72535 and 72536

Impact Melt Breccia

221.4 and 52.3 grams

Figure 1: Photo of 72535. Cube is 1 cm. S73-19580. Note the clast on right side.

Figure 2: Photo of 72535. Cube is 1 cm. S73-19581. Note the black glass splash.

Introduction

Rake samples 72535 and 72536 are impact melt breccias from the landslide off of the South Massif. They have an Ar/Ar age of ~3.9 b.y. with 107 m.y. exposure to cosmic radiation.

Figure 3: Photo of 72536 showing micrometeorite craters. Cube is 1 cm. S73-19461.

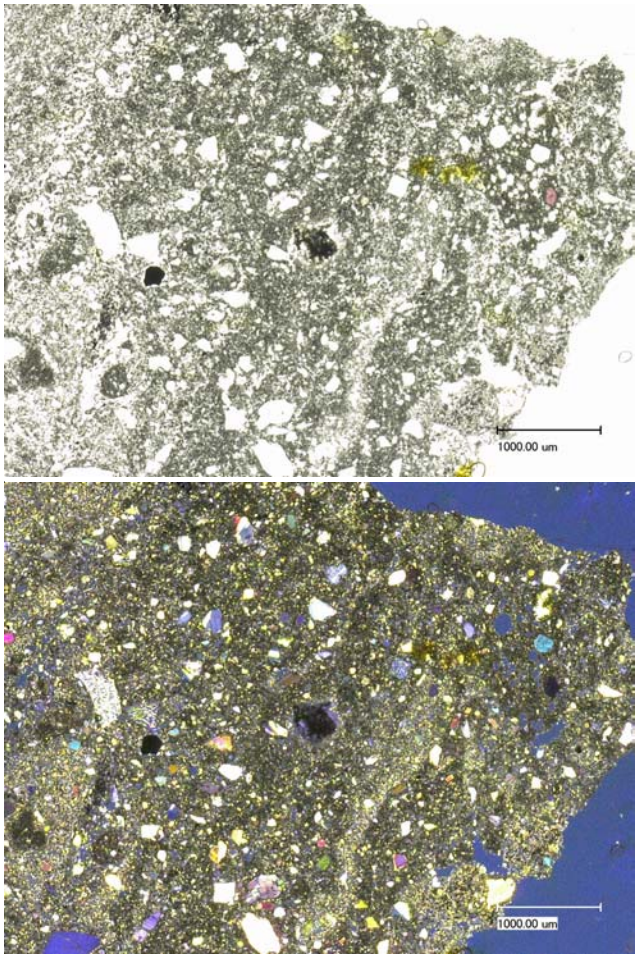

Figure 4: Photomicrographs of thin section 72535,6 @ 50x by C Meyer.

