laths of plagioclase with parallel twins. Breccia is a single clast of ilmenite and an annealed aggregate of plagioclase, pigeonite, and spinel. Grains range in size from 0.01 - 0.25 mm. The breccia is unusual in that it lacks abundant sub-0.01 mm fragments.

TEXTURE: The rock has a fine-grained subophitic texture with plagioclase laths partially incased in the mafics. The minor visible mesostasis in the rock is associated with the ilmenite. A finer grained round patch in the section has the same mineralogy as the rest of the rock and may be either a clast or an indigenous part of the rock.

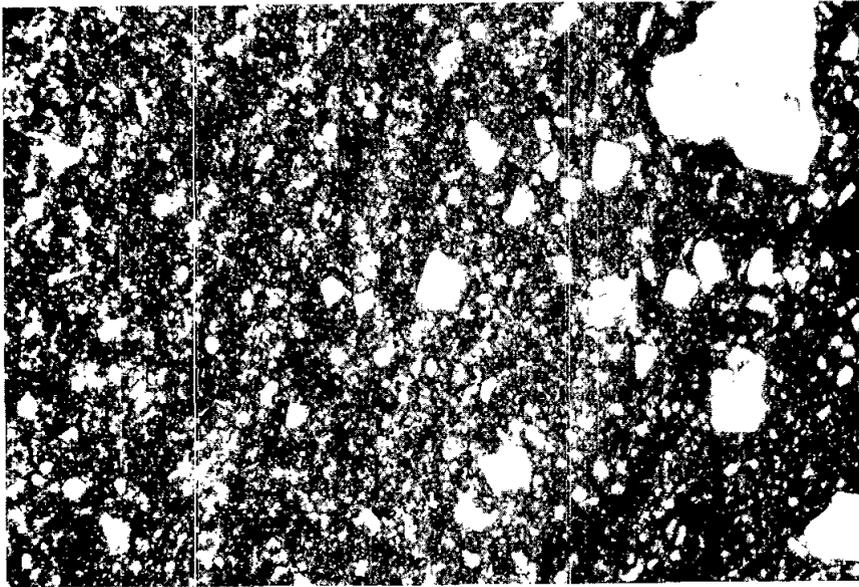
OPAQUES DESCRIPTION

BY: Brett

DATE: 2/16/73

SECTION: 76315,11

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	2	Laths, feathery	0.01	Opaque minerals form bimodal size population: the larger, 2 mineral clasts are usually rounded and commonly greater than 100 $\mu$ ; the matrix opaque minerals are commonly 10 $\mu$ or less. Possible armalcolite.
Fe-Ni	< 0.3	Rnd, ragged	To 0.5	
Troil	< 0.2	Rnd	To 0.2	



Section 76315,11 S-73-19996  
Width of field 3.16 mm, plane light

76335

ROCK TYPE: Anorthositic cataclastic

WEIGHT: 352.9 g

COLOR: Light gray (N7)

DIMENSIONS: 8 x 6.5 x 5 cm

SHAPE: Rounded block

Largest fragment

COHERENCE: Intergranular - Friable with coherent kernels

Fracturing - Many, penetrative and non-penetrative

BINOCULAR DESCRIPTION

BY: Agrell and Agrell

DATE: 3/30/73

FABRIC: Shattered cataclastic

VARIABILITY: Homogeneous

SURFACE: Part dust-coated, part small shatter blocks

ZAP PITS: None

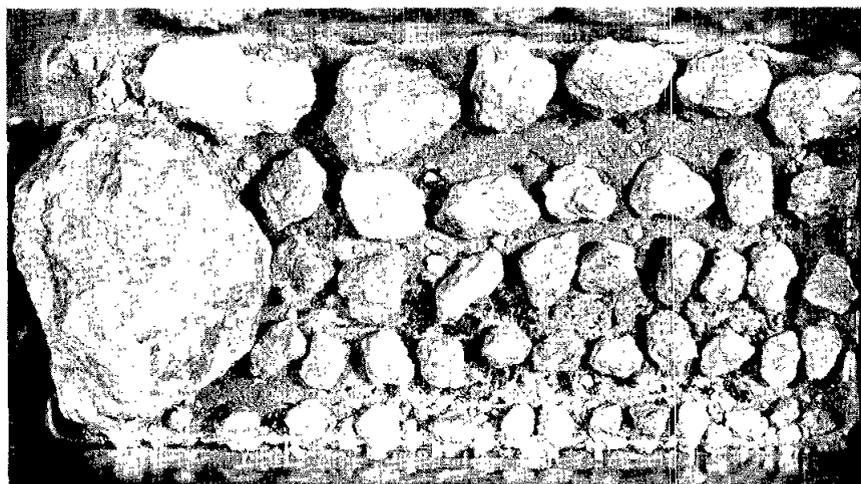
CAVITIES: Nil

SPECIAL FEATURES: The rock is composed of a series of closely packed polygonal blocks about 3 - 5 mm in size. These blocks are formed by intersecting sheared surfaces and the surface of the rock where freshly broken is outlined by these blocks (as in second largest fragment in tray). A few isolated areas up to 0.6 mm in size of slightly coarser, >0.05 mm granular plagioclase and olivine were observed.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	92		<0.05	0.04 - 3	1
Oliv	Very pale green	8		<0.05	0.04 - 2	
Opaq	Black	0.5		<0.05		

## NOTES:

1. Original grain size of plagioclase was 3 - 4 mm, as now represented by equant areas composed of finely crystalline crushed plagioclase. Coarse 2 mm interstitial areas of crushed olivine may occur between the originally larger plagioclase crystals.



Sample 76335

S-73-19384

76505-76506, 76535-76577

(exclusive of numbers ending in digits 0-4)

SAMPLE TYPE: Rocks (fragments >1 cm) from the Station 6 rake (23 fragments) and associated soil (2 fragments).

CLASSIFICATION

BY: Lofgren

DATE: 2/28/73

## NORITE

76535 and 76536

76535 is a coarse-grained (0.5 to 1.0 cm) norite containing about 60% plagioclase and 40% orthopyroxene. It appears to be relatively fresh and unshocked. 76536 has the same mineralogy but is more granulated with only a few relict large grains.

## BASALT

76537-76539

These are typical mare basalts with about 50% clinopyroxene, 30 - 35% plagioclase, and 15 - 20% opaque minerals (mostly ilmenite). 76537 is fine-grained (grain size of 0.1 to 0.3 mm), 76538 is medium-grained (0.5 to 1.0 mm), and 76539 is aphanitic, probably devitrified.

## COHERENT, DARK GRAY BRECCIA

76545-76549

Subangular to subrounded, coherent, dark gray, vitreous breccia. Some are partially coated with vesicular glass which penetrates a few features. Clasts are generally white and angular and comprise about 20% of the rocks. All five fragments are so similar they all might be from the same parent rock.

## TOUGH, CRYSTALLINE BRECCIA

76555-76559

Subangular to subrounded, tough, crystalline, matrix-rich breccia containing only a few percent of millimeter sized clasts which are mainly pyroxene and plagioclase. Some are partially glass-coated.

## FRIABLE, DARK GRAY BRECCIA

76506, 76565-76567

Subrounded, friable, dark gray, matrix-rich breccias containing 5 - 10% white clasts and a few percent lithic or green and black mineral clasts.

## MISCELLANEOUS CRYSTALLINE BRECCIAS

76505, 76568 and 76569, 76575-76577

These rocks comprise a heterogeneous set of subrounded, coherent, crystalline breccias similar to the group 76555-59 but each is a distinctly different type. 76505 is a greenish-gray, matrix-rich breccia with a few mineral clasts. 76568 contains over 50% clasts of basalt. 76569 is a very dark gray, matrix-rich breccia with about 10% mineral clasts. 76575 is a mottled gray breccia with large clasts and about 20 - 30% crystalline matrix. 76576 consists of 70 to 90% very light gray crystalline matrix with mainly plagioclase fragments as clasts. 76577 consists of 40 to 50% very light gray matrix containing generally salt and pepper textured clasts.

76505

ROCK TYPE: Polymict breccia of unique type WEIGHT: 4.69 g  
 COLOR: Light greenish gray (N7 GY 7/1)  
 SHAPE: Equant, irregular  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few, non-penetrative

BINOCULAR DESCRIPTION

BY: Simonds

DATE: 3/21/73

FABRIC: Granular to crystalline  
 VARIABILITY: Substantial variation in ratio of light to dark material.  
 SURFACE: N is fresh; others hummocky with adhering dust.  
 ZAP PITS: None recognized, but should be on T, E, W, S, and B.  
 CAVITIES: None  
 SPECIAL FEATURES: The rock has two principal regions: one of light colored feldspathic breccia (60% of the rock), and a darker region of speckled black and white grains (40%). The contact between the two regions is irregular but rather sharp. The rock does not have a large scale foliation or organization to the light and dark material.



BINOCULAR DESCRIPTION

BY: Lofgren

DATE: 2/28/73

VARIABILITY: Each rock is fairly uniform

ZAP PITS: All have some pits on one or two surfaces; all are pitted on 76576.

CAVITIES: 76577 has irregular distribution and shaped cavities  
5 - 10%; rest none.

SPECIAL FEATURES: The rocks in this group are recrystallized breccias, all broadly similar to the 76555 - 76559 group, but they are distinct from one another. 76568 has a relatively high proportion (&gt;50%) of basalt fragments. 76569 is 80 - 85% dark (almost black) fine-grained to aphanitic matrix with a few large plag and opx(?) crystals. 76575 is a mottled gray breccia, high recrystallized, with large clasts and 20 - 30% crystalline matrix. 76576 is highly recrystallized, and is composed of 70 - 90% very light gray matrix of mineral fragments which are mostly plagioclase. 76577 is similar to 76576, but has larger clasts and a higher proportion of mineral fragments. It is 40 - 50% light gray matrix, and the rest is large (0.5 - 1 mm) salt and pepper clasts. 76505 is greenish-gray breccia with mineral clasts and is very dust-covered.

## 76506

ROCK TYPE: Polymict breccia (tan)

WEIGHT: 2.81 g

COLOR: Dark olive gray (5Y 3/2)

DIMENSIONS: 1.3 x 1 x 1 cm

SHAPE: Equant, irregular with some angular  
broken surfaces

COHERENCE: Intergranular - Tough

Fracturing - Few, non-penetrative

BINOCULAR DESCRIPTION

BY: Simonds

DATE:

FABRIC: Granulated crystalline isotropic

VARIABILITY: Homogeneous

SURFACE: Smooth with a few zaps

ZAP PITS: Few on all; many have glass lining which appears to be very dark red where fractured.

CAVITIES: None

SPECIAL FEATURES: Surprisingly tough rock considering the clastic appearance of matrix, which indicates possible metamorphism.



BINOCULAR DESCRIPTION

BY: Lofgren

DATE: 2/28/73

VARIABILITY: Uniform

SURFACE: Granular - fresh - unshocked

CAVITIES: None

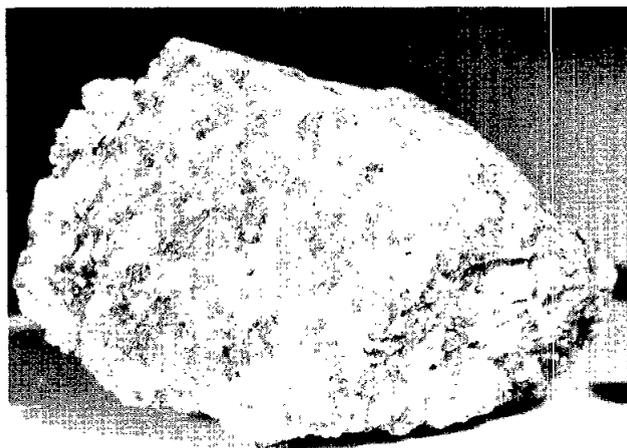
ZAP PITS: Few

SPECIAL FEATURES: 76536 has same mineralogy as 76535 but is finer grained and granulated (probably more shocked); it has some relict large grains.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Trans	60	Tab		5 - 10	1
Opx		35-40	Equant		4 - 8	
Cpx	Apple green	2-3	Equant		0.5 - 1	
Spinel	Dark brown	<1	Irreg		0.1 - 0.3	

## NOTES:

1. Twinning visible.

Sample 76535 N<sub>1</sub> S-73-19456

76537 - 76539

WEIGHT: 76537 - 26.48 g  
76538 - 5.87 g  
76539 - 14.80 g

ROCK TYPE: Basalt

SHAPE: Subrounded, rounded

COHERENCE: Intergranular - 76538 is friable; 76537 and 76539 are tough  
Fracturing - Few; non-penetrative for 76537 and 76539;  
penetrative in 76538

BINOCULAR DESCRIPTION

BY: Lofgren

DATE: 2/28/73

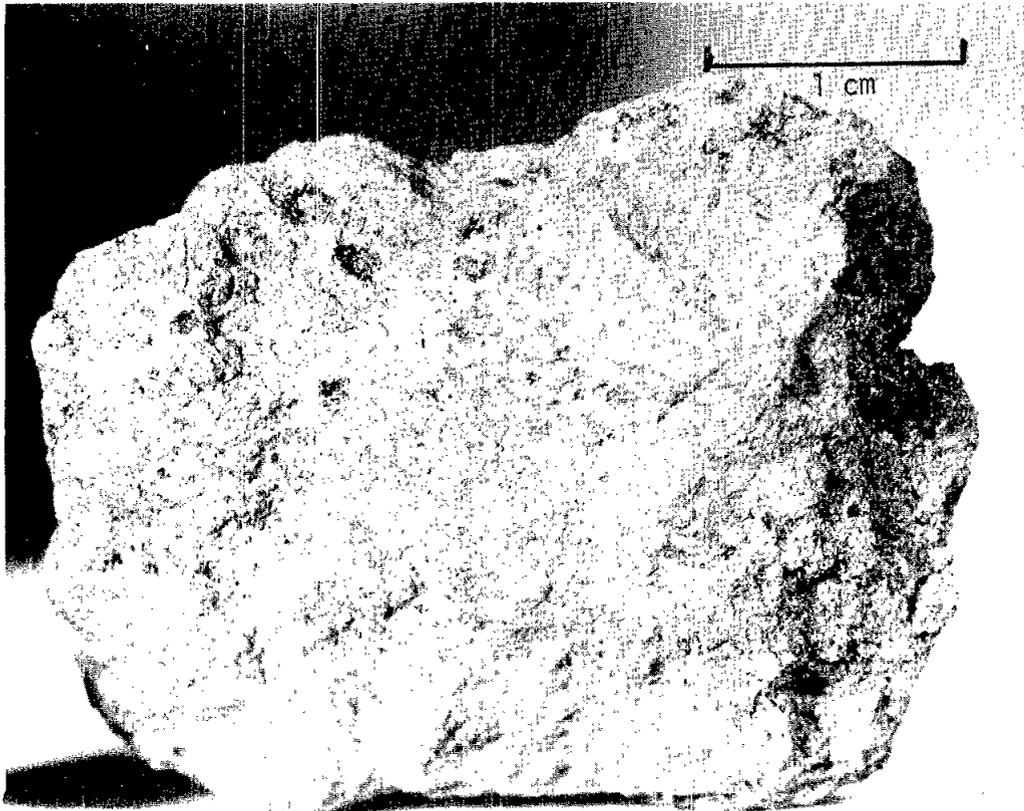
FABRIC: Equigranular

ZAP PITS: Few on all sides of 76537

CAVITIES: None

SPECIAL FEATURES: 76539 is aphanitic and very black, showing only a few cleavage elongate flashes. 76537 is fine-grained (0.1 - 0.3 mm); 76538 is coarser-grained averaging 0.5 mm with ilmenite reaching 1 mm.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	30-35				
Cpx	Honey brown	50-55				
Ilm	Black	15				

Sample 76537 T<sub>1</sub>

S-73-19733



ROCK TYPE: Crushed anorthositic gabbro                      WEIGHT: 1730 g  
 COLOR: An-gabbro - light gray to greenish                      DIMENSIONS: 17 x 12.5 x 9 cm  
           gray (N7-5GY 8/1). Glass - dark gray  
           (N3).  
 SHAPE: Subrounded, knobby  
 COHERENCE: Intergranular - Tough  
               Fracturing        - One non-penetrative

BINOCULAR DESCRIPTION

BY: Agrell and Marvin

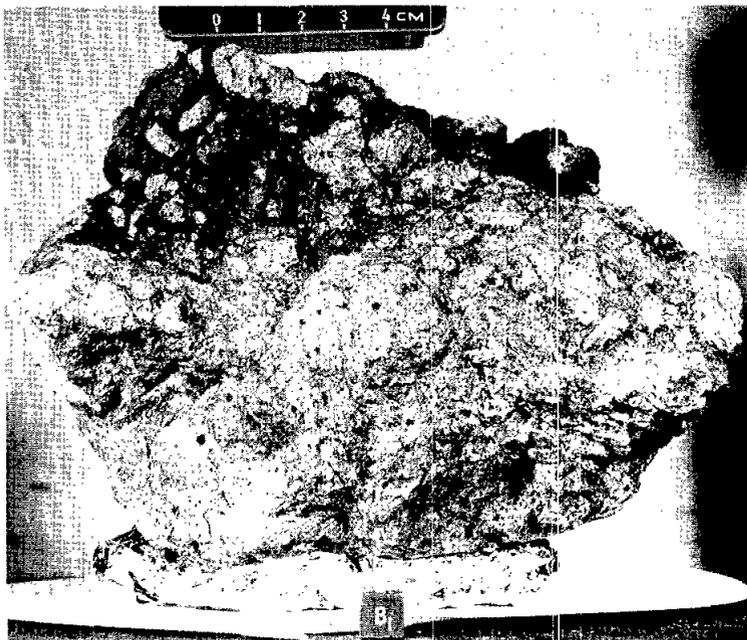
DATE: 2/23/73

FABRIC: Cataclastic, veined and disrupted by glass.  
 VARIABILITY: Two components: glassy and gabbroic.  
 SURFACE: N and T rubbly, dominantly vesicular dark glass (50%) coating and invading 2 - 0.5 cm fragments of an-gabbro (50%). B, W, and S dominantly shattered an-gabbro, net-veined in part by thin (1 mm) glass veins which decrease in abundance from N face to south face.  
 ZAP PITS: Many on E, S, and B; few on T, W, and N. Zaps occur both on glass and more abundantly on an-gabbro, on which the zap glass is almost colorless or very pale gray.  
 CAVITIES: None in the an-gabbro. Vesicular and cavernous cavities form 15% of the glass-rich portion.  
 SPECIAL FEATURES: Anorthositic gabbro is brecciated and invaded by glass. The first stage of brecciation is shown by 0.1 mm wide gray glass veins which break the rock up into polygonal fragments with no visible displacement. As the brecciation becomes more intense, the gray veins become wider and include many fragments of anorthositic gabbro. The fragments being more rounded in the wider veins. The veins pinch and swell and gradually expand into the rubbly glass brecciated zone covering the N face of the sample. The rubbly zone varies from 90% glass, 10% An-gabbro clasts, to 20% glass, 80% An-gabbro clasts. In it the clasts are angular to rounded and from 0.1 - 2 cm in size, and the glass is darker than in the narrow veins, in the An-gabbro. Broken fresh surfaces have a silky appearance as if devitrified. Vesicles compose about 20% of glass and, between larger clasts, the glass may be cavernous as if the glass coating had to fill the voids between the fragments.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	70 - 90	Blocky	0.5	0.1 - 1	1
Maf sil	Grayish yellow	10 - 30	Anhed	0.5	0.05 - 1	2
Opaq	Black	<0.5	Rnd	<1		
Oxides metal	Silvery	<0.5	Rnd	<0.5		

## NOTES:

1. Most of plagioclase is chalky white and probably shocked. Lens-like areas occur relatively free of crushing where blocky fracture of vitreous plagioclase and interstitial mafic silicate are clearly seen. These isolated lenses about 3 mm wide are set in finely crushed plagioclase and mafic silicate (pyroxene).
2. Pyroxene.



Sample 77017

S-73-1772

THIN SECTION DESCRIPTION

BY: Agrell

DATE: 2/19/73

SECTION: 77017,11

SUMMARY: Anorthositic olivine gabbro, subject to extensive cataclasis and cut by glass veins of variable composition. Residual areas of uncrushed anorthositic-olivine-gabbro are set in a matrix of crushed rock of the same composition. The original rock is characterized by idiomorphic plagioclase and hypidiomorphic olivine closely packed in poikilitic plates of clinopyroxene. The cataclasis of the gabbro and the veins belong to the same dynamic episode.

## UNCRUSHED GABBRO:

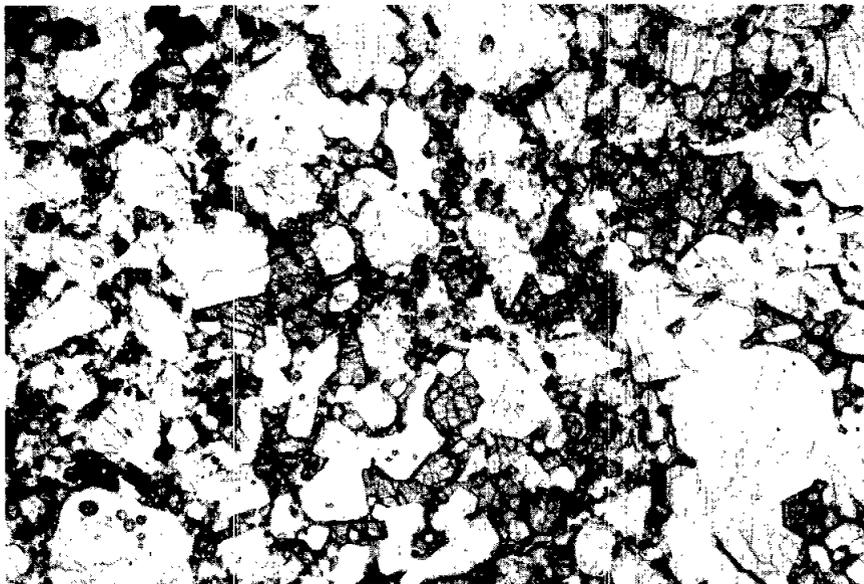
PHASE	% OF UNCRUSHED		SIZE (mm.)	COMMENTS
	AREAS	SHAPE		
Plag	65	Equant	0.5 - 1.5	Olivine -2V is very large, occurs as rounded crystals, sandy yellow in color, nearly always in clinopyroxene.
Oliv	9	Rnd	0.3 - 0.5	
Cpx	24	Inters	0.2 - 2.5	
Opa	1	Blocky to inters	0.1 - 1.0	
Troil	0.5	Inters	0.2	Plagioclase-anorthosite, idiomorphic, blocky crystals with sparse twinning may included rounded drop-like 25 $\mu$ crystals of olivine. There is indication
Metal	0.5	Patchy	0.2	

of variation in amount of plagioclase. In one uncrushed area, it exceeds 90% with about 10% interstitial clinopyroxene.

Pyroxene - pigeonite to subcalcic augite (+2V 5°-40°), pale straw in color with narrow exsolution lamellae of hypersthene, possible same are shocked lamellae. The clinopyroxene occur in oikiocrystal plates enclosing several plagioclase and rarer olivine crsytals. Its relation to plagioclase and olivine could be described as interprecipitate.

Ilmenite - isolated interstitial crystals. In one case a 1 mm crystal poikilitically enclosed plagioclase and olivine.

Metal - Fe-Ni alloy occurs interstitially and may be associated troilite.



Section 77017,11 S-73-20006  
Width of field 3.16 mm, plane light

CRUSHED AREAS: The crushing is without significant displacement of material as the gross primary texture is preserved in the crushed areas. The plagioclase-pyroxene boundaries are the first contacts to respond to crushing. A granulitized mosaic, set with large mineral clasts and pseudomorphing the initial texture of the rock is first produced. More extensive crushing, usually localized to narrow zones, gives a very fine-grained cataclasite with residual mineral clasts much smaller than the original grain size. All the minerals in the crushed rock show cataclastic and shock features: undulose extinction, secondary twinning, partial maskelynitization (plagioclase), mosaicism. Shredding shock-melting are shown by Fe-Ni metal and troilite.

VEINS: The rock is fragmented and cut by glass veins with straight to curved margins. The veins show a continuous variation of types from (1) frothy vesicular dark glass at the exterior through (2) fawn-colored vesicular glass to (3) pale gray glass at the sides, in the narrowest parts or ends of some of the veins.

Type 1. Highly vesicular (25%) partially devitrified dark gray brown glass with from 10-70% lithic clasts and some mineral clasts. Devitrification locally renders the glass opaque. Flow banding and chemical inhomogeneity is revealed by refractive index variations.  $2\mu$  to sub-micron droplets of metallic iron  $\pm$  troilite are evenly dispersed in the glass. Lithic clasts are: (a) crushed anorthositic olivine gabbro fragments predominate ( $\sim$ 90%) and show all textures of host crushed rock. They are usually rounded in outline. (b) Mare-type basalt ( $\sim$ 10%) with cinnamon colored clinopyroxene, ilmenite, and minor plagioclase. They are highly shocked and often partially melted. The ilmenite is streaked out and twisted and in one case neo-crystallization of ilmenite from the melt glass was observed. All mineral clasts that occur in the anorthositic olivine - gabbro host may occur, always in their shocked state. They grade in size down to micron-sized particles "floating" in the glass.

Type 2. Fawn colored vesicular glass - with fewer and smaller vesicles <5%, <30 $\mu$  diameter. This glass only occurs within the rock, is never devitrified, shows good flow banding, and many submicron-sized metal and troilite droplets. The clasts are overwhelmingly crushed anorthositic gabbro or its constituent minerals. Remnants of mare basalt fragments are very rare. Flow banding is common, with smaller clasts sometimes streaked out this plane. A thin zone of gray glass may occur along vein margins.

Type 3. Pale gray glass with a dark dusty appearance occurs at the extremities and ends of vein systems. Lithic clasts are uncommon, Micron-sized mineral clasts with plagioclase predominant are common. Submicron-sized metal and troilite drops occur as in previous types. These are partially responsible for the dusty appearance, but probably this is also enhanced by minute vesicles in the same size range. Ilmenite and metal fragments were included in margin of

vein are drawn out and shredded into streaks and droplets. These veins are the product of shock melting, but it is evident from their variable color and clast content that they vary in chemical composition. That more basaltic (Fe-rich) material has been introduced and probably only the pale gray glass is isochemical with the host rock.

