15672 MEDIUM-GRAINED OLIVINE-NORMATIVE MARE BASALT ST. 9A 21.40 g

INTRODUCTION: 15672 is a medium-grained, olivine-bearing mare basalt which is vesicular (Fig. 1). The olivines do not form phenocrysts but some of the pyroxenes do. In chemistry, the sample is a primitive member of the Apollo 15 olivine-normative mare basalt group. It appears to have a distinct top and bottom in that one side is rounded with a moderate zap pit density. 15672 was collected as part of the rake sample from Station 9A.

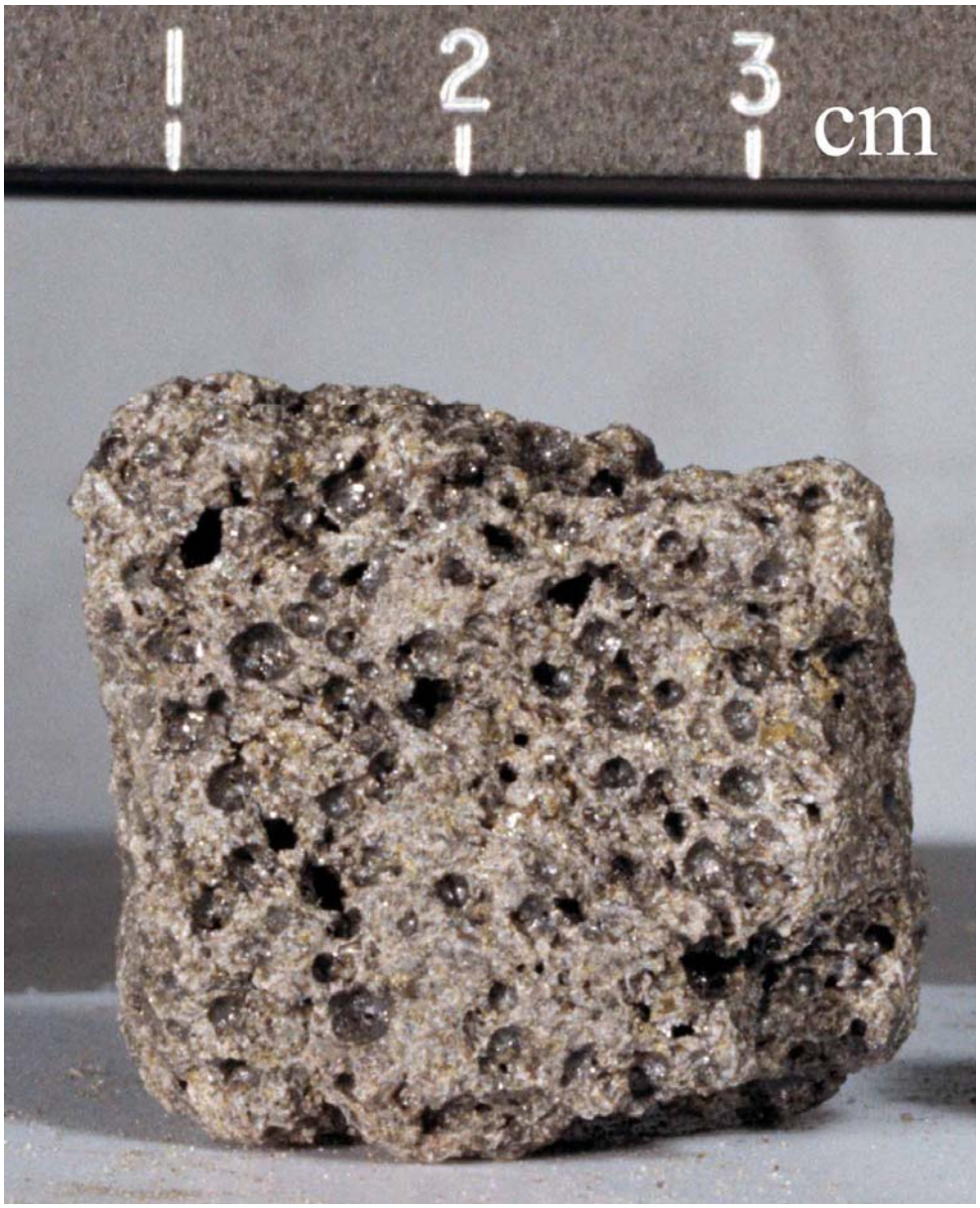

Figure 1. Pre-chip, non-pitted surface of 15672. S-71-49818

PETROLOGY: 15672 is a medium-grained, olivine-bearing, vesicular basalt (Fig. 2). Pyroxene prisms reach 2 mm long, and are zoned; many contain small olivine inclusions. Most olivines are less than 0.5 mm across and are anhedral. Plagioclases are laths about 1 mm long. Cristobalite, fayalite, ilmenite, ulvospinel, euhedral chromites, and residual glass are also present. Dowty et al. (1973b) reported a mode of 58% pyroxene, 22% plagioclase, 10% olivine, 6% opaques, 0.4% silica, and 3.6% miscellaneous (Dowty et al., 1973a, adjusted this to 11% olivine, 2% miscellaneous). They found that some pyroxenes appeared porphyritic, and that some chromites were mantled with ulvospinel. Dowty et al. (1973c) tabulated microprobe analyses of pyroxene, olivine, plagioclase, Ba-K feldspar, Si-K glass, and Fe-metals; Nehru et al. (1973) tabulated microprobe analyses