

10048
Regolith Breccia
579 grams

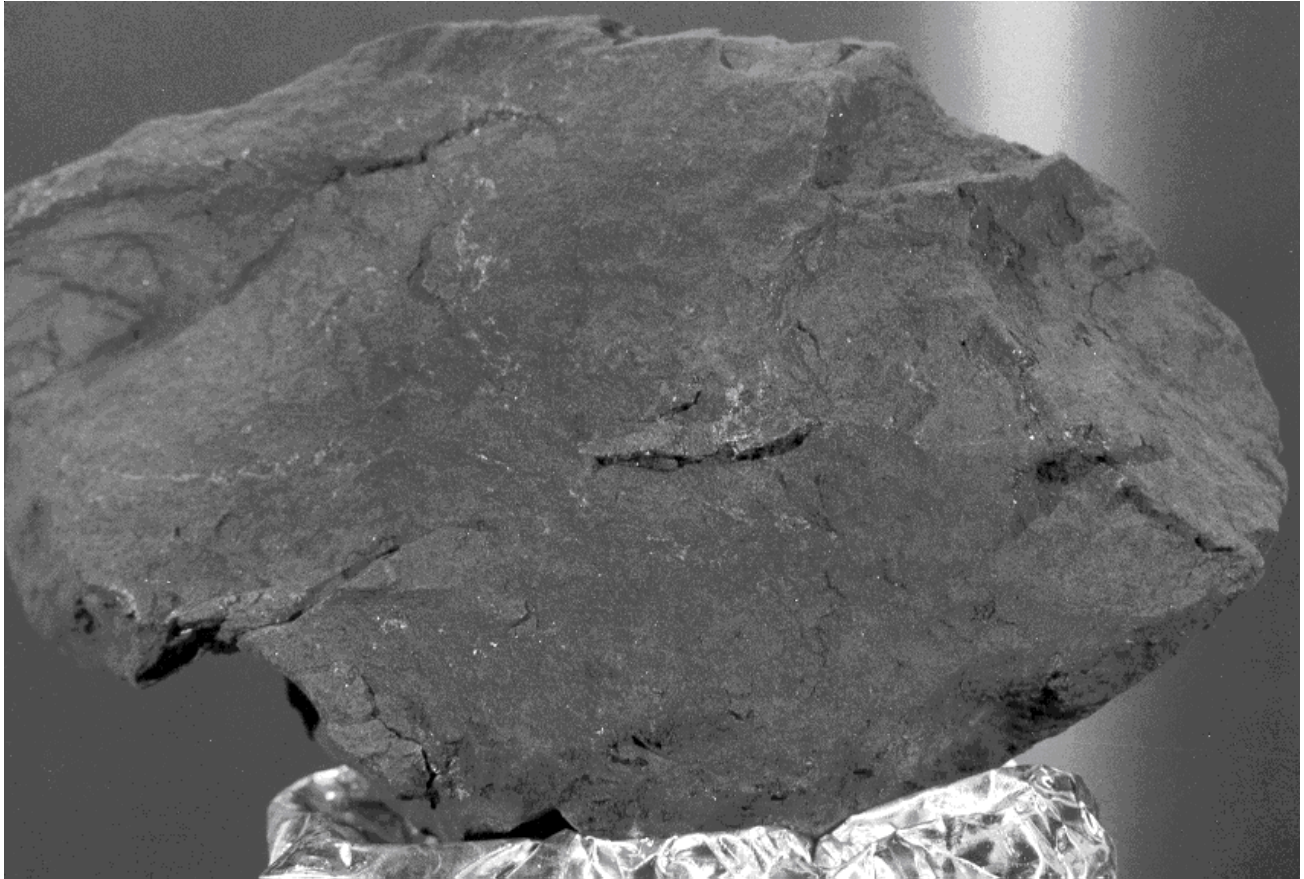


Figure 1: Photo of 10048 before breaking. Sample is 13 cm, end-to-end. NASA S69-45678.

