

**10092**  
Ilmenite Basalt (low K)  
46 grams



*Figure 1: Photo of 10092,0. NASA S76-25871. Sample is about 3 cm.*

**Introduction**

10092 is a low-K, ilmenite basalt (figure 1). It was originally labeled 10002,22, but because of its size, was renumbered 10092. It was returned in rock box #1003.

**Petrography**

According to Beatty and Albee (1978), 10092 is similar in texture to 10045 and 10020. These rocks have an overall texture characterized by an open network of randomly-oriented plagioclase laths and ilmenite platelets with dominant pyroxene in between. Minor minerals include a silica phase, ulvospinel, Cr-spinel, troilite and a K-rich glass.

Olivine in 10092 is too Mg-rich to be in equilibrium with the bulk composition, indicating that it may have cumulate origin.

---

**Mineralogical Mode for 10092**

	<b>Beatty and Albee 1978</b>
Olivine	4.9
Pyroxene	45
Plagioclase	31
Ilmenite	15.6
Glass	0.14
silica	2.6
troilite	0.23
phosphate	0.06

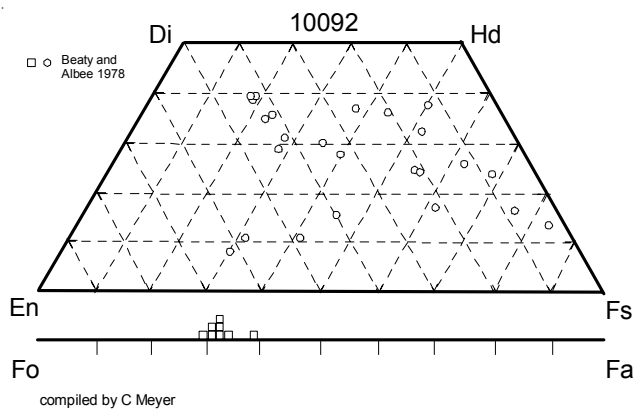


Figure 2: Pyroxene and olivine composition of 10092 (from Beaty and Albee 1978).

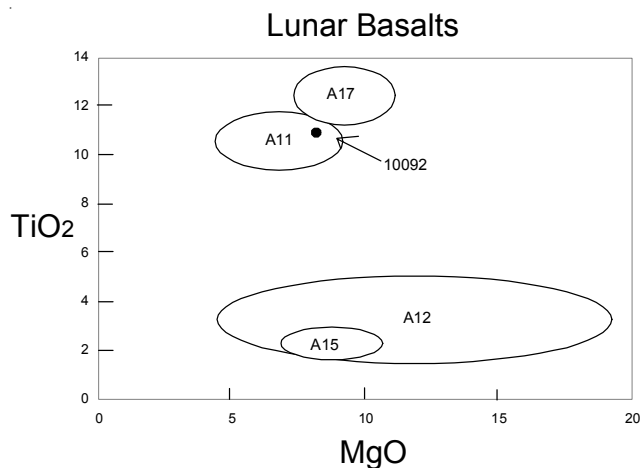


Figure 3: Composition of 10092 compared with that of other Apollo lunar samples.

### Mineralogy

**Olivine:** Olivine is  $Fe_{72-60}$ .

**Pyroxene:** Pyroxene has compositional zoning (figure 2).

**Plagioclase:** Plagioclase is  $An_{92-82}$ .

**Ilmenite:** Ilmenite has 2.5% MgO (Beaty and Albee 1978).

### Chemistry

Rhodes and Blanchard (1980) obtained an analysis of 10092 (table 1, figures 3 and 4).

### Radiogenic age dating

10092 has not be dated.

### Processing

Apollo 11 samples were originally described and cataloged in 1969 and “re-cataloged” by Kramer et al. (1977). There are 5 thin sections.

