

75085 - 75089 High-Ti Basalt

DRAFT

4.3, 2.3, 2.3, 2 and 1.7 grams



Figure 1: Photo of 75089, 75088, 75087, 75086 and 75085. Cube is 1 cm for scale. NASA S73-19401.

Introduction

Samples 75085 to 75089 are chips that were sieved from soil sample 75080, collected near the rim of Camelot crater. They have a range of grain size and texture, but are all fragments of mare basalt (figure 1).

Petrography

Basalts from the same lava flow can have a range of grain size and texture, and these five fragments all have similar composition (figures 2 and 3).

75085 is a coarse-grained basalt (figure 4). The mineralogy of 75085 was reported by Warner et al. (1979), Neal et al. (1989) and Neal and Taylor (1992).

75086 is a medium-grained subophitic basalt, made up of plagioclase (up to 1 mm), pink pyroxene (up to 2 mm) and ilmenite laths. There are small inclusions of olivine in pyroxene, armalcolite in plagioclase and iron in troilite. Olivine is Fo(67-58), plagioclase is An(88-79) and pyroxene (figure 6).

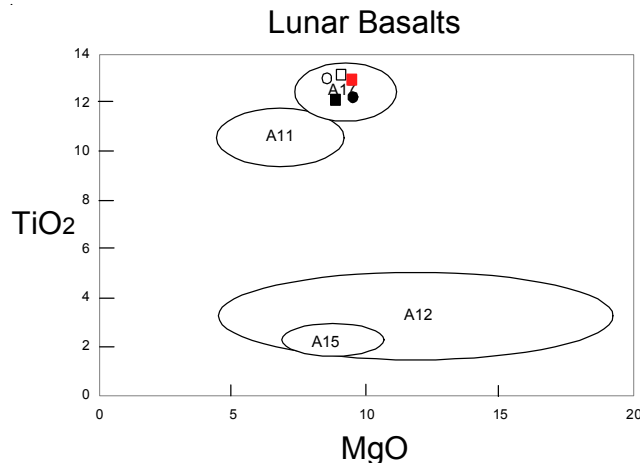


Figure 2: Chemical composition of high-Ti basalts from 75080 compared with other lunar basalts.

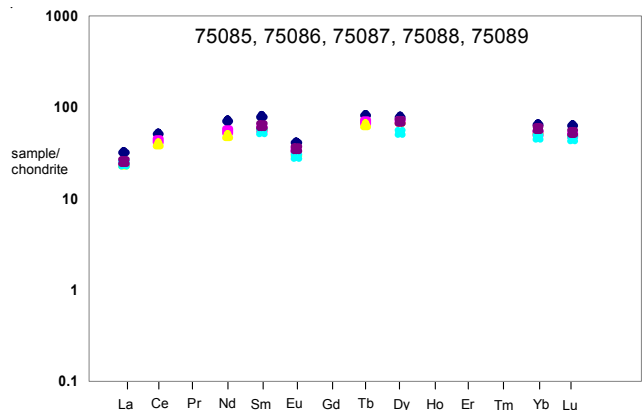


Figure 3: All five basalts have similar REE abundance.

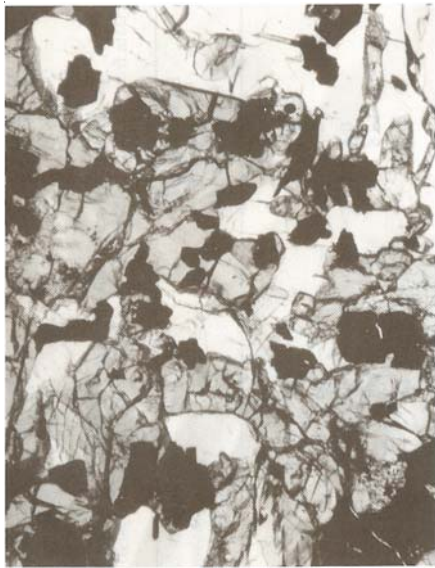


Figure 4: Thin section of 75085. Scale 2 mm.

