DRAFT

70180

Reference Soil (portion frozen)

259.78 grams

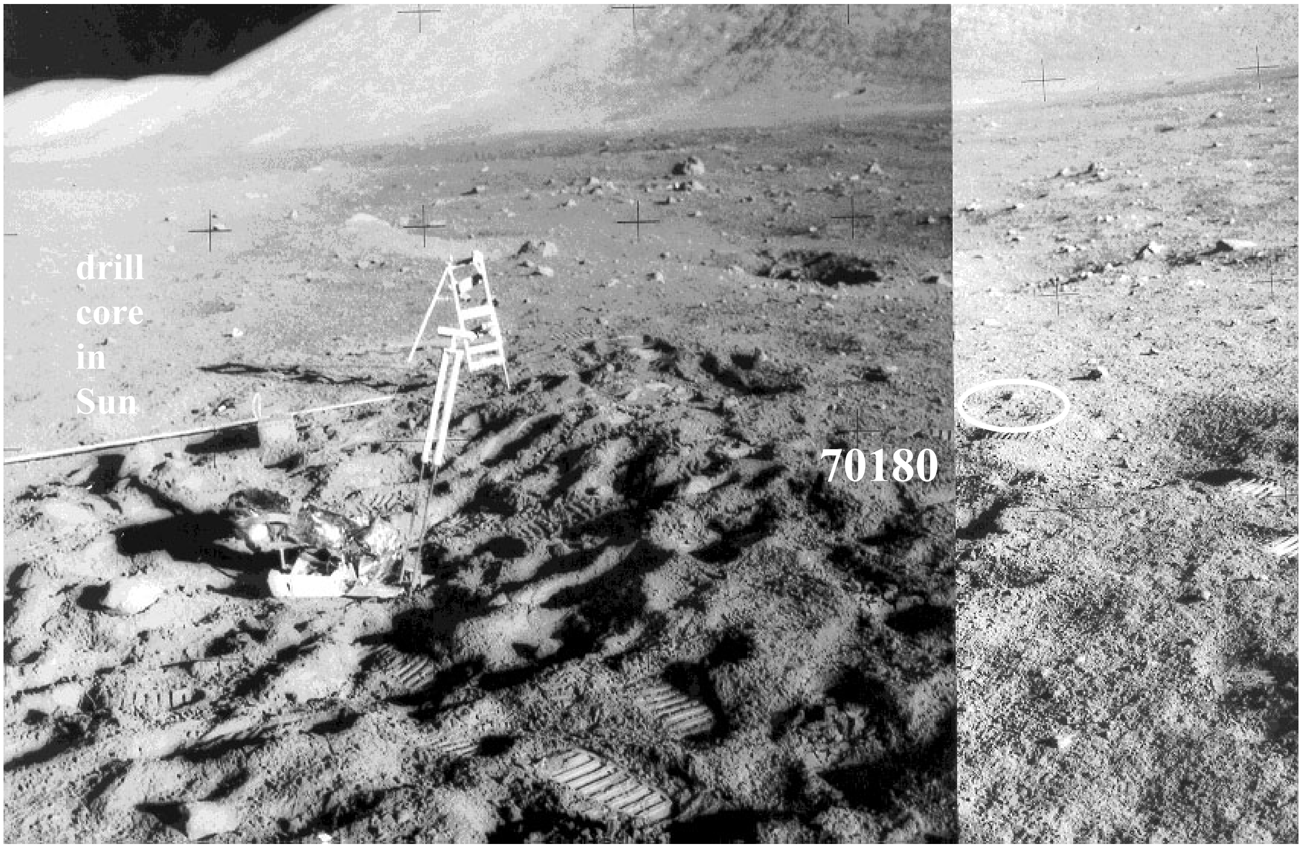

Figure 1: The Apollo 17 deep drill site with location of reference soil sample indicated. NASA AS17-136-20720 and 20721. Note the long drill string in the Sun and indication of degree of difficulty to perform task.

Modal content of soil 70181 (90-150 micron).
From Heiken and McKay 1974.

Agglutinates	56 %
Basalt	14
Breccia	7.5
Anorthosite	0.3
Norite	-
Gabbro	-
Plagioclase	4.3
Pyroxene	10.6
Olivine	-
Ilmenite	2.3
Orange glass	3
Glass other	1.5

Introduction

Soil sample 70180 was collected about 3 meters from the location of the deep drill sample at the ALSEP site (figure 1). It is estimated to be soil material from 0 – 5 cm deep, and it contained a high percentage of agglutinates (56%, Heiken and McKay 1974). This soil sample has I_s/FeO = 56 (submature). McKay et al. (1974) determined a mean grain size of 57 microns.

