

67115
Fragmental Breccia
240 grams



Figure 1: First look at 67115. Cube is 1 inch. S72-37747

Introduction

67115 is a glass-coated, fragmental breccia from the rim of North Ray Crater (figure 2). The glass coat is rather thick, but has been fractured and broken off by micrometeorite bombardment (figure 5).

Petrography

The bulk of the sample beneath the glass coating is a suevite similar to 67016 (from the same location). Ryder and Norman (1980) provide the only petrographic description. The sample is very fractured and somewhat friable. 67115 is feldspar-rich.

The glass coat has devitrified at the boundary with the breccia (figure 3). Glass veins are also reported although they are not observed in photos.

Glass: Shaal et al. (1979), Taylor et al. (1973), See et al. (1987) and Morris et al. (1987) studied the glass coat.

Chemistry

67115 has a high Al content. The matrix of 67115 is rather low in meteoritic siderophile elements (similar to other breccia samples from the rim of North Ray Crater).

Cosmogenic isotopes and exposure ages

The cosmic-ray-induced activity of $^{22}\text{Na} = 29$ dpm/kg, $^{26}\text{Al} = 62$ dpm/kg, and $^{53}\text{Mn} = 1.7$ dpm/kg (Clark and Kieth 1973).

Other Studies

Brownlee et al. (1973) studied the micrometeorite craters.

Processing

67115 has not been sawn. There are 17 grams of additional material in the residue from the sample bag. There are 9 thin sections.

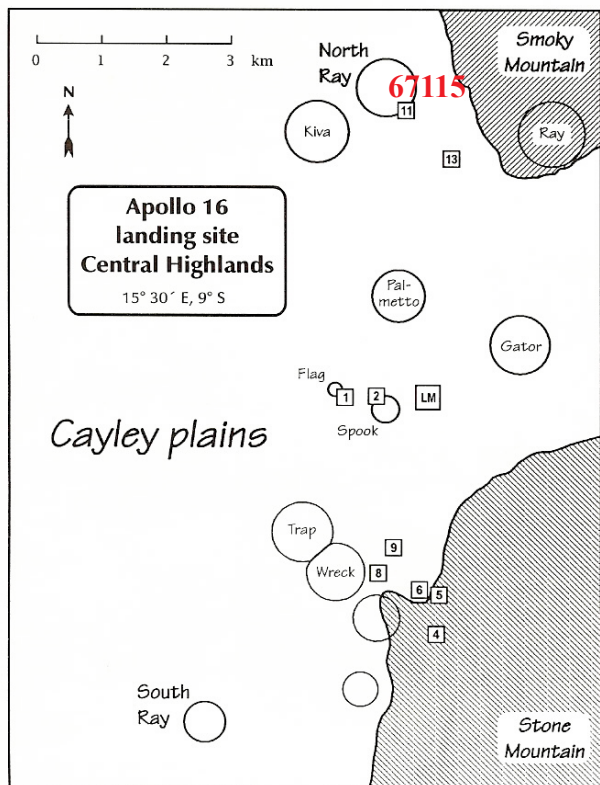


Figure 2: Map of Apollo 16 site, with 67115 location.



Figure 3: Photomicrograph of thin section 67115,30 showing breccia included in glass (clear, cracked), which is devitrified around edges.

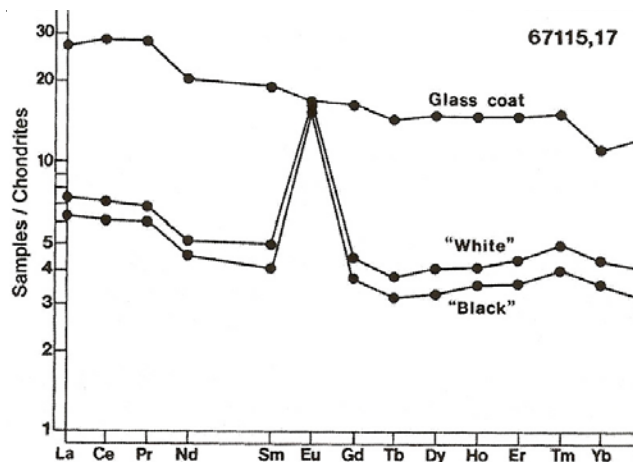


Figure 4: Normalized rare-earth-element diagram for matrix and glass coat on 67115 (data from Taylor et al. 1973).