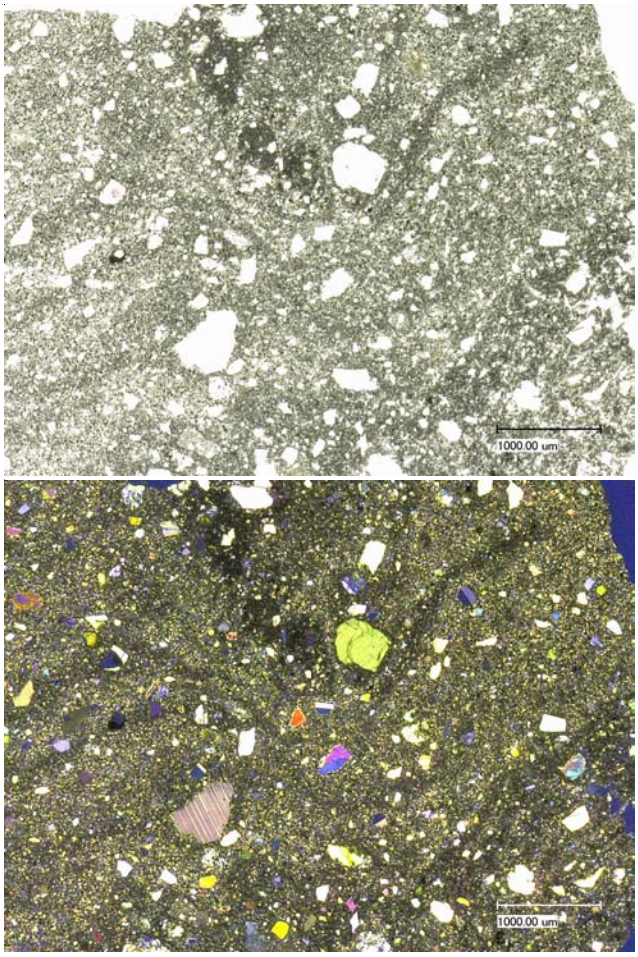

Figure 5: Photomicrographs of thin section 72536,8 @ 50x by C Meyer.

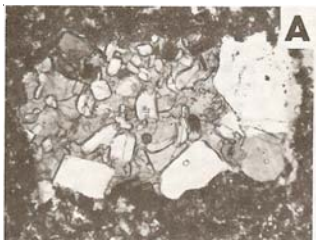

Figure 6: Poikilitic clast in 72535 (from Warner et al. 1977). Field of view 1 mm. Single large orthopyroxene encloses rounded olivine and euhedral plagioclase.

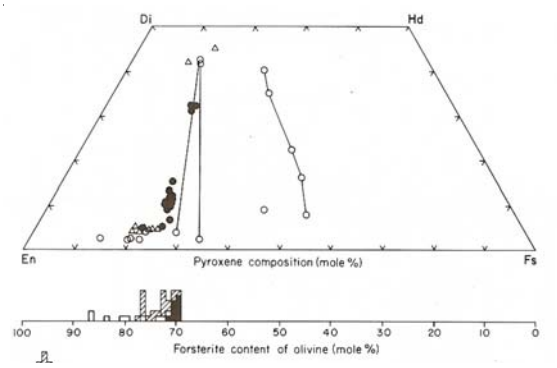

Figure 7: Composition of pyroxene and olivine in 72535 (from Warner et al. 1978).

Mineralogical Modes for 72535 and 72536

	Warner et al. 1978	
	72535	**72536**
Matrix		83%
Plagioclase	53 %	52.3
Mafic minerals	44	44.3
Opaques	3	3

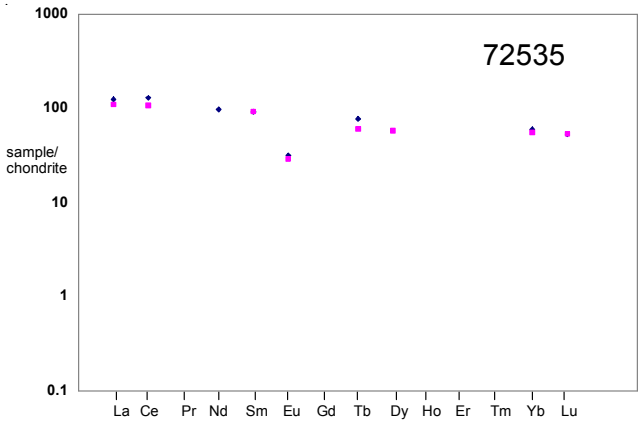

Figure 8: Normalized rare-earth-element diagram for 72535 (data from Laul and Schmitt 1975 and Dalrymple and Ryder 1996).

Petrography

72535 and 72536 are covered with micrometeorite craters (figures 1. 2 and 3). They have a texture charististic of a fine-grained, clast-bearing impact melt rather typical of the Apollo 17 highland breccias (figures 4 and 5). Warner et al. (1977) and Ryder (1993) describe the dark porous groundmass as basaltic-textured, with plagioclase laths less than 30 microns long subophitically enclosed by irregular mafic crystals. Ca-plagioclase is the major mineral clast. Small lithic clasts make up about ~5 % of the sample (figure 6).

Mineralogy

Olivine: Olivine is Fo_{70-86}.

Pyroxene: Warner et al. (1978) determined the composition of pyroxene in the matrix and in clasts of 72535 (figure 7).

Plagioclase: Plagioclase ranges from An_{97} to An_{72}.

Ilmenite: Engelhardt (1997) reported ilmenite.

Chemistry

Laul and Schmitt (1975) and Dalrymple and Ryder (1996) have analyzed 72535 and find that it is similar to the nearby boulder #2 (figure 8). The sample has high meteoritic siderophiles (Ni 250 ppm, Ir 7 ppb).