<u>OPAQUES DESCRIPTION</u>		BY: Brett	DATE: 3/15/73	
<u>PHASE</u>	<u>SECTION</u>	<u>SHAPE</u>	<u>SIZE</u>	<u>COMMENTS</u>
	SECTION: 77017,11			
	% OF		(mm)	
Ilm	<1	Irreg	To 0.75	Ilmenite occurs as large Mg-rich, rounded grains, which commonly contain spinel and rutile lamellae, and also occurs as smaller angular and rounded grains.
Armal	<0.2	Ang, rnd	<0.05	
Troil	<0.2	Blebs, ragged	<0.03	Troilite occurs as ragged grains and rounded blebs commonly associated with metal.
Fe-Ni	<0.2	Blebs, ragged	<0.03	
Spinel	Tr	Lamel	To 0.1	Armalcolite occurs in discrete angular to rounded grains. Along glass veins, the average size of opaque minerals is less than one micron.
Rutile	Tr	Lamel	To 0.1	

## 77035

ROCK TYPE: Breccia  
 COLOR: Light gray (N7)  
 SHAPE: Blocky-subangular  
 COHERENCE: Intergranular - Tough  
 Fracturing - Few, non-penetrative

WEIGHT: 5727 g  
 DIMENSIONS: 15 x 15.5 x 22 cm

BINOCULAR DESCRIPTION BY: Horz and Wilshire DATE: 1/23/73

FABRIC: Isotropic matrix with one big clast  
 VARIABILITY: Irregular cavity and clast distribution  
 SURFACE: B is hackly, fresh fracture surface  
 ZAP PITS: None on B; many on T, S, N, E, W  
 CAVITIES: Highly irregular cavities, about 5% total but in local concentrations as high as 20%. Cavities are arranged in bands about 6 cm thick. Cavities are 0.1 mm to 30 mm, most are discoid shaped with irregular, drusy linings.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Light gray (N7)	85-90		<0.1	<0.1 - 0.2	1
Clasts		5	Ang	0.1	0.1 - 1	2
Lithic clasts		5-10				
I	Light gray		Ang		3	3
II	Medium dark gray				3	4
III	Medium dark gray					5
IV	Light gray				1	6
V	Medium brownish gray		Subrnd		15	7
VI	Very light gray		Subrnd	70x60		8
VII	Light gray		Ang			9

## NOTES:

1. Feldspar dominant. Recrystallized, sugary texture. 1-2% opaques, pyroxene metal spheres, irregular metal splashes and pieces and troilite in hexagonal plates.
2. Mineral debris, mostly feldspar, some yellow green, some brown minerals (pyroxene ?).
3. 70% plagioclase, 30% brown pyroxene, trace of ilmenite.
4. Dark aphanitic lithic fragments.



BINOCULAR DESCRIPTION

BY: Agrell and Reid

DATE: 2/19/73

FABRIC: Veined, cataclastic

VARIABILITY: Light material (30% of sample) has narrow veins of very dark gray material (70% of sample). Main dark vein homogeneous but finer grained at contact.

SURFACE: Hackly

ZAP PITS: Many on single faces of two fragments.

CAVITIES: None in light material. Narrow (1 - 3 mm) veins contain occasional <0.01 mm cavities. Main dark vein has a few (<0.5%) vesicles of <0.01 mm in "chilled" part. Main portion vesicles increase in abundance to about 0.3% in unchilled portion, size 0.1 - 0.3 mm, rounded or flattened. One area on surface of second fragment suggests one cm<sup>2</sup> area of flattened vesicle lining which is glassy.

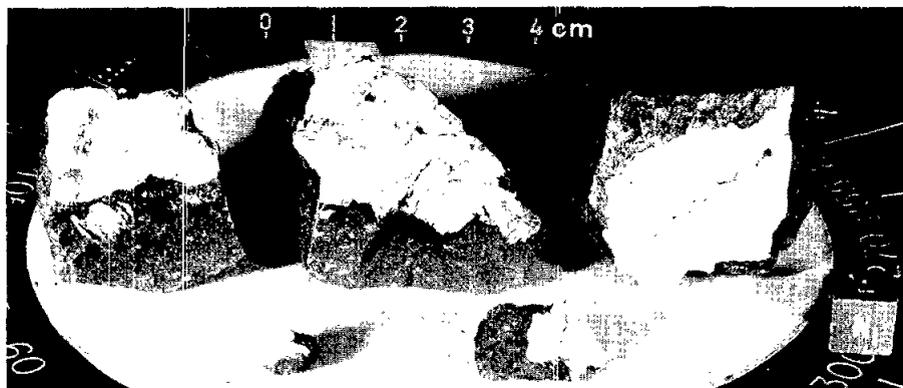
SPECIAL FEATURES: The contact between the dark aphanitic rock and the pale crushed anorthositic rock is sharp and sealed. The contact in detail is wavy with some sharp cusp-like projections into the troctolitic anorthosite. Some of such veins which penetrate the latter arise from the cusps, the others are random. The veins may crosscut the structure of the crushed troctolitic anorthosite or utilize the lens-like shear surfaces that are available. Their width is from 0.5 mm - 3 mm, they pinch and swell and in places are crowded with minute white clasts, probably derived from the host rock.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DCM.</u>	<u>RANGE</u>	
Crushed troctolitic anorthosite	Pale yellowish gray					1
Opagues	Black	<1	Specks	<0.05		
Plag	White	14	Ang equant	0.20	0.05 - 0.25	
Oliv	Pale yellow-green	6	Ang equant	0.15	0.05 - 0.25	
Dark vein component	Dark gray					2
Plag	Gray to c'less	40	Laths	0.05	<0.25	
Maf sil		28	Inter- stitial	0.05	<0.25	3
Glass	Dark gray	4				4

Clasts						
A	Pale gray	3			0.05 - 3	5 6
B	Glassy	5	Laths		0.05 - 2	7
C	Resinous brown	Tr		1.2		8
D	C'less	1			0.3 - 0.7	9
E	Dull greenish yellow	Tr	Ang	1.5		10
F	White		Ang		Up to 10	11

## NOTES:

1. Host rock which is veined by dark aphanitic material. Areas of crushed olivine up to 3 mm across occur in a mosaic of crushed plagioclase with minor olivine. There are coarser grained patches outlined by more finely crushed material with lens-like form.
2. Fine grained - aphanitic, slightly darker within 5 mm of main contact and in mm veins in host rock.
3. Possibly occurs in rounded areas including plag.
4. Occurs within 5 mm of contact and in veins in the pale host. The veins are darker and more vitreous in appearance.
5. These clasts make up 8 - 9% of dark vein.
6. Anorthositic hornfels with grain size 0.05 - 0.1 mm, welded into matrix.
7. Plagioclase-single crystal clasts, which probably extend down to matrix size.
8. Pyroxene, only one clast.
9. Mostly in chilled margin. Either plagioclase or very pale mafic silicate.
10. Cataclastic dunite(?).
11. Confined to one fragment. Concentration of angular white clasts (possibly sheared troctolite) containing a little pale brown pyroxene. Several clasts feather away into tenuous veins as if partly melted in the enclosing dark aphanitic rock.



Sample 77075

S-73-17186

THIN SECTION DESCRIPTION

BY: Agrell

DATE: 2/24/73

SECTION: 77075,11

SUMMARY: Mylonitised anorthositic norite in contact with a later dark fine-grained aphanitic vein containing mineral clasts. The vein is described separately after the norite.

## MATRIX, 60% OF ANORTHOSITIC NORITE

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	70	Ang - subrnd	0.01 - 0.001	Matrix - mylonitic, very fine-grained, possibly some glass.
Hypers	25	Subrnd	0.01 - 0.001	Sporadic dusty streaks of finely disseminated Fe-Ni metal and oxides (ilmenite?).
Metal	<0.5	Gran	<0.01	
Oxide	<0.5	Gran	<0.01	
Glass	?			Clasts - plagioclase often packed with glass inclusions rectangular

or rhomboidal in form and from 10 - 30  $\mu$  in size, arranged parallel to crystallographic directions. Glass, probably SiO<sub>2</sub> rich, often contains a single micron-sized metal or troilite drop, and 1-2 micron pyroxene(?) crystal and gas bubble. In some cases has devitrified to irresolvable material.

Hypersthene - some crystals have drop and rod exsolution of clinopyroxene up to 10%.

FeNi metal - mossy outline in some areas sometimes streaked out. Occurs in hairline fractures and cleavages in one plagioclase.

Tridymite - 50 $\mu$  patches (+2V 40°) associated with barred intergrowth with probable orthoclase.

Rose-amber - isotropic phase associated with tridymite in one case, not identified.

Spinel - few orange brown crystals.

## CLASTS, 40% OF ANORTHOSITIC NORITE

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>
Plag	40	Ang	<0.5
Hypers	55	Ang	<0.5
Cpx	1	Ang	0.1
Tridy	<0.5	Ang	<0.1
Ortho	<0.5	Lathy	0.05
Ilm	<0.5	Equant	0.03
Spinel	<0.1	Equant	0.02
Rose-amber	<0.1	Ang	0.02
FeNi metal	<0.5	Mossy	0.05

TEXTURE: Intersecting zones of a mylonitic nature, either pale brown or colorless, separate areas of shattered rock. In the latter the proportion of mineral fragments increases and the mylonitic matrix decreases in amount. In the mylonitic zones the matrix consists of submicron to 10 $\mu$  chips of plagioclase and pyroxene rounded and welded together. Glass may be present in this matrix, though its apparently isotropic nature may be due to close packing of minute randomly orientated crushed crystals.

## MATRIX, 85% OF VEIN ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	46	Laths	0.02	Plagioclase occurs in 5 x 10 $\mu$ laths set in 30 x 50 $\mu$ ophitic plates of pale pyroxene.
Pyrox	42	Allotrio-morphic	0.05	
Ilm	1	Plates	0.01	About 5% of plagioclase occurs as blocky crystals 50 x 50 $\mu$ .
Troil	<0.5	Inters	0.01	
Metal	<0.5	Inters	0.01	Within 0.5 mm of contact with crushed feldspathic wall rock, the vein matrix decreases in grain size, possibly some interstitial glass is present, the plagioclase laths become more skeletal in form.

## CLASTS, 15% OF VEIN ROCK

<u>PHASE</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	56	Rnd - ang	0.05 - 1.2	Plagioclase - several types occur as broken fragments, most are relatively unshocked and some have narrow more sodic rim.
Oliv	20	Subang	0.05 - 2.0	
Hyper	14	Subang	0.05 - 0.7	Devitrified or recrystallized maskelynite as sheaf-like aggregates or microcrystalline types occur, and a few plagioclase show strong cataclasis.
Oxides	<1	Rnd	0.12	
Metal	2	Rnd	0.05 - 0.7	
Lithic	7		0.2	

Hypersthene - occasionally shows schiller exsolution possibly ilmenite and one crystal clast includes yellow brown octahedra of spinel.

Olivine - little sign of shock, one crystal includes many micron-sized droplets of metallic iron.

Fe-Ni metal - rounded pools, intergrown with matrix silicates on a 5 $\mu$  scale. Little troilite present, and schreibersite was tentatively identified as 2 or 3 rounded inclusions (10 $\mu$ ) in the largest metal fragment.

LITHIC CLASTS: Only one type, a pale, fine-grained feldspathic microbreccia.

## 77075 (Continued)

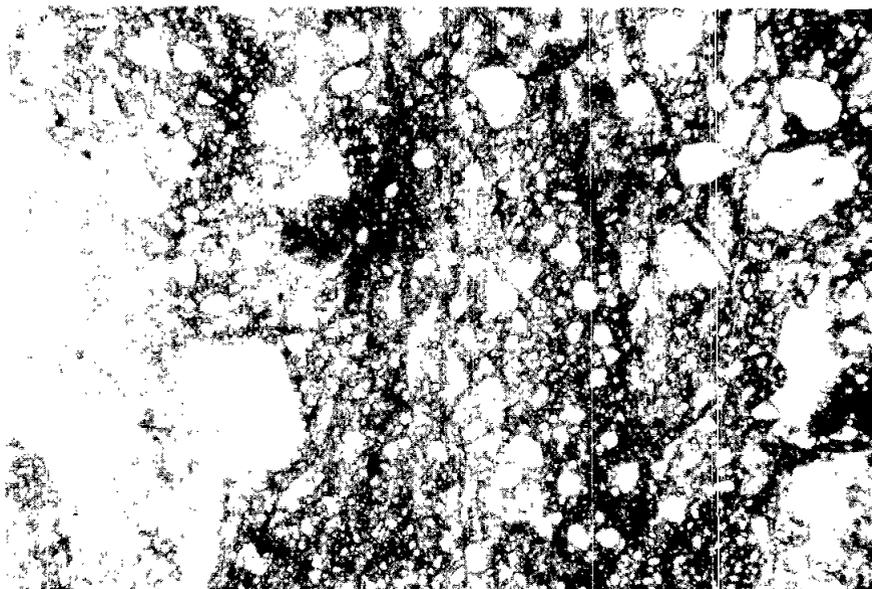
OPAQUES DESCRIPTION

BY: Brett

DATE: 3/15/73

SECTION: 77075,11

COMMENTS: Bulk of opaque minerals (less than 2 percent of rocks) are very fine-grained, less than 10 $\mu$  and mostly micron and sub-micron ilmenite laths, metal and troilite blebs. Some rounded ilmenite and Mg-Al spinel grains to 50 $\mu$ ; one huge plag clast contains Mg-Al spinel inclusions. One olivine clast contains about 10% of metal inclusions.



Section 77075,11

S-73-20044

Width of field 3.16 mm, plane light

77076

ROCK TYPE: Basaltic veins in  
crushed troctolitic anorthosite  
COLOR: Dark part is between dark gray  
(N3) and brownish black (5YR 2/1);  
white part is pinkish gray (5GY 8/1)

WEIGHT: 13.97 g  
DIMENSIONS: 3 x 2 x 2 cm

COHERENCE: Intergranular - Tough  
Fracturing - None

BINOCULAR DESCRIPTION

BY: Agrell and Stuart-Alexander

DATE: 2/12/73

FABRIC: Veins in host rock

SURFACE: Dark gray component smooth; white component hackly.

ZAP PITS: Few on S and W; none on N and E.

CAVITIES: White component has none; dark component has <0.1%,  
round vesicles locally near contact.

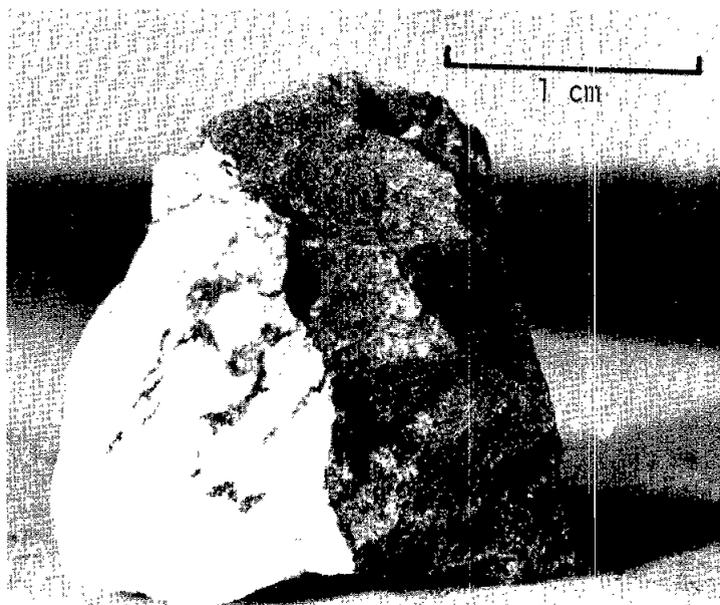
SPECIAL FEATURES: The white part of the sample is crushed plagioclase-olivine rock. Owing to crushing the white part is composed of closely packed lens-like areas, whose cores are more coarsely and margins more finely crystalline. The white part is penetrated by narrow veins of very dark gray aphanitic material which emanate from the major veining unit. These veins are 0.1 - 4 mm in diameter, pinch and swell, and may follow a lenticular crush system, or may be completely discordant. The narrow veins are darker and more vitreous than the main vein from which they emanate and are often crowded with 0.01 - 1 mm fragments of the white crushed plagioclase-olivine rock. The dark part is noritic pseudo-trachylite or clast-bearing tachylite vein. The dark color is due essentially to fine-grain size; the possible mineralogy is plagioclase and orthopyroxene. Sharp contact with the white plagioclase-olivine rock and no change in grain size of the dark material except in veins where slight darkening of contact suggests chilling. Small incipient squirts and protrusions may occur along main contact. Clasts within the dark vein rock are sporadic, but crowd it where it disrupts the sheared troctolitic anorthosite.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
White part						
Plag	White	16	Blocky to granular	0.05	0.01 - 0.4	1
Oliv(?)	Greenish yellow	4	Blocky to granular	0.05	0.01 - 0.3	1
Opagues	Black	<1	Equant	0.05	0.05	2
Dark part						
Pyrox(?)	Pale sienna	40	Patchy	0.1	0.05 - 0.3	
Plag	Colorless	40	Inter- stitial and laths	0.05	0.02 - 0.3	3
Ilm(?)	Black	<1	Platy			
Metal	Silver	<1	Drops	0.05		4

Clasts						5
Oliv	Green	<1	Ang	0.5	0.2 - 1.5	
Plag	Colorless	<1	Ang	0.5	0.2 - 1.5	
Lithic	Gray green	<1	Ang	1.5	0.5 - 3	6

## NOTES:

1. Plagioclase and olivine occur as about 5% residual less crushed crystals up to 0.4 mm.
2. Fe-Cr spinel(?).
3. Minute crystals included in pyroxene as well.
4. Only seen in narrow veins in plagioclase-olivine rock.
5. 8% of dark vein rock.
6. Crushed pyroxene and plagioclase, granulitic texture.

Sample 77076 E<sub>1</sub>

S-73-17101

ROCK TYPE: Crushed troctolitic anorthosite veined by dark aphanite  
 WEIGHT: 5.45 g  
 DIMENSIONS: 2 x 2 x 1.5 cm  
 COLOR: Yellowish gray (5Y 8/1) with dark gray veins (N3)  
 SHAPE: Blocky  
 COHERENCE: Intergranular - Tough  
 Fracturing - One penetrative

BINOCULAR DESCRIPTION BY: Agrell and Lofgren DATE: 2/14/73

FABRIC: Veined, cataclastic  
 VARIABILITY: Homogeneous with narrow dark veins  
 SURFACE: N face is about half outer surface with a rougher, browner appearance; the rest are all freshly broken surfaces.  
 ZAP PITS: Few on N; none on other faces.  
 CAVITIES: None  
 SPECIAL FEATURES: Narrow veins of dark, very fine-grained aphanite (partly glassy?) cut, crushed troctolitic anorthosite. Olivine content of latter may exceed 25% as its color disappears when finely crushed. The narrow veins carry introduced clasts from main body of vein, which is not present in this sample.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Crushed troctolitic anorthosite	Pale yellow gray		Blocky			
Oliv	Greeny yellow	18	Equant ang	0.2	0.05 - 0.3	1
Plag	White	70	Equant-ang	0.2	0.05 - 0.25	2
Opagues	Black	<1	Equant	<0.05		3
Pyrox	Pale	<4	Pris	0.3		4
Dark aphanitic veins	Very dark gray					5
Plag	Glassy	5	Equant	0.03	0.01 - 0.1	
Pyrox	Gray brown	3	Interstitial	0.03	0.01 - 0.1	
Glass Clasts	Black	<1				6
A	Gray	<1	Ang		0.2	7
B	Yellowish gray	<1			0.1 - 0.5	8
Plag	Clear	<1	Ang		0.1 - 0.2	
Plag	Vitreous	<1	Rnd		0.05 - 0.5	

## NOTES:

1. Olivine occurs as 3 mm crushed areas that are entirely olivine and also dispersed in plagioclase.
2. Both plagioclase and olivine have small patches of slightly coarser grain size set in matrix of finer grain size.
3. Dark Fe spinel.
4. Orthopyroxene(?)
5. Veins cut rock in an irregular manner, narrowest is 0.2 mm, and pinch and swell up to 3 mm. Contacts with "anorthosite" are sharply welded, in places straight, and in others sinuous as if contact was plastic. Dark vein may include clasts of wall rock, and also clasts introduced from main vein. The veins are rather vitreous in appearance. In one place flow orientation of plagioclase parallels a vein contact.
6. These clasts compose 8 to 10% of the dark vein.
7. Sugary texture.
8. Troctolitic anorthosite.

Sample 77077 S<sub>1</sub>

S-73-17182



Lithic clast		2	Square	8x6	3
Lithic clast				8x4	4
Tan-gray material					
Maf sil	Dark bronzitic gray	3	Tab to subrnd		Up to 3 5
Oliv(?)	Olivine green	1	Subrnd - irreg		0.5 - 1
Opaque	Metal luster	<0.5		0.1	
Plag(?)	Light gray	2.5	Anhed		0.1 - 0.5
Pyrox(?)	Yellow brown	3	Anhed		
Blue-gray material	Blue - gray	<0.5	Elong		2 - 4

## NOTES:

1. Components of the matrix, which is crystalline, with the grain-size somewhat variable. Matrix contains many, small irregular vugs and is tough coherent, possibly recrystallized. Some drusy cavities contain delicate white plagioclase(?) crystallites coating the cavity, some have small crystals colored light brown, possibly a coating - a few yellow opaque spheres. The rest of the components of the blue-gray material are small, angular, commonly monomineralic inclusions. E end of rock is locally enriched in brown pyroxene and yellow green olivine speckled by a black opaque mineral.
2. Olivine or pyroxene.
3. 75% plagioclase, 20% light green mafic, 5% brown mafic, <2% shiny opaque.
4. One clast (at the extreme E end of the rock) is coarse-grained with crystals several mm in size, and is composed of green olivine, brown pyroxene, and plagioclase.
5. Large crystals, with good cleavage or conchoidal fracture.

THIN SECTION DESCRIPTION

BY: Reid

DATE: 3/15/73

SECTION: 77115,7

SUMMARY: Both tan-gray and blue-gray breccia are present in the section. The tan-gray breccia is mostly monomict consisting of a crushed, very mafic rock with little admixing of other material. Its grain size is larger than blue-gray portion. The blue-gray breccia is a polymict annealed metaclastic rock which has a very fine-grained matrix of tightly intergrown, very irregular grains. Its clasts are mostly mineral fragments, with few "basaltic" clasts.

## TAN-GRAY PORTION

MINERAL CLASTS, 98% OF TAN-GRAY				
<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	30	Ang	Up to 0.2	Apparently homogeneous large single grains are abundant and little deformed, except cpx.
Opx	10	Ang, elong	Up to 0.4	
Oliv	40	Ang	Up to 0.3	
Cpx	20	Subang	Up to 0.4	
Ilm	2			
Metal	1			

LITHIC CLASTS, 2% OF TAN-GRAY				
<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Basaltic	100	Subrnd clot	0.3	Very fine-grained pyx-plag intergrowth.

ADDITIONAL COMMENTS ON TAN-GRAY: No very fine-grained matrix and most grains greater than 0.02 mm. Nearly all mineral clasts are unzoned, and from crushed plutonic rock. Cpx grains have small scattered inclusions, unlike other phases, and may be foreign. Few opaques, opx may have very fine cpx lamellae. About 10% of tan-gray part is irregular voids.

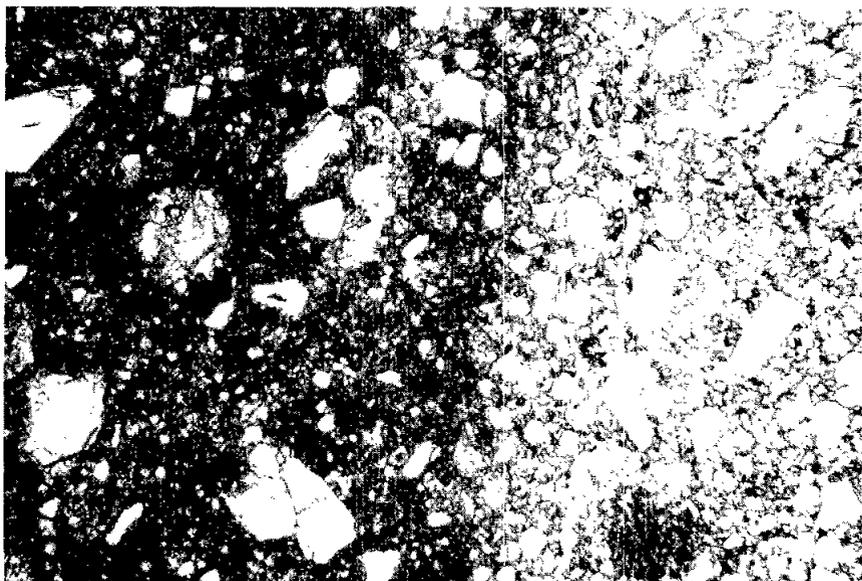
## BLUE-GRAY PORTION

MATRIX, 80% OF BLUE-GRAY				
<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	45	Irreg, ang	0.01 - 0.05	Matrix is a dense intergrowth of highly irregular mineral grains. No poikiloblasts, but opaques partially rim some areas as occurs around oikocrysts in poikiloblastic rock.
Pyrox	45	Irreg, ang	0.01 - 0.05	
Ilm	7	Laths	0.01	
Metal	1	Irreg		
Troil	1	Irreg	0.005 - 0.01	

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	60	Ang to subrnd	0.02 - 0.6	Plagioclase is commonly recrystallized to equigranular or spherulitic "anorthosite" aggregates. There are a few inverted pigeonites with irregular blebby exsolution. One cpx is highly zoned parallel to the grain margins.
Pig	10	Ang	0.02 - 0.4	
Cpx	20	Ang	0.02 - 0.5	
Oliv	7	Ang	0.02 - 0.2	
Metal	3	Irreg	0.02 - 0.2	

LITHIC CLASTS, 5% OF BLUE-GRAY

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I	10	Rnd	0.3	I Basalt - Large cpx laths protruding into a spherical cavity.
II	10	Subrnd	0.2	II Basalt - Plagioclase-olivine.
III	60	Subrnd	0.1	III Basalt - Plagioclase-clinopyroxene.
IV	20	Subrnd	0.15	IV Anorthosite - Equigranular plagioclase with minor clinopyroxene.



