15401

Soil

152.7 grams

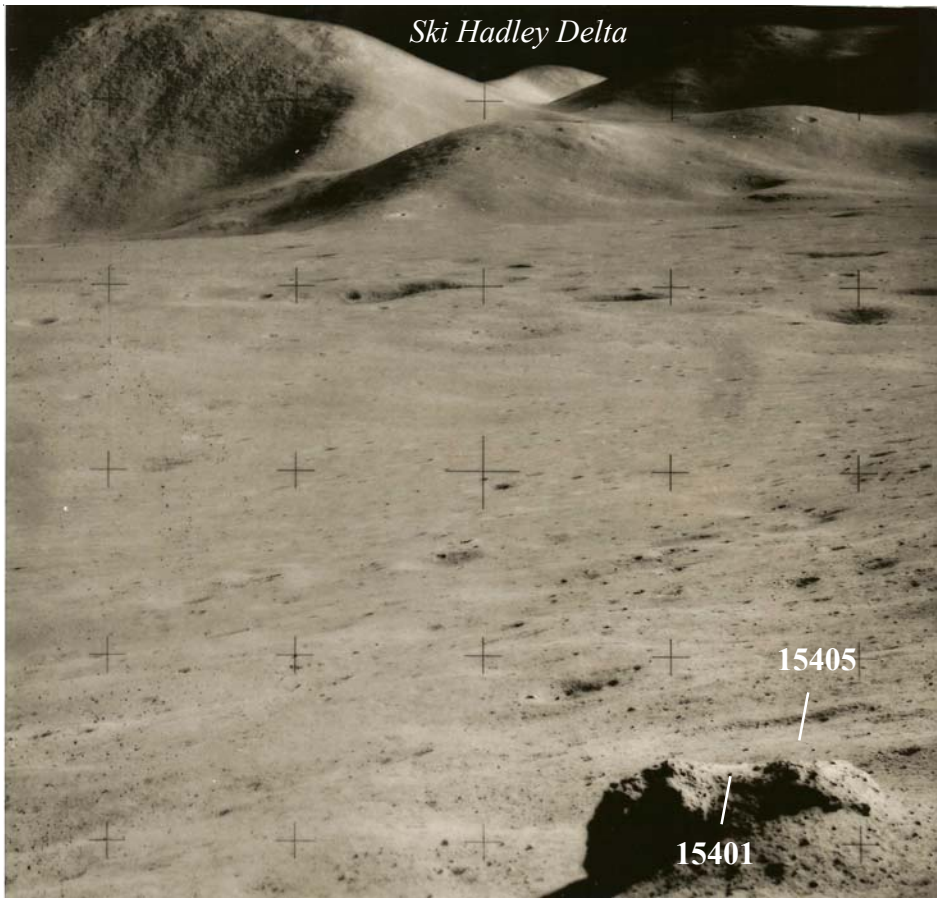


Figure 1: Location of samples 15401 and 15405 from top of boulder at station 6a at the base of the Apennine Front. AS15-90-12187.

Introduction

Station 6a was the highest point reached on the Apennine Front (figure 1). A "soil sample" (15400-15404) was collected from a "saddle" on the top of a small boulder (15405 is a nearby piece of that boulder). As such, it is not a typical soil.

Petrography

15401 is very immature (I_s/FeO = 5.6) (Morris 1978) and it has an unusual grain size distribution weight towards large particles (figure 5). The average grain size distribution of 15401 is 89 microns.

The coarse fines (4-10 mm) were cataloged by Powell (1972) and partially studied by Ryder and Sherman

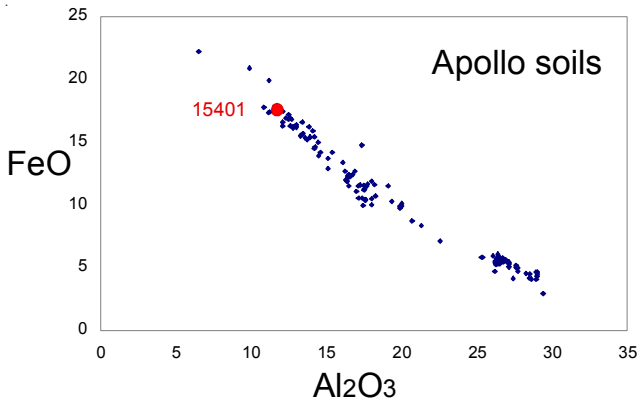


Figure 2: Composition of 15401 compared with other Apollo soils.

