14068

Crystalline-matrix Breccia

35.07 grams

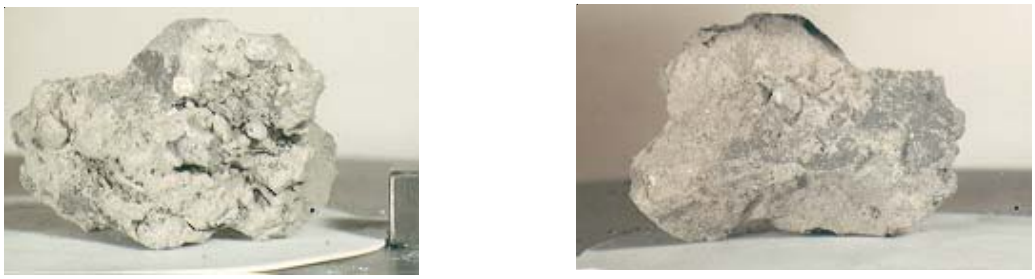


Figure 1: Two views of 14068. Cube is 1 cm for scale. NASA S71-30334 and 30336.

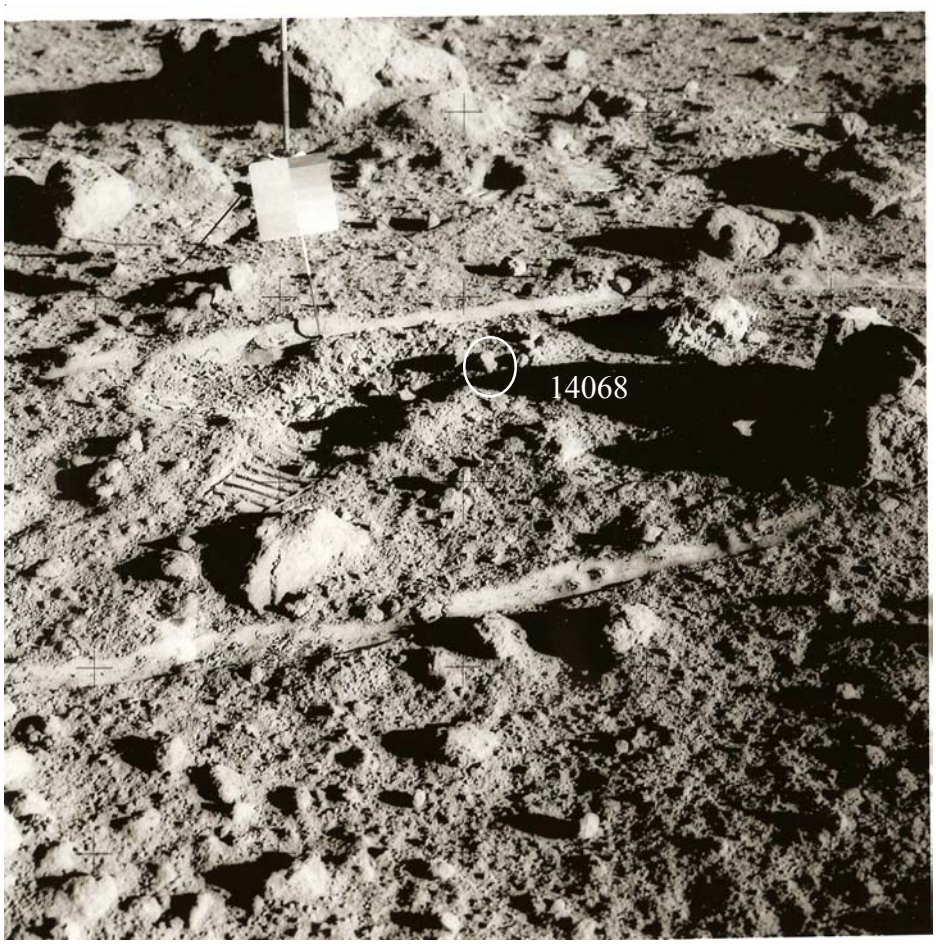


Figure 2: Location of 14068, between MET tracks, near rim of Cone Crater. AS14-64-9125.

Introduction

This breccia sample was picked up on the flank of Cone Crater (Swann et al. 1971). It was collected from a gray layer along with soil sample 14140-14143.

