

DESCRIPTION, CLASSIFICATION, AND INVENTORY
OF APOLLO 17 RAKE SAMPLES FROM
STATION 6



National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER

Houston, Texas

September, 1974

DESCRIPTION, CLASSIFICATION, AND INVENTORY
OF APOLLO 17 RAKE SAMPLES FROM
STATION 6

William Phinney, Charles Simonds, and Jeffrey Warner

NASA

Lyndon B. Johnson Space Center

Houston, Texas

September, 1974

Apollo 17 Rake Sample from Station 6

Introduction

A preliminary description of the Apollo 17, Station 6 rake sample was included in the Apollo 17 Lunar Sample Information Catalog.

This new document contains more detailed data developed during binocular microscopic examination of this rake sample in preparation for chipping to obtain fragments for thin sections and chemical analyses. The data in this document consists of a description and photograph of each specimen.

Summary of Station 6 Rake Samples

Sample Number	Mass	Description	Comments
76505*	4.69 gm	Annealed crystalline rock	
06*	2.81	Dark matrix breccia	
76535*	155.5	Troctolite	
36*	10.26	Crushed feldspathic crystalline rock	
37*	26.5	Mare olivine basalt	
38*	5.87	Coarse mare basalt	
39*	14.8	Aphanitic mare basalt	
76545*	7.67	Black matrix breccia	Mated with 76546,47, and 49
46	24.3	do	Now part of 76545
47	10.05	do	New part of 76545
48**	2.53	do	
49	9.17	do	Now part of 76545
76555*	8.44	Vesicular crystalline rock	
56*	7.40	Very fine crystalline rock	
57*	5.59	Crystalline sugary breccia	
58	0.68	White recrystallized breccia	
59*	0.75	do	

*Chips taken for thin sections and chemical analysis
 **Chips taken for thin section only

Sample Number	Mass	Description	Comments
76565*	11.6	Polymict breccia	
66	2.64	do	
67*	5.49	do	
68*	9.58	Mare basalt breccia	
69*	4.21	Glassy (or aphanitic) matrix-rich breccia	
76575*	16.25	Crystalline breccia	
76*	5.33	Crushed anorthositic rock	
77*	13.54	Mosaic textured breccia	

*Chips taken for thin sections and chemical analysis
 **Chips taken for thin section only

Generic No: 76505

Rock Type: Annealed crystalline rock

Weight (g): 4.69

Dimensions (cm): 1.6 x 1.4 x 1.5

Color (fresh): Dark gray (N3)

Shape: Blocky, subangular

Variability: Can't tell because most of rock is coated with a white adhering dust.

Coherence: intergranular - tough; fracturing: few, non penetrative

Fabric/texture: annealed, sugary

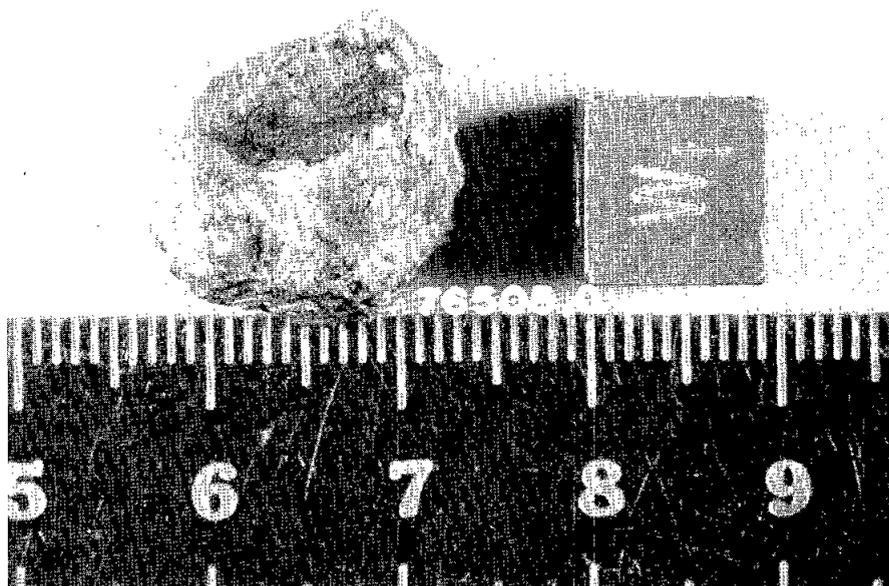
Cavities (%): Irregular to flat vugs, 2mm long, too small an area for estimate of % but appear to be abundant. Groups of crystals protrude from matrix into cavities.

Surface (face): Hackly surface (fresh face)

Zap pits (density/face): None

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Dark gray	100%			<0.1	Flashes from grain surfaces suggest that it is crystalline

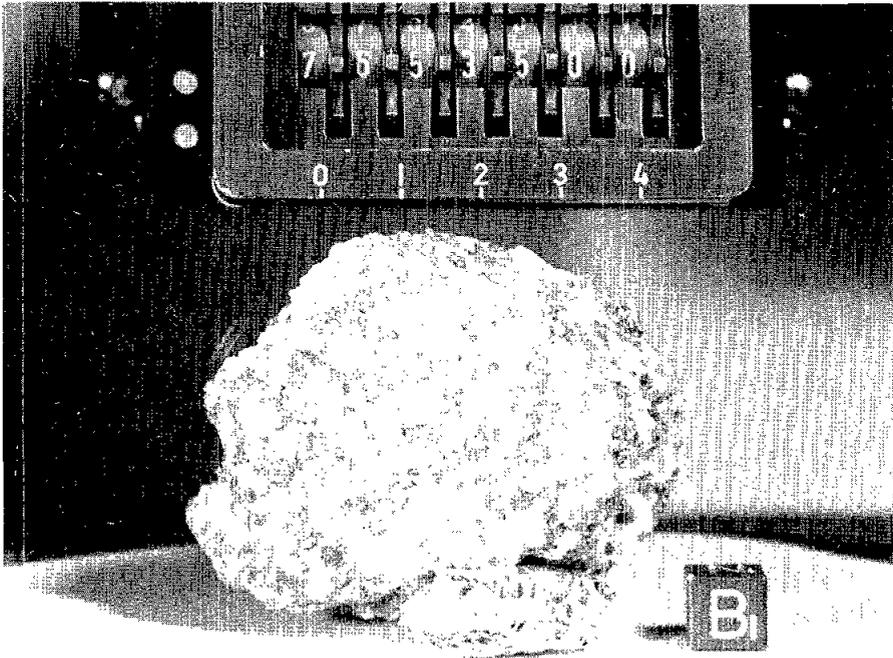
Special Features: Adhering coat of white granular material (feldspar and olivine, plus one orange red mineral grain) as in 76536 obscures most of rock. Description based on freshly fractured surface visible only at one corner of rock.



Generic No: 76506Rock Type: Dark matrix brecciaWeight (g): 2.81Dimensions (cm): 1.8 x 1.5 x 1.0Color (fresh): Medium dark gray (N4)Shape: Blocky, subroundVariability: HomogeneousCoherence: intergranular - friable; fracturing - few, penetrativeFabric/texture: Seriate, brecciaCavities (%): NoneSurface (face): AbradedZap pits (density/face): Few pits with black glass lining on one side

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Medium dark gray	70-80			<0.1	Matrix is more granular than 76545 type breccia
Lithic clast I	Gray with pinkish hue	5-10	sub-angular		<0.5	Fine-grained mare basalt
Lithic clast II	Very light gray	10-15	sub-angular to sub-round		<2.0	May be more than one lithologic type but all are highly feldspathic as in 76545 white clasts





Generic No: 76535
Rock Type: Troctolite

Weight (g): 155.5

Dimensions (cm): See special features

Color (fresh): Mottled white and tan

Shape: See special features

Variability: Homogeneous except for clustering of opaques

Coherence: intergranular - very friable; fracturing: some, penetrative

Fabric/texture: equigranular

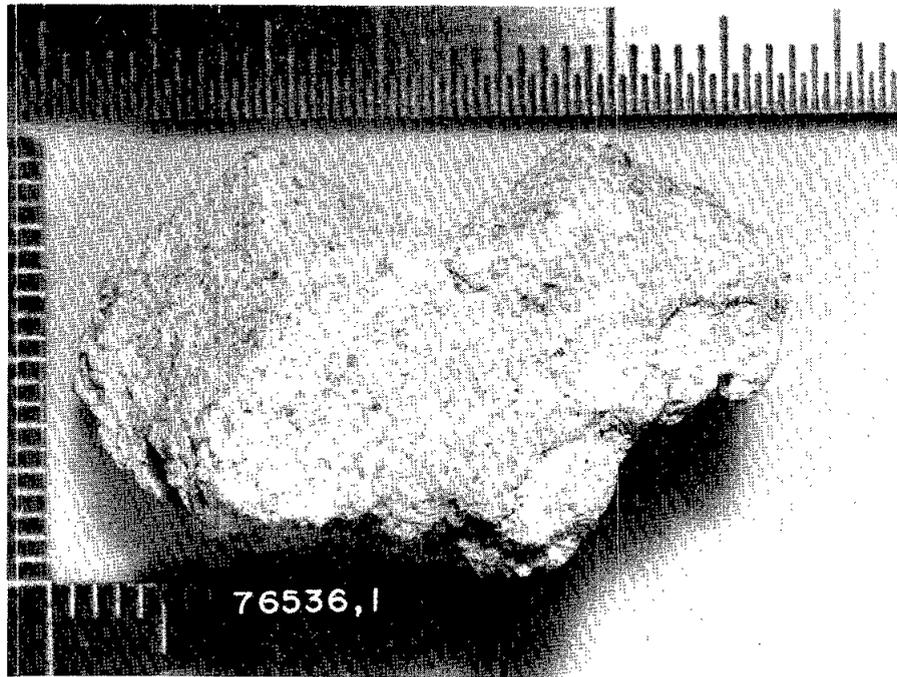
Cavities (%): None

Surface (face): See special features

Zap pits (density/face): See special features

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Plagioclase	Trans- parent	60	tabular		5-10	Twinning visible, some grains have mosaic texture with twinnings showing different orientation. Grains in mosaic are $\approx 1/3$ the size of larger grains
Mafic silicate	Honey yellow	35-40	equant		4-8	Olivine
Mafic silicate	Pale green	2-3	equant		.5-1	Pyroxene
Opaque	Sub-metallic luster dark brown				up to 1.0	Occur between olivine and pyroxene or olivine and feldspar

Special Features: Because of extremely friable nature the previous processing of this rock has caused original shape and surfaces to become abraded and not applicable for an initial description. There is an extensive collection of abraded grains as residue.



Generic No: 76536
Rock Type: Crushed feldspathic
 crystalline rock

Weight (g): 10.26

Dimensions (cm): 3.5 x 1.8 x 1.0

Color (fresh): Very light gray (N8)

Shape: Irregular, subangular

Variability: Homogeneous

Coherence: intergranular - moderately tough; fracturing: many penetrative
 one parallel set determines rock shape

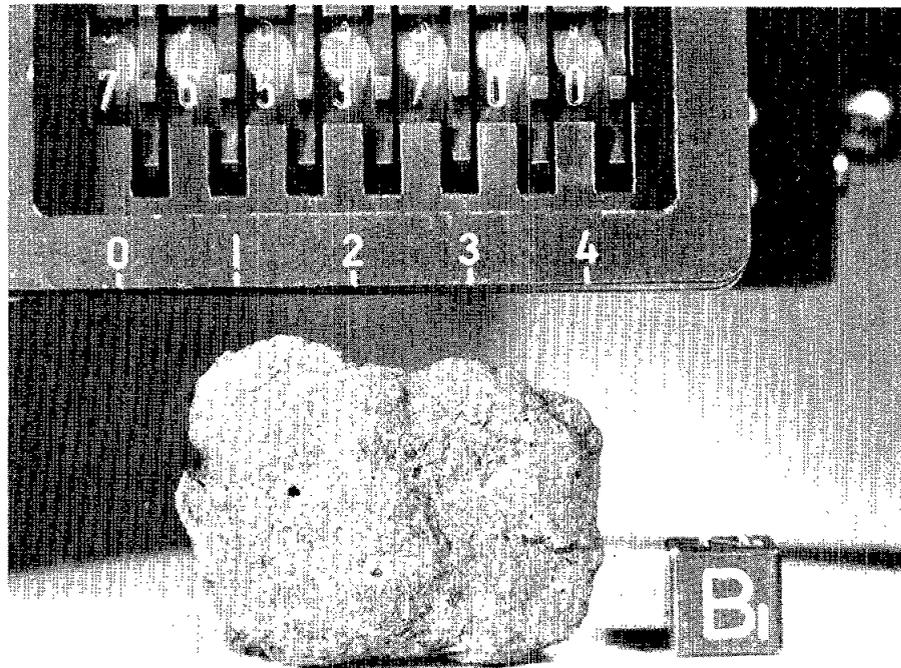
Fabric/texture: Crushed

Cavities (%): None

Surface (face): Hackly

Zap pits (density/face): One pit formed of white glass lining, some
 small glassy areas may be remnants of glass linings
 from zap pits.

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm) Dom. Range</u>	<u>Comments</u>
Matrix	Snow white	50	equant, granular	<<0.1 <0.1	Appears to be crushed equivalent of a coarser composition
Feldspar	White to light gray	30-40	blocky subround to sub- angular	0.1- 0.5 <0.5	Some have vitreous luster, some are crushed, some intact
Mafic silicate	pale yellow green	10	subround to sub- angular	<0.2	Olivine, some crushed and others reasonably intact
Opaque	black	trace	specks	<<0.1	



Generic No: 76537
Rock Type: Mare olivine basalt

Weight (g): 26.5

Dimensions (cm): 3.2 x 2.7 x 1.5

Color (fresh): Dark gray (N3)

Shape: Blocky to irregular, subangular to subround

Variability: Homogeneous, olivine, may be grouped in clusters

Coherence: intergranular - tough; fracturing: few, nonpenetrative

Fabric/texture: May be porphyritic, diabasic to ophitic

Cavities (%): <1%, vugs <1 mm across, some protruding crystals in vugs

Surface (face): Some patination on a few surfaces

Zap pits (density/face): Some pits with black glass linings on all but one side

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Feldspar	White	?	lathy	0.1 up to	0.2	Intergrown with other minerals
Mafic silicate	Pink	?	lathy?	0.1 up to	0.2	Probably clinopyroxene intergrown with feldspar
Mafic silicate	Green	5-10	rounded	0.2 up to	1.0	Olivine?
Opaque	Black	?	lathy	0.1 up to	0.2	Ilmenite? intergrown with other minerals

Special Features: Intergrowths of minerals make estimates of their respective percentages nearly impossible without thin sections.

Generic No: 76538
Rock Type: Coarse mare basalt

Weight (g): 5.87

Dimensions (cm): 1.4 x 2.0 x 1.5

Color (fresh): Medium gray

Shape: Rounded, equant

Variability: Homogeneous

Coherence: intergranular - reasonably tough; fracturing: many, penetrative

Fabric/texture: Sub-ophitic, coarse-grained

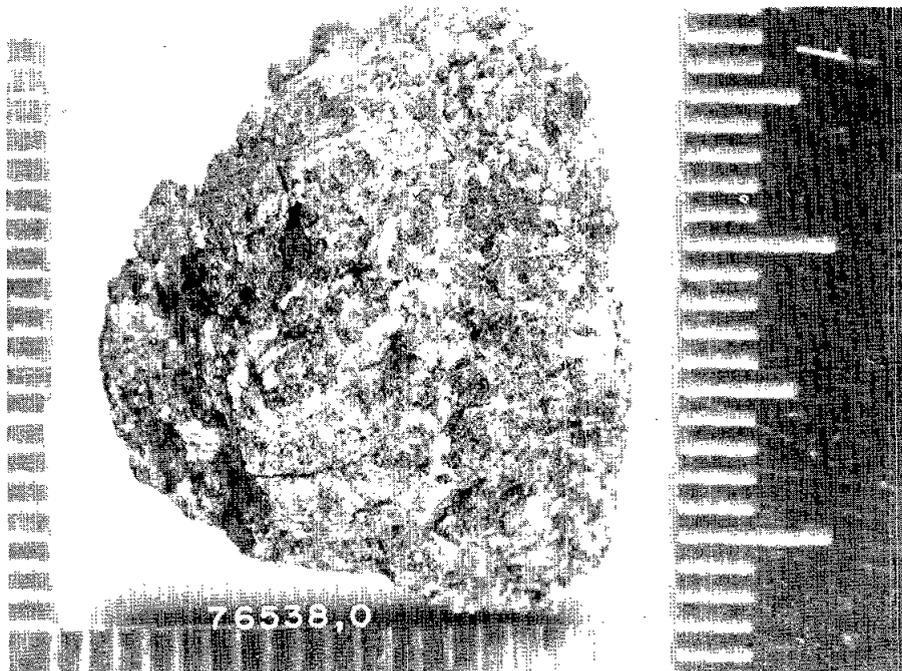
Cavities (%): None

Surface (face): All surfaces are eroded

Zap pits (density/face): Some on all surfaces

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm) Dom. Range</u>	<u>Comments</u>
Feldspar	White	45	Tabular to elongate	1.0x0.5	Some intergrown with pyroxene
Mafic silicate	Pink	35	"	1.0x0.5	Clinopyroxene
Opaque	Black	20	ehedral equant	0.5	Ilmenite

Special Features: No olivine found



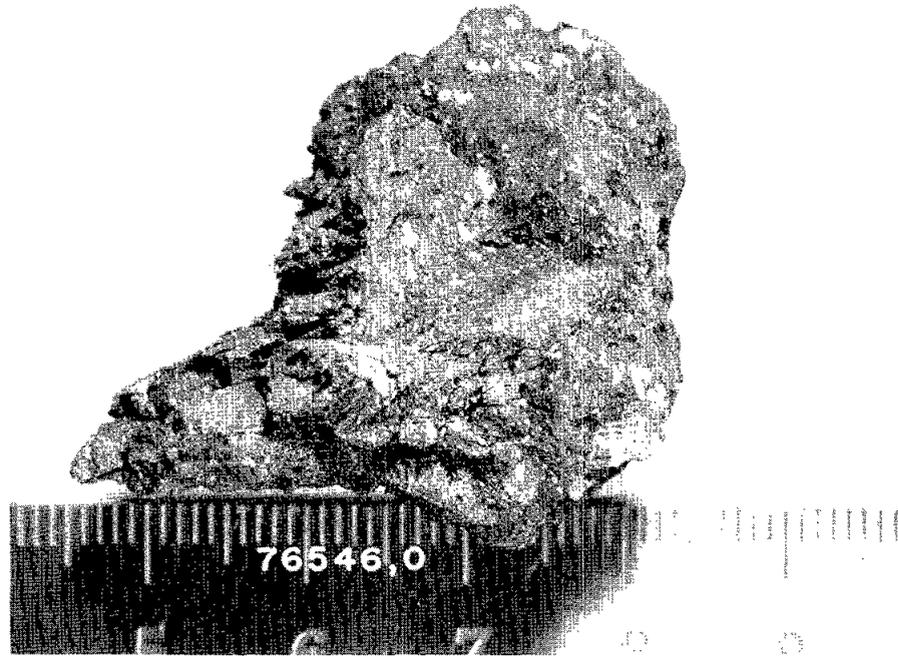
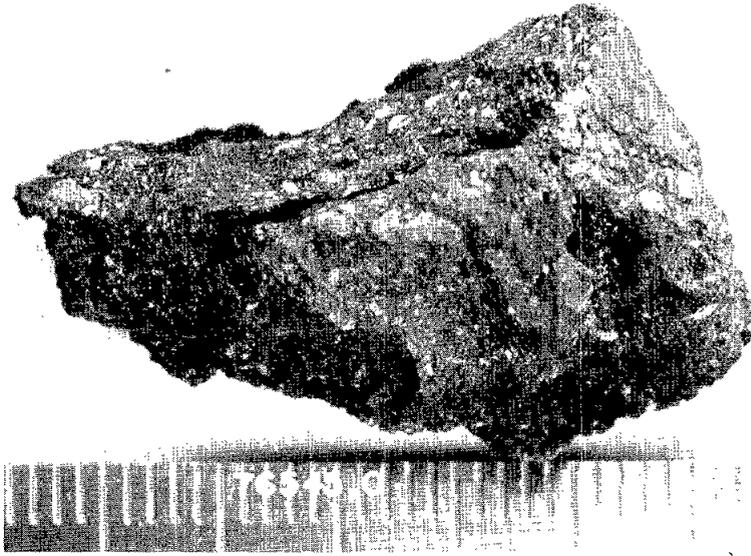
Generic No: 76539
Rock Type: Aphanitic mare basalt

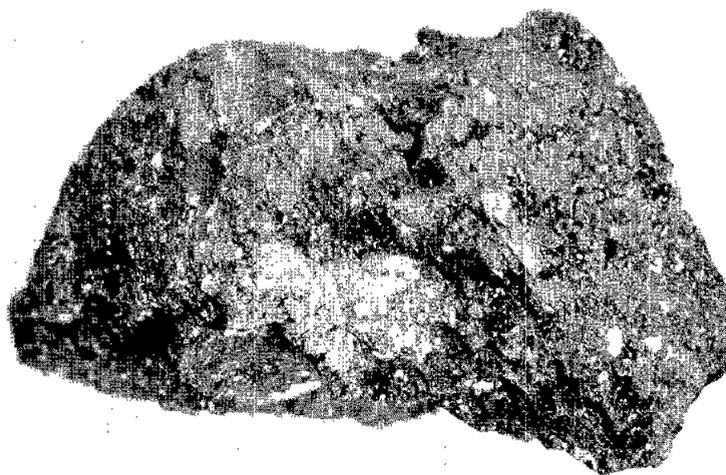
Weight (g): 14.8
Dimensions (cm): 3 x 2 x 7
Color (fresh): Dark gray (N3)
Shape: Equant
Variability: Homogeneous
Coherecne: intergranular - tough; fracturing: None
Fabric/texture: Variolitic with a few skeletal crystals
Cavities (%): Very few (<1%) small vugs <0.2 mm
Surface (face): Hackly
Zap pits (density/face): None

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Dark gray	100				Aphanitic matrix with a few skeletal crystals up to 3 mm long by 0.5 mm recognized by flashes from cleavage.

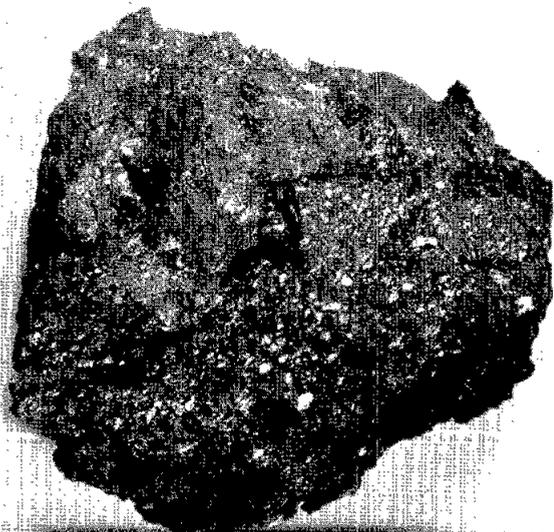
Special Features: Possibly devitrified glass or a very fine porphyritic texture.







0 1 2 3 4 5 6 7 8 9 10
cm
mm



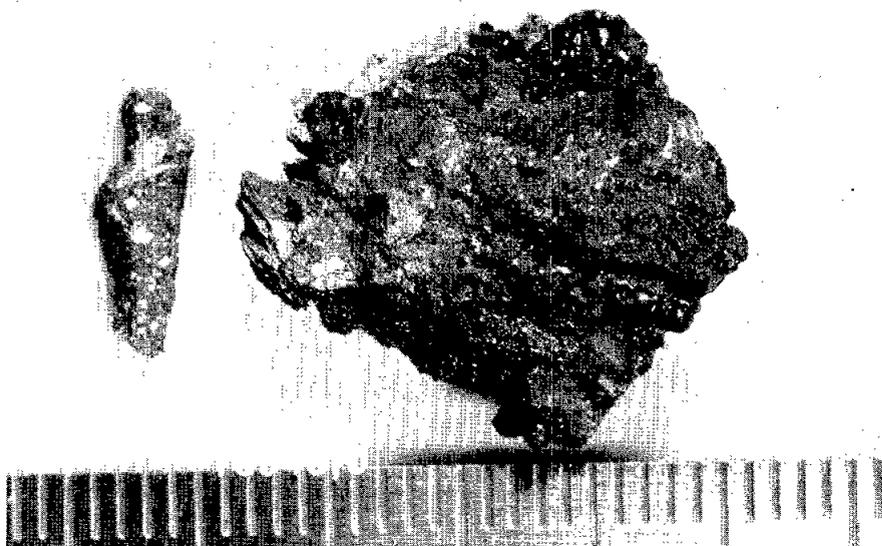
76549,0

Generic No: 76545, 76546, 76547,
76549 (all mated to
become 76545)
Rock Type: Black matrix breccia

Weight (g): 51.20 (total)
Dimensions (cm): 4 x 3 x 3
Color (fresh): Dark gray (N3)
Shape: Sub-angular, blocky
Variability: Homogeneous
Coherence: intergranular - moderately tough; fracturing: many penetrative
parallel fractures spaced at about 1 mm
Fabric/texture: Breccia, seriate clast sizes
Cavities (%): Glass has 15% of 2 mm spherical vesicles
Surface (face): Vesicular glass splatter over most of rock
Zap pits (density/face): Some pits on all external surfaces

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Black	70-75			<0.1	May be partly glassy
Lithic clast	White	20-25	Subround, tabular		0.1-1.0	Contain specks of black opaque grains 0.1 mm
Lithic clast	Gray	1 clast	Subround		1.0	Fine-grained mare basalt, grain size 0.1 mm
Mafic silicate clast	Red- brown	1%	Rounded		<0.5	Granulated
Highly vesicular glass	Dark gray	1-2 mm	Thick coating over most of rock.			Penetrates as veins

Special Features: White clasts aligned to form foliation



Generic No: 76548
Rock Type: Black matrix breccia
 with glass splash

Weight (g): 2.53

Dimensions (cm): 1.5 x 1.5 x 1.0

Color (fresh): Very dark matrix (N3) with white clasts

Shape: Angular - irregular

Variability: Grades from typical black matrix breccia to vesicular black glass coating

Coherence: intergranular - angular; fracturing: few, penetrative, with glass intruded into them

Fabric/texture: Seriate breccia

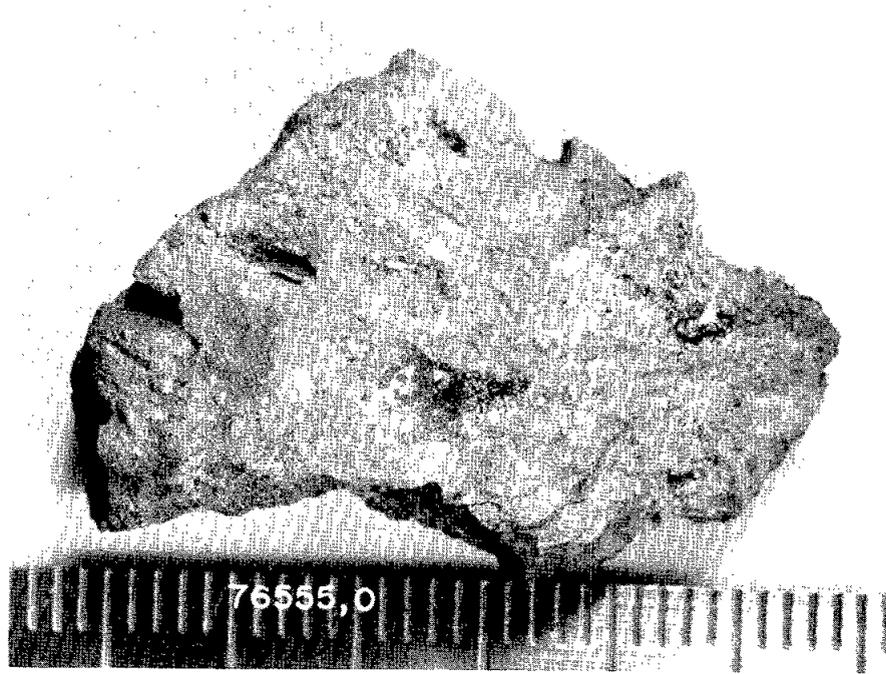
Cavities (%): None in breccia, abundant round vesicles up to 1.5 mm across in glass coating

Surface (face): Rough and angular, much of rock has glass splash coating.

Zap pits (density/face): Very few on one surface of breccia, none on glass

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm) Dom. Range</u>	<u>Comments</u>
Matrix	Very dark gray	65-70		<0.1	Same as 76545 matrix
Lithic clasts	White	10	Subrounded tabular	0.1-1.0	Same as 76545 clasts. Some are smeared out as if they were sheared and flowed with the breccia
Vesicular glass	Steel gray		Coating		1 mm thick coating

Special Features: Probably this is a broken piece of 76545 but not able to accomplish an exact mating.



Generic No. 76555
Rock Type: Vesicular crystalline rock

Weight (g): 8.44

Dimensions (cm): 2.5 x 2.0 x 1.0

Color (fresh): Medium gray (N5)

Shape: Angular, irregular

Variability: Homogeneous

Coherence: intergranular - tough; fracturing: None

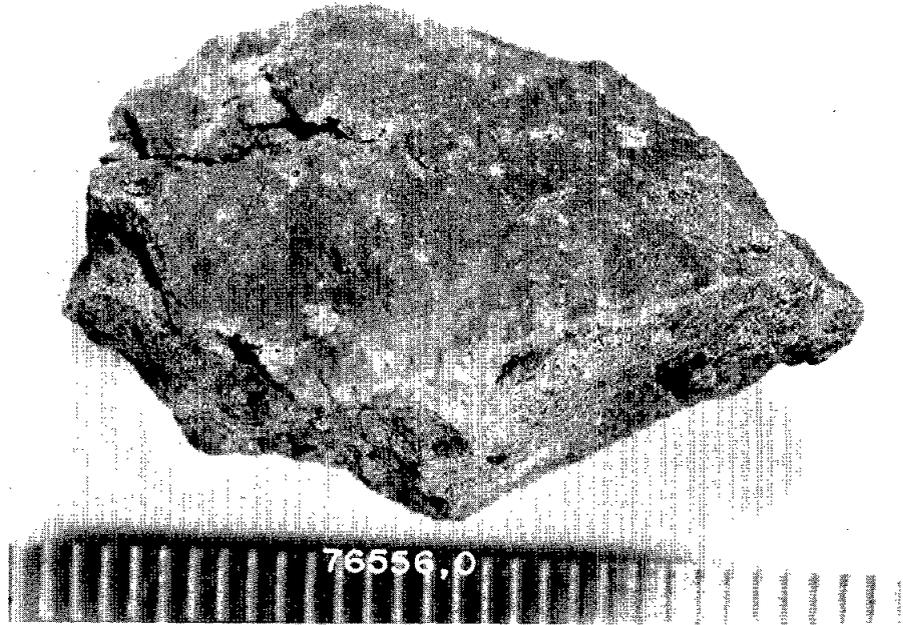
Fabric/texture: Very fine grained, homogeneous, non-poikilitic

Cavities (%): Two types of cavities: foliated slits up to 5 mm long,
 >1 mm wide, lined with fine drusy crystals of gray mineral,
 and round 0.1 - 0.3 mm, not obviously lined

Surface (face): One-hackly, fresh, remainder have adhering light gray powder
 that is not removed with jet of N₂.

Zap pits (density/face): None

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Medium gray	99		<0.1	mm	
Lithic clast I	Medium light gray	<1	Subrounded	2		Coarser than matrix (grain size ~0.1 mm), sugary texture, 1 pinkish polycrystalline area
Lithic clast II troctolite	Green and white	<1	Angular	7 x 4		1/2 plagioclase, 1/2 greenish olivine in equigranular, interlocking texture
Olivine	Green	<1	Rounded	0.4		Fractured single grains



76556,0

Generic No: 76556
Rock Type: Crystalline rock

Weight (g): 7.40

Dimensions (cm) 2-1/2 x 2 x 2

Color (fresh): Medium gray (N5) with greenish tint

Shape: Angular, irregular

Variability: Homogeneous

Coherence: intergranular - tough; fracturing: few, non-penetrative

Fabric/texture: Sugary to mosaic

Cavities (%): None

Surface (face): Most of surfaces are patinated and somewhat smooth.
 One fresh hackly face.

Zap pits (density/face): Many on most surfaces, the fresh surface has a few.

