



APOLLO 11 VOICE TRANSCRIPT
PERTAINING TO THE GEOLOGY OF THE LANDING SITE

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Pertaining to the geology of the landing site

by

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INTRODUCTION

On July 20, 1969, America's Eagle touched down in southwestern Mare Tranquillitatis beginning man's firsthand exploration of the moon. This document is an edited record of the conversations between astronauts Neil Armstrong and Edwin "Buzz" Aldrin, Jr., at Tranquility Base, and Bruce McCandless at Mission Control in Houston during the approximately 22 hours spent on the lunar surface. It includes additional commentary during their return to Earth. It is a condensation hopefully of all the verbal data having geological 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 supplementary remarks essential to the continuity of events during the mission. We have deleted the words of mechanical housekeeping and engineering data, attempting not to lose the personal and philosophical aspects of this intensely human experience.

The sources of this verbal transcript are the complete audio tapes recorded during the mission and the Technical Air-to-Ground Voice Transcription published by NASA. The voice record is listed chronologically given in days, hours, minutes, and seconds. These are the Ground Elapsed Times (GET) after launch from Kennedy Space Center which was 9:32 a.m. EDT on July 16, 1969.

Figure 1 shows the vicinity of the landing site that was described, sampled, and photographed by the Apollo 11 crewmen.

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GLOSSARY OF TERMS, ABBREVIATIONS, ACRONYMS, AND SYMBOLS

ASTRONAUT CREW

CC	Capsule Communicator ("Houston"), Bruce McCandless
CDR	Mission Commander, Neil Armstrong
LMP	Lunar Module Pilot, Edwin "Buzz" Aldrin
CMP	Command Module Pilot, Michael Collins
Cat's Paw	Landmark craters near the landing site
Big V	Landmark craters near the landing site
Bulk Sample (BULK)	Bag of soil and rocks collected approximately one hour after start of EVA
Core	Drive tube coring device for collecting soil samples
CSC	Closeup Stereo Camera for photographing 60-sq.-cm area of lunar surface
CSM	Command and Service Module, Command Module, "Columbia"
Contingency Sample (CONT)	Bag of soil and rocks collected early in the EVA
Documented Sample (DOC)	Planned for on EVA but became "Selected Sample" due to time constraints
DPS	Descent Propulsion System - rocket engine beneath LM
EASEP	Early Apollo Scientific Experiment Package
EVA	Extravehicular Activity; astronaut activity outside the LM
GET	Ground Elapsed Time - since launch from Earth (days-hrs-mins-secs)
LM	Lunar Module, "Eagle"
LR Cubed (LRRR)	Laser Ranging Retroreflector
MESA	Modularized Equipment Stowage Assembly
PHO	Photographic reference in transcript

GLOSSARY CONT'D.

PSE, PSEP	Passive Seismic Experiment
SAMP	Sample reference in transcript
SEQ	Scientific Equipment Bay
Solar Wind, SWC	Solar-Wind Composition experiment
SRC	Sample Return Container
Strut	One of four legs on the LM
Plus-Z Strut	Forward leg on which the ladder is mounted
Minus-Z Strut	Rear leg of LM
Plus-Y Strut	Right leg of LM
Minus-Y Strut	Left leg of the LM
Tranquility Base	Lunar Module landing site in Mare Tranquillitatis
Quad	One of four sides of LM descent stage, labeled I-IV
Skirt	Bell-shaped housing around descent engine beneath LM
***	Garbled or clipped transmission
- - -	Deletions between statements of statements that are not geologically relevant
-	Pause by speaker
- -	Interruption by another speaker, or abrupt termination of a recording
(words)	Explanation of words probably said that were garbled during transmission
(words?)	Explanation of words possibly said that were garbled during transmission

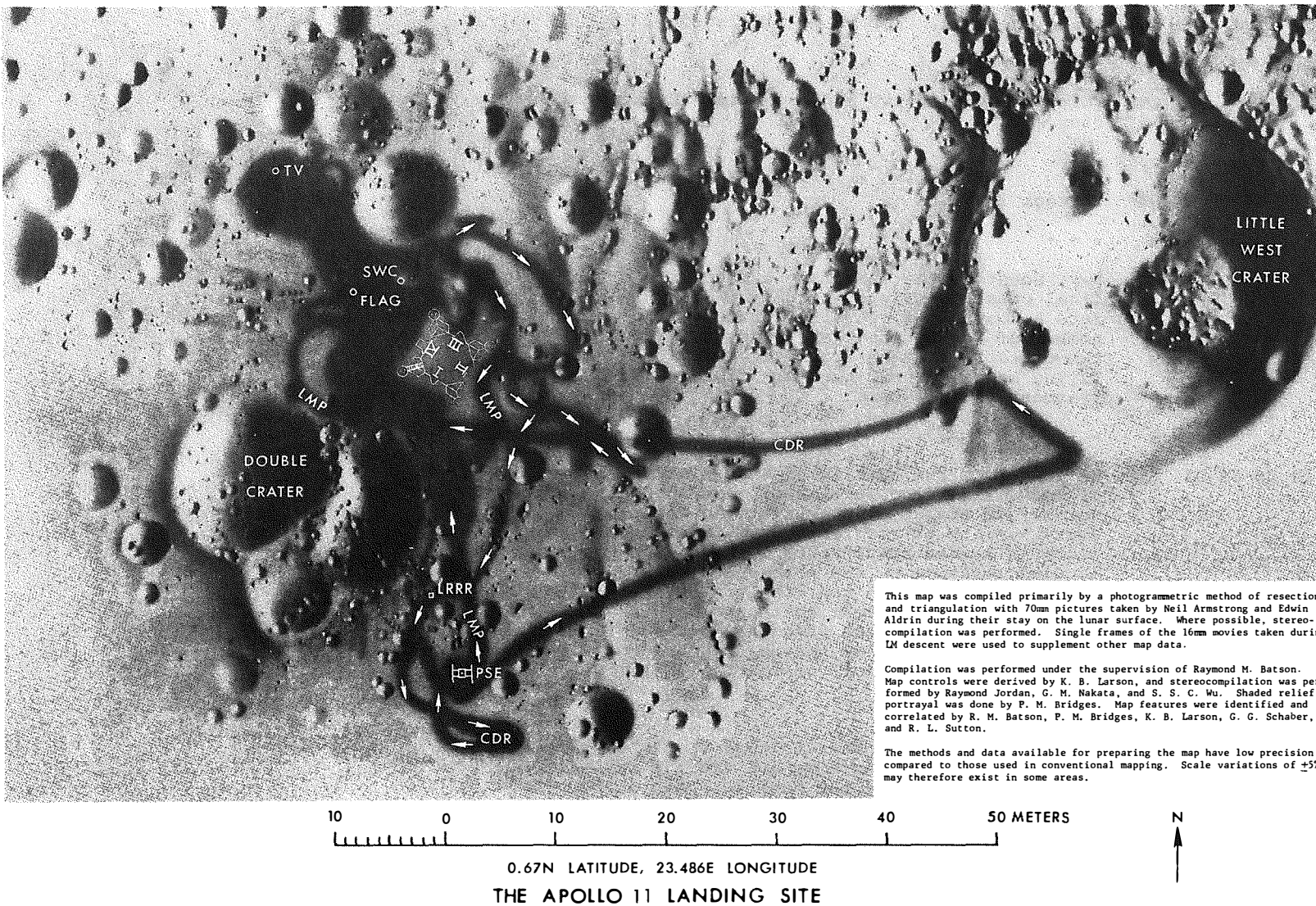


Figure 1. Apollo 11 landing site showing LM location and area traveled by astronauts during EVA.