Introduction

McKay et al. (1970), McKay and Morrison (1971), Fruland (1983) and Simon et al. (1984) reported that 10048 is very similar to the Apollo 11 soil in its character. It is a glass matrix breccia derived from the soil by impact, containing a lot of solar wind elements.

Petrography

Schmitt et al. (1970) reported the bulk density as 2.45 g/cm³. Phinney et al. (1976) describe 10048 as a coherent, vitric microbreccia with about 50 % glass in the matrix. Simon et al. (1984) included breccia 10048 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.

There are small clasts of mare basalt in the matrix along with dark orange to red glass beads (~100 microns) in 10048.

Simon's Mode

	S	L
Mare Basalt	4.3	12.4
Highland Component	0.4	0.3
Regolith breccia	3.7	0.1
Agglutinate	5.8	3.7
Pyroxene	4.7	0.4
Olivine	0.1	
Plagioclase	3.7	0.2
Ilmenite	2.8	
Orange glass	2.7	0.2
Other glass	3.1	0.3
Matrix	50.1%	

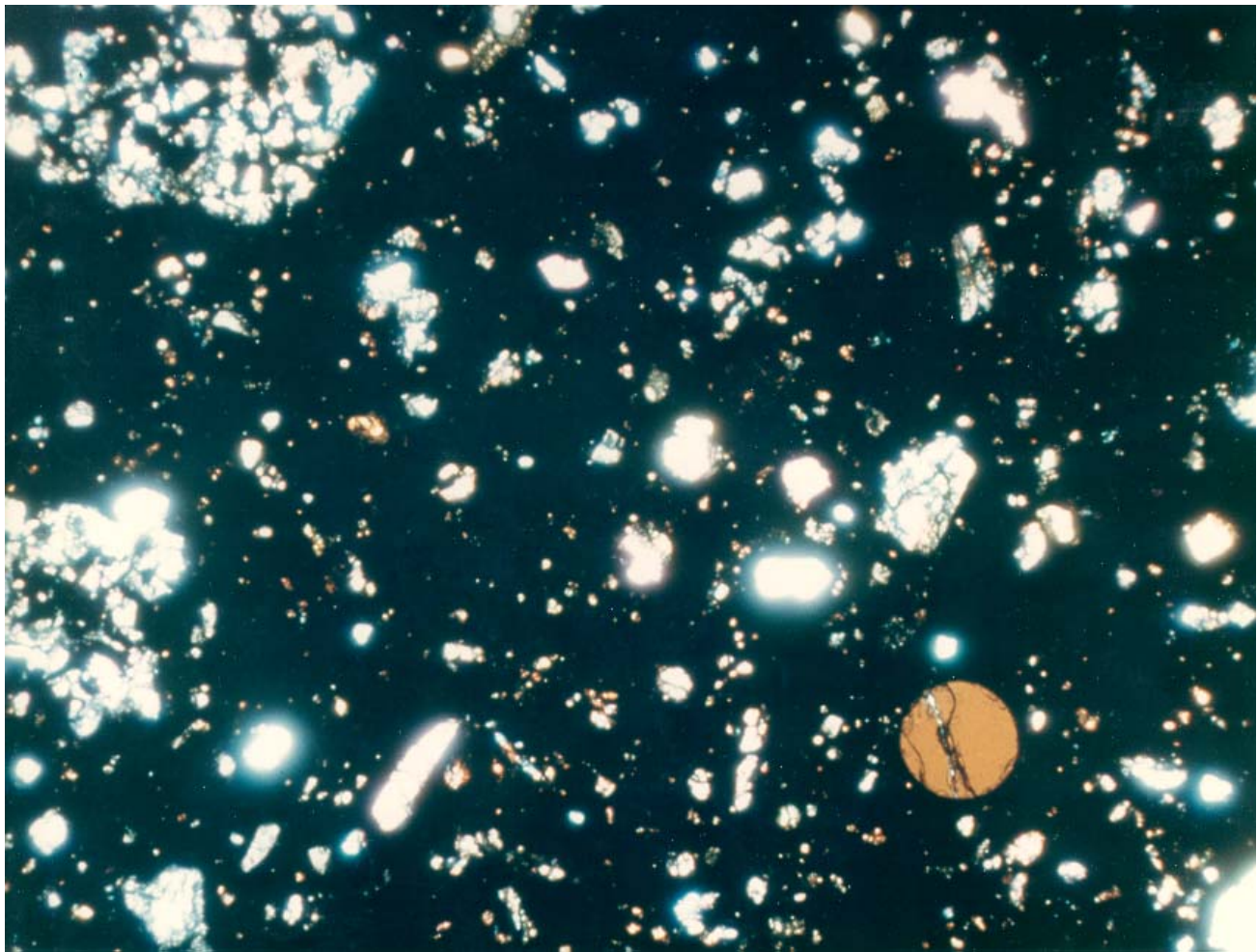


Figure 2: Transmitted light photomicrograph of thin section 10048,33 showing orange glass bead and basalt fragments in ultrafine matrix. Scale is 2.5 mm. NASA S70-49472.

Chemistry

Rose et al. (1970), Goles et al. (1970) and Rhodes et al. (1981) reported the major element composition of 10048 (table 1). Haskin et al. (1970), Goles et al. (1970), Ganapathy et al. (1970), Wasson et al (1970) and Wiesmann and Hubbard (1976) reported trace element content.