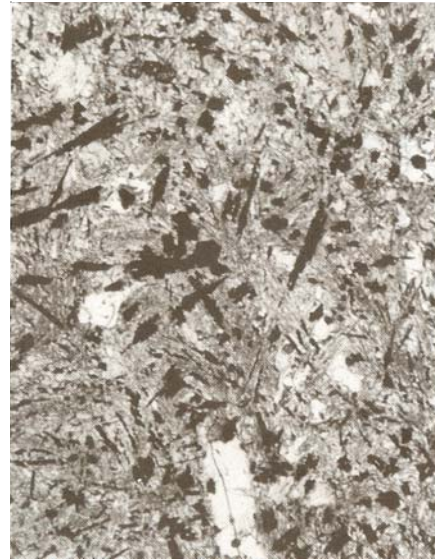


Figure 5: Thin section of 75088. Scale 2 mm.

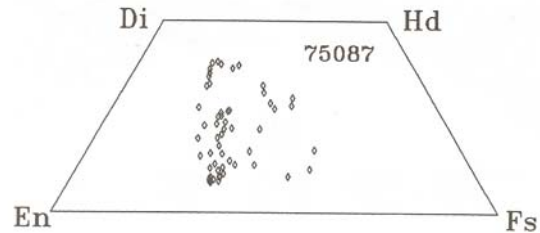
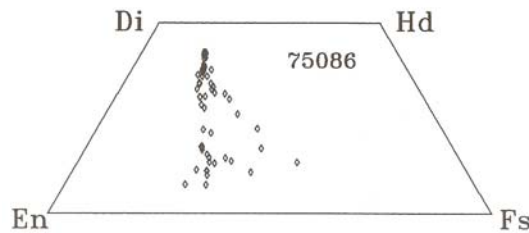


Figure 6: Pyroxene composition of 75086 and 75087 as determined by Neal and Taylor (1993).

75087 is a subophitic basalt with plagioclase (1.4 mm), pyroxene (1.4 mm) and ilmenite (0.8 mm). Pyroxene composition is given in figure 6.

75088 is a fine-grained basalt with olivine and ilmenite phenocrysts (1 mm). The groundmass is very fine (0.1 mm) and made of plagioclase, pyroxene, ilmenite and minor glass (figure 5).

75089 is medium-grained (0.4 mm) equigranular basalt, composed of pink pyroxene, plagioclase and ilmenite (0.6 mm) with no olivine, armalcolite. Troilite iron, silica and glass form interstitial phases.

Mineralogical Mode

	75086	75087
Olivine	1.3 %	0.4
Pyroxene	51.3	48.9
Plagioclase	26.3	21
Ilmenite	18.2	21
Armalcolite	1.3	
Troilite with iron	1.6	6.6
Silica		3.3

Chemistry

The chemical composition of 75085 etc. is given in table 1.

Radiogenic age dating

None

Table 1. Chemical composition of 75085 - 75089.

