NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Technical Report 32-1246

Surveyor V Mission Report
Part II: Science Results

Prepared by:

The Surveyor Investigator Teams, Scientific Evaluation Advisory Team, and Working Groups

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

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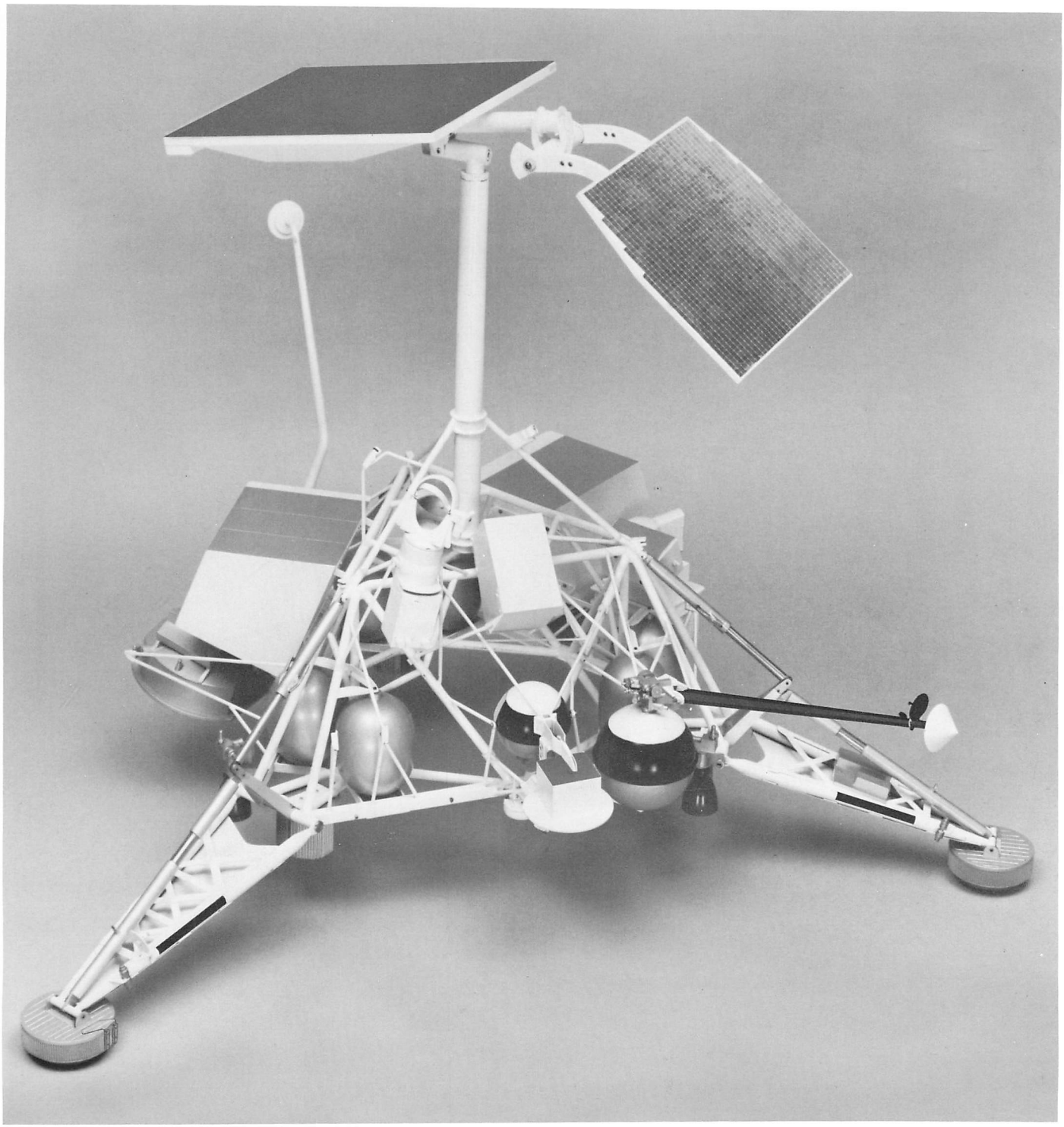


NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

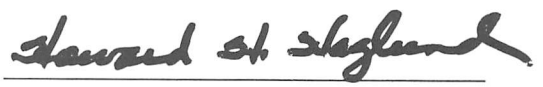
Technical Report 32-1246

Surveyor V Mission Report

Part III. Television Data

Thomas H. Bird
M. I. Smokler
D. L. Smyth

Approved for publication by:



Howard H. Haglund,
Surveyor Project Manager

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CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

July 15, 1968

TECHNICAL REPORT 32-1246

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Preface

This three-part document constitutes the Project Mission Report on *Surveyor V*, the fifth in a series of unmanned lunar soft-landing missions.

Part I of this Technical Report consists of a technical description and an evaluation of engineering results of the systems used in the *Surveyor V* mission. Part II presents the scientific data derived from the mission, and the scientific analyses conducted by the *Surveyor* Scientific Evaluation Advisory Team, the *Surveyor* Investigator Teams, and the associated Working Groups. Part III consists of selected pictures from *Surveyor V* and appropriate explanatory material.

This Part III presents 164 of the total number of television pictures transmitted to earth from the lunar surface, between September 11 and December 17, 1967; 39 mosaics composed of individual frames are also included. Appropriate information for interpreting these pictures is given in the individual sections of the report.

Acknowledgment

The authors wish to acknowledge the valuable assistance provided by Stanley B. Seng of the Space Science Division of JPL, who spent many hours selecting and coordinating the material in this report.

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I. Introduction

Thomas H. Bird

This document, Part III of the Mission Report, contains a selection of 164 TV pictures relating to the *Surveyor V* mission. A total of over 19,000 individual frames were obtained during the television (TV) activities. These included approximately 18,006 frames the first lunar day, 1048 frames on the second lunar day, and 64 frames on the fourth lunar day. Only marginal TV imagery was recovered on these last two periods of camera activity.

In addition to the individual frames, copies of 39 selected mosaics of the information collected by the TV camera are presented in this document. Some of these mosaics are copies of preliminary data constructed during the actual mission operational time. Spatial relationships among various features on the lunar surface are best evaluated by reference to the mosaic of the area of interest. The most direct means of locating individual items of interest is by reference to camera azimuth and elevation and the associated mosaics areas. Also included are several special mosaics showing areas of particular interest.

Individual frames are best identified by the Greenwich Mean Time (GMT) of the record. Differences in recording time between various ground stations may cause variations of ± 1 s in the time related on the frame. This should cause no ambiguity between any two frames, as the minimum interval between successive frames was 3.6 s.

The National Space Science Data Center at Goddard Space Flight Center, Greenbelt, Maryland, is responsible for dissemination of *Surveyor V* pictures and other scientific data. An index and copies of the pictures in various forms can be obtained from that Data Center.

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II. Television System

M. I. Smokler

The *Surveyor* TV system is designed primarily to obtain video pictures of the lunar surface. It includes a survey camera capable of panoramic viewing, and a TV auxiliary that serves to commutate identification signals and to provide appropriate video mixing.

A. Camera Description

The slow-scan survey TV camera, shown in Figs. II-1 and II-2, provides images of the lunar surface over a 360-deg panorama. Each picture, or frame, is imaged through an optical system onto a vidicon image sensor whose electron beam scans a photoconductive surface to produce an electrical output proportional to conductivity changes resulting from the varying receipt of photons from the object space. The camera is designed to accommodate scene luminance levels from approximately 0.008 to 2600 ft-L, using both electromechanical mode changes and iris control.

Frame-by-frame coverage of the lunar surface provides a 360-deg azimuth view and an elevation view from approximately +40 deg above the plane normal to the camera Z axis to −60 deg below this same plane. The camera Z axis is inclined 16 deg from the spacecraft Z axis. Camera operation is totally dependent on receiving the correct commands from earth. Commandable operation allows each frame to be generated by sequencing the shutter with appropriate lens settings and mirror azimuth-and-elevation positioning to obtain adjacent views of the object space. The camera provides a designed resolution capability of approximately 1 mm at 4 m and can focus from 1.22 m to infinity. The 7.3-kg camera consists essentially of six major components: mirror, lens, shutter, filter wheel, vidicon, and attendant electronic circuitry.

The mirror assembly, as shown in Fig. II-3 without hood extension, comprises a 10.5- by 15-cm elliptical mirror supported at its minor axis by trunnions. This mirror is formed by vacuum-depositing a Kanogen surface on a beryllium blank, followed by a deposition of aluminum with an overcoat of silicon monoxide. The mirrored surface is flat over the entire surface to less than ¼ wavelength at $\lambda = 550$ mμ and exhibits an average specular reflectivity in excess of 86%. The mirror is

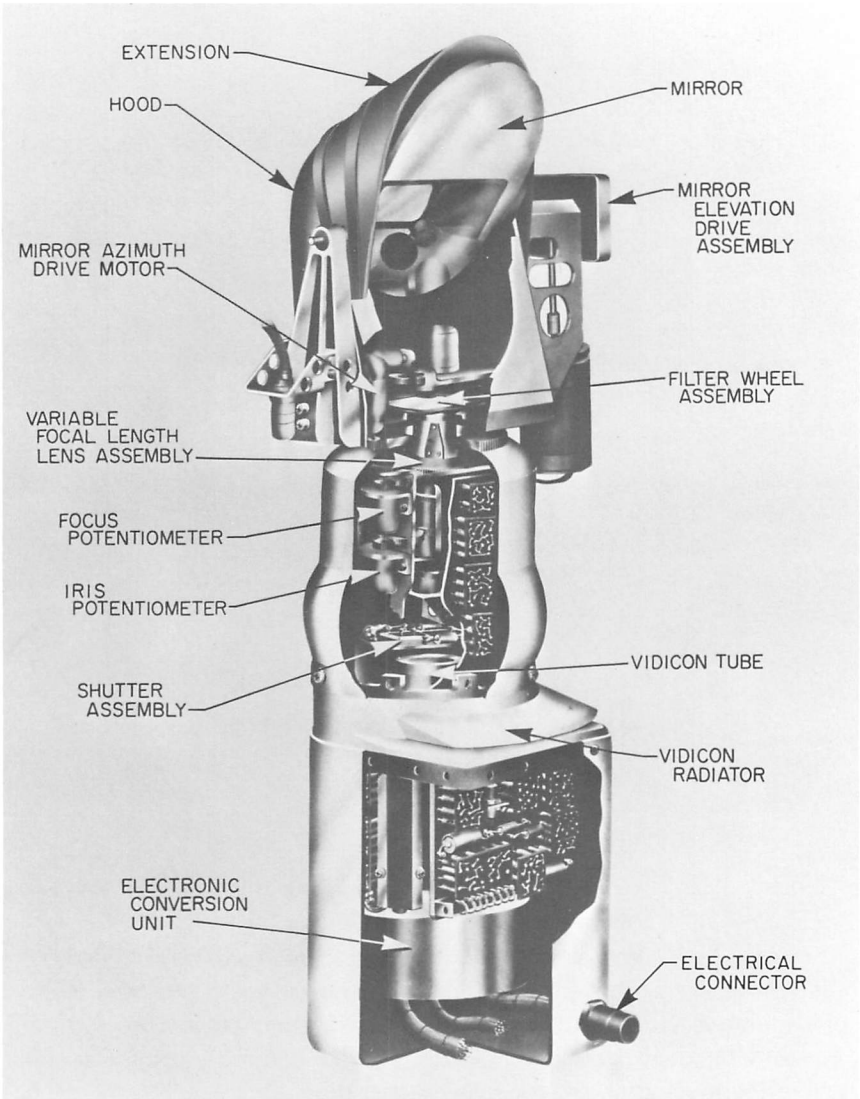

Fig. II-1. Cutaway view of survey camera

positioned by means of two drive mechanisms, one for azimuth and the other for elevation. The drive mechanisms consist of stepper motors that provide, through appropriate gear reduction, a mirror step size of 2.48 $\pm$0.1 deg in elevation and 3.0 $\pm$0.1 deg in azimuth. Angular step positions of both axes are sensed by position potentiometers, the outputs of which are digitized and transmitted to earth in pulse code modulation (PCM) form.

The camera used on the *Surveyor V* spacecraft was fitted with a hood extension (shown in Fig. II-2) similar to that used on *Surveyor III* in order to reduce the possibility of direct sunlight striking the camera lens (through the filter elements). This reduced the number of cases in which image glare could be caused by multiple reflections within the lens assembly.

The rotation of the mirror in the azimuth direction, while providing the azimuth coverage capability to the camera, creates an image rotation proportional to the angular azimuth position of the mirror, since the image plane and the scanning raster of the image sensor (the vidicon) are stationary with respect to the mirror azimuth axis.

In addition to the mirror itself, the mirror assembly contains a commandable filter-wheel mechanism (Fig. II-4) that accommodates four separate sections of optical-

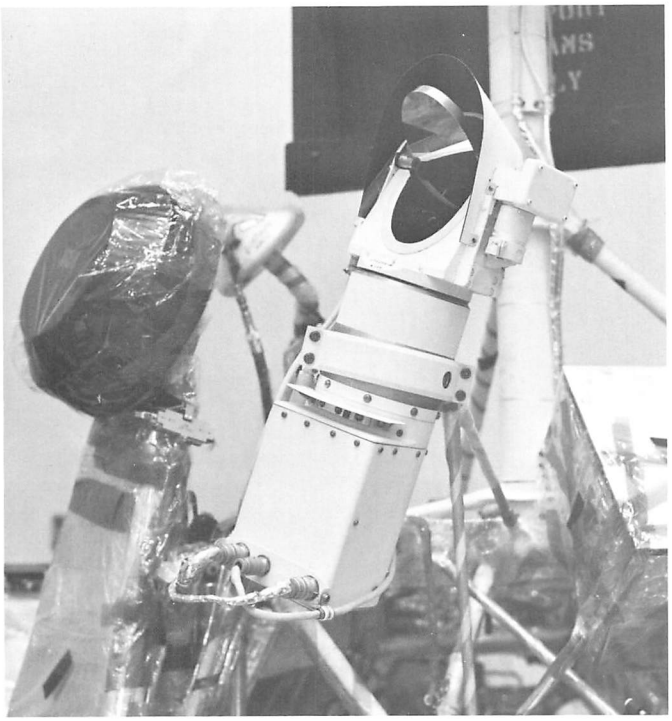

Fig. II-2. Survey camera on the spacecraft

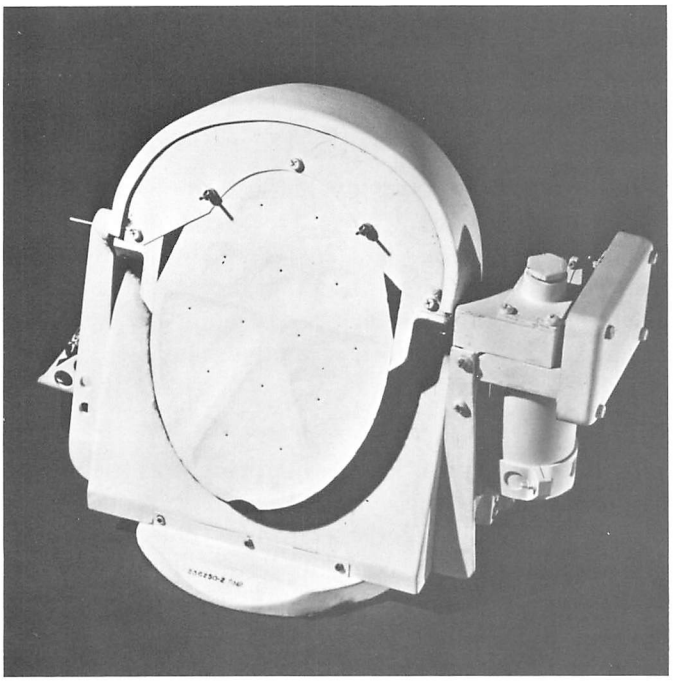

Fig. II-3. Mirror assembly

quality glass filters. The *Surveyor V* filter wheel contained red, green, and blue filters; the fourth section contained a clear element for non-monochromatic obser-

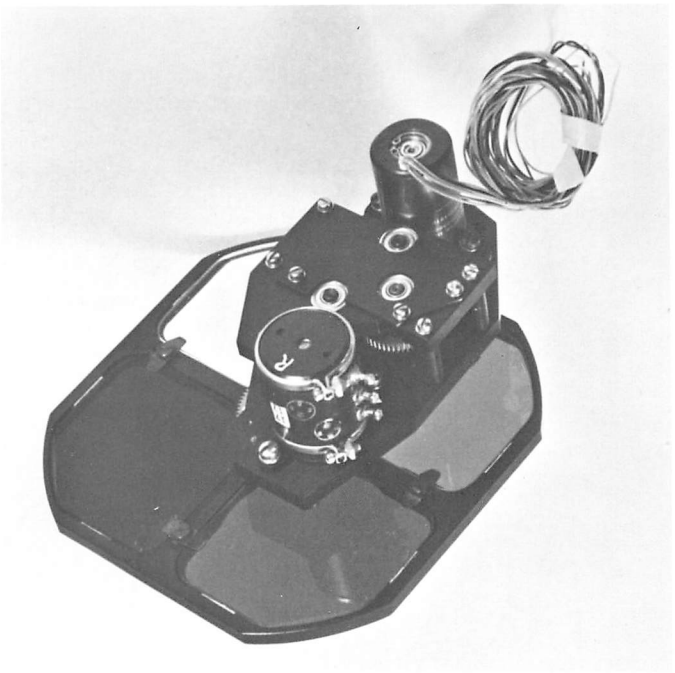

Fig. II-4. Filter-wheel assembly

vations. Segments of the filter wheel were placed sequentially in the field of view of the camera, following receipt of the proper earth-originated command. Color pictures of a scene can be reproduced on earth after three video transmissions, each with a different color filter element in the field of view. Response curves for typical color-filter elements used on *Surveyor V* are shown in Fig. II-5.

The optical formation of the image was performed by means of a variable-focal-length lens assembly between the vidicon image sensor and the mirror assembly. The lens (Fig. II-6) was capable of either a 100-mm or 25-mm focal length, providing optical fields of view of approximately 6.43 and 25.3 deg, respectively. Additionally, the lens assembly could vary its focus by means of a rotating focus cell from near 1.22 m to infinity, while an adjustable iris provided effective aperture changes of $f/4$ to $f/22$ in increments that resulted in an aperture-area change of 0.5. While the most effective iris control is accomplished by command operation, a servo-type automatic iris was available to control the aperture area in proportion to the average scene luminance. As in the mirror assembly, potentiometers were geared to the iris, focal length, and focus elements to allow ground determination of these functions. A beam splitter, integral to the lens assembly, provided a light sample for operation of the automatic iris.