* * * * DESCENT AND LM WINDOW DESCRIPTION * * * *

04 06 42 10 CC Eagle, Houston. You're go for landing.
- - -

04 06 45 17 LMP Forty feet, down two and one-half. Picking up some dust.
- - -

04 06 45 40 LMP Contact light.
- - -

04 06 55 16 CDR Hey, Houston, that may have seemed like a very long final phase. The auto targeting was taking us right into a football-field sized crater, with a large number of big boulders and rocks for about one or two crater diameters around it, and it required *** flying manually over the rock field to find a reasonably good area.
- - -

04 06 56 02 LMP We'll get to the details of what's around here, but it looks like a collection of just about every variety of shape, angularity, granularity, about every variety of rock you could find. The colors - well, it varies pretty much depending on how you're looking relative to the zero-phase point. There doesn't appear to be too much of a general color at all. However, it looks as though some of the rocks and boulders, of which there are quite a few in the near area, it looks as though they are going to have some interesting colors to them.
- - -

04 07 02 03 CDR Houston, the guys that said that we wouldn't be able to tell precisely where we are are the winners today. We were a little busy worrying about program alarms and things like that in the part of the descent where we would normally be picking out our landing spot; and aside from a good look at several of the craters we came over in the final descent, I haven't been able to pick out the things on the horizon as a reference as yet.

04 07 02 41 CC Roger, Tranquillity. No sweat. We'll figure it out.

- - -

04 07 03 55 CDR The area out the left-hand window is a relatively level plain cratered with a fairly large number of craters of the 5 to 50-foot variety, and some ridges 20, 30 feet high I would guess, and literally thousands of little 1- and 2-foot craters around the area. We see some angular blocks out several hundred feet in front of us that are probably 2 feet in size and have angular edges. There is a hill in view, just about on the ground track ahead of us. Difficult to estimate, but might be a half a mile or a mile.

- - -

04 04 05 01 CMP Sounds like it looks a lot better than it did yesterday at that very low sun angle. It looked rough as a cob then.

04 07 05 11 CDR It really was rough, Mike, over the targeted landing area. It was extremely rough - cratered, and large numbers of rocks that were probably larger than five or ten feet in size.

04 07 05 32 CMP When in doubt, land long.

04 07 05 38 CDR That's what we did.

- - -

04 07 12 44 CDR I'd say the color of the local surface is very comparable to that we observed from orbit at this sun angle, about 10 degrees sun angle, or that nature. It's pretty much without color. It's gray, and it's a very white, chalky gray, as you look into the zero-phase line; and it's considerably darker gray, more like ashen gray as you look out 90 degrees to the Sun. Some of the surface rocks in close here that have been fractured or disturbed by the rocket engine plume are coated with this light gray on the outside; but where they've been broken, they display a very dark gray interior; and it looks like it could be country basalt.

* * * * EVA * * * *

04 13 07 33 CDR The hatch is coming open.

- - -

04 13 19 16 CDR Okay. Houston, I'm on the porch.

- - -

04 13 22 00 CC We're getting a picture on the TV.

- - -

04 13 22 48 CC Okay. Neil, we can see you coming down the ladder now.

- - -

04 13 23 38 CDR I'm at the foot of the ladder. The LM footpads are only depressed in the surface about 1 or 2 inches, although the surface appears to be very, very fine grained as you get close to it. It's almost like a powder. Down there, it's very fine.

04 13 23 13 CDR I'm going to step off the LM now.

04 13 24 48 CDR That's one small step for man, one giant leap for mankind.

04 13 24 48 CDR Yes, the surface is fine and powdery. I can kick it up loosely with my toe. It does adhere in fine layers like powdered charcoal to the sole and sides of my boots. I only go in a small fraction of an inch, maybe an eighth of an inch, but I can see the footprints of my boots and the treads in the fine, sandy particles.

04 13 25 30 CC Neil, this is Houston. We're copying.

04 13 25 45 CDR There seems to be no difficulty in moving around, as we suspected. It's even perhaps easier than the simulations at one-sixth g that we performed in the various simulations on the ground. It's virtually no trouble to walk around. The descent engine did not leave a crater of any size. It has about 1 foot clearance on the ground. We're essentially on a very level place here. I can see some evidence of rays emanating from the descent engine, but a very insignificant amount.

- - -

04 13 27 13 CDR It's quite dark here in the shadow and a little hard
for me to see that I have good footing. I'll work
my way over into the sunlight here without looking
directly into the Sun.
- - -

04 13 28 17 CDR Looking up at the LM, I'm standing directly in the
shadow now looking up at Buzz in the windows. And I
can see everything quite clearly. The light is
sufficiently bright, backlighted into the front of
the LM, that everything is very clearly visible.
- - -

04 13 30 53 CDR I'll step out and take some of my first pictures
here. (PHO 40 5850-58)

04 13 31 05 CC Roger. Neil, we're reading you loud and clear. We
see you getting some pictures and the Contingency
Sample.

04 13 32 19 CC Neil, this is Houston. Did you copy about the
Contingency Sample?

04 13 32 26 CDR Roger. I'm going to get to that just as soon as I
finish these picture series. (PHO 40 5850-58)

04 13 33 25 LMP Okay. Going to get the Contingency Sample there,
Neil.

04 13 33 27 CDR Right.

04 13 33 58 LMP Okay. The Contingency Sample is down and it's up -
(sampled?). Looks like it's a little difficult to
dig through the (surficial?) crust there. (SAMP CONT 10010-11;10017-33)

04 13 34 12 CDR This surface is very interesting. It's a very soft
surface, but here and there where I (played) with the
Contingency Sample collector, I run into a very hard
surface. But it appears to be very cohesive material
of the same sort. I'll try to get a rock in here.
Just a couple. (SAMP CONT 10010-11;10017-33)
- - -

04 13 34 56 CDR It has a stark beauty all its own. It's like much of the high desert of the United States. It's different but it's very pretty out here. Be advised that a lot of the rock samples out here, the hard rock samples, have what appear to be vesicles in the surface. Also, I am looking at one now that appears to have some sort of phenocrysts.

- - -

04 13 35 43 LMP Okay. The handle is off the (Contingency Sampler.) It pushes in about 6, 8 inches into the surface. (Looks) like it's pretty easy to (push in.) (SAMP CONT 10010-11;10017-33)

04 13 35 56 CDR Yes, it is. I'm sure I could push it in farther, but it's hard for me to bend down further than that. (SAMP CONT 10010-11;10017-33)

- - -

04 13 37 08 CDR Contingency Sample is in the pocket. (SAMP CONT 10010-11;10017-33)

- - -

04 13 37 40 LMP Okay. I have got the cameras on at one frame a second. (PHO 16MM)

- - -

04 13 41 28 LMP Okay. Now I want to back up and partially close the hatch. Making sure not to lock it on my way out. (PHO 40 5862-63;5866-69)

- - -

04 13 43 08 CDR That's a good step. About a 3-footer. (PHO 40 5869)

04 13 43 16 LMP Beautiful view!

04 13 43 18 CDR Isn't that something! Magnificent sight out here.

04 13 43 24 LMP Magnificent desolation.

- - -

04 13 44 07 LMP Very, very fine powder, isn't it?

04 13 44 09 CDR Isn't it fine?

04 13 44 11 LMP Right in this area I don't think there's much of any (thing but) fine powder. Some of (it) clods together, and it's hard to tell whether it's a clod or a rock.

04 13 44 23 CDR Notice how you can kick it out.

04 13 44 28 LMP Yes. And it bounces and then -

04 13 44 55 LMP Reaching down is fairly easy. Get my suit dirty at this stage.

