15501, 15511 and 15531

Soils

140, 275.8 and 291.7grams

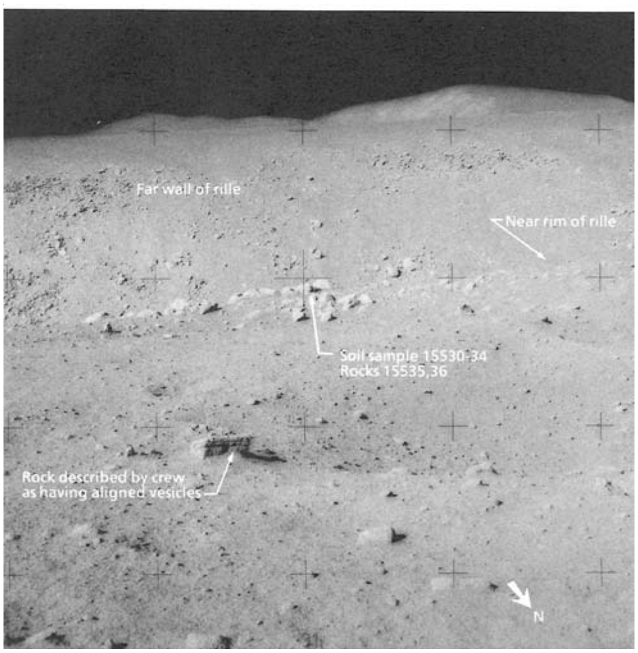

Figure 1: Tele-photo of edge of Hadley Rille where 15531 was taken. 15501 and 15511 were from the foreground. AS15-82-11126.

Modal content of soil 15501 and 15531.

From Basu et al. 1981.

	15501	15531
Agglutinates	35.1%	23.7
Mare Basalt	7.7	15.8
KREEP basalt	1.3	0.8
Breccia	13.1	3.9
Anorthosite	0.4	0.1
Norite		
Gabbro	0.3	0.6
Plagioclase	6.6	7.2
Pyroxene	18.6	30.1
Olivine	2.7	5.3
Ilmenite	0.3	0.9
Glass other	11.3	7.1

From Carr and Meyer 1974

Agglutinates	56.9%	25.6
Basalt	6.9	22.4
Breccia	1.6	0.6
Plagioclase	6	8
Pyroxene	16	34.9
Olivine	2.6	1.2
Ilmenite	0.2	0.6
Glass other	9.8	6.7

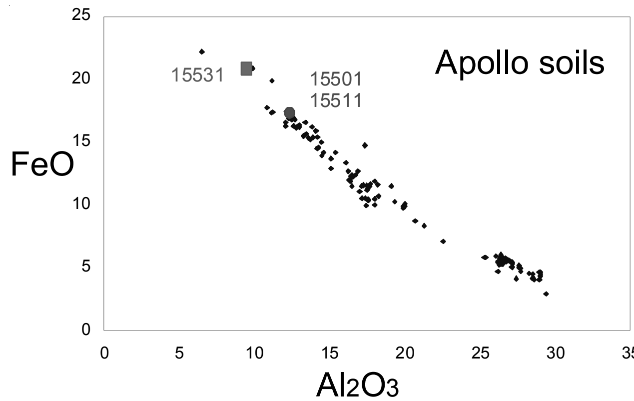

Figure 2: Chemical composition of 15501 and 15531 compared with that of other Apollo soils.

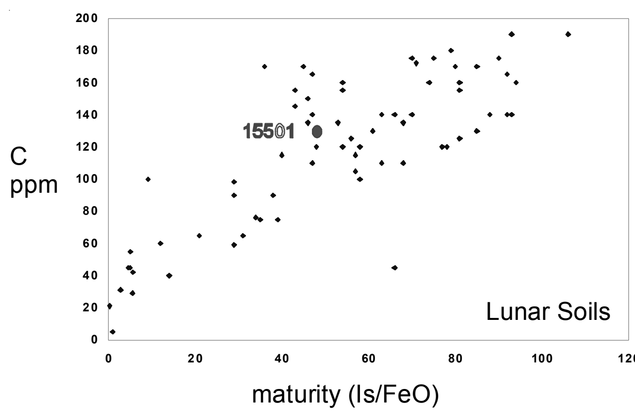

Figure 3: Maturity index and carbon content of 15501.

