71135 - 36.85 grams
71136 – 25.39 grams
Ilmenite Basalt

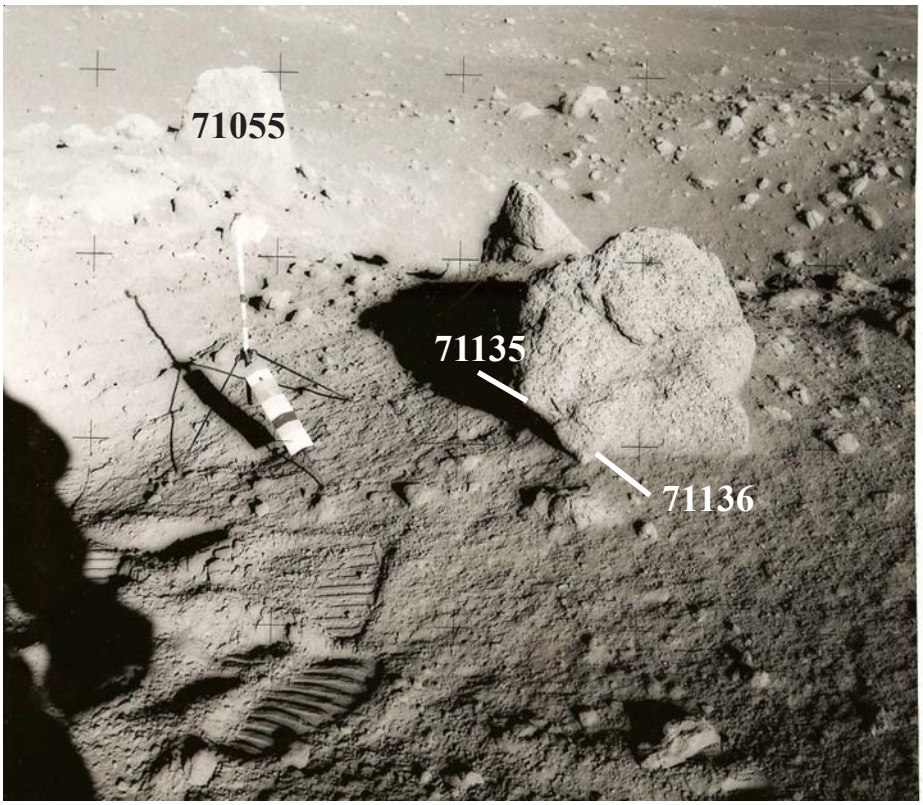


Figure 1: Astronaut photo of boulders sampled at station 1, Apollo 17. AS-136-20741.

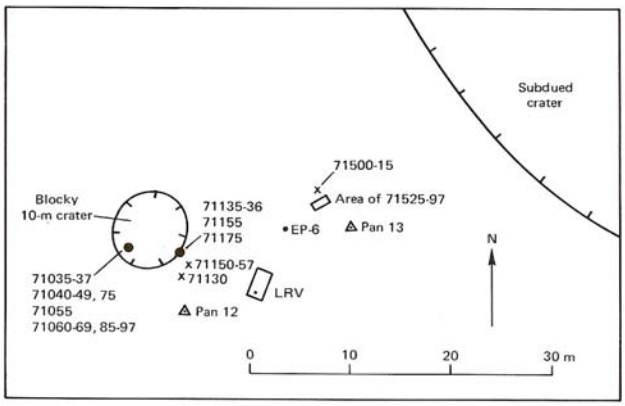


Figure 2: Location map for station 1, Apollo 17.

Transcript at station 1

CDR Hey, look at this rock, where the vesicularity changes from a hummocky vesicularity to a very fine vesicularity. Look at this. Let me try and crack see that? The change?

LMP Yes, that's what I'm after; that's it. That's what I saw in that other boulder (71055?)

CDR Let's see if I can't crack the corner and get that contact.

LMP Yes. And get a piece of both – think you can get - if you can reach down there. That's a contact in a rock.

CC Do you guys see any 2-meter boulders around there?

CDR We just sampled one - -

LMP We're not where you think we are. We're not sure where we are. Gene, can you get down into that? Need some help?

CDR Yes, just give me a shovel to hold myself with. Give me a shove.

LMP How about that one?

CDR Yes.

LMP Get that little piece.

CDR OK, I see it. It's pretty hard. See if I can't. It's low and hard to hit.

LMP How about coming around from this side?

CDR Well, I got the gnomon in the wrong place really. Can you reach it?

