15676 FINE-GRAINED OLIVINE-NORMATIVE MARE BASALT ST. 9A 25.3 g

INTRODUCTION: 15676 is a fine-grained, olivine-bearing mare basalt. The olivines form small phenocrysts. In chemistry, it appears to be an average member of the Apollo 15 olivine-normative mare basalt group. It is tough, irregular, and rounded (Fig. 1). 15676 was collected as part of the rake sample at Station 9A.

Figure 1. Post-sawing view of 15676. S-71-59558

PETROLOGY: 15676 is one of the finest-grained olivine-bearing mare basalts (Fig. 2). It contains sparse, small (less than 1 mm) olivine phenocrysts in a groundmass of small raggedy plagioclase laths and tiny (most less than 100 microns) granular pyroxenes. Some tiny olivine grains are also present. Dowty et al. (1973a,b) found a mode of 59% pyroxene, 9% olivine, 27% plagioclase, 4% opaque minerals, 0.5% silica phase, and 0.5% miscellaneous. They also provided mineral chemistry summaries (Fig. 3), with tabulations of pyroxene, olivine, plagioclase, potash feldspar, glass, and metal microprobe analyses in Dowty et al. (1973c). Nehru et al. (1973) tabulated spinel group mineral and ilmenite analyses. The residual silica glass contains up to 7.7% K_2O; the potash feldspar contains 9.0% BaO. Nehru et al. (1974) included 15676 in their general discussion of opaque minerals in Apollo 15 rocks but made no specific mention.

CHEMISTRY: Bulk rock chemical analyses are listed in Table 1, and a defocussed beam microprobe bulk analysis in Table 2. The rare earths are shown in Figure 4. The Cu abundance listed in Cuttitta et al. (1973) is listed erroneously as 0.25 ppm, and La and Yb abundances of Cuttitta et al. (1973) and Christian et al. (1972) are anomalously high. These authors listed an "excess reducing capacity" of +0.12.

The chemistry is of an average Apollo 15 olivine-normative basalt. Ma et al. (1976) found it to have a higher Sm/Eu than most other olivine-normative basalts, and suggested it was (with 15607) a second magma type, even though another split analyzed by Laul and Schmitt has a "normal" Sm/Eu ratio. The latter they attribute to "excess" plagioclase, i.e., sampling problems. The defocussed beam analysis is remarkably similar to the more conventional analyses with the exception of its high TiO_2.

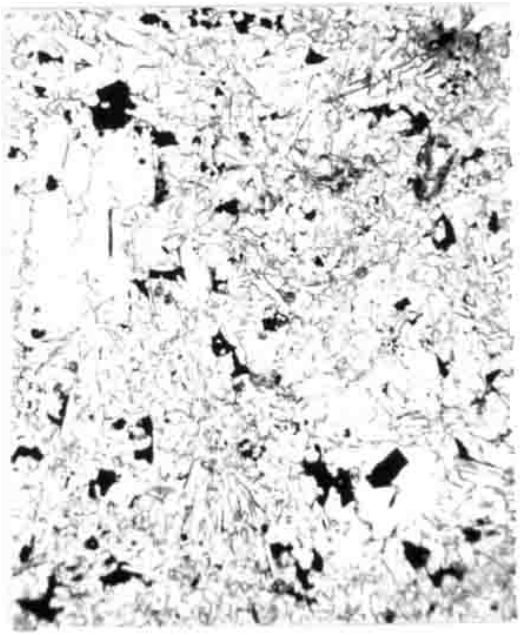

Fig. 2a

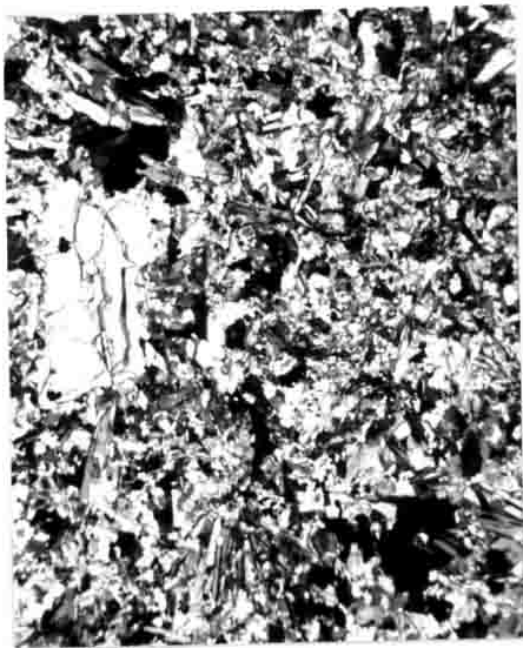

Figure 2. Photomicrographs of 15676,15. Widths about 3 mm.
a) transmitted light; b) crossed polarizers.