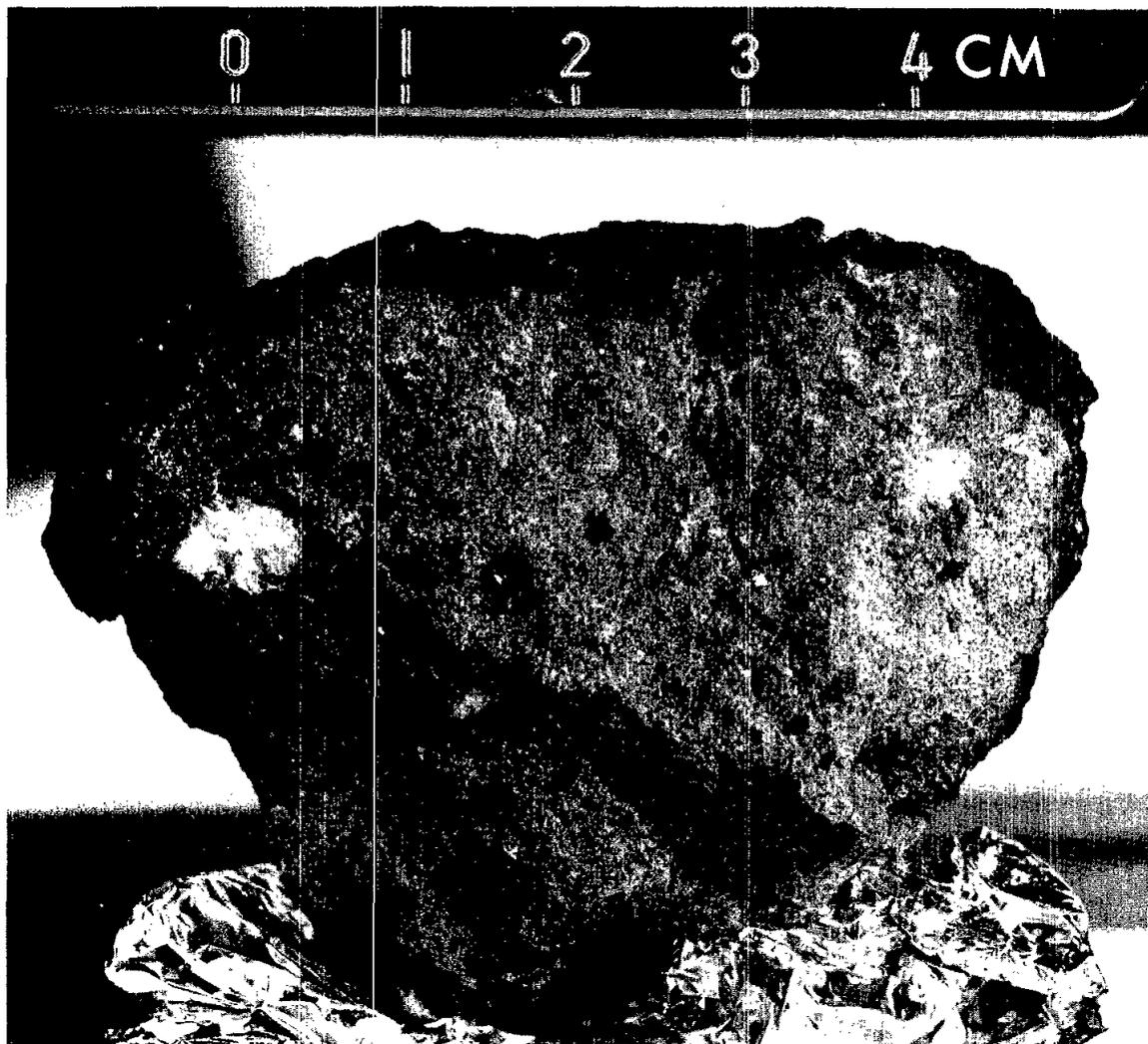
Section 77115,7 S-73-19909  
 Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION  
SECTION: 77115,7

BY: Brett

DATE: 2/1/73

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	1	Subhed	0.01 - 0.02	Ilmenite as laths and subhedral crystals; well recrystallized at grain boundaries of silicates. Troilite and metal as usual rounded blebs. Possible trace of ulvospinel and chromite.
Fe	<0.1	Rnd	0.01	
Troil	<0.1	Rnd	0.01	

Sample 77115 B<sub>1</sub>

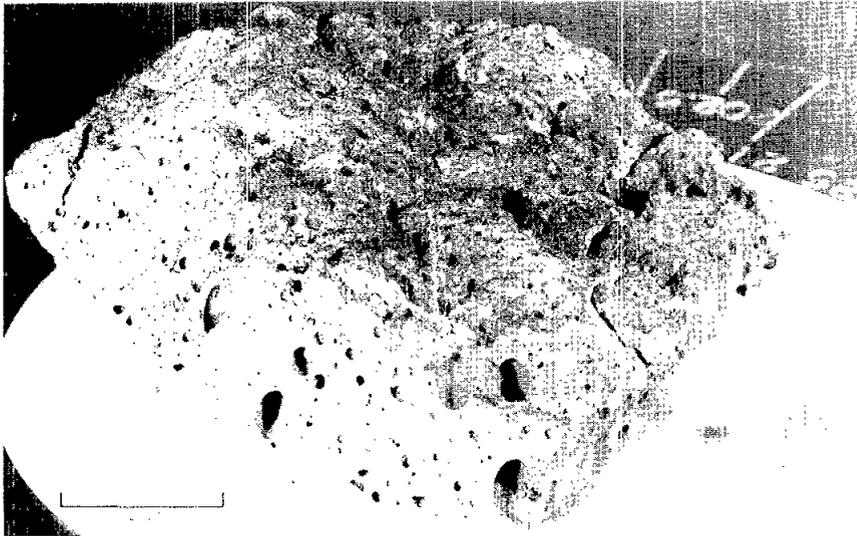
S-73-15011

Tan-gray material is in central and lower part of this face;  
weathered surface shows on upper edge.



## NOTES:

1. Matrix mineral. The matrix is crystalline, equigranular, salt and pepper, and consists of plagioclase (?) and mafic silicate. The mafic silicate is in irregular shapes and is commonly intergrown with plagioclase.
2. Mafic silicate (oliv ?). Homogeneous distribution.
3. Dense aphanitic. Uneven distribution.
4. One seen, fine-grained hornfels.
5. Spinel (?)
6. Metal. The largest grains occur only in the vug walls. The smaller grains are disseminated in matrix.
7. Sulfide (?)

Sample 77135 N<sub>1</sub>

S-72-56387

THIN SECTION DESCRIPTION

BY: Williams

DATE: 1/22/73

SECTION: 77135,7

SUMMARY: A holocrystalline poikilitic rock with about 20% of mineral clasts.

## MATRIX, 80% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Pyx	70	Equant ang	0.02	Matrix is organized into areas of poikilitic pyx 0.1 x 0.3 up to 1.7 x 0.4 mm which ranges from equant to tabular. All the opq is concentrated in the plag which fill in between the poikiliblast. The plag areas range from 0.3 to 0.1 mm wide.
Plag	30	Equant ang	0.02	

Ilm	0.5	Equant	0.1x0.02
		to	to
		lath	0.02x
			0.02
Fe	>0.2	Rnd	0.02 -
			0.01
Fe-S	>0.2		

## MINERAL CLASTS, 20% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ol	20	Rnd to ang	1 - 0.02	Clast size appears to be completely seriate. There is one olivine clast and 2 plag
Plag	80	Rnd to lath	1 - 0.02	clasts which have mosaic texture.

## LITHIC CLASTS, &lt;1% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I	Only 1 seen	Rnd	1	Type I. Composed of hollow cored plag in coarse acicular pattern with crystalline-glassy mesostasis.
II	Only 1	Rnd	1.2	Type II. Holocrystalline composed of feathery plag with 0.01 mm crystal size. Looks shocked.
III	Only 1	Rnd	0.5	Type III. Composed of fine (0.01 mm) grains of plag, looks shocked.

ADDITIONAL COMMENTS: The rock contains about 7% of vugs from 1.5 mm dia down to 0.05 mm diameter. They have very smooth walls. The rock shows no increase in grain size as vug is approached. One vug shows a concentration of opaque and another may have a thin glass lining. The vugs are concentrated at the 10% level at one end of the specimen, in another area it is only at the 2 - 3% level (all % are estimated by the eye).

THIN SECTION DESCRIPTION

BY: Stuart-Alexander

DATE: 1/22/73

SECTION: 77135,7

SUMMARY: Vesicular metaclastic rock rich in mafics. Relict clasts form 15% of the rock and vesicles 5%. Matrix is recrystallized into predominantly poikiloblastic orthopyroxene and tiny plagioclase laths.

## MATRIX, 85% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opx	65	Irreg	1	Poikiloblastic opx with tiny plag laths; also encloses mineral clasts of both plag and oliv.
Plag	17	Laths to anhed	<0.1	
Oliv	5	Irreg	0.5	Olivine is both poikiloblastic and in tiny fragments.
Ilm	13	Highly irreg	<0.1	

## MINERAL CLASTS, 12% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Oliv	25	Ang	0.7	Olivines two larger grains appear zoned. Many have granulated borders.
Plag	72	Ang	0.5	
Opx	1	Ang		
Shocked plag	Tr	Rnd	1	
Ilm	2		0.1	

## LITHIC CLASTS, 3% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I		Rnd	0.6	All are one clast only.
II		Subrnd	0.3	I. Mosaic of olivine grains.
III		Irreg	0.5	II. Plagioclase granulite.
IV		Subrnd	0.8	III. Plagioclase-rich rock with diabasic texture. IV. Feathery plagioclase with <5% pyroxene.

ADDITIONAL COMMENTS: Ilmenite is concentrated around edges of poikiloblasts. Vesicles form 5% of the rock; maximum diameter is 1.4 mm. They are smooth-walled, and almost perfect circles. Crystallization and mineral percents do not change as vesicles are approached.

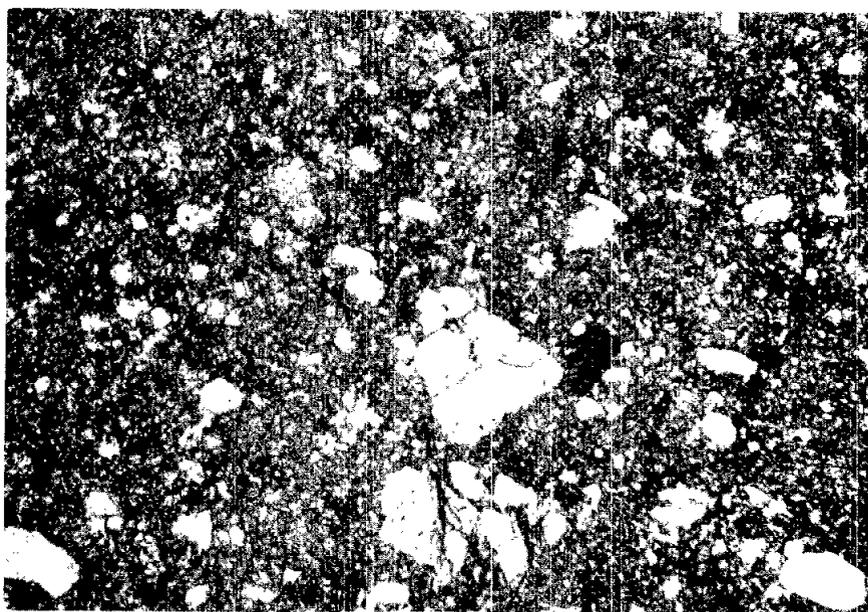
OPAQUES DESCRIPTION

BY: Brett

DATE: 2/9/73

SECTION: 77135,7

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	3	Laths, blocky, irreg	To 0.3	Similar to other massif breccias, opaque content somewhat high. Little in the way of intergrowths except usual rutile-spinel-ilmenite. Large metal and troilite concentrations in some areas. Much of the ilmenite and armalcolite have planar boundaries imposed by other minerals, largely plagioclase.
Armal	<1	Irreg	To 0.2	
Ulvo	<0.2	Ang, rnd	To 0.05	
Rut	<0.1	Lamel	To 0.075	
Fe-Ni	<0.2	Blebs	To 0.1	
Troil	<0.2	Blebs	To 0.15	
Spin	Tr	Lamel	To 0.03	



Section 77135,7 S-73-19913  
Width of field 3.16 mm, plane light

77215

ROCK TYPE: Friable breccia cut by dark veins and dikes

COLOR: White (N8 to N9), grayish black (N2) veins and dikes

SHAPE: Most are subangular

COHERENCE: Intergranular - White is friable; black is tough  
Fracturing - Many penetrative

WEIGHT: 846.4

DIMENSIONS: 41 pieces,  
range from 1 cm to  
6.5 x 4.5 x 2.5 cm

BINOCULAR DESCRIPTION

BY: Wilshire and Marvin

DATE: 2/22/73

FABRIC: Breccia

VARIABILITY: Local veining of white breccia; irregular clast distribution

SURFACE: Several fragments have one bounding face that is slickensided; dark clasts stand out on weathered surfaces.

ZAP PITTS: Original surfaces have many zaps. Zap glass varies in color from dark gray to light greenish.

CAVITIES: None in white; rare tiny vugs in dike rock.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>	
				<u>DOM.</u>	<u>RANGE</u>		
Dikes	Grayish black	5				1	
Breccia	White						
Clasts I	Dark gray	5	Ang		1 - 15	2	
Clasts II	Yellowish white	3 - 5	Ang		Up to 15	3	
Clast III		} <1	Irreg		6x10	4	
Maf sil clasts				} 85		Up to 10	5
Plag clasts	Light gray						
Matrix					0.1 - 1	6	

## NOTES:

1. Dikes range from <0.5 mm to 20 mm. Contacts are crenulate with many small apophyses into white rock; various stages of quarrying. No clear sign of chilling, but thin veins are more vitreous than thick ones. Dikes interconnect in irregular networks. Very few clasts, up to 3 mm, of white rock in the dikes; present only adjacent to contact. Other fragments include rare "cherty" plagioclase, brown pyroxene clasts to 2 mm, <1 - 2 mm vitreous gray material with bright green internal reflections, scarce olivine, plagioclase and rare spinel fragments in an aphanitic matrix. The thick dikes are entirely crystalline, but very fine-grained.
2. Most are angular, many are thin slabs, large ones are commonly shattered but not entirely disaggregated. Large ones are breccias enclosing mineral and lithic clasts; lithic clasts include yellowish white, finely pulverized material that may be veined by its host rock.
3. Composed of varying proportions of greenish yellow mineral and plagioclase; range is 35 - 60% greenish yellow, 65 - 40% plagioclase; average is about 45:55 mafic silicate to plagioclase. These clasts are intensely crushed, but not smeared, patches of yellowish mineral range from 1 to 5 mm.

4. One clast of crushed plagioclase and yellow mineral with gray inclusions.
5. Patches of shattered olivine(?).
6. Partly to completely mixed and pulverized material like type II clasts; proportions of greenish yellow mineral and plagioclase are variable, probably within the limits for type II clasts. Less mixed areas resemble type II clasts, but have no distinct boundaries. Extremely variable proportions of mineral debris in the 0.1 - 1 mm size range; greenish yellow mineral more greenish in larger pieces - it is probably olivine. Rare honey-colored pyroxene(?).

Sample 77215 S<sub>1</sub>

S-73-17778

THIN SECTION DESCRIPTION

BY: Wilshire

DATE: 3/1/73

SECTION: 77215,11

SUMMARY: Cataclasite composed dominantly of crushed orthopyroxene and plagioclase. Well developed cataclastic flow structures.

## MATRIX, 65% OF ROCK

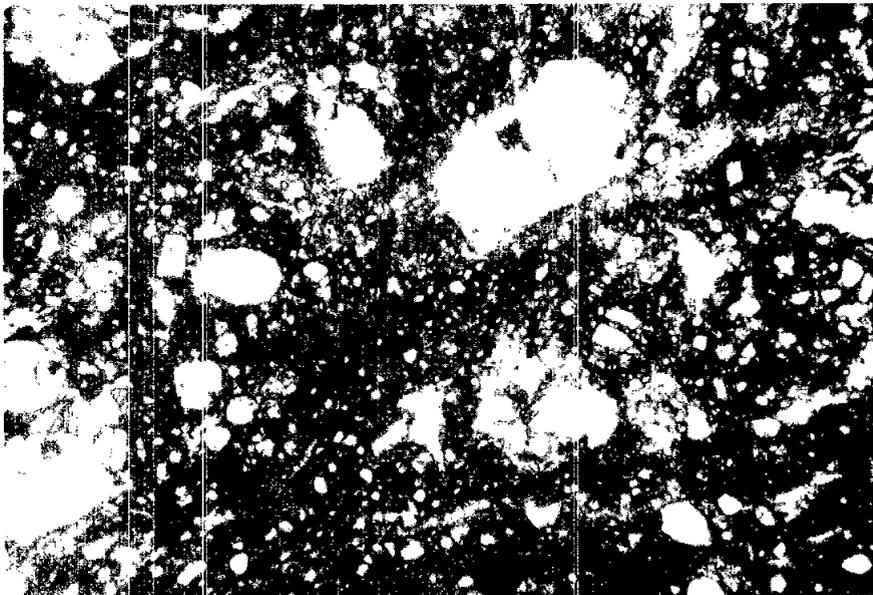
<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Pyrox				Matrix is mostly finely granulated orthopyroxene and plagioclase.
Plag				
Red spin	Tr			
Brown glass	Tr			

## MINERAL CLASTS, 20% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opx	75-80	Ang	To 0.3	Some orthopyroxenes have well developed exsolution lamellae.
Plag	15-20	Ang	To 0.3	
Oliv	5	Ang	To 0.3	
Opa	Tr	Ang		

## LITHIC CLASTS, 15% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I	70	Irreg	To 3	Plagioclase-rich cataclasite mostly irregularly strung out augen.
II	30	Subrnd	To 3	Mafic rich, indistinctly bounded area. Plagioclase commonly has abundant tiny short prism negative crystals with high negative relief.



Section 77215,11 S-73-19917  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION

BY: Brett

DATE: 3/15/73

SECTION: 77215,11

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	<0.5	Ang	To 0.1	Mg-rich ilmenite with strong reflection pleochromism.
Fe-Ni	<0.1	Ragged, rnd	To 0.05	Opaque mineral grains range in size down to less than a micron.
Troil	<0.1	Ragged, rnd	To 0.05	

77515-77526, 77535-77545

(exclusive of numbers ending in digits 0-4)

SAMPLE TYPE: Rocks (fragments >1 cm) from Station 7 collected with the scoop in a 4 to 5 m<sup>2</sup> area. Soil was included with these rocks.

CLASSIFICATION

BY: Wilshire and Morrison

DATE: 2/21/73

## GREEN-GRAY BRECCIA

77515, 77518 and 77519, 77537, 77545

Subangular to subrounded, tough, medium light gray with tan to greenish tint, crystalline, matrix-rich breccia. Rocks are over 95% matrix with clasts consisting generally of plagioclase and olivine plus a few lithic fragments. Vesicles and vugs of various shapes and sizes are common.

## BASALT

77516, 77535 and 77536

Typical olivine-bearing, coarse-grained, mare basalts containing about 50% clinopyroxene, 35% plagioclase, and 15% opaques.

## FELDSPATHIC BRECCIA

77517, 77525 and 77526

Blocky to tabular, tough, very light gray breccia containing about 50 to 75% white, fine-grained, sugary matrix containing predominantly light gray, very fine-grained clasts.

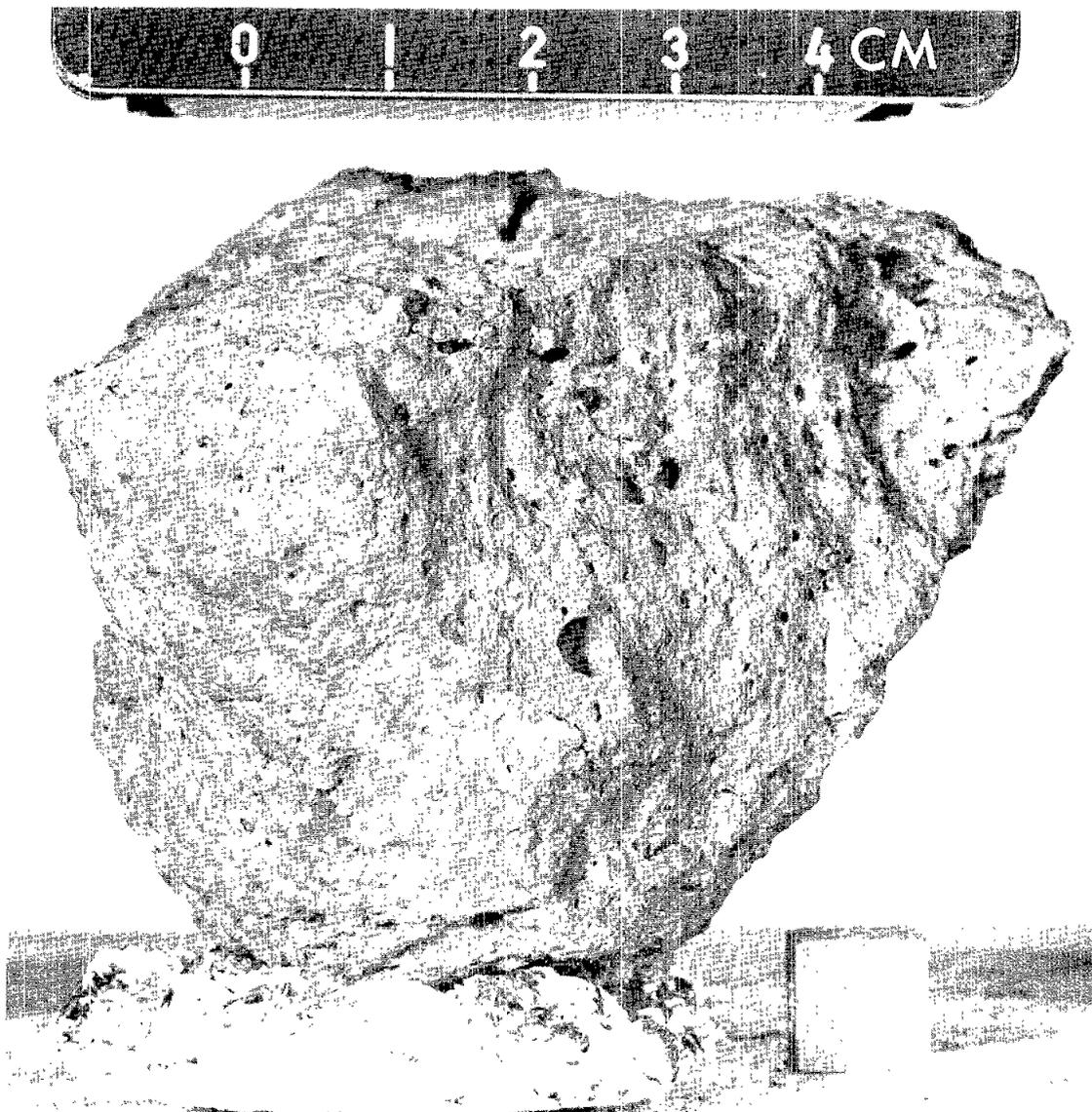
## MISCELLANEOUS CRYSTALLINE BRECCIA

77538 and 77539

77538 is a subangular, moderately coherent, very light gray matrix-rich breccia containing about 5% clasts most of which are very fine-grained and medium gray.

77539 is a subangular, tough, light tannish-gray, crystalline breccia consisting of about 70% fine, sugary, light gray matrix and 30% very fine-grained, very light gray, sugary clasts.





Sample 77515

S-73-19421

77515

ROCK TYPE: Crystalline breccia

COLOR: Greenish gray

SHAPE: Subangular

COHERENCE: Intergranular - Tough

Fracturing - Few, non-penetrative

WEIGHT: 337.6 g

DIMENSIONS: 8 x 7 x 5 cm

Largest

BINOCULAR DESCRIPTION

BY: Lofgren

DATE: 3/30/73

FABRIC: Breccia - crystalline

VARIABILITY: Uniform

SURFACE: Granular

ZAP PITS: Few to many on most surfaces; none on fractured surfaces

CAVITIES: 5 - 10% rounded cavities up to 3 mm down to &lt;0.5 mm with metallic crystals in some.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Trans	5	Blocky	5	2 - 10	1
Oliv	Yellowish green	<1	Subrnd	2	0.5 - 4	2
Crystalline matrix	Greenish gray				0.1	3
Plag(?)	Trans	90			<0.1 - 0.3	
Ilm (?)	Black	5			<0.1	
	Dark gray	1-2			0.5	

## NOTES:

1. Relict.
2. Relict.
3. Fine-grained crystalline material.

77516

ROCK TYPE: Basalt

WEIGHT: 103.7 g

COLOR: Gray (N4 to N5) with brownish  
tint

DIMENSIONS: 5.5 x 4 x 3

SHAPE: Subrounded to subangular, somewhat slabby

COHERENCE: Intergranular - Tough

Fracturing - One penetrative parallel to slabby direction

BINOCULAR DESCRIPTION

BY: Wilshire and Morrison

DATE: 2/21/73

FABRIC: Variolitic, locally trachytic

VARIABILITY: Inhomogeneous distribution of vugs.

SURFACE: Uneven, finely hackly.

ZAP PITS: Zapped on all sides.

CAVITIES: 1 - 2%; up to 8 mm; contain projecting  
ilmenite, pyroxene, and plagioclase crystals.

SPECIAL FEATURES: - -

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag		35	Lath	0.75	0.5 - 3	1
Pyrox	Root beer brown	45-50	Equant		0.1 - 0.5	
Opagues	Black	10-15	Platy		<0.1 - 1	
Oliv	Green	5	Equant	0.5	0.2 - 1.0	2

## NOTES:

1. Plagioclase is lath-shaped, commonly has pyroxene(?) prisms growing down center of laths.
2. Appears to be concentrated in one part of rock.

