APOLLO 17 VOICE TRANSCRIPT PERTAINING TO THE GEOLOGY OF THE LANDING SITE

N. G. Bailey, et al

Geological Survey
Flagstaff, Arizona

1975
APOLLO 17 VOICE TRANSCRIPT

Pertaining to the geology of the landing site

by

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This is Apollo Voice Transcript Volume No. 6 of a series produced for the six manned lunar landings.

This document is an edited record of the conversations between the Apollo 17 astronauts and mission control pertaining to the geology of the landing site. It contains all discussions and observations documenting the lunar landscape, its geologic characteristics, the rocks and soils collected, and the lunar surface photographic record along with supplementary remarks essential to the continuity of events during the mission. This transcript is derived from audio tapes and the NASA Technical Air-to-Ground Voice Transcription and includes time of transcription and, photographic and sample numbers. The report also includes a glossary, landing site map, and sample table.

17a. Descriptors
   Astrogeology 0301
   Astronauts 0509
   Lunar bases 2201
   Lunar craters 0302
   Lunar dust 0302
   Lunar geology 0302
   Lunar photography 0301, 1405
   Lunar rock 0302
   Lunar topography 0302

17b. Identifiers/Open-Ended Terms
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   22/A Space Technology, Astronautics

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INTRODUCTION

The sixth and last of the Apollo program manned lunar landings occurred on December 11, 1972 when the lunar module Challenger landed in the Taurus-Littrow region of the Moon. The Apollo 17 crew spent 22.1 hours in surface exploration and traversed approximately 35 km with the lunar rover vehicle.

This document is an edited record of the conversations between astronauts Eugene A. Cernan and Harrison H. Schmitt on the lunar surface and EVA capcom Robert A. Parker at Mission Control in Houston during the descent, landing, and 75 hours of lunar stay time. It also contains landing site observations from the orbiting command module America by command module pilot Ronald E. Evans, while the LM was on the Moon, by all three astronauts prior to command module-lunar module separation, and after docking and reentry of the surface explorers back into the command module. Conversations of interest are also included from the transearth phase of the mission. It is a condensation hopefully of all the verbal data having geologic significance. All discussions and observations documenting the lunar landscape, its geologic characteristics, the rocks and soils collected, and the photographic record are retained along with the supplementary remarks essential to the continuity of events during the mission. We have deleted the words of mechanical housekeeping and engineering data while attempting not to lose the personal and philosophical aspects of the exploration.

The sources of this voice transcript are the complete audio and video tapes recorded during the EVAs and the Technical Air-to-Ground Voice Transcription prepared by NASA. The voice record is listed chronologically with each individual comment preceded by the day, hour, minute and, occasionally, second when the statement was made. These times are Apollo Elapsed Time (AET) which is the true mission-elapsed time after liftoff from Cape Kennedy at 12:33 a.m. E.S.T. on December 7, 1972.

Figure 1 shows the landing site area that was described, sampled, and photographed by the Apollo 17 crewmen.

ACKNOWLEDGMENTS

The assistance of Apollo 17 EVA capcom Robert A. Parker who reviewed his portion of the transcript is gratefully acknowledged. R. L. Sutton, U. S. Geological Survey gave invaluable assistance with the sample and photo indexing. The cover illustration and figure 1 were prepared by R. E. Seabold, U. S. Geological Survey. This report was duplicated by J. L. Remy, U. S. Geological Survey. Thanks are due to Cyndee Condit for her able communication with the WILBUR text editing program on the National Institutes of Health Computer System which made possible the efficient editing and reproduction of the transcript. This project was supported by NASA Order No. W13,677.
GLOSSARY OF TERMS, ABBREVIATIONS, ACRONYMS, AND SYMBOLS

**APOLLO 17 CREW**

<table>
<thead>
<tr>
<th>CC</th>
<th>Capsule Communicator (Robert A. Parker during EVAs, other astronauts during other time periods)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDR</td>
<td>Commander (Eugene A. Cernan)</td>
</tr>
<tr>
<td>CMP</td>
<td>Command Module Pilot (Ronald E. Evans)</td>
</tr>
<tr>
<td>LMP</td>
<td>Lunar Module Pilot (Harrison H. Schmitt)</td>
</tr>
<tr>
<td>MCC</td>
<td>Mission Control Center (unidentified voice)</td>
</tr>
</tbody>
</table>

**AET**  
Apollo Elapsed Time - after launch from earth (days-hrs-mins-secs)

**ALSEP**  
Apollo Lunar Surface Experiments Package

**B & W**  
Black and White

**BSLSS**  
Buddy Secondary Life Support System

**CM, CSM**  
Command Module, Command Service Module, "America"

**COMP**  
Comprehensive Sample - sample reference in transcript keywording

**CONT**  
Contingency Sample - bag of soil and rocks collected early in the EVA - sample reference in transcript keywording

**Cape**  
Cape Kennedy

**Core**  
Drive tube coring device for collecting soil samples

**CRE (Cosmic Ray)**  
Cosmic Ray Experiment

**CSVC**  
Core Sample Vacuum Container - for storage of chemically ultraclean drive tube sample

**DAC**  
Data Acquisition Camera, 16 mm

**DOC**  
Documented Sample - soil and/or rocks that are documented by photography before and after sampling

**DSEA**  
Data Storage Equipment Assembly

**EP 4**  
Explosive Package number 4 of Seismic Profiling Experiment
GLOSSARY CONT'D.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETB</td>
<td>Equipment Transfer Bag for transport of items between LM hatch and lunar surface</td>
</tr>
<tr>
<td>EVA</td>
<td>Extravehicular Activity - astronaut activities on the lunar surface</td>
</tr>
<tr>
<td>FSR</td>
<td>Football-Sized Rock</td>
</tr>
<tr>
<td>GCTA</td>
<td>Ground Controlled Television Assembly</td>
</tr>
<tr>
<td>HFE</td>
<td>Heat Flow Experiment</td>
</tr>
<tr>
<td>IPS</td>
<td>Inches Per Second</td>
</tr>
<tr>
<td>ISA</td>
<td>Interim Stowage Assembly</td>
</tr>
<tr>
<td>L and A</td>
<td>Landing and Analysis training display at Cape Kennedy</td>
</tr>
<tr>
<td>LCG</td>
<td>Liquid Cooled Garment</td>
</tr>
<tr>
<td>LEAM</td>
<td>Lunar Ejecta and Meteorites experiment</td>
</tr>
<tr>
<td>LEC</td>
<td>Lunar Equipment Conveyor</td>
</tr>
<tr>
<td>LM</td>
<td>Lunar Module, &quot;Challenger&quot;</td>
</tr>
<tr>
<td>LMS</td>
<td>Lunar Mass Spectrometer</td>
</tr>
<tr>
<td>LOS</td>
<td>Loss of signal</td>
</tr>
<tr>
<td>LRV</td>
<td>Lunar Roving Vehicle - &quot;Rover&quot;</td>
</tr>
<tr>
<td>LSG</td>
<td>Lunar Surface Gravimeter</td>
</tr>
<tr>
<td>LSPE</td>
<td>Lunar Seismic Profiling Experiment</td>
</tr>
<tr>
<td>LSRK</td>
<td>Loose Rock</td>
</tr>
<tr>
<td>Mag/Mags</td>
<td>Magazine/Magazines - photographic</td>
</tr>
<tr>
<td>MESA</td>
<td>Modularized Equipment Stowage Assembly - a storage area on the LM that contains science equipment</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>MOCR</td>
<td>Mission Operations Control Room</td>
</tr>
<tr>
<td>Neutron Flux</td>
<td>Lunar Neutron Probe Experiment</td>
</tr>
<tr>
<td>PAN</td>
<td>Panorama of 70-mm photographs</td>
</tr>
<tr>
<td>PLSS</td>
<td>Primary Life Support System for space suit</td>
</tr>
<tr>
<td>PHO</td>
<td>Photo, photograph</td>
</tr>
<tr>
<td>RHSSC</td>
<td>Right Hand Side Stowage Console</td>
</tr>
<tr>
<td>RTG</td>
<td>Radioisotope Thermoelectric Generator</td>
</tr>
<tr>
<td>S-IVB</td>
<td>Saturn 4B Rocket</td>
</tr>
<tr>
<td>SCB</td>
<td>Sample Collection Bag</td>
</tr>
<tr>
<td>SEP</td>
<td>Surface Electrical Properties experiment</td>
</tr>
<tr>
<td>SESC</td>
<td>Special Environmental Sample Container</td>
</tr>
<tr>
<td>SRC</td>
<td>Sample Return Container, &quot;Rock Box&quot;</td>
</tr>
<tr>
<td>Strut</td>
<td>One of four legs on the LM</td>
</tr>
<tr>
<td>Plus-Z Strut</td>
<td>Forward leg on which the ladder is mounted</td>
</tr>
<tr>
<td>Minus-Z Strut</td>
<td>Rear leg of LM</td>
</tr>
<tr>
<td>Plus-Y Strut</td>
<td>Right leg of LM</td>
</tr>
<tr>
<td>Minus-Y Strut</td>
<td>Left leg of the LM</td>
</tr>
<tr>
<td>SWP</td>
<td>SWP crater just west of Station 8</td>
</tr>
<tr>
<td>T 38</td>
<td>Jet training plane</td>
</tr>
<tr>
<td>TCA</td>
<td>Time Centered Above</td>
</tr>
<tr>
<td>TGE</td>
<td>Traverse Gravimeter Experiment</td>
</tr>
<tr>
<td>VIP (site)</td>
<td>&quot;Very Important Place&quot; - final parking site of LRV</td>
</tr>
</tbody>
</table>
GLOSSARY CONT'D.

---

Garbled or clipped transmission

--
Deletions between statements of statements that are not socio-linguistically relevant

-
Pause by speaker

--
Interuption by another speaker, or abrupt termination of a recording

(words)
Explanation of words probably said that were garbled during transmission, or additional explanation by editor

(words?)
Explanation of words possibly said that were garbled during transmission, or additional explanation by editor
EXPLANATION OF KEYWORDING

The purpose of the keywords enclosed in parentheses to the right of the transcript is to inform the reader of either the phase of the mission (DESCENT, ORBITAL, etc.) during which the statements were made, or the particular location or station (LM, "LSEP, 1, LRV 1, etc.) where the speaker was, or between which locations (LM-LSEP, SEP-1, etc.) the speaker was traversing. There are also separate sample (SAMP xxxxxx) and photo (PHO xxxxxxx) keys to denote the particular samples and photos either being described or taken at that particular moment. Normally, where both sample and photo keys occur in the same line, the photo numbers are cross-indexed to the sample numbers in that line. The occasional exceptions can be inferred from the context of the transcript -- AET 04 23 39+ -- where the sample numbers 71130, 35-36 are not necessarily referenced to the closeup stereo photo numbers keyed in the same line. Where remarks in the beginning of a statement were not either specifically or generally about the sampling or photography mentioned later in the same statement, the wording was placed in the particular line containing the first mention of the referenced activity as with SAMP 71040-49, 75 in the statement made at 04 23 34+. Temporary stops for sampling (LRV 1, LRV 2, etc.) and emplacing explosive charge 4 (EP 4) during the EVA 2 traverse are also keyed.

Because the taking of specific photos was not always mentioned, we have keyed all photos known to show a sample or its location in the first line that contains sample keywording at the time the sample was collected.

Photo keys placed in the "- - -" lines (where non-relevant statements are deleted) show the intervals when those particular photos were taken even though not mentioned.

Conventions used in keyword sample and photo numbering:

SAMP 70018 - Sample number 70018
SAMP CORE 70001-10 - Sample core 70001 through 70010 inclusive
SAMP 71050,55 - Sample numbers 71050 and 71055
SAMP 71040-49,75 - Sample numbers 71040 through 71049 and sample number 71075
SAMP? - Sample for which the number is unknown

PHO 136 20720 - Magazine 136, frame 20720
PHO 147 22492-520 - Magazine 147, frames 22492 through 22520 inclusive
PHO? - Photo or photos taken that have not been identified
Figure 1. Apollo 17 landing site showing LM location and area traversed by astronauts during EVA.
GEOLOGIC CONDENSATION OF THE APOLLO 17 VOICE TRANSCRIPT

*** DESCENT ***

04 14 18 17 CDR Okay, I got the South Massif. (DESCENT)

04 14 18 35 CDR Okay, Gordo, I've got Nansen; I've got Lara; and I've got the scarp. Oh, man, we're level with the top of the massifs now. (DESCENT)

04 14 19 21 CDR And there it is, Houston. There's Camelot! Right on target. (DESCENT)

04 14 19+ LMP I see it. (DESCENT)

04 14 19+ CDR We got them all. (DESCENT)

04 14 19 54 CDR Okay, I've got Barjea; I've got Popoyl; I've got the triangle. (DESCENT)

04 14 19+ LMP Contact. (DESCENT)
CDR Okay, Houston. The Challenger has landed! (LM WINDOW)

04 14 22+ CDR Jack, are we going to have some nice boulders in this area. (LM WINDOW)

04 14 23+ CDR Oh, man. Look at that rock out there. (LM WINDOW)

04 14 23+ LMP Absolutely incredible. Absolutely incredible. (LM WINDOW)

04 14 23+ CDR I think I can see the rim of Camelot. (LM WINDOW)

04 14 23+ LMP Hey, you can see the boulder tracks. (LM WINDOW)

04 14 23+ LMP There are boulders all over those massifs. (LM WINDOW)

04 14 23+ CDR I shot for a spot around 2 o'clock from Poppy. There's a number of boulders out at 12 o'clock from Poppy, and I really think I'm probably not more than about 100 meters out in front of it - and slightly to the north. Actually, I may be a little bit closer to Trident than I expected Poppy to be. I think I've got Trident right out the left window. And our first 'ut at the mobility around here in the Rover. It ought to be super.

04 14 24+ LMP I tell you, the massifs and Bear mountain are two different products.

04 14 24+ CDR Do look it, don't they?

04 14 24+ LMP Of course, they're different slopes, too.
04 14 24+ CDR I think that may be Rudolph, right there, Jack, out your window. I was looking more at those boulders and trying to stay in the spots between them -

04 14 25+ CDR There was practically no dust, just a little bit of a film; all the way to the ground.

04 14 26+ CDR You can't see into Camelot, Jack; that rim - is Camelot out in front of us.

04 14 26+ LMP Yes.

04 14 29+ CDR Okay, I can see the scarp. I can see Hanover. Good thing we didn't plan to go to Hanover. It's steep.

04 14 29+ LMP Look at the boulder - halfway up the hill.

04 14 29+ CDR The boulder tracks - they're beautiful.

04 14 29+ LMP It's sitting right there in the end of the tracks. There are tracks all over that hillside. There's a boulder came right down to the surface there. See it?

04 14 29+ CDR Yes.

04 14 29+ LMP That one right through that little crater - sitting right there for us tosample. Look at it.

04 14 29+ CDR Yes, sir. I'll bet Bear Mountain and the Sculpture Hill's are the same.

04 14 29+ LMP Yes. Well, the slope's different. We'll have to look at it from outside. You may be right. Now I see why they call them sculptured. My gosh, they're so hummocky that there's shadow all over them.
04 14 29+ CDR Yes.  
04 14 29+ LMP There are some holes and rocks around here. Who told me this was a flat landing site?  
04 14 29+ CDR It is flat. For crying out loud. What do you want, an airtight guarantee?  
04 14 30+ LMP Let's see, we got about 2 degrees left and about 5-degrees pitchup.  
04 14 30+ CDR We're about what - about 100 meters from Trident?  
04 14 30+ LMP Yes, less than that, I think Trident's right here. Our shadow's about 100 feet, Geno, I think.  
04 14 30+ CDR Yes, we're *** less than 100 meters then.  
04 14 30+ LMP Yes, there are some holes I'm glad I didn't land in around here, I'll tell you.  
04 14 30+ CDR Now, if you look at the massif, Jack *** you see, they are almost like a series of linear boulder tracks, but they come crossways down the slope. So it looks like there may very definitely be some jointed - there's outcrop on top the massif, too.  
04 14 30+ LMP Oh, it sure looks like it, gray outcrop. And there's a bluish-gray compared to the brown or tan-gray of the massif side.  
04 14 30+ CDR And a lot of that outcrop down on the bottom is boulder.  
04 14 30+ CDR Yes. Do you know what that reminds me of, way up or top - that outcrop? It reminds me of Sunset where you could just get a little piece of outcrop around the corner.  
04 14 30+ LMP That's right.  
04 14 43+ CDR The L and A are the landing site, from a relief point of view, I think, are Identical. I actually didn't look around nearly as much as I thought I
would, or as I want to, because I had fixation on
a reasonable spot to land. They're not all
reasonable in that there's some very subtle
hummock-like craters right in and around where we
are. And there's not a lot of boulders laying on
the surface, but there's a lot of what appear to be
boulders that are covered up by some of the dark
mantle. Numerous enough that you wouldn't like to
take a chance at putting a bad one on one of them
or in one of those hummocky subtle craters.

04 14 43+ CDR I guess the thing that probably surprised me most
about the site, as far as landing is concerned, is
the fact that there were these - I hesitate to say
they're outcrops but certainly they're buried
massive pieces of rock - whether they're boulders or
not, we'll have to find out - out here in the plains
area, partially covered and sheltered by the dark
mantle. And I expected to find a number of craters,
but I guess I really didn't expect to find the rock
types around. And we're talking about anywhere from
1 to 2 meters down to - oh, 2 or 3 feet, which when
they're sticking out and on the sides of some of
these subtle craters look pretty menacing.

04 14 45 49 CDR The visibility prior to pitchover was such that I
could see Nansen. I could see the scarp. I could
see Lars. I could not see Camelot until after
pitchover. Even at 6000 feet, the small triangle
with Frosty and Rudolph and Punk were visible to me.
I had Poppy in orbit, so it was easy to see.
Barjeel was a very sharp round crater just as
depicted on the L and A. The thing I really didn't
get a good look at, because I didn't pay too much
attention to it, was from Trident on to the south.

04 15 50 17 CDR My best guess is 150 meters from Poppy at 1 to 2
o'clock.

04 15 50+ CDR Mostly west, but slightly north.
04 16 01+ CDR We're just about abeam of Trident 1. I can see it (LM WINDOW) out there, but I can't really define Trident 1 from Trident 2. And the thing that is a little different is that I appear to be closer to it than I normally would have expected to be.

04 16 01+ CDR I thought Rudolph was right out there at 3 o'clock. (LM WINDOW) Jack's looking at it and he said, yes, that is Rudolph right at 3 o'clock out his right-hand window.

04 16 01+ CDR The shadow of the LM, the rendezvous radar antenna, (LM WINDOW) is pointing about one-third of the way down from the peak of Family. I must be right here abeam of Trident 1. I guess it's close to 100 meters - 80 meters anyway - to where the rim of Trident 1 falls off. And I am abeam of the center of Trident 1, and that's the only possible thing it could be. And that would put Poppy just about where I expected it to be.

04 16 01+ CC You're referring to Trident 1 as the easternmost part of Trident, is that right?

04 16 01+ CDR No, it's always been the westernmost part of Trident. The landing site was on a line between Trident 1 and Rudolph and judging from what Jack's got on his right-hand window and what I got on my left-hand window we're right there, except possibly a shooosh further south on that line.

04 16 01+ LMP We can't see into Camelot; we can just see the rim (LM WINDOW) of it. It's at least 200 meters - 2 to 300 meters up there, I expect.

04 16 01+ CC What o'clock position is the nearest part of the rim (LM WINDOW) of Camelot? Or maybe if it's better defined --
04 16 01+ LMP Twelve o'clock. (LM WINDOW)

04 16 01+ OC -- define the south rim. Can you see the south rim (LM WINDOW) of it?

04 16 01+ CDR Yes, Gordy, but it blends in so well; all we're seeing is an undulating high as the rim. And to the best of my knowledge, we've got the east rim right at 12 o'clock.

04 16 01+ LMP Hey, Gordy, right at 12 o'clock also is a boulder that's at least 3 meters and maybe 5, and I wouldn't be a bit surprised if you can find it. It's on a line between us and the intersection of the South Massif and the Family mountain horizon. Just slightly left of that line or south of that line. And that boulder ought to show up on your best photography.

---

04 16 01+ LMP That boulder's at least 200 meters away. (LM WINDOW)

---

04 16 01+ CDR The west rim of Trident, which, by the way, is full of outcropping-looking boulders, is at 10 o'clock.

04 16 01+ CDR I can look back around the corner now and I can see where Trident I rose up to its rim on the east side, and I would say we're abeam of a point one-third the way from east to west up the center of Trident; that is, we've covered one-third of Trident I and we're abeam of a point of a line that goes through the one-third point from east to west of Trident I.

---

04 16 01+ CDR I think it's very close to our planned landing site. (LM WINDOW)

---

04 16 16+ LMP I took the binocs and looked at some large boulders (LM WINDOW) at our 12 o'clock position. They're probably on the order of a half meter to 2 meters, buried but without strong illuming. And most of them that I
could see had the same mottled light-gray and medium-gray texture, and it looked like there's a lineation in it. And whatever the mottling is, it's on a grain-size, or fragment-size, of a few centimeters, and it looks as if it's very uniform in that mottling; that is, there's one fragment size.

04 16 16  LMP  There are a few near one crater out at 12 o'clock - (LM WINDOW)
dark-gray rock that may be glass-coated. One of them looks like it's right at the rim and might have been part of a projectile that made the crater.

04 16 17 47 LMP  The large boulder that I mentioned that's several meters in diameter - I'm not even sure it's a boulder - it does have a well-developed fillet. It's highly fractured. It looks like the fractures generally are north-south. At least we can't see end on into the fractures. And it's too far away to be sure, but it looks like it's mottled also, although there did appear in the monocular to be a more heterogeneous mottling. It might be a breccia.

04 16 17  LMP  That boulder ought to be very close to the ALSEP (LM WINDOW)
site.

04 16 17  CDR  In reference to these boulders, everywhere I can see (LM WINDOW)
out of my left window and out ahead of me in referring to that boulder Jack's talking about which is just a little bit on my side at 12 o'clock it appears that the dark mantle has filleted and, for the most part, covered part of, or is up on top of, some of the crevices and the crannies in the boulders themselves, even the very small ones. I'd say from a population point of view, boulders of the size Jack's talking about that are visible through the surface anywhere from 1 to 2 to 3 meters - a very small percentage, but when you look at them at our level, it looks like they are quite populous. I'd say there are maybe about 25 of them in view between myself and where the horizon falls off down away from us towards the South Massif. The area back towards Station 1, at least the other side of Trident, looks like it's more heavily strewn with some of these filleted and partially mantled large fragments.
To say that there is a boulder, as such, actually sitting on the surface, I really can't find one, unless they're around something very small and possibly younger craters. But I think for the most part everything is somewhat mantled.

Gordy, I think maybe the predictions of a fairly thin regolith were good. I have a crater at about 130 feet. It looks like it's not more than a meter deep. It's very fresh, has a bright halo around it, and it's very rocky in its interior and has some rocks that are at least 10 or 20 centimeters in diameter on the rim. It looks like it's penetrated into some much rockier substrate than what we're seeing on the surface. The surface itself looks like probably 15 percent fragments greater than half a centimeter.

I don't see any general size, Gordy. I do have a crater out here that's - maybe a meter in diameter - fairly fresh, although not bright halo - that has not penetrated to blocky material. And it looks like the saturation crater size is very small in the area we can see; that is, there don't seem to be any old or very subdued craters. It's obviously saturated with craters a few centimeters in diameter, but when you get bigger than that, there seems to be more of a clear distribution rather than a saturation.

Let me give you a quick far horizon. At 12 o'clock, I've got Family mountain. It and South Massif are a replica from their plane form from where I am, except that Family mountain is much more symmetrical and rounds off to a very more definite peak. The South Massif, in turn, has got a high plateau, a high flat peak on top. My far horizon then, from about 12 to 11:30 is dominated by Family mountain. I hate to use the word anorthosite without getting out of the spacecraft, but it sure is white. It sure is white, but it's varied shades of white - with sort of a tendency on its southern or southeastern slope to be marble caked with a darker material much the same color as the mantle that we've landed on. The Family mountain disappears.
just about at the level of the rim of Camelot on my far horizon and just in front of it - that's at about 11 o'clock - just there is where the South Massif starts up very abruptly - I'd say certainly 30 degrees, - very abruptly to a very impressive altitude. It plateau' off from about 10:30 to about 9:30, and then it starts sloping back down towards the east at about the same angle. Very symmetrical.

There are several places where you can see what appear to be outcrops. I say several - about a dozen anyway, where you can see relatively large areas of outcrop on the South Massif. That outcrop is a darker-gray color than the white-gray of the massif itself. The one most dominant outcrop is right at the change in slope to the west, where it goes upslope and then plateaus off, and there is a definite outcrop. And you can see several boulders on all levels of the massif that have come apparently from outcrops and I feel certain we will be able to get to some of those that have come all the way down. South Massif, too, appears to be in areas marbled caked dirty, such as if it was sprinkled with a dirty or a darker covering, and that covering is more evident as it slopes back here towards the east. At the far horizon now, I can see South Massif all the way to 9 o'clock, but then behind it, there's just a little breadloaf-type dome of a much darker, much more hummocky mound back there, relatively big. It's probably, from where I stand, at least 10 percent the size of the South Massif. Grey in texture. There appears to be some lineations dipping down into the west at about 20 degrees, but that may be a sun-angle problem. But they're definitely there. And then, contrasting that is Bear mountain which is also much darker-gray, much different than the massif from where I stand, much more hummocky surface. It appears to be to me what I would expect Sculptured Hills to be like. One other thing about the South Massif is that at about 9:30 to 10:30, there is a little knob of the south Massif that sort of flows towards the east or slightly towards the northeast. That's the one that tends to be a little bit more heavily covered with the - darker dusty material - -
04 16 28+ CDR  I can see a couple of places where craters have penetrated very small craters and penetrated the massif - craters maybe a meter or two in size, some 5 meters, and there's a lot of rock debris around them, which tends to believe that there is very little, if any, soft covering on that massif.

04 16 28+ LMP  Just a couple more words about the North Massif. It looks like a good distribution of boulder tracks. Many of the boulders are accessible. The tracks can be traced up, at least to midslope. That's at my 3 o'clock position. And occasionally, at that midslope position, particularly northwest of Henson, you can see abundant boulders suggestive of outcrop. That's something that we had missed seeing on the pre-mission photos. And it isn't as abundant as on the South Massif, but there are apparent ledge formers about midslope.

04 16 31 03 LMP  There's also a few very bright sparkles from the surface - not abundant, but a few.

04 18 09+ CDR  From the looks of that soil out there, that drill may have a job ahead of it.

04 18 09+ LMP  Yes, I don't think the regolith is very thick, and I think you've got rocks below it.
04 18 21 32 LMP Okay. I'll start my watch. (LM)
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04 18 23 58 CDR It's open now. (LM)
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04 18 31 09 CDR I'm on the footpad. We landed in a very shallow depression. That's why we've got a slight pitch-up angle. Very shallow, dinner-plate-like dish crater just about the width of the struts. (LM)
---

04 18 32+ CDR Do we have boulder tracks coming down? I think I may be just in front of Punk. (LM)
---

04 18 32 53 CDR On the North Massif, we've got very obvious boulder tracks. A couple of large boulders come within 20 or 30 feet of where we can get to them, but there's a couple I know we can get to. The sun angle is such that, what I saw on the South Massif earlier I can't see very well. But, I know there were boulder tracks over there. Boy, it's hard to look to the east. Bear Mountain and the Sculptured Hills have a very similar texture on the surface. The Sculptured Hills is like the wrinkled skin of an old, old, 100-year-old man. Very very hummocky, but smoothly pockmarked. I do not see any boulders up by the Sculptured Hills from here. But it's awful hard to look to the east and to the southeast. (LM)
---

04 18 34 09 CDR We didn't have an awful lot of dust on landing; but I can dig my foot in 8 or 10 inches, and I know we're at least that thick. There's a small little 1-meter crater right in front of us with a whole mess of glass right in the middle. That's right in front of the MESA, as a matter of fact. Right where I want to park the Rover.
04 18 34+ CDR I'm going to take a quick look back. I think this is Poppy. (LM)

04 18 35 01 LMP Oh, I'm on the porch. Who said this place was smooth? (LM)

04 18 35+ CDR There's a lot of local depressions here I didn't figure existed. (LM)

04 18 35+ CDR I'm east of the LM now. The LM straddles this crater I talked about, and that's where we get the pitch angle; the back strut is probably right down in the eastern one-third of that crater. Just a little - very subtle crater. (LM)

04 18 35+ CDR Boy, I look at some of these rocks that are filleted here, and there sure are a lot of sparkles in them. (LM)

04 18 35+ LMP You landed in a crater! (LM)

04 18 36 39 CDR All these little craters have got glass in the bottom of them. Here's another one. (LM)

04 18 36+ CDR There's very clear sweeping of the surface by the descent plume out about 15 meters. (LM)

04 18 37 28 CDR I tell you where I think I landed - about 100 meters from Poppy at 1G o'clock. (LM)

04 18 37+ LMP That's an awful big hole. (LM)

04 18 37+ CDR Well, I know. I got to look around a little more. (LM)
04 18 37+ LMP You sure it's not Trident?

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04 18 37+ CDR It might be part of Trident.

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04 18 37+ LMP The surface is moderately cohesive, which holds a pretty good bootprint - very fine grain. Gene's ** looks very much like previous soils.

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04 18 40 20 CDR Man, there's sparkles in the soil. You can just look at it. See them all over? Very fine-grained. It's sparkly.

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04 18 40+ CDR See the soil sparkle?

04 18 40+ LMP Yes, I think that's a little glass.

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04 18 40+ CDR I'll show you that crater that's got nothing but glass in the bottom.

04 18 40+ LMP That's a vesicular rock of some kind there. It almost looks like Mono craters - pumice, but don't quote me.

04 18 41 01 CDR Even the very small - the 1- and 2-inch - 3-inch fragments that are laying around here have been dusted and filleted -- with the dark mantlo.

04 18 41+ CDR And that sweeping by the descent stage goes all the way out there to where we were, which was about 50 meters, I guess. These rocks almost have a very light pinkish hue to them, and they're not obviously breccia. Now, that's like a breccia there. But this stuff is something else again.

04 18 41+ CDR I don't think there is any place you could land around here where you wouldn't have one foot in the crater.
04 18 41+ LMP Looks like a vesicular, very light-colored porphyry (LM) of some kind; it's about 10 or 15 percent vesicles. I'm right in front of the LM. Quite a few of the rocks look like that type. Sort of a pinkish hue to them. The texture is coarse, but I'm not sure how crystalline they are, yet.

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04 18 42+ CDR There's craters all over here. (LM)

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04 18 46+ CDR This place is not locally level. (LM)

04 18 46+ LMP You're right. (LM)

04 18 46+ CDR There's not many place--you could put the LM down and have it be zero, zero, zero. (LM)

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04 18 48+ LMP Got a different breed of rock up here. The stuff's (LM) sticking through this thin regolith--or regolith period. I don't know whether it's thin or thick yet.

---

04 18 50 32 LMP I think it's safe to say this surface was not formed (LM) yesterday. There is a regolith; it looks classic. Area distribution of particles up to 3 or 4 centimeters, anyway. Then you start to get maybe a selective distribution of larger fragments.

---

04 18 51+ LMP Here's a couple of different looking rocks. One's (LM) very white; one's quite dark. But we do have a general rock type, I think, in the area--of the big boulders.

---
04 18 52+ LMP A glass-bottom crater with a little bench. Looks (L4)
like one of the Flagstaff explosion craters except for the glass in it. Right out at 12 o'clock.
That's the one I was talking about, about having a bright halo.

---

04 18 55+ CDR There's a piece of glass I picked up. I'm going to (LM)(SAMP 70018)
set it right on the floor of the Rover.

---

04 18 59+ CDR I put a little piece of glass I picked up right by (LM)(SAMP 70018)
the Rover, here.

04 18 59+ CDR Just a little piece. I'm going to leave it right (LM)(SAMP 70018)
behind you - footstool. It just sparkled at me I had
to pick it up.

04 19 03+ LMP The old 4 o'clock pan. (LM)(PHO 147 22492-520)

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04 19 10 09 LMP The basic material around the LM is just what I said (LM)
- a fine-grained, medium-gray, regolith-appearing
material that is the standard area's population.
The craters, though, bigger than about a meter in
diameter, seem to - get to - rock fragments - which
I haven't yet learned how to pick up.

---

04 19 10+ CDR I'm parked right next to Barjoea. And we are from (LM)
Barjoea, 12 o'clock. I guess about 150 meters due west of Barjoea. And that's why we looked so close
to Trident. I'm coming right up on Poppy. No
question about where I am now. I've got Trident.
We are abreast of Trident 1, just where I said we
were. I'm right at Poppy. We're about 100 meters
just about due west of Poppy, which is almost in
line with Barjoea, of course, but basically on that
line, I think, between Rudolph and Trident 1. And
as I look at it in the cross section, about 100 meters north of Trident 1. That's the landing point.
CDR Sure get dirty fast. That is Trident right here that we walked over to.

LMP I just got my first initiation to getting very dirty.

---

CDR I'm very firm of that now. I'm almost positive. Unless I'm awfully mistaken about Trident. I don't see how I could be from here.

LMP At the sacrifice of my cleanliness, Houston, the basic bright-colored rock type in the area looks very much like the cristobalite gabbros of the - I didn't see cristobalite, but it looks like the gabbros in the mare basalt suite. The coarse-grained clinopyroxene plagioclase rocks.

---

CDR Am I gonna screw up that little crater with glass in it if I park there?

---

LMP I haven't quite learned how to pick up rocks with my hands yet, Bob, or I would have had you a sample. That's why I fell down. It's an old blue-traverse gravimeter.

CDR Okay. On the plains of Taurus-Littrow. What a valley. I'd like to cut down through here, with a T 38 sometime.

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LMP Well I haven't learned to pick up rocks, which is a very embarrassing thing for a geologist.

---

LMP Houston, I've seen an awful lot of rocks, as I worked here. They look just like those pyroxene gabbros that I mentioned. The pyroxene's iridescent in the bright sun. The grain size -
maybe the mean is 2 millimeters with max maybe up at 3 or 4. And it looks like predominantly a pyroxene plagioclase rock - clinopyroxene, but I haven't looked at it real closely.

- - -

04 19 24+ LMP You did a great job of parking, so I was standing in (LM) a hole.

04 19 24+ CDR Don't want to mess up all those good looking craters (LM) around here.

- - -

04 19 26+ CDR Okay, here we go. Coming up. I've got the TV camera in my hand, Bob. Oh, man. Roy, Jack, just stop. You owe yourself 30 seconds to look up over the South Massif and look at the Earth.

- - -

04 19 26+ LMP You've seen one earth, you've seen them all.

- - -

04 19 28 56 LMP SCB 3 is on the handheld.

- - -

04 19 36+ CDR SRC is closed. And the organic sample has been sealed.

- - -

04 19 36+ CDR I'm taking SCB 1 to the tool gate.

- - -

04 19 39+ CDR Okay, Jack. How about the flag right over here in this little mound?

- - -

04 19 40+ CDR Yes. Hey, you're in the edge of the crater though. (LM) That's no test.
04 19 40+ CDR Okay, let me give it a few whacks. Belney. (LM)

04 19 40+ CDR I don't know how far we could drill, but we hit something solid with that one. (LM)

04 19 40+ LMP No, it was still going. (LM)

04 19 40+ CDR Yes, but did you ever see a vibrator like that? (LM)

04 19 40+ LMP Take a couple this way, and we'll take a couple that (LM)(PHO 134 20377-87) way. How's that?

04 19 40+ LMP Okay, you're - it's partially covering the Rover, but I think it's a pretty good shot. How's that? Let me get the focus right. (LM)(PHO 134 20377-87)

04 19 40+ LMP All right I got you reaching for the flag. (LM)(PHO 134 20377-87)

04 19 40+ LMP That's very good, Gene. Let me get it in stereo. (LM)(PHO 134 20377-87)

04 19 43+ LMP I don't - I don't think it's going - you're a little (LM)(PHO 134 20377-87) close, maybe. Get them both in focus.

04 19 47+ LMP I'll take the old CDR's camera. Not a bad camera to (LM) take.
04 19 50+ LMP Hey, Bob -- just behind the LM in that fairly fresh (LM)(SAMP LRK2 NOT RETURNED) crater, I picked up an example of the kind of gabbro I was talking about. And I'll stick it in the big bag, except the big bag has disappeared.

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04 19 50+ CDR Jack, I put that there to hold the SRC down. (LM)(SAMP LRK2 NOT RETURNED)

04 19 50+ LMP That's alright, I just put our sample in it. It's in the bottom of the bag. It's about 8 by 5 centimeters by 3 centimeters. Slightly tabular.

04 19 50+ CC We copy that. It's in the big bag. (LM)(SAMP LRK2 NOT RETURNED)

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04 19 54+ CDR The shade is deployed facing deep space. (LM)

04 19 54+ CC Understand, the Cosmic Ray. (LM)

04 19 54+ CDR The antenna is deployed. It's not on the pole yet, but it's deployed.

04 19 54+ CDR I think - just about got - the sunside deployed, just as perpendicular to the Sun as I think anybody could do.

---

04 20 06 01 CDR It's 570, 017, 201; 670, 017, 201. And it was about (LM) 75 percent in the shade of the Rover.

04 20 06+ CC And now we're ready for bias. (LM)

04 20 06+ CDR A bias coming at you on the ground. (LM)

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04 20 09+ LMP I'm moving down-sun, and where we've walked, we stir (LM) up darker material - just slightly, but it's darker. The same old thing, that most mature - that most regoliths have.

04 20 09+ CC Have you got a bias reading there, Gene? (LM)
04 20 11 54  COR  Yes, 337, 454, B1 - that's 337, 454, 071.  (LM)

04 20 11+  LMP  Bob, texturally, some of these rocks that I believe (LM) are gabbros - have a texture not unlike a welded tuff. But I know they're not. But they've got some mottled characteristic to them that I haven't yet figured out.

04 20 11+  CC  I say there, Jack that looks like a big rock there beyond you.

04 20 11+  LMP  That's the one we were talking about. Earlier.  (LM)

04 20 11+  LMP  Okay, Bob. I think I'm going to move a little bit (LM) to the north-west of my present position in order to get a little farther away from that big rock.

04 20 11+  LMP  And to get out of the shallow depression - that's here.

04 20 11+  CC  Roger. It's not so shallow. You disappeared out of (LM) sight from the last ***

04 20 16 10  LMP  Well it's shallow relative to other depressions I've (LM-ALSEP) been in.

04 20 16+  LMP  I've not seen any sign of layering in any of the (LM-ALSEP) craters. In their walls.

04 20 16+  LMP  The rocks still seem to be - the pinkish-grey gabbro (LM-ALSEP) out here.

04 20 19+  LMP  Central Station no be near a crater. Going to put (LM-ALSEP) your drill too close to that rock, though. Bob. Mark if he's worried about rocks as much as craters.
04 20 19+ LMP I've got a rock about 2 meters in diameter, partially buried - that one of the probes may be near.

04 20 19+ CC Stand by as define near.

04 20 19+ LMP Well it could be 10 feet.

04 20 19+ LMP I can move a little more south.

04 20 19+ CC If you're about 3 meters from the rock, that's no problem.

04 20 19+ LMP Okay, this is it.

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04 20 19+ LMP It looks like the probes are going to be in a shallow depression. I'll try to improve that a little. It's not a real crater - it's just a shallow depression.

04 20 19+ CC Okay, shallow depression's all right, Jack, don't worry about it.

04 20 19+ LMP It's not more than a meter deep.

04 20 19+ CC Stay there.

04 20 19+ LMP All righty. It looks pretty good to me.

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04 20 19+ LMP The meter and half-meter scale relief is a little more than we can stand here for a good site. But I think this will be all right.

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04 20 24+ CDR Okay, Jack, I'm on the way.

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04 20 29+ CC Okay, we'd like you to park facing the Sun.

04 20 29+ CC About 60 feet north of the Central Station.
04 20 30 04  LMP  Okay, ALSEP is connected, RTG is connected.  (ALSEP)

04 20 30+ LMP  Okay, about 60 feet northeast. How does it look behind you? (LRV parked at ALSEP).

04 20 46 17 CDR  670, 002, 601 - 670, 002, 601.  (ALSEP)

04 20 52+ CC  - and Gano, you're leaning pretty heavy forward on that drill.

04 20 52+ CDR  She's going in like she's in some pretty dead stuff, (ALSEP) and then I hit some rock here.

04 20 52+ CDR  It sounds to me like she's chipping away through rock. May be just a little longer drilling hole than I was at the Cape.

04 20 55 14 CDR  Bob, she's going in - but not without a little bit of resistance.  (ALSEP)

04 20 55+ CDR  Every once in a while, she breaks through a soft spot.  (ALSEP)

05 20 55+ LMP  Bob, I'll tell you, this Central Station's a bear to get level. Well, I just got dust on it now. It's just too soft.

04 20 55+ CDR  That sure was drilling in hard stuff because it took (ALSEP) a lot to get it off.

04 20 59+ LMP  Yes, I think I lost all the time I might have made up.  (ALSEP)
CDR  It's obvious that I'm going through some pretty tough stuff. Consolidated material, like rock fragments, and then it breaks through; and then it jumps for about 3 or 4 inches and then I hit some more fragments.

CDR  Man, is that thing biting.

CDR  I'm in something tough down there now. Whew!

CDR  I'm into the white mark; it depends on what you want to call the surface. I can give or take 6 or 8 inches.

LMP  Gene, is the dust coming up changing color on you at all?

CDR  No, Jack. It isn't changing color. I can't even tell where it's coming up.

CDR  I don't think it is coming up. I think I'm just pushing it aside.

CDR  Now this one down to Fl. Would you believe Fl?

CDR  Bob, in this soil, best number I can give you is about an inch below the white spots - or Bravo 1.

CDR  Hey, can you see this big mound that I just walked - it's just to the north - not the mound - the depression that's just to the north of me?

CDR  It's probably behind the Rover. Well, how's that look for the core?

CC   Does it look like it's 80 feet or so?
04 21 15+ CDR  Yes.
04 21 15+ CC  Then that sounds good.  (ALSEP)

04 21 15+ CDR  If you're looking at me, what I'm talking about is this depression in here for the core - oh, maybe 15, 20 meters out in here. Jack, what did you have in mind for the Neutron Flux?
04 21 15+ LMP  Either the one you're down in there, or next one over behind that rock in front of you over there.  (ALSEP)

04 21 15+ LMP  Either way I think is fine, Gene. But I would suggest behind a rock.
04 21 15+ CDR  -- for a neutron flux, huh?
04 21 15+ LMP  Yes, sir; and the core.
04 21 15+ CDR  I thought they wanted a core in that depression.  (ALSEP)

04 21 15+ CDR  I'll go behind that rock; that looks good from here.  (ALSEP)

04 21 15+ CDR  The long bore's in.
04 21 15+ CC  Looked like that one went in fairly well.  (ALSEP)
04 21 15+ CDR  Well probably about like the other one did. Not too bad.  (ALSEP)

04 21 20+ LMP  Bob, I've got a rock about 10 feet southeast of my LEAM location. I can move a little more north and get 15 feet from that.
04 21 20+ CC  How big is the rock there, Jack?  (ALSEP)
04 21 0+ UMP It's a meter wide and stands about a third of a
meter high. (ALSEP)

04 21 20+ CDR How's that for soil mechanics? I pulled the first
bore right on out trying to get this thing on right.

04 21 20+ CDR Right now I'm interested in getting this second bore (ALSEP)
on. Now, let's see if I can get it back in. Well,
not quite as far, but high enough for me to reach
the - it still feels, Bob, like there's a lot of
fragmental material down there.

04 21 28+ CDR Bob, I occasionally hit stuff and it spits this
whole drill back at me. Knocks it back about a half
an inch or so, and then it will bite through it.

04 21 26+ CDR My general impression is that there is an awful lot
of fragments I'm busting up down there.

04 21 28+ CDR That last 6 inches, I really came into something
hard, but it's down all the way.

04 21 35+ CDR Let me give you another one here. I'm in to the
bottom of the white marks, and that's about Bravo 1
again.

04 21 35+ CDR Now the bore stem is in to the top of the white
marks; I'm still putting the probe down.

04 21 35+ CDR And the top of the white marks is about Bravo 1.

04 21 35+ CDR Here goes the probe.

04 21 36+ CDR Papa 1. (ALSEP)

34
04 21 38+ CDR Okay. I'm going to go behind a rock over there -- in that depression. Bob you do want the core in a depression, right?

04 21 38+ CC That's affirmative, Geno.

04 21 38+ CDR This is right in line with the shallow depression; and it's right in line with RTG, with a rock in the middle.

04 21 38+ CDR That's where you're going to get it. Let me see what I need. Drill rock, core bag, drill at 1 IPS. Okay. Let's go do it right.

04 21 42 29 CDR I'm going to put it right in this depression.

04 21 42+ LMP There, get the middle of that.

04 21 42+ CDR It's a shallow one. If I go over there, I'm not shielded, Jack.

04 21 42+ LMP No, that's good. Get in the middle. Get it in that place.

04 21 42+ CDR It's only about a 4-meter depression.

04 21 42+ LMP Oh, wait a minute - oh, you're on the other side of the rock. Okay.

04 21 42+ CDR Yes, yes. Yes, I want to get back here.

04 21 42+ LMP That's good.

04 21 42+ LMP All of these big boulders around here that I've looked at, are the same rock type.

04 21 42+ CDR All these little craters are filled with glass.
04 21 42+ LMP I've seen glass covers. (ALSEP)

04 21 42+ LMP As I was saying, Bob, all these big blocks that I've (ALSEP) looked at look like the gabbroic rock that I was talking about - possibly upwards of 50 percent plagioclase rather than 30 like the mare - but an intermediate gabbro of some kind. And one big block there had very sharply defined - parallel parting planes. I think there is a foliation of minerals that parallel that parting, but I'll have to check it out.

04 21 46+ LMP Those parting planes go through the whole boulder on (ALSEP) the order of at least 3 meters long in outcrop.

04 21 50+ CDR The first core was awful loose. I think I could have pulled it back out with my hands. (ALSEP)(SAMP CORE 70001-09)

04 21 56+ CDR Darn it. You know, Bob, one of the problems is I'm (ALSEP)(SAMP CORE 70001-09) working in a small crater; and it's just a little difficult to work on these slopes. Okay. It's on. I'm ready to put the drill in.

04 22 03 14 CDR Hey, Bob, would you settle for about 8 inches out of (ALSEP)(SAMP CORE 70001-09) the ground? It's about as low as I can get.

04 22 03+ CC Okay -- (ALSEP)(SAMP CORE 70001-09)

04 22 03+ CDR I'm within an inch of the white stripes. (ALSEP)(SAMP CORE 70001-09)

04 22 03+ CDR An inch of the white stripes, Bob. (ALSEP)(SAMP COPE 70001-09)

04 22 03+ CDR I was able to pull the core out with the drill, about 3 inches. And it's all jacking material from there out. (ALSEP)(SAMP CORE 70001-09)
04 22 03+ CC  Why don't we just take two stereo pans for the ALSEP (ALSEP) photos. First stereo pan will be in the vicinity of (PHO 147 22565-88) the original stereo pan; and the second one, they suggested, will be to the northwest of that original one.

04 22 03+ LMP  Northwest. Okay. (ALSEP)

04 22 03+ CC  Yes, and I suggest that you go far enough so that you can see the LEAM past the Central Station. (ALSEP) (PHO 147 22589-606; 136 20683-710)

04 22 03+ CDR  I just put a plug in the top of that core; and it disappeared from sight down the center of the core. I'll put a cap on it, too; but I want to plug it first. I want to get the rammer to plug it down. (ALSEP) (SAMP CORE 70001-09)

04 22 07 43 LMP  Where do you want the focus on the pan to be? (ALSEP) (PHO 147 22565-88)

04 22 07+ LMP  About 15 feet? (ALSEP) (PHO 147 22565-88)

04 22 07+ CDR  That's strange, that plug was too small for the core. (ALSEP) (SAMP CORE 70001-09)

04 22 07+ CC  You got a focus that's just a little short of 74 feet? (ALSEP) (PHO 147 22565-88)

04 22 07+ LMP  I've already taken it at 15. (ALSEP) (PHO 147 22565-88)

04 22 07+ LMP  It's not a calibrated detent, but I don't think you need it here. (ALSEP) (PHO 147 22565-88)

04 22 07+ LMP  How far northwest? (ALSEP) (PHO 147 22589-606)

04 22 07+ LMP  About the same position as the heat flow down-sun - or up-sun? (ALSEP)

04 22 07+ CC  Yes. That sounds pretty good to me, Jack. (ALSEP)
04 22 07+ CDR I ran that plug - two-thirds of the way down the rammer, and it hit solid paydirt.

(ALSEP)(SAMP CORE 70001-09)

04 22 07+ CDR And I'll put a cap on it. So you, too.

(ALSEP)(SAMP CORE 70001-09)

04 22 11+ CDR That's cap Alpha that's on the core.

(ALSEP)(SAMP CORE 70001-09)

04 22 11+ CC Jack, you're taking your second pan, right?

(ALSEP)(PHO 147 22589-606)

04 22 11+ LMP Yes, but the camera just stopped.

(ALSEP)(PHO 147 22589-606)

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04 22 11+ LMP Would you believe I'm out of film, Bob?

(ALSEP)(PHO 147 22589-606)

04 22 11+ CC You want to give me a frame count, Jack?

(ALSEP)(PHO 147 22589-606)

04 22 11+ LMP Mag Alpha is empty.

(ALSEP)(PHO 147 22589-606)

04 22 11+ LMP It's 158.

(ALSEP)(PHO 147 22589-606)

04 22 11+ CC Jack, we're recommending magazine Hotel, and we also suggest you take the second pan, when you retake it, at 74 feet.

(ALSEP)(PHO 136 20683-710)

04 22 11+ CDR Man, it didn't feel like this stuff was that hard.

(ALSEP)(SAMP CORE 70001-09)

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04 22 11+ CDR See if I can get it out. I may be jacking the treadle down into the surface.

(ALSEP)(SAMP CORE 70001-09)

04 22 11+ CC Jack, if you haven't put magazine Hotel on, we want to recall that and make it magazine Golf - Gail.

(ALSEP)

04 22 11+ LMP Well, Bob, I've already got it on. Is that okay?

(ALSEP)

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04 22 11+ CC Leave Hotel on.

(ALSEP)

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04 22 11+ LMP Let me finish the pan and come and help you.

(ALSEP)(PHO 136 20683-710)
04 22 15+ CDR Come on baby, I'm going to get this thing out, now that I got it.  (ALSEP)(SAMPCORE 70001-09)

04 22 15+ CDR I hope this core is appreciated.  (ALSEP)(SAMPCORE 70001-09)

04 22 15+ CDR Man, I don't know what it's in.  (ALSEP)(SAMPCORE 70001-09)

04 22 15+ LMP I was afraid that would happen -- with all those rocks.  (ALSEP)(SAMPCORE 70001-09)

04 22 15+ CDR Yes, but it didn't go in that hard.  (ALSEP)(SAMPCORE 70001-09)

04 22 18 19 LMP I got your pans and a couple pictures of the heat flow probe.  (ALSEP)(PHO 147 22565-88; 136 20683-713)

04 22 21+ CDR You don't suppose this is why we didn't have much dust from the LM, do you?  (ALSEP)(SAMPCORE 70001-09)

04 22 21+ LMP I think it is.  (ALSEP)(SAMPCORE 70001-09)

04 22 21+ CDR I saw all the way to the ground during landing.  (ALSEP)

04 22 24+ LMP Bag 10 Echo is a sample of a very large boulder that's just beyond geophone 3. Just west -- just south.  (ALSEP)(SAMPCORE 70130-57)(PHO 147 22535-36)

04 22 24+ LMP South of geophone 3 -- southwest. And I got a few photos to document the boulder. I'm not sure I documented the sample, though.  (ALSEP)(SAMPCORE 70130-57)(PHO 147 22535-36)

04 22 24+ LMP It's the same kind of rock I saw near the LM -- and the gabbro -- I'm beginning to lean towards 50 percent plagioclase, though.  (ALSEP)(SAMPCORE 70130-57)

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04 22 27+ CDR I've got a delicate core in one hand, and I'm trying (ALSEP)(SAMP CORE 70 01-09) to get some core caps in the other. You'd be glad to know it's full, Bob. And while I'm the only one to see the bottom end right now, I'm going to tell you, it looks like what I'm walking on, but it's obviously not powdery. It's obviously very cohesive. The bottom of the core is not smooth, it's very jaggedy, and fragmental-like.

---

04 22 27+ CC And Jack, in your travels there, while you're doing (ALSEP) some sampling, if you happen to wander by in the - approximate vicinity of the deep core, you might get us a Rover sample of the soil there.

04 22 27+ LMP Okay. (ALSEP)

04 22 27+ CDR The core is filled to within an eighth or certainly less than a quarter of an inch from the bit. (ALSEP)(SAMP CORE 70001-09)

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04 22 27+ CDR It's got Bravo on and the plug has been discarded (ALSEP)(SAMP CORE 70001-09)

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04 22 31+ LMP I see no clear alignment of plagioclase or pyroxene in this rock. That's the one with the parting in it. It looks as if - integrating what I've seen here and over at the big rock - the geophone rock - that the layering or the foliation or the parting, whichever it is, is the result of variations in vesicle concentrations. The sample 10 Echo is a sample of the more coarsely vesicular rock. I could not get one of the finer - more finely or nonvesicular fragments. But I got pictures of it. (PHO 147 22535-36)

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04 22 31+ CC Can you see any evidence of soil on top of some of these medium-sized boulders? (ALSEP)(SAMP 70130-57)

04 22 31+ LMP There's soil. A little bit of dust in some of the holes. But there's not enough to sample at this point. I may find some later.
LMP Vesicle walls do not seem to be as shiny. Most of them seem to have dust in them.

LMP The vesicles are not cleanly spherical - they're spherical but they have fairly rough outlines. They look as if there's been some recrystallization.

LMP I picked the wrong rock to sample with a scoop, I'll tell you that.

LMP Bag 174 - 474, 474, soil from next to this big rock. It's the fillet. I can't get a chunk of the rock.

CC -- and, Jack, while you're coming back here to the Rover, why don't you get one more Rover sample in the vicinity of the deep drill, while you and Gene get ready to take on the core stems. And because of being a little bit behind here, what we're doing is, we're getting prepared to drop Station 1 in favor of doing Steno.

LMP Okay, you want me to get a - you want to break that and I'll go get this sample, Gene.

LMP Gene has pretty well chewed up the ground. I helped him. Do you want me to get a little ways away from it?

CC Anything there in the dirt, Jack. It doesn't have to be a skim sample of any sort.

CDR Okay, first piece of three sections - Bob, it's full.
LMP There's a mixture of soil and a rock in 475.

LMP The soil came from about 0 to 5 centimeters.

LMP And it's about 3 meters from the hole.

CDR Cap Charlie is opposite Alpha, that was the first three section.

LMP It's about 3 meters from the hole. I got stereo before at 11 feet and one after at 11 feet.

CC When you took those two pans off the ALSEP, was one at 15 feet and one at 20 feet?

LMP One was at focus for 15 and 74.

LMP There's a partial pan on mag A, which was taken at 15.

CDR I can't see what it is - I guess Delta and Echo is the two section core. Delta being adjacent to the first section of 3.

CDR The last one is Foxtrot, and it's on tight.


LMP Right now, 10 Echo is in my suit pocket, I hope.

CDR Did you get the heat flow pictures, by the way?

LMP I got most of them. Not all of them.
04 22 57 24 CDR I'm on mag Bravo and frame count 19.  (ALSEP)

04 22 59+ CDR Station 6 is pretty obvious up on the hill. It's fairly high up. I don't know if we'll get to drive up there or not.  (ALSEP)

04 22 59+ CC I think you can see the boulder and that's how you can tell, right?  (ALSEP)

04 22 59+ CDR Yes. And the crater.  (ALSEP)

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04 23 02+ LMP I'm at the SEP site, and I found a place I think we can lay out a pretty good grid.  (SEP)

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04 23 03 39 CDR Okay, Jack, here I come. Just about all you can see in that direction is the LM. Boy, that's tough driving into the Sun!  (ALSEP-LM)

04 23 03+ LMP Go right to the LM, and then a little bit to your left, to the left of the LM.  (ALSEP-LM)

04 23 03+ CDR Yes, I've got to go to the LM and give them a reading here.  (ALSEP-LM)

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04 23 03+ LMP Everything I've seen so far indicates that the so-called subfloor boulders, if we have gotten that deep, are this gabbro. I'm out here at the SEP site, and the large blocks are still the plagioclase pyroxene — —

---

04 23 05 45 CDR Bearing 292, 0.2, and 0.2. I'm standing right in front of the MESA.  (LM)

04 23 06 00 CDR Okay. I'm coming Jack.  (LM-SEP)
04 23 06+ LMP The zap pits are nice white halos, although, for the (SEP) most part, the rock's too coarse to show them very well, some of the larger ones have white halos. We may not be down to the subfloor, but - it's hard to say.

---

04 23 06+ LMP I did see a dense gray rock that's different than the others on my traverse out here. We'll try to find some of that, too.

04 23 07 12 CDR I'm reading 278, 003, and 003 at the SEP site.

---

04 23 08+ CC Let me fill you in on the plan, guys. We're going to go to the west side of Steno, which is where you would have driven by anyway, and the stop will be at the 340/1.2, which is where you've got the little Delta for EP 6, in your checklist. And we will plan on spending about 30 minutes there sampling primarily boulders.

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04 23 08+ LMP You got a good feeling on how to head out of here?

04 23 08+ CDR Yes, I want to get around on the back side of Trident, and make sure that that's what I'm looking at, is Trident over there.