14068 appears to be distinctly different from other Apollo 14 breccias. Round vesicles indicate that the groundmass was once a melt, but it has subsequently quenched to a microcrystalline basaltic texture. The sample is Mg-rich and has abundant metallic iron grains.

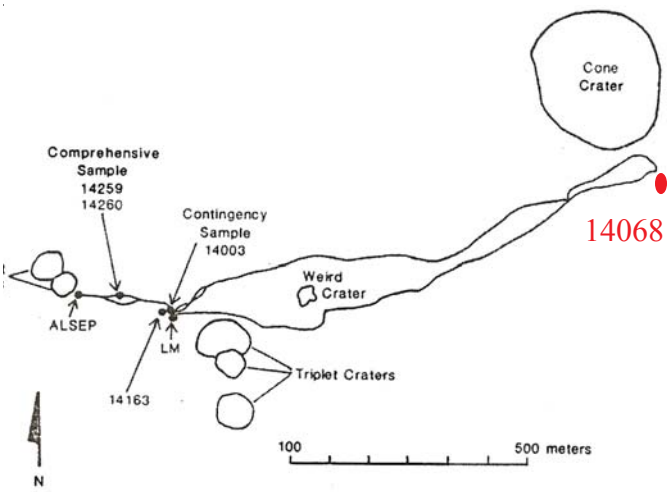


Figure 3: Map of Apollo 14 traverse to Cone Crater.

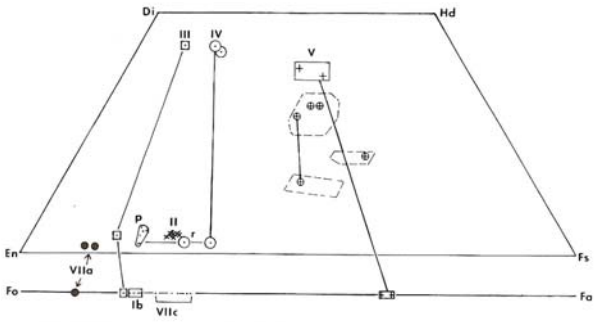


Figure 4: Composition of pyroxene and olivine in various clasts and matrix of 14068 (from Helx 1972).

Mineralogical Mode for 14068

(matrix) Helz 1972

Plagioclase	48 %	53	49
Olivine	16	18	13
Pyroxene	4	5	5
Iron	30	23	28
Spinel			
Opaque	2	1	4
Pink	0	1	1

Petrography

The matrix of 14068 is holocrystalline with needles of Mg-rich olivine crystallites (Nelen et al. 1972). There are a wide variety of mineral and lithic clasts.

14068 was carefully studied by Helz (1972) who determined that it was unusual, compared with other lunar samples. The feldspar composition is considerably more sodic than other lunar breccias, and the texture is that of a rapidly quenched igneous rock. The matrix is olivine rich and the clast assemblage is unusual, with numerous relics of K-rich material.

Chemistry

14068 has a very high concentration of MgO (17 %) and is chemically distinct from the crystalline matrix breccias (figure 5). Warner (1972) claims 14068 is "isochemical" with white breccias 14063 — !!

Radiogenic age dating

Stadermann et al. (1991) determined an Ar plateau age of 3.73 ± 0.04 b.y. for 14068 (figure 8). This ages is too young to be that of the Imbrium event, which is a problem yet to be resolved.

Cosmogenic isotopes and exposure ages

Bhandari et al. (1972) reported a track age (subdecimeter) of 15 m.y. while Bogard and Nyquist (1972) reported a spallogenic Ne age of 20 m.y. Stadermann et al. (1991) determined an Ar exposure age of 33 m.y. (age of Cone Crater).

Other Studies

Bogard and Nyquist (1972) determined the composition and isotopic ratios of rare gases in 14068.

Processing

14068 was returned under vacuum in ALSRC 1006 and has since been in nitrogen. There are 7 thin sections. Larry Nyquist is listed as consortium chief for 14068.

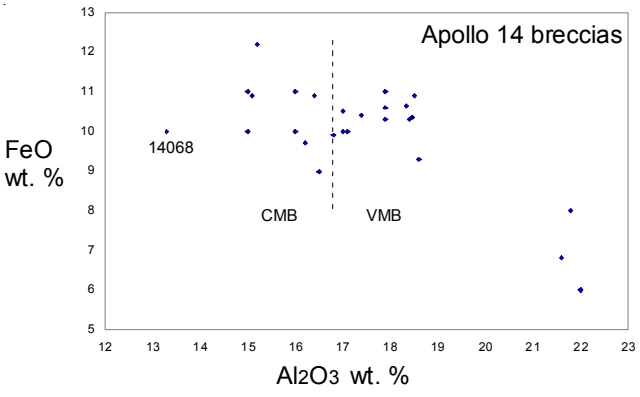


Figure 5: Composition of Apollo 14 breccias.