## 77516

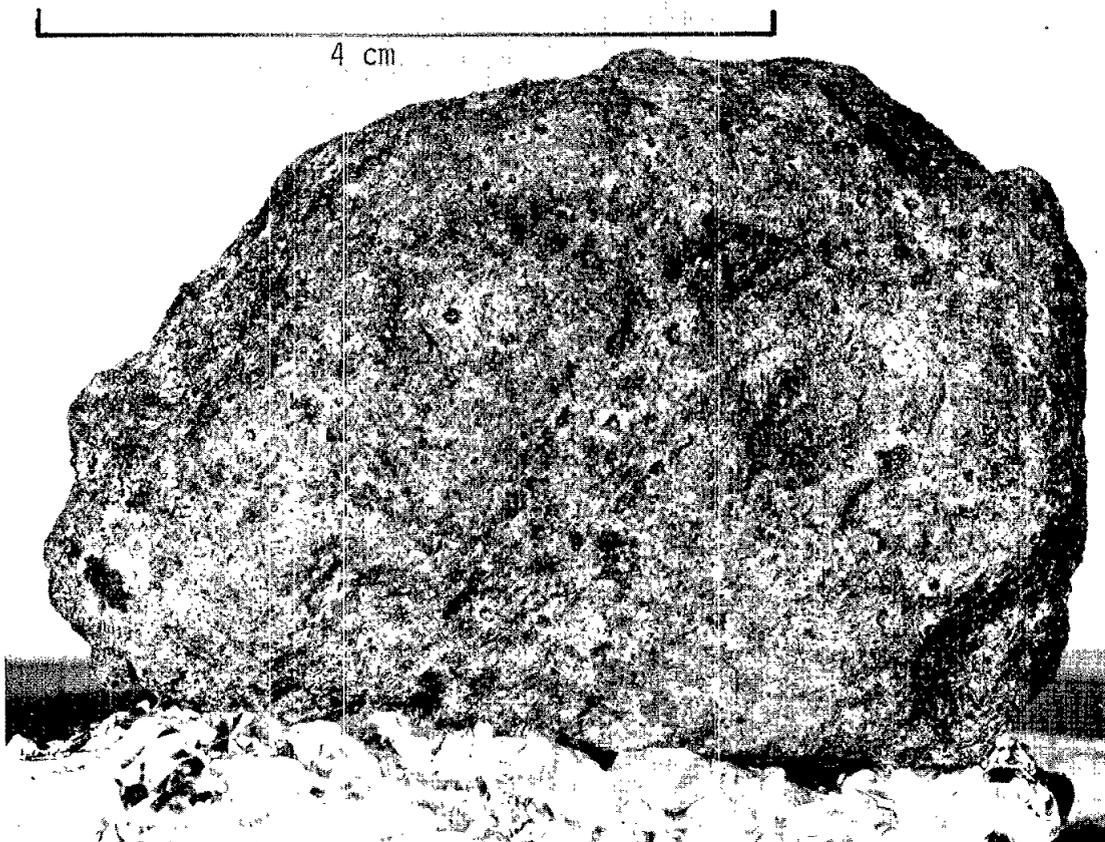
ROCK TYPE: Basalt  
 COLOR: Medium gray  
 SHAPE: Subrounded  
 COHERENCE: Intergranular - Coherent  
 Fracturing - Few, non-penetrative

WEIGHT: 103.7 g  
 DIMENSIONS: 6 x 4 x 2.5 cm

BINOCULAR DESCRIPTION BY: Lofgren DATE: 3/30/73

FABRIC: Igneous  
 VARIABILITY: Uniform  
 SURFACE: Weathered  
 ZAP PITS: Few to many on all surfaces  
 CAVITIES: Few; crystal-lined vugs; slightly layered, more euhedral crystals in vugs.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Trans	30-35	Tab		0.1 - 0.5	
Cpx	Honey brown	40-45	Prism to equant		0.1 - 0.5	
Ilm	Black metallic	15-20	Prism to equant		0.2 - 0.7	
Oliv	Yellowish green	5	Equant		0.3 - 0.7	

Sample 77516 T<sub>1</sub>

S-73-19410

77517

ROCK TYPE: Feldspathic metaclastic  
breccia

WEIGHT: 45.6 g

DIMENSIONS: 4 x 4 x 3 cm

COLOR: Light gray (N7 to N8)

SHAPE: Blocky, rounded

COHERENCE: Intergranular - Moderately tough

Fracturing - Several penetrative

BINOCULAR DESCRIPTION

BY: Morrison and Wilshire

DATE: 2/21/73

FABRIC: Breccia, annealed breccia

VARIABILITY: Homogeneous in fragment distribution and matrix  
characteristics.

SURFACE: All surfaces uneven.

ZAP PITS: Zapped on all but freshly broken face.

CAVITIES: &lt;1%, &lt;1 mm.

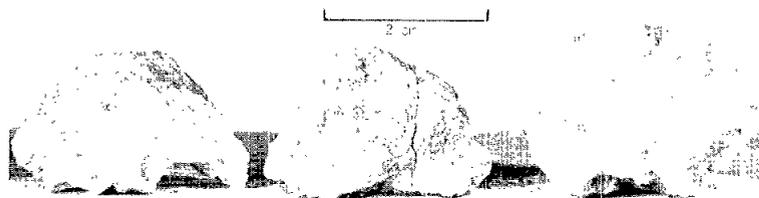
SPECIAL FEATURES: Matrix cement appears to be feldspar, cleavage flashes

suggest either matrix is recrystallized or presence of a large number of relict plagioclase fragments up to 1 mm. This rock does not fit any of the breccia categories based on boulder or large rock samples.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOY.</u>	<u>RANGE</u>	
Clast Type						
I	N5-N6	20-25	Ang blocky		<1 - 5	1
II	N6		Ang blocky		10x10	2
III	Yellow green	≤1			<1 - 1	3
IV	Light bluish gray	1 - 2			1 - 2	4
V	Yellow green to brown	Tr			2	5
Maf sil	Green	≤1			≤1	
Maf sil	Brown				≤1	
Matrix		80 - 75				6

## NOTES:

1. Cryptocrystalline and very uniform; contain no clasts.
2. Like type I but more vitreous.
3. Mineral debris.
4. Crushed feldspar(?), cryptocrystalline.
5. Yellow green rim, reddish brown interior.
6. Fine-grained, sugary white material plus small fragments of lithic and mineral debris.

Sample 77517 S<sub>1</sub>

S-73-19406

ROCK TYPE: Breccia  
 COLOR: Grayish white  
 SHAPE: Subrounded  
 COHERENCE: Intergranular - Coherent  
 Fracturing - Few, penetrative

WEIGHT: 45.6 g  
 DIMENSIONS: All three pieces  
 about same: 3 x 2.5 x 2 cm

BINOCULAR DESCRIPTION

BY: Lofgren

DATE: 3/30/73

FABRIC: Breccia  
 VARIABILITY: Distribution of clasts is irregular  
 SURFACE: Smooth, hackly when fresh  
 ZAP PITS: On all unfractured surfaces  
 CAVITIES: <1%, rounded, <0.5 mm  
 SPECIAL FEATURES: The three pieces are all fractured fragments of one piece.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Pale grayish white	90-40			<0.1	1
Greenish gray clast	Greenish gray	5-50	Subang	1	0.1 - 3	1
Maf sil	Yellowish green	1	Equant		0.1 - 0.5	2
Plag	Trans	2	Equant, tab		1 - 2	2
Opaq	Black	1			<0.5	2

## NOTES:

1. Variable proportion depends on locality in the rock.
2. Distribution is highly variable.

ROCK TYPE: Metaclastic rock (tan breccia  
 group)  
 COLOR: Medium light gray (N6)  
 SHAPE: Blocky, subround  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 42.5 g  
 DIMENSIONS: 3.5 x 3.5 x 2.5 cm

BINOCULAR DESCRIPTION

BY: Morrison and Wilshire

DATE: 2/21/73

FABRIC: Annealed

VARIABILITY: Homogeneous

SURFACE: Rough

ZAP PITS: Pitted all sides.

CAVITIES: 3 x 5 mm to <1 mm, irregular. 2% cavities have some coarse (0.5 mm) euhedral blocky crystals, suggesting grain growth, but do not have fine druses as in most rocks of this type. One area has slit-like cavities with preferred orientation.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
Maf sil	Yellow green- brown	<1	Prism	1.5x1		1
Maf sil	Deep reddish brown	<1	Ang	1		2
Maf sil	Yellow green		Equant	1		
Lithic	Med gray aphanitic	<1	Ang		Up to 1x2	3
Matrix						4

## NOTES:

1. Zoned to brown at edge, probably pyroxene.
2. Pyroxene(?).
3. Very fine-grained.
4. Annealed fine-grained mixture of half gray and half white components with about 5% opaque specks.

77518

ROCK TYPE: Crystalline breccia

COLOR: Pale greenish gray

SHAPE: Subrounded

COHERENCE: Intergranular - Coherent

Fracturing - Few, non-penetrative

WEIGHT: 42.5 g

DIMENSIONS: 3.5 x 3.5 x 2.5 cm

BINOCULAR DESCRIPTION

BY: Lofgren

DATE: 3/30/73

FABRIC: Porphyritic (relict)

VARIABILITY: Uniform

SURFACE: Smooth

ZAP PITS: Many on all surfaces

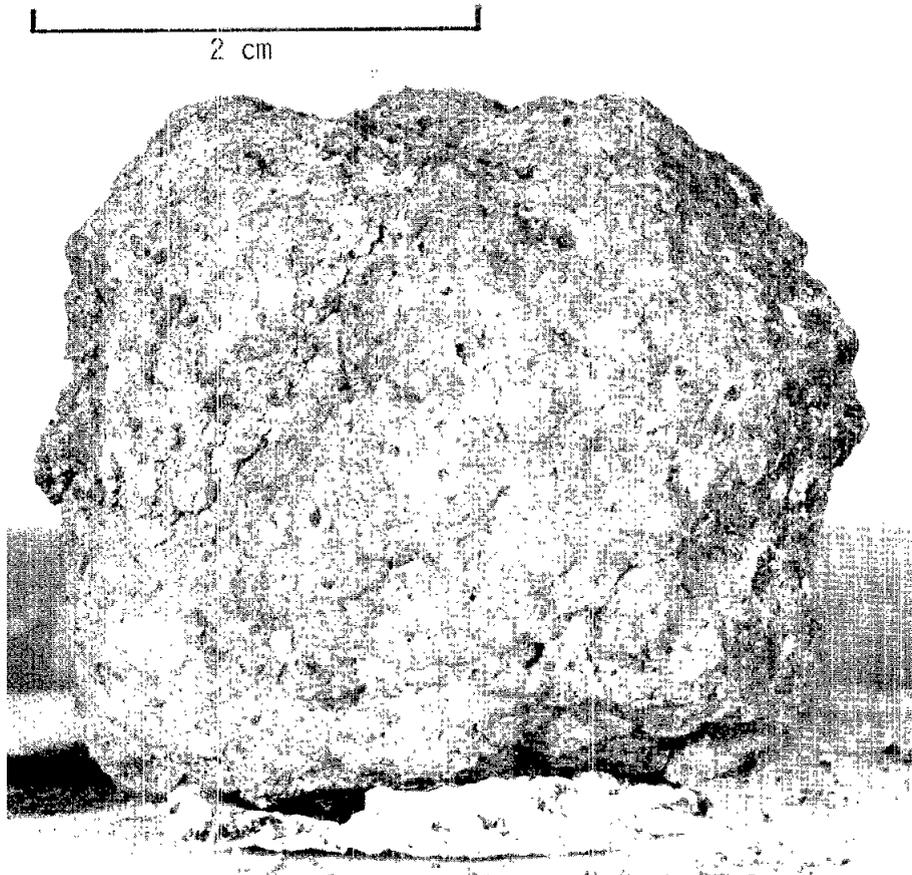
CAVITIES: Very few; vuggy to rounded &lt;0.5 mm

SPECIAL FEATURES: Probably poikilitic breccia

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	Trans	2-3	Blocky		1 - 2	1
Maf sil	Pale green	1-2	Blocky		1 - 2	1
Matrix	Pale yellowish green					
1	Trans	70			<0.2	
2	Black	5			<0.2	
3	Pale yellow green	20			<0.3	

## NOTES:

1. Relict(?)

Sample 77518 T<sub>1</sub>

S-73-19143



Sample 77519 T<sub>1</sub>

S-73-19135

77525

ROCK TYPE: Feldspathic metaclastic  
breccia

WEIGHT: 1.19 g

DIMENSIONS: 1 x 1 x 0.5 cm

COLOR: Light gray (N7)

SHAPE: Blocky

COHERENCE: Intergranular - Tough

Fracturing - None penetrative

BINOCULAR DESCRIPTION

BY: Morrison

DATE: 2/22/73

SURFACE: Rough

ZAP PITS: Pitted on two sides.

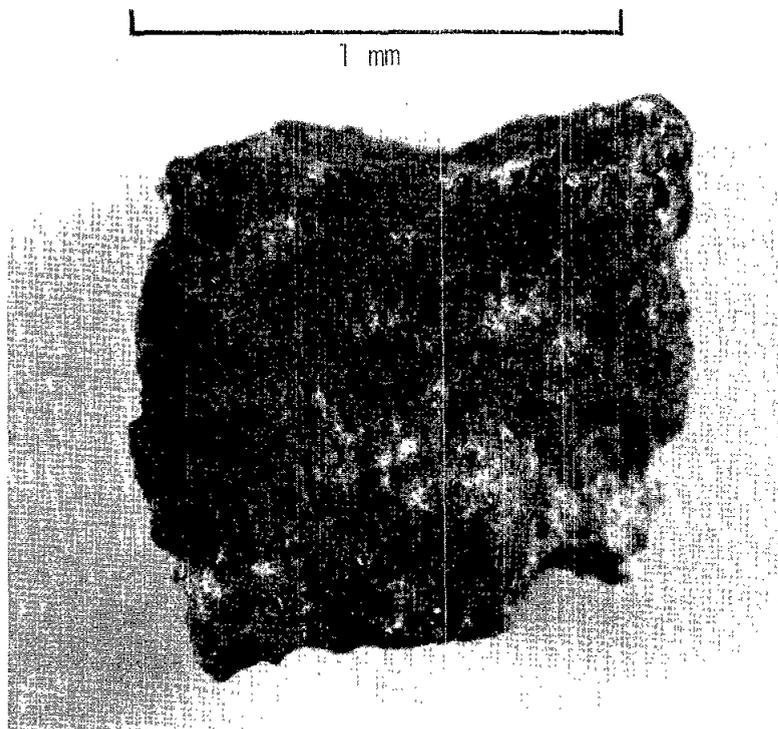
CAVITIES: 1%

SPECIAL FEATURES: This rock is identical to 77516 and 77517, and is probably a chip from 77517.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts	Light gray	40	Ang	2	Up to 4	1
Matrix	White	60		<1		2

## NOTES:

1. Cryptocrystalline sugary clasts.
2. Consists of white material with significant number of cleavage flashes and small (0.5 mm) areas with vitreous crystalline luster, which may be plagioclase crystals.



Sample 77525

S-73-19379

77526

ROCK TYPE: Feldspathic metaclastic  
breccia

SHAPE: Tabular

COHERENCE: Intergranular - Tough  
Fracturing - None penetrative

WEIGHT: 1.07 g

DIMENSIONS: 1.5 x 1 x 0.5 cm

BINOCULAR DESCRIPTION

BY: Morrison

DATE: 2/22/73

SURFACE: Tough

ZAP PITS: Dusty and pitted on one surface

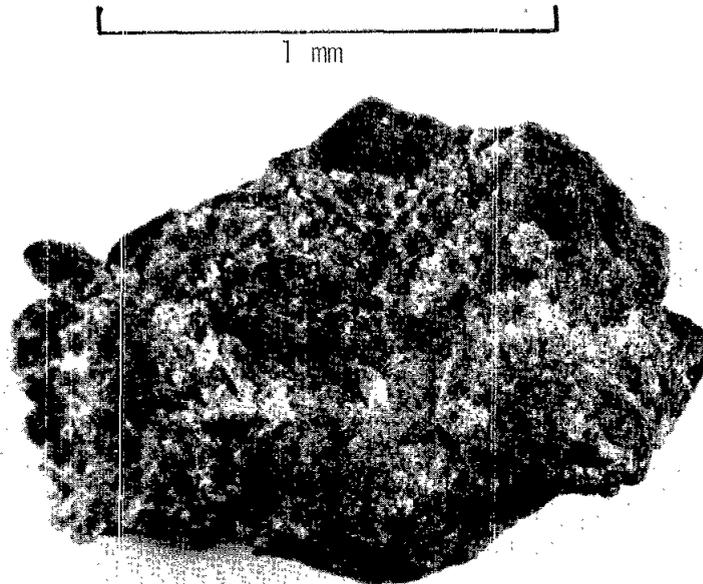
CAVITIES: 1%

SPECIAL FEATURES: This rock resembles 77517 and is probably a chip from it.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clast	Light gray	50	Ang	1	Up to 4x3	1
Matrix	White	50		<1		2

## NOTES:

1. Cryptocrystalline, sugary, appearance.
2. Fine-grained white material with dull luster, probably crushed plagioclase. One metallic spherule seen in matrix. Some 1 mm<sup>2</sup> areas have vitreous luster and look like maskelynite. Also cleavages flashes are locally visible.



Sample 77526

S-73-19380

77535

ROCK TYPE: Basalt  
 COLOR: Gray with brownish cast (N5)  
 SHAPE: Slabby subrounded  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 577.8 g  
 DIMENSIONS: 10.5 x 8.5 x 3.5

BINOCULAR DESCRIPTION BY: Wilshire and Morrison DATE: 2/21/73

FABRIC: Large poikilitic plagioclases

VARIABILITY:

SURFACE: Hackly, Partial glass coating one surface.

ZAP PITS: Zapped on all sides.

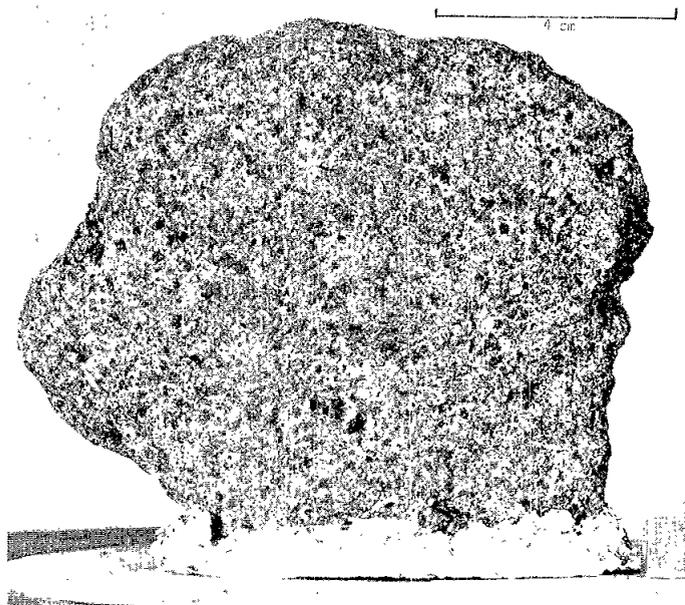
CAVITIES: 1%, from <1 cm to 6 mm vugs with projecting pyroxene and opaque crystals.

SPECIAL FEATURES:

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	35	Laths	1.5	1 to 7x5	1
Pyrox	Brown	45-50	Equant	0.5	0.1 - 1	2
Opaque	Black	10-15	Equant	0.5	0.1 - 1	
Oliv(?)	Green	Tr	Equant	<1		

NOTES:

- Poikilitic grains.
- Intergrowths of pyroxene and ilmenite, about 1x2 mm, form 5% of the rock.



Sample 77535

S-73-19122



77537

ROCK TYPE: Metaclastic tan breccia group      WEIGHT: 71.7 g  
 COLOR: Tan luster (N5 to N6)      DIMENSIONS: 5 x 4.5 x 3 cm  
 SHAPE: Somewhat tabular, wedge-shaped,  
           subangular  
 COHERENCE: Intergranular - Tough  
               Fracturing     - None

BINOCULAR DESCRIPTION      BY: Morrison and Wilshire      DATE: 2/73

FABRIC: Annealed metaclastic  
 VARIABILITY: Homogeneous  
 SURFACE: Hackly  
 ZAP PITS: Pitted all over  
 CAVITIES: <1 mm to 15 mm, 20-25%, ellipsoidal, have a preferred orientation, smooth-walled drusy coating with grain size smaller than matrix grain size. Metal in several cavities.  
 SPECIAL FEATURES: Walls of some of larger cavities have smaller cavities developed on them. In one case two adjacent 5 mm cavities are joined by tabular cavities penetrating a 0.1 mm thick wall. Preferred orientation of cavities.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
Vitreous	Gray		Tabular		2x1	
Maf sil	Yellow-green				1	
Maf sil	Waxy yellow-green		Prism		1.5x2.5	
I	Med gray		Rnd		1x1	1
Matrix		99				2

## NOTES:

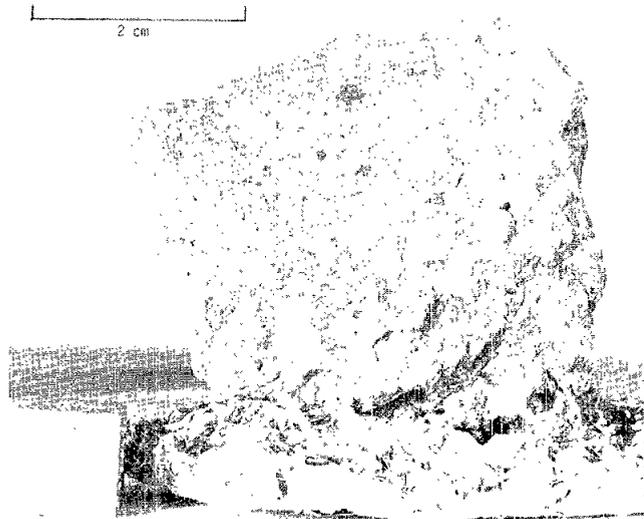
1. Cryptocrystalline.
2. Fine-grained, sugary intergrowth of gray (80%) and white (20%).



<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
Lithic I	Med gray	5	Ang		<1 - 3	1
Lithic II	White	<1			2	2
Lithic III	Reddish brown	<1		1		
Matrix	Light gray	94			<1	3

## NOTES:

1. Forms several fragments to nearly 3 mm; aphanitic to vitreous.
2. Very fine chalky white.
3. Matrix contains clast types in seriate sizes down to limit of resolution, plus some plagioclase debris.



Sample 77538

S-73-19064

77539

ROCK TYPE: Annealed breccia                      WEIGHT: 39.6 g  
 COLOR: Light gray (N6 to N7) with pale        DIMENSIONS: 5 x 3 x 2  
           tan coat.  
 SHAPE: Slightly slabby, subangular  
 COHERENCE: Intergranular - Tough  
               Fracturing        - Two penetrative features

BINOCULAR DESCRIPTION

BY: Wilshire and Morrison DATE: 2/73

FABRIC: Annealed

VARIABILITY:

SURFACE: Rough, very hackly

ZAP PITS: Zapped all over.

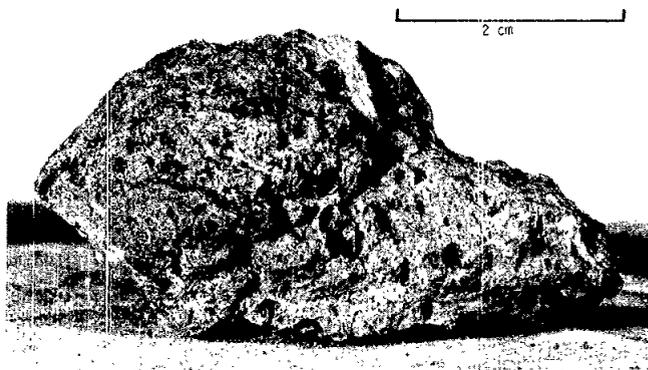
CAVITIES: 15-20%, <1 mm to 11 mm, irregular to slit-like; the slit cavities are lined, have drusy coatings. In one well-exposed cavity, the drusy coating has very fine sugary material with tiny opaque grains.

SPECIAL FEATURES: Large single clast of very fine sugary material forms about 30% of rock.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
Lithic I	Very light gray	30	Slabby subang		21x14x12	1
Lithic II	Yellow green				4x3	2
Lithic III	Pale brownish gray		Subrnd		1x2 - 3x4	3
Plag		<1	Ang		<1 - 1.5	
Maf sil	Yellow green	<1	Ang		1 - 1.5	
Matrix	Gray	70		<1		4

## NOTES:

1. Single large clast; very finely sugary, grain size is <0.1 mm; yellow green mineral (3%) occurs in patches up to 2 mm.
2. 65% yellow green in grains to 3 mm; 35% plagioclase in grains to 1 mm.
3. Very finely crystalline; second clast is 3x4 mm.
4. Very fine sugary intergrowth with scattered mineral debris.

Sample 77539 N<sub>1</sub>

S-73-19070

ROCK TYPE: Metaclastic (tan breccia group)

WEIGHT: 29.5 g

DIMENSIONS: 3.5 x 3 x 2.5 cm

COLOR: Medium light gray (N6)

SHAPE: Blocky, subangular

COHERENCE: Intergranular - Tough  
Fracturing - None

BINOCULAR DESCRIPTION

BY: Morrison and Wilshire

DATE: 2/21/73

FABRIC: Fragmental and granoblastic

VARIABILITY: Homogeneous

SURFACE: Rough

ZAP PITS: Zapped all over

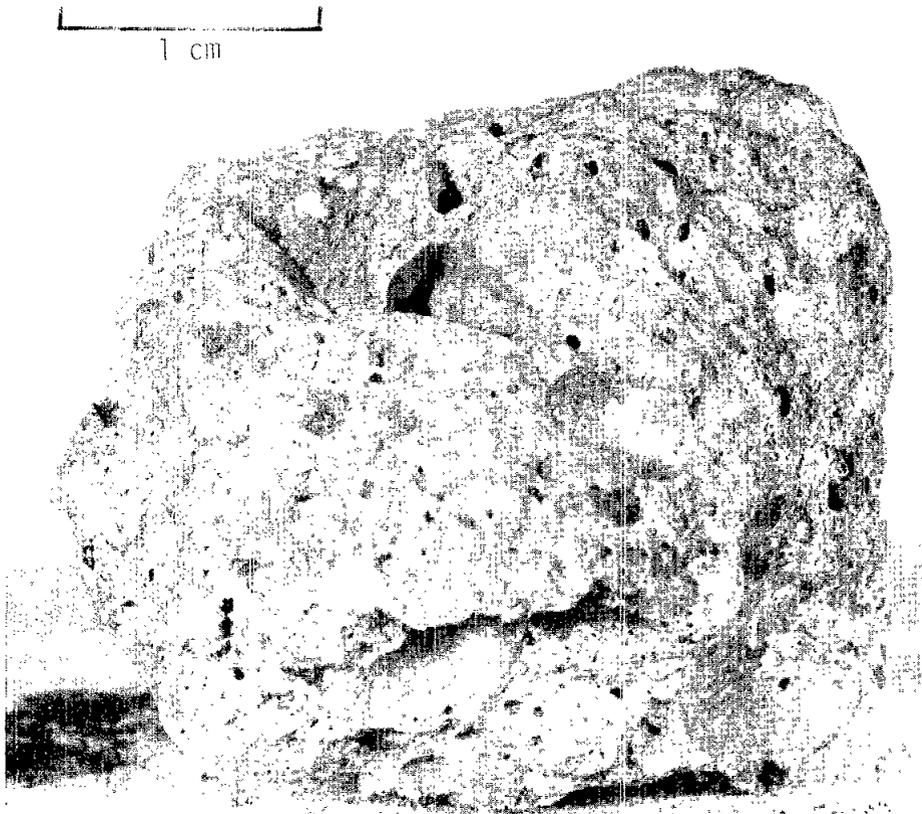
CAVITIES: 25%. 1 cm - size ellipsoidal to <1 mm ellipsoidal to spherical, average 4 mm. Smooth-walled. Fine druse and metal particles on some cavity walls. Yellow green mineral at edge of one cavity. Troilite and Fe in some cavities.

