75061

Mare Soil

186.5 grams

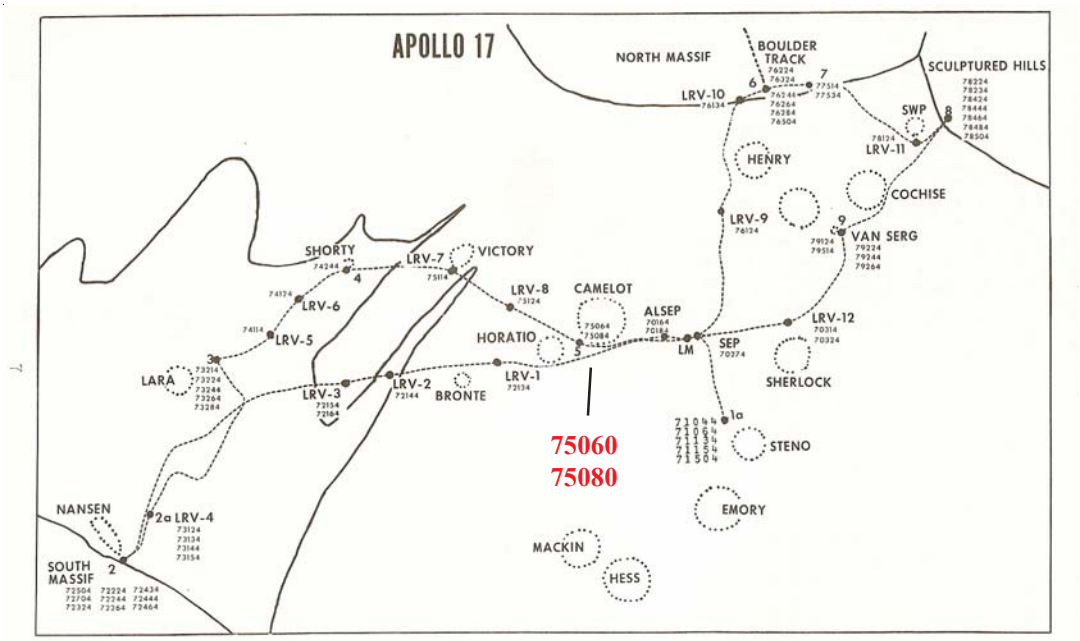


Figure 1: Map of Apollo 17 showing location of soil samples and coarse-fines (Meyer 1973). S73-24071

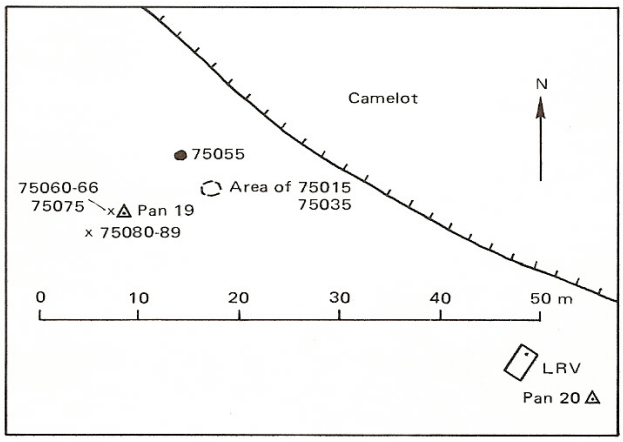


Figure 2: Map of station 5, Apollo 17.

Introduction

75060 was collected from the top surface of a flat boulder of basalt on the rim of Camelot Crater. It is made up of comminuted pieces of that boulder mixed with some soil that was undoubtedly kicked up by meteorite impacts in the adjacent soil. 75075 is a large piece of the boulder and 75080 is a sample of nearby soil (also very basaltic).

Petrography

The maturity of 75061 is I_s/FeO = 33 and the average grain size is 112 microns (Morris 1978, Graf 1993). Heiken and McKay (1974) reported on 24% agglutinate. Meyer (1973) found that most all of the 4 – 10 mm coarse fines were mare basalt.

Chemistry

The FeO content of 75061 is very high (figure 3), and the composition is similar to the basaltic boulder (table).