- - -

04 13 45 30 LMP There's a slight tendency, I can see now, to (fall?) backwards *** due to the soft, very soft texture.

04 13 45 45 CDR You're standing on a rock, a big rock there now.

04 13 46 01 LMP This pad sure didn't (penetrate much?)

04 13 46 05 CDR No. It didn't.

04 13 46 08 LMP There's absolutely no crater there at all from the engine.

04 13 46 10 CDR No.

- - -

04 13 47 04 LMP Can't say too much for the visibility right here without the visor up. Pretty dark. It looks like here's the surface of a rounded rock. Incidentally, these rocks have a very powdery surface, ***

04 13 47 45 LMP I say that the rocks are rather slippery.

04 13 47 52 LMP A powdery surface when it's on there. Fill up all the very little fine pores. You tend to slide over it rather easily.

04 13 48 25 LMP Traction seems quite good. ***

04 13 48 30 LMP I'm about to lose my balance in one direction and recovery is a quite natural and very (process?). And, moving your arms around, Jack, doesn't *** off the surface *** not quite that light-footed.

- - -

04 13 49 37 LMP And, Neil, didn't I say we might see some purple rock?

04 13 49 42 CDR Find a purple rock?

04 13 49 44 LMP Yes. Very small, sparkly fragments are *** (the rock especially strong) in places. I would make a first guess of some biotite. I will leave that to the further analysis.

04 13 50 28 LMP Soil compacts underneath. You don't sink down more than a quarter of an inch.

04 13 50 59 CDR Okay, Houston. I'm going to change lenses on you.

04 13 51 05 CC Roger, Neil.

04 13 51 30 CDR Okay, Houston. Tell me if you're getting a new picture.

04 13 51 35 CC Neil, this is Houston. That's affirmative. We're getting a new picture. You can tell it's a longer focal length lens. And for your information, all LM systems are go.

- - -

04 13 52 19 LMP Neil is now unveiling the plaque (on the landing) gear.

- - -

04 13 52 40 CDR For those who haven't read the plaque, we'll read the plaque that's on the front landing gear of this LM. First there's two hemispheres, one showing each of the two hemispheres of the Earth. Underneath it says, "Here man from the planet Earth first set foot upon the Moon, July 1969 A. D. We came in peace for all mankind." It has the crew members' signatures and the signature of the President of the United States.

04 13 53 35 CDR Ready for the camera? I'll get it.

04 13 53 38 LMP No, you take this TV on out.

- - -

04 13 54 07 LMP The surface material is powdery. I don't know how good your lens is, but if you can (see the) smudges on my gloves. Very much like a very finely powdered carbon, but pretty sooty looking.

- - -

04 13 56 51 CDR Something interesting in the bottom of this little crater here - it may be -

- - -

04 13 57 33 LMP Forty, fifty feet. Why don't you turn around and let them get a view from there and see what the field of view looks like?

- - -

04 13 58 06 LMP Houston. How's that field of view going to pick up the MESA (from that) far away?

04 13 58 20 CC Neil, this is Houston. The field of view is okay. We'd like you to aim it a little bit more to the right.

- - -

04 13 58 40 CC A little bit too much to the right. Can you bring it back left about 4 or 5 degrees?

04 13 58 50 CC Okay. That looks good Neil.

04 13 58 55 CDR Okay, now. Do you think I ought to be farther away, or closer?

04 13 59 01 LMP Can't get too much further away.

04 13 59 05 CDR Let's try it like that for a while. I'll get a couple of panoramas with it, here.

04 13 59 13 CC Roger. You look okay as far as distance goes, Neil. And we'll line you up again when you finish the panorama. Now you're going too fast on the panorama sweep. You're going to have to stop, or -

04 13 59 28 CDR I haven't set it down yet. That's the first picture in the panorama right there.

04 13 59 40 CDR That's taken just - about north, northeast.

- - -

04 13 59 58 CDR Okay. I'm going to move it.

04 14 00 10 CC Okay. There's another good one.

04 14 00 23 CC Okay. We got that one.

04 14 00 29 CDR Okay. Now, this one is right down sun, straight west. And I want to know if you can see an angular rock in the foreground, sticking up out of the soil.

04 14 00 41 CC Roger. We have a large angular rock in the foreground, and it looks like a much smaller rock a couple of inches to the left of it.

04 14 00 52 CDR Right. And then on beyond it about 10 feet is an even larger rock that's very rounded. That rock is the closest one to you - is sticking out of the sand about 1 foot. It's about a foot and a half long, and it's about 6 inches thick, but it's standing on edge.

- - -

04 14 01 33 CC We've got this view, Neil.

04 14 01 42 CDR This is straight south.

04 14 01 45 CC Roger. And we see the shadow of the LM.

04 14 01 48 CDR Roger. The little hill just beyond the shadow of the LM is a pair of elongate craters probably the pair together is 40 feet long and 20 feet across, and they're probably 6 feet deep. We'll probably get some more work in there later.

04 14 02 20 CC Roger. We see Buzz going about his work.

04 14 02 22 CDR How's that for a final?

04 14 02 26 CC For a final orientation, we'd like you to come left about 5 degrees.

04 14 02 36 CC Now back to the right about half as much.

04 14 02 53 CC Okay. That looks good there, Neil.

04 14 03 20 LMP Okay. You can make a mark, Houston. (Solar Wind) deployed. (PHO 40 5872-73)

04 14 03 24 CC Roger. Solar Wind.

- - -

04 14 04 05 LMP Some of these small depressions (are pretty soft) and you tend to sink - oh, maybe 2 or 3 inches. I can see exactly what the Surveyor pictures showed when they pushed away a little bit, because force is transmitted through the upper surface of the soil, and about 5 or 6 inches away, it breaks loose and moves as if it were caked on the surface, when in fact it really isn't.

04 14 04 43 CDR I noticed in the soft spots where we had footprints nearly an inch deep that the soil is very cohesive and it will retain a slope of probably 70 degrees on the side of the footprints.

- - -

04 14 09 43 CC Yes, indeed. They've got the flag up now and you can see the stars and stripes on the lunar surface.

(PHO 40 5874-75)

- - -

04 14 20 06 LMP Houston, it's very interesting to note that when I kick my foot *** material *** with no atmosphere here in this gravity *** they seem to leave, and most of them have about the same angle of departure and velocity. From where I stand, a large portion of them will impact at a certain distance out or several ***. There is a percentage of course, that will impact different ranges out, so it's highly dependent upon the initial trajectory upward. Determines where most of the *** the majority of the particles come down *** strike the terrain.

- - -

04 14 21 24 LMP I've noticed several times in going from the sunlight into the shadow, that just as I go in, I catch an additional reflection off the LM *** along with the reflection off my face onto the visor, makes visibility very poor just at the transition (from) sunlight into the shadow. I essentially have so much glare coming onto my visor, that when *** my helmet actually gets the shadow. Then it takes a short while for my eyes to adapt to the lighting conditions. *** inside the shadow area, visibility, as we said before, is not too great, but with both visor's up (we can tell?) what sort of footprints we have and the general condition of the soil. Then, after being out in the sunlight a while, it takes - watch it, Neil! Neil, you're on the cable.

- - -

04 14 23 32 LMP The blue color of my boots has completely disappeared now into this *** still don't know exactly what color to describe this other than grayish cocoa color. Appears to be covering most of the lighter part of the boot *** color that *** very fine particles, ***.

