<u>15059 REGOLITH BRECCIA, GLASS-COATED ST. 8 1149.0 g</u>

<u>INTRODUCTION</u>: 15059 is a tough regolith breccia containing mare basalt and KREEP basalt fragments and abundant glass, in a glassy matrix. A thin very vesicular glass coat covers most of the sample and intrudes it along fractures (Figs. 1,2). Its chemical composition is very similar to local regolith compositions. The sample was studied by the Goles Consortium.

15059 was collected approximately 15 m south of the ALSEP central station. No other fragments of similar size were nearby. It is angular, tough and medium-dull gray, with a very vesicular grayish black glass coating most of its surface. It has no well-developed fillet, and only a few (micro) zap pits were found on its lunar upper surface.

Figure 1. Whole sample 15059 showing vesicular glass. Chipped part in lower right exposes fresh breccia matrix. S-71-48799

<u>PETROLOGY</u>: Macroscopically 15059 consists of about 55% unresolvable gray matrix enclosing identifiable fragments which are dominantly white or pale-colored but including green and orange materials. McKay and Wentworth (1983) found 15059 to have a compact intergranular porosity, an intermediate fracture porosity, spheres and agglutinates to be rare, and shock features to be common. Wentworth and McKay (1984) found the sample to have a bulk density of 2.19 g/cm^3. An I_s/FeO of 32-49 was reported

by McKay et al. (1984) (reported as 36 by Korotev, 1984 unpublished), i.e., a submature index.