Thiemens and Clayton (1980) determined 119 ppm nitrogen (with a very negative delta ^{15}N).

Simon et al. (1984) calculate that 10048 is made up of about 75% local mare basalt and about 25% highland component.

Radiogenic age dating

none

Cosmogenic isotopes and exposure ages

None

Other Studies

The total organic carbon content of 10048 was determined by hydrogen flame ionization pyrolysis (Ponnamperuma et al. 1970). Filleux et al. (1978) studied the carbon on the surface and the interior of 10048 (figure 7).

Funkhauser et al. (1970) and Hintenberger et al. (1975) determined rare gas abundance and isotopic ratios (figure 5).

Dunn and Fuller (1972) and Nagata et al. (1971, 1972) determined magnetic properties. Schwerer et al. (1972) determined the Mossbauer spectra and magnetic susceptibility.

Processing

Apollo 11 samples were originally described and cataloged in 1969 and “re-cataloged” by Kramer et al. (1977). Pieces of 10048 were used for public displays



Figure 3: Photo of 10048,49. Sample is 5 cm across. NASA S76-26847.

in 1969-71, until more favorable samples were available (figure). Portions of 10048 were added to the “biopool” sample used to check for pathogens and life forms during Apollo 11 quarantine.

Saw cuts (wire saw) can be seen in some of the photos of 10048.

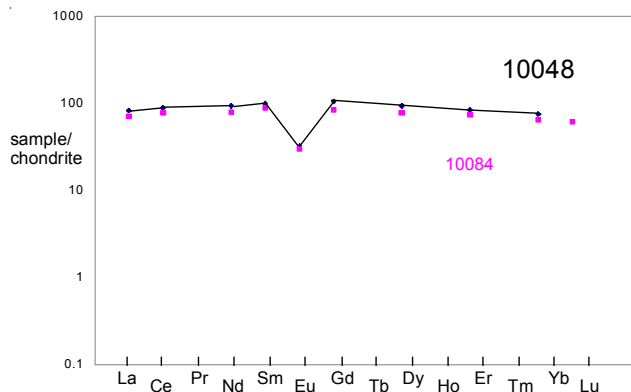


Figure 4: Normalized rare earth element diagram for breccia 10048 compared with soil 10084 (data from Wiesmann et al. 1975).