Radiogenic age dating

Dalrymple and Ryder (1996) determined an Ar/Ar plateau age of 3.887 ± 0.016 b.y. (figure 9) - finding that this sample is probably an impact melt from Serenitatis.

Cosmogenic isotopes and exposure ages

Arvidson et al. (1976) reported an exposure age of 107 m.y. by ^{81}Kr.

Processing

There are only one thin section each for these two samples, but they appear identical.

Summary of Age Data for 72535

	Ar/Ar
Dalrymple and Ryder 1996	3.887 ± 0.016 b.y.

Table 1. Chemical composition of 72535.

							72536		72536	
reference	Dalrymple96		Laul75		Warner77		Murali77		Warner77	
weight										
SiO2 %	45.6	(b)			47.9	(c)			46.7	(c)
TiO2	1.5	(b)	1.4	(a)	1.68	(c)	1.4	(a)	1.68	(c)
Al2O3	17.7	(b)	17.8	(a)	18.1	(c)	17.1	(a)	18.2	(c)
FeO	9.1	(a)	8.4	(a)	8.7	(c)	10	(a)	8.8	(c)
MnO	0.11	(b)	0.099	(a)	0.13	(c)	0.12	(a)	0.13	(c)
MgO	13.2	(b)	11	(a)	10.6	(c)	11	(a)	11.1	(c)
CaO	11.2	(b)	11.2	(a)	11.9	(c)	10.6	(a)	11.5	(c)
Na2O	0.56	(a)	0.58	(a)	0.54	(c)	0.53	(a)	0.57	(c)
K2O	0.32	(a)	0.13	(a)	0.07	(c)	0.21	(a)	0.21	(c)
P2O5					0.27	(c)			0.3	(c)
S %										
sum										
Sc ppm	19.3	(a)	16	(a)			19	(a)		
V			40	(a)			60	(a)		
Cr	17.91	(a)	1300	(a)	1163	(c)	1957	(a)	1095	(c)
Co	29	(a)	29.2	(a)			32	(a)		
Ni	220	(a)	250	(a)			320	(a)		
Cu										
Zn										
Ga										
Ge ppb										
As										
Se										
Rb										
Sr	150	(a)								
Y										
Zr	290	(a)	400	(a)			320	(a)		
Nb										
Mo										
Ru										
Rh										
Pd ppb										
Ag ppb										
Cd ppb										
In ppb										
Sn ppb										
Sb ppb										
Te ppb										
Cs ppm	0.19	(a)								
Ba	315	(a)	300	(a)			290	(a)		
La	29.1	(a)	25.8	(a)			29.5	(a)		
Ce	77.9	(a)	65	(a)			80	(a)		
Pr										
Nd	44	(a)								
Sm	13.5	(a)	13.6	(a)			11.3	(a)		
Eu	1.77	(a)	1.62	(a)			1.8	(a)		
Gd										
Tb	2.8	(a)	2.2	(a)			2.4	(a)		
Dy			14	(a)			15	(a)		
Ho										
Er										
Tm										
Yb	9.8	(a)	9	(a)			8.2	(a)		
Lu	1.3	(a)	1.3	(a)			1.3	(a)		
Hf	10.3	(a)	8.7	(a)			9.6	(a)		
Ta	1.33	(a)	1.2	(a)						
W ppb										
Re ppb										
Os ppb										
Ir ppb	7	(a)					4	(a)		
Pt ppb										
Au ppb	12.3	(a)					1.5	(a)		
Th ppm	4.3	(a)	3.4	(a)			2.5	(a)		
U ppm	1.33	(a)								

technique: (a) INAA, (b) Fused bead, (c) broad beam e-probe

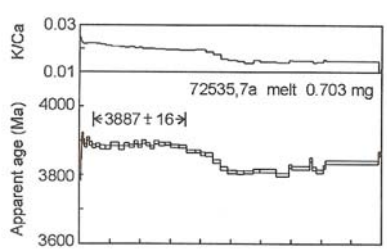

Figure 9: Ar/Ar plateau age diagram for 72535 (from Dalrymple and Ryder 1996).

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