LMP Well, I'm going to lean on the rock maybe. I got the other little piece in sight.

CDR OK, I got that piece in sight, too. Let me –

LMP Let me get them both right now.

CDR Okay, this is a sample of a more coarsely vesicular rock.

Figure 3: Photo of broken surface of 71135. S73-15686. Cube is 1 cm.

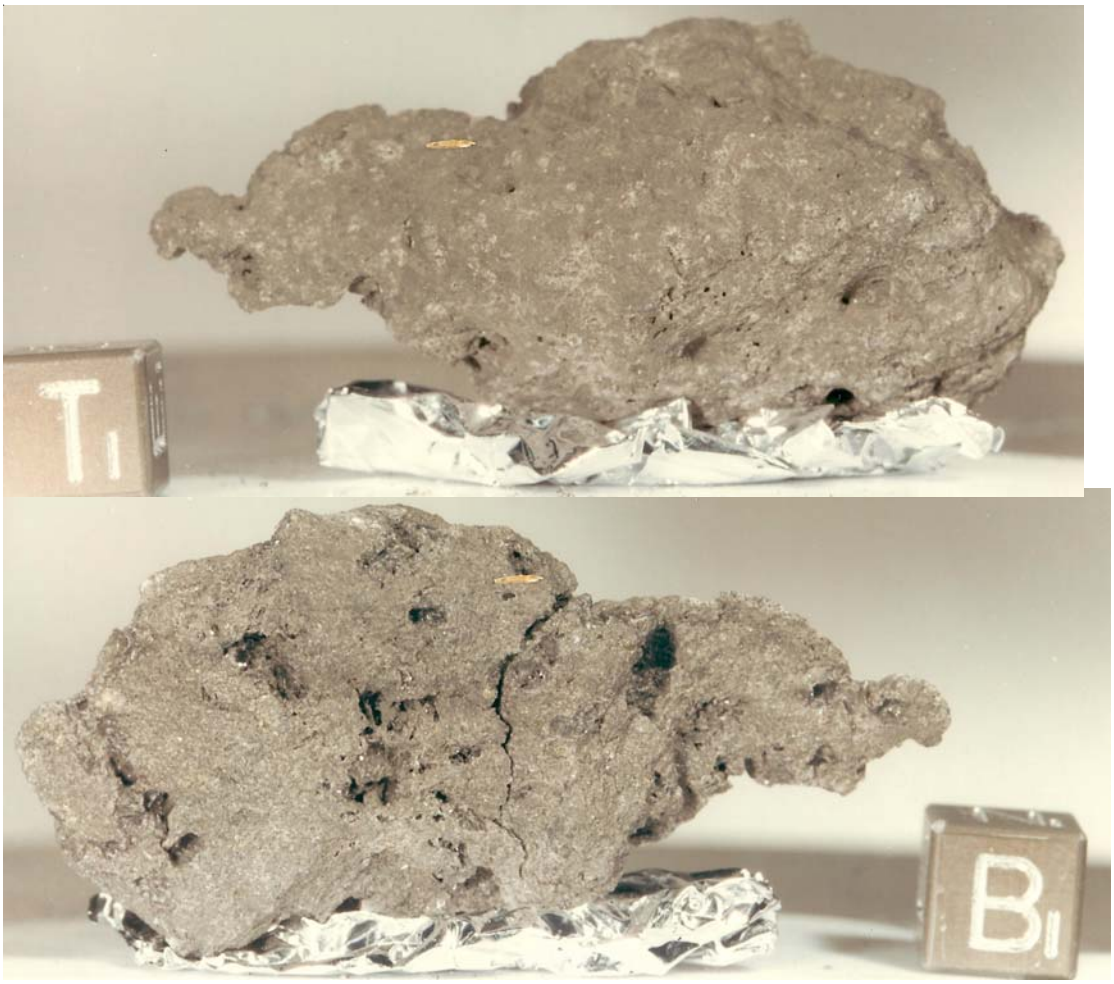


Figure 4: Top and bottom of 71136. S73-16424 and 425. Cube is 1 cm.

LMP You got it in your hand?

CDR I got them both. I think, actually, we got a sample of both sides; but I wouldn't bet on it.

LMP OK, I just got a chunk of that side.

CDR OK, I got both of these.

LMP See that rock right over there on the little mound, just projecting out of the edge of it? There you go; you just touch it. Right there that piece.