### List of Photo #s for 10092

S76-25871 – 76 color mug

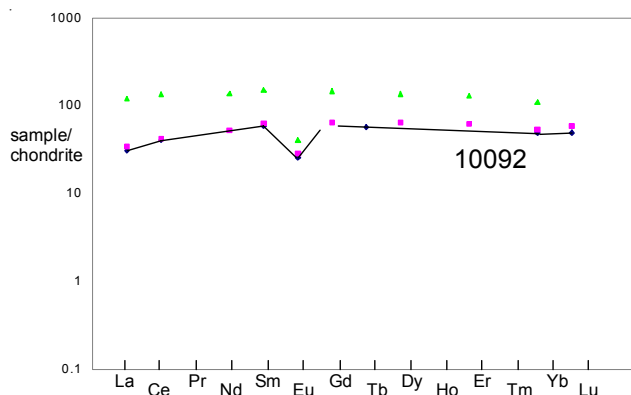
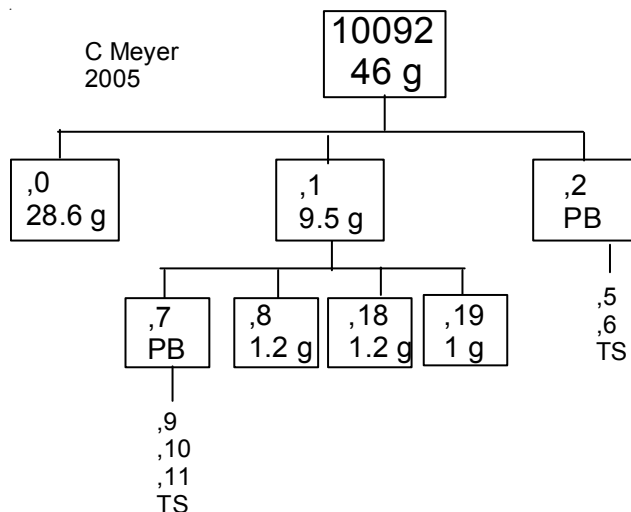


Figure 4: Normalized rare-earth-element composition for low-K basalt 10092 (the line) compared with that of low-K basalt 10020 and high-K basalt 10049 (the dots) (data from Wiesmann et al. 1975).



**Table 1. Chemical composition of 10092.**

reference weight	Rhodes80	Beaty 78	Neal2001	
SiO <sub>2</sub> %	38.85	(a) 38.05	(c)	
TiO <sub>2</sub>	10.87	(a) 12.74	(c)	
Al <sub>2</sub> O <sub>3</sub>	9.44	(a) 9.66	(c)	
FeO	19.35	(a) 18.38	(c)	
MnO	0.3	(a) 0.23	(c)	
MgO	8.52	(a) 8.9	(c)	
CaO	10.99	(a) 11.38	(c)	
Na <sub>2</sub> O	0.34	(b) 0.33	(c)	
K <sub>2</sub> O	0.06	(a) 0.02	(c)	
P <sub>2</sub> O <sub>5</sub>	0.07	(a) 0.03	(c)	
S %		0.11	(c)	
sum				
Sc ppm	82		85.6	(d)
V			96	(d)
Cr	2930	(b) 3010	(c) 2446	(d)
Co	19.3		21.4	(d)
Ni			3.6	(d)
Cu			43.7	(d)
Zn			72.7	(d)
Ga			3.64	(d)
Ge ppb				
As				
Se				
Rb			0.81	(d)
Sr			144	(d)
Y			92	(d)
Zr			210	(d)
Nb			18.2	(d)
Mo			0.06	(d)
Ru				
Rh				
Pd ppb				
Ag ppb				
Cd ppb				
In ppb				
Sn ppb				
Sb ppb			20	(d)
Te ppb				
Cs ppm			0.03	(d)
Ba			73.2	(d)
La	7.3	(b)	8.03	(d)
Ce	25	(b)	24.9	(d)
Pr			4.41	(d)
Nd			23.2	(d)
Sm	8.9	(b)	9.15	(d)
Eu	1.48	(b)	1.57	(d)
Gd			13.4	(d)
Tb	2.1	(b)	2.37	(d)
Dy			16	(d)
Ho			3.34	(d)
Er			9.73	(d)
Tm			1.39	(d)
Yb	8.1	(b)	9.03	(d)
Lu	1.22	(b)	1.23	(d)
Hf	6.8	(b)	7.56	(d)
Ta	1.4	(b)	1.18	(d)
W ppb			70	(d)
Re ppb				
Os ppb				
Ir ppb				
Pt ppb				
Au ppb				
Th ppm			0.68	(d)
U ppm			0.22	(d)

technique: (a) XRF, (b) INAA, (c) elec. Probe, (d) ICP-MS

**References for 10092**

- Beaty D.W. and Albee A.L. (1978) Comparative petrology and possible genetic relations among the Apollo 11 basalts. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 359-463.
- James O.B. and Jackson E.D. (1970) Petrology of the Apollo 11 ilmenite basalts. *J. Geophys. Res.* **75**, 5793-5824.
- Kramer F.E., Twedell D.B. and Walton W.J.A. (1977) **Apollo 11 Lunar Sample Information Catalogue** (revised). Curator's Office, JSC 12522
- LSPET (1969) Preliminary examination of lunar samples from Apollo 11. *Science* **165**, 1211-1227.
- Neal C.R. (2001) Interior of the moon: The presence of garnet in the primitive deep lunar mantle. *J. Geophys. Res.* **106**, 27865-27885.
- Rhodes J.M. and Blanchard D.P. (1980) Chemistry of Apollo 11 low-K mare basalts. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 49-66.
- Schmitt H.H., Lofgren G., Swann G.A. and Simmons G. (1970) The Apollo 11 samples: Introduction. *Proc. Apollo 11 Lunar Science Conf.* 1-54.