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SUBJECT: Status Report on Preliminary
 Traverse Planning for Apollo 15
 Hadley-Apennine - Case 340

DATE: February 16, 1971
FROM: J. W. Head

MEMORANDUM FOR FILE

The Apollo 15 mission to the Hadley-Apennine region will investigate several important areas of scientific interest. The purpose of this memo is to outline the characteristics of the preliminary traverses designed to explore these areas. The primary areas of scientific interest (figure 1) include, in order of decreasing priority, 1) the Apennine Front, 2) Hadley Rille, 3) a portion of Mare Imbrium, 4) North Complex (a possible constructional volcanic region) and 5) a secondary crater cluster. The general characteristics of these features have been discussed elsewhere¹ and a summary of the detailed characteristics and sampling rationale for each feature is in preparation.² The Apollo 15 landing site is located on a portion of Mare Imbrium approximately 3.0 KM north of an EW trending segment of the Apennine Front and 1.5 KM east of Hadley Rille (figure 1). Traverses from this point to the various objectives were designed by the Traverse Planning Subpanel of the Science Working Panel, chaired by J. Sevier/ASPO, and including representatives from the U.S.G.S., MSC, and Bellcomm. Operational assumptions were provided by ASPO and are presented in Table 1. Preliminary traverses utilizing the Lunar Roving Vehicle are presented in Figure 2 and the accompanying station times, activities and observations are outlined in Tables 2 and 3. Figure 3 and Tables 4 and 5 outline walking traverses and activities in the event that the LRV is not utilized. Table 6 summarizes the characteristics of both sets of traverses. These preliminary traverses were presented to the Science Working Panel on February 3, 1971 and are being revised based on detailed geologic mapping, analysis of Apollo 14 mission activities, and other considerations.

James W. Head

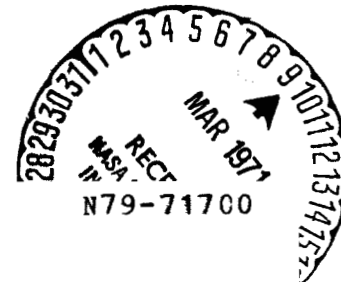
J. W. Head

2015-JWH-dmu

Attachments
 Tables 1-6
 Figures 1-3

Copy to

(NASA-CR-116999) PRELIMINARY TRAVERSE
 PLANNING FOR APOLLO 15 HADLEY-APENNINE
 STATUS REPORT (Bellcomm, Inc.) 25 p



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CR-116999

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(CATEGORY)

REFERENCES

1. J. W. Head, An Analysis of the Scientific Objectives and Proposed Landing Sites in the Hadley-Apennine Region, Bellcomm Memorandum for File, B70 10029, October 13, 1970.
2. J. W. Head, Sampling Rationale for Scientific Objectives in the Hadley-Apennine Region, Bellcomm Memorandum for File, in preparation.

TABLE 1

OPERATIONAL ASSUMPTIONS

LRV TRAVERSES

LRV SPEED = 8KM/HR

-7 PLSS = EXPECTED PERFORMANCE

EVA I = 7 HOURS MAXIMUM

ALSEP DEPLOYED FIRST (2:45)

