



National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

CATALOG OF LUNAR MARE BASALTS GREATER THAN 40 GRAMS

PART 1. MAJOR AND TRACE CHEMISTRY

WITH MEGASCOPIC DESCRIPTIONS and
ROCK AND THIN SECTION PHOTOGRAPHS

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INTRODUCTION

The information in this catalog has been assembled from many sources in an attempt to bring together in one place a comprehensive description of the basaltic rocks returned from the moon which weigh in excess of 40 grams. Three kinds of information are contained in this preliminary edition, megascopic descriptions of the rocks, photographs of each rock and its thin section, if available, and a summary of the major and trace element chemistry, if available.

The megascopic descriptions were drawn from ones completed during the preliminary examination of each sample which are contained in the lunar sample catalogs and from the personal experience of one of the authors (GEL). The individuals who did the descriptions are noted.

The photographs of the rocks were chosen from documentation photographs taken during the preliminary examination. In most cases they show the whole rock, but in some instances photographs were chosen which show broken surfaces because of the increased information content. The thin section photographs were all taken by one of the authors (GEL) at a magnification suitable to show the overall texture of the basalt.

The chemistry was compiled from the published literature and those references used are listed in the bibliography; individual analyses or numbers are not referenced. Major element analyses are averages of all the available, high quality, analyses on each rock. A CIPW calculation of normative minerals is also given. The trace element chemistry was compiled differently. The values for each element are not averages and the technique by which each number was obtained is shown. Isotope dilution (ID) numbers were used where available, then neutron activation analysis (NAA) or X-ray fluorescence (XRF) numbers, and optical emission spectroscopy numbers (OES) were used in that order. This order

varies somewhat from element to element depending on which techniques are most accurate. Unfortunately not all elements have been analyzed for in all rocks, but the coverage is, in general, quite good.

APOLLO 11

ROCK NUMBER: 10003
WEIGHT: 213 g

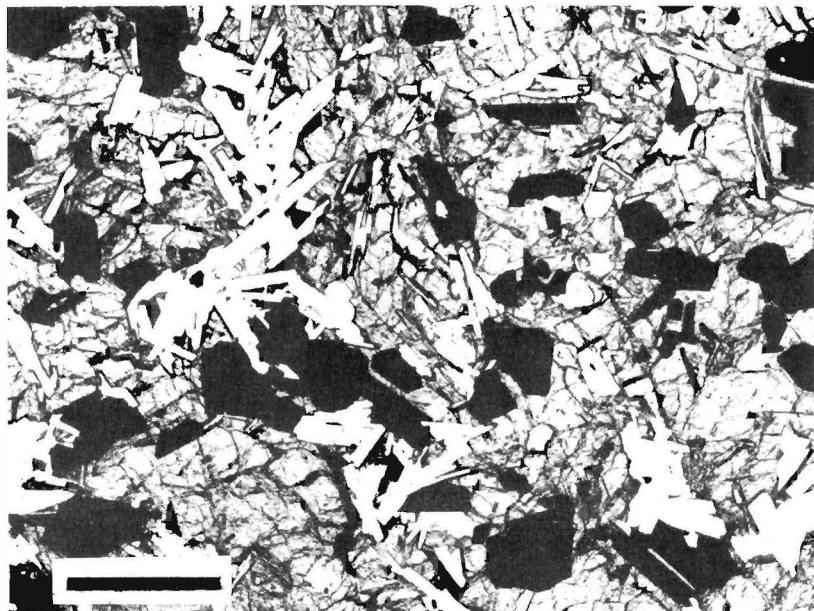
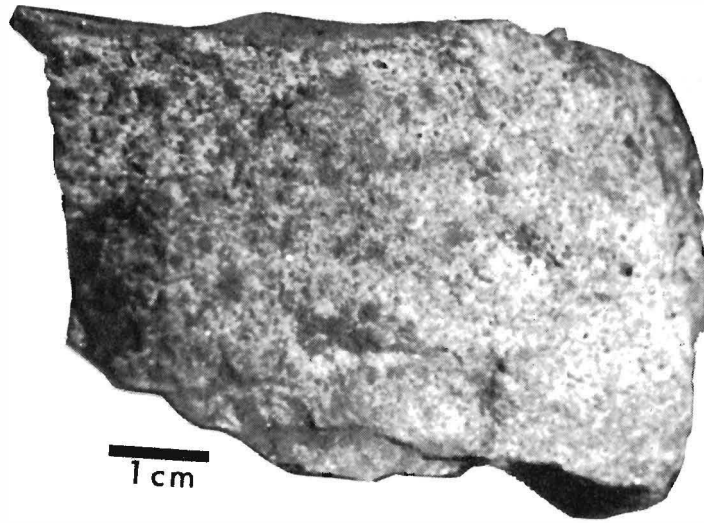
DIMENSIONS: 7 x 4.5 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray (salt and pepper) with a brownish cast
SHAPE: Subangular, tabular
FABRIC: Equigranular, medium-grained
COHERENCE: Coherent
Fracturing: Few-nonpenetrative
VARIABILITY: Homogeneous
SURFACE: Granulated, pitted to a chalky white in places - the white haloes without the glass linings. One large glass splash, 4 x 5 mm, clear to black. Tightly adhering dust.
ZAP PITS: Many glass-lined pits (up to 1 mm diameter glass lining) with white haloes on one surface, other surfaces have few.
CAVITIES: Few vugs (5% by volume) up to 3 mm, many are lined with plagioclase
SPECIAL FEATURES: Large glass splash

BY: Lofgren

10003



.5mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	39.76
TiO ₂	=	10.50
Al ₂ O ₃	=	10.43
FeO	=	19.80
MnO	=	0.3
MgO	=	6.69
CaO	=	11.13
Na ₂ O	=	0.4
K ₂ O	=	0.06
P ₂ O ₅	=	0.12
S	=	0.18
Cr ₂ O ₃	=	0.26
TOTAL		<u>99.63</u>

CIPW NORM

Qtz	=	0.93
Or	=	0.35
Ab	=	3.38
An	=	26.49
Di	=	23.31
Hy	=	24.41
Ne	=	-
Ol	=	-
Chr	=	0.38
Ilm	=	19.94
Apa	=	0.26
TOTAL		<u>99.45</u>

100 Mg/(Mg+Fe) = 37.6
An/Ab/Or = 88/11/1

TRACE AND MINOR ELEMENTS

Li	=	9	(OES)
Rb	=	0.5	(ID)
K	=	440	(ID)
Ba	=	106	(ID)
Sr	=	152.7	(ID)
Cr	=	-	
V	=	63	(NAA)
Sc	=	74	(NAA)
Ni	=	2.6717	(OES)
Co	=	14.1	(NAA)
Cu	=	6.7	(OES)
Zn	=	-	
Th	=	0.971	(ID)
U	=	0.2535	(ID)
Zr	=	309	(XRF)
Hf	=	11.6	(NAA)
Nb	=	21	(OES)

RARE EARTH ELEMENTS (ID)

La	=	14.7
Ce	=	45.5
Pr	=	-
Nd	=	38.3
Sm	=	14
Eu	=	1.76
Gd	=	19
Tb	=	-
Dy	=	21.6
Ho	=	-
Er	=	13.4
Tm	=	-
Yb	=	13
Lu	=	1
Y	=	112 (XRF)

ROCK NUMBER: 10017
WEIGHT: 973 g

DIMENSIONS: 12 x 10 x 8 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray

SHAPE: Subrounded, hemispherical with a flat surface

FABRIC: Fine-grained, granular to subophitic

COHERENCE: Tough

Fracturing: Few, nonpenetrative, subparallel to surface, one penetrative

VARIABILITY: Homogeneous

SURFACE: Chalky white halo material dominates irregular surface

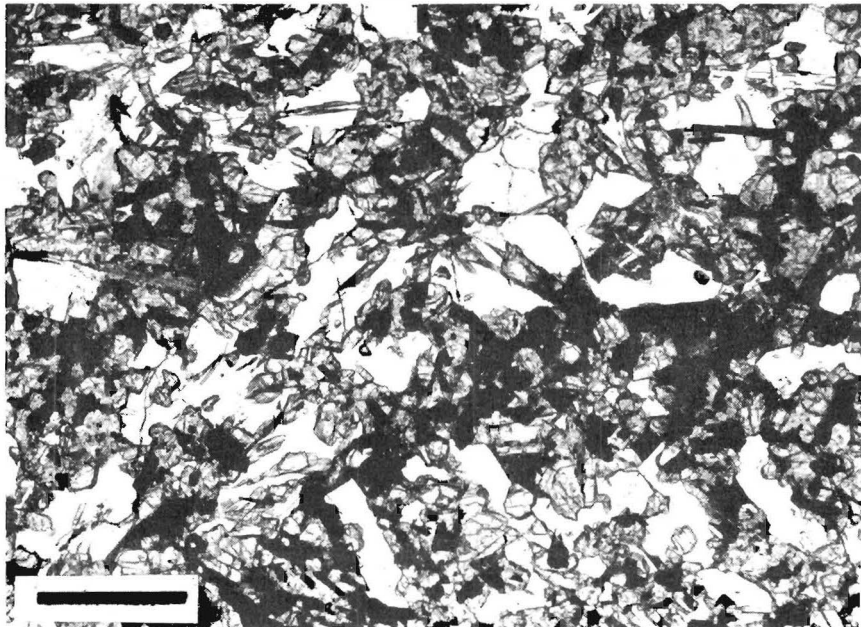
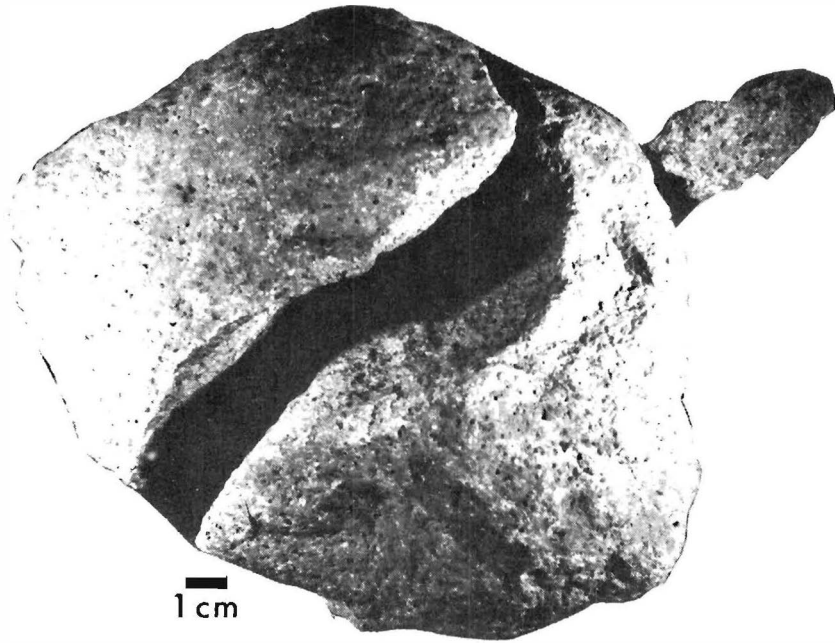
ZAP PITS: Pits with glass linings are sparse, the glass is easily flaked off. The white haloes are common, 1-3 mm diameter

CAVITIES: Vugs and vesicles 1-3 mm, vesicles smooth-walled and glass-lined, 15-20% by volume. Vugs are irregular in shape, some elongate.

SPECIAL FEATURES: One large olivine crystal, rectangular (5 mm long) and not resorbed occurs on freshly (in LRL) fractured surface. Two other olivine phenocrysts were observed.

BY: Lofgren, Morrison

10017



.5 mm

CHEMISTRY

MAJOR ELEMENTS (4)

SiO ₂	=	40.64
TiO ₂	=	11.78
Al ₂ O ₃	=	7.98
FeO	=	19.65
MnO	=	0.24
MgO	=	7.68
CaO	=	10.65
Na ₂ O	=	0.51
K ₂ O	=	0.29
P ₂ O ₅	=	0.16
S	=	0.22
Cr ₂ O ₃	=	0.36
TOTAL		<u>100.16</u>

CIPW NORM

Qtz	=	2.25
Or	=	1.71
Ab	=	4.32
An	=	18.63
Di	=	27.40
Hy	=	22.38
Ne	=	-
Ol	=	-
Chr	=	0.53
Ilm	=	22.37
Apa	=	0.35
TOTAL		<u>99.94</u>

100 Mg/(Mg+Fe) = 41.1
An/Ab/Or = 75/18/7

TRACE AND MINOR ELEMENTS

Li	=	18.1	(ID)
Rb	=	5.63	(ID)
K	=	2092	(ID)
Ba	=	309	(ID)
Sr	=	174.8	(ID)
Cr	=	-	
V	=	46	(NAA)
Sc	=	86	(NAA)
Ni	=	60.034	(AA)
Co	=	31	(RNAA)
Cu	=	7.7	(NAA)
Zn	=	18	(NAA)
Th	=	2.961	(ID)
U	=	0.7840	(ID)
Zr	=	476	(XRF)
Hf	=	17.9	(NAA)
Nb	=	27.4	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	26.6	
Ce	=	77.3	
Pr	=	-	
Nd	=	59.5	
Sm	=	20.9	
Eu	=	2.14	
Gd	=	27.4	
Tb	=	-	
Dy	=	31.7	
Ho	=	-	
Er	=	20.0	
Tm	=	-	
Yb	=	19.2	
Lu	=	2.66	
Y	=	159	(XRF)

ROCK NUMBER: 10020
WEIGHT: 425 g

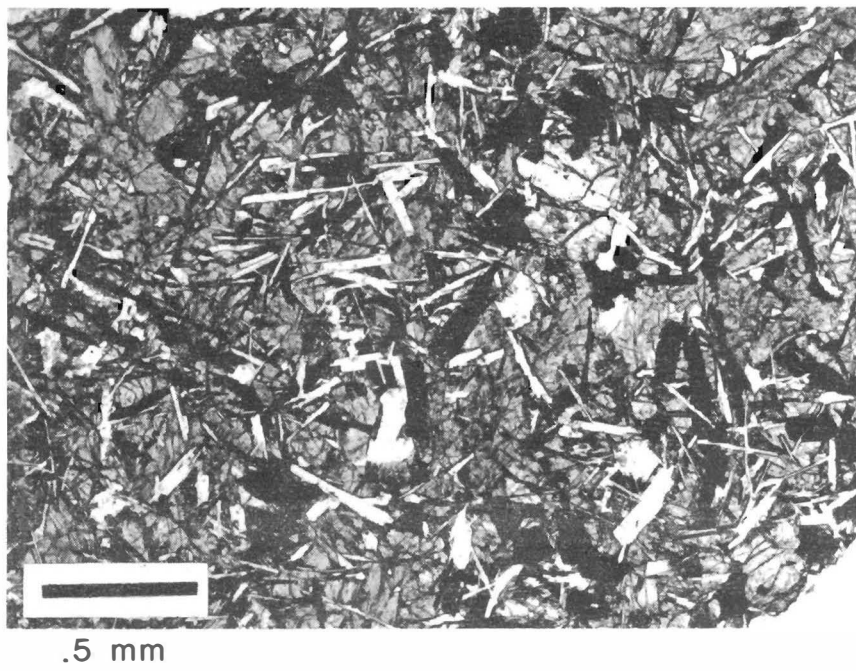
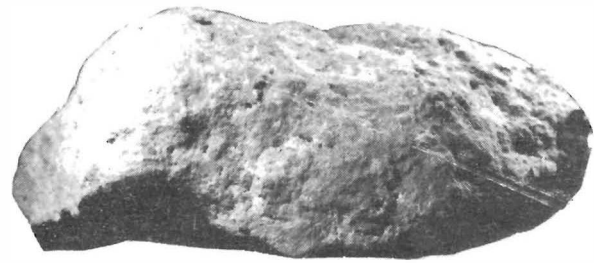
DIMENSIONS: 9 x 8 x 4 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray
SHAPE: Subangular, hemispherical with one flat side
FABRIC: Porphyritic (few olivine phenocrysts), matrix equigranular
COHERENCE: Tough
Fracturing: Very few - nonpenetrative
VARIABILITY: Homogeneous
SURFACE: Speckled white shatter crust on rounded surfaces. Flat surface hackly
ZAP PITS: Many on rounded surface, none on flat side; many pits are glass lined, white haloes without glass centers also common. Pits are shallow with glass center <1 mm, haloes <3 mm.
CAVITIES: Vesicles are spherical and smooth walled and <1 mm, vugs are irregular up to 3 mm with euhedral plagioclase and pyroxene up to 0.5 mm
SPECIAL FEATURES: Large olivine crystals present up to 2-3 mm. One relatively unpitted side.

BY: Lofgren, Wilcox

10020



CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	39.79
TiO ₂	=	10.62
Al ₂ O ₃	=	9.93
FeO	=	19.21
MnO	=	0.26
MgO	=	7.93
CaO	=	11.32
Na ₂ O	=	0.39
K ₂ O	=	0.04
P ₂ O ₅	=	0.09
S	=	0.17
Cr ₂ O ₃	=	0.39

TOTAL		100.14
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CIPW NORM

Qtz	=	-
Or	=	0.26
Ab	=	3.30
An	=	25.21
Di	=	25.08
Hy	=	24.97
Ne	=	-
Ol	=	0.20
Chr	=	0.57
Ilm	=	20.17
Apa	=	0.20

TOTAL		99.98
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100 Mg/(Mg+Fe) = 42.4

An/Ab/Or = 88/11/1

TRACE AND MINOR ELEMENTS

Li	=	12.0	(OES)
Rb	=	0.63	(ID)
K	=	486	(ID)
Ba	=	77.1	(ID)
Sr	=	149.8	(ID)
Cr	=	-	
V	=	81	(XRF)
Sc	=	85	(NAA)
Ni	=	<2	(XRF)
Co	=	5.65	(NAA)
Cu	=	<2	(XRF)
Zn	=	2	(XRF)
Th	=	0.678	(ID)
U	=	0.192	(ID)
Zr	=	224	(XRF)
Hf	=		
Nb	=	17.6	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	8.11	
Ce	=	25.8	
Pr	=	-	
Nd	=	23.9	
Sm	=	9.47	
Eu	=	1.6	
Gd	=	12.8	
Tb	=	-	
Dy	=	15.8	
Ho	=	-	
Er	=	10	
Tm	=	-	
Yb	=	9.87	
Lu	=	1.43	
Y	=	84	(XRF)

ROCK NUMBER: 10022
WEIGHT: 95.6 g

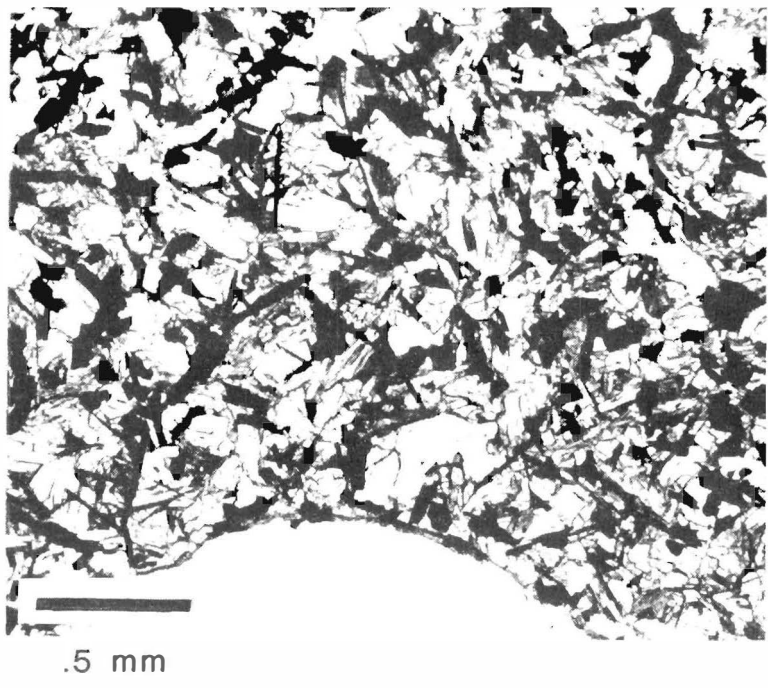
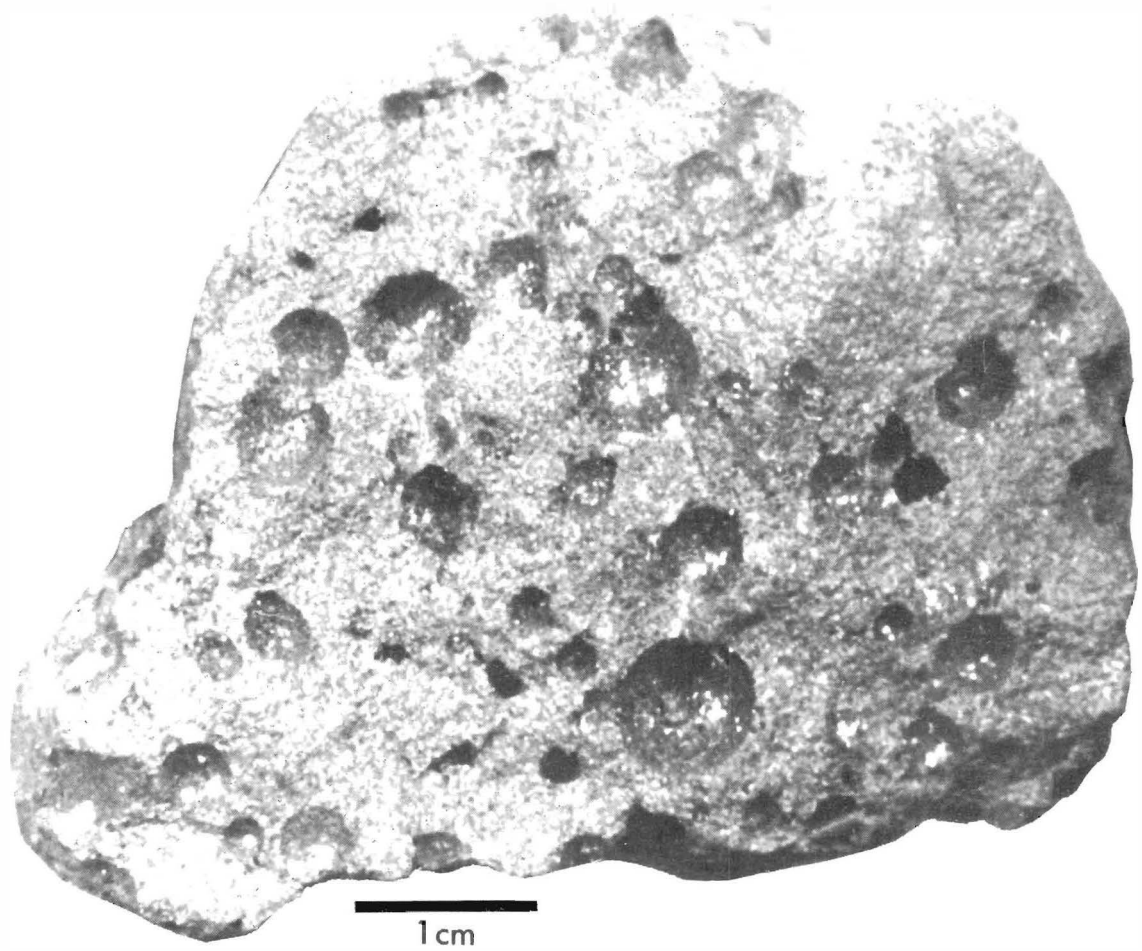
DIMENSIONS: 6 x 4 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray
SHAPE: Subrounded with irregular angular protrusions, elongate
FABRIC: Equigranular, fine-grained
COHERENCE: Tough
Fracturing: Few-nonpenetrative, microcracks with many orientations
VARIABILITY: Homogeneous
SURFACE: Smooth, dust free, with white shatter crust
ZAP PITS: Many shallow, glass-lined pits with white haloes randomly distributed; haloes have concentric exfoliation. Small crusts of glass also randomly distributed, glass varicolored with botryoidal surface
CAVITIES: Vesicles spherical to ovate, 2-3 cm², glittering submetallic lining of very small crystals, most are 1-3 mm
SPECIAL FEATURES: Most vesicular of Apollo 11 collection

BY: Smith, Lofgren

10022



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	40.1
TiO ₂	=	12.2
Al ₂ O ₃	=	8.6
FeO	=	18.9
MnO	=	0.25
MgO	=	7.74
CaO	=	10.7
Na ₂ O	=	0.46
K ₂ O	=	0.3
P ₂ O ₅	=	0.2
S	=	-
Cr ₂ O ₃	=	0.37

TOTAL		99.82
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CIPW NORM

Qtz	=	2.40
Or	=	1.77
Ab	=	3.89
An	=	20.52
Di	=	25.74
Hy	=	21.34
Ne	=	-
Ol	=	-
Chr	=	0.54
Ilm	=	23.17
Apa	=	0.44

TOTAL		99.82
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100 Mg/(Mg+Fe) = 42.2
An/Ab/Or = 78/15/7

TRACE AND MINOR ELEMENTS

Li	=	11.5	(OES)
Rb	=	5.57	(ID)
K	=	2289	(ID)
Ba	=	277	(ID)
Sr	=	163	(ID)
Cr	=	2254	(NAA)
V	=	70	(NAA)
Sc	=	76	(NAA)
Ni	=	9.98	(NAA)
Co	=	29	(NAA)
Cu	=	5.1	(NAA)
Zn	=	2.9	(NAA)
Th	=	-	
U	=	-	
Zr	=	130	(NAA)
Hf	=	21.5	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	26.4
Ce	=	68.5
Pr	=	-
Nd	=	65
Sm	=	21.2
Eu	=	2.01
Gd	=	23.9
Tb	=	4.5
Dy	=	30.1
Ho	=	7.1
Er	=	15.8
Tm	=	-
Yb	=	17.5
Lu	=	2.47
Y	=	-

ROCK NUMBER: 10024
WEIGHT: 68.1 g

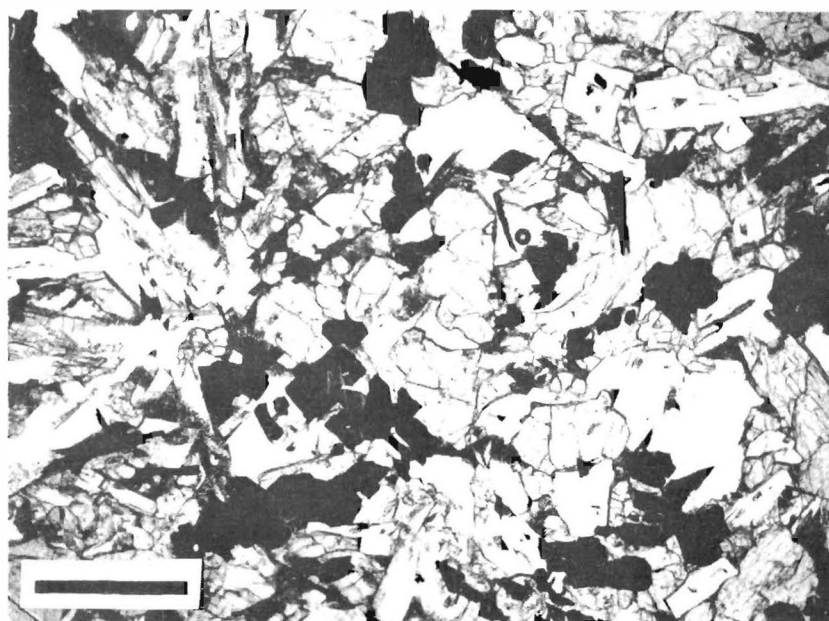
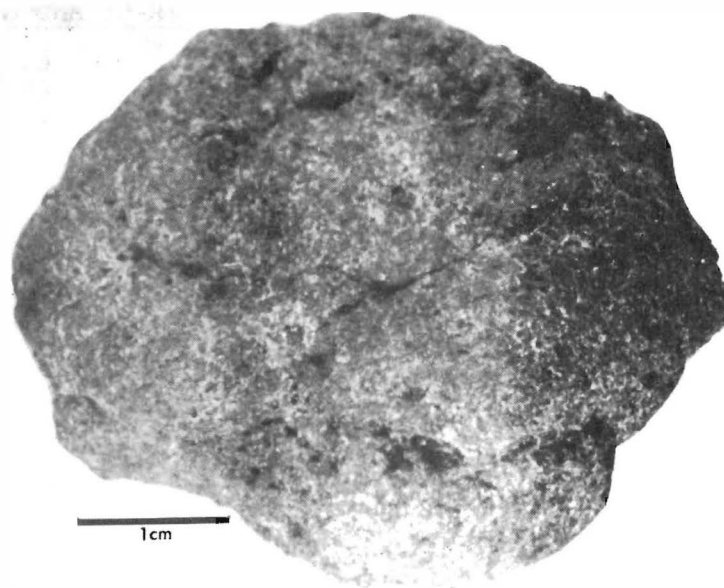
DIMENSIONS: 5 x 4 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Medium light gray
SHAPE: Subangular, dome-shaped, flat fracture on one side
FABRIC: Equigranular, medium-grained
COHERENCE: Friable
Fracturing: Few - nonpenetrative
VARIABILITY: Homogeneous
SURFACE: Granulated, glass patches
ZAP PITS: Few glass-lined pits 2 surfaces, none on others
CAVITIES: Vugs irregularly shaped, up to 2 mm, lined by euhedral
crystals, vesicles <1 mm
SPECIAL FEATURES: Euhedral crystals in vugs, unpitted surfaces

BY: Twedell, Chao, Lofgren

10024



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	40.25
TiO ₂	=	11.9
Al ₂ O ₃	=	8.09
FeO	=	19.46
MnO	=	0.24
MgO	=	7.53
CaO	=	10.66
Na ₂ O	=	0.52
K ₂ O	=	0.3
P ₂ O ₅	=	0.2
S	=	0.22
Cr ₂ O ₃	=	0.38
<hr/>		
TOTAL		99.75

CIPW NORM

Qtz	=	2.24
Or	=	1.77
Ab	=	4.4
An	=	18.86
Di	=	27.05
Hy	=	21.62
Ne	=	-
Ol	=	-
Chr	=	0.56
Ilm	=	22.6
Apa	=	0.44
<hr/>		
TOTAL		99.53

100 Mg/(Mg+Fe) = 40.8
 An/Ab/Or = 75/18/7

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	5.64	(ID)
K	=	2430	(ID)
Ba	=	285	(ID)
Sr	=	167	(ID)
Cr	=	-	
V	=	37	(XRF)
Sc	=	76.2	(NAA)
Ni	=	20.037	(XRF)
Co	=	28.4	(NAA)
Cu	=	16	(XRF)
Zn	=	14	(XRF)
Th	=	4.1	(XRF)
U	=	0.67	(NAA)
Zr	=	375	(XRF)
Hf	=	20	(NAA)
Nb	=	25	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	76.6	
Pr	=	-	
Nd	=	66.1	
Sm	=	23.4	
Eu	=	2.21	
Gd	=	28.6	
Tb	=	-	
Dy	=	33.6	
Ho	=	-	
Er	=	19.3	
Tm	=	-	
Yb	=	16.6	
Lu	=	-	
Y	=	168	(XRF)

ROCK NUMBER: 10044
WEIGHT: 247.5 g

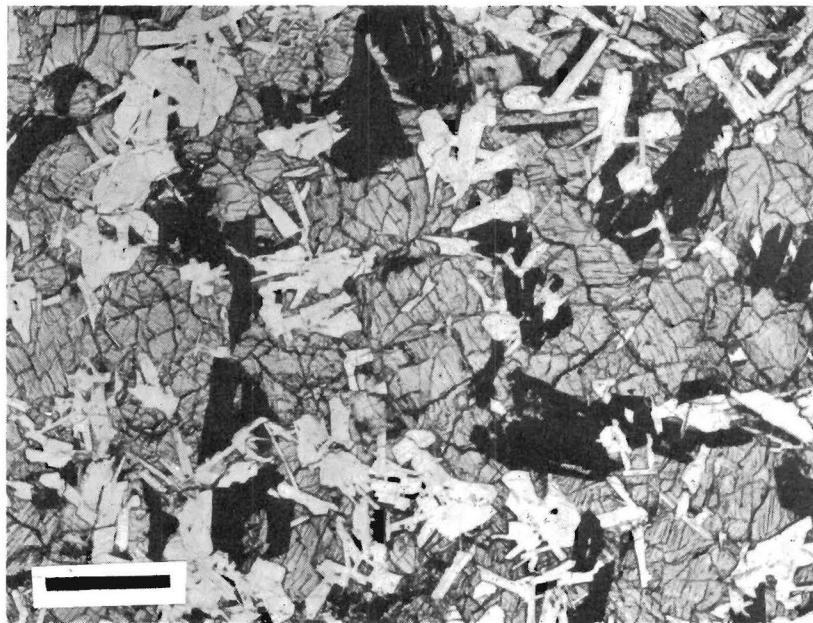
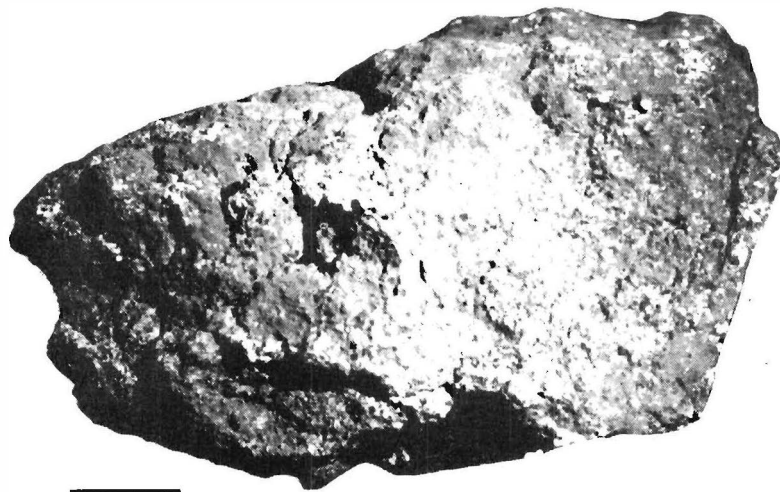
DIMENSIONS: 7 x 4 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Light gray (salt and pepper)
SHAPE: Subangular, irregularly rounded with flat sides and angular protuberances
FABRIC: Medium-grained, equigranular, isotropic
COHERENCE: Friable
Fracturing: Many - penetrative, irregular, non-planar, nonparallel cracks, many minor fractures
VARIABILITY: Homogeneous
SURFACE: Granulated, very dust covered, crumbly, dust adheres (welded on?)
ZAP PITS: Pits present evidenced by haloes, very few glass centers present, they spall off easily
CAVITIES: Vugs - irregularly shaped up to 2 mm
SPECIAL FEATURES: One of the more friable of the Apollo 11 basalts

BY: Lofgren, Wilcox

10044



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	42.23
TiO ₂	=	9.0
Al ₂ O ₃	=	10.94
FeO	=	18.37
MnO	=	0.26
MgO	=	6.11
CaO	=	12.22
Na ₂ O	=	0.48
K ₂ O	=	0.11
P ₂ O ₅	=	0.06
S	=	0.18
Cr ₂ O ₃	=	0.21
<hr/>		
TOTAL		100.17

CIPW NORM

Qtz	=	2.25
Or	=	0.65
Ab	=	4.06
An	=	27.37
Di	=	27.44
Hy	=	20.69
Ne	=	-
Ol	=	-
Chr	=	0.31
Ilm	=	17.09
Apa	=	0.13
<hr/>		
TOTAL		99.99

100 Mg/(Mg+Fe) = 37.2
An/Ab/Or = 85/13/2

TRACE AND MINOR ELEMENTS

Li	=	11.8	(ID)
Rb	=	1.15	(ID)
K	=	781	(ID)
Ba	=	95	(ID)
Sr	=	224	(ID)
Cr	=	-	
V	=	38.5	(NAA)
Sc	=	92	(NAA)
Ni	=	4.0075	(XRF)
Co	=	11	(NAA)
Cu	=	4.2	(NAA)
Zn	=	3	(XRF)
Th	=	0.98	(NAA)
U	=	0.28	(NAA)
Zr	=	366	(XRF)
Hf	=	12	(NAA)
Nb	=	21	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	12	
Ce	=	44	
Pr	=	-	
Nd	=	50	
Sm	=	17.9	
Eu	=	2.69	
Gd	=	24	
Tb	=	4.5	
Dy	=	-	
Ho	=	-	
Er	=	-	
Tm	=	-	
Yb	=	15	
Lu	=	1.96	
Y	=	147	(XRF)

ROCK NUMBER: 10045
WEIGHT: 185 g

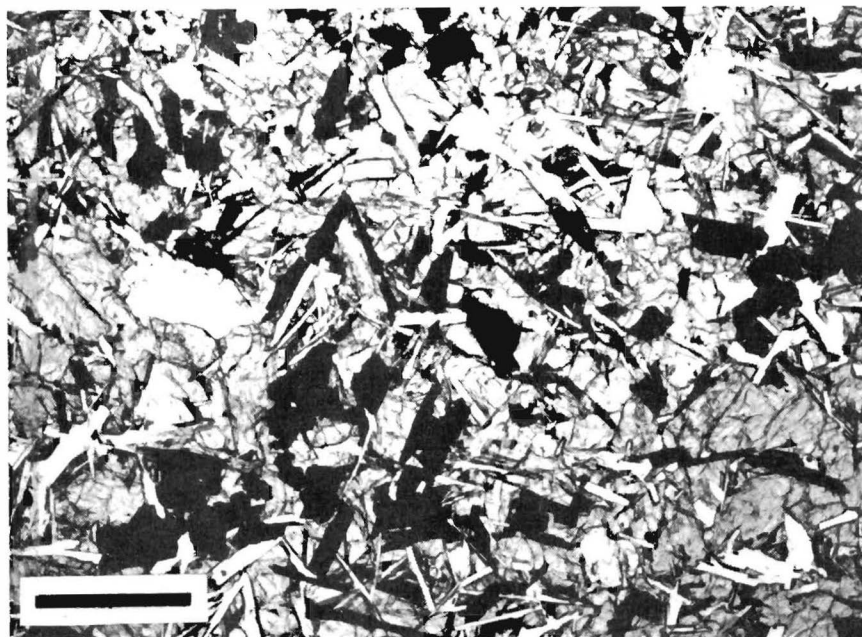
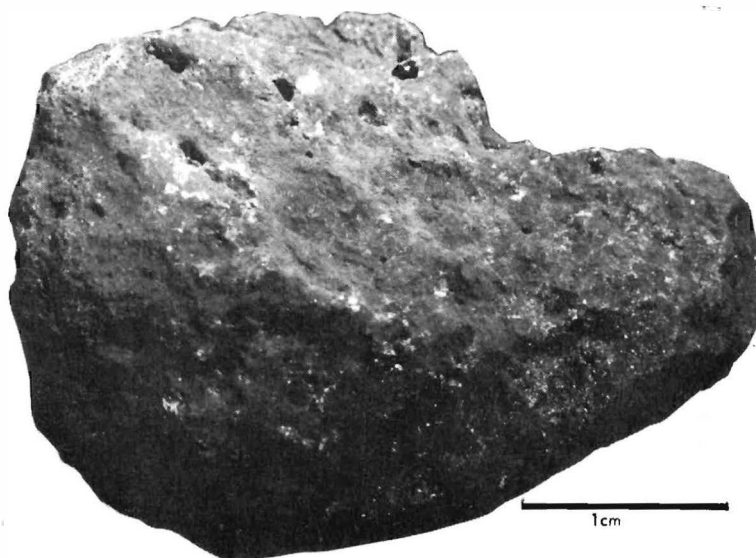
DIMENSIONS: 4 x 3 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Dark to medium gray
SHAPE: Subrounded with subangular protuberances
FABRIC: Fine to medium grained, equigranular
COHERENCE: Tough
Fracturing: Many - penetrative, some open into cavities
VARIABILITY: Some preferred orientation of vesicles along fractures
SURFACE: Smooth, dust coated; fresh surfaces hackly
ZAP PITS: Glass-lined pits with haloes on rounded surfaces
CAVITIES: Vugs, 1-3 mm, irregularly shaped, lined with subhedral
to euhedral pyroxene and feldspar, 10-20% by volume. Some vugs
are nearly vesicles.
SPECIAL FEATURES: Similar to 10024

BY: Greenwood, Heiken, Lofgren

10045



.5 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	39.32
TiO ₂	=	11.21
Al ₂ O ₃	=	9.51
FeO	=	19.41
MnO	=	0.28
MgO	=	7.91
CaO	=	11.17
Na ₂ O	=	0.36
K ₂ O	=	0.05
P ₂ O ₅	=	0.07
S	=	0.14
Cr ₂ O ₃	=	0.41

TOTAL 99.84

CIPW NORM

Qtz	=	0.26
Or	=	0.30
Ab	=	3.05
An	=	24.19
Di	=	25.39
Hy	=	24.47
Ne	=	-
Ol	=	-
Chr	=	0.60
Ilm	=	21.29
Apa	=	0.15

TOTAL 99.70

100 Mg/(Mg+Fe) = 42.1
 An/Ab/Or = 88/11/1

TRACE AND MINOR ELEMENTS

Li	=	15	(OES)
Rb	=	0.62	(ID)
K	=	424	(ID)
Ba	=	10	(XRF)
Sr	=	137.7	(ID)
Cr	=	-	
V	=	98	(XRF)
Sc	=	78	(NAA)
Ni	=	20.037	(XRF)
Co	=	16.1	(NAA)
Cu	=	6.2	(NAA)
Zn	=	14	(XRF)
Th	=	0.765	(ID)
U	=	0.17	(NAA)
Zr	=	194	(XRF)
Hf	=	7.7	(NAA)
Nb	=	14	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	6.7	
Ce	=	22.5	
Pr	=	-	
Nd	=	21.1	
Sm	=	8.42	
Eu	=	1.54	
Gd	=	13.2	
Tb	=	2.13	
Dy	=	14.5	
Ho	=	2.8	
Er	=	9.7	
Tm	=	-	
Yb	=	8.53	
Lu	=	1.17	
Y	=	73	(XRF)

ROCK NUMBER: 10047
WEIGHT: 138 g

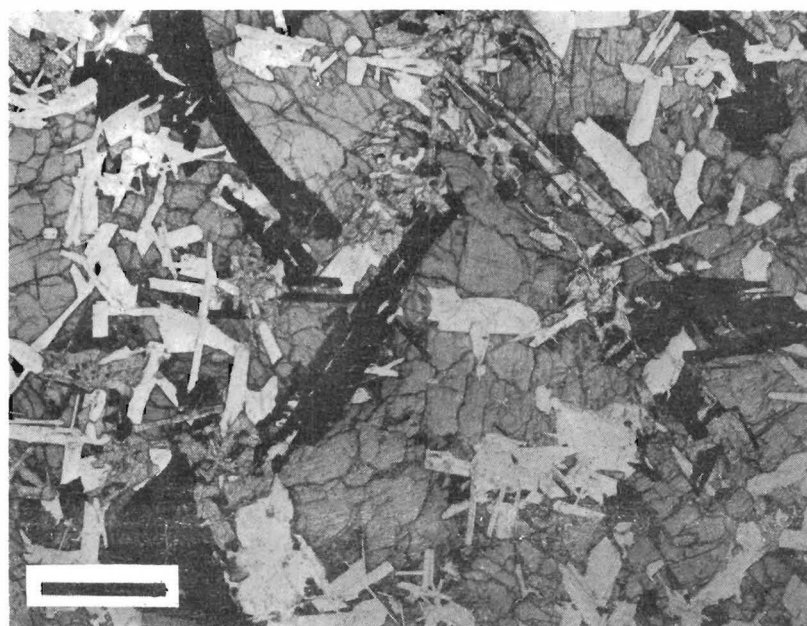
DIMENSIONS: 7 x 4 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Light gray (salt and pepper)
SHAPE: Subangular, one rounded side
FABRIC: Coarse-grained, equigranular
COHERENCE: Moderately friable
Fracturing: Many - few penetrative
VARIABILITY: Homogeneous
SURFACE: Granulated, dust has adhered (welded?) in irregular pattern
ZAP PITS: Pits not readily visible, usually only white halo visible
CAVITIES: Irregular vugs up to 6 mm appear to be concentrated near surface of rock, fewer vugs on fresh surfaces. Well formed crystals project from walls.
SPECIAL FEATURES: Very similar to 10044

BY: Wilcox, Lofgren

10047



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	42.16
TiO ₂	=	9.43
Al ₂ O ₃	=	9.89
FeO	=	19.11
MnO	=	0.28
MgO	=	5.67
CaO	=	12.15
Na ₂ O	=	0.45
K ₂ O	=	0.11
P ₂ O ₅	=	0.11
S	=	0.18
Cr ₂ O ₃	=	0.18

TOTAL		99.72
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CIPW NORM

Qtz	=	3.41
Or	=	0.65
Ab	=	3.81
An	=	24.64
Di	=	29.29
Hy	=	19.33
Ne	=	-
Ol	=	-
Chr	=	0.27
Ilm	=	17.91
Apa	=	0.24

TOTAL		99.54
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100 Mg/(Mg+Fe) = 34.6
An/Ab/Or = 85/13/2

TRACE AND MINOR ELEMENTS

Li	=	16.31	(NAA)
Rb	=	0.93	(ID)
K	=	786	(ID)
Ba	=	88	(XRF)
Sr	=	194	(ID)
Cr	=	-	
V	=	13	(XRF)
Sc	=	92	(NAA)
Ni	=	20.04	(XRF)
Co	=	12.2	(NAA)
Cu	=	16	(XRF)
Zn	=	13	(XRF)
Th	=	0.724	(ID)
U	=	0.224	(ID)
Zr	=	334	(XRF)
Hf	=	13.2	(NAA)
Nb	=	23	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	11.3	
Ce	=	46	
Pr	=	-	
Nd	=	-	
Sm	=	18.9	
Eu	=	2.71	
Gd	=	-	
Tb	=	4.1	
Dy	=	-	
Ho	=	7.9	
Er	=	-	
Tm	=	-	
Yb	=	18.2	
Lu	=	2.88	
Y	=	134	(XRF)

ROCK NUMBER: 10049
WEIGHT: 193 g

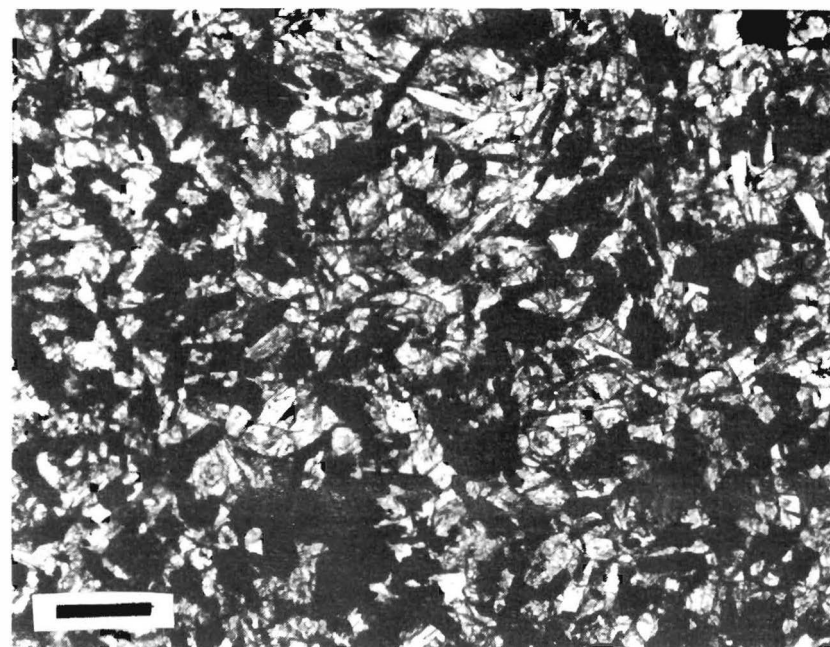
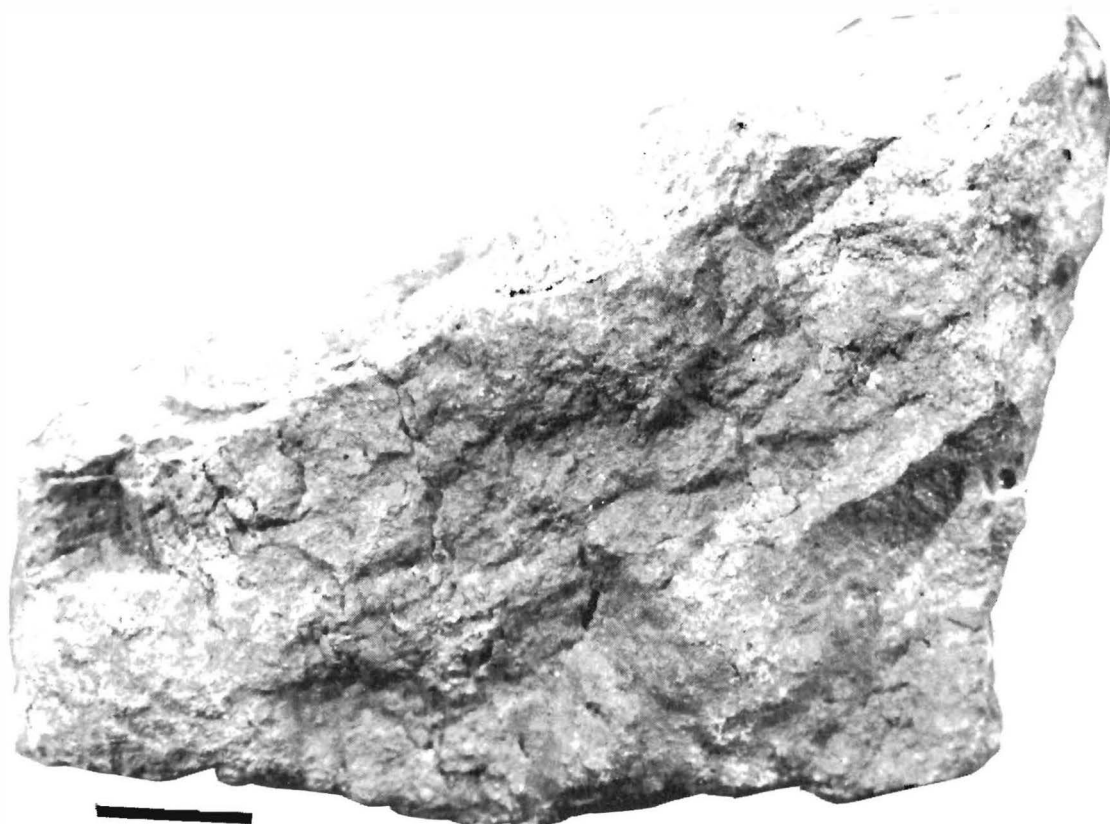
DIMENSIONS: 10 x 5 x 3.5 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray
SHAPE: Angular, tabular
FABRIC: Very fine grained, crystals barely visible
COHERENCE: Tough
Fracturing: Few, nonpenetrative
VARIABILITY: Homogeneous
SURFACE: Hackly, fracture sculptured surface
ZAP PITS: Few, glass-lined pits with white halo, appropriately placed
fracture exposes third dimension of pit and reveals that the halo
extends beneath glass lining.
CAVITIES: Vesicles and vugs, vesicles abundant, .2 to 1.5 mm, smooth
walled; few vugs, irregular in shape and generally larger than vesicles
SPECIAL FEATURES: Concentration of pits very localized. One of
toughest rocks (is now the "touch-rock" on display in the Smithsonian)
returned from the moon. Also one of the more angular rocks

BY: Lofgren, Frondel

10049



.1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	41.00
TiO ₂	=	11.30
Al ₂ O ₃	=	9.5
FeO	=	18.7
MnO	=	0.25
MgO	=	7.03
CaO	=	11.0
Na ₂ O	=	0.51
K ₂ O	=	0.36
P ₂ O ₅	=	0.20
S	=	-
Cr ₂ O ₃	=	0.32
<hr/>		
TOTAL		100.17

CIPW NORM

Qtz	=	2.54
Or	=	2.13
Ab	=	4.32
An	=	22.57
Di	=	25.42
Hy	=	20.82
Ne	=	-
Ol	=	-
Chr	=	0.47
Ilm	=	21.46
Apa	=	0.44
<hr/>		
TOTAL		100.17

100 Mg/(Mg+Fe) = 40.1
 An/Ab/Or = 78/15/7

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	6.2	(ID)
K	=	290	(ID)
Ba	=	330	(ID)
Sr	=	160.8	(ID)
Cr	=	-	
V	=	-	
Sc	=	80.9	(NAA)
Ni	=	-	
Co	=	24	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	4.03	(NAA)
U	=	0.814	(NAA)
Zr	=	-	
Hf	=	17.3	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	28.8
Ce	=	82.8
Pr	=	-
Nd	=	62.8
Sm	=	22.3
Eu	=	2.29
Gd	=	29.3
Tb	=	-
Dy	=	33.4
Ho	=	-
Er	=	30.9
Tm	=	-
Yb	=	20.2
Lu	=	-
Y	=	-

ROCK NUMBER: 10050
WEIGHT: 114.5 g

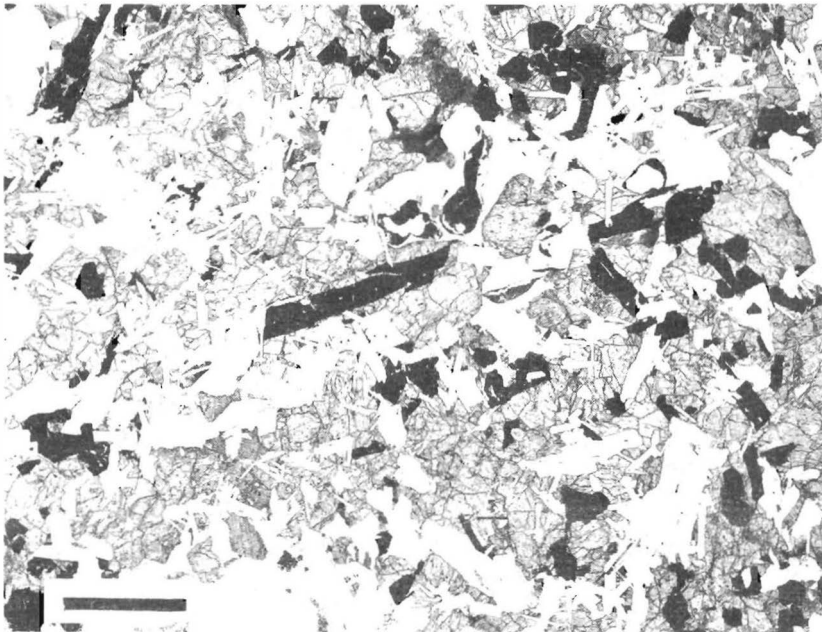
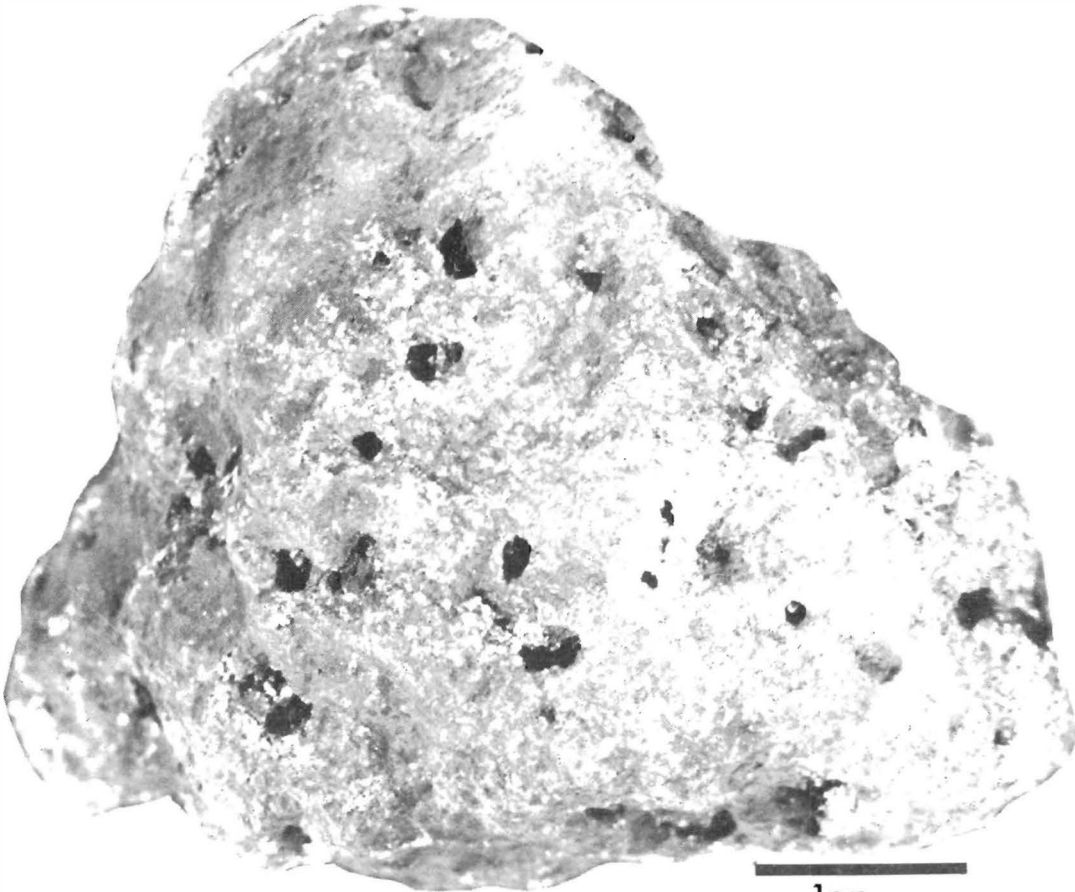
DIMENSIONS: 5 x 4 x 3.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray (salt and pepper)
SHAPE: Subrounded to rounded with subangular protuberences
FABRIC: Coarse grained, equigranular
COHERENCE: Coherent
Fracturing: Few, nonpenetrative
VARIABILITY: Homogeneous
SURFACE: Irregular, dust covered (welded?), shatter crust
ZAP PITS: Pits not readily visible, only haloes present without
glass centers; dust probably hides many pits
CAVITIES: Vugs irregular up to 5 mm, like miarolitic cavities
with crystals of pyroxene and plagioclase protruding into cavities,
20% by volume.
SPECIAL FEATURES: Very similar to 10044, but more vugs

BY: Lofgren, Frondel

10050



1 mm

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	40.41
TiO ₂	=	11.12
Al ₂ O ₃	=	9.99
FeO	=	17.46
MnO	=	0.26
MgO	=	7.93
CaO	=	11.95
Na ₂ O	=	0.48
K ₂ O	=	0.05
P ₂ O ₅	=	0.08
S	=	0.13
Cr ₂ O ₃	=	0.36
TOTAL		<u>100.22</u>

CIPW NORM

Qtz	=	1.2
Or	=	0.3
Ab	=	4.06
An	=	24.96
Di	=	27.69
Hy	=	20.06
Ne	=	-
Ol	=	-
Chr	=	0.53
Ilm	=	21.12
Apa	=	0.17
TOTAL		<u>100.09</u>

100 Mg/(Mg+Fe) = 44.7
An/Ab/Or = 85/14/1

TRACE AND MINOR ELEMENTS

Li	=	11	(ID)
Rb	=	0.75	(ID)
K	=	664	(ID)
Ba	=	92	(ID)
Sr	=	171.3	(ID)
Cr	=	-	
V	=	88	(XRF)
Sc	=	92.5	(NAA)
Ni	=	2	(XRF)
Co	=	14	(XRF)
Cu	=	2	(XRF)
Zn	=	2	(XRF)
Th	=	0.531	(ID)
U	=	0.156	(ID)
Zr	=	265	(XRF)
Hf	=	13.5	(NAA)
Nb	=	21	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	8.2	
Ce	=	37	
Pr	=	6.2	
Nd	=	36	
Sm	=	15.1	
Eu	=	2.15	
Gd	=	19.9	
Tb	=	4.3	
Dy	=	28	
Ho	=	4.9	
Er	=	-	
Tm	=	-	
Yb	=	12.9	
Lu	=	1.8	
Y	=	103	(XRF)

ROCK NUMBER: 10057

WEIGHT: 919 g

DIMENSIONS: 11 x 10 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Medium to dark gray

SHAPE: Subrounded, potato shape

FABRIC: Fine-grained, equigranular

COHERENCE: Tough

Fracturing: Few, nonpenetrative, two sets of fine fractures, one coarse fracture subparallel to rounded surface

VARIABILITY: Homogeneous - except grain size coarser near vugs

SURFACE: Irregular, dust adheres very well (welded?). Some small patches (<2 cm square) of black glassy splatter noted on several exterior surfaces

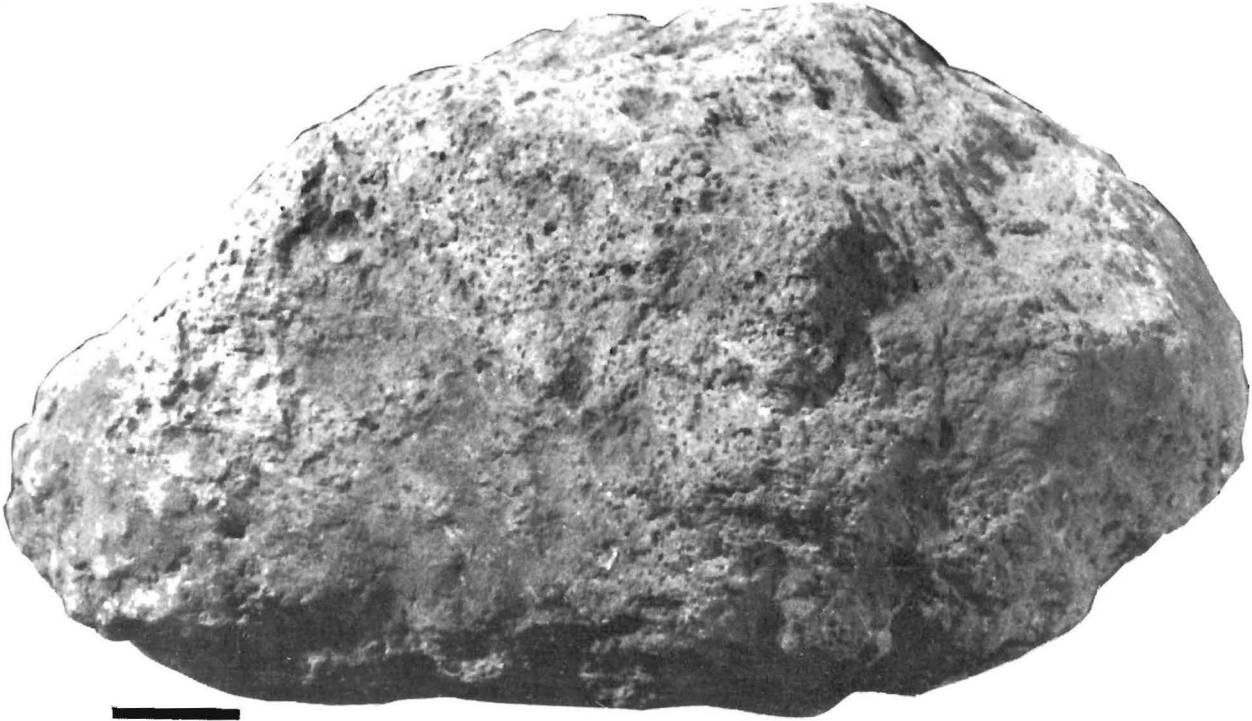
ZAP PITS: Many - mostly just the white haloes in evidence, sparse yellow-brown glass in some pits. One pit, 15 mm diameter depression, 5 mm speckled white center.

CAVITIES: Vugs and vesicles: vugs irregular up to 4 mm diameter; plagioclase and pyroxene protrude into them; vesicles are smooth walled, 0.5 - 1.5 mm diameter, 15 - 20% by volume

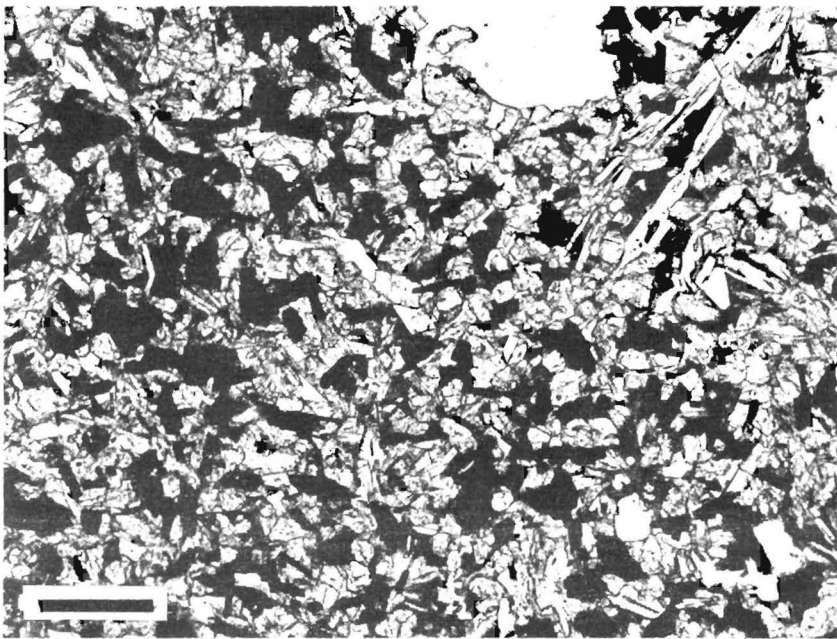
SPECIAL FEATURES: Inclusion of 5 mm x 2.5 mm (rounded) lighter colored rock fragment that is nonvesicular

BY: Chao, Lofgren

10057



1cm



.25 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	40.23
TiO ₂	=	11.4
Al ₂ O ₃	=	9.42
FeO	=	19.38
MnO	=	0.22
MgO	=	7.65
CaO	=	10.42
Na ₂ O	=	0.56
K ₂ O	=	0.3
P ₂ O ₅	=	0.18
S	=	0.26
Cr ₂ O ₃	=	0.35

TOTAL 100.36

CIPW NORM

Qtz	=	1.01
Or	=	1.77
Ab	=	4.70
An	=	22.33
Di	=	23.33
Hy	=	24.41
Ne	=	-
Ol	=	-
Chr	=	0.51
Ilm	=	21.65
Apa	=	0.39

TOTAL 100.10

100 Mg/(Mg+Fe) = 41.3
 An/Ab/Or = 78/16/6

TRACE AND MINOR ELEMENTS

Li	=	14	(NAA)
Rb	=	5.9	(ID)
K	=	274	(ID)
Ba	=	319	(XRF)
Sr	=	173.3	(ID)
Cr	=	-	
V	=	47	(XRF)
Sc	=	87	(NAA)
Ni	=	2	(XRF)
Co	=	25.4	(NAA)
Cu	=	2	(XRF)
Zn	=	2	(XRF)
Th	=	3.41	(ID)
U	=	0.865	(ID)
Zr	=	517	(XRF)
Hf	=	16.9	(NAA)
Nb	=	28.7	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	28.2	
Ce	=	75	
Pr	=	-	
Nd	=	69	
Sm	=	20.8	
Eu	=	2.18	
Gd	=	26	
Tb	=	5	
Dy	=	34.7	
Ho	=	6.4	
Er	=	19	
Tm	=	-	
Yb	=	18.8	
Lu	=	2.66	
Y	=	170	(XRF)

ROCK NUMBER: 10058
WEIGHT: 282 g

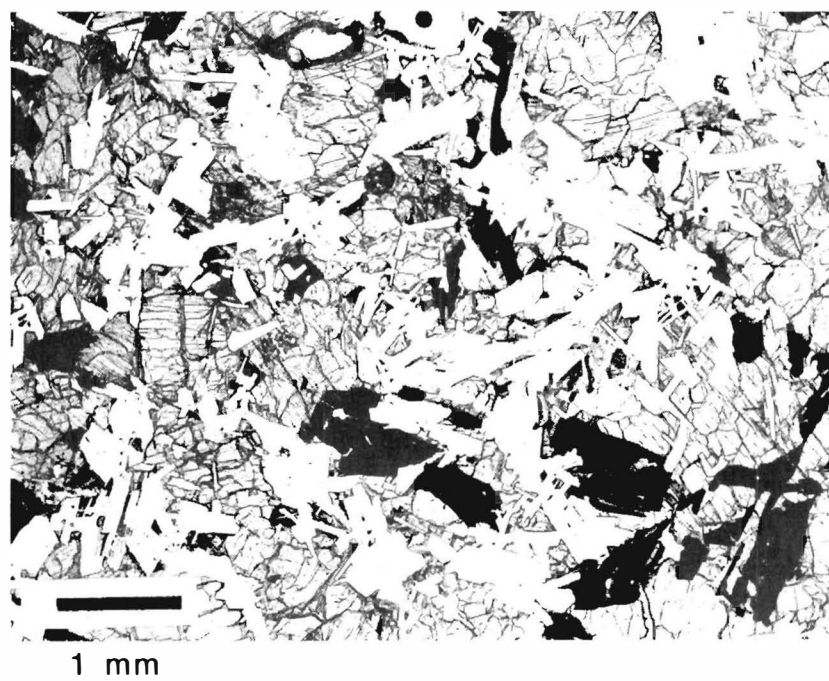
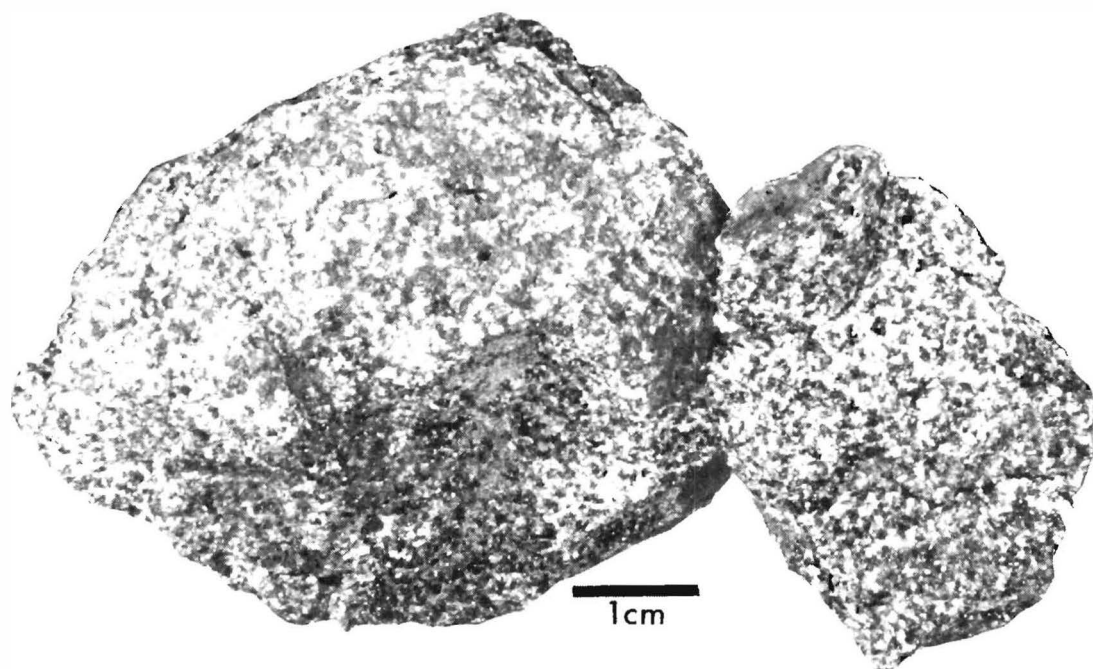
DIMENSIONS: 5.5 x 5.5 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Light gray (salt and pepper) - brownish cast
SHAPE: Subangular, rounded on three sides, one flat fractured surface, generally blocky
FABRIC: Coarse grained, equigranular
COHERENCE: Friable
Fracturing: Many - nonpenetrative, randomly oriented
VARIABILITY: Homogeneous
SURFACE: Granulated, small patches of glass with globular surfaces; adherent dust (welded?)
ZAP PITS: Few distinct pits, just haloes and chalky to milky white feldspar
CAVITIES: Vugs with irregular shapes up to 3 mm, all crystal types protrude into vugs
SPECIAL FEATURES: Coarsest grained of Apollo 11 basalts

BY: Chao, Lofgren

10058



CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	41.63
TiO ₂	=	9.91
Al ₂ O ₃	=	10.98
FeO	=	18.06
MnO	=	0.27
MgO	=	6.17
CaO	=	11.81
Na ₂ O	=	0.65
K ₂ O	=	0.08
P ₂ O ₅	=	0.13
S	=	0.19
Cr ₂ O ₃	=	0.22
TOTAL		<u>100.10</u>

CIPW NORM

Qtz	=	2.28
Or	=	0.47
Ab	=	5.5
An	=	26.81
Di	=	25.76
Hy	=	19.67
Ne	=	-
Ol	=	-
Chr	=	0.32
Ilm	=	18.82
Apa	=	0.28
TOTAL		<u>99.91</u>

100 Mg/(Mg+Fe) = 37.8
An/Ab/Or = 82/17/1

TRACE AND MINOR ELEMENTS

Li	=	11.4	(ID)
Rb	=	0.98	(ID)
K	=	877	(ID)
Ba	=	117	(ID)
Sr	=	218.3	(ID)
Cr	=	1960.0	(NAA)
V	=	46	(XRF)
Sc	=	80.8	(NAA)
Ni	=	2	(XRF)
Co	=	14.4	(NAA)
Cu	=	2	(XRF)
Zn	=	2	(XRF)
Th	=	1.1	(MS)
U	=	0.2	(NAA)
Zr	=	376	(XRF)
Hf	=	11.2	(NAA)
Nb	=	28.4	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	11.5	
Ce	=	40.2	
Pr	=	-	
Nd	=	41.2	
Sm	=	17.2	
Eu	=	2.64	
Gd	=	23.6	
Tb	=	-	
Dy	=	27	
Ho	=	-	
Er	=	16.3	
Tm	=	-	
Yb	=	15.5	
Lu	=	2.14	
Y	=	147	(XRF)

ROCK NUMBER: 10062
WEIGHT: 78.5 g

DIMENSIONS: 4 x 2.5 x 1.7 cm

BINOCULAR DESCRIPTION

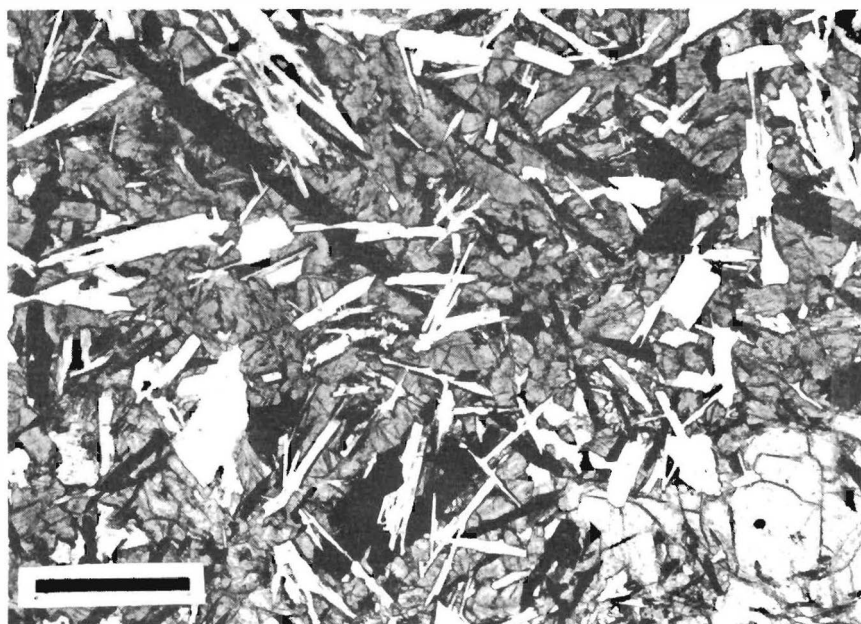
COLOR: Medium to dark gray
SHAPE: Subrounded, blocky
FABRIC: Medium grained, equigranular
COHERENCE: Coherent
Fracturing: Few, nonpenetrative, spall-like
VARIABILITY: Homogeneous
SURFACE: Granular, irregular; hackly on fresh surfaces
ZAP PITS: Few on one surface, none on others; glass-lined pits up to 1 mm in diameter
CAVITIES: Vugs and vesicles; vugs irregular shape, lined with same crystals as in the rock
SPECIAL FEATURES: Several unpitted surfaces

BY: Kramer

10062



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	39.8
TiO ₂	=	10.74
Al ₂ O ₃	=	10.22
FeO	=	19.22
MnO	=	0.3
MgO	=	7.08
CaO	=	11.47
Na ₂ O	=	0.41
K ₂ O	=	0.08
P ₂ O ₅	=	0.12
S	=	0.16
Cr ₂ O ₃	=	-
TOTAL		<u>99.60</u>

CIPW NORM

Qtz	=	0.59
Or	=	0.47
Ab	=	3.47
An	=	25.81
Di	=	25.17
Hy	=	23.27
Ne	=	-
Ol	=	-
Chr	=	-
Ilm	=	20.40
Apa	=	0.26
TOTAL		<u>99.44</u>

100 Mg/(Mg+Fe) = 39.6
An/Ab/Or = 86/12/2

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	0.81	(ID)
K	=	660	(ID)
Ba	=	140	(ID)
Sr	=	196.4	(ID)
Cr	=	-	
V	=	75	(NAA)
Sc	=	74.7	(NAA)
Ni	=	15.008	(NAA)
Co	=	13.8	(NAA)
Cu	=	4	(NAA)
Zn	=	-	
Th	=	0.9	(XRF)
U	=	0.27	(NAA)
Zr	=	319	(XRF)
Hf	=	11.8	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	14.5	
Ce	=	44.8	
Pr	=	-	
Nd	=	37.5	
Sm	=	13.7	
Eu	=	2.06	
Gd	=	18.2	
Tb	=	-	
Dy	=	20.4	
Ho	=	-	
Er	=	12.8	
Tm	=	-	
Yb	=	12.3	
Lu	=	1.73	
Y	=	103	(XRF)

ROCK NUMBER: 10069
WEIGHT: 119.5 g

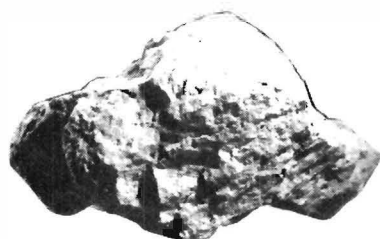
DIMENSIONS: 7 x 5 x 5 cm

BINOCULAR DESCRIPTION

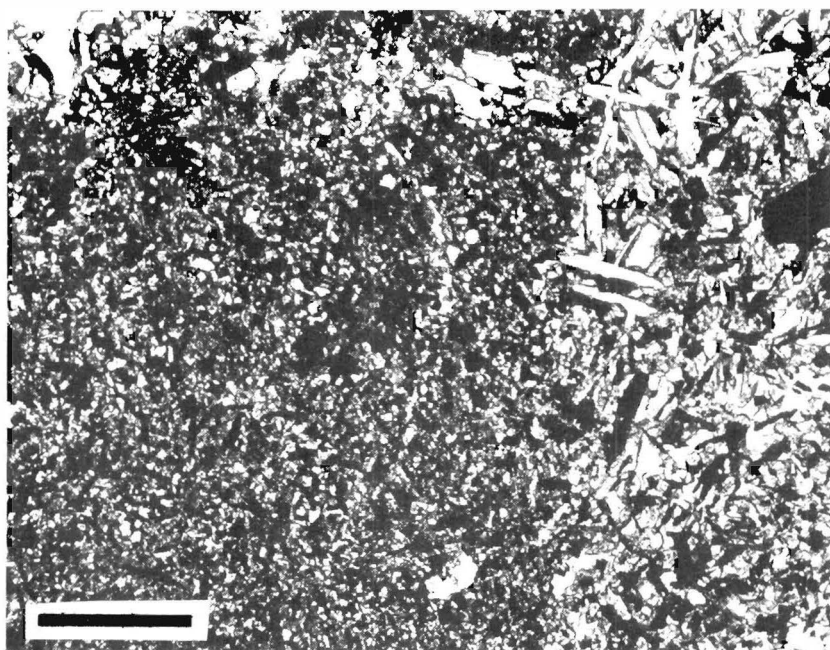
COLOR: Dark to medium gray
SHAPE: Subangular to angular, irregular
FABRIC: Fine grained, equigranular
COHERENCE: Friable
Fracturing: Few, nonpenetrative, mainly rehealed
VARIABILITY: Homogeneous
SURFACE: Hackly, locally smooth, dust adhering on all surfaces
ZAP PITS: Few glass-lined pits up to 1 mm with white haloes on one surface - none on others
CAVITIES: Vesicles and vugs in equal quantities; vesicles are spherical, smooth, and glass lined. Vugs are very irregular in shape and crystal lined.
SPECIAL FEATURES: Several unpitted surfaces

BY: Twedell, Wilcox, Lofgren

10069



1cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	40.32
TiO ₂	=	11.59
Al ₂ O ₃	=	7.90
FeO	=	19.61
MnO	=	0.24
MgO	=	7.77
CaO	=	10.7
Na ₂ O	=	0.59
K ₂ O	=	0.29
P ₂ O ₅	=	0.2
S	=	0.26
Cr ₂ O ₃	=	0.36

TOTAL 99.83

CIPW NORM

Qtz	=	1.36
Or	=	1.69
Ab	=	4.99
An	=	18.06
Di	=	27.88
Hy	=	22.59
Ne	=	-
Ol	=	-
Chr	=	0.54
Ilm	=	22.01
Apa	=	0.44

TOTAL 99.57

100 Mg/(Mg+Fe) = 41.4

An/Ab/Or = 73/20/7

TRACE AND MINOR ELEMENTS

Li	=	17.2	(ID)
Rb	=	5.7	(ID)
K	=	2438	(ID)
Ba	=	288	(ID)
Sr	=	155.6	(ID)
Cr	=	2270	(NAA)
V	=	52	(XRF)
Sc	=	72.4	(NAA)
Ni	=	3	(XRF)
Co	=	26	(NAA)
Cu	=	12	(NAA)
Zn	=	2	(XRF)
Th	=	-	
U	=	0.78	(NAA)
Zr	=	522	(XRF)
Hf	=	17.8	(NAA)
Nb	=	29	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	23.7	
Ce	=	65	
Pr	=	-	
Nd	=	-	
Sm	=	18	
Eu	=	2.04	
Gd	=	-	
Tb	=	4.8	
Dy	=	-	
Ho	=	6.9	
Er	=	-	
Tm	=	-	
Yb	=	20.8	
Lu	=	2.67	
Y	=	169	(XRF)

ROCK NUMBER: 10071
WEIGHT: 189.5 g

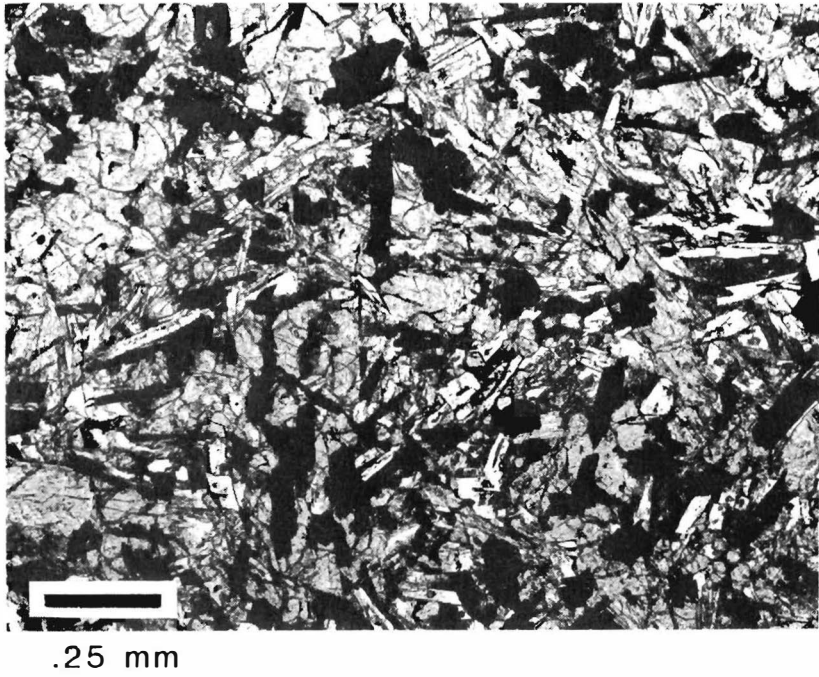
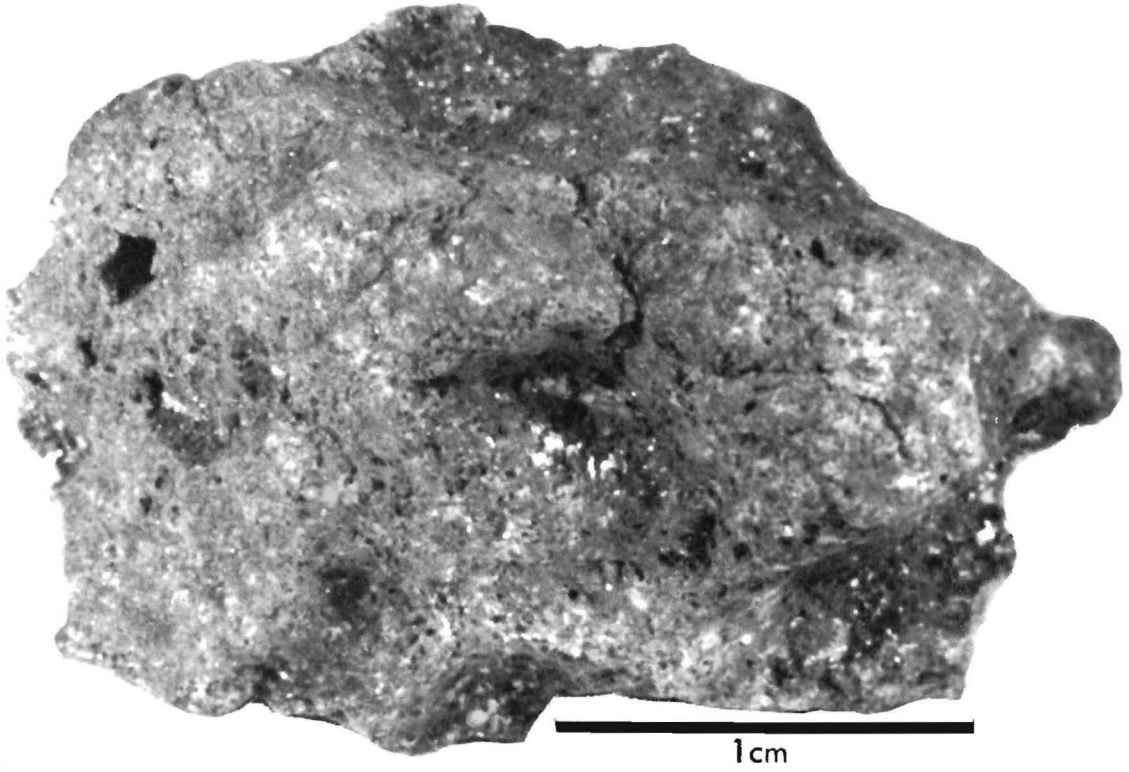
DIMENSIONS: 10 x 5 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Medium light gray
SHAPE: Subangular, knobby, irregular, elongate
FABRIC: Fine-grained, equigranular except for few large olivine crystals
COHERENCE: Friable
Fracturing: Few - nonpenetrative
VARIABILITY: Grain size variable, olivine up to 1 mm and rare
SURFACE: Irregular, dust adhering
ZAP PITS: Many glass-lined pits on nearly all surfaces, some are raised above rock surface and have white haloes
CAVITIES: Large vesicles more or less spherical with variable crystal lining
SPECIAL FEATURES: Largest vesicles of Apollo 11 basalts

BY: Smith, Twedell, Warner

10071



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	40.51
TiO ₂	=	11.87
Al ₂ O ₃	=	7.91
FeO	=	19.65
MnO	=	0.25
MgO	=	7.51
CaO	=	10.48
Na ₂ O	=	0.53
K ₂ O	=	0.30
P ₂ O ₅	=	0.22
S	=	-
Cr ₂ O ₃	=	0.35
TOTAL		<u>99.58</u>

CIPW NORM

Qtz	=	2.60
Or	=	1.77
Ab	=	4.48
An	=	18.32
Di	=	26.69
Hy	=	22.18
Ne	=	-
Ol	=	-
Chr	=	0.52
Ilm	=	22.54
Apa	=	0.58
TOTAL		<u>99.58</u>

$$100 \text{ Mg}/(\text{Mg}+\text{Fe}) = 40.05$$

$$\text{An}/\text{Ab}/\text{Or} = 74.5/18.3/7.2$$

TRACE AND MINOR ELEMENTS

Li	=	17	(OES)
Rb	=	5.93	(ID)
K	=	2740.0	(ID)
Ba	=	327	(ID)
Sr	=	160.9	(ID)
Cr	=	2290	(NAA)
V	=	92	(NAA)
Sc	=	77	(NAA)
Ni	=	6.9	(OES)
Co	=	28	(NAA)
Cu	=	11	(NAA)
Zn	=	-	(NAA)
Th	=	3.36	(ID)
U	=	.859	(ID)
Zr	=	562	(NAA)
Hf	=	16.6	(NAA)
Nb	=	24	(OES)

RARE EARTH ELEMENTS

(ID)

La	=	28.8	
Ce	=	83.5	
Pr	=	-	
Nd	=	64.5	
Sm	=	22.7	
Eu	=	2.32	
Gd	=	29.3	
Tb	=	-	
Dy	=	33.5	
Ho	=	-	
Er	=	21.3	
Tm	=	-	
Yb	=	20.5	
Lu	=	2.87	
Y	=	162	(OES)

ROCK NUMBER: 10072
WEIGHT: 447 g

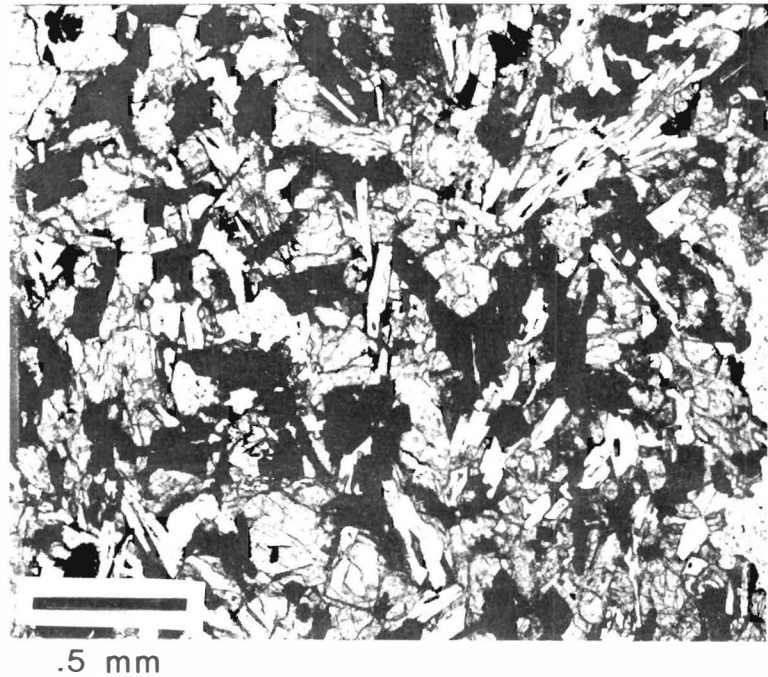
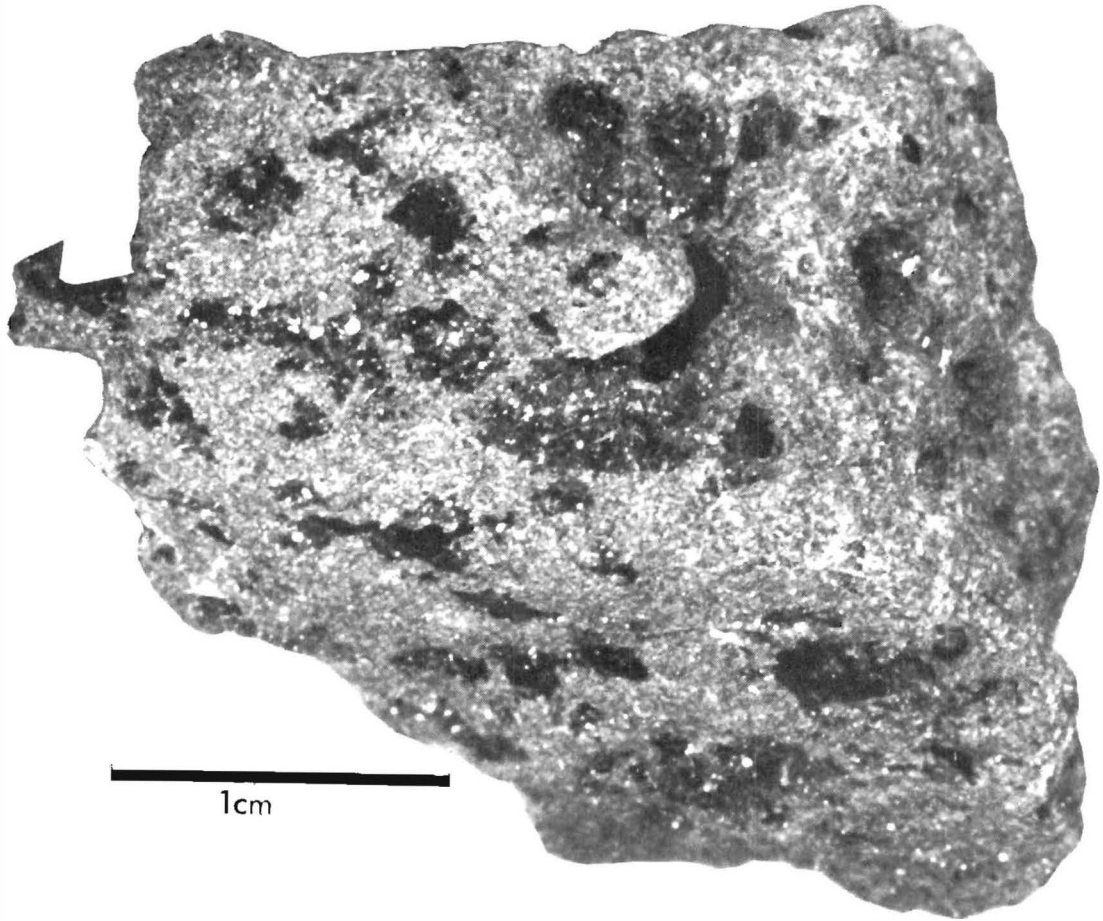
DIMENSIONS: 8 x 8 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Medium to dark gray
SHAPE: Angular, blocky, equidimensional
FABRIC: Fine grained, equigranular
COHERENCE: Coherent
Fracturing: Few, nonpenetrative
VARIABILITY: Homogeneous
SURFACE: Hackly
ZAP PITS: Few white haloes and chalky white material on one surface,
others have no pits
CAVITIES: Vugs are very large (up to 10 x 11 mm) and often intricately
lined with a boxwork of needle-like plagioclase and ilmenite,
vesicles are present but not plentiful
SPECIAL FEATURES: Largest, most spectacular vugs with largest euhedral
crystals.