This soil sample was collected in the vicinity of the Apollo 17 deep drill string 70001 – 70009 and represents a reference sample for the core. However, it was apparently not included in the detailed petrologic studies of the core samples (i.e. Vaniman et al. 1979).

70180 is a surface sample and that has been exposed to the sun and experienced the full range of thermal cycling, micrometeorite bombardment, cosmic ray exposure and gardening typical of a lunar soil. However, it was returned in a vacuum container, opened only in nitrogen and a portion kept frozen all these years. This surface sample also included a large basalt sample 70185 (not included in weight of soil; not frozen).

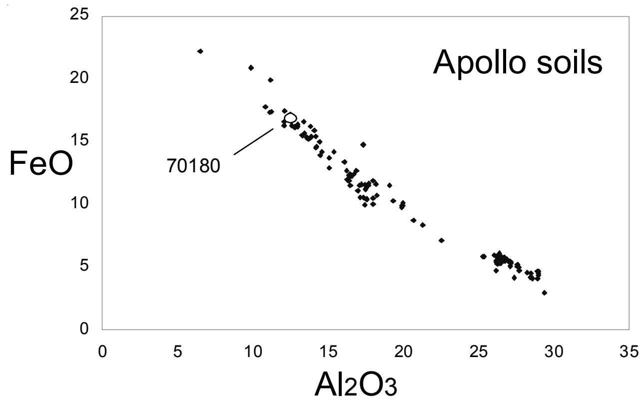

Figure 2: Chemical composition of Apollo soils with 70180.

Petrography

Taylor et al. (1978) compared 70181 with the top section of the Apollo 17 drill core. 70181 was found to have a much higher content of agglutinate (56%) than the top of the core (32%) with higher content of nonmare lithic fragments (14% for 70181 compared with 2.9% for top of core).

Soil sample 70181 also appears to be chemically different from the bottom of the core (figure 2). Again the high agglutinate content (56%) for 70181 exceeds that of any depth in the core (~20-30%).

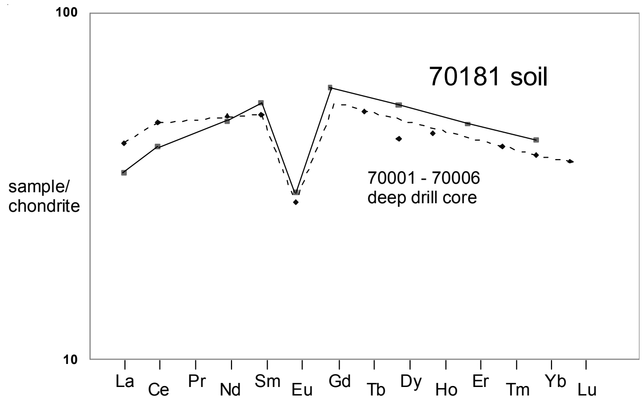

Figure 3: Normalized rare-earth-element pattern of reference soil compared with average of bottom segments of drill.

Chemistry

Rhodes et al. (1974), Rose et al. (1974), Philpotts et al. (1974), Wiesmann and Hubbard (1975), Blanchard et al. (1975), Korotev et al. (1976) and Korotev and Kremser (1992) analyzed 70181 (Table 1; figure 2). Jovanovic and Reed (1974) determined Hg, Os, Ru and halogens in 70181.

Cosmogenic isotopes and exposure ages

Goswami and Lal (1974) determined track densities in gains from 70181.

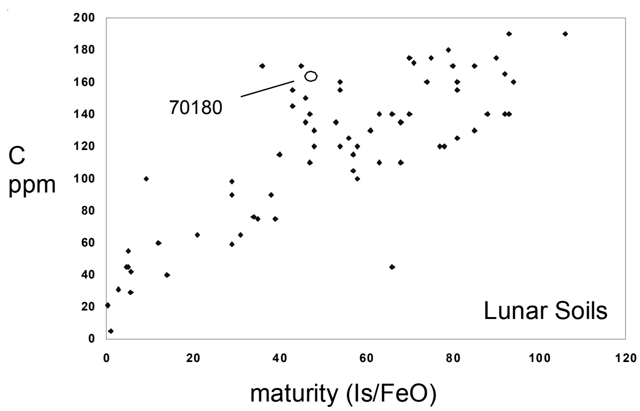

Figure 4: Carbon content and maturity of Apollo soils.