LM OVERHEAD

0:45 EGRESS

0:44 INGRESS

EVA II = 7 HOURS MAXIMUM

LM OVERHEAD

0:38 EGRESS

0:45 INGRESS

EVA III = 6 HOURS MAXIMUM

LM OVERHEAD

0:38 EGRESS

0:45 INGRESS

WALKING TRAVERSES

WALKING SPEED = 3.3 KM/HR

-7 PLSS = EXPECTED PERFORMANCE

CONTINGENCY WALKBACK SPEED = 4.0 KM/HR

EVA TIMES AND OVERHEAD SAME AS LRV TRAVERSES

TABLE 2

LRV TRAVERSE EVA I

Station Stop Time (Minutes)	Segment Distance (Kilometers)	Ride Time (Minutes)	EVA Time Accumulated (Hr:Min)	Walk-Back Distance (Kilometers)
LM(210)	---	---	3:30	0.0
1(5)	1.4	0:11	3:46	1.4
2(41)	2.3	0:17	4:44	3.7
3(55)	1.0	0:08	5:47	3.2
4(5)	0.9	0:07	5:59	2.3
LM(44)	<u>2.3</u>	<u>0:17</u>	7:00	0.0
	7.9	1:00		
LRV TRAVERSE EVA II				
LM(38)	---	---	0:38	---
5(40)	5.2	0:38	1:56	5.2
6(60)	2.8	0:21	3:17	8.0
7(30)	1.8	0:14	4:01	6.3
8(27)	1.1	0:08	4:36	5.2
9(40)	2.0	0:15	5:31	3.2
10(20)	2.1	0:06	6:07	1.1
LM(45)	<u>1.1</u>	<u>0:08</u>	7:00	---
	16.1	1:50		
LRV TRAVERSE EVA III				
LM(38)	---	---	0:38	---
11(40)	2.3	0:17	1:35	2.3
12(25)	1.1	0:08	2:08	3.4
13(35)	2.2	0:17	3:00	5.6
14(60)	1.2	0:09	4:09	5.5
15(25)	1.5	0:11	4:45	4.0
LM(45)	<u>4.0</u>	<u>0:30</u>	6:00	--
	12.3	1:32		

TABLE 3

APOLLO 15

HADLEY-APENNINE

PRELIMINARY EXPLORATION TRAVERSES

Preliminary traverse stations, observations, and activities

February 11, 1971

Gerald G. Schaber and James W. Head

HADLEY APENNINE
GEOLOGICAL FEATURES, OBSERVATIONS AND ACTIVITIES

EVA I - LRV RIDING

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	Smooth mare	•ALSEP deployment and experiments
Travel	Typical smooth mare fill	•Observe, describe traverse over smooth mare fill material •Describe surface features, block distribution
1	Broad low ridge in mare	•Pan •Describe terrain and evaluate subsequent traverse areas
Travel	Smooth mare between low ridge and Apennine Front	•Evaluate terrain properties between high and lower portions of mare •Describe surface features, block distribution
2	Base of Apennine Front on debris slope	•Documented samples •Pan •Sample of coarse fines and rock chips •Observe and describe lateral and vertical changes in lithologies of surface blocks; compare to mare material
Travel	Across debris slope of front to intersection of mare fill material, Apennine Front and Hadley Rille at rim of 355 m crater in rille rim; 2.2 km crater penetrating Apennine Front to southwest	•Observe debris and relation to mare surface •Note distribution of blocks from 2.2 km crater
3	Rim of 355 m crater on rille rim and ejecta blanket of 2.2 km crater in Apennine Front	•Describe stratigraphy in far rille wall •Stereo pans of rille with 100-300 m base •Documented samples from crater penetrating rille rim •Documented samples from ejecta of 2.2 km crater penetrating Apennine Front

EVA 1 - LRV Riding (cont.)

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
Travel	Rim of Hadley Rille	<ul style="list-style-type: none"> •Describe opposite rille wall •Describe properties of rille rim material; note lateral variations, compare to mare material
4	On rim of Hadley opposite meander	<ul style="list-style-type: none"> •Describe E-W trending ridge on western side of rille •Describe rille wall •Documented sample
Travel	From rille rim across mare material	<ul style="list-style-type: none"> •Compare rille rim material to mare material
LM	Smooth mare	<ul style="list-style-type: none"> •Store samples and records •Ingress LM