Muller (1974) determined 42 ppm nitrogen in 75061. Petrowski et al. (1974) determined 94 ppm carbon, 49 ppm nitrogen and 43 ppm hydrogen

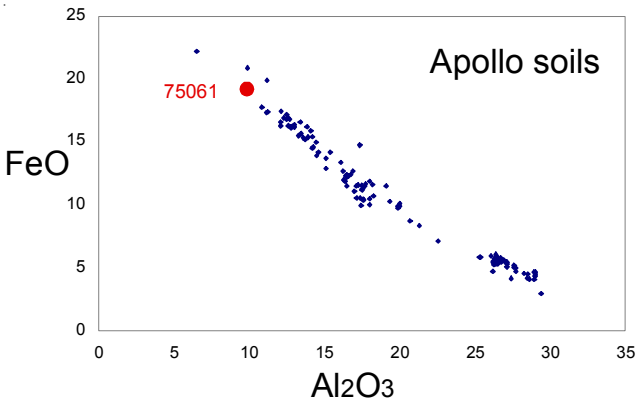


Figure 3: Composition of 75061 compared with other Apollo soils.

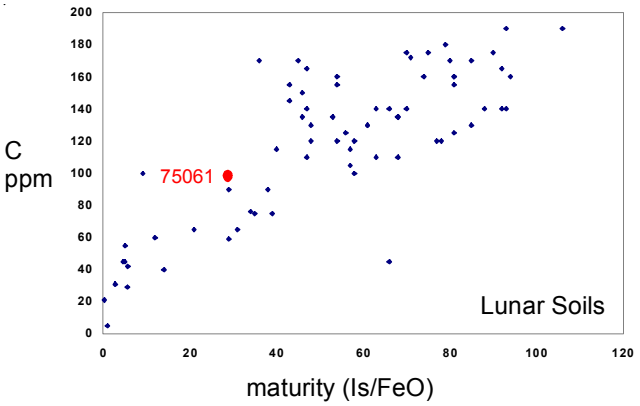


Figure 5: Carbon content and maturity index for 75061.

Cosmogenic isotopes and exposure ages

Keith et al. (1974) determined the cosmic-ray-induced activity of ^{22}Na = 187 dpm/kg, ^{26}Al = 180 dpm/kg, ^{46}Sc = 86 dpm/kg, ^{48}V = 47 dpm/kg, ^{54}Mn = 200 dpm/kg and ^{56}Co = 490 dpm/kg. Rancitelli et al. (1974) determined the cosmic-ray-induced activity of ^{22}Na = 171 dpm/kg, ^{26}Al = 174 dpm/kg, ^{46}Sc = 112 dpm/kg,

Modal content of soil 75061 (90-150 micron).
From Heiken and McKay 1974.

	75061
Agglutinates	24 %
Basalt	26.6
Breccia	4.9
Anorthosite	
Norite	
Gabbro	
Plagioclase	4.6
Pyroxene	29.6
Olivine	0.3
Ilmenite	5.3
Orange glass	1
Glass other	3.2

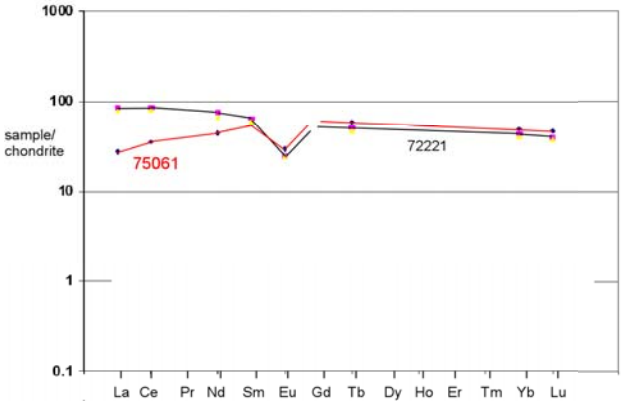
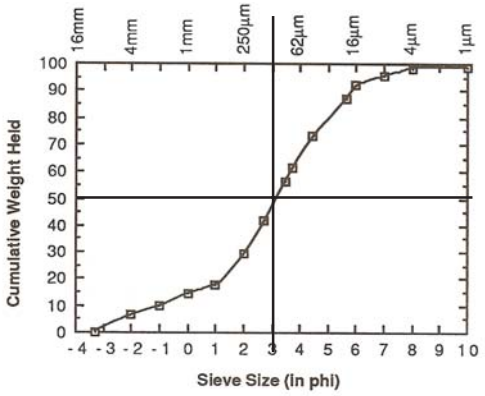


Figure 4: Normalized rare-earth-element diagram for 75061 compared with highland soil 72221.

