10073

Regolith Breccia

124.5 grams

Figure 1: Photo of 10073,1. Cube is 1 cm. S76-22591

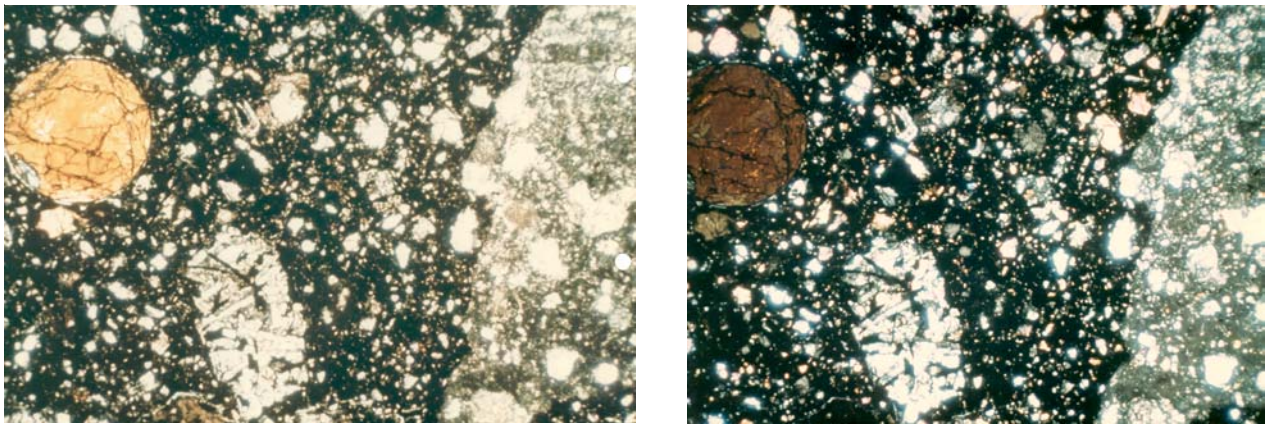


Figure 2: Photomicrographs of thin section of 10073 showing large glass sphere (left side). NASA S70-48989-990. Scale is 2.5 mm. Image on right is with crossed-Nicols.

Introduction

10073 is a friable, porous fragmental soil breccia, rather typical of Apollo 11 regolith breccias. Broken pieces soon developed rounded corners (figure 1) and considerable fine material (figure 8).

Fruland (1983) selected 10073 as one of the type samples for regolith breccias.

Petrography

Dence et al. (1970) and McKay and Morrison (1971) described Apollo 11 breccias. Quaide and Bunch (1970) determined the size distribution of grains in 10073 (figure 6). Sclar (1970) found a surprisingly small amount of shocked material. Simon et al. (1984) included breccia 10073 in their comprehensive study of Apollo 11 regolith breccias – their mode is given in the table. They calculated that it had about 25 % highland component, but couldn't directly identify that many clasts of highland rock.

10073 contains glass spheres and lithic fragments set in a fine matrix (figures 2 and 3). Many of the fragments are mare basalt and minerals derived from mare basalt.

Chemistry

Annell and Heltz (1970), Gast et al.(1970) , Goles et al. (1970) and Rhodes and Blanchard (1981) analyzed 10073 (table 1). It has a composition similar to Apollo 11 soil (figures 4 and 5).

Schonfeld and Meyer (1972) calculated that 10073 was a mix of mare basalt with ~21 % gabboic anorthosite and ~1 % KREEP, while Rhodes and Blanchard (1981) found it was a mix of soil and high-K basalt. However, Simon et al. (1984) could not identify such a high percentage of highland component.