EVA II - LRV RIDING

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	Smooth mare	• Egress LM - prepare for traverse
Travel	Cross smooth mare to edge of secondary crater cluster	• Compare mare material and material near crater cluster • Describe crater cluster
5	Rim of two 330-400 m. secondary craters	• Observe crater interior and ejecta • Compare to mare material • Representative sample and exotics • Double core tube • Wide based stereo pan; base oriented approx. NW-SE • Estimate amount of blanketing by secondary material
Travel	Mare fill material possibly covered by secondary crater ejecta; to base of 340 m. crater at base of Apennine Front.	• Compare mare material and secondary crater material • Compare with Apennine slope • Describe vertical variation in Apennine Front
6	Base of Apennine Front at 340 m. crater	• Document samples around crater rim • Trench in crater rim in Apennine slope material • Stereo pan • Double core tube on slope • Documented sample up slope from crater • Stereo pairs up slope
Travel	Along base of Apennine Front	• Observe lateral variations in material and surface textures • Photography as appropriate
7	Along base of Apennine Front on slope in intercrater area; chosen at crew's discretion based on previous observations	• Documented sample of front material • Stereo pairs up slope • Sample of coarse fines and rock chips • Single core tube

EVA II - LRV Riding (cont.)

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
Travel	Along base of Apennine Front	<ul style="list-style-type: none"> • Observe lateral variations in materials and surface textures • Photography as appropriate • Compare secondary crater cluster material to front
8	Along base of Apennine Front on slope	<ul style="list-style-type: none"> • Pan • Documented samples: the last Apennine Front stop; based on previous observations along front crew uses discretion to complete sampling
Travel	Southwestern edge of secondary crater cluster	<ul style="list-style-type: none"> • Observe secondary crater deposits and compare to other terrain • Photograph as appropriate
9	Secondary crater cluster; SW corner of 400 m. crater	<ul style="list-style-type: none"> • Trench • Compare mare material and secondary crater material • Observe crater interior and ejecta • Representative sample and exotics • Pan
Travel	Mare material and broad ridge in mare	<ul style="list-style-type: none"> • Note number of secondaries to NW of 400 m. crater • Compare mare materials and surface structure to front and cluster observations • Photograph as appropriate
10	Flank of broad very low ridge in mare	<ul style="list-style-type: none"> • Single core tube • Pan • Documented Sample
Travel	Smooth mare fill	<ul style="list-style-type: none"> • Compare mare material with other terrain • Observe 300 m. crater and deposits
LM	Smooth mare	<ul style="list-style-type: none"> • Store samples and records • Ingress LM

EVA III - LRV RIDING

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	Smooth mare	• Egress LM - Prepare for traverse
Travel	Smooth mare to rille rim	• Compare mare material properties and rille rim properties.
11	Rim of Hadley Rille	<ul style="list-style-type: none"> • Traverse as near rim as possible • Radial sample of 50 m. crater on rille rim • Observation and photography of far rille wall • Stereo pan • Documented sample of rille rim
Travel	Rim of Hadley Rille	<ul style="list-style-type: none"> • Note differences in rille rim materials and lateral changes in surface characteristics • Observe lateral and vertical changes in rille wall • Photography as appropriate
12	Rim of Hadley Rille between 150 m. crater and smaller craters on edge of rille rim	<ul style="list-style-type: none"> • Observations and photography of far rille wall • Examination of craters penetrating rille rim • Documented sample of rille rim • Documented sample of crater rim material • Stereo pan • Double core tube
Travel	Across mare material between rille rim and North Complex; mare may be partly covered by secondary craters and deposits	<ul style="list-style-type: none"> • Observe differences between rille rim material and mare material • Note characteristics of mare material and any possible secondary craters • Note lateral variations in materials and surface textures as approach North Complex to determine nature of boundary between two • Describe N-S trending elongate depression toward end of traverse

EVA III - LRV Riding (Cont.)

