71559 – 82.1 grams
71536 – 5.3 grams
71539 – 10.9 grams
71568 – 10 grams
Ilmenite Basalt

Figure 1: Photo of 71559. Scale in cm and mm. S73-31335

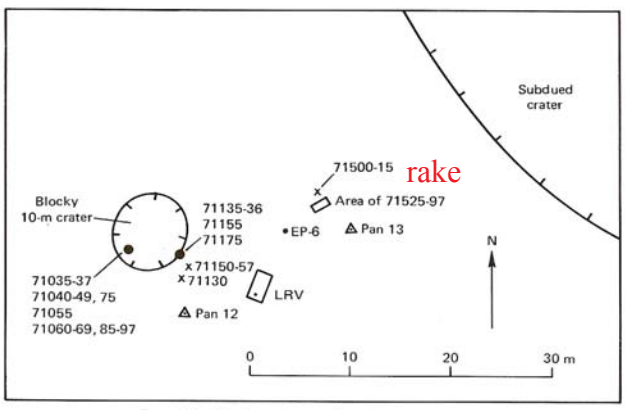


Figure 2: Location of rake sample 71525 - 71595 at station 1, Apollo 17.

Mineralogical Mode

	71559	71536	71539	71568
Olivine	- -	tr.	tr.	tr.
Pyroxene	50.2	49.5	50.2	49.1
Plagioclase	35.6	35.6	32.2	34,7
Opaques	10.6	10.9	12.2	12.1
Silica	2.4	2.7	4.5	3.3
Meostasis	0.6	1	0.8	0.9

Introduction

71559, 71536, 71539 and 71568 are coarse-grain ilmenite basalts with salt and pepper texture (figure 1), They are unusual in that they have only moderate Ti contents.

71525 - 71596 etc. are rake samples collected as part of a comprehensive sample at station 1, taken near Steno Crater, Apollo 17 (figure 2). They include numerous small ilmenite basalts.

