15557

Olivine-normative Basalt

2518 grams

Figure 1: Photo of 15557 showing smooth surface created by micrometeorite bombardment. Sample is 12 cm across. NASA S71-44840.

Introduction

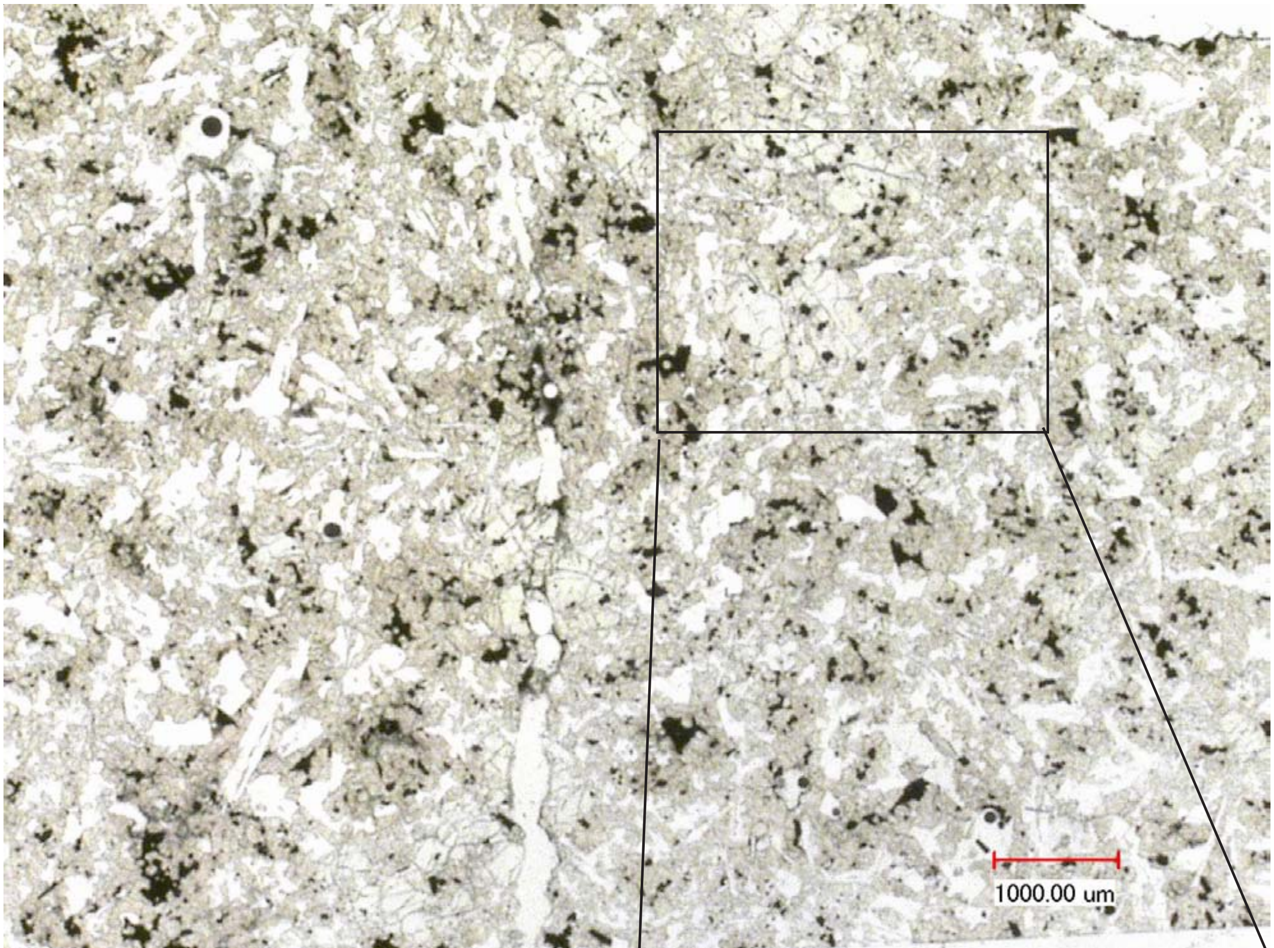
15557 was collected about 40 meters from the edge of Hadley Rille in an area called The Terrace. The lunar regolith was thin in this area, with abundant rock samples (basalts) exposed (Swann et al. 1971). The orientation was documented with surface photography and the top surface is eroded (rounded) by micrometeorites (figure 1). This large sample has not been dated nor properly described (i.e. no mineral analyses).