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
13	Southeastern rim of 600 m. crater in North Complex at junction of elongate depression	<ul style="list-style-type: none"> • Documented sample of crater ejecta • Pan • Describe wall of crater and relation to elongate depression • Documented sample of North Complex material • Attempt to determine if crater is endogenetic or impact; search for exotics
Travel	In North Complex between 600 m. crater and 750 m. crater	<ul style="list-style-type: none"> • Observe intercrater area in North Complex and compare ejecta between craters
14	Multiple objective stop at end of North Complex scarp near rims of 750 m. and 380 m. crater	<ul style="list-style-type: none"> • 750 m. crater <ul style="list-style-type: none"> • Observe and describe crater interior and rim • Documented sample • Attempt to determine if crater is endogenetic or impact; search for exotics • Photography • Edge of scarp <ul style="list-style-type: none"> • Note any layering or changes in vertical scarp and sample • Photograph scarp • Note relation of scarp to rest of complex • 380 m. crater <ul style="list-style-type: none"> • Observe and describe crater interior and rim • Photograph and describe extremely large boulder in southwestern part of crater and assess possibility of sampling • Documented samples <p>The following tasks should be completed in the North Complex area; location at discretion of crew based on their observations</p> <ul style="list-style-type: none"> • Coarse fines and chips in typical North Complex • Single core tube • Trench • Stereo pan

EVA III - LRV Riding (Cont.)

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
Travel	From North Complex into mare fill region with possible secondaries	<ul style="list-style-type: none"> •Observe and describe differences in material and surface textures between North Complex and mare •Note amount of secondary cratering •Photograph as appropriate
15	Fresh blocky crater south of North Complex in mare	<ul style="list-style-type: none"> •Compare blocks and mare material with North Complex •Documented sample
Travel	Mare fill in region between North Complex and LM	<ul style="list-style-type: none"> •Describe differences between this area and other mare areas •Note distribution of possible secondaries
LM	Smooth mare fill	<ul style="list-style-type: none"> •Store samples and records •Ingress LM

TABLE 4

WALKING TRAVERSE EVA I

Station Stop Time (Minutes)	Segment Distance (Kilometers)	Walk Time (Minutes)	EVA Time Accumulated (Hr:Min)	Walk-Back Distance (Kilometers)
LM(210)	--	--	3:30	--
A(37)	2.4	0:44	4:51	2.4
B(24)	1.2	0:22	5:37	1.5
LM(42)	<u>1.5</u>	<u>0:28</u>	6:47	--
	5.1	1:34		
WALKING TRAVERSE EVA II				
LM(38)	--	--	0:38	--
C(30)	3.1	0:56	2:04	3.1
D(70)	0.7	0:13	3:27	3.8
E(30)	1.0	0:18	4:15	3.2
F(10)	2.7	0:49	5:14	0.45
LM(45)	<u>0.45</u>	<u>0:09</u>	6:08	--
	7.95	2.25		
WALKING TRAVERSE EVA III				
LM(38)	--	--	0:38	--
G(30)	3.6	1:05	2:13	3.6
H(19)	1.0	0:18	2:50	3.8
I(20)	0.7	0:13	3:23	3.8
J(20)	1.0	0:18	4:01	3.2
LM(45)	<u>3.2</u>	<u>0:58</u>	5:44	--
	9.5	2:52		

TABLE 5

APOLLO 15

HADLEY-APENNINE

PRELIMINARY EXPLORATION TRAVERSES

Preliminary traverse stations, observations, and activities

February 11, 1971

Gerald G. Schaber and James W. Head

EVA I - WALKING

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	Smooth mare	•ALSEP Deployment and experiments
Travel	Across typical smooth mare fill to rille rim	•Compare rille rim material to mare material
a	Rim of Hadley Rille	<ul style="list-style-type: none"> •Traverse as near rim as possible •Radial sample of 50 m crater on rille rim •Observation and photography of far rille wall •Stereo pan •Double core tube •Documented sample of rille rim
Travel	Rim of Hadley Rille	<ul style="list-style-type: none"> •Note differences in rille rim materials and lateral changes in surface characteristics •Observe lateral and vertical changes in rille wall •Photography as appropriate
b	Rim of Hadley Rille	<ul style="list-style-type: none"> •Observations and photography of far rille wall •Examination and sampling of crater penetrating rille rim •Stereo pan •Sample coarse fines and rock chips on rille rim
Travel	From rille rim across mare fill	•Compare rille rim material to mare material
LM	Smooth mare fill	<ul style="list-style-type: none"> •Store samples and records •Ingress LM