Introduction

15501 and 15511 were collected from the rim of a small crater at station 9, while 15531 was collected at station 9a (near Hadley Rille). 15501 is the < 1 mm soil that came with 15505 (a large breccia), 15511 is the soil that came with the rake sample (15515 etc.), and double drive tube 15011/10 was collected near 15531 and 15600 (rake).

Petrography

The maturity index (I_s/FeO) of 15501 is 51 (submature) and that of 15531 is 27 (immature) (Morris 1978). Carr and Meyer (1974) and Basu et al. (1981) determined the mineralogic mode for 15501 and 15531. There were ~57% agglutinates in 15501 while 15531, from near the Rille, only had about 25% agglutinates.

Powell (1972) and Ryder and Sherman (1989) cataloged the coarse-fines.

Chemistry

The chemical composition is plotted in figures 2 and 4.

The carbon content of 15501 is 110 or 130 ppm (Cadogen 1972 or Moore et al. 1973)(figure 3).

Walker and Papike (1981) calcultated that 15501 – 15511 was composed of about 60 % mare basalt, 20 % KREEP and 5 % grenn glass.

Radiogenic age dating

Alexander et al. (1976) produced an isochron (figure 6), but it has no real meaning.

Cosmogenic isotopes and exposure ages

Rancitelli et al. (1972) determined the cosmic-ray-induced activity of ^{22}Na = 62 dpm/kg, ^{26}Al = 74 dpm/kg and ^{46}Sc = 7 dpm/kg.

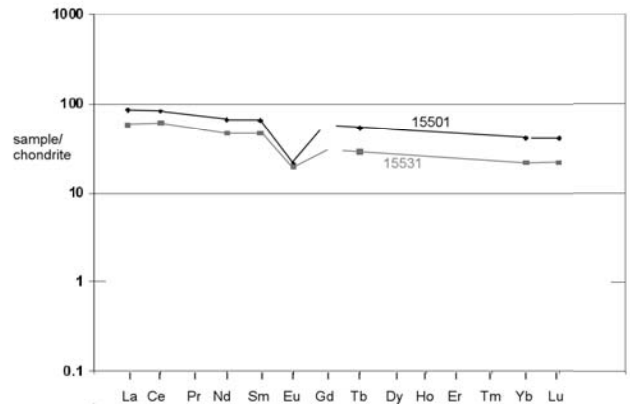

Figure 4: Normalized rare-earth-element diagrams for 15501 and 15531 (Korotev 1987).

Processing

15500, 15510 and 15530 were returned in a sample collection bag (#7) placed in ALSRC#2 (which did not seal).

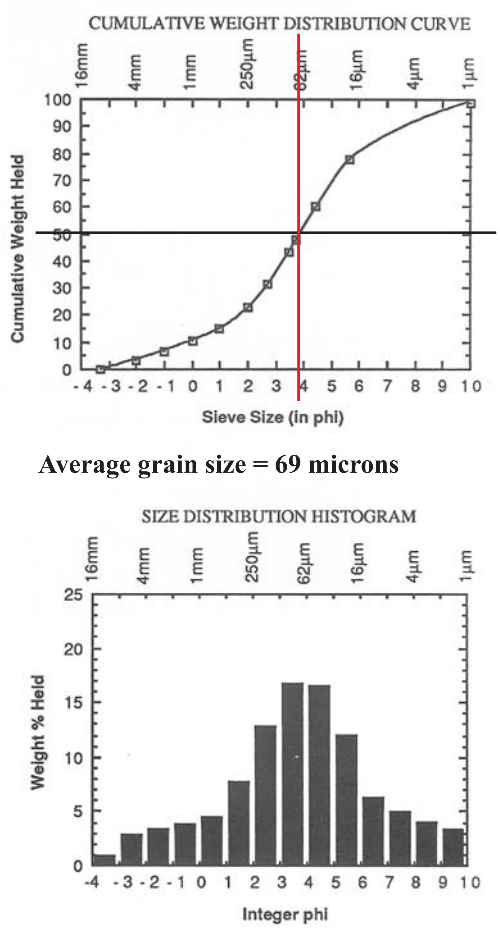

Figure 5a: Grain size distribution of 15500 (Graf 1993).

