

61135
Ancient Regolith Breccia
245.1 grams

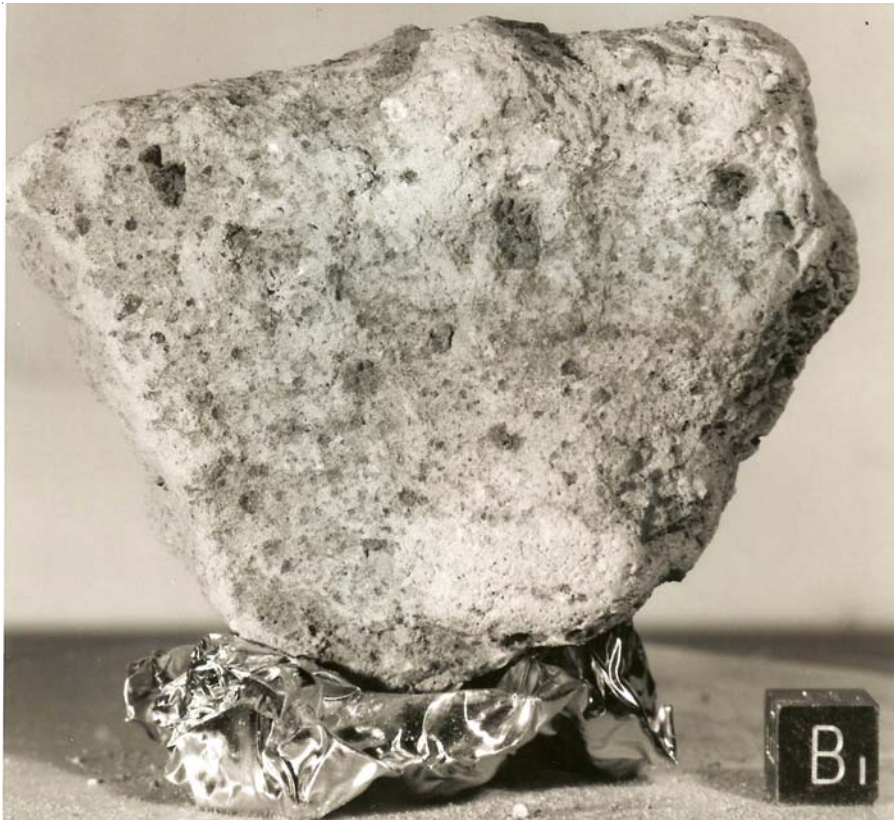


Figure 1: Photo of 61135. Cube is 1 cm. S72-41516.

Introduction

James (1981), Fruland (1983), McKay et al. (1986), Simon et al. (1988) and Eugster et al. (2001) found that 61135 was an ancient regolith breccia that became a closed system about 3.9 b.y. ago. It has an exposure to cosmic ray for about 50 m.y. and has a few zap pits (figure 1).

Petrography

61135 is a welded, clastic breccia with many components. It has a light matrix with both light and dark clasts. It has a high percent of glass, but few recognized agglutinates. The maturity index (Is/FeO) is low (McKay et al. 1986).

The modal analysis by McKay et al. and Simon et al. do not agree, probably because they studied different portions of the sample. While McKay et al. reported fragments of KREEP basalt and

Mineralogical Mode for 61135

(from McKay et al. 1986) ("Optical")

	>500 micron	20-500 micron
Mare basalt	0	0
KREEP basalt	11.3	0.7
Plutonic rock frag.	33.3	9
Other lithic	0	5.3
Granulitic	0	0
Poik. Rocks	17.3	2.3
Subophitic	2.4	5
Intergranular	20.2	2.7
Intersertal		0.3
Vitric breccia	10.1	0.7
Frag. Breccia		0.7
Plagioclase	4.2	53
Olivine		8.3
Pyroxene		2
Opagues		0
Glass		10

