10085

Coarse-fines

569 grams

DRAFT

Figure 1: Selected coarse fines from 10085. Scale is in mm. Photo from Wood et al. 1969.

Introduction

!0085 and 10084 were created during the Apollo 11 preliminary examination by sieving a large portion of 10002. 10084 was what passed through a 1 mm sieve and 10085 was what did not (figure 1). However, it is not likely that sieving such a large mass would have gone to completion, so 10085 would still have had a lot of < 1 mm material.

The coarse-fine particles from 10085 were widely distributed during the first allocations of lunar samples (e.g. Chao et al. 1970, Wood et al. 1970, King et al. 1970, von Englehardt et al. 1970). An interesting aspect of lunar samples is that they are fine-grained enough for a sample on the order of 100 mg, or 2 mm in size, to generally be large enough to represent a "whole rock".

Petrography

There are ~250 thin sections of 10085 material. This is how the first anorthosites were recognized (Wood et al. 1970) and Luny Rock # 1 was probably found this way (Albee and Chodos 1970). A large metal particle (88 mg), termed "minimoon", was found in 10085 (figure 2).

Figure 2: "Minimoon". 3.5 mm. Goldstein et al. 1970.

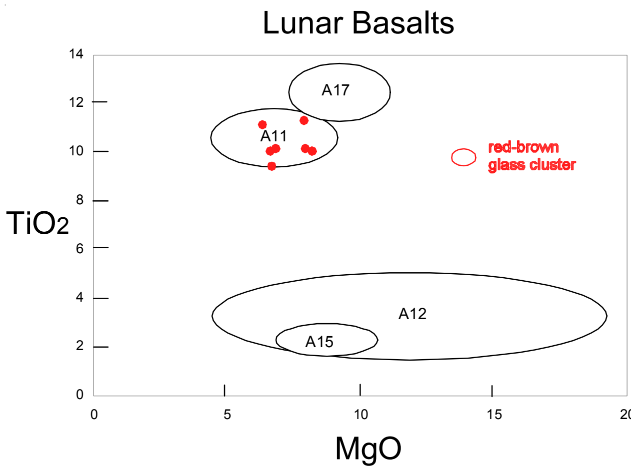


Figure 3: Compsoition of small basalt fragments and of tightly-clustered volcanic glass in coarse-fines.

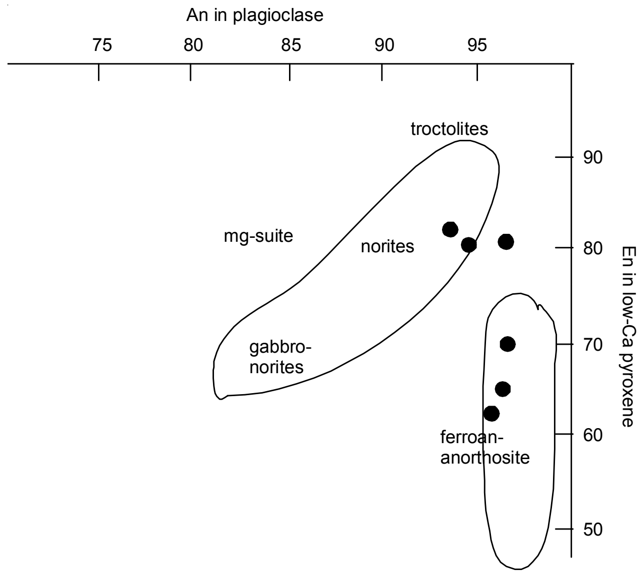


Figure 4: Composition of pyroxene and plagioclase in some of the white rocks from 10085 (from Simon et al. 1983).

King et al. (1970) state " sample 10085,11 contained 1227 grains as follows: mafic holocrystalline rock fragments, 585; microbreccia, 395; glass splatter and agglomerates, 204; regularly shaped glass (spheres, dumbbells etc), 6 ; anorthosite and other light colored rock fragments, 37." Wood et al. (1970) reported 37% basalt, 52% soil breccia, 4% glass, 2% anorthosite, 1.5% anorthosite glass and 1.5% anorthositic breccia.

Beaty et al. (1979) and Grove and Beaty (1980) studied numerous small basalt samples (figure 3, table 1).

Simon et al. (1983) and Laul et al. (1983) studied the small white particles in 10085 (figure 4, table 2).

Chemistry
Laul et al. (1983) analyzed 38 small white rock fragments from 10085 (table 2) and Beaty et al. (1979) analyzed a number of small basalt fragments (table 1).

