

71569
Ilmenite Basalt
289.6 grams



Figure 1: Photo of 71569 with mm scale. S73- 31337. Sample is 7 cm across

Introduction

According to Warner et al. (1978), 71569 is an olivine-microporphritic ilmenite basalt similar to 71577 and 71578. According to Longhi et al. (1974), 71569 is nearly identical to 70215, but that is debatable – see below. Both the textures and the compositions are the same for these, rather large, samples.

71525 - 71596 etc. are rake samples collected as part of a comprehensive sample at station 1, taken near Steno Crater, in the middle of the Taurus-Littrow valley, Apollo 17. They include numerous ilmenite basalts – all with similar compositions.

Petrography

There is apparently some variability to the texture of 71569, but generally groundmass is variolitic. Olivine phenocrysts are skeletal, often partially resorbed. Ilmenite is irregular or bladed in shape, often broken and sometimes acicular (figure 3).

71569 and its related rocks are fine-grained and the minerals are interpenetrating. Brown et al. (1975) reported too high a proportion of ilmenite. Warner et al. (1975, 1976 a, b), Longhi et al. (1975) and Neal and Taylor (1993) reported mineral compositions (figure 2). Warner et al. (1976) determined the composition of armalcolite in 71569 (table 2).

Usselman et al. (1975) experimentally reproduced textures and mineral chemistries of high-titanium mare basalts of this composition and calculated a cooling rate of 5-15 deg./hr. for 71569. Walker et al. (1975) and O'Hara and Humphries (1975) used a synthetic major element composition similar to 71569 to determine the phase diagram and sequence of crystallization and Longhi et al. (1978) studied the distribution of Fe and Mg between olivine and melt.

Chemistry

The chemical analyses by Wanke et al. (1974), Rhodes et al. (1976) and Warner et al. (1975, 1978) are in close agreement and the composition closely matches that of 71577, 71578. This is classified as a type A, Apollo 17 basalt (figure 5).

Note: 70215, which has been compared with 71569, is type B.

Radiogenic age dating

none

Cosmogenic isotopes and exposure ages

Niemeyer et al. (1977a) determined a cosmic-ray exposure age of 134 m.y. by the ⁸¹Kr method for 71569. This is typical of the ages of the craters of the central cluster at Taurus-Littrow (Drozd et al. 1977).

Other Studies

Simmons et al. (1975) studied the microcracks in 71569.

The abundance and isotopic composition of rare gases in 71569 was reported by Niemeyer et al. (1977).

The isotopic systematics of Rb/Sr and U/Th/Pb were studied by Nyquist et al. (1976) and Nunes et al. (1974).

Processing

71569 was sawn with a band saw to make a slab from the middle (figure 7). There were numerous allocations of this basalt. There are 14 thin sections.

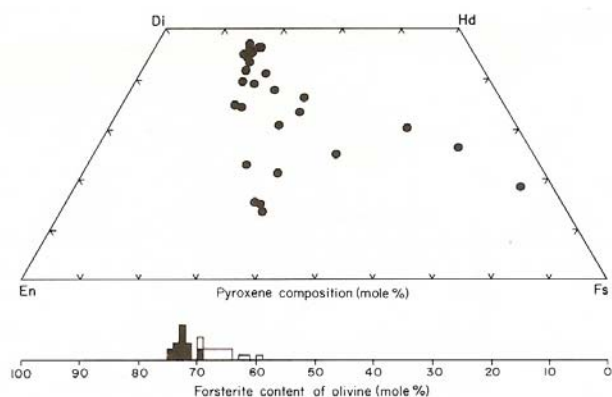


Figure 2: Pyroxene and olivine composition of 71569 (Warner et al. 1978).

Mineralogical Mode

	Warner	Brown
Olivine	6.3	7.8
Pyroxene	43.7	28.9
Plagioclase	26.8	10.8
Opagues	17	38.6
Silica	5.4	
Meostasis	0.9	



Figure 3: Photomicrograph of thin section 71569,61. 2.8 mm across.

