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

	Dowty et al. 1973
Olivine	11
Pyroxene	51
Plagioclase	29
Opaque	6

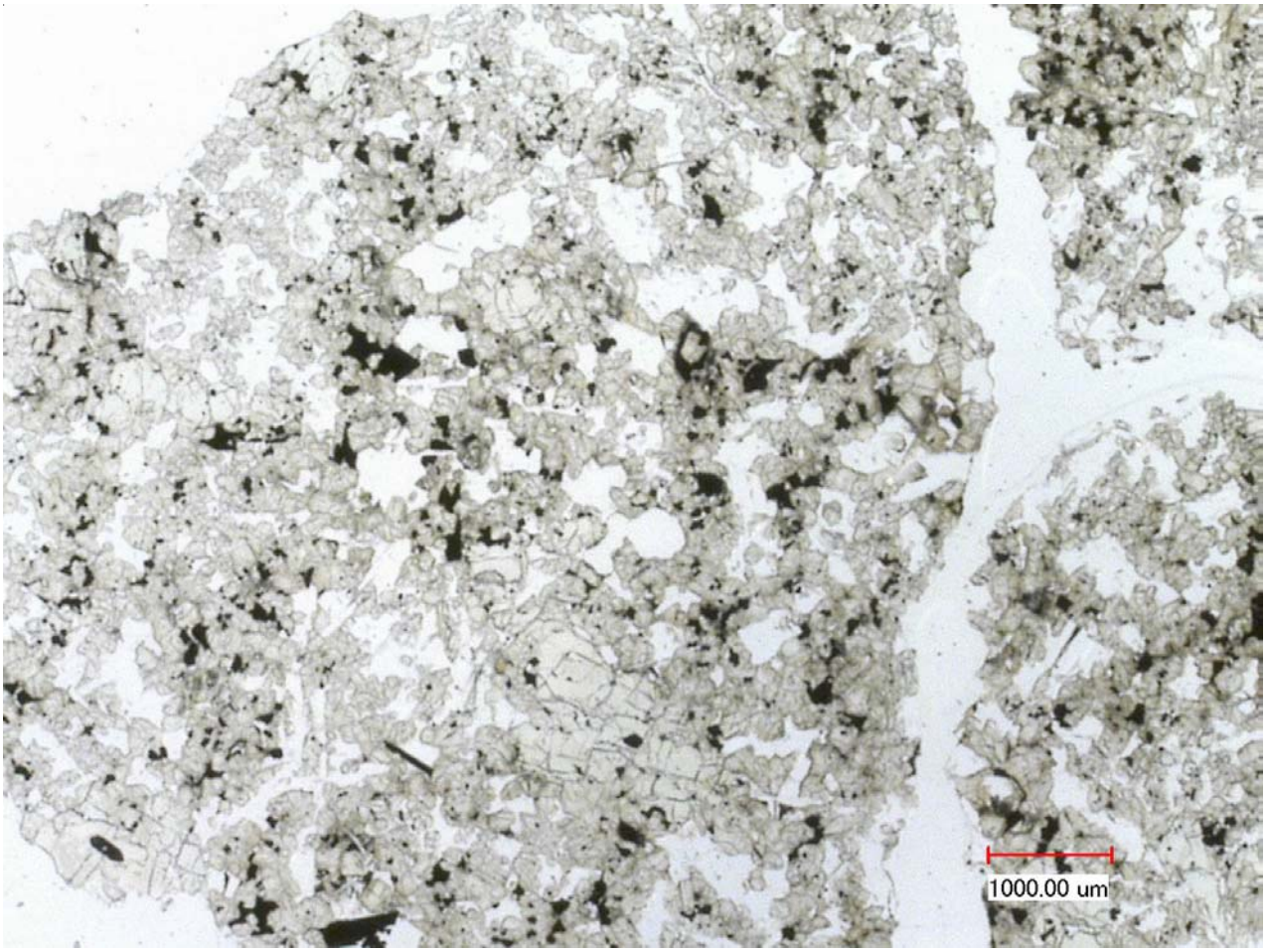

Figure 2a: Photomicrograph of thin section of 15647,7 by C Meyer @ 30x.

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 residum."

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_2O.

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

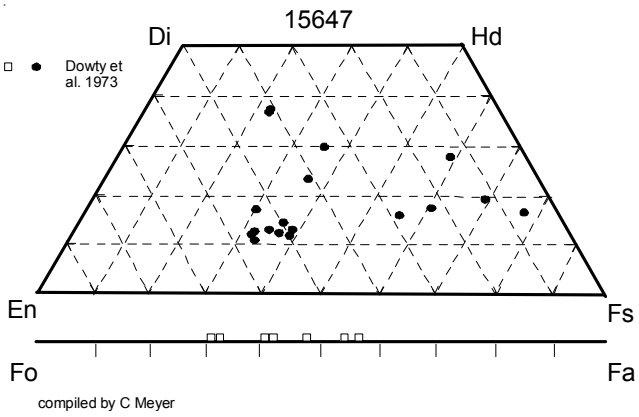

Figure 3: Pyroxene and olivine composition of 15647 (from Dowty et al. 1973).