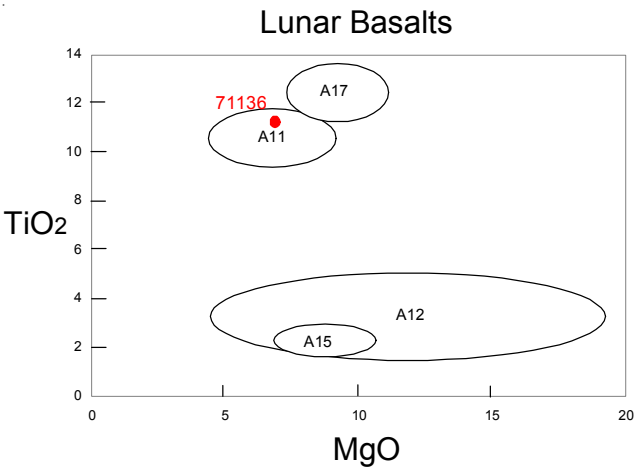


Figure 5: The Ti content of 71135 and 71136 is like that of Apollo 11.

CDR OK, let me get these in a bag here.
LMP Well, I'll get that piece; and that the samples from either side of the contact anyway. Can you get a bag - -
CRD They're pretty small. Give me a hammer, and get a bag and I'll - - I got these in my hand I want to put there.
LMP bag 477 is the coarsely vesicular rock (71135, 71136)
CDR Are there two of them there? I hope two of them fell in.
LMP No, I only got one.
CDR OK, here's that other one. It had to fall right here.
LPM Now your're full of dirt in the scoop; you just covered it up.
CDR Got it; I got it. A little dirt never hurt anybody.
LMP Here, put it in here with the dirt. That's good. In 477 are two chips – there're small, but I think they'll give you the – if there's any compositional difference (elapsed time ~ 4 min).
LMP In bag 478 is the chip from the more finely vesicular rock (71155). Both of them are coarse. It's a small chip; but it'll tell the story I think. Gene, if you can pick up one more rock in that picture, with your tongs, let's bag it. I've got a sample that was laying next to that boulder (71175).

Introduction

Figure 1 shows a very vesicular boulder on the rim of a small (10m) crater, which is itself on the ejecta blanket of Steno Crater (figure 2). The astronauts spotted what appeared to be a contact between two areas of different vesicularity. They hammered off two pieces (71135 and 71136) from one side of the contact and one piece from the other side (71155) (see transcript).

71135 and 71136 are vesicular ilmenite basalt with both freshly broken and exposed surfaces (figures 3 and 4). They are characterized by large sawtooth needles of ilmenite set in a fine-grained intergrown plagioclase-pyroxene matrix (figures 6 and 7).

Mineralogical Mode

Olivine	tr.
Pyroxene	49.7
Plagioclase	20
Opaques	24.8
Silica	1.2
Meostasis	4.3

Petrography

Brown et al. (1975) and Neal and Taylor (1993) give brief descriptions of the mineral mode and texture, but a detailed petrographic study has never been reported. Usselman et al. (1975) performed controlled cooling experiments that yielded this texture at cooling rate ~ = 2-5 deg / hr.

Chemistry

Rhodes et al. (1976), Eldridge et al. (1974) and Warner et al. (1975) have reported similar compositions for these samples. Based on trace elements, it is classified as a type B1 basalt by Neal and Taylor (1993).

Radiogenic age dating

Not dated, but Nyquist et al. (1975) reported whole rock values for Rb, Sr and $Sr^{87/86}$.