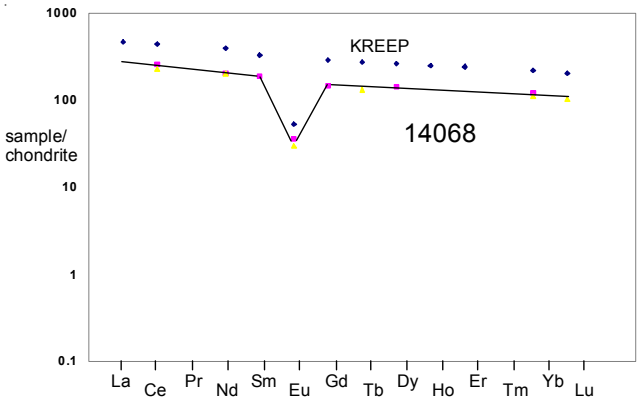


Figure 6: Normalized rare-earth-element diagram for 14068 compared with KREEP.

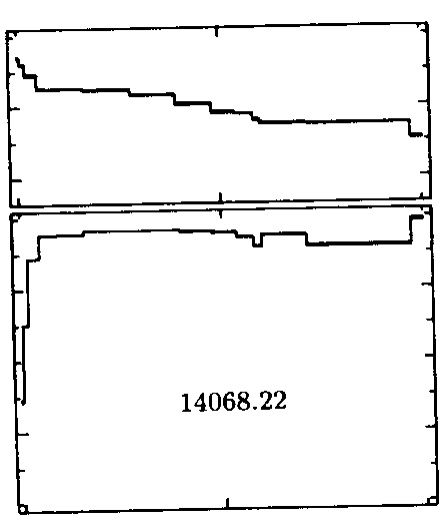
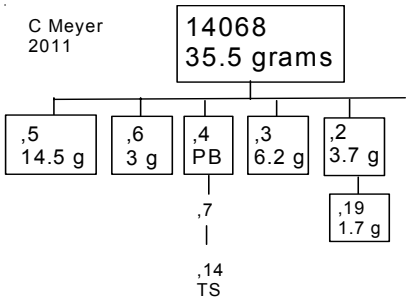


Figure 8: Argon plateau diagram for 14068 (Stadermann et al. 1991).

Summary of Age Data for 14068

	Ar/Ar
Stadermann et al. 1991	3.73 ± 0.04 b.y.

Caution: Beware of Ar standard.



Next page Figure 7: Photomicrograph of thin section 14068,10 by C Meyer.

