

**15647**  
Olivine-normative Basalt  
58.2 grams



*Figure 1: Photo of 15647,0. NASA S87-4334. Cube and scale are 1 cm.*

**Introduction**

15647 is a relatively large, relatively coarse-grained olivine basalt. It is coherent, rounded by micrometeorite bombardment and has numerous micrometeorite pits on the outer surface (figure 1). It was collected by rake about 20 meters from Hadley Rille (Swann et al. 1971). It has not been dated.

**Mineralogical Mode for 15647**

	<b>Dowty et al. 1973</b>
Olivine	11
Pyroxene	51
Plagioclase	29
Opaque	6

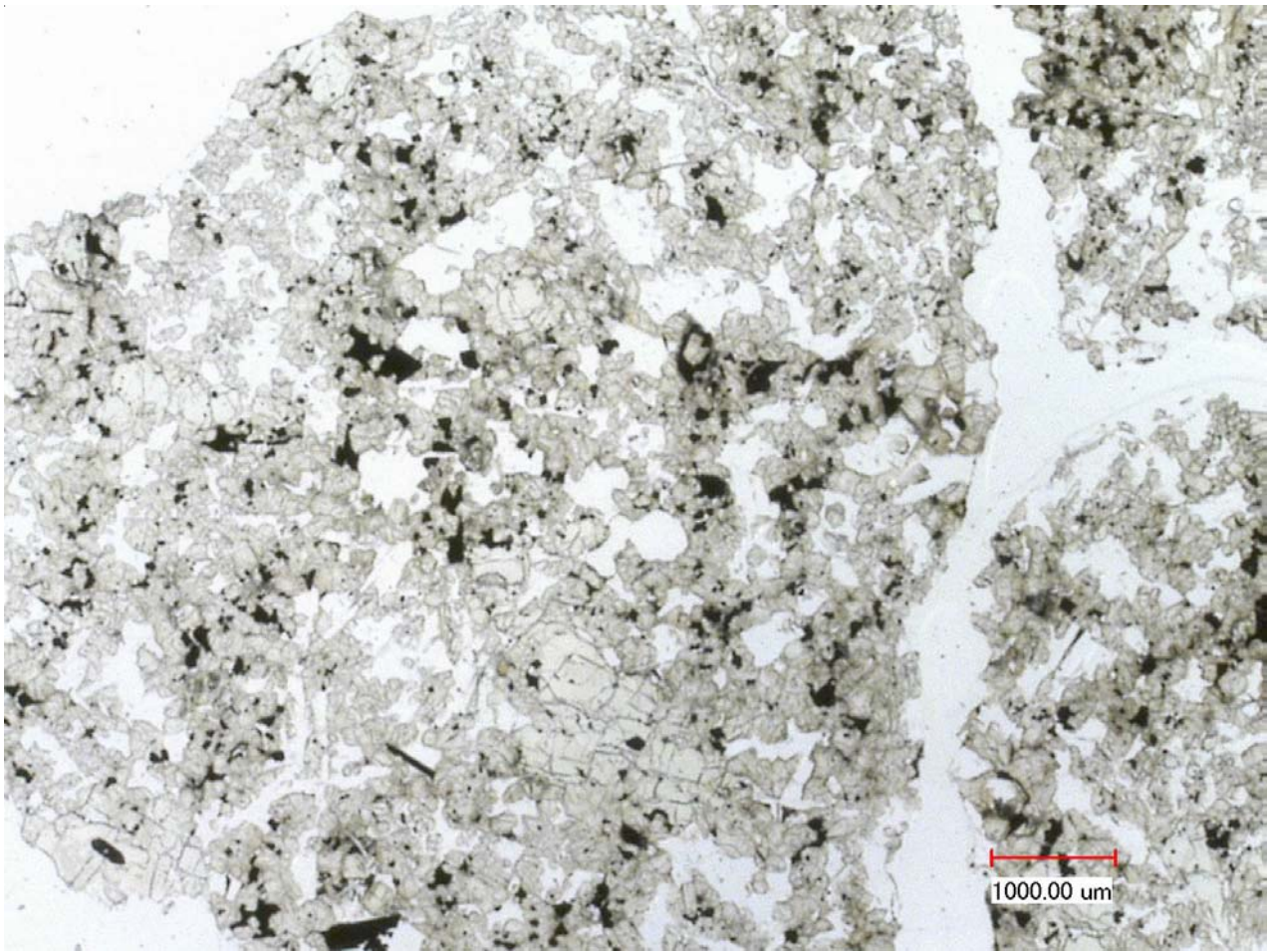


Figure 2a: Photomicrograph of thin section of 15647,7 by C Meyer @ 30x.

### **Petrography**

Dowty et al. (1973) and Ryder (1985) give the following description. “15647 consists of anhedral, small (<1mm) olivines, small granular pyroxenes and some granular olivines, and