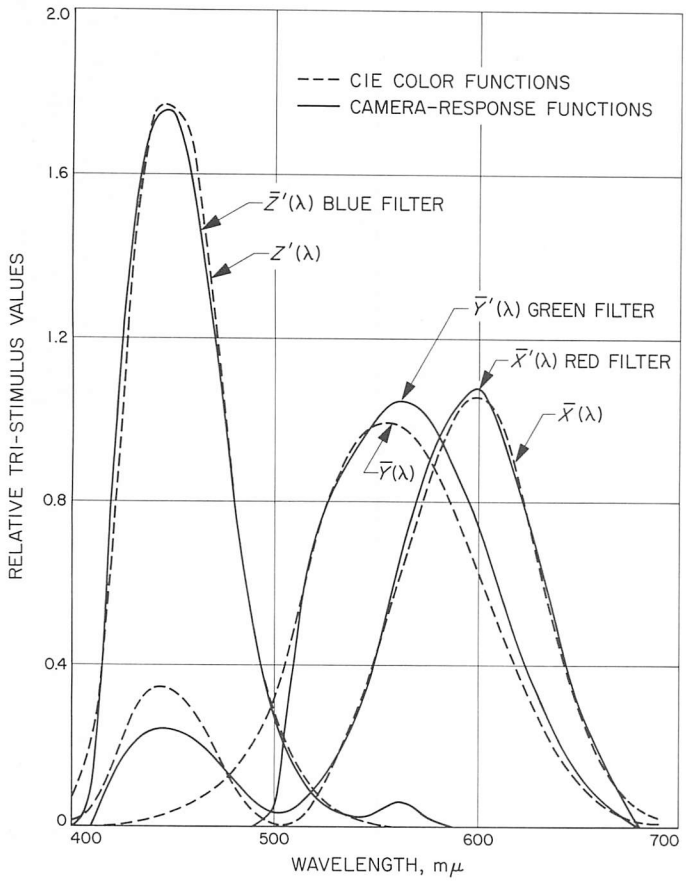

Fig. II-5. Camera-response functions compared with CIE (Commission Internationale d'Eclairage 1931) color-matching functions

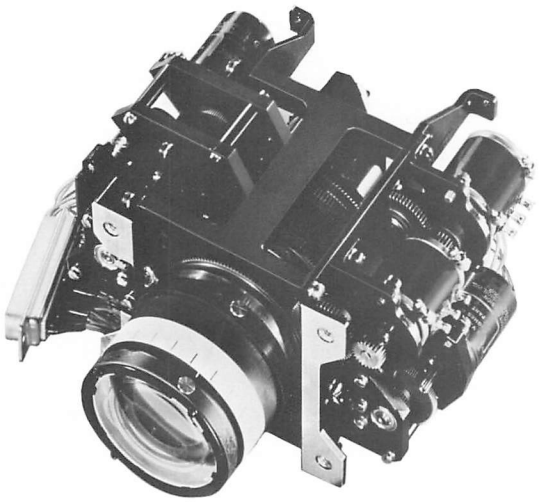

Fig. II-6. Variable-focal-length lens assembly

Three modes of exposure control are afforded the camera by means of a mechanical focal plane shutter (Fig. II-7) located between the lens assembly and the

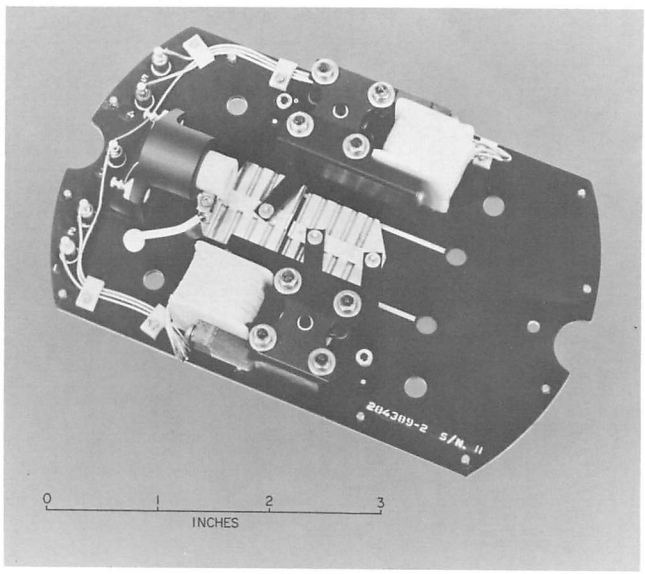

Fig. II-7. Shutter assembly

vidicon image sensor. In the *normal shutter* mode, upon earth command, the shutter blades are sequentially driven by solenoids across an aperture in the shutter base plate, thereby allowing light energy to reach the image sensor. The time interval between the initiation of each blade determines the exposure interval, nominally 150 ms.

In the second exposure mode (*open shutter* mode), the blades are positioned to leave the aperture open, thereby providing continuous light energy to the image sensor. This mode of operation is useful in the imaging of scenes exhibiting low luminance levels, including some of the brighter stars. The effective shutter time in this mode is 1.2 s, nominally.

A third exposure mode, used for extremely low-luminance levels such as stellar observations, lunar-surface observations under earthshine illumination conditions, and faint solar-corona observations, is referred to as the *integrate* mode. This mode is implemented by opening the shutter, turning off the vidicon electron beam, and then, after any desired exposure time, turning on the vidicon electron beam, and closing the shutter after the desired exposure time. Scene luminance on the order of 0.008 ft-L is reproduced in this mode of operation, thereby permitting pictures under earthshine conditions. Detection of sixth-magnitude stars is also possible using this mode of operation.

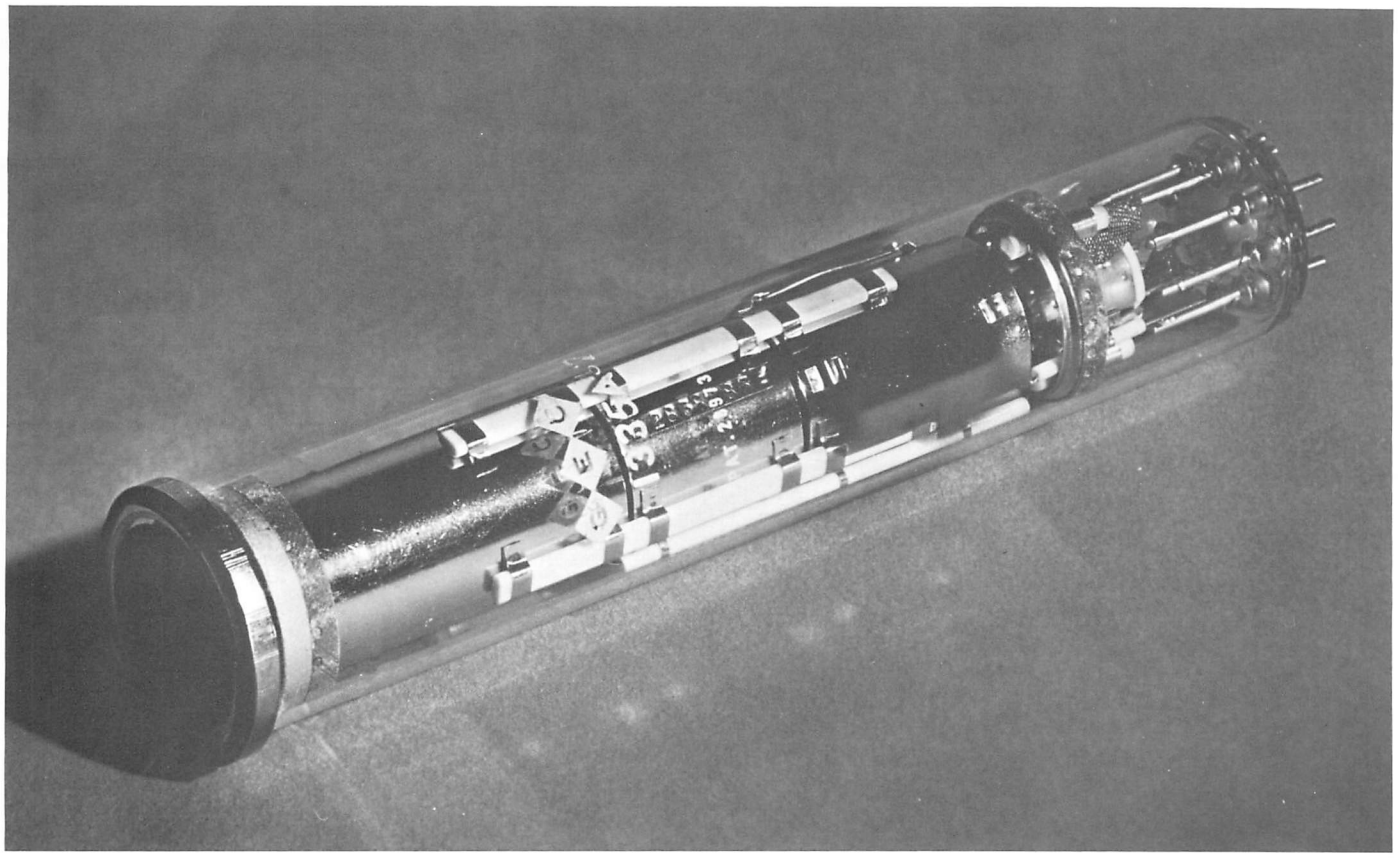

Fig. II-8. The 2.58-cm vidicon for survey camera

The transducing process of converting light energy from the object space to an equivalent electrical signal in the image plane is accomplished by the vidicon tube; this hybrid tube (Fig. II-8) uses electrostatic focus and electromagnetic deflection. The principle by which the video signal is produced from the photoconductive surface is illustrated in Fig. II-9. A low-velocity scanning beam strikes one side of the surface; the other receives illumination through a signal plate from which the video signal is taken. Light imaged on the photoconductive surface increases over each differential area proportionately to the integrated illumination on that area. A corresponding positive charge pattern appears on the target. During the succeeding scan, the beam deposits sufficient numbers of electrons over each differential area, sequentially, to neutralize the accumulated charge, thereby generating the video signal.

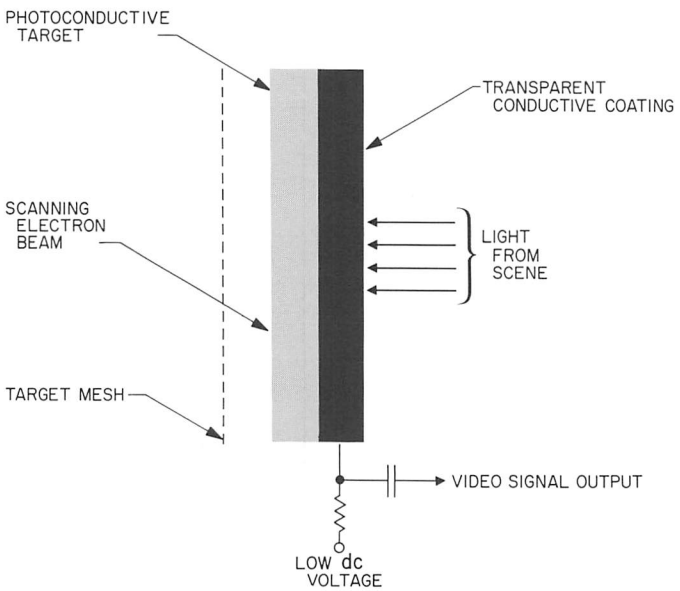

Fig. II-9. Vidicon functional diagram

The photoconductor incorporated in the vidicon sensor consists of a selenium derivative. Integral to the photoconductor surface is a 5-by-5 matrix of dots comprising a reseau that can be used in correcting the image information for nonlinearities and distortions. A reference mark is included in each corner of the scanned format to provide, in the video signal, an electronic level representing optical black for photometric reference.

Electronic circuitry for timing, power, and amplification functions of the camera is constructed of solid-state components and packaged in module form, as shown in Fig. II-10. This circuitry comprises five functional groups:

(1) Drive circuits for lens and mirror mechanical positioning.

(2) Video amplifier.

(3) Horizontal- and vertical-sweep circuits that create the scanning raster.

(4) Synchronization circuitry for ground recording and reproduction purposes.

(5) Electronic conversion unit to provide voltages and regulation from the spacecraft central power source for camera operation.

Thermal control devices are (1) within the camera, surrounding the vidicon faceplate, (2) on selected electronic modules, and (3) within the mirror assembly for providing and maintaining operational temperatures when the camera experiences low transit- and lunar-temperature conditions.

Functionally, the camera operates in a slow-scan mode, in contrast to the standard scan used in commercial television. Such a reduced scan rate requires less information bandwidth from the spacecraft communications system for a given picture quality, and thus reduces the RF power requirements for the lunar distances involved.

In the normal scan mode of operation, the camera provides one 600-line frame each 3.6 s. Each frame requires 1 s to be read from the vidicon; the transmission of lens- and mirror-position information, plus temperature measurements, require 200 ms. The remaining 2.4 s are used in erasing the image from the vidicon, in preparation for the next exposure. The vidicon bandwidth required is 220 kHz.

A second scan mode of operation in the camera provides one 200-line frame each 60.8 s. Each frame requires 20 s to complete the video transmission and uses a bandwidth of 1.2 kHz. This 200-line mode is used in instances

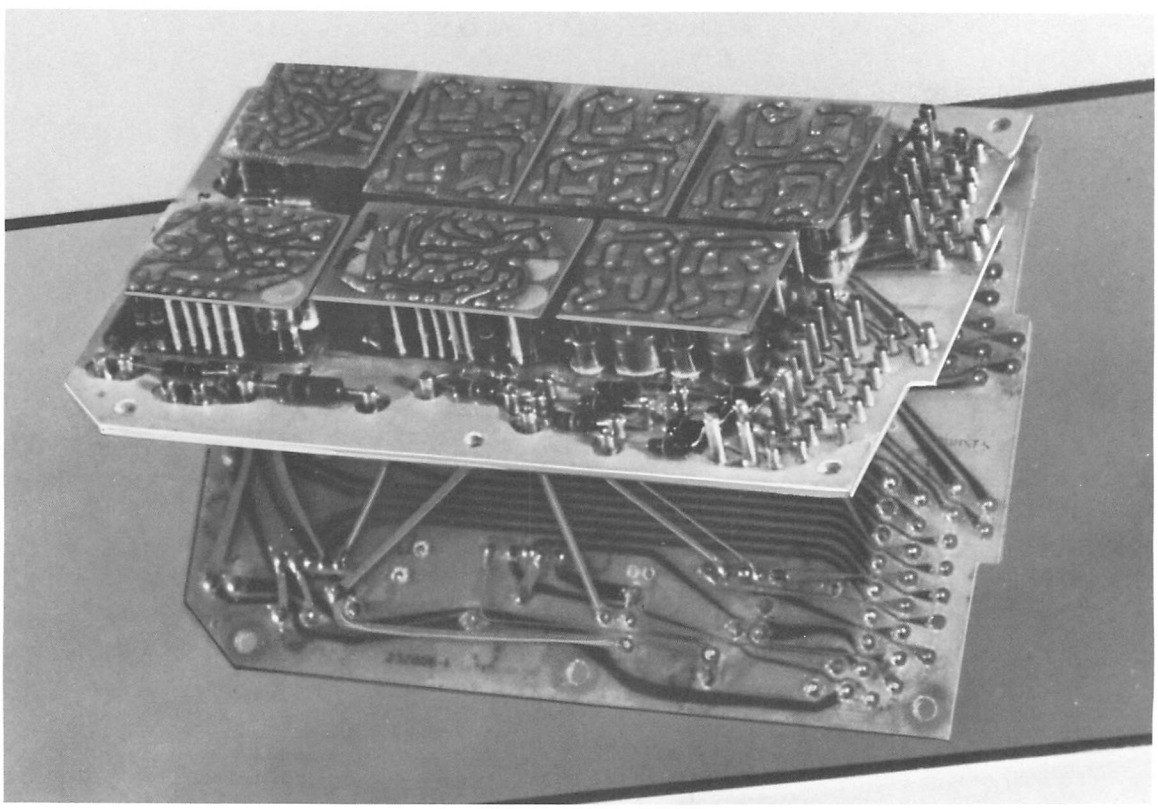

Fig. II-10. Electronic module configuration

of omnidirectional antenna transmission from the spacecraft. The 600-line mode can be used only when the directional antenna is oriented toward the earth.

Integral to the spacecraft, and within the viewing capability of the camera, are two photometric/colorimetric reference targets. These targets are located on an omnidirectional antenna and on a spacecraft leg adjacent to the footpad, so that the line of sight of the camera in viewing each target is normal (± 3 deg) to the target plane. The targets are identical; each has a series of 13 gray wedges arranged circumferentially. In addition, three color wedges (with known CIE[1] chromaticity coordinates) are located radially from the target center. A series of radial lines is incorporated to provide a gross estimate of camera resolution. Finally, each target contains a center post to help determine solar angles, by means of the shadow information, after the lunar landing. Prior to launch, the targets were calibrated goniophotometrically to allow an estimation of postlanding camera dynamic range.

B. Camera Calibration

To derive maximum scientific information from a picture, it is necessary to have precise quantitative information on the camera that obtained the picture in terms of those parameters that describe the quality of the image. To ensure such precise information, a calibration was performed on *Surveyor V* with the camera mounted on the spacecraft. Each calibration used the entire telecommunication system of the spacecraft, so as to include those factors of the modulator, transmitter, etc., that influenced overall image-transfer characteristics. This calibration was performed at the launch complex on July 18 through 21, 1967.

Calibration information was used both prior to the mission and during the post-mission data-analysis period. Prior to launch, the entire TV ground data-handling system (TV-GDHS) was adjusted and calibrated, using the prerecorded spacecraft/camera video signal derived during the calibration of the camera. This allowed the ground equipment to be optimized for the particular spacecraft in terms of real-time receipt and processing of image information. With respect to the post-mission analysis, camera calibration could be used to correct the images for geometric nonlinearities and distortions, falloff of spatial frequency response, photometric nonuniformities, and coherent noise.

Digital computer techniques, developed and utilized in conjunction with the *Ranger* and *Mariner* photographic experiment and applied to *Surveyor* imagery, allowed correction factors to be applied to any selected frame of video in a pre-programmed manner. An example of spatial frequency falloff correction by the use of digital techniques is shown in *Surveyor V* TV picture numbers 62 and 63 of Section VII. The first of these two pictures depicts original film data, the second is a processed digitized picture after sine-wave correction. The correction shown in this instance represents a flat response out to the 38% relative response point on the spatial frequency falloff response curve.

Those factors, or parameters, of the camera that control the first-order effects in the resulting images are:

(1) Dynamic range or light-transfer characteristics.

(2) Modulation transfer or spatial frequency response.

(3) Geometric distortion.

(4) Shading.

(5) Vignetting of the lens/vidicon combination.

These parameters are calibrated extensively on the *Surveyor* camera.

Calibration stimuli for the television camera system consist of test slides accurately calibrated and configured for placement in a special light source. Representative samples of these test slides are shown in Figs. II-11 and II-12. Figure II-11 is a sine-wave slide for determining the modulation transfer or spatial frequency response of the system. It should be noted that the true sine wave is used in contrast to the more frequently used square wave, thus enabling a determination of the true Fourier representation of the camera response. Figure II-12 has a series of gray-scale wedges that determine the vidicon erasure characteristics, thereby enabling a correction to be applied as a function of latent image level resulting from previous exposures. Finally, there is a grid pattern which, by means of either manual or computer techniques, permits nonlinearities and distortions to be removed from each image. Light-transfer characteristics and shading measurements are obtained by exposing the camera to a series of uniform light fields, each progressively brighter, until a saturation point is reached.

[1]Commission Internationale d'Eclairage (International Commission on Illumination, formerly ICI).