Table 1. Chemical composition of 67115

reference	Taylor73			Rose73	glass See87	glass Hertogen77	Clark73	Eldridge75					
weight	black	white	g. Glass		Morris87								
SiO2 %	44.6	43.8	44.2	(a) 44.75	(b) 44.5	(e)							
TiO2	0.16	0.16	0.64	(a) 0.24	(b) 0.65	(e)							
Al2O3	32.4	24.5	27.8	(a) 31.15	(b) 27.9	(e)							
FeO	2.13	4.78	5.02	(a) 2.6	(b) 4.8	(e)							
MnO													
MgO	2.62	5.06	5.09	(a) 3.03	(b) 4.9	(e)							
CaO	17.7	13.9	15.7	(a) 17.76	(b) 15.8	(e)							
Na2O	0.55	0.52	0.47	(a) 0.51	(b) 0.45	(e)							
K2O	0.13	0.13	0.14	(a) 0.08	(b) 0.12	(e)	0.056	0.057	(f)				
P2O5				0.02	(b)								
S %													
sum													
Sc ppm	2	2		(a) 23	8.51	(d)							
V	12	13		(a) 15									
Cr	400	470	680	(a)	556	(d)							
Co	5.7	3.8		(a) 6.2	20	(d)							
Ni	72	44		(a) 62	218	(d)	45	164	28	24	(e)		
Cu	1.6	3		(a) 1.4									
Zn				4			4.1	2.5	4.8	4.2	(e)		
Ga				2.3									
Ge ppb							79	319	19	19	(e)		
As													
Se							15	72	12	9	(e)		
Rb	0.27	0.59	1.34	(a) 1.2			0.45	1.64	0.36	0.61	(e)		
Sr				180									
Y	7	9.1	31.5	(a) 6.6									
Zr	22	26	137	(a) 22									
Nb	1.87	2.4	11.2	(a)									
Mo													
Ru													
Rh													
Pd ppb							1.2	7.9	1	0.7	(e)		
Ag ppb							1.2	1.5	0.9	1.1	(e)		
Cd ppb							2.4	2.6	0.7	2.3	(e)		
In ppb							0.3	9	1.6	0.2	(e)		
Sn ppb													
Sb ppb							0.11	0.94	0.08	0.132	(e)		
Te ppb							35	17	18	28	(e)		
Cs ppm			0.06	(a)			0.07	0.08	0.02	0.076	(e)		
Ba	45	55	137	(a) 50	(c) 120	(d)							
La	2.08	2.44	9	(a)	9.08	(d)							
Ce	5.35	6.23	25.2	(a)	25.2	(d)							
Pr	0.68	0.76	3.17	(a)									
Nd	2.7	3.1	12.3	(a)									
Sm	0.76	0.91	3.48	(a)	4.29	(d)							
Eu	1.07	1.1	1.17	(a)	1.34	(d)							
Gd	0.94	1.14	4.1	(a)									
Tb	0.15	0.18	0.68	(a)	0.76	(d)							
Dy	1	1.23	4.54	(a)									
Ho	0.25	0.29	1.06	(a)									
Er	0.72	0.88	3.03	(a)									
Tm	0.12	0.15	0.46	(a)									
Yb	0.72	0.91	2.77	(a) 0.6	(c) 3.04	(d)							
Lu	0.11	0.14	0.43	(a)	0.43	(d)							
Hf	0.44	0.59	2.53	(a)	3.02	(d)							
Ta					0.27	(d)							
W ppb													
Re ppb													
Os ppb													
Ir ppb													
Pt ppb													
Au ppb													
Th ppm	0.26	0.4	1.49	(a)	1.35				0.43	0.44	(f)		
U ppm	0.07	0.09	0.4	(a)	0.56	(d)	0.13	0.38	0.05	0.105	(e)	0.12	(f)

technique: (a) SSMS, (b) microchem., (c) ES, (d) INAA, (e) RNAA, (f) radiation count.