SPECIAL FEATURES: No slit cavities. Well developed, very fine druses on exceptionally smooth-walled cavities, similar to 76215 in this respect.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Clasts						
Lithic I	Greenish yellow	1	Ang		6x6	1
Lithic II	Yellowish green		Ang		6x6	2
Maf sil	Yellow green	1	Blocky ang		To 1.5	
Plag	Gray		1x1			
Glass	Gray		1			
Matrix		98				3

NOTES:

1. Vitreous luster. 30% plagioclase, 20% waxy mafic silicate. Possibly pyroxene (brown) grain size up to 4 mm; plag is interstitial.
2. Fractured. All waxy mafic silicate; looks glassy, grain size 4 mm.
3. Opaque specks to 2% with very fine-grained intergrowth of white and light gray components, some mineral debris, some metal, troilite, and some vitreous blebs.

Sample 77545 T<sub>1</sub>

S-73-19129

78135

ROCK TYPE: Basalt

WEIGHT: 133.9 g

COLOR: Medium gray (N4)

DIMENSIONS: 5 x 4 x 3 cm

SHAPE: Irregular

COHERENCE: Intergranular - Coherent

Fracturing - Several non-penetrative

BINOCULAR DESCRIPTION

BY: Meyer and Agrell

DATE: 1/5/73

FABRIC: Equigranular

VARIABILITY: Homogeneous

SURFACE: T is hackly, part original and part broken surface, B is 50% covered by a 0.2 mm thick film of dark glass with a patch of fine adherent dust concentrated at south end. S face has a thin glass veneer which covers 50% of surface and thins toward N.

ZAP PITTS: Few on T (S half), B, S; none on W and N.

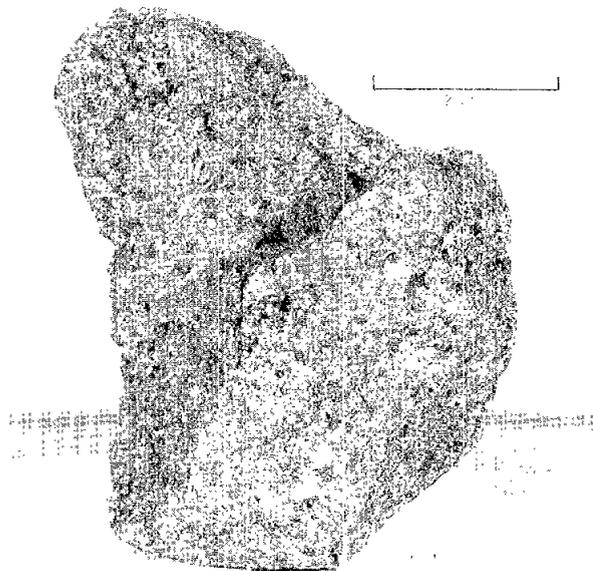
CAVITIES: 5%, small vugs (<2 mm diameter) are common. These may be aligned, interconnected, and control the direction of some non-penetrative fractures, pyroxene and plagioclase visible on the walls of the vugs.

SPECIAL FEATURES: Many small vugs - contain idiomorphic plagioclase and pyroxene, vugs have tendency to alignment which has controlled fractures. Pyroxene in plagioclase is cinnamon brown in color, but polycrystalline groups possibly associated with ilmenite are darker, duller brown.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White trans- lucent	35	Lathy tablets	0.5	0.2 - 4	1
Pyrox	Cinnamon to dark brown	50	Equant granular	0.1 - 0.2	0.1 - 0.3	
Oliv	Pale yellow green	<1	Equant	0.1		
Opaque	Black	15	Patchy	0.2		2

NOTES:

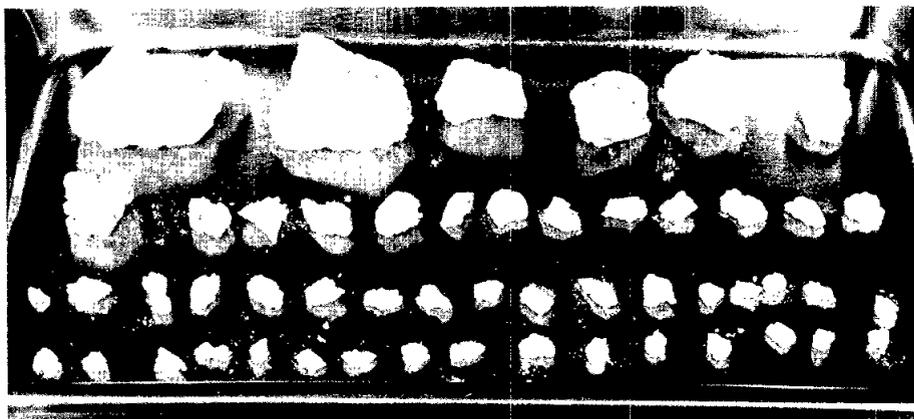
1. Also interstitial, orientation random.
2. Tabular - associated with pyroxene.



Sample 78135

S-73-15003





Sample 78155

S-73-15408

THIN SECTION DESCRIPTION

BY: Stuart-Alexander

DATE: 1/20/73

SECTION: 78155, 7 and 8

SUMMARY: Rock is a monomict breccia of a metaclastic rock, possibly locally melted. Present grain size is seriate from matrix into clast sizes. Clinopyroxene seems to have been preferentially granulated. The borders of lithic clasts are gradational into the matrix.

## MATRIX, 65% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	55	Ang	<0.1	Composed mainly of ground-up plagioclase and possibly recrystallized(?) clinopyroxene granules.
Cpx	45	Gran	<0.1	
Ilm	<1	Irreg	<0.1	
Oliv	Tr	Irreg	<0.1	

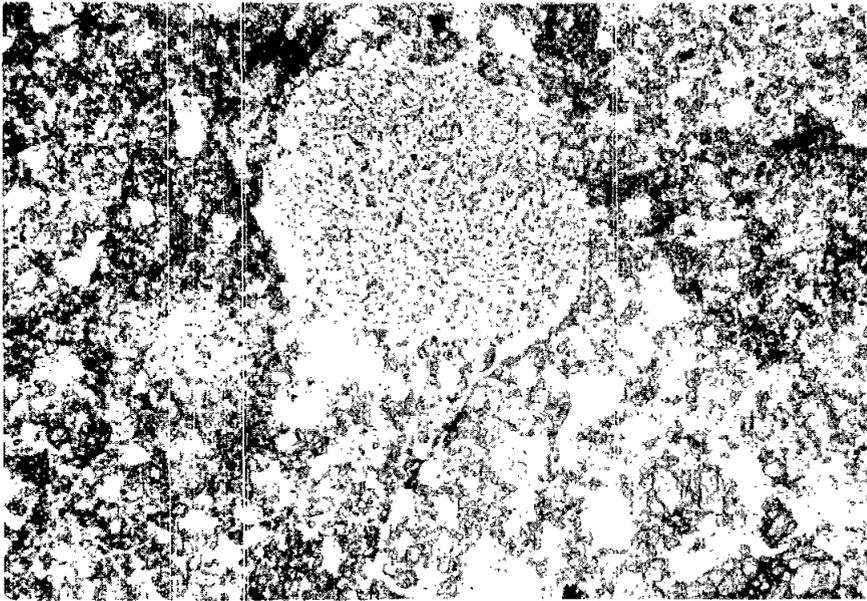
## MINERAL CLASTS, 25% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	70	Ang to rnd	Up to 1.4	Olivine is more abundant in section 8 than 7.
Cpx	30		Up to 0.7	
Oliv	Tr		Up to 0.1	

## LITHIC CLASTS, 10% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I	50	Rnd	Up to 2.2	I. Plagioclase laths and about 25% broken plagioclase phenocrysts with granules of clinopyroxene. One clast of this type grades into a mosaic texture of plagioclase with some remnant mineral clasts.
II	50	?	Up to 1.5	

II. Plagioclase - pyroxene metaclastic rock having about same mineral proportions as matrix of rock.



Section 78155,8 S-73-19921  
Width of field 3.16 mm, plane light

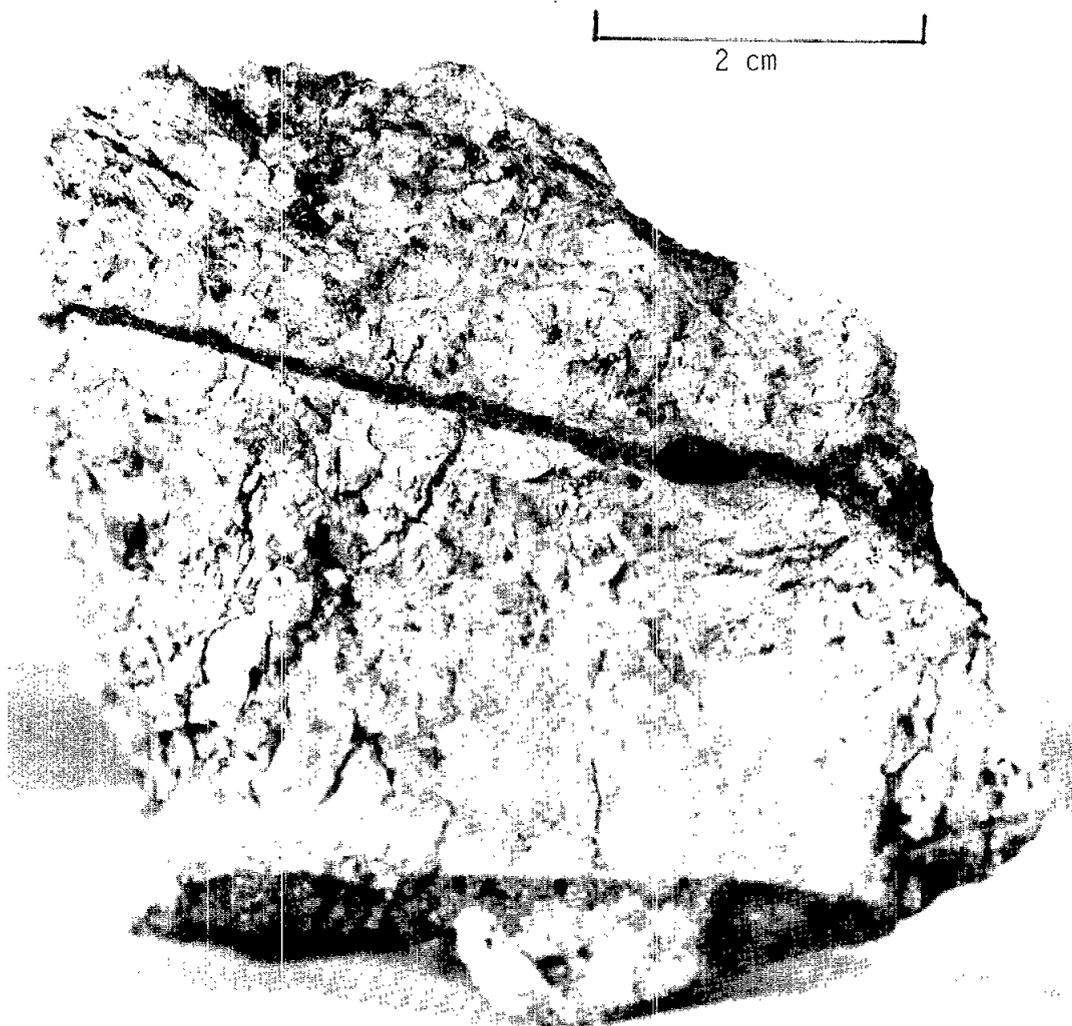
<u>OPAQUES DESCRIPTION</u>		<u>BY: Brett</u>		<u>DATE: 2/9/73</u>
<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Cr-sp	< 0.1	Ang	To 0.05	Unusal section in that the dominant (but rare oxide) is chrome-spinel, intergrown with what appears to be armalcolite. Metal and troilite are relatively rare, angular rather than rounded grains.
Arm (?)	< 0.1	Lamel, ang	To 0.04	
Fe-Ni	< 0.1	Ang, blebs	To 0.04	
Troil	< 0.1	Ang, rnd	To 0.05	



Plag	Glassy- milky	30 - 35	Interstit	3	6x4 - 1x1	5
Opaque	Black	Tr	Rnd	>0.1		6

## NOTES:

1. Rectangular shape dominant on E and N faces. Fine granular aggregate completely recrystallized. Mottled appearance. Grain size less than 0.1 mm. Probably olivine.
2. Looks like all is shocked. Milky is probably fine-grained aggregates.
3. Specks in maf sil.
4. Appears to be exactly like maf sil in layer I.
5. Blocky plagioclase is rare.
6. Specks in maf sil.

Sample 78235 B<sub>1</sub>

S-73-15180

78236

ROCK TYPE: Coarsely crystalline gabbroic rock  
 WEIGHT: 93.06 g  
 DIMENSIONS: 7.5 x 2.0 x 5.5 cm  
 COLOR: Glass - medium gray (N4); rock - yellowish gray (5Y 7/2)  
 SHAPE: Rounded on five sides; B is planar  
 COHERENCE: Intergranular - Tough  
 Fracturing - One through-going fracture visible on T which goes from S to N, plus numerous short irregular fractures in rock.

BINOCULAR DESCRIPTION

BY: Jackson and Morrison

DATE: 1/17/73

FABRIC: Coarse, equigranular

VARIABILITY: Partial thin glass coating on T extends over all of S and half of W, glass has spalled from T and W.

SURFACE: Glass coating on all sides but B, and part of W and T where glass has been stripped off. Glass surface is smooth and pitted, rock surface is hackly and not pitted.

ZAP PITS: Few on T (a non-equilibrium or "production surface"). Largest spall is 6 mm diameter, average pit size is 0.5 mm, counted 10 sub-millimeter spalls on glass on one area, and 5 - 6 spalls on another. Density increases towards W.

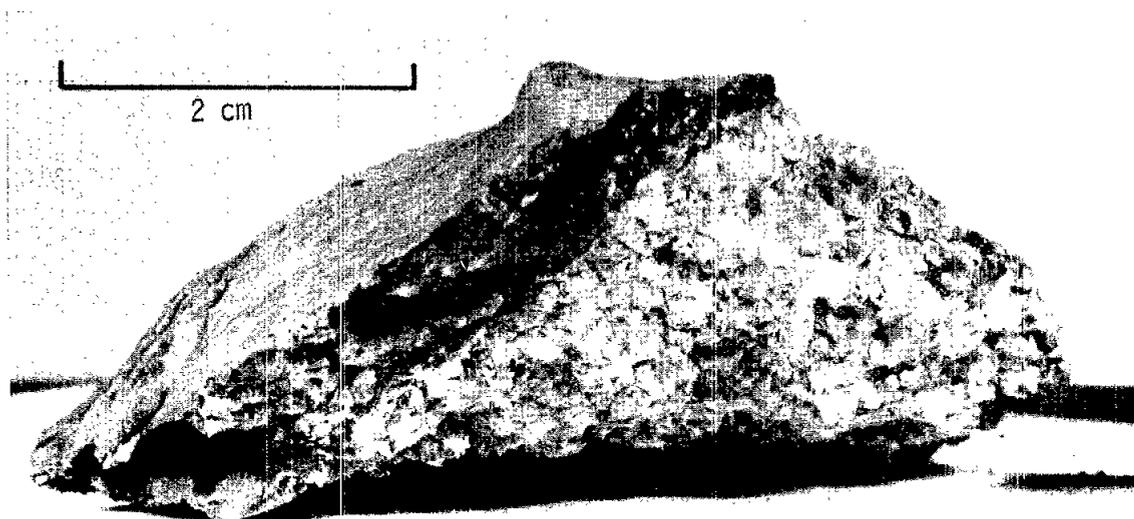
CAVITIES: For glass, see Note 1 below; cavities in crystalline rock are &lt;4%, 1-2 mm, circular to square, concentrated near margins and along glass veins.

SPECIAL FEATURES: Relative to 78255 from another part of the same 2/3 in boulder, this rock may be more shocked because its mafic minerals seems duller and its maskelynite percentage is possibly higher. In other respects (mixture and mode) the two samples are very similar.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Glass	N4					1
Maf sil	Grayish yellow to yellow gray	45-50	Blocky	3x4	5x7 to 2x2	2
Plag	Gray vitreous	10	Blocky	4x5	3x3 to 5x5	3
Plag	Milky to white	40	Irreg	1 - 2	1 - 2	
Opauques		<<1				4

## NOTES:

1. Coating whose thickness varies from 1 cm to 2 mm contains vesicles up to 1 cm dia. These are lined with felted crystals and reticulated rosette shapes. Average vesicle <1 mm. Where glass is thick it has disaggregated the rock and incorporated fragments. Biggest fragment is 3 mm. No metal in glass, which may be same composition as rock. There are robin's egg blue areas of unknown nature restricted to a small part of the glass on the B surface. They may be alterations minerals, or coatings.
2. Very fine-grained, polycrystalline aggregates of olivine or opx.
3. 50% of all plagioclase is maskelynite, 30% of all is milky, and <20% is fresh; fills in between mafic sil.
4. No clearly visible opaques except blocky particles in mafic silicate.

Sample 78236 E<sub>1</sub>

S-73-15392

78238

ROCK TYPE: Glass coated, coarse-grained  
gabbroic rock

WEIGHT: 57.58 g

DIMENSIONS: 4.5 x 5.0 x 3.5 cm

COLOR: Rock: yellowish gray (5Y 7/2).

Glass coat: grayish black (N2)

SHAPE: Wedge-shaped to pyramidal.

COHERENCE: Intergranular - Tough

Fracturing - Penetrative. Two sets, one perpendicular to T. The other subparallel to B. Some are glass filled, others cut glass.

BINOCULAR DESCRIPTION BY: Williams and Jackson

DATE: 1/18/73

FABRIC: Equigranular

VARIABILITY: Glass-coated and veined. Crystalline rock, homogeneous.

SURFACE: B is fresh and hackly; N and T are mostly glass coated, smooth; E is mostly fresh broken, hackly; S and W partly glass covered, scrubbed. Glass coating ranges from 0-2 mm in thickness.

ZAP PITS: Many (10-15/cm<sup>2</sup>) on T, N and S; few (5/cm) on W; others none. Zaps are 1 mm diameter and on W and S they penetrate the glass coating.

CAVITIES: Glass coating: vesicles, &lt;5% 1 mm and smaller.

Glass vein: vesicles, 20% ranging from 1.0 to 5.0 mm, average 2 mm.

Crystalline rock: Very few 1 to 2 mm cavities, unlined, so sparse cannot be localized.

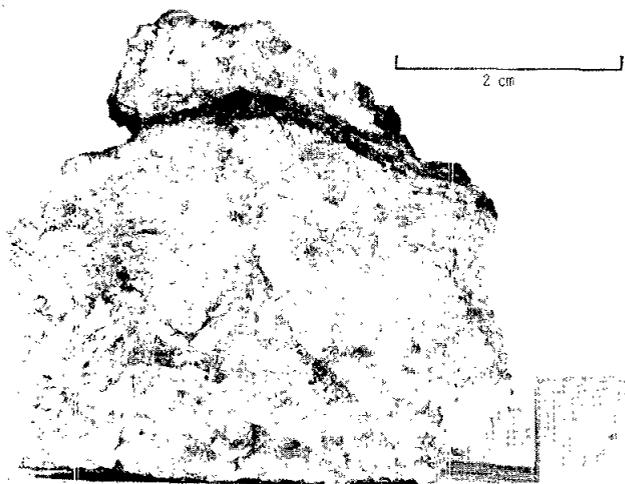
SPECIAL FEATURES:

1. Some mafic silicates show especially good crystal shapes. Dominant shape rectangular with corners cut off by 45° crystal faces, pure rectangular or euhedral forms present but rare. The length to width ratio of the crystals is 2 to 3.
2. Very blue coating on maskelynite near glass vein.
3. Possible foliation of minerals parallel to B.

COMPONENT	COLOR	% OF ROCK	SHAPE	SIZE (mm)		NOTES
				DOM.	RANGE	
Mafic silicate	Medium greenish yellow (10Y 7/2)	45	See note 1	3x5	6x12 to 1.5 x 2.5	1
Plagioclase	Glassy to grayish	20	Blocky	3.5	5x8 to 2x3	2
Plagioclase	Chalky white	35	Inter- stitial	0.2		
Opaque	Black	Tr	Para- llelo- grams		0.2	3
Opaque	Black	Tr	Rnd		>0.1	4

NOTES:

1. Dull fine aggregates make up the areas which were once individual grains. Thoroughly crystallized.
2. Plagioclase is 90% maskelynite. About 5% is dull and cloudy, 5% may still be plagioclase. See Special Features "2."
3. Only several grains in whole rock. Very shiny located in interstitial plagioclase. Probably not ilmenite.
4. In mafic silicate.



Sample 78238

S-73-15461

THIN SECTION DESCRIPTION

BY: Jackson

DATE: 2/10/73

SECTION: 78238,7

SUMMARY: Meta-norite; formerly a coarse-grained rock, pulverized to an aggregate of orthopyroxene, plagioclase and mineral glasses.

<u>PHASE</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opx	25	Ang		Opx is crushed; largest surviving grains are about 1 mm, smallest below level of resolution. Remaining grains show heavy shock damage, including shock twinning. No original exsolution lamellae are present. The tan glass has abundant opx-rich areas, and is probably fused opx.
Pale tan glass	25			
Plag	15	Ang		
Brown glass	1	Veins	Width 0.1	
Cpx	<1	Ang	0.1	
Opaq	<1	Ang	0.1	

Plagioclase is also shattered and shock-deformed. Albite twin lamellae survive in some grains. Fragments reach about 1 mm and range down to the limit of resolution. More than half of the plagioclase is maskelynite. Contacts between maskelynite and opx are ragged and interdigitated by shearing. Cores of recognizable plagioclase are in areas away from pyroxenite contacts.

Pale tan glass is confined to opx-rich areas, and is probably pyroxene glass.



ROCK TYPE: Coarse-grained gabbroic rock      WEIGHT: 48.31 g  
 COLOR: Glass; grayish black to dark      DIMENSIONS: Two pieces  
         gray (N2-4). Rock; light olive  
         gray (5Y 6/1).  
 SHAPE: Angular broken  
 COHERENCE: Intergranular - Tough  
             Fracturing - Moderately fractured, most non-penetrative

BINOCULAR DESCRIPTION      BY: Jackson/Wilshire      DATE: 1/12/73

FABRIC: Equigranular

VARIABILITY: Glass coating is of irregular thickness. Mafic silicate to plagioclase ratio in crystalline rock is somewhat variable.

SURFACE: N is half covered by glass; B and E are glass-covered; S is half covered by glass. Uncovered surfaces of crystalline rock are hackly.

ZAP PITS: Pits are only on glass. Many on B, E, S; none on T, N, W.

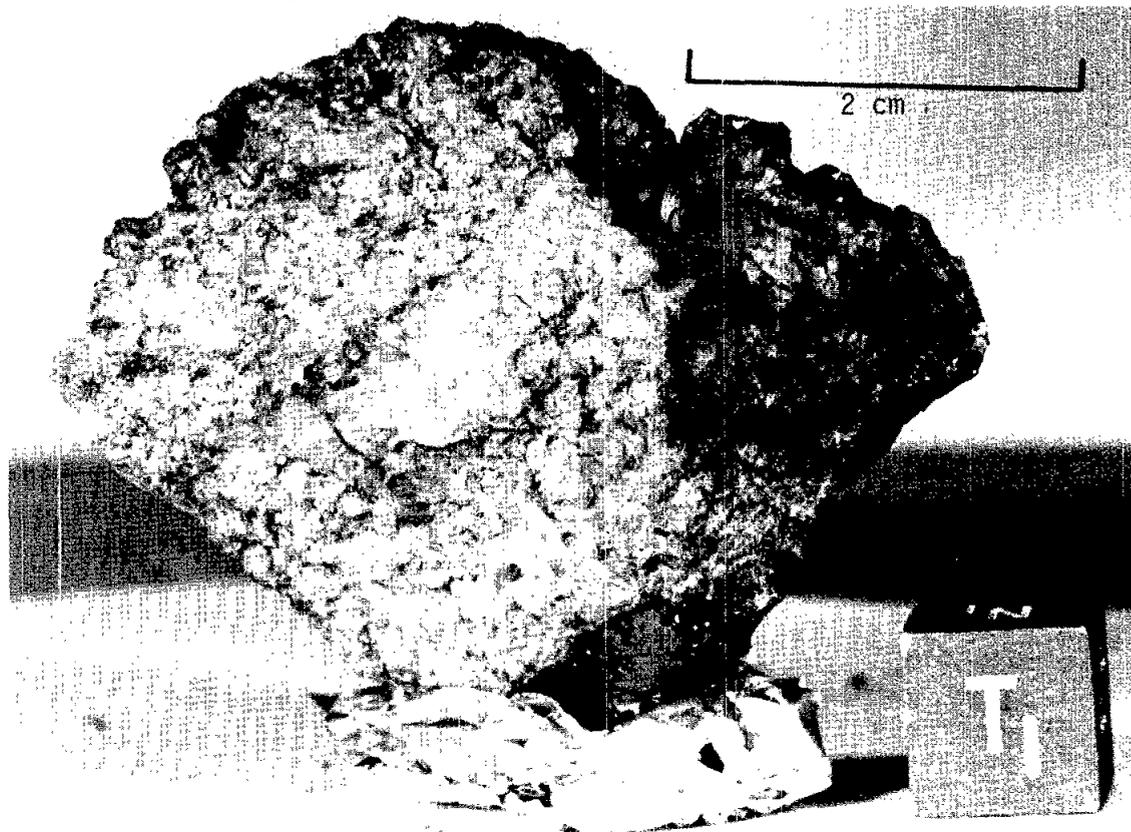
CAVITIES: Glass is vesicular, consists of about 10% vesicles, from <1-7 mm in diameter. Crystalline rock has tiny cavities in both principal minerals, these amount of <1% of the rock, and are about 0.5 mm in diameter; they are localized close to glass selvages or veins.

