78255

Shocked Norite

48.31 grams (two pieces)

Figure 1: PET photo of 78255 showing relict zap pits on underside of boulder. Cube is 1 cm. Photo # S73-15190

Introduction

Samples 78255-78256 were chipped off the bottom of the Station 8 boulder after had been rolled over by the astronauts (Jackson et al. 1975). The pieces fell in the soil where they were collected. Sample 78256 was found to fit 78255, so they were numbered together as 78255 (48.31 grams).

Although 78255 was chipped from the bottom of the boulder, it was found to have numerous zap pits (figure 1) indicating that it had been the top surface sometime in the past. Indeed, the astronauts noted that it was very easy to roll the boulder. Cosmic ray studies (below) showed 78255 to be less exposed than 78235. However, it still had elevated radioactivity and hence the boulder has rotated during its history.

Petrography

Perhaps the only petrographic description of 78255 is given in a footnote by Warren and Wasson (1978). The rock is, of course, the same as 78235.

Mineralogy

Pyroxene: Bersch (1991) analyzed the pyroxene.

Chemistry

Warren and Wasson (1978, 1979) analyzed two different chips of 78255 (table 1 and figure 2) and found them to be relatively low in siderophile elements, hence "pristine" by their definition. The pieces they analyzed were more feldspathic than 78235, which they attribute to the small size of their sample and the coarse grain size of the rock.

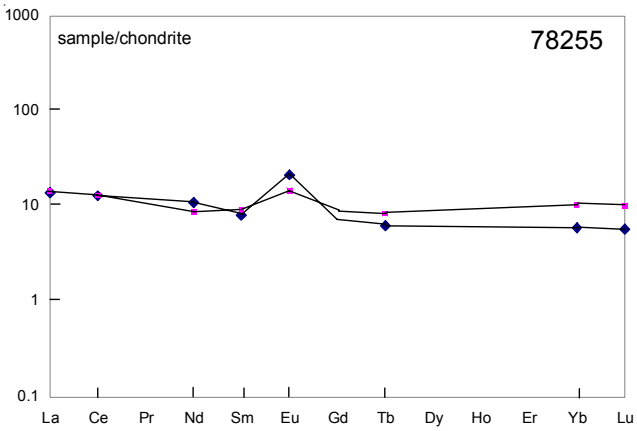

Figure 2: Normalized rare-earth-element diagram for 78255 (data from Warren et al. 1978 , 1979).

Radiogenic age dating

The age of this sample is given in the section on 78235.

Cosmogenic isotopes and exposure ages

Keith et al. (1974) determined the cosmic ray and solar flare induced activity from the large solar flare of August 1972 using the top and bottom of this boulder (table 2). The bottom of the boulder (78255) was shielded from the recent solar flare, but not completely from neutrons produced by high energy cosmic rays.

Processing

List of Photos #
S73-15189
S73-15190

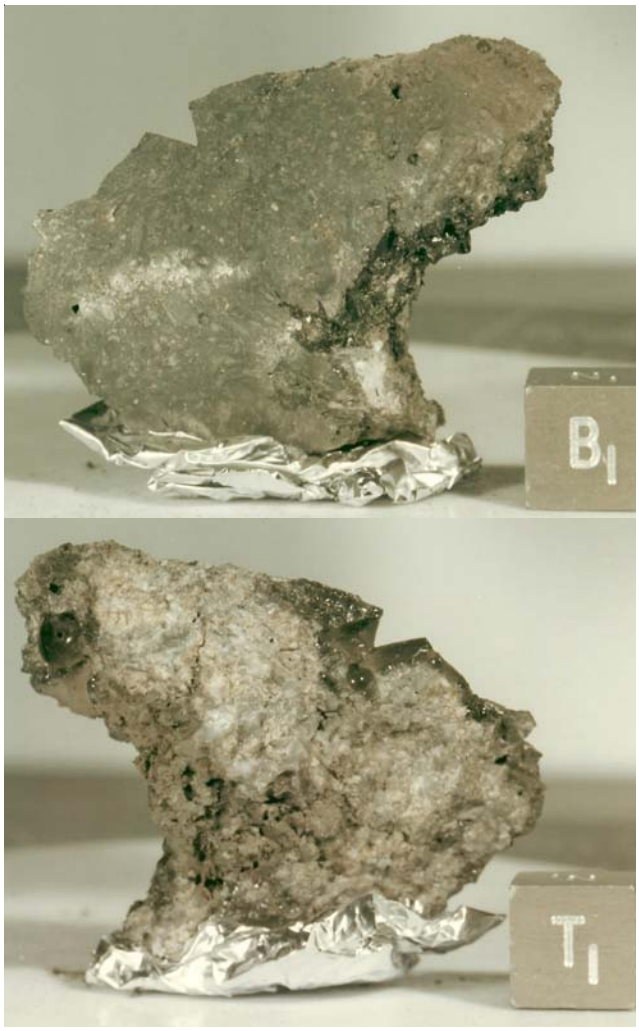

Figure 3 a, b: Two views of 78255,2 (78256). Cube is 1 cm. S73-15177 and 178.

