12012

Olivine Basalt

176.2 grams

Figure 1: Photo of 12012,0, taken in 1991, after subdivision. NASA # S91-38939.

Introduction

Olivine basalt 12012 has not been well studied and no age is available.

Petrography

Rhodes et al. (1977) describe the texture of 12012 as "porphyritic-subophitic" with partially resorbed olivine phenocrysts in a subophitic groundmass (figure 2).

Mineralogy

Olivine: Average Fo_{67} (Baldridge et al. 1979).

Plagioclase: Average An_{87}.

Chromite-Ulvöspinel: Figure 4 shows chrome spinel overgrown by ulvöspinel, with metallic iron attached.

Chemistry

The chemical composition of 12012 was determined by LSPET (1970), Rhodes et al. (1977) and Neal et al. (1994).

Mineralogical Mode for 12012

	Neal et al. 1994	Baldridge et al. 1979
Olivine	21.6	18
Pyroxene	53.5	52.7
Plagioclase	19	25
Ilmenite	1.9	2
Chromite +Usp	1.3	0.6
mesostasis	1.6	0.4
"silica"	0.2	0.8

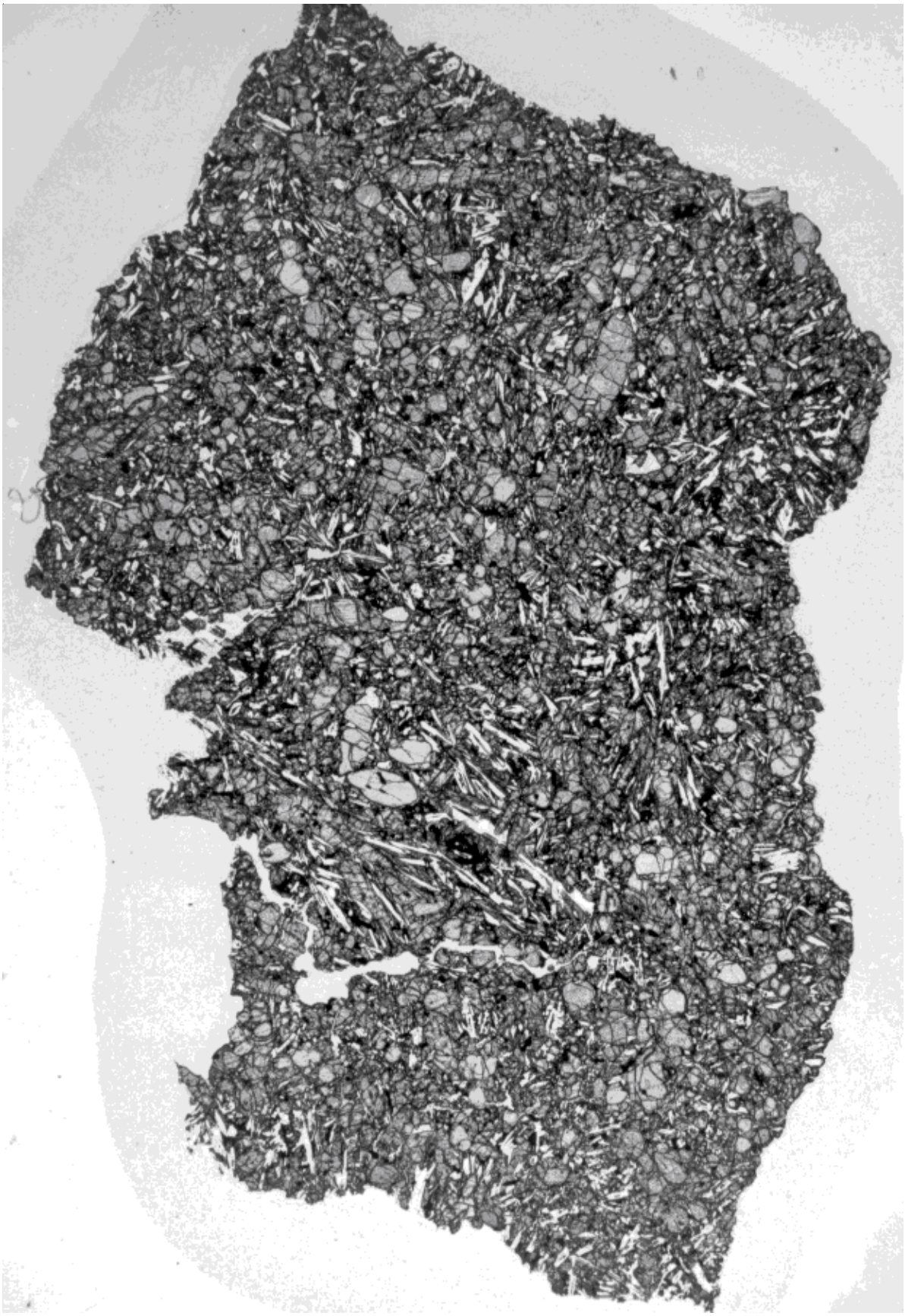


Figure 2 : Photomicrograph of thin section of 12012. NASA # S69-24220. Length = 2 cm.

