76335

Cataclastic Magnesian Anorthosite

503 grams

Figure 1: Tray full of 76335. S73-19384.

LMP and 560 has an undocumented except for the pans – very white – looks like a crushed anorthosite. It look like – some of the inclusions in the grey breccia – grey and recrystallized breccia.

Introduction

76335 was collected at station 6 on the lower slope of the North Massif near the large boulder (and not far from where the troctolite 76535 was found as a rake sample). It was returned in documented bag 560 is the BSLSS as a bunch of fragments (figure 1). It is not known if this is all one rock, or if it is a range of rock fragments. Most rocks like this are, in fact, breccias.

76335 has been dated as 4.3 b.y. old, but it is greatly affected by shock.

Petrography

Ryder and Norman (1979) and Meyer (1994) included descriptions of 76335 in their catalogs and indicated that it deserved further study. The sample is highly shocked, but apparently "pristine".

Warren and Wasson (1977) reported that their fragment of 76335 was 88% plagioclase ($An_{95.6}$) and12% olivine ($Fo_{86.8}$) and that there was no pyroxene. However, Edmunson et al. (2010) describe "an orthopyroxene-dominated assemblage" in 76335 which includes orthopyroxene, chromite, phosphate and a new lunar mineral "keiviite-Y". Edmunson and Cohen (2009) had previously reported baddelyite and zirkelite as well.

Mineralogy

Olivine: Olivine (Fo_{87}) occurs as large (mm sized) regions of crushed material (Bersch et al. 1991).

Pyroxene: Orthopyroxene was reported (Bersch et al. 1991; Edmumson et al. 2010).

Plagioclase: Plagioclase (An_{96}) is highly crushed, but still remains as large relict grains (Warren and Wasson 1977).

Phosphate: Merrillite is reported (Edmumson et al. 2010).

Chromite: Small grains of chromite are observed *(and may provide a way to date the rock*).

Iron metal: Ryder et al. (1980) determined Ni and Co in metallic iron grains, finding them outside the meteorite range (high Co).

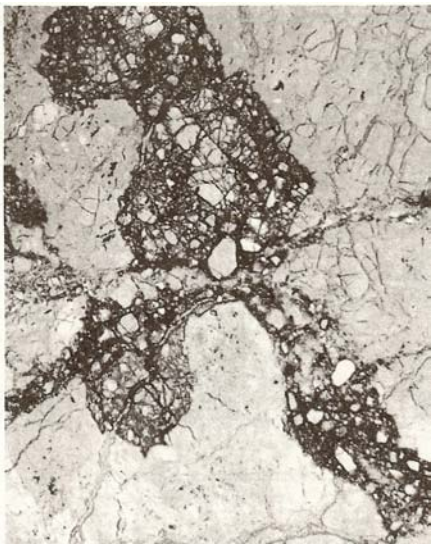

Figure 2: Photomicrograph of thin section 76335,28 (Meyer 1994). Field of view 2 x 3 mm.

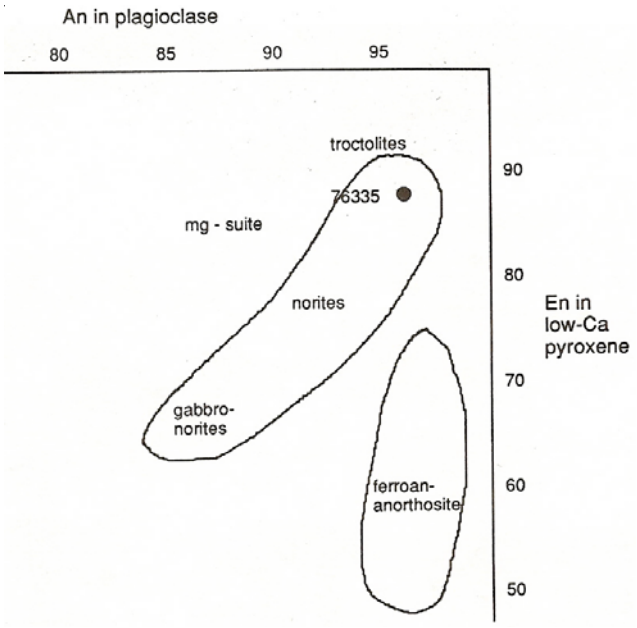

Figure 4: Composition of minerals in 76335 (Meyer 1994).

Keiviite-Y: Small grains of yttrium silicate $(Y,REE)_2Si_2O_7$ have been identified as keiviite –(Y) by Edmunson et al. (2010) and Carpender et al. (2011). They report an analysis and a formula. This phase is likely to be metamict, due to high – U content (50 ppm). It undoubtedly influences the Sm-Nd age.