EVA II - WALKING

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	Smooth mare	•Egress LM; prepare for traverse
Travel	Across mare to rim of Hadley Rille	•Compare rille rim material to mare material
c	Rim of 355 m crater on rille rim	•Describe stratigraphy in far rille wall •Stereo pan of rille •Documented samples from crater penetrating rille rim •Double core tube
Travel	Along rille rim to base of 2.2 km crater on Apennine Front	•Describe changes in material and surface textures toward crater
d	At base of Apennine Front near 2.2 km crater	•Describe changes in surface materials and sample •Stereo pan •Sample coarse fines and rock chips •Documented sample of variety of Apennine Front material
Travel	Base of Apennine Front slope	•Note lateral changes in material and surface textures •Observe relation of debris slope and relation to mare surface
e	At base of Apennine Front on south rim of approximately 50 m crater	•Documented samples •Double core tube •Pan •Observe and describe lateral and vertical changes in lithologies of surface blocks; compare to mare material
Travel	Mare fill material	•Observe lateral differences in material and surface textures

EVA II-Walking (Continued)

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
f	Mare material	<ul style="list-style-type: none"> • Documented sample • Core tube
Travel	Mare material	<ul style="list-style-type: none"> • Observe lateral differences in material and surface characteristics
LM	Mare material	<ul style="list-style-type: none"> • Store samples and records • Ingress LM

EVA III - WALKING

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	Mare material	•Egress LM; prepare for traverse
Travel	Across mare material	•Observe lateral differences in material and surface characteristics •Observe debris slope and relation to mare surface •Describe lateral and vertical variations in Apennine Front
g	Base of Apennine Front slope	•Documented samples •Pan •Sample of coarse fines and rock chips •Observe and describe lateral and vertical changes in lithologies of surface blocks
Travel	Along base of Apennine Front slope	•Observe lateral variations in materials and surface textures •Photography as appropriate
h	Base of Apennine Front slope	•Documented samples •Pan •Observe and describe lateral and vertical changes in lithologies of surface blocks
Travel	Off of Apennine Front slope to bright crater near group of secondary craters	•Observe and describe relation of front slope and secondary crater cluster
i	Bright crater in margin of secondary crater cluster	•Observe crater interior and ejecta •Documented representative sample and exotics •Estimate amount of blanketing by secondary material •Double core tube
Travel	Across smooth part of secondary crater cluster	•Observe secondary crater deposits and compare to other terrain •Photography as appropriate

EVA III-Walking (Continued)

STATION	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
j	Secondary crater cluster; SW corner of 400 m crater	<ul style="list-style-type: none"> • Compare mare material and secondary crater material • Observe crater interior and ejecta • Documented representative sample and exotics • Sample coarse fines and rock chips • Pan • Trench
Travel	From secondary crater cluster across mare material and broad ridge	<ul style="list-style-type: none"> • Note number of secondaries to NW of 400 m crater • Compare mare materials and surface structures to front and cluster • Photograph as appropriate
LM	Smooth mare	<ul style="list-style-type: none"> • Store samples and records • Ingress LM

TABLE 6
 APOLLO 15 TRAVERSE SUMMARY

<u>LRV TRAVERSES</u>				
	OVERHEAD/ALSEP TIME	LRV RIDING TIME	STATION STOP/ TIME	TOTAL TRAVERSE DISTANCE
EVA I	4:14	1:00	1:46	7.9 KM
EVA II	1:23	1:50	3:37	16.1 KM
EVA III	1:23	1:32	3:05	12.3 KM
TOTAL	<u>7:00</u>	<u>4:22</u>	<u>8:28</u>	<u>36.3 KM</u>

<u>WALKING TRAVERSES</u>				
EVA I	4:12	1:34	1:01	5.1 KM
EVA II	1:23	2:25	2:20	7.95KM
EVA III	1:23	2:52	1:29	9.5 KM
TOTAL	<u>6:58</u>	<u>6:51</u>	<u>4:50</u>	<u>22.55KM</u>