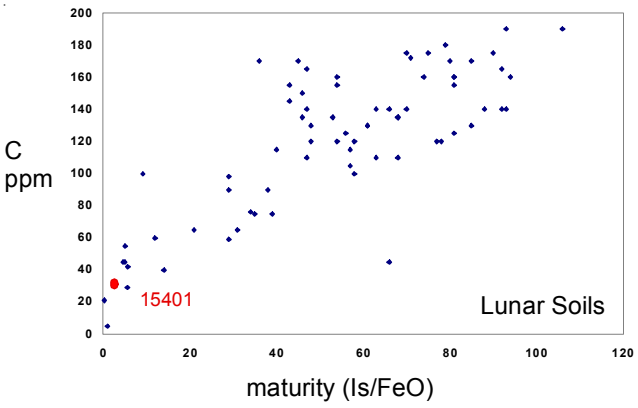


Figure 3: Carbon content and maturity of 15401 compared with other Apollo soils.

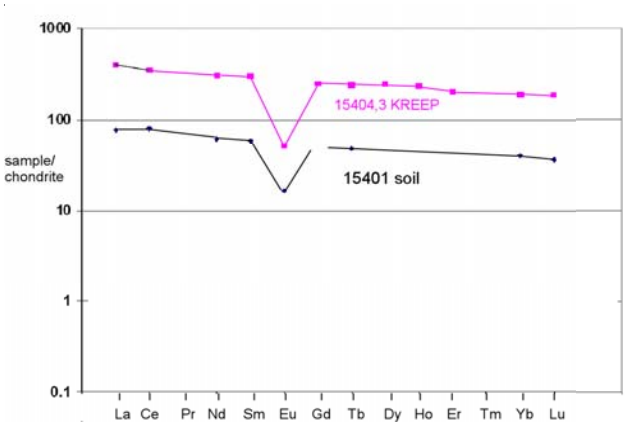


Figure 4: Normalized rare-earth-element diagram for 15401 (Korotev 1987) and 15404,3 (Helmke et al. 1973).

(1989). KREEP particle (15404,3) is partly glass (Helmke et al. 1973) while 15404,5 is a KREEP basalt.

Chemistry

Keith et al. (1972), Korotev (1987), Taylor et al. (1973), Ganapathy et al. (1973) and Masuda et al. (1972) determined the chemical composition of 15401 (table 1 and figures 2 and 4). The trace element content is dominated by the KREEP component (figure 4).

Moore et al. (1973) reported only 29 ppm carbon and DesMarais et al. (1973) found only 21 ppm C, consistent with the very low maturity (figure 3).

Cosmogenic isotopes and exposure ages

Keith et al. (1972) determined the cosmic-ray-induced activity as ^{22}Na = 58 dpm/kg, ^{26}Al = 73 dpm/kg, ^{54}Mn = 29 dpm/kg, ^{56}Co = 12 dpm/kg and ^{46}Sc = 4.1 dpm/kg.

