

**12075**  
Olivine Basalt  
232.5 grams



*Figure 1: Photo of 12075,4. Sample is 4 cm across. NASA # S70-44018.*

**Introduction**

12075 is a vuggy, medium-grained olivine basalt with olivine and pyroxene phenocrysts set in a variolitic groundmass (figures 1 and 3). It was termed an “olivine dolerite cumulate” by Gay et al. (1971). 12075 hasn’t been dated.

Sutton and Schaber (1971) discuss the location on the lunar surface.

**Petrography**

Champness et al. (1971) give a brief description of 12075: “This is a medium-grained basic igneous rock in which pyroxenes (about 20%) and olivine (20%) phenocrysts (lengths < 3 mm) are embedded in a matrix of finer-grained, irregular intergrowths of pyroxene, plagioclase laths (20 – 50 microns in width and mostly untwinned) and elongated lamellae of ilmenite”.

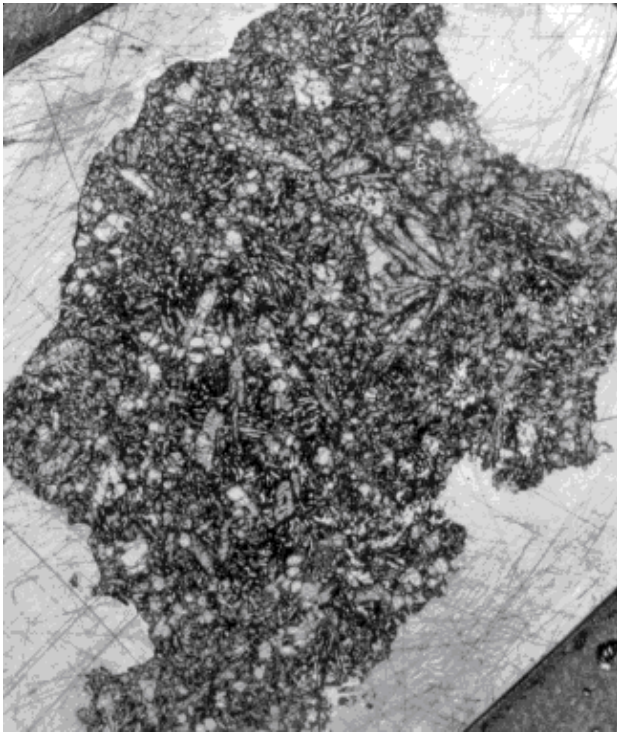


Figure 2: Photomicrograph of thin section 12075,25. Section is 1.5 cm. across. NASA # S70-46347.

Olivine crystals tend to occur in aggregates. Gay et al. (1971) reported melt inclusions in olivine.

Figures 2 and 4 show an unusual spray of large pyroxene grains radiating from a common point.

**Mineralogy**

**Olivine:** Olivine composition is Fo<sub>78-67</sub> (Champlness et al. 1971).

**Chemistry**

Wakita et al. (1971), Cuttitta et al. (1971), Hubbard and Gast (1971), Haskin et al. (1971) and Engel et al. (1971) determined the chemical composition of 12075 (table 1, figures 5 and 6).



Figure 3: Photomicrographs of 12075,23. Field of view is 2.6 mm across.. NASA # S70-49949-950.

**Radiogenic age dating**

Not dated.

**Other Studies**

Bogard et al. (1971) and Funkhouser et al. (1971) reported the content and isotopic composition of rare gases in 12075. Wrigley (1971) determined the cosmic-ray-induced activity of <sup>22</sup>Na (74 dpm/kg) and <sup>26</sup>Al (107 dpm/kg).

There are 12 thin sections.

