

12044
Soil
92 grams



Figure 1: Location of soil sample 12044. AS12-48-7082.

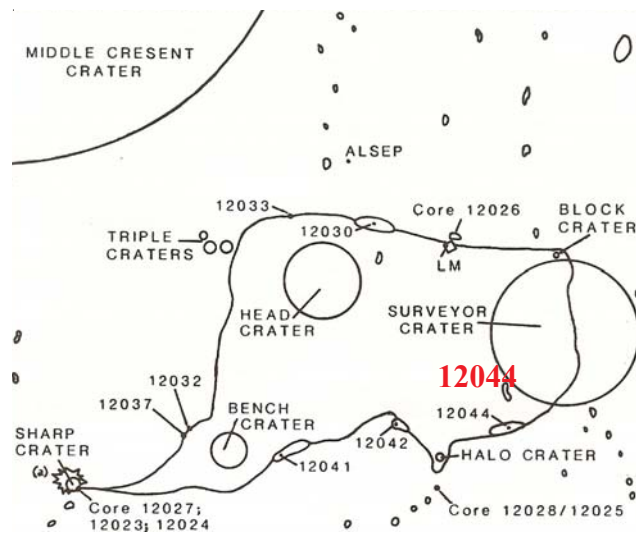


Figure 2: Map of Apollo 12 traverse showing location of 12044.

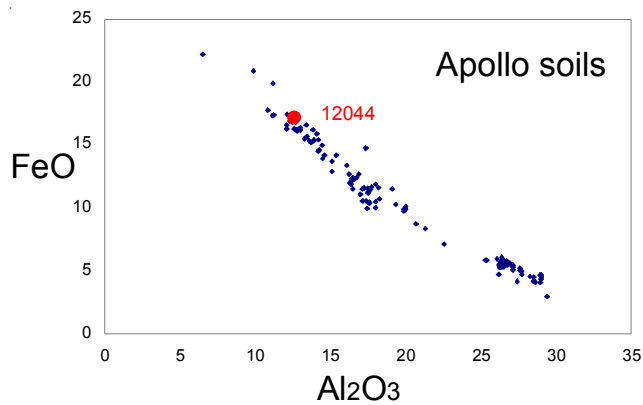


Figure 3: Composition of 12044 compared with that of other Apollo soil samples.

Introduction

12044 are fines collected in documented bag 14, which also contained a basalt sample (12043). They were collected from south rim of Surveyor Crater (figure 2).

The astronauts observed a “double glass bead” on the surface, but it has not been identified as such in the sample.

Petrography

The maturity index for 12044 is $I_s/FeO = 57$ and the average grain size of 12044 is 45 microns (figure 5) so it is a relatively mature lunar soil. However, McKay et al. (1971) reported only 26 % agglutinates. Frondel et al. (1971) also determined the mineral mode, but did not specify agglutinates.

Marvin (1978) described the coarse particles from the Apollo 12 soils, including fragments of a broken glass bubble – perhaps the one reported by the astronauts.

Chemistry

The analysis by Gast and Hubbard (1971) by isotope dilution mass spectrometry agrees with that of Goles et al. (1971) done by instrumental neutron activation analysis (figure 6).

Kerridge et al. (1978) found 150 ppm C and 72 ppm N, which are relatively high (figure 4).

Mineralogical Mode

Frondel et al. 1971

Olivine +	
Pyroxene	61.2 %
Plagioclase	14.9
Opagues	10.6
Glass, angular	8.6
Glass, rounded	2.7
Silica	1.9

Mineralogical Mode

McKay et al. 1971

Grain size	37-62.5	62.5-125
Olivine	6 %	3
Pyroxene	26	23
Plagioclase	14	13
Glass	25	17
Aggregates	25	44

Mineralogical Mode (250-1000 microns)

McKay et al. (1971)

Glazed	
Aggregates	26 %
Single xtl.	17
Glasses	31
Rocks	8
Breccias	12
Spherules	1.6

Other Studies

Hintenberger et al. (1971), Heymann et al. (1972) and Pepin et al. (1971) reported rare gas content and isotopic ratios of 12044. Yaniv and Heymann (1972) offered an explanation for the apparent excess ^{40}Ar in lunar fines.

Arrhenius et al. (1971) and Crozaz et al. (1971, 1972) studied the frequency of grains with high fossil nuclear tracks in 12044 (and all other Apollo 12 soil and core samples)(see diagram in 12070).