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Medium gray	99				Primarily small (<0.1 mm) white and gray grains in sugary to interlocking texture with a few small opaque grains interspersed. Some mosaic-like areas 0.5 mm across containing sugary to sutured grains.
Mafic silicate clast	Greenish yellow	only 3 or 4 grains	Round	0.5		Olivine?
Silicate clast	Pale lime green	1 clast	Irregular angular	3 x 2		Waxy appearance



Generic No: 76557
Rock Type: Crystalline sugary breccia

Weight (g): 5.59

Dimensions (cm): 2 x 1-1/2 x 1

Color (fresh): Medium gray (N5) with greenish tint

Shape: Angular-blocky

Variability: Homogeneous

Coherence: intergranular - tough; fracturing: None

Fabric/texture: Fine grained, sugary, equigranular

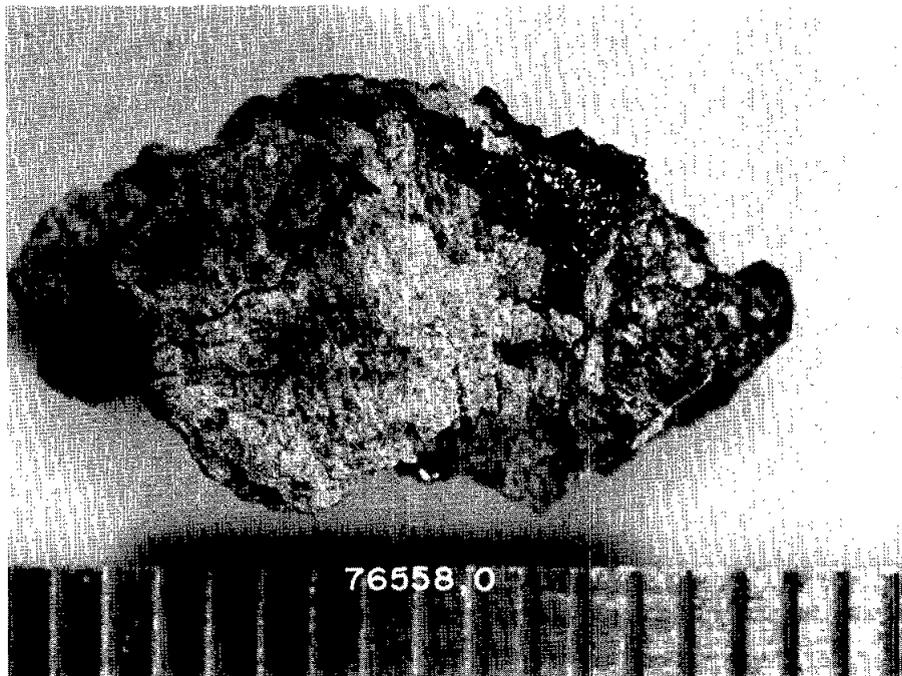
Cavities (%): ~2%, numerous, flattened cavities .2 - .5 x 1-3 mm - look like opened cracks

Surface (face):

Zap pits (density/face): Some on 2 surfaces only

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Greenish medium gray	>95	equi-granular	.1		Contains a few % 0.1 mm long plate-shaped, black opaque minerals
Mafic mineral clasts	Yellow-green	4	Rounded		<1.0	Olivine?
Mafic clasts	Brown	Trace	Rounded		<1.0	
Plagioclase clasts	White	Trace	Sub-rounded		<2.0	

Special Features: Flattened cavities define a foliation.



Generic No: 76558
Rock Type: White recrystallized
 breccia with black glass

Weight (g): 0.68

Dimensions (cm): 1.5 x .8 x .5

Color (fresh): Light gray

Shape: Irregular - angular

Variability: White breccia fragments held together by black glass.
 Some dark gray breccia also occurs.

Coherence: intergranular : somewhat coherent; fracturing: many penetrative
 (glass along them)

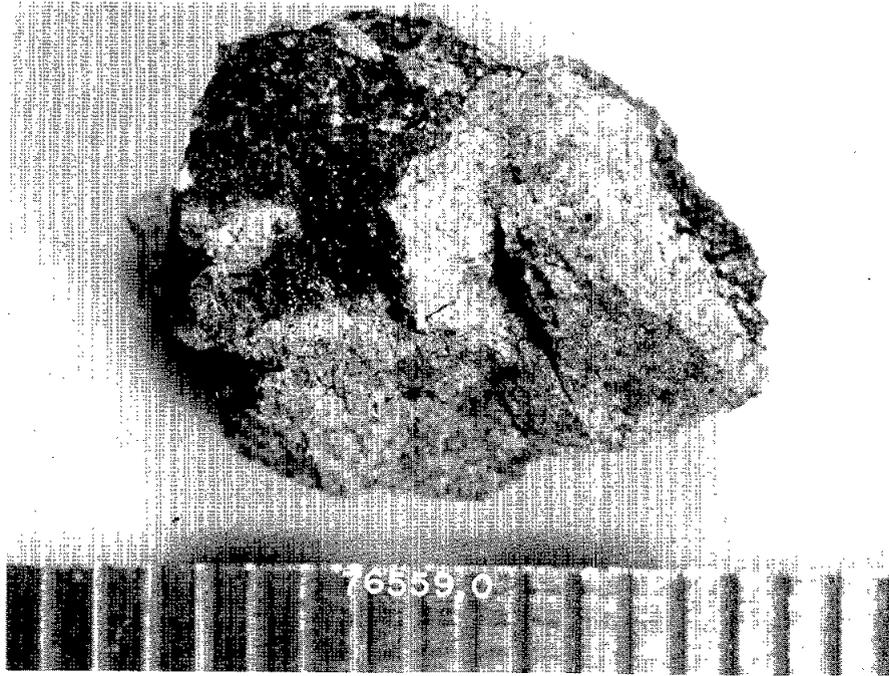
Fabric/texture: granular to sutured grain boundaries

Cavities (%): 25% round vesicles in black glass, up to 1 mm diameter

Surface (face):

Zap pits (density/face): None on breccia, some on black glass

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
White breccia	Light gray	60				Same as 76559 except for one gray area 2 to 3mm across but it has same texture as 76559.
Dark breccia	Dark gray	10				Same as 76559
Glass	Black	30				



Generic No: 76559Rock Type: White recrystallized brecciaWeight (g): 0.75Dimensions (cm): 1 x 1 x 3/4Color (fresh): Light gray (N7) and medium dark gray (N4)Shape: AngularVariability: There are two distinct materials: white and dark gray breccias: each are relatively homogeneous.Coherence: intergranular - somewhat friable; fracturing: few non-penetrativeFabric/texture: White part; granular to sutured grain boundariesCavities (%): NoneSurface (face): All surfaces appear to be freshly broken. Some black glass splatter on one surface.Zap pits (density/face): None

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
White breccia	Light gray	90				Consists of a mosaic of light gray and gray somewhat vitreous-appearing areas up to 0.3 mm across. Both types of areas are polycrystalline with grain size <0.1 mm except for platelets of dark opaque material up to 0.2 mm long. The light gray areas comprise about 60 % and the gray about 40% of the white breccia. Relic mineral grains up to 0.3 mm across occur throughout.
Dark breccia	Dark gray	10				Consists of 70 to 80% aphanitic dark gray material and 20 to 30 % white subrounded clasts (lithic?) <5 mm across that are probably crushed plagioclase.

Special Features: Black glass splatter on one surface.

Generic No: 76565
Rock Type: Polymict breccia

Weight (g): 11.6

Dimensions (cm): 2-1/2 x 2-1/2 x 2

Color (fresh): Medium gray (N5) to medium dark gray (N4)

Shape: Blocky, subangular

Variability: Homogeneous for breccia

Coherence: intergranular - somewhat friable; fracturing: few, nonpenetrative

Fabric/texture: Seriate breccia

Cavities (%): None

Surface (face): Somewhat smooth but with a few irregularities

Zap pits (density/face): Some on all surfaces

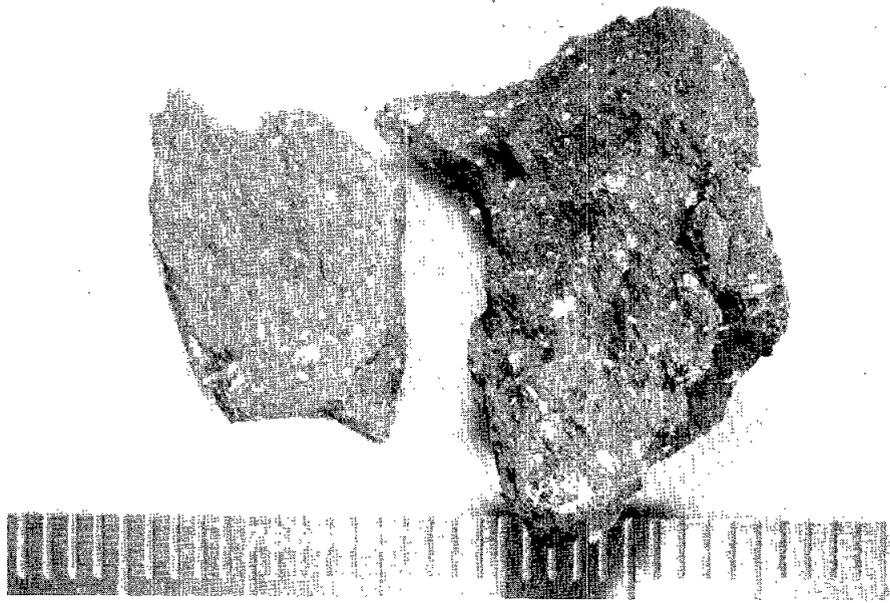
<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Medium gray	70-75			<0.1	

Clasts

Some population as 76566
 although sizes and percentages
 may differ somewhat

Special Features: Elongate white grains have same alignment.





Generic No: 76566
Rock Type: Polymict breccia

Weight (g): 2.64

Dimensions (cm): 2 x 1-1/2 x 1

Color (fresh): Medium gray (N5) to medium dark gray (N4)

Shape: Irregular, angular on one surface, rounded on others

Variability: Homogeneous for breccia

Coherence: intergranular - somewhat friable; fracturing: few, penetrative

Fabric/texture: Seriate breccia

Cavities (%): None

Surface (face): Rough, irregular on fresh surface, rounded on others

Zap pits (density/face): Few on rounded surfaces, none on fresh surface

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Medium gray	70-75			<0.1	
Lithic clast	Medium light gray	5	Subangular	up to 2		Fine-grained salt and pepper
Lithic clast	White	10	Subrounded	up to 1		Fine-grained, crushed, probably plagioclase
Plagioclase clast	White	5	Tabular	0.5 to 0.1		
Mineral clast	Deep red-brown	2-3	Irregular to rounded	up to 0.5		Probably pyroxene from mare basalts
Lithic clast	Red-brown and white	3-4	Subrounded	up to 1		Mixture of white and red-brown grains of varying grain size, probably mare basalt
Mafic silicate clast	Green	1 or 2 grains	Rounded		0.2	Olivine?

Special Features: Several elongate white clasts oriented in same direction



Generic No: 76567
Rock Type: Polymict breccia

Weight (g): 5.49

Dimensions (cm): 2 x 1 x 1-1/2

Color (fresh): Medium grey (N5)

Shape: Blocky - sub-angular

Variability: breccia

Coherence: intergranular: Moderately coherent; fracturing: few, non-penetrative

Fabric/texture: Seriate breccia

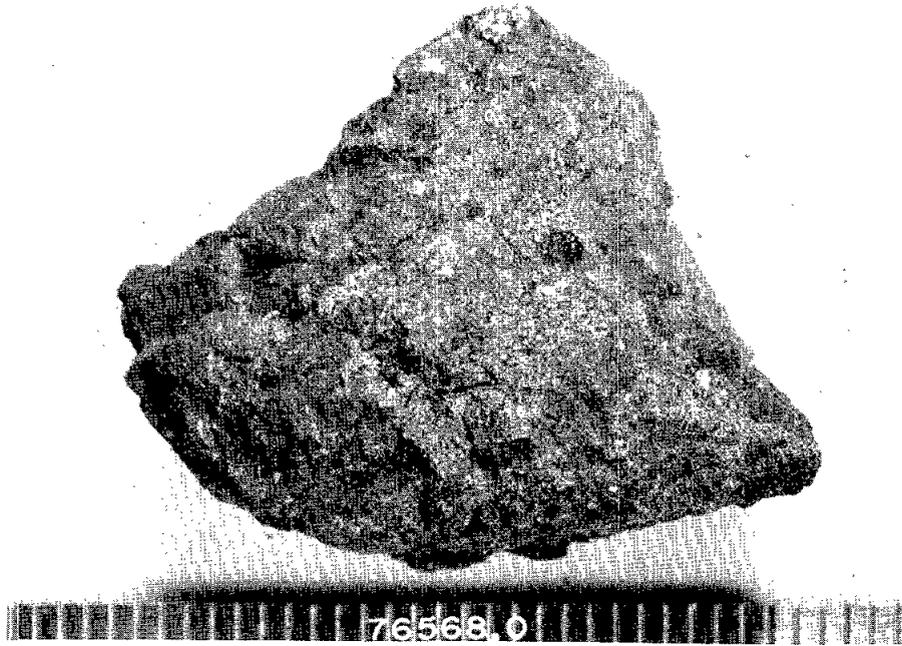
Cavities (%): None

Surface (face): One surface is fresher than remainder

Zap pits (density/face): Some on all surfaces

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Medium gray	75		<.1		
Lithic clast I	White	2.5	Subangular		<5	Contains granulated mix of white, green, and black (opaque) minerals. White is about 80%
Lithic clast II	White	2.5	Subangular		<5	Mostly white but contains a few black opaque minerals plus pink spinel? or pyroxene?
Lithic clast III	White	1 fragment	Sub- rounded		6-7 mm	Pink-spinel troctolite containing white plagioclase, green olivine, brown pyroxene, pink spinel and black ilmenite
Mineral clast	Pink	<1				Spinel?
Mafic mineral clast	Green	5	Rounded		<1.5	Olivine
Feldspar	White	5-10	Subrounded		<1	Poly-crystalline
Feldspar?	Moderately dark gray	5			<1	
Mineral or glass clast	Orange	Trace	Blocky	.5		Crushed

Special Features: Rock does not have the brown tint of most glassy breccias - but we think we see glass in sample.



Generic No: 76568
Rock Type: Mare basalt clast breccia

Weight (g): 9.48

Dimensions (cm): 2.5 x 2.0 x 2.0

Color (fresh): Medium gray (N5)

Shape: Block, subangular

Variability: Extreme

Coherence: intergranular - tough; fracturing: few, widely spaced

Fabric/texture:

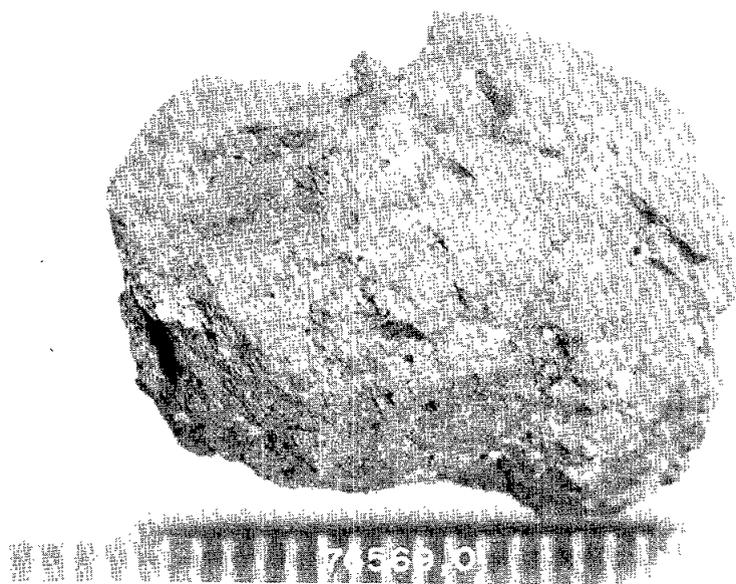
Cavities (%): None

Surface (face): One surface has scattered drops of black glass splatter, others are eroded

Zap pits (density/face): Few to many on all surfaces, some are lined with mottled steel gray and red glass.

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Mare basalt I clasts	Medium gray	90	Angular	20		Forms bulk of rock, 0.3mm grain size, granular, ilmenite-rich basalt with a few xenolithic patches of gray aphanitic material.
Mare basalt II clasts	Medium gray	5	Angular	5		Coarser grain size (2 mm) than I with feldspar, pinkish pyroxene and ilmenite
Matrix	Dark orange gray	5		<1		Granular soil-like material generally similar to station 8 and 9 mare-rich breccias

Special Features: Relations between matrix, clasts, and large mare basalts fragment are unclear. There may be xenoliths in the mare basalt I fragment.



Generic No: 76569
Rock Type: Glassy (or aphanitic) matrix-rich breccia

Weight (g): 4.21

Dimensions (cm): 2 x 1-1/2 x 1

Color (fresh): Medium dark gray (N4)

Shape: Irregular, rounded to angular

Variability: Homogeneous

Coherence: intergranular - tough; fracturing: few, nonpenetrative

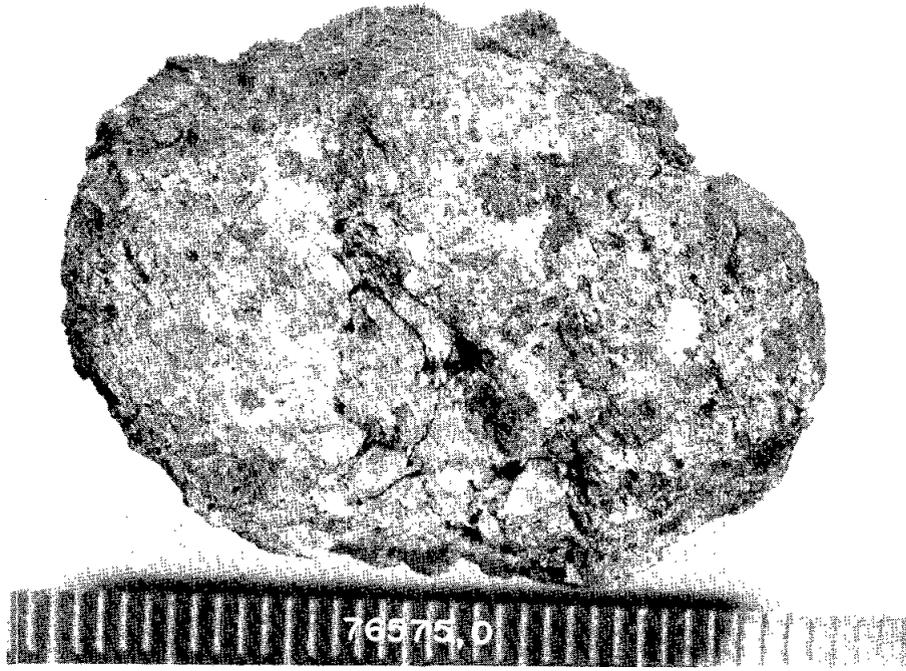
Fabric/texture: Matrix-rich breccia, possibly prophyritic matrix

Cavities (%): None

Surface (face): Rough and rounded on one surface, hackly and angular on other.

Zap pits (density/face): Some on all surfaces

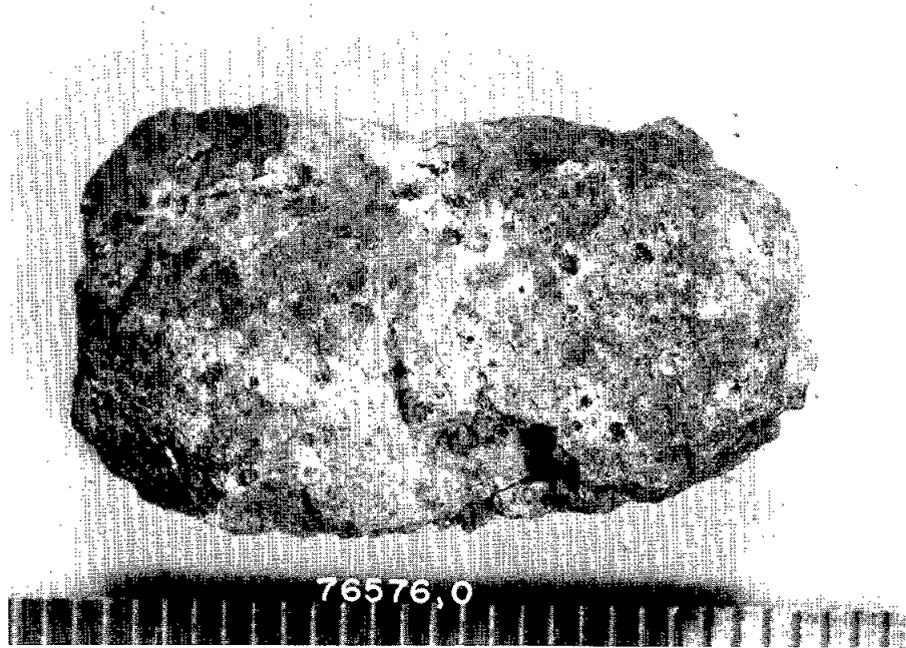
<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Dark gray	90		Aphanitic		(May be somewhat glassy)
Lithic clast	White	5-7	Sub-angular		up to 2	Crushed plagioclase?
Mafic silicate clast	Green	1	Rounded		1 mm	
Plagioclase clast	Light gray	3-5	{ Rounded to angular Some tabular		up to 1 mm	Some look like phenocrysts, others like clasts
					0.5 to 0.1	



Generic No: 76575
Rock Type: Crystalline breccia

Weight (g): 16.25
 Dimensions (cm): 3 x 2 x 2
 Color (fresh): Medium gray (N5)
 Shape: Rounded, blocky
 Variability: Homogeneous for a breccia
 Coherence: intergranular - tough; fracturing: few, non-penetrative
 Fabric/texture: Seriate
 Cavities (%): None
 Surface (face): Pitted and patinated on all surfaces
 Zap pits (density/face): Many on all surfaces. Pits have dark brown to black glass lining.

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Very light gray	4-5			<0.1	Granular or sugary texture
Lithic clasts	Medium gray	5	Subrounded to sub-angular		0.1-3.0	Some variation in grain size and texture (some more sugary than others, some contain white clasts)
Mafic silicate	Green	1	Angular		0.1-0.5	Probably olivine
Feldspar	White	2	Sub-angular to sub-rounded		0.1-0.7	Some are single crystals, others are polycrystalline
Metal	Silvery	<1	Blebs		<0.2	



Generic No: 76576

Rock Type: Crushed anorthositic rock

Weight (g): 5.33

Dimensions (cm): 2-1/2 x 1-1/2 x 1-1/2

Color (fresh): Light gray

Shape: Blocky, subrounded

Variability: Homogeneous

Coherence: intergranular - tough; fracturing: few, non-penetrative

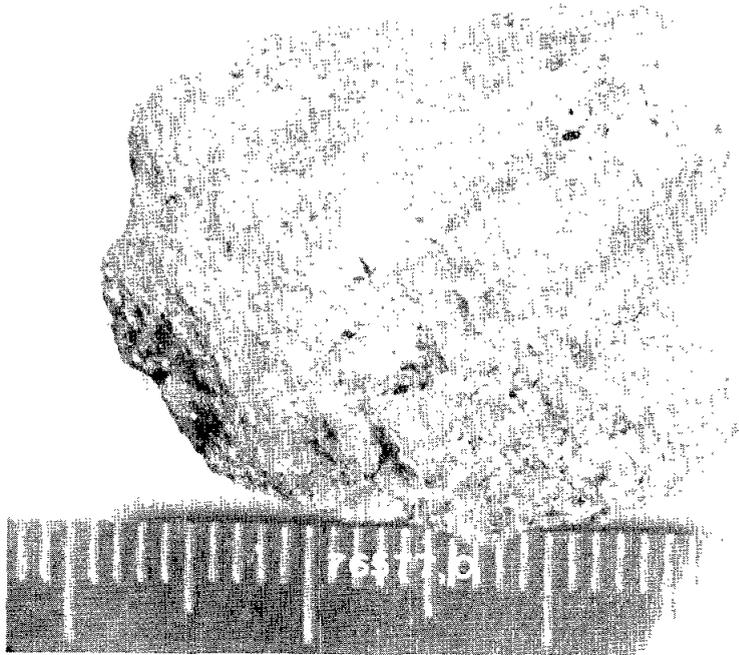
Fabric/texture: Seriate

Cavities (%): None

Surface (face): Mostly smooth to slightly irregular and patinated.
One small patch is freshly broken to expose fresh surface.

Zap pits (density/face): Some on all surfaces

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Feldspar	White	60-70	Sub-angular to rounded	0.1 or less	<0.1 to 0.5	
Feldspar	Gray	15-20	Sub-angular to rounded	0.5	0.1 to 1.5	
Mafic silicate	Light green	10-15	Sub-rounded to rounded		0.1 to 0.5	
Opagues	Black	Trace	Equidimensional		<0.1	



Generic No: 76577
Rock Type: Recrystallized mosaic
 textured breccia

Weight (g): 13.54
Dimensions (cm): 2-1/2 x 2 x 2
Color (fresh): Between olive gray and light olive gray on "weathered" surface
Shape: Subrounded, blocky
Variability: Reasonably homogeneous
Coherence: intergranular - tough; fracturing: None
Fabric /texture: Mosaic
Cavities (%): 1-2%, rounded, up to 1 mm diameter
Surface (face): Hackly on a few fresh patches, somewhat smoother on
 patinated surfaces. One small black glass splash
Zap pits (density/face): Some on all surfaces

<u>Component</u>	<u>Color</u>	<u>% of Rock</u>	<u>Shape</u>	<u>Size (mm)</u>		<u>Comments</u>
				<u>Dom.</u>	<u>Range</u>	
Matrix	Light gray	98				Consists of equidimensional patches roughly 1 mm across of granulated material. Patches are white, gray, green and brown in order of abundance. Granulated material is equigranular about 0.1 mm. A few % opaques also present.
Silicate mineral clasts	Green	1-2	Rounded to sub- angular		up to 1mm	Probably olivine
Feldspar clasts	White to gray	<1	Sub- angular		up to 1 mm	

Special Features: On one side there is a concentration of olivine that is not
granulated. This may be a clast but also may be a less crushed area.

APOLLO 15 DEEP-DRILL-CORE: CLASSIFICATION,
DESCRIPTION, AND INVENTORY OF SEPARATED PARTICLES



National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER

Houston, Texas

OCTOBER 1974

APOLLO 15 DEEP-DRILL-CORE: CLASSIFICATION,
DESCRIPTION, AND INVENTORY OF SEPARATED PARTICLES

MICHAEL J. DRAKE
DEPARTMENT OF PLANETARY SCIENCES
UNIVERSITY OF ARIZONA
TUCSON, ARIZONA 85721

CONTENTS

SECTION	PAGE
INTRODUCTION	1
ACKNOWLEDGMENTS	2
SAMPLE NUMBERING	3
SAMPLE CLASSIFICATION	4
SAMPLE PROCESSING, CAVEAT	6
SAMPLE DESCRIPTIONS	7
REFERENCES	105

TABLES

TABLE	PAGE
1 Distribution of particle types in drill-stem sections	101
2 Census of particles separated from the Apollo 15 deep-drill-core	102

INTRODUCTION

This catalog presents the results of a binocular microscope examination of all particles separated by the Curator's staff from Apollo 15 deep-drill-core sections 15001, 15002, 15003, 15005, and 15006. Examination was performed through a window in a nitrogen atmosphere processing cabinet without the aid of thin sections or analyses of any kind. Consequently classifications must be considered strictly tentative. The primary purpose of this preliminary examination is to classify each particle on the basis of its "macroscopic" features in order to facilitate intelligent allocation of samples for future detailed studies.

ACKNOWLEDGMENTS

The author wishes to acknowledge the friendly and efficient assistance of Betty Gabel, Vic Alexander, Frank Kramer and other members of the Curator's staff. The study was supported by NASA grant NGR 03-002-388.

SAMPLE NUMBERING

The deep-drill-core was obtained at station 8 (LM,ALSEP). It is divided into six sections, numbered 15001 to 15006 from bottom to top (see Apollo 15 Lunar Sample Information Catalog MSC 03209; Heiken et al., 1973). The parent samples examined for this report were separated by the Curator's staff at known intervals along the core and assigned numbers in the usual manner. Daughter samples established in the course of this examination contain all particles formerly present in the parent sample. Parent samples now contain only the fines formerly adhering to the particles. Daughter sample numbers are sequential within each drill-stem section. Sample numbers are given in the order "generic, daughter (, parent)" e.g., 15001, 272(, 43).

SAMPLE CLASSIFICATION

The classification which has been adopted is that employed by Powell (1972) for the study of Apollo 15 4-10mm coarse fines, with the following minor modifications. Friable and coherent microbreccias (types 1 and 2 of Powell) are combined in this classification. Gabbros with a grain size of approximately 1 mm (type 11 of Powell) were not observed. An additional category for mineral fragments has been added. Descriptions of each subgroup follow.

1. Microbreccias

Most microbreccias are characterized by medium-to-strong intergranular coherency. Very few friable microbreccias were observed, perhaps because they did not survive the coring process. Matrix is usually finegrained. The most common lithic clasts are white and presumably anorthositic in composition. Mineral clasts of plagioclase, olivine, and pyroxene are frequently observed, and some microbreccias may be the monomict products of comminuted basalts. Microbreccias often have splashed glass partially coating one-or-more surfaces.

2. Agglutinates

These particles generally consist of fragments of other rock types (often microbreccias) welded together by dark gray, brown, or black glass which also coats one-or-more surfaces. Shapes vary but are generally highly irregular.

3. Glass

These particles consist of at least 75 percent and usually entirely of dark gray, brown, or black glass. Shapes are variable and include irregular, angular, rounded, and spherical. Fractures are generally conchoidal. Some particles may be partly or wholly devitrified, or may be microcrystalline basalts which were mistakenly identified.

4. Non-mare crystalline rocks

These particles are typically plagioclase-rich and light in color with shades of white, brown, or gray. Textures are generally non-igneous. Specific rock names are tentatively used when minerals can be identified.

5. Light green glass

These particles consist of light apple-green glass. Shapes include glass spherules, and angular clasts in a friable, lighter green matrix.

6. "Ultrabasic" rocks

Members of this group are rare, generally small, and consist almost entirely of one-or-more ferromagnesian silicate minerals.

7. Basalts

These are typical mare ferrobasalts with igneous textures. Minerals include plagioclase, pyroxene (cinnamon-brown to dark gray), opaque phases (presumably predominantly ilmenite), with or without minor (less than 5%) olivine.

8. Olivine basalts

These are similar to the above except for the higher abundance of olivine.

9. Vesicular basalts

These particles are rare, and contain vesicles of up to 5 mm diameter.

10. Microcrystalline basalts

These particles are classified with considerable uncertainty due to their finegrained nature. Individual minerals could not be resolved with the binocular microscope, yet the surface appeared to have some granularity. They are generally dark gray to black in color, with a dull luster on fresh surfaces. They are presumed to be very finegrained basalts, but some may be devitrified glass, and finegrained clast-free microbreccias may also be present.

11. Mineral fragments

These particles are predominantly broken single crystals of plagioclase. One metal sphere was observed.

SAMPLE PROCESSING, CAVEAT

Particles were separated at recorded intervals along the drill-stem by the Curator and his staff. The drill-stem sections were not treated identically. From sections 15001, 15002, 15005, and 15006, only a few, large particles were removed. A more exhaustive dissection of 15003 was performed, resulting in the removal of all particles with a diameter of greater than approximately 0.5mm. Thus 62 out of 93 daughter samples, and 478 out of 531 particles are from 15003 (Table 1).

Particles were examined through a window in a nitrogen atmosphere processing cabinet using a binocular microscope. The particles were lightly dusted with a dry nitrogen jet prior to examination, but in many cases a considerable amount of dust still adhered to the particle making examination difficult. Samples were examined sequentially and it was not possible to return to a particle examined earlier for supplemental study. The classification is based only on "macroscopic" features: thin sections and chemical analyses were not available. Consequently mistakes in the classification of some particles are inevitable. The accuracy of assignment of particles to a given classification subgroup will undoubtedly vary with the subgroup. For example, assignment of particles to the light green glass subgroup should be essentially 100% correct, while microcrystalline basalts may exhibit considerable variability when studied in detail.

