15607 FINE-GRAINED OLIVINE-NORMATIVE MARE BASALT ST. 9A 14.8 g

INTRODUCTION: 15607 is a fine-grained, olivine-bearing mare basalt (Fig. l) in which olivine forms small phenocrysts. In chemistry the sample is an average member of the Apollo 15 olivine-normative mare basalt group. A ^{40}Ar-^{39}Ar plateau age of 3.27 ± 0.12 b.y. (Husain, 1974) is only slightly lower than other such basalts and the sample has suffered considerable gas loss. The sample is gray brown with yellow-green olivines visible. It is irregularly-shaped and is coherent. Small vugs are common; no zap pits were observed. 15607 was collected as part of the rake sample at Station 9A.

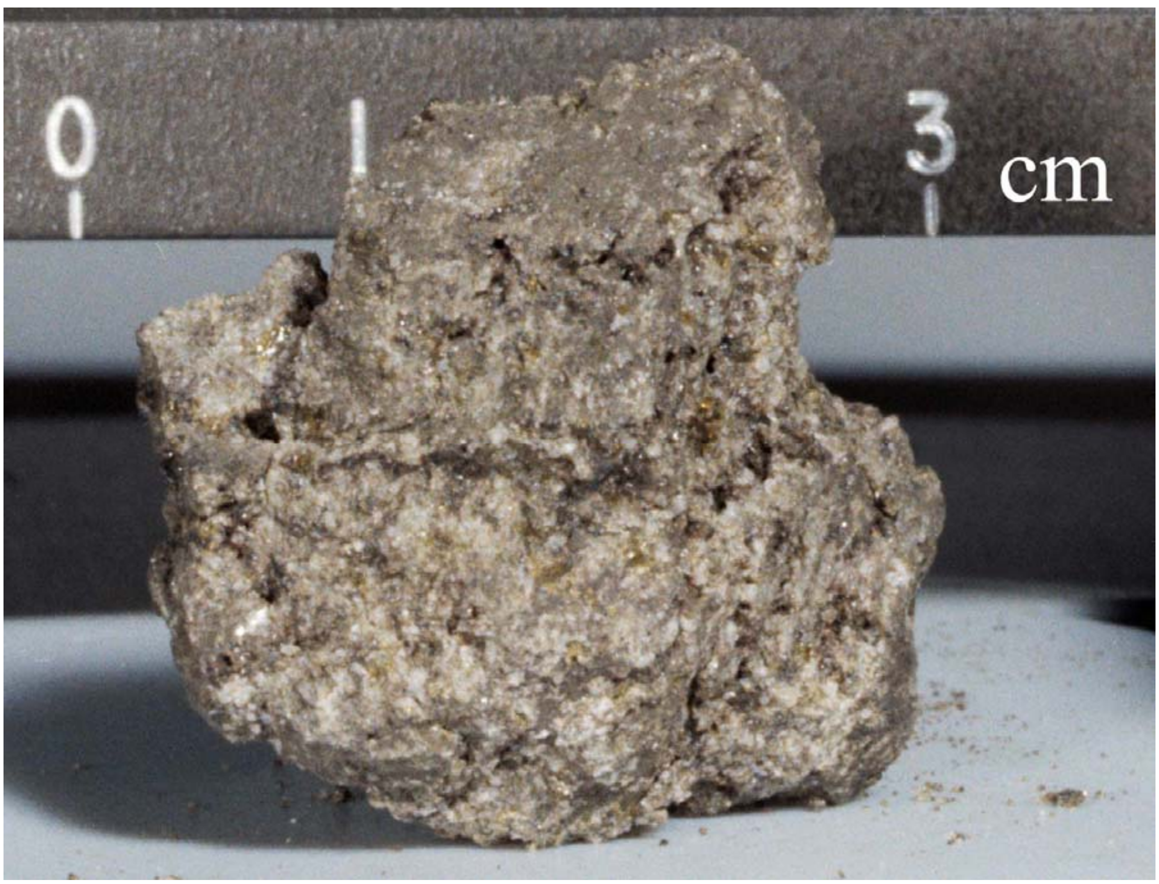

Figure 1. Pre-chip view of 15607. S-71-44933