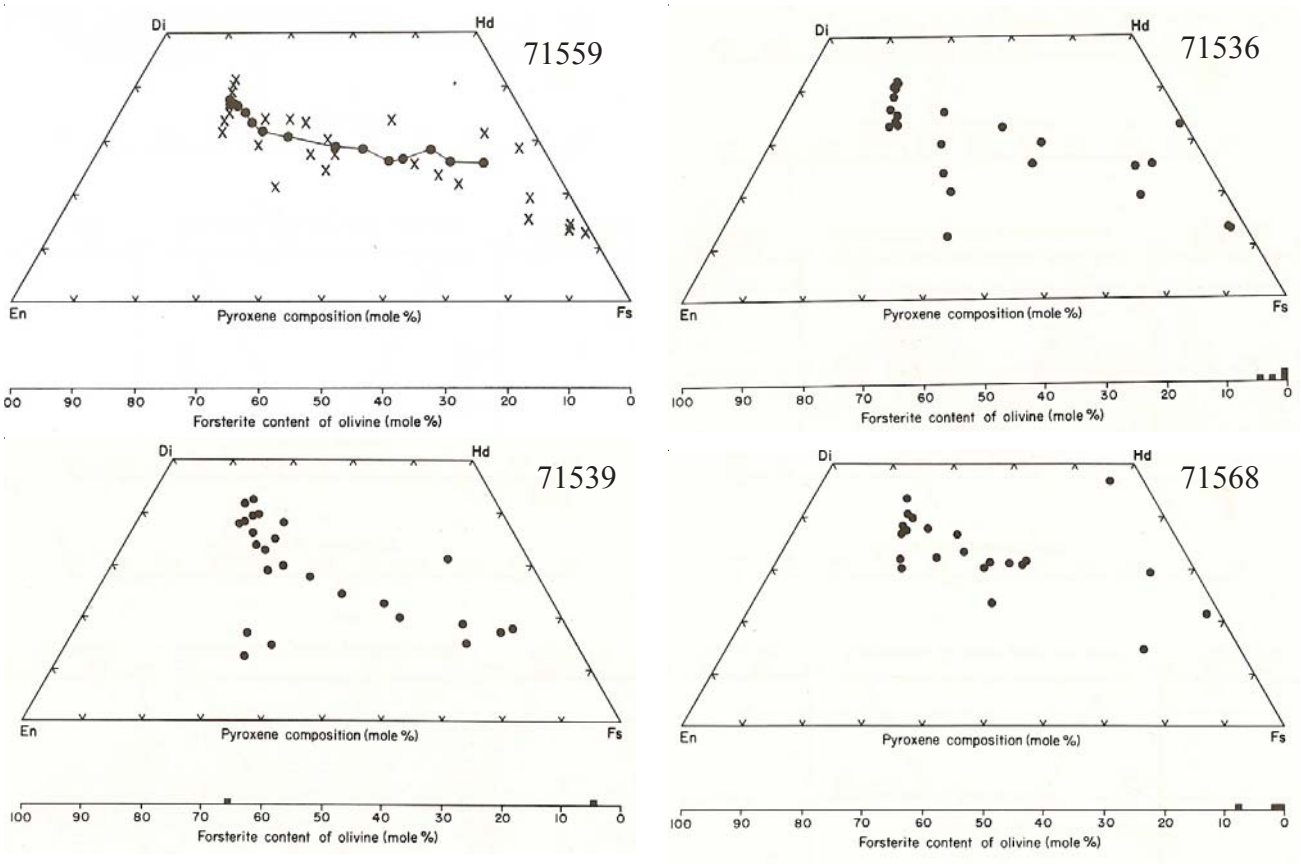


Figure 3: Composition of pyroxene in 71559 and associated rocks (Warner et al. 1978).

Petrography

71559 has a subophitic-granular texture with blocky ilmenite and little or no olivine (Warner et al . 1978). Grain size is 1 – 2 mm. Pyroxene has extreme iron enrichment (figure 3) and there is trace fayalite. Ilmenite in 71559 is blocky while it is bladed in 71539 (figure 4). These samples are somewhat like Apollo 11 high-Ti basalts from *"a thousand miles away"!*

Warner et al. (1978) reported armalcolite, tranquillityite, barian K-feldspar, zirconolite, and baddeleyite in these coarse-grain Apollo 17 basalts. Warner et al. (1976) gives the composition of armalcolite (table 5) and tranquillityite (table 6).

Chemistry

Warner et al. (1975) and Murali et al. (1977) reported the composition, finding that these coarse-grain rocks have lower Ti than for other Apollo 17 (figure 5). The REE pattern is like that of type A Apollo 17 basalt (figure 6).

Radiogenic age dating

Of these samples, only 71539 has been dated. Paces et al. (1991) determined a Rb/Sr isochron of 3.67 ± 0.1 b.y. and a Nd/Sm isochron of 3.75 ± 0.067 b.y. *(3.75 is typical of type A basalts)*