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04 23 08+ CDR Let's see if we can't get around Trident east over here.

---

04 23 11 02 CDR We're on the move, Bob.

04 23 11+ LMP Okay, this is Trident, isn't it?

04 23 11+ CDR Yes. It's got to be.
04 23 11+ CDR This has got to be Trident east, right here, Jack. See that? That's got to be Trident east. That's the big one. (SEP-1)

04 23 11+ LMP On the right or the left? (SEP-1)

04 23 11+ CDR On the right. (SEP-1)

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04 23 13+ LMP What are you headed now, south pretty much? (SEP-1)

04 23 13+ CDR Yes. (SEP-1)

04 23 13+ LMP That must be Emory over there. See with all the blocks in the wall? (SEP-1)

04 23 13+ CDR Where you looking? Which way? (SEP-1)

04 23 13+ LMP Southeast. Way over there. (SEP-1)

04 23 13+ CDR Yes. (SEP-1)

04 23 13+ LMP This is very easily Steno right over here. We're between the two big ones. (SEP-1)

04 23 13+ CDR That would be Powell. (SEP-1)

04 23 13+ LMP That would be Powell on the right. (SEP-1)

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04 23 13+ CDR 330, 0.3. (SEP-1)

04 23 13+ CC Okay, i sounds like you're probably just driving by the east Trident or Trident 3. (SEP-1)

04 23 14 45 LMP You think all that right there is Trident? (SEP-1)

04 23 14+ CDR My gosh, if it is, that's incredible. That's hard to believe. (SEP-1)

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04 23 14+ CC Jack, could you give me a frame count some time? (SEP-1)
04 23 14+ LMP Looks like 45.  
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04 23 14+ CDR Hey, don't you suppose that's Trident?  
04 23 14+ LMP Well, it sure looks like it, doesn't it?  
04 23 14+ CDR Yes. We were quite a ways from Trident.  
04 23 14+ LMP I bet you it is.  
04 23 14+ CDR If that's true, we're at 342.4. That's about right; boy, what I was looking at Trident isn't anywhere near that big.  
04 23 14+ LMP Okay, if that's true, then we want to go!  
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04 23 14+ CDR We're all right now. That's got to be Trident.  
---
04 23 16 12 LMP Well, it's a triplet all right, with some sepa between. Well, wish I could take pictures.  
---
04 23 16+ LMP Take a few, but it's not continuous. My hands are giving out. Okay, we're at 0.5 and 346. And the surface has not really changed except slightly more hummocky and rolling, because of a larger number of irregular depressions, or craters. The rocks at first glance from the Rover look very much like what we had around the LM. That's the big ones.  
---
04 23 18+ LMP Okay, how far have you come?  
04 23 18+ CDR I've got to go about another 0.7 kilometers. I may be coming up on the edge of it. Boy, this is a heck of a way to start out our navigation because it's into the Sun here. Now, that's got to be Powell, wouldn't you say?
04 23 18+ LMP Yes. Must be.
04 23 18+ CDR Then that's Steno with all the blocks in it.
04 23 18+ CDR Boy, am I glad we didn't land out here! Whew!
04 23 18+ LMP See this high point up here coming ahead?
04 23 18+ CDR Yes.
04 23 18+ LMP That should give us our bearings, I hope.

---

04 23 18+ CDR Okay, that's Powell, huh?
04 23 18+ LMP Yes.
04 23 19 53 LMP Okay, if that's Powell. Quite a ways over there, but I think the thing to do is get up on that little ridge there.
04 23 20 03 CDR I think we may end up looking right into Steno when we get up there. Bob, we're 342.9.

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04 23 20+ LMP Houston, there sure is certainly a lot of big boulders. Let me take a look into the Sun here. That doesn't look like what I thought Steno looked like. There's no dimple there. I.J. he said. All right.
04 23 20+ CDR This is it over here, though, I guess.

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04 23 20+ LMP I think they can locate us if we work that block field right there.

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04 23 20+ CDR It doesn't look like what I expected Steno to look like--
04 23 20+ LMP No, me either.

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04 23 23 03 CDR 346; 1.1. I think it would almost be worth - I bet (SEP-1) that's emory up on that hill. It's got to be.

04 23 23+ LMP We better park in this boulder field here. (SEP-1)

04 23 24 02 CDR Okay, I'm parked 180.

04 23 24 27 CDR I'm heading 162, 346, 1.2, 1.1.

04 23 24+ LMP You want this charge deployed here? (1)

04 23 24+ CC That's affirmative, Jack. (1)

04 23 24+ LMP I'll deploy it now. (1)

04 23 25+ CDR Pin 1, *** two - (1)

04 23 25+ CDR Mark, safe. (1)

04 23 25+ CDR Pin 3 - (1)

04 23 25 47 CDR Mark, safe. (1)

04 23 25+ LMP We're about 15 meters from a 20-meter blocky-rimmed (1) crater. It's about 3 to 4 meters deep. All the blocks on the rim look like the pyroxene, plagioclase gb;bro - the vesicular rocks seen at the LM. At least all that I've seen so far.

04 23 25+ CC Is this crater to the east or west? (1)

04 23 27 01 LMP It's to the northwest of the Rover. (1)
04 23 27+ LMP The vesicle population varies from about a millimeter to 1 centimeter. It forms about 15 percent of the rock - 10 to 15. And I've given you grain size for the rocks near the LM and that goes well for this one.

04 23 27+ LAF There is - the parting that I mentioned, still of somewhat unknown origin, and we'll try and cut a sample along a parting plane. It's clearly evident in one of the bigger blocks.

04 23 27+ LMP Bob, you're going to want a core at this site?

04 23 27+ CC Roger. We'd like to get - number 1 priority will be (1) some block samples, including any dirt that was on the blocks, if there is such. And then the second priority is a rake soil sample; the third priority is a double core. Then, also in there, the pans, of course, and other documenta samples. But the double core is there although it is third priority.

04 23 29+ CDR Okay, you got one picked out?

04 23 29+ LMP Yes, let's hit this - see if we can work on that one, it's at the edge, but we can chip at the parting plane. And that's one of the things that's come up that I think is of interest that we've got to figure out why they have that foliation in them.

04 23 29+ CDR Boy, that rock is one of the more vesicular ones I've seen around.

04 23 29+ LMP Well, they're all about that, Gene. They're either that or mixed with that variety. In the same boulder, you'll see a nonvesicular - a relatively nonvesicular. Okay, that's the - that's the down-sun. Okay, right into the Sun.

04 23 29+ LMP Right at that overlapping fracture, huh?

04 23 29+ CDR Yes.

(SAMP 71030-37) (PHO 134 20394-96; 136 20739-40)
04 23 29+ LMP Let me get where I can maybe save the rock. If you (1)(SAMP 71030-37) can hook your -

04 23 29+ CDR I'm going to try and get it right up on top 's where (1)(SAMP 71030-37)
I'd like to -

04 23 29+ LMP If you hit it on the right side, I'll go this way. (1)(SAMP 71030-37)
maybe. There you go.

04 23 29+ CDR Place right there. (1)(SAMP 71030-37)

04 23 29+ LMP I can get another one, too. Try another one; don't (1)(SAMP 71030-37)
lose that one.

04 23 29+ CDR Let me get that one for you. (1)(SAMP 71030-37)

04 23 29+ LMP I can get it. (1)(SAMP 71030-37)

04 23 29+ CDR Got it? Whoops. Can you keep it in sight here for (1)(SAMP 71030-37)
a minute? Is that it?

04 23 29+ LMP Yes. Go ahead. Try hitting - there you go. Can (1)(SAMP 71030-37)
you use the other end against the right side of the rock?

04 23 29+ CDR It's coming. (1)(SAMP 71030-37)

04 23 29+ LMP That's all right. (1)(SAMP 71030-37)

04 23 29+ CDR I'll get that one. Wait a minute. (1)(SAMP 71030-37)

04 23 29+ LMP Be careful down in there. (1)(SAMP 71030-37)

04 23 29+ CDR The whole thing is going to fracture off here, in a (1)(SAMP 71030-37)
minute.

04 23 29+ LMP It's trying to fall. Don't wear your hand out. (1)(SAMP 71030-37)
That's good Gene.

04 23 29+ CDR Wait a minute. Let me give one more whack. The (1)(SAMP 71030-37)
whole thing is - no, that's too tight. Let me get that other piece -
04 23 32 21  LMP  Bag 476 is the rock sample with a little bit of the soil near it - with a chip off the rock, watch it, Gene.

04 23 32+  CDR  Here's your other chip. If I go down there, that thing is about 15 feet deep.

04 23 32+  LMP  Right. Got it.

04 23 32+  LMP  Now, do you think you can chip off the other side of the plane, up on the edge?

04 23 32+  CDR  Yes.

04 23 32+  LMP  Then we'll get the soil, and maybe just a small rock, one nonchipped.

04 23 32+  LMP  476.

04 23 32+  LMP  It's from the southeast side of the parting plane.

04 23 32+  CDR  There it is - a whole big slab, right there.

04 23 32+  CDR  Oh, look at those dark minerals in there. Are those dark black?

04 23 32+  LMP  Yes, they may be ilmenite or fresh pyroxene. We'll look at it. Gives the impression of pyroxene.

04 23 32+  CDR  Okay, you want my bag? I tell you, if you work on any kind of slope, like this little crater - okay, I'm going to leave it open for a minute.

04 23 32+  CDR  While we get that one.

04 23 32+  LMP  You're going to have to use your tongs on that one, I think.

04 23 32+  LMP  I got it.
CDR: Here's a big one. Get him the bag number, too.  (1)(SAMP 71050,55)

LMP: Bag 454. Okay, and the flashes are from inside of vugs and recrystallized vesicles. They look like pyroxene flashes; they could be ilmenite.  (1)(SAMP 71050,55)

CDR: I'll get my after picture.  (1)(SAMP 71050,55)(PHC 134 20396)

LMP: And let me get in there and get some soil.  (1)(SAMP 71040-49,75),(PHO 134 20394-96; 136 20739-40)

CDR: Okay, let's get it first.  (1)(SAMP 71040-49,75)

LMP: From the north side. The bag tore around that; it's pretty jagged rock, but I think it'll hold.  (1)(SAMP 71040-49,75)

LMP: It's in Gene's sample collection bag. And a scoop sample. You got a bag handy, Gene? Okay, bag 455, Bob. It's from the west side of the rock. It's under a slight overhang of the rock - in a shadow, anyway. Okay, that's from about 1 centimeter down - deep, 1 to 2 centimeters. And the next one is down to about 5 or 6. And it's got some chips in it.  (SAMP 71060-69,85-97),(PHO 134 20394-96; 136 20739-40)

CDR: That's bag 456, Bob.  (1)(SAMP 71060-69,85-97)

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CDR: Turn around and let me help you get these in your bag.  (1)

LMP: Yes, let's - get your after -  (1)(PHO 134 20396)

LMP: And if we can, we might get just a block instead of breaking on it, and then we'll go to the rake.  (1)

CDR: Bob wanted a core here, too, huh?  (1)

LMP: Yes, but the rake's next, as you might imagine. This stuff here looks a little less vesicular. Why don't we try that one?  (1)

CDR: Hey, look at this rock, where the vesicularity changes from a hummocky vesicularity to a very fine vesicular. Look at this. Let me try and crack - see that? The change?  (1)(SAMP 71130,35-36),(PHO 134 20397-400; 136 20741)
04 23 35+ LMP Yes, that's what I'm after; that's it. (1)(SAMP 71130,35-36)
04 23 35+ CDR Let's see if I can't crack — (1)(SAMP 71130,35-36)
04 23 35+ LMP That's it. That's what I saw in that other boulder. (1)(SAMP 71130,35-36)
04 23 35+ CDR Let's see if I can't crack the corner and get that contact. (1)
04 23 35+ LMP Yes. And get a piece of both — I think you can get — if you can reach down there. (1)(SAMP 71130,35-36)
04 23 35+ LMP That's a contact in a rock. (1)(SAMP 71130,35-36)
04 23 35+ CC Do you guys see any 2-meter boulders around there? (1)(SAMP 71130,35-36)
04 23 35+ LMP We just sampled one. *** - (1)(SAMP 71030-37,40-49,50,55,60-69,75,85-97)
04 23 35+ LMP We're not where you think we are. We're not sure where we are. Gene, can you get down into that? Need some help? (1)(SAMP 71130,35-36)
04 23 35+ CDR Yes, just — give me the shovel to hold myself with. Give me a shovel. (1)(SAMP 71130,35-36)
04 23 35+ LMP How about that one? (1)(SAMP 71130,35-36)
04 23 35+ CDR Yes. (1)(SAMP 71130,35-36)
04 23 35+ LMP Get that little piece. (1)(SAMP 71130,35-36)
04 23 35+ CDR Okay, I see it. It's pretty hard. See if I can't — it's low and hard to hit. (1)(SAMP 71130,35-36)
04 23 35+ LMP How about coming around from this side? (1)(SAMP 71130,35-36)
04 23 38 59 CDR Well, I got the gnomon in the wrong place really. (1)(SAMP 71130,35-36)
04 23 39+ CDR Can you reach it? (1)(SAMP 71130,35-36)
04 23 39+ LMP Well, I'm going to lean on the rock maybe. I got that other little piece in sight. (1)(SAMP 71130,35-36)
04 23 39+ CDR Okay, I got that piece in sight, too. Let me — (1)(SAMP 71130,35-36)
04 23 39+ LMP Get them both with your -
04 23 39+ CDR Let me get them both right now.
04 23 39+ CDR Okay, this is a sample of the more coarsely vesicular rock.
04 23 39+ LMP You got it in your hand?
04 23 39+ CDR I got them both. I think, actually, we got a sample of both sides; but I wouldn't bet on it.
04 23 39+ LMP Okay, I just got a chunk of that side.
04 23 39+ CDR Okay, I got both of these.
04 23 39+ LMP See that rock right over there on the little mound, just projecting out of the edge of it?
04 23 39+ LMP There you go; you just about touched it. Right there, that piece.
04 23 39+ CDR Okay, let me get these in a bag here.
04 23 39+ LMP Well, I'll get that piece; and that's the samples from either side of the contact anyway. Can you get a bag --
04 23 39+ CDR They're pretty small.
04 23 39+ CDR Give me a hammer, and get a bag and I'll -
04 23 39+ CDR I got these in my hand I want to put there.
04 23 39+ LMP Bag 477 is the - coarsely vesicular rock.
04 23 39+ CDR Are two of them there? I hope two of them fell in.
04 23 39+ LMP No, I only got one.
04 23 39+ CDR Okay, here's that other one. It had to fall right here.
04 23 39+ LMP I can't think it ever - is that - there it is; get your tongs.
04 23 39+ CDR Right here?
04 23 39+ LMP Now you're full of dirt in the scoop; you just covered it up.
04 23 39+ CDR Got it; I got it.
04 23 39+ LMP Here, put it in here with the dirt. That's good.
04 23 39+ CDR A little dirt never hurt anybody.
04 23 39+ LMP Got it.
04 23 39+ LMP 477 are two chips - they're small, but I think they'll give you the - if there's any compositional difference.
04 23 39+ CDR But these two are the ones you saw - that right there? That's what you pointed at.
04 23 39+ LMP Yes, I think you got it.
04 23 39+ CDR Okay, I'm going to take a closeup stereo on that contact.
04 23 39+ LMP Yes, definitely.
        ---
04 23 39+ LMP In bag 478 is the chip from the more finely vesicular rock. Both of them are coarse, it's a small chip; but it'll tell the story, I think.
04 23 39+ CDR I'll go ahead and get a closeup stereo --
04 23 39+ LMP Get a closeup, and I'll get the rake. I'll get started on the rake.
04 23 39+ LMP Gene, if you can pick up one more rock in that picture, with your tongs, let's bag it.
04 23 39+ CDR I'll get it.
04 23 39+ LMP As you come back.
LMP: I can bag it for you, Geno.

CDR: That's all right. I want to get this closeup here.

LMP: Okay, I've moved about 5 to 8 meters northeast of the Rover. And - as soon as Gene gets here with the gnomon -

LMP: I've got a sample that was laying next to that boulder. I did not get an after picture of it, as I was taking my closeup pictures, it - is on my side of the boulder just 4 or 5 inches, covered with the dark mantle.

CDR: I think we probably disturbed that one. It'll probably show up in the before.

LMP: That's in bag 479.

CDR: Let's rake right out there.

CDR: Look, let's go ahead and bag that one; and I'll get the gnomon out there.

LMP: Bob, as you might have seen from the camera, up towards where we think Emory is you get a pretty high concentration of boulders up there.

CDR: Well, we thought about going on up there; although - we're in a pretty good area here, too, from the standpoint of boulders.

CDR: I think for the most part, large and small, all the fragments seem to be filleted or even mantled by the dark material.

CDR: What area are you going to rake?
04 23 43+ LMP  Ahead of the gnomon and to your left, there.  

04 23 43+ CC  I also gathered that most of the rocks look pretty much the same.  

04 23 43+ LMP  That's what I said.  

04 23 43+ CDR  Yes, except a change in vesicularity -- in terms of the size of vesicles, where I described one as being a more hummocky vesicular-type rock. The first time I've noticed any of the dark minerals was when we took that one big flat chip off that boulder.  

04 23 43+ CDR  I didn't look at it that close to see what it was.  

04 23 43+ CDR  I'm going to get a pan, Jack, while you're doing that.  

04 23 46+ LMP  I'm only penetrating about, at the most, 3 centimeters into this area with the rake. I've picked up a very good sample of boulders but most of them were in that distance of the surface and projecting out of it.  

04 23 46+ CDR  A couple of more Jack. Okay, coming at you. Bob, the pan is complete.  

04 23 46+ CDR  There's two bags, I think.  

04 23 46+ LMP  Two bags full. First bag is 457 --  

04 23 46+ CDR  Don't let me lose them. That's enough. Give me a couple of small ones.  

04 23 46+ CDR  Okay, that's good. That's good. Okay.  

04 23 46+ LMP  Here, *** they are.  

04 23 46+ CDR  Okay, in bag 458 is the rest of the rake sample. They're all fragments.
04 23 46+ CC Now we need the kilogram of the soil. (1)(SAMP 71500-09,15)(PHO 134 20405-07,23-27,32; 136 20742-43)

04 23 46+ CDR All the fragments, of course are completely covered with the mantle; and they are slightly oh, maybe 20 percent vesicular. I just took a glance at them. But, for the most part, they appear to be rounded and subrounded fragments. (1)(SAMP 71500-09,15)

04 23 46+ CDR Let's get the kilogram. (1)(SAMP 71500-09,15)

04 23 46+ LMP Ch, well, shoot. Start all over. (1)(SAMP 71500-09,15)

04 23 46+ CDR Try it again. 459 will get the kilogram, Bob. (1)(SAMP 71500-09,15)

04 23 46+ LMP Get some more. (1)

04 23 46+ CDR Okay, fill it up. (1)(SAMP 71500-09,15)

04 23 46+ LMP Can you close it? (1)(SAMP 71500-09,15)

04 23 46+ CDR Yes, yes, I can close it. (1)(SAMP 71500-09,15)

04 23 46+ LMP That's a good kilogram. (1)(SAMP 71500-09,15)

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04 23 46+ LMP I think it's going to be hard to get a double core here. We could try a single right there. Bob, we got time to get the core? (1)

04 23 46+ CC Negative. The core has been deleted. We'd like for you to get your second pan, Jack, and then we'll press on. (1)(PHO 136 20744-76)

04 23 46+ LMP I'll get over here where our two sample sites are in view. (1)(PHO 136 20744-76)

04 23 46+ CDR We'll, now I know why I felt that we were much too close to Trident than what I thought. We weren't really too close to Trident because Trident is way out here. That makes me feel better. A guy would know if he landed 100 meters from a big set of crags like that. You know, on a landing site like this, you ought to know exactly where you are. Anyway I landed where I wanted to.
04 23 51+ LMP I'm taking your camera.
04 23 51+ CC Jack, you got the pan or getting it?
04 23 51+ LMP Yes, sir.
04 23 51+ CDR CDR is on frame count 60.
04 23 51+ LMP And the LMP is on 95.

04 23 51+ LMP Bob, my impression right now is that the dark mantle may just be a well, at least in here, it's indistinguishable from a regolith that might be derived from these other rocks. It seems to to be a little dark for that, but that might be the answer.

04 23 55+ CDR We are rolling.

04 23 56+ CC Remember you'll be taking photos coming back here, Jack -- if you get a chance.
04 23 56+ LMP Yes, sir. I got a few going out, Bob, but they weren't too well spaced.
04 23 56+ CDR That's got to be Trident, Jack, because that's too big for anything else.
There's - the classic raindrop pattern over this fine debris. I'd say that the surface definitely is sorted, the fine regolith material forming one fraction and then the blocks another. Those blocks are greater than 2 centimeters in diameter. In general, make up less than 10 percent of the surface. But there are some big ones. And it - fairly uniformly distributed. There are blocks a meter in diameter.

Hey, Jack, that big crater out there at 2 o'clock has probably got to be Sherlock. That's got to be Sherlock over there.

Yes, probably. I think the only place I've really identified that we can go to is to Station 6.

Okay, Bob, here's another crater about the same size we sampled - the last station. And it doesn't have as many blocks, but it does have blocks. And from this distance, their vesicular texture and their light color shows up very well. I suspect they're the same general kind. There's a glass-bottom crater.

Okay. You got a range and -- bearing, there, guys, please?

341, 0.8.

Did you take a picture, Jack?

Yes.

You're pointed right at Station 6, I think, Gene.

I think you may be right. There's that boulder.

Not the one with the track but the one over there to the right of that.

Unless the one with the track - I've got mixed emotions which is 6.

Look over there to the left. You see that.
04 23 58+ LMP Yes. (I-SEP)
04 23 58+ CDR That's Trident. Man, I'll tell you. (I-SEP)
04 23 58+ LMP Look at this thing. That looks like the same kind
of rock except it doesn't have any vesicles. (I-SEP)
04 23 58+ CDR There's some white stuff in that rock. Just let me
take a quick pic *** (I-SEP)(PHO?)
04 23 58+ CDR See that one right in front of it? Take a picture
of it. (I-SEP)(PHO?)
04 23 58+ LMP Oh, you mean this one, here. (I-SEP)(PHO?)
04 23 58+ CDR That's a big zap pit, isn't it? Take a picture of
that? (I-SEP)(PHO?)
04 23 58+ LMP Yes, they're big zap pits. Same rock with big zap
pits. I think those are zap pits. It's a little
hard to say. (I-SEP)(PHO?)
04 23 58+ CDR Looks like a big chip out of the rock. (I-SEP)
04 23 58+ LMP They're white halos; it just has more of them. (I-SEP)
04 23 58+ CDR But it's a big one; it's about an inch and a half or
2 inches across. (I-SEP)
---
04 23 58+ CC Okay, 17, how about -- range and bearing? (I-SEP)
04 23 58+ CDR 341, 0.7. (I-SEP)
04 23 58+ CDR Over there's the white mantle. Jack, look over
there. Can you look to your left? (I-SEP)
04 23 58+ CDR That's the white mantle. (I-SEP)
04 23 58+ LMP Swing around that way. (I-SEP)
04 23 58+ CDR Call it a slide or not, but that's the white mantle. (I-SEP)
Whoa! That's my first real good picture of it. That
is something.

61
04 23 58+ LMP I got some of that. Okay, how are we doing? (I-SEP)(PHO?)
04 23 58+ CDR I don't want to go in that crater. We're at 0.6; how about 339 *** (I-SEP)
04 23 58+ LMP I got a couple of shots right in there. (I-SEP)(PHO?)
04 23 58+ CDR Coming right around to you. (I-SEP)
04 23 58+ LMP Hold that heading. Whoa. That'll be good. (I-SEP)
04 23 58+ CDR Right here? (I-SEP)
04 23 58+ LMP Yes, whoa. (I-SEP)
04 23 58+ CDR I got my locator. (EP 7) (I-SEP)
04 23 58+ LMP Okay, now this one we want me to get a partial pan until something's identified. (I-SEP)(PHO 136 20812-28)
04 23 58+ CDR Okay. We'll do that. We've got to turn that way anyway. (I-SEP)
05 00 02 32 LMP Okay, pin 1 pull, safe. Pin 2, pull, safe. Pin 3 - (I-SEP)
05 00 02 41 LMP Mark it, pull safe. (I-SEP)
05 00 02+ CC I copy that as charge number 7. (I-SEP)
05 00 02+ LMP That's affirm. (I-SEP)
05 00 02+ CDR Okay. Bearing is 339, 0.6. (I-SEP)
05 00 02+ LMP Start a pan around it, Gene. (I-SEP)(PHO 134 20433-34)
05 00 02+ CDR Okay. We're on our way. (I-SEP)
05 00 02+ CDR Okay. We're heading on back to SEP. (I-SEP)
05 00 02+ LMP The pan was more or less complete at 146. (I-SEP)(PHO 136 20812-28)
05 00 02+ CC Copy, 146 on Hotel. (I-SEP)

05 00 02+ LMP The more I look at this dark dust, if you will, the (I-SEP)
more it doesn't seem like the kind of thing you'd (I-SEP)
epect to have been derived from the underlying (I-SEP)
bedrock.

---

05 00 02+ LMP It just seems dark and much too fine-grained. It - (I-SEP)
don't have the impression that you're getting the (I-SEP)
size distribution you'd expect to get by having all (I-SEP)
these blocks around.

00 02+ LMP Definitely, I think at least in my mind, two (I-SEP)
populations - size populations.

05 00 02+ CDR Jack, that almost looks like bedrock over exposed in (I-SEP)
there. See that?

05 00 02+ LMP Yes, why don't you take a pass over that way. Get (I-SEP)
through there?

05 00 02+ CDR Yes, I can get through there.

05 00 02+ LMP Do you know where you are? (I-SEP)

05 00 02+ CDR Yes. (I-SEP)

05 00 02+ LMP In Trident?

05 00 02+ CDR No we're not in Trident. That's awful - that's (I-SEP)
pretty steep down in there. I'd walk down there. (I-SEP)
i'm not sure I want to drive down there yet.

05 00 02+ LMP No, I didn't mean down in there. I meant right over (I-SEP)
there.

05 00 02+ CDR Well, here's some right here. (I-SFP)

05 00 02+ CDR Take a picture of that? (I-SEP)(PHO?)

05 00 02+ LMP Yes. (I-SEP)(Phu?)

05 00 02+ CC And how about a range and bearing when you stop, to (I-SEP)(PHO?)
take the picture.
05 00 02+ CDR 336, 0.4. (1-SEP)(PHO?)

- - -

05 00 05 59 CDR Jack says it's going to be hard to tell whether this (1-SEP)
is regolith composed from the rock field we see
around, but - I get a distinct impression - you can
see that dark mantle on top of almost all the rocks.
Except we have fresh glass, possibly, in the bottom
of some of these small craters.

05 00 05+ CDR Everywhere else there is actually mantle, I believe, (1-SEP)
in and around some of the crevices and in the
vesicles and what have you.

05 00 05+ LMP It's all material though, that could be - knocked in (1-SEP)
there by the local impact.

05 00 05+ CC Okay; but I gather you find a lot of material on top (1-SEP)
of the rocks.

05 00 05+ CDR Not a lot. It's there, though. (1-SEP)

05 00 05+ CDR They're not nearly as covered with dust as they get
when you drop one. It's just really a scattering or a
cattering of debris in the depressions - - on the
rock. The projections of the rock are perfectly
clean.

05 00 05+ CDR Yes, but most of all - the craters are - have
relatively ***, except where the rocks are showing
the boulders on the side, or - within the craters
are evident - are suddenly covered over with this
mantle. You don't see any good sharp ridges or
walls on some of these craters. Even the small
ones.

- - -

05 00 05+ LMP I'm going to state what Gene said slightly
differently. There just aren't a lot of very sharp,
bright craters, but there are some. All the craters
seem to be pretty well formed. It isn't an
extensive mantle. Matter of fact for example,
hasn't filled the - - bottom of the craters.
05 00 05+ LMP We're back at the SEP, Bob. I'm starting to lay out (SEP) my first track.

05 00 11 02 LMP Let me leave my camera. (SEP)

05 00 11+ CDR 252, 2.5, and 0. I'm resetting. (SEP)

05 00 11+ LMP And the LMP frame count is 197, and it was still turning. (SEP)

05 00 11+ LMP We're deploying it. No, you take the pictures. (SEP)(PHO 134 20435-36)

05 00 11+ LMP The location is in about the least-cratered area I could find, between a large crater or a large depression that — ranges from maybe 50 to 150 meters behind the LM. That's maybe — south — or east-southeast; and it's between that depression and another large depression that is really a doublet with a blocky septum between them. That's to the northeast of the LM about 200 meters; that's the start of that second depression. I think we can get a nice layout, although there'll be a general slope, I believe, toward the LM — of about 1 degree. (SEP)

05 00 11+ LMP That depression to the northeast is at least a couple hundred meters in diameter, and it's joined with one that's probably of comparable size just to the northwest of the first depression. (SEP)

05 00 14 03 CDR Okay, Bob, I've stopped back at the SEP. (SEP)
05 00 14+ LMP This fine-grained dust that we're in could be ground (SEP) up pyroclastic. It might grind more easily than other things, and the blocks are just those blocks that have been excavated from below that pyroclastic by the larger craters and some of the smaller ones in the area.

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05 00 17+ LMP You'd think glassy pyroclastic might turn into regolith a little bit faster than some of these other things. But we'll check that one out.

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05 00 17+ CDR Stay there, and I'll take a picture. (SEP) (PHO 134 20435-36)

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05 00 22+ CDR I found a brown rock that I'm going to bring back. (SEP)

05 00 22+ CDR I think it's the back side of a piece of glass, but it's brown.

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05 00 22+ CDR Okay, Jack wait a minute. That looks orthogonal to me, got your picture?

05 00 22+ LMP Will have in a sec. (SEP) (PHO 134 20435-36)

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05 00 22+ CDR Okay, I got it. I straightened the line out a little bit better after I took the picture - a few kinks in it. Now where's my brown rock? I saw it when I was driving with the Rover. I knew I'd be able to come back here because of the tracks. Looks like an old piece of bread.

05 00 22+ CDR Okay, I got it. I straightened the line out a little bit better after I took the picture - a few kinks in it. Now where's my brown rock? I saw it when I was driving with the Rover. I knew I'd be able to come back here because of the tracks. Looks like an old piece of bread.

05 00 22+ CDR It's a piece of glass, all right - part of it crumbled but - I got to get that in a bag. Oh, man, is that a nice piece of glass. Just laying out there all by itself. Jack, you got a jag handy while I take my pan. I can't reach a bag; I got this sample in the wrong hand.

05 00 22+ CDR It's a piece of glass, all right - part of it crumbled but - I got to get that in a bag. Oh, man, is that a nice piece of glass. Just laying out there all by itself. Jack, you got a jag handy while I take my pan. I can't reach a bag; I got this sample in the wrong hand.
05 00 22+ LMP I don't have a bag. (SEP)(SAMP?)

05 00 22+ CDR You don't have - well, take one off of mine and give it to me. I'll take it back to the Rover. (SEP)(SAMP?)

05 00 22+ LMP Bag number 460. (SEP)(SAMP?)

05 00 22+ CDR I'm halfway out on the north course of the SEP. (SEP)

05 00 22+ LMP It's brown vesicular glass. Sort of a yellow-brown, as a matter of fact. (SEP)(SAMP?)

05 00 26 01 CDR Okay, it says - take locator photo to LM. I thought I took a pan here. The LM wasn't - okay. (PHO 134 26437-46)

05 00 26+ CDR Yes, I'm here. I'm going to get a partial pan, Bob. (PHO 134 20437-46)

05 00 26+ CDR Okay, take locator to photo LM; I got it. I'm on about 71 on my frame count. (PHO 134 20437-46)

05 00 26+ CDR Okay, 670, 010, 101; that's 670, 010, 101. (SEP)

05 00 29+ LMP I'll walk back. (SEP)

05 00 29+ LMP Boy, here's a big boulder. (SEP-LM)

05 00 33 39 LMP Hey, I got a football-size rock of this coarsely vesicular gabbro. It's off a large 3- to 4-meter buried boulder northeast of the LM about 30 meters. (SEP-LM)(SAMP 70035)

05 00 33+ LMP It'll be in the big bag. (SEP-LM)(SAMP 70035)
05 00 33+ LMP Undocumented, it's roughly tabular - 15 by 25 centimeters and about 5 to 7 centimeters thick. One face is very flat; looks like it was off of a parting plane, which were in that rock.

05 00 33+ CC Okay, and if it fits in the SRC with all the other samples, you might put it there because the SRC's going to be kind of empty.

05 00 33+ LMP Well, it was pretty big. It's in the big bag now. We can do that.

05 00 36+ CDR Okay, Bob, 086, 0.5, 0.1, (LRV at LM).

05 00 36+ CC Let's put all the stuff in that bag, Jack - both the (LM) stuff that's in yours and the stuff that's in Gene's.

05 00 36+ LMP Okay *** samples - two samples from under the LMP's seat.

05 00 36+ LMP I've got to put your those samples in the SRC, in your bag; and we'll save this one, I guess.

05 00 36+ CDR Okay, you're filling which bag, the -

05 00 36+ LMP Putting them in the bag that goes into the SRC -

05 00 36+ CDR That's SCB 1.

05 00 36+ CDR Okay; let's see, offload LM - PLSS - core cpr dispenser tools. Okay, as soon as you get that, I'll take that SCB 1 from you, and I'll close the SRC 1.

05 00 36+ CC I gather you didn't have any Rover samples today, did you, Jack?

---
05 00 36+ LMP No, I have one sample bag in my pocket that has a rock in it. (LM)(SAMP?)

05 00 36+ LMP Okay, Gene, where's that - you want to put that little rock? (LM)(SAMP 70018)

05 00 36+ CDR Yes, is it there? (LM)(SAMP 70018)

05 00 36+ LMP Well, what did you do with it? (LM)(SAMP 70018)

05 00 36+ CDR It was on the floor on my side. (LM)(SAMP 70018)

05 00 36+ LMP Your side? (LM)(SAMP 70019)

05 00 36+ CDR There it is; let me get it. (LM)(SAMP 70018)

05 00 36+ LMP We can put that in one of the core tube slots here. (LM)(SAMP 70016)

05 00 43+ LMP The rock that Gene picked up - early - right at the start, is in a core tube slot in the SRC 1. (LM)(SAMP 70018)

05 00 43+ LMP That's almost full of samples, and I think that big rock probably wouldn't fit in there. (LM)(SAMP 70035)

05 00 43+ CC Okay, then we'll put that in the big bag. (LM)(SAMP 70035)

05 00 43+ LMP It's in the big bag. (LM)(SAMP 70035)

05 00 43+ CDR Okay, the seal is clear, like I promised I'd make it, coming over the top. Bob, the seal is clear (LM)

05 00 43+ LK^2 Containment bags and two cameras are stowed in the ETB. (LM)
05 00 43+ CC Give me your consideration - on that question of bringing back the big bag into the cabin. (LM)
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05 00 47+ LMP I'd like to do that - look at that rock with a hand lens on it (LM)(SAMP 70035)
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05 00 47+ CC Do you think it'll go in the SCB number 2? (LM)(SAMP 70035)
05 00 47+ LMP What would - the rock? (LM)(SAMP 70035)
05 00 47+ CC Yes, that's right. (LM)(SAMP 70035)
05 00 47+ LMP Well, it'll go in there. It's not that big. (LM)(SAMP 70035)
05 00 47+ CC Why don't you put it in SCB 2 and bring that in, instead. Leave SRC out, and then we'll just leave SCB 2 in forever. (LM)(SAMP 70035)
05 00 47+ LMP Okay. (LM)
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05 00 48+ LMP While you were talking, I got all the mags - Romeo, Alpha, Bravo, (6c'f?), Charlie. (LM)
05 00 48+ CC Hotel. Hotel. (LM)
05 00 48+ LMP That's on our camera. (LM)
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05 00 48+ LMP Put it down here. Okay, I've got the maps, the 500 mag, yes - and the three - two cameras. (LM)
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05 00 56+ CC SCB 2 for the big rock there, Jack. (LM)(SAMP 70035)
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05 00 56+  'MP I got it. That's a big rock.  (LM) (SAMP 70035)

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05 01 16 55  CDR Okay. The reading is 000, 133, 201, and I can only (LM) assume that one of us hit it. I think I've got time to give you another one.

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05 01 21 11  CDR 670, 021, 501 – 670, 021, 501.  (LM)

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05 01 31 08  CDR Forward hatch is closed.  (LM)
05 02 35 24 LMP Joe, bag - collection bag 2 is 16. 
(BETWEEN EVAS)

05 02 35 01 LMP And the SRC is 32 pounds. 
(BETWEEN EVAS)

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05 03 43+ CC Was there any spillage of the material in the drill core while you were breaking it down? 
(BETWEEN EVAS)(SAMP CORE 70001-09)

05 03 43+ CDR No, sir; I didn't lose any. 
(BETWEEN EVAS)(SAMP CORE 70001-09)

04 03 43+ CC When you were drilling the deep core where the neutron probe was, could you see the RTG over the rock? 

04 03 43+ CDR Yes.

04 03 43+ CC You have any feel for how high the rock is or how low - how deep the thing was with respect to the - with respect to the RTG? Were you down in a level that was below, even without the rocks being there? 

05 03 48 10 CDR Yes, I think I - yes, I was in a slump. There was a ridge between us and the RTG, and I had the rock in a line of sight between it and where I put that core. And I'd say the rock was certainly near the ridge and it was - what, Jack? - I don't know was it meter high for the most part. And it sloped off, and I'd say at least a half a meter high in the line of sight from where the neutron probe is to the RTG. Plus, there's a lot of undulations - I think it'll be below the line of sight, anyway. 

05 03 48+ CC And a somewhat more general question, here. It says (BETWEEN EVAS) - and I'll read it. We're still puzzled as to whether there is a dark mantle. Could you say something more about the dark regolith surface? There's a lot of discussion, today, about whether or not it could have been a regolith derived from the intermediate gabbro which you were sampling as boulders.
05 03 48+ LMP Bob, I think I don't have too much to add to what I said, near the end of the EVA, is that I do not have an intuitive feeling that the regolith has been derived from most of the boulders that we're seeing. But - because those boulders are fairly light-colored, they look like they're probably 50 percent plagioclase. It could be that the regolith is derived from some other material that has blanketed the area. I don't think we have that answer, yet.

05 03 48+ CDR Bob, the boulders we are sampling - I think Jack and I both feel that it's probably - we feel we sampled the subfloor because we saw on the sides of the craters where some of these boulders were exposed almost as if they were bedrock down there. In driving back from what we called Station 1, we could definitely see the light mantle out in the area where the potentials of a slide are.

05 03 48+ LMP It is sort of strange that we don't see a good population of finer-grained rocks. These rocks look very much like igneous rocks, but they're considerably coarser than comparable - we'll, they're about the grain size of some of the coarse-grain mare basalts that tend to differentiate the crustobalite and tridymite - but we didn't see any of the finer-grain versions. If it's an intermediate crystalline rock, we have not seen any fine-grain equivalents yet. At least not in abundance.

05 03 48+ CC We gather that there's no color change in the dark mantle material at depth. In other words, the footprints, wheel tracks, and the rake sample, etcetera, were sort of uniform in color.

05 03 48+ LMP No, there's no major change, but looking out the window and I think I commented on it, the disturbed regolith is darker. Oh, I don't know, maybe by 10 percent albedo, something like that, than the undisturbed surface.

05 03 48+ CC I remember your commenting that when you were walking to the ALSEP, I think, Jack in fact.

(BETWEEN EVAS)
05 03 48+ CC Okay, during drilling of the heat flow holes, Gene --

05 03 48+ LMP That's right.

05 03 48+ CC - - - - was there change in color of the cuttings as they piled up - as you went down in depth? Do you remember any of that?

05 03 48+ CDR Yes, Bob, both in the core and the heat flow holes, it really didn't seem to pile it up like you're accustomed to it at the Cape, and I guess maybe that's because I was kicking so much dust around there. But I looked specifically when I cleared flutes, and what have you, and I didn't see any difference in terms of color, texture, or anything else coming up.

05 03 53 04 CC The outcrops you think you see in the North and South Massifs, do they appear to be linear, horizontal, or subhorizontal? Can you see layers and do you have any feel for the thickness of the attitude or the continuity of them? Can you discuss these outcrops?

05 03 53+ CDR Bob, going over yesterday, I thought I could see a structure dipping off to the southeast, apparent dip anyway, on the eastern side of the South Massif. Or northeastern side. We haven't examined them in detail because we were in a rush to get out. We'll put the binoculars on them and try to examine that question. There's nothing very obvious, any more than you can see in the photos, that the edges were concentrated in the upper portion of the massif's units.

05 03 53+ CC Okay, the next question which calls for a little bit of discussion is: The layers of lineaments that you remarked on in the Sculptured Hills, can you say anything about them?

05 03 53+ CDR Yes, Bob, I did. I think I said - and I commented, I'm not sure whether it was the sun angle or not, but see, I was not looking at the Sculptured Hills. I was looking back at Bear mountain, I believe.
And, to me it looked like there was some organization that was digging back to the east, somewhere between, oh, 20 and 25 degrees maybe. And it was very obvious to me but I'm a little hesitant because of some of this sun-angle stuff.

05 03 53+ CC I gather we didn't get any 500 millimeters of these... limitations, that right? (BETWEEN EVAS)

05 03 55+ CDR No, but I think we will. They were on the western side of Bear mountain back there, and I think I commented that I thought that Bear mountain is probably what the Sculptured Hills look like. (BETWEEN EVAS)

05 03 53+ CC Is there a scar above the light mantle material? In other words, the slide, is there a scar above that on the South Massif? Can you see anything up there to indicate that it might have come off of there? (BETWEEN EVAS)

05 03 55+ CDR Nothing obvious yet, Bob. (BETWEEN EVAS)

05 03 53+ CC On the way back to Station 1, you described a small crater with light material on the bottom. Can you say anything more about that crater? (BETWEEN EVAS)

05 03 53+ LMP Bob I don't remember saying that, or Gene doesn't either. (BETWEEN EVAS)

05 03 53+ CC You talked about something that was light I don't remember — I thought it was a boulder, but the question's about a crater. (BETWEEN EVAS)

05 03 53+ LMP You're right, there was a large zap pit in a boulder that was very white. It must have been — the crater must have been 2 centimeters diameter anyway. And it had about that, or maybe 3 centimeters worth of crushed minerals around it, that gave it a white, very bright white appearance. (BETWEEN EVAS)

05 03 57+ CC When you went to Station 1A, we're calling the new Station 1 — Station 1A, were the blocks there as well-filleted as those near the LM and the ALSEP? Do they all look the same? (BETWEEN EVAS)
05 03 57+ **LMP** All the boulders had filleting to a slight degree but not an extreme amount. I think it no more than that what is being caused by the redistribution of the darker, fine-grained regolith.

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05 03 57+ **CDR** - - - If I had to answer that question, I'd say yes. Yes that the fillet - boulders are filleted over there about like they are over here. That would be my impression.

05 03 57+ **CC** Is there any indication that the fillets are directional, in other words, that the fillets are heavier on one side than the other?

05 03 57+ **LMP** Bob, haven't noticed that.

05 04 01 49 **CC** Okay, I copy that. Do you have the feeling that some boulders are more rounded --

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05 04 01+ **CDR** That's a good reminder, Bob.

05 04 01+ **CC** Do you have an; feeling that some boulders are more rounded than others? Apparently this looked this way in some of the TV pictures.

05 04 01+ **CDR** Some of the big ones that are just barely exposed above the regolith looked quite well-rounded. Most of those around the craters are subangular. I got the impression that it's just purely a function of how long the same material's been exposed; but some of the big boulders like the one out near the geophones is quite angular in part and quite rounded on other parts. It's quite variable.

05 04 01+ **CC** Do you want to say any more about that boulder? Did it seem to have more or less the same lithology, in addition to the variation in vesicle size that the other rocks in the vicinity of the ALSEP, and the other rocks out at Station 1 had?

05 04 01+ **LMP** It's very comparable to the ones that we saw at Station 1, as a matter of fact.
Both types of rocks were there, both variations. (BETWEEN EVAS)

Do you have a feeling for where the big blocks in the LM-ALSEP area came from? Do you think they were from Camelot, like I've been saying?

Don't have any idea yet, I'm really not sure. (BETWEEN EVAS)

As you drove along on the traverse from the SEP to Station 1, did the size of the small craters with blocky rims vary? In other words, what we are looking for here is the variation in the thickness of the dark mantle.

I can't answer that one yet, Bob. (BETWEEN EVAS)

Let me sum up by saying that I guess, as I indicated before, our best guess is that the vesicular crystalline rock, probably gabbro, or I think you've been calling it intermediate basalt or gabbro, forms at least the upper part of the subfloor. I don't think we've been close enough to a large crater rim to say that it's what the deep sections of the subfloor form, but we think that this intermediate gabbro vesicular rock, at least medium-grained, perhaps coarse-grained rock, forms at least the upper layer of the subfloor.

Yes, Bob, I think that's pretty safe, right now. (BETWEEN EVAS)

Once again, I'm surprised that it's as coarse as it is, that being the upper portion of a plains unit.

Driving back from Station 1, where we did some of our circling and what have you. We didn't have time to get off, but we did see down in — I don't remember whether it was in the slopes of some craters, or down on the slope itself, but I'd say several meters down below the mantle where there was what we almost agreed to, might be bedrock at least, a deeper portion of the subfloor.
05 04 07: CC Okay. After the line: "Empty ETB as follows," change the first line which reads: "B&W mag Golf in forward RH SSC," to read: "B&W mag Hotel in LCG compartment." And then go into the next column which begins: "Stow in ETB." Change the second line, which reads: "LMP's camera with B&W mag Hotel" to "LMP's camera with B&W mag Golf." Then mag G, ETB. Over.

05 04 07: CDR Got you. Hotel, stow it; end go out with Golf. (BETWEEN EVAS)

05 04 17: LMP Just to bring you up to date on magazines. Mag "bravo" has 77 frames. (BETWEEN EVAS)

05 04 17: LMP "tag" Hotel has 03 frames. (BETWEEN EVAS)

05 04 17+ CC Jack, on your mag Hotel, we'd showed you all the way up to 183 at one time, on that. Did you miss the 1, this time?

05 04 17+ LMP I may have clipped it out, Joe. 183, yes. (BETWEEN EVAS)

05 04 17+ LMP Mag Romeo has 21 frames. And I took a few, random, and probably not very good 500 millimeter of the North and South Massifs. (BETWEEN EVAS)

05 04 22+ LMP And Joe, verify that you want mag Charlie substituted for mag Bravo on CDR's camera. (BETWEEN EVAS)

05 04 22+ CC Jack, I think the answer to that is yes. Per the checklist, by the way. That's the way we show it in our checklist here. (BETWEEN EVAS)

05 04 22+ LMP Roger. We probably have about 100 frames left on Bravo, so we'll just keep track of that. (BETWEEN EVAS)
05 05 24+ LMP Joe, I just took a – quick look with the hand lens at that large rock I brought in, and I don’t think there’s much more than 30 percent plagioclase. I’ll go back could be more of a standard basalt or gabbro. It has a fair proportion of ilmenite in it, I believe. There’s bright platelets – in the vugs or vesicles – of ilmenite. Now it could be that the glass – if the soil is very glassy, that it’s developed the darker color from the contribution of the basic minerals through the glass, particularly the iron and the titanium.

05 05 24+ LMP All it means is that we don’t yet know the origin of the dark mantle.

05 05 24+ LMP That rock – looks I may have, by accident, sampled the front side of one of the parting planes that I mentioned. Very, very sharply bounded on one side of a planar surface.

05 05 24+ LMP I mentioned when I sampled it, it had one very planar surface, and looking at it more closely, it looks like one of those parting planes that I talked about earlier in the EVA.

05 14 48+ CDR After thinking and looking at the map last night and recalling what I saw during landing and where I was planning on putting it down and everything, I still think, to the best of my knowledge, that we are about 1 or 2 o’clock, and I’ll increase up to about 200 meters or so west and slightly north of Poppy.

05 14 50 56 CDR The thing that fooled me yesterday is this depression out at 9 o’clock here, which is greatly undersized for Trident, really isn’t Trident, and I said yesterday, I didn’t think how we could be that close. Well, we really aren’t. Trident is way out there, and I’ll still hold to my 200 meters at 1 to 2 o’clock of Poppy.

05 14 50+ CC We’re thinking you might have, on the way to the geology stops, driven between a couple of the Trident craters then.
05 14 50+ CDR Yes, we may have coming back. I think went all the way around to the east of the last one going out, though.

05 15 04+ LMP Family mountain, the northeast facing slopes, although lower has boulders and outcrops. I mean below the outcrop. It has boulders from local block concentrations. Looks very much like the South Massif does.

05 15 09 50 LMP Let me give you a few observations. That outcrop I talked about that was way at the top of the South Massif at the break in slope - at the very top of the break in slope - almost looks - it's hard to tell that it's in place outcrop up there. It's hard to convince myself that it is. Looks like there's some very large and many, many small fragments of large-like 3- and 4-meter rocks up there and a lot of smaller fragments. I've seen that type of thing in a number of places over the South Massif. However, they all seem to be sitting on top of the South Massif surface, but I do see one other area that looks like there is a - it is protruding from within some sort of mantle on the South Massif. So conceivably some of that could be in place. An additional impression I got is that at least with the monocular, that those fragments - those boulders look much more angular than what we've seen here. And, for the most part they appear to be - if covered at all - very little by any mantle except the one I just mentioned.

05 15 09+ LMP Through the monocular, in contrast to the tan-gray of the South Massif, those large blocks up there look blue - very distinctly blue-gray. Not unlike Gene mentioned yesterday, anorthosite - anorthosites look in certain terrestrial environments.
I can look up on the scarp — out to 9 and 10 o'clock. It's practically the same color as the South Massif. It just looks to be very undulating. I see no outcrop evidenced here in the scarp. I think I can just about see where Hole-in-the-wall is, but it's so subtle that I can't really tell you much about it. And the local terrain, which I think is the southern rim of Camelot, just about blanks out where Hole-in-the-wall should be — just about covers it up. But what I can see in a small little saddle to our local horizon here in front of us — I can see out there just about — oh, I'd say, 100 meters or so to the south of Hole-in-the-wall and it just looks like a subtle undulating slope. We can't really tell too much the steepness from here.

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Bob, I think, based on what I saw yesterday, that the chances are pretty good that all the big blocks out here in the dark mantle area will be pretty much the gabbros. By the way, I looked at that with a hand lens last night, and I don't know that you got the report, and I'm back to saying that it's probably closer to 30 — 40 percent plagioclase. It's a good gabbro, a final pyroxene gabbro, and it apparently has a fair amount of ilmenite in it. There's some bright shiny needles within the vugs and some dark minerals in the matrix that are probably ilmenite. And one other additional possibility then, is that the mantling we're seeing here, is just dark fine glass — darker than usual, because of the iron and the titanium in the rock itself. Also, the probability, I think, still has to be considered that you're dealing with a true mantle that has been gardened enough that at least where we're seeing it now, in the first few tenths of a centimeter that it is unrecognizable as a mantling unit yet. The relationship to the large boulders is, I think, one right now, of just filleting and a small amount of covering because of the local gardening process. We haven't seen any clearly mantling relationships between the dark mantle or the surface materials here and the large boulders.
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* * * * EVA 2 * * * *

05 17 54+ CDR Okay. We can start our watch. (LM)

05 18 02+ CDR Okay. I'm going down the ladder. (LM)

05 18 03+ CDR The reading is 222, 262, 207; that's 222, 262, 207. (LM)

05 18 05 LMP Okay. I'm on the ladder. Door is closed. (LM)

05 18 10 48 LMP Mag Romeo is going to go on the old 500 in a minute. (LM)
Mag 'rdia is in there. Mag Kilo, mag Juliet, mag Bravo, mag Delta.

05 18 12 05 CDR The SRC organic sample has been sealed. And the SRC (LM)
lid is staying almost closed, about 2 or 3 inches open; if that's fine, I'd like to leave that.

05 18 21 22 LMP Okay. The pan's complete. (LM)(PHO 137 20866-93)

05 18 21+ LMP And, Bob, those pans around here have more pictures (LM)(PHO 137 20866-93)
because I'm having to be sure I get the masses -
I'm having to take extra pictures.

05 18 24+ CDR Okay; SCB goes under your seat. (LM)

05 18 24+ CDR We got SCB 4, goes to you, and SCB 6 goes on the gate. (LM)
05 18 27 19 LMP SCB 7's in my seat. (LM)

05 18 33+ CDR Now, I want 4. (LM)
05 18 33+ LMP I took 8 off. (LM)
05 18 33+ CDR No, sir. I want 4 and 6. Why don't you just substitute -- (LM)
05 18 33+ LMP Hey, I just took 8 off. Can we use 8 instead of 6. (LM)
05 18 33+ CC Yes. (LM)

05 18 33+ CDR We'll use 8 instead of 4. (LM)

05 18 33+ CC -- 8 will be on the LMP. (LM)

05 18 33+ CDR We need 6 off of there, Jack. (LM)
05 18 33+ LMP Oh, your 5 stays back here, huh? (LM)
05 18 33+ CDR We need 6 to the gate. (LM)
05 18 33+ LMP It's probably behind 4, isn't it. (LM)
05 18 33+ CC Well, put 4 on the gate -- then put 5 on the Commander. (LM)
05 18 33+ LMP Yes. Okay; 4 is going on the gate and 5 on the Commander. (LM)

05 18 36+ CDR You've got -- we I guess SCB 8, if I'm not mistaken. (LM)
05 18 36+ LMP Yes. (LM)
05 18 36+ LMP Okay. You can give me SCB 5.

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05 18 39+ CDR 670, 017, 701; 670, 017, 701.

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05 18 41+ CDR This here's frame 27, mag Charlie.

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05 18 41+ LMP I had to relaunch how to document samples, Bob. I just have. The first part of my roll will have a lot of random exposures and focuses.

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05 18 41+ LMP And while I'm waiting for Gene, getting a rock - it looks a little finer-grained than the others we've seen in the LRV sampler, along with some soil. And that's in bag 22E. It has the stereo documentation and a locator to the LM, and it's about 2 meters from the SEP.

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05 18 44+ CDR I'm on the way. (LRV leaving LM)

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05 18 44+ CDR Hey, Bob, I'm 3 meters to the west of the transmitter and about 2-1/2 meters south of the line going west.

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05 18 47+ CDR Okay. 265, 0.2, and 0.1.

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05 18 48 24 LMP Twenty-three Echo, if that followed in sequence, is another rock near the SEP documented in the same way.

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05 18 48+ CDR Okay, Bob. 265 - 265, 0.3, 0.1; roll is 1 right, pitch is 0, and the sun-shadow device is 0. I'm heading 281 degrees.
051848+ CC   Okay. We're ready for you guys to go. We presume you have the SEP photos, Jack.  
051848+ LMP  Yes, I do.
051848+ CC   Remember to pick up EP 4 when you get in the Rover.
051848+ LMP  Okay. We got it, and the frame count is 17.
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05185104 CDR  Okay. We are moving right now.
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05185143 CDR  Mark it. (end of SEP antenna)
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05185147 LMP  We want to get at 080 and 0.4 and get rid of this charge.
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05185147 CC   Because we think we're 200 meters east of where we were, you should probably increase all those numbers except for the explosive package numbers by about two-tenths to get the distance at which you will come across these areas. Again it's about 0.4, 0.5, and we expect to deploy EP 4. The most important number though is that it's 0.2 west of the ALSEP. As you pass the ALSEP, you might know what the range and distance are reading at that point.
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05185147 CDR  Let me get around your flag. There's your flag way out there, isn't it?
05185147 LMP  Yes.
05185147 CDR  Let me get around that. Man - that's really giving the ALSEP some room.
05 18 51+ LMP Yes. Okay, Bob. We're still seeing - the light-colored gabbroic rocks. I think the reason I said 50 percent was because in this light they look light-colored, and that's probably largely because of the zap of the halos.

05 18 51+ LMP But, in the hand lens, it looked like the standard gabbro.

05 18 51+ LMP We're almost due south of the ALSEP now.

05 18 51+ LMP Let's see a little rocky out here.

05 18 51+ CDR We just clicked to 4. I want to move over this way just a skosh.

05 18 51+ LMP I'm just south of my geophone 2 flag now.

05 18 51+ CC Okay. If you just clicked to 4, let's go to 6 then, just past the click on 6.

05 18 51+ LMP Okay. And you want about 0807?

05 18 51+ LMP Okay. Hole-in-the-wall should be just to the left of the notch.

05 18 51+ CDR Yes. That's exactly where I'm heading.

05 18 51+ LMP And I think we're coming up closer to the rim of Camelot. It's starting to look like a crater now.

05 18 55 00 LMP Looking down-sun, I see no major albedo changes except for the very fresh crater which are brighter. By maybe 20 percent.

05 18 55+ LMP Can you move forward, and I'll get it (E7) in that little depression.
05 18 55+ LMP You see on the other side of the rock. (SEP-2)(EP 4)
05 18 55+ CDR Okay, Bob; 083, 0.6, and 0.5. (EP). (SEP-2)(EP 4)
05 18 55 57 LMP Okay. Pin 1, pulled and safe; pin 2 is pulled and safe; pin 3, pulled and safe. (SEP-2)(EP 4)

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05 18 56+ CDR I'll do a partial for you. (SEP-2)(EP 4)(PHO 135 20563-69)
05 18 56+ LMP Yes. We got to do a partial. (SEP-2)(EP 4)(PHO 135 20563-69)

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05 18 56+ CDR Get your pan?
05 18 56+ LMP Yes. (SEP-2)(EP 4)(PHO 135 20563-69)

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05 18 56+ CDR Okay. I'll just come on around, and I'll pick up my tracks. (SEP-2)(EP 4)

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05 18 58+ LMP And we're rolling. (from EP site) (SEP-2)
05 18 59 22 CC Okay, copy. You're moving. (SEP-2)
05 18 59+ LMP Let's go to Hole-in-the-wall. (SEP-2)

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05 18 59+ LMP The surface is not changing in terms of the detail. (SEP-2)
   The surface texture of the fine-grained regolith
   still has a raindrop pattern. The blocks still look
   very much like what we sampled yesterday around the
   LM. They're light-colored, apparently gabbros, with
   zap pits - zap halos. Occasional craters show
   lighter-colored ejecta all the way down to - say
   half a meter in size. Other craters that are just
   as blocky as those with bright halos have no
   brightness associated with them. Most of the
   brightest craters have a little central pit in the
   bottom which is glass-lined. The pit is maybe - a
fifth of the diameter of the crater itself. It's a fairly standard thing for most of these fresher craters, is that little central pit.