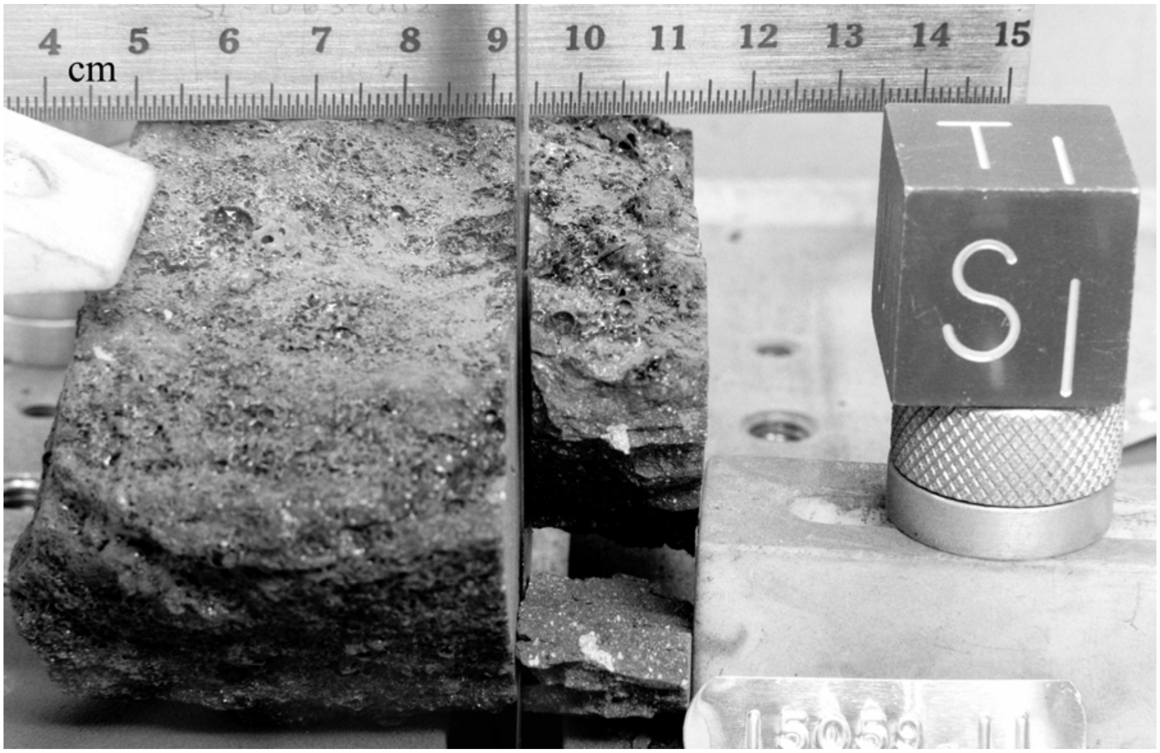

Figure 2. Sawing of 15059 to show glass coat. S-72-16050

Kridelbaugh et al. (1972) provided a petrographic description. The sample consists of lithic fragments of basalt, microbreccias, glass of various shapes and colors, and monomineralic fragments set in a cryptocrystalline, unrecrystallized matrix (Figs. 3, 4). There are crosscutting veinlets of a highly vesicular glass. The basalts are ophitic pyroxene basalts without olivine, containing plagioclase (An_{87-92}), ilmenite, Ti-chromite, Fe-metal, troilite, and residual phases. Microbreccia clasts are subordinate to the basalts and are noritic (orthopyroxene and plagioclase) with minor high-Ca pyroxene, ilmenite, olivine, and whitlockite. The monomineralic fragments are low-Ca pyroxenes, augitic pyroxenes, plagioclases (An_{95-76}), olivines (Fo_{89-44}), ilmenite (0 to 5% MgO), Fe-metal (1.5-14.0% Ni), troilite, and Ti-chromites.

Glasses form 20% by volume, and individual pieces are generally homogeneous. Mare basalts are most abundant, with Fra Mauro (KREEP) slightly less. Apollo 15 green glasses are present. Analyses presented by Kridelbaugh et al. (1972) did not distinguish glasses from 15028 and 15059. The glass in the veinlets is the same as the coat, and both were probably emplaced during excavation of the sample.