- - -

04 14 28 22 LMP As I look around the area, the contrast, in general, is wiped out completely by virtue of the shadow ***. Looking down sun, zero phase, very light gray colored, a halo around my own shadow, around the shadow of my helmet. Then, as I look off across Sun the contrast becomes strongest, in that the surrounding color is still fairly light. As you look down into the Sun (with) the larger amount of *** shadowed areas looking toward us, the general color of the *** is darker than cross sun; the contrast is not as great. Surveying all the dusty area that we've kicked up *** considerably darker in texture. Now, I've kicked up one, and I imagine that this has been *** now by certain impact *** Surveyor. The same is true when I survey across Sun - along the area that we've been walking, in general due to the fact that there are footprints there. General terrain where I've been kicking up a lot of this surface material is generally of a darker contrast, I mean color.

04 14 31 29 LMP The panorama I'll be taking is about 30 or 40 feet out (from the) plus-2 strut. (PHO 40 5881-91)

04 14 31 48 LMP And right in this area, there are two craters. The one that's right in front of me now as I look off in about the eleven o'clock position from the spacecraft, about 30 to 35 feet across. And several rocks to boulders 6, 8 inches across *** many sizes.

04 14 34 13 LMP I'm now in the area of the minus-Y strut taking some more, extra photographs. (PHO 40 5892-96)

04 14 35 52 LMP How's the Bulk Sample coming, Neil? (SAMP BULK 10044-50;10056-59)

04 14 35 56 CDR Bulk Sample is just being sealed.

- - -

04 14 36 58 CMP Houston, Columbia.

04 14 37 01 CC Columbia, this is Houston. Go ahead. Over.

04 14 37 09 CMP Roger. No marks on the LM that time. I did see a suspiciously small white object where the coordinates are -

04 14 37 25 CC Go ahead with the coordinates on the small white object.

04 14 37 28 CMP E.3, 7.6 but I'm not sure of the coordinates; it's right on the southwest rim of a crater. I think they would know it if they were in such a location. It looks like their LM would be pitched up at quite a degree; it's on the southwest wall of a small crater.

- - -

04 14 40 18 LMP I say the jets deflector that's mounted on Quad 4 - the surface of it seems to be more wrinkled than the one that's on Quad 1. Generally, underneath part of the LM seems to have stood up quite well to the (landing?). Get some pictures in the aft part of the LM that will illuminate the thermal effects much better than we could get them up here in the front.

- - -

04 14 40 58 LMP We're going to get some particular photographs of the Bulk Sample area, Neil? (PHO 40 5914-16)

04 14 41 07 CDR Okay.

- - -

04 14 43 18 LMP Let's get the panorama now. (PHO 40 5905-16)

04 14 43 22 CDR Okay.

- - -

04 14 47 18 LMP It's very surprising, the lack of penetration of all four of the foot pads. I'd say if we were to try and determine just how far below the surface they would have penetrated, you'd measure 2 or 3 inches, wouldn't you say, Neil?

04 14 47 37 CDR At the most, yes. That Y-strut there is probably even less than that.

- - -

04 14 48 04 LMP I'll get a picture of the plus-Y strut taken from near the descent stage, and I think we'll be able to see a little bit better what the thermal effects are. Seem to be quite minimal. (PHO 40 5917-20)

04 14 48 48 LMP There's one picture taken in the right rear of the spacecraft looking at the skirt of the descent stage, shows a slight darkening of the surface color, a rather minimal amount of radiating or etching away or erosion of the surface. On descent, both of us remarked that we could see a large amount of very fine dust particles moving out. It was reported beforehand that we would probably see an outgassing from the surface after actual engine shutdown, but as I recall I was unable to verify that. (PHO 40 5921-22)

- - -

04 14 51 29 LMP We're back at the minus-Z strut now. The stereo pair we're taking of it (shows the?) very little force of impact that we actually had. (PHO 40 5925-26)

04 14 52 01 LMP And, Neil, if you'll take the camera, I'll get to work on the SEQ Bay.

- - -

04 14 52 20 LMP Taking some close-up pictures of that rock. (PHO CSC 45-6709)

- - -

04 14 55 42 LMP Houston, the Passive Seismometer has been deployed manually.

04 14 56 30 LMP And the manual deployment of the LR Cubed, the little spring that is at the end of the string is pulled off of the pip-pin. However, I was able to reach up and get hold of the pip-pin and pull it loose. So, it will be deployed manually, also.

04 14 57 05 CDR And, the panorama is complete, is - got the LM at 7:30 position at about 60 feet. (PHO 40 5930-41)

- - -

04 14 57 50 LMP Have you got us a good area picked out?

04 14 57 53 CDR Well, I think right out on that rise out there it's probably as good as any.

04 14 58 08 CDR I'll probably stay on the high ground there and - -

04 14 58 16 LMP Watch it; the edge of that crater is - drops - - (PHO 40 5942-44)

04 14 58 19 CDR Yes. It drops off there, doesn't it?

04 14 58 24 LMP Get a couple of close-ups on these quite rounded large boulders. (PHO CSC 45-6710-13)

04 14 58 44 CDR About 40 feet out - I'd say out to the end of that next - -

04 14 58 50 LMP It's going to be a little difficult to find a good level spot here.

04 14 58 55 CDR The top of that next little ridge there. Wouldn't that be a pretty good place?

04 14 59 03 LMP Should I put the LR Cubed right about here? (PHO 40 5945)

04 14 59 07 CDR All right.

04 14 59 10 LMP I'm going to have to get on the other side of this rock here.

04 14 59 19 CDR I would go right around the crater to the left there. Isn't that a level spot there?

04 14 59 25 LMP I think this right here is just as level.

04 15 00 00 CDR These boulders look like basalt, and they have probably 2 percent white minerals in them, white crystals. And the thing that I reported as vesicular before, I don't believe I believe that any more. I think that small craters - they look like little impact craters where B-B shot has hit the surface.

04 15 02 08 LMP Houston. I have the seismic experiment flipped over now, and I'm aligning it, but I'm having a little bit of difficulty getting the b-b in the center. It wants to move around and around on the outside. (PHO 40 5946-49)

04 15 02 49 LMP Roger. I say I'm not having too much success in leveling the PSE experiment.

04 15 03 57 CDR The laser reflector is installed and the bubble is leveled and the alignment appears to be good. (PHO 40 5952)

- - -

04 15 07 02 CC Buzz, this is Houston. I understand that you did successfully deploy both solar arrays.

04 15 07 10 LMP Roger. That's affirmative. And there isn't any way of telling whether that's lined up. I'm getting in the way; maybe I can get down here.

- - -

04 15 08 15 CC Roger. We've been looking at your consumables, and you're in good shape. Subject to your concurrence we'd like to extend the duration of the EVA 15 minutes from nominal. We will still give Buzz a hack at 10 minutes for heading in. Your current elapsed time is 2 plus 12.

- - -

04 15 09 07 CC Buzz, this is Houston. If you're still in the vicinity of the PSE, could you get a photograph of the ball level? (PHO 40 5953)

04 15 09 16 CDR I'll do that, Buzz. (PHO 40 5953)

04 15 09 18 LMP Right. We'll get a photograph of that. Houston, what time would you estimate we could allow for the Documented Sample? (PHO 40 5953)

04 15 09 43 CDR Would you believe the ball is right in the middle now?

04 15 09 50 LMP Wonderful. Take a picture before it moves. (PHO 40 5953)

04 15 10 00 CC Neil, this is Houston. We're estimating about 10 minutes for the Documented Sampling.

- - -

04 15 11 15 CC Buzz, this is Houston. You've got about 10 minutes left now prior to commencing your EVA termination activities.

- - -

04 15 12 32 CC Tranquillity Base, this is Houston. The Passive Seismic Experiment has been uncaged and we're observing short-period oscillations in it.