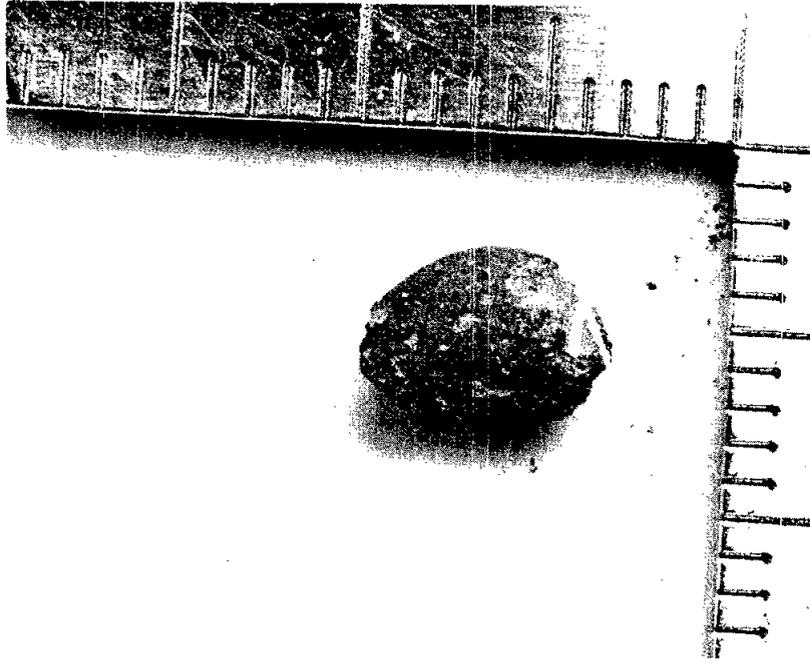
All particles from a given parent sample were described, photographed as a group, and assigned a new daughter sample-number. Thus in any daughter sample, several types of particle will be found. Individual particles may be accessed with the aid of the photographs and individual sample descriptions.

SAMPLE DESCRIPTIONS

The following pages contain descriptions of all particles in daughter samples established as a result of this examination. Descriptions follow the numerical order of the daughter sample numbers. A photograph showing all particles in each daughter sample, together with a millimeter scale, accompanies each description. Particle type, color, surface structure, shape, coherence, and any special features are recorded. Many mineral identifications are tentative, and a list of minerals is not necessarily exclusive. Modal abundances are not generally reported because of the small size of most of the particles. Following the descriptions, Table 1 summarizes the distribution of particle types in each drill-stem section, and Table 2 contains a census of all particles separated from the Apollo 15 deep-drill-core.

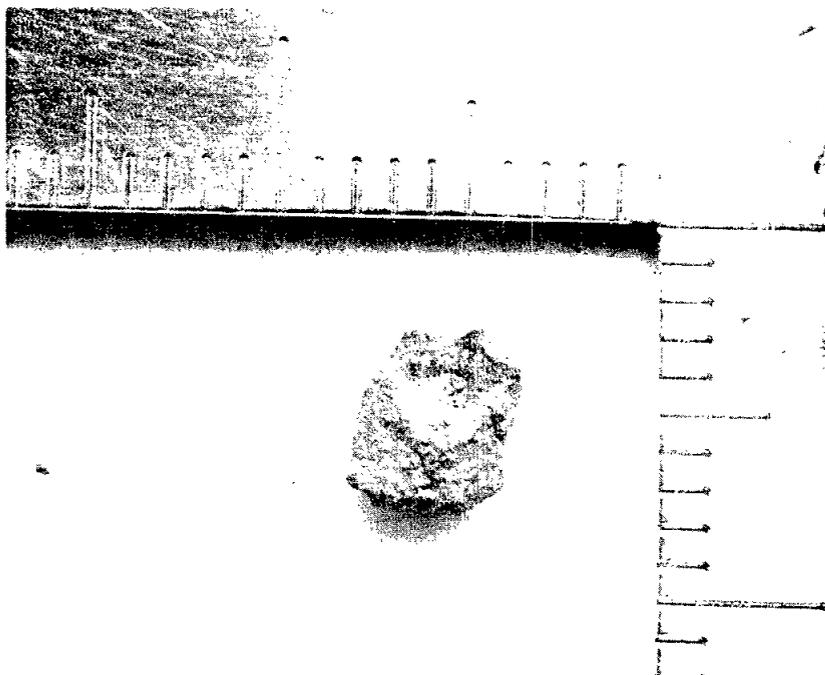
15001,272 (,43)

PARTICLE #: None
ROCK TYPE: Microcrystalline basalt
COHERENCE: Tough
SHAPE: Rounded
SURFACE: Smooth
COLOR: Dark gray
TOTAL WEIGHT: 0.14 g
NO. PARTICLES: 1
REMARKS: Very finegrained, perhaps glassy. Possibly a devitrified glass sphere. Fractured surface very dusty.



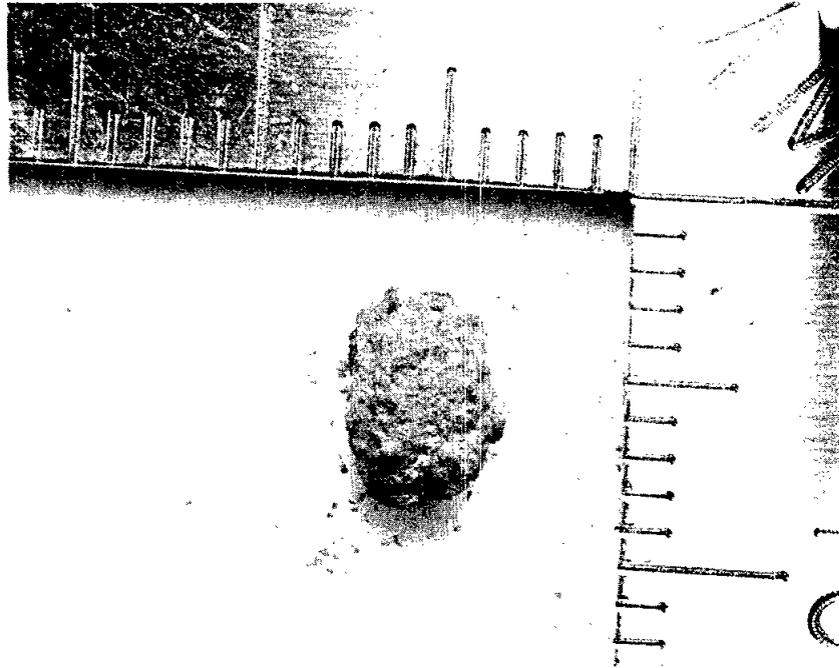
15001, 273 (,47)

PARTICLE #: None
ROCK TYPE: Basalt
COHERENCE: Medium, penetrating fractures
SHAPE: Subangular
SURFACE: Very finely granular
COLOR: Dark gray
TOTAL WEIGHT: 0.08 g
NO. PARTICLES: 1
REMARKS: Identification difficult because of adhering dust.
Appears to contain olivine and pyroxene phenocrysts in
dark crystalline groundmass.



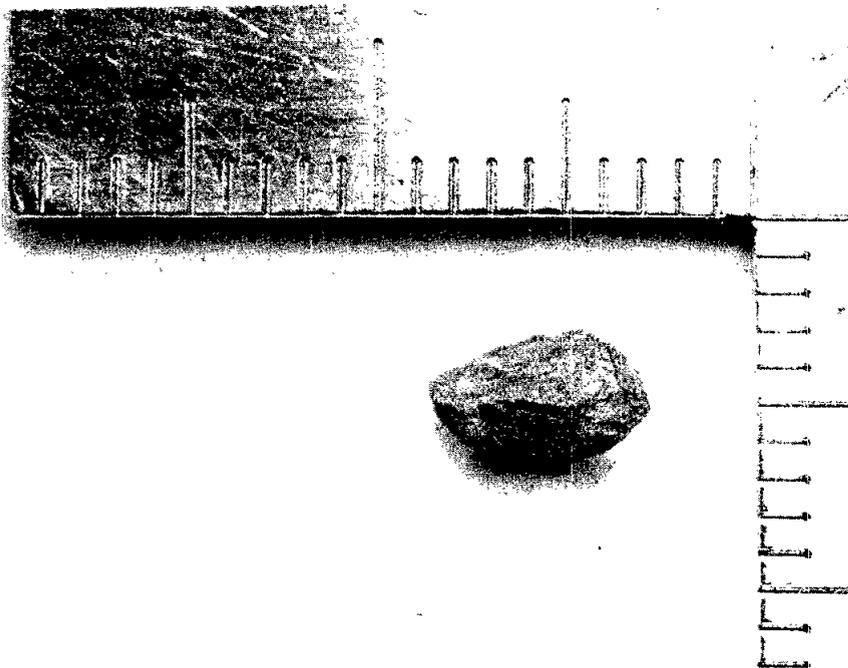
15001,274 (.48)

PARTICLE #: None
ROCK TYPE: Microbreccia
COHERENCE: Tough
SHAPE: Subrounded
SURFACE: Very finely granular
COLOR: Dark gray
TOTAL WEIGHT: 0.11 g
NO. PARTICLES: 1
REMARKS: Covered with dust. Probably a very tough microbreccia,
possibly devitrified glass with clasts. Scraping dust
reveals white clast (?).



15001,275 (,50)

PARTICLE #: None
ROCK TYPE: Microcrystalline basalt
COHERENCE: Very tough
SHAPE: Subangular
SURFACE: Very finely granular
COLOR: Very dark gray
TOTAL WEIGHT: 0.07 g
NO. PARTICLES: 1
REMARKS: No identifiable minerals, but appears crystalline.



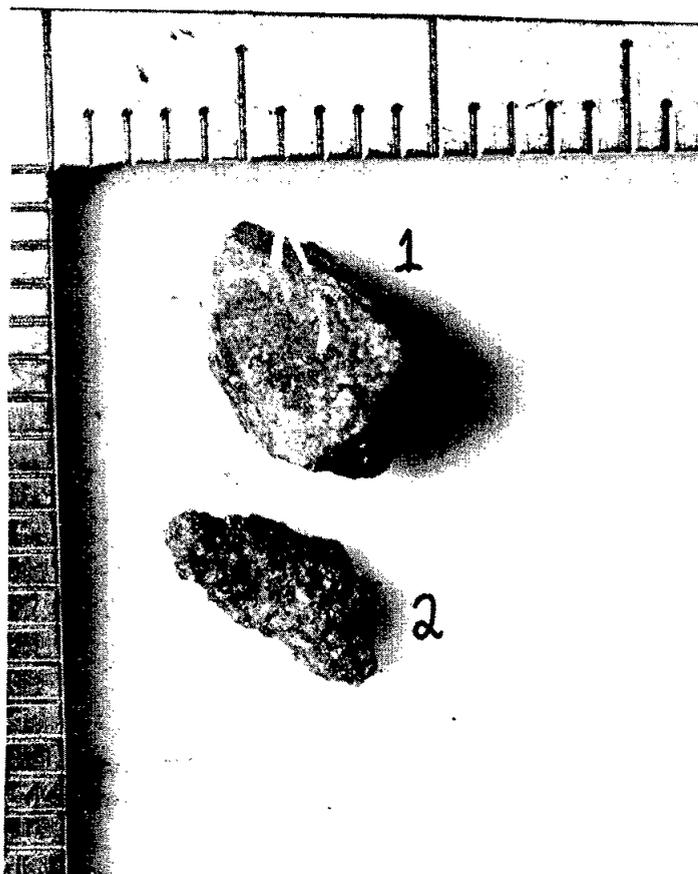
15001,276 (,53)

PARTICLE #: None
ROCK TYPE: Olivine basalt
COHERENCE: Medium
SHAPE: Subrounded
SURFACE: Hackly
COLOR: Mottled gray and white
TOTAL WEIGHT: 0.05 g
NO. PARTICLES: 1
REMARKS: Very large green olivine, white plagioclase, cinnamon-brown pyroxene, dark gray mineral (second pyroxene?), acicular and tabular opaque phases.



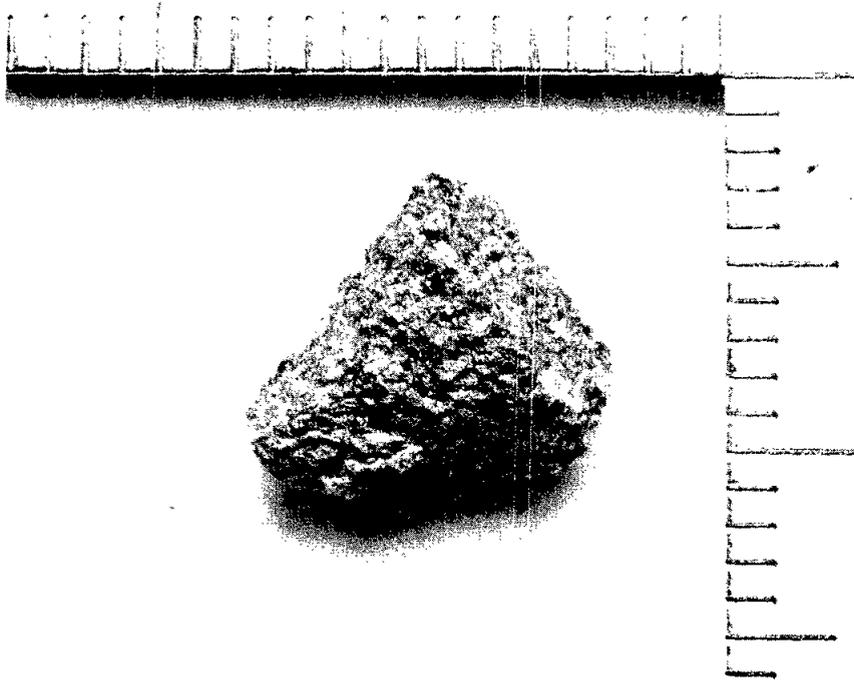
15001,277 (,60)

PARTICLE #:	1	2
ROCK TYPE:	Microbreccia?	Olivine basalt
COHERENCE:	Very tough	Medium
SHAPE:	Subangular	Subangular
SURFACE:	Smooth	Hackly
COLOR:	Mottled dark gray and white	Green-brown
TOTAL WEIGHT:	0.29 g	
NO. PARTICLES:	2	
REMARKS:	<ol style="list-style-type: none"> 1. Dust adheres to surface. White clasts. Very highly lithified. 2. Olivine, cinnamon-brown pyroxene, plagioclase all have similar grain size. Opaque phases usually smaller. 	



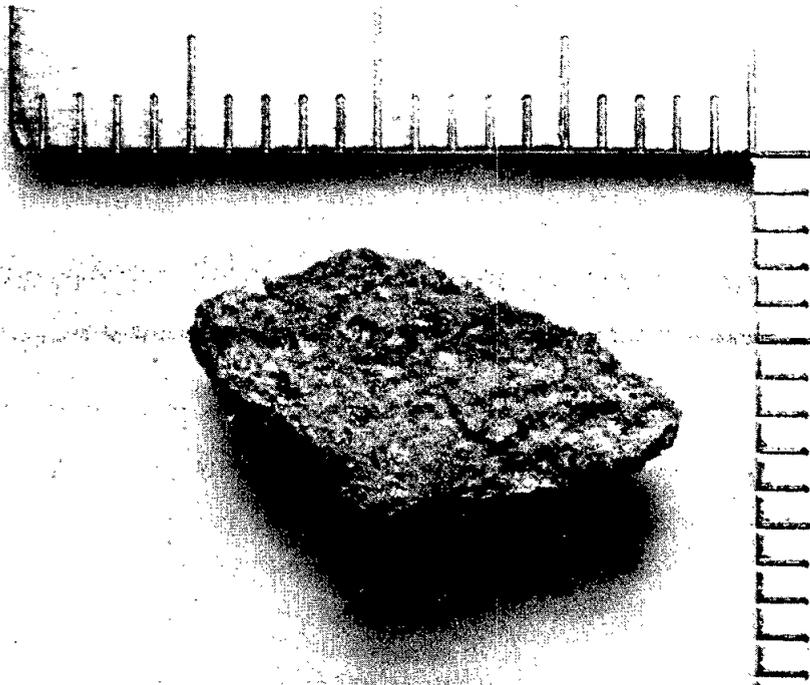
15001,278 (,63)

PARTICLE #: None
ROCK TYPE: Olivine basalt
COHERENCE: Medium, penetrating fractures
SHAPE: Angular
SURFACE: Hackly
COLOR: Green-gray
TOTAL WEIGHT: 0.49 g
NO. PARTICLES: 1
REMARKS: Olivine, cinnamon-brown pyroxene. Plagioclase. Small opaques.



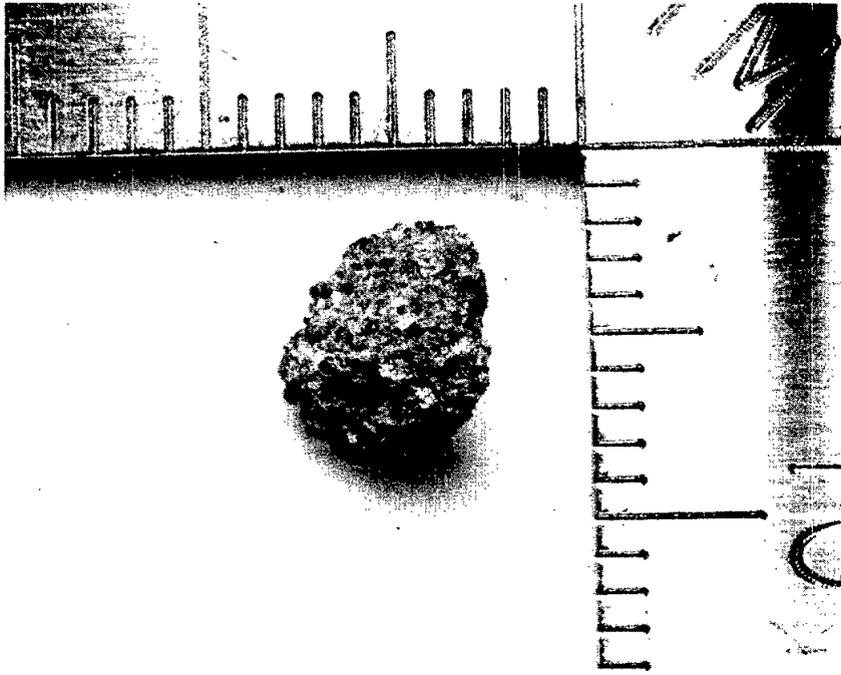
15001,279 (.64)

PARTICLE #: None
ROCK TYPE: Olivine basalt
COHERENCE: Medium, penetrating fractures
SHAPE: Angular
SURFACE: Hackly
COLOR: Green-gray
TOTAL WEIGHT: 0.77 g
NO. PARTICLES: 1
REMARKS: Olivine, cinnamon-brown pyroxene. Plagioclase. Opaque phases. Occasional vesicle with smooth lining.



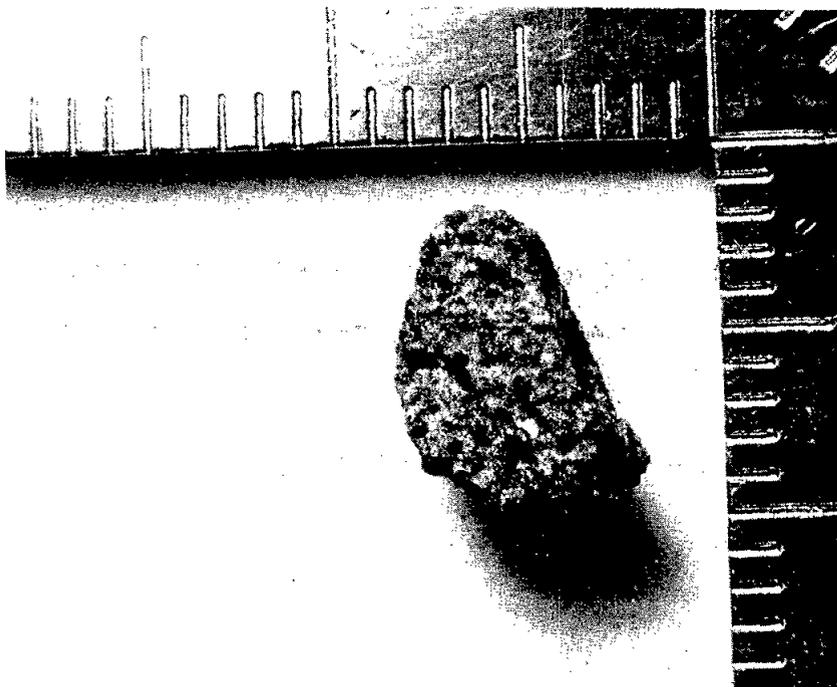
15001,280 (,65)

PARTICLE #: None
ROCK TYPE: Olivine basalt
COHERENCE: Medium
SHAPE: Subangular
SURFACE: Hackly
COLOR: Green-gray
TOTAL WEIGHT: 0.21 g
NO. PARTICLES: 1
REMARKS: No vesicles, but vugs with crystals (especially plagioclase) protruding. Olivine, cinnamon-brown pyroxene. Similar to 15001,279.



15001,281 (,67)

PARTICLE #: None
ROCK TYPE: Olivine basalt
COHERENCE: Medium
SHAPE: Subangular
SURFACE: Hackly
COLOR: Green-gray
TOTAL WEIGHT: 0.35 g
NO. PARTICLES: 1
REMARKS: Similar to 15001,279.



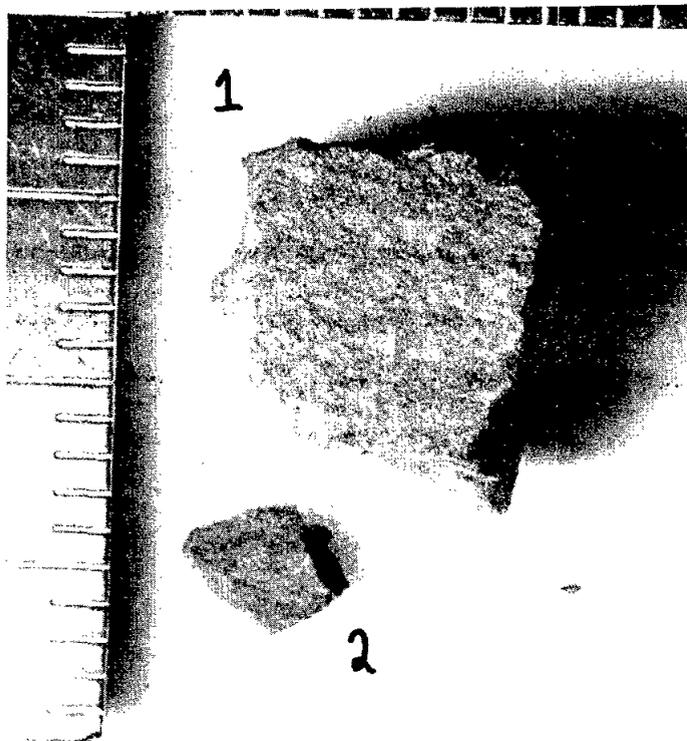
15001,283 (,75)

PARTICLE #: None
ROCK TYPE: Olivine basalt
COHERENCE: Medium, penetrating fractures
SHAPE: Subangular
SURFACE: Hackly
COLOR: Green-gray
TOTAL WEIGHT: 1.39 g
NO. PARTICLES: 1
REMARKS: Vesicles. Similar to 15001,279.



15001,285 (,105)

PARTICLE #: 1 and 2
ROCK TYPE: Microbreccia
COHERENCE: Tough
SHAPE: Angular
SURFACE: Very finely granular - smooth
COLOR: Dark gray
TOTAL WEIGHT: 1.12 g
NO. PARTICLES: 2
REMARKS: Some dust adheres to surface. Large plagioclase clast, olivine clasts. Foliation (parallel to plane of photograph)? Highly lithified.



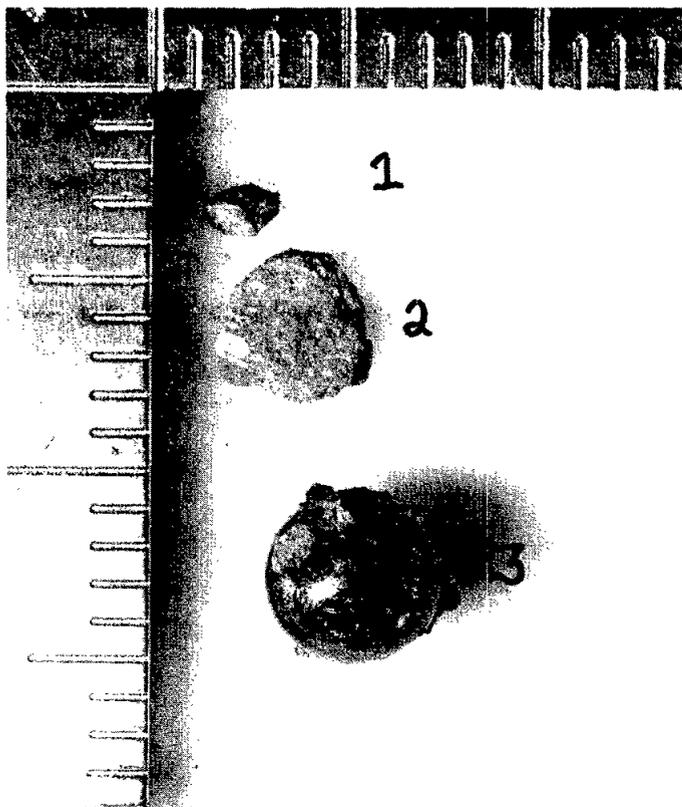
15001,286 (,103)

PARTICLE #: None
ROCK TYPE: Olivine basalt
COHERENCE: Medium, penetrating fractures
SHAPE: Subangular
SURFACE: Hackly
COLOR: Green-gray
TOTAL WEIGHT: 0.29 g
NO. PARTICLES: 1
REMARKS: Olivine, cinnamon-brown to (and?) dark gray pyroxene.
Acicular opaque phases. Plagioclase.



15001,287 (,107)

PARTICLE #:	1	2	3
ROCK TYPE:	Microcrystalline basalt	Microbreccia	Glass
COHERENCE:	Tough	Medium	Tough
SHAPE:	Angular	Subrounded	Spherical
SURFACE:	Very finely granular-smooth	Finely granular	Smooth, vitreous
COLOR:	Very dark gray	Medium gray	Dark brown
TOTAL WEIGHT:	0.11 g		
NO. PARTICLES:	3		
REMARKS:	1. Dust adheres to surface 2. White clasts 3. Small pieces of microbreccia adhere to surface. Vesicles visible beneath surface.		



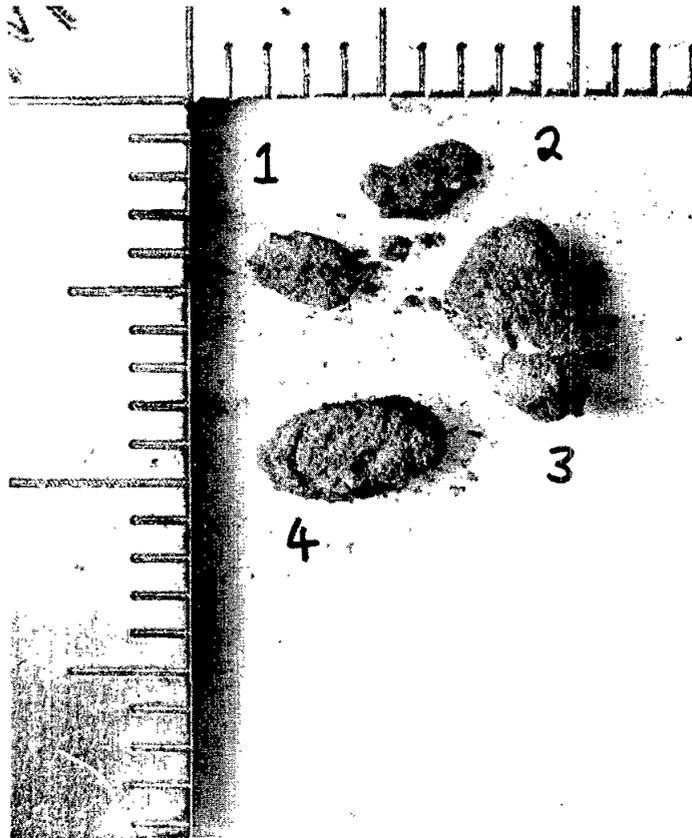
15001,288 (,110)

PARTICLE #: None
ROCK TYPE: Basalt
COHERENCE: Tough
SHAPE: Angular
SURFACE: Uneven-hackly
COLOR: Brown
TOTAL WEIGHT: 0.44 g
NO. PARTICLES: 1
REMARKS: Very dusty. Can only identify cinnamon-brown pyroxene.
(Olivine?)



15001,289 (,116)

PARTICLE #: 1-4
ROCK TYPE: Microbreccia
COHERENCE: Friable
SHAPE: Rounded
SURFACE: Finely granular
COLOR: Gray-brown
TOTAL WEIGHT: 0.09 g
NO. PARTICLES: 4
REMARKS: Very dusty. White clasts and streaks. Individual clasts of plagioclase and pyroxene. Dark (glassy?) clasts. Extremely friable.



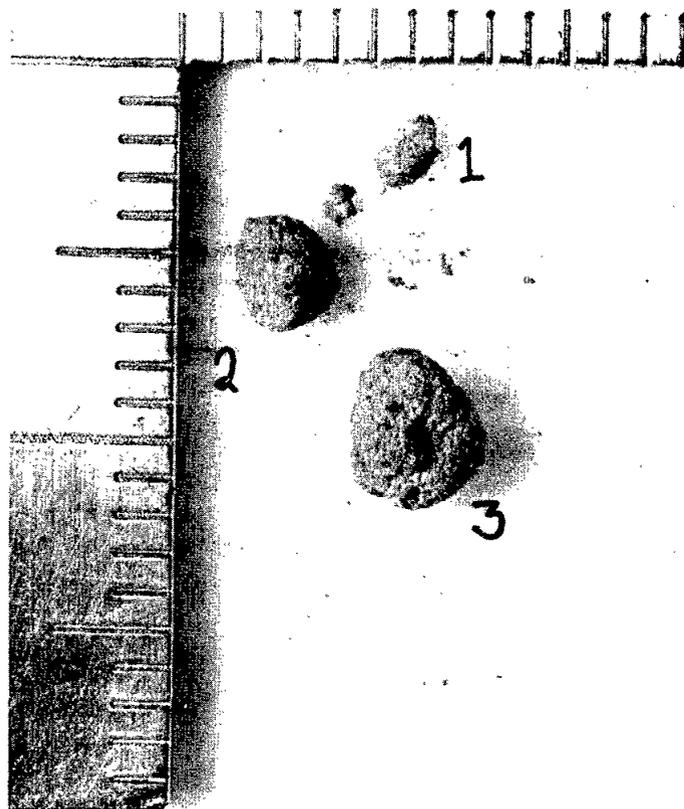
15001,290 (,117)

PARTICLE #: None
ROCK TYPE: Microbreccia
COHERENCE: Medium
SHAPE: Subangular
SURFACE: Uneven - finely granular
COLOR: Medium gray
TOTAL WEIGHT: 0.65 g
NO. PARTICLES: 1
REMARKS: White clasts, olivine clasts. Occasional glass splashes.
Recrystallized matrix. Fractures cause flaking.



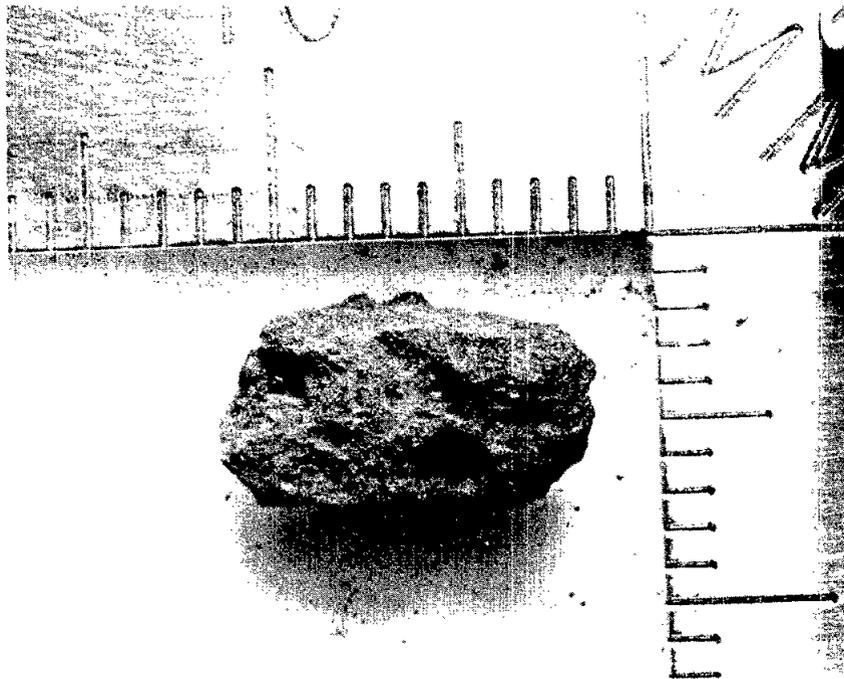
15001,291 (,126)

PARTICLE #: 1-3
ROCK TYPE: Microbreccia
COHERENCE: Friable
SHAPE: Rounded
SURFACE: Finely granular
COLOR: Gray-brown
TOTAL WEIGHT: 0.07 g
NO. PARTICLES: 3
REMARKS: Clasts of plagioclase, olivine, pyroxene.