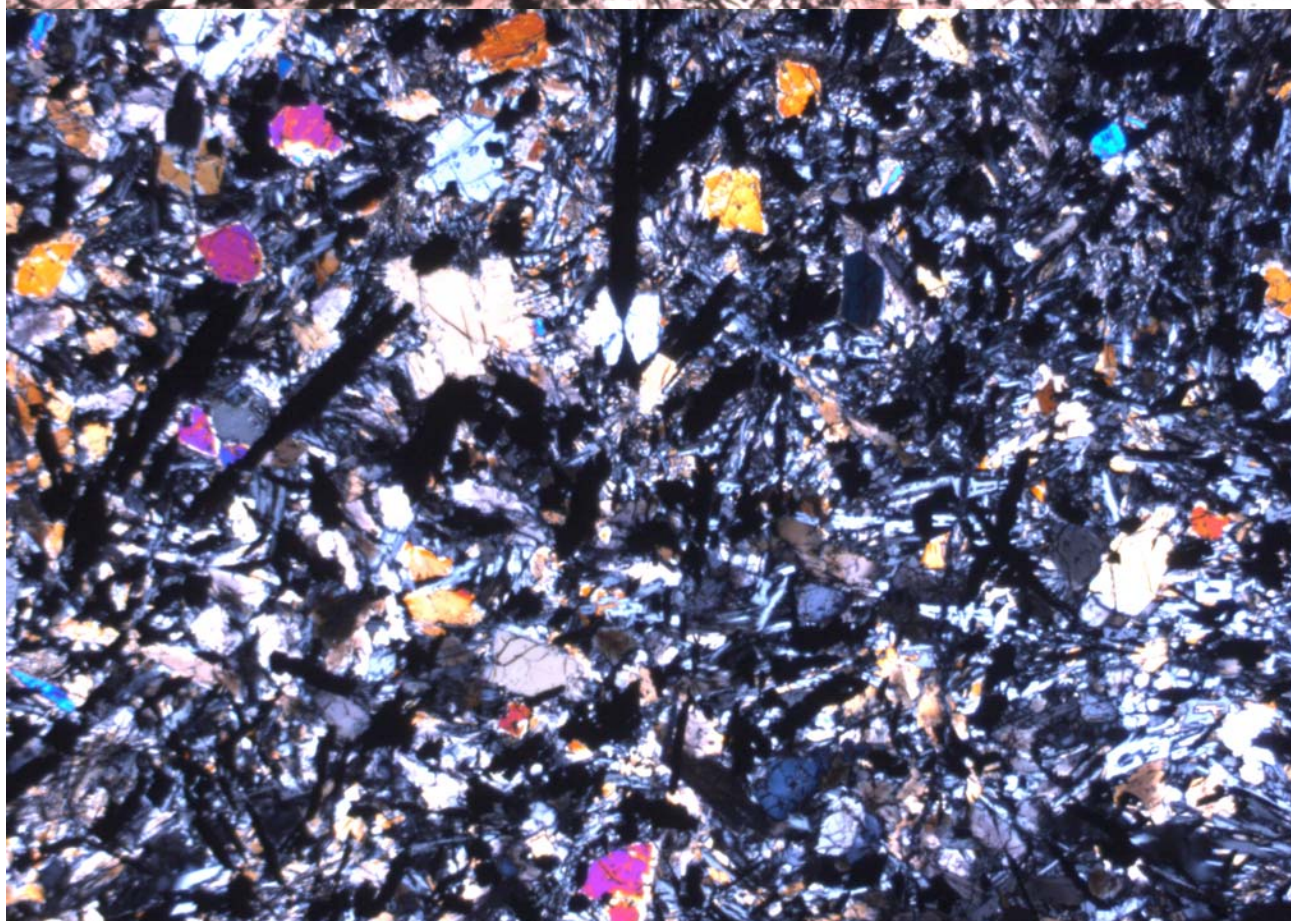


Table 1. Chemical composition of 71569.

reference weight	Wanke74	Warner78 Warner75	Rhodes76 Nyquist76	
SiO ₂ %	39.4 (a)		39.97 (d)	
TiO ₂	12.2 (a)	13.2 (b)	11.57 (d)	
Al ₂ O ₃	8.6 (a)	8.5 (b)	9.08 (d)	
FeO	18.9 (a)	17.9 (b)	18.85 (d)	
MnO	0.245 (a)	0.22 (b)	0.28 (d)	
MgO	8.47 (a)	9.2 (b)	7.66 (d)	
CaO	10.6 (a)	9.6 (b)	11.27 (d)	
Na ₂ O	0.39 (a)	0.37 (b)	0.41 (d)	
K ₂ O	0.067 (a)	0.07 (b)	0.06 (d)	
P ₂ O ₅	0.066 (a)		0.06 (d)	
S %	0.16 (a)		0.19 (d)	
sum				
Sc ppm	82.4 (b)	73 (b)	81 (b)	
V		100 (b)		
Cr	3180 (a)		2463 (d)	
Co	18.6 (b)	17.5 (b)	18 (b)	
Ni				
Cu	4 (b)			
Zn				
Ga	2.15 (b)			
Ge ppb				
As	0.012 (b)			
Se	0.11 (b)			
Rb	0.74 (b)		0.64 (e)	
Sr	170 (b)		195 (e)	
Y	91 (b)			
Zr	258 (b)			
Nb	24 (b)			
Mo				
Ru				
Rh				
Pd ppb				
Ag ppb				
Cd ppb				
In ppb				
Sn ppb				
Sb ppb				
Te ppb				
Cs ppm	0.041 (b)			
Ba	88 (b)		84 (e)	
La	6.82 (b)	6.1 (b)	6.74 (e)	
Ce	23 (b)	22 (b)	23.8 (e)	
Pr	4.3 (b)			
Nd	26 (b)		26.3 (e)	
Sm	10.4 (b)	11.1 (b)	10.9 (e)	
Eu	2.03 (b)	1.97 (b)	2.19 (e)	
Gd	15.1 (b)		17.1 (e)	
Tb	2.7 (b)	2.4 (b)		
Dy	17.1 (b)	15 (b)	19 (e)	
Ho	3.7 (b)			
Er	11 (b)		11.6 (e)	
Tm		(b)		
Yb	10.1 (b)	9.8 (b)	10.5 (e)	
Lu	1.42 (b)	1.4 (b)	1.5 (b)	
Hf	8.7 (b)	8.4 (b)	9.7 (b)	
Ta	1.75 (b)	1.7 (b)		
W ppb	79 (b)			
Re ppb				
Os ppb				
Ir ppb	4.8 (b)			
Pt ppb				
Au ppb	0.25 (b)			
Th ppm				
U ppm	0.147 (b)			