Figure 3. Interior breccia matrix of 15059 as exposed in sawn slab. S-72-16064

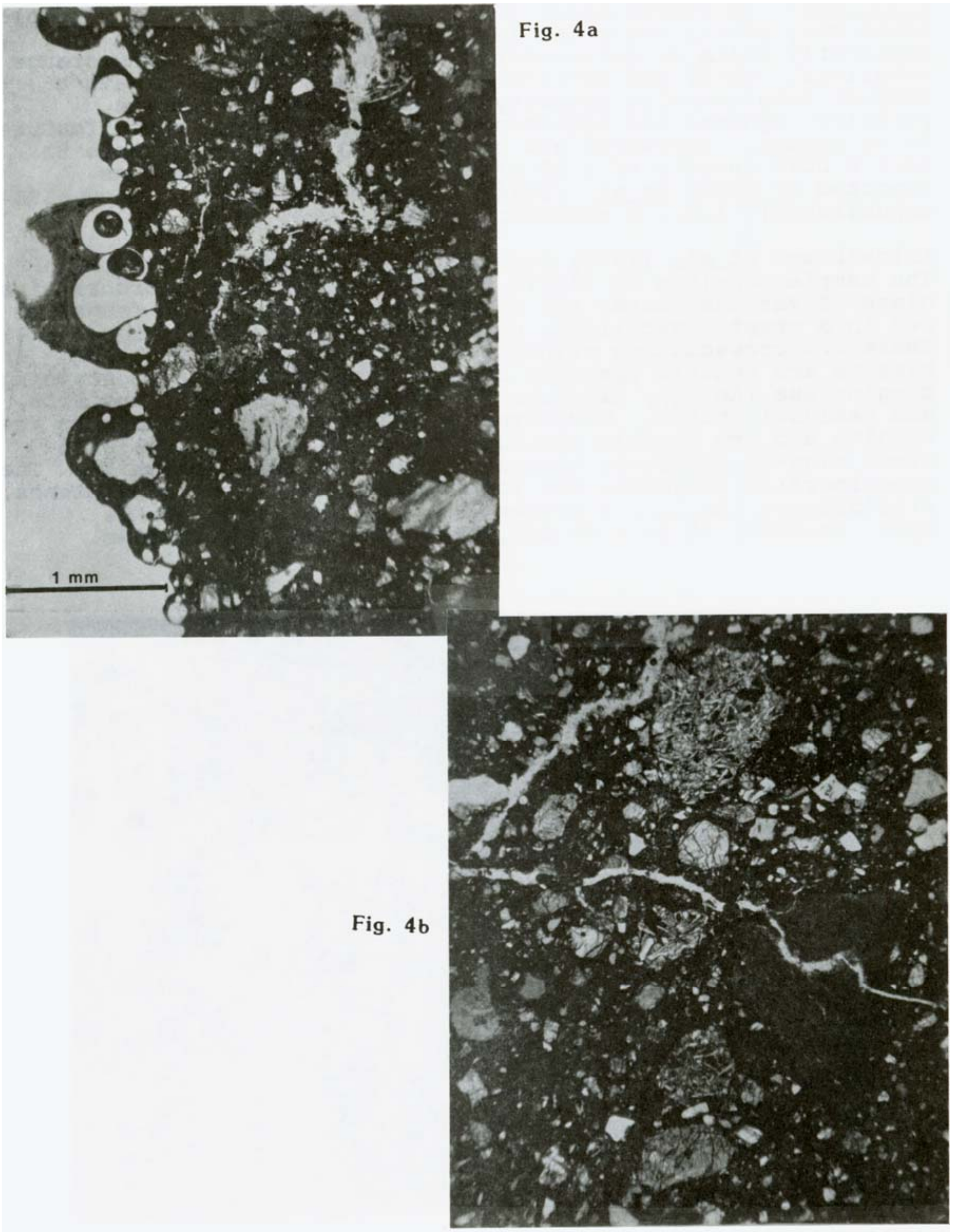

Figure 4. Photomicrographs of the 15059,48 breccia matrix, transmitted light (a) also shows vesicular glass coat.

CHEMISTRY: Fruchter et al. (1973) reported the acquisition of data for 22 subsamples, including physically separated clasts. The published data are presented in Tables 1 and 2 and Figure 5. The matrix samples show 15059 to be homogeneous on a mm-scale, and to be very similar to neighboring soil, e.g. 15021; the analysis of Korotev (1984 unpublished) is consistent with that of Fruchter et al. (1973). The glass coat is also similar, and Fruchter et al. (1972) believed it to be remobilized matrix; more likely is that it is melted soil. The four clast analyses reported span the range for all clasts analyzed. Two samples appeared to be mare basalts but only one has chemistry like local basalts; the two "noritic" clasts look similar to Apollo 15 KREEP basalts.

Ganapathy et al. (1973) made no specific discussion of their matrix analysis, placing it in their meteoritic group A.

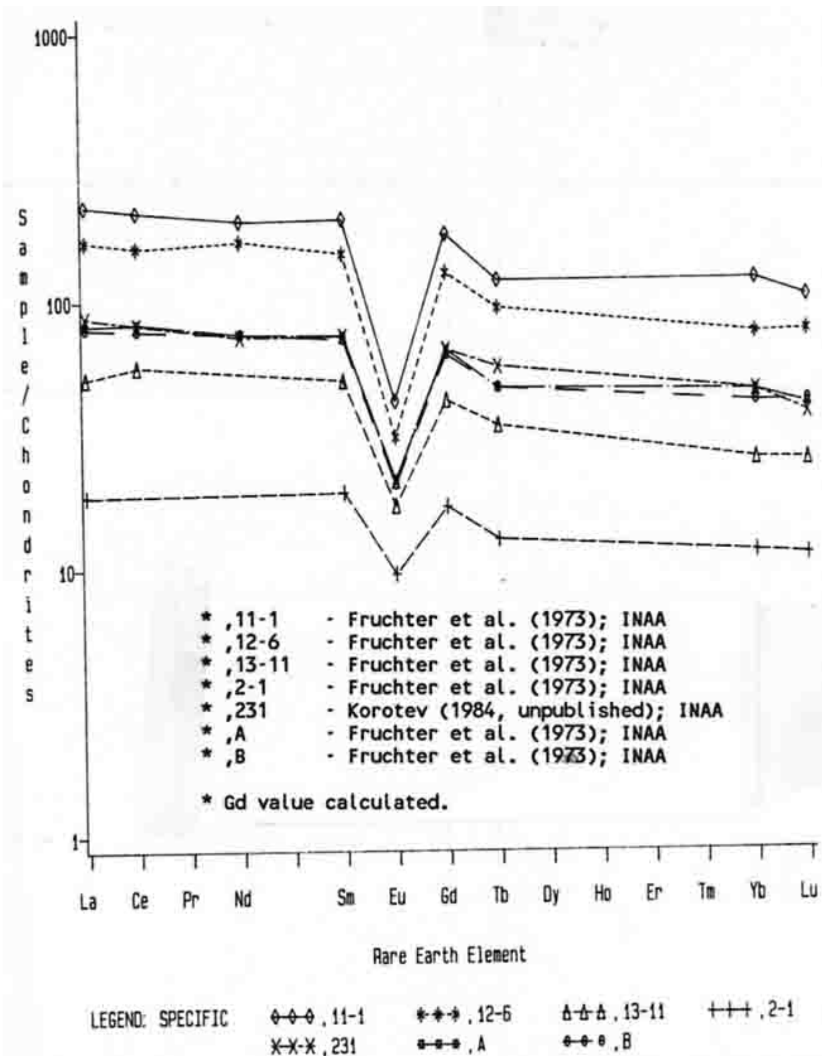

Figure 5. Rare earths in matrix (upper two curves)
and clasts in 15059.