PETROLOGY: 15607 is a fine-grained olivine-bearing mare basalt. The texture is dominated by small granular pyroxenes and olivines embedded or partly embedded in plagioclases up to 2 mm long (Fig. 2). Olivines form sparse anhedral phenocrysts. Dowty et al. (1973a,b) reported a mode with 56% pyroxene, 30% plagioclase, 8% olivine, 5% opaques, and 1% silica (which is actually cristobalite). Microprobe analyses of pyroxenes, plagioclases, olivines, potash feldspar, Si-K glass, and Fe-metals were reported by Dowty et al. (1973b,c) with the opaque phases tabulated in Nehru et al. (1973). Nehru et al. (1974) included 15607 in their general discussion and tabulated a chromite analysis. Some of the mineral chemistries are diagrammed in Figure 3. The metal contains 1.4 to 1.8% Co and 4.3 to 7.7% Ni; the ilmenite contains 0.5 to 0.91% MgO.

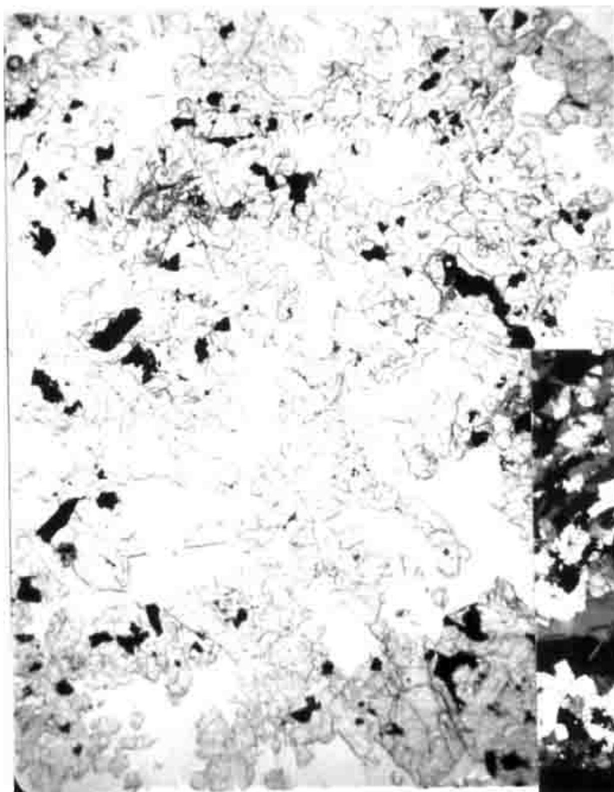

Fig. 2a

Fig. 2b

Figure 2. Photomicrographs of 15607,8.
Widths about 3 mm. a) transmitted light; b) crossed polarizers.

