72501 and 72530

Landslide Soil

1061 and 18 grams

Introduction

72501 is a soil sample collected about 5 meters from boulder 2 at station 2 on the landslide off of the South Massif at Apollo 17 (Wolfe et al. 1981). It contained one rock fragment - 72505. A large rake sample (72535-559) was collected adjacent to this soil sample. The rock fragments from this location are all impact melt breccias – similar to the adjacent boulder (72315). 72530 is the residue in the bag for the rake sample and may contain material abraded off of the rake samples – mixed with some soil.

Station 2 is located on the bottom slope of the South Massif, but in close proximity of Nansen Crater (figures 5 and 6). Soil sample 72320 was collected about 5 meters away. 72700 was collected on the other side of Nansen Crater.

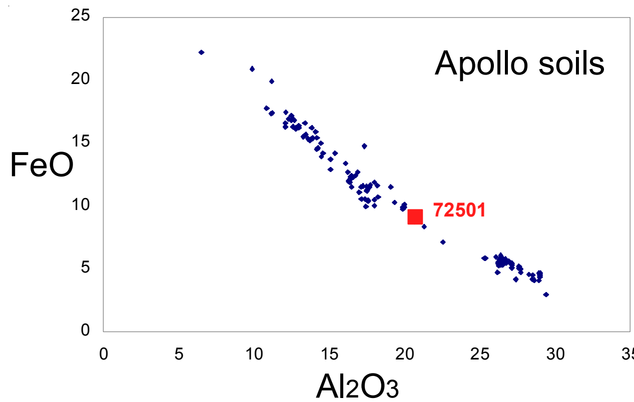


Figure 1: Composition of 72501 (landslide) compared with other lunar soils.

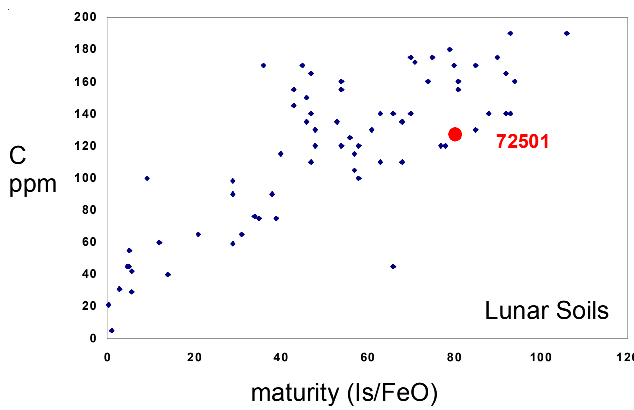


Figure 2: Carbon content and maturity index for 72501 compared with other lunar soil samples.

Petrography

72501 is one of the soils that Papike et al. (1982) considered a "reference" soil. It is a mature soil with maturity index I_s/FeO = 81 (Morris 1978), average grain size 59 microns (Graf 1992) and high agglutinate content. The grain size distribution was determined by Butler and King (1974) and Green et al. (1975) and the mineralogic mode given by Heiken and McKay (1974) and Simon et al. (1981). Meyer (1973) cataloged the 4 – 10 mm coarse-fines. Bence et al. (1974) and Jolliff et al. (1996) studied several coarse-fines from 72503 (figures 7 and 8).

Chemistry

This is an Al-rich and Fe-poor soil (figure 1), derived from feldspathic impact melt rocks from high up on the South Massif (rim of Serenitatis basin?). Laul et al. (1981) also reported the composition as function of grain size. The rare earth pattern is distinctive of a high KREEP component (figure 9). Krahenbuhl et al. (1977) studied the distribution of volatile elements (Cd, Ge, Hg, In, Sb and Zn) as function of grain size.