TABLE 15059-1. Chemical analyses of breccia matrix

		,13-1	,Aa	,231
Wt %	SiO2			
	TiO2		1.99	1.73
	Al2O3		13.31	13.6
	FeO		14.8	15.0
	MgO			10.4
	CaO			10.2
	Na2O		0.4631	0.45
	K2O		0.196	
	P2O5			
(ppm)	Sc		30	28.9
	V			100
	Cr		2890	2840
	Mn			1520
	Co		42	61.6
	Ni			615
	Rb	5.8		
	Sr			165
	Y			
	Zr		330	420
	Nb			
	Hf		10.0	10.7
	Ba		300	287
	Th		4.8	4.9
	U	1.31		1.35
	Pb			
	La		27.0	28.8
	Ce		73	72
	Pr			
	Nd		45	44
	Sm		13.4	13.4
	Eu		1.48	1.46
	Gd			
	Tb		2.2	2.65
	Dy			
	Ho			
	Er			
	Tm			
	Yb		9.1	9.1
	Lu		1.38	1.28
	Li			
	Be			
	B			
	C			
	N			
	S			
	F			
	Cl			
	Br	0.115		
	Cu			
	Zn	13.5		
(ppb)	I			
	At			
	Ga			
	Ge	306		
	As			
	Se	225		
	Mo			
	Tc			
	Ru			
	Rh			
	Pd			
	Ag	5.4		
	Cd	35.5		
	In	2.7		
	Sn			
	Sb	0.99		
	Te	15.5		
	Cs	2455		280
	Ta		1200	1310
	W			
	Re	0.55		
	Os			
	Ir	7.0		6.2
	Pt			
	Au	2.45		<4
	Hg			
	Tl	2.4		
	Bi	0.88		
		(1)	(2)	(3)

References and Methods:

(1) Ganapathy et al. (1973); RNAA
(2) Fruchter et al. (1973); INAA
(3) Korotev (1984 unpublished); INAA

Notes:

(a) average of 7 analyses

TABLE 15059-2. Chemical analyses of glass coat and clasts

		,Bb	,2-1c	,13-11d	,11-1	,12-6e
Wt %	SiO2					
	TiO2	2.00	1.60	1.87	2.8	2.09
	Al2O3	13.8	6.03	9.96	15.5	16.0
	FeO	14.8	21.8	17.5	13.5	11.9
	Mg					
	CaO					
	Na2O	0.4700	0.189	0.339	0.850	0.767
	K2O	0.215	0.041	0.128	0.593	0.419
	P2O5					
(ppm)	Sc	30	27	30	29	24
	V					
	Cr	2880	4600	4300	2400	2550
	Mn					
	Co	44	73	57	30	28
	Ni					
	Rb					
	Sr					
	Y					
	Zr	300			730	680
	Nb					
	Hf	9.4	2.5	6.3	25.5	19.3
	Ba	270			820	670
	Th	4.2	1.1	2.9	13.4	9.7
	U					
	Pb					
	La	26.0	6.2	17.0	75.0	55.0
	Ce	68		50	189	140
	Pr					
	Nd	45			120	100
	Sm	13.0	3.5	9.1	36.7	27.3
	Eu	1.42	0.66	1.18	2.91	2.14
	Gd					
	Tb	2.2	0.6	1.6	5.6	4.4
	Dy					
	Ho					
	Er					
	Tm					
	Yb	8.3	2.3	5.1	24.0	15.0
	Lu	1.42	0.38	0.86	3.48	2.59
	Li					
	Be					
	B					
	C					
	N					
	S					
	F					
	Cl					
	Br					
	Cu					
	Zn					
(ppb)	I					
	At					
	Ga					
	Ge					
	As					
	Se					
	Mo					
	Tc					
	Ru					
	Rh					
	Pd					
	Ag					
	Cd					
	In					
	Sn					
	Sb					
	Te					
	Cs					
	Ta	1200			3000	2100
	W					
	Re					
	Os					
	Ir					
	Pt					
	Au					
	Hg					
	Tl					
	Bi					
		(1)	(1)	(1)	(1)	(1)

References and Methods:

(1) Fruchter et al. (1973); INAA

Notes:

(b) glass coat/veins, average of 3 analyses
(c) mare clast
(d) mare-appearing clast macroscopically
(e) norite (probably A15 KREEP basalts)

Leich et al. (1973 a,b) studied the depth distribution of hydrogen in the surfaces of two glass chips, one from the lunar top and one from the lunar bottom. They showed depth profiles, with hydrogen concentrated in a few hundred microns at the surface with very little deeper than 1000 Å. Because the bottom has no resolvable microcraters, it has probably never been exposed, and the H is probably a result of terrestrial contamination, probably as H_2O. Any solar wind implanted hydrogen has been lost from the depths measured. Filleux et al. (1978) studied carbon in the same bottom glass chip that Leich et al. (1973a, b) studied, finding a low volume (i.e., 0-2 m depth) carbon.

