

10024
Ilmenite Basalt (high K)
68.1 grams



Figure 1: Photo of 10024. Sample is 3.2 cm long. NASA S69-46035.

Introduction

10024 was collected as part of the contingency sample and returned (in air) to the crew reception area in the lunar receiving laboratory JSC. It is a medium-grained high-K ilmenite basalt (figure 1).

The crystallization age of 10024 has been determined as 3.6 b.y. with a cosmic ray exposure age of 360 m.y.

Petrography

Schmitt et al. (1970) termed 10024 as a “medium-grained, vuggy, granular cristobalite basalt.” Beatty and Albee (1978) found that it was the coarsest grained of the high-K variety of Apollo 11 basalts. Kushiro and Nakamura (1970) reported the maximum grain size in 10024 as about 2 mm.

Mineralogy

Olivine: There is only a trace of olivine (Fo₇₀₋₆₅).

Pyroxene: Kushiro and Nakamura (1970) determined the composition of pyroxene (figure 3). They provided tie lines for the composition of coexisting pigeonite and augite.

Plagioclase: Plagioclase in 10024 is An₈₀₋₇₈.

Ilmenite: Reid et al. (1970) reported the composition of ilmenite.

Cristobalite: Kushiro and Nakamura (1970) reported large grains of cristobalite.



Figure 2: Photomicrographs of thin section of 10024 showing medium-grained basaltic texture. Field of view is 2.5 mm. NASA S70-49977 and 978.

Metallic Iron: Kushiro and Nakamura (1970) found 0.6 wt % Ni in metallic iron.

Chemistry

Compston et al. (1970), Rose et al. (1970) and others reported the chemical analysis (table 1, figures 4 and 5).

Note: the chemical analysis of 10044 reported by Philpotts and Schnetzler (1970) may be that of 10024 instead – see page 1473.

Radiogenic age dating

Papanastassiou and Wasserburg (1971) measured a Rb/Sr isochron as 3.61 ± 0.07 b.y. (figure 6) and Turner (1970) determined the age of 10024 by Ar/Ar as 3.48 b.y.

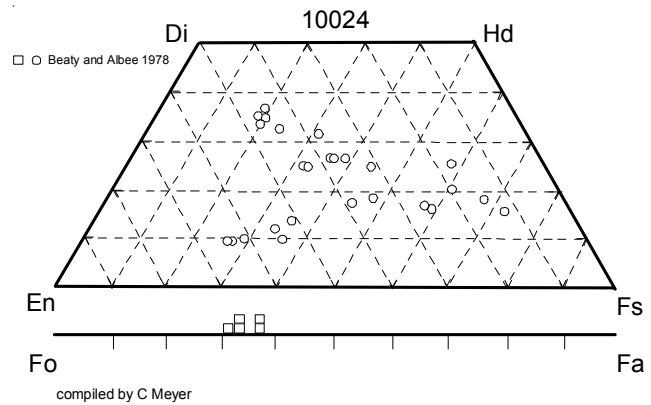


Figure 3: Pyroxene and olivine composition of 10024 (from Beaty and Albee 1978).

Cosmogenic isotopes and exposure ages

Turner et al. (1970) determined ^{38}Ar exposure age of 360 m.y. Eberhardt et al. (1970) also reported 360 m.y.

Other Studies

The total organic carbon content of 10024 was determined by hydrogen flame ionization pyrolysis (Ponnamperuma et al. 1970).

Nagata et al. (1970) studied the magnetic properties of 10024.

Funkhouser et al. (1970) and Bogard et al. (1971) reported the abundance and isotopic composition of rare gases from 10024.

Processing

Apollo 11 samples were originally described and cataloged in 1969 and “re-cataloged” by Kramer et al. (1977).

There are 11 thin sections.

