

15356

Impact melt
2.0 grams



Figure 1: Photo of 15356. S71-49372.
Sample is 1.3 cm.

Introduction

Lunar sample 15356 is a rake sample from the rim of Spur Crater (see section on 15311). It is a very fine-grained impact melt rock and has been dated at 3.84 b.y. (the apparent age of the Imbrium event). It should be compared with 15357 and 15359.

Petrography

Simonds et al. (1975) termed 15356 a “ultrafine subophitic impact melt with mineral clasts” (figure 2). Dowty et al. (1973) called it a “microbreccia” and provided mineral analyses. Ryder and Spudis (1987) found that 15356 had a “well-developed micropoikilitic texture with pigeonite oikocrysts” enclosing 40 % plagioclase laths. Interoikocrysts patches contain larger stubby plagioclases and interstices of silicic glass. Nehru et al. (1974) found that 15356 contained armalcolite, rutile and pink-spinel. Ryder (1985) gives a complete description.

Chemistry

Ryder and Spudis (1987) and Dowty et al. (1973) determined the chemical composition (table 1 and figure 4). Ni and Co in metal grains indicates the sample is an impact melt.

Radiogenic age dating

Dalrymple and Ryder (1991 and 1993) obtained an age of 3.84 b.y. by Ar/Ar dating of 15356 (figure 5).

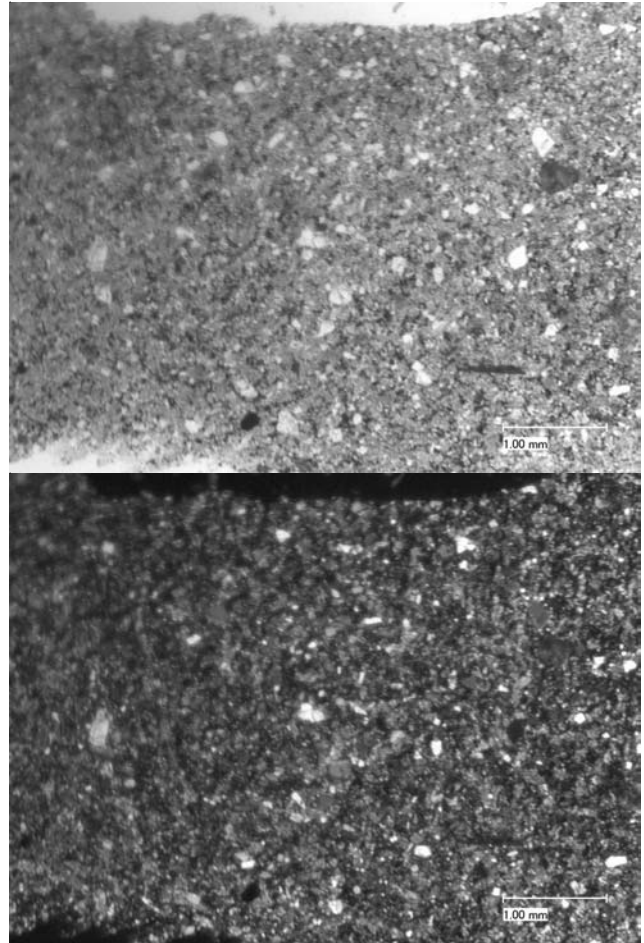


Figure 2: Photomicrographs of thin section 15356,3 @ 50x by C Meyer.

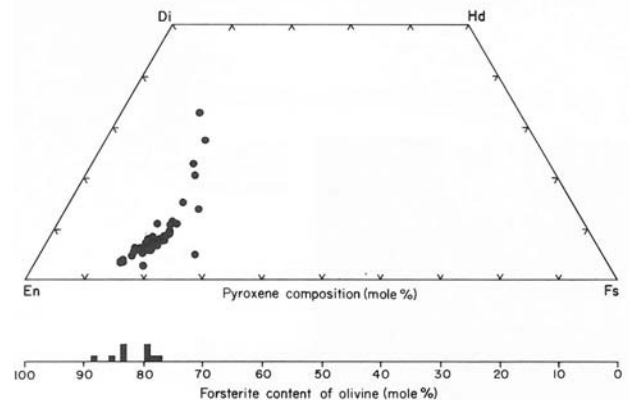


Figure 3: Composition of olivine and pyroxene for 15356 (Dowty et al. 1973).