04 15 15 13 LMP I hope you're watching how hard I have to hit this into the ground, to the tune of about 5 inches. Houston. (SAMP CORE 10005) (PHO 40 5963-64)

04 15 15 35 LMP It almost looks wet. (SAMP CORE 10005)

04 15 15 46 CDR Got a sample.

04 15 15 57 LMP Wait a minute. Wait a minute, you got the cable
again.
- - -

04 15 16 13 CC Neil, this is Houston. We'd like you all to get two
core tubes and the Solar Wind Experiment; two core
tubes and the Solar Wind.

04 15 16 51 LMP Okay. While I'm getting the next one, maybe you can (SAMP CORE 10004)
- square away the box a little bit ***

04 15 18 04 CC Buzz, this is Houston. You have approximately 3
minutes until you must commence your EVA termination
activities.
- - -

04 15 18 59 LMP Houston, were you able to record in a documentary (SAMP CORE 10004;10005)
way where the two core tube samples were taken?

04 15 19 12 CC Negative.

04 15 19 19 CDR I didn't get a stereopair of those two, but they are (PHO 40 5967-70)
right in the vicinity of the Solar Wind.

04 15 19 29 CC Neil, this is Houston. After you've got the core
tubes and the Solar Wind, anything else that you can
throw into the box would be acceptable.

04 15 19 44 CDR Righto.

04 15 20 01 LMP I got the cap.

04 15 20 03 CDR Got the cap?

04 15 20 04 LMP They've both got caps on them now.

04 15 20 07 LMP And, you want to pick up some stuff, and I'll move
the Solar Wind in.

04 15 20 09 CDR Get these aseptic ones.

04 15 21 05 CC Buzz, this is Houston. It's about time for you to
start your EVA closeout activities.
- - -

04 15 22 20 CC Neil and Buzz, this is Houston. We'd like to remind
you of the closeup camera magazine before you start
up the ladder, Buzz.

04 15 22 30 LMP Okay. Got that over with you, Neil?

04 15 22 34 CDR No, the closeup camera is underneath the MESA. I'll
have to pick it up with the tongs, I'm picking up
several pieces of really vesicular rock out here
now. (SAMP DOC 10060-75)

04 15 22 53 LMP You didn't get anything in those Environmental
Samples, did you? (SAMP)

04 15 22 56 CDR Not yet. (SAMP)

04 15 22 59 LMP Well, I don't think we'll have time. (SAMP)

04 15 23 07 CC Roger, Neil and Buzz. Let's press on with getting
the closeup camera magazine and closing out of the
Sample Return Container. We're running a little low
on time.

- - -

04 15 27 23 LMP Okay. I'm heading on in.

- - -

04 15 37 35 CDR And we got about, I'd say 20 pounds of carefully
selected, if not documented, samples. (SAMP DOC 10060-75)

- - -

* * * * POST-EVA * * * *

04 15 39 13 LMP Okay. The hatch is closed and latched, and verified secure.
- - -

04 16 20 56 CDR Roger, Houston. Tranquillity Base. We're in the process of using up what film we have, and I'm just getting ready to change the primary ECS canister. (PHO)
- - -

04 16 21 31 CDR We've probably got another half an hour's worth of picture taking, an eat cycle and then change the canister and then depress. (PHO)
- - -

04 18 33 06 CC Tranquillity, this is Houston. We also have a set of about 10 questions relating to observations you made, things you may have seen during the EVA. You can either discuss a little later on this evening or sometime later in the mission at your option. How do you feel?

04 18 33 35 CDR I guess we can take them up now.

04 18 33 39 CC I'll put Owen on with the questions.

04 18 33 59 CC Tranquillity, Houston. First question here is - your best estimate of the yaw of the LM as compared to the nominal preflight plan.

04 18 34 16 LMP We got 13 degrees left on the ball, and I think that's probably about right. Looking at the shadow and so on, probably about 13 degrees left of the shadow.

04 18 34 31 CC Roger. That's 13 degrees left of the shadow. And, next question relates to the depth of the bulk sampling that you obtained near the first part of the EVA and any changes in composition that you might have observed during the bulk sampling interval. (SAMP BULK 10044-50;10056-59)

04 18 35 02 CDR I'm not sure I understand that question, but we got a good bit of the groundmass in the Bulk Sample plus a sizable number of selected rock fragments of different types. (SAMP BULK 10044-50;10056-59)

04 18 35 22 CC Roger, Neil. One of the implications here is the depth from which the Bulk Sample was collected. Did you manage to get down there several inches or nearer the surface? (SAMP BULK 10044-50;10056-59)

04 18 35 37 CDR We got some down from as much as 3 inches in the area where I was looking at variation with depth in the Bulk Sample. There really wasn't appreciable difference, and I didn't run into any hard bed. Later on, or at some other times and other areas why, I'd get down just a short distance, an inch or two, and couldn't go any further. (SAMP BULK 10044-50;10056-59)

04 18 36 06 CC Roger. Believe we understand down as deep as 3 inches, did not hit any hard bed, and no significant changes in composition to that depth. Next question, the second SRC was packed rather hurriedly due to the time limitation, and wonder if you would be able to provide any more detailed description of the samples which were included in the second SRC. (SAMP BULK 10044-50;10056-59)

04 18 36 40 CDR We got two core tubes and Solar Wind and about half of the big sample bag full of assorted rocks which I picked up hurriedly from around the area. I tried to get as many representative types as I could. (SAMP CORE 10004; 10005)

04 18 37 09 CC Roger, Neil. Next topic here relates to the rays which emanate from the DPS engine burning area. We're wondering if the rays emanating from beneath the engine are any darker or lighter than the surrounding surface.

04 18 37 42 LMP The ones that I saw back in the aft end of the spacecraft appeared to be a good bit darker; of course, viewed from the aft end, why they did have the Sun shining directly on them. It seemed as though the material had been baked somewhat and also scattered in a radially outward direction, but in that particular area, this feature didn't extend more than about 2, maybe 3 feet, from the skirt of the engine. (PHO 40 5921)

04 18 38 24 CC Roger. Understand that near the aft end out to the east that the rays did appear darker. I understand, Buzz, that this was the appearance of the material which had been uncovered by the rays that appeared darker for 2 or 3 feet extending outward. Is that correct?

04 18 38 49 LMP No. I wouldn't say it was necessarily material that had been uncovered. I think some of the material might have been baked or in some way caused to be more cohesive and perhaps flow together in some way, I don't know. Now, in other areas, before we started trampling around out front, why we could see that small erosion had taken place in a radially outward direction, but it had left no significant mark on the surface other than just having eroded it away. Now, it was different back in right under the skirt itself. It seems as though the surface had been baked in a streak fashion, and I think a couple of pictures on film will show this. But that didn't extend out very far. (PHO 40 5921)

04 18 39 48 CC Roger, Tranquillity. And this baked appearance that you described, at least the suggestion is that it was due to the heat of the engine at any rate.

04 18 40 01 LMP I believe so.

04 18 40 02 CC Roger. Next subject, did either of the solar panels on the PSE touch the surface of the Moon during deployment?

04 18 40 19 LMP I think that two corners did touch, since when it was deployed, both of them didn't come out at the same time. It unfolded a little unevenly, and of course, the terrain that it was on was not quite as level as I would like to have it. and I think that two corners did touch to about 1 inch - no, three-quarters to a half an inch deep; and maybe along the bottom, it might have been maybe 3 inches, leaving a small triangular coating on two of the corners; and I think these are on the western ones.

