

JSC 14434

APOLLO 12 COARSE FINES (2-10):
SAMPLE LOCATIONS, DESCRIPTION, AND INVENTORY

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July 1978



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INTRODUCTION

The Apollo 12 astronauts collected twelve soil samples with a total weight of about 5.9 kg. This catalogue describes the particle types in the 4-10 μ m and 2-4 mm fractions of these soils. Descriptions of a few coarser and finer fractions that were unpackaged during the survey are also included.

The project was undertaken because those small samples that were distributed for study early in 1970 soon after the return of the Apollo 12 mission included an intriguing array of exceptional particle types. Among these were a fragment of a carbonaceous chondrite, a potash rhyolite, a niobian rutile, and a clod of red-black, highly Ti-rich glass spherules. In the hope of discovering additional examples of the red-black glass and other rare particles, the author volunteered to catalogue all of the previously undescribed Apollo 12 coarse fines. The coarse portions of each sample remaining in storage at the Curatorial facility (Sterile Sample Processing Laboratory) were opened, sieved, dusted, and subdivided by particle type. All examinations and photographs were made through the windows of a nitrogen cabinet.

The expectation of finding unusual lithologies provided a pleasant sense of anticipation during the operations. Rather than keep the reader in suspense, however, it may be stated at the outset that, despite close scrutiny with a practiced eye, no spherules of red-black glass, meteorite fragments, or other exotic materials were identified in these soil fractions.

SAMPLES AND SOURCES

The Apollo 12 module landed on a mare surface amid a cluster of small craters with diameters of 10 to 400 m. Premission photographs suggested that the regolith would contain materials from two main sources: the mare basalts underfoot and ray material from the crater Copernicus, 370 km to the northeast. When the astronauts found streaks and lenses of light gray soil in the dark regolith, many observers jumped to the conclusion that the light-colored particles (which included a high proportion of rocky fragments of KREEP-rich glass) were Copernicus ejecta. The consensus was short-lived; many lunar scientists began to doubt that amounts of ejecta sufficient to form visible layers at the site would follow so long a trajectory. They ascribe the gray soils, such as 12033, to a local source, possibly excavated by a projectile from Copernicus.

Figures 1 and 2 show the general topography of the landing site and the locations where the following soil samples were collected:

- 12001 <1 cm fraction of bulk regolith collected near the landing module.
- 12003 A coarse (>1 cm) split of 12001, plus material from the bottom of the sample box.
- 12023 Soil from the bottom of a trench 20 cm deep dug in the E. rim of Sharp Crater.
- 12024 Surface sample taken from near the trench on the E. rim of Sharp Crater. The rim material is softer and has a higher albedo than the normal regolith.
- 12030 Sample of the fragmental lining of a 1 m crater on the NE flank of Head Crater. The crater lining appeared to consist of weakly coherent clods of soil similar to those in experimentally produced secondary craters.
- 12032 Soil from the north rim of Bench Crater, including some light gray material from just below the surface.
- 12033 Light gray soil from the bottom of a trench 15 cm deep dug in the NW rim of Head Crater.
- 12037 Not statistically a soil sample; soil from the NW rim of Bench Crater was carried in the same bag with Rock 12036, a coarse, vuggy, friable basalt which shed chips and fines into the sample.

- 12041 Surface sample from an area about 35 m east of Bench Crater.
- 12042 Soil from the southwest outer flank of Surveyor Crater; patches of the regolith at this site are characterized by cohesive 1 mm to 1 cm clots of soil.
- 12044 Surface soil from the south rim of Surveyor Crater.
- 12070 The contingency sample: 6 scoops of soil taken near the rim of a 6 m crater about 15 m NW of the landing module.

REFERENCES

Information on the sampling sites was taken from:

Warner, J. (1970) Apollo 12 Lunar Sample Information. NASA Technical Report 353.

Heiken, G. (1974) Catalog of Lunar Soils. (Draft) NASA JSC.



Figure 1. Topography of that portion of the Apollo 12 landing site where the soil samples were collected. The triangle locates the landing module on the NW rim of Surveyor Crater. (Enlarged from Lunar Orbiter photograph III-154H2.)

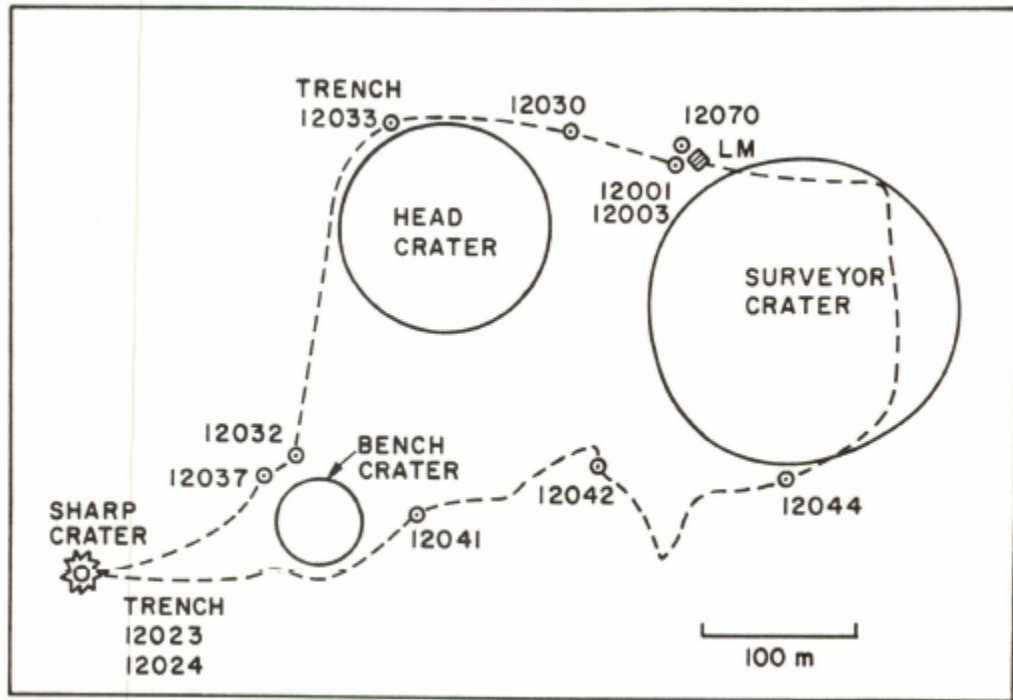


Figure 2. Sketch map indicating a traverse and the sampling sites of the Apollo 12 soils. (Adapted from Warner, 1970, page 18.)

DESCRIPTIVE TERMS

All of the sample descriptions are based on binocular microscope examinations of particles inside a nitrogen cabinet. Each bulk sample coarser than 2 mm was quickly picked into subsamples using forceps to separate particle types by broad categories. The rock classifications should be regarded as strictly tentative.

In order to avoid generating a very large number of 1 and 2-grain fractions, many subsamples include a range of particle types. The descriptions employ very general terms most of which need no explanation. A photograph of each subsample is included to illustrate particle sizes, shapes, and general character. The following terms are used for degrees of coherence and rock types.

Degrees of coherence:

- Very friable: crumbles on gentle handling
- Friable: crumbles on moderate pressure
- Coherent: breaks along grain boundaries when struck with moderate force
- Tough: breaks across grain boundaries; requires force and determination
- Brittle: applies to glasses

Rock types:

- Soil breccias: polymict aggregates of rock, mineral, and glass fragments in a finer-grained matrix which may range from weak and powdery to tough and glassy or recrystallized.
 - Agglutinates: compound particles consisting of soil breccias and other debris welded together by filaments of dark brown, vesicular glass.
- Glasses and glass-rich fragments are of three main types:
1. Dark-colored, vesicular masses, crusts, spherules, or bomblets; these are generally impact-melted soil.
 2. Transparent fragments--yellow, orange, green, colorless-- with the compositions of rocks, minerals, or magmas.
 3. Ropy KREEP-rich glasses: small irregular fragments resembling chunks of twisted taffy coated with light-colored dust. Such particles, first recognized in the Apollo 12 soils, are the prototype KREEP glass. Their macroscopic appearance is so characteristic that they are listed as KREEP-rich even though none of the particles in this catalogue has been analysed.

Rock types (cont.)

Aphanites: particles that are cryptocrystalline, glassy, or both; their character is uncertain until observed in thin sections. Many such particles in the Apollo 12 soils have proved to be recrystallized noritic breccias.

Norites: fine-grained, sugary, gray crystallines; typical particles, first seen in the Apollo 12 soils, consist chiefly of plagioclase and orthopyroxenes. Some are annealed fragmental breccias, others are recrystallized to igneous-looking textures.

Basalts: mare lavas occurring in a range of grain sizes and olivine-pyroxene-plagioclase-ilmenite proportions; vitrophyric basalts have crystallites or phenocrysts of olivine or pyroxene in a cryptocrystalline or glassy matrix.

Anorthosites: rocks consisting mainly of plagioclase; this particle-type was first observed in the Apollo 11 soils but is relatively rare in the Apollo 12 samples.

12001,101 4-10mm
3 Subsamples (,523 ,524 ,525)

12001,523

Basalt

2 particles; 0.380 grams

Coherence : Moderately coherent

Shape: Subangular

Surface: Rough, grainy, with sparse zap pits

Character: Fine-grained ophitic to subophitic basalts;
approximately 40% plagioclase, 40% cinnamon brown
pyroxenes, 15% olivine and 5% opaques.

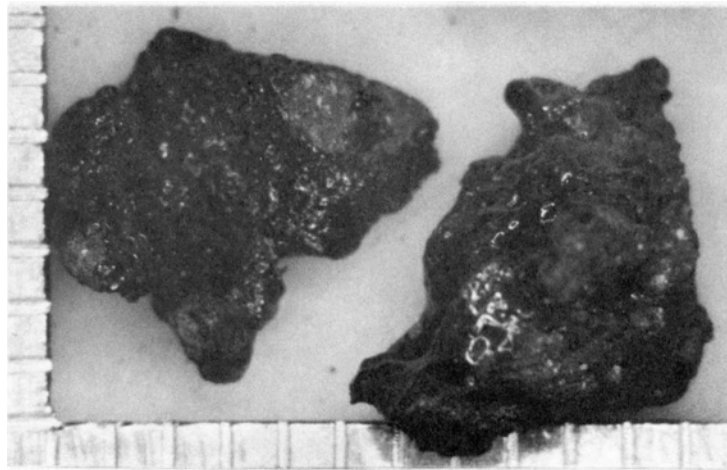


12001,524

Glass coated soil breccias

2 particles; 0.190 grams

Character: Angular clods of dark gray, fine-grained coherent soil breccia partially coated and welded together by dark brown, vesicular glass.



12001,525

Soil breccia

1 particle; 0.080 grams

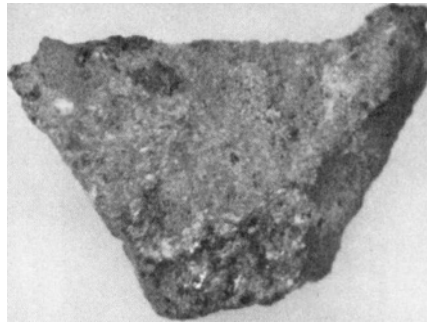
Coherence: Strongly coherent

Shape: Angular

Surface: Partially coated with small rough patches of dark glass (upper left in photograph)

Color: Medium gray

Character: Soil microbreccia cut by a few thin veinlets of dark glass and containing one large clast of mare basalt (lower center in photograph) .



12001,100 2-4mm
5 Subsamples (,528 - ,532)

12001,528
Glass-rich fragments
12 particles; 0.230grams

Coherence: Brittle
Shape: Angular and blocky, rough and ropy, or smooth and
 conchoidal
Surface: Some particles coated with fine gray dust
Color: Medium to dark gray; green
Character: 2 particles (at right in photograph) are thin
 conchoidal shells of green glass; several particles are
 ropy KREEP-rich glass; the remainder are nondescript
 aphanites,



12001,529
Soil breccias and agglutinates
Numerous particles; 0.700 grams

Coherence: Friable to moderately coherent
Shape: Subrounded, to irregular
Character: Smooth microbreccias with conspicuous coatings of
 blebby, vesicular brown glass



12001,530
Soil breccias
22 particles; 0.720 grams

Coherence: Friable to moderately coherent
Shape: Subrounded to subangular
Surface: Mostly smooth; with a few patches of dark glass;
sparse zap pits
Character: Medium-gray polymict microbreccias



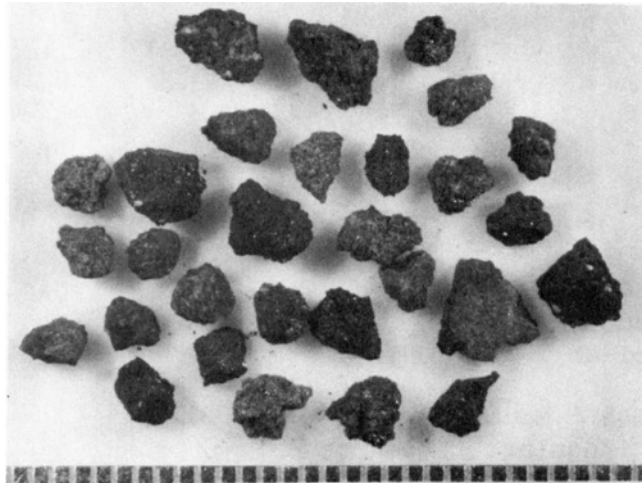
12001,531
Crystallines; basalts, norites, anorthosites
32 particles; 0.450 grams

Coherence: Very friable to moderately coherent
Shape: Subrounded to angular
Surface: Rough; controlled by grain boundaries; one particle
(upper right in photograph) has a conspicuous glass-lined
zap pit.
Character: 5 or 6 chalky-white anorthositic fragments; 5 gray,
sugary, recrystallized noritic breccias; numerous fine to
medium-grained golden to cinnamon-brown mare basalts.