of spinel group minerals and two ilmenites. Nehru et al. (1974) tabulated an ulvospinel analysis but gave no specific discussion of 15672 in their general discussion of opaque minerals. Fe-metal grains generally contain 1.1 to 1.6% Co and 2.7 to 6.4% Ni, but grains with up to 3.7% Co and 22% Ni are present. Ilmenites contain 0.80 to 1.04% MgO. Mineral analyses are generally similar to those from other Apollo 15 olivine-normative mare basalts (Fig. 3).

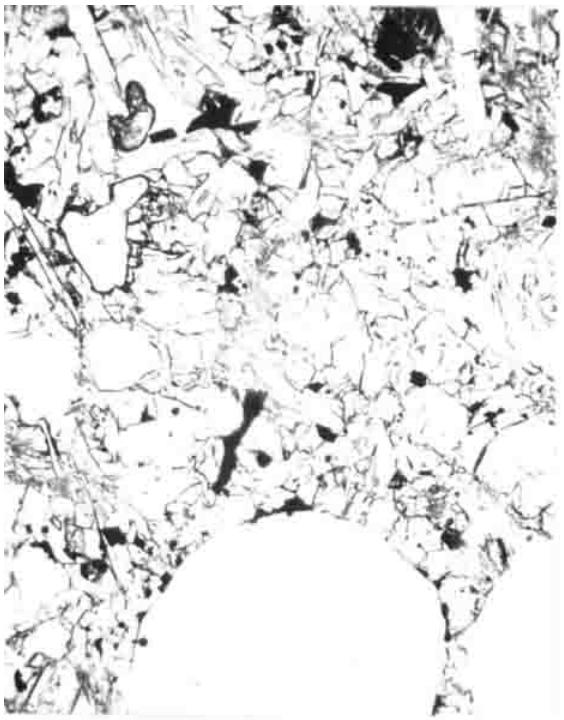

Fig. 2a

Fig. 2b

Figure 2. Photomicrographs of 15672,14. Widths about 3 mm.
a) transmitted light; b) crossed polarizers.

CHEMISTRY: Bulk rock analyses are listed in Table 1 and the rare earths shown in Figure 4. The data are very consistent with each other and show the sample to be low in Ti and rare earths and high in MgO compared with average Apollo 15 olivine-normative mare basalts, i.e., the sample is rather primitive. Cuttitta et al. (1973) and christian et al. (1972) have an Yb determination inconsistent with the other analyses and with other Apollo 15 olivine-normative mare basalts, and their data for Yb cannot be considered reliable. They also analyzed for, and found no, Fe_2O_3. They reported an "excess reducing capacity" (over FeO) of 0.12. The defocussed beam microprobe analysis (Table 2) is inconsistent with the other chemical analyses, indicating a more evolved olivine-normative basalt, and suggesting sampling problems due to grain size.

