15476

Porphyritic Pigeonite Basalt

266.3 grams

Figure 1: Photo of 15476 showing micrometeorite craters and underlying foliation caused by long pyroxene phenocrysts. Sample is about 8 cm across. NASA S71-46905.

Introduction

15476 was collected from Dune Crater – along with 15475, 15485, 15495 and 15499 (Swann et al. 1971). It has a beautiful texture very like that of 15475. It has not been dated. However, another pigeonite basalt, with strikingly similar texture, (15682) has been dated at 3.4 b.y.

Petrography

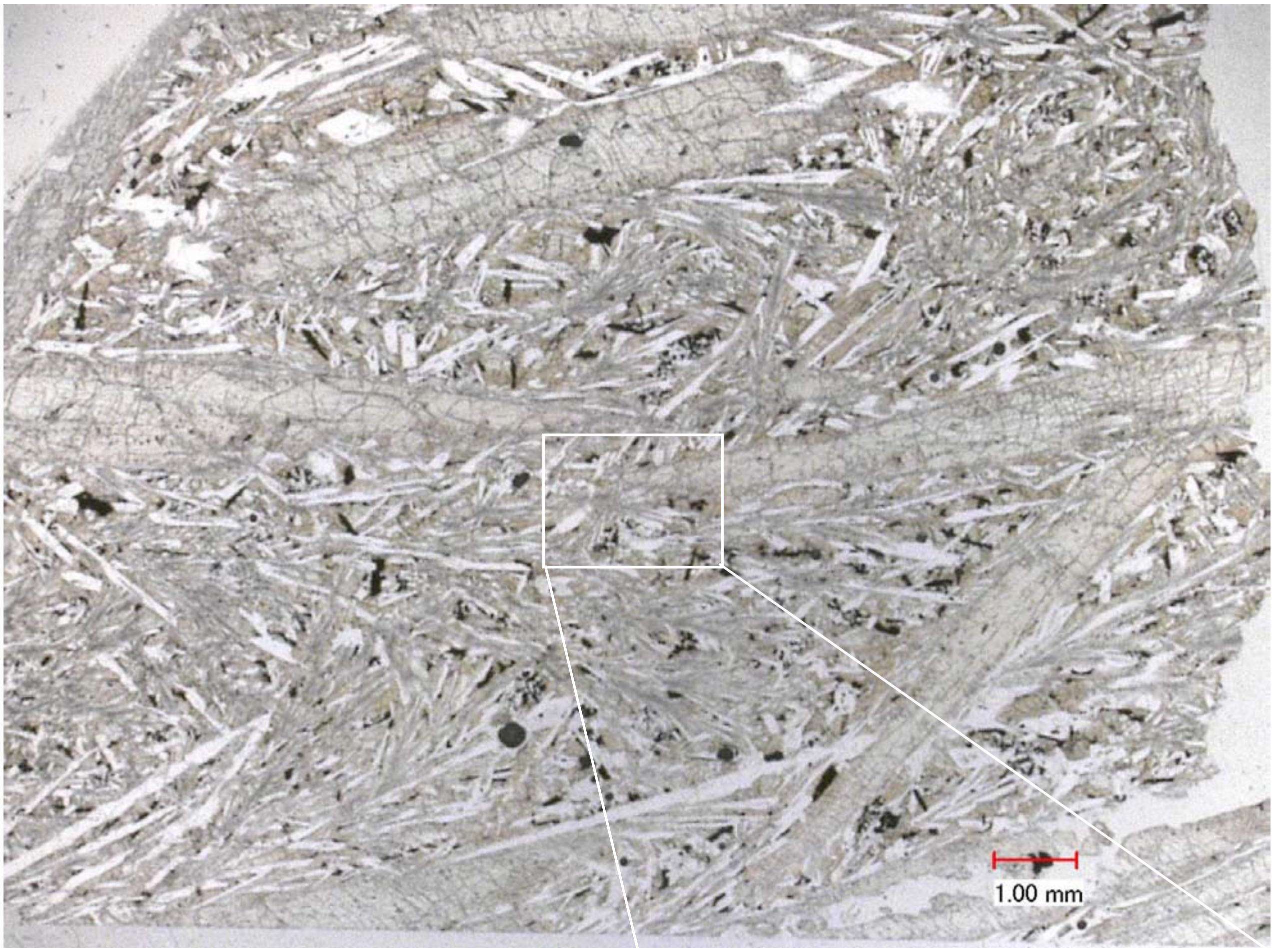
According to Ryder (1985), "15476 is a pigeonite-porphyritic mare basalt with large phenocrysts, a radiate, finer-grained groundmass and a distinct foliation or lineation (figure 1). It is an average-member of the quartz-normative mare basalt suite. It is light brown with green to brown zoned prismatic pyroxene phenocrysts and a few percent vugs. It is coherent, slabby or tabular, and has a few zap pits on all faces."

