VI. The Lunar Samples

The lunar samples were on board the U.S.S. *Hornet,* and we were eager to get additional information on the quantity and types of samples. The crew had been very busy while on the Moon and had not been too talkative about matters that would help us prepare for sample processing and preliminary examination. We decided to send a message to the *Hornet:*

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Answers to the first six questions are required prior to arrival of the samples. Please ask the crew the following questions.

1. Approximate amount of fine-sized sample material in documented (second) box
2. Ratio of rocks to fine-sized material in bulk (first) box

3. What is the estimated number of rocks in the documented box?
4. Approximate number of different rock types collected?
5. Are there any samples that appear friable or weakly coherent? If so, approximately how many?
6. Did any samples show color or albedo differences that will enable us to tell tops from bottoms?

Also, please ensure that the documented sample box (second box collected) returns on the first aircraft.

Richard S. Johnston, Special Assistant to the Director
Elbert A. King, Jr., Curator
July 24, 1969, 3:50 p.m.

Their reply came promptly:

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1. Very little, pretty much hard rock
2. Approximately 60 percent fine-sized material
3. Twenty rocks in sample, average one earth pound
4. Approximately six rock types
5. Somewhere packed, doubtful if still in rock form
6. Some lighter on top and darker on bottom

With great euphoria we set up tools and containers in the high vacuum glove chamber accordingly. Arrival at the LRL of the lunar samples was only hours away.

We had taken great precautions to ensure the safety and integrity of the lunar samples once they arrived on Earth. Besides the quarantine precautions, the rock boxes were placed in crash-proof boxes. At 05:15 Greenwich mean time, July 25, an aircraft carrying the documented sample box was launched from the *Hornet*. It was bound for Johnston Island, where another long-range aircraft would carry the box to Houston. Six hours and 30 minutes later, the *Hornet* launched another aircraft transporting the bulk sample box toward Hickam Air Force Base, Hawaii, with the same final destination for the samples.

Someone made a bad joke that it would be a shame if the samples got almost to the LRL but never made it. How could this happen? Maybe a radical group of "hippies" would use the occasion to draw attention to their cause by mounting a demonstration or protest involving the samples. It was the sixties. All kinds of crazy things were happening. Students burned flags and blew up computers. Under the circumstances, I felt extremely paranoid. Only a weak link connected the chain of sample security beginning with the landing of the samples at Ellington. Once the samples were on the base they would most likely be safe. However, a long stretch of Old Galveston Highway and NASA Road One left the samples vulnerable to sabotage before arriving at the space center. I decided the only prudent thing to do was to personally escort the samples. I went home and dropped six fresh rounds into the cylinder of my long-barreled Smith & Wesson .357 magnum, wrapped it in a bath towel, and stuck it under the front seat of my '63 Plymouth Valiant. Of course, probably nothing would happen, but if it did, someone would quickly know I meant business.

The first aircraft carrying the documented sample box landed (with one engine out!) at Ellington more or less on time. I parked where I could see everything on the edge of the runway and watched the transfer of the rock box container from the aircraft to a NASA vehicle (Photo 48). As I imagined, the scene was disorganized and uncontrolled. I followed as the NASA vehicle pulled away and stayed closely behind all the way to the space center. A couple of other cars, one of which was driven by a NASA security officer I knew, jockeyed for position in the column. The NASA security man honked and waved me off. I just honked back, waved, and smiled. The trip from Ellington to MSC proved uneventful, and the documented rock box was admitted to the LRL. The bulk sample box arrived seven hours later. The long-awaited lunar samples were "in the bag!"

A lengthy procedure was necessary in order to move the first rock box into the high vacuum glove chamber where it would be opened. The anticipation was intense. We believed a glimpse of the samples would reveal before our eyes the hidden secrets of the Moon. Four science observer members of the Preliminary Examination Team (PET) waited at their stations on the vacuum chamber when the lid of the documented sample box was popped open. Frondel and I were together on the glove operator's side of the vacuum chamber, and two colleagues shared the other side. After the packing mesh was pulled aside and the foil from the solar wind experiment was moved out of the way, the glove operator came out of the gloves and stepped back, allowing us our first view of rocks from the moon. The sight was unimpressive. Dark lunar dust cov-