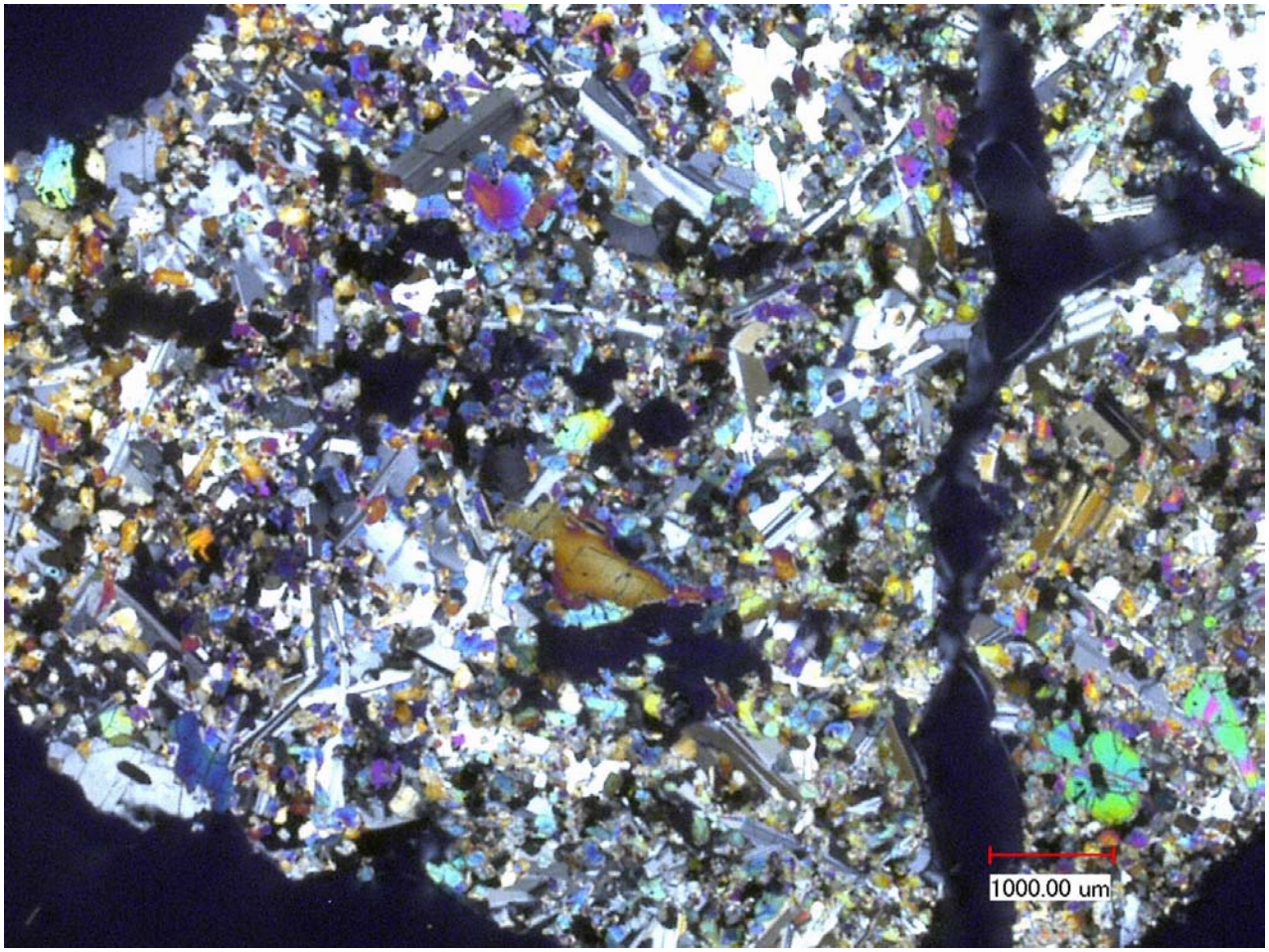

Figure 2b: Photomicrograph of thin section of 15647,7 by C Meyer @ 30x (crossed polarizers).

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).

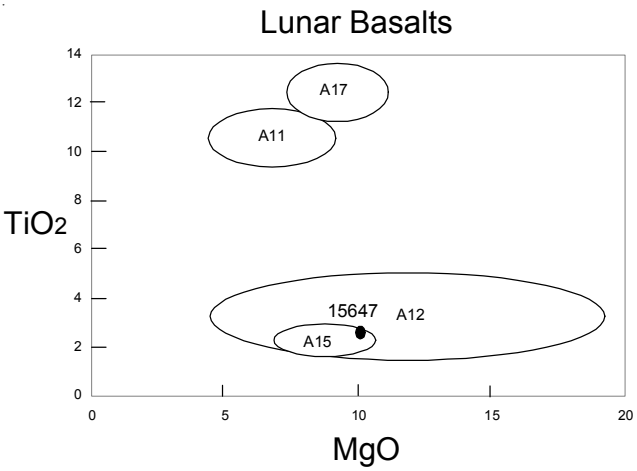

Figure 4: Composition of 15647 compared with that of other lunar basalt types.