Petrography

Lunar sample 15557 is a fine-grained olivine-normative basalt with intergranular texture (figure 2). Small (1.5 mm) olivine phenocrysts occur as anhedral crystals rimmed with pyroxene. Augite and pigeonite occur as discrete grains, but pigeonite is overgrown by augite. The mafic minerals are poikititically enclosed in plagioclase (up to 1.5 mm). Interstitial phases include cristobalite, ilmenite, ulvospinel, troilite and Fe-metal

Mineralogical Mode for 15557

	Sample Catalog Butler 1971	Nord et al. 1973
Olivine	3 5 %	10 - 15
Pyroxene	45	50
Plagioclase	50	35
Silica		tr.
Opaques	3	
Mesostasis		5



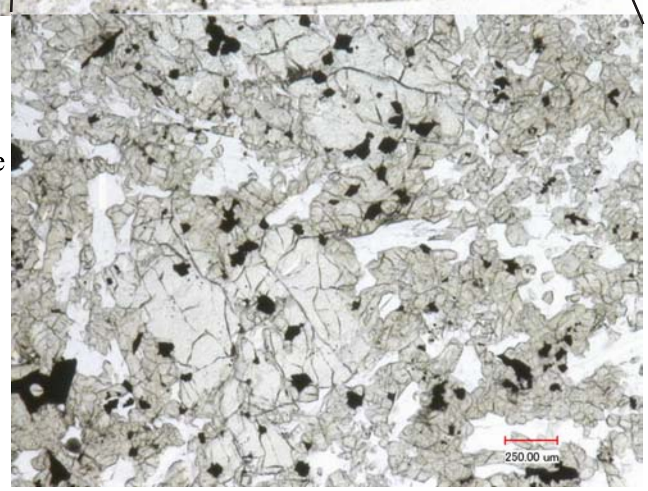


Figure 2a: Photomicrographs of 15557,94 by C Meyer @30x and 100x.

(Nord et al. 1973). There is about 3% void space (figure 6).

