15485 VITROPHYRIC QUARTZ-NORMATIVE MARE BASALT ST. 4 104.9 g

INTRODUCTION: 15485 is a vitrophyric pigeonite basalt collected from the same vesicular boulder as the similar samples 15486 and 15499 (see Fig. 15499-1) on the south rim of Dune Crater. It is one of the most rapidly cooled of the quartz-normative basalts.

15485 is a vesicular basalt with a porphyritic, diktytaxitic texture (Figs. 1, 2). It is medium-gray, angular, and tough. One surface (laboratory N) is fresh where it was broken from the boulder. There are a few zap pits on B. A greenish yellow powdery material seeped in along a fracture, similar to that which is more abundant on 15486.

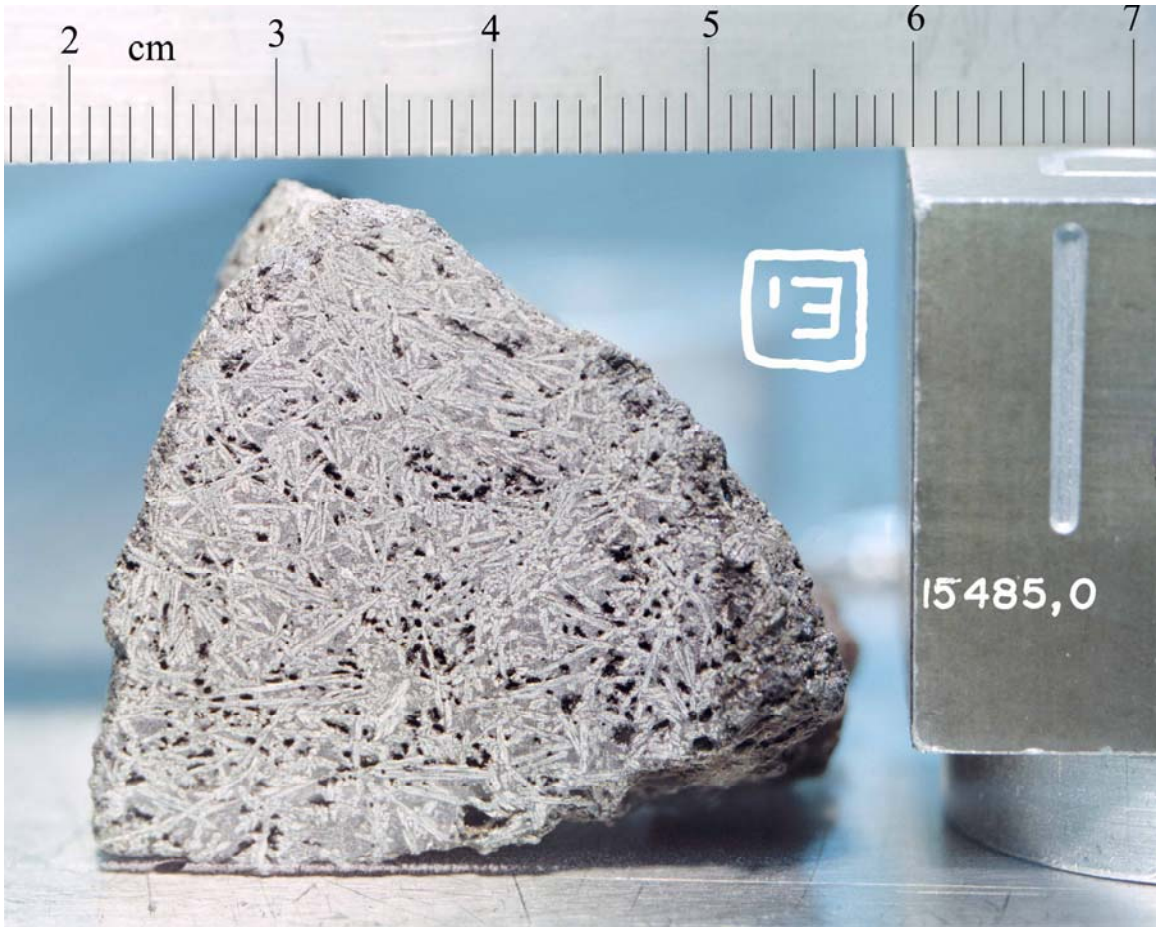

Figure 1. Sawn face of W end piece ,21, showing pigeonite phenocrysts. S-74-32562

PETROLOGY: 15485 contains abundant elongated pyroxene phenocrysts (Figs. 1 to 3) up to 1 cm long in a fine-grained, dark-colored matrix. The pyroxenes are yellow-gray. A general description of thin section ,3 was given in the Apollo 15 Lunar Sample