04 18 41 06 CC Roger. Understand the description there. And the next subject, on the two core tubes which you collected, how did the driving force required to collect these tubes compare? Was there any difference? (SAMP CORE 10004;10005)

- 04 18 41 27 LMP Not significantly. I could get down to about the first 2 inches without much of a problem, and then as I would pound it in about as hard as I could do it; and the second one took two hands on the hammer, and I was putting pretty good dents in the top of the extension rod, and it just wouldn't go much more than - I think the total depth might have been about 8 or 9 inches. But even there, for some reason it didn't seem to want to stand up straight. In other words, I'd keep driving it in and it would dig some sort of a hole but it wouldn't penetrate in a way that would support it and keep it from falling over, if that makes any sense at all. It didn't really to me. (SAMP CORE 10004;10005)
- 04 18 42 22 CC Roger, Buzz. I think I've got the picture. You indicate that little difference between the two samples and that in each case you got down about 2 inches without any problems and then had to continue hammering rather vigorously in order to continue driving it in to a total depth of 8 or 9 inches, and even at that point the rods did not want to stay vertical, that they'd tend to fall over on you even after pounding in that far. Is that correct? (SAMP CORE 10004;10005)
- 04 18 42 59 LMP Yes. That's about it. It wasn't a rapid change in resistive force. And also I noticed when I took the bit off that the material was quite well packed, a good bit darker, and the way it adhered to the core tube gave me the distinct impression of being moist. (SAMP CORE 10004;10005)
- 04 18 43 23 CC Roger. Understand the general impression of being moist as it packed in the core tube. Next question: we did copy your comments prior to the EVA of your general description of the area. We wonder if either of you would have any more lengthy description or more detailed description of the general summary of the geology of the area. (SAMP CORE 10004;10005)
- 04 18 44 01 LMP Yes, we'll postpone our answer to that one until tomorrow. Okay?

- - -

04 18 44 52 CC Next topic. Just after landing, you pointed out that there was a hill to the west along the plus-Z axis from the LM. Are there any large rocks in that direction that might block the solar array during the sunset - as sunset approaches in your locality - are there any large rocks that might tend to obscure the array?

04 18 45 32 LMP No. I don't believe so. I think that it's about as level as any other areas that we chose.

04 18 45 47 LMP There's nothing large, anyway, that's going to get in the way.

04 18 45 50 CC Roger. Copy. That's also the way it appeared from the television, I think. And now the final question. You commented, Neil, that on your approach to the landing spot, you had passed over a football-field-sized crater containing rather large blocks of solid rock perhaps 10 to 15 feet in size. Can you estimate the distance to this football-sized crater from your present position?

04 18 46 25 CDR I thought we'd be close enough so that when we got outside we could see its rim back there, but I couldn't. But I don't think that we're more than a half mile beyond it. That is, a half mile west of it.

04 18 46 45 CC Roger. So you estimate your present position less than half a mile approximately west of this large crater.

04 18 46 56 CDR That's correct.

04 18 46 58 CC Okay. Well, that takes care of the questions from our geologists for tonight, and unless you have something else, that'll be all from us for the evening.

- - -

05 03 10 32 CDR Houston, Tranquillity Base is going to give you a few comments with regard to the geology question of last night. We are landed in a relatively smooth crater field of circular secondary craters, most of which have raised rims irrespective of their size. That's not universally true. There are a few of the smaller craters around which do not have a discernable rim. The groundmass throughout the area is a very fine sand to a silt. I'd say the thing that would be most like it on Earth is powdered graphite. Immersed in this groundmass are a wide variety of rock shapes sizes, textures, rounded and angular, many with varying consistencies. As I said, I've seen what looked to be plain basalt and vesicular basalt. Others with no crystals, some with small white phenocrysts, maybe 1 to less than 5 percent. And we are in a boulder field where the boulders range generally up to 2 feet with a few larger than that. Now, some of the boulders are lying on top of the surface, some are partially exposed, and some are just barely exposed. And in our traverse around on the surface and particularly working with the scoop, we've run into boulders below the surface that were probably buried under several inches of the groundmass.

05 03 12 55 CC Tranquillity, Houston. Roger. Very fine description.

05 03 13 05 CDR I suspect this boulder field may have some of its origin with this large sharp-edged blocky rim crater that we passed over at final descent. Now yesterday I said that was about the size of a football field, and I have to admit it was a little hard to measure coming in. But I thought that it might just fit in the Astrodome as we came by it. And the rocks in the vicinity of this blocky rim crater are much larger than these in this area. Some are 10 feet or so and perhaps bigger, and they are very thickly populated out to about one crater diameter beyond the crater rim. Beyond that, there is some diminishing, and even out in this area the blocks seem to run out in rows with irregular patterns, and then there are paths between them where there are considerably less surface evidence of hard rocks.

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05 04 04 51 CC And you're cleared for takeoff.

05 04 05 00 CDR Roger. Understand. We're number 1 on the runway.

* * * * TRANS-EARTH COAST * * * *

05 17 17 01 CC Apollo 11, Houston. A couple of questions for the Moon walkers, if you got a second.

05 17 17 09 CDR Go ahead.

05 17 17 11 CC We're seeing some temperature rises on the Passive Seismic Experiment that are a little higher than normal and we're wondering if you could verify the deployed position. We understand it's about 40 feet from the LM in the eleven o'clock position.

05 17 17 37 CDR No. It's about in the nine or nine-thirty position, and I'd say it's about 50 or 60 feet.

05 17 17 50 CC Roger. Copy. Also, was there any indication of any dust cloud as you lifted off?

05 17 18 02 CDR Not very much. There was quite a bit of Kapton and parts of the LM that went out in all directions, usually for great distances, as far as I can tell. But I don't remember seeing anything of a dust cloud to speak of.

05 17 18 21 CC Roger. Understand all you could see was parts of the LM going out. What was your first comment?

05 17 18 35 CDR I don't remember. Just that the Kapton and other parts on the LM staging scattering all around the area for great distances, but I didn't see much dust.

- - -

06 07 33 33 CC Apollo 11, this is Houston. While you're waiting for the CSM to settle down and for us to look at the tapes on your latest maneuver, would you feel like answering some more questions with relation to the lunar surface?

06 07 33 57 CDR Go ahead, Houston.

06 07 33 59 CC Roger. For 64 thousand dollars, we're still trying to work out the location of your landing site, Tranquillity Base. We think it is located on LAM-2 chart at Juliet 0.5 and 7.8. Do you still have those charts on board?

06 07 34 24 CDR Yes. Stand by one. They're packed.

06 07 34 31 CC Roger. You may not have to unpack it. The position which I just gave you is slightly west of West crater. I guess it's about two-tenths of a kilometer west of it, and we're wondering if Neil or Buzz had observed any additional landmarks during descent, lunar stay, or ascent which would confirm or disprove this. One thing that we're wondering about is that if you were at this position, you would have seen the Cat's Paw during ascent just up to the north of your track.

06 07 35 18 CDR We were looking for the Cat's Paw, too, thinking we were probably downrange, beyond the Big V. But I think that it's likely that that might have been West crater that we went across in landing, but - stand by.

06 07 36 22 CDR We're hoping, Bruce, that our 16-mm film was working at that point in descent, and we'll be able to confirm our touchdown position. We thought that during ascent we might be able to pick up some recognizable objects close to the landing site, and we did see a number of small craters, and crater rows, and things like that, which we may be able to pick out after the fact, but we haven't been able to yet.

