15071 and 15081

Soil

157.7 and 185.3 grams

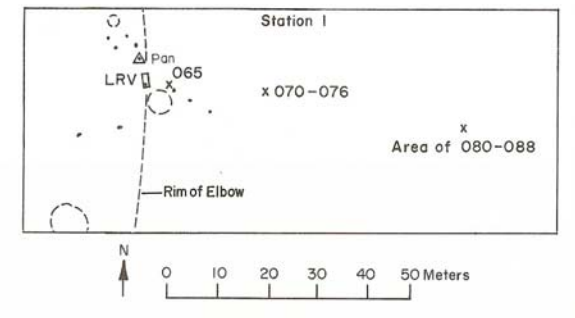


Figure 1: Map of station 1, Apollo 15, on rim of Elbow Crater, showing locations of 15070 and 15080.

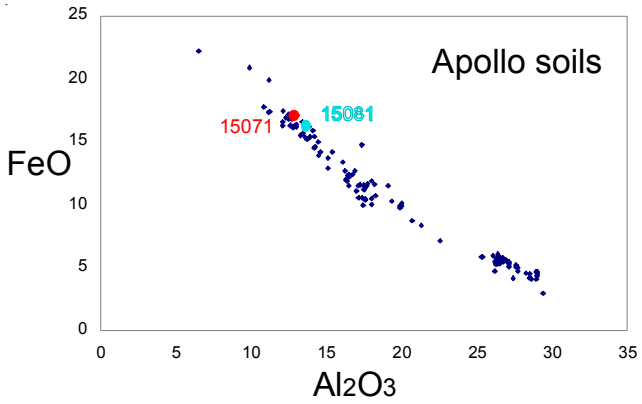


Figure 2: Composition of 15070 (and 15080) compared with that of other Apollo soil samples.

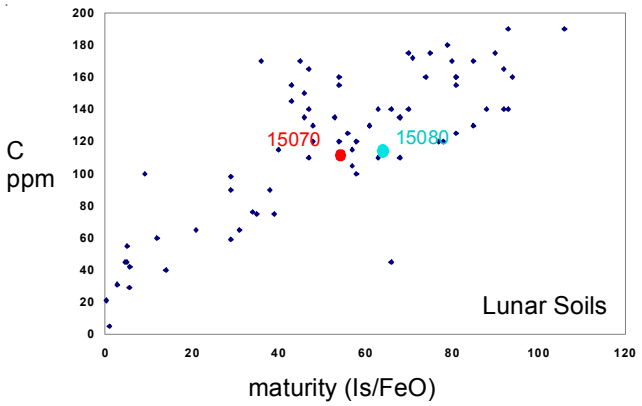


Figure 3: Carbon content and maturity index for 15070 and 15080 (Moore et al. 1973; Morris 1978).

Introduction

15070 and 15080 were collected from the ejecta blanket of Elbow Crater (figure 1). 15070 was about 20 meters from the rim and 15080 was about 60 meters. Elbow crater is at the turn in Hadley Rille and at the boundary of the mare surface with the Apennine Front. These soils were collected and returned with rock samples.

Petrography

The maturity index (I_s/FeO) is 52 for 15070 and 68 for 15080 (Morris et al. 1978). 15071 has 39 % agglutinates (Basu et al. 1981) and the average grain size for 15071 is 87 microns (figure 5). 15081 has 58 % agglutinates (Carr and Meyer 1974).

Modal content of soils 15071 and 15081.
From Basu et al. 1981 and Carr and Meyer 1974.

	15071	15081
Agglutinates	39.2%	58.1
Basalt	5.6	5.9
KREEP basalt	1.3	
Breccia	7.5	1.6
Anorthosite	1.1	
Plagioclase	9.2	7.5
Pyroxene	23.9	16
Olivine	1.9	1.2
Ilmenite	0.8	0.6
Glass other	6.5	9.1

Chemistry

Duncan et al. (1975), Fruchter et al. (1973), Wanke et al. (1973, 1975), Korotev (1987) and others determined the chemical composition of these soils (tables 1 and 2; figures 2 and 4).

Moore et al. (1973) reported 110 ppm carbon for 15071 and 115 ppm for 15080 (figure 3). DesMarais et al. (1973) reported only 87 ppm C for 15080.

Walker and Papaike (1981) calculated that 15071 and 15081 had 8 % and 15 % KREEP, respectively.