LSPET (1973), Moore et al. (1974) and DesMarais et al. (1975) reported 125 and 135 ppm carbon, respectively. Müller (1974) determined nitrogen = 70

Mineralogical Mode for 72501

	Simon et al. 1981 (90 to 1000 micron)	*Heiken 1974 (90 to 150 micron*
Mare basalt	2.9	3.3
feldspathic basalt	0.2	
anorthosite, norite	5.2	2.7
breccias, light	2.4	8.7
poikilitic breccias	9.7	12.6
mafic mineral	5.2	6
plagioclase	10.9	6.3
opaque	0.1	0.3
glass	3	3.4
agglutinate	37.6	48
dark breccias	22.6	8.3

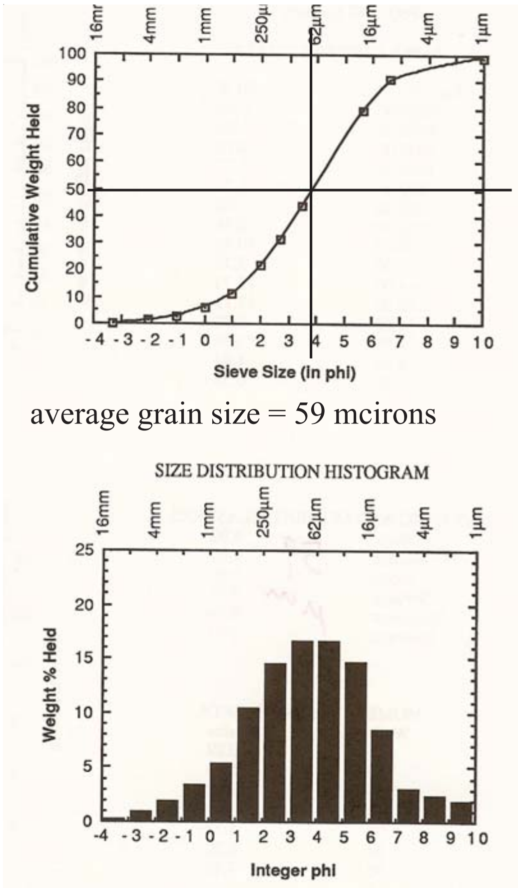


Figure 3: Grain size distribution for 72500 (Graf 1993, data by McKay).

ppm. Norris et al. (1983) reported carbon = 109 ppm and nitrogen = 94 ppm in 72501. Most carbon and nitrogen are implanted by the solar wind, and are a measure of soil maturity (figure 2). Goel et al. (1975) found 92 ppm nitrogen.

Radiogenic age dating

Particles from 72503 have been dated by Schaeffer and Husain (1974) with the $^{40}Ar/^{39}Ar$ plateau technique (figure 10).

Cosmogenic isotopes and exposure ages

Goswami and Lal (1974) determined the fossil SCR nuclear track density.

Curtis and Wasserburg (1977) determined the isotopic ratio for Gd to determine the total flux of neutrons.

Other Studies

Hua et al. (1976) determined the ultraviolet spectra. Durrani and Hwang (1975) produced "glow curves" for 72501 to compare with samples from different depths in the station 8 trench (figure 11).

Merlivat (1974) reported the hydrogen content and isotopic ratio of 72501.

Silver (1974) determined the U, Th and Pb isotope system for 72500 and other Apollo 17 soils.

Rees and Thode (1974) reported the isotopic composition of sulfur.

Bogard et al. (1974) and Hubner et al. (1974) reported the rare gas content and isotopic ratios and Wieler et al. (1983) reported rare gas content and isotopic ratios for mineral separates (plagioclase, pyroxene and agglutinate) from 72501.

