63335 HETEROGENEOUS FINE-GRAINED IMPACT MELT/BRECCIA 65.4 g

INTRODUCTION: 63335 is polymict, consisting of differing glassy or microcrystalline breccias and intrusive fine-grained or glassy veins. It exists as several angular, coherent, medium to medium dark gray pieces (Fig. 1) which macroscopically are fairly homogeneous.

63335 was chipped from Shadow Rock, as were 60017 and 63355 accounting for its being in several pieces. Its exact location on the boulder is unknown although the general area is known. A few zap pits occur on some of the fragments.

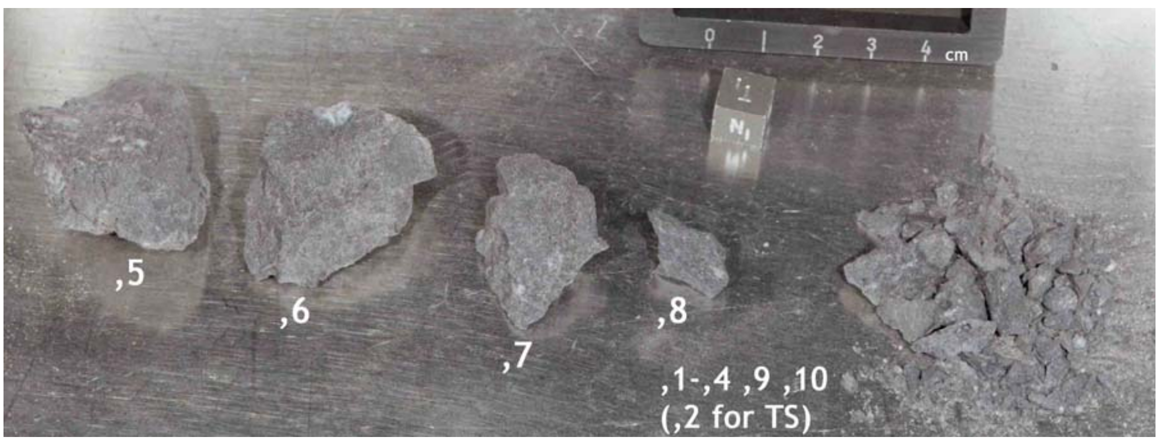

FIGURE 1. S-72-37807.

PETROLOGY: Kridelbaugh et al. (1973) describe, with microprobe analyses, a thin section which appears to be typical of the rock. Nord et al. (1975) report petrographic and transmission electron microscopy (TEM) studies of a similar sample; Misra and Taylor (1975) report metal data.

The rock is complex on a microscopic scale, with various melt-breccia (including glassy) textures prominent (Fig. 2). The main (?) micro-breccia has a cryptocrystalline matrix with dendritic laths of either olivine or orthopyroxene, and about 20% fragments of anorthosite, plagioclase and gabbroic anorthosite. A few small fragments of olivine, ilmenite, troilite, and Fe-metal are also present (Kridelbaugh et al., 1973). The small plagioclases are partially resorbed. Anorthosite and anorthositic gabbro clasts have plagioclase An_{93-97}; the anorthositic gabbro has olivine Fo_{85-72} (Kridelbaugh et al., 1973). The vein described by Kridelbaugh et al. (1973) varies from spherulitic to variolitic with plagioclase laths An_{95}. Nord et al. (1975) describe similar complex breccias which are essentially fine-grained with igneous textures. They did not find glass in their section.

Misra and Taylor (1975) report ranges of compositions for 5 metal grains, averaging 5.65% Ni and 0.55% Co (Fig. 3). They describe the sample as a mesostasis-olivine-plagioclase melt rock with devitrified glass a minor component. LSPET (1973) states that 63335 contains more than 2% ilmenite.