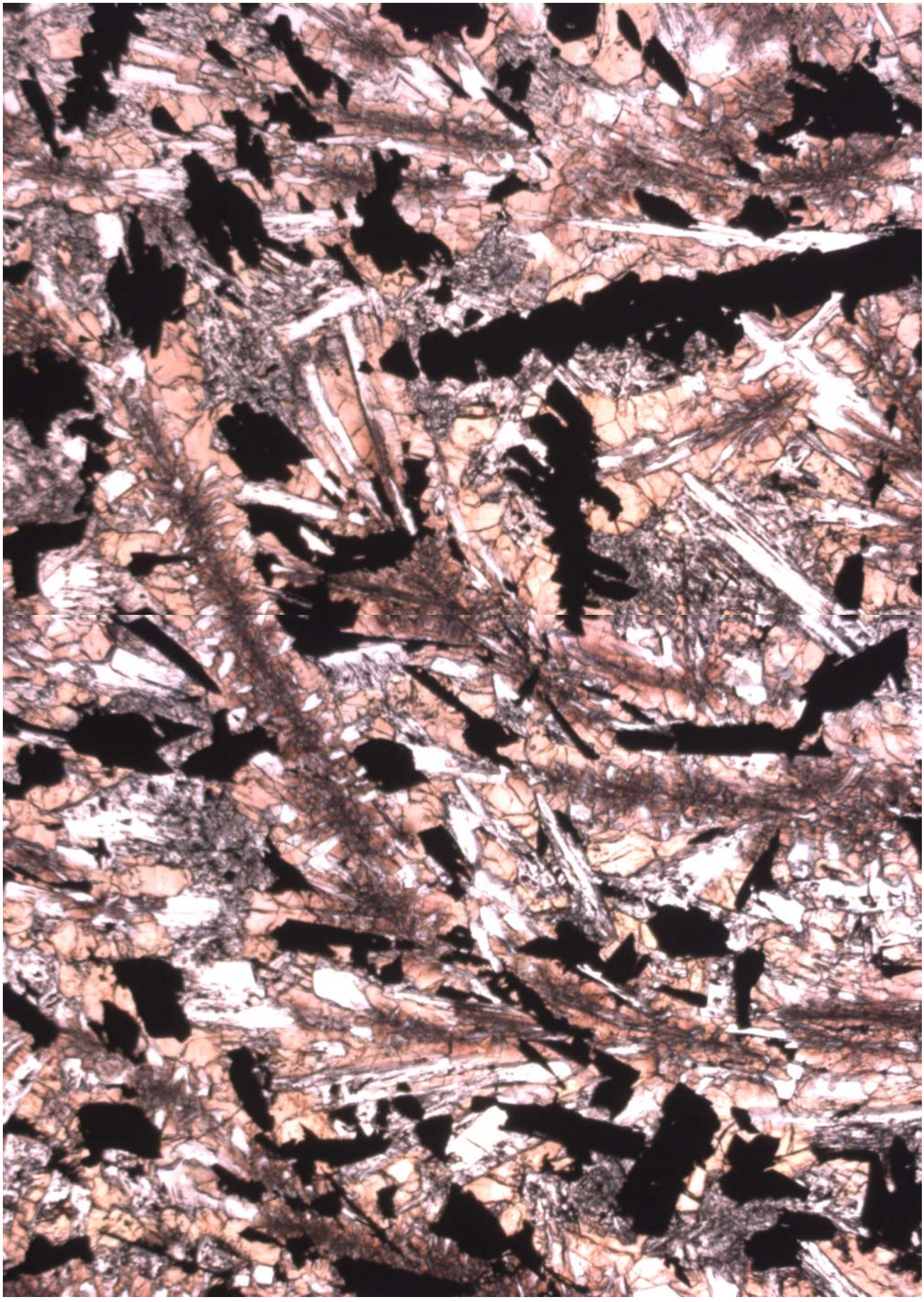
Cosmogenic isotopes and exposure ages

Niemeyer et al. (1977) determined an exposure age for 71135 of ~ 102 m.y.

For 71135 O'Kelley et al. (1974) determined the cosmic-ray-induced activity of ^{22}Na = 95 dpm/kg., ^{26}Al = 80 dpm/kg., ^{46}Sc = 70 dpm/kg., ^{54}Mn = 140 dpm/kg and ^{56}Co = 290 dpm/kg. For 71136 they determined ^{22}Na = 93 dpm/kg., ^{26}Al = 90 dpm/kg., ^{46}Sc = 70 dpm/kg., ^{54}Mn = 160 dpm/kg and ^{56}Co = 300 dpm/kg.

Processing

71135 has been broken into pieces (figure 10). There are 8 thin sections for 71135 and 3 for 71136.