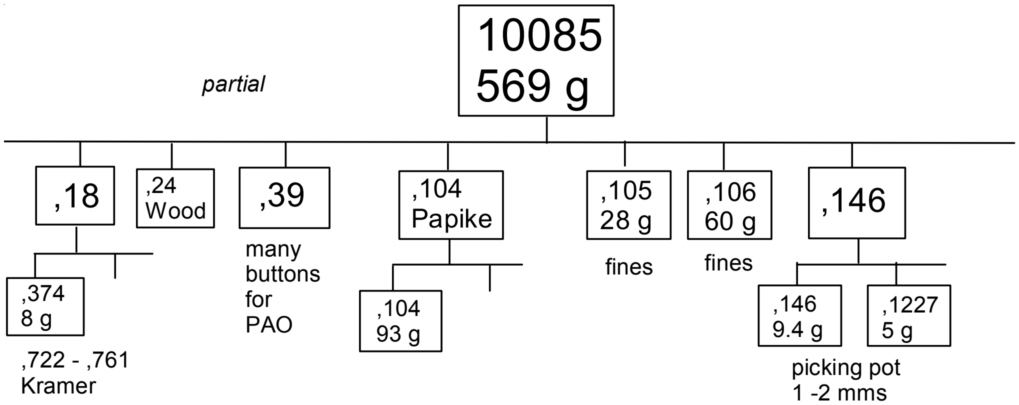
Processing
The sieving of 10084, 10085 is a mystery – see section on 10084. In the 1980s, Simon picked white particles out of ,104, followed by Larry Taylor who picked out basalt particles – see processing photos from data pack.

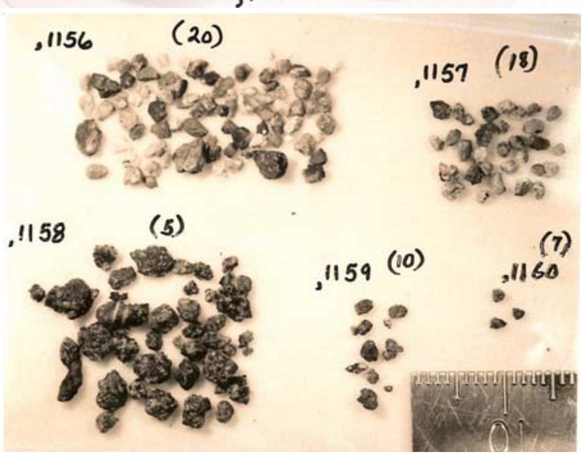
Table 1. Chemical composition of 10085 particles (basalts).

reference	Beaty 79								
weight									
SiO2 %									
TiO2	10.2	11.6	10.2	10.1	9.3	10.3	12.1	11.1	(a)
Al2O3	8	8.2	8.1	8.1	8.7	8.2	8.8	8.3	(a)
FeO	20	21.5	20.2	20.4	20	20.6	20.4	19.5	(a)
MnO	0.25	0.25	0.25	0.25	0.25	0.24	0.23	0.25	(a)
MgO	8	8	8	7	7	7	8	7	(a)
CaO	10	11.1	10.6	11	10.8	10.1	10.7	10	(a)
Na2O	0.5	0.5	0.52	0.51	0.58	0.49	0.5	0.48	(a)
K2O	0.26	0.25	0.32	0.32	0.34	0.31	0.28	0.3	(a)
P2O5									
S %									
sum									
Sc ppm	84	89	82	84	76	84	85	87	(a)
V	66	84	63	66	52	56	79	65	(a)
Cr									
Co	26	29	27	27	24	26	27	28	(a)
Ni									
Cu									
Zn									
Ga									
Ge ppb									
As									
Se									
Rb									
Sr									
Y									
Zr	520	360	430	440	400	500		370	
Nb									
Mo									
Ru									
Rh									
Pd ppb									
Ag ppb									
Cd ppb									
In ppb									
Sn ppb									
Sb ppb									
Te ppb									
Cs ppm									
Ba	230	240	330	320	380	330	290	400	
La	23	22.3	27.2	26.9	33	28.7	25.2	25.7	
Ce	75	72	83	80	98	100	90	79	
Pr									
Nd	62	58	71	70	80	74	64	65	
Sm	19.2	18.2	21.6	21.1	24.6	22.6	20.1	20.6	
Eu	2.11	2.06	2.25	2.26	2.55	2.55	2.19	2.18	
Gd									
Tb	4.4	4.2	4.7	4.6	5.2	5	4.6	4.5	
Dy	31	29						30	
Ho									
Er									
Tm									
Yb	15.5	15.1	17.3	17.2	19.6	18.2	16.3	16.8	
Lu	2.27	2.24	2.55	2.54	2.86	2.63	2.32	2.46	
Hf	14.4	15.3	15.9	14.9	16.7	15.8	15.1	15.4	
Ta	2.5	2.2	2.6	2.3	2.6	2.4	2.2	2.7	
W ppb									
Re ppb									
Os ppb									
Ir ppb									
Pt ppb									
Au ppb									
Th ppm	1.8	1.6	2.1	1.9	2.8	2.3	2	2.1	
U ppm									
technique:	*(a) INAA*								

