71097

High-Ti Mare Basalt
1.355 g, 1.5 x 1 x 0.7 cm

INTRODUCTION

71097 (Fig. 1) was described as a medium dark gray, medium-grained, microporphyritic basalt (Apollo 17 Lunar Sample Information Catalog, 1973). It contains several small vugs; one end of the specimen is a large rounded cavity surface, lined with ilmenite needles and coated with a smooth, colorless glass. This basalt has an angular shape with some penetrative fracturing and was collected from Station 1A.

PETROGRAPHY AND MINERAL CHEMISTRY

Veal et al. (1989) described 71097 as a fine-grained, subvariolitic, olivine porphyritic (up to 1 mm) basalt, although ilmenite phenocrysts (up to 1.2mm) are also present. Plagioclase (up to 0.6mm), pyroxene (up to 0.4mm), and ilmenite form the groundmass. Chromite and rutile exsolution lamellae (<0.005mm) are present in ilmenite. Olivines occasionally contain an overgrowth of pink pyroxene. Ilmenites exhibit "sawtooth" margins. Ilmenite-free armalcolite inclusions (~ 0.1mm) are present in pyroxene and Cr-ulvospinel (~ 0.05mm) inclusions are present in olivine. Native Fe, troilite, and silica form interstitial phases. Point counting reveals that 71097 is comprised of: 43.9% pyroxene; 23.4% ilmenite; 23.1% plagioclase; 6.8^{0}1o olivine; 1.1% native Fe and troilite; 0.7% silica; 0.5% spinel; and 0.5% armalcolite.

The largest olivines display some core-to-rim zonation, but the greatest variability is between grains (FO_{60-72})• Plagioclase exhibits moderate compositional variation (An_{78-88}), with only minor coreto-rim zonation. The majority of pyroxenes are titan-augites, although occasional pigeonites are present (Fig. 2). Compositional intermediates between these two compositions exist and limited Fe enrichment is noted. Al/Ti ratios are constant at ~2, and Cr_2O_3 contents decrease with decreasing pyroxene MG#. Armalcolite and Cr-ulvospinel both exhibit practically no compositional variability

Figure 1: Hand specimen photograph of 71097,0.

(MG# = 40-42 and 7-9, resp.). Ilmenite displays a relatively large compositional variability (MG# = 2-15), usually between grains.

ISOTOPES

Paces et al. (1991) reported Rb-Sr (Table 2) and Sin-Nd (Table 3) data for 71097,5. These analyses were part of a larger study characterizing the basalts at the Apollo 17 site.

WHOLE-ROCK CHEMISTRY

Neal et al. (1990) described 71097 as a Type B2 Apollo 17 high-Ti basalt. 71097 contains 12.0 wt% TiO_2 (Table 1) with a MG# of 38.9. The REE profile (Fig. 3) is LREE-depleted, but with an overall convex-upward shape. A negative Eu anomaly is present ($[Eu/Eu^*]_N = 0.53$).

PROCESSING

Of the original 1.355g of 71097, 0, approximately 1 g remains. 0.358 was irradiated as 71097, 4 for INAA, and 0.01 g was used in the preparation of thin section 71097,3.