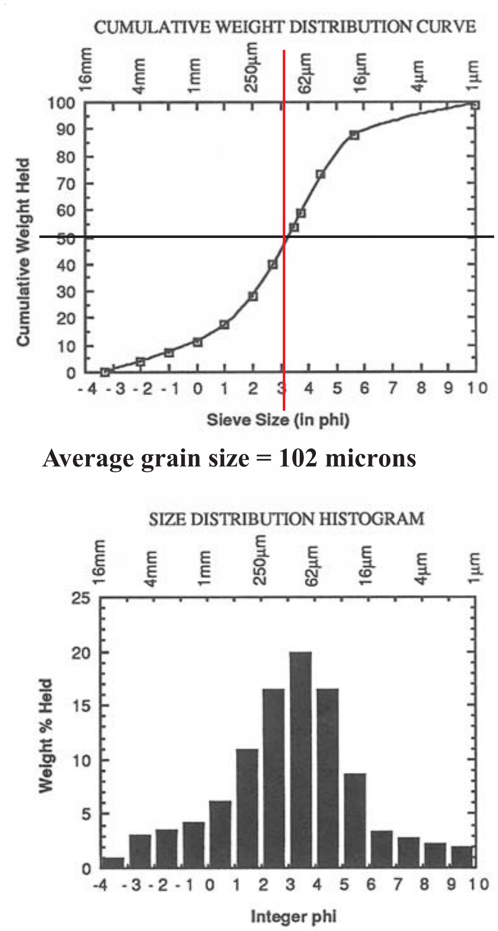

Figure 5b: Grain size distribution of 15530 (Graf 1993).

Table 1. Chemical composition of 15501.

reference	LSPET72		Laul72		Morgan72		Rancitelli72		Chou74		Duncan75		Korotev87	
weight					Ganapathy73		46.6 g							
SiO2 %	46.21	(a)									46.46	(a)		
TiO2	1.81	(a)	1.6	(b)							1.78	(a)	1.78	(b)
Al2O3	12.2	(a)	12.7	(b)					13.2	(b)	12.54	(a)	12.5	(b)
FeO	16.72	(a)	16.5	(b)					16.7	(b)	16.61	(a)	16.8	(b)
MnO	0.22	(a)	0.207	(b)					0.22	(b)	0.212	(a)	0.21	(b)
MgO	10.8	(a)									10.98	(a)	11	(b)
CaO	10.25	(a)	10	(b)					10.4	(b)	10.31	(a)	9.8	(b)
Na2O	0.37	(a)	0.377	(b)					0.38	(b)	0.36	(a)	0.37	(b)
K2O	0.16	(a)	0.17	(b)			0.15	(d)			0.158	(a)		
P2O5	0.17	(a)							0.17	(b)	0.184	(a)		
S %	0.07	(a)									0.08	(a)		
sum														
Sc ppm			31	(b)					34	(b)			32.9	(b)
V			139	(b)					220	(b)	129	(a)		
Cr	3353	(a)	2942	(b)							3134	(a)	3000	(b)
Co					43.6	(c)			50	(b)	50	(a)	48.5	(b)
Ni			43	(b)	150	(c)			238	(c)	224	(a)	201	(b)
Cu											3	(a)		
Zn					14	(c)			13.7	(c)	13	(a)		
Ga									4.46	(c)				
Ge ppb					317	(c)			303	(c)				
As														
Se														
Rb	4.7	(a)			4.18	(c)					4.8	(a)		
Sr	122	(a)									115	(a)	120	(b)
Y	72	(a)									67.9	(a)		
Zr	317	(a)	370	(b)							312	(a)	330	(b)
Nb											19.5	(a)		
Mo														
Ru														
Rh														
Pd ppb														
Ag ppb					30.7	(c)								
Cd ppb					36	(c)			45	(c)				
In ppb					7.4	(c)			35	(c)				
Sn ppb														
Sb ppb					1.51	(c)								
Te ppb					6.2	(c)								
Cs ppm					0.175	(c)							0.24	(b)
Ba			120	(b)					230	(b)	220	(a)	195	(b)
La			20	(b)					20	(b)			19.9	(b)
Ce			53	(b)					55	(b)			50	(b)
Pr														
Nd													30	(b)
Sm			9.7	(b)					9.35	(b)			9.56	(b)
Eu			0.77	(b)					1.1	(b)			1.17	(b)
Gd														
Tb			1.8	(b)					1.7	(b)			1.93	(b)
Dy									10	(b)				
Ho														
Er														
Tm														
Yb			6.2	(b)					6.4	(b)			6.7	(b)
Lu			1.1	(b)					0.91	(b)			0.99	(b)
Hf			7.1	(b)					6.4	(b)			8.1	(b)
Ta			0.83	(b)									0.98	(b)
W ppb														
Re ppb					0.64	(c)								
Os ppb														
Ir ppb					6.3	(c)			6.3	(c)			5.7	(b)
Pt ppb														
Au ppb					2.09	(c)			2.4	(c)			1.3	(b)
Th ppm	3.1	(a)	3.4	(b)			4.15	(d)	2.9	(b)			3.4	(b)
U ppm			1	(b)			1.03	(d)					0.89	(b)