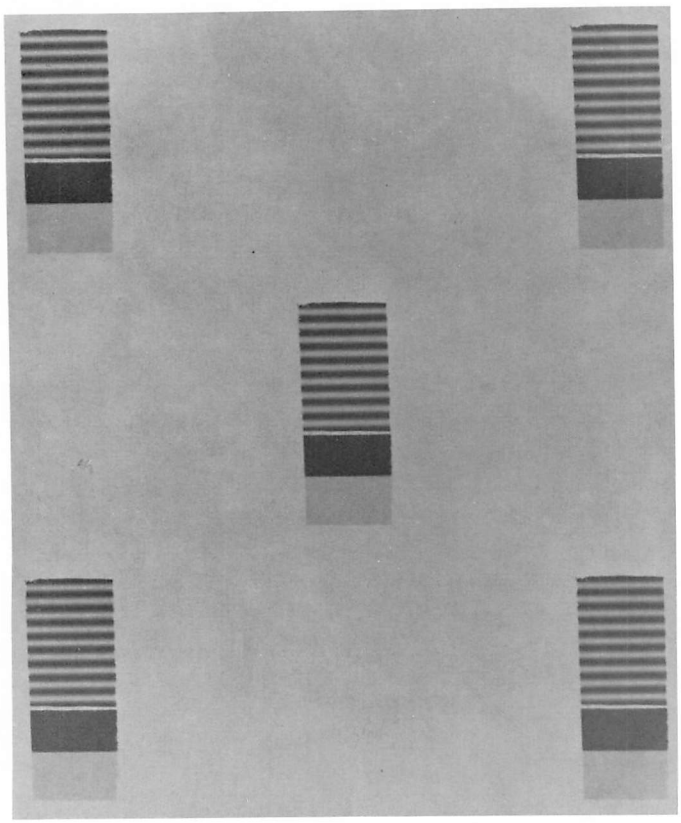

Fig. II-11. Sine-wave target used in determining spatial frequency response of camera during calibration

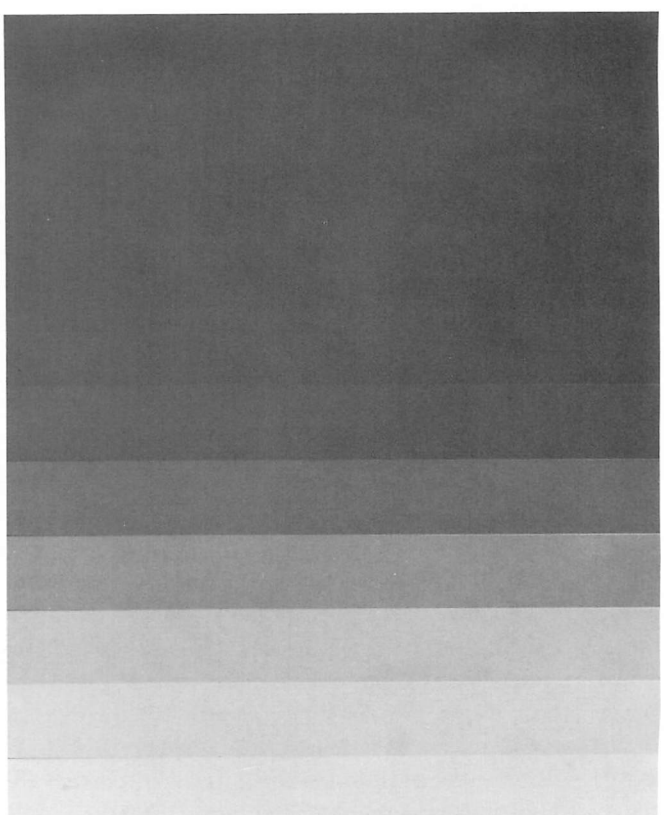

Fig. II-12. Gray-scale calibration target for erasure-characteristic calibration

Data of the type obtained during camera calibration are presented in Figs. II-13 through II-16. The ordinate in these graphs is scaled in frequency deviation units at the output of the spacecraft transmitter with sync-tip frequency deviation set to the nominal values of 1.25 MHz for the 600-line scan mode and 5.0 kHz for the 200-line scan mode. The ordinate scale can, therefore, be viewed as a measure of relative video voltage. Figures II-13 through II-15 indicate light-transfer characteristics of the camera in various modes of operation. They are based on actual lunar scene brightness, as determined through appropriate correction-factor calculations. These correction-factor calculations involve the spectra of the camera, standard eye, measuring photometer, light source, lunar light, and a separate National Bureau of Standards calibration light source. Figure II-16 shows the modulation transfer-response characteristic in terms of a relative response (normalized to the DC component) with respect to spatial frequency in TV lines per picture height.

The data in Fig. II-15 show that the light-transfer characteristics for the three color filters are almost identical. This filter design provides the capability of taking a set of color pictures without the necessity of changing iris position. Reduction of color data is then independent of accuracy or repeatability limitations in iris control.

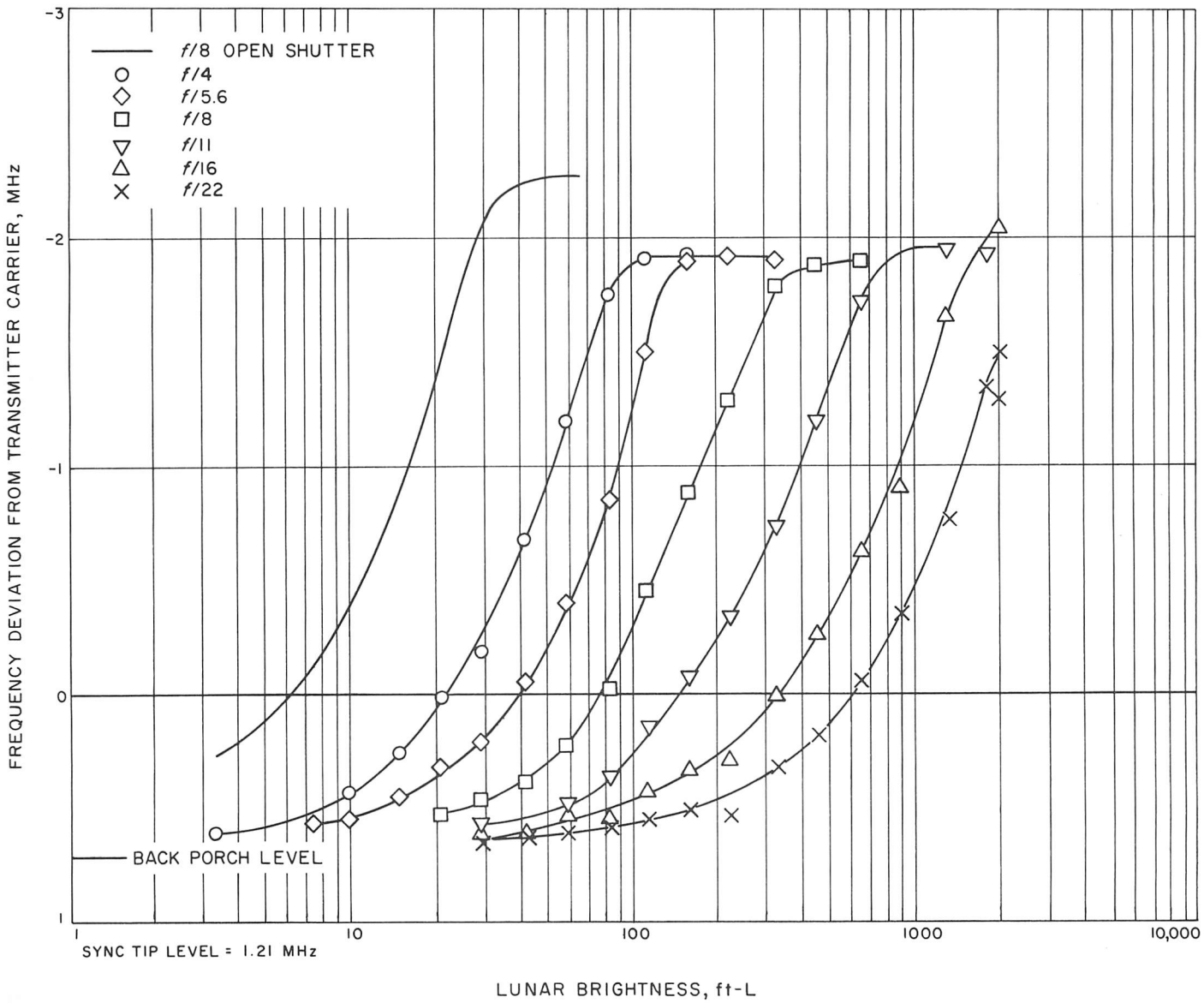

Fig. II-13. *Surveyor V* camera light-transfer characteristic, 600-line scan mode

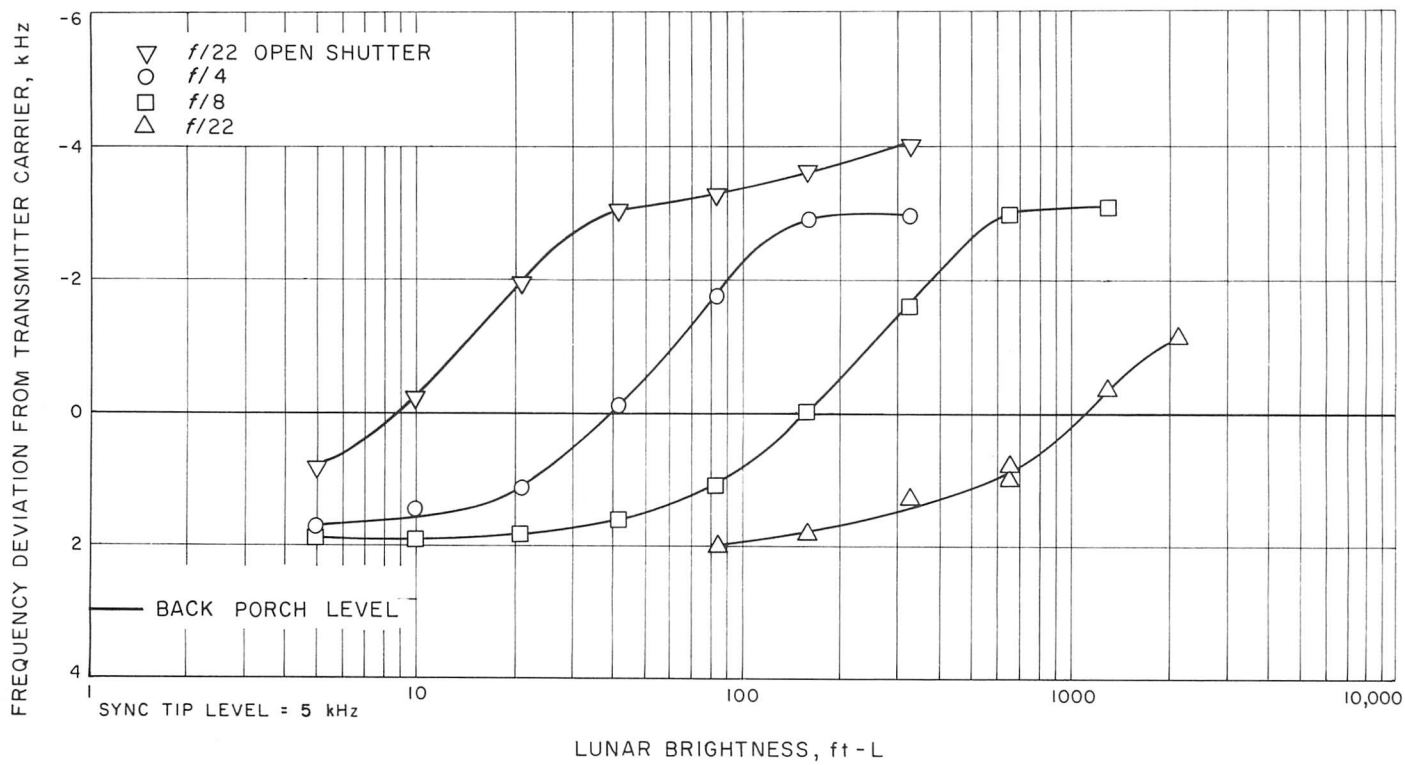

Fig. II-14. *Surveyor V* camera light-transfer characteristic, 200-line scan mode

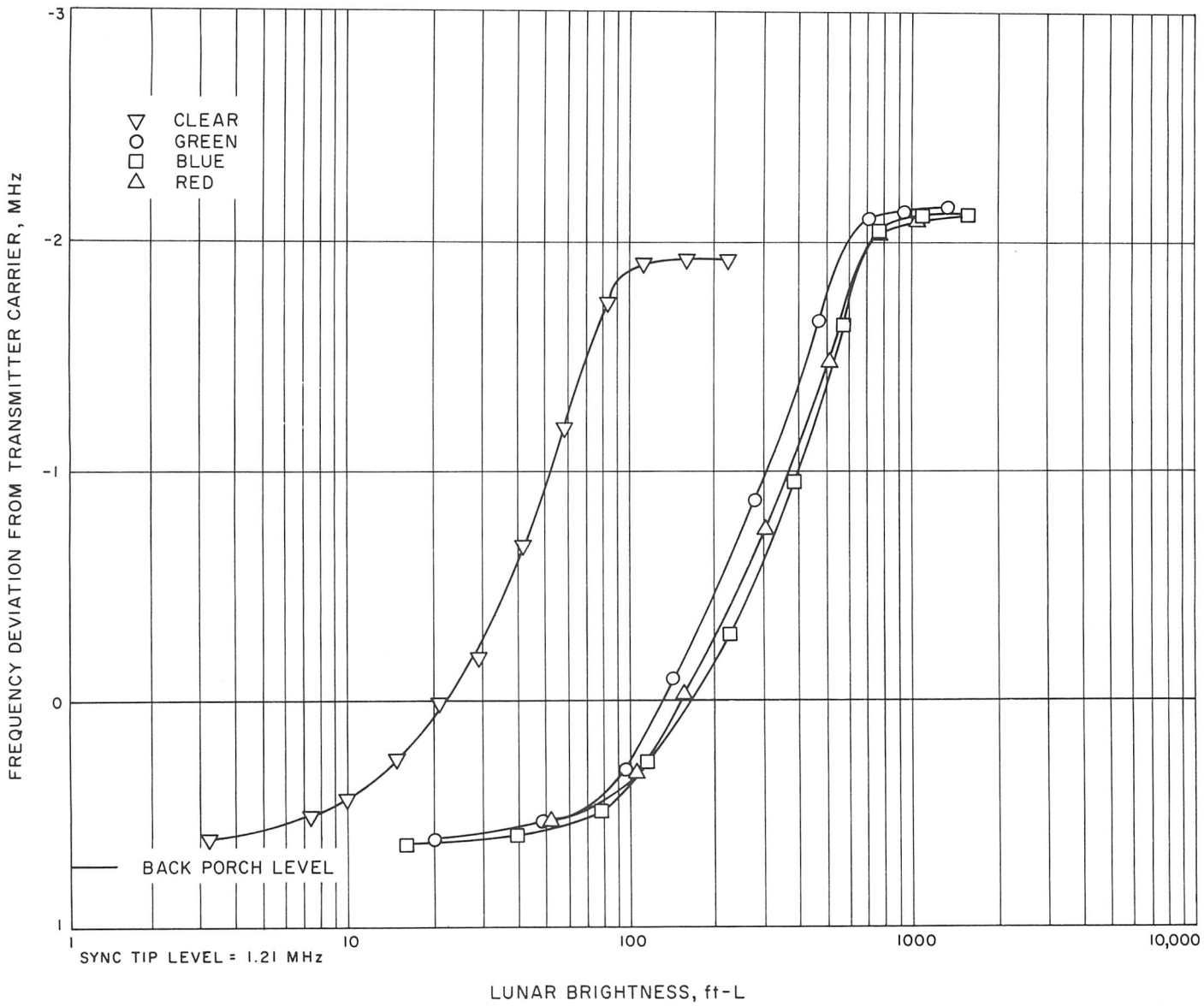

Fig. II-15. *Surveyor V* camera *f*/4 light-transfer characteristic for all filter-wheel positions, 600-line scan mode

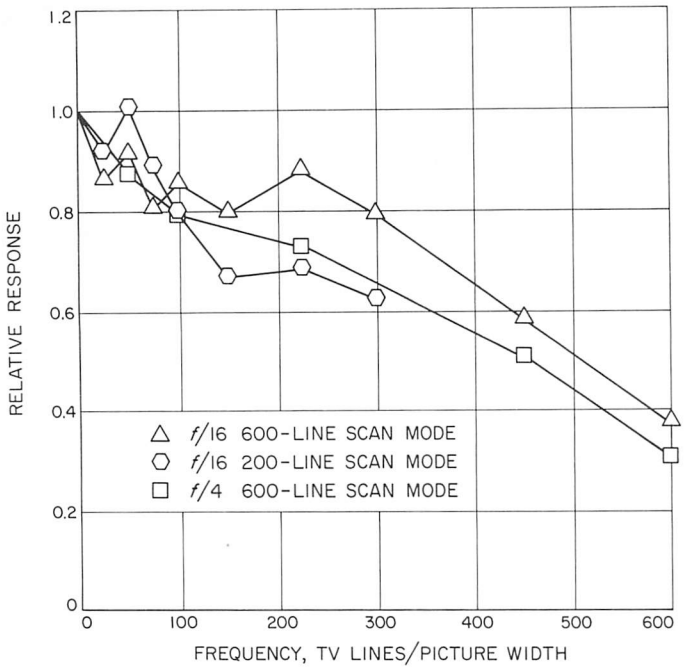

Fig. II-16. Frequency response

C. Mission Performance

Camera performance was better than on previous *Surveyor* Missions, both in quality of pictures and in number of operations unrestricted by camera problems. The quality was better because the camera characteristics exhibited the good dynamic range of *Surveyor I* with the good resolution of *Surveyor III*. An additional factor was the cleanliness of the optical surfaces resulting from the decision to launch with the camera mirror virtually closed.

The camera was operated from DSS-42 (Canberra) in addition to DSS-11 (Goldstone), resulting in 18,006 pictures taken during the first lunar day. These included spacecraft and lunar surface surveys, auxiliary mirror surveys, photometric surveys, star surveys, focus ranging, shadow progressions, solar corona, and color pictures. A surface depression and displacement of the alpha-scattering instrument (ASI) caused by static firing of the vernier engines was revealed by the camera. The camera

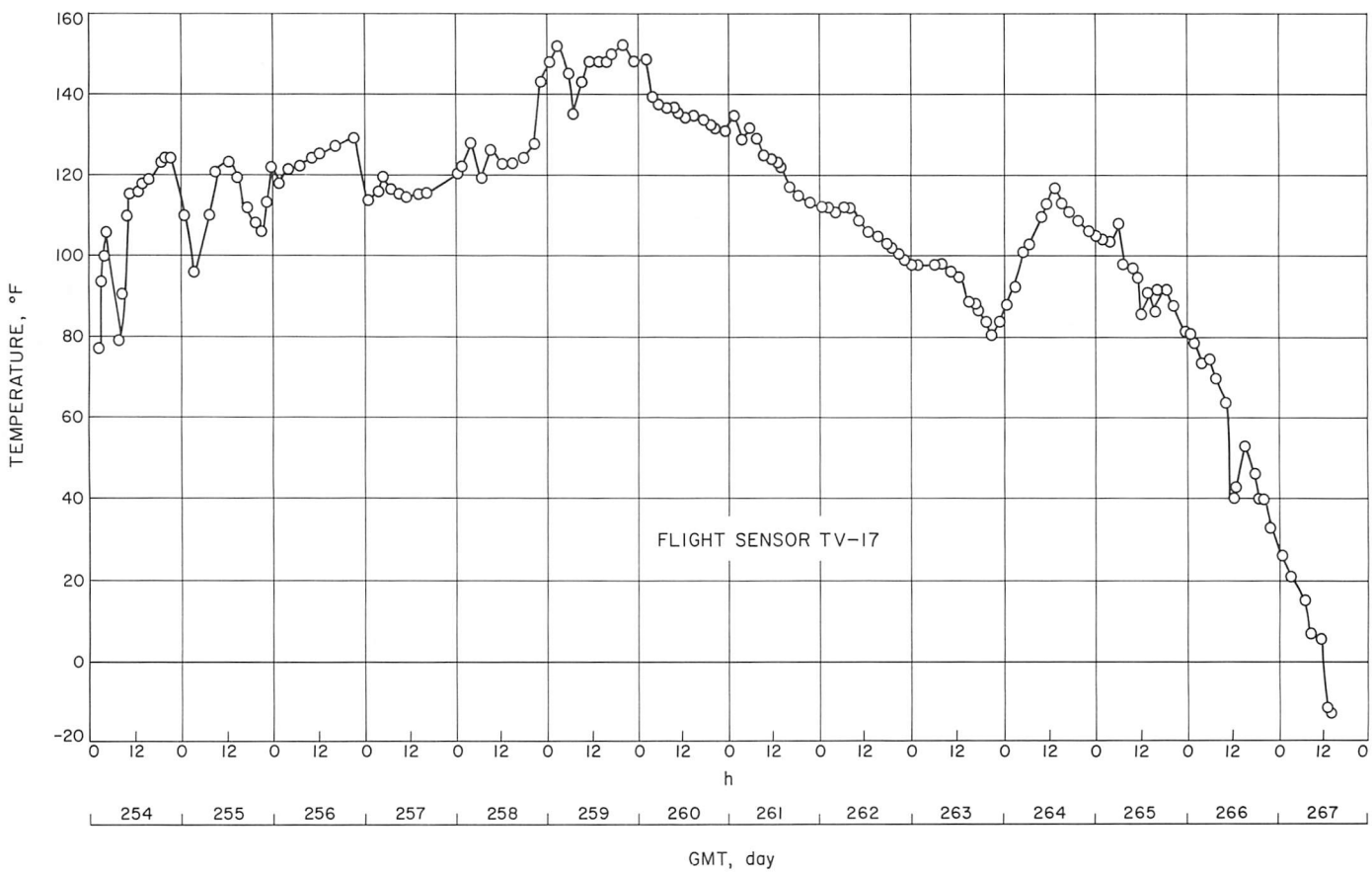

Fig. II-17. Mirror base-plate temperatures on 1st lunar day

also revealed the vertical displacement of the spacecraft at the end of the first lunar day. The magnet experiment was conducted entirely by TV viewing of particle accumulation and distribution.