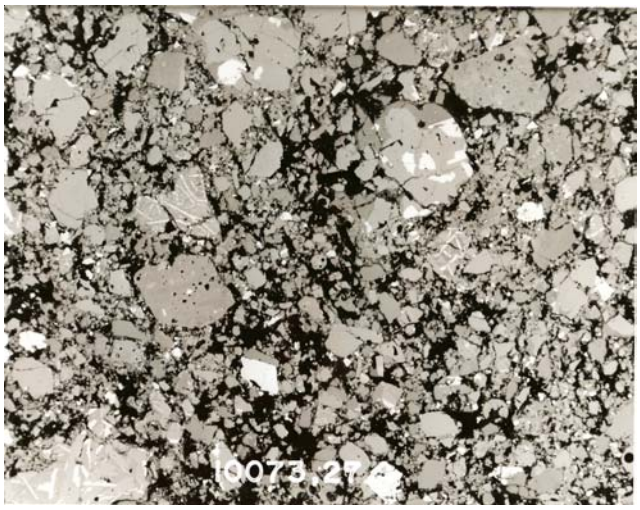


Figure 3: Reflected light image of matrix of 10073. S76-25831. Scale unknown.

Simon's Mode for 10073

	S	L
Mare Basalt	3.4	13.5
Highland Component	0.3	
Regolith breccia	2.4	2.8
Agglutinate	5.9	1.2
Pyroxene	5	0.4
Olivine	0.1	
Plagioclase	2.7	0.4
Ilmenite	1.4	
Orange glass	2.3	1.9
Other glass	2	0.4
Matrix	53.9 %	

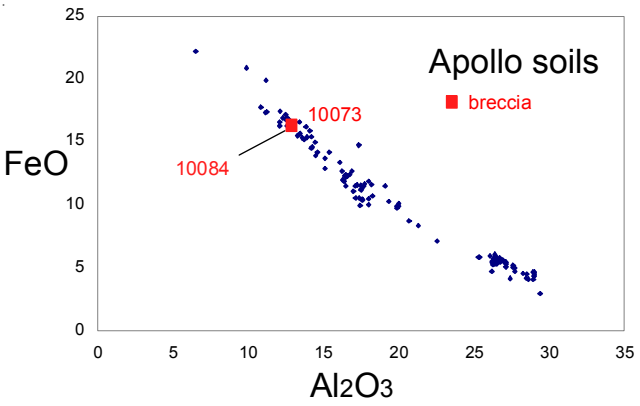


Figure 4: Composition of 10073 compared with all Apollo soils.

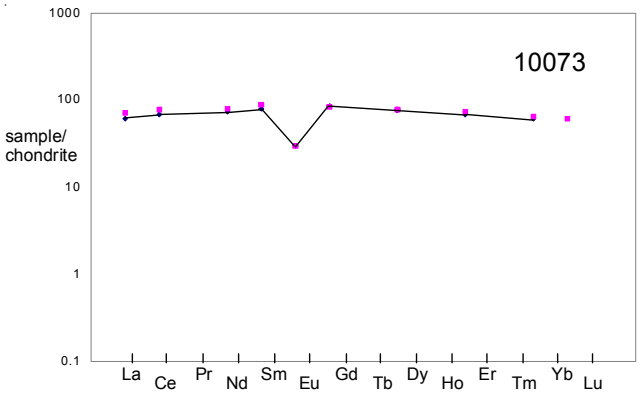


Figure 5: Normalized rare earth element diagram for breccia 10073 compared with soil 10084 (data from Wiesmann et al. 1975).

Other Studies

Gibson and Johnson (1971) reported that 10073 had the same outgassing profile as the Apollo 11 soil, but that the H/He ratio was less.

Processing

Apollo 11 samples were originally described and cataloged in 1969 and "recataloged" by Kramer et al. (1977). There are 10 thin sections. It was returned in ALSRC#1004.