**List of Photo #s of 12075**

S69-61490 – 61513	B&W mug
S70-19108	
S70-19112 – 19122	B & W
S70-44014 – 44023	color
S70-49949 – 49954	TS

**Mineralogical Mode for 12075**

	Neal et al. 1994	Papike et al. 1976
Olivine	15.7	20.5
Pyroxene	57.5	58
Plagioclase	21.7	13.2
Opagues		8
Ilmenite	0.6	
Chromite +Usp	2.7	
mesostasis	1.6	0.2
“silica”		



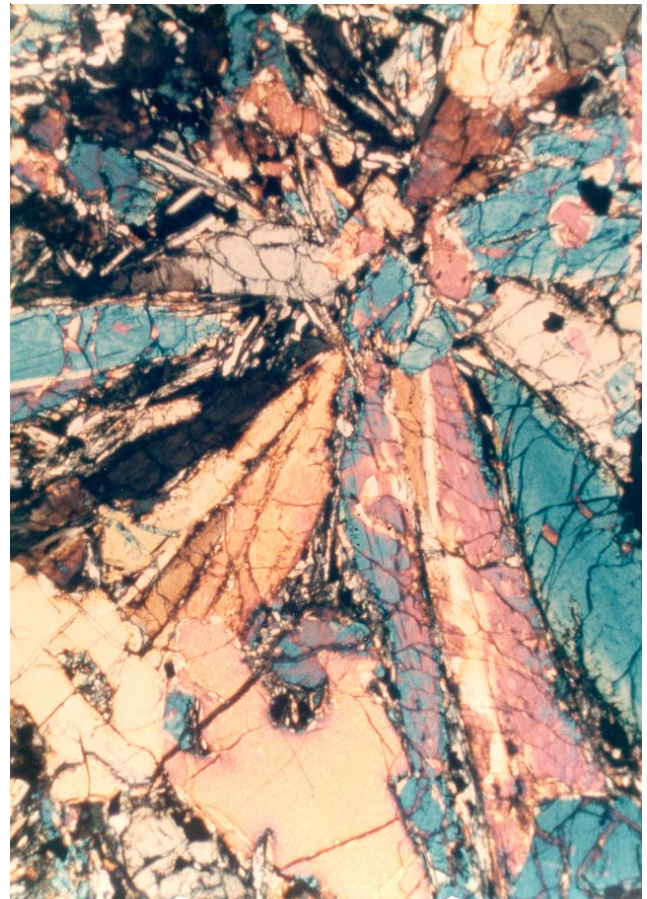
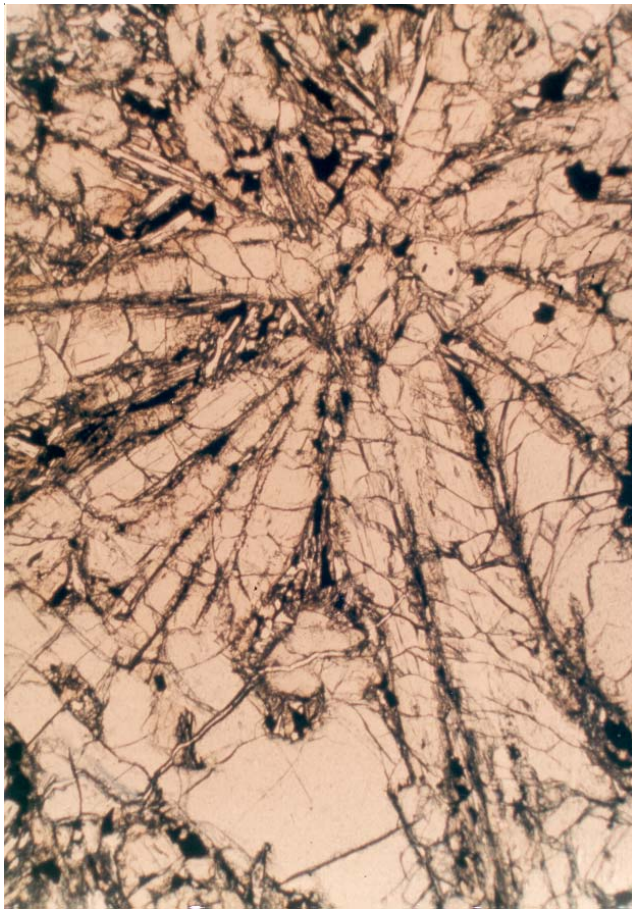


Figure 4: Photomicrographs of thin section 12075,25 showing pyroxene star. Field of view is 2.6 mm across. NASA # S70-49953-954.