During the above operating period, temperatures were essentially as expected. The record of TV electronics and mirror baseplate temperatures is given in Figs. II-17 and 18.

On the second lunar day, the camera was found operative. However, the pictures were not of the same quality as those taken during the first lunar day because of camera degradation resulting from the lunar night temperatures.

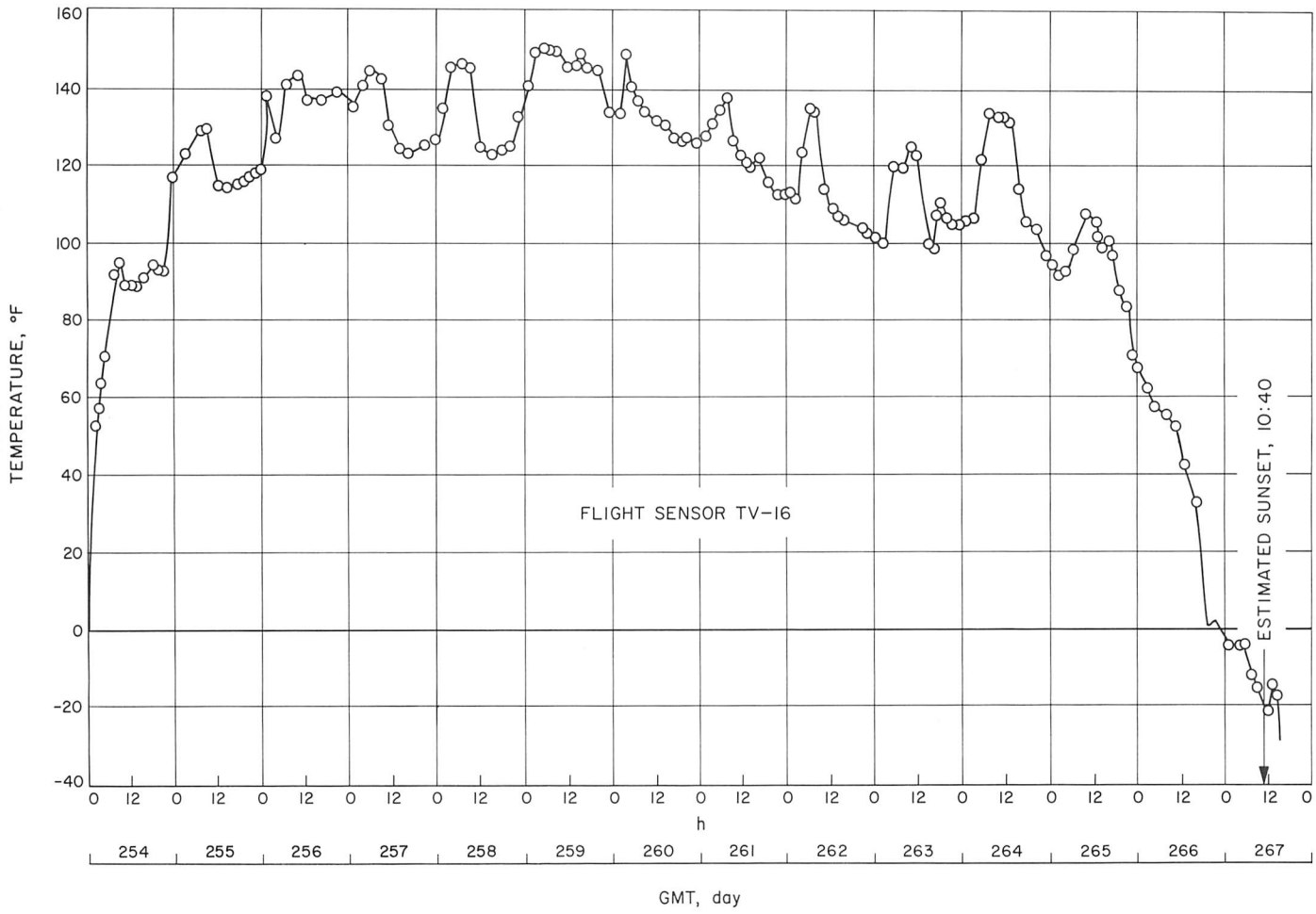

Fig. II-18. TV electronics temperatures on 1st lunar day

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III. Orientation of Camera and Sun

D. L. Smyth

The landing site of *Surveyor V*, as determined from inflight tracking data, is at 1.50° N latitude and 23.20° E longitude. On the basis of post-landing tracking data, the landing site is at 1.42° N latitude and 23.20° E longitude.

The orientation of the spacecraft and of the camera has been determined from TV camera observations of the stars and planets, and of the lunar horizon, and also from the angular settings of the spacecraft's solar-panel sun sensor and positional tuning of the planar array antenna. Preliminary reduction of these observations showed that the spacecraft was tilted 19.7 deg at an azimuth of N 17° E. Observations of the lunar horizon, on the other hand, indicate that the spacecraft was tilted 19.4 deg at an azimuth of N 13° E. The amount of tilt of the spacecraft, at the time of these observations, is known within a few tenths of a degree, but the present solution for azimuth of tilt has a probable error of several degrees. The camera 0-deg azimuth at zero camera elevation was found from stellar observations to be oriented approximately N 24° E; this solution is accurate to within a degree. The camera-axis attitude was approximately 32.5 deg of tilt oriented N 33° E. Near the end of the first lunar day, the shock absorbers on legs 2 and 3 compressed, and the spacecraft was tilted about 3 deg more to the northeast. The final attitude at the end of the first lunar day is not accurately known.

At *Surveyor V* landing, the sun was 17 deg above the eastern horizon. Figures III-1 and III-2 show the sun azimuth and elevation during the first and second lunar day.

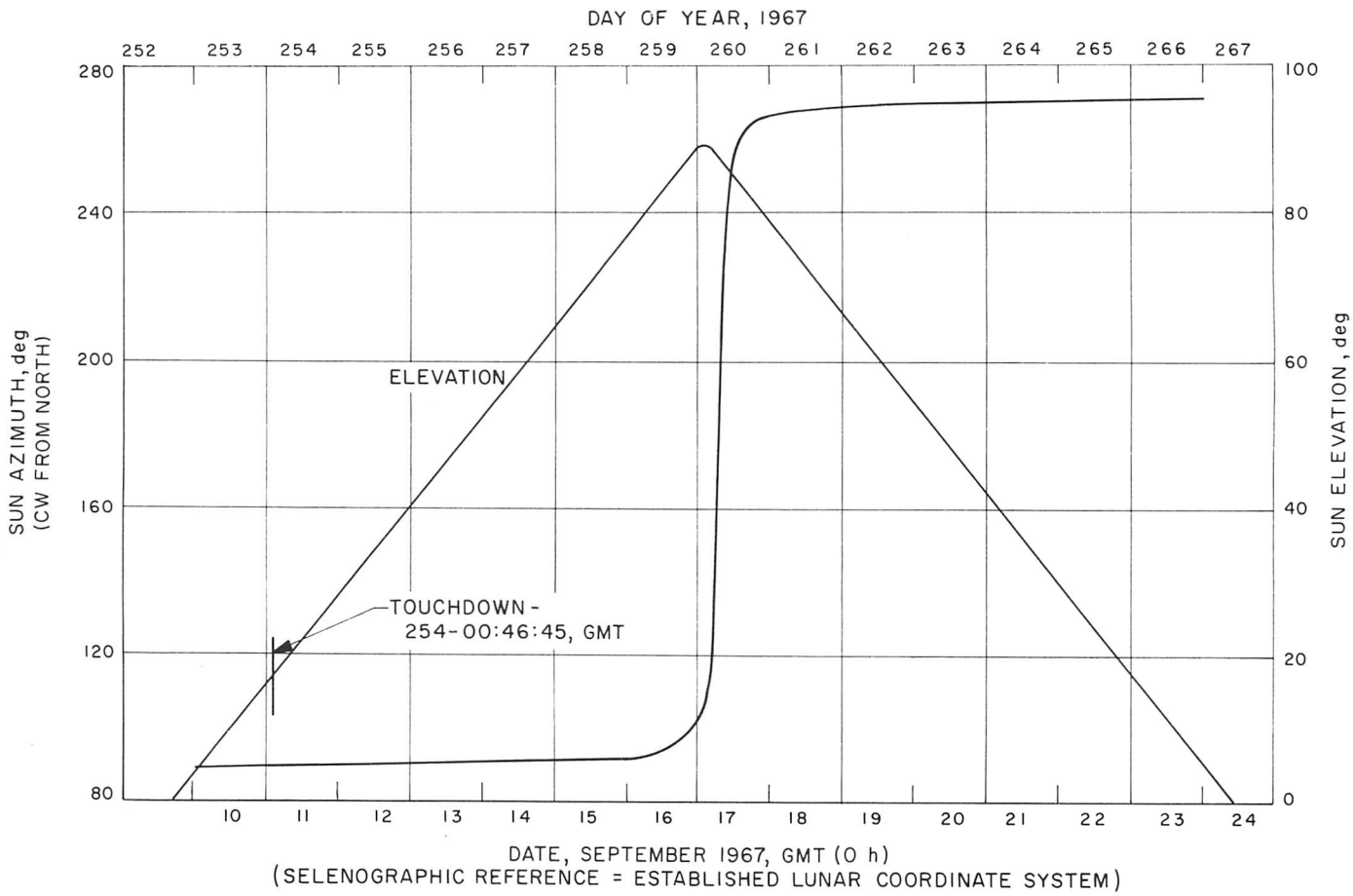

Fig. III-1. Sun position at *Surveyor V* location during 1st lunar day

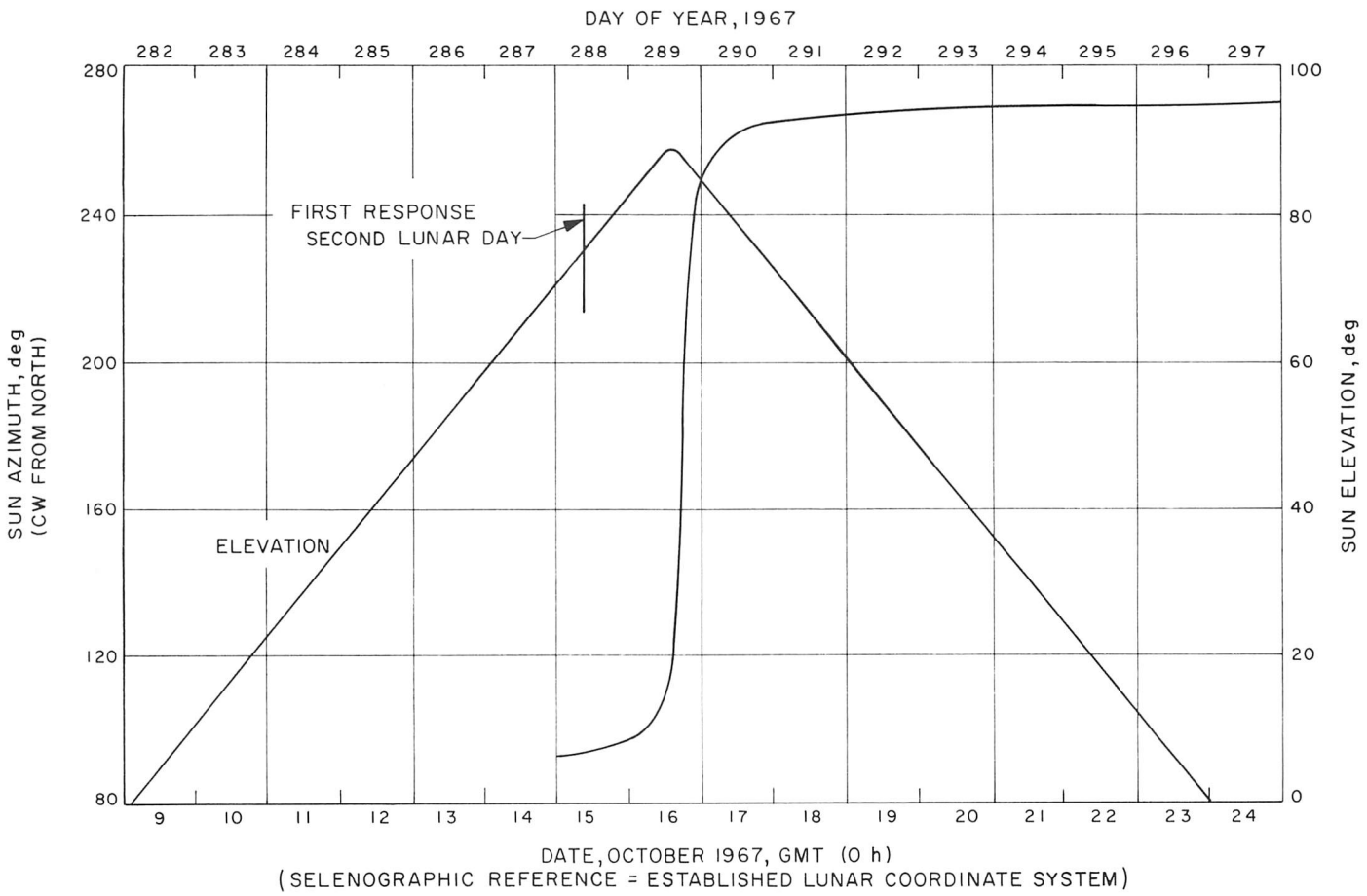

Fig. III-2. Sun position at *Surveyor V* location during 2nd lunar day

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IV. *Surveyor* Television Ground-Recording System

D. L. Smyth

The *Surveyor* TV ground recording system produces various types of records at each tracking station. The Goldstone tracking station (DSS-11) records the data on FR-800 magnetic tape as a 4 MHz predetected RF signal, on FR-1400 magnetic tape as a demodulated baseband signal, and on 70-mm and 35-mm film as reconstructed video. The overseas stations in Australia (DSS-42) and Spain (DSS-61) produce the same records as DSS-11 with the exception of 70-mm film. In addition to the records made at Goldstone, the video data are transmitted to the JPL/SFOF via 6 MHz microwave, in real time, and recorded on FR-800 and FR-1400 magnetic tapes, 70-mm film, and displayed on standard video monitors.

Upon receipt of the recorded data from DSS-42 and DSS-61 at JPL/SFOF, the FR-800 magnetic tapes were played and recorded on 70-mm film. All film processing and printing was performed at JPL by the TV Ground Data-Handling System (TVGDHS). A description of the Spacecraft TV Ground Data-Handling System (SC-TVGDHS) is contained in JPL TR 32-1023, *Surveyor I Mission Report: Part I. Mission Description and Performance*, dated August 31, 1966, pp. 116–119.

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V. Picture Identification Data

D. L. Smyth

The camera identification data that caption each picture are derived from the telemetry transmitted with the picture. By use of pre-launch calibration data, the telemetry data were converted to engineering units. The data in the picture caption have been validated by editing through the use of mission sequence logs, command data logs, and mosaic references. Table V-1 contains the picture index and identification data for each picture. Table V-2 contains a reference list of picture subjects and areas.

The format of the identification data is as follows:

Time

The Greenwich Mean Time (GMT) of picture receipt by tracking station is given as day of year, hours, minutes, and seconds.

Azimuth

The camera–mirror azimuth in camera coordinates. The range is +132.0 to −222.0 deg in nominal 3-deg increments; + is counterclockwise as seen from above, and − is clockwise as seen from above.

Elevation

The camera–mirror elevation in camera coordinates. The effective range in elevation positions is +36.46 to −67.7 deg in nominal 4.96-deg increments.

Focus

The distance to the plane of principal focus, in meters. The range of the focus is from 1.22 to infinity meters for steps 0 to 49, respectively.

Iris

The camera iris setting is expressed as *f*/number. The range is *f*/4.0 to *f*/22.0.

Lens focal length

The focal length of the camera optic is 25 mm for wide angle and 100 mm for narrow angle.

Filter

The filter position can be clear, green, blue, or red. For verification, the color sector on the picture of the photometric chart which is lightest in tone corresponds to the correct filter used. In order, clockwise from the light-gray step on the outer gray scale of the chart, the color sectors are green, blue, gray, and red.

Picture perspective

Included as a part of the caption on each picture is a vector diagram indicating the direction of the proper perspective to the reader. The perspective refers to the orientation of the scene as it would appear to the viewer if he were standing at the camera position, looking in the direction of the camera azimuth. The arrows in the vector diagrams point up and designate the direction of local vertical. (See Table V-3 for additional information.)

Table V-1. Selected lunar pictures

Picture	GMT				Azimuth	Elevation	Focus distance, m	Iris setting	Lens focal length[a]	Filter	Remarks
	Day	Hour	Minute	Second							
1	254	02	29	34	−60	−55	2.5	f/15.8	N	Clear	
2	254	05	29	53	−57	−60	2.3	f/9.0	W	Clear	Processed[b]
3	254	05	50	45	−3	−45	2.3	f/9.0	W	Clear	
4	254	05	59	20	−3	15	2.3	f/9.4	W	Clear	
5	254	06	01	17	−3	30	2.3	f/9.4	W	Clear	
6	254	06	03	16	15	30	2.3	f/7.4	W	Clear	
7	254	06	15	21	33	30	2.3	f/8.0	W	Clear	
8	254	06	22	42	51	30	2.3	f/8.0	W	Clear	
9	254	06	24	51	51	15	2.3	f/10.9	W	Clear	
10	254	06	26	09	51	−45	2.3	f/21.1	W	Clear	
11	254	06	30	03	69	15	2.3	f/13.8	W	Clear	
12	254	06	33	28	87	−30	2.3	f/23.7	W	Clear	
13	254	06	36	48	105	0	2.3	f/15.9	W	Clear	
14	254	06	52	41	33	−60	2.3	f/19.9	W	Clear	
15	254	06	58	29	−93	−30	2.3	f/9.5	W	Clear	
16	254	07	03	13	−111	−30	2.3	f/9.4	W	Clear	
17	254	07	06	46	−129	−30	2.3	f/8.5	W	Clear	
18	254	07	09	53	−147	−30	2.3	f/14.7	W	Clear	
19	254	08	15	33	−165	−30	2.3	f/20.8	W	Clear	
20	254	08	19	56	−183	−30	2.3	f/20.8	W	Clear	
21	254	08	26	08	−201	−30	2.3	f/23.6	W	Clear	Processed
22	254	08	29	27	−219	−15	2.3	f/23.6	W	Clear	
23	254	23	49	27	33	−45	2.4	f/17.3	W	Clear	
24	254	23	50	17	51	−45	2.4	f/17.9	W	Clear	
25	254	23	51	09	87	−30	2.4	f/23.6	W	Clear	
26	254	23	52	36	33	−60	2.4	f/14.6	W	Clear	
27	254	23	52	53	−21	−60	2.4	f/13.7	W	Clear	
28	254	23	53	03	−57	−60	2.4	f/15.9	W	Clear	
29	254	23	57	52	−90	−60	2.4	f/15.3	W	Clear	
30	254	23	58	01	−54	−60	2.4	f/16.6	W	Clear	
31	255	00	03	26	−60	−55	2.2	f/12.3	N	Clear	
32	255	00	33	33	−57	−60	2.4	f/12.3	N	Clear	Processed
33	255	00	39	53	39	−50	1.3	f/17.6	W	Clear	Processed
34	255	02	02	48	78	−20	2.7	f/16.8	N	Clear	
35	255	02	04	04	75	−20	2.6	f/23.5	N	Clear	
36	255	02	04	27	81	−20	2.6	f/23.5	N	Clear	
37	255	02	08	31	81	−25	2.9	f/23.5	N	Clear	
38	255	02	37	25	−168	−40	1.3	f/11.6	N	Clear	
39	255	02	37	58	−171	−35	1.5	f/11.6	N	Clear	
40	255	02	47	42	−201	−35	3.0	f/10.1	N	Clear	
41	255	02	50	31	−210	−35	2.4	f/16.5	N	Clear	Processed
42	255	04	54	01	30	−45	2.1	f/12.3	N	Clear	
43	255	04	54	37	21	−40	2.2	f/12.3	N	Clear	
44	255	05	09	25	57	−20	2.5	f/12.3	N	Clear	

[a]W = wide angle, 25 mm;
N = narrow angle, 100 mm.