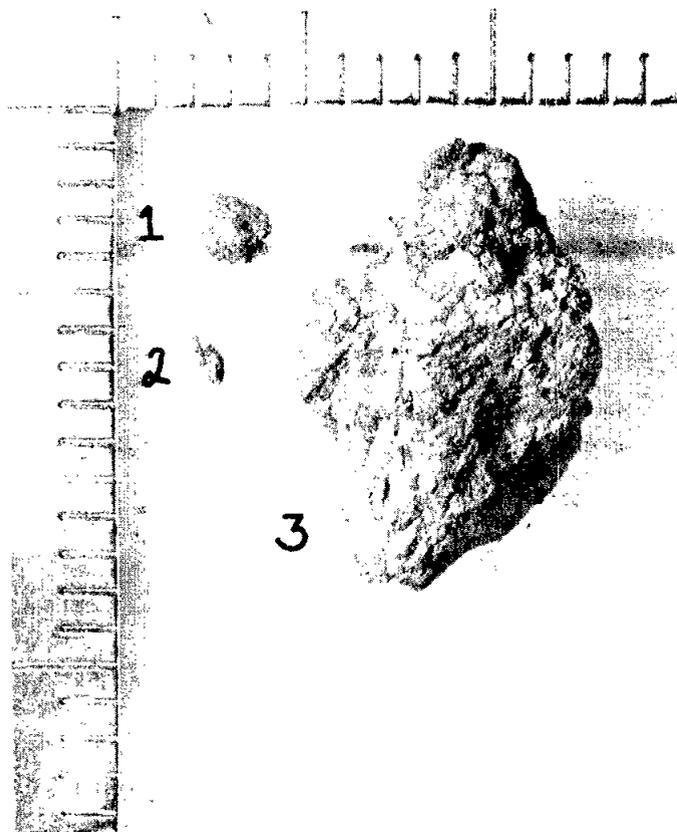
15002,335 (,78)

PARTICLE #: None
ROCK TYPE: Basalt
COHERENCE: Tough
SHAPE: Angular
SURFACE: Granular
COLOR: Very dark gray
TOTAL WEIGHT: 0.46 g
NO. PARTICLES: 1
REMARKS: Vugs lined with pyroxene crystals. Very finely crystallized dark matrix. Olivine phenocrysts, dark gray laths probably pyroxene. Rock may be olivine vitrophyre.



15002,336 (.98)

PARTICLE #:	1	2	3
ROCK TYPE:	Basalt	Basalt	Microbreccia
COHERENCE:	Medium	Medium	Medium, penetrating fractures
SHAPE:	Subangular	Subrounded	Subangular
SURFACE:	Granular	Granular?	Finely granular
COLOR:	Light gray-brown	Light gray-brown	Gray
TOTAL WEIGHT:	0.61 g		
NO. PARTICLES:	3		
REMARKS:	1,2. Plagioclase, light brown pyroxene, olivine, opaque phases.		
	3. Large plagioclase clasts. Glass splashes. Identification uncertain.		



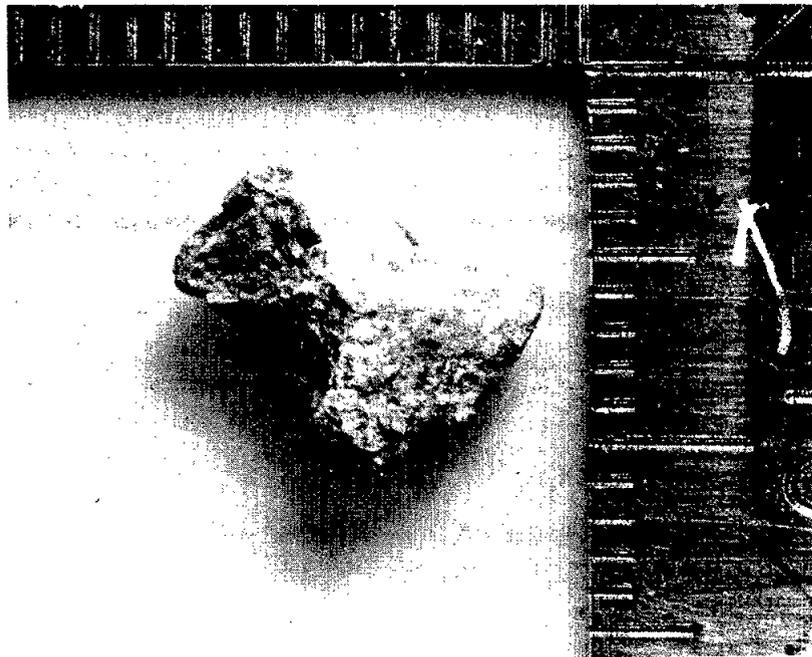
15002,337 (,100)

PARTICLE #: 1-5
ROCK TYPE: Microbreccia
COHERENCE: Medium
SHAPE: Subangular to angular
SURFACE: Finely granular
COLOR: Medium gray on fresh surfaces
TOTAL WEIGHT: 2.255 g
NO. PARTICLES: 5
REMARKS: Many clasts, usually plagioclase-rich. Occasional olivine (or green glass?) clast. Splashed glass on one surface. Fragments 2-5 probably spalled off fragment 1.



15002,338 (,105)

PARTICLE #: None
ROCK TYPE: Non-mare crystalline rock
COHERENCE: Medium - tough, penetrating fractures
SHAPE: Angular
SURFACE: Granular to powdery
COLOR: White to light gray
TOTAL WEIGHT: 0.33 g
NO. PARTICLES: 1
REMARKS: Plagioclase greater than 95%. Minor brown mineral, probably pyroxene. Outer surface is powdery white as if bombarded by minute projectiles. Fresh (?) inner surface is gray, translucent, massive crystalline plagioclase.



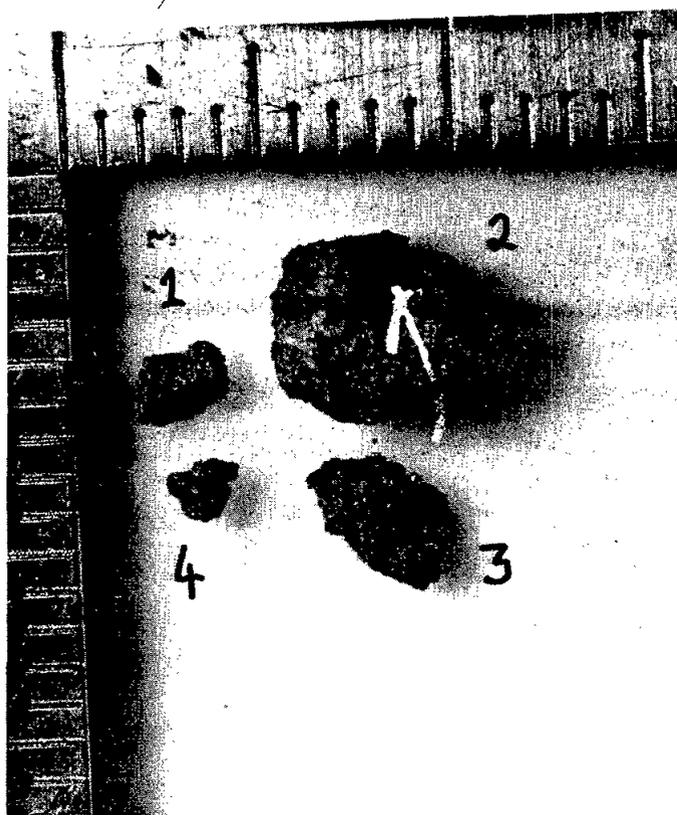
15002,339 (,113)

PARTICLE #: None
ROCK TYPE: Vesicular basalt
COHERENCE: Tough
SHAPE: Angular
SURFACE: Granular to hackly
COLOR: Gray-brown
TOTAL WEIGHT: 0.78 g
NO. PARTICLES: 1
REMARKS: Large (2-5mm) vesicles. Plagioclase, cinnamon-brown
pyroxene, opaque phases. Minor olivine.



15002,340 (,120)

PARTICLE #: 1-4
ROCK TYPE: Basalt
COHERENCE: Medium
SHAPE: Subangular
SURFACE: Hackly
COLOR: Gray-brown
TOTAL WEIGHT: 0.20 g
NO. PARTICLES: 4
REMARKS: Probably all from same original particle. Plagioclase, cinnamon-brown pyroxene, opaque phases. Rare olivine phenocrysts.

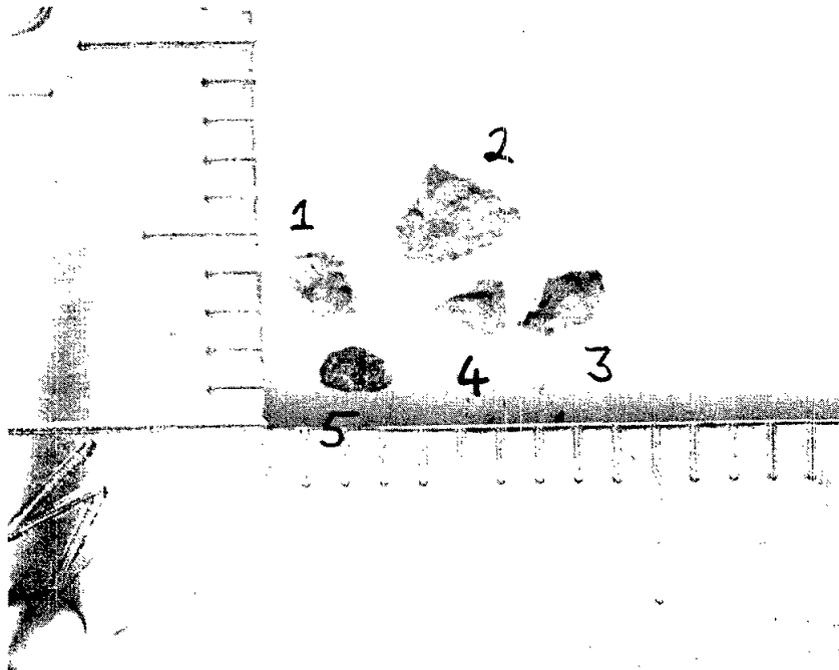


15003,334 (,41)

PARTICLE #:	1	2	3
ROCK TYPE:	Microbreccia	Basalt	Microcrystalline Basalt
COHERENCE:	Medium	Medium	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Finely granular	Granular	Finely granular - smooth
COLOR:	Tan	Mottled gray and white	Dark gray

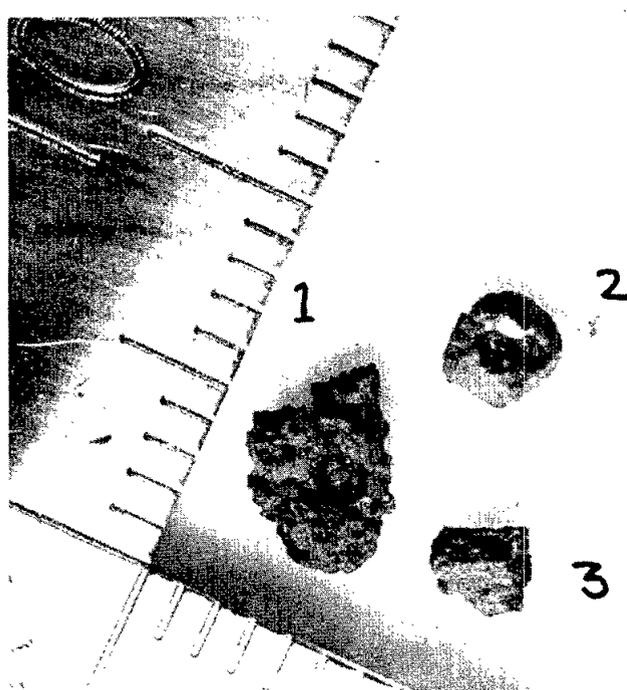
PARTICLE #:	4	5
ROCK TYPE:	Basalt	Glass
COHERENCE:	Tough	Tough
SHAPE:	Angular	Rounded
SURFACE:	Granular	Smooth, vitreous
COLOR:	Gray-brown	Black

TOTAL WEIGHT: 0.035 g
 NO. PARTICLES: 5
 REMARKS: None



15003,335 (,43)

PARTICLE #:	1	2	3
ROCK TYPE:	Agglutinate	Basalt?	Olivine basalt
COHERENCE:	Tough	Tough	Tough
SHAPE:	Irregular	Subrounded	Angular
SURFACE:	Granular to smooth, vitreous	Very finely granular to smooth	Hackly
COLOR:	Dark gray	Dark gray	Tan-gray
TOTAL WEIGHT:	0.067 g		
NO. PARTICLES:	3		
REMARKS:	2. Glassy areas with vitreous luster, olivine crystals. Dusty. Identification uncertain.		
	3. Olivine, plagioclase, pyroxene.		



15003,336 (,50)

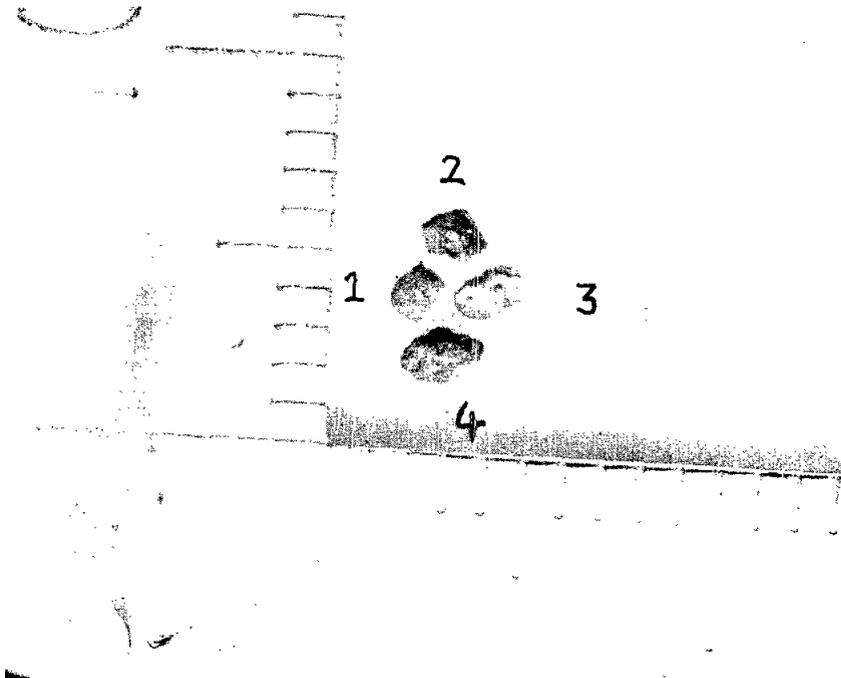
PARTICLE #:	1	2	3
ROCK TYPE:	Metal particle	Glass	Green glass
COHERENCE:	Tough	Tough	Friable
SHAPE:	Rounded	Angular	Rounded, fresh fractured surface
SURFACE:	Smooth	Smooth, vitreous	Granular outside, hackly when fresh
COLOR:	Silver	Black	Light apple green

PARTICLE #: 4
 ROCK TYPE: Microbreccia
 COHERENCE: Medium
 SHAPE: Subangular
 SURFACE: Finely granular
 COLOR: Dark gray

TOTAL WEIGHT: 0.020 g

NO. PARTICLES: 4

REMARKS: 1. Attracted to stainless steel tweezers.
 4. Lighter gray clasts in finely crystalline matrix.



15003,337 (,53)

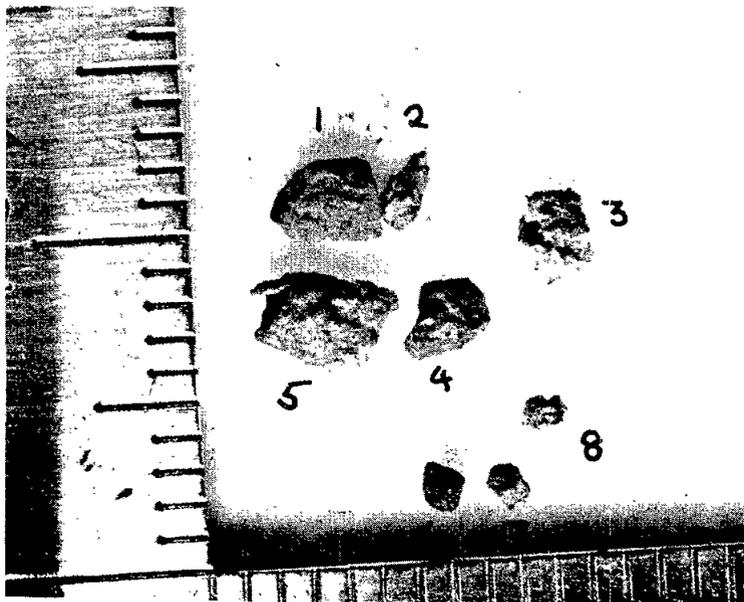
PARTICLE #:	1	2	3
ROCK TYPE:	Microbreccia	Basalt	Olivine basalt
COHERENCE:	Medium	Medium	Medium
SHAPE:	Angular	Subangular	Angular
SURFACE:	Granular	Hackly	Hackly
COLOR:	Gray-brown	Gray-brown	Mottled yellow and white
PARTICLE #:	4	5	6
ROCK TYPE:	Glass	Microcrystalline basalt	Olivine vitrophyre
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Smooth, vitreous	Finely granular? - uneven	Finely granular to smooth
COLOR:	Black	Dark gray	Dark gray
PARTICLE #:	7	8	
ROCK TYPE:	Microbreccia	Basalt	
COHERENCE:	Medium	Medium	
SHAPE:	Subangular	Angular	
SURFACE:	Finely granular	Hackly	
COLOR:	Medium gray	Mottled gray and brown	

TOTAL WEIGHT: 0.074 g

NO. PARTICLES: 8

REMARKS:

1. Dark clasts, mineral fragments.
2. Dust adheres to surface. Mineral identification difficult.
3. Olivine, plagioclase, gray pyroxene, minor opaque phases.
5. Dust adheres to surface. Identification uncertain.
6. Some vesicles, olivine crystals identified. Finegrained or glassy groundmass. Olivine vitrophyre?
7. White clasts.
8. Plagioclase approximately 50%. Two pyroxenes?



15003,338 (.55)

PARTICLE #:	1	2	3
ROCK TYPE:	Microbreccia	Microbreccia	Green glass
COHERENCE:	Medium	Medium	Tough
SHAPE:	Angular	Subangular	Angular
SURFACE:	Finely granular	Finely granular	Smooth, vitreous
COLOR:	Gray	Light gray	Light apple green
PARTICLE #:	4	5	6
ROCK TYPE:	Non-mare crystal- line rock	Green glass	Microcrystalline basalt
COHERENCE:	Tough	Tough	Tough
SHAPE:	Subangular	Rounded	Subangular
SURFACE:	Finely granular	Smooth, vitreous	Very finely granular
COLOR:	Light gray	Light apple green	Very dark gray
PARTICLE #:	7	8	
ROCK TYPE:	Basalt	Olivine basalt	
COHERENCE:	Tough	Tough	
SHAPE:	Angular	Subangular	
SURFACE:	Hackly	Hackly	
COLOR:	Gray-brown	Gray	

TOTAL WEIGHT: 0.102 g

NO. PARTICLES: 8

REMARKS:

1. Large white clast attached to gray matrix by a glassy cement.
2. Dark clasts.
4. Greater than 75% plagioclase.
6. Small vesicles.
7. Olivine, pyroxene, plagioclase.
8. Olivine, pyroxene, plagioclase.



15003,339 (,57)

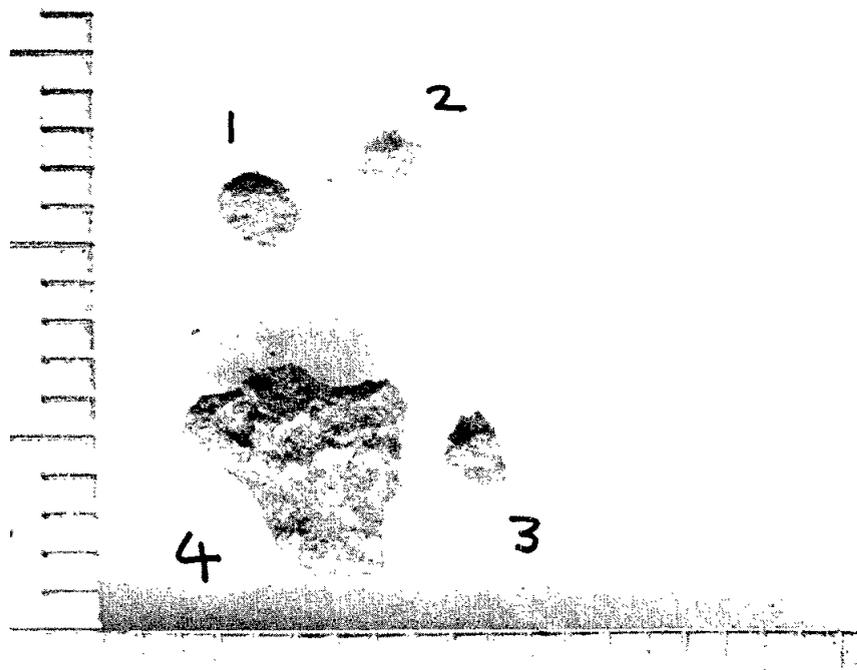
PARTICLE #:	1	2	3,4
ROCK TYPE:	Microbreccia	Green glass	Basalts
COHERENCE:	Friable	Tough	Tough
SHAPE:	Rounded	Subrounded	Angular
SURFACE:	Finely granular	Smooth outside, hackly on fresh surface	Granular
COLOR:	Gray	Light apple green	Gray

TOTAL WEIGHT: 0.087 g

NO. PARTICLES: 4

REMARKS:

1. Clasts of plagioclase, olivine.
2. Outer surface gray, fresh surface light apple green.
- 3,4. Olivine, euhedral pyroxene, plagioclase. Dusty.



15003,340 (,60)

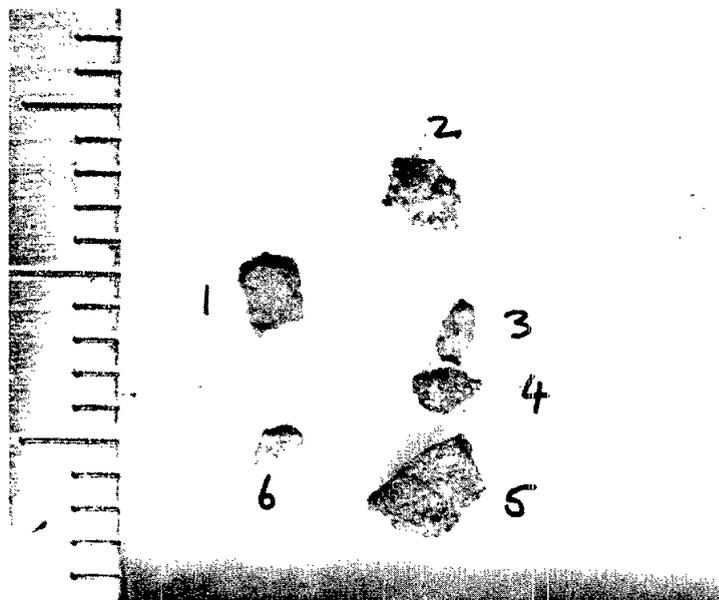
PARTICLE #:	1	2	3
ROCK TYPE:	Microcrystalline basalt	Olivine basalt	Olivine basalt
COHERENCE:	Tough	Medium	Medium
SHAPE:	Angular	Angular	Angular
SURFACE:	Smooth	Hackly	Hackly
COLOR:	Very dark gray	Green-gray	Green-gray
PARTICLE #:	4	5	6
ROCK TYPE:	Microbreccia	Basalt	Non-mare crystalline rock
COHERENCE:	Medium	Medium	Medium
SHAPE:	Subangular	Angular	Rounded
SURFACE:	Finely granular	Granular	Granular
COLOR:	Medium gray	Light gray	Very light gray

TOTAL WEIGHT: 0.046 g

NO. PARTICLES: 6

REMARKS:

2. 20-30% olivine, 50% plagioclase, pyroxene.
4. Large white clasts contain plagioclase, cinnamon-brown pyroxene.
5. Plagioclase, dark gray pyroxene, olivine.
6. At least 75% plagioclase, cinnamon-brown pyroxene, opaque oxide. Glass coating on one side.



15003,341 (,62)

PARTICLE #:	1, 2	3	4-6
ROCK TYPE:	Microbreccia	Microbreccia	Basalt
COHERENCE:	Friable	Medium	Tough
SHAPE:	Subangular	Subangular	Subangular to subrounded
SURFACE:	Finely granular	Finely granular	Granular
COLOR:	Light gray	Light gray	Dark gray

PARTICLE #:	7	8, 10	9
ROCK TYPE:	Aggultinate	Olivine basalt	Olivine basalt
COHERENCE:	Medium - tough	Medium	Medium
SHAPE:	Angular	Angular	Subangular
SURFACE:	Irregular	Hackly	Hackly
COLOR:	Gray to black	Green-brown	Green-brown

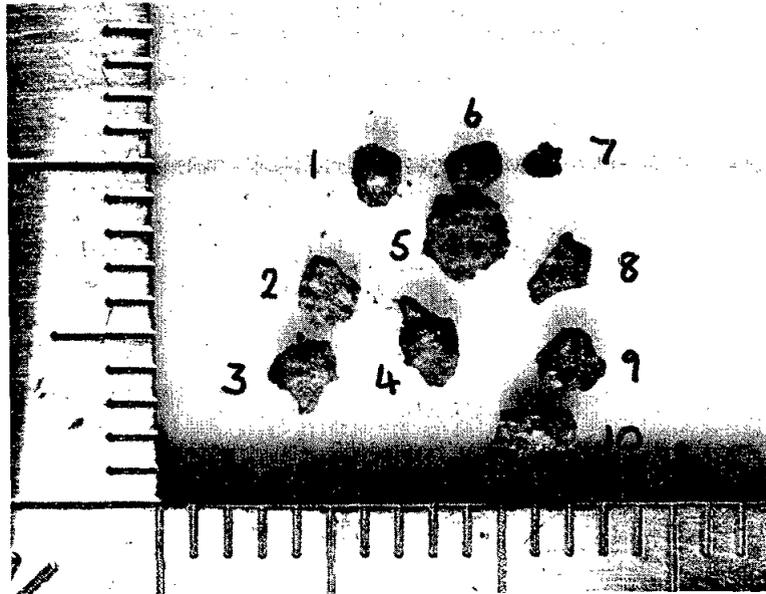
TOTAL WEIGHT: 0.042 g

NO. PARTICLES: 10

REMARKS: 4-6. Very dusty, impedes identification. Can recognize olivine, plagioclase, pyroxene and opaque phase.

7. Much scoriaceous glass.

8-10. Olivine, cinnamon-brown pyroxene, plagioclase, minor opaque phase.



15003,342 (,64)

PARTICLE #:	1	2	3
ROCK TYPE:	Basalt	Microcrystalline basalt	Glass
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Angular	Subrounded
SURFACE:	Granular	Very finely granular	Pitted, vitreous
COLOR:	Dark gray	Dark gray	Black

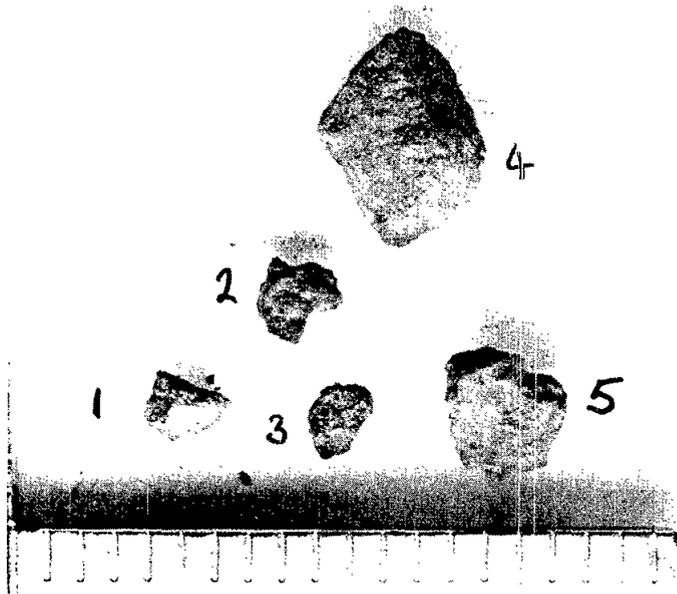
PARTICLE #:	4	5
ROCK TYPE:	Microbreccia	Microbreccia
COHERENCE:	Tough	Tough
SHAPE:	Subrounded	Subangular
SURFACE:	Finely granular	Finely granular
COLOR:	Gray-brown	Gray-brown

TOTAL WEIGHT: 0.189 g

NO. PARTICLES: 5

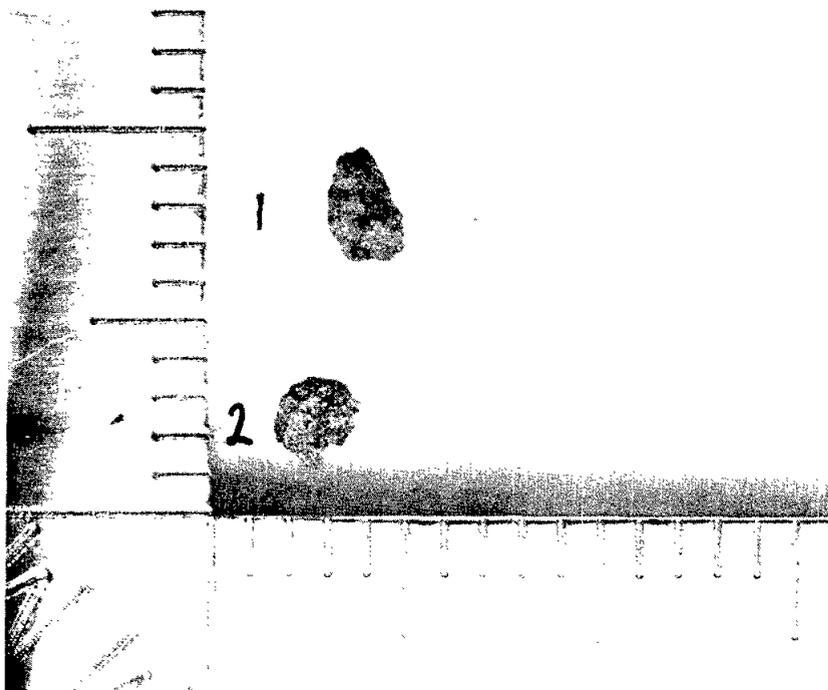
REMARKS:

1. Dusty, impedes identification.
4. White clasts.
5. Very dusty. Identification uncertain.



15003,343 (,66)

PARTICLE #:	1	2
ROCK TYPE:	Microbreccia	Olivine basalt
COHERENCE:	Tough	Medium
SHAPE:	Subrounded	Subangular
SURFACE:	Granular	Hackly
COLOR:	Gray-brown	Green-brown
TOTAL WEIGHT:	0.025 g	
NO. PARTICLES:	2	
REMARKS:	1. White clasts. Dusty. 2. Large olivine crystals. Dusty.	