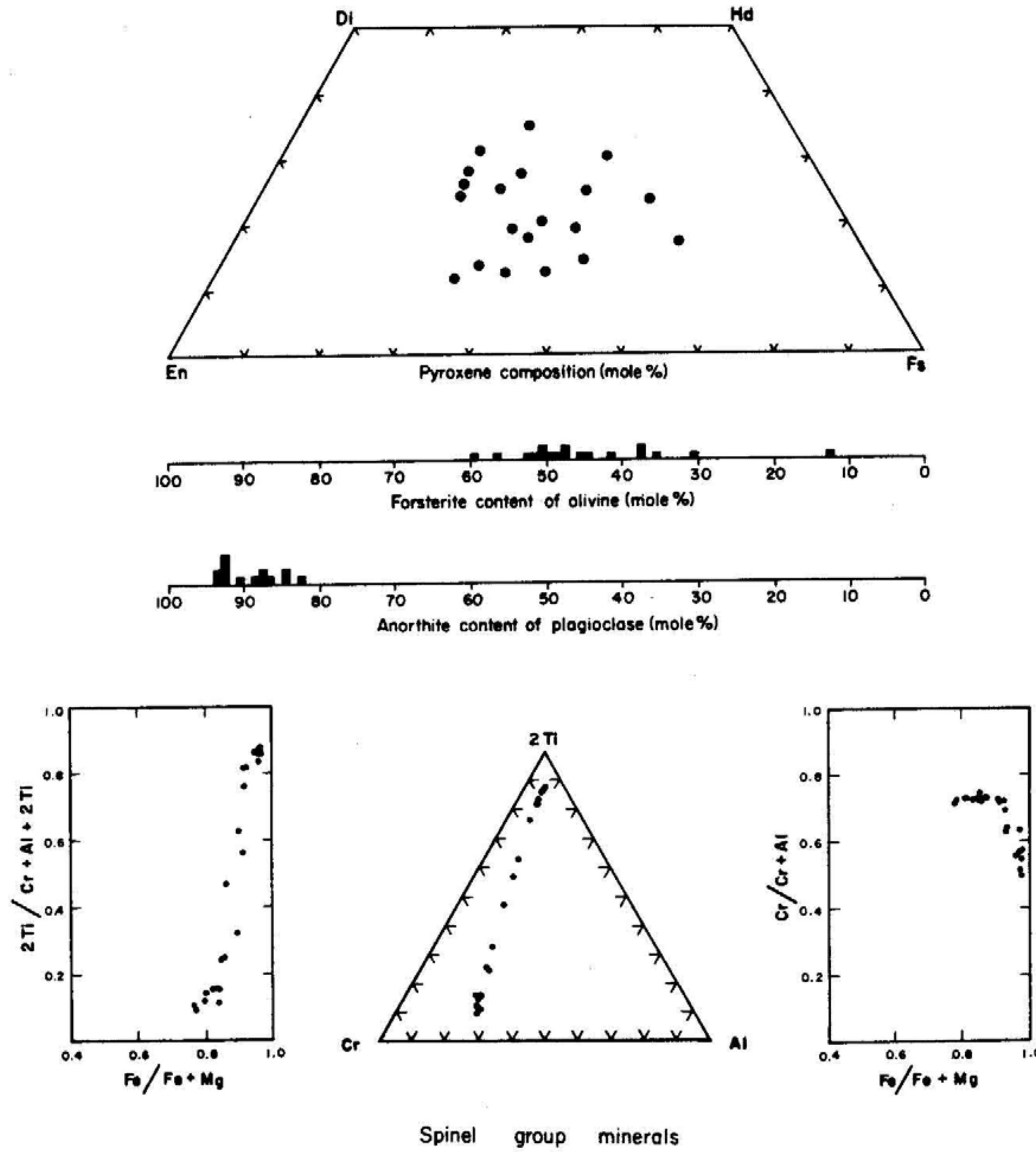

Figure 3. Chemistry of minerals in 15607
(Dowty et al., 1973b).

CHEMISTRY: Chemical analyses are listed in Table 1 with the rare earths shown in Figure 4. A bulk analysis using the microprobe defocussed-beam method is listed as Table 2 and is very consistent with the conventional chemical analyses. The analyses show 15607 to be a fairly average Apollo 15 olivine-normative mare basalt. Ma et al. (1976) found a high Sm/Eu and suggested that it belonged to a group different from some other such basalts, but the analysis of Laul and Schmitt (1973) has a low Sm/Eu and suggests that Sm/Eu is either too subject to sampling errors or too imprecisely determined to be a group discriminator in this case.

Christian et al. (1972) and Cuttitta et al. (1973) analyzed for Fe_2O_3 and found none, and reported an "excess reducing capacity" (over FeO) of +0.17. Their rare earth data is (systematically) higher than other group's analyses and are unreliable.

