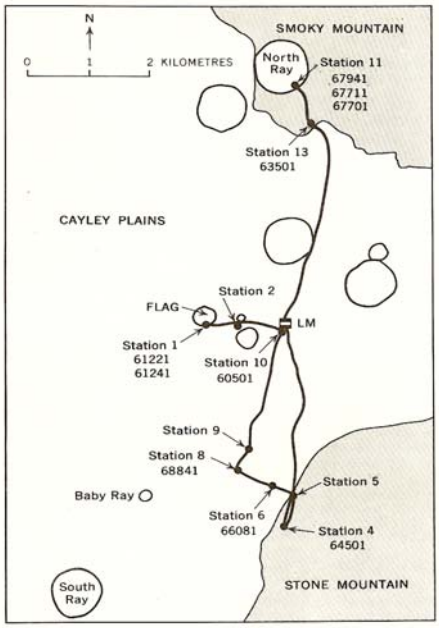
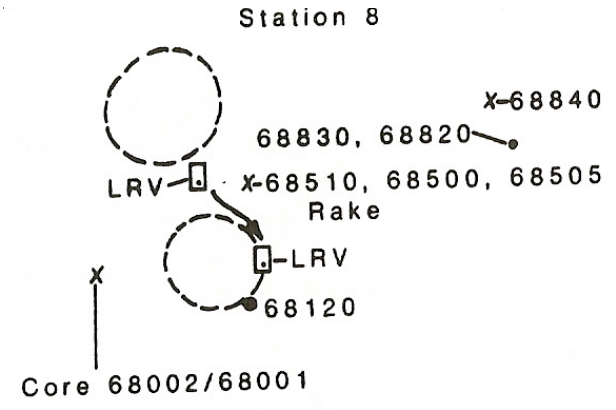
68841

Soil

449 grams

Figure 1: Close-up photo of area where 68840 was collected. AS16-107-17557





Figures 2 and 3: Maps of Apollo 16 and station 8.

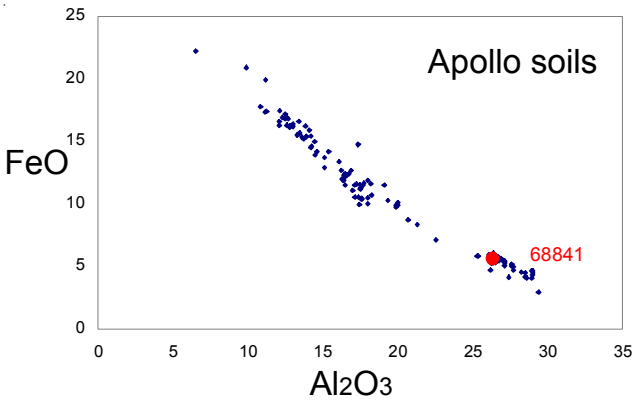


Figure 4: Composition of 68841 compared with that of other Apollo soil samples.

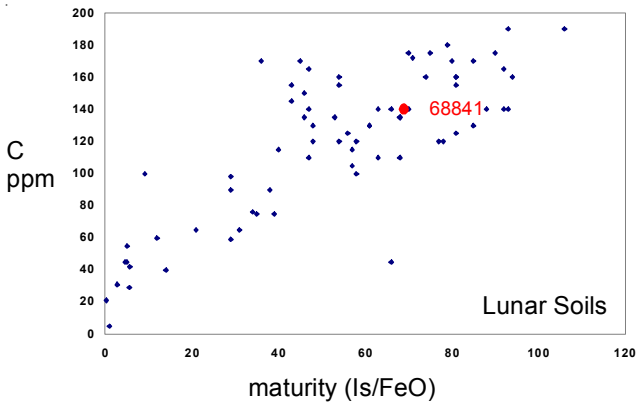


Figure 5: Carbon content and maturity index for 68841 and other Apollo soil samples.

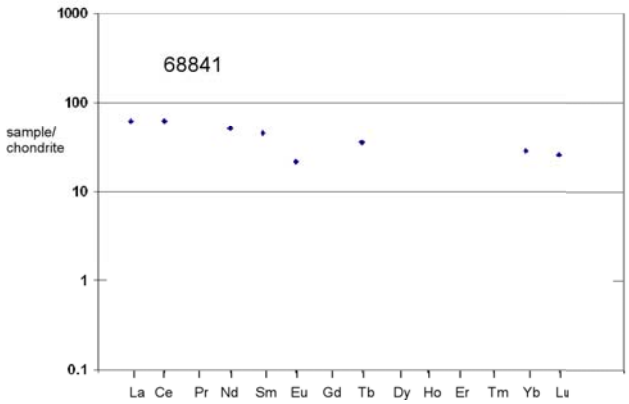


Figure 6: Normalized rare-earth-element diagram for 68841.

Mineralogical Mode

From Morris 1983

Agglutinate	80 %
Glass	4
Breccia	4
Pyroxene	3
Plagioclase	7

Introduction

Figure 1 – 3 show location of soil sample 68840 - out in the open, on the smooth Cayley Plain.