The cores of large pyroxene phenocrysts are relatively unzoned, with a rather sharp boundaries when they transition to high-Ca, high-Fe margins (Kushiro 1973). Some pyroxene phenocrysts appear to have grown with hollow cores, now filled with fine-crystalline matrix. The lack of augite exsolution in the pigeonite cores led Virgo (1972) to surmise that the cooling rate was rapid. The overall texture indicates a two stage cooling history. The groundmass between the phenocrysts locally has variable texture from "radiate" to subophitic.

Lofgren et al. (1975, 1976) and Grove and Walker (1977) studied the cooling history of Apollo 15 pigeonite basalts (reported elsewhere).

Chemistry

All Apollo 15 basalts have similar composition, although they can be divided into two groups (olivine-normative and pyroxene-phyric). 15476 is of the later.



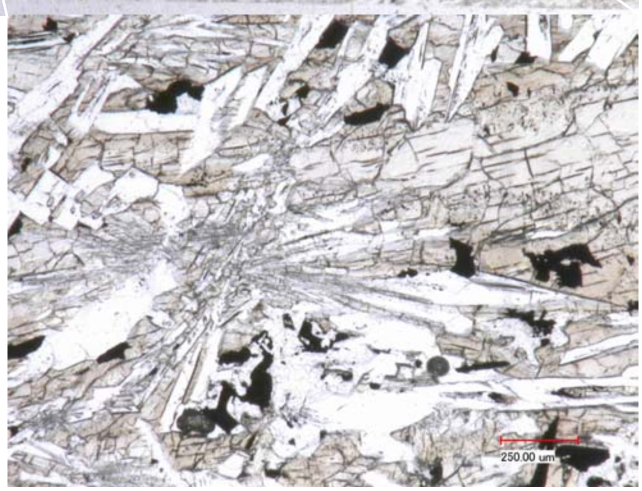


Figure 2a: Photomicrographs of thin section 15476,36 by C Meyer @20 and 150x.

Mason et al. (1972), Brunfelt et al. (1972), O'Kelley (1972) and Duncan et al (1975) analyzed 15475 (table 1 and figures 7, 8 and 9).

Radiogenic age dating

Tatsumoto et al. (1972) determined the isotopic composition of U-Th-Pb.

Cosmogenic isotopes and exposure ages

Eldridge et al. (1972) reported the cosmic-ray-induced activity of ^{22}Na = 43 dpm/kg, ^{26}Al = 62 dpm/kg, ^{54}Mn = 27 dpm/kg and ^{56}Co = 20 dpm/kg.

Processing

15476 has never been sawn (a messy process at best). There are 8 thin sections. In general, the sample has not received the study it deserves – perhaps because it is an apparent "sister" to sample 15475. See also 15682.