^{48}V = 26 dpm/kg, ^{54}Mn = 286 dpm/kg, ^{7}Be = 350 dpm/kg and ^{56}Co = 548 dpm/kg.



average grain size = 112 microns

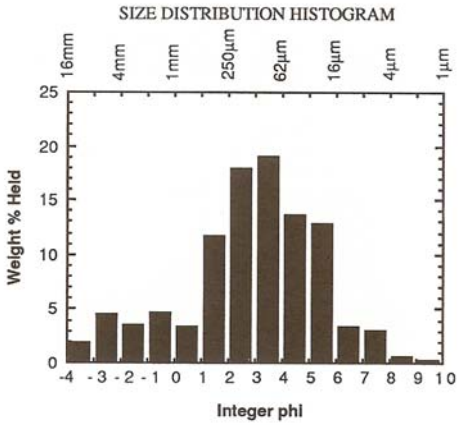
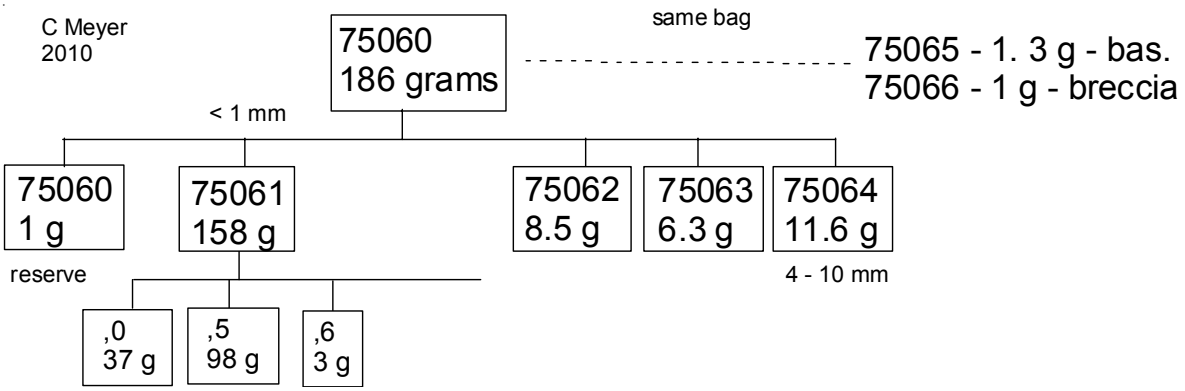


Figure 6: Grain size distribution of 75060 (Graf 1993, data from McKay).

