LARGE GLASSY OBJECTS FROM THE APOLLO 16 LANDING SITE, Thomas H. See, Lockheed/EMSCO, 1830 NASA Rd. 1, Houston, Tx 77058; F. Horz and D. Blanchard, NASA-Johnson Space Center, Houston, Tx 77058

Impact melts are common among lunar materials and range in size from small agglutinitic soil components to sizeable holocrystalline handspecimens of large melt sheets. We are presently studying impact melts of intermediate size that occur as drapings or coatings on various host rocks, as large hollow or solid spheres and/or veins penetrating the host rock. These objects-termed "Large Glassy Objects" (LGO's)-are defined as melts with masses >1 g. They are particularly abundant at Apollo 16 where they reflect either (1) the more intensive cumulative cratering history relative to mare surfaces and/or the highland slopes at Apollo 15 and 17 or (2) the presence of North- and South-Ray craters, i.e., two relatively young impact structures. Our studies include petrographic observations, major and trace element analysis and ferromagnetic resonance. The major objective is to distinguish between a source area of regolith or of underlying "bedrock". Those specimens of nonregolithic composition reflect large impact events that penetrated the local soil. The impact melts generated in such events reflect a physical target volume that is generally orders of magnitude larger than the handspecimen returned and thus the LGO's may potentially yield a good average composition of the substrate. By analyzing some 50 glassy objects we hope to be able to see systematic compositional differences between the Cayley Plains and Descartes Mountains at Apollo 16. This is a progress report detailing our findings on the first 9 glassy objects.

Chemical data are presented in Table 1; the major element data represent averages of approximately 50 individual spots. In general, compositional ranges of both holohyalline and aphanitic objects are limited; Al_2O_3 may range 2% from the average. Figure 1 compares the major element content of the LGO's with those of other Apollo 16 materials. The majority of the LGO's have a strong chemical affinity to Apollo 16 soils for which only averages of each station are plotted. Samples 60015, 60095, 64455, 65016 and 67115 are most likely derived from the regolith. The other melt compositions appear to be mixtures of the diverse Apollo 16 lithologies either with or without a regolith component. Sample 64435 requires a distinctly more mafic component, while samples 65035, 60135, and 61016 obviously have higher feldspar contents than the soils. These melt compositions are distinctly different from any Apollo 16 host rock.

Trace element data on samples 60095, 64455, and 65016 confirm the similarities between these samples and local regolith soils from Stations 5, 6, 8, 9, and 10. Sample 61016 most closely resembles data from soil Station 11 which is the most felsic of all the Apollo 16 soil stations. Sample 64435 shows little similarity to any of the Apollo 16 soil stations; no one source can account for its composition.

The compositional variations which have been observed in these LGO's have not yielded a discernable difference that can be attributed to the Cayley Plain, Descartes Mountain question. In addition, even though some similarities exist between some of the LGO's and various Apollo 16 lithologies, no LGO composition can clearly be attributed to the identified host rock.

REFERENCES

(1) Korotev, R. L. (1981) Proc. Lunar Planet. Sci., 12th, p. 577-606.

(2) Ryder, G. and Norman, M. D. (1980) Catalog of Apollo 16 Rocks, NASA publication 52, JSC 16904.

LARGE GLASSY OBJECTS

See, Thomas H., et al.