05 19 01 CDR Okay, we're just south of the rim of Camelot. There (SEP-2) is a light mantle on the other side. Look at that crater.

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05 19 02 CDR Take a couple of pictures looking at that. (SEP-2)(PHO?)
05 19 02+ LMP Okay. Can you swing a little? (SEP-2)(PHO?)
05 19 02+ CDR Yes. (SEP-2)(PHO?)
05 19 02 36 LMP Okay, I got them. (SEP-2)(PHO?)
05 19 02+ CDR That is a 600-meter crater. (SEP-2)
05 19 02+ CDR And it is very likely we won't have any problem finding blocks on the rim of Camelot. (SEP-2)

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05 19 02+ CC How about bearing and range to help us pick out the LM location. (SEP-2)
05 19 02 50 CDR 083, 1.2, and 1.0. (SEP-2)

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05 19 02+ CDR Man, are there blocks there. (SEP-2)
05 19 02+ LMP Now that - little crater in the ejecta of Camelot, at least the rim of Camelot, did not bring up blocks on the rim. It may have been an old depression. Bob, there is extremely blocky area. I think Station 5 was over there where that block area is. The light-colored areas on the photos are essentially - blocky. They're probably 30 percent blocks. Many of them are in the 2- to 3- to 4-meter size range. All of them look light-colored, look like the gabbro we sampled from a distance. They have light-halo zap pits on them. I see only occasional gray varieties, which I believe are the nonvesicular ones like we also sampled.
05 19 02+ LMP  But the light-colored gabbros are dominant.  (SEP-2)

05 19 02+ LMP  Station 5 would have been - rather than in a light-colored area would have been in a very blocky area. Station 5 is probably still very good for blocks. (SEP-2)

05 19 02+ LMP  There is probably as big blocks there as anywhere on the rim that we've seen.  (SEP-2)

05 19 02+ LMP  We ought to be going - really between Horatio and Camelot now. (SEP-2)

05 19 02+ CDR  No. I'm going to give them a call when we're due south of Camelot and see if they can't get a position on us. (SEP-2)

05 19 02+ LMP  Watch that block there; it's probably more than 14 inches. And got a fairly close look at the rock, and it is the vesicular - looks very much like the vesicular clinopyroxene gabbro.  (SEP-2)

05 19 02+ LMP  Now, the surface of Camelot is mantled - or the rim - is mantled with the same dark-gray material, and it has the same surface texture - a very fine raindrop pattern. The saturation crater size does not look bigger than a half a meter, if that. (SEP-2)

05 19 05 30 CDR  081, 1.6, and 1.4. We're south of the center of Camelot. (SEP-2)

05 19 05 52 CDR  We can definitely see the light mantle as it comes out over the valley here, and we're looking at Hole-in-the-wall, although it's still too subtle. We're looking right at Lara, as a matter of fact,  (SEP-2)

05 19 05+ LMP  Yes. There's Lara, very clear; and Hole-in-the-wall, you can see it.  (SEP-2)

05 19 06 09 CDR  There's Horatio way over there where those blocks are. See it?
05 19 06+ LMP Yes, that's Horatio. We're right on course, sir. Here's a little depression we didn't talk about, though, between Horatio and Camelot. But it's a depression and not a blocky crater at all. As a matter of fact, the total block population has changed - once we get away from the rim of Camelot the block frequency is quite a bit smaller. It's down - maybe to only - less than 1 percent of the surface.

05 19 06+ CDR Much easier driving with the hover. Because of the blocks and because of the smaller blocky craters, and very subtle-type craters are in this area.

05 19 06+ LMP There are up to 2-meter, bright-halo, blocky craters - and that's blocky-wall craters that may be instant rock rather than - I think it is rather than bedrock in the rim area of Camelot.

05 19 07 27 C Horatio has got to be - there's Horatio, right there.

05 19 07+ LMP Yes. That's Horatio.

05 19 07+ CDR Let me give another mark on the southern rim of Horatio.

05 19 07+ LMP The scarp looks very smooth from here - no obvious outcrops at this time. Don't seem to be stratifying to any bedrock in the area we're traversing now, just to the southeast of Horatio. Note that there's a blocky wall; however, the upper several meters, probably, of rim block is less weathered mantled or composed of - material, with material we've been driving through. They don't come to the rim of Horatio -

05 19 07+ LMP Horatio has quite a different appearance than Camelot. It is - and that's the main one - the rims - the blocks do not get to the rim.

05 19 07+ LMP It looks like - If Horatio is any name, the rim thickness of maybe, and this is a wild guess, but it's an average of 20- or 30-meters.
thickness lies above the exposures of the subfloor; exposures being blocks in the wall. And some of those blocks, again, are several meters, if not 5 to 10 meters in diameter. And they're concentrated on the west rim that I can see. There are very few blocks on the east -- excuse me, the west wall -- there are very few blocks on the east, north, and south walls of Horatio.

05 19 09 41 CDR We're on the southern rim; 078, 2.3, and 2.0. (SEP-2)

05 19 09+ LMP Yes. We're maybe 100 meters south of the rim. Actually, we're on the rim crest. We're 100 meters south of the break in slope into the crater. (SEP-2)

05 19 09+ CDR It's an undulating, hummocky traverse terrain in here, Jack. (SEP-2)

05 19 09+ CDR These little craters make it bumpy; but, other than that, it's really smooth sailing. (SEP-2)

05 19 09+ LMP This is what I sort of expected dark mantle to look like, rather than what we landed on. Not more than 1 percent of the surface, and that percentage continues right over the rim crest of Horatio down onto the wall until you hit the big blocks. (SEP-2)

05 19 10 24 CDR What's this depression? We're not to Bronte yet. (SEP-2)

05 19 10+ LMP No, we're not at Bronte. (SEP-2)

05 19 11 13 CDR I'm sitting on 080 right now and 2.6. I think we've got to add a little bit to that ***

05 19 11+ LMP The surface is not changing. We see no craters that seem to penetrate into bedrock cut in here -- that is with blocky rims, and that's quite a contrast to the area we sampled at Station 1A yesterday. I cannot see in my field of view any blocky-rim craters. There are light craters with fragmental rims and rims, but it looks like instant rock rather than the subfloor material.
CDR Jack, can you see over there to the left? I'll turn a little bit—on the dark area of the South Massif where you get those impressed lineations. See them going from left upward to the right?

LMP Yes. I see what you mean; right. (SEP-2)

CDR That's what I saw out my window. (SEP-2)

LMP Yes—towards left—they go obliquely up the slope. (SEP-2)

CDR They're more like wrinkles, they're—linear wrinkles. (SEP-2)

LMP Yes, crumulations, you might say, in the slope that look something like those I saw from orbit—looking in the shadowed area—at the edge of the shadows. Bob, we've seen craters as much as—20 meters, maybe 30 meters in diameter without blocky rims. (SEP-2)

LMP The rim block population is not much different than the average for the terrain here. (SEP-2)

CDR If we can't recognize a change is that albedo when we get onto that white mantle, I'm going to be surprised. (SEP-2)

LMP The right mantle is just what Gene has said. There are some very bright craters in it—they stand out. Bright-haloed craters scattered over it, that—seem to be quite a bit brighter than anything we have out here on the dark mantle. See those blocks over there? That's the first different colored blocks I've seen; they're sort of gray-looking. (SEP-2)

CDR Where are you looking?

LMP Over to the right a little bit. (SEP-2)

JR Darker-gray, a little bit. (SEP-2)

LMP There's a crater with a big mass of block in the bottom. It looks like it might be a secondary fragment from somewhere. (SEP-2)

CDR Do you want to get a photo as we go by? (SEP-2)
05 19 13+ LMP Yes, can you swing a little bit to the right? (SEP-2)(PHO 135 20623-27; 137 20895)
05 19 13+ CDR Yes. (SEP-2)(PHO 135 20623-27; 137 20895)

05 19 13+ LMP Do we have time for an LRV sample? (SEP-2)(LRV 1)(SAMP 72130-35)(PHO 135 20623-27; 137 20895)
05 19 13+ CDR If you can do it quickly. (SEP-2)(LRV 1)(SAMP 72130-35)

05 19 14+ LMP Swing a little bit to the right now. (SEP-2)(LRV 1)(SAMP 72130-35)
05 19 14+ LMP Right up across that little ray. (SEP-2)(LRV 1)(SAMP 72130-35)

05 19 14 34 CDR 082, 3.0, and 2.6. (SEP-2)(LRV 1)(SAMP 72130-35)

05 19 14+ LMP Okay, Gene. That's a pretty big rock in there. (SEP-2)(LRV 1)(SAMP 72130-35)

05 19 14+ CDR It's got quite a bit of dirt in it. (SEP-2)(LRV 1)(SAMP 72130-35)
05 19 14+ LMP This is a block from a linear-strewn field of very irregular and jagged rocks that are southwest of a crater that's 10 to 15 meters in diameter. It looks like the material that may have formed the crater, and you can look at some of the pictures and make up your own decision. (SEP-2)(LRV 1)(SAMP 72130-35)

05 19 16 02 CDR Twenty-six Echo, Bob. We're on our way. (SEP-2)(SAMP 72130-35)

05 19 16+ CDR And I did get my locator here. (SEP-2)(PHO 135 20623-27; 137 20895)
05 19 16+ LMP I got mine. (SEP-2)(PHO 135 20623-27; 137 20895)
05 19 16 17 LMP The frame count is 95. (SEP-2)
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05 19 16+ LMP We're in a little area where the fragment population may be up to 3 percent. It's getting a little more like what we saw around the LM. In fact, I would say it was comparable now.
05 19 16+ CDR I'm going down this slope and up the other side. (SEP-2)
05 19 16+ LMP But nothing like Station 1. (SEP-2)
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05 19 16+ LMP The blocks I see still seem to be the gabbro, except for that one sample we took, which I hope was what I thought it was.
05 19 16+ CDR Gee, it's blocky here.
05 19 16+ CDR Oh, that's a big crater. We got to get around here. (SEP-2)
05 19 17 50 LMP That must be Bronte. (SEP-2)
05 19 17+ CDR My gosh, is that big. (SEP-2)
05 19 17+ LMP That's bigger than I expected. (SEP-2)
05 19 17+ CDR I got to go around this thing. (SEP-2)
05 19 17+ LMP Yes, yes. There are some very--- (SEP-2)
05 19 17+ LMP *** blocks, greater than the normal gabbro we've seen, that have very large, egg-sized vesicles in them. (SEP-2)
---
05 19 17+ LMP I wonder if I took a picture of that block deal? I hope I did. (SEP-2)
05 19 17+ CDR I'm going to go through this niche between--- on a high point in the saddle here. (SEP-2)
05 19 19 03  CDR  0.8, 3.5, and 2.9; and we're on the north side of Bronte.  (SEP-2)

05 19 19+ LMP  And it looks like Bronte has penetrated the dark mantle in here.  It got the subfloor, but there's not an awful lot of blocks around the rim - there are just some small ones - compared to what we saw around - watch it.  (SEP-2)

05 19 19+ LMP  What we saw around Horatio or in the walls of Horatio and around Camelot.  Nothing, also, like we saw yesterday at Station i.  Bob, that characteristic little dimple in the bottom of the craters is still with us, and it's invariably glass-lined in the fresh ones.  (SEP-2)

05 19 19+ LMP  Now, that's not a complete lining.  There seems to be glass agglutinates, if you will - that's holding the fragments in the bottom of the crater together.  There's one on the side of an older crater.  We're back into about a 1-percent coverage.  I suspect that the reason our block population went up there was because of Bronte.  (SEP-2)

05 19 19+ CDR  An awful lot of these small glass-lined little craters around.  (SEP-2)

05 19 19+ LMP  Yes, and you notice, Gene, what I was saying about the little dimple in the bottom?  (SEP-2)

05 19 19+ LMP  Watch the fresh ones, and they all have that little dimple as if that - you see, there's one right there.  (SEP-2)

05 19 19+ CDR  I think the white mantle is starting right over there.  See on your right?  (SEP-2)

05 19 19+ LMP  Yes, that's the first - (SEP-2)

05 19 19+ CDR  The place you can really see it is where it's reflected off the slopes of the cliffs out there.  I hate to say it, but Charlie may be right.
LMP: Well, but you know, one thing that may distinguish it is the bright-halo craters are brighter.

CDR: But I can see it from here — on the floor of the valley here.

CDR: On the scarp it really shows up.

LMP: Block population is unchanged; when I can see large enough blocks — appears to be the gabbro, although there's not as much to look at now in terms of blocks. The surface characteristics have not changed. There are no craters that we see that are bringing up clear, blocky rims. Most of the fresh craters have instant rock around them. The craters are the same size. They are older and more subdued. That instant rock is apparently broken down. I suspect a small zapping breaks that down fairly quickly.

CDR: *** up-and-down, hummocky terrain.

CDR: The terrain gets a lot more locally hummocky with some well-rounded rims but very large-aspect-ratio craters, which you got to get around in here — in the 4- or 5-meter size.

CDR: That's the white mantle we're coming up on right up here.

CDR: See that on your right?

LMP: Yes.

CDR: That's it, there's not going to be that much difference.

CDR: See, now you can look where we're going to come up on the white mantle. It's dusted with that light — look at it.

LMP: Yes.
05 19 23+ CDR We're only 100 meters from the light mantle. (SEP-2)

05 19 23+ CDR Look at this crater in here. We're coming right up on it now. (SEP-2)

05 19 23+ LMP Yes. There certainly is a change in the general albedo, particularly in the craters. The craters are much brighter in their walls than we've seen before. (SEP-2)

05 19 23+ LMP Although there still is a brown - a light-gray dusting over the top of it in here, but it's clearly different - no question about that. (SEP-2)

05 19 23+ CDR You can't see the contact as you cross it but we know we're coming into something lighter - you can obviously see it. (SEP-2)

05 19 23+ LMP Yes. We ought to sample the rim of one of these craters when we get our LRV sample, because that's what's distinctly lighter. (SEP-2)

05 19 24 44 CDR We're at 3.8 here, and we can sample that rim. -- (SEP-2)

05 19 24 48 CDR 083, 4.4, 3.8. (SEP-2)

05 . + LMP Can you get on the rim of that crater? -- right to the right there. Right here - that light stuff. See the big crater here -- and the light material right on the rim? (SEP-2)(LRV 2)(SAMP 72140)(PHO 135 20641-43; 137 70896)

05 19 24+ CDR Yes. I can get there. But I'm going to have to not give you much of a turn because it's -- (SEP-2)(LRV 2)(SAMP 72140)

05 19 24+ LMP That's all right. I got the pictures. Now, if you can swing to the left a little bit and then back - whose. Now, back right. (SEP-2)(LRV 2)(SAMP 72140)(PHO 135 20641-43)

05 19 25 17 CDR Okay, Bob. We're 083, 4.4, and 3.8. (SEP-2)(LRV 2)(SAMP 72140)
05 19 25+ CDR  We are in the light mantle. It's not a contrasting light like you might expect, or like we're looking at on the scarp as the Sun shines on it, but I don't think there's any question.

05 19 25+ LMP  Yes. The craters that penetrate into it are definitely different. However, the surface texture is unchanged. There may be fewer blocks.

05 19 26 02 CDR  Bag 27 Echo.

05 19 26+ LMP  Okay; my locator.

05 19 26+ CDR  And my locator.

05 19 26 31 LMP  I10.

05 19 26 50 CDR  One of the remarkable things is the sun-angle difference on that light mantle when you're looking at the slopes of the scarp versus what we're on. I hate to use a familiar term, but my impression right here is there is more of a raindrop influence than back at the LM, or in the darker mantle.

05 19 27+ LMP  I think the big thing is, though, that each one of these little craters is much more lightly-colored. There's no crater in view that has a blocky rim. There is fragmental rims based on, almost certainly, instant rock, but no blocky rims.

05 19 27+ CDR  You know, one of the reasons those craters look lighter is because of their sun angle. Walls of some of these little craters - it's the same material we're driving on, I'll bet. Yes, there is instant rock right there, Jack, you're right.

05 19 27+ LMP  The fragment population is certainly less than 1 percent in here.
05 19 27+ LMP When I say fragments, I'm talking about rocks that are greater than a centimeter in grain size. (SEP-2)

05 19 27+ CDR You know, it may be me, Bob; but it also seems to be a little bit more difficult to drive down-sun in this area. (SEP-2)

05 19 27+ LMP Yes, I think it is brighter, Geno. I was thinking that a minute ago, I think your normal albedo is greater. Here's some rocks now starting **. ** (SEP-2)

05 19 27+ CDR And the little craters still have the central pits. (SEP-2)

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05 19 28+ LMP Yes. There're a few blocks. They still look like the gabbro, though. Hard to tell. (SEP-2)

05 19 28+ CDR Well, a couple of them looked to me like they had some very light *** crystals in them. See that? (SEP-2)

05 19 28+ LMP I'm afraid those are zap pits. (SEP-2)

05 19 28+ CDR They could be. (SEP-2)

05 19 28+ LMP I got - I think I've been fooled by that, too, and that's why I estimated the plagiolase high. (SEP-2)

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05 19 29 14 CDR We're getting a little more blocks in here. Of course, we're approaching the dark mantle again. Now, you can see the difference. You got to look hard for it. But, you see those craters out in there are not white anymore. (SEP-2)

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05 19 29 50 LMP Looking up on the South Massif, we've got real good views of the block-strown fields. There seems to be two dominant colorations of the rock. The light-colored ones, very light-tan and to white, and then there are the blue-gray rocks. There's one major outcrop of blue-gray about a sixth of the way down the slope, the center of the field of view we have; and it looks very much like similar blue-gray
rocks right at the crest, the highest point from our vantage point.

---

05 19 30+ CDR  Bob, you want another sample of the dark mantle here? Could you use that?

05 19 30+ CC  Yes, we want - as soon as you get into the dark mantle - we're estimating it's something like 4.3, 4.4, 4.5, somewhere in that vicinity.

05 19 30+ LMP  We're there. See that batch of rocks there?

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05 19 30+ CDR  082, 5.0, and 4.3.

05 19 30+ LMP  I got the rock, and there's some dirt in there. Maybe I'd better get a little bit more dirt.

---

05 19 30+ LMP  Much soil?

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05 19 30+ CDR  Couple teaspoonsfull. Twenty-eight Echo, Bob.

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05 19 32+ CDR  And that's primarily a rock fragment. Jack's getting a soil fragment - soil sample with it.

05 19 32+ CDR  Jack, look at the wrinkles over there on the North Massif.

05 19 32+ LMP  Yes, there's no question that there is apparent lineations all over these massifs, in a variety of directions. Hey, look at how that scarp goes up beside there. There's a distinct change in texture.

05 19 32+ LMP  As a matter of fact, lineations are not present on the scarp, that we can see, where it crosses the North Massif. There is no sign of those lineations on there.
05 19 32+ LMP Look over by Hanover. (SEP-2)(LRV 3)

05 19 32+ CDR It looks like the scarp overlays the North Massif, doesn't it? (SEP-2)(LRV 3)

05 19 32+ LMP Yes. (SEP-2)(LRV 3)

05 19 32+ CDR This last one was 29 Echo. (SEP-2)(LRV 3)(SAMP 72160-64)

05 19 32+ CC And that's the soil. (SEP-2)(LRV 3)(SAMP 72160-64)

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05 19 33 28 CDR We are rolling. (SEP-2)

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05 19 33+ LMP Hanover is quite a ways up the slope. I don't think we'd have gotten to it, as we planned that time. But the appearance you have of the scarp - North Massif contact is one of the scarp being smoother-textured, less cratered, and certainly less lineated. And I wouldn't be a bit surprised if it's, as Gene says, younger. (SEP-2)

05 19 33+ CDR But it's not just this slope, it's the materials on the other side of the scarp, on the west side. (SEP-2)

05 19 33+ LMP Okay, I'm going to have to really ease up on pictures. (SEP-2)

05 19 33+ LMP That frame at the LRV sample was about 115. (SEP-2)

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05 19 33+ LMP Okay, we're back down in our old friend, the dark mantle. And I think the zero phase point is not as bright as it was. Passing a small crater, but the block population is still way down there in about 1 percent. (SEP-2)
05 19 36 12 LMP Okay here's another small crater - instant rock, with the same little pits and a spattering of glass holding the pit materials together. None of the glass linings look very coherent. They mainly just seem to be a sprinkling of glass that's - some - helping or coating the instant rock.

05 19 36+ LMP The craters at about 10 to 15 meters in diameter seem to have somewhat more blocky material in their rims. But they're not clear cut blocky-rim craters. And here's one that's probably 50 meters across that has a fair number of blocks in the bottom. Looks like it might have just about gotten down to where the gabbro starts to be abundant again.

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05 19 36+ CDR Got Hole-in-the-wall, Bob. It's a very long, very subtle, very gentle slope. We'll just have to get some more words when we get there.

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05 19 37+ CDR Oka-, 082, 5.6, and 4.9.
05 19 37+ CC Copy 4.9 on the rang. 

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05 19 37+ LMP We're not in light mantle, I don't think. Maybe we are.
05 19 37+ CDR I think we are, Jack.
05 19 37+ LMP Yes, I guess we are.
05 19 37+ CDR I think we are. According to my geology map ***
05 19 37+ LMP I guess we are. Gosh, I was going to say the craters are whiter than they have been. So, we're back in it. And - - even the phase point's brighter too.
05 19 37+ CDR I think that place where we had those small, blocky craters was in the dark mantle. They're not evident here in the lighter stuff.
05 19 39+ LMP The rock fragments still look like gabbro. The
    craters tend to have white walls and white rims,
    which they don't have in the dark mantle area. The
    block population is way down, 1 percent or less.
    However, the bigger craters do have more blocks; but
    nowhere does that population seem to get above about
    5 percent. And that's on the walls and the rims of
    the craters, say bigger than 15 meters. There's one
    probably 20 meters in diameter that has some blocks
    on it.

---

05 19 41 10 LMP We're looking at Lara. I can see blocks in the
    northwest rim of Lara. At least, it's rugged
    terrain; and it looks like blocky terrain. One spot
    is all I see. It looks like it may be a couple
    hundred meters in average diameter. It starts about
    maybe three-quarters of the way up the wall and
    goes right up on the rim.

05 19 41+ LMP Look at that crater! That pit - that central pit
    goes down about half the depth of the crater, and
    the crater is a fresh 3-meter crater. It almost was
    a cylindrical pit. Hole-in-the-wall is just a step
    - headed down to the south or southeast on the
    scarp. Scarp is just about what I think we all
    expected it to be. It's very rolling and relatively
    smooth. I don't really see any outcrops exposed
    anywhere out here to the south.

05 19 41+ LMP You see, now there's Station 3 area right up there.
05 19 41+ LMP See that bright bigger crater over there to the
    right of Lara? That's probably a good place for
    Station 3.

05 19 41+ CDR Yes, way over there. Okay, we're going to find out
    something very shortly.

05 19 41+ LMP It doesn't look very rocky, Gene.
05 19 41+ CC How about bearing and range, guys?
05 19 41+ CDR Bob, I'll give it to you just as soon as I make (at Hole-in-the-wall?) my turn. It's not too far - 100 meters -

05 19 41+ CDR I'm going right up straight ahead and then go on to the inside of that place.

05 19 41+ LMP That's more than 100 meters. (SEP-2)

05 19 43 C8 CDR 081 and 5.6. (SEP-2)

05 19 43+ LMP Now the craters are getting very, very light-colored - in the rims and walls.

05 19 43+ CDR You notice when we're in the light mantle looking at the scarp, at this angle, it loses some of its high albedo?

05 19 43+ LMP Yes. Yes. I think we're getting -- (SEP-2)

05 19 43+ CDR We've got a long depression to go around. (SEP-2)

05 19 43+ LMP Your eyes get used to it. (SEP-2)

05 19 43+ CDR Okay, Jack, we got to watch it because I got to go around a long depression. That's a crater over there.

05 19 43+ LMP On the right, yes. (SEP-2)

05 19 43+ CDR I may have to go up over there. I can't go down that hole. That one's not going to make it. (SEP-2)

05 19 43+ CDR We'll go up this gentle slope. See what's on top. (SEP-2)

05 19 44 17 LMP We made a turn to the south a little bit at 081 and 5.7. (SEP-2)

05 19 44 47 CDR I'm starting up the scarp at 081, 6.6, and 5.7. (SEP-2)

05 19 44+ LMP This is the first tongue of the scarp. (SEP-2)
Whatever makes up the light mantle is—at least, the instant rock that it forms is much lighter than anything we see. Those fragments probably are 50 percent lighter than any fragments we see on the dark mantle. And that’s around the fresh craters. But it is not blocky.

We’re doing a little zig-zag navigation. Literally came up a slope at about a heading of 240. We couldn’t get through the actual turn to the south because there is a big crater right at the foot of it. So we’re just making our way through some relatively local undulating slopes that get pretty steep, but it seems to be no problem.

There are not any blocks big enough to really make a statement about what the rock is. But it really doesn’t look like gabbro anymore.

We’re not on top of that scarp, yet. We’re still in the Hole-in-the-wall rim.

As far as lineations in the soil or on the surface that are observable at this range, I don’t see any. I think there may be a finer raindrop pattern on the light mantle than maybe there was on the dark. But that’s an awfully hard judgment to make.

Bob, it looks like maybe the large fragments in here are still crystalline. They have white zap pits on them. But they do not yet really resemble the gabbro.

I’ve got to go cross-slope some of the time because the Rover is really working to go uphill now.
05 19 48+ LMP As I look up the scarp to the west, there are some big blocks scattered around on our horizon; but, again, I would guess that we're not dealing with more than 2 or 3 percent total coverage of blocks in here, at that.

---

05 19 48+ LMP We're on top.

05 19 49 53 CDR Bob, we're at 078, 7.2, and 6.2.

05 19 49+ CDR Jack, where was Nansen with respect to those tracks up there?

05 19 49+ LMP Well, they never really had any good tracks pinned down. You'll be able to see Nansen, I think soon as you get over this hill.

---

05 19 49+ LMP Head towards that track area there. There are a lot of boulder tracks coming down from the blue-gray rocks. Well see whether or not we're going to get to those tracks at Nansen, or we might want to move over to the track and see if we can find the boulder that made them.

---

05 19 49+ LMP But there's no question where those tracks come from.

---

05 19 49+ LMP I have the impression that there is a dipping zone of blue-gray outcrops or block concentrations up there on the massif that trends from the high point just beneath the earth - cross-slope - and the apparent dip is - oh, I don't know, 10 or 15 degrees to the east. It looks like those outcrops may match up along that trend.

05 19 49+ CDR Jack, I'm going to head right along this ridge because I think that's the depression we were talking about.
05 19 49+ LMP Yes, that's Nansen down there.

---

05 19 49+ LMP We're a little more west, I think, than we intended to be.

05 19 49+ CDR Yes, I think you're right.

05 19 52 18 LMP 7.8 and 6.5.

05 19 52+ LMP I've had an impression, and I can't prove it yet, that we're dealing with more heterogeneous rock. Possibly there are breccias in here. But it's awfully hard to tell right now. They're very light-colored rocks - I think even lighter-colored than the gabbros.

---

05 19 52+ LMP I think the ones (tracks) from the big outcrop of blue-gray rock, though, are the ones going into Nansen.

05 19 53 29 CDR My best guess - 077, 7.7, 6.6 - is that we're coming up on the northern side of Nansen.

---

05 19 53+ CDR Okay, there's Nansen over there, huh?

05 19 53+ LMP Well, I think so.

05 19 53+ CDR Yes.

05 19 53+ LMP I think you're right. It's got to be it. I think we're into a breccia population now. I think the blocks in the light mantle are largely breccias. They're mottled in their characteristics. Their white caps do not seem to be nearly as apparent. They tend to be chalky when they get hit. At least, in the large craters, the walls are chalky-looking. Oh, yes. We've got boulders in Station ?

---
LMP We're very clearly going downhill now, into the
trough area that surrounds the massif - or between
the mantle and the massif. But the trough is much
greater in extent than just Nansen scale. It's
probably a kilometer wide. I never realized that it
was so much of a depression in here.

---

CDR 074, 8.2, 6.9.

CDR We won't be able to see the LM from down here.
We'll be too low to see it.

LMP The surface patterns are still the same, Bob. The
main difference being that we're getting probably a
gradual increase in block population and the blocks
seem to be of a different character. They may be
breccias.

LMP And around the crater here that's maybe 75 meters in
diameter, there's probably 5 percent blocks -
fragments, I should say - greater than a centimeter.

---

LMP There's a good-sized block, sort of blue-gray.

---

CDR Some of that stuff is mantled - or buried in the
massif material. Some of it just seems to be laying
on it, of course.

LMP Yes. Well, I think it has to do with how long it's
been there. You'll tend to get the downslope
movements forming uphill fillets, and that's what a
lot of it looks like.

CDR Most of it is uphill fillets. Most of it is pretty
sharp. But my guess, from back at the LM, that
those blocks on the massif were much more angular -
I think is a good guess because that's what they
look like to me here.
05 19 56+ LMP And looking up into our blue-gray outcrop area, I still have even more the impression that there's a planar orientation that dips off to the southeast—maybe just fracturing, but pretty clear up there, I think. It may be shadows.

---

05 19 58+ LMP As we get closer, we're out of the very— the block area. And that bright region of 5 percent may have been just associated with that crater. I still see no lineations although—

05 19 58+ CDR Look at these wrinkles, though, Jack --

05 19 58+ LMP Yes. I was talking about the mantle.

05 19 58+ LMP But you're right about on the massif.

05 19 58+ CDR The same wrinkled lineations we saw sloping uphill to the west on the eastern half of the massif are still very evident at this sun angle.

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05 19 58+ LMP The boulder tracks are really just chains of small craters, for the most part.

---

05 20 01 08 CDR We're 071, 8.9, and 7.4.

05 20 01+ LMP There's Nansen off to my right now.

05 20 01+ CDR Yes, I just want to make sure that I'm not driving down a hole here, which I am, but--I don't want to drive down Nansen.

05 20 01+ LMP No, you won't. The saddle—the end of Nansen is over there near those blocks. Right over there.

05 20 01+ LMP Look at those blocks. Unfortunately, the good boulder tracks are over into Nansen.

05 20 01+ LMP I think just about anywhere near the big blocks--- would be a good Station 2.
0520 01+ CDR - that's where I'm going to put it. (SEP-2)

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05 20 01+ CDR Boy, you're looking right into Nansen. (SEP-2)

05 20 01+ LMP Yes. We're right where we wanted to be for Station 2. It looks like a great place. Big blocks. It looks like quite a bit of variety from here. Different colors, anyway. Grays and lighter-colored tans. (SEP-2)

05 20 01+ CDR Hey, Jack, I'm going to do a 180 and park the Rover at 045. (SEP-2)

05 20 01+ LMP Those are two good - there's a blue-gray rock and a lighter-colored tan rock. (SEP-2)

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05 20 01+ CDR Right on the other side of this little crater. *** heading *** 045. (SEP-2)

05 20 01+ CDR 045 *** 9.1, 7.6. (2)

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05 20 01+ CC And you want to give me the bearing one more time there, Gene. (2)

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05 20 05+ CDR 071, 071 is the bearing. (2)

05 20 05+ LMP 142 on the LMP's camera. (2)

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05 20 06+ CC Jack, we'd like to go to India on the magazine for you. (2)

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05 20 09+ LMP The number of blocks plotted on the map are not nearly enough. In the greater than 1-meter range, there are many hundred blocks on the massif flank of Nansen and up around Station 2, where we are. There
are only one or two blocks on the light mantle side of Nansen. It looks as if the material in the bottom of Nansen is overriding the light mantle materials of the north wall. That's just an impression. They're slightly lighter albedo than the north wall of Nansen.

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05 20 09+ LMP I suggest that we do our raking - fairly close to the Rover to get the front of the general population of talus material coming off the massif.

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05 20 12+ LMP The blue-gray rocks are breccias. They're multilithic, gray matrix - matrix breccias, I guess. There are fragments in them, but it doesn't look like more than about 10 or 15 percent fragments. Some of the light-colored fragments seem to have very fine-grained dark halos around them. The zap pits do not have white halos, so I suspect they are not crystalline. They might be glass - they might be the vitric or glassy breccias. At least, the one big rock we have here.

05 20 12+ LMP There's a rough, very rough, foliation in them - it's shown by the elongate knobs on the surface. It looks like a fracture foliation of some kind.

05 20 12+ CDR Jack, that rock has almost got to have come down, don't you think?

05 20 12+ LMP Oh, no question about it. I'll bet you it's the same as the blue-gray rocks we see up higher. Here's some more blue-gray ones over here.

05 20 12+ CDR Look at the size of some of these light fragments in here.

05 20 12+ LMP It looks like they're dominantly matrix breccias. There are light-colored fragments, and they may be crystalline.

05 20 12+ LMP They are. They're very light-colored; they look like the shattered anorthosites. They have white halos - I think that's what those fragments are.
05 20 12+ CDR Jack, let's get a piece of this one right here. (2) (SAMP 72210, 15) (PHO 137 20900-09; 138 21029-37)

05 20 12+ CDR Biggest one here. (2) (SAMP 72210, 15)

05 20 12+ LMP Get her up. This is the blue-gray variety. (2) (SAMP 72210, 15)

05 20 12+ CDR I'm going to take that little knob off up there. (2) (SAMP 72210, 15)

05 20 12+ LMP Okay; well, you can sample - you can work that block over -- we can get several examples. We ought to sample across that layering, actually - that foliation. (2) (SAMP 72210, 15)

05 20 15 21 CDR When you look down into the bottom of Nansen, it looks like, I guess - which sounds obvious - that some of the debris that has rolled off of the South Massif covers up the original material there that covers the north wall of Nansen. There is a distinct difference. You've got that very wrinkled texture in the north slopes of Nansen, and you've got the South Massif - debris in the south slopes of Nansen. And the debris, of course, overlays the north slope. And all the rock fragments, all the boulders that have come down are all on the south side of the slope of Nansen.

05 20 15+ LMP I take back what I said about no halos. There are light - not very sharply light - but light halos around zap pits in the matrix. The matrix glass is dark, and it seems to have a greenish cast; but it's very dark.

05 20 15+ CDR Oh, look at that blue. (2)

05 20 15+ CDR Look at the white fragments in there. (?)

05 20 15+ CDR Man, there's some boulder rolling rocks here, Jack. (2)

05 20 15+ LMP Okay, don't wreck the fillet. There's an overhang we've got to get into.

05 20 16 53 LMP 514 is the - okay, I'll take it back. On the fresh surface, these look like fragment breccias although the fragment size is fairly small. There are dark-gray fragments and the light fragments we talked about. The gray ones are very fine-grained.
and dense, although I see flashes that indicated they may be crystalline. The light-colored fragments are as I described them earlier, I think.

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05 20 16+ LMP Gene's got a rock to go. That's from up higher? (2) (SAMP 72230,35)(PHO 137 20900-09; 138 21029-37)

05 20 16+ CDR That's a little higher. See that shelf up there? (2) (SAMP 72230,35)

05 20 16+ LMP The first rock was from about a - 514 was from a meter above the base of the rocks; 515 is from about (SAMP 72230,33) a meter and a half.

05 20 18 05 LMP Can you get some on either side of those two now? (2)

05 20 18+ CDR Yes. (2)

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05 20 18+ LMP That's a north/south overhang. (2)

05 20 18+ CDR Yes. That one? (2)

05 20 18+ LMP Yes, you're facing right into the east. (2)

05 20 18+ CDR Yes. I don't know if I can get a piece back here or not. (2) (SAMP 72250,55)(PHO 137 20906-09; 138 21029-37)

05 20 18+ LMP How about right where you *** yes. (2) (SAMP 72250,55)

05 20 18+ CDR Right here? I can get that. (2) (SAMP 72250,55)

05 20 18+ LMP Yes, that's good. (2) (SAMP 72250,55)

05 20 18+ LMP Oh, beautiful. Hit the gnomon. (2) (SAMP 72250,55)

05 20 18+ CDR It didn't move. It just tilted it. (2) (SAMP 72250,55)

05 20 18+ LMP This it? (2) (SAMP 72250,55)

05 20 18+ CDR Yes, that's it right there. (2) (SAMP 72250,55)

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05 20 18+ LMP 494 is from a half a meter above the base of the rock. (2) (SAMP 72250,55)
LMP: And these are samples from across the layering - or the foliation.

CDR: How about this one? Here's a whole big piece.

LMP: Okay. That's a good representative fragment. Can you get it?

LMP: That's a football-size fragment. Okay, this next sample - can you get a bag out, and we'll try to put it around it. Around the end. It's highly variable. This is a light-matrix breccia; whereas the other three fragments were dark-fragment or dark-fragment breccias. The big rock is a light-matrix breccia with dark fragments, and it's the one that has the halos around the light fragments. And that's in 495, barely. It's not even in it. 495 is wrapped around it.

CDR: It's not going to stay.

CDR: It's a football-size fragmental rock.

LMP: Why don't you just stuff it. See if you can stuff it in there with the bag down.

CDR: We'll be able to identify it when we get - 495 when we get back. Okay, it'll stay.

LMP: Is the bag on it now?

CDR: Well, yes.

CC: Do you guys see any tracks coming down to these boulders? Do you have any feeling that you can place these that way?

LMP: Unfortunately, no. The main tracks are out into Nansen, and I don't think we can get over there.
05 20 20+ LMP Coming up I was looking; and there are no obvious tracks coming down here.

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05 20 20+ LMP The gnomon was moved a little between the samples. (2)
05 20 20+ CDR Do you need to take a vertical pan? (2)
05 20 20+ LMP Yes, I've gotten it all. I'm getting it all. (2)
05 20 20+ CDR You getting the flight line? I'll get a flight line (2)(PHO 137 20902-09) this way. Postsample, flight line.
05 20 20+ CDR I'm on frame count 42. (2)
05 20 22 19 CDR Did you get a locator from here, Jack? (2)(PHO?)
05 20 22+ LMP Yes. (2)(PHO?)
05 20 22+ LMP I got flight line on the north/south trend; Gene got (2)(PHO 138 21029-35) east/west. (PHO 137 20902-09)
05 20 22+ CDR You going to get that sample under there? (2)(SAMP 72220-24)(PHO 137 20900-09; 138 21029-37)
05 20 22+ LMP Yes, we got to get the soil. (2)(SAMP 72220-24)
05 20 22+ CDR There must be an overhang. And look at that frag - (2) that rock is - fragmented; let's see it's southeast/northwest. - there's a split.

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05 20 22+ LMP This is a fillet from underneath the rock. (2)(SAMP 72220-24)
05 20 22+ LMP This fillet is up underneath an overhang. I got it (2)(SAMP 72220-24) from about - - oh, a third of a meter under an overhang. And it's the upper 3 centimeters of soil.
05 20 22+ CDR And it's bag 496. (2)(SAMP 72220-24)
05 20 22+ LMP Now let me get one out away from the overhang a little bit. (2)(SAMP 72240-44)(PHO 137 20900-09; 138 21029-37)
05 20 22+ CC You think that's permanent shadow? (2)(SAMP 72240-44)
05 20 22+ CDR No. It's facing east. (2)(SAMP 72240-44)
05 20 22+ LMP And a sample down to a depth of about 5 centimeters, about two-thirds of a meter from the - boulder - the south side - is in 497. (2)(SAMP 72240-44)
05 20 22+ LMP Now let me get a skim sample, Geno. (2)(SAMP 72260-64)(PHO 137 20900-09; 138 21029-37)
05 20 22+ CDR Okay. I got to take a set of pictures after that, by the way. Show where they are. (2)(SAMP 72260-64)(PHO?)
05 20 22+ LMP I can piece them into my flight line stereo. (2)(SAMP 72260-64)(PHO 138 21029-37)
05 20 22+ CDR They were in both of the before pictures on those rocks. (2)(SAMP 72260-64)(PHO 137 20900-01)
05 20 22+ LMP Okay; about a centimeter deep - skim. (2)(SAMP 72260-64)
05 20 22+ CDR Careful. You're in a hole. You better come out. (2)(SAMP 72260-64)
05 20 22+ CC Give sample bag number, please. (2)(SAMP 72260-64)
05 20 22+ LMP Okay, Bob. I missed that. I didn't give it to you; but I think - well the next bag I take out, you can check the num - well, wait a minute, I'll do it for you. (2)(SAMP 72260-64)
05 20 22+ CC No. That's okay. I suspect it's 498. (2)(SAMP 72260-64)
05 20 22+ LMP I'm almost positive it was 498. (2)(SAMP 72260-64)
05 20 26+ LMP Looking at the blocks directly down-sun, the light-gray, or the gray-matrix breccias seem to be fragments, or schlieren anyway, within the white-matrix breccias. (2)
05 20 26+ LMP And I got a couple pictures down-sun to show that texture. (2)(PHO 138 21036-37)
05 20 26+ LMP We're going after a gray - I mean a lighter-colored block, now. Are you going up there?

05 20 26+ CDR Yes.

05 20 26+ LMP You're still on the talus. The rims of the small craters in the talus are softer than the - normal terrain. My foot goes in maybe 10 centimeters where normally it only goes in a centimeter.

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05 20 28 20 LMP Okay, 670, 155, 201; 670, 155, 201.

05 20 28+ CDR I'm at another boulder up the slope here. It's looks quite similar to the one we just sampled, except there is a lot of flake fractures on it. Nondirectional - but quite different at least from that other rock, in terms of the fracture pattern. The texture looks to be quite similar.

05 20 28+ LMP On these rake samples, there is just no point in carrying a rake all the way up here - because all we needed was a break in the slope.

05 20 28+ CC As long as you're above the break in the slope; that's right.

05 20 28+ LMP It's being done.

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05 20 28+ LMP We want to get away from that big rock because it's probably shedding. Hey, that's a different rock, Gene.

05 20 28+ CDR Yes. Well, it looks like the same texture, but it's got that flaky fracture pattern all over it. I'm going to get a stereo while I'm at it.

05 20 28+ CDR This ought to cover any samples I take off of that thing.

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05 20 28+ LMP This is a crystalline rock, Houston. It's got nice (2) white halos around the zap pits. The zaps are not dense black glass, but a very dark greenish-gray.

05 20 28+ CDR Are those halos or fragments? (2)

05 20 28+ LMP No, they're halos. Well, they are fragments, I think, also. It's fairly crystalline, but it is heterogeneous. Matter of fact there's a big fragment of a porphyry caught up in this thing, I think.

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05 20 31+ LMP And there's a chunk there we can get. That's a big (2)(SAMP 72310,15)(PHO 137 20912-16; 138 21038-42) fragment within this crystalline rock -- inclusion.

05 20 31+ CDR Take a picture of that and then your locator, I'll get it. (2)(SAMP 72310,15)(PHO 138 21038-39)

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05 20 31+ LMP Looks like a porphyry is what it looks like. (2)(SAMP 72310,15)

05 20 31+ CDR It does look like a crystalline rock. (2)(SAMP 72310,15)

05 20 31+ LMP Looks like an andesite porphyry. (2)(SAMP 72310,15)

05 20 31+ CDR The *** has got the very large crystals in there. They're very reflective, elongated crystals. (2)(SAMP 72310,15)

05 20 31+ LMP It's a relatively angular inclusion about a half a meter in size, and it's a square cross section. Well, it's irregular; but generally square cross section. It's in bag 516, and it looks like a -- well it's a high feldspar rock. It may be an anorthositic gabbro, but it does look like a porphyry.

05 20 31+ CDR There's a big chunk where I've got -- I can't get it (2) out, though; it's buried in a rock -- half of an inch elongated -- I can't see whether they are colorless or not, but they are certainly reflective crystals. See that up here? See right there?

05 20 31+ LMP Yes. (2)
05 20 31+ CDR And then in the big rock, you've got massive things like this big fragment here - that's 5 inches across.

05 20 31+ LMP That may be a spall point, Gene, that's a lighter-color, in general, because of a zap or something.

05 20 31+ CDR Let me get some more samples of it.

05 20 31+ LMP Yes, we need to get some of the host rock here.

05 20 31+ CDR We'll get a piece here.

05 20 31+ LMP You're still sampling the one we just got. So we'll get another one.

05 20 33 42 LMP The same kind - or the contact of that rock looks like it might be finer-grained - but it's about the same - in 517. That's the contact in the inclusion side of the contact. Keep going after the other one, Gene, I'll get this in your bag.

05 20 33+ LMP The host rock for the inclusion, which appears to be also crystalline but may be a recrystallized rock of same kind -- metamorphic -- also looks like it's high plagioclase - high feldspar, anyway. That's in bag 518 - and that was a loose frag - fairly loose but in place fragment along the fracture zone.

05 20 33+ CDR I'm going to try to get the rest of it up there.

05 20 33+ LMP This is a medium-grained anorthositic gabbro, and it looks like it has some pastel-green olivine crystals in it. Did you get it?

05 20 33+ CDR I can't get any more of it, Jack, up there. I can't reach any more.

05 20 33+ LMP Okay, and that small chip of that is in 519. It's the same host rock, much like the previous sample.

05 20 33+ CDR There's a good sample for you.
05 20 33+ LMP Another chunk of the host -

- - -

05 20 33+ LMP It's in there. I haven't closed your bag yet. And we've got to - get one soil sample up the hill here. Oh, we didn't get the rake -

05 20 33+ LMP We'll get the rake sample right over here on this slope.

- - -

05 20 33+ CC Was that last sample in 518, as well?

05 20 33+ CDR There it is. That's it right there.

05 20 36 31 LMP No. We haven't put it in yet.

05 20 36+ CDR That will go in 499.

05 20 36+ LMP This is a fairly uniform-looking rock. It does have some widely spaced fractures across it. It's clearly crystalline and has crystalline inclusions in it.

05 20 36+ CDR Might get the soil from around that thing.

05 20 36+ LMP Both rocks look like they might be in the anorthositic class - of rocks. It's just that - one has the appearance of being a finer-grained matrix. Looks like a porphyry in the boulder.

05 20 37 59 CDR I've got a stereo - I'll just continue my stereo around here. Hey, Jack, you can get way under there, and I know you could get soil. I don't know how long it's been shadowed, but it's been shadowed as long as this rock's been here.

05 20 37+ LMP I'll do that.

05 20 37+ CDR I've got a stereo of this one.

05 20 37+ CDR I've already got it.
05 20 37+ LMP Well, I'm getting it from this way, and they like that. Did we kick any dirt in under there?

05 20 37+ CDR I don't think so. Go way down in there. Let me get a couple of after pictures. Yes, we want to get two sides of these rocks, and you can see their structure.

05 20 37+ LMP I took that stereo.

05 20 37+ LMP I got under an east-west overhang about 20 centimeters away back - quite a ways back; it goes even farther, but that's about as far as I can reach back there now.

05 20 37+ LMP That's in bag 500.

05 20 40+ CDR And, Bob, I took an after picture of where Jack just got the soil sample under the rock from; and I'm on 60.

05 20 40+ CDR I'll go up there and get a pan, Jack.

05 20 40+ LMP We're on a pretty good slope, Geno.

05 20 40+ CDR This pan may be looking right smack in the sides of the mess!s. Only way you can get it is to lean back - and I can't lean downhill.

05 20 40+ CC Hey. Watch out for that crater behind you there, Geno.

05 20 40+ CDR I'm standing in the crater so I can get level.

05 20 40+ CDR Well, I have some good pictures of Nansen, anyway.
05 20 40+ LMP bob, my down-sun pictures on the rake were taken at
8:48. I'm sorry.

05 20 40+ CDR I'll be right down there to bag that rake for you.

05 20 42+ LMP Not many small walnut-sized fragments in here, Bob.
Gotten about seven or eight.

05 20 42+ CDR Bag 501.

05 20 42+ CDR No, there aren't a lot; but that'll fill up a bag.

05 20 42+ CC And this is the one that we would like to get the
kilogram of soil from, Jack.

05 20 42+ LMP Okay. I'll use my scoop for that.

05 20 45 27 CDR Bag 501.

05 20 45+ CDR Okay, my pan, by the way - I got extensive vertical
coverage down into Nansen, Bob.

05 20 45+ CDR 502, Bob, will be the kilogram.

05 20 45+ LMP And that's sample down to about 4 centimeters.

05 20 45+ CDR Oh, that's a big bag full.

05 20 46+ CC Okay. And guys - do you see any more different
blocks up there that are worth sampling before you
go on down on to the flats and sample the light
mantle?
05 20 46+ LMP We haven't had a chance to look around any more than (2) you've heard.

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05 20 46+ LMP Get an after, Gene.

(2) (SAMP SOIL 72500-05) (PHO 137 20962)

05 20 46+ CDR Yes. Got it.

(2) (SAMP SOIL 72500-05) (PHO 137 20962)

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05 20 46+ CDR Jack got the befores on the rake and I got the after.

(2) (PHO 138 21043-46; 137 20962)

05 20 46+ CDR Here are two rocks side by side, a meter or two in diameter. And one is the anorthositic gabbro, if I can use the term; and the other is that two-cycle breccia.

(2) (SAMP 72410,15-18) (PHO 138 21047-49; 137 20963-65)

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05 20 46+ LMP Set up right there. Let's get that big clast.

(2) (SAMP 72410,15-18)

05 20 46+ LMP There's a fracture right in there I want to get near.

(2) (SAMP 72410,15-18)

05 20 46+ CDR Oh, the clast.

(2) (SAMP 72410,15-18)

05 20 46+ LMP Yes.

(2) (SAMP 72410,15-18)

05 20 46+ LMP Big white clast in the gray-matrix breccia.

(2) (SAMP 72410,15-18)

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05 20 46+ LMP Pretty hard, isn't it? That boulder's going to roll.

(2) (SAMP 72410,15-18)

05 20 46+ CDR Men, that is hard. There's the same clast over there.

(2) (SAMP 72410,15-18)

05 20 46+ CDR That clast is soft.

(2) (SAMP 72410,15-18)

05 20 46+ LMP Can you use your - your blade end?

(2) (SAMP 72410,15-18)
05 20 46+ CLR Yes, let me get that little piece, anyway, to start with. Got it. There's two more pieces.

05 20 46+ LMP Before we cover them up, let's get them.

05 20 46+ CDR I got to get a sample of that mother (host) rock.

05 20 46+ LMP Want to try to hit that one more time. I think we've got another one coming there. There's another little one.

05 20 46+ LMP That looks almost like a rhyolite from here. I don't believe it, though.

05 20 50 16 LMP This is a fine-grained - but crystalline white clast (2)(SAMP 72410,15-18) - in the gray breccia; and it's mixed with soil. We had to pick up a little soil. 503.

05 20 50+ LMP There are three clasts, - way - or three fragments (2)(SAMP 72410,15-18) that we got off.

05 20 50+ CDR Chips. Let me get a piece of the rock it's in. And (2)(SAMP 72430-35)(PHO 138 21047-49; 137 20963-65) I'm going to take a closeup stereo of that. (PHO 137 20966-73?)

05 20 50+ LMP The host rock for that inclusion of white material will be in bag 504. Two chips with soil.

05 20 50+ CDR We're getting some samples this time. I want to get an after, and I want to get a closeup stereo of that. And I'm going to get some pictures around this block, too.

05 20 50+ CDR There's an after and now I'm going to get - sort of a closeup stereo around it.

05 20 52 18 LMP There's a real good example of pit-bottom crater up here even on this talus slope. I'll try to take a stereo of it.
05 20 52+ LMP There isn't any glass in this crater - you can see it with your TV.

05 20 52+ LMP It's just bigger than the average crater. And it still has that pit, the pit being about a third of the inner diameter of the crater - make it a fourth of the rim diameter, that's easier.

05 20 52+ CDR Look out, Jack.

05 20 52+ CC It's the old boulder-rolling trick.

05 20 52+ CDR How about getting a soil sample under there? (2)(SAMP SOIL 72440-44)(PHO 138 21047-49; 137 20963-65)

05 20 52+ CDR Get that sample under there, Jack. Under that rock. (2)(SAMP SOIL 72440-44)

05 20 54 12 LMP The soil from right underneath the rock - down to about 4 centimeters - in 505. And I'll try to skim it here a little, too. Get the upper centimeter.

05 20 54+ CDR Bob, this big white clast - I'm not sure there aren't some smaller ones in some of those other big boulders. That's just an intuitive guess.

05 20 54+ LMP Oh, there are.

05 20 54+ CDR But we never saw any as obviously big, as gross as this one. Such as this particular boulder I photographed, I had three of them other than the one we sampled. And that's 505 - and 506, in that order.

05 20 54+ LMP That white clast - I looked at it, and it has a light pastel-green - fairly rounded crystals in a fine-grained white to light pinkish-tan matrix. And you can figure that one out. Looks like olivine and something.
05 20 54+ CDR Hey, Bob, have you panned down into Nansen and seen this rock that's — oh, 30 or 40 meters from us? To give you an idea of the kind of up slope filleting you have on some of those boulders.

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05 20 57 22 LMP Gene. You getting your pan? (2)

05 20 57+ CDR Yes, I said where do you want it? (2)

05 20 57+ LMP Well, right over there where there's some fragments. (2)

05 20 57+ CDR I'll get the before and the locator. (2)(PHO 137 20974-77)

05 20 57+ LMP Okay, and then I'll get the down. (2)(PHO 138 21074)

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05 20 57+ LMP Okay, pan's complete. (2)(PHO '38 21053-73)

05 20 57+ CDR Let's get the rake sample so we can move on. (2)(SAMP RAKE 72730, 35-38)(PHO 137 20974-78; 138 21074)

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05 20 58+ LMP There just aren't any rocks. (2)(SAMP RAKE 72730, 35-38)

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05 20 58+ CDR There's a couple, keep going. (2)(SAMP RAKE 72730, 35-38)

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05 20 58+ CDR There's one under the gnomon you can get. (2)(SAMP RAKE 72730, 35-38)

05 20 58+ LMP Several I thought were rocks turned out to be clods. (2)(SAMP RAKE 72730, 35-38)

05 20 58+ CDR Yes, that's what most of them are is clods. How do you get clods if it's never been wet? You're not getting any. You've had three in there ever since the last four scoops.

05 20 58+ LMP There just aren't any. (2)(SAMP RAKE 72730, 35-38)

05 20 58+ CDR 507. (2)(SAMP RAKE 72730, 35-38)
05 20 58+ CDR Three rocks. Yes, you got about four rocks - about 2 inches and smaller.

05 20 58+ LMP And let me get the down-sun.

05 20 58+ CC Get the soil.

05 20 58+ LMP One-scoop-Schmitt, they call me.

05 20 58+ CDR That's good. That's bag 508.

05 21 00+ CDR Let me get one after of the area that we messed up.

05 21 00+ CDR Look where we kicked up this stuff. There's some light - well, I can't see it now.

05 21 00+ LMP Occasionally there's a light-colored fragment I think we break into.

05 21 00+ CDR Yes, we kick it up.

05 21 00+ LMP They are light-colored clods.

05 21 00+ CDR And when I was walking uphill, I really wasn't sinking in probably more than an inch or two.

05 21 00+ CDR Bag 8 is on the gate, and Jack's getting bag 4.

05 21 06+ LMP Okay. LMP is at 46.

05 21 06+ CDR And CDR is at 113.

05 21 07 25 CDR We're rolling.
05 21 07+ LMP Those two major kinds of blocks that we sampled there — it was about the two varieties we saw in the area, it's a long extrapolation I realize, but they do resemble in color, and I believe in texture, the blue-gray rocks and the light tan rocks up on the massif. So I feel fairly confident that we sampled at least the two major units visible from a distance in the South Massif.

05 21 07+ LMP I think that there is a lot of postmission work to be done on correlating the angularity and possibly even the albedos of the rocks we sampled with those on the massif. We should have good pictures of both from a distance and up close.

05 21 09+ CC Rover sample - used to be at 073 and 6.3 — halfway to Hole-in-the-wall. We're now going to have that rover sample stop at 078 and 7.0. That should be along your tracks — we're going — to get a gravimeter reading at that location.

05 21 09+ CDR We're on the top, coming off the highest lobe of the scarp looking back into the valley.

05 21 09+ LMP Hey, turn a partial pan, I know it's into the Sun. (2-2A)(PHO 138 21077-92)

05 21 09+ CDR Okay. Let's take one from right here. I want the whole thing. (2-2A)(PHO 138 21077-92)

05 21 09+ CDR You ready to start? (2-2A)(PHO 138 21077-92)

05 21 10 18 LMP Yes, I got it. (2-2A)(PHO 138 21077-92)

05 21 10+ CDR Take the whole thing. (2-2A)(PHO 138 21077-92)

05 21 10+ LMP I got a pan down in the valley. (2-2A)(PHO 138 21077-92)
05 21 10+ LMP Keep turning around over there, and I'll get that scarp.  

05 21 11 10 LMP Okay, looking at the light mantle. No more comments except that by that rake sample and just looking, there certainly are fewer fragments than we saw at Station 2. The main thing that we can tell about the light mantle and when we're on it, of course, is the light-colored craters. The fresher craters all appear to be light-colored. As they get older, the albedo goes down and potentially have been dusted with material from the dark mantle or from other sites. Either that or it's just the lunar patination that we're all familiar with.