SPECIAL FEATURES: Plagioclase locally broken down to granular aggregates, 1 mm in size. Good candidate for exposure age of glass.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTE</u>
				<u>DOM.</u>	<u>RANGE</u>	
Glass	Grayish black-dark gray	10	Coating and veins			1
Crystalline Rock						
Mafic silicate	Dusty yellow	40	Stubby prisms	3x5	2x3-5x7	2
Opaque	Black	<1	Molded shapes	0.7	0.3 - 1	3
Opaque	Adamantine black	<1	Equidimensional	0.1		4
Plagioclase	Clear gray-white	50	Blocky, rectangular	4x8	4x10-2x5	5
Plagioclase	White		Interstitial		1 - 2	6

## NOTES:

1. Contains small inclusions of coarse gabbroic rock; sharp contact; veins in coarse rock.
2. Dull luster, may be composed of very fine poly-crystalline aggregates; parting, possible relict cleavage in two sets, prismatic,  $90^\circ$  to each other, normal to long sides of prisms.
3. Sparsely distributed along mafic silicate - plagioclase contacts.
4. Inclusions in mafic silicate.
5. Albite twinning seen in one grain. Partly recrystallized, some converted to maskelynite, some relicts (maskelynite more than 50% of plagioclase).
6. Except texturally same as above plagioclase.



Sample 78255

S-73-15189

ROCK TYPE: Dark matrix breccia  
 COLOR: Medium dark gray (N4)  
 SHAPE: Roughly conical  
 COHERENCE: Intergranular - Friable  
 Fracturing - Many, penetrative

WEIGHT: 1.039 g  
 DIMENSIONS: 1 x 1 x 1.5 cm

BINOCULAR DESCRIPTION

BY: Butler

DATE: 4/6/73

VARIABILITY: Homogeneous

SURFACE: Fresh glass splash covers part of E and penetrates  
 fractures a short way.

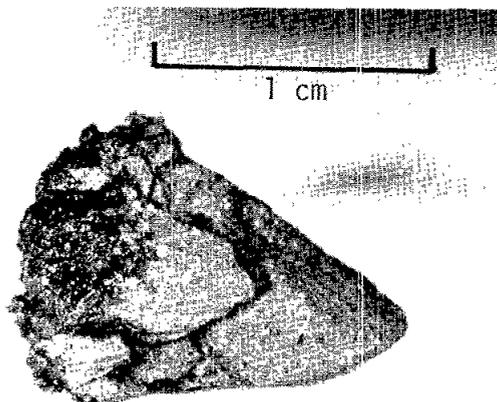
ZAP PITS: None

CAVITIES: None in rock; the glass is bubbly

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Glass coating	Dark brwn	5				
Matrix Clasts		90		<0.1		1
Plag	White, c'less	4	Ang, equant		0.1 - 1	2
Lithic	White	<1		0.5		3

## NOTES:

1. About 60% fragments and spherules of shiny black glass and brown glass, and 40% light gray and white, very fine-grained minerals.
2. Some are white and powdery, others are gray, clear, and vitreous. A few have disseminated dark specks, and thus are lithic clasts.
3. 50% plagioclase (white and colorless); 25% pale brownish-yellow in bands (opx?); 25% light pinkish-red (spinel?) as grains bordering the clast. One only.

Sample 78465 N<sub>1</sub>

S-73-19724

78505-78519, 78525-78528, 78535-78599  
(exclusive of numbers ending in digits 0-4)

SAMPLE TYPE: Rocks (fragments >1 cm) from the Station 8 rake sample  
(39 fragments) and associated soil (9 fragments).

CLASSIFICATION AND DESCRIPTION BY: Simonds, Ridley, DATE: 1/27 -  
and Wilshire 1/28/73

#### FRIABLE MEDIUM GRAY BRECCIAS

78508 (10.67 g)	78549 (16.09 g)	78559 (3.05 g)
78516 (3.18 g)	78555 (6.64 g)	78565 (3.50 g)
78518 (0.88 g)	78556 (9.50 g)	78566 (0.77 g)
78547 (29.91 g)	78557 (7.19 g)	78567 (18.88 g)
78548 (15.95)	78558 (3.78 g)	

Subrounded, friable, medium gray (N5) to medium dark gray (N4) matrix-rich breccias with clasts generally of millimeter size composing less than 5% of the rock. Clasts are generally white and subangular to rounded but there also occur clasts of mare basalt, black aphanitic material, olivine, orange glass, and green glass. All or some combination of this clast population may be present in any sample.

#### MODERATELY COHERENT MEDIUM GRAY BRECCIA

78515 (4.76 g)	78537 (11.76 g)	78545 (8.60 g)
78535 (103.4 g)	78538 (5.82 g)	78546 (42.66 g)
78536 (8.67 g)	78539 (3.73 g)	78568 (3.57 g)

Subangular, moderately coherent, medium gray to medium dark gray, matrix-rich breccias with clasts generally of millimeter size comprising less than 5% of the rock (78546 and 78568 may contain up to 10%). Clasts are predominantly white and consist of plagioclase or sugary lithic material; but there are also clasts of mare basalt and green mafic silicate (probably olivine). Orange glass clasts occur in 78546.

#### BASALT

These are all basalts having variations similar to those of the Station 1 rake sample (71505-71597). Some individual characteristics of the fragments are listed in the following table. The olivine generally occurs in clusters. Grain size refers to an average size; coarse is greater than 1 mm, and very fine is less than 0.1 mm.

<u>SAMPLE NUMBER</u>	<u>WEIGHT (g)</u>	<u>OLIVINE CONTENT</u>	<u>GRAIN SIZE</u>	<u>COMMENTS</u>
78505	506.3	3-5%	Coarse	Vuggy
78506	55.97	2-3%	Coarse	Irregular, elongate vugs 2 to 5 mm in size
78507	23.35	<1%	Coarse	Vugs up to 3 mm (avg 1 mm)
78509	8.68		Medium	Vuggy
78528	7.00	None	Fine	Partial breccia coating suggests this may have been a clast
78569	14.53	None	Fine	Partial breccia coating suggests this may have been a clast
78575	140.0	<1%	Medium	Vuggy
78576	11.64	None	Coarse	Vuggy
78577	8.84	None	Coarse	Vuggy
78578	17.13	None	Coarse	Vuggy
78579	6.07	<1%	Medium	Vuggy
78585	44.60	None	Very fine	
78586	10.73	None	Very fine	May have flow texture, one large plag (3 mm long)
78587	11.48	None	Very fine	
78588	3.77	None	Very fine	Vuggy
78589	4.10	None	Very fine	Vuggy
78595	4.19	None	Very fine	Vuggy
78596	7.55	None	Very fine	Vuggy, one 7.5 mm diameter vesicle
78597	319.1	2-3%	Medium	Porphyritic plag crystals, vuggy
78598	224.1	<1%	Very fine	A few large plag crystals
78599	198.6	None	Fine	Vuggy

78505

ROCK TYPE: Basalt  
 COLOR: Medium dark brownish gray  
 (between 5YR 4/1 and N4)  
 SHAPE: Blocky, irregular  
 COHERENCE: Intergranular - Massive, coherent  
 Fracturing - Several penetrative fractures; few  
 approximately parallel to S face,  
 otherwise irregular.

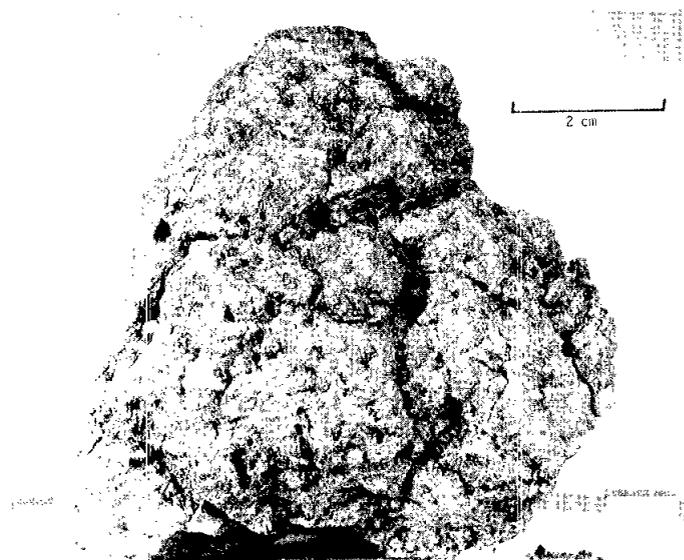
BINOCULAR DESCRIPTION BY: Jackson and Ridley DATE: 1/17/73

FABRIC: Not oriented; diabasic - intergranular  
 VARIABILITY: Homogeneous  
 SURFACE: All hackly except S and parts of T and B, which have a  
 smooth 0.5 - 1 mm thick adhering soil cover which smooths the  
 surface.  
 ZAP PITS: Fresh hackly faces have no pits. Of the soil covered  
 faces: none on W, and few on S. Pits are difficult to identify  
 because of hackly surfaces.  
 CAVITIES: 5% vugs, with a size range 1 - 5 mm, half brown pyroxene  
 and half glassy plagioclase, average 2.0 mm and irregular shapes.  
 No orientation. Contain euhedral mineral projecting from the body  
 of the rock into vugs. Ilmenite is present in a few vugs but  
 decidedly rare.  
 SPECIAL FEATURES: Chip for thin section is representative of the rock.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Oliv	Yellow	<5	Subhed	1	0.7 - 1.5	1
Pyrox	Root beer brown	40	Blocky to irreg	0.5	0.2 - 1.5	2
Plag		35	Blocky to poik	1	0.5 - 7	3
Ilm		20	Rods	0.3x1	0.1 - 1.5	
Silica		≤5		0.4		4

## NOTES:

1. Clear, appear to be microphenocrysts. No apparent zoning. Irregularly scattered.
2. Only one type of pyroxene. Occasionally changes color to deep reddish-brown.
3. The poikilitic feldspar includes well shaped crystals of pyroxene and ilmenite and tends to form larger crystals than the other feldspar.
4. Concentrated near vugs; clear, glassy luster.



Sample 78505

S-73-15384

THIN SECTION DESCRIPTION

BY: Jackson

DATE: 1/10/73

SECTION: 78505,7

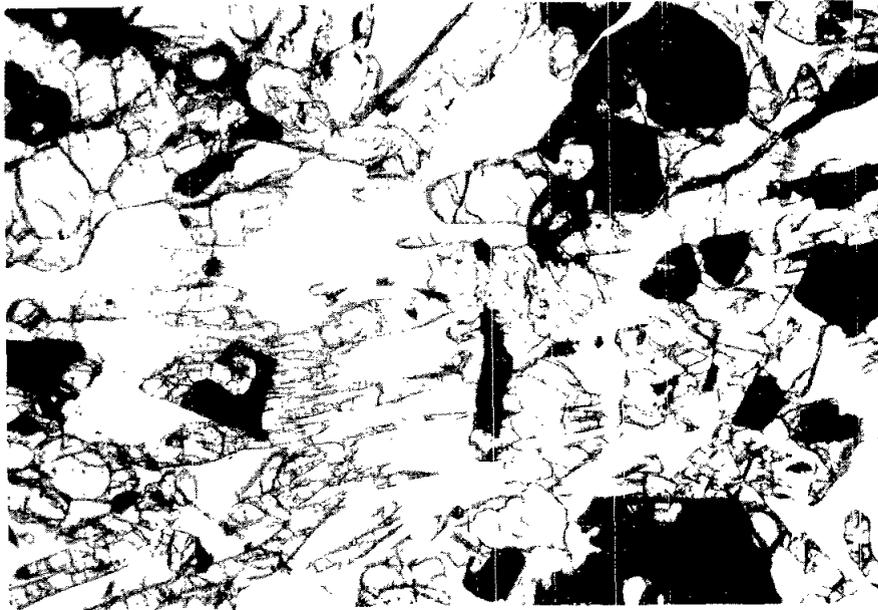
SUMMARY: Coarse-grained poikilitic basalt

<u>PHASE</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Oliv	5	Rnd to prism	0.2	Ilmenite has a very even distribution and is probably an early phase. Olivine is evenly scattered and is euhedral in plagioclase, but partially resorbed in pyroxene.
Cpx	45	Blocky to prism	0.5 - 2.0	
Plag	30	Interstit	2 - 5	Pyroxenes are of two shapes: large and blocky, poikilitically enclosing ilmenite crystals, and smaller and prismatic with a tendency to be displayed in variolitic sheaths.
Brown glass	1	Interstit	0.02	
Silica	3	Interstit	0.1	Plagioclase is commonly poikilitic, in plates as large as 5 mm. Cristobalite is usually in fairly well-shaped grains, interstitially disposed.
Ilm	15	Prism to irreg	0.4	
Sulfide	1	Vermicular	0.02	
Spinel	Tr	Octahed	0.02	

TEXTURE: Dominantly poikilitic, with large continuous plagioclase plates enclosing more or less well shaped crystals of pyroxene, ilmenite, and

olivine. Pyroxene has a tendency to be variolitic in places. A little glass is present in an intersertal arrangement.

ADDITIONAL COMMENTS: All percentages are estimates. Vesicles are very sparse in this chip. Where present, their walls are coated by a thin rind of glass.



Section 78505,7 S-73-19970  
Width of field 3.16 mm, plane light

OPAQUES DESCRIPTION		BY: Brett	DATE: 2/9/73	
SECTION: 78505,7				
PHASE	% OF SECTION	SHAPE	SIZE (mm)	COMMENTS
Ilm	15	Blocky, laths	To 1	Pinkish Mg-rich ilmenite with usual rutile and spinel lamellae. Thin wire-like metal veins are common in the vicinity of ilmenite. Armalcolite crystals occur largely included in olivine, in some cases partly replaced by ilmenite. Ulvospinel as spherules and rare anhedral grains containing ilmenite lamellae and metal. Metal and troilite in usual type of occurrence.
Fe-Ni	< 0.2	Anhed	To 0.075	
Troil	< 0.2	Blebs, rnd	To 0.1	
Arm	Tr	Euhed to subhed	To 0.15	
Ulv	Tr	Blebs, anhed	To 0.05	





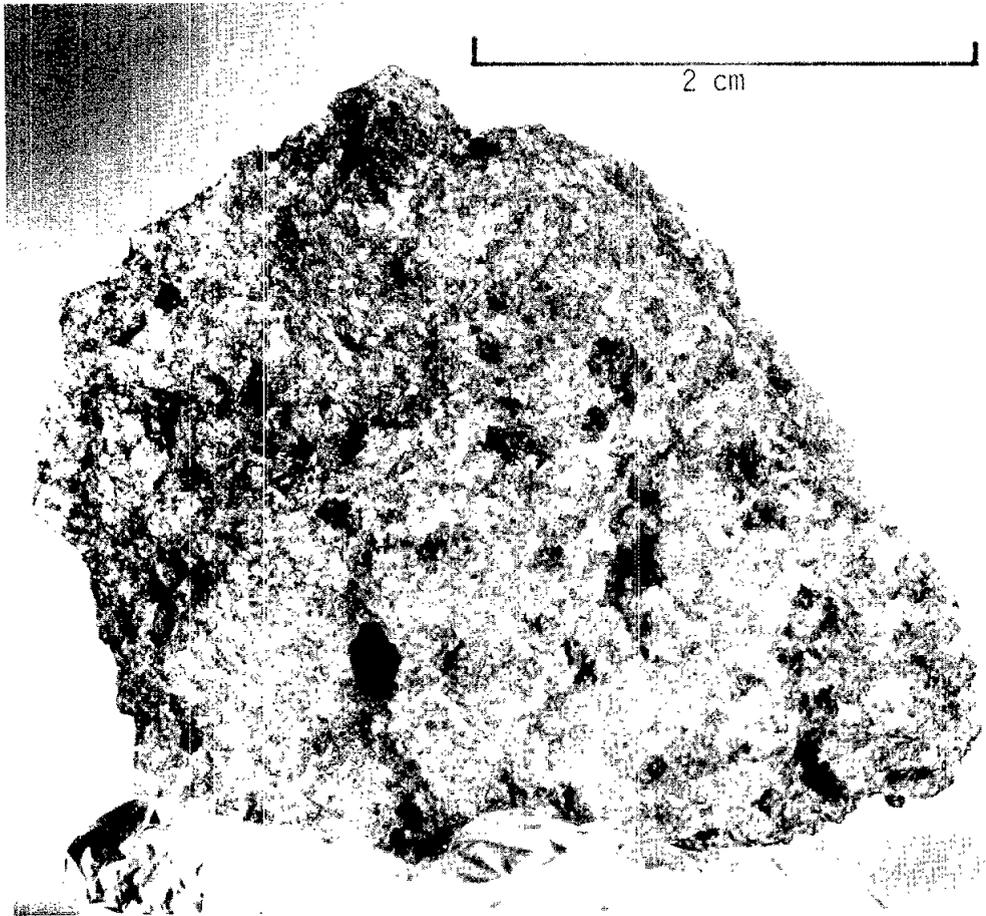
412

## 78507 (Continued)

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox	Light to med brown	50-55	Anhed	0.4	0.2 - 1.5	1
Plag	White to c'less	30	Lathy to irreg	0.5	0.2 - 1.5	2
Opaque	Black metallic luster	15-20	Irreg	0.6	Up to 2	
Oliv	Pale yellow	1	Rnd to irreg	0.3	Up to 1	

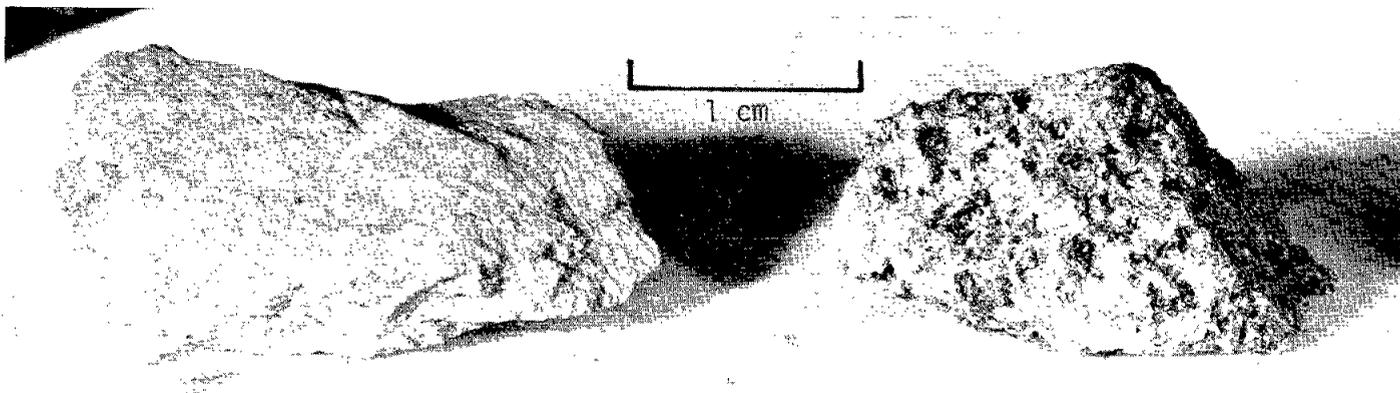
## NOTES:

1. Some in vugs, zoned yellowish core to pale brown rim, some in clots.
2. Glassy luster.



Sample 78507

S-73-16144

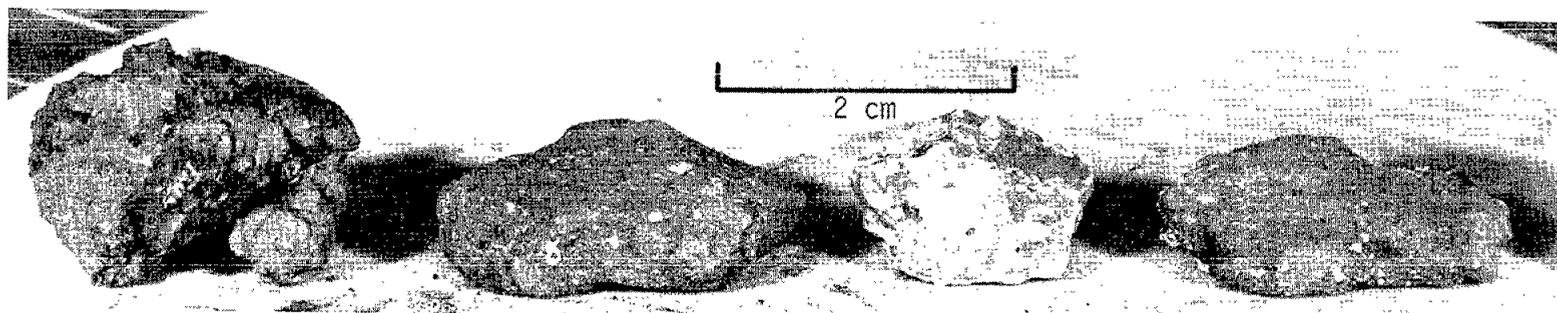


Sample

78508

N<sub>1</sub> S-73-18608

78509



Sample

78515

78516

N<sub>1</sub> S-73-18607

78517

78518

## MISCELLANEOUS ROCK TYPES

78517, 78525-78527

78517 (1.82 g) is a friable, white cataclasite.

78525 (5.11 g) is an agglutinate of dark matrix breccia with a few percent small white clasts cemented by a vesicular black glass.

78526 (8.77 g) is a mixture of coherent gray breccia disrupted by numerous veins of pale green glass. The breccia contains small white clasts.

78527 (5.16 g) is a brecciated, coarse-grained (up to 4 mm) gabbroic rock with a dark glass coating. The feldspar is probably maskelynite and the mafic silicate is pale green.

79035

ROCK TYPE: Breccia  
 COLOR: Dark olive gray (5Y 4/1)  
 SHAPE: Rounded, blocky  
 COHERENCE: Intergranular - Friable  
           Fracturing - Few, non-  
                           penetrative

WEIGHT: 2806 g  
 DIMENSIONS: Three large fragments:  
 19 x 14 x 10 cm  
 15 x 10 x 6 cm  
 15 x 6 x 4.5 cm  
 and three smaller fragments

BINOCULAR DESCRIPTION      BY: Stuart-Alexander      DATE: 1/23/73

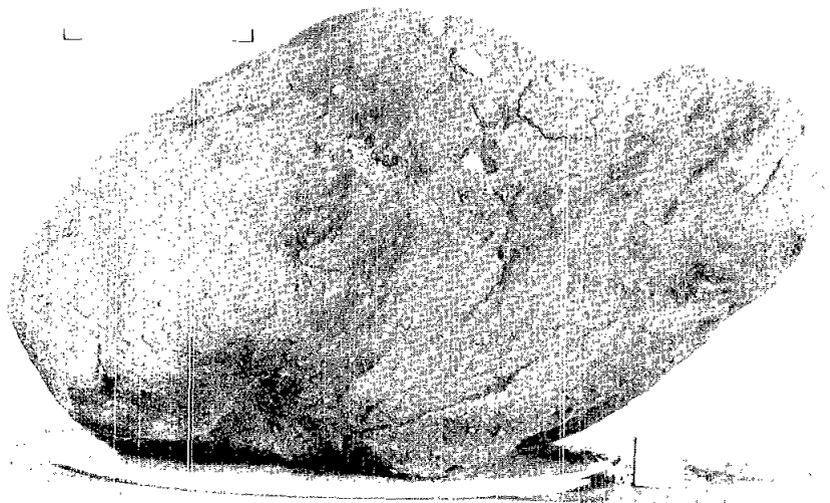
FABRIC: Seriate breccia  
 VARIABILITY: Suggestion of layering in clast size.  
 SURFACE: All rounded, grainy with clasts standing out in relief.  
 ZAP PITS: None, but undoubtedly would have spalled off.  
 CAVITIES: None  
 SPECIAL FEATURES: All clasts are more or less dust covered so that many are difficult to identify.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Basalt clast	Gray brown	1 - 2	Irreg to rnd		12	1
Basalt(?) clast	Medium gray	<1				2
Anorthoclase	White	<1			Up to 10	3
Glass clast	Dark gray- black	<1			3 - 4	4
Glass- coated white clast		<1	Irreg		2 - 3	5
Glass clast	Dark	<1	Irreg			6
Lithic clast	Medium gray	<1	Ang to blocky	6		7
Maf silclast	Yellow green	Tr	Ang to prismatic	2x0.4		8
Plag clast	White to colorless	<1				9
Opaque clast	Black	Tr				10
Matrix	Dark olive gray	95			<1 to re- solution of micro- scope	11

## NOTES:

1. Seem to have lower ilmenite content than typical basalts of area.
2. Speckled gray, under high power can see browns, etc. May be breccia of shocked basalt.
3. Probably mainly shocked plag; may contain mafics. One has about 10% pale green (pyrox(?)).

4. Can see some plag beneath glass.
5. White material, powdery to very fine grained.
6. Frothy vesicular with adhering soil.
7. Aphanitic(?). Very shiny surfaces, so may be glass.
8. Sugary texture.
9. Some are sugary, some are single grains.
10. Plates. Ilmenite or black glass.
11. All minerals and clasts listed above. Also some very shiny metallic grains that are probably ilmenite. Minor metal spherules.



Sample 79035

S-73-15736

THIN SECTION DESCRIPTION

BY: Stuart-Alexander

DATE: 2/15/73

SECTION: 79035, 1

SUMMARY: Rock is a moderately friable breccia, locally cemented by glass. It consists primarily of basaltic lithic and mineral debris, which is variably shocked and altered, with admixtures of glass.

## MATRIX, 60% OF ROCK

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
I		Ang	<0.05	Mineral and glass debris, same types as in clasts.
II		Irreg to ropy		Glass - varying yellowish shades; as vesicular blobs and as matrix cement.
III		Irreg		Dark unresolved material, some of which seems to be shocked mineral debris.

## MINERAL CLASTS, 30% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Opa	25	Ang	0.2	
Plag	35	Ang	0.3	Some plagioclase is quite altered and shocked.
Cpx	35	Ang	0.25	Clinopyroxene is primarily a lime titanium rich clinopyroxene, and most is pale lavender.
Oliv	5	Ang		Most olivine is intimately mixed with black material.

## LITHIC CLASTS, 5% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Basalt	75		1.5	Basalt mineral percents vary from clast to clast; some are highly altered.
Breccia	20	Rnd	0.3	Fine-grained breccias. No obvious glass or recrystallization. Plagioclase, olivine, pyroxene clasts.
Anorth	5		1.0	Fine-grained mosaic plagioclase with mafic granules scattered all over.