Mineralogical Mode of 15476

	Rhodes and Hubbard 1973	Papike et al. 1976
Olivine		
Pyroxene	66.2	69.7
Plagioclase	26.3	24.7
Opaques	4	3.4
Silica	3.3	1.7
Other	0.2	0.5

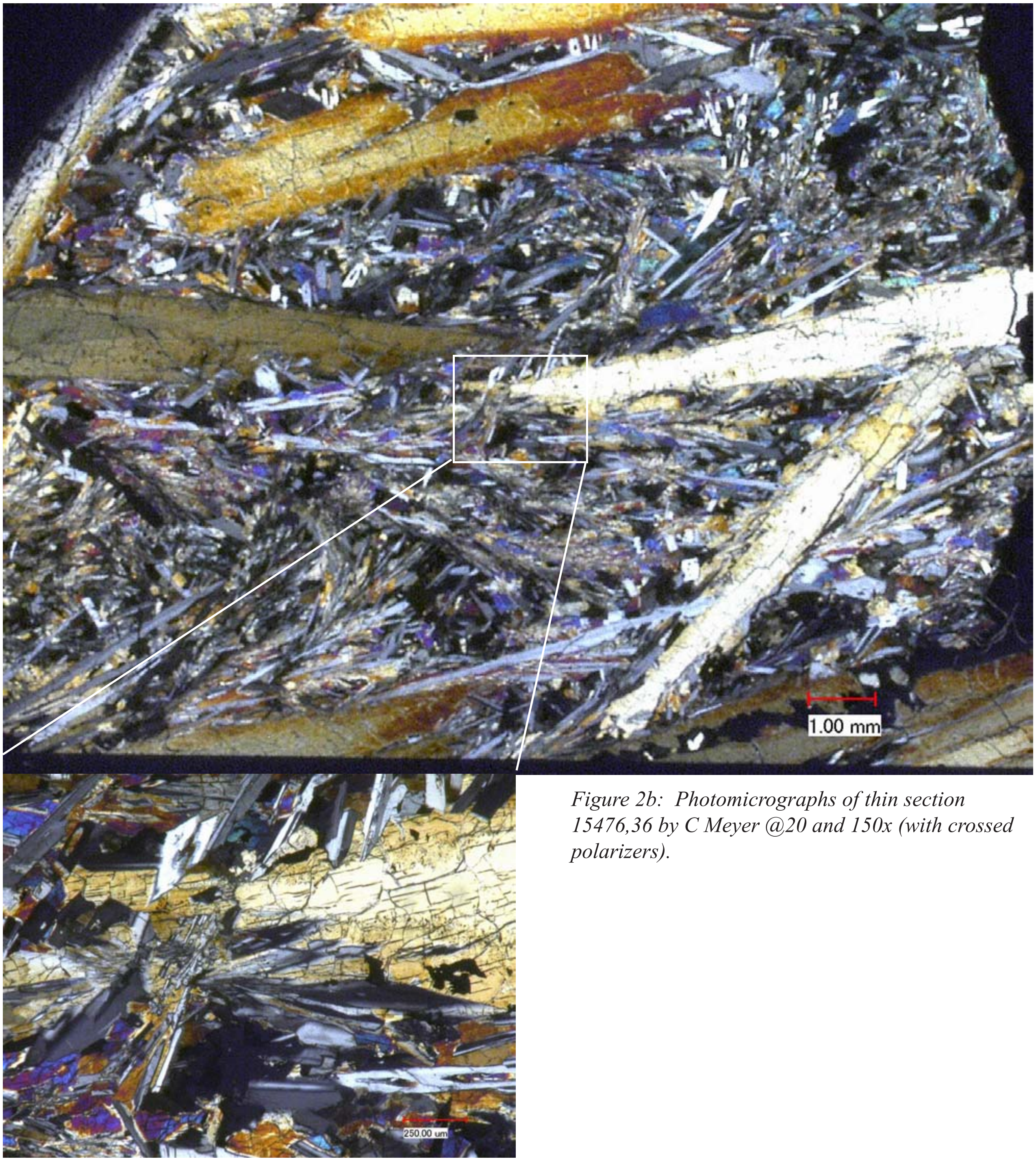


Figure 2b: Photomicrographs of thin section 15476,36 by C Meyer @20 and 150x (with crossed polarizers).