Mineralogical Mode of 10024

	Kushiro and Nakamura 70	Beaty and Albee 78
Olivine		0.1
Pyroxene	52.2	51.4
Plagioclase	16.4	21.7
Ilmenite	21.8	16.4
mesostasis	9	8.2
silica	0.7	1.3
troilite		0.53
phosphate		0.24

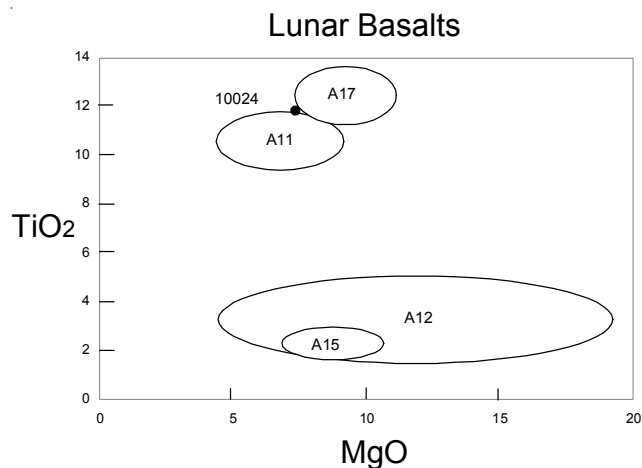


Figure 4: Composition of 10024 compared with that of other Apollo lunar samples.

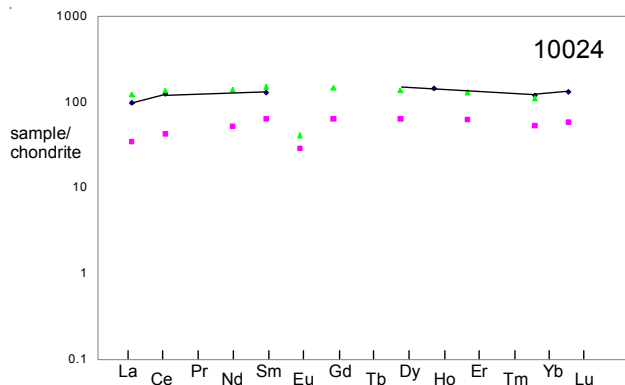


Figure 5: Normalized rare-earth-element composition for high-K basalt 10024 (the line) compared with that of low-K basalt 10020 and high-K basalt 10049 (the dots) (data from Wiesmann et al. 1975).

List of Photo #s for 10024

- S69-46026 – 035 PET mug B&W
- S69-46620 – 621
- S69-46397
- S70-48948 – 949 TS color
- S70-48977 – 980 TS color
- S70-49192 – 193
- S70-49880 – 881
- S76-26260 – 262

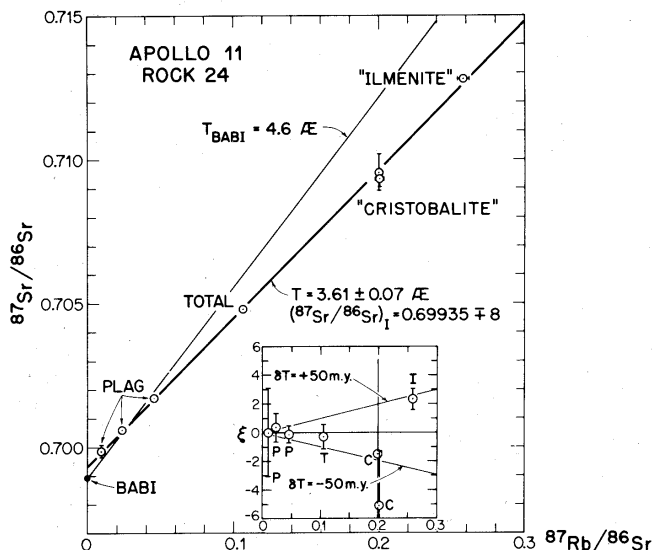
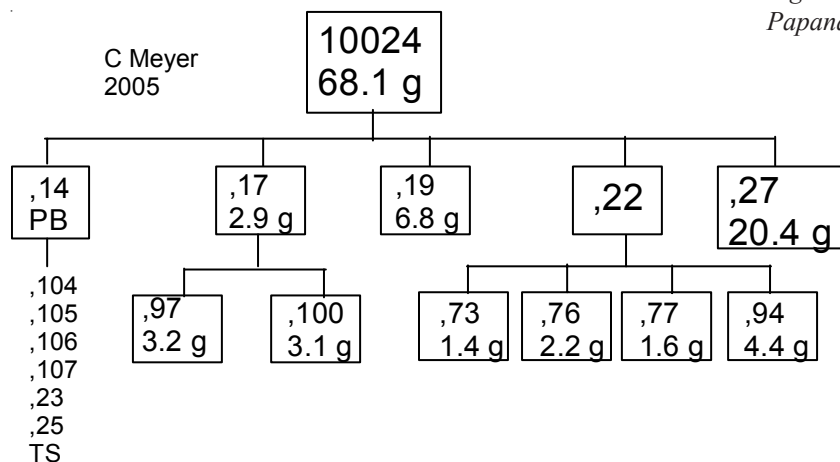