12001,532
Aphanitic fragments
29 particles; 0.810 grams

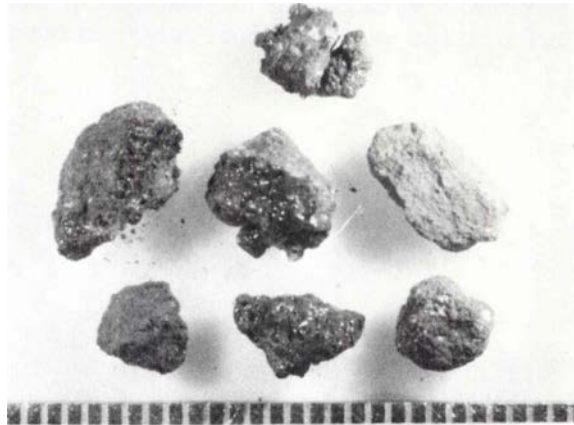
Coherence: Tough to brittle
Shape: Angular, blocky
Surface: Fine-grained and smooth to rough and sugary
Color: Medium gray to black
Character: Dense, nondescript aphanitic particles; partly
glassy and partly crystalline; probably include recrystallized
noritic microbreccias and various compositions of impact melts.



12001,119 4-10mm
3 Subsamples (,535 ,536 ,537)

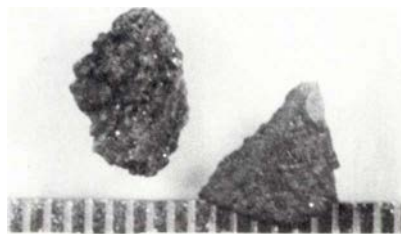
12001,535
Soil breccias
7 particles; 0.780 grams

Coherence: Friable to moderately coherent
Shape: Rounded to subrounded
Surface: Partly coated with dark, vesicular glass
Color: Medium gray
Character: 6 particles are soil breccias with patches of
blebby glass; 1 consists of 2 glass-welded breccia clods.



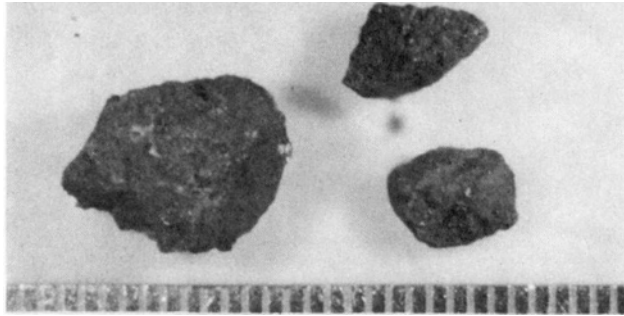
12001,536
Basalts
2 particles; 0.360 grams

Coherence: Moderately coherent
Shape: Angular
Surface: Rough, grainy
Character: 1 fine-grained, dark brown basalt with approximately
40% plagioclase, 50% pyroxene, 10% opaques; 1 medium-grained
golden-brown basalt with about 30% plagioclase, 55% pyroxene,
10% olivine, 5% opaques.



12001,537
Noritic fragments (?)
3 particles; 1.280 grams

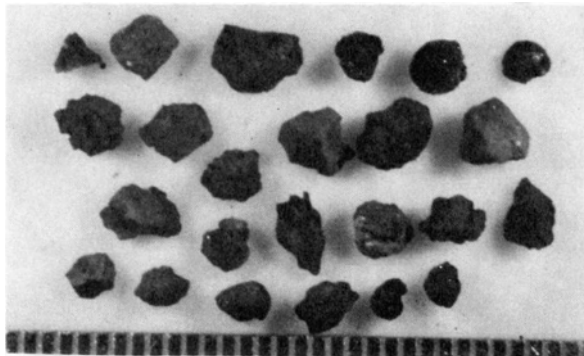
Coherence: Tough
Shape: Subangular
Surface: Rough, lumpy; conspicuous zap pits on 2 surfaces
of largest fragment
Color: Medium gray
Character: Nondescript fine-grained to aphanitic rocks of the
type that generally prove to be recrystallized noritic
breccias.



12001,119 2-4mm
6 Subsamples (,538 - 543)

12001,538
Glass-rich fragments
24 particles; 0.610 grams

Coherence: Tough, brittle
Shape: Ranges from spherules to ropy masses and conchoidal
fragments
Surface: Generally jagged and rough
Color: Light through dark gray; most have a dull matte luster,
a few are vitreous
Character: These particles include bomblets of molten soil and
ropy pieces of KREEP-rich glass.



12001,539
Agglutinates
29 particles; 0.560 grams

Coherence: Friable soil breccias; brittle glass
Shape: Irregular; lumpy
Surface: Rough; vesicular
Character: Rounded clods of soil breccia welded together
by brown glass.



12001,540
Soil breccias
35 particles; 0.790 grams

Coherence: Friable to moderately coherent
Shape: Rounded to angular
Surface: Textures range from smooth to granular with a few
small patches of vesicular glass
Character: Microbreccias of mare soil



12001,541

Crystallines: basalts and norites

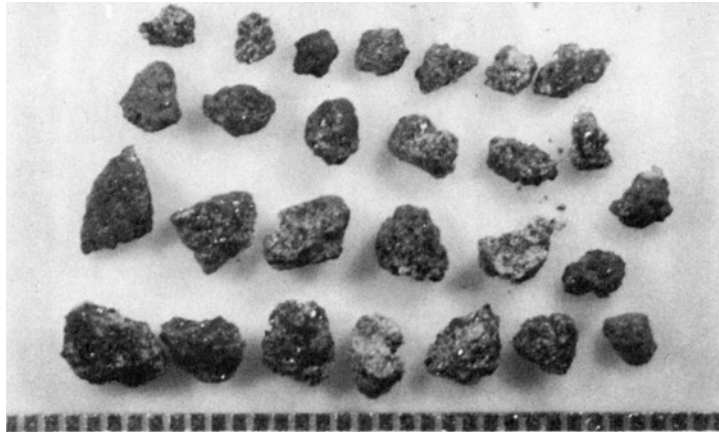
26 particles; 0.750 grams

Coherence: Friable to moderately coherent

Shape: Subrounded to subangular

Surface: Rough, and, in some cases, shedding grains

Character: 24 of these particles are fine to medium-grained
golden to cinnamon-brown mare basalts; 2 are fine-grained,
sugary grayish-brown fragments, probably norites.



12001,542
Aphanites
14 particles; 0.390 grams

Coherence: Strongly coherent to tough
Shape: Subrounded to angular
Surface: Rough, sugary texture
Color: Dark grayish brown
Character: Dense, aphanitic particles; probably recrystallized
noritic breccias.



12001,543
Metallic fragments
2 particles; 0.010 grams

Character: 2 silvery metallic particles that look like
contaminants, but are of mysterious provenance; one is a
triangular sliver 8mm long; the other is a group of small
subhedral crystals.



12001,119 1-2mrn
1 Subsample (,544)

Unsorted bulk sample including the full range of typical Apollo
12 regolith components.



12001,4 4-lOrrun
7 Subsamples (,549 - ,555)

12001,549

Glasses

4 particles; 1.840 grams

12001,549a: a fragment of ropy KREEP-rich glass 1cm long;
fractured surface is vitreous and reddish brown;
ropy surface coated with fine gray dust.

,549b: a broken, hollow bornblet of dark glass with a
dendritic pattern of crystallites on the smooth
exterior surface; patches of dust adhere to the
surface.

,549c : a concave fragment of a dark, vitreous, vesicular
glass.

,549d: a dark bornblet with a matte texture incorporating
one conspicuous inclusion of basalt.

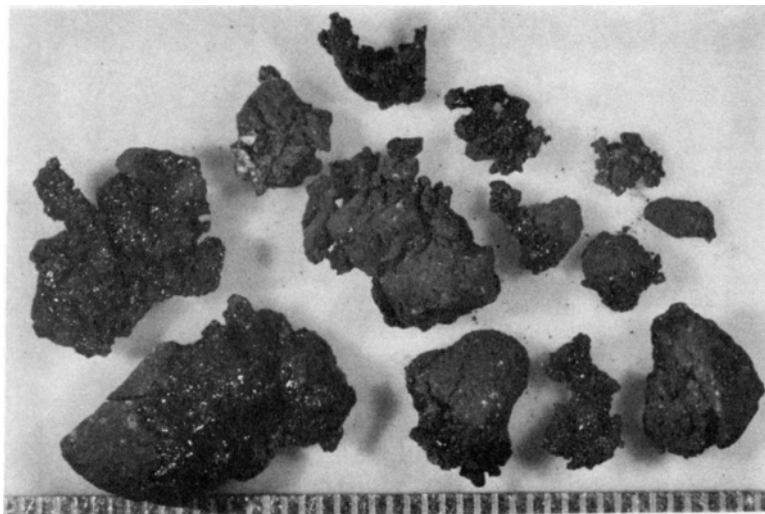


12001,550

Agglutinates

13 particles; 2.370 grams

Character: Mare regolith products: friable to moderately coherent clods of soil breccia partially coated and welded together by irregular masses of dark, vesicular glass,



12001,551
Soil breccias
9 particles; 0.980 grams

Coherence: Friable to tough
Shape: Rounded to angular
Surfaces : Mostly smooth with a few patches of glassy crust;
sparse zap pits
Character: Polymict soil breccias ranging from barely
compacted to strongly annealed .



12001,552
Crystallines
7 particles; 2.510 grams

Coherence: Moderately coherent to tough
Shape: Rounded to angular, irregular
Surfaces: Rough and grainy; the particle at lower right is
bounded by exterior surfaces with numerous zap pits.
Character: One particle (lower center) is a medium-grained
golden-cinnamon basalt; the rest are dark gray and fine-
grained to aphanitic metabasalts or norites.



12001,553
Aphanite
1 particle; 0.250 grams

Character: Tough, smooth, medium-gray fragment with a dull matte luster, one large vesicle; devitrified or finely recrystallized glass.



12001,554
Soil breccias
3 particles; 0.590 grams

Coherence: Friable
Shape: Subrounded
Surface: Partially coated with vesicular glass
Character: Undistinguished medium to dark gray soil breccias



12001,555

Basalts

5 particles; 0.710grams

Coherence: Friable to moderately coherent

Shape: Subrounded to subangular

Surface: Fine-grained and relatively smooth to medium-grained and vuggy; a few zap pits

Character: 3 particles (bottom row in photograph) are medium-grained basalt with 35-40% plagioclase, 25-30% pyroxene, 25-30% olivine, 5-10% opaques; 2 particles of fine-grained dark brown basalt with about 35% plagioclase, 60% pyroxene, 5% opaques.



12001,4 2-4mrn
5 Subsamples (,556 - ,560)

12001,556
Soil breccias and agglutinates
Numerous particles; 7.180 grams

Character: Typical mare regolith products

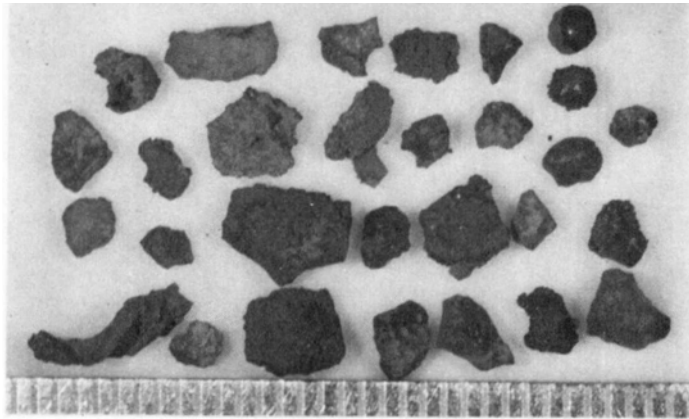


12001,557

Glasses

29 Particles; 0.700 grams

Character: An assortment of glassy fragments including 3 subvitreous hollow spherules or bomblets and numerous dull gray matte chunks of conchoidal to ropy KREEP-rich glass.