## GLASS CLASTS, 5 % OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Orange	70	Sphere to ang	0.15	A few of the orange glasses are angular fragments encased in spheres of black opaque material.
Yellowish	20	Ang	0.2	
Brown	5	Ang to spheres	<0.1	
Devic, yellowish	5		0.3	
Purplish	Tr			

ADDITIONAL COMMENTS: All sizes given are maximum sizes.

OPAQUES DESCRIPTION

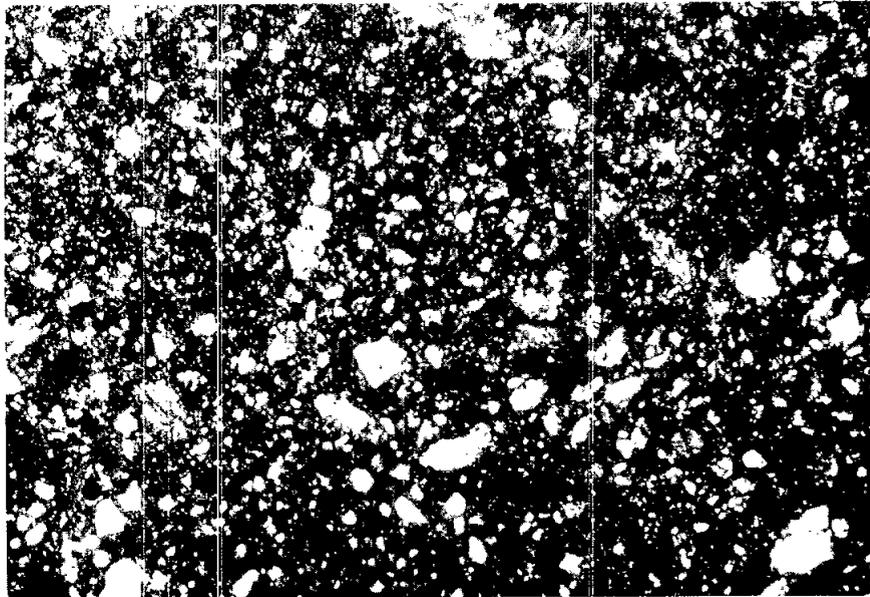
BY: Brett

DATE: 2/8/73

SECTION: 79035,7  
1/2 OF

<u>PHASE</u>	<u>SECTION</u>	<u>SHAPE</u>	<u>SIZE</u> (mm)	<u>COMMENTS</u>
Ilm	5	Ang	0.001-1	Both Mg-rich and Mg-poor ilmenite present as rare laths and angular grains, and in more glassy clasts as feathery intergrowths. Rare rutile and spinel as lamellae in ilmenite. One classic grain, about 1.5 mm long, of ilmenite with a large armalcolite grain included. Ilmenite shows coarse spinel and rutile development.
Arm	< 1	Ang	To 0.3	
Fe-Ni	< 0.1	Ang & rnd	0.001-0.05	
Troil	< 0.1	Ang & rnd	0.001-0.05	
Rut	Tr	Laths	To 0.05	
Spin	Tr	Laths	To 0.05	

SUMMARY: Abundance and grain size of opaques definitely suggests that rock has more affinities to sub-floor rocks than to massif type.



Section 79035,7

S-73-19975

Width of field 3.16 mm, plane light

ROCK TYPE: Medium gray soil breccia                      WEIGHT: 346.3 g  
 COLOR: Medium light gray (N6) to medium              DIMENSIONS: 5 x 7.5 x 9.5 cm  
           gray (N5)  
 SHAPE: Lumpy - irregular  
 COHERENCE: Intergranular - Friable  
                   Fracturing - Intense, platy fracturing. Particularly  
   on W face. Few random, but radial set  
   on W face.

BINOCULAR DESCRIPTION                      BY: Jackson and Ridley                      DATE: 1/17/73

FABRIC: Foliated appearance due to intense fracturing. Generally fine-grained  
 VARIABILITY: Heterogeneous  
 SURFACE: All surfaces irregular. T and B flattest. All are relatively fresh, soil is most obvious on T, but still not abundant.  
 ZAP PITS: Few on T; few on B, only near large white clast.  
 CAVITIES: None, except for few clast clasts.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Maf sil clasts	Mod yellow green (10GY 6/4)	1.5	Rnd	1	<1 - 1.5	1
Maf sil clasts	Mod brown (5GY 3/4)	0.2	Blocky-irreg	1	<1 - 2	2
Anorth clasts	Var snow white to grayish white	8.5	Rnd elong few blocky	2	<1 - 15x30	3
Basalt clasts	Speckled	<0.1	Ang - subrnd	1	1 - 2	4
Matrix	Medium light gray (N6)	90		<1		5

NOTES:

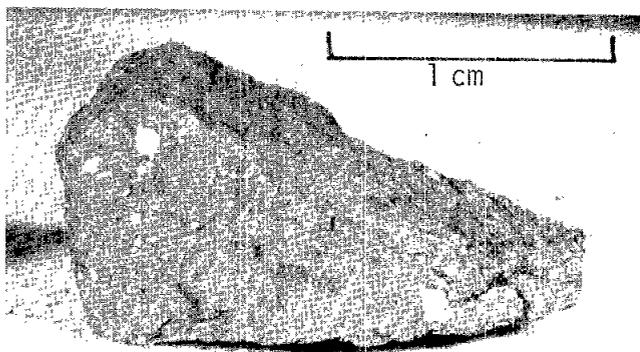
1. Clinopyroxene(?). Mostly very fine-grained aggregates, but locally single mineral grains.
2. Orthopyroxene(?). Mostly very fine-grained aggregates, but locally single mineral grains.
3. Contain more than 95% plagioclase. Most are mixtures of glassy material (maskelynite) and cloudy white material, grain size 0.1 mm. Some contain tiny strings of shiny black dust. All have very sharp boundaries with groundmass.



<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Dark gray					
Glass(?) & pyrox(?)	Dark	40			Up to 0.05	
Plag(?)	Pale	30			Up to 0.05	
Clasts						
Plag		10	Subang	0.4	0.05 - 0.7	
Cpx		4	Subang	0.4	0.05 - 0.7	
Oliv		<0.5	Subang	0.2		
Ilm		3	Subrnd	0.15	0.1 - 0.2	1
Glass	Brown through black	4	Subrnd	0.15	0.1 - 0.2	
Basalt		5	Subang		Up to 3	2
Peridotite (oliv?)	Green yellow	<1	Rnd	1		3
Anorth		2	Subang	0.4	Up to 0.6	4

## NOTES:

1. Black glass and ilmenite may be confused with one another.
2. 10% ilm, 45% plag, 45% pyrox.
3. One only; crystals in a cataclastic matrix.
4. A number of clasts with granulitic plagioclase occur. These are not clearly distinguishable from crushed plagioclase of basaltic origin.

Sample 79125 S<sub>1</sub> S-73-21773

ROCK TYPE: Polymict matrix breccia                      WEIGHT: 2283 g  
 COLOR: Medium dark gray (N4)                              DIMENSIONS: 20 x 12 x 10 cm  
 SHAPE: Angular, irregular  
 COHERENCE: Intergranular - Coherent  
                   Fracturing        - Many penetrative

BINOCULAR DESCRIPTION      BY: Meyer and Marvin              DATE: 1/19/73

FABRIC: Fine breccia  
 VARIABILITY: Homogeneous matrix and clast distribution  
 SURFACE: T is freshly broken, W has a few glass drops (1 cm),  
           B has original surface with minor amounts of glass coating.  
 ZAP PITS: None  
 CAVITIES: Less than 1%  
 SPECIAL FEATURES: There are many fractures which cause the rock to break  
                           into platelets and rhombs. Possibly there are two sets of joints,  
                           some with very fine slickensides.

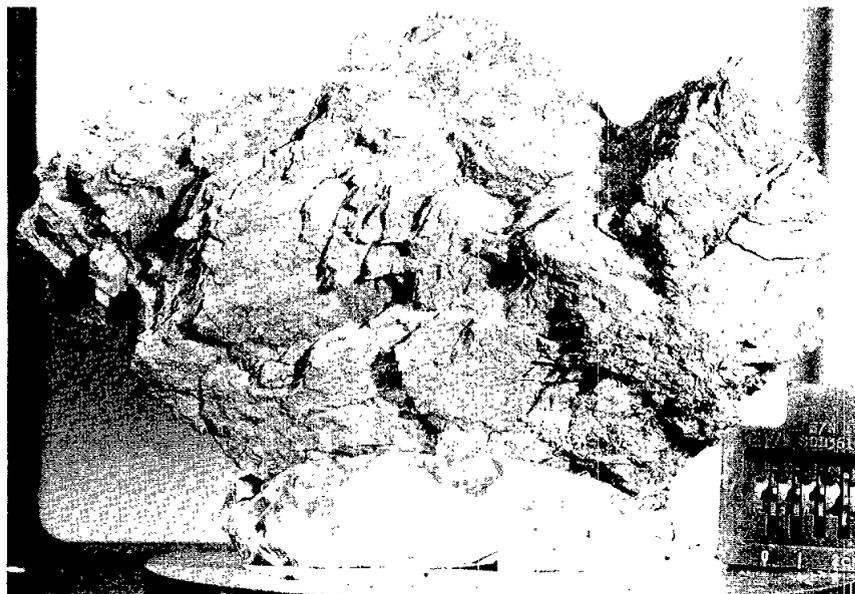
<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Dark gray	80			0 - 0.1	1
Basalt clasts		10	Ang		0.1 - 20	2
Plag clasts	White	5	Ang		0.1 - 2	3
Glass	Brownish orange	2	Irreg		0.1 - 4	4

NOTES:

1. Includes mineral and lithic fragments in very fine grained matrix.
2. 45% plagioclase, 45% pyroxene, and 10% ilmenite (1).
3. Anorthositic(?).
4. Crushed and devitrified (2).

(1) The dominant clast type above 2 mm is basalt which also makes up about  $\frac{1}{2}$  of the smallest clasts.

(2) Irregular patches of peculiar brown-orange glass occur as stringers in matrix.



Sample 79135

S-73-15443

THIN SECTION DESCRIPTION

BY: Meyer

DATE: 2/10/73

SECTION: 79135,11 ,12 ,13

SUMMARY: Lithified mature soil. This breccia was a mature soil before it was lithified. The orange glasses appear to be similar to those of station 4. A 4 mm clast at one end of these sections is described separately by Marvin below.

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>MATRIX, 25% OF ROCK</u>		<u>COMMENTS</u>
			<u>SIZE (mm)</u>		
Glass	50	Devit	0.01		Matrix is mostly small mineral grains held in devitrified (opaque) glass.
Plag	25	Ang	<0.1		
Pyrox	25	Ang	<0.1		

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>MINERAL CLASTS, 25% OF ROCK</u>		<u>COMMENTS</u>
			<u>SIZE (mm)</u>		
Plag	45	Ang	0.1 - 0.5		Mafic minerals are mostly clinopyroxene; only minor olivine and orthopyroxene.
Pyrox	45	Ang	0.1 - 0.5		
Opaque	10	Ang	0.1 - 0.5		
Iron	1	Rnd	0.2 - 2		

## LITHIC CLASTS, 20% OF ROCK

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Basalt	40	Ang	2 - 5	The basalt has the mineralogy and texture of mare basalt. Some of the anorthosite clasts are polygonalized plagioclase. The hornfels has annealed breccia texture including orthopyroxene. A large (1 cm) clast is hornfels with mode: 10% opaque, 30% plag, 50% orthopyroxene and 10% augite. Grain size is 1 mm.
Hornfels (norite)	30	Ang	2 - 5	
Anorth	30	Ang	2	

## GLASS CLASTS, 30% OF ROCK

<u>COLOR</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Orange	50	Rnd to ang	0.5	Many of the orange glasses are partially devitrified (although some are not) and form a gradational sequence to the opaque glass. The opaque glass are devitrified with abundant ilmenite. Many of the orange
Opaque	25	Rnd to ang	0.5	
Multi	25	Ropy to stringy	1 - 5	

glasses are spheres although some are broken. The glass shards have sharp unrounded corners and are often undevidtrified.

ADDITIONAL COMMENTS: This breccia could not have reached a very high temperature because the glass shards have sharp edges and many glasses are undevidtrified. The matrix is devitrified but not recrystallized. The breccia is dense with few (<5%) vuggy or open areas. The percentage mare basalt clasts is not as high as would be expected for a regolith developed on a mare basalt although most of the individual mineral grain appears to also be of mare basalt origin. A distinctive feature is the presence of ropy or stringy glass and glass "bombs" which have a range in composition and color, some contain microlites and partially melted inclusions of plagioclase.

OPAQUES DESCRIPTION

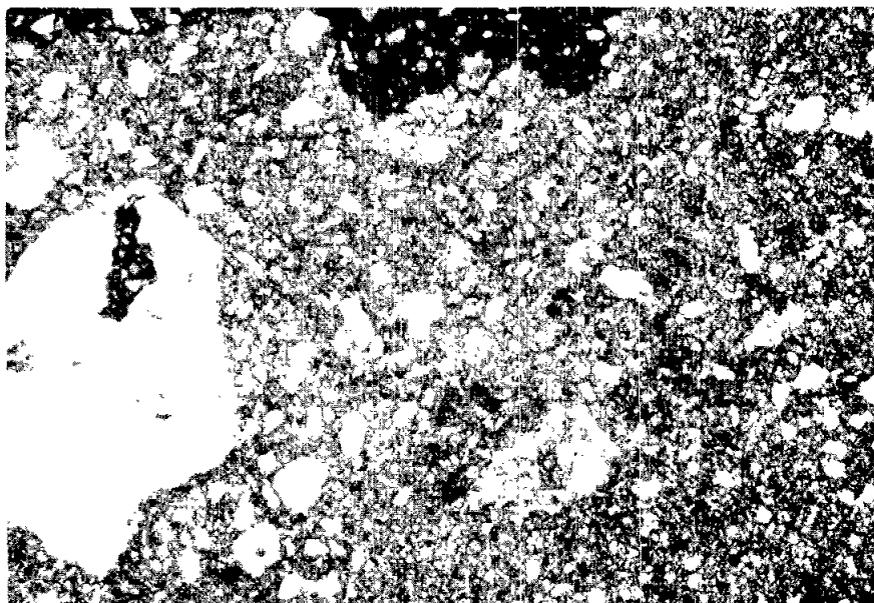
BY: Brett

DATE: 2/9/73

SECTION: 79135,11

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Ilm	15	Ang, feathery	To 1.5	Ilmenite population is bimodal - angular to rounded large clasts and feathery intergrowths of much smaller
Arm	<0.5	Ang	To 0.1	

Ulvo	<0.2	Ang	To 0.05	grain size in glasses and devitrified glasses. Large ilmenite commonly contains rutile and spinel lamellae. Armalcolite and ulvospinel as rare angular fragments. Fe-Ni and troilite in characteristic occurrence. Abundance and nature of opaques suggest rock is a breccia of mare origin.
Rut	<0.2	Lamel	To 0.15	
Spin	<0.2	Lamel, ang	To 0.1	
Fe-Ni	<0.3	Ang, blebs	To 0.15	
Troil	<0.2	Ang, blebs	To 0.15	



Section 79135,12 S-73-19983  
Width of field 3.16 mm, plane light

THIN SECTION DESCRIPTION

BY: Marvin

DATE: 3/3/73

SECTION: 79135, 12 and ,13

SUMMARY: This is a description of a 4 mm clast at one end of the sections. (See the description by Meyer above for the rest of the section.) Matrix and clasts are predominantly plagioclase. The dissemination of opaques resembles that in the matrixes of many noritic lunar breccias.

## MATRIX, 70% OF CLAST

<u>PHASE</u>	<u>% OF MATRIX</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Non-descript	90	Vermicular	0.005 - 0.01	Matrix is light colored, very fine-grained, vermicular intergrowth of feldspathic glass(?) and tiny (0.02 mm) disseminated opaques.
Opa	10	Equant to irreg	0.02	

## MINERAL CLASTS, 20% OF CLAST

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	80	Ang	0.1 - 0.5	Most clasts have margins intergrown with matrix.
Cpx	15	to		
Oliv	5	subrnd		

## LITHIC CLASTS, &lt;1% OF CLAST

<u>TYPE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Gab-anorth			0.7	One large clast of anorthositic gabbro, 0.7 mm. Maximum individual grain size is 0.2 mm for plagioclase and 0.1 mm for pyroxene.

## GLASS CLASTS, 10% OF CLAST

<u>COLOR</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Light brown to c'less		Irreg		Mostly devitrified to leafy intergrowths of feldspathic material, which have ragged margins that grade into the matrix.

79155

ROCK TYPE: Gabbro, partially coated with glass

WEIGHT: 318.8 g

DIMENSIONS: 8 x 6 x 5 cm

COLOR: Rock - brownish gray to light brownish gray (5YR 4/1 - 5YR 6/1)

SHAPE: Subrounded

COHERENCE: Intergranular - Tough

Fracturing - None in rock; array of thin tension fractures in glass

BINOCULAR DESCRIPTION

BY: Marvin

DATE: 3/7/73

FABRIC: Coarse grained subdiabasic

VARIABILITY: Homogeneous

SURFACE: Dark glass approximately 1 mm thick, covers all of B face and greater than 1/3 of W and S faces; the glass dwindles to discontinuous smears on E face.

ZAP PITS: Common on all exposures of gabbro. The rock is coarse-grained enough so that glass lining in zaps ranges from white to pale yellow or green to dark gray. Zaps absent from the glass coat on B face, but abundant on the glass coating of S face. Zaps in the dark glass have fractured haloes that are conspicuously orange.

CAVITIES: Very minor (<1%), 4 or 5 irregular cavities, each about 4 - 5 mm across, occur in center of N face. A few rounded cavities occur in the glass.

SPECIAL FEATURES: The rock is a homogeneous gabbro with minor variations in grain size. It is about 1/2 covered with an exceptionally smooth coating of glass having relatively few minute gas vents and vesicles. To the naked eye, the glass is dark gray with a dull submetallic luster; where vesicles are broken open their walls are smooth, bright, and vitreous. The glass also has a very few, small ( $\leq 1$  mm), rounded blebs. Under the binoculars, the glass is seen to be dark molasses brown, which, in fine particles (zap haloes) is orange. Thin veinlets of glass penetrate the gabbroic rock (evident on T and W). Similar glass also partially fills the cavities on the N face where zaps are made conspicuous by orange haloes. On E face, the glass thins out and exposes the underlying rock in subangular patches. However, some triangular patches of finer grained basalt are also present. These may be a marginal phase of main rock or adhering clasts or another composition. In this area there are one or two 1 - 2 mm patches of green material - probably green glass, but possibly olivine grains.

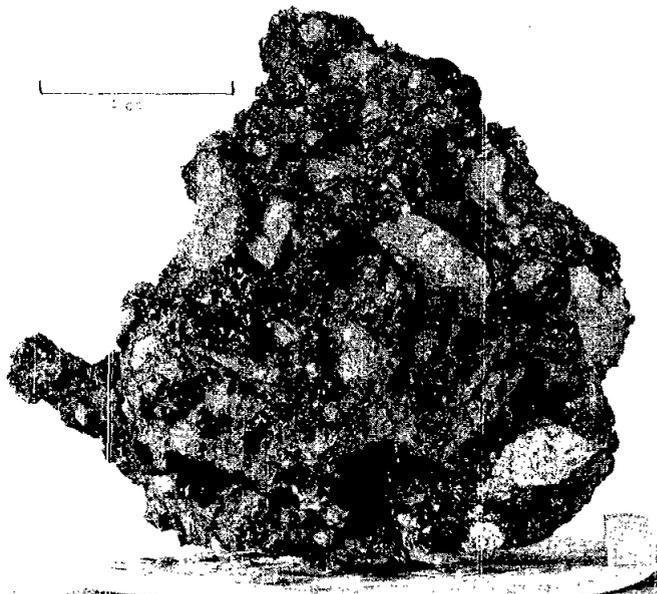
<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag	White	35 - 40	Plates- laths	2	1 - 3	1
Pyrox	Pale brown	40 - 45	Subhed to anhed	1.3	1 - 2	2
Maf sil (Oliv?)	Yellow- green	<3	Anhed grains	<1	0.5 - 1.5	3
Opa	Black	15	Thin plates & equant grains	0.7	0.2 - 1	4



<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Glass	Dark gray to red- brown (N8 <sub>2</sub> 5YR 3/2)	40	Ropy masses			1
Clasts						
Soil breccias	Medium gray	40	Subang		1x1x1- 30x15x15	2
Basalts	Brownish gray	15	Ang	10	Up to 20	3
Dense sugary clasts	Light gray	2	Margins inde- finite		30 - 50	4
Lithic	White	<1		10x7		

## NOTES:

1. Glass permeates the rock, welding clasts of soil breccia, basalts (coarse and fine-grained) and other rock types into a coherent mass. The glass varies from fresh and vitreous to dull and aphanitic. Luster varies from vitreous to sub-metallic. It is coated with dust in many areas. Color is predominantly the color blackstrap molasses, but it is orange where freshly fractured by zap pitting.
2. Soil breccia clasts are medium gray, fine-grained, and moderately coherent. They contain small angular inclusions of rock and mineral debris and a few gray glass spherules.
3. Basalt clasts have textures ranging from medium-grained to dense, almost aphanitic. One clast is 40% plag laths, which reach 3 mm long, 45% cinnamon pyroxene in grains up to 2 mm, and 15% black opaques, up to 0.5 mm in size. Another clast is a very fine-grained, ilmenite-rich basalt. A third clast, on the E face, is a glomero-porphyrific basalt.
4. Small light gray clasts with a waxy to sugary texture. Probably plagioclase-rich.



Sample 79175

S-73-17784

79195

ROCK TYPE: Breccia	WEIGHT: 368.5 g
COLOR: Dark gray (M4)	DIMENSIONS: (4 pieces)
SHAPE: Subangular	9 x 6.5 x 5
COHERENCE: Intergranular - Friable	7 x 5.5 x 4
Fracturing - Several	2.5 x 2 x 1.5
penetrative	1.5 x 1.5 x 1

BINOCULAR DESCRIPTION      BY: Reid and Wilshire      DATE: 2/22/73

FABRIC: Breccia  
 VARIABILITY: Variable clast distribution.  
 SURFACE: Rough on a small scale.  
 ZAP PITS: None on S, E, B, W; few on N, T.  
 CAVITIES: None  
 SPECIAL FEATURES:

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Lithic Clasts		10-15				
Basalt	Brownish gray		Triang to equant ang		25x25 to 1	1

Basalt			Ang	1.5x2	2
Lithic I	White		Ang	1x2	3
Lithic II	Bluish gray		Ang	5x7	4
Lithic III	Light grayish green		Ang	4x3	5
Mineral Clasts		10			
Maf sil	Light emerald green		Ang	2	6
Maf sil	Brown		Ang	1.5 to <1	7
Plag	Gray to chalky white		Ang	<1 - 2	
Maf sil	Yellow green		Ang	<1 - 1	8
Metal	Yellowish		Sphere	2 - 3	
Mineral I	Colorless		Subang	2 - 3	9
Matrix		75-80		0.1	10

## NOTES:

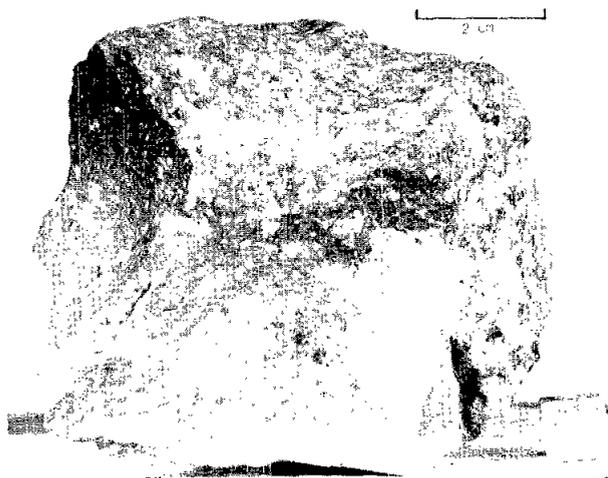
1. Basalt, average grain size 0.5 mm, variable; <5% olivine(?), 50% plagioclase, 40% brown pyroxene, and 10% opaques.
2. About 50% plagioclase, 15% brown pyroxene, 5-10% opaques, 20-25% olivine(?).
3. Mostly feldspar, with 10-15% pale green mineral.
4. Aphanitic and fractured, with small, ellipsoidal vesicles.
5. 50-60% green pyroxene(?), 20% dark gray silicate, 20% plagioclase. Crushed, but relicts reach 1 mm.
6. Crushed aggregate.
7. Pyroxene.
8. Olivine(?).
9. Conchoidal fracture.
10. Mineral and lithic debris, of the types described above, in sizes less than 1 mm. Possible finely divided orange glass, <0.1 mm. Many small metallic black spheres in matrix.



Maf sil clast	Greenish yellow	}		Rnd		<0.1 to 1
Ilm clast	Black		1	Plates		To 0.3
Maf sil clast	Pale brown			Rnd		
Lithic I	N4-1/2		<1	Irreg- rnd	2 - 4	2
Lithic II	Yellow and white		<1	Rnd to irreg		3

## NOTES:

1. Very fine sugary texture with a slight vitreous luster.
2. Very fine-grained, dark gray, locally concentrated in one area. One clast of this type is 1 x 7 mm.
3. One clast which is sugary and consists of plagioclase - 40%, yellow mafic silicate - 60%. The clast adjacent to a dense gray clast on the W face.



Sample 79215

S-73-17183

THIN SECTION DESCRIPTION

BY: Marvin

DATE: 2/26/73

SECTION: 79215,11

SUMMARY: Recrystallized anorthositic gabbro or troctolite. A few poikilitic orthopyroxenes with small inclusions of euhedral to subhedral plagioclase occur interstitially in the groundmass.