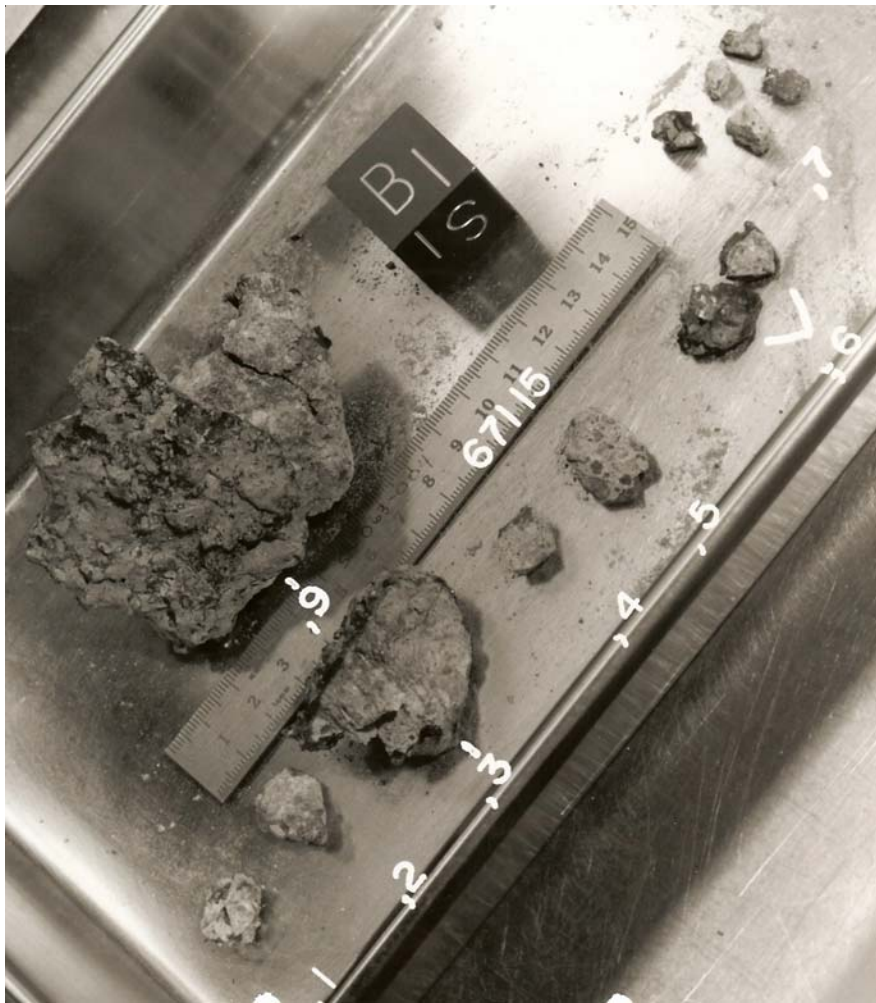


Figure 5: Initial processing of 67115. Scale in cm. S72-43318

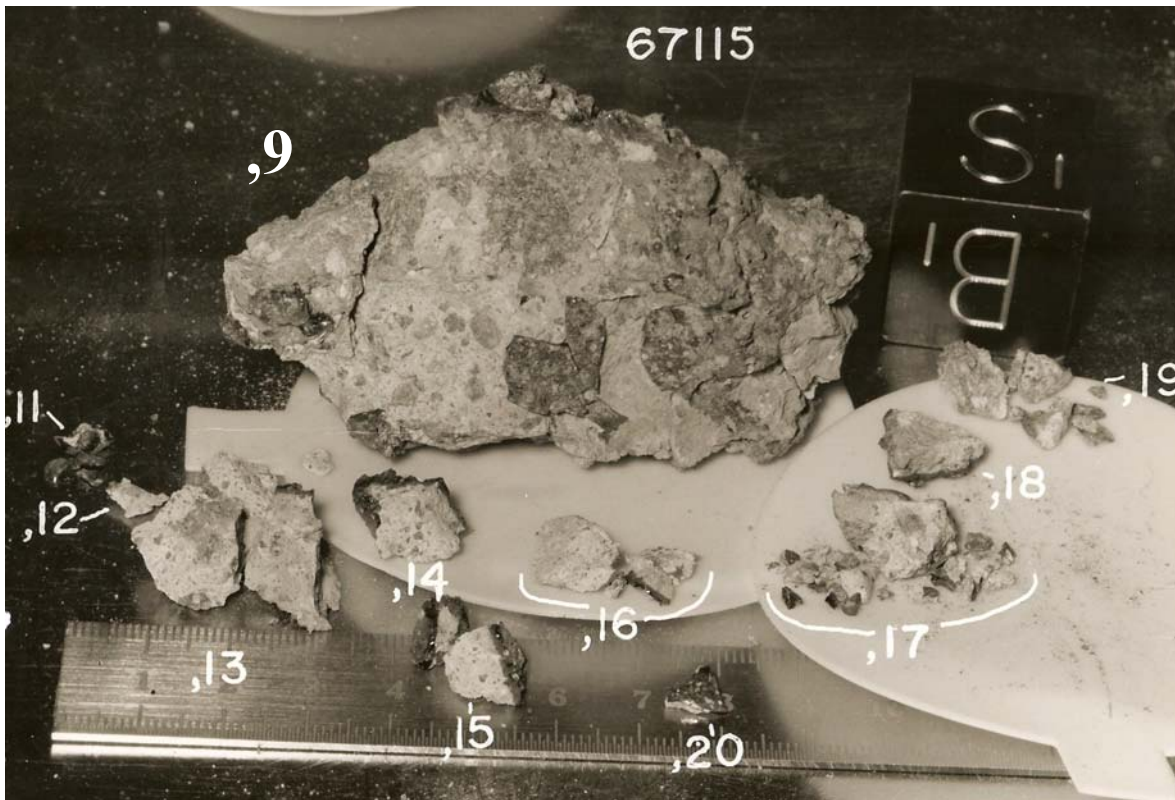