05 21 11+ LMP None of the craters out here in the light mantle appear to show - they've got new bedrock. Almost all of them are instant rock craters.

05 21 12 32 CDR How about 071 and 7.0? Will that do?

05 21 12+ CC Yes.

05 21 12+ CDR I'm stopping here.

05 21 12+ CDR 071 *** 9.8 and 7.0.

05 21 12+ CC And the Rover *** should be fairly flat for the gravimeter.

05 21 12+ CDR Well - that means we have to change here.

05 21 12+ LMP Hey, right over here to my right --

05 21 12+ LMP Maybe it's the best we can do, but it's still going to be on a slope.
05 21 12+ CDR Well, I'll level it off on a local -- (2A)
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05 21 12+ CDR On the rim of that crater that's built up a little
  bit? Right up here. (2A)
  ---
05 21 14+ LMP 071, 9.8, and 7.0. (2A)
  ---
05 21 15+ LMP Bag 30 Easy. (2A)(SAMP SOIL 73120-24)
05 21 15+ CC Are you guys finding much in the way of rocks here? (2A)(SAMP 73130-34)(PHO 138 21096-7)
05 21 15+ LMP I'm looking. I can get you some instant rock out of (2A)
  a small pit bottom crater.
05 21 17 25 CDR Up to frame count 5: is the outcrop or boulders at (2A)(PHO 144 22003-15)
  the top of the South Massif.
05 21 17+ LMP Bag 31 Easy. Instant rock out of a 3-meter pit (2A)(SAMP 73130-34)
  --bottom crater -- off the inner wall.
05 21 17+ LMP Well, let's make it 30 centimeters down from the (2A)(SAMP 73130-34)
  rim.
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05 21 17+ CDR And through frame count 57 are the North Massif from (2A)(PHO 144 22016-32)
  part of the western portions to part of the eastern portions.
  ---
05 21 17+ LMP A chunk of yellow-brown rock that apparently has (2A)(SAMP 73150-56)(PHO 138 21098-99)
  several spots behind it, probably indicating direction from which it came -- oh, no -- what is
  that? That's a reflection. That really fooled me.
  A reflection off the mylar. Crazy. Well, what the heck, I'll sample it anyway.
  ---
05 21 17+ CDR I've got Family mountain and some of the hills way up to the right of Family mountain. I'm at 67 on the 500. (2A)(PHO 144 22033-45)

05 21 17+ LMP Thirty-two Easy is another small fragment. (2A)(SAMP 73150-56)

05 21 20 56 CDR 670, 123, 501 - 670, 123, 501. (2A)

05 21 21+ CDR About 2 inches below the surface here, you ran into that blue-gray material down there and it's in little clods, and it breaks apart in your hands. (2A)

05 21 21+ LMP Yes, that's right. (2A)

05 21 21+ CDR Did you get some of that in your Rover sample? (2A)

05 21 21+ LMP No, but I got it out of that instant rock crater. (2A)(SAMP 73130-34)

05 21 21+ CDR Let's grab a quick Rover sample and we'll take off. (2A)(SAMP SOIL 73140-46)(PHO 138 21098-99)

05 21 21+ LMP But, really those trenches - those craters are giving us the same information. That there's a light-colored material underneath. (2A)

05 21 23+ LMP Forty Yankee. (2A)(SAMP SOIL 73140-46)

05 21 23+ LMP That's light-colored soil from a depth of about - it's mixed with a little of the upper surface, but mostly light-colored soil from a depth of about 15 centimeters. (2A)(SAMP SOIL 73140-46)

05 21 23+ LMP It looks like the light mantle here is covered with dark to a depth of about 5 to 10 centimeters. (2A)

05 21 23+ CDR Did you take any pictures at all while you were there. (2A)
05 21 23+ LMP Oh, yes. I didn't take a pan. Why don't you turn right to a ***?

05 21 23+ CDR We're rolling.

05 21 25 08 CC Okay. Mark that.

05 21 25+ CDR Making a right-hand turn for a pan.

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05 21 25+ LMP Left.

05 21 25+ LMP Not a complete pan but it will show the location.

05 21 25+ LMP LMP frame count 80.

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05 21 26 25 LMP I think we have a good sample of only partially contaminated light mantle in that last Rover sample that Gene accidentally discovered was right under our feet. It's almost certainly the light-colored material that we've been talking about in the walls of the crater. And, as a matter of fact, that instant rock sample I took was light-colored and probably represents the same stuff, indurated slightly.

05 21 26+ CDR Light-colored mantle has that bluish tint that I saw in those rocks.

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05 21 26+ CDR G73, 10.3, 6.6.

05 21 26+ LMP I have a feeling that whatever darkens the - ooh, there's a beautiful little glass-lined crater, pit-bottom crater - whatever darkens the light mantle is not a one-time only mantling of darker material. It's something that happens over a period of time, continually, because craters of all sizes and apparent degradation are darkened and there are lighter craters that are light to varying degrees, there seem to be a continuum of albedo change.
05 21 29 08 CDR That little crater on the side of the North Massif that we're thinking about going to doesn't look nearly as light-colored or haloed as it does in pictures, does it? (2A-3)

05 21 29+ LMP No. (2A-3)

05 21 29+ LMP I think you're almost to the rim. (2A-3)

05 21 29+ CDR Yes, I want to go down here if I can. My tracks are over there to the left, I haven't crossed them yet. (2A-3)

05 21 29 45 LMP 073, 6.3. (2A-3)

05 21 29+ LMP LMP frame count is 96. (2A-3)

05 21 29+ LMP See the lobes coming out - looks like lobes out from the scarp. The scarp rather being a line in there on the plain, appears to be lobes. I got a couple of shots of 'that. Whereas when it gets up on the massif, it's a fairly continuous curve; although it does appear to be younger, at least there's less relief on it for the first few kilometers of that bend there. (2A-3)

05 21 29+ CDR We're going to have to go down like the way we came because there's that big crater down at the bottom. (2A-3)

05 21 29+ LMP Bob, the scarp, so-called scarp, impresses me as less of a scarp than a series of lobes which roughly have a north-south trend. And we've been driving over various hummocks within those lobes. (2A-3)

05 21 29+ LMP I think you've got something right ahead of you. Here - (2A-3)

05 21 29+ LMP See the instant rock. (2A-3)
05 21 33 08 LMP Okay, there's Lero, and I think we can see Station - (2A-3)

05 21 33+ LMP The light mantle is a uniform surface and I think you've heard just about everything we've had to say so far. (2A-3)

05 21 33+ LMP The fragment population hasn't changed, nor has the crater population, as near as I can tell. (2A-3)

05 21 33+ CDR Yes, I got to get over to this next knoll and I'm going to be off the scarp. We're about three-quarters of the way down. (2A-3)

05 21 33+ LMP Oh, there's Nemo over there to my right. (2A-3)

05 21 35 45 CC You guys cut each other out but I take it that you're at the edge of the scarp. (2A-3)

05 21 35+ CDR We're off, we came down. (2A-3)

05 21 35+ LMP It's that bright - see that bright crater? You can just start to see Station 3 over there now. (2A-3)

05 21 35+ CDR We're at 079, 11.5, and 5.7. (2A-3)

05 21 35+ CDR And I'm headed northwest. (2A-3)
LMP Right over there is Station 3, I think. (2A-3)

CDR I can just start to see two craters -- and they're closer to Lara.

---

CDR Here's a nice sharp little hole; look at that. (2A-3)

LMP The texture of the light mantle - surface texture - is really no different on the scarp, on its flank, or out here to the east of the scarp. Fragment population, crater population, everything looking about the same. If there is such a thing as a light mantle, it seems to be uniform across the scarp.

LMP Here are your tracks - hey! We crossed somebody's tracks. (2A-3)

CDR We sure did *** we made a loop. (2A-3)

CDR That was at 081, 5.7. (2A-3)

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CDR This is where we went to the big crater and I came southeast in order to get around it. (2A-3)

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CDR We're still headed northwest, Bob. (2A-3)

LMP Bob, I guess one thing we don't have a handle on yet is what are the - I think we sampled them - once in a Rover sample, but what are the fragments out here mixed with the light mantle?

LMP I think I got one at our last gravimeter stop, a small one, and I guess there's one other Rover sample, but - Station 3, we probably ought to make sure we get a representative suite of those fragments.

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135
LMP We're at 083, 5.7. (2A-3)

CDR That must be Lara right there, huh? (2A-3)

LMP Yes. (2A-3)

CDR On the left. You can see the blocks on the other side of her. (2A-3)

LMP That's right. I told them about those earlier. I think, Gene, you want to bear a little bit to the left. See those two crater, two bright craters, that are just this side of Lara? (2A-3)

LMP You're pointed almost right at them, now. (2A-3)

LMP Those are the two I think they wanted us to be at, and I think that's a good choice if we can get up there. (2A-3)

CDR Bob, I want to get some 500's the way that scarp flows up on top - well, it looks like it flows up on top of the North Massif. Now it may look like the North Massif may drape material down upon it. Look at that. (2A-3)

CDP Not really. The texture is so different. It just doesn't look like as old a surface, but definitely different. (2A-3)

LMP There's another big crater with a pit in it. (2A-3)

LMP You know, that big block up there might be worth going to. (2A-3)

CDR 087 at 5.9. I think that's the best station we've got right here. (2A-3)
05 21 41+ CDR Let's see what's over on your right. Let's see if we can get at that scarp over there. (2A-3)

05 21 41+ CDR Well, there's that first crater, there, Jack. (2A-3)

05 21 42+ CDR We're at 087, 6.0. I think that's probably about right. Why don't we stop here? (2A-3)

05 21 43+ CDR We've got some boulders over here that are in the light mantle. (2A-3)

05 21 43+ CDR We can see a little bit down into Lara, too. (2A-3)

05 21 43+ CDR We'll park right out here and we can work those blocks right up behind us. (2A-3)

05 21 43+ CDR I'm looking for a level spot, but my gosh, there sure aren't very many. (2A-3)

05 21 46 CDR 087 and 12.6, 6.0. (2A-3)

05 21 46+ LMP Looks like a pretty good location to sample the rim materials of this crater. (2A-3)

05 21 46+ LMP Bob, I'm at the south, let's say the east-south-east rim of a — oh, 30-meter crater in the light mantle, of course; up on the scarp and maybe 300 - 200 meters from the rim of Lara in a northeast direction. (3)

05 21 46+ CDR It probably shows up as a bright crater on your map. (3) There's only about a half a centimeter of gray cover over very white material that forms the rim.
05 21 48 45  CDR  087, 12.7, 6.0.  (3)

05 21 48+  CDR  Heading is 043.  (3)

05 21 50+  CDR  If there is a scarp, and if it is a fault, I'm right.  (3)

05 21 50+  LMP  You're right on it because the projection of it would be uphill a little bit.  (3)

05 21 50+  CC  Jack, what's your frame count?  (3)

05 21 51 35  LMP  122.  (3)

05 21 51+  LMP  I dug a trench in the side of this crater. I've got down-sun pictures of it. There is quite a marbling of light and dark soil or fine-grained material. It looks as if there's a uniform, about 3-centimeter layer of light material over that marbled light and dark. On the very top surface, there's a half centimeter of light-gray, and when I say dark, I mean a medium-gray. (SAMP TRENCH 73220-25) (PHO 138 21143-48, 78)

05 21 51+  LMP  I'm going to start sampling the soils, and then I'll get you the fragments.  (SAMP TRENCH 73220-25)

05 21 51+  CC  Okay, I presume that we'll at least have the single upper core which we can use to sample of that stuff in the soil, and we -

05 21 51+  LMP  Oh, there's no guarantee. This is a crater rim.  (3)(SAMP TRENCH 73220-25)
LMP: Can you see any pattern in the marbling? I'm still not sure where the soil is going to be.

05 21 56 36 LMP The upper 5 centimeters - 3 centimeters mixed with that upper half centimeter, is in the next sample.

05 21 57+ LMP And 521 is the sample bag.

05 21 57+ CDR Well, the first core has gone down pretty good.

05 21 57+ LMP Oh, you won't have any problem in here coring.

05 21 57+ CDR Oh, man, I tell you, I wish I was putting a drill hole in here. Looks pretty nice.

05 21 58 29 LMP The next sample is mostly the medium-gray fraction of the marbling. It's mixed, though.

05 21 59 19 LMP That's in bag 522.

05 22 00 15 CDR 670, 049, 701; 670, 049, 701.

05 22 00+ LMP The white fraction in the marble zone in 523.

05 22 00+ CDR 524 is what I think is a blue-gray rock probably breccia. It's got a little dust cover.

05 22 00+ LMP From just off the rim of this little crater.

05 22 00+ CC It's a blue-gray rock, it's not part of the trench, right? You finish with the trench?

05 22 00+ LMP Yes.
05 22 05 38 LMP What I know is a blue-gray breccia is in bag 525. (3)(SAMP 73250,55)(PHO 13B 21143-48,78)

05 22 05+ CC And, Jack, you just scooping up little rocks along here - in your little xenolith mode?

05 22 05+ LMP Yes, *** you read my mind. I do want to get one of these light-colored rocks, though.

05 22 05+ CDR When I broke the cores apart, there's just a lot of dried clods and the bottom core's full; but about an inch and a half of the (top) core just zero g to 1/6 g'd itself right out.

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05 22 07 23 LMP Bag 526. (3)(SAMP 73270,75)(PHO 13B 21143-48,78)

05 22 07+ LMP That may have been a piece of gabbro. But again, I can't be completely sure.

05 22 07+ LMP It's either that or anorthositic gabbro we saw up on the front. Up on the massif.

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05 22 07 56 CDR Forty-six, Bob, is going into the long can. (3)(SAMP CORE 73001-02)

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05 22 08+ CDR Okay, Bob, the long can is sealed. (3)(SAMP CORE 73001-02)

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05 22 08+ CDR None of the material in this core, in either the top section or the bottom section, look unlike that stuff just beneath the surface that we sampled at that special stop back there. It's a bluish-gray, and it tends to clod and break up in your hands. And that's core 31 - upper is 31.

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05 22 09+ CDR You've got two-thirds of a core after I packed it down a little bit. (3)(SAMP CORE 73001-02)
05 22 09+ LMP  That little set of 4 samples is in 527, barely.  

05 22 09+ CC  Jack, have you ever started your pan?  

05 22 13+ CC  We're watching you, Jack.  (60mm pan)  

05 22 13+ LMP  *** the samples from that - wait I gotta go up there. Take an after - cross-sun, from over to the north of the gnomon.  

05 22 13+ CDR  You didn't get an after, huh?  

05 22 13+ LMP  No.  

05 22 16 03 CC  Don't forget the gnomon.  

05 22 16+ CDR  We're going back to get that after - and we won't forget it.  

05 22 17+ CC  Okay, how about frame counts on both you guys before you start?  

05 22 19 43 LMP  152 on the LMP.  

05 22 19+ CC  We suggest magazine Juliett, please.  

05 22 19+ CDR  The CDR's on 118.  

05 22 19+ LMP  Fire fire, two frames. You know, I'd enjoy this if it weren't so much fun.  

05 22 19+ CDR  Shoot a 500 while you're doing that.
05 22 19+ CDR Take a portion of the scarp over there you can see.  (3)

05 22 19+ CDR Okay, I'm picking up with frame 66 (500mm) and I'm going to try to get a little bit of where the scarp overlaps the North Massif. I can't see much of it. All I could get was three frames of that. Now I'm picking up the South Massif.  (PHO 144 22047-50)

05 22 22 51 CDR When I finished with South Massif, I was on 94 and I took five more pictures back over to the northeast.  (PHO 144 22051-71)

05 22 25 29 CDR *** (Mark) Bob.  (3-4)

05 22 26 24 CDR We've been rolling for about 30 seconds. (about 55)  (3-4)

05 22 26+ CDR We're at 087 and 5.9 on the range.  (3-4)

05 22 27+ CDR Just drive by this big rock. Want to look at it.  (3-4)

05 22 27+ LMP Looks like one of the gray breccias.  (3-4)

05 22 27+ LMP Big 3- to 4-meter block out here all by itself on the light mantle - I got some pictures. It was at 088, 5.6.  (PHO??)

05 22 27+ LMP And it looked like a gray breccia, I'm not sure though, all I could see was the surface texture, and it had the nodular or elongate nodular texture that those breccias had up on the South Massif.
05 22 29+ LMP As far as any of the things we talked about trying to see at the surface, dynamics or a variation of the light mantle, I think you've heard it all, there isn't much to say about the dynamics right now. I have a feeling that the surfaces are old enough that all those kind of detailed relationships have been obscured. Filleting is just about the same all over here, it varies, but there are no systematics that I've seen.

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05 22 29+ CDR Good lord! Was that a - what was the aspect ratio of that little thing?

05 22 29+ LMP Yes, that's what they call a pit crater. Can you swing a little bit and let me get that fragment crater - see that one on your left there?

05 22 29+ LMP *** crater's we've seen here.

05 22 29+ CDR Got your pictures?

05 22 31 04 LMP Yes, I got them.

05 22 31+ CDR We're at 090, 5.3 for a quick Rover sample of a very very fragmental crater. The ejecta is about 50 percent small angular fragments, much different than we have seen before in terms of the type of patterns.

05 22 31 35 LMP Okay, and that's in bag - 41 Yankee.

05 22 31 40 CDR And we're on our way.

05 22 31+ CDR Get your picture, Jack?

05 22 31 51 LMP Yes. LMP frame count is 15.

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05 22 31 58 CDR I'm 090, 5.3 now Bob. We're heading toward your stop.

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05 22 32 17 LMP I couldn't tell whether that was just - it looked like that might have been a crater that had got to bedrock. There may have been a high point, or let's say a thin point in the light mantle, and it got down to bedrock. But I can't - it's the most blocky-rimmed crater we've seen for a long time. (SAMP 74110-19)

05 22 32+ CDR Yes. All these others are nowhere near that. (3-4)

05 22 32+ LMP It was about 15 meters in diameter. (SAMP 74110-19)

05 22 32+ LMP There are no obvious lineations, at the scale we can observe, on the light mantle. I think the pan photography and the metric stuff may be what you'll have to use for any directional trends out in here. Depending on what we decide the origin is. (3-4)

05 22 33 54 CDR We're 093 and 5.2. (3-4)

05 22 33+ LMP Going to be right on the rim of that crater. (3-4)

05 22 34 08 CC Okay. And, 17, the word from the backroom is - with that last Rover sample you got, we'd like to go straight to Station 4 - and we won't get the one here at 094 and 5.3 - 5.1. (LRV 6)

05 22 34+ LMP I thought the purpose was to sample the light mantle? (LRV 6)

05 22 34+ CC I - we talked to them about that, but they - - (LRV 6)

05 22 34+ LMP We didn't sample light mantle at that last one. (LRV 6)

05 22 34+ CC -- I agree. I talked to them about that. But they are so anxious to get to Station 4, I guess they don't want to do it. (LRV 6)

05 22 34+ LMP Well, how about it, Gene? A little real time - (LRV 6)

05 22 34+ CDR I think we got to, right here. (LRV 6) (SAMP 74120-24)

05 22 34 48 CDR 094, 5.1. You got your picture? (SAMP 74120-24)

05 22 34+ LMP Yes. Okay; that's good enough. (LRV 6) (SAMP 74120-24)
05 22 34+ LMP We'll get the sample - anyway. [3-4](LRV 6)(SAMP 79120-24)
05 22 34 58 CDR Okay. 094, 5.1. [3-4](LRV 6)(SAMP 79120-24)

05 22 35 02 CDR Sample is in 42 Yankee. [3-4](LRV 6)(SAMP 79120-24)
05 22 35 13 CDR And we are rolling. [3-4]

05 22 35 29 CDR We're now at 094 and 5.0. [3-4]
05 22 35 33 LMP LMP frame count is 25. [3-4]

05 22 35+ LMP There aren't very many rocks that just sit on the surface. All of them seem to be slightly buried or moderately buried. That one looked like it might be vesicular. There's a trench - linear set of craters. [3-4]

05 22 35+ CDR I'll just get down this slope. I don't see Shorty though do you? [3-4]
05 22 35+ LMP Is that it out there straight ahead? [3-4]
05 22 35+ CDR Well, let me get down this slope. [3-4]
05 22 35+ LMP Something's dark out there. I think that's it. [3-4]

05 22 35+ LMP I forgot to take pictures again. That scarp certainly is spectacular going up there by Hanover, isn't it? [3-4]
05 22 35+ CDR It just rolls over the side, doesn't it? [3-4]
05 22 38 00 LMP I don't know what else we can say about it, though. Okay, we're getting a good view of the North Massif, and the cross-hatched lineaments that Gene has
talked about are over there, also. They seem to be a set that plunge about, 30 degrees to the east and another set that plunge about the same to the west. Plus the boulder tracks, which we see occasionally over there. And there are areas — boulder fields up on the massif itself, such as we saw on the South Massif. As a matter of fact, it looks like there’s one just above where Station 6 may be. Straight ahead of us there, Geno.

05 22 39 02 LMP About bearing 060 from our present position, which is 098 and 4.8.

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05 22 39+ LMP I don’t see anything like layering up there. Although the upper boundary of those boulder fields on the North Massif, and as a matter of fact, on the South Massif —

05 22 39+ CDR That’s Shorty straight ahead of us, I think.

05 22 39+ LMP Yes.

05 22 39+ CDR Yes, that’s got to be it.

05 22 39+ LMP — all tend to have a linear boundary. That’s the upper portion of the field; the lower portion is strung out downslope. That looks like it might be Shorty. Yes.

05 22 40 07 CDR We’re at 099, 4.7.

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05 22 40+ CDR I think we got it in front of us.

05 22 40+ LMP Looking at the Sculptured Hills, I think Gene’s comments the other day about Bear mountain would apply. There’s a small relief — or small amplitude hummockiness to the surface. It’s formed by a crossmatch of — let’s say the slope. I’m looking at is sort of west-facing slope. So on the other side of Wessex cleft, it’s formed by lineaments plunging about 10 degrees to the north and about 10 degrees to the south. And the combination gives some hummocks that are quite distinct.
05 22 40+ CDR Well, you know it's hard to see a blanket here, but that's got to be Shorty right there.

05 22 40+ CDR It's the only large - real large -

05 22 40+ LMP We want to park. I don't think we'll see a blanket.

05 22 40+ CDR I don't either.

05 22 40+ LMP At least we're going to see where the break in slope is for the rim. My goodness.

05 22 40+ CDR Oh, look at the boulders sitting on that rim.

05 22 40+ LMP It's different.

05 22 40+ CDR It is darker.

05 22 40+ LMP Let's go over there.

05 22 41 42 CDR No question. We're at 10i, 4.5.

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05 22 41+ LMP I think we ought to park over here near that big boulder.

05 22 41+ CDR Yes - yes, if I can get up there. I think I can.

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05 22 41+ CDR Let me get up there slowly. I'll put them on this low saddle here. 045 will give them a good heading.

05 22 41+ LMP Shorty is a crater, the size of which you know. It's obviously darker-rimmed, although the fragment population for most of the blanket does not seem too different than the light mantle. But inside - whoo, whoo, whoo!

05 22 41+ CDR Man, are you going to get a picture now.

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05 22 42 57  CDR  We're heading 041; bearing is 102; distance, 5.1; and 4.4 on the range.

05 22 42+  CC  And did I understand 4.2 on the range, Gene?  

05 22 42+  CDR  Yes sir!

05 22 42+  LMP  Shorty is clearly a darker-rimmed crater. The inner wall is quite blocky – except for the western portion of it, which is less blocky than the others. The floor is hummocky, as we thought it was in the photograph. The central peak, if you will, or central mound, is very blocky and jagged. And the impression I have of the other mounds in the bottom is that they look like slump masses that may have come off the side.

05 22 42+  LMP  That's just what they look like. They have a bench appearance.

05 22 42+  LMP  We've got a large boulder of very intensely fractured rock, right on the rim, right near the Rover. It looks like a finely vesicular version of our clinopyroxene gabbro. It's obviously crystalline and has generally that same appearance. There is, in one spot here, some inclusions of a darker-gray rock also intensely fractured. The fracture systems, I think, will show up well in the flight-line stereo.

05 22 45+  LMP  Okay, I'm going to take a pan while I'm waiting for you.

05 22 46 22  LMP  Oh, hey! Wait a minute –

05 22 46+  CDR  What?

05 22 46+  LMP  -- where are the reflections? I've been fooled once. There is orange soil!
05 22 46+ CDR Well, don't move till I see it!
05 22 46+ LMP It's all over! Orange!
05 22 46+ CDR Don't move it until I see 't.
05 22 46+ LMP I stirred it up with my feet.
05 22 46+ CDR Hey, it is! I can see it from here!
05 22 46+ LMP It's orange!
05 22 46+ CDR Wait a minute, let me put my visor up. It's still orange!
05 22 46+ LMP Sure it is! Crazy! Orange! I've got to dig a trench, Houston.
05 22 46+ CDR Hey, he's not - he's not going out of his wits. It really is.
05 22 47+ LMP It's almost the same color as the LMP decal on my camera.
05 22 47+ CDR That is orange, Jack!
05 22 47+ LMP It's trench time. You can see this in your color television, I'll bet you.
05 22 47+ CDR How can there be orange soil on the Moon?
05 22 47+ CDR Jack, that is really orange. It's been oxidized.
05 22 47+ LMP It looks just like - an oxidized desert soil, that's exactly right.
05 22 47+ LMP That orange is along a line along the rim crest -
05 22 47+ CDR Circumferential?
05 22 47+ LMP Yes, man if there ever was something that looked like a fumarole alteration, this is it.
05 22 51+ LMP I've trenched across the trend of the yellow - or the orange. There is light-gray material on either side.
05 22 51+ LMP You need to get a down-sun color --
05 22 51+ LMP I'll get my black-and-white.
05 22 51+ CDR Let's start sampling that trench.
05 22 51+ CDR Look at where the contact between the gray and the -
05 22 51+ LMP Yes. Right, and it's on both sides --
05 22 51+ CDR Before you disturb it, let me just get a couple of closeups of that.
05 22 51+ LMP Hey, can you get a down-sun? I think your color will be best down-sun.
05 22 51+ CDR Okay.
05 22 51+ LMP Go to hell. Get a little closer, Geno, if you think you're minimum.
05 22 51+ CDR Let me get one more.
05 22 51+ LMP Hey, you want any of this bagged in the can, Bob?
05 22 51+ CC Roger. Let's got the short can for some of that and --
05 22 51+  CDR  It's quite - it's indurated.  
   - - -  
05 22 51+  CDR  See if you can get a sample right across that 
   contact too.  
05 22 51+  LMP  I will. Okay, bag that one.  
05 22 53 49  CDR  Bag 509 has got the - the orange material from, oh, 
   about 2 to 3 inches down.  
   - - -  
05 22 54+  LMP  Okay, the light-gray, which is on either side. Want 
   me to get some more?  
05 22 54+  CDR  Yes, a little more.  
05 22 54+  LMP  All of this is getting mixed a little bit with 
   - about a half-centimeter thick light-gray or a 
   medium-gray covering over the whole area.  
05 22 54 57  CDR  The gray material that is adjacent to the red 
   material is in 510.  
   - - -  
05 22 54+  CDR  And that orange band is about a meter wide, I think.  
05 22 54+  LMP  About a meter.  
05 22 54+  CDR  You can't get to the end of it - bottom of it 
   though, can you?  
05 22 54+  LMP  I haven't been able to yet.  
05 22 54+  LMP  Just to be sure, why don't we sample this side of 
   it, too?  
   - - -  
05 22 55 40  LMP  511 has the gray from the other side of the orange 
   band.  
05 22 55+  CDR  And the other side happens to be the crater side.  

05 22 55+ LMP That's right. North side. (4)(SAMP 74001-02)

05 22 55+ LMP Okay. I'm going to see if this goes on down here as (4)
   a zone.

05 22 55+ CDR It looks like it's ellipsoidal area if my footprints (4)
   are any indication.

05 22 55+ CC We'd like to get the double core here instead of the (4)(SAMP CORE 74001-02)
   small can.

05 22 55+ LMP Did you want it in the orange? (4)(SAMP CORE 74001-02)

05 22 55+ CC Roger, that's affirm. We can put cores in the gray
   soil all the time.

05 22 55 LMP Well, it's a vertical stratigraphy. Do you want to
   go sideways a little with it? Or you just want to
   get it as deep as you can, huh?

05 22 56 52 CC Let's go as deep as we can in the orange.  (4)(SAMP CORE 74001-02)

05 22 57 15 CDR The bottom will be 44, and the top will be 35.  (4)(SAMP CORE 74001-02)

05 22 57+ CC And I'm not sure whether your pan will look down
   into the crater or not, Jack. But if it didn't,
   we'd like to get another one from there. Hey
   there's the crater.

05 22 57+ CDR It did. Yes - look into it yourself - and then I'll (4)
   also get you a stereo pan before we leave. I can do (PHO 137 20991-21027)
   that.

05 22 57+ CDR Yes. I've practiced too long on taking stereo pans
   of craters, without getting one here.

05 22 57+ LMP I got mine from right - right down there, Gene. (4)(PHO 133 20229-56)

05 22 57+ CDR What is that right there? (4)(SAMP 74230,35)
LMP Oh, it's a piece of glass, probably.

CDR Boy, it sure is.

LMP You know that we just about got to the upper edge of this little ellipsoidal zone. I think we've messed up most of it. Let's try right over here.

CDR I've got a little piece of glass in my pocket.

LMP The upper portion of the core is going to be a little bit disturbed, because we've walked around the area so much.

CDR There was a little piece of black glass -- solid black glass.

LMP I'll get a shot.

CDR Take your picture. That's about as far as I could shove it in.

CC Was the gray mantle over the top of this, or was this showing all the way through to the surface?

LMP No, it was over the top. It was about a half a centimeter over the top.

LMP He's getting about 3 centimeters a whack.

CC Very good.

CDR I'll tell you, it's a lot harder going in than that double core was back there. It's pretty hard.

LMP It acts like it's inherently cohesive. It breaks up in angular fragments.

LMP An essential portion of the zone actually has a crimson hue, or red hue. Outside of that it's orange. And outside of that, it's gray.
05 22 59+ CDR I'm going up to max here for just a minute or two.  (4)
05 22 59+ CDR Okay, let me hit some more. Ready?  (4)(SAMP CORE 74001-02)
   ---
05 22 59+ LMP Have at it. He's still getting a centimeter a
   whack, poor guy. I better get a locator.  (4)(SAMP CORE 74001-02)
   (PHO 133 20257-68 BLANK)
05 23 01 05 CDR The only thing I question is our ability to get it
   out. Man, that's really hit bottom.  (4)(SAMP CORE 74001-02)
   ---
05 23 01 57 CDR Pull slowly. Slowly so I can cap it all right. Let
   (4)(SAMP CORE 74001-02)
   me get a cap.
   ---
05 23 01 57 CDR Okay, very slow. Even the core tube is red!  (4)(SAMP CORE 74001-02)
05 23 01+ CDR Even the core is red! The bottom one's black -
   black and orange, and the top one's gray and orange!  (4)(SAMP CORE 74001-02)
05 23 01+ LMP The fact is, the bottom of the core is very black
   compared to anything we've seen.  (4)(SAMP CORE 74001-02)
05 23 01+ CDR Hey, we must have gone through the red soil because
   it's filled, but it's filled with a black material.  (4)(SAMP CORE 74001-02)
05 23 01+ CDR Dark gray, almost a very fine-grained --
05 23 01+ LMP That might be magnetite.  (4)(SAMP CORE 74001-02)
   ---
05 23 01+ LMP God, it is black isn't it?  (4)(SAMP CORE 74001-02)
05 23 01+ CDR Yes. Boy, it is black and is it contrasted to that
   orange stuff. Very black. Well, not very black.
   It's a good dark-gray. Very dark bluish-gray.
   ---
05 23 03+ CDP Why don't you take a picture of the hole, while
   you've got a camera there?
   (4)(SAMP CORE 74001-02)(PHO 133 20257-68 BLANK)
05 23 03+ CC The caps are in SCB 7. They're under the LMP seat. (4)(SAMP CORE 74001-02)

05 23 03+ LMP Well, the hole's mostly in shadow. (4)(SAMP CORE 74001-02)

05 23 03+ LMP We'd like to get a quick sample of the basalt up there on the rim, and Gene's stereo pan, and then press on. (4)(SAMP 74250,55) (PHO 137 20991-21027)

05 23 03+ LMP Okay, Bob, I'll get a sample. I'll sample it by hand. But it'll be documented. And I'll get it in a bag in a minute since I don't have any. (4)(SAMP 74250,55)

05 23 03+ CDR The bottom of the upper core is also dark. (4)(SAMP CORE 74001-02)

05 23 03+ CDR And, like you might expect, the top of the bottom core is dark, too. (4)(SAMP CORE 74001-02)

05 23 03+ LMP If I ever saw a classic alteration halo around a volcanic crater, this is it. It's ellipsoidal. It appears to be zoned. There's one sample we didn't get. We didn't get the more yellowy stuff, we got the center portion. (4)

05 23 06 10 LMP Basalt is in bag 512. (4)(SAMP 74250,55)

05 27 07 00 CDR I'm going to go get my pan. (4)(PHO 137 20991-21027)

05 23 07 31 CDR I'm going several meters around to the east and towards the south to get this pan. (4)(PHO 137 20991-21027)

05 23 07+ CDR I'm going upslope. I'm circum - oh, you know, on the rim. And I'm up. (4)(PHO 137 20991-21027)
05 23 07 LMP  The lower core is chucky-jam full. I don't think I've budged that thing.  

05 23 08 CDR  From where I am, about 100 meters around the west side of the rim of his crater, the mantle on the inside of the rim runs from this gray material we've been sampling in here - to a very dark-gray material. And there's a lot of (orange?) stuff that goes down - radially down into the pit of the crater.  

05 23 08 LMP  Hey, Bob, those cores didn't feel like the follower went down at all.  

05 23 08 LMP  Shouldn't it have gone a little bit?  

05 23 08 CC  Not necessarily, if it's pretty compact stuff. You were having a hard time getting it in.  

05 23 08 LMP  Well, I thought there was a little space up there, but maybe I just didn't feel it.  

05 23 08 CC  Not very much --  

05 23 08 CDR  I got to take a couple of more pictures at that contact slope over there. I know you can't see it from where you are, Jack, but I guess we got to leave. Otherwise it would be nice to sample that dark stuff up on top.  

05 23 08 CDR  I bet I'm out of film! Well, I got them all anyway. I'm at 162. I'm out of film. That stuff - and you're looking at me with the camera - that stuff is up toward that boulder, around that - about as far away from that boulder on the other side as we are on this side. And we want a hack at that boulder, too. Jack, let's see if we can't get that boulder, anyway.
05 23 08+ **CDR** There's a lot of little pieces - not a lot - but enough that I've seen five or six of them. Little pieces of obsidian-like glass. I got one in my pocket. Unbagged. Undocumented. This boulder that you were looking at with the TV. I'm going to take (SAMP 74270,75) a sample. Undocumented.

05 23 11 00 **LMP** I got it! I got it! (SAMP 74270,75)

05 23 11+ **CDR** I'm sorry, I didn't know you got that. (SAMP 74270,75)

05 23 11+ **LMP** Bag 461 has another sample of basalt that I picked up right near where we dug the trench. (SAMP 74270,75)

05 23 11+ **CDR** I'm going to give you something with the TV. I want (4) to show you where that dark material starts.

05 23 11+ **CDR** As you look at the inner rim - as it goes down to the right - you see a lot of boulders - a lot of rocks that are protruding out. Where that rock pattern thins out, just beyond that is an orange - a visible orange radial pattern, and then beyond that is a definite change in albedo where you get the gray material, and a definite change in the number of rocks on the slope.

05 23 12+ **CDR** That particular rim material there continues around to the due north, and then there's a drastic change again where you see the inner rim completely terraced with this boulder fill.

05 23 12+ **CDR** It's 670, 012, 501; 670, 012, 501. (4)

05 23 14+ **LMP** LMP is at 75. (4)
05 23 16 24 LMP Okay. We're moving, Houston. (4-5)

05 23 16+ LMP So you saw a radial orange, huh? (4-5)

05 23 16+ CDR Yes, it was radial, Jack. You could see it very - it'll be in the pictures. (PHO 137 20591-21027)

05 23 16+ LMP That was on the inside of the crater? (4-5)

05 23 16+ CDR On the inside rim of the crater. (4-5)

05 23 16+ LMP Yes, that's where the surface *** keeps slumping off so it's exposed, probably. (4-5)

05 23 16+ LMP I didn't have time to really think at that station but - if I hadn't seen that alteration, and all I'd seen - is the fractured block on the rim, - which looked like the stuff in the bottom - I might have said it was just another impact. But having all the color changes and everything, I think we might have to consider that it could be a volcanic vent. (4-5)

05 23 20+ CDR We moved out into the Tortilla Flat area, I guess. Not very flat. (4-5)

05 23 20+ CDR 102, 3.8. (4-5)

05 23 20+ CDR Boy, Victory is going to be subtle. (4-5)

05 23 20+ LMP There's Victory over there, I bet. See that's the long edge. (4-5)
05 23 20+ CDR That's got to be Victory over there, Jack. (4-5)
05 23 20+ LMP Yes. (4-5)
05 23 23 03 CDR We're at 103, 3.4 (4-5)
05 23 23 03 CDR That is Victory. (4-5)
05 23 23+ LMP We're still seeing — the glass-lined, pit-bottomed
craters. How's that?
---
05 23 23+ CDR There's a square boulder — look at that one! (4-5)
05 23 23+ LMP Yes, it's square all right — or at least one side of
it is.
05 23 23+ CDR No, three sides of it are square. It just fractured
that way — that's by accident, looking at it. So
how do we get over here?
05 23 23+ LMP Go left, probably. And along the rim. (4-5)
05 23 23+ CDR Yes, that's where I'm going to go. Hold on. (4-5)
---
05 23 23+ CDR 106, 3.2. We're approaching the rim of Victory. (4-5)
05 23 23+ LMP And the LMP frame count is somewhere around 85,
maybe. (4-5)(PHO 133 20269-79)
05 23 23+ CDR That's Victory; look at it go to the left and look
at it go to the right. That's Victory; we're right
on the ridge.
---
05 23 23+ CDR 106, 3.2 (4-5)(LRV 7)
05 23 23+ CDR Tell me where you want that thing (EP 1) and we'll
get a pan around it.
---

159
05 23 23+ CDR I'm going, right here; you could put it in that hole.

05 23 23+ CDR Just pick a spot and take your photos.

05 23 23+ LMP Okay, I've got them. Now, go just beyond there. Little bit more. That's good.

05 23 25+ CDR We're at 106, 3.2.

05 23 26 04 LMP Pin 1 is pulled and safe. Pin 2 is pulled and safe. (4-5)(LRV 7)

05 23 27 00 LMP Pin 3 is out and safe.

05 23 27+ LMP And look at the orange flag.

05 23 27+ CC That's what you guys were sampling at Station 4, I bet.

05 23 27+ CDR Yes - it's about that orange, only - not quite as bright. Same shade.

05 23 27+ CDR There's no question but what that we're at Victory.

05 23 27+ CDR Okay, let's get a nice Rover pan here.

05 23 27+ LMP Look at the light mantle over there.

05 23 27+ CDR You can sure see it now, can't you now?

05 23 27+ LMP 'Yes.

05 23 27+ CDR Getting your setting changed fast enough?

05 23 27+ LMP I got it; yes.
05 23 27+ CDR Let's get our Rover sample. (4-5)(LRV 7)(SAMP SOIL 75110-15)(THG 133 20280)
05 23 29 01 CDR And the Rover sample will be from the same locality. (4-5)(LRV 7)(SAMP SOIL 75110-15)
   It's just a couple of meters from the charge.
05 23 29+ LMP Yes. I hope I didn't put too much soil in there for (4-5)(LRV 7)(SAMP SOIL 75110-15)
   you.
05 23 29+ CDR Bag 43 Yankee. (4-5)(LRV 7)(SAMP SOIL 75110-15)
05 23 29+ CC And how about a frame count right now, Jack. (4-5)(LRV 7)
05 23 29+ LMP 106. (4-5)(LRV 7)
   --
05 23 29+ LMP Gene, can you swing out there and give me one look down north into Victor? (4-5)(LRV 7)
   --
05 23 29+ LMP North. Just swing it - point north so I can look in (4-5)(LRV 7)
   there.
05 23 29+ CDR Yes. (4-5)(LRV 7)
05 23 29+ CDR I never got a good look at it. It's a series of (4-5)(LRV 7)
   three craters. There's some boulders on the talus slope of the eastern slope of the southernmost
   crater, the one we're closest to.
05 23 29+ CDR Now how does that look to you? (4-5)(LRV 7)
   --
05 23 29+ LMP I don't know what it looks like. The northwest end (4-5)(LRV 7)
   of the V has a white block - white blocks on it -
   boulders - on the inner wall and right at the rim.
   And the northeast end of the V looks like it has
   somewhat darker rocks.
05 23 29+ LMP Part of that is shadowed, but I think they are (4-5)(LRV 7)
   darker. And they look like about the same as down
   here near the tip of the V.
05 23 29+ CDR Got to be careful on that one, because there's one (4-5)(LRV 7)
   sloping away and one sloping towards us.

161
05 23 31 28 CDR Okay; we are rolling, by the way. And we're at 106 (4-5) and - well, we're still 31.

05 23 31+ LMP In the rim itself though, Victory is not blocky. (4-5) There is some increase in fragment size, but that seems to be the result of some craters in the rim that have gotten below the debris that's covering it. I'd say that Victory's somewhat like Horatio in that it has blocky inner walls but essentially a normal block population on the rim.

05 23 31+ CDR That one I could have gone through. (4-5)

05 23 31+ CDR Look at the size of that one. That's another one of (4-5) those -

05 23 31+ LMP Yes. (4-5)

05 23 31+ CDR *** - there's another one on the right. Look it. (4-5)

05 23 31+ LMP Some of them have -

05 23 31+ CDR Well, that one doesn't have any fragments in the bottom of it.

05 23 31+ LMP No. (4-5)

05 23 31+ CDR Looks like someone walked across it. (4-5)

05 23 31+ LMP I think that there's quite a variability in the thickness of the dark mantle in here. I didn't notice us crossing that one tongue of light mantle.

05 23 31+ CDR No, I didn't either. (4-5)
05 23 31+  CDR  Looking into the Sun, you can't tell any difference anyway. However, I tell you, I certainly get the impression there is a mantle. I would say that -

05 23 31+  LMP  Oh, I think so. I don't know what it is, but the dark mantle exists. These craters are just too big not to have thrown up blocks. And they're either subdued by the mantle or they haven't penetrated it.

05 23 31+  LMP  And I think you probably have both.

05 23 31+  CDR  I'd say they've been subdued by the mantle. That really imposes an impression on me.

05 23 31+  LMP  Yes. There are those that appear that way, like Horatio, for example, or the big ones. But others, I think, are too young. They just don't penetrate. Particularly those that are big and have bright halos.

05 23 31+  CDR  Yes, but the only ones that look fresh and not enough to penetrate are these little ones with the glass in them.

05 23 31+  LMP  Well, there's been some big fresh ones. We'll look for one.

05 23 31+  CDR  Now there's one with glass in it, probably.

05 23 31+  LMP  Yes. I think that's one --

05 23 31+  CDR  And without any blocks on it. That may not have penetrated.

05 23 31+  LMP  Yes, that just has mostly the shock-indurated rock.

05 23 35 13  CDR  We're coming up to 103 at 2.6 now, so we need a sample up here.

05 23 35+  CDR  103, 2.5, anywhere.

---

05 23 35+  LMP  Okay. Right out in that little inter-crater area, right out in there is good. If you let me guide you a little, I might get a rock sample.
05 23 35+  CDR  Okay.  Pick a point.  

05 23 35+  LMP  Whoa!  Now we'll give it a try.  

05 23 35+  CDR  103, 2.5.  

05 23 36+  LMP  The soil is in 44 Yankee.  
05 23 36+  LMP  That block's too big.  I can't get it.  
05 23 36+  CDR  Get your picture?  
05 23 36+  LMP  No.  Okay, got mine.  

05 23 37 04  LMP  125's the LMP frame.  

05 23 37+  LMP  I think Station 5 is a pretty good spot.  

05 23 37+  LMP  It's probably the most concentrated boulder field on Camelot.  

05 23 37+  LMP  Wonder where Horatio is?  

05 23 37+  CDR  It's probably right over that on the right, Jack.  Right off your right hand at 2 o'clock.  
05 23 37+  LMP  Right.  I guess so.  
05 23 37+  CDR  You know, it doesn't have boulders on it.  It should be over there.  That should be right over that rim.
05 23 37+ CDR I'm sure glad I went up to take that second pan to see that stuff go radially down into the center of the crater at that contact.

05 23 37+ CDR Look at - up the cleft over there. You can see definite change in albedo now between the North Massif and the Sculptured Hills. Look right up the valley.

05 23 37+ LMP Yes. But, again, that may be your photometric effect.

05 23 37+ CDR Yes, one's an upslope and one's a downslope.

05 23 37+ LMP Yes. Yes. Just about right, but it's supposed to be darker in the cleft you know.

05 23 40 40 LMP Bob, the fragment population - we're at 099, 2.0 - is still about 1 percent category of - and it's hard to tell, going into the Sun, what kind of blocks you're dealing with. But my guess is - well, more than a guess - most of them look like they're slightly vesicular. And, in that regard, resemble the gabbros.

05 23 40+ LMP Now there is something - there's a class of boulders that is flat-topped and fairly well rounded that is just about completely burled. Not more than 5 centimeters of it projects above the surface. We've seen those off and on, both days.

05 23 40+ LMP And they seem to be quite distinct. At least you notice them. Now, whether it's just a continuation of the mantling, I don't know. But most other boulders - the big ones seem to be - project above the surface more than just that 5 or 10 centimeters.

05 23 40+ CDR I tell you, the Sculptured Hills just have that wrinkled old-face feeling.
05 23 40+ LMP Yes. There are blocks over there though, aren't there? (4-5)
05 23 40+ CDR There's blocks, but I don't see any concentrated outcrops -- or concentrated masses of blocks up on the slope anywhere -- like you did on the massif. (4-5)
05 23 40+ CDR Do you think that's Camelot or not? (4-5)
05 23 40+ LMP I think that might be Camelot. (4-5)

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05 23 40+ CDR -- southwestern rim. (4-5)
05 23 40+ LMP Yes. (4-5)
05 23 40+ CDR Yes, because Horatio's got to be on our right. (4-5)
05 23 40+ LMP It's not Horatio, is it? (4-5)
05 23 42 43 CDR Well, we're at 094, 1.7. (4-5)
05 23 42+ LMP No, I think that's Camelot. Horatio didn't have blocks that far up the rim. (4-5)
05 23 42+ CDR Let me look at the bottom. I'll tell you. I remember. (4-5)

---

05 23 42+ LMP Yes. (4-5)
05 23 42+ CC That kind of sounds like Camelot to us. (4-5)
05 23 42+ CDR Yes, I remember. Yes, that's it, Bob. We're coming right up at Station 5. Right at it. (4-5)
05 23 42+ LMP You want to park up on the rim so they can have a good panorama? (4-5)
05 23 42+ CDR I'd like to get a little on the other side of those blocks, if I can. (4-5)
05 23 42+ LMP Yes, you better. Then they can look with the Sun on them. (4-5)
05 23 42+ CDR Because, otherwise, they can't see that other rim over there. (4-5)

---

05 23 42+ CDR I'll get to the other side. Then they can look at these blocks and those across the way. I got to go around this block field, though. (4-5)

05 23 42+ LMP I should hope so. *** (4-5)

05 23 42+ LMP There's Horatio back there. I can see Horatio now. (4-5)

05 23 42+ LMP Looks just like it did before. (4-5)

05 23 42+ CDR So, we came right where we were supposed to. (4-5)

05 23 42+ LMP All the blocks look very much the same in the wall of Horatio. (4-5)

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05 23 42+ CDR Talk about a block field! (4-5)

05 23 42+ LMP I think my guess of 30 percent was reasonably good before. (4-5)

05 23 42+ CDR I'll park right over here, so that they can look in it. (4-5)

05 23 42+ CDR I got to head 045, so I head right into those blocks. (4-5)

---

05 23 45 15 CDR We're stopped. 086 and 1.4. (5)

05 23 45+ LMP Not very level for the gravimeter. What's their limit? (5)

05 23 45+ CDR I don't know, but it's taken a couple better than this. (5)

05 23 45+ CDR Hey, I got to change film. (5)
05 23 45+ LMP I think I can get by this station without it. (5)

- - -

05 23 47+ LMP Bob, I have 135 frames. (5)

- - -

05 23 48+ LMP This looks just like our old friend, the pyroxene (5)
gabbro with the shiny limonite platelets in the vugs
and partially recrystallized vesicles. The textural
variations are planar, and they're primarily -
subplanar in the concentrations of vesicles.

- - -

05 23 48+ CDR Bob, what magazine? (5)

05 23 48+ CC Magazine Delta. (5)

- - -

05 23 48+ CDR Delta - Bravo. There's Delta. (5)

05 23 48+ LMP Boy, this is certainly a subfloor, as we mapped it. (5)
It's certainly a uniform rock type. I'll tell you.
The only variation - are those gray zones which just
seem to be either finer or the absence of vesicles.
Boy, I'm nose to nose with a piece of it right now.

- - -

05 23 50 37 LMP Here I am in the middle of a boulder field. The (5)
texture - mineral texture appears to be subophitic
to - sort of like a good diabase, although a little
coarser. But it's unquestionably organized and -
with that variation in vesicle concentration.

05 23 50+ CDR Starting on frame 4, Bob. (5)

- - -
05 23 50+ LMP I have the impression that these blocks are buried up here. That the mantle does exist, even on Camelot. There are a few blocks that - looks like they're lying more or less on the surface, you can attribute those to craters that have disrupted the block field.

05 23 50+ LMP The big ones seem to be projecting out of the mantle.

05 23 50+ CC Do you see any such mantle - - on top of them?

05 23 50+ LMP No, I don't. What's there seems to be what could have been knocked up there.

05 23 50+ LMP I see a place where I think we can skim some off the top of a rock, which I think we probably ought to do.

05 23 50+ LMP But I don't have the impression of draping, so much as I have just of burial. And I have a feeling that the zap-pitting process just has cleaned these boulders off - of anything that may have been on top of them, in excess of what's around them, right now.

05 23 50+ CC You're talking about mantle - blocks - then mantle - and then cleaned off by zap pits, in other words.

05 23 53 38 Lr: That's right. That seems to be what has happened all over the Moon that we've looked at. But the rocks are always cleaner than the surface, of course. The far rim of Camelot - you can see - fact is everywhere but where we are and on the rim near the LM - the rim seems to be completely covered or, at least, the blocks don't show through. They show up in the wall but not at the rim. That's much like Horatio, but not to the extreme that we saw at Horatio. I'd say, at Camelot, the mantle is - oh, maybe - at the most - the rim thickness, if that's mantle, is on the order of a half of what we saw at Horatio.

05 23 53+ LMP The pan should let you measure that - well, we didn't get a pan at Horatio, but we got some Rover shots of it. But you may be able to - quantify that a little bit.
Here's a nicely structured rock that we probably ought to work on here. Structured again in the vesicle concentration. And then I think we ought to try to get right over there, we can get mantle.

Hey, I'll tell you what impresses me about some of these rocks. There's a lot of — they may be zap pits — I guess you looked at them closer than I did, but there sure is a lot of lineation in some of that white material, Jack.

But at what scale?

On a visual-obvious scale.

The crystal grains seem to be linear, but they are more or less random. Is that what you mean?

No, they're linear, though. — can't be really linear and random. There's some rocks here — that are highly vesicular and there's others that are not.

That's right.

Let me get these two first and then we'll go get that one, because there's two different kinds here — at least apparent kinds. One's a relatively new fracture.

We need to sample the structures, though, in this thing. We haven't really done that.

We'll try and get an around-the-corner — — picture.
05 23 55+ LMP We need to get that stuff on the mantle, too. I mean on the blocks.  
(5)(SAMP 75010,15)

05 23 55+ CDR We want to get an around-the-corner picture of one of those big ones, too. See if we can get the structure of it. Okay, you get your picture?  
(5)(SAMP 75010,15)(PHO 133 20328-29)

05 23 55+ LMP Yes.  
(5)(SAMP 75010,15)(PHO 133 20328-29)

05 23 57 19 CDR Here's a piece right here.  
(5)(SAMP 75010,15)

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05 23 57+ LMP Okay, I got it. That looks like our old friend, the *gabbro*, all right.  
(5)(SAMP 75010,15)

05 23 57+ LMP 462 is Gene's fairly freshly fractured rock.  
(5)(SAMP 75010,15)

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05 23 57+ CDR Here's another one right here.  
(5)(SAMP 75030,35)(PHO 133 20328-29; 145 22136-40)

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05 23 58 53 LMP 463. Is another of the same variety. Wish we'd started on that structured rock because we're going to run out of time. Let's go over there and get at least one off of it.  
(5)(SAMP 75030,35)

05 23 58+ CDR Yes, we'll get it.  
(5)(SAMP 75030,35)

05 23 58+ LMP Get the after.  
(5)(SAMP 75030,35)(PHO 145 22139-40)

05 23 58+ CDR Got it.  
(5)(SAMP 75030,35)(PHO 145 22139-40)

05 23 58+ CDR What did you have picked out?  
(5)(SAMP 75050,55)(PHO 133 20330-36; 145 22141-53)

05 23 58+ LMP This in here with the layering in it.  
(5)(SAMP 75050,55)

05 23 58+ LMP I'll get a -- a flight line photo.  
(5)(SAMP 75050,55)(PHO 133 20330-34)

05 23 58+ LMP Why don't you get a flight line -  
(5)(SAMP 75050,55)(PHO 145 22141-53)

05 23 58+ CDR I'm going to get that from here.  
(5)(SAMP 75050,55)(PHO 145 22141-53)

05 23 58+ LMP Sort of northeast. How you going to go?  
(5)(SAMP 75050,55)(PHO 145 22141-53)
CDR  I'll come around from this end and go around to that side. (SAMP 75050,55) (PHO 145 22141-53) (PHO 133 20330-34)

LMP  Okay, I'll go perpendicular to you more or less. (SAMP 75050,55)

CDR  Boy, that one right behind you is just vesicular, by comparison, to a high degree - like three times as much. (SAMP 75050,55)

CDR  I hope those bags weren't in the way of every one of those pictures. There ought to be a lot of permanent shaded samples in here, Jack. (SAMP 75050,55)

LMP  Okay, I got the down-sun. (SAMP 75050,55) (PHO 133 20335)

CDR  Men! That's a hard Moon. (SAMP 75050,55)

LMP  How about this chunk down there, Gene? (SAMP 75050,55)

CDR  I don't think that'll come off very easy. (SAMP 75050,55)

CDR  By golly, your geology training did come in handy. You learned where to hit rocks. (SAMP 75050,55)

CDR  464. Won't all go in there but -- (SAMP 75050,55)

LMP  That's all right, you can wrap it around it. (SAMP 75050,55)

CDR  No, I'll get it, babe. It's in there. (SAMP 75050,55)

CDR  These rocks here have a much greater density of the white minerals in them, or crystals, than I've ever seen before, Jack. Where did we see these kind before?

LMP  Well, when I looked at them right at first, that's what I thought - but I think that the zap pits are making the white stand out more. They're fooling you a little bit. (SAMP 75050,55)
LMP: Because when I looked at it with the hand lens, it looked like a fairly normal gabbro — like some of those that have crystallized with the mare basalt.

CDR: Where are you?

LMP: I'm back over here. What I want is a sample of this soil off one of these rocks.

CDR: Okay, let's get that now and then let's get the rake sample.

LMP: But it looks to me like it's soil that's been thrown up there rather than — this rock is about 3 meters in diameter — but it's one of the flat-surfaced rocks. It only stands about — at the most — one-third of a meter high.

LMP: But we can get up about a meter from the soil/rock interface and get soil off the rock, I think.

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LMP: I got some soil.

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CDR: 465 is that bag number.

LMP: Okay, this is soil from a half a meter in. It's about a centimeter deep and a-half-a-meter in.

CDR: Let's take that chip there that's lying on top with the next scoop.

CDR: Let's take the soil on that. Okay, take that one then. Well, that's another bag. Before you pick that one up, pick that little chip up.

LMP: I don't want to get the chips. I want the soil. Either that or a coherent rock.

---

CDR: Okay, 465. Pick that other one up and I'll bag it real quick.
06 00 05+ CDR That's the soil from on top the rock. And we're taking a piece of the rock itself, which looks pretty much like the other one. It might be a little bit more vesicular.

06 00 05+ CC That'll be in 467, right?

06 00 06 06 CDR You're right again.

06 00 06+ LMP Okay, the soil came from a half a meter in... the soil boundary. Let me get over here and get one bag of soil that's away from the boulders.

06 00 06+ CDR I'm going to get my after while I'm here.

06 00 06+ CC We'd just like to get the kilogram of soil somewhere between the boulders - as open as you can.

06 00 06+ LMP Let's do it right here.

06 00 06+ CDR This will be a matched pair with our soil sample, too.

06 00 07 32 CDR Bag 467 is where your kilogram is coming from.

06 00 07+ CDR Another scoopful.

06 00 07+ LMP I'm sampling down to about 5 centimeters.

05 00 08 15 CDR That's full. That's 467.

06 00 08+ CDR Jack, you got a shot of where my scoop was, didn't you?

06 00 08+ LMP Yes.