12001,558

Basalts

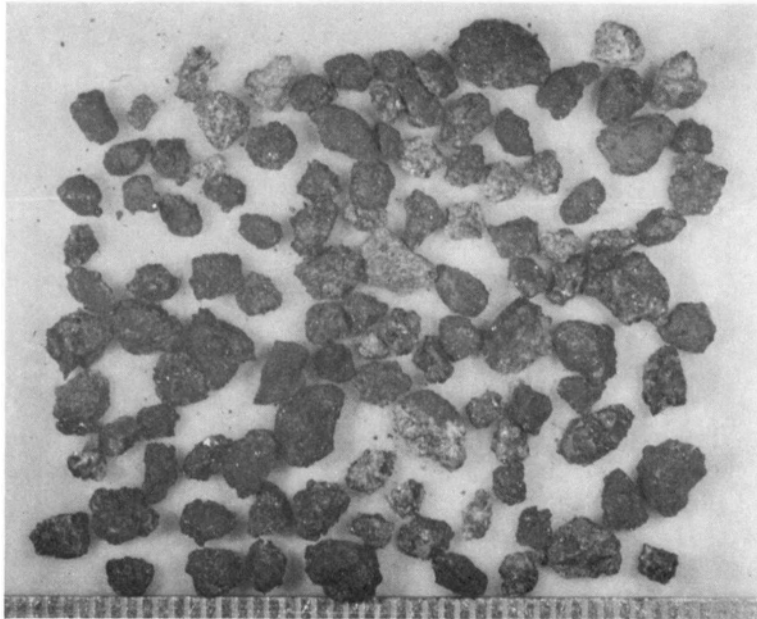
Numerous particles; 2.270 grams

Coherence: Friable to strongly coherent

Shape: Angular to subangular

Surface: Rough and grainy; medium-grained fragments are vuggy;
sparse zap pits

Character: Ranges from light-colored, medium-grained, ophitic
basalts to fine-grained dark brown or gray varieties



12001,559

Aphanites

30 particles; 1.070 grams

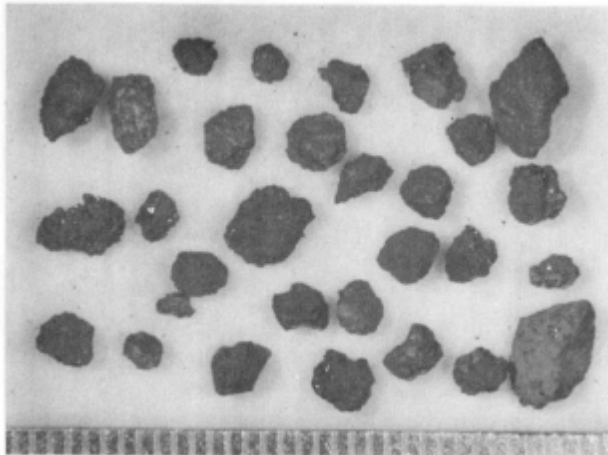
Coherence: Tough

Shape: Angular, blocky

Surface: Smooth to rough and irregular; a few have vesicles
with vitreous linings

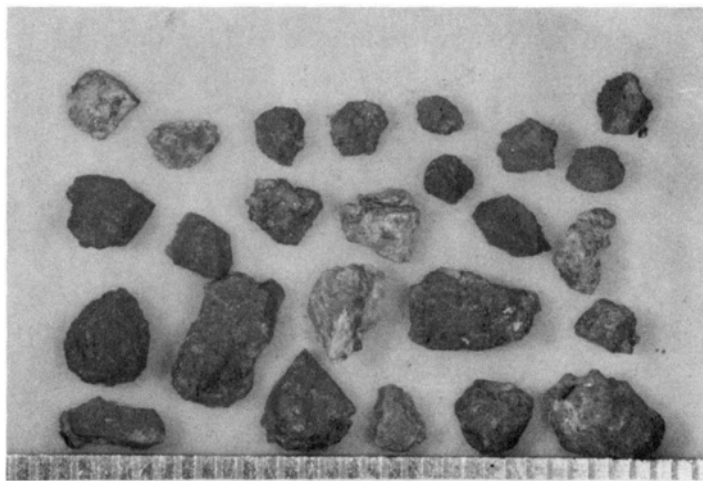
Color: Dark brown

Character: Dense gray enigmatic particles; partly glassy
partly crystalline; some are probably recrystallized noritic
breccias.



12001,560
Norites and aphanites
25 particles; 0.930 grams

Coherence: Tough
Shape: Angular and blocky to ropy
Surface: Smooth to lumpy; vesicles in a few particles;
sparse zap pits
Color: Light to medium gray
Character: The lightest gray particles are fine-grained
sugary norites; the darker particles include various fine-
grained to glassy types. Some may be fragments of KREEP-
rich glass; others, recrystallized noritic breccias .

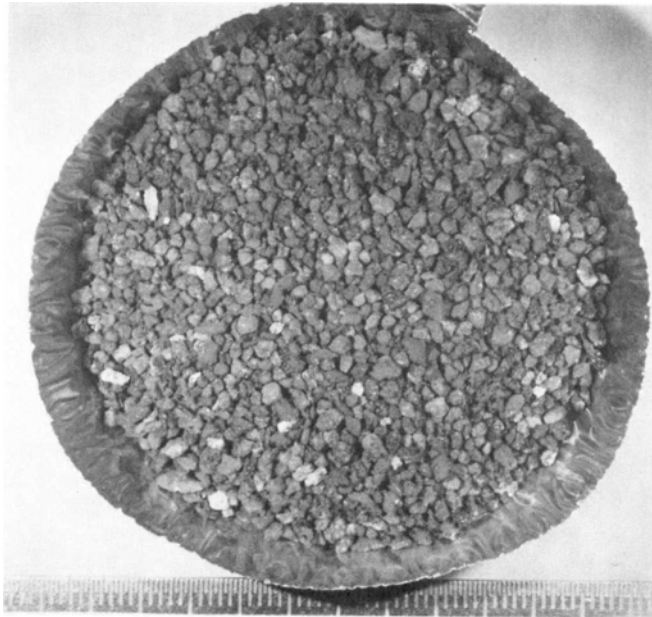


12001,4 1-2mm
4 Subsamples (,561 - ,564)

12001,561
Bulk sample (unsorted)
10.260 grams

Character: Particle types include the full range of typical Apollo 12 soil breccias, glass-bonded agglutinates, conchoidal fragments of green, yellow, and dark brown glasses; ropy KREEP-rich glasses, basalts, aphanites, a few light-gray, sugary norites, and sparse chalky white, anorthositic fragments.

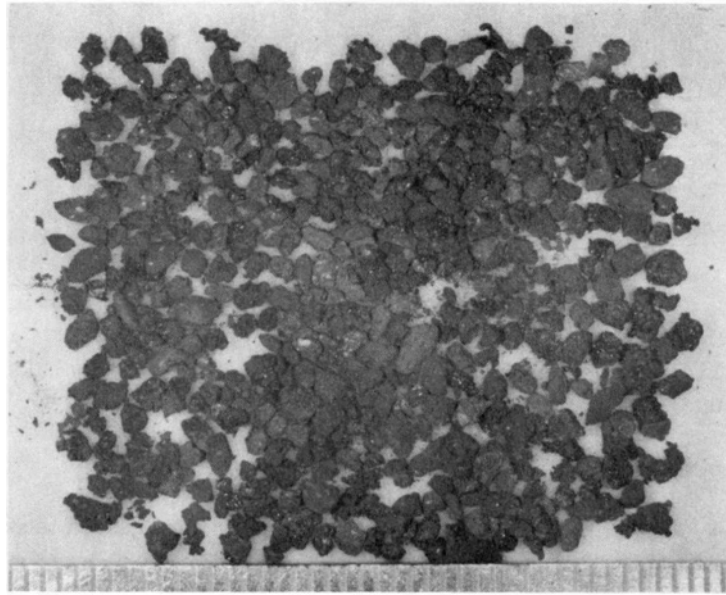
Note: Before sample 12001,561 was weighed, a 7-gram split was taken and subdivided into samples ,562 ,563 and ,564.



12001,561 1-2rnm
3 Subsamples (,562 ,563 ,564)

12001,562
Soil breccias and agglutinates
Numerous particles; 0.330 grams

Character: Unexceptional

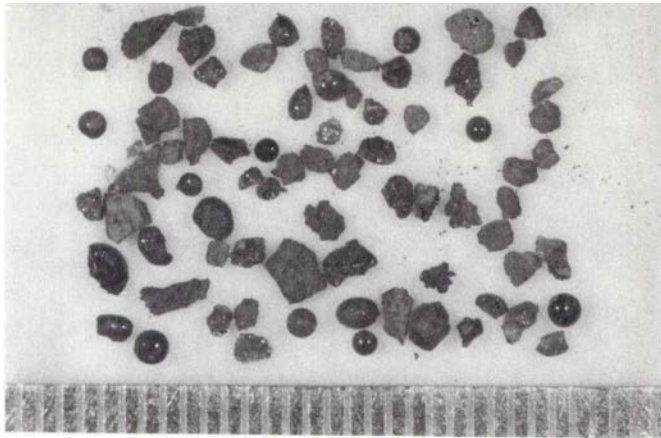


12001,563

Glasses

Numerous particles; 0.290 grams

Character: Dark brown spherules (some vitreous, some with a dull matte luster), conchoidal vesicular fragments, chunks of ropy KREEP-rich glass, and blocky aphanites.



12001,564

Crystallines

Numerous particles; 6.330 grams

Coherence: Friable to tough

Shape: Subrounded to angular

Surface: Granular; roughness depends on grain size which is rnedimn to very fine,

Character: Lithologies include basalts, norites, and 2 anorthositic particles. The basalts are of two main types--the medium-grained ophitic variety rich in golden and cinnamon pyroxenes, and a fine-grained dark brown, nondescript variety. The norites are very fine-grained, sugary gray particles; probably recrystallized breccias. The largest anorthosite fragment (lower right in photograph) is a sheared mass of plagioclase with a cluster of dark brown pyroxene crystals at one end.



12003,28 4-10mm
6 Subsamples (,174 - ,179)

12003,174

Basalts

24 particles; 4.190 grams

Coherence: Moderately to strongly coherent

Shape: Angular to subangular

Surface: Rough and grainy; a few conspicuous zap pits; one
fragment vuggy, with euhedral pyroxene crystals

Color: Yellow-brown to dark brown

Character: Fine to medium-grained, ophitic and subophitic
mare basalts: 50-55% Pyroxene, 10-15% olivine, 35-45%
plagioclase, 5-10% opaques.



12003,175

Soil breccias and cindery glass

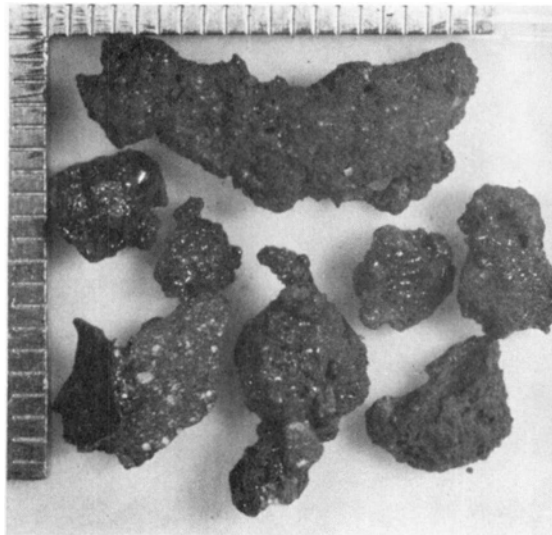
8 particles; 1.150 grams

Coherence: Coherent to tough; brittle

Shape: Angular, irregular

Surface: Rough; partly coated with glass

Character: Lithified clods of dark gray, fine-grained soil
splashed with dark, vesicular glass; the particle at the
lower right has a sintery texture and is more recrystallized
than the others.



12003,176

Basalts

3 particles; 0.790 grams

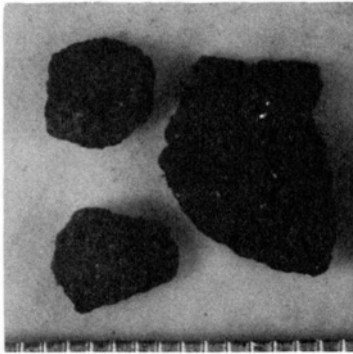
Coherence: Moderately coherent

Shape: Subrounded

Surface: Grainy

Color: Dark gray

Character: Very fine-grained, almost aphanitic, essentially nondescript crystallines; probably mare basalts; possibly recrystallized impact melts.



12003,177

Basalt clasts in soil breccias

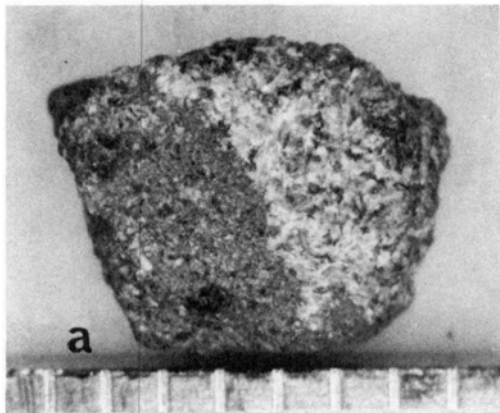
2 particles; 0.450 grams

12003,177a

Character: 50% soil breccia; 50% plagioclase-rich ophitic basalt; particle as a whole is coherent, subangular, and smooth, with sparse zap pits on its surfaces.

12003,177b

Character: Fine-grained, coherent, yellow-brown mare basalt with 2 or 3 patches of soil breccia adhering to the surface.



12003,178

Basalt

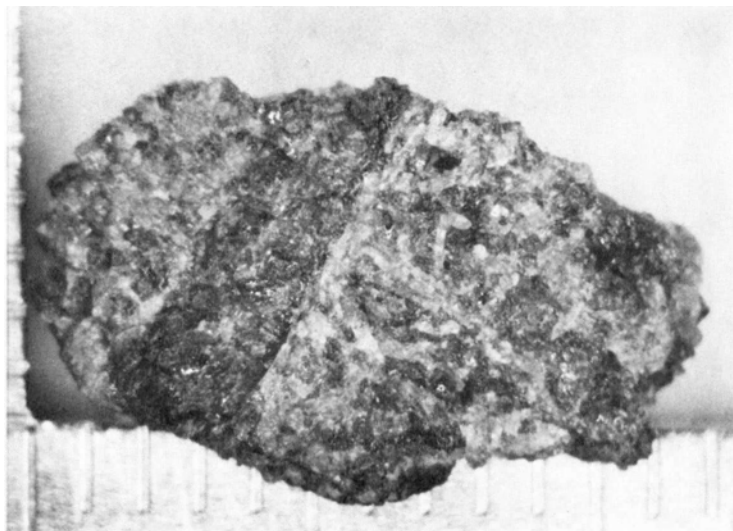
1 particle; 0.490 grams

Coherence: Moderately coherent

Shape: Subangular

Surface: Roughness reflects coarse grain size

Character: Coarse-grained, vuggy basalt with plagioclase laths up to 5 mm long; one surface (see photograph) is dominated by a single crystal of pyroxene 0.8 mm long. The mode is approximately 40% plagioclase, 40% pyroxene, 15% olivine, and 5% opaques.