Table 1. Chemical composition of 75061

reference	LSPET73		Wiesman76		Korotev92			Rose74		Keith74	Rancitelli74		Brunfelt74	
weight	Rhodes74		Rhodes74										unpublished	
SiO2 %	39.32	(a)						39.7	(d)					
TiO2	10.31	(a)	11	(b)				10.46	(d)				9.5	(c)
Al2O3	10.42	(a)						10.6	(d)				10.5	(c)
FeO	18.19	(a)			18	17.9	(c)	17.86	(d)				16.8	(c)
MnO	0.25	(a)						0.24	(d)				0.24	(c)
MgO	9.53	(a)						9.65	(d)				7.8	(c)
CaO	10.72	(a)						10.72	(d)				8.96	(c)
Na2O	0.33	(a)	0.35		0.344	0.36	(c)	0.37	(d)				0.39	(c)
K2O	0.08	(a)	0.075	(b)				0.08	(d)	0.079	0.072	(e)	0.084	(c)
P2O5	0.06	(a)												
S %	0.13	(a)												
sum														
Sc ppm					75	70	(c)	78	(d)				65	(c)
V								95	(d)				137	(c)
Cr	3284	(a)	3090	(b)	3480	3280	(c)	3284	(d)				2840	(c)
Co					26.3	27.8	(c)	36	(d)				25	(c)
Ni	115	(a)			100	100	(c)	154	(d)					
Cu								27	(d)				6.9	(c)
Zn	25	(a)						12	(d)				30	(c)
Ga								4.3	(d)				4.1	(c)
Ge ppb														
As														
Se														
Rb	1.6	(a)	1.11	(b)				1	(d)				1.3	(c)
Sr	166	(a)	1.66	(b)	130	210	(c)	157	(d)				173	(c)
Y	83	(a)						91	(d)					
Zr	237	(a)			250	330	(c)	340	(d)					
Nb	21	(a)						20	(d)					
Mo														
Ru														
Rh														
Pd ppb														
Ag ppb														
Cd ppb														
In ppb														
Sn ppb														
Sb ppb														
Te ppb														
Cs ppm													0.075	(c)
Ba			89.5	(b)	80	105	(c)	135	(d)				76	(c)
La			7.07	(b)	6.4	7.34	(c)						5.7	(c)
Ce			23.6	(b)	21	21.3	(c)							
Pr														
Nd			23.1	(b)	20	20	(c)							
Sm			9.09	(b)	8.24	8.62	(c)						8.44	(c)
Eu			1.77	(b)	1.64	1.74	(c)						1.33	(c)
Gd			13.4	(b)										
Tb					2.11	2.18	(c)						2.2	(c)
Dy			15.5	(b)									12.6	(c)
Ho														
Er			9.02	(b)										
Tm														
Yb			8.36	(b)	7.94	8.21	(c)	9.6	(d)				9.8	(c)
Lu					1.12	1.12	(c)						1.08	(c)
Hf					7.37	7.93	(c)						6.8	(c)
Ta					1.4	1.4	(c)						1.32	(c)
W ppb													120	(c)
Re ppb														
Os ppb														
Ir ppb					< 5	5	(c)							
Pt ppb														
Au ppb					< 6	< 7	(c)							
Th ppm					1.1	0.5	(c)			0.91	0.87	(e)	0.61	(c)
U ppm			0.21	(b)	0.23	0.3	(c)			0.248	0.22	(e)	0.22	(c)

technique: (a) XRF, (b) IDMS, (c) INAA, (d) "microchemical", (e) radiation count.



References for 75061

Becker R.H. and Clayton R.N. (1975) Nitrogen abundances and isotopic compositions in lunar samples. *Proc. 6th Lunar Sci. Conf.* 2131-2149.

Butler P. (1973) Lunar Sample Information Catalog Apollo 17. Lunar Receiving Laboratory. MSC 03211 Curator's Catalog. pp. 447.

Fireman E.L., D'Amico J. and DeFelice J. (1973) Radioactivities vs. depth in Apollo 16 and 17 soil. *Proc. 4th Lunar Sci. Conf.* 2131-2144.

Graf J.C. (1993) Lunar Soils Grain Size Catalog. NASA Reference Pub. 1265, March 1993

Heiken G.H. (1974) A catalog of lunar soils. JSC Curator

Heiken G.H. (1975) Petrology of lunar soils. *Rev. Geophys. Space Phys.* **13**, 567-587.

Heiken G.H. and McKay D.S. (1974) Petrology of Apollo 17 soils. *Proc. 5th Lunar Sci. Conf.* 843-860.

Keith J.E., Clark R.S. and Bennett L.J. (1974a) Determination of natural and cosmic ray induced radionuclides in Apollo 17 lunar samples. *Proc. 5th Lunar Sci. Conf.* 2121-2138.

Hintenberger H., Schultz L., and Weber H.W. (1975) A comparison of noble gases in lunar fines and soil breccias: Implications for the origin of soil breccias. *Proc. 6th Lunar Sci. Conf.* 2261-2270.

Hubner W., Kirsten T and Kiko J. (1975) Rare gases in Apollo 17 soils with emphasis on analysis of size and mineral fractions of soil 74241. *Proc. 6th Lunar Sci. Conf.* 2009-2026.

Keith J.E., Clark R.S. and Bennett L.J. (1974a) Determination of natural and cosmic ray induced radionuclides in Apollo 17 lunar samples. *Proc. 5th Lunar Sci. Conf.* 2121-2138.

Korotev R.L. and Kremser D. (1992) Compositional variations in Apollo 17 soils and their relationships to the geology of the Taurus-Littrow site. *Proc. 22nd Lunar Planet. Sci. Conf.* 275-301.

LSPET (1973a) Apollo 17 lunar samples : Chemical and petrographic description. *Science* **182**, 659-690.