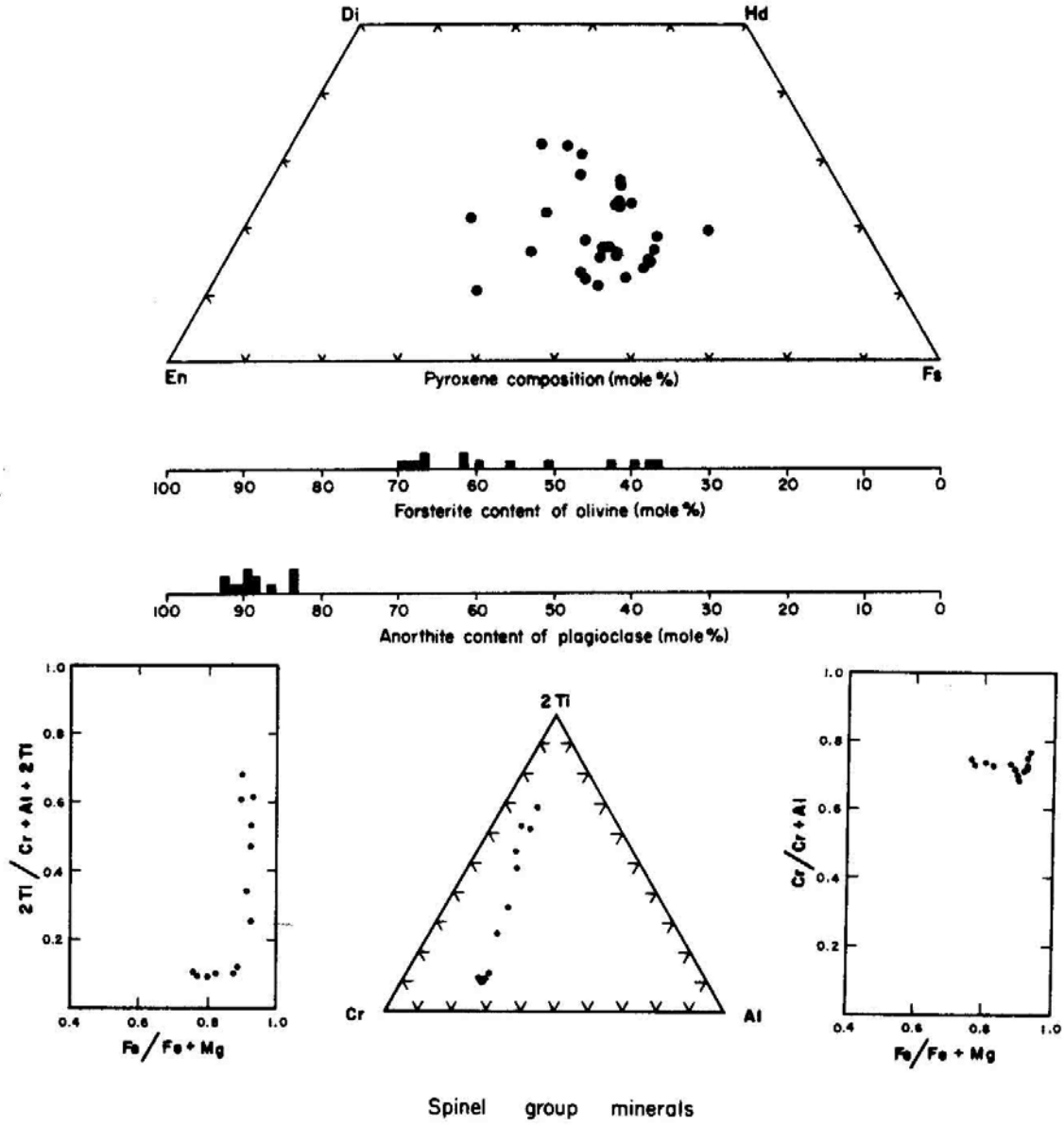

Figure 3. Chemistry of minerals in 15676
(Dowty ,et al., 1973b).

PROCESSING AND SUBDIVISIONS: An end was sawn off (Fig. 1) and split to produce ,1 and ,2, which were subdivided for allocations. Thin sections were made from two subchips, ,5 (thin sections ,10 and ,11) and ,8 (thin sections ,14 and ,15). ,0 is now 22.56 g.