Chemistry

Warren and Wasson (1978) give the chemical composition of two fragments of 76335 (figure 6). They found that the sample was "pristine" in that it had very low Ni, Ir and Au.

Figure 3: Photomicrograph of thin section 76335,29 (Warren and Wasson 1977). Field of view 8 x 12 mm.

Radiogenic age dating

Edmunson et al. (2007) were able to date 76335 by Nd/Sm (figure 5), but were unable to obtain a Rb/Sr age.

Summary of Age Data for 76335

	Sm/Nd
Edmunson et al. 2007	4278 ± 60 m.y.

Processing

The BSLSS (which included the Teflon bag containing 76330 and 76335) was found sitting in ¼ in. of water for 10 hrs. in the CM on reentry (Butler 1973, page 38).

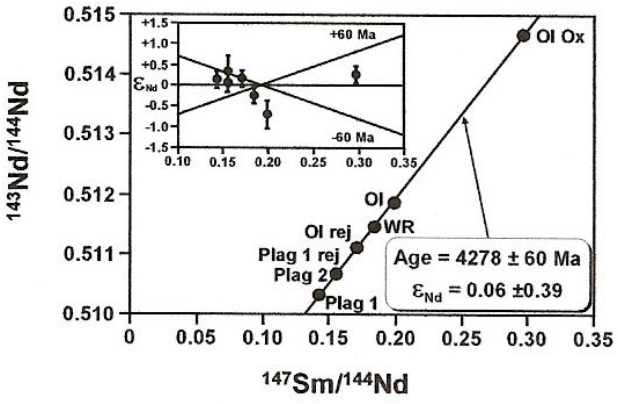

Figure 5: Sm-Nd internal isochron for 76335 (abs. by Edmunson et al. 2007).

Table 1. Chemical composition of 76335.

	clast		
reference	Warren 78		
weight			
SiO2 %		43.4	
TiO2		0.067	(a)
Al2O3	31.2	27.6	(a)
FeO	2.25	2.57	(a)
MnO	0.026	0.037	(a)
MgO	8.95	10.3	(a)
CaO	16.8	15	(a)
Na2O	0.35	0.31	(a)
K2O	0.036		(a)
P2O5			
S %			
sum			
Sc ppm	1.33	1.72	(a)
V			
Cr	356	408	(a)
Co	13.1	15.6	(a)
Ni	20.4	20	(a)
Cu			
Zn	3.1	0.38	(a)
Ga	3.5	3.15	(a)
Ge ppb	10.2	1.1	(a)
As			
Se			
Rb			
Sr			
Y			
Zr	160		(a)
Nb			
Mo			
Ru			
Rh			
Pd ppb			
Ag ppb			
Cd ppb	5.2	8.7	(a)
In ppb	0.078	1.1	(a)
Sn ppb			
Sb ppb			
Te ppb			
Cs ppm			
Ba	56	46	(a)
La	2.47	2.12	(a)
Ce	6.7	5.3	(a)
Pr			
Nd			
Sm			
Eu	1.03	0.91	(a)
Gd			
Tb	0.12	0.13	(a)
Dy			
Ho			
Er			
Tm			
Yb	0.56	0.56	(a)
Lu	0.073	0.082	(a)
Hf	0.4	0.45	(a)
Ta			
W ppb			
Re ppb			
Os ppb			
Ir ppb	0.013	0.13	(a)
Pt ppb			(a)
Au ppb	0.089	0.013	(a)
Th ppm		0.16	(a)
U ppm		0.1	(a)
technique:	*(a) INAA*		

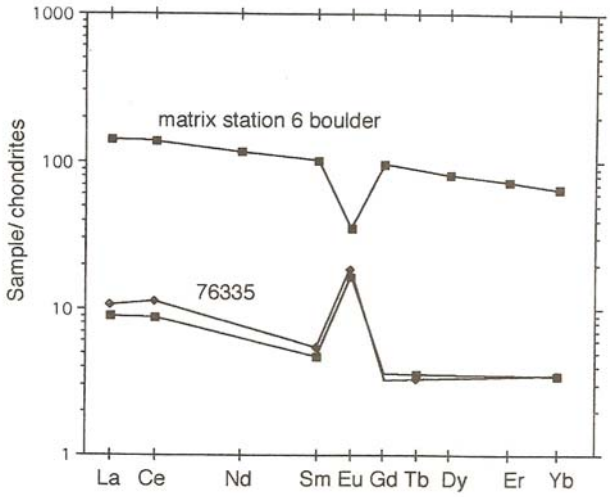

Figure 6: Normalized rare-earth-element diagram for 76335 (data from Warren and Wasson 1978).

Tabe 2: Mineral composition 76335.