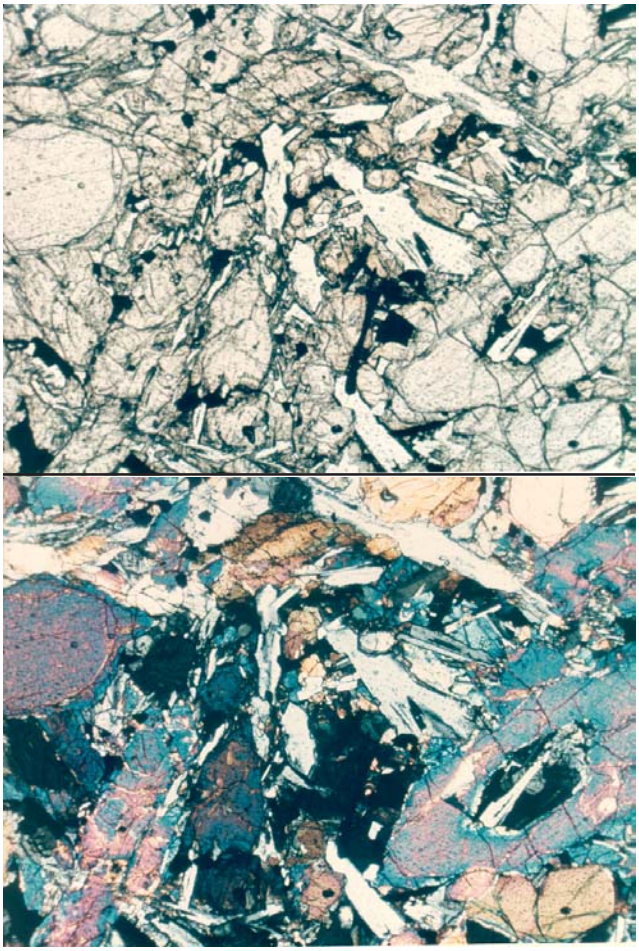


Figure 3: Photomicrographs of thin section 12012,7 in transmitted and cross-polarizing light showing large, corred pyroxene in cross section. Field of view is 2.2 mm. NASA #S70-49552 and 553.

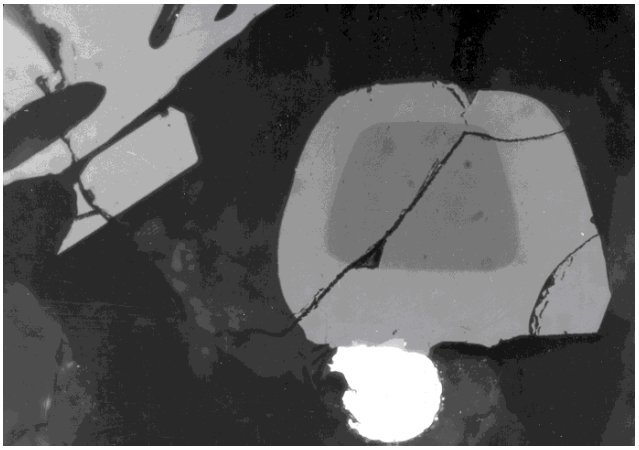


Figure 4: Reflected light photomicrograph of thin section 12012,8 showing chromite overgrown by ulvospinel with attached metallic iron grain. Also ilmenite in top corner. NASA #S70-25431. Chromite is 20 microns.

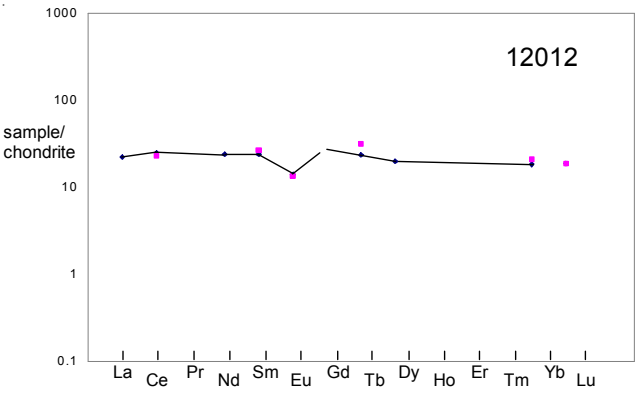


Figure 5: Normalized rare-earth-element diagram for 12012 (data from Rhodes et al. 1977).

