BRECCIAS 64435, 63335, and 63355, J. C. Laul and R. A. Schmitt, Department of Chemistry and the Radiation Center, Oregon State University, Corvallis, Oregon 97331, and B. Mason, Smithsonian Institution, Washington DC 20560.

The petrographic description and microprobe data have been obtained by one of us (B. M.) on separate fragments of breccia 64435: light gray matrix, white anorthositic clasts and dark glass coating. Bulk and trace element data, including 9 REE, have been obtained via INAA by J.C.L. and R.A.S. in these 64435 separated fragments and in breccias 63335 and 63355. The chemical data for 30 elements are reported in Table 1. The chondritic normalized K, Ba, REE, Hf, Ta and Th patterns of these samples are shown in Figure 1.

64435: The light gray matrix is a firmly welded rock with a cataclastic texture. It consists largely of anorthite (An 95-100) with minor amounts of orthopyroxene and olivine, in a ground mass of pale brown partly devitrified glass. Based on chemical data, the matrix is gabbroic anorthosite with 88% Pl. The REE pattern is flat like the anorthositic gabbroic breccia 15418 (1) with a positive Eu anomaly (Sm/Eu=0.92). The 64435 anorthositic clast consists of ∿97% Pl with minor contents of other minerals, olivine, orthopyroxene and augite. Higher REE (except Eu) abundances in the 64435 anorthositic clast relative to 15415 and 60015 (2) are not attributed to contamination by the matrix or the glassy phases of 64435. Differences in the absolute REE abundances (except Eu) in the anorthosite phases of rocks such as 61016 (3), 15415 and 60015 (2), and 64435 may indicate that these four anorthositic phases crystallized from the same magma but at different times; i.e., 61016 first, 15415 and 60015 middle and 64435 last. A low FeO/MnO ratio of 55 in the 64435 anorthositic clast merely reflects preferential partitioning of Mn relative to Fe in pure plagioclase.

The 64435 glass coating is gray-black and lustrous and shows no signs of devitrification. The siderophiles Au, Ir and Ni, which are indicators for meteoritic impact, and even Co in this glass are more abundant than observed in any other lunar rock or soil (Table 1). Based on the low Ir/Au cosmic normalized ratio, an ancient meteoritic planetesimal of LN type is associated with the glass fraction of rock 64435. The REE distribution is about 25 times chondritic and has a negative Eu anomaly. The KREEP pattern (Sm/Eu=4.7) lies below the pattern for the Apollo 16 soils S. of the LM. This breccia, collected near Cinco B crater, was probably ejected from S. Ray crater.

Rocks 60017, 63335 and 63355 are different chips from a 5 m boulder (STA 13). Rocks 60017 and 63335 are (85% Pl) gabbroic anorthosites and are similar in composition (Table 1). Breccia 60017 is a B4 dark matrix-light clast (4), and is partially molten, type IV rock and a product of partial melting of a clastic rock (5). Rock 67031 (STA 11), a fragment of breccia 67035, while gray in color and collected from S. E. rim of N. Ray crater, is chemically similar (2) to breccia 60017 in our suite of 30 elements (Figure 1). This suggests that the 5 m boulder, though 0.7 km distant from STA 11, was most likely ejected from the N. Ray crater. Similar Ni/Ir/Au ratios in rock 63355 and in the glass fraction of 64435 indicate association with similar types of ancient meteoritic projectiles. Rock 63355 is a medium K KREEP type rock similar to Apollo 17 boulder-2 rocks of the S. Massif (6). From the REE

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Table 1. Bulk and trace element abundances in breccias 64435, 63335, 63355 and 60017.

	64435+			63335*	63355*	60017*
Element	Matrix 271mg	Glass 38 mg	Anorthosite 53 mg	115 mg	137 mg	295 mg
TiO_2(%)	0.2	0.5	<0.1	0.34	0.88	0.37
Al_2O_3	32.1	24.5	35.5	31.5	21.5	31.2
FeO	3.0	8.0	0.61	2.6	8.3	3.6
MgO	3	8	-	2	8	3
CaO	17.0	13.3	19.0	17.6	12.0	17.0
Na_2O	0.34	0.55	0.29	0.69	0.50	0.52
K_2O	0.024	0.086	0.025	0.049	0.22	0.056
MnO	0.040	0.105	0.011	0.035	0.089	0.048
Cr_2O_3	0.064	0.170	0.0083	0.035	0.169	0.054
Sc(ppm)	5.2	6.9	0.90	4.4	12	6.7
V	15	20	<4	10	35	10
Co	7	100	1.3	5	62	7
Zr	-	100	-	-	280	~30
Ba	20	90	<9	40	280	50
La	1.5	9.6	0.16	2.6	30	3.1
Ce	4	24	-	6	74	8
Nd	3	15	<0.4	4	47	5
Sm	0.70	4.3	0.086	1.2	12.0	1.4
Eu	0.76	0.91	0.69	1.32	1.51	1.24
Tb	<0.2	0.80	0.03	0.2	2.5	0.3
Dy	0.8	5.1	0.2	1.5	16	1.7
Yb	0.58	2.8	0.06	0.9	8.8	1.2
Lu	0.082	0.43	0.008	0.13	1.3	0.16
Hf	0.41	3.2	<0.03	0.60	8.9	1.0
Ta	0.07	0.35	<0.02	0.10	1.2	0.14
Th	0.25	1.1	-	0.25	4.2	0.5
U	<0.1	0.4	<0.02	<0.1	1.2	<0.14
Ni	-	1800	-	-	940	45
Ir(ppb)	-	50	-	<3	24	<1.5
Au(ppb)	-	30	-	4	16	4

+This rock has been assigned to the Mason consortium.

*These three rocks are chips from the ≈5m Shadow Rock at Station 13. Data for 60017 were reported by Laul and Schmitt (2).

contents and patterns, it is clear that the breccias are not compacted soils (Figure 1).

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6. Laul J.C. and Schmitt R.A. (1974) Chemical composition of Apollo 17 boulder-2 rocks and soils. Abstract, this conference.