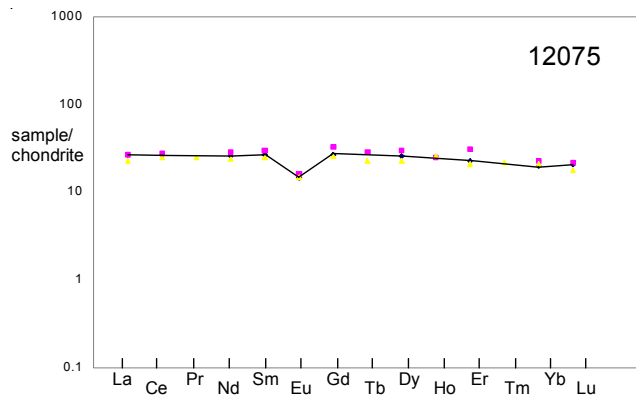


Figure 6: Normalized rare-earth-element pattern for 12075 (data from ...)

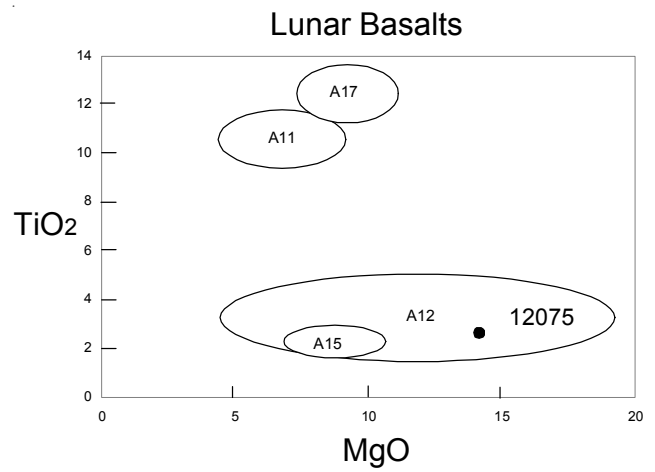


Figure 7: Composition of 12075 compared with that of other Apollo 12 basalts.