15003,344 (,68)

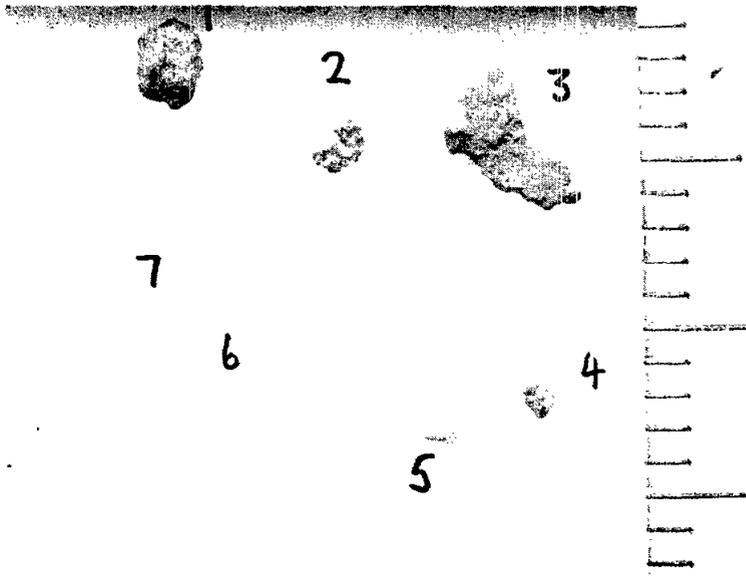
PARTICLE #:	1	2	3
ROCK TYPE:	Microcrystalline basalt	Basalt	Glass or microcrystalline basalt?
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Angular	Irregular
SURFACE:	Uneven	Hackly	Uneven
COLOR:	Black	Mottled brown and white	Black
PARTICLE #:	4	5	6,7
ROCK TYPE:	Basalt	Non-mare crystalline rock "Anorthosite"	Non-mare crystalline rock "Anorthosite"
COHERENCE:	Tough	Tough	Medium
SHAPE:	Angular	Subrounded	Angular
SURFACE:	Hackly	Smooth	Finely granular-chalky
COLOR:	Mottled brown and white	Gray-white	White

TOTAL WEIGHT: 0.032 g

NO. PARTICLES: 7

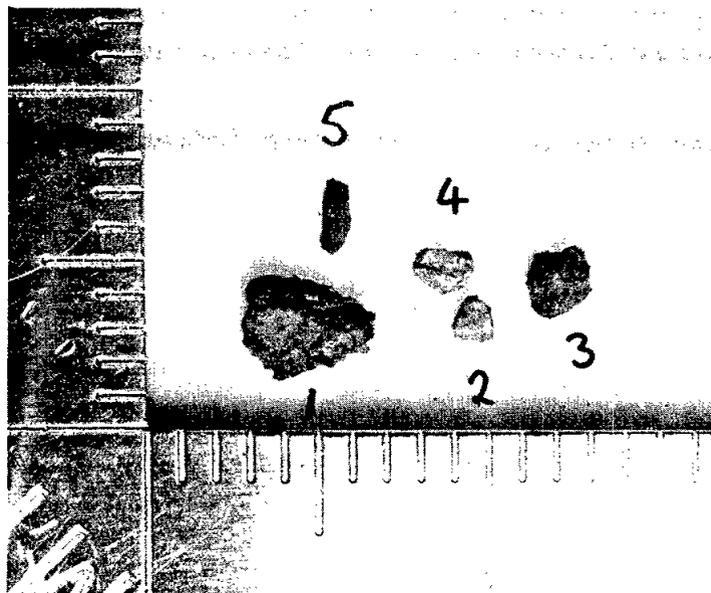
REMARKS:

2. Cinnamon-brown pyroxene, plagioclase (approximately 50%), opaque phase. No olivine.
3. Covered with dust. Identification uncertain.
4. Pyroxene, plagioclase (30-50%), olivine.
- 5-7. 100% plagioclase.



15003,345 (,70)

PARTICLE #:	1	2	3
ROCK TYPE:	Basalt	Non-mare crystal- line rock	Glass
COHERENCE:	Tough	Medium	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Hackly	Smooth-chalky	Uneven, vitreous
COLOR:	Mottled gray-brown	Light gray	Black
PARTICLE #:	4	5	
ROCK TYPE:	Basalt	Microcrystalline basalt	
COHERENCE:	Medium	Tough	
SHAPE:	Angular	Subrounded	
SURFACE:	Granular	Finely granular	
COLOR:	Gray-green	Dark gray	
TOTAL WEIGHT:	0.058 g		
NO. PARTICLES:	5		
REMARKS:	<ol style="list-style-type: none"> 1. Dusty. Pyroxene, plagioclase, some olivine. 2. Dominated by plagioclase. Brecciated. 4. Olivine, cinnamon-brown pyroxene, plagioclase, acicular opaque phase. 		



15003,346 (,73)

PARTICLE #:	1	2-4	5-6
ROCK TYPE:	Non-mare crystal- line rock	Olivine basalt	Microbreccia
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Smooth	Hackly	Finely granular
COLOR:	White	Mottled green and gray	Gray

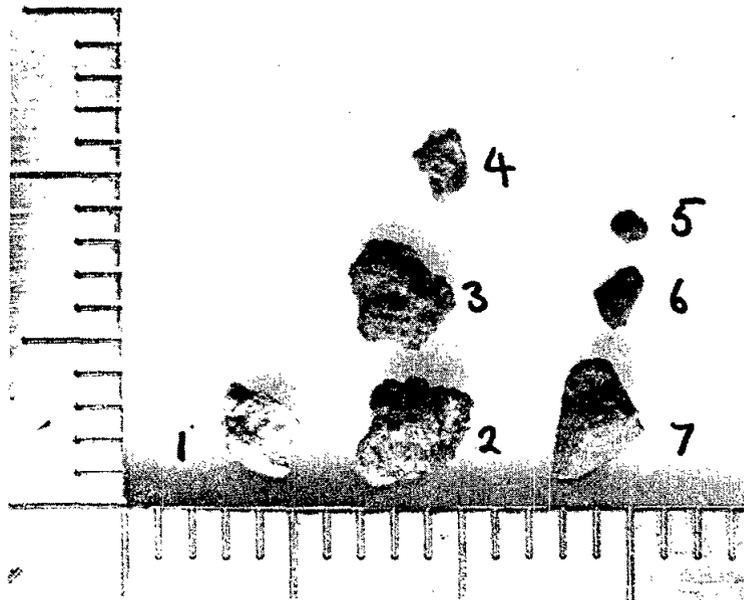
PARTICLE #:	7
ROCK TYPE:	Microbreccia
COHERENCE:	Tough
SHAPE:	Rounded
SURFACE:	Finely granular
COLOR:	Gray

TOTAL WEIGHT: 0.098 g

NO. PARTICLES: 7

REMARKS:

1. At least 80% plagioclase.
- 2-4. Olivine, pyroxene, plagioclase, opaque phase.
- 5-7. White clasts.



15003,347 (,75)

PARTICLE #:	1	2	3
ROCK TYPE:	Microcrystalline basalt	Basalt	Basalt
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Finely granular	Hackly	Hackly
COLOR:	Black	Brown	Gray-brown

PARTICLE #:	4	5	6-8
ROCK TYPE:	Basalt	Basalt	Basalt
COHERENCE:	Tough, penetrating fractures	Tough, penetrating fractures	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Hackly	Hackly	Granular
COLOR:	Brown	Light gray	Dark gray

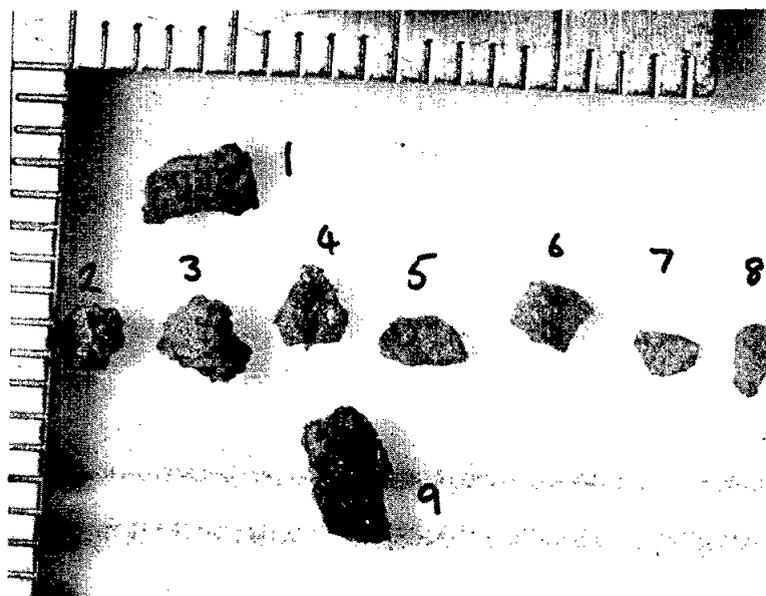
PARTICLE #:	9
ROCK TYPE:	Glass
COHERENCE:	Tough
SHAPE:	Angular
SURFACE:	Smooth, vitreous
COLOR:	Black

TOTAL WEIGHT: 0.112 g

NO. PARTICLES 9

REMARKS:

2. Minor olivine, two (?) pyroxenes, plagioclase.
3. Pyroxene darker, more olivine than 2.
5. More plagioclase than 2, cinnamon-brown pyroxene, olivine.
- 6-8. Dark gray pyroxene, plagioclase, olivine.
9. Vesicles.



15003,348 (,77)

PARTICLE #:	1	2	3-5
ROCK TYPE:	Microbreccia	Glass	Olivine basalt
COHERENCE:	Medium	Very tough	Medium
SHAPE:	Angular	Angular	Subangular
SURFACE:	Finely granular	Smooth, vitreous	Hackly
COLOR:	Variable, light gray-black	Yellow-brown	Mottled green and brown

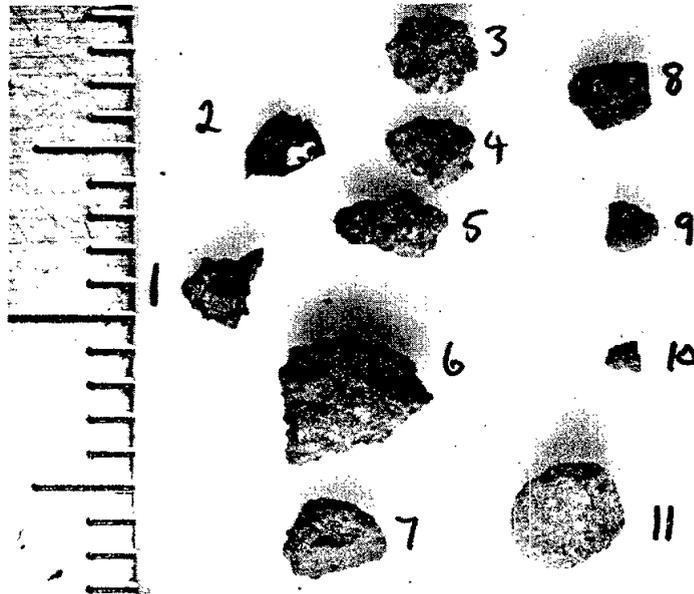
PARTICLE #:	6-7	8-10	11
ROCK TYPE:	Basalt	Basalt	Microbreccia?
COHERENCE:	Medium	Tough	Tough
SHAPE:	Subangular	Angular	Subrounded
SURFACE:	Hackly	Granular	Granular
COLOR:	Brown	Gray	Medium gray

TOTAL WEIGHT: 0.168 g

NO. PARTICLES 11

REMARKS:

1. Glass coats part of surface.
2. Conchoidal fractures.
- 3-5. Olivine, pyroxene, plagioclase, opaque phase.
- 6,7. Pyroxene, plagioclase, opaque phase. No olivine.
- 8-10. May be monomict breccias. Appears to be shocked.
11. Large crystals. May be a shocked monomict basalt. Identification uncertain.



15003,349 (,79)

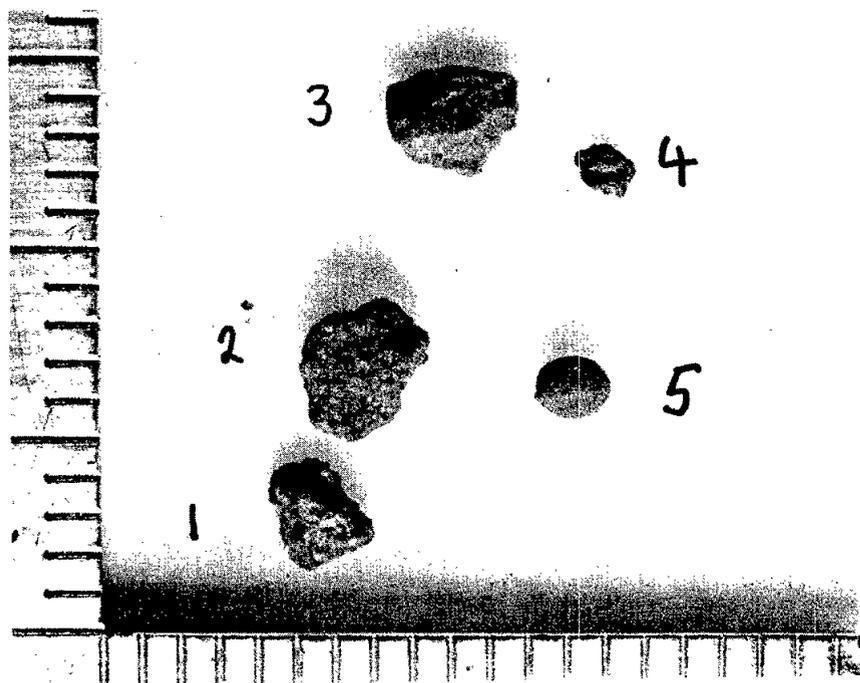
PARTICLE #:	1	2-4	5
ROCK TYPE:	Basalt	Basalt	Microcrystalline basalt
COHERENCE:	Medium	Medium	Tough
SHAPE:	Angular	Subangular	Rounded
SURFACE:	Hackly	Granular	Smooth
COLOR:	Mottled brown and white	Gray	Dark gray

TOTAL WEIGHT: 0.086 g

NO. PARTICLES: 5

REMARKS:

1. 40-50% plagioclase, no olivine.
- 2-4. Appear to be shocked. May be breccias.
5. Unidentified crystals either protrude from or are stuck to outside of sphere. Green glass splashes on surface?



15003,350 (,81)

PARTICLE #:	1	2	3
ROCK TYPE:	Agglutinate	Microbreccia	Microbreccia
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Subangular	Angular
SURFACE:	Uneven - vitreous	Uneven - granular	Granular
COLOR:	Dark gray	Gray	Brown

PARTICLE #:	4	5
ROCK TYPE:	Basalt	Basalt
COHERENCE:	Medium	Medium
SHAPE:	Subrounded	Angular
SURFACE:	Hackly	Hackly
COLOR:	Gray	Green-brown

TOTAL WEIGHT: 0.056 g

NO. PARTICLES: 5

REMARKS:

2. Large plagioclase clast.
3. Dusty. Large olivine crystals. Possibly a monomict brecciated olivine basalt. Identification uncertain.



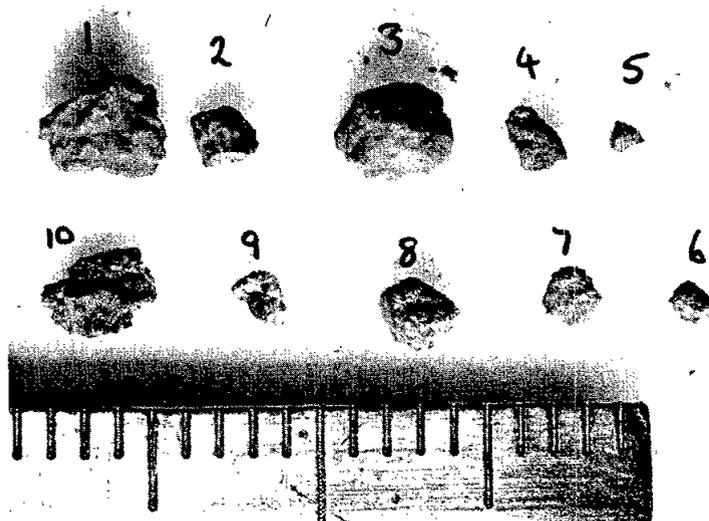
15003,351 (,84)

PARTICLE #:	1	2,5	3
ROCK TYPE:	Microbreccia?	Microbreccia?	Microbreccia?
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Angular	Subrounded
SURFACE:	Finely granular?	Finely granular?	Finely granular?
COLOR:	Gray-brown	Dark gray	Dark gray
PARTICLE #:	4	6-8	9
ROCK TYPE:	Basalt	Basalt	Basalt
COHERENCE:	Medium	Tough	Medium
SHAPE:	Subangular	Subangular	Angular
SURFACE:	Granular	Granular	Hackly
COLOR:	Medium gray	Gray-brown	Mottled brown and white
PARTICLE #:	10		
ROCK TYPE:	Olivine basalt		
COHERENCE:	Medium		
SHAPE:	Angular		
SURFACE:	Hackly		
COLOR:	Yellow-brown		

TOTAL WEIGHT: 0.135 g

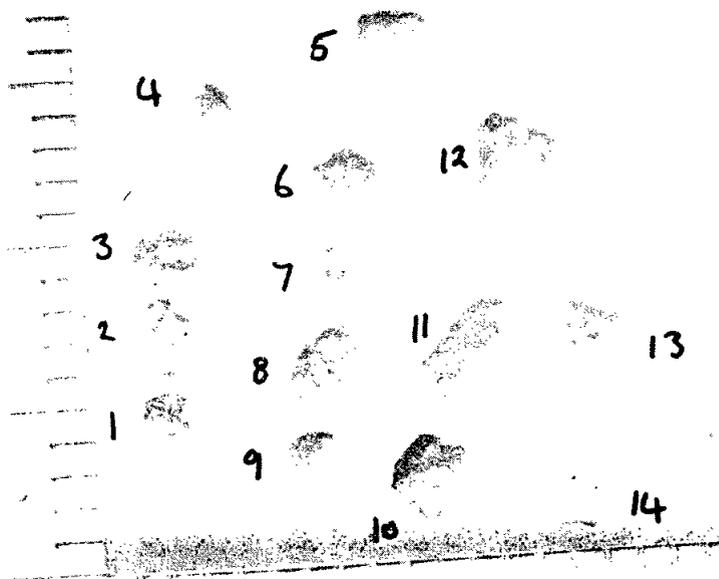
NO. PARTICLES: 10

REMARKS: 1. Covered with dust. Identification uncertain.
 2,3,5. Very dusty, identification uncertain. Could also be micro-crystalline basalt.
 4. May be breccia.
 6-8. Also dust covered. May be breccias.
 9. Pyroxene, plagioclase, opaque phase (ilmenite). No olivine.
 10. Olivine-rich.



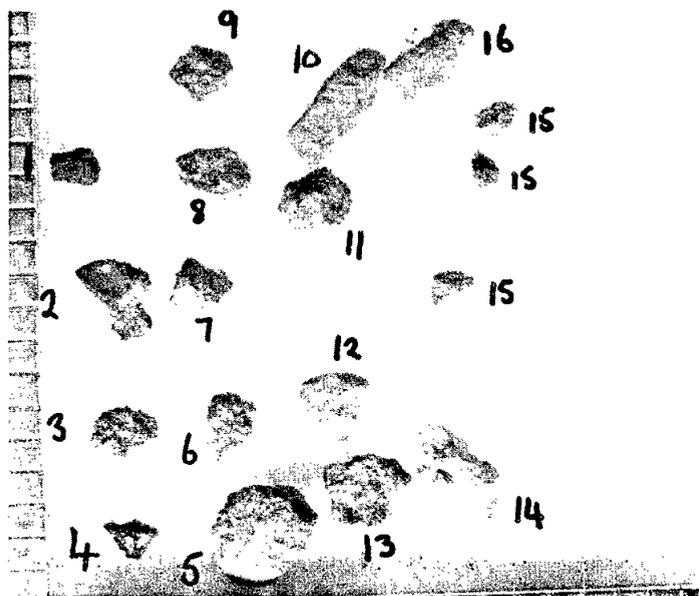
15003,352 (.87)

PARTICLE #:	1-4	5-9	10
ROCK TYPE:	Basalt	Basalt	Microbreccia
COHERENCE:	Medium	Medium	Medium, penetrating fracture
SHAPE:	1-3, angular; 4, subrounded	Subangular	Angular
SURFACE:	Hackly	Hackly	Finely granular
COLOR:	Gray-brown	Gray	Dark gray
PARTICLE #:	11	12	13
ROCK TYPE:	Microcrystalline basalt	Microcrystalline basalt	Non-mare crystalline rock
COHERENCE:	Tough	Tough	Medium
SHAPE:	Angular	Angular	Angular
SURFACE:	Finely granular	Smooth	Finely granular
COLOR:	Dark gray	Dark gray	Light gray
PARTICLE #:	14		
ROCK TYPE:	Non-mare crystalline rock		
COHERENCE:	Tough		
SHAPE:	Angular		
SURFACE:	Granular		
COLOR:	Very light gray		
TOTAL WEIGHT:	0.105 g		
NO. PARTICLES:	14		
REMARKS:	1-4. Little olivine. 5-9. Surfaces smoother than 1-4. More dust. 10. White c asts. 11. Cannot identify crystalline phases. 13. Contains white clast.		



15003,353 (.89)

PARTICLE #:	1	2	3
ROCK TYPE:	Microcrystalline basalt	Agglutinate	Agglutinate
COHERENCE:	Tough	Medium	Medium
SHAPE:	Angular	Irregular	Angular
SURFACE:	Granular	Finely granular to smooth, vitreous	Pitted, scoriaceous
COLOR:	Dark gray	Dark gray	Dark gray
PARTICLE #:	4	5-13	14
ROCK TYPE:	Glass	Basalt	Non-mare crystalline rock
COHERENCE:	Tough	Medium	Medium
SHAPE:	Angular	Angular to sub- rounded	Angular
SURFACE:	Smooth, vitreous	Hackly to granular	Finely granular
COLOR:	Yellow-brown	Gray-brown	Light gray
PARTICLE #:	15 (3 pieces)	16	
ROCK TYPE:	Microbreccia	Microbreccia	
COHERENCE:	Friable	Medium	
SHAPE:	Subangular	Subrounded	
SURFACE:	Finely granular	Finely granular	
COLOR:	Dark gray	Brown-gray	
TOTAL WEIGHT:	0.134 g		
NO. PARTICLES:	16		
REMARKS:	5-13. 8, 10, and 11 contain olivine, remainder do not.		



15003,354 (.91)

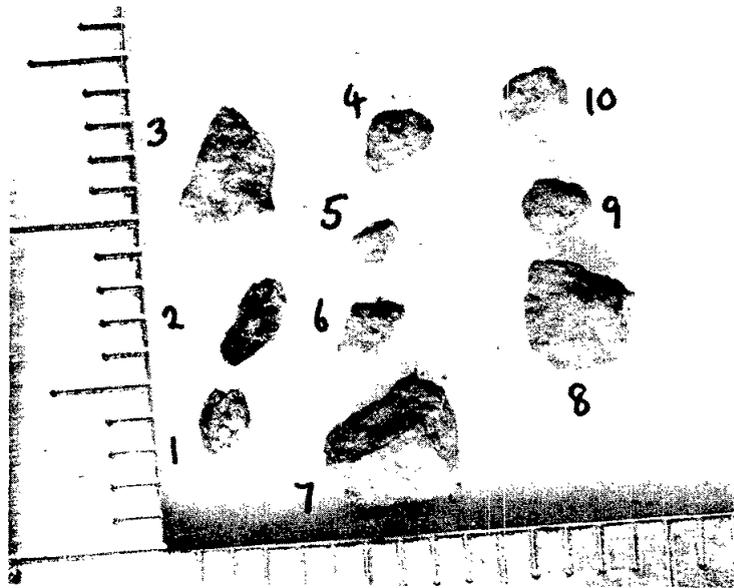
PARTICLE #:	1	2	3
ROCK TYPE:	"Ultrabasic" crys- talline rock	"Ultrabasic" crys- talline rock	Microbreccia
COHERENCE:	Medium	Tough	Medium
SHAPE:	Subangular	Subangular	Angular
SURFACE:	Hackly	Hackly	Finely granular
COLOR:	Green	Deep green	Light gray

PARTICLE #: 4-10
 ROCK TYPE: Microbreccias?
 COHERENCE: Medium
 SHAPE: Angular to sub-
 rounded
 SURFACE: Finely granular
 COLOR: Medium gray

TOTAL WEIGHT: 0.136 g

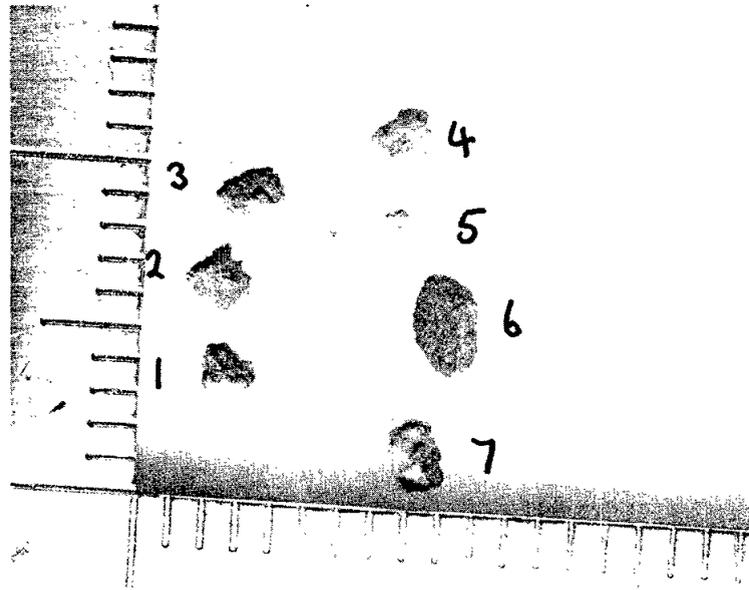
NO. PARTICLES: 10

REMARKS: 3. White clasts and streaks.
 4-10. Some mineral clasts. Dust makes identification uncertain.
 Possibly finegrained basalts or monomict basaltic breccias.



15003,355 (,93)

PARTICLE #:	1-3	4	5
ROCK TYPE:	Basalts	Microbreccia	Non-mare crystalline rock (troctolite ?)
COHERENCE:	Medium	Tough	Medium
SHAPE:	Angular	Angular	Rounded
SURFACE:	Hackly	Granular	Granular
COLOR:	Green-brown	Gray-brown	Gray-white
PARTICLE #:	6	7	
ROCK TYPE:	Microcrystalline basalt	Microbreccia ?	
COHERENCE:	Tough	Tough	
SHAPE:	Subrounded	Angular	
SURFACE:	Finely granular	Finely granular	
COLOR:	Dark gray	Black and white	
TOTAL WEIGHT:	0.034 g		
NO. PARTICLES:	7		
REMARKS:	5. Approximately 75% plagioclase, 20% olivine, few opaque phases. 7. Appears to be a devitrified microcrystalline basalt with a large plagioclase clast. Polymict.		



15003,356 (.95)

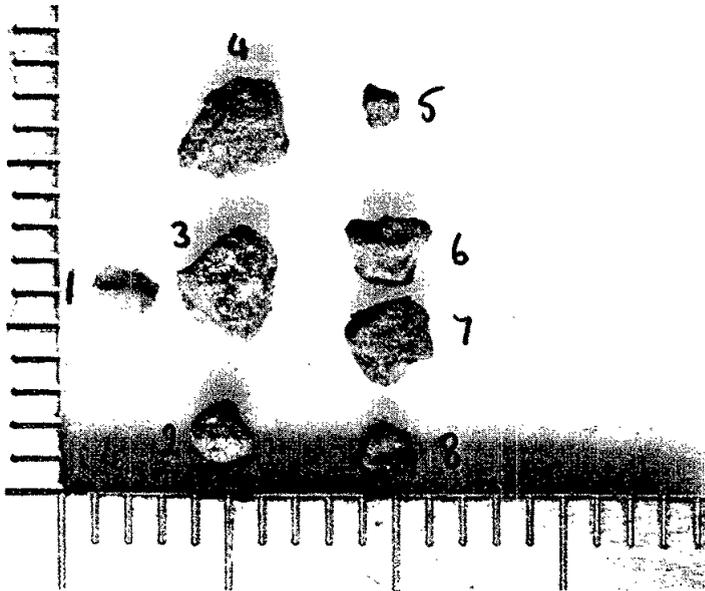
PARTICLE #:	1	2,3	4
ROCK TYPE:	Plagioclase mineral fragment	Olivine basalt	Basalt
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Subangular	Angular
SURFACE:	Smooth,vitreous	Granular	Granular
COLOR:	White	Mottled gray and white	Dark gray

PARTICLE #: 5-8
 ROCK TYPE: Microcrystalline
 basalt
 COHERENCE: Tough
 SHAPE: Angular
 SURFACE: Finely granular
 COLOR: Very dark gray

TOTAL WEIGHT: 0.100 g

NO. PARTICLES: 8

REMARKS: 2,3. Olivine 10-15%, dark gray pyroxene, plagioclase.
 4. Minor olivine, dark gray pyroxene, plagioclase.
 5-8. Finegrained crystalline groundmass.
 6. Few small olivine crystals.



15003,357 (,98)

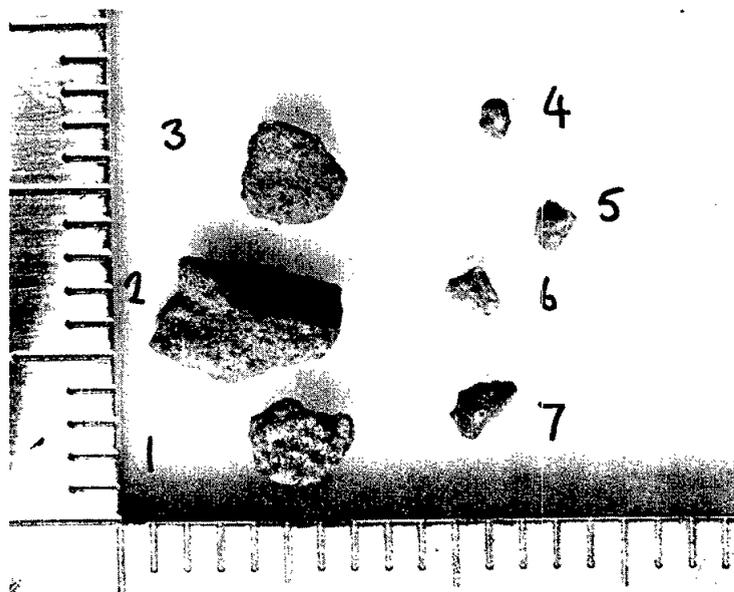
PARTICLE #:	1	2,3	4
ROCK TYPE:	Olivine basalt	Microcrystalline basalt	Microbreccia
COHERENCE:	Medium	Tough	Medium
SHAPE:	Angular	Angular	Subrounded
SURFACE:	Hackly	Finely granular	Granular
COLOR:	Green-brown	Dark gray	Medium gray
PARTICLE #:	5	6	7
ROCK TYPE:	Non-mare crystalline rock "Anorthosite"	Non-mare crystalline rock	Glass
COHERENCE:	Tough	Medium	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Granular	Finely granular	Smooth, vitreous
COLOR:	Light gray	Light gray	Black

TOTAL WEIGHT: 0.114 g

NO. PARTICLES: 7

REMARKS:

1. 20-40% olivine.
- 2,3. Occasional plagioclase phenocryst. Probably plagioclase, dark gray pyroxene, opaque phase.
4. White clasts.
5. Probably 100% translucent gray plagioclase.
6. Greater than 80% plagioclase.



15003,358 (,104)

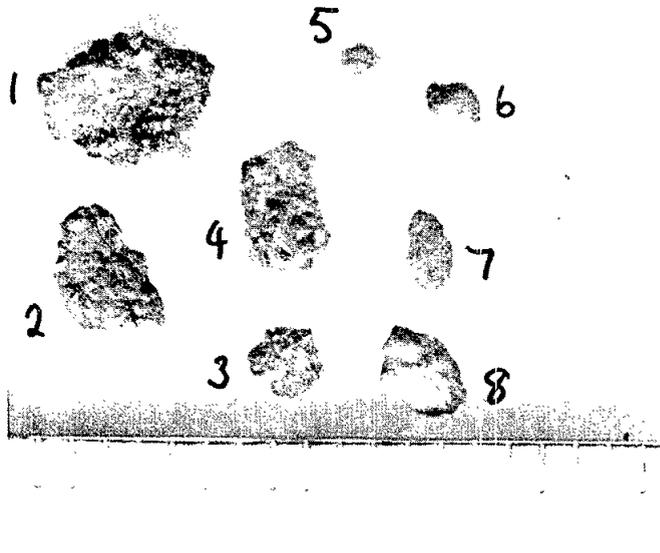
PARTICLE #:	1	2	3,5
ROCK TYPE:	Microbreccia	Microbreccia	Basalt
COHERENCE:	Medium, penetrating fractures	Medium, penetrating fractures	Medium
SHAPE:	Angular	Subrounded	Angular
SURFACE:	Finely granular to smooth glass	Finely granular	Hackly
COLOR:	Gray	Gray	Dark gray
PARTICLE #:	4	6-8	
ROCK TYPE:	Olivine basalt	Microcrystalline basalts	
COHERENCE:	Medium	Tough	
SHAPE:	Angular	Subrounded	
SURFACE:	Hackly	Finely granular	
COLOR:	Dark gray	Dark gray	

TOTAL WEIGHT: 0.113 g

NO. PARTICLES: 8

REMARKS:

1. Partially coated with glass.
2. Plagioclase, olivine clasts.
4. Olivine phenocryst runs diagonally across long axis of particle.
- 6-8. Appear to be finely crystalline.



