

## Station 8 Boulder

Station 8 at Apollo 17 was located at the base of the Sculptured Hills, although it was located only about 20 meters above the valley floor and within the zone mapped as dark mantle in detailed pre-mission maps (Jackson et al., 1975). The small boulder at Station 8 was selected for sampling because it was perched on the surface. However, it had no boulder track leading up the mountain, and its glass coating may mean that it was delivered to the location as a "bomb" (Wolfe and others, 1981). Fig. 1 is a planimetric map of Station 8 showing the location of the samples collected.

The boulder dimensions are about 30 x 55 x 55 cm (Fig. 2). The astronauts rolled the Station 8 Boulder completely over and then

chipped samples of the original top surface to get pieces 78235, 78236, 78237, and 78238. These fell in the dirt, where they were collected along with some soil (78230). Samples 78235 and 78237 were found to fit together, so were combined. 78236 was located a few centimeters away from where 78235 was chipped. Samples 78255 and 78256 were taken from the original bottom surface of the boulder after it had been rolled further and were also collected with dirt. In the laboratory, 78255 and 78256 were found to fit together, so 78256 was relabeled as a part of 78255. 78255 had a lower solar flare-cosmic ray induced activity, as would be expected because of the shielding by the boulder from the solar flare.

However, the glass coating on 78255 had numerous micrometeorite craters (Butler, 1973), indicating that it had been on top at one time. The astronauts noted how easy it was to roll the boulder on the slope where it was located.

All of the samples from the boulder have the same norite lithology, although the 78255 sample may have more plagioclase. The boulder is coarse grained (-5-10 mm) with about 50% yellow-tan orthopyroxene and 50% blue-grey plagioclase. Distinct structural features such as foliations and fracture planes, as well as branching glass veins, are conspicuous features of the boulder and the samples taken from it (Jackson et al., 1975).

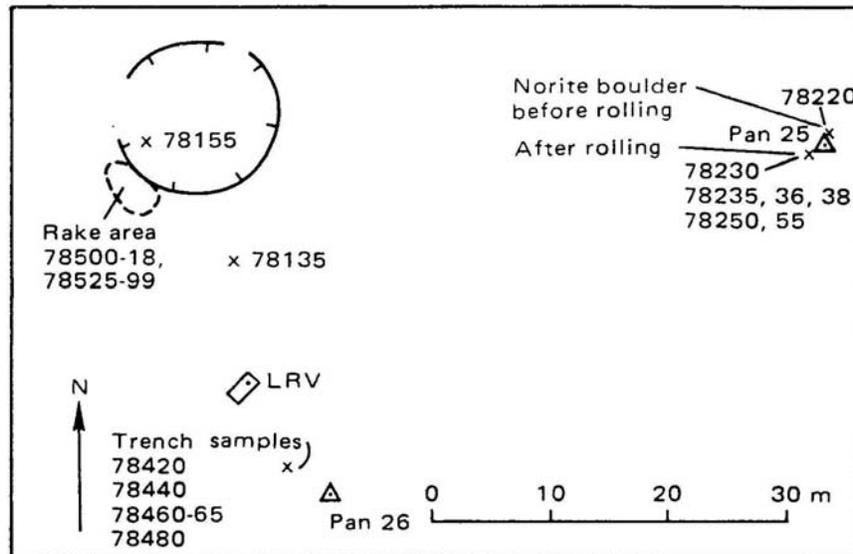


Figure 1: Planimetric map of Station 8. From Wolfe and others (1981).

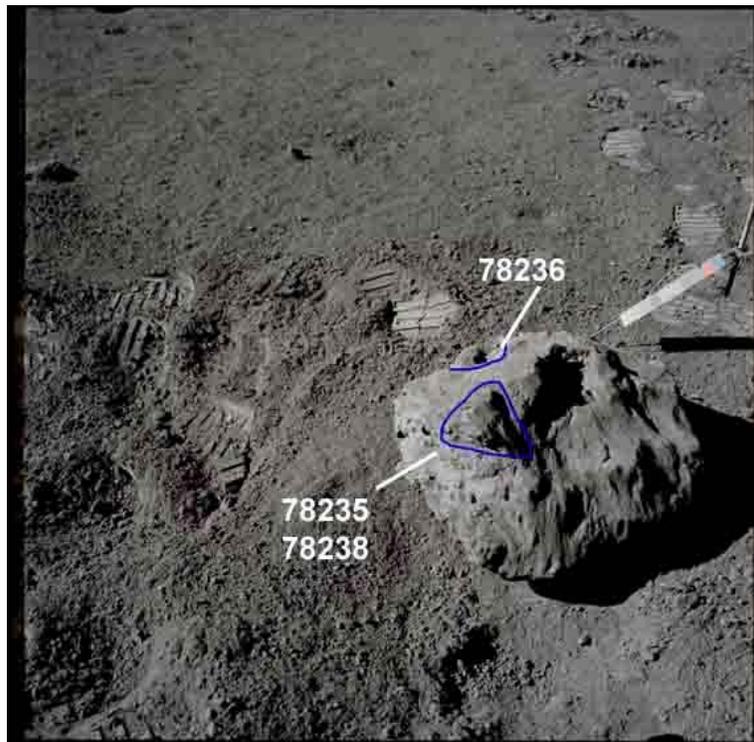


Figure 2: Photograph of the Station 8 Boulder showing location of samples. AS17-146-22370.