HADLEY NORTH

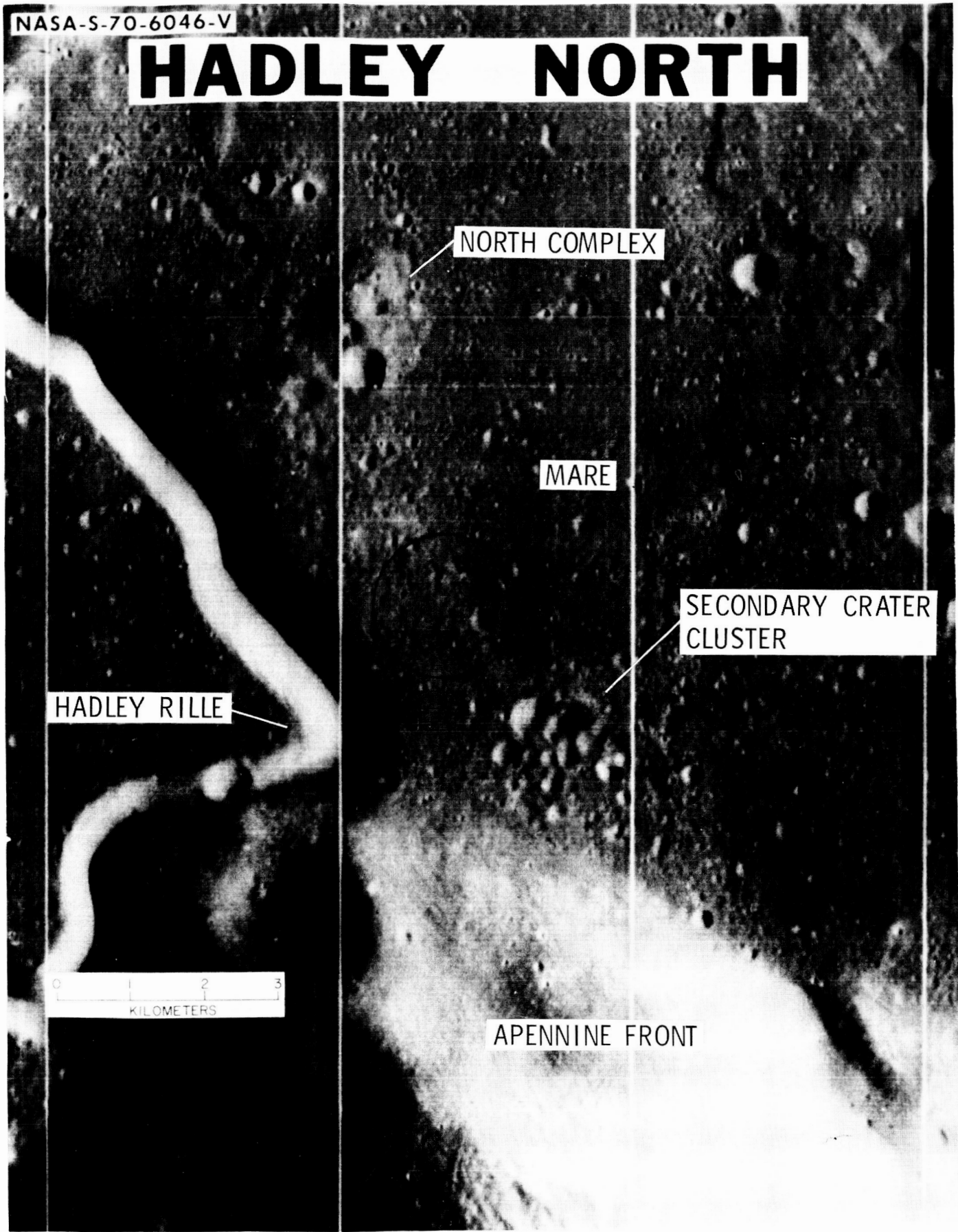


FIGURE 1

HADLEY NORTH

LRV TRAVERSES