(5)(SAMP SOIL 75060-66) (SAMP 75070,75)

(5)(SAMP 75070,75)

(5)(SAMP 75070,75)

(5)(SAMP SOIL 75080-89)(PHO 145 22156-57)

(5)(SAMP SOIL 75080-89)

(5)(SAMP SOIL 75080-89)

(5)(SAMP SOIL 75080-65)

(5)(SAMP SOIL 75080-89)

(5)(SAMP SOIL 75080-89)

(5)(SAMP SOIL 75080-89)

(5)(SAMP SOIL 75080-89)

(5)(SAMP SOIL 75080-89)

(5)(SAMP SOIL 75080-89)
06 00 08+ CDR Let me get an after of it, though. (5) (SAMP SOIL 75080-89) (PHO 145 22158)
06 00 08+ LMP We sampled about 3 meters southwest of the gnomon that was set up for the top-of-boulder soil sample. So it's a matched pair, really, in that rega.

06 00 08+ LMP Now I need to get a pan - are you in a pan? (5) (PHO 133 20339-61)
06 00 08+ CDR I've already started it. (5) (PHO 145 22159-03)
06 00 08+ LMP I'll go over near the Rover and get one. (5) (PHO 133 20339-61)

06 00 11 23 CDR 670, 031, and 401. 670, 031, and 401. (5)

06 00 11+ CDR CDR's at 50. (5)
06 00 11+ LMP 170. (5)

06 00 11+ LMP I'll use it until it runs out. (5)
06 00 11+ CDR I got a lot of film anyway. (5)

06 00 11+ LMP Let's go. (5)
06 00 15 16 CDR Okay, the switch is coming on. (5)

06 00 15 59 CDR I'm reading 085/1.4. (5)

06 00 15+ LMP I guess my impression and it's purely pure interpretation right at this stage - that Camelot is mantled by whatever has formed the dark mantle. (5-ALSEP)
06 00 15+ LMP It does not seem to be mantled to the degree that Horatio is. (5-ALSEP)
---
06 00 16 58 LMP And we've been going about - a minute. (5-ALSEP)
---
06 00 16+ LMP The inner wall of Camelot to the east is certainly blocky. (5-ALSEP)
---
06 00 18 08 CDR Okay, we're at 083 and 1.1. We're just about abeam the eastern rim of Camelot. And there's Challenger. (5-ALSEP)
---
06 00 18+ LMP You can even see the ALSEP. (5-ALSEP)
---
06 00 18+ LMP Looking over there, though, we're about 50 meters from boulders in Camelot. And their appearance from this distance is the same as what we sampled at 5. I think we've pretty well identified the subfloor. (5-ALSEP)
06 00 18+ CC Sounds like from the very deepest - even from the bottom of Camelot - it looks like it's about the same. (5-ALSEP)
06 00 18+ LMP It sure does. I can't say I understand it. But that's the way it appears right now. (5-ALSEP)
---
06 00 18+ LMP Whatever filled this valley - it certainly was different than the massifs. I think we've proved that. And it, presumably, at least everything I see indicates that it was an igneous extrusion of some kind. Either that, or the whole valley's been tilted and we're looking at some strange cross section, planar more or less - relative to the other mountains, of a crystalline body that was formed at depth. But I don't think that's likely.
06 00 20+ LMP Look at the Italian flag. (5-ALSEP)
06 00 20+ CDR Hey, there is one there. I saw the box before I saw the flag. No I didn't, I saw the flag first. (5-ALSEP)

06 00 20+ CDR I'm 082 and I'm 0.5. I'll just head right in towards the LM. Man, I want to stay away from ALSEP, I see that big boulder. (5-ALSEP)

06 00 20+ CDR Did we ever get any glass out of the bottom of those craters? (5-ALSEP)(SAMP 70019)
06 00 20+ LMP No, we haven't, we've got to try to do that before we leave. (5-ALSEP)(SAMP 70019)

06 00 22 47 CDR 081, 0.4. (5-ALSEP)
06 00 22+ LMP Okay, let's put it in that little depression there. See right ahead of us to the right. (5-ALSEP)
06 00 22+ CDR Got your picture? (5-ALSEP)
06 00 22+ LMP I'm getting them. (5-ALSEP)(PHO 133 20369-73)
06 00 22+ LMP Now just swing into that depression and I'll put it there. (5-ALSEP)

06 00 23 12 LMP Okay, charge number 8. (5-ALSEP)
06 00 23+ CDR You didn't get a picture to the LM then, did you? (5-ALSEP)
06 00 23+ LMP I got several of them. (5-ALSEP)(PHO 133 20369-73)
06 00 23 21 LMP Okay, antenna is deployed. Pin 1 is pulled and safe. And let me check that. It's dusty. Yes, it's safe. Pin 2 is pulled and safe. Pin 3, pulled and safe.

---

06 00 23+ LMP Okay, the LM was in the approach shot, I believe, let me - go ahead and turn around -- (5-ALSEP)

06 00 23+ CDR Yes, I got to go around anyway. (5-ALSEP)

06 00 23+ CDR This way I can get a running shot of *** - right in the middle of it - let me get them both in it. (5-ALSEP)(PHO 145 22184)

06 00 23+ LMP Okay, I ran out of film, too. (5-ALSEP)

06 00 23+ LMP When you come around, take a picture of the LM on your camera. (5-ALSEP)

06 00 23+ CDR I will. I'll take it right out the front looking right at the thing. (5-ALSEP)(PHO 145 22184)

06 00 23+ LMP Yes, and give them a frame count. (5-ALSEP)(PHO 145 22184)

06 00 23+ CDR Five-six. (5-ALSEP)(PHO 145 22184)

06 00 23+ CDR Bob, I've got the locator of the charge and the LM all in the same order here, and I'm one more than what I just gave you. I can't look at it now. (5-ALSEP)(PHO 145 22184)

---

06 00 25+ CC Jack, if you'll get out at the ALSEP, we'll have you take a look at the surface gravimeter and Gene can press on home to the LM. (5-ALSEP)

06 00 25+ CDR Jack, I'm going to drive you in this way, and then I'll drive all the way back around that one geophone. (5-ALSEP)

06 00 25+ CC While you're to the north, you could drive in toward the heat flow, towards that big rock, if you can see that. (5-ALSEP)

06 00 25+ CDR Yes, that's as good as anything. (5-ALSEP)
06 00 26+ CDR Do you have any film at all?  (ALSEP)
06 00 26+ LMP No, I want your camera.  (ALSEP)

06 00 26+ CC Okay, Jack. We aren't planning on taking the ALSEP photos right now.  (ALSEP)

06 00 26+ CDR Okay, Jack's got my camera and tongs, and I'm on my way.  (ALSEP-LM)

06 00 27 42 CDR I'm reading 089, 20.1, 002.  (ALSEP-LM)

06 00 32 24 CDR Yes, sir. I'm parked.  (LM)

06 00 32+ CC Gene, are you at the Rover?  (LM)

06 00 32+ CDR Yes, sir. I'm parked.  (LM)

06 00 39+ LMP I just sampled the glass in the bottom of a crater. I documented it by shooting the LM across the crater at infinity and then shooting the crater with stereo at 11 feet and in that cross-sun pair at 7; and then I sampled it.  (ALSEP)(SAMP 70019)(PHO 145 22185-91)

06 00 39+ LMP Then I took a cross-sun pair at 7 after.  (ALSEP)(SAMP 70019)(PHO 145 22190-91)

06 00 39+ LMP It's very fragile, and I double bagged it. I don't know whether we can keep it or not.  (ALSEP-LM)(SAMP 70019)

06 00 39+ CDR You may think about how to preserve it.  (ALSEP-LM)(SAMP 70019)

06 00 39+ LMP While you're thinking, I'll put it on my floor pan.  (LM)(SAMP 70019)
06 00 41 50 CDR As you look at those little sparkles in the soil we're walking on and they change colors on you -- greens and purples, iridescent. Iridescent sparkles.

06 00 42+ CC Okay, guys. We're going to put stuff in loose, because they'd like to segregate stuff in the following way. Like to put the long can and four core tubes in the SRC. They'd like to get the long can and three core tubes in the SRC number 1. And then we'd like to get all the SCB 4 samples in the same SRC.

06 00 42+ CDR Three plus the long can; that's four cores all together.

06 00 42+ CC Right. Put those in the SRC --

06 00 42+ CDR All samples from 4.

06 00 42+ CC All the samples from SCB 4.

06 00 42+ LMP These are 4. You want to get the core tubes in first, though.

06 00 44 40 CDR Yes. I want to put these in.

06 00 44+ CC Do you remember where the three trench soil samples -- which bag those were put in -- from Station 4?

06 00 44+ CDR I'm the only one who had bags, so I bagged them and put them in whatever bag Jack had.

06 00 44+ CC Okay, then that'll be SCB 4, so we'd like those in SCB 4. And those are the ones that will go in the rock box.

06 00 44+ CDR Give me these other two cores, if you've got them, Jack.
06 00 44+  CDR Long can. (LM)
06 00 44+  LMP The long can. (LM)
06 00 44+  CDR Yes, and we need one more core. (LM)
06 00 44+  LMP One more core. (LM)
05 00 44+  CDR That right now? Three core tubes and a long can? (LM)
06 00 44+  CDR Yes, got them all. (LM)
06 00 44+  CC And then all the samples in SCB 4. Then beyond that we’ll fill them up with samples from SCB 5.

06 00 47 27  CC Jack, it probably would protect the glass a bit better if you put it in the SRC gently with the other rocks there. (LM)(SAMP 70019)

06 00 47+  LMP Leave a space for a sample, I guess, Gene. (LM)(SAMP 70019)

06 00 47+  LMP Just set it in there. (LM)(SAMP 70019)
05 00 47+  CDR Yes, I’ll tell you, I’ll be delicate with it. (LM)(SAMP 70019)
06 00 47+  LMP Okay. It’s in the right-hand back corner of the SRC. (LM)(SAMP 70019)

05 00 48+  LMP There’s samples in (SCB) 6. (LM)
06 00 48+  CC Okay. You should also have SCB 8 under your seat with samples in it. (LM)
06 00 .48+  LMP This is what I sampled at —
06 00 48+  CC At Station 3, maybe. (LM)
06 00 48+  LMP Six has the samples rom – from – yes. (LM)
06 00 48+ CC Okay. Let's take up SCB 8 --  

- - -  

06 00 48+ CC And let's take up SCB 6 and why don't you dump out the Rover samples into SCB 6?  

06 00 48+ LMP Well, one reason not to take 6 is I don't know if I can get it off.  

06 00 48+ CC And let's save SCB 4 because I think you may need that tomorrow.  

06 00 48+ CDR Four is on the rack, empty.  

06 00 48+ CC How about SCB 5? Is that only partially emptied, or is it totally emptied?  

06 00 48+ CDR Oh, it's about half full, Bob.  

06 00 48+ CC Okay. We'll take that up with us.  

- - -  

06 00 50 08 LMP I've got SCB 8 full.  

06 06 50+ LMP Let's take it up.  

06 00 50+ LMP It's got Rover samples in it.  

06 00 50+ LMP But I can't get them all. They won't all be in there.  

06 00 50+ CDR The seal was clean. It was clear and I got your four cores - three cores, plus a long can. I got Jack's glass. I got SCB 4 and a couple of samples out of SCB 5.  

- - -  

06 00 50+ CDR Now, Jack, we've got SCB 5 that's half full. What have you got over there?  

06 00 50+ LMP Bring it over here, and I'll put it into 6. Six is a little more than half full.  

06 00 50+ CDR Well, this is a little less than half full.
CDR That ought to make one full bag. These are big rocks so they'll come out easy. Where's that big, big rock we got? That's in one of those bags, too. Picked up a big rock - here let me see if I can't dump it.

---

LMP Okay, Bob. SCB 8 and 6 are going up.

CC Okay, and I understand 5 will be -- on the gate.

CDR Yes, sir, Bob. It'll be there.

LMP And 7 under the LMP's seat.

CDR Four and five will be on the gate.

---

LMP Nothing's in the big bag.

LMP Unless there's one rock that disappeared yesterday. I don't know what happened to it.

---

CC Jack, while you're unloading there -- on the 500 millimeter, you might squeeze off a few shots of the North and South Massif there, if there's any lineations visible.

LMP I'll give it a try.

---

CDR Why don't you give it to me while you're packing the ETB, Jack; I'll do it.

---

LMP Oh, I should call - mag Charlie.

LMP Mag Kilo, Mag Bravo, Mag Golf, Mag India.
06 00 57+ CC  Tell Gene that we can confirm that his lense cover's (LM)(PHO 144 22080-132) off.
   - - -

06 00 57+ LMP  Try f:5.6 directly down-sun or up-sun at that (LM)(PHO 144 22080-132)
   Sculptured Hills there in the distance.

06 00 57+ CDR  Yes, I'll get it. (LM)(PHO 144 22080-132)
   - - -

06 00 57+ CDR  Some of these won't overlap, Bob, because I'm (LM)(PHO 144 22080-132)
   hurrying.
   - - -

06 00 57+ CDR  They're not smeared, but I just didn't overlap some (LM)(PHO 144 22080-132)
   of them.
   - - -

06 00 57+ CDR  Frame count is 152 on the 500. (LM)(PHO 144 22080-132)
   - - -

06 01 00+ LMP  Mag Romeo. (LM)
   - - -

06 01 14 22 LMF  What is this rock, right here, by the pad? (LM)
   - - -

06 01 14+ LMP  Yes. I've just been intending to mention that (LM)
   several times. Anybody that lands on a rock ought to have their head examined.
   - - -

06 01 14+ CDR  Gosh dang that rock! If I was strong enough, I'd (LM)
   move it. Hey, I am strong enough. That's one we ought to bring home.
   - - -
06 01 24 CDR SRC 2 is in my hand. The big bag is not required. (UM)

06 01 22+ CDR Are the three SCBs inside the hatch, already? (UM)

06 01 22+ CDR I've got 8 here and 6 here, and we emptied the contents of 4 into the SRC, and we emptied the contents of 5 into one of these other two bags. So we've only got two of them here, plus the SRC. (UM)

06 01 22+ CDR Five went into 6. (UM)

06 01 27+ CDR And we've got two of them hanging on the tail of the SRC. And I don't know what it is under Jack's seat right now. (UM)

06 01 22+ UHP Seven is under my seat. (UM)

06 01 29 44 CDR Okay. Hatch is closed and locked. (UM)
06 02 32+ CDR I just dug a rock out of my pocket. When we were at (BETWEEN EVAS)(SAMP 74230,35) Shorty, fumbling around, trying to get everything done, I said there was a piece of very shiny black glass-like-looking material that reminded me of obsidian. Well, it's not. It looks like a very fine-grained gray rock. But, it's a fractured piece and I've picked up fractures of about three or four vesicle faces on it. The vesicle faces are very shiny and that's what reflected and caught my eye. I picked it up at Shorty. Undocumented, halfway between the Rover and where we were sampling that orange stuff. And it will be in bag 12 Echo.

---

06 22 32+ CDR We'll put it in SCB 8. (BETWEEN EVAS)(SAMP 74230,35)

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06 02 33+ LMP This rock looks very much like 12003. It's a fine-grained, very coarsely vesicular gray rock - probably basaltic. (BETWEEN EVAS)(SAMP 74230,35)

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06 02 33+ LMP The vesicles, if I may project the size of them, probably were up to 4 or 5 centimeters in diameter. They're irregular in shape, but they're clearly vesicles and it looks like they are lined with either glass or very fine-grained crystals. They're very shiny. (BETWEEN EVAS)(SAMP 74230,35)

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06 02 36+ LMP You might make a note that 12003 area samples went into bag 8 as:

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06 02 36+ CDR SRC is 41.5. Bag 6 is 8 is 35. (lbs.) (BETWEEN EVAS)

---
Now two real quick geology questions that will help us do the planning for your EVA tomorrow. The first one has to do with Station 4. You called out some material on the rim there - the crater at Station 4 - which looked like bedded spatter. And we're wondering if that resembled that you'd seen in Hawaii?

'Think that's heard. I think I may have said shattered and you might of thought spattered. Neither one of us intended to leave that impression. The big rock we sampled looked like intensely shattered gabbro, such as we've had around the Li. The rocks, probably more significantly, that Gene - one of which Gene picked up with the fine-grained vesicular basalt - coarsely vesicular basalt. And we didn't have any time to really examine the interrelationships of those rock types there, but those were the two fragment types we saw.'

The bottom of that crater, now, had material that was extremely disorganized in its aspect and, really, we didn't have time to examine it in detail in order to decide why it was disorganized. It did not necessarily look like the boulder that we sampled at the rim.

A question about the boulder you sampled at the rim. Would you compare the basalt in this boulder which you may have called a gabbro, I'm not sure - in any case the basalt - to samples which you collected at Camelot and at ALSEP?

Well, my impression was that they were the same rock types.
CDR: The small craters — of course, are the ones that can (BETWEEN EVAS) really jolt you. But the trouble is, you can never see what's just over the next ridge, and the next ridge may be 20 meters away, and you just can't see it until you're there, and you don't know whether it's a dish crater or pit crater.

LMP: That description fits the geology up in there, (BETWEEN EVAS) because we weren't seeing blocky-rimmed craters and otherwise you would have been able to tell more easily about the old versus new craters, which would be the ones you could either go through or not go through, respectively.

CC: Your mag Bravo is about 77 frames, and we'd like for (BETWEEN EVAS) you to leave it in the ETB and take it out with you tomorrow.
I think in terms of sampling, Gene and I will try to (BETWEEN EVAS) shift the emphasis in the mantle area to fragments that are different from the gabbros that we've sampled fairly well. I think, up to now, that presumably are subfloor materials. You might pass that word on and see if they agree with us.

Let me read up the planning for EVA 3 and the summary of what we think we have so far. (BETWEEN EVAS)

CC

Let me read up the planning for EVA 3 and the summary of what we think we have so far. (BETWEEN EVAS)

LMP

Go ahead. (BETWEEN EVAS)

LMP

Go ahead. (BETWEEN EVAS)

CC

Okay, I'll read here from this thing just verbatim. (BETWEEN EVAS) It says, "EVA 3 continues to follow essentially the minimal pre-mission plan. Main objectives continue to be the North Massif; Station 6, 7; Sculpture Hills; and Van Gogh crater. In view of the extensive observations of the dark mantle and plains subfloor unit on EVA 1 and 2, particularly those before Station 5, the relative priority of Station 10 is reduced, so that Station 10 becomes a flexible station as time allotment is a reserve, possibly providing more time at the earlier station, if desired. However, mantle and block sampling at Station 10 are still important objectives. Back-pack constraints are not nearly as tight as they were yesterday, guys, and so we can be more flexible in rescheduling station times if we need. We probably won't be coming up against option walkbacks like we did at Station 4. Closeout time at the LM has been increased by 20 minutes to make the closeout less rushed and to allow for potential ALSEP troubleshooting. It is currently planned to take this time from Station 6, 7."

But if 6/7 requires more time when we get there, we can borrow it from one of the other stations; I guess, in particular, Station 10, probably. As the initial activity then, we are going to have to take explosive package 5 with us, and we'll stick it under the LMP seat, and I'll remind you in real time...
when we get down on the ground on that one. And number 5, 3 pound, will be deployed at Station 10, and again I'll remind you about that in real time, so you don't have to bother to write it in on your checklist. Planned traverse proceeds as normal. We're expecting to spend about an hour and 20 minutes at Stations 6 and 7, and the suggestion is that we may end up wanting to spend that totally at the split boulder at Station 6, but, of course, the option still exists to visit more than one place and sample other boulders if it seems feasible and attractive and desirable. They are suggesting additional 500-millimeter photographs, especially if it seems that we can use those to document tracks and sources - of the sampled boulders; for instance, at Stations 6 and 7. We are continuing to hold the nominal 47 minutes at Station 8 - that is, 8A, and we still think that's as good a place as any to sample the Sculptured Hills. Station 9 is still nominal 30 minutes, but in view of the similarities - to Station 4, we're anticipating a possible desirability to remove time from Station 10 to enlarge Station 9, but that will have to be a real-time decision, based upon what we find at Station 9. Station 10 continues nominal. We're still interested in sampling the blocks and also interested in trenching to try and see - if we can say something about the dark mantle - light area relationship and, perhaps, the nominal coring. We're going to deploy EP 5 there; and, other than that, they're basically the same. If we have the time during that closeout, somewhat, of the LM, based on our experience the last two nights, particularly for dusting; but also, if time permits, in that time we might try and use up the extra double core, if there is one, in the dark mantle near the LM or do some trenching near the LM. But that's only if time permits at the very end, depending upon how the consumables run out. They want to call attention to two particular things here. One, since you guys really haven't gotten any very big rocks so far, they're recommending, they say here, and I quote: "The value of large individual samples has been demonstrated. We recommend that several football-sized samples of a uniform igneous rock be collected at Station 9 or 10." I'll pass that on as that.
Another point of interest is the 1- to 20-millimeter (BETWEEN EVAS) size section of the regolith, the dark mantle, the lithology. Then, any observations or collections you can make pertinent to that would be of interest in trying to determine the relationship of the dark mantle to the subfloor units of gabbro underneath. Two short questions which I'll ask, which I hope you can answer in just a few words. One of them is a yes and no answer. One, they can't find the geophone photos specifically called out in the transcript. There is probably a little bit of garble at that point, and the people in the back room will be very happy if you could say once and for all, Jack, that, yes, you did get the geophone photos. Over.

Yes. (BETWEEN EVAS)(PHO 147 22528-32)

Roger. And the second one concerns the one-fourth-pound charge which we deployed on the way in last night. Two questions on that. It appears to us from your voice transcript that we weren't fast enough on it at the time that that may be deployed closer to the ALSEP than the one you deployed on the way out. And we'd like an impression on that. And, number 2, you mentioned that you placed it in a depression. We'd like some feeling for that depression in terms of how much of a danger that bomb charge might play to the ALSEP when it goes off. If it's in a depression of any sort, they're probably pretty well protecting the ALSEP. Any comment on those two questions? Over.

Well, the second one. It's not in a major depression. It's a little ditch, maybe a third of a meter deep. I imagine it will help a little bit. That's why we picked it.
06 14 50+ CC Remember, you drove back by and you said you saw the flag, and then you said you actually saw the charge itself first. And it was some time after that you said you deployed the charge. And we have the opinion from both that and the mileages that you probably deployed the second charge closer to the ALSEP than the first one. Do you have any sort of a feel for that?

06 14 51 43 CDR Oh, yes. I remember saying that, but that's when I did a big 360, and Jack was out of film. And I just lined up to take that picture with LM up in the background. And when I said, hey, I saw the charge first.

---

06 14 51+ CDR Hey, Bob. How far should that last charge be from the ALSEP?

06 14 51+ CC They want it about 300 to 400 meters.

06 14 51+ CC And, Gene, 0.2 for range when -- you got back to the LM. And I guess the question would be, did you ever go through zero on the way back to the LM? If you were at 0.2, and we think 092 was the bearing, then the LM is right where we thought it was, and we were just a little confused by our distances.

06 14 51+ CDR No, I don't think I ever went through zero, because I initiated at the SEP.

---

06 14 51+ CDR I'm positive.

---

06 14 51+ LMP Bob, I can -- hey, Bob; this is Jack. I can see the charge with the binocular. It's out almost behind a rock that's between it and the LM. I can't give you any idea, though, how far it is.

06 14 51+ CC Okay.
06 14 54 54 LMP No, it's the one off to the left. Hey, Bob. Let me (BETWEEN EVAS)
say again, I think we ought to emphasize the
exotic-looking fragments on the dark mantle. And we
ought to try to make sure that we look at a variety
of rocks from the North Massif. I think we saw the
major rock types on the South Massif yesterday, but
we really didn't spend a lot of time ranging along
the Front there to verify that completely. The
other comment on the 1- to 20-millimeter-size
fraction. There isn't an awful lot of that in the
dark mantle. That's one of the striking things
about it.

06 14 57+ CDR I've got them both. And the last one we deployed, (BETWEEN EVAS)
which I think is the easternmost one, is definitely
farther out than the first one we deployed. At this
distance, it's awful hard by looking at Jack's
geophones. I got to give you at least 300 meters,
Bob.

06 14 57+ CDR Yes, I've got both of them with the monocular now. (BETWEEN EVAS)
And the second one, the last one we deployed is
quite a bit farther out than the first one.

06 14 57+ CC Okay. I think that's what they want to hear. (BETWEEN EVAS)

06 14 57+ CDR Gordo, I guess it's half again or maybe even twice
as far away as - as the first we deployed. So we're
going to forget it.

06 1  + CC Okay, Geno. That sounds good. (BETWEEN EVAS)
06 16 52 33 CDR Okay, Bob, I'm starting my watch. (LM)
---
06 17 01+ CDR Okay, Bob, I'm on the pad. The first thing I'll do is I'll turn the TGE on and I'll give you a reading. (LM)
---
06 17 02 40 CDR It's on, it reads 222, 262, 207; 222, 262, 207. (LM)
---
06 17 02+ CDR Beautiful out here today, Bob. We can look to the east for a change - a little bit, anyway. (LM)
06 17 02+ CDR A higher sun angle. (LM)
---
06 17 04 49 LMP Okay. I'm on the porch and the hatch is closed. (LM)
---
06 17 04+ CC And, 17, if you guys are interested, your shadows will be 8 feet long tonight. (LM)
---
06 17 10+ CDR Okay, we'll take the big bag. I hope we can keep it on. (LM)
---
06 17 10+ LMP Okay, mag Kilo does on the 500; is that correct? (LM)
06 17 10+ CC That's affirm. (LM)
06 17 10+ LMP Okay, I've got Mary and Franny and Nancy and Donna and Bobby -- and Karen. (LM)
06 17 14+ CDR Okay, Bob, the big bag is on the inside of the pallet.

06 17 14+ CDR Big bag. SCB 7 to gate.

---

06 17 14+ CC Okay. And, Jack are you going out to take the pan now?

06 17 16 15 LMP Well, as soon as I finish up here.

06 17 16+ CC Okay. And after you take the pan, we'd like you to retrieve the Cosmic Ray Experiment. They're expecting a little solar storm, and before the rain gets on the Cosmic Ray Experiment, they'd like to retrieve it. We'll leave it in the ETB during the traverse.

06 17 16+ LMP Okay, after the pan. All right.

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06 17 16+ CDR Okay, SCB 7 - 20-bag dispenser goes on my camera when it gets back. Short can under the LMP's seat. Okay, Jack, I'll just go ahead and mount some of these bags on your camera while I'm here.

---

06 17 16+ CC Okay. And did you get Jack's camera fixed last night? I didn't hear.

06 17 16+ CDR Yes, we did. Twenty-bag dispenser on Commander's camera, we'll do it when I get back - 20 bags on the LMP's cameras, core cap dispenser to gate - there's one there, there's one under the seat - short can's under the LMP's seat. Okay, I got to put that cap dispenser on him. I got to get my hammer, hammer - hey, Bob, what bag do you want on the LMP? Do we have 8 here?
06 17 19 45 CDP Okay. 670, 027, 001; that's 670, 027, 001. (LM)

06 17 20 17 LMP Mark it. The Cosmic Ray is terminated. (LM)

06 17 20+ LMP I took two 5-foot stereopairs of the configuration. (LM) (PMO 140 21381-84)

06 17 20+ CC Copy. And we'll stick it in the "TB and just hang it there.

06 17 20+ LMP Yes. And in case you're wondering, and so you don't (LM) confuse it with a rock, it's in bag 106.

06 17 22+ CC The one under LMP's seat will go on the CDR, the one (LM) with all the stuff in it. (SCB 7)

06 17 22+ LMP Sure is strange not to see some fine-grained rocks (LM) out here. Seen a couple but certainly not very many.

06 17 22+ LMP That rock that you picked up at - what are you doing (LM) up there? Okay.

06 17 22+ LMP Gene, your bag's going to have two lowers and one (LM) upper. (SCB 7)

06 17 26+ CDR Okay, Bob, I'm going to put SCB 4 on Jack. (LM)

06 17 26+ CDR What charge you got there, Jack? (LM)

06 17 26+ LMP Five is under my seat. (LM)

06 17 26+ CDR Five, okay. You got 5 there, we got 2 and 3 on the (LM) Rover.
06 17 30+ CDR Just come over here by the left front wheel. I know (LM) (PHO 140 21385-87) you got a second. Just a little bit closer to the left front wheel, towards me. Oh, that's good, anywhere in there. Wait a minute.

06 17 30+ CDR Can you do that likewise? Or can you hold it with that other camera? It's already set at 30. (LM)

06 17 30+ LMP Okay. (LM)

06 17 30+ CDR And you might want to take a couple *** (LM) (PHO 140 21386-91)

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06 17 35+ CC Okay, and Gene, we'd like to torque to 287, 287. (LM-SEP)

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06 17 36 31 LMP Forty-five Yankee is a sample from near the SEP. (SEP) (SAMP 70290,95)

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06 17 36+ CC We copied 45 Yankee near the SLs'. That's all we have. If you give us a frame count when you get done, and give us an approximate location for the Rover, at least crosswise from the Y, we'd appreciate it. And we also need SEP receiver power and DSEA both on. (SEP) (SAMP 70290,95)

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06 17 36+ LMP Bob, that 45 Yankee was a fine-grained basalt, I think. One of the few around here. That's why I picked it up. (SEP) (SAMP 70290,95)

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06 17 36+ CDR I'm stopped and I'm ready to go. I'm 2 meters to the west of the north line. (SEP)

06 17 36+ CDR And I guess I'm certainly within 5 meters of the transmitter. (SEP)

06 17 36+ CC We'll get that in the photos. (SEP) (PHO 141 21310-17)

06 17 39 07 CDR It's oriented 355 and my heading is 352. (SEP)
06 17 39+ CC Roger. Both the receiver and the recorder on.

06 17 39+ CC And we're ready for you guys to roll.

06 17 40+ CDR I'm going to head on at about 012. We ought to go right through Jones.

06 17 40+ CC Okay, and, Gene, remember the driving fairly slow - or fairly well controlled the fists 300 meters, and a mark at the end of the antenna.

06 17 40+ CC Okay. Give us another mark when you start up on that side.

06 17 40+ CDR Yes, I'm right on the track. Same tracks exactly.

06 17 40+ CDR We're starting Bob -

06 17 42 36 CDR Mark it.

06 17 42+ CDR We can't go too far in this heading. We've got a big hole up here.

06 17 42+ CDR Like a big one.

06 17 42+ LMP Wonder if that's Rudolph?

06 17 42+ LMP Well, let's see, this is east, it's a double crater but it's much bigger than I thought Rudolph would be.

06 17 42+ CC No, if you're where we think you are, you're beyond - you're east of Rudolph quite a ways.
06 17 42+ CDR Hey, I think you ought to know where we are by now, Bob.

06 17 42+ LMP Maybe that's Lewis and Clark.

06 17 42+ CDR After you give me a mark there, I'll talk to you about it.

06 17 42+ CDR I'm sorry Bob. I guess you didn't hear it. We're passed the end of the antenna and we're headed northeast.

06 17 42+ CDR I gave you a mark when I started and it took about 20 seconds to get to the end.

06 17 42+ CC No. Press on. And, Jack, if you look at your contour map there, we think you are located right now at approximately where the P in SEP is, just below the P in Poppy. In which case you're probably driving through that little crater that's just to the northeast there.

06 17 42+ CDR Not very little though.

06 17 44 59 LMP The major boulders still look like the pyroxene 
gabbro. Surface texture has not changed. There is 
a granule population, now that I look at it more 
closely, with the shadows. But I have a feeling 
that most of those are - they look like they're just 
very small clods. That should show up in some of 
the bulk samples we've taken. It is remarkable to 
me - only a small number of fine-grain rocks.
There's one at about halfway between the SEP and the (SAMP 70215) 
LM that I'd like to pick up, it's a fairly good 
sized one. Maybe we can get it when we get back. 
It looks like a fine-grained basalt. I may have 
sampled one in 45 Yankee there.

06 17 44+ CDR Well, I tell you, it's not exactly the greatest 
place to navigate through.
LMP: I think you ought to bear left, don't you?

CDR: Yes. That's where I'm going. I just want to get across this - around these boulders.

LMP: There's a crater we're just passing at 207/A about 20 meters in diameter, with the pyroxene gabbro blocks on the rim, few of them. It's not an exceptionally blocky rim crater, but we are in an area where the block population is up to about 5 percent in contrast to most of the area we traversed yesterday.

CDR: I tell you, going is a little bit rough; there's a population of blocks as Jack said - an awful lot of small craters.

LMP: Yes, I was just going to add that the frequency of craters in the 10-meter-size range is quite a bit higher than we were used to yesterday. Oops, there's one.

CDR: Yes.

LMP: Snuck up on you. And they all - although not exceptionally blocky rim - they all have a slightly, maybe 2 or 3 or 5 percent more blocks in their walls and on their rim than does the normal terrain.

LMP: Still no obvious structure within the dark mantling material itself.

CDR: Bob, you said 185/1.5?

CC: That's affirmative.

LMP: What do you want? For the Rover?

CC: 'yes, for a sample'

LMP: Oh, they changed it on us. Okay - there's - still seeing the little pit-bottom craters with the glass in them. And you asked me for an LMP frame count awhile back and I believe it was 5. That was at the SEP.

CC: That was after the SEP photos, right?
06 17 46+ LMP Negative; that was before the SEP photos. 
(SEP-6) (PHO 141 21510-17)

06 17 48 39 LMP Looking up at the North Massif, we see the scattered, strewn field of boulders, that generally seem to start, more or less, from a line of large boulders, which might indicate some structure. And those lines are roughly horizontal across the face that we're looking at. The boulder tracks are irregular in shape, obviously downhill, but you'll see in the pictures that they are curved in places but they're all - that I see - tend to be aggregates of little craters - where the boulder was obviously tumbling and bouncing a little bit. We're out in population of fragments now in the immediate area at 1 - is that 188?

06 17 49 52 CDR 188, 0.9. 
(SEP-6)

06 17 49+ LMP It's generally about 1 percent between craters. But at the crater rim, it's up to about 5 percent. 
(SEP-6)

06 17 49+ CC Okay. Copy that Jack. And how far down the North Massif is the line of boulders?
(SEP-6)

06 17 49+ LMP Oh, there are several of them, Bob. What I'm talking about is about 100-meter-long lines where the boulder trains initiate and they are - there's one about - looks like about halfway - maybe two-thirds of the way down in perspective. Another one that's probably about halfway - they're just sort of scattered around on the massif.

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06 17 49+ LMP That must be Jones. 
(SEP-6)

06 17 49+ CDR Where are you looking? 
(SEP-6)

06 17 49+ LMP Off to the right. 
(SEP-6)

06 17 49+ CDR Yes, our heading that they're sending us down here, it really should put us to west of Jones. So that's about right.

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LMP And they look like there are boulders up on the side (SEP-6) of Sculptured Hills, except that they aren't nearly as big as those on the North Massif. The areas where the boulder source is, look like they're made up of boulders no bigger than a meter maybe; whereas, the North Massif boulders are up to several meters. Those boulder sources all seem to be up within a third of the height of the Sculptured Hills, just east of the Wessex cleft. Here is a boulder track that crossed the slope. See that Geno?

06 17 52+ CDR Yes. I sure do now. (SEP-6)

06 17 52+ LMP It looks like it goes, rather than perpendicular contours, it probably is crossing them in a fairly straight line on an angle of 60 degrees, maybe. (SEP-6)

06 17 52+ CDR Back to the east. (SEP-6)

06 17 52+ LMP Yes, to the east. That one may be fairly near -- (SEP-6)

06 17 52+ CDR Jack, see that big boulder with that big track -- it looks like it's an elongated rolled-up boulder. (SEP-6)

06 17 52+ LMP Yes, it does. Look like it may be broken now. (SEP-6)

06 17 52+ CDR Okay, here we are 1.5 and 185. (SEP-6)(LRV 9)

06 17 52+ LMP Okay, is this a Rover sample? (SEP-6)(LRV 9)(SAMP 76120-24)(PHD 140 21392; 141 21542-44)

06 17 52+ CDR A Rover sample.
06 17 52+ LMP —— see that little pit right over there about 30 feet ahead.

06 17 52+ CDR Yes, I think so.

06 17 52+ LMP Okay, I've got two pictures there.

06 17 52+ CDR How's that?

06 17 52+ LMP That's great. Okay, this is soil sample.

06 17 52+ CDR Okay, and I just took a locator; and CDR is on frame 41.

06 17 52+ CDR Bag 46 Yankee.

06 17 52+ CDR Your bag open?

0: 7 52+ LMP Yes.

06 : 7 54+ CDR Okay. It's in.

06 17 54+ LMP Okay. And LMP's frame count is 35.

06 17 54+ CC Bearing and range for the large block, just beyond the crater Henry, the large block there near the break in the slope, which is our next aiming point. The bearing and range there is 188 and 2.8.

06 17 54+ CC Jack, what do you see in the way of boulders coming down to the base of the Sculptured Hills, in terms of sampling opportunities at Station 8 and in terms of any boulder tracks that might lead down to boulders that might just possibly be accessible at Station 8.

06 17 54+ LMP Boulder tracks are not obvious on the Sculptured Hills at all. It looks like there are fragments over there that would have had their source up in the slope. I think we can get boulders there.
06 17 54+  CDR  We'll have to get a little closer, Bob.  

06 17 54+  CDR  See that big boulder, Jack, with those tracks?  

06 17 54+  CDR  That's a funny looking boulder.  

06 17 54+  LMP  It looks like it may have stopped rolling because it broke up.  

06 17 54+  LMP  Looks broken to me now.  

06 17 54+  LMP  Okay, you've got yourself in some holes here. Okay, there's a big crater. I haven't recognized Jones yet. Looks like you're getting up on the rim of Henry here.  

06 17 54+  CDR  Should be well west of Henry, I think. I wouldn't be surprised if Henry isn't right over that little rise on the right.  

06 17 54+  LMP  The surface structure hasn't changed texture. We're on a little bit of a rise in here now and still about 1 percent of the surface - -  

06 17 57 48  CDR  There's Henry right there, Jack.  

06 17 57+  LMP  There's Henry.  

06 17 57+  CDR  188, l.b.  

06 17 57+  LMP  And we're just southwest of Henry.  

06 17 57+  LMP  On the rim.  

06 17 57+  LMP  Henry looks much like Horatio did. Has boulders on its inner wall - not as many. They look light colored - a light albedo gabbroic appearance. There may be some right down there, though, that are fine grained; they look a little gray.
06 17 57+ CDR Jack, there's our target - either one of - that's one right down there on ***
(SEP-6)
06 17 57+ LMP Break in slope.
(SEP-6)
06 17 57+ CDR See the one we've got over there has a boulder track. That's the one, that crossed slope.
(SEP-6)(PHO 141 21549-50)
06 17 57+ LMP Yes, if we could get --
(SEP-6)
06 17 57+ CDR That's awful high.
(SEP-6)
06 17 57+ LMP -- can we get up there?
(SEP-6)
06 17 57+ CDR We'll see.
(SEP-6)
06 17 57+ LMP That's the one - that's Station 6, and that was the turning boulder.
(SEP-6)
06 17 57+ CDR Yes, that's it.
(SEP-6)
06 17 57+ CDR Station 6 - we can probably get up there.
(SEP-6)
06 17 57+ LMP I think we can; it doesn't look too bad. At the break in slope, right now, doesn't show anything obvious, except that's where the boulders start.
(SEP-6)
06 17 59+ LMP But as I was saying, Henry just looks like somewhat more mantled Horatio.
(SEP-6)
06 17 59+ CDR I'm headed northwest now - to get around the western rim of Henry.
(SEP-6)
06 17 59+ LMP And on that west rim, we've got about 10 percent boulder cover.
(SEP-6)
06 17 59+ CC Okay. And a reminder Jack, to keep taking your Rover photos.
(SEP-6)
06 17 59+ LMP Yes, sir. By boulder, I generally mean fragment, (SEP-6)
Bob, in this case. When I say 10 percent, I'm
looking at stuff greater than about a centimeter in
diameter. I'll try to say fragment from now on and
be more precise. Okay. Here's a little area where
there's - this part of Henry - this is the one part
of the rim of Henry I see that has fairly large
fragments, or boulders, on them up to 2 or 3 meters.
But, again, they all appear to be buried. There are
very few, except small ones, sitting out on the
surface.

06 18 00 32 CDR And, you know, the fragment population out here only (SEP-6)
goes out to maybe 200 meters, I expect.

06 18 00+ LMP Okay. Now this concentration of boulders is because (SEP-6)
of a 50-meter crater in the rim of Henry.

06 18 00+ CC Okay that sounds like Locke up on the rim of Henry. (SEP-6)

06 18 00+ CDR Take a picture in here, Jack. (SEP-6)(PHO 140 21393)

06 18 00+ LMP No. Locke, I can see - (SEP-6)

06 18 00+ CDR I'm getting the picture. (SEP-6)(PHO 140 21393)

06 18 00+ CDR Yes, Locke's right ahead of us. (SEP-6)

06 18 00+ LMP This is one on the - about 50 meters right on the (SEP-6)
rim crest of Henry, almost due - the west rim - due
west rim. Now Locke is just ahead of us. It also
has boulders in its walls but has relatively few on
the rim.

06 18 00+ LMP Characteristic of both Henry, Locke, and Horatio is (SEP-6)
essentially no change in the average frequency of
boulders on the rim. The increase comes in the
wall.

06 18 00+ CDR We're at 1B4, 2.3. We're just about between Henry
and - (SEP-6)

06 18 00+ LMP Locke. (SEP-6)

06 18 00+ CDR Locke. Yes; right between them. (SEP-6)
06 18 00+ CC Okay. I copy that. And you guys are heading for that big boulder, which must be just dead ahead of you there, about half a kilometer.

06 18 00+ LMP Well, Gene's sort of headed for Station 6 now.

06 18 00+ CDR I'm going to take a tour around that boulder and and get location on it.

06 18 00+ CC Yes. That would be a good mark to give us a range and a bearing on, since that's a pretty good straight point.

06 18 02 09 LMP The boulder concentrations in the wall of Henry have their upslope start at about - I would guess an average of 30 meters down from the rim crest. The rim crest of Henry is not very well defined, but it's there. And from that initiation of boulders, they stream down the slope to the break in slope down at the floor. Still no obvious change in the dark mantle, as we're just to the east of Locke now. There's a 30-meter crater, fairly subdued but still quite deep - subdued rim. Again it looks as if it were mantled; that has no significant increase in blocks on its rim. That crater, in any other place, would have been a very blocky-rim crater. It's maybe 30 meters by 5 meters deep. Man, that is a big rock up there. Turning Point rock is a split rock - looks like a northwest-southeast overhang, with another block just this side of it - just to the south of that overhang. It's a pyramid shape in cross section - triangular shape in cross section. And it looks like it is pretty well fractured, although not pervasively like the rock at Shorty was.

06 18 02+ CDR Okay, Jack, I know I can get up to Station 6.

06 18 02+ LMP Yes. Now, Bob, Station 6 rock - one of them - is from that boulder track that runs obliquely across the contour.

06 18 02+ LMP And the pictures ought to pin down at least the end of the boulder track pretty well.

06 18 02+ CDR Boy, this is a big rock, Jack, whew.
06 18 02+ LMP As I recall - as I saw it, the boulder tracks stopped about halfway up the slope of the North Massif. That is a big rock. (SEP-6)

06 18 02+ CDR We're at Turning Point rock. I don't know if it's mantled on top, but it's certainly filleted. There's a lot of the dark mantle up and on some of the shallower slopes of the boulder. And it's on a little mound itself, as if much of it might be covered up. (SEP-6)

06 18 02+ LMP Yes, it looks like a breccia from here. (SEP-6)

06 18 02+ CDR Can you get a sample of it right here? You see these little chips? (SEP-6)(LRV 10)(SAMP 76130-37)(PHO 140 21566-98; 141 21566-68)

06 18 02+ LMP Yes, I probably can. (SEP-6)(LRV 10)(SAMP 76130-37)

06 18 02+ CDR I'm 3 meters from Turning Point rock. On the east side, and I'm reading 186 and 2.8. (SEP-6)(LRV 10)(SAMP 76130-37)

06 18 02+ LMP Can you drive up to the - right there, let's see - no. I can get them. The thing is, I don't know what it is. (SEP-6)(LRV 10)(SAMP 76130-37)

06 18 02+ CDR Well, but at least it's part of these fragments around here. I guess Turning Point rock is 1, 2, 3, 4, 5, 6, - 6 meters high anyway. I'd say it's a very rough sub-rounded type of rock - by the face - let me get this, Jack. Okay. There are two fragments in that sample. (SEP-6)(LRV 10)(SAMP 76130-37)

06 18 02+ CDR Forty-seven Yankee. (SEP-6)(LRV 10)(SAMP 76130-37)

06 18 02+ LMP Plus some dirt. And it's about 4 meters from the - Turning Point rock on the north side. (SEP-6)(LRV 10)(SAMP 76130-37)

06 18 02+ CC And presume you got some good photos of the rock. (SEP-6)(LRV 10)

06 18 06 21 LMP Yes, I got a couple. I hope they're good. (SEP-6)(LRV 10)(PHO 141 21567-68)

06 18 06 LMP And my locator is - - 5, 6. (56) (SEP-6)(LRV 10)(SAMP 76130-37)(PHO 141 21567-68)

06 18 06+ CDR Jack, let me spin around this little crater here to the left. (SEP-6)(LRV 10)
06 18 06+ **LMP** Bob, it looks—it's very coarsely vesicular, but, at first glance, it did not look like the pyroxene gabbro—although the rock—that rock does. It looks like it might be fragmental, although I'm suspicious that I'm looking at zap pits. -- I got them. Pick one. That's a nice view.

06 18 06+ **CDR** And we're on a little rise looking at this boulder. That's incredible.

06 18 07 15 **CDR** Okay. We're on the roll, Bob.

06 18 07+ **LMP** Bob, my guess is, right now, is that Turning Point rock is a big piece of subfloor gabbro.

06 18 07+ **CC** Okay. I gather you changed your opinion.

06 18 07+ **LMP** What looked like fragments is just big spills of where the zap pits have cleaned off the rock.

06 18 07+ **CC** Okay, I copy that. And guys, you might be happy to know that we think we've finally found the LM, because we were calling that for 188 and 2.8, and you got there at 186 and 2.8.

06 18 08 12 **CDR** It's the split one up there, Jack. I've had my eye on it. There's some big boulders down here.

06 18 08+ **CDR** Now, I got it. I've had my eye on that boulder. You can't see the track from here. I'll bet you can. I can see it now. We'll see it. We'll be looking right up it—looking right up the old boulder track. Man, I tell you, this navigating through here is not --

06 18 08+ **LMP** Okay. We're in a region where the general fragment population is no different. We're up off the break in slope, although you wouldn't notice it—but we are quite a ways. But the fragment population is not much different than that on the plains. The big difference is that there are these scattered blocks that are from a meter to probably 10 meters—no 5 meters in diameter. Hard to say, maybe 8.
06 18 08+ CDR See that track coming down? We'll be looking right up that track.

06 18 08+ LMP I didn't realize you were that far upslope. (SEP-6)

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06 18 08+ LMP Oh, I feel fine. - until I looked down there and saw the slope we're on. (SEP-6)

06 18 08+ LMP And I can't see any obvious change in albedo, like we could see with the light mantle yesterday. There you got a nice place. Oh, oh, you don't want to go over that way. (SEP-6)

06 18 08+ CDR I can make it. I want to park right -- (SEP-6)

06 18 08+ CC And 17, you want to park at a heading of 107 -- (SEP-6)

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06 18 08+ LMP That's going to be moderately level right there. (SEP-6)

06 18 08+ LMP Trouble is, they're looking into the shady side of the block. (SEP-6)

06 18 08+ CDR Well, if I park on the other side, they won't be able to - I can go right upslope a little bit. (SEP-6)

06 18 08+ LMP That's all right. We can work in there. No, that's all right. (SEP-6)

06 18 10 35 CDR Yes, I can't go up there. Let me just - this is going to have to be good. (SEP-6)

06 18 10+ LMP I think you're all right. (SEP-6)

06 18 10+ CDR That's not very level, but -- (SEP-6)

06 18 10+ LMP Not too hard. Watch that turn. (SEP-6)

06 18 10+ CDR That's not very level, but we're not going to get much more level than that. (SEP-6)

06 18 10+ CDR They wanted 107. That's the best I can do. That's not very level for the gravimeter. (SEP-6)
06 18 11 24 CDR Okay. We're parked on a heading of 107.  

06 18 11+ LMP You parked on a slope, too.  

06 18 11+ CDR There's no level spot to park here, though.  

06 18 11+ LMP You want some help getting off?  

06 18 11+ CDR I've got to go uphill.  

06 18 11+ LMP I just about ended up down at the bottom of the hill.  

06 18 11+ CDR Okay; 192, 3.8, 3.1.  

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06 18 11+ LMP You want me to block the wheels? You got the brake on, I hope.  

06 18 11+ CDR You betcha. Boy, are we on a slope!  

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06 18 11+ LMP Okay, I'm going to stay out from between the rocks. It's a beautiful east-west split rock. It's even got a north overhang that we can work with. And let me see what it is. We're right at Station 6. You wouldn't believe it.  

06 18 11+ CDR I would. Oh man, what a slope!  

06 18 11+ LMP And this boulder's got its own little track, right up the hill, cross contours. It's a chain of craters track, and it looks like it starts *** where it started. If starts in, what looks to be, a lighter colored linear zone - trying to give you perspective; it's probably only about a third of the way up the North Massif.  

06 18 11+ CC Read you loud and clear; and we got a picture.  

---  

06 18 11+ CDR I don't know whether your TGE's going to hack it.  

06 18 11+ CC Okay. It'll pick up to 15 degrees.
06 18 11+ LMP It's a coarsely vesicular, crystalline rock - finely (6) crystalline. Looks like - probably an anorthositic gabbro - trying to see the zap pits, for glass color, I don't have a good one yet.

06 18 11+ CDR Say, Bob, you want both the recorder - and the other (6) switch off?

06 18 11+ CC Roger. Both of those off, and the --

06 18 11+ LMP Bob, it looks like the glass is fairly light colored. It's not white. Well no - it's black. It's anorthositic gabbro, rather than gabbroic anorthosite, I think. Yes, that's black glass in the pits.

06 18 11+ LMP Bob, some of the vesicles are flattened. All of them are flattened. There's a strong foliation of vesicles in the rock. Most of them are flattened, and they are up to 15 or 20 centimeters in diameter and about 5 to 6 centimeters thick - or wide.

06 18 15 56 LMP And there's some beautiful north overhangs all around the block. Well, on the north side of the block.

06 18 15+ CC Okay. That's the best place - to have north overhang; and I guess that means one of you guys might grab - the small can - before you leave the Rover.

06 18 15+ LMP Bob, let's get it straight, you want the north overhang sample in the short can?

06 18 15+ CC Miracle of miracles. They don't want the short can. (6) I'm not sure I understand that, Jack, but they don't want the short can here, they say, I guess they're looking for volcanics today.

06 18 15+ LMP Okay, we'll put them in bags.
CC They're looking for volcanics today, Jack.  

LMP Oh, they are huh? We found those yesterday.  

CC Well, they're hoping again at Station 9.  

LMP Now, that ilation I mentioned does not go all the way through the rock. There are variations in texture. One zone was strongly foliated. There's another - it almost looks like a large - it is - a large inclusion of nonvesicular rock within the vesicular rock. There may be some autobrecciation involved in the formation of this thing. It really looks mineralogically like the light-colored samples from the South Messilf. But I tell you, that's only because it's light colored, and I can't give you anymore than that right now, until we get a fresh surface.  

CC And Jack, how about a frame count, if convenient.  

LMP It's now 68.  

LMP I think I'll get over here and get a pan while we're awaiting a sample.  

LMP Well, I found a place to stand where I can take a pan.  

LMP I'm taking a pan.  

CDR Very good. I'm coming right now. I bet you a dollar to doughnuts that you don't get a TGE reading.  

CC Yes. Gene. If it's easy enough to take it off, why don't you take it off the Rover; and we'll try and level it in the stuff.
06 18 18+ CDR Yes. That looks level to me. (6)

06 18 21+ LMP Hey, I'm standing on a boulder track. How does that make you feel? (6)

06 18 21+ CDR That makes me feel like I'm coming over to do some sampling. (6)

06 18 21+ LMP Let's get the boulder and then get in that east-west split. I got an undocumented sample from the middle (SAMP 76220-24) of the boulder track. (6)

06 18 21+ LMP Soil sample. Gene, if you hit them off in there, it's going to be awful hard to find them, that's the problem. (SAMP 76220-24)

06 18 21+ CDR Did you pick a good spot while you were over here? (6)

06 18 21+ LMP No, I didn't. I just was looking at it. I think we need to get in the light, though. (6)

06 18 21+ LMP Let me put a sample in your bag. (SAMP 76220-24)

06 18 21+ CDR Okay. Go ahead. (SAMP 76220-24)

06 18 21+ LMP It's bag 534. (SAMP 76220-24)

06 18 21+ CDR This boulder looks fairly uniform from top to bottom. (6)

06 18 21+ LMP We've got to get a reference sample out - this soil. (SAMP 76280-86)(PHO 141 2104-06; 140 21401-09)

06 18 21+ CDR Let's get where we can get that 90-degree picture, too; so we want to get on the - sun side. Let me get that slab right there, though, to start with. I can get that one off. Let's go over on the sun side because we can't really photograph it. (6)

06 18 21+ LMP Okay. I got to get out of here first. (6)
06 18 21+  CDR  Let's go through the split.  (6)
06 18 21+  LMP  Well, okay.  Be careful, though.  Why don't we sample the split first so we don't--  (6)(SNAP 76240-46)(PHO 140 21404-46; 140 21401-09)
06 18 21+  CDR  Look at that overhang.  Man, I tell you, if you can get your shovel down there, you'd have a ball.  (6)(SNAP 76240-46)
06 18 21+  LMP  Yes, let's sample in the split first so that we don't get it too messed up.  And then we can sample some of this stuff.  We want this overhang over here, Geno - the north facing one.  (6)(SNAP 76240-46)
06 18 21+  CDR  Right here?  (6)(SNAP 76240-46)
06 18 21+  LMP  Yes, I got to get - sneaky by over there.  Whoops!  Don't shuffle too much dirt in there.  (6)(SNAP 76240-46)
06 18 21+  CDR  Okay.  You by re so I can set the gnomon down.  (6)(SNAP 76240-46)
06 18 21+  LMP  Not quite.  Don't think I can make it - without hitting you.  I can't.  (6)(SNAP 76240-46)
06 18 21+  CDR  Let me set the gnomon down - -  (6)(SNAP 76240-46)
06 18 21+  LMP  Set it down just outside the shadow there.  Right there.  That's good.  There's still some good clean ground there.  (6)(SNAP 76240-46)
06 18 21+  CDR  I can get back far enough to take these pictures.  I want to go get a stereo pan around the corner anyway.  Let's see if I can't start here with about 5/6.  I'm so close.  (6)(SNAP 76240-46)
06 18 21+  CDR  I must have a boulder ***  (6)
06 18 21+  CDR  Okay.  You got a bag?  (6)(SNAP 76240-46)
06 18 21+  LMP  I'm going to get the shadowed material.  (6)(SNAP 76240-46)
06 18 21+  CDR  It's in bag 312, Bob.  (6)(SNAP 76240-46)
06 18 21+ LMP It's from - I think you saw where I got it. It's about a half a meter back of the limit of the overhang.

06 18 21+ CDR Okay. Can you reach it.

06 18 21+ LMP I will in a minute. You can turn it a little bit towards me. Okey, 312. And the soil outside the overhang will be next.

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06 18 26 57 LMP And the first one is from the upper 2 centimeters.

06 18 26+ CDR Bag 313.

06 18 26+ LMP And the second one is from 2 centimeters down to about 8.

06 18 26+ LMP It looks like - the boulder just to the south of us has some inclusions in it - light-colored inclusions.

06 18 26+ CDR Bag 472 on that.

06 18 26+ CC Copy 472 on that. You mean the south half of the split boulder?

06 18 26+ LMP Yes. I haven't seen inclusions in the other half.

06 18 26+ LMP Now we need boulder stuff.

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06 18 26+ LMP Got your hammer?

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06 18 26+ LMP It's a little hard, huh?

06 18 26+ CDR I've got to find a corner I can get at.

06 18 26+ CDR Let me get an after picture down in this hole.

06 18 26+ LMP Oh, that's right. You almost stepped on the - I forgot the after, too.
06 18 26+ LMP Hey, there are chips up here on top. Also, that's been spalled off.
(6)

06 18 26+ LMP We can get some of those, but --
(6)

06 18 26+ CDR Looks like somebody's been chipping up there.
(6)

06 18 26+ LMP Looks like there's been a geologist here before us.
(6)

06 18 26+ CDR Let me get the gnomon. I think I can get some of these pieces over here. I want to get that 90-degree angular flight line around this boulder, too.
(6) (PHO 140 21414-40)

06 18 26+ LMP Here's the piece that fell off. Here's the piece that was knocked off up there.
(6)

06 18 26+ CDR We ought to bring a big piece of that home. That's obvious.
(6)

06 18 26+ LMP How about this one up here? Take your picture. I think we can just lift that off. See that?
(6) (SAMP 76015)

06 18 26+ CDR Ill get a locator from here.
(6) (SAMP 76015) (PHO 140 21412)

06 18 26+ LMP Okay. I was going to get my down-sun, but I'm afraid -- afraid --
(6) (SAMP 76015)

06 18 26+ CDR You may be down-sun if you do.
(6) (SAMP 76015)

06 18 26+ LMP Yes, we'll get some. Get it?
(6) (SAMP 76015)

06 18 26+ CDR Yes, will it come off?
(6) (SAMP 76015)

06 18 26+ LMP Yes.
(6) (SAMP 76015)

06 18 26+ CDR Just throw it in my bag. It's broken, but it's in place. That's a nice, big piece, too.
(6) (SAMP 76015)

06 18 26+ LMP Don't you put it in mine. I can't get a thing in it.
(6) (SAMP 76015)
There's a big spall lying on the ground here that has been knocked off up there, from right on top of the boulder. And, I tell you, the more I look at this - the south half of this boulder, the more heterogeneous in texture it looks. It looks as if it may be either a recrystallized breccia of some kind, or you had a gabbroic anorthosite magma catch up an awful lot of inclusions. I guess I prefer the latter explanation because of the extreme vesicularity of the rock.