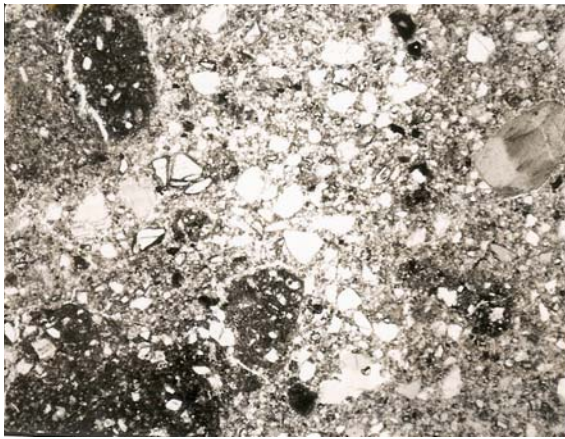


Figure 2: Photomicrograph of thin section 61135,8. Scale unknown.

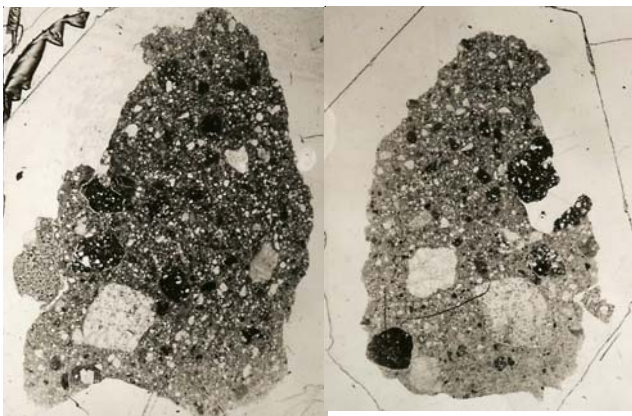


Figure 3: Thin section photomicrographs of 61135,8 and ,7. Sample is about 1 cm.

plutonic rock, Simon et al. found mostly mineral and glass fragments. Plagioclase is dominant, with minor amounts of pyroxene, Fe-metal and troilite. Lithic fragments include granoblastic anorthosite, noritic anorthosite, basaltic and poikilitic impact melts (Ryder and Norman 1980).

Chemistry

Eldridge et al. 1973, McKay et al. 1986, Simon et al 1988 and Korotov 1996) reported high Al_2O_3 and high Ni, Ir and Au contents (table 1). Moore and Lewis (1976) reported 55 ppm nitrogen and 54 ppm carbon for 61135 (figure 5).

Radiogenic age dating

Schaeffer and Schaeffer (1977) determined an Ar/Ar plateau age of 3.9 ± 0.1 b.y. for one split, but were unable to get good ages from other splits, probably because the sample is a regolith breccia full of trapped gas.

Cosmogenic isotopes and exposure ages

Eldridge et al. (1973) reported the cosmic ray induced activity of $^{26}Al = 120$ dpm/kg and $^{22}Na = 41$ dpm/kg. Schaeffer and Schaeffer (1977) reported ^{38}Ar exposure ages of 44 m.y. and 61 m.y.

Other Studies

McKay et al. (1986) find the rare gas content to be consistent with an ancient radiation.

Processing

The rock was not sawn. Allocations were from the smaller pieces. There are only 6 thin sections.

Mineralogical Mode for 61135

(from Simon et al. 1988)

	20-90 micron	90-1000 micron
Matrix < 20 micron	45.9 %	
Mare basalt	0	0
KREEP basalt	0	0
Feldspathic basalt	0	0
Plutonic rock frag.	0.3	4.4
Granulite	0.2	0
Poik. rocks	0.1	0.9
Impact melts	0	4.8
Regolith brec.	0	0
Agglutinate	0.1	3.5
Plagioclase	12.8	10.3
Olivine	3.5	0.9
Pyroxene	3.2	0.8
Opagues	0	0
Glass	1.9	4.7

