14047

Regolith Breccia

242 grams

Figure 1: 14047 is a soil breccia, pure and simple. S71-64-9073.

Introduction

14047 was collected at station B (figure 1) on the 2nd EVA. It is a blocky, subagnular rock with about 10 percent of its surface coated by vesicular glass. The glass-covered surface was apparently protected by the pronounced fillet (figure). The other surfaces are irregular, slightly-rounded and lightly covered with glass-lined zap pits. One nearly planer bounding surface of the rock has well-developed *slickensides*. Multiple sets of irregular fractures occur at one end of the specimen. The rock is a friable fine-grained clastic rock have a small perentage of subangular light clasts in a medium-gray matrix. Schmitt would call it “instant rock”.

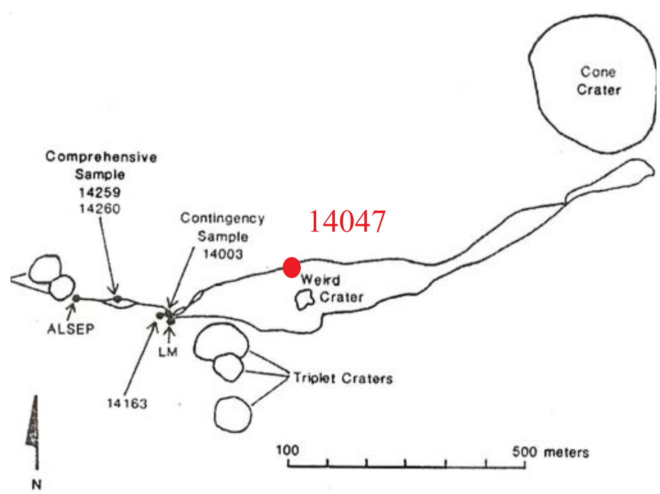


Figure 2: Map of Apollo 14 traverse showing location of 14047.

Figure 3: Photo of 14047 showing white clast. Sample is 9 cm long. NASA S71-32429.

Mineralogical Mode for 14047

	Drozd et al. 1977
Mineral fragments	27.6 %
Lithic fragments	15.9
Colored glass	6.9
Agglutinate glass	46.5
Colorless glass	0.9
Chondrules	0
Devitrified glass	2.2

Mineralogical Mode for 14047

	Simonds et al 1977	Simon et al. 1989
Matrix	85.5 %	62.3
Clasts		
Plagioclase	0.5	4.2
Mafic	2	3.4
Breccia	7.5	
Glass	4	13.2
Granulite	1	2
Agglutinate		8.8

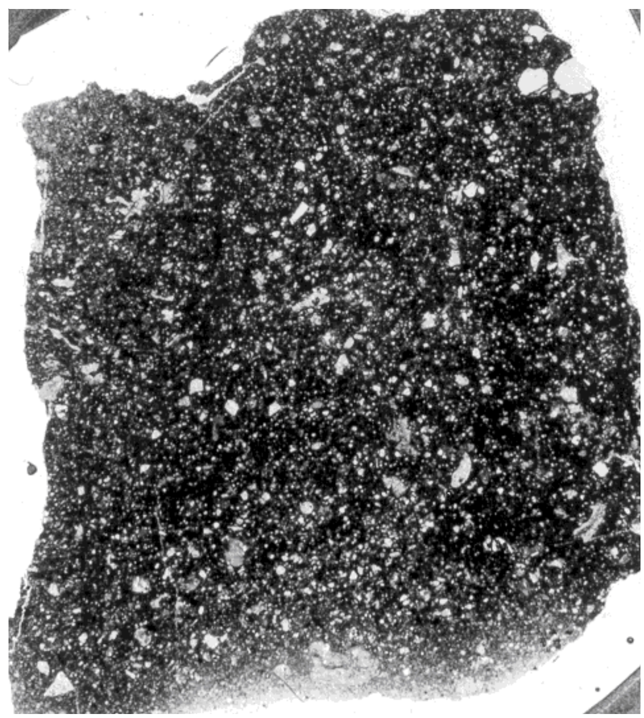


Figure 4: Photo of thin section 14047,50. Field of view is 1 cm. NASA S71-43121.

Fruland (1983) and Simon et al. (1989) included 14047 in the suite of regolith breccias. Indeed it has a high carbon content.

The Apollo 14 regolith breccias (vitric matrix breccias) are slightly more aluminous than the Fra Mauro breccias (crystalline matrix breccias).

Petrography

Simon et al. (1989) determined the mineral mode and classified the sample as a regolith breccia. Abundant brown glass is obvious in thin section (figure 5).