A few of the inclusions are - well, they're all subrounded to rounded, and a few of them are very light colored.

I'm coming around the corner ***

Are you going to do it now? Okay. Well, you know, I ought to get one shot back here with a black and white. I'll get this half black and white.

I think we ought to pick up a piece of that spall there by the gnomon -

I can break it off.

There's one right by the gnomon we can just pick up. It's a finer-grained vesicular rock than -

I thought I was going to get this half.

Well, they like to have some of it in black and white, you know.

I'll get that rock.

I forgot to look at the objectives for this station. I hope we're meeting them.

We want to get 500's of that boulder track.

Okay. A piece of that spalled rock that was sitting by the gnomon - watch out gnomon. How about that? - is in - bag 535.
06 18 26+ CDR You got one in there already?  
06 18 26+ LMP Yes.  

06 18 26+ CDR You won't be able to reach my bag.  
06 18 26+ LMP No, but you can put it in mine. Can you reach it?  
06 18 26+ LMP One of the light-colored inclusions looks like it may be anorthositic - gabbroic anorthosite - let me get my terms straight. The host rock has dark enough zap pits that it's probablyColor - anorthositic gabbro, if I didn't say that. Some of the light-colored inclusions have slightly lighter-colored glass, and they may be the gabbroic anorthosite.  
06 18 26+ LMP Inclusions like this one and that one.  
06 18 26+ CDR Some of those inclusions get to be bigger than the size of a baseball. There's one here and a couple up there.  
06 18 26+ LMP Let me borrow your hammer.  
06 18 26+ CDR Yes. Jack, try a little higher. See that one right on the - right there.  
06 18 26+ CDR Yes, that's a hard rock.  
06 18 26+ LMP Yes, that's a hard rock. You might be able to do it; I can't.  
06 18 26+ CDR I can't get down there. Okay, we need some of the soil outside the shadow here.  
06 18 26+ LMP Yes. How about over where your bag went? Let's move around here. Get on this slope over here. How about out over here? Are we supposed to get a - where are we here?  

06 18 26+ LMP We want to get a rake on the rim of that little crater down there, I guess.
06 18 26+ CC Okay, 17. Roger. You were asking about objectives. (6) The primary objective is documented samples of the blocks; and then also, we'd like to get some of the rake and soil sample out in the surface, namely, the rim crater there, if that's available. And one of the things, we're looking for is the variety of rocks here, if there's more than just the one boulder. You can sample the boulder for a while, but we would be interested in seeing if there is more than just the single type of rock. Probably, also, samples from both sides - both halves of the rock.

06 18 35+ LMP Come on up here, Gene, if you can. (6)

06 18 35+ CDR Okay. (6)

06 18 35+ CC And so it's sort of your option as to how much time (6) you spend here and how much you go on to Station 7 and spend. If you feel that it's worthwhile, we could spend essentially all that hour and 20 minutes at this station. But if we did that, we'd like to get a fair variety of blocks, if they're available.

06 18 35+ CDR Okay. (6)

06 18 35+ LMP Gene, we sampled some of the light-colored group - (6) as a matter of fact, this block looks different.

06 18 35+ CDR Well, so does that big one -- (6)

06 18 35+ LMP It's grayier. (6)

06 18 35+ CDR That's why I've bee photographing it. (6)(P140 141-40)

06 18 35+ LMP What it is, I think - it's a big blue-gray rock - (6) itself is crystalline, I believe. The inclusions are much more sharply defined, and it's nonvesicular; and it's included, or at least it's in contact with the very vesicular anorthositic gabbro - right up there. See that?

06 18 35+ CDR Yes, the whole big one. (6)

06 18 35+ LMP Did you get some pictures of it? (6)
As I bounced around there, I took pictures of it.

Look, we can get some of that light-colored stuff in there, along with the blue-gray.

We ought to get as big a piece of that inclusion as we can. There's -

See it up in there.

Yes. I think we're out of line of sight with them. We're behind a boulder.

The boulder downslope is more of a light-gray vesicular boulder. The one Jack just talked about with some of these larger white inclusions is less vesicular, and it's more of blue-gray rock.

The locator is of Henry.

Okay, let me try and get up there. Henry? We must be high enough to see something. I haven't even looked back.

Let me get a closeup before you start pounding.

No, I might go from this angle too. That will give them something. A little different up in there too, Jack.

We ought to try and sample that.

You want me to get my scoop under there? Probably won't fall out.

Okay. Get as many of these pieces as we can. I don't know how many are going to come out.

This whole thing will come out here in a minute.

I'll watch it. I'll watch it. Got it?
06 18 38+ CDR Have your arm up or down. Okay, I got it in case we don't get another one.

06 18 38+ CDR Hey, we're getting good at that.

06 18 38+ LMP Yes. Can't hold that much longer.

06 18 38+ CDR Let me get up on this - up here.

06 18 38+ LMP Why don't we get a bag out. Let me put these in a bag.

06 18 38+ CDR That's why I'm getting up here so I can just get my balance. Bob, 556 is one of the light-colored inclusions in the blue-gray rock.

06 18 38+ LMP It's chips.

06 18 38+ LMP I think we lost that other one. That's good enough.

06 18 38+ CDR I got it; I know where it is.

06 18 38+ LMP That's all right. It's not a lot of sample, but it's representative, I think. It looks a lot like that sugary rock I sampled yesterday, doesn't it?

06 18 39 43 CDR Yes, it's pretty easy to break up; it's really not very coherent at all.

06 18 39+ LMP You know, I thought last night, Bob, that I should use the word aplastic for a texture that we saw in that inclusion yesterday on the South Massif.

06 18 39+ LMP Okay, you going to get some of that?

06 18 39+ CDR Yes, that's a different kind; that's a more beat up inclusion of some sort. Oh, there's a nice piece coming out. Oh, wait a minute - don't lose it.

06 18 39+ LMP I got it. I've got it.

06 18 39+ CDR Got it.
CDR  Okay.  We have another inclusion that, on the surface, has a more reddish-brown texture.  Interior looks pretty much the same; it's a very light gray.

LMP  This looks like a piece of breccia.  Looks like a fragment breccia that got caught up in this thing.

CDR  Yes, well, the whole thing is obviously a breccia. I'd sure like to get that - -

LMP  Well, I'd say - I'm not sure; it's obviously a breccia.  I think it may be an igneous rock with breccia inclusions.

LMP  Which is sort of in the same class.

CDR  Sort of makes a breccia out of the big rock.

CDR  Except you can - -

LMP  I can't get in there, Geno, you'll have to.

LMP  No way -

LMP  Watch it.  Hold still.  I think it's easier for you.

CDR  Did I give them a number on that?  - no.

CDR  It's 536.

LMP  Squash it - cramp it a little bit, if you can; a little more.

CDR  Okay.  Let's go get the host rock here.

LMP  How about that piece?

CDR  How about this one, with the inclusion?  Maybe I can get this one.

LMP  That may have been a little optimistic.
06 18 39+ CC Do you guys have a feeling that the two halves of the big boulder are different rocks? Or is it the same rock split?

06 18 42 13 LMP No, they're two - they were all one boulder, I think. They are just two major rock types in the - whatever they came from. And I tried to describe that to you. We have the contact in the central boulder. They're really three big boulders. The central boulder has the contact between the light-gray rocks - or the blue-gray rocks and the vesicular anorthositic gabbro.

06 18 42 13 CC Okay. And you guys have that pretty well documented, right?

06 18 42+ LMP Yes, it's in pretty good shape. We're working on it still.

06 18 42+ LMP Try going on the side there, Geno.

06 18 42+ CDR Just go from the side, Jack.

06 18 42+ LMP That's enough. You got a piece of host rock.

06 18 42+ CDR I wanted that one cause it had that inclusion wrapped in it. Which one are you talking about? This one here?

06 18 42+ LMP Yes, I just - it's about to come. I've got it.

06 18 42+ CDR They're both host rocks; we can put them in the same bag.

06 18 42+ LMP No, let's don't. No, they're different places. 5371 is a chip of the blue-gray rock; and the blue-gray host rock - and let me get that other one -

06 18 42+ CDR Pick the rock up while you're there. It's right at your hand.

06 18 42+ LMP I will.

06 18 42+ CDR *** hammer somewhere.
06 18 42+ LMP And 538 is another sample of that material - a little dustier.

06 18 44 57 LMP That's the blue-gray, Bob, with the inclusions in it. Now the blue-gray, the more you looked at it, it looks like a --

06 18 44+ CDR Give me your right hand. Turn it over. Turn it over. Turn it over.

06 18 44+ LMP Well, I did. How do you want it over?

06 18 44+ CDR You kept turning it over in the same direction. Like that, so I can fix that. Okay. Now give me your bag, and I'll get it in there.

06 18 44+ LMP The blue-gray rock, on closer examination, looks like a partially re-crystallized fragment breccia. It's very hard.

06 18 44+ LMP Are you going to get the afters in there? (6)(SAMP 76290,95)(PHO 140 21452,55,57)

06 18 44+ CDR Yes, I'll get them. I want to do a little bit better documentation on this thing. (6)(SAMP 76290,95)(PHO 140 21452,55,57)

06 18 44+ LMP I'm going to go over and look at that contact.

06 18 44+ CDR I got a few close-up stereos of the inclusion that we tried to sample, and I'm going to see if I can't give you a little flight line stereo around this thing - if I can stay on my feet.

06 18 46+ CDR You can see where we've been pounding on this rock. We didn't succeed in getting samples everywhere. And I'm giving you a 90-degree corner.

06 18 46+ LMP Bob, it looks to me like there are inclusions or blue-gray in the gabbro - in the anorthositic gabbro.

06 18 46+ CDR Are you saying you think - you think this whole big blue-gray thing is an inclusion?

06 18 46+ LMP Yes, sir. And there's some little ones over here.

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06 18 46+ CDR But then within the blue-gray, we've got all these other fragments.

06 18 46+ LMP Well, that's right. It's just several generations of activity; and it looks like the gabbro though, picked up the fragmental breccia as inclusions. Bob, it really looks that way right now.

06 18 46+ CC Okay, Charlie is here mumbling something about it looking just like House Rock.

06 18 46+ LMP It's very crystalline. I'll tell you, it's not a breccia - not like House Rock. Not to anything away from House Rock though.

06 18 46+ CDR Hey, Bob, there's a lot of mantling on a very shallow slope of a fracture here on one of the upslope rocks. I would assume it's just part of the talus picked up as it's rolled down. But if it's worth sampling, you might think about it.

06 18 46+ CC Okay, Gene, if you can get that fairly readily, why don't you - you can perhaps just scoop it up with the bag.

06 18 46+ CDR That's exactly what I can do.

06 18 46+ CC If you can get up to the rock there.

06 18 46+ CDR And it will be in my flight line stereo, and it's going to be bag 557. And I'll take an after and show you where it came from.

06 18 46+ CDR This is the easiest part of the rock in the world to work. Here's a big white clast. There's one on top about a foot and a half across, and here's one - must be 2 feet across - 3 feet. And that's in the blue-gray.

06 18 46+ LMP Well, Bob, I think I've done the best I can. I would - I'd say that they're pretty clearly inclusions of blue-gray in the anorthositic gabbro here, near the contact.
Okay. And Gene, your bag is hanging on a hook there. Be careful, if you can - or LMP --

Okay, Bob, I didn't think I could do it but I got a sample of the inclusion. And it's in bag 539.

Hey, Jack, that's your bag that's hanging on a hook. Let me get it.

Oh, they're talking to me, huh?

I didn't think they could see me. I'm way up on top.

And it's blue-gray with light colored inclusions in it.

Put these in my bag.

But the whole thing seems to be pretty well altered, or metamorphosed - compared to the major rock we sampled - to the other blue-gray rock.

Man, there's a dark hole in there.

Here's another bag to put in there before you go.

Now let me fix your bag.

Okay, Bob, I think that inclusion will give you an example of what this thing - what the orthosilicate gabro did to the blue-gray breccia.

Okay. We copy that. And we're ready for you guys to leave this rock and press on and either get the rake rmd cores near that crater down below the rock just a shade, or else go on to some other different variety rocks in the area.
06 18 50+ LMP Well, I tell you, going down to that crater is not a (6)
problem. Getting back up is.

06 18 50+ CC Okay, well, find a decent area to get the rake soil (6)
and a couple of cores.

06 18 50+ LMP Tell you what, Gene, I could go down there and start (6)(SAMP RAKE 76530, 35-77)(PHO 141 21621-27)
a rake, and you could come down there.

06 18 50+ CDR Okay. Yes, I don't think you ought to try and walk (6)(SAMP RAKE 76530, 35-77)
back up, Jack. Let me get a pan from right here
(PHO 140 21483-509)
where I got this sample.

06 18 50+ LMP Okay. I'm going to come over and - I'll go get the
(PHO 140 21483-509)
rake and get the -

06 18 50+ CC Seventeen, it's not that vital to get o that
(PHO 140 21483-509)
crater. We just need a good place for a rake soil
and a single core.

06 18 50+ LMP Get uphill a little bit, if you can, for the pan, so
(PHO 140 21483-509)
that you don't - so you see my other pan station.
(PHO 141 21575-603)

06 18 50+ CDR Where was it?
(PHO 141 21575-603)

06 18 50+ LMP It was over there in that crater, just uphill from
(PHO 141 21575-603)
the Rover.

06 18 50+ CDR I'm going up there.
(PHO 140 21483-509)

06 18 50+ CDR Bob, we don't want to move around from here too
(PHO 140 21483-509)
much. I tell you, these slopes are something else.

06 18 50+ CC Yes. We agree with that, from what we see on the
(PHO 140 21483-509)
television. So use your judgement, and get the
(PHO 141 21575-603)
where it's the best place.

06 18 50+ CDR Well, you might take a look at me walking up. But I (6)
don't think I can get to the top. I just got to get
(PHO 140 21483-509)
a place I can get a pan from, right here. Right in
(this little hole. Okay, now I left the gnomon down
there.

06 18 50+ LMP I'll have to go get it. I think they're set up
(PHO 140 21483-509)
right here near the Rover.

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06 18 50+ CDR Hope my lens is clean. Bob, from up here, the light (6)(PHO 140 21483-509) mantle is not evident until you see the angular reflection up on the scarp. Very thin-like patches might be evident out on the valley, but not nearly as pronounced as I might have thought from this altitude.

06 18 50+ CDR And there's Challenger. You know, Jack, when we finish with Station 8, we will have covered this whole valley from corner to corner.

06 18 50+ LMP That was the idea.

06 18 55 20 CDR Yes, but I didn't think we'd ever really quite get to that far corner. Not 2, but this other one. And we're going to make it.

06 18 55 20 LMP Bob, that blue-gray rock near the contact with the anorthositic gabbro does get some vesicles in it. I think they'll show up in Gene's pictures.

06 18 55+ CDR I just ran out of film at 150. And I'm about two pictures short of the pan, and they're upslope. I think I can cover most of that with the 500.

06 18 55+ CC Okay, Gene. You going to go to the Rover and change your mags now.

06 18 55+ CDR Well, Jack's going to need some help from me.

06 18 55+ LMP I'm starting to rake.

06 18 55+ CC Let me know when you get to the Rover to change the mags after you get done with that, and I'll tell you what mag to change.

06 18 55+ CC But press on and help Jack with those first.

06 18 55+ CDR Jack, if you got enough film, I'll just come and help you.

06 18 55+ CDR Remind me to dust my camera, too, will you?

06 18 55+ LMP Don't forget to dust your camera.
06 18 55+ CC  We'll keep track of that for you, Gene.
06 18 55+ CDR  Did you get any before pictures?
06 18 55+ LMP  I'm getting them now.
06 18 55+ CDR  Man, I tell you, these slopes are great. I wouldn't
mind being up on top coming down; but - hey, that
boulder track is quite a trench.
06 18 57 26 CDR  That thing must be a meter or 2 deep, huh?
06 18 57+ LMP  Ok; the big re...e.
06 18 57+ CDR  Wouldn't it be easier to rake downhill.
06 18 57+ LMP  It would, but the stuff wouldn't stay in. Right?
06 18 57+ CDR  Well, I don't know.
06 18 57+ LMP  It's a thought.
06 18 57+ CDR  Make sure you get that one by the --
06 18 57+ LMP  Yes, I will.
06 18 57+ LMP  We're not really supposed to be selective about
raking.
06 18 57+ CDR  Well, you're not; you're just covering the area.
06 18 57+ LMP  That's why I set up there.
06 18 57+ CDR  A selective sample is better than no sample at all.
Let me put some in there.
06 18 57+ CDR  Bag 558.
06 18 57+ LMP  Let me go another couple of swipes.
06 18 57+ CDR  Okay. There's one a couple of inches. Most of them
are an inch or so smaller. They're angular to
subrounded fragments. Some of them look like
inclusions. As a matter of fact, the ones that are
broken open look like some of the light-colored
inclusions we saw in the big boulder. The others
are too dust covered to say anything about.
06 18 57+ CDR A couple of them look fairly coarsely crystalline. (6) (SAMP RAKE 76530, 35-77)
06 18 57+ LMP Okay. Put these in there. (6) (SAMP RAKE 76530, 35-77)
06 18 57+ CDR Big deal. Now we ended up with three more. (6) (SAMP RAKE 76530, 35-77)
06 18 57+ LMP Let me get an after, such as it is. Oh, we want the -- (6) (SAMP RAKE 76530, 35-77) (PHO 141 21625-27)
06 18 57+ CDR They want the soil here. (6) (SAMP SOIL 76500-06) (PHO 141 21621-27)
06 18 57+ LMP Soil – that's right. (6) (SAMP SOIL 76500-06)
06 18 59 46 LMP Okay. You want to put that in? (6) (SAMP SOIL 76500-06)
06 18 59+ CDR Yes, I'd better put it in before I - okay. Let's try for the soil. 559's the soil. (6) (SAMP SOIL 76500-06)
06 18 59+ CC And 17, our present plans from the back room are that we'd like to get the single core, the 500-millimeter shots - and, I guess, maybe one could do one, and one could do the other - and then we'd like to press on and do a short Station 7 unless you think you have got a fair variety of rocks here. The feeling is to do that, you have to take a look at the variety of rocks. (6) (SAMP CORE 76001) (PHO 139 21186-211)
06 18 59+ CDR Little more, little more, little more. (6) (SAMP SOIL 76500-06)
06 18 59+ CDR Okay, Bob. I'll get the core and let Jack get the 500. 559 is the kilogram of soil. I think we've pretty much covered the general variety we've seen here. I think we've seen most of them in that boulder. (6) (SAMP CORE 76001) (SAMP SOIL 76500-06)
06 18 59+ CC Okay. And so we'd like to go on to Station 7, then, when you get the 500 and the core, in hopes of finding a variation of boulders along the Front. (6)
06 19 01 02 CDR Okay. Let me know when you get it. (6)
06 19 01+ LMP Okay. The after. (6) (SAMP SOIL 76500-06) (PHO 141 21625-27)
06 19 01+ CDR Okay, why don't you get the 500, and I'll get the core. (6)
06 19 01+ LMP And the LMP's on 120. (6)
06 19 01+ CC Copy 120 there. And, Gene, if you want to change, we recommend magazine Foxtrot or Fran, as the case may be.

06 19 01+ CDR Okay. We'll try Foxtrot Franny. Don't forget to get that boulder track.

06 19 01+ LMP Hey, Bob, I think we could use an upper here if you want to save the lowers.

06 19 01+ CDR I think so, too.

06 19 01+ LMP Well there's some in under my seat if you want to use those.

06 19 01+ CDR I'll use those.

06 19 01+ CC Stand by, Jack. We have three lowers and two uppers, so we'd just as soon use the extra lower here in the single core. That'll give us two uppers and two lowers left - for doubles.

06 19 01+ LMP Okay.

06 19 01+ LMP There should be a2 lower in there, Geno.

06 19 01+ CDR Yes, Bob, any special place you want that? Just out here on the slope?

06 19 01+ LMP Should have put the gnomon up. Well -

06 19 01+ CC Just out there on the slope. I guess if you saw a crater *** you might look at that, but primarily we're looking at the crater.

06 19 01+ CDR Did he say in a crater?

06 19 01+ LMP I'm not sure what he said. Thinking - how do I get this doggone -
06 19 01+ LMP How am I going to see up there to shoot this thing? (6)(PHO 139 21186-211)

06 19 01+ CDR Well, why don't you lean against the rock? Go over there and lean against it. (6)(PHO 139 21186-211)

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06 19 01+ CC Okay. And, Jack, and if you'll listen for a minute, I'll tell you some possible 500-millimeter targets the people have in mind. One, the LM if you can see it from there. Two, Nansen, if you can see it from there. Three, Lara; and four, Shorty. In other words, I guess they're talking about looking along your traverse from yesterday. It would be mostly the back shots, apparently. And then, also, the South Massif, and I don't know what you can get of boulder tracks leading up the North Massif. And most of those will be looking downhill towards the LM, Stations 2, 3, and 4. Over. Nansen Lara, and Shorty.

06 19 01+ LMP I got you, Bob. (6)(PHO 139 21186-211)

06 19 01+ CDR Yes, the LM is visible by the way. (6)(PHO 139 21186-211)

06 19 05 27 LMP Okay, I got a set of what looks like the outcrop from which the boulder came. (6)(PHO 139 21186-93)

06 19 05+ LMP I'm afraid they're moved a little bit. (6)(PHO 139 21186-93)

06 19 05+ LMP Oh, I can't. That's it. I got a few pictures looking up the boulder track and then off to the right - to the left a little bit - and the one off to the right. And I think - I'm not sure how well they overlap; that's just an awful hard shot. (6)(PHO 139 21186-93)

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06 19 05+ CDR Okay. My camera is clean. Magazine Foxtrot - is on about frame 2, and I cycled through it. And I've got the core all set, and I'm going to go get it. And I didn't hear where you said to put it, Bob. (SAMP CORE 76001)

06 19 05+ CC Anywhere. (SAMP CORE 76001)

06 19 05+ CDR Oh, man, you're easy. (SAMP CORE 76001)
06 19 05+ CDR Anywhere. Not the bottom of a small crater, huh? (6) (SAMP CORE 76001)
06 19 05+ CC Any place. And did you get your camera dusted? (6) (SAMP CORE 76001)
06 19 05+ CDR Yes, I got it all dusted and the mag's changed. (6)
06 19 05+ CDR It's core 48. (6) (SAMP CORE 76001)
06 19 08 06 CDR I'll even get you a picture of it. (6) (SAMP CORE 76001) (PHO 146 22291-92)
36 19 08+ CDR Can you get the LM from there? (6) (PHO 139 21203-05)
06 19 08+ LMP Yes. (6) (PHO 139 21203-05)
06 19 08+ CDR That core went in very easy, Bob. I pushed it in about a quarter of the way. And about another five or six whacks, and it's in all the way. (6) (SAMP CORE 76001)
06 19 08+ CDR Okay. Come on out now, baby. (6) (SAMP CORE 76001)
06 19 08+ LMP Okay, Bob. Shorty, and Station 3, and Station 2, and what else? (6) (PHO 139 21186-211)
36 19 08+ CC And any sort of outcrops you see in the South Massif. (6) (PHO 139 21186-211)
06 19 08+ LMP I thought we shot those. (6) (PHO 139 21186-211)
06 19 08+ CC Okay. If you got those, fine. (6) (PHO 139 21186-211)
06 19 08+ LMP No, I mean the other day. (6) (PHO 139 21186-211)
06 19 08+ LMP I'll try again. (6) (PHO 139 21186-211)
06 19 08+ CC Stereo is stereo is stereo, I guess. (6) (PHO 139 21186-211)
06 19 08+ LMP Well, but it's not stereo; it's right along the same line. (6) (PHO 139 21186-211)
06 19 08+ CDR Okay, and I got you a little soil mechanics of the hole; which stayed intact; very nice and round. (6) (SAMP CORE 76001)
06 19 08+ LMP You aren't going to get anything else out of me if I keep taking pictures. (6) (PHO 139 21186-211)
06 19 08+  CDR  Frame 31, Bob.  
(6)(SAMP CORE 76001)(PHO 146 22291-95)

06 19 08+  LMP  Okay.  LMP was what?  120?  I guess we can get to 
the next station with that.  
(6)

06 19 08+  CDR  Yes, I got a brand new mag on.  
(6)

06 19 08+  CC  And we'd like to get you guys rolling as soon as 
feasible there.  
(6)

06 19 11+  CDR  Okay.  I'll need your rammer, so if you'll just turn 
(6)(SAMP CORE 76001) 
right.  
(6)

06 19 11+  CDR  Good timing.  Pin's out; core tube is safe.  In 
full.  
(6)(SAMP CORE 76001)

06 19 11+  CDR  I knew it was.  Okay.  You take this and put this 
under your seat, if you want, Jack.  And I'll get 
the TGE.  Oh, let me put your shovel back on for 
you.  I'll get it.  
(6)(SAMP CORE 76001)

06 19 11+  LMP  Don't lose that.  Boy, if you do -  
(6)

06 19 11+  LMP  Okay.  Did you give them the number?  
(6)(SAMP CORE 76001)

06 19 11+  CDR  Yes, they got the number.  
(6)(SAMP CORE 76001)

06 19 11+  LMP  Under the LMP's seat.  
(6)(SAMP CORE 76001)

06 19 11+  CC  Roger.  We got it.  Copy that - under the LMP's 
seat.  
(6)(SAMP CORE 76001)

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06 19 12 51  CDR  670, 109, 801; 670, 109, 801.  
(6)

06 19 12+  LMP  I wish we - the one thing I didn't do.  While you're 
doing that -  
(6)

06 19 12+  LMP  Didn't get pictures of those foliated vesicles.  I 
don't think the ones you had were in that kind of 
rock.  
(6)
06 19 12+ CDR I don't want to lose that thing, so I guess --

06 19 12+ CC Okay, I7 when you get back on here, we don't need any charges, and we'll leave the SEP turned off.

---

06 19 12+ CDR Yes, I turned it off. Let me see. We want to move on to 7 here. Rake, talus, documented core, you got your stereos, we got two pans, TGE, camera. Okay, we're going to head east and look for Station 7 - block variation, contact change, and get a different sample of rocks. I want to get one or two of those nice ones in the big bag while you're over there. (SAMP 76055)

06 19 12+ LMP Open the gate, and I'll bring one. (SAMP 76055)

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06 19 12+ CDR Guess what isn't opening again. Should, though. It's all set right.

06 19 12+ CC You could put them under Jack's seat if it's easier. (SAMP 76055)

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06 19 12+ LMP Big bag open?

06 19 12+ CDR Yes, it's all open. All set. (SAMP 76055)

06 19 12+ LMP Get me a - I need a normal sample bag for one here. It's pretty fragile.

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06 19 12+ LMP Here, let me get this big one. I'm about ready to drop it. It looks like a gabbro. (SAMP 76055)

06 19 12+ CDR There's sample bag 560. (SAMP 76330, 35)

06 19 12+ LMP And 560 has an undocumented except by the pans - very white - looks like a crushed anorthosite. It looks like - some of the inclusions in the gray breccia - gray and recrystallized breccia.
06 19 16 30 CDR Wait a minute. Let me get this out of the way. Okay. Close it. Yes. That's got it.

06 19 17 10 CDR Okay. We're moving. Sort of.

06 19 17+ LMP Your camera lens looks all right, Geno.

06 19 17+ CDR Yes, I dusted it already.

06 19 17+ CDR I can drive, Jack.

06 19 17+ LMP Why don't you drive down and get - so you're not *** you can get on -

06 19 17+ CDR You can go downhill very easy.

06 19 17+ LMP Yes.

06 19 17+ CDR Why don't you just go down there.

06 19 17+ LMP I'll carry the Rover samples. Just in case.

06 19 17+ LMP Got it?

06 19 17+ CDR Okay. I'll get that out of your way, too.

06 19 17+ LMP Okay. I'll head down to that side hill over to those boulders right over there and then see if that's any change.

06 19 17+ CDR Okay. You might, if you get another sample - a large sample, you might grab it, and we'll throw it in the footpan here and I'll see. I can't find a level spot to - -

06 19 19 14 LMP I sort of ought to have my scoop, too.

06 19 19+ CDR --- help you get on. No don't take too much; just take that. That's all you need.
06 19 19+ LMP How about letting me have your hammer, then? (6)

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06 19 19+ CDR Gnomon is on the Rover. The TGE is on the Rover. (6)

06 19 19+ CDR The rake is on the Rover. The scoop's on the Rover. You put the core under your pan, right? (SAMP CORE 76001)

06 19 19+ LMP Yes, that's right. (6)(SAMP CORE 76001)

06 19 19+ CDR Okay. I'm going to power up and see if I can't come down and get you.

06 19 19+ CDR It's fun walking downhill. Boy that boulder track is impressive.

06 19 19+ CC Ok; and, 17, when you get moving we want to get, and: (6) I quote, a maximum variety of hand samples with a minimum amount of documentation, in a minimum amount of time at Station 7. It's just an attempt to see what kind of variety we can get along the face of the Front.

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06 19 22 10 CDR Okay. I'm rolling. (6)

06 19 22+ CDR Man, this is still a slope. Jack, I'm going to pull around and in front of the way you're facing.

06 19 22+ LMP I can go down - there's a crater over here. Don't drive through it.

06 19 22+ CDR Oh, there you are. This is much better. How is this?

06 19 22+ CDR We ought to be able to pick up lots of those fragments out in that field out there.

06 19 22+ CDR Okay. Bob, I just came downslope reading 193/3.1 - just about 100 meters to pick up Jack.

06 19 22+ LMP Okay. Bag 48 Yankee has a sample of about a half - one-third-meter boulder that was lying in - that's sitting right smack dab in a little crater of its own. (SAMP 76030-37)
06 19 22+ CDR Oh, Jack.
06 19 22+ LMP What:
06 19 22+ CDR Oh, you just kicked a snowstorm of dust across here.
06 19 22+ LMP I'm sorry. I just fell, too.
05 19 22+ CDR Did you? You all right?
06 19 22+ LMP Yes. Got your hammer?
06 19 22+ CDR I got to drop it in the pan here. Hold on to it, I think.

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06 19 25 36 CDR We're rolling, Bob.
06 19 25+ LMP LMP frame is 130.

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06 19 25+ LMP Hey, you got a rock on your right.
06 19 25+ CDR Yes. I got them.

---

06 19 26 10 LMP Okay. How about that field, not this block but there's sort of a collection of them -- way out there, about 300 meters or so.
06 19 26+ CDR Oh, at least. Yes.
06 19 26+ LMP Oh; going into the sun, I can't see a thing to tell you about Wessex Cleft.

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06 19 26+ CDR You feel like you're on a downslope over there?
06 19 26+ LMP Yes. I feel like you're about ready to spin out downhill any minute.
06 19 26+ CDR I don't feel that at all up here.
06 19 26+ CDR  We must be about 200 meters up the slope, looking at (6-7) that little valley down there, Jack. Am I right?

06 19 26+ LMP  Yes. I think you're right. The pattern on the (6-7) slope really doesn't look much different than on the light mantle. Matter of fact, it looks very much like light mantle, except for these large blocks that are in it.

06 19 27+ LMP  That looks like a pretty good pile to work on. (6-7)

06 19 27+ CDR  I want to get in that flat area, Jack, so I can dust (6-7) the radiators.

06 19 27 57 LMP  Yes. (6-7)

06 19 27+ CC  This is going to be a very short station. Probably (6-7) not more than 10 or 15 minutes. But just to grab a maximum variety of hand samples with a minimum amount of documentation and a minimum amount of time.

06 19 27+ CDR  We can do a pan, and pick up a lot of those small ones, Jack. (6-7)

06 19 27+ CDR  I'd like to see us a little more level. (6-7)

06 19 27+ LMP  I thought you were going to stop back there. (6-7)

06 19 27+ CDR  I was going out here around this big one. (6-7)

06 19 27+ CDR  See, there's a lot of little ones up in here. (6-7)
06 19 27+ CDR Right here to give you as much of a level spot as I can. That's about as level a spot as I can find. I'm inside the slope of a crater.

06 19 29 05 CDR I'm at 200/3.3. (7)

06 19 29+ CDR You take a pan before, and we'll start picking up some of those samples, and I'll take a pan afterward. (7)(PHO 141 21646-67)

06 19 29+ LMP There is another one of our blue-gray breccias, I think, over there; recrystallized breccias with some of that crushed anorthosite in it. I think right in here I'm going to take the pan. (PHO 141 21646-67)

06 19 29+ CC Jack, what's your frame count? (PHO 141 21646-67)

06 19 29+ LMP 131. (PHO 141 21646-67)

06 19 30 23 LMP I'm going to take the pan at 11 feet so you can see the fragments that we are going to pick up here. Then we can take another one at - for location work. (PHO 141 21646-67)

06 19 31 09 CC We've got a TV. (7)

06 19 33 09 LMP 540 is the first bag of selected samples. (SAMP 7710-19,25-26)(PHO 146 22298-300,336-38)

06 19 33+ CDR Here, put that one in there. (SAMP 77017)

06 19 33+ LMP Let's get a bag on it. We're getting too many rocks, and we don't know where they came from. (SAMP 77017)

06 19 33+ LMP I don't think it will fit. (SAMP 77017)

06 19 33+ CDR Yes, we'll wrap it a little bit *** it will fit. (SAMP 77017)
10 19 34 WPM Don't hesi'tate around another big rock in
here's collection bag.

09 19 54 CDR Did you not pictures of this thing here?

10 19 54 WPM Yes, well, not the big rock yet. Not in focus
anyway.

10 19 54 CDR I got to do that.

10 19 54 WPM I was just collecting in this area.

10 19 54 CDR Why don't you keep grabbing a few, and I'm going
to -

10 19 54 WPM That's what I'm doing.

10 19 54 CDR That's one of the blue-gray rocks. And it's got a
light-colored fragment that runs the full height of
it, about a meter and a half thick. And then it's
got the gray or blue-gray rock on the other side.
As a matter of fact - I let me look at it closely.
It's a fragment in it all right.

---

10 19 35 CDR I wouldn't be absolutely positive, but it sure looks
like I see a dikelet in here that's in the
illusion. And I'm going to get a close-up stereo of it.
I'd call it a dikelet, if you pinned me down.

---

10 19 34 CDR I wish I could break a sample of that off. Here's
another one. It's a dikelet. There's three or
four of them.

10 19 34 CDR The material in this dike looks - yes, it's not
covering it. It's between the lighter-colored rock,
and it's the blue-gray rock.

10 19 37 WPM 542 is another bag of goodies.

---

10 19 37 CDR Well, maybe it isn't a dikelet. Maybe it's just a
screen covering, a flow covering.
LMP No, they're dikes.

LMP They're little veins of -

CDR Let me get this whole thing in a bag.

CDR I got a rock, Bob. It's fractured, primarily around the dike. It's in several pieces, but we're going to put it all in one bag.

LMP 543.

CDR We need to put one of those dikes in another bag. It looks like some fraction of the blue-gray material has obviously intruded.

CDR Now, can you get that dike there? Piece of it?

CDR I can get it right here.

CDR Yes. It's this soft, white inclusion again. It breaks pretty easy.

CDR Oh, it's got to be a dike. Look at that.

LMP It is.

LMP Okay, 544.

CDR Oh, yes, it is because I just broke into it.

LMP Although the blue-gray up on the hill looked like a fragment breccia, if this is still related, then it's - been some partial melting at some time.

CDR There's a preserved contact between the dike and the white matter.

LMP That's what I wanted.
06 19 38+ CDR Why don't we get this big piece of dike now? (7) (SAMP 77070,75-77)

06 19 38+ LMP See if you can get - whoa! Don't hit it again. There, you've still got some contact there. (7) (SAMP 77070,75-77)

06 19 38+ CDR Now, there's some good contact. That'll do it. (7) (SAMP 77070,75-77)

06 19 38+ LMP Dike and intruded rock in 544. Now, these dikes are a dark bluish-gray. And it looks like they're very finely crystalline - maybe with some --

06 19 39+ CDR I'm taking some closeups. (7) (SAMP 77070,75-77) (PHO 146 22298-99,336-38)

06 19 39+ LMP -- very fine phenocrysts. (7) (SAMP 77070,75-77)

06 19 39+ LMP We ought to get a piece of the normal gray that the dikes are coming from. (7) (SAMP 77110,15) (PHO 146 22298-99,336-38)

06 19 39+ CDR I want to get this. -- finish documenting this thing. (7) (SAMP 77070,75-77) (PHO 146 22298-99,336-38)

06 19 39+ LMP Hey, over here on this side, it looks like the vesicular anorthositic gabbro. (7) (SAMP 77130,35) (PHO 146 22298-300,331-38)

06 19 39+ CDR I got to get some regular pictures on this set. (7) (PHO 146 22331-38)

06 19 40 38 LMP Yes. 561. That's a sample of the gray, looks like recrystallized breccia that the dikes are continuous with. (7) (SAMP 77110,15)

06 19 40+ LMP And the vesicular rocks -

06 19 40+ CDR Let me finish the stereo around the corner here. (7) (PHO 146 22331-38)

06 19 41+ CC And you might grab one FSR on the way out. (7) (SAMP 77035)

06 19 41+ CDR We'll do that. (7)
0619 41 39 LMP Okay. There's that one. The vesicular anorthositic (7)(SAMP 77130,35) gabbro is in 5 - what is it? 62.

0619 43 09 CDR Here's a football-size rock that was 50 percent buried.

0619 43+ LMP That one looked like a piece of the gray rock, I think.

0619 43+ CC Jack, we'd like you to change mags before you leave this station.

0619 43+ LMP Yes, sir.

0619 43+ LMP What magazine did you want, Bob?

0619 43+ CC Magazine, Mike.

0619 45+ CC Gene, you might spend your time taking a standard 74-foot pan while Jack is changing his mag.

0619 45+ CDR That's exactly what I'll do. I don't mind going uphill, because it's so much fun coming down.

0619 47 26 LMP Mag's changed.

0619 47+ LMP Those two bags with the goodies in them will have enough soil to be representative of the area we sampled, too, I think.

0619 50 48 CDR CDR is about 73 on the frames.
06 19 51 09  CDR  Okay. We're rolling, and I'd like the range and bear in to the next -

06 19 52 27  LMP  We're still about 100 meters, I think, from where the break in slope is — with the flank. But we're away from the block population except for two great big blocks out ahead of us, this side of the SMP crater. But the average population is down to the 1 percent or less, again.

06 19 52+  LMP  That average population really never changed up in here. Just the big blocks we're around. I saw some little — half-meter to one-third-meter, glass-lined, pit-bottom craters.

06 19 52+  LMP  Look at the size of those things!

06 19 52+  CDR  Boy, aren't they big mammoths.

06 19 52+  LMP  And it looks like they're probably the same thing that we sampled. They have the inclusions in them, white inclusions. They look like a mixture of the gray of the recrystallized breccia, and the tan-gray of the anorthositic gabbro.

06 19 54 02  LMP  There's Van Serg, blocky rim crater. That's the other side of Cochise there. See it?

06 19 54+  CDR  Yes. Way over there.

06 19 54+  LMP  Yes. Cochise is certainly a shallow crater, although we knew that. It only has one place I can see that has any blocks on the inner wall of Cochise. Otherwise, it has a surface much like what we're driving on for walls and for the floor. One place on the south-southeast wall is a concentration of blocks much like we saw in Henry or in Horatio. But the rest of the crater seems to be pretty well mantled. Van Serg is a very blocky rim crater, big blocks up on the rim.

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06 19 54+ CDR I'm looking at the Sculptured Hills, and I still have that old man wrinkled face appearance, even up close at this sun angle. And those wrinkles go from, generally, upslope at the west to downslope at the east.

06 19 54+ LMP You're right at the edge of Cochise. Aren't you? (7-8)

06 19 54+ CDR No, we're not that close. Cochise is up at - see that rim where those blocks are? (7-8)

06 19 54+ LMP No, that's a small crater. (7-8)

06 19 54+ CDR Oh, I'll bet you that's Cochise up there. We've got to go quite a ways yet to get to - (7-8)

06 19 54+ CDR This sideslope driving is really a tough -- (7-8)

06 19 55 45 CC How about a range and bearing? (7-8)

06 19 55+ CDR Okay. It's 210/3.4. (7-8)

06 19 55+ CDR I guess that's some other - that's just a depression. I think Cochise is over that rim. (7-8)

06 19 55+ LMP That's just a depression. (7-8)

06 19 55+ LMP That's just a big, shallow depression. (7-8)

06 19 55+ LMP There's another one of those deep craters that's not - that doesn't have a blocky rim. (7-8)

06 19 56 57 CDR Okay. 214/3.4. (7-8)

06 19 56+ LMP That's one of the more striking characteristics of the mantle are these craters that look, as far as the diameter-to-depth ratio is concerned, like they ought to be fairly young. But there's no blocks on the rim, and they seem to have this mantled appearance, just like some of the large craters.
CDR: As I look up Wessex Clear from just about abreast of it, it still shows me an albedo change and a surface wrinkle-texture change.

LMP: Yes, I think so. I've got it at the same sun angle more or less.

CDR: Is that SWP?

LMP: I don't know.

LMP: Bob, there's something I haven't mentioned, but if one had time on the next program...

CDR: I think that's SWP right there, Jack.

LMP: -- you can sample secondary craters, and they tend to have blocks either in them or on one rim, suggesting that you could tell directions if you put your mind to it. Directions of where the secondaries came from. These are small ones.

CDR: Did we ever get a piece of glass in place?

LMP: Yes, I did yesterday.

CDR: Documented in place?

LMP: Yes.

LMP: That's what I was trying to protect in the SRC yesterday.

CDR: Here's SWP, Jack. It's coming right up, and I'll go along the southern rim.

LMP: I'm forgetting to take my pictures.

LMP: There's a crater, that double pit-bottom crater. That's the first one of those I've seen.
06 19 59+ CDR Right here, Jack, you're going to be able to peek right over the top of SWP.

06 19 59 36 CDR Right here. How's that grab you?

06 19 59+ LMP That's SWP, all right. SWP's a bigger hole than I thought it was.

06 19 59+ LMP SWP even has some blocks in the wall.

06 19 59+ CDR Yes, but the eastern and southeastern rim of SWP are just continuous with the slopes of the Sculptured Hills.

06 20 00 16 CDR How does 238/4.2 sound for the beginning of 8?

06 20 00+ CC 238 and 4.0 we're expecting for Station 8.

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06 20 00+ CDR Let me tell you, this Rover is a machine. I don't know if it saw that hill we're climbing, but I did.

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06 20 00+ CDR Doing fine. I'm trying to get around SWP over here and start hitting that-

06 20 00+ LMP East Massif has outcrops on it. I can see now on the north side. And they also tend to have linear upper terminations. And some of those line up as if there's roughly horizontal structure within the upper one-half of the East Massif.

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06 20 00+ LMP Go by that little dark crater over there. There's a very blocky-rim small crater that's a dark-rimmed crater instead of a bright rim like we'd seen some around that looked fresh. It partly may be the angle at which we're approaching it.

06 20 02 35 CDR We're on the southeastern rim of SWP at 226 and 3.6. (LRV II)

06 20 02+ LMP Why don't we get some samples of that material in there.

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249
06 20 02+ LMP Okay. Keep driving toward the rim and then just - a (7-8)(LRV II)(SAMP 78120-24) shallow curve.

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06 20 03 03 CDR 226/3.6. There's a highly fragmental, small crater about 30 or 40 meters across, right on the southeastern rim of SMP. And most of the fragments are football size and smaller, and they're very angular.

06 20 03+ LMP Turns out that they'll break. They're clods.

06 20 03+ CDR I guess that's going to be about 70 percent covered on the inside of the rim with these things.

06 20 03+ LMP It's all instant rock, but the crater rim looks dark compared to other fresh craters like this that we've seen.

06 20 03 47 CDR Fifty Yankee.

06 20 03 52 LMP LMP frame is 26.

---

06 20 04 02 LMP We're rolling.

06 20 04+ LMP Your wheels are just chewing those things up.

---

06 20 04+ LMP I think we ought to get below the highest peak up there because that seems to have the rocks on it.

06 20 04+ LMP I only see one rock so far --

06 20 04+ CDR *** straight ahead, in there. See that one. Of course, I don't know where that came down. Doesn't look like it may have come down from the top.

06 20 04+ LMP Certainly aren't many rocks. It's certainly not like the old North and South Massifs. Yes. There's one big rock over there.

06 20 04+ CDR Well, let's head that way. That's about where the station is, anyway.
06 20 04+ LMP *** I think we're starting to see blocks. That one (7-8)
is so unusual -

06 20 04+ CDR That's the northernmost station anyway. There's (7-8)
another one there.

06 20 04+ LMP We can get the other smaller population around it. (7-8)
I'm worried about that one being exotic to the
Sculptured Hills.

06 20 04+ CDR Yes, it doesn't look like it rolled - (7-8)

06 20 04+ CDR But I don't see any others, do you? (7-8)

06 20 04+ LMP Well, there's some small ones up in there. Off to (7-8)
about the 2 o'clock position. But I think that's
all. We're going to have to be satisfied with small
ones. Big ones don't get down. There's some big
ones way up on the slope.

---

06 20 05 59 CDR We're at 227/3.9. (7-8)

06 20 05+ CDR There's smaller ones around here, too, Jack. (7-8)

06 20 05+ LMP Yes. That looks like subfloor from here. (7-8)

06 20 05+ CDR What's it look like? If it doesn't look worthwhile (7-8)
stooping, I'll move on up over there.

06 20 05+ LMP Yes, it looks like subfloor. I would recommend that (7-8)
we try to get up to some of those. I don't know
whether we can or not.

---

06 20 05+ LMP Those two up there would be reasonably well up the (7-8)slope.

---

06 20 06+ CDR I have to park about 045 because I've got to be (7-8)
pointing uphill so we can get out.

---
06 20 06+ LMP How about just that rim of that little crater there? (7-8)
06 20 06+ CDR Well, this is so level right here, Jack, I'm going to just park it - (7-8)
06 20 06+ LMP Well, I was just thinking on top of that crater is closer to the - that's level, too, on the rim. It'll give them a good view of the sampling area. I think if we work on those blocks there, we're in pretty good shape.
06 20 07+ LMP Bob, we're directly downhill, and that is from the highest point that I could see up on this first sculptured hill.
06 20 07 40 CDR Bob, I'm parked at 026; bearing 226; distance, 6.6; (8) range, 4.0.
---
06 20 07+ CDR Yes. And I'm fairly level. (8)
06 20 07+ LMP Not really. (8)
06 20 07+ CDR I'm not, huh? (8)
06 20 07+ LMP I just about rolled downhill again. (8)
06 20 07+ CDR I am pointing uphill, aren't I? (8)
---
06 20 07+ LMP The first block I looked at here looks like subfloor (8) gabbro.
06 20 10 17 CC Okay. We've got a picture. (8)
---
06 20 12+ LMP All the blocks bigger than 20 centimeters that I've looked at up here are subfloor gabbro in appearance.
06 20 12+ LMP I've looked at about five. (8)
---
LMP: Gena, I'm going to go up and look at this one rock. Why don't you set up and sample any of these other big ones. They're all the same. Like the one near the Rover. And I'll go up and try to get this big one down there.

LMP: It's the only one left to look at, but right now we're dealing with subfloor material, I think.

CDR: What about some of these little fragments that seem to be sitting more on the surface?

LMP: Yes, we're supposed to rake here. We'll get those with the rake.

CDR: That one up there, by the way, is sitting on the surface. These others are submerged.

LMP: Yes, that's why I want to look at it.

CC: A reminder, 17. We'd like to have you leaving here in 30 minutes to make up some of the time we spent at Stations 6 and 7, a little extra. And we'd also remind you that we'd like a rake soil sample here, too. That may be the only way we try and pick up some stuff other than subfloor if that, indeed, has come down from the top of the Sculptured Hills.

LMP: This rock is a big chunk of shattered, but still visible, blueish-gray anorthosite. It's glass-coated, and it actually looks like it's vesicular. I'm going to roll it downhill so we can work on it. Well, I'll document it first.

LMP: But the point is, as Gene said, it's the only rock, big one anyway, in the area that I see that's perched on the surface as if it might have rolled here.

LMP: But I don't see a track.

CDR: Man, this one here is tough as a -
06 20 14+ LMP Well, we can get some small ones.  
06 20 14+ CDR Yes. That's what I'm going to do.  
06 20 14+ LMP I thought you might be able to break it up.  
06 20 14+ CDR There's no corners on it.  

---

06 20 16 28 CDR Bob, 563 is the sample.  

---

06 20 16+ LMP Go, roll. Look, I would roll on this slope, why don't you? Hey, I'll bet you they would like, if I didn't step on it, sample out of the bottom of that thing.  
06 20 16+ CDR These others all look - you're right, Jack, they look like what we've been sampling. And they're all pretty well mantled except the one you got up there. There's one more piece I see on the side of that crater that may not be.  

06 20 17+ LMP Bag 545 will be soil from under that anorthosite boulder. The only thing that bothers me about that boulder being subfloor - I mean Sculptured Hills is that it's glass-coated.  
06 20 17+ LMP It may have been thrown in here by an impact. Oh, you're here.  
06 20 17+ CDR Thought I'd sample it, and then roll it down.  
06 20 17+ LMP Well, okay. I never would have moved it if I thought you were coming up.  

---

06 20 17+ LMP I got it documented up in place. I think that's the side that was down. Let me roll it over -  

06 20 17+ CDR Well, let me get a piece of that side since it was underneath. Then we'll roll it over and get a piece of the other side.
06 20 17+ LMP Okay, yes. Let's do it again. Except I got dust all over it. (8)(SAMP 7:230-38)

06 20 18 57 LMP The albedo - the down-sun picture's not going to mean much. Let me get this sample in your bag. I think we ought to change your bag because the stuff's going to start flying out. (8)(SAMP 78230-38)

06 20 18+ CDR Jack, after this one, there's one more in that crater. It may be from that crater, but I don't know. (8)

06 20 18+ CDR Two pieces for you. (8)(SAMP 78230-38)

06 20 18+ CDR Oh, that's a pretty one inside! (8)(SAMP 78230-38)

06 20 18+ LMP Well, it's stained by the glass coating. (8)(SAMP 78230-38)

06 20 18+ CDR While I'm at it, I'm going to chop another piece off right here. (8)(SAMP 78230-38)

06 20 18+ LMP Yes, get more than that. (8)(SAMP 78230-38)

06 20 18+ CDR Piece right there. You've got three pieces laying around. Let's get those before we lose them. (8)(SAMP 78230-38)

06 20 20 26 LMP Bag 564. (8)(SAMP 78230-38)

06 20 20 26 CC 564 from the bottom of the boulder. (8)(SAMP 78230-38)

06 20 20+ CDR Sure that's the bottom, huh? (8)(SAMP 78230-38)

06 20 20+ LMP Yes. (8)(SAMP 78230-38)

06 20 20+ CDR It's mixed with local soil. (8)(SAMP 78230-38)

06 20 20+ LMP Yes, I'm pretty sure. Let's turn it over. I think I'd recognize the top, although it's got dust all over it now. (8)
06 20 20+ CDR I think I'll get one more swap off there. I don't want to seal this. Let me get another swap off there. I can get it.

06 20 20+ CDR Well, that disappeared. Get it this way. (8) SAMP 78230-38

06 20 20+ CDR One time. That disappeared, too? That probably went into orbit. (8) SAMP 78230-38

06 20 20+ CDR Boy, is that pretty inside. Whoa! We haven't seen anything like this. I haven't. Unless you've been holding out on me. (8) SAMP 78230-38

06 20 20+ LMP No, this is a nice crystalline rock. (8) SAMP 78230-38

06 20 20+ CDR Okay, I see that one. (8) SAMP 78230-38

06 20 20+ CDR That's a good one. I'll go get it with my tongs. That one I worked too hard to get. Hey, I see how it makes boulder tracks. It just skipped along, made those little pothole craters as it went. (8) SAMP 78230-38

06 20 22 30 LMP This is about a 50-50 mixture of what looks like maskelynite or at least blue-gray plagioclase, and a very - let's say light yellow-tan mineral, probably orthopyroxene. It's fairly coarsely crystalline. (8) SAMP 78230-38

06 20 22 CC When you guys get done with that rock, we'd like to get to the rake sample, please. And that's probably just as well done by the Rover as anywhere else. We don't seem to see anything worthwhile here doing besides that.

06 20 23 29 CDR Okay. That went in the same bag, Bob, as the rest of the chips from the bottom (top?). All the chips from the bottom are in 464. (8) SAMP 78230-38

06 20 23+ LMP Here, let me roll it over. (8) SAMP 78250, 55 (PHO 146 22372-74, 98)

06 20 23+ LMP By coarsely crystalline, probably, the average grain size will turn out to be about 3 or 4 millimeters, maybe half a centimeter. (8)

06 20 24+ CDR Well, I got to go get a couple of pictures. (8) PHO 146 22372-74

06 20 24+ LMP Yes, we really got that one messed up. (8)
06 20 24+ CDR | If you'd hold your scoop where that one came off, it'd help. | (8)(PHO 146 223:2-74)
06 20 24+ LMP | Yes: I was just going over there. | (8)(PHO 146 22372-74)
06 20 24+ CDR | On that other side. | (8)(PHO 146 22372-74)
06 20 24+ LMP | Just going over there. | (8)(PHO 146 22372-74)
06 20 24+ CDR | This side is clear. That last one I took off. | (8)
06 20 24+ LMP | Right there. | (8)
05 20 24+ CDR | Okay, that's good. Let's move the gnomon, and we won't roll it over on the gnomon. | (8)(PHO 146 22372-74)
06 20 24+ LMP | That other side is the one that was up. Well, I'm not sure now. It's got so much dust on it. | (8)
06 20 24+ CDR | It's not going to roll down that hill unless we got it on edge. | (8)
06 20 24+ CDR | Well, look at that glass on it. | (8)
06 20 24+ CDR | Which side was the glass on when you looked at it? | (8)
06 20 24+ LMP | It's on all sides. | (8)
06 20 24+ CC | There's probably not much point in spending a lot of time out here trying to decide which is the top. It's not big enough, anyway, really to worry about the top and bottom samples. They're radiologically significant. | (8)
06 20 24+ LMP | If you don't want another sample, then we can go ahead. | (8)(SAMP 78250,55)
06 20 24+ CDR | Let me get a piece of this glass. | (8)(SAMP 78250,55)
06 20 24+ LMP | There it is. Let me try to get them. Put them in here. | (8)(SAMP 78250,55)
06 20 26 29 CDR | A piece of the glass from it, Bob, is 546. (bottom). | (8)(SAMP 78250,55)
06 20 26+ CDR | With a little of the local soil. | (8)(SAMP 78250,55)
06 20 26+ CDR We'll rake.

06 20 26+ CC They suggest the crater rim if possible. Probably over there near the Rover.

06 20 26+ LMP Okay. Now you got a sample of that big block down there, huh?

06 20 26+ CDR Yes.

06 20 26+ LMP Don't forget your gnomon.

05 20 27 08 CDR Bob, I'm on frame count: 85.

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06 20 27+ CDR Jack, did you get a pan up here?

06 20 27+ LMP No.

06 20 27 25 CDR I'll get one.

---

06 20 27+ CDR Let's see, I must be looking back at -- well there's SWP. Golly, I don't know. I'm looking back at the complex: Cochise and Shakespeare, and I can see the LM.

06 20 27+ CDR One interesting thing up here, you can see the erosional pattern of the talus, the mantle that -- I call it a mantle, but the talus that's on the Sculptured Hills, there's little boulder tracks of all sizes from all these little clods. And they all, of course, point downhill or nearly downhill.

06 20 27+ LMP In the interest of time, I'll document this without (PHO 146 22375-97) the gnomon.

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06 20 27+ CDR Oh. You documented already; I was just going to put this in the field of view anyway.

06 20 27+ LMP Yes. Here on the after we can have it there. (PHO 142 21706-11)
06 20 30 55 CDR There's not much in here worth - man, there's just nothing. This has been totally mantled with talus. Well, it is, because that downhill pattern goes right down the slope of this crater, and, actually, it goes upslope of the crater. This may be on a rav somewhat. Because it goes right downhill - this little bitty boulder-trail pattern goes right up the slope.

06 20 30+ LMP I think those are later than the crater by a long ways.

06 20 30+ CDR Did you sample anything over here?

06 20 30+ LMP No, I haven't done anything - -

06 20 30+ CDR I'm going to pick up the piece out of that little - - crater.

06 20 30+ LMP Want your gnomon over there?

06 20 30+ CDR No. I'll just take it to it. Let me know when you're ready for a bag.

06 20 30+ LMP Well, I'm about ready.

06 20 32 .7 LMP I raked about a 2-meter-square area - and down to 4 or 5 centimeters for these. Pretty good population. They all going to go in?

06 20 32+ CDR They're all in; - - 565.

06 20 33 16 CDR The kilogram is in 566.

06 20 33+ CC And, remaining here, we'd have primarily a trench. If you fellows think it's feasible, we'd like to be moving in 11 minutes. And we could use a pan from this lower location also, probably.

06 20 33+ CDR Why don't you go back and dig a trench at the Rover? (8)
06 20 33+ CDR Once you get a trench at the Rover -- we just scoop this out. I'll get the sample here that I got documented now and --
(SAMP 78150,55) (PHO 142 21706-16; 146 22399-403)

06 20 33+ LMP Is that all going to go in there?
(SAMP 78150,55)

06 20 33+ CDR Yes, it'll go.
(SAMP 78150,55)

06 20 33+ LMP That *** rock may have been too much. Take that rock out, if it is.
(SAMP 78150,55)

06 20 33+ CDR No, it'll stay. We're going to have to put it in mine, though. Well, let me try. Since we're going to unload your bag, this may be the last one. That's the last one for your bag.
(SAMP 78150,55)

06 20 33+ LMP Did you get anything out of that little crater?
(SAMP 78150,55)

06 20 33+ CDR No. But I'm going to right now.
(SAMP 78150,55)

06 20 33+ CDR Why don't you get your after picture over there and go down and get that trench.
(PHO 142 21712-16?)

