15498

Regolith Breccia

2340 grams

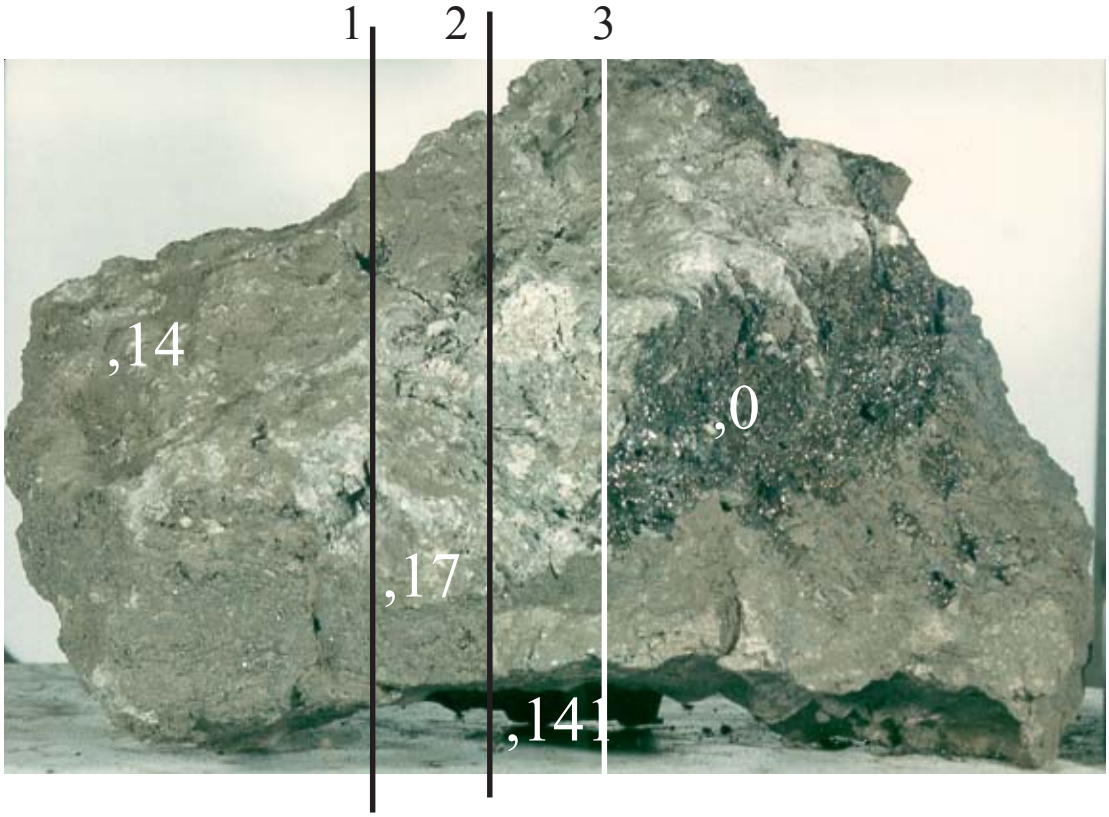


Figure 1: Photo of S1 surface of 15498. NASA S71-44196. Sample is about 15 cm across. Position of saw cuts is illustrated. Black lines for 1972 and white line in 1985.

Introduction

15498 was collected from the soil at the base of the boulder where 15485 and 15499 were sampled (Dune Crater, station 4). It is a brown glass matrix breccia with abundant clasts of mare basalt (figures 1 – 8).

Two large slabs have been cut though the middle of 15498 to provide material for analysis by Lindstrom et al. (1988) and Vetter et al. (1988). No white clasts of highland material were found.