technique: (a) XRF, (b) INAA, (c) RNAA, (d) radiation count.

Table 2. Chemical composition of 15511

reference	Laul 73		Chou74		Duncan75		Korotev87	
weight								
SiO2 %					46.04	(c)		
TiO2	1.9	(a)			1.8	(c)	1.8	(a)
Al2O3	12.4	(a)	12.5	(a)	12.14	(c)	12.3	(a)
FeO	17.4	(a)	15.8	(a)	16.79	(c)	16.9	(a)
MnO	0.216	(a)	0.23	(a)	0.215	(c)	0.22	(a)
MgO	12	(a)			10.89	(c)	10.9	(a)
CaO	10	(a)	9.4	(a)	10.2	(c)	10.3	(a)
Na2O	0.369	(a)	0.38	(a)	0.35	(c)	0.39	(a)
K2O	0.14	(a)	0.17	(a)	0.153	(c)		
P2O5					0.193	(c)		
S %					0.08	(c)		
sum								
Sc ppm	32	(a)	32	(a)			33.1	(a)
V	149	(a)	130	(a)	131	(c)	130	(a)
Cr	3106	(a)	3200	(a)	3168	(c)	3220	(a)
Co	48	(a)	47	(a)	47	(c)	48.1	(a)
Ni			213	(b)	197	(c)	215	(a)
Cu					10	(c)		
Zn			14.5	(b)	16	(c)		
Ga			4.65	(b)				
Ge ppb			325	(a)				
As								
Se								
Rb					4.9	(c)		
Sr					115	(c)	105	(a)
Y					68.7	(c)		
Zr	?				319	(c)	300	(a)
Nb					19.9	(c)		
Mo								
Ru								
Rh								
Pd ppb								
Ag ppb								
Cd ppb			43	(b)				
In ppb			44	(b)				
Sn ppb								
Sb ppb								
Te ppb								
Cs ppm							0.2	(a)
Ba	220	(a)	190	(a)	210	(c)	211	(a)
La	20	(a)	20	(a)			21.6	(a)
Ce	52	(a)	59	(a)			57	(a)
Pr								
Nd							35	(a)
Sm	9.1	(a)	9.35	(a)			10.4	(a)
Eu	1.3	(a)	1.15	(a)			1.23	(a)
Gd								
Tb	1.9	(a)	1.7	(a)			1.95	(a)
Dy	11	(a)	11	(a)				
Ho								
Er								
Tm								
Yb	6.9	(a)	6.5	(a)			7.2	(a)
Lu	0.98	(a)	0.9	(a)			0.98	(a)
Hf	6.4	(a)	6.5	(a)			8.1	(a)
Ta	1.2	(a)					1.05	(a)
W ppb								
Re ppb								
Os ppb								
Ir ppb			5.8	(b)			6.4	(a)
Pt ppb								
Au ppb			2	(b)				(a)
Th ppm	3	(a)	3	(a)			3.1	(a)
U ppm	0.7	(a)					0.81	(a)