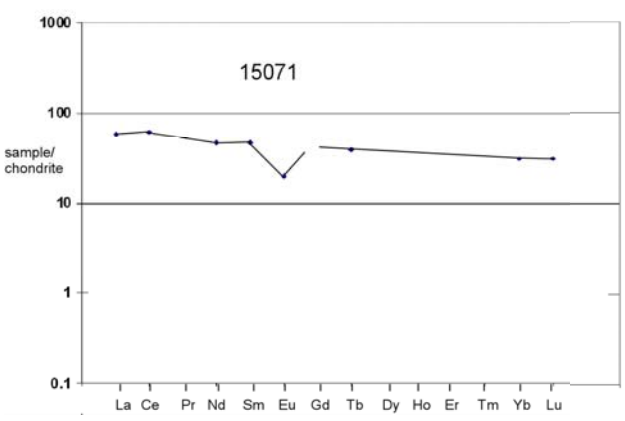


Figure 4: Normalized rare-earth-element diagram for 15071 (data from Korotev 1987).

Radiogenic age dating

Tatsumoto et al. (1972), Silver (1972) and Compston et al. (1972) determined the isotopic composition of Pb and Sr.

Processing

15070 and 15080 were returned in a sealed ALSRC (#1) and processed in dry GN_2.

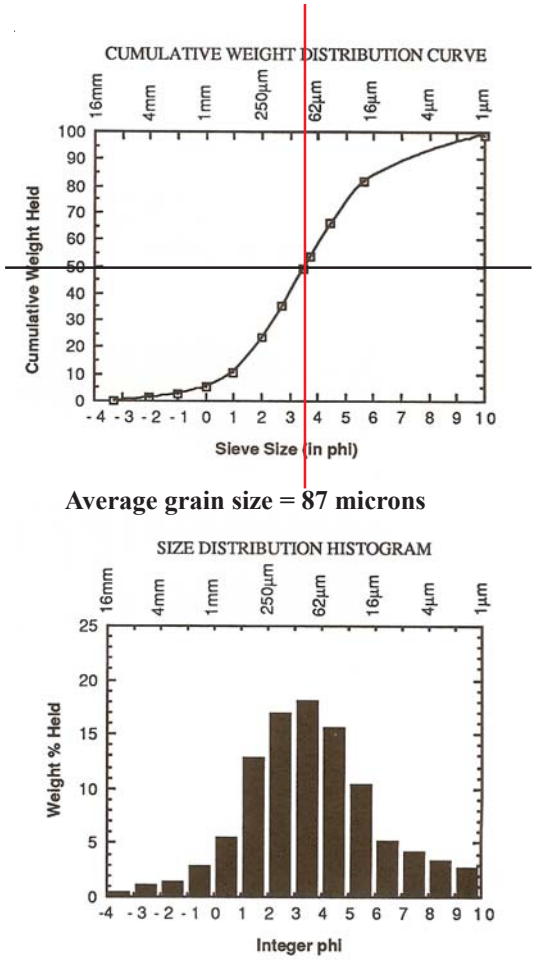


Figure5 : Grain size analysis of 15070 (Graf 1993).

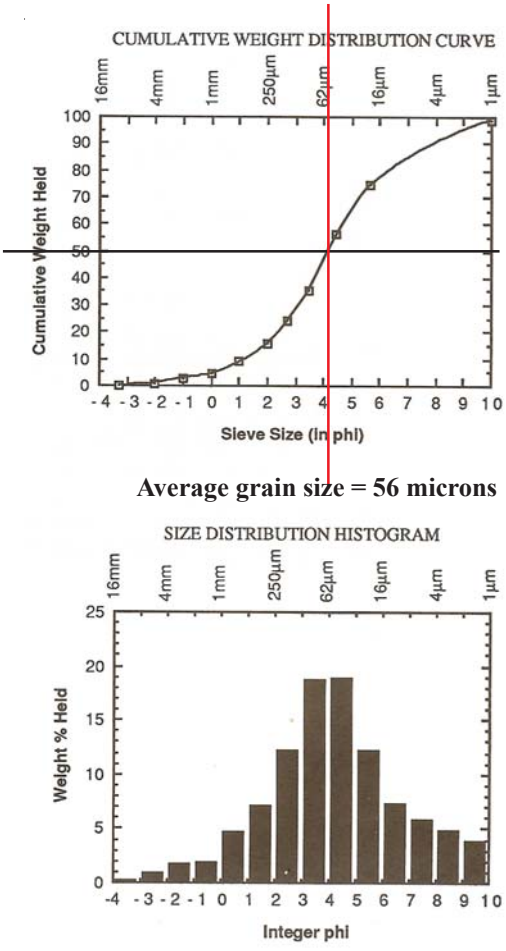


Figure 6: Grain size analysis of 15086 (clod) disagravated by "freeze thaw" technique (Graf 1993).