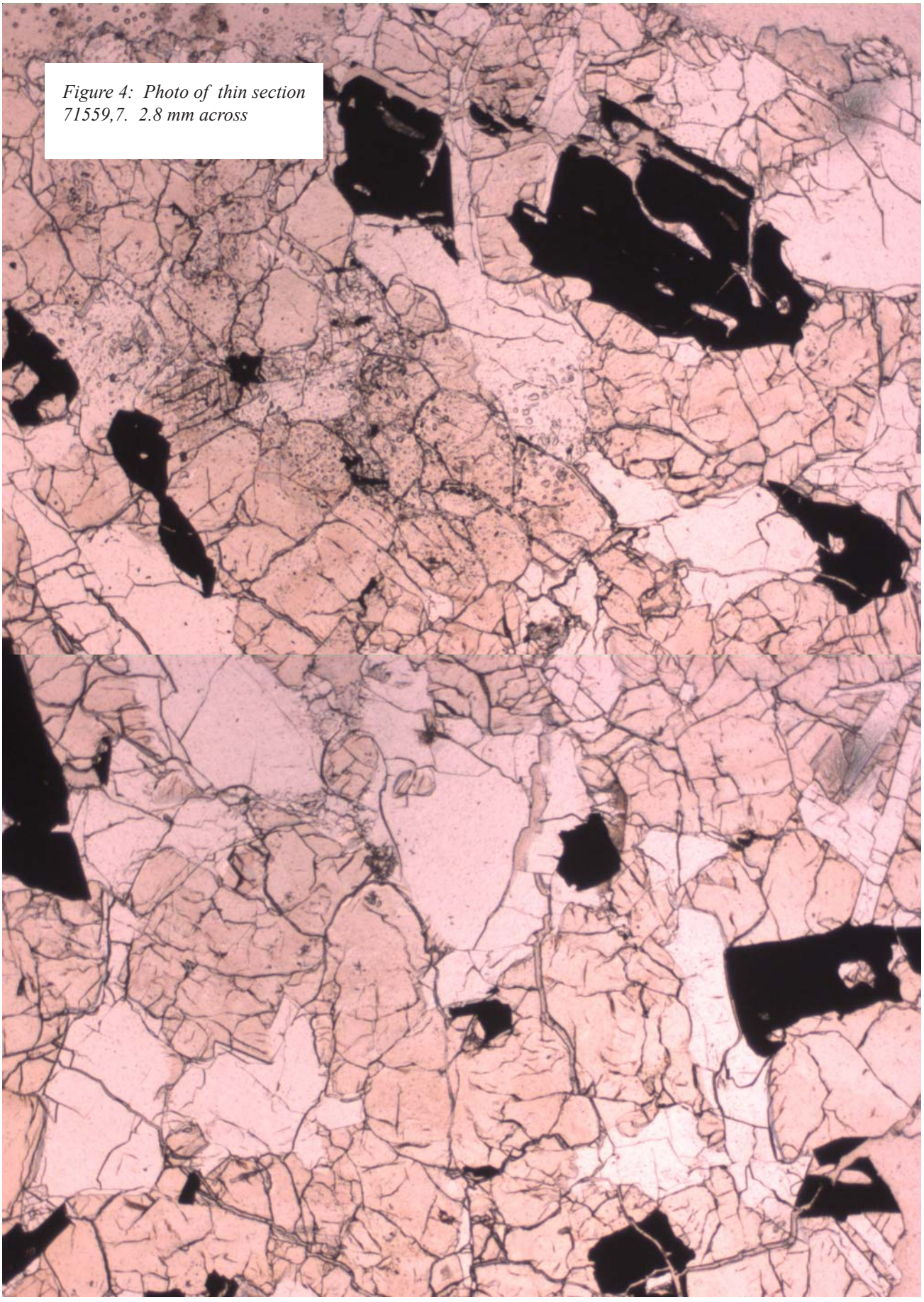


Figure 4: Photo of thin section 71559,7. 2.8 mm across

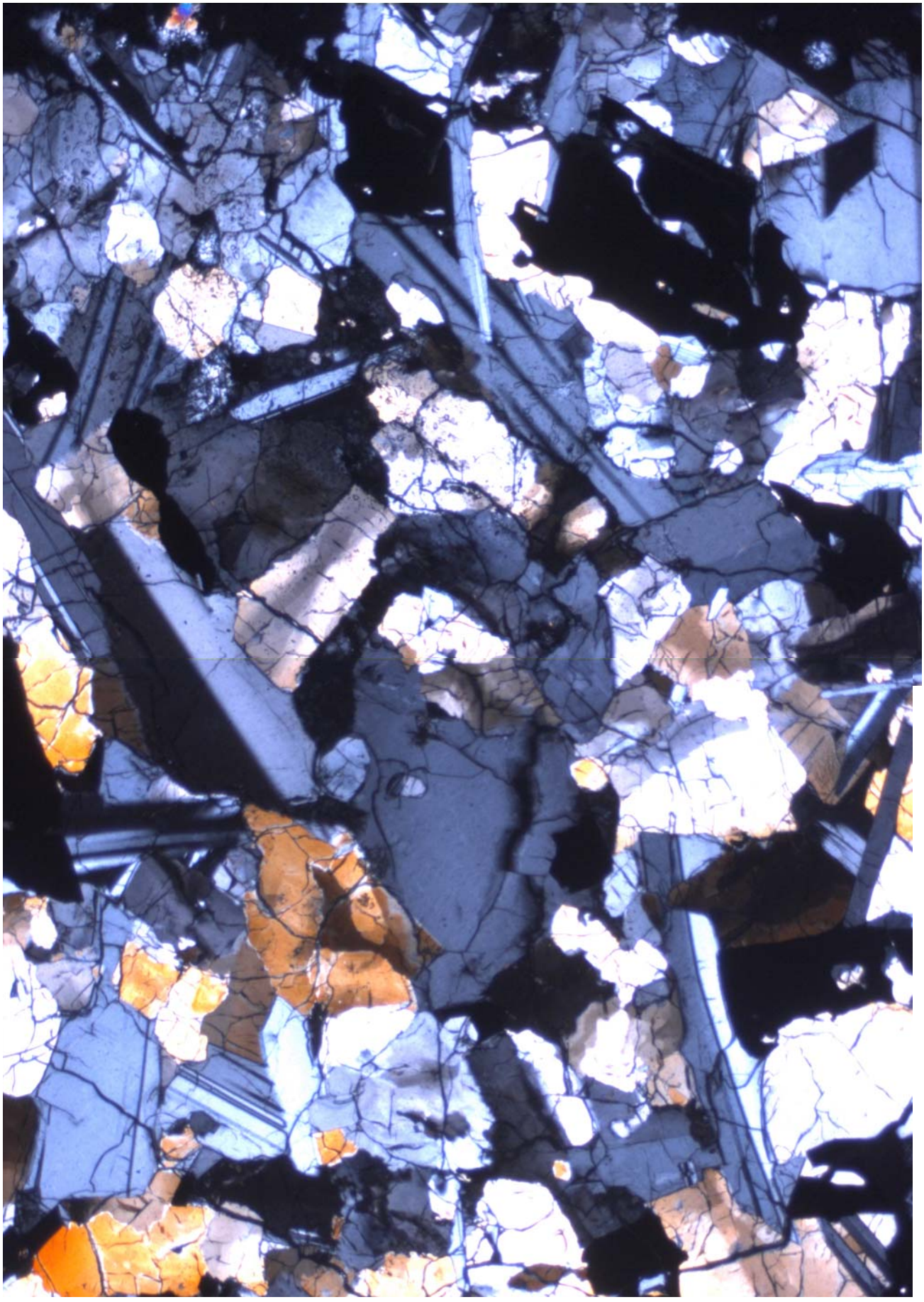


Table 1. Chemical composition of 71559.

reference	Warner75	
weight	Warner78	
SiO2 %		
TiO2	8.3	(a)
Al2O3	10.3	(a)
FeO	17.8	(a)
MnO	0.226	(a)
MgO	6.3	(a)
CaO	12.2	(a)
Na2O	0.48	(a)
K2O	0.068	(a)
P2O5		
S %		
sum		
Sc ppm	72	(a)
V	30	(a)
Cr	1577	(a)
Co	14.4	(a)
Ni		
Cu		
Zn		
Ga		
Ge ppb		
As		
Se		
Rb		
Sr		
Y		
Zr		
Nb		
Mo		
Ru		
Rh		
Pd ppb		
Ag ppb		
Cd ppb		
In ppb		
Sn ppb		
Sb ppb		
Te ppb		
Cs ppm		
Ba		
La	6.6	(a)
Ce	26	(a)
Pr		
Nd	24	(a)
Sm	10.4	(a)
Eu	2.2	(a)
Gd		
Tb	2.6	(a)
Dy	17	(a)
Ho		
Er		
Tm		
Yb	9.2	(a)
Lu	1.4	(a)
Hf	8.8	(a)
Ta	1.5	(a)
W ppb		
Re ppb		
Os ppb		
Ir ppb		