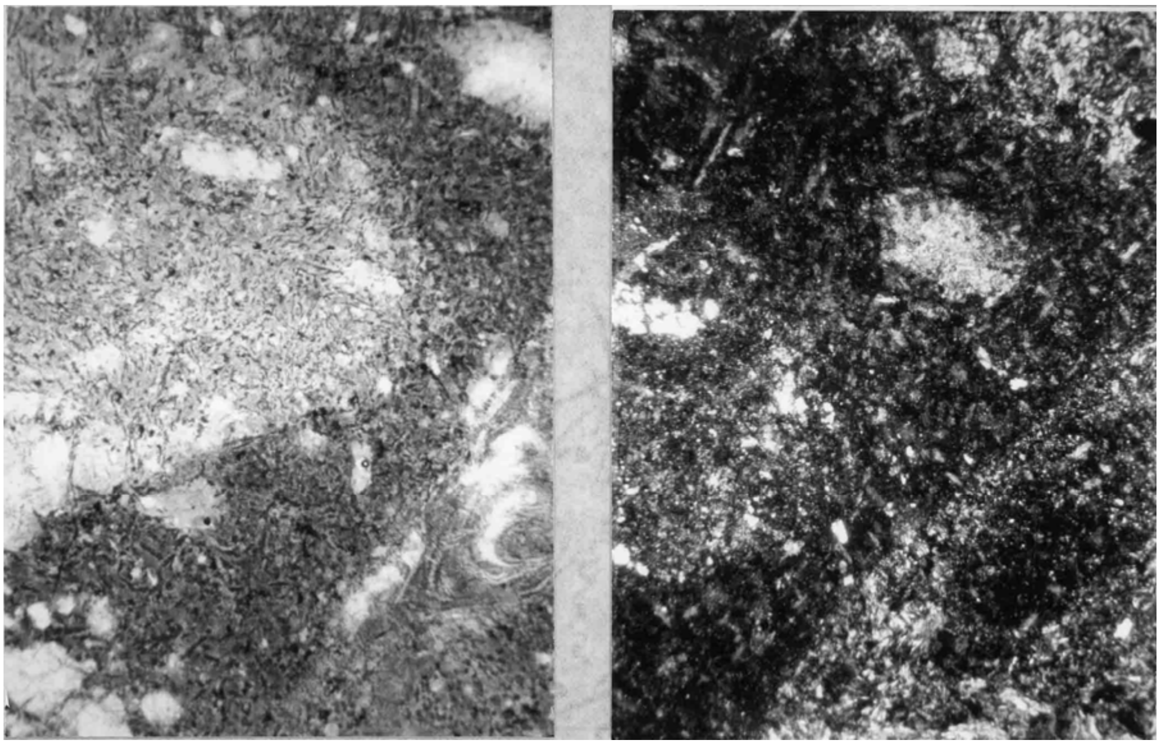

FIGURE 2. 63335,32.
a) Melt matrix, ppl. Width 2 mm.
b) Matrix and dark clasts, xpl. Width 2 mm.

CHEMISTRY: Laul et al. (1974) and LSPET (1973) report major and trace element abundances, Hubbard et al. (1974) report trace element abundances, Ganapathy et al. (1974) report meteoritic siderophile and volatile element abundances, and Clark and Keith (1973) report K, U, Th and radionuclide abundances from γ-ray spectroscopy. Cripe and Moore (1975) and Moore and Lewis (1976) report S, and C and N abundances respectively. Some chemical data are presented in the work of geochronologists (below). All these analyses are for bulk rock samples. Kridlebaugh et al. (1973) tabulate microprobe analyses of the matrix and of the devitrified glass veins.

The bulk rock data are summarized in Table 1 and Figure 4. The sample is chemically very similar to 60017 but unlike 63355, from the same boulder. The low siderophile and rare-earth abundances are like North Ray Crater samples and unlike most polymict breccias and soils. Hubbard et al. (1974) note that the sample has unusually high Eu and St, hence a large Eu anomaly (confirmed by the Laul et al., 1974, data). Ganapathy et al. (1974) assign the sample to their meteoritic Group 4, but Hertogen et al. (1977) assign it tentatively to Group 2 (and abandon Group 4).

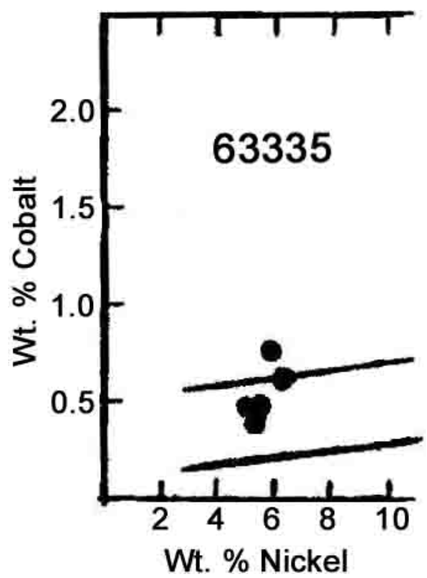

FIGURE 3. Metals, from Misra and Taylor (1975).