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

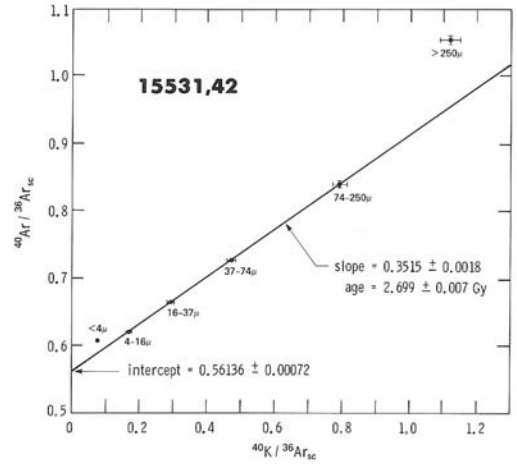

Figure 6: Rare gas in 15531 (Alexander et al. 1976).

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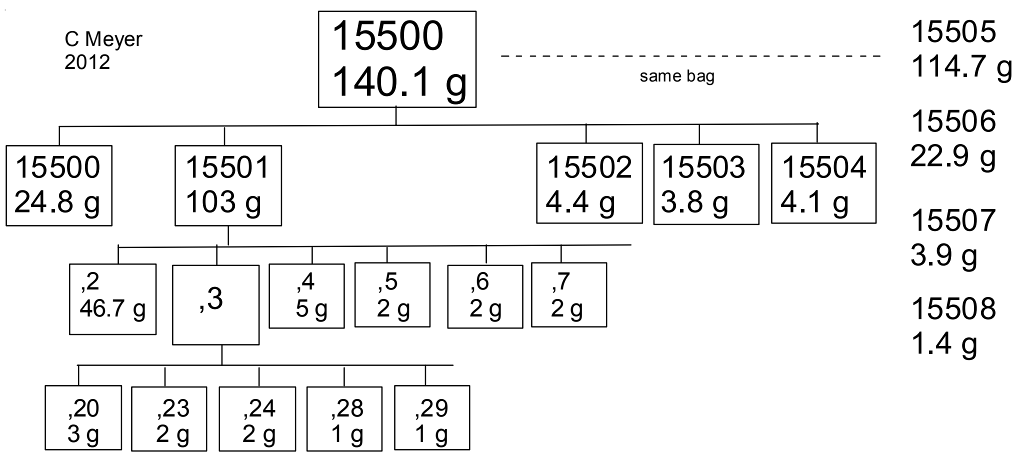
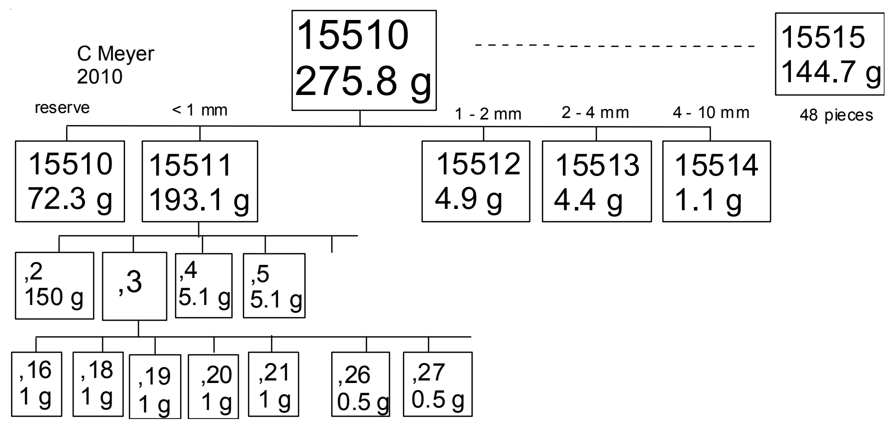
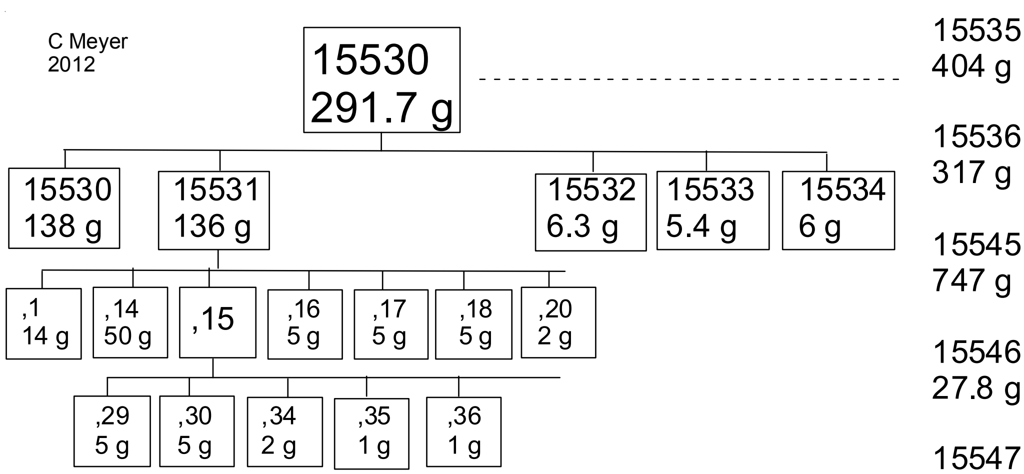
Table 3. Chemical composition of 15531.

