14318

Breccia sample 14318 was collected from the regolith near the south end of North Boulder Field at station H during the second EVA. It was returned in weigh bag 1038. Sample 14318 is one of the specimens chosen for study by the Imbrium Consortium, who received 14318,0. A complete set of matched thin sections, across the entire specimen was made by the Consortium (1976), and their findings are included in this description.

PHYSICAL CHARACTERISTICS

Mass	Dimensions
600.2 g	11.4 x 7.8 x 5.3 cm

This sample is a very coherent, gray, polymict breccia consisting of light gray clasts in a medium gray matrix.

SURFACE FEATURES

The sample is densely pitted on all surfaces, with pits ranging from < 0.1 to 2 mm in diameter. Pit density is 60 pits per square centimeter. More than 90% of the pits are glass lined.

The rock is cut by three sets of mutually orthogonal planar fractures. Two sets have 0.1 mm thick black vesicular glass filling the fractures, and the surface of the third fracture set is not visible. Many small veins of glass diverge from the fracture plane and extend into the matrix.

PETROGRAPHIC DESCRIPTION

Clasts larger than 1 mm make up at least 20% of the volume. Three clast types are pure white or gray-white plagioclase rich fragments, apple-green olivine-rich spheres (chondrules) (see King et al., 1972; Kurat et al., 1972, 1974), and light yellow-brown "basaltic" fragments. In appearance, the hand specimen, with its range of clast sizes, colors, and shapes, is said to be reminiscent of the Allende meteorite (Imbrium Consortium, 1976). The matrix consists of feldspar, with ~5% olivine and 1% pink pyroxene. This is a highly complex fragmental rock with 50% of the clasts pieces of crystalline rocks and 50% leucocratic microbreccia.

In thin section sample 14318 is described by the Imbrium Consortium (op. cit. 1976) as a very coherent, low porosity polymict breccia which is partly coated with a grayish-green glass containing numerous micron-sized droplets. This is the glass filling some of the fractures in the rock. The grain size ranges continuously from > 1 µm to at least 7 mm. Clasts larger than 1 mm account for 30% (Wilshire and Jackson, 1972) to 50% (Warner, 1972) of individual thin sections. As noted by Warner (1972) and Chao et al. (1972), the large clasts exhibit a faint alignment. The matrix (consisting of crystal, rock, and glass fragments less than an arbitrary 100µ in dimension) is tightly welded together, but not recrystallized to any significant extent. Glass fragments as small as a few microns are not devitrified and some glass and crystal fragments are angular. However, many other grain boundaries are diffuse and there is a small amount of glass that appears to help cement the rock together. Some of this cementing glass is amoeboid in shape (see Kurat et al., 1974, their Fig. 1C), and some is petrographically identical to the brown glass in glass-welded aggregates, or agglutinates. The matrix texture places the rock in Warner's (1972) group 3.

Kurat et al. (1974) attached special importance to the presence of rapidly crystallized spherules, or chondrules, and to the overall textural similarities between 14318 and polymict, brecciated

chondritic meteorites. Although they recognized that chondrites and lunar rocks differ markedly in composition, Kurat et al. argued that impact processes played central roles in producing both 14318 and the chondrites. Chao et al. (1972) also considered the presence of spherules of glass, devitrified glass, and chondrules to be significant. They classified 14318 as a "spherule-rich, transported microbreccia". Kurat et al. (1972, 1974) measured the chemical compositions of lithic fragments, glasses, and chondrules in 14318, but did not ascertain their relative abundances. To obtain abundance data, the Imbrium Consortium (op. cit., 1976) made a modal analysis of one thin section, took a census of all fragments larger than 1 mm in two sections, and compiled another census of particles between 0.2 and 1.0 mm diameter, in randomly selected regions of one section. The following discussion is a summary of their results:

Lithic fragments are of the same varieties as found in the Apollo 14 soils (e.g., Taylor et al., 1972) and other breccias (e.g., Chao et al., 1972). Most have KREEP chemistry and are breccias, recrystallized to varying degrees. Some are clearly polymict. Lithic fragments were classified as follows: recrystallized noritic breccias, in which the matrix is fine-grained and unmelted; partially melted noritic breccias, characterized by igneous- textured matrices; granulitic noritic breccias, with coarsely-crystalline, equant matrices. Nonmare basalts, some of which could be total impact melts; mare-like basalts, which are distinguished from nonmare basalts by higher contents of mafic silicates and ilmenite; anorthositic (or ANT) rocks; and others, (ultramafic rocks, graphic intergrowths of quartz and alkali-feldspar, and coarse-grained, unbrecciated noritic fragments). All but the last three categories are chemically equivalent to KREEP.