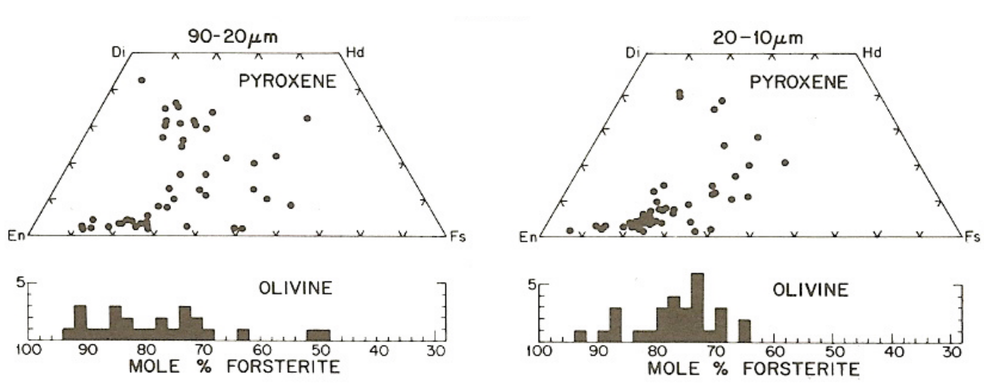


Figure 4: Composition of olivine and pyroxene in 72501 (Simon et al. 1981).