BY: Lofgren

10072



CHEMISTRY

MAJOR ELEMENTS (4)

SiO ₂	=	40.26
TiO ₂	=	12.07
Al ₂ O ₃	=	7.93
FeO	=	19.58
MnO	=	0.23
MgO	=	7.8
CaO	=	10.41
Na ₂ O	=	0.53
K ₂ O	=	0.28
P ₂ O ₅	=	0.18
S	=	0.24
Cr ₂ O ₃	=	0.36

TOTAL 99.87

CIPW NORM

Qtz	=	2.22
Or	=	1.65
Ab	=	4.48
An	=	18.43
Di	=	26.44
Hy	=	22.55
Ne	=	-
Ol	=	-
Chr	=	0.53
Ilm	=	22.92
Apa	=	0.39

TOTAL 99.63

100 Mg/(Mg+Fe) = 41.5

An/Ab/Or = 75/18/7

TRACE AND MINOR ELEMENTS

Li	=	14	(OES)
Rb	=	5.72	(ID)
K	=	2539	(ID)
Ba	=	294	(XRF)
Sr	=	168.2	(ID)
Cr	=	-	
V	=	62	(XRF)
Sc	=	77	(OES)
Ni	=	3	(XRF)
Co	=	27.2	(NAA)
Cu	=	2	(XRF)
Zn	=	2	(XRF)
Th	=	3.156	(ID)
U	=	0.857	(ID)
Zr	=	504	(XRF)
Hf	=	12	(OES)
Nb	=	27.8	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	22.7	
Ce	=	69	
Pr	=	-	
Nd	=	51	
Sm	=	17.9	
Eu	=	2.07	
Gd	=	26	
Tb	=	4.3	
Dy	=	31.2	
Ho	=	6.8	
Er	=	16	
Tm	=	-	
Yb	=	16.6	
Lu	=	2.24	
Y	=	161	(XRF)

ROCK NUMBER: 10092
WEIGHT: 46 g

DIMENSIONS: 4.2 x 3 x 2.6 cm

BINOCULAR DESCRIPTION

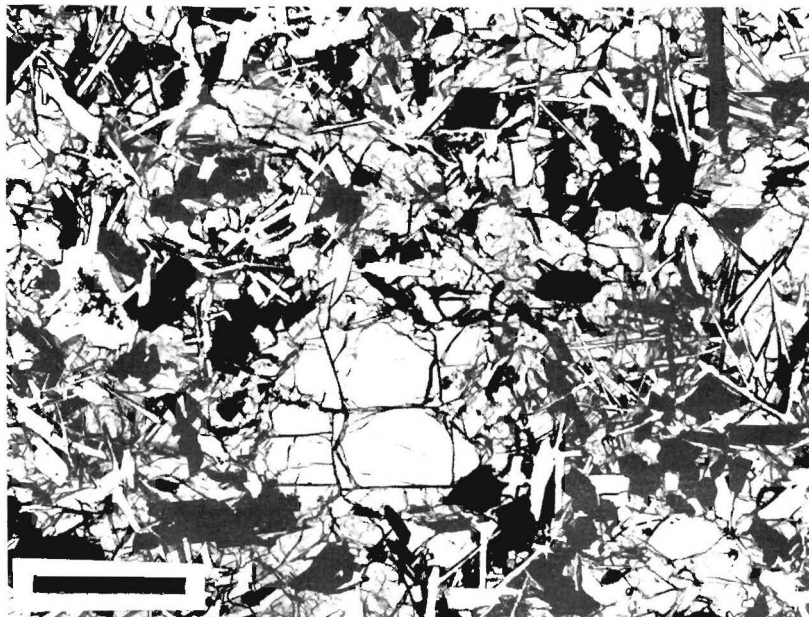
COLOR: Medium light gray
SHAPE: Angular
FABRIC: Fine grained, equigranular
COHERENCE: Tough
Fracturing: Few - nonpenetrative, one penetrative
VARIABILITY: Homogeneous
SURFACE: Irregular, coated with patina (shatter crust); one fresh surface
ZAP PITS: Many glass-lined pits up to 0.8 mm diameter on 2 faces, few on one other, and none on the rest
CAVITIES: Vugs up to 30% by volume, crystal lined and up to 5 mm diameter
SPECIAL FEATURES: Originally part of sample 12002 and designated 12002,22, only recently given separate sample number

BY: Twedell

10092



1 Cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.85
TiO ₂	=	10.87
Al ₂ O ₃	=	9.44
FeO	=	19.35
MnO	=	0.30
MgO	=	8.52
CaO	=	10.99
Na ₂ O	=	0.34
K ₂ O	=	0.06
P ₂ O ₅	=	0.07
S	=	n.a.
Cr ₂ O ₃	=	0.43
		<hr/>
TOTAL		99.22

CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	2.88
An	=	24.06
Di	=	24.72
Hy	=	22.95
Ne	=	-
Ol	=	2.83
Chr	=	0.63
Ilm	=	20.64
Apa	=	0.15
		<hr/>
TOTAL		99.22

100 Mg/(Mg+Fe) = 44.0
An/Ab/Or = 88/11/1

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	
Sr	=	
Cr	=	2930 (NAA)
V	=	
Sc	=	82 (NAA)
Ni	=	
Co	=	19.3 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	
Hf	=	6.8 (NAA)
Nb	=	

RARE EARTH ELEMENTS (NAA)

La	=	7.3
Ce	=	25
Pr	=	
Nd	=	
Sm	=	8.9
Eu	=	1.48
Gd	=	
Tb	=	2.1
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	8.1
Lu	=	1.22
Y	=	

Ref: Rhodes, J. M. and Blanchard, D. P. (1980) Proc. Lunar Sci. Conf. 11th, 49-66.

APOLLO 12

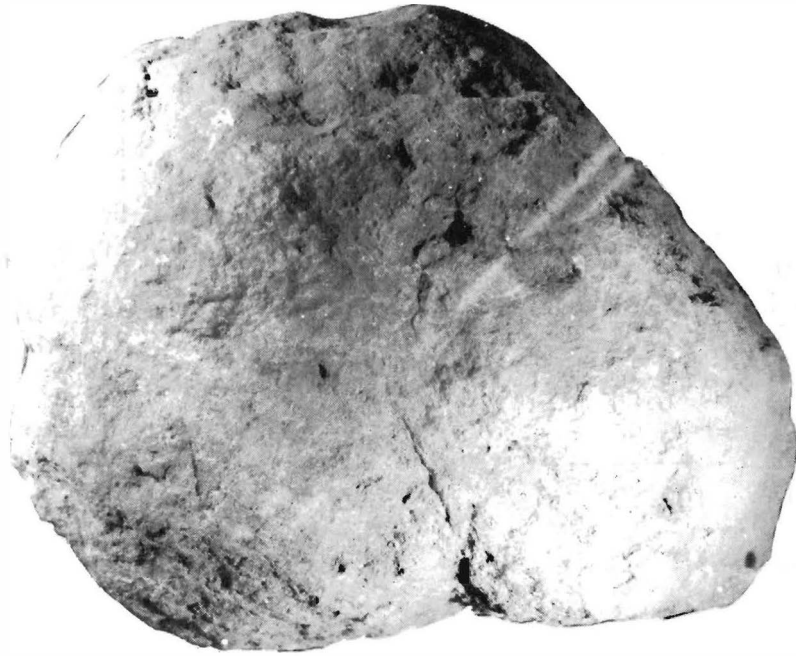
ROCK NUMBER: 12002
WEIGHT: 1529.5 g DIMENSIONS: 11 x 9 x 6 cm

BINOCULAR DESCRIPTION

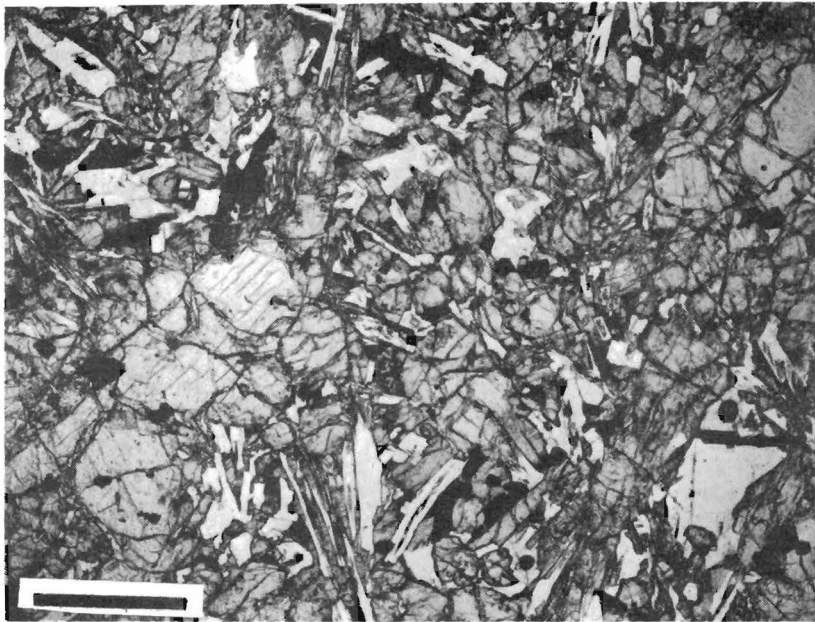
COLOR: Speckled medium brownish gray
SHAPE: Subrounded
FABRIC: Holocrystalline granular
COHERENCE: Tough
 Fracturing: One prominent fracture - nonpenetrative
VARIABILITY: Homogeneous
SURFACE: Smooth
ZAP PITS: Few 3-4 mm diameter glass lined pits
CAVITIES: Vugs are rare, evenly distributed
SPECIAL FEATURES: Dust adheres strongly to surface

BY: Morrison, Warner, Anderson

12002



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	43.56
TiO ₂	=	2.6
Al ₂ O ₃	=	7.87
FeO	=	21.66
MnO	=	0.28
MgO	=	14.88
CaO	=	8.26
Na ₂ O	=	0.23
K ₂ O	=	0.05
P ₂ O ₅	=	0.11
S	=	0.06
Cr ₂ O ₃	=	0.96

TOTAL 100.52

CIPW NORM

Qtz	=	-
Or	=	0.3
Ab	=	1.95
An	=	20.29
Di	=	16.55
Hy	=	29.01
Ne	=	-
Ol	=	25.77
Chr	=	1.41
Ilm	=	4.94
Apa	=	0.24

TOTAL 100.47

100 Mg/(Mg+Fe) = 55.0
An/Ab/Or = 90/9/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	1.04	(ID)
K	=	467	(ID)
Ba	=	67.2	(ID)
Sr	=	101	(ID)
Cr	=	5620	(NAA)
V	=	175	(OES)
Sc	=	38.3	(NAA)
Ni	=	63.9	(XRF)
Co	=	65.8	(NAA)
Cu	=	4.6	(XRF)
Zn	=	1.5	(XRF)
Th	=	0.7470	(ID)
U	=	0.2190	(ID)
Zr	=	106	(XRF)
Hf	=	2.49	(NAA)
Nb	=	8.5	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	6.020	
Ce	=	17	
Pr	=	-	
Nd	=	12.30	
Sm	=	4.24	
Eu	=	0.8530	
Gd	=	5.65	
Tb	=	-	
Dy	=	6.34	
Ho	=	-	
Er	=	3.89	
Tm	=	-	
Yb	=	3.78	
Lu	=	-	
Y	=	39	(XRF)

ROCK NUMBER: 12004
WEIGHT: 585 g

DIMENSIONS: 9 x 8 x 4 cm

BINOCULAR DESCRIPTION

COLOR:

SHAPE: Subrounded, a flat-topped dome

FABRIC: Holocrystalline granular

COHERENCE:

Fracturing: Few, nonpenetrative, parallel to top and bottom

VARIABILITY: Homogeneous

SURFACE: Granular to smooth

ZAP PITS: Few glass lined pits

CAVITIES: Irregularly shaped vugs $\sim 3/\text{cm}^3$

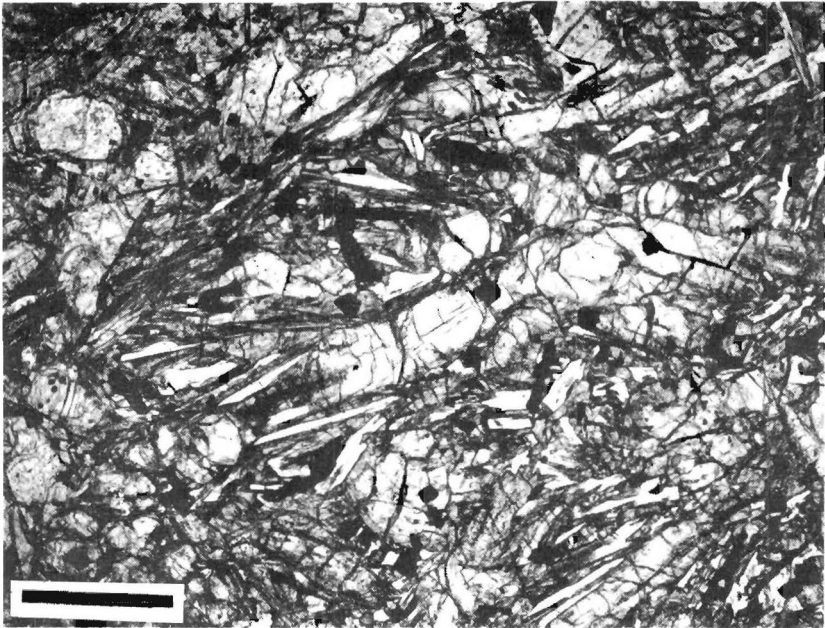
SPECIAL FEATURES: Sample broke in two pieces in can, must have had at least one penetrative fracture.

BY: Warner

12004



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	44.91
TiO ₂	=	2.84
Al ₂ O ₃	=	8.26
FeO	=	21.34
MnO	=	0.29
MgO	=	12.60
CaO	=	9.02
Na ₂ O	=	0.21
K ₂ O	=	0.07
P ₂ O ₅	=	0.07
S	=	0.07
Cr ₂ O ₃	=	0.61
TOTAL		100.29

CIPW NORM

Qtz	=	-
Or	=	0.41
Ab	=	1.78
An	=	21.39
Di	=	19.05
Hy	=	36.29
Ne	=	-
Ol	=	14.86
Chr	=	0.90
Ilm	=	5.39
Apa	=	0.15
TOTAL		100.22

100 Mg/(Mg+Fe) = 51.3
 An/Ab/Or = 91/7/2

TRACE AND MINOR ELEMENTS

Li	=	11	(NAA)
Rb	=	1.123	(ID)
K	=	-	
Ba	=	55	(XRF)
Sr	=	94.3	(ID)
Cr	=	4200	(NAA)
V	=	145	(XRF)
Sc	=	43.8	(NAA)
Ni	=	52	(XRF)
Co	=	47.9	(NAA)
Cu	=	9	(XRF)
Zn	=	3	(XRF)
Th	=	0.92	(ID)
U	=	0.303	(ID)
Zr	=	110	(XRF)
Hf	=	5.1	(NAA)
Nb	=	7	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	5.43	
Ce	=	15	
Pr	=	1.9	
Nd	=	12.9	
Sm	=	3.2	
Eu	=	0.82	
Gd	=	4.7	
Tb	=	0.97	
Dy	=	5.5	
Ho	=	1.4	
Er	=	3.84	
Tm	=	-	
Yb	=	3.17	
Lu	=	0.44	
Y	=	36	(XRF)

ROCK NUMBER: 12005
WEIGHT: 482 g

DIMENSIONS: 10 x 5 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Charcoal gray surface with white patches and streaks

SHAPE: Subrounded to rounded

FABRIC: Holocrystalline granular

COHERENCE: Coherent

Fracturing: Few, one penetrative, most nonpenetrative

VARIABILITY: Grain size variations, some areas of coarser pyroxene and olivine especially near major fracture

SURFACE: Granulated, pulverized appearance, initially dust covered

ZAP PITS: Many black glass-lined pits ranging up to 1 mm in diameter.

CAVITIES: Vugs have irregular distribution; average density 1/cm².

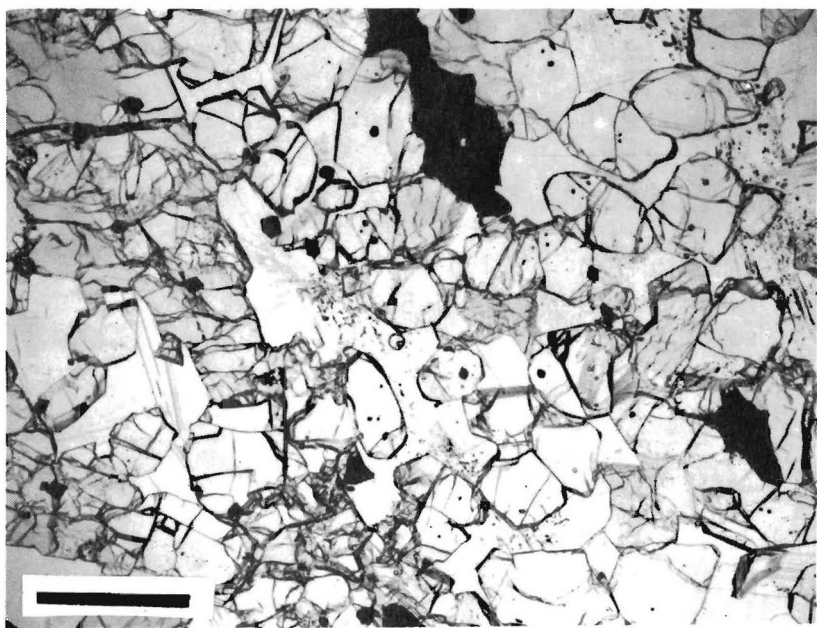
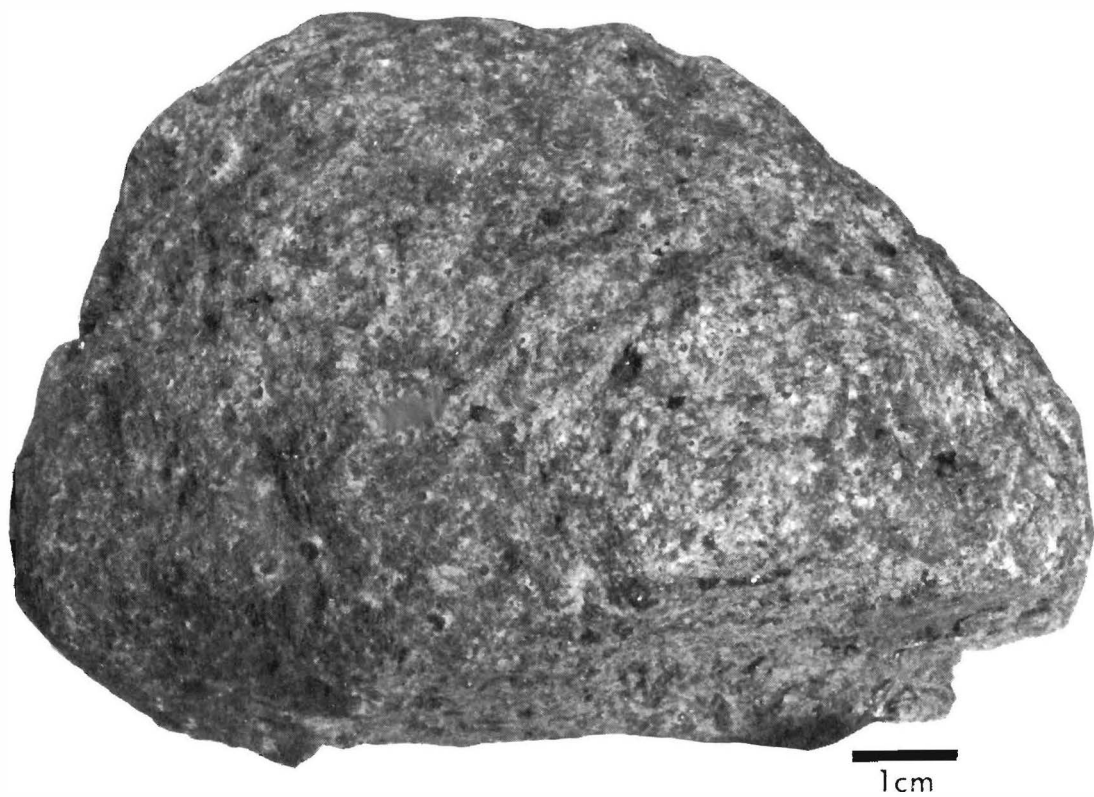
Shape irregular but roughly equidimensional, 1-2 mm diameter.

Olivine and ilmenite on vug walls.

SPECIAL FEATURES: Black glass is set up on a white pulverized mound that is extremely fragile and easily destroyed by handling.

BY: Butler, Warner

12005



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	41.56
TiO ₂	=	2.76
Al ₂ O ₃	=	5.30
FeO	=	22.27
MnO	=	0.30
MgO	=	19.97
CaO	=	6.31
Na ₂ O	=	0.16
K ₂ O	=	0.04
P ₂ O ₅	=	0.04
S	=	0.04
Cr ₂ O ₃	=	0.75
TOTAL		<u>99.50</u>

CIPW NORM

Qtz	=	0.24
Or	=	-
Ab	=	1.35
An	=	13.63
Di	=	14.28
Hy	=	21.57
Ne	=	-
Ol	=	41.96
Chr	=	1.1
Ilm	=	5.24
Apa	=	0.09
TOTAL		<u>99.46</u>

$$100 \text{ Mg} / (\text{Mg} + \text{Fe}) = 61.5 \text{ An} /$$

$$\text{Ab} / \text{Or} = 89.55 / 8.9 / 1.55$$

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	35 (ID)
Sr	=	83 (XRF)
Cr	=	5200 (NAA)
V	=	
Sc	=	37.1 (NAA)
Ni	=	90 (NAA)
Co	=	71 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	66 (XRF)
Hf	=	2.4 (NAA)
Nb	=	4.3 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	10.2
Pr	=	
Nd	=	
Sm	=	2.99
Eu	=	0.62
Gd	=	
Tb	=	0.77
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	2.66
Lu	=	0.41
Y	=	28 (XRF)

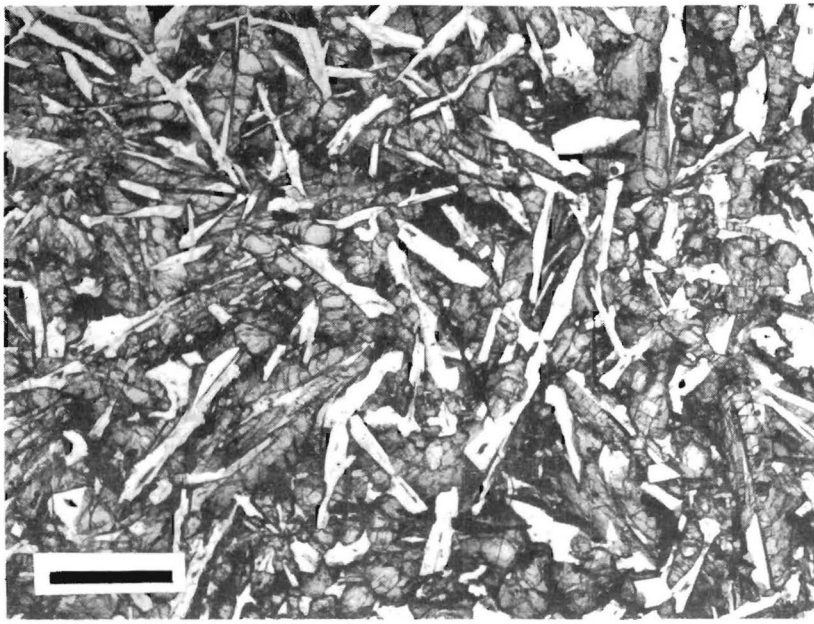
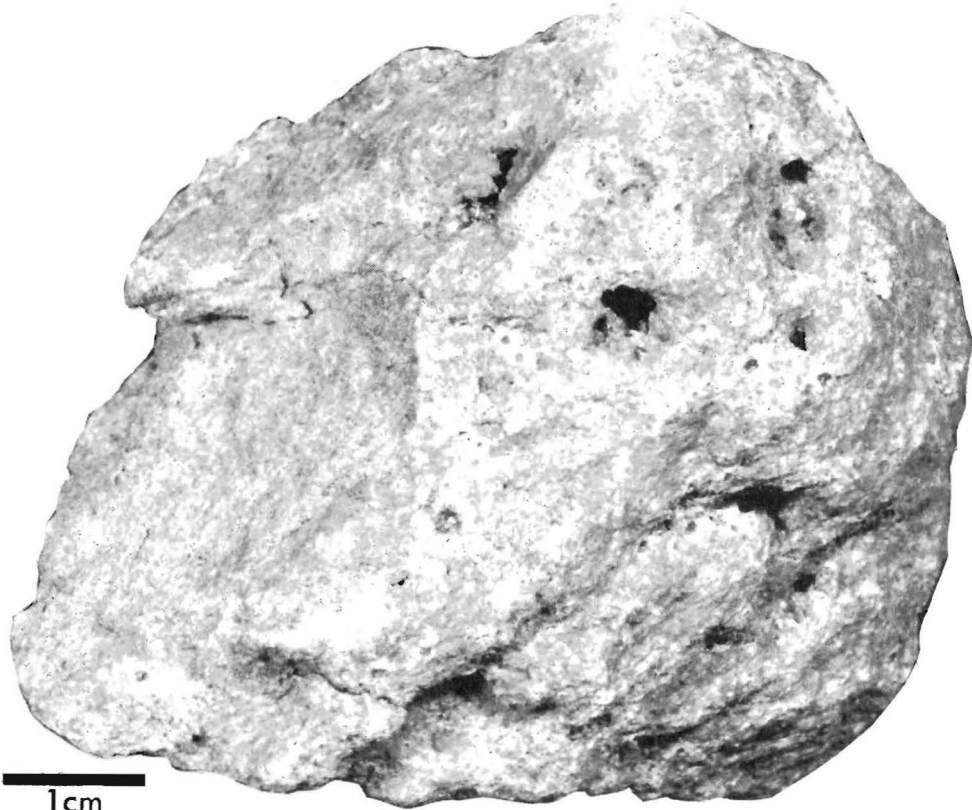
ROCK NUMBER: 12006
WEIGHT: 206.4 g DIMENSIONS: 6 x 6 x 4 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray
SHAPE: Subrounded, flat bottom has angular edges
FABRIC: Trachytic
COHERENCE: Coherent
 Fracturing: Few, nonpenetrative
VARIABILITY: Crystals coarser near vugs and grow out into vugs
SURFACE: Granulated, dust covered
ZAP PITS: Few pits, glass lined and on raised mounds
CAVITIES: Vugs are irregular, crystal bounded, up to 10 mm in
 diameter. Vugs are arranged in planes.
SPECIAL FEATURES: Pyroxene laths up to 3 mm long and radiate in
 three dimensions

BY: Greenwood, Heiken

12006



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	44.23
TiO ₂	=	2.59
Al ₂ O ₃	=	7.67
FeO	=	20.94
MnO	=	0.29
MgO	=	14.67
CaO	=	8.13
Na ₂ O	=	0.20
K ₂ O	=	0.05
P ₂ O ₅	=	0.05
S	=	0.06
Cr ₂ O ₃	=	0.91
TOTAL		<u>99.79</u>

CIPW NORM

Qtz	=	-
Or	=	0.30
Ab	=	1.69
An	=	19.88
Di	=	16.64
Hy	=	34.36
Ne	=	-
Ol	=	20.49
Chr	=	1.34
Ilm	=	4.92
Apa	=	0.11
TOTAL		<u>99.73</u>

100 Mg/(Mg+Fe) = 55.5
 An/Ab/Or = 90.91/7.74/1.35

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	56 (ID)
Sr	=	89 (XRF)
Cr	=	6250 (NAA)
V	=	
Sc	=	40.1 (NAA)
Ni	=	110 (NAA)
Co	=	60 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	97 (XRF)
Hf	=	3.0 (NAA)
Nb	=	6.4 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	15.7
Pr	=	
Nd	=	
Sm	=	3.77
Eu	=	0.72
Gd	=	
Tb	=	1.02
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	3.3
Lu	=	0.47
Y	=	31 (XRF)

ROCK NUMBER: 12007
WEIGHT: 65.2 g

DIMENSIONS: 5.5 x 3.2 x 4.0 cm

BINOCULAR DESCRIPTION

COLOR: Reddish brown

SHAPE: Angular

FABRIC: Holocrystalline, porphyritic

COHERENCE: Coherent

Fracturing: Few, one penetrative (length of long axis of rock);
most nonpenetrative

VARIABILITY: Homogeneous

SURFACE: Granulated, dust adherent

ZAP PITS: None

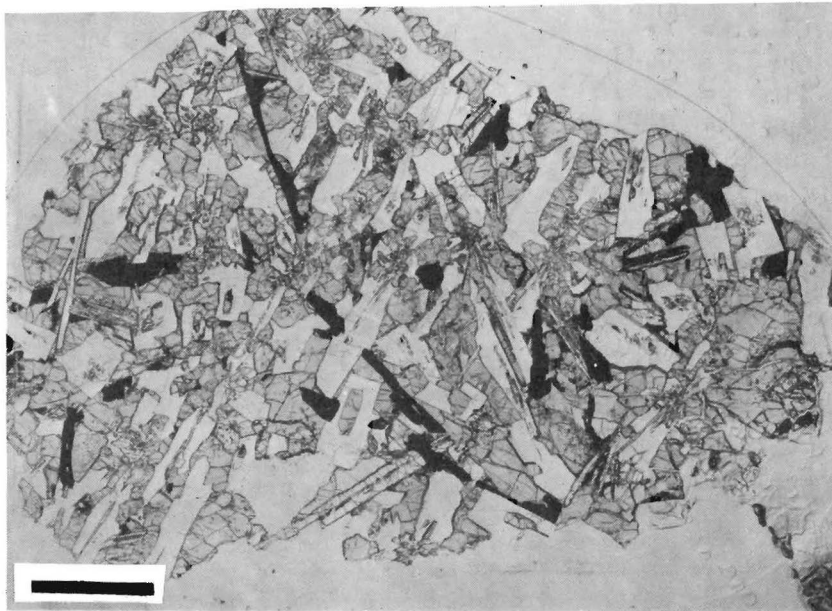
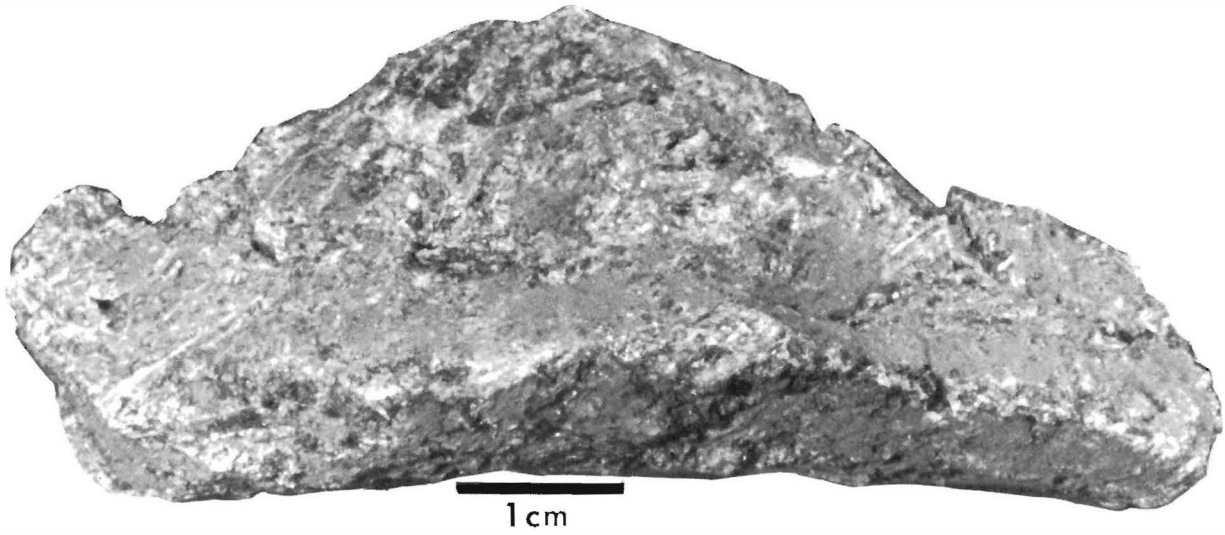
CAVITIES: Vugs between elongate crystals, diameter greater than 0.2 mm

SPECIAL FEATURES: Pyroxene and plagioclase form radiate clusters.

Fractures are subparallel to long axis of rock.

BY: Heiken

12007



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	46.42
TiO ₂	=	3.90
Al ₂ O ₃	=	11.28
FeO	=	19.05
MnO	=	0.28
MgO	=	5.86
CaO	=	11.52
Na ₂ O	=	0.32
K ₂ O	=	0.08
P ₂ O ₅	=	0.10
S	=	0.10
Cr ₂ O ₃	=	0.28
<hr/>		
TOTAL		99.19

CIPW NORM

Qtz	=	3.89
Or	=	.47
Ab	=	2.71
An	=	29.11
Di	=	23.24
Hy	=	31.64
Ne	=	-
Ol	=	-
Chr	=	0.41
Ilm	=	7.41
Apa	=	0.22
<hr/>		
TOTAL		99.09

100 Mg/(Mg+Fe) = 35.4
 An/Ab/Or = 90.15/8.39/1.46

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	91 (ID)
Sr	=	142 (XRF)
Cr	=	1980 (NAA)
V	=	
Sc	=	52.3 (NAA)
Ni	=	
Co	=	26 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	156 (XRF)
Hf	=	6.4 (NAA)
Nb	=	10.0 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	23.6
Pr	=	
Nd	=	
Sm	=	6.4
Eu	=	1.20
Gd	=	
Tb	=	1.48
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	5.3
Lu	=	0.77
Y	=	51 (XRF)

ROCK NUMBER: 12008
WEIGHT: 58.4 g

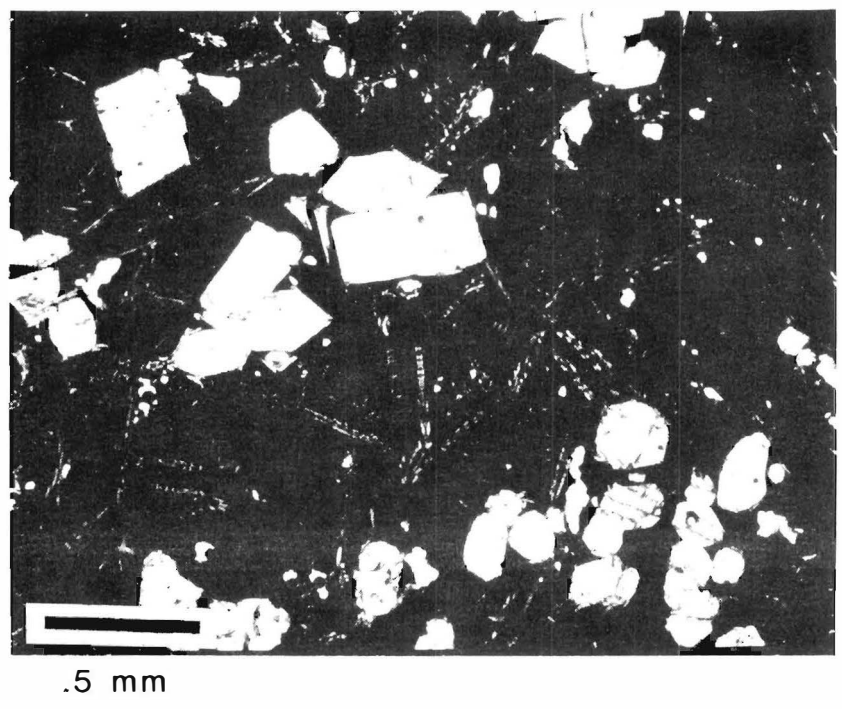
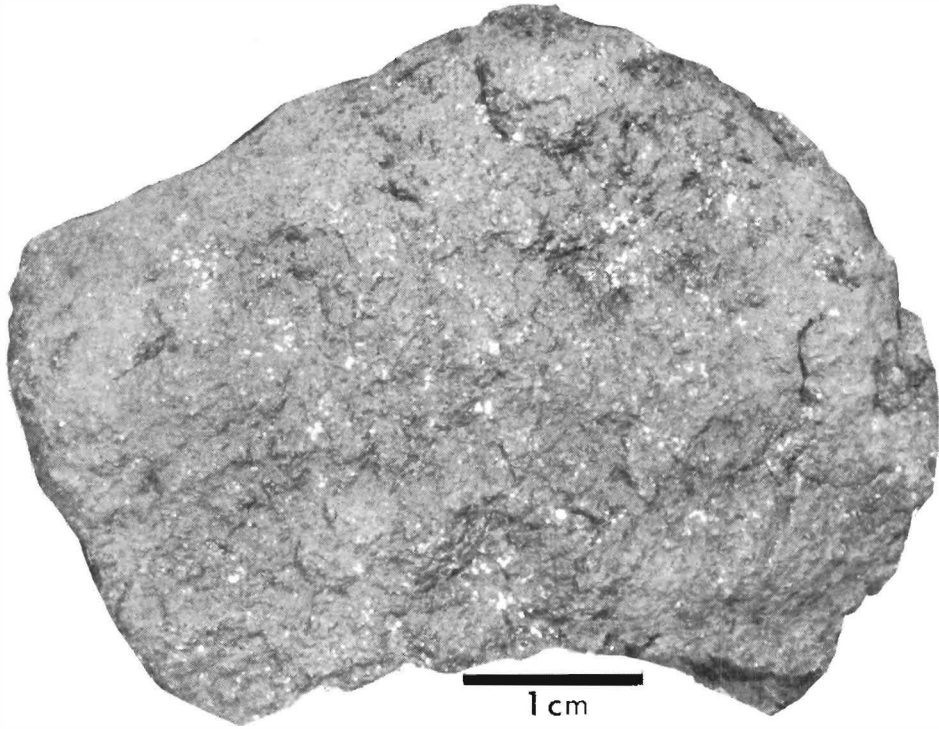
DIMENSIONS: 2 x 3.5 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray to black
SHAPE: Subangular, lens-shaped
FABRIC: Vitrophyric
COHERENCE: Coherent
Fracturing: Few, non penetrative
VARIABILITY: Homogeneous
SURFACE: Smooth with bright adamantine cleavage planes
ZAP PITS: Few on B and T, one glass lined pit (2 mm); most pits
001 to 0.4 mm lined with both smooth and bubbly glass
CAVITIES: None
SPECIAL FEATURES: Finest matrix, closely resembles 12009 and 12015

BY: Greenwood, Heiken

12008



CHEMISTRY

MAJOR ELEMENTS

SiO₂ = 42.75
 TiO₂ = 4.45
 Al₂O₃ = 7.98
 FeO = 21.94
 MnO = 0.30
 MgO = 12.33
 CaO = 8.97
 Na₂O = 0.25
 K₂O = 0.05
 P₂O₅ = 0.07
 S = 0.08
 Cr₂O₃ = 0.61

TOTAL 99.78

CIPW NORM

Qtz = 0.3
 Or = -
 Ab = 2.12
 An = 20.51
 Di = 19.56
 Hy = 30.17
 Ne = -
 Ol = 17.55
 Chr = 0.90
 Ilm = 8.45
 Apa = 0.15

TOTAL 99.70

100 Mg/(Mg+Fe) = 50.0
 An/Ab/Or = 89.48/9.23/1
 .29

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba = 51 (ID)
 Sr = 130 (XRF)
 Cr = 4200 (NAA)
 V =
 Sc = 52.4 (NAA)
 Ni =
 Co = 51 (NAA)
 Cu =
 Zn =
 Th =
 U =
 Zr = 117 (XRF)
 Hf = 3.8 (NAA)
 Nb = 5.9 (XRF)

RARE EARTH ELEMENTS (NAA)

La =
 Ce = 16.9
 Pr =
 Nd =
 Sm = 5.35
 Eu = 1.06
 Gd =
 Tb = 1.39
 Dy =
 Ho =
 Er =
 Tm =
 Yb = 4.9
 Lu = 0.71
 Y = 45 (XRF)

ROCK NUMBER: 12009
WEIGHT: 468.2 g

DIMENSIONS: 10 x 7 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray (N6 to N7)

SHAPE: Subangular

FABRIC: Vitrophyre

COHERENCE: Coherent

Fracturing: Many nonpenetrative subparallel to surfaces,
1 to 0.5 cm apart

VARIABILITY: Homogeneous

SURFACE: Irregular dust adheres strongly, a few small white
powdered areas. All but one surface are fresh

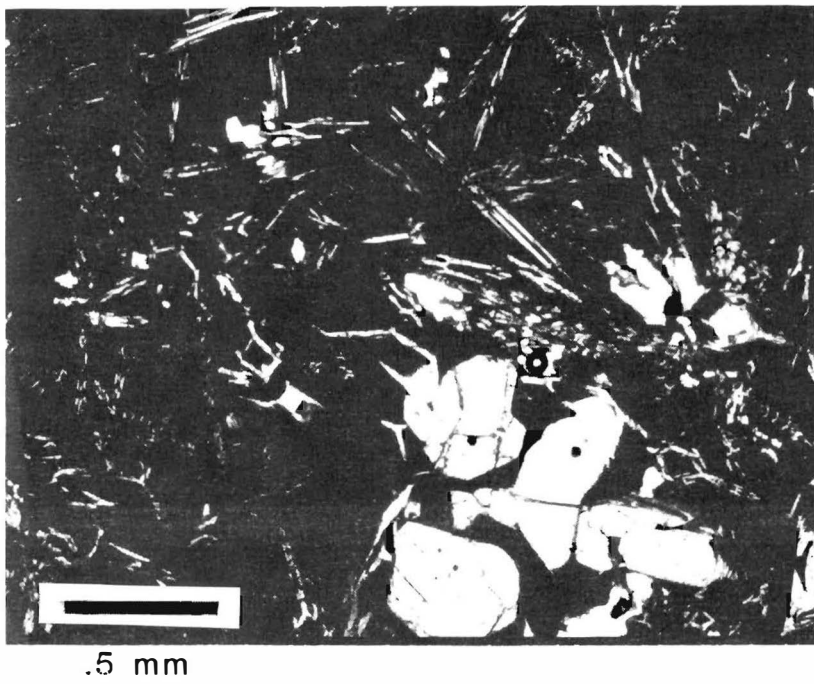
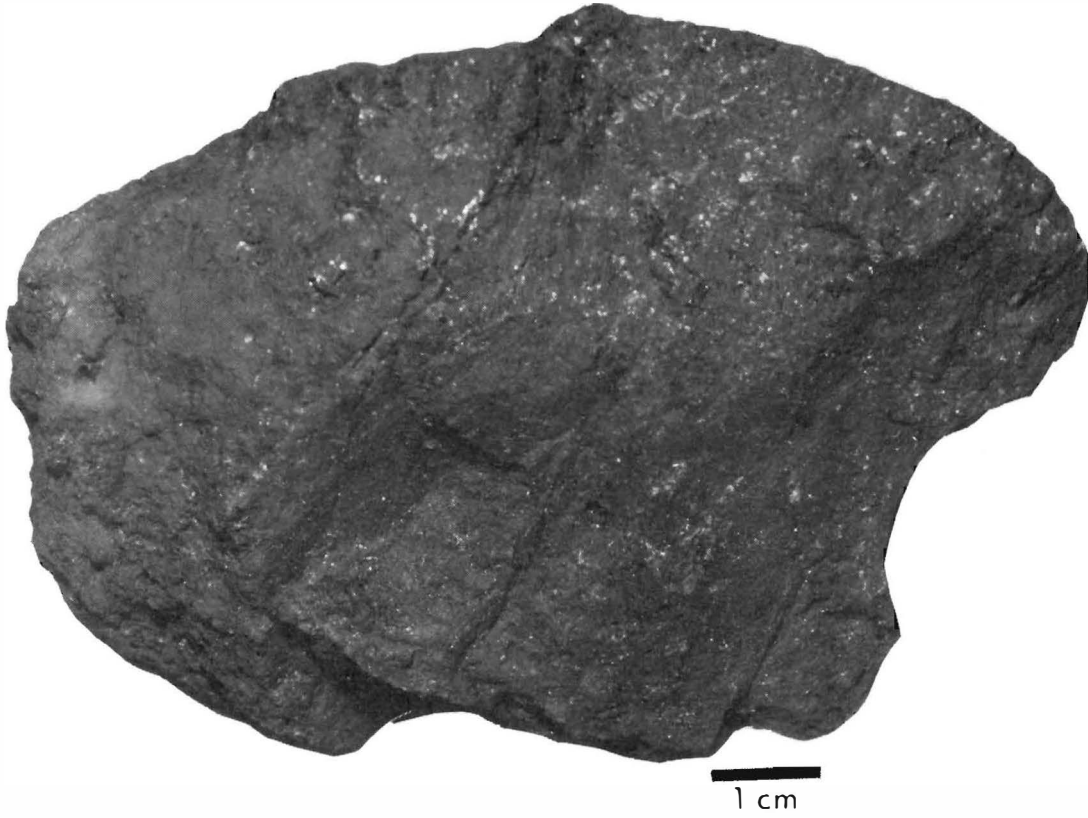
ZAP PITS: None

CAVITIES: Three large egg-shaped cavities with smooth walls
(1.5 x 3 cm), (5 x 3 cm), (2 x 2 cm) Few vugs ~1 mm diameter

SPECIAL FEATURES: Olivine phenocrysts, olivine laths in matrix

BY: Butler, Warner, Wones

12009



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	45.03
TiO ₂	=	2.90
Al ₂ O ₃	=	8.59
FeO	=	21.03
MnO	=	0.28
MgO	=	11.55
CaO	=	9.42
Na ₂ O	=	0.23
K ₂ O	=	0.06
P ₂ O ₅	=	0.07
S	=	0.06
Cr ₂ O ₃	=	0.55
<hr/>		
TOTAL		99.77

CIPW NORM

Qtz	=	-
Or	=	0.38
Ab	=	1.95
An	=	22.22
Di	=	20.05
Hy	=	37.31
Ne	=	-
Ol	=	11.34
Chr	=	0.81
Ilm	=	5.51
Apa	=	0.15
<hr/>		
TOTAL		99.72

$$100 \text{ Mg}/(\text{Mg}+\text{Fe}) = 49.5$$

$$\text{An}/\text{Ab}/\text{Or} = 90/8/2$$

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	1.0463	(ID)
K	=	531	(XRF)
Ba	=	60	(XRF)
Sr	=	95.6	(XRF)
Cr	=	-	
V	=	153	(XRF)
Sc	=	46	(NAA)
Ni	=	51.9	(XRF)
Co	=	49	(XRF)
Cu	=	41	(XRF)
Zn	=	30	(XRF)
Th	=	0.881	(ID)
U	=	0.243	(ID)
Zr	=	107	(XRF)
Hf	=	4	(NAA)
Nb	=	6	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	6.1
Ce	=	16.8
Pr	=	-
Nd	=	16
Sm	=	4.53
Eu	=	0.94
Gd	=	5.2
Tb	=	1.11
Dy	=	7.13
Ho	=	-
Er	=	3.6
Tm	=	-
Yb	=	3.74
Lu	=	0.5510
Y	=	

ROCK NUMBER: 12011
WEIGHT: 193 g

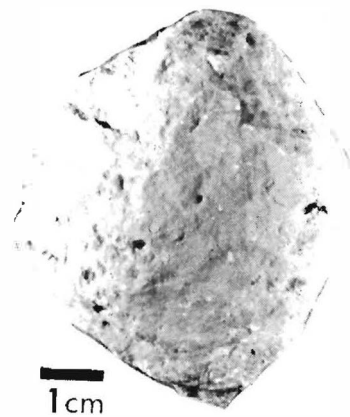
DIMENSIONS: 5 x 5 x 4 cm

BINOCULAR DESCRIPTION

COLOR: Surface brownish to charcoal gray, fresh surface medium to light gray
SHAPE: Rounded
FABRIC: Holocrystalline granular, radiating tabular crystals
COHERENCE: Tough
Fracturing: None
VARIABILITY: Homogeneous
SURFACE: Smooth, dust strongly adheres
ZAP PITS: Few glass lined pits, 2-3 mm diameter
CAVITIES: Few smooth-walled vesicles ~3 mm diameter. Lined with clear glass
SPECIAL FEATURES: Dust difficult to brush off

BY: Warner, Gibson

12011



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	46.63
TiO ₂	=	3.29
Al ₂ O ₃	=	9.77
FeO	=	19.53
MnO	=	0.29
MgO	=	8.26
CaO	=	10.63
Na ₂ O	=	0.25
K ₂ O	=	0.06
P ₂ O ₅	=	0.07
S	=	0.06
Cr ₂ O ₃	=	0.59

TOTAL 99.43

CIPW NORM

Qtz	=	1.99
Or	=	0.35
Ab	=	2.12
An	=	25.36
Di	=	22.61
Hy	=	39.68
Ne	=	-
Ol	=	-
Chr	=	0.87
Ilm	=	6.25
Apa	=	0.15

TOTAL 99.37

100 Mg/(Mg+Fe) = 43.0
 An/Ab/Or = 91.12/7.60/1.27

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	71 (ID)
Sr	=	113 (XRF)
Cr	=	4050 (NAA)
V	=	
Sc	=	52.2 (NAA)
Ni	=	
Co	=	39 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	128 (XRF)
Hf	=	3.7 (NAA)
Nb	=	7.4 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	19.9
Pr	=	
Nd	=	
Sm	=	5.0
Eu	=	0.95
Gd	=	
Tb	=	1.06
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	4.2
Lu	=	0.62
Y	=	39 (XRF)

ROCK NUMBER: 12012
WEIGHT: 176.2 g

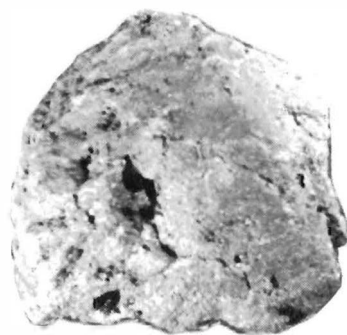
DIMENSIONS: 6 x 6 x 4 cm

BINOCULAR DESCRIPTION

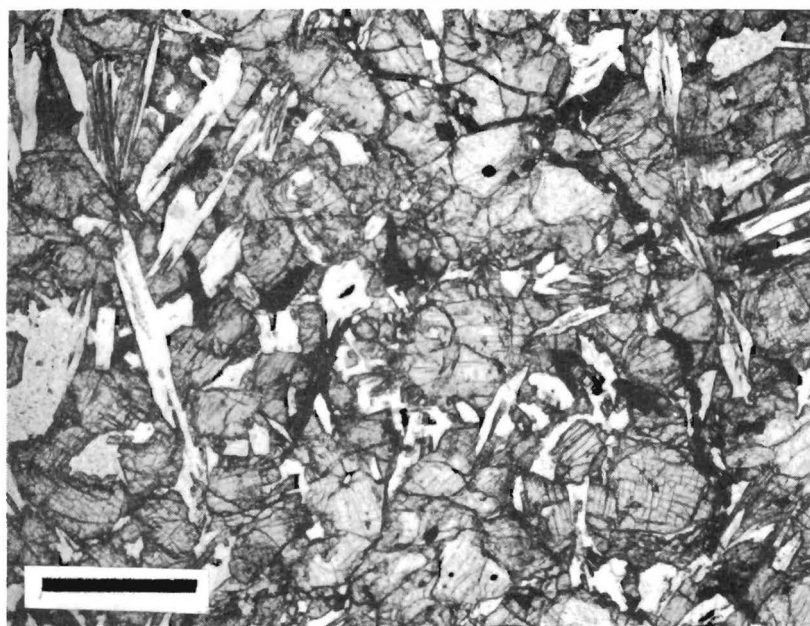
COLOR: Medium gray
SHAPE: Subangular, blocky
FABRIC: Holocrystalline
COHERENCE: Coherent
Fracturing: Many, nonpenetrative, irregular orientation
VARIABILITY: Irregular distribution of vugs
SURFACE: Smooth to granular
ZAP PITS: None observed
CAVITIES: Many vugs of variable size containing elongate crystals
SPECIAL FEATURES: Pyroxene and olivine crystals pronounced and structure is open making crystals easy to pick out

BY: Anderson, Gibson

12012



1cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	44.17
TiO ₂	=	2.64
Al ₂ O ₃	=	7.71
FeO	=	20.69
MnO	=	0.30
MgO	=	14.37
CaO	=	8.47
Na ₂ O	=	0.21
K ₂ O	=	0.06
P ₂ O ₅	=	0.09
S	=	0.07
Cr ₂ O ₃	=	0.69
<hr/>		
TOTAL		99.47

CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	1.78
An	=	19.92
Di	=	17.81
Hy	=	33.14
Ne	=	-
Ol	=	20.18
Chr	=	1.02
Ilm	=	5.01
Apa	=	0.2
<hr/>		
TOTAL		99.4

100 Mg/(Mg+Fe) = 55.3
 An/Ab/Or = 90.33/8.06/1.61

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	56 (ID)
Sr	=	89 (XRF)
Cr	=	4780 (NAA)
V	=	
Sc	=	41.9 (NAA)
Ni	=	60 (NAA)
Co	=	56 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	99 (XRF)
Hf	=	3.4 (NAA)
Nb	=	6.6 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	13.8
Pr	=	
Nd	=	
Sm	=	4.02
Eu	=	0.76
Gd	=	
Tb	=	1.17
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	3.4
Lu	=	0.47
Y	=	33 (XRF)

ROCK NUMBER: 12014
WEIGHT: 159.4 g

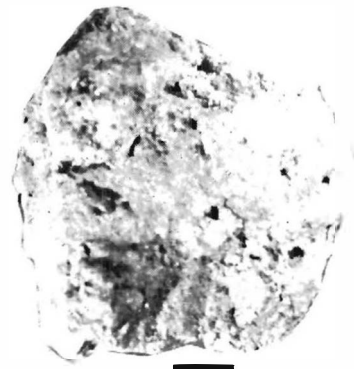
DIMENSIONS: 5 x 5 x 4 cm

BINOCULAR DESCRIPTION

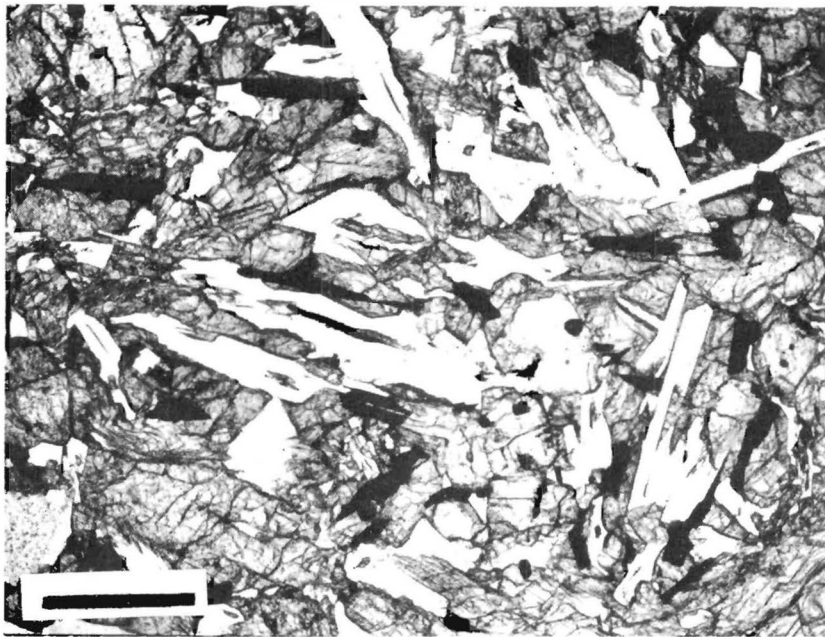
COLOR: Medium gray
SHAPE: Subangular, rectangular
FABRIC: Holocrystalline, porphyritic
COHERENCE: Coherent
Fracturing: Few, nonpenetrative
VARIABILITY: Homogeneous
SURFACE: Granulated to smooth
ZAP PITS: Only one glass lined pit observed
CAVITIES: Vugs vary greatly in size up to 1.5 cm
SPECIAL FEATURES: Euhedral pyroxene crystals up to 1 cm long in vugs

BY: Gibson

12014



1cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	45.34
TiO ₂	=	2.68
Al ₂ O ₃	=	8.00
FeO	=	20.33
MnO	=	0.26
MgO	=	13.85
CaO	=	8.63
Na ₂ O	=	0.21
K ₂ O	=	0.06
P ₂ O ₅	=	0.05
S	=	0.07
Cr ₂ O ₃	=	0.64

TOTAL		100.12
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CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	1.78
An	=	20.71
Di	=	18.02
Hy	=	38.13
Ne	=	-
Ol	=	14.92
Chr	=	0.94
Ilm	=	5.09
Apa	=	0.11

TOTAL		100.05
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100 Mg/(Mg+Fe) = 54.8

An/Ab/Or = 90.67/7.78/1.55

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	53 (ID)
Sr	=	93 (XRF)
Cr	=	4450 (NAA)
V	=	
Sc	=	42.8 (NAA)
Ni	=	40 (NAA)
Co	=	54 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	101 (XRF)
Hf	=	3.3 (NAA)
Nb	=	6.8 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	14.7
Pr	=	
Nd	=	
Sm	=	4.14
Eu	=	0.75
Gd	=	
Tb	=	1.01
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	3.3
Lu	=	0.53
Y	=	32 (XRF)

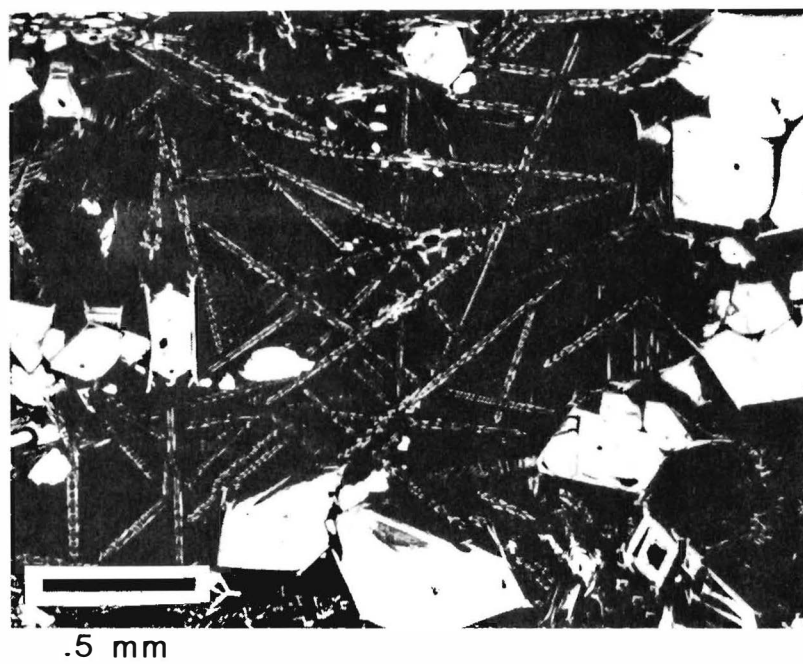
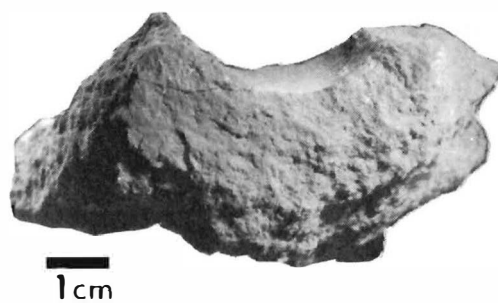
ROCK NUMBER: 12015
WEIGHT: 191.2 g DIMENSIONS: 4 x 4 x 2 cm

BINOCULAR DESCRIPTION

COLOR: Medium to dark gray, brownish tint
SHAPE: Angular
FABRIC: Vitrophyre
COHERENCE: Coherent
 Fracturing: Many, few penetrative
VARIABILITY: Homogeneous
SURFACE: Irregular, dust adheres strongly
ZAP PITS: Few pits on one slightly rounded surface
CAVITIES: Vugs, irregularly-shaped, 0.2 to 2 mm. One large (4 x 2.5 cm)
 smooth-walled, crystal-lined vesicle.
SPECIAL FEATURES: Grain size increases near vugs. Suggestions of shock

BY: Brett, Harmon, Gibson

12015



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	44.98
TiO ₂	=	2.86
Al ₂ O ₃	=	8.57
FeO	=	20.18
MnO	=	0.29
MgO	=	11.88
CaO	=	9.21
Na ₂ O	=	0.23
K ₂ O	=	0.06
P ₂ O ₅	=	0.06
S	=	0.07
Cr ₂ O ₃	=	0.68

TOTAL		99.07
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CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	1.95
An	=	22.18
Di	=	19.22
Hy	=	38.66
Ne	=	-
Ol	=	10.08
Chr	=	1.00
Ilm	=	5.43
Apa	=	0.13

TOTAL		99.00
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100 Mg/(Mg+Fe) = 51.2

An/Ab/Or = 90.6/7.95/1.45

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	61 (ID)
Sr	=	94 (XRF)
Cr	=	4600 (NAA)
V	=	
Sc	=	46.1 (NAA)
Ni	=	50 (NAA)
Co	=	51 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	110 (XRF)
Hf	=	3.5 (NAA)
Nb	=	6.6 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	16.3
Pr	=	
Nd	=	
Sm	=	4.31
Eu	=	0.81
Gd	=	
Tb	=	1.05
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	3.7
Lu	=	0.53
Y	=	35 (XRF)

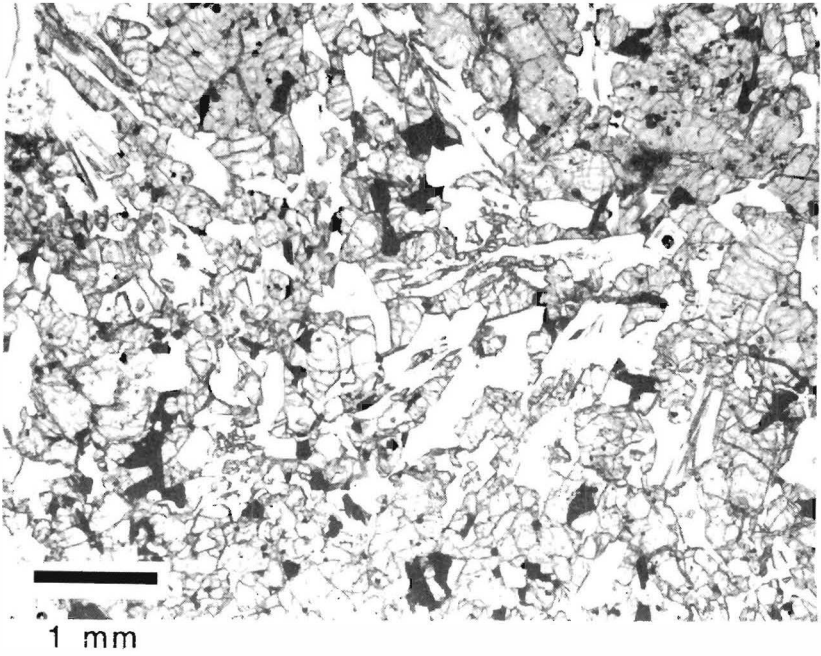
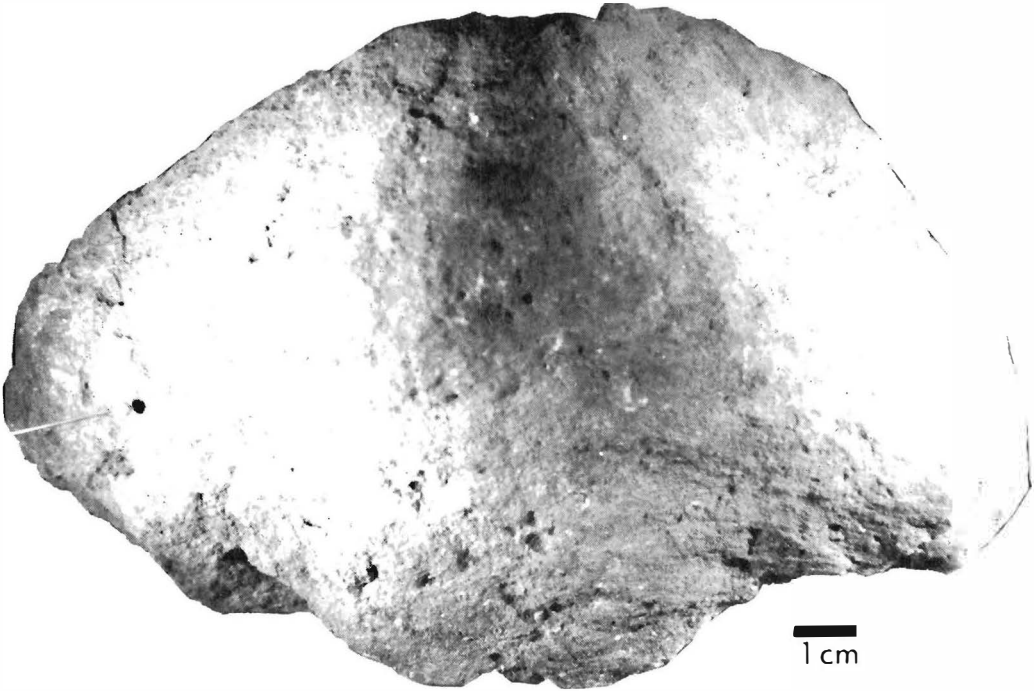
ROCK NUMBER: 12016
WEIGHT: 2028.3 g DIMENSIONS: 17.5 x 12.5 x 10 cm

BINOCULAR DESCRIPTION

COLOR: Medium to light gray
SHAPE: Subangular, one concave surface
FABRIC: Holocrystalline
COHERENCE: Coherent to friable
 Fracturing: Many, nonpenetrative
VARIABILITY: Fracturing irregularly distributed causing variable
 coherence. Cavities irregularly distributed
SURFACE: Irregular, dust adheres strongly.
ZAP PITS: Few 2-3 mm glass lined pits
CAVITIES: Few vesicles, some have coalesced and appear vuggy -
 some crystal faces visible
SPECIAL FEATURES: Chalky-white surface material or crust is
 probably feldspar shocked by particles that caused glass lined pits

BY: Smith, Harmon

12016



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	42.78
TiO ₂	=	4.02
Al ₂ O ₃	=	7.23
FeO	=	22.64
MnO	=	0.30
MgO	=	12.65
CaO	=	8.42
Na ₂ O	=	0.22
K ₂ O	=	0.06
P ₂ O ₅	=	0.08
S	=	0.08
Cr ₂ O ₃	=	0.57

TOTAL		99.05
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CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	1.86
An	=	18.56
Di	=	18.88
Hy	=	32.45
Ne	=	-
Ol	=	18.21
Chr	=	0.84
Ilm	=	7.63
Apa	=	0.17

TOTAL		98.97
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100 Mg/(Mg+Fe) = 49.9

An/Ab/Or = 89.33/8.96/1.71

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	59 (ID)
Sr	=	126 (XRF)
Cr	=	3950 (NAA)
V	=	
Sc	=	49.4 (NAA)
Ni	=	25 (NAA)
Co	=	54 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	117 (XRF)
Hf	=	6.3 (NAA)
Nb	=	6.1 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	16.2
Pr	=	
Nd	=	
Sm	=	5.5
Eu	=	1.06
Gd	=	
Tb	=	1.42
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	5.0
Lu	=	0.67
Y	=	45 (XRF)

ROCK NUMBER: 12017

WEIGHT: 53 g

DIMENSIONS: 5 x 3 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray, salt and pepper

SHAPE: Subrounded pyramid

FABRIC: Holocrystalline granular

COHERENCE: Coherent

Fracturing: Very few, nonpenetrative

VARIABILITY: Homogeneous rock with glass covering part of surface

SURFACE: Granulated

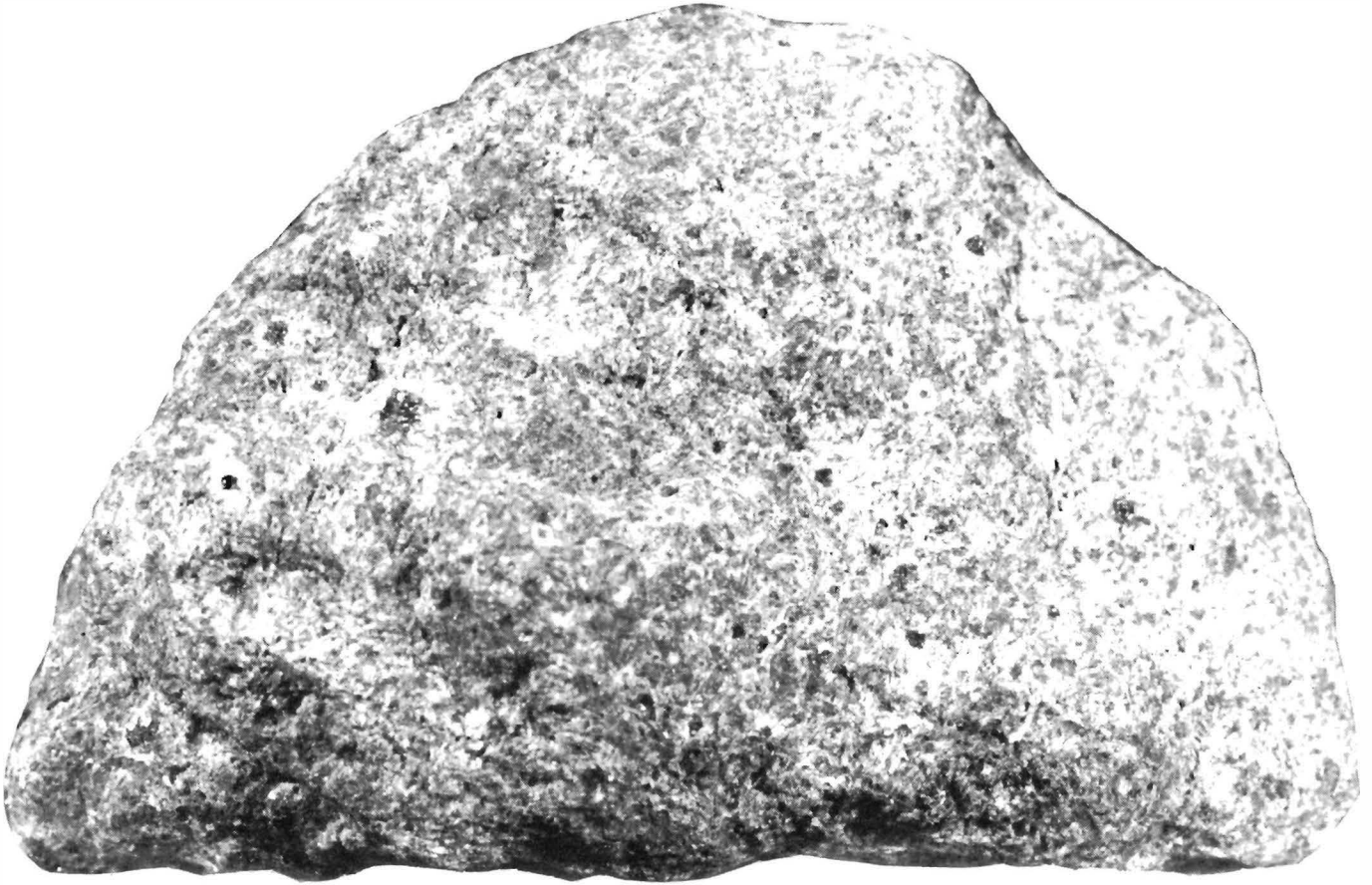
ZAP PITS: Many on rounded surfaces, most with glass lining

CAVITIES: None

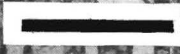
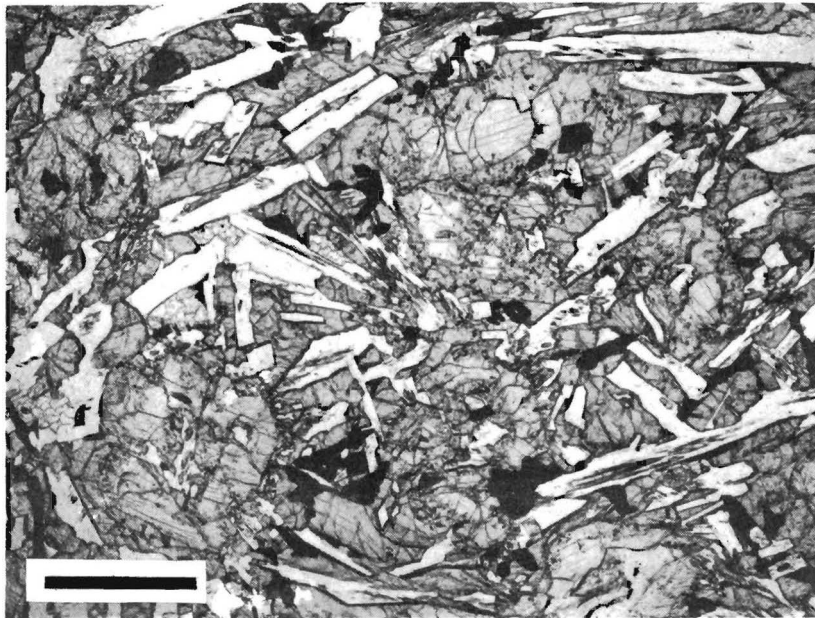
SPECIAL FEATURES: The glass covering part of surface has no impact pits and a variable thickness. It is modestly fractured and has a few vesicles. Surface under glass resembles remaining surface of rock

BY: Anderson, Gibson

12017



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	47.27
TiO ₂	=	3.37
Al ₂ O ₃	=	10.02
FeO	=	19.72
MnO	=	0.29
MgO	=	7.63
CaO	=	10.97
Na ₂ O	=	0.27
K ₂ O	=	0.09
P ₂ O ₅	=	0.09
S	=	0.03
Cr ₂ O ₃	=	0.52

TOTAL		100.27
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CIPW NORM

Qtz	=	2.76
Or	=	0.53
Ab	=	2.28
An	=	25.86
Di	=	23.57
Hy	=	37.87
Ne	=	-
Ol	=	-
Chr	=	0.77
Ilm	=	6.4
Apa	=	0.2

TOTAL		100.24
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100 Mg/(Mg+Fe)	=	40.8
An/Ab/Or	=	90/8/2

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	1.06 (NAA)
K	=	
Ba	=	150 (NAA)
Sr	=	118 (XRF)
Cr	=	3460 (NAA)
V	=	
Sc	=	47.4 (NAA)
Ni	=	
Co	=	45 (NAA)
Cu	=	
Zn	=	1.02 (NAA)
Th	=	2.19 (NAA)
U	=	
Zr	=	180 (NAA)
Hf	=	6.7 (NAA)
Nb	=	

RARE EARTH ELEMENTS (NAA)

La	=	17.1
Ce	=	49
Pr	=	
Nd	=	40
Sm	=	9.65
Eu	=	1.36
Gd	=	
Tb	=	
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	8.08
Lu	=	1.26
Y	=	

ROCK NUMBER: 12018
WEIGHT: 787 g

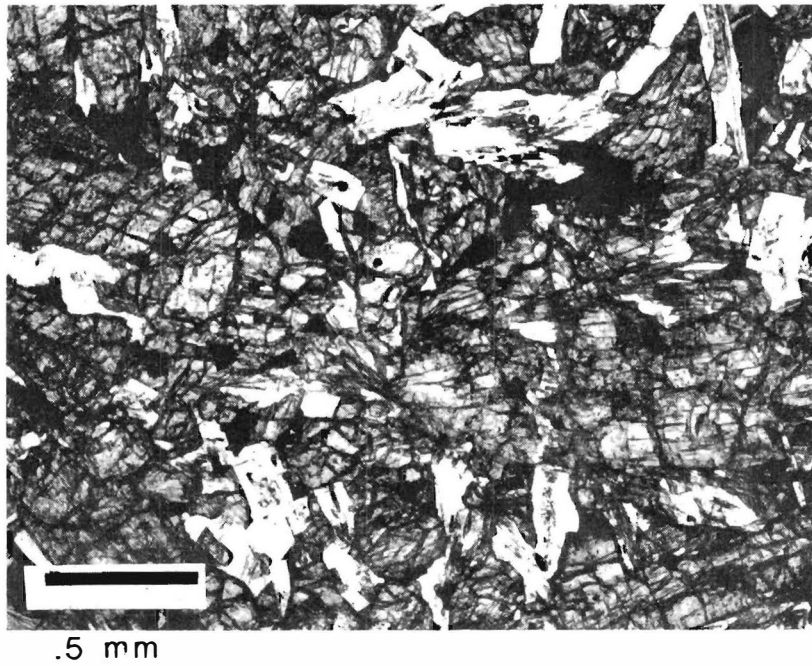
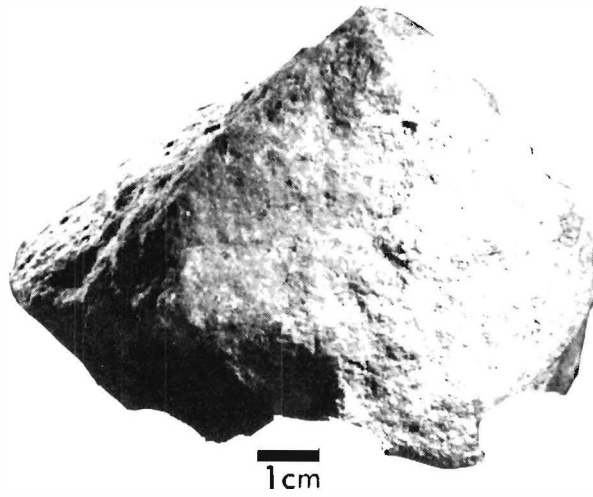
DIMENSIONS: 8 x 6 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Neutral gray N7 to N6
SHAPE: Subangular
FABRIC: Holocrystalline, granular
COHERENCE: Coherent
Fracturing: None
VARIABILITY: Homogeneous
SURFACE: Granular to smooth
ZAP PITS: Few glass lined pits about 1 mm diameter
CAVITIES: Few irregularly-shaped vugs containing randomly oriented crystals
SPECIAL FEATURES: Crushed plagioclase on surface of rock shows chalky white. Pyroxene more elongate near vugs.

BY: Butler, Wones, Anderson

12018



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	43.9
TiO ₂	=	2.59
Al ₂ O ₃	=	7.97
FeO	=	20.96
MnO	=	0.27
MgO	=	15.23
CaO	=	8.33
Na ₂ O	=	0.22
K ₂ O	=	0.05
P ₂ O ₅	=	0.07
S	=	0.05
Cr ₂ O ₃	=	0.62

TOTAL		100.26
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CIPW NORM

Qtz	=	-
Or	=	0.30
Ab	=	1.86
An	=	20.61
Di	=	16.74
Hy	=	29.46
Ne	=	-
Ol	=	25.26
Chr	=	0.91
Ilm	=	4.92
Apa	=	0.15

TOTAL		100.21
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100 Mg/(Mg+Fe) = 56.4
An/Ab/Or = 91/8/1

TRACE AND MINOR ELEMENTS

Li	=	7.51	(ID)
Rb	=	1.04	(ID)
K	=	429	(ID)
Ba	=	60.3	(ID)
Sr	=	89.3	(ID)
Cr	=	3690	(NAA)
V	=	140	(XRF)
Sc	=	38.9	(NAA)
Ni	=	55	(XRF)
Co	=	58	(NAA)
Cu	=	8	(XRF)
Zn	=	2	(XRF)
Th	=	0.879	(ID)
U	=	0.248	(ID)
Zr	=	89	(XRF)
Hf	=	2.48	(NAA)
Nb	=	5	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	15.9	
Pr	=	-	
Nd	=	11.8	
Sm	=	3.91	
Eu	=	0.834	
Gd	=	5.55	
Tb	=	-	
Dy	=	6.54	
Ho	=	-	
Er	=	3.8	
Tm	=	-	
Yb	=	3.42	
Lu	=	0.52	
Y	=	30	(XRF)

ROCK NUMBER: 12019
WEIGHT: 462.4 g

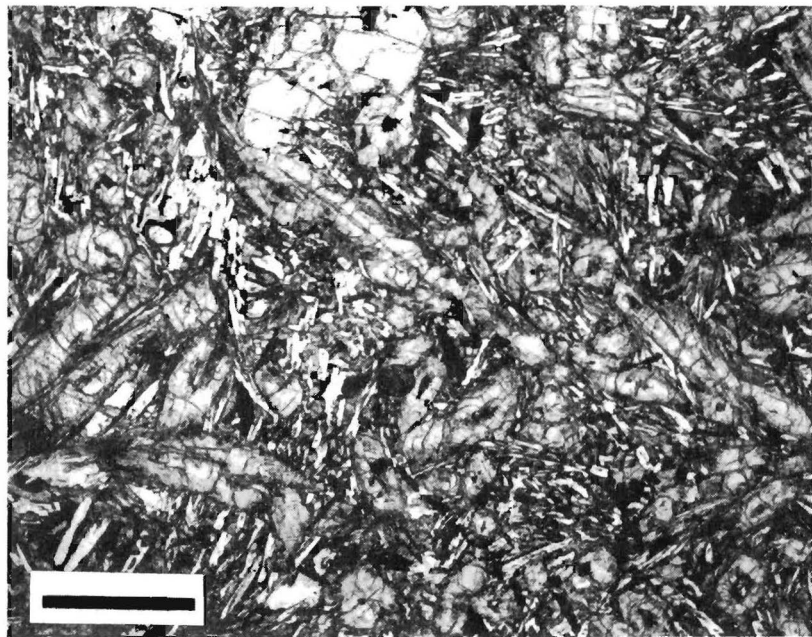
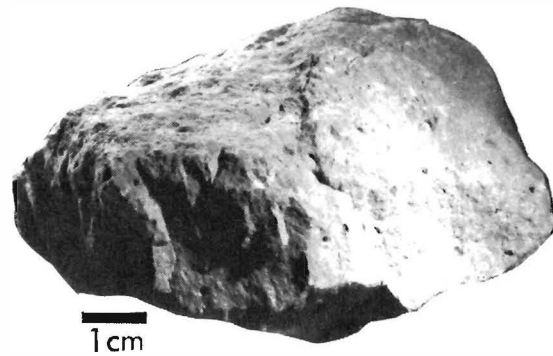
DIMENSIONS: 9 x 7 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Light to medium charcoal gray
SHAPE: Subrounded, hemispherical with flat bottom
FABRIC: Holocrystalline
COHERENCE: Coherent
Fracturing: Few, nonpenetrative; two perpendicular fractures
VARIABILITY: Homogeneous
SURFACE: Smooth
ZAP PITS: Few glass lined pits (0.5-2 mm), more pits on rounded side than flat side. Lined with black glass ranging in thickness from 0.02 to 0.2 mm. The pits are 0.2 to 0.5 mm deep.
CAVITIES: Few vugs, many are filled with dust
SPECIAL FEATURES: Flat side was probably the bottom for significant period of time on lunar surface

BY: Gibson

12019



.5 mm

NOT ALLOCATED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 12020
WEIGHT: 312 g

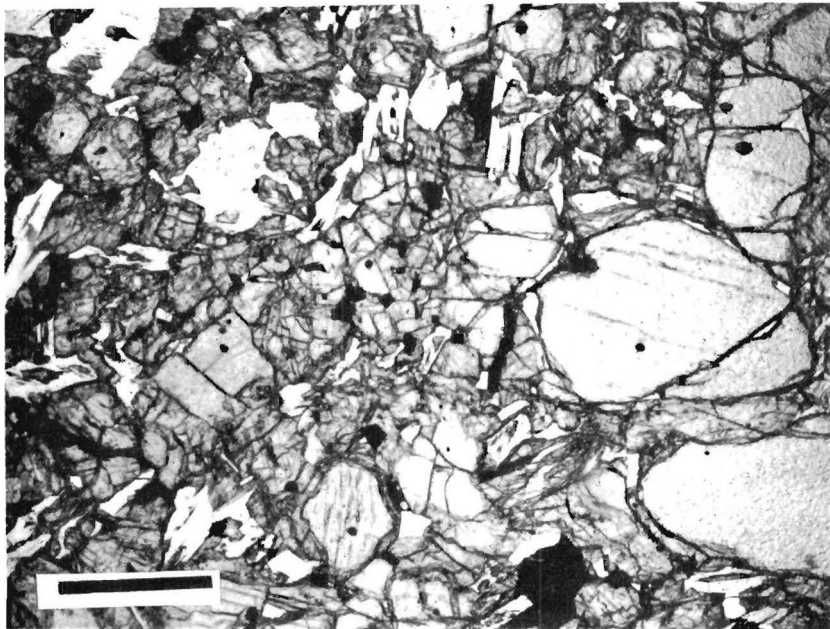
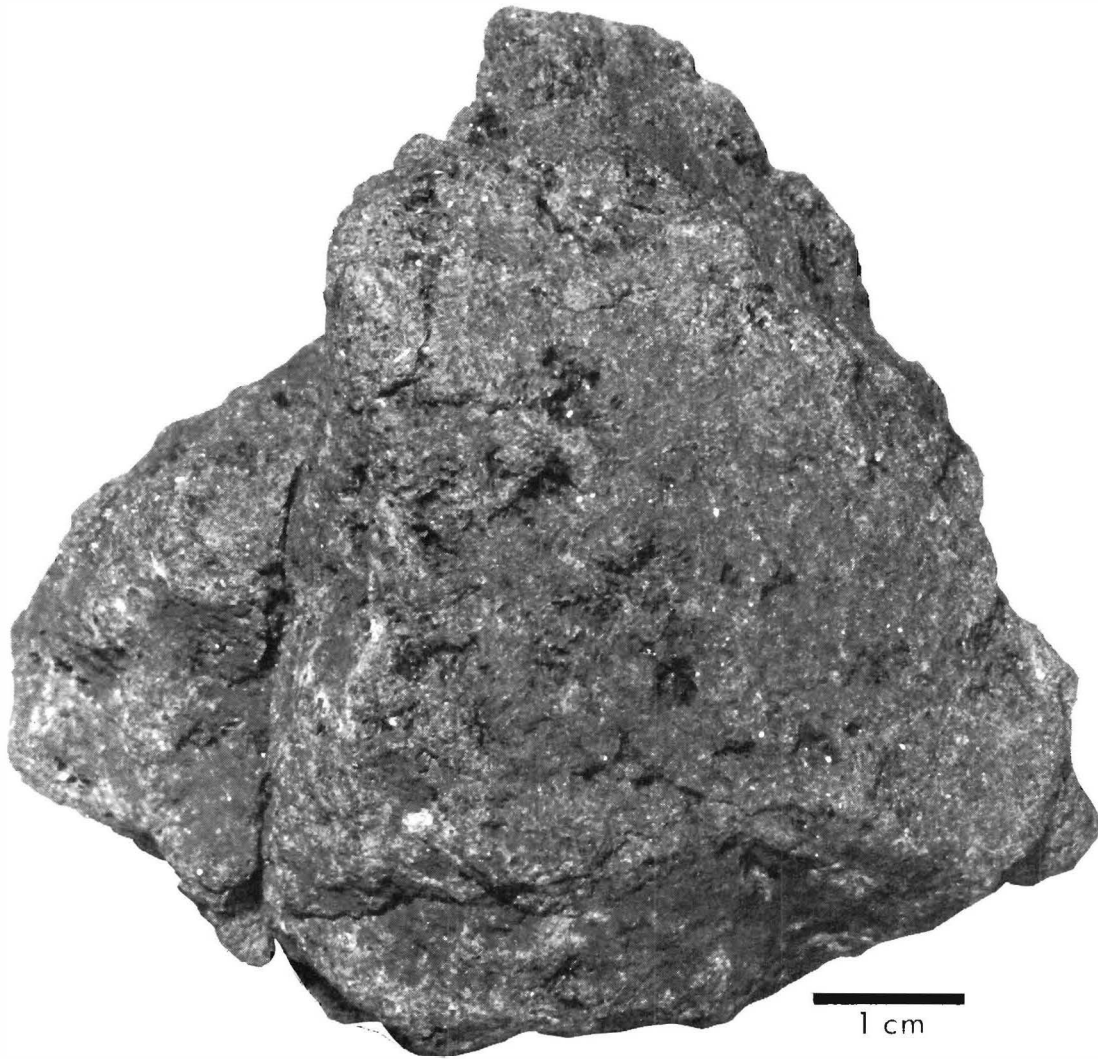
DIMENSIONS: 8 x 6 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Speckled brownish charcoal gray
SHAPE: Subangular, trigonal dipyramid
FABRIC: Holocrystalline granular
COHERENCE: Friable to coherent
Fracturing: Many, one penetrative planar fracture
VARIABILITY: Homogeneous
SURFACE: Hackly, appear to be mostly freshly broken
ZAP PITS: Few glass-lined pits
CAVITIES: Many vugs irregular shape and variable size up to 4 cm.
Pyroxene, olivine, and plagioclase in vugs 0.1 to 2 mm
SPECIAL FEATURES: Crystals in vugs would be good for single crystal studies

BY: Warner

12020



.5 mm

103

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	44.57
TiO ₂	=	2.76
Al ₂ O ₃	=	7.77
FeO	=	20.98
MnO	=	0.27
MgO	=	14.40
CaO	=	8.60
Na ₂ O	=	0.22
K ₂ O	=	0.06
P ₂ O ₅	=	0.08
S	=	0.06
Cr ₂ O ₃	=	0.61
<hr/>		
TOTAL		100.38

CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	1.86
An	=	20.04
Di	=	18.30
Hy	=	33.15
Ne	=	-
Ol	=	20.30
Chr	=	0.90
Ilm	=	5.24
Apa	=	0.17
<hr/>		
TOTAL		100.32

100 Mg/(Mg+Fe) = 55.0
 An/Ab/Or = 90/8/2

TRACE AND MINOR ELEMENTS

Li	=	5.7	(OES)
Rb	=	0.997	(ID)
K	=	468	(ID)
Ba	=	64.4	(ID)
Sr	=	93.6	(ID)
Cr	=	-	
V	=	146	(XRF)
Sc	=	45.4	(NAA)
Ni	=	50	(XRF)
Co	=	61	(NAA)
Cu	=	13	(XRF)
Zn	=	4	(XRF)
Th	=	0.71	(NAA)
U	=	-	
Zr	=	97	(XRF)
Hf	=	3.8	(NAA)
Nb	=	5	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	16.1	
Pr	=	-	
Nd	=	12	
Sm	=	4.5	
Eu	=	0.839	
Gd	=	5.43	
Tb	=	-	
Dy	=	6.13	
Ho	=	-	
Er	=	3.75	
Tm	=	-	
Yb	=	3.69	
Lu	=	-	
Y	=	32	(XRF)

ROCK NUMBER: 12021
WEIGHT: 1876.6 g

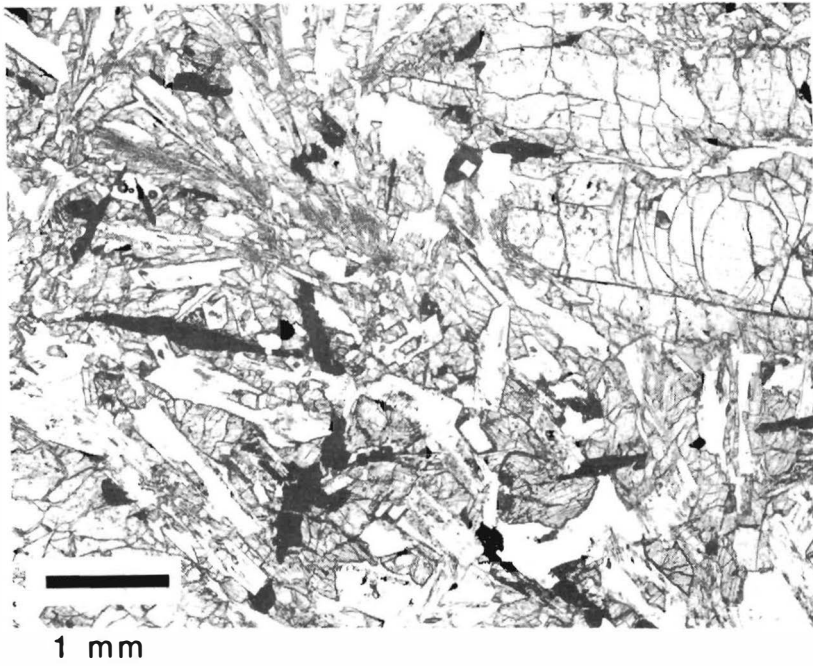
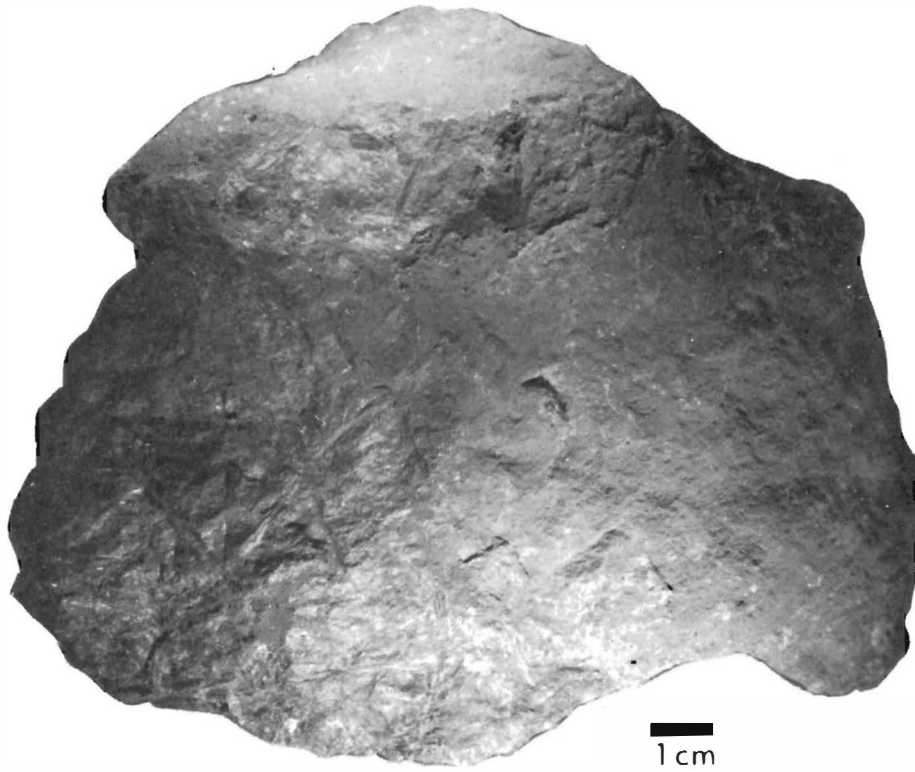
DIMENSIONS: 14 x 12 x 8 cm

BINOCULAR DESCRIPTION

COLOR: Neutral gray with a greenish cast
SHAPE: Deformed triangular prism with a concave base. Appears to be a spalled block
FABRIC: Coarse ophitic texture, pegmatitic, bladed pyroxene
COHERENCE: Coherent
Fracturing: Few, non-penetrative, occur near edges and concentrated on concave side
VARIABILITY: Chip off most protruding corner is finer grained and more olivine rich than rest of sample
SURFACE: Dust covered, displays texture well on convex side
ZAP PITS: Concave side pitted - small pits with halves - could study pits on individual grains
CAVITIES: Vugs at intersection of plagioclase grains. Concentration of ilmenite near vugs. No vesicles
SPECIAL FEATURES: Pyroxenes are zoned with honey yellow cores and brown rims.

BY: Wones

12021



CHEMISTRY

MAJOR ELEMENTS (4)

SiO ₂	=	46.68
TiO ₂	=	3.53
Al ₂ O ₃	=	10.78
FeO	=	19.31
MnO	=	0.26
MgO	=	7.39
CaO	=	11.38
Na ₂ O	=	0.31
K ₂ O	=	0.07
P ₂ O ₅	=	0.09
S	=	-
Cr ₂ O ₃	=	0.40
<hr/>		
TOTAL		100.20

CIPW NORM

Qtz	=	1.95
Or	=	0.41
Ab	=	2.62
An	=	27.82
Di	=	23.64
Hy	=	36.27
Ne	=	-
Ol	=	-
Chr	=	0.59
Ilm	=	6.70
Apa	=	0.20
<hr/>		
TOTAL		100.20

100 Mg/(Mg+Fe) = 40.5
An/Ab/Or = 90/9/1

TRACE AND MINOR ELEMENTS

Li	=	8.37	(ID)
Rb	=	1.14	(ID)
K	=	529	(ID)
Ba	=	71.1	(ID)
Sr	=	128.5	(ID)
Cr	=	1870	(NAA)
V	=	160	(ID)
Sc	=	49.8	(NAA)
Ni	=	16	(OES)
Co	=	27.7	(NAA)
Cu	=	8.1	(NAA)
Zn	=	4.15	(OES)
Th	=	0.932	(ID)
U	=	0.2610	(ID)
Zr	=	123.0	(OES)
Hf	=	4.09	(NAA)
Nb	=	14	(OES)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	19.8	
Pr	=	-	
Nd	=	14.4	
Sm	=	4.84	
Eu	=	1.116	
Gd	=	6.59	
Tb	=	-	
Dy	=	7.86	
Ho	=	-	
Er	=	4.53	
Tm	=	-	
Yb	=	4.12	
Lu	=	0.64	
Y	=	50.5	(OES)

ROCK NUMBER: 12022

WEIGHT: 1864.3 g

DIMENSIONS: 14 x 9.5 x 7 cm

BINOCULAR DESCRIPTION

COLOR: Medium to dark gray on fresh surfaces, medium gray to white on surface

SHAPE: Subangular, blocky, irregular pyramid

FABRIC: Crystalline, porphyritic

COHERENCE: Tough

Fracturing: None

VARIABILITY: Homogeneous

SURFACE: Granulated - is generally whiter than interior of rock, dust covered.