Figure 6: Rb/Sr isochron for 10024 (from Papanastassiou and Wasserburg 1971).



Summary of Age Data for 10024

	Rb/Sr	Ar/Ar plateau
Papanastassiou and Wasserburg 1971	3.61 ± 0.07 b.y.	
Tuner 1970		3.48 ± 0.05

Table 1. Chemical composition of 10024.

reference weight	Compston70	Rose70	Goles70	Philpotts69 Philpotts70 10044 ??	Beaty78	
SiO2 %	40.25	(a) 39	(b) 39.6	(c)	40	(e)
TiO2	11.9	(a) 13.2	(b) 12.5	(c)	12.93	(e)
Al2O3	8.09	(a) 9.5	(b) 7.9	(c)	7.2	(e)
FeO	19.46	(a) 18.5	(b) 19.8	(c)	19.09	(e)
MnO	0.24	(a) 0.24	(b) 0.21	(c)	0.23	(e)
MgO	7.53	(a) 8.11	(b) 7.13	(c)	8.74	(e)
CaO	10.66	(a) 10	(b) 9.93	(c)	10.1	(e)
Na2O	0.52	0.8	(b) 0.49	(c)	0.43	(e)
K2O	0.3	(a) 0.28	(b)	0.29	(d) 0.41	(e)
P2O5	0.2	(a)			0.1	(e)
S %	0.22	(a)			0.26	(e)
sum						
Sc ppm			76.2	(c)		
V	37		84	(c)		
Cr	2610	2737	(b) 2290	(c)		
Co	32		28.4	(c)		
Ni	<20					
Cu	16					
Zn	14					
Ga	5					
Ge ppb						
As						
Se						
Rb	5.96	(a)		5.64	(d)	
Sr	178	(a)		167	(d)	
Y	168	(a)				
Zr	375	(a)	650	(c)		
Nb	25					
Mo						
Ru						
Rh						
Pd ppb						
Ag ppb						
Cd ppb						
In ppb						
Sn ppb						
Sb ppb						
Te ppb						
Cs ppm						
Ba	310		170	(c) 285	(d)	
La	39		23	(c)		
Ce	108		76	(c) 76.6	(d)	
Pr	12					
Nd	55			66.1	(d)	
Sm			19.2	(c) 23.4	(d)	
Eu				2.21	(d)	
Gd				28.6	(d)	
Tb						
Dy				33.6	(d)	
Ho			8.1	(c)		
Er				19.3	(d)	
Tm						
Yb			19.6	(c) 16.6	(d)	
Lu			3.2	(c)		
Hf			20	(c)		
Ta			2.4	(c)		
W ppb						
Re ppb						
Os ppb						
Ir ppb						
Pt ppb						
Au ppb						
Th ppm						
U ppm			0.67	(c)		

technique: (a) XRF, (b) semimicro XRF, (c) INAA, (d) IDMS, (e) elec. Probe

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