Petrography

Mason (1972) presented the first description of 15498. Ryder (1985) gives a more thorough description. It is a coherent rock with a glass matrix and with a glass splash on the surface (figure 1). It appears to be clast rich; albeit, the clasts are all mare basalts. The sample is also cut by fissures filled with vesicular glass. Much

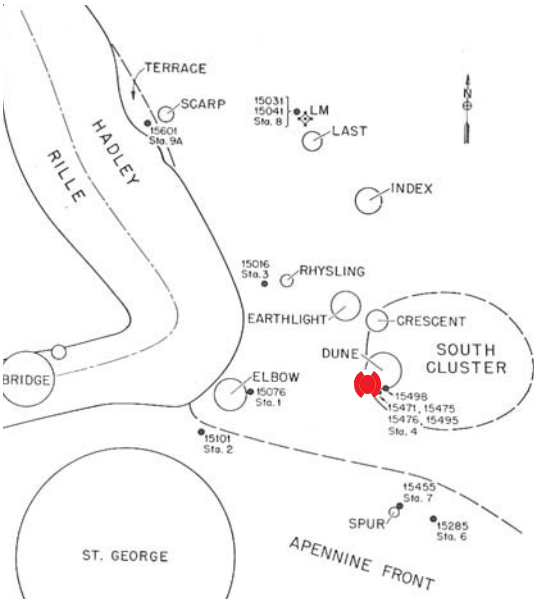


Figure 2: Location of 15498 at Dune Crater (map from O'Kelley et al. 1973).

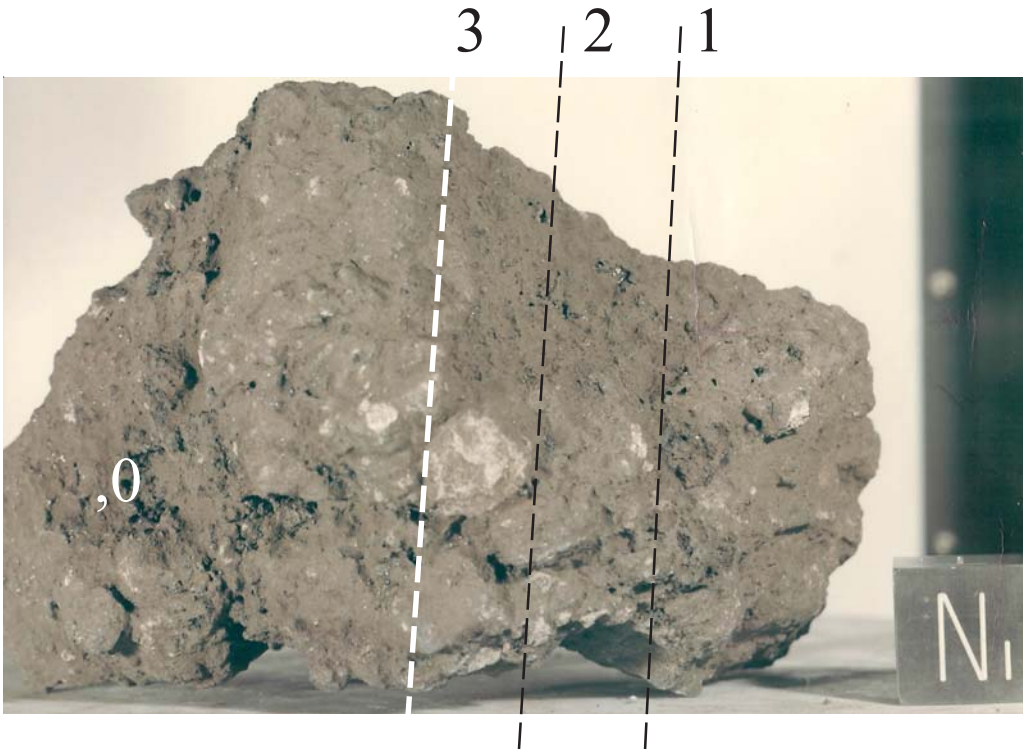


Figure 3: Backside of 15498 with approximate location of saw cuts. S71-45981. Cube is 1 inch.

of the matrix is made up of mineral fragments, apparently from mare basalt.

McKay et al. (1989) reported that the maturity index for 15498 was I_s/FeO = 18. The density is 2.43 g/cm^3.

Most of the lithic clasts in 15498 are mare basalts. Vetter et al. (1988) determined the composition of pyroxene and described the textures of about 25 examples – ranging from olivine normative to quartz normative (figure 10). They include olivine-pyroxene cumulates, which may be biased by small size.