Pt ppb		
Au ppb		
Th ppm		
U ppm		

technique: (a) INAA

Table 2. Chemical composition of 71536.

reference	Murali77	
weight		
SiO2 %		
TiO2	7.8	(a)
Al2O3	11.7	(a)
FeO	16.1	(a)
MnO	0.223	(a)
MgO	7.3	(a)
CaO	13.6	(a)
Na2O	0.5	(a)
K2O	0.071	(a)
P2O5		
S %		
sum		
Sc ppm	73	(a)
V	39	(a)
Cr	2313	(a)
Co	13	(a)
Ni		
Cu		
Zn		
Ga		
Ge ppb		
As		
Se		
Rb		
Sr		
Y		
Zr		
Nb		
Mo		
Ru		
Rh		
Pd ppb		
Ag ppb		
Cd ppb		
In ppb		
Sn ppb		
Sb ppb		
Te ppb		
Cs ppm		
Ba		
La	6.2	(a)
Ce	29	(a)
Pr		
Nd		
Sm	9.6	(a)
Eu	2.17	(a)
Gd		
Tb	2.4	(a)
Dy	14	(a)
Ho		
Er		
Tm		
Yb	9	(a)
Lu	1.4	(a)
Hf	7.2	(a)
Ta	1.4	(a)
W ppb		
Re ppb		
Os ppb		
Ir ppb		
Pt ppb		
Au ppb	1.4	(a)
Th ppm		
U ppm		

technique: (a) INAA

Table 3. Chemical composition of 71539.