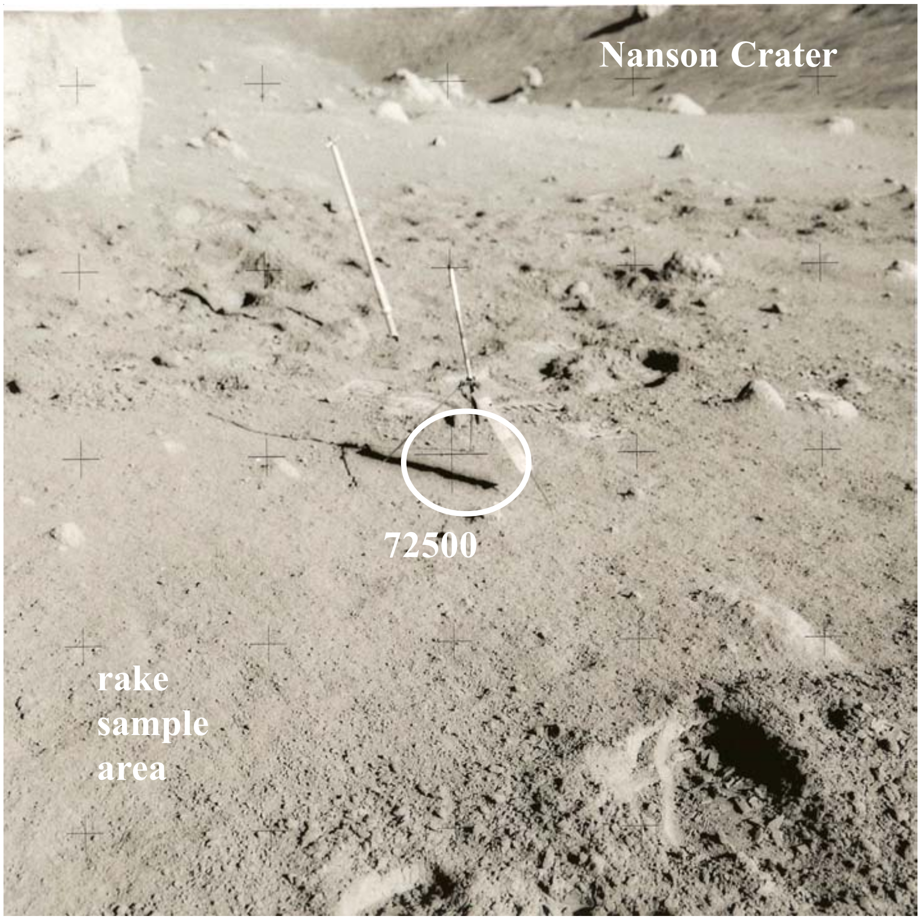


Figure 5: Location of 72500 near Nanson Crater. AS17-138-21045

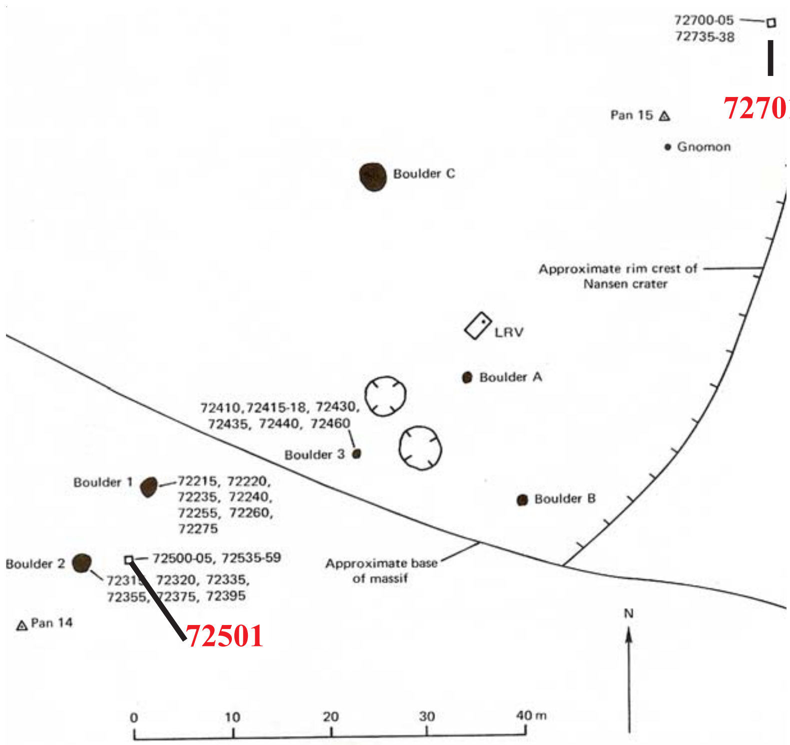


Figure 6: Map showing locations of soils and boulders at station 2, Apollo 17.

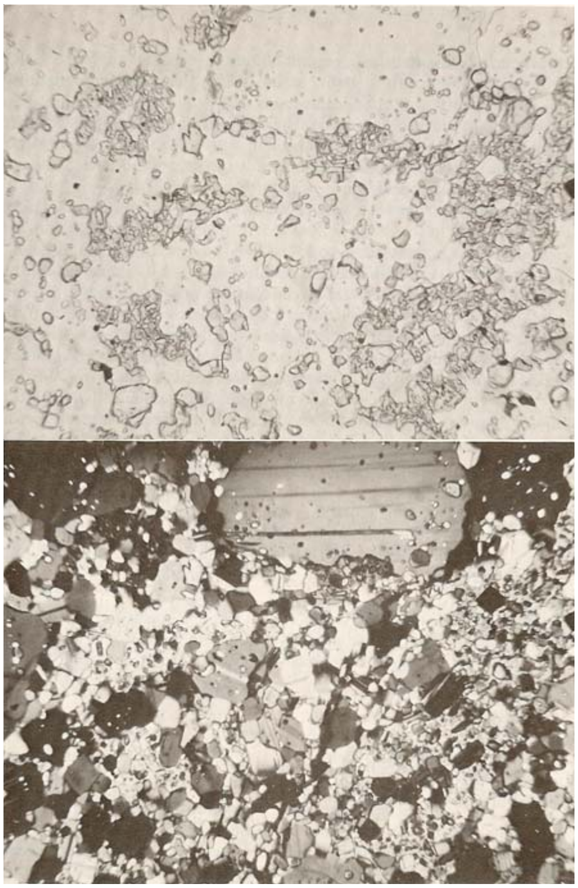


Figure 7: Photomicrographs of thin section of recrystallized noritic anorthositie particle 72503,8,15 (Bence et al. 1974). Field of view is 1.4 mm.