Information Catalog (1972), with a mode of 64% skeletal clinopyroxene phenocrysts, 33% groundmass of plumose intergrowths of pyroxene and plagioclase laths, and 0.1% each of ilmenite, Fe-metal, Cr-spinel, ulvospinel, and troilite. Brown et al. (1972) reported 53% phenocrysts in a glassy groundmass, which is a greater abundance of phenocrysts than slower-cooled quartz-normative basalts. The phenocrysts are 1-6 mm prisms, originally with hollow cores, zoned from Mg-pigeonite cores, to sharp discontinuities against narrow augite mantles. Al/Ti is greater in the cores (7 to 10) than in the rims (5 to 7). Spinels also show a sharp discontinuity from a chromite core (in pyroxene) to ulvospinel mantles (in groundmass). The groundmass contains abundant occult plagioclase. Engelhardt (1979) tabulated ilmenite paragenesis.

Figure 2. Slab subdivisions of 15485. S-74-32581

Cooling history: Lofgren et al. (1975) in a comparison of natural rocks with the products of linear cooling rate experiments on a similar composition (15597) found 15485 to be one of the fastest cooled of the quartz-normative basalts, with phenocryst shapes indicating 5-20°C/hr, and the matrix >30°C/hr. Grove and Walker (1977) made a similar but more sophisticated study, again on comparison of natural rocks with the products of dynamic crystallization experiments. Pyroxene nucleation density indicated a cooling rate at nucleation of ~3.75°C/hr, and pyroxene "size" indicated an integrated rate during

pyroxene growth of between 3.75°C and 10°C/hr. The late-stage cooling, from plagioclase "size" indicated 85°C to 250°C/hr. Thus two-stage cooling is most consistent with the rock characteristics. Grove and Walker (1977) suggested a final cooling history 6-9 cm from a conductive boundary.

The fracture filling is represented in thin sections ,5 and ,6. It is a pale-green material, isotropic but fine-grained and not glassy. The particles are mainly submicroscopic (Fig. 4) but some bands are made up of grains almost 10 µm across (e.g., Fig. 4a) which are rounded. Flow structures including current bedding are present, and where the flow-stream was interrupted by cavities, the cavities tend to have accumulated coarser grains and material plucked from the basalt (Figs. 4c, d).