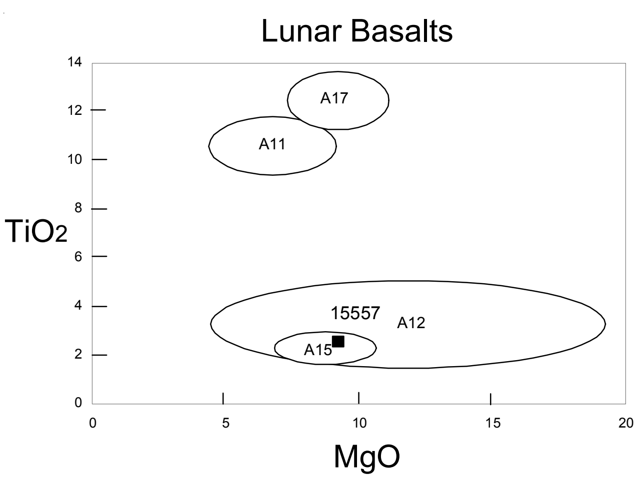


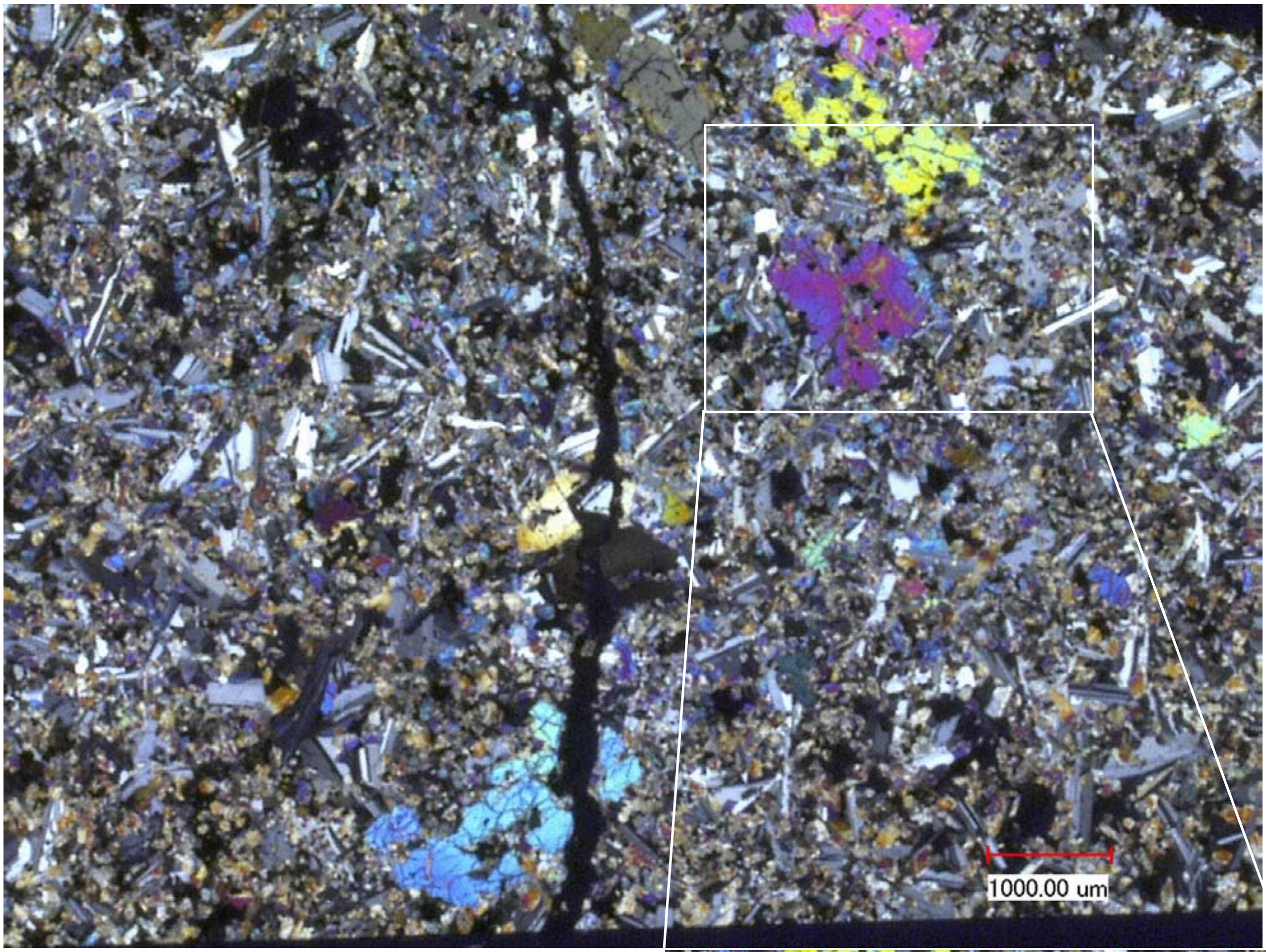
Figure 3: Chemical composition of 15557 compared with other lunar basalts.

Haggerty (1977) remarked on the presence of symplectite in olivine, but it is apparently a minor feature.

Mineralogy

Olivine: Bell et al. (1975) give the composition of the olivine "host" for symplectite.