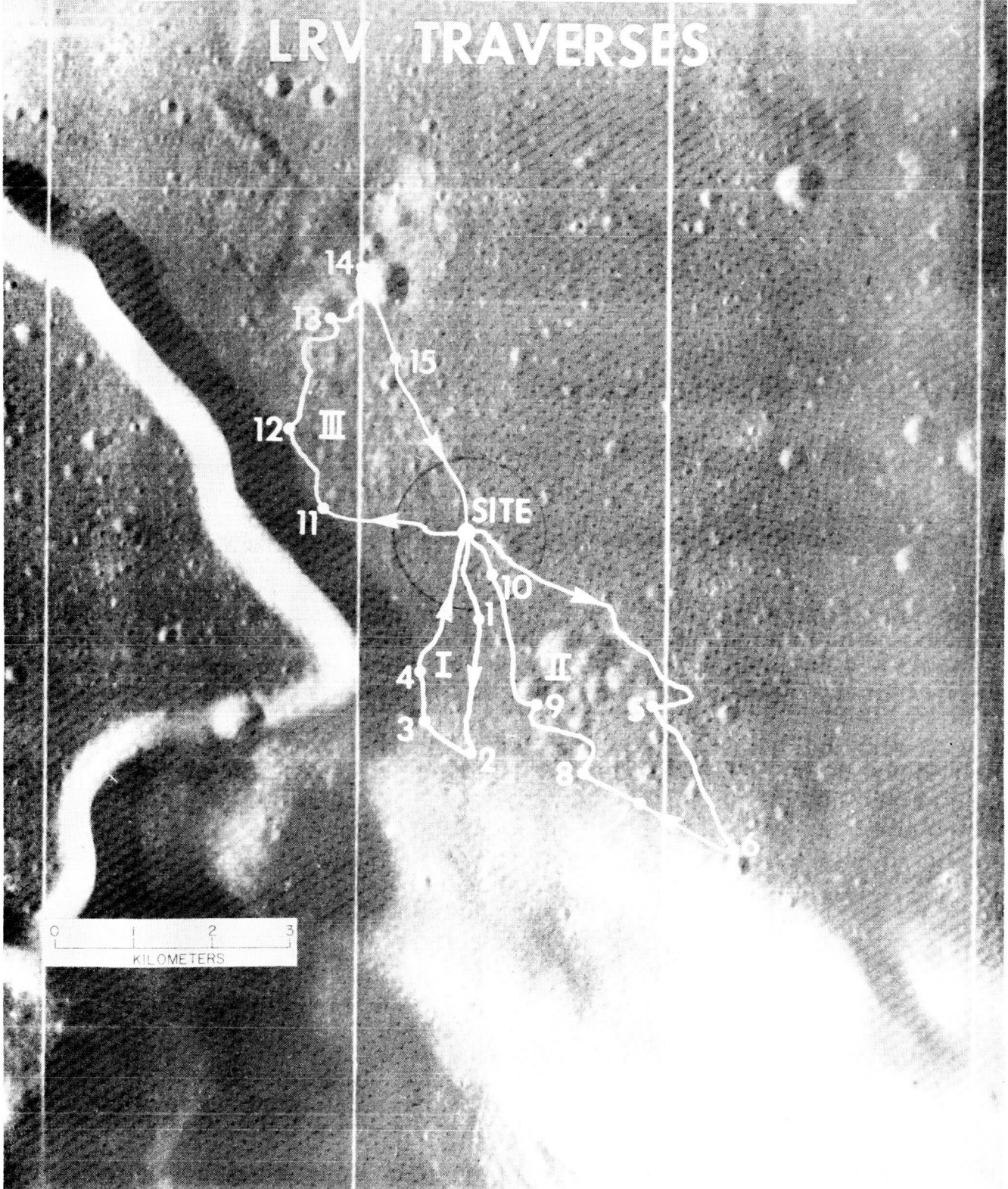


FIGURE 2

HADLEY NORTH

WALKING TRAVERSES