plagioclases (figures 2 a,b). The plagioclases, up to 2 mm long, are ragged and poikilitically enclose the small mafic phases. In places they grow in a radial arrangement.”

“The olivine phenocrysts appear optically unzoned, generally, and a few contain quenched silicate liquid inclusions. Chromite is present in the olivines, but ulvospinel is the dominant opaque phase. Ilmenite, cristobalite, glass, fayalite and triolite form the residuum.”

Pyroxene is chemically zoned (figure 3). Metallic iron has Ni = 2.2 – 7.7% and Co = 1.3 – 1.8%. The residual silicic glass contains up to 7.9% K<sub>2</sub>O.

Logren et al. (1975) and others have studied the texture of Apollo 15 basalts, using experiments to determine the nucleation and cooling rate.

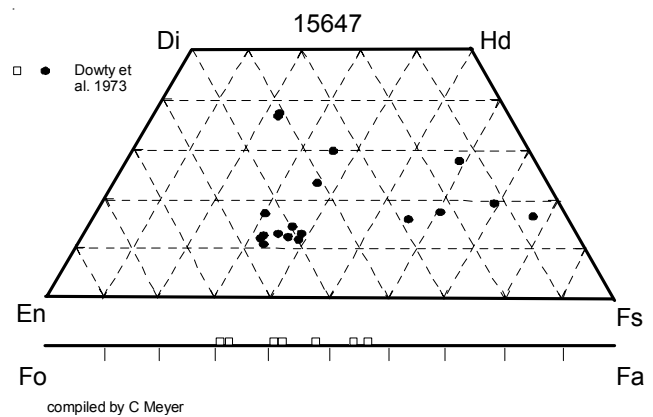


Figure 3: Pyroxene and olivine composition of 15647 (from Dowty et al. 1973).