Pyroxene: no analyses. Nord et al. (1973) report fine exsolution in pyroxene.



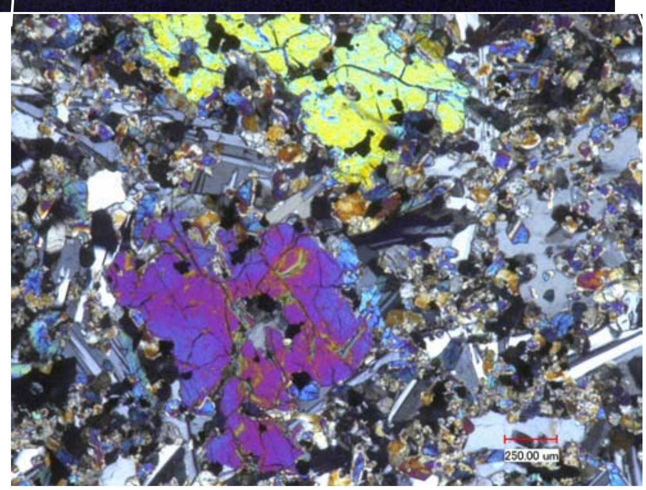


Figure 2b: Photomicrographs of 15557,94 by C Meyer @30x and 100x (with crossed polarizers).

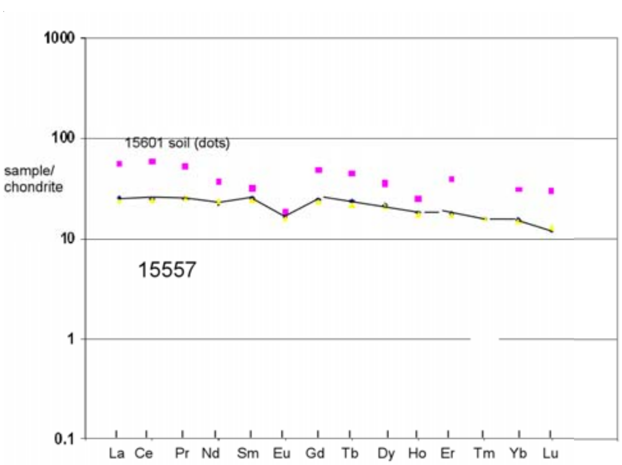


Figure 4: Normalized rare-earth-element composition diagram for 15557 (data by Helmke connected by lines. 15601 for referenece).