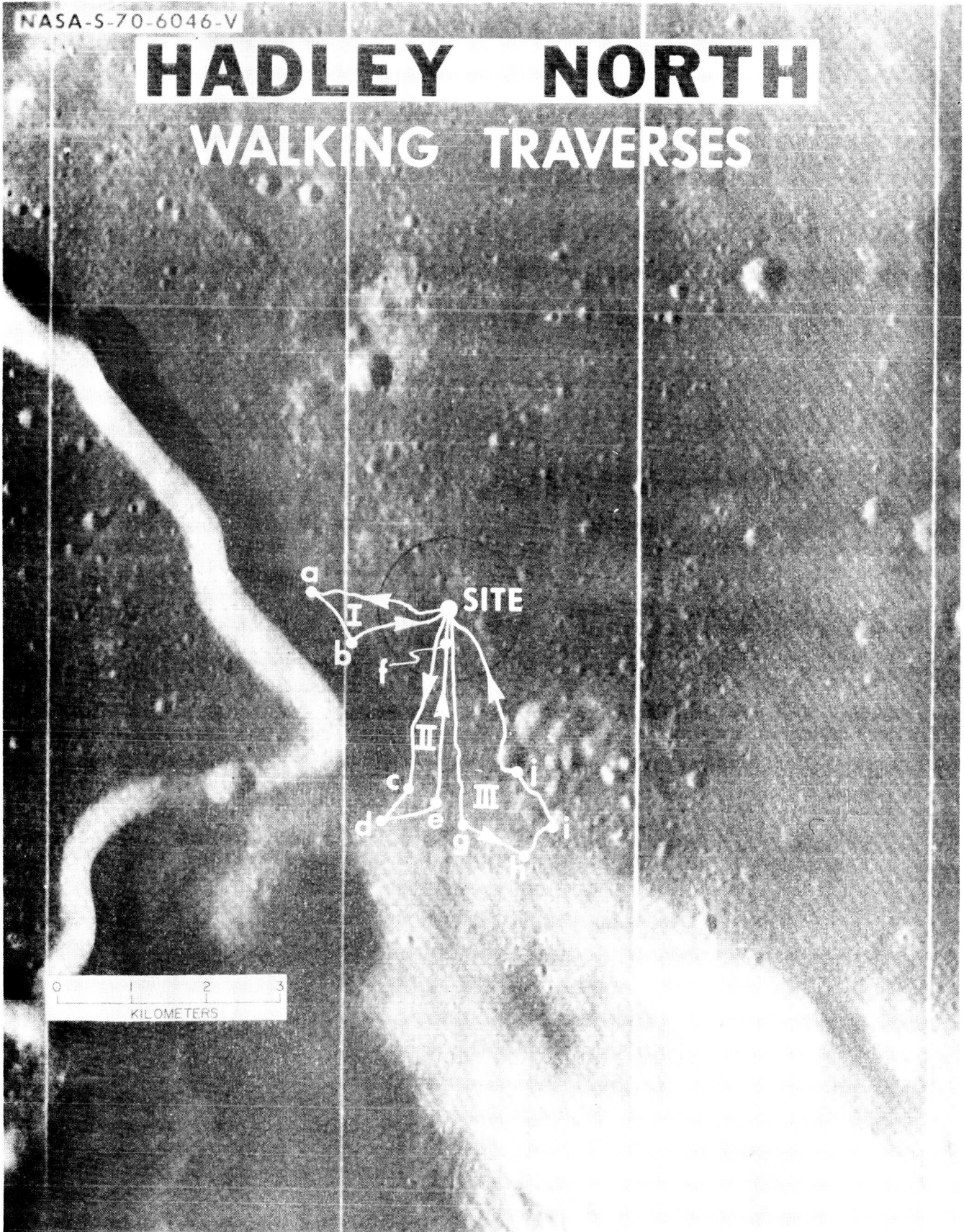


FIGURE 3

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