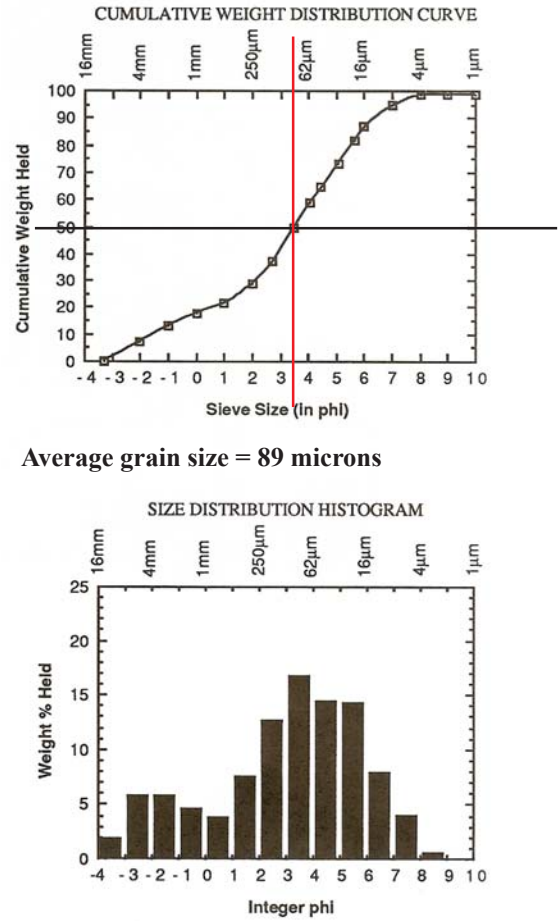
Other Studies

Lipschutz et al. (1973) determined the abundance and isotopic ratio of vanadium.

Hart et al. (1972) determined the density of solar flare tracks in green glass beads and amber shards (figure 6).

Stone et al. (1982) studied 10 green glass beads and several other glass particles from 15401.

Jordan et al. (1974) determined the concentration and isotopic ratio of the rare gasses in 15401.



Average grain size = 89 microns

Figure 5: Grain size distribution for 15400 (Graf 1993).

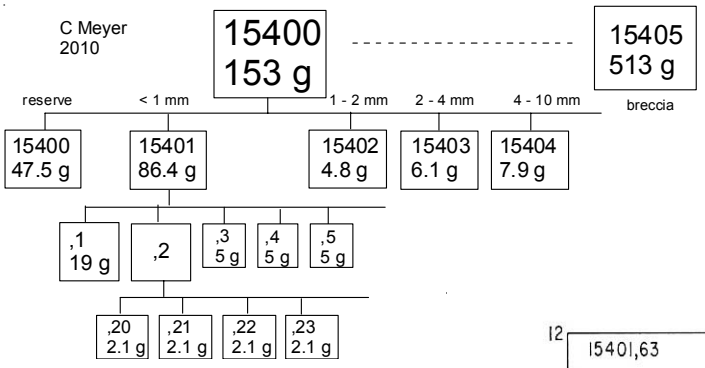
Processing

15400 was returned in a sample collection bag (#6) placed in ALSRC#2 (which did not seal).

Table 1. Chemical composition of 15401.