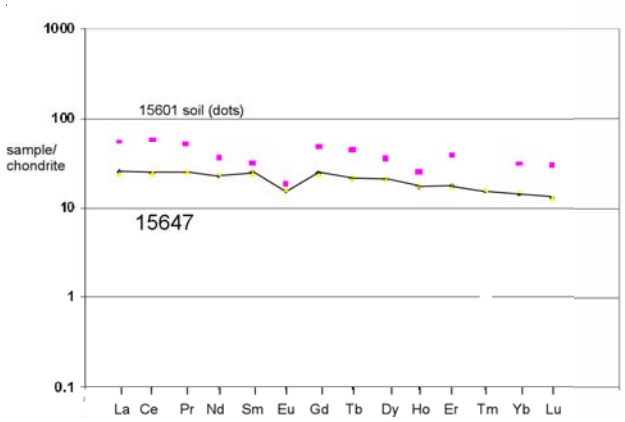

Figure 5: Normalized rare-earth-element diagram for 15647 with 15601 soil for comparison.

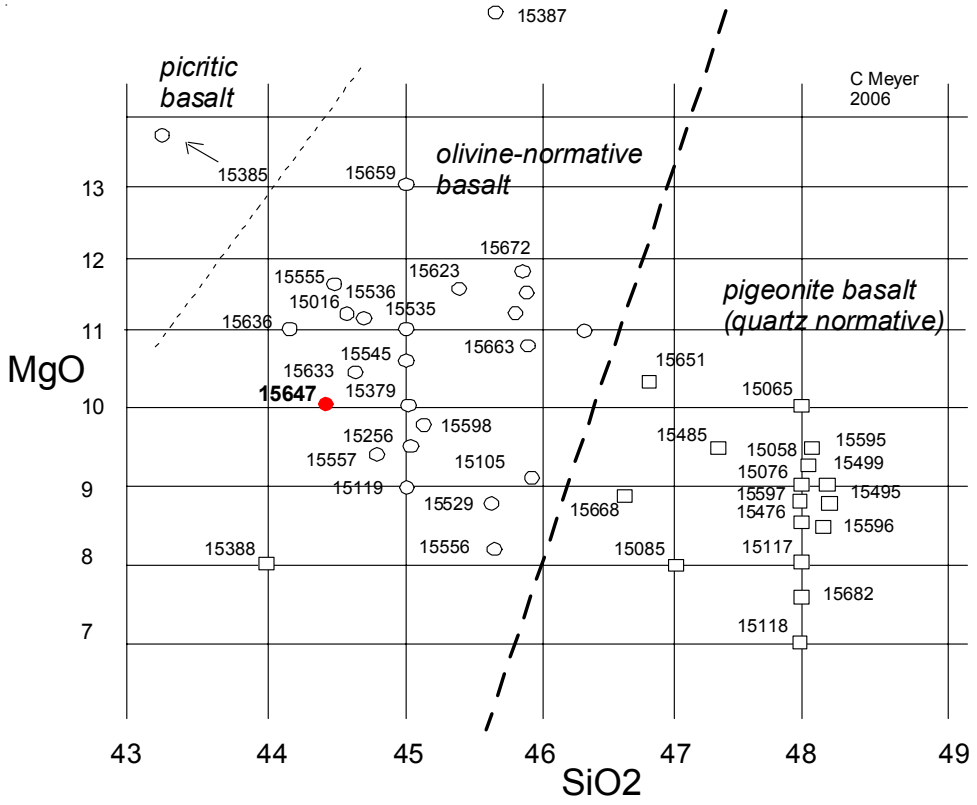

Figure 6: The big picture (with regard to 15647 and its relationship to other Apollo 15 basalts).

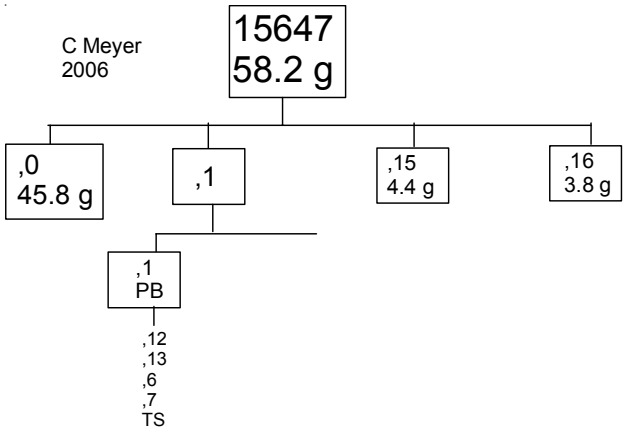

Table 1. Chemical composition of 15647.

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

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