Table 1. Chemical composition of 15356

reference weight	Ryder87	Dowty73
SiO ₂ %	47.5	(b) 45.6 (c)
TiO ₂	1.03	(b) 1.12 (c)
Al ₂ O ₃	18	(b) 20 (c)
FeO	8.1	(b) 7.5 (c)
MnO	0.134	(b) 0.1 (c)
MgO	13.7	(b) 13.7 (c)
CaO	10.8	(b) 10.2 (c)
Na ₂ O	0.594	(b) 0.68 (c)
K ₂ O	0.252	(b) 0.58 (c)
P ₂ O ₅	0.185	(b) 0.34 (c)
S %		
sum		
Sc ppm	14.2	(a)
V		
Cr	1305	(a) 1200 (c)
Co	55.8	(a)
Ni	557	(a)
Cu		
Zn		
Ga		
Ge ppb		
As		
Se		
Rb	8.3	(a)
Sr		
Y		
Zr	240	(a)
Nb		
Mo		
Ru		
Rh		
Pd ppb		
Ag ppb		
Cd ppb		
In ppb		
Sn ppb		
Sb ppb		
Te ppb		
Cs ppm	0.37	(a)
Ba	317	(a)
La	29.9	(a)
Ce	73	(a)
Pr		
Nd	45	(a)
Sm	14.4	(a)
Eu	1.85	(a)
Gd		
Tb	3.2	(a)
Dy		
Ho		
Er		
Tm		
Yb	10.3	(a)
Lu	1.45	(a)
Hf	10.5	(a)
Ta	1.1	(a)
W ppb		
Re ppb		
Os ppb		
Ir ppb		
Pt ppb		
Au ppb		
Th ppm	4.3	(a)
U ppm	1.2	(a)

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

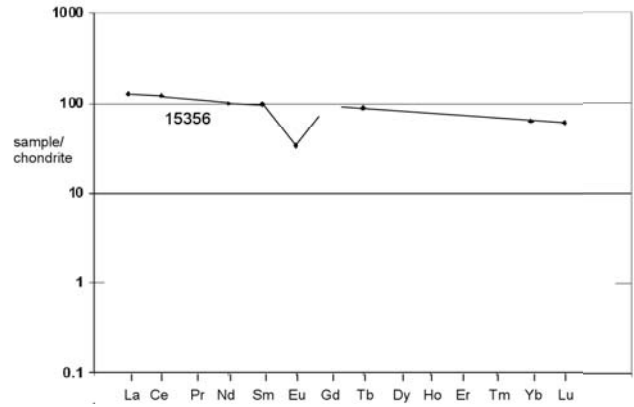


Figure 4: Normalized REE diagram for 15356.