TABLE 15676-1. Bulk rock chemical analyses

		,6	,2	,1
Wt %	SiO2	44.10		
	TiO2	2.66	2.7	2.6
	Al2O3	8.76	9.5	8.5
	FeO	23.03	22.5	21.7
	MgO	9.82	8	9.1
	CaO	10.10	10.7	9.3
	Na2O	0.31	0.275	0.275
	K2O	0.06	0.048	0.042
	P2O5	0.11		
(ppm)	Sc	37	42	40
	V	190	200	197
	Cr	3220	3390	2400
	Mn	2170	2080	2070
	Co	60	43	44
	Ni	63		45
	Rb	<1		
	Sr	130		
	Y	27		
	Zr	70	<230	
	Nb	<10		
	Hf		3.1	2.6
	Ba	56	<120	
	Th			
	U			
	Pb			
	La	12	5.3	4.9
	Ce		15	
	Pr			
	Nd			
	Sm		3.8	3.5
	Eu		1.0	0.82
	Gd			
	Tb		0.7	0.59
	Dy		4.4	4.6
	Ho			
	Er			
	Tm			
	Yb	3.9	2.5	2.1
	Lu		0.40	0.39
	Li	7.7		
	Be	<1		
	B			
	C			
	N			
	S			
	F			
	Cl			
	Br			
	Cu	25		
	Zn			
(ppb)	I			
	At			
	Ga	3600		
	Ge			
	As			
	Se			
	Mo			
	Tc			
	Ru			
	Rh			
	Pd			
	Ag			
	Cd			
	In			
	Sn			
	Sb			
	Te			
	Cs			
	Ta		600	390
	W			
	Re			
	Os			
	Ir			
	Pt			
	Au			
	Hg			
	Tl			
	Bi			
		(1)	(2)	(3)

References and methods:

(1) Cuttitta et al. (1973), Christian et al. (1972); XRF, semi-micro chem, opt emiss. spec.
(2) Laul and Schmitt (1973); INAA
(3) Ma et al. (1976); INAA

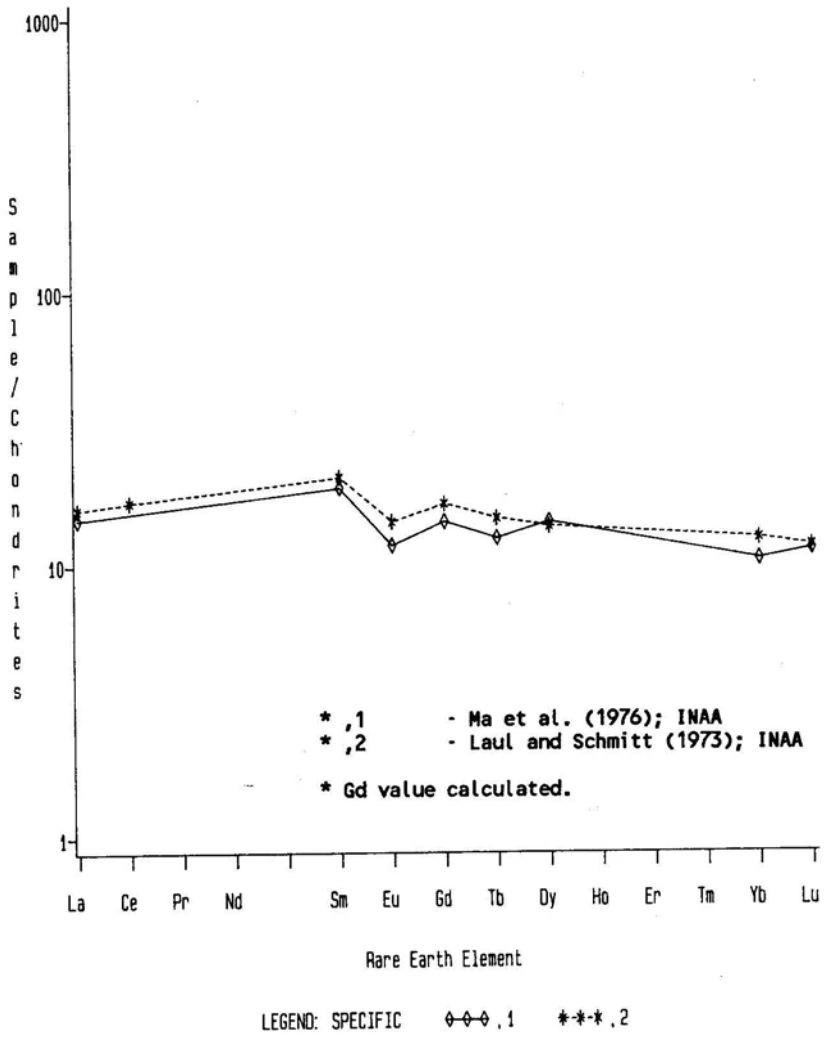

Figure 4. Rare earths in 15676.

TABLE 15676-2. Defocussed beam microprobe bulk analysis (Dowty et al., 1973a, b)

Wt %	SiO_2	44.2
	TiO_2	3.0
	Al_2O_3	8.9
	FeO	22.4
	MgO	9.2
	CaO	9.5
	Na_2O	0.31
	K_2O	0.01
	P_2O_5	0.08
ppm	Cr	2530
	Mn	2090