reference	75085	75086	75087	75088	75089
weight	Warner79	Neal90	Neal90	Warner75	Warner75
	310 mg			226 mg	202 mg
SiO ₂ %					
TiO ₂	13.1	(a) 12.1	13.4	11.9	13.2
Al ₂ O ₃	8.7	8.02	7.37	10.4	8.7
FeO	18.8	19.3	19	20.4	20.6
MnO	0.25	0.245	0.254	0.255	0.24
MgO	9	10.1	9.4	8.9	9.8
CaO	9.9	9.1	9.8	11.8	10
Na ₂ O	0.416	0.36	0.34	0.379	0.394
K ₂ O	0.064	0.09	0.05	0.06	0.065
P ₂ O ₅					
S %					
sum					
Sc ppm	81	80.2	87	87	87
V	133	153	154	92	117
Cr	3223	3870	3740	2121	3633
Co	19	23	20	18.9	20.7
Ni		7	12		
Cu					
Zn					
Ga					
Ge ppb					
As					
Se					
Rb		0.8			
Sr		160	80		
Y					
Zr		150	240		
Nb					
Mo					
Ru					
Rh					
Pd ppb					
Ag ppb					
Cd ppb					
In ppb					
Sn ppb					
Sb ppb					
Te ppb					
Cs ppm		0.15	0.11		
Ba		64	91		
La	7.5	5.75	5.76	5.7	6
Ce	31	26	24		
Pr					
Nd	32	25	22		
Sm	11.6	8.62	8.78	7.9	9.3
Eu	2.32	1.91	1.74	1.64	1.95
Gd					
Tb	3	2.5	2.37		
Dy	19	17	17.1	13	17
Ho					
Er					
Tm					
Yb	10.6	8.54	8.75	7.7	9.5
Lu	1.54	1.22	1.25	1.1	1.3
Hf	9.7	8.12	8.13		
Ta	2.2	1.6	1.61		
W ppb					
Re ppb					
Os ppb					
Ir ppb					
Pt ppb					
Au ppb					
Th ppm			0.14		
U ppm		0.15	0.19		

technique: (a) INAA

References for 75085 – 75089

- Butler P. (1973) Lunar Sample Information Catalog Apollo 17. Lunar Receiving Laboratory. MSC 03211 Curator's Catalog. pp. 447.
- Ma M-S., Schmitt R.A., Warner R.D., Taylor G.J. and Keil K. (1979) Composition, petrography, and genesis of Apollo 17 high-Ti mare basalts (abs). *Lunar Planet. Sci.* **X**, 765-767. Lunar Planetary Institute, Houston.
- Neal C.R., Taylor L.A., Hughes S.S. and Schmitt R.A. (1989e) Apollo 17 high-Ti basalt petrogenesis: An integrated approach using whole-rock major and trace element analysis (abs). *Lunar Planet. Sci.* **XX**, 776-777. Lunar Planetary Institute, Houston.
- Neal C.R., Taylor L.A., Patchen A.D. and Ballington M. (1989f) Mineralogy and petrography of 28 "new" Apollo 17 basalts (abs). *Lunar Planet. Sci.* **XX**, 780-781. Lunar Planetary Institute, Houston.
- Neal C.R., Taylor L.A., Patchen A.D., Hughes S.S. and Schmitt R.A. (1990a) The significance of fractional crystallization in the petrogenesis of Apollo 17 Type A and B high-Ti basalts. *Geochim. Cosmochim. Acta* **54**, 1817-1833.
- Neal C.R., Paces J.B., Taylor L.A. and Hughes S.S. (1990b) Two new Type C basalts: Petrogenetic implications for source evolution and magma genesis at the Apollo 17 site (abs). *Lunar Planet. Sci.* **XXI**, 855-856. Lunar Planetary Institute, Houston.
- Neal C.R. and Taylor L.A. (1993) Catalog of Apollo 17 rocks, central valley. Volumes 2 and 3. Curators Office #26088 JSC, Houston.
- Warner R.D., Keil K., Murali A.V. and Schmitt R.A. (1975a) Petrogenetic relationships among Apollo-17 basalts. In Papers presented to the Conference on Origins of Mare Basalts and their Implications for Lunar Evolution (Lunar Science Institute, Houston), 179-183.
- Warner R.D., Taylor G.J., Conrad G.H., Northrop H.R., Barker S., Keil K., Ma M.-S. and Schmitt R. (1979a) Apollo 17 high-Ti mare basalts: New bulk compositional data, magma types, and petrogenesis. *Proc. 10th Lunar Planet. Sci. Conf.* 225-247.
- Wolfe E.W., Bailey N.G., Lucchitta B.K., Muehlberger W.R., Scott D.H., Sutton R.L. and Wilshire H.G. (1981) The geologic investigation of the Taurus-Littrow Valley: Apollo 17 Landing Site. US Geol. Survey Prof. Paper, 1080, pp. 280.