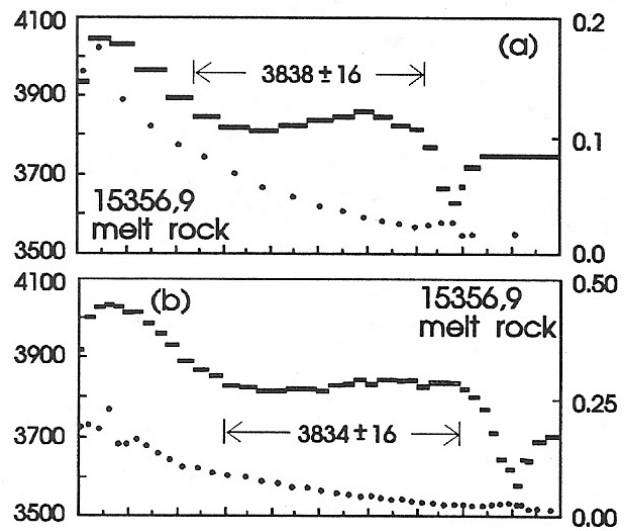
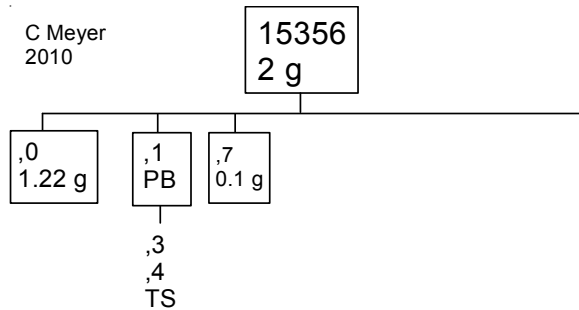


Figure 5: Age vs % Ar released (Dalrymple and Ryder 1993).



References for 15356

- Butler P. (1971) Lunar Sample Catalog, Apollo 15. Curators' Office, MSC 03209
- Dalrymple G.B. and Ryder G. (1991) $^{40}\text{Ar}/^{39}\text{Ar}$ ages of six Apollo 15 impact melt rocks by laser step heating. *Geophys. Res. Lett.* **18**, 1163-1166.
- Dalrymple G.B. and Ryder G. (1993) $^{40}\text{Ar}/^{39}\text{Ar}$ age spectra of Apollo 15 impact melt rocks by laser step-heating and their bearing on the history of lunar basin formation. *J. Geophys. Res.* **98**, 13,085-13,095.
- Dowty E., Conrad G.H., Green J.A., Hlava P.F., Keil K., Moore R.B., Nehru C.E. and Prinz M. (1973a) Catalog of Apollo 15 rake samples from stations 2 (St. George), 7 (Spur Crater) and 9a (Hadley Rille). Inst. Meteoritics Spec. Publ. No 11, 51-73. Univ. New Mex. ABQ.
- Hlava P.F., Green J.A., Prinz M., Keil K., Dowty E. and Bunch T.E. (1973) Apollo 15 rake samples, microbreccias and non-mare rocks: Bulk rock, mineral and glass electron microprobe analyses. Inst. Meteoritics Spec. Publ. No 11, 51-73. Univ. New Mex. ABQ
- LSPET (1972a) The Apollo 15 lunar samples: A preliminary description. *Science* **175**, 363-375.
- LSPET (1972b) Preliminary examination of lunar samples. Apollo 15 Preliminary Science Report. NASA SP-289, 6-1—6-28.
- Nehru C.E., Prinz M., Dowty E. and Keil K. (1974) Spinel-group minerals and ilmenite in Apollo 15 rake samples. *Am. Mineral.* **59**, 1220-1235.
- Ryder G. (1985) Catalog of Apollo 15 Rocks (three volumes). Curatorial Branch Pub. # 72, JSC#20787
- Ryder G. and Spudis P. (1987) Chemical composition and origin of Apollo 15 impact melts. *Proc. 17th Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* **92**, E432-446.
- Simonds C.H., Warner J.L. and Phinney W.C. (1975b) The petrology of the Apennine Front revisited. *Lunar Sci.* **VI**, 744-746.
- Swann G.A., Hait M.H., Schaber G.C., Freeman V.L., Ulrich G.E., Wolfe E.W., Reed V.S. and Sutton R.L. (1971b) Preliminary description of Apollo 15 sample environments. U.S.G.S. Interagency report: 36. pp219 with maps
- Swann G.A., Bailey N.G., Batson R.M., Freeman V.L., Hait M.H., Head J.W., Holt H.E., Howard K.A., Irwin J.B., Larson K.B., Muehlberger W.R., Reed V.S., Rennilson J.J., Schaber G.G., Scott D.R., Silver L.T., Sutton R.L., Ulrich G.E.,