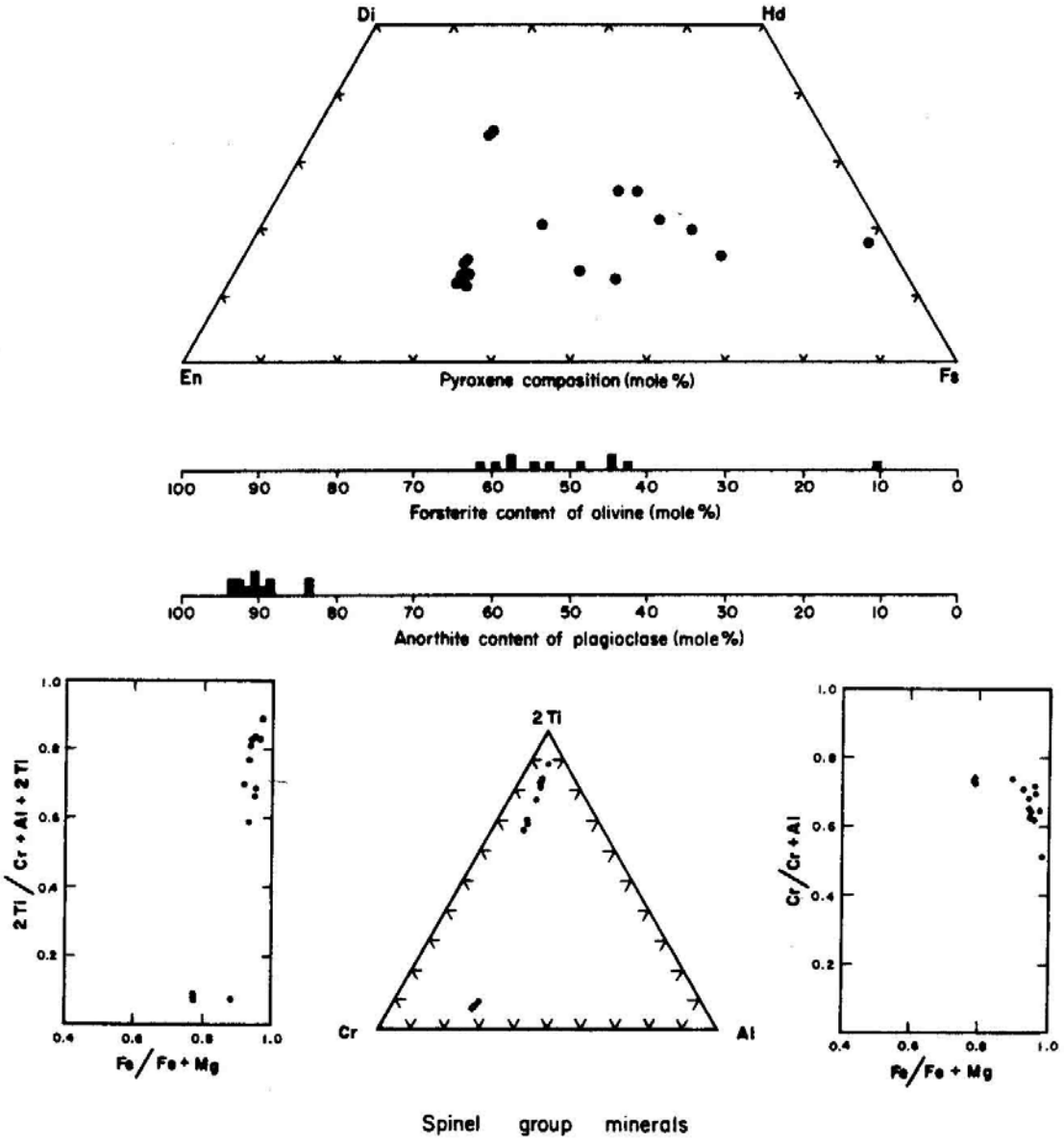

Figure 3. Compositions of minerals in 15672 (Dowty et al., 1973b) .

TABLE 15672-1. Bulk rock chemical analyses

		,4	,3	,1A	,1B
Wt %	SiO2	44.8			
	TiO2	2.16	2.1	2.2	1.9
	Al2O3	8.62	8.7	9.0	8.4
	FeO	21.78	22.5	21.2	21.1
	MgO	11.98	12	11.9	12.2
	CaO	9.44	8.6	9.1	9.2
	Na2O	0.28	0.243	0.263	0.245
	K2O	0.06	0.035	0.035	0.032
	P2O5	0.12			
(ppm)	Sc	31	40	39	40
	V	180	200	229	230
	Cr	3220	4410	3885	3505
	Mn	2090	2060	2045	2045
	Co	66	53	49	49
	Ni	69		79	77
	Rb	1.2			
	Sr	120			
	Y	24			
	Zr	59	<180		
	Nb	<10			
	Hf		2.5	2.2	2.1
	Ba	56	60	32(a)	21(b)
	Th				
	U				
	Pb				
	La	<10	4.5	4.2	3.9
	Ce				
	Pr				
	Nd				
	Sm		3.0	2.9	2.6
	Eu		0.86	0.77	0.66
	Gd				
	Tb		0.6	0.49	0.53
	Dy		4.2	3.8	4.0
	Ho				
	Er				
	Tm				
	Yb	4.0	2.1	1.9	1.8
	Lu		0.30	0.33	0.37
	Li	5.6			
	Be				
	B				
	C				
	N				
	S				
	F				
	Cl				
	Br				
	Cu	11			
	Zn				
(ppb)	I				
	At				
	Ga	4500			
	Ge				
	As				
	Sc				
	Mo				
	Tc				
	Ru				
	Rh				
	Pd				
	Ag				
	Cd				
	In				
	Sn				
	Sb				
	Te				
	Cs				
	Ta		500	310	340
	W				
	Re				
	Os				
	Ir				
	Pt				
	Au				
	Hg				
	Tl				
	Bi				
		(1)	(2)	(3)	(3)