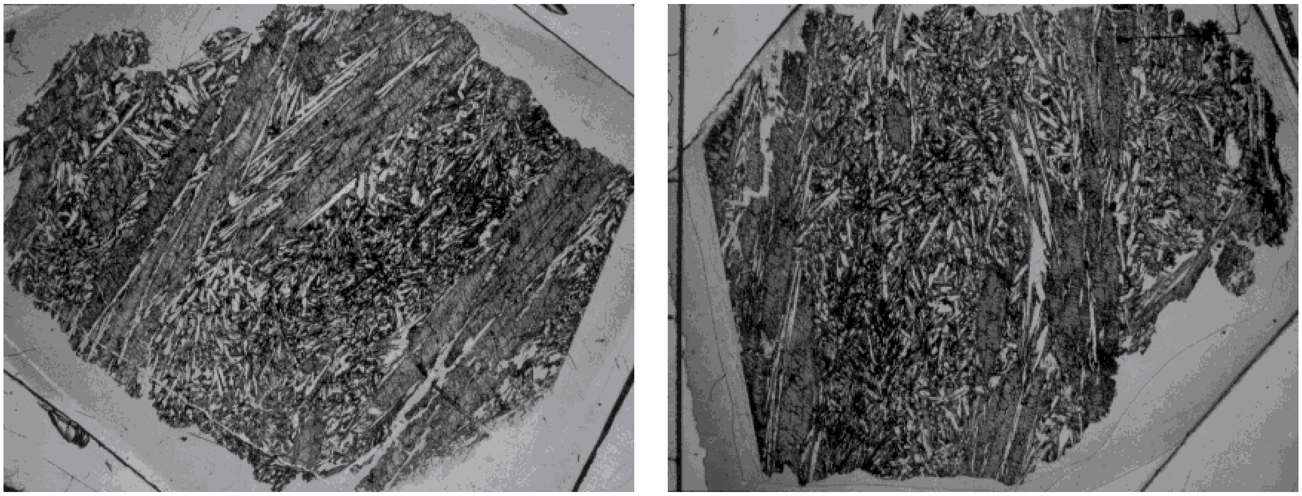


Figure 3: Photomicrographs of thin section of 15476. a) 15476,38, b) 15476,37. Scale about 1 cm.

