

15647 MEDIUM-GRAINED OLIVINE-NORMATIVE ST. 9A 58.2 g  
MARE BASALT

**INTRODUCTION:** 15647 is a fine-grained, olivine-bearing mare basalt (Fig. 1). The olivines form small phenocrysts. In chemistry, the basalt appears to be an average member of the Apollo 15 olivine-normative mare basalt group. It is a coherent, rounded sample with numerous zap pits. It was collected as part of the rake sample at Station 9A.

**PETROLOGY:** 15647 consists of anhedral, small (less than 1 mm) olivines, small granular pyroxenes and some granular olivine, and plagioclases (Fig. 2). The plagioclases, up to 2 mm long, are ragged and poikilitically enclose the small mafic phases. In places they grow in a radial arrangement. The olivine phenocrysts appear optically unzoned generally, and a few contain quenched silicate liquid inclusions. Chromite is present in the olivines, but ulvospinel is the dominant opaque phase. Ilmenite, cristobalite, glass, fayalite, and troilite form the residuum. Dowty et al. (1973a,b) described 15647 as the coarsest (by far) of the olivine-phyric basalts they studied; coarser rocks have a gabbroic, non-porphyrific texture. They reported a mode of 51% pyroxene, 29% plagioclase, 11% olivine, 6% opaques, and 3% miscellaneous. Microprobe analyses of pyroxenes, olivines, plagioclases, and residual glass were listed in Dowty et al. (1973c) (Fig. 3), and Nehru et al. (1973, 1974) reported and generally discussed spinel group and ilmenite analyses. Metal grains contain 1.3 to 1.8% Co and 2.2 to 7.7% Ni (some up to 23% Ni), and the ilmenite has 0.6 to 1.11% MgO. The residual silicic glass contains up to 7.9% K<sub>2</sub>O.