(Bersch et al. 1991)

	pyx.	olivine
SiO2	56.05	39.94
MgO	31.65	46.86
FeO	8.12	12.82
CaO	1.26	0.035
TiO2	0.663	0.03
Al2O3	1.385	0.017
Cr2O3	0.575	0.025
MnO	0.159	0.148

The original Apollo 17 catalog (Butler 1973) says that 76335 weighs 352.9 grams, with 418.6 gr. of residue (76330) in the Doc. Bag # 560 (total = 771.5 gr.). Currently (2011), the inventory weights are 502.9 gr. for 76335 and 306.1 gr. for 76330 (total = 809 gr.). The difference is attributed to the addition of 70054 fragments and 76330 fragments to 76335 (see diagram).

The documented bag (560) was quite full and must have spilled over into the BSLSS bag (sample 70050). Two fractions of 70054 (4-10 mm coarse-fines)(,2 and ,3) were found to be white particles similar to 76335 and were apparently renumbered 76335,6 and ,7 respectively (figure 7). Obviously, there is additional material in the 2-4 mm, 1-2 mm and less than 1 mm fractions of 70050.

Figure 7: White particles found in 70050 (4-10 mm) and relabled 76335,6. S80-32972.

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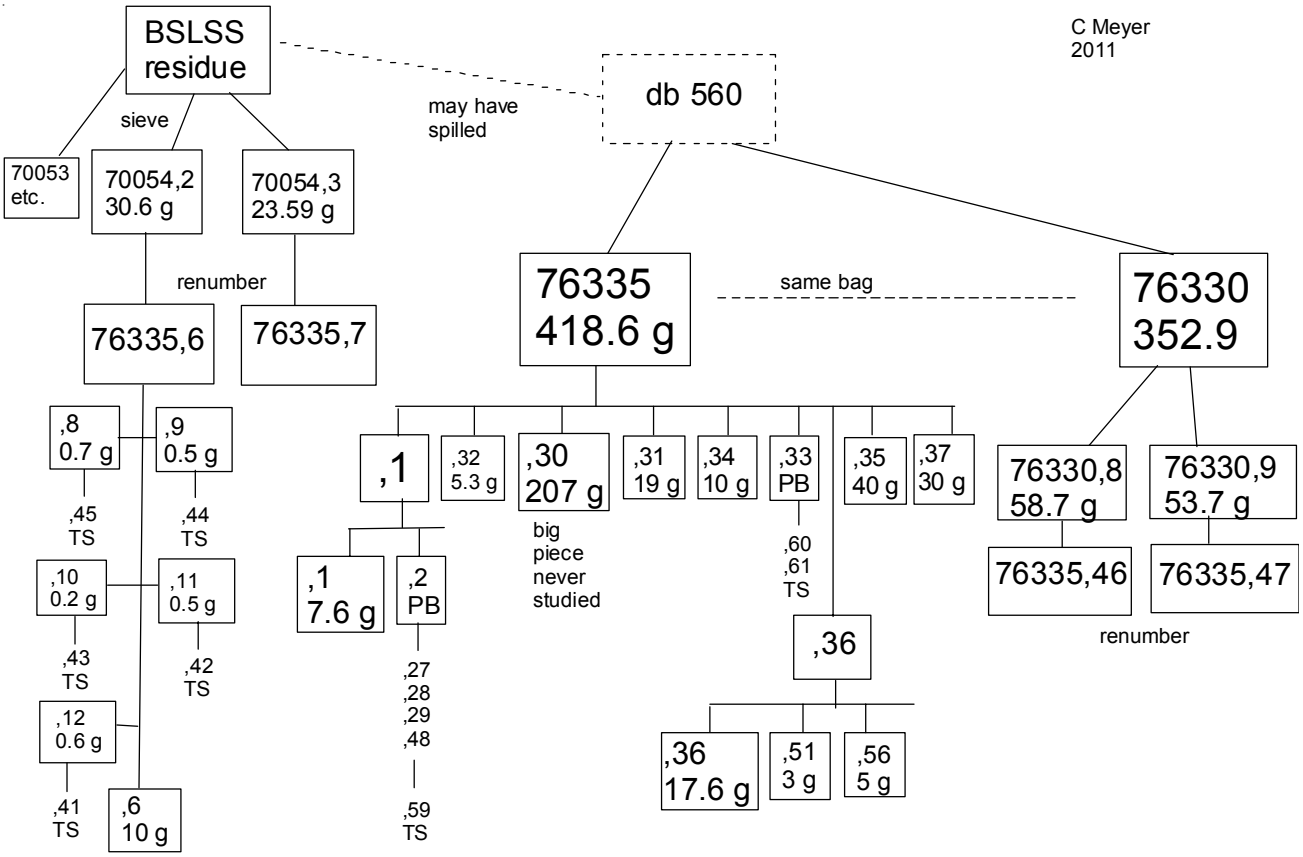

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