**Table 1. Chemical composition of 12075.**

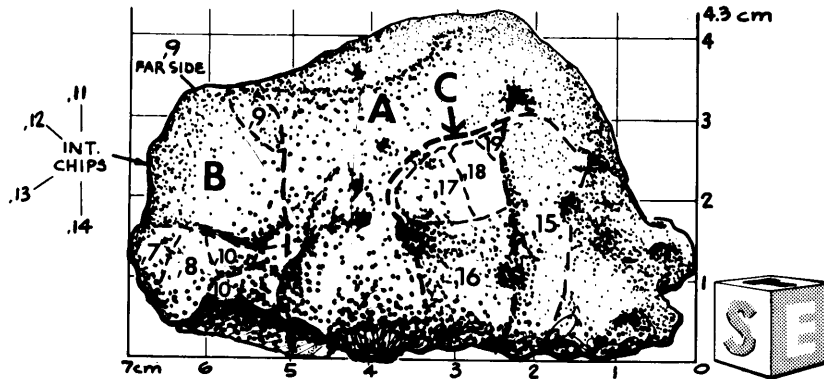
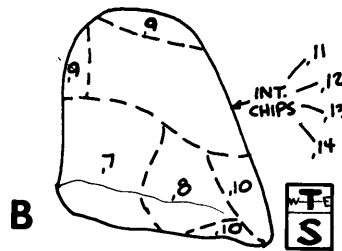
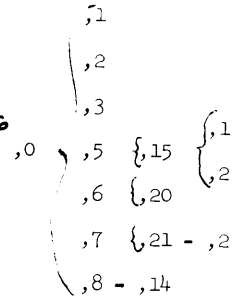
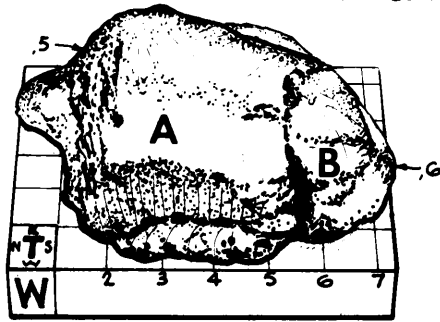
reference weight	Hubbard71 208 mg	Weismann75 208 mg	Cuttitta71	Wakita71a, b 0.496 0.523	Haskin71	Engel71	Wrigley 71
SiO <sub>2</sub> %			44.8	(b) 41.1	(c)	45.06	(e)
TiO <sub>2</sub>			2.55	(b) 3	2.6	(c)	2.84 (e)
Al <sub>2</sub> O <sub>3</sub>			7.87	(b) 8.1	7.9	(c)	8.92 (e)
FeO			20.7	(b) 21.6	(c)	20.23	(e)
MnO			0.27	(b) 0.257	0.257	(c)	0.26 (e)
MgO			14.4	(b) 13.9	(c)	13.32	(e)
CaO			8.53	(b) 8.4	8.5	(c)	8.64 (e)
Na <sub>2</sub> O			0.23	(b) 0.22	0.208	(c)	0.3 (e)
K <sub>2</sub> O	0.055	(a) 0.055	(a) 0.07	(b)	0.1	(c)	0.05 (e)
P <sub>2</sub> O <sub>5</sub>			0.08	(b)			0.16 (e)
S %							
sum							
Sc ppm			37	(b) 43	(c)	35	
V			158	(b) 210	190	(d)	180
Cr			4000	(b) 4256	(c)	4700	
Co			69	(b) 61	(c)	40	
Ni			72	(b)		63	
Cu			8.5	(b)		6	
Zn							
Ga			4.8	(b)			
Ge ppb							
As							
Se							
Rb	0.993	(a) 0.993	(a) 1.4	(b)	1.4	(d)	
Sr	94.3	(a) 94.3	(a) 59	(b)			95
Y			38	(b)	30	(d)	50
Zr			95	(b)			132
Nb							
Mo							
Ru							
Rh							
Pd ppb							
Ag ppb							
Cd ppb							
In ppb							
Sn ppb							
Sb ppb							
Te ppb							
Cs ppm					0.08	(d)	
Ba	63.9	(a) 63.9	(a) 58	(b) 30			66
La	3	(a) 6.34	(a)	5.8	5.3	(d) 6.33	(c)
Ce	16.1	(a) 16.1	(a)		14.9	(d) 17	(c)
Pr					2.2	(d)	
Nd	11.6	(a) 11.6	(a)		10.9	(d) 13	(c)
Sm	3.94	(a) 3.94	(a)	4.1	3.68	(d) 4.41	(c)
Eu	0.828	(a) 0.828	(a)	0.86	0.84	(d) 0.91	(c)
Gd	5.3	(a) 5.3	(a)		5.1	(d) 6.6	(c)
Tb					0.85	(d) 1.06	(c)
Dy	6.22	(a) 6.22	(a)		5.7	(d) 7.26	(c)
Ho					1.46	(d) 1.37	(c)
Er	3.73	(a) 3.73	(a)		3.4	(d) 5	(c)
Tm					0.54	(d)	
Yb	3.71	(a) 3.3	(a) 5.1	(b) 3.6	3.4	(d) 3.76	(c) 10
Lu	0.508	(a) 0.508	(a)		0.44	(d) 0.53	(c)
Hf				2.7			
Ta							
W ppb							
Re ppb							
Os ppb							
Ir ppb							
Pt ppb							
Au ppb							
Th ppm				0.7			0.62 (f)
U ppm							0.19 (f)

technique (a) IDMS, (b) mixed microchem., XRF, em. Spec., (c) INAA, (d) RNAA, (e) conventional wet, (f) radiation counting