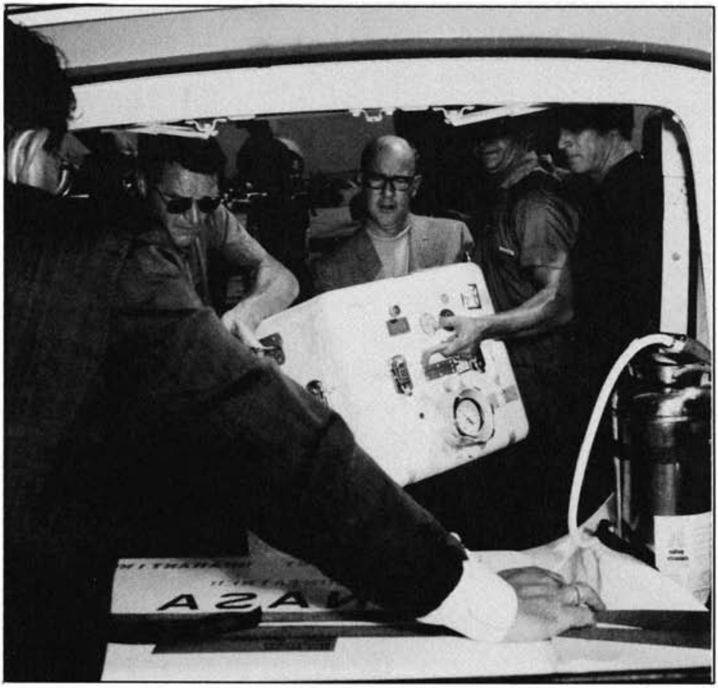

Photo 48. The first lunar rock box from the Apollo 11 mission arrives at Ellington Air Force Base, Houston, in its protective container and is loaded into a NASA vehicle for the short trip to the Lunar Receiving Laboratory. (NASA Photograph S-69-39967)

ered every rock so the true nature of the materials was not visible. One of our colleagues on the far side of the chamber said he could see a light-colored phenocryst (a crystal of larger size than the general matrix of the sample) in one of the samples—almost certainly feldspar and probably plagioclase. From our side of the chamber we could tell it was a flake of the alumina thermal coating from the outside of the box that had fallen on the rock when we opened the lid. We motioned over the top of the chamber for them to "cool it!"

The moment was truly history, but there was little we could observe or say.[22] We counted the rocks and described the size and shape of each piece, but they looked like lumps of charcoal in the bottom of a backyard barbecue grill. The pervasive dark lunar dust obscured everything for the time being.

Frondel became fascinated with the dark, opaque dust. He postulated the dust might be high in carbon, an idea Urey liked a great deal. Frondel stated this hypothesis at a press conference, but cautioned that his conjecture still had to be verified by analysis. His idea turned out to be incorrect.

The MQF, with the crew inside, arrived on July 28. The crew egressed into the LRL Crew Reception Area, which was spacious compared to the MQF. At least here the crew could enjoy some recreation, such as movies and reading material. I had left 10 years of back issues of *Playboy* magazine in the small library, each issue marked "Courtesy of your friendly neighborhood curator."

On July 30, the Command Module was delivered to the LRL, where it was scavenged for lunar dust after the quarantine period.

I participated in one of the technical debriefings of the crew, which took place across the biological barrier in a special room of the LRL Crew Reception Area (Photo 49). The crew seemed rested and happy, and we were all grinning from ear to ear. Little of scientific importance was gleaned from the debriefing. The science story was locked in the rocks, and we had plenty of those.

The rocks were individually cleaned and dusted, inside plastic

[22]For another account of the events of this time, see S. F. Cooper, Jr., *Moon Rocks* (New York: Dial Press, 1970).

