PETROLOGY, CLAST CHARACTERISTICS, AND SELENOLOGIC HISTORY OF GLASS-COATED BRECCIA 15205, R. F. Dymek, A. L. Albee, and A. A. Chodos, Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California 91109. Contribution No. 2440.

Lunar breccia 15205 is a 337 g sample collected at the Apennine Front from a 1 m boulder near St. George Crater. This boulder is coated with dark-green, vesicular glass, which penetrated it along fractures and was present even on the underside of the block. Petrographic observations on ten polished thin sections (15205,60-69) and binocular microscope studies of two chips (15205,18 4.1 g; 15205,40 21.0 g) indicate that this sample is well-lithified soil consisting of rock (40%), mineral (20%), and glass (15%) fragments in a clastic matrix (25%) [1]. The latter includes the <20μ particles, which appear to be the comminuted equivalents of the larger ones.

The rock is layered, as exhibited by the consistent alignment of clasts and glass layers. Recrystallization has been slight, glass is well preserved, and no reaction relations occur around any fragments.

Subparallel microfractures in the rock offset, but do not rotate, clasts. Some are filled with brown, vesicular-glass veins (.05-.10 mm wide). These veins are compositionally similar to, and appear to be truncated by, the coating of green glass. This green-glass rind is flow banded and chemically homogenous, but compositionally unlike any of the glass fragments in the rock. It is also dissimilar in composition to the soil at Station #2 (Table 1).

The lithic fragments have undergone differing degrees of crushing and granulation (none to extreme), and their boundaries with surrounding material range from sharp to gradational to indistinct. Six types have been recognized: 1) Intersertal, feldspathic basalt with up to 10% high-K interstitial "glass"; 2) Pyroxene vitrophyric basalt with or without olivine; 3) Olivine, granular-pyroxene basalt; 4) Pyroxene, poikilitic-plagioclase basalt; 5) Norite and anorthosite; and 6) Breccia.

Group 1 is compositionally and texturally similar to rock 14310 [2] and "KREEP" basalt fragments such as the one described by Meyer [3]. Groups 1 and 2 occur in subequal proportions and together constitute approximately 90% of the total lithic fragments.

Glass clasts have the following general compositional and textural features:

1) Ultramafic glass occurs as the characteristic pale-green spheres (or pieces thereof) and in spheroidal agglutinates. The latter are clasts, up to 1 cm long, which consist of glassy spheres in a matrix of compositionally-identical glass. This group is remarkably homogenous with a composition corresponding to a feldspathic peridotite.

2) High-alkali, high-alumina glass displays a range in color (white, yellow, brown, purple), texture, and physical and textural homogeneity. It occurs as uniform, sharply-bounded, angular to subrounded fragments, flow-banded layers and fragments, and as sheaths around Group 1 basalt fragments. Thus, it may be the melted equivalent of the latter.

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3) Mare-basalt glass is recognized by its high total iron (FeO >18%) and high Fe/Mg ratio (∿2). Two types are distinguished here:
a) bright-yellow to orange fragments with TiO_2>2%; and
b) olive-green fragments locally associated with shock melting of vitrophyric basalt.
4) Gabbroic-anorthosite glass occurs as subrounded, white fragments with Al_2O_3 ∿27%.

Groups 1 and 2 occur in subequal proportions and constitute ∿95% of the glass fragments. Fragments of glass with Al_2O_3 greater than 20% are extremely rare in this rock. Table 1 presents the average compositions of the glass types and an analysis of soil from Station #2 for comparative purposes.

The following sequence of events is proposed for lunar sample 15205:
1) Impact events produced soils, which were later lithified and now occur as breccia fragments within 15205.
2) Impact events deposited clastic debris as a layered soil, which was subsequently lithified.
3) Fracturing of this lithified soil, followed, perhaps contemporaneously, by shock melting of the matrix produced glass veins.
4) An impact event caused excavation and melting of local soil to produce the green-glass rind.
5) A final excavation deposited the boulder at its present site near the Apennine Front.

Since this rock represents a lithified soil, the clast population should characterize the source region at the time of formation of the soil. Within 15205, three lithologies are dominant: intersertal, feldspathic basalt and equivalent glass; ultramafic glass; and vitrophyric basalt. If this rock is locally derived, representing a mixture of material descending from the Apennine Front with mare rocks, then high-alkali, high-alumina basaltic material must be abundant in the adjacent highland region. Alternatively, if the boulder is exotic, as suggested in the Apollo 15 PET report ("...the boulder impacted at a low angle from the north or northwest..." [4]), its makeup may have little relationship to the lithologic units at the landing site.

However, the ultramafic glass and vitrophyric basalts, which represent two of the principal lithologies in 15205, are recognized in other Apollo 15 samples [5]. Hence, we conclude that the similarity between certain clasts in 15205 and other Apollo 15 samples requires that the point of origin of the boulder be comprised of materials not unlike those of the Apollo 15 site, and that that region may possess nearly 30% high-alkali, high-alumina basaltic material, which might be identified with "KREEP".

[1] Glass rind not included in modal analysis.
[2] Gancarz, et al., (1971) EPSL, 12, p. 1-18
[3] Meyer, C. (1972) Lunar Science III, p. 542
[4] Apollo 15 -- Preliminary Science Report (1972) NASA SP-289, p. 5-76, 77, 78; 6-13,14
[5] e.g. ultramafic glass: 15426, 15086; vitrophyric basalt: 15499, 15597, 15486

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Table 1 - Average Glass Compositions

	1	2	3a	3b	4	5	6	7
Na_2O	0.15	0.78	0.31	0.36	0.24	0.51	0.57	0.39
MgO	17.50	8.30	9.32	9.78	4.84	10.27	9.97	10.36
Al_2O_3	7.36	16.68	9.74	9.39	27.37	14.09	12.90	17.38
SiO_2	45.56	50.08	44.26	47.71	44.61	47.32	48.24	45.95
K_2O	0.02	0.59	0.04	0.07	0.03	0.22	0.30	0.17
CaO	8.25	10.65	10.74	10.35	16.57	10.91	9.94	11.52
TiO_2	0.43	1.65	2.44	1.67	0.23	1.59	1.94	1.27
Cr_2O_3	0.55	0.25	0.50	0.56	0.11	0.38	0.42	-
MnO	0.27	0.26	0.27	0.16	0.21	0.16	0.21	0.16
FeO	19.58	9.47	20.98	20.09	4.49	14.13	14.82	11.65
NiO	0.03	0.01	0.03	0.02	0.07	0.03	0.03	-
P_2O_5	0.03	0.51	0.06	0.06	0.05	0.23	0.34	0.13
SO_3	0.02	0.08	0.06	0.08	0.06	0.11	0.19	0.15*
Total	99.75	99.20	98.78	100.40	98.94	99.95	99.87	99.13

1) Ultramafic glass
2) High-alkali, high-alumina glass
3a) Bright-yellow, mare-basalt glass
3b) Olive-green, vitrophyric basalt glass
4) Gabbroic-anorthosite glass
5) Brown-glass vein
6) Green-glass rind
7) Station 2 soil (15101), PET Report, p. 6-17, table 6- IV
* Converted from S.

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