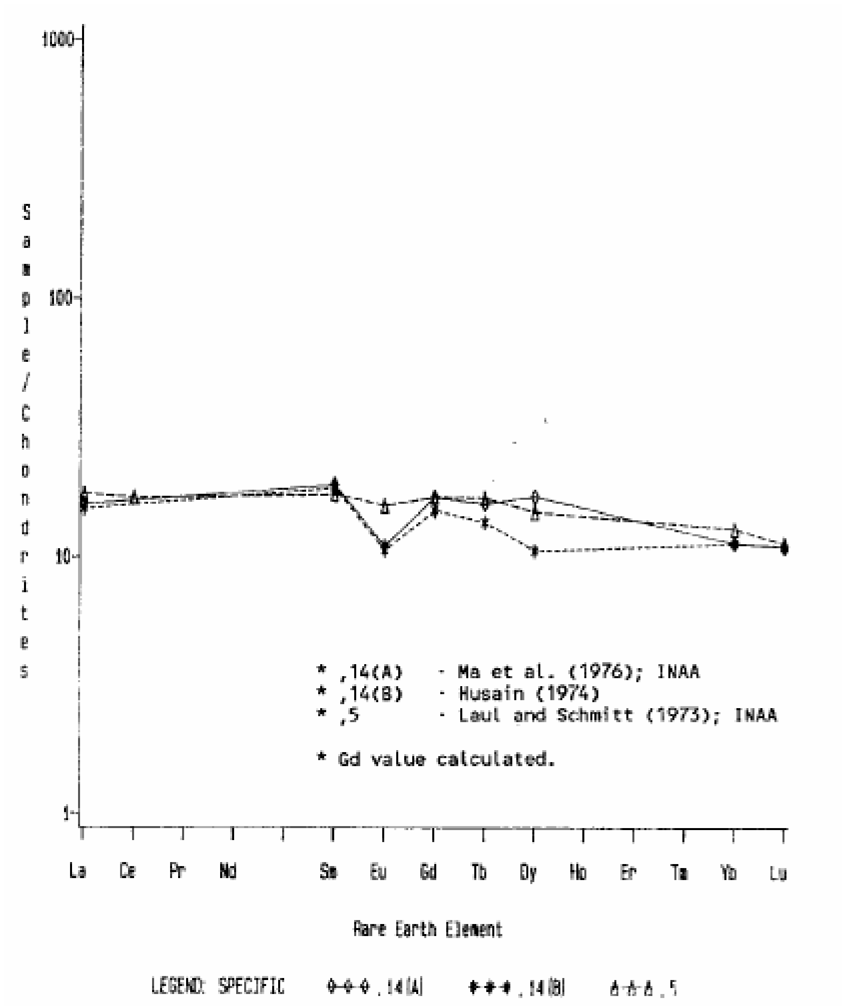

Figure 4. Rare earths in 15607.

TABLE 15607-1. Bulk rock chemical analyses

		,3	,5	,14A	,14B	,4
Wt %	SiO2	45.55				
	TiO2	2.51	2.4	2.4	2.6	
	Al2O3	8.55	8.9	9.0	9.0	
	FeO	22.33	23.7	23.3	23.1	
	MgO	9.96	10	9.9	9.9	
	CaO	10.10	10.2	8.9	8.9	7.0
	Na2O	0.35	0.251	0.263	0.274	
	K2O	0.05	0.044	0.048	0.046	0.0476
	P2O5	0.08				
(ppm)	Sc	44	38	40	40	
	V	185	200	194	213	
	Cr	3425	3725	3990	3900	
	Mn	2250	2100	2125	2125	
	Co	60	50	48	46	
	Ni	51		37	73	
	Rb	<1				
	Sr	125				
	Y	44				
	Zr	75				
	Nb	<10				
	Hf		3.3	2.9	2.7	
	Ba	50	50	38(a)	55(b)	
	Th					
	U					
	Pb					
	La	15	5.8	5.3	5.1	
	Ce		15			
	Pr					
	Nd					
	Sm		3.2	3.5	3.4	
	Eu		1.1	0.77	0.74	
	Gd					
	Tb		0.8	0.76	0.65	
	Dy		4.8	5.5	3.4	
	Ho					
	Er					
	Tm					
	Yb	4.6	2.6	2.3	2.3	
	Lu		0.39	0.38	0.38	
	Li	6.3				
	Be					
	B					
	C					
	N					
	S					
	F					
	Cl					
	Br					
	Cu	20				
	Zn					
(ppb)	I					
	At					
	Ga	4700				
	Ge					
	As					
	Se					
	Mo					
	Tc					
	Ru					
	Rh					
	Pd					
	Ag					
	Cd					
	In					
	Sn					
	Sb					
	Te					
	Cs					
	Ta		700	470	430	
	W					
	Re					
	Os					
	Ir					
	Pt					
	Au					
	Hg					
	Tl					
	Bi					
		(1)	(2)	(3)	(4)	