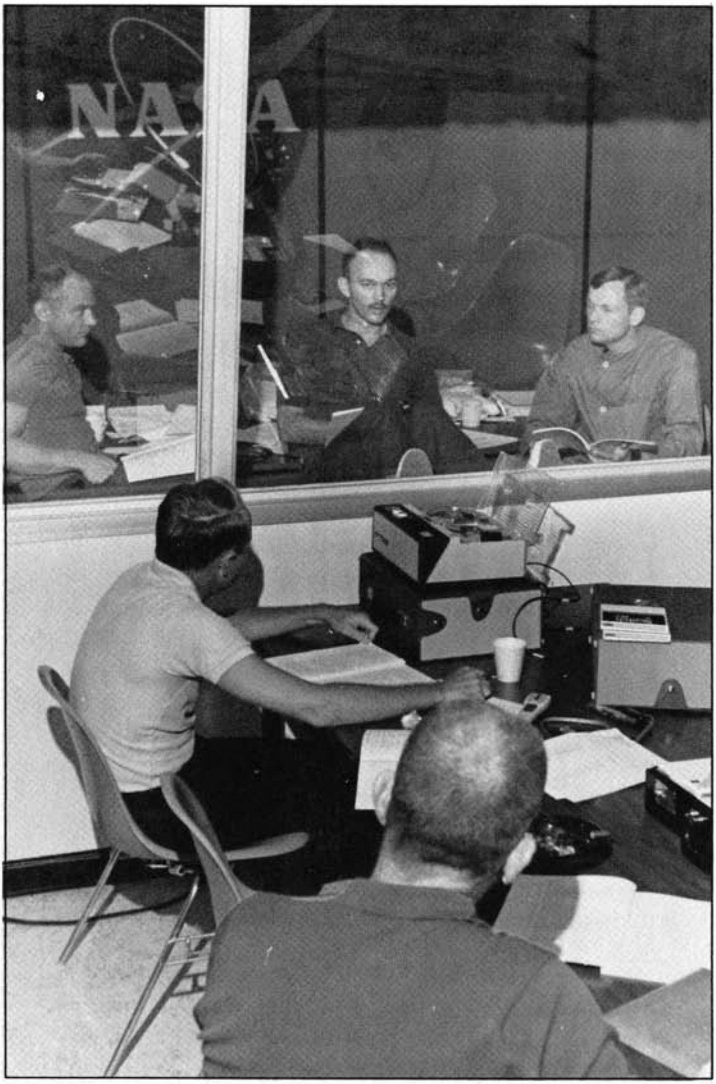

Photo 49. The Apollo 11 crew of (left to right) Buzz Aldrin, Mike Collins, and Neil Armstrong at their first post-flight debriefing in the Lunar Receiving Laboratory. The crew are isolated on one side of a biological barrier and the debriefing team on the other. Deke Slayton (foreground) and Lloyd Reeder (training coordinator) are shown on this side of the barrier. (NASA photograph S-69-40216)

bags in order to avoid losing any dust particles. Their true nature quickly became apparent (Photo 50). The large rocks were of two types. There were ordinary-looking fine-grained volcanic igneous rocks that appeared as fresh as if they had been erupted only yesterday. Also, there were breccias composed of many rock clasts and fine material that had somehow become lithified from crumbly to hard rocks (Photo 51). We hesitated to identify by eye the minerals

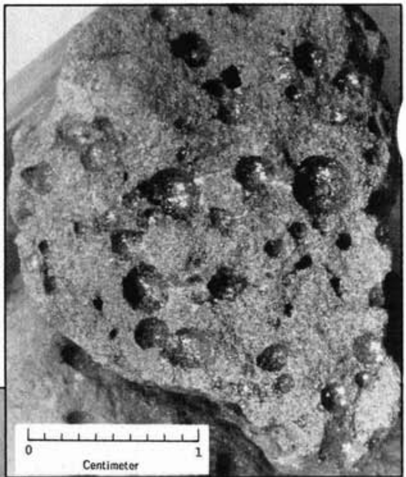

Photo 50. Fine-grained lunar basalt with numerous vesicles or gas bubbles collected on the Apollo 11 mission. (Sample 10022, NASA photograph S-69-45524)

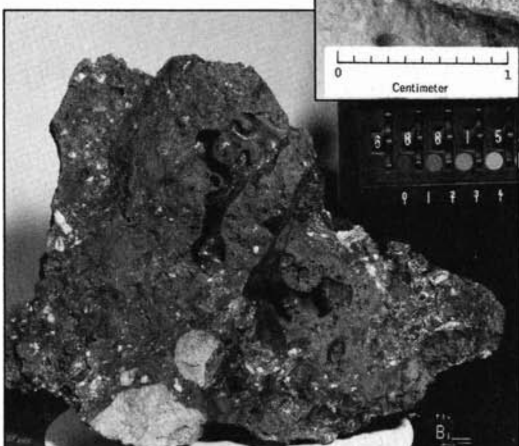

Photo 51. Glassy impact melt-breccia collected at the Apollo 16 landing site. This rock consists of many fragments with different grain sizes and textures held together by glassy material formed by meteoroid impact. Scale (right) is in centimeters. (NASA photograph S-72-37155)

in the igneous rocks because, as one PET member put it, "Remember, these rocks are from the Moon!" Observations were particularly difficult in the vacuum system (Photo 52) since the lighting was poor, the samples commonly were dusty, and there was little space