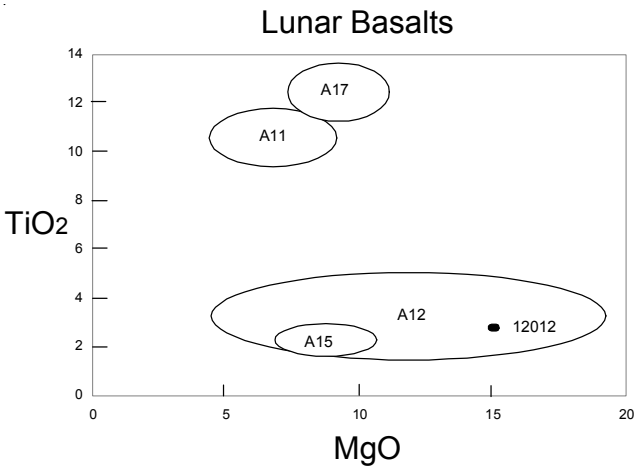


Figure 6: Composition of 12012 compared with that of other lunar basalts.

Radiogenic age dating

Not dated.

Other Studies

Bogard et al. (1971) reported the content and isotopic composition of rare gases in 12012.

There are 5 thin sections.

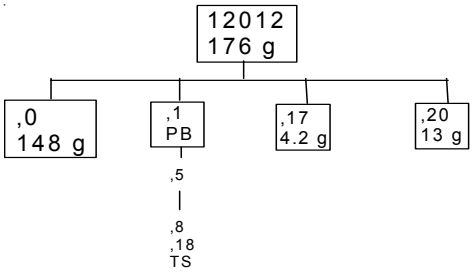
List of Photo #s for 12012

S69-63333-63341	B&W
S69-63417-63421	
S69-63396-63399	
S70-25405	TS
S70-20747	TS
S69-24220	TS
S70-49163-166	
S70-49553-554	
S91-38939	

Table 1. Chemical composition of 12012.

reference	Neal 94		Rhodes77		LSPET70
weight	.0604 g				
SiO2 %			44.17	(c)	35
TiO2	2.7	(a)	2.64	(c)	3.1
Al2O3	8.1	(a)	7.71	(c)	11
FeO	21.4	(a)	20.69	(c)	23
MnO	0.262	(a)	0.3	(c)	0.17
MgO	16	(a)	14.37	(c)	17.5
CaO	8	(a)	8.47	(c)	9.3
Na2O	0.207	(a)	0.21	(a)	0.53
K2O	0.052	(a)	0.06	(c)	0.055
P2O5			0.09	(c)	
S %			0.07	(c)	
sum					
Sc ppm	44	(a)	41.9	(a)	38
V	186	(a)			65
Cr	4260	(a)	4780	(a)	3900
Co	57.7	(a)	56	(a)	48
Ni	43	(a)	60	(a)	135
Cu					
Zn					
Ga					
Ge ppb					
As					
Se					
Rb					0.64
Sr	143	(a)	89	(c)	110
Y			33	(c)	40
Zr			99	(c)	120
Nb			6.6	(c)	
Mo					
Ru					
Rh					
Pd ppb					
Ag ppb					
Cd ppb					
In ppb					
Sn ppb					
Sb ppb					
Te ppb					
Cs ppm					
Ba	104	(a)	56	(b)	38
La	5.3	(a)			
Ce	15.3	(a)	13.8	(a)	
Pr					
Nd	10.8	(a)			
Sm	3.6	(a)	4.02	(a)	
Eu	0.8	(a)	0.76	(a)	
Gd					
Tb	0.86	(a)	1.17	(a)	
Dy	4.9	(a)			
Ho					
Er					
Tm					
Yb	3	(a)	3.4	(a)	
Lu	0.46	(a)	0.47	(a)	
Hf	2.6	(a)	3.4	(a)	
Ta	0.37	(a)			
W ppb					
Re ppb					
Os ppb					
Ir ppb					
Pt ppb					
Au ppb					
Th ppm	0.67	(a)			
U ppm					

technique (a) INAA, (b) IDMS, (c) XRF



References for 12012

Baldridge W.S., Beaty D.W., Hill S.M.R. and Albee A.L. (1979) The petrology of the Apollo 12 pigeonite basalt suite. *Proc. 10th Lunar Planet. Sci. Conf.* 141-179.

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.

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.

Rhodes J.M., Blanchard D.P., Dungan M.A., Brannon J.C., and Rodgers K.V. (1977) Chemistry of Apollo 12 mare basalts: Magma types and fractionation processes. *Proc. 8th Lunar Sci. Conf.* 1305-1338.