reference	Murali77		Paces91	
weight				
SiO2 %				
TiO2	8.6	(a)		
Al2O3	9.8	(a)		
FeO	19.1	(a)		
MnO	0.258	(a)		
MgO	5.4	(a)		
CaO	12.1	(a)		
Na2O	0.47	(a)		
K2O	0.081	(a)		
P2O5				
S %				
sum				
Sc ppm	73	(a)		
V	36	(a)		
Cr	1273	(a)		
Co	13.5	(a)		
Ni				
Cu				
Zn				
Ga				
Ge ppb				
As				
Se				
Rb			0.787	(b)
Sr			229	(b)
Y				
Zr				
Nb				
Mo				
Ru				
Rh				
Pd ppb				
Ag ppb				
Cd ppb				
In ppb				
Sn ppb				
Sb ppb				
Te ppb				
Cs ppm				
Ba				
La	8	(a)		
Ce	30	(a)		
Pr				
Nd			32.5	(b)
Sm	12.1	(a)	13.4	(b)
Eu	2.44	(a)		
Gd				
Tb	3.3	(a)		
Dy	21	(a)		
Ho				
Er				
Tm				
Yb	11.5	(a)		
Lu	1.52	(a)		
Hf	9.9	(a)		
Ta	1.8	(a)		
W ppb				
Re ppb				
Os ppb				
Ir ppb				
Pt ppb				
Au ppb				
Th ppm				
U ppm				

technique: (a) INAA, (b) IDMS.

Table 4. Chemical composition of 71568.

reference	Murali77	
weight		
SiO2 %		
TiO2	9.8	(a)
Al2O3	10.1	(a)
FeO	19.4	(a)
MnO	0.249	(a)
MgO	7.9	(a)
CaO	13.4	(a)
Na2O	0.46	(a)
K2O	0.058	(a)
P2O5		
S %		
sum		
Sc ppm	79	(a)
V	27	(a)
Cr	1690	(a)
Co	15	(a)
Ni		
Cu		
Zn		
Ga		
Ge ppb		
As		
Se		
Rb		
Sr		
Y		
Zr		
Nb		
Mo		
Ru		
Rh		
Pd ppb		
Ag ppb		
Cd ppb		
In ppb		
Sn ppb		
Sb ppb		
Te ppb		
Cs ppm		
Ba		
La	5.3	(a)
Ce	29	(a)
Pr		
Nd		
Sm	8.5	(a)
Eu	1.91	(a)
Gd		
Tb	2.4	(a)
Dy	14	(a)
Ho		
Er		
Tm		
Yb	8.1	(a)
Lu	1.36	(a)
Hf	8.6	(a)
Ta	1.6	(a)
W ppb		
Re ppb		
Os ppb		
Ir ppb		
Pt ppb		
Au ppb		
Th ppm		
U ppm		

technique: (a) INAA

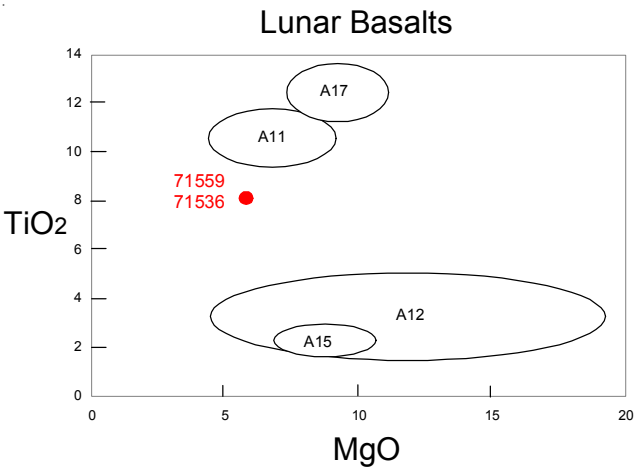


Figure 5: Composition of 71559 compared with other Apollo basalts.