Petrography

Soil sample 68841 has a maturity index I_s/FeO = 70, and average grain size = 100 microns (Butler et al. 1973).

The mineral mode has not been carefully studied, but Morris et al. (1983) reported that 68841 was 80 % agglutinate!!

Marvin (1972) cataloged the 4 – 10 mm coarse fine fraction.

Chemistry

Almost all Apollo 16 soils have the same composition (with notable exception of station 11)(see Korotev 1982). Figure 4 compares the FeO and Al_2O_3 content with other Apollo soil samples and figure 6 shows the REE pattern.

Moore et al. (1973) determined 140 ppm carbon for 68841 (figure 5). Kerridge et al. (1975) and Moore and Lewis (1975) reported 97 ppm and 113 ppm nitrogen for 68841, respectively.

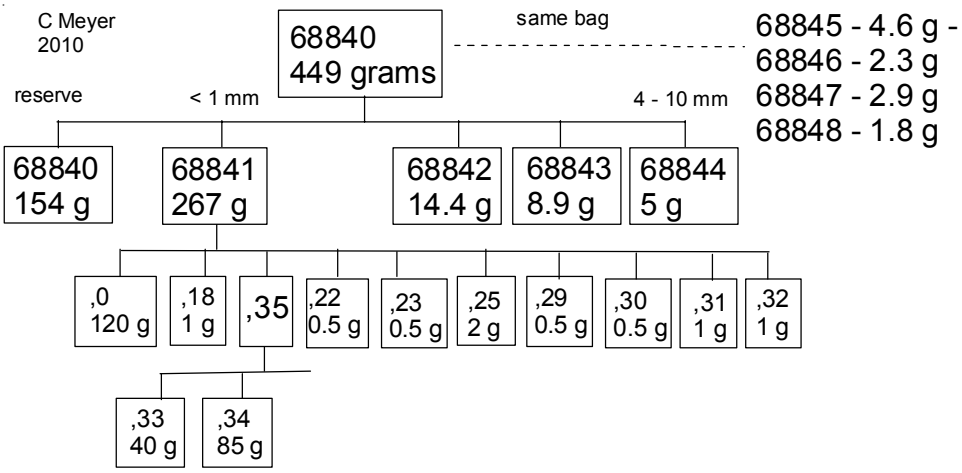
Cosmogenic isotopes and exposure ages

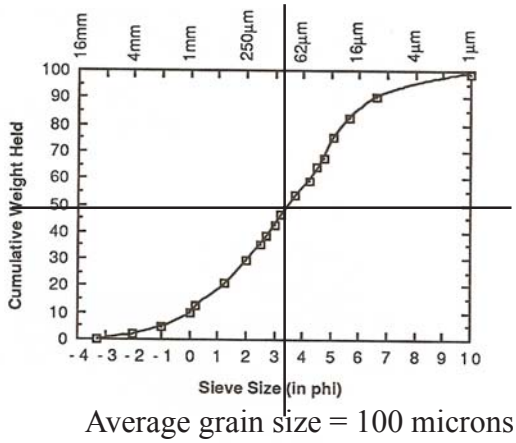
Clark and Keith (1973) determined the cosmic-ray-induced activity of ^{26}Al = 82 dpm/kg, ^{22}Na = 33 dpm/kg, ^{54}Mn = 10 dpm/kg, and ^{46}Sc = 2.3 dpm/kg. Wrigley (1973) determined the cosmic-ray-induced activity of ^{26}Al = 91 dpm/kg and ^{22}Na = 39 dpm/kg. Walton et al. (1973) determined that the ^{21}Ne exposure age was 180 m.y.

Other Studies

Behrmann et al. (1973) reported that 90% of the crystals they studied had fossil nuclear tracks density >10^8/cm^3.

Walton et al. (1973) reported the rare gas content and isotopic ratios of 68841.





Average grain size = 100 microns

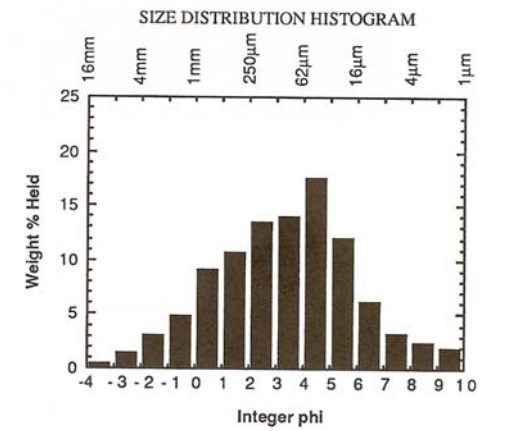


Figure 7: Grain size distribution of 68840 (Graf 1993, from data by Butler et al. 1973).