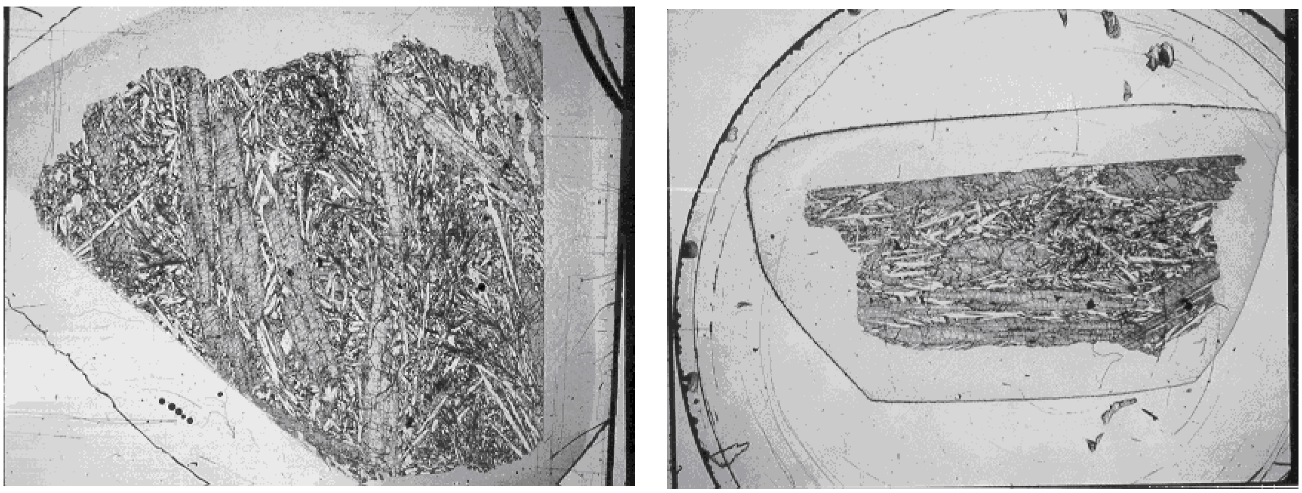


Figure 4: Photos of thin sections of 15476. a) 15476,36, b) 15476,35. Scale is about 1 cm.

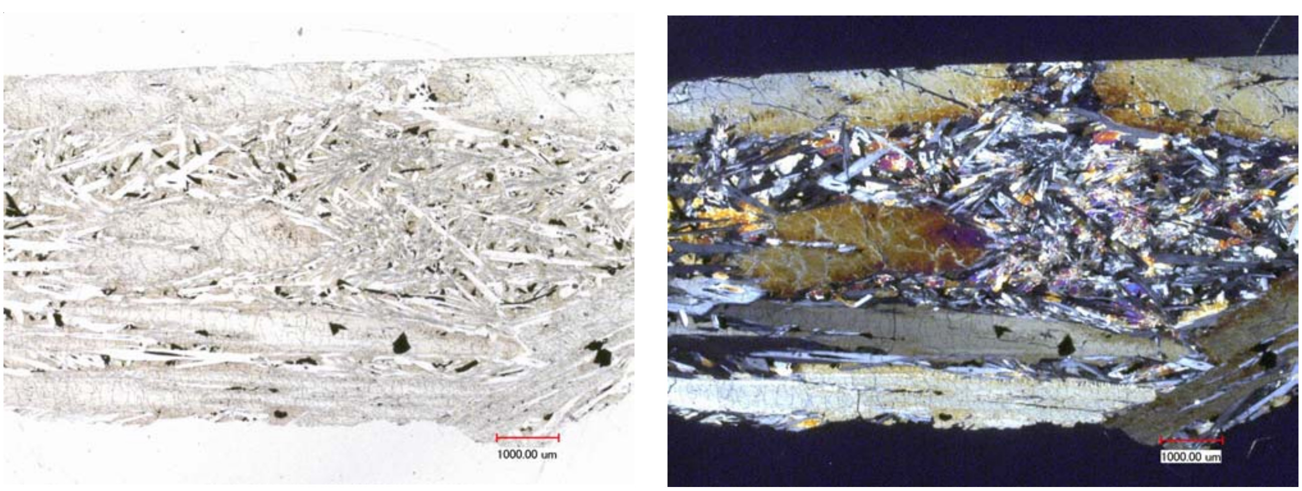


Figure 5: Photomicrographs of thin section 15476,35 by C Meyer @ 30x.

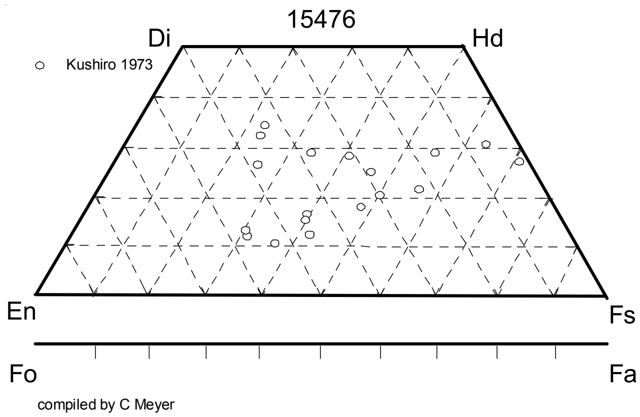


Figure 6: Pyroxene composition of 15476.

