PRELIMINARY DESCRIPTION OF APOLLO 17 STATION 7 BOULDER CONSORTIUM ROCKS

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Samples 77135, 77115, 77215, and 77075 were collected by Eugene Cernan and Harrison Schmitt from a boulder about 2.5 m. in diameter at Station 7 at the foot of North Massif at Taurus-Littrow (1). Field relations and photographs taken by Cernan and Schmitt show that a large, off-white, moderately coherent clast is the oldest material in the boulder (represented by 77215). Dark veinlets (77075) which cut this clast were observed by Schmitt to be continuous with "blue-gray matrix-rich breccia" (77115), the material which surrounds the white clast. Distinct fractures probably produced by shock cut across all three as a block. This fractured block is enclosed by largely unfractured, highly vesicular rock (77135); the youngest material in the boulder.

77135, a fragment-laden, fine-grained, phyric, pigeonite feldspathic basalt, is described by us in another abstract (2). Here we present a preliminary description of the other three rocks.

77115 is a vuggy, very fine-grained, gray (blue-gray breccia of PET (3)) fragment-laden crystalline rock, about 6.5×5.5×3.5 cm. and weighing about 116 g. As compared to 77135, 77115 is much more heterogeneous, contains more abundant and a wider and somewhat different variety of xenoliths, and is finer-grained than the fine-grained part of 77135. 77115 can be divided roughly into 2 portions, a gray aphanite (A) and a brownish gray, more fragmental-appearing, coarser-grained part (B). Both parts are coherent and crystalline. There are areas where materials similar to B are intimately dispersed within A.

Part A is vuggy and holocrystalline. The chemical composition obtained by expanded beam electron-microprobe analysis is shown in Table 1. The principal minerals are low calcium pyroxenes, plagioclase, olivine and ilmenite. The pyroxenes, which are very pale brown in color, are rarely greater than 0.2 mm. and range from microsubophitic to micropoikilitic. Under high magnification (1000X) most show inclined extinction. Their compositions Wo_{4-10} $En_{71-58}Fs_{25-32}$ are richer in iron than those in 77135. Plagioclase occurs as laths surrounded or enclosed by pyroxenes, or as anhedral grains associated with platy ilmenite in interstitial areas between the pyroxenes and olivines. The small plagioclase laths range from An_{88-92} while plagioclase xenocrysts are generally more calcic, An_{96}. Most olivine grains occur discretely, rarely as inclusions in clinopyroxenes. Olivine xenocrysts have cores Fo_{69-89} and rims Fo_{68-78} converging toward the composition of olivine in the matrix Fo_{67-71} also slightly more iron-rich than in 77135. Ilmenite occurs as platy crystals concentrated in areas richer in anhedral plagioclase, and there are small areas of mesostasis which are rich in potassium, much as in 77135. Rare spinel xenocrysts are present. Different kinds of olivine-plagioclase xenoliths and slightly devitrified glass xenoliths occur in this rock. Most of these are too small to be studied systematically.

Part B consists of a recrystallized aggregate of angular olivine and plagioclase grains interspersed with much larger granulated single grains of pyroxene. It also contains fine-grained dark crystalline areas which appear to penetrate B but are unlike A in composition. B has apparently

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recrystallized with anhedral plagioclase cementing the fragments. In bulk composition it is more feldspathic than A (Table 1).

77215 is a shock-compressed, sheared, and granulated microbreccia with only a few clasts about 1 cm. across. It consists of 3 principal lithologies: 1. Grayish white to white xenoliths of granular plagioclase aggregates and fragments of light-colored pyroxene; 2. Xenoliths of troctolitic and olivine-rich aggregates and xenocrysts of pale greenish yellow olivines; 3. Dark gray to black shattered, partly devitrified fragment-laden glass. Other lithic fragments are also present but they appear to be minor and have not yet been studied.