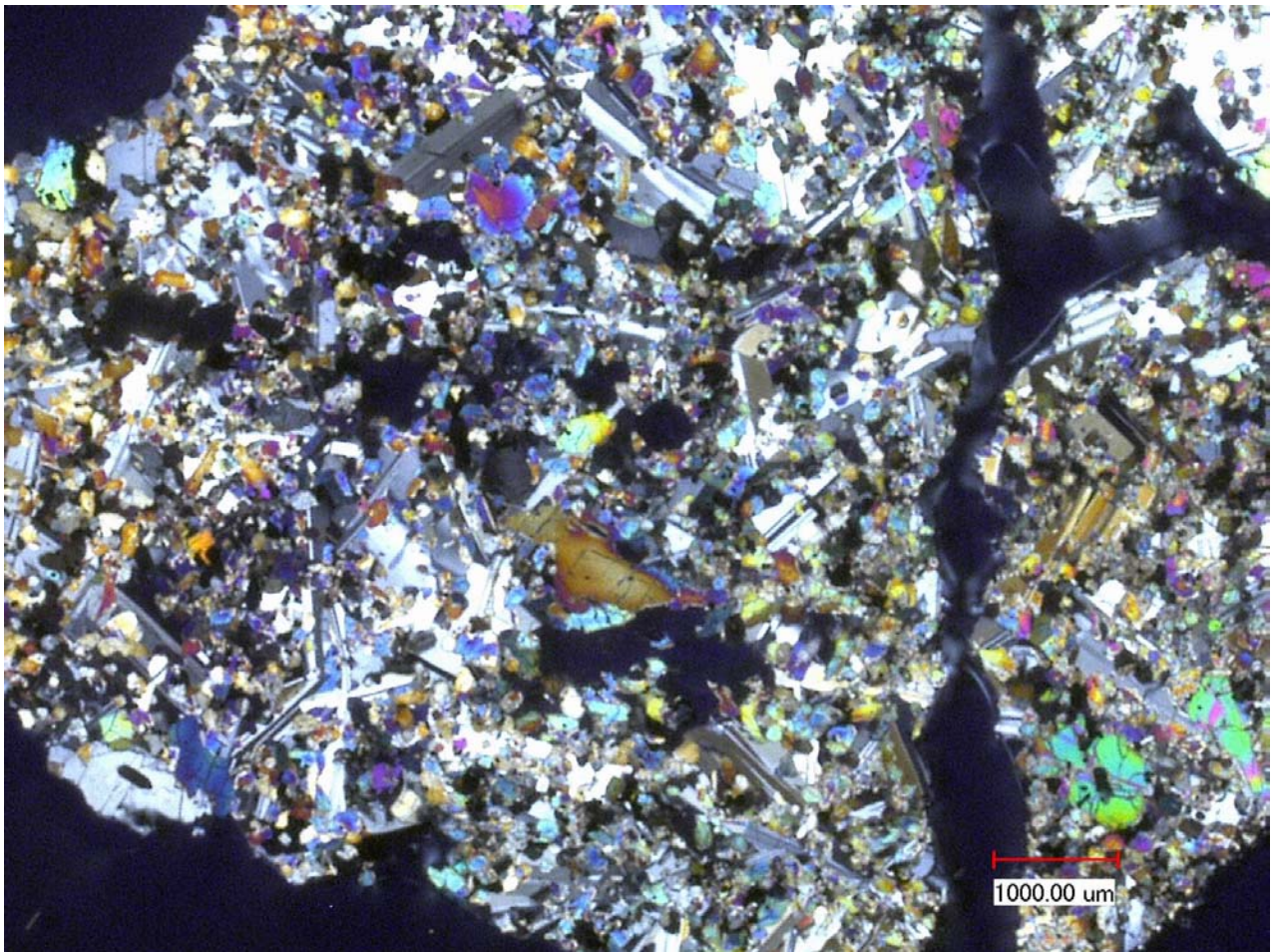


Figure 2b: Photomicrograph of thin section of 15647,7 by C Meyer @ 30x (crossed polarizers).

### Chemistry

The chemical composition of 15647 has been determined by Helmke et al. (1973), Neal (2001) and Ryder et al. (2001)(table and figures 4 and 5). It falls in the field of “olivine-normative basalt” (figure 6).

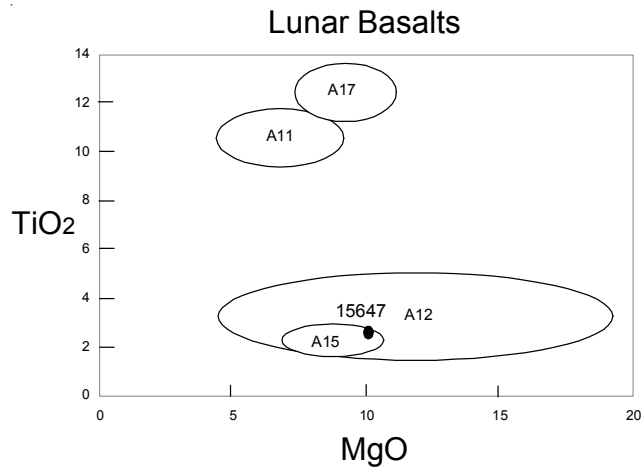


Figure 4: Composition of 15647 compared with that of other lunar basalt types.