References and methods:

(1) Christian et al. (1972); Cuttitta et al. (1973); XRF, semi-micro chem, opt. emmiss. spec.
(2) Laul and Schmitt (1973); INAA
(3) Ma et al. (1976); INAA
(4) Husain (1974); Ar-isotopes, irradiation

Notes:

(a) ± 18 ppm
(b) ± 25 ppm

TABLE 15607-2. Defocussed beam bulk analysis (Dowty et al., 1973 a,b)

Wt %	SiO_2	44.6
	TiO_2	2.58
	Al_2O_3	8.8
	FeO	22.3
	MgO	9.7
	CaO	9.8
	Na_2O	0.33
	K_2O	0.02
	P_2O_5	0.09
ppm	Cr	3010
	Mn	1860

RADIOGENIC ISOTOPES AND GEOCHRONOLOGY: Husain (1974) reported Ar isotopic data for step-wise heating. He found that 39.4% of the ^{40}Ar had been lost, resulting in a K-Ar age of 2.52 ± 0.02 b.y. However, a ^{40}Ar-^{39}Ar plateau age (high temperature releases) was 3.27 ± 0.12 b.y., slightly lower than but within error of the ages of other Apollo 15 mare basalts. Plieninger and Schaeffer (1976) tabulated laser-probe-released argon isotopic analyses for individual phases. The interiors of plagioclase gave an average age of 3.55 ± 0.20 b.y., imprecise but within error of the usual age of such basalts. The pyroxenes and the K-rich mesostasis showed abundant gas loss giving substantially lower ages (Fig. 5), with the K-rich mesostasis giving an age (2.56 ± 0.05 b.y.) similar to the K-Ar age.

EXPOSURE: Husain (1974) reported a ^{38}Ar spallation age of 300 ± 12 m.y. for 15607.

PROCESSING AND SUBDIVISIONS: Small chips were removed from ,0, which is now 11.66 g. ,2 was potted and partly used to make thin sections ,6 to ,8. In 1975 further chipping produced ,14 for chemical analysis.

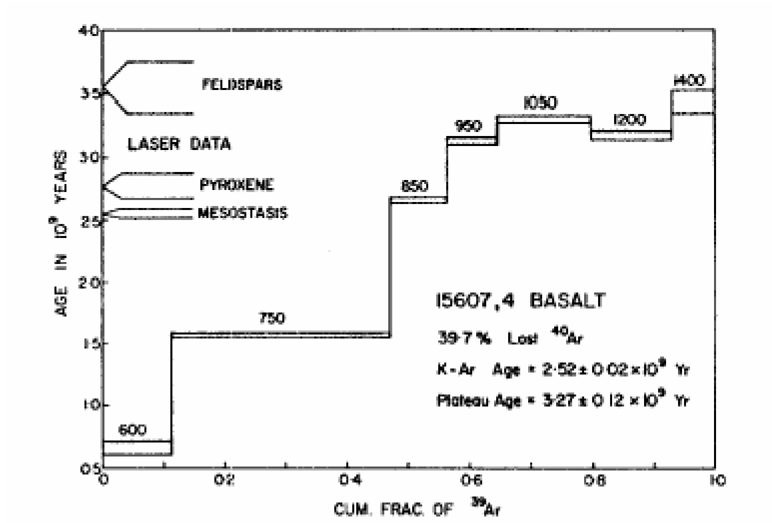

Figure 5. Laser-probe ages (left) and argon-release ages for 15607
(Plieninger and Schaeffer, 1976, and Husain, 1974).