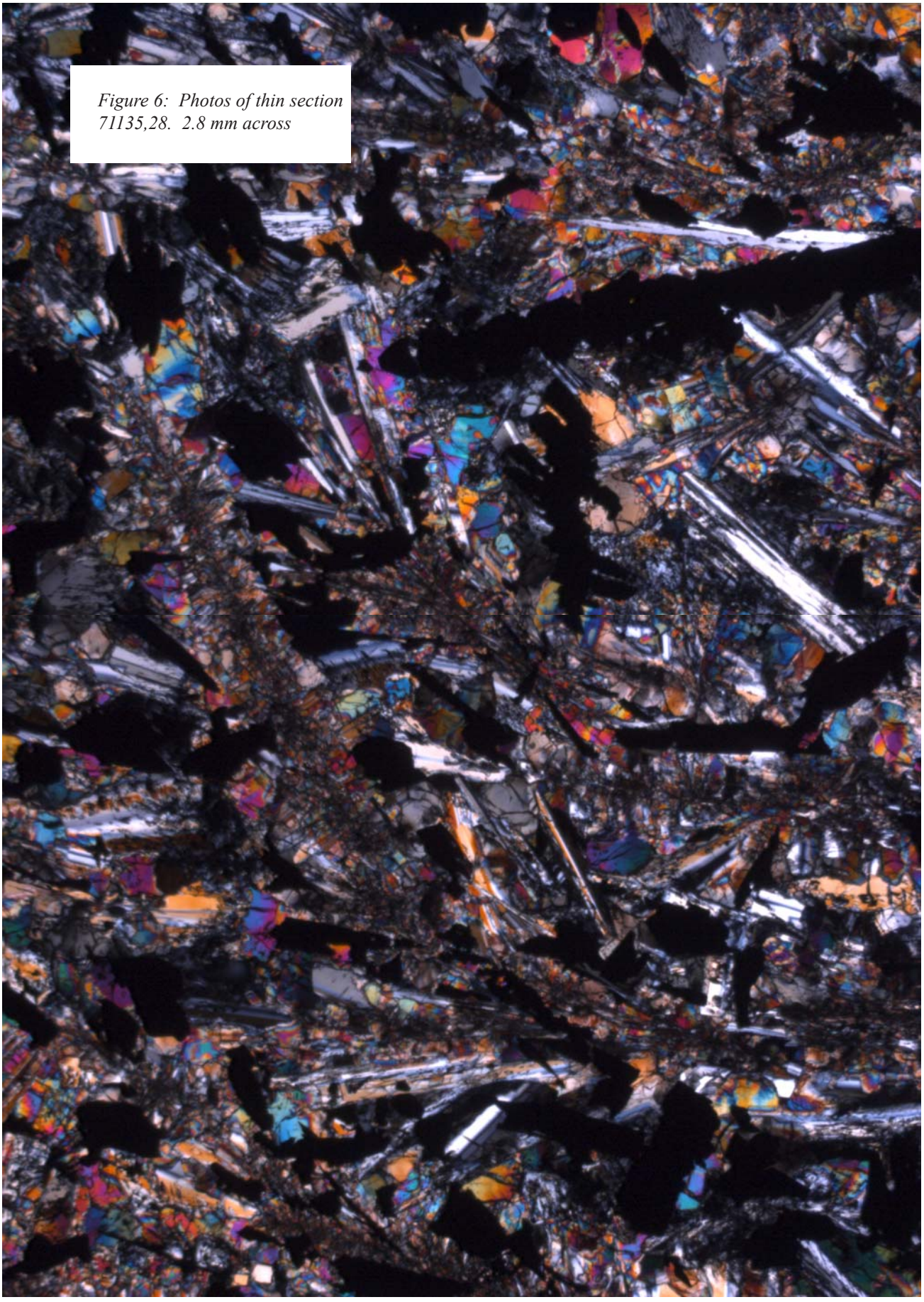


Figure 6: Photos of thin section 71135,28. 2.8 mm across

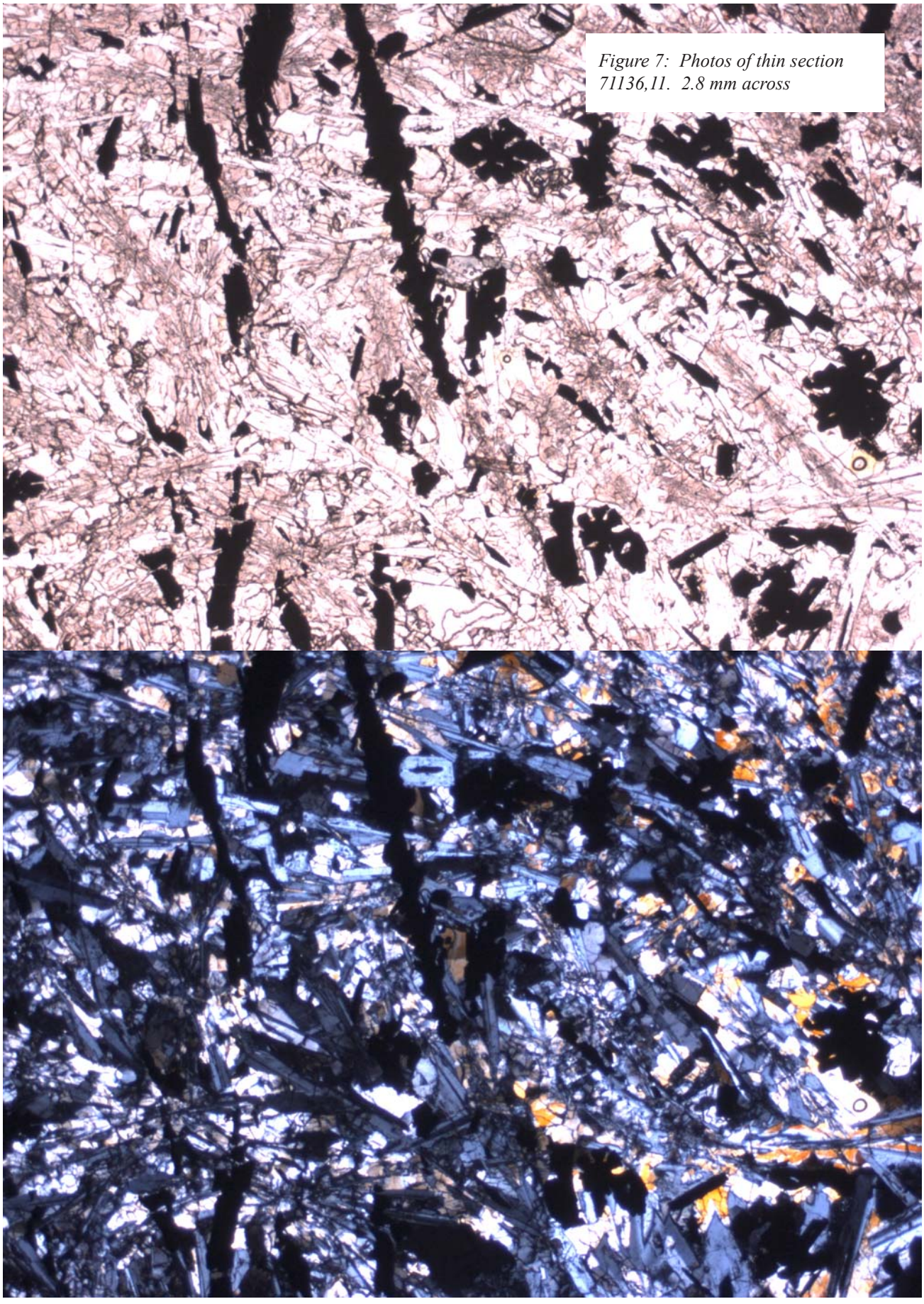


Figure 7: Photos of thin section 71136,11. 2.8 mm across

Table 1. Chemical composition of 71135.

reference	Eldridge74		Rhodes76		Shih75	
weight					Wiesman76	
SiO2 %			39.71	(a)		
TiO2			10.74	(a)		
Al2O3			10.1	(a)		
FeO			18.57	(a)		
MnO			0.28	(a)		
MgO			7.31	(a)		
CaO			11.62	(a)		
Na2O			0.38	(a)		
K2O	0.042	(c)	0.05	(a)	0.045	(b)
P2O5			0.06	(a)		
S %			0.11	(a)		
sum						
Sc ppm					82.1	(d)
V						
Cr			2121	(a)		
Co					17.5	(d)
Ni						
Cu						
Zn						
Ga						
Ge ppb						
As						
Se						
Rb					0.354	(b)
Sr					143	(b)
Y						
Zr					185	(b)
Nb						
Mo						
Ru						
Rh						
Pd ppb						
Ag ppb						
Cd ppb						
In ppb						
Sn ppb						
Sb ppb						
Te ppb						
Cs ppm						
Ba					61.4	(b)
La					5.43	(b)
Ce					17.8	(b)
Pr						
Nd					18.6	(b)
Sm					7.55	(b)
Eu					1.56	(b)
Gd					12	(b)
Tb						
Dy					13.3	(b)
Ho						
Er					7.95	(b)
Tm						
Yb					7.28	(b)
Lu					1	(b)
Hf						
Ta						
W ppb						
Re ppb						
Os ppb						
Ir ppb						
Pt ppb						
Au ppb						
Th ppm	0.6	(c)				
U ppm	0.14	(c)			0.11	(b)

technique: (a) XRF, (b) IDMS, (c) radiation count. (d) INAA

Table 2. Chemical composition of 71136.