15003,359 (,106)

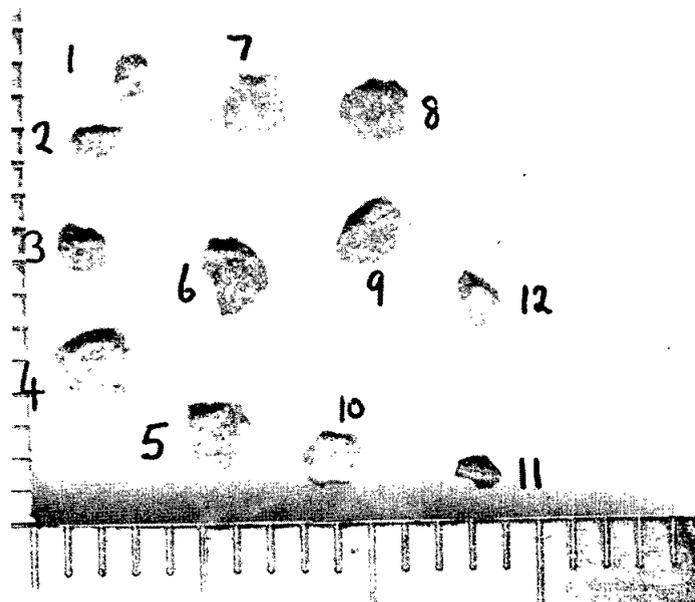
PARTICLE #:	1	2-4	5-6
ROCK TYPE:	Basalt	Basalt	Basalt
COHERENCE:	Medium	Medium	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Hackly	Hackly	Granular
COLOR:	Mottled brown and white	Gray-brown	Dark gray
PARTICLE #:	7	8,9	10
ROCK TYPE:	Non-mare crys- talline rock	Microbreccia	Microbreccia
COHERENCE:	Tough	Medium, penetra- ting fractures	Medium
SHAPE:	Angular	Subangular	Subangular
SURFACE:	Granular	Finely granular	Finely granular
COLOR:	Light gray	Medium gray	Dark gray
PARTICLE #:	11,12		
ROCK TYPE:	Microcrystalline basalt		
COHERENCE:	Tough		
SHAPE:	Angular		
SURFACE:	Finely granular		
COLOR:	Dark gray		

TOTAL WEIGHT: 0.056 g

NO. PARTICLES: 12

REMARKS:

1. Cinnamon brown pyroxene, plagioclase. Few opaque phases.
- 2-4. Gray pyroxene, more opaque phases.
- 5-6. Finer grained than 1-4.
- 8,9. Identification uncertain.
10. Large white clast.



15003,360 (,109)

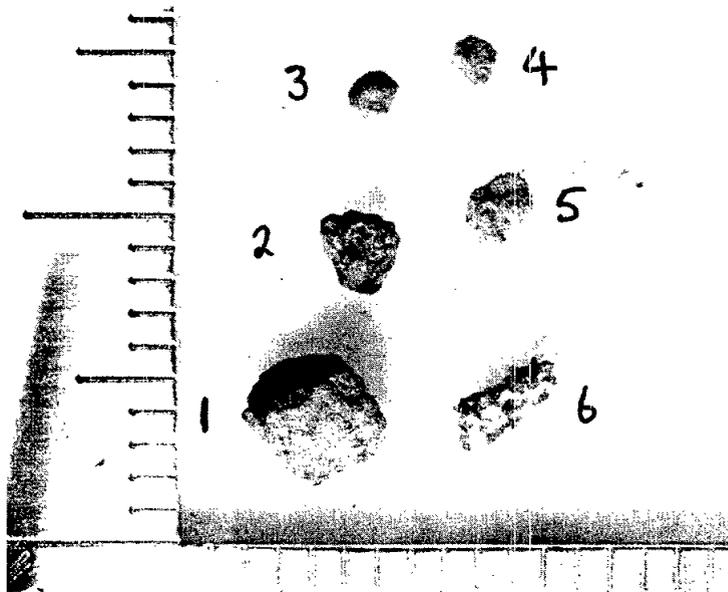
PARTICLE #:	1	2	3
ROCK TYPE:	Finegrained basalt	Microcrystalline basalt	Microbreccia
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Finely granular	Smooth	Finely granular
COLOR:	Dark gray	Very dark gray	Gray
PARTICLE #:	4	5	6
ROCK TYPE:	Microbreccia	Microbreccia	Basalt
COHERENCE:	Medium	Medium	Medium
SHAPE:	Subangular	Subangular	Angular
SURFACE:	Finely granular	Finely granular	Hackly
COLOR:	Light gray	Light gray	Mottled brown and white

TOTAL WEIGHT: 0.109 g

NO. PARTICLES: 6

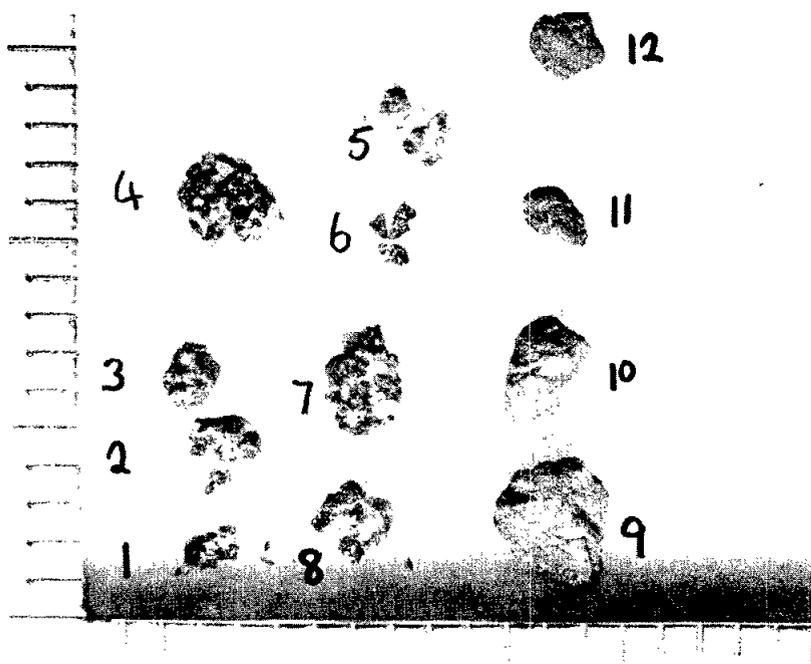
REMARKS:

1. Very finegrained. Individual minerals could not be identified.
3. Olivine crystals.
4. White clast.
5. Mineral clasts. Possibly a brecciated basalt. Finegrained.
6. Pyroxene, plagioclase.



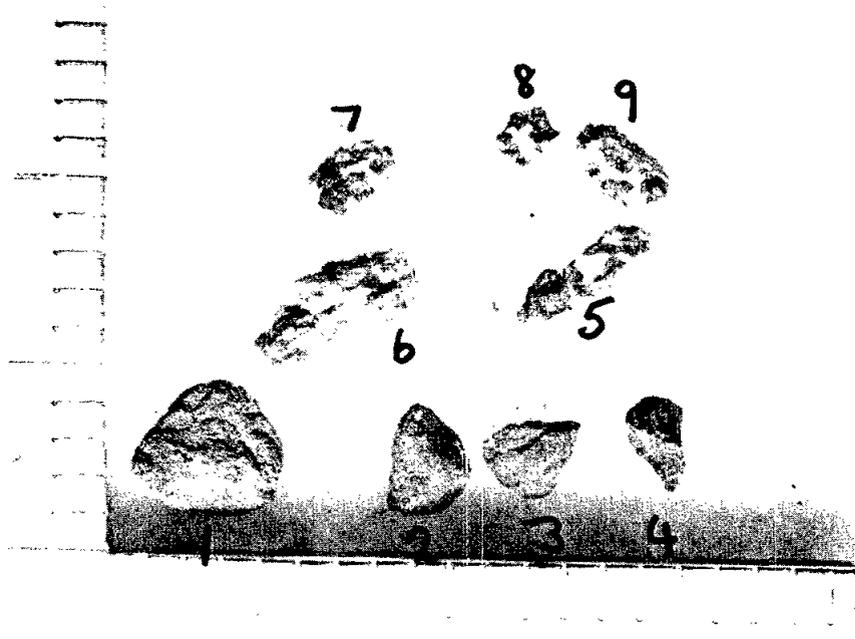
15003,361 (,111)

PARTICLE #:	1-8	9-12
ROCK TYPE:	Basalt	Microbreccia
COHERENCE:	Weak	Medium
SHAPE:	Angular	Subrounded
SURFACE:	Hackly	Finely granular
COLOR:	Mottled brown and white	Medium gray
TOTAL WEIGHT:	0.057 g	
NO. PARTICLES:	12	
REMARKS:	1-8. Olivine, pyroxene, plagioclase, opaque phases. 9-12. Plagioclase, olivine clasts.	



15003,362 (,113)

PARTICLE #:	1-3	4	5-9
ROCK TYPE:	Microbreccia	Microbreccia	Basalt
COHERENCE:	Medium-tough	Medium-tough	Weak
SHAPE:	Subrounded	Subangular	Subangular
SURFACE:	Finely granular	Finely granular	Hackly
COLOR:	Medium gray	Medium gray	Mottled brown and white
TOTAL WEIGHT:	0.092 g		
NO. PARTICLES:	9		
REMARKS:	Very similar to 15003,361.		
	4. Glass coating on one face.		



15003,363 (,115)

PARTICLE #:	1-5	6,7	8
ROCK TYPE:	Basalts	Agglutinates	Glass
COHERENCE:	Medium	Medium	Tough
SHAPE:	Angular	Irregular	Spherical
SURFACE:	Hackly	Granular to glassy	Smooth, vitreous
COLOR:	Mottled brown and white	Medium gray	Black

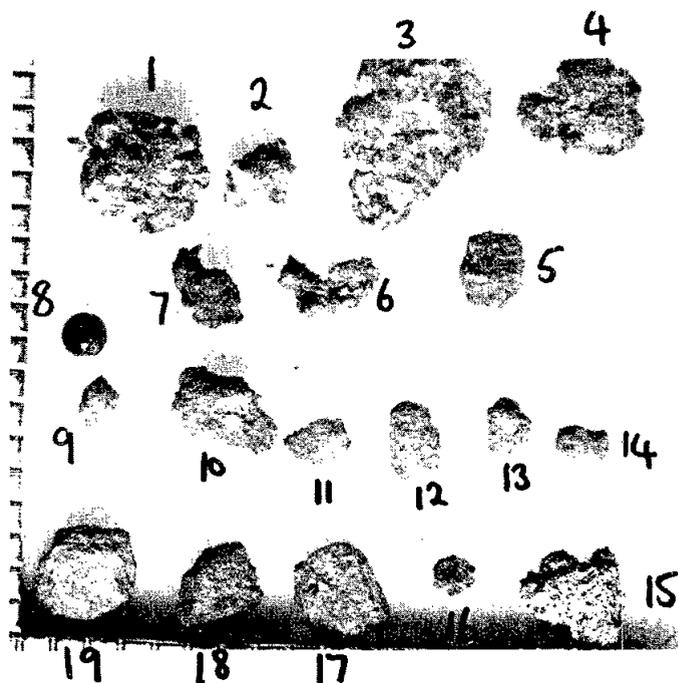
PARTICLE #:	9-14, 19	15	16-18
ROCK TYPE:	Microbreccia	Non-mare crystalline rock	Microcrystalline Basalts
COHERENCE:	Medium-tough	Medium	Tough
SHAPE:	Subangular to subrounded	Angular	Angular
SURFACE:	Finely granular	Hackly	Finely granular
COLOR:	Medium gray	Light gray	Dark gray

TOTAL WEIGHT: 0.292 g

NO. PARTICLES: 19

REMARKS:

- 1-5. Minor olivine, pyroxene, plagioclase, opaques.
- 6,7. Glass splashes on surfaces.
8. Almost perfect sphere.
- 9-14,19. White clasts common, 11 contains a red mineral.
15. Greater than 50% plagioclase. One or two pyroxenes. Opaques? Dusty on one side.



15003,364 (,118)

PARTICLE #:	1	2	3
ROCK TYPE:	Plagioclase mineral fragment	Non-mare crystalline rock (2 pieces)	Plagioclase mineral fragment
COHERENCE:	Tough	Weak	Tough
SHAPE:	Angular	Subangular	Angular
SURFACE:	Smooth	Finely granular	Smooth
COLOR:	White	White	Gray-white
PARTICLE #:	4,5	6	7
ROCK TYPE:	Agglutinates	Non-mare crystalline rock?	Basalt
COHERENCE:	Medium	Medium	Medium
SHAPE:	Angular	Angular	Angular
SURFACE:	Finely granular	Hackly	Hackly
COLOR:	Dark gray	Very light gray	Mottled gray and white
PARTICLE #:	8	9-12	13, 14
ROCK TYPE:	Basalt	Microbreccias	Finegrained basalt
COHERENCE:	Tough	Medium	Tough
SHAPE:	Angular	Subangular to subrounded	Angular
SURFACE:	Granular	Finely granular	Finely granular
COLOR:	Dark gray	Medium gray	Dark gray
PARTICLE #:	15		
ROCK TYPE:	Microcrystalline basalt?		
COHERENCE:	Tough		
SHAPE:	Subangular		
SURFACE:	Irregular		
COLOR:	Dark gray		
TOTAL WEIGHT:	0.069 g		
NO. PARTICLES:	15		
REMARKS:	<p>6. Possibly small, plagioclase-rich fragment of mare basalt. Greater than 80% plagioclase, minor olivine or pyroxene.</p> <p>7. Olivine, plagioclase, dark gray pyroxene.</p> <p>8. Plagioclase, dark gray pyroxene.</p> <p>9-12. Olivine, plagioclase, basalt clasts.</p> <p>13,14. Plagioclase, dark gray pyroxene.</p>		



15003,365 (,120)

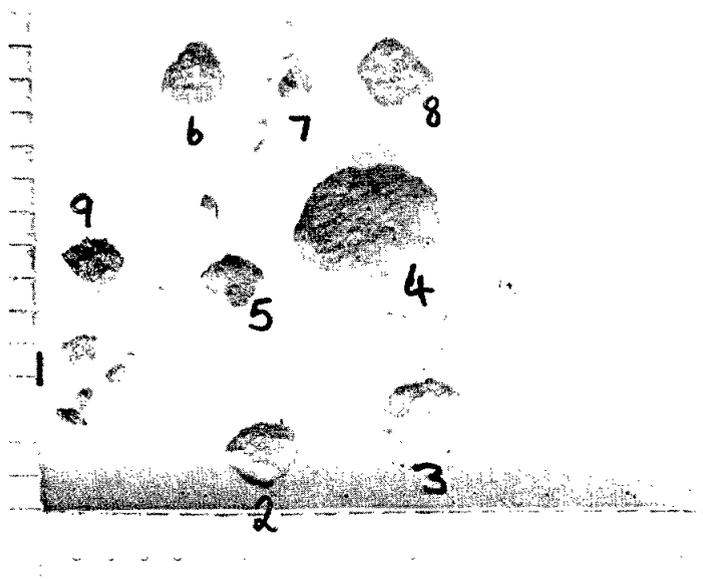
PARTICLE #:	1	2-5	6
ROCK TYPE:	Microbreccia (at least 4 pieces)	Microbreccia	Basalt
COHERENCE:	Weak	Tough	Tough
SHAPE:	Subangular	Subrounded	Subrounded
SURFACE:	Finely granular	Finely granular	Hackly
COLOR:	Medium gray	Medium-dark gray	Medium gray
PARTICLE #:	7	8	9
ROCK TYPE:	Basalt	Basalt	Agglutinate
COHERENCE:	Weak	Tough	Tough
SHAPE:	Angular	Subangular	Angular
SURFACE:	Hackly	Granular	Finely granular to vitreous
COLOR:	Light gray	Mottled gray and white	Gray to black

TOTAL WEIGHT: 0.111 g

NO. PARTICLES: 9

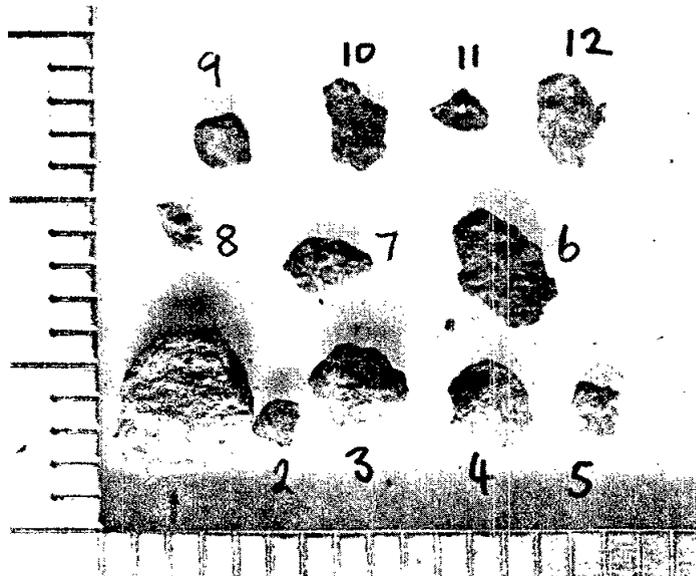
REMARKS:

6. Contains olivine, pyroxene, plagioclase.
7. No olivine.
8. Plagioclase, dark gray pyroxene, olivine?
9. Glass coats one surface.



15003,366 (,122)

PARTICLE #:	1-5	6	7
ROCK TYPE:	Microbreccias	Basalt	Basalt
COHERENCE:	Tough	Medium	Medium
SHAPE:	Subangular to sub-rounded	Subangular	Subangular
SURFACE:	Finely granular	Hackly	Granular
COLOR:	Medium gray	Gray-brown	Mottled gray and white
PARTICLE #:	8	9-11	12
ROCK TYPE:	Basalt	Microcrystalline basalt	Microcrystalline basalt
COHERENCE:	Medium	Tough	Tough
SHAPE:	Angular	Angular	Subrounded
SURFACE:	Hackly	Smooth to finely granular	Smooth
COLOR:	Green-brown	Dark gray	Medium gray
TOTAL WEIGHT:	0.169 g		
NO. PARTICLES:	12		
REMARKS:	6. Very dusty. 7. Dark gray pyroxene. 8. Plagioclase, olivine, lighter colored pyroxene, opaque phase. 12. Plagioclase (?) crystals or clast at one end. Gray pyroxene? Identification uncertain.		



15003,367 (,124)

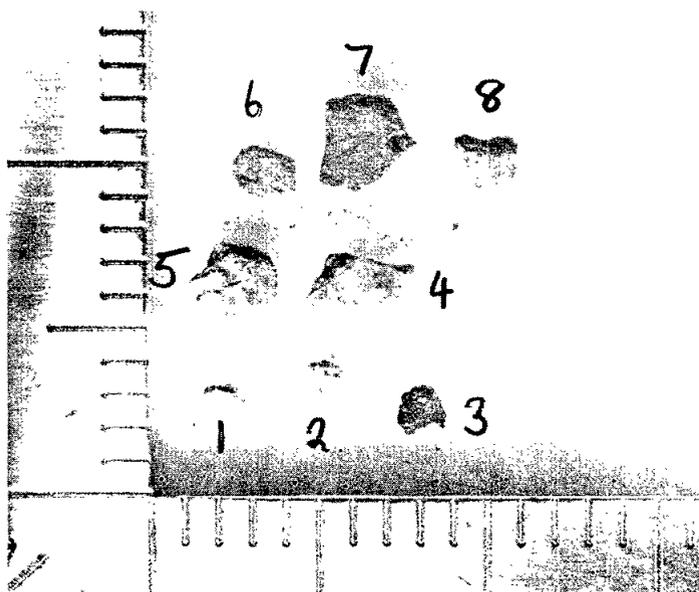
PARTICLE #:	1,2	3	4
ROCK TYPE:	Basalt	Agglutinate	Non-mare crystalline rock
COHERENCE:	Medium	Medium	Tough
SHAPE:	Subrounded	Irregular	Angular
SURFACE:	Granular	Finely granular to smooth, vitreous	Granular
COLOR:	Gray	Gray to black	Chalky gray
PARTICLE #:	5	6, 7	8
ROCK TYPE:	Non-mare crystalline rock	Microbreccia	Microcrystalline basalt?
COHERENCE:	Tough, penetrating fracture	Tough	Tough
SHAPE:	Subrounded	Angular	Angular
SURFACE:	Granular	Finely granular	Very finely granular
COLOR:	Chalky gray	Dark gray	Dark gray

TOTAL WEIGHT: 0.060 g

NO. PARTICLES: 8

REMARKS:

3. Glass coating on one side.
- 4,5. Mineral identification difficult, but appear to be plagioclase rich.
- 6,7. Olivine clasts, particularly large one in 7. These rocks are possibly igneous, possibly monomict breccias.
8. White clast. May be highly lithified breccia. Identification uncertain.



15003,368 (,126)

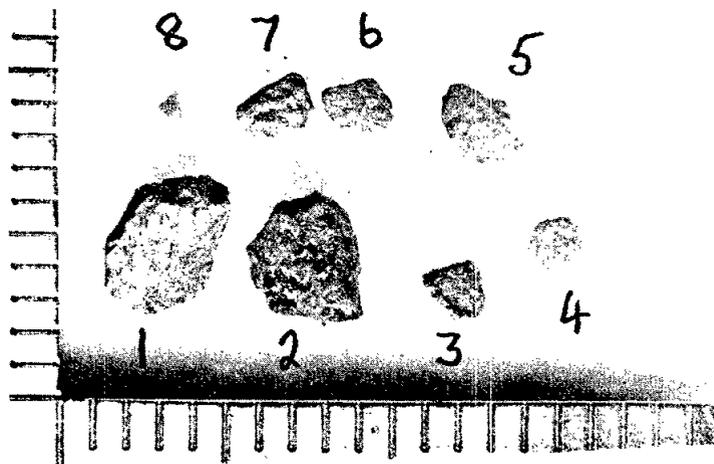
PARTICLE #:	1	2	3
ROCK TYPE:	Basalt	Basalt	Basalt
COHERENCE:	Tough	Tough	Tough
SHAPE:	Subangular	Angular	Angular
SURFACE:	Relatively smooth, granular	Smooth	Granular
COLOR:	Mottled black and white	Dark gray	Dark gray
PARTICLE #:	4	5	6
ROCK TYPE:	Basalt	Microcrystalline basalt	Microbreccia
COHERENCE:	Tough	Tough	Medium-tough
SHAPE:	Subrounded	Subangular	Subrounded
SURFACE:	Relatively smooth, granular	Smooth	Finely granular
COLOR:	Dark gray	Dark gray	Gray
PARTICLE #:	7	8	
ROCK TYPE:	Basalt	Plagioclase mineral fragment	
COHERENCE:	Tough	Tough	
SHAPE:	Angular	Angular	
SURFACE:	Granular	Smooth, vitreous	
COLOR:	Gray	White	

TOTAL WEIGHT: 0.143 g

NO. PARTICLES: 8

REMARKS:

- 1,4. Plagioclase, dark gray pyroxene.
2. Olivine or pyroxene vitrophyre?
3. Plagioclase, dark gray pyroxene, some olivine.
6. Crystal-rich breccia. Large olivine crystals, also plagioclase, glass spheres?
7. Finegrained. May also be a crystal-rich breccia. Glass splashes on surface. Identification uncertain.



15003,369 (,128)

PARTICLE #:	1-3	4	5
ROCK TYPE:	Microbreccias	Basalt	Basalt
COHERENCE:	Tough	Tough	Tough
SHAPE:	Subrounded	Angular	Subangular
SURFACE:	Finely granular	Finely granular	Granular
COLOR:	Gray	Very dark gray	Dark gray

PARTICLE #:	6
ROCK TYPE:	Basalt
COHERENCE:	Tough
SHAPE:	Rounded
SURFACE:	Granular
COLOR:	Gray

TOTAL WEIGHT: 0.021 g

NO. PARTICLES: 6

REMARKS: 1-4. Very finegrained. Mineral identification impossible.
 5. Dark gray pyroxene, plagioclase, either olivine or a second pyroxene.
 6. Dark gray pyroxene, plagioclase.



15003,370 (,131)

PARTICLE #:	1, 2	3	4
ROCK TYPE:	Microcrystalline basalt	Olivine vitrophyre	Basalt
COHERENCE:	Tough	Tough	Medium
SHAPE:	Angular	Angular	Angular
SURFACE:	Smooth	Smooth	Hackly
COLOR:	Very dark gray	Very dark gray	Gray-brown

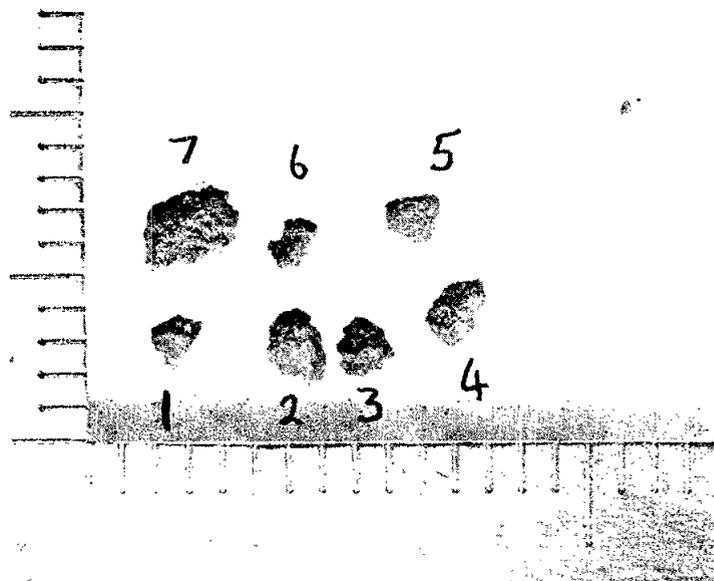
PARTICLE #:	5	6, 7
ROCK TYPE:	Microbreccia	Agglutinates
COHERENCE:	Medium	Medium
SHAPE:	Subangular	Irregular
SURFACE:	Granular	Finely granular to smooth, vitreous
COLOR:	Medium gray	Dark gray to black

TOTAL WEIGHT: 0.033 g

NO. PARTICLES: 7

REMARKS:

3. Olivine phenocrysts in very finegrained or glassy groundmass.
4. Minor olivine, cinnamon-brown pyroxene, plagioclase, opaques.
5. Crystal rich-olivine, pyroxene, plagioclase identified.
- 6,7. Glass coating.



15003,371 (,133)

PARTICLE #:	1	2	3
ROCK TYPE:	Microbreccia	Basalt	Microbreccia (2 pieces)
COHERENCE:	Tough	Medium	Friable
SHAPE:	Subrounded	Angular	Angular
SURFACE:	Finely granular	Granular	Finely granular
COLOR:	Gray	Dark gray	Gray
TOTAL WEIGHT:	0.025 g		
NO. PARTICLES:	3		
REMARKS:	<ol style="list-style-type: none"> 1. Plagioclase clasts. 2. Cinnamon-brown pyroxene, dark gray pyroxene, plagioclase, opaques. 		



15003,372 (,140)

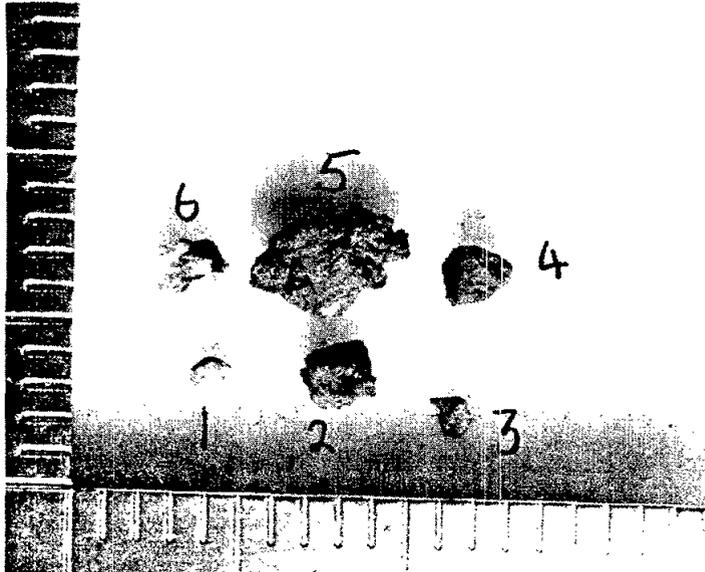
PARTICLE #:	1	2	3
ROCK TYPE:	Microbreccia	Olivine vitrophyre	Basalt
COHERENCE:	Medium	Tough	Medium-tough
SHAPE:	Subrounded	Angular	Angular
SURFACE:	Finely granular	Finely granular - smooth	Granular
COLOR:	Gray and white	Dark gray	Dark gray
PARTICLE #:	4	5	6
ROCK TYPE:	Microcrystalline basalt	Microbreccia	Non-mare crystalline rock
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Finely granular	Finely granular	Granular
COLOR:	Very dark gray	Gray	White

TOTAL WEIGHT: 0.075 g

NO. PARTICLES: 6

REMARKS:

1. Half microbreccia, half plagioclase clast.
2. Large olivine crystals in finegrained or glassy groundmass.
3. Dark gray pyroxene, plagioclase.
5. Glass coating on one side.
6. Probably greater than 80% plagioclase.



15003,373 (,143)

PARTICLE #:	1	2-6	7-9
ROCK TYPE:	Agglutinate	Microbreccia	Basalt
COHERENCE:	Medium	Tough	Tough
SHAPE:	Irregular	Angular to sub- rounded	Angular
SURFACE:	Finely granular to smooth, vitreous	Finely granular	Hackly
COLOR:	Dark gray	Medium gray	Gray

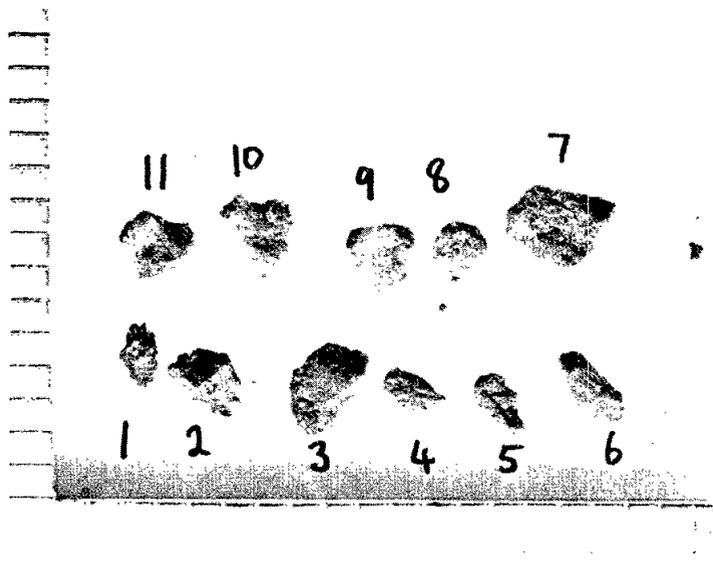
PARTICLE #:	10, 11
ROCK TYPE:	Olivine basalt
COHERENCE:	Tough
SHAPE:	Angular
SURFACE:	Hackly
COLOR:	Green-gray

TOTAL WEIGHT: 0.074 g

NO. PARTICLES: 11

REMARKS:

1. Glass coating on one side.
- 2-6. Pyroxene, plagioclase clasts.
- 7-9. Minor olivine, plagioclase, pyroxene.
- 10,11. Large, elongate olivine crystals run length of particles.