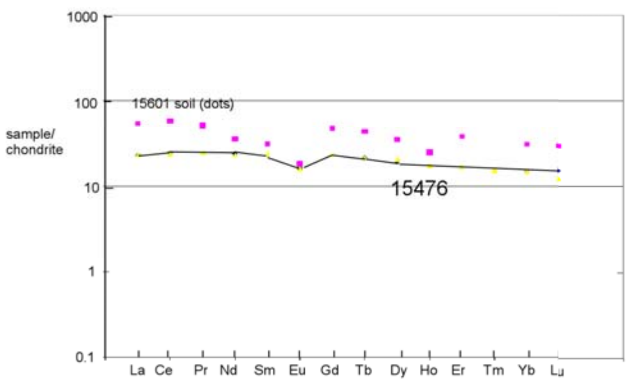


Figure 7: Normalized rare-earth-element diagram for 15476 compared with soil 15601.

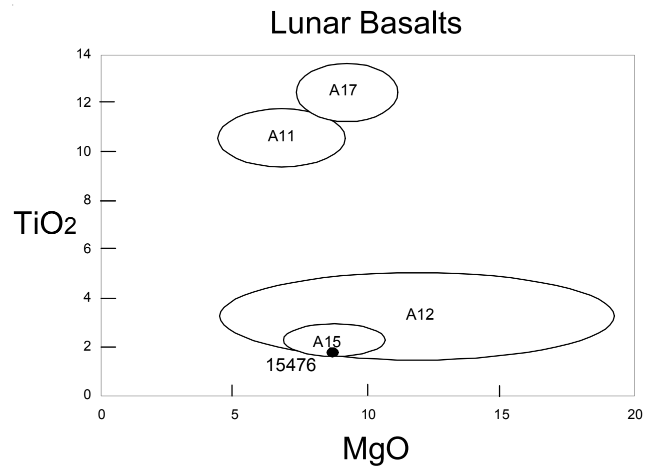


Figure 8: Chemical composition of 15476 compared with other lunar basalts.

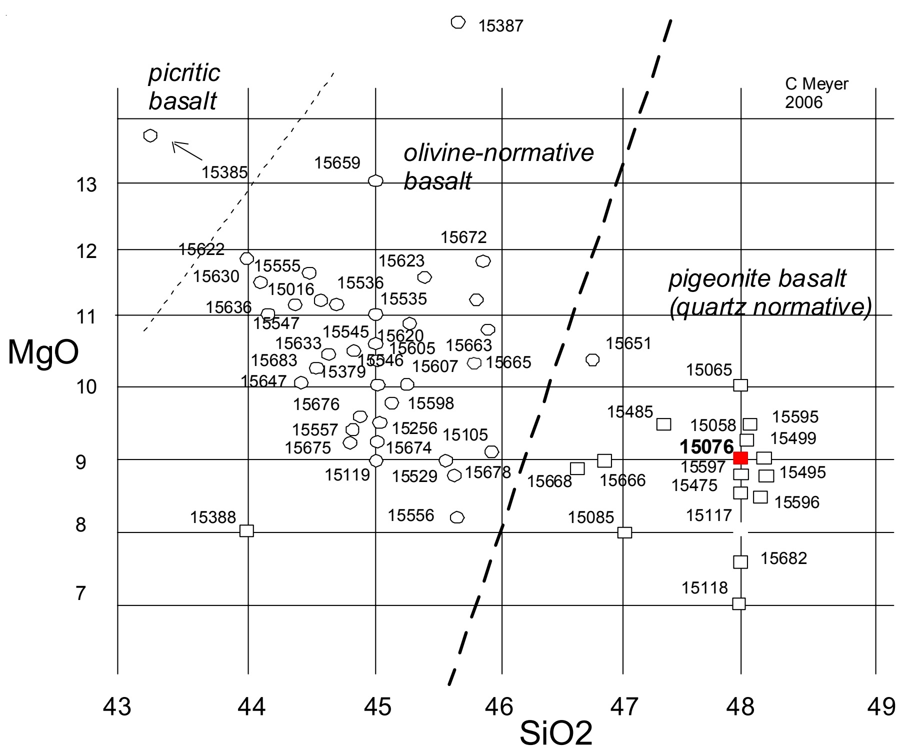
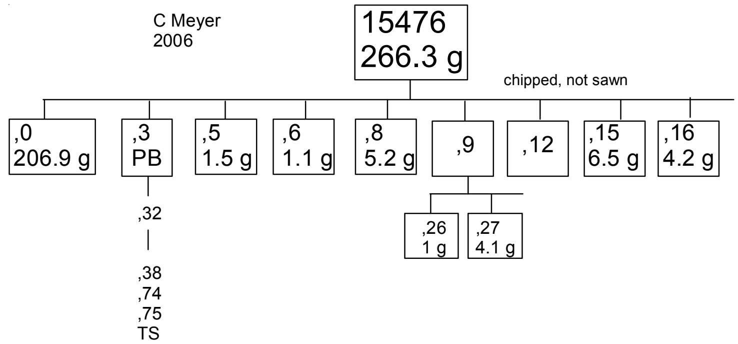