TABLE 1. Summary chemistry of 63335 whole-rock.

Rb ppm	Sr ppm	$^{87}Sr/^{86}Sr$	T_{BABI}* (b.y.)	T_{LUNI}*
1.146	222.1	.69997±5	4.08±.29	4.40±.29

*Values adjusted for interlaboratory bias.

GEOCHRONOLOGY: Nyquist et al. (1974) report Rb-Sr isotopic data for a whole-rock sample (Table 2). The measured $^{87}Sr/^{86}Sr$ is considerably lower than most lunar polymict breccias and soils.

Murthy (1978) reports the $^{87}Sr/^{86}Sr$ ratio of a plagioclase separate from 63335, which, adjusted for interlaboratory bias to conform with Caltech data, is 0.69907 ± 4. Extrapolated back to 4.6 b.y., this gives $^{87}Sr/^{86}Sr$ = 0.69890 ± 4, i.e. extremely primitive (Murthy, 1978).

Alexander and Kahl (1974) report ^{40}Ar-^{39}Ar data, but no plateau was found (Fig. 5) indicating extensive gas loss. Unlike most lunar samples, most of the ^{39}Ar was released at very high temperature. A minimum age of 3.65 b.y. can be inferred for the rock. The outgassing was possibly due to the North Ray cratering event.

TABLE 2. Summary of Rb-Sr isotopic data from Nyquist et al. (1974).

SiO_2	45.2
TiO_2	0.38
Al_2O_3	31.2
Cr_2O_3	0.05
FeO	~3.0
MnO	
MgO	~2.6
CaO	17.4
Na_2O	0.63
K_2O	0.05
P_2O_5	0.03
Sr	223
La	2.9
Lu	0.15
Rb	1.2
Sc	4.4
Ni	26-70
Co	5+
Ir ppb	<2
Au ppb	<4
C	53
N	49
S	265
Zn	16.3
Cu	

Oxides in wt%; others in ppm except as noted.