15003,374 (,145)

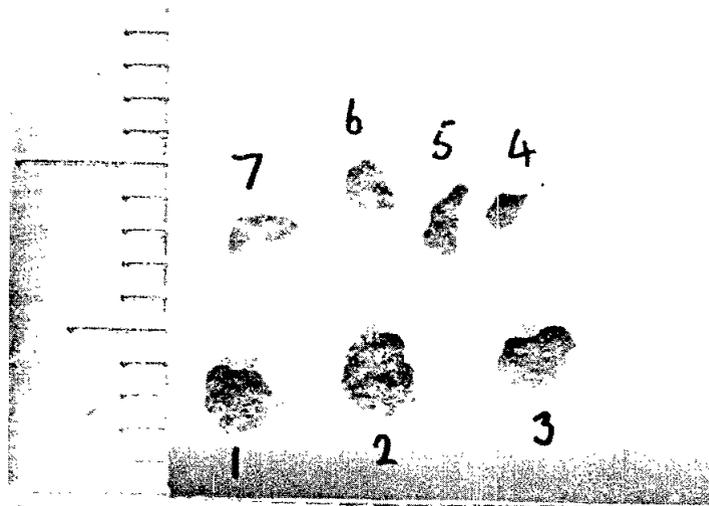
PARTICLE #:	1	2	3
ROCK TYPE:	Basalt	Basalt	Microbreccia
COHERENCE:	Tough	Tough, penetrating fracture	Tough
SHAPE:	Angular	Angular	Subangular
SURFACE:	Hackly	Hackly	Finely granular
COLOR:	Gray-brown	Dark gray	Dark gray
PARTICLE #:	4, 5	6	7
ROCK TYPE:	Agglutinates	Non-mare crystalline rock	Non-mare crystalline rock "anorthosite"
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Subrounded	Angular
SURFACE:	Irregular	Finely granular	Relatively smooth
COLOR:	Dark gray	Light gray	Light gray

TOTAL WEIGHT: 0.036 g

NO. PARTICLES: 7

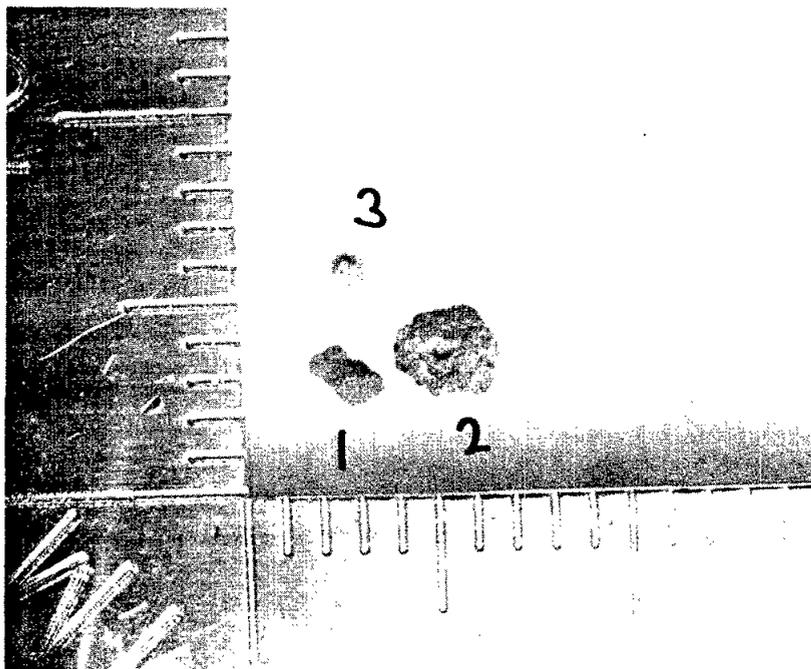
REMARKS:

1. Dark gray pyroxene, plagioclase.
2. Euhedral plagioclase, brown pyroxene in dark gray "matrix". Possibly a recrystallized breccia.
6. More plagioclase than a mare basalt, but appears low for terrae rock.
7. Appears to be all plagioclase.



15003,375 (,147)

PARTICLE #:	1	2	3
ROCK TYPE:	Microcrystalline basalt	Basalt	Basalt
COHERENCE:	Tough	Tough	Medium
SHAPE:	Angular	Angular	Angular
SURFACE:	Finely granular	Granular	Hackly
COLOR:	Very dark gray	Dark gray	Light green-gray
TOTAL WEIGHT:	0.027 g		
NO. PARTICLES:	3		
REMARKS:	<p>2. Large olivine crystals, plagioclase, in finegrained gray groundmass.</p> <p>3. Olivine, plagioclase, pyroxene, opaque phase (ilmenite?).</p>		



15003,376 (,149)

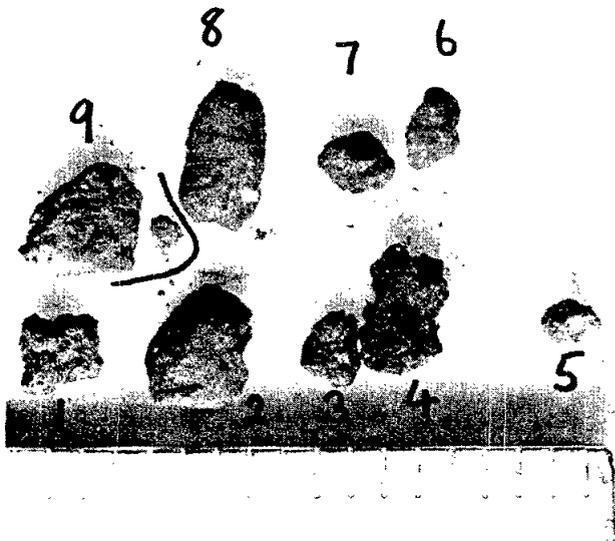
PARTICLE #:	1	2	3
ROCK TYPE:	Basalt	Finegrained basalt	Basalt
COHERENCE:	Medium	Tough	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Hackly	Finely granular	Granular
COLOR:	Gray-brown	Dark gray	Dark gray
PARTICLE #:	4	5	6-9
ROCK TYPE:	Agglutinate	Non-mare crystal- line rock	Microbreccia
COHERENCE:	Medium	Tough	Medium
SHAPE:	Angular	Subangular	Subrounded
SURFACE:	Finely granular to smooth, vitreous	Granular	Finely granular
COLOR:	Gray to black	Light gray	Gray

TOTAL WEIGHT: 0.161 g

NO. PARTICLES: 9

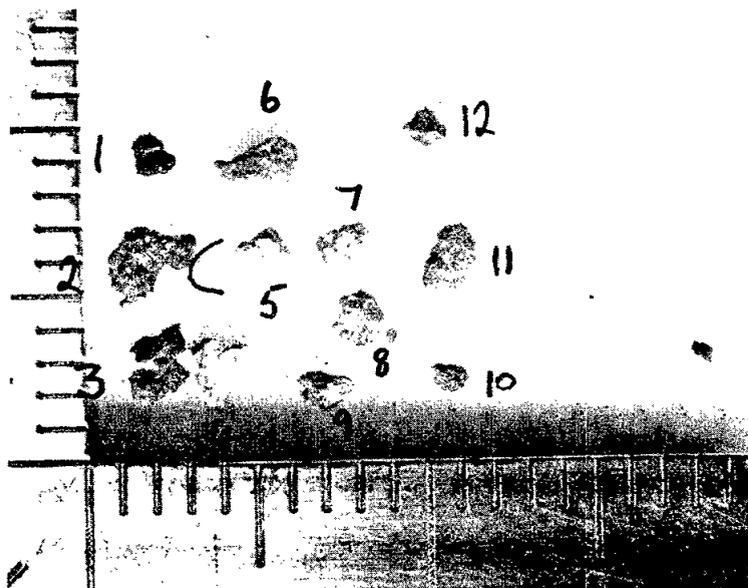
REMARKS:

2. Olivine identified.
3. Large olivine crystals. Olivine vitrophyre?
4. Glass coating on surface.
5. Appears to have too much plagioclase to be a mare basalt, but low for terrae rock.



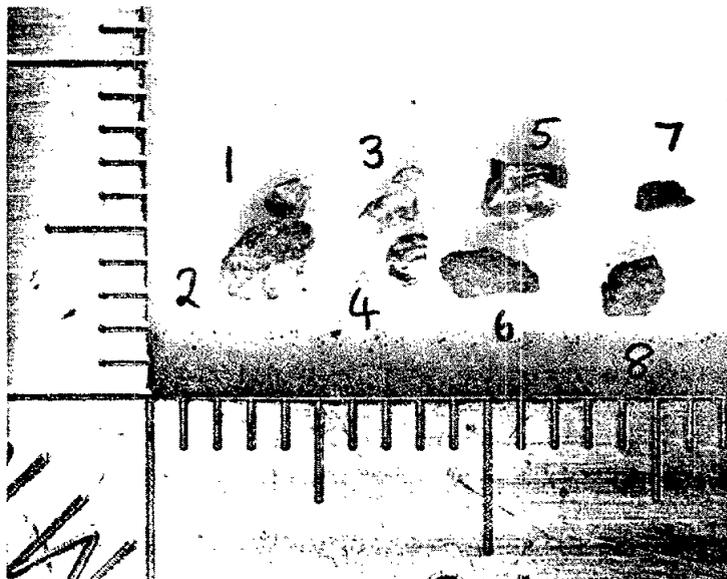
15003,377 (,151)

PARTICLE #:	1-3	4, 5	6
ROCK TYPE:	Agglutinates	Non-mare crystal- line rocks	Microbreccia
COHERENCE:	Medium	Medium	Medium, penetrating fracture
SHAPE:	Irregular	Angular	Subangular
SURFACE:	Finely granular to smooth, vitreous	Finely granular	Finely granular
COLOR:	Gray to black	Very light gray	Gray
PARTICLE #:	7, 9	8	10
ROCK TYPE:	Basalt	Basalt	Microcrystalline basalt
COHERENCE:	Medium	Medium	Tough
SHAPE:	Angular	Subangular	Angular
SURFACE:	Hackly	Hackly	Finely granular
COLOR:	Light brown	Gray	Dark gray
PARTICLE #:	11	12	
ROCK TYPE:	Basalt	Microbreccia	
COHERENCE:	Tough	Tough	
SHAPE:	Subrounded	Angular	
SURFACE:	Hackly	Granular	
COLOR:	Gray-brown	Gray and white	
TOTAL WEIGHT:	0.027 g		
NO. PARTICLES:	12		
REMARKS:	<p>1-3. Glass coated.</p> <p>4-5. Plagioclase greater than 80%. Igneous texture?</p> <p>6. Green clast, basalt clast.</p> <p>7,9. Cinnamon-brown pyroxene, plagioclase, opaque phase.</p> <p>8. Dark gray pyroxene, plagioclase, opaque phase. Minor olivine.</p> <p>11. Dusty. Could possibly be a crystal-rich breccia. Identification uncertain.</p> <p>12. Half plagioclase-rich clast, half matrix. Sharp contact.</p>		



15003,378 (,153)

PARTICLE #:	1	2	3
ROCK TYPE:	Basalt	Basalt	Non-mare crystalline rock "anorthosite"
COHERENCE:	Medium	Tough	Tough
SHAPE:	Angular	Subrounded	Angular
SURFACE:	Hackly	Hackly	Granular
COLOR:	Mottled brown and white	Light gray	White
PARTICLE #:	4	5	6
ROCK TYPE:	Non-mare crystalline rock	Microbreccia	Microbreccia
COHERENCE:	Tough	Medium	Tough
SHAPE:	Subrounded	Angular	Subrounded
SURFACE:	Granular to hackly	Granular to hackly	Finely granular
COLOR:	Light gray	Dark gray and white	Gray
PARTICLE #:	7, 8		
ROCK TYPE:	Microcrystalline basalt		
COHERENCE:	Tough		
SHAPE:	Angular		
SURFACE:	Finely granular		
COLOR:	Very dark gray		
TOTAL WEIGHT:	0.036 g		
NO. PARTICLES:	8		
REMARKS:	<ol style="list-style-type: none"> 1. Cinnamon-brown pyroxene, plagioclase. 2. Minor olivine, dark gray pyroxene, cinnamon-brown pyroxene?, plagioclase, acicular opaque phase (ilmenite?). 3. Approximately 100% plagioclase. 4. Approximately 80% plagioclase. Tabular dark gray pyroxene with hackly surface. 5. Half white clast, half dark gray matrix. 		



15003,379 (,156)

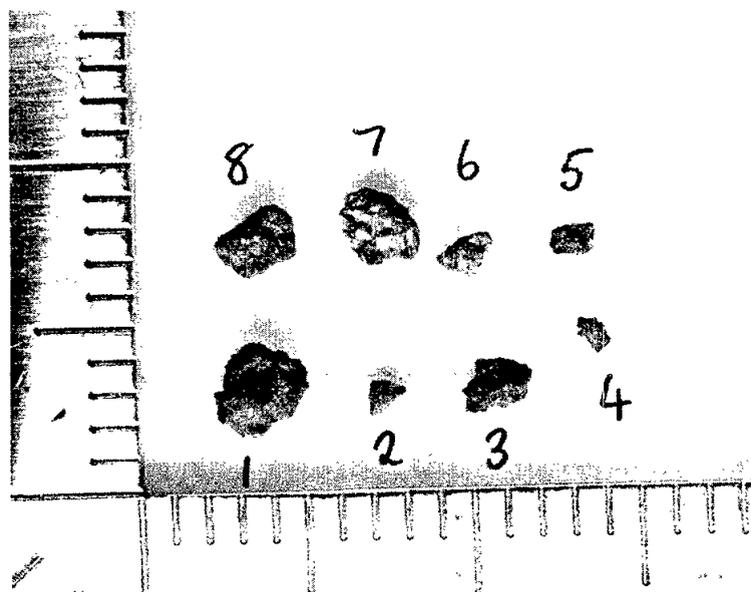
PARTICLE #:	1	2	3, 4
ROCK TYPE:	Vesicular micro-crystalline basalt	Microcrystalline basalt	Microbreccia
COHERENCE:	Tough	Tough	Medium
SHAPE:	Angular	Angular	Angular
SURFACE:	Finely granular	Finely granular	Finely granular
COLOR:	Dark gray	Dark gray	Medium gray
PARTICLE #:	5	6, 7	8
ROCK TYPE:	"Ultra basic" rock	Basalt	Basalt
COHERENCE:	Tough	Medium	Medium
SHAPE:	Angular	Subangular	Angular
SURFACE:	Hackly	Hackly	Hackly
COLOR:	Very dark gray	Mottled gray and white	Gray

TOTAL WEIGHT: 0.039 g

NO. PARTICLES: 8

REMARKS:

1. Large vesicles (up to 1mm). Too finegrained for mineral identification.
- 3,4. Glass coated.
5. 75% dark gray pyroxene, minor olivine, plagioclase.
- 6,7. Minor olivine, dark gray pyroxene, plagioclase, opaque phase.
8. As 6, 7. Also contains a brown phase (another pyroxene?).



15003,380 (,158)

PARTICLE #:	1	2	3
ROCK TYPE:	Microbreccia	Agglutinate	Finegrained basalt
COHERENCE:	Tough	Tough	Tough
SHAPE:	Subangular	Irregular	Subrounded
SURFACE:	Finely granular	Finely granular to smooth, vitreous	Finely granular
COLOR:	Medium gray	Gray to black	Dark gray

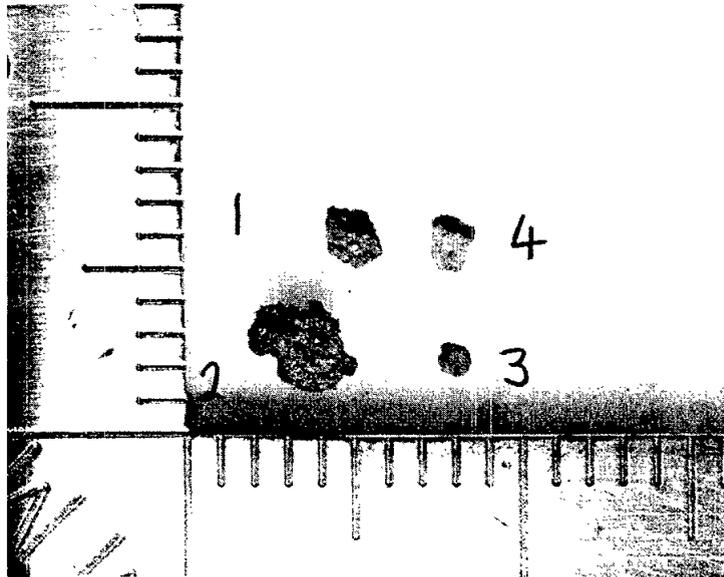
PARTICLE #:	4
ROCK TYPE:	Basalt
COHERENCE:	Tough
SHAPE:	Subangular
SURFACE:	Granular
COLOR:	Medium gray

TOTAL WEIGHT: 0.017 g

NO. PARTICLES: 4

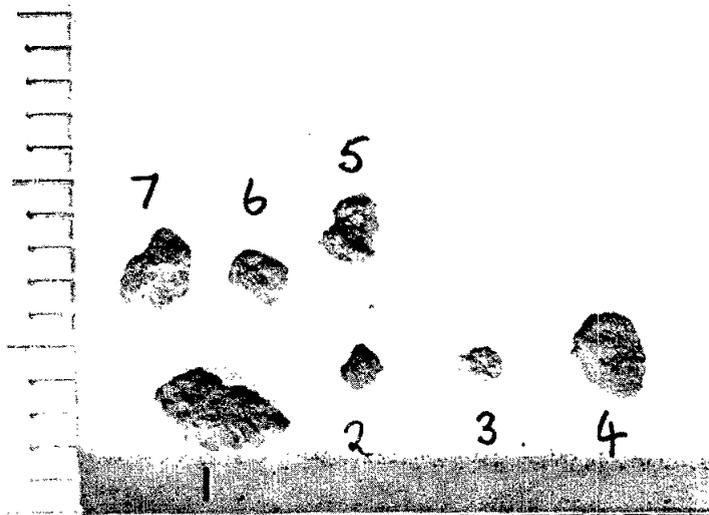
REMARKS:

2. Glass coating.
3. Very dusty. Probably pyroxene-rich.
4. Dusty. Large plagioclase, pyroxene crystals.



15003,381 (,160)

PARTICLE #:	1, 2	3	4
ROCK TYPE:	Agglutinate	Non-mare crystal- line rock	Microbreccia
COHERENCE:	Tough	Medium, penetrating fracture	Tough
SHAPE:	Angular	Subrounded	Subrounded
SURFACE:	Finely granular	Granular	Finely granular
COLOR:	Dark gray-brown	Light gray	Medium gray
PARTICLE #:	5	6, 7	
ROCK TYPE:	Basalt	Basalt	
COHERENCE:	Medium	Tough	
SHAPE:	Angular	Subangular	
SURFACE:	Hackly	Hackly to granular	
COLOR:	Brown	Medium gray	
TOTAL WEIGHT:	0.039 g		
NO. PARTICLES:	7		
REMARKS:	3. Percentage of plagioclase uncertain. Appears to be shocked. 4. Olivine and pyroxene clasts. 5. Large brown pyroxene. Plagioclase. 6,7. Dusty. Shocked?		



15003,382 (,162)

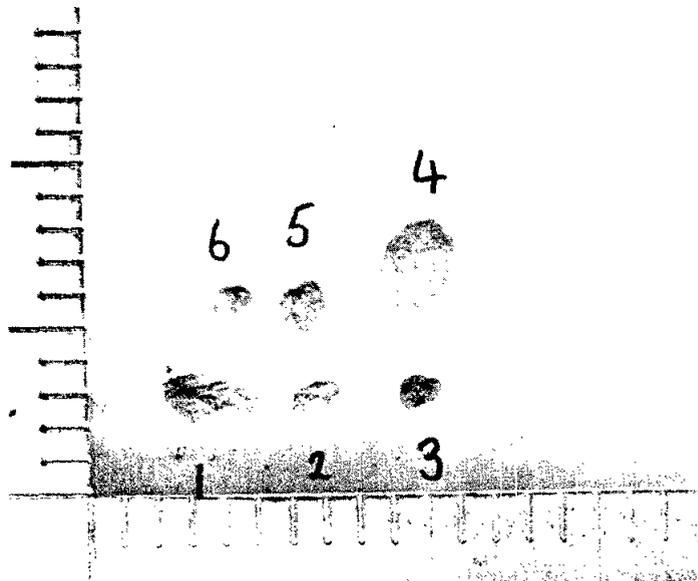
PARTICLE #:	1	2	3
ROCK TYPE:	Non-mare crystal- line rock "Anorthosite"	Non-mare crystal- line rock "Anorthosite"	Agglutinate
COHERENCE:	Medium	Medium	Tough
SHAPE:	Subrounded	Subangular	Angular
SURFACE:	Finely granular	Granular	Finely granular
COLOR:	White	Light gray	Very dark gray
PARTICLE #:	4	5	6
ROCK TYPE:	Basalt	Basalt	Basalt
COHERENCE:	Tough	Medium	Medium
SHAPE:	Subrounded	Angular	Angular
SURFACE:	Hackly	Hackly	Hackly
COLOR:	Gray-brown	Gray-brown	Gray-brown

TOTAL WEIGHT: 0.17 g

NO. PARTICLES: 6

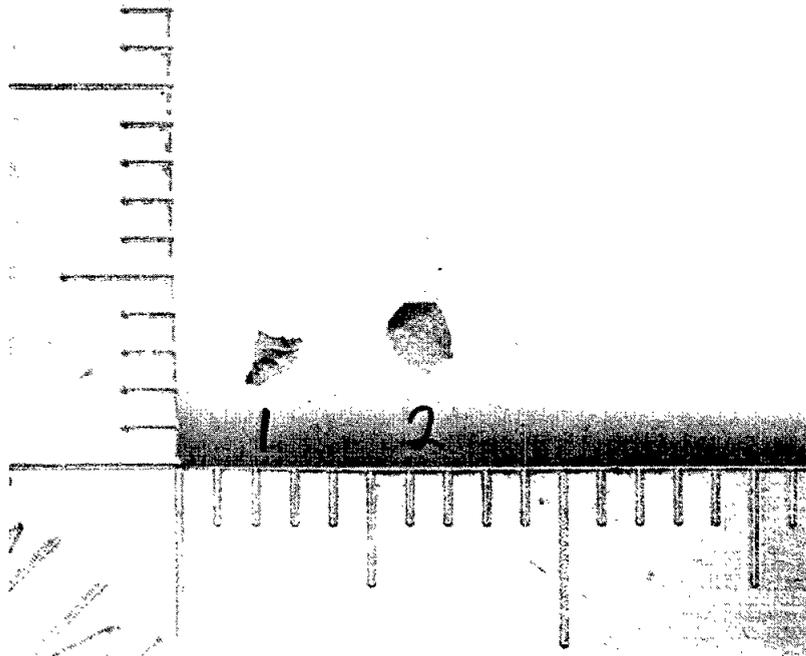
REMARKS:

1. Soil attached to one end of particle. Probably a clast from a breccia. Approximately 100% plagioclase.
2. Greater than 90% plagioclase. Minor mafic phase(s).
4. Very dusty. Plagioclase, pyroxene, opaque phase. May be shocked.
- 5,6. Olivine, pyroxene, plagioclase, opaque phase.



15003,383 (,165)

PARTICLE #:	1	2
ROCK TYPE:	Microbreccia	Microbreccia
COHERENCE:	Weak	Tough
SHAPE:	Angular	Angular
SURFACE:	Finely granular	Granular
COLOR:	Gray	Dark gray
TOTAL WEIGHT:	0.005 g	
NO. PARTICLES:	2	
REMARKS:	2. Well lithified. Possibly monomict basaltic breccia. Pyroxene-plagioclase matrix? Olivine, plagioclase clasts? Identification uncertain.	



15003,384 (,167)

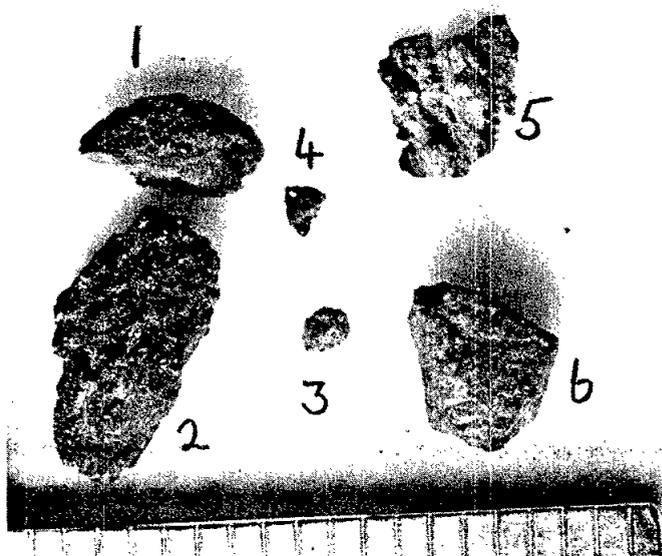
PARTICLE #:	1	2	3
ROCK TYPE:	Microbreccia	Microbreccia	Basalt
COHERENCE:	Medium	Medium	Medium
SHAPE:	Subrounded	Subangular	Subangular
SURFACE:	Finely granular	Finely granular	Hackly
COLOR:	Gray	Gray	Mottled gray and white
PARTICLE #:	4	5	6
ROCK TYPE:	Microbreccia	Glass	Microbreccia
COHERENCE:	Medium	Tough	Tough
SHAPE:	Angular	Contorted	Angular
SURFACE:	Finely granular	Vitreous	Medium granular
COLOR:	Gray	Light gray with black stripes	Medium gray

TOTAL WEIGHT: 0.309 g

NO. PARTICLES: 6

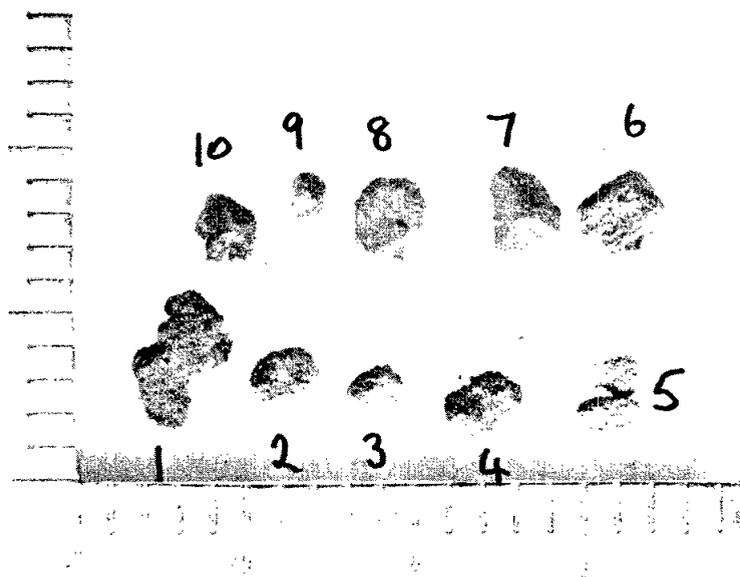
REMARKS:

- 1,4. Glass coated.
3. Minor olivine, dark gray pyroxene, plagioclase, opaque phase.
5. Ropy glass with olivine crystal attached.
6. Possibly monomict basaltic breccia. Pyroxene, plagioclase, opaque. No olivine.



15003,385 (,169)

PARTICLE #:	1-4	5	6
ROCK TYPE:	Agglutinates	Microbreccia (2 pieces)	Olivine basalt
COHERENCE:	Medium	Weak	Tough
SHAPE:	Irregular	Subangular	Angular
SURFACE:	Finely granular to smooth, vitreous	Finely granular	Smooth
COLOR:	Gray to black	Gray	Dark gray
PARTICLE #:	7	8	9, 10
ROCK TYPE:	Microbreccia	Microbreccia	Glass
COHERENCE:	Tough	Tough	Tough
SHAPE:	Subangular	Subrounded	Angular
SURFACE:	Granular	Granular	Smooth, vitreous
COLOR:	Dark gray	Dark gray	Black
TOTAL WEIGHT:	0.071 g		
NO. PARTICLES:	10		
REMARKS:	6. Large elongate olivine, pyroxene, plagioclase. 7,8. Identification uncertain.		



15003,386 (,176)

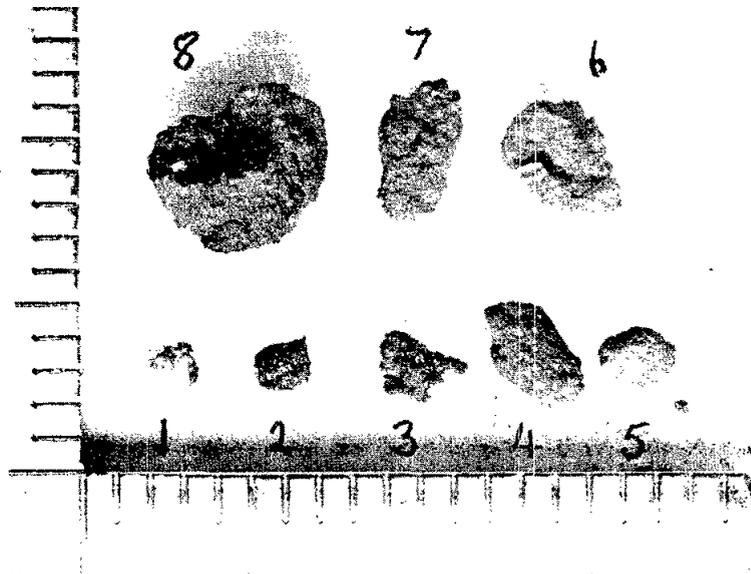
PARTICLE #:	1	2, 3	4, 5
ROCK TYPE:	Non-mare crystalline rock "Anorthosite"	Agglutinate	Microbreccia
COHERENCE:	Weak-medium	Medium	Weak
SHAPE:	Angular	Angular	Subrounded
SURFACE:	Granular	Finely granular to smooth, vitreous	Finely granular
COLOR:	Gray-white	Gray to black	Medium gray
PARTICLE #:	6	7, 8	
ROCK TYPE:	Microbreccia	Olivine vitrophyre	
COHERENCE:	Medium, penetrating fracture	Medium	
SHAPE:	Subrounded	Angular	
SURFACE:	Finely granular	Finely granular	
COLOR:	Medium gray	Very dark gray	

TOTAL WEIGHT: 0.199 g

NO. PARTICLES: 8

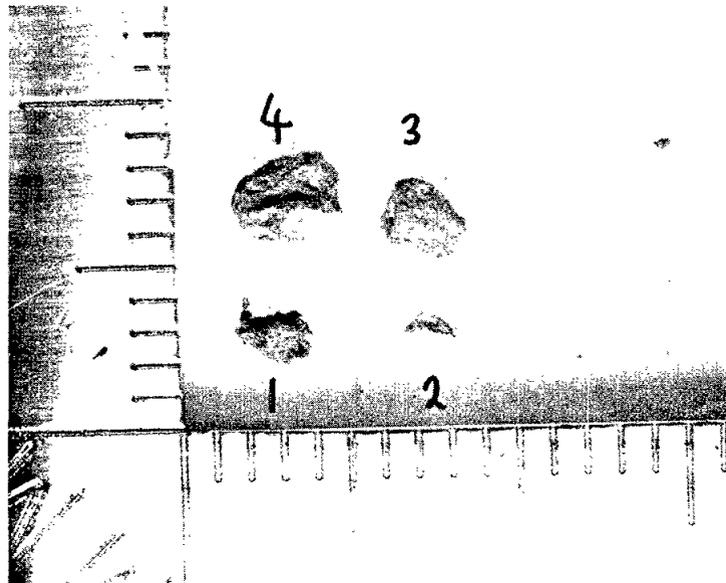
REMARKS:

1. Greater than 90% plagioclase.
6. Large olivine, plagioclase, smaller pyroxene clasts.
- 7,8. Olivine phenocrysts in finegrained matrix.



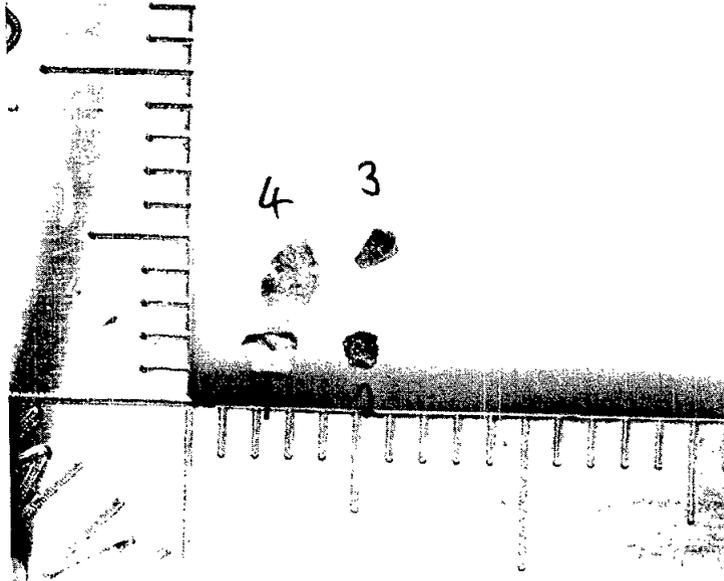
15003,387 (,179)

PARTICLE #:	1	2	3
ROCK TYPE:	Basalt	Non-mare crystal- line rock "Anorthosite"	Microbreccia
COHERENCE:	Medium, penetrating fracture	Medium, penetrating fracture	Medium
SHAPE:	Subangular	Subrounded	Subrounded
SURFACE:	Hackly	Granular	Finely granular
COLOR:	Dark gray-brown	White	Gray
PARTICLE #:	4		
ROCK TYPE:	Microbreccia		
COHERENCE:	Medium		
SHAPE:	Subangular		
SURFACE:	Finely granular		
COLOR:	Gray		
TOTAL WEIGHT:	0.040 g		
NO. PARTICLES:	4		
REMARKS:	<ol style="list-style-type: none"> 1. Dark gray pyroxene, plagioclase. No olivine. 2. Greater than 90% plagioclase. 3. Plagioclase clasts. 4. Large olivine, plagioclase clasts. 		