reference	Rhodes76		Warner75		Eldridge74	
weight						
SiO2 %	40.3	(a)				
TiO2	11.12	(a)	11.1	(b)		
Al2O3	10.21	(a)	10.9	(b)		
FeO	18.44	(a)	19.3	(b)		
MnO	0.28	(a)	0.224	(b)		
MgO	7.03	(a)	7.5	(b)		
CaO	11.73	(a)	11.4	(b)		
Na2O	0.37	(a)	0.374	(b)		
K2O	0.03	(a)	0.05	(b)	0.044	(c)
P2O5	0.06	(a)				
S %	0.17	(a)				
sum						
Sc ppm			87	(b)		
V			89	(b)		
Cr	1916	(a)	2025	(b)		
Co			16	(b)		
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			5.9	(b)		
Ce						
Pr						
Nd						
Sm			8	(b)		
Eu			1.7	(b)		
Gd						
Tb						
Dy			15	(b)		
Ho						
Er						
Tm						
Yb			7.9	(b)		
Lu			1.1	(b)		
Hf						
Ta						
W ppb						
Re ppb						
Os ppb						
Ir ppb						
Pt ppb						
Au ppb						
Th ppm					0.46	(c)
U ppm					0.22	(c)

technique: (a) XRF, (b) INAA, (c) radiation count.

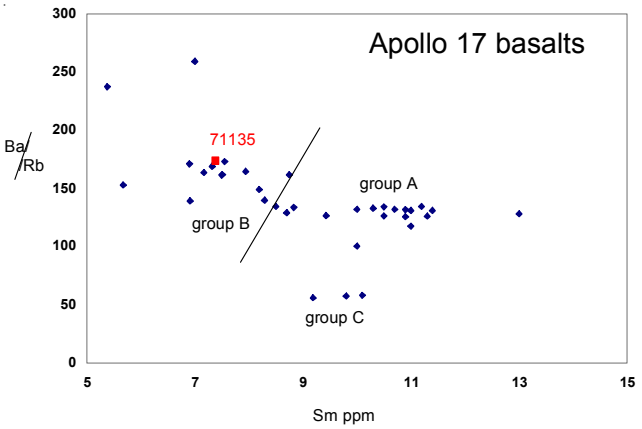


Figure 8: Trace element characterization allowing that 71135 is a type B, Apollo 17 basalt.

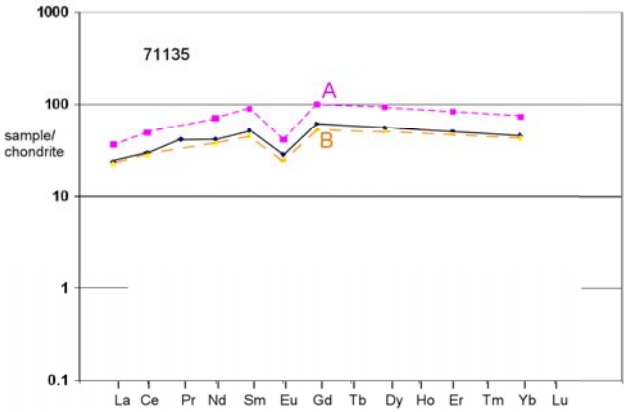
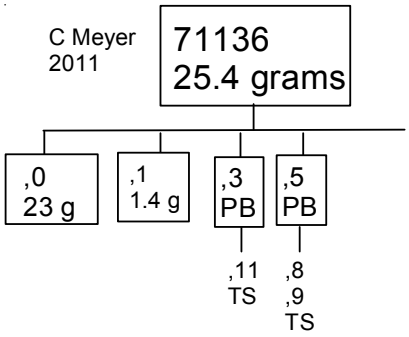


Figure 9a: Normalized rare-earth-element diagram for 71135 and type A and B basalts.