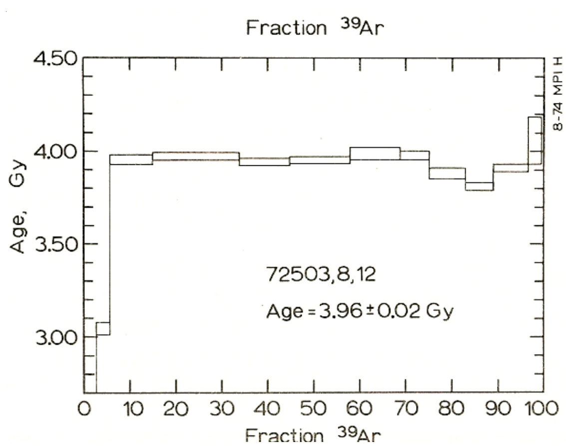


Figure 10: Ar age plateau for coarse-fine particle from 72503 (Schaeffer and Husain 1974).

Summary of Age Data for 72503

	Ar/Ar
Schaeffer et al. 1974	3.96 ± 0.02 b.y.

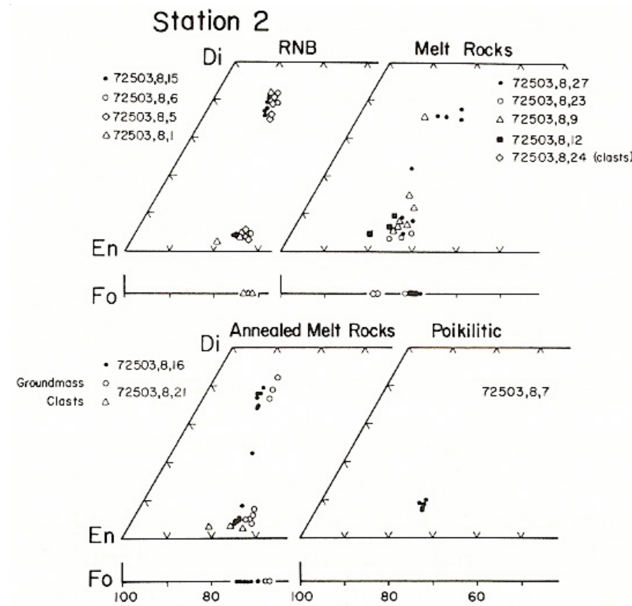


Figure 8: Pyroxenes in several particles from soil 72500 (Bence et al. 1974).

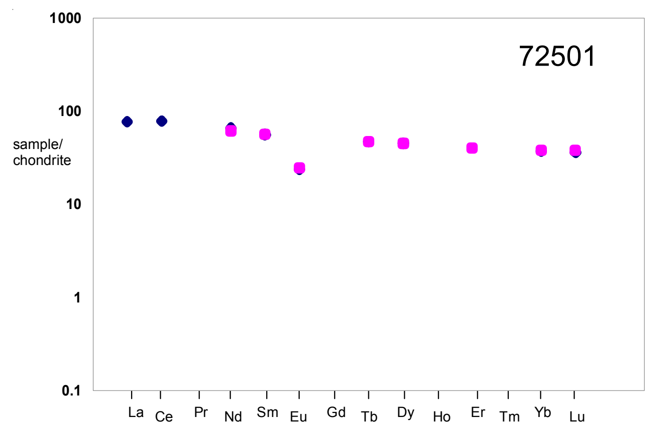


Figure 9: Normalized rare-earth-element diagram for 72501.

