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".

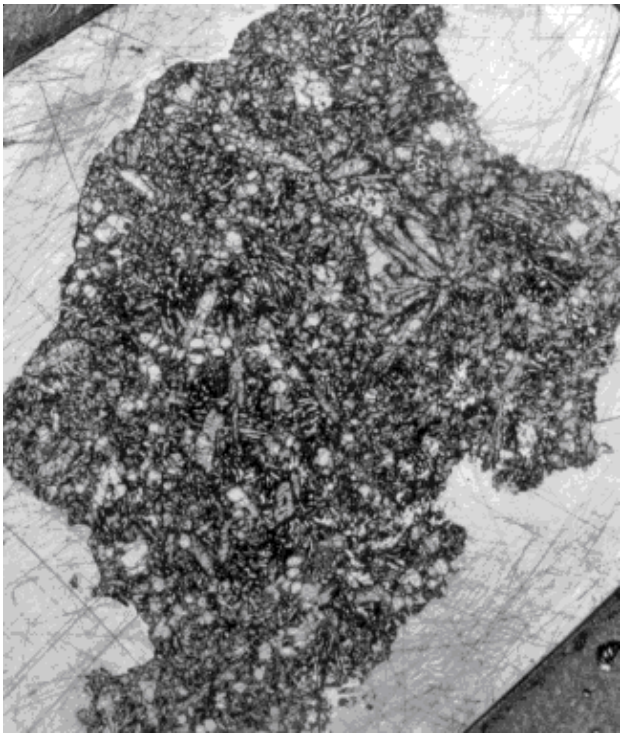


Figure 2: Photomicrograph of thin sedction 12075,25. Section is 1.5 cm. across. NASA # S70-46347.

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_{78-67} (Champness 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).

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
Opaques		8
Ilmenite	0.6	
Chromite +Usp	2.7	
mesostasis "silica"	1.6	0.2

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 ^{22}Na (74 dpm/kg) and ^{26}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

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

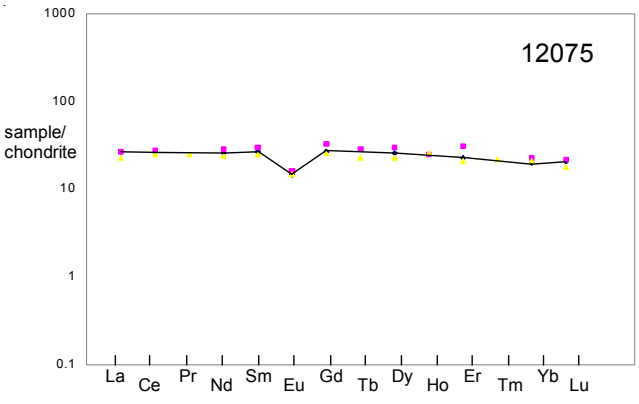


Figure 6: Normalized rare-earth-element pattern for 12075 (data from

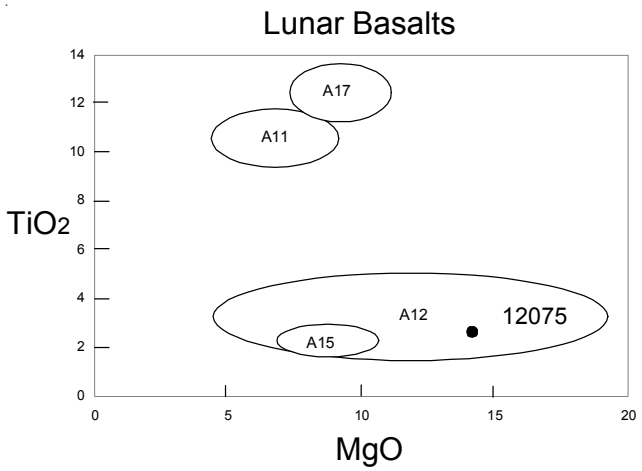


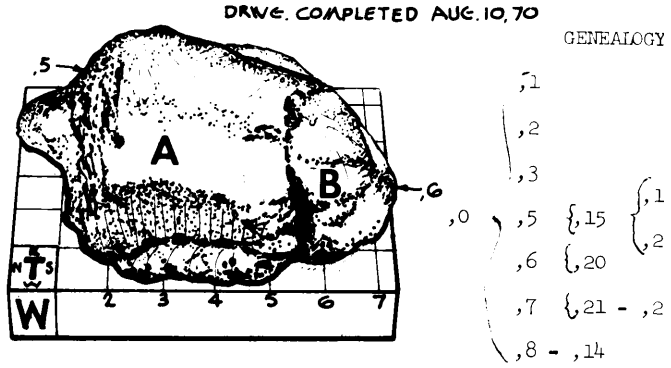
Figure 7: Composition of 12075 compared with that of other Apollo 12 basalts.