Table 1. Chemical composition of 15071.

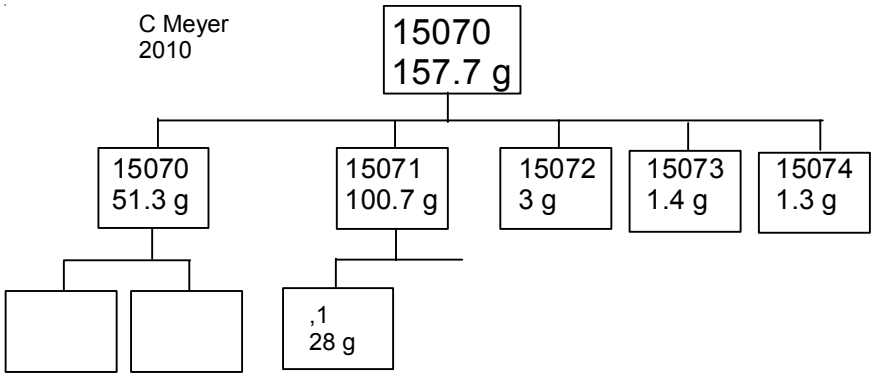
reference	Duncan75		Fruchter73		Ganapathy73		Korotev87		Chou75		Tatsumoto72	
weight					Morgan72							
SiO2 %	46.95	(a)										
TiO2	1.6	(a)	1.63	(b)			1.6	(b)				
Al2O3	12.7	(a)	12.3	(b)			12.7	(b)	13	(b)		
FeO	16.29	(a)	16.6	(b)			16.8	(b)	15.5	(b)		
MnO	0.22	(a)							0.22	(b)		
MgO	10.75	(a)					10.8	(b)				
CaO	10.49	(a)					9.8	(b)	9.8	(b)		
Na2O	0.33	(a)	0.33	(b)			0.35	(b)	0.36	(b)		
K2O	0.092	(a)									0.12	(d)
P2O5	0.13	(a)							0.12	(b)		
S %	0.07	(a)										
sum												
Sc ppm			35	(b)			35.6	(b)	32.5	(b)		
V				(b)					150	(b)		
Cr	3181	(a)	3100	(b)			3330	(b)	3300	(b)		
Co			46	(b)	46	(c)	46.7	(b)	46	(b)		
Ni					170	(c)	183	(b)	203	(c)		
Cu												
Zn					10	(c)			12.6	(c)		
Ga									4.36	(c)		
Ge ppb					269	(c)			295	(c)		
As												
Se					162	(c)						
Rb					3.2	(c)					3.1	(d)
Sr							100	(b)			116	(d)
Y												
Zr							200	(b)				
Nb												
Mo												
Ru												
Rh												
Pd ppb												
Ag ppb					6.5	(c)						
Cd ppb					22	(c)			32	(c)		
In ppb					3.4	(c)			37	(c)		
Sn ppb						(c)						
Sb ppb					2.7	(c)						
Te ppb					7	(c)						
Cs ppm					0.125	(c)	0.13	(b)				
Ba							149	(b)	160	(b)		
La			17	(b)			13.6	(b)	15.85	(b)		
Ce			52	(b)			37	(b)	44	(b)		
Pr												
Nd							21	(b)				
Sm			7.3	(b)			6.82	(b)	7.8	(b)		
Eu			1.2	(b)			1.095	(b)	1.05	(b)		
Gd												
Tb			1.1	(b)			1.42	(b)	1.4	(b)		
Dy									9	(b)		
Ho												
Er												
Tm												
Yb			5.5	(b)			5	(b)	5.3	(b)		
Lu			0.84	(b)			0.75	(b)	0.775	(b)		
Hf			5.4	(b)			5.6	(b)	5.25	(b)		
Ta			1.1	(b)			0.65	(b)				
W ppb												
Re ppb					0.71	(c)						
Os ppb						(c)						
Ir ppb					5.6	(c)	6.4	(b)	5.6	(c)		
Pt ppb												
Au ppb					1.99	(c)	1.5	(b)	2.4	(c)		
Th ppm			5.7	(b)			1.8	(b)	2.6	(b)	2.456	(d)
U ppm							0.52	(b)			0.68	(d)

