

15633 COARSE-GRAINED OLIVINE-NORMATIVE ST. 9A 7.40 g
MARE BASALT

INTRODUCTION: 15633 is a coarse-grained, olivine-bearing mare basalt which is vuggy but not vesicular (Fig. 1). The olivines do not form phenocrysts. In chemistry, the sample is a member of the Apollo 15 olivine-normative group. It has a crystallization age of 3.26 ± 0.05 b.y. (Husain, 1974). 15633 is tough and has no zap pits, although there is some welded dust on the surface. It was collected as part of the rake sample at Station 9A.

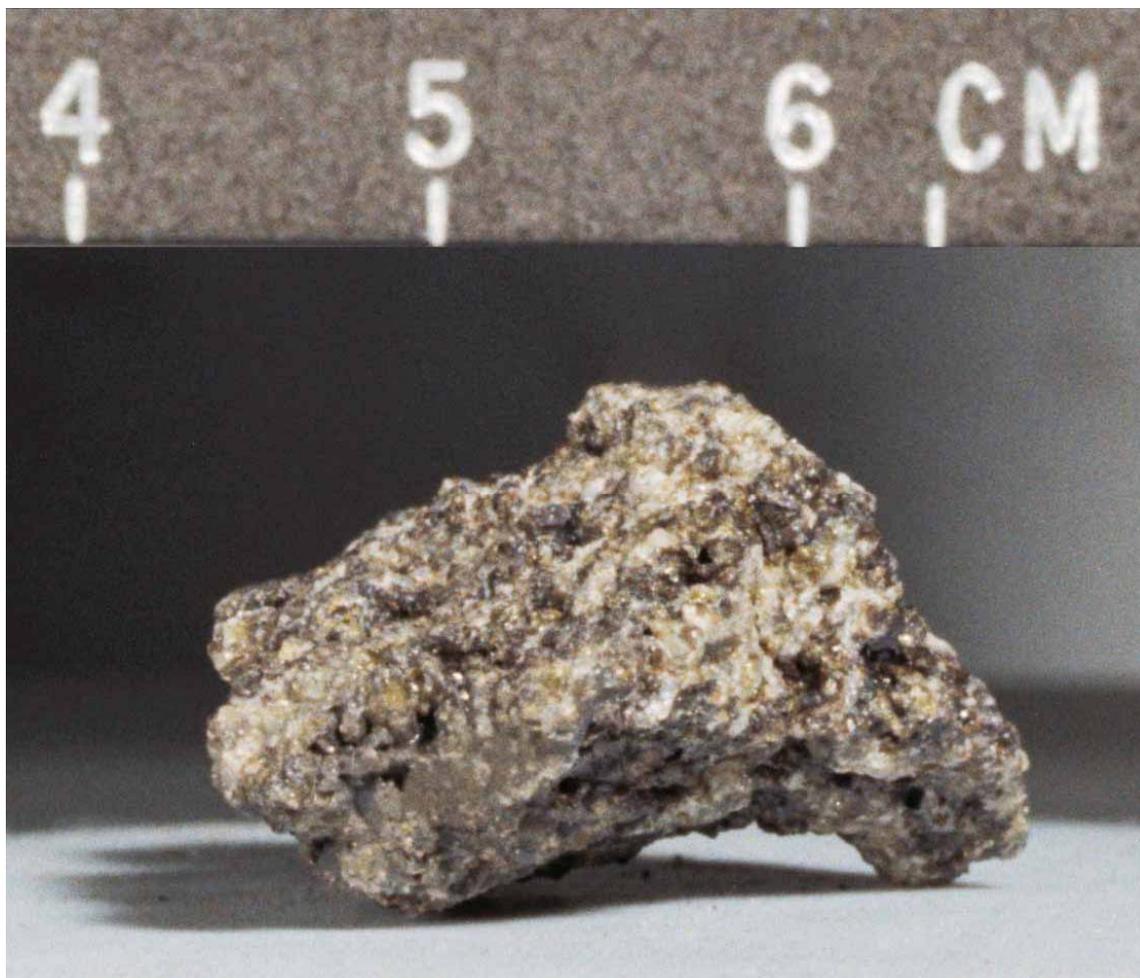


Figure 1. Pre-chip view of 15633. S-71-49294

PETROLOGY: 15633 is a coarse-grained basalt with pigeonites up to 2 mm long and commonly twinned, zoned, and containing olivine inclusions (Fig. 2). Plagioclases are ophitic, enclosing small pyroxenes and olivines, and are up to about 1.5 mm. Most