Figure 6: Initial processing of 67115. S72-53517

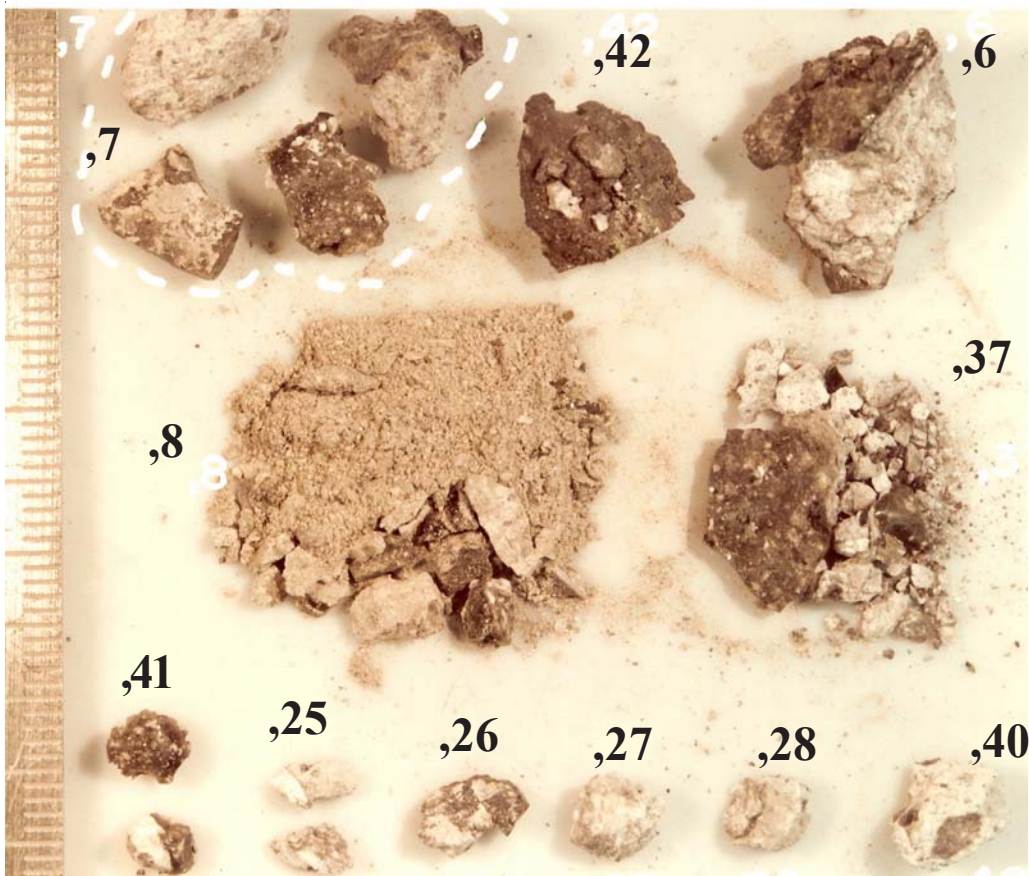
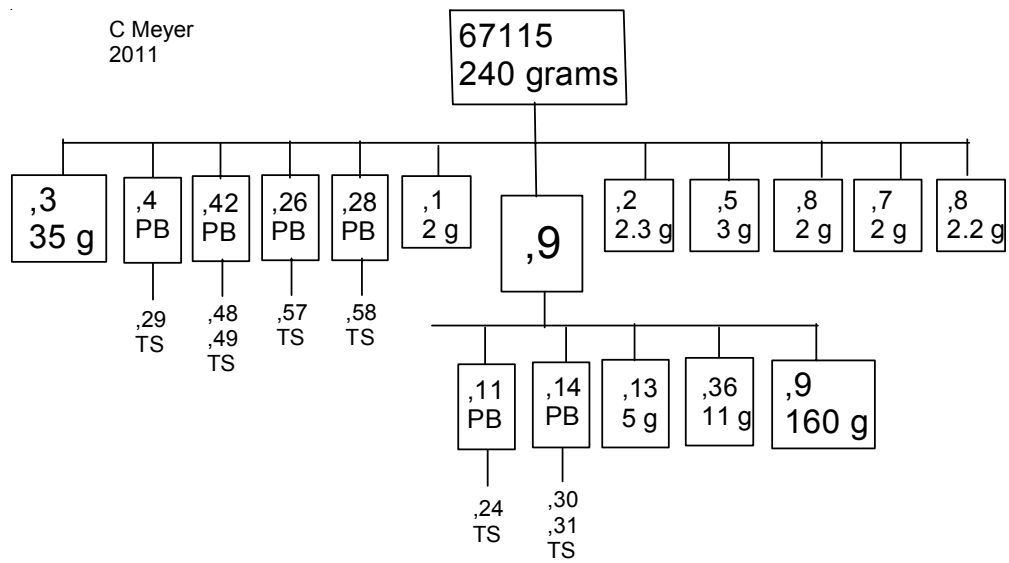


Figure 7: Photo of chips from 67115. Scale in mm. S74-33199



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