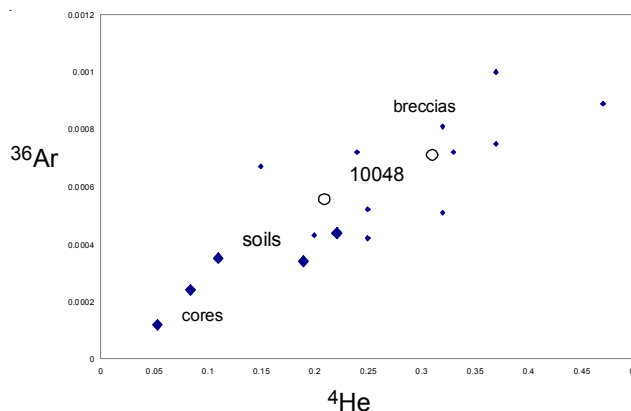


Figure 5: Implanted solar wind in 10048 compared with Apollo 11 soils and breccias (Funkhouser et al. 1970 and Hintenberger et al. 1976). Units STP cc/g.

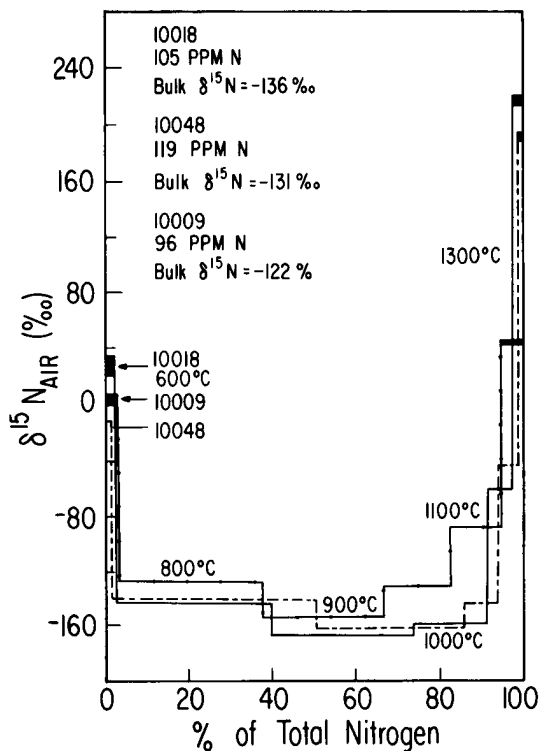


Figure 6: Thermal release pattern for nitrogen isotopes from 10048 and other samples (Thiemens and Clayton 1980).

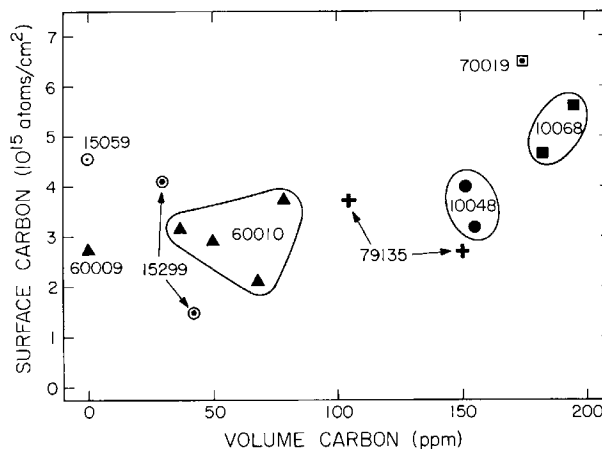


Figure 7: Measured surface and volume concentrations of carbon for regolith samples from several missions (Filleau et al. 1978).