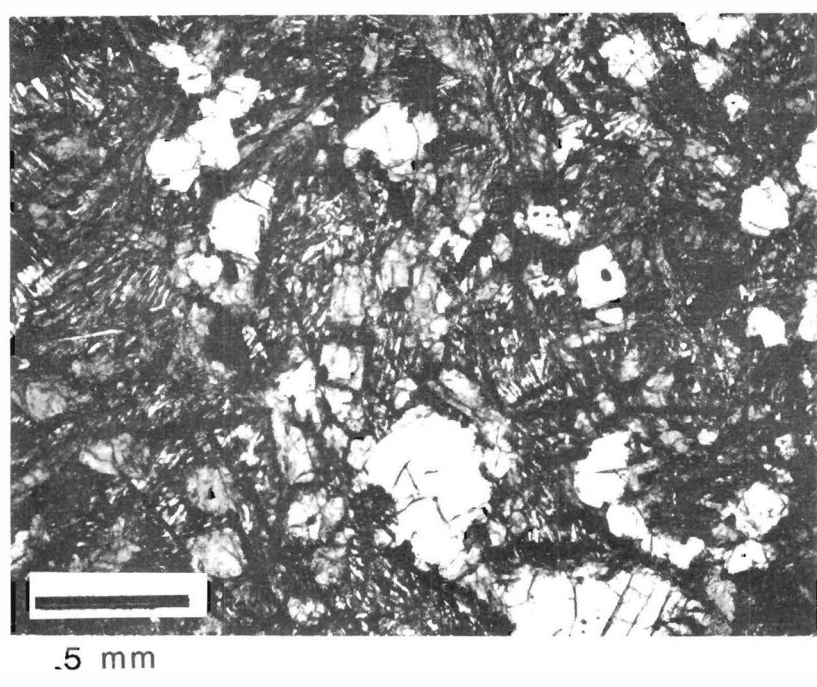
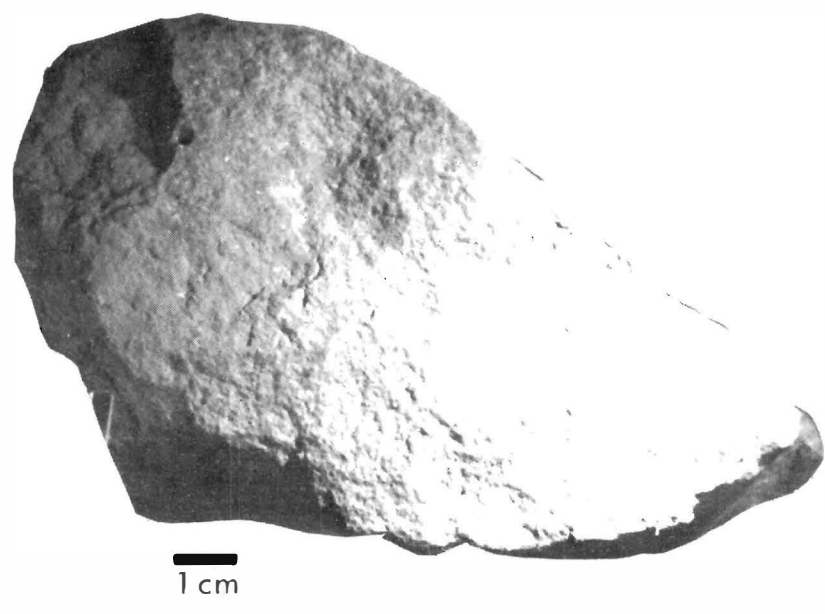
ZAP PITS: Many glass-lined pits (2 mm to 0.1 mm) on all surfaces. One surface appears less pitted as if it were exposed more recently than rest of surface.

CAVITIES: Vugs - many, up to 1 cm in diameter, often coalesced.

SPECIAL FEATURES: Distinct shatter crust enclosed entire rock

BY: Anderson, Hormon

12022



CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	42.77
TiO ₂	=	4.85
Al ₂ O ₃	=	9.08
FeO	=	21.75
MnO	=	0.25
MgO	=	11.01
CaO	=	9.47
Na ₂ O	=	0.38
K ₂ O	=	0.07
P ₂ O ₅	=	0.13
S	=	-
Cr ₂ O ₃	=	0.56
TOTAL		<u>100.32</u>

CIPW NORM

Qtz	=	-
Or	=	0.41
Ab	=	3.22
An	=	22.86
Di	=	19.42
Hy	=	28.30
Ne	=	-
Ol	=	15.79
Chr	=	0.82
Ilm	=	9.21
Apa	=	0.28
TOTAL		<u>100.32</u>

100 Mg/(Mg+Fe) = 47.4
An/Ab/Or = 86/12/2

TRACE AND MINOR ELEMENTS

Li	=	9.51	(ID)
Rb	=	0.738	(ID)
K	=	536	(ID)
Ba	=	55	(ID)
Sr	=	143	(ID)
Cr	=	3300	(OES)
V	=	180	(GRV)
Sc	=	53.80	(NAA)
Ni	=	41.9	(GRV)
Co	=	42.5	(NAA)
Cu	=	8	(GRV)
Zn	=	1.2	(NAA)
Th	=	0.71	(ID)
U	=	0.198	(ID)
Zr	=	180	(GRV)
Hf	=	3.4	(NAA)
Nb	=	6	(MS)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	17.4	
Pr	=	-	
Nd	=	14.4	
Sm	=	5.38	
Eu	=	1.26	
Gd	=	7.71	
Tb	=	-	
Dy	=	9.37	
Ho	=	-	
Er	=	5.42	
Tm	=	-	
Yb	=	5.69	
Lu	=	-	
Y	=	68	(GRV)

ROCK NUMBER: 12031

WEIGHT: 185 g

DIMENSIONS: 5.5 x 5 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Brownish gray

SHAPE: Subangular, blocky, equant

FABRIC: Coarse-grained, holocrystalline, large radiating crystals

COHERENCE: Coherent to friable

Fracturing: Many - some penetrative

VARIABILITY: Grain size and texture varies slightly

SURFACE: Granular

ZAP PITS: Few (<0.5 mm) glass-lined pits

CAVITIES: Few vugs, widely scattered (~1 mm). Feldspars intersect to form vugs.

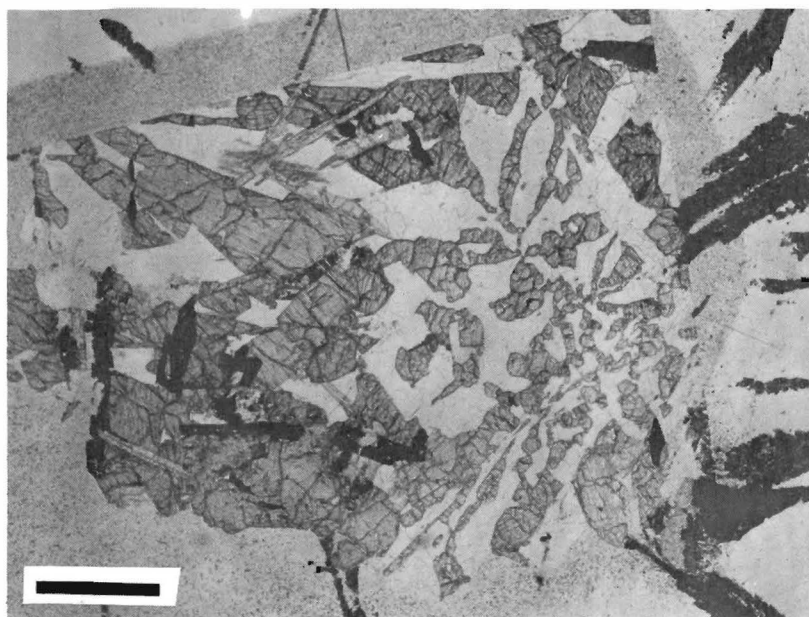
SPECIAL FEATURES: Pyroxene visibly zoned with greenish cores and brown rims.

BY: Heiken, Chao

12031



1 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	46.97
TiO ₂	=	2.88
Al ₂ O ₃	=	12.63
FeO	=	16.78
MnO	=	0.26
MgO	=	7.13
CaO	=	12.25
Na ₂ O	=	0.33
K ₂ O	=	0.05
P ₂ O ₅	=	0.05
S	=	0.05
Cr ₂ O ₃	=	0.35

TOTAL		99.73
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CIPW NORM

Qtz	=	2.13
Or	=	0.3
Ab	=	2.79
An	=	32.83
Di	=	23.18
Hy	=	32.36
Ne	=	-
Ol	=	-
Chr	=	0.52
Ilm	=	5.47
Apa	=	0.11

TOTAL		99.68
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100 Mg/(Mg+Fe) = 43.1

An/Ab/Or = 91.4/7.77/.82

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	60 (ID)
Sr	=	136 (XRF)
Cr	=	2460 (NAA)
V	=	
Sc	=	48.9 (NAA)
Ni	=	
Co	=	26 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	100 (XRF)
Hf	=	3.3 (NAA)
Nb	=	7.0 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	15.6
Pr	=	
Nd	=	
Sm	=	4.23
Eu	=	1.00
Gd	=	
Tb	=	1.19
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	3.7
Lu	=	0.55
Y	=	35 (XRF)

ROCK NUMBER: 12035

WEIGHT: 71 g

DIMENSIONS: 5 x 4 x 1.5 cm

BINOCULAR DESCRIPTION

COLOR: Light olive gray

SHAPE: Subrounded, triaxial ellipsoid

FABRIC: Coarse grained, granular

COHERENCE: Friable

Fracturing: Many, penetrative, no orientation

VARIABILITY: Homogeneous

SURFACE: Granulated - fresh

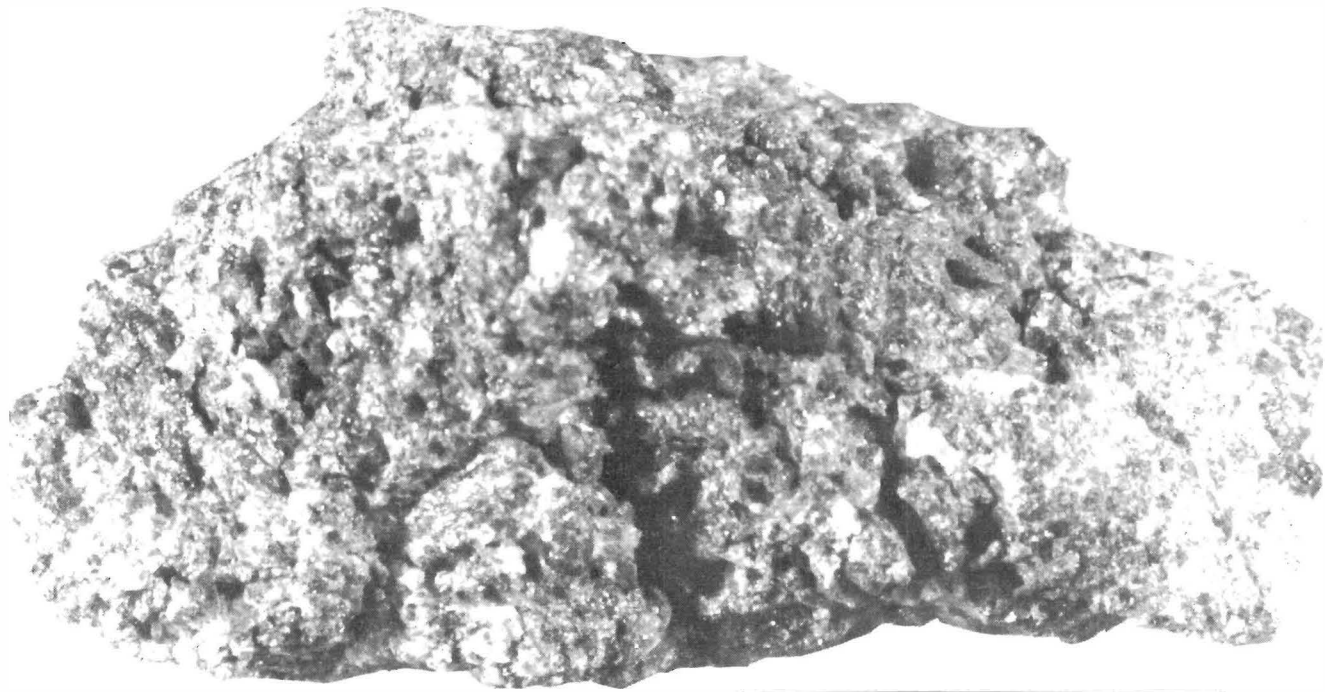
ZAP PITS: None

CAVITIES: Many - irregular up to 4 mm, not clustered. Olivine
in vugs

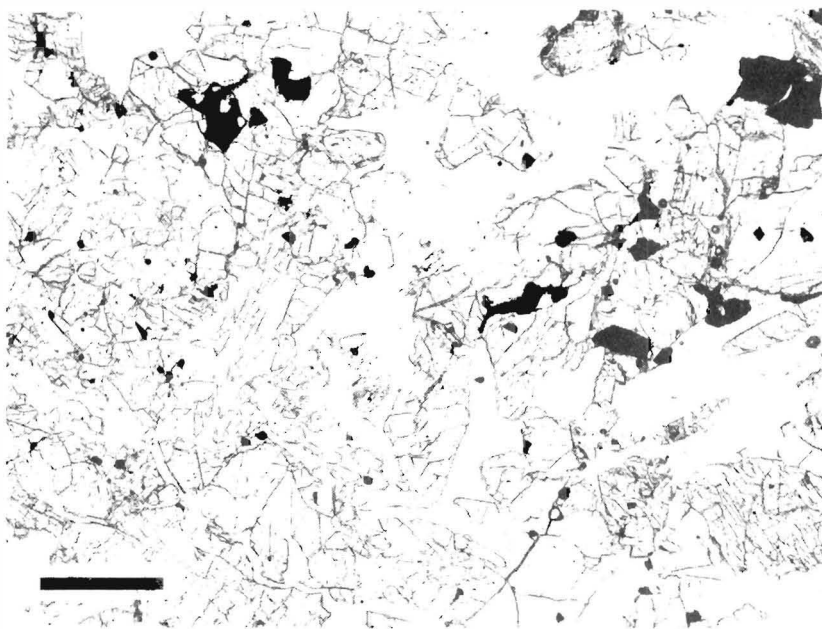
SPECIAL FEATURES: Now fragmented into 5 pieces and fines

BY: Wones

12035



.5 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	43.17
TiO ₂	=	2.28
Al ₂ O ₃	=	8.03
FeO	=	22.20
MnO	=	0.29
MgO	=	15.49
CaO	=	8.08
Na ₂ O	=	0.21
K ₂ O	=	0.05
P ₂ O ₅	=	0.06
S	=	0.05
Cr ₂ O ₃	=	0.49
<hr/>		
TOTAL		100.40

CIPW NORM

Qtz	=	-
Or	=	0.32
Ab	=	1.78
An	=	20.81
Di	=	15.64
Hy	=	25.09
Ne	=	-
Ol	=	31.54
Chr	=	0.72
Ilm	=	4.33
Apa	=	0.13
<hr/>		
TOTAL		100.36

100 Mg/(Mg+Fe) = 55.4
An/Ab/Or = 91/8/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	0.689	(ID)
K	=	363	(ID)
Ba	=	47.2	(ID)
Sr	=	84.3	(ID)
Cr	=	-	
V	=	130	(XRF)
Sc	=	33.7	(NAA)
Ni	=	32.9	(XRF)
Co	=	53.2	(NAA)
Cu	=	2	(XRF)
Zn	=	2	(XRF)
Th	=	0.682	(ID)
U	=	0.199	(ID)
Zr	=	81	(XRF)
Hf	=	1	(NAA)
Nb	=	4	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	11.5	
Pr	=	-	
Nd	=	8.91	
Sm	=	3.22	
Eu	=	0.751	
Gd	=	4.32	
Tb	=	-	
Dy	=	5.07	
Ho	=	-	
Er	=	3.09	
Tm	=	-	
Yb	=	3.04	
Lu	=	0.423	
Y	=	29	(XRF)

ROCK NUMBER: 12036

WEIGHT: 75 g

DIMENSIONS: 6 x 3.5 x 3.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray

SHAPE: Subangular, elongate, one flat surface

FABRIC: Medium grained, holocrystalline; crude orientation of vugs parallel to long dimension of rock

COHERENCE: Coherent

Fracturing: Few - some penetrative, extend out from vugs

VARIABILITY: Homogeneous

SURFACE: Very irregular, granulated, dusty

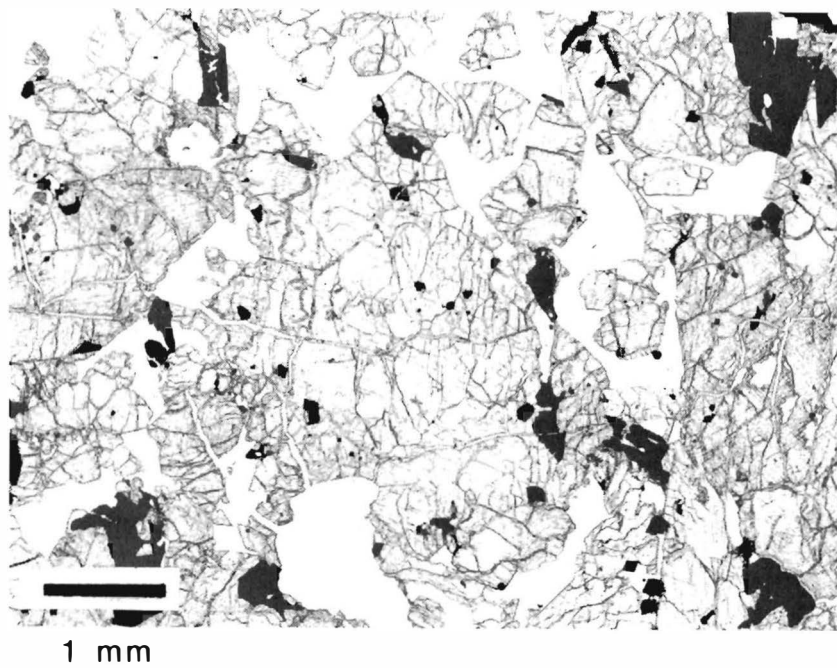
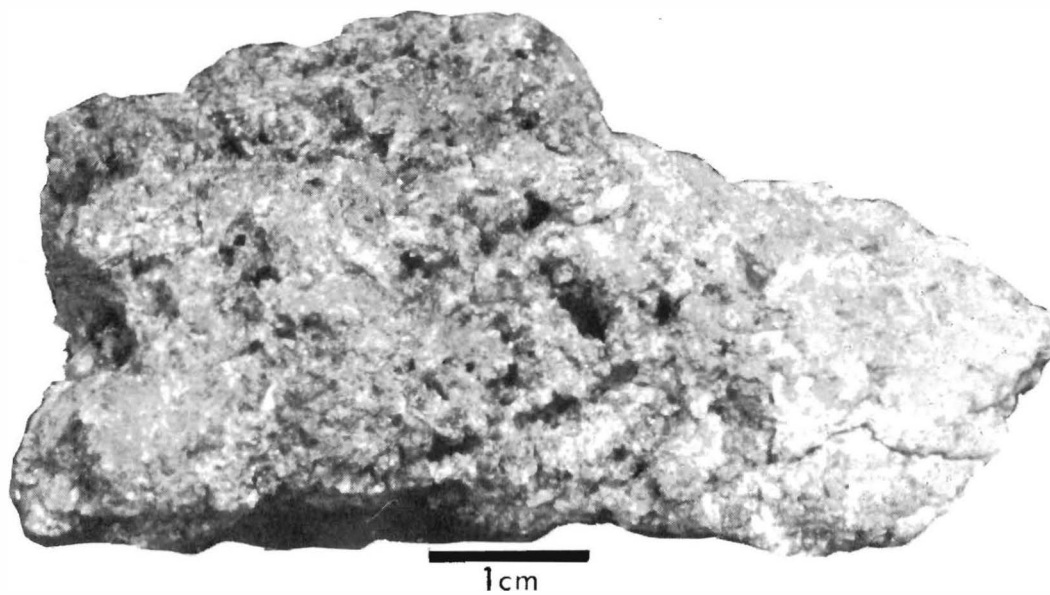
ZAP PITS: None

CAVITIES: Very vuggy (15 volume %) up to 4 mm

SPECIAL FEATURES: Crystals in vugs have good crystal faces

BY: Heiken

12036



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	43.11
TiO ₂	=	3.20
Al ₂ O ₃	=	6.16
FeO	=	21.82
MnO	=	0.30
MgO	=	16.71
CaO	=	7.46
Na ₂ O	=	0.18
K ₂ O	=	0.06
P ₂ O ₅	=	0.02
S	=	0.07
Cr ₂ O ₃	=	0.72

TOTAL		99.81
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CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	1.52
An	=	15.82
Di	=	17.33
Hy	=	29.3
Ne	=	-
Ol	=	28.23
Chr	=	1.06
Ilm	=	6.08
Apa	=	0.04

TOTAL		99.74
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100 Mg/(Mg+Fe) = 57.7
An/Ab/Or = 89.39/8.6/2

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	56 (ID)
Sr	=	91 (XRF)
Cr	=	4880 (NAA)
V	=	
Sc	=	42.6 (NAA)
Ni	=	60 (NAA)
Co	=	63 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	97 (XRF)
Hf	=	4.7 (NAA)
Nb	=	6.6 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	14.0
Pr	=	
Nd	=	
Sm	=	4.03
Eu	=	0.75
Gd	=	
Tb	=	0.95
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	3.5
Lu	=	0.51
Y	=	36 (XRF)

ROCK NUMBER: 12038
WEIGHT: 746 g

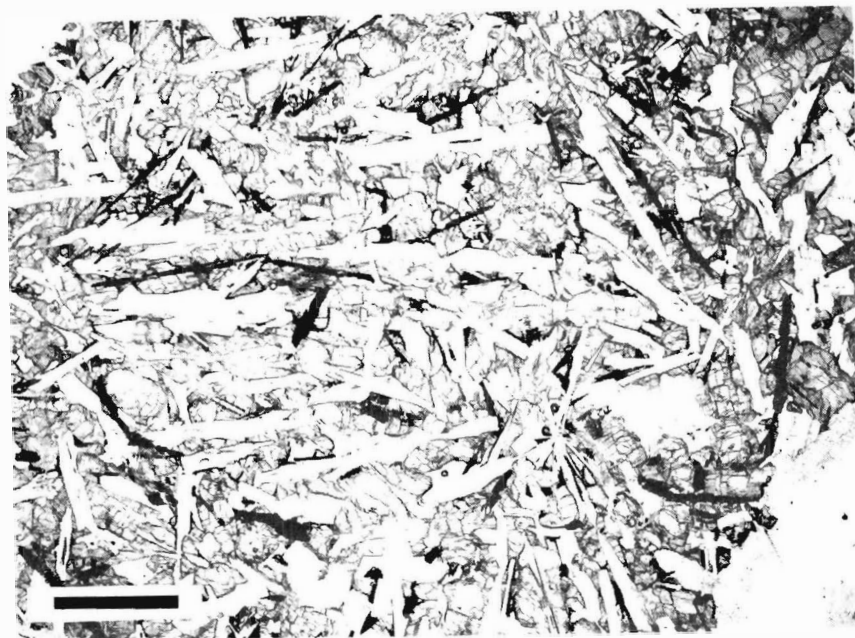
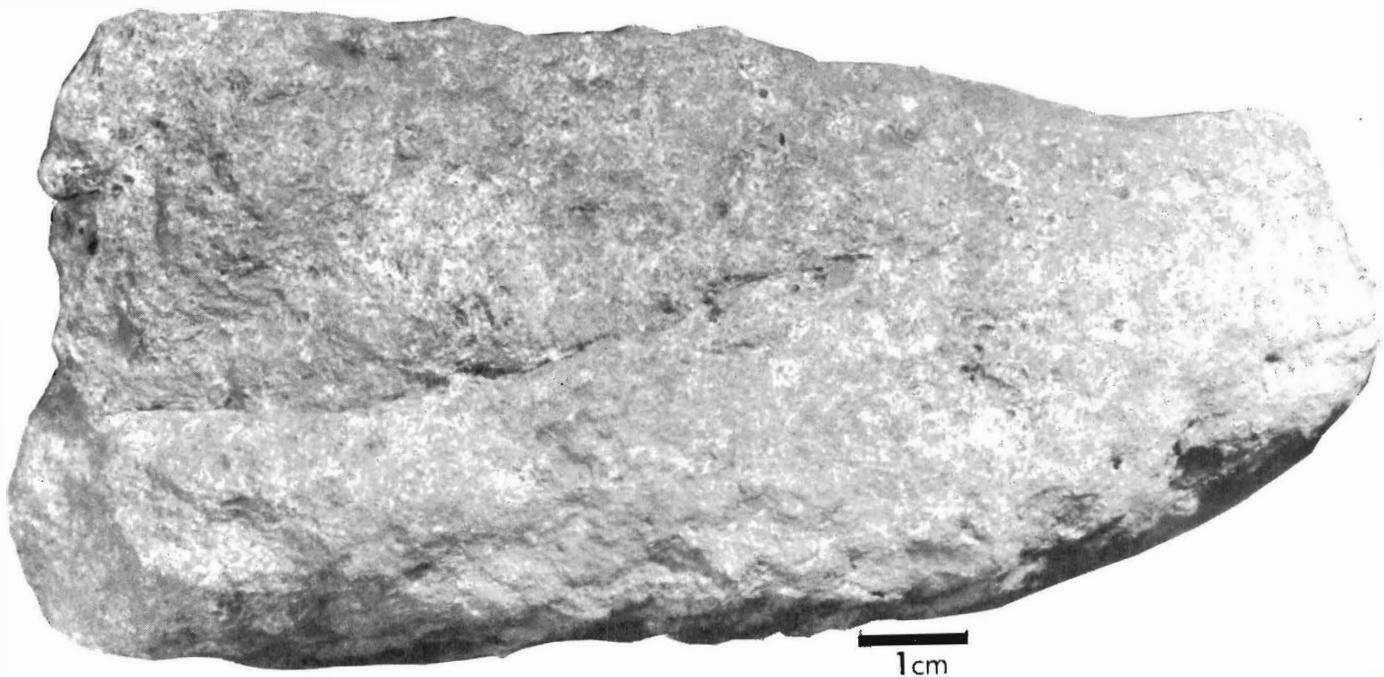
DIMENSIONS: 12.5 x 7.5 x 5.5 cm

BINOCULAR DESCRIPTION

COLOR: Interior medium gray (N5), surface medium dark gray (N4)
SHAPE: Subangular, roughly triangular and flat
FABRIC: Fine to medium-grained, equigranular
COHERENCE: Coherent
Fracturing: Few-nonpenetrative, slab-like
VARIABILITY: Slightly more rounded surface is more weathered -
opposing surface more angular
SURFACE: Smooth - covered modestly with dust
ZAP PITS: Many, some glass-lined with white halves - more
numerous on rounded surface
CAVITIES: Crystal lined vugs, more numerous on one half of rock,
no vesicles
SPECIAL FEATURES: Pyroxene equant in rock but acicular in vugs.

BY: Lindsay

12038



1 mm

121

CHEMISTRY

MAJOR ELEMENTS (5)

SiO ₂	= 46.83
TiO ₂	= 3.24
Al ₂ O ₃	= 12.48
FeO	= 17.76
MnO	= 0.25
MgO	= 6.86
CaO	= 11.49
Na ₂ O	= 0.65
K ₂ O	= 0.07
P ₂ O ₅	= 0.14
S	= 0.07
Cr ₂ O ₃	= 0.31
<hr/>	
TOTAL	100.15

CIPW NORM

Qtz	= 1.24
Or	= 0.41
Ab	= 5.50
An	= 30.93
Di	= 21.23
Hy	= 33.86
Ne	= -
Ol	= -
Chr	= 0.46
Ilm	= 6.15
Apa	= 0.31
<hr/>	
TOTAL	100.08

100 Mg/(Mg+Fe) = 40.8
An/Ab/Or = 84/15/1

TRACE AND MINOR ELEMENTS

Li	= 10.8	(ID)
Rb	= 0.604	(ID)
K	= 634	(ID)
Ba	= 130	(ID)
Sr	= 190	(ID)
Cr	= 2100	(OES)
V	= 104	(XRF)
Sc	= 44.6	(NAA)
Ni	= 2	(XRF)
Co	= 28.4	(NAA)
Cu	= 8	(XRF)
Zn	= 3	(XRF)
Th	= 0.615	(ID)
U	= 0.157	(ID)
Zr	= 160	(XRF)
Hf	= 5	(NAA)
Nb	= 7	(XRF)

RARE EARTH ELEMENTS (ID)

La	= -	
Ce	= 35	
Pr	= -	
Nd	= 26.3	
Sm	= 80.2	
Eu	= 2.19	
Gd	= 10.6	
Tb	= -	
Dy	= 11.1	
Ho	= -	
Er	= 6.12	
Tm	= -	
Yb	= 5.26	
Lu	= 0.814	
Y	= 46	(XRF)

ROCK NUMBER: 12039
WEIGHT: 255 g

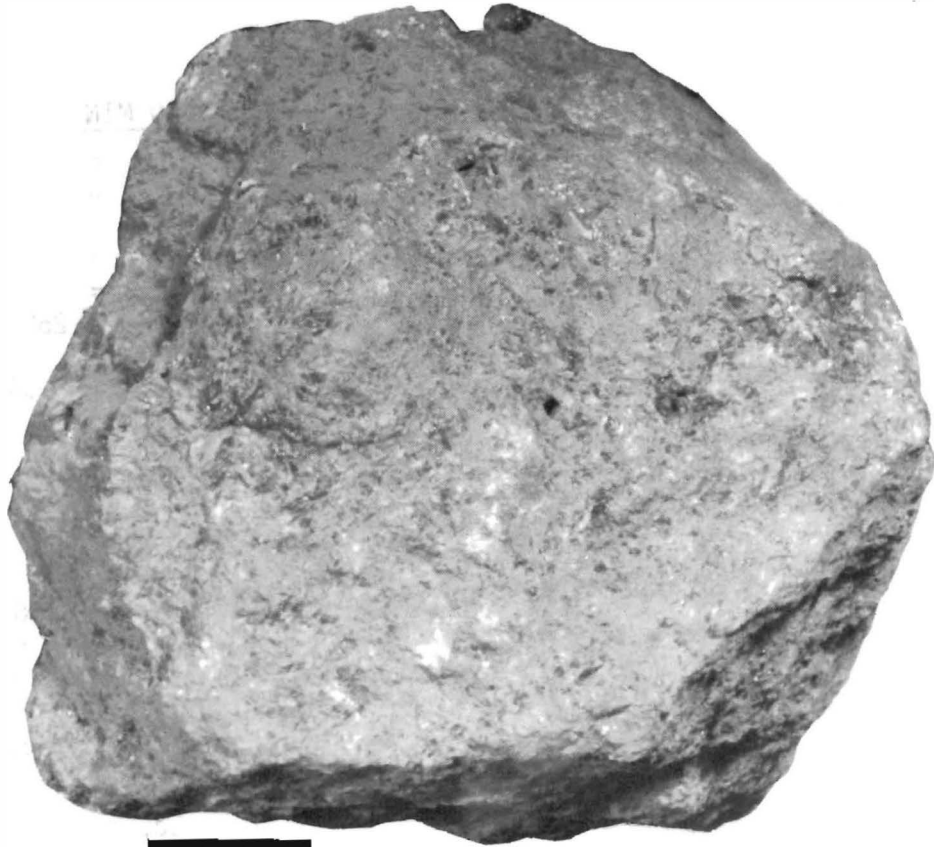
DIMENSIONS: 7 x 6 x 4 cm

BINOCULAR DESCRIPTION

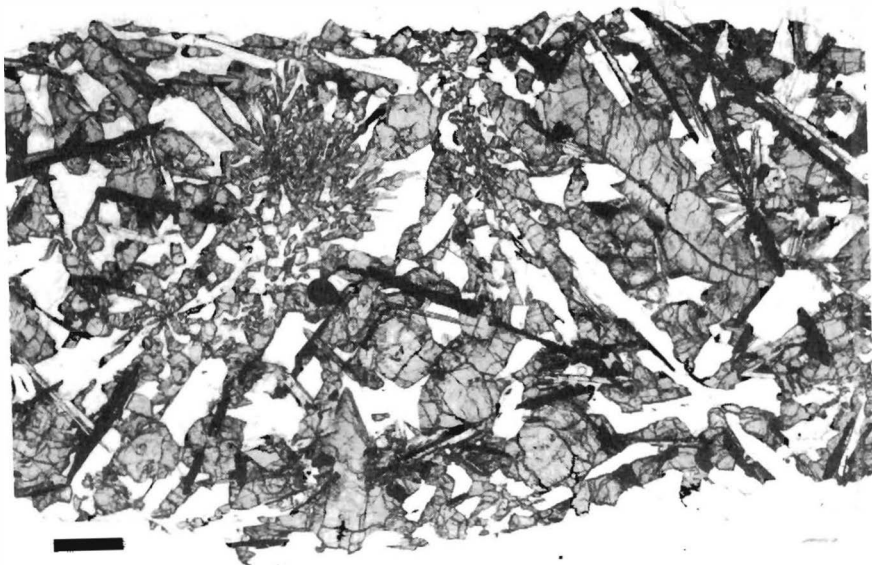
COLOR: Medium gray - speckled
SHAPE: Subrounded, pyramidal
FABRIC: Equigranular
COHERENCE: Coherent
Fracturing: One welded fracture
VARIABILITY: Homogeneous
SURFACE: Granulated, dust covered
ZAP PITS: Few glass-lined pits
CAVITIES: Few vugs, widely scattered, no vesicles
SPECIAL FEATURES: No olivine, visibly zoned pyroxene

BY: Morrison

12039



1 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	46.09
TiO ₂	=	4.46
Al ₂ O ₃	=	10.52
FeO	=	20.32
MnO	=	0.29
MgO	=	5.75
CaO	=	11.67
Na ₂ O	=	0.29
K ₂ O	=	0.10
P ₂ O ₅	=	0.09
S	=	0.11
Cr ₂ O ₃	=	0.38

TOTAL		100.07
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CIPW NORM

Qtz	=	3.47
Or	=	0.59
Ab	=	2.45
An	=	27.11
Di	=	25.67
Hy	=	31.45
Ne	=	-
Ol	=	-
Chr	=	0.56
Ilm	=	8.47
Apa	=	0.2

TOTAL		99.96
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100 Mg/(Mg+Fe) = 33.5

An/Ab/Or = 89.9/8.14/1.96

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	88 (ID)
Sr	=	122 (XRF)
Cr	=	2500 (NAA)
V	=	
Sc	=	56.0 (NAA)
Ni	=	
Co	=	28 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	156 (XRF)
Hf	=	4.7 (NAA)
Nb	=	10.7 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	25.7
Pr	=	
Nd	=	
Sm	=	6.55
Eu	=	1.18
Gd	=	
Tb	=	1.66
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	5.5
Lu	=	0.81
Y	=	52 (XRF)

ROCK NUMBER: 12040
WEIGHT: 319 g

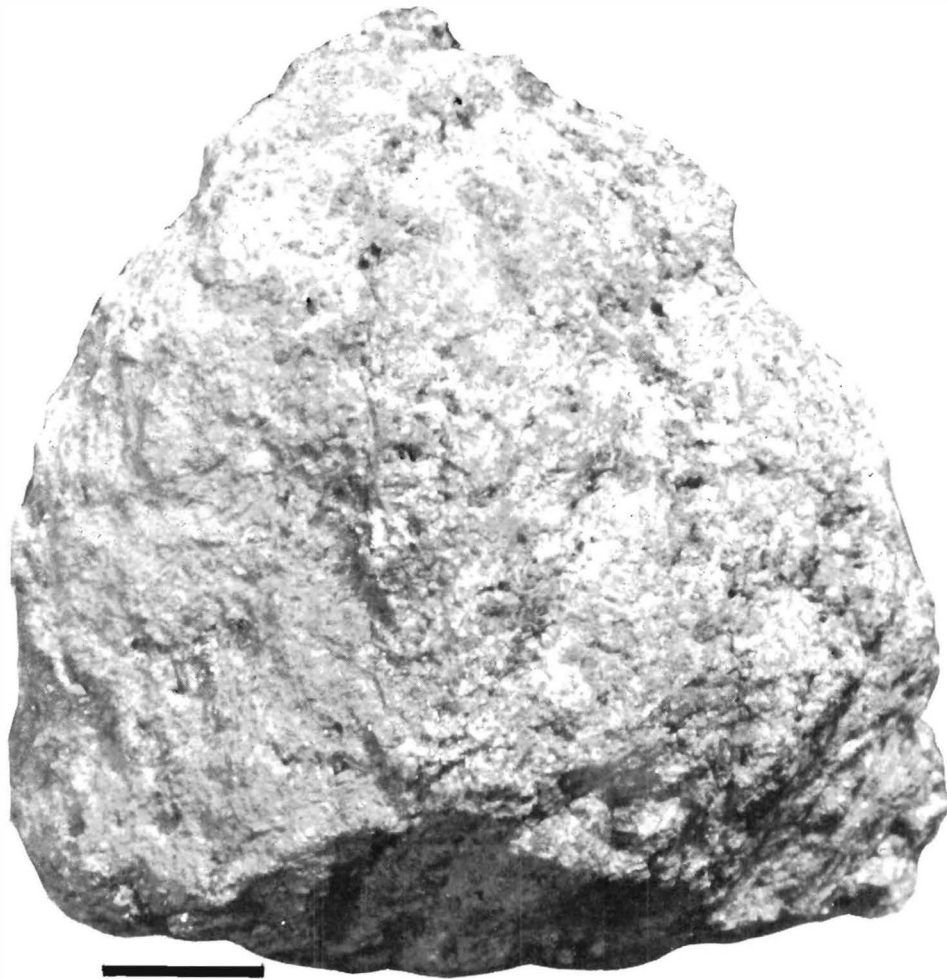
DIMENSIONS: 7 x 6 x 5.5 cm

BINOCULAR DESCRIPTION

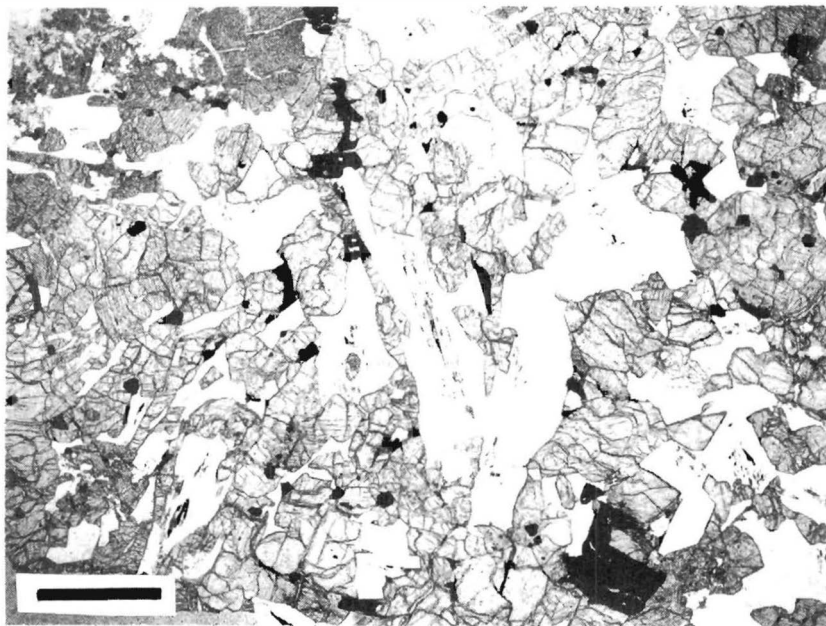
COLOR: Medium gray N4
SHAPE: Subrounded, equant, one flat side
FABRIC: Medium grained, equigranular
COHERENCE: Friable to coherent
Fracturing: Few-nonpenetrative, some radiate from a point
VARIABILITY: Homogeneous
SURFACE: Granulated, irregular
ZAP PITS: None observed
CAVITIES: Vugs up to 5 mm x 15 mm, weakly oriented, lined with
euhedral crystals.
SPECIAL FEATURES: No zap pits and weakly oriented vugs.

BY: Lindsay, Sutton

12040



1 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	43.88
TiO ₂	=	2.45
Al ₂ O ₃	=	7.27
FeO	=	21.09
MnO	=	0.27
MgO	=	16.45
CaO	=	8.01
Na ₂ O	=	0.17
K ₂ O	=	0.05
P ₂ O ₅	=	0.06
S	=	0.04
Cr ₂ O ₃	=	0.63

TOTAL 100.37

CIPW NORM

Qtz	=	-
Or	=	0.30
Ab	=	1.44
An	=	18.93
Di	=	16.83
Hy	=	29.09
Ne	=	-
Ol	=	28.04
Chr	=	0.93
Ilm	=	4.65
Apa	=	0.13

TOTAL 100.33

100 Mg/(Mg+Fe) = 58.2

An/Ab/Or = 91/7/2

TRACE AND MINOR ELEMENTS

Li	=	6.67	(ID)
Rb	=	1.0	(ID)
K	=	411	(ID)
Ba	=	57.2	(ID)
Sr	=	85.5	(ID)
Cr	=	3826.67	(NAA)
V	=	153	(XRF)
Sc	=	37.53	(NAA)
Ni	=	40	(XRF)
Co	=	61.1	(NAA)
Cu	=	13	(XRF)
Zn	=	8	(XRF)
Th	=	0.47	(GAM)
U	=	0.16	(GAM)
Zr	=	57	(XRF)
Hf	=	2.39	(NAA)
Nb	=	2	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	15.3	
Pr	=	-	
Nd	=	12	
Sm	=	4.03	
Eu	=	0.796	
Gd	=	5.6	
Tb	=	-	
Dy	=	6.36	
Ho	=	-	
Er	=	3.71	
Tm	=	-	
Yb	=	3.38	
Lu	=	0.521	
Y	=	22	(XRF)

ROCK NUMBER: 12043
WEIGHT: 60g

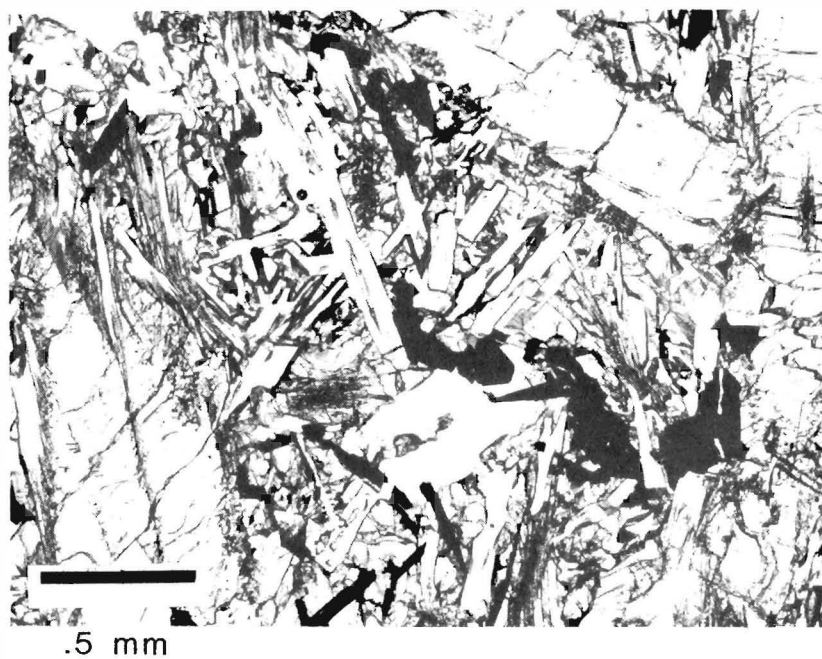
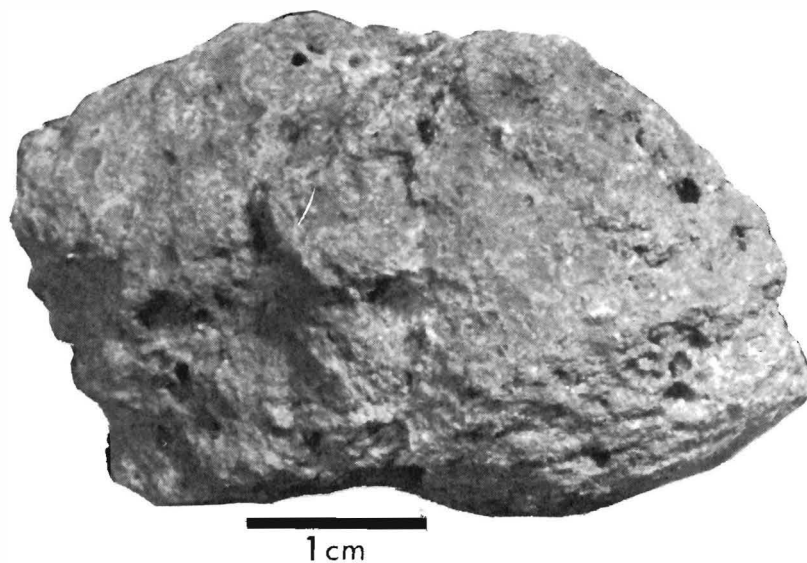
DIMENSIONS: 4.5 x 3.5 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray, dark gray on fresh surface
SHAPE: Subrounded, ovoid rock with broken angular surface
FABRIC: Medium-grained, holocrystalline
COHERENCE: Coherent
Fracturing: Few-nonpenetrative on fractured side parallel to surface
VARIABILITY: Irregularly distributed glass splashes on surface, interior appears homogeneous
SURFACE: Granulated, shock crust, dusty; glass splash (2.5 x 2 cm) less than 0.1 mm thick - glass is highly vesicular.
ZAP PITS: Pits lined with thin bubbly glass, old surface densely pitted, broken surface pitted but not as numerous. Pit linings raised above surface of rock.
CAVITIES: Spherical vesicles (10 volume %) no orientation (up to 2 mm); surface broken in lab shows crystal lined vugs and spherical vesicles - vugs aligned in zones.
SPECIAL FEATURES: Inclusion of breccia in glass splash on surface - contact with basalt sharp and smooth.

BY: Heiken, Greenwood

12043



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	46.77
TiO ₂	=	3.38
Al ₂ O ₃	=	10.09
FeO	=	19.50
MnO	=	0.29
MgO	=	7.68
CaO	=	10.96
Na ₂ O	=	0.27
K ₂ O	=	0.06
P ₂ O ₅	=	0.06
S	=	0.07
Cr ₂ O ₃	=	0.50
TOTAL		<u>99.63</u>

CIPW NORM

Qtz	=	2.40
Or	=	0.35
Ab	=	2.28
An	=	26.14
Di	=	23.43
Hy	=	37.67
Ne	=	-
Ol	=	-
Chr	=	0.74
Ilm	=	6.42
Apa	=	0.13
TOTAL		<u>99.56</u>

100 Mg/(Mg+Fe) = 41.3
 An/Ab/Or = 90.83/7.94/1.23

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	73 (ID)
Sr	=	117 (XRF)
Cr	=	3300 (NAA)
V	=	
Sc	=	52.4 (NAA)
Ni	=	
Co	=	37 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	123 (XRF)
Hf	=	4.0 (NAA)
Nb	=	7.5 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	17.7
Pr	=	
Nd	=	
Sm	=	5.25
Eu	=	1.00
Gd	=	
Tb	=	1.25
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	4.4
Lu	=	0.63
Y	=	40 (XRF)

ROCK NUMBER: 12044
WEIGHT: 92g

DIMENSIONS: 3.5 x 2 x 1.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray on fresh surface

SHAPE: Subrounded, elongate

FABRIC: Holocrystalline, medium grained

COHERENCE: Friable

Fracturing: Many-several penetrative, irregular orientation

VARIABILITY: Homogeneous

SURFACE: Granulated, irregular

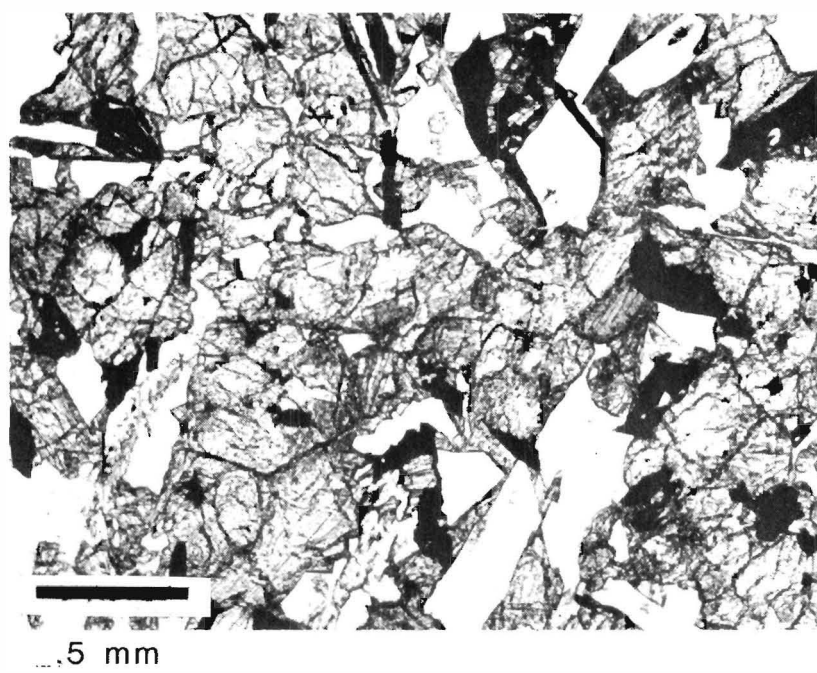
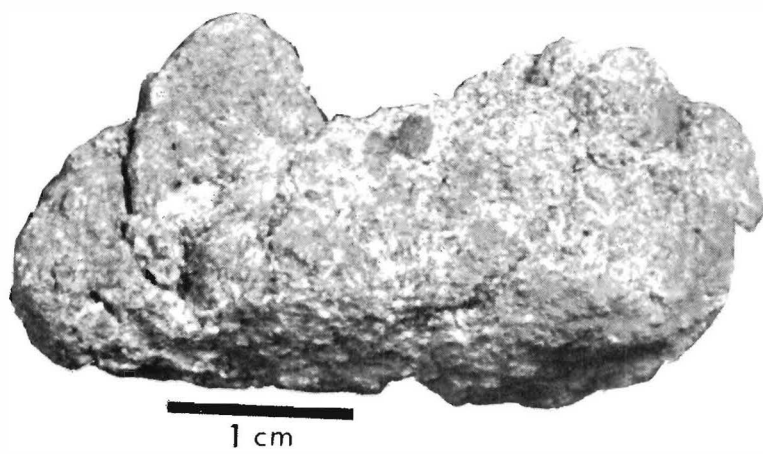
ZAP PITS: Pits not obvious, some glass splashes and chalky white
feldspar indicate pits have been eroded away

CAVITIES: Crystal-lined vugs aligned with fractures, no vesicles

SPECIAL FEATURES: Broken in several pieces

BY: Heiken, Greenwood

12044



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	
TiO ₂	=	
Al ₂ O ₃	=	
FeO	=	
MnO	=	
MgO	=	
CaO	=	
Na ₂ O	=	
K ₂ O	=	
P ₂ O ₅	=	
S	=	
Cr ₂ O ₃	=	
<hr/>		
TOTAL		

CIPW NORM

Qtz	=	
Or	=	
Ab	=	
An	=	
Di	=	
Hy	=	
Ne	=	
Ol	=	
Chr	=	
Ilm	=	
Apa	=	
<hr/>		
TOTAL		
100 Mg/(Mg+Fe)	=	
An/Ab/Or	=	

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	-	
K	=	2110	(ID)
Ba	=	380	(ID)
Sr	=	-	
Cr	=	2590	(NAA)
V	=	-	
Sc	=	37.9	(NAA)
Ni	=	-	
Co	=	45.5	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	350	(NAA)
Hf	=	12.9	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	33.1
Ce	=	91.6
Pr	=	-
Nd	=	54.8
Sm	=	16.7
Eu	=	1.72
Gd	=	19.8
Tb	=	-
Dy	=	21.20
Ho	=	-
Er	=	13.3
Tm	=	-
Yb	=	12.9
Lu	=	1.76
Y	=	

ROCK NUMBER: 12045
WEIGHT: 63 g

DIMENSIONS: 5 x 3.5 x 2 cm

BINOCULAR DESCRIPTION

COLOR: Medium to dark gray

SHAPE: Subrounded, one side flat the other convex

FABRIC: Fine-grained granular with olivine phenocrysts

COHERENCE: Coherent

Fracturing: Few penetrative fractures most nonpenetrative

VARIABILITY: Homogeneous

SURFACE: Hackly

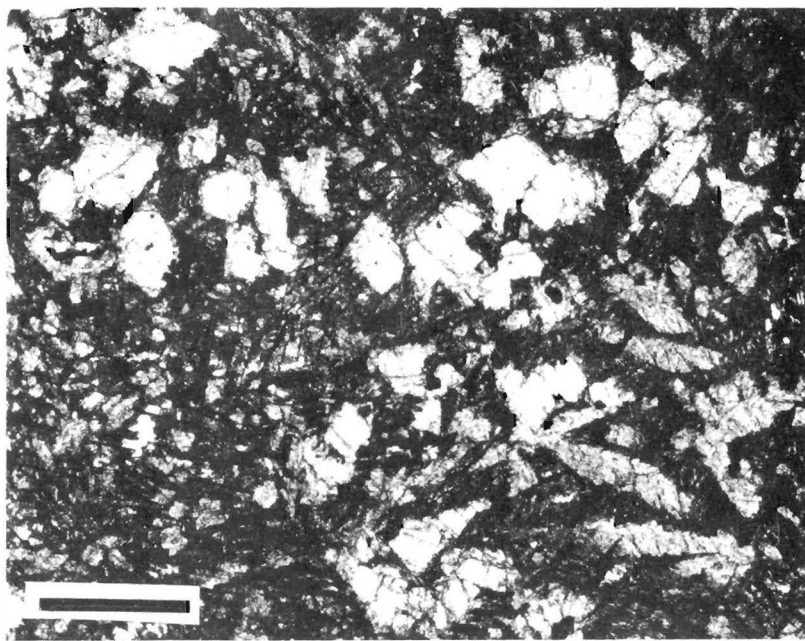
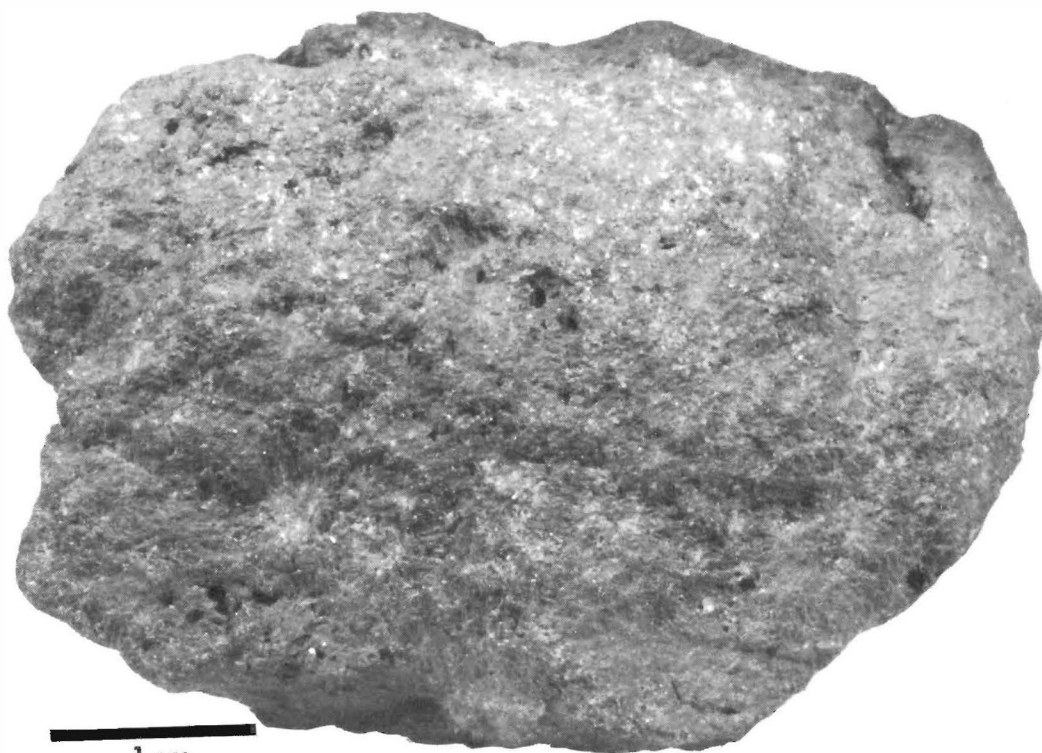
ZAP PITS: Many glass-lined pits, linings are fractured

CAVITIES: Vugs and vesicles (~5 volume %), vugs tend to cluster

SPECIAL FEATURES: Pyroxene-brownish, olivine-apple green up to
3 x 1 mm

BY: Dahlem, Wones

12045



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	42.30
TiO ₂	=	4.78
Al ₂ O ₃	=	8.06
FeO	=	22.09
MnO	=	0.29
MgO	=	11.63
CaO	=	9.09
Na ₂ O	=	0.26
K ₂ O	=	0.07
P ₂ O ₅	=	0.09
S	=	0.09
Cr ₂ O ₃	=	0.59

TOTAL		99.34
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CIPW NORM

Qtz	=	-
Or	=	0.41
Ab	=	2.20
An	=	20.62
Di	=	19.9
Hy	=	29.63
Ne	=	-
Ol	=	16.35
Chr	=	0.87
Ilm	=	9.08
Apa	=	0.2

TOTAL		99.25
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100 Mg/(Mg+Fe) = 48.4
An/Ab/Or = 88.75/9.47/1.78

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	52 (ID)
Sr	=	136 (XRF)
Cr	=	4060 (NAA)
V	=	
Sc	=	54.0 (NAA)
Ni	=	40 (NAA)
Co	=	52 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	112 (XRF)
Hf	=	4.5 (NAA)
Nb	=	5.3 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	17.4
Pr	=	
Nd	=	
Sm	=	5.6
Eu	=	1.19
Gd	=	
Tb	=	1.51
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	5.1
Lu	=	0.73
Y	=	50 (XRF)

ROCK NUMBER: 12046
WEIGHT: 166 g

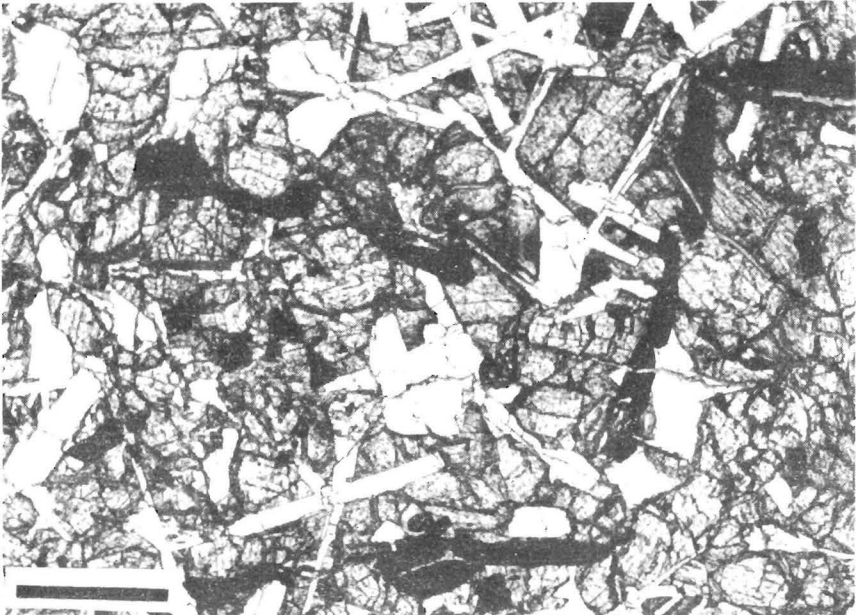
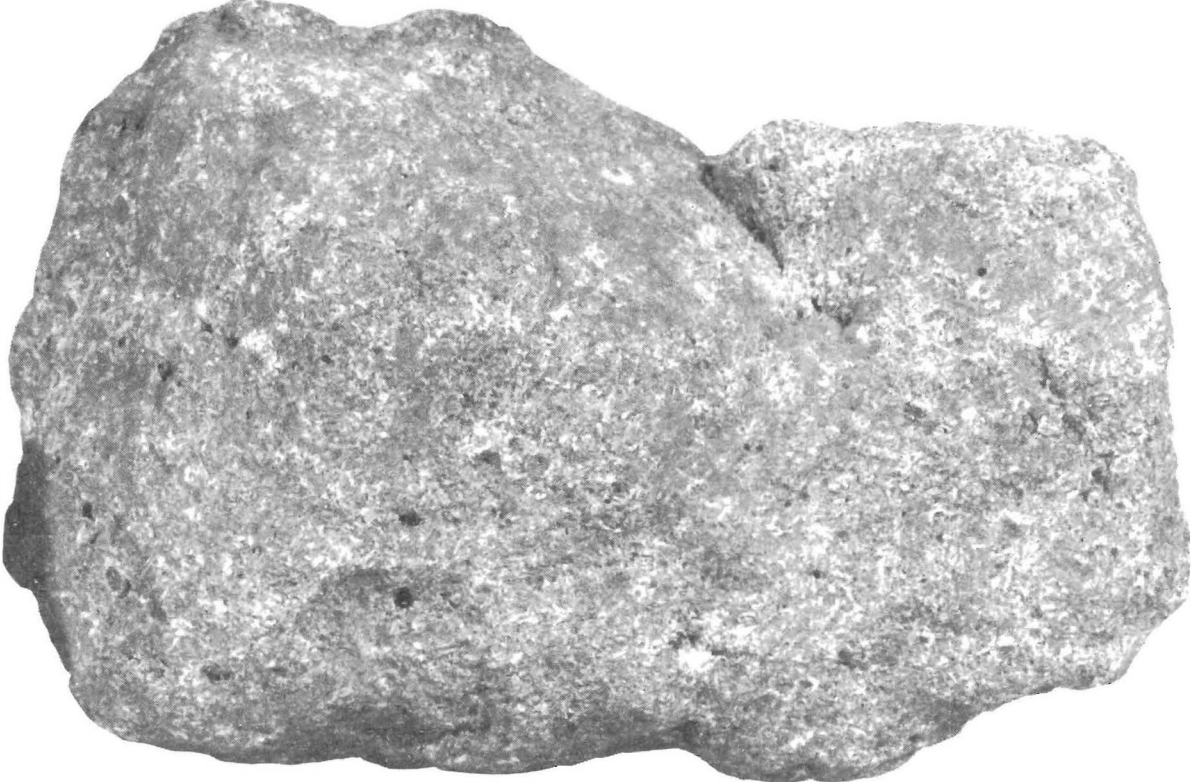
DIMENSIONS: 7 x 4 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray, brownish cast
SHAPE: Subrounded, rectangular prism, 2 sides more rounded than the others
FABRIC: Fine-grained, ophitic
COHERENCE: Coherent to tough
Fracturing: Few - nonpenetrative, concentrated near surface - spalling features?
VARIABILITY: Homogeneous
SURFACE: Granulated, well pitted
ZAP PITS: Glass-lined pits on all surfaces
CAVITIES: Vugs and vesicles, 2 mm maximum size, make up less than 1% by volume
SPECIAL FEATURES: Opaque mineral may be concentrated near vugs, plagioclase laths show twinning.

BY: Wones

12046



.5 mm

NOT ALLOCATED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

 TOTAL

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

 TOTAL

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 12047
WEIGHT: 193 g

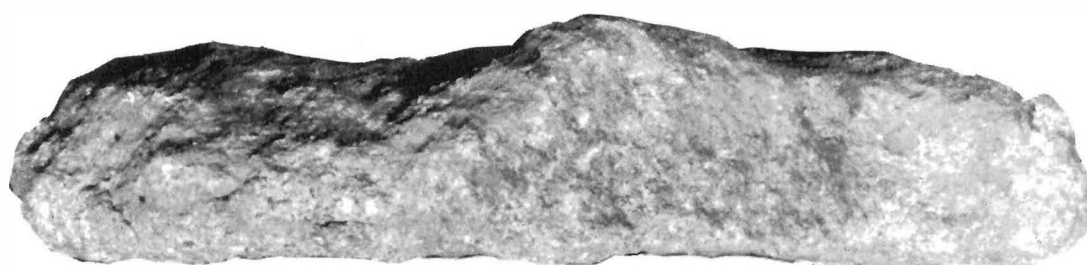
DIMENSIONS: 9 x 6 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray
SHAPE: Subrounded, tabular
FABRIC: Medium-grained, holocrystalline, hypidiomorphic granular
COHERENCE: Coherent
Fracturing: Few - nonpenetrative, parallel to long dimension
and concentric to rounded end
VARIABILITY: Irregularly distributed vugs and fractures
SURFACE: Dust adheres well, glass patches up to 2 mm in diameter
ZAP PITS: Glass-lined pits with white haloes .5 to 3 mm, the
concentration of pits varies from one surface to another.
CAVITIES: Few vesicles and vugs up to 8 mm in diameter, some have
coalesced, lined with euhedral crystals
SPECIAL FEATURES: Feldspar in radial clusters

BY: Heiken

12047



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	45.13
TiO ₂	=	5.20
Al ₂ O ₃	=	10.10
FeO	=	20.50
MnO	=	0.29
MgO	=	6.59
CaO	=	11.32
Na ₂ O	=	0.31
K ₂ O	=	0.08
P ₂ O ₅	=	0.08
S	=	0.12
Cr ₂ O ₃	=	0.31

TOTAL 100.03

CIPW NORM

Qtz	=	2.21
Or	=	0.47
Ab	=	2.62
An	=	25.93
Di	=	25.11
Hy	=	33.06
Ne	=	-
Ol	=	-
Chr	=	0.46
Ilm	=	9.88
Apa	=	0.17

TOTAL 99.91

100 Mg/(Mg+Fe) = 36.4
 An/Ab/Or = 89.33/9.04/1.63

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	69 (ID)
Sr	=	171 (XRF)
Cr	=	2190 (NAA)
V	=	
Sc	=	61.0 (NAA)
Ni	=	
Co	=	32 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	141 (XRF)
Hf	=	5.1 (NAA)
Nb	=	7.0 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	20.7
Pr	=	
Nd	=	
Sm	=	6.5
Eu	=	1.36
Gd	=	
Tb	=	1.80
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	5.9
Lu	=	0.89
Y	=	57 (XRF)

ROCK NUMBER: 12051

WEIGHT: 1660 g

DIMENSIONS: 16 x 11.5 x 7 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray with brownish gray, bottom darker gray

SHAPE: Subrounded, assymetric dome with flat bottom, or relatively fresh fracture surface

FABRIC: Holocrystalline, radiate to ophitic to dictytaxitic

COHERENCE: Coherent

Fracturing: Few - nonpenetrative, spallation fractures parallel to bottom; one penetrative fracture

VARIABILITY: Fabric varies modestly

SURFACE: Pitted on rounded side, flat side has no pits

ZAP PITS: Glass-lined pits 0.1 to 2 mm, glass variable in color, white haloes 1/2 crater diameter

CAVITIES: Vesicles up to 4 mm, few vugs

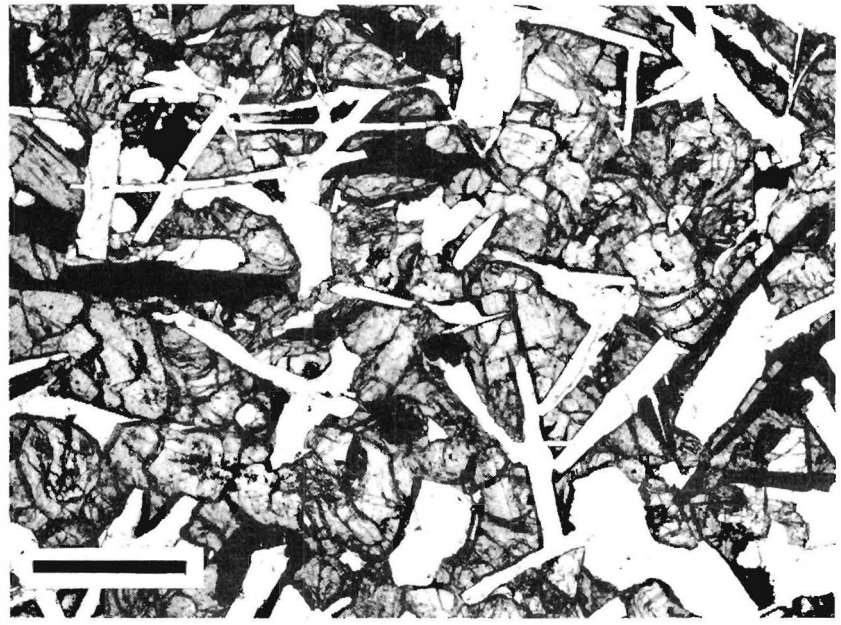
SPECIAL FEATURES: No pits on flat side

BY: Heiken

12051



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	45.31
TiO ₂	=	4.68
Al ₂ O ₃	=	9.95
FeO	=	20.22
MnO	=	0.28
MgO	=	7.01
CaO	=	11.39
Na ₂ O	=	0.29
K ₂ O	=	0.06
P ₂ O ₅	=	0.08
S	=	0.09
Cr ₂ O ₃	=	0.31
TOTAL		99.67

CIPW NORM

Qtz	=	1.79
Or	=	0.35
Ab	=	2.45
An	=	25.67
Di	=	25.58
Hy	=	34.21
Ne	=	-
Ol	=	-
Chr	=	0.46
Ilm	=	8.89
Apa	=	0.17
TOTAL		99.58

100 Mg/(Mg+Fe) = 38.2
An/Ab/Or = 90/9/1

TRACE AND MINOR ELEMENTS

Li	=	7.4	(MS)
Rb	=	0.909	(ID)
K	=	530	(ID)
Ba	=	73.6	(ID)
Sr	=	148	(ID)
Cr	=	-	
V	=	102	(XRF)
Sc	=	58	(NAA)
Ni	=	5.9	(XRF)
Co	=	35.1	(NAA)
Cu	=	6	(XRF)
Zn	=	2	(XRF)
Th	=	1	(GAM)
U	=	0.26	(GAM)
Zr	=	128	(XRF)
Hf	=	3.1	(NAA)
Nb	=	7	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	6.53	
Ce	=	19.2	
Pr	=	-	
Nd	=	15.4	
Sm	=	5.68	
Eu	=	1.23	
Gd	=	7.89	
Tb	=	-	
Dy	=	9.05	
Ho	=	-	
Er	=	5.57	
Tm	=	-	
Yb	=	5.46	
Lu	=	-	
Y	=	48	(XRF)

ROCK NUMBER: 12052
WEIGHT: 1866 g

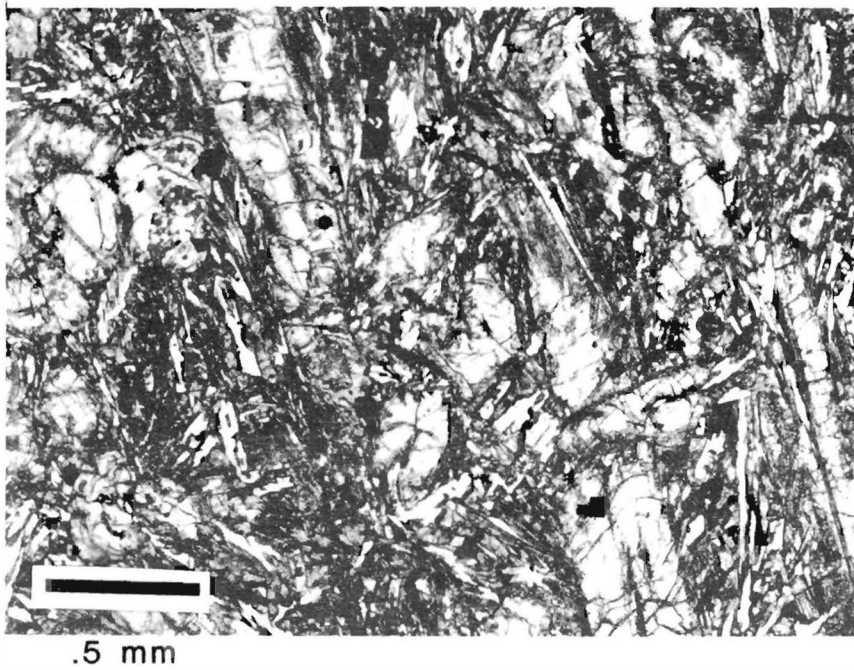
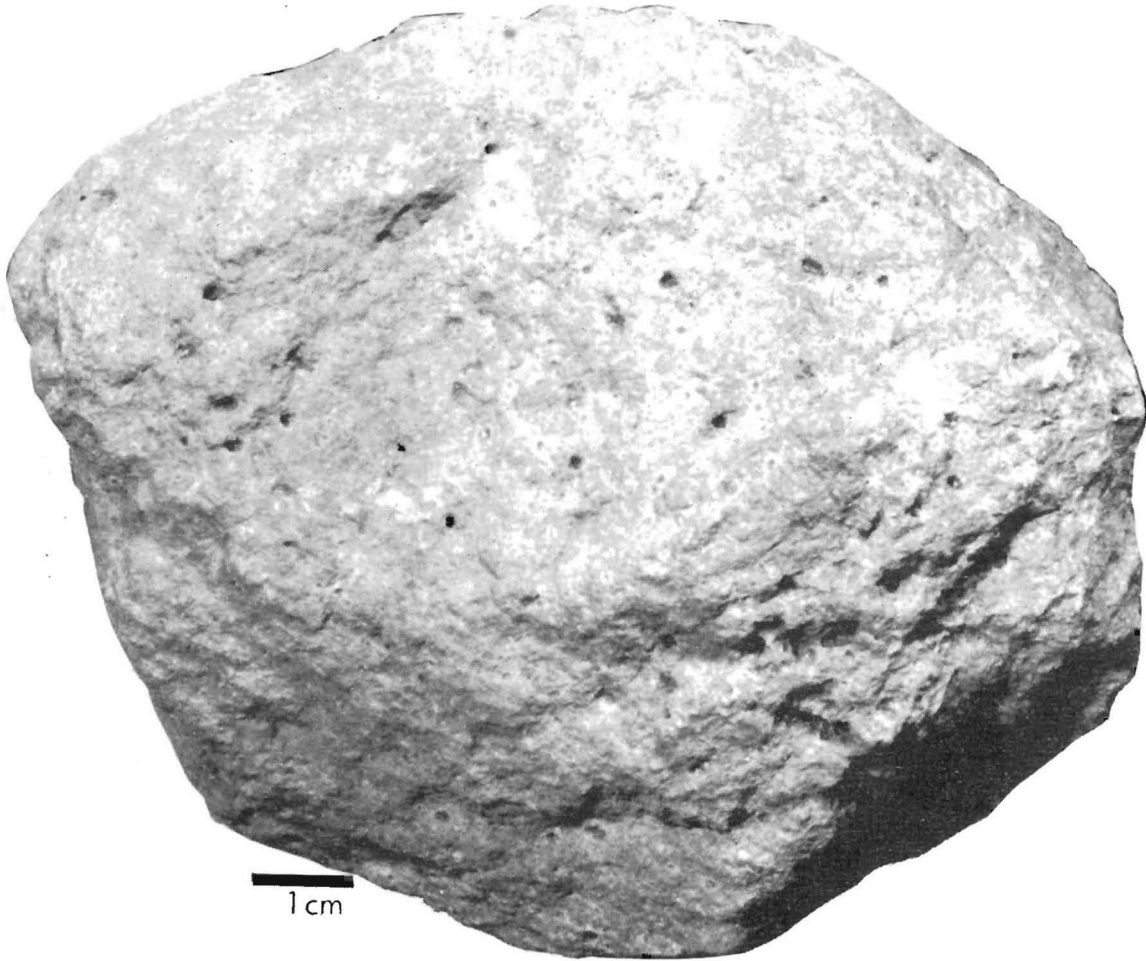
DIMENSIONS: 12 x 8.5 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray, pitted surfaces medium gray
SHAPE: Subrounded to rounded with one subangular, freshly fractured side
FABRIC: Porphyritic
COHERENCE: Coherent to tough
Fracturing: Few - nonpenetrative, spallation cracks
VARIABILITY: Homogeneous
SURFACE: Fresh surface hackly, other surfaces pitted and granulated
ZAP PITS: Many glass-lined pits (0.1 to 2 mm) with white haloes, no impact pits on freshly fractured surface
CAVITIES: Vugs and vesicles up to 5% by volume and 3 mm diameter
SPECIAL FEATURES: Radiate matrix texture, pyroxene in vugs

BY: Heiken, Anderson

12052



CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	46.40
TiO ₂	=	3.28
Al ₂ O ₃	=	10.16
FeO	=	20.15
MnO	=	0.27
MgO	=	8.22
CaO	=	10.80
Na ₂ O	=	0.27
K ₂ O	=	0.07
P ₂ O ₅	=	0.08
S	=	0.07
Cr ₂ O ₃	=	0.52

TOTAL 100.29

CIPW NORM

Qtz	=	0.75
Or	=	0.41
Ab	=	2.28
An	=	26.31
Di	=	22.51
Hy	=	40.79
Ne	=	-
Ol	=	-
Chr	=	0.77
Ilm	=	6.23
Apa	=	0.17

TOTAL 100.22

100 Mg/(Mg+Fe) = 42.1
 An/Ab/Or = 91/8/1

TRACE AND MINOR ELEMENTS

Li	=	8.04	(ID)
Rb	=	1.26	(ID)
K	=	534	(ID)
Ba	=	75	(ID)
Sr	=	116	(ID)
Cr	=	3300	(OES)
V	=	149	(XRF)
Sc	=	50.6	(NAA)
Ni	=	5.9	(XRF)
Co	=	38.4	(NAA)
Cu	=	8	(XRF)
Zn	=	9	(XRF)
Th	=	1.282	(ID)
U	=	0.365	(ID)
Zr	=	121	(XRF)
Hf	=	3.8	(NAA)
Nb	=	7	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-
Ce	=	18.8
Pr	=	-
Nd	=	14.7
Sm	=	4.91
Eu	=	1.04
Gd	=	6.87
Tb	=	-
Dy	=	7.74
Ho	=	-
Er	=	4.55
Tm	=	-
Yb	=	4.32
Lu	=	0.651
Y	=	-

ROCK NUMBER: 12053
WEIGHT: 879 g

DIMENSIONS: 12 x 8.5 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray, fresh and weathered surfaces have same color

SHAPE: Flat bottom with angular edges and subrounded peaked top

FABRIC: Holocrystalline fine grained

COHERENCE: Coherent to tough

Fracturing: Few - nonpenetrative, one fracture set subparallel to flat bottom and one lesser set intersects at 40°

VARIABILITY: Homogeneous

SURFACE: Rounded surface pitted, fresh flat surface hackly with 0.3 cm square patch of glass

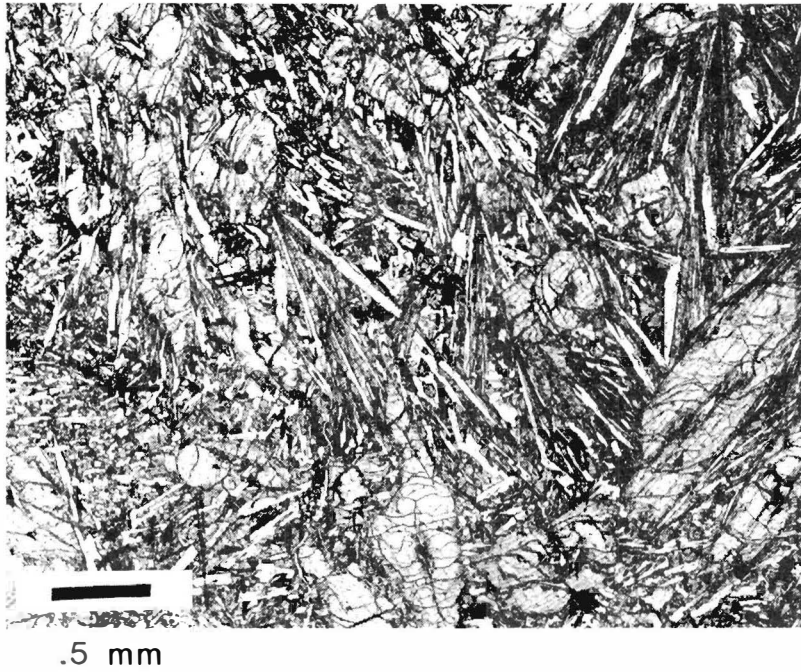
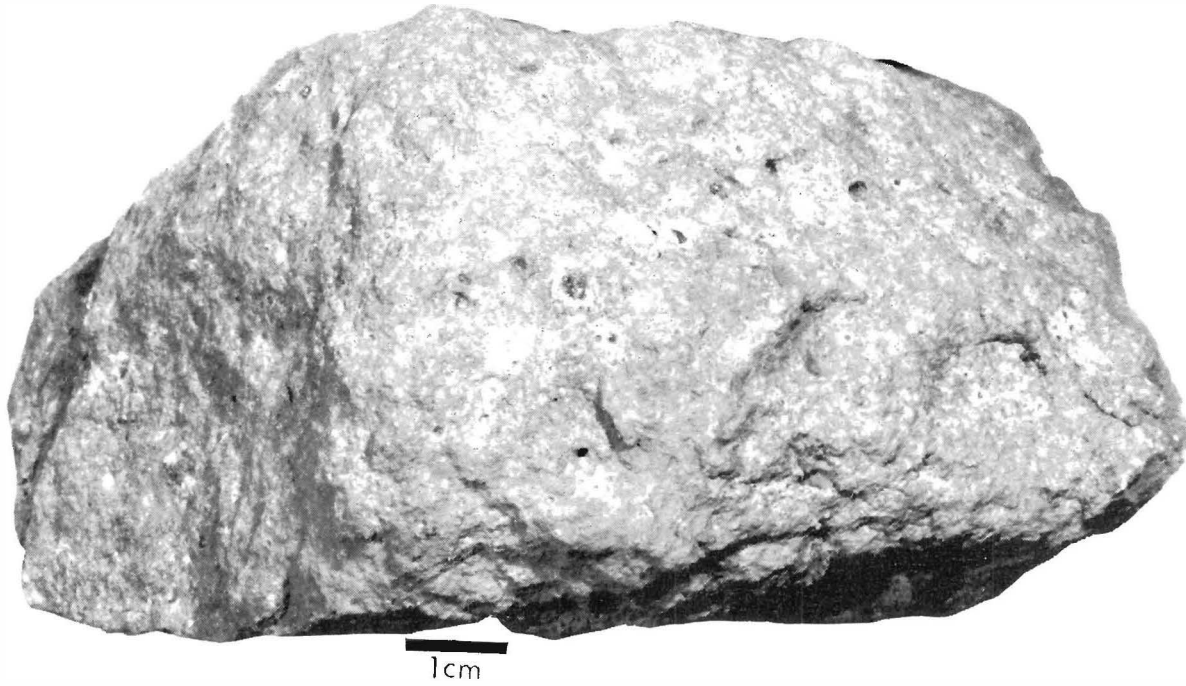
ZAP PITS: Many glass-lined pits on rounded surface have white haloes - flat bottom free of pits

CAVITIES: Vesicles (5% by volume) crystal lined (pyroxene and olivine), 2-3 mm.

SPECIAL FEATURES: Radiate feldspar

BY: Greenwood

12053



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	46.21
TiO ₂	=	3.32
Al ₂ O ₃	=	10.14
FeO	=	19.77
MnO	=	0.28
MgO	=	8.17
CaO	=	11.01
Na ₂ O	=	0.26
K ₂ O	=	0.06
P ₂ O ₅	=	0.14
S	=	0.08
Cr ₂ O ₃	=	0.49
<hr/>		
TOTAL		99.94

CIPW NORM

Qtz	=	0.89
Or	=	0.38
Ab	=	2.20
An	=	26.31
Di	=	23.07
Hy	=	39.67
Ne	=	-
Ol	=	-
Chr	=	0.72
Ilm	=	6.31
Apa	=	0.31
<hr/>		
TOTAL		99.86

100 Mg/(Mg+Fe) = 42.4
An/Ab/Or = 91/8/1

TRACE AND MINOR ELEMENTS

Li	=	4.8	(NAA)
Rb	=	1.24	(ID)
K	=	582	(ID)
Ba	=	84.4	(ID)
Sr	=	138	(ID)
Cr	=	-	
V	=	148	(OES)
Sc	=	56.4	(NAA)
Ni	=	9.9	(XRF)
Co	=	30	(OES)
Cu	=	26	(XRF)
Zn	=	1.2	(XRF)
Th	=	1.34	(ID)
U	=	0.322	(ID)
Zr	=	138	(XRF)
Hf	=	4	(NAA)
Nb	=	10	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	7.32	
Ce	=	20.9	
Pr	=	-	
Nd	=	15.3	
Sm	=	5.25	
Eu	=	1.1	
Gd	=	-	
Tb	=	-	
Dy	=	8.01	
Ho	=	-	
Er	=	4.88	
Tm	=	-	
Yb	=	4.71	
Lu	=	0.662	
Y	=	52	(XRF)

ROCK NUMBER: 12054
WEIGHT: 687 g

DIMENSIONS: 9 x 7 x 7 cm

BINOCULAR DESCRIPTION

COLOR: Light gray

SHAPE: Angular, pyramidal

FABRIC: Holocrystalline, coarse grained, subophitic

COHERENCE: Friable

Fracturing: Many - penetrative, many are open, others filled with glass-rock appears expanded like a breadcrust bomb. Top of pyramid has fracture filled with reddish yellow glass.

VARIABILITY: Irregular distribution of fractures

SURFACE: Base of pyramid covered with thin (.2 mm) coating of glass approximately half way up pyramid. Much of rest of rock covered with a brownish-black dull coating that goes into fractures. Remainder of surface has shatter crust

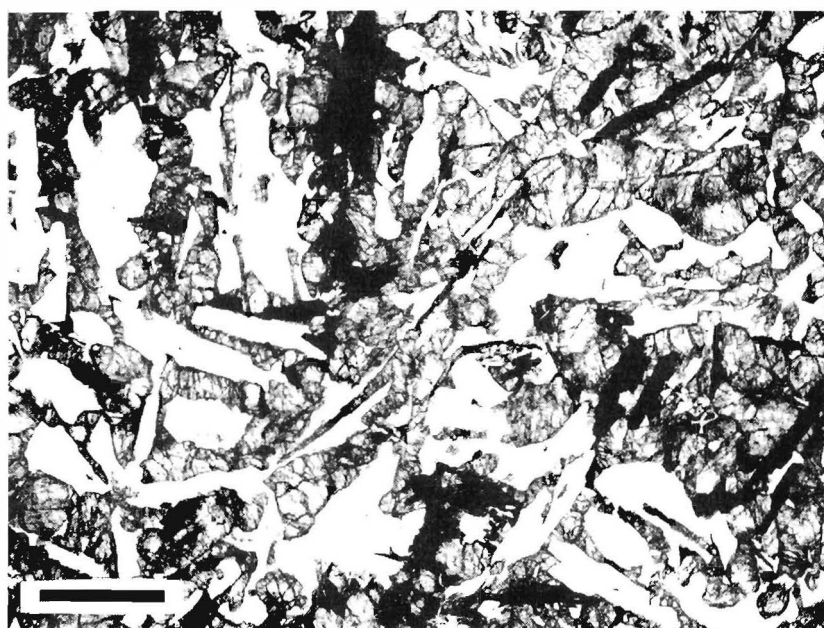
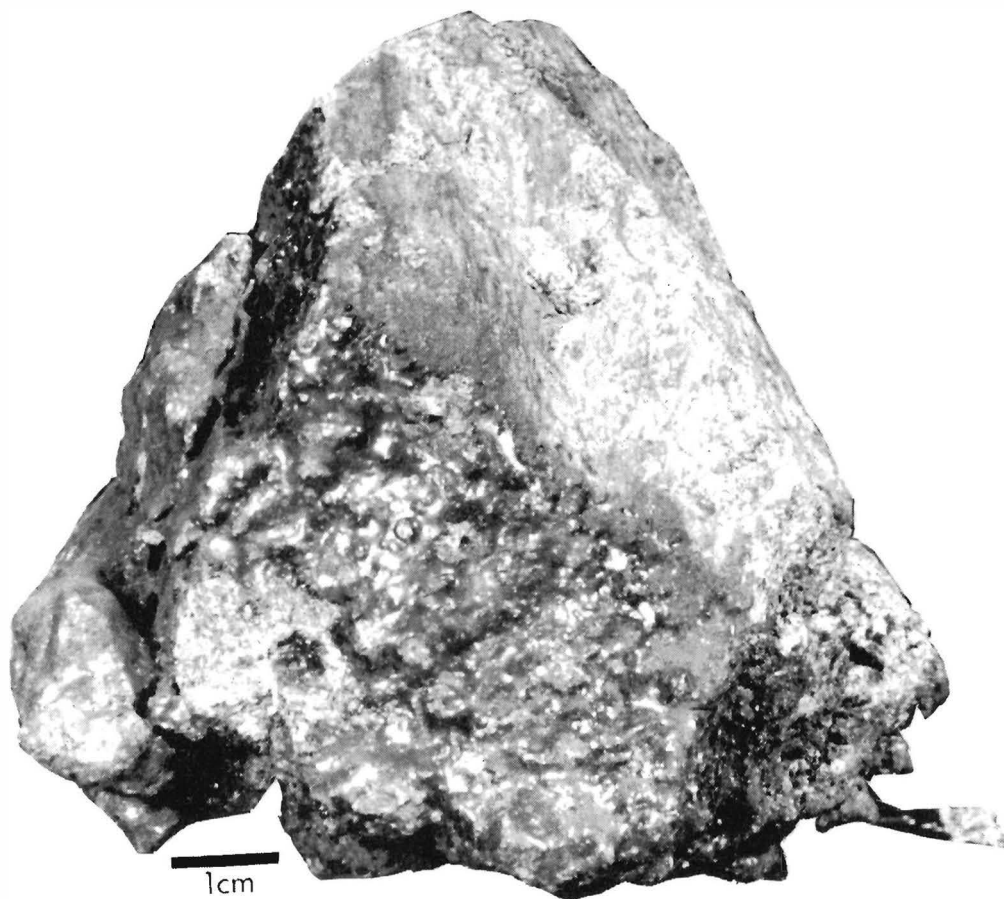
ZAP PITS: Many glass-lined pits, some have penetrated glass coating (>1 mm), smaller ones do not penetrate the glass.

CAVITIES: Few irregular vugs

SPECIAL FEATURES: Rock is shocked - one of the very few that is visibly shocked

BY: Greenwood

12054



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	45.86
TiO ₂	=	4.63
Al ₂ O ₃	=	10.47
FeO	=	19.51
MnO	=	0.29
MgO	=	6.76
CaO	=	11.93
Na ₂ O	=	0.31
K ₂ O	=	0.07
P ₂ O ₅	=	0.06
S	=	0.09
Cr ₂ O ₃	=	0.33
<hr/>		
TOTAL		100.31

CIPW NORM

Qtz	=	2.23
Or	=	0.41
Ab	=	2.62
An	=	26.97
Di	=	26.83
Hy	=	31.74
Ne	=	-
Ol	=	-
Chr	=	0.49
Ilm	=	8.79
Apa	=	0.13
<hr/>		
TOTAL		100.22

100 Mg/(Mg+Fe) = 38.2
 An/Ab/Or = 89.88/8.74/1.38

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	64 (ID)
Sr	=	162 (XRF)
Cr	=	2300 (NAA)
V	=	
Sc	=	64.0 (NAA)
Ni	=	
Co	=	31 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	128 (XRF)
Hf	=	4.8 (NAA)
Nb	=	6.3 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	18.8
Pr	=	
Nd	=	
Sm	=	6.0
Eu	=	1.27
Gd	=	
Tb	=	1.85
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	5.8
Lu	=	0.78
Y	=	51 (XRF)

ROCK NUMBER: 12055

WEIGHT: 912 g

DIMENSIONS: 12.5 x 10 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Light gray, neutral N7

SHAPE: Subangular, blocky, shape controlled by fractures

FABRIC: Medium-grained holocrystalline, subophitic, no lineations

COHERENCE: Coherent to friable

Fracturing: Many - some penetrative, parallel to long dimension
and subparallel to each other

VARIABILITY: Homogeneous

SURFACE: Granulated, pitted; glass splashes up to 4 mm may be
large zap pits

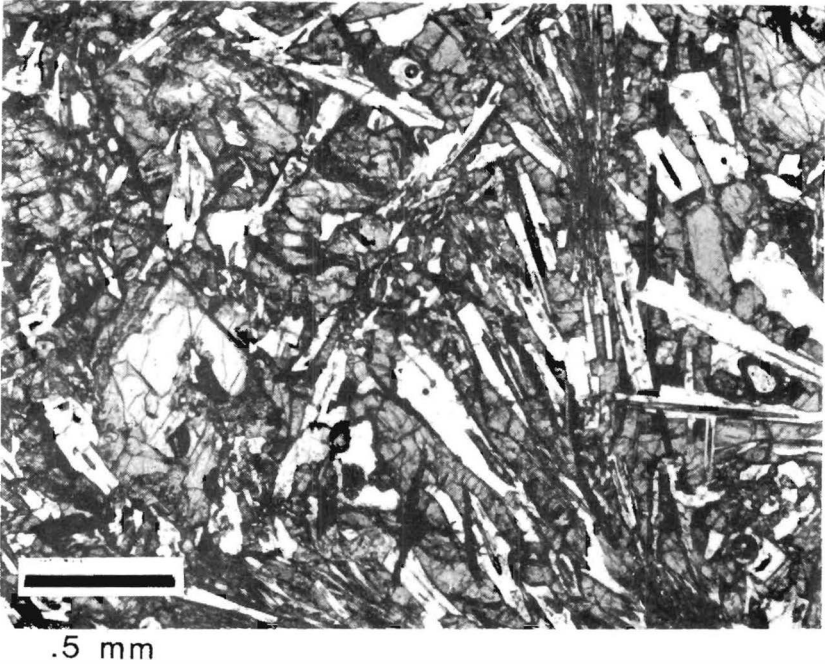
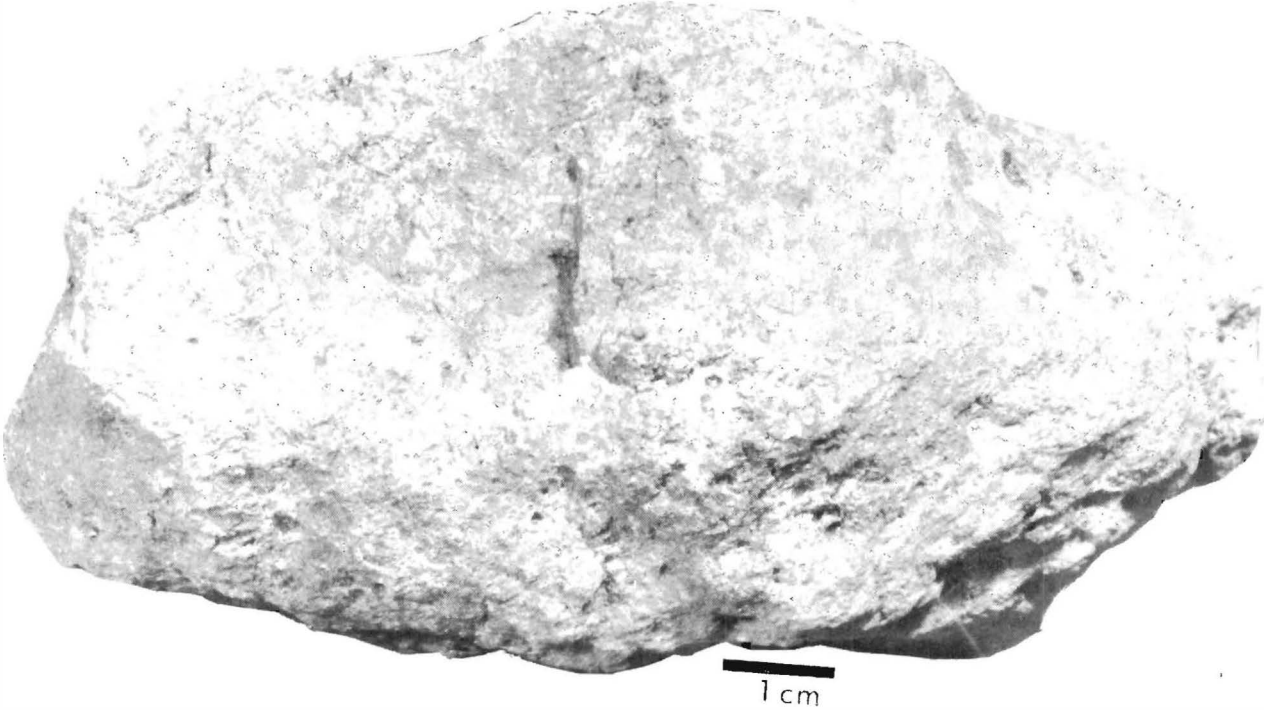
ZAP PITS: Many glass-lined pits on all surfaces (0.5 to 3 mm)
glass is dark brown and bubbly

CAVITIES: Vugs are lined with euhedral crystals, few vesicles
present, some have coalesced.