olivines are small and anhedral, but a few are about 1 mm with silicate liquid inclusions. Dowty et al. (1973b) noted such large olivines as amoeboid and zoned. Dowty et al. (1973a,b) reported a mode of 52% pyroxene, 21% plagioclase, 18% olivines, 6% opaque minerals, 1% silica (actually cristobalite), and 2% miscellaneous. Dowty et al. (1973c) tabulated microprobe analyses of pyroxene, olivine, plagioclase, Si-K glass, and Fe-metal, and Nehru et al. (1973) tabulated spinel group and ilmenite analyses. Nehru et al. (1974) noted that there was a sharp break from chromite cores to ulvospinel mantles. The Fe-metal contains 1.5 to 1.6% Co and 5.6 to 7.1% Ni, and the ilmenite contains 0.52 to 4.6% MgO. The mineral chemistry (Fig. 3) is typical for Apollo 15 olivine-normative mare basalts.

CHEMISTRY: The bulk rock analyses (Table 1, Fig. 4) and the defocussed beam microprobe analysis (Table 2) all show 15633 to be an Apollo 15 olivine-normative mare basalt, but there are considerable differences among them. These differences are probably a result of the coarse grain size of the sample. The analysis of Helmke et al. (1973) is particularly high in TiO_2 and FeO and low in Al_2O_3 . On average, the sample appears to be fairly magnesian. The Ca analysis of Husain (1974) is probably spuriously high.

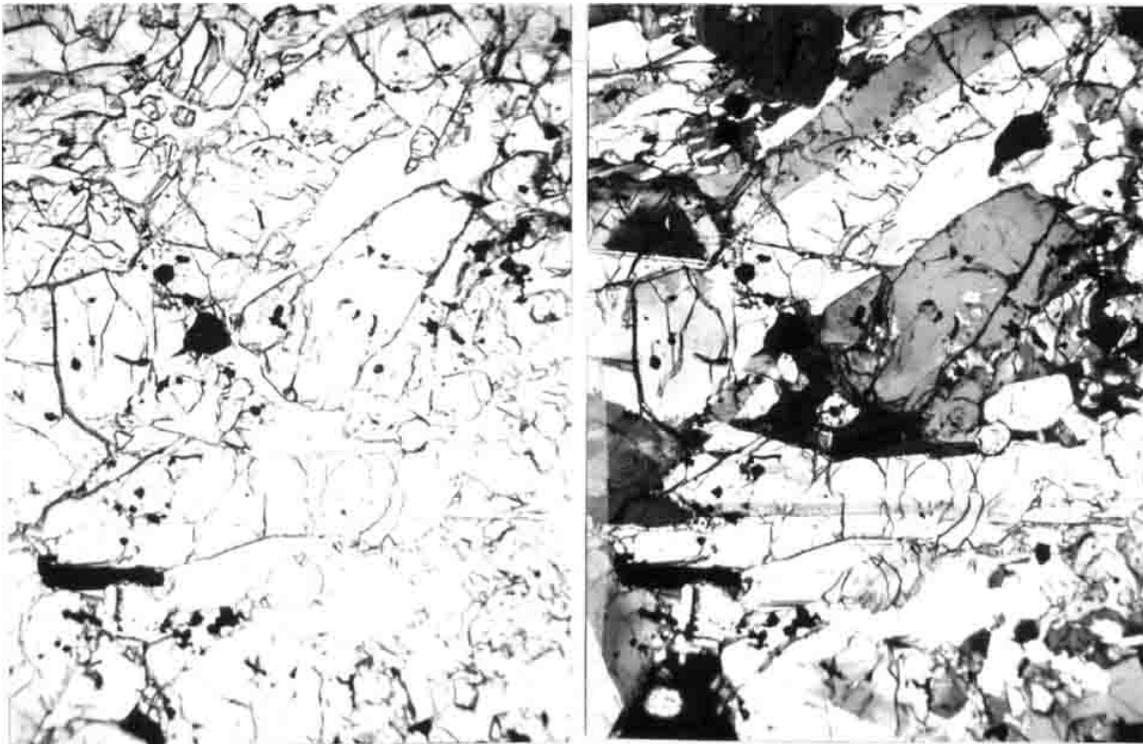


Fig. 2a

Fig. 2b

Figure 2. Photomicrographs of 15633,15.
Widths about 3 mm. a) transmitted light; b) crossed polarizers.