Figure 9: Chemical composition of Apollo 15 basalts showing two basic types. 15476 is pigeonite basatl.

Table 1. Chemical composition of 15476.

reference	Mason 72		Brunfelt 72		Duncan 75		O'Kelley 72	
weight								
SiO2 %	48.46	(a)			47.84	(d)		
TiO2	1.75	(a)	1.9	(e)	1.82	(d)		
Al2O3	9.54	(a)	9.16	(e)	10.02	(d)		
FeO	20.76	(a)	19.43	(e)	19.79	(d)		
MnO	0.28	(a)	0.28	(e)	0.26	(d)		
MgO	8.69	(a)	8.29	(e)	8.35	(d)		
CaO	10.5	(a)	13.85	(e)	10.74	(d)		
Na2O	0.28	(a)	0.35	(e)	0.35	(d)		
K2O	0.07	(a)			0.043	(d)	0.05	(c)
P2O5	0.05	(a)			0.081	(d)		
S %					0.067	(d)		
sum								
Sc ppm			40.6	(e)				
V	90	(b)	220	(e)	160	(d)		
Cr	3600	(b)	2244	(e)	3200	(d)		
Co			34.4	(e)	38	(d)		
Ni	27	(b)	20	(e)	15	(d)		
Cu	7	(b)			4	(d)		
Zn					<1.5	(d)		
Ga	3	(b)						
Ge ppb								
As								
Se								
Rb	<5	(b)	6	(e)	1.5	(d)		
Sr	98	(b)	114	(e)	115	(d)		
Y	42	(b)			31.4	(d)		
Zr	105	(b)			110	(d)		
Nb					5.6	(d)		
Mo								
Ru								
Rh								
Pd ppb								
Ag ppb								
Cd ppb								
In ppb								
Sn ppb								
Sb ppb								
Te ppb								
Cs ppm			0.31	(e)				
Ba	63	(b)	54	(e)	75	(d)		
La			5.9	(e)				
Ce								
Pr								
Nd								
Sm			4.3	(e)				
Eu			1.13	(e)				
Gd								
Tb			0.88	(e)				
Dy			3.5	(e)				
Ho								
Er								
Tm								
Yb			3.4	(e)				
Lu								
Hf			3.6	(e)				
Ta			0.4	(e)				
W ppb								
Re ppb								
Os ppb								
Ir ppb								
Pt ppb								
Au ppb								
Th ppm			0.52	(e)			0.51	(c)
U ppm			0.21	(e)			0.14	(c)

technique: (a) wet chemical, (b) OES, (c) radiation counting, (d) XRF, (e) INAA



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