Mineralogy

Pearce et al. (1976) determined the composition of metallic iron grains (figure 9).

Chemistry

Laul and Schmitt (1973) and McKay et al. (1989) reported analyses of the bulk rock (table 1). It is similar to the soil from Dune Crater (figure 14). Lindstrom et al. (1988) analyzed the glass that is so abundant in 15498. Wanke et al. (1976) analyzed a clast.

15498 is one of the most iron rich breccias from Apollo 15 (figure 13), containing an abundance of mare basalt – of variable types (Vetter et al. 1988).

Most of the attention on this breccias sample has been on the analysis of numerous clasts of mare basalt (too numerous to repeat here, see Vetter). They are apparently more diverse than the large samples of mare basalt at Apollo 15 (figure 11).

Kaplan et al. (1976) reported 62 ppm C and 55 ppm N for 15498 and also determined their isotopic composition.

Cosmogenic isotopes and exposure ages

Eldridge et al. (1972) reported the cosmic-ray-induced activity of 15498 as ^{22}Na = 26 dpm/kg, ^{26}Al = 60 dpm/kg, ^{54}Mn = 25 dpm/kg and ^{56}Co = 15 dpm/kg.

Other Studies

Rare gases were determined by Bogard and Nyquist (1972), Megrue (1973) and McKay et al. (1989).

Gose et al. (1973), Pearce et al. (1976) and Brecher (1976) reported magnetic properties.

Alvarez (1975), Warren et al. (1973) and others studied physical properties. Uhlmann and Klein (1976) and Yinnon et al. (1980) reported on glass.

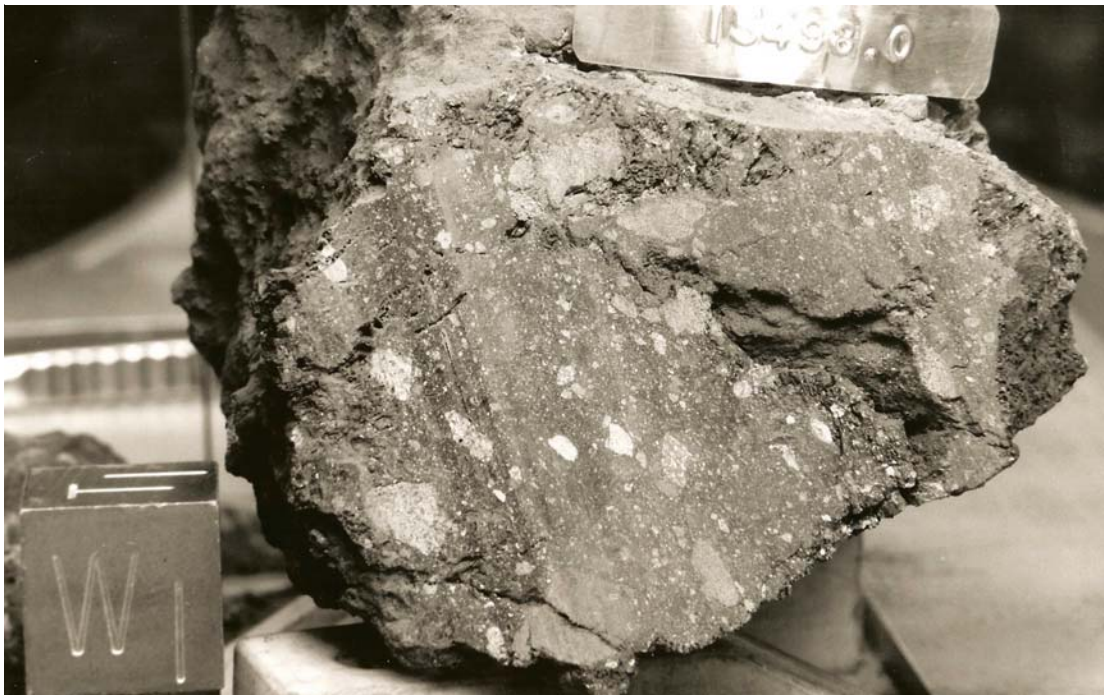


Figure 4: Main mass ,0 after first saw cut. S72-16734. Cube is 1 inch.