Chemistry

Ryder et al. (2001) and Neal (2001) appear to have verified the work of earlier chemists (table and figures 4 and 5).

Radiogenic age dating

No determination

Table 1. Chemical composition of 15557.

reference	Cuttitta73	Baedecker73	Maxwell72	O'Kelley72	Willis 72	Ryder2001		Rancitelli73	Helmke73	Neal2001
weight	Christian72									
SiO2 %	45.74 (a)		45.06 (c)		45.01 (f)	44.8 (f)				
TiO2	2.55 (a)		2.43 (c)		2.53 (f)	2.55 (f)				
Al2O3	8.99 (a)		8.82 (c)		8.84 (f)	9.01 (f)				
FeO	22.35 (a)		22.5 (c)		22.68 (f)	22.02 (f)	21.9 (g)			
MnO	0.28 (a)		0.29 (c)		0.284 (f)	0.284 (f)				
MgO	9.43 (a)		9.52 (c)		9.38 (f)	9.61 (f)				
CaO	10.29 (a)		10.05 (c)		9.99 (f)	9.98 (f)				
Na2O	0.27 (a)		0.34 (c)		0.25 (f)	0.252 (f)	0.26 (g)			
K2O	0.05 (a)		0.04 (c)	0.041 (e)	0.045 (f)	0.044 (f)		0.041 (e)		
P2O5	0.07 (a)		0.07 (c)		0.071 (f)	0.063 (f)				
S %			0.065 (c)		0.09 (f)					
sum										
Sc ppm	37 (a)		48 (d)				45 (g)		43.5 (g)	52.2 (h)
V	185 (a)		240 (d)							316 (h)
Cr	3079 (a)		4584 (d)		3968 (f)	2778 (f)	4320 (g)		4700 (g)	4759 (h)
Co	60 (a)		54 (d)				48.9 (g)			63 (h)
Ni	49 (a)	56 (b)	65 (d)			49 (f)	55 (g)		50 (g)	64 (h)
Cu	14 (a)		13 (d)			11 (f)				19 (h)
Zn		1.3 (b)								21 (h)
Ga	4.9	4 (b)							3.6 (g)	4.46 (h)
Ge ppb		14 (b)								
As										
Se										
Rb	<1				<2 (f)	3 (f)				1.06 (h)
Sr	105		94 (d)		96.4 (f)	97 (f)	79 (g)			123 (h)
Y	37		25 (d)		24.2 (f)	23 (f)				34.6 (h)
Zr	63		140 (d)		88.4 (f)	85 (f)				116 (h)
Nb	12				6.1 (f)	11 (f)				7.42 (h)
Mo										0.1 (h)
Ru										
Rh										
Pd ppb										
Ag ppb										
Cd ppb		2 (b)								
In ppb		0.5 (b)								
Sn ppb										
Sb ppb										
Te ppb										
Cs ppm									0.035 (g)	0.01 (h)
Ba	40		49 (d)		55 (f)		57 (g)			60.4 (h)
La	22						5.1 (g)		5.77 (g)	5.93 (h)
Ce							15.5 (g)		16.1 (g)	14.9 (h)
Pr										2.24 (h)
Nd							7 (g)		12.1 (g)	10.4 (h)
Sm							3.7 (g)		4.36 (g)	3.72 (h)
Eu							0.91 (g)		1.1 (g)	0.93 (h)
Gd									5.8 (g)	4.78 (h)
Tb							0.79 (g)		0.98 (g)	0.85 (h)
Dy									6.43 (g)	5.18 (h)
Ho									1.3 (g)	1 (h)
Er									3.6 (g)	2.78 (h)
Tm										0.38 (h)
Yb	4.4		4.6 (d)				2.27 (g)		2.64 (g)	2.49 (h)
Lu							0.32 (g)		0.39 (g)	0.29 (h)
Hf							2.62 (g)		2.3 (g)	2.65 (h)
Ta							0.4 (g)			0.48 (h)
W ppb										80 (h)
Re ppb										
Os ppb										
Ir ppb		0.061 (b)								
Pt ppb										
Au ppb		0.084 (b)								
Th ppm				0.45 (e)			0.4 (g)	0.44 (e)		0.34 (h)
U ppm				0.14 (e)				0.131 (e)		0.1 (h)

technique: (a) conventional, (b) RNAA, (c) wet chem., (d) various, (e) radiation counting, (f) XRF, (g) INAA, (h) ICP-MS