12003,179

Norite

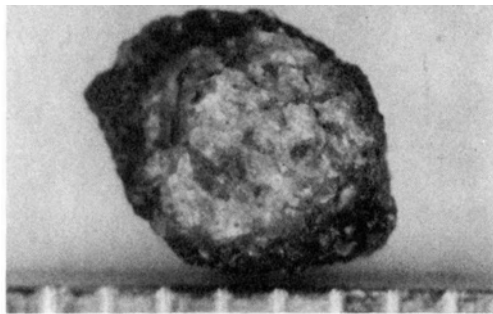
1 particle; 0.100 grams

Coherence: Strongly coherent

Shape: Rounded

Surface: One dark gray "exterior" surface, one light gray fractured surface (see photograph) ; both surfaces marked by zap pits

Character: Fine-grained, recrystallized noritic breccia



12003,27 2-4nm
5 Subsamples (,182 - ,186)

12003,182
Glasses and aphanites
55 particles; 1.710grams

Coherence: Tough and brittle

Color: Muddy brown to dark gray; vitreous to dull matte
luster

Character: Rough spherules and bomblets, vesicular masses,
conchoidal fragments, ropy particles; the 2 largest fragments
(upper right in photograph) are broken shards of one large
>1cm spheroid.



12003,183

Soil breccias and agglutinates

Numerous particles; 1.950 grams

Coherence: Moderately coherent to brittle

Shape: Angular, irregular

Surface: Fairly smooth, partially coated with dark, vesicular
glass

Color: Muddy-brown to dark gray

Character: Undistinguished



12003,184

Soil breccias

Numerous particles; 1.390 grams

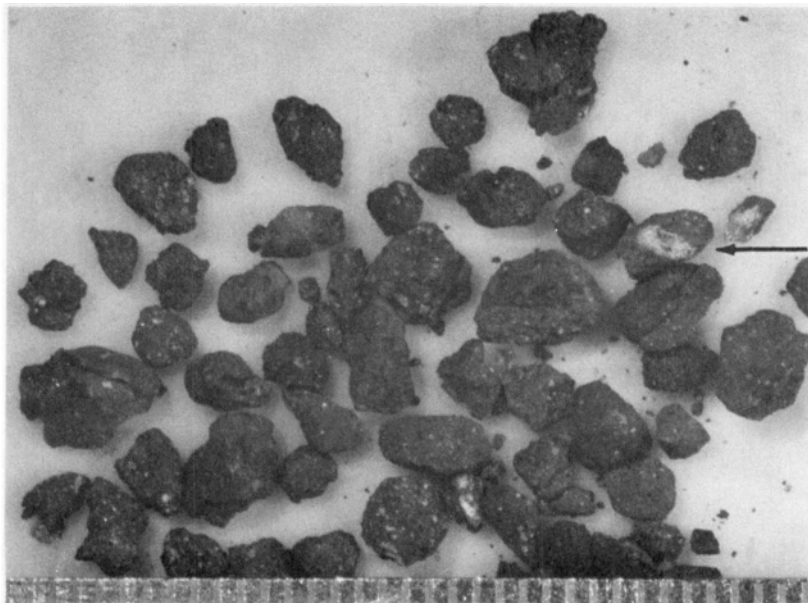
Coherence: Friable to coherent

Shape: Subangular to subrounded

Surface: Rough, grainy

Color: Medium to dark gray

Character: Most particles are standard soil breccias with minute glass, lithic, and mineral clasts; one fragment (arrow in photograph) includes a conspicuous pink-rimmed green clast; and adjacent, much smaller fragment consists mainly of similar pink and green spinel troctolite (?)



12003,185
Unsorted crystallines
Numerous particles; 4.490grams

Coherence: Coarser-grained particles friable; fine-grained
particles strongly coherent
Shape: Angular to subrounded
Surface: Roughness reflects grain size
Color: Ranges from light gray to dark brown
Character: Most of these particles are mare basalts; also
present are a few sugary, recrystallized impact melts,



12003,186

Aphanites and very fine-grained crystallines

31 particles; 1.290 grams

Coherence: Strongly coherent to tough

Shape: Angular

Surface: Relatively smooth; fine-grained sugary texture;
partly dust coated

Color: Dark brown

Character: Nondescript recrystallized-glassy materials of
uncertain composition



FOR REPRODUCTION PURPOSES ONLY - NOT TO BE USED FOR OTHER PURPOSES

12023,0 4-10mm
2 particles; 0.360 grams

12023,78a
Aphanite

Coherence: Tough
Shape: Subangular, blocky
Surface: Relatively smooth; delicately grooved; sparse zap pits
Color: Medium gray
Character: Nondescript; probably a glass matrix breccia

12023,78b
Soil breccia

Coherence: Moderately coherent
Shape: Subrounded
Surface: Partly coated with brown, vesicular glass
Character: Polymict, with numerous visible clast types



12023,0 2-4nun
3 Subsamples (,79 ,80 ,81)

12023,79

Soil breccias and agglutinates

24 particles; 0.470 grams

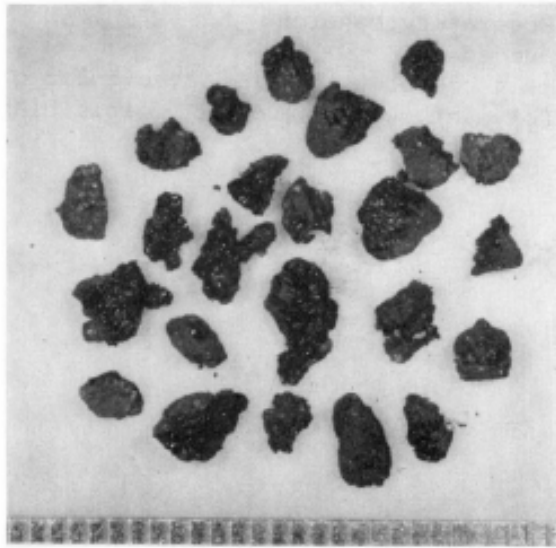
Coherence: Friable to moderately coherent

Shape: Subrounded, irregular

Surface: Partly coated with dark vesicular glass

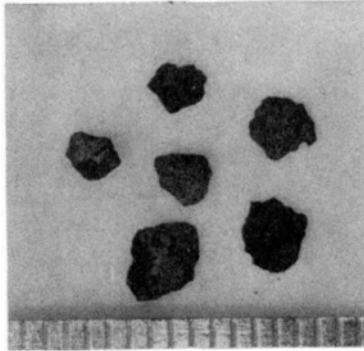
Color : Medium to dark gray breccias; brown glass

Character: Mare regolith products



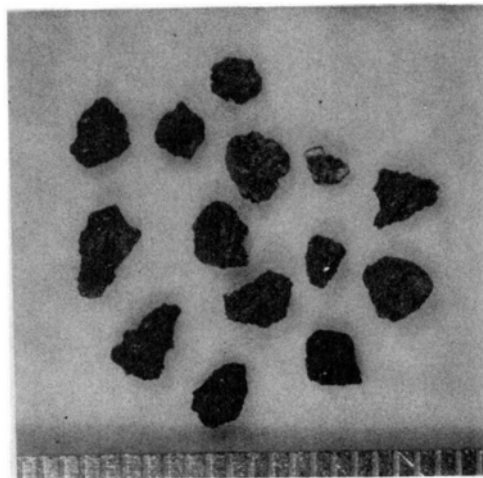
12023,80
Glass-rich fragments
6 particles; 0.100 grams

Coherence: Tough to brittle
Shape: Angular to ropy
Surface: Rough; conchoidal fracture
Color: Light to medium gray
Character: 5 particles are KREEP-rich ropy glass; one particle
(top in photograph) is a chunk of brown, vitreous, vesicular
glass.



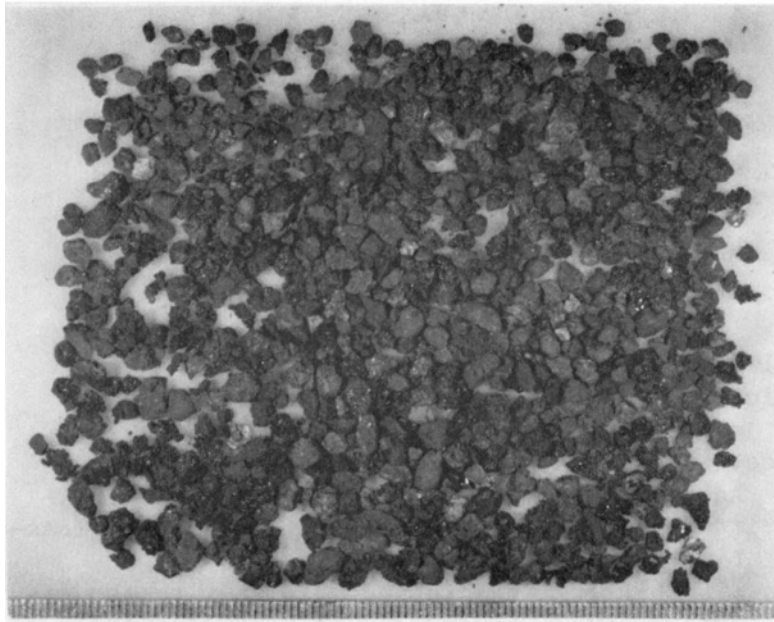
12023,81
Crystallines
14 particles; 0.260 grams

Coherence: Moderately coherent to tough
Shape: Angular
Surface: Rough and grainy; one particle partly glass-coated
Color: Light brown to dark gray
Character: Chiefly fine-grained basalts with about 40%
plagioclase, 50% pyroxene and olivine, and 10% opaques; a
few particles are aphanitic, recrystallized impact melts (?);
one (left center in photograph) is a lithified soil breccia
splashed with dark glass.



12023,82 1-2nun
Bulk Sample; 1.400grams

Character: Particles in this size range were not sorted and counted. The photograph shows the materials present: mainly soil breccias, agglutinates, and fragments of dark glass; basalts and chunks of ropy glass make up a small percentage of the sample, and there are about 5 light gray plagioclase-rich particles.



12023,0 2-4mm
4 Subsamples (,84 ,85 ,86 ,87)

12023,84

Agglutinates and soil breccias
18 particles; 0.450 grams

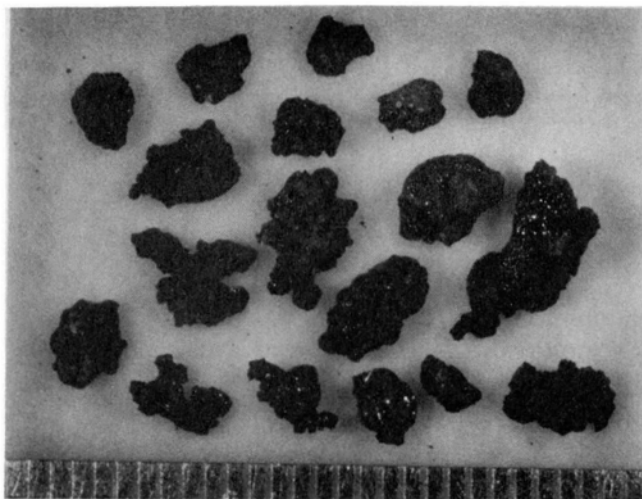
Coherence: Coherent to brittle

Shape: Irregular

Surface: Smooth soil breccias with lumpy, vesicular glass
coatings

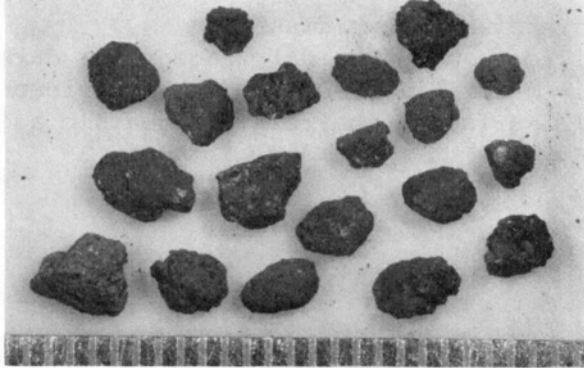
Color: Dark gray breccias; brown glass

Character: 1 particle is a conchoidal fragment of dark vesicular
glass; 5 particles are soil breccias with conspicuous patches
of glass on their surfaces; the rest are classic agglutinates .



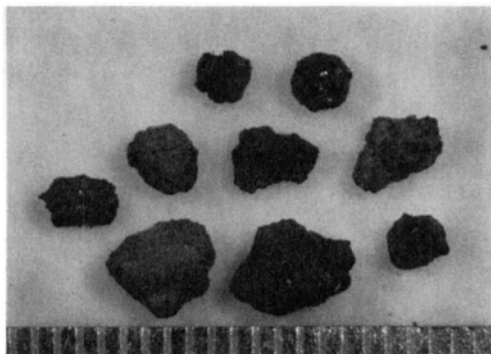
12023,85
Soil breccias
19 particles; 0.330 grams

Coherence: Friable to coherent
Shape: Rounded to subangular
Surface: Smooth, fine-grained, with small patches of vesicular
glass on 4 particles
Color: Medium to dark gray
Character: Typical soil breccias of a mare regolith



12023,86
Glass-rich fragments
9 particles; 0.270 grams

Coherence: Tough to brittle
Shape: Roughly spherical to ropy and irregular
Surface: Rough
Color: Light gray and dull to dark and vitreous
Character: Several particles are typical ropy KREEP-rich
glasses; one (upper right in photograph) is a devitrified
spherule with a cindery surface; the rest are blocky,
nondescript aphanites.