MAJOR ELEMENTS	60015	60095	60135	61016	64435	64455	65016	65035	67115	SOILS STATIONS 5,6,8,9,10	SOILS STATION 11
SiO_2	44.7 (42.02-46.82)	44.82 (44.31-46.0)	43.71 (42.17-44.53)	44.23 (43.30-44.98)	45.41 (44.9-45.89)	44.76 (43.94-46.45)	44.7 (43.17-45.82)	43.93 (43.56-44.4)	44.81 (44.59-45.46)	45.22 (44.5 -45.63)	45.1 (44.2 -45.75)
TiO_2	.32 (.14- .63)	.48 (.43- .9)	.11 (0 - .37)	.16 (.01- .97)	.38 (.3- .73)	.44 (.33- .73)	.48 (.33- .55)	.12 (0.0 - .29)	.72 (.17- 1.17)	.61 (.5 - .7)	.41 (.26- .54)
Al_2O_3	29.33 (14.75-31.14)	25.94 (22.12-26.38)	32.57 (29.87-36.85)	32.52 (24.8-35.38)	24.43 (24.02-25.19)	25.84 (23.99-27.58)	26.56 (24.29-28.04)	33.9 (30.72-36.31)	28.44 (27.72-29.36)	26.4 (26.07-27.14)	28.9 (26.18-29.4)
Cr_2O_3	.12 (0 - .26)	0.0	.03 (0 - .12)	.....	.17 (.14- .22)	.15 (.06- .21)	.11 (.07- .23)	.....	0.0	.....	.....
FeO	4.03 (3.9 -10.42)	5.72 (5.43- 6.34)	2.39 (.05- 8.43)	2.46 (.55- 7.93)	6.85 (6.34- 7.11)	5.6 (4.36- 6.42)	5.06 (4.75- 5.7)	1.67 (.13- 2.96)	4.85 (4.22- 5.65)	5.68 (5.4 - 6.08)	4.2 (2.96- 4.73)
MnO	.....	.....	.....	.....	.....	.06 (.04- .17)	.07 (.03- .12)	.....	.....	.....	.....
MgO	5.49 (3.9 -11.0)	7.89 (7.59-10.36)	2.47 (.04- 5.35)	2.63 (.51-11.26)	9.4 (8.98- 9.74)	8.07 (7.86- 9.09)	7.16 (6.13- 8.18)	1.5 (.9 - 3.14)	5.07 (4.1 - 5.35)	6.27 (5.52- 6.39)	4.3 (3.86- 6.48)
CaO	16.19 (13.09-17.45)	14.61 (13.75-14.85)	18.04 (15.92-20.01)	17.97 (12.9 -19.3)	13.5 (13.37-13.74)	14.31 (13.59-14.69)	15.33 (14.58-16.79)	18.44 (17.36-19.84)	15.72 (15.10-16.73)	15.36 (14.97-15.57)	16.5 (15.56-16.87)
Na_2O	.43 (.05- 1.28)	.32 (.2 - 1.09)	.34 (.22- .44)	.33 (.18- .56)	.53 (.47- .62)	.36 (.21- .59)	.26 (.14- .38)	.41 (.25- .43)	.61 (.52- .76)	.46 (.38- .53)	.48 (.42- .73)
K_2O	.11 (0 - .35)	.12 (.09- .2)	.05 (0 - .08)	.06 (.01- .18)	.12 (.11- .14)	.13 (.06- .26)	.08 (.03- .12)	.05 (.07- .16)	.11 (.07- .16)	.12 (.11- .16)	.07 (.06- .73)
TOTAL	100.72	99.9	99.71	100.36	100.79	99.7	99.79	100.02	100.32	100.12	99.96
NUMBER OF DATA POINTS	68	44	46	39	20	52	75	10	8	14	4
TRACE ELEMENTS											
Co		40.		23.5	92.5	44.93	36.05			32.3 (21 -47)	14.5 (13 -16.3)
Ni		470.		280.	1645.	788.33	392.5			462. (290 -720)	140.
La		14.6		6.3	18.9	15.57	13.9			13.6 (12.5 -14.7)	5.9 (3 -11)
Ce		42.5		16.5	49.95	41.53	38.45			35 (32.6 -38.3)	15.3 (9 -28)
Nd		24.		9.	37.5	27.08	23.5			.....	.....
Sm		6.8		3.	9.	7.23	6.44			6.56 (3.9 - 7.01)	2.8 (1.3 - 5.7)
Eu		1.14		.97	1.2	1.13	1.14			1.24 (1.13- 1.28)	1.13 (1.1 - 1.3)
Tb		1.46		.59	2.16	1.6	1.46			1.29 (1.22- 1.46)	.56
Yb		4.5		2.	5.88	4.77	4.25			4.64 (3.6 - 5.05)	2.05 (1.1 - 3.9)
Lu		.67		.29	.89	.71	.64			.68 (.58- .71)	.29 (.18- .58)
Sc		7.1		3.75	9.3	7.13	6.65			10.06 (8.8 -11.8)	7.3 (5.2 - 8.2)
Hf		4.7		2.25	6.95	5.23	4.65			4.7 (4.6 - 5.4)	1.85 (.8 - 3.5)
Ta		1.0		.....	.9	.8	.57			.57	.3 (.3 - .5)
Pa (Th)		2.0		.9	3.	2.41	2.15			2.26	1.0 (.4 - 1.7)
Np (U)		.....		.....	.7	.08	1.5			.65	.27

Table 1. Major and trace element data for LGO's and selected soil stations. Values in () are range of composition. Average values for soil stations taken from Korotev (1).

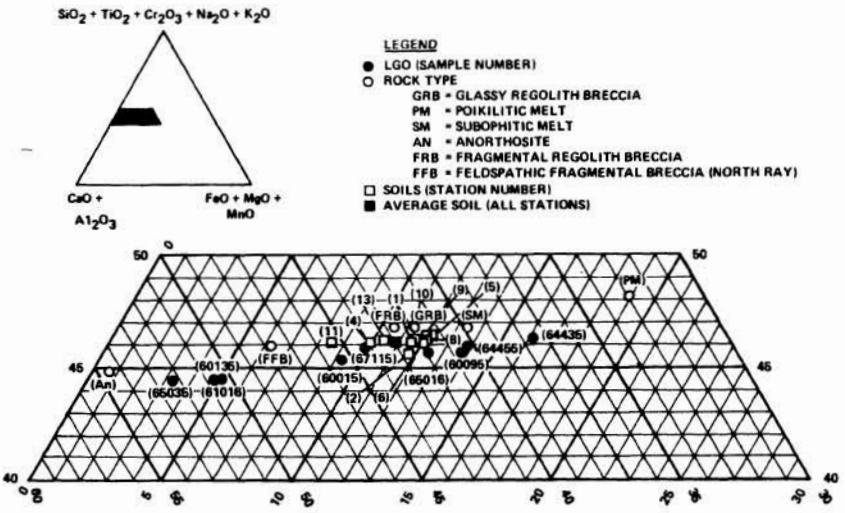

Figure 1. Average compositions of LGO's and other Apollo 16 materials. Data for rock samples taken from Ryder and Norman (2).