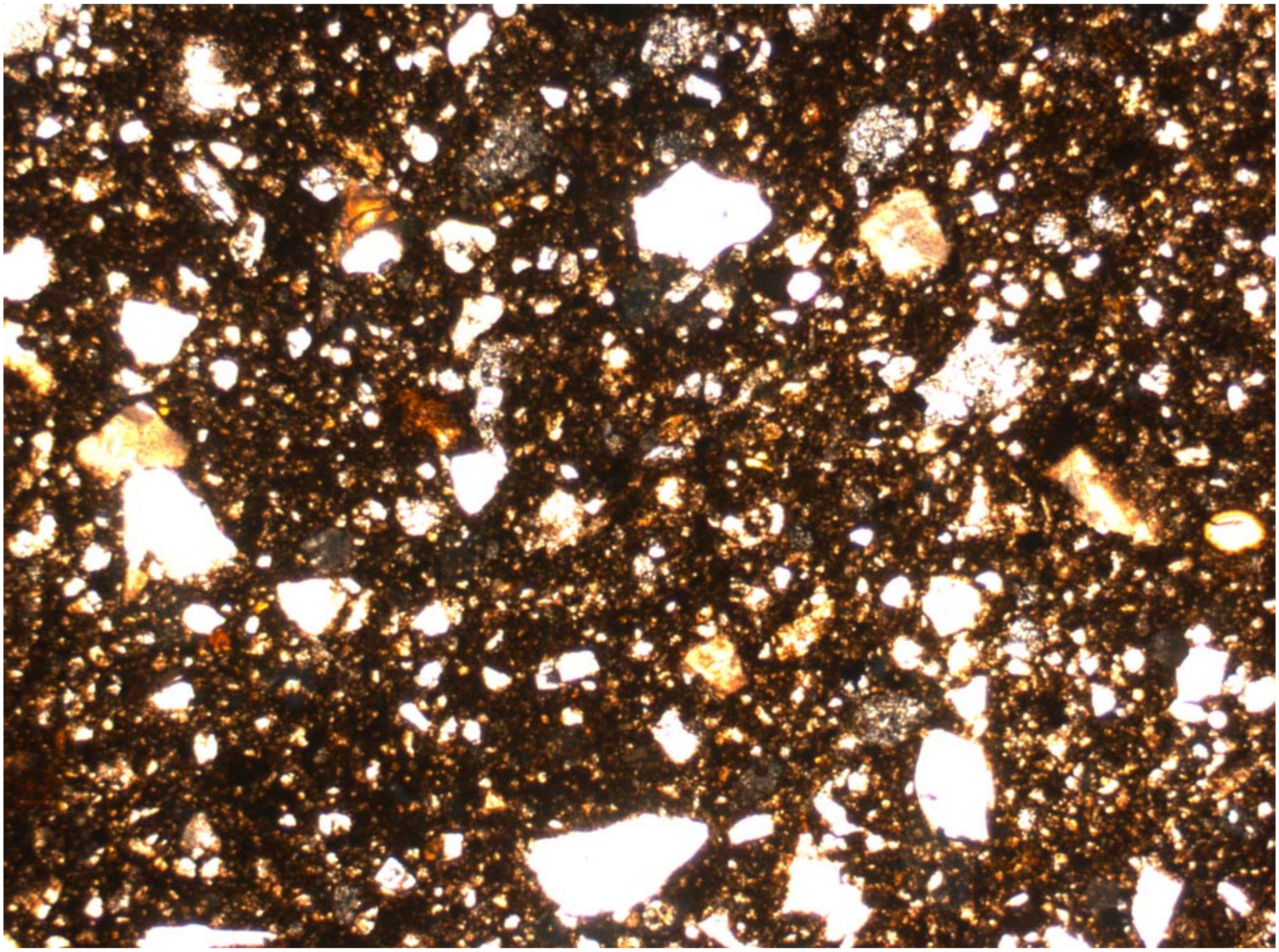


Figure 5: Photomicrograph of thin section 14047, by C meyer. Field of view is 2.8 mm across.

Simonds et al. (1977) found that 14047 was primarily made up of matrix with only minor clasts (figure 6).

Phinney et al. (1976) studied the matrix using SEM techniques. The matrix has low porosity with a lot of glass fragments and some spheres in the matrix. However, welding did not occur, and this is a "low-grade" breccia apparently derived from the local soil (instant rock).

Significant Clast

Alkali anorthosite ,112

Warren et al. (1983) describe a large clast and give mineral compositions . Bersch et al. (1991) presented pigeonite analysis for this clast. This is probably the clast seen in figure 10.