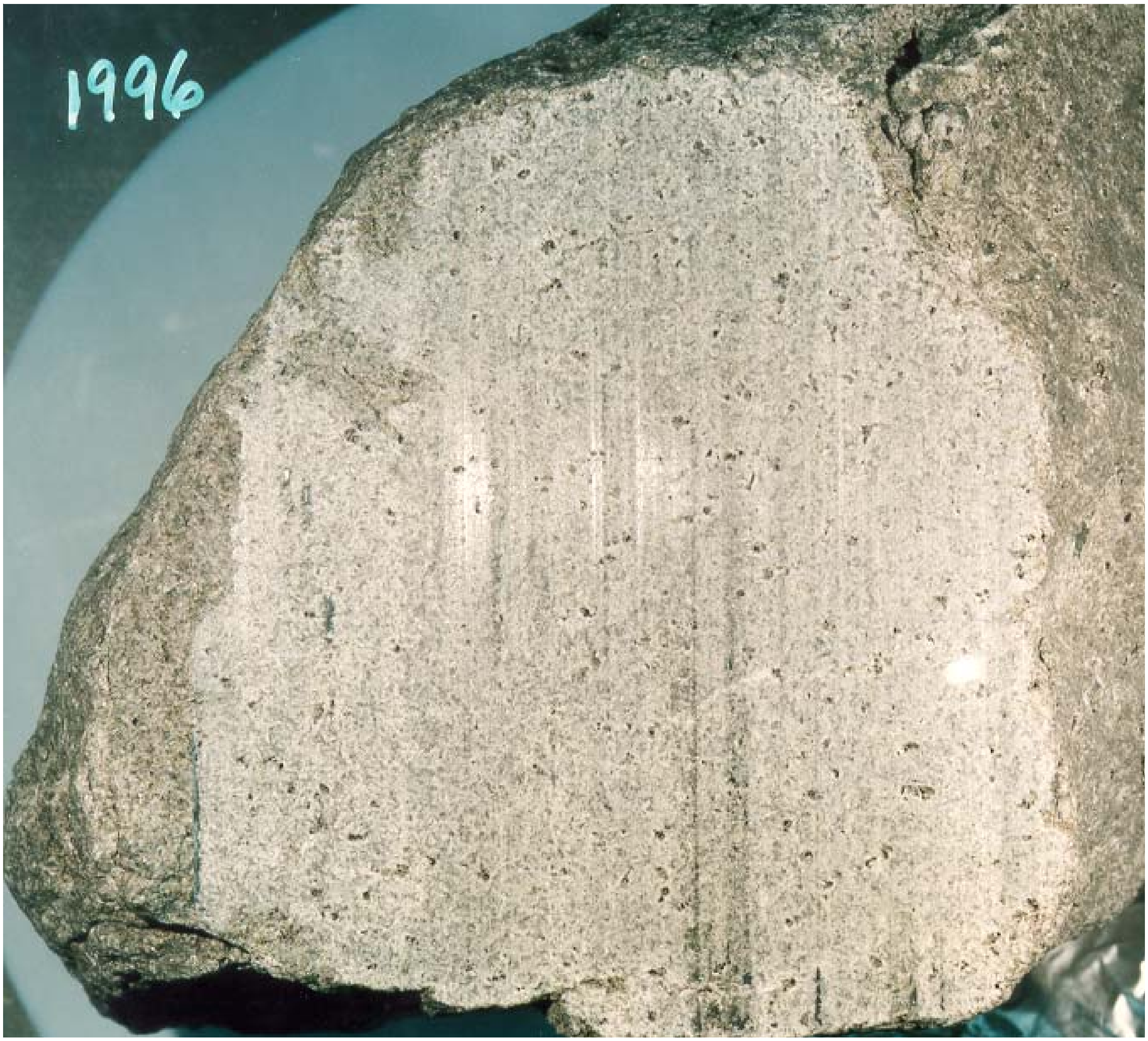


Figure 5: Sawn surface of 15557,0 showing saw marks. NASA S97-16847. This surface is about 7 cm across.

Cosmogenic isotopes and exposure ages

Rancitellit et al. (1972) determined the cosmic-ray-induced activity of ^{22}Na = 39 dpm/kg, ^{26}Al = 75 dpm/kg, ^{46}Sc = 3.4 dpm/kg, and ^{54}Mn = 34 dpm/kg.

Other Studies

Thode and Reese (1972) determined the isotopic composition of sulfur. Bhandari et al. (1973) measured the density of solar flare tracks as function of depth.

Processing

A slab was cut through the middle.

There are only 6 thin sections of this large rock.