[b]Processed, as used throughout, means digitally processed.

Table V-1 (contd)

Picture	GMT				Azimuth	Elevation	Focus distance, m	Iris setting	Lens focal length[a]	Filter	Remarks
	Day	Hour	Minute	Second							
45	255	05	26	17	63	−35	2.1	f/17.7	N	Clear	
46	255	05	26	23	60	−30	2.2	f/17.7	N	Clear	
47	255	05	26	28	66	−30	2.2	f/25.4	N	Clear	
48	256	00	36	15	−54	−55	2.5	f/12.3	N	Clear	Processed
49	256	01	14	44	−201	−40	3.0	f/16.8	W	Clear	
50	256	06	32	34	−60	−50	2.5	f/16.9	N	Clear	Processed
51	257	01	07	36	−57	−60	2.4	f/12.2	N	Clear	Processed
52	257	04	41	24	−78	−70	2.4	f/16.5	W	Clear	
53	257	04	42	06	−78	−60	2.5	f/16.5	N	Clear	
54	257	04	42	28	−84	−60	2.6	f/16.5	N	Clear	
55	257	04	42	44	−90	−60	2.6	f/16.5	N	Clear	
56	257	04	43	02	−96	−60	2.6	f/16.5	N	Clear	
57	257	05	59	57	36	−50	2.3	f/16.9	W	Clear	
58	257	06	02	32	54	−50	2.3	f/23.7	W	Clear	
59	257	06	11	31	−108	−65	2.3	f/16.5	W	Clear	
60	257	06	11	37	−90	−65	2.3	f/16.5	W	Clear	
61	257	06	59	16	6	−55	2.1	f/17.7	N	Clear	
62	257	08	02	05	−57	−60	2.4	f/8.1	N	Clear	
63	257	08	02	05	−57	−60	2.4	f/8.1	N	Clear	Processed
64	257	08	08	41	−54	−55	2.5	f/16.9	N	Clear	Processed
65	257	08	08	46	−60	−55	2.5	f/16.9	N	Clear	Processed
66	257	08	09	09	−51	−50	2.5	f/16.8	N	Clear	
67	257	08	10	02	−63	−40	3.1	f/16.9	N	Clear	
68	257	08	16	44	−60	−5	10.4	f/11.5	N	Clear	
69	257	08	30	03	−12	−5	3.2	f/16.9	N	Clear	
70	258	02	45	59	57	−20	2.5	f/8.2	N	Green	
71	258	03	30	19	54	−20	2.3	f/23.7	W	Clear	
72	258	03	40	28	−108	−65	2.3	f/16.5	W	Clear	
73	258	03	48	09	−57	−60	2.4	f/16.6	N	Clear	
74	258	03	53	11	−57	−60	2.4	f/5.9	N	Clear	
75	258	08	30	02	−120	−60	2.5	f/17.8	N	Clear	
76	261	03	41	52	−39	−45	2.5	f/8.3	N	Green	
77	261	05	29	42	−63	−55	2.5	f/14.5	N	Green	
78	261	07	16	55	−162	−35	2.3	f/7.2	N	Green	
79	262	06	20	03	−201	−40	2.2	f/6.0	N	Green	
80	262	06	21	28	−204	−35	2.3	f/25.4	N	Green	
81	262	07	33	07	60	−30	2.5	f/16.8	N	Clear	
82	262	07	36	05	63	−30	2.5	f/16.8	N	Clear	
83	263	07	04	25	132	20	25.2	f/4.1	N	Clear	Jupiter 1.2-s exp.
84	263	07	10	15	123	20	25.2	f/4.1	N	Clear	Venus 1.2-s exp.
85	263	09	30	54	9	5	3.9	f/16.6	N	Clear	
86	263	09	38	48	60	−30	2.4	f/16.6	N	Clear	

[a]W = wide angle, 25 mm;
N = narrow angle, 100 mm.

Table V-1 (contd)

Picture	GMT				Azimuth	Elevation	Focus distance, m	Iris setting	Lens focal length[a]	Filter	Remarks
	Day	Hour	Minute	Second							
87	263	11	46	49	−207	−40	2.2	f/16.7	W	Clear	Processed
88	263	11	47	37	−201	−40	2.2	f/16.7	N	Clear	
89	264	10	43	24	−156	−30	19.4	f/11.8	N	Clear	
90	264	10	49	04	−123	−55	2.6	f/16.5	N	Clear	
91	264	11	57	23	−3	15	4.3	f/16.5	N	Clear	
92	264	12	08	31	12	−40	2.3	f/16.5	N	Clear	
93	264	12	22	48	36	−40	2.3	f/16.5	N	Clear	
94	264	12	48	03	42	30	25.0	f/11.5	N	Clear	
95	265	04	46	10	−54	−20	2.3	f/23.6	W	Clear	
96	265	04	46	15	−54	−35	2.3	f/23.6	W	Clear	
97	265	05	03	56	−144	−35	2.3	f/11.6	W	Clear	
98	265	05	34	40	33	−45	2.2	f/16.7	N	Clear	
99	265	06	05	52	−204	−35	2.3	f/11.6	N	Clear	
100	265	06	27	13	−156	−30	8.8	f/11.6	N	Clear	
101	265	12	15	52	−3	−45	2.3	f/16.7	N	Clear	
102	265	12	31	59	−3	15	4.3	f/16.7	N	Clear	
103	265	13	36	49	81	−45	2.3	f/12.3	N	Clear	
104	265	13	48	13	78	−20	2.7	f/17.5	N	Clear	
105	265	14	09	07	−204	−35	2.3	f/12.3	N	Clear	
106	265	15	02	26	24	−30	2.4	f/16.6	N	Clear	
107	265	15	16	15	39	−35	2.3	f/16.7	N	Clear	
108	265	15	26	21	60	10	3.6	f/11.6	N	Clear	
109	265	15	27	58	54	20	6.4	f/11.6	N	Clear	
110	265	15	29	13	51	25	14.3	f/11.6	N	Clear	
111	265	15	29	17	57	25	14.3	f/11.6	N	Clear	
112	265	15	30	22	42	30	22.7	f/5.0	N	Clear	
113	265	15	30	32	36	30	22.5	f/11.6	N	Clear	
114	265	15	30	48	30	30	22.7	f/11.6	N	Clear	
115	265	15	46	14	78	10	8.7	f/11.6	N	Clear	
116	266	05	49	34	−129	−30	2.3	f/11.2	W	Clear	
117	266	05	49	58	−150	−35	11.1	f/25.4	W	Clear	
118	266	08	32	13	−60	−20	3.9	f/16.4	W	Clear	
119	266	09	17	15	−144	−30	16.8	f/8.0	N	Clear	
120	266	09	17	49	−156	−30	45.6	f/8.1	N	Clear	
121	266	09	17	54	−162	−30	16.4	f/8.1	N	Clear	
122	266	09	52	49	−57	−60	2.3	f/23.3	N	Clear	Processed
123	266	10	09	52	−36	−10	3.8	f/16.5	N	Clear	
124	266	10	59	41	−24	−55	2.2	f/11.5	N	Clear	
125	266	11	02	47	−27	−25	46.9	f/11.5	N	Clear	
126	266	11	10	34	−18	5	3.2	f/11.5	N	Clear	
127	266	11	14	03	−3	15	4.2	f/11.5	N	Clear	
128	266	11	14	39	0	20	6.2	f/4.7	N	Clear	
129	266	11	24	40	0	25	2.3	f/11.5	W	Clear	
130	266	11	26	28	54	25	2.3	f/8.1	W	Clear	

[a]W = wide angle, 25 mm;
N = narrow angle, 100 mm.

Table V-1 (contd)

Picture	GMT				Azimuth	Elevation	Focus distance, m	Iris setting	Lens focal length[a]	Filter	Remarks
	Day	Hour	Minute	Second							
131	266	11	33	49	−126	−35	2.3	f/11.5	W	Clear	
132	266	12	09	50	9	25	11.9	f/11.5	N	Clear	
133	266	12	09	53	15	25	11.9	f/11.5	N	Clear	
134	266	12	23	31	48	20	6.5	f/8.1	N	Clear	
135	266	12	23	35	45	20	7.3	f/8.1	N	Clear	
136	266	12	24	43	57	25	16.3	f/8.1	N	Clear	
137	266	12	37	37	42	30	24.9	f/8.1	N	Clear	
138	266	12	37	51	36	30	24.9	f/8.1	N	Clear	
139	266	12	38	04	30	30	24.9	f/8.1	N	Clear	
140	266	14	04	41	114	20	8.2	f/8.1	N	Clear	
141	266	14	19	44	−66	−20	3.5	f/16.3	W	Clear	
142	267	06	32	34	−147	−35	4.6	f/12.1	N	Green	
143	267	06	37	55	−108	−30	4.6	f/12.1	N	Green	
144	267	06	38	05	−120	−30	4.5	f/12.1	N	Green	
145	267	06	41	37	−105	−25	4.5	f/17.3	N	Green	
146	267	06	41	41	−99	−25	4.6	f/17.3	N	Green	
147	267	06	42	17	−90	−20	4.5	f/17.3	N	Green	
148	267	06	42	22	−96	−20	4.6	f/17.3	N	Green	
149	267	06	42	49	−81	−15	4.6	f/24.9	N	Green	
150	267	06	47	41	−57	−5	4.6	f/23.4	N	Green	
151	267	06	48	21	−54	−5	4.7	f/23.4	N	Green	
152	267	06	55	18	−27	15	4.6	f/16.6	N	Green	
153	267	07	00	53	21	25	4.6	f/11.6	N	Green	
154	267	08	10	39	−105	−25	4.6	f/16.5	N	Green	
155	267	08	10	44	−99	−25	4.1	f/15.8	N	Green	
156	267	08	16	34	−54	−5	4.6	f/23.2	N	Green	
157	267	08	25	32	−27	15	4.5	f/16.5	N	Green	
158	267	09	10	39	−105	−25	4.5	f/16.5	N	Green	
159	267	10	02	52	−105	−25	4.5	f/16.5	N	Green	
160	267	11	08	32	114	5	4.5	f/23.2	N	Green	30-s exp.
161	267	11	12	42	114	5	4.5	f/23.2	N	Green	90-s exp.
162	290	03	15	06	−171	−45	1.3	f/11.5	W	Clear	
163	255	02	37	53	−165	−35	1.5	f/11.6	N	Clear	
164	294	06	34	20	−165	−35	1.5	f/11.6	N	Clear	

[a]W = wide angle, 25 mm;
N = narrow angle, 100 mm.

Table V-2. Reference list of picture subjects

Subject	Picture number
1. 200-line mode	1
2. Foot pad 3	1, 25, 34, 35, 37
3. Foot pad 2	2, 3, 28, 30, 31, 48, 65, 77, 104
4. Area to east	67, 68, 76, 95, 96, 118, 124, 125, 141, 150, 151, 156
5. Area to northeast	4, 5, 6, 69, 101, 102, 123, 126, 127, 128, 129, 152, 157
6. Area to north	7, 8, 42, 43, 61, 85, 91, 92, 93, 106, 112, 113, 114, 132, 133, 137, 138, 139, 153
7. Area to northwest	9, 10, 12, 44, 70, 71, 94, 107, 108, 109, 110, 111, 115, 130, 134, 135, 136, 140
8. Area to west	13, 160, 161
9. Area to south	17, 18, 19, 20, 78, 89, 97, 100, 117, 119, 120, 121, 142
10. Area to southeast	15, 16, 116, 131, 143, 144, 145, 146, 147, 148, 149, 154, 155, 158, 159
11. Alpha-scattering instrument	11, 14, 21, 23, 24, 26, 33, 41, 49, 57, 58, 79, 87, 98
12. Compartment A	18, 19, 20, 38, 39, 78, 97, 117, 162, 163, 164
13. Compartment B	22
14. Spacecraft shadow	13, 70, 71, 95, 96, 118, 141
15. Auxiliary mirrors	21, 40, 41, 49, 79, 80, 87, 88, 99, 105
16. Crush block 3 and vernier 3 area	21, 40, 49, 79, 80, 87, 88, 99, 103, 105
17. Pad 2 throw-out	3, 27, 28, 30, 48, 50, 64, 65, 66, 90, 104
18. Pad 2 trench	28, 29, 52, 53, 54, 55, 56, 59, 60, 72, 75
19. Pad 3 throw-out	1, 34, 35, 36, 37
20. Leg 3 and trench	1, 25, 36, 37
21. Magnets and photo target	32, 51, 62, 63, 64, 65, 73, 74, 122
22. Rock near He tank	45, 46, 47, 81, 82, 86
23. Rock, Azimuth +57, Elevation −20	44, 70, 71
24. Omni-antenna B, photo target	71
25. Stars and planets	83, 84
26. Solar corona	160, 161
27. Second lunar day	162, 164

Table V-3. Camera azimuth vs lunar-view rotation vs report view

Az[a]	R[b]	r[c]	Az[a]	R[b]	r[c]	Az[a]	R[b]	r[c]
135	−165	15	12	−2	−2	−108	127	37
132	−162	18	9	3	3	−111	128	38
129	−159	21	6	7	7	−114	130	40
126	−156	24	3	12	12	−117	132	42
123	−153	27	0	16	16	−120	133	43
120	−150	30	−3	20	20	−123	135	45
117	−147	33	−6	25	25	−126	136	−44
114	−144	36	−9	29	29	−129	138	−42
111	−141	39	−12	33	33	−132	140	−40
108	−137	43	−15	37	37	−135	141	−39
105	−134	−44	−18	41	41	−138	143	−37
102	−130	−40	−21	45	45	−141	144	−36
99	−127	−37	−24	49	−41	−144	146	−34
96	−122	−33	−27	53	−37	−147	147	−33
93	−119	−29	−30	57	−33	−150	148	−32
90	−115	−25	−33	61	−29	−153	150	−30
87	−111	−21	−36	64	−26	−156	151	−29
84	−107	−17	−39	68	−22	−159	153	−27
81	−103	−13	−42	71	−19	−162	154	−26
78	−99	−9	−45	75	−15	−165	156	−24
75	−95	−5	−48	78	−12	−168	158	−22
72	−91	−1	−51	81	−9	−171	159	−21
69	−86	4	−54	84	−6	−174	161	−19
66	−82	8	−57	87	−3	−177	162	−18
63	−78	12	−60	90	0	−180	164	−16
60	−73	17	−63	93	3	−183	166	−14
57	−69	21	−66	96	6	−186	167	−13
54	−64	26	−69	99	9	−189	169	−11
51	−60	30	−72	101	11	−192	171	−9
48	−56	34	−75	104	14	−195	173	−7
45	−51	39	−78	106	16	−198	175	−5
42	−47	43	−81	109	19	−201	177	−3
39	−42	−42	−84	111	21	−204	179	−1
36	−38	−38	−87	113	23	−207	181	1
33	−33	−33	−90	115	25	−210	183	3
30	−28	−28	−93	117	27	−213	185	5
27	−24	−24	−96	119	29	−216	188	8
24	−19	−19	−99	121	31	−219	190	10
21	−15	−15	−102	123	33	−222	193	13
18	−10	−10	−105	125	35	−225	195	15
15	−6	−6						

[a]Camera azimuth.

[b]Rotation of lunar view; + is clockwise, and − is counterclockwise.

[c]Angle between report view and lunar view; + is clockwise, and − is counterclockwise.

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VI. *Surveyor* Mosaics

D. L. Smyth

The mosaics included in this report consist of those prepared in real-time, semi-improved mosaics, and specially prepared mosaics.

The real-time (operations) mosaics are prepared during operations for immediate analysis of the surface features and camera performance. These mosaics are not archival quality.

The semi-improved mosaics are prepared during the mission as a better quality print becomes available. This type of mosaic is also the first type prepared from data received from the overseas stations. These mosaics provide a more accurate representation of the surface features and conditions as viewed by the camera.

The special mosaics are usually prepared of small areas for detailed analysis purposes. Considerable care is taken in the printing and the placement of the frames on a grid for the special mosaics.

Table VI-1 lists the mosaics included and describes their subject matter.

Table VI-1. Selected mosaics

Mosaic	Day	Azimuth, deg	Lens focal length[a]	Identification
1	254	−216 to +126	W	Catalog No. 5–26–SI; 360 pan—semi-improved mosaic
2	254	−216 to +126	W	Catalog No. 5–3–SI; 360 pan—semi-improved mosaic
3	258	−216 to +126	W	Catalog No. 5–35–SI; 360 pan—semi-improved mosaic
4	263	−177 to −144	N	Catalog No. 5–66; operations mosaic
5	264	−141 to −108	N	Catalog No. 5–88; operations mosaic
6	258	−105 to −72	N	Catalog No. 5–41–SI; semi-improved mosaic
7	264	−105 to −72	N	Catalog No. 5–87; operations mosaic
8	257	−69 to −36	N	Catalog No. 5–33–SI; semi-improved mosaic
9	264	−69 to −36	N	Catalog No. 5–89; operations (zero phase) mosaic
10	265	−33 to 0	N	Catalog No. 5–111; operations mosaic
11	255	+3 to +36	N	Catalog No. 5–13–SI; semi-improved mosaic
12	264	+3 to +36	N	Catalog No. 5–91; operations mosaic
13	255	+39 to +66	N	Catalog No. 5–14–SI; semi-improved mosaic
14	264	+39 to +72	N	Catalog No. 5–92; operations mosaic
15	264	+75 to +108	N	Catalog No. 5–94; operations mosaic
16	264	+111 to +126	N	Catalog No. 5–95; operations mosaic
17	254	−156 to +90	W	Catalog No. 5–MP–9; pad 2 to pad 3 mosaic
18	258	−138 to −54	N	Catalog No. 5–MP–34; pad 2 area and trench mosaic
19	257	−108 to −60	W	Catalog No. 5–MP–19; pad 2 area and trench mosaic
20	256	−93 to −72	N	Catalog No. 5–MP–36; pad 2 trench mosaic
21	255	−72 to −36	N	Catalog No. 5–MP–26; pad 2 area—pre-firing mosaic
22	256	−75 to −39	N	Catalog No. 5–MP–27; pad 2 area—post-firing mosaic
23	255	+72 to +93	N	Catalog No. 5–MP–32; pad 3 area—pre-firing mosaic
24	258	+57 to +102	N	Catalog No. 5–MP–29; pad 3 area—post-firing mosaic
25	263	+57 to +102	W	Catalog No. 5–MP–33; pad 3 area—post-firing mosaic
26	264	+57 to +102	N	Catalog No. 5–MP–30; pad 3 area—post-firing mosaic
27	255	+75 to +87	N	Catalog No. 5–MP–37; vernier 3 area, direct—pre-firing mosaic
28	256	+75 to +87	N	Catalog No. 5–MP–38; vernier 3 area, direct—pre-firing mosaic
29	263	+75 to +87	N	Catalog No. 5–MP–39; vernier 3 area, direct—post-firing mosaic
30	264	+75 to +87	N	Catalog No. 5–MP–40; vernier 3 area, direct—post-firing mosaic
31	265	+75 to +87	N	Catalog No. 5–MP–41; vernier 3 area, direct—post-firing mosaic
32	255	−216 to −201	N	Catalog No. 5–MP–32; aux. mirror—pre-firing mosaic
33	256	−216 to −201	N	Catalog No. 5–MP–17; aux. mirror—pre-firing mosaic
34	256	−216 to −201	N	Catalog No. 5–MP–18; aux. mirror—post-firing mosaic
35	263	−216 to −201	N	Catalog No. 5–MP–28; aux. mirror—post-firing mosaic
36	265	−216 to −201	N	Catalog No. 5–MP–22; aux. mirror—post-firing mosaic
37	266	−216 to −201	N	Catalog No. 5–MP–35; aux. mirror—post-firing mosaic
38	255	+27 to +69	N	Catalog No. 5–MP–24; ASI—area—pre-firing mosaic
39	257	+30 to +63	N	Catalog No. 5–MP–25; ASI—area—post-firing mosaic