Scale = 2.8 mm across

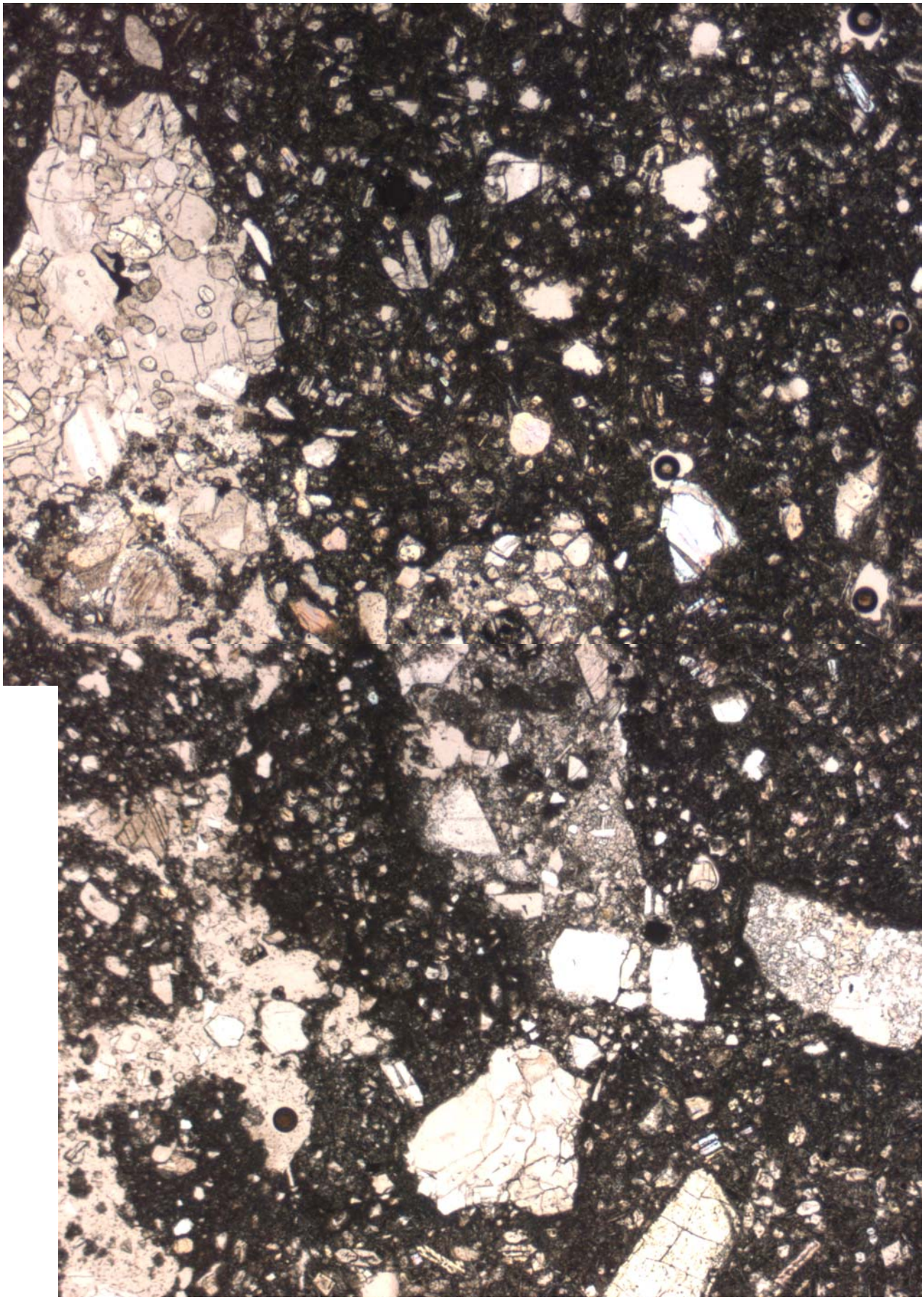


Table 1. Chemical composition of 14068.

reference	Hubbard72				Ebihara93	
weight			Wiesmann76			
SiO2 %	47.2	(a)				
TiO2	1.39	(a)	1.37	(b)		
Al2O3	13.3	(a)				
FeO	10	(a)				
MnO	0.13	(a)				
MgO	17.6	(a)	17.6	(b)		
CaO	8.28	(a)	7.84	(b)		
Na2O	0.75	(a)				
K2O	0.59	(b)				
P2O5	0.55	(a)	0.56	(b)		
S %	0.07	(a)				
sum						
Sc ppm						
V						
Cr			1811	(b)		
Co						
Ni					327	(c)
Cu						
Zn					1.53	(c)
Ga						
Ge ppb					229	(c)
As						
Se					90.4	(c)
Rb	14.5	(b)			15	(c)
Sr	139	(b)				
Y						
Zr						
Nb						
Mo						
Ru						
Rh						
Pd ppb					13	(c)
Ag ppb					1.27	(c)
Cd ppb					22	(c)
In ppb					53	(c)
Sn ppb					0.087	(c)
Sb ppb					1.76	(c)
Te ppb					4.15	(c)
Cs ppm					0.666	(c)
Ba	780	(b)				
La						
Ce	157	(b)			139	(c)
Pr						
Nd	93.4	(b)			92.5	(c)
Sm	28.1	(b)				
Eu	2.01	(b)			1.67	(c)
Gd	29.1	(b)				
Tb					4.83	(c)
Dy	35.1	(b)				
Ho						
Er						
Tm						
Yb	20	(b)			18.1	(c)
Lu					2.51	(c)
Hf						
Ta						
W ppb						
Re ppb					0.61	(c)
Os ppb					7.71	(c)
Ir ppb					6.02	(c)
Pt ppb						
Au ppb					3.46	(c)
Th ppm						
U ppm	3.47	(a)			3.11	(c)

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

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