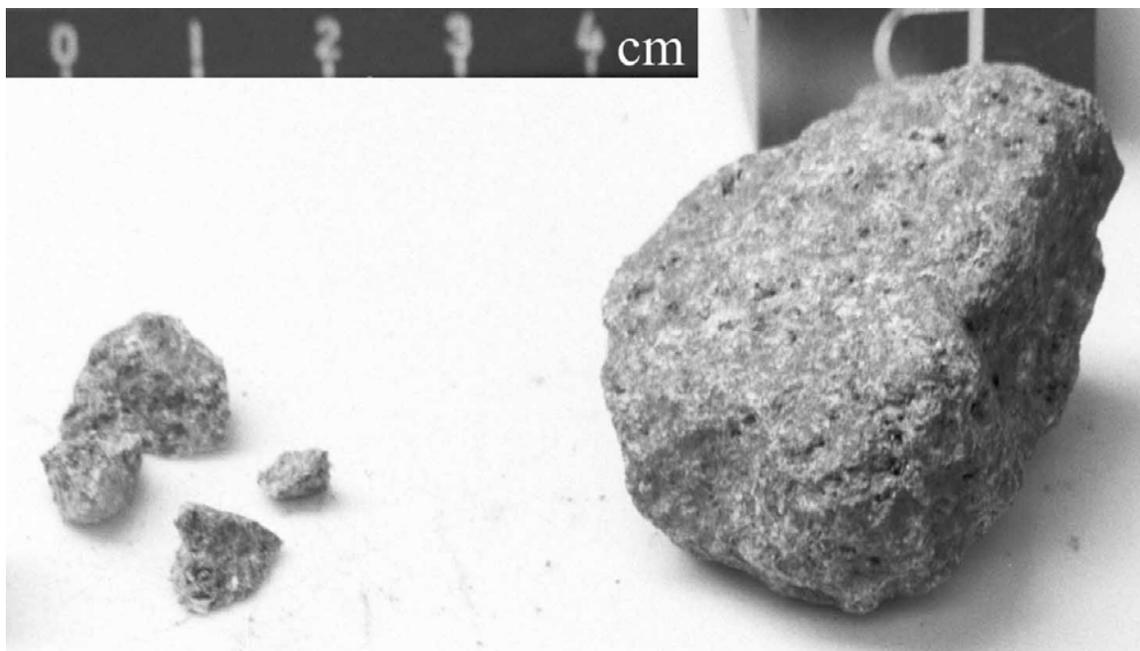


Figure 1. Post chip view of 15647. S-71-56353

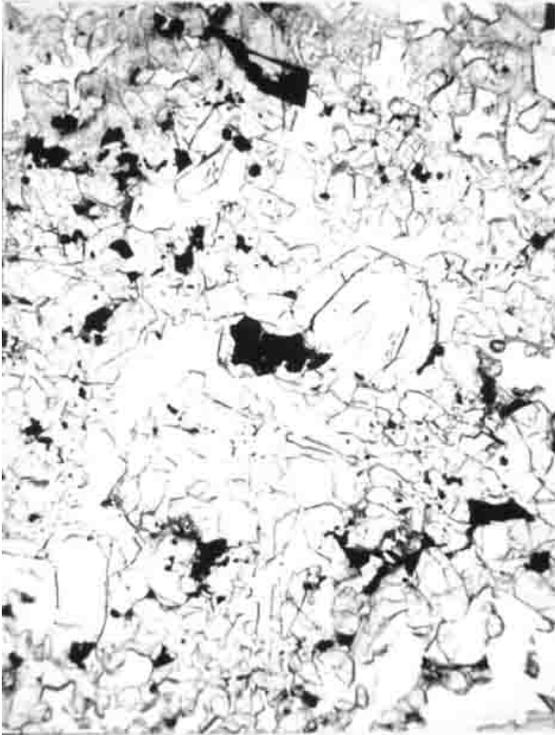


Fig. 2a



Fig. 2b

Figure 2. Photomicrographs of 15647,6. Widths about 3 mm.  
a) transmitted light; b) crossed polarizers.

Olivine phenocryst (center) has a quenched silicate liquid inclusion, and euhedral crystal faces against plagioclase, anhedral against mafic phases.

**CHEMISTRY:** A major and trace element analysis reported by Helmke and Haskin (1972) and Helmke et al. (19731) is listed in Table 1, with the rare earths plotted in Figure 4. Although Helmke and Haskin (1972) stated that 15647 is representative of most of the olivine-normative basalts (for trace elements), it has higher  $\text{TiO}_2$  and  $\text{FeO}$ , and lower  $\text{Al}_2\text{O}_3$ . The defocussed beam analysis of Dowty et al. (1973a,b) (erroneously listed under 15697 in 1973a) is similar to the Helmke et al. (1973) analysis except for more "normal"  $\text{TiO}_2$  and  $\text{Al}_2\text{O}_3$  abundances. The sample would thus appear to be a fairly average member of the Apollo 15 olivine-normative mare basalt group. The Hf abundance for 15647 (and all other samples analyzed) reported by Helmke et al. (1973) is a revision downwards of the Helmke and Haskin (1972) data.

**PROCESSING AND SUBDIVISIONS:** A few small pieces were chipped from 15647 (,0 now 55.39 g) for allocations (Fig. 1). Thin sections were made from two pieces: ,1 produced ,6 and ,7; and ,2 produced ,12 and ,13.