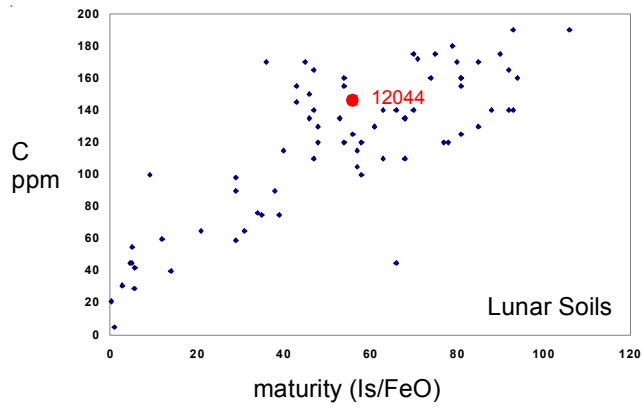


Figure 4: Carbon content and maturity index for 12044 compared with Apollo soil samples.

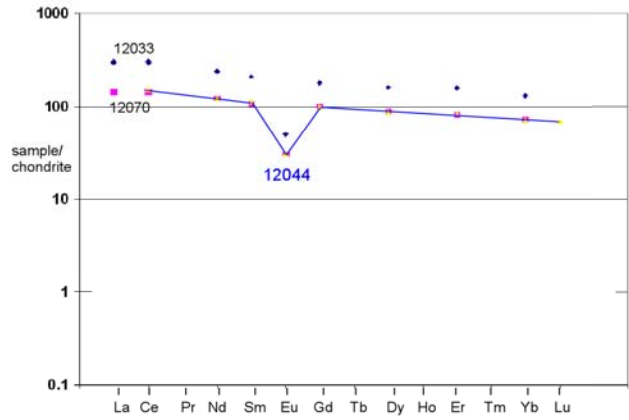
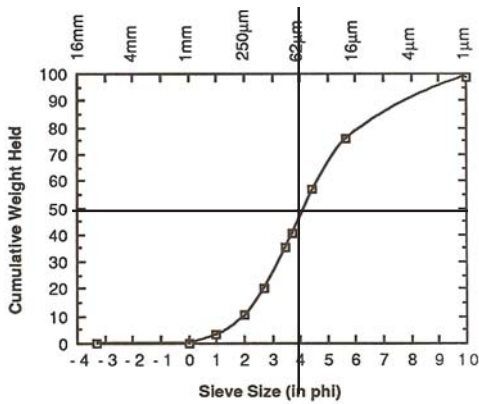


Figure 6: Normalized rare-earth-element diagram for 12044 compared with soils 12033 and 12070.



average grain size = 45 microns

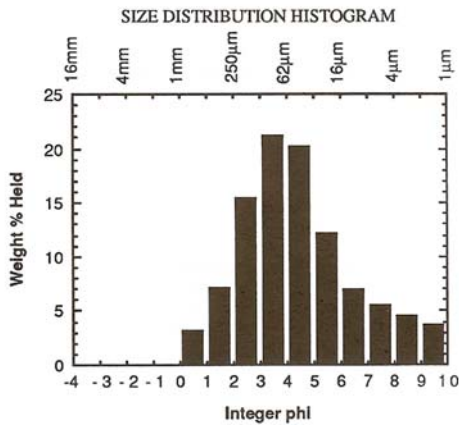
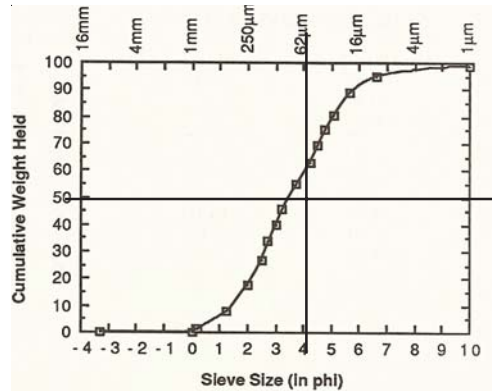


Figure 5a: Grain size distribution for 12044 (Graf 1993, from data by McKay et al. 1971).



average grain size = 86 microns

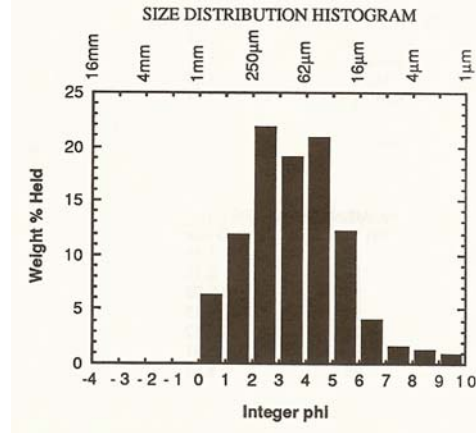


Figure 5b: Grain size distribution for 12044 (Graf 1993, from data by King et al. 1971).

