67935, 67936 and 67937

Basaltic Impact Melt with glass veins

108.9, 61.8 and 59.7 grams

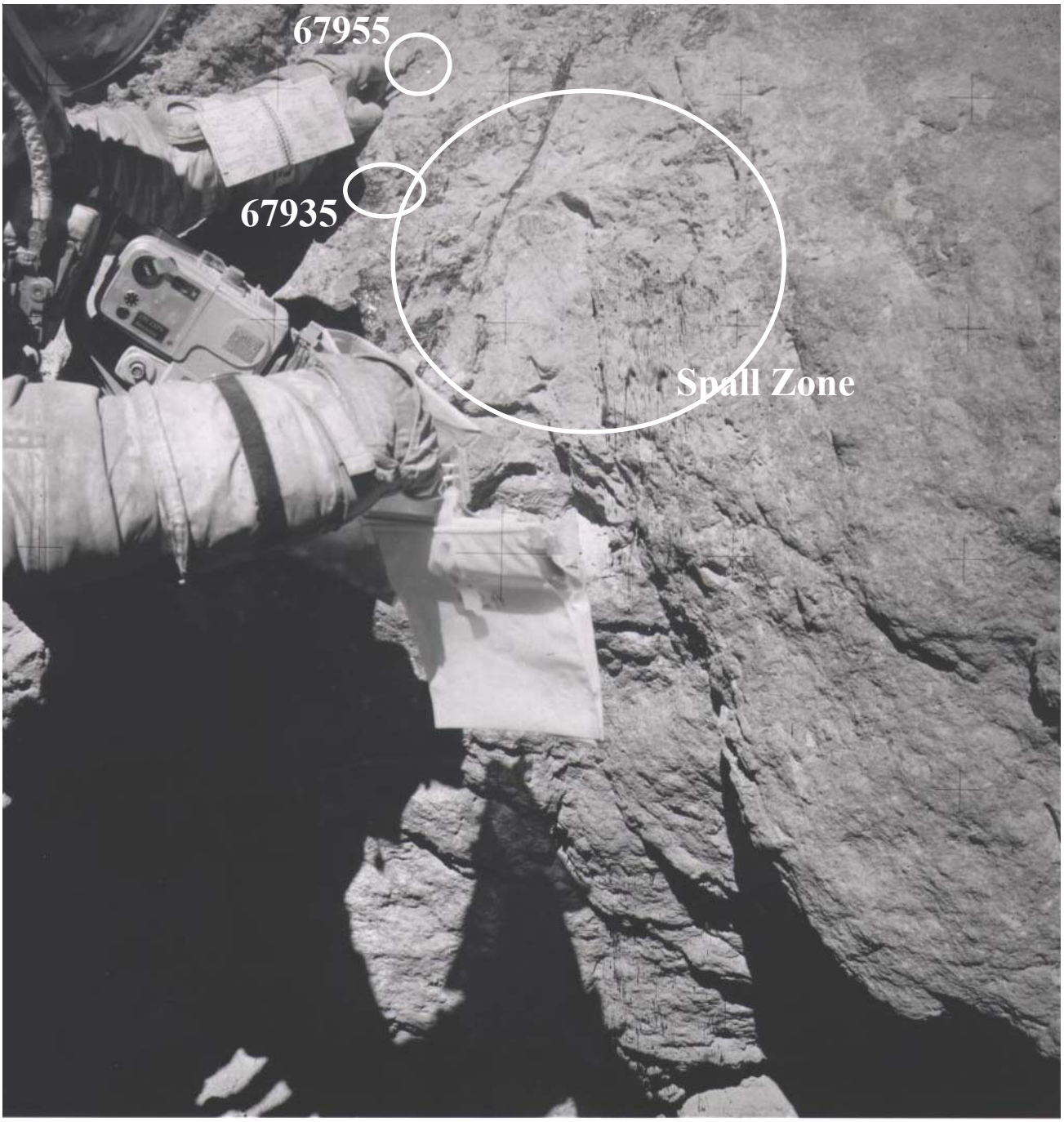

Figure 1: Outhouse Rock on rim of North Ray Crater. Note the spall zone, and sample locations. See also section on 67955. AS16-116-18649