Figure 5: Main mass ,0 after second saw cut in 1985. S85-43130 Cube is 1 cm.

Figure 6: Photo of sawn slab 15498,17. S72-16987. Cube is 1 inch.

Figure 7: Subdivision of slab ,17 cut from 15498. Cube is 1 inch. S72-16973

Processing

15498 was the subject of a Consortium led by Brian Mason. Two slabs have been cut; yet one butt end remains huge! There are 45 thin sections.

Figure 8 a, b: Both sides of second slab of 15498 (,141). Cube is 1 cm in this photo. S85-43128 - 129.

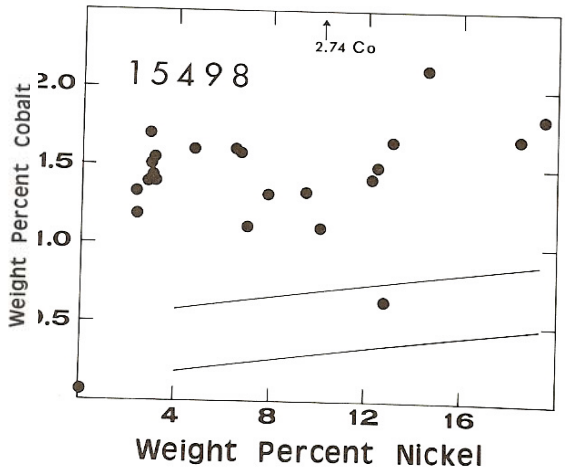


Figure 9: Composition of metal grains in 15498 (Pearce et al. 1976).

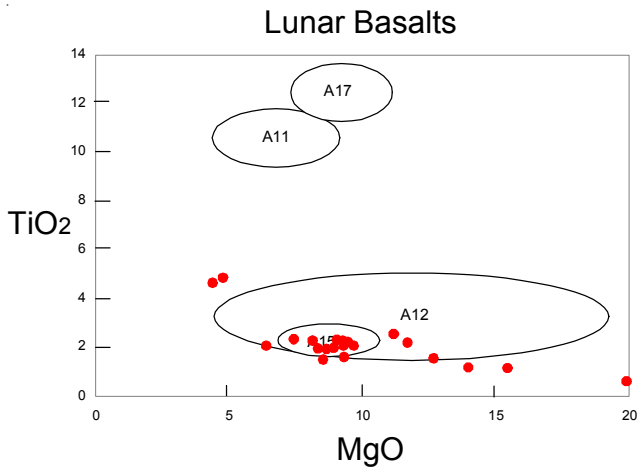


Figure 11: Composition of basalt clast in 15498, from Vetter et al. (1988).

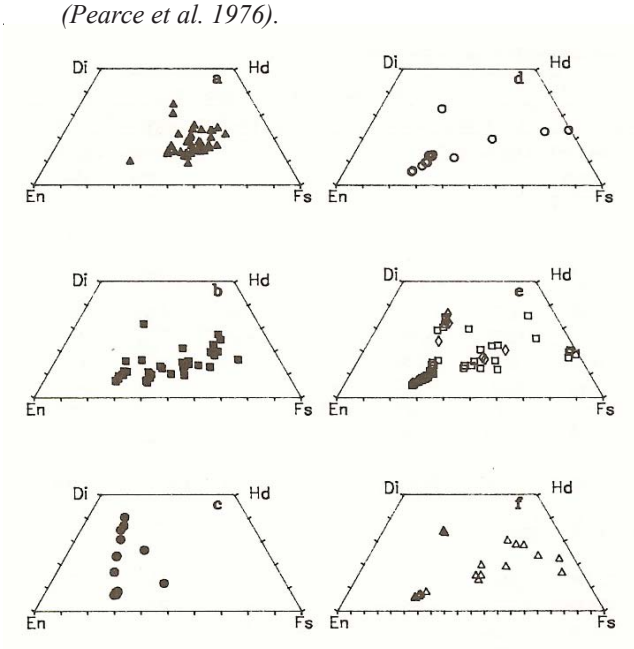


Figure 10: Pyroxenes in mare basalt clasts form 15498 (Vetter et al. 1988).