Other Studies

Stoenner et al. (1974) determined the radioactive rare gasses in the ALSRC container.

Processing

70180 was returned, under vacuum, in ALSRC #1. In the nitrogen processing cabinets, a large basaltic rock (70185) was removed, and a portion was sieved to create size fractions (see diagram). A 20-gram portion (70180,2) was split, placed in a sealed 3-liter bolt top can and put in the freezer (~256 K). *Beware MoS2 grease.* Another large portion (55 gams) is a "reserve sample" and may still be in its original Teflon collection bag?

70180,2 has never been opened, nor allocated.

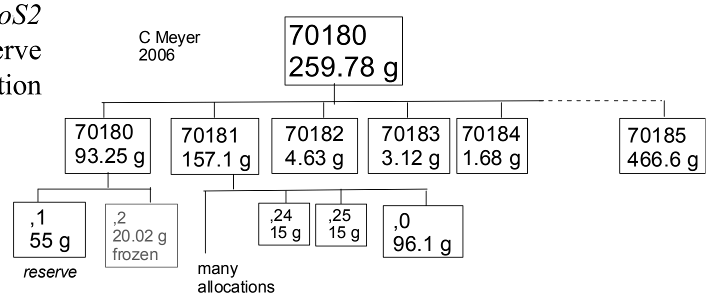

Table 1. Chemical composition of 70181.

reference	Philpotts74		Rhodes74		Wiesmann75		Korotev76	Blanchard75	Korotev92		Rose74		Jovanovic74
weight					Nyquist74		90-150	70181					
SiO2 %			40.87	(b)							40.9	(d)	
TiO2			8.11	(b)	8.17	(a)					8.4	(d)	
Al2O3			12.3	(b)							12.4	(d)	
FeO			16.37	(b)			17.7	16.4	16.6	(c)	16.55	(d)	
MnO			0.24	(b)							0.21	(d)	
MgO			9.82	(b)							9.76	(d)	
CaO			11.05	(b)							10.97	(d)	
Na2O			0.35	(b)	0.36		0.38	0.458	0.389	(c)	0.38	(d)	
K2O	0.084	(a)	0.08	(b)	0.087	(a)					0.09	(d)	
P2O5			0.06	(b)							0.07	(d)	
S %			0.11	(b)									
sum													
Sc ppm							66.5		59.5	(c)	61	(d)	
V											60	(d)	
Cr					2566	(a)	3407	2940	3060	(c)			
Co							33	30.2	33.7	(c)	42	(d)	
Ni			190	(b)			160	140	150	(c)	220	(d)	
Cu											28	(d)	
Zn			47	(b)							13	(d)	
Ga											4.1	(d)	
Ge ppb													
As													
Se													
Rb	1.42	(a)	1.9	(b)	1.468	(a)					1.4	(d)	
Sr	167	(a)	169	(b)	170	(a)			*270*	(c)	144	(d)	
Y			70	(b)							66	(d)	
Zr	338	(a)	216	(b)					220	(c)	270	(d)	
Nb			18	(b)							18	(d)	
Mo													
Ru													14
Rh													
Pd ppb													
Ag ppb													
Cd ppb													
In ppb													
Sn ppb													
Sb ppb													
Te ppb													
Cs ppm													
Ba	104	(a)			98	(a)			90	(c)	107	(d)	
La					8.09	(a)	6.72	8	8.22	(c)			
Ce	24.7	(a)			24.8	(a)	23.3	25.2	24.9	(c)			
Pr													
Nd	22	(a)			21.6	(a)			25				
Sm	8.18	(a)			8.07	(a)	7.67	8.31	8.02	(c)			
Eu	1.71	(a)			1.66	(a)	1.46	1.71	1.67	(c)			
Gd	11	(a)			12	(a)							
Tb							2.16	2.2	1.96	(c)			
Dy	13.1	(a)			13.2	(a)							
Ho													
Er	7.52	(a)			7.63	(a)							
Tm													
Yb	7.06	(a)			7.02	(a)	7.68	7.6	6.97	(c)			
Lu	1.07	(a)					1.05	1.03	0.94	(c)			
Hf							6.7	7.2	6.66	(c)			
Ta							1.3	1.2	1.1	(c)			
W ppb													
Re ppb													
Os ppb													1.5
Ir ppb									<5	(c)			
Pt ppb													
Au ppb									<7	(c)			
Th ppm							0.6		0.9	(c)			
U ppm					0.28	(a)			0.5	(c)			0.16

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

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