SPECIAL FEATURES: Feldspar radiate, pyroxene equant; vug mineral
is pyroxene

BY: Heiken

12055



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	47.00
TiO ₂	=	3.52
Al ₂ O ₃	=	10.15
FeO	=	19.54
MnO	=	0.29
MgO	=	7.46
CaO	=	11.10
Na ₂ O	=	0.27
K ₂ O	=	0.07
P ₂ O ₅	=	0.07
S	=	0.07
Cr ₂ O ₃	=	0.47
TOTAL		<u>100.01</u>

CIPW NORM

Qtz	=	2.81
Or	=	0.41
Ab	=	2.28
An	=	26.28
Di	=	23.87
Hy	=	36.76
Ne	=	-
Ol	=	-
Chr	=	0.69
Ilm	=	6.69
Apa	=	0.15
TOTAL		<u>99.94</u>

100 Mg/(Mg+Fe) = 40.5
 An/Ab/Or = 90.69/7.88/1.43

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	69 (ID)
Sr	=	121 (XRF)
Cr	=	3200 (NAA)
V	=	
Sc	=	54.0 (NAA)
Ni	=	
Co	=	38 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	131 (XRF)
Hf	=	5.2 (NAA)
Nb	=	8.5 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	18.2
Pr	=	
Nd	=	
Sm	=	5.25
Eu	=	0.95
Gd	=	
Tb	=	1.02
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	4.4
Lu	=	0.67
Y	=	43 (XRF)

ROCK NUMBER: 12056

WEIGHT: 121 g

DIMENSIONS: 8 x 5 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Brownish gray 5 YR 6/1

SHAPE: Subangular to subrounded, one subrounded side opposed by subangular fresh fracture surfaces - overall an asymmetric triangular pyramid

FABRIC: Holocrystalline, fine-grained, subophitic; tendency for vugs to be aligned along planes.

COHERENCE: Coherent

Fracturing: Few - nonpenetrative, subparallel to rounded edges and fresh fracture surface

VARIABILITY: Homogeneous

SURFACE: Hackly to pitted, some glass adhering that may not be from zap pits

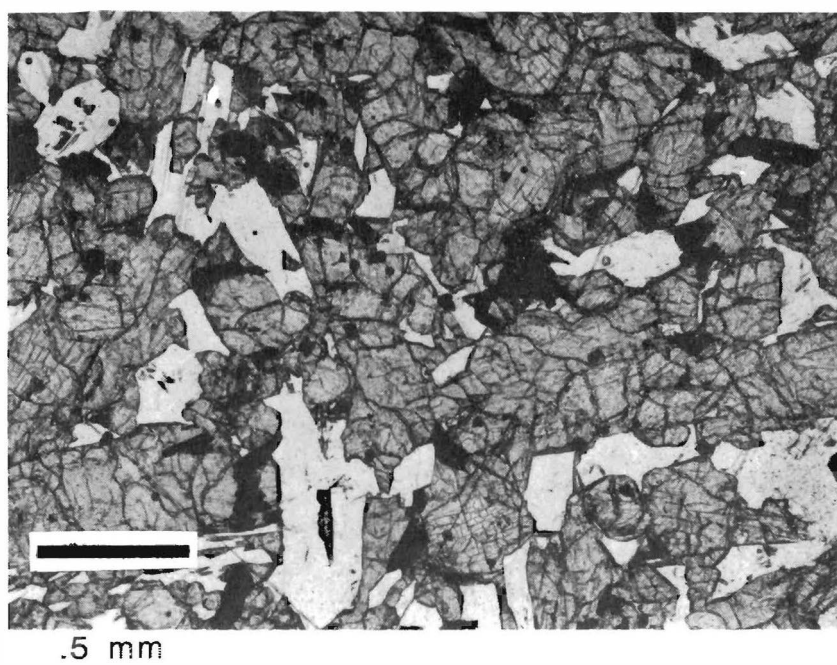
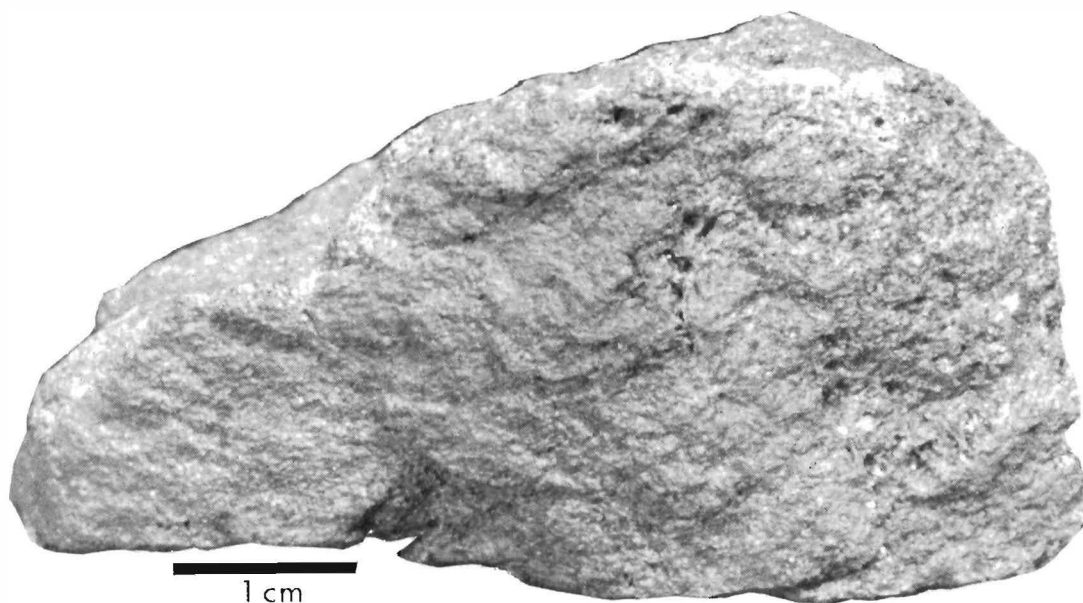
ZAP PITS: Many glass-lined pits (0.1 to 2 mm) with raised edges with white haloes, glass is bubbly and dark brown. No pits on freshly fractured surfaces.

CAVITIES: Elongate chains of vesicles on bottom side; vugs abundant and irregular in shape with euhedral pyroxene and olivine

SPECIAL FEATURES: Feldspar radiate, pyroxene elongate up to 1.5 mm. Two freshly fractured surfaces have no pits

BY: Heiken, Wones

12056



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	43.44
TiO ₂	=	5.07
Al ₂ O ₃	=	8.82
FeO	=	21.60
MnO	=	0.29
MgO	=	9.30
CaO	=	10.21
Na ₂ O	=	0.29
K ₂ O	=	0.07
P ₂ O ₅	=	0.07
S	=	0.10
Cr ₂ O ₃	=	0.48
<hr/>		
TOTAL		99.74

CIPW NORM

Qtz	=	-
Or	=	0.41
Ab	=	2.45
An	=	22.56
Di	=	23.14
Hy	=	33.67
Ne	=	-
Ol	=	6.92
Chr	=	0.71
Ilm	=	9.63
Apa	=	0.15
<hr/>		
TOTAL		99.64

100 Mg / (Mg+Fe) = 43.4 An/

Ab/Or = 88.72/9.65/1.63

TRACE AND MINOR ELEMENTS

Li	=	
Rb	=	
K	=	
Ba	=	62 (ID)
Sr	=	159 (XRF)
Cr	=	3310 (NAA)
V	=	
Sc	=	60.0 (NAA)
Ni	=	
Co	=	42 (NAA)
Cu	=	
Zn	=	
Th	=	
U	=	
Zr	=	135 (XRF)
Hf	=	4.8 (NAA)
Nb	=	6.1 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	
Ce	=	20.2
Pr	=	
Nd	=	
Sm	=	6.4
Eu	=	1.31
Gd	=	
Tb	=	1.73
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	6.0
Lu	=	0.82
Y	=	55 (XRF)

ROCK NUMBER: 12062
WEIGHT: 738.7 g

DIMENSIONS: 12 x 8 x 4 cm

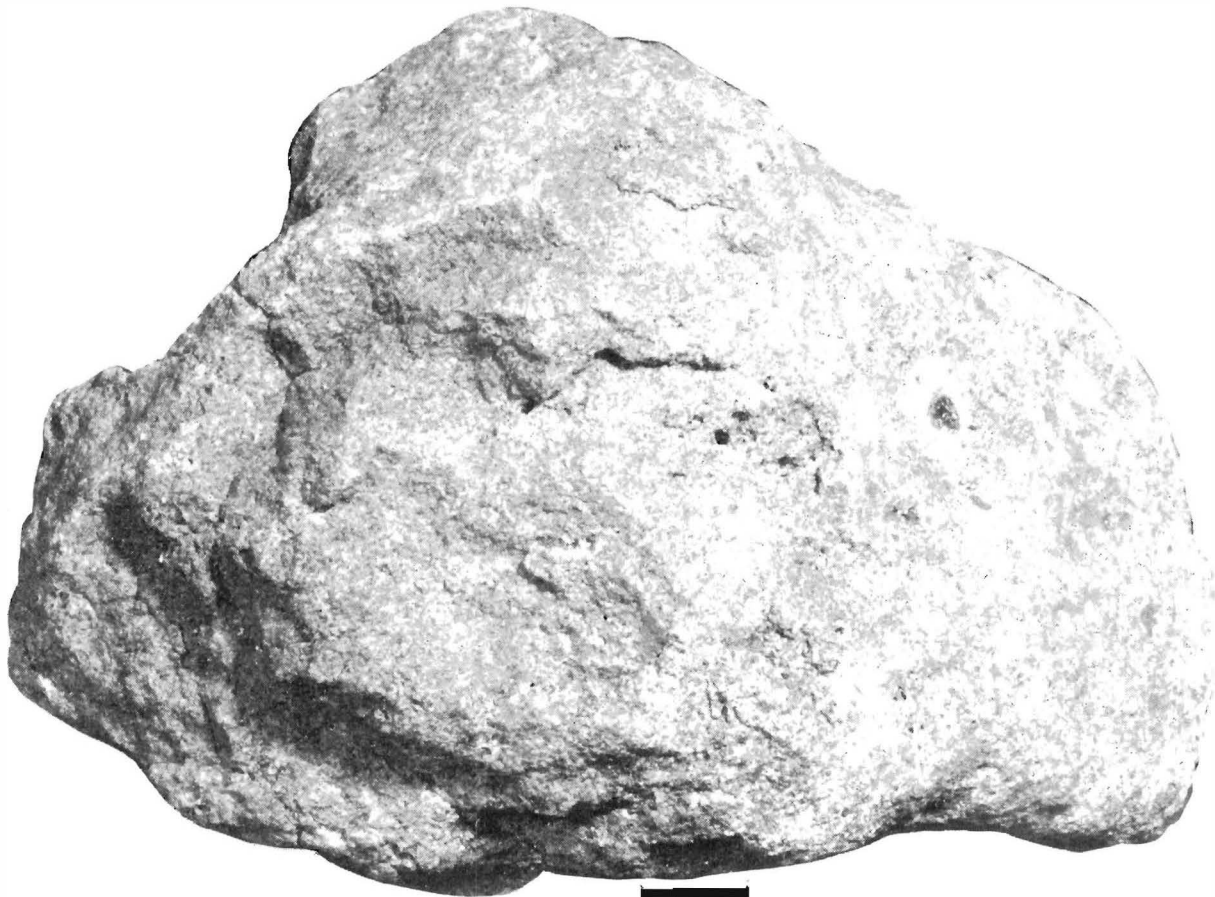
BINOCULAR DESCRIPTION

COLOR: Medium to light gray with whitish mottling (surface pitting).
Freshly broken surface darker gray
SHAPE: Subangular; irregular flattened half dome rounded top
with partly concave bottom and an angular broken side.
FABRIC: Holocrystalline, ophitic to subophitic, no lineations present
COHERENCE: Coherent to tough
Fracturing: Few - rarely penetrative; subparallel to surface
like exfoliation
VARIABILITY: Interior appears homogeneous; irregularly distributed
surface features
SURFACE: Hackly to granulated, strongly adhering dust, glass
splash on concave bottom
ZAP PITS: Few, glass-lined pits on domical side, absent on concave
bottom
CAVITIES: Few small vesicles and vugs, larger crystals in vuggy
areas of rock. Vesicles crystal lined
SPECIAL FEATURES: There is a subdued flat cone or mound about 1.2 cm
in diameter and several mm high in the center of the concave
surface that forms the focus for a subtle radial fracture set.
Concave surface may be impact crater

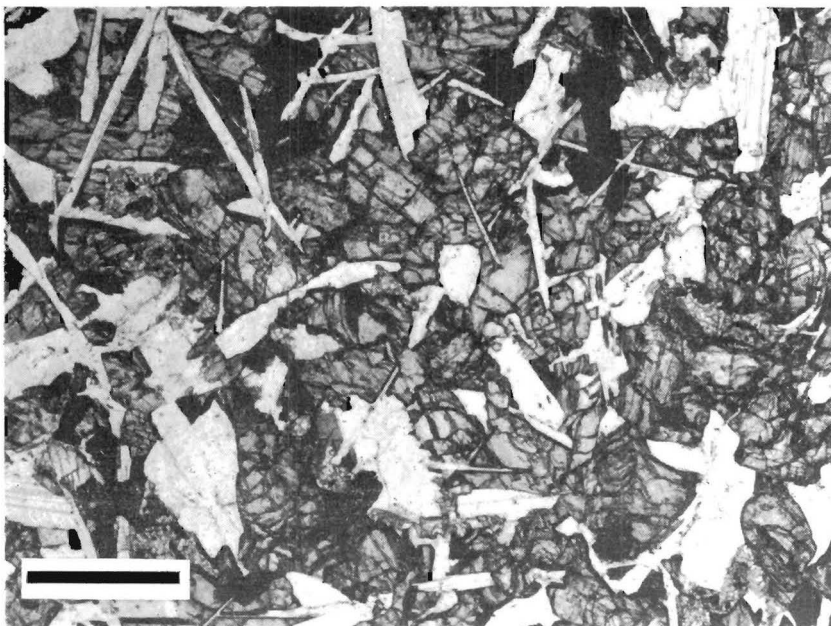
BY: Smith

162

12062



1 cm



.5 mm

NOT ALLOCATED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

 TOTAL
CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

 TOTAL

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 12063
WEIGHT: 2426 g

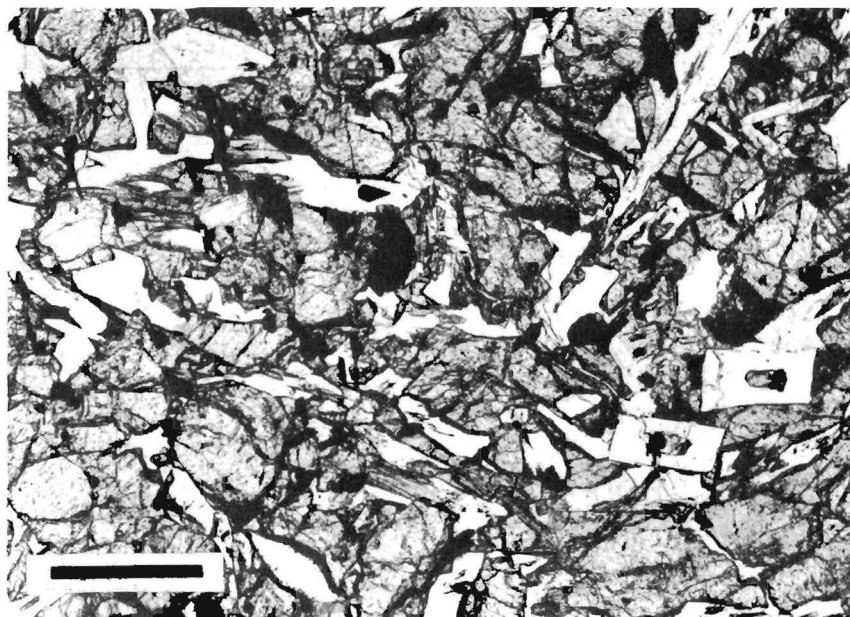
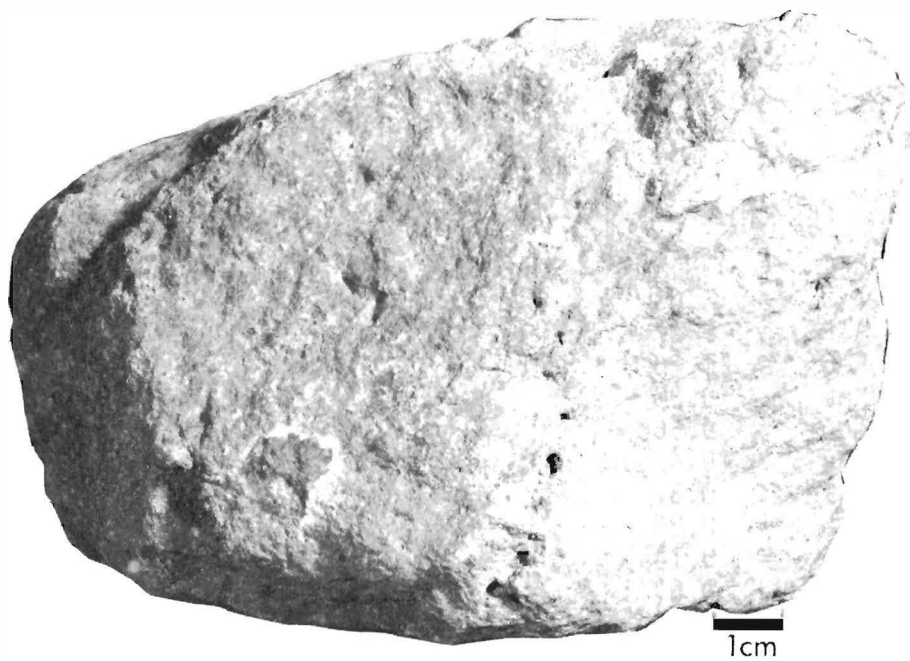
DIMENSIONS: 18 x 12 x 8 cm

BINOCULAR DESCRIPTION

COLOR: Light to medium gray
SHAPE: Subangular, elongate with triangular cross section, one flat side
FABRIC: Fine-grained holocrystalline, ophitic to subophitic
COHERENCE: Coherent to tough
Fracturing: Few - nonpenetrative, one cavity. Bounded by fracture planes, one major fracture coincides with plane of vesicles
VARIABILITY: A plane of vesicles extends through central part of rock, concentrated on flat side
SURFACE: Pitted shatter crust over most of rock, granulated surface. One large patch of glass (6 x 10 mm) - may be remnant from large impact pit
ZAP PITS: Few glass-lined pits with white haloes on rounded sides (.1 to 1 mm) - very few on flatter surfaces
CAVITIES: Vesicles and vugs (~0.5 cm) elongate in plane, form funnels indicating a joint surface along which gases may have escaped. Smaller vesicles throughout rock
SPECIAL FEATURES: Plane of vesicles

BY: Foss, Chao

12063



Rock Number 12063

CHEMISTRY

MAJOR ELEMENTS

SiO₂ = 43.48
 TiO₂ = 5.00
 Al₂O₃ = 9.27
 FeO = 21.26
 MnO = 0.28
 MgO = 9.56
 CaO = 10.49
 Na₂O = 0.31
 K₂O = 0.06
 P₂O₅ = 0.14
 S = 0.09
 Cr₂O₃ = 0.44

 TOTAL 100.38
CIPW NORM

Qtz = -
 Or = 0.36
 Ab = 2.62
 An = 23.72
 Di = 22.95
 Hy = 31.38
 Ne = -
 Ol = 8.80
 Chr = 0.65
 Ilm = 9.50
 Apa = 0.31

 TOTAL 100.29

100 Mg/(Mg+Fe) = 44.5
 An/Ab/Or = 89/10/1

TRACE AND MINOR ELEMENTS

Li = 5.9 (NAA)
 Rb = 0.93 (ID)
 K = 522 (ID)
 Ba = 64 (ID)
 Sr = 150 (ID)
 Cr = 2500 (OES)
 V = 135 (OES)
 Sc = 60.8 (NAA)
 Ni = 20 (XRF)
 Co = 43.4 (NAA)
 Cu = 8 (XRF)
 Zn = 4.5 (XRF)
 Th = 0.679 (ID)
 U = 0.191 (ID)
 Zr = 133 (XRF)
 Hf = 4.6 (NAA)
 Nb = 7.9 (XRF)

RARE EARTH ELEMENTS (NAA)

La = 6.24
 Ce = 17.8
 Pr = -
 Nd = 16
 Sm = 6.48
 Eu = 1.36
 Gd = 9.4
 Tb = 1.66
 Dy = 11.3
 Ho = 2
 Er = 5.3
 Tm = -
 Yb = 5.4
 Lu = 0.79
 Y = 65 (XRF)

ROCK NUMBER: 12064

WEIGHT: 1214.3 g

DIMENSIONS: 11 x 8 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Light gray, rounded surface (shatter crust) has lighter cast. Brownish cast imparted by pyroxene

SHAPE: Subangular to angular, blocky, fracture controlled

FABRIC: Holocrystalline, coarse grained, equigranular to subophitic

COHERENCE: Friable

Fracturing: Many - several penetrative

VARIABILITY: Homogeneous

SURFACE: Granulated, crumbly

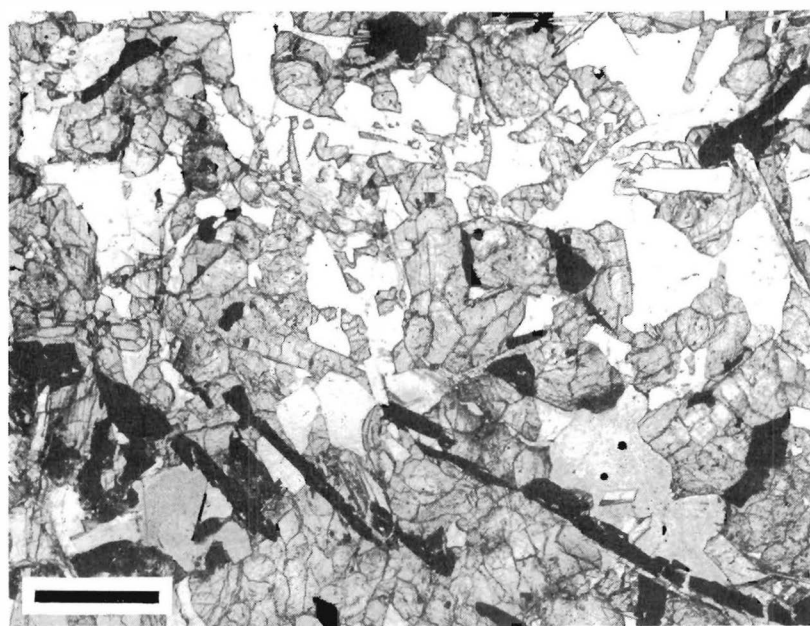
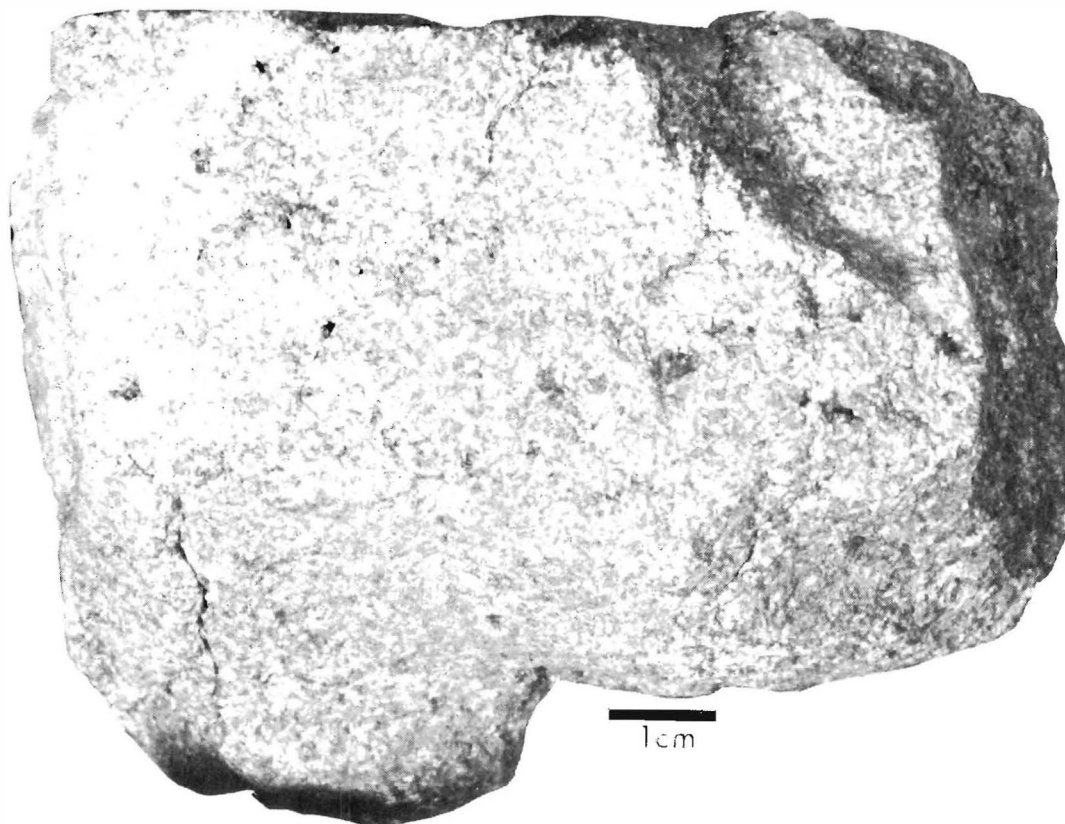
ZAP PITS: Few pits or white haloes on slightly rounded surface, on 2 glass-lined pits, other surfaces have no pits but do have a shatter crust

CAVITIES: Few vugs, irregular shape, crystals in vicinity are coarser grained

SPECIAL FEATURES: Ilmenite in vugs (up to 5 mm in rock), plagioclase up to 3 mm

BY: Lofgren, Chao

12064



1 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	46.30
TiO ₂	=	3.99
Al ₂ O ₃	=	10.73
FeO	=	19.89
MnO	=	0.27
MgO	=	6.49
CaO	=	11.77
Na ₂ O	=	0.28
K ₂ O	=	0.07
P ₂ O ₅	=	0.04
S	=	0.07
Cr ₂ O ₃	=	0.37
<hr/>		
TOTAL		100.28

C1PW NORM

Qtz	=	2.42
Or	=	0.41
Ab	=	2.41
An	=	27.79
Di	=	25.66
Hy	=	33.30
Ne	=	-
Ol	=	-
Chr	=	0.54
Ilm	=	7.58
Apa	=	0.09
<hr/>		
TOTAL		100.27

100 Mg/(Mg+Fe) = 36.8
 An/Ab/Or = 91/8/1

TRACE AND MINOR ELEMENTS

Li	=	6.7	(OES)
Rb	=	1.046	(ID)
K	=	-	
Ba	=	70	(XRF)
Sr	=	134.8	(XRF)
Cr	=	-	
V	=	119	(XRF)
Sc	=	63.1	(NAA)
Ni	=	6.9	(XRF)
Co	=	27.2	(NAA)
Cu	=	7	(XRF)
Zn	=	2	(XRF)
Th	=	0.842	(ID)
U	=	0.221	(ID)
Zr	=	114	(XRF)
Hf	=	3.9	(NAA)
Nb	=	7	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	6.76	
Ce	=	17.5	
Pr	=	-	
Nd	=	16	
Sm	=	5.51	
Eu	=	1.161	
Gd	=	7.2	
Tb	=	1.27	
Dy	=	9.03	
Ho	=	1.72	
Er	=	6	
Tm	=	-	
Yb	=	4.59	
Lu	=	0.67	
Y	=	41	(XRF)

ROCK NUMBER: 12065

WEIGHT: 2109 g

DIMENSIONS: 12 x 12 x 8 cm

BINOCULAR DESCRIPTION

COLOR: Neutral gray (N6 to N8) with a cast of 10 YR 6/2

Color varies with amount of glaze

SHAPE: Subrounded, rectangular prism with an asymmetric termination
(pyramidal)

FABRIC: Porphyritic, radiate matrix, no linear fabric

COHERENCE: Coherent to tough

Fracturing: Few - nonpenetrative-generally parallel to present
surfaces

VARIABILITY: Homogeneous interior

SURFACE: Granulated, white shatter crust covers rock, locally
hackly. Glass patches present

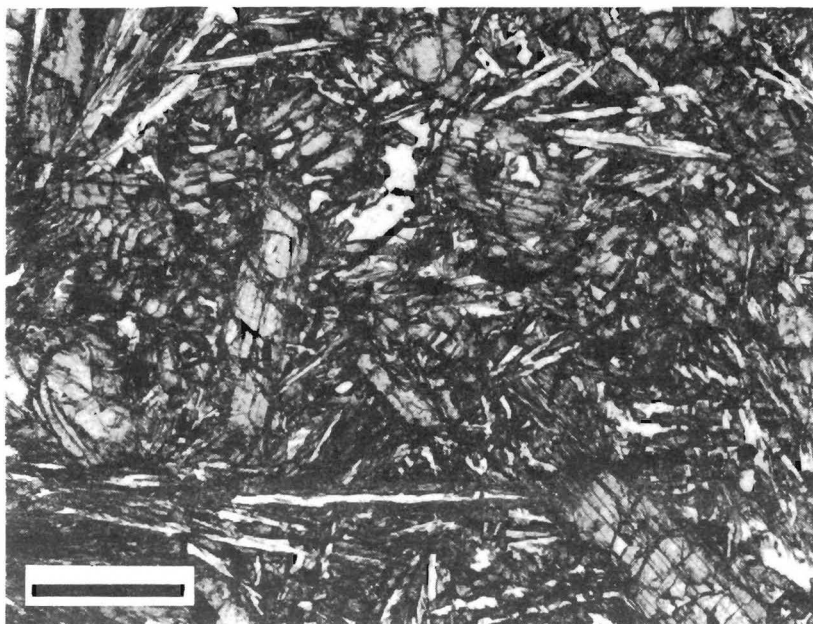
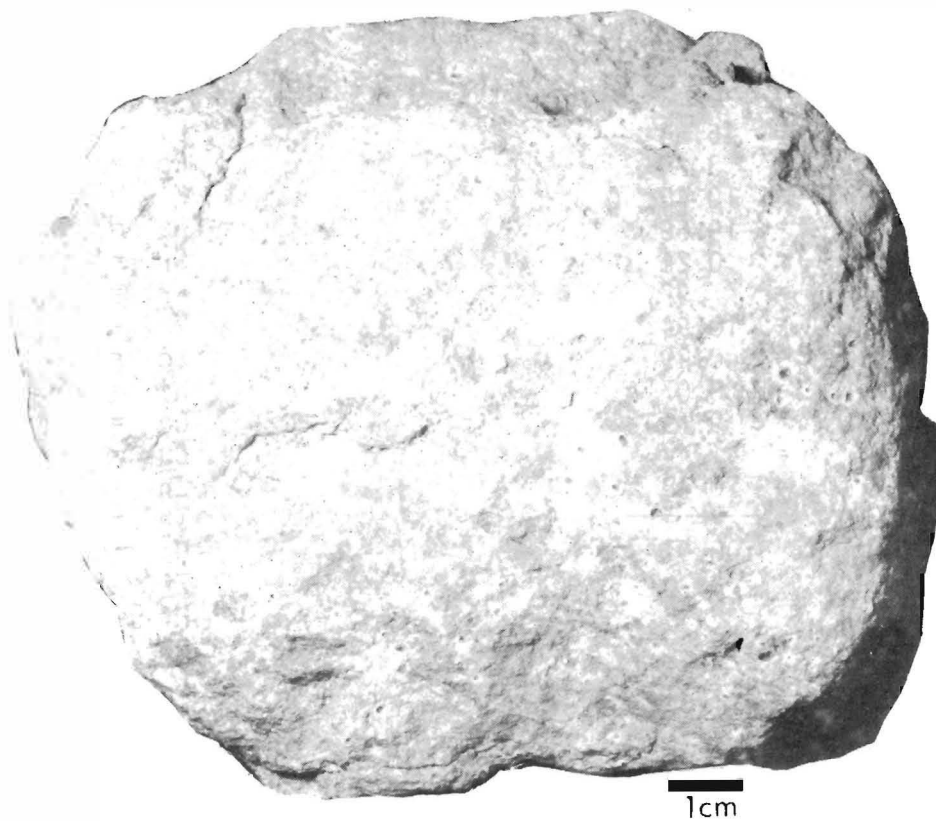
ZAP PITS: Few glass-lined pits on all surfaces, 1.3 mm average
diameter

CAVITIES: Few vugs and rarer vesicles

SPECIAL FEATURES: Slightly finer-grained version of 12021

BY: Wones, Chao

12065



.5 mm

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	46.54
TiO ₂	=	3.28
Al ₂ O ₃	=	10.45
FeO	=	19.66
MnO	=	0.26
MgO	=	7.97
CaO	=	10.94
Na ₂ O	=	0.29
K ₂ O	=	0.07
P ₂ O ₅	=	0.13
S	=	-
Cr ₂ O ₃	=	0.48

TOTAL 100.07

CIPW NORM

Qtz	=	1.31
Or	=	0.41
Ab	=	2.45
An	=	27.01
Di	=	22.26
Hy	=	39.41
Ne	=	-
Ol	=	-
Chr	=	0.71
Ilm	=	6.23
Apa	=	0.28

TOTAL 100.07

100 Mg/(Mg+Fe) = 41.9

An/Ab/Or = 90.4/8.2/1.4

TRACE AND MINOR ELEMENTS

Li	=	6	(OES)
Rb	=	1.185	(ID)
K	=	523	(ID)
Ba	=	67	(ID)
Sr	=	113.2	(ID)
Cr	=	3090	(NAA)
V	=	150	(OES)
Sc	=	56.5	(NAA)
Ni	=	20	(OES)
Co	=	38.8	(NAA)
Cu	=	7.8	(NAA)
Zn	=	0.93	(NAA)
Th	=	1.06	(GAM)
U	=	0.27	(GAM)
Zr	=	140	(OES)
Hf	=	3.9	(NAA)
Nb	=	16	(MS)

RARE EARTH ELEMENTS (NAA)

La	=	6.68	
Ce	=	24	
Pr	=	-	
Nd	=	24	
Sm	=	4.5	
Eu	=	1.06	
Gd	=	-	
Tb	=	1.58	
Dy	=	7.64	
Ho	=	1.11	
Er	=	-	
Tm	=	-	
Yb	=	3.78	
Lu	=	0.59	
Y	=	40	(XRF)

ROCK NUMBER: 12072
WEIGHT: 103.6 g

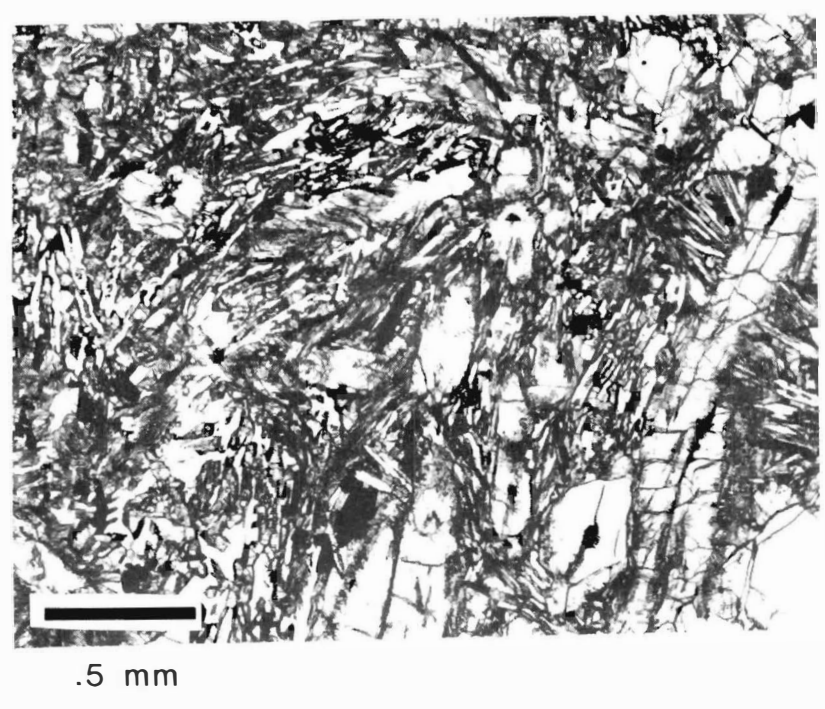
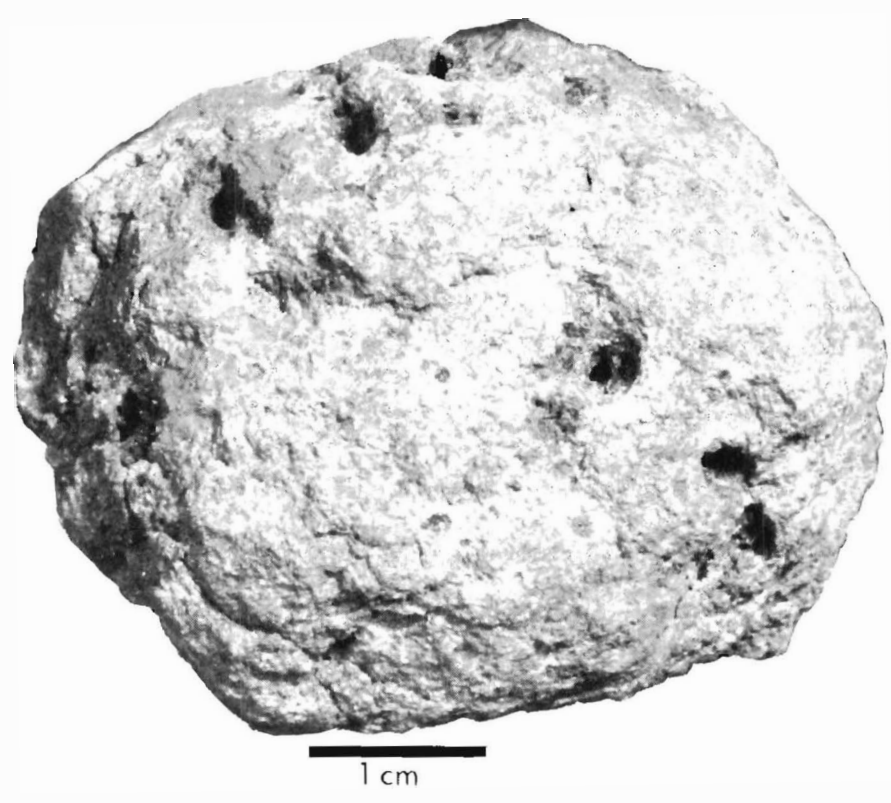
DIMENSIONS: 5 x 3 x 2.7 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray
SHAPE: Rounded, egg shaped
FABRIC: Holocrystalline, equigranular
COHERENCE: Coherent
Fracturing: Few - nonpenetrative, generally parallel to surface
VARIABILITY: Homogeneous
SURFACE: Pitted, chalky white shatter crust
ZAP PITS: Few, glass-lined pits (0.5 to 1.5 mm) with white haloes.
Some glass linings are raised some are still in pits
CAVITIES: Vugs are large, up to 6 mm, subrounded and lined with
crystals of pyroxene and olivine (rare), irregularly distributed
throughout rock
SPECIAL FEATURES: Olivine-green (5-10%), pyroxene is honey brown

BY: Lofgren

12072



NOT ALLOCATED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL _____

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL _____

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 12075
WEIGHT: 232.5 g

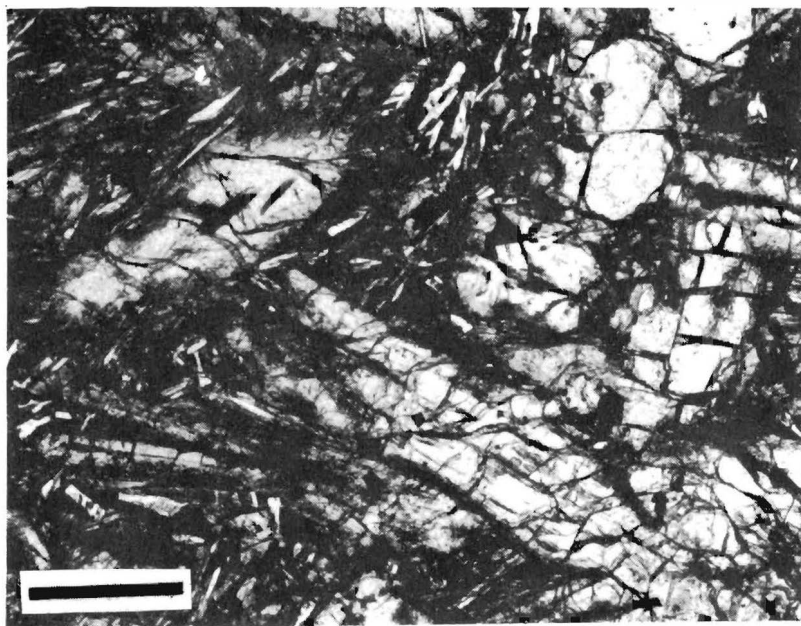
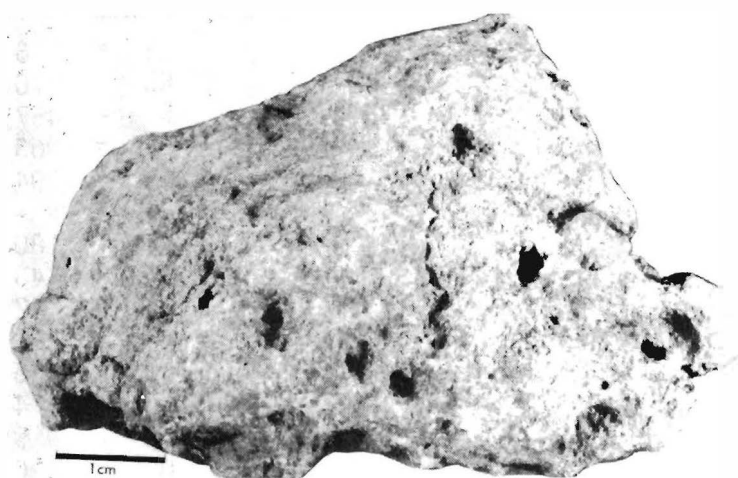
DIMENSIONS: 8.5 x 5 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Neutral to medium gray (N5 to N6)
SHAPE: Subrounded, triangular prism with projection at one end
FABRIC: Holocrystalline, fine-grained porphyritic, vugs tend to occur in planes
COHERENCE: Coherent to tough
Fracturing: Few, one penetrative, generally parallel to present surfaces; one corner about to break off
VARIABILITY: Homogeneous interior, distribution of vugs irregular
SURFACE: One fresh hackly surface, rest covered with shatter crust
ZAP PITS: Glass-lined pits with haloes on rounded side of rock, fresh surface has no pits
CAVITIES: Vugs are clustered, 2 to 7 mm diameter, 5-10% by volume, irregular shape and crystal lined
SPECIAL FEATURES: Vugs contain good crystals for single crystal studies. Small opaque octahedra should be identified, could be magnetite

BY: Wones

12075



.5 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	44.93
TiO ₂	=	2.69
Al ₂ O ₃	=	8.39
FeO	=	20.47
MnO	=	0.27
MgO	=	13.86
CaO	=	8.59
Na ₂ O	=	0.27
K ₂ O	=	0.06
P ₂ O ₅	=	0.12
S	=	-
Cr ₂ O ₃	=	0.60
<hr/>		
TOTAL		100.25

CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	2.28
An	=	21.50
Di	=	16.86
Hy	=	35.42
Ne	=	-
Ol	=	17.58
Chr	=	0.88
Ilm	=	5.11
Apa	=	0.26
<hr/>		
TOTAL		100.25

100 Mg/(Mg+Fe) = 54.7
An/Ab/Or = 89/9/1

TRACE AND MINOR ELEMENTS

Li	=	6	(GRV)
Rb	=	0.993	(ID)
K	=	457.4	(ID)
Ba	=	63.9	(ID)
Sr	=	94.3	(ID)
Cr	=	-	
V	=	180	(GRV)
Sc	=	43	(NAA)
Ni	=	62.99	(GRV)
Co	=	61	(NAA)
Cu	=	6	(GRV)
Zn	=	4	(OES)
Th	=	0.62	(GAM)
U	=	0.19	(GAM)
Zr	=	132	(GRV)
Hf	=	2.7	(NAA)
Nb	=	16	(OES)

RARE EARTH ELEMENTS (ID)

La	=	6.34	
Ce	=	16.1	
Pr	=	-	
Nd	=	11.6	
Sm	=	3.94	
Eu	=	0.828	
Gd	=	5.3	
Tb	=	-	
Dy	=	6.22	
Ho	=	-	
Er	=	3.73	
Tm	=	-	
Yb	=	3.71	
Lu	=	0.508	
Y	=	50	(GRV)

ROCK NUMBER: 12076

WEIGHT: 54.6 g

DIMENSIONS: 5 x 4.3 x 2.6 cm

BINOCULAR DESCRIPTION

COLOR: Neutral gray, N7, speckled white

SHAPE: Subangular, very irregular shape

FABRIC: Fine grained subophitic

COHERENCE: Friable

Fracturing: Many - some penetrative, random orientation

VARIABILITY: Homogeneous

SURFACE: Most surfaces are fresh, hackly; one old surface has
shatter crust; vug coated with glass splash

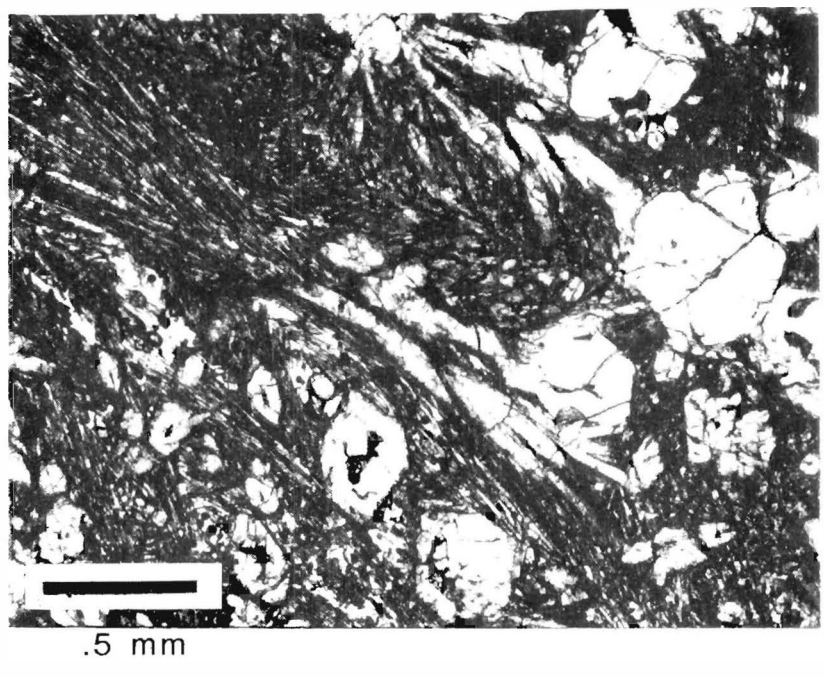
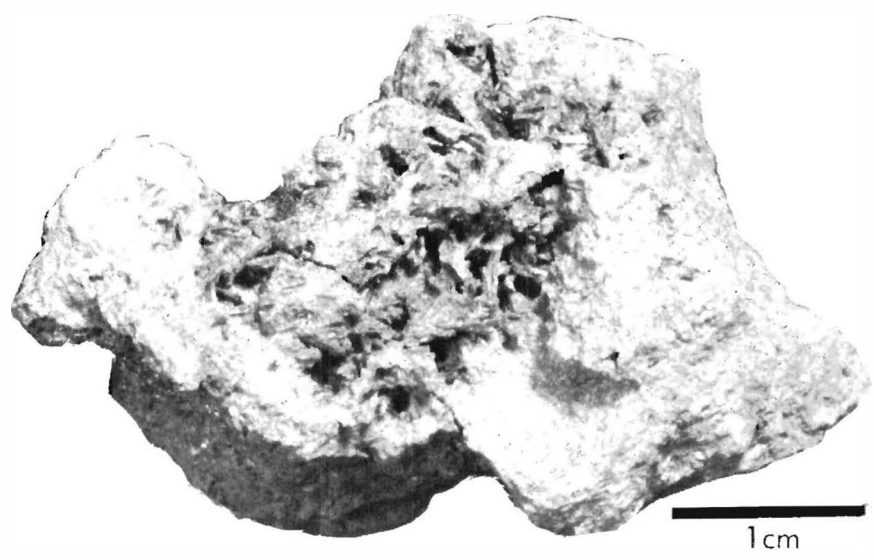
ZAP PITS: Few glass-lined pits on old surface, no pits on fresh
surfaces

CAVITIES: One large vug which is comprised of a fretwork of crystals

SPECIAL FEATURES: Pyroxene and plagioclase appear radiate

BY: Wones

12076



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	44.87
TiO ₂	=	2.76
Al ₂ O ₃	=	8.10
FeO	=	20.66
MnO	=	0.30
MgO	=	12.26
CaO	=	9.03
Na ₂ O	=	0.21
K ₂ O	=	0.06
P ₂ O ₅	=	0.03
S	=	-
Cr ₂ O ₃	=	0.68
<hr/>		
TOTAL		98.96

C1PW NORM

Qtz	=	-
Or	=	0.35
Ab	=	1.78
An	=	20.98
Di	=	19.62
Hy	=	38.06
Ne	=	-
Ol	=	11.87
Chr	=	1.00
Ilm	=	5.24
Apa	=	0.07
<hr/>		
TOTAL		98.96

100 Mg/(Mg+Fe) = 51.4
 An/Ab/Or = 90.78/7.69/1.53

TRACE AND MINOR ELEMENTS

Li	=	7.4	(ID)
Rb	=	1.022	(ID)
K	=	467	(ID)
Ba	=	59.4	(ID)
Sr	=	93.6	(ID)
Cr	=	4640	(NAA)
V	=		
Sc	=	46.4	(NAA)
Ni	=		
Co	=	54	(NAA)
Cu	=		
Zn	=		
Th	=	0.87	(ID)
U	=	0.23	(ID)
Zr	=	108	(ID)
Hf	=		
Nb	=		

RARE EARTH ELEMENTS (ID)

La	=	5.68
Ce	=	15.9
Pr	=	
Nd	=	12.0
Sm	=	4.03
Eu	=	0.825
Gd	=	5.67
Tb	=	
Dy	=	6.52
Ho	=	
Er	=	3.85
Tm	=	
Yb	=	3.39
Lu	=	0.492
Y	=	

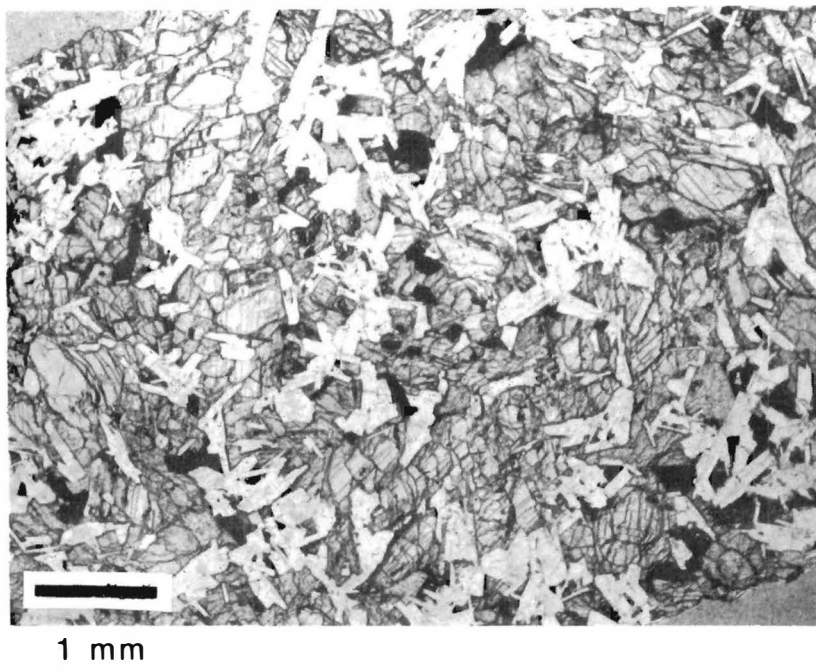
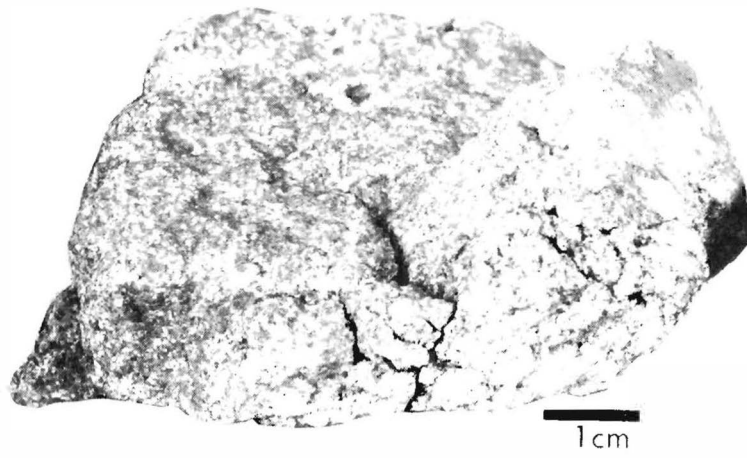
APOLLO 14

ROCK NUMBER: 14053
 WEIGHT: 251.3 g DIMENSIONS: 8 x 6 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Salt and pepper
 SHAPE: A slabby, flat rock with rectangular shape and rounded corners
 FABRIC: Holocrystalline, fine grained equigranular
 COHERENCE: Rock is friable and fragile due to fractures
 Fractures: There are 3 planar and 4 non-planar fractures appearing in two sets. Fractures have an irregular orientation. There are numerous hair-like cracks a few millimeters long. The entire fracture pattern is somewhat irregular.
 VARIABILITY: Inhomogeneous, some areas display relative concentrations of olivine and pyroxene on a 1-2 cm scale.
 SURFACE:
 ZAP PITS: The flat, relatively fresh, surface is unpitted. The convex surface has gentle relief with elevated prominences approximately 1-3 mm. These features are not abrupt but rounded. Pits appear on the convex surface but not on the flat surface. Pits are glass lined and have a size range from 0.5 to 3 mm. Average pit size is 1 to 2 mm. Density of pits is approximately 10 pits per cm².
 CAVITIES: Cavities are both vesicular and vuggy. Irregular vugs range in size from 1-2 mm. Rounded vesicles range from 1-2 mm in size. Small vugs (0.5 mm diameter) and vesicles (1 mm in diameter) contain feldspar and orthopyroxene crystals.
 SPECIAL FEATURES: Pits are good top and bottom indicator as is the presence of a dusty soil line. The two surfaces are distinct. Flat face is apparently a fracture surface and is without zap pits.
 BY: Hörz, Wilshire, Jackson

14053



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	46.4
TiO ₂	=	2.64
Al ₂ O ₃	=	13.6
FeO	=	16.8
MnO	=	0.26
MgO	=	8.48
CaO	=	11.2
Na ₂ O	=	-
K ₂ O	=	0.10
P ₂ O ₅	=	0.09
S	=	0.14
Cr ₂ O ₃	=	-
<hr/>		
TOTAL		99.71

CIPW NORM

Qtz	=	1.26
Or	=	0.59
Ab	=	-
An	=	36.83
Di	=	15.2
Hy	=	40.5
Ne	=	-
Ol	=	-
Chr	=	-
Ilm	=	5.01
Apa	=	0.2
<hr/>		
TOTAL		99.51

100 Mg/(Mg+Fe) = 47.7
 An/Ab/Or = 98.42/ - /1.58

TRACE AND MINOR ELEMENTS

Li	=	-
Rb	=	2.19 (ID)
K	=	912 (ID)
Ba	=	146 (ID)
Sr	=	98 (ID)
Cr	=	2860 (NAA)
V	=	-
Sc	=	55 (NAA)
Ni	=	14 (NAA)
Co	=	25 (NAA)
Cu	=	-
Zn	=	3.4 (NAA)
Th	=	2.101 (ID)
U	=	0.592 (ID)
Zr	=	215 (XRF)
Hf	=	9.8 (NAA)
Nb	=	15.7 (XRF)

RARE EARTH ELEMENTS (ID)

La	=	13
Ce	=	34.5
Pr	=	-
Nd	=	21.9
Sm	=	6.56
Eu	=	1.21
Gd	=	8.59
Tb	=	-
Dy	=	10.5
Ho	=	-
Er	=	6.51
Tm	=	-
Yb	=	6
Lu	=	-
Y	=	54.7 (XRF)

ROCK NUMBER: 14072
WEIGHT: 45.06 g

DIMENSIONS: 4.1 x 3.4 x 2.1 cm

BINOCULAR DESCRIPTION

COLOR: Dust covered

SHAPE: A blocky, subrounded rock with one relatively smooth surface

FABRIC: Microporphyrritic

COHERENCE: Tough

Fracturing: One planar fracture transects the rock at 30° to the long axis.

VARIABILITY: The texture and mineralogy are homogeneous

ZAP PITS: No pits were observed

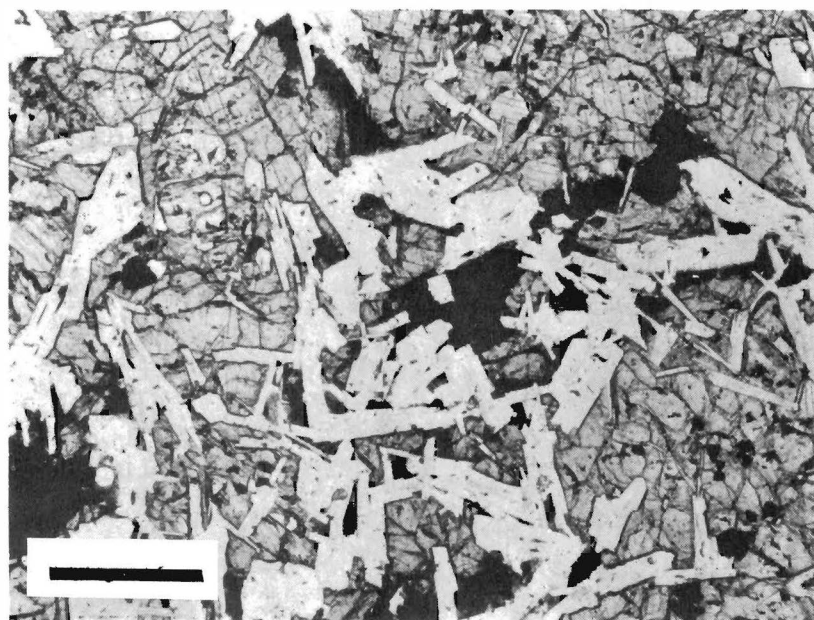
CAVITIES: Flattened elliptical vugs 3 to 11 mm occur in zones and appear to be arranged in an imbricate fashion.

BY: Lindsay, Trask

14072



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	45.15
TiO ₂	=	2.57
Al ₂ O ₃	=	11.07
FeO	=	17.82
MnO	=	0.27
MgO	=	12.16
CaO	=	9.84
Na ₂ O	=	0.32
K ₂ O	=	0.08
P ₂ O ₅	=	0.08
S	=	0.12
Cr ₂ O ₃	=	0.51

TOTAL		99.99
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CIPW NORM

Qtz	=	-
Or	=	0.47
Ab	=	2.71
An	=	28.53
Di	=	16.36
Hy	=	32.81
Ne	=	-
Ol	=	13.19
Chr	=	0.75
Ilm	=	4.88
Apa	=	0.17

TOTAL		99.87
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100 Mg/(Mg+Fe) = 54.9

An/Ab/Or = 90/9/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	1.4	(MS)
K	=	660	(XRF)
Ba	=	128	(MS)
Sr	=	108	(XRF)
Cr	=	3880	(NAA)
V	=	-	
Sc	=	47.1	(NAA)
Ni	=	31	(NAA)
Co	=	32	(NAA)
Cu	=	-	
Zn	=	8	(NAA)
Th	=	-	
U	=	-	
Zr	=	166	(XRF)
Hf	=	6.9	(NAA)
Nb	=	11.45	(MS)

RARE EARTH ELEMENTS (NAA)

La	=	6.76	
Ce	=	17.9	
Pr	=	-	
Nd	=	13	
Sm	=	3.93	
Eu	=	0.88	
Gd	=	4.2	
Tb	=	0.98	
Dy	=	6	
Ho	=	1.5	
Er	=	3.5	
Tm	=	-	
Yb	=	4.05	
Lu	=	0.61	
Y	=	38	(XRF)

ROCK NUMBER: 14310
WEIGHT: 3439 g

DIMENSIONS: 19 x 14 x 11 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray

SHAPE: Blocky and very angular, subrounded on the pitted sides.

FABRIC: Equigranular, massive, inhomogeneous

COHERENCE: Tough

Fracturing: There are two exfoliation fractures one of which is parallel to the fresh surface. The prominent fracture is about 0.5 cm away from the fresh surface and measures approximately 2 cm long.

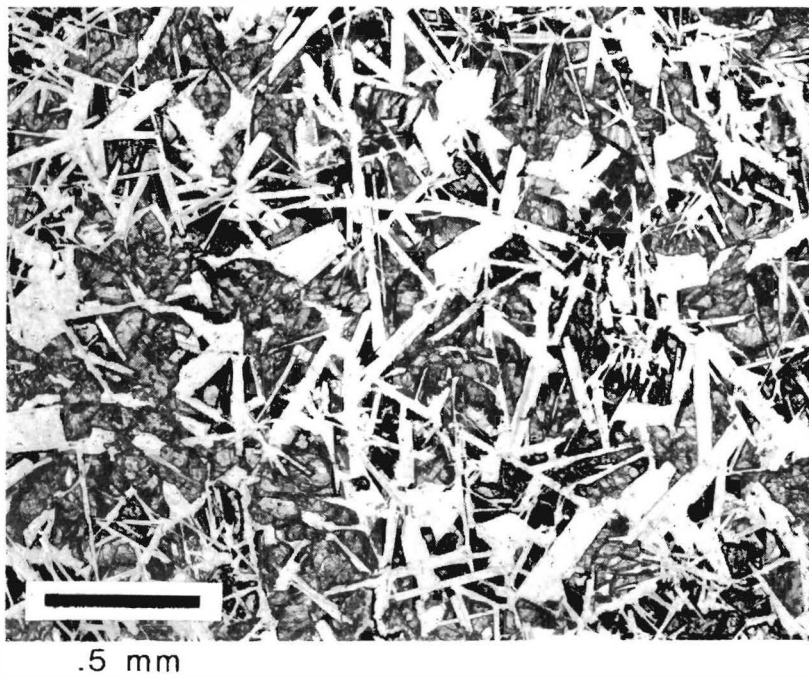
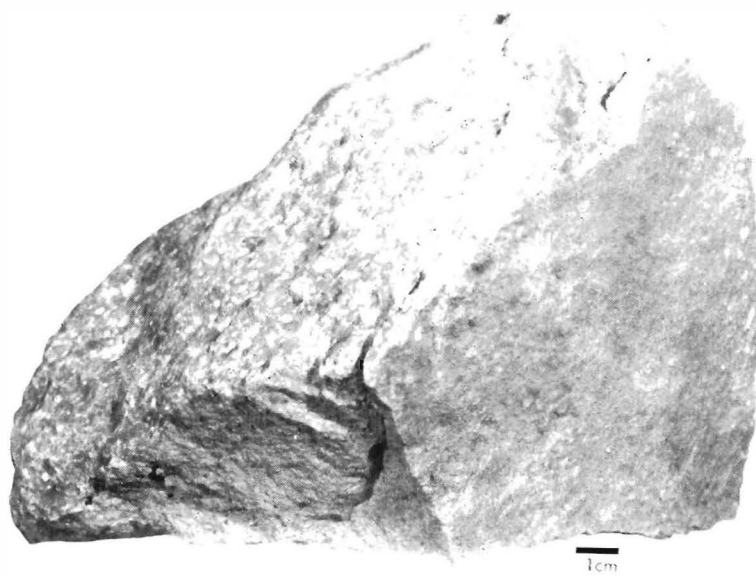
VARIABILITY: Homogeneous in mineralogy

ZAP PITS: Pits from 0.1 mm to 4.0 mm in size appear on two surfaces of the rock. About 90% of the pits are glass-lined and 10% are unlined. There are 20 to 50 pits per square centimeter.

CAVITIES: Irregular shaped vugs 0.5 to 2 mm in size appear in clusters and have irregular distribution. Vugs are 1% of the volume and are spaced 0.5 to 1 cm apart. Projecting 0.25 mm feldspar crystals line the vugs. Feldspar crystal lining varies from clear to gray in color. In larger cavities feldspar has honeycomb texture.

BY: Anderson, Lindsay, Ridley

14310



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	47.20
TiO ₂	=	1.24
Al ₂ O ₃	=	20.10
FeO	=	8.38
MnO	=	0.11
MgO	=	7.87
CaO	=	12.30
Na ₂ O	=	0.63
K ₂ O	=	0.49
P ₂ O ₅	=	0.34
S	=	0.02
Cr ₂ O ₃	=	0.18
<hr/>		
TOTAL		98.86

CIPW NORM

Qtz	=	0.16
Or	=	2.90
Ab	=	5.33
An	=	50.57
Di	=	6.91
Hy	=	29.61
Ne	=	-
Ol	=	-
Chr	=	0.27
Ilm	=	2.36
Apa	=	0.74
<hr/>		
TOTAL		98.84

100 Mg/(Mg+Fe) = 62.6
An/Ab/Or = 86/9/5

TRACE AND MINOR ELEMENTS

Li	=	22	(OES)
Rb	=	12.8	(ID)
K	=	4250	(ID)
Ba	=	617	(ID)
Sr	=	193	(ID)
Cr	=	-	
V	=	36	(OES)
Sc	=	16.6	(NAA)
Ni	=	63.9	(XRF)
Co	=	16.0	(NAA)
Cu	=	5	(OES)
Zn	=	2.3	(NAA)
Th	=	11.5	(MS)
U	=	3.11	(MS)
Zr	=	842	(XRF)
Hf	=	15.1	(NAA)
Nb	=	52	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	56.4	
Ce	=	144	
Pr	=	-	
Nd	=	87	
Sm	=	24	
Eu	=	2.15	
Gd	=	28.1	
Tb	=	-	
Dy	=	32.7	
Ho	=	-	
Er	=	19.7	
Tm	=	-	
Yb	=	18.4	
Lu	=	-	
Y	=	174	(XRF)

APOLLO 15

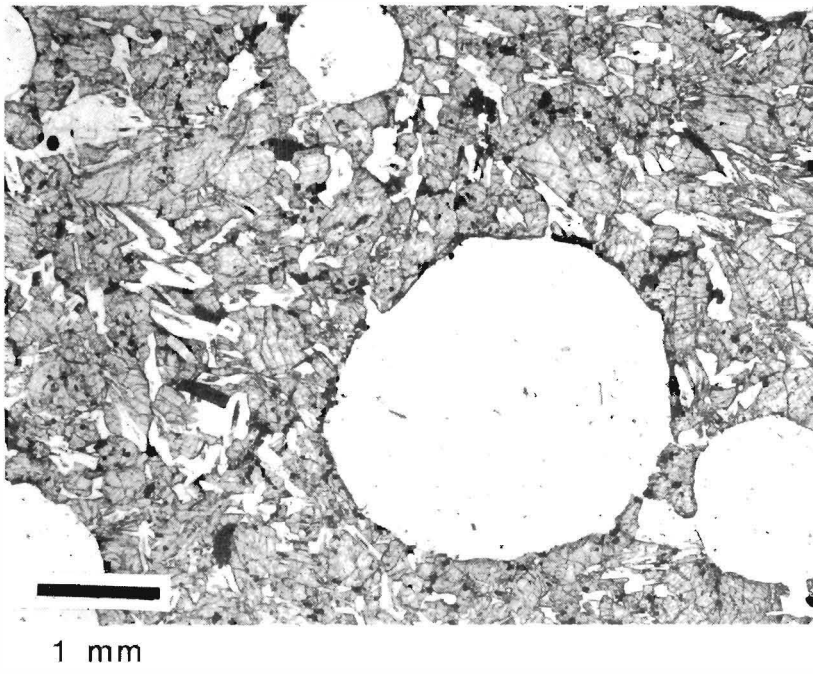
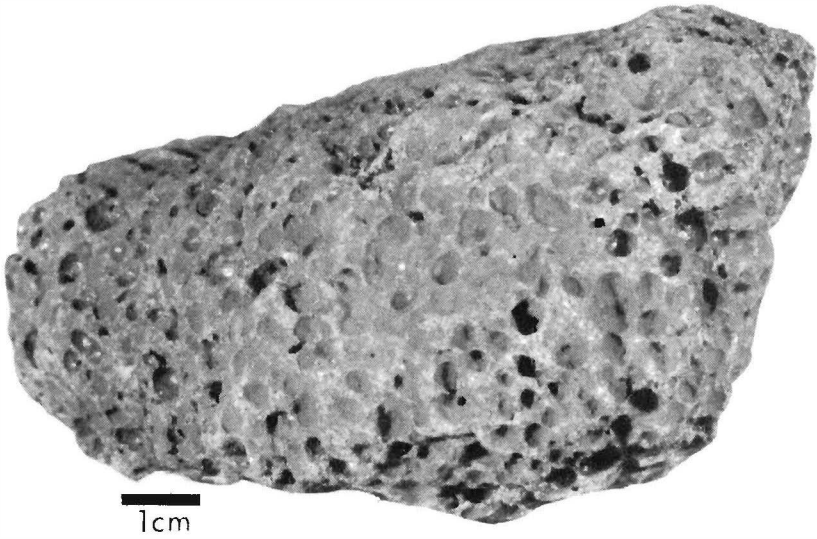
ROCK NUMBER: 15016
WEIGHT: 923.7 g DIMENSIONS: 13.5 x 10.5 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Light brownish gray (5YR 6/1)
SHAPE: Blocky, subrounded
FABRIC: Isotropic, porphyritic
COHERENCE: Intergranular: Tough
 Fracturing: Few, nonpenetrative
VARIABILITY: Vesicles are slightly larger on B (4 mm) than on T
 (3 mm).
SURFACE: The E half of the rock shows vesicles with soil coatings and
 therefore was probably buried.
ZAP PITS: None on all.
CAVITIES: 60%, most are vesicles, a few are vugs.
SPECIAL FEATURES: Vesicles are rounded, spheroidal, and most
 intersect other vesicles. Their walls are rough on a 0.05 mm
 scale, and show the lath shapes of the underlying plagioclase.
 The vesicle walls have very thin black glassy linings, which
 in some places is either not present or is so thin that the
 colors of underlying minerals are visible. Vugs compose about
 2% of the cavities and show projecting brown pyroxene crystals.

BY: Butler

15016



CHEMISTRY

MAJOR ELEMENTS (4)

SiO ₂	=	44.08
TiO ₂	=	2.28
Al ₂ O ₃	=	8.38
FeO	=	22.74
MnO	=	0.32
MgO	=	11.30
CaO	=	9.27
Na ₂ O	=	0.27
K ₂ O	=	0.04
P ₂ O ₅	=	0.07
S	=	0.10
Cr ₂ O ₃	=	0.85
TOTAL		<u>99.70</u>

C1PW NORM

Qtz	=	-
Or	=	0.24
Ab	=	2.28
An	=	21.54
Di	=	20.09
Hy	=	31.85
Ne	=	-
Ol	=	17.86
Chr	=	1.25
Ilm	=	4.33
Apa	=	0.15
TOTAL		<u>99.60</u>

100 Mg/(Mg+Fe) = 47.0
An/Ab/Or = 89.5/9.5/1

TRACE AND MINOR ELEMENTS

Li	=	4.6	(ID)
Rb	=	0.81	(ID)
K	=	249	(XRF)
Ba	=	61.0	(MS)
Sr	=	91.4	(ID)
Cr	=	6400	(NAA)
V	=	200	(OES)
Sc	=	39.1	(NAA)
Ni	=	85.9	(OES)
Co	=	54	(NAA)
Cu	=	11	(OES)
Zn	=	4	(NAA)
Th	=	0.50	(MS)
U	=	0.12	(MS)
Zr	=	86	(XRF)
Hf	=	2.6	(NAA)
Nb	=	10	(OES)

RARE EARTH ELEMENTS (NAA)

La	=	5.58
Ce	=	15.6
Pr	=	-
Nd	=	11.4
Sm	=	4.05
Eu	=	0.97
Gd	=	5.4
Tb	=	0.9
Dy	=	5.74
Ho	=	1.1
Er	=	3.1
Tm	=	-
Yb	=	2.62
Lu	=	0.321
Y	=	21 (OES)

ROCK NUMBER: 15058
WEIGHT: 2672.5 g DIMENSIONS: 10 x 12 x 16 cm

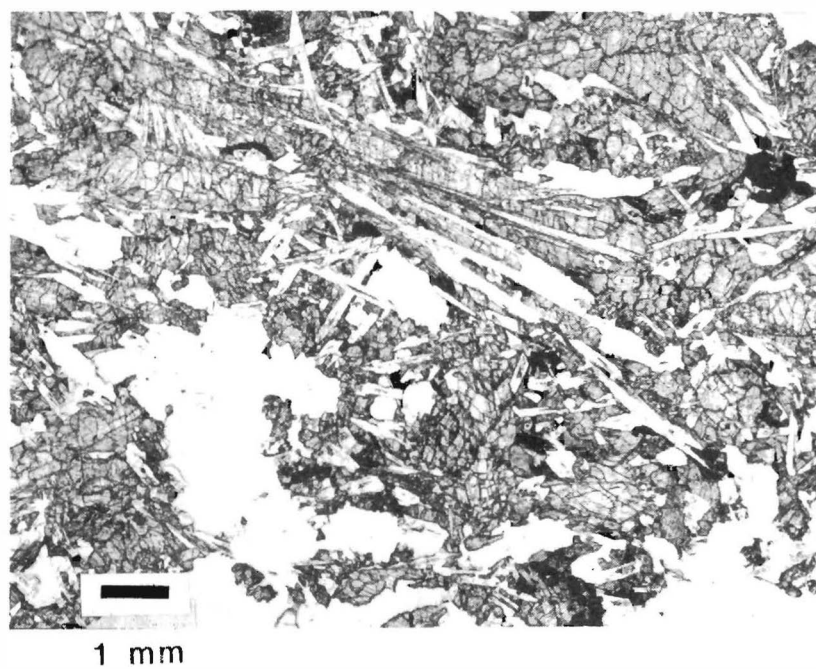
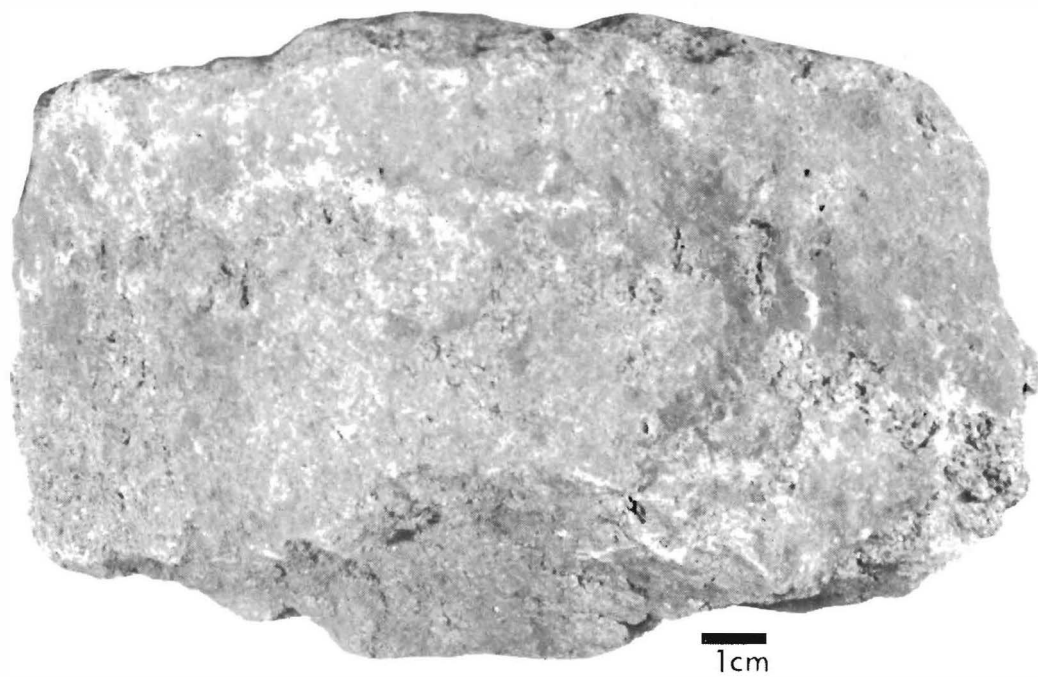
BINOCULAR DESCRIPTION

COLOR: Olive gray (near 5Y 4/1)
SHAPE: Blocky, angular
FABRIC: Diabasic, porphyritic
COHERENCE: Intergranular: Tough
 Fracturing: Numerous, nonpenetrative on S; few, nonpenetrative
 on E, absent on others
VARIABILITY: Abundance of vugs and phenocrysts
SURFACE: Granulated, irregular in vuggy areas, generally 80% soil
 covered (90% on N, 40% on B). Shocked plagioclase (white)
 over much of E, N, B.
ZAP PITS: Few on E, W, B; none on N, S, T.
CAVITIES: Vugs average 5% of rock, locally 10% on S, 50% on E,
 <5% on others.
SPECIAL FEATURES: Crystals in vugs are mainly plagioclase and
 brown pyroxene, and uncommonly a yellow-green mafic silicate.
 Where the vugs are abundant, the rock is locally diktytaxitic.

Plagioclase: Random orientation; phenocrysts are uncommon and
 are present only on faces with few vugs (e.g., B).
Mafic silicate: Often too large relative to plagioclase to the
 intergranular; brown rims uncommon, very thin; probably
 pyroxene.
Pyroxene phenocrysts: Most abundant near vuggy areas; 5% on
 vuggy faces, 1% on others.
Intergranular pyroxene: Medium to dark brown

BY: Bass

15058



CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	48.14
TiO ₂	=	1.69
Al ₂ O ₃	=	8.89
FeO	=	19.86
MnO	=	0.27
MgO	=	9.28
CaO	=	10.27
Na ₂ O	=	0.28
K ₂ O	=	0.03
P ₂ O ₅	=	0.07
S	=	0.07
Cr ₂ O ₃	=	0.66
<hr/>		
TOTAL		99.51

CIPW NORM

Qtz	=	1.40
Or	=	0.18
Ab	=	2.37
An	=	22.91
Di	=	23.15
Hy	=	45.10
Ne	=	-
Ol	=	-
Chr	=	0.97
Ilm	=	3.21
Apa	=	0.15
<hr/>		
TOTAL		99.44

100 Mg/(Mg+Fe) = 45.4
An/Ab/Or = 90/9/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	2.0	(XRF)
K	=	249	(XRF)
Ba	=	62	(NAA)
Sr	=	99.2	(XRF)
Cr	=	2840	(NAA)
V	=	-	
Sc	=	42	(NAA)
Ni	=	31	(NAA)
Co	=	42	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	0.52	(GAM)
U	=	0.13	(GAM)
Zr	=	98.0	(XRF)
Hf	=	2.16	(NAA)
Nb	=	4.9	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	-	
Ce	=	14.5	
Pr	=	-	
Nd	=	10.9	
Sm	=	3.9	
Eu	=	0.908	
Gd	=	5.0	
Tb	=	8.7	
Dy	=	5.9	
Ho	=	1.1	
Er	=	3.2	
Tm	=	-	
Yb	=	2.54	
Lu	=	0.388	
Y	=	21.1	(XRF)

ROCK NUMBER: 15065
WEIGHT: 1475.5 g DIMENSIONS: 8 x 10 x 15 cm

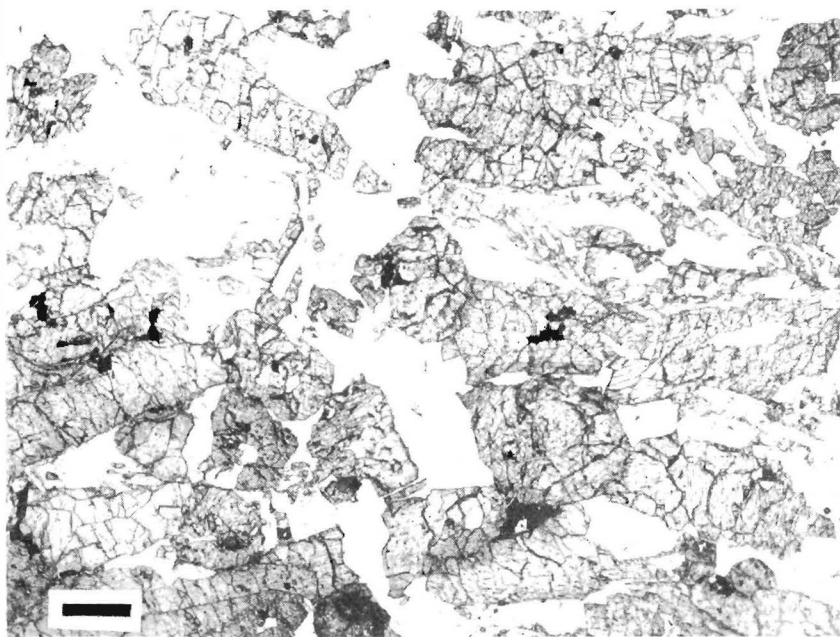
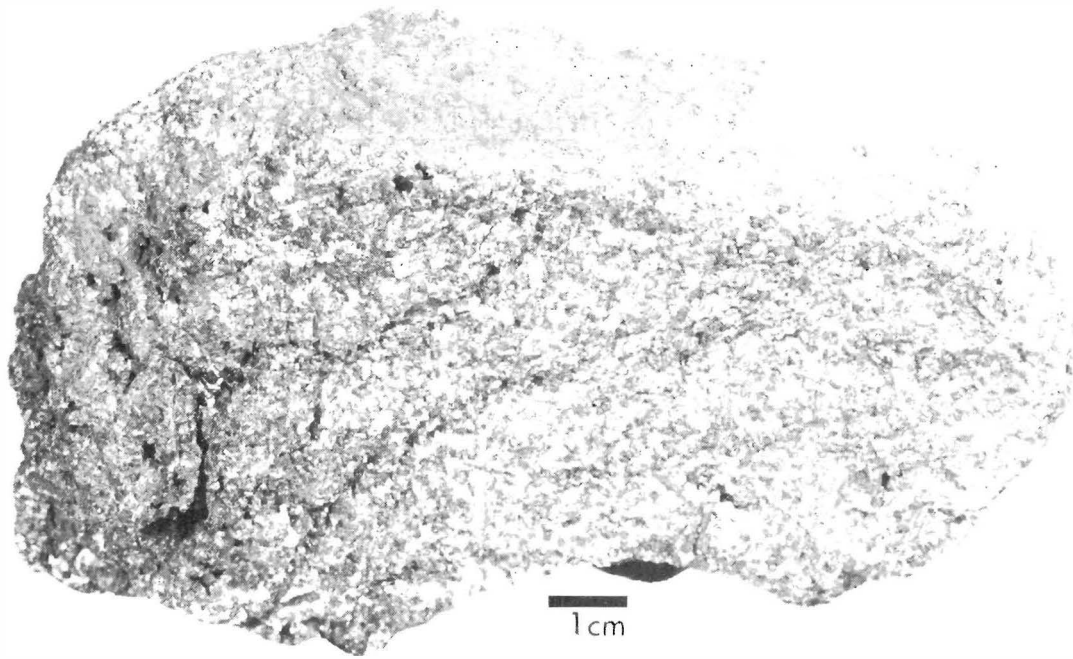
BINOCULAR DESCRIPTION

COLOR: Brownish gray (5YR 4/1)
SHAPE: Blocky, subrounded
FABRIC: Inequigranular
COHERENCE: Intergranular: Tough on fresh surfaces, friable on rounded surface.
Fracturing: Numerous and penetrative fractures. Two sets orthogonal, set parallel to B is dominant. One set is oblique to others.
VARIABILITY: Two distinct domains; predominant one is felsic with mafic: felsic ratio approximately 1:1; less abundant one has mafics 3:1 to 5:1 over plagioclase. Boundaries are generally diffuse between two domains.
SURFACE: Others smooth and rounded, S and W smooth, rounded. N irregular recessive; B hackly fresh.
ZAP PITS: B none, others few
CAVITIES: 3% scattered, 3-4 mm, with prismatic crystals, localized with pyroxene concentrations.
SPECIAL FEATURES: Fractures appear to be associated with possible pyroxene concentrations and vug development. On N an older fracture has crystals to 3.3. cm long which may have developed on the surface rather than under T.

Plagioclase: Some well defined plates, other anhedral.
Opaques: Occasionally in plagioclase and pyroxene; also ilmenite plates in some vugs.
Zoned pyroxenes: Generally green core is about 1/3 of total pyroxene. One crystal has 50% radius yellow-green core with pale brown 10% inner core. Boundaries between zones are moderately sharp. Several crystal cross sections have a colorless inner zone suggesting a distinct inner core phase.

BY: Morrison, Silver

15065



1 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	48.34
TiO ₂	=	1.46
Al ₂ O ₃	=	9.79
FeO	=	18.82
MnO	=	0.25
MgO	=	10.47
CaO	=	9.75
Na ₂ O	=	0.34
K ₂ O	=	0.05
P ₂ O ₅	=	0.07
S	=	-
Cr ₂ O ₃	=	0.50
TOTAL		<hr/> 99.84

CIPW NORM

Qtz	=	0.14
Or	=	0.3
Ab	=	2.88
An	=	25.04
Di	=	19.1
Hy	=	48.72
Ne	=	-
Ol	=	-
Chr	=	0.74
Ilm	=	2.77
Apa	=	.15
TOTAL		<hr/> 99.84

100 Mg/(Mg+Fe) = 49.8
 An/Ab/Or = 88.75/10.2/1.05

TRACE AND MINOR ELEMENTS

Li	=	-
Rb	=	0.7 (NAA)
K	=	-
Ba	=	96 (NAA)
Sr	=	134 (NAA)
Cr	=	3610 (NAA)
V	=	158 (XRF)
Sc	=	38 (XRF)
Ni	=	75.9 (XRF)
Co	=	52 (XRF)
Cu	=	64 (XRF)
Zn	=	5 (XRF)
Th	=	0.5244 (MS)
U	=	0.1368 (MS)
Zr	=	68 (XRF)
Hf	=	3.36 (NAA)
Nb	=	12 (XRF)

RARE EARTH ELEMENTS (NAA)

La	=	7.73
Ce	=	20.6
Pr	=	3.15
Nd	=	14.6
Sm	=	4.72
Eu	=	1.14
Gd	=	5.3
Tb	=	0.96
Dy	=	6.66
Ho	=	1.2
Er	=	3.7
Tm	=	-
Yb	=	2.98
Lu	=	0.43
Y	=	23 (XRF)

ROCK NUMBER: 15075
WEIGHT: 809.3 g DIMENSIONS: 8 x 7 x 6 cm

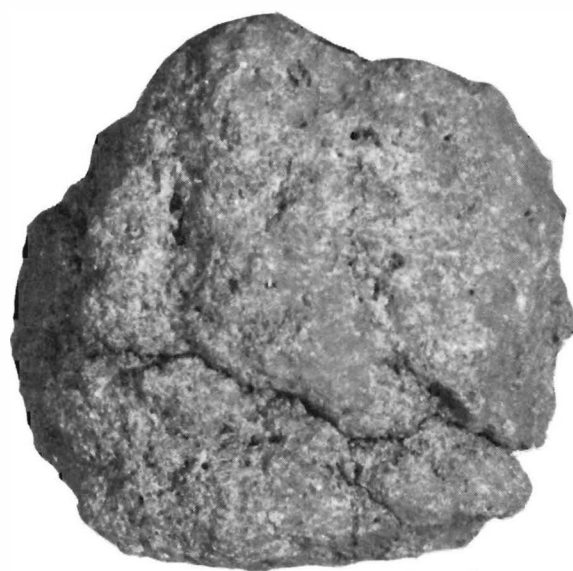
BINOCULAR DESCRIPTION

COLOR: Light olive gray (5Y 6/1)
SHAPE: Blocky, subrounded (corners rounded)
FABRIC: Inequigranular, possible weak orientation of plagioclase.
COHERENCE: Intergranular: Tough
Fracturing: One penetrative fracture perpendicular to S.
VARIABILITY: None
SURFACE: S smooth and irregular, E has some splash glass (<1%).
ZAP PITS: None on N and W (dusty); few on T, S, E and B (dusty)
CAVITIES: Vugs - 5%, projecting plagioclase and pyroxene
SPECIAL FEATURES: May be boundary between zapped and unzapped surfaces across T, unzapped on right. Plagioclase is ground up and white on N, possibly a sheared surface.

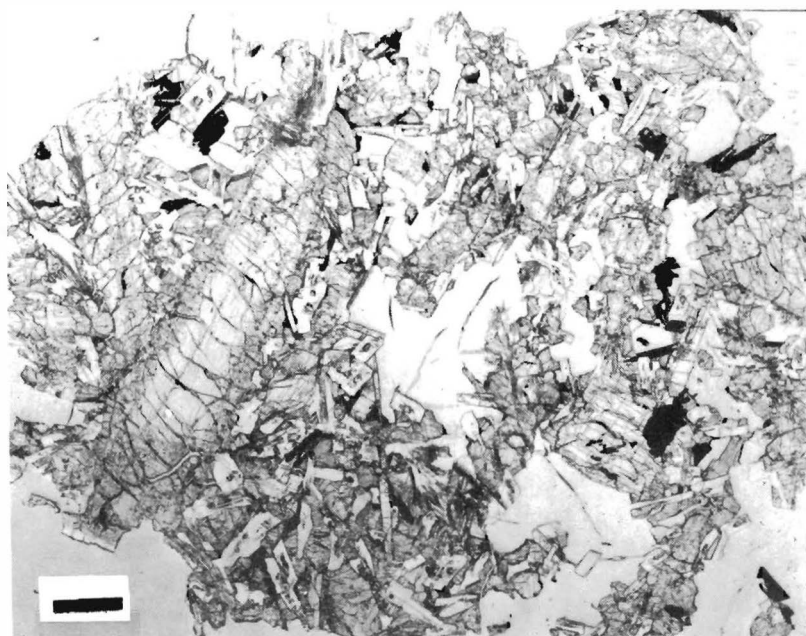
Plagioclase: Possibly two size groups
Mafic silicate: Probably olivine although some may be pigeonite.
Possibly some mantling by pyroxene. There appears to be rare pyroxene laths to 8 mm.

BY: Morrison

15075



1 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	48.07
TiO ₂	=	1.81
Al ₂ O ₃	=	9.45
FeO	=	19.53
MnO	=	0.29
MgO	=	8.11
CaO	=	10.83
Na ₂ O	=	n.d.
K ₂ O	=	0.04
P ₂ O ₅	=	0.05
S	=	0.05
Cr ₂ O ₃	=	0.45
<hr/>		
TOTAL		98.68

CIPW NORM

Qtz	=
Or	=
Ab	=
An	=
Di	=
Hy	=
Ne	=
Ol	=
Chr	=
Ilm	=
Apa	=
<hr/>	
TOTAL	

$$100 \text{ Mg}/(\text{Mg}+\text{Fe}) = 42.5$$

$$\text{An}/\text{Ab}/\text{Or} =$$

TRACE AND MINOR ELEMENTS

Li	=
Rb	=
K	=
Ba	=
Sr	=
Cr	=
V	=
Sc	=
Ni	=
Co	=
Cu	=
Zn	=
Th	=
U	=
Zr	=
Hf	=
Nb	=

RARE EARTH ELEMENTS

La	=
Ce	=
Pr	=
Nd	=
Sm	=
Eu	=
Gd	=
Tb	=
Dy	=
Ho	=
Er	=
Tm	=
Yb	=
Lu	=
Y	=

Rhodes, M. J., unpublished data

ROCK NUMBER: 15076
WEIGHT 400.5 g DIMENSIONS: 9 x 6 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Light olive gray (5Y 6/1)
SHAPE: Blocky, angular
FABRIC: Possibly subophitic microporphyritic inequigranular, local flow alignment of plagioclase
COHERENCE: Intergranular: Tough
Fracturing: Penetrative and nonpenetrative, planar
VARIABILITY: Vugs are irregularly distributed
SURFACE: Slickensides, W, angular, irregular; T is dusty and not rounded.
ZAP PITS: None on T, N and W; few on S, B; none on E, but it is dusty.
CAVITIES: Vugs (5%) with projecting plagioclase crystals.
SPECIAL FEATURES: Some of long plagioclase crossing vuggy areas are bent and broken; brown mafic silicate (pyroxene) rimming green mafic silicate (olivine). No soil line found on S face.