Summary of Age Data for 61135

	Ar/Ar
Schaeffer and Schaeffer 1977	3.9 ± 0.1 b.y

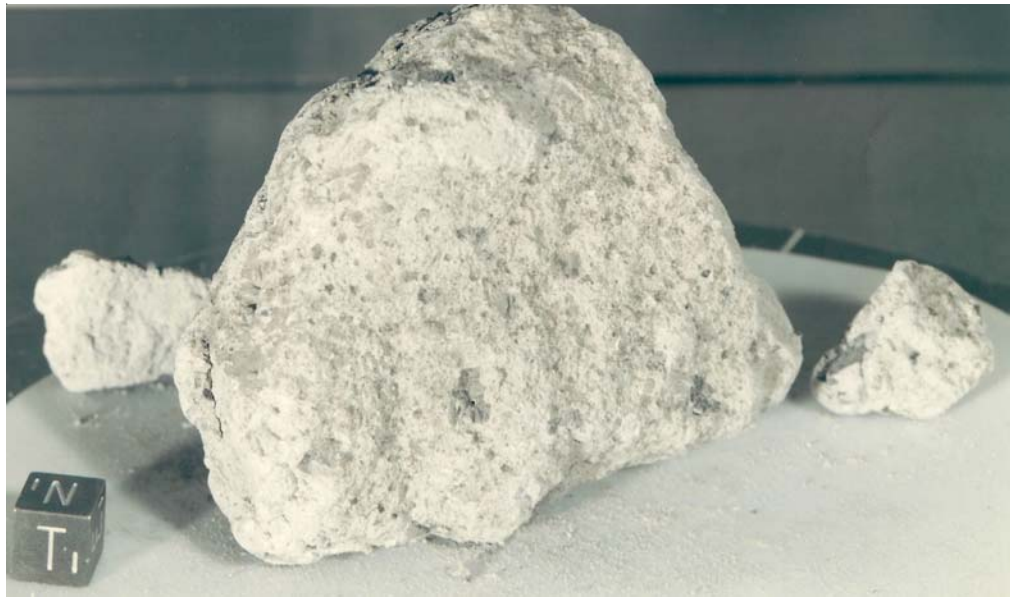


Figure 4: Photo of 61135. Cube is 1 cm. S72-38312

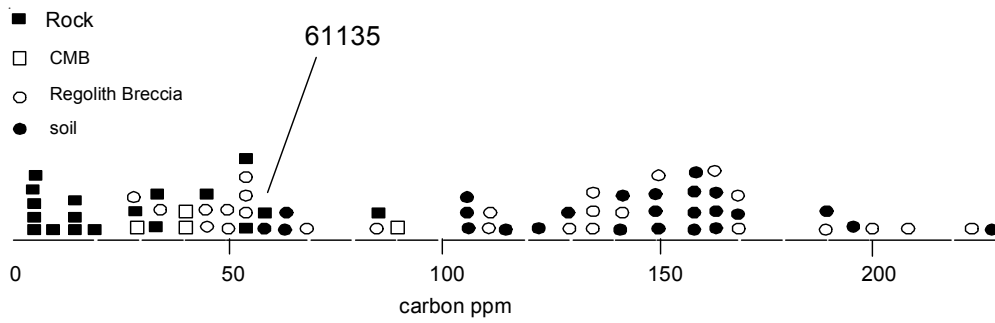


Figure 5: Carbon content of Apollo 16 samples (Moore

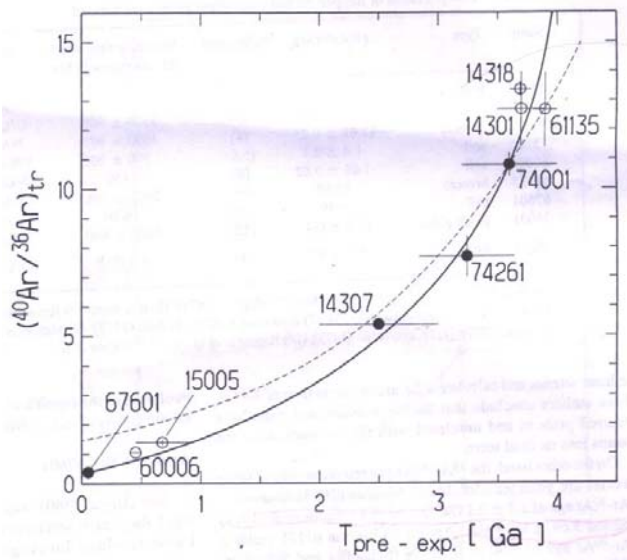
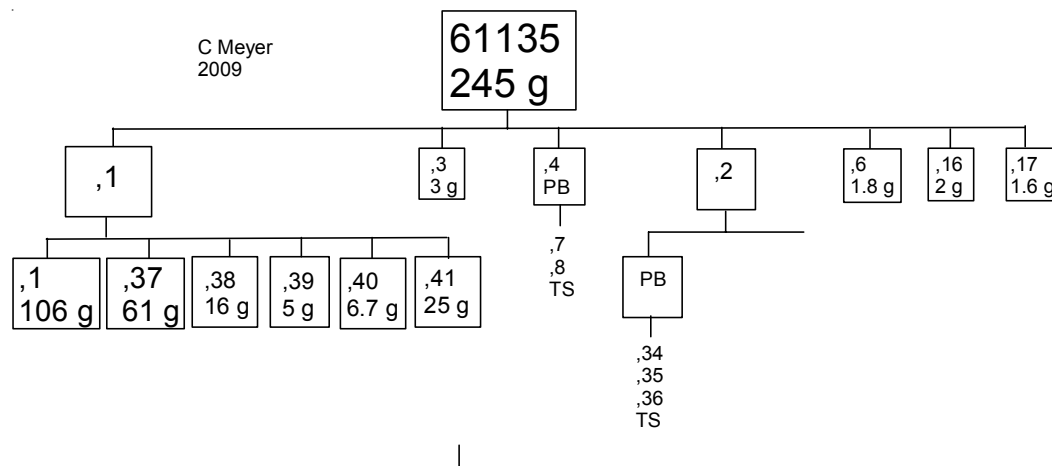


Figure 6: Eugster et al. (2001) identified 61135 as one of the ancient regolith breccias with high $^{40}\text{Ar}/^{38}\text{Ar}$:

Table 1. Chemical composition of 61135.

reference	Eldridge73	McKay86	Simon88	Korotev95	
<i>weight</i>					
SiO2 %					
TiO2		0.54	0.46		
Al2O3		29.4	30.3		
FeO		3.31	3.63	4.1	(b)
MnO			0.056		
MgO		4.5	4.8		
CaO		16.7	16.1	16.4	(b)
Na2O		0.542	0.53	0.51	(b)
K2O	0.083	(a)	0.091		
P2O5					
S %					
<i>sum</i>					
Sc ppm		4.96	5.7	5.96	(b)
V			28		
Cr		376	417	468	(b)