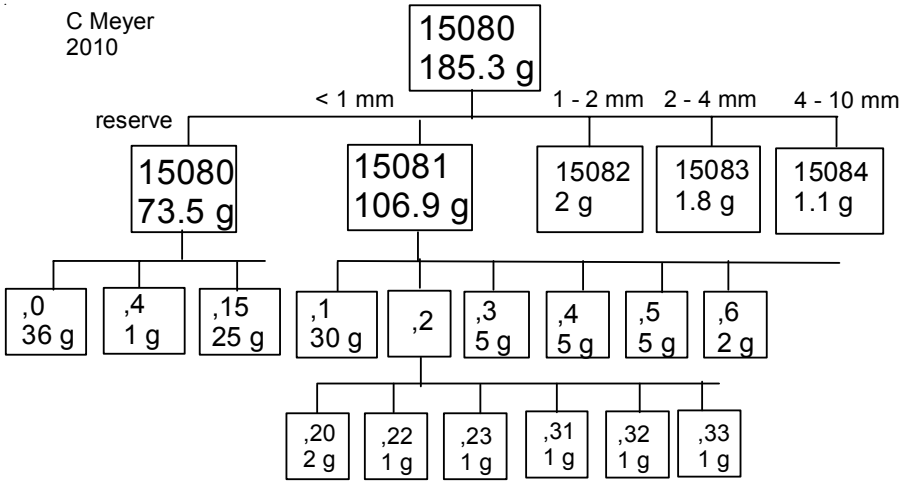
technique: (a) XRF, (b) INAA, (c) RNAA, (d) IDMS

Table 2. Chemical composition of 15081.

reference	Wanke75		Fruchter1973		Ganapathy73		Duncan75		Baedecker73		Tatsumoto72	
weight	Wanke73				Morgan72							
SiO2 %	46.8	(a)					46.5	(b)				
TiO2	1.58	(a)	1.62	(a)			1.58	(b)				
Al2O3	13.7	(a)	13.04	(a)			13.6	(b)				
FeO	15.3	(a)	15.8	(a)			15.28	(b)				
MnO	0.2	(a)					0.2	(b)				
MgO	10.6	(a)					10.86	(b)				
CaO	10.7	(a)					10.66	(b)				
Na2O	0.38	(a)	0.36	(a)			0.34	(b)				
K2O	0.14	(a)					0.13	(b)			0.14	(d)
P2O5	0.15	(a)					0.16	(b)				
S %	0.05	(a)					0.079	(b)				
sum												
Sc ppm	31.7	(a)	32	(a)								
V												
Cr			2900	(a)			3017	(b)				
Co	45.1	(a)	46	(a)	46	(c)	46	(b)				
Ni	260	(a)			200	(c)	116	(b)	220	(c)		
Cu							36	(b)				
Zn					14	(c)	33	(b)	14	(c)		
Ga									4.2	(c)		
Ge ppb					269	(c)			340	(c)		
As												
Se					217	(c)						
Rb					3.9	(c)	4.2	(b)			3.73	(d)
Sr	160	(a)					120	(b)			122	(d)
Y							61	(b)				
Zr	290	(a)					273	(b)				
Nb							16	(b)				
Mo												
Ru												
Rh												
Pd ppb												
Ag ppb					13	(c)						
Cd ppb					28	(c)			30	(c)		
In ppb					42	(c)			3.3	(c)		
Sn ppb												
Sb ppb					2.7	(c)						
Te ppb					12	(c)						
Cs ppm	0.14	(a)			0.153	(c)						
Ba	220	(a)	240	(a)			185	(b)				
La	18.4	(a)	20	(a)								
Ce	51	(a)	54	(a)								
Pr												
Nd	29	(a)										
Sm	8.5	(a)	8.6	(a)								
Eu	1.2	(a)	1.27	(a)								
Gd		(a)										
Tb	1.85	(a)	1.4	(a)								
Dy	11.4	(a)										
Ho	2.3	(a)										
Er												
Tm												
Yb	6.03	(a)	6	(a)								
Lu	0.86	(a)	0.92	(a)								
Hf	6.53	(a)	6.4	(a)								
Ta	0.88	(a)										
W ppb												
Re ppb					0.76							
Os ppb												
Ir ppb	8	(a)			7.1	(c)			6.8	(c)		
Pt ppb												
Au ppb					2.3	(c)			2.3	(c)		
Th ppm	2.58	(a)	6.4	(a)							2.924	(d)
U ppm											0.7854	(d)

technique: (a) INAA (mostly), (b) XRF, (c) RNAA, (d) IDMS





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