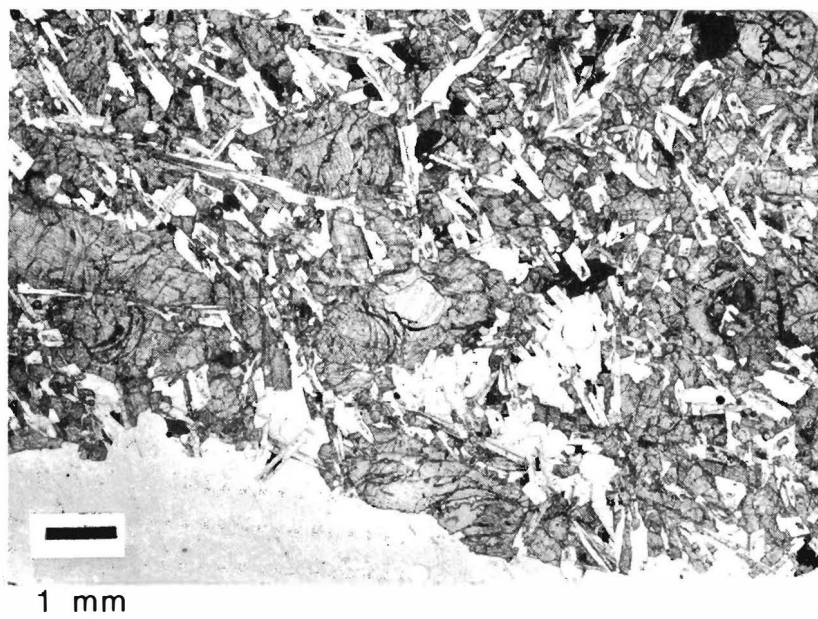
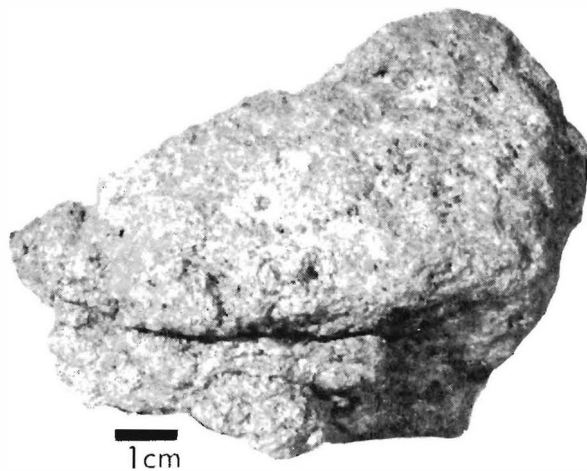
Mafic silicate: Olivine? Good parting parallel to long dimension. Pyroxene rims around olivine. One olivine is 7 x 11 mm, second is 12 mm long. Prismatic olivine may be pigeonite.

Plagioclase: Has small equant black inclusions. A closer look says seriate size distribution of plagioclase.

Opagues: Some from these plates (ilmenite?) penetrating pyroxene.

BY: Wilshire

15076



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	48.44
TiO ₂	=	1.92
Al ₂ O ₃	=	8.97
FeO	=	20.33
MnO	=	0.29
MgO	=	8.61
CaO	=	10.52
Na ₂ O	=	0.34
K ₂ O	=	0.07
P ₂ O ₅	=	0.07
S	=	0.08
Cr ₂ O ₃	=	0.31

TOTAL		99.95
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CIPW NORM

Qtz	=	1.59
Or	=	0.41
Ab	=	2.88
An	=	22.74
Di	=	24.41
Hy	=	43.59
Ne	=	-
Ol	=	-
Chr	=	0.46
Ilm	=	3.65
Apa	=	0.15

TOTAL		99.87
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100 Mg/(Mg+Fe) = 43.0
An/Ab/Or = 87/11/2

TRACE AND MINOR ELEMENTS

Li	=	5.6	(OES)
Rb	=	0.917	(ID)
K	=	411	(ID)
Ba	=	62.7	(ID)
Sr	=	112	(ID)
Cr	=	-	
V	=	135	(OES)
Sc	=	47	(NAA)
Ni	=	11	(XRF)
Co	=	41	(NAA)
Cu	=	9.1	(OES)
Zn	=	-	
Th	=	0.5901	(MS)
U	=	0.1532	(MS)
Zr	=	97	(XRF)
Hf	=	2.1	(NAA)
Nb	=	6.2	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	7.38	
Ce	=	15.1	
Pr	=	-	
Nd	=	10.6	
Sm	=	3.52	
Eu	=	0.978	
Gd	=	4.95	
Tb	=	-	
Dy	=	5.6	
Ho	=	-	
Er	=	3.4	
Tm	=	-	
Yb	=	2.77	
Lu	=	0.326	
Y	=	29	(XRF)

ROCK NUMBER: 15085
WEIGHT: 471.3 g DIMENSIONS: 8.5 x 8 x 5 cm

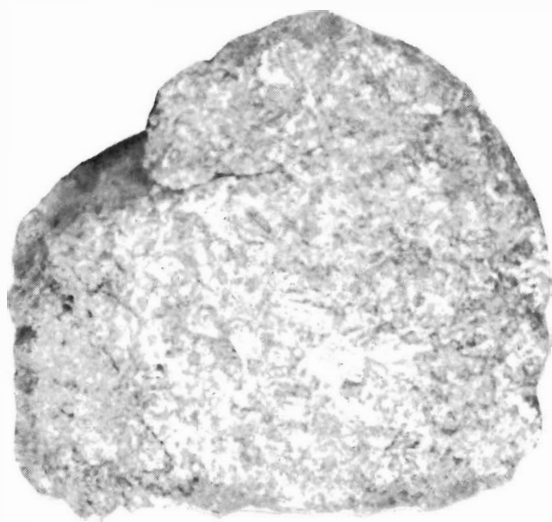
BINOCULAR DESCRIPTION

COLOR: Light brownish gray (less brown than 5YR 6/1)
SHAPE: Blocky, subrounded
FABRIC: Intergranular, diabasic
COHERENCE: Intergranular: Tough, coherent
 Fracturing: Few penetrative. One major irregular joint branching
 into irregular fractures.
VARIABILITY: N surface is much coarser and lighter colored
SURFACE: Granular
ZAP PITS: None, glass coating on one pyroxene grain not clearly
 a zap pit.
CAVITIES: 2% equant vugs. Pyroxene and plagioclase project
 into vugs.
SPECIAL FEATURES: In coarse patches local average grain size
 approaches 1 cm. Pale green pyroxene is commonly mantled by
 brown pyroxene.

Pyroxene: Intergranular, dominant size is 5 mm on N face
Olivine or possibly green pyroxene: Contacts with plagioclase
 are common on N, and includes rare opaque grains.
Plagioclase: Random orientation. On N face seriate grain size,
 the dominant size is 5 mm.

BY: Ridley, Bass

15085



1cm



1 mm

Coarse grained rock, different splits have significantly different chemistry, probably because splits were too small relative to grain size, analyses for both splits listed.

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	46.61	47.73
TiO ₂	=	2.63	1.96
Al ₂ O ₃	=	7.13	9.92
FeO	=	24.38	19.69
MnO	=	0.30	0.26
MgO	=	7.90	8.84
CaO	=	9.68	10.63
Na ₂ O	=	0.26	0.33
K ₂ O	=	0.06	0.04
P ₂ O ₅	=	0.11	0.06
S	=	0.14	0.52
Cr ₂ O ₃	=	0.61	0.52
TOTAL		99.73	100.01

CIPW NORM Not calculated

Qtz	=
Or	=
Ab	=
An	=
Di	=
Hy	=
Ne	=
Ol	=
Chr	=
Ilm	=
Apa	=

TOTAL

100 Mg/(Mg+Fe) =
An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li	=		
Rb	=	1.8	<115 (XRF)
K	=		
Ba	=	110	60 (XRF)
Sr	=	120	112 (XRF)
Cr	=		
V	=	172	165 (XRF)
Sc	=		
Ni	=	20	23 (XRF)
Co	=	43	41 (XRF)
Cu	=	9	29 (XRF)
Zn	=	<1.5	17 (XRF)
Th	=		
U	=		
Zr	=	156	92 (XRF)
Hf	=		
Nb	=	10.0	6.6 (XRF)

RARE EARTH ELEMENTS

La	=		
Ce	=		
Pr	=		
Nd	=		
Sm	=		
Eu	=		
Gd	=		
Tb	=		
Dy	=		
Ho	=		
Er	=		
Tm	=		
Yb	=		
Lu	=		
Y	=	44.0	28.6 (XRF)

Ref: Duncan et al. (1975) Proc. Lunar Sci. Conf. 6th, 2309-2320.

ROCK NUMBER: 15475
WEIGHT: 298.2 g DIMENSIONS: 6 x 6 x 5 cm (largest
piece of 3)

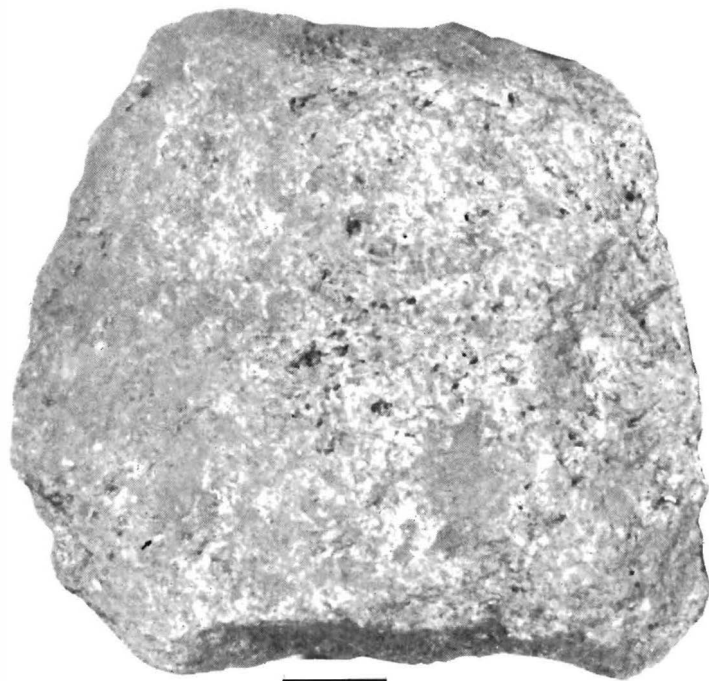
BINOCULAR DESCRIPTION

COLOR: Light brown (5YR 6/4)
SHAPE: Blocky, subangular corners
FABRIC: Inequigranular
COHERENCE: Intergranular: Tough
Fracturing: One penetrative fracture, two pieces have broken
off the largest one
VARIABILITY: Mafic-felsic concentration varies from 60-40 to nearly
50-50.
SURFACE: All surfaces are hackly to irregular. Certain areas of
rock have coating of light gray soil distinctly lighter than
brown "regolith" soil.
ZAP PITS: Few on T, S, W; none on E (fresh surface), SE (dull),
B (dull).
CAVITIES: 2% vugs, irregular shape and formed around crystals.
SPECIAL FEATURES: The white euhedral vug mineral (on N) can be
removed easily for study.

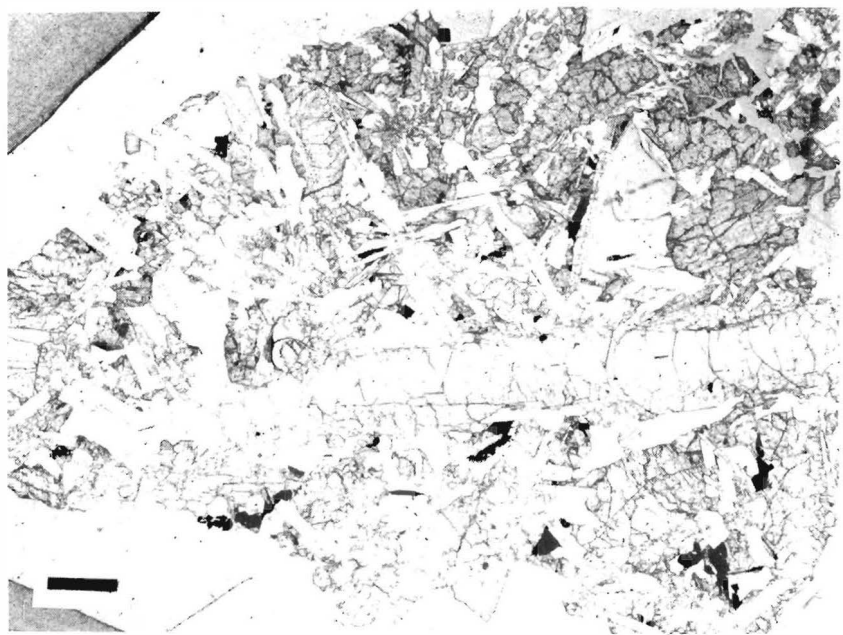
Pigeonite cores: Moderate yellow-green (10Y 7/4), are surrounded
by thick augite(?) rims, reddish brown (10R 3/4 to 10R 4/6),
which form 40-60% of radius of crystals. The boundary between
core and rim is sharp but irregular. In one grain the yellow-
green core appears to be cored itself by colorless translucent
mineral. Fine-grained brown pyroxene(?) may also be present.
Olivine(?): Interstitial grains, does not have the green cast
of pigeonite.
Plagioclase: Occurs both as laths and plates, which grow across
vugs, and as milky granulated interstitial masses.
Opagues: Rare plates in vugs and as rare black inclusions in
other phases.

BY: Morrison

15475



1cm



1 mm

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	48.15
TiO ₂	=	1.77
Al ₂ O ₃	=	9.44
FeO	=	19.98
MnO	=	0.30
MgO	=	8.85
CaO	=	10.58
Na ₂ O	=	0.27
K ₂ O	=	0.06
P ₂ O ₅	=	0.06
S	=	0.05
Cr ₂ O ₃	=	0.63
<hr/>		
TOTAL		100.14

CIPW NORM

Qtz	=	1.25
Or	=	0.35
Ab	=	2.28
An	=	24.37
Di	=	23.31
Hy	=	44.10
Ne	=	-
Ol	=	-
Chr	=	0.93
Ilm	=	3.36
Apa	=	0.13
<hr/>		
TOTAL		100.09

100 Mg/(Mg+Fe) = 44.1
 An/Ab/Or = 90.3/8.4/1.3

TRACE AND MINOR ELEMENTS

Li	=	15.3	(ID)
Rb	=	0.696	(ID)
K	=	347	(ID)
Ba	=	45.2	(ID)
Sr	=	111.0	(ID)
Cr	=	3875.0	(XRF)
V	=	130	(OES)
Sc	=	47.7	(NAA)
Ni	=	8.9	(XRF)
Co	=	44.6	(NAA)
Cu	=	6.0	(OES)
Zn	=	10.0	(OES)
Th	=	0.4	(GAM)
U	=	0.12	(GAM)
Zr	=	89.0	(XRF)
Hf	=	2.37	(NAA)
Nb	=	5.9	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	4.01
Ce	=	13.1
Pr	=	-
Nd	=	8.87
Sm	=	2.93
Eu	=	0.481
Gd	=	-
Tb	=	-
Dy	=	4.59
Ho	=	-
Er	=	2.7
Tm	=	-
Yb	=	2.35
Lu	=	0.35
Y	=	-

ROCK NUMBER: 15476
WEIGHT: 266.3 g DIMENSIONS: 8.5 x 7 x 3 cm

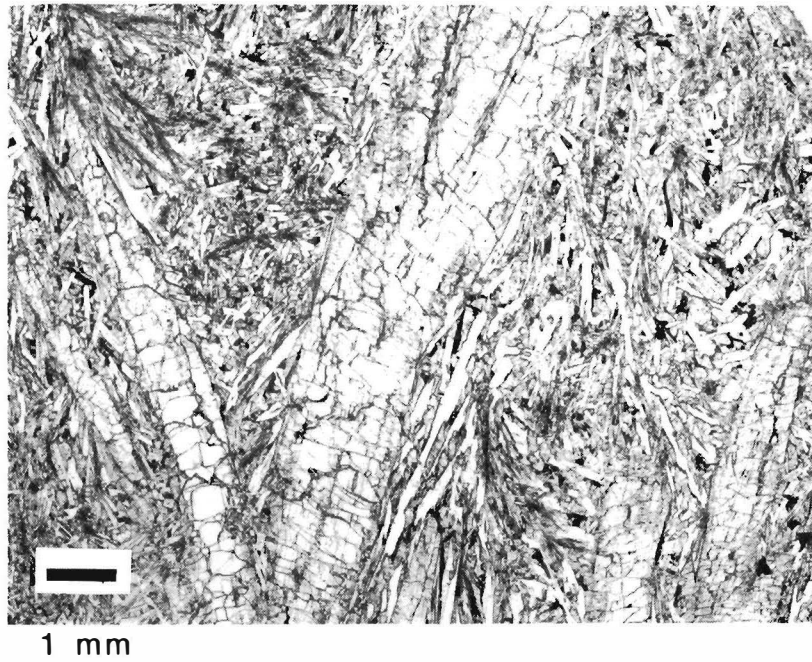
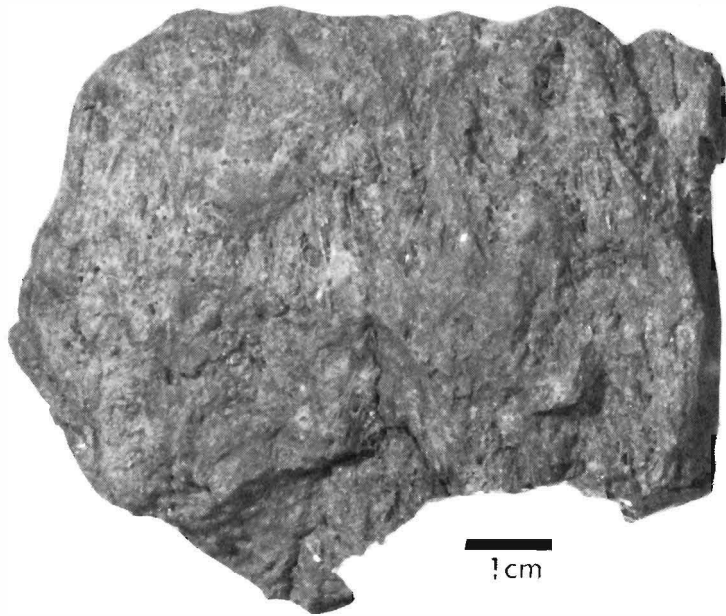
BINOCULAR DESCRIPTION

COLOR: Light brown (5YR 6/4), green gray (5GY 6/1)
SHAPE: Slabby
FABRIC: Porphyritic spherulitic
COHERENCE: Intergranular: Coherent
Fracturing: Few, one major fracture parallels N.
VARIABILITY: Foliated and porphyritic
SURFACE: Granulated
ZAP PITS: Few on all faces
CAVITIES: 3-2% vugs, matrix phases project into cavity.
SPECIAL FEATURES: The orientation of lath-shaped plagioclase produces a crude foliation parallel to E and W planes. A lineation is produced in this plane by the orientation of elongate pyroxene parallel to the T and B planes. Similar to 14086 in structure and gross appearance.

Plagioclase: Lath-shaped, generally oriented with a girdle of lath poles N, E, S, W, slightly sheaf-like pattern.
Phenocrysts: Zoned pigeonite to augite.
Augite: Columnar crystals parallel to B.

BY: Warner

15476



CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	48.15
TiO ₂	=	1.79
Al ₂ O ₃	=	9.78
FeO	=	20.27
MnO	=	0.27
MgO	=	8.52
CaO	=	10.62
Na ₂ O	=	0.31
K ₂ O	=	0.06
P ₂ O ₅	=	0.06
S	=	0.01
Cr ₂ O ₃	=	0.45

TOTAL 100.30

CIPW NORM

Qtz	=	1.03
Or	=	0.33
Ab	=	2.67
An	=	25.11
Di	=	22.88
Hy	=	44.08
Ne	=	-
Ol	=	-
Chr	=	0.66
Ilm	=	3.40
Apa	=	0.14

TOTAL 100.29

100 Mg/(Mg+Fe) = 42.8
 An/Ab/Or = 89/10/1

TRACE AND MINOR ELEMENTS

Li	=	8.0	(OES)
Rb	=	1.5	(XRF)
K	=	357	(XRF)
Ba	=	74	(XRF)
Sr	=	115	(XRF)
Cr	=	-	
V	=	160	(XRF)
Sc	=	40.6	(NAA)
Ni	=	15	(XRF)
Co	=	38	(XRF)
Cu	=	4.0	(XRF)
Zn	=	1.5	(XRF)
Th	=	0.7334	(MS)
U	=	0.1919	(MS)
Zr	=	110	(XRF)
Hf	=	3.6	(NAA)
Nb	=	5.6	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	5.9	
Ce	=	-	
Pr	=	-	
Nd	=	-	
Sm	=	4.3	
Eu	=	1.13	
Gd	=	-	
Tb	=	0.88	
Dy	=	3.5	
Ho	=	-	
Er	=	-	
Tm	=	-	
Yb	=	3.4	
Lu	=	-	
Y	=	31.4	(XRF)

ROCK NUMBER: 15485
WEIGHT: 104.9 g DIMENSIONS: 7 x 3 x 3.5 cm

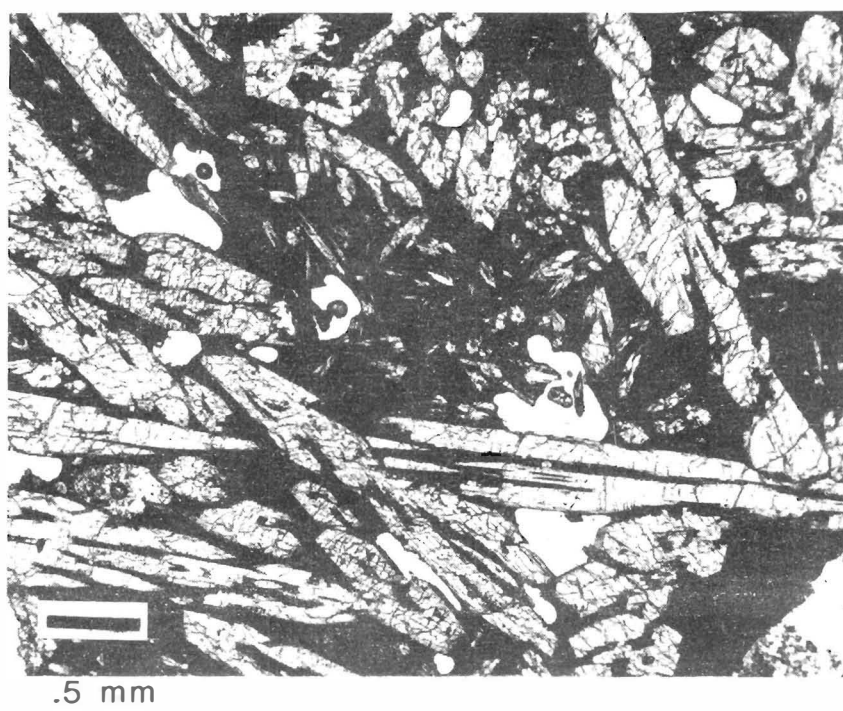
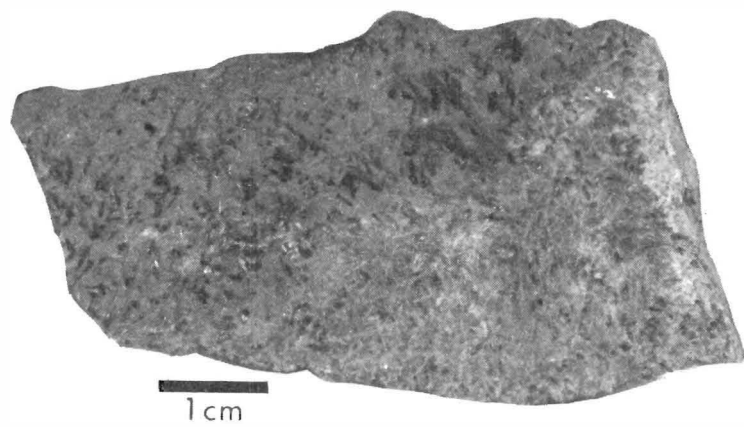
BINOCULAR DESCRIPTION

COLOR: Medium gray (N5)
SHAPE: Angular
FABRIC: Isotropic
COHERENCE: Intergranular: Tough
 Fracturing: None (single fracture on B created during collection
 of sample by hammer)
VARIABILITY: Surfaces vary from fresh to weathered; diktytaxitic
 to subophitic one side of rock to the other.
SURFACE: N fresh broken surface; S is half exterior surface,
 half interior **fracture** surface with yellowish material on the
 surface; B is exterior surface.
ZAP PITS: Few on B; none on others
CAVITIES: 20-60% rounded to angular; rounded are often glass
 lined; angular are formed by large crystals.
SPECIAL FEATURES: Yellowish white powder (sublimate?) along
 fracture between chip 15485,1 and main rock for about 5 mm as
 seen in S face photo.

Plagioclase: Forms some spherulite clusters
Pyroxene - pigeonite: Striations parallel to prismatic axis.
Spinel(?): Evenly distributed through rock.

BY: Lofgren

15485



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	47.39
TiO ₂	=	1.77
Al ₂ O ₃	=	9.14
FeO	=	19.82
MnO	=	0.27
MgO	=	9.48
CaO	=	10.21
Na ₂ O	=	0.28
K ₂ O	=	0.03
P ₂ O ₅	=	0.08
S	=	0.06
Cr ₂ O ₃	=	0.57

TOTAL 99.11

CIPW NORM

Qtz	=	0.34
Or	=	0.18
Ab	=	2.37
An	=	23.59
Di	=	22.24
Hy	=	45.93
Ne	=	-
Ol	=	-
Chr	=	0.85
Ilm	=	3.36
Apa	=	0.18

TOTAL 99.05

100 Mg/(Mg+Fe) = 46.0
 An/Ab/Or = 90/9/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	1.4	(XRF)
K	=	257	(XRF)
Ba	=	71	(XRF)
Sr	=	104	(XRF)
Cr	=	-	
V	=	177	(XRF)
Sc	=	-	
Ni	=	22	(XRF)
Co	=	42	(XRF)
Cu	=	4	(XRF)
Zn	=	2	(XRF)
Th	=	-	
U	=	-	
Zr	=	113	(XRF)
Hf	=	-	
Nb	=	5.5	(XRF)

RARE EARTH ELEMENTS

La	=		
Ce	=		
Pr	=		
Nd	=		
Sm	=		
Eu	=		
Gd	=		
Tb	=		
Dy	=		
Ho	=		
Er	=		
Tm	=		
Yb	=		
Lu	=		
Y	=	32.2	(XRF)

ROCK NUMBER: 15486
 WEIGHT: 46.8 g DIMENSIONS: 5.6 x 3 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Olive black (5Y 2/1), grayish black (N2), color of coating:
 fresh-medium dark gray (N4)

SHAPE: Blocky, angular

FABRIC: Porphyritic, inequigranular

COHERENCE: Intergranular: Tough

Fracturing: Few penetrative and few nonpenetrative

VARIABILITY: Differences in coating on several surfaces and in
 the densities of vugs.

SURFACE: T is a break along veins of preexisting vugs with
 coalescing walls. B is smoother with a darker coating. N has
 glassy vugs, a light olive gray coating, and faint striations
 with preferred orientation.

ZAP PITS: Few to many on B; few on T; none on N, W.

CAVITIES: 5% vugs. T has one 1 cm vug with crystals 5-7 mm.

B locally has a high density of vugs with 1-10 mm pyroxene prisms.
 These prisms have a few greenish spots.

SPECIAL FEATURES: Coating of light olive gray on N is clearly
 related to a fracture, which can be followed into the rock.

Metallic surface grains on T are probably part of the alteration
 or coating. Alteration or coatings are on the surfaces of
 pyroxene prisms. On old penetrative fractures the mineralogy
 is obscured by coating. Compare to 15485 which is a nearly
 identical rock.

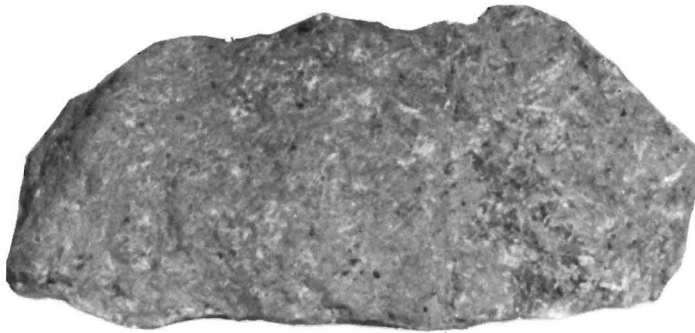
Pyroxene: Pale brown with thin dark rims and some with darker
 cores, randomly oriented with interlocking grains.

Matrix: Pyroxene(?) intergrowths, pyroxene to feldspar proportion
 is 3.2.

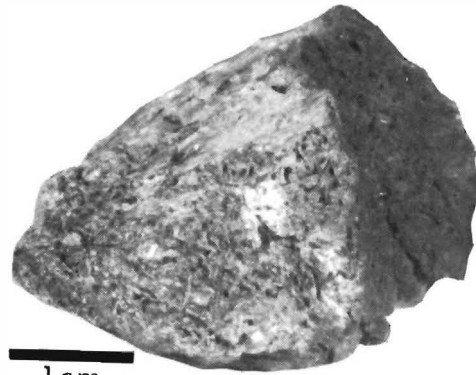
Olivine: Trace amounts, maybe.

BY: Silver, Jakes

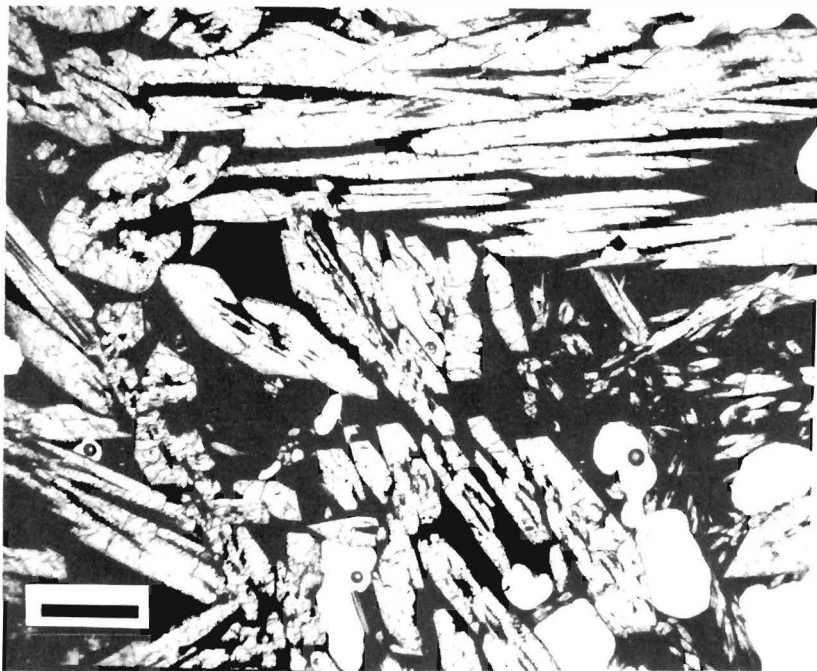
15486



1 cm



1 cm



0.5 mm

.5 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	48.06
TiO ₂	=	1.79
Al ₂ O ₃	=	9.60
FeO	=	19.90
MnO	=	0.29
MgO	=	8.97
CaO	=	10.27
Na ₂ O	=	0.37
K ₂ O	=	0.06
P ₂ O ₅	=	0.10
S	=	0.06
Cr ₂ O ₃	=	0.50

TOTAL		99.98
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CIPW NORM

Qtz	=	0.83
Or	=	0.38
Ab	=	3.13
An	=	24.36
Di	=	21.77
Hy	=	45.08
Ne	=	-
Ol	=	-
Chr	=	0.74
Ilm	=	3.40
Apa	=	0.23

TOTAL		99.92
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100 Mg/(Mg+Fe) = 44.5
An/Ab/Or = 87.4/11.2/1.4

TRACE AND MINOR ELEMENTS

Li	=	8.8	(OES)
Rb	=	1.3	(OES)
K	=	664	(XRF)
Ba	=	74	(OES)
Sr	=	135	(OES)
Cr	=	-	
V	=	-	
Sc	=	44.2	(NAA)
Ni	=	61.9	(OES)
Co	=	47	(NAA)
Cu	=	10	(OES)
Zn	=	-	
Th	=	0.64	(GAM)
U	=	0.15	(GAM)
Zr	=	127	(OES)
Hf	=	3	(NAA)
Nb	=	10	(OES)

RARE EARTH ELEMENTS (NAA)

La	=	7.09	
Ce	=	18	
Pr	=	-	
Nd	=	1.4	
Sm	=	4.57	
Eu	=	0.977	
Gd	=	5.5	
Tb	=	0.92	
Dy	=	5.96	
Ho	=	1.2	
Er	=	3	
Tm	=	-	
Yb	=	2.79	
Lu	=	0.44	
Y	=	36	(OES)

ROCK NUMBER: 15495
WEIGHT: 908.9 g DIMENSIONS: 12 x 10 x 6.5 cm

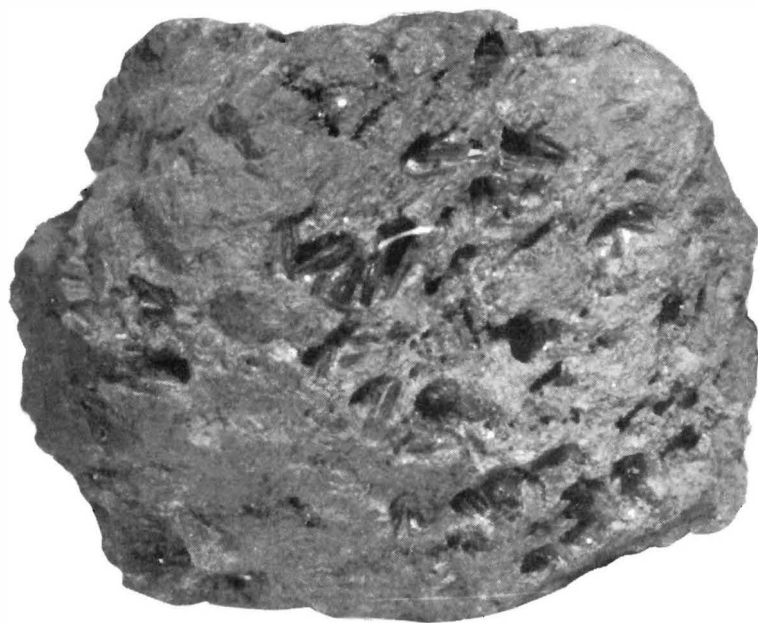
BINOCULAR DESCRIPTION

COLOR: Brownish gray near (5YR 4/1)
SHAPE: Blocky, subangular
FABRIC: Porphyritic; parallel to subradial feldspar-pyroxene intergrowths in groundmass, with preferential orientation E-W on S.
COHERENCE: Intergranular: Tough
 Fracturing: Few nonpenetrative (S); second set, three members, one of them exposed on B.
VARIABILITY: Moderate variability in abundance of vugs.
SURFACE: Granulated
ZAP PITS: None on N, W; few on S, T, E, and B. Shattered feldspar suggests S may be saturated with zap pits from which glassy central areas were lost.
CAVITIES: 5-10% vugs with abundant pyroxene and minor plagioclase and ilmenite crystals.
SPECIAL FEATURES: Euhedral pyroxene prisms up to 15 x 2 mm (dark brownish green exterior, green cores) exposed in vugs, otherwise similar to phenocrysts. The rock is gabbro by grain size and porphyritic variolitic basalt by texture (compare 12021).

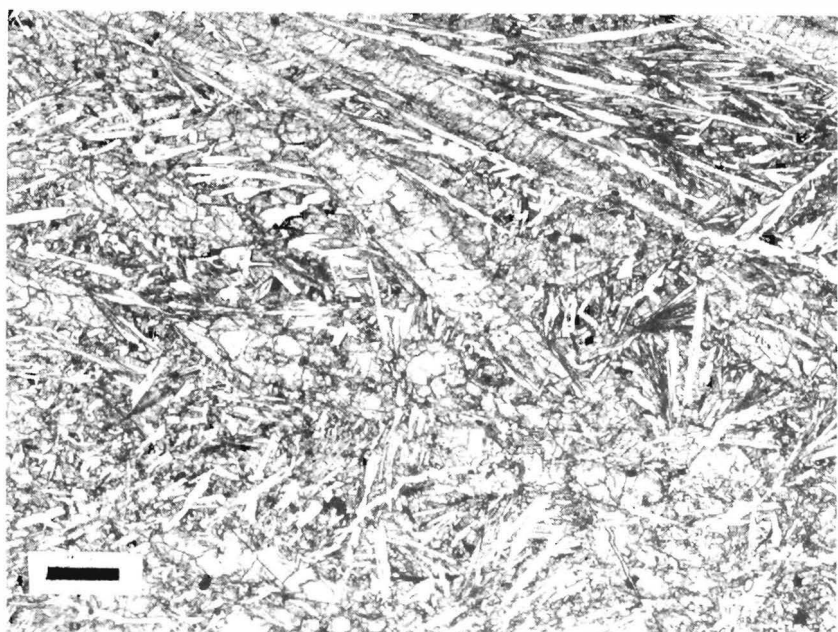
Pyroxene phenocrysts: More abundant on S than on N, hollow cores in some, discontinuous color zoning, green cores are possibly pigeonite.
Pyroxene: Intergrown with feldspar
Plagioclase: White, opaque where shocked. Intergrown with pyroxene. No definite phenocrysts.
Glass?: Round vitreous surfaces exposed in a few vugs on N.

BY: Reid, Bass

15495



1 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	47.22
TiO ₂	=	1.92
Al ₂ O ₃	=	9.80
FeO	=	20.36
MnO	=	0.28
MgO	=	8.47
CaO	=	10.50
Na ₂ O	=	0.34
K ₂ O	=	0.06
P ₂ O ₅	=	0.09
S	=	-
Cr ₂ O ₃	=	0.40
TOTAL		99.44

CIPW NORM

Qtz	=	0.16
Or	=	0.35
Ab	=	2.92
An	=	25.02
Di	=	22.33
Hy	=	44.24
Ne	=	-
Ol	=	-
Chr	=	0.59
Ilm	=	3.65
Apa	=	0.20
TOTAL		99.45

100 Mg/(Mg+Fe) = 42.6
 An/Ab/Or = 88.4/10.3/1.2

TRACE AND MINOR ELEMENTS

Li	=	6.4	(OES)
Rb	=	1.032	(ID)
K	=	515	(XRF)
Ba	=	92	(OES)
Sr	=	108.42	(ID)
Cr	=	3830	(NAA)
V	=	152	(OES)
Sc	=	46	(NAA)
Ni	=	26	(XRF)
Co	=	46	(NAA)
Cu	=	12	(OES)
Zn	=	1.3	(NAA)
Th	=	0.6331	(MS)
U	=	0.172	(MS)
Zr	=	126	(XRF)
Hf	=	3.2	(NAA)
Nb	=	7.7	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	8.1	
Ce	=	22	
Pr	=	-	
Nd	=	-	
Sm	=	5.4	
Eu	=	1.1	
Gd	=	-	
Tb	=	0.9	
Dy	=	5.8	
Ho	=	-	
Er	=	-	
Tm	=	-	
Yb	=	3.3	
Lu	=	0.49	
Y	=	32.2	(XRF)

ROCK NUMBER: 15499
WEIGHT: 2024.0 g DIMENSIONS: 17 x 15 x 8 cm

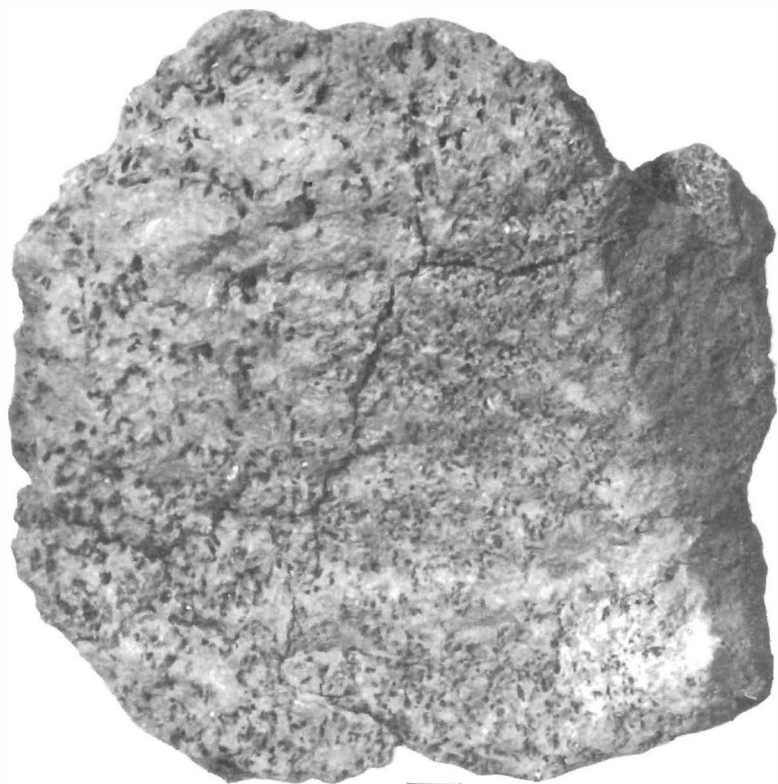
BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4)
SHAPE: Blocky, angular, subangular
FABRIC: Microporphyrritic, diktytaxitic texture.
COHERENCE: Intergranular: Tough
Fracturing: Few irregular, nonpenetrative
VARIABILITY: Homogeneous, E has more matrix material.
SURFACE: S irregular, vesicular, homogeneous, granulated; N deep, irregular, penetrative fracture.
ZAP PITS: Many on S (0.2 mm, 40-50/cm²); few on W; none on N, E.
CAVITIES: Vesicles 30% (variable) subrounded, ovoid, empty.
SPECIAL FEATURES: On a microscopic scale some areas of N are exclusively dark brown pyroxene and minor olivine. Another area is fine-grained, dark gray, homogeneous, with 10% cavities irregularly distributed. Microphenocrysts (0.4 mm) of plagioclase(?), greenish pyroxene. Medium brown-gray, equigranular, submicroscopic. Sharpish contact with coarse, diktytaxitic basalt.

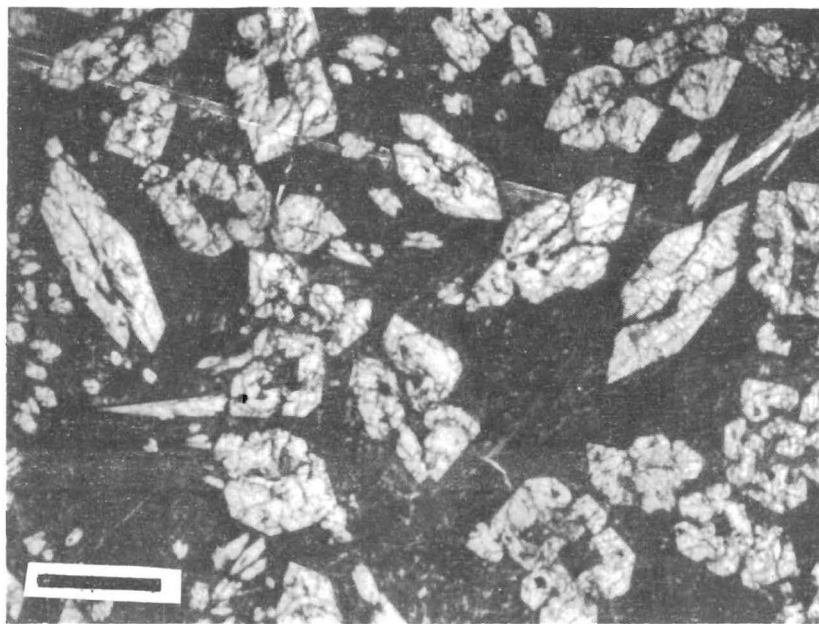
Zoned pyroxene: Yellow cores and dark brown rims, some very thin.

BY: Ridley, Jakes

15499



1cm



1 mm

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	47.81
TiO ₂	=	1.78
Al ₂ O ₃	=	9.71
FeO	=	20.19
MnO	=	0.28
MgO	=	9.33
CaO	=	10.34
Na ₂ O	=	0.32
K ₂ O	=	0.05
P ₂ O ₅	=	0.08
S	=	0.07
Cr ₂ O ₃	=	0.57
TOTAL		<u>99.93</u>

CIPW NORM

Qtz	=	0.29
Or	=	0.30
Ab	=	2.71
An	=	23.27
Di	=	23.10
Hy	=	45.80
Ne	=	-
Ol	=	-
Chr	=	0.84
Ilm	=	3.38
Apa	=	0.17
TOTAL		<u>99.86</u>

100 Mg/(Mg+Fe) = 45.2
An/Ab/Or = 89/10/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	0.995	(ID)
K	=	232	(XRF)
Ba	=	69	(XRF)
Sr	=	108.4	(ID)
Cr	=	-	
V	=	189	(XRF)
Sc	=	-	
Ni	=	19	(XRF)
Co	=	44	(XRF)
Cu	=	3	(XRF)
Zn	=	2	(XRF)
Th	=	0.59	(GAM)
U	=	0.16	(GAM)
Zr	=	109	(XRF)
Hf	=	-	
Nb	=	5.4	(XRF)

RARE EARTH ELEMENTS

La	=	
Ce	=	
Pr	=	
Nd	=	
Sm	=	
Eu	=	
Gd	=	
Tb	=	
Dy	=	
Ho	=	
Er	=	
Tm	=	
Yb	=	
Lu	=	
Y	=	31.1 (XRF)

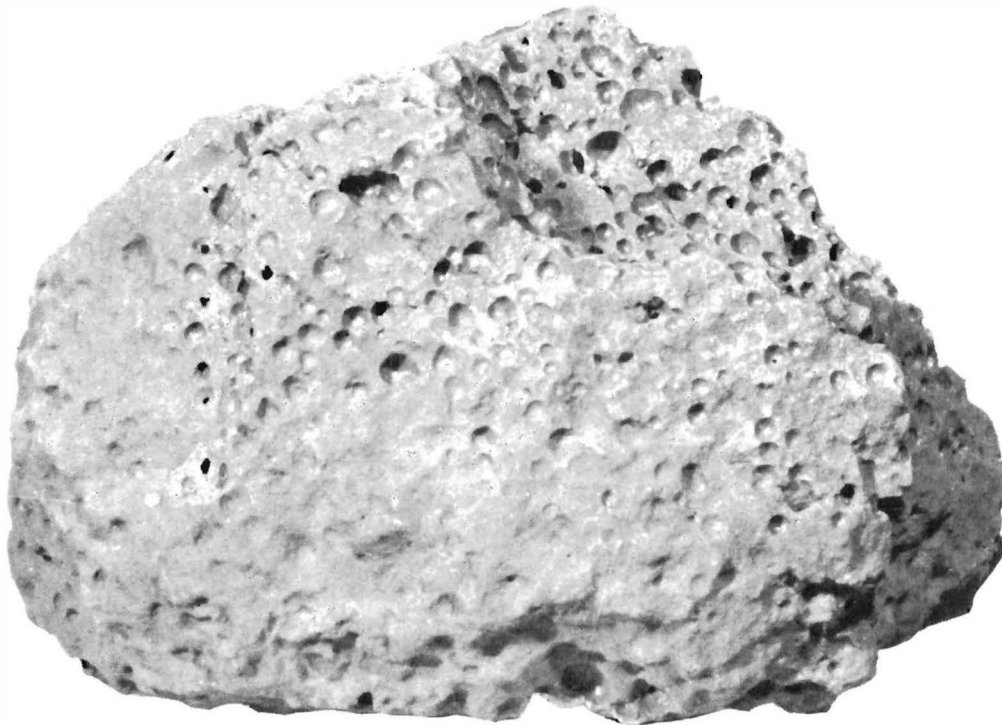
ROCK NUMBER: 15529
WEIGHT: 1531.0 g DIMENSIONS: 14 x 10 x 10 cm

BINOCULAR DESCRIPTION

COLOR: Light olive gray (5Y 5/2)
SHAPE: Rounded, in part subangular
FABRIC: Equigranular
COHERENCE: Intergranular: Coherent to tough
 Fracturing: A few parallel fractures, nonpenetrative, although soil and weathering partly obscures (see special features)
VARIABILITY: Grain size appears to approach aphanitic in places.
SURFACE: Very irregular due to vesicles, smoother where soil adheres and is weathered. Intervesicular areas range from smooth to hackly depending on abundance of vesicles and coincidence of walls. Vesicles are glass lined with some crystals parallel to linings of vesicles.
ZAP PITS: None
CAVITIES: Vesicles are 30% of rock, average 4 mm and reach 7 mm. Some vugs are present.
SPECIAL FEATURES: Vesicles are generally glass-lined and show no apparent preferred orientation. Vesicles on bottom and sides of rock are generally filled with soil. T appears most soil free. There appears to be a series of parallel fractures which cut through vesicles and range from 1-4 cm apart. These are best shown on W face. Vesicles have minute laths (pyroxene?). Vug has plagioclase plates protruding into it. Glass-lined cavities and intervesicle areas appear to be worn smooth, rather than just soil filled. White plagioclase 0.2 x 1 mm laths have no preferred orientation. Plagioclase content is very variable over whole rock.

BY: Head

15529



1cm

NOT ALLOCATED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL _____

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL _____

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 15535
WEIGHT: 404.5 g

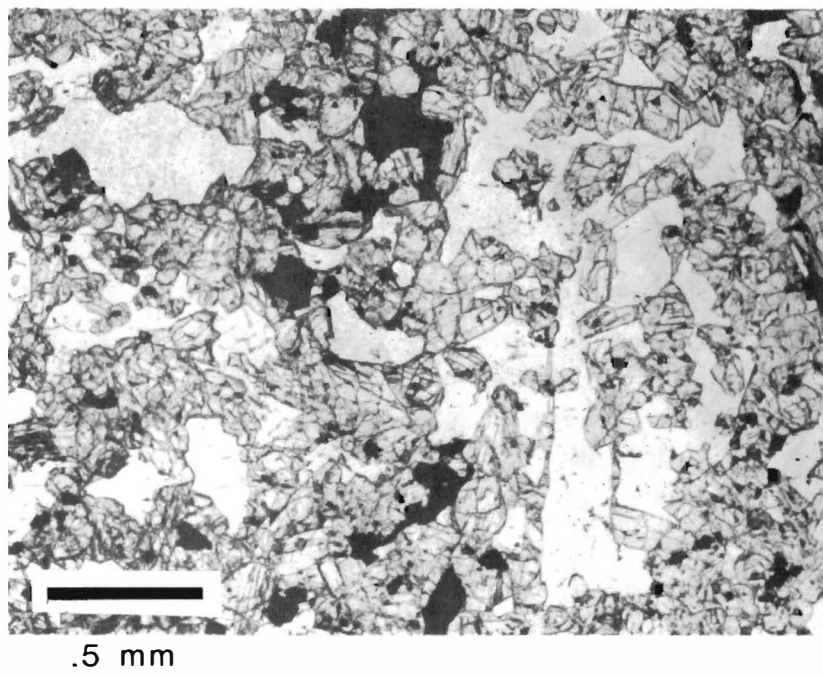
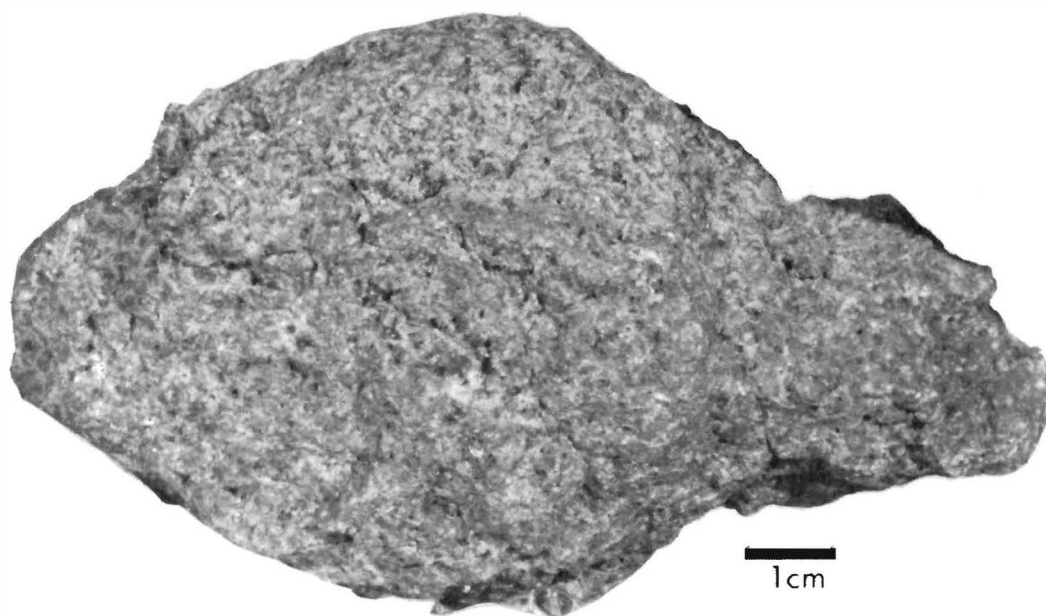
DIMENSIONS: 12.5 x 7 x 3.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4) to brownish gray (5YR 4/1) to olive gray (5Y 4/1)
SHAPE: Slabby, subangular to angular
FABRIC: Porphyritic, granular
COHERENCE: Intergranular: Tough
Fracturing: Several penetrative subparallel to principal surfaces
VARIABILITY: None
SURFACE: Irregular, somewhat hackly, T is mostly fresh surfaces where chipped from boulder
ZAP PITS: Few on N, S (more than on N), T (upper edge only), B, E, W.
CAVITIES: 3-5% vugs, crystals project into cavities.
SPECIAL FEATURES:
Mafic silicate: Greenish yellow equant crystals, probably olivine phenocrysts.
Mafic silicate: Pale brown to cinnamon brown, darkest around vugs, euhedral in vugs, probably pyroxene.
Opagues: Occur as inclusions in all other phases.
Plagioclase: Granular crystals range 0.1-0.5 mm in size; large platy ones reach 0.5 x 4 mm.

BY: Silver, Phinney

15535



CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	44.90
TiO ₂	=	2.51
Al ₂ O ₃	=	9.31
FeO	=	22.55
MnO	=	0.30
MgO	=	10.65
CaO	=	9.14
Na ₂ O	=	0.22
K ₂ O	=	0.04
P ₂ O ₅	=	0.06
S	=	-
Cr ₂ O ₃	=	0.58
<hr/>		
TOTAL		100.26

CIPW NORM

Qtz	=	-
Or	=	0.24
Ab	=	1.86
An	=	24.30
Di	=	17.32
Hy	=	38.20
Ne	=	-
Ol	=	12.60
Chr	=	0.85
Ilm	=	4.77
Apa	=	0.13
<hr/>		
TOTAL		100.26

100 Mg/(Mg+Fe) = 45.7
An/Ab/Or = 92/7/1

TRACE AND MINOR ELEMENTS

Li	=	7.1	(NAA)
Rb	=	5.0	(OES)
K	=	365	(NAA)
Ba	=	45	(NAA)
Sr	=	83.0	(OES)
Cr	=	-	
V	=	140	(OES)
Sc	=	-	
Ni	=	69.9	(OES)
Co	=	52	(OES)
Cu	=	8.0	(OES)
Zn	=	10	(OES)
Th	=	0.45	(GAM)
U	=	0.104	(GAM)
Zr	=	85.0	(OES)
Hf	=	-	
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	3.49	
Ce	=	9.7	
Pr	=	-	
Nd	=	6.7	
Sm	=	2.6	
Eu	=	0.69	
Gd	=	3.6	
Tb	=	0.59	
Dy	=	4.07	
Ho	=	0.73	
Er	=	-	
Tm	=	-	
Yb	=	1.69	
Lu	=	0.236	
Y	=	42	(OES)

ROCK NUMBER: 15536
WEIGHT: 317.2 g DIMENSIONS: 11 x 8 x 3.5 cm

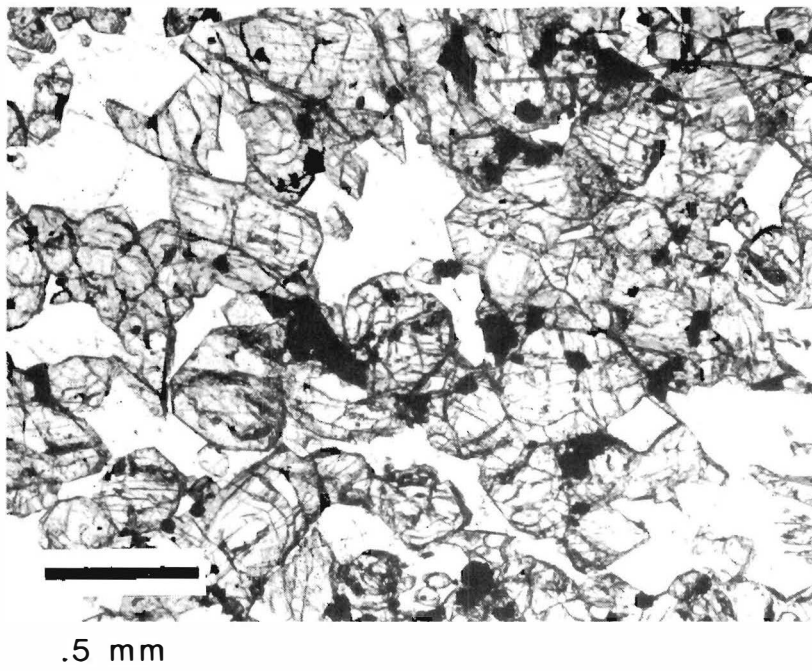
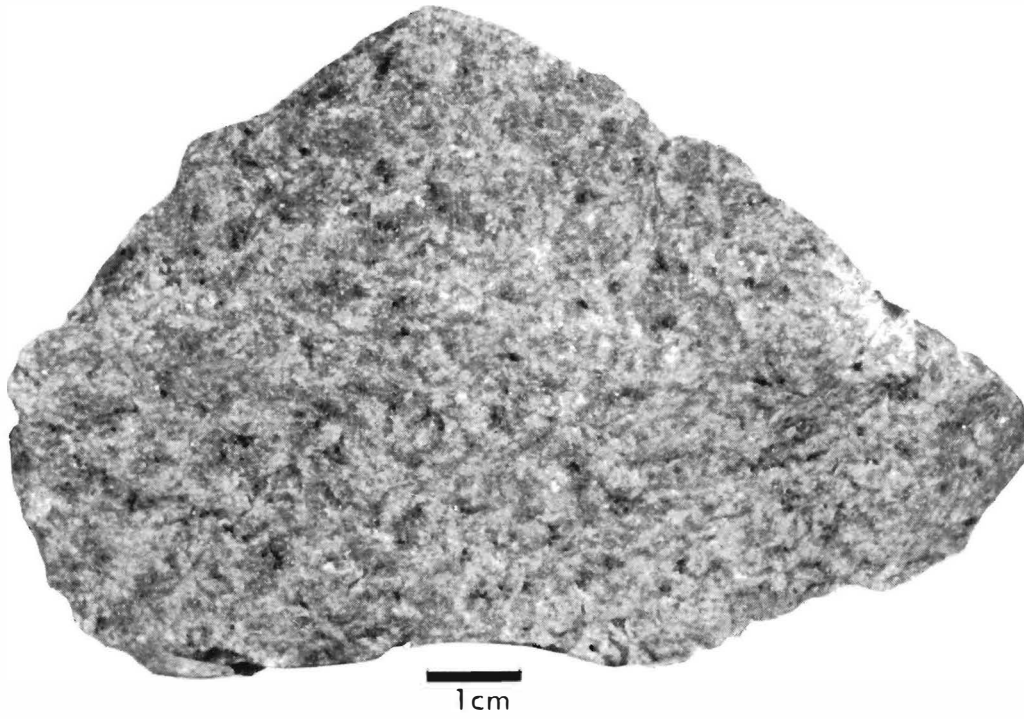
BINOCULAR DESCRIPTION

COLOR: Light olivine gray (5Y 5/2)
SHAPE: Blocky, angular to subangular
FABRIC: Equigranular
COHERENCE: Intergranular: Tough
Fracturing: Irregular, nonpenetrative, few. Penetrative on B.
VARIABILITY: Microscopic banding with pyroxene-rich and plagioclase-rich bands.
SURFACE: N, S granulated. Light patchy soil cover on S.
ZAP PITS: N none, S few
CAVITIES: Vugs are 5%, average 2 mm, and contain pyroxene crystals.
SPECIAL FEATURES: B face shows cataclastic texture and 3 mm accumulations of olivine. Mode varies inversely with mafic silicates from 20% to 60% in plagioclase-rich bands.

Pyroxene: Together with olivine and much less plagioclase, forms clusters and bands.

BY: Jakes, Ridley

15536



ALLOCATED, BUT NOTHING EVER PUBLISHED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL _____

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL _____

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 15545
WEIGHT: 746.6 g

DIMENSIONS: 13 x 6 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Light brownish gray (5YR 6/1)

SHAPE: Blocky

FABRIC: Intergranular

COHERENCE: Intergranular: Coherent

Fracturing: Few, nonpenetrative

VARIABILITY: None

SURFACE: Granulated. All faces are dust covered but B, which may be the lunar upper surface.

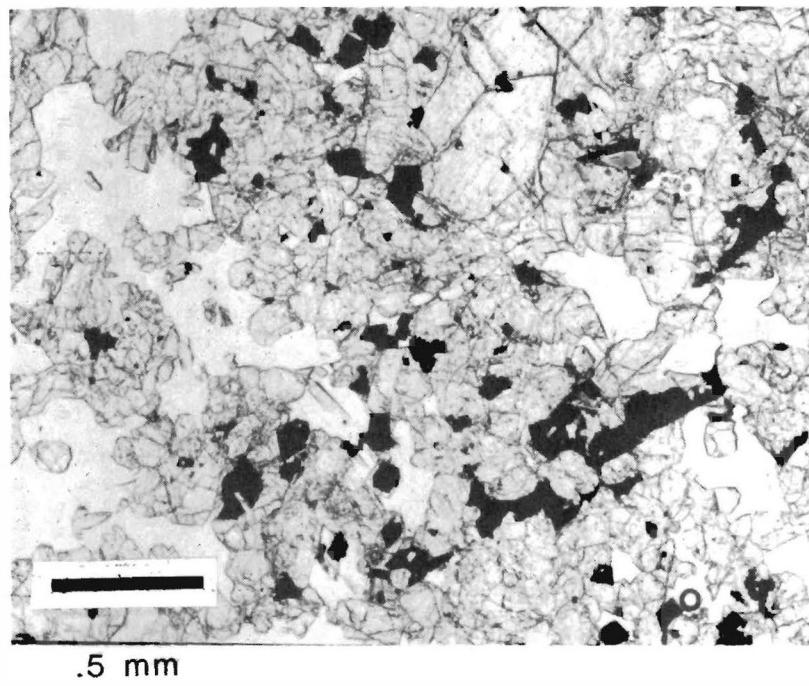
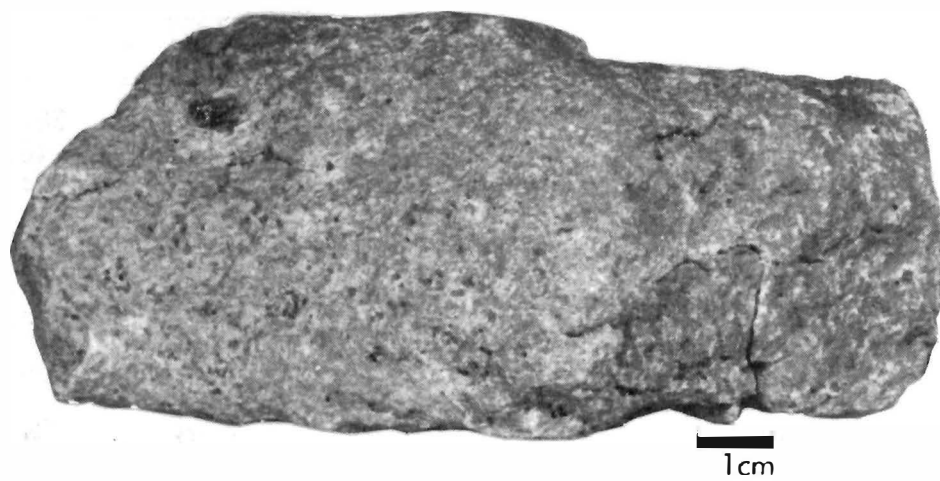
ZAP PITS: Few on all faces

CAVITIES: 2% vugs with all matrix phases projecting into them.

SPECIAL FEATURES: Nonporphyritic

BY: Warner

15545



CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	45.21
TiO ₂	=	2.41
Al ₂ O ₃	=	8.59
FeO	=	22.15
MnO	=	0.30
MgO	=	10.28
CaO	=	9.82
Na ₂ O	=	0.31
K ₂ O	=	0.04
P ₂ O ₅	=	0.08
S	=	0.06
Cr ₂ O ₃	=	0.68

TOTAL		99.93
-------	--	-------

CIPW NORM

Qtz	=	-
Or	=	0.24
Ab	=	2.62
An	=	21.93
Di	=	22.04
Hy	=	35.96
Ne	=	-
Ol	=	11.33
Chr	=	1.00
Ilm	=	4.58
Apa	=	0.17

TOTAL		99.87
-------	--	-------

100 Mg/(Mg+Fe) = 45.3
An/Ab/Or = 88/11/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	0.75	(ID)
K	=	387	(ID)
Ba	=	46.7	(ID)
Sr	=	104	(ID)
Cr	=	-	
V	=	168	(OES)
Sc	=	42.0	(OES)
Ni	=	68.9	(OES)
Co	=	21	(OES)
Cu	=	370	(OES)
Zn	=	23	(AAS)
Th	=	0.43	(GAM)
U	=	0.13	(GAM)
Zr	=	190	(NAA)
Hf	=	2.2	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	4.93	
Ce	=	13.9	
Pr	=	-	
Nd	=	9.82	
Sm	=	3.29	
Eu	=	0.895	
Gd	=	4.48	
Tb	=	-	
Dy	=	4.68	
Ho	=	-	
Er	=	2.67	
Tm	=	-	
Yb	=	2.16	
Lu	=	0.308	
Y	=	33	(OES)

ROCK NUMBER: 1555
WEIGHT: 9613.7 g DIMENSIONS: 30 x 15 x 15 cm

BINOCULAR DESCRIPTION

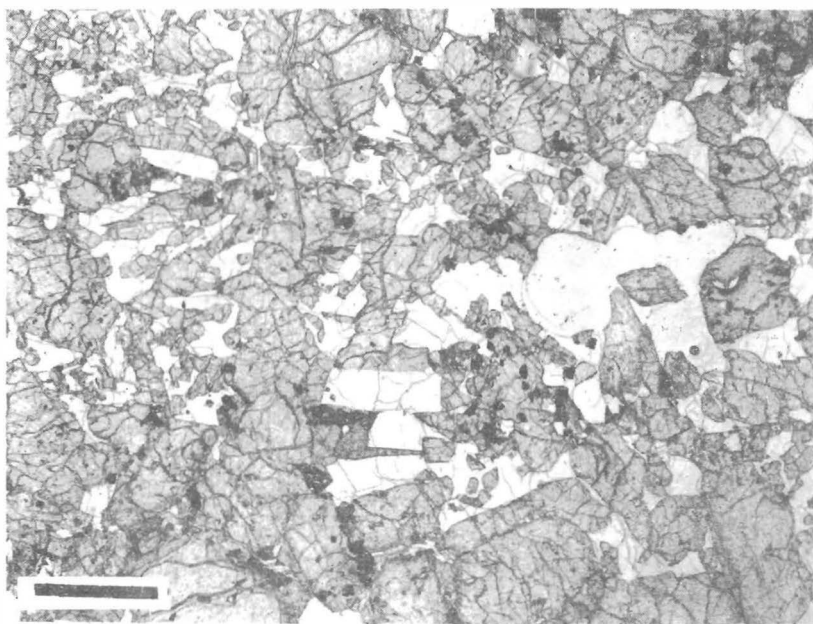
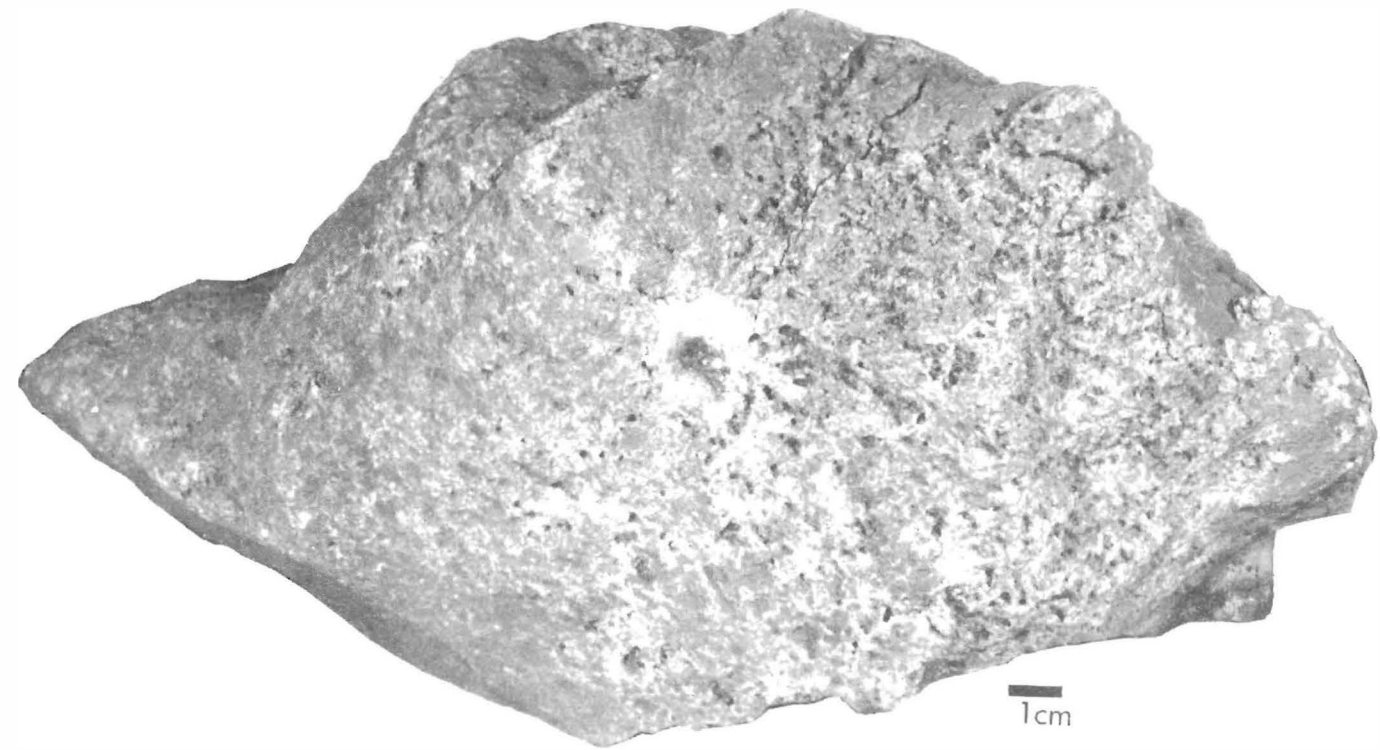
COLOR: Brownish-gray (5YR 4/1)
SHAPE: Blocky, subrounded
FABRIC: Equigranular; possibly subophitic
COHERENCE: Intergranular: Tough
 Fracturing: Set of fractures generally E-W dipping 45° N.
VARIABILITY: None
SURFACE: Unequally smooth surface
ZAP PITS: Few on B, many on all others
CAVITIES: Vugs are irregular up to 1 mm, contain euhedral crystals,
 and make up 10% of rock.
SPECIAL FEATURES: Face S has a large pit with central glass area
 of 8 mm diameter and 2.2 mm spall zone. Crystal surfaces in
 some areas have glassy films. B is less rounded than other faces
 and may have been shielded.

Olivine: Contains minute opaque inclusions.

Pyroxene: Prismatic in vugs.

BY: Morrison, Lofgren

15555



1 mm

CHEMISTRY

MAJOR ELEMENTS (7)

SiO ₂	=	44.57
TiO ₂	=	2.10
Al ₂ O ₃	=	8.69
FeC	=	22.53
MnO	=	0.29
MgO	=	11.36
CaO	=	9.40
Na ₂ O	=	0.27
K ₂ O	=	0.09
P ₂ O ₅	=	0.06
S	=	0.06
Cr ₂ O ₃	=	0.61

TOTAL 100.03

CIPW NORM

Qtz	=	-
Or	=	0.53
Ab	=	2.28
An	=	22.23
Di	=	20.10
Hy	=	31.60
Ne	=	-
Ol	=	18.21
Chr	=	0.90
Ilm	=	3.99
Apa	=	0.13

TOTAL 99.97

100 Mg/(Mg+Fe) = 47.3
 An/Ab/Or = 89/9/2

TRACE AND MINOR ELEMENTS

Li	=	6.36	(ID)
Rb	=	0.445	(ID)
K	=	232	(ID)
Ba	=	32.2	(ID)
Sr	=	84.4	(ID)
Cr	=	-	
V	=	-	
Sc	=	-	
Ni	=	41.9	(XRF)
Co	=	-	
Cu	=	-	
Zn	=	10	(OES)
Th	=	0.4596	(MS)
U	=	0.1264	(MS)
Zr	=	76	(XRF)
Hf	=	-	
Nb	=	4.3	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	8.06	
Pr	=	-	
Nd	=	6.26	
Sm	=	2.09	
Eu	=	0.688	
Gd	=	2.9	
Tb	=	-	
Dy	=	3.27	
Ho	=	-	
Er	=	1.7	
Tm	=	-	
Yb	=	1.45	
Lu	=	-	
Y	=	23	(XRF)

ROCK NUMBER: 15556
WEIGHT: 1542.3 g DIMENSIONS: 13 x 10 x 11 cm

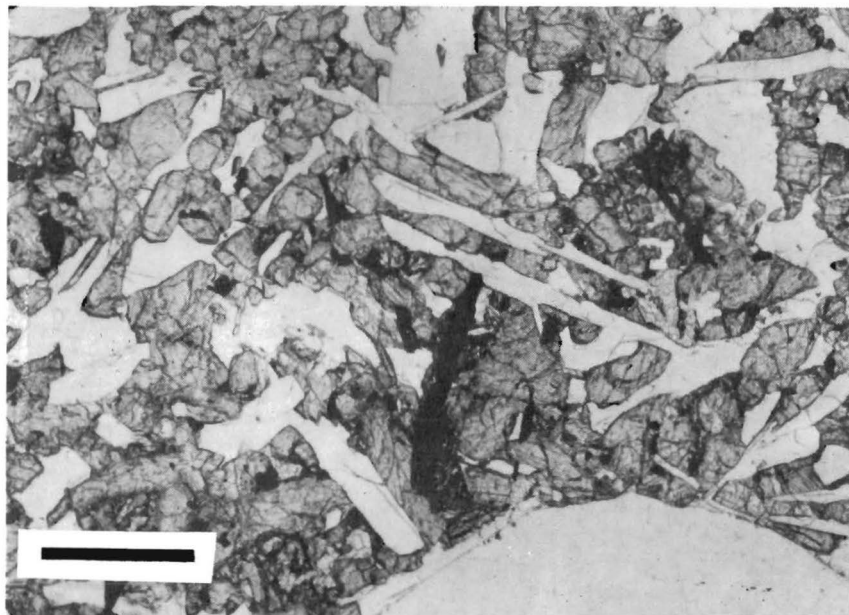
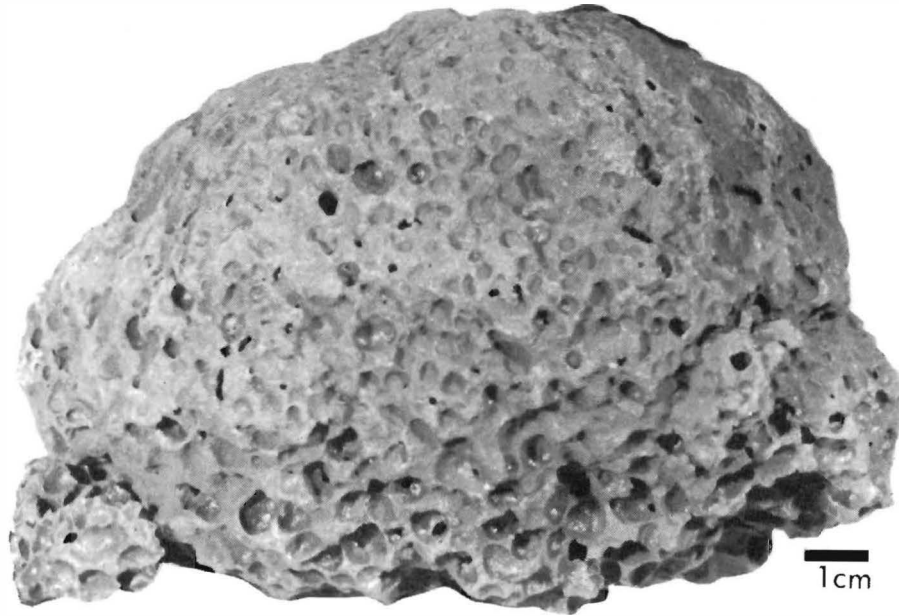
BINOCULAR DESCRIPTION

COLOR: Medium gray (N5)
SHAPE: Subrounded
FABRIC: Inequigranular, isotropic
COHERENCE: Intergranular: Tough
Fracturing: Few fractures
VARIABILITY: There are continuous changes from T to B manifested by an increase in vesicle size and abundance, concurrent with a decrease in grain size. On T, vesicles are 50% of the rock volume and range <1 mm to 3 mm. On B the vesicles reach 80% and range 2-10 mm in size. The coarsest grains are on T, approaching 1 mm, and decrease by a factor of two on B.
SURFACE:
ZAP PITS: Few on all faces, T has more than others.
CAVITIES: Vesicles (see Variability) appear to be glass lined with some crystals showing through. A vug is totally lined with crystals like a miarolitic cavity.
SPECIAL FEATURES: The rapid changes in vesicularity and grain size across the rock indicates if formed at or near the top of a lava flow, with the B face closest to the surface. A 1 cm xenolith (face W) has about the same mineralogic composition as the rest of the rock, with perhaps slightly more plagioclase, but is distinguished by coarser grain size than elsewhere, some crystals reaching 2 mm.

Olivine: phenocrysts.
Pyroxene: Color variable from light brown to medium cinnamon brown and may indicate more than one type of pyroxene.

BY: Lofgren

15556



.5 mm

CHEMISTRY

MAJOR ELEMENTS (4)

SiO ₂	=	45.73
TiO ₂	=	2.68
Al ₂ O ₃	=	9.62
FeO	=	21.92
MnO	=	0.29
MgO	=	7.95
CaO	=	10.77
Na ₂ O	=	0.27
K ₂ O	=	0.05
P ₂ O ₅	=	0.08
S	=	0.08
Cr ₂ O ₃	=	0.70
TOTAL		<u>100.14</u>

CIPW NORM

Qtz	=	-
Or	=	0.30
Ab	=	2.28
An	=	24.89
Di	=	23.69
Hy	=	39.71
Ne	=	-
Ol	=	2.89
Chr	=	1.03
Ilm	=	5.09
Apa	=	0.17
TOTAL		<u>100.06</u>

100 Mg/(Mg+Fe) = 39.3
An/Ab/Or = 91/8/1

TRACE AND MINOR ELEMENTS

Li	=	9.0	(OES)
Rb	=	0.84	(NAA)
K	=	249	(XRF)
Ba	=	59	(NAA)
Sr	=	88.0	(NAA)
Cr	=	-	
V	=	266	(NAA)
Sc	=	43.1	(NAA)
Ni	=	64.9	(OES)
Co	=	50.3	(NAA)
Cu	=	10	(OES)
Zn	=	5	(XRF)
Th	=	0.560	(GAM)
U	=	0.15	(GAM)
Zr	=	91	(XRF)
Hf	=	3.1	(NAA)
Nb	=	7	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	4.8	
Ce	=	18	
Pr	=	-	
Nd	=	-	
Sm	=	4	
Eu	=	1	
Gd	=	-	
Tb	=	0.77	
Dy	=	4.4	
Ho	=	0.91	
Er	=	3.3	
Tm	=	-	
Yb	=	1.59	
Lu	=	0.39	
Y	=	50	(OES)

ROCK NUMBER: 15557
WEIGHT: 2518.0 g DIMENSIONS: 18.1 x 10.5 x 7.2 cm

BINOCULAR DESCRIPTION

COLOR: Light gray to medium light gray (N7, N6), corners and
edges very light gray (N8)
SHAPE: Blocky, subangular
FABRIC: Microporphyritic, intergranular groundmass
COHERENCE: Intergranular: Tough
Fracturing: Nonpenetrative
VARIABILITY: Cavities irregularly distributed in generally uniform
rock.
SURFACE: All are smooth to finely irregular
ZAP PITS: None on B; few on N (dusty); S (dusty); E and W.
CAVITIES: One irregular to angular vug. No lining.
SPECIAL FEATURES: Weak alignment of plagioclase laths parallel to
concave surface of rock.

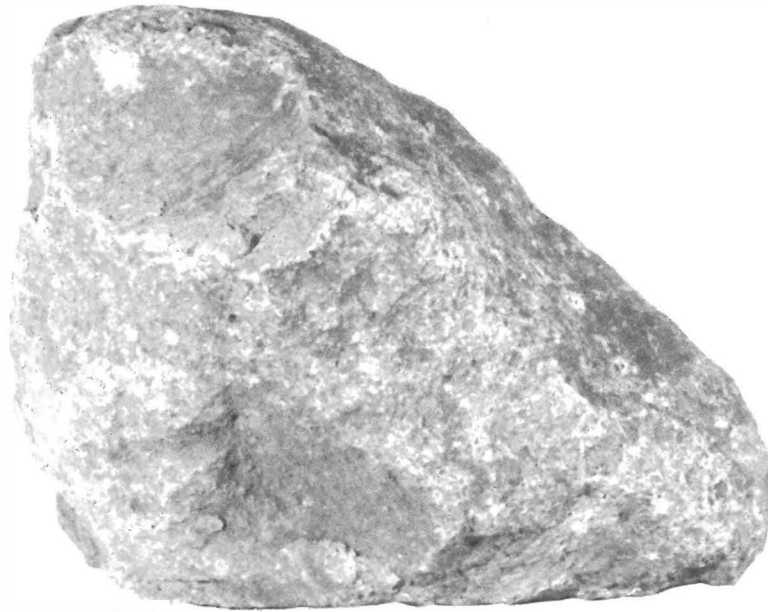
Olivine: Isolated crystals

Pyroxene: Color varies from light to dark.

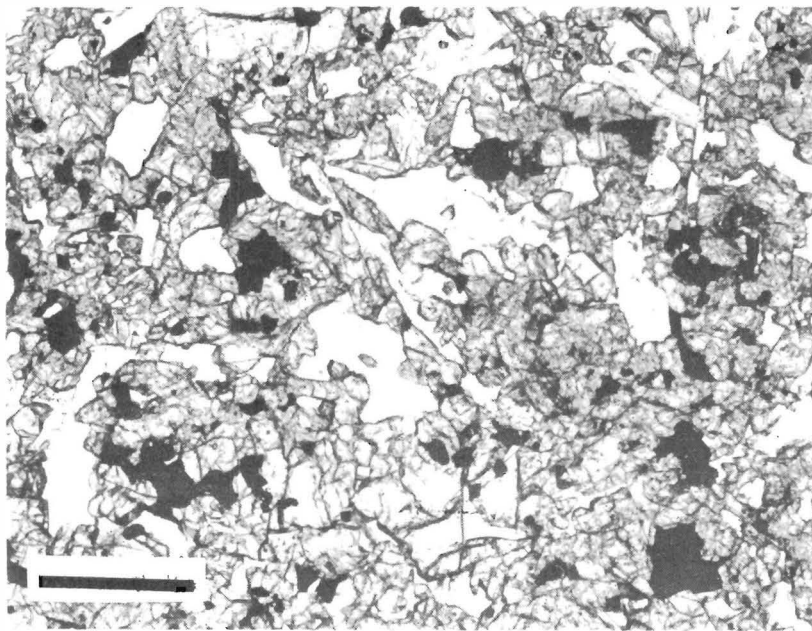
Plagioclase: Small percentage of microphenocrysts about 1 mm.

BY: Wilshire, Silver

15557



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	45.09
TiO ₂	=	2.50
Al ₂ O ₃	=	9.33
FeO	=	22.51
MnO	=	0.28
MgO	=	9.44
CaO	=	10.11
Na ₂ O	=	0.29
K ₂ O	=	0.05
P ₂ O ₅	=	0.07
S	=	0.08
Cr ₂ O ₃	=	0.57
<hr/>		
TOTAL		100.32

CIPW NORM

Qtz	=	-
Or	=	0.30
Ab	=	2.45
An	=	24.01
Di	=	21.63
Hy	=	35.20
Ne	=	-
Ol	=	10.92
Chr	=	0.84
Ilm	=	4.75
Apa	=	0.15
<hr/>		
TOTAL		100.24

100 Mg/(Mg+Fe) = 42.8
An/Ab/Or = 90/9/1

TRACE AND MINOR ELEMENTS

Li	=	5.6	(NAA)
Rb	=	2.0	(XRF)
K	=	415	(XRF)
Ba	=	55	(XRF)
Sr	=	96.4	(XRF)
Cr	=	4700	(NAA)
V	=	185	(OES)
Sc	=	43.5	(NAA)
Ni	=	55.5	(AA)
Co	=	50	(NAA)
Cu	=	14	(OES)
Zn	=	4	(NAA)
Th	=	0.45	(GAM)
U	=	0.14	(GAM)
Zr	=	88.4	(XRF)
Hf	=	2.3	(NAA)
Nb	=	6.1	(XRF)

RARE EARTH ELEMENTS (NAA)

La	=	5.77	
Ce	=	16.1	
Pr	=	-	
Nd	=	12.1	
Sm	=	4.36	
Eu	=	1.1	
Gd	=	5.8	
Tb	=	0.98	
Dy	=	6.43	
Ho	=	1.3	
Er	=	3.6	
Tm	=	-	
Yb	=	2.64	
Lu	=	0.39	
Y	=	24.2	(XRF)

ROCK NUMBER: 15595
WEIGHT: 237.6 g DIMENSIONS: 10 x 5 x 4.5 cm

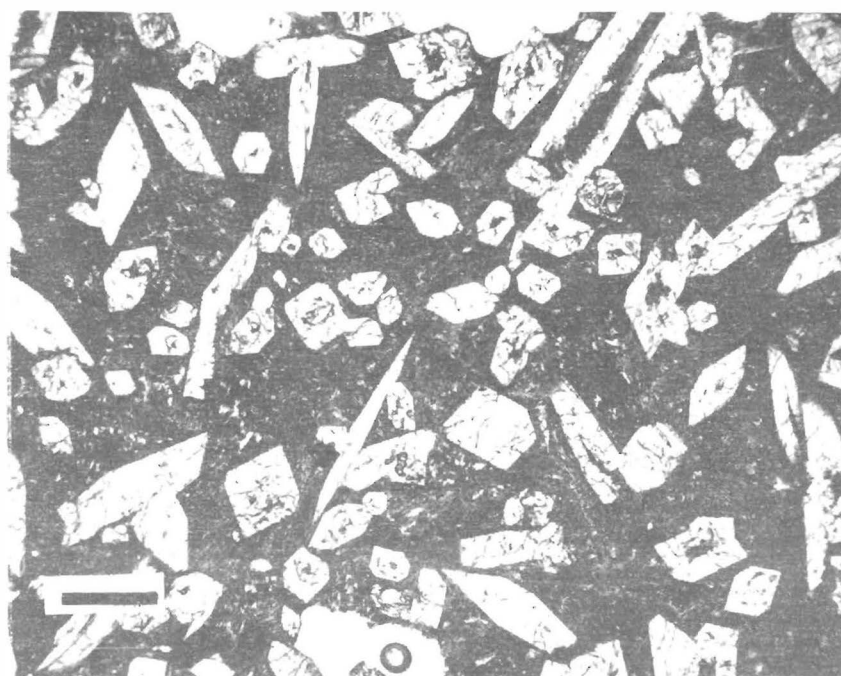
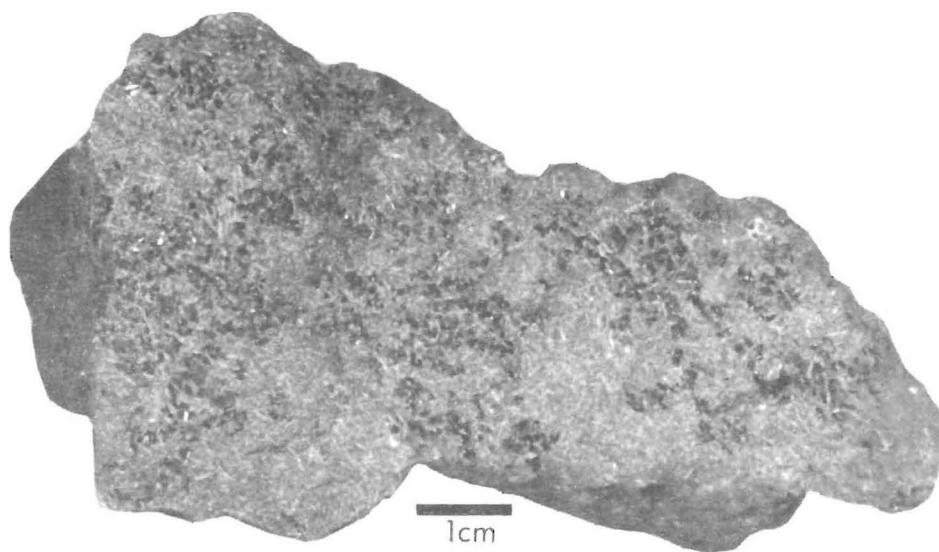
BINOCULAR DESCRIPTION

COLOR: Between olive gray (5Y 4/1) and olive black (5Y 2/1)
SHAPE: Angular
FABRIC: Porphyritic, inequigranular
COHERENCE: Intergranular: Tough
Fracturing: None penetrative, part of E face, may be on old fracture.
VARIABILITY: Vugs are irregularly distributed in clusters
SURFACE: N hackly, others irregular to smoothed
ZAP PITS: May on T, B, S and top area of W; none on E, N.
CAVITIES: Vuggy over 30% of fresh surface, brown pyroxene prisms
projecting into and through vugs.
SPECIAL FEATURES: Gray black stain on face E is deserving of special
study. Top from lunar surface photos shown on B view.

Pyroxene: Occur as phenocrysts. Matrix contains prisms. The
linear elements oblique to prisms are probably pyroxene. Some
plagioclase interleaved with pyroxene.

BY: Phinney

15595



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	48.07
TiO ₂	=	1.77
Al ₂ O ₃	=	9.06
FeO	=	20.23
MnO	=	0.30
MgO	=	9.21
CaO	=	10.52
Na ₂ O	=	0.35
K ₂ O	=	0.05
P ₂ O ₅	=	0.07
S	=	0.05
Cr ₂ O ₃	=	0.52
<hr/>		
TOTAL		100.20

CIPW NORM

Qtz	=	0.33
Or	=	0.30
Ab	=	2.96
An	=	23.00
Di	=	24.14
Hy	=	45.15
Ne	=	-
Ol	=	-
Chr	=	0.77
Ilm	=	3.36
Apa	=	0.15
<hr/>		
TOTAL		100.15

100 Mg/(Mg+Fe) = 44.8
An/Ab/Or = 88/11/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	0.90	(ID)
K	=	-	
Ba	=	-	
Sr	=	99.4	(ID)
Cr	=	-	
V	=	-	
Sc	=	45.0	(NAA)
Ni	=	-	
Co	=	42	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	2	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	5.4
Ce	=	-
Pr	=	-
Nd	=	-
Sm	=	3.9
Eu	=	0.81
Gd	=	-
Tb	=	0.7
Dy	=	-
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	2.3
Lu	=	0.4
Y	=	-

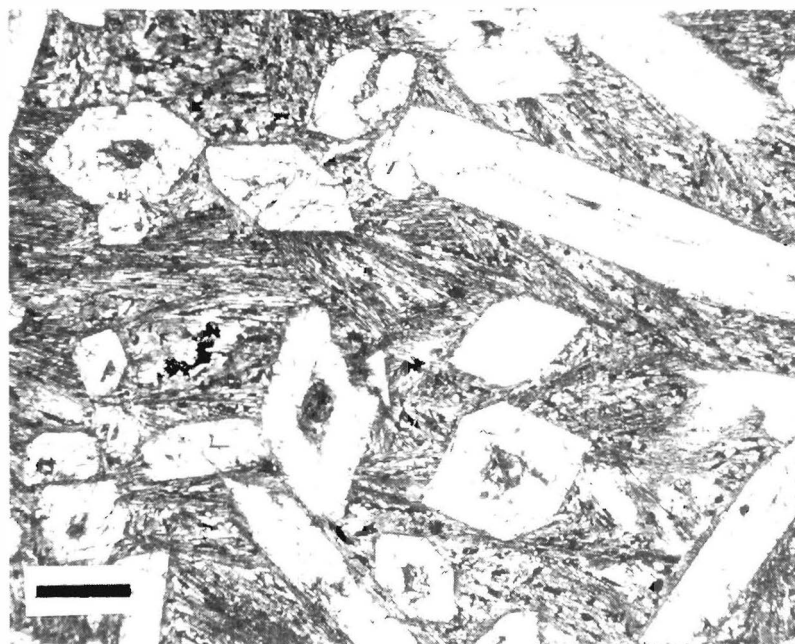
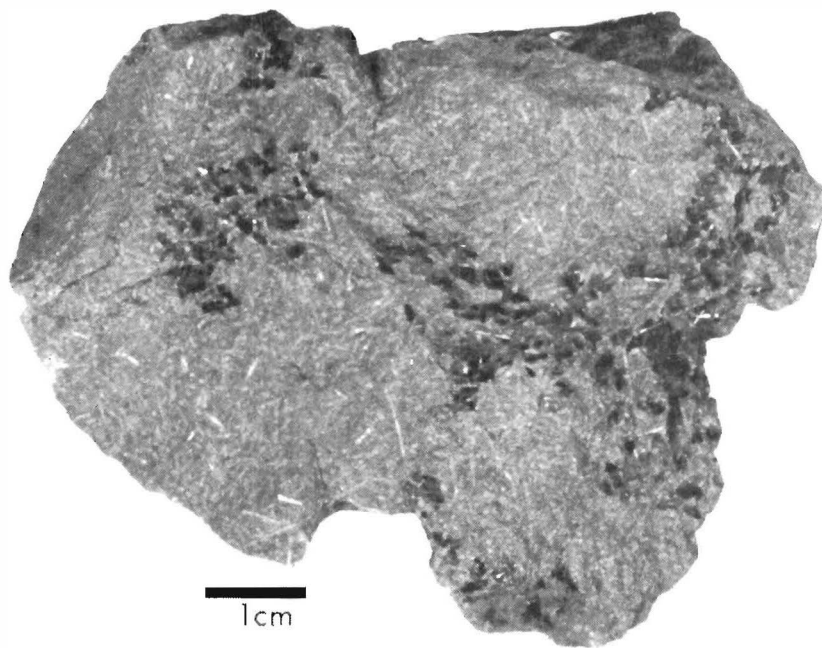
ROCK NUMBER: 15596
WEIGHT: 224.8 g DIMENSIONS: 8.5 x 7 x 4 cm

BINOCULAR DESCRIPTION

COLOR: Medium olive gray (5Y 5/2 to 5Y 3/2)
SHAPE: Blocky, angular
FABRIC: Porphyritic
COHERENCE: Intergranular: Tough
 Fracturing: Nonpenetrative, irregular, few
VARIABILITY: Irregular distribution of vugs
SURFACE: S granulated and rough; N irregular, granular, rough
ZAP PITS: Many on N; none on S.
CAVITIES: 15% vugs
SPECIAL FEATURES: The prismatic euhedral pyroxenes have two zones,
dark-brown rims and yellow green cores, and some have a thin core
of dark brown color as a third zone.