Table 1. Chemical composition of 12044.

	Gast71			
reference	Hubard71	Goles71	Frondel71	Kharkar71
weight	Wiesmann76		< 0.37 mm	ave.
SiO2 %			46.7 (c)	
TiO2		2.67 (b)	3.6 (c)	4 (b)
Al2O3		12.1 (b)	14.6 (c)	
FeO		16.75 (b)	14.2 (c)	15.7 (b)
MnO		0.2 (b)	0.21 (c)	0.22 (b)
MgO			9.5 (c)	
CaO	10	9.8 (b)	10.6 (c)	12.7 (b)
Na2O	0.48	0.43 (b)	0.43 (c)	0.45 (b)
K2O	0.25 (a)		0.24 (c)	
P2O5				
S %				
sum				
Sc ppm		37.9 (b)		41 (b)
V				
Cr		2590 (b)	1916 (c)	2410 (b)
Co		45.5 (b)		42 (b)
Ni				
Cu				
Zn				
Ga				
Ge ppb				
As				
Se				
Rb	6.08 (a)			
Sr	157 (a)			
Y				
Zr		350 (b)		
Nb				
Mo				
Ru				
Rh				
Pd ppb				
Ag ppb				
Cd ppb				
In ppb				
Sn ppb				
Sb ppb				
Te ppb				
Cs ppm				
Ba	380 (a)	380 (b)		
La		33.1 (b)		32.7 (b)
Ce	91.6 (a)	94 (b)		71 (b)
Pr				
Nd	54.8 (a)	63 (b)		
Sm	16.7 (a)	16.2 (b)		15.1 (b)
Eu	1.72 (a)	1.69 (b)		1.82 (b)
Gd	19.2 (a)			
Tb		3.79 (b)		3.2 (b)
Dy	21.2 (a)			26.8 (b)
Ho		4.2 (b)		
Er	13.3 (a)			
Tm				
Yb	11.5 (a)	12.9 (b)		12.3 (b)
Lu	1.67 (a)	1.81 (b)		1.76 (b)
Hf		12.9 (b)		14.3 (b)
Ta		1.9 (b)		2 (b)
W ppb				
Re ppb				
Os ppb				
Ir ppb				
Pt ppb				
Au ppb				
Th ppm		7.4 (b)		
U ppm				

technique: (a) IDMS, (b) INAA, (c) wet

References for 12044

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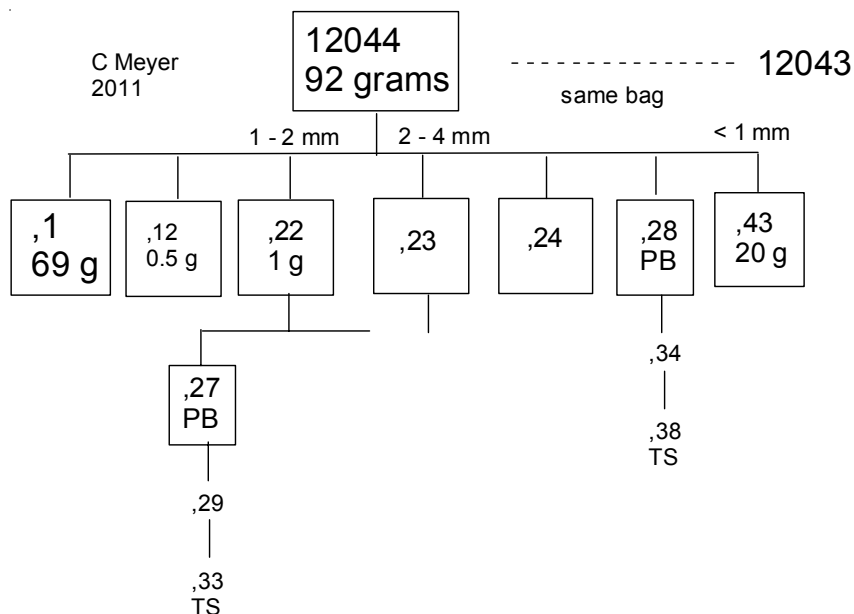
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