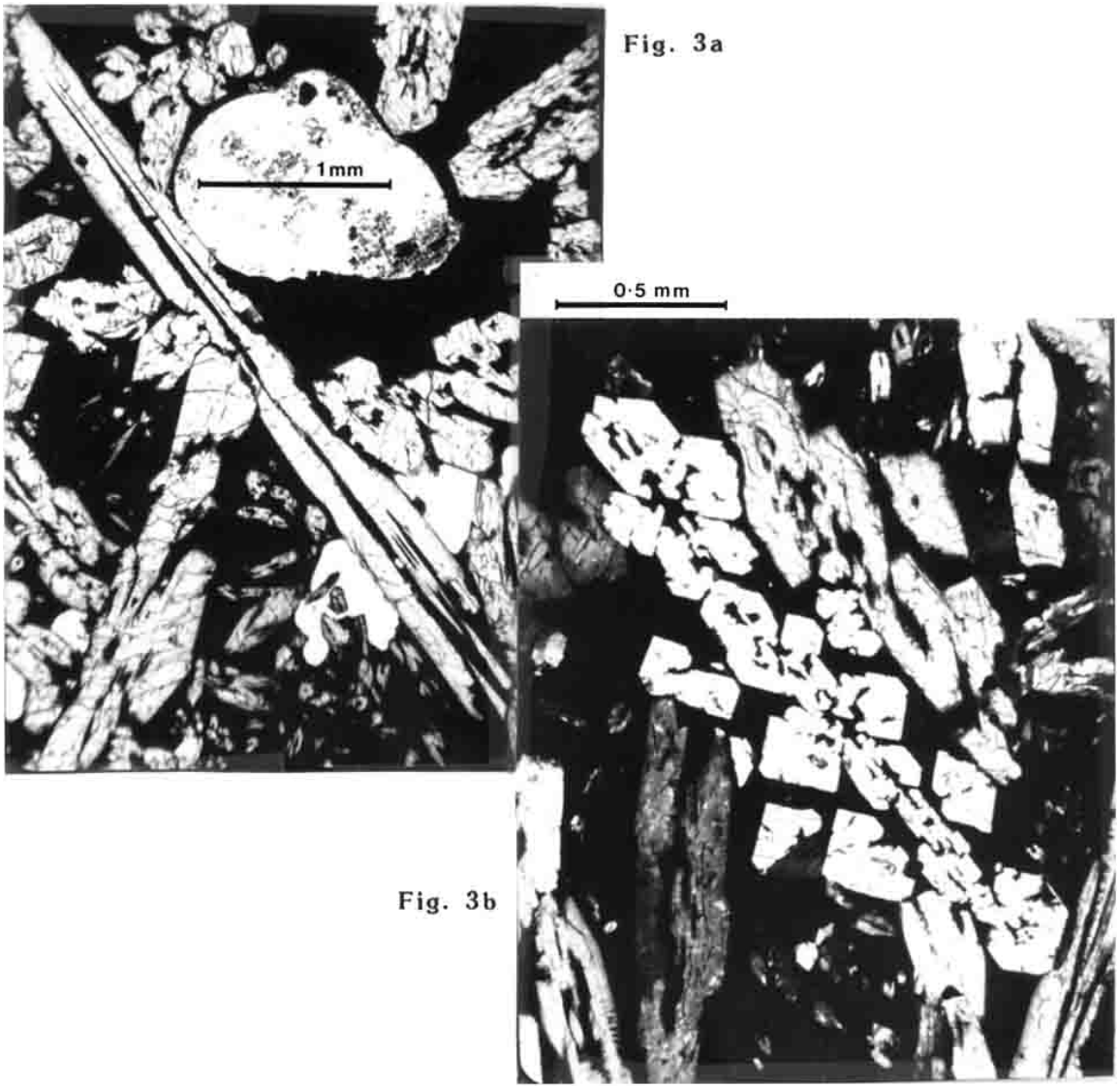

Figure 3. Photomicrographs of 15485,5 (a) transmitted light, showing skeletal pigeonite phenocrysts, opaque matrix, and vesicles; (b) crossed polarizers, showing single skeletal pyroxene (top left to bottom right).

CHEMISTRY: Duncan et al. (1976) presented the only chemical data for 15485 (Table 1), without discussion. The chemistry is fairly typical of A15 quartz-normative basalts.

TABLE 15485-1

		,17
Wt %	SiO2	47.39
	TiO2	1.77
	Al2O3	9.14
	FeO	19.82
	MgO	9.48
	CaO	10.21
	Na2O	0.28
	K2O	0.031
	P2O5	0.084
(ppm)	Sc	
	V	177
	Cr	4000
	Mn	2100
	Co	42
	Ni	22
	Rb	<1.4
	Sr	104
	Y	32.2
	Zr	113
	Nb	5.5
	Hf	
	Ba	71
	Th	
	U	
	Pb	
	La	
	Ce	
	Pr	
	Nd	
	Sm	
	Eu	
	Gd	
	Tb	
	Dy	
	Ho	
	Er	
	Tm	
	Yb	
	Lu	
	Li	
	Be	
	B	
	C	
	N	
	S	640
	F	
	Cl	
	Br	
	Cu	4
	Zn	<2
(ppb)	I	
	At	
	Ga	
	Ge	
	As	
	Se	
	Mo	
	Tc	
	Ru	
	Rh	
	Pd	
	Ag	
	Cd	
	In	
	Sn	
	Sb	
	Te	
	Cs	
	Ta	
	W	
	Re	
	Os	
	Ir	
	Pt	
	Au	
	Hg	
	Tl	
	Bi	
		(1)

Reference and method:

(1) Duncan et al. (1976); XRF

PROCESSING AND SUBDIVISIONS: One sample originally numbered 15487 was found to fit onto 15485, and was renumbered 15485,1. Apart from a few small chips, most subdivisions were made by sawing a slab from the sample (Fig. 2). The only remaining pieces larger than 3 g are the end pieces ,9 (28.1 g) in remote storage, and ,21 (57.1 g). Thin sections ,3 to ,6 were made from chip ,2 which came from ,1. One other thin section ,31 was made from part of ,20.