BY: Reid, Jakes

15596



.5 mm

NOT ALLOCATED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 15597
 WEIGHT: 145.7 g DIMENSIONS: 8 x 5 x 2.5 cm

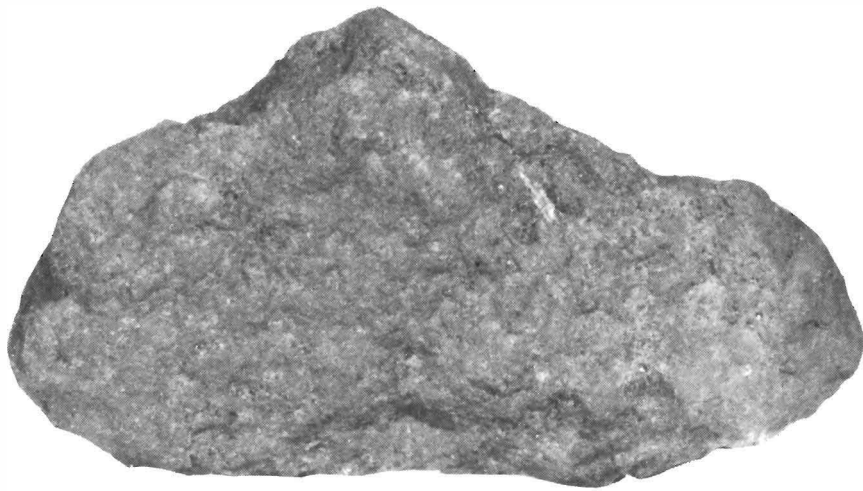
BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4)
 SHAPE: Slabby, two flat faces, subangular
 FABRIC: Lineate lamination of phenocrysts. Diabasic
 COHERENCE: Intergranular: Tough
 Fracturing: Few nonpenetrative fractures especially on E end.
 VARIABILITY: Homogeneous
 SURFACE: On S planar lamination of phenocrysts (2 grains) goes from top left to bottom right. On N, planar lamination of phenocrysts top left to bottom right, one grain plunges E. On T, broken dusty surface. Planar lamination strike E. One grain has steep plunge to E (50-60°). Some cross sections of phenocrysts on this face. E, vugs concentrated on this face. Lamination of phenocrysts continued. This face shows two directions of elongation of phenocrysts. B, phenocrysts five cross sections on this face.
 ZAP PITS: Few on S (more than others), N, E, B, T (W end only)
 CAVITIES: Small (1 mm) vugs, 1%.
 SPECIAL FEATURES: Definite lineate lamination of pyroxene phenocrysts. Rock should be cut with that in mind. Plane of lamination shown on N and S photos. May have two generations of pyroxene, or may be seriate. Different from Apollo 15 basalts we have seen in texture, structure, and abundance of pyroxene.

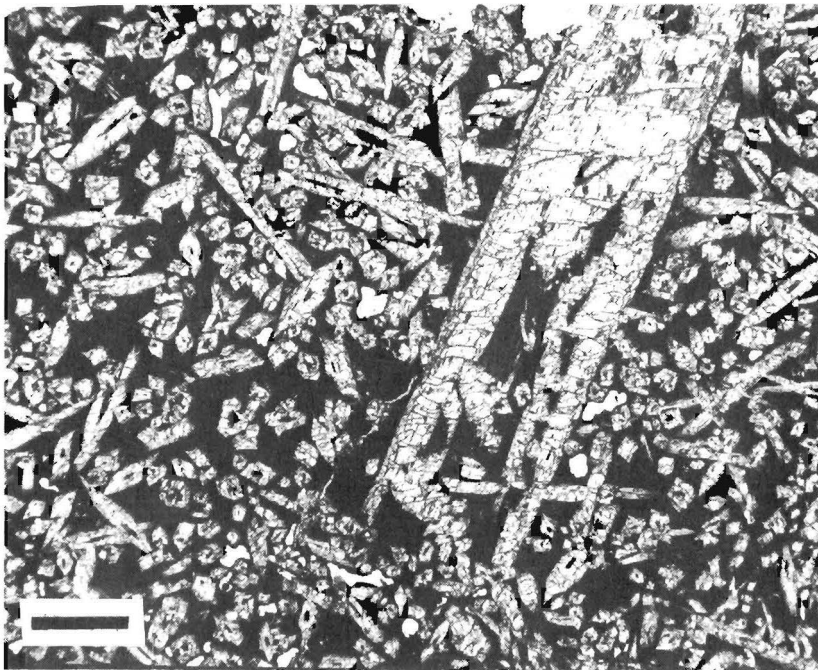
Phenocrysts: Yellow green oriented in rock. Contains some glass, random to roseate.
 Pyroxene: Some is prismatic in vugs, a late mineral, brownish red.

BY: Reid, Jackson

15597



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	47.98
TiO ₂	=	1.80
Al ₂ O ₃	=	9.44
FeO	=	20.23
MnO	=	0.30
MgO	=	8.74
CaO	=	10.43
Na ₂ O	=	0.32
K ₂ O	=	0.06
P ₂ O ₅	=	0.07
S	=	0.06
Cr ₂ O ₃	=	0.48
<hr/>		
TOTAL		99.91

CIPW NORM

Qtz	=	0.93
Or	=	0.35
Ab	=	2.71
An	=	24.15
Di	=	22.84
Hy	=	44.59
Ne	=	-
Ol	=	-
Chr	=	0.71
Ilm	=	3.42
Apa	=	0.15
<hr/>		
TOTAL		99.85

100 Mg/(Mg+Fe) = 43.5
 An/Ab/Or = 89/10/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	1.13	(ID)
K	=	465	(ID)
Ba	=	52	(NAA)
Sr	=	111	(ID)
Cr	=	-	
V	=	-	
Sc	=	-	
Ni	=	30.0	(NAA)
Co	=	39.6	(NAA)
Cu	=	-	
Zn	=	1.2	(NAA)
Th	=	0.53	(GAM)
U	=	0.14	(GAM)
Zr	=	-	
Hf	=	-	
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	4.86
Ce	=	13
Pr	=	-
Nd	=	9.3
Sm	=	3.09
Eu	=	0.84
Gd	=	4.4
Tb	=	0.69
Dy	=	4.51
Ho	=	0.86
Er	=	1.9
Tm	=	-
Yb	=	2.13
Lu	=	0.301
Y	=	-

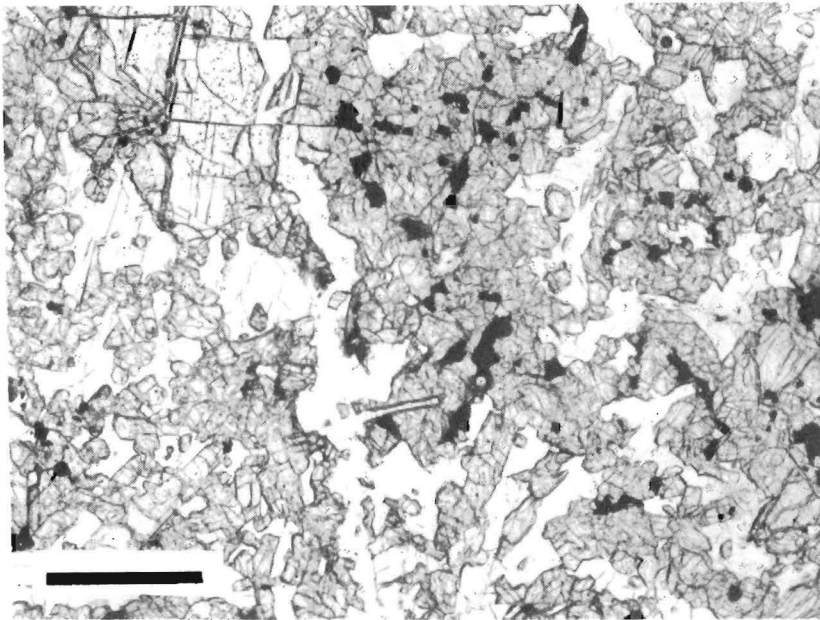
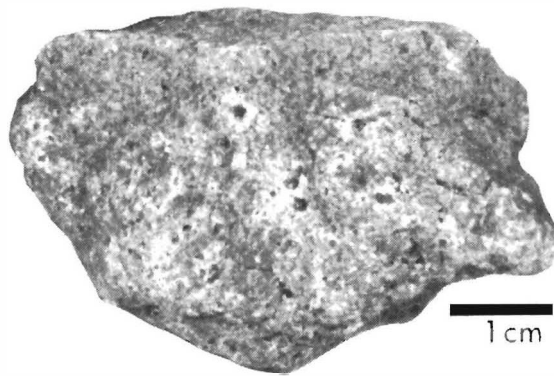
ROCK NUMBER: 15598
WEIGHT: 135.7 g DIMENSIONS: 6 x 5.5 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Light brownish gray (5YR 6/1)
SHAPE: Blocky, subrounded
FABRIC: Inequigranular, nearly microporphyritic
COHERENCE: Intergranular: Tough
 Fracturing: None penetrative
VARIABILITY: May be minor variations in mode and texture.
SURFACE: S hackly, others irregular
ZAP PITS: Many on N, E, W, B; few on S; T is pitted but also has
 fresh areas; note number of small fresh surfaces.
CAVITIES: 1% vugs, 1 mm; crystals project into but not through
 cavities.
SPECIAL FEATURES:
 Pyroxene: No indication of zoning
 Olivine: Microphenocrysts
 Ilmenite(?): As minute inclusions in olivine, rare plates, and
 small black anhedral crystals.

BY: Morrison

15598



.5 mm

NOT ALLOCATED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

APOLLO 16

ROCK NUMBER: 62295
WEIGHT: 251 g

DIMENSIONS: 8.5 x 6.5 x 4 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray (N5) to dark greenish gray (5GY/4/1)

SHAPE: Angular, blocky

FABRIC: Isotropic

COHERENCE: Intergranular: Tough

Fracturing: Few nonpenetrative, one eroded out on zapped surface

VARIABILITY: Plagioclase to mafic ratio varies from place to place.

Clots of fine sugary-textured material.

SURFACE: T is hackly; E is subangular; B, E, N, and S are subrounded

ZAP PITS: Very many on B; many on N, E, S; few on W; none on T.

Most pits are lined with botryoidal glass.

CAVITIES: Two percent irregular miarolitic cavities, 0.5-2 mm, with dominant size 3/4 mm. Spectacular crystal projections into cavities, mostly plagioclase, and a small amount of brown mafic silicate.

SPECIAL FEATURES: Clots of sugary material, 1-2 mm, with grain size 0.1 mm and the color of the bulk of the rock.

Feldspar: Sizes are not seriate; a few large grains but most are small. Local development of 12 mm plagioclase laths.

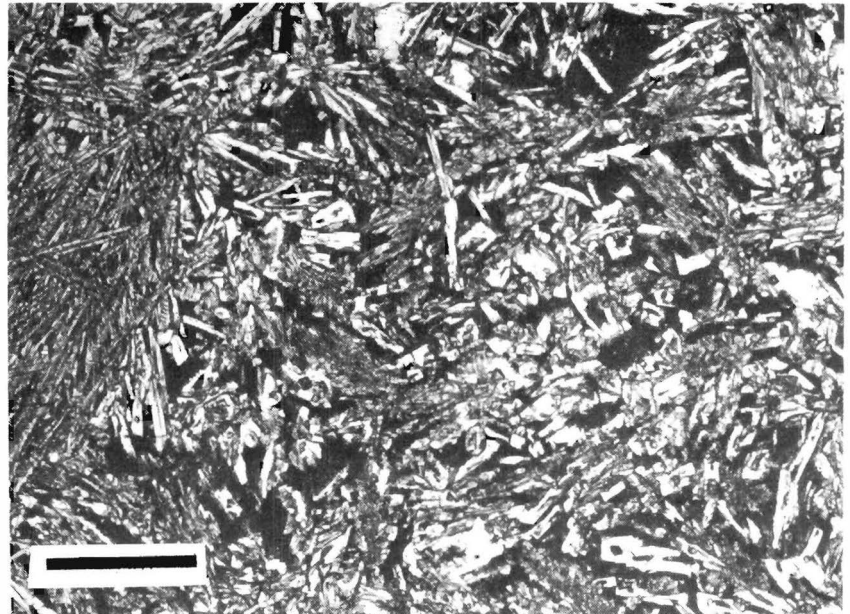
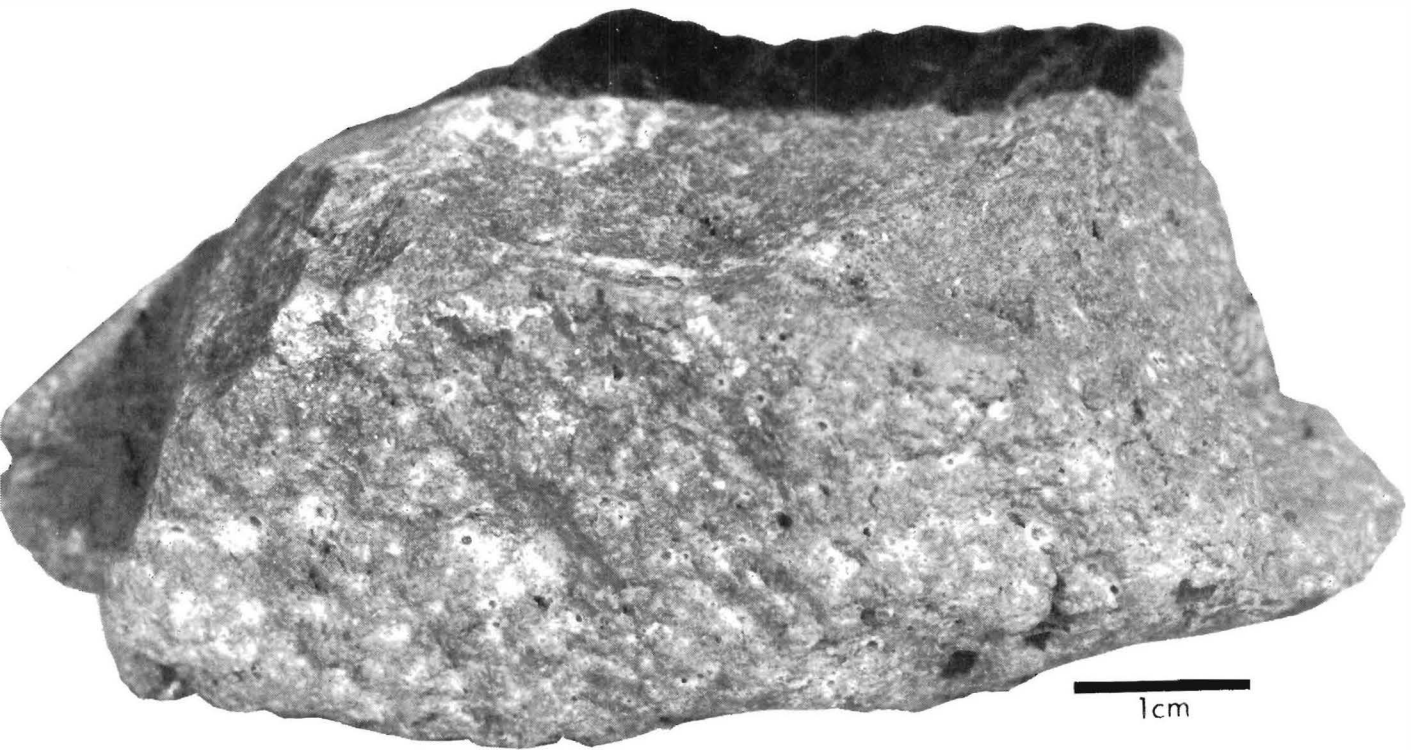
Mafic silicate I: Pale translucent grains; orthopyroxene or olivine.

Mafic silicate II: Very fine-grained.

Lithic or mineral: Fine, cryptocrystalline material.

BY: Simonds and Wilshire

62295



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	45.16
TiO ₂	=	0.70
Al ₂ O ₃	=	20.05
FeO	=	6.40
MnO	=	0.09
MgO	=	14.85
CaO	=	11.85
Na ₂ O	=	0.48
K ₂ O	=	0.11
P ₂ O ₅	=	0.15
S	=	-
Cr ₂ O ₃	=	0.19
TOTAL		<u>100.03</u>

CIPW NORM

Qtz	=	-
Or	=	0.65
Ab	=	4.06
An	=	52.23
Di	=	4.53
Hy	=	14.36
Ne	=	-
Ol	=	22.26
Chr	=	0.28
Ilm	=	1.33
Apa	=	0.33
TOTAL		<u>100.03</u>

$$100 \text{ Mg}/(\text{Mg}+\text{Fe}) = 80.5$$

$$\text{An}/\text{Ab}/\text{Or} = 92/7/1$$

TRACE AND MINOR ELEMENTS

Li	=	8.2	(OES)
Rb	=	4.59	(ID)
K	=	605	(ID)
Ba	=	187	(ID)
Sr	=	139	(ID)
Cr	=	-	
V	=	23	(OES)
Sc	=	9.2	(OES)
Ni	=	312.9	(OES)
Co	=	34	(OES)
Cu	=	10	(OES)
Zn	=	18	(OES)
Th	=	3.2	(GAM)
U	=	0.882	(MS)
Zr	=	210	(OES)
Hf	=	-	
Nb	=	12	(OES)

RARE EARTH ELEMENTS (ID)

La	=	18.6	
Ce	=	45.9	
Pr	=	-	
Nd	=	29	
Sm	=	8.3	
Eu	=	1.18	
Gd	=	10.10	
Tb	=	-	
Dy	=	10.8	
Ho	=	-	
Er	=	6.85	
Tm	=	-	
Yb	=	6.06	
Lu	=	0.879	
Y	=	58	(OES)

ROCK NUMBER: 68415,1
WEIGHT: 203 g DIMENSIONS: 6 x 8 x 10 cm Larger of
2 pieces (Original rock
is 371 g and 4 x 6 x 15 cm)

BINOCULAR DESCRIPTION

COLOR: Greenish-gray (5GY)
SHAPE: Top: rounded
FABRIC: Isotropic, equigranular
COHERENCE: Intergranular: Tough
Fracturing: Penetrative (few and small)
VARIABILITY: Patchy on a 10-20 mm scale
SURFACE: Fresh fractures are smooth on 10 mm scale and irregular,
hackly on 1 mm scale; cratered areas are rounded off.
ZAP PITS: Many on T, N, S, and E; none on B. W.
CAVITIES: Vugs, 0-5%, 0.1 to 2 mm in size, occur in clusters and
trains.
SPECIAL FEATURES:
1. Crystalline rock; no clear cut inclusions and clasts observed;
however, patchy distribution of light and dark colored parts
is suggestive of almost completely resorbed clasts; thus it is
probably not of genuine igneous origin.
2. Beautiful, water-clear, tabular and/or stubby plagioclase
crystals in vugs; no pyroxenes were observed in vugs.
3. Occasionally exceptionally large feldspars (1-3 mm, total
2-5%) of irregular outlines, resembling fractured detritus.
BY: Horz

ROCK NUMBER: 68415,2
WEIGHT: 168 g

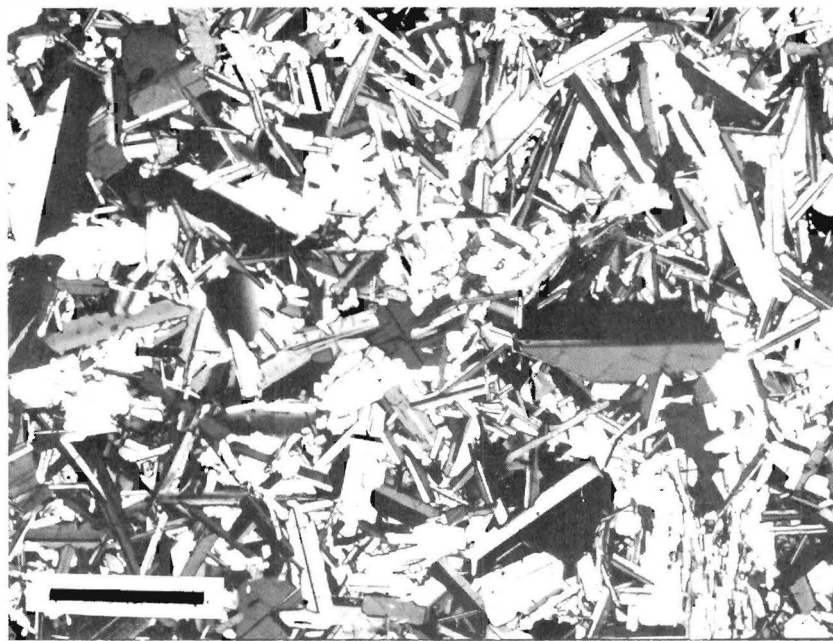
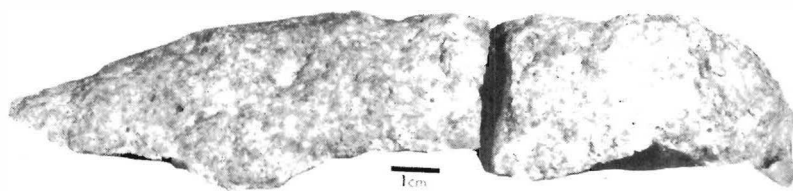
DIMENSIONS: 10 x 5 x 3.5 cm

BINOCULAR DESCRIPTION

COLOR: Light gray (N7)
SHAPE: Subround, broken
FABRIC: Isotropic, finely crystalline
COHERENCE: Intergranular: Tough
Fracturing: Minor nonpenetrative, 3 penetrative fractures on fresh face.
VARIABILITY: 15 x 20 mm patch of coarser grain size
SURFACE: T, W, N, S are fine hackly; B, E, are fresh
ZAP PITS: Many on N, S, W, T; none on E, B.
CAVITIES: Mirolitic cavities, <0.5%, unevenly distributed, 1/2 mm diameter projecting white plagioclase
SPECIAL FEATURES: Coarse patch has 10% voids. The large drusy cavity area is just the same as the small mirolitic cavities except for the yellowish pyroxene (?).

Coarse Patch: 55% glassy gray-white, 35% yellowish gray, and 10% voids. The glassy gray-white is mainly 1-3 mm translucent plates and some 1-2 mm needles with crystal terminations. A few stubby 1-2 mm prisms have conchoidal fractures (quartz?). The yellowish gray is mostly yellow translucent interstitial pyroxene(?), some reddish brown interstitial pyroxene(?), opaque black inclusions in the yellow pyroxene, and black plates (ilmenite?) associated with the brown pyroxene.

68415



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	45.40
TiO ₂	=	0.32
Al ₂ O ₃	=	28.63
FeO	=	4.25
MnO	=	0.06
MgO	=	4.38
CaO	=	16.39
Na ₂ O	=	0.41
K ₂ O	=	0.06
P ₂ O ₅	=	0.07
S	=	0.04
Cr ₂ O ₃	=	0.10

TOTAL 100.11

CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	3.47
An	=	76.11
Di	=	3.92
Hy	=	12.68
Ne	=	-
Ol	=	2.63
Chr	=	0.15
Ilm	=	0.61
Apa	=	0.15

TOTAL 100.07

100 Mg/(Mg+Fe) = 64.7
 An/Ab/Or = 95.2/4.3/.4

TRACE AND MINOR ELEMENTS

Li	=	5.1	(ID)
Rb	=	1.704	(ID)
K	=	56.5	(ID)
Ba	=	76.2	(ID)
Sr	=	182.4	(ID)
Cr	=	599	(ID)
V	=	20	(OES)
Sc	=	8.2	(OES)
Ni	=	48.9	(XRF)
Co	=	11	(OES)
Cu	=	12	(OES)
Zn	=	4	(OES)
Th	=	1.3	(MS)
U	=	0.347	(MS)
Zr	=	98	(XRF)
Hf	=	2.4	(ID)
Nb	=	5.6	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	6.81	
Ce	=	18.3	
Pr	=	-	
Nd	=	10.9	
Sm	=	3.09	
Eu	=	1.11	
Gd	=	3.78	
Tb	=	-	
Dy	=	4.18	
Ho	=	-	
Er	=	2.57	
Tm	=	-	
Yb	=	2.29	
Lu	=	0.34	
Y	=	23	(XRF)

ROCK NUMBER: 68416
WEIGHT: 179 g

DIMENSIONS: 6 x 4.5 x 3 cm

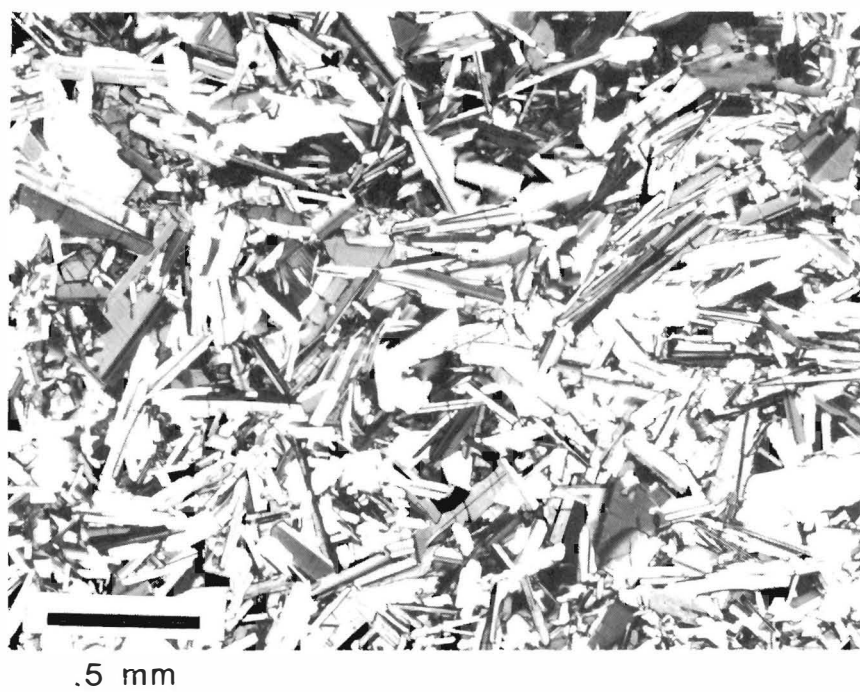
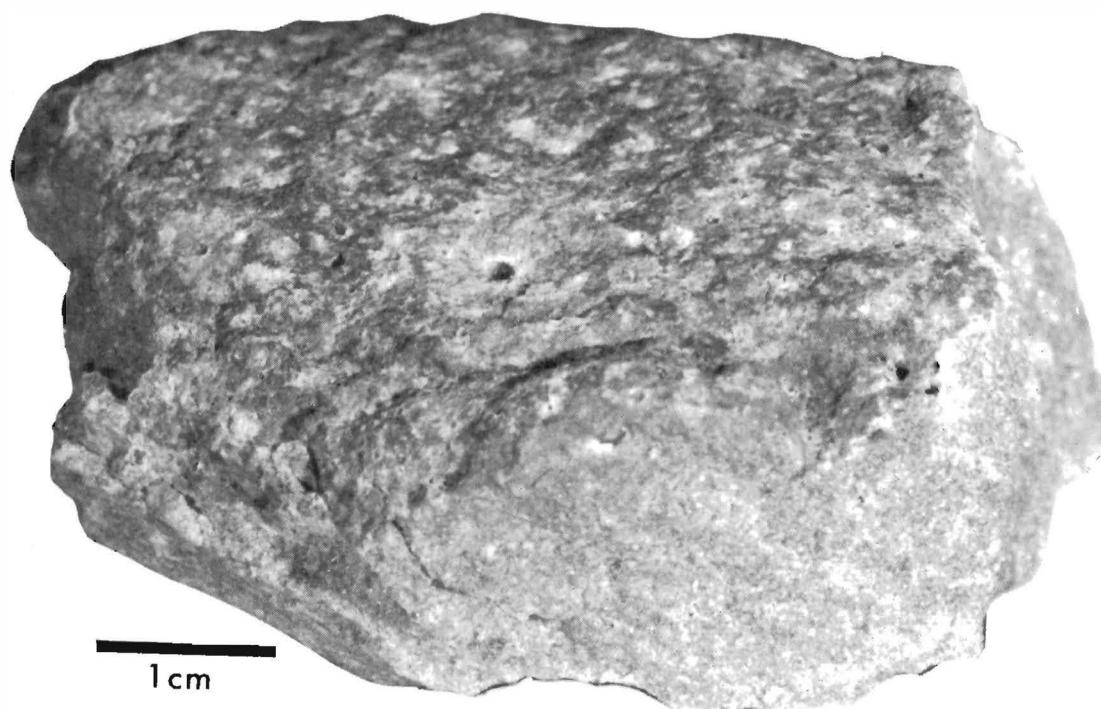
BINOCULAR DESCRIPTION

COLOR: Pale gray (N7)
SHAPE: Roughly tabular with some external surfaces rounded
FABRIC: Equigranular
COHERENCE: Intergranular: Tough
Fracturing: Few, non-penetrative
VARIABILITY: Generally homogeneous except for several plagioclase megacrysts and a somewhat patchy distribution of the yellowish green mineral.
SURFACE: N, W and B are granulated. E is 1/2 granulated and 1/2 knobby and pitted. T and S are knobby and pitted.
ZAP PITS: Few on T, S, and E (1/2 of face); none on others
CAVITIES: Five percent bounded by crystal faces. Some plagioclase crystals project into cavities.
SPECIAL FEATURES: A chip of this rock has an exterior surface with one glass lined zap pit. This chip represents the average mineralogy and texture of the parent sample. It is 1 x 1.5 x 1 cm.

Plagioclase: One megacryst is 7 mm x 7 mm. Another is 4 mm and circular in section.

BY: Williams

68416



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	45.04
TiO ₂	=	0.33
Al ₂ O ₃	=	28.75
FeO	=	4.27
MnO	=	0.07
MgO	=	4.49
CaO	=	16.31
Na ₂ O	=	0.34
K ₂ O	=	0.08
P ₂ O ₅	=	0.08
S	=	-
Cr ₂ O ₃	=	-
TOTAL		99.76

CIPW NORM

Qtz	=	-
Or	=	0.47
Ab	=	2.88
An	=	76.69
Di	=	3.07
Hy	=	12.47
Ne	=	-
Ol	=	3.38
Chr	=	-
Ilm	=	0.63
Apa	=	0.17
TOTAL		99.76

100 Mg/(Mg+Fe) = 65.2
 An/Ab/Or = 95.8/3.6/.6

TRACE AND MINOR ELEMENTS

Li	=	4.4	(ID)
Rb	=	1.705	(ID)
K	=	559	(ID)
Ba	=	78.2	(ID)
Sr	=	-	
Cr	=	683	(ID)
V	=	21	(OES)
Sc	=	9.2	(OES)
Ni	=	205	(OES)
Co	=	10	(OES)
Cu	=	14	(OES)
Zn	=	30	(COL)
Th	=	1.24	(GAM)
U	=	0.34	(GAM)
Zr	=	80	(OES)
Hf	=	-	
Nb	=	10	(OES)

RARE EARTH ELEMENTS (ID)

La	=	7.24	
Ce	=	18.4	
Pr	=	-	
Nd	=	11.5	
Sm	=	3.28	
Eu	=	1.11	
Gd	=	4.07	
Tb	=	-	
Dy	=	4.29	
Ho	=	-	
Er	=	2.86	
Tm	=	-	
Yb	=	2.42	
Lu	=	-	
Y	=	21	(OES)

APOLLO 17

ROCK NUMBER: 70017
WEIGHT: 2957 g

DIMENSIONS: 18 x 14 x 10 cm

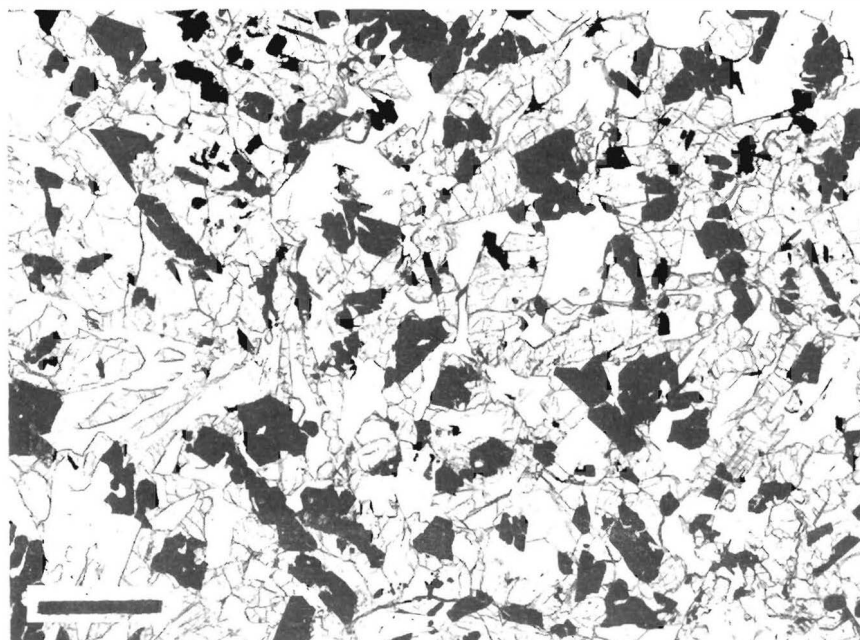
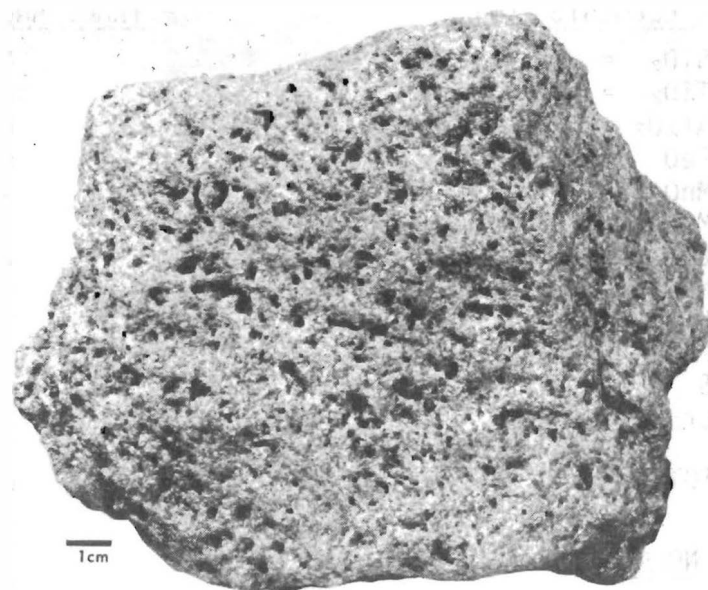
BINOCULAR DESCRIPTION

COLOR: Brownish gray (5YR 4/1)
SHAPE: Block subangular
FABRIC: Holocrystalline, equigranular, some poikilitic plagioclase
COHERENCE: Intergranular - Tough
Fracturing: None penetrative
VARIABILITY: Homogeneous, but plagioclase decreases somewhat near vugs.
SURFACE: All hackly, few small glass patches on surface
ZAP PITS: Some on B and the adjacent parts of N, E, S, W; none on T, which was buried
CAVITIES: Vugs: 10-15%; contain pyroxene and plagioclase; pyroxene is more abundant in vugs than plagioclase; ilmenite is minor
SPECIAL FEATURES: On the fresh surface (B), there are occasional crushed places suggesting possible exposure for a short time.

Plagioclase: Some laths up to 5 mm long and 1 mm wide
Pyroxene: May be zoned - yellow core to tan brown to dark brown outside.
Ilmenite: Platy, generally grainy in the pyroxene
Olivine: Typically has opaque inclusions.

BY: R. Gooley

70017



1 mm

CHEMISTRY

MAJOR ELEMENTS (5)

SiO ₂	=	38.54
TiO ₂	=	12.99
Al ₂ O ₃	=	8.65
FeO	=	18.25
MnO	=	0.25
MgO	=	9.98
CaO	=	10.28
Na ₂ O	=	0.39
K ₂ O	=	0.05
P ₂ O ₅	=	0.05
S	=	0.16
Cr ₂ O ₃	=	0.50

TOTAL 100.09

C1PW NORM

Qtz	=	0.06
Or	=	0.30
Ab	=	3.30
An	=	21.71
Di	=	23.46
Hy	=	25.59
Ne	=	-
Ol	=	-
Chr	=	0.74
Ilm	=	24.67
Apa	=	0.11

TOTAL 99.93

100 Mg/(Mg+Fe) = 49.4
 An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	8.57	(ID)
Rb	=	0.28	(ID)
K	=	-	
Ba	=	43	(ID)
Sr	=	168	(ID)
Cr	=	3490	(ID)
V	=	146	(XRF)
Sc	=	80	(XRF)
Ni	=	<3	(XRF)
Co	=	32	(XRF)
Cu	=	28	(XRF)
Zn	=	<2	(XRF)
Th	=	0.198	(ID)
U	=	0.060	(ID)
Zr	=	218	(XRF)
Hf	=	6.4	(NAA)
Nb	=	18.5	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	10.7	
Pr	=	-	
Nd	=	12.1	
Sm	=	5.13	
Eu	=	1.62	
Gd	=	-	
Tb	=	-	
Dy	=	10.2	
Ho	=	-	
Er	=	6.31	
Tm	=	-	
Yb	=	6.25	
Lu	=	0.954	
Y	=	71.2	(XRF)

ROCK NUMBER: 70035
WEIGHT: 5765 g

DIMENSIONS: 15 x 23 x 10 cm

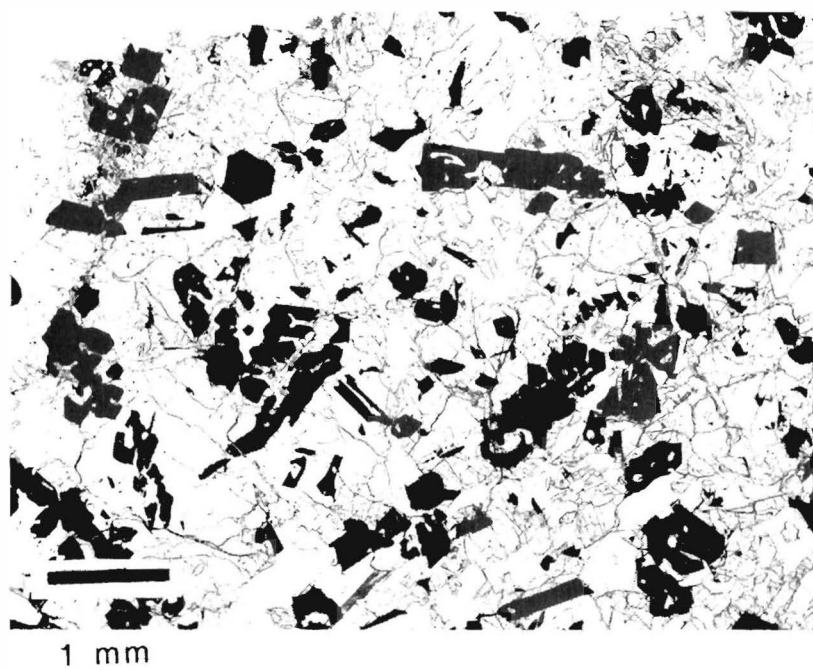
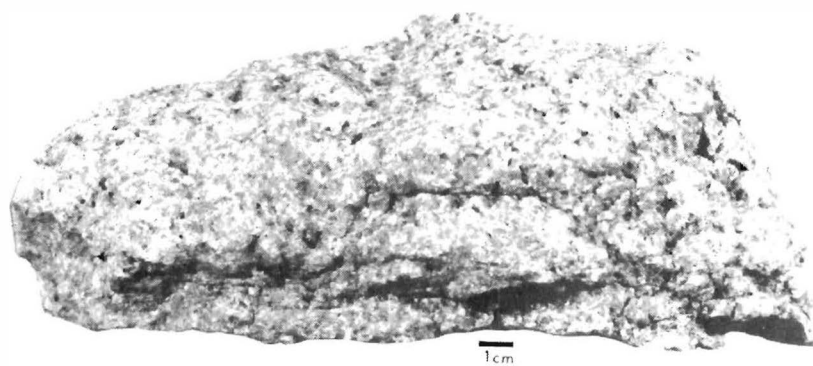
BINOCULAR DESCRIPTION

COLOR: Moderate brown
SHAPE: Subround top, angular bottom
FABRIC: Microporphyritic
COHERENCE: Intergranular - Tough
Fracturing - 1 set parallel to bottom, 1 cm spacing, penetrative
VARIABILITY: Slight coarsening of grain size near vugs
SURFACE: All but B, which is lunar bottom as well, are moderately smooth, B has glassy patches (noted on B photo).
ZAP PITS: All but B are rounded and zapped, B is not zapped.
CAVITIES: 5 - 10% vugs with projecting crystals, average 3 mm, up to 1 cm diameter.
SPECIAL FEATURES: B is flat fracture surface parallel to fracture set in rock, B is unpitted and is lunar bottom. Patches of dull glass appear to be relicts of an injected glass. Patches of brownish debris in these islands may be powdered glass or soil retained on surface. Brown debris is distinctly lighter in color than typical regolith.

Pyroxene: Larger near vugs; intergrown with ilmenite. Microphenocrysts (2-3 mm) consisting of pyroxene which is intergrown, equant, and euhedral make up <1% of the pyroxenes.
Plagioclase: Forms both laths and interstitial anhedral grains.
Olivine: Tends to be enriched in some area but absent in most of rock. Areas enriched in olivine are depleted in pyroxene.
Silica: Observed in vugs.

BY: Morrison and Wilshire

70035



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	37.84
TiO ₂	=	12.97
Al ₂ O ₃	=	8.85
FeO	=	18.46
MnO	=	0.28
MgO	=	9.89
CaO	=	10.07
Na ₂ O	=	0.35
K ₂ O	=	0.06
P ₂ O ₅	=	0.05
S	=	0.15
Cr ₂ O ₃	=	0.61
<hr/>		
TOTAL		99.58

CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	2.96
An	=	22.40
Di	=	22.08
Hy	=	24.91
Ne	=	-
Ol	=	1.08
Chr	=	0.90
Ilm	=	24.63
Apa	=	0.11
<hr/>		
TOTAL		99.43

100 Mg/(Mg+Fe) = 48.8
An/Ab/Or = 87/12/1

TRACE AND MINOR ELEMENTS

Li	=	8.7	(ID)
Rb	=	0.461	(ID)
K	=	452	(ID)
Ba	=	62.1	(ID)
Sr	=	174	(ID)
Cr	=	3890	(ID)
V	=	-	
Sc	=	82.5	(NAA)
Ni	=	2	(XRF)
Co	=	20.7	(NAA)
Cu	=	-	
Zn	=	4	(XRF)
Th	=	-	
U	=	0.091	(ID)
Zr	=	217	(ID)
Hf	=	-	
Nb	=	20	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	4.79	
Ce	=	16.4	
Pr	=	-	
Nd	=	18.2	
Sm	=	7.63	
Eu	=	1.82	
Gd	=	11.0	
Tb	=	-	
Dy	=	14.1	
Ho	=	-	
Er	=	8.4	
Tm	=	-	
Yb	=	7.79	
Lu	=	1.17	
Y	=	75	(XRF)

ROCK NUMBER: 70135
WEIGHT: 446.3 g

DIMENSIONS: 10.5 x 6 x 3.5 cm

BINOCULAR DESCRIPTION

COLOR: Slightly brownish gray (N7-5YR 6/1)

SHAPE: Blocky, angular, wedge shaped

FABRIC: Foliated locally; inequigranular

COHERENCE: Intergranular - Tough

Fracturing: 2 parallel, irregular penetrative fractures, 1 cm apart.

VARIABILITY: Local foliation - see special features

SURFACE: T, N, and E are patina covered; S, W, and B are hackly.

All surfaces but W have some patina.

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

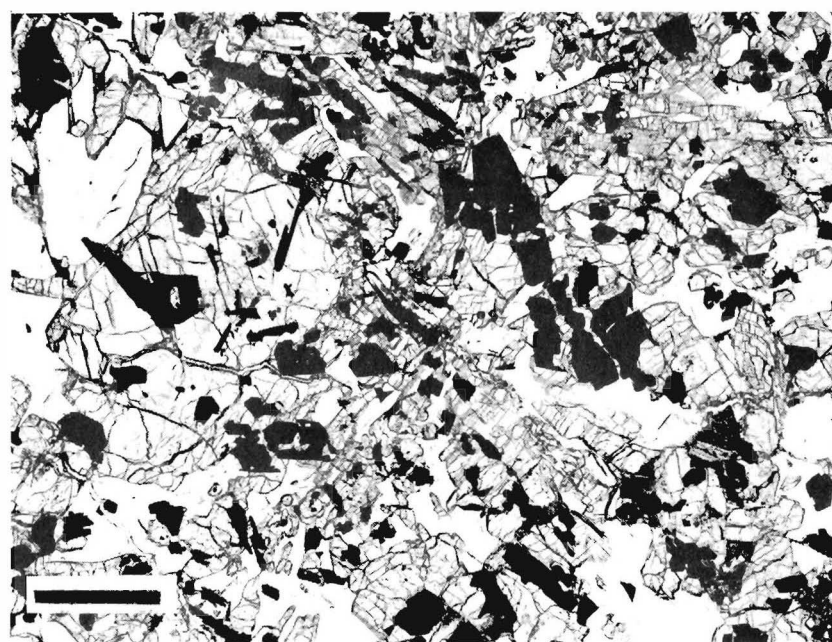
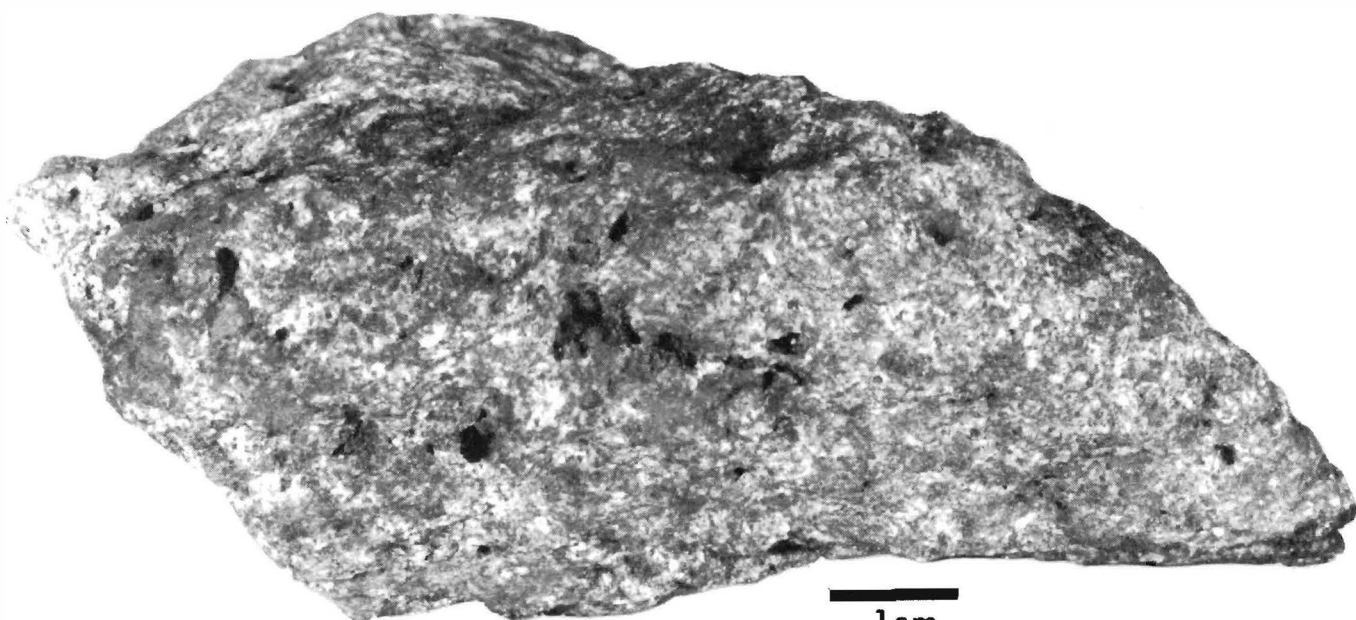
CAVITIES: Irregular vugs 1-6 mm diameter, average about 3 mm.

Vugs in band about 1 cm thick, about normal to S; vugs are lined with same size crystals as rest of rock.

SPECIAL FEATURES: Plagioclase and ilmenite foliation (see W view) strong but local - contrasted by diabasic texture - zone about 3 cm wide across west face approximately perpendicular to west face. Eleven small chips returned in the documented bag (70136-39, 70145-49, 70155-57) with this sample, are from the same boulder and some or all may have broken from 70135 after collection, but none could be remated to it.

BY: Jackson, Wilshire and Lofgren

70135



1 mm

CHEMISTRY

MAJOR ELEMENTS (3)

SiO ₂	=	38.04
TiO ₂	=	13.50
Al ₂ O ₃	=	7.92
FeO	=	19.46
MnO	=	0.28
MgO	=	9.58
CaO	=	9.93
Na ₂ O	=	0.37
K ₂ O	=	0.07
P ₂ O ₅	=	0.06
S	=	0.17
Cr ₂ O ₃	=	0.56

TOTAL		99.94
-------	--	-------

C1PW NORM

Qtz	=	0.39
Or	=	0.40
Ab	=	3.13
An	=	19.75
Di	=	23.68
Hy	=	25.81
Ne	=	-
Ol	=	-
Chr	=	0.83
Ilm	=	25.64
Apa	=	0.14

TOTAL		99.77
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100 Mg/(Mg+Fe) = 46.7
An/Ab/Or = 85/13/2

TRACE AND MINOR ELEMENTS

Li	=	11.4	(ID)
Rb	=	0.819	(ID)
K	=	735	(ID)
Ba	=	105	(ID)
Sr	=	186	(ID)
Cr	=	-	
V	=	127	(XRF)
Sc	=	81.7	(INAA)
Ni	=	2	(XRF)
Co	=	16.6	(INAA)
Cu	=	2	(XRF)
Zn	=	2.0	(XRF)
Th	=	0.31	(GAM)
U	=	0.12	(GAM)
Zr	=	299	(XRF)
Hf	=	14.0	(INAA)
Nb	=	26.3	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	8.49	
Ce	=	29.4	
Pr	=	-	
Nd	=	31.6	
Sm	=	13	
Eu	=	2.3	
Gd	=	19.6	
Tb	=	-	
Dy	=	22.6	
Ho	=	-	
Er	=	13.2	
Tm	=	-	
Yb	=	11.9	
Lu	=	-	
Y	=	103	(XRF)

ROCK NUMBER: 70185
WEIGHT: 466.6 g

DIMENSIONS: 9 x 7.5 x 5.5 cm
3.2 x 2.3 x 1.5 cm

BINOCULAR DESCRIPTION

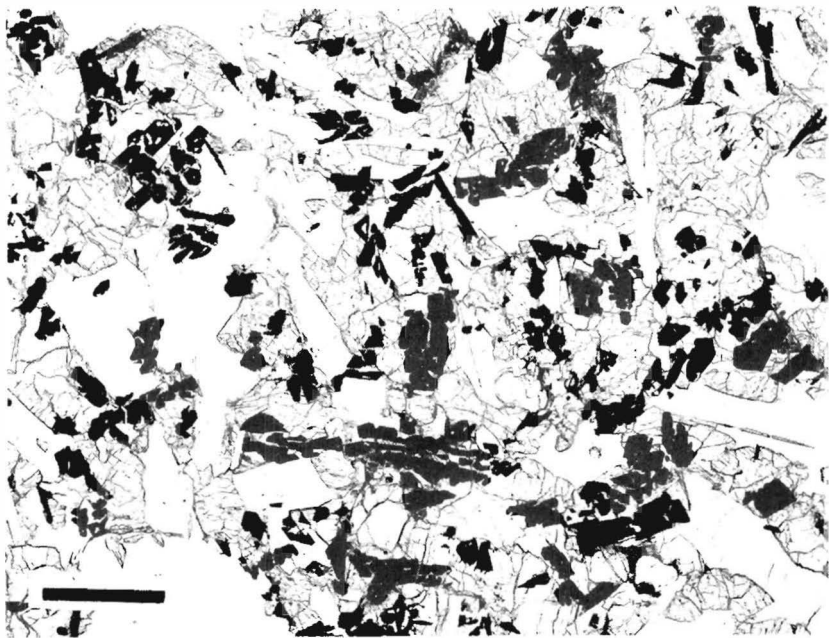
COLOR: Medium gray (N5)
SHAPE: Irregular
FABRIC: Isotropic, diabasic
COHERENCE: Intergranular - Tough
Fracturing: Few, mostly penetrative
VARIABILITY: Mineralogy remains constant, but grain size and number of cavities vary.
SURFACE: Soil line along E, S, and W; T, N, S, E, and W are rounded; B is subangular.
ZAP PITS: Many on T, N, S, E and W; few on B. On the smaller piece; few on T, none on B.
SPECIAL FEATURES: Plagioclase lath average 1 mm on T, 0.7 mm on W, and 0.6 mm on B. On the smaller piece of rock, the grain size is coarser than on the larger piece; the plagioclase laths reach 2.5 mm in length. The smaller piece (70185,1) broke from the E face of the larger piece before unpacking in the LRL.

BY: Simonds, Marvin

70185



1 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	40.18
TiO ₂	=	-
Al ₂ O ₃	=	9.04
FeO	=	17.64
MnO	=	0.26
MgO	=	8.11
CaO	=	11.95
Na ₂ O	=	0.39
K ₂ O	=	0.04
P ₂ O ₅	=	0.02
S	=	0.17
Cr ₂ O ₃	=	0.40
TOTAL		<hr/> 99.72

CIPW NORM

Qtz	=	1.82
Or	=	0.24
Ab	=	3.30
An	=	22.80
Di	=	29.70
Hy	=	19.19
Ne	=	-
Ol	=	-
Chr	=	0.59
Ilm	=	21.88
Apa	=	0.04
TOTAL		<hr/> 99.55

100 Mg/(Mg+Fe) = 45.0
An/Ab/Or = 80/12/8

TRACE AND MINOR ELEMENTS

Li	=	9.6	(ID)
Rb	=	0.49	(ID)
K	=	459	(ID)
Ba	=	66.3	(ID)
Sr	=	173	(ID)
Cr	=	3580	(NAA)
V	=	-	
Sc	=	84	(NAA)
Ni	=	-	
Co	=	19.7	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	0.3	(GAM)
U	=	0.1	(GAM)
Zr	=	-	
Hf	=	8.2	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	5.24	
Ce	=	18.5	
Pr	=	-	
Nd	=	21.1	
Sm	=	8.83	
Eu	=	1.87	
Gd	=	14.0	
Tb	=	-	
Dy	=	16.0	
Ho	=	-	
Er	=	9.52	
Tm	=	-	
Yb	=	8.67	
Lu	=	1.21	(NAA)
Y	=		

ROCK NUMBER: 70215
WEIGHT: 8110 g

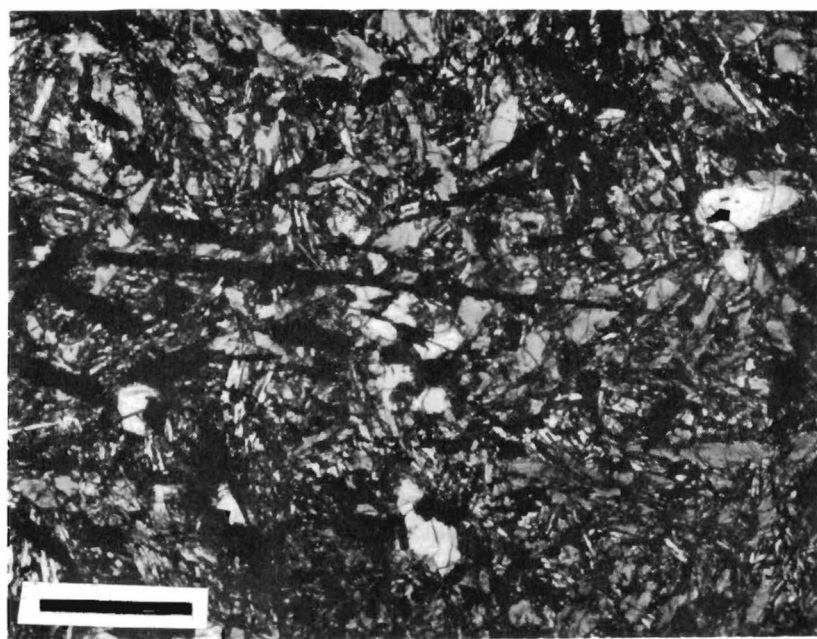
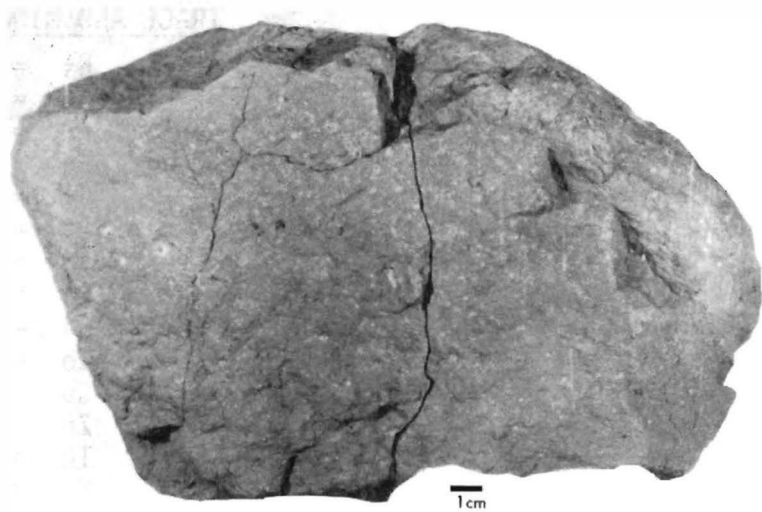
DIMENSIONS: 23 x 13 x 10.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray with faint brownish tint (N4)
SHAPE: Blocky, subangular; one flat surface
FABRIC: Intersertal-intergranular
COHERENCE: Intergranular - Tough
Fracturing: Several penetrative
VARIABILITY: Possibly, in grain size from aphanitic to very fine-grained
SURFACE: T has thin 5 x 3 mm crusts with slickensides, whole surface of B lighter colored than body of rock due to zaps. All surfaces finely hackly.
ZAP PITS: Many on all faces except a patch on N (see photo) which has few.
CAVITIES: Trace of 0.5 - 3 mm diameter vugs with projecting pyroxene and ilmenite prisms and plates.
SPECIAL FEATURES: Olivine phenocrysts, possible also in groundmass

BY: Wilshire, Ridley

70215



.5 mm

CHEMISTRY

MAJOR ELEMENTS (4)

SiO ₂	=	37.79
TiO ₂	=	12.97
Al ₂ O ₃	=	8.85
FeO	=	19.66
MnO	=	0.27
MgO	=	8.44
CaO	=	10.74
Na ₂ O	=	0.36
K ₂ O	=	0.05
P ₂ O ₅	=	0.09
S	=	0.18
Cr ₂ O ₃	=	0.41
TOTAL		99.81

CIPW NORM

Qtz	=	-
Or	=	0.30
Ab	=	3.05
An	=	22.39
Di	=	24.84
Hy	=	23.48
Ne	=	-
Ol	=	0.15
Chr	=	0.60
Ilm	=	24.63
Apa	=	0.20
TOTAL		99.63

100 Mg/(Mg+Fe) = 43.3
An/Ab/Or = 87/12/1

TRACE AND MINOR ELEMENTS

Li	=	7.1	(NAA)
Rb	=	0.356	(ID)
K	=	361	(ID)
Ba	=	56.9	(ID)
Sr	=	121.0	(ID)
Cr	=	3030	(ID)
V	=	50	(XRF)
Sc	=	85.9	(INAA)
Ni	=	3	(XRF)
Co	=	21.3	(INAA)
Cu	=	6.39	(NAA)
Zn	=	-	
Th	=	0.34	(NAA)
U	=	0.13	(ID)
Zr	=	192	(XRF)
Hf	=	6.33	(NAA)
Nb	=	20.8	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	5.22
Ce	=	16.5
Pr	=	-
Nd	=	16.7
Sm	=	6.69
Eu	=	1.37
Gd	=	10.4
Tb	=	-
Dy	=	12.2
Ho	=	-
Er	=	7.4
Tm	=	-
Yb	=	7.04
Lu	=	1.03
Y	=	-

ROCK NUMBER: 70255
WEIGHT: 277.2 g

DIMENSIONS: Two mated pieces:
5.5 x 3.5 x 3 cm
7.5 x 5.5 x 4.5 cm

BINOCULAR DESCRIPTION

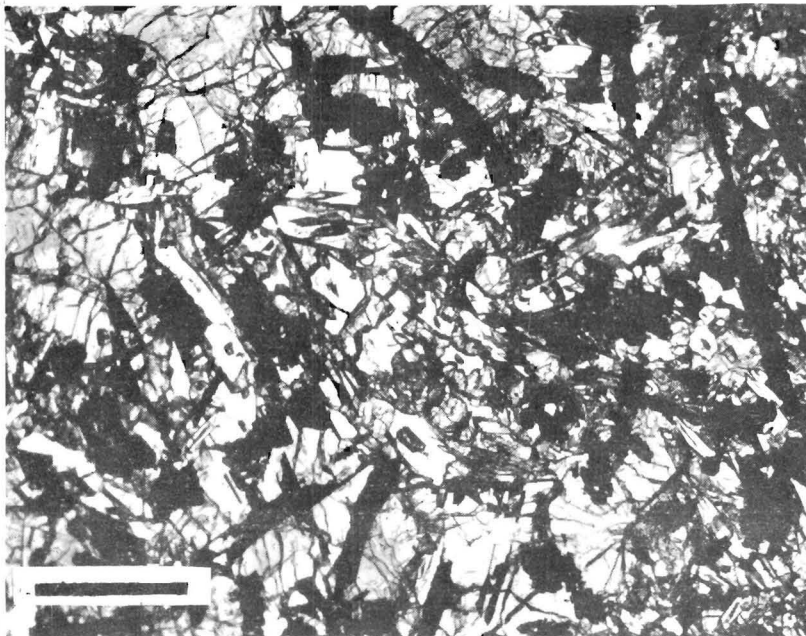
COLOR: Medium dark gray (N4)
SHAPE: Blocky, subangular
FABRIC: Intergranular, possible vitrophyric
COHERENCE: Intergranular - Tough
Fracturing: One penetrative
VARIABILITY: Homogeneous
SURFACE: Finely hackly
ZAP PITS: Few on B and E; many on T, S, W, and N.
CAVITIES: 1-2%, up to 9 mm, vugs. Lined by irregular mattes of
ilmenite needles (to 1 mm), plagioclase (scarce), pale yellowish
mineral, and brown pyroxene.

BY: Stuart-Alexander

70255



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	40.11
TiO ₂	=	11.41
Al ₂ O ₃	=	9.02
FeO	=	18.73
MnO	=	0.29
MgO	=	7.63
CaO	=	11.30
Na ₂ O	=	0.39
K ₂ O	=	0.05
P ₂ O ₅	=	0.04
S	=	0.19
Cr ₂ O ₃	=	0.34
<hr/>		
TOTAL		99.50

CIPW NORM

Qtz	=	2.12
Or	=	0.30
Ab	=	3.30
An	=	22.71
Di	=	27.23
Hy	=	21.39
Ne	=	-
Ol	=	-
Chr	=	0.50
Ilm	=	21.67
Apa	=	0.09
<hr/>		
TOTAL		99.31

$$100 \text{ Mg}/(\text{Mg}+\text{Fe}) = 42.1$$

$$\text{An}/\text{Ab}/\text{Or} = 86/13/1$$

TRACE AND MINOR ELEMENTS

Li	=	10.4	(ID)
Rb	=	0.65	(ID)
K	=	593	(ID)
Ba	=	85.3	(ID)
Sr	=	199	(ID)
Cr	=	2860	(NAA)
V	=	-	
Sc	=	80	(NAA)
Ni	=	-	
Co	=	17.5	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	9.7	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	7.05
Ce	=	24.7
Pr	=	-
Nd	=	27.3
Sm	=	11.4
Eu	=	2.23
Gd	=	17.6
Tb	=	-
Dy	=	20.2
Ho	=	-
Er	=	12.1
Tm	=	-
Yb	=	11.8
Lu	=	1.48
Y	=	-

ROCK NUMBER: 70275
WEIGHT: 171.4 g

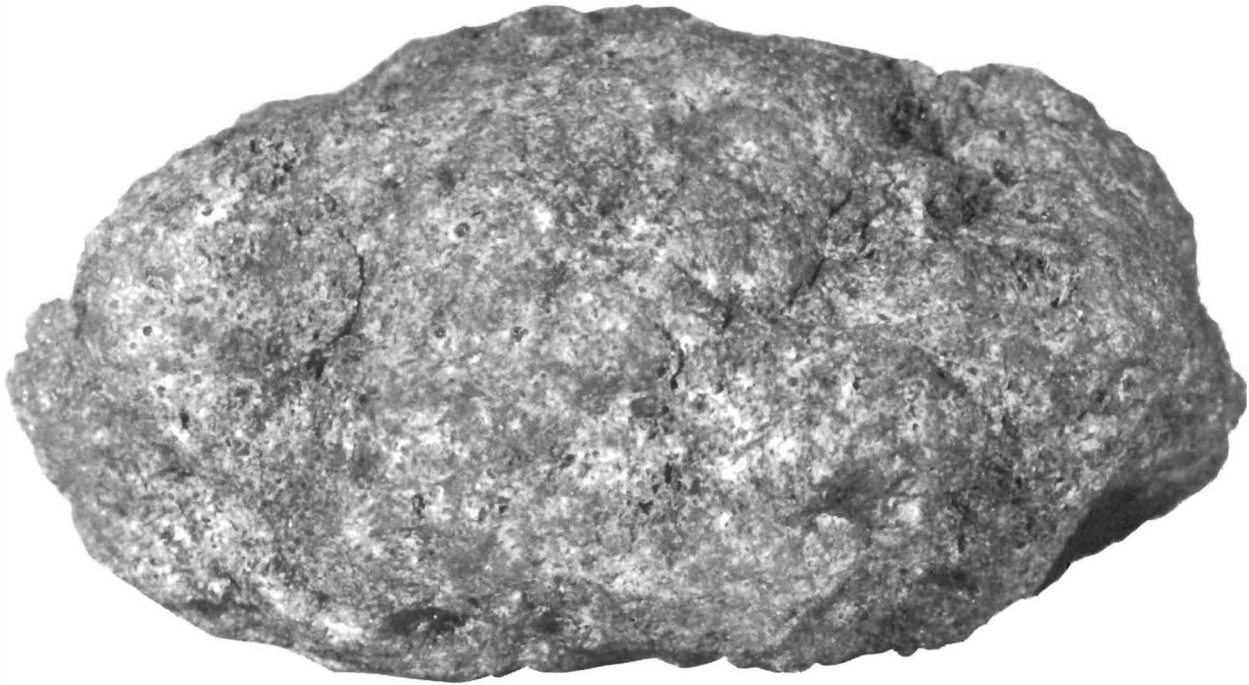
DIMENSIONS: 6.5 x 5.0 x 3.5 cm

BINOCULAR DESCRIPTION

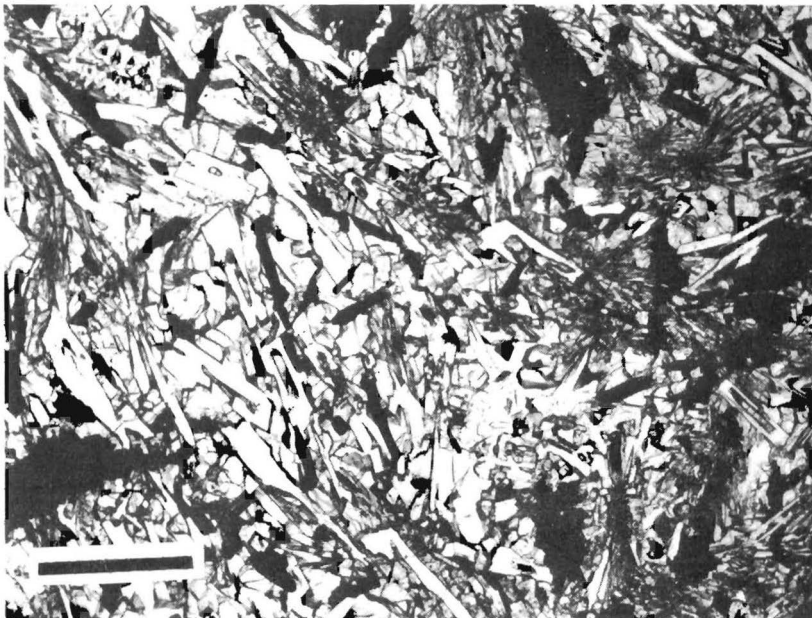
COLOR: Between medium gray (N5) and light brownish gray (5YR 6/1)
SHAPE: Blocky, subrounded
FABRIC: Intergranular to plumose; olivine microphenocrysts and
glomeroporphyritic clots.
COHERENCE: Intergranular - Tough
Fracturing: One, penetrative
VARIABILITY: Texture variable
SURFACE: All surfaces weathered and finely lumpy
ZAP PITS: All faces have many
CAVITIES: 2-3%, vugs up to 2-3 mm, most <1 mm.

BY: Stuart-Alexander

70275



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	39.37
TiO ₂	=	11.90
Al ₂ O ₃	=	10.23
FeO	=	18.61
MnO	=	0.28
MgO	=	6.09
CaO	=	11.65
Na ₂ O	=	0.38
K ₂ O	=	0.06
P ₂ O ₅	=	0.08
S	=	0.15
Cr ₂ O ₃	=	0.26

TOTAL		99.06
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C1PW NORM

Qtz	=	3.10
Or	=	0.35
Ab	=	3.22
An	=	26.03
Di	=	25.87
Hy	=	17.18
Ne	=	-
Ol	=	-
Chr	=	0.38
Ilm	=	22.60
Apa	=	0.17

TOTAL		98.91
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100 Mg/(Mg+Fe) = 36.8
An/Ab/Or = 88/11/1

TRACE AND MINOR ELEMENTS

Li	=	-
Rb	=	0.454 (ID)
K	=	459 (ID)
Ba	=	73.5 (ID)
Sr	=	153 (ID)
Cr	=	-
V	=	-
Sc	=	85 (NAA)
Ni	=	-
Co	=	15.7 (NAA)
Cu	=	-
Zn	=	-
Th	=	0.43 (GAM)
U	=	0.12 (GAM)
Zr	=	-
Hf	=	-
Nb	=	-

RARE EARTH ELEMENTS (ID)

La	=	6.32
Ce	=	20.8
Pr	=	-
Nd	=	21.8
Sm	=	8.75
Eu	=	1.73
Gd	=	14.0
Tb	=	-
Dy	=	15.2
Ho	=	-
Er	=	9.14
Tm	=	-
Yb	=	8.3
Lu	=	-
Y	=	-

ROCK NUMBER: 70315
WEIGHT: 148.6 g

DIMENSIONS: 5 x 4.5 x 4.5 cm

BINOCULAR DESCRIPTION

COLOR: White, black, and brown, average color 5YR 4/1

SHAPE: Subrounded, irregularly surfaced cube

FABRIC: Primarily intergranular

COHERENCE: Intergranular - Weakly coherent

Fracturing: One penetrative

VARIABILITY: Vugs inhomogeneously distributed

SURFACE: All equally weathered, no obvious soil line

ZAP PITS: Few on all except none on N. However, density may be low due to friable nature of rock surface

CAVITIES: Vugs, 5-10%, a few vesicles, maximum size 1 cm. Where vugs are almost filled, there is a high proportion of ilmenite and pyroxene euhedral crystals; where only lined, there is a normal rock distribution of minerals.

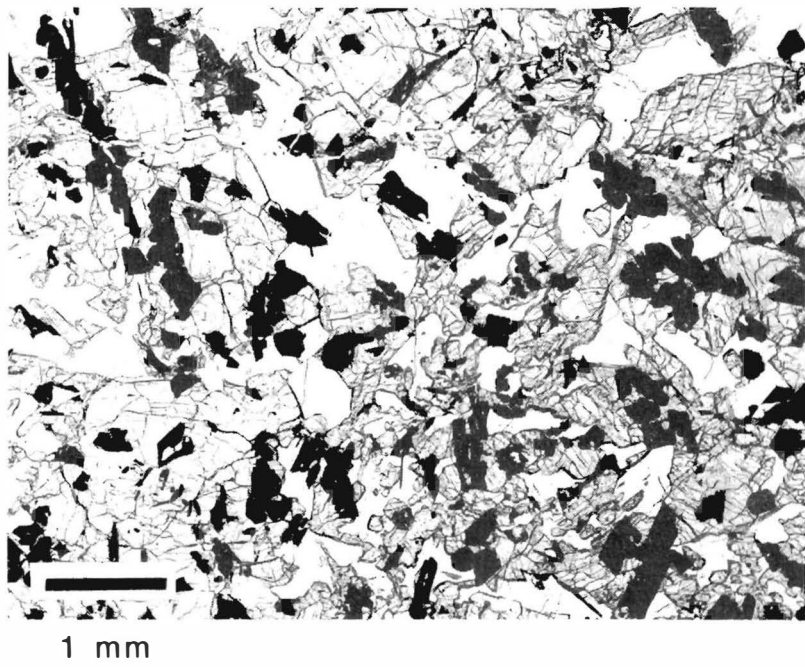
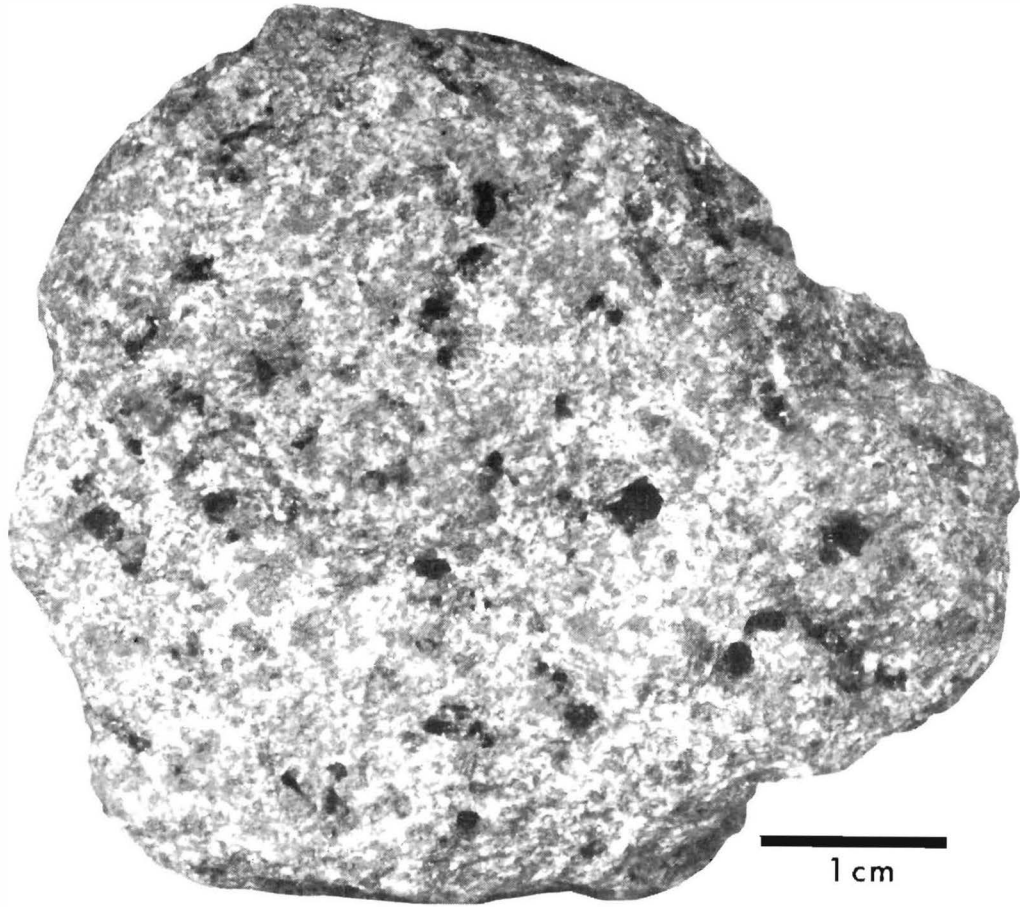
SPECIAL FEATURES: Local glomeroporphyritic clots of pyroxene and ilmenite, largest is 3 mm.

Plagioclase: Largest grain, located on W face, is an oikocryst, but laths predominate and largest is 3 mm - local plumose texture. A small percentage of these show conchoidal fracturing, and thus may be silica mineral.

Pyroxene: A few percent of grains appear zoned with darker brown interiors, lighter exteriors.

BY: Stuart-Alexander, Ridley

70315



CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V = 148 (NAA)
 Sc = 81 (NAA)
 Ni =
 Co = 20 (NAA)
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf = 5.7 (NAA)
 Nb =

RARE EARTH ELEMENTS (NAA)

La = 3.2
 Ce = 13
 Pr =
 Nd = 14
 Sm = 5.8
 Eu = 1.40
 Gd =
 Tb = 1.4
 Dy = 10
 Ho =
 Er =
 Tm =
 Yb = 5.6
 Lu = 0.81
 Y =

ROCK NUMBER: 71035
WEIGHT: 144.8 g

DIMENSIONS: 8 x 5 x 2.5 cm

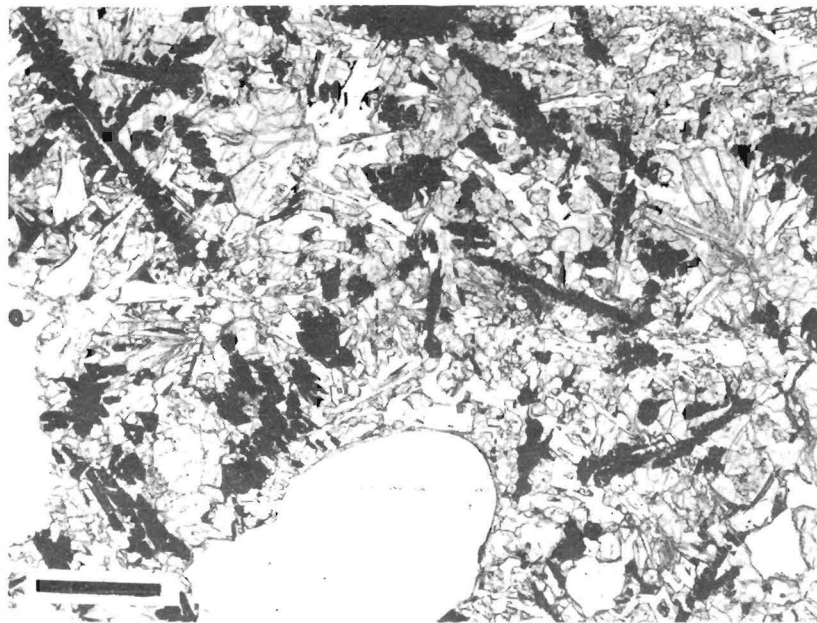
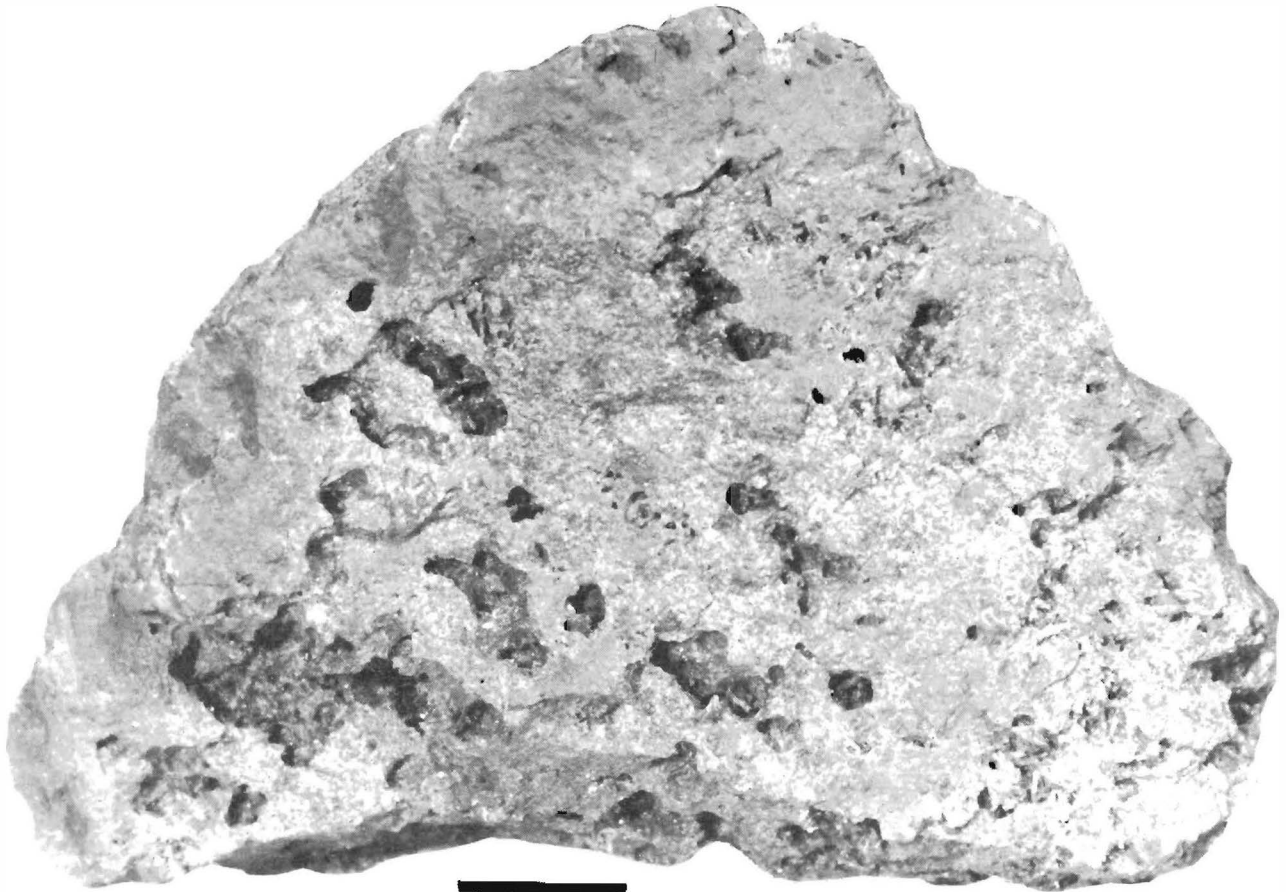
BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4)
SHAPE: One-half of a hemisphere
FABRIC: Medium grained porphyritic
COHERENCE: Intergranular - Coherent
Fracturing: Non-penetrative
VARIABILITY: Homogeneous
SURFACE: B and S are fresh; T, N, E and W are rounded and dusty.
ZAP PITS: Very sparse pits on T and N and E and W.
CAVITIES: 40% are subround to irregular vugs; concentrated on T and S faces. Their size ranges from 0.2 mm up to 1 cm but averages 3 mm. Lined with euhedral crystals that are larger than groundmass.
SPECIAL FEATURES: Crystals in vugs are ilmenite (predominant), pyroxene cinnamon and plagioclase. Vugs coarser toward SW corner. Sparse yellow crystals (clivine or pyroxene) are also present in vugs. Pyroferroite(?) present in some vugs.

Plagioclase: In some areas up to 4-5 mm.

BY. Williams, Marvin

71035



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.25
TiO ₂	=	13.06
Al ₂ O ₃	=	8.77
FeO	=	19.74
MnO	=	0.29
MgO	=	7.98
CaO	=	10.87
Na ₂ O	=	0.38
K ₂ O	=	0.03
P ₂ O ₅	=	0.10
S	=	0.15
Cr ₂ O ₃	=	0.39
<hr/>		
TOTAL		100.01

CIPW NORM

Qtz	=	0.95
Or	=	0.18
Ab	=	3.22
An	=	22.14
Di	=	25.57
Hy	=	22.21
Ne	=	-
Ol	=	-
Chr	=	0.57
Ilm	=	24.80
Apa	=	0.22
<hr/>		
TOTAL		99.86

100 Mg/(Mg+Fe) = 41.9
 An/Ab/Or = 86.7/12.6/.7

TRACE AND MINOR ELEMENTS

Li	=	7.6	(ID)
Rb	=	0.41	(ID)
K	=	430	(ID)
Ba	=	66.3	(ID)
Sr	=	130	(ID)
Cr	=	3310	(NAA)
V	=	-	
Sc	=	87	(NAA)
Ni	=	-	
Co	=	19	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	0.44	(GAM)
U	=	0.11	(GAM)
Zr	=	-	
Hf	=	7	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	5.77	
Ce	=	18.7	
Pr	=	-	
Nd	=	18.8	
Sm	=	7.5	
Eu	=	1.5	
Gd	=	12.1	
Tb	=	-	
Dy	=	13.6	
Ho	=	-	
Er	=	8.27	
Tm	=	-	
Yb	=	7.71	
Lu	=	1.14	(NAA)
Y	=	-	

ROCK NUMBER: 71036
WEIGHT: 118.4 g

DIMENSIONS: 8.5 x 3 x 4 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4)
SHAPE: Half of a hemisphere
FABRIC: Medium grained porphyritic
COHERENCE: Intergranular - Coherent
VARIABILITY: Homogeneous
SURFACE: S, T, and E are fresh fractures, W is partly exposed surface and partly chipped; B is exposed.
ZAP PITS: Few on all surfaces
CAVITIES: 30% vugs with a marked concentration on B. They are irregular 0.5 - 5 mm long and average 2 mm. They contain euhedral crystals of ilmenite pyroxene, plagioclase, and rare olivine up to 1 mm long.
SPECIAL FEATURES: Sample 71036 was probably located on the same boulder near 71035, which has the same components. None of the fresh surfaces of 71035 and 71036 fit together, but B of 71035 and T of 71036 are about the same dimensions. The nature of the vugs on these two surfaces are distinctly different (compare photos).

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

BY: Williams, Marvin

71036



NOT ALLOCATED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ = _____
 TOTAL

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa = _____
 TOTAL

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 71055
WEIGHT: 669.6 g

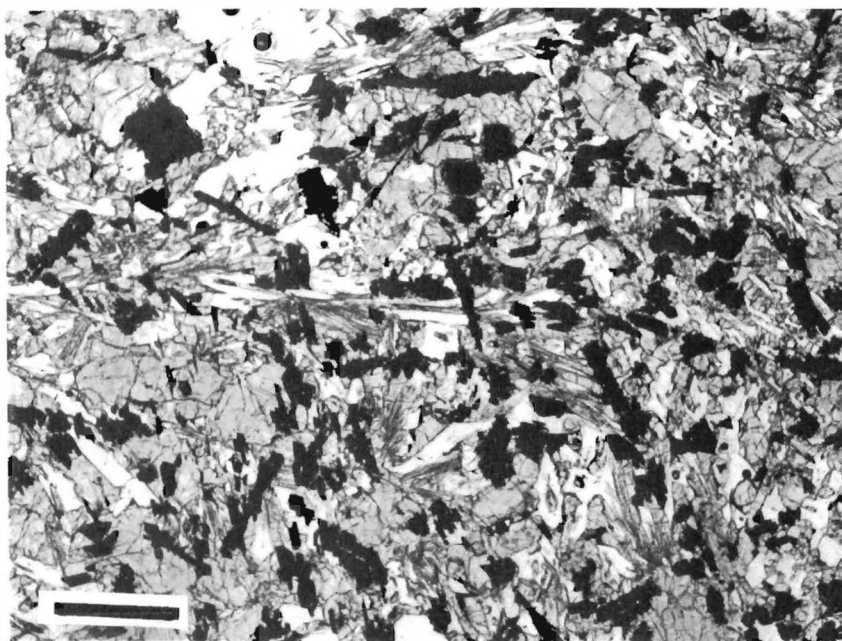
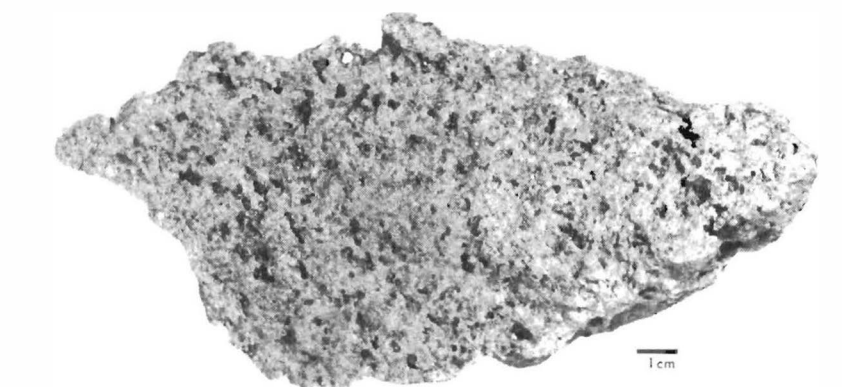
DIMENSIONS: 19.5 x 9.5 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Light brownish gray (N4-IR5 Y/R 4/1)
SHAPE: Angular broken rock, natural surface rounded
FABRIC: Intergranular
COHERENCE: Tough and no fractures
VARIABILITY: Homogeneous mineralogy, heterogeneous vug distribution
SURFACE: Finely hackly on both sides. B-S has thin dark gray film and is rounded.
ZAP PITS: B is rounded but has few zap pits. S - few to many.
CAVITIES: Vugs 20-25% (<1-12 mm), 1% smooth-walled vesicles (1 mm), vugs lined with euhedral crystals of ilmenite, pyroxene, plagioclase and yellow-green mineral. Vugs do not appear to be layered in distribution. Pyroxene projecting into cavities are thin and needlelike.

BY: Wilshire, Meyer

71055



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.14
TiO ₂	=	13.41
Al ₂ O ₃	=	8.62
FeO	=	19.20
MnO	=	0.26
MgO	=	9.04
CaO	=	10.77
Na ₂ O	=	0.31
K ₂ O	=	0.06
P ₂ O ₅	=	0.08
S	=	-
Cr ₂ O ₃	=	0.41

TOTAL 100.30

CIPW NORM

Qtz	=	0.42
Or	=	0.35
Ab	=	2.62
An	=	21.95
Di	=	25.22
Hy	=	23.48
Ne	=	-
Ol	=	-
Chr	=	0.60
Ilm	=	25.47
Apa	=	0.17

TOTAL 100.30

100 Mg/(Mg+Fe) = 45.6

An/Ab/Or = 88/11/1

TRACE AND MINOR ELEMENTS

Li	=	9.32	(ID)
Rb	=	0.362	(ID)
K	=	342	(ID)
Ba	=	62.4	(ID)
Sr	=	121	(ID)
Cr	=	2800	(NAA)
V	=	88	(XRF)
Sc	=	86	(NAA)
Ni	=	43	(XRF)
Co	=	26	(NAA)
Cu	=	31	(XRF)
Zn	=	4	(XRF)
Th	=	0.65	(NAA)
U	=	-	
Zr	=	223	(XRF)
Hf	=	7.0	(NAA)
Nb	=	27	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	15.6	
Pr	=	-	
Nd	=	17.0	
Sm	=	6.72	
Eu	=	1.36	
Gd	=	-	
Tb	=	-	
Dy	=	13.0	
Ho	=	-	
Er	=	7.74	
Tm	=	-	
Yb	=	7.75	
Lu	=	-	
Y	=	69	(XRF)

ROCK NUMBER: 71175
WEIGHT: 207.8 g DIMENSIONS: 8 x 5 x 4 cm

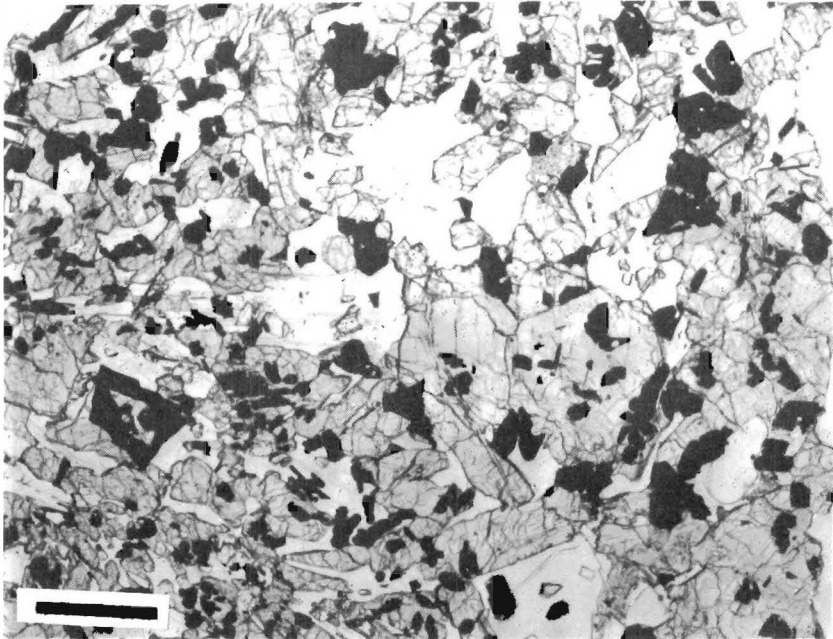
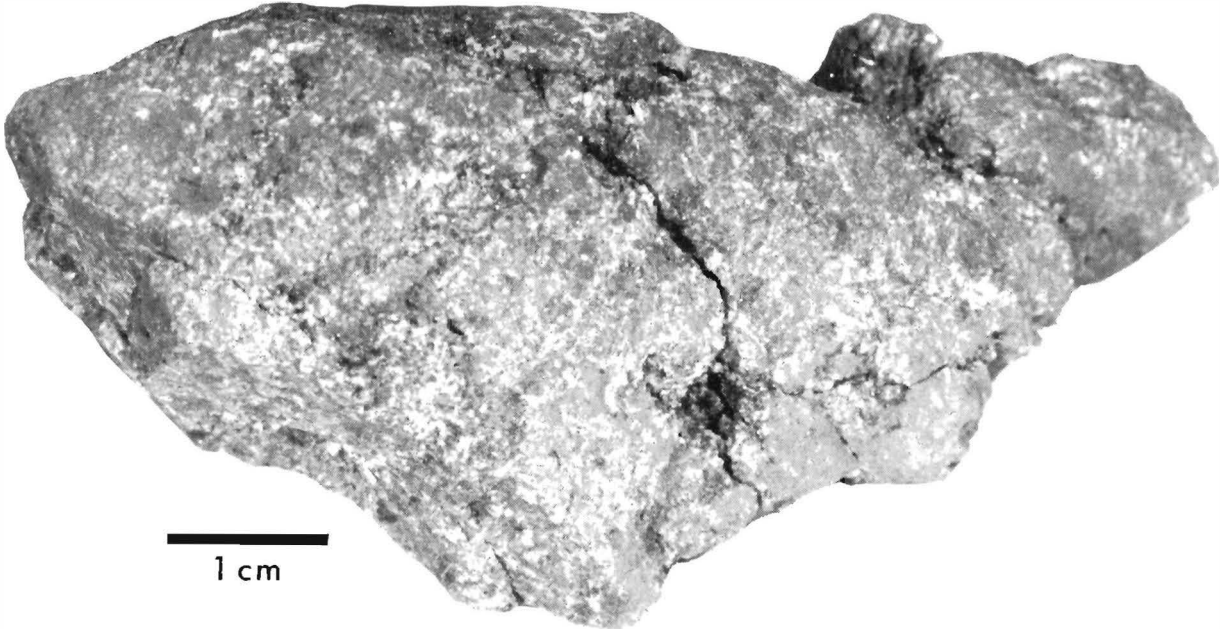
BINOCULAR DESCRIPTION

COLOR: Medium gray (N5)
SHAPE: Subangular
FABRIC: Isotropic equigranular
COHERENCE: Intergranular - Coherent
 Fracturing: Few, penetrative and non-penetrative
VARIABILITY: Variable proportions of olivine from one area to another.
SURFACE: Irregular to granular all faces. All surfaces dusty which
 obscures 60% of the rock surface, except on B and T faces where a
 fragment broke off.
ZAP PITS: None on B, E, S, W and N; few on T.
CAVITIES: 5-10%, 1-8 mm diameter miarolitic cavities with irregular
 distribution and shapes. They rarely contain euhedral minerals.
 The surfaces of cavities are like the surface of rock. Some
 cavities are tabular.
SPECIAL FEATURES: Suggestion of some crystal growth along fractures
 emanating from pipe-like cavities. Two small fragments can be
 rejoined to the largest piece and have typical outer and fresh surfaces
 and mineral percentages.

Olivine: Conchoidal fractures.