This boulder is one of the oldest samples from the Moon. Its original crystallization age is about 4.4 b.y.

The following summary of the crystallization ages for samples of

this rock is from Nyquist and Shih (1992).

**Summary of Age Determinations**

|       | <sup>39</sup> Ar- <sup>40</sup> Ar | Rb-Sr           | Sm-Nd           | U-Pb              |
|-------|------------------------------------|-----------------|-----------------|-------------------|
| 78235 |                                    |                 |                 | 4.426 ± 0.065 (a) |
| 78236 | 4.39 (b)                           | 4.38 ± 0.02 (b) | 4.43 ± 0.05 (b) |                   |
|       | 4.11 ± 0.02 (d)                    |                 | 4.34 ± 0.04 (c) |                   |

(a) Premo and Tatsumoto (1991); (b) Nyquist et al. (1981); (c) Carlson and Lugmair (1981); (d) Aeschlimann et al. (1982)

The chemical composition of the norite boulder has been difficult to determine precisely because of the coarse grain size and the small sample allocations (~100 mg) that have been made for chemical analysis. The A1203 contents

reported range from 14 to 27%, indicating variable amounts of plagioclase in the analyzed splits. This is also seen in the range of Eu contents. The low Ir in samples 78235 (Higuchi and Morgan, 1975) and 78255 (Warren and Wasson,

1978) shows that the rock is free of meteorite contamination and is chemically "pristine." The lack of meteorite signature is also indicated by the low Ni in the metallic iron particles in the norite.

### Summary of Compositional Data

|       | Al <sub>2</sub> O <sub>3</sub> (wt. %) | Th (ppm) | Ce (ppm) | Eu (ppm) | Reference                  |
|-------|--|----------|----------|----------|----------------------------|
| 78234 | 14.36                                  | 0.62     | 8.6      | 0.7      | Warren et al. (1987)       |
| 78235 | 20.87                                  |          | 9.2      | 1.03     | Winzer et al. (1975)       |
|       |  | 0.59     |          |          | Keith et al. (1974)        |
| 78236 | 17.66                                  | 0.6      | 12.8     | 0.82     | Blanchard and McKay (1981) |
| 78255 | 27.40                                  | 0.44     | 7.8      | 1.21     | Warren and Wasson (1979)   |
|       |  | 0.83     |          |          | Keith et al. (1974)        |

#### BOULDER HISTORY

Jackson et al. (1975) wrote a suggested history of the norite boulder.

Crystallization from a magma, with plagioclase and orthopyroxene on the liquidus. The grain size and texture argue that the depth of crystallization was at least 8 km, and perhaps as much as 30 km.

Settling of the plagioclase and orthopyroxene crystals onto a floored chamber under the influence of lunar gravity.

Folding of the planer lamination by unknown process, possibly an irregular magma chamber floor.

Shock metamorphism, producing maskelynite and fractures.

Shock metamorphism, possibly during excavation or possibly during the same event, producing additional fractures and veins.

At rest at an unknown location for about 0.75 m.y. with its bottom up, receiving micrometeorite craters on its glass coating.

Movement to its discovery site at Station 8, where it rested, with top side up, for an amount of time approximately equal to that at its former site.

Rolling and sampling by the Apollo 17 crew. Return to earth. Preliminary examination.

Cutting, distribution, dissolution, irradiation, and vaporization. Use for education of students.

#### FIELD GEOLOGY

*Note: During collection of the samples from the Station 8 Boulder by the astronauts, many observations about the lithology of this coarse-grained sample were correctly made, proving that field geology could be done on the Moon--by humans at least. Obvious excitement was noted in their voices.*

06 20 20+ CDR "I think I'll get one more swap off there. Well, that disappeared. Get it this way. That disappeared, too? That probably went into orbit. Boy, is that pretty inside. Who! We haven't seen anything like this. I haven't. Unless you've been holding out on me."

LMP "No, this is a nice crystalline rock. This is about a 50-50 mixture of what looks like maskelynite or at least blue-grey plagioclase, and a very-let's say light yellow-tan mineral, probably orthopyroxene. It's fairly coarsely crystalline. By coarsely crystalline, probably, the average grain size will turn out to be about 3 or 4 millimeters, maybe half a centimeter."