- - -

06 07 39 15 CC Okay, 11. Now, with respect to the Documented Sample container: on television it appeared to us as though the samples for that container were in fact being selected in accordance with some thought or consideration being given to the rocks themselves. And we were wondering if you could give any further details from memory about any of these samples, and the context of the material or the surface from which they were taken. (SAMP 10055-75;10084-85)

06 07 39 56 CDR Yes. You remember I initially started on the side of the LM that the TV camera was on, and I took a number of samples of rocks on the surface, and several that were just subsurface - about 15 to 20 feet north of the LM. And then I recalled that that area had been probably swept pretty well by the exhaust of the descent engine, so I crossed over to the southern side of the LM, and took a number of samples from the area around the elongate double crater that we commented on, and several beyond that, and tried to take as many different rock types as I could see by eye - as I could in the short time we had available. There were a number of other samples that I had seen earlier in our stroll around the LM that I had hoped to get back and pick up and put in the Documented Sample but I didn't get those, and I'll be able to comment in detail when we get in the debriefing session. (SAMP 10055-75;10084-85)

06 07 41 17 CC Roger. Did you observe any small craters with conspicuously blocky rims?

06 07 41 28 CDR Well, aside from the one big one that we went over, I guess there were none in our area. I took a stroll back after putting up the PSEP, and while Buzz was starting to unpack the Documented Samples - took a stroll back to a crater behind us that was maybe 70 or 80 feet in diameter and 15 or 20 feet deep, and took some pictures of it. It had rocks in the bottom of pretty good size, considerably bigger than any that were out on the surface, but there was no - we apparently, at 15 feet or so, had not gotten below the regolith. We were essentially showing no bedrock, at least in the walls of the crater at that depth. (PHO 40 5954-60)

TABLE 1. APOLLO 11 SAMPLE LISTING CROSS-REFERENCED TO 70 MM PHOTOGRAPHS AND GROUND ELAPSED TIMES

<u>LRL SAMPLE NO.</u>	<u>SAMPLE CLASS</u>	<u>70 MM PHOTO COVERAGE</u>	<u>TRANSCRIPT REFERENCES (GET)</u>	
10001	THE DOCUMENTED SAMPLE BOX			
10002	CHIPS & FINES, RESIDUE - BULK SAMPLE BOX			
10003	BASALT, DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10004	DRIVE TUBE, CORE 1 (2ND CORE TAKEN)	5963-64 DURING SAMPLING	04 15 15 13	04 18 41 06
10005	DRIVE TUBE, CORE 2 (1ST CORE TAKEN)		04 15 16 51	04 18 41 06
10007	RENUMBERED 10015			
10008	SOIL RESIDUE COMBINED FROM 10001 FOR BIOL. ANALYSIS			
10009	BRECCIA - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10010	SOIL RESIDUE - CONTINGENCY SAMPLE			
10011	SOIL FRACTION - DOC. SAMPLE BOX - DISTRIBUTED AS 10087			
10013	PART OF BIOL. SAMPLE FROM 10002			
10014	CHIPS - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10015	SOIL, GAS REACTION CELL (FROM 10001)			
10017	BASALT - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10018	BRECCIA - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10019	BRECCIA - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10020	BASALT - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10021	BRECCIA - CONTINGENCY SAMPLE		04 13 33 58	
10022	BASALT - CONTINGENCY SAMPLE	5777,5857 BEFORE SAMPLING	04 13 33 58	

TABLE 1 CONT'D.

<u>LRL SAMPLE NO.</u>	<u>SAMPLE CLASS</u>	<u>70 MM PHOTO COVERAGE</u>	<u>TRANSCRIPT REFERENCES (GET)</u>
10023	BRECCIA - CONTINGENCY SAMPLE	5774,5777,5857 BEFORE SAMPLING	04 13 33 58
10024	BASALT - CONTINGENCY SAMPLE		04 13 33 58
10025	BRECCIA - CONTINGENCY SAMPLE		04 13 33 58
10026	BRECCIA - CONTINGENCY SAMPLE		04 13 33 58
10027	BRECCIA - CONTINGENCY SAMPLE		04 13 33 58
10028	BRECCIA - CONTINGENCY SAMPLE	5777,5857 BEFORE SAMPLING	04 13 33 58
10029	BASALT - CONTINGENCY SAMPLE		04 13 33 58
10030	BRECCIA - CONTINGENCY SAMPLE		04 13 33 58
10031	BRECCIA - CONTINGENCY SAMPLE		04 13 33 58
10032	BASALT - CONTINGENCY SAMPLE	5774,5777,5857 BEFORE SAMPLING	04 13 33 58
10033	CHIP - CONTINGENCY SAMPLE		04 13 33 58
10034	RESIDUE - CONTINGENCY SAMPLE		
10035	RESIDUE - CONTINGENCY SAMPLE		
10036	RESIDUE FROM BIOL. SAMPLE		
10037	RESIDUE FROM BIOL. SAMPLE		
10038	RESIDUE FROM BIOL. SAMPLE		
10039	MIXED RESIDUE		
10040	MIXED RESIDUE		
10041	MIXED RESIDUE		
10042	MIXED RESIDUE		
10043	MIXED RESIDUE		

TABLE 1 CONT'D.

<u>LRL SAMPLE NO.</u>	<u>SAMPLE CLASS</u>	<u>70 MM PHOTO COVERAGE</u>	<u>TRANSCRIPT REFERENCES (GET)</u>	
10044	BASALT - BULK SAMPLE	5914-16 AFTER SAMPLING	04 14 35 52	04 18 34 31
10045	BASALT - BULK SAMPLE		04 14 35 52	04 18 34 31
10046	BRECCIA - BULK SAMPLE	5738,5853 BEFORE SAMPLING 5502,5887 AFTER SAMPLING	04 14 35 52	04 18 34 31
10047	BASALT - BULK SAMPLE		04 14 35 52	04 18 34 31
10048	BRECCIA - BULK SAMPLE		04 14 35 52	04 18 34 31
10049	BASALT - BULK SAMPLE		04 14 35 52	04 18 34 31
10050	BASALT - BULK SAMPLE		04 14 35 52	04 18 34 31
10054	RESIDUE FROM BIOL. ANALYSIS			
10055	RESIDUE - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10056	BRECCIA - BULK SAMPLE		04 14 35 52	04 18 34 31
10057	BASALT - BULK SAMPLE		04 14 35 52	04 18 34 31
10058	BASALT - BULK SAMPLE		04 14 35 52	04 18 34 31
10059	BRECCIA - BULK SAMPLE		04 14 35 52	04 18 34 31
10060	BRECCIA - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10061	BRECCIA - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10062	BASALT - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10063	BRECCIA - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10064	BRECCIA - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10065	BRECCIA - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15
10066	BASALT - DOC. SAMPLE BOX		04 15 22 34	06 07 39 15

TABLE 1 CONT'D.