# THE CHIPPING OF LUNAR ROCK 12075

DRWG. COMPLETED AUG. 10, 70

GENEALOGY



## References for 12075

- Bogard D.D., Funkhouser J.G., Schaeffer O.A. and Zahringer J. (1971) Noble gas abundances in lunar material-cosmic ray spallation products and radiation ages from the Sea of Tranquillity and the Ocean of Storms. *J. Geophys. Res.* **76**, 2757-2779.
- Champness P.E., Dunham A.C., Gibb F.G.F., Giles H.N., MacKenzie W.S., Stumpel E.F. and Zussman J. (1971) Mineralogy and petrology of some Apollo 12 lunar samples. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 359-376.
- Cuttitta F., Rose H.J., Annell C.S., Carron M.K., Christian R.P., Dwornik E.J., Greenland L.P., Helz A.P. and Ligon D.T. (1971) Elemental composition of some Apollo 12 lunar rocks and soils. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 1217-1229.
- Engel A.E.J., Engel C.G., Sutton A.L. and Myers A.T. (1971) Composition of five Apollo 11 and Apollo 12 rocks and one Apollo 11 soil and some petrogenetic considerations. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 439-448.
- Funkhauser J.G., Jessberger E., Muller O. and Zahringer J. (1971) Active and inert gasses in Apollo 12 and 11 samples released by crushing at room temperature and heating at low temperature. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 1381-1396.
- Gay P., Brown M.G., Muir I.D., Bancroft G.M. and Williams PGL (1971) Mineralogical and petrographic investigations of some Apollo 12 samples. *Proc. Second Lunar Sci. Conf.* 377-392.
- Haskin L.A., Helmke P.A., Allen R.O., Anderson M.R., Korotev R.L. and Zweifel K.A. (1971) Rare-earth elements in Apollo 12 lunar materials. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 1307-1317.
- Hubbard N.J. and Gast P.W. (1971) Chemical composition and origin of nonmare lunar basalts. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 999-1020.
- James O.B. and Wright T.L. (1972) Apollo 11 and 12 mare basalts and gabbros: Classification, compositional variations and possible petrogenetic relations. *Geol. Soc. Am. Bull.* **83**, 2357-2382.
- LSPET (1970) Preliminary examination of lunar samples from Apollo 12. *Science* **167**, 1325-1339.
- Neal C.R., Hacker M.D., Snyder G.A., Taylor L.A., Liu Y.-G. and Schmitt R.A. (1994a) Basalt generation at the Apollo 12 site, Part 1: New data, classification and re-evaluation. *Meteoritics* **29**, 334-348.
- Neal C.R., Hacker M.D., Snyder G.A., Taylor L.A., Liu Y.-G. and Schmitt R.A. (1994b) Basalt generation at the Apollo 12 site, Part 2: Source heterogeneity, multiple melts and crustal contamination. *Meteoritics* **29**, 349-361.
- Papike J.J., Hodges F.N., Bence A.E., Cameron M. and Rhodes J.M. (1976) Mare basalts: Crystal chemistry, mineralogy and petrology. *Rev. Geophys. Space Phys.* **14**, 475-540.
- Sutton R.L. and Schaber G.G. (1971) Lunar locations and orientations of rock samples from Apollo missions 11 and 12. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 17-26.
- Wakita H. and Schmitt R.A. (1971) Bulk elemental composition of Apollo 12 samples: Five igneous and one breccia rocks and four soils. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 1231-1236.
- Wakita H., Rey P. and Schmitt R.A. (1971) Abundances of the 14 rare earth elements and 12 other trace elements in Apollo 12 samples: Five igneous and one breccia rocks and four soils. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 1319-1329.
- Walker D., Kirkpatrick R.J., Longhi J. and Hays J.F. (1976) Crystallization history of lunar picritic basalt sample 12002: Phase-equilibria and cooling-rate studies. *Geol. Soc. Am. Bull.* **87**, 646-656.
- Wrigley R.C. (1971) Some cosmogenic and primordial radionuclides in Apollo 12 lunar surface materials. *Proc. Second Lunar Sci. Conf.* 1791-1796.