BY: Lofgren, Argrell

71175



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	37.93
TiO ₂	=	13.08
Al ₂ O ₃	=	8.47
FeO	=	19.37
MnO	=	0.28
MgO	=	9.63
CaO	=	9.79
Na ₂ O	=	0.38
K ₂ O	=	0.04
P ₂ O ₅	=	0.04
S	=	0.16
Cr ₂ O ₃	=	0.54

TOTAL		99.71
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CIPW NORM

Qtz	=	-
Or	=	0.24
Ab	=	3.22
An	=	21.29
Di	=	22.00
Hy	=	26.53
Ne	=	-
Ol	=	0.56
Chr	=	0.80
Ilm	=	24.84
Apa	=	0.09

TOTAL		99.55
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100 Mg/(Mg+Fe) = 47.0

An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	10.0	(ID)
Rb	=	0.59	(ID)
K	=	552.0	(ID)
Ba	=	78.5	(ID)
Sr	=	-	
Cr	=	4400	(NAA)
V	=	-	
Sc	=	77	(NAA)
Ni	=	-	
Co	=	17.6	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	0.39	(GAM)
U	=	0.11	(GAM)
Zr	=	-	
Hf	=	8.9	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	6.43
Ce	=	22.3
Pr	=	-
Nd	=	24.7
Sm	=	10.3
Eu	=	2.08
Gd	=	15.7
Tb	=	-
Dy	=	18.0
Ho	=	-
Er	=	11.0
Tm	=	-
Yb	=	9.69
Lu	=	1.52
Y	=	-

ROCK NUMBER: 71546
WEIGHT: 150.7 g

DIMENSIONS: 6.0 x 4.4 x 3.3 cm

BINOCULAR DESCRIPTION

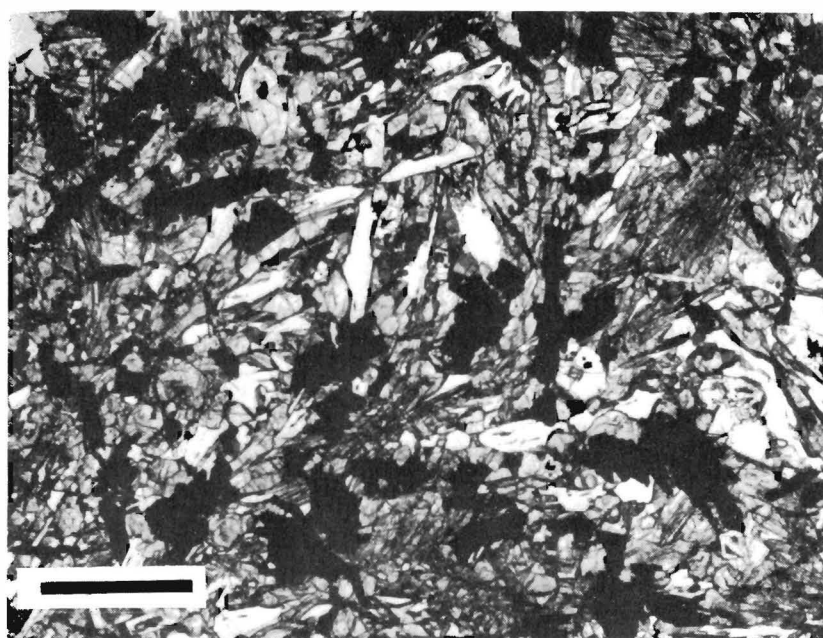
COLOR: Dark gray
SHAPE: Subangular
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: Few, non-penetrative
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: None
CAVITIES: 5% vugs, 2% vesicles
SPECIAL FEATURES: Vesicles are lined with plates of ilmenite

BY: Keil, Dowty, Prinz

71546



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	39.14
TiO ₂	=	12.33
Al ₂ O ₃	=	8.91
FeO	=	19.11
MnO	=	0.28
MgO	=	8.34
CaO	=	10.79
Na ₂ O	=	0.40
K ₂ O	=	0.05
P ₂ O ₅	=	0.05
S	=	0.19
Cr ₂ O ₃	=	0.41

TOTAL 100.00

CIPW NORM

Qtz	=	1.08
Or	=	0.30
Ab	=	3.38
An	=	22.37
Di	=	25.26
Hy	=	23.29
Ne	=	-
Ol	=	-
Chr	=	0.60
Ilm	=	23.42
Apa	=	0.11

TOTAL 99.81

100 Mg/(Mg+Fe) = 43.8
An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	10.2	(ID)
Rb	=	0.63	(ID)
K	=	580	(ID)
Ba	=	83.2	(ID)
Sr	=	191	(ID)
Cr	=	3450	(NAA)
V	=	120	(NAA)
Sc	=	80	(NAA)
Ni	=	-	
Co	=	18.4	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	0.40	(GAM)
U	=	0.15	(GAM)
Zr	=	-	
Hf	=	9.4	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	6.69	
Ce	=	23.8	
Pr	=	-	
Nd	=	25.9	
Sm	=	10.7	
Eu	=	2.14	
Gd	=	16.7	
Tb	=	-	
Dy	=	19.1	
Ho	=	-	
Er	=	11.2	
Tm	=	-	
Yb	=	10.3	
Lu	=	1.47	(NAA)
Y	=	-	

ROCK NUMBER: 71557
WEIGHT: 40.35 g

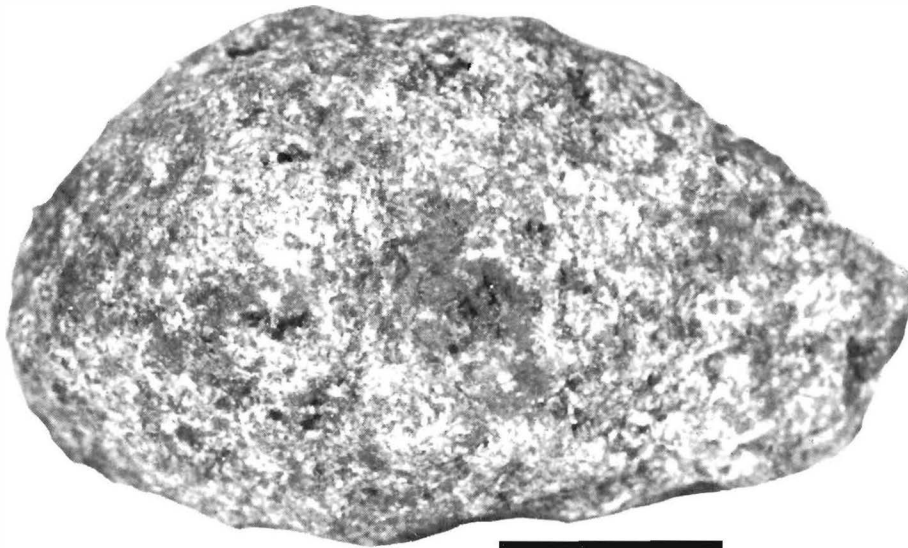
DIMENSIONS: 3.2 x 2.7 x 2.5 cm

BINOCULAR DESCRIPTION

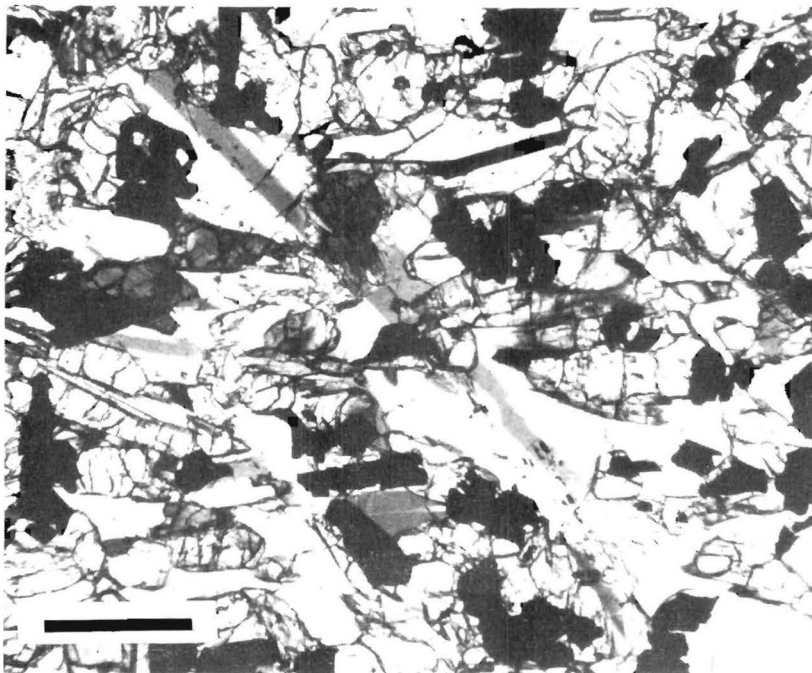
COLOR: Medium dark gray (N4)
SHAPE: Subrounded
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: Few, non-penetrative
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: None
CAVITIES: 2% vugs

BY: Keil, Dowty, Prinz

71557



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.39
TiO ₂	=	13.00
Al ₂ O ₃	=	9.30
FeO	=	19.10
MnO	=	0.24
MgO	=	8.50
CaO	=	10.50
Na ₂ O	=	0.41
K ₂ O	=	0.06
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.51
TOTAL		<u>100.01</u>

CIPW NORM

Qtz	=	0.61
Or	=	0.35
Ab	=	3.47
An	=	23.36
Di	=	23.44
Hy	=	23.34
Ne	=	-
Ol	=	-
Chr	=	0.75
Ilm	=	24.69
Apa	=	-
TOTAL		<u>100.01</u>

100 Mg/(Mg+Fe) = 44.2
An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	-
Rb	=	-
K	=	473 (NAA)
Ba	=	-
Sr	=	-
Cr	=	-
V	=	120 (NAA)
Sc	=	80 (NAA)
Ni	=	-
Co	=	19.3 (NAA)
Cu	=	-
Zn	=	-
Th	=	-
U	=	-
Zr	=	-
Hf	=	6.8 (NAA)
Nb	=	-

RARE EARTH ELEMENTS (NAA)

La	=	4.8
Ce	=	24
Pr	=	-
Nd	=	-
Sm	=	7.5
Eu	=	1.72
Gd	=	-
Tb	=	1.8
Dy	=	13
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	7.2
Lu	=	1.1
Y	=	-

ROCK NUMBER: 71559
WEIGHT: 82.16 g

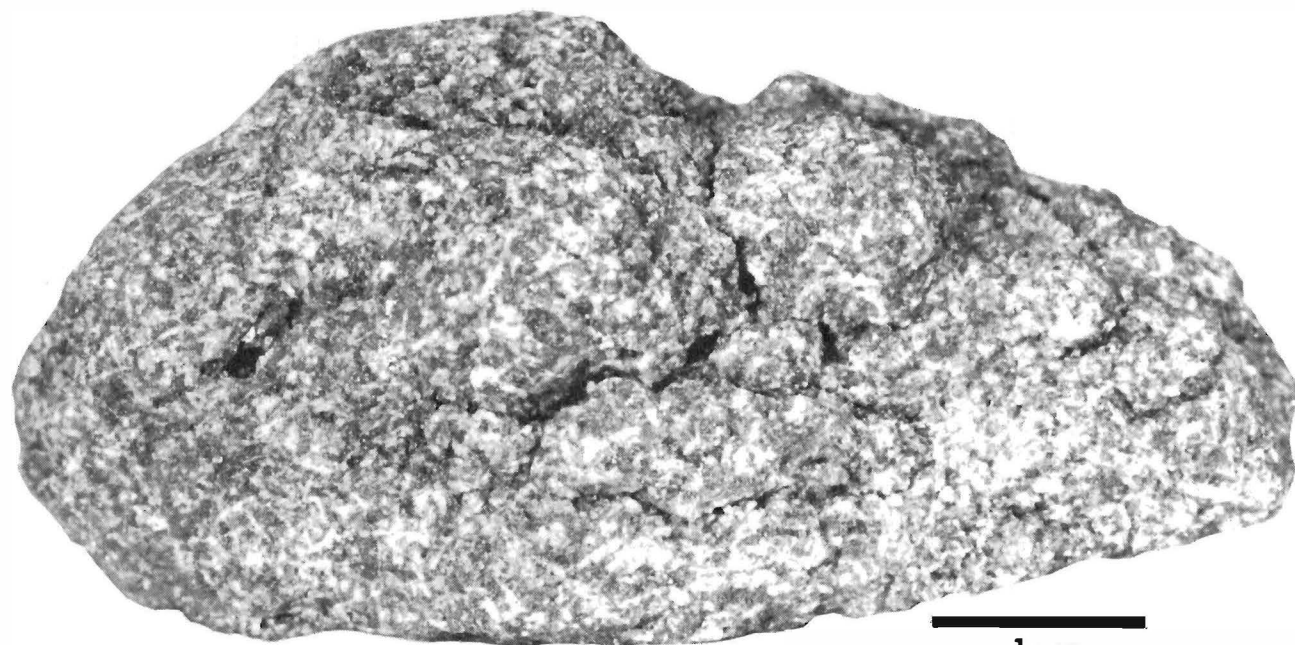
DIMENSIONS: 6.3 x 3.5 x 3.4 cm

BINOCULAR DESCRIPTION

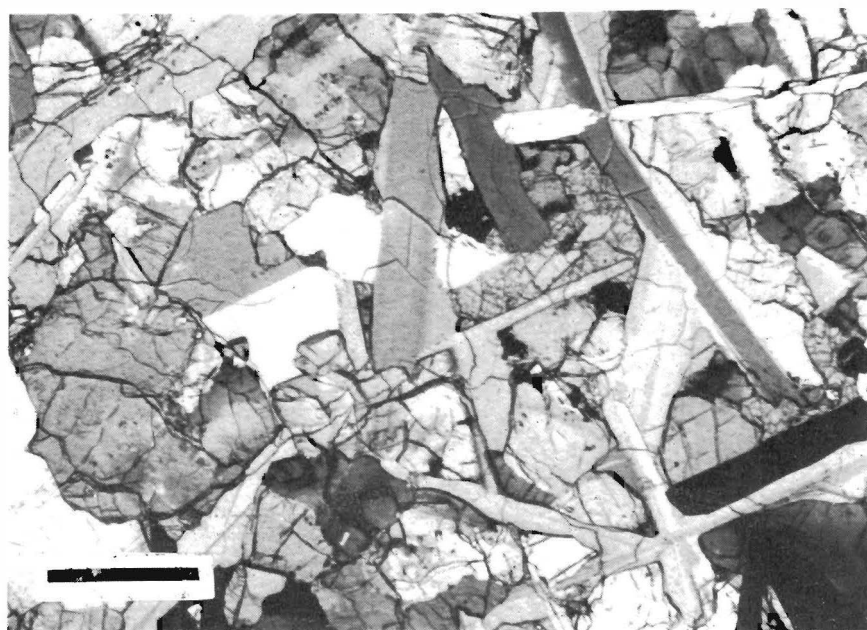
COLOR: Dark gray (N3)
SHAPE: Blocky - subangular
FABRIC: Isotropic
COHERENCE: Intergranular - Friable
Fracturing: Few, nearly penetrative
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: None
CAVITIES: 1% vugs
SPECIAL FEATURES:

BY: Keil, Dowty, Prinz

71559



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	44.10
TiO ₂	=	8.30
Al ₂ O ₃	=	10.30
FeO	=	17.80
MnO	=	0.23
MgO	=	6.30
CaO	=	12.20
Na ₂ O	=	0.48
K ₂ O	=	0.07
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.23
<hr/>		
TOTAL		100.00

CIPW NORM

Qtz	=	4.28
Or	=	0.40
Ab	=	4.06
An	=	25.75
Di	=	28.97
Hy	=	20.44
Ne	=	-
Ol	=	-
Chr	=	0.34
Ilm	=	15.76
Apa	=	-
<hr/>		
TOTAL		100.00

100 Mg/(Mg+Fe) = 38.7
 An/Ab/Or = 85.2/13.4/1.3

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	-	
K	=	565	(NAA)
Ba	=	-	
Sr	=	-	
Cr	=	-	
V	=	30	(NAA)
Sc	=	72	(NAA)
Ni	=	-	
Co	=	14.4	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	8.8	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	6.6
Ce	=	26
Pr	=	-
Nd	=	24
Sm	=	10.4
Eu	=	2.2
Gd	=	-
Tb	=	2.6
Dy	=	17
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	9.2
Lu	=	1.4
Y	=	-

ROCK NUMBER: 71566
WEIGHT: 415.4 g

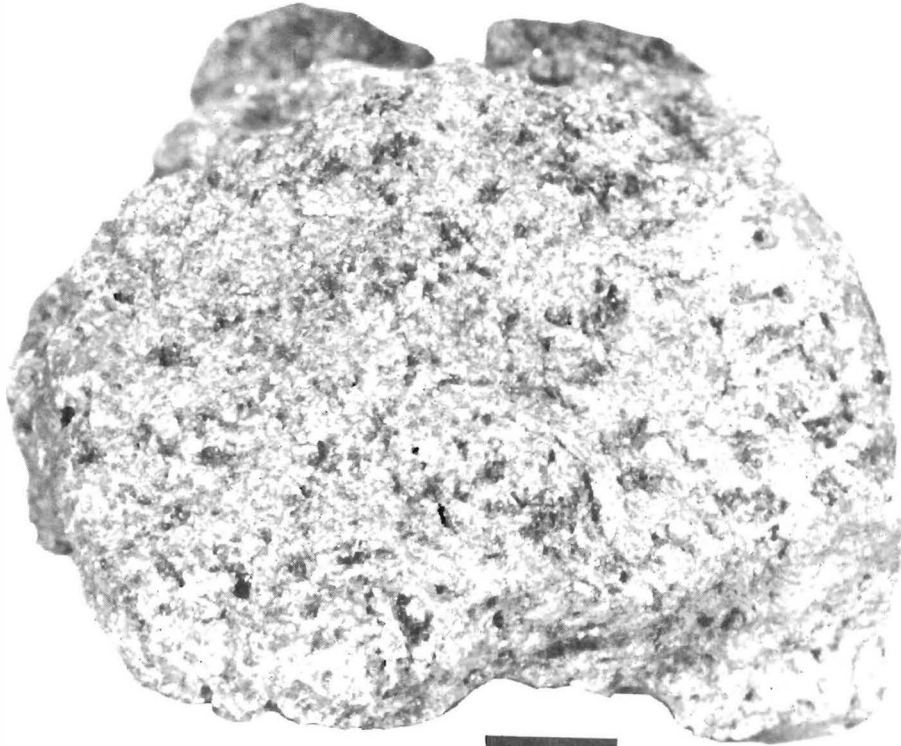
DIMENSIONS: 10.6 x 6.3 x 4.7 cm

BINOCULAR DESCRIPTION

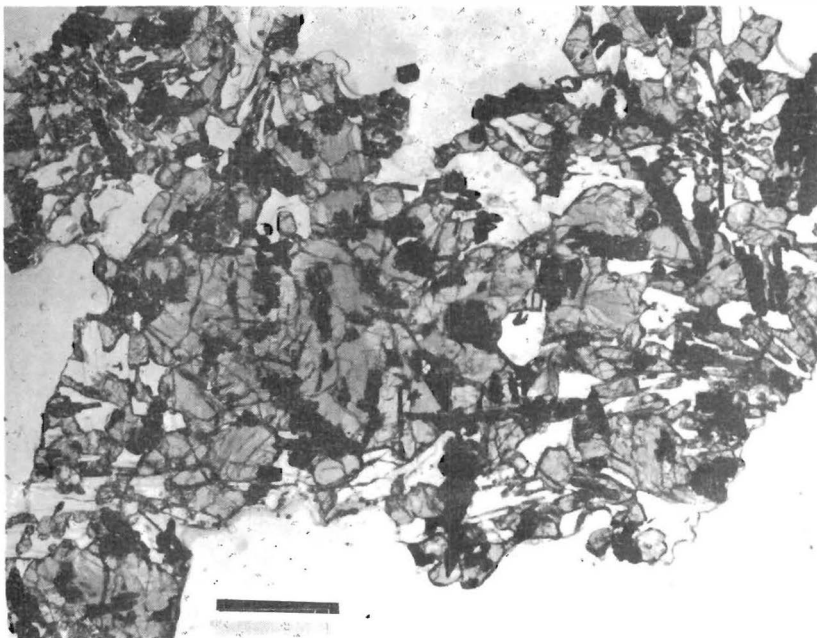
COLOR: Medium dark gray (N4)
SHAPE: Subrounded
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: Few nearly penetrative
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: None
CAVITIES: 2% vugs, 1% vesicles
SPECIAL FEATURES: Vesicles lined with ilmenite.

BY: Keil, Dowty, Prinz

71566



1 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	39.27
TiO ₂	=	12.01
Al ₂ O ₃	=	9.22
FeO	=	18.73
MnO	=	0.27
MgO	=	8.40
CaO	=	10.89
Na ₂ O	=	0.40
K ₂ O	=	0.03
P ₂ O ₅	=	0.03
S	=	0.16
Cr ₂ O ₃	=	0.38
<hr/>		
TOTAL		99.79

CIPW NORM

Qtz	=	0.94
Or	=	0.18
Ab	=	3.38
An	=	23.27
Di	=	25.01
Hy	=	23.41
Ne	=	-
Ol	=	-
Chr	=	0.56
Ilm	=	22.81
Apa	=	0.07
<hr/>		
TOTAL		99.63

100 Mg/(Mg+Fe) = 44.4
 An/Ab/Or = 86.7/12.6/.7

TRACE AND MINOR ELEMENTS

Li	=	-
Rb	=	-
K	=	382 (NAA)
Ba	=	-
Sr	=	-
Cr	=	3430 (NAA)
V	=	90 (NAA)
Sc	=	78 (NAA)
Ni	=	-
Co	=	18.1 (NAA)
Cu	=	-
Zn	=	-
Th	=	-
U	=	-
Zr	=	-
Hf	=	7.8 (NAA)
Nb	=	-

RARE EARTH ELEMENTS (NAA)

La	=	4.29
Ce	=	17.2
Pr	=	-
Nd	=	-
Sm	=	7.62
Eu	=	1.75
Gd	=	-
Tb	=	-
Dy	=	-
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	7.9
Lu	=	1.16
Y	=	-

ROCK NUMBER: 71567
WEIGHT: 146.0 g

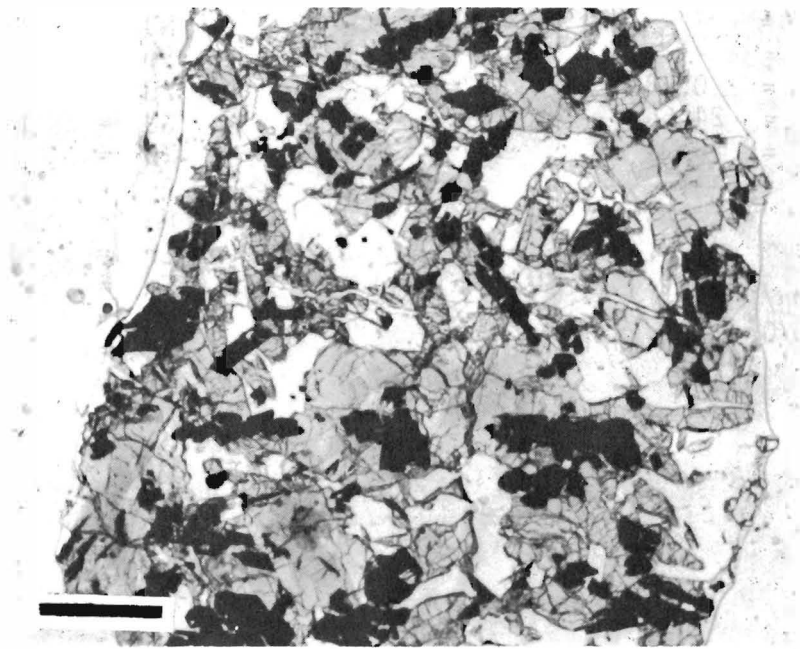
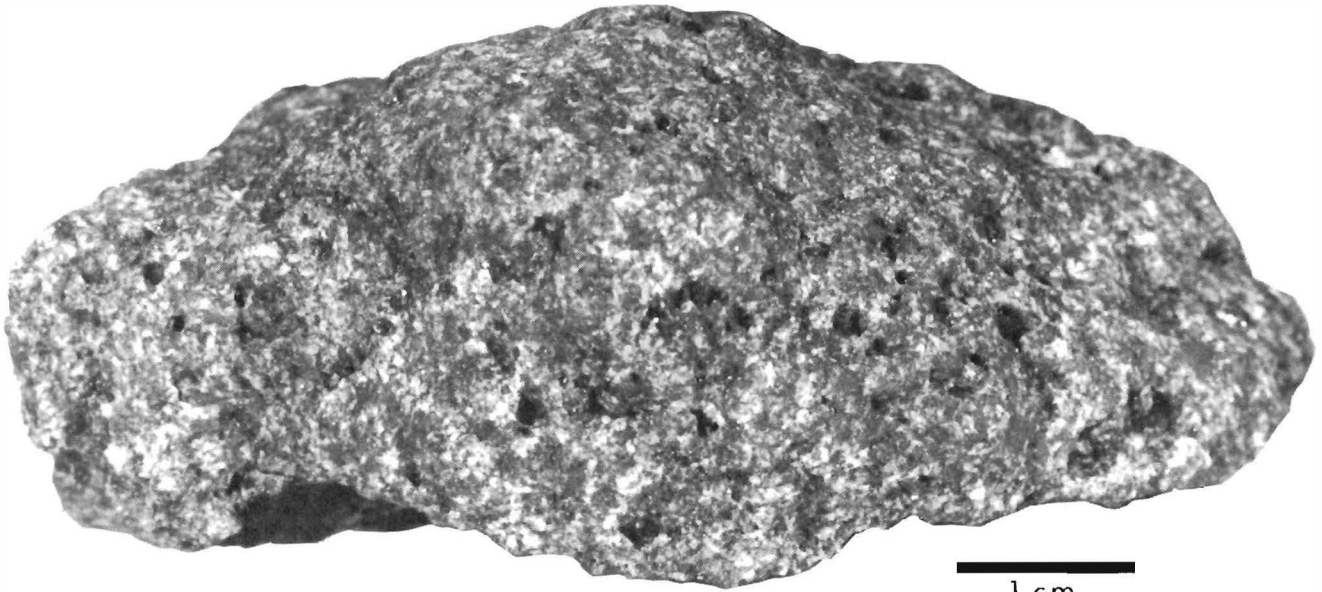
DIMENSIONS: 5.8 x 5.0 x 4.2 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4)
SHAPE: Subrounded
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: Few, non-penetrative
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: None
CAVITIES: 5% vugs
SPECIAL FEATURES:

BY: Keil, Dowty, Prinz

71567



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.06
TiO ₂	=	12.98
Al ₂ O ₃	=	8.59
FeO	=	19.40
MnO	=	0.28
MgO	=	8.83
CaO	=	10.57
Na ₂ O	=	0.38
K ₂ O	=	0.03
P ₂ O ₅	=	0.02
S	=	0.16
Cr ₂ O ₃	=	0.43

TOTAL		99.73
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CIPW NORM

Qtz	=	0.07
Or	=	0.18
Ab	=	3.22
An	=	21.65
Di	=	25.03
Hy	=	24.10
Ne	=	-
Ol	=	-
Chr	=	0.63
Ilm	=	24.65
Apa	=	0.04

TOTAL		99.57
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100 Mg/(Mg+Fe) = 44.8

An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	9.2	(ID)
Rb	=	0.39	(ID)
K	=	386	(ID)
Ba	=	54.4	(ID)
Sr	=	161	(ID)
Cr	=	3690	(NAA)
V	=	100	(NAA)
Sc	=	79	(NAA)
Ni	=	-	
Co	=	19.9	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	7.6	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	4.15	
Ce	=	14.4	
Pr	=	-	
Nd	=	16.3	
Sm	=	6.91	
Eu	=	1.66	
Gd	=	11.4	
Tb	=	-	
Dy	=	12.7	
Ho	=	-	
Er	=	8.28	
Tm	=	-	
Yb	=	7.35	
Lu	=	1.08	(NAA)
Y	=	-	

ROCK NUMBER: 71569
WEIGHT: 289.6 g

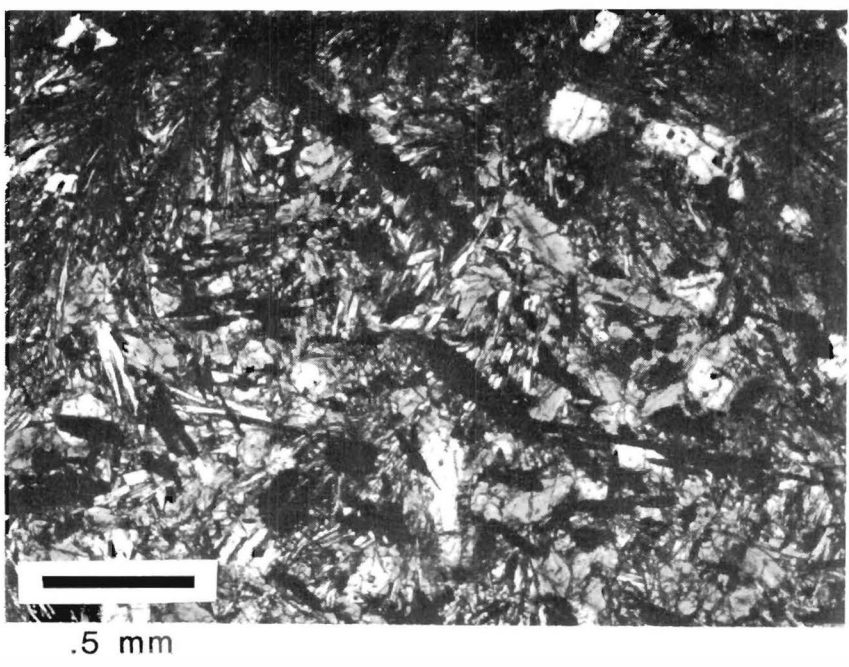
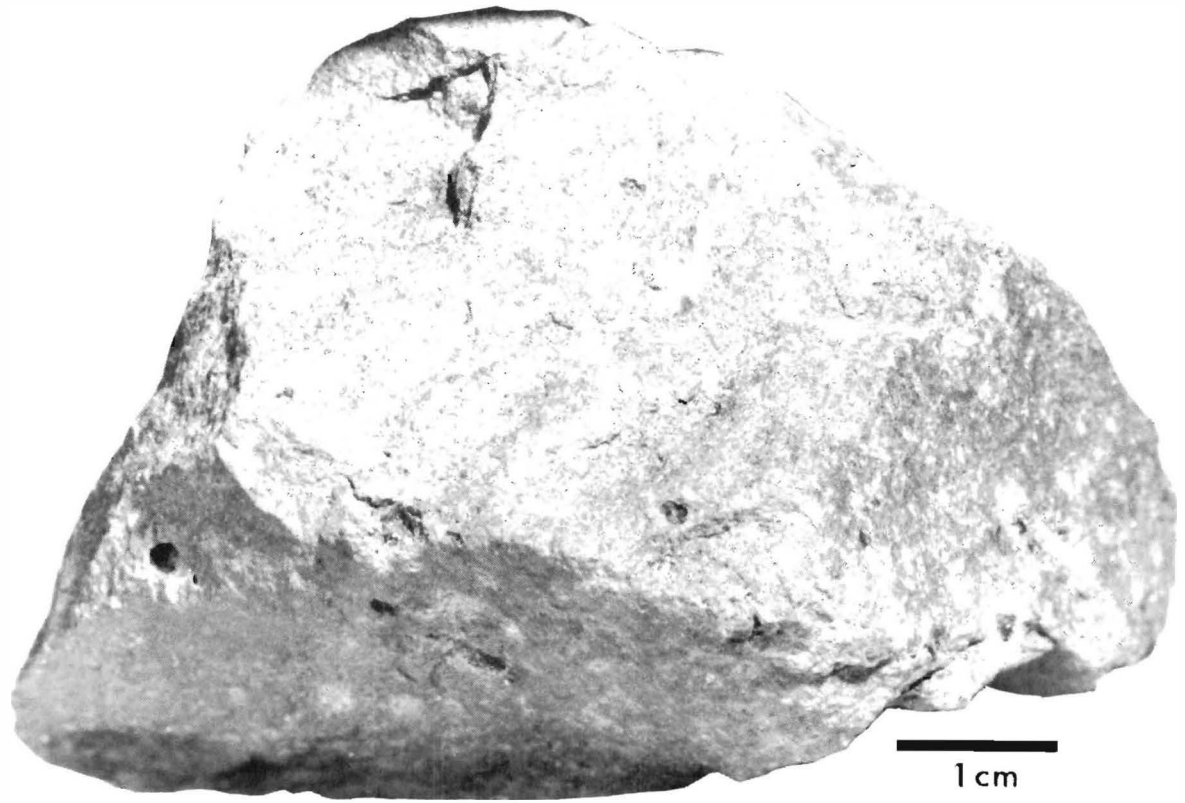
DIMENSIONS: 8.3 x 7.5 x 4.1 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray (N3)
SHAPE: Subangular
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: None
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: Few
CAVITIES: 1% vugs, 1% vesicles
SPECIAL FEATURES: Vesicles lined with ilmenite

BY: Keil, Dowty, Prinz

71569



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	39.97
TiO ₂	=	11.57
Al ₂ O ₃	=	9.08
FeO	=	18.85
MnO	=	0.28
MgO	=	7.66
CaO	=	11.27
Na ₂ O	=	0.41
K ₂ O	=	0.06
P ₂ O ₅	=	0.06
S	=	0.19
Cr ₂ O ₃	=	0.36
TOTAL		99.76

CIPW NORM

Qtz	=	1.87
Or	=	0.35
Ab	=	3.47
An	=	22.76
Di	=	26.97
Hy	=	21.52
Ne	=	-
Ol	=	-
Chr	=	0.53
Ilm	=	21.97
Apa	=	0.13
TOTAL		99.57

100 Mg/(Mg+Fe) = 42.0
 An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	10.1	(ID)
Rb	=	0.64	(ID)
K	=	585	(ID)
Ba	=	84.4	(ID)
Sr	=	195	(ID)
Cr	=	3020	(NAA)
V	=	-	
Sc	=	81	(NAA)
Ni	=	-	
Co	=	18	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	9.7	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	6.74	
Ce	=	23.8	
Pr	=	-	
Nd	=	26.3	
Sm	=	10.9	
Eu	=	2.19	
Gd	=	17.1	
Tb	=	-	
Dy	=	19.0	
Ho	=	-	
Er	=	11.6	
Tm	=	-	
Yb	=	10.5	
Lu	=	1.5	(NAA)
Y	=	-	

ROCK NUMBER: 71577
WEIGHT: 234.7 g

DIMENSIONS: 4.9 x 4.8 x 4.7 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray (N3)
SHAPE:
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: None
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: Few
CAVITIES: 8% vugs (up to 2 cm long)
SPECIAL FEATURES: Vugs lined with ilmenite

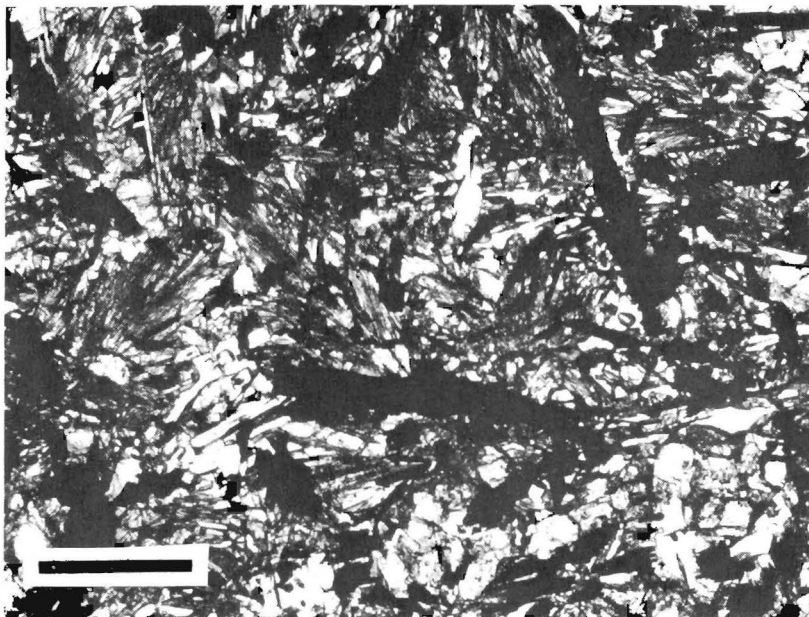
BY: Keil, Dowty, Prinz

71577

329



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	39.18
TiO ₂	=	12.04
Al ₂ O ₃	=	8.92
FeO	=	18.90
MnO	=	0.28
MgO	=	8.15
CaO	=	10.95
Na ₂ O	=	0.39
K ₂ O	=	0.06
P ₂ O ₅	=	0.05
S	=	0.17
Cr ₂ O ₃	=	0.41

TOTAL		99.50
-------	--	-------

CIPW NORM

Qtz	=	1.20
Or	=	0.35
Ab	=	3.30
An	=	22.41
Di	=	25.90
Hy	=	22.59
Ne	=	-
Ol	=	-
Chr	=	0.60
Ilm	=	22.87
Apa	=	0.11

TOTAL		99.33
-------	--	-------

100 Mg/(Mg+Fe) = 43.5

An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	10.4	(ID)
Rb	=	0.64	(ID)
K	=	583	(ID)
Ba	=	83.9	(ID)
Sr	=	-	
Cr	=	3610	(NAA)
V	=	110	(NAA)
Sc	=	81	(NAA)
Ni	=	-	
Co	=	18.4	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	9.7	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	6.9	
Ce	=	23.8	
Pr	=	-	
Nd	=	26.5	
Sm	=	11.0	
Eu	=	2.17	
Gd	=	16.8	
Tb	=	-	
Dy	=	19.5	
Ho	=	-	
Er	=	11.4	
Tm	=	-	
Yb	=	10.4	
Lu	=	1.43	(NAA)
Y	=	-	

ROCK NUMBER: 71578
WEIGHT: 353.9 g

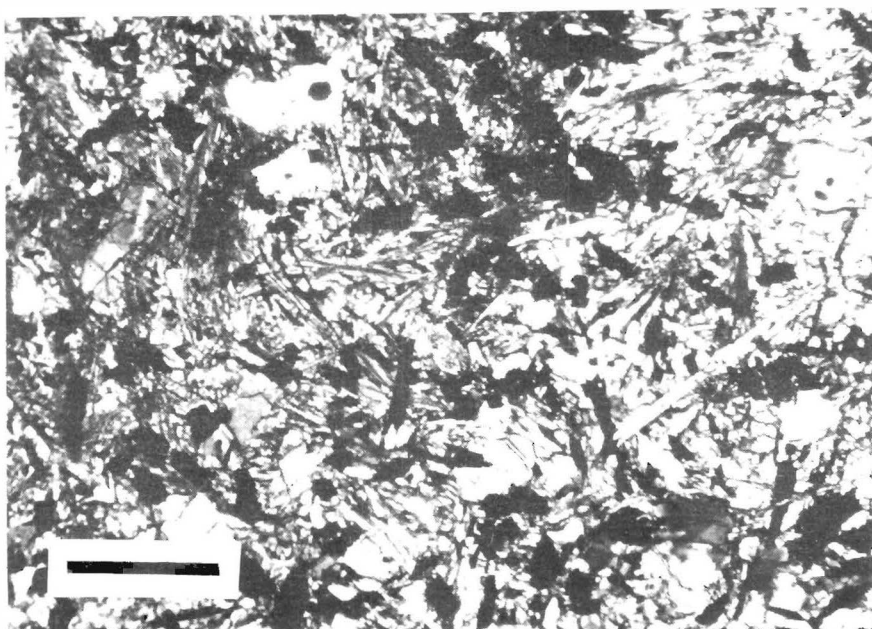
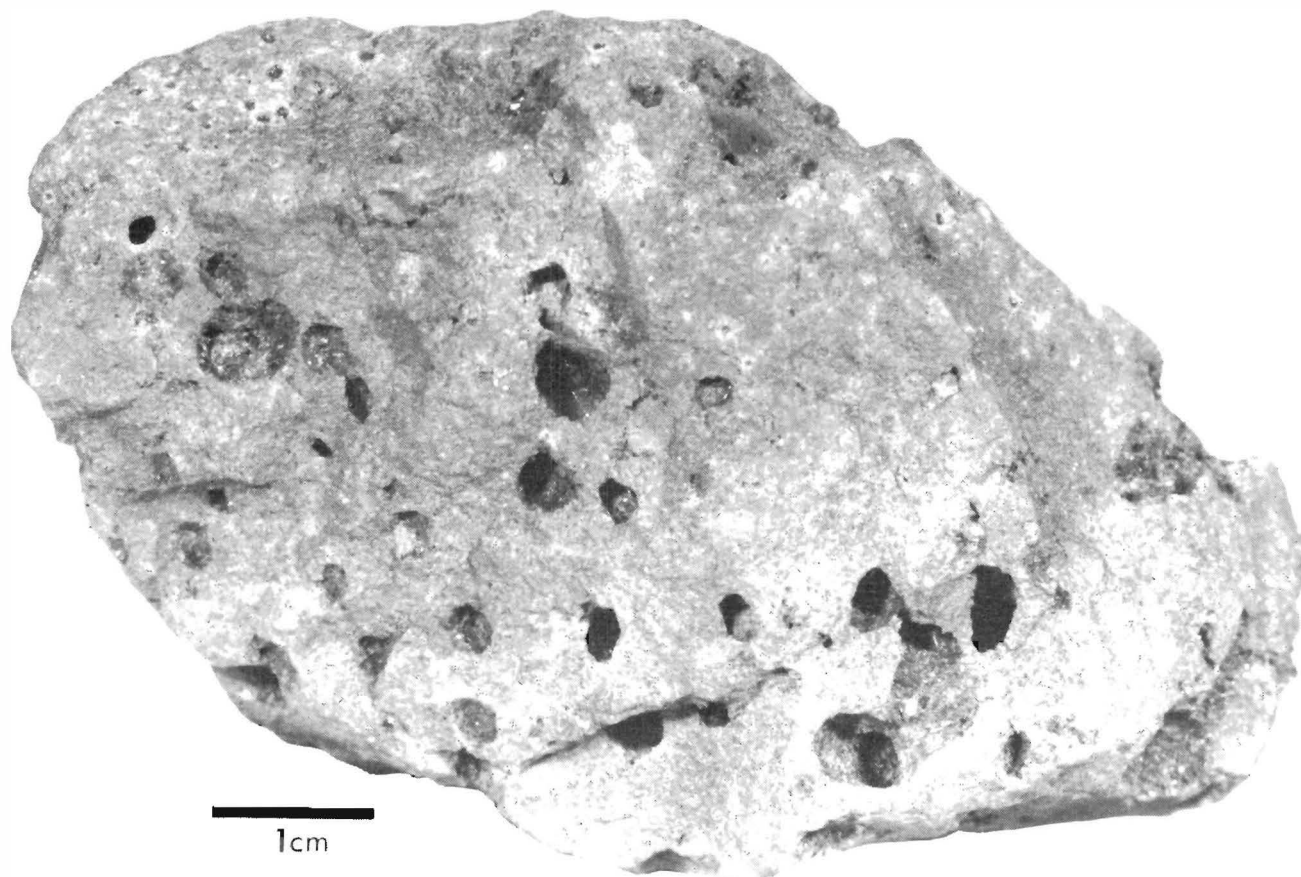
DIMENSIONS: 8.9 x 6.8 x 4.7 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4)
SHAPE: Subrounded
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: Few, non-penetrative
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: Few, many in places
CAVITIES: 5% vesicles lined with ilmenite, 1% vugs
SPECIAL FEATURES:

BY: Keil, Dowty, Prinz

71578



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	42.55
TiO ₂	=	11.70
Al ₂ O ₃	=	8.40
FeO	=	18.60
MnO	=	0.24
MgO	=	8.10
CaO	=	9.50
Na ₂ O	=	0.42
K ₂ O	=	0.07
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.42
<hr/>		
TOTAL		100.00

CIPW NORM

Qtz	=	6.30
Or	=	0.41
Ab	=	3.55
An	=	20.83
Di	=	21.55
Hy	=	24.52
Ne	=	-
Ol	=	-
Chr	=	0.62
Ilm	=	22.22
Apa	=	-
<hr/>		
TOTAL		100.00

100 Mg/(Mg+Fe) = 43.7
An/Ab/Or = 84/14/2

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	-	
K	=	581	(NAA)
Ba	=	-	
Sr	=	-	
Cr	=	-	
V	=	100	(NAA)
Sc	=	74	(NAA)
Ni	=	-	
Co	=	18.5	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	8.9	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	6
Ce	=	25
Pr	=	-
Nd	=	28
Sm	=	9.8
Eu	=	1.96
Gd	=	-
Tb	=	2.5
Dy	=	17
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	8.5
Lu	=	1.3
Y	=	-

ROCK NUMBER: 71587
WEIGHT: 41.27 g

DIMENSIONS: 5.0 x 2.9 x 1.6 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray (N3)
SHAPE: Subrounded
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
 Fracturing: None
VARIABILITY: Fine-grained, but coarser near vugs
SURFACE: Granulated
ZAP PITS: Few, to many
CAVITIES: 1-2% vugs, ilmenite commonly project into vugs
SPECIAL FEATURES: Possibly different from other basalts
 Ilmenite: Gets large and abundant near vugs.

BY: Keil, Dowty, Prinz

71587



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	40.42
TiO ₂	=	12.70
Al ₂ O ₃	=	8.70
FeO	=	19.20
MnO	=	0.24
MgO	=	7.60
CaO	=	10.30
Na ₂ O	=	0.39
K ₂ O	=	0.05
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.41
TOTAL		<u>100.00</u>

CIPW NORM

Qtz	=	4.33
Or	=	0.30
Ab	=	3.30
An	=	21.84
Di	=	23.99
Hy	=	21.53
Ne	=	-
Ol	=	-
Chr	=	0.60
Ilm	=	24.12
Apa	=	-
TOTAL		<u>100.01</u>

100 Mg/(Mg+Fe) = 41.4
An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	-
Rb	=	-
K	=	415 (NAA)
Ba	=	-
Sr	=	-
Cr	=	-
V	=	100 (NAA)
Sc	=	80 (NAA)
Ni	=	-
Co	=	20.8 (NAA)
Cu	=	-
Zn	=	-
Th	=	-
U	=	-
Zr	=	-
Hf	=	6.2 (NAA)
Nb	=	-

RARE EARTH ELEMENTS (NAA)

La	=	5.7
Ce	=	22
Pr	=	-
Nd	=	-
Sm	=	7.6
Eu	=	1.4
Gd	=	-
Tb	=	1.9
Dy	=	12
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	6.9
Lu	=	1.0
Y	=	-

ROCK NUMBER: 71588

WEIGHT: 48.98 g

DIMENSIONS: 3.8 x 3.0 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray (N3)

SHAPE: Subangular

FABRIC: Isotropic

COHERENCE: Intergranular - Coherent

Fracturing: Few, near-penetrative

VARIABILITY: None

SURFACE: Granulated

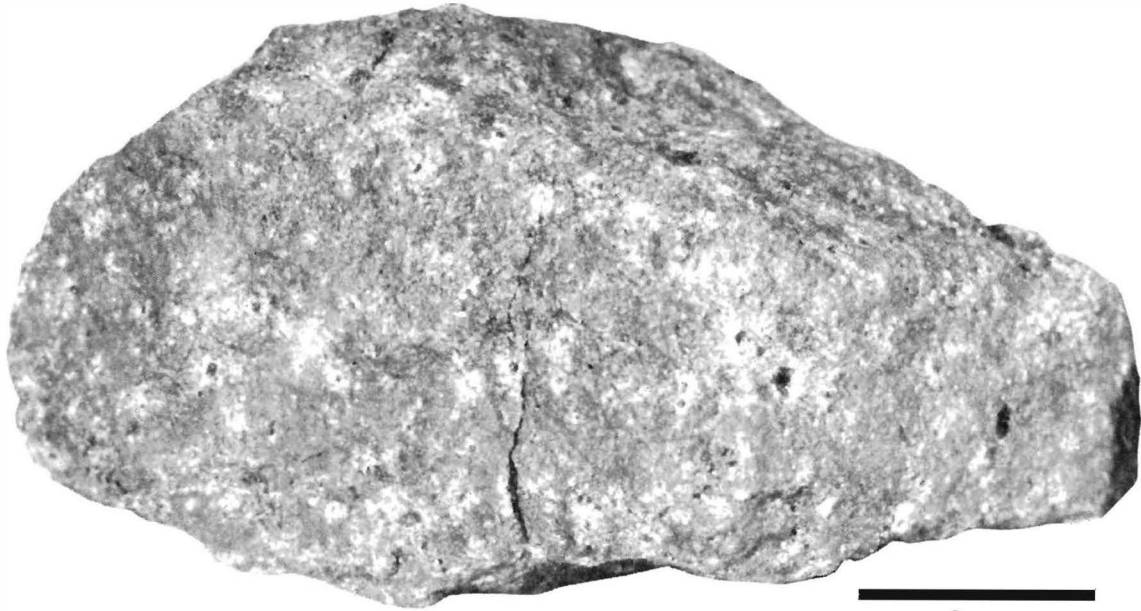
ZAP PITS: Few, one large one (3 mm)

CAVITIES: 2% vugs

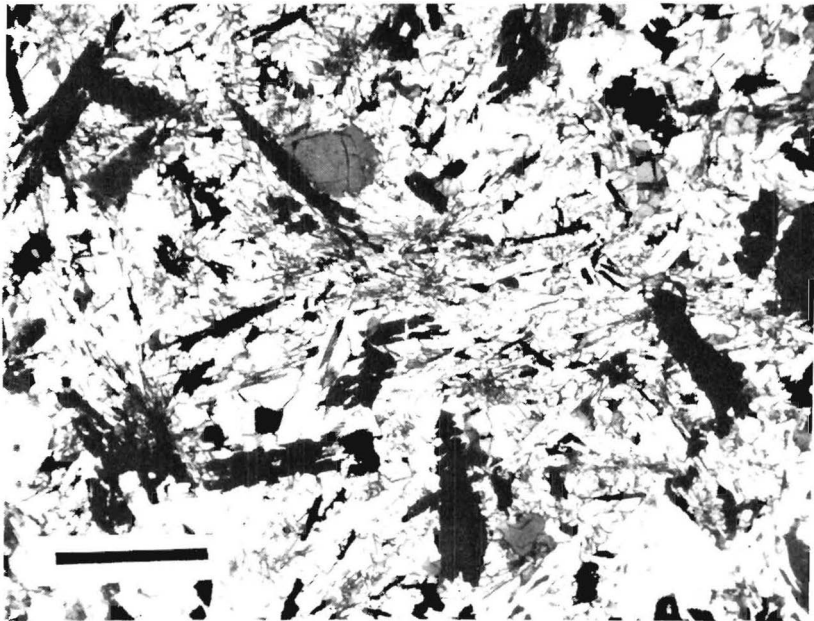
SPECIAL FEATURES:

BY: Keil, Dowty, Prinz

71588



1 cm



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	40.55
TiO ₂	=	12.00
Al ₂ O ₃	=	8.40
FeO	=	19.90
MnO	=	0.24
MgO	=	8.00
CaO	=	10.10
Na ₂ O	=	0.35
K ₂ O	=	0.04
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.42
TOTAL		<u>100.00</u>

CIPW NORM

Qtz	=	3.37
Or	=	0.24
Ab	=	2.96
An	=	21.23
Di	=	23.76
Hy	=	25.04
Ne	=	-
Ol	=	-
Chr	=	0.62
Ilm	=	22.79
Apa	=	-
TOTAL		<u>100.01</u>

100 Mg/(Mg+Fe) = 41.7
An/Ab/Or = 87/12/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	-	
K	=	332	(NAA)
Ba	=	-	
Sr	=	-	
Cr	=	-	
V	=	110	(NAA)
Sc	=	79	(NAA)
Ni	=	-	
Co	=	23.1	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	6.0	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	4.9
Ce	=	18
Pr	=	-
Nd	=	-
Sm	=	6.1
Eu	=	1.3
Gd	=	-
Tb	=	1.7
Dy	=	11
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	6.2
Lu	=	0.91
Y	=	-

ROCK NUMBER: 71596
WEIGHT: 61.05 g

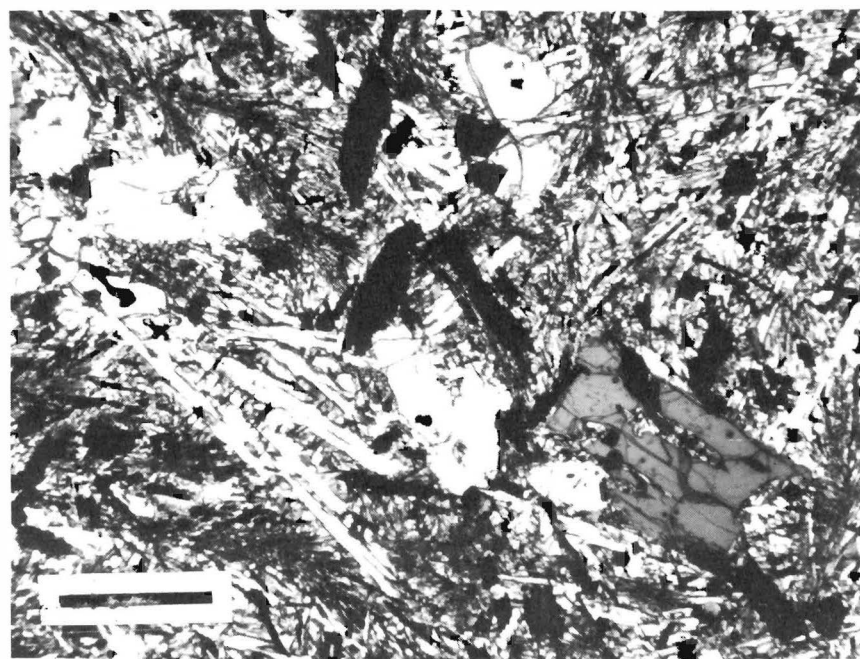
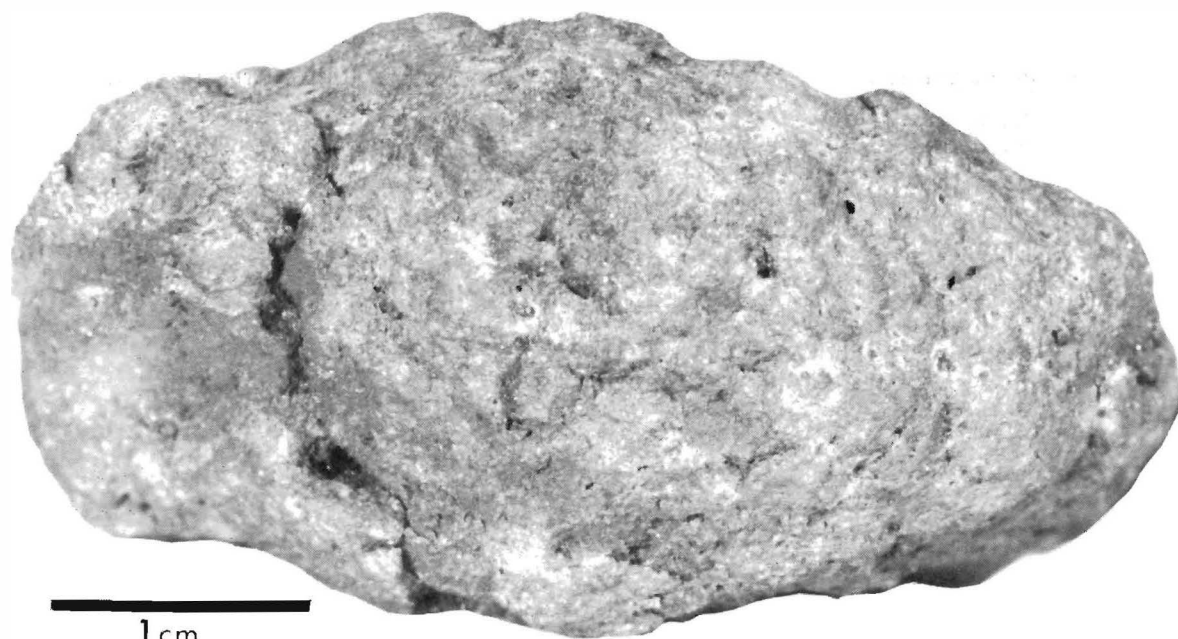
DIMENSIONS: 4.1 x 3.6 c 2.3 cm

BINOCULAR DESCRIPTION

COLOR: Dark gray (N3)
SHAPE: Subrounded
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: Few, non-penetrative
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: Few to many
CAVITIES: 1% vugs
SPECIAL FEATURES:

BY: Keil, Dowty, Prinz

71596



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	41.83
TiO ₂	=	11.00
Al ₂ O ₃	=	9.20
FeO	=	18.80
MnO	=	0.25
MgO	=	7.80
CaO	=	10.30
Na ₂ O	=	0.38
K ₂ O	=	0.04
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.40
<hr/>		
TOTAL		100.00

CIPW NORM

Qtz	=	4.26
Or	=	0.26
Ab	=	3.22
An	=	23.27
Di	=	22.90
Hy	=	24.61
Ne	=	-
Ol	=	-
Chr	=	0.59
Ilm	=	20.89
Apa	=	-
<hr/>		
TOTAL		100.00
100 Mg/(Mg+Fe) = 42.5		
An/Ab/Or = 87/12/1		

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	-	
K	=	365	(NAA)
Ba	=	-	
Sr	=	-	
Cr	=	-	
V	=	120	(NAA)
Sc	=	75	(NAA)
Ni	=	-	
Co	=	20.2	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	6.3	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	5.5
Ce	=	21
Pr	=	-
Nd	=	20
Sm	=	7.2
Eu	=	1.5
Gd	=	-
Tb	=	1.8
Dy	=	11
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	6.5
Lu	=	0.96
Y	=	-

ROCK NUMBER: 72155
WEIGHT: 238.5 g

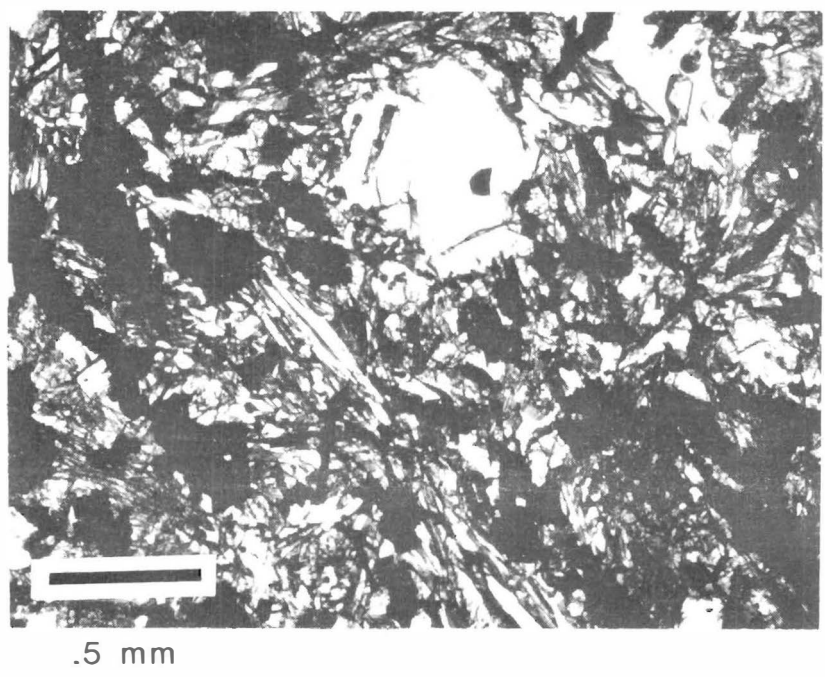
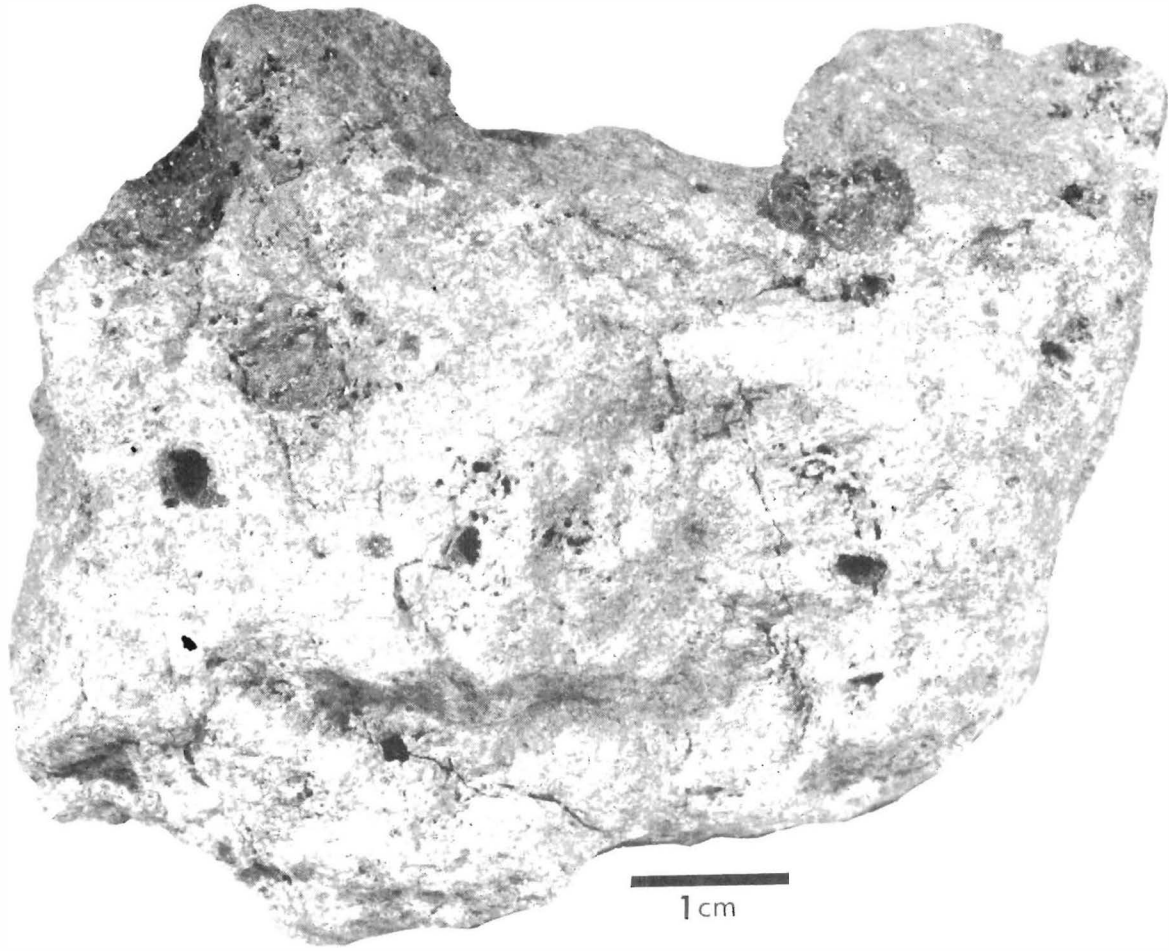
DIMENSIONS: 7 x 5 x 4

BINOCULAR DESCRIPTION

COLOR: Brownish gray (5YR 4/1)
SHAPE: Blocky-angular
FABRIC: Porphyritic, scarce olivine phenocrysts
COHERENCE: Intergranular - Tough
Fracturing: No penetrative
VARIABILITY: Homogeneous
SURFACE: Hackly
ZAP PITS: Few on E, W, B. Many on S, T.
CAVITIES: 10%, as 1 x 2 cm to <1 mm vugs and vesicles. Vesicles have projecting crystals and linings of pyroxene and ilmenite.
SPECIAL FEATURES: Extremely well developed flat black and gold hexagonal plates occur in larger cavities. Some are up to 1 mm in diameter and have grown parallel to wall.

BY: Morrison, Wilshire

72155



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.67
TiO ₂	=	12.32
Al ₂ O ₃	=	8.64
FeO	=	18.77
MnO	=	-
MgO	=	8.47
CaO	=	10.69
Na ₂ O	=	0.40
K ₂ O	=	0.07
P ₂ O ₅	=	0.05
S	=	0.15
Cr ₂ O ₃	=	-
<hr/>		
TOTAL		98.08

CIPW NORM

Qtz	=	0.97
Or	=	0.41
Ab	=	3.38
An	=	21.57
Di	=	25.45
Hy	=	22.78
Ne	=	-
Ol	=	-
Chr	=	-
Ilm	=	23.40
Apa	=	0.11
<hr/>		
TOTAL		98.08

100 Mg/(Mg+Fe) = 44.6
An/Ab/Or = 85/13/2

TRACE AND MINOR ELEMENTS

Li	=	9.4	(ID)
Rb	=	0.609	(ID)
K	=	560	(ID)
Ba	=	78.1	(ID)
Sr	=	180	(ID)
Cr	=	3220	(NAA)
V	=	100	(NAA)
Sc	=	80	(NAA)
Ni	=	1.5	(NAA)
Co	=	18.8	(NAA)
Cu	=	-	
Zn	=	2.2	(NAA)
Th	=	0.3879	(MS)
U	=	0.1182	(MS)
Zr	=	271	(NAA)
Hf	=	8.7	(NAA)
Nb	=	22	(NAA)

RARE EARTH ELEMENTS (ID)

La	=	6.38
Ce	=	22.1
Pr	=	-
Nd	=	24.4
Sm	=	10.2
Eu	=	2.02
Gd	=	15.6
Tb	=	-
Dy	=	18.3
Ho	=	-
Er	=	10.8
Tm	=	-
Yb	=	9.7
Lu	=	-
Y	=	-

ROCK NUMBER: 74235
WEIGHT: 59.04 g

DIMENSIONS: 4.3 x 3.4 x 3.3 cm

BINOCULAR DESCRIPTION

COLOR: Grayish black (N2) with metallic luster

SHAPE: Angular, blocky

FABRIC: Aphanitic

COHERENCE: Intergranular - Tough

Fracturing: Few, penetrative

VARIABILITY: Homogeneous

SURFACE: Smooth to gently lumpy inside vesicles; hackly on rest of rock.

ZAP PITS: None

CAVITIES: Vesicles and minor small vugs. Vesicles 0.5 mm to 3 cm, dominantly 1 cm range.

SPECIAL FEATURES: Large vesicles (see photo) lined with felted mats of thin ilmenite needles up to 2 mm long.

Ilmenite: Thin needles line vesicles and also some in groundmass near vesicles.

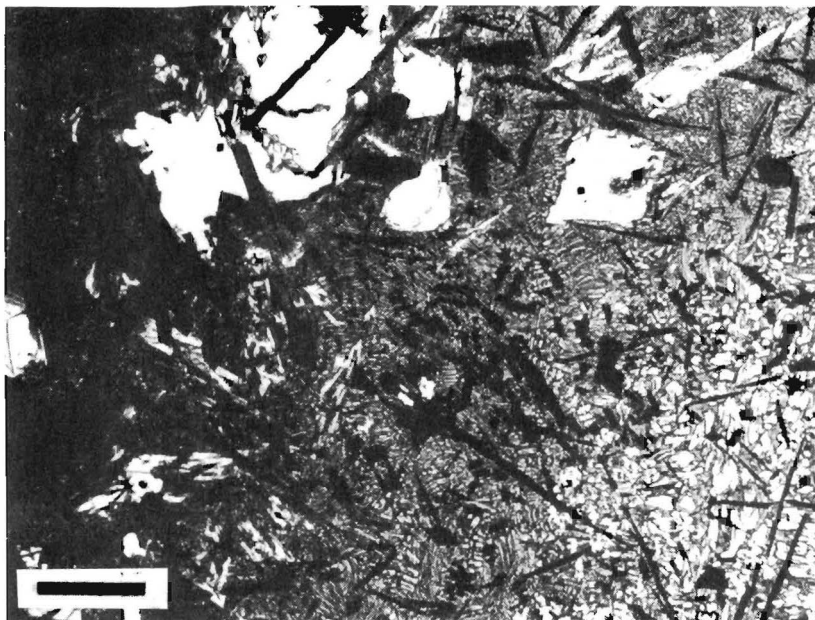
Groundmass: Aphanitic. Probably crystalline because no vitreous luster and no conchoidal fractures. Appears slightly grainy under highest power.

BY: Stuart-Alexander, Hörz

74235



1 cm



.2 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	39.02
TiO ₂	=	12.28
Al ₂ O ₃	=	8.91
FeO	=	18.93
MnO	=	0.27
MgO	=	8.90
CaO	=	10.78
Na ₂ O	=	0.38
K ₂ O	=	0.08
P ₂ O ₅	=	0.05
S	=	0.15
Cr ₂ O ₃	=	0.47

TOTAL	100.22
-------	--------

CIPW NORM

Qtz	=	0.27
Or	=	0.44
Ab	=	3.26
An	=	22.36
Di	=	25.16
Hy	=	24.45
Ne	=	-
Ol	=	-
Chr	=	0.69
Ilm	=	23.32
Apa	=	0.11

TOTAL	100.07
-------	--------

100 Mg/(Mg+Fe) = 45.6
An/Ab/Or = 86/12/2

TRACE AND MINOR ELEMENTS

Li	=	13.3	(ID)
Rb	=	0.612	(ID)
K	=	560	(ID)
Ba	=	82.2	(ID)
Sr	=	186	(ID)
Cr	=	-	
V	=	61	(XRF)
Sc	=	81.4	(NAA)
Ni	=	1.0	(XRF)
Co	=	19.1	(NAA)
Cu	=	29	(XRF)
Zn	=	3.7	(XRF)
Th	=	0.4004	(MS)
U	=	0.12	(MS)
Zr	=	263	(ID)
Hf	=	-	
Nb	=	10	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	11.4	
Ce	=	22.8	
Pr	=	-	
Nd	=	25.3	
Sm	=	10.5	
Eu	=	2.10	
Gd	=	16.6	
Tb	=	-	
Dy	=	18.8	
Ho	=	-	
Er	=	11.1	
Tm	=	-	
Yb	=	9.85	
Lu	=	-	
Y	=	160	(XRF)

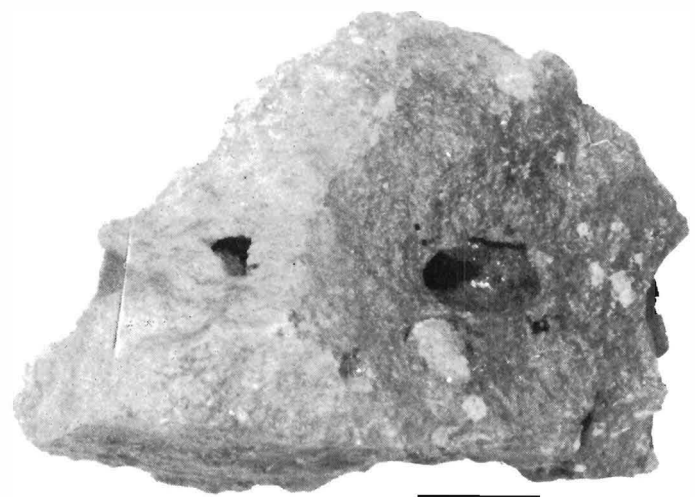
ROCK NUMBER: 74245
WEIGHT: 64.34 g DIMENSIONS: 5.5 x 3.5 x 2 cm

BINOCULAR DESCRIPTION

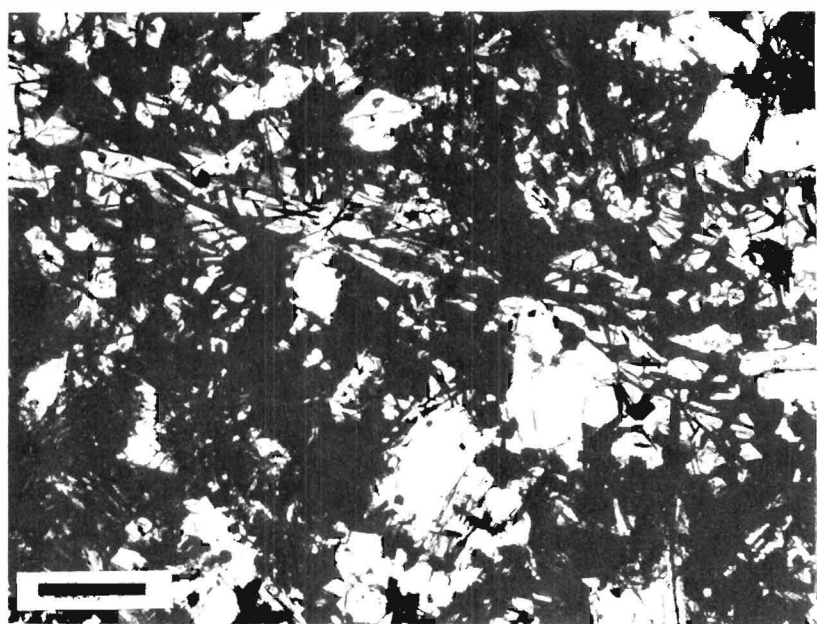
COLOR: Dark gray (N3); grayish black (N2) with a semi-metallic luster on surfaces of former cavities
SHAPE: Angular, wedge-shaped
FABRIC: Very fine-grained to aphanitic
COHERENCE: Intergranular - Very tough
Fracturing: Minor fractures could yield thin chips near large cavities.
VARIABILITY: Homogeneous
SURFACE: Both of the broadest surfaces are fresh fractures. The thicker edge of the wedge and the blunt end are remnants of former interior cavity walls. They are irregular and somewhat intricately patterned but smoothed over with a black surface layer having semimetallic luster and numerous felty ilmenite needles.
ZAP PITS: None observed
CAVITIES: About 20% of fractured surfaces; 0.3 mm to 1 cm; rounded to somewhat irregular; lined with felty intergrowths of lustrous ilmenite needles.
SPECIAL FEATURES: The rock is too fine-grained to estimate a mode. It is a dense, ilmenite-rich basalt with a grain size of <0.1 mm. The groundmass includes fine needles visible only in reflected light. Yellow grains of a mafic silicate (olivine?), averaging 0.7, and totaling <5%, are sparsely disseminated through the groundmass.

BY: Marvin

74245



1 cm



.2 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.59
TiO ₂	=	11.92
Al ₂ O ₃	=	8.72
FeO	=	18.06
MnO	=	0.27
MgO	=	9.65
CaO	=	10.59
Na ₂ O	=	0.36
K ₂ O	=	0.06
P ₂ O ₅	=	0.04
S	=	0.14
Cr ₂ O ₃	=	0.54
TOTAL		<hr/> 98.94

CIPW NORM

Qtz	=	-
Or	=	0.35
Ab	=	3.05
An	=	22.00
Di	=	24.62
Hy	=	24.42
Ne	=	-
Ol	=	0.85
Chr	=	0.80
Ilm	=	22.64
Apa	=	0.09
TOTAL		<hr/> 98.80

100 Mg/(Mg+Fe) = 48.8
An/Ab/Or = 86.6/12/1.4

TRACE AND MINOR ELEMENTS

Li	=	8.5	(ID)
Rb	=	1.17	(ID)
K	=	655	(ID)
Ba	=	67.4	(ID)
Sr	=	159	(ID)
Cr	=	4630	(NAA)
V	=	-	
Sc	=	77	(NAA)
Ni	=	-	
Co	=	23.6	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	0.4	(GAM)
U	=	0.13	(GAM)
Zr	=	-	
Hf	=	8.7	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	6.24	
Ce	=	22.2	
Pr	=	-	
Nd	=	24.9	
Sm	=	9.8	
Eu	=	1.77	
Gd	=	-	
Tb	=	-	
Dy	=	17.5	
Ho	=	-	
Er	=	9.68	
Tm	=	-	
Yb	=	9.13	
Lu	=	1.25	(NAA)
Y	=	-	

ROCK NUMBER: 74255
WEIGHT: 737.3 g DIMENSIONS: 13 x 7 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N5 to N4)
SHAPE: Angular, irregular
FABRIC: Equigranular
COHERENCE: Intergranular - Coherent
Fracturing: One major penetrative parallel to N, with many smaller fractures parallel to it.
VARIABILITY: Homogeneous
SURFACE: T, N, S, E, and W are hackly; B is rounded.
ZAP PITS: None on T, N, S, E, and W; many on B.
CAVITIES: 10% vugs; average size 2-3 mm; lined with crystals of pyroxene, plagioclase, ilmenite, and very rare olivine (one observed).
SPECIAL FEATURES: Large number of vugs. Possibly more plagioclase than average.

Olivine: Usually single crystals but occasional clots of 3 or 4 crystals.

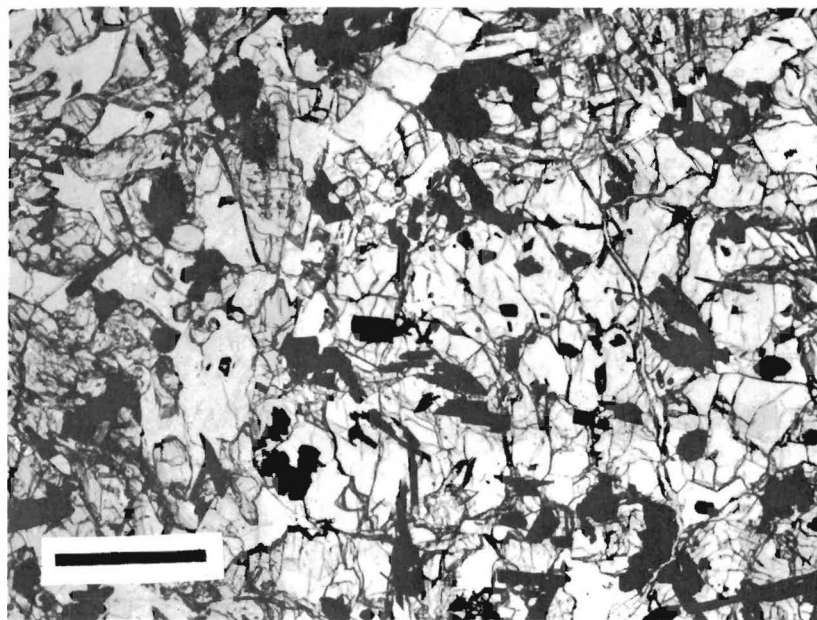
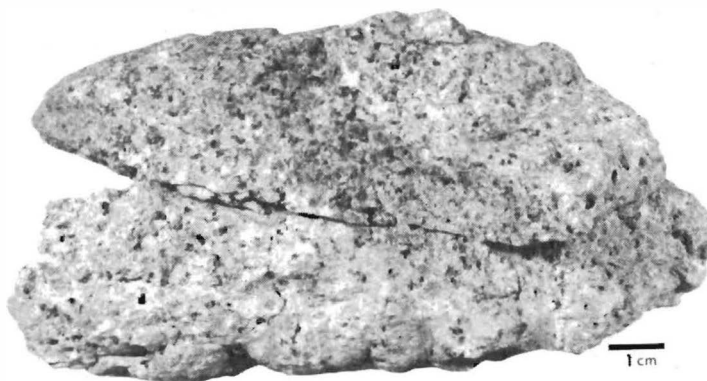
Pyroxene: More yellow brown when they occur as small crystals in plagioclase.

Plagioclase: Habit variable, some blocky crystals among lathy ones.

Ilmenite: Two generations: blocky where large, but small laths in plagioclase.

BY: Agrell, Lofgren

74255



.5 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	38.18
TiO ₂	=	12.47
Al ₂ O ₃	=	8.69
FeO	=	18.05
MnO	=	0.28
MgO	=	10.61
CaO	=	10.27
Na ₂ O	=	0.37
K ₂ O	=	0.09
P ₂ O ₅	=	0.06
S	=	0.11
Cr ₂ O ₃	=	0.60
<hr/>		
TOTAL		99.78

CIPW NORM

Qtz	=	-
Or	=	0.53
Ab	=	3.13
An	=	21.79
Di	=	23.30
Hy	=	22.35
Ne	=	-
Ol	=	3.88
Chr	=	0.88
Ilm	=	23.68
Apa	=	0.13
<hr/>		
TOTAL		99.67

100 Mg/(Mg+Fe) = 51.2
An/Ab/Or = 86/12/2

TRACE AND MINOR ELEMENTS

Li	=	8.3	(ID)
Rb	=	1.22	(ID)
K	=	672	(ID)
Ba	=	71.1	(ID)
Sr	=	163	(ID)
Cr	=	-	
V	=	65	(XRF)
Sc	=	74.2	(NAA)
Ni	=	17	(XRF)
Co	=	22.3	(NAA)
Cu	=	36	(XRF)
Zn	=	5.4	(XRF)
Th	=	0.4451	(MS)
U	=	0.1323	(MS)
Zr	=	238	(ID)
Hf	=	-	
Nb	=	<10	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	6.5	
Ce	=	22.5	
Pr	=	-	
Nd	=	24.7	
Sm	=	10.1	
Eu	=	1.85	
Gd	=	15.3	
Tb	=	-	
Dy	=	17.3	
Ho	=	-	
Er	=	10	
Tm	=	-	
Yb	=	8.93	
Lu	=	-	
Y	=	160.0	(XRF)

ROCK NUMBER: 74275
WEIGHT: 1493 g

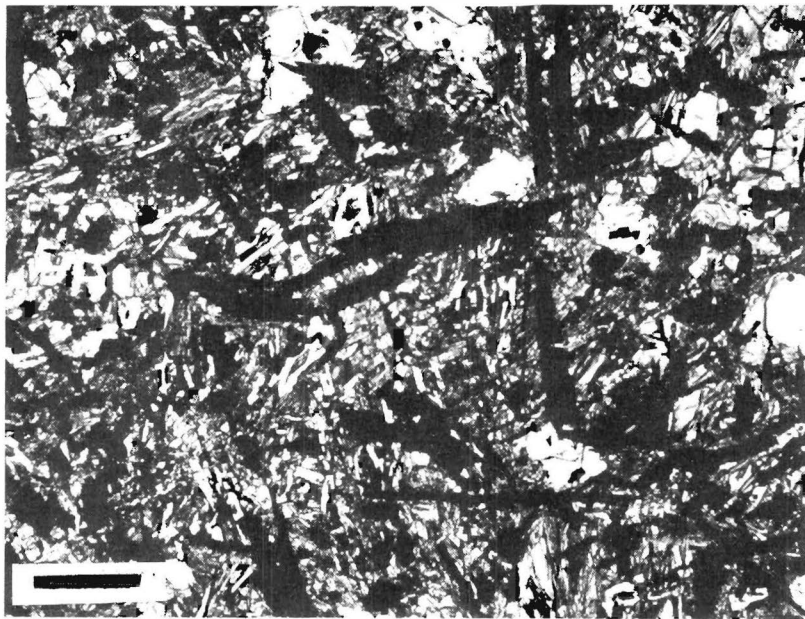
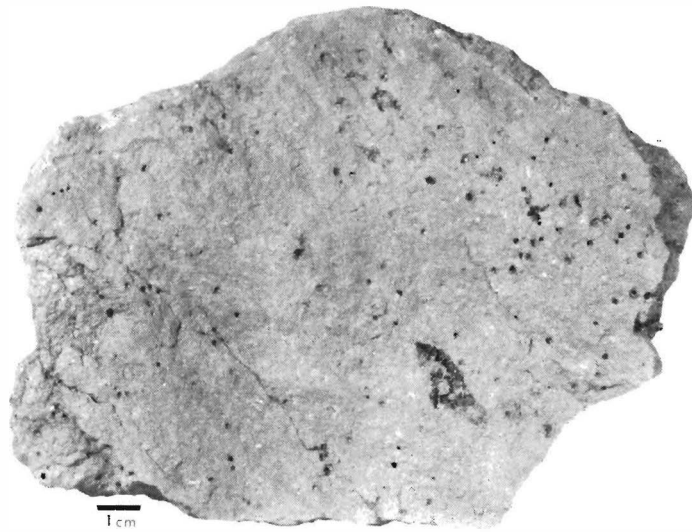
DIMENSIONS: 17 x 12 x 4 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4)
SHAPE: Slabby subangular
FABRIC: Porphyritic
COHERENCE: Intergranular - Tough
Fracturing: Several penetrative
VARIABILITY: Irregular distribution of cavities
SURFACE: B is fluted, from fracturing most likely, and is a very
fresh surface
ZAP PITS: Many on T, E, N, and W; few on S; none on B.
CAVITIES: 5% vugs and vesicles. Vesicles are smooth-walled, crystal
lined (with ilmenite), 2 mm; vugs up to 2 cm, projecting plagioclase,
pyroxene, and opaque mineral.

BY: Lofgren, Wilshire

74275



.2 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	38.43
TiO ₂	=	12.70
Al ₂ O ₃	=	8.72
FeO	=	18.14
MnO	=	0.26
MgO	=	10.36
CaO	=	10.32
Na ₂ O	=	0.35
K ₂ O	=	0.07
P ₂ O ₅	=	0.06
S	=	0.14
Cr ₂ O ₃	=	0.65

TOTAL 100.20

CIPW NORM

Qtz	=	-
Or	=	0.41
Ab	=	2.96
An	=	22.02
Di	=	23.31
Hy	=	24.49
Ne	=	-
Ol	=	1.66
Chr	=	0.96
Ilm	=	24.12
Apa	=	0.13

TOTAL 100.06

100 Mg/(Mg+Fe) = 50.4
 An/Ab/Or = 86.7/11.7/1.6

TRACE AND MINOR ELEMENTS

Li	=	9.6	(ID)
Rb	=	1.2	(ID)
K	=	623	(ID)
Ba	=	67.3	(ID)
Sr	=	153	(ID)
Cr	=	-	
V	=	79	(XRF)
Sc	=	75.1	(NAA)
Ni	=	3	(XRF)
Co	=	23.5	(NAA)
Cu	=	3	(XRF)
Zn	=	<2	(XRF)
Th	=	0.4654	(MS)
U	=	0.1360	(MS)
Zr	=	248	(XRF)
Hf	=	8.55	(NAA)
Nb	=	22.1	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	6.33	
Ce	=	21.4	
Pr	=	-	
Nd	=	22.8	
Sm	=	9.19	
Eu	=	1.8	
Gd	=	14.8	
Tb	=	-	
Dy	=	16.3	
Ho	=	-	
Er	=	9.66	
Tm	=	-	
Yb	=	8.47	
Lu	=	-	
Y	=	81.5	(XRF)

ROCK NUMBER: 75015
WEIGHT: 1006 g

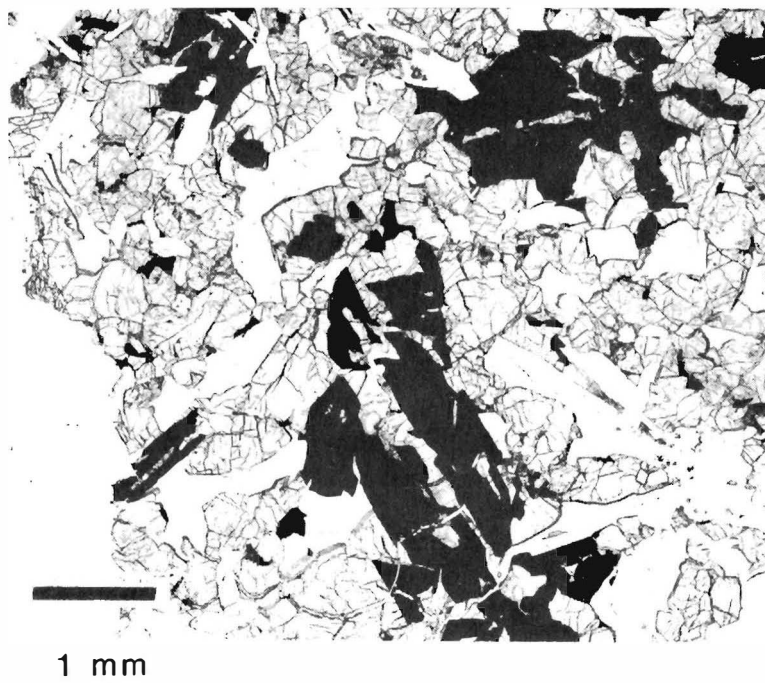
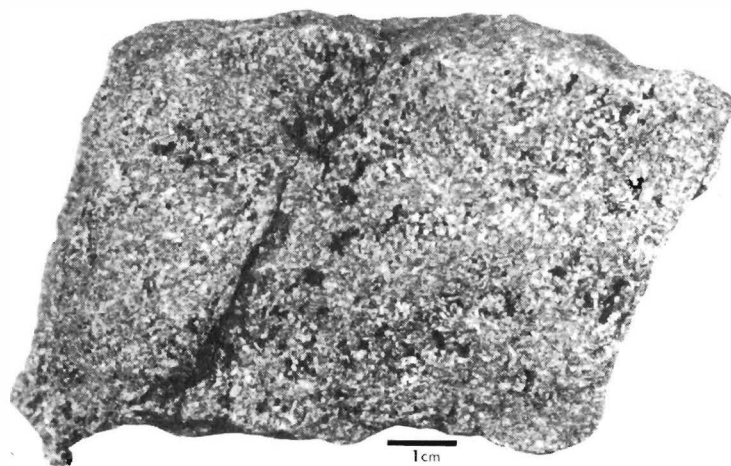
DIMENSIONS: 10 x 9 x 6 cm

BINOCULAR DESCRIPTION

COLOR: Brownish gray (a little lighter than 5YR 4/1)
SHAPE: Blocky, angular
FABRIC: Ophitic-intergranular
COHERENCE: Intergranular - Tough
Fracturing: Few, penetrative
VARIABILITY: Irregular vug distribution
SURFACE: Moderately hackly
ZAP PITS: Few on T, W, and S; none on others.
CAVITIES: 10% vugs (<1-3 mm) in clusters which reach 4 x 6 cm.
The vugs are lined by projecting plagioclase, opaque, and pyroxene.

BY: Wilshire

75015



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	41.92
TiO ₂	=	9.56
Al ₂ O ₃	=	10.06
FeO	=	18.77
MnO	=	0.29
MgO	=	6.20
CaO	=	12.15
Na ₂ O	=	0.48
K ₂ O	=	0.06
P ₂ O ₅	=	0.05
S	=	0.2
Cr ₂ O ₃	=	0.17

TOTAL		99.91
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CIPW NORM

Qtz	=	2.59
Or	=	0.35
Ab	=	4.06
An	=	25.12
Di	=	29.05
Hy	=	20.02
Ne	=	-
Ol	=	-
Chr	=	0.25
Ilm	=	18.16
Apa	=	0.11

TOTAL		99.71
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100 Mg/(Mg+Fe) = 37.1
An/Ab/Or = 85/14/1

TRACE AND MINOR ELEMENTS

Li	=	10.9	(ID)
Rb	=	0.65	(ID)
K	=	613	(ID)
Ba	=	87.5	(ID)
Sr	=	215	(ID)
Cr	=	1490	(NAA)
V	=	-	
Sc	=	77	(NAA)
Ni	=	-	
Co	=	14.7	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	9.6	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	6.74	
Ce	=	23.8	
Pr	=	-	
Nd	=	26.5	
Sm	=	11.2	
Eu	=	2.34	
Gd	=	17.7	
Tb	=	-	
Dy	=	20.1	
Ho	=	-	
Er	=	12.2	
Tm	=	-	
Yb	=	10.8	
Lu	=	1.62	(NAA)
Y	=	-	

ROCK NUMBER: 75035
WEIGHT: 1235 g

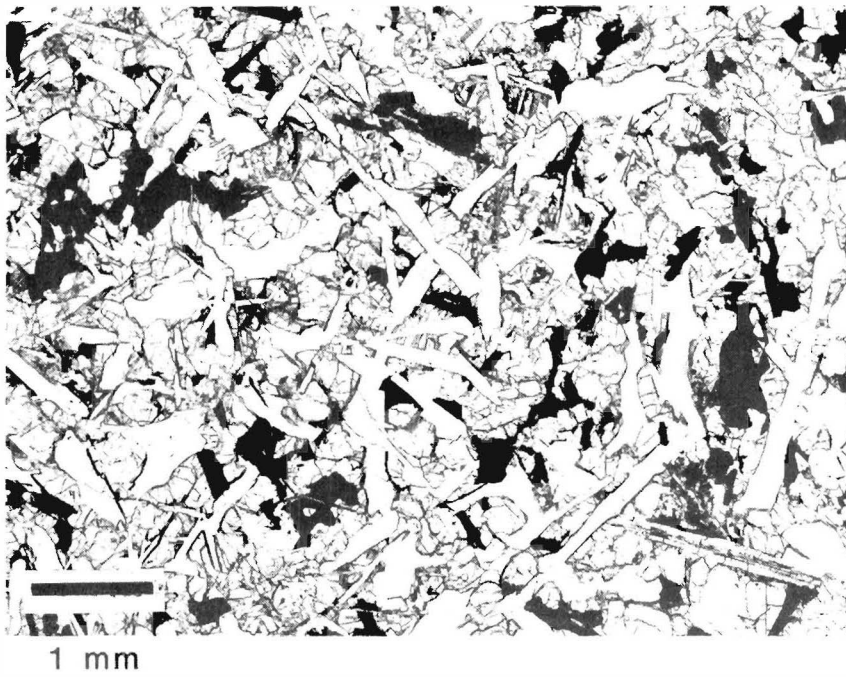
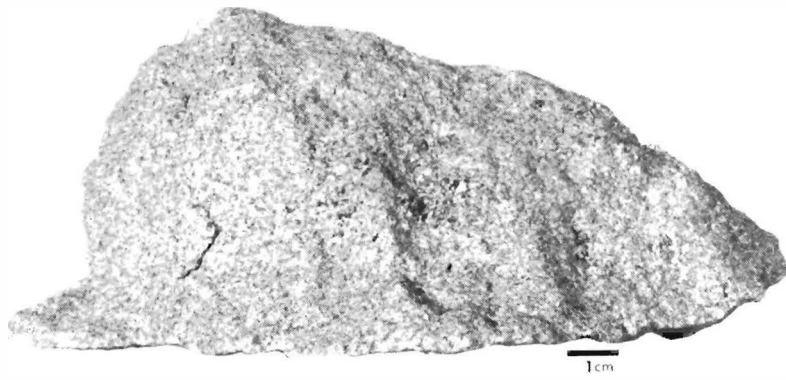
DIMENSIONS: 16 x 14 x 7 cm

BINOCULAR DESCRIPTION

COLOR: Between medium gray (N5) and brownish gray (5YR 4/1)
SHAPE: Subangular, triangular
FABRIC: Plumose texture within planar fabric; minor oikocrysts
COHERENCE: Intergranular - Tough
Fracturing: None
VARIABILITY: Planar fabric apparent on some faces only
SURFACE: Hackly on fresh surfaces
ZAP PITS: None on fresh surfaces (T and N); few on S, E, and W;
many on B.
CAVITIES: 2-3%, vugs up to 5 mm. Euhedral crystals of average rock
mineralogy project into vugs.
SPECIAL FEATURES:
Pyroxene: Some are zoned with darker cores and lighter yellowish
brown rims.
Plagioclase: Scattered oikocrysts to 1-2 mm.

BY: Stuart-Alexander

75035



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	42.31
TiO ₂	=	8.95
Al ₂ O ₃	=	10.30
FeO	=	18.57
MnO	=	0.26
MgO	=	6.28
CaO	=	12.15
Na ₂ O	=	0.53
K ₂ O	=	0.06
P ₂ O ₅	=	0.08
S	=	0.22
Cr ₂ O ₃	=	0.21
<hr/>		
TOTAL		99.92

CIPW NORM

Qtz	=	2.26
Or	=	0.36
Ab	=	4.48
An	=	25.55
Di	=	28.55
Hy	=	21.02
Ne	=	-
Ol	=	-
Chr	=	0.30
Ilm	=	17.00
Apa	=	0.18
<hr/>		
TOTAL		99.71

100 Mg/(Mg+Fe) = 37.6
 An/Ab/Or = 84/15/1

TRACE AND MINOR ELEMENTS

Li	=	11.0	(ID)
Rb	=	0.679	(ID)
K	=	549	(ID)
Ba	=	92.9	(ID)
Sr	=	192	(ID)
Cr	=	-	
V	=	19	(XRF)
Sc	=	79.3	(NAA)
Ni	=	<2	(XRF)
Co	=	16.6	(NAA)
Cu	=	2	(XRF)
Zn	=	2	(XRF)
Th	=	0.488	(MS)
U	=	0.151	(MS)
Zr	=	319	(XRF)
Hf	=	11.4	(NAA)
Nb	=	29.1	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	-	
Ce	=	23.6	
Pr	=	-	
Nd	=	27.3	
Sm	=	11.2	
Eu	=	2.52	
Gd	=	17.1	
Tb	=	-	
Dy	=	19.7	
Ho	=	-	
Er	=	11.1	
Tm	=	-	
Yb	=	11.4	
Lu	=	1.7	
Y	=	118	(XRF)

ROCK NUMBER: 75055
WEIGHT: 949.4 g

DIMENSIONS: 21 x 14 x 1.8 cm

BINOCULAR DESCRIPTION

COLOR: White and medium brownish gray

SHAPE: Flat slab

FABRIC: Equigranular

COHERENCE: Intergranular - Coherent

Fracturing: Few, penetrative planar

VARIABILITY: Homogeneous except vugs unevenly distributed

SURFACE: Fresh surface is platy; exposed surface gently lumpy

ZAP PITS: Few on all exposed surfaces

CAVITIES: 5% vugs, maximum size is 8 mm; filled with euhedral crystals of plagioclase, pyroxene and ilmenite.