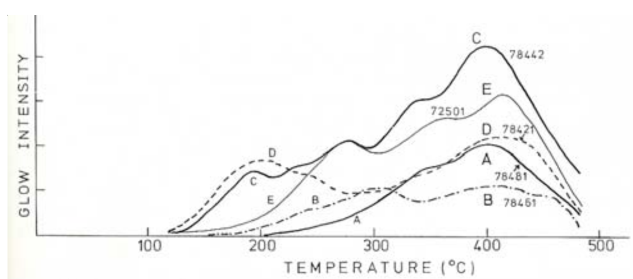
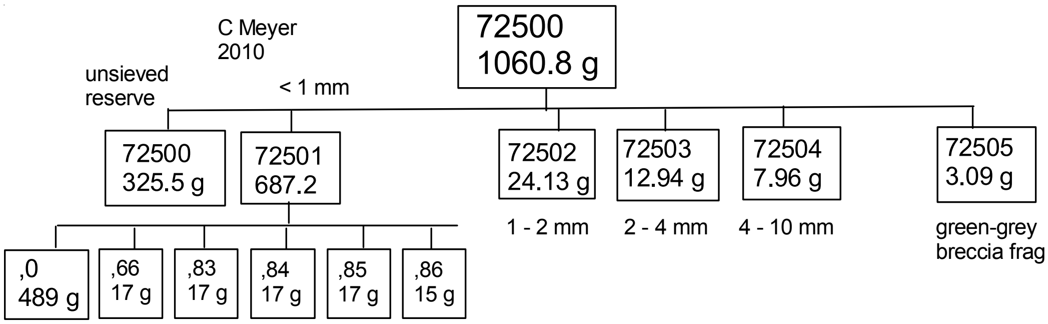


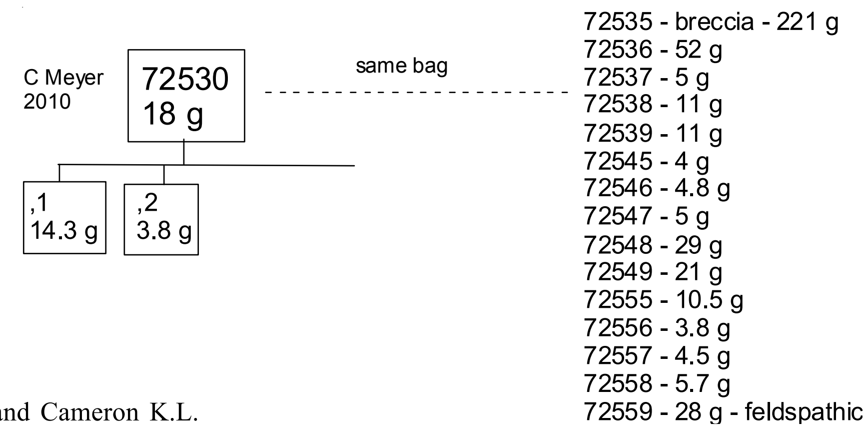
Figure 11: Glow curve for Apollo 17 samples (Duranni and Huang 1974).

Table 1. Chemical composition of 72501.