Glasses are also of the same types as found in soils. They were classified into the following groups: homogeneous 91ass, almost all of which were pale yellow to bright yellow; ropy, or suevite-like glass that contains crystallites and mineral fragments; brown, swirly, agglutinitic-like g1ass; and devitrified glass. Chondrules were placed in a separate category, as were mineral fragments.

The modal analysis, incorporating both clasts and matrix, was done on section 14318,48, using a magnification of 80x. An area of about 6 cm^2 was scanned and 4,847 points were counted. Results are as follows:

Lithic fragments	59.6%
Mineral fragments	14.7%
Homogeneous glass	3.0%
Suevite-like glass	5.9%
Brown, swirly glass	10.2%
Devitrified glass	2.5%
Chondrules	4.1%
	100.0%

Compared to Apollo 14 breccias that are obvious soil breccias, such as 14047 and 14055, rock 14318 is much richer in lithic fragments (60% vs. ~10%) and poorer in brown, swirly matrix glass (10% vs. 50%). Nevertheless, the same constituents normally found in lunar soils are present. Perhaps 14318 was made from a relatively immature soil.

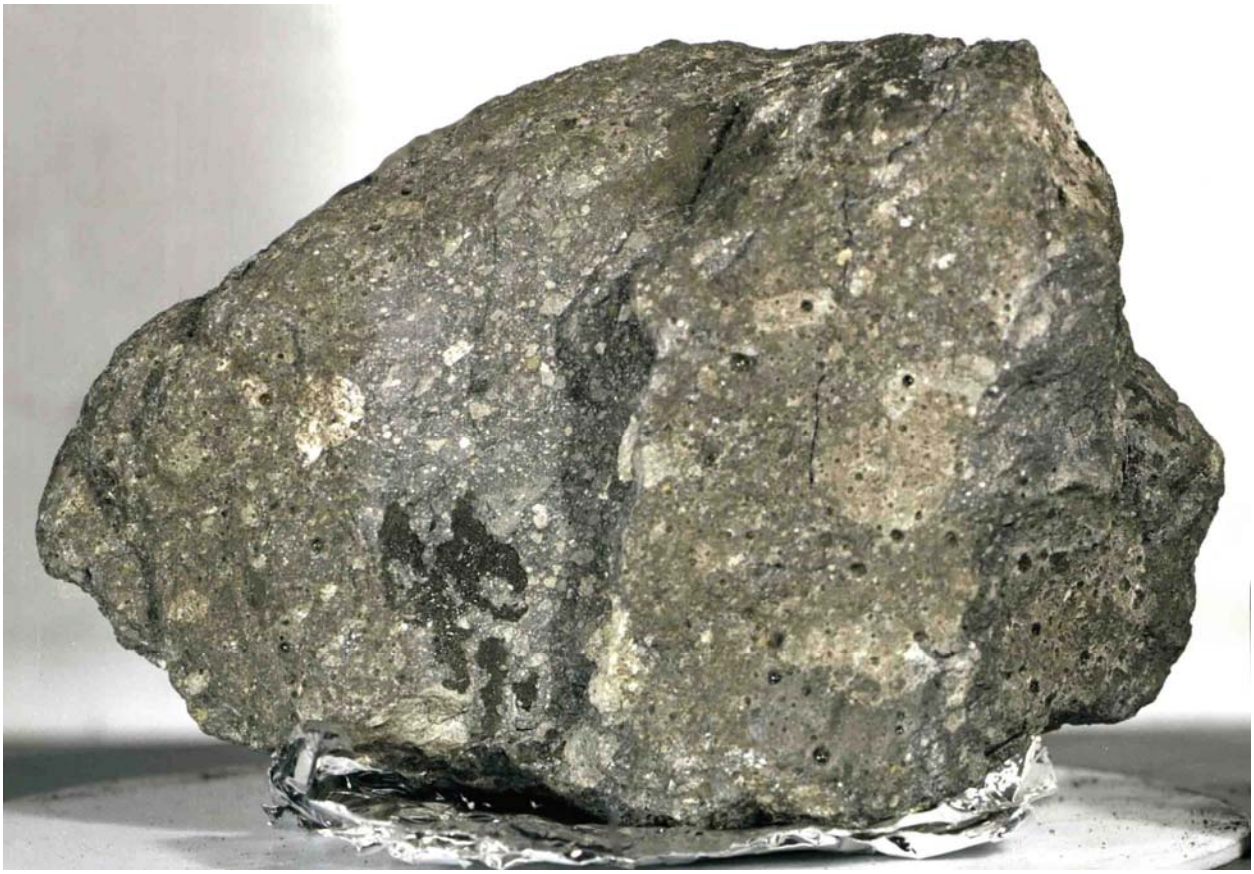
Chondrules are confined to the < 1 mm fraction. These results are consistent with those reported by Wilshire and Jackson (1972). Essentially the same proportions of types are found in each. Curiously, the relative abundances of types of KREEP lithic fragments in 14318 is quite similar to those in the freshest (least mature) soils from Apollo 14: 14142 from Cone Crater and 14151