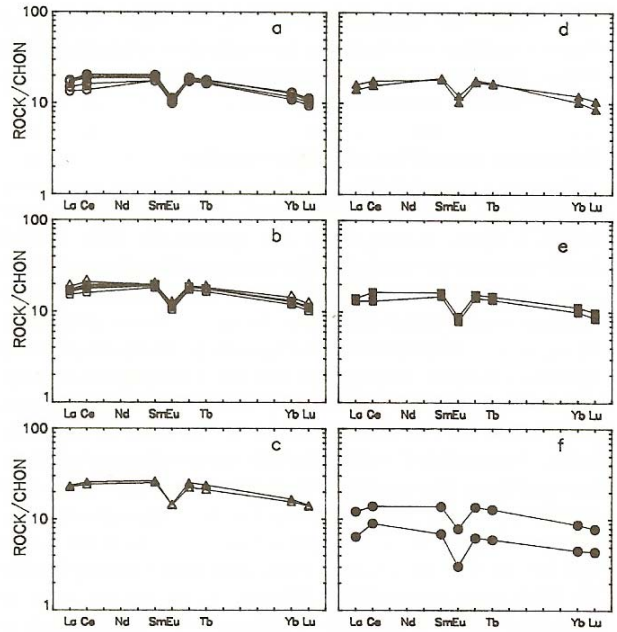


Figure 12: Normalized rare-earth-element diagram for 15498 (from Vetter et al. 1988).

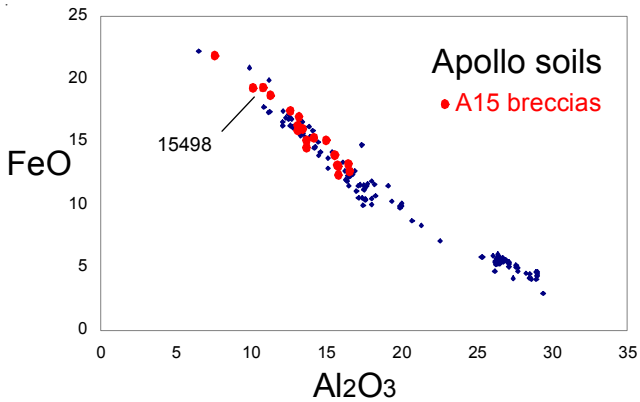


Figure 13: Composition of 15498 compared with Apollo soils and Apollo 15 breccias.