PROCESSING AND SUBDIVISIONS: 15059 was slabbed (Fig. 6). The end pieces ,0 (526g) and ,4 (376g) remain intact, the latter in Brooks. The slab was substantially dissected and allocated under the Goles Consortium. A large number of small pieces of ,12 and ,13 were used for educational disks. Thin sections ,44 and ,48 were made from ,38 (a chip from ,6) and ,47 and ,49 from ,39 (a chip from ,35). Thin section ,86 was made from ,18. The glass coat is prominent in thin sections ,48 and ,49

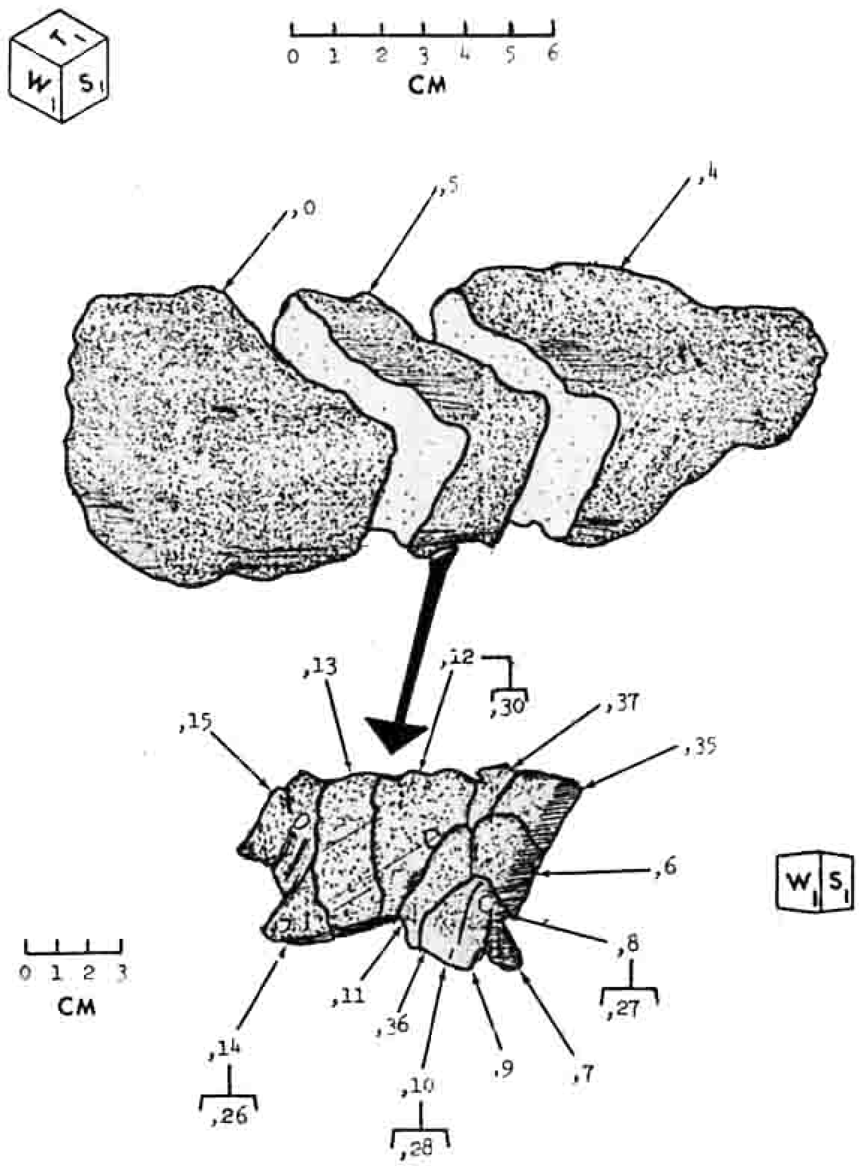

Figure 6. Sawing and slab subdivisions.