	86 g																	
reference	Keith72		Korotev87		Taylor73		Ganapathy73			Masuda72			15404,3 Helmke73		15404,5 Ryder93		Green Glass Taylor73	
weight													KREEP		KREEP basalt			
SiO2 %													glass		52.2	(f)	45.3	(b)
TiO2			1.08	(a)											1.78	(f)	0.4	(b)
Al2O3			12.1	(a)											15.5	(f)	7.52	(b)
FeO			16.3	(a)											9.7	(f)	20	(b)
MnO			0.22	(a)											0.14	(f)	0.22	(b)
MgO			14.8	(a)											10.95	(f)	17.1	(b)
CaO			8.3	(a)											9.27	(f)	8.43	(b)
Na2O			0.35	(a)											0.66	(f)	0.13	(b)
K2O	0.172	(c)													0.48	(f)	0.06	(b)
P2O5															0.31	(f)		
S %																		
sum																		
Sc ppm			29.8	(a)	14	(b)							32.2	(a)	19.6	(a)	30	(b)
V			125	(a)	102	(b)											160	(b)
Cr			3070	(a)	2300	(b)												
Co			58.5	(a)	46	(b)	59		(e)				28.2	(a)	25.6	(a)	72	(b)
Ni			160	(a)	217	(b)									68	(a)	185	(b)
Cu					10.5	(b)											6.8	(b)
Zn							65	52	(e)									
Ga					4.4	(b)											4.7	(b)
Ge ppb							248	192	(e)									
As																		
Se							231	162	(e)									
Rb					4.4	(b)	2.9	4.5	(e)						15.2	(a)	0.41	(b)
Sr			100	(a)											178	(a)		
Y					55	(b)											9.5	(b)
Zr			300	(a)	271	(b)									711	(a)	28	(b)
Nb					17.1	(b)											2.1	(b)
Mo																		
Ru																		
Rh																		
Pd ppb																		
Ag ppb							61	59	(e)									
Cd ppb							102	79	(e)									
In ppb							50		(e)									
Sn ppb																		
Sb ppb							0.96	0.74	(e)									
Te ppb							16	18	(e)									
Cs ppm			0.16	(a)	0.19	(b)	0.175	0.195	(e)									
Ba			227	(a)	233	(b)											20	(b)
La			18.2	(a)	18.9	(b)				19.4	(d)		93	(a)	55.8	(a)	1.42	(b)
Ce			49	(a)	46	(b)				51	(d)		210	(a)	143	(a)	3.9	(b)
Pr																	0.51	(b)
Nd			28	(a)	27.5	(b)				31.9	(d)		138	(a)	84	(a)	2.1	(b)
Sm			8.68	(a)	8.5	(b)				9.2	(d)		43.9	(a)	26.1	(a)	0.8	(b)
Eu			0.923	(a)	0.86	(b)				1.003	(d)		2.92	(a)	2.22	(a)	0.26	(b)
Gd					9.5	(b)				10.67	(d)		49	(a)			0.99	(b)
Tb			1.75	(a)	1.59	(b)							8.7	(a)	4.48	(a)	0.16	(b)
Dy					10.1	(b)				12.5	(d)		59.7	(a)			1.1	(b)
Ho					2.5	(b)							13	(a)			0.28	(b)
Er					6.6	(b)				7.33	(d)		32	(a)			0.85	(b)
Tm					1	(b)											0.14	(b)
Yb			6.5	(a)	6.2	(b)				6.41	(d)		30.4	(a)	17.3	(a)	0.81	(b)
Lu			0.88	(a)	0.95	(b)				0.952	(d)		4.51	(a)	2.25	(a)	0.13	(b)
Hf			6.9	(a)	5	(b)							33	(a)	20.7	(a)		
Ta			0.93	(a)											2.21	(a)		
W ppb																		
Re ppb							0.19	0.21	(e)									
Os ppb																		
Ir ppb			<3	(a)			2.3	1.94	(e)									
Pt ppb																		
Au ppb			25	(a)			0.99	1.06	(e)									
Th ppm	3.4	(c)	1.11	(a)	2.93	(b)									9.21	(a)	0.21	(b)
U ppm	0.9	(c)	0.31	(a)	0.74	(b)	0.91	0.92	(e)						2.33	(a)		

technique: (a) INAA, (b) SSMS, (c) radiation counting, (d) IDMS, (e) RNAA, (f) fused-bead e-probe



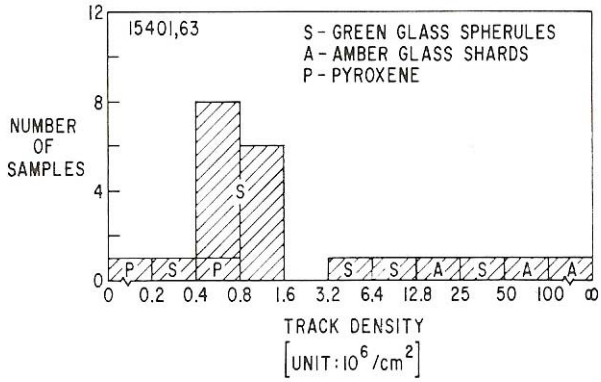


Figure 6: Track density in particles from 15401 (Hart et al. 1972).

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