14141

Soil

56.25 grams

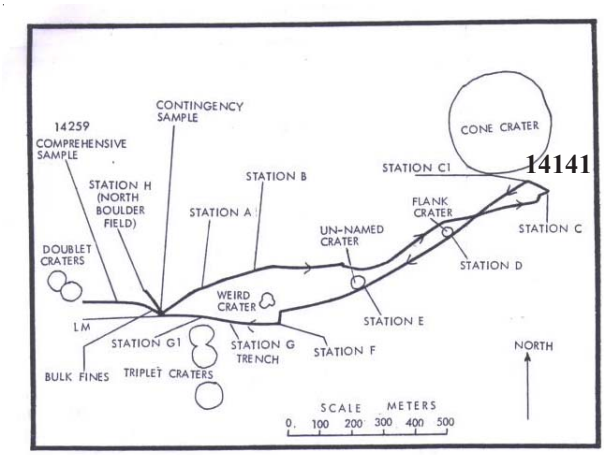

Figure 1: Map of Apollo 14 trip to Cone Crater and ALSEP.

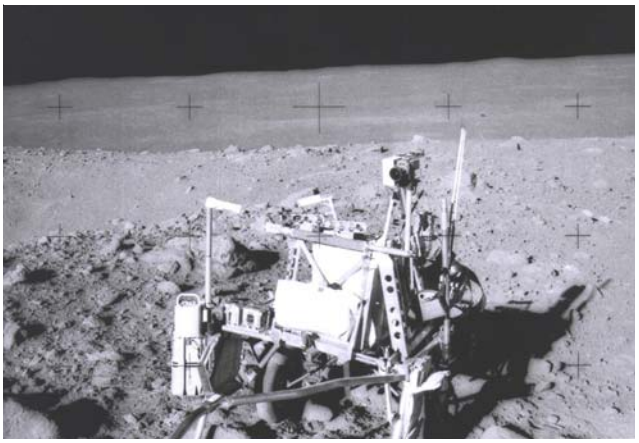

Figure 2 : Rocky rim of Cone Crater with cart for carrying tools and samples. NASA AS14-64-9121.

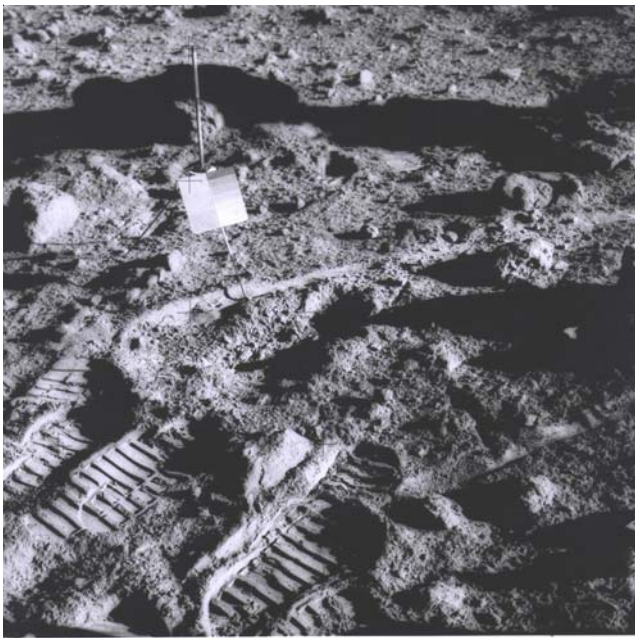

Figure 3: Photo of area where 14141 was collected. NASA AS14-64-9127.

CDR Right now, I'm sampling a layer that is sort of a light grey just under the regolith. That went into bag 9 (14141) and bag 10 was a sample of some of the surface rocks (14068-14072) – that were right around that area. It looks like kind of a secondary impact that has disrupted the surface regolith and gone on down into the grey area.

Introduction

Soil sample 14141 was collected from near the rim of Cone Crater (figures 1, 2, 3). An attempt to take a core sample at Cone Crater didn't work, because the material was too coarse and fell out (Sutton et al. (1972) and Swann et al. (1972). The material in the soil is similar to the Fra Mauro breccias – see 14321 etc.