## RECRYSTALLIZED GROUNDMASS, 85% OF ROCK

<u>PHASE</u>	<u>% OF GROUNDMASS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	73	Poly- hed	0.5	Predominantly plagioclase polyhedra in closely packed array - varying somewhat in coarseness from 0.3 - 0.8 mm. Small, nearly euhedral olivines outline the polyhedra and occur as inclusions in plagioclase. Sparse, tiny opaques are mainly metallic iron, but also traces of ilmenite, troilite.
Oliv	26	Euhed	0.1	
Pyx	<1	Anhed	1.3	
Opaq	<1	Glob to irreg	0.05	

## RELICT CLASTS, 15% OF ROCK

<u>PHASE</u>	<u>% OF CLASTS</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Plag	80	Anhed		Large relict clasts of plag in unshocked twinned crystals occur sporadically through groundmass. In some cases these have been sufficiently recrystallized to show polyhedra free of olivine grains. A few large pyroxene grains, and 1 or 2 of olivine also, occur as relicts.
Pyx	15	Anhed		
Oliv	5	Anhed		

ADDITIONAL COMMENTS: The rock contains three generations of plagioclase: first are relict clasts; second are polyhedra; third are inclusions in pyroxene. Two generations of pyroxene: first are relicts, second are interstitial. Two generations of olivine, relicts and euhedral grains. One area is characterized by a large group of opaques - ilmenite and magnesio-ilmenite - rimmed by a fan-shaped array of elongate plagioclase polyhedra.

OPAQUES DESCRIPTION

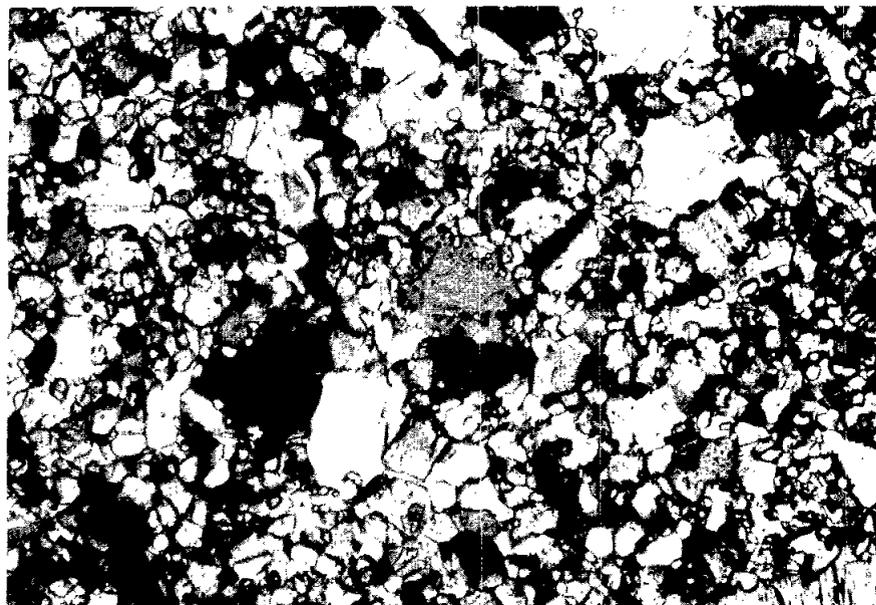
BY: Brett

DATE: 3/15/73

SECTION: 79215,11

<u>PHASE</u>	<u>% OF SECTION</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>	<u>COMMENTS</u>
Armal	<0.5	Polyg irreg	To 0.5	Opaques occur in two textural types: (1) as polygons, blebs, and laths (in the case of ilm), which apparently are products of recrystallization; (2) as ragged rounded mineral clasts, which is exemplified by a 500 $\mu$ grain of armalcolite rimmed by ilmenite.
Ilm	<0.3	Laths, irreg	<0.03	
Fe-Ni	<0.2	Blebs, polyg	<0.02	
Troil	<0.2	Irreg, polyg	<0.02	
Rut	Tr	Lamel	<0.01	

Armalcolite contains tiny laths of rutile or possibly ilmenite. Same grains contain ilmenite-armalcolite with subhedral boundaries.



Section 79215,1

S-73-20033

Width of field 0.825 mm, crossed polars

79225

ROCK TYPE: Friable microbreccia

WEIGHT: 7.42 g

COLOR: Brownish black (5YR 2/1)

DIMENSIONS: 3.5 x 2 x 1 cm

SHAPE: Rounded disc-like

COHERENCE: Intergranular - Friable

Fracturing - None

BINOCULAR DESCRIPTION

BY: Agrell

DATE: 3/28/73

FABRIC: Microbreccia

VARIABILITY: Homogeneous

SURFACE: Surfaces all dusty, friable; B possibly is an exposed surface, occasional zap glass or agglutinate patches seen.

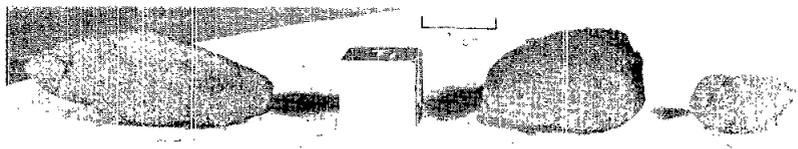
ZAP PITS: Few on B; none on T, N, S.

CAVITIES: No cavities but has a porous appearance.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Matrix	Brownish black	50			0.01 - 0.05	1
Clasts						
Glass	Brown to black	15	Variable	0.15		
Plag	Colorless	15	Ang	0.15		
Oliv	Pale green	3	Subang	0.15		
Pyrox	Cinnamon	7	Subang	0.15		
Feldspathic metagranulites		2	Ang		1 - 3	2
Anorth		2	Subang		1 - 2	3
Basalt		1	Subang		5	4

## NOTES:

1. Matrix is irresolvable fine chips, is dark in color and is dominantly glass with little plagioclase.
2. More than 70% plagioclase, vitreous.
3. Greater than 70% plagioclase.
4. Only one seen, grain size average 0.3 mm, composed of 50% pyroxene, 40% plagioclase, 10% ilmenite.



Sample 79225

79226

S-73-17960

79226

ROCK TYPE: Friable microbreccia

WEIGHT: 6.73 g

COLOR: Brownish black (5YR 2/1)

DIMENSIONS: Two fragments

SHAPE: Rounded

COHERENCE: Intergranular - Friable

Fracturing - Few, non-penetrative

BINOCULAR DESCRIPTION

BY: Agrell

DATE: 3/28/73

FABRIC: Microbreccia  
 VARIABILITY: Homogeneous  
 SURFACE: All surfaces dusty and friable  
 ZAP PITS: None  
 CAVITIES: No cavities, but has a porous appearance.  
 SPECIAL FEATURES: The matrix and mineral clasts are nearly identical to 79225. Lithic clasts which compose about 3% of rock are shocked feldspathic fragments (as in 79225), and vesicular fine-grained basalt (only one).

79227, 79228

ROCK TYPE: Clod  
 NOTE: After separation from the soil sample, these two samples disaggregated to soil-like material and were not described.

WEIGHT: 79227 - 5.57 g  
 79228 - 2.50 g

79245

ROCK TYPE: High grade metaclastic  
 COLOR: Medium gray (N5)  
 SHAPE: Angular, block  
 COHERENCE: Intergranular - Tough  
 Fracturing - Very few; non-penetrative

WEIGHT: 10.11 g  
 DIMENSIONS: 3.2 x 2 x 1.5 cm

BINOCULAR DESCRIPTION

BY: Agr ell and Agrell

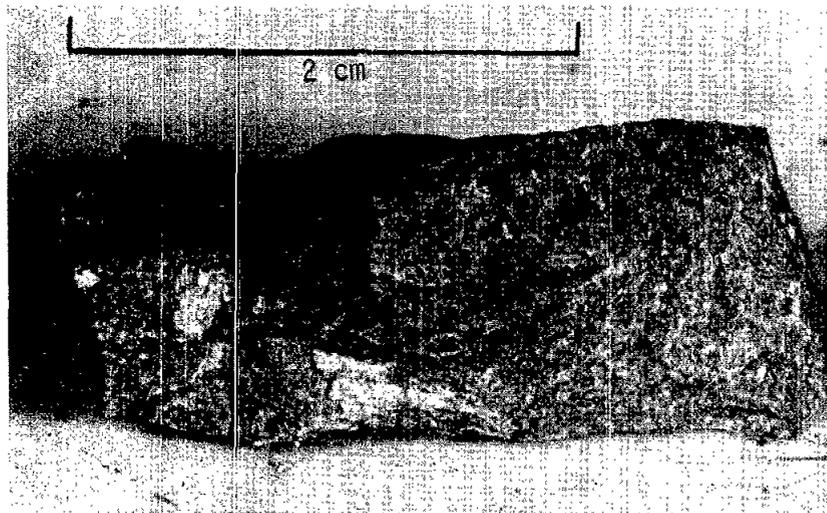
DATE: 3/23/73

FABRIC: Holocrystalline, equigranular  
 VARIABILITY: Homogeneous  
 SURFACE: T, B, S, and N are fracture surfaces; W (almost an apex) has fawn colored dust; E has a little dust, some chalky plagioclase, and was probably an outer surface.  
 ZAP PITS: None on all except possibly one on E.  
 CAVITIES: None  
 SPECIAL FEATURES: On T there is an impression of banding: darker pyroxene-rich bands with minute equant plagioclase alternate with plagioclase-rich bands in which the plagioclase is equant and coarser (0.2 mm). It is difficult to decide whether this sample is a crystallized impact melt or a metaclastic rock recrystallized at high temperature.

COMPONENT	COLOR	% OF ROCK	SHAPE	SIZE (mm)		NOTES
				DOM.	RANGE	
Matrix						
Plag	C'less	44	Subang	0.4		1
Maf sil	Pale gray	53	Irreg	0.4		2
Ilm(?)	Black	<1	Equant	<0.02		
Troil	Yellow	<0.5	Equant	0.05		
Metal	Silvery	<0.5	Equant	0.05		
Mineral clasts						
Oliv	Yellow green	Tr	Equant	0.15		
Plag	C'less	<1	Tabuloid	0.6	0.5 - 2.0	
Metal frag	Metallic	Tr	Rnd	0.1		
Lithic clasts						
I		<1		1.5		3
II				4.0		4

## NOTES:

1. Sugary, composite grains.
2. Pyroxene(?) tend to enclose plagioclase.
3. One only, consists of 0.1 mm clasts of 90% lathy, chalky-white plagioclase and of 10% interstitial, pale gray mafic silicate.
4. One only, consists of 0.4 mm clasts of 50% lathy, colorless plagioclase and 50% interstitial, pale gray mafic silicate. Texture is rather like body of rock but the mafic silicate is paler, possibly an artifact.

Sample 79245 S<sub>1</sub>

S-73-17870

79265

ROCK TYPE: Basalt  
 COLOR: Between medium gray (N5).  
 and medium dark gray (N4)  
 SHAPE: Angular, blocky  
 COHERENCE: Intergranular - Tough  
 Fracturing - None

WEIGHT: 2.60 g  
 DIMENSIONS: 1.3 x 1 x 1 cm

BINOCULAR DESCRIPTION

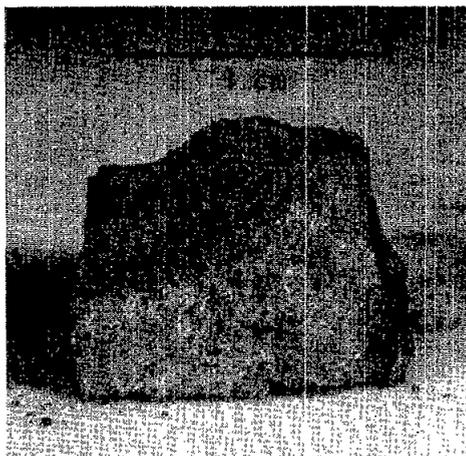
BY: Agrell and Agrell

DATE: 3/29/73

SURFACE: Adherent dust on all surfaces

CAVITIES: None

SPECIAL FEATURES: Minerals present are brown pyroxene, white plagioclase, and black opaques. The rock is too coated with dust for an estimation of proportions. The grain size is approximately 0.2 mm as judged from protruding crystals. In dust, 0.1 - 0.2 mm fragments of pyrox and feldspar can be seen along with a small proportion of dark glass droplets.

Sample 79265 N<sub>1</sub>

S-73-17873

79515

ROCK TYPE: Basalt  
 COLOR: Tan  
 SHAPE: Blocky, rounded  
 COHERENCE: Intergranular - Tough

WEIGHT: 33.00 g  
 DIMENSIONS: 4 x 3.5 x 3 cm

BINOCULAR DESCRIPTION

BY: Morrison

FABRIC: Inequigranular

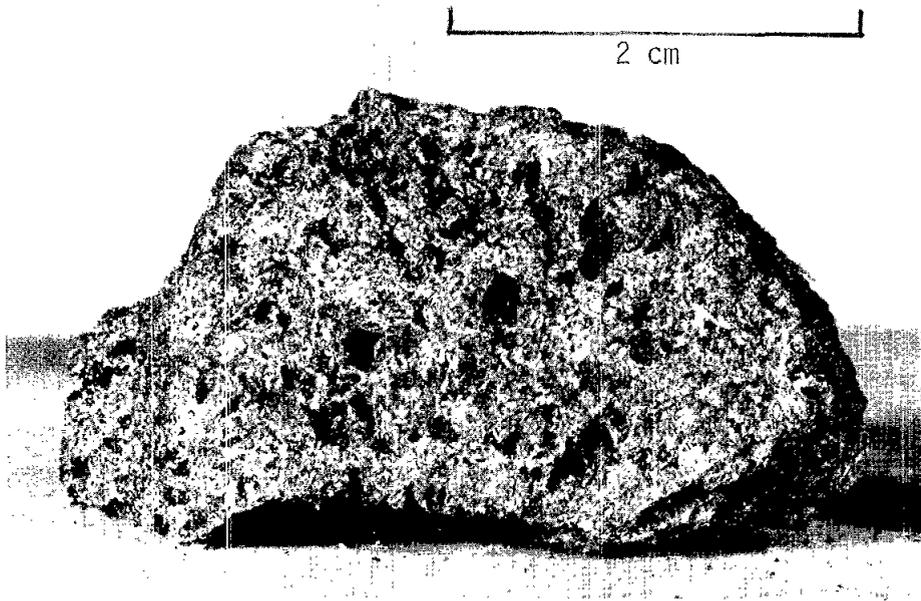
ZAP PITS: Some on T; none on B

CAVITIES: 15 - 20%, with projecting crystals and possibly some cristobalite.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox	Brown	58			1	
Opa	Black	20	Blebs			
Plag	White	20				1
Ma f sil	Yellow green	1-2	Equant		1 - 2	2

## NOTES:

1. Some acicular clusters, 4 - 5 mm in length.
2. These form rare phenocrysts.

Sample 79515 S<sub>1</sub>

S-73-19747

79516

ROCK TYPE: Basalt  
 COLOR: Brown gray (5YR 4/1)  
 SHAPE: Blocks, subrounded  
 COHERENCE: Intergranular - Tough

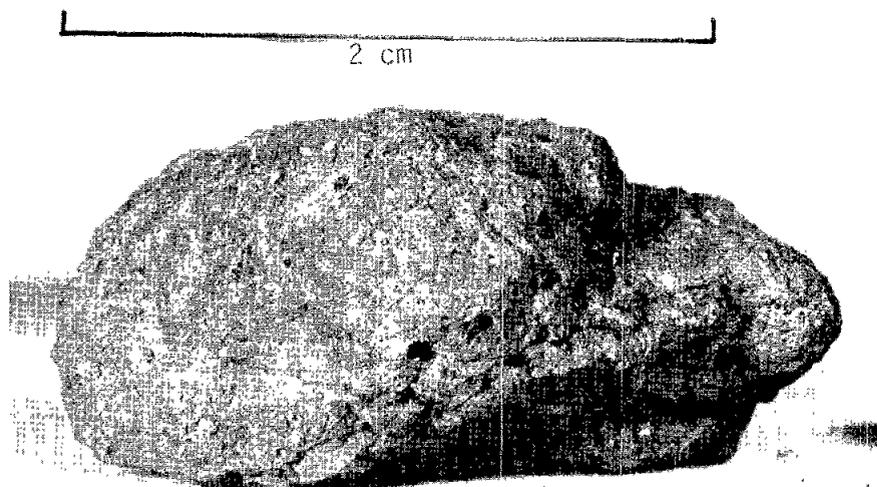
WEIGHT: 23.92 g  
 DIMENSIONS: 3 x 3 x 2 cm

BINOCULAR DESCRIPTION

BY: Morrison

FABRIC: Inequigranular  
 VARIABILITY: Homogeneous  
 ZAP PITS: Pitted on all sides  
 CAVITIES: 5%, 2 - 3 mm, projecting crystals  
 SPECIAL FEATURES: Grain size is much less than 1 mm, but pyroxene(?)  
 forms acicular phenocrysts.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Pyrox		60-70				
Plag		20				
Opa		10				
Oliv		1-5				

Sample 79516 S<sub>1</sub>

S-73-19754

79517

ROCK TYPE: Dark matrix breccia

WEIGHT: 10.23 g

COLOR: Gray

DIMENSIONS: 3 x 3 x 2.5 cm

SHAPE: Rounded

COHERENCE: Intergranular - Moderate

Fracturing - None

BINOCULAR DESCRIPTION

BY: Morrison

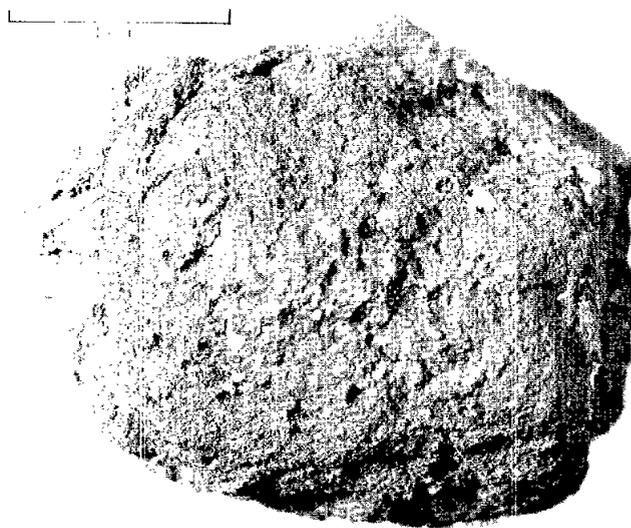
ZAP PITS: Pitted on all sides

SPECIAL FEATURES: This rock is typical of the dark matrix breccias collected at Van Serg crater. Its surface has small glass patches and droplets in abundance.

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Crushed plag	White	5		1		1
Green mafic aggs	Green	Tr		1		
Crushed pyrox	Brown			1		
Basalt frags	Brown	≤1		1		2
Matrix	Dark gray	95			<<1	

## NOTES:

1. Some of light brwn mafic silicates.
2. 70 - 80% brown pyroxene, 5% opaques, 5% olivine, 10 - 20% plagioclase.



Sample 79517

S-73-20193

79518

ROCK TYPE: Dark matrix breccia  
 SHAPE: Angular  
 COHERENCE: Intergranular - Moderate

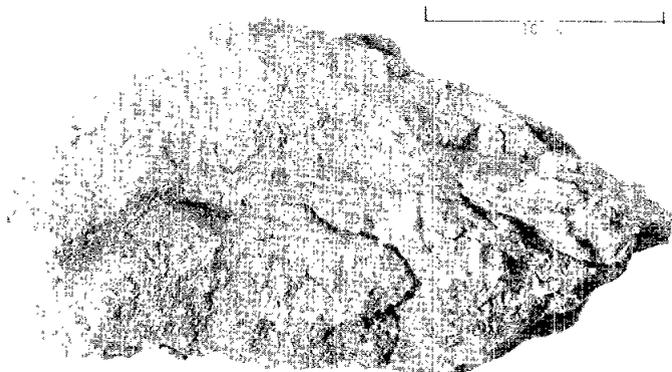
WEIGHT: 5.20 g  
 DIMENSIONS: 3 x 1 x 1 cm

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Pitted on one side; other is fracture surface which has chipped a thin glass coating.

SPECIAL FEATURES: Thin glass coating partially covering unpitted side.



Sample 79518

S-73-20192

79519

ROCK TYPE: Dark matrix breccia  
 COLOR: Gray  
 COHERENCE: Intergranular - Moderate

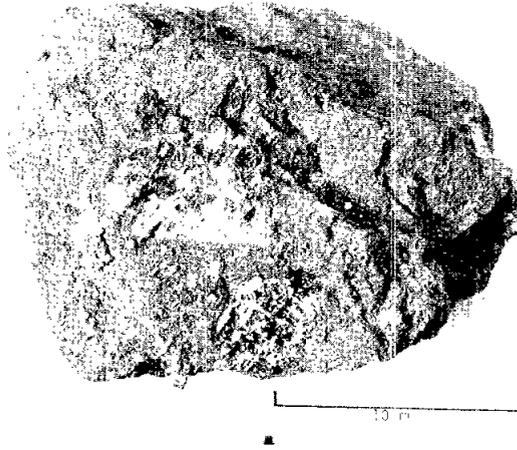
WEIGHT: 3.65 g  
 DIMENSIONS: 2 x 2 x 1.5 cm

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Pitted on one side

SPECIAL FEATURES: Has the following clasts: a 3 x 3 mm basalt fragment with 65% pyroxene, 8% opaque, 25-30% plagioclase; an ultramafic fragment with 60% green mafic silicate (may have been up to 1 cm in grain size) and gray-brown or purplish pyroxene with grain size >1 mm.



Sample 79519

S-73-20191

79525

ROCK TYPE: Dark matrix breccia

WEIGHT: 3.03 g

SHAPE: Blocky

DIMENSIONS: 1.5 x 1 x 1 cm

COHERENCE: Intergranular - Moderate

Fracturing - Sheet fracturing

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Pitted on both sides, but extensive fresh fractures on both sides reduce pitted area greatly.

SPECIAL FEATURES: See 79517 for a description of a typical dark matrix breccia from Van Serg crater. One side has a 1 cm slickenside patch.

79526

ROCK TYPE: Dark matrix breccia

WEIGHT: 2.93 g

COHERENCE: Intergranular - Moderate

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Pitted on all sides

SPECIAL FEATURES: Similar to the type dark matrix breccia 79517, but has the following two clasts: a 3x2 millimeter matrix breccia fragment with a black glass matrix which may be simply fresh fracture surface (if so then matrix of 79526 is glassy), and a 4x2 mm basalt fragment similar to subfloor basalts.

79527

445

ROCK TYPE: Dark matrix breccia                      WEIGHT: 2.65 g  
 SHAPE: Blocky - tabular                              DIMENSIONS: 1.5 x 1 x 1 cm  
 COHERENCE: Intergranular - Moderate

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Pitted on all sides  
 SPECIAL FEATURES: See the description of 79517.

79528

ROCK TYPE: Dark matrix breccia                      WEIGHT: 2.38 g  
 SHAPE: Blade-like                                      DIMENSIONS: 2.5 x 1.5 x 1 cm  
 COHERENCE: Intergranular - Moderate

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Two largest sides are fresh fractures and are unpitted.  
 Rock is pitted on rounded edges.  
 SPECIAL FEATURES: Van Serg dark matrix breccia (see 79517 description),  
 but appears to be richer in mafic components than the others of this  
 type.

79529

ROCK TYPE: Dark matrix breccia                      WEIGHT: 1.84 g  
 COHERENCE: Intergranular - Moderate              DIMENSIONS: 2 x 1 x 1 cm

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Pitted on one side only  
 SPECIAL FEATURES: Same rock type as 79526

<u>COMPONENT</u>	<u>COLOR</u>	<u>% OF ROCK</u>	<u>SHAPE</u>	<u>SIZE (mm)</u>		<u>NOTES</u>
				<u>DOM.</u>	<u>RANGE</u>	
Plag		7				
Plag - maf sil aggreg		1				
Crushed pyrox		1				
Basalt frags		1				
Matrix	Med gray	90				

446

79535

ROCK TYPE: Dark matrix breccia  
SHAPE: Tabular  
COHERENCE: Intergranular - Moderate

WEIGHT: 1.69 g  
DIMENSIONS: 1.5 x 1 x 0.5 cm

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Moderate pit density on flat sides  
SPECIAL FEATURES: Van Serg type of dark matrix breccia - see the description of 79517. The flat sides are grooved fracture surfaces which pre-date the pitting.

79536

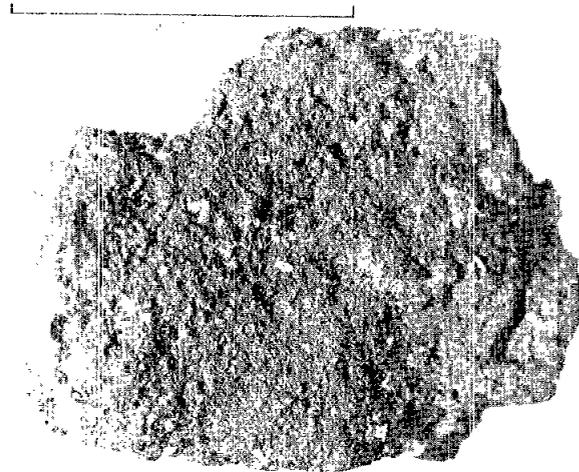
ROCK TYPE: Dark matrix breccia  
SHAPE: Tabular  
COHERENCE: Intergranular - Moderate

WEIGHT: 1.66 g  
DIMENSIONS: 1.5 x 1 x 0.5 cm

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PITS: Pitted on all sides  
SPECIAL FEATURES: Has one 2x2 mm mafic lithic clast.



Sample 79536

S-73-20184

79537

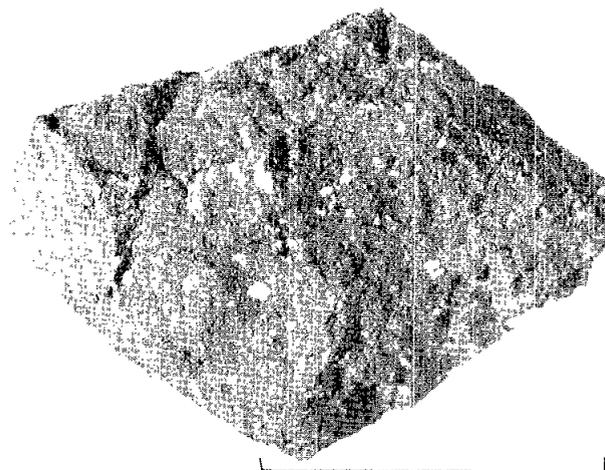
ROCK TYPE: Dark matrix breccia  
SHAPE: Tabular  
COHERENCE: Intergranular - Moderate  
Fracturing - Moderate penetrative fracturing

WEIGHT: 1.05 g  
DIMENSIONS: 1 x 1 x 0.5 cm

BINOCULAR DESCRIPTION

BY: Morrison

ZAP PTS: Pitted on both sides



Sample 79537

S-73-20183