06 20 35 04 CDR Boy, almost pure white and very friable. Oh, boy, is it! Pure white. Right out of a small little pit crater on the side of this crater I just walked in. Houston. And it's pure white, very friable. I got one big piece and several small in 567.
(SAMP 78150,55)

08 20 35+ LMP Bob, the walls of these craters, the big craters around here, that is, the ones that are, say, 15 meters in diameter, tend to be a little bit lighter albedo than ones down in the mantled area. I'm afraid those pictures on that rake may be through a dust-colored lens.
(SAMP RAKE 78525-28,30,35-99) (PHO 142 21712-16?)

06 20 35+ CDR Yes, they were also in my doc- sample here, too.
(SAMP 78150,55) (PHO 146 22399-403)

06 20 35+ CDR Okay. Where do you want this trench? On the side of this crater?
(SAMP TRENCH 784.0-24) (PHO 142 1717-25)

06 20 35+ CDR I'll drop my gnomon.
(SAMP TRENCH 78420-24) (PHO 142 21717-25)

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LMP - - I don't know. I was just thinking about that. I think we ought to get out in the inter-crater area to see if there's any stratigraphy to whatever the talus is.

CDR Okay, Jack. I'm going to leave the gnomon right here.

LMP I'll get it.

CDR And, while you're digging that trench, we've got to pan to get, but I want to fix this fender.

LMP I guess. The pan's mine, isn't it, this one?

CDR Yes, it is.

CDR The gravimeter's coming up. 670, 096, 001 - 670, 096, 001.

CDR You want it (gravimeter) dropped on the ground?

CC Gently.

LMP I have dug - have gotten a wall, now in one place that's standing about 25 centimeters high. And it shows no apparent change in the texture of the soil to that depth; except possibly at the lower 5 centimeters, there's some zones that might be slightly more granular. Particle size may be up a little bit.

LMP Okay - the bottom 10 centimeters - -

CDR Let me get your bags - I left my camera off.

LMP I didn't take a picture of the trench after I dug it. Let me take one - one shot.
On 20 42 41 CDR The bottom is in 548. It's very cloddy. Looks very (8)(SAMP TRENCH 78420-24) much like the surface we're standing on except it clods up quite a bit more. Can you tell them anything from the trench itself?

06 20 42+ LMP I talked to them a little bit about it. (8)

06 20 42+ LMP It looked a little coarser-grained, but that's all. (8)

06 20 42+ CDR Okay. It sure holds a nice wall, though. (8)

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06 20 42+ LMP Skim sample of the upper half centimeter. Maybe a centimeter deep. (8)(SAMP TRENCH 78480-84)(PHO 142 21717-25)

06 20 42+ CDR I'm going to put it in your bag. (8)(SAMP TRENCH 78480-84)

06 20 42+ CDR There's no choice, right now. Let me see if these little ones will fit in there. Stand by. I want to put this one in there, too. (8)(SAMP TRENCH 78480-84)

06 20 43 45 CDR That's in bag 545. (8)(SAMP TRENCH 78480-84)

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06 20 43+ LMP Below that skim, the next 5 centimeters. (8)(SAMP TRENCH 78460-65)(PHO 142 21717-25)

06 20 44 33 CDR 550. (8)(SAMP TRENCH 78460-65)

06 20 44+ CDR And the next 10 centimeters down - (8)(SAMP TRENCH 78440-44)(PHO 142 21717-25)

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06 20 44+ LMP Now, I go to - get your bag. (8)(SAMP TRENCH 78440-44)

06 20 44+ LMP That was the next 10 centimeters, and then the first (8)(SAMP TRENCH 78440-44) sample, of course, was the 10 centimeters below that.

06 20 45 05 CDR And that last bag was 551. (8)(SAMP TRENCH 78440-44)
06 20 45+ CDR You didn't get a pan here - while I clean up the Rover, you can get your after of the trench in the pan.

06 20 45+ LMP I'll get the pan.

06 20 45+ LMP You took a pan up the hill there?

06 20 45+ CDR Yes. It took it way up there, somewhere.

06 20 45+ LMP Okay. I'll take it right here, then. Uh oh.

06 20 45+ LMP Sample came out.

06 20 45+ LMP I'll pick it up.

06 20 45+ CDR Your top came open. It's awful full, Jack. If you can't get it, I'll get it with the tongs.

06 20 45+ LMP Go ahead and go to work, and I'll get the pan first. I lost two of them, I guess.

06 20 45+ CDR Yes, those are the last two I put in there. Your bag is so full they won't stay.

06 20 46 44 CDR 670, 117, 301 - that's 670, 117, 301.

06 20 46+ CDR I'll get those things with my tongs. You can't get them - you'd have to bend over. Every time you jump around, you come close to losing something. I'll just take them back there. Put them under the seat.

06 20 46+ CC You got another one dropped there, Gene - Jack - got it.

06 20 46+ CDR Another one?
06 20 46+ CC Jack's getting it. (6)

06 20 46+ LMP I have a sample. (8)

06 20 46+ CDR Okay. Let me take your bag off first. (8)

06 20 46+ LMP Okay. Well, you might as well fill it as full as you can. (8)

06 20 46+ CDR Okay. It's off. Let me fill it. (8)

06 20 46+ LMP Your bag isn't in much better shape. (8)

06 20 46+ CDR Bag number 4 is absolutely full - and it's under Jack's seat. (8)

06 20 49+ LMP SCB 5 is on the LMP. (8)

06 20 49+ LMP There is nothing on the gate. (8)

06 20 49+ CDR I've got one more loose sample I'm going to throw in (8) (SAMP NOT RETURNED) the big bag back there. ***(4)**

06 20 49+ LMP A local one, you mean? (8) (SAMP NOT RETURNED)

06 20 49+ CDR Yes. (8) (SAMP NOT RETURNED)

06 20 49+ CDR Well, let me leave it under your seat. (8) (SAMP NOT RETURNED)

06 20 49+ LMP Can I put a bag around it? (8) (SAMP NOT RETURNED)

06 20 49+ CDR No, it's got a bag around it - it's all bagged. (8) (SAMP NOT RETURNED)
06 20 55 33 CDR We're heading to Station 9 pointed about 267. The switch is on. Okay, I'm going to make a turn to the right.

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06 20 55+ LMP I think your rake sample here at the Sculptured Hills is going to have to tell a tale combined with the observation that most of the blocks we saw were, like Gene sampled, looked like subfloor gabbro. It's conceivable that the Sculptured Hills could be the same kind of material. I think it's fairly clear that the boulder population does not resemble the massif population at all.

06 20 55+ CDR You been ridin' on this downslope all the time?

06 20 55+ CDR And you hadn't said anything, huh?

06 20 55+ LMP Scary, isn't it?

06 20 56 58 CDR Man, I'm glad I'm driving.

06 20 56+ CC You have a bearing of 234 -- and a range of 2.1.

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06 20 57 27 LMP We got to get around SWP here and then --

06 20 57+ LMP LMP frame is at 80.

06 20 57+ LMP SWP or Bowen, -- Bowen, I guess it is.

06 20 57+ LMP That's SWP over there. Bowen is out here ahead of us.

---

06 20 57+ LMP And all the big blocks still look like subfloor from the Rover. But big blocks in here are only about a third of a meter in diameter. And they're subrounded to subangular. Okay. We're up on the plains again now, just off the block in slope.

06 20 59 48 CDR That sure looks like outcrop back there in the East Massif on the lower slopes, where the high albedo is.
06 20 59+ LMP Yes. Was one of my guidelines for the geophone deployment - (guide?) points.

06 21 00 21 CDR There’s some more of the blue-gray rock here in the east end of the South Massif down low.

06 21 00+ LMP Yes. It looks like it might have been a slump block or something.

06 21 00+ CDR Yes. You can see it’s blue-gray because of it’s contrast with the light mantle.

06 21 00+ LMP Yes. It might be a slump block, or something like that.

06 21 00+ LMP That’s probably Bowen there, don’t you think?

06 21 00+ LMP *** aren’t very far from SWP.

06 21 00+ CDR It’s 228/3.4.

06 21 00+ LMP We’re back into the mantled area - population of fragments is still 1 percent or so. The crater off to our left, which is at 227 and 3.3 -

06 21 00+ LMP - is a fairly good-sized depression, but it’s completely mantled. There’s no blocks showing in the wall at all.

06 21 02 38 LMP Now there’s that crater in the wall of that depression or hollow near it. And it has one big block in the side as if it penetrated the mantle and exposed some of the wall of the depression. Just about a 30-meter crater.

06 21 02+ CDR Valley of Taurus-Littrow is not planar.

06 21 02+ LMP I’m glad we changed it to a subfloor instead of a plains unit.
We're in the inner wall of the depression here, and the rocks still look like subfloor gabbro. Boy, there's certainly not much variety.

Generally, there are few exotics.

That's Cochise.

Get yourself a couple pictures while you're looking right at it.

Could you swing right. Swing right!

We are on the northeastern rim of Cochise. I'm going to work my way around the other side.

And Bob -- looking at the western wall of Cochise, I can see a contact within the subfloor between albedo units, one of which is a light tan-gray and the other is a light blue-gray. May reflect the two kinds of subfloor gabbro we've already sampled. Vesicular and nonvesicular. And that contact that looked like it was dipping - apparent dip in the wall - was to the north. And the west wall dipping to the north about 20 degrees.

Which one's on top? Can you tell?

The blue-gray's on top.

I took a picture of it. We're at 228/3.0, and we're headed south and not quite on the east rim.

I got a - a picture of that contact.

I took some pictures right into Cochise, too, when we were coming up.

Good. It'll show on yours, too, probably - I hope.

Okay. We're sort of on the inner -

Quick; give them a mark.

Mark. 230/2.9. We're on the east rim.
06 21 05+  LMP  Well, we're sort of inside the east rim a little bit.  (8-9)
06 21 05+  LMP  We're halfway between the rim and where the blocky wall starts.  (8-9)
06 21 05+  LMP  Cochise is much like Horatio and - actually, more like Camelot, although not as blocky in the walls, in general, in that it has blocky walls but a mantled rim. Again, all the blocks I see in here are big ones. And blocks down to about 20 centimeters are subangular, in general, and appear to have the appearance of the subfloor gabbro, although most of the smaller rocks do not appear to be highly vesicular.  (8-9)
06 21 07 05  CDR  We're at 232 and 2.7.  (7-9)
06 21 07+  LMP  I got another view of that contact, and let's put that on the northwest wall of Cochise and dipping to the southeast.  (8-9)
06 21 07-  CDR  Is that right? South and east is to our left.  (8-9)
06 21 07+  LMP  No, put it on the northwest wall dipping to the northeast.  (8-9)
06 21 07+  LMP  Yes, that's right. See that, Geno, can you see that over there?  (8-9)
06 21 07+  CDR  Oh, yes. I can see it now between the gray and blue-grey.  (8-9)
06 21 07+  LMP  Can you swing in there, and let me get another shot of it?  (8-9)(PHO?)
06 21 07+  CDR  You betcha.  (8-9)
06 21 07+  LMP  This is a good view right here. Now, I need to have you go left.  (8-9)
06 21 07+  CDR  I got two of them there, too.  (8-9)(PHO?)
06 21 07+  CDR  Look at that rock right in front of us. It looks like a contact between a blue and a gray.
06 21 07+ CDR We can't get down to it, but take a picture. (8-9)(Ph?)

06 21 07+ LMP I think we've got their relationship. I think we got it at Station 1, as a matter of fact. (8-9)

06 21 07+ CDR But that's a big beautiful boulder on the -- inner south rim of Cochise. (8-9)

06 21 07+ CDR It's a single block. (8-9)

06 21 07+ LMP That might be glass-covered. That might be a glass coating; the way it sort of hangs on the outside there. Hard to say. (8-9)

06 21 09 20 CDR We're at 234/2.5. (8-9)

06 21 09+ LMP Starting to sling dust. I wonder if we've lost our fender. (8-9)

06 21 09+ CDR No, they're on there tight. *** -- (8-9)

06 21 09+ CDR You think that's Van Serg? Right over there. (8-9)

06 21 09+ LMP No. (8-9)

06 21 09+ LMP There it is. Bet you. (8-9)

06 21 09 37 CDR Yes. I think you're right, because that's just about the right place. Let's see, 234 -- and 2.1 is where we want to go, and I'm at 230/2.5. (8-9)

06 21 09+ LMP Okay -- our block population in here now on the south rim of Cochise and up ahead of us looks like it's up to 5 percent. And it all looks like subfloor -- light- to tan-subfloor gabbro -- or tan-gray. You don't see much blue-gray; not out on here. (8-9)

06 21 09+ LMP There's a recent hit. -- (8-9)

06 21 09+ LMP There's a different looking rock here. -- (8-9)
LMP We're still primarily in an extreme block field here (9-9) now. It's up to a 20 percent cover of fragments mostly the subfloor. Some of it looks quite highly shattered. I just saw one piece that looked like a white anorthose rock.

CDR How's this look to you? We can go farther up there, (8-9) I guess. Let me go farther up.

LMP Okay, if you can get up. (8-9)

CDR Get a little farther on the southeast. (8-9)

LMP A little higher is apt to overdo it. (8-9)

LMP There are some grayish rocks that are - (8-9)

CDR Right, coming up here. I turn to the right and park (8-9) right here.

LMP -- that have somewhat of a swirl texture. (8-9)

CDR We're at 230/2.2. (8-9)

CC Copy you parked. (9)

CDR Yes, I'm parked on a heading of 320 which gives you (9) a better view.

CC Copy 320 for the parking. (9)

CDR Yes, 330. (9)

LMP Van Sevy looks like a blocky-rim fresh-impact crater (9) right now.

CC How about scuffing you down and seeing if it looks (9) orange underneath?

LMP Slight differences - don't worry. (9)
06 21 17+ CL And you might give me a frame count or check it to make sure you're okay.

06 21 18 54 LMP I just did, and it's 123.

06 21 18+ LMP This is starting to look like a Geological Survey expedition. The vehicles are all covered with dust.

06 21 20+ LMP We're going to go up there and sample on the rim, look at the walls, and the floor, and miscellaneous.

06 21 20+ CDR Well, we are on the rim.

06 21 20+ LMP But the first thing we do is go up to the crater. I think the mantle objective here really is immaterial because the blocky ejecta around the crater covers -- well, it looks like it extends several hundred meters out from the rim -- say a couple of hundred meters.

06 21 20+ LMP We're pretty close to the rim.

06 21 20+ LMP I'll go up on the rim, Gene, and see what we've got.

06 21 22+ CC Let's get grab before you guys leave.

06 21 22+ LMP I'm getting it right now.

06 21 22+ LMP Sure look like shocked rocks to me.

06 21 22+ CDR Lot of grits splattered on some of these, Jack.

06 21 22+ LMP Yes.

06 21 22+ LMP We might even find some shattered cones.

06 21 22+ LMP Well, I'll say one thing for old Van Serg, it's blocky.
LMP This is at least a large blocky-rim crater. But even it has the mantle dust material covering the rim, partially buried rocks. And it's down on the floor, as near as I can tell, and on the walls. The crater itself has a central mound of blocks that's probably 50 meters in diameter - that's a little high - 30 meters in diameter. Many of the blocks are -- intensely shattered in that area, as the ones that are on the walls. I don't see any sign of organization of the blocks in the walls right now. There's a possibility that on the west wall, there's an indication that there's a lightly darker gray rocks starting about halfway down the crater. And that level is coincident with what appears to be a bench on the northwest wall. And that bench - hints of that bench - it's not continuous, but hints of it are around on the north wall and, I think, right below us - yes, on the southeast wall. The rocks are pretty badly broken in many cases. And - well, I haven't seen any real glass yet. We'll start looking at them a little more carefully.

LMP That looks like a breccia right there in front of us.

CDR Yes. There's some interesting patterns on the surface.

LMP Okay, there. Afraid I haven't been doing my duty on locators, occasionally.

CDR Do that?

LMP Yea. I got it.

LMP Okay, Gene's tearing apart one of the -- very intensely fractured rocks. And it comes off in small flakes. Let's get this one, because this will be the best oriented one for documentation, plus why don't you get that one you've got inside there?

CDR Yes, I am.

CDR Bag 566 is a fragment from the surface.
06 21 27+ LMP That's a corner, I think, off the block that Gene documented here. (9)(SAMP 79110,15)(PHO 146 22415-14)

06 21 27+ CDR Yes; it is. (9)(SAMP 79110,15)

06 21 27+ LMP We'll get another sample - that'll be from inside the block. (9)(SAMP 79130,35)(PHO 146 22415-18; 142 21791-94)

06 21 27+ CDR Get it with this real easy. Here's a whole big - we ought to take that just as is. (9)(SAMP 79130,35)

06 21 27+ CDR Put a bag around one end if we can. Here the other end is smaller. (9)(SAMP 79130,35)

06 21 27+ CDR That's a breccia, too. (9)(SAMP 79130,35)

06 21 27+ CDR See the white fragments in there? (9)(SAMP 79130,35)

06 21 27+ CDR It's got a lot of very small -- (9)(SAMP 79130,35)

06 21 27+ LMP It looks like this big one over here. You know, it might be that these might be pieces of the projectile. I don't know. Because it doesn't look like - it's not subfloor. (9)(SAMP 79130,35)

06 21 27+ LMP Well, that's wrapped in - if you put it end down, it may stay in the bag. (5)(SAMP 79130,35)

06 21 27+ CDR I doubt it. (9)(SAMP 79130,35)

06 21 28 45 CDR It's 480, and it's a relatively tabular shape, and it's about -- 10 inches long. (9)(SAMP 79130,35)

06 21 28+ LMP And it's highly friable. It breaks apart. (9)(SAMP 79130,35)

06 21 28+ CDR Oh, not so much. (9)(SAMP 79130,35)

06 21 28+ LMP In small chips. Well, you did it with your hands there. I call that being friable, compared to what we've seen anyway. (9)(SAMP 79130,35)

06 21 28+ CDR Okay, and let me get an after of that. (9)(SAMP 79130,35)(PHO 146 22415-18)
LMP Let me get a soil right over here. Okay. The soil next to the boulder down about 3 centimeters, is in bag 569.

LMP And the soil and chip - about two-thirds of a meter from the boulder are in bag 570.

LMP There, very clearly, is a central mound. And now that we've looked at this one, the mound looks like it's composed of gray fragment breccias much like what we've just sampled - dark gray. And again it might be related to the projectile. Now, we've got to see if there is subfloor up here, or whether we're dealing with another unit somewhere.

LMP Got your after. (PHO 146 22416-18)

LMP Well, the more coherent rocks - this looks like subfloor.

CDR I don't see any orange material either. (PHO 146 22416-18)

LMP Not yet. (PHO 146 22416-18)

CDR This particular rock we've sampled has tabular fractures, and in one-half of the rock, they are definite, oriented.

LMP There's more dust on these rocks it's harder to see a fresh surface. They're not as clean. That's subfloor.

CDR Even the floor of the crater is mantled down there. (SAMP 79150,55)

LMP What you got? A piece of glass? (SAMP 79150,55)

CDR Yes, I think it is glass-covered. At least it's glass-covered - just glass-covered. I've got an undocumented sample. It's about 2 meters west of where we just sampled. It's a glass-covered baseball-size rock in 571.
A lot of these blocks up here, particularly the more fractured ones, but even some that aren't — are a gray matrix fragment breccia. And it looks like — really, the fragments are quite fine. There are no — on the rim anyway, we haven't seen any large fragments. The largest I've seen is about 2 centimeters. But down in the mound you can see some fragments that are probably half a meter in diameter.

Jack, are you going around that rim of the crater up there?

I was just looking at rocks.

I want to get a pan before we leave back there.

Yes. We need to see if we can get some of the subfloor. I'm not sure I understand what's happened here, yet. This should have brought up subfloor according to the theory, and it hasn't.

That looks like some of the — look at some of the breccias — the blue breccias with the white — big old slabby white — with the fracture face with the white inclusions.

Down there.

Yes, down in the floor, Jack.

Yes, it has that appearance all right. Hey, Gene —

Do you see that — that's fractured in sort of a pyramid shape down there? Out here on the right — the right end of the floor down there — that big one?

Yes.

It's sort of pointing west.

Yes.

It's really neat. That's a unique fracture, isn't it?
CC We'd like to be moving from here in about 10 minutes, so we probably better be trending back toward the Rover, unless you're seeing something really neat out there.

LMP We ought to find what the rock is here, if you've got a little time.

CDR One thing I notice we do uncover. There's a lot of - oh, 2-, 3-, 4-millimeter-size fragments of glass we're kicking up all over the place.

LMP Yes.

CDR Little glass balls.

CDR Almost like Pele's -

LMP Can you come over here? I think there's some subfloor here.

LMP We ought to try to document it. But I tell you, most of the rocks are the fine-fragment breccias.

CDR Let me see if I can't get one of those little --

LMP There's some glass.

CDR You see if they're like Pele's - - eyeballs or whatever they are.

LMP I think we can get some over here. If you're careful coming over here, we can get glass that looks like it may have crystallized in place there.

CDR Okay. I'm talking about those little balls, too.

LMP Put your gnomon right over here, and we can get that for glass, and that for subfloor.
LMP: But I'm not sure that is. It may be breccia. Everything is covered with dust here, and it's hard to tell the types. Most of the rocks we're seeing are breccias. Make sure that that glass is in your stereo.

LMP: Okay, the glass — looks like a glass agglutinate.

LMP: It's a frothy — glass agglutinate is going to be in bag 481.

LMP: And it looks almost like a cowpie — pile-type of bomb, Bob, if you'll pardon the expression.

LMP: Although it's not flattened. It's an aggregate of glass — or it's a pile of about four fragments, much like the one we're sampling.

CDR: Jack, we want to get a good scoop sample here. Maybe can we get some of those little fine pieces of glass around.

LMP: And it looks like it's in place from the day it was born.

LMP: I'm having a ha. time with this one.

CDR: A piece of that rock right behind it.

CDR: Yes, I'm going to turn around. Just not going to be able to get that one in the bag, I don't think.

CDR: My sample's in — 482 is a rock, but it doesn't look like subfloor. It looks like the blue-gray material we've been seeing — the breccia-type material.

LMP: I don't think there's any difference.

CDR: Got it in!
06 21 37+ LMP Might just as well throw them in my bag. (9)(SAMP 79190,95)

06 21 37+ CDR I want a scoop out of here, though, Jack. (9)(SAMP NOT RETURNED)(PHO 142 21825-26)

06 21 37+ CC Why don't we get that scoop sample as the first sample of Jack's radial sample? (9)(SAMP NOT RETURNED)

06 21 37+ CDR Okay. That's right. You're getting a radial sample.

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06 21 39 46 CDR Before you go back - I got to get an after picture here. And I want to get a pan of this thing. We can get a stereo pan - as you start your radial sample. (9)(SAMP NOT RETURNED)(PHO?)

06 21 39+ LMP *<s. You take the after from there, and I'll go over here. (9)(SAMP NOT RETURNED)(PHO?)

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06 21 39+ CDR I'm going to go over behind me and take part of the stereo. (9)(SAMP NOT RETURNED)(PHO?)

06 21 39+ LMP Where are you going to take your pan? (9)

06 21 39+ CDR From behind me, where we were. (9)

06 21 39+ LMP I think I'll just take my radial right from here to the Rover. (9)(SAMP NOT RETURNED)

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06 21 39+ LMP And I'll take my pan from here. (9)(PHO 142 21798-824)

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06 21 42+ CDR I think I'm out of film. (9)

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06 21 42+ CDR 150. And it stopped clicking. Jack, I didn't get the rest of that crater down there. (9)

06 21 42+ CDR I only got it 12 o'clock and around. (9)
06 21 40 LMP I can get it.

06 21 40 LMP Well, I'm going to be out of film, too, here before long.

06 21 40 CDR Just don't worry about it then. Just press on with your radials.

06 21 40 LMP I got a good pan over here. Did you get the crater at all?

06 21 40 CDR I got the right half of it and probably two-thirds of it, so I'm just going to have to let that do. I'm going to see if I can get some 500's while you're doing that.

06 21 40 LMP Hey, this isn't going to be an ideal radial sample but it will have to do.

06 21 40 CDR Bob, would you tell me what your primary desires are again on the 500, based upon what we have?

06 21 40 CC The primary desire will be the North Massif, the blocks, and the trails.

06 21 40 CDR 670, 037, 801; 670, 037, 801.

06 21 40 CDR Bag 52 Yankee is at the rim crest.

06 21 40 LMP I'm going to use the Rover to steady the 500, and see what happens.

06 21 40 LMP This isn't working out too well. I've got to get rid of this sloop.

06 21 40 CDF Just set it there and take your sample. We'll get it.
06 21 44+ LMP I’ll take the samples going back. (9) (SAMP NOT RETURNED)

06 21 47 46 CC We’d like you to press on. We’ll abort the radial sample. We’d like to leave here immediately. Enough of the 500 millimeters, Gene. (9) (PHO 139 21212-68)

06 21 47+ CDR Eighty-five is the max count on the 500. (9) (PHO 139 21212-68)

06 21 47+ LMP I think that’s a smart move. I don’t think the radial sample’s going to tell you much here. (9) (SAMP NOT RETURNED)

06 21 47+ CDR Jack, you ought to get a scoop of that dirt, though. (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65) (PHO 142 21827-29)

06 21 47+ LMP Well, there’s one scoop -- (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65)

06 21 47+ CDR We don’t have a scoop of it, do we? (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65)

06 21 47+ LMP Look what’s underneath it. (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65)

06 21 47+ CDR Well, I don’t know what’s underneath it. (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65)

06 21 47+ LMP It’s white. (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65)

06 21 47+ CDR Well, I wanted to make sure we got some of those small glass balls. (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65)

06 21 47+ LMP Yes, we’ll get a scoop of it. Up on the too. (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65)

06 21 47+ CC Seventeen, we’re anxious for you guys to get going. (9)

06 21 49 52 CDR Here’s your gravimeter reading from the surface; 670, 057, 101; 670, 057, 101. (9)

06 21 49+ LMP Come here, Gene, quickly. We can’t leave this. This may be the youngest mantle over, whatever was -- (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65)

06 21 49+ CDR Take pictures of it. I don’t have any film. (9) (SAMP TRENCH SOIL 72220-28,40-45,60-65) (PHO 142 21827-29)
LMP -- was thrown out of the craters.

CDR Take pictures of it. Bob, we've got to take 5 more minutes. We'll be right with you.

CDR What Jack's done is he dug a trench in a southwest-northeast direction, and he discovered about 3 inches below - 4 inches below the surface - a very light-gray material.

CDR Take that crust

LMP I'm trying to get the upper portion there. There we go.

LMP The first 2 centimeters, bag 483. The next 5 - in 484.

CDR Get some?

LMP I got quite a bit.

LMP And the next 10 centimeters of the light-gray material, be in - probably in 486, if we're lucky - get it off.

LMP I think it is 486, right?

CDR Yes. 485!


LMP Okay. The third sample is in 485.

LMP A possibility here is that this upper 6 inches of gray material in here is the latest mantling in the area and the light-colored debris may be what's left over from the impact.
06 21 52+ CL We need Jack to put on magazine Nancy. (9)

---

06 21 52+ CDR Okay, I need a magazine too, Bob. I don't have any film at all. (9)

06 21 52+ CC That'll be Bravo if you change yours here. You could change it at Station 10. (9)

06 21 52+ CDR I'll change it here. (9)

---

06 21 52+ CDR I got Bravo. (9)

06 21 52+ LMP Okay. I got that one. (9)

06 21 52+ CDR We lost the dark slide out of Bravo, and it's in the dirt. I'm not going to pick it up. (9)

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06 21 54+ CDR I'm changed. And I don't know what the mag count is. Hey, we got some rocks in that big bag. (9)

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06 21 55+ CDR I can't even pick up that big bag to close the gate. (9)

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06 21 55+ CC We've had a change of heart here again, as usual. And we're going to drop Station 10 now that we've hurried you so much, and we're going to get a double core here. And we'd like to get some football-size rocks while you're doing that. And then we're going to leave here and go back to the LH. (9)(SAMP CORE 79001-02)(PHO 143 21836-38)

06 21 55+ LMP You don't want a double core can do it, Bob. It's too ro (9)(SAMP CORE 79001-02)

06 21 55+ CDR You don't think we just trench this stuff you just trenched? (9)(SAMP CORE 79001-02)

06 21 55+ LMP Well, I'm afraid that will shut through it. (9)(SAMP CORE 79001-02)
06 21 55+ CDR Let's try it.

---

06 21 55+ LMP Mag Nancy in on the LMP's camera.

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06 21 55+ LMP Oh, you're doing it, huh?

---

06 21 55+ CDR I've got it started.

---

06 21 57+ CC And we'd like to also deploy EP number 5 here.

---

06 21 57+ CDR The lower is 50; the upper is 37.

---

06 21 57+ LMP Why aren't you putting it up - well - you put the gnomon away. Put it near to that trench. At least there is some documentation there. I'll try to have (PHC 143 21836-58) the pen going while you're doing it.

---

06 21 59 20 LMP Okay. Pin 1 in pulled and safe. Pin 2 is pulled - safe. Pin 3 is pulled and safe.

---

06 21 59+ CDR The first core was easy; the second one's little tougher; and then it got tough down at the end.

06 21 59+ LMP There, I'm getting a picture of you. Okay?

---

06 21 59+ LMP I got it.

---

06 21 59+ CDR Core lifter wants to slide out. It's full. No rocks in it. It looks like just the same stuff we've been traveling through.
06 21 59+ CC Jack. I think you better help Gene with recovering that core.

06 21 59+ LMP And if you'll just wait until I finish the pan, that's exactly what I'm going to do.

06 22 01+ CDR Box, it's capped.

06 22 01+ CDR it's very loose soil, just any little movement and you'll lose some of it.

06 22 01+ CDR The top rammed down - oh, almost half way without any effort.

06 22 01+ CDR The bottom rammed down about an inch.

06 22 03+ LMP And I got one sample of a radial sample.

06 22 03+ LMP In my pocket.

06 22 03+ LMP And we want to get a large block.

06 22 03+ CDR No, let's get a couple of them. I've got one.

06 22 04+ LMP Got a big rock there, too?

06 22 04+ LMP The thing that amazes me is that there's no subfloor for around here.

06 22 04+ CDR I got one here.
06 22 05+ LMP Bag 486 is a light-colored rock taken about 3 meters to the right of the Rover. You should be able to pick it out in that last pan, unless the focus was bad.

---

06 22 07+ LMP Yes. You know, I don't think there is any subfloor in here. The rocks are so dust covered that it's hard to be sure, but no rock I picked up looked like subfloor.

06 22 07+ CDR Get on there one time. Ready? I got three of them that time.

---

06 22 07+ CDR Jack, there's a big one right there in my floor pan. (SAMP 79035) That's what I did last time.

---

06 22 07+ CDR Get out of this block field, we'll be able to move it a little bit.

---

06 22 09+ LMP Where are we headed, now that we are moving? (9-SEP)

06 22 09+ CDR Well, I'm trying to get out of the block field here, then I'll head back to the southwest.

---

06 22 09+ LMP That must be Gatsby over there. (9-SEP)

---

06 22 09+ CDR That's Gatsby there, I guess, huh? (9-SEP)

06 22 09+ LMP Yes. (9-SEP)

06 22 09+ CDR It's not unlike Van Serg, though. (9-SEP)

06 22 09+ LMP Hey, you know that looks like mantling. (9-SEP)
06 22 09+ LMP Hopefully, we can get a shot looking back to the northwest --

(9-SEP)(PHO?)

06 22 09+ CDR Yes, I'll get that when I --

(9-SEP)

06 22 09+ LMP -- into Gatsby, because it looks like the mantle streams over the side from the southwest. Can you swing to your right - get up a little closer to the rim, there?

(9-SEP)(PHO?)

06 22 09+ CDR Hey, here's a couple fragments in spots -

(9-SEP)

06 22 09+ LMP Look at that!

(9-SEP)

06 22 09+ LMP See that structure.

(9-SEP)

06 22 09+ LMP -- see how the mantle streams over from the northwest. Can you get that?

(9-SEP)

06 22 09+ CDR Yes.

(9-SEP)

06 22 09+ LMP And from the southwest.

(9-SEP)

06 22 09+ CDR Got it?

(9-SEP)(PHO?)

06 22 09+ LMP Yes.

(9-SEP)(PHO?)

06 22 11 41 CDR We're 236/2.1.

(9-SEP)

06 22 11+ LMP What I'm looking at is the northwest portion of Gatsby, where there's a very very concentrated block field on the inner wall, except where there are, on the southwest, three streams and on the northwest and north a continuous stream, if you will, or band, radial band, of mantle that appears to be burying that field, overlying and mantling the field. We got some pretty good pictures of it, I think.

(9-SEP)

06 22 11+ LMP I'm more and more convinced there's a mantle. One possibility, I guess, is that, if it's a pyroclastic mantle, that in the lunar vacuum environment and with whatever volatiles we're dealing with, the stuff becomes extremely fine upon vesiculation. We may have been on it all the time and not known it - as far as recognizing it.
06 22 11+ CDR As soon as we come through this draw, how smooth or (9-SEP)
free of any debris or boulders it is on the other
side of the upslope.

---

06 22 11+ LMP I guess Sherlock's going to be right over the top (9-SEP)
over here. I saw it when we were on that other
ridge.

---

06 22 11+ OC -- and if you keep going straight to the LM, you're (9-SEP)
probably going to run into this crater area around
San Luis Ray. You probably ought to head somewhat
south of directly back to the LM, so we can at least
tip the - western edge of Sherlock and then pick it
up and go from there back to the SEP. It looks like
it might be rather rough there in that dotted-lined
area.

06 22 15 00 CDR Bob, I've already been doing it. I'm at 244/1.7. (9-SEP)

---

06 22 15+ LMP About 200 meters back, we crossed back into our (9-SEP)
standard mantle surface of about 1-percent fragment
cover -- out of this - the block field, which -

---

06 22 15+ CDR I can see the LM. And there's Sherlock, where those (9-SEP)
blocks are.

06 22 15+ LMP Yes, that's the block field, the Sherlock block
field; that's right. That is a block field.

06 22 15+ CDR Some big ones there.

06 22 15+ CDR Old Station 10.

---

06 22 15+ LMP Pull close to this big block, if you can. (9-SEP)

06 22 15+ LMP And I'll try to get a reading on what it is - some
pictures of it as we come up to it. (9-SEP)(PHO?)
06 22 15+ CDR Yes. Boy that's a big one.  
06 22 15+ LMP Looks like our old friend, the subfloor --  
06 22 15+ CDR Subfloor, isn't it? Yes.  
06 22 15+ LMP Yes. Vesicular subfloor. Vesicles are about a centimeter maximum size. They look like they're fairly evenly sorted. And the rock itself seemed to be massive.

06 22 17 08 CDR 250/1.4.  
06 22 17+ LMP We're back into about a 5-percent rock cover as we cross the edge of the Sherlock block field.  
06 22 17+ CDR That's Sherlock over that rim over there.  
06 22 17+ LMP Yes. Once again, all these subfloor blocks look as if they're buried. Not mantled, necessarily, except maybe that one. Can you swing right, just a tad?

06 22 17 41 CDR That one's got the mantle blowing up on it, in it's fractures and everything.  
06 22 17+ LMP That's the best example of that, I think.  
06 22 17+ CDR Take a picture of that?  
06 22 17+ LMP I got it.  

06 22 17+ LMP Everything in here so far is the tan-gray subfloor gabbro that I've seen. Oh, there's one over there that's a blue-gray. But blue-gray is not abundant.  
06 22 17+ CC And 17, as you're getting closer, we'll going to want an LRV sample at 1.1 on the range.  
06 22 17+ LMP What are we now? 1.2?  
06 22 17+ CDR 1.2. We'll try to get block and soil.  
06 22 17+ LMP There's a fresh little pit.
06 22 17+ LMP I am continually impressed by the lack of exotic fragments in here.

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06 22 17+ LMP If you head into that little well that's a crater there.

06 22 17+ CDR Let me get around it. We can go a little bit further.

06 22 17+ CDR I'll go up on that flat area up there.

06 22 17+ LMP Yes. There are a lot of little fragments over there by that area.

06 22 17+ LMP Okay. Now swing a shallow turn. Whoa.

06 22 17+ CDR Did you get any of those?

06 22 17+ LMP Unfortunately, I can't see them - the shadow.

06 22 17+ CDR How about that one right in front of you, in front of the television camera shadow. See that little one up there?

06 22 17+ LMP It's a little big, I think.

06 22 17+ CDR No upper right. Straight up the line.

06 22 17+ LMP Yes. If you can get over there, I can get it.

06 22 17+ CDR I can get there.

06 22 17+ LMP I guess I wasn't looking at the right one. The shadow is making it impossible to see down there. Now, see what you can get.

06 22 20 04 CDR We're at 253/1.1.

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06 22 20 28 LMP Fifty-three Yankee.

06 22 20+ LMP That's soil. I can't see to get a rock.

06 22 20+ LMP Go forward just a little bit, Gene.
06 22 20+ CDR I can't see the LM anymore. (9-SEP)(LRV 12)(SAMP 70310-15)
06 22 21 LMP Okay. The rock fragments, that's 54 Yankee. You got a rock right in front of you don't you? (9-SEP)(LRV 12)(SAMP 70310-15)
06 22 21+ CDR I see it. Rolled over. (9-SEP)(LRV 12)(SAMP 70310-15)
06 22 21+ LMP LMP frame for that sample - looks like about 60. (9-SEP)(LRV 12)(SAMP 70310-15)(PHO 143 21894)

06 22 21+ LMP Looks like some of our gray variety of subfloor up here - around the rim of that little crater. You know, I'm starting to think that maybe the gray relatively nonvesicular subfloor may be deeper fraction, based on what we saw - well, actually, though, let's see - that could have been overturn, I don't know. Take that back. There just isn't much of it around here, although we saw a lot of it in the wall of Cochise. (9-SEP)

06 22 23 02 LMP What do you think this is, San Luis Rey? We're at 252/0.9. (9-SEP)
06 22 23+ CDR I wouldn't doubt it at all. I'll bet that's San Luis Rey. We're on the east side of it - Mariner and San Luis Rey. They're shallow - filled with rocks. (9-SEP)

06 22 23 36 CDR We're at 250/0.9. (9-SEP)
06 22 23+ LMP Mariner should look pretty fresh. (9-SEP)
06 22 23+ LMP Boy, I certainly don't see much variety other than the gray and the tan subfloor variety. There's old Challenger. (9-SEP)

06 22 23+ CDR Boy, I tell you there's no getting out of this stuff. You go from one to the other. (9-SEP)
06 22 24 25 LMP Bob, we're moving in and out of areas of say 1-percent to 5- to 10-percent blockiness. And where it gets blocky - not only is it more blocky, but we seem to have more of the medium-sized craters in the range of 20- to 50-meter-diameter craters. That may be Mariner right there.

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06 22 24+ LMP Van Serg, let me mention again, was an unusual experience in the plains geology here. That must be part of San Luis Rey or Mariner, one.

06 22 24+ CDR Yes. That's pretty deep.

06 22 24+ LMP Yes, it is.

06 22 26 13 CDR It's really big. We're at 252 and 0.6.

06 22 26+ LMP The crater on our left - that is, south of us - is a large crater. It's somewhat deeper than craters of the same size that we've seen. And it, too, though, has its large blocks mainly in the walls, although there are blocks up here in the rim, occasionally up to 3 meters.

06 22 26+ LMP Look at that string of blocks over there - that may be it.

06 22 26+ CDR Yes.

06 22 26+ LMP That's an edge of a crater, I guess.

06 22 26+ CDR Want a picture of that?

06 22 26+ LMP Got it. Look at the way that thing's fractured.

06 22 26+ CDR This is the San Luis Rey complex because see how elongated it is?

06 22 26+ LMP Yes.

06 22 26+ CDR Fact is, we're going to cut right through the western half here.

06 22 27 30 CDR We're at 244/0.4.
06 22 27+ LMP Bob, I may have said early on up there at Van Serg that I saw subfloor, but we never did sample any that I know of. And the dust was thick enough that I'm just not sure. Breccias were the most obvious thing there.

06 22 27+ LMP It might have been a window in the plains here, of some kind. But it's strange to see it there, with so much subfloor all around it that we saw.

06 22 28 51 CDR 252 and 0.2.

06 22 29+ CDR *** point one though. We're almost to SEP. We're about -- 50 meters from SEP.

06 22 29+ LMP We're about 30 meters east of the antenna.

06 22 30 11 CDR And we're measuring 221 and 0.2.

06 22 30+ LMP There's a rock. I stood up down there, and I want to get it --

06 22 30+ CDR Okay. EP 2.


06 22 32+ LMP I'll try to put it in a depression. I'm going to put it in a depression, if you want. And then I've got to take a pan, huh? Will a locator -- yes -- how about a locator to the LM?

06 22 32+ CC Be fine.

06 22 32+ CDR You going to get on, Jack or walk back?
06 22 32+ LMP I'll get on. (SEP)
06 22 32+ LMP Locator to the LM. I'll give you a frame count, 92. (SEP-LM) (SEP-RO 143 21924)
06 22 32+ LMP You're going to have to go left a little, right here. (SEP-LM)
06 22 32+ CDR Go left?
06 22 32+ LMP To avoid the antenna. (SEP-LM)

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06 22 32+ LMP I want to point out a rock to you I set up on end. We need to get in the bag, and you can let me off there and I'll carry it. (SEP-LM) (SAMP 70215)

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06 22 32+ LMP It's near the LM. (SEP-LM) (SAMP 70215)

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06 22 34+ LMP I think it's that one there that's sort of dark. (SEP-LM) (SAMP 70215)
06 22 34+ CDR Up there, straight ahead? (SEP-LM) (SAMP 70215)
06 22 34+ LMP Yes. (SEP-LM) (SAMP 70215)
06 22 34+ CDR Bootprints are by it. That must be it. (SEP-LM) (SAMP 70215)
06 22 34+ LMP That's it, yes. Can you swing over so I can lean on the Rover when I put the -- (SEP-LM) (SAMP 70215)

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06 22 34+ LMP That's perfect. (SEP-LM) (SAMP 70215)
06 22 34+ CDR Okay. You off? (SEP-LM) (SAMP 70215)
06 22 34+ LMP Well now, what did I do that for? (SEP-LM) (SAMP 70215)
06 22 34+ CDR What did you do. Kick it under? (SEP-LM) (SAMP 70215)
06 22 34+ LMP Yes. (SEP-LM) (SAMP 70215)
06 22 35 35 LMP I got my rock. It's halfway between the SEP and the (SEP-LM)(SAMP 70215)
LM. Let me put it in the big bag.
06 22 35+ CC Is this that brown one you saw out here before, (SEP-LM)(SAMP 70215)
Jack?
06 22 35+ LMP No, it's a gray one. (SEP-LM)(SAMP 70215)
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06 22 35+ LMP Yes, I just lost the sample. It's in my pocket, I guess. Let me get some tongs.
06 22 35+ LMP Then you can go ahead. I'll walk back. (SEP-LM)
06 22 37 47 CDR Okay, Bob. I'm back at the LM - - (LM)
06 22 37+ CDR 151, 12.0, and 001. (LM)
06 22 37+ LMP Can you get it? (LM)
06 22 37+ CDR I got to get your bag - - (LM)
06 22 37+ LMP I got it. (LM)
---
06 22 40 11 CDR The core tubes are going in SCB 7 - (LM)(SAMP CORES 76001, 79001-02)
---
06 22 40+ CDR Did you get my bag already? (LM)
06 22 40+ LMP Yes. (LM)
---
06 22 40+ CDR We'll have one more to put in here. I'm just going (LM)
to lay this one over here. Yes, the big one. Man, (LM)
there's some big ones in there, too.
06 22 40+ LMP We can get some of that subfloor. (LM)
06 22 40+ CDR Yes, there's one in my footpan, too. (LM)(SAMP 79035)
06 22 40+ CDR Why don't you leave that there for a minute? (LM)(SAMP 79035)
06 22 41 53  CDR  How are we fixed for samples? Here's 5, and it's about 1/2 to 3/4 full.  

06 22 41+  LMP  -- let's dump these --  
06 22 41+  CDR  We got 3.  
06 22 41+  LMP  -- three in there, the Rover samples.  
06 22 41+  CDR  We probably ought to put the SESC in there, huh? It there's room for it.  
06 22 41+  CC  Let's put the SESC someplace where it's accessible to get that contamination sample.  

06 22 41+  CDR  Let's get it now. We can get the bag cleaned up we can put it in bag 5.  

06 22 41+  CDR  Get your scoop. Let's get it over with.  
06 22 41+  LMP  I don't have a scoop, I don't even have a rake.  

06 22 41+  CDR  Use your Rover sampler.  
06 22 41+  CDR  They both fell off when that thing (pallet) opened.  
06 22 41+  CDR  Here's a full core tube we can't forget.  

06 22 43 37  LMP  I'll put it over here in 4. I mean in 7.  

06 22 44 20  CDR  We're going to get this SESC now.  

---
06 22 44+ LMP You want it in front of the minus-2 footpad? (LM)
06 22 44+ CC Roger. Sort of underneath where you probably had
    the solar side of the Cosmic Ray Experiment there. Between the footpad and the A SEP doors
    there. (LM)
06 22 44+ CDR Let's fill it up. (LM)
06 22 45+ CDR Would you brush that white thing off for me? (LM)
06 22 45+ LMP Okay. Take a couple over here. (LM)
06 22 45+ CDR Let me go past the radar. Good job. (LM)
06 22 46 43 LMP I'm on trame 96, and the short can sample
    contaminated sample is documented by two stereopairs
    prior to that. And the before is the cosmic ray
    pictures. (LM) (SAMP SESC 70011) (PHO 143 21927-30)
    (PH) 147 21381-82
06 22 46+ CC Which SCB is that going in, Jack? (LM) (SAMP SESC 70011)
06 22 46+ LMP Number 5. (LM) (SAMP SESC 70011)
06 22 46+ CDR Yes, short on in 5. (LM) (SAMP SESC 70011)
06 22 47 47 CDR We've got the big bag, bag 7, bag 5, bag 4 at the
    footpad. (LM)
06 22 47+ CC We've also got SCB 3 with the Rover samples in it on the
    Rover. (LM)
06 22 47+ LMP No, we emptied those onto E. (LM)
LMP  You've got another big rock over here from the --

CDR  It's in my footpan.

LMP  That's from Station 9, righ?

CDR  Yes.

CDR  That's what I told them. Station 9, I got a football-size rock, and I've put it in there.

LMP  Gene's football-sized rock looks like it might be glass coated. And it might even have a shatter cone or two on it.

LMP  I don't know what you're focused on -- but here's his rock.

CC   Jack, we're going to let you take the Commander's camera out to the ALSEP and take a few photos that people think we need. And Gene's going to take your camera out and document the geophone.

LMP  Okay. Bob. I've got the cosmic ray in the ETB.

LMP  Mag Foxtrot, or Franny, I guess, we changed it to.

LMP  Mag Donna, the DSEA, Mag Echo, Mag Linda, Mag Mary.

CDR  Are you through with the 500?

CC   We're through with the 500?

LMP  I don't think the 500's working anymore, anyway.

CDR  It was working -- (last time?) I used it.

LMP  There it is. Okay. Film cycle. Three times.
06 22 54 49 LMP Okay. Mag Karen is in. (LM)
06 22 54+ LMP And there are two on the cameras. (LM)
06 22 55 09 CDR Bob, I'm reading 670, 010, 701; 670, 010, 701. (LM)
06 22 55+ LMP Yes. Take a picture for you. (LM)(PHO?)
06 22 58+ CC Did all the FSR's get off the Rover into the big bag? (LM)
06 22 58+ LMP That's affirm. (LM)
06 22 58+ CDR Yes, this is the one you need anyway. That's color. (LM)(PHO 134 20473-79)
Why don't you see if you can grab a couple?
06 22 58+ LMP Yes, right here. (LM)(PHO 134 20473-79)
06 22 58+ LMP Such a pose. Let me get a little different - focus. (LM)(PHO 134 20473-79)
That looks good.
06 22 58+ LMP One more. (LM)(PHO 134 20473-79)
06 22 58+ CDR How's like this? (LM)(PHO 134 20473-79)
06 22 58+ CDR You got that camera. That's the color camera. (LM)
06 22 58+ LMP Yes. (LM)
06 22 58+ CDR You take it. (LM)
06 22 58+ LMP I've got to go get a neutron flux probe, I guess. (LM)
06 22 58+ LMP I'm headed for the ALSEP. (LM)
06 23 01 33 CDR I'm ready to get out, and go to the VIP site. (LM)

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06 23 02 11 CDR What was it happened to that one in my footpan? (LM)(SAMP 79035)
06 23 02+ LMP I put it in the big bag. (LM)(SAMP 79035)
06 23 02+ CDR Okay. Here we go, Jack. Here's one here. (LM)(SAMP 70017)
06 23 02+ LMP Yes. Let me get it, so you won't get it too dirty. (LM)(SAMP 70017)

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06 23 02+ CDR I'll put it right over here against that background. (LM)(SAMP 70017)

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06 23 03 11 CDR Jack has picked up a very significant rock, typical of what we have here in the valley of Taurus-Littrow. It's a rock composed of many fragments, of many sizes and many shapes. (LM)(SAMP 70017)

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06 23 05+ LMP Put that in the big bag, Gano. (LM)(SAMP 70017)

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06 23 11 11 CDR 337, 417, 101; 337, 417, 101 (bias). (LM)

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06 23 11+ CDR I'm going to have to take you out to the VIP site -- (LM)

---

06 23 13+ CDR The camera is under the seat. (LM)
We want to take some photographs at the central station and a few selected photographs of the ALSEP. Number one, we want a 7-foot cross-sun to the south of the ALSEP central station and then a 7-foot down-sun of the central station. Over.

Okay. I got it. What else?

There's a problem with the central station - which they think the south end is buried more deeply in the dirt than they had intended.

You couldn't anticipate the soil, Bob. It's very soft.

Bob, we are at VIP.

I may move just a little bit. There's a little rise here I can give you. I think I'll give it to you.

By the way, Bob, the soil gets more cohesive with depth. I hadn't really noticed that before.

It's quite a bit more cohesive at - feels about the same down to 3 centimeters out here, and then the cohesiveness goes up, so it's difficult to scrape with the Rover sampler.

Well, I think you can see almost everything from here.

I'll get the heat flow pictures. One was 11-foot, I think. And then the stereopair.

I'm getting the standard ones, Bob.
06 23 30+ LMP Eleven-footers and 7-foot stereos.  

06 23 30+ CC We'd like a 3-foot shot of the lunar mass spectrometer, including the orifice where the break was.  

06 23 30+ LMP Cross-sun?  

06 23 30+ CC Yes, yes, Jack; 7-foot cross-sun.  

06 23 32 15 LMP Okay. Got it. Now wh.??  

06 23 32+ CC Now we want to go over the neutron flux, Jack.  

06 23 33+ LMP What do you want me to do with the neutron flux?  

06 23 33+ CC We want a photograph facing south, for the 7-foot. So a 7-foot cross-sun essentially, of the neutron flux in the soil.  

06 23 33+ LMP Okay. Would you like to have the RTG in that picture?  

06 23 33+ CC You might take a partial pan around to the RTG.  

06 23 33+ LMP Okay. Now what?  

06 23 33+ CC Okay. Now let's remove the neutron probe experiment from the ground, and turn it off.  

06 23 33+ LMP Okay.  

---
And, Jack, you might note as you withdraw just how difficult it is to withdraw it. Whether or not it's been seized by the soil collapsing around it or not.

LMP: Not at all.

I'm going to look under the seats one more time. Nothing but a 500.

I got the LMP's camera.

OK; let me get one parting shot of - one of the finest running little machines I've ever had the pleasure to drive.

Pin 1 is pulled.

Mark that.

I'm at the end of the west SEP antenna.

Okay, Pin 2 is pulled. Still safe. Pin 3 is pulled, and it is still safe (EP 3).

LMP: Fifty-five Yankee is an exotic-looking rock I found about 5 meters south of the neutron flux hole. It's another gray - possibly gray basalt. It's just that there aren't many of them around here, and so I picked it up.

Okay, the (SEP) transmitter is off.
06 23 40+ LMP I'm at the MESA.  

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06 23 46+ CDR I need a locator here to the LM.  

---

06 23 46+ CDR My pictures are taken; I'm on the way.  

(VIP-LM)(PHO 143 21935-37)

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06 23 46+ LMP I got another batch of pictures - the LM and the flag and --

(LM)(PHO 134 20506-13)

06 23 49 57 CDR Well, watch this real quick.

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06 23 49+ LMP Stereo, even.  

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06 23 49+ CDR Okay, here, this is an ETB.

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06 23 49+ LMP Let me - let me make sure that that's all cinched up.

---

06 23 49+ CDR And I'll try and get the big bag here cinched up.

---

06 23 49+ CDR Is it heavy? Something in that core tube you put in there?  

---

06 23 49+ LMP Tube 52. Has about three-quarters of a core - hand pushed - half a meter inside the plus-Y footpad.

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07 00 04 46 CDR Hatch is closed. Let's see if I can lock it.  

(LM)
07 00 37+ LMP echo has a...ch of dust and that gradually accumulated in my pocket. (PRE LIFTOFF) (SAMP 70060-64)
---
07 00 37+ LMP Right now I can't find the sample containment bag number 5. Number 5 collection bag will be in bag 3. (PRE LIFTOFF)
---
07 00 41 49 LMP We're going to cross out 3 on the bag, and put a 5 on it. (PRE LIFTOFF)
---
07 00 56 33 CDR Bag 7 is 32, bag 4 is 31.5, bag 5 is 21, the big bag is 11, the ISA is 22 (lbs.). (PRE LIFTOFF)
---
07 02 46+ MCC Okay. Would you like for me to just read you all the questions, and let you mull those over before you work on it, or you want to do one at a time? (PRE LIFTOFF)
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07 02 46+ LMP One at a time's better, Ken. (PRE LIFTOFF)
07 02 46+ MCC All right, sir. Number 1. Wanted to know if the blue-gray rocks at Station 6 are similar to those at Station 2? (PRE LIFTOFF)
07 02 46+ LMP Ken, I think they are. But I think you'll find that the ones in Station 6 are much more metamorphic rock, or recrystallized rock, than the ones we had at Station 2. I had the impression that the ones we were sampling at Station 6 were really inclinations in the anorthositic gabbro - and had been probably considerably metamorphosed by it being included in it; whereas, the ones we had at Station 2 were a separate rock type apparently as I recall it, anyway. (PRE LIFTOFF)
07 02 46+ MCC Okay; that's good. (PRE LIFTOFF)
07 02 46+ LMP Ken, let me just say that my impression is that there was a lot more action in the rocks at Station

304
6 than 2. I saw a lot more, a lot more was evident, the inclusions and, some of the patterns, some of the other things we saw.

07 02 52 08 MCC All right sir. Let's go on to the second one, and it said: Do we understand that there were no breccias at Station 8?

07 02 52+ LMP In the one - that apparent orthopyroxene plagioclase rock - was a breccia in the sense it was fractured and was injected by dark glass. But it would be what we would call a mosaic breccia in that respect, I think, and not the - didn't see any Station 6- or Station 2-type breccias there at all. Other than the subfloor gabbro, that orthopyroxene plagioclase rock was the only major rock type I think we saw, unless we picked up some in the rake sample.

07 02 52+ LMP Okay. Ok; the third one says: What are your impressions of the distribution of the - familiar subfloor gabbros throughout the EVA-3 traverse?

07 02 52+ LMP Well, I think we discussed that a little bit on the traverse - quite a bit, as a matter of fact. The impression I had was that most of the traverse on the plains, with the one exception of Van Serg crater, were - we were in block fields or fragment fields that were almost - well, were dominantly subfloor. And visually from the Rover, I had no impression of any other significant rock type, with the exception of occasional blocks of the gray variety of the subfloor gabbro. And I don't know - Gene I - don't know what Gene's impression was. He was driving a lot, but - pass it on.

07 02 52+ CDR I think - we actually even commented when we hit the break in slope coming back out of Station 6 and 7, and then back off at - coming back down at 8 - how the terrain features changed. I think that was due principally to the - what we've been calling the subfloor material evident. And there again, it was, what I would say, particularly mantled, filleted, much like we have here where the LM is, with the exception of Van Serg, where we actually saw fragmental boulders for the most part, a lot less buried sitting on the surface.
I all right, sir. At Van Serg, some rocks were described as gray breccias, and some contained white fragments. Was there a variety of breccias present?

I think not, Ken. My impression was that there was a variety only in their - in the degree to which they were fractured. We found and sampled, I think, the two major - one - extremely fractured rock that I said was - was friable. Anyway, it broke into small pieces very easily with a hammer or in your hand, if you worked at it. And the other was a breccia that was not - was much more cohesive than that. It was not 'fractured or friable at all, but they both were on the rim, and I think they were just varieties of - probably of shock fracturing.

Okay. Could the Van Serg breccias correlate with the blue-gray material at Cochise?

That's possible, I guess. But my first guess would be that the gray at Cochise was blue-gray subfloor. And, well, I don't know. That's a good question. That's a good question. We - maybe with the pictures we have, we can work out the - an attitude - approximate attitude on that contact that I talked about in Cochise, and see if it would project over reasonably to Van Serg. I wouldn't be surprised if it would. That's a good point. To me they looked very similar.