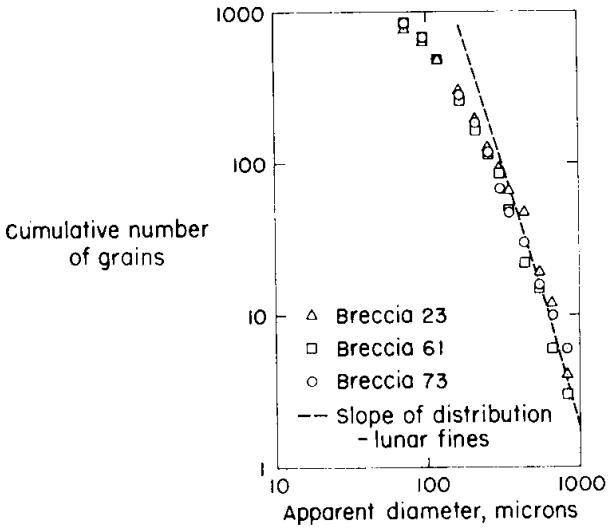


Figure 6: Size distribution for 10073 (Quaide and Bunch 1970).

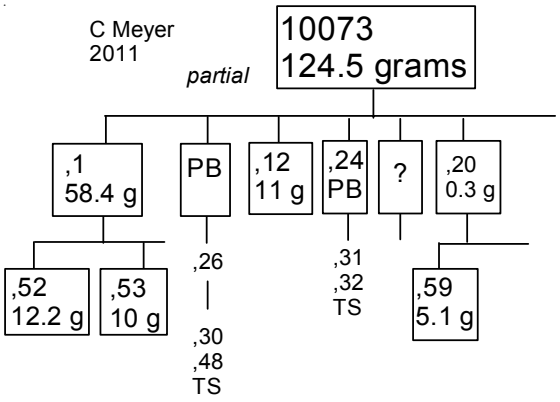
Figure 7: PET photo of 10073. Scale is 1 cm. S69-47290

Table 1. Chemical composition of 10073.

reference	Rhodes81		Wiesmann75			Goles70		Annell70	
weight			Gast70						
SiO2 %	41.6	(a)				43.8			
TiO2	7.76	(a)				8.2			
Al2O3	12.96	(a)				14.2			
FeO	15.8	(a)				16.2			
MnO	0.22	(a)				0.2	(c)	0.24	(e)
MgO	7.87	(a)				7.8			
CaO	11.96	(a)				12.5			
Na2O	0.45	(a)	0.47			0.43	(c)		
K2O	0.13	(a)	0.14	0.13	(b)				
P2O5	0.12	(a)							
S %									
sum									
Sc ppm						62	(c)	21	(e)
V						82	(c)	66	(e)
Cr	2121	(a)				1900	(c)	2330	(e)
Co						31.1	(c)	29	(e)
Ni								199	(e)
Cu						14	(c)	19	(e)
Zn								23	(e)
Ga								3.7	(e)
Ge ppb									
As									
Se									
Rb			2.89	2.51	(b)			2.1	(e)
Sr			168	164	(b)			160	(e)
Y								89	(e)
Zr				290	(b)			322	(e)
Nb								14	(e)
Mo									
Ru									
Rh									
Pd ppb									
Ag ppb									
Cd ppb									
In ppb									
Sn ppb									
Sb ppb									
Te ppb									
Cs ppm			0.098						
Ba			175	148	(b)			240	(e)
La				14.5	(b)	12.8	(c)	21	(e)
Ce			46.5	41.4	(b)	48	(c)		
Pr									
Nd			35.4	33.6	(b)				
Sm			12.4	11.8	(b)	11.5	(c)		
Eu			1.7	1.69	(b)	1.6	(c)		
Gd			15.9	16.9	(b)				
Tb									
Dy			18.3	18.9	(b)				
Ho						5	(c)		
Er			11.4	10.9	(b)				
Tm									
Yb			9.88	10.1	(b)	7.2	(c)		
Lu			1.56			1.76	(c)		
Hf						8.9	(c)		
Ta						1.6	(c)		
W ppb									
Re ppb									
Os ppb									
Ir ppb									
Pt ppb									
Au ppb									
Th ppm				1.85	(b)				
U ppm				0.5	(b)	0.45	(c)		

technique: (a) XRF, (b) IDMS, (c) INAA, (d) emission spec.

Figure 8: More splits derived from 10073. Scale is in cm. S76-22590



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