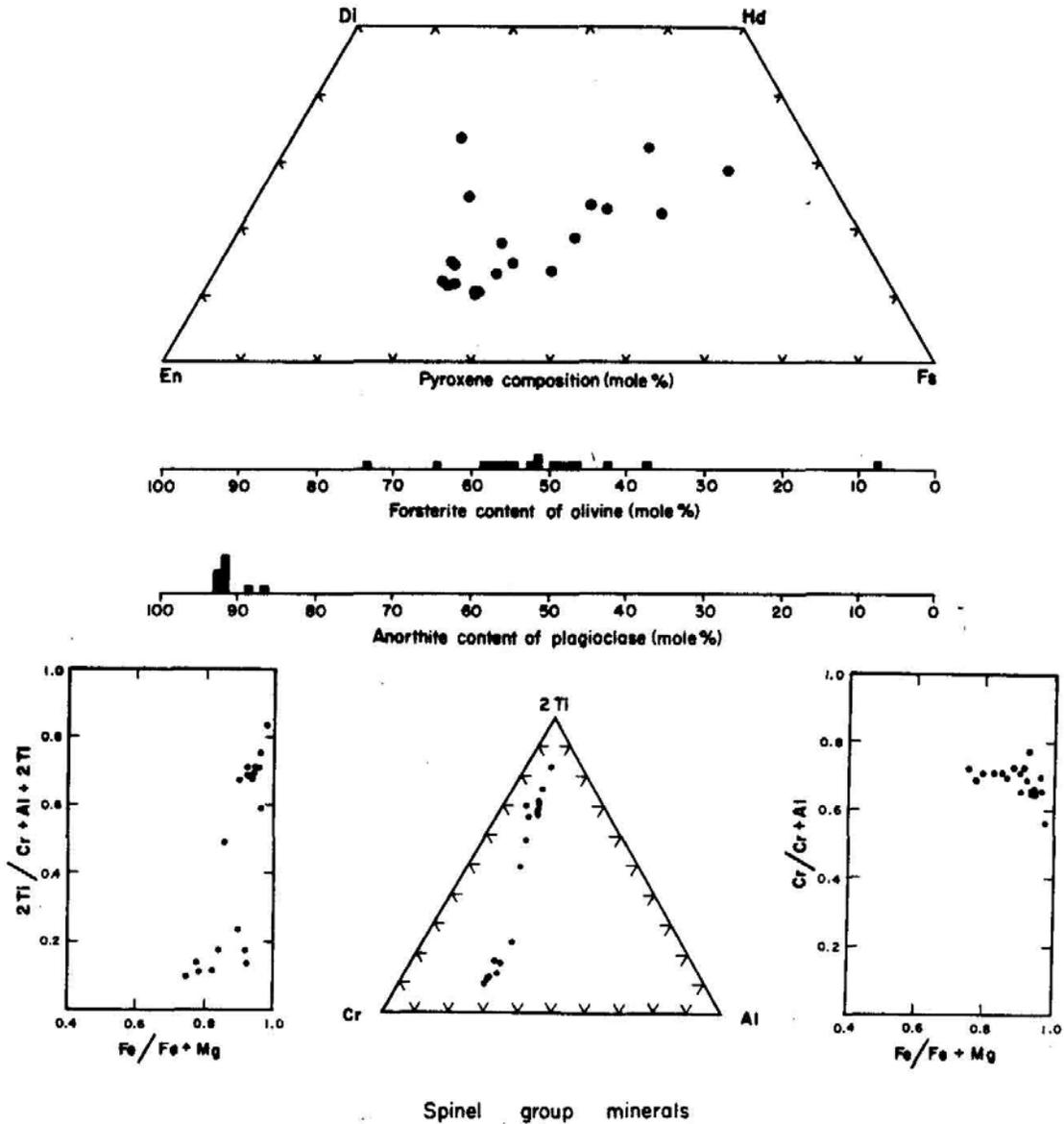


Figure 3. Chemistry of minerals in 15633 (Dowty et al., 1973b).

RADIOGENIC ISOTOPES AND GEOCHRONOLOGY: In an Ar-Ar study, Husain (1974) found that 20.3% of the $^{40}\text{Ar}^*$ had been lost, giving a low K-Ar age of 2.95 ± 0.08 b.y. The plateau age (from the 950°C to 1250°C releases) of 3.26 ± 0.05 b.y. is within error of the age of other Apollo 15 mare basalts.

RARE GASES AND EXPOSURE: Husain (1974) tabulated Ar isotopic temperature release data for 15633. He reported a ^{38}Ar -Ca exposure age of 66 ± 4 m.y.