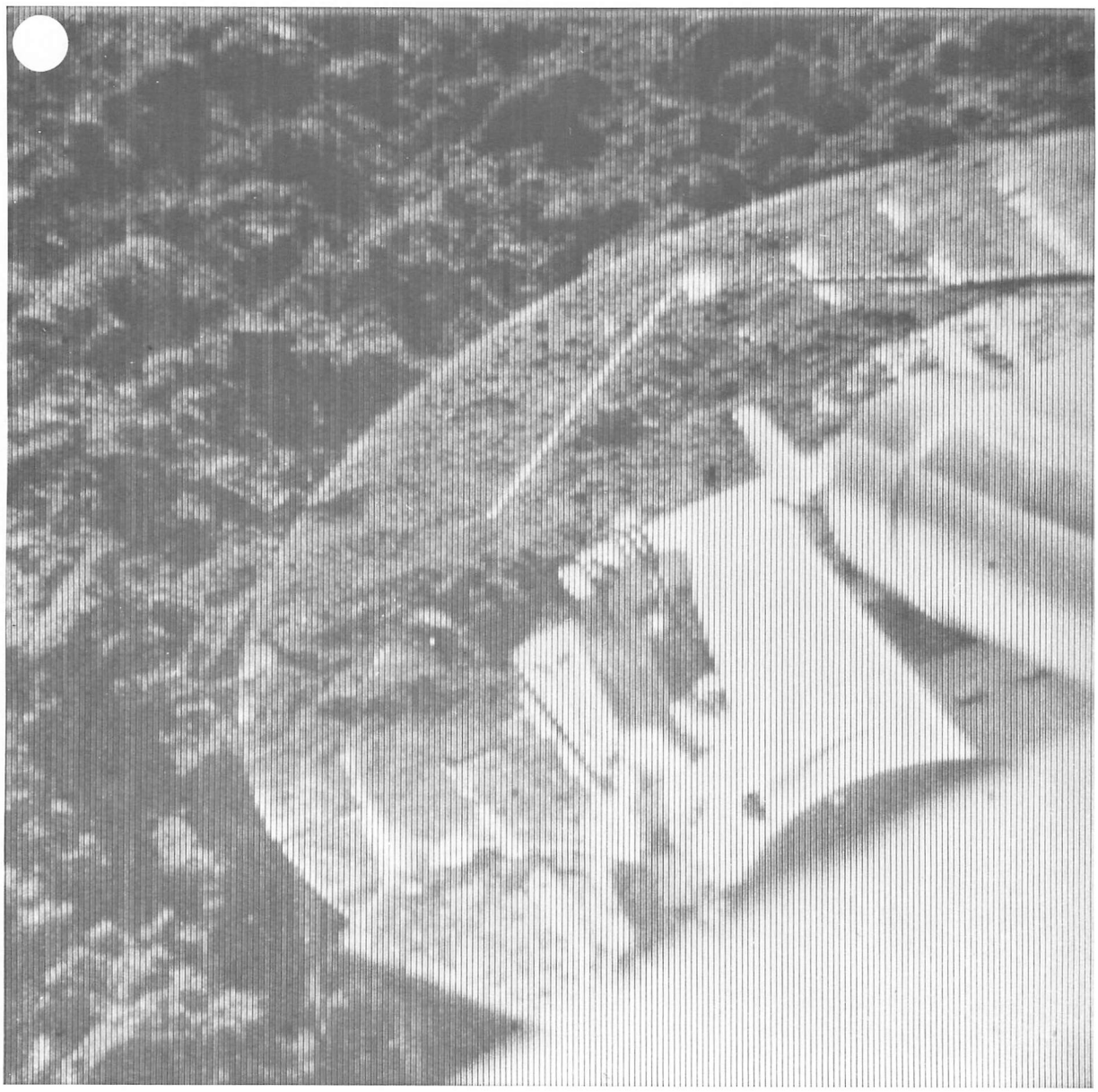
[a]W = wide angle, 25 mm;
N = narrow angle, 100 mm.

VII. Selected Lunar Pictures and Mosaics

D. L. Smyth

This section contains selected pictures and mosaics representing the *Surveyor V* area. Each picture in this section is oriented such that the local lunar horizon, or surface features, appear near the proper perspective for the reader; "proper perspective for the reader" assumes the reader is at the location of the camera mirror. The white dot on each selected picture, however, refers to the position of the upper right-hand corner of the vidicon raster.

The National Space Science Data Center at Goddard Space Flight Center, Greenbelt, Maryland, is responsible for dissemination of *Surveyor* pictures and other scientific data. An index and copies of pictures in various forms can be obtained from that NASA data center.



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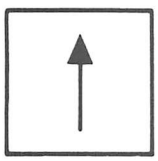
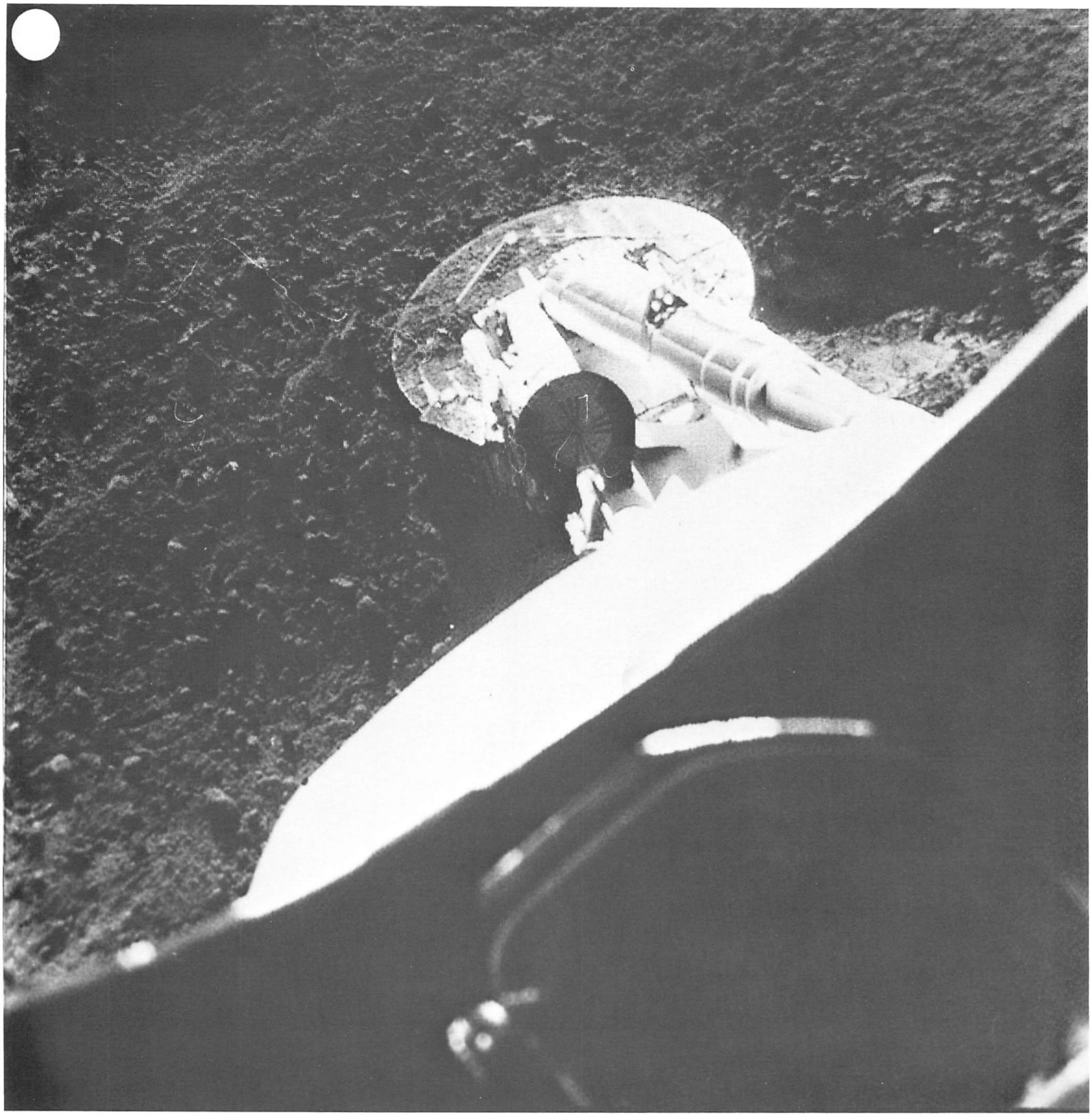
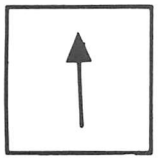
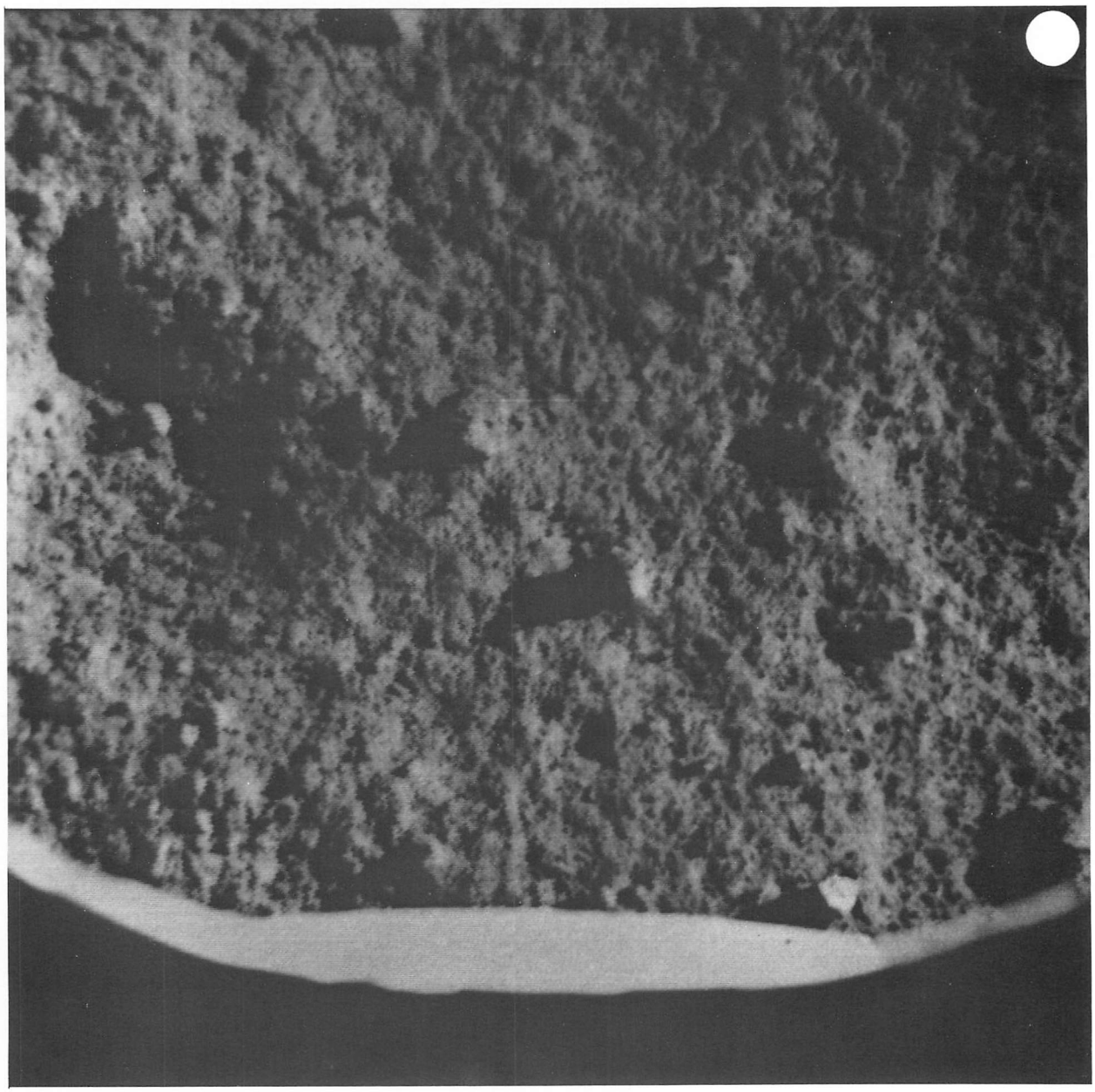




	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(2)	Day 254, 05:29:53	−57	−60	2.3	*f*/9.0	W	Clear	Processed





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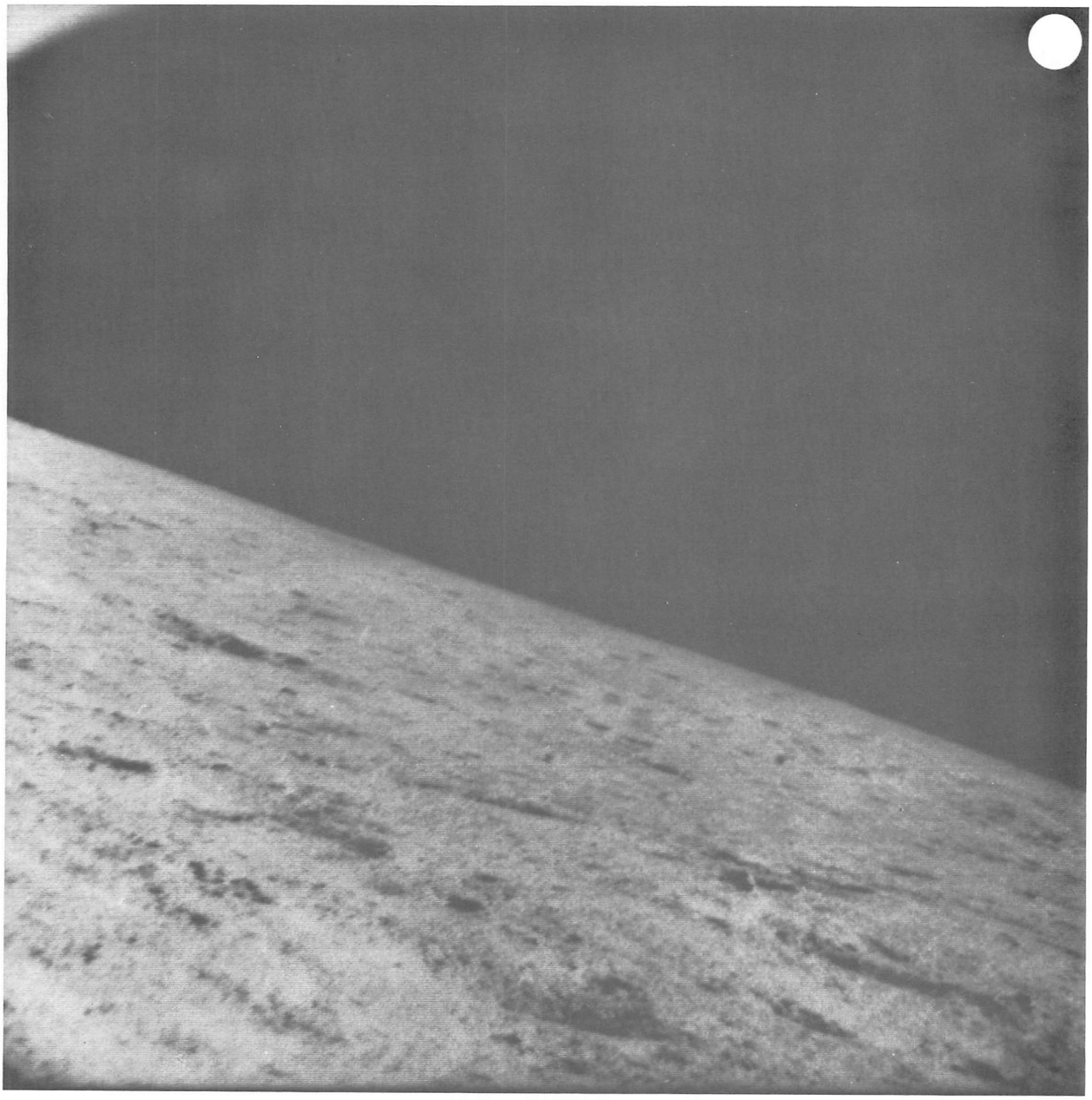
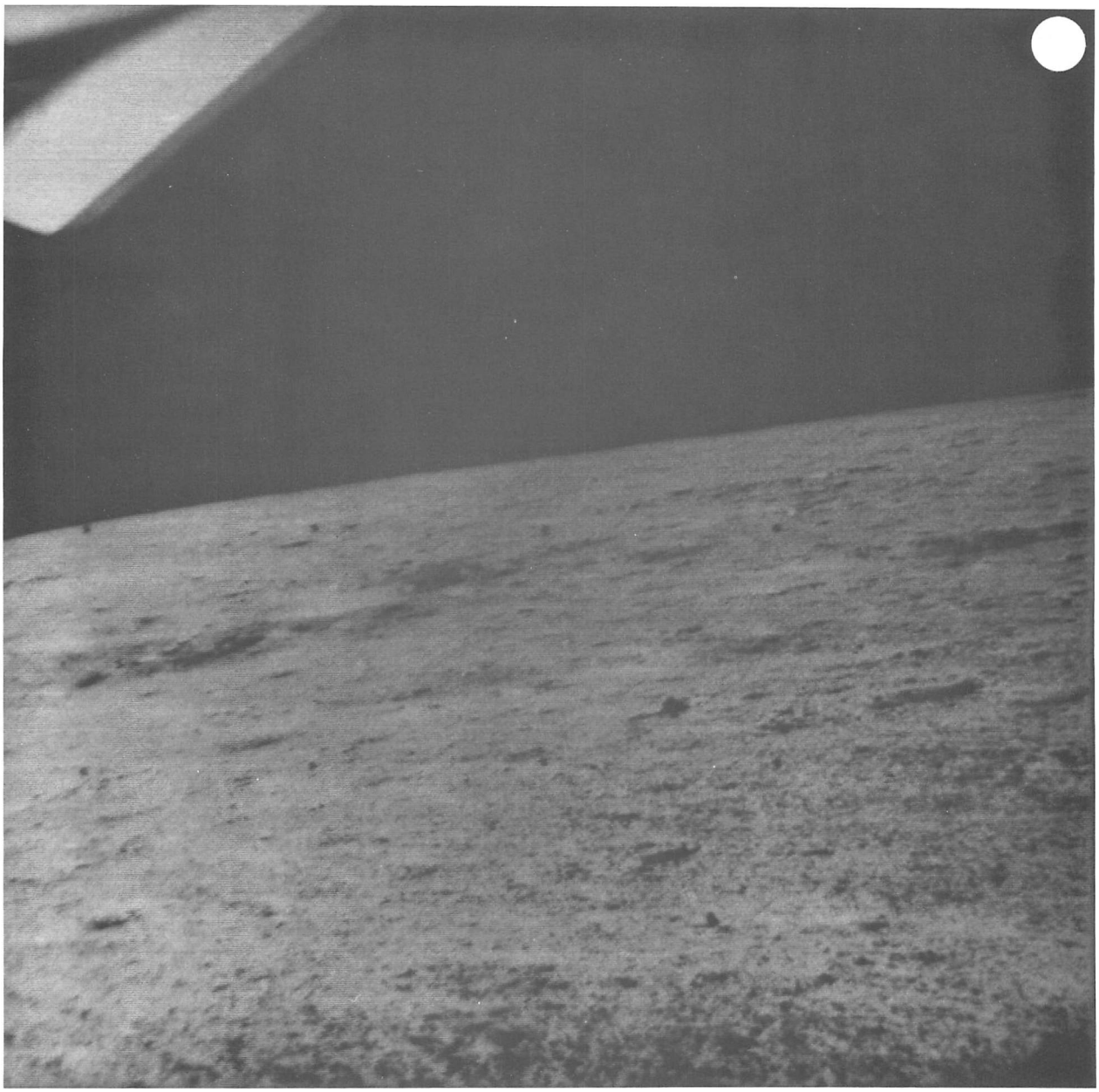
(3)	Day 254, 05:50:45	−3	−45	2.3	f/9.0	W	Clear

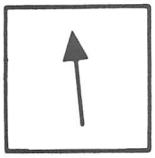
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(4)	Day 254, 05:59:20	−3	15	2.3	f/9.4	W	Clear