You just - yes, Ken. I think from a distance we saw the blue-gray in Cochise, you couldn't make a definite correlation. But it's a good idea and ought to be considered as one of the possibilities. The other is that we just had a window in the subfloor that coincidentally - I mean one underneath the subfloor might be that breccia. Oh, incidentally - the Van Serg impact hit that window.

Okay. Can you tell us anything about the couple at Van Serg. Was that a clast in the breccia?

It was an aggregate of irregular - looked like agglutinated glass in fragments just sitting on the rim of Van Serg. And the reason I said I thought it was in place or had fallen there and crystallized there, is that there were four or five similar
fragments arranged in a small coherent area. Not making that very clear I don't think, but it looks as if it hit and broke apart upon hitting a little bit but didn't really splatter or break apart in any significant manner.

07 02 56+ LMP There are similar things - tell you what it looks like. If anybody'd walked up the rim of Kilauea Iki in the ash out there, and on top of the ash, there are bombs that were fairly clearly molten when they hit, and they had just enough spring to break when they hit. But the individual pieces didn't move very far at all. And you can see that pattern on Kilauea Iki. And it was the same kind of thing, except that there was no directional aspect of it here.

07 02 56+ LMP And that's not to say it's volcanic glass. That's just the kind of pattern it was.

07 02 56+ MCC Okay. Can you tell us if the darker material in the bottom of Van Seerg was similar to the collected rim material?

07 03 00 52 LMP I think so, except as Gene pointed out, the clasts were coarser. They were coarser in the bottom than about anything we saw in the rim.

07 03 09+ MCC Okay. Are there any distinctive features, other than color, to separate tan from blue-gray breccias, such as jointing, or massive nature, continuity, anything of that nature?

07 03 00+ LMP Yes, we're --

07 03 00+ COR Where did we find those tan breccias?

07 03 00+ CC Challenger, this is Bob. I think we were talking about some of them, I think, at Station I the first night. We had both natures. In fact, I think we had - didn't we have two of those in the same rock together?

07 03 00+ LMP They were both gabbros.

07 03 01 57 LMP Bob, they were tan gabbros and blue-gray gabbros.
Okay, yesterday, the breccias - they were tan and blue-gray breccias yesterday at Station 2, were there not? You have the two types of breccias at Station 2.

Oh well, yes, yes, that's right. And now as I think back I guess that's the main difference between the tan rocks at Station 2 and Station 6, but the ones at 6 appear to be - have an igneous texture or at least a very crystalline texture and inclusion-like masses of other rocks. Whereas, the ones at Station 2 - they seem to be fragment breccias, as I recall. That's right, although they may have been recrystallized or metamorphosed they were clearly breccias at Station 2. I just forgot about that.

Okay, copy that. Okay, and can you amplify your description going out to Station 6. In particular, were there blue-gray and tan-gray bands on the North Massif?

Rather than bands, there were lines that appeared to be the upper terminus of the source of the boulders that were strewn below that line. And those lines tended to be either - show a blue-gray source or a tan-gray source, if you will.

Okay, do you have any preliminary stratigraphic sequence for the plains?

For the plains, huh? Well, my guess would be that the Van Stry breccias were the oldest rocks. The gabbro - subfloor gabbro's the next oldest, and the mantle material's the youngest. But that's - the only good clear relationship was mantle on top of the subfloor gabbros. We really don't have a good relationship of the breccias and I guess I lean towards thinking that Van Stry was a window in the subfloor rather than being a bed of some kind, on top of the subfloor.

Okay, and do you have an opinion on what underlies the Sculptured Hills?
07 03 06+ LMP Well, I think we said - the rake sample is probably (PRE LIFTOFF) going to tell the tale there. My guess is from the boulders and subfloor around up there that - are of gabbro and maybe the Sculptured Hills are a version of the subfloor rock. I don't think that the orthopyroxene anorthosite rock was necessarily indigenous to the Sculptured Hills. It was glass-coated and permeated by glass so I suspect it may have been thrown there by an impact somewhere else.

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07 03 08+ CDR And I guess if you could go in - my feeling is if (PRE LIFTOFF) you go to the bottom of every one of those large craters like Camelot, you could examine some of those fragments on the walls and down into the bottom, I just get a feeling you'd find this - this blue-gray breccia down there.

07 03 08+ CDR I mean in all the big craters like Camelot. (PRE LIFTOFF)

07 03 08+ LMP Well we - I think maybe that's true, however, we did (PRE LIFTOFF) not see isolated fragments of it very often, if at all, out here on the plains themselves, away from the craters. So if the blue-gray breccia does - the Van Serg breccia does underlie the subfloor, the craters are not - it's far enough that the craters we have apparently have not penetrated and brought up much of that kind of material. Well, that's it.

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07 03 48 03 LMP Ken, this is Jack, why don't you make a note that mag Bravo is empty, with miscellaneous photos since the last report on it.

07 03 51 36 CDR And, Ken, we're stowing mag Nancy at a reading 153. (PRE LIFTOFF)

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07 12 56+ LMP Hey, Gordie, in honor of one of your comm handovers last night, and in the tradition of Apollo 8, I've got a paraphrase of a familiar poem for you.

07 12 56+ CC Ok; go ahead. (PRE LIFTOFF)
LMP: Well, it's the week before Christmas and all through the LM, not a Commander was stirring, not even Cernan. The samples were stowed in their places with care, in hopes that with you, they soon will be there. And Gene in his hammock and I in my cap, had just settled our brains for a short lunar nap. But up on com loop there rose such a scatter, I sprang from my hammock, to see what was the matter. The Sun on the crest of the surface below gave the luster of objects, as if in snow. And what to my wandering eyes should appear, but a miniature Rover and eight tiny reindeer. And a little old driver so lively and quick, I knew in a moment, it must be St. Nick. I heard him exclaim as over the hills he did speed, Merry Christmas to all and to you all godspeed.

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LMP: People always said we ought to have a moon in June. (PF LIFTOFF)

LMP: I just don't think we've made it yet. (PF LIFTOFF)
03 15 01+ LMP Can you see the landing site? I think it's going to be in the darkness.

---

03 15 02+ CDR No, it's just dark. (ORBIT)

03 15 02+ LMP Isn't it a little north of track? (ORBIT)

03 15 02+ CDR No, I think it's right below us, Jack. I think it's right smack below us in darkness.

03 15 02+ LMP Yes, I see, it is. I can't - I think I'm looking at Littrow right there, right below us. But I can't quite tell.

03 15 02+ CDR If I could see Vitruvius, I'd have a better handle on it. (ORBIT)

---

03 17 07 09 LMP Okay, Houston. We've got a good shot of the landing site.

03 17 07+ LMP The shadows, Bob, go all the way across the scarp and very long pyramiding shadows go all the way past Family mountain. They look like the Sculptured Hills are lit up on this side, but it almost puts the entire North Massif in shadow, from where I stand.

03 17 08 07 LMP Quite an interesting place to land down there. (ORBIT)

03 17 08+ CDR We can now, I think, see contrast down in the shadow. And the only part of the scarp that is visible - I think Jack picked it out - as being right where Lara is.

---

03 17 08+ CDR Bob, that's a fantastic black-and-white shot of the landing area with the shadow stretching across most of it.
Bob, I can now see down through the Shadow, 1 Bar, I can now see down through the Shadow, 1
Bear Mountain. I can't really make out the slide yet. Most of the North Massif is still in shadow due to the Sculptured Hills. And just at the point where we can start really to see through the shadows and see some hummocky terrain on the North Massif, it just went out of my next reach. But, I did see some sort of albedo change that went across the canyon about in the vicinity of the scarp.

03 17 12 20 LMP Bob, with respect to the landing site, when I first--(ORBIT)

03 19 11+ CDR That's a mess there, too. (ORBIT)

03 19 11+ LWP Now we're just over the rim of Serenitatis, looking (ORBIT)

03 19 11+ CDR Seventeen I was just barely in the - Sherlock was over the general plains. (ORBIT)

03 19 11+ LWP This is all supposedly covered with the dark mantle, (ORBIT)

03 19 11+ CDR Yes, the sun angles are so that you can't tell the difference in albedo, though. (ORBIT)

03 19 11+ LWP And look at those mare ridges, though.
03 19 11+ CDR I tell you, that's looking out into the gray - gray (ORBIT) desert down in there.

03 19 11+ LMP That's the old Littrow site. (ORBIT)

---

03 19 11+ CC Jack, Houston. Can you see any albedo difference in (ORBIT) the landing site area between the dark massif and the light area?

03 19 11+ LMP We can't see any difference between - in the low (ORBIT) areas, between the dark mantle and other materials right now. We're right at the terminator.

---

03 19 14+ CMP Jerry, you could really see a difference between the (ORBIT) South Massif and the mantle material around through there. The mantle is not nearly as dark as it looks on the pictures, though. But the massif, South Massif, especially, looked almost a whitish color. I guess it's because partly the Sun was shining on it.

03 19 14+ CDR Could you see anything that looks like the slide? (ORBIT)

03 19 14+ CMP Oh yes. You can see the slide on the thing and definitely see the scarp going across through there. I was primarily concentrating on looking for the various craters so I didn't spend that much time, you know, concentrating on how the thing looked. I saw Sherlock about halfway through it and I got about five marks on the Sherlock for 17 l.

---

03 21 08+ LMP Roger. I just - we didn't get a view of the site, (ORBIT) though, going over this time.

---

03 23 01 53 LMP Okay, I got the landing site. We're right over (ORBIT) the top of it, and the scarp is fantastically detailed at this - can you see in there, Gene? Right down, straight down there.
13 21 CDR No, I can't.

13 21 LMF The light mantis... we've obviously mantled the area. The stars were very detailed, and... I... I didn't have much to watch, it was quite brown.

13 21 LMF It's very... well, I'm not sure... I'm sure... well, it was rather than... I'll be, MP operator was... I'm... a bit dark.

13 21 LMF Well, I'll tell you from this altitude, and with the... We... may, therefore, be... I'm... it's... those... topographic features in the area... look... dark... high... with... the... I'm... it's... that... that... that... I... you... and... is... to... it... it's... it's... it's... I'm... it's... it's... it's... it's... it's... it's... it's... it's... it's... it's... it's...

13 21 LMF I can just... I... we... we... and... command... and... our... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll... we'll...

4 12 13 LMF Hey, *** we got the landing site, we're coming ***

4 12 18 LMF That slide really shows up beautiful

04 12 19 39 CDR Hey, we got the landing site, Gordo.

04 12 19 CDR Gordo, we got the landing site. We're coming right (ORBIT) over the front of it. Stand by a minute. You can see the slide. I think you can see the Great Ross.
04 12 19+ CDR We've got Family mountain; we've got the massif; we can see the scarp; we can see the light mantle; I've got the Great Cross, Camelot, Sherlock.
---

04 12 19+ LMP I see possible structure in the upper part of the South massif, little bit east of Station 2. It's subhorizontal, dipping to the southeast.

04 12 19+ CDR Houston, I can even see Poppy, right where we're going to set this baby down.

04 12 19+ CDR I can see Rudolph. I can even see the triangle: Rudolph, Frosty, and Punk.
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04 16 16+ CMP Hey, I think I can see a light spot down there on the landing site where they might have blown off some of that halo stuff.

04 16 16+ CMP It's between Sherlock and Camelot - between -
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04 16 19+ CMP I didn't have my map there, but I was looking at the landing site, and as close as I can remember, it had to be somewhere around about DN 83.3 on the 200-meter scale, the TL 25-8.
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04 16 29 01 CC America, while we're waiting for this lunar sounder to operate for 2 minutes, could you - could you say again those coordinates you gave us. I dug out the map TL 25-8, and I got the 83.3, but what was the azimuth coordinate on that, Ron?

04 16 29+ CMP It was Dog November, and maybe just a little bit to the right of Dog November.

04 16 29+ CC Ok; Dog November. Thank you. And you think that's where they are, huh?

04 16 29+ CMP Yes.
04 16 29+ CMP Well, there's a real white spot down there, you know. I only got a look at that thing for about 30 seconds before I had to do something else. But I'm just recalling in my mind where the white spot is with respect to those - there's Camelot and there's Sherlock, and then from Camelot to Sherlock, there were two other craters, and they were just a little bit closer to Camelot, but between those two other craters there.

04 16 29+ CC Good show. Roger.

04 16 29+ CMP There's a white spot - yes, there's a white spot on the - like it might have been dust blowing or something, you know.

04 16 29+ CC Roger. That may be the - the rocket exhaust. It might be just a little off that light spot.

---

04 18 11+ CMP Coming in, I can see the landing site, now - quite well. The appearance of the slide area definitely shows up. The South Massif seems to have the sun shining right on the walls. I'm looking for any type of layering, or anything like that. And can't see anything that would show up. The big difference between the massif structures and the Sculptured Hills is that the massifs look like they are a steeper slope. And they don't seem to have that type of covering over them, like the Sculptured Hills do.

04 18 11+ CMP I'm right over now. The scarp definitely cuts up through the North Massif. I can't see continuation on into the South Massif at all. But, you can definitely see a vertical exaggeration as it cuts on around up over the North Massif. And I'd have to take another look at it for sure, but it almost looks like a flow coming from Family or in the vicinity - in the direction of Family mountain - but from the direction of Family mountain - lapping up on the side of the North Massif. That's the way it looks as you go on by it. I couldn't see anything that would lead you to believe that the slide area, so to speak, would come on across anything that
would be the source of that slide area. I still think I can see the - one spot that has a lighter albedo than the surrounding area there in the Pentagon complex. And it's pretty close to the - let me get my chart out here and take a look at it again.

04 18 16 50 CMP No, it still looks like that area that's blown away (ORBIT) there is Dog November - between Dog November and Dog Papa. And about 83.4 or something like that.

---

04 22 09+ CMP The craters that are inside Marsidi, they're smaller-type craters and they have a definite bluish tinge to the halo that comes out as opposed to the bright craters or white-type thing and those are - have more of a darkish-bluish tinge to them. And oddly enough, that's the same type of bluish tinge that I see right in the landing site right now. In the Pentagon complex, MODR shows up that same type of a bluish tinge to it.

04 22 09+ CC Roger. Did you have any luck locating the LM area in the landing site this time? (ORBIT)

04 22 09+ CMP Yes, I don't even see the bright spot there anymore. I know where to look for it and I don't even see it. (ORBIT)

04 22 12 30 CMP Well, South Massif just went into a hole, too. (ORBIT)

04 22 12+ CC Roger. Our best estimate of their location down here. Ron is - 63 - Delta Mike 83. Delta Mike 83.

04 22 12+ CMP Delta Mike 83, huh? (ORBIT)

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05 09 52 09 CC Ron, if you'd like, I could give you a summary of the EVA 1. I'm just sort of editing the report put out by the back room on that.

05 09 52+ CMP Sure. Go ahead, Gordo; appreciate it. (ORBIT)
Okay. I'll read a few selected excerpts here. The surface around the landing site is generally an undulating plain, which was somewhat rougher and had a greater abundance of blocks than was expected by the astronauts. It is saturated with small craters, not exceeding a few centimeters in size but not with larger craters. Small craters commonly have glass on their floors. Boulders ranging from about one-half meter to 4 meters are common. All of them are partially buried or covered with the dust of the dark mantle. In one locality, a crater of about 1 meter deep penetrated the relatively fine dark surface material and excavated small blocks. Other shallower craters in this area did not fully penetrate the mantle. This fact, together with the abundance of small boulders on and near the surface, indicates that the dark mantle is relatively thin.

A minor amount of dust noted upon landing suggested a thin layer of fine grain unconsolidated material. Footprints and LRV tracks left firm impressions in the fine-grain material when darker material was kicked up from underneath. At the ALSEP site, the drill encountered harder material several times and definitely seem to reach harder material at about a 7-foot depth. The deep drill core apparently also bottomed in harder material. In the core, the material was noted to be cohesive, and it contained more fragments than did the surficial material.

Predominant rock type below the LM and Steno crater is medium grained, vesicular or nonvesicular basalts or gabbro. They contain about equal amounts of plagioclase and pyroxene along with less abundant opaque material. The guys took a total of - well, they took a lot of pictures. They had 229 color and 197 black-and-white during EVA 1. And they got 17 samples in addition to the deep drill core. Those were large, unbagged rocks, and the total, excluding the core, estimated to weigh about 13 kilograms so far, and they traveled about 3 kilometers in the Rover. As a summary conclusion, the observations made on the first EVA support the premission interpretation that at least the upper part of the subfloor materials consist of basaltic lava flow. The overlying dark mantle may be part of the regolith on subfloor material, but the possibility that it is an independent unit remains open and will
be tested by observations on second and third EVAs.
Both the dark mantle and upper subfloor units
contain remarkably little foreign material between
the ALSEP site and Steno which suggests
comparatively young ages. Over.

05 09 52+ CMP Hey, that sounds like a good report there. Sounds (ORBIT) like they got a lot of stuff done and also getting a
lot of good information out of it already.

05 09 52+ CC Yes, I think that's a safe conclusion. They're (ORBIT) going to get a lot more today.

05 09 55 52 CMP Oh, you bet. (ORBIT)

05 09 58 01 CC Ron, for your information, the ALSEP seems to be (ORBIT) working pretty well. The Central Station and all
the experiments with the exception of one are
working normally. The one that's giving them
trouble is the LEAM, and the data on the LEAM
doesn't seem to want to sync up properly. They're
thinking that one over and maybe have something for
them to try to get that to work right.

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05 11 58+ CMP Let me take another look at the landing site. (ORBIT)

05 11 59 57 CMP Okay, the Sun's getting a little bit higher now. (ORBIT)
And as I look at the landing site and the albedo -
differences in the color in there - the color in the
Maraidi gamma is the same as in the landing site
itself. And, also, it looks like the type of
material that we say is essentially covering the
whole area - goes on out to and includes the annulus
of Serenitatis.

05 11 59+ CMP Let's see. Did I mention that - that it looks like (ORBIT)
- the flow out of Maraidi has gone on around it and
down to, and almost encroaches on the Vitruvius A.
But, it's breached out of the side of Maraidi. Gone
around that depression and up to the side of
Vitruvius A.

05 11 59+ CC Roger, Ron. (ORBIT)
You still get that same bluish - bluish-type tint from the area in the landing site. At Station number 2, on the landslide - it's going to be a pretty good little depression there. The scarp itself - it looks like they had picked the least-slope portion to go up it. And, that's kind of between Lara - I think Lara's the one, the crater just to the west of the scarp.

Roger. I haven't been on all your revs. You ever had any - anything you'd call a visual on the LM?

No, I really haven't looked that much, Gordo. See, my optics are always pointing up in the air; so I can't use the sextant. The binocs - I'm having a heck of a time holding them still enough to - to concentrate on anything very small.

Houston, America. Magazine Lima Lima will be starting with frame 54.

Boy, that scarp sure looks like a flow down there to me.

Roger. On the landing site scarp?

Yes. I don't know how you get it to go up the North Massif, but it sure looks like it runs that way - just from the shadows and everything.

Gordo, does this go all the way out to Bessel? Does it cross the annulus ridge there?

It doesn't go all the way to Bessel. It stops short of Bessel. About halfway across Serenity from the Taurus-Littrow to Bessel.

Oh, okay. Forgot to look where it stopped.

Okay. I ended up on frame 92.
We've got some data here for you, for if you're planning on taking those red- and blue-filtered exposures across the landing site - if you want this information.

Oh, yes. Ok; go ahead.

Okay, Ron. Here it is. It's a Nikon(SIC) - NK - November Kilo 55; VH - VH; mag X-ray X-ray. With the red-blue filtered exposure you want 50 f:11, 1/125, one frame each filter; f:11, 1/250; one frame each filter. With no filter, expose at f:11, 1/1000. And if you want to use the polarizing filter, expose at f:11, 1/500 of a second.

Okay. Here's a note that I'm not sure I understand totally, but let me read it to you. "Observe targets through viewfinder and shoot as desired with polarizing filter in different positions. Mark exposure time with polarizing filter as data analysis requires the incidence angle."

Okay. So we need the get time when we take the picture.

That's affirm - with the polarizer.

And there's another note here. Do not exceed 18 frames total for the above pictures.

And your TCA for the landing site - is 138:39:11.

Stand by. Is it 1/500? Yes. Stand by.

Mark it. And the polarizer all the way to the left. Stand by.

Mark it. That's the polarizer all the way, counterclockwise.

Okay. That's eight pictures. Stand by. Okay. Wait a minute. I lost the landing site.
05 15 59 34 CMP Mark it. It's all the way to counterclockwise. (ORBIT)

05 15 59 42 CMP Mark it. And that's all the way clockwise. (ORBIT)

05 15 59+ CMP Frame 23 and 24. We're looking north along the ridges there. The other two polarizers - the two before that were looking at the landing site. Then I had three red ones at a 1/500 and a 1/25th and the rest 16. And, the blue one's at the same thing. (ORBIT)

05 15 59+ CMP And we're setting on frame number 25 on mag XX. (ORBIT)

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05 17 57 44 CMP Okay. Mars-like geology looks just like the rest of all of the surrounding hills around there. I think that's just a - some of the - Sculptured Hills type of material that was high and has been inundated by mare flow at one time or another. Mare flows kind of come up around it. (ORBIT)

05 17 57+ CC Okay. How about the Dcamical Hills inside of Vitruvius A, as compared to Aitken? (ORBIT)

05 17 57+ CMP Okay. I just missed that one. We'll have to get that one on the way by. (ORBIT)

05 17 58 23 CMP Next time I guess. Right now, I'm looking at the ridge system around the annulus of Serenitatis. And the dark material stops before you get up to - oh, what's the crater that sticks into the side of Serenitatis and sticks out beyond the eastern edge of Serenitatis? Anyhow, the dark material stops before you get to there. The dark material only goes up to - let's see - there's a definite rille. There's a wrinkled ridge and at the east of the wrinkled ridge, there are two craters, about 20 kilometers in diameter. And then farther east of that is the - the Rille. A graben, it looks like that goes up - and that's about the extent of the dark area that's the same as the - the same material as the landing site.

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05 18 03+ CC Any textural difference between the dark mantle in the site and the Sulpicius Gallus formation, Ron? (ORBIT)
Yes, there is.

Would you attribute it to the actual ground or to possibly the sun angle difference?

I think I would attribute it really to the - to the actual ground. I guess what I am going to have to do is really wait until the sun angle gets a little bit higher there in the Tacquet region to answer that for sure. But it seems to me like the material in the landing site area is more smooth or smoother than what's in the Tacquet region. The part in the Tacquet region seems to me like it's just a rougher-looking type material. You know, not massive.

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The dark annulus around Serenitatis - as you look north - the dark variation there, and I'm looking a little backwards now - but that dark has no continuity with the ridge at all. Goes right down the middle of the ridges. As you look directly west of Litratow, the wrinkle ridge is there, and then you have the light tan, tannish. There's a dark tannish-gray. And then you get out to the light tan of the mare Serenitatis, itself.

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Looking back at Sulpicius Gallus and just to the north of that, there's a crater that's right at the end of those rilles that go north from Sulpicius Gallus. And you can really see the ejecta blanket. The ejecta blanket looks very dark, around it now in this sun. Now you look out across the Mare Serenitatis now and you're getting toward the sunset, looking back into the Sun, and the color is disappearing all except in that one spot. Now that must be either a fresh ejecta - and you look at the brightness of it or something - or it's dark. It's sure a dark ejecta blanket around it. The blanket itself goes out maybe two or three crater diameters, and it looks like it has kind of a ray-type pattern to it. I'll mark that crater. I don't even know if it has a name or not, but I'll mark it on my map.
06 15 41 39 CMP I'm looking out of window 2 now, and you can definitely get three different color textures on the thing. You've got the light tan of Serenitatis, and then you've got an annulus ring that stops somewhere in about the middle of the two ridge systems that go around. And then you come down south in the landing site area and the two dark things change - ah, I can't quite see it anymore. Then landing site is a darker - more or a gray, and it goes on up - there's a subdued crater; there's kind of 2 - the rilles go on up there, and there's a filled-in crater just to the west of one that's about 20 kilometers in diameter. And that's about where the dark-gray material ends, right on the edge of that crater. And then you run into the annulus that goes all the way around Serenitatis.

06 15 43 33 CMP Frames 110 and 111 were taken, just now, out of mag Oscar Oscar - one of the landing site, and one north of the landing site, trying to get the color distinction between the three of them there.

06 15 48 31 CMP Okay, 113, 114, and 115 were taken on the western edge of Serenitatis.

06 19 22 14 CC Hey, Ron, when you come up on the landing site, we would like you to concentrate on Shorty crater and F crater and then the other dark-halo craters. As you know, as I told you last night, Shorty ended up with some orange-colored material that looks an awful lot like a fumarole.

05 19 22+ CMP Fumarole?

06 19 22+ CC Looks an awful lot like it and what we're trying to do is see what you see from there, and that may give us some correlation on some of these other ones.

06 19 22 49 CMP Okay, I got to take a look and see which one's Shorty.
06 19 22+ CC Ron, it's the dark crater on the slide, the dark crater on the slide.

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06 19 35 38 CC Ron, is there any similarity between the highlands west of Crisium and those east of Serenitatis?

06 19 35+ CMP Yes, west of Crisium and east of Serenitatis. Those seem to be a different type of highlands, and I want to check the other ones when I go by, but it looked like when I was coming up on those west of Crisium, they're more of a tan-type color, smaller undulations smaller--they have a corn-cob effect, I guess is what you'd call it. Smaller ears of corn or small mounds closer together as opposed to, when you get over to the landing site--the ones on the landing site seem to be more--raised, I guess. In other words, you still have a group of the small mounds and what have you, but they're a little more massive; you get more of an appearance of a dark between the bumps.

06 19 35+ CC Are you getting the landing site into view now?

06 19 37 34 CMP I got it in window 2.

06 19 37 51 CMP Okay, I've got Shorty in the--picture. It looks like a sharper crater than any of them in the Pentagon complex. The other thing that looks sharp, just like that one, is F crater.

06 19 38 48 CMP *** back to the other window.

06 19 38+ CMP Did they kind of find that orange stuff on the north side of it?

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06 19 38+ CC Station 4 was on the south side of it.

06 19 38+ CMP I'd say they just barely got into the stuff, then, because--but it looks like--kind of the north rim of it has more of a tint of a different color to it.

06 19 38+ CMP *** my pictures.

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CC Is the color differentiation concentric around the - (ORBIT) the crater or is it just in splotches?

CMP No. It's just in the - kind of the north side of it. (ORBIT)

CC What would you say the color is then? Is it one of the different tans? (ORBIT)

CMP Yes, the color - yes, it's a kind of a different - would you believe kind of an orangish-tan through these binocs? I got to take another look at that when I go by the next time. (ORBIT)

CC Ron, when you get back - when you get done with this, we'd like you to sketch - when you get a chance, the color variations - just some thoughts on where the color splotches are with respect to Shorty, in particular. (ORBIT)

CC Roger. Did you get a chance to look at F crater? (ORBIT)

CMP Yes, F crater is - is sharp, - just like - Shorty. I hope I was getting F crater. F crater is about the same size as Shorty, isn't it? If not, I was getting one between Family mountain and - (ORBIT)

CC Just about the same size, Ron. Maybe just a tad bigger. (ORBIT)

CC Ron, is there a cone associated with F crater? (ORBIT)

CMP I didn't get a chance to look at it that much. I'll have to check it the next time. (ORBIT)

CC Okay. Have any thoughts on what's its origin? (ORBIT)

CMP I'll have to look at F crater again the next time I come over on the thing, because I spent most of the time looking at - Shorty. (ORBIT)

CMP This formation again from - Tacquet on down to Menelaus. Just went over that again, and I was looking at it with the binoculars, and I saw one sharp crater in the area that had an ejecta - almost the same color as the stuff around Shorty.
Ron, I think if you put an order of priority on some (ORBIT) activity, as far as the geology goes, you might consider sketching out on Shorty - with just a rough handle on where you thought you saw some of the coloring differentiation up on the northern side of Shorty - and also give some thought on F crater, if you will. I know you didn't get a chance to look at it because - if we can tie what you see from orbit on Shorty to what we know we've got from the ground truth, we might really have something here, as far as matching up on some of these other craters.

Okay. I think I said north and as I look at the map (ORBIT) - the orange distribution goes generally about. A crater diameter to the north, but it essentially starts - well, if you'd cut a 60-degree angle - from Dog Sierra AY 63 - cut a 60-degree angle there and then make that go around - out about a crater diameter.

Okay. To the north at Dog Sierra at 63? (ORBIT)

Yes, Dog Sierra at 63; that's on the 400-meter scale (ORBIT) there.

Yes, I've got it. (ORBIT)

On TL 50. And, at the right-hand side. If you're looking at the thing from the bottom, the right-hand side is 0 - up to 60 degrees. You're 60 degrees up from the horizontal and 30 degrees down from the vertical. It'll be something about like that.

It had kind of a brownish-orange tint to it. (ORBIT)

Ron, I guess one of the things that at least goes through Stu's and my mind on that Shorty crater - and I think you dispelled it when you say it goes out like in a 60-degree angular cone away from it. But the question we'd really like to be thinking about - is that a concentric coloring around there, like it might be just a layering from a turned-over
frag or something like that, or whether it just seems to be some sort of a - I don't want to say flow, but something that would give it direction that one - the one 60-degree direction like that.

06 20 11+ CM: Yes, I see what you're saying. And - it all - almost looked to me like it was gradational, as you, as you went away from the crater. In other words, more orangish closer to the crater than as you got away from it.

06 20 13+ CM: The crater that I described as looking comparable to Shorty, I don't think is the one on Family mountain. I think it's the one on - right dot - about the same size dot as Shorty on the 17-I leadin for the - 17 I for the landmark tracking.

06 20 14 15 CM: I think Family mountain is the bigger of the two mounds to the west of the landing site, isn't it?

06 20 14+ CC: Stand by a minute, Ron. Let me clarify that.

06 20 14+ CC: Roger, it's west of the landing site, and I believe it's the bigger of the two.

06 20 14+ CM: Yes, okay. The one that I said that looked like Shorty is kind of between the two mounds, and that's the one I looked at.

06 20 17 33 CM: Hey, when you all draw that 60-degree angle, were you making that 60 degrees up from line 63.

06 20 17+ CC: Yes. I didn't know how to handle on 63, but I took a point at Dog Sierra and C3 and created a 60-degree cone away from the crater at that point.

06 20 17+ CM: No, you want to create a semicircle. That's the center of the sem - well, let's see. With the flat half of the semicircle along the line that goes through Dog Sierra 63 and Dog Whiskey 57.

---
Okay. I've connected a line.

Connect a semicircle to the right of that line.

Okay. To the right of that line or to the north side of that line?

Yes. Actually, it will be kind of to the northeast, but to the north side of it, yes.

You know, through these glasses, Stoney (Shorty) still looks like it's a light tannish-orange. And it's - doesn't come all the way down to the center of the crater. It's kind of tangent to the north edge or tangent to the edge - it's perpendicular to the scarp line, itself, as it goes down there.

Everytime I focus on F crater I jiggle a little bit, and I can't focus.

You know, I looked down here, just between Tacquet and Menelaus and off to the west of Menelaus, there's a crater that's about 20 kilometers in diameter. And just to the right of it, out in the brown stuff, there's a brand-new spanking-fresh impact crater that has brown ejecta on it. And then some of the other craters - that crater happens to be right on the edge of the brownish-type material, right over one of the rilles. Hope I can mark that on a picture on the map. And some of the other craters about that same size, around the area, out in there, they have the light-colored ejecta just like the normal small impact craters - recent impact craters out in the mare Serenitatis itself.

We're passing over the Sculptured Hills. And coming into the landing site now. I still say - I'll start the old DAC. Oh, boy, that's going to be bright.
07 15 21+ CMP Long, long ways off. I was pointing up to Family mountain. (ORBIT)

07 15 22+ CMP Through the telescope, anyhow, the whole area down there's a lot lighter than it used to be, and I am sure this is due to the increase of the sun angle. However, the landing site itself and the whole valley extending out to the Serenitatis annulus is still darker - darker than the surrounding territory, but it- the higher sun now, it's a lighter-tan than it used to be. Okay, in this sunlight, Family mountain looks like it is black on the top. Not black, but real dark gray on top of it.

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08 01 16 24 CC Mark, 1 minute to impact. (ORBIT)

08 01 16+ CMP Okay, I minute. Yes, we're right over Vitruvius A, now. (ORBIT)

08 01 16+ CC 10 seconds. (ORBIT)

08 01 16+ CC Okay, we had LOS LM. And we don't believe we saw it down here, fellows. (ORBIT)

08 01 16+ CMP What do you mean, you don't believe you saw it? (ORBIT)

08 01 16+ CC That means that we didn't see it - on the TV. (ORBIT)

08 01 16+ CC We are picking up the signal on the seismograph, though, the geophones. (ORBIT)

08 01 20 08 CMP I can see a bright spot on the South Massif - on the top of the South Massif. (ORBIT)

08 01 20 08 CMP I can see a bright spot on the top of the South Massif and - let me see - from the west you got the first hill or the first part of the mountains, then there's the valley, and then - there's a valley that kind of goes into a Y-looking it's a Y-looking valley. I guess, if you come from the east, it's the second ridge from the east, and right on top of that ridge is a bright spot. I don't know how big a crater it should make.
And, I'll put a spot on my map, if I can do it here. (ORBIT)
just a second.

I don't have a map with South Massif on it. You know with the meridian interval on the thing and it looks like the only thing I can use is in the visual observations book here - landing site 204. And, if you draw a line from Shorty to that reseau mark that's on the top of the South Massif - and then, extend about a little better than one-eighth of an inch toward Shorty from that reseau mark. Yes, somewhere right in there. I'll look at it again the next time I come over. But, that's a bright spot on the top of the massif that I hadn't noticed before. I'm not looking in any of the observations going by there.

You know that bright spot might already be there; but I don't think so. I don't remember seeing it.

Do you fellows think you would have any chance next time to take a picture of that possible impact point - with the handheld Hasselblad - or something?

Ah, sure can. You bet you. I think the best way to do it is with the 250 lens on the Hasselblad.

And, America, if you guys are interested in trying to take a couple of 250-millimeter shots of that tonight, we've got a little camera pad here for it we can pass up - if you're interested.

Okay, it's a LM impact TCA and it's time is 197:56:35 and the camera data is CH, 5, CL, 250, CEK, f:5.6, 1/125, infinity. And magazine Kappa Kappa or Kilc Kilo, and you can use up to 10 frames on it. Over.
08 02 55+ CMP Okay. I think I put Kappa Kappa back, I've got Oscar on there. How about it if I use that, okay?

08 02 55+ CC Okay, that's fine, Ron.

08 03 18 44 CMP That was frame 145 to 150 on magazine Oscar Oscar.

08 03 27+ LMP A little historical note. Passing over the Hadley Apennines sites from Apollo 15 we notice that at their landing point, there's the same slightly or distinctly brighter albedo area as there is at Taurus-Littrow site.

08 03 27+ CC You mean down on the plains of Taurus-Littrow, like where the LM landed. Or do you mean where you think the LM impact was?

08 03 27+ LMP Where the LM landed. As we walked along the surface, and this was true at Hadley also, you stirred up a darker zone, albedo-wise. When you look at it from orbit, the area around where the LM landed - it's a distinct bright spot on the surface of a fairly uniform gray albedo plain. And both sites look just alike - in that regard, anyway.

08 14 49+ CC When you get up on the landing site, we'd like you to concentrate on Stoney (Shorty) and F crater for those textural differences we noticed the other day.

08 15 04 54 CMP The landing site really shows up - even from this distance right now. We're right over Proclus and looking off across down through the hills there, you have that definite dark - and now the albedo or the colored texture of the thing to me is turning more of a gray than a tan-gray. In the early parts of it, I thought it was a dark greyish-tan, I guess, or something like that. Now it looks to me like it's more tan - I mean more gray, I'm sorry, more gray. It has essentially the same -
I think if you use the binoculars on the landing site --

I've got it or and the streaked albedo changed differences very definitely. One is the dark mantle on the floor. One is the South and North Massifs and the other is the Sculptured Hills. And the Sculptured Hills are at a light-gray albedo between the massif and the dark mantle. This line is very evident and there's a definite break in slope that you can see between the South Massif the, I won't call it the slide, but the white mantle is cut on the valley floor. And from here, Shorty stands out like a sore thumb.

We're interested in all three of you on that color texture difference up at Shorty and then we'd like to have a comparison of Shorty to F crater if it is possible.

That crater is harder than a son-of-a-buck to find. F crater is right on Family mountain, and there's one to the north of Family mountain, a little ways there's a darker crater and then there's also one to the south of it. I can't find one on Family mountain at all. I couldn't the other day so I'm going to see if I can find it today.

Bob, to me the Sculptured Hills incorporate the albedo, both of the North Massif, or the massif and the mantle area and combine them to give you a generally in-between gray albedo, but the sculpturing is produced by the darker albedo that looks like the mantle, and the lighter albedo that looks like the massif.

Rogor. And for Ron, the F crater is just to the south of Family mountain. It's the one that you mentioned south of Family mountain.

That's the one I saw the other day. It looks about like Shorty.

Is there a cone associated with that crater?
08 15 07+ CDR From here Bob, they're both very dark. (ORBIT)
08 15 07+ CC Is there a color associated with that crater? (ORBIT)
08 15 07+ CMP Have to check that just a second. (ORBIT)

08 15 07+ CMP There is a definite bright spot up on the side of the hill - it's almost an extension of that slide area from Shorty. (ORBIT)

08 15 09+ CMP On Shorty, I still have that light orangish-tan-type material - it's essentially perpendicular to the line of the slide area there in the northern semicircle of the thing. I see F crater. Boy, I can't hold these crazy glasses still enough. (ORBIT)

08 15 09+ CC If you'll direct your attention to F crater. We'd like to know the shape of the crater profile, the rim crest, and probable or possible breaching, the smoothness and distribution of rim deposits, and the superposition-relationship with Family mountain or Family hill. (ORBIT)

08 15 09+ CMP There is a raised rim to it. It's light color down inside the crater, though. And I can't hold the glasses close enough to see if it's breached or not. (ORBIT)

08 15 10 35 CDR I can't see it any more but let me add to it what I can remember real quick. The inside is white. (ORBIT)

08 15 10+ CDR The outside is rimmed with a - it's as if the rim itself, was just dark, very dark. There's some white to the south about a crater diameter, sort of a small distribution radially to the south, and then there is sort of a, what I would call, a free-patterned dark-like ray about 2-crater diameters, maybe 3 crater diameters, to the south just slightly to the west of this light area I was talking about, but to the south, another definite one to the west and another defined to the north, but none to the east. (ORBIT)
08 15 10+ CMP I'm going to draw a picture, here, while I'm thinking of it. (ORBIT)

08 15 10+ CDR My white spot, there, is *** the same spot. There are two white spots I'm talking about, now. The one I'm talking about primarily is the one I saw right after landing, on the thing was a lighter grayish area that was evidently blown up from the LM landing. And that's still in the same spot. You can still see that all right.

08 15 13+ CC How large is the bright zone you were talking about, Ron? (ORBIT)

08 15 13+ CMP Right between Sherlock and Camelot there are two small craters there and I'll have to get my map out to look for the name of them for sure. (ORBIT)

08 15 13+ CMP They should have been right behind the LM. And the bright spot is about the same size as those. (ORBIT)

08 15 13+ CMP And it makes me would say an equilateral triangle with those two craters. (ORBIT)

08 15 30+ CMP Gene's drawing in the flight plan, there. That crater - (ORBIT)

08 17 01+ LMP The fronts of the major ring in Crisium are strikingly different than those of the Apennines just in their general slopes; sharpness of topographical features; and in any appearance of having even a hint of boulder fields on their slopes like we observed, say, on the South Massif, anything like that. At least Serenitatis Massifs seem to locally show fairly major boulder fields on their flanks. And I haven't seen any around Crisium yet. Maybe Ron's already talked to you about that, but I haven't seen any.
Getting into areas that resemble, in their surface texture, the Sculptured Hills of the Taurus-Littrow landing area, here we're just passing - now where are we? - that would be - I got disoriented all of the sudden. Proclus is there, so it's in the ray-excluded zone of Proclus where there is a mare surface projecting up into terrain that looks like Sculptured Hills. And that mare has a distinct bluish-gray color, in contrast to the regolith associated with the Sculptured Hills - between the hills at least - which is a brown - let's call it a tannish-gray. Quite a sharp color hue contrast to my eyes, at any rate.

That was a projection of Facunditatis mare, I guess, up into there. Sculptured Hills tend to have both a regional distribution and a structurally controlled distribution, the structural control being apparently related to the rims of old craters. For example, there are some Sculptured-Hills-appearing topographic materials that - again, in the ray-excluded zone, but out in Facunditatis - we find the rim of a fairly large flooded crater - in Facunditatis. And all of this may tie in with the possible - possibility that we saw at the landing site, that Sculptured Hills are composed of an igneous gabbroic rock. And these may represent local intrusions controlled by the structure of an old impact crater - extrusions controlled by the structure of the old impact crater.

I've noticed - now I'm getting a good view of where in Facunditatis there is a tannish - or let's call it more of a brownish-gray mare in contrast to bluish-gray mare in Facunditatis itself.

And in the walls of some - of a large crater - I'll try to figure out which one it is in a minute. It's near the large crater that the Sculptured Hills define you can see in the east wall - or maybe northeast wall of that crater - an area of bluish-gray - material that is striking the normal tan-gray of that crater wall.
This isn't a good viewing attitude at all, and we get a few isolated views that may be worth commenting on. The contrast, in my eye anyway, between the three color units around the landing site is a—let's call it a medium bluish-gray to gray for the dark mantle; a light blue-gray for the annulus around Serenitatis; and, then, a tan-gray for the Serenitatis mare proper. And, in Dawes, I think you can see that the overturned—or the rim materials are made up of the brownish-gray material, and the walls underneath those rims are the bluish-gray, which is the age relationship suggested by topography. That'd be the lower unit is forming the rim with inverted stratigraphy.

The light blue-gray annulus is also the locus of most of the circumferential grabens, that Serenitatis is noted for, is in that area. And that's nothing new. But, in one place, there's a very subdued, flooded crater which seems to control a arcuate projection—or, let's say, a circular projection—of the light blue-gray out over the tan-gray mare. Most of the major wrinkle-ridge system of Serenitatis, of course, is outside the annulus of blue-gray, except locally, and one of those places was to the west of the Taurus-Littrow site. As we look in the southern portions of Serenitatis that wrinkle-ridge system does cross the contact between the blue-gray and the tan-gray. That's the light blue-gray and the tan-gray.

The impression I've had in looking at all the mare where the wrinkle-ridge systems are developed is that they're a late feature. They—at least at low sun, and sometimes even at high sun—they have very sharply defined ridges with steep slopes on either side that, in general, give me the impression that they're constructional, possibly associated with some thrusting movement.

In the vicinity of Sulpicius Gallus, there are several small craters that look like impact craters that, believe it or not, have—in my eye, anyway—orange ejecta blankets.
08 17 13+ LMP Ron says that he already commented on those, and they look very obvious to me.

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08 17 13+ LMP It's a light orange, obviously, but it's in contrast to the brown-gray of the dark mantle in the vicinity of Sulpicius Gallus. There's a good one right down there. Now, that one looks like a constructional cone that's orangish. And that's right out of a raised projection of the brown-gray dark mantle out onto the light blue-gray annulus material.

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08 17 16 06 LMP This southern and southwestern portion of Serenitatis has a general appearance of the Sculptured Hills, although the individual hills seem to be more widely spaced than around Taurus-Littrow. Once again, historically, we're passing near the landing site of Apollo 15.

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08 17 30 19 CDR My best guess after looking down there from here is that I've got the northeast chart of the lunar surface traverses and about 83.3 and Delta 5 point 5. We're right on the top of the "O" in Poppy. Looks to be about where we landed.

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08 17 30+ CDR The first thought I had about being close to Trident, I didn't think I was anywhere near that close. And, of course, when you look out there and see a big hole, you don't know how big is big when you're down there. That big hole out there might very easily could have been Poppy out at 9 o'clock.

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08 17 30+ CC Okay, Geno, from science we finally got it to where it converted to your map coordinates; and their guess was close. Their best guess, with all the data considered, is 83.2 and DN 0.1 - Delta November 0.1.

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08 17 30+ LMP That would definitely make sense, Geno north of where we put the remember, that was a little ways away. You were at the edge of the depression, and it would - move it a little.
38 17 32 11 CDR Yes, I'll buy that. That's in my scatter. And then (ORBIT) that crater, as I looked out at 9 o'clock, we landed next to was actually Poppy. Pretty sure that's that large crater.

38 19 03 43 LMP My impression from Shorty the other day, and also (ORBIT) from seeing these craters that seem to have orange - that are - around them, that look very much like impact craters from orbit, at any site - it may be if that is an alteration phenomenon, - that it's being localized around the structure created by the impact. But in this latter case, it looks as if the impact itself penetrated into a zone of that color.

38 20 49 41 CC We've got a request for a little visual observation (ORBIT) at the landing site area, having to do with orange material.

38 20 49+ CC This was triggered off by your observation of orange (ORBIT) material last rev, I guess, and possibly earlier. The idea here is to look for some craters that we've identified on photographs that are in similar geologic setting to Shorty crater and see if we can see orange material around them. We're trying to determine if the orange material at Shorty is a one-time special occasion or whether possibly it's common to the area and just never been noticed before. And we think you'll be able to determine this visually, better than any other way. So, if you can get out the orbit charts; the orbit photographs; let's see, the lunar landmark maps for the CSM, and turn to the landing site number 2 or 4 picture. And I'll show you where we think a likely point is to see craters that are similar in setting to Shorty, to look for orange material.

38 20 51 31 LMP I've made a couple passes with the binoculars over the dark mantle around Littrow already, and have seen nothing comparable with what's around Sulpicius; but let's have the examples, and we'll make a special effort on it.

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Okay. Have you got the site photo number 2 or 4?

Here it is. Stand by just 1.

Tab on it.

Which one is that, Gordo?

Number 2 of 4 of the site photos.

You can see the landing site there at - down about 4 o'clock, and the 7-kilometer crater on the centerline of the page, about a third of the way down from the top, the large bright crater there is Littrow B is the name of it.

And on the southern half of the ejecta blanket from that crater, there are several dark halo craters, which we think are in similar structure as Shorty. We think that would be a likely spot to look for orange material. Farouk has circled about four or five. They show up, say, at 4 o'clock, 7 o'clock, 8 o'clock, and 9 o'clock out about a crater diameter. In other words, a crater radius beyond the lip, roughly. And use the same camera setup, with the exception of using the 250-millimeter lens, if you can, that you're going to be setting up for as per the Flight Plan for the orbital science photos. If you can put the 250 on there; use KX as shown; and f:8, 1/250, and infinity. What we're looking for is orange material.

The craters we're seeing around Sulpicius that are orange - orangish-gray and the whole, or at least most of the crater is that way. We looked at Shorty today, and Ron said that even the little bit of orange that he saw the other day is not visible, and I'd have to agree with that. The amount of orange we saw on the surface certainly would not be comparable to what we're seeing around Sulpicius Gallus.

And in a couple of quick scans, on previous revs, of the area, the dark mantle, near Littrow, I did not notice any obvious orange-gray craters.
08 20 58+ CC We suggest that area to look for them only as a likely spot; but any evidence of craters with orange material, in the whole dark-mantle area around Littrow and the edge of Tranquility there, is worth noting and getting a picture of, if you see it. (ORBIT)

08 21 05 58 CMP I don't think there's anything there. (ORBIT)

08 21 05+ LMP Why don't you take a couple of pictures, then. (ORBIT)

08 21 05+ CMP I've got a few. (ORBIT)

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08 21 05+ CMP Okay. 5.6 at 1/250, huh? (ORBIT)

08 21 05+ CMP No, I don't either. I don't see anything comparable at all. The ones that we've been seeing the - definite orange or the light-tan stuff around are pure light ejecta blankets around them, not dark. (ORBIT)

08 21 05+ LMP I guess none of us see anything comparable to what is down by Sulpiici's. (ORBIT)

08 21 05+ LMP And no obvious color either. (ORBIT)

08 21 05+ CMP Well, they're comparable to Shorty, but they're not comparable to the ones that we've been seeing the obvious orange. (ORBIT)

08 21 05+ CDR Yes. The craters are comparable to Shorty, as Ron points out, but the color is not there. (ORBIT)

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08 23 03+ LMP Areas in the landing site where we now know there are extensive blocks of the subfloor material, particularly in the walls of the larger craters, I have the impression that those block fields, from this altitude, give a light bluish-gray appearance. (ORBIT)

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08 23 13 02 CMP We sure got to look and see if those things still look orange tomorrow. Because, yesterday, (Shorty) looked kind of orange there - on the northeast rim: but, it sure doesn't today -
09 10 56+ LMP Okay. I'm looking right down the slope of the South (ORBIT) Massif, above the slide right now - right down at the - just about the angle of the slope. And there's a very slight indentation in the slope, just opposite the maximum - the point of maximum extent of the dark - light mantle. Opposite other portions of it, though, it - there's no clear indication of any change in the direction of the Massif - front. It's very, very slight, and I'd say you'd have a hard time saying that it is a source area for the light mantle but it's - there's a slight indentation.
* * * TRANSEARTH COAST * * *

10 00 12+ LMP Hey, old. What time does the old backroom not up this morning?

10 00 12+ CC Which backroom?

10 08 12+ LMP The geology backroom, of course.

10 08 12+ CC Well, beats me. I don't know if there's anyone down there or not. Let me see if I can find out.

10 08 12+ LMP No, that's all right, Bob. I just want you to pass on a thought. I had a little trouble getting to sleep last night. And they've probably already thought of it. But it has to do with Van Sera.

10 08 12+ CC Go ahead. I'll copy it down.

10 08 12+ LMP No, just ask them if they've thought about the possibility that the - those Van Sera breccias might be the old indurated regolith over the subfloor.

10 08 12+ CC Okay; I got that.

10 08 12+ LMP That's an alternative that in the heat of battle did not occur to me at the time. It should have, and it may have occurred to some of them.

10 08 12+ CC Okay. That's as opposed to being a window through - to the - below the subfloor, which is what you suggested the other night.

10 08 12+ LMP Yes, sir. I think I like the regolith better. I think it makes sense from a lot of points of view: The size of the crater, the fact that we should have expected to see something but hadn't up to that time.

10 08 12+ LMP And the breccias were, thinking back on it, could very easily have been soil breccias and just getting coarser as you got closer to the base of the sub - to the top of the subfloor, which is what we were looking at down in the bottom of the crater.
I've been talking to Don Beaty and Dick Kruse and looking over a transcript of a science press conference we edited up. It was kind of ragged but possibly interesting summary of the science as it stands now. In response to your question of items that might help you prepare for tomorrow's press conference, I can come with you with those words any time you wish.

*** you can come up with them now.

Okay. Let's start with the LSPE. All eight charges have now been exploded, and they were all on schedule and produced excellent signals. These data were used in conjunction with the ascent stage lift-off and also its impact data, which should give us an excellent picture of the geologic structure of the outer 3 kilometers of the Moon. This little summary I'm reading right now is was written by Joel Watkins. The geophone array is functioning beautifully and we're already talking about its potential in a listening mode for study of meteorite impact frequency. We still don't have precise EP locations from Ray Batson, so the following interpretation will almost certainly be changed when we get better data and field tapes, which we will use to refine our arrival times. Bearing the above in mind, my preliminary interpretation is as follows. The low-velocity layer seems to be thicker and higher in velocity than at either Apollo 14 or 16 sites. I think this may mean that the low-velocity layer here includes dark mantle material as well as the regolith. Details of the higher velocity substrata are fuzzy, but velocities increase with depth in a way which would be consistent with a thick accumulation of lava flows. This probably represents the subfloor material. And he concludes by saying, "You guys did a great job, see you after splash." On the same subject, Dr. Kovach went a little further, and he just recently admitted to seeing evidence of two high-velocity layers, especially after the 6-pound charge was fired, that - evidence showed up. He also mentioned in his press conference yesterday that the data point allowed by the ascent-stage impact was very important - the fact that they got it in about 9
kilometers away and the - that data is right in a critical range where they see a big change in the - the percentage of - velocity change. I'm getting kind of balled up here in the words, but that data is very important because it's in - where the steep gradient of velocity change occurs. On looking through here, I guess, in summary I'll read a couple of sentences again out of the press conference. We do find evidence of lunar crust as we did in the past, but we may have to thin it considerably. We may have, in fact, have to thin it as much as to 25 kilometers instead of 60 - that they believed it was up until now. And they're thinking they may have to lower the velocity of seismic waves in the mantle, which, I guess, at last guess was around 9 kilometers per second. Now it's looking more like 7.5, and the crustal velocity is probably as low as 6.3 kilometers per second. Okay, yes. That was - that last data was really from Dr. Latham, and he was interpreting that data mainly from the S-IVB impact and readings from some of the other seismic sites. Any questions on that? I realize that this is pretty ragged. Over.

10 22 59+ LMP Oh, that's - that's great, Gordy. Did Kovach indicate his tentative depth for the second high -velocity layer?

10 22 59+ CC No. As far as the information we have here, he's just - I don't see any - the only thing I can see is he mentions we're getting a depth sample down to 3 to 4 kilometers, but that was before all the charges had gone off. So I think, as I say, he just doesn't really state that yet.

10 22 59+ LMP Yes, it's a little early. Okay, good. Sounds like what we saw in the field to a certain extent.

11 12 28 29 CC I've got an interesting little press release here. Jack Schmitt - and I'm sure all of you will be interested in, but based upon your work up on the Shorty area on the surface, the people out at Flagstaff went back and looked at the Apollo 14 250-millimeter camera frames from - and showed that it has colored frames that showed brownish and
orangish colorations on a bulbous dome in the crater Langrenus and on a 4-kilometer dark halo crater on the ejecta blanket of Theophilus. And they've made that news release today.

LMP: Very good. We may have triggered something.

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CC: Okay. As usual in these inflight news conferences, the questions that will be asked of you were prepared by correspondents covering the Apollo 17 mission at the Manned Spacecraft Center in Houston. They will be read exactly as written and in the order determined by the newsmen. The first question is for Jack Schmitt. If you, as a geologist, were coming home from a field trip on Earth, you'd be drafting a preliminary report and discussing it with fellow geologists. In terms understandable to laymen, can you summarize what you would be saying in your preliminary report about your field trip to Taurus-Littrow?

LMP: I think the thing we had hoped to accomplish at Taurus-Littrow was to look at as broad a spectrum of the history of the Moon as possible in one small area, as the concluding flight to the Apollo Program. And I think we did that. I think we did look at some of the oldest rocks that it is possible to see with our capability in the breccias of the South and North Massifs. I think we saw some intermediate-age rocks of fairly unexpected character, I believe, in the subfloor crystalline or igneous rocks, the gabbro, as we called them there. And we also understood, I think, that those rocks, in fact, had intruded into the breccias of the North Massif. We found, I believe, at the crater Van Serg, on the third EVA, that the regolith, or the garden zone, on the top of that subfloor gabbro, or the igneous rocks, was quite thick, or appears to be very thick, which is an expected result, and will—happily, those rocks will have much information about a fairly extended period of lunar erosion. And, we found that there was indeed a dark mantle over the area of—variable thickness; but, apparently, of relatively recent age, and that in turn had a light mantle of material of which we do
not yet understand, and I think that the samples are
going to have to tell that story. It may well be a
landslide that has come off the South Massif. And,
then, possibly as important as any finding, we found
that even later than that relatively young light
mantle deposit or possible avalanche - we have
alteration reminiscent of the alteration by hot
waters or hot gases on Earth, and that was the
orange - appears to be the orange soil that we found
around the crater Shorty. And, subsequently, in
orbit we started to pick up, and particularly
through Ron Evans' efforts, pick up more of the
apparent evidence of such alteration taking place in
fairly recent time on the Moon. All of those items,
I think, are extremely significant and go through
the full range of our present knowledge of lunar
history. And, a report I could write would
initially summarize that particular sequence of
events.

11 17 27+ CC Question number 2 is for Jack, again. What other
probable explanations besides volcanic origin do you
have for the orange rock and colored soil that you
found at Shorty crater?

11 17 33 02 LMP Well, they don't necessarily have to be volcanic
Gordy. I refer to them as alteration, and much of
the hydrothermal, or hot water, alteration we see on
Earth is related to recent volcanism, or ancient
volcanism; but, also, we know of that kind of
alteration of preexisting materials to take place as
a result of - of just fluids working their way up
through the Earth's crust, and I presume that such a
process is also possible on the Moon. The ones we
saw seem to be associated with areas of dark mantle
of various types, and most of the photographic
evidence we have is that those dark mantle deposits
are associated with volcanism, but it is not
necessarily proved yet, I believe, that the - the
orange soils or the alterations we've seen are
volcanic. However, the process would be a related
process, that is, one of internal origin.
The third question is for Cernan or Schmitt. Your voices are so much alike that it is unclear to some of us which one of you found the orange rock and who first spotted the layer of orange soil on the crater rim.

Jack found it. He uncovered it as he was walking on the rim, and we worked with that, and then, as I went around the crater to take the stereo base pan from within the crater, I could see alterations radially down from the rim farther beyond where we were working down to the center.

I don't think that that question of who found it is as specifically as important as that we were there with the equipment and the training jointly to not only recognize that but to take advantage of having recognized it, and I hope that we did.

---

Question II is for Jack. Do you think the United States waited too long to send a geologist to the Moon?

We're grinning because I think we predicted that question. Gordy, I think the United States waited too long to go into space in the first place, and I think they're probably going to wait too long to go back. I will always feel that way no matter who goes or what qualifications he may have or may think he has. I think that the most important thing that maybe I have done is to - to be able to show that we can build a transportation system that allows you to fly people of a wide variety of disciplines. And I think that we have shown that, and I think that it's occurred at about as soon as possible within the Apollo Program.

*** END OF TRANSCRIPT ***
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