References for 15557

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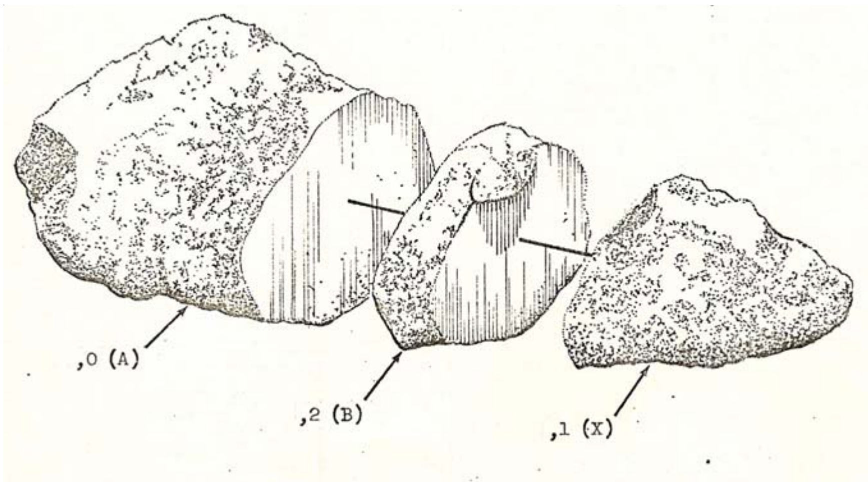
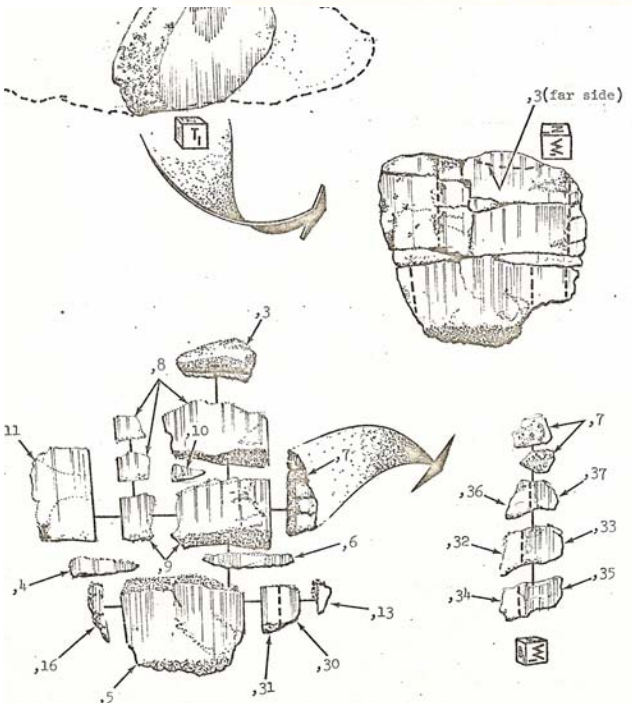
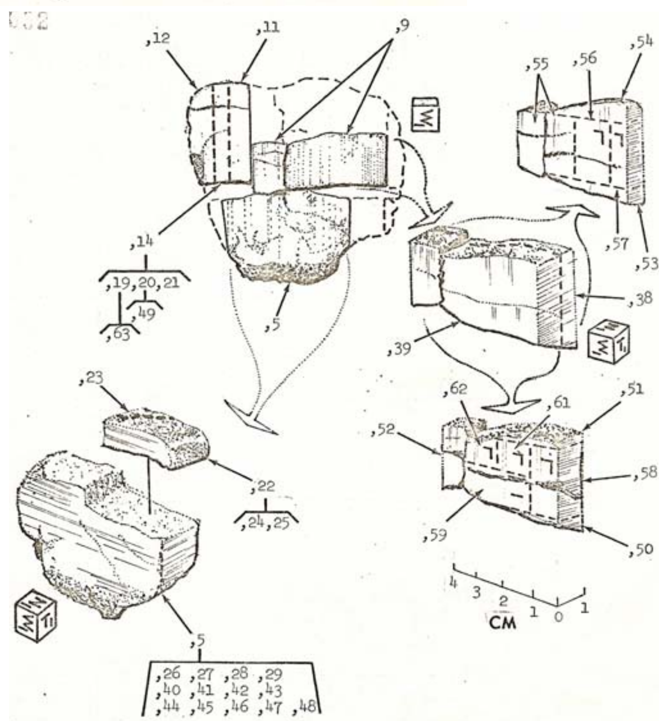
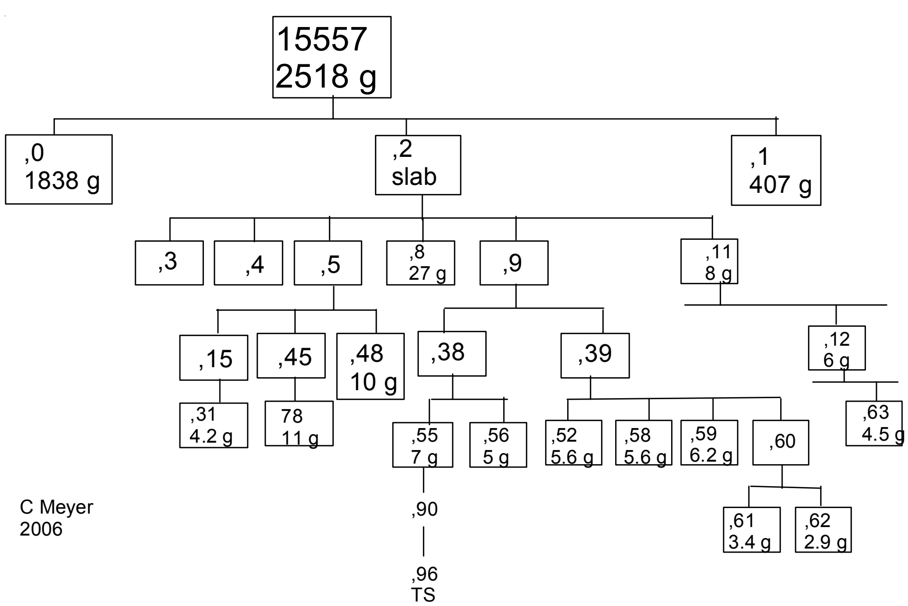

