12072

Olivine Basalt

103.6 grams

Figure 1: Photo of 12072. Sample is 5.5 cm. NASA # S69-61750.

Introduction

Olivine basalt 12072 is rounded and covered by micrometeorite craters on all sides (figure 1). It has numerous vugs and vesicles and has been used in the past for public display. 12072 has not been dated.

Petrography

The petrology of 12072 is discussed by Beaty et al. (1979) and Neal et al. (1994). Olivine, chromite and pyroxene phenocrysts are set in a variolitic groundmass of pyroxene, plagioclase, ilmenite and minor spinel, troilite, cristobalite, Fe-metal, apatite, fayalite and two immiscible glasses (Beaty et al. 1979). Olivine phenocrysts are rimmed by pyroxene and include chromite octahedra. Pyroxenes have colorless pigeonite cores rimmed with pinkish augite which grades continuously into Fe-rich groundmass pyroxene (figure 2). While Beaty et al. concluded that 12072 was a feldspathic basalt, the analyses by Neal et al. showed that it belonged to the grouping known as olivine basalt (identical mode?).

Mineralogy

Olivine: Olivine is Fo_{76} to Fo_{62} (Beaty et al. 1979).

Mineralogical Mode of 12072

	Beaty et al. 1979	Neal et al. 1994
Olivine	5.7	5.7
Pyroxene	49	49
Plagioclase	39	38.9
Ilmenite	1.1	1.4
Chromite ‘	0.3	0.2
Mesostasis	1.1	1.4
“silica”		3.1

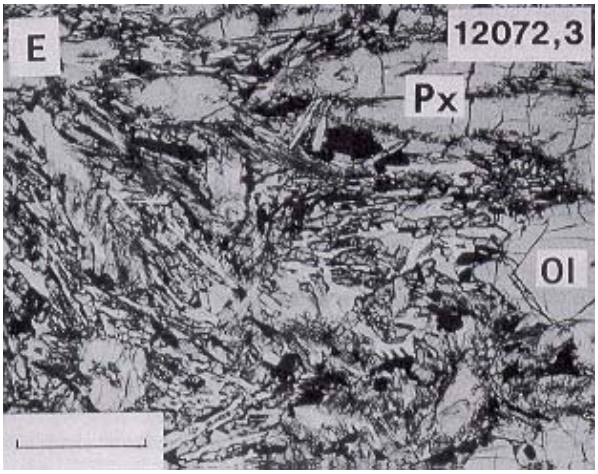


Figure 2: Texture of 12072.. Scale is 0.5 mm. Figure 2e from Neal et al. (1994).

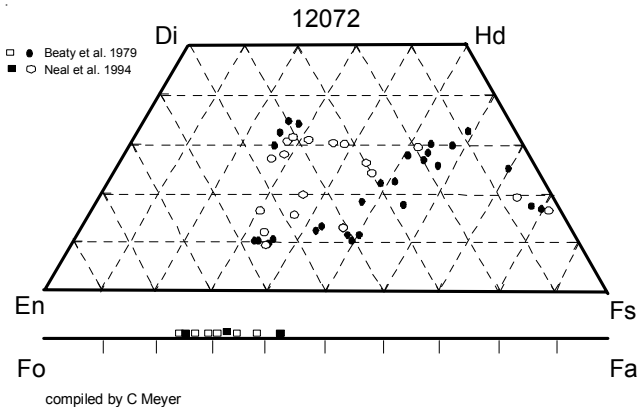


Figure 3: Pyroxene composition for 12072 (adapted loosely from Beaty et al. 1979, Neal et al. 1994).

Pyroxene: Beaty et al. (1979) determined the composition of pyroxene (figure 3). Pyroxenes zone continuously to pyroxferroite (no discontinuity).

Plagioclase: Plagioclase is An_{96} to An_{85} (Beaty et al. 1979).

Metallic Iron: Small iron grains are found in the mesostasis (figure 4).

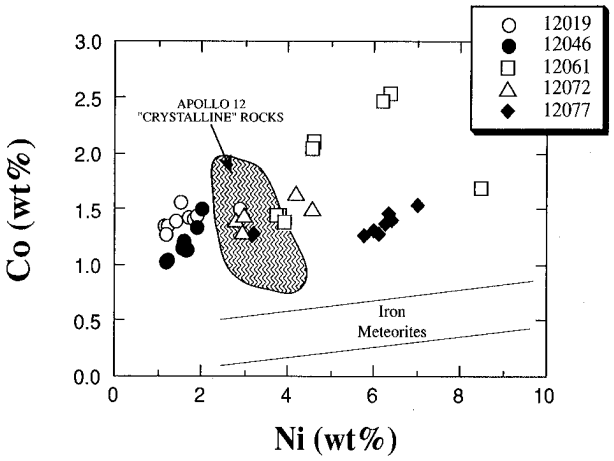


Figure 4: Composition of iron grain in Apollo 12 basalts (from Neal et al. 1994).

Chemistry

Chemical analysis by ICP-MS (Snyder et al. 1997) seem to agree with those by INAA (Neal et al. 1994). However, a calculated analysis for major elements by Beaty et al. (1979) was not as mafic (table 1).

Radiogenic age dating

Not dated.

Other Studies

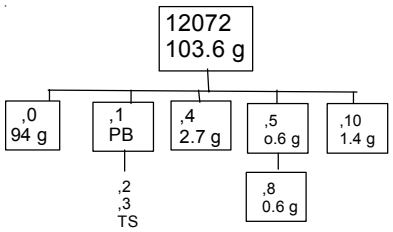
Bogard et al. (1971) reported the content and isotopic composition of rare gases in 12072.