from the bottom of a 30 cm deep trench (Taylor et al., 1972b). As noted above, it is possible that 14318 was formed from an immature soil. (The previous petrographic discussion of sample 14318 is from Interdisciplinary Studies by the Imbrium Consortium, volume I_ pp. 67-69.)

DISCUSSION

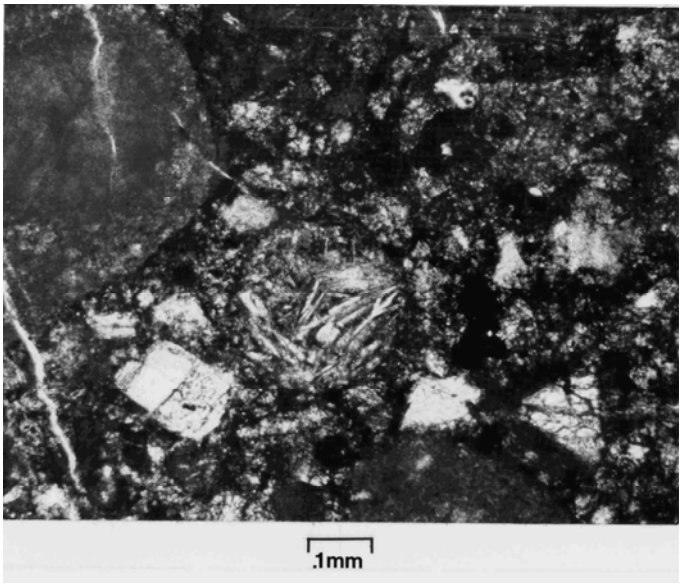
Sample 14318 is classified as an F_2 by Wilshire and Jackson (1972) because of its coherence and abundant leucocratic clasts. Warner (1972) assigned it to his medium metamorphic grade 3, and Chao et al. (1972) placed it in his spherule-rich group (3). Quaide and Wrigley (1972) call it a regolith breccia, and von Engelhardt et al. (1972) place it in their glass-rich regolith breccia category. Simonds et al. (1977) list it as a VMB.

This rock has been studied extensively by Kurat et al. (1972, 1974), mentioned by King et al. (1972), and finally studied by the Imbrium Consortium (1976). It contains fissionogenic xenon derived from extinct 244 Pu (Behrmann et al., 1973; Reynolds et al., 1974). The most interesting feature of 14318, however, is its chondrule content.



Width of image is approximately 12 cm, S-71-29142

The block is 1”, the scale is in cm, S-71-38662



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