Only one thin section (77215,13) of a random chip was studied. It is a fairly porous microbreccia containing abundant white clasts and a few dark particles. Most of the light-colored lithic clasts consist of plagioclase plus orthopyroxene or plagioclase plus orthopyroxene and augite aggregate too small to reveal its general lithic type. Plagioclase and light-colored orthopyroxene grains are abundant. Orthopyroxenes are hypersthene $Wo_{4-7}En_{63-64}$ Fs_{33-29}. Some of the hypersthene contains coarse planar to irregular-shaped exsolved lamellae of augite with composition $Wo_{32-42}En_{50-45}Fs_{18-13}$ suggesting a deep-seated origin. Augite also occurs as separate clasts, mostly about $Wo_{43}En_{43}Fs_{14}$ in composition. As a whole, hypersthene is much more abundant than augite. Olivine clasts are also locally abundant. They have a wide range of composition, Fo_{85-97}. The composition of calcic plagioclase ranges from An_{88-93}. The dark gray specks are partly devitrified glassy particles with a few scattered xenocrysts. Their chemical composition (from 77215,13) is shown in Table 1. These dark glassy particles may represent impact glasses from source materials similar to the material in which they are embedded. The bulk composition of this orthopyroxene-rich microbreccia with locally variable composition is not yet available for comparison.

77075 is a dark, very fine-grained essentially holocrystalline rock with very fine-grained intergrowths of plagioclase and pyroxene and widely scattered xenocrysts of plagioclase and olivine. The bulk chemical composition of 77075 is shown in Table 1.

The mineral and clast assemblage of 77215 is distinctive. The bulk chemical compositions of the black veinlets 77075 and the gray portion of 77115 are very similar to 77135. Both 77075 and 77115 had been fractured by shock before they were or appeared to be incorporated in 77135. The lack of relict clasts with strong shock effects precludes the interpretation that the melt portions of these rocks were produced by in situ partial melting caused by impact. If the melts of 77075, 77115 and 77135 were of impact origin, two or even three large impact events were necessary to produce them: an earlier event for 77075 and 77115 (if they are part of the same melt) and a later melt for 77135. If the melts were igneous in origin, then partial melting by igneous activities was a continuing process in this period of early lunar history in the highlands.

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References

(1) Apollo 17 Mission Report, 1973, NASA Tech. Publ. JSC-07904 (National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston).

(2) Chao, E.C.T. and Minkin, J.A., 1973, The petrology and origin of 77135, a fragment-laden pigeonite feldspathic basalt--a major highland rock type. Abstract, this volume.

(3) Apollo 17 Preliminary Examination Team, 1973, The Apollo 17 Lunar samples: Chemical and petrographic description. Science, v. 182, p. 659-672.

Table 1. Preliminary data of the chemical composition of the Apollo 17 Station 7 boulder consortium rocks, in weight percent*

	77135,2**	77115,9-1 gray portion	77115,10-3 brownish gray portion	Dark glassy particles in 77215,13	77075
SiO_2	46.13	46.9	47.0	49.9	46.6
TiO_2	1.54	1.16	0.94	0.35	1.50
Al_2O_3	18.01	19.6	23.5	12.1	18.6
FeO	9.11	7.8	6.8	9.8	8.6
MnO	0.13	n.d.	n.d.	0.16	n.d.
MgO	12.63	10.3	8.8	16.9	11.0
CaO	11.03	11.9	12.4	8.2	11.8
Na_2O	0.53	0.83	1.00	0.60	0.74
K_2O	0.30	0.35	0.30	0.23	0.36
P_2O_5	0.28	n.d.	n.d.	n.d.	n.d.
Cr_2O_3	0.20	0.12	n.d.	0.32	0.22
S	0.08	n.d.	n.d.	n.d.	n.d.
Total	99.97	99.	101.	99.	99.

*Expanded beam electron microprobe analyses by Jean A. Minkin.
**PET, 1973.