Table 1. Chemical composition of 10048.

reference weight	Wiesmann75	Haskin70	Goles70	Rhodes81	Ganapathy70	Wasson70	Rose70
SiO2 %			38.7	41.9	(a)		42.2 (e)
TiO2			8	8.15	(a)		8.95 (e)
Al2O3			12.1	12.49	(a)		12.9 (e)
FeO			17	16.45	(a)		15.7 (e)
MnO		0.22	(c) 0.2	(c) 0.2	(a)		0.22 (e)
MgO			6.8	7.75	(a)		7.54 (e)
CaO			11.2	11.69	(a)		11.4 (e)
Na2O			0.47	(c) 0.48	(a)		0.52 (e)
K2O	0.19	(b) 0.17	(c)	0.21	(a)		0.17 (e)
P2O5				0.13			0.2 (e)
S %							
sum							
Sc ppm		66	(c) 62.7	(c)			
V			67	(c)			
Cr		2160	(c) 1950	(c) 1984	(a)		
Co		35	(c) 32.2	(c)	34.8	(d)	
Ni		214	(c)				
Cu		11.1	(c)		9.2	(d)	
Zn		30.2	(c)		28.6	(d)	
Ga		5.9	(c)		5.85	(d)	
Ge ppb						350	(d)
As							
Se		1.6	(c)				
Rb	3.95	(b) 4.16	(c)		4.15	(d)	
Sr	167	(b) 190	(c)				
Y							
Zr	366	(b)	240	(c)			
Nb							
Mo							
Ru							
Rh							
Pd ppb					13	(d)	
Ag ppb		16	(c)		24	(d)	
Cd ppb					78	(d)	
In ppb		180	(c)		96	(d) 60	(d)
Sn ppb							
Sb ppb		8.8	(c)				
Te ppb					72	(d)	
Cs ppm		0.124	(c)		0.128	(d)	
Ba	206	(b) 167	(c) 200	(c)			
La	19.5	(b) 20.2	22	(c) 17.3	(c)		
Ce	54.3	(b) 56	57.4	(c) 38.1	(c)		
Pr							
Nd	42.5	(b) 41	39	(c)			
Sm	14.6	(b) 14.8	15.1	(c) 13.2	(c)		
Eu	1.82	(b) 1.95	1.95	(c) 1.91	(c)		
Gd	20.6	(b) 20	19.7	(c)			
Tb		3.5	3.44	(c) 3.8	(c)		
Dy	22.9	(b) 25	24.9	(c)			
Ho				4.6	(c)		
Er	13.5	(b) 14	14	(c)			
Tm							
Yb	12.3	(b) 12.5	12.4	(c) 15.2	(c)		
Lu		2.1	2	(c) 1.9	(c)		
Hf		11.7		(c) 14.5	(c)		
Ta				1.9	(c)		
W ppb							
Re ppb							
Os ppb							
Ir ppb					6.88	(d) 10.4	(d)
Pt ppb							
Au ppb		2.5	(c)		2.66	(d) 1.8	(d)
Th ppm	2.58	(b)					
U ppm	0.67	(b)	0.69	(c)			

technique: (a) XRF, (b) IDMS, (c) INAA, (d) RNAA, (e) semi-micro. chem.

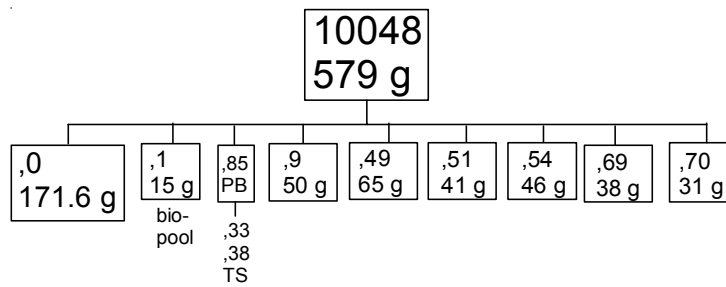


Figure 8: Display sample 10048,51 (no longer used). S74-24907

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Figure 9: Photo of 10048,9. Scale is in mm and cm, at top.

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