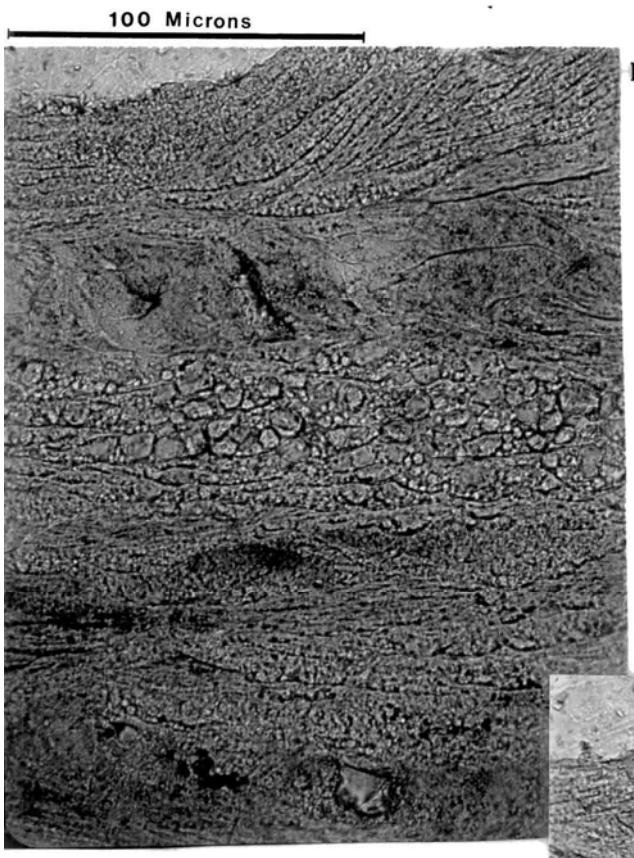

Fig. 4a

Fig. 4b

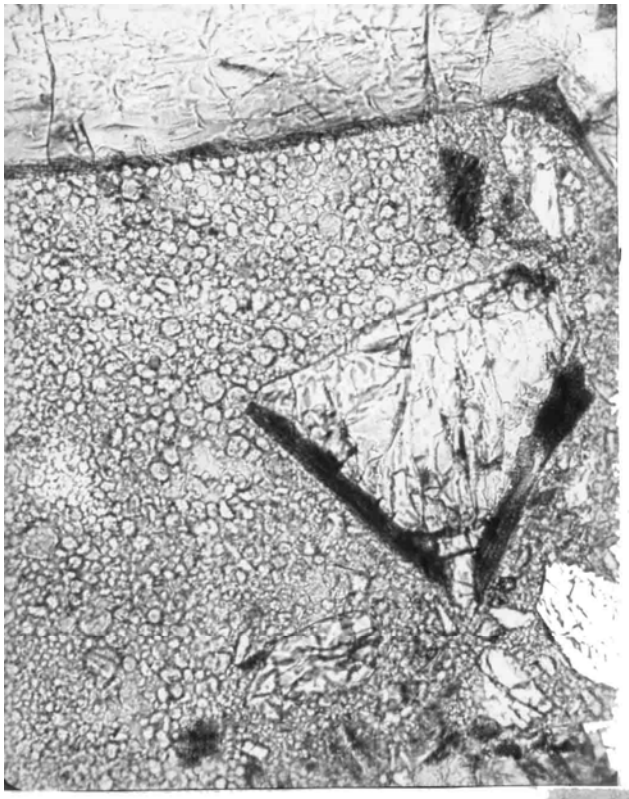

Fig. 4c

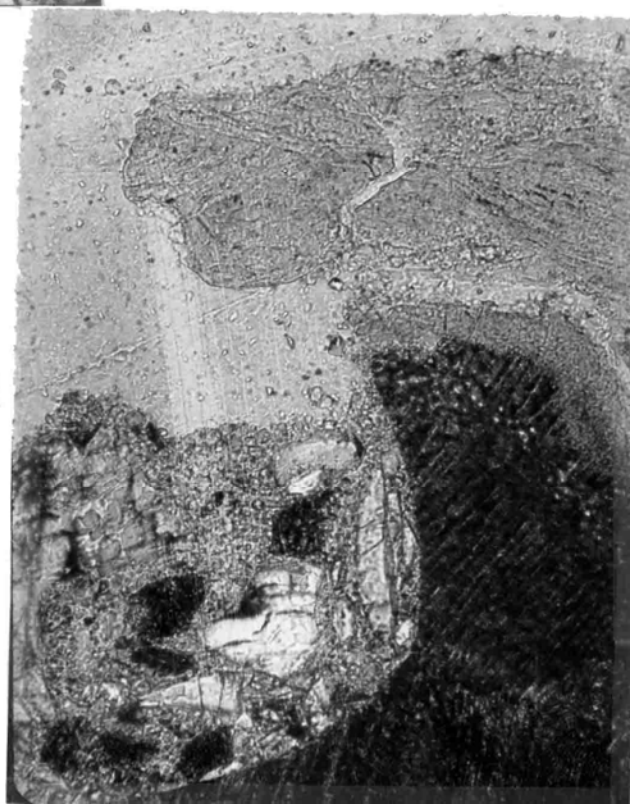

Fig. 4d

Figure 4. Photomicrographs of powdery fissure fill in 15485, transmitted light, all to same scale (a)(b)(c) 15485,5 general "sedimentary" structures; (d) coarser grains and debris trapped behind an obstacle in 15485,6.