12023,87

Basalts and norites

14 particles; 0.390 grams

Basalts (9 particles at right in photograph)

Coherence: Friable to coherent

Shape: Angular

Surface: Rough, grainy; vuggy

Color: Predominantly golden to cinnamon brown

Character: A range of coarse to fine-grained mare basalts

Norites (5 particles at left in photograph)

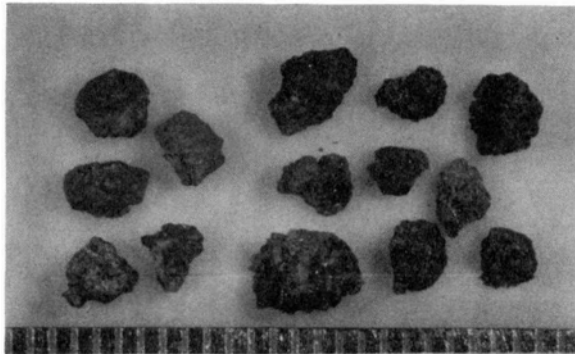
Coherence: Coherent to tough

Shape: Angular, blocky

Surface: Relatively smooth

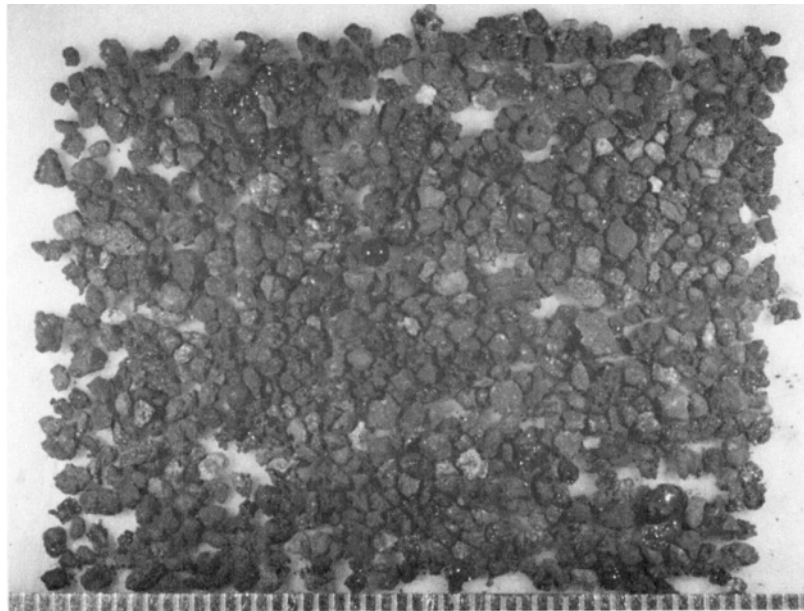
Color: Light gray

Character: 3 fine-grained crystalline particles with a sugary texture; two coherent, recrystallized breccias



12023,88 1-2mrn
Numerous particles; 2.370 grams

Character: A sieved but unsorted soil sample with the full range of Apollo 12 particle types: one or two conspicuous spherules and conchoidal chunks of orange-brown glass, numerous agglutinates, soil breccias, basaltic fragments, noritic particles, and 3 or 4 very light-colored plagioclase-rich particles.



12024,0 >1 cm
2 Subsamples (,15 ,16)

12024,15
Olivine vitrophyre
1 particle; 14.10 grams

Coherence: Tough

Shape: Angular, blocky, with two main surfaces (T and N in photograph) that are almost triangular

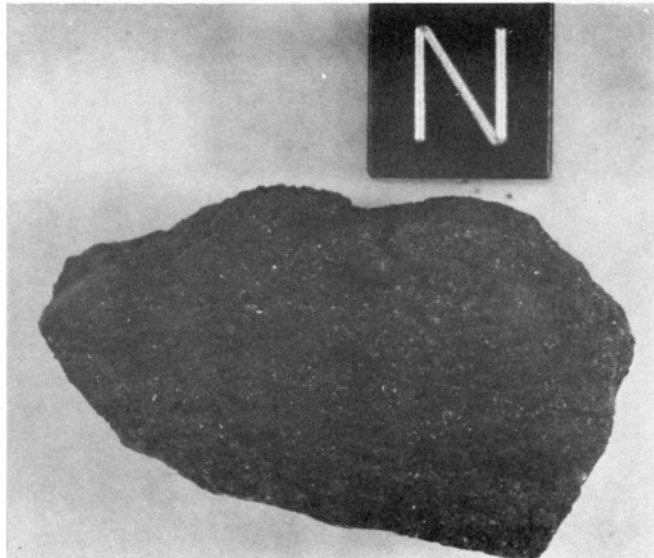
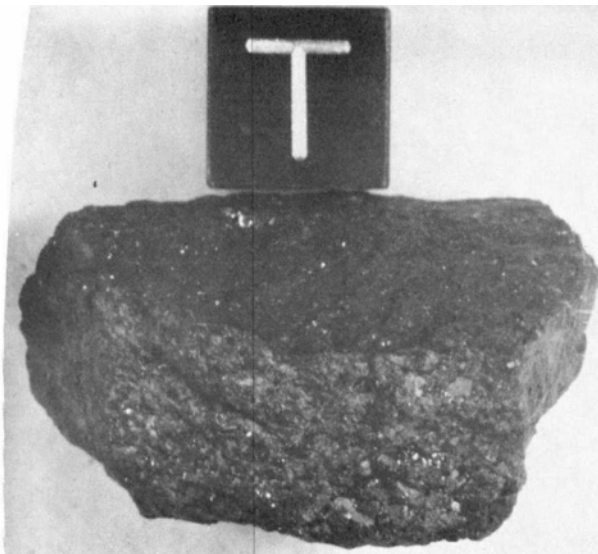
Surface: The "T" surface appears to have been partially molten; it shows a microtopography of tongues and ponds of smooth bronzy glass; the glass is not vesicular and not marked by zap pits; in places it has a quasipolygonal surface pattern resembling that of quenched slags. The glass appears to be part of the rock and not a splashed-on surface coating; it is a very unusual type of occurrence among lunar samples.

The "N" surface is glass-free and shows a strong pattern of microgrooves resembling slickensides trending toward the pointed end (left in photograph). Numerous small step-like cross fractures interrupt the microgrooves at right angles to the lination.

The edges of the specimen are rough and hackly with no glassy surfaces.

Character: A glistening black rock with yellow olivine crystals (averaging 0.5 mm but ranging up to 2 mm) evenly distributed through a cryptocrystalline or glassy matrix. The molten appearance of one surface suggests that this specimen came from the top of a flow where it acquired a protective covering before receiving any micrometeorite bombardment.

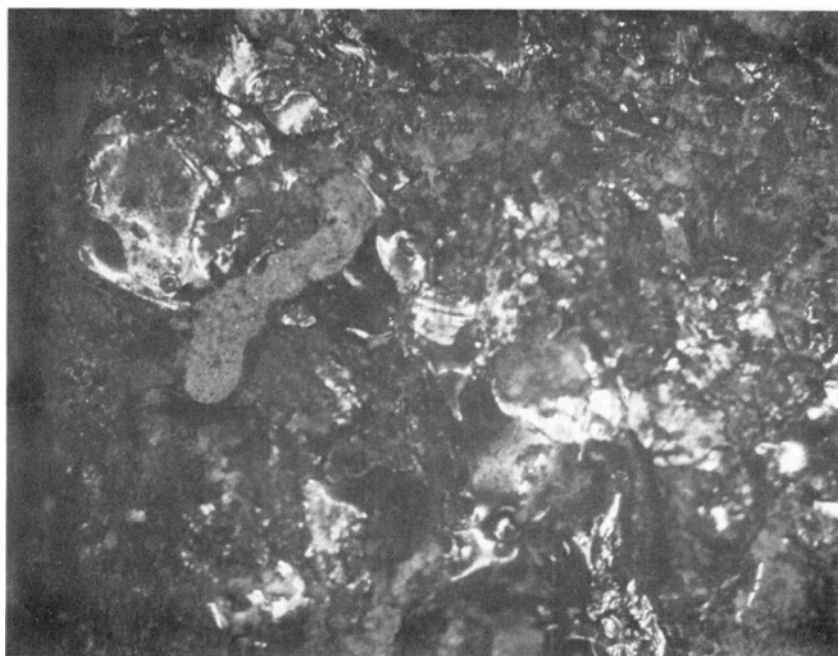
Cube: 1cm



12024,15

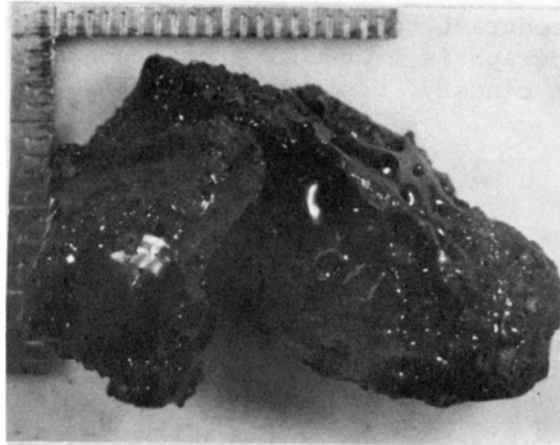
Detail of the glassy surface; polygonal pattern of bronzy glass and a tongue of glass coated with fine soil are visible at upper left.

Width of field: 8mm



12024,16 >1cm
Glass-coated soil breccia
1 composite particle; 18.310 grams

Character: Two large clods of coherent, dark-gray, polymict soil breccia welded together and covered on one side by a thick coating of dark, vesicular glass.



12030,33 >1cm
1 Subsample (,103)

12030,103

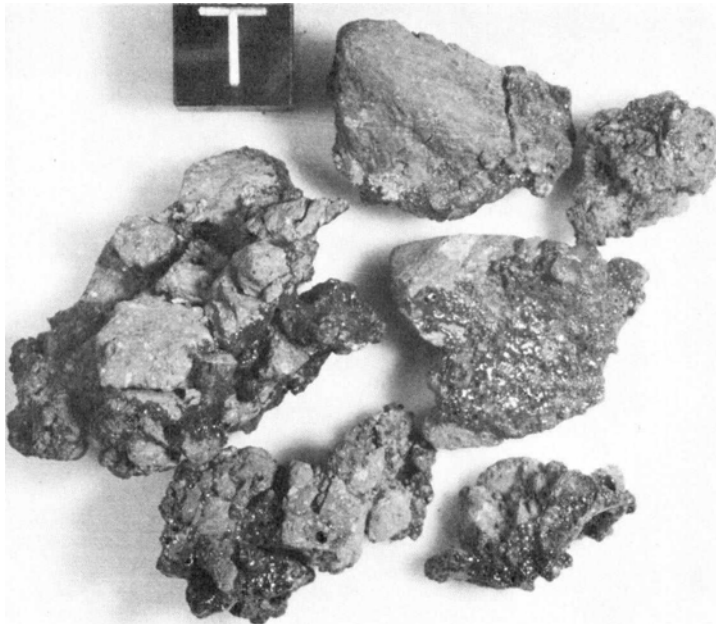
Glass-coated soil breccias
6 particles; 15.560 grams

Coherence: Strongly coherent breccias; brittle glass

Shape: Lumpy, irregular aggregates of subrounded to conical breccias

Surface: Breccia surfaces smooth; glass blebby and vesicular

Character: Fine-grained polymict breccias with a variety of lithic, mineral and glass clasts in a strongly coherent matrix; in contrast to the others the particle at top right in the photograph is a breccia that appears to be sintered to an almost cindery, vesicular texture.

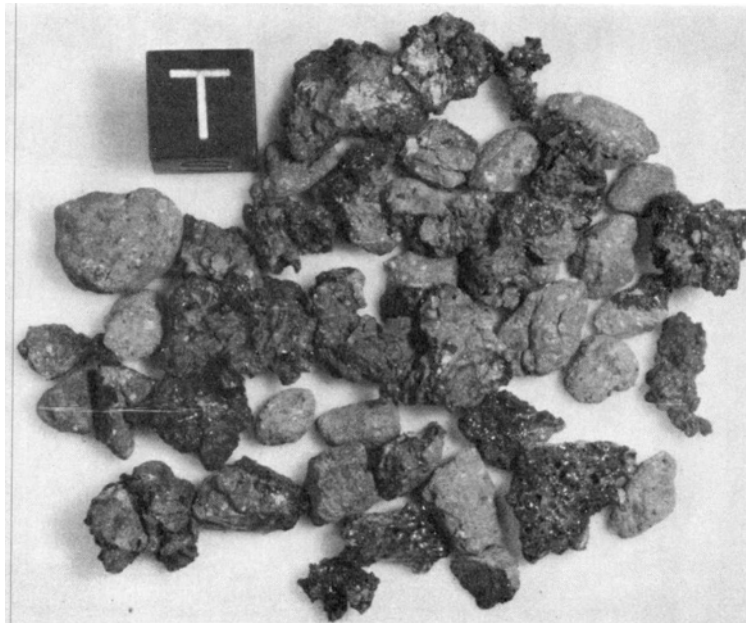


Cube: 1 cm

12030,33 4-10mrn
2 Subsamples (,104 ,105)

12030,104 4-10mrn
Soil breccias and glass-bonded agglutinates
45 particles; 11.940 grams

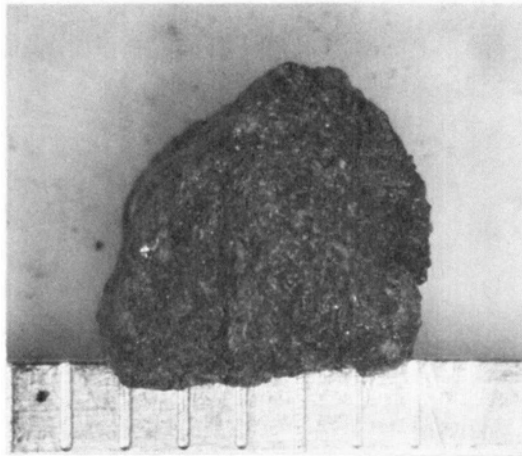
Coherence: Strongly coherent
Shape: Subrounded to irregular, rough, and jagged
Surface: Smooth breccias partially coated with cindery,
vesicular glass
Color: Medium gray breccias; dark brown to black glass
Character: Polymict breccias with numerous clast-types
visible. 16 of the particles are soil clods with little
or no glass on their surfaces; 29 particles are partially
or wholly glassy.



Cube: 1 cm

12030,105 4-IOrun
Vitrophyric basalt
1particle; 0.190 grams

Coherence: Tough
Shape: Angular
Surface: Somewhat rough
Color: Dark brown; semivitreous luster
Character: Appears to be a vitrophyric basalt with fibrous
olivine crystals in a dark, cryptocrystalline or glassy
groundmass.