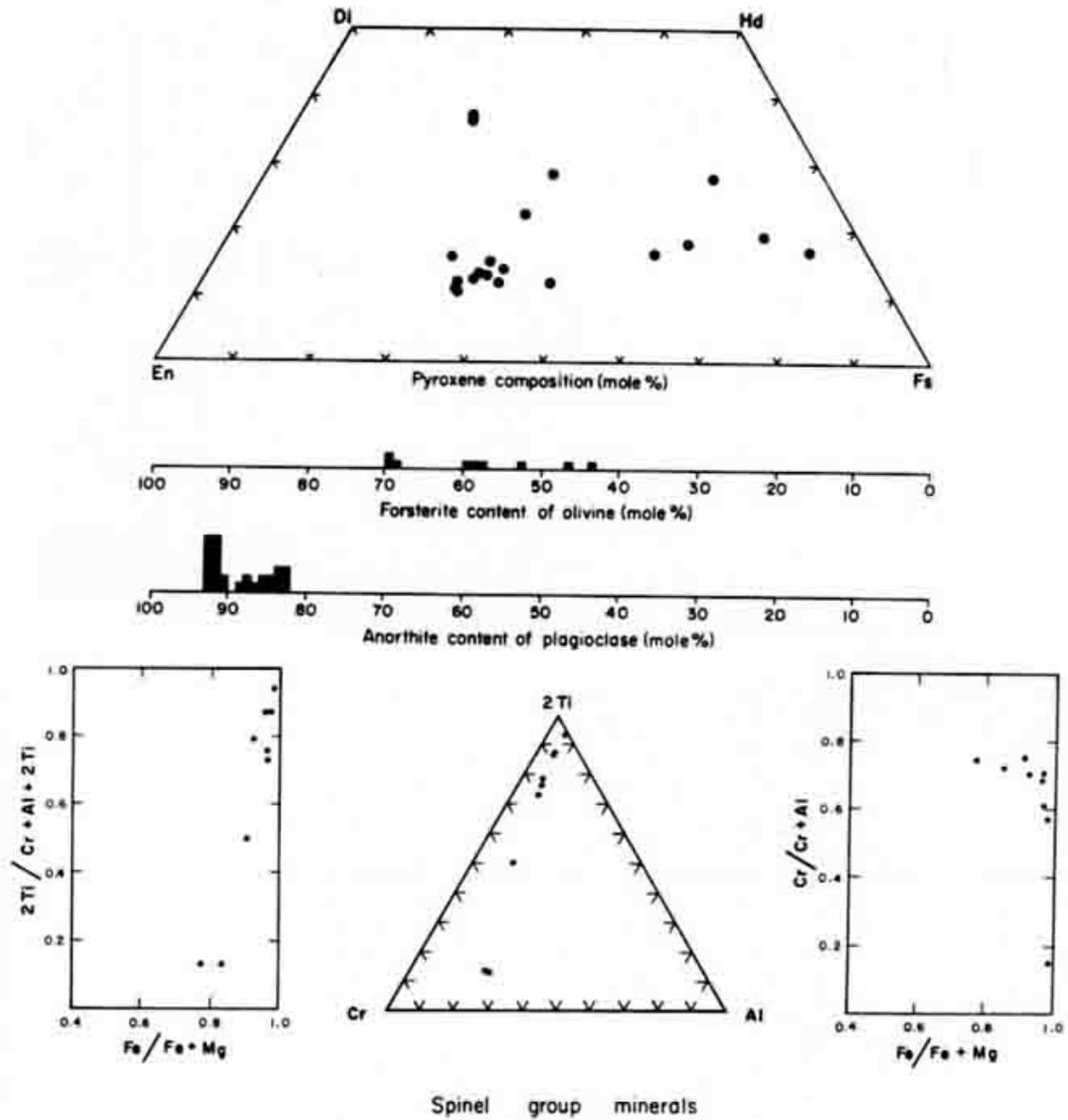


Figure 3. Compositions of mineral phases in 15647 (Dowty et al., 1973b).