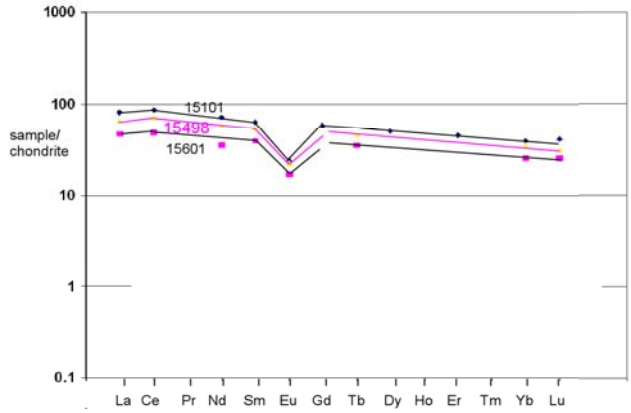
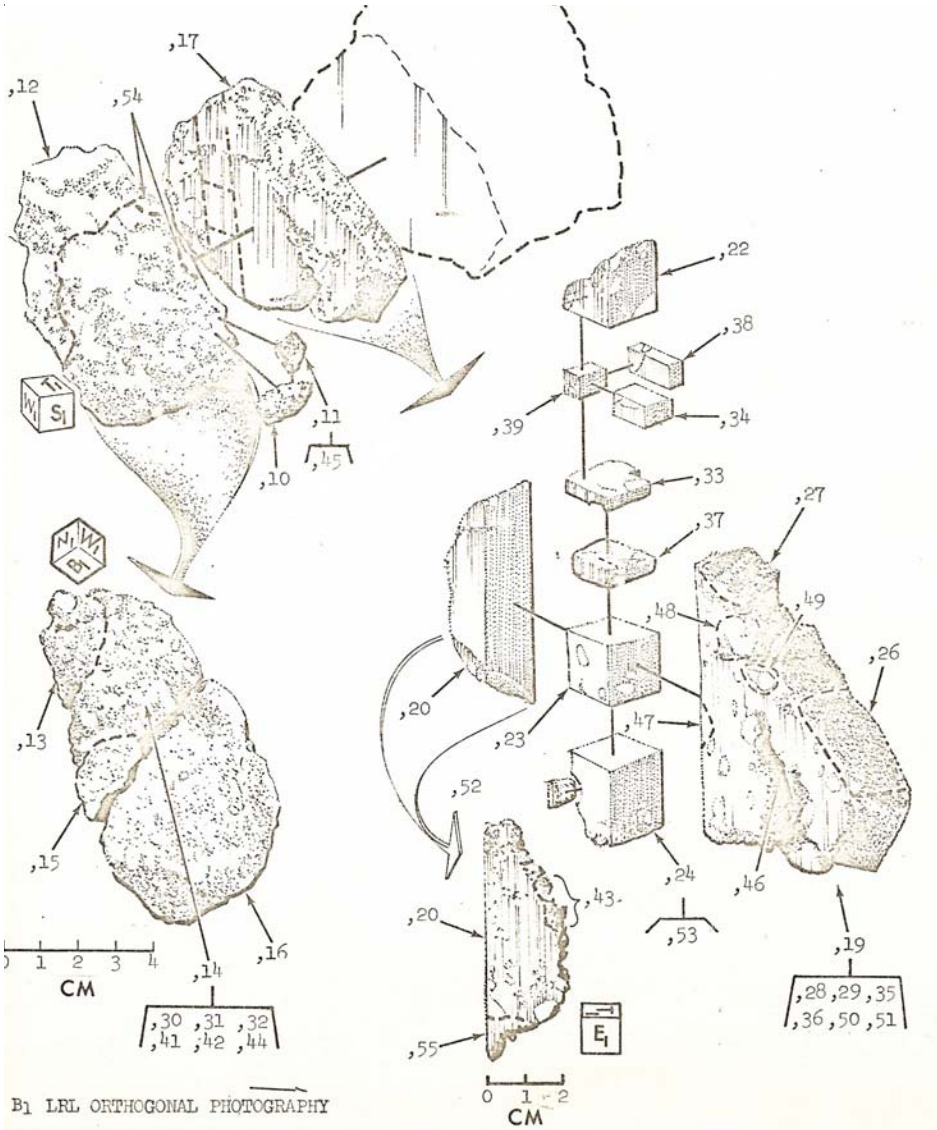


Figure 14: Normalized rare-earth-element diagram for 15498 compared with soils from Apollo 15.

Table 1. Chemical composition of 15498.