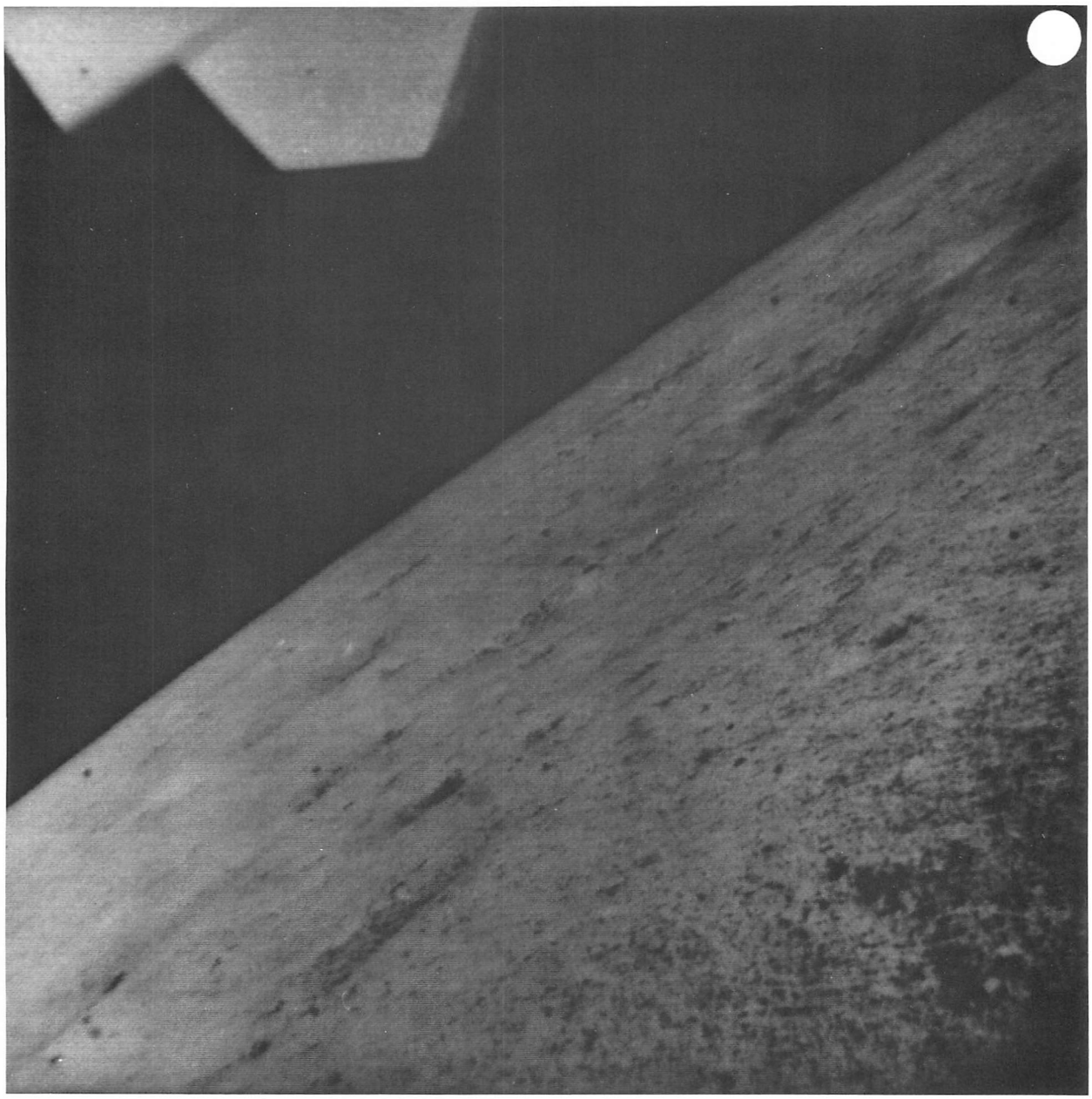


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(5)	Day 254, 06:01:17	−3	30	2.3	*f*/9.4	W	Clear

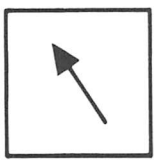


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(6)	Day 254, 06:03:16	15	30	2.3	f/7.4	W	Clear





	GMT	Az	El	Focus, m	Iris	Lens	Filter
(7)	Day 254, 06:15:21	33	30	2.3	f/8.0	W	Clear



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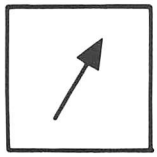
(8)	Day 254, 06:22:42	51	30	2.3	f/8.0	W	Clear



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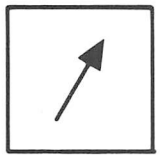
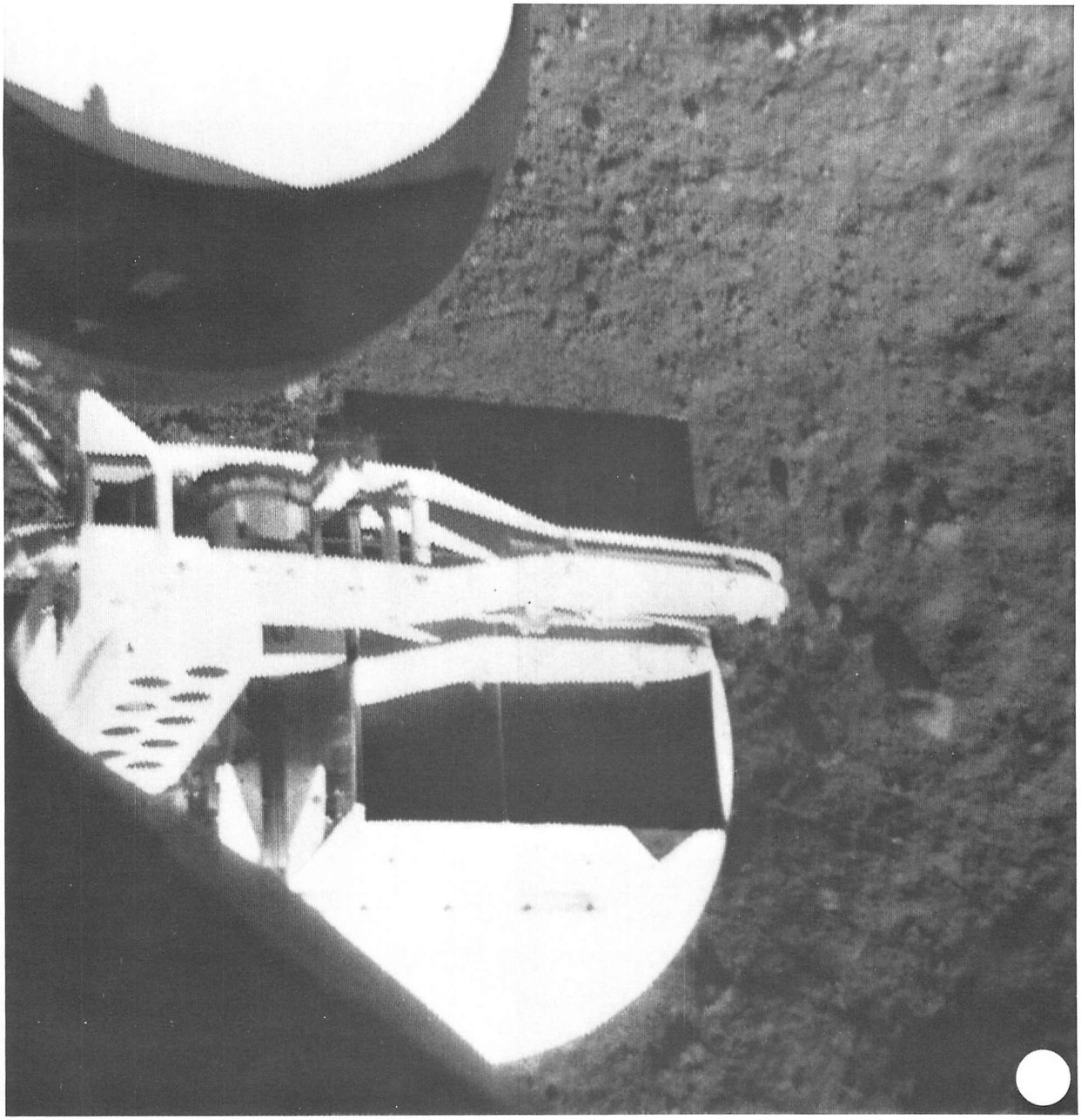
(9)	Day 254, 06:24:51	51	15	2.3	f/10.9	W	Clear





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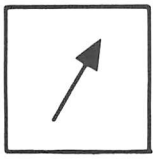
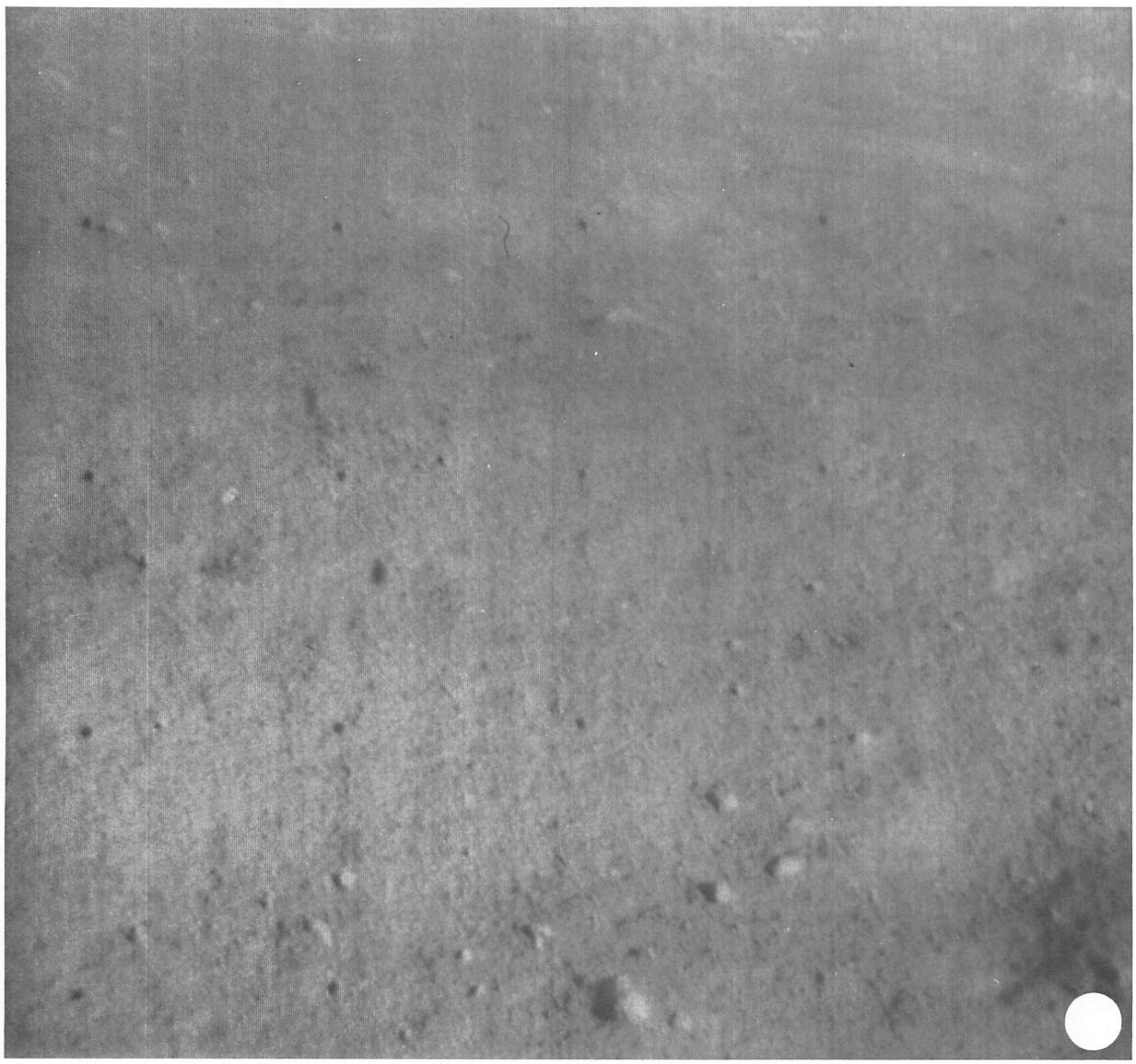
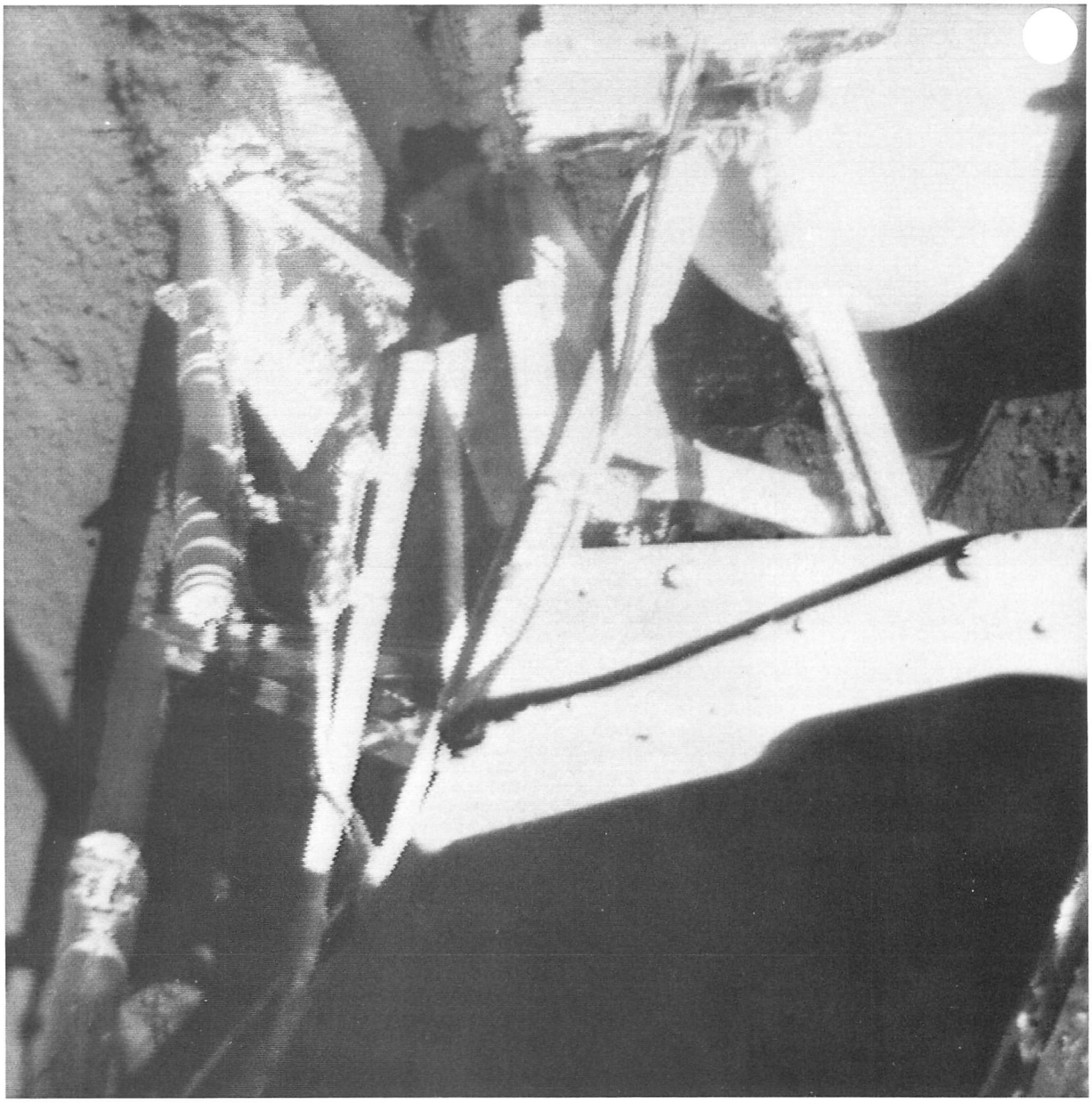
(10)	Day 254, 06:26:09	51	−45	2.3	f/21.1	W	Clear





	GMT	Az	El	Focus, m	Iris	Lens	Filter
(11)	Day 254, 06:30:03	69	15	2.3	f/13.8	W	Clear



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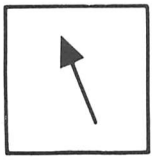
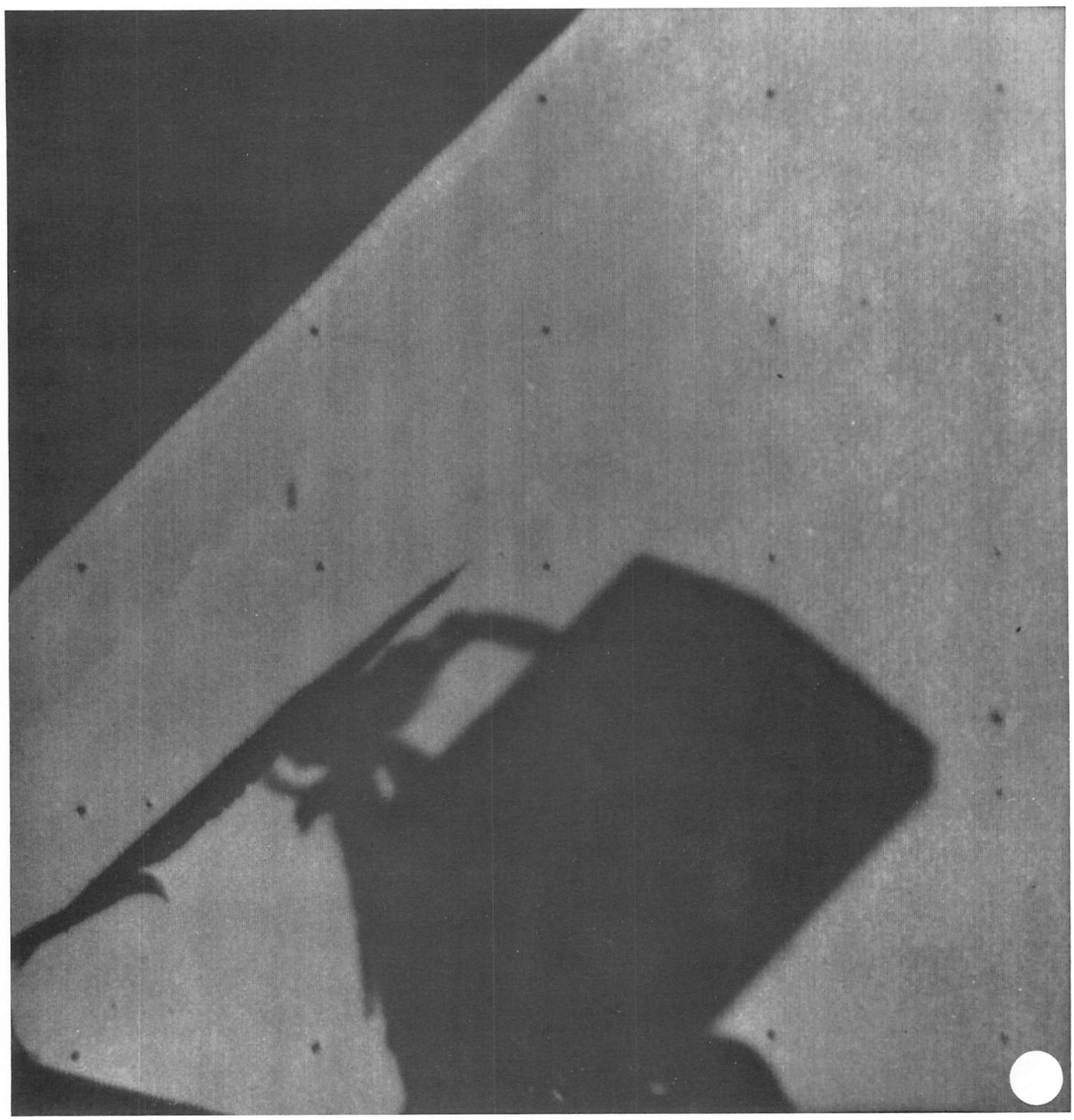
(12)	Day 254, 06:33:28	87	−30	2.3	*f*/23.7	W	Clear