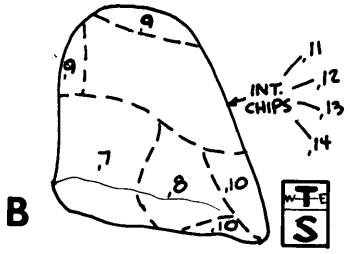
Table 1. Chemical composition of 12075.

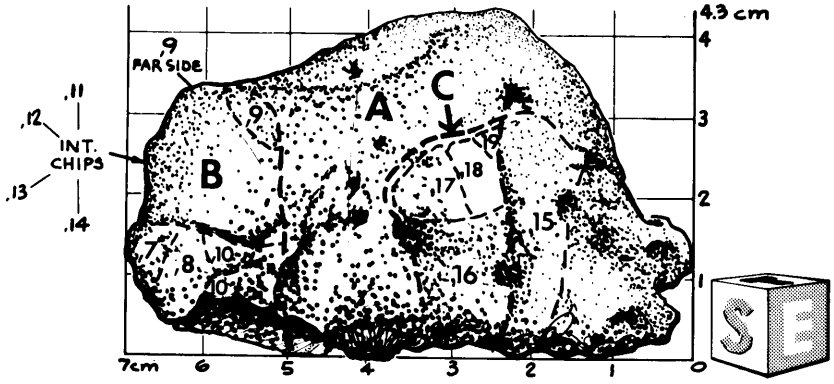
reference	Hubbard71		Weismann75		Cuttitta71		Wakita71a, b			Haskin71		Engel71		Wrigley 71	
weight	208 mg		208 mg				0.496	0.523							
SiO2 %					44.8	(b)	41.1		(c)			45.06	(e)		
TiO2					2.55	(b)	3	2.6	(c)			2.84	(e)		
Al2O3					7.87	(b)	8.1	7.9	(c)			8.92	(e)		
FeO					20.7	(b)	21.6		(c)			20.23	(e)		
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)		
Na2O					0.23	(b)	0.22	0.208	(c)			0.3	(e)		
K2O	0.055	(a)	0.055	(a)	0.07	(b)		0.1	(c)			0.05	(e)		
P2O5					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)

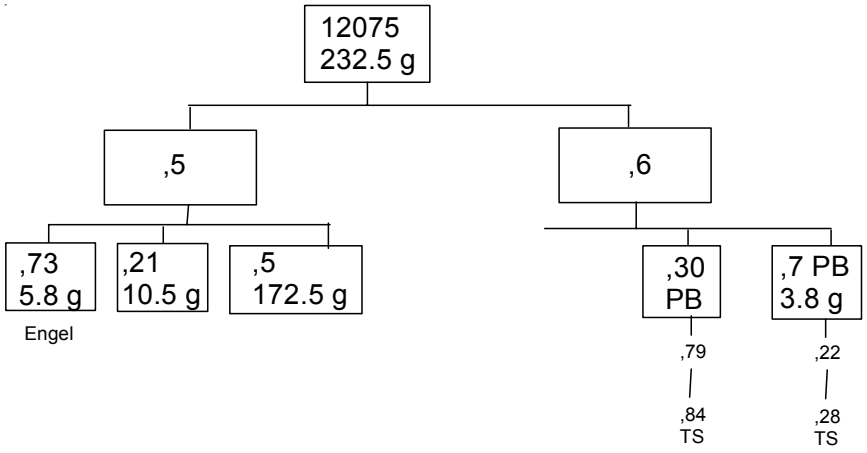
technique (a) IDMS, (b) mixed microchem., XRF, em. Spec., (c) INAA, (d) RNAA, (e) conventional wet, (f) radiation counting

THE CHIPPING OF LUNAR ROCK 12075









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. 2nd 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. 2nd 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. 2nd 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. 2nd 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. 2nd Lunar Sci. Conf.* 1307-1317.

Hubbard N.J. and Gast P.W. (1971) Chemical composition and origin of nonmare lunar basalts. *Proc. 2nd 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. 2nd 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. 2nd 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. 2nd 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.