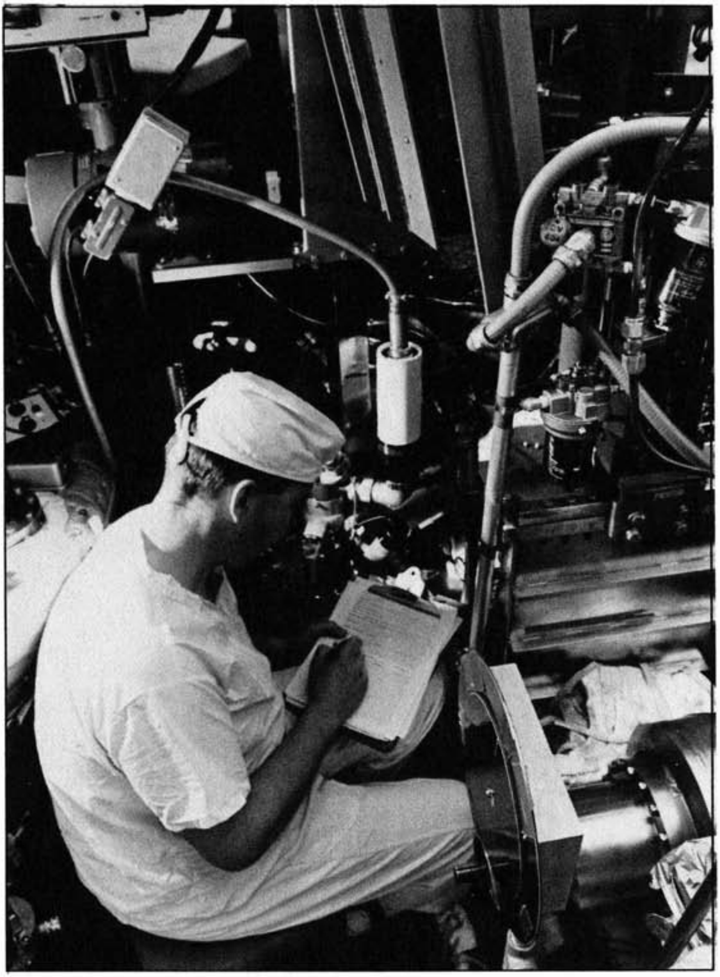

Photo 52. The author noting observations on an Apollo 11 rock sample at the main observer's port on the main vacuum system where the lunar samples were first opened. (NASA photograph S-69-29689)

for an observer. As each shift of PET came off duty, we discussed the new observations with LSAPT.

A curious feature observed on the first crystalline rock we examined was the presence of small glass-lined pits (Photo 53). The members of the PET generally agreed the pits were glass-lined micrometeoritic impact craters because the glass had splashed out over the rims. When this observation was reported to the Lunar Sample Analysis Planning Team (LSAPT) at the end of the shift, Shoemaker took strong exception to the interpretation and suggested the glass-lined cavities probably were vesicles or gas bubbles and would probably be found inside the rocks as well when samples were split. After all, there were no experimentally produced micrometeorite craters with glass linings. Discussion centered over the possibility that lunar microcraters might be produced by higher velocity meteoroids than the experimental ones, but Shoemaker was adamant. Soon we found the craters (which became informally known as "zap pits") on breccias and, of course, did not

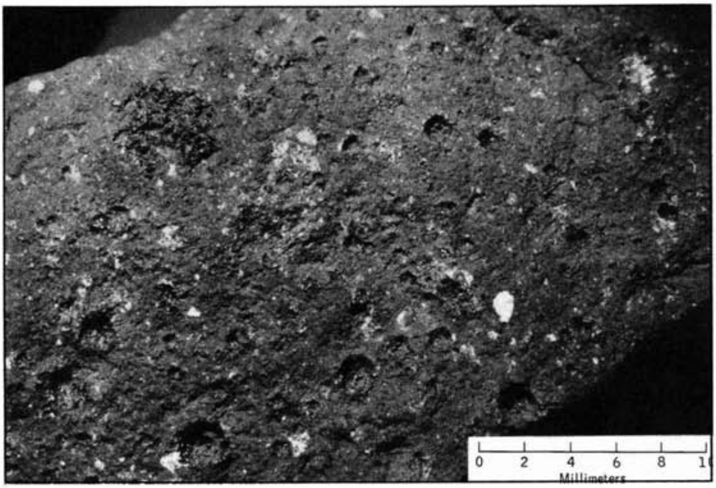

Photo 53. Apollo 11 breccia sample 10019, showing its surface with abundant micrometeoroid impact craters or "zap pits." These small glass-lined craters are abundant on many rocks from the lunar surface. (NASA photograph S-69-47905)