Table 1a. Chemical composition of 68841.

reference	LSPET72		Wrigley73		Clark73		Rose75			Philpotts73		Krahenbuhl73		Finkelman75		
weight							<30 um	30-100 um						30-1000	<30um	
SiO2 %	45.08	(a)					45.51	45.56	(c)							
TiO2	0.59	(a)					0.59	0.56	(c)							
Al2O3	26.49	(a)					26.04	25.93	(c)							
FeO	5.65	(a)					5.39	5.42	(c)							
MnO	0.07	(a)					0.08	0.07	(c)							
MgO	6.27	(a)					6.17	6.58	(c)							
CaO	15.3	(a)					15.24	15.14	(c)							
Na2O	0.41	(a)					0.65	0.41	(c)							
K2O	0.11	(a)	0.12	(b)	0.12	(b)	0.15	0.11	(c)	0.138	(d)					
P2O5	0.12	(a)					0.15	0.14	(c)							
S %	0.08	(a)														
sum																
Sc ppm							10	9.2	(c)					9.2	10	(e)
V							15	14	(c)					14	15	(e)
Cr	780	(a)					890	821	(c)							
Co							23	34	(c)					34	23	(e)
Ni	296	(a)					488	680	(c)			590	(d)	680	488	(e)
Cu							12	6.8	(c)					6.8	12	(e)
Zn							25	8.8	(c)			18.7	(d)	8.8	25	(e)
Ga							4.4	3.3	(c)					3.3	4.4	(e)
Ge ppb												875	(d)			
As																
Se																
Rb	3.1	(a)								2.78	(d)	3	(d)			
Sr	169	(a)					146	113	(c)	168	(d)			115	146	(e)
Y	46	(a)					48	50	(c)					50	48	(e)
Zr	201	(a)					163	164	(c)					164	163	(e)
Nb	13	(a)														
Mo																
Ru																
Rh																
Pd ppb																
Ag ppb												8.4	(d)			
Cd ppb												56.5	(d)			
In ppb																
Sn ppb																
Sb ppb												2.45	(d)			
Te ppb												21	(d)			
Cs ppm												0.13	(d)			
Ba							175	120	(c)					120	175	(e)
La																
Ce																
Pr																
Nd																
Sm																
Eu																
Gd																
Tb																
Dy																
Ho																
Er																
Tm																
Yb																
Lu																
Hf																
Ta																
W ppb																
Re ppb												1.56	(d)			
Os ppb																
Ir ppb												12.8	(d)			
Pt ppb																
Au ppb												9.02	(d)			
Th ppm	2.4	(a)	2.34	(b)	2.33	(b)										
U ppm			0.56	(b)	0.59	(b)						0.67	(d)			

technique: (a) XRF, (b) radiation count. (c) 'microchem." (d) RNAA, (e) OES

Table 1b. Chemical composition of 68841.

reference	Compston73		Fruchter74		Korotev91		ave st. 8 Korotev81
weight							
SiO2 %	44.96	(a)					45.1
TiO2	0.58	(a)					0.56
Al2O3	26.47	(a)					26.6
FeO	5.65	(a)	5.15	(b)	5.37	(b)	5.35
MnO	0.08	(a)					0.07
MgO	6.2	(a)					6.3
CaO	15.41	(a)			14.9	(b)	15.3
Na2O	0.43	(a)	0.47		0.449	(b)	0.46
K2O	0.11	(a)					0.121
P2O5	0.12	(a)					
S %	0.08	(a)					
sum							
Sc ppm			10.1	(b)	9.32	(b)	9.6
V							14
Cr			770	(b)	768	(b)	760
Co			30.7	(b)	27.5	(b)	30
Ni					410	(b)	490
Cu							
Zn							
Ga							
Ge ppb							
As							
Se							
Rb	2.76	(d)					2.7
Sr	172	(d)			180	(b)	158
Y							48
Zr					183	(b)	194
Nb							
Mo							
Ru							
Rh							
Pd ppb							
Ag ppb							
Cd ppb							
In ppb							
Sn ppb							
Sb ppb							
Te ppb							
Cs ppm					0.11	(b)	
Ba			160	(b)	146	(b)	147
La			13.4	(b)	14.4	(b)	13.4
Ce			34.3	(b)	37.2	(b)	34
Pr							
Nd			23	(b)	23	(b)	
Sm			6.9	(b)	6.65	(b)	6.55
Eu			1.3	(b)	1.2	(b)	1.25
Gd							
Tb			1.3	(b)	1.3	(b)	1.27
Dy							
Ho							
Er							
Tm							
Yb			4.9	(b)	4.62	(b)	4.65
Lu			0.7	(b)	0.626	(b)	0.67
Hf			4.6	(b)	4.89	(b)	4.5
Ta			0.5	(b)	0.58	(b)	0.6
W ppb							
Re ppb							
Os ppb							
Ir ppb					12.2	(b)	
Pt ppb							
Au ppb					6.4	(b)	
Th ppm			2.6	(b)	2.35	(b)	2.4
U ppm					0.56	(b)	0.62

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

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