Table 2: Solar flare activity (Keith et al. 1974).

sample	78135	78235	**78255**
dpm/Kg			
^{26}Al	42 ± 4	77 ± 7	65 ± 6
^{22}Na	74 ± 5	111 ± 8	50 ± 5
^{54}Mn	180 ± 20	55 ± 8	10 ± 5
^{56}Co	240 ± 20	52 ± 9	30 ± 20
^{46}Sc	76 ± 5	1.4 ± 0.9	<15
^{48}V	18 ± 5	<12	

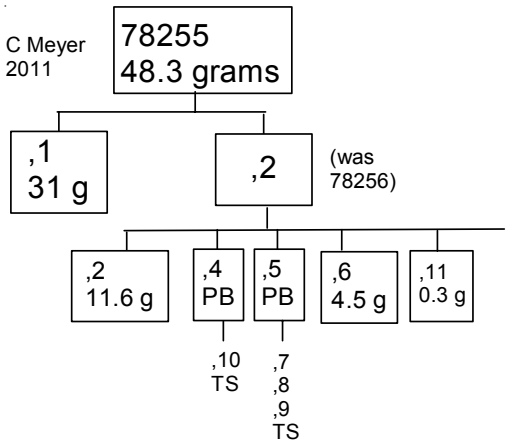

Table1. Chemical composition of 78255.

reference	Warren 78	Warren 79	Keith 74	
weight				
SiO2 %	47.29			
TiO2	0.068			
Al2O3	27.4			
FeO	2.64			
MnO	0.046			
MgO	5.98			
CaO	14.98			
Na2O	0.446			
K2O	0.084		0.071	(c)
P2O5				
S %				
sum				
Sc ppm	4.6	10.7		
V				
Cr	990	2210		
Co	22.6	31		
Ni	21.7	22		
Cu				
Zn	0.95	1.6		
Ga	5.1	4.3		
Ge ppb	58	61		
As				
Se				
Rb				
Sr				
Y				
Zr				
Nb				
Mo				
Ru				
Rh				
Pd ppb				
Ag ppb				
Cd ppb	4.2	4.6		
In ppb	0.05	0.39		
Sn ppb				
Sb ppb				
Te ppb				
Cs ppm				
Ba	86	65		
La	3.3	3.4		
Ce	7.8	8		
Pr				
Nd	5	4		
Sm	1.2	1.36		
Eu	1.21	0.83		
Gd				
Tb	0.23	0.31		
Dy				
Ho				
Er				
Tm				
Yb	0.98	1.7		
Lu	0.14	0.25		
Hf	0.67	1		
Ta	0.086	0.1		
W ppb				
Re ppb	21	54		
Os ppb				
Ir ppb	0.43	0.71		
Pt ppb				
Au ppb	0.107	0.17		
Th ppm	0.44	0.53	0.83	(c)
U ppm	0.19	0.14	0.227	(c)

technique (a) INAA, (b) RNAA, (c) radiation counting

References for 78255

Bersch M.G., Taylor G.J., Keil K. and Norman M.D. (1991) Mineral compositions in pristine lunar highland rocks and the diversity of highland magmatism. *Geophys. Res. Lett.* **18**, 2085-2088.

Butler P. (1973) **Lunar Sample Information Catalog Apollo 17.** Lunar Receiving Laboratory. MSC 03211 Curator's Catalog. pp. 447.

Jackson E.D., Sutton R.L. and Wilshire H.G. (1975) Structure and petrology of a cumulus norite boulder sampled by Apollo 17 in Taurus-Littrow valley, the Moon. *Geol. Soc. Am. Bull*. **86**, 433-442.

James O.B. (1980) Rocks of the early lunar crust. *Proc. 11th Lunar Planet. Sci. Conf.* 365-393.

Keith J.E., Clark R.S. and Bennett L.J. (1974a) Determination of natural and cosmic ray induced radionuclides in Apollo 17 lunar samples. *Proc. 5th Lunar Sci. Conf.* 2121-2138.

LSPET (1973) Apollo 17 lunar samples: Chemical and petrographic description. *Science* **182**, 659-672.

LSPET (1973) Preliminary Examination of lunar samples. Apollo 17 Preliminary Science Rpt. NASA SP-330. 7-1 – 7-46.

Marti K. (1983) Recoils: New opportunities to study and date early solar system processes (abs). *Lunar Planet. Sci.* **XIV**, 462-463. Lunar Planetary Institute, Houston.

Meyer C. (1994) Catalog of Apollo 17 rocks. Vol. 4 North Massif

Muehlberger et al. (1973) Documentation and environment of the Apollo 17 samples: A preliminary report. Astrogeology 71 322 pp superceeded by Astrogeolgy 73 (1975) and by Wolfe et al. (1981)

Muehlberger W.R. and many others (1973) Preliminary Geological Investigation of the Apollo 17 Landing Site. *In* **Apollo 17 Preliminary Science Report.** NASA SP-330.

Ryder G. and Norman M.D. (1979a) Catalog of pristine non-mare materials Part 1. Non-anorthosites, revised. NASA-JSC Curatorial Facility Publ. JSC 14565, Houston. 147 pp.

Warren P.H. and Wasson J.T. (1979) The compositional-petrographic search for pristine nonmare rocks: Third foray. *Proc. 10th Lunar Planet. Sci. Conf.* 583-610.