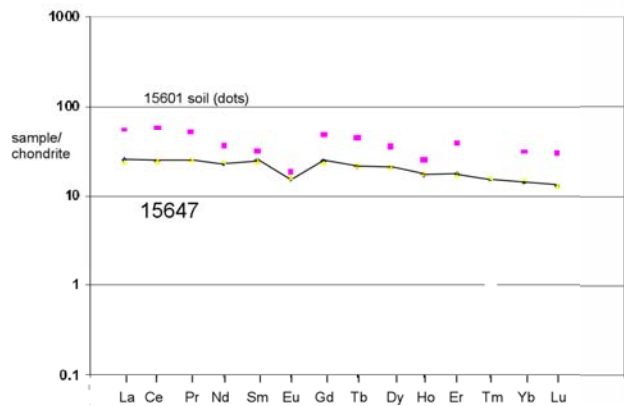


Figure 5: Normalized rare-earth-element diagram for 15647 with 15601 soil for comparison.

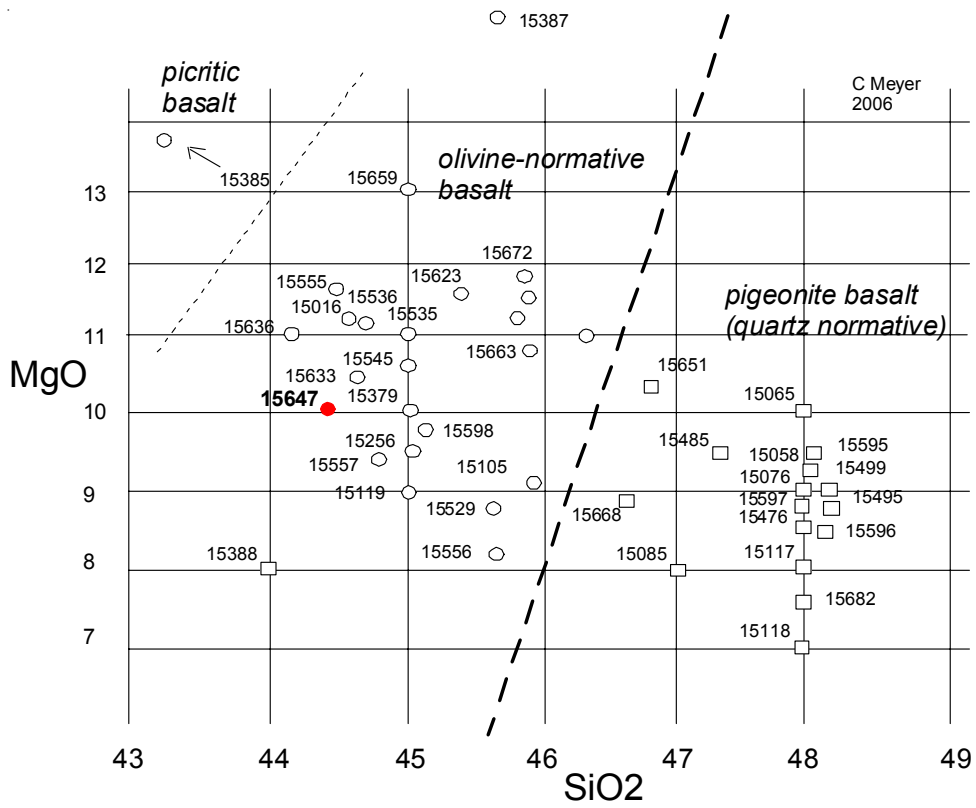
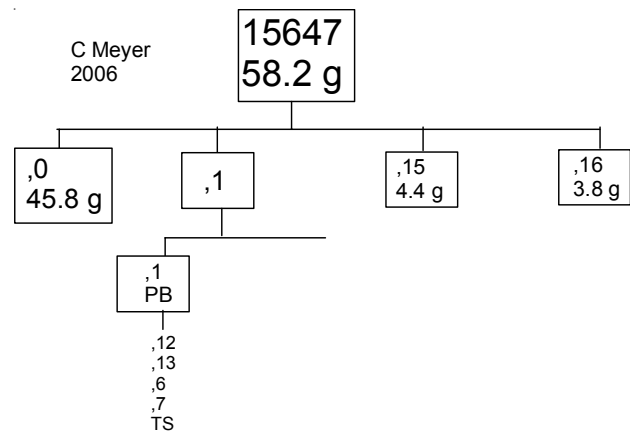