Table 2. Chemical composition of 10085 particles (white rx).

reference	Laul 83		(see ref for more data)											
weight														
SiO2 %	Poik.			granulitic			anor.			gabbro			norite	
TiO2	0.4	0.56	0.5	0.3	0.29	0.82	0.2	0.2	0.1	0.3	0.3	0.37	0.3	(a)
Al2O3	29	19.9	22.8	25.5	30	27.8	32	35.5	34	20.6	27	25.5	16.5	(a)
FeO	2.7	7	7	5.4	2.7	4.2	1	0.17	0.3	7	7.9	5.55	8	(a)
MnO														
MgO	2	10	9	7.5	4	5	0.5	0.5	0.5	11.5	2	6.4	17.5	(a)
CaO	16.9	13.5	14.3	16	16.2	16.2	18.9	19.6	18.5	12.9	16.5	15.8	9.3	(a)
Na2O	0.54	0.48	0.34	0.36	0.57	0.56	0.37	0.29	0.42	0.26	0.35	0.34	0.3	(a)
K2O	0.14	0.05	0.061	0.055	0.04	0.048	0.009	0.009	0.01	0.015	0.02	0.052	0.03	(a)
P2O5														
S %														
sum														
Sc ppm	6	21	16.3	10.5	5.1	5.4	2.3	0.52	0.48	10	13	15	14	(a)
V	10	30	50	30	20	20				20	20	40	110	(a)
Cr														
Co	6	12.6	50	18	6.6	9.9	2.1	0.75	0.7	15	6	19	40	(a)
Ni	40	20	300	150	20	30				20		200		(a)
Cu														
Zn														
Ga														
Ge ppb														
As														
Se														
Rb														
Sr	180	130	150	160	230	200	170		160	140	160	170	110	
Y														
Zr														
Nb														
Mo														
Ru														
Rh														
Pd ppb														
Ag ppb														
Cd ppb														
In ppb														
Sn ppb														
Sb ppb														
Te ppb														
Cs ppm														
Ba	90	40	50	60	30	50						80	90	
La	5.5	2.6	2.5	3.7	2.3	2.5	0.42	0.28	0.15	1.25	0.68	3.6	8	
Ce	13	8.5	6.1	8.7	5.9	5.7				3	2	8.8	20	
Pr														
Nd	8.4	9	4	5.4	4	4				2.3		6.5	12	
Sm	2.4	3.1	1.2	1.7	1	1	0.21	0.08	0.06	0.7	0.35	2	3.3	
Eu	1.2	1	0.82	0.85	1.3	1.3	0.83	0.8	0.89	0.71	0.85	0.87	1.1	
Gd														
Tb	0.5	0.88	0.3	0.4	0.21	0.23				0.16		0.46	0.8	
Dy	3.3	8	2.1	2.5	1.5	1.4	0.29			1.2	0.65	3.3	5.5	
Ho														
Er														
Tm														
Yb	2	4.6	1.55	1.55	0.9	1	0.2			0.73	0.45	2.1	4	
Lu	0.29	0.71	0.22	0.21	0.12	0.12	0.032		0.01	0.11	0.07	0.31	0.81	
Hf	1.6	2.5	1.4	1.1	0.8	0.95	0.21			0.35		0.97	1.1	
Ta	0.24		0.23	0.15	0.1	0.19				0.08		0.08	0.16	
W ppb														
Re ppb														
Os ppb														
Ir ppb														
Pt ppb														
Au ppb														
Th ppm	0.9			0.6	0.3	0.14				0.12		0.5	0.82	
U ppm	0.3			1										
technique:	*(a) INAA*													





Processing photos for ,104 and ,1161.

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