References and methods:

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

Notes:

(a) ± 19 ppm
(b) ± 15 ppm

PROCESSING AND SUBDIVISIONS: Chipping produced several chips (,1 to ,5). ,2 was used partly to produce thin sections ,14 and ,18. Several of the other chips were allocated for chemistry, etc. In 1975, ,1, which consisted of several chips, was subdivided to produce materials for chemical analysis and further thin sections, ,12 and ,13. ,0 is now 18.65 g

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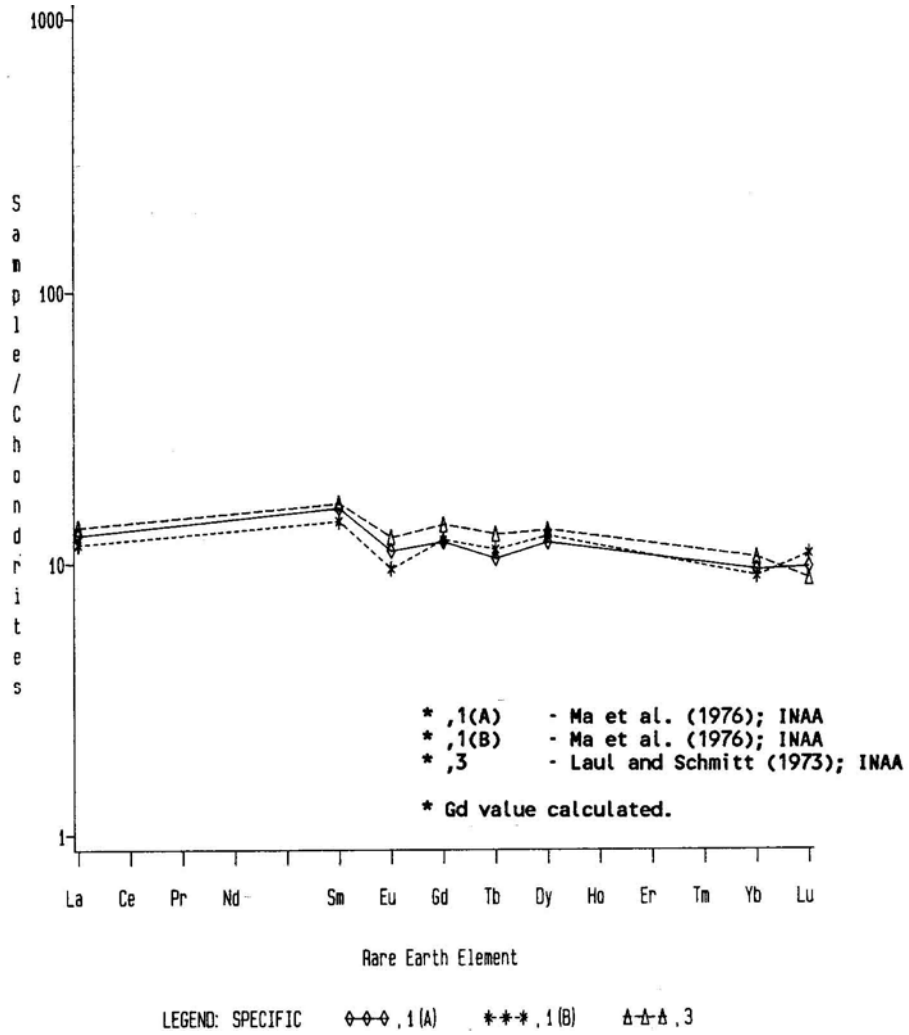

Figure 4. Rare earths in 15672.

TABLE 15672-2. Defocussed beam microprobe bulk analysis (Dowty et al., 1973a,b)

Wt %	SiO2	44.7
	TiO2	2.75
	Al2O3	10.4
	FeO	21.6
	MgO	9.3
	CaO	9.9
	Na2O	0.38
	K2O	0.03
	P2O5	0.09
ppm	Cr	3765
	Mn	1850