reference	Laul 72		Schnetzler72		Baedecker73		Korotov87		Fruchter73		Wanke73		Murthy72	
weight														
SiO2 %											46.4			
TiO2	2.1	(a)					2.2	(a)	2.2	(a)	2.17	(a)		
Al2O3	10	(a)					9.9	(a)	10	(a)	9.9	(a)		
FeO	19.5	(a)					20.9	(a)	20.7	(a)	20.7	(a)		
MnO	0.248	(a)					0.22	(a)			0.25	(a)		
MgO							11.3	(a)			11.49	(a)		
CaO	10.5	(a)					8	(a)			9.4	(a)		
Na2O	0.301	(a)					0.27	(a)	0.29	(a)	0.3	(a)		
K2O	0.09	(a)	0.091	(c)					0.09	(a)	0.086	(a)	0.109	(c)
P2O5														
S %														
sum														
Sc ppm	36	(a)					40.7	(a)	41	(a)	39.9	(a)		
V	182	(a)												
Cr	3353	(a)					3840	(a)	3750	(a)	3810	(a)		
Co	50	(a)					55.1	(a)	53	(a)	55	(a)		
Ni					145	(b)	183	(a)						
Cu														
Zn					8	(b)								
Ga					3.9	(b)								
Ge ppb					141	(b)								
As														
Se														
Rb			2.24	(c)									2.618	(c)
Sr			103	(c)			100	(a)					104.3	(c)
Y														
Zr	130	(a)	173	(c)			200	(a)						
Nb														
Mo														
Ru														
Rh														
Pd ppb														
Ag ppb														
Cd ppb					21	(b)								
In ppb					*400*	(b)								
Sn ppb														
Sb ppb														
Te ppb														
Cs ppm							0.13	(a)						
Ba	110	(a)	117	(c)			149	(a)					118	(c)
La	10.9	(a)	28.4	(c)			13.6	(a)	12	(a)	11.6	(a)		
Ce	35	(a)	19.6	(c)			37	(a)						
Pr														
Nd			5.81	(c)			21	(a)			24	(a)		
Sm	5.7	(a)	1	(c)			6.82	(a)	5.7	(a)	5.9	(a)		
Eu	1	(a)					1.095	(a)	1	(a)	1.04	(a)		
Gd		(a)	7.44	(c)										
Tb	1	(a)					1.05	(a)	1.2	(a)				
Dy			8.06	(c)							8	(a)		
Ho											2	(a)		
Er			4.67	(c)										
Tm														
Yb	4.8	(a)	4.14	(c)			3.61	(a)	4.2	(a)	3.9	(a)		
Lu	0.66	(a)	0.61	(c)			0.534	(a)	0.67	(a)	0.67	(a)		
Hf	4.4	(a)					4.1	(a)	4.2	(a)	3.9	(a)		
Ta	0.6	(a)					0.57	(a)			0.52	(a)		
W ppb														
Re ppb														
Os ppb														
Ir ppb					3.4	(b)	2	(a)						
Pt ppb														
Au ppb					1.8	(b)	1	(a)						
Th ppm	1.8	(a)					1.19	(a)						
U ppm							0.29	(a)						

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







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