TABLE 15633-1. Bulk rock chemical analyses

	,7	,5	,3
wt %			
SiO ₂		44.1	
TiO ₂	2.2	3.04	
Al ₂ O ₃	8.8	7.20	
FeO	23.0	25.0	
MgO	11.1	10.7	
CaO	9.3	9.09	13.6
Na ₂ O	0.247	0.305	
K ₂ O	0.033	0.056	0.034
P ₂ O ₅			
(ppm)			
Sc	41	47.0	
V	225		
Cr	4080	3930	
Mn	2085	2330	
Co	50	56	
Ni	101		
Rb		0.5	
Sr			
Y			
Zr			
Mo			
Hf	2.3	2.5	
Ko	45		
Th			
U			
Pb			
La	4.3	4.93	
Ce		13.4	
Pr			
Nd		10.8	
Sm	2.9	3.54	
Eu	0.74	0.88	
Gd		4.6	
Tb	0.60	0.81	
Dy	4.2	5.7	
Ho		1.04	
Er		3.0	
Tm			
Yb	1.8	2.26	
Lu	0.36	0.328	
Li			
Be			
B			
C			
N			
S			
F			
Cl			
Br			
Cu			
Zn		<3	
(ppb)			
I			
At			
Ga		2900	
Ge			
As			
Se			
Mo			
Tc			
Ru			
Rh			
Pd			
Ag			
Cd			
In			
Sn			
Sb			
Te			
Cs		17	
Ta	380		
W			
Re			
Os			
Ir			
Pt			
Au			
Hg			
Tl			
Pb			
	(1)	(2)	(3)

References and methods:

- (1) Ma et al. (1976); INAA
- (2) Helmke et al. (1973); INAA, MAS, RNAA
- (3) Husain (1974); Ar isotopes, irradiation

Notes:

(a) $\pm 1\sigma$ ppm

PROCESSING AND SUBDIVISIONS: Chipping produced ,1 (single chip); ,2 (two chips); and ,3; ,4; and ,5 (several small chips and fines). ,1 was partly used to produce thin sections ,15 and ,16. ,0 is now 4.60 g.

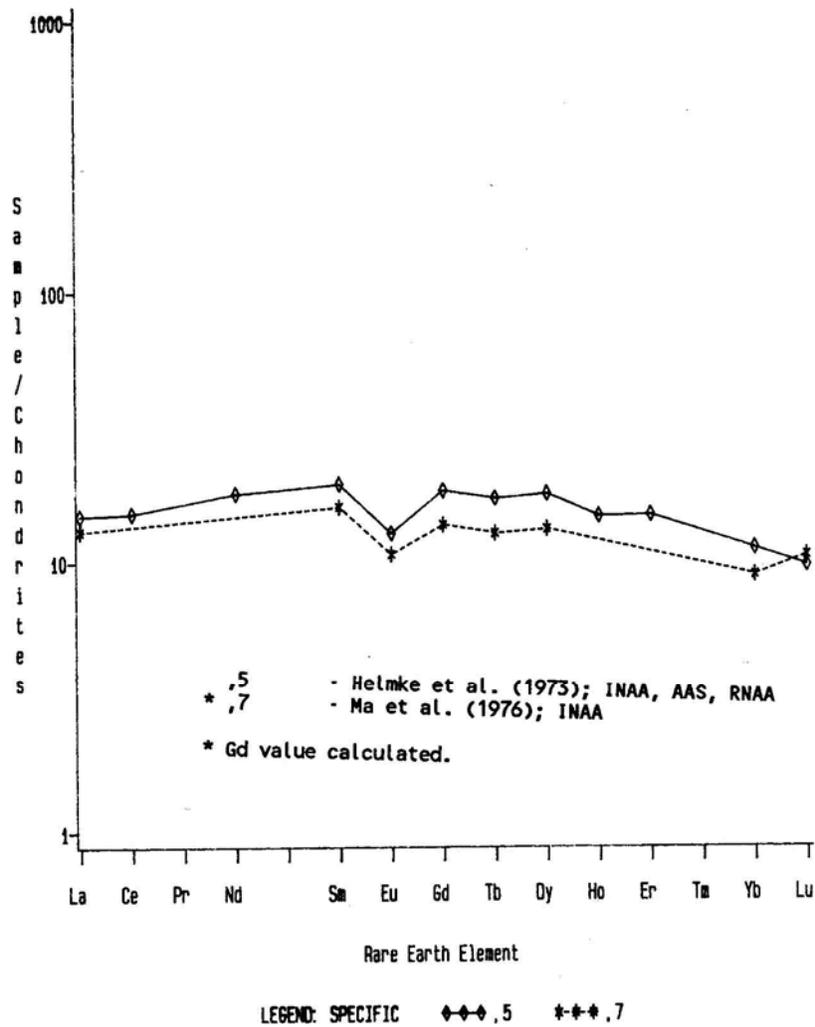


Figure 4. Rare earths in 15633

TABLE 15633-2. Defocussed beam bulk rock analysis

Wt%	SiO ₂	46.4
	TiO ₂	1.28
	Al ₂ O ₃	8.5
	FeO	22.2
	MgO	12.7
	CaO	8.6
	Na ₂ O	0.27
	K ₂ O	0.02
	P ₂ O ₅	0.05
	ppm	Cr
Mn		2170