TABLE 15647-1. Bulk rock chemical analysis

		.4
wt%	SiO <sub>2</sub>	46.2
	TiO <sub>2</sub>	3.01
	Al <sub>2</sub> O <sub>3</sub>	7.86
	FeO	23.9
	MgO	10.4
	CaO	9.67
	Na <sub>2</sub> O	0.275
	K <sub>2</sub> O	0.047
	P <sub>2</sub> O <sub>5</sub>	
(ppm)	Sc	46.1
	V	
	Cr	4000
	Mn	2290
	Co	53
	Ni	
	Rb	1.7
	Sr	
	Y	
	Zr	
	Nb	
	Hf	2.6(a)
	Ba	
	Th	
	U	
	Pb	
	La	4.83
	Ce	13.3
	Pr	
	Nd	10.6
	Sm	3.54
	Eu	0.92
	Gd	5.0
	Tb	0.83
	Dy	5.64
	Ho	0.93
	Er	3.0
	Tm	
Yb	2.27	
Lu	0.327	
Li		
Be		
B		
C		
N		
S		
F		
Cl		
Br		
Cu		
Zn		
(ppb)	I	
	At	
	Ge	3500
	As	
	Se	
	Mo	
	Tc	
	Ru	
	Rh	
	Pd	
	Ag	
	Cd	
	In	
	Sn	
	Sb	
	Te	
	Cs	41
	Ta	
	W	
	Re	
	Os	
Ir		
Pt		
Au		
Hg		
Tl		
Pb		

References and methods:

- (1) Helmke and Haskin (1972), Helmke et al., (1973); INAA, AAS, RFAA

Notes:

- (a) listed as 6.5 ppm in Helmke and Haskin (1972)

(1)

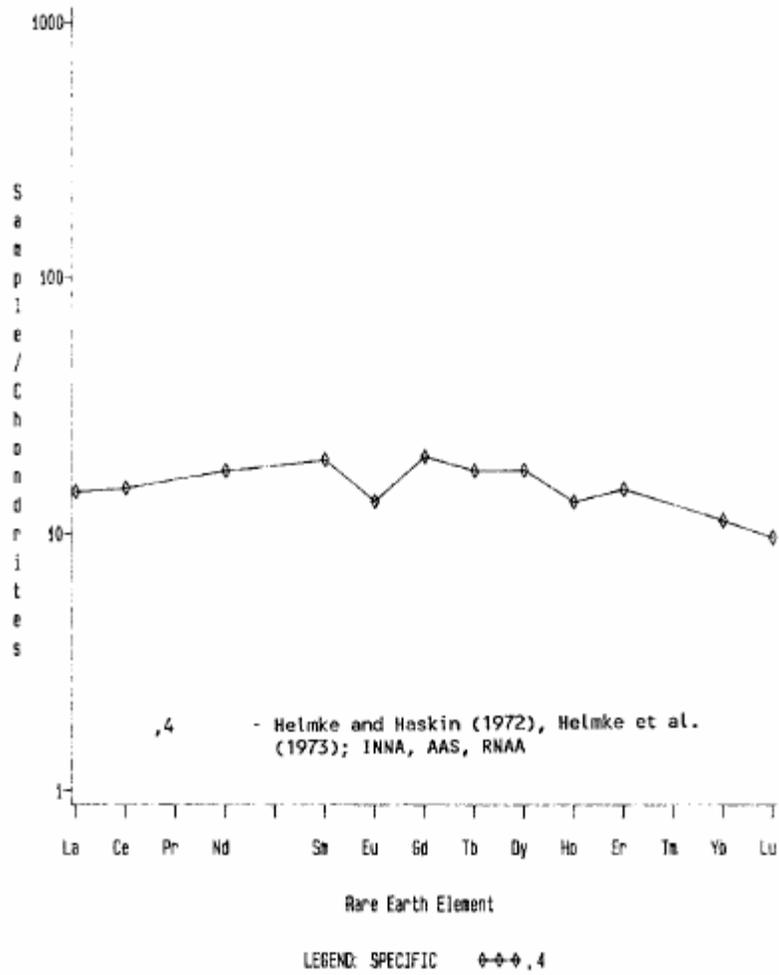


Figure 4. Rare earths in 15647,4.

TABLE 15647-2. Defocussed beam bulk rock analysis (Dowty et al., 1973a,b)

Wt %	SiO <sub>2</sub>	44.8
	TiO <sub>2</sub>	2.35
	Al <sub>2</sub> O <sub>3</sub>	9.0
	FeO	23.6
	MgO	10.5
	CaO	8.8
	Na <sub>2</sub> O	0.33
	K <sub>2</sub> O	0.04
	P <sub>2</sub> O <sub>5</sub>	0.07
ppm	Cr	3015
	Mn	2015