reference	Laul74			Laul 81		LSPET73 Rhodes74 Wiesmann76			Philpotts74		Chou76		Brunfelt74		Jolliff96 unpublished		Miller74	Scoon74	
weight																			
SiO2 %				45.2	(a)	45.12	45.17	(b)									44.5	45.52	(e)
TiO2	1.5	1.7	(a)	1.4	(a)	1.56	1.55	(b)					1.17	(a)			~1.7	1.62	(e)
Al2O3	20.7	21	(a)	20.1	(a)	20.64	20.63	(b)					21.3	(a)			20.2	20.52	(e)
FeO	8.6	8.6	(a)	9.5	(a)	8.77	8.74	(b)			8.62	(a)	8.46	(a)	8.52	(a)	8.2	8.98	(e)
MnO	0.112	0.114	(a)	0.12	(a)	0.11	0.13	(b)			0.125	(a)	0.115	(a)			0.11	0.12	(e)
MgO	10	10	(a)	10	(a)	10.08	9.87	(b)					10.9	(a)			10.4	9.9	(e)
CaO	12.6	12.8	(a)	12.5	(a)	12.86	12.84	(b)					14.8	(a)	13.1	(a)	12.7	12.69	(e)
Na2O	0.47	0.49	(a)	0.44	(a)	0.4	0.46	(b)					0.47	(a)	0.45	(a)	0.54	0.5	(e)
K2O	0.16	0.16	(a)	0.17	(a)	0.164		(c)	0.17	(c)	0.16	(a)	0.17	(a)				0.17	(e)
P2O5						0.13	0.15	(b)										0.04	(e)
S %						0.09	0.06	(b)											
sum																			
Sc ppm	18	18	(a)	20	(a)						19	(a)	17.7	(a)	18.9	(a)			
V	45	50	(a)	45	(a)								61	(a)					
Cr	1437	1485	(a)	1573	(a)	1476		(c)			1450	(a)	1390	(a)	1495	(a)			
Co	31	35	(a)	33	(a)						32	(a)	38	(a)	27.6	(a)			
Ni	250	340	(a)	260	(a)	241	231	(b)			293	(a)			250	(a)			
Cu	**Krahenbuhl77**		**(d)**										6.4	(a)					
Zn	18	17	**(d)**			21	21	(b)					20	(a)	26	(a)			
Ga													4.5	(a)					
Ge ppb	368	400	**(d)**																
As																			
Se																			
Rb						4.077		(c)	4.6	(c)			3.8	(a)	6	(a)			
Sr				160	(a)	155		(c)	155	(c)			101	(a)	143	(a)			
Y						64	63	(b)											
Zr	220	200	(a)			259		(c)	288	(c)					248	(a)			
Nb						18	18	(b)											
Mo																			
Ru																			
Rh																			
Pd ppb																			
Ag ppb																			
Cd ppb	42	39	**(d)**																
In ppb	2.8	2.1	**(d)**																
Sn ppb																			
Sb ppb	2.8	2.5	**(d)**																
Te ppb																			
Cs ppm													0.18	(a)	0.16	(a)			
Ba	190	170	(a)	210	(a)	200		(c)	211	(c)	186	(a)	163	(a)	209	(a)			
La	18	17.8	(a)	16.2	(a)	17.1		(c)			17.1	(a)	13.9	(a)	17.3	(a)			
Ce	47	47	(a)	46	(a)	44.6		(c)			47	(a)			45.4	(a)			
Pr																			
Nd	30	31	(a)	29	(a)				27.8	(c)	29	(a)			26.5	(a)			
Sm	8.2	8.3	(a)	8	(a)	8.18		(c)	8.18	(c)	8.1	(a)	7.99	(a)	8.45	(a)			
Eu	1.33	1.32	(a)	1.3	(a)	1.33		(c)	1.38	(c)	1.37	(a)	1.43	(a)	1.32	(a)			
Gd						10.4		(c)	9.74	(c)									
Tb	1.7	1.6	(a)	1.6	(a)						1.7	(a)	1.58	(a)	1.76	(a)			
Dy	11	11	(a)	10	(a)	11.1		(c)	11	(c)	11	(a)	9	(a)					
Ho																			
Er						6.58		(c)	6.33	(c)									
Tm				0.84	(a)														
Yb	6	6.2	(a)	5.9	(a)	6.15		(c)	6.14	(c)	6	(a)	6.6	(a)	6.16	(a)			
Lu	0.87	0.84	(a)	0.82	(a)				0.929	(c)	0.91	(a)	0.89	(a)	0.86	(a)			
Hf	6.1	6.1	(a)	6	(a)						7	(a)	4.7	(a)	6.5	(a)			
Ta	0.84	0.84	(a)	0.9	(a)						0.86	(a)	0.9	(a)	0.86	(a)			
W ppb													520	(a)					
Re ppb																			
Os ppb																			
Ir ppb	8	10	(a)								9	(a)			7.9	(a)			
Pt ppb																			
Au ppb	4	5	(a)								5.5	(a)			3.8	(a)			
Th ppm	2.9	3	(a)	3	(a)	3.14		(c)			2.8	(a)	2.24	(a)	3	(a)			
U ppm	1	1	(a)	1	(a)	0.87		(c)					0.75	(a)	0.82	(a)			

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





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