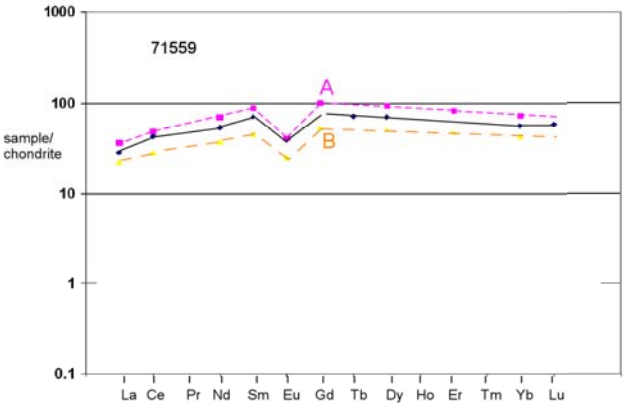
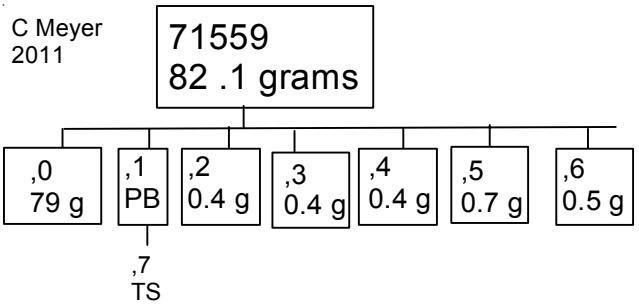
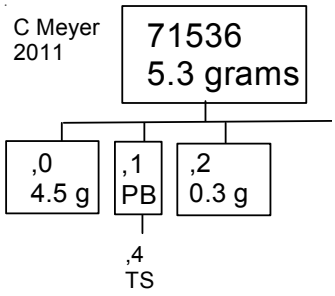
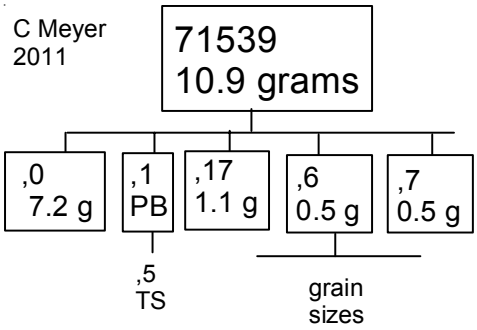


Figure 6: Normalized rare-earth-element diagram for 71559 and type A and B basalts.







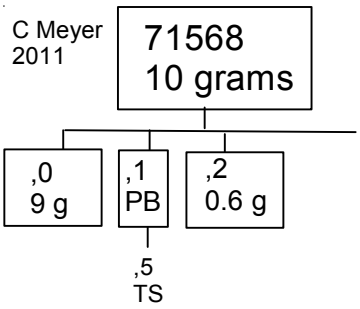


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Table 5: Armalcolite in 71559.

(Warner et al. 1976)

TiO2	70.7
Al2O3	2.75
Cr2O3	1.07
FeO	14.6
MgO	0.9
CaO	6.1
ZrO2	0.9
Y2O3	0.2

Table 6: Tranquillityite in 71559.

(Warner et al. 1976)

SiO2	15.1	14.3	14.4	14.6	14.4
TiO2	19.5	13.9	19.5	17.7	19.8
Al2O3	1.63	1.59	1.5	1.73	1.62
Cr2O3	0.4	0.11	0.04	0.05	
FeO	40.8	41	42.3	42.7	42.8
MnO	0.86	0.43	0.36	0.43	0.31
MgO	0.86	0.49	0.22	0.06	0.15
CaO	1.13	1.34	1.25	1.1.34	1.06
ZrO2	14.5	16.5	12.6	18.5	14.4
HfO2	0.37	0.64	0.4	0.51	0.51
Nb2O5	0.8	0.91	0.76	0.29	0.8
Y2O3	2.73	2.77	3.7	3.3	2.96
REE	tr.	tr.	high	tr.	tr.

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