<u>LRL SAMPLE NO.</u>	<u>SAMPLE CLASS</u>	<u>70 MM PHOTO COVERAGE</u>	<u>TRANSCRIPT REFERENCES (GET)</u>
10067	BRECCIA - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10068	BRECCIA - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10069	BASALT - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10070	BRECCIA - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10071	BASALT - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10072	BASALT - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10073	BRECCIA - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10074	BRECCIA - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10075	BRECCIA - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10082	BRECCIA - DOC. SAMPLE BOX		04 15 22 34 06 07 39 15
10084	SOIL FROM 10002		
10085	SOIL FROM 10002		
10086	SOIL FROM 10002		
10087	SOIL FROM 10011		
10089	BRECCIA CHIP FROM 10002		
10090	BRECCIA CHIP FROM 10002		04 14 35 52 04 18 34 31
10091	BRECCIA CHIP FROM 10002		04 14 35 52 04 18 34 31
10100	RESIDUE FROM CURATOR PROCESSING		
10101	RESIDUE FROM CURATOR PROCESSING		
10102	RESIDUE FROM CURATOR PROCESSING		
10103	RESIDUE FROM CURATOR PROCESSING		

TABLE 2. 70 MM PHOTOGRAPHS TAKEN DURING THE EVA

<u>70MM PHO. NO.</u>	<u>SUBJECT</u>	<u>LRL SAMPLE NO.</u>	<u>TRANSCRIPT REFERENCE NO.</u>
40-5847	LM WINDOW		
40-5848	LM WINDOW		
40-5849	LM WINDOW		
40-5850	PANORAMA 1 -Y STRUT		04 13 30 53
40-5851	PANORAMA 1		
40-5852	PANORAMA 1		
40-5853	PANORAMA 1	10046	
40-5854	PANORAMA 1 LM SHADOW		
40-5855	PANORAMA 1		
40-5856	PANORAMA 1		
40-5857	PANORAMA 1	10022,10023,10028,10032	
40-5858	PANORAMA 1 +Y STRUT		
40-5859	DOUBLE CRATER SW SIDE OF LM		
40-5860	DOUBLE CRATER SW SIDE OF LM		
40-5861	DOUBLE CRATER SW SIDE OF LM		
40-5862	LM INSPECTION (LMP EGRESS)		04 13 41 28
40-5863			
40-5864	DPS AREA		
40-5865	-Y FOOTPAD, LITTLE WEST CRATER		
40-5866	LMP EGRESS		04 13 41 28
40-5867	LMP EGRESS		

TABLE 2 CONT'D.

<u>70MM PHO. NO.</u>	<u>SUBJECT</u>	<u>LRL SAMPLE NO.</u>	<u>TRANSCRIPT REFERENCE NO.</u>
40-5868	LMP EGRESS		
40-5869	LMP EGRESS		04 13 43 08
40-5870	+Y FOOTPAD AREA		
40-5871	+Z STRUT		
40-5872	SOLAR WIND, LMP		04 14 03 20
40-5873	SOLAR WIND, LMP		
40-5874	FLAG		04 14 09 43
40-5875	FLAG		
40-5876	UNDISTURBED SURFACE		
40-5877	BOOTPRINT (LEFT STEREO)		
40-5878	BOOTPRINT (RIGHT STEREO)		
40-5879	ROCK BY BOOT (LEFT STEREO)		
40-5880	ROCK BY BOOT (RIGHT STEREO)		
40-5881	PANORAMA 2		04 14 31 29
40-5882	PANORAMA 2		
40-5883	PANORAMA 2		04 14 32
40-5884	PANORAMA 2 TV CAMERA		
40-5885	PANORAMA 2 FLAG, SWC		
40-5886	PANORAMA 2 FLAG, SWC, CDR, MESA		
40-5887	PANORAMA 2 -Y STRUT AREA	10046	
40-5888	PANORAMA 2		

TABLE 2 CONT'D.

<u>70MM PHO. NO.</u>	<u>SUBJECT</u>	<u>LRL SAMPLE NO.</u>	<u>TRANSCRIPT REFERENCE NO.</u>
40-5889	PANORAMA 2		
40-5890	PANORAMA 2		
40-5891	PANORAMA 2		
40-5892	DPS AREA, -Y STRUT		04 14 34 13
40-5893	-Y STRUT, ASCENT STAGE		
40-5894	SHADED LM		04 14 40 18
40-5895	+Z STRUT, SWC		
40-5896	+Z FOOTPAD		
40-5897	LM PLAQUE		
40-5898	LM PLAQUE		
40-5899	LM PLAQUE		
40-5900	LM PLAQUE		
40-5901	+Y FOOTPAD		
40-5902	LMP, +Y FOOTPAD		
40-5903			
40-5904	OUT OF FOCUS		
40-5905	PANORAMA 3		04 14 43 18
40-5906	PANORAMA 3		
40-5907	PANORAMA 3		
40-5908	PANORAMA 3		
40-5909	PANORAMA 3		

TABLE 2 CONT'D.

<u>70MM PHO. NO.</u>	<u>SUBJECT</u>	<u>LRL SAMPLE NO.</u>	<u>TRANSCRIPT REFERENCE NO.</u>
40-5910	PANORAMA 3		
40-5911	PANORAMA 3		
40-5912	PANORAMA 3		
40-5913	PANORAMA 3		
40-5914	PANORAMA 3, BULK SAMPLE AREA, AFTER SAMPLING		04 14 40 58
40-5915	PANORAMA 3, BULK SAMPLE AREA, AFTER SAMPLING		
40-5916	PANORAMA 3, BULK SAMPLE AREA, AFTER SAMPLING		
40-5917	LM INSPECTION		04 14 48 04
40-5918	LM INSPECTION		
40-5919	LM INSPECTION		
40-5920	LM INSPECTION		
40-5921	LM INSPECTION		04 14 48 48
40-5922	LM INSPECTION		
40-5923	LM INSPECTION		
40-5924	LM INSPECTION		
40-5925	LM INSPECTION (STEREO ?)		04 14 51 29
40-5926	LM INSPECTION (STEREO ?)		
40-5927	SHORT PANORAMA OF LM		04 14 54
40-5928	SHORT PANORAMA OF LM		
40-5929	SHORT PANORAMA OF LM		04 14 56
40-5930	PANORAMA 4		04 14 57 05

TABLE 2 CONT'D.

<u>70MM PHO. NO.</u>	<u>SUBJECT</u>	<u>LRL SAMPLE NO.</u>	<u>TRANSCRIPT REFERENCE NO.</u>
40-5931	PANORAMA 4		
40-5932	PANORAMA 4		
40-5933	PANORAMA 4		
40-5934	PANORAMA 4		
40-5935	PANORAMA 4		
40-5936	PANORAMA 4		
40-5937	PANORAMA 4		04 14 57
40-5938	PANORAMA 4		
40-5939	PANORAMA 4		
40-5940	PANORAMA 4		
40-5941	PANORAMA 4		
40-5942	LMP ENROUTE TO EASEP SITE		04 14 58 08
40-5943	LMP ENROUTE TO EASEP SITE		
40-5944	LMP ENROUTE TO EASEP SITE		
40-5945	LMP ENROUTE TO EASEP SITE		04 14 59 03
40-5946	LMP ASSEMBLING PSEP		04 15 02 08
40-5947	LMP ASSEMBLING PSEP		04 15 06
40-5948	LMP ASSEMBLING PSEP		
40-5949	LMP ASSEMBLING PSEP		
40-5950	PSEP AND LM		
40-5951	PSEP		

TABLE 2 CONT'D.

<u>70MM PHO. NO.</u>	<u>SUBJECT</u>	<u>LRL SAMPLE NO.</u>	<u>TRANSCRIPT REFERENCE NO.</u>
40-5952	LRRR DEPLOYED		04 15 03 57
40-5953	PSEP		
40-5954	PANORAMA 5 (33M CRATER EAST OF LM)		
40-5955	PANORAMA 5		
40-5956	PANORAMA 5		
40-5957	PANORAMA 5		
40-5958	PANORAMA 5		
40-5959	PANORAMA 5		
40-5960	PANORAMA 5		
40-5961	PANORAMA 5		
40-5962	LM		
40-5963	CORE 1 AND SOLAR WIND	10004	04 15 15
40-5964	CORE 1 AND SOLAR WIND	10004	
40-5965	LM INSPECTION		
40-5966	LM INSPECTION		
40-5967	SOLAR-WIND STAFF & TV	10004	
40-5968	SOLAR-WIND STAFF	10004	
40-5969	SOLAR-WIND STAFF	10004	
40-5970	SOLAR-WIND STAFF	10004	

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