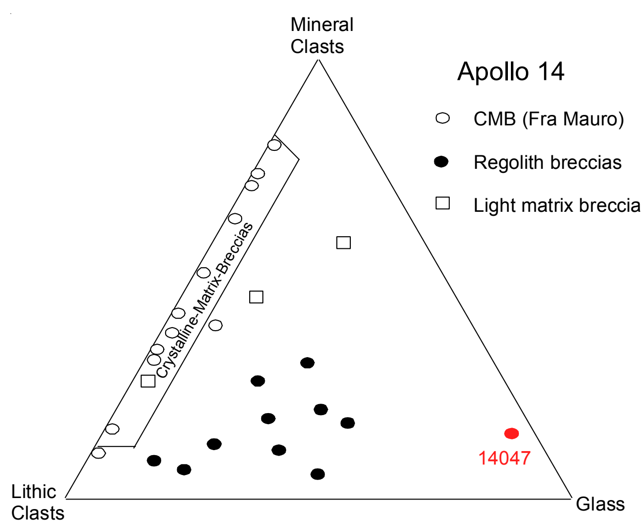


Figure 6: Simonds idea of how to split Apollo 14 breccias. 14047 is kind of an end member.

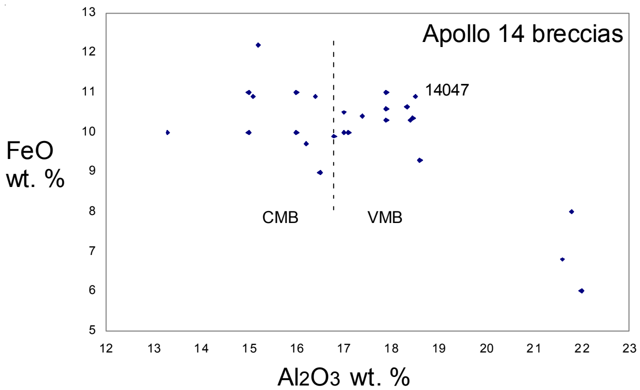


Figure 7: Composition of Apollo 14 breccias showing 14047.

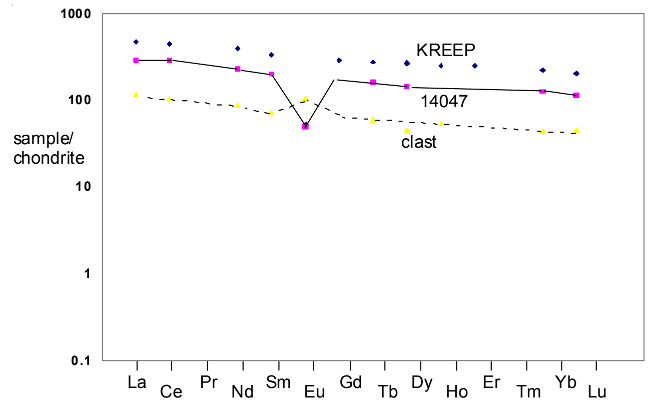


Figure 8: Normalized rare-earth-element diagram for 14047, and a light clast compared with that of KREEP.

Chemistry

The composition of 14047 is like that of the Apollo 14 soil (figure 7, 8). Ni, ir and Au are high.

Note the very high Eu in the clast studied by Warren et al. (1983).

The carbon content is 140 or 210 ppm (Moore et al. 1972) and about the same as Apollo 14 soil (figure 9).

Other Studies

Drozd et al. (1975) determined Kr and Xe content and isotopes.

Gose et al. (1972), and Nagata et al. (1972, 1975) reported the magnetic properties, while Schwerer et al (1972) and Huffman et al. (1974) determined the Mossbauer spectra.

Processing

14047 has been allocated for many studies and has been substantially subdivided (figure 10). There are 13 thin section of 14047.

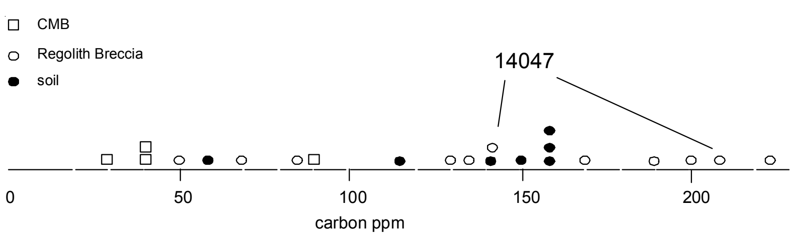


Figure 9: 14047 has a very high carbon content.