technique: (a) mixed, (b) INAA, (c) broad beam e probe. (d) XRF, (e) IDMS

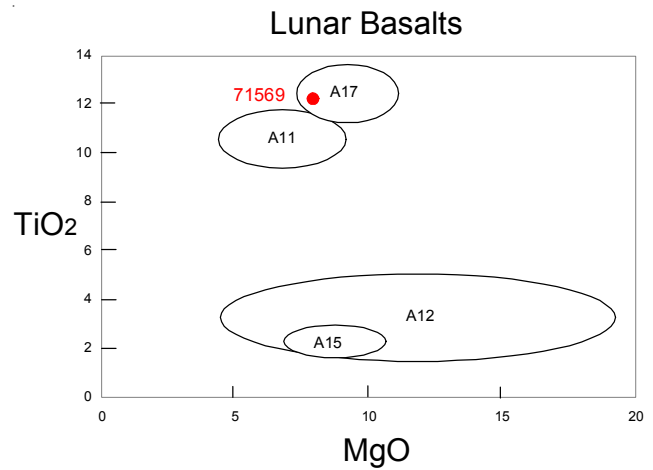


Figure 4: Composition of 71569 compared with that of Apollo basalts.

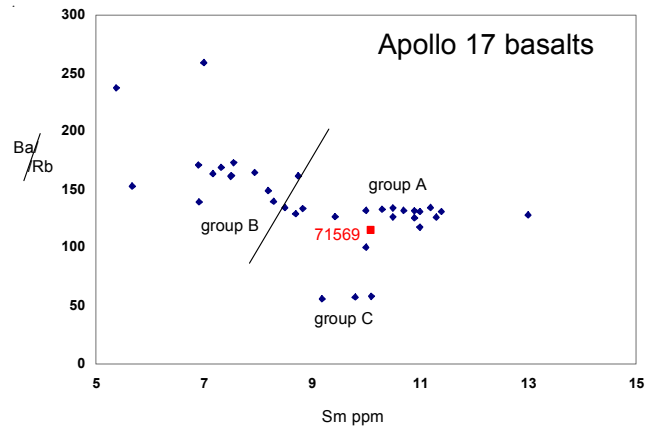


Figure 5: Trace element composition of Apollo 17 basalts.

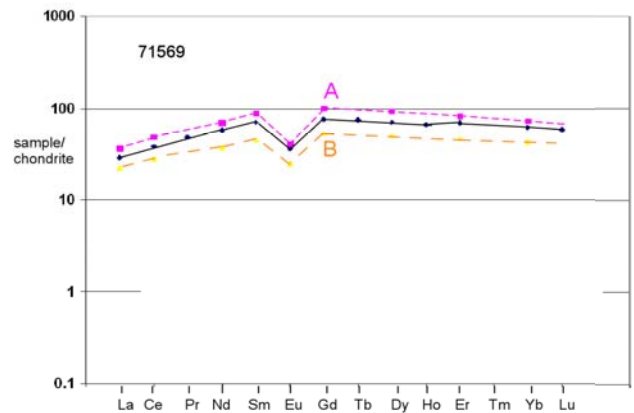


Figure 6: Normalized rare-earth-element diagram for 71569 and type A and B basalts.