Processing

12072 (whole piece) was once used as a public display, and has since been demounted, and re-entered into the collection. There are 2 thin sections.

List of Photo #s for 12072

S69-61740 – 61763	B & W mug
S94-035807 – 035808	color
S94-035811	



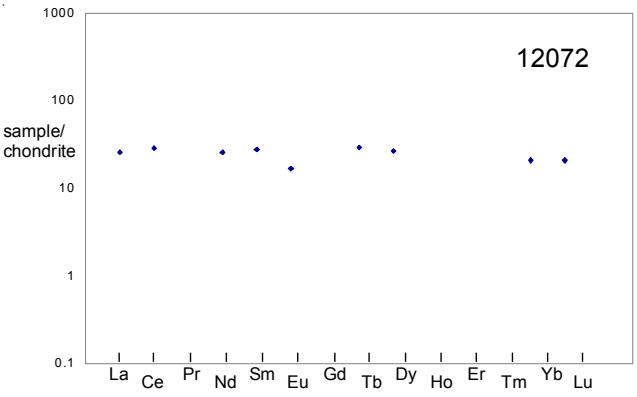


Figure 5: Normalized rare-earth-element composition for 12072 (data from Neal et al. 1994).

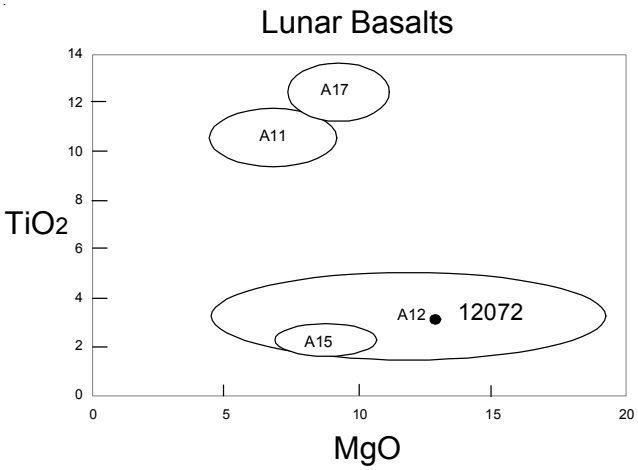


Figure 6: Composition of 12072 compared with that of other lunar samples.

Table 1. Chemical composition of 12072.

reference	Neal94		Beaty79		Snyder97	
weight	.618 g					
SiO2 %			48.14	(b)		
TiO2	3	(a)	1.81		3	
Al2O3	8.5	(a)	11.64		8.5	
FeO	21.3	(a)	17.46		21.3	
MnO	0.262	(a)	0.25		0.26	
MgO	13.3	(a)	8.57		13.3	
CaO	8.7	(a)	11.38		8.7	
Na2O	0.227	(a)	0.37		0.23	
K2O	0.059	(a)	0.04		0.06	
P2O5			0.06			
S %			0.16			
sum						
Sc ppm	47.1	(a)				
V	165	(a)				
Cr	3760	(a)	2737		3820	(c)
Co	50.5	(a)			48.2	(c)
Ni	54	(a)			55.5	(c)
Cu					8.86	(c)
Zn					8.14	(c)
Ga					2.85	(c)
Ge ppb						
As						
Se						
Rb					0.883	(c)
Sr					75.13	(c)
Y					30.7	(c)
Zr					95.9	(c)
Nb					5.36	(c)
Mo						
Ru						
Rh						
Pd ppb						
Ag ppb					107	(c)
Cd ppb						
In ppb						
Sn ppb						
Sb ppb						
Te ppb						
Cs ppm					0.047	(c)
Ba	56	(a)			51.2	(c)
La	6.2	(a)			6.23	(c)
Ce	17.7	(a)			17	(c)
Pr					2.22	(c)
Nd	11.6	(a)			11	(c)
Sm	4.2	(a)			4.01	(c)
Eu	0.96	(a)			0.85	(c)
Gd					3.91	(c)
Tb	1.07	(a)			0.74	(c)
Dy	6.6	(a)			4.52	(c)
Ho					0.97	(c)
Er					2.66	(c)
Tm					0.37	(c)
Yb	3.6	(a)			2.63	(c)
Lu	0.5	(a)			0.33	(c)
Hf	3	(a)				
Ta	0.43	(a)			0.244	(c)
W ppb						
Re ppb						
Os ppb						
Ir ppb						
Pt ppb						
Au ppb						
Th ppm	0.77	(a)			0.726	(c)
U ppm					0.164	(c)

technique: (a) INAA, (b) modal analysis, (c) ICP-MS

References for 12072

Beaty D.W., Hill S.M.R., Albee A.L. and Baldridge W.S. (1979b) Apollo 12 feldspathic basalts 12031, 12038, and 12072: Petrology, comparison and interpretations. *Proc. 10th Lunar Sci. Conf.* 115-139.

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.

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.

Snyder G.A., Neal C.R., Taylor L.A. and Halliday A.N. (1997a) Anataxis of lunar cumulate mantle in time and space: Clues from trace-element, strontium and neodymium isotopic chemistry of parental Apollo 12 basalts. *Geochim. Cosmochim. Acta* **61**, 2731-2747.

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.

Warner J. (1970) Apollo 12 Lunar Sample Information. NASA TR R-353. JSC (catalog)