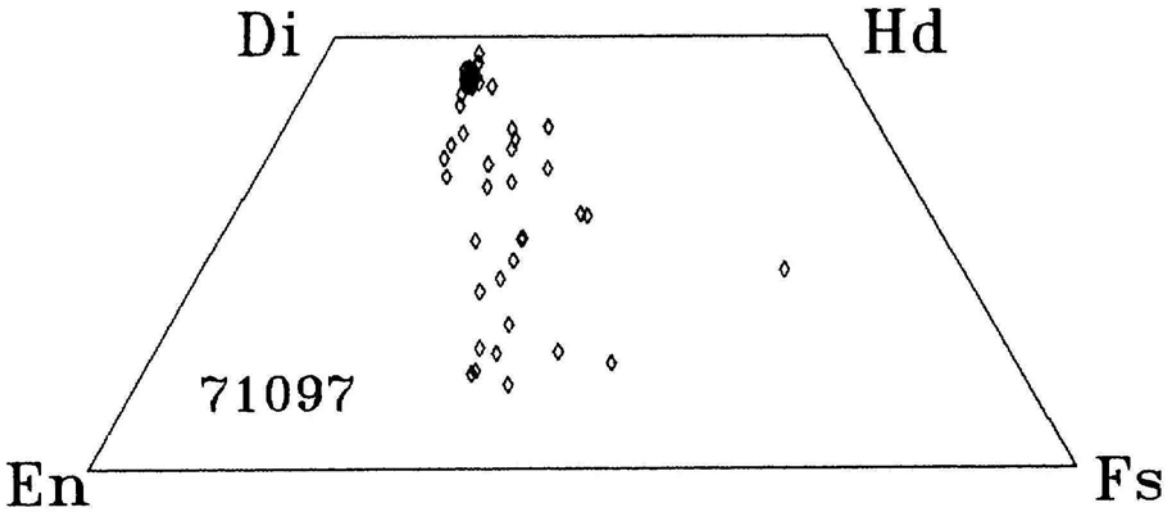

Figure 2: Pyroxene compositions of 71097 represented on a pyroxene quadrilateral

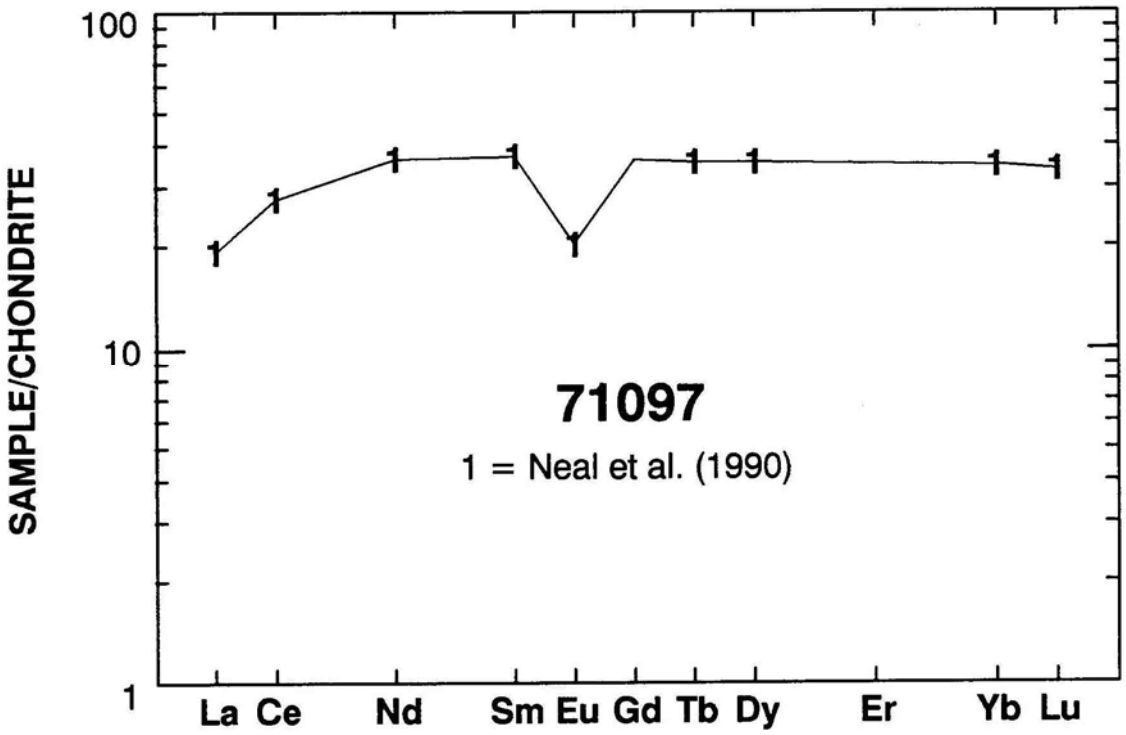

Figure 3: Chondrite- normalized rare-earth element profile of 71097.

Table 1: Whole-rock chemistry of 71097.
Data from Neal et al. (1990).

	Sample 71097,4 Method N		Sample 71097,4 Method N
SiO_2 (wt %)		Cu	
TiO_2	12.0	Ni	32
Al_2O_3	8.92	Co	21
Cr_2O_3	0.162	V	74
FeO	19.6	Sc	86
MnO	0.259	La	6.35
MgO	7.1	Ce	24
CaO	10.8	Nd	23
Na_2O	0.42	Sm	7.56
K_2O	0.06	Eu	1.56
P_2O_5		Gd	
S		Tb	2.07
Nb (ppm)		Dy	14.6
Zr	158	Er	
Hf	6.71	Yb	7.70
Ta	1.61	Lu	1.15
U	0.14	Ga	
Th	0.47	F	
W		Cl	
Y		C	
Sr	88	N	
Rb		H	
Li		He	
Ba	76	Ge (ppb)	
Cs	0.05	Ir	
Be		Au	
Zn		Ru	
Pb		Os	

Analysis by: N = INAA.

Table 2: Rb-Sr isotopic data for 71097,5.
Data from Paces et al. (1991).

Rb (ppm)	0.293
Sr (ppm)	109
$^{87}Rb/^{86}Sr$	0.007747 ± 77
$^{87}Sr/^{86}Sr$	0.699635 ± 12
I(Sr)[a]	0.699218 ± 16
T_{LUNI}[b](Ga)	5.4

[a]Initial Sr isotopic ratios calculated at 3.69 Ga using ^{87}Rb decay constant = $1.42 \times 10^{-11} yr^{-1}$.

[b]Model age relative to I(Sr) = LUNI = 0.69903 (Nyquist et al., 1974; Shih et al., 1986).
$T_{LUNI} = 1/\lambda * \ln[((^{87}Sr/^{86}Sr - 0.69903)^{87}Rb/^{86}Sr) + 1]$.

Table 3: Sm-Nd isotopic data for 71097,5.
Data from Paces et al. (1991).

Sm (ppm)	6.61
Nd (ppm)	16.6
$^{147}Sm/^{144}Nd$	0.24141 ± 48
$^{143}Nd/^{144}Nd$	0.514028 ± 12
I(Nd)[a]	0.508131 ± 24
$\varepsilon_{Nd}(t)$[b]	5.9 ± 0.5
T_{CHUR}[c](Ga)	4.7

[a]Initial Nd isotopic ratios calculated at 3.69 Ga using ^{147}Sm decay constant = $6.54 \times 10^{-12} yr^{-1}$.

[b]Initial ε_{Nd} calculated at 3.69 Ga using present-day chondritic values of $^{143}Nd/^{144}Nd$ = 0.512638 and $^{147}Sm/^{144}Nd$ = 0.1967.

[c]Model age relative to CHUR reservoir using present-day chondritic values listed above.
$T_{CHUR} = 1/\lambda * [((^{143}Nd/^{144}Nd - 0.512638)/(^{147}Sm/^{144}Nd - 0.1967)) + 1]$.