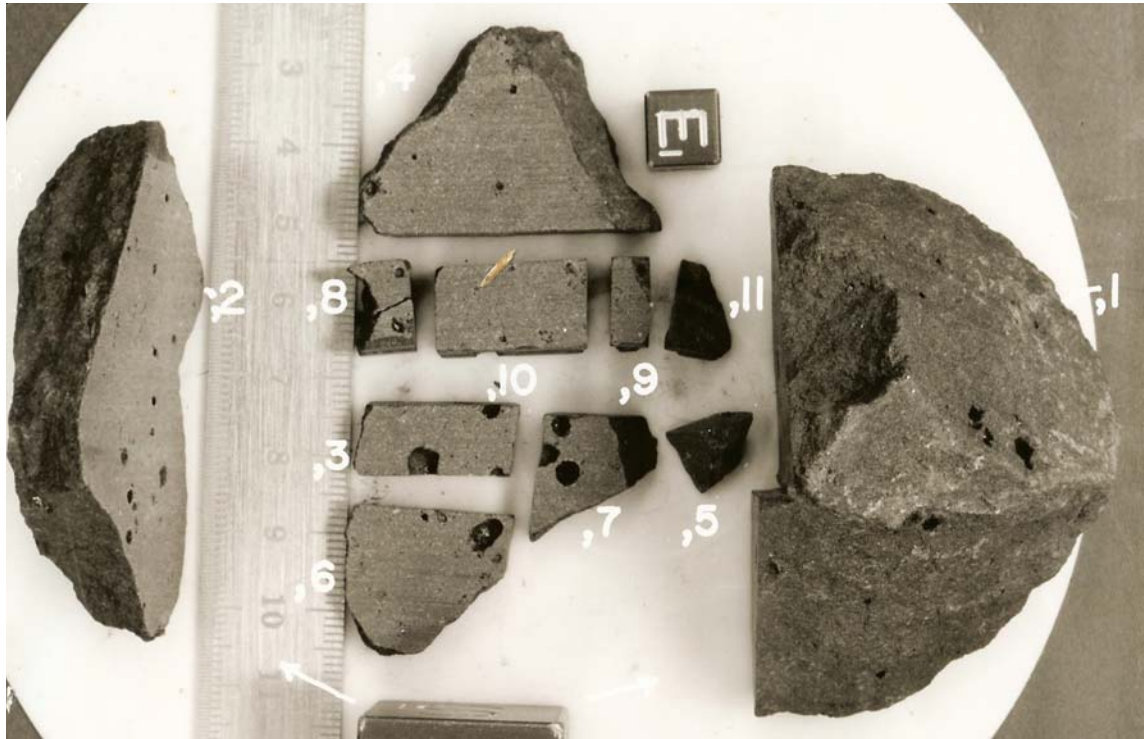


Figure 7: Slab cut from 71569. Small cube is 1 cm. S74-17828.

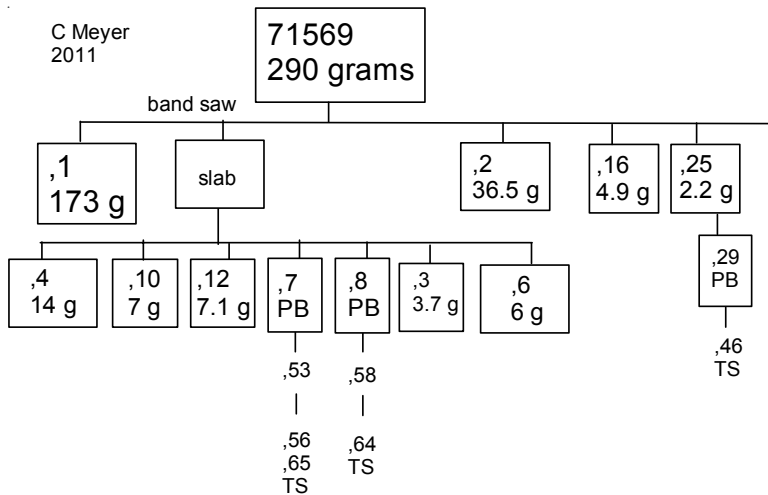


Table 2: Armalcolite in 71569 (Warner et al. 1976).

(traverse across one grain)

TiO ₂	70.8	71.7	72.3	72.3	72.3	72.2	72.6	72	71.7	71.5
Al ₂ O ₃	1.79	1.86	2.05	1.76	1.87	1.8	1.51	1.6	1.85	1.87
Cr ₂ O ₃	1.28	1.4	1.38	1.48	1.38	1.59	1.6	1.33	1.27	1.12
FeO	19.1	17.1	16.9	16.4	15.9	16.1	16.6	16.9	17.9	18.7
MgO	5.6	6.4	6.7	6.7	7	7.2	6.8	6.5	5.9	5.2
CaO	0.31	0.25	0.3	0.26	0.26	0.26	0.26	0.27	0.29	0.29
ZrO ₂	0.09	0.09	0.05	0.03	0.01	0.06	0.01	0.03	0.05	0.06

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