Table 1. Chemical composition of 14047

reference	Rose 72		Taylor72		Morgan72			Boynton75			Laul72			Warren 83			Simon89	
weight														clast	i. clast		145 mg	
SiO2 %	47.45	(a)	47.16	(c)										48.1	47.7			
TiO2	1.48	(a)	1.75	(c)							1.8	1.9	(a)	0.42	0.55	(e)	1.72	(e)
Al2O3	17.75	(a)	18.22	(c)				17.6		(e)	18.5	18.8	(a)	28.1	29.5	(e)	18.5	(e)
FeO	10.36	(a)	10.52	(c)				9.39	10.3	(e)	10.9		(a)	4.25	2.92	(e)	10.7	(e)
MnO	0.13	(a)	0.14	(c)				0.13		(e)	0.125	0.123	(a)	0.06	0.04	(e)	0.125	(e)
MgO	9.35	(a)	8.89	(c)										2.77	1.76	(e)	9.5	(e)
CaO	11.19	(a)	11.49	(c)				10.2	12.6	(e)	12	11	(a)	14.8	15.3	(e)	11.3	(e)
Na2O	0.75	(a)	0.68	(c)				0.65		(e)	0.67	0.662	(a)	1.56	1.67	(e)	0.67	(e)
K2O	0.49	(a)	0.48	(c)							0.48	0.47	(a)	0.21	0.28	(e)	0.53	(e)
P2O5	0.39	(a)	0.5	(c)														
S %			0.08	(c)														
sum																		
Sc ppm			23	(b)				20.6	21.6	(e)	22		(a)	9.2	7	(e)	22.1	(e)
V			43	(b)							40	50	(a)				44	(e)
Cr	1505	(a)	1220	(b)				1290	1320	(e)	1396		(a)	274	299	(e)	1320	(e)
Co			34	(b)				31	35	(e)	38		(a)	6.7	11.7	(e)	34	(e)
Ni			370	(b)				351		(d)				9.5	52	(e)	450	(e)
Cu																		
Zn					23	20	(d)	25		(d)				3.2	4.3	(e)		
Ga			4.1	(b)				6.69		(d)				18	14	(e)		
Ge ppb								660		(d)				67	150	(e)		
As																		
Se					315	320	(d)											
Rb			16	(b)	16.2	14.6	(d)										14	(e)
Sr			180	(b)													90	(e)
Y			191	(b)														
Zr			780	(b)							880		(a)	470	550	(e)	710	(e)
Nb			45	(b)														
Mo																		
Ru																		
Rh																		
Pd ppb																		
Ag ppb					10.3	11	(d)											
Cd ppb					78	102	(d)	90		(d)				9.6	282	(e)		
In ppb					27	50	(d)	15		(d)								
Sn ppb			400	(b)														
Sb ppb					2	2.1	(d)											
Te ppb					35	85	(d)											
Cs ppm			1	(b)	0.67	0.65	(d)							0.22	0.51	(e)	0.79	(e)
Ba			730	(b)				720	740	(e)	730		(a)	600	670	(e)	890	(e)
La			80	(b)				65	65	(e)	69		(a)	27.7	33.6	(e)	68.8	(e)
Ce			235	(b)				170	180	(e)	204		(a)	64	84	(e)	177	(e)
Pr			26	(b)														
Nd			102	(b)										40	48	(e)	103	(e)
Sm			28	(b)				29	29	(e)	29		(a)	10.7	13.4	(e)	29.6	(e)
Eu			2.6	(b)				2.36	2.41	(e)	2.7		(a)	5.9	6	(e)	2.75	(e)
Gd			31	(b)														
Tb			4.7	(b)				5.2	6.1	(e)				2.17	2.52	(e)	5.9	(e)
Dy			33	(b)				30		(e)				11.3	15.5	(e)	35	(e)
Ho			8	(b)										3	3.3	(e)		
Er			19	(b)														
Tm			3.3	(b)														
Yb			17	(b)				20	22	(e)	22		(a)	7.2	7.5	(e)	20.7	(e)
Lu								2.7	3	(e)	3		(a)	1.13	1.13	(e)	2.77	(e)
Hf			17	(b)				19	20	(e)	20		(a)	6.8	9.5	(e)	21.4	(e)
Ta								3.2		(e)				0.95	0.64	(e)	2.8	(e)
W ppb																		
Re ppb					1.12	1.06	(d)							0.06		(e)		
Os ppb																		
Ir ppb					11.7	11.2	(d)	11		(d)				0.76	1.4	(e)	10	(e)
Pt ppb																	7.3	(e)
Au ppb					5.2	5.4	(d)	4.3		(d)				0.07	0.88	(e)		
Th ppm			12	(b)				12	12	(e)	14		(a)	2.85	3.95	(e)	12	(e)
U ppm			3.2	(b)										0.71	1.11	(e)	3.2	(e)