LSPET (1973c) Preliminary examination of lunar samples. Apollo 17 Preliminary Science Report. NASA SP-330, 7-1—7-46.

McKay D.S., Fruland R.M. and Heiken G.H. (1974) Grain size and the evolution of lunar soils. *Proc. 5th Lunar Sci. Conf.* 887-906.

Meyer C. (1973) Apollo 17 Coarse Fines (4-10 mm) Sample Location, Classification and Photo Index. Curator Report. pp. 182.

Mitchell J.K., Carrier W.D., Costes N.C., Houston W.N., Scott R.F. and Hovland H.J. (1973) 8. Soil-Mechanics. *In* Apollo 17 Preliminary Science Rpt. NASA SP-330. pages 8-1-22.

Morris R.V. (1976) Surface exposure indicies of lunar soils: A comparative FMR study. *Proc. 7th Lunar Sci. Conf.* 315-335.

Morris R.V., Score R., Dardano C. and Heiken G. (1983) Handbook of Lunar Soils. Two Parts. JSC 19069. Curator's Office, Houston

Morris R.V. (1978) The surface exposure (maturity) of lunar soils: Some concepts and Is/FeO compilation. *Proc. 9th Lunar Sci. Conf.* 2287-2297.

Müller O. (1974a) Solar wind nitrogen and indigenous nitrogen in Apollo 17 lunar samples. *Proc. 5th Lunar Sci. Conf.* 1907-1918.

Müller O. (1974b) Solar wind and indigenous nitrogen in Apollo 17 lunar samples (abs). *Lunar Sci.* **V**, 534-536. Lunar Planetary Institute, Houston.

Müller O. (1975) Lithophile trace and major elements in Apollo 16 and 17 lunar samples. *Proc. 6th Lunar Sci. Conf. 1303*-1312.

Norris S.J., Swart P.K., Wright I.P., Grady M.M. and Pillinger C.T. (1983) A search for a correlatable, isotopically light carbon and nitrogen components in lunar soils and breccias. *Proc. 14th Lunar Planet. Sci. Conf.* in J. Geophys. Res. **88,** B200-B210.

Nyquist L.E., Bansal B.M., Wiesmann H. and Jahn B.M. (1974) Taurus-Littrow chronology: Some constraints on the Early Lunar crustal development. *Proc. 5th Lunar Sci. Conf.* 1515-1540.

Papike J.J., Simon S.B. and Laul J.C. (1982) The lunar regolith: Chemistry, Mineralogy and Petrology. *Rev. Geophys. Space Phys*. **20**, 761-826.

Petrowski C., Kerridge J.F. and Kaplan I.R. (1974) Light element geochemistry of the Apollo 17 site. *Proc. 5th Lunar Sci. Conf*. 1939-1948.

Rancitelli L.A., Perkins R.W., Felix W.D. and Wogman N.A. (1974a) Solar flare and lunar surface process characterization at the Apollo 17 site. *Proc. 5th Lunar Sci. Conf.* 2185-2203.

Rhodes J.M., Rodgers K.V., Shih C., Bansal B.M., Nyquist L.E., Wiesmann H. and Hubbard N.J. (1974) The relationships between geology and soil chemistry at the Apollo 17 landing site. *Proc. 5th Lunar Sci. Conf.* 1097-1117.

Rose H.J., Cuttitta F., Berman S., Brown F.W., Carron M.K., Christian R.P., Dwornik E.J. and Greenland L.P. (1974a) Chemical composition of rocks and soils at Taurus-Littrow. *Proc. 5th Lunar Sci. Conf.* 1119-1133.

Schonfeld E. (1974) The contamination of lunar highland rocks by KREEP: Interpretations by mixing models. *Proc. 5th Lunar Sci. Conf*. 1269-1286.

Wiesmann H. and Hubbard N.J. (1975) A compilation of the Lunar Sample Data Generated by the Gast, Nyquist and Hubbard Lunar Sample PI-Ships. Unpublished. JSC

Wolfe E.W., Bailey N.G., Lucchitta B.K., Muehlberger W.R., Scott D.H., Sutton R.L and Wilshire H.G. (1981) The geologic investigation of the Taurus-Littrow Valley: Apollo 17 Landing Site. US Geol. Survey Prof. Paper, 1080, pp. 280.