Co		13.2	17.2	17.1	(b)
Ni		146	200	195	(b)
Cu					
Zn					
Ga					
Ge ppb					
As					
Se					
Rb			5.6		
Sr		211	170	182	(b)
Y					
Zr		85	120	117	(b)
Nb					
Mo					
Ru					
Rh					
Pd ppb					
Ag ppb					
Cd ppb					
In ppb					
Sn ppb					
Sb ppb					
Te ppb					
Cs ppm		0.1	0.09		
Ba		78	110	101	(b)
La		6.41	9.1	9.19	(b)
Ce		16.7	23.1	23.9	(b)
Pr					
Nd		10	15		
Sm		2.98	4.18	4.22	(b)
Eu		1.22	1.23	1.24	(b)
Gd			5.3		
Tb		0.54	0.85	0.87	(b)
Dy			5.5		
Ho			1.3		
Er					
Tm					
Yb		2.01	2.9	2.97	(b)
Lu		0.282	0.4	0.401	(b)
Hf		2.25	3.1	3.18	(b)
Ta		0.26	0.34	0.33	(b)
W ppb					
Re ppb					
Os ppb					
Ir ppb		5.4	2.6	6	(b)
Pt ppb					
Au ppb		2.9	0.65	3.2	(b)
Th ppm	1.39	(a) 1.04	1.22	1.45	(b)
U ppm	0.38	(a) 0.24	0.41	0.38	(b)
<i>technique: (a) radiation counting, (b) INAA</i>					



References for 61135

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