Figure 6: The big picture (with regard to 15647 and its relationship to other Apollo 15 basalts).



**Table 1. Chemical composition of 15647.**

reference	Ryder2001		Helmke73	Dowty73	Neal2001
weight	5 g		Helmke72		
SiO2 %	44.4 (a)		46.2	44.8 (c)	
TiO2	2.44 (a)		3	2.35 (c)	
Al2O3	9 (a)		7.86	9 (c)	
FeO	22.36 (a)	22.2 (b)	23.9	23.6 (c)	
MnO	0.28 (a)		0.29	0.26 (c)	
MgO	10.04 (a)		10.4	10.5 (c)	
CaO	9.65 (a)		9.67	8.8 (c)	
Na2O	0.22 (a)	0.25 (b)	0.275	0.33 (c)	
K2O	0.044 (a)		0.047	0.04 (c)	
P2O5	0.065 (a)			0.07 (c)	
S %					
sum					
Sc ppm		42.5 (b)	46.1 (b)		49.6 (d)
V					275 (d)
Cr	4294 (a)	4110 (b)	4000 (b)	3015 (c)	5228 (d)
Co		52.7 (b)	53 (b)		66 (d)
Ni	52 (a)	61 (b)			71.5 (d)
Cu	16 (a)				16 (d)
Zn					19.6 (d)
Ga			3.5 (b)		4.07 (d)
Ge ppb					
As					
Se					
Rb	6 (a)		1.7 (b)		1.05 (d)
Sr	97 (a)	89 (b)			117 (d)
Y	22 (a)				32.2 (d)
Zr	92 (a)				108.5 (d)
Nb	11 (a)				7.35 (d)
Mo					0.08 (d)
Ru					
Rh					
Pd ppb					
Ag ppb					
Cd ppb					
In ppb					
Sn ppb					
Sb ppb					10 (d)
Te ppb					
Cs ppm			0.041 (b)		0.03 (d)
Ba		56 (b)			59 (d)
La		5.06 (b)	4.83 (b)		5.9 (d)
Ce		15.3 (b)	13.3 (b)		14.6 (d)
Pr					2.21 (d)
Nd		10 (b)	10.6 (b)		10.4 (d)
Sm		3.58 (b)	3.54 (b)		3.66 (d)
Eu		0.89 (b)	0.92 (b)		0.87 (d)
Gd			5 (b)		4.75 (d)
Tb		0.78 (b)	0.83 (b)		0.77 (d)
Dy			5.64 (b)		5.01 (d)
Ho			0.93 (b)		0.95 (d)
Er			3 (b)		2.77 (d)
Tm					0.37 (d)
Yb		2.23 (b)	2.27 (b)		2.33 (d)
Lu		0.3 (b)	0.327 (b)		0.31 (d)
Hf		2.63 (b)	2.6 (b)		2.67 (d)
Ta		0.39 (b)			0.5 (d)
W ppb					80 (d)
Re ppb					
Os ppb					
Ir ppb					
Pt ppb					
Au ppb					
Th ppm		0.42 (b)			0.5 (d)
U ppm					0.13 (d)

technique: (a) XRF, (b) INAA, (c) elec. Probe (d) ICP-MS

## References for 15647

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