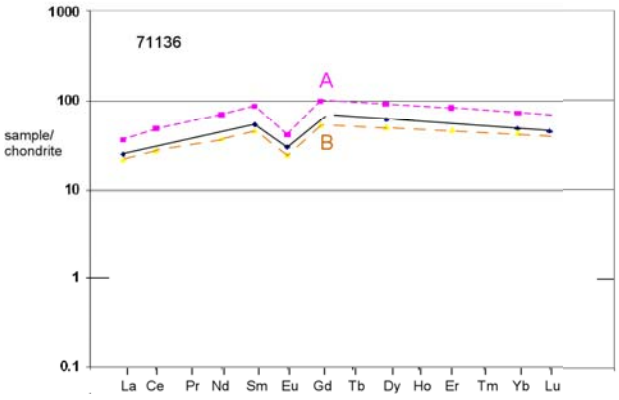
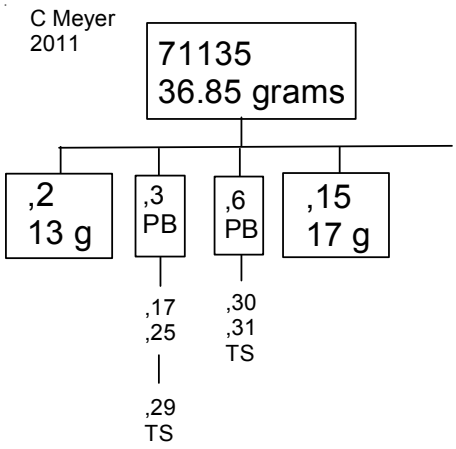


Figure 9b: Normalized rare-earth-element diagram for 71136 and type A and B basalts.



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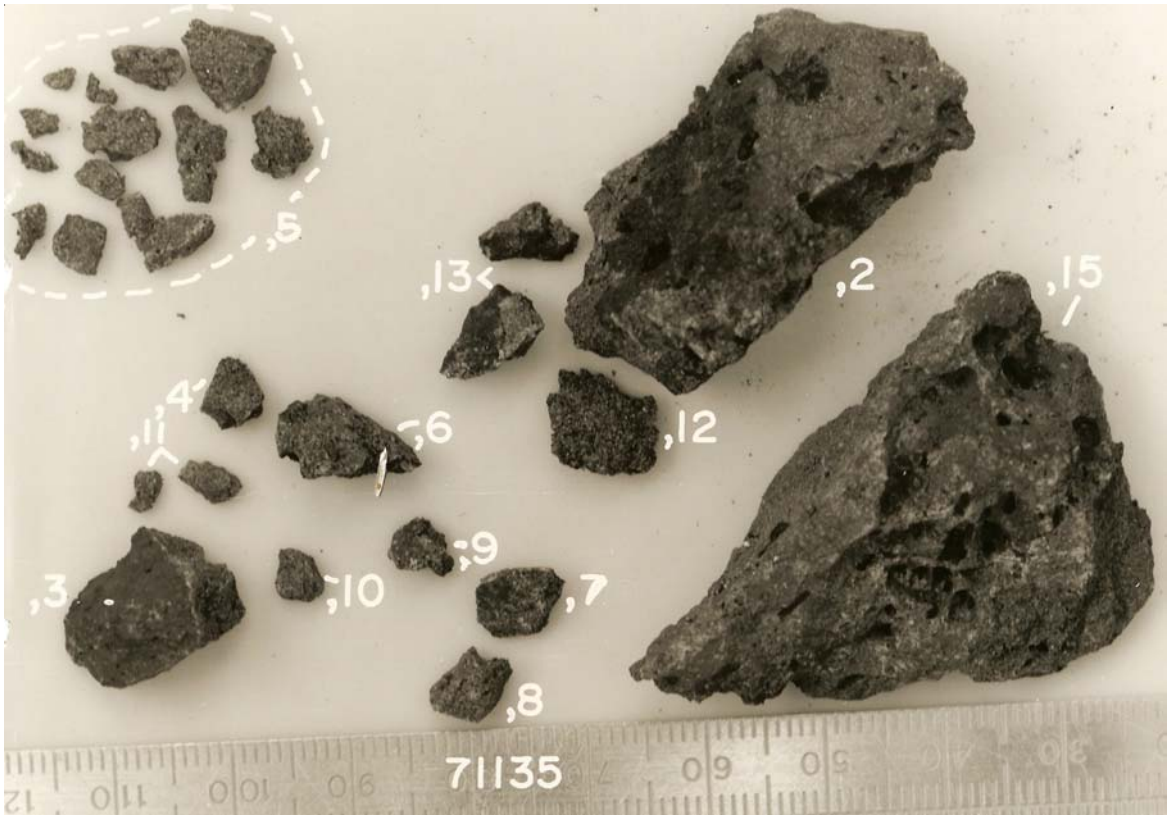

Figure 10: Subdivision of 71135. Scale is in Cm/. S74-19018

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