Figure 2: Thin section photomicrograph of 67937,13 (field of view about 3 mm). From Ryder and Norman 1980

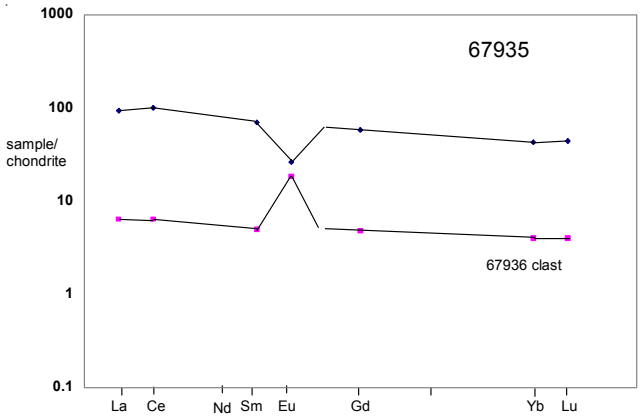

Figure 3: Normalized rare-earth-element diagram for matrix and clast in 67935 (see table).

Introduction

The Apollo 16 astronauts sampled several areas on this side of Outhouse Rock (figure 1). Samples 67935, 67936 and 67937 were collected from the same area outside the spall zone of a large impact crater (shatter cone). Thin veins of black glass could be seen in the area sampled, and the samples contained this glass within a rather crushed matrix (figures 4 – 9).

Petrography

Ryder and Norman (1980) found that these samples of Outhouse Rock had the texture of fine-grained subophitic basalt (figure 2). They also noted that small clasts of plagioclase or "anorthosite" were included in the basaltic matrix. In general, these samples are poorly described.

Roedder and Weiblen (1977) made a detailed study the glass veins in Outhouse Rock, including rather thick veins in sample 67936. They concluded that the glass veins were probably made at time of excavation of Outhouse Rock from North Ray Crater.

Hunter and Taylor (1981) reported rust in 67935.

Mineralogy

In general, mineral data for 67935 has not been reported.

Chemistry

The chemical analysis shows high Al_2O_3 content for the "basaltic matrix". Clarke and Keith (1973) and Eldridge et al. (1973) reported K, U and Th for these three samples (table 1). Lindstrom and Salpus (1982) give analyses of the matrix and an aluminous clast (figure 3). Hertogen et al. (1977) determined trace elements, finding high Ni, Ir and Au.

Cosmogenic isotopes and exposure ages

Clarke and Keith (1973) reported the cosmic-ray-inducted activity of ^{26}Al = for 67935 and 67936 respectively and Eldridge et al. (1973) reported the cosmic-ray-inducted activity of ^{26}Al for 67937. Fruchter et al. (1978) determined the activity $^{26}Al = 51$ dpm/kg. and $^{53}Mn = 156$ dpm/kg. and discussed the age of the shatter cone.

Other Studies

Roedder and Weiblen (1977) reported rare gas content of veins and matrix of 67936.

Processing

There are 7 thin sections of 67935, 9 TS for 67936 and 5 TS for 67937. These friable samples were chipped, and not sawn.