SPECIAL FEATURES:

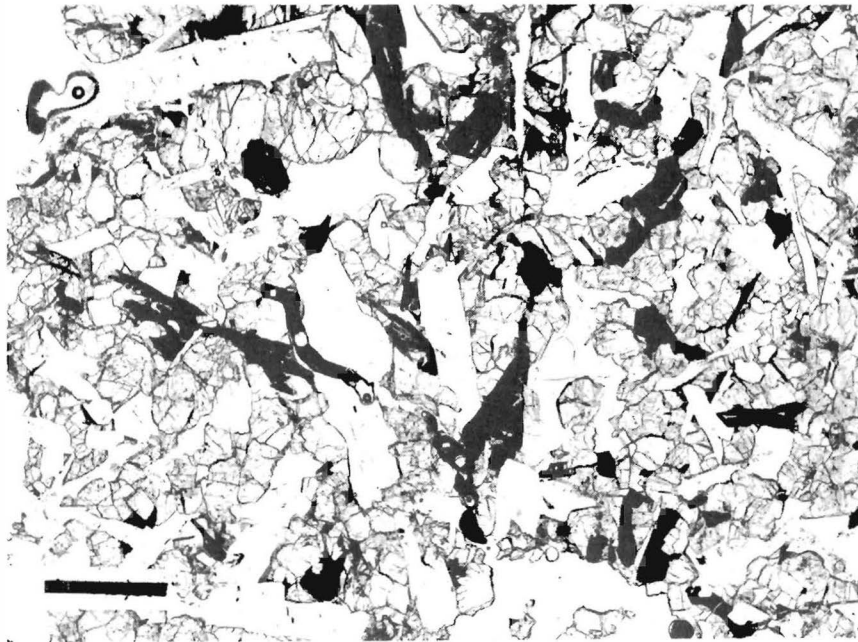
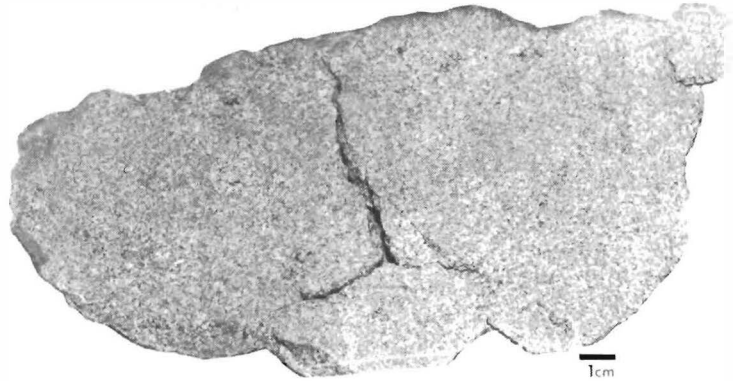
Plagioclase: On fresh surface most crystals appear equant; on exposed surfaces most appear to be laths. No discernible preferred orientation.

Pyroxene: Seems zoned. Yellowish brown is <1% of pyroxene.

Ilmenite: Irregular to equant grains dominant.

BY: Stuart-Alexander, Marvin

75055



CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	40.60
TiO ₂	=	10.79
Al ₂ O ₃	=	9.67
FeO	=	18.01
MnO	=	0.29
MgO	=	7.05
CaO	=	12.35
Na ₂ O	=	0.43
K ₂ O	=	0.08
P ₂ O ₅	=	0.06
S	=	0.17
Cr ₂ O ₃	=	0.27
		<hr/>
TOTAL		99.77

CIPW NORM

Qtz	=	1.81
Or	=	0.47
Ab	=	3.64
An	=	24.22
Di	=	30.24
Hy	=	18.20
Ne	=	-
Ol	=	-
Chr	=	0.40
Ilm	=	20.49
Apa	=	0.13
		<hr/>
TOTAL		99.60

100 Mg/(Mg+Fe) = 41.1
An/Ab/Or = 85/13/2

TRACE AND MINOR ELEMENTS

Li	=	9.35	(ID)
Rb	=	0.584	(ID)
K	=	545	(ID)
Ba	=	76.2	(ID)
Sr	=	190.5	(ID)
Cr	=	-	
V	=	-	
Sc	=	82.7	(ID)
Ni	=	2	(XRF)
Co	=	14.5	(ID)
Cu	=	-	
Zn	=	7	(XRF)
Th	=	0.447	(MS)
U	=	0.136	(MS)
Zr	=	272	(XRF)
Hf	=	7.2	(NAA)
Nb	=	25	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	6.265	
Ce	=	21.5	
Pr	=	-	
Nd	=	23.9	
Sm	=	10.05	
Eu	=	2.09	
Gd	=	15.7	
Tb	=	-	
Dy	=	18.1	
Ho	=	-	
Er	=	10.72	
Tm	=	-	
Yb	=	9.79	
Lu	=	-	
Y	=	112	(XRF)

ROCK NUMBER: 75075
 WEIGHT: 1008 g

DIMENSIONS: 15 x 12 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray with a hint of burnt sienna (N3-N4)

SHAPE: Slabby, irregular

FABRIC: Equigranular, vuggy

COHERENCE: Intergranular - Tough

Fracturing: Several fractures - one large penetrative N-S across T and B.

VARIABILITY: Homogeneous

SURFACE: T is coated by dark gray (N2) fine-grained, cohesive patina.

This in turn is partially coated by thin red brown material (10R 4/6) which has collected in shallow depressions. One large patch visible in orthogonals of T and S surfaces. Parallel microgrooves (≈ 10 grooves/mm) run N-S over much of the T surface. B surface is fresh except for small patches of gray patina. Top and bottom may both be "mylonitized" fractures; bottom fresher with only small patches of patina.

ZAP PITS: None found

CAVITIES: Vugs occupy about 20% of the fresh surfaces; on top surface they are masked by gray coating. Most vugs 2-5 mm in size; a few are elongate, and up to 2 cm. They are irregularly distributed with no preferred orientation. Many vugs are lined with terminations of matrix crystals. Others are filled with beautiful euhedral crystals of the same minerals as in groundmass but larger in size. Crystals in vugs are: pyroxenes - elongate along their c-axes; equant on a and b, up to 3 mm long. Ilmenite - tabular with growth lines, up to 2 mm across. Troilite - up to 1 mm across. Plagioclase - tabular, up to 2 mm across. There are a few smaller vesicles(?) with smooth interiors.

SPECIAL FEATURES:

Plagioclase: Two generations(?) or all gradations

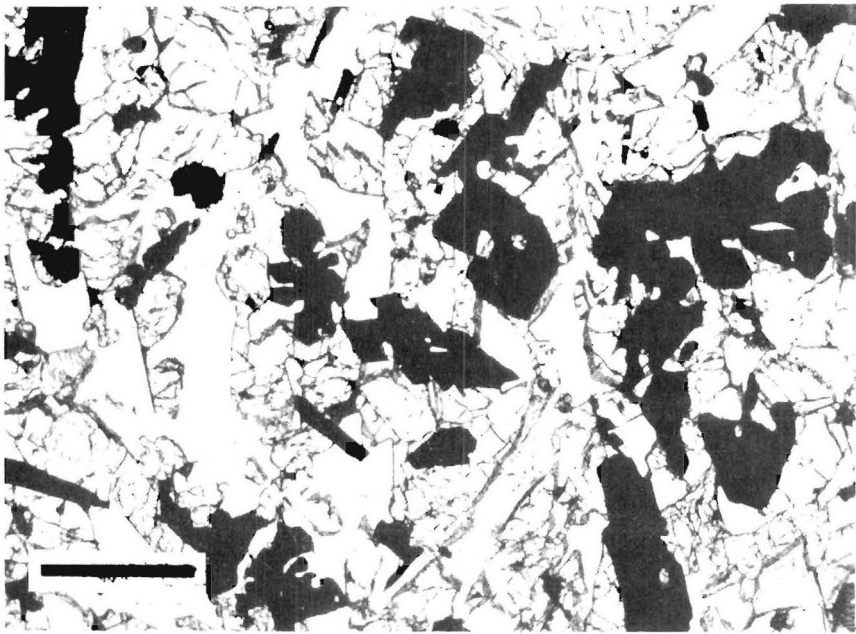
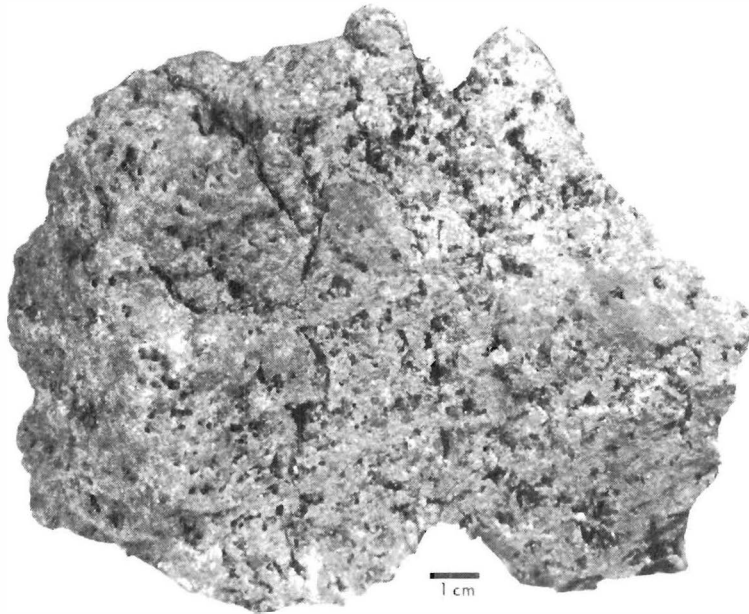
Pyroxene: Two generations: subhedral are large, anhedral are small and intergrown with plagioclase

Olivine: Some grains isolated, most in clots up to 5 mm across

Ilmenite: Early and late generations

BY: Marvin, Reid

75075



.5 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	38.07
TiO ₂	=	13.39
Al ₂ O ₃	=	8.25
FeO	=	18.81
MnO	=	0.26
MgO	=	9.59
CaO	=	10.23
Na ₂ O	=	0.39
K ₂ O	=	0.05
P ₂ O ₅	=	0.05
S	=	0.16
Cr ₂ O ₃	=	0.56
<hr/>		
TOTAL		99.81

CIPW NORM

Qtz	=	0.31
Or	=	0.30
Ab	=	3.30
An	=	20.61
Di	=	24.19
Hy	=	24.58
Ne	=	-
Ol	=	-
Chr	=	0.82
Ilm	=	25.43
Apa	=	0.11
<hr/>		
TOTAL		99.65

100 Mg/(Mg+Fe) = 47.6
An/Ab/Or = 35/14/1

TRACE AND MINOR ELEMENTS

Li	=	8.5	(ID)
Rb	=	0.46	(ID)
K	=	435	(ID)
Ba	=	64.4	(ID)
Sr	=	164.6	(ID)
Cr	=		
V	=	108	(XRF)
Sc	=	78.3	(NAA)
Ni	=	1	(XRF)
Co	=	20.5	(NAA)
Cu	=	34	(XRF)
Zn	=	5	(XRF)
Th	=	0.32	(ID)
U	=	0.096	(ID)
Zr	=	208	(XRF)
Hf	=		
Nb	=	21	(XRF)

RARE EARTH ELEMENTS (ID)

La	=	5.01
Ce	=	17.6
Pr	=	
Nd	=	19.8
Sm	=	8.29
Eu	=	1.77
Gd	=	12.9
Tb	=	-
Dy	=	15.1
Ho	=	-
Er	=	8.89
Tm	=	-
Yb	=	8.31
Lu	=	-
Y	=	-

ROCK NUMBER: 76136
WEIGHT: 86.60 g

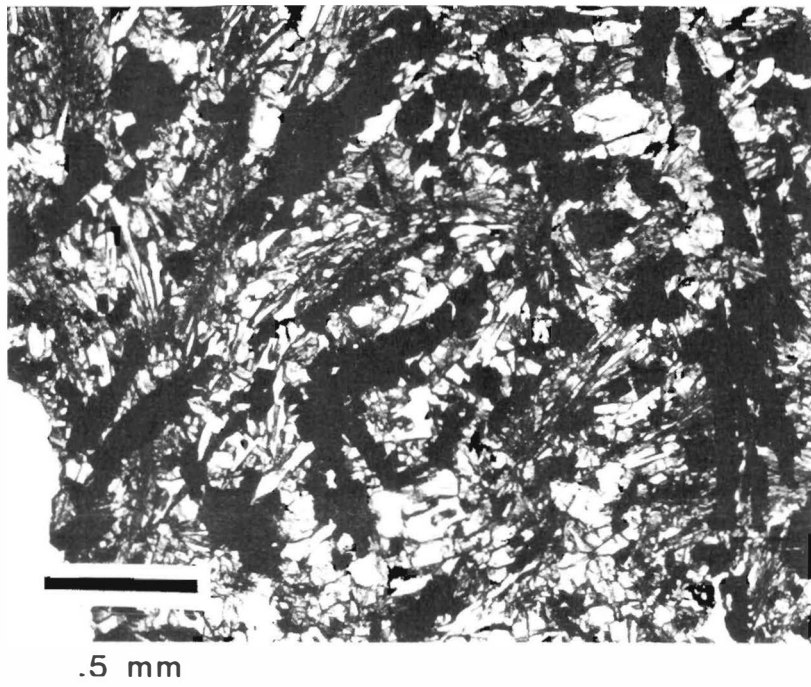
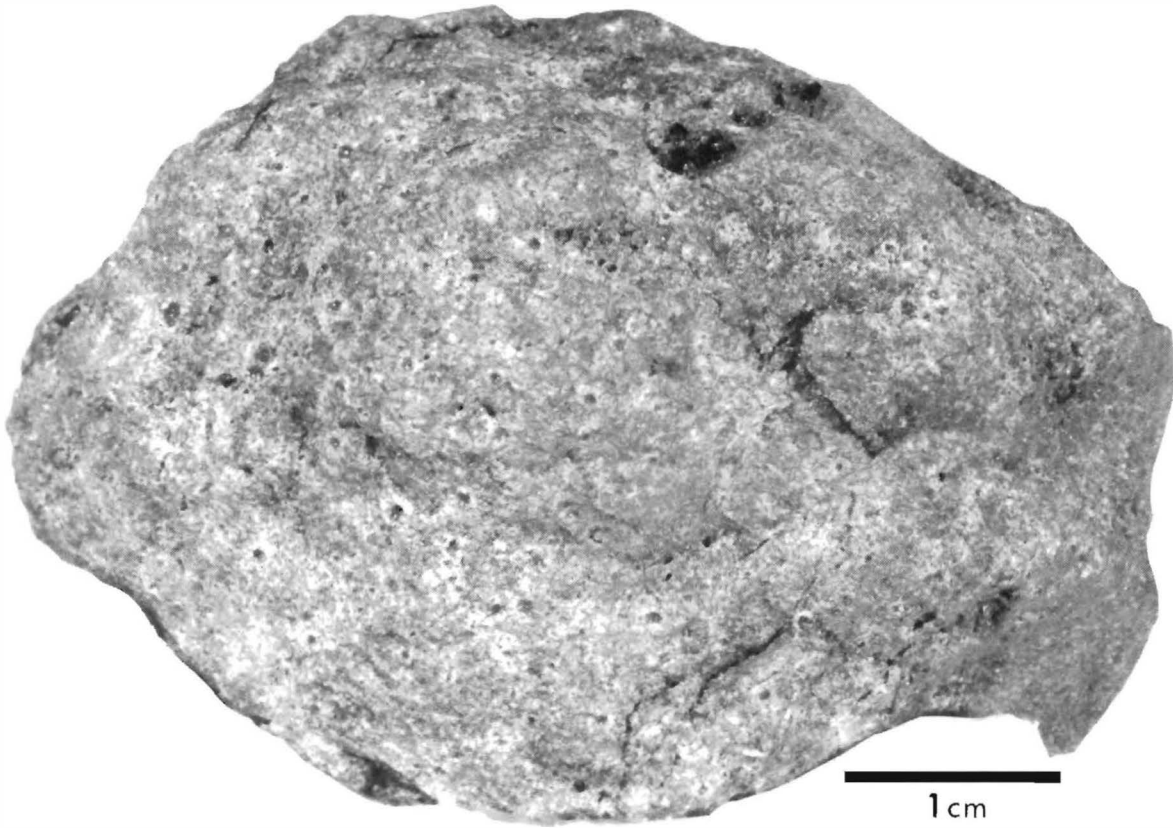
DIMENSIONS: 6 x 4 x 3 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray (N5)
SHAPE: Subrounded
FABRIC: Subophitic to intergranular, fine-grained
COHERENCE: Intergranular - Coherent, tough
Fracturing: None, non-penetrative spalls on T
VARIABILITY: Homogeneous except for few scattered cavities
SURFACE: B is dusty and 3/4 coated with one 5 x 3 mm very thin transparent glass coating. E end of N has miarolitic cavities up to 6 mm long which contain pyroxene, plagioclase, olivine with a glazed surface appearance
ZAP PITS: None on B; many 0.5 mm diameter lined by gray glass on T; many on S; few on E, W, and N.
CAVITIES: B has one 3 mm diameter miarolitic cavity. T has <1% small (<1 mm) miarolitic cavities. N, E, several larger (4-6 mm) miarolitic cavities.
SPECIAL FEATURES:

Olivine: Abundance apparently higher at E end of N near cavities, and grain size coarser
Pyroxene: Tends to occur in clots. Larger pyroxenes are darker brown, lighter brown pyroxenes are smaller and intergrown with feldspar.
Ilmenite: Long thin plates up to 1 mm long
BY: Agrell, Reid

76136



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.6
TiO ₂	=	12.64
Al ₂ O ₃	=	8.65
FeO	=	19.12
MnO	=	0.28
MgO	=	8.61
CaO	=	10.53
Na ₂ O	=	0.38
K ₂ O	=	0.06
P ₂ O ₅	=	0.06
S	=	0.18
Cr ₂ O ₃	=	0.44

TOTAL 99.55

C1PW NORM

Qtz	=	0.88
Or	=	0.35
Ab	=	3.22
An	=	21.72
Di	=	24.64
Hy	=	23.78
Ne	=	-
Ol	=	-
Chr	=	0.65
Ilm	=	24.01
Apa	=	0.3

TOTAL 99.37

100 Mg/(Mg+Fe) = 44.5
An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	8.9	(ID)
Rb	=	0.67	(ID)
K	=	610	(ID)
Ba	=	83.7	(ID)
Sr	=	190	(ID)
Cr	=	3790	(NAA)
V	=	-	
Sc	=	82	(NAA)
Ni	=	-	
Co	=	18.7	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	9.4	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	6.91	
Ce	=	23.8	
Pr	=	-	
Nd	=	26.2	
Sm	=	10.9	
Eu	=	2.14	
Gd	=	16.4	
Tb	=	-	
Dy	=	19.3	
Ho	=	-	
Er	=	11.4	
Tm	=	-	
Yb	=	10.2	
Lu	=	1.42	(NAA)
Y	=	-	

ROCK NUMBER: 77516
WEIGHT: 103.7 g DIMENSIONS: 5.5 x 4 x 3

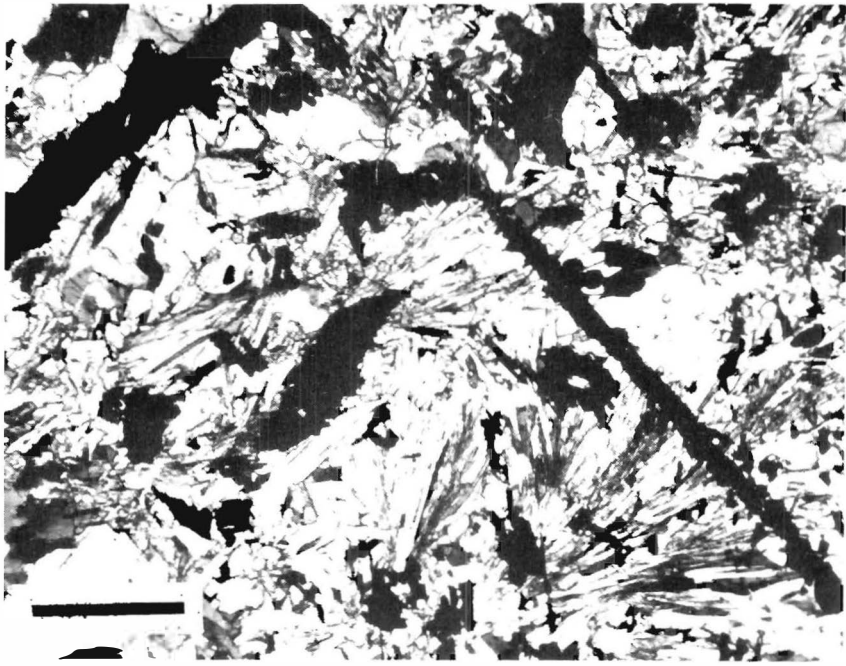
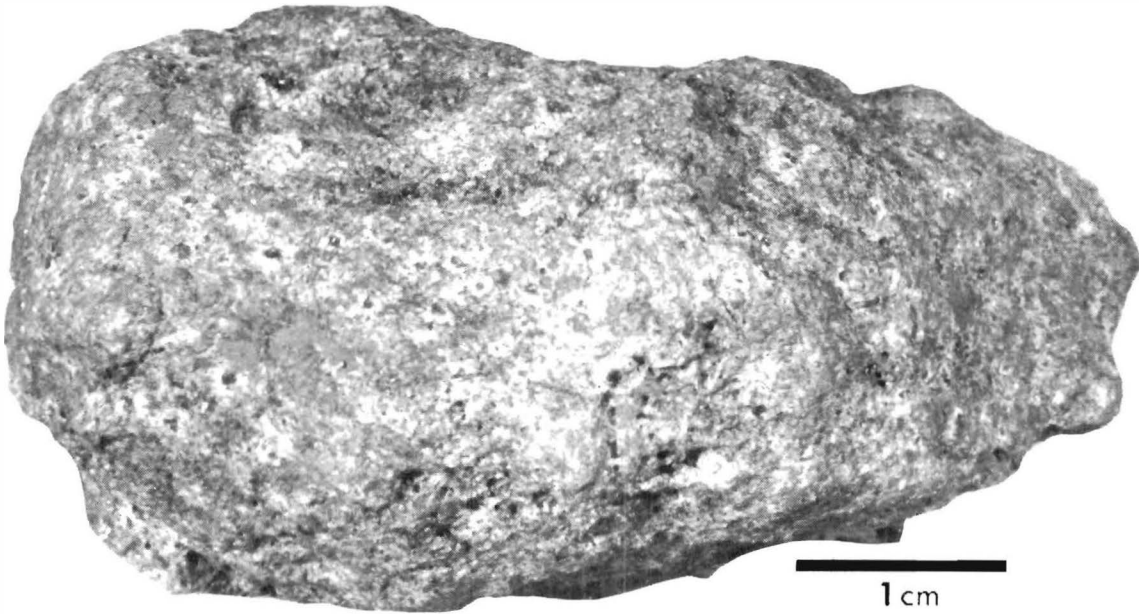
BINOCULAR DESCRIPTION

COLOR: Gray (N4 to N5) with brownish tint
SHAPE: Subrounded to subangular, somewhat slabby
FABRIC: Variolitic, locally trachytic
COHERENCE: Intergranular - Tough
Fracturing: One penetrative parallel to slabby direction
VARIABILITY: Inhomogeneous distribution of vugs
SURFACE: Uneven, finely hackly
ZAP PITS: Zapped on all sides
CAVITIES: 1-2%; up to 8 mm; contain projecting ilmenite, pyroxene,
and plagioclase crystals
SPECIAL FEATURES:

Plagioclase: lath-shaped, commonly has pyroxene(?) prisms growing
down center of laths
Olivine: Appears to be concentrated in one part of rock

BY: Keil, Dowty, Prinz

77516



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.40
TiO ₂	=	13.70
Al ₂ O ₃	=	7.80
FeO	=	20.20
MnO	=	0.25
MgO	=	9.40
CaO	=	9.40
Na ₂ O	=	0.33
K ₂ O	=	0.04
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.48
TOTAL		100.00

CIPW NORM

Qtz	=	1.39
Or	=	0.24
Ab	=	2.79
An	=	19.68
Di	=	21.96
Hy	=	27.21
Ne	=	-
Ol	=	-
Chr	=	0.71
Ilm	=	26.02
Apa	=	-
TOTAL		100.00

100 Mg/(Mg+Fe) = 45.3
An/Ab/Or = 87/12/1

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	-	
K	=	332	(NAA)
Ba	=	-	
Sr	=	-	
Cr	=	-	
V	=	120	(NAA)
Sc	=	80	(NAA)
Ni	=	-	
Co	=	24.6	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	6.2	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	4.7
Ce	=	18
Pr	=	-
Nd	=	18
Sm	=	6
Eu	=	1.25
Gd	=	-
Tb	=	1.6
Dy	=	10
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	6
Lu	=	0.91
Y	=	-

ROCK NUMBER: 77535

WEIGHT: 577.8 g

DIMENSIONS: 10.5 x 8.5 x 3.5 cm

BINOCULAR DESCRIPTION

COLOR: Gray with brownish cast (N5)

SHAPE: Slabby subrounded

FABRIC: Large poikilitic plagioclases

COHERENCE: Intergranular - Tough

Fracturing: None

VARIABILITY: None

SURFACE: Hackly. Partial glass coating one surface

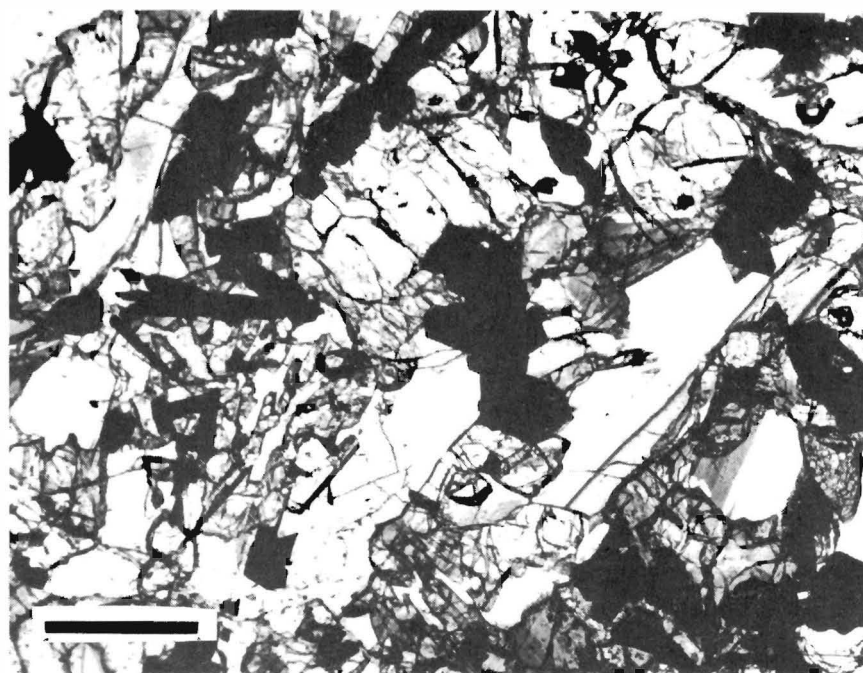
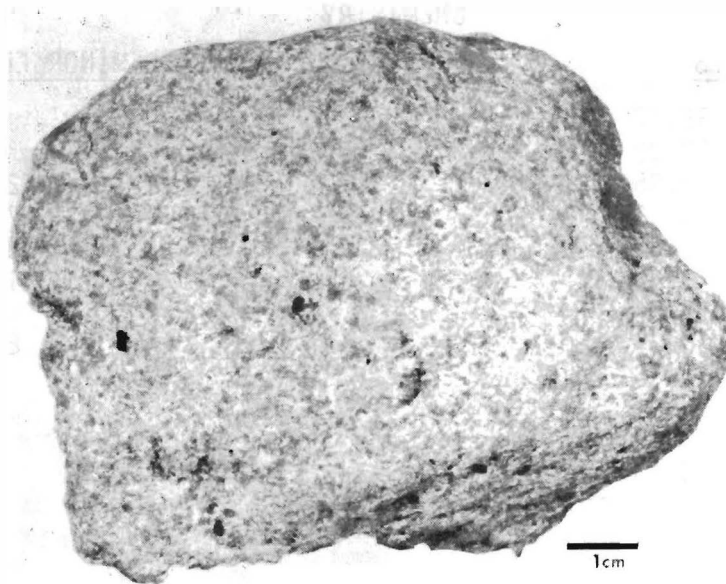
ZAP PITS: Zapped on all sides

CAVITIES: 1%, from <1 cm to 6 mm vugs with projecting pyroxene and opaque crystals

SPECIAL FEATURES: Plagioclase in poikilitic grains. Intergrowths of pyroxene and ilmenite, about 1 x 2 mm, form 5% of the rock.

BY: Keil, Dowty, Prinz

77535



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.57
TiO ₂	=	12.39
Al ₂ O ₃	=	8.95
FeO	=	18.53
MnO	=	0.27
MgO	=	8.85
CaO	=	10.66
Na ₂ O	=	0.39
K ₂ O	=	0.05
P ₂ O ₅	=	0.04
S	=	0.16
Cr ₂ O ₃	=	0.43

TOTAL		99.29
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CIPW NORM

Qtz	=	0.45
Or	=	0.30
Ab	=	3.30
An	=	22.52
Di	=	24.55
Hy	=	23.77
Ne	=	-
Ol	=	-
Chr	=	0.63
Ilm	=	23.53
Apa	=	0.09

TOTAL		99.13
-------	--	-------

100 Mg/(Mg+Fe) = 46.0
An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	9.7	(ID)
Rb	=	0.55	(ID)
K	=	526	(ID)
Ba	=	70.7	(ID)
Sr	=	184	(ID)
Cr	=	3810	(NAA)
V	=	-	
Sc	=	80	(NAA)
Ni	=	-	
Co	=	20.4	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	8.6	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	5.24	
Ce	=	18.3	
Pr	=	-	
Nd	=	20.7	
Sm	=	8.7	
Eu	=	1.98	
Gd	=	13.6	
Tb	=	-	
Dy	=	15.8	
Ho	=	-	
Er	=	9.84	
Tm	=	-	
Yb	=	8.91	
Lu	=	1.29	(NAA)
Y	=	-	

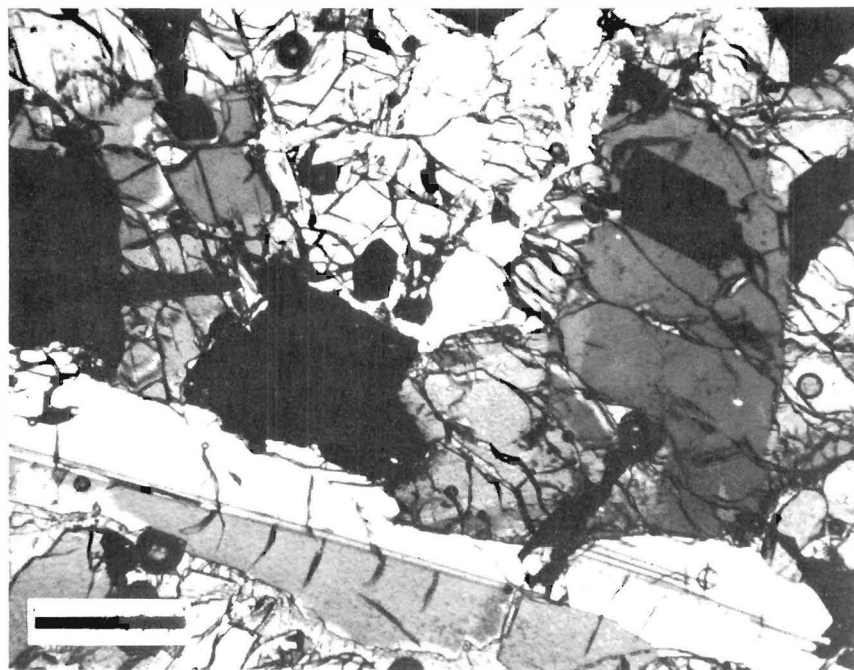
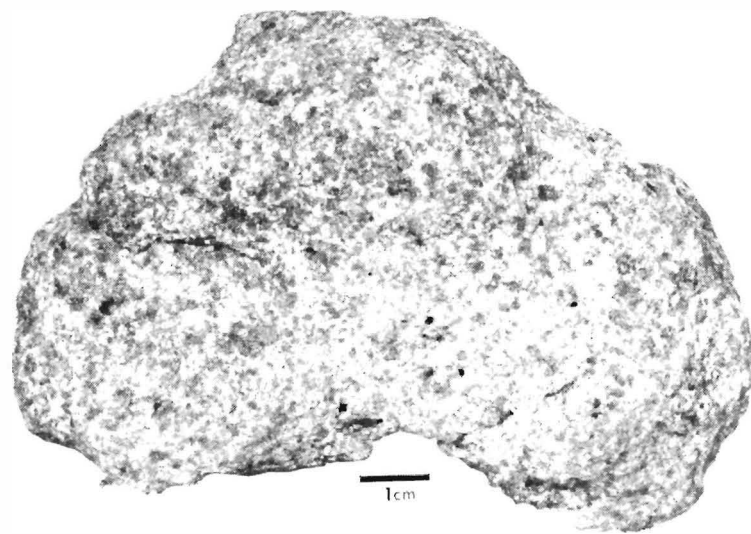
ROCK NUMBER: 77536
WEIGHT: 355.3 g DIMENSIONS: 11 x 7.0 x 3.5 cm

BINOCULAR DESCRIPTION

COLOR: Brownish gray (5 YR 4/1)
SHAPE: Tabular, subrounded
FABRIC: Subophitic
COHERENCE: Intergranular - Tough
Fracturing: Penetrative normal to major and intermediate axes
VARIABILITY: Some textural variation
SURFACE: Hackly; one side has partial glass coating
ZAP PITS: All zapped except glass-coated side
CAVITIES; 1% yugs with projecting pyroxenes, and ilmenite to 2 mm
SPECIAL FEATURES: Glass on unpitted side, also one 1 cm square area on this surface looks slickensided. Plagioclase laths may have weak preferred orientation. Brown mafic clots of 80% pyroxene and 20% opaques average 3 x 4 mm and reach 10 x 15 mm. One plagioclase crystal is 10 x 3 cm and is poikilitic.

BY: Keil, Dowty, Prinz

77536



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.11
TiO ₂	=	14.50
Al ₂ O ₃	=	8.0
FeO	=	18.80
MnO	=	0.23
MgO	=	9.20
CaO	=	10.20
Na ₂ O	=	0.33
K ₂ O	=	0.07
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.56
TOTAL		<u>100.00</u>

CIPW NORM

Qtz	=	2.14
Or	=	0.41
Ab	=	2.79
An	=	20.14
Di	=	24.61
Hy	=	21.55
Ne	=	-
Ol	=	-
Chr	=	0.82
Ilm	=	27.54
Apa	=	-
TOTAL		<u>100.01</u>

100 Mg/(Mg+Fe) = 46.6
 An/Ab/Or = 86/12/2

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	-	
K	=	581	(NAA)
Ba	=	-	
Sr	=	-	
Cr	=	-	
V	=	140	(NAA)
Sc	=	78	(NAA)
Ni	=	-	
Co	=	17.8	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	8.8	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	6.1
Ce	=	20
Pr	=	-
Nd	=	25
Sm	=	8.5
Eu	=	1.94
Gd	=	-
Tb	=	2
Dy	=	14
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	8.5
Lu	=	1.3
Y	=	-

ROCK NUMBER: 78135
WEIGHT: 133.9 g DIMENSIONS: 5 x 4 x 3 cm

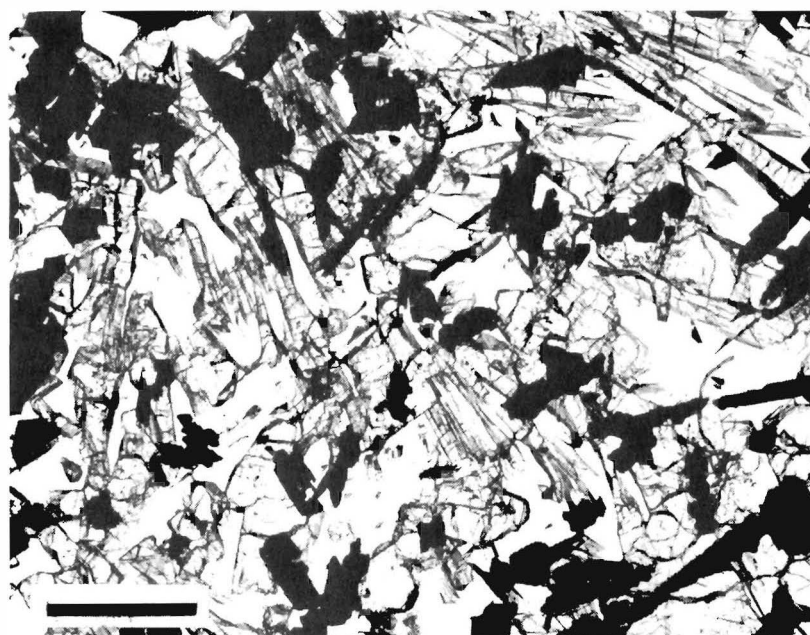
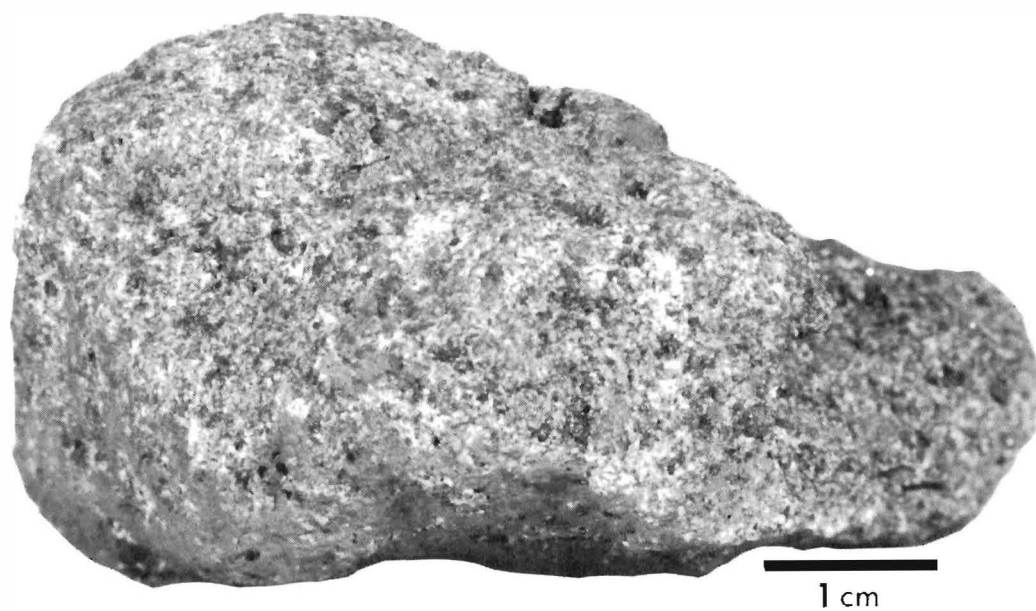
BINOCULAR DESCRIPTION

COLOR: Medium gray (N4)
SHAPE: Irregular
FABRIC: Equigranular
COHERENCE; Intergranular - Coherent
 Fracturing: Several non-penetrative
VARIABILITY: Homogeneous
SURFACE: T is hackly, part original and part broken surface, B is
 50% covered by a 0.2 mm thick film of dark glass with a patch of
 fine adherent dust concentrated at south end. S face has a thin
 glass veneer which covers 50% of surface and thins toward N.
ZAP PITS: Few on T (S half), B, S; none on W and N.
CAVITIES: 5%, small vugs (<2 mm diameter) are common. These may
 be aligned, interconnected, and control the direction of some
 nonpenetrative fractures; idiomorphic pyroxene and plagioclase
 are visible on the walls of the vugs.
SPECIAL FEATURES: Pyroxene in plagioclase is cinnamon brown in color,
 but polycrystalline groups possibly associated with ilmenite are
 darker, duller brown.

Plagioclase: Also interstitial, orientation random
Opagues: Tabular - associated with pyroxene.

BY: Meyer, Agrell

78135



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	37.98
TiO ₂	=	12.89
Al ₂ O ₃	=	8.38
FeO	=	19.05
MnO	=	0.27
MgO	=	8.69
CaO	=	10.71
Na ₂ O	=	0.36
K ₂ O	=	0.05
P ₂ O ₅	=	0.04
S	=	0.18
Cr ₂ O ₃	=	0.45

TOTAL		99.05
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CIPW NORM

Qtz	=	0.47
Or	=	0.30
Ab	=	3.05
An	=	21.10
Di	=	25.93
Hy	=	22.8
Ne	=	-
Ol	=	-
Chr	=	0.66
Ilm	=	24.48
Apa	=	0.09

TOTAL		98.87
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100 Mg/(Mg+Fe) = 44.8
An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	9.2	(ID)
Rb	=	0.58	(ID)
K	=	545	(ID)
Ba	=	74.1	(ID)
Sr	=	174	(ID)
Cr	=	4010	(NAA)
V	=	-	
Sc	=	84	(NAA)
Ni	=	-	
Co	=	18.4	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	0.35	(GAM)
U	=	0.11	(GAM)
Zr	=	-	
Hf	=	9.3	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	5.80	
Ce	=	20.2	
Pr	=	-	
Nd	=	22.4	
Sm	=	9.43	
Eu	=	1.93	
Gd	=	14.9	
Tb	=	-	
Dy	=	17.0	
Ho	=	-	
Er	=	10.5	
Tm	=	-	
Yb	=	9.21	
Lu	=	1.33	(NAA)
Y	=	-	

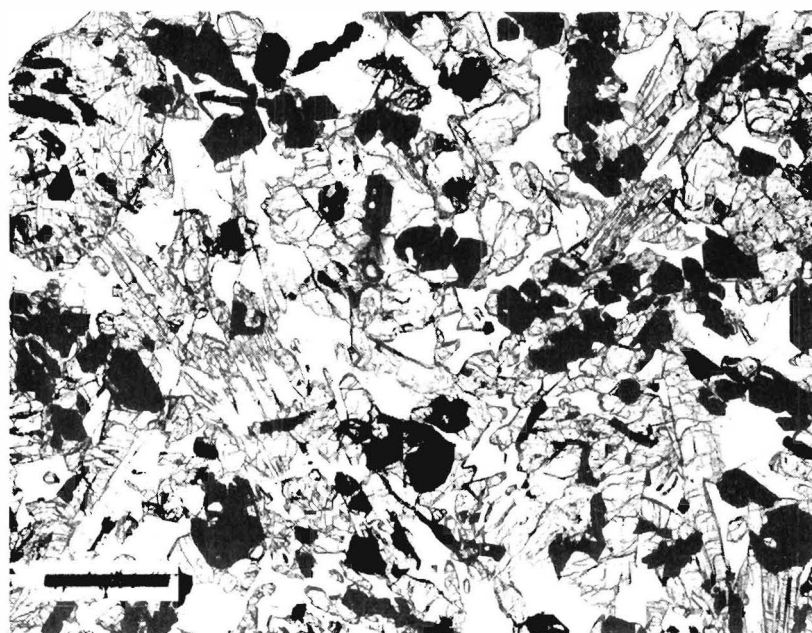
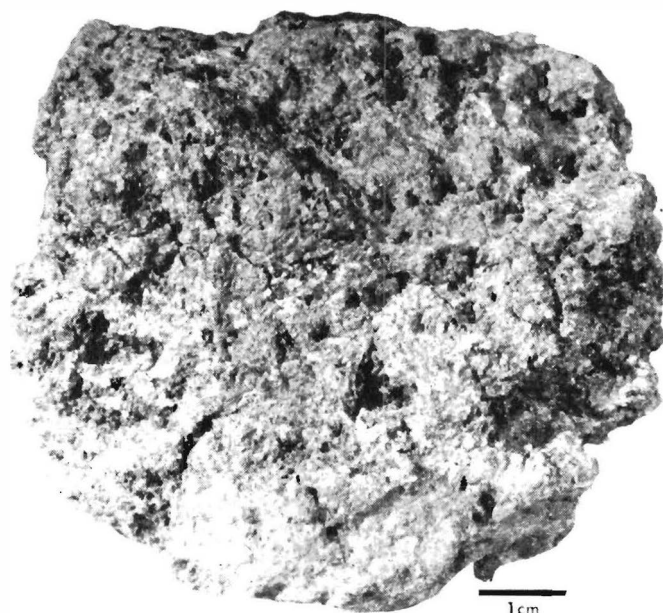
ROCK NUMBER: 78505
WEIGHT: 506.3 g DIMENSIONS: 6.5 x 7.5 x 8.0 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark brownish gray (between 5YR 4/1 and N4)
SHAPE: Blocky, irregular
FABRIC: Not oriented; diabasic - intergranular
COHERENCE: Intergranular - Massive, coherent
Fracturing: Several penetrative fractures; few approximately parallel to S face, otherwise irregular
VARIABILITY: Homogeneous
SURFACE: All hackly except S and parts of T and B, which have a smooth 0.5-1 mm thick adhering soil cover which smooths the surface.
ZAP PITS: Fresh hackly faces have no pits. Of the soil covered faces: none on W, and few on S. Pits are difficult to identify because of hackly surfaces.
CAVITIES: 5% vugs, with a size range 1-5 mm, half brown pyroxene and half glassy plagioclase, average 2.0 mm and irregular shapes. No orientation. Contain euhedral mineral projecting from the body of the rock into vugs. Ilmenite is present in a few vugs but decidedly rare.
SPECIAL FEATURES:
Olivine: Clear, appear to be microphenocrysts. No apparent zoning. Irregularly scattered.
Pyroxene: Only one type of pyroxene. Occasionally changes color to deep reddish-brown.
Plagioclase: The poikilitic feldspar includes well shaped crystals of pyroxene and ilmenite and tends to form larger crystals than the other feldspar.
Silica: Concentrated near vugs; clear, glassy luster.

BY: Jackson, Ridley

78505



1 mm

ALLOCATED, BUT NOTHING PUBLISHED

CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL

100 Mg / (Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V =
 Sc =
 Ni =
 Co =
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf =
 Nb =

RARE EARTH ELEMENTS

La =
 Ce =
 Pr =
 Nd =
 Sm =
 Eu =
 Gd =
 Tb =
 Dy =
 Ho =
 Er =
 Tm =
 Yb =
 Lu =
 Y =

ROCK NUMBER: 78506
WEIGHT: 55.97 g

DIMENSIONS: 4 x 4.5 x 3 cm

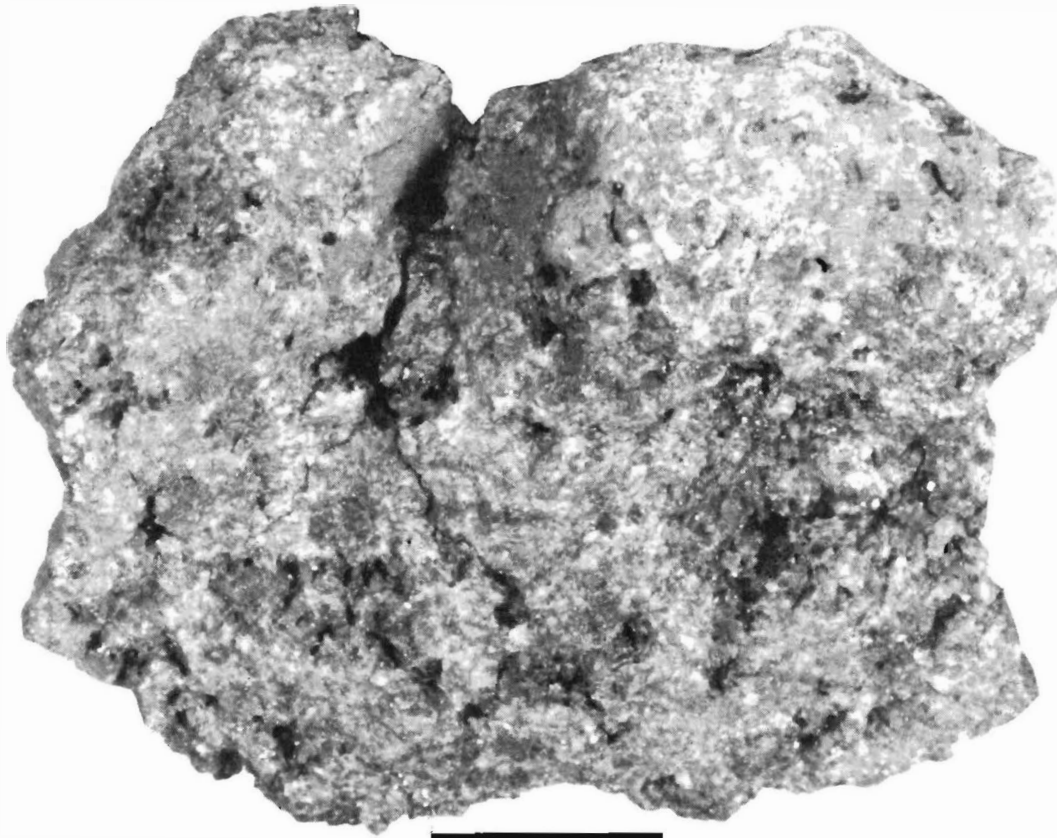
BINOCULAR DESCRIPTION

COLOR: Medium gray with brownish tint (N4-5YR 4/1)
SHAPE: Irregular, subangular
FABRIC: Intergranular
COHERENCE: Intergranular - Tough
Fracturing: Irregular penetrative fractures
VARIABILITY: Vugs inhomogeneously distributed
SURFACE: Hackly
ZAP PITS: None on W, E, N; few on B, T, and S.
CAVITIES: 5-10%, irregular, elongate vugs with an average size
2 mm to 5 mm occur in clusters. Normal rock texture at vug walls,
but coarser in vugs. Projecting feldspar in vugs on E face.
SPECIAL FEATURES:

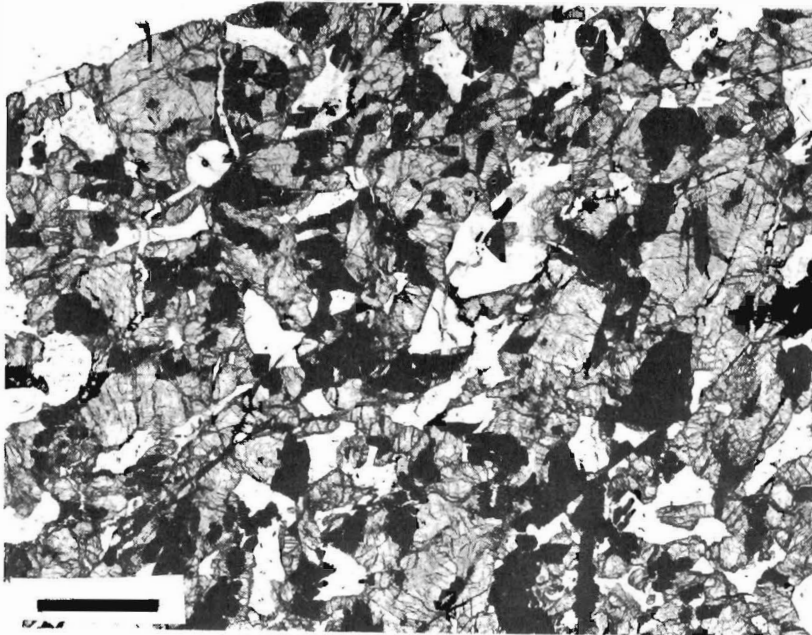
Plagioclase: Pyroxene and opaque inclusions. 3 x 4 mm blocky,
clots of ilmenite and pyroxene compose about 10% of the rock.
Pyroxenes: Appear to be lighter colored than in several other
basalts.
Olivine: Occurs in clusters; more seen on W than elsewhere.
Silica: Lines cavities.

BY: Wilshire, Ridley

78506



1 cm



1 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.55
TiO ₂	=	12.93
Al ₂ O ₃	=	8.99
FeO	=	19.36
MnO	=	0.27
MgO	=	9.59
CaO	=	9.94
Na ₂ O	=	0.39
K ₂ O	=	0.46
P ₂ O ₅	=	0.02
S	=	0.16
Cr ₂ O ₃	=	0.51
<hr/>		
TOTAL		100.76

CIPW NORM

Qtz	=	-
Or	=	0.30
Ab	=	3.30
An	=	22.63
Di	=	21.62
Hy	=	26.84
Ne	=	-
Ol	=	0.56
Chr	=	0.75
Ilm	=	24.56
Apa	=	0.04
<hr/>		
TOTAL		100.60

100 Mg/(Mg+Fe) = 46.9
 An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	9.4	(ID)
Rb	=	0.44	(ID)
K	=	429	(ID)
Ba	=	65.9	(ID)
Sr	=	175	(ID)
Cr	=	4200	(NAA)
V	=	-	
Sc	=	73	(NAA)
Ni	=	-	
Co	=	17.6	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	8.2	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	5.10	
Ce	=	17.8	
Pr	=	-	
Nd	=	19.6	
Sm	=	8.19	
Eu	=	1.85	
Gd	=	12.9	
Tb	=	-	
Dy	=	14.9	
Ho	=	-	
Er	=	-	
Tm	=	-	
Yb	=	7.99	
Lu	=	1.11	(NAA)
Y	=	-	

ROCK NUMBER: 78575
WEIGHT: 140.0 g

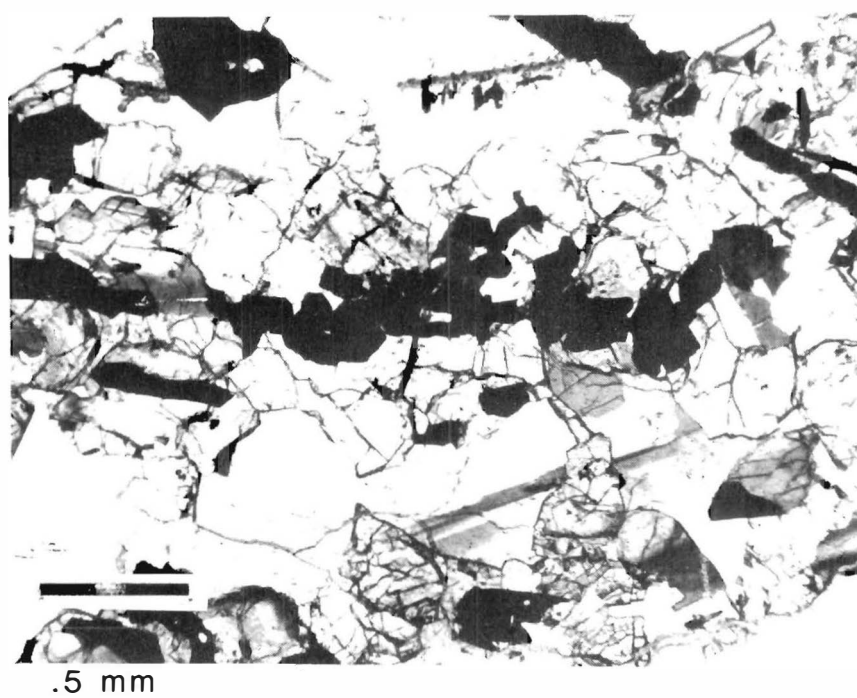
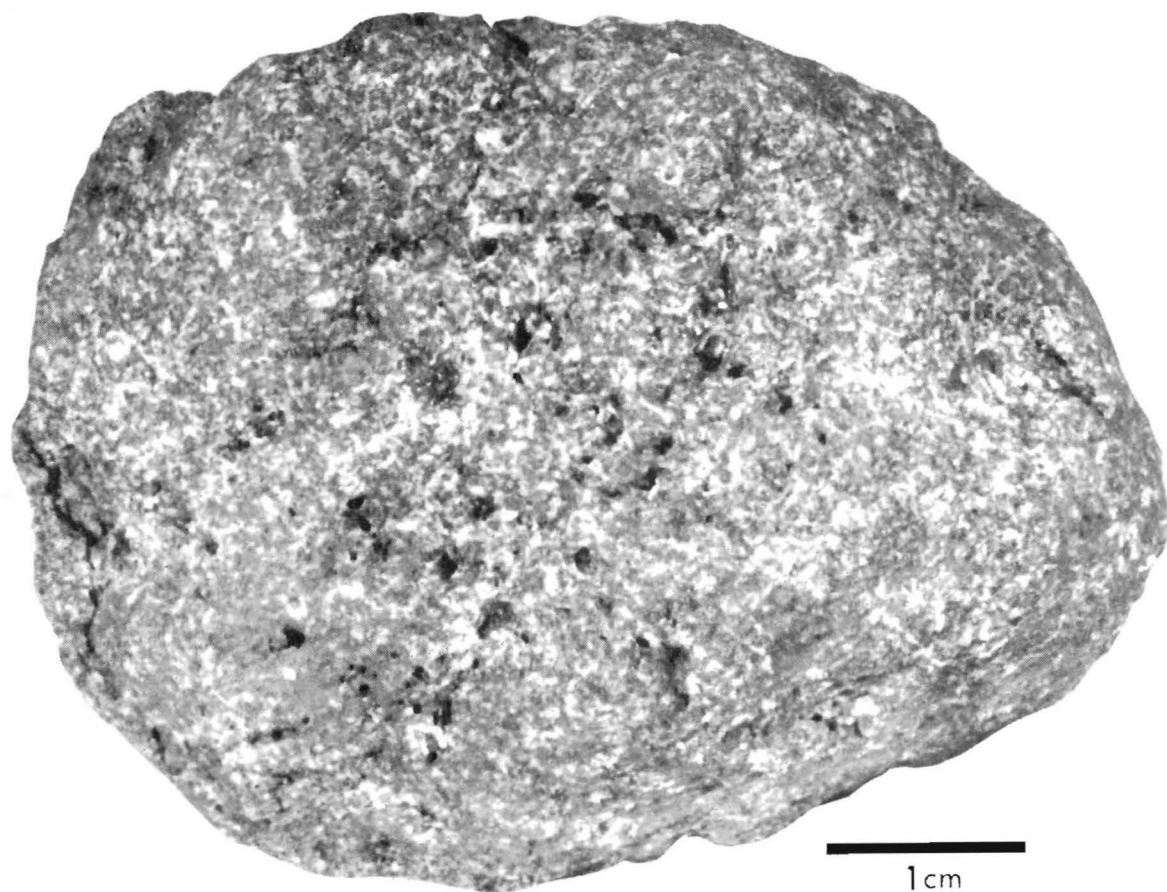
DIMENSIONS: 5.8 x 4.8 x 3.4 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray (N5)
SHAPE: Subrounded
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: None
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: Few
CAVITIES: 2% vugs
SPECIAL FEATURES:

BY: Keil, Dowty, Prinz

78575



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	42.62
TiO ₂	=	11.80
Al ₂ O ₃	=	9.00
FeO	=	17.0
MnO	=	0.22
MgO	=	7.50
CaO	=	11.00
Na ₂ O	=	0.36
K ₂ O	=	0.04
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.46
TOTAL		<hr/> 100.00

CIPW NORM

Qtz	=	7.13
Or	=	0.24
Ab	=	3.05
An	=	22.82
Di	=	25.88
Hy	=	17.79
Ne	=	-
Ol	=	-
Chr	=	0.68
Ilm	=	22.41
Apa	=	-
TOTAL		<hr/> 100.00

100 Mg/(Mg+Fe) = 44.0
An/Ab/Or = 87/12/1

TRACE AND MINOR ELEMENTS

Li	=	-
Rb	=	-
K	=	332 (NAA)
Ba	=	-
Sr	=	-
Cr	=	-
V	=	100 (NAA)
Sc	=	75 (NAA)
Ni	=	-
Co	=	16.1 (NAA)
Cu	=	-
Zn	=	-
Th	=	-
U	=	-
Zr	=	-
Hf	=	5.4 (NAA)
Nb	=	-

RARE EARTH ELEMENTS (NAA)

La	=	3.6
Ce	=	15
Pr	=	-
Nd	=	-
Sm	=	6.7
Eu	=	1.47
Gd	=	-
Tb	=	1.8
Dy	=	11
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	6.6
Lu	=	0.95
Y	=	-

ROCK NUMBER: 78585
WEIGHT: 44.56 g

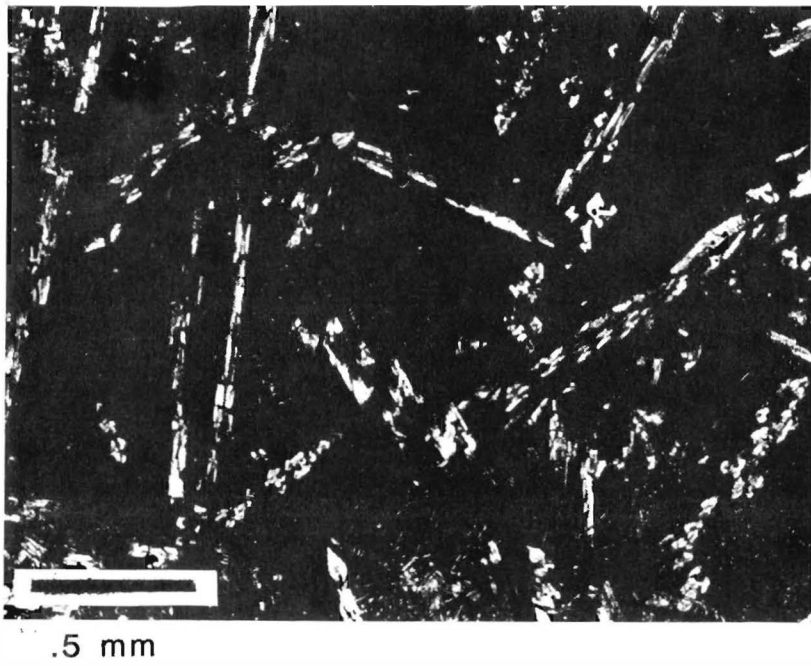
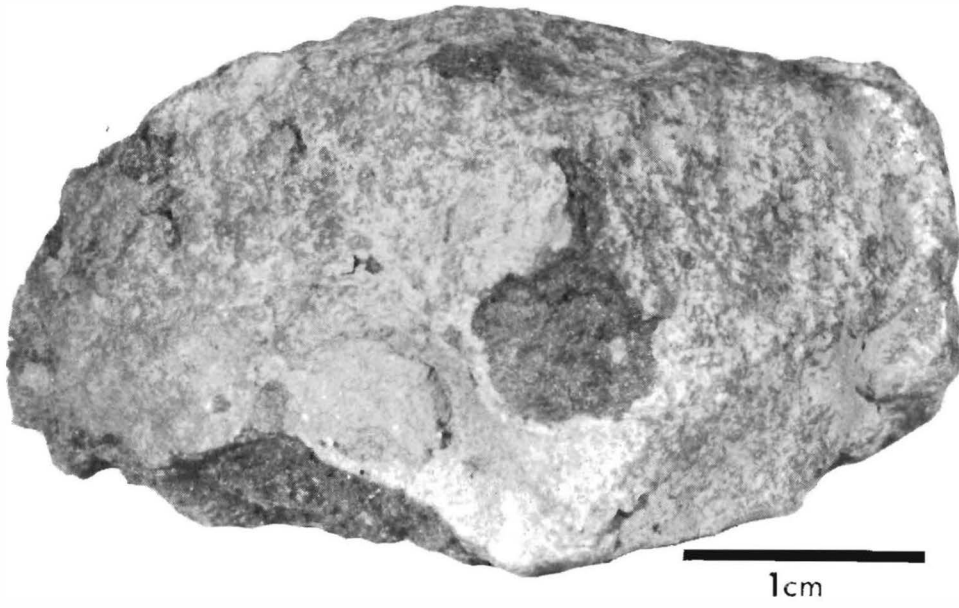
DIMENSIONS: 4 x 3 x 2.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N-4)
SHAPE: Subangular
FABRIC: Fine-grained, holocrystalline(?)
COHERENCE: Intergranular, tough
Fracturing: Very few, non-penetrative, concentrated near freshly broken surface
VARIABILITY: Concentration of vugs variable
SURFACE: Fresh surface hackly with some dust, other surfaces smooth and dust covered
ZAP PITS: Few, less than 1/2 mm diameter, possible glass linings, no obvious pits
CAVITIES: Irregularly distributed, less than 1 mm vugs, less than 2% vugs usually, locally up to 10%
SPECIAL FEATURES: No obvious pits on rock

BY: Lofgren

78585



CHEMISTRY

MAJOR ELEMENTS

SiO₂ =
 TiO₂ =
 Al₂O₃ =
 FeO =
 MnO =
 MgO =
 CaO =
 Na₂O =
 K₂O =
 P₂O₅ =
 S =
 Cr₂O₃ =

TOTAL

CIPW NORM

Qtz =
 Or =
 Ab =
 An =
 Di =
 Hy =
 Ne =
 Ol =
 Chr =
 Ilm =
 Apa =

TOTAL

100 Mg/(Mg+Fe) =
 An/Ab/Or =

TRACE AND MINOR ELEMENTS

Li =
 Rb =
 K =
 Ba =
 Sr =
 Cr =
 V = 79 (NAA)
 Sc = 86 (NAA)
 Ni =
 Co = 21 (NAA)
 Cu =
 Zn =
 Th =
 U =
 Zr =
 Hf = 6.4 (NAA)
 Nb =

RARE EARTH ELEMENTS (NAA)

La = 5.6
 Ce = 20
 Pr =
 Nd = 21
 Sm = 7.5
 Eu = 1.42
 Gd =
 Tb = 1.8
 Dy = 12
 Ho =
 Er =
 Tm =
 Yb = 6.9
 Lu = 0.97
 Y =

ROCK NUMBER: 78597

WEIGHT: 319.1 g

DIMENSIONS: 6.7 x 5.7 x 5.0 cm

BINOCULAR DESCRIPTION

COLOR: Medium dark gray (N4)

SHAPE: Subangular

FABRIC: Isotropic

COHERENCE: Intergranular - Coherent

Fracturing: None

VARIABILITY: None

SURFACE: Granulated

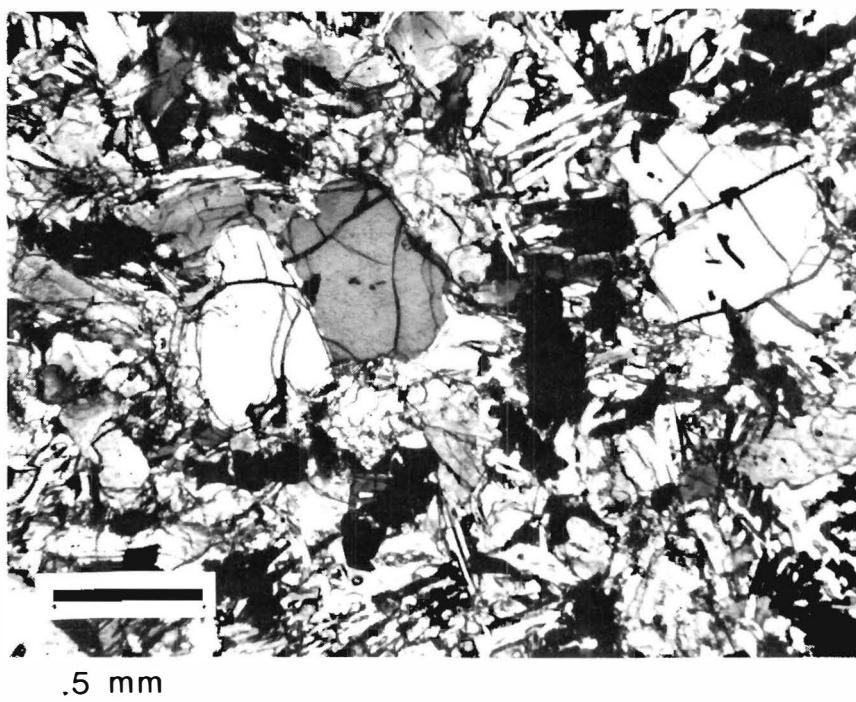
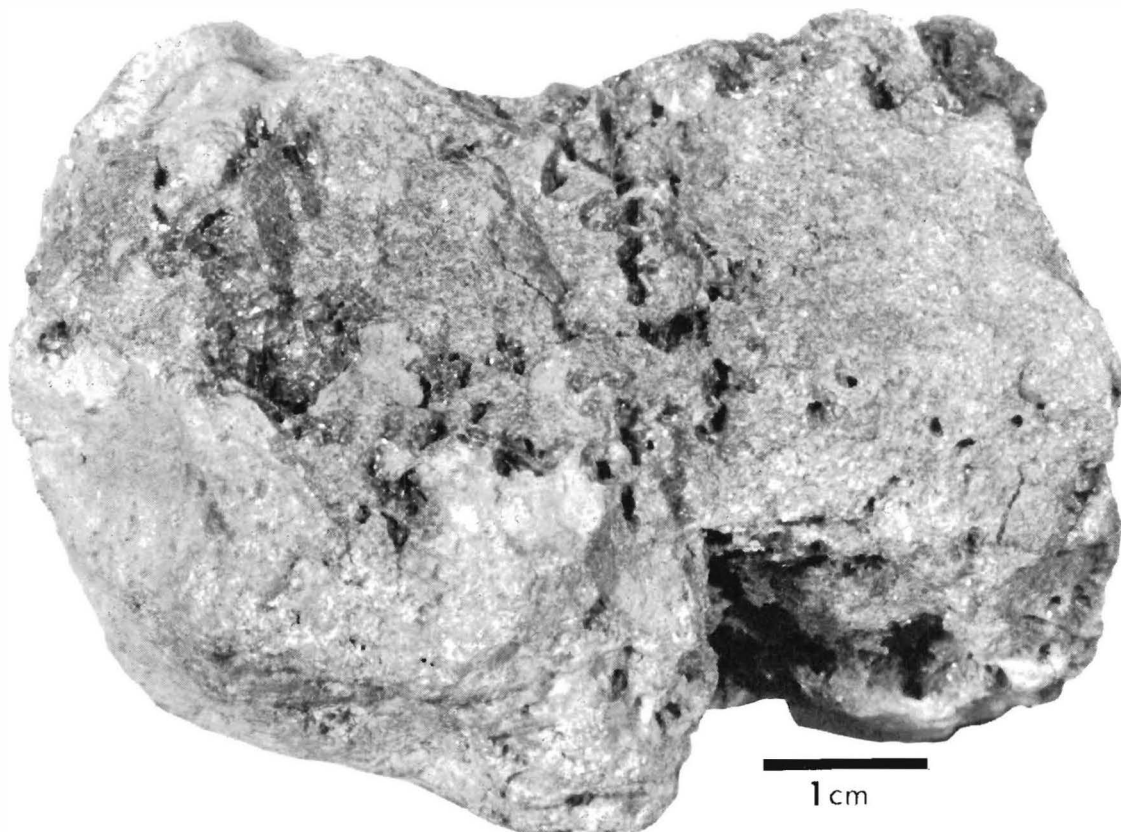
ZAP PITS: None

CAVITIES: 5% vesicles. Large crystals of olivine and pyroxene in vesicles.

SPECIAL FEATURES:

BY: Keil, Dowty, Prinz

78597



CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.54
TiO ₂	=	12.39
Al ₂ O ₃	=	8.85
FeO	=	19.67
MnO	=	0.29
MgO	=	7.83
CaO	=	10.94
Na ₂ O	=	0.39
K ₂ O	=	0.04
P ₂ O ₅	=	0.11
S	=	0.19
Cr ₂ O ₃	=	0.32
<hr/>		
TOTAL		99.56

CIPW NORM

Qtz	=	0.80
Or	=	0.24
Ab	=	3.30
An	=	22.28
Di	=	25.76
Hy	=	22.75
Ne	=	-
Ol	=	-
Chr	=	0.47
Ilm	=	23.53
Apa	=	0.24
<hr/>		
TOTAL		99.37

100 Mg/(Mg+Fe) = 41.5
An/Ab/Or = 86/13/1

TRACE AND MINOR ELEMENTS

Li	=	9.9	(ID)
Rb	=	0.37	(ID)
K	=	396	(ID)
Ba	=	60.6	(ID)
Sr	=	130	(ID)
Cr	=	2800	(NAA)
V	=	100	(NAA)
Sc	=	85	(NAA)
Ni	=	-	
Co	=	20.7	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	0.38	(GAM)
U	=	0.11	(GAM)
Zr	=	-	
Hf	=	6.8	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	5.67	
Ce	=	17.9	
Pr	=	-	
Nd	=	18.8	
Sm	=	7.17	
Eu	=	1.48	
Gd	=	11.2	
Tb	=	-	
Dy	=	13.0	
Ho	=	-	
Er	=	7.94	
Tm	=	-	
Yb	=	7.37	
Lu	=	1.07	(NAA)
Y	=	-	

ROCK NUMBER: 78598
WEIGHT: 224.1 g

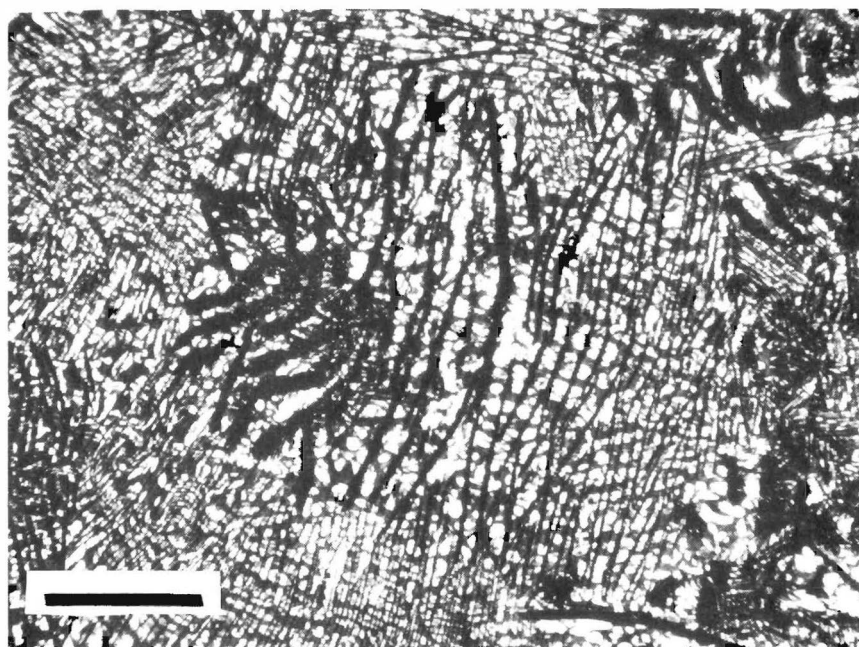
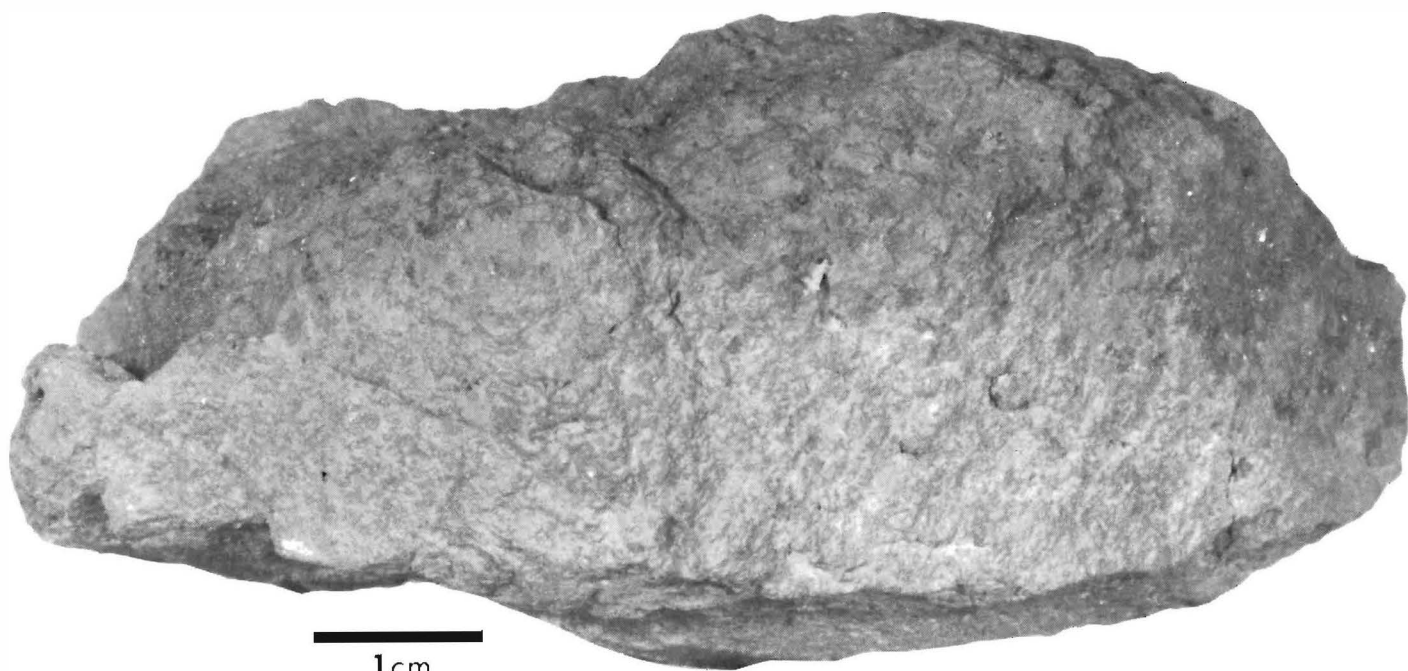
DIMENSIONS: 8.6 x 4.5 x 4.5 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray (N5)
SHAPE: Angular to subangular
FABRIC: Isotropic
COHERENCE: Intergranular - Coherent
Fracturing: None
VARIABILITY: None
SURFACE: Granulated
ZAP PITS: Few
CAVITIES: 2% vugs
SPECIAL FEATURES: Covered with dust making description difficult.
Too fine-grained to see minerals clearly.

BY: Keil, Dowty, Prinz

78598



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	44.94
TiO ₂	=	8.90
Al ₂ O ₃	=	10.00
FeO	=	18.50
MnO	=	0.25
MgO	=	5.20
CaO	=	11.50
Na ₂ O	=	0.44
K ₂ O	=	0.08
P ₂ O ₅	=	-
S	=	-
Cr ₂ O ₃	=	0.20
TOTAL		<u>100.00</u>

CIPW NORM

Qtz	=	7.69
Or	=	0.44
Ab	=	3.72
An	=	25.09
Di	=	26.82
Hy	=	19.04
Ne	=	-
Ol	=	-
Chr	=	0.29
Ilm	=	16.90
Apa	=	-
TOTAL		<u>100.00</u>

100 Mg/(Mg+Fe) = 33.4
 An/Ab/Or = 85.8/12.7/1.5

TRACE AND MINOR ELEMENTS

Li	=	-	
Rb	=	-	
K	=	623	(NAA)
Ba	=	-	
Sr	=	-	
Cr	=	-	
V	=	20	(NAA)
Sc	=	72	(NAA)
Ni	=	-	
Co	=	15	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	9.7	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (NAA)

La	=	7.8
Ce	=	30
Pr	=	-
Nd	=	30
Sm	=	11.6
Eu	=	2.4
Gd	=	-
Tb	=	3
Dy	=	19
Ho	=	-
Er	=	-
Tm	=	-
Yb	=	10.3
Lu	=	1.5
Y	=	-

ROCK NUMBER: 78599
WEIGHT: 198.6 g

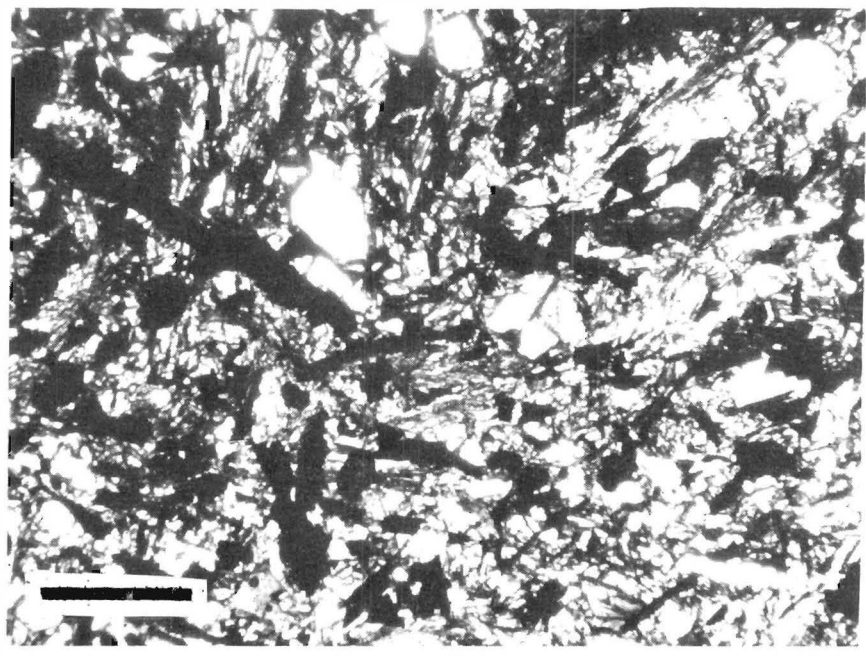
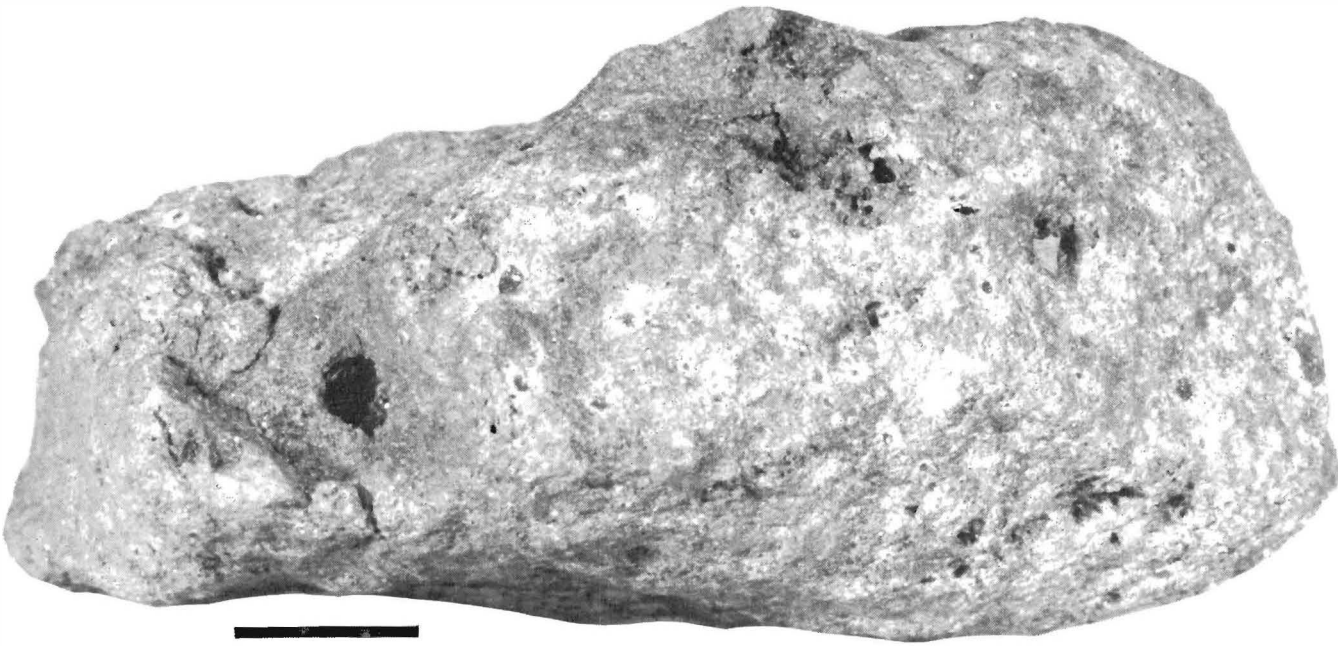
DIMENSIONS: 7.2 x 4.7 x 3.0 cm

BINOCULAR DESCRIPTION

COLOR: Medium gray (N5)
SHAPE: Subrounded
FABRIC: Isotropic
COHERENCE: Intergranular -
Fracturing: None
VARIABILITY: None
SURFACE Granulated
ZAP PITS: Many
CAVITIES: 2% vugs
SPECIAL FEATURES:

BY: Keil, Dowty, Prinz

78599



.5 mm

CHEMISTRY

MAJOR ELEMENTS

SiO ₂	=	38.44
TiO ₂	=	12.52
Al ₂ O ₃	=	8.67
FeO	=	19.14
MnO	=	0.28
MgO	=	8.47
CaO	=	10.48
Na ₂ O	=	0.38
K ₂ O	=	0.06
P ₂ O ₅	=	0.04
S	=	0.18
Cr ₂ O ₃	=	0.43
<hr/>		
TOTAL		99.09

CIPW NORM

Qtz	=	0.84
Or	=	0.35
Ab	=	3.22
An	=	21.77
Di	=	24.51
Hy	=	23.72
Ne	=	-
Ol	=	-
Chr	=	0.63
Ilm	=	23.78
Apa	=	0.09
<hr/>		
TOTAL		98.91

100 Mg/(Mg+Fe) = 44.1
 An/Ab/Or = 85.9/12.7/1.4

TRACE AND MINOR ELEMENTS

Li	=	10.4	(ID)
Rb	=	0.71	(ID)
K	=	699	(ID)
Ba	=	83.2	(ID)
Sr	=	190	(ID)
Cr	=	3600	(NAA)
V	=	-	
Sc	=	79	(NAA)
Ni	=	-	
Co	=	18.4	(NAA)
Cu	=	-	
Zn	=	-	
Th	=	-	
U	=	-	
Zr	=	-	
Hf	=	10.1	(NAA)
Nb	=	-	

RARE EARTH ELEMENTS (ID)

La	=	6.45	
Ce	=	23.7	
Pr	=	-	
Nd	=	25.8	
Sm	=	11.0	
Eu	=	2.12	
Gd	=	16.6	
Tb	=	-	
Dy	=	18.8	
Ho	=	-	
Er	=	11.2	
Tm	=	-	
Yb	=	10.2	
Lu	=	1.46	(NAA)
Y	=	-	

ROCK NUMBER: 79155
 WEIGHT: 318.8 g

DIMENSIONS: 8 x 6 x 5 cm

BINOCULAR DESCRIPTION

COLOR: Rock - brownish gray to light brownish gray (5YR 4/1 - 5YR 6/1)

SHAPE: Subrounded

FABRIC: Coarse grained subdiabasic

COHERENCE: Intergranular - Tough

Fracturing: None in rock; array of thin, tension fractures in glass

VARIABILITY: Homogeneous

SURFACE: Dark glass approximately 1 mm thick, covers all of B face and greater than 1/3 of W and S faces; the glass dwindles to discontinuous smears on E face.

ZAP PITS: Common on all exposures of gabbro. The rock is coarse-grained enough so that glass lining in zaps ranges from white to pale yellow or green to dark gray. Zaps absent from the glass coat on B face, but abundant on the glass coating of S face. Zaps in the dark glass have fractured haloes that are conspicuously orange.

CAVITIES: Very minor (<1%), 4 or 5 irregular cavities, each about 4-5 mm across, occur in center of N face. A few rounded cavities occur in the glass.

SPECIAL FEATURES: The rock is a homogeneous gabbro with minor variations in grain size. It is about 1/2 covered with an exceptionally smooth coating of glass having relatively few minute gas vents and vesicles. To the naked eye, the glass is dark gray with a dull submetallic luster; where vesicles are broken open their walls are smooth, bright, and vitreous. The glass also has a very few, small (≤ 1 mm), rounded blebs. Under the binoculars, the glass is seen to be dark molasses brown, which, in fine particles (zap haloes) is orange. Thin veinlets of glass penetrate the gabbroic rock (evident on T and W). Similar glass also partially fills the cavities on the N face where zaps are made conspicuous by orange haloes. On E face, the glass thins out and exposes the underlying rock in subangular patches. However, some triangular patches of finer grained basalt are also present. These may be a marginal phase of main rock or adhering clasts or another composition. In this area there are one or two 1-2 mm patches of green material - probably green glass, but possibly olivine grains.

Plagioclase: Shows tendency to occur in randomly oriented laths.

Percentage also includes a small amount of colorless and vitreous plagioclase(?) or cristobalite(?).

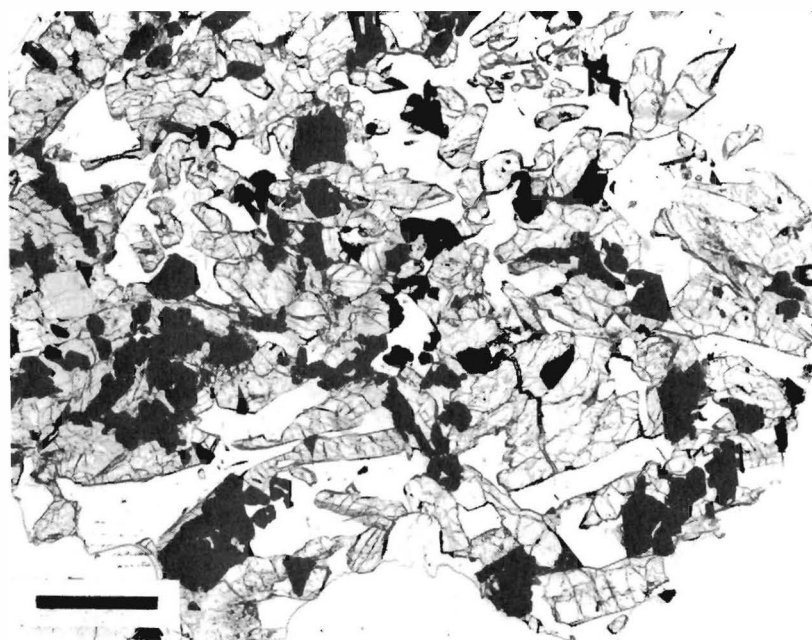
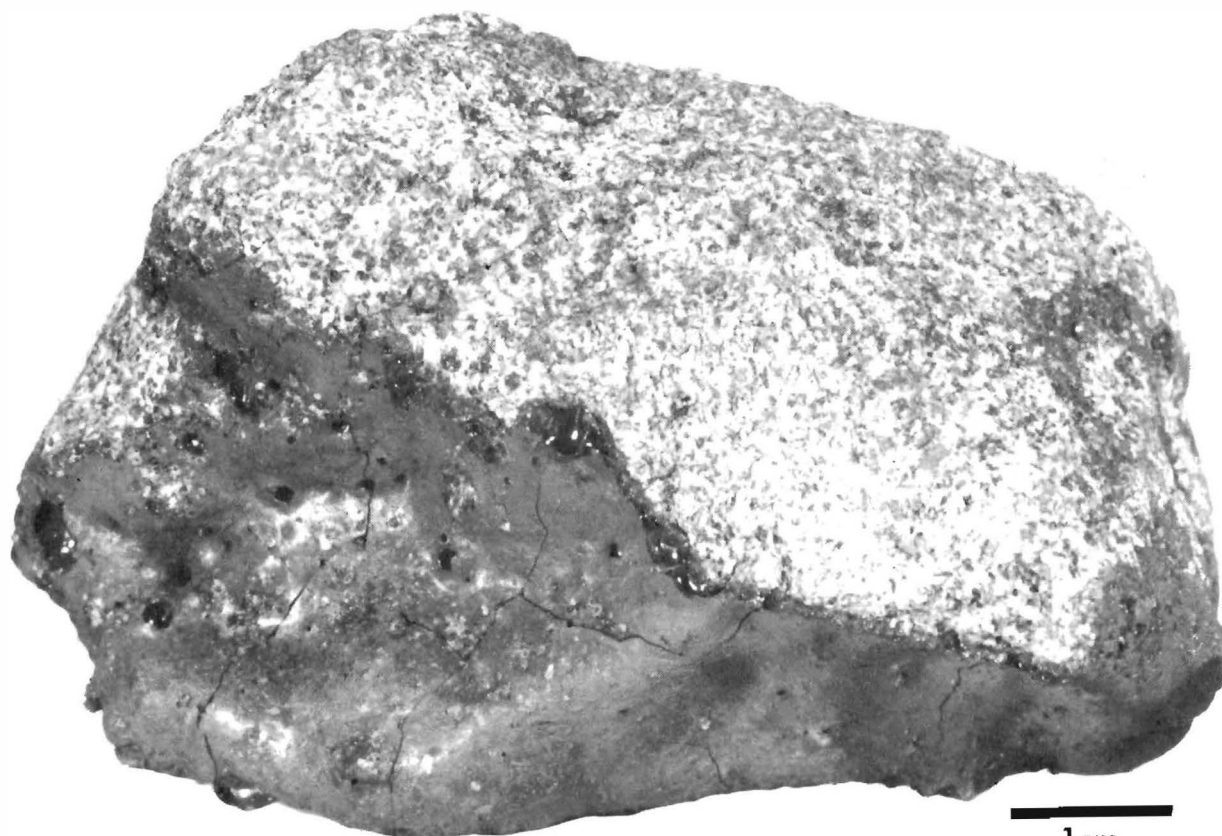
Pyroxene: Rather coarse - sometimes clearly interstitial. Others not so clearly.

Olivine: Occurs in and around plagioclase grains

Opaque: Occurs in and with the pyroxene.

BY: Marvin

79155



1 mm

CHEMISTRY

MAJOR ELEMENTS (2)

SiO ₂	=	38.31
TiO ₂	=	12.77
Al ₂ O ₃	=	8.99
FeO	=	18.62
MnO	=	0.27
MgO	=	9.36
CaO	=	10.24
Na ₂ O	=	0.37
K ₂ O	=	0.07
P ₂ O ₅	=	0.05
S	=	0.17
Cr ₂ O ₃	=	0.50
<hr/>		
TOTAL		99.72

CIPW NORM

Qtz	=	0.14
Or	=	0.41
Ab	=	3.13
An	=	22.66
Di	=	22.62
Hy	=	25.48
Ne	=	-
Ol	=	-
Chr	=	0.74
Ilm	=	24.25
Apa	=	0.11
<hr/>		
TOTAL		99.55

100 Mg/(Mg+Fe) = 47.3
 An/Ab/Or = 86.5/11/9.1.6

TRACE AND MINOR ELEMENTS

Li	=	9	(ID)
Rb	=	0.485	(ID)
K	=	457	(ID)
Ba	=	65.3	(ID)
Sr	=	173	(ID)
Cr	=	3600	(NAA)
V	=	62	(XRF)
Sc	=	82.5	(NAA)
Ni	=	3.6	(NAA)
Co	=	20.7	(NAA)
Cu	=	4.66	(NAA)
Zn	=	1.9	(NAA)
Th	=	0.793	(MS)
U	=	0.2198	(MS)
Zr	=	222	(ID)
Hf	=	8.77	(NAA)
Nb	=	17.4	(NAA)

RARE EARTH ELEMENTS (ID)

La	=	5.2
Ce	=	17.9
Pr	=	-
Nd	=	20.1
Sm	=	8.5
Eu	=	1.88
Gd	=	13.2
Tb	=	-
Dy	=	15.6
Ho	=	-
Er	=	9.22
Tm	=	-
Yb	=	8.51
Lu	=	-
Y	=	-

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