Petrography

The maturity index Is/FeO = 5.7 is very low for this soil (Morris 1978). The grain size distribution for 14141 was determined by King et al. (1972) and McKay et al. (1972) and summarized by Graf (1993). It is a much coarser soil that other Apollo samples (figure 4).

McKay et al. (1972) and Simon et al. (1982) studied the petrology of this soil and compared it with other Apollo 14 soils. It is similar except that there are fewer agglutinates.

Kramer and Twedell (1977) described some of the particles (coarse fines) that were seived from this soil. Hubbard et al. (1973) and Warren et al. (1978) have analyzed coarse fine particles (table 1).

Chemistry

Laul et al. (1982), Lindstrom et al. (1972), Morgan et al. (19720 and Wasson et al. (1973) determined the

Modal content of soil 14141

90 – 150 micron
from McKay et al. 1972

Agglutinates	5.2%
Basalt	4.2
Breccia	57.3
Anorthosite	
Norite	
Gabbro	
Plagioclase	7.6
Pyroxene 11.8	
Olivine	0.4
Ilmenite	0.4
Glass other	12.4

Mode for soil 14141.

from Simon et al. 1982

	90+ microns	90-20	20-10
agglutinates	11.7		
dark matrix breccia	21.3		
fused component		16.9	14.3
lithic clasts	36.2	42.2	18.3
plagioclase	9.7	14	27.7
pyroxene	14.7	18	13.7
olivine		3.8	3
silica			1.7
ilmenite	0.2	0.4	0.7
glass	5.6	4.7	20.3

chemical composition of 14141 (table 1). Hubbard et al. (1973) and Warren et al. (1978) give compositions of coarse fine particles.

Moore et al. (1972) and Cadogen et al. (1972) reported low carbon content (figure 6).

Other Studies

Crozaz et al. (1972) and Berdot et al. (1972) measured tracks from cosmic rays, finding fewer grains with high track density than for 14259 (mature surface).

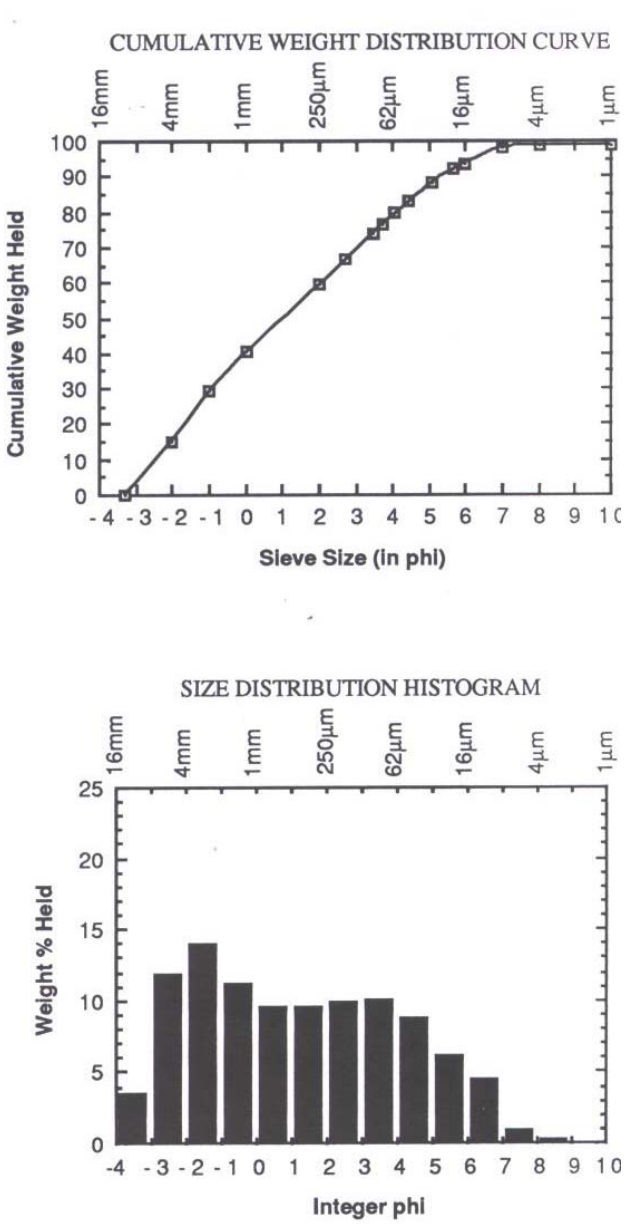

Figure 4: Unusual grain size distribution for 14141 (from Graf 1993).