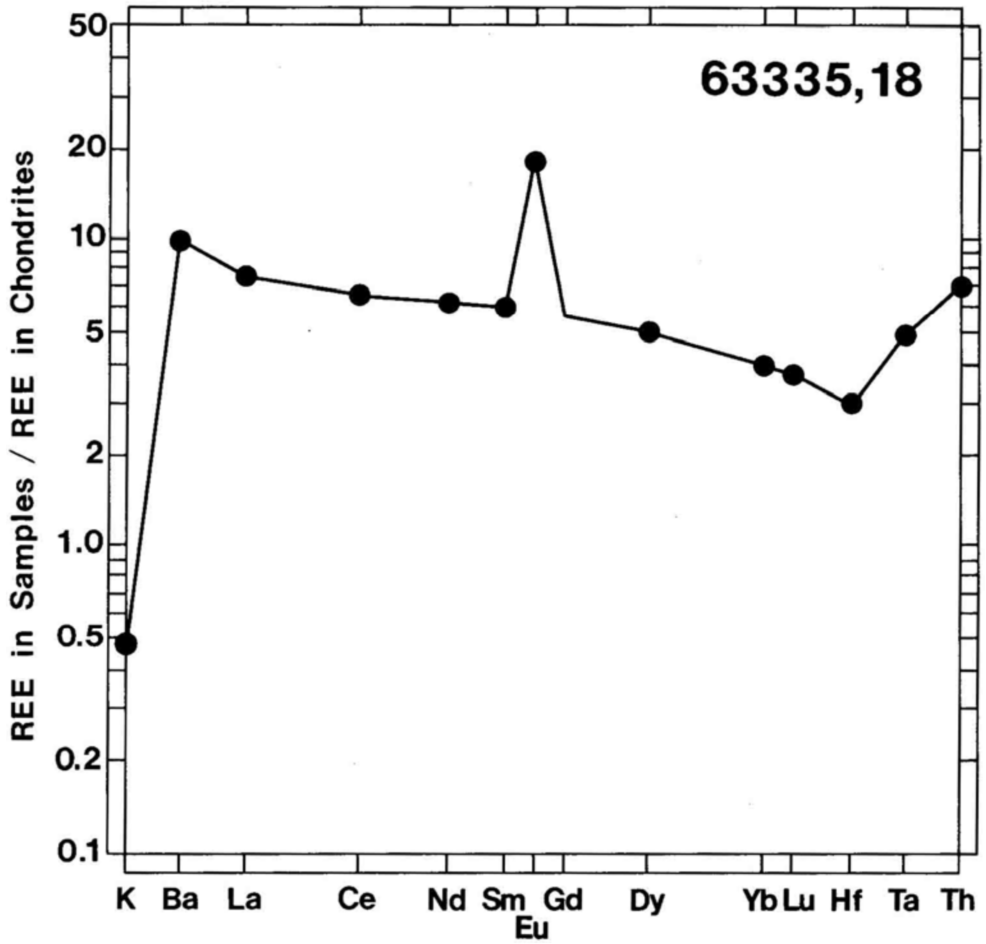

FIGURE 4. Rare earths, from Laul et al. (1974).

EXPOSURE AGE: Alexander and Kahl (1974) report an exposure age of 41 ± 8 m.y. from the ^{38}Ar method. This exposure age is similar to that of many North Ray crater breccias.

PROCESSING AND SUBDIVISIONS: 63335 was returned as several pieces (Fig. 1), several of which were separate and numbered. Of the larger chips (Fig. 1) ,5 and ,18 are preserved and ,6 (Fig. 6) and ,7 have been subdivided.