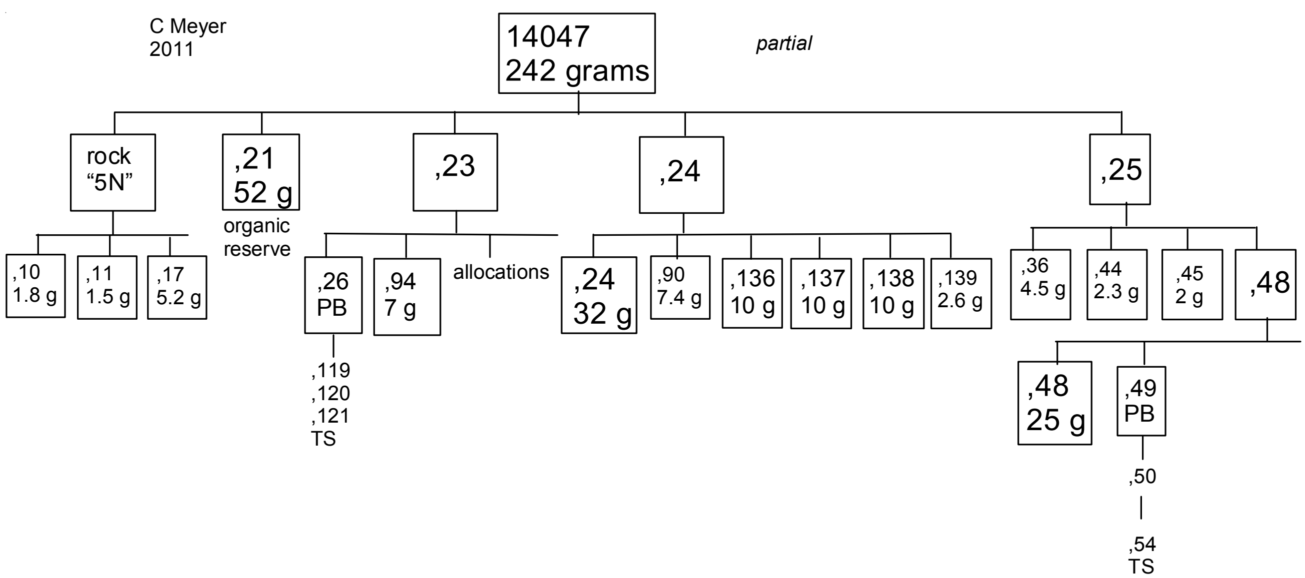
technique: (a) "microchemical", (b) spark source mass spec., (c) XRF, (d) RNAA, (e) INAA

Table 2. Chemical composition of 14047.

reference	Janghorbani73			Baedecker73		Silver72	
weight	210	285 mg					
SiO2 %							
TiO2							
Al2O3							
FeO	10.8	10.4	(e)				
MnO							
MgO							
CaO							
Na2O	0.62	0.62	(e)				
K2O							
P2O5							
S %							
sum							
Sc ppm	24	24					
V							
Cr	1370	1320	(e)				
Co	36	37	(e)				
Ni				390	(d)		
Cu							
Zn				24	(d)		
Ga				6.6	(d)		
Ge ppb				610	(d)		
As							
Se							
Rb							
Sr							
Y				Chyi73			
Zr				1270			
Nb							
Mo							
Ru							
Rh							
Pd ppb							
Ag ppb							
Cd ppb				91	(d)		
In ppb				31	(d)		
Sn ppb							
Sb ppb							
Te ppb							
Cs ppm							
Ba							
La	74	74	(e)				
Ce							
Pr							
Nd							
Sm							
Eu	2.2	(e)	(e)				
Gd							
Tb							
Dy							
Ho							
Er							
Tm							
Yb							
Lu				Chyi73			
Hf				24.9			
Ta							
W ppb							
Re ppb							
Os ppb							
Ir ppb				12.3	(d)		
Pt ppb							
Au ppb				5.9	(d)		
Th ppm	8.9	7.6	(e)			12.39	(f)
U ppm						3.34	(f)

technique: (d) RNAA, (e) INAA, (f) IDMS

Figure 10: Photo of 14047 pieces after extraction of large white clast in 1980. Largest piece,24 is 5 cm: white piece ,109 is about 1 cm. NASA S80-38169.



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