Figure 4: Photo of 67935. Scale is in cm. NASA S72-53502

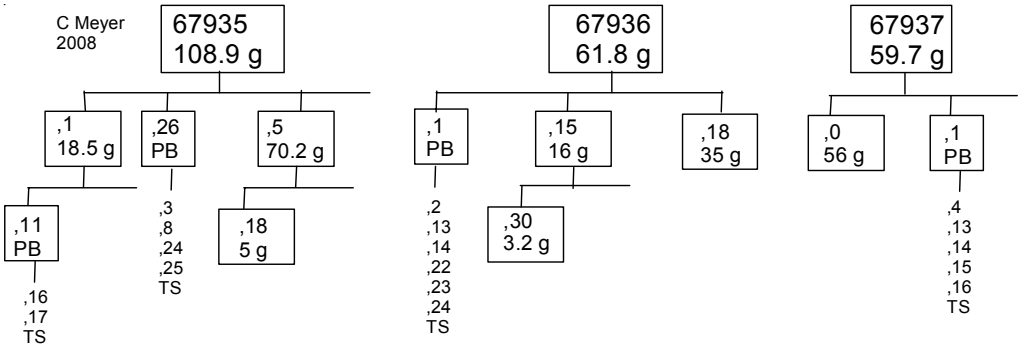

Figure 5: Close-up photo of 67937. Scale is in cm. S79-37057.

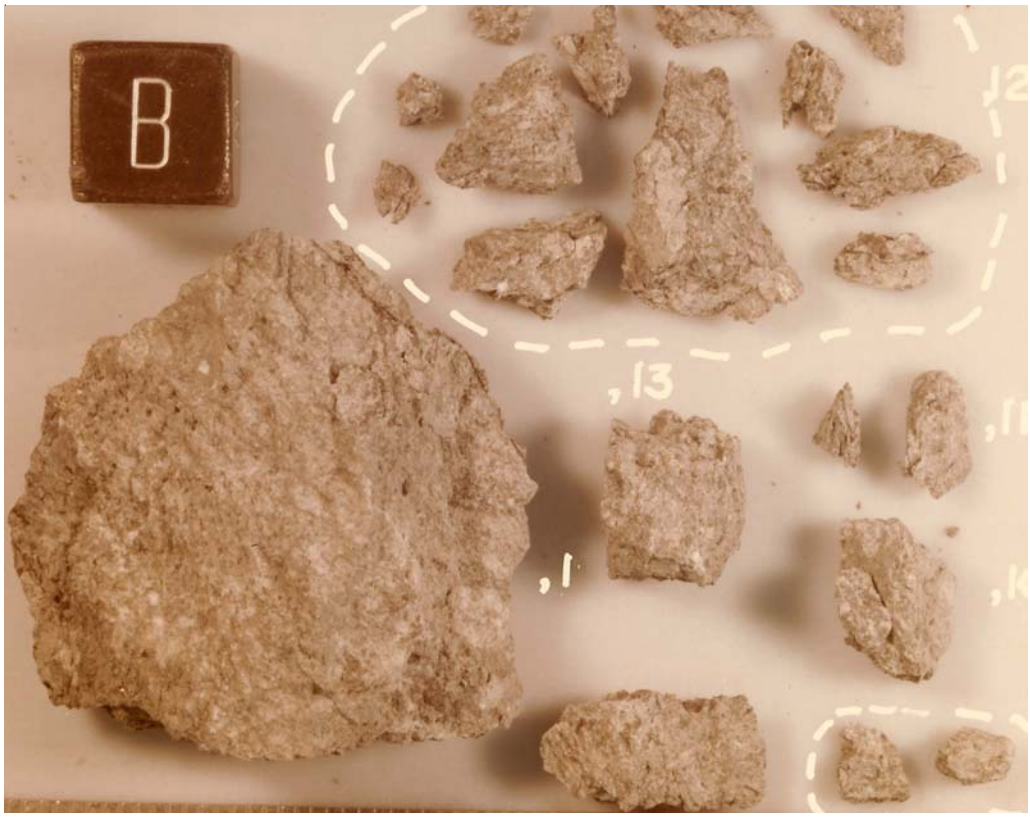

Figure 6: Processing photo of 67935,1. Cube is 1 cm. NASA S75-24301.

Figure 7: Processing photo of 67935,5. Cube is 1 cm. NASA S77-21523.

Table 1. Chemical composition of 67935.