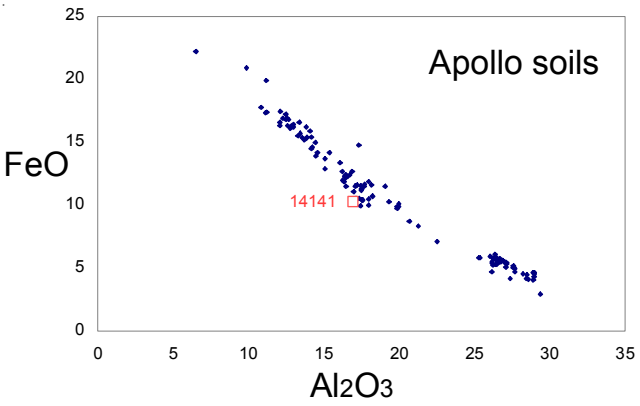

Figure 5: Composition of Apollo soil samples including 14141.

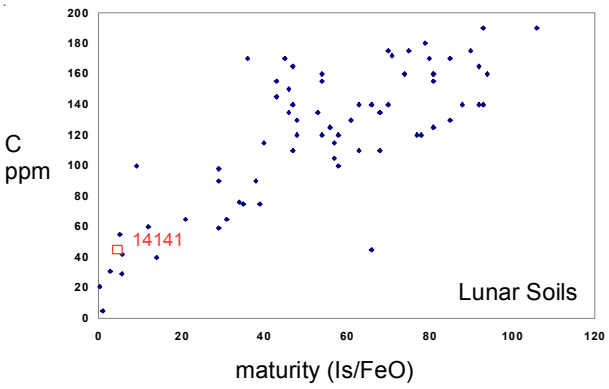

Figure 6: Carbon content and maturity index for 14141 (data from Moore et al. 1972 and Morris 1978).

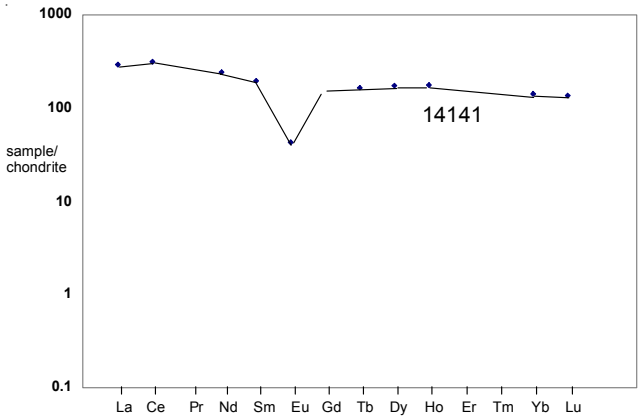

Figure 7: Normalized rare-earth-element diagram for 14141 (data from Laul et al. 1982).

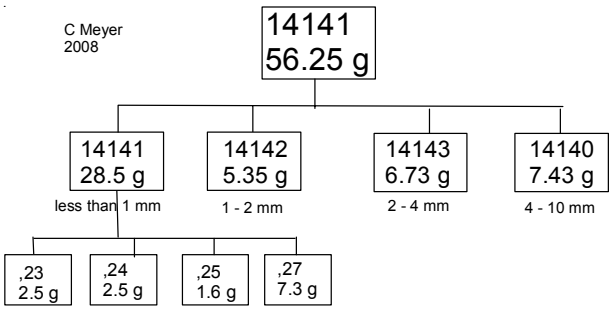

Table 1. Chemical composition of 14141.