						green glass			impact melt						
reference	Laul73			O'Kelley72		Lindstrom87					McKay89	Korotev		Wanke77	
weight												unpuplished		clast	
SiO2 %														47.1	(c)
TiO2	1.6	1.6	(a)			1.11	1.64	0.78	0.72	(a)	1.93	1.93	(a)	1.97	(c)
Al2O3	12.9	13.7	(a)			16.9		22	21.4	(a)	11.8	11.2	(a)	9.8	(c)
FeO	17.3	16.7	(a)			10.2	9.05	6.21	6.48	(a)	17.9	17.9	(a)	19.2	(c)
MnO	0.219	0.207	(a)								0.15	0.15	(a)		(c)
MgO	10	11	(a)			8.2	9.15	8.49	8.5	(a)	9.7	9.7	(a)	9.1	(c)
CaO	10.8	11.1	(a)			12.9	10.81	12.94	12.87	(a)	8.5	8.5	(a)	10.1	(c)
Na2O	0.385	0.395	(a)			0.621	0.72	0.656	0.636	(a)	0.36	0.36	(a)	0.255	(c)
K2O	0.13	0.13	(a)	0.137	(b)	0.44	0.44	0.29	0.29	(a)				0.041	(c)
P2O5															
S %															
sum															
Sc ppm	34	31	(a)			19.2	18	11.4	12.6	(a)	34.1	34.1	(a)	45.9	(c)
V	160	150	(a)								125	117	(a)	182	(c)
Cr	3147	3079	(a)			1570	1670	910	900	(a)	3090	3090	(a)	4020	(c)
Co	43	44	(a)			55.6	20.9	18.5	16.7	(a)	45.7	46	(a)	44.9	(c)
Ni						830				(a)	169	169	(a)	90	(c)
Cu															
Zn															
Ga															
Ge ppb															
As															
Se															
Rb						18	17	13	9	(a)				0.8	
Sr						190	150	200	170	(a)	120	120	(a)	80	
Y														35	(c)
Zr						460	650	400	350	(a)	250	250	(a)	94	(c)
Nb														10	(c)
Mo															
Ru															
Rh															
Pd ppb															
Ag ppb															
Cd ppb															
In ppb															
Sn ppb															
Sb ppb															
Te ppb															
Cs ppm						0.95	0.49	0.23	0.22	(a)	0.15	0.15	(a)		
Ba	140	150	(a)			400	530	330	310	(a)	149	149	(a)	60	(c)
La	15	16	(a)			38	51.1	34.1	27.8	(a)	15.4	15.4	(a)	5.93	(c)
Ce	42	43	(a)			101	141	94	75.6	(a)	43	43	(a)	18	(c)
Pr														2.4	(c)
Nd						54	90	50	42	(a)	25	25	(a)	12	(c)
Sm	7.8	7.8	(a)			17.3	23.1	15.1	12.1	(a)	7.92	7.92	(a)	3.58	(c)
Eu	1.2	1.2	(a)			1.36	2.07	1.62	1.54	(a)	1.24	1.24	(a)	0.76	(c)
Gd														4.91	(c)
Tb	1.6	1.6	(a)			3.96	4.97	3.13	2.72	(a)	1.66	1.66	(a)	0.79	(c)
Dy	9.6	10	(a)											5.35	(c)
Ho														1.09	(c)
Er														3.19	(c)
Tm															
Yb	5.5	5.8	(a)			13	16.2	10.7	10.3	(a)	5.6	5.6	(a)	2.62	(c)
Lu	0.79	0.85	(a)			1.83	2.38	1.55	1.53	(a)	0.75	0.75	(a)	0.37	(c)
Hf	5.7	5.3	(a)			13.8	18.1	10.8	10.3	(a)	6.7	6.7	(a)	2.49	(c)
Ta	0.8	0.8	(a)			1.69	2.02	1.17	1.11	(a)	0.83	0.83	(a)	0.39	(c)
W ppb														96	(c)
Re ppb															
Os ppb															
Ir ppb						2.3		4		(a)	7.1	7.4	(a)		
Pt ppb															
Au ppb						6.7		7		(a)	1.6	1.4	(a)	0.13	(c)
Th ppm	1.9	2.1	(a)	2.5	(b)	7.78	9	6.7	6.1	(a)	2.4	2.4	(a)	1.08	(c)
U ppm	0.7	0.7	(a)	0.65	(b)	2.03	2.5	1.7	1.7	(a)	0.68	0.68	(a)	0.18	(c)