	67935	67936	67937		67935		67935	67936	
reference	Clarke73	Clarke73	Eldridge73		Hertogen77		Lindstrom and Salpus 82		
weight			Eldridge75						
SiO2 %									
TiO2									
Al2O3							20.9	30.7	(c)
FeO							7.52	2.53	(c)
MnO									
MgO							12.6	3.2	(c)
CaO							13	18.1	(c)
Na2O							0.581	0.484	(c)
K2O	0.196	0.194	0.199	(a)					
P2O5									
S %									
sum									
Sc ppm							10.4	5	(c)
V									
Cr							1017	334	(c)
Co							43.6	6	(c)
Ni					659	(b)	695	44	(c)
Cu									
Zn					3.98	(b)			
Ga									
Ge ppb					633	(b)			
As									
Se					233	(b)			
Rb					6.07	(b)			
Sr							192	185	(c)
Y									
Zr									
Nb									
Mo									
Ru									
Rh									
Pd ppb					28.4	(b)			
Ag ppb					1.74	(b)			
Cd ppb					4.1	(b)			
In ppb					2.33	(b)			
Sn ppb									
Sb ppb					2.7	(b)			
Te ppb					8.4	(b)			
Cs ppm					0.325	(b)			
Ba							235	28	(c)
La							21.8	1.51	(c)
Ce							61.2	3.87	(c)
Pr									
Nd									
Sm							10.3	0.736	(c)
Eu							1.45	1.03	(c)
Gd									
Tb							2.1	0.173	(c)
Dy									
Ho									
Er									
Tm									
Yb							7	0.64	(c)
Lu							1.07	0.097	(c)
Hf							8.15	0.53	(c)
Ta							1.19	0.094	(c)
W ppb									
Re ppb					1.37	(b)			
Os ppb					13.9	(b)			
Ir ppb					12.9	(b)			
Pt ppb									
Au ppb					12.3	(b)			
Th ppm	2.9	3.12	3.24	(a)			3.88	0.2	(c)
U ppm	0.84	0.91	0.96	(a)	1	(b)	1.18	0.07	(c)

technique: (a) radiation counting, (B) RNAA, (c) INAA

Figure 8: Photo of 67936. Scale is in cm. NASA S72-53501.

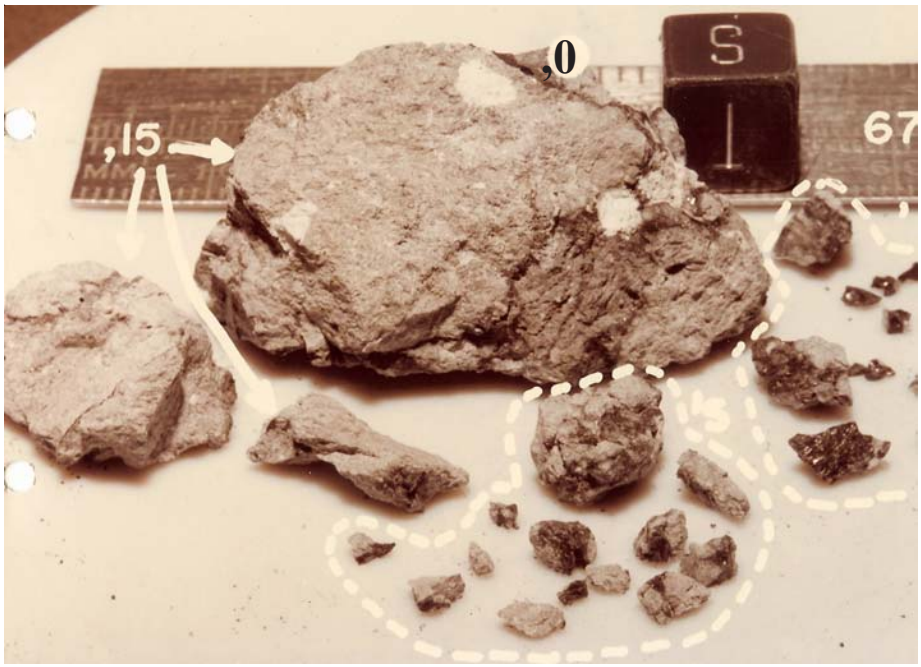

Figure 9: Photo of 67936,0 after splitting. Cube is 1 cm. NASA S74-33202.

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