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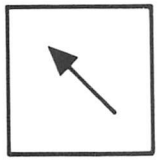
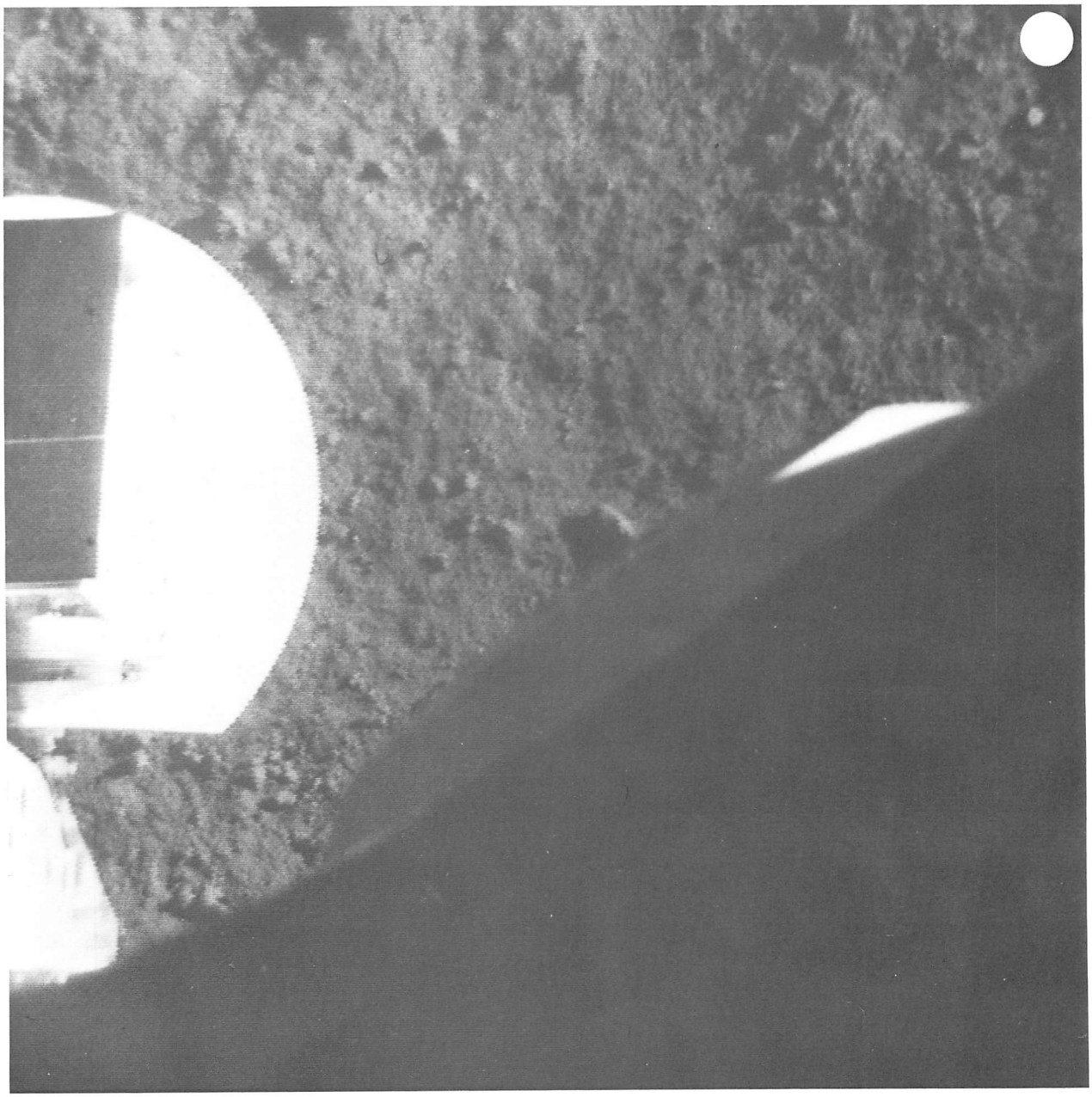
(13)	Day 254, 06:36:48	105	0	2.3	f/15.9	W	Clear





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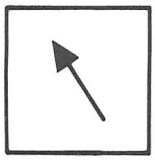
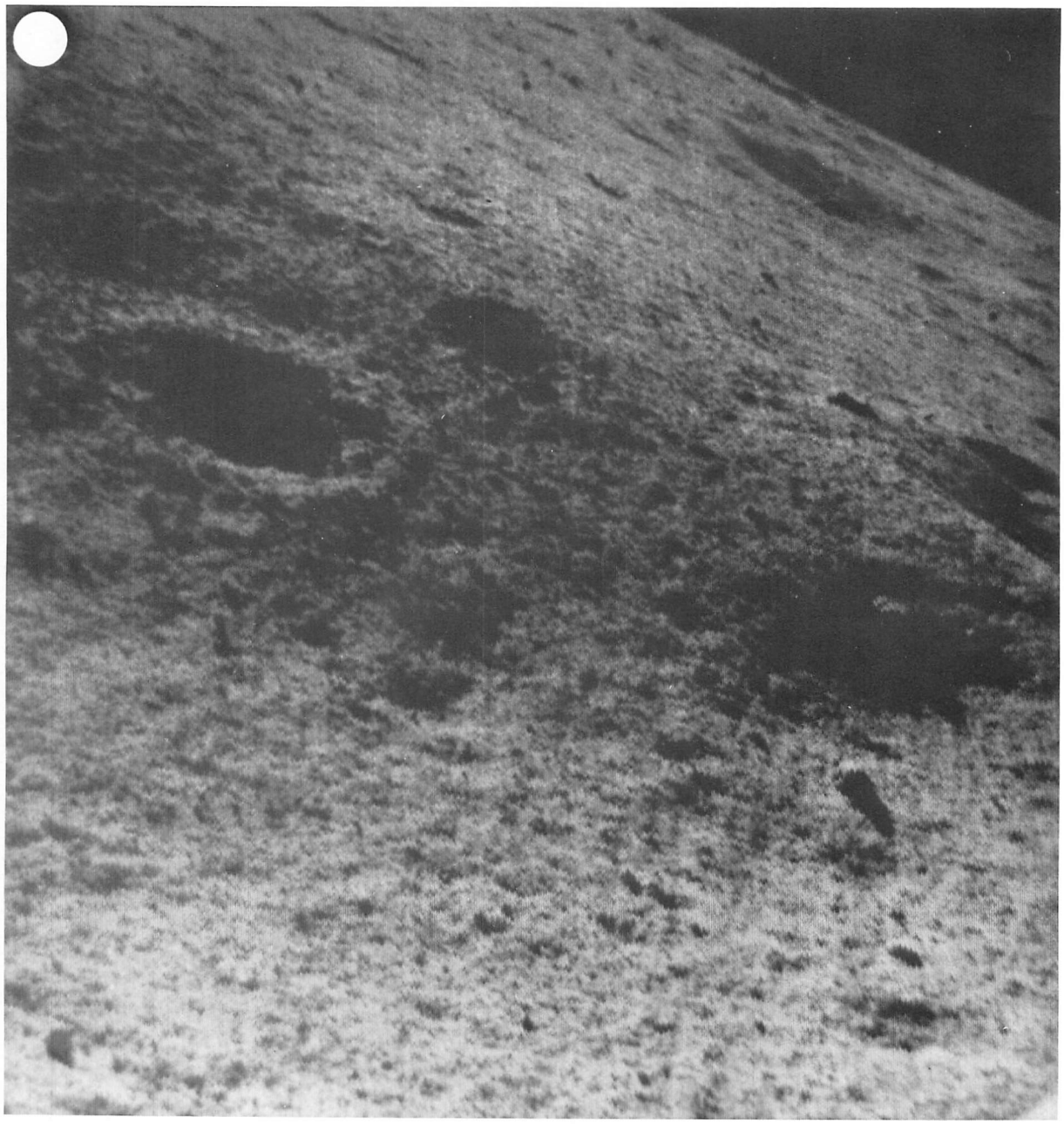
(14)	Day 254, 06:52:41	33	−60	2.3	f/19.9	W	Clear





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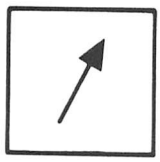
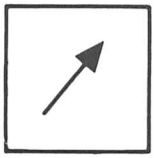
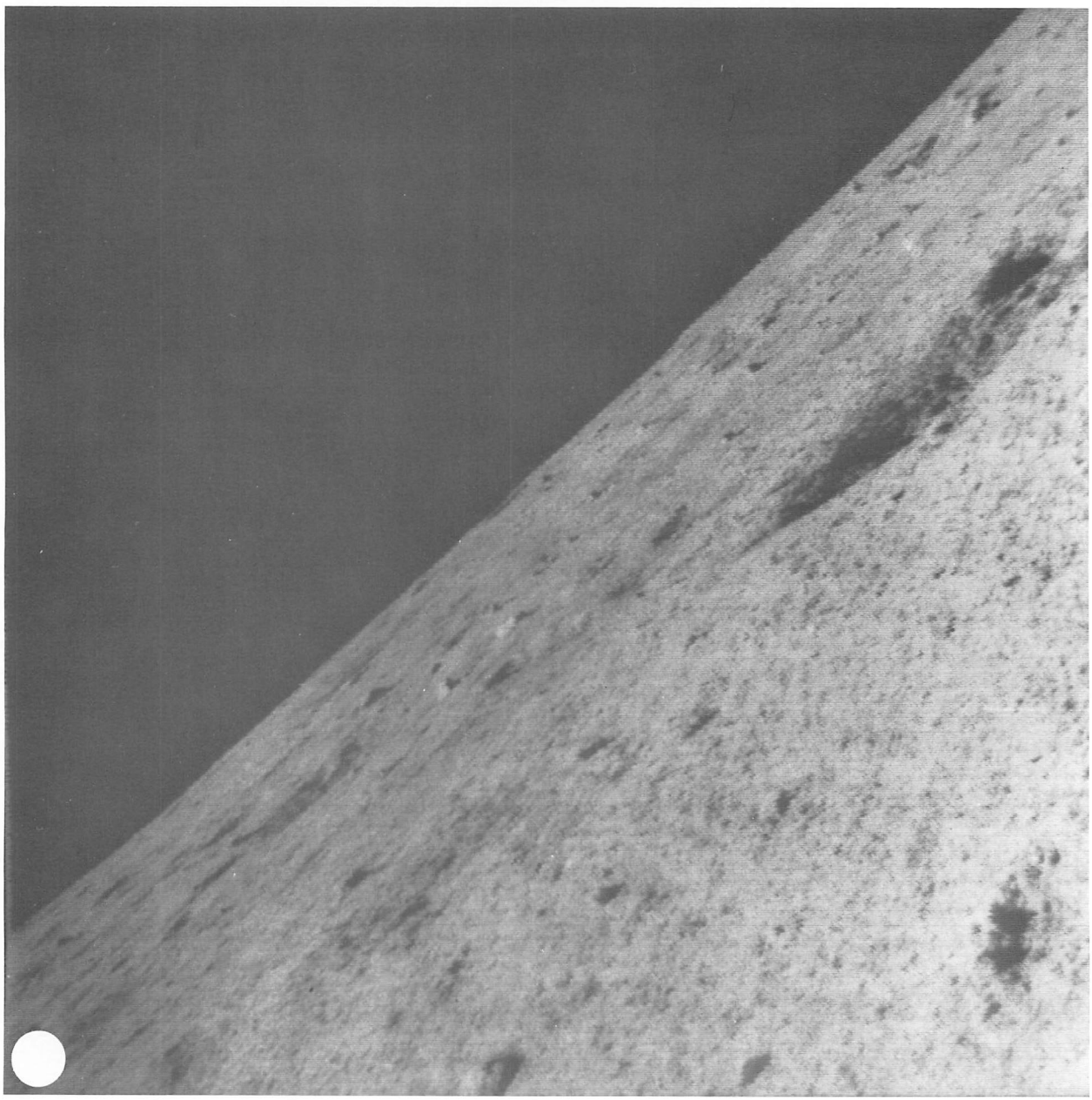
(15)	Day 254, 06:58:29	−93	−30	2.3	f/9.5	W	Clear



	GMT	Az	El	Focus, m	Iris	Lens	Filter
(16)	Day 254, 07:03:13	−111	−30	2.3	f/9.4	W	Clear





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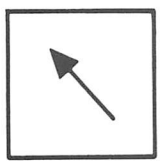
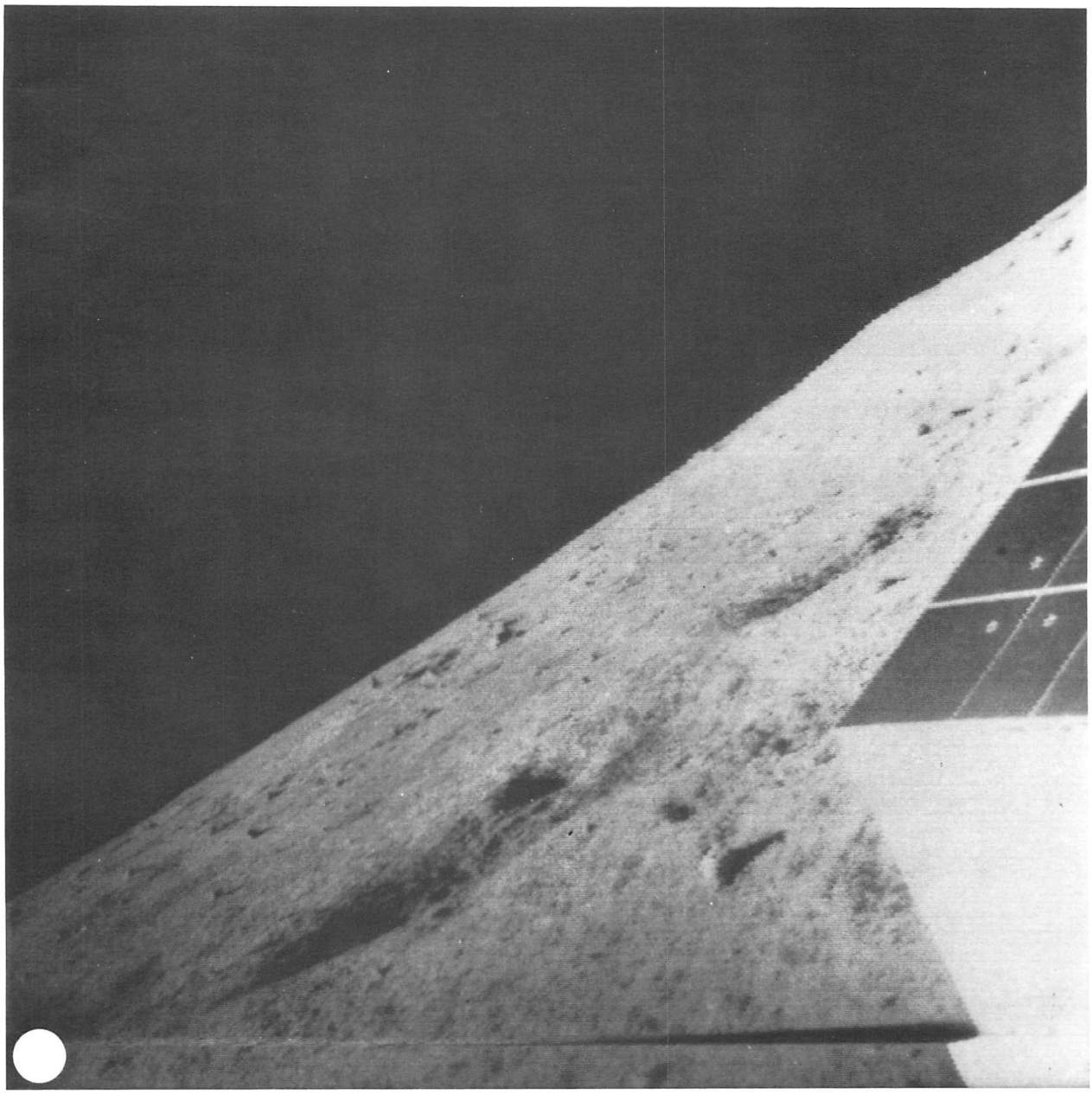
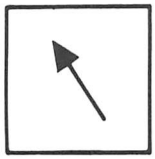
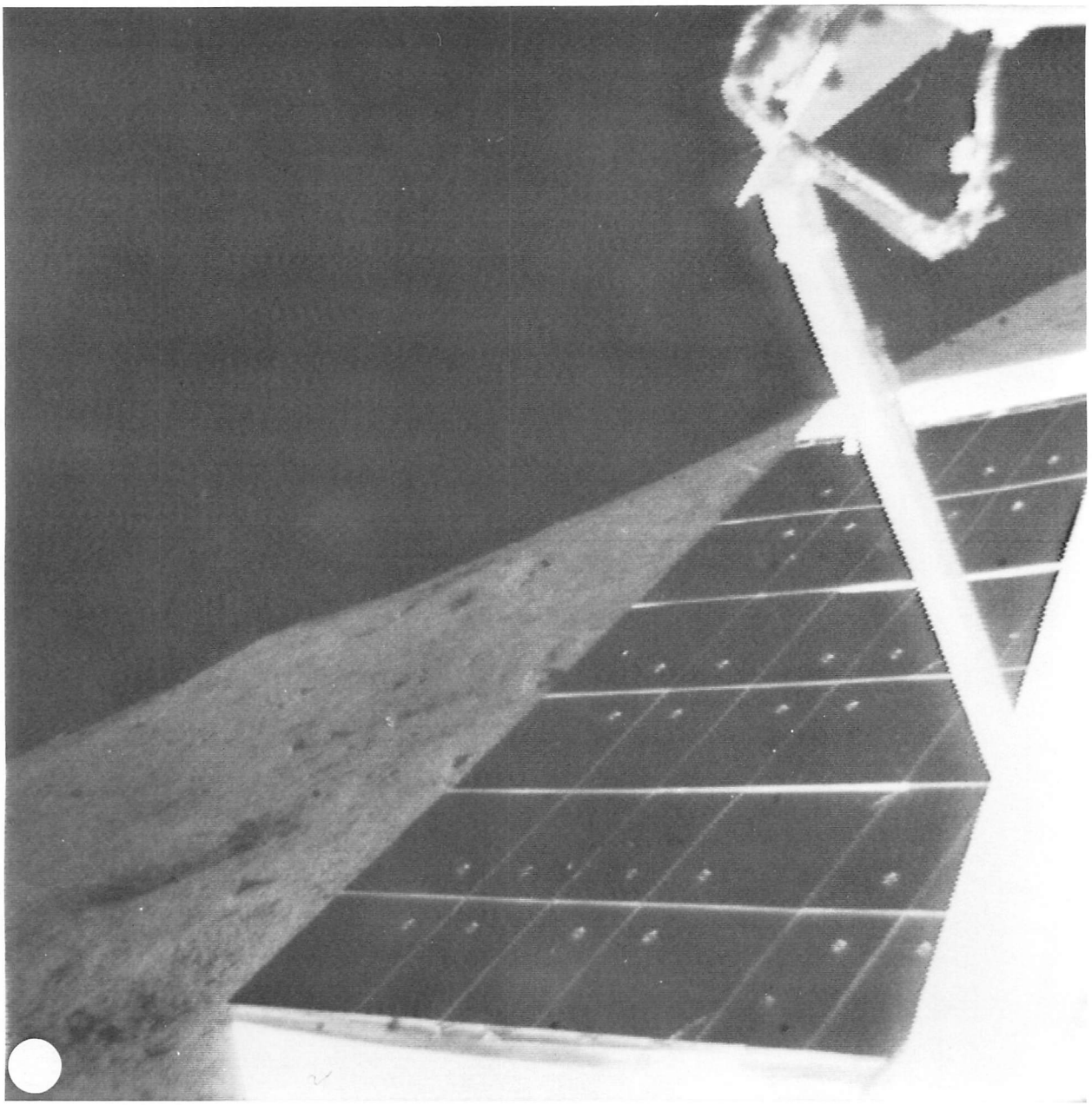
(17)	Day 254, 07:06:46	−129	−30	2.3	f/8.5	W	Clear