15003,388 (,0)

PARTICLE #:	1	2	3
ROCK TYPE:	Non-mare crystal- line rock "Anorthosite"	"Ultrabasic rock"	Microbreccia
COHERENCE:	Tough	Tough	Tough
SHAPE:	Angular	Subangular	Angular
SURFACE:	Granular	Hackly	Medium granular
COLOR:	White	Dark gray-green	Gray
PARTICLE #:	4		
ROCK TYPE:	Microbreccia		
COHERENCE:	Tough		
SHAPE:	Angular		
SURFACE:	Medium granular		
COLOR:	Medium gray		
TOTAL WEIGHT:	0.002 g		
NO. PARTICLES:	4		
REMARKS:	1. 100% plagioclase. 2. Dark gray pyroxene, green olivine. 3. Glass coating.		



15003,389 (,183)

PARTICLE #:	1, 2	3, 4	5
ROCK TYPE:	Agglutinate	Basalt	Microbreccia
COHERENCE:	Medium	Medium-tough	Medium
SHAPE:	Angular	Subangular	Subrounded
SURFACE:	Finely granular to smooth, vitreous	Granular to hackly	Finely granular-
COLOR:	Gray and black	Dark gray	Gray
PARTICLE #:	6	7	
ROCK TYPE:	Microbreccia	Non-mare crystalline rock	
COHERENCE:	Medium	Medium	
SHAPE:	Subangular	Subangular	
SURFACE:	Finely granular	Granular	
COLOR:	White and dark gray	Light gray	

TOTAL WEIGHT: 0.012 g

NO. PARTICLES: 7

REMARKS:

- 3,4. Dark gray pyroxene, plagioclase.
 5. Crystal-rich. Olivine, plagioclase clasts.
 6. Half plagioclase clast, half dark matrix.
 7. Matrix adheres to one side. Probably a clast from a breccia. Percentage of plagioclase uncertain.



15003,390 (,186)

PARTICLE #:	1, 2	3	4
ROCK TYPE:	Agglutinates	Glass	Microcrystalline basalt
COHERENCE:	Weak-medium	Tough	Tough
SHAPE:	Irregular	Angular	Subangular
SURFACE:	Finely granular to smooth, vitreous	Smooth, vitreous	Finely granular
COLOR:	Dark gray to black	Black	Very dark gray

PARTICLE #:	5	6	7
ROCK TYPE:	Microbreccia	Non-mare crystalline rock "Anorthosite"	Basalt
COHERENCE:	Medium-tough	Tough	Medium
SHAPE:	Subrounded	Angular	Angular
SURFACE:	Finely granular	Granular	Hackly
COLOR:	Gray	Very light gray	Brown

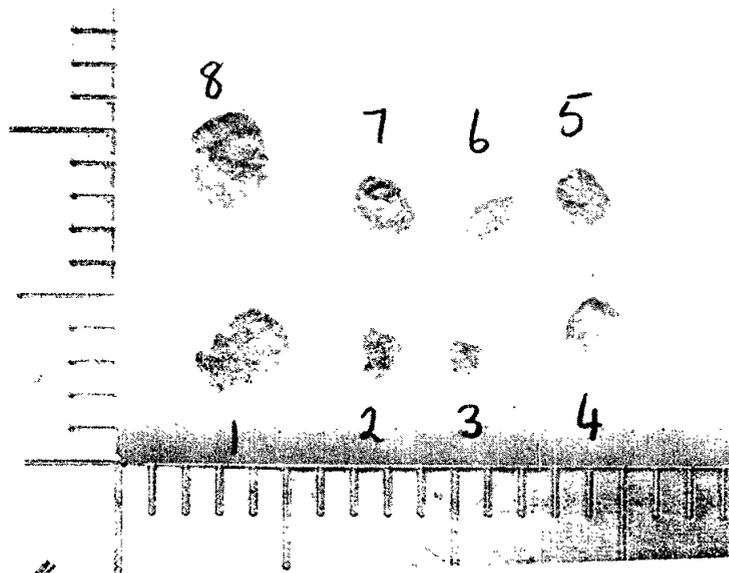
PARTICLE #:	8
ROCK TYPE:	Olivine basalt
COHERENCE:	Tough
SHAPE:	Hackly
COLOR:	Green-gray

TOTAL WEIGHT: 0.047 g

NO. PARTICLES: 8

REMARKS:

4. Appears to be finely crystalline.
5. White clasts.
6. Approximately 100% plagioclase, very minor mafic or opaque phases.
7. Cinnamon-brown pyroxene, plagioclase, opaque phases.
8. Large olivine crystals, pyroxene, smaller plagioclase.



15003,391 (,189)

PARTICLE #:	1-3	4	5
ROCK TYPE:	Agglutinate	Microbreccia	Microcrystalline basalt
COHERENCE:	Medium	Weak	Tough
SHAPE:	Irregular	Rounded	Angular
SURFACE:	Finely granular to smooth, vitreous	Finely granular	Finely granular
COLOR:	Gray to black	Light gray	Very dark gray

PARTICLE #:	6	7, 9	8
ROCK TYPE:	Microbreccia	Microbreccia	Microbreccia
COHERENCE:	Medium, penetrating fracture	Medium	Tough
SHAPE:	Angular	Subangular	Subangular
SURFACE:	Medium granular	Finely granular	Finely granular
COLOR:	Gray	Light gray	Medium gray

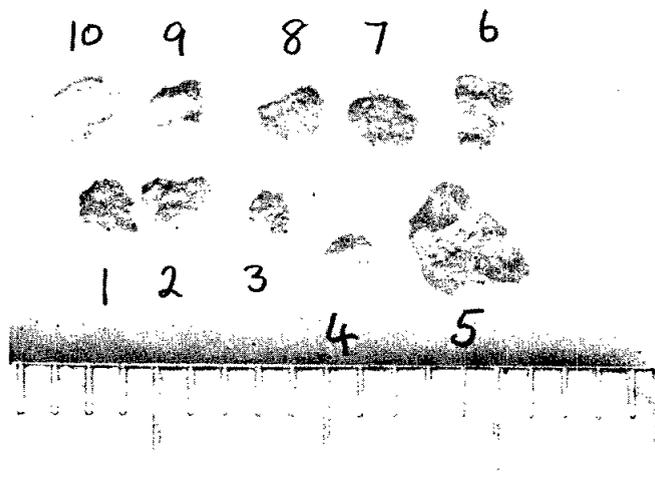
PARTICLE #:	10
ROCK TYPE:	Microbreccia
COHERENCE:	Medium
SHAPE:	Angular
SURFACE:	Medium granular
COLOR:	Dark gray and white

TOTAL WEIGHT: 0.028 g

NO. PARTICLES: 10

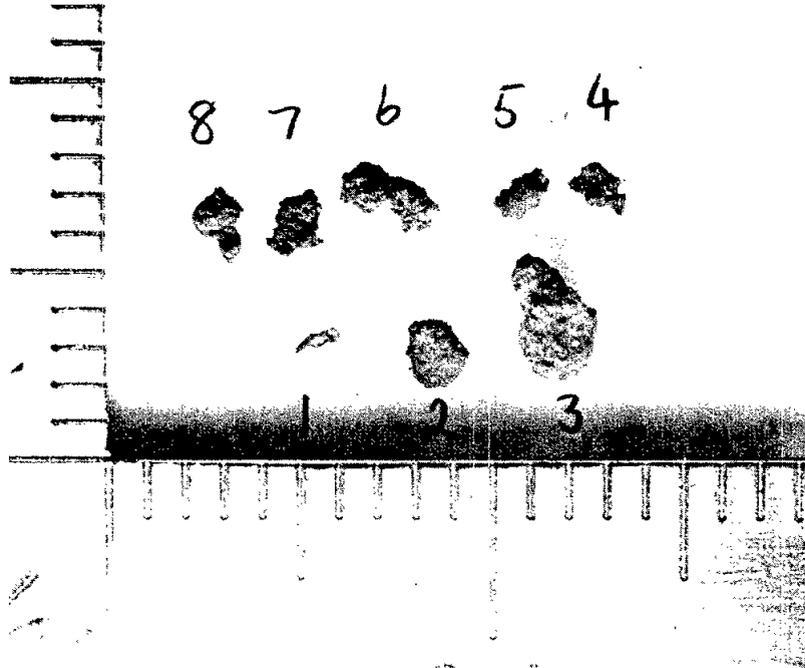
REMARKS:

5. Occasional olivine phenocrysts? Olivine vitrophyre?
6. Large (1/3 to 1/2 particle) clast - plagioclase, pyroxene, opaque phase.
7. Glass coating.
8. Plagioclase clasts, recrystallized matrix.
9. Clasts - plagioclase, olivine, opaque phase
- plagioclase, cinnamon-brown pyroxene, opaque phase.
10. Half white clast, half matrix. White clast 95-100% plagioclase.



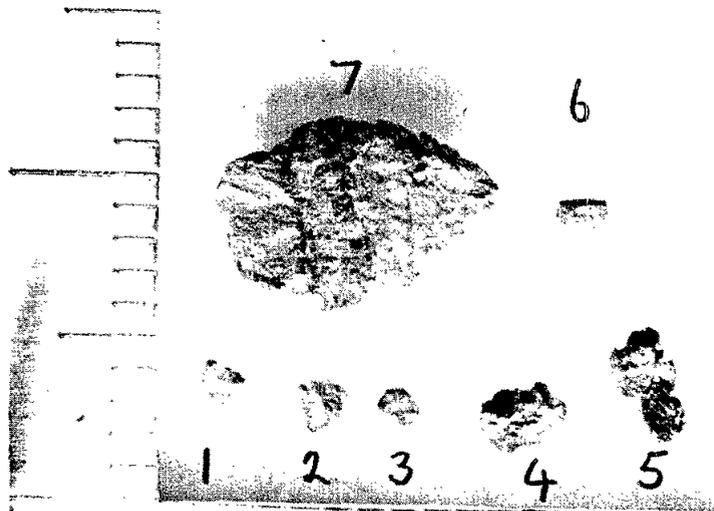
15003,392 (,191)

PARTICLE #:	1	2, 3	4-8
ROCK TYPE:	Non-mare crystal- line rock "Anorthosite"	Microbreccias	Agglutinate
COHERENCE:	Medium-tough	Medium, penetra- ting fracture	Medium
SHAPE:	Subrounded	Subangular	Irregular
SURFACE:	Finely granular	Finely granular	Finely granular to smooth, vitreous
COLOR:	White	Medium gray	Dark gray to black
TOTAL WEIGHT:	0.015 g		
NO. PARTICLES:	8		
REMARKS:	1. Greater than 95% plagioclase.		



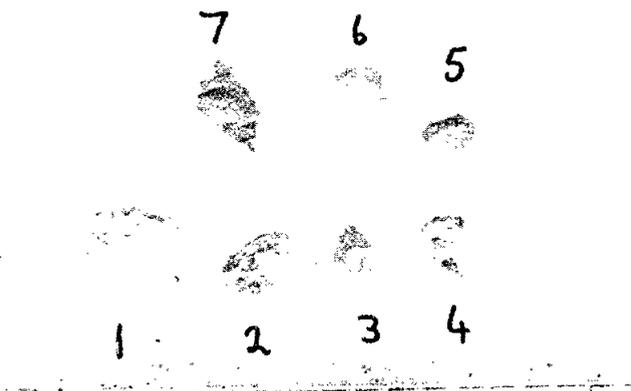
15003,393 (,193)

PARTICLE #:	1	2	3
ROCK TYPE:	Finegrained basalt	Basalt	Microcrystalline basalt
COHERENCE:	Medium-tough	Medium	Tough
SHAPE:	Angular	Angular	Angular
SURFACE:	Hackly	Hackly	Finely granular
COLOR:	Gray brown	Brown	Dark gray
PARTICLE #:	4, 5	6	7
ROCK TYPE:	Agglutinate	Microbreccia	Olivine basalt
COHERENCE:	Weak	Tough	Medium, penetrating fracture
SHAPE:	Irregular	Angular	Angular
SURFACE:	Finely granular to smooth, vitreous	Finely granular	Hackly
COLOR:	Gray and black	Gray	Gray-brown
TOTAL WEIGHT:	0.314 g		
NO. PARTICLES:	7		
REMARKS:	2. Cinnamon-brown pyroxene, plagioclase, minor opaque phases. 3. Dusty. 6. Recrystallized. Glassy coating. 7. Large olivine crystals traverse particle, cinnamon-brown pyroxene, plagioclase, opaque phase.		



15003,394 (,195)

PARTICLE #:	1	2	3, 4
ROCK TYPE:	Basalt	Olivine basalt	Basalt
COHERENCE:	Tough	Tough	Medium
SHAPE:	Subangular	Subangular	Subangular
SURFACE:	Hackly	Hackly	Hackly
COLOR:	Mottled light brown and white	Mottled brown and white	Mottled brown and white
PARTICLE #:	5	6	7
ROCK TYPE:	Basalt	Glass	Agglutinate
COHERENCE:	Tough	Tough	Medium
SHAPE:	Subangular	Rounded	Irregular
SURFACE:	Granular	Smooth, vitreous	Finely granular to smooth, vitreous
COLOR:	Gray-brown	Very dark gray	Dark gray.
TOTAL WEIGHT:	0.043 g		
NO. PARTICLES:	7		
REMARKS:	<ol style="list-style-type: none"> 1. Coarse grained. White plagioclase 50%, light brown pyroxene 50%. Minor opaque phase. No olivine. 2. Olivine phenocrysts, plagioclase, pyroxene, opaque phases. Finer grained than 1. 3,4. Cinnamon-brown pyroxene, plagioclase, minor opaques. No olivine. 5. Identification uncertain because of dust. Definitely plagioclase, pyroxene. 		



15003,395 (,198)

PARTICLE #:	1	2	3, 4
ROCK TYPE:	Agglutinate	Glass	Microcrystalline basalt
COHERENCE:	Medium	Tough	Tough
SHAPE:	Irregular	Rounded	Angular
SURFACE:	Finely granular to smooth, vitreous	Smooth	Finely granular
COLOR:	Dark gray and black	Very dark gray	Very dark gray

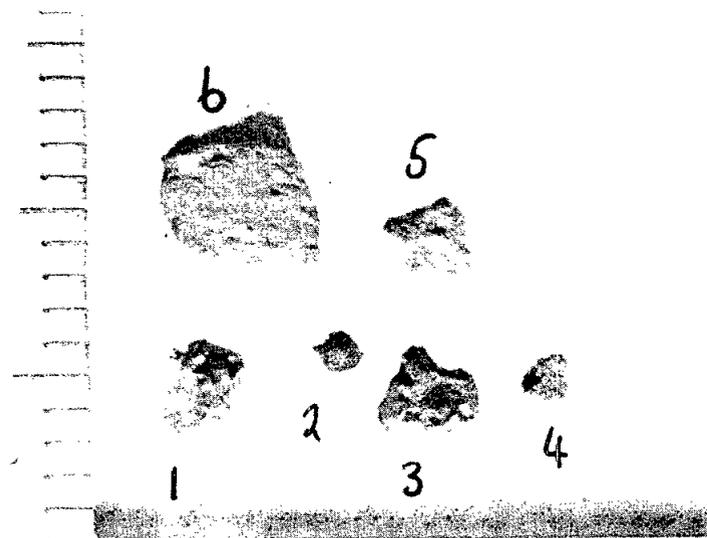
PARTICLE #:	5, 6
ROCK TYPE:	Microbreccias
COHERENCE:	Tough
SHAPE:	Angular
SURFACE:	Finely granular
COLOR:	Medium gray

TOTAL WEIGHT: 0.088 g

NO. PARTICLES: 6

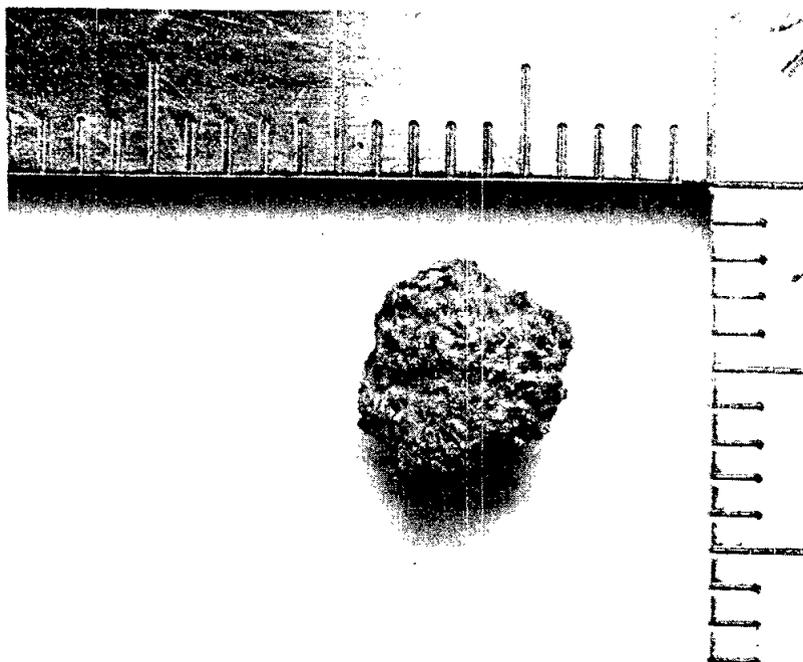
REMARKS:

1. Glass coating has broken vesicles.
2. Matrix adheres to sphere.
- 3,4. Probably pyroxene and plagioclase crystals. Very finegrained.
- 5,6. Plagioclase clasts.



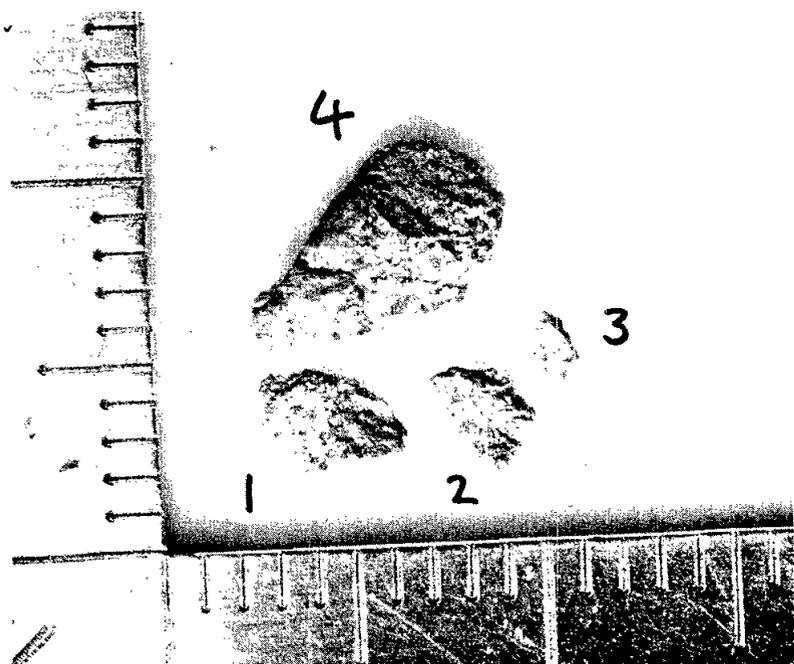
15005,396 (,34)

PARTICLE #: None
ROCK TYPE: Basalt
COHERENCE: Tough
SHAPE: Subangular
SURFACE: Hackly
COLOR: Mottled brown and white
TOTAL WEIGHT: 0.15 g
NO. PARTICLES: 1
REMARKS: Plagioclase, cinnamon-brown pyroxene, opaque phases.
Vugs or vesicles with smooth walls, lined with pyroxene
or brown glass.



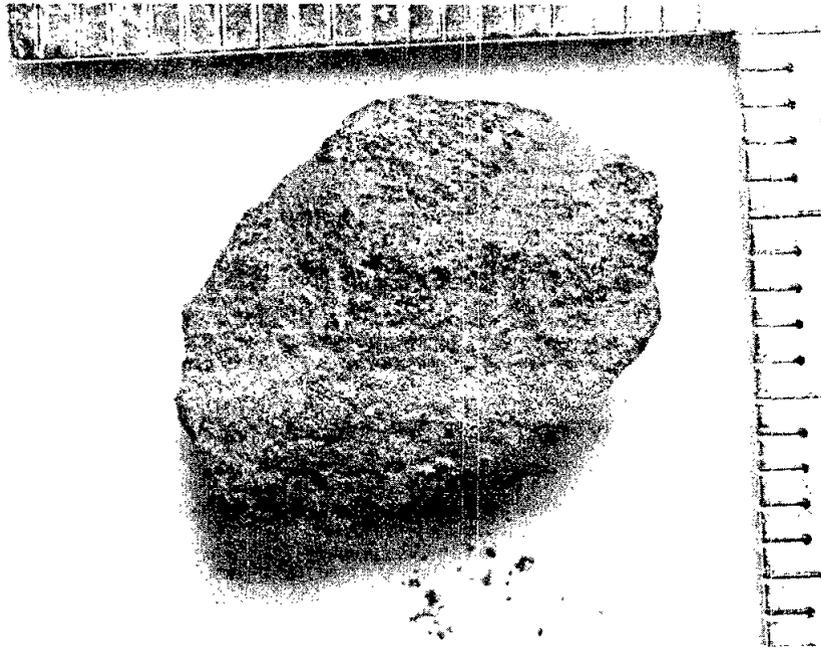
15005,397 (,93)

PARTICLE #: 1-4
ROCK TYPE: Basalt
COHERENCE: Weak to medium, penetrating fractures
SHAPE: Subangular to angular
SURFACE: Granular
COLOR: Mottled light-brown and white
TOTAL WEIGHT: 0.18 g
NO. PARTICLES: 4
REMARKS: Light brown pyroxene, opaque phases, approximately 50% plagioclase. No olivine. Outer surface weathered.



15005,398 (,96)

PARTICLE #: None
ROCK TYPE: Microcrystalline basalt
COHERENCE: Very tough
SHAPE: Subangular
SURFACE: Finely granular
COLOR: Black
TOTAL WEIGHT: 1.51 g
NO. PARTICLES: 1
REMARKS: Dust covered. Finegrained, individual minerals cannot be identified.



15006,205 (,105)

PARTICLE #: None
ROCK TYPE: Microbreccia
COHERENCE: Weak, penetrating fractures
SHAPE: Angular
SURFACE: Finely granular to vitreous
COLOR: Gray
TOTAL WEIGHT: 0.01 g
NO. PARTICLES: 1
REMARKS: Black glass coats one side. Plagioclase clasts.



15006,206 (,110)

PARTICLE #: None
ROCK TYPE: Olivine basalt
COHERENCE: Medium, penetrating fractures
SHAPE: Subangular
SURFACE: Hackly
COLOR: Mottled light brown and white
TOTAL WEIGHT: 0.08 g
NO. PARTICLES: 1
REMARKS: Large olivine phenocrysts, cinnamon-brown pyroxene.
Often intergrown with plagioclase, opaque phase
(ilmenite?). Mode varies across particle.

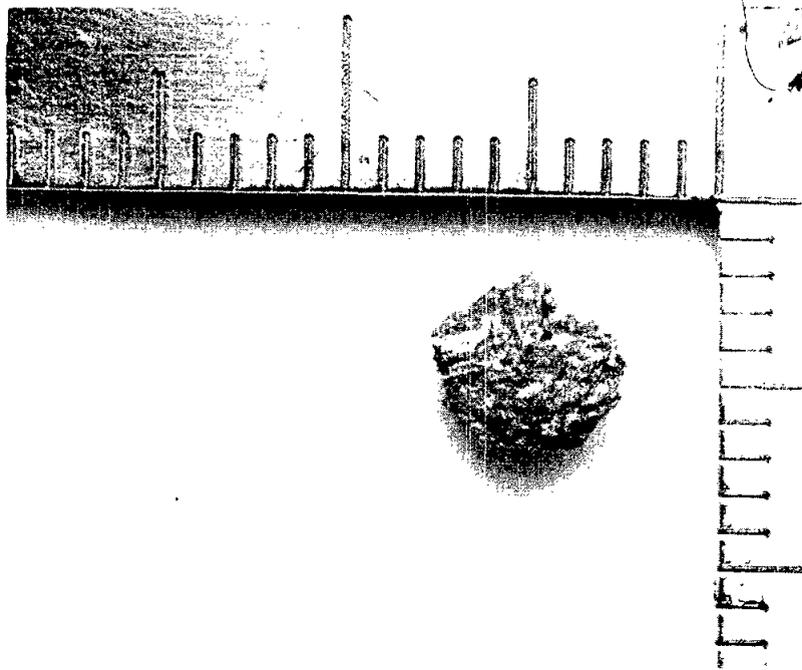


Table 1. Distribution of particle types in drill-stem sections.

Total # particles	Particle type										
	1	2	3	4	5	6	7	8	9	10	11
30	15	0	1	0	0	0	2	9	0	3	0
15	6	0	0	1	0	0	7	0	1	0	0
478 (100%)	135 (28%)	46 (10%)	17 (4%)	36 (8%)	4 (1%)	4 (1%)	152 (32%)	29 (6%)	0 (0%)	50 (10%)	5 (1%)
6	0	0	0	0	0	0	5	0	0	1	0
2	1	0	0	0	0	0	0	1	0	0	0

Table 2. Census of particles separated from the Apollo 15 deep-drill-core.

Daughter # .	Particle Type											TOTAL
	1	2	3	4	5	6	7	8	9	10	11	
15001, 272	-	-	-	-	-	-	-	-	-	1	-	1
, 273	-	-	-	-	-	-	1	-	-	-	-	1
, 274	1	-	-	-	-	-	-	-	-	-	-	1
, 275	-	-	-	-	-	-	-	-	-	1	-	1
, 276	-	-	-	-	-	-	-	1	-	-	-	1
, 277	1	-	-	-	-	-	-	1	-	-	-	2
, 278	-	-	-	-	-	-	-	1	-	-	-	1
, 279	-	-	-	-	-	-	-	1	-	-	-	1
, 280	-	-	-	-	-	-	-	1	-	-	-	1
, 281	-	-	-	-	-	-	-	1	-	-	-	1
, 282	-	-	-	-	-	-	-	1	-	-	-	1
, 283	-	-	-	-	-	-	-	1	-	-	-	1
, 284	2	-	-	-	-	-	-	-	-	-	-	2
, 285	2	-	-	-	-	-	-	-	-	-	-	2
, 286	-	-	-	-	-	-	-	1	-	-	-	1
, 287	1	-	1	-	-	-	-	-	-	1	-	3
, 288	-	-	-	-	-	-	-	-	-	-	-	1
, 289	4	-	-	-	-	-	-	-	-	-	-	4
, 290	1	-	-	-	-	-	-	-	-	-	-	1
, 291	3	-	-	-	-	-	-	-	-	-	-	3
15002, 335	-	-	-	-	-	-	1	-	-	-	-	1
, 336	1	-	-	-	-	-	2	-	-	-	-	3
, 337	5	-	-	-	-	-	-	-	-	-	-	5
, 338	-	-	-	1	-	-	-	-	-	-	-	1
, 339	-	-	-	-	-	-	-	-	1	-	-	1
, 340	-	-	-	-	-	-	4	-	-	-	-	4
15003, 334	1	-	1	-	-	-	2	-	-	1	-	5
, 335	-	1	-	-	-	-	1	-	-	1	-	3
, 336	1	-	1	-	1	-	-	-	-	-	1	4
, 337	2	-	1	-	-	-	2	2	-	1	-	8

Table 2. (Continued)

Daughter #	Particle Type											TOTAL
	1	2	3	4	5	6	7	8	9	10	11	
15003, 338	2	-	-	1	2	-	1	1	-	1	-	8
, 339	1	-	-	-	1	-	2	-	-	-	-	4
, 340	1	-	-	1	-	-	1	2	-	1	-	6
, 341	3	1	-	-	-	-	3	3	-	-	-	10
, 342	2	-	1	-	-	-	1	-	-	1	-	5
, 343	1	-	-	-	-	-	1	-	-	-	-	2
, 344	-	-	1	3	-	-	2	-	-	1	-	7
, 345	-	-	1	1	-	-	2	-	-	1	-	5
, 346	3	-	-	1	-	-	-	3	-	-	-	7
, 347	-	-	1	-	-	-	7	-	-	1	-	9
, 348	2	-	1	-	-	-	5	3	-	-	-	11
, 349	-	-	-	-	-	-	4	-	-	1	-	5
, 350	2	1	-	-	-	-	2	-	-	-	-	5
, 351	4	-	-	-	-	-	5	1	-	-	-	10
, 352	1	-	-	2	-	-	9	-	-	2	-	14
, 353	2	2	1	1	-	-	9	-	-	1	-	16
, 354	8	-	-	-	-	2	-	-	-	-	-	10
, 355	2	-	-	1	-	-	3	-	-	1	-	7
, 356	-	-	-	-	-	-	1	2	-	4	1	8
, 357	1	-	1	2	-	-	-	1	-	2	-	7
, 358	2	-	-	-	-	-	2	1	-	3	-	8
, 359	3	-	-	1	-	-	6	-	-	2	-	12
, 360	3	-	-	-	-	-	2	-	-	1	-	6
, 361	4	-	-	-	-	-	8	-	-	-	-	12
, 362	4	-	-	-	-	-	5	-	-	-	-	9
, 363	7	2	1	1	-	-	5	-	-	3	-	19
, 364	4	2	-	2	-	-	4	-	-	1	2	15
, 365	5	1	-	-	-	-	3	-	-	-	-	9
, 366	5	-	-	-	-	-	3	-	-	4	-	12
, 367	2	1	-	2	-	-	2	-	-	1	-	8
, 368	1	-	-	-	-	-	5	-	-	1	1	8

Table 2. (Continued)

Daughter #	Particle Type											TOTAL
	1	2	3	4	5	6	7	8	9	10	11	
15003, 369	3	-	-	-	-	-	3	-	-	-	-	6
, 370	1	2	-	-	-	-	1	1	-	2	-	7
, 371	2	-	-	-	-	-	1	-	-	-	-	3
, 372	2	-	-	1	-	-	1	1	-	1	-	6
, 373	5	1	-	-	-	-	3	2	-	-	-	11
, 374	1	2	-	2	-	-	2	-	-	-	-	7
, 375	-	-	-	-	-	-	2	-	-	1	-	3
, 376	4	1	-	1	-	-	3	-	-	-	-	9
, 377	2	3	-	2	-	-	4	-	-	1	-	12
, 378	2	-	-	2	-	-	2	-	-	2	-	8
, 379	2	-	-	-	-	1	3	-	-	2	-	8
, 380	1	1	-	-	-	-	2	-	-	-	-	4
, 381	1	2	-	1	-	-	3	-	-	-	-	7
, 382	-	1	-	2	-	-	3	-	-	-	-	6
, 383	2	-	-	-	-	-	-	-	-	-	-	2
, 384	4	-	1	-	-	-	1	-	-	-	-	6
, 385	3	4	2	-	-	-	-	1	-	-	-	10
, 386	3	2	-	1	-	-	-	2	-	-	-	8
, 387	2	-	-	1	-	-	1	-	-	-	-	4
, 388	2	-	-	1	-	1	-	-	-	-	-	4
, 389	2	2	-	1	-	-	2	-	-	-	-	7
, 390	1	2	1	1	-	-	1	1	-	1	-	5
, 391	6	3	-	-	-	-	-	-	-	1	-	10
, 392	2	5	-	1	-	-	-	-	-	-	-	8
, 393	1	2	-	-	-	-	2	1	-	1	-	7
, 394	-	1	1	-	-	-	4	1	-	-	-	7
, 395	2	1	1	-	-	-	-	-	-	2	-	6
15005, 396	-	-	-	-	-	-	1	-	-	-	-	1
, 397	-	-	-	-	-	-	4	-	-	-	-	4
, 398	-	-	-	-	-	-	-	-	-	1	-	1
15006, 205	1	-	-	-	-	-	-	-	-	-	-	1
, 206	-	-	-	-	-	-	-	1	-	-	-	1

REFERENCES

1. Apollo 15 Lunar Sample Information Catalog, MSC 03209, Manned Spacecraft Center, Houston. November 1971.
2. Heiken, G., Duke, M., McKay, D., Clanton, U., Fryxell, R., Nagle, J., Scott, R., and Sellers, G. (1973) Preliminary Stratigraphy of the Apollo 15 drill core. Proceedings of the Fourth Lunar Science Conference, Geochim. Cosmochim. Acta, Suppl. 4, 1, 191-213.
3. Powell, B. (1972) Apollo 15 coarse fines (4-10mm): sample classification, description, and inventory. MSC 03228, Manned Spacecraft Center, Houston. February 1972.