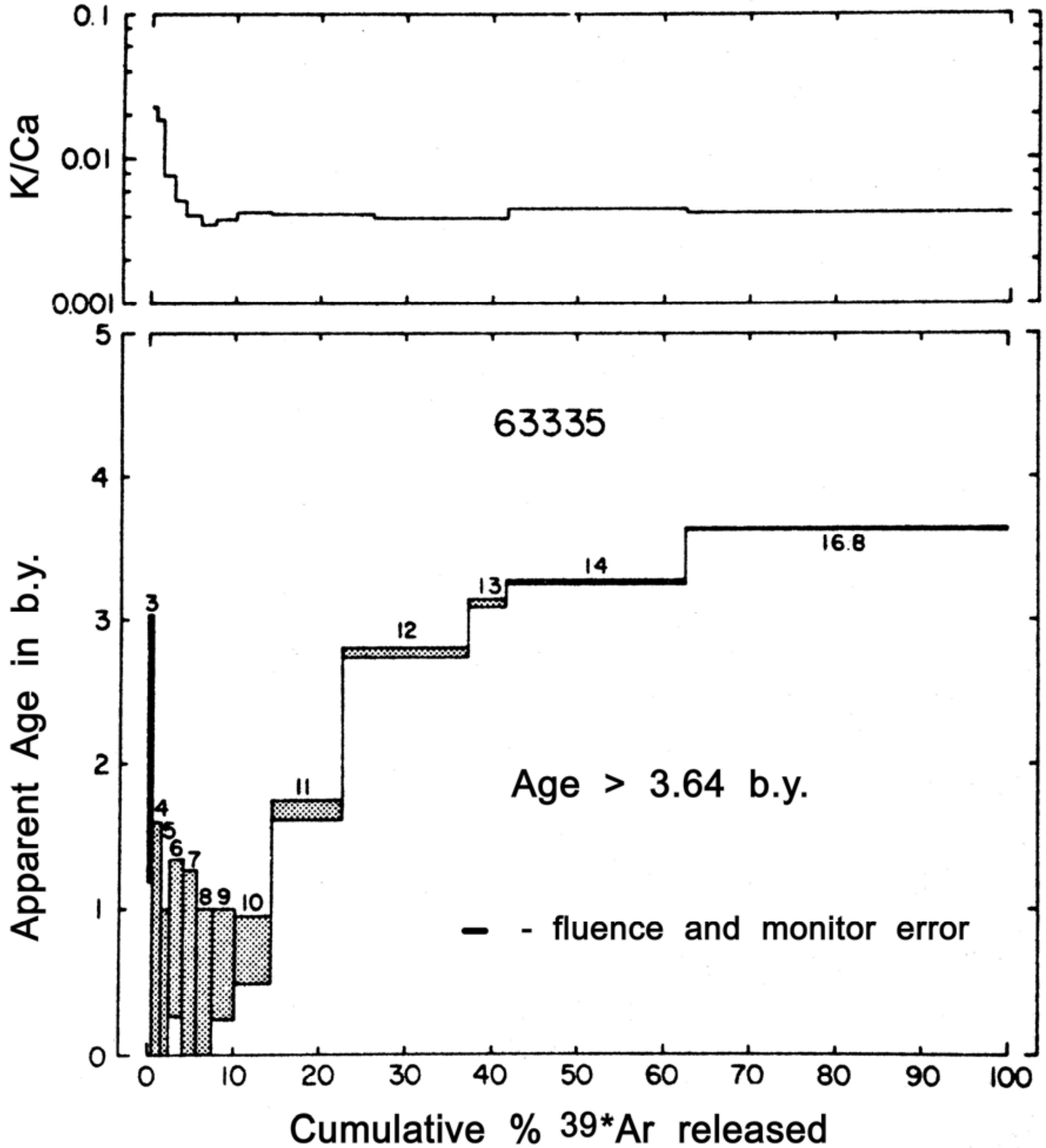

FIGURE 5. Ar releases, from Alexander and Kahl (1974).

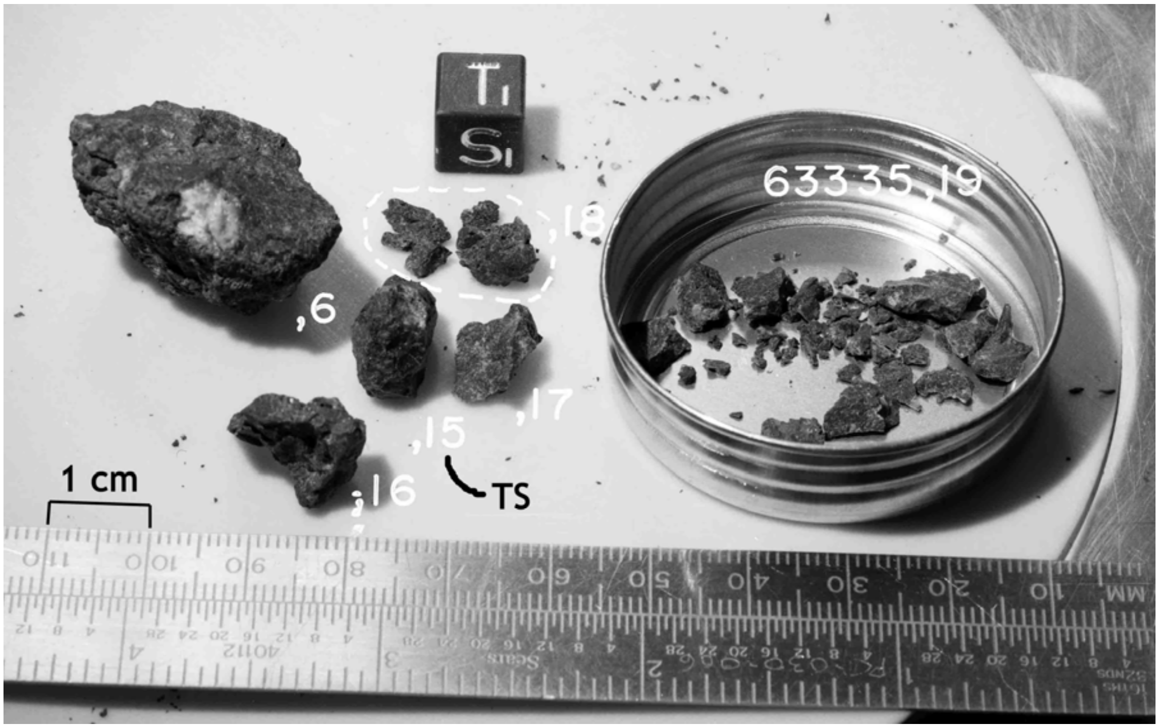

FIGURE 6. Subdivisions of 63335,6. S-73-22357.