technique: (a) INAA, (b) radiation count., (c) various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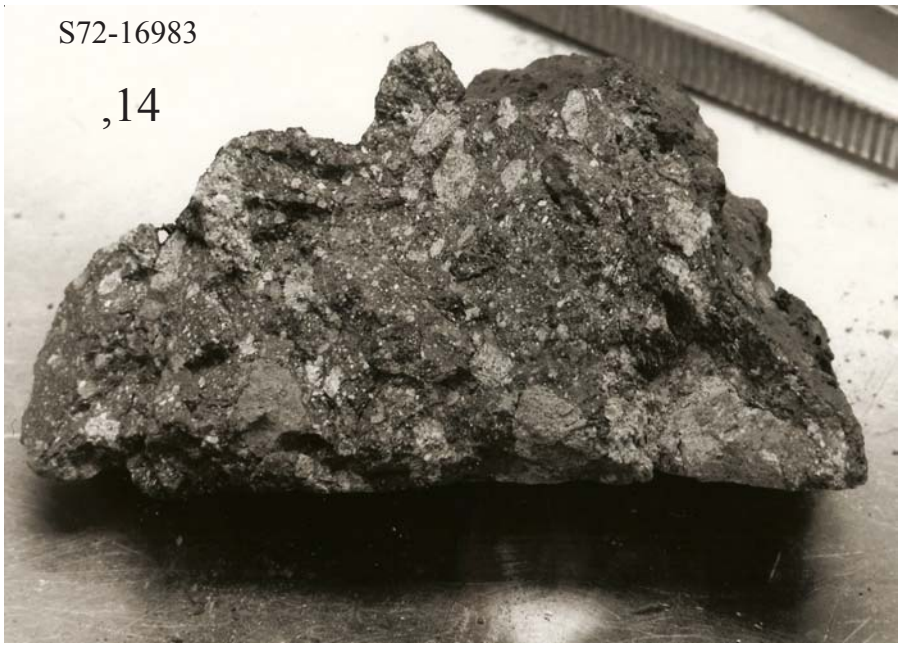
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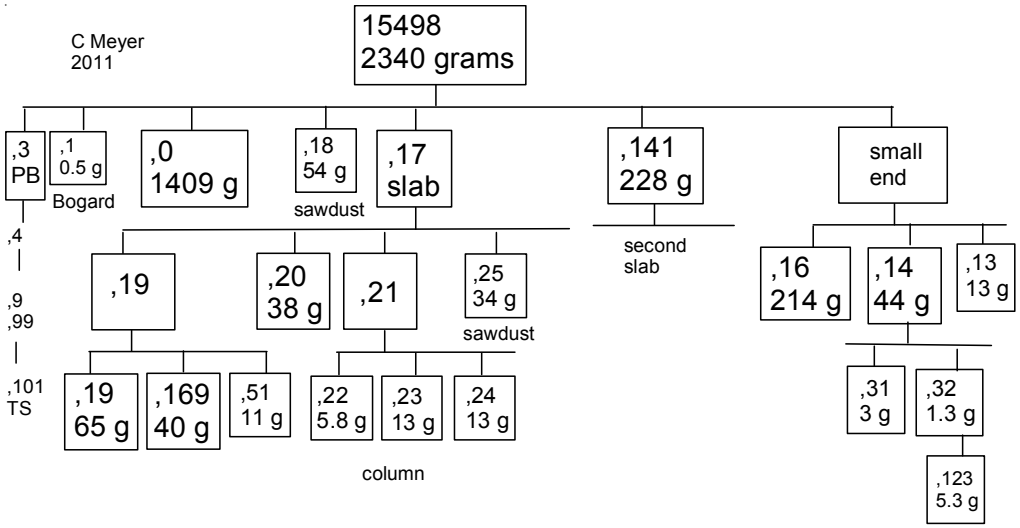

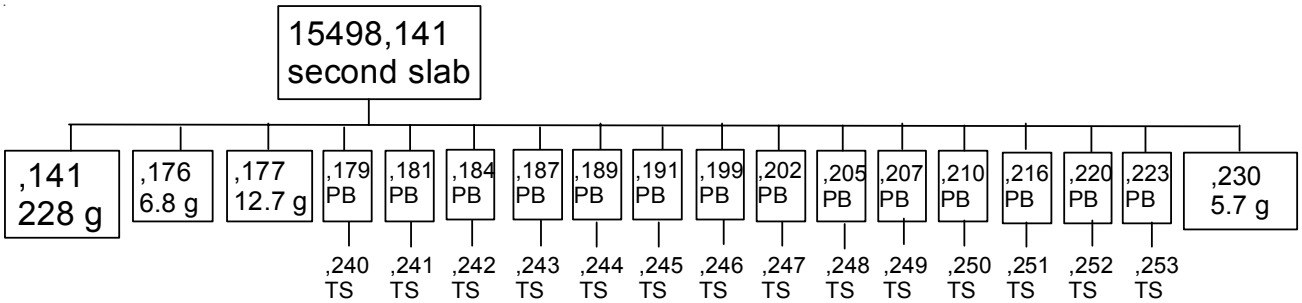

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