,0 (A)
,2 (B)
,1 (X)






15557
2518 g
,0
1838 g
,2
slab
,1
407 g
,3
,4
,5
,8
27 g
,9
,11
8 g
,15
,45
,48
10 g
,38
,39
,12
6 g
,31
4.2 g
78
11 g
,55
7 g
,56
5 g
,52
5.6 g
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5.6 g
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6.2 g
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C Meyer
2006
,90
,61
3.4 g
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2.9 g
,96
TS

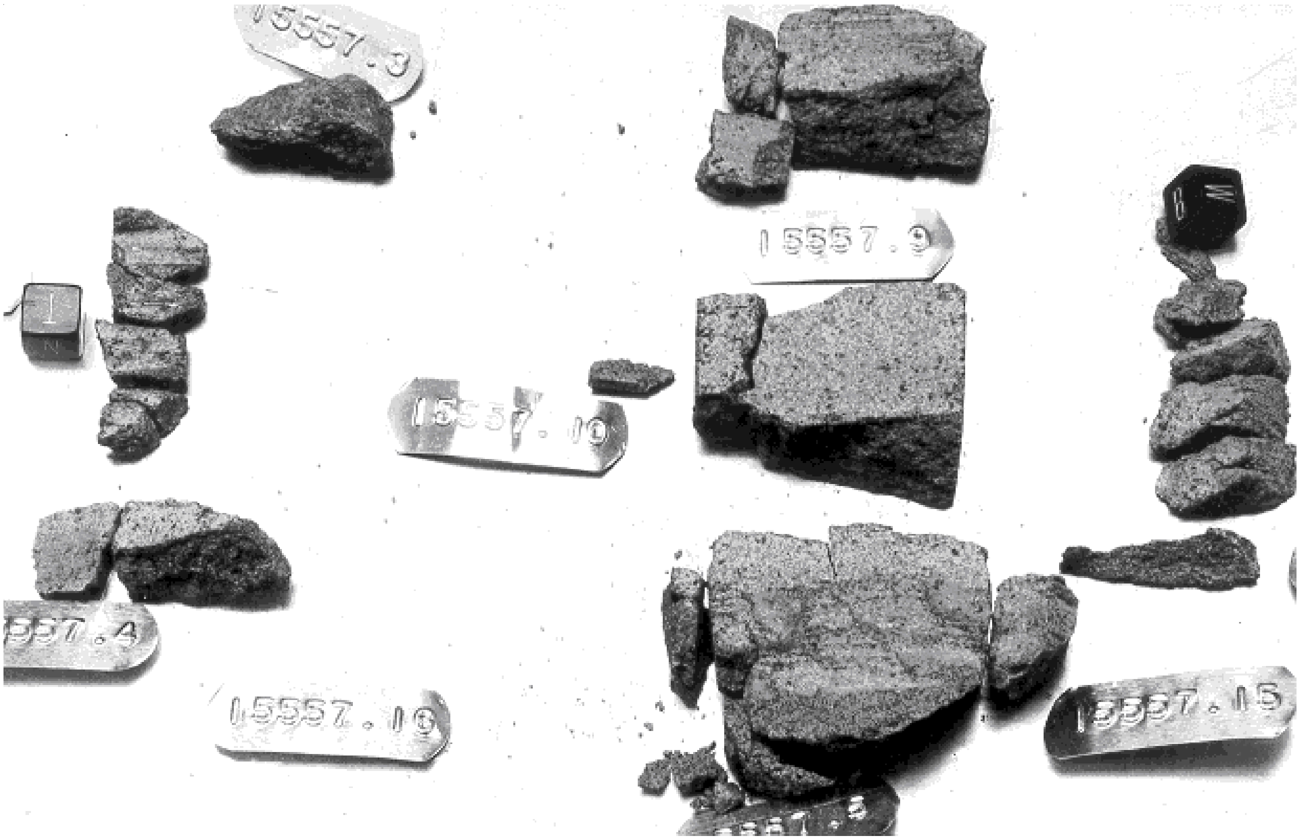
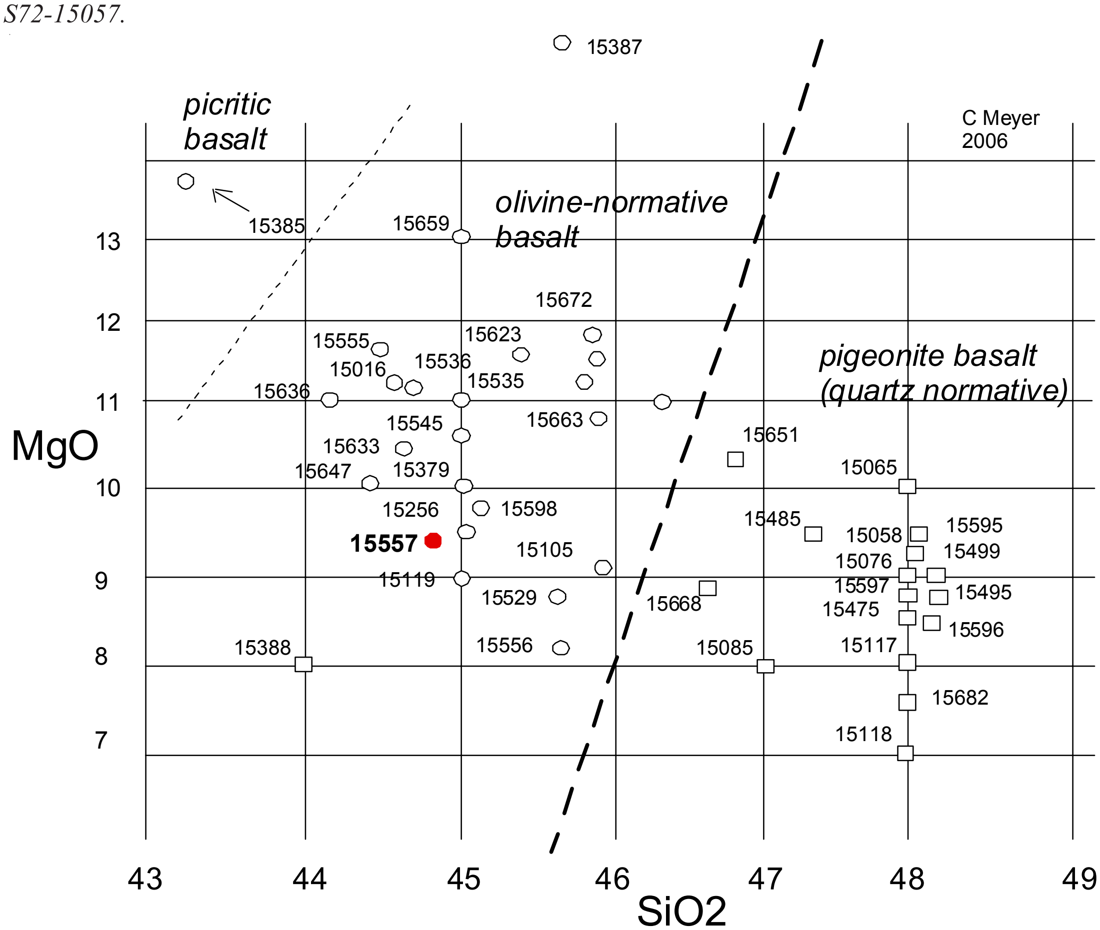


Figure 6: Parts diagram for the slab that was cut from 15557. Largest piece is just over one inch. NASA S72-15057.



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