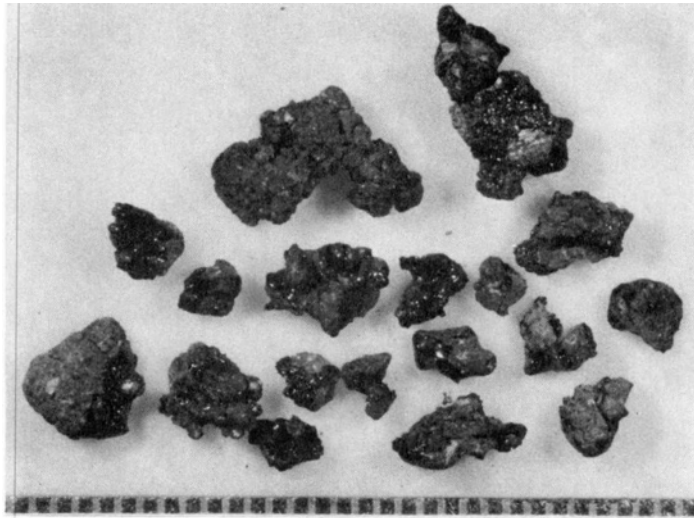


12030,106 2-4mm
3 Subsamples (,111 ,112 ,113)

12030,111

Agglutinates and glass-coated soil breccias
19 particles; 0.570 grams

Coherence: Strongly coherent to brittle
Shape: Angular, irregular
Surface: Rough; partly coated with blebby, vesicular glass
Color: Gray breccias; dark brown glass
Character: Polymict soil breccias with few conspicuous clasts;
clods coated and welded together by glass.



12030,112

Soil breccias

34 particles; 1.030 grams

Coherence: Friable to moderately coherent

Shape: Subangular to subrounded

Surface: Mostly smooth to grainy

Color: Medium gray

Character: Polymict breccias with a wide variety of mineral and lithic clasts and glass spherules; a few particles include sizable basalt clasts.



12030,113

Basalts

10 particles; 0.290 grams

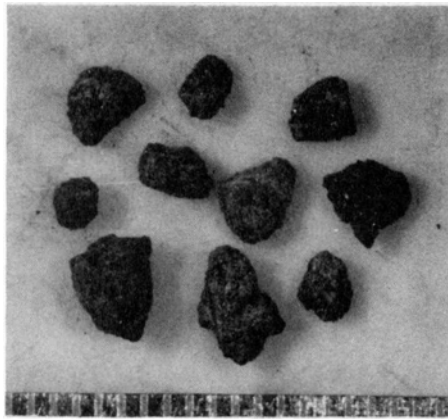
Coherence: Moderately coherent to tough

Shape: Angular to subrounded

Surface: Rough, grainy

Color: Dark brown

Character: Fine-grained basalts with textures ranging from
ophitic to equigranular



12030,3 2-4mm
4 Subsamples (,115 ,116 ,117 ,118)

12030,115

Agglutinates and glass-coated soil breccias
40 particles; 1.130 grams

Coherence: Tough, brittle

Shape: Angular, jagged; conchoidal fracture

Surface: Rough and grainy; glass is vesicular

Color: Gray breccias; dark brown, muddy glass

Character: Most of these particles are mainly or wholly
glassy; some of the breccia remnants appear to be sintered
into tough, sugary masses.



12030,116
Soil breccias
Numerous particles; 2.770 grams

Coherence: Friable to moderately coherent
Shape: Subrounded pellets and clods
Surface: Relatively smooth; some particles shedding dust
Color: Medium to light gray
Character: Polymict breccias containing a wide range of
regolith debris



12030,117

Soil breccias with large lithic clasts
4 particles; 0.340grams

Coherence: Moderately coherent

Shape: Subrounded

Surface: Partly smooth breccia; partly rough crystalline rock

Character: Each of these particles is dominated by a single large lithic clast. Two (top and left) include brown, fine-grained basaltic clasts; the other two contain light gray clasts of norite or anorthositic gabbro.



12030,118

Fine-grained crystallines and aphanites
14 particles; 0.380 grams

Coherence: Strongly coherent to tough

Shape: Angular to subrounded

Surface: Smooth to finely granular; some particles have dust welded to their surfaces.

Color: Light gray to medium brown

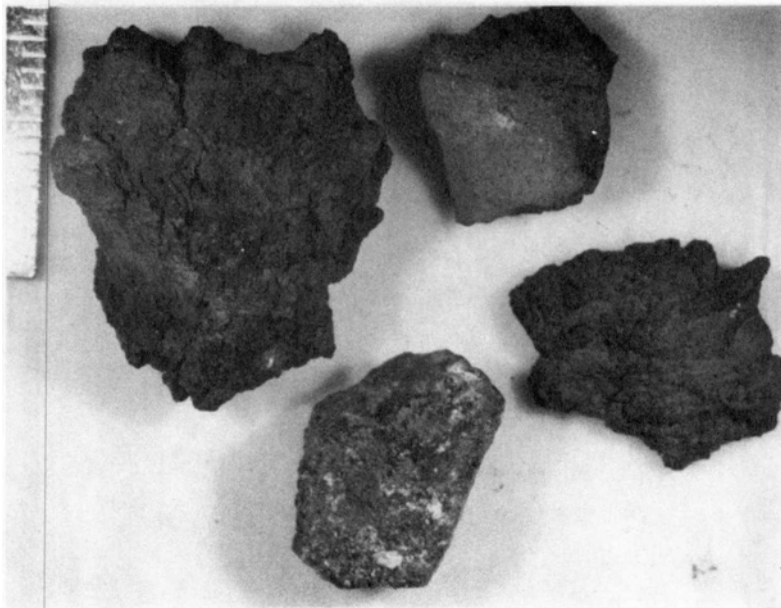
Character: Nondescript fine-grained to partially glassy particles; 9 fragments (bottom two rows) are gray, sugary, recrystallized noritic breccias (?); the rest are probably very fine-grained basalts.



12032,200 >1cm
2 Subsamples (,272 ,273)

12032,272
Glass-rich fragments
4 particles; 12.020 grams

Character: 3 particles are tough, ropy, dark gray fragments of typical KREEP glass; the lower particle in the photograph is a smooth, blocky aphanite with conspicuous white patches and sparse zap pits on the surface. It is probably an annealed norite breccia.



12032,273

Vitrophyric basalt

1 particle; 3.690 grams

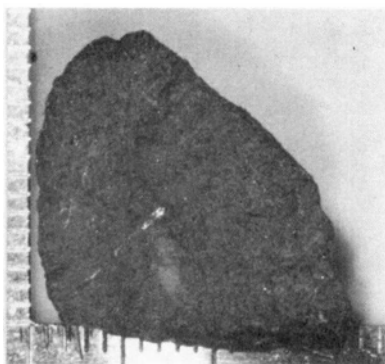
Coherence: Tough

Shape: Subangular

Surface: Somewhat rough

Color: Dark brownish-gray with a seimvitreous luster

Remarks: The vitrophyric nature of the fragment is indicated by the presence of a few needle-like crystallites up to 9mm long (diagonal SW-NE streak in photograph) in an aphanitic matrix.



12032,200 4-10nun
4 Subsamples (,274 ,275 ,276 ,277)

12032,274

Glass-rich fragments
28 particles; 5.940 grams

Coherence: Tough to brittle

Shape: Mostly ropy; a few blocky

Surface: Rough and irregular; many particles coated with
fine dust

Color: Medium to dark gray; white clasts visible in 3 or 4
fragments

Remarks: The majority of these particles are ropy glass typical
of the Apollo 12 KREEP-rich variety; a few have visible clasts
and appear to be recrystallized breccias.



12032,275

Basalts

5 particles; 2.110 grams

Coherence: Friable to tough

Shape: Subrounded to subangular

Surface: Fine-grained particles fairly smooth; coarser one rough, vuggy. 1 particle (lower left in photograph) is partly coated with dark glass.

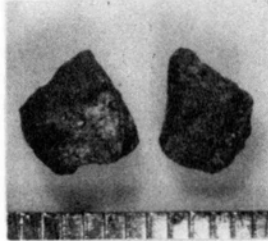
Color: Coarse particle is golden brown; the others, dark brown.

Character: The particle at upper left is a friable, equigranular, olivine basalt. The glass-coated one at lower left is a vitrophyre or metabasalt; the remaining 3 are fine-grained, dark brown basalts.



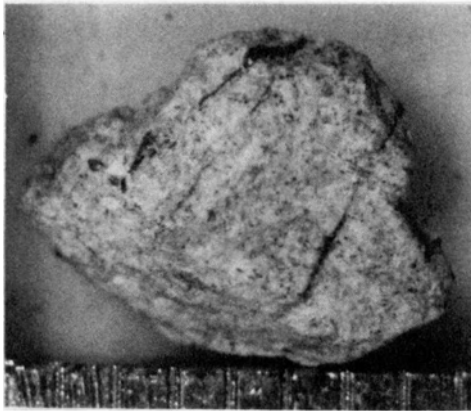
12032,276
Noritic fragments (?)
2 particles; 0.360 grams

Coherence: Tough
Shape: Angular, blocky
Surface: Fairly smooth; one particle partly coated with glass
Color: Dark gray
Character: Dense, sugary-textured particles similar to many
recrystallized noritic breccias.



12032,277
Norite
1 particle; 0.200 grams

Coherence: Moderately coherent
Shape: Subangular
Surface: Relatively smooth due to fine grain size
Color: Light gray pepper-and-salt pattern
Special features: Subparallel microfractures sealed with
veinlets of black glass
Character: A very fine-grained, plagioclase-rich non-mare
rock; probably a shocked and recrystallized norite but
possible a gabbroic anorthosite.



12032,279 1-2mm
1 Subsample (,279)

12032,279
Unsorted
32 particles; 0.120 grams

Character: 29 particles of ropy KREEP-rich glass and glass-coated
soil breccias, and 3 basalts.



12032,278 4-10mm
3 Subsamples (,282 ,283 ,284)

12032,282
Glasses
5 particles; 0.320 grams

Coherence: Brittle
Shape: Ropy
Surface: Rough and partly dust-coated
Color: Dark gray
Remarks: Typical KREEP-rich ropy glasses



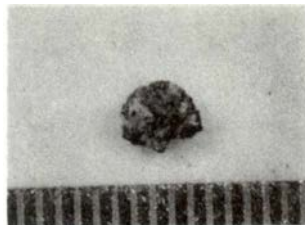
12032,283
Soil breccias
4 particles; 0.290 grams

Coherence: Moderately to strongly coherent
Shape: Subrounded
Surface: Smooth to grainy
Color: Medium gray
Character: Polymict breccias with a variety of clast types
in annealed matrixes



12032,284
Olivine basalt
1 particle; 0.030 grams

Coherence: Friable
Shape: Rounded
Surface: Granular
Color: Golden brown
Character: A medium-grained basalt with about 30% olivine,
30% pyroxene, 35% plagioclase, and 5% opaques.



12033,1 > 1cm
2 Subsamples (,103 ,104)

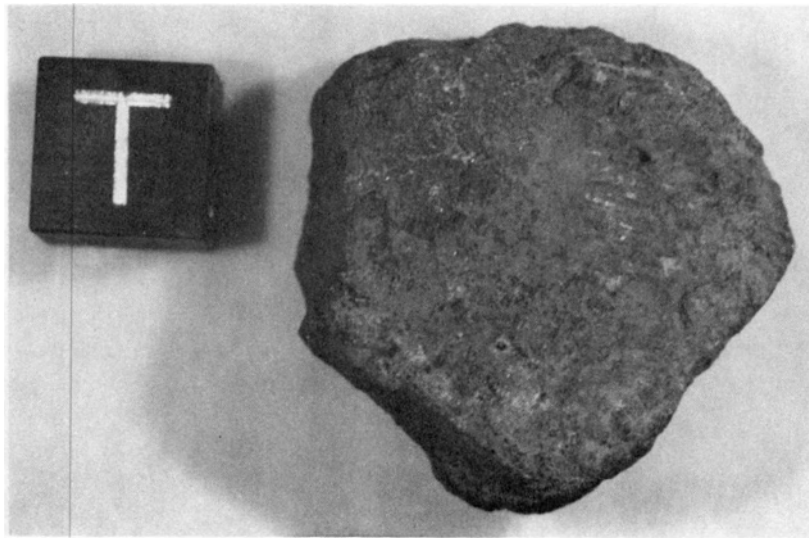
12033,103
Aphanite
1 particle; 3.740 grams

Coherence: Tough
Shape: Subrounded, with 1 curving fractured surface
Surface: Exterior smooth, almost molten in appearance;
coated with fine gray dust
Color: Medium gray
Character: The fractured surface exposes a dense, partly glassy
interior; particle is probably a recrystallized noritic breccia.



12033,104
Basalt (?)
1particle; 17.290

Coherence: Tough
Shape: Subangular
Surface: Coated with fine, adhesive dust; sparse zap pits on
all surfaces; irregular patches of dense, darker gray material
on 2 surfaces
Color: Gray
Character: The interior is not exposed, but gentle scratching on
the surface suggests that this is a very fine-grained mare
basalt. Alternatively, the rock may be a dark, sugary norite.



Cube: 1cm

12033,1 4-1Onun
2 Subsamples (,125 ,126)

12033 ,125

Glasses

11 particles; 7.540 grams

Coherence: Tough, brittle

Shape: Ropy

Surface: Very rough; fine light gray dust welded to some
surfaces; sparse zap pits

Color: Dark gray to blackish; small white clasts visible on
3 particles

Character: The classic types of ropy KREEP-rich glass crowded
with plagioclase crystallites first discovered in sample 12033.



12033,126

Basalts

7 particles; 1.990 grams

Coherence: Coarse-grained particles, moderately friable;
fine-grained ones, coherent

Shape: Subrounded to subangular

Surface: Most are fresh fractures; roughness reflects
grain size. Particle at upper left is vuggy.

Character: Olivine basalts



12033,307 4-10mm
4 Subsamples (,418 ,419 ,420 ,421)

12033,418

Aphanites

22 particles; 3.880 grams

Coherence: Tough, brittle

Shape: Most are ropy, a few angular; conchoidal fracture

Surface: Rough except on fractures; powdery gray dust welded
to exterior surfaces

Color: Medium gray; translucent on fresh fractures

Character: Ropy fragments of KREEP-rich glass; smooth fragments
may be similar or may be recrystallized noritic breccias,



12033,419
Soil breccias
11 particles; 2.370 grams

Coherence: Weakly to moderately coherent
Shape: Most particles subrounded; two or three of the more
coherent ones are angular,
Surface: Grainy; small patches of vesicular brown glass on two
fragments
Color: Medium gray
Character: Polymict breccias with a variety of rock, mineral,
and glass clasts



12033,420

Basalts

4 particles; 1.150 grams

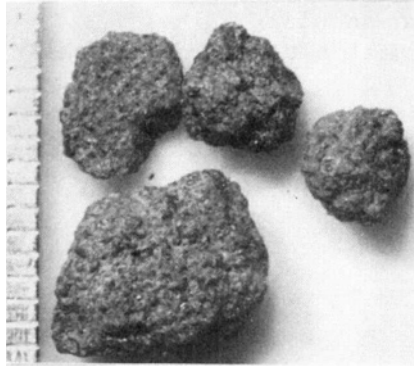
Coherence: Weakly coherent

Shape: Subrounded

Surface: Rough; controlled by individual mineral grains

Color: Golden brown

Character: Mare basalts with fine-grained subophitic texture;
olivine, 1-10%; brown pyroxene, 50-60%; plagioclase, 30-40%;
opaques, 5-10%.



12033,421

2 particles; 1.070 grams

Norite (left *in* photograph)

Coherence: Tough

Shape: Angular, blocky

Surface: Smooth, due to fine-grained, sugary texture

Color: Medium gray

Character: Dense gray fragments of this type generally prove,
on thin sectioning, to be recrystallized noritic breccias.

Basaltic vitrophyre (right *in* photograph)

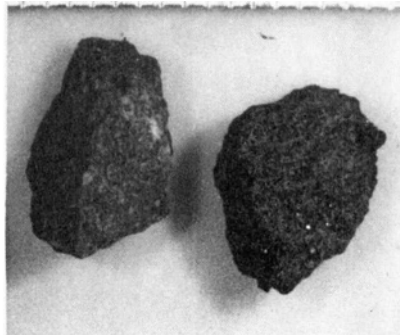
Coherence: Tough

Shape: Angular

Surface: Marked with minute vesicles and sparse zap pits

Color: Black with semivitreous luster

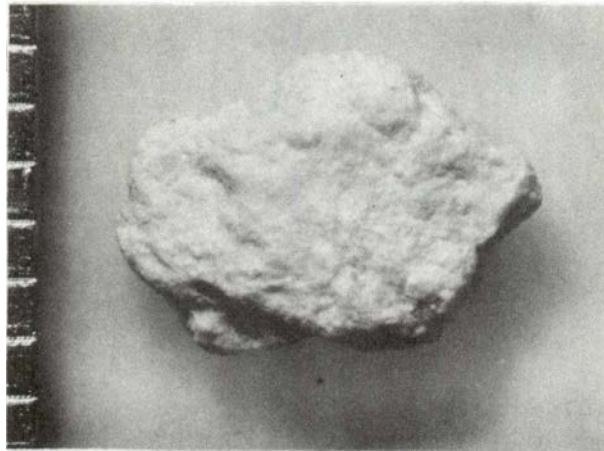
Character: Basaltic rock with fibrous crystallites of pyroxene or
olivine 1-2mm long in a glassy groundmass.



12033,124 4-1Onun
4 Subsamples (,425 ,426 ,427 ,428)

12033,425
Anorthosite
1 particle; 0.130grams

Coherence: Strongly coherent
Shape: Subrounded
Surface: Smoothly undulating
Color: White, with an almost waxy luster
Character: 100% plagioclase; no visible olivine, pyroxene,
or metal grains. Anorthosites of this purity are rare in the
Apollo 12 soils. This particle is so fine-grained that indi-
vidual mineral grains are not distinguishable. It appears to
be a shocked and recrystallized anorthositic breccia .



12033,426

Aphanitic and vitrophyric fragments

4 particles; 7.90 grams

Coherence: Tough

Shape: Subangular

Surface: Fairly smooth; sparse vesicles; zap pits

Color: Dark gray with dull matte texture; black and semi-vitreous

Character: 3 particles of gray, aphanitic recrystallized noritic breccia; 1 particle (lower left in photograph) of basaltic vitrophyre with fibrous crystallites of pyroxene or olivine in a glassy matrix.



12033,427

Basalts

2 particles; 0.570 grams

Coherence: a. Coherent

b. Tough

Shape: a. Rounded

b. Angular

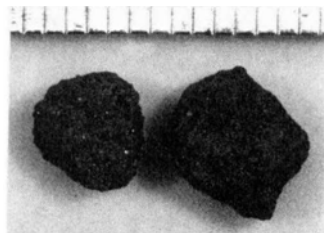
Surface: a. Rough, grainy

b. Relatively smooth and completely covered with adhering dust

Color: Both particles dark brown

Character: a. Fine-grained variolitic to subophitic basalt

b. Dust-coated and nondescript



12033,428
Norites and anorthositic gabbro
4 particles; 0.900 grams

Character: 2 particles (left in photograph) are very fine-grained norites with approximately 50% plagioclase and 50% dark brown pyroxenes plus minute opaques giving the rocks a pepper-and-salt appearance.

1 particle (lower right) is a dense, gray, sugary norite in which the mineral components are indistinguishable.

1 particle (upper right) is a coarse-grained, . rounded fragment with a waxy luster and sparse zap pits. It appears to consist of about 55% plagioclase and 45% yellow-brown olivine or pyroxene.



12037,1 4-10mm
3 Subsamples (,156 ,157 ,158)

12037,156

Basalts

14 particles; 3.400 grams

Coherence: Medium-grained particles are friable; fine-grained ones, coherent.

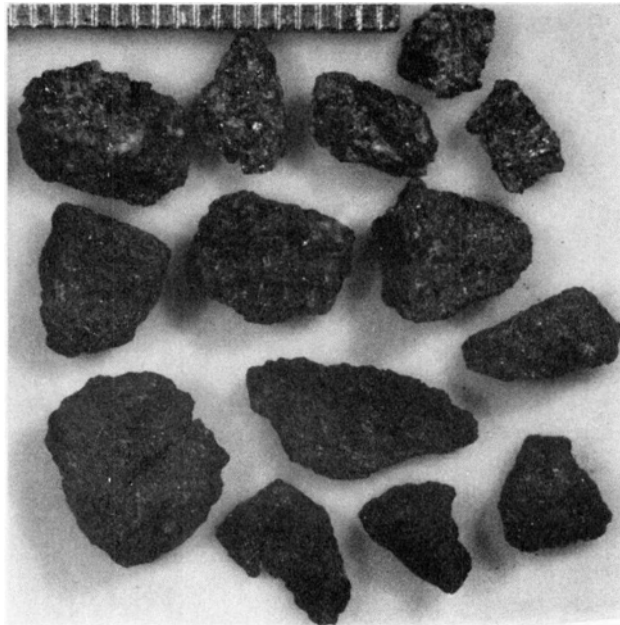
Shape: Angular to subangular

Surfaces: Roughness reflects grain size

Character: 6 medium-grained particles (top row and second row) are golden-brown olivine basalts: pyroxene 30%, olivine 30%, plagioclase 35%, opaques 5%.

3 particles (bottom row, left) are dense gray crystallines; poikilitic or variolitic basalts. Mineral components are indistinguishable.

The remaining 5 particles are fine-grained basalts with about 60% pyroxene, 15% olivine, 20% plagioclase and 5% opaques.



12037,157
Soil breccia
1particle; 1.550 grams

Coherence: Strongly coherent
Shape: Subangular
Surface: Fairly smooth
Color: Medium gray matrix with an abundance of light colored
clasts
Character: Polymict breccia with recrystallized matrix; clast
types include several 1-3mm fragments of basalt.



12037,158
Aphanite
1particle; 0.230 grams

Coherence: Tough
Shape: Angular, blocky
Surface: Fairly smooth
Color: Medium gray
Character: A dense, sugary crystalline rock; a recrystallized
impact melt or noritic breccia (?)



12037,2 2-4nun
6 Subsamples (,161-,166)

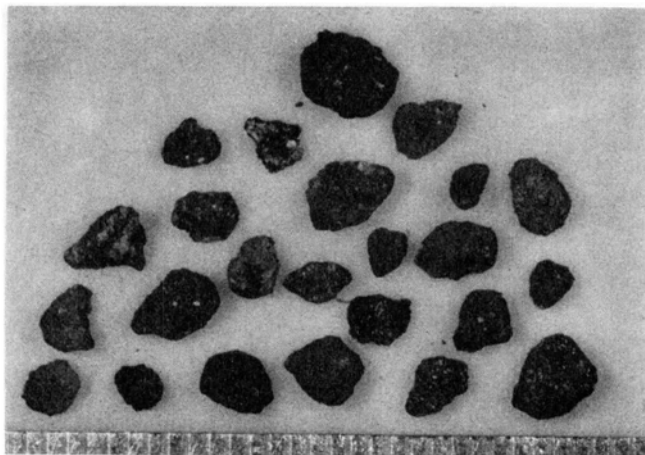
12037,161
Glassy and aphanitic fragments
12 particles; 0.370 grams

This assortment includes 4 agglutinates (bottom row of photograph), which are a relatively rare type of particle in sample 12037. Also present are 4 rough, brittle fragments of light gray ropy KREEP-rich glass, and 4 blocky, cryptocrystalline particles.



12037,162
Soil breccias
24 particles; 0.520 grams

Coherence: Friable to moderately coherent
Shape: Rounded to subrounded
Surface: Grainy; a few are partially glass-coated
Color: Medium to dark gray with microclasts
Character: **Unexceptional**



12037,163

Basalts

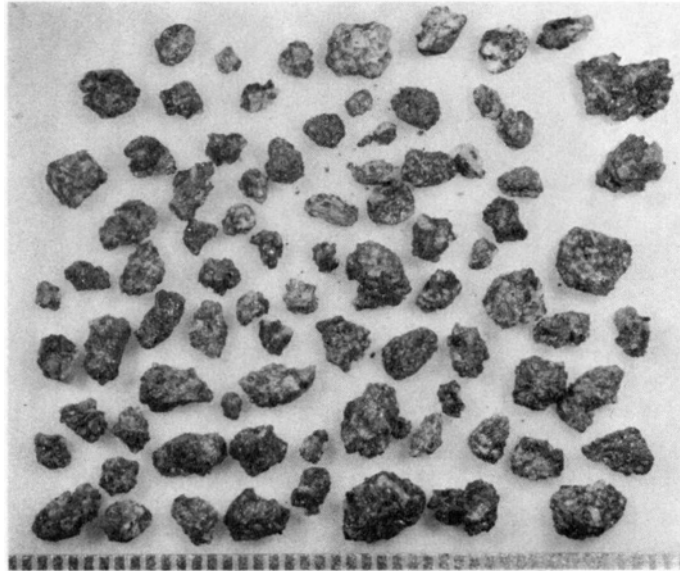
Numerous fragments; 2.430 grams

Coherence: Friable to coherent

Shape: Angular

Surface: Fairly rough; determined by coarse (1-3mm) grain size

Character: Predominantly light-colored basalts rich in plagioclase, yellow olivine, and cinnamon pyroxene; a few particles are vuggy with euhedral olivine crystals in the voids. Most of the particles in this sample are probably fragments of rock 12036.



12037,164

Fine-grained crystalline and glassy fragments

44 particles; 1.480 grams

Coherence: Tough

Shape: Angular

Surface: Rough

Color: Predominantly dark brown

Character: This assortment includes several fibrous aphanitic particles of variolitic basalt or devitrified glass, and numerous very fine-grained basalts or impact melts.



12037,165

Noritic (?) fragments

14 particles; 0.300 grams

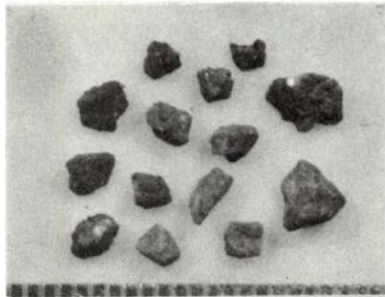
Coherence: Tough

Shape: Angular, blocky

Surface: Relatively smooth

Color: Light gray

Character: Nondescript fine-grained to aphanitic materials;
probably recrystallized noritic microbreccias.



12037,166

Exceptional particle types (in sample 12037)

5 particles; 0.200 grams

Character: 2 fragments of coherent, very fine-grained norites (?)
with a pepper-and-salt texture (at right in photograph)

2 friable, coarse-grained green and white anorthositic
particles (upper left)

1 small fragment of chalky-white shocked plagioclase (lower
left)



12041,4 4-10rrun
Glass spherule
1 particle; 0.250 grams

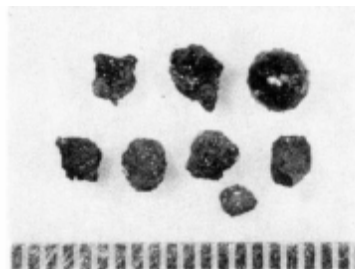
Character: A large, nearly spherical bomblet of muddy brown glass with a semivitreous luster; surface marked by minute blebs and gas cavities; one side is rough and has a clod of soil welded to it.



12041,3 2-4rrun
3 Subsamples (,73 ,74 ,75)

12041,73
Soil breccias and vesicular glasses
8 particles; 0.160 grams

Coherence: Coherent to brittle
Shape: Subangular breccias; 1 spherule
Surface: Rough and grainy; spherule studded with soil grains and pitted with gas cavities
Character: Mare regolith products; medium gray, polymict soil breccias and muddy vesicular impact glasses.



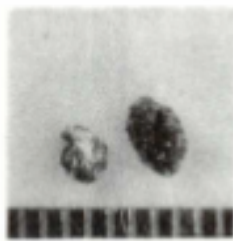
12041,74
Aphanites; norites (?)
4 particles; 0.250 grams

Coherence: Tough
Shape: Subangular
Surface: Rough, with sintered texture
Color: Light gray
Character: Particles are nondescript mineralogically but probably noritic in composition.



12041,75
Basalts
2 particles; 0.010 grams

Coherence: Moderately friable
Shape: Rounded
Surface: Grainy, except where one particle (right) is dominated by a single large glass-lined zap pit
Color: Yellow-brown
Mineralogy: Fine-grained; pyroxene 65%, plagioclase 35%



12042,182 4-10mm
3 Subsamples (,242 ,243 ,244)

12042,242

Soil breccias

2 particles; 0.190 grams

Coherence and shape: 1 friable and rounded; 1 angular and coherent (top in photograph)

Character: Two polymict soil breccias, one much more strongly annealed than the other

12042,243

Norite

1 particle; 0.260 grams

Coherence and shape: Strongly coherent; rounded and lumpy

Surface: Smooth; with zap pits on all but one small area

Color: Light gray

Character: Fine-grained norite with plagioclase and pyroxene in pepper-and-salt texture (lower left).

12042,244

Basalt

1 particle; 0.090 grams

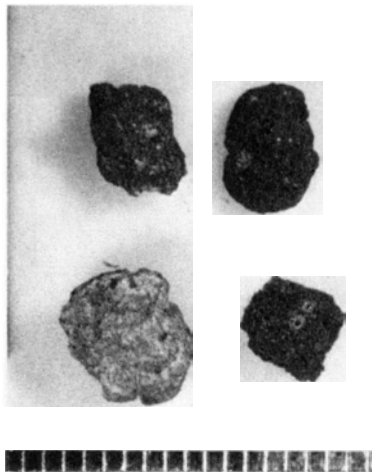
Coherence: Tough

Shape: Angular, blocky

Surface: Rough, with zap pits on 2 sides

Color: Dark brown

Character: An aphanitic to fine-grained particle; probably a vitrophyric basalt (.lower right).



12042,2 2-4nun
3 Subsamples (,245 ,246 ,247)

12042,245
Glass-rich fragments
29 particles; 0.340 grams

Coherence: Tough to brittle
Shape: Angular, jagged, irregular; 1 spherule
Surface: Mostly rough, vesicular; spherule is smooth, vitreous.
Character: Mare regolith products: agglutinates, glass-coated
soil breccias, conchoidal chunks and spherule of dark glass.
A few dense aphanites may be crystallized noritic breccias.



12042,246
Soil breccias
29 particles; 0.650 grams

Coherence: Weakly to strongly coherent
Shape: Subangular to subrounded
Surface: Relatively smooth but slightly grainy; patches of vesicular glass on a few fragments
Color: Medium to dark gray
Character: Polymict breccias with a variety of mineral, lithic, and glass clasts; 1 particle is dominated by a large basalt clast



12042,247
Aphanites
14 particles; 0.290 grams

Coherence: Tough
Shape: Angular, blocky
Surface: Rough, sugary
Color: Medium gray to brownish
Character: Very fine-grained cryptocrystalline to glassy particles; probably recrystallized noritic breccias.



12044,39 4-10mm
Shattered glass spherule
8 shards; 0.050 grams

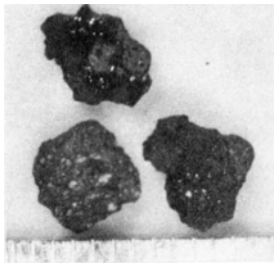
Coherence: Brittle
Shape: Conchoidal shards of a single, large, hollow spherule
Surface: Generally smooth, with minute mounds and droplets on
the convex, exterior surfaces
Color: Dark brown with a greenish hue; vitreous luster
Remarks: This spherule was broken and designated as a single
subsample previous to cataloguing -



12044,24 4-10rnm
2 Subsamples (,111 ,112)

12044,111
Soil breccias
3 particles; 0.290 grams

Coherence: Moderately tough
Shape: Subangular
Surface: Two particles partially coated with black vesicular
glass
Color: Medium gray
Mineralogy: Polymict breccias with conspicuous clasts



12044,112
Basalts
5 Particles; 0.950 grams

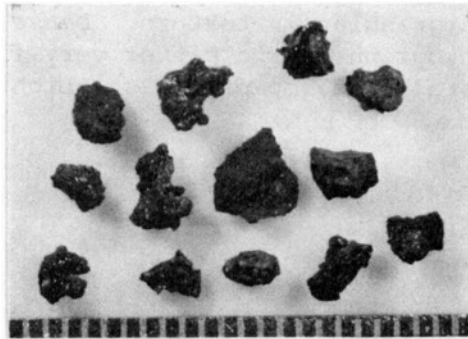
Coherence: Weakly coherent
Shape: Subangular
Surface: Rough; controlled by fine to medium grain size
Color: Golden brown
Mineralogy: Subophitic to equigranular textures; 55-60% pyroxene,
0-10% olivine; 40-45% plagioclase, 5% opaques



12044,23 2-4mm
4 Subsamples (,115 ,116 ,117 ,118)

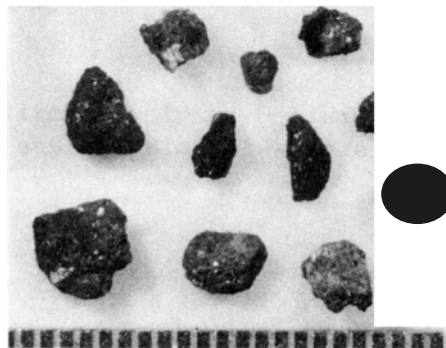
12044,115
Glass-rich fragments
13 particles; 0.220 grams

Coherence: Tough to brittle
Shape: Angular, irregular
Surface: Rough, granular; partially coated with vesicular glass
Character: Mare regolith products; agglutinates, dark vesicular glass, glass-coated soil breccias, dense sintered or devitrified materials .



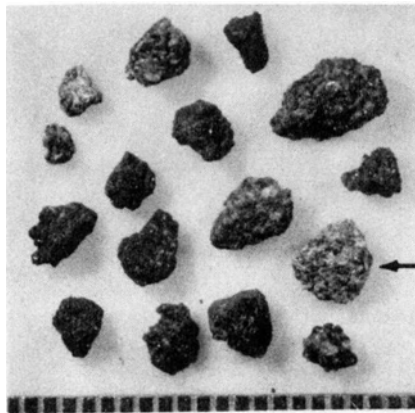
12044,116
Soil breccias
11 particles; 0.290 grams

Coherence: Moderately coherent
Shape: Subrounded to angular
Surface: Small patches of glass on some particles
Color: Light to medium gray
Character: Polymict breccias with mineral, lithic, and glass clasts



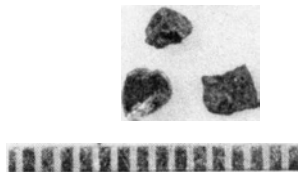
12044,117
Crystallines
16 particles; 0.480 grams

Coherence: Friable to strongly coherent
Shape: Subrounded
Surface: Rough, grainy
Color: Light gray through golden to dark brown
Character: Particles grouped as "igneous-looking" crystallines; all are fine-grained, most are mare basalts ranging from variolitic to equigranular in texture. Dense fragments at lower left in photograph may be either very fine-grained basalts or recrystallized impact melts. Light gray particle (arrow) is a norite.



12044,118
Aphanites
4 particles; 0.050 grams

Coherence: Very tough
Shape: Blocky, angular
Surface: Smooth to finely sugary
Color: Light gray
Character: Dense, fine-grained to glassy noritic materials; one particle includes a large white plagioclase clast.

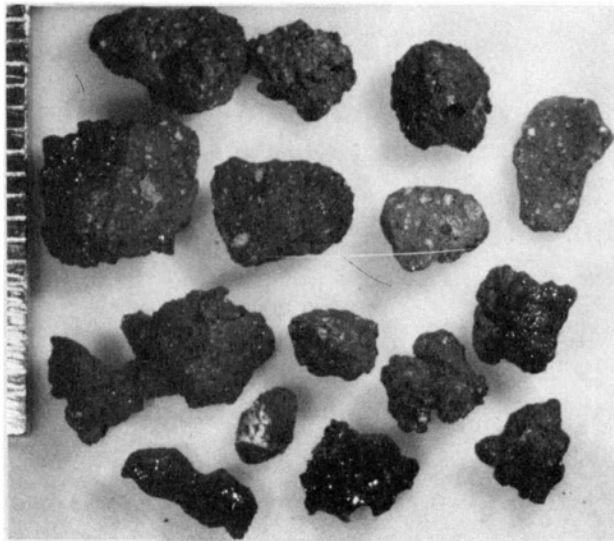


12070,135 4-10mm
2 Subsamples (,788 ,789)

12070,788

Soil breccias and vesicular glasses
16 particles; 1.220 grams

Coherence: Moderately coherent to tough; brittle
Shape: Subrounded to angular; irregular
Surface: Smooth to rough and grainy; patches of vesicular glass; sparse zap pits
Character: Mare regolith products; medium to dark gray polymict breccias and conchoidal fragments of brown, vesicular glass.



12070,789

Vitrophyre
1 particle; 0.320 grams

Coherence: Tough
Shape: Angular, blocky
Surface: Relatively smooth; texture very fine-grained to aphanitic
Color: Dark brown
Character: Vitrophyric basalt with crystals of olivine or pyroxene in a cryptocrystalline or glassy groundmass.



ACKNOWLEDGEMENTS

Many thanks are owed to Andrea Mosie of Northrup Services, Inc., who processed and photographed all of the soil samples, and to Melanie Phipps, Linda Prestera, and Karen Motylewski of the Center for Astrophysics, who helped with the typing and editing of the Catalogue.

This project was supported by NASA Contract NGL 09-015-150.

Inventory

<u>Sample</u>	<u>Parent</u>	Size Range	Grams	Page
12001,523	101	4-10mm	0.380	8
,524			0.190	9
,525			0.080	10
12001,528	100	2-4mm	0.230	11
,529			0.700	11
,530			0.720	12
,531			0.450	12
,532			0.810	13
12001,535	119	4-10mm	0.780	14
,536			0.360	14
,537			1.280	15
12001,538	119	2-4mm	0.610	15
,539			0.560	16
,540			0.790	16
,541			0.750	17
,542			0.390	18
,543			0.010	18
12001,544	119	1-2mm	5.090	19
12001,549	4	4-10mm	1.840	20
,550			2.370	21
,551			0.980	22
,552			2.510	22
,553			0.250	23
,554			0.590	23
,555			0.710	24
12001,556	4	2-4mm	7.180	25
,557			0.700	26
,558			2.270	27
,559			1.070	28
,560			0.930	29
12001,561	4	1-2mm	19.260	30
,562			1.390	31
,563			0.290	32
,564			6.330	32

<u>Sample</u>	Parent	Size Range	Grams	<u>Page</u>
12003,174	28	4-10mm	4.190	33
,175			1.150	34
,176			0.790	35
,177			0.450	35
,178			0.490	36
,179			0.100	37
12003,182	27	2-4mm	1.710	38
,183			1.950	39
,184			1.390	40
,185			4.490	41
,186			1.290	42

12023,78	0	4-10mm	0.360	43
12023,79	0	2-4mm	0.470	44
,80			0.100	45
,81			0.260	45
12023,82	0	1-2mm	1.400	46
12023,84	0	2-4mm	0.450	47
,85			0.330	48
,86			0.270	48
,87			0.390	49
12023,88	0	1-2mm	2.370	50

12024,15	0	>1cm	14.100	51,52
,16			8.310	53

12030,103	33	>1cm	15.560	54
12030,104	33	4-10mm	11.940	55
,105			0.190	56
12030,111	106	2-4mm	0.570	57
,112			1.030	58
,113			0.290	59
12030,115	3	2-4mm	1.130	60
,116			2.770	61
,117			0.340	62
,118			0.380	62

Sample	Parent	Size <u>Range</u>	Grams	<u>Page</u>
12032,272	200	>1cm	12.020	63
,273			3.690	64
12032,274	200	4-10mm	5.940	65
,275			2.110	66
,276			0.360	67
,277			0.200	67
12032,279	200	1-2mm	0.120	68
12032,282	278	2-4 mm	0.320	68
,283			0.290	69
,284			0.030	69

12033,103	1	>1cm	3.740	70
,104			17.290	71
12033,125	1	4-10mm	7.540	72
,126	11		1.990	73
12033,418	307	4-10mm	3.880	74
,419			2.370	75
,420			1.150	76
,421			1.070	76
12033,425	124	4-10mm	0.130	77
,426			0.790	78
,427			0.570	78
,428			0.900	79

12037,156	1	4-10mm	3.400	80
,157			1.550	81
,158			0.230	81
12037,161	2	2-4mm	0.370	82
,162			0.520	82
,163			2.430	83
,164			1.480	84
,165			0.300	85
,166			0.200	85

Sample	Parent	Size Range	Grams	Page
12041,4	0	4-10mm	0.230	86
12041,73	3	2-4mm	0.160	86
,74			0.250	87
,75			0.010	87

12042,242	182	4-10mm	0.190	88
,243			0.260	88
,244			0.090	88
12042,245	2	2-4mm	0.340	89
,246			0.650	90
,247			0.290	90

12044,39	22	4-10mm	0.050	91
12044,111	24	4-10mm	0.290	92
,112			0.950	92
12044,115	23	2-4mm	0.220	93
,116			0.290	93
,117			0.480	94
,118			0.050	94

12070,788	135	4-10mm	1.220	95
,789			0.320	95