	soil < 1 mm								coarse fines						
reference	Laul 82		Lindstrom72		Morgan72		Wasson73		Warren78					Hubbard73	
weight									14143A	14143B	14143C	14143D		Weismann76	
SiO2 %															
TiO2	1.6	(a)	1.63	(a)					2.33	2.9	1.57	1.57	(a)	6.13	(c)
Al2O3	17	(a)	16.5	(a)					13.2	15.9	17.2	16.8	(a)		
FeO	10.4	(a)	10.16	(a)					17.4	10.9	9.6	10.9	(a)		
MnO	0.135	(a)	0.124	(a)					0.27	0.15	0.13	0.14	(a)		
MgO	9.8	(a)							9.95	10.9	11.3	10.6	(a)	4.8	(c)
CaO	10.4	(a)							12.7	9	9.2	9.2	(a)	16	(c)
Na2O	0.85	(a)	0.79	(a)					0.71	0.9	0.9	0.81	(a)	0.63	(c)
K2O	0.64	(a)	0.64	(a)					0.23	0.83	1.1	0.9	(a)		
Cr2O3	0.19	(a)												0.23	(c)
S %															
sum															
Sc ppm	23.4	(a)	21.5	(a)					59	22.5	21.6	24.8	(a)		
V	45	(a)							135	42	45	47	(a)		
Cr			1350	(a)					3080	1320	1280	1560	(a)		
Co	33.1	(a)	31	(a)					33	39	33	56	(a)		
Ni	400	(a)					273	(b)	190	140	196	196	(a)		
Cu															
Zn					31	(b)	42	(b)		3.6			(b)		
Ga							7.6	(b)		7.5			(b)		
Ge ppb							600	(b)		720			(b)		
As															
Se															
Rb					18.3	(b)								5.56	(c)
Sr	170	(a)												157	(c)
Y															
Zr	800	(a)	760	(a)						2080	1150	1100	(a)		
Nb															
Mo															
Ru															
Rh															
Pd ppb															
Ag ppb					30	(b)									
Cd ppb					461	(b)	550	(b)		15			(b)		
In ppb							111	(b)		1.2			(b)		
Sn ppb															
Sb ppb					3.1	(b)									
Te ppb					20	(b)									
Cs ppm			0.62	(a)	0.79	(b)									
Ba	900	(a)	900	(a)					160	1100	1300	1050	(a)	294	(c)
La	68.5	(a)	71.4	(a)					18.7	107	80	67	(a)	23.7	(c)
Ce	190	(a)	200	(a)					50	260	192	166	(a)	61.3	(c)
Pr															
Nd	110	(a)	104	(a)					32	160	110	90	(a)	37.6	(c)
Sm	28.5	(a)	34.7	(a)					9	44	33	26.5	(a)	10.6	(c)
Eu	2.4	(a)	2.82	(a)					1.2	3.2	2	2.4	(a)	1.34	(c)
Gd														12.6	(c)
Tb	6	(a)	7.4	(a)					2.1	10	7.5	5.8	(a)		
Dy	42	(a)								67	56	44	(a)	14.3	(c)
Ho	9.8	(a)													
Er														8.8	(c)
Tm	3.2	(a)													
Yb	23	(a)	23.8	(a)					6.1	33	27	20.4	(a)	7.72	(c)
Lu	3.3	(a)	3.35	(a)					0.94	4.7	3.8	2.9	(a)	1.16	(c)
Hf	23.9	(a)	25	(a)					7.2	39	26	21	(a)		
Ta	3.3	(a)	5.7	(a)							*3.1*	*3.1*	(a)		
W ppb															
Re ppb					1.26	(b)									
Os ppb															
Ir ppb					12.6	(b)	7.3	(b)		4.7			(b)		
Pt ppb															
Au ppb					11	(b)	7.8	(b)		4.4	*5.1*	*5.1*	(b)		
Th ppm	15	(a)	15.3	(a)							*15.4*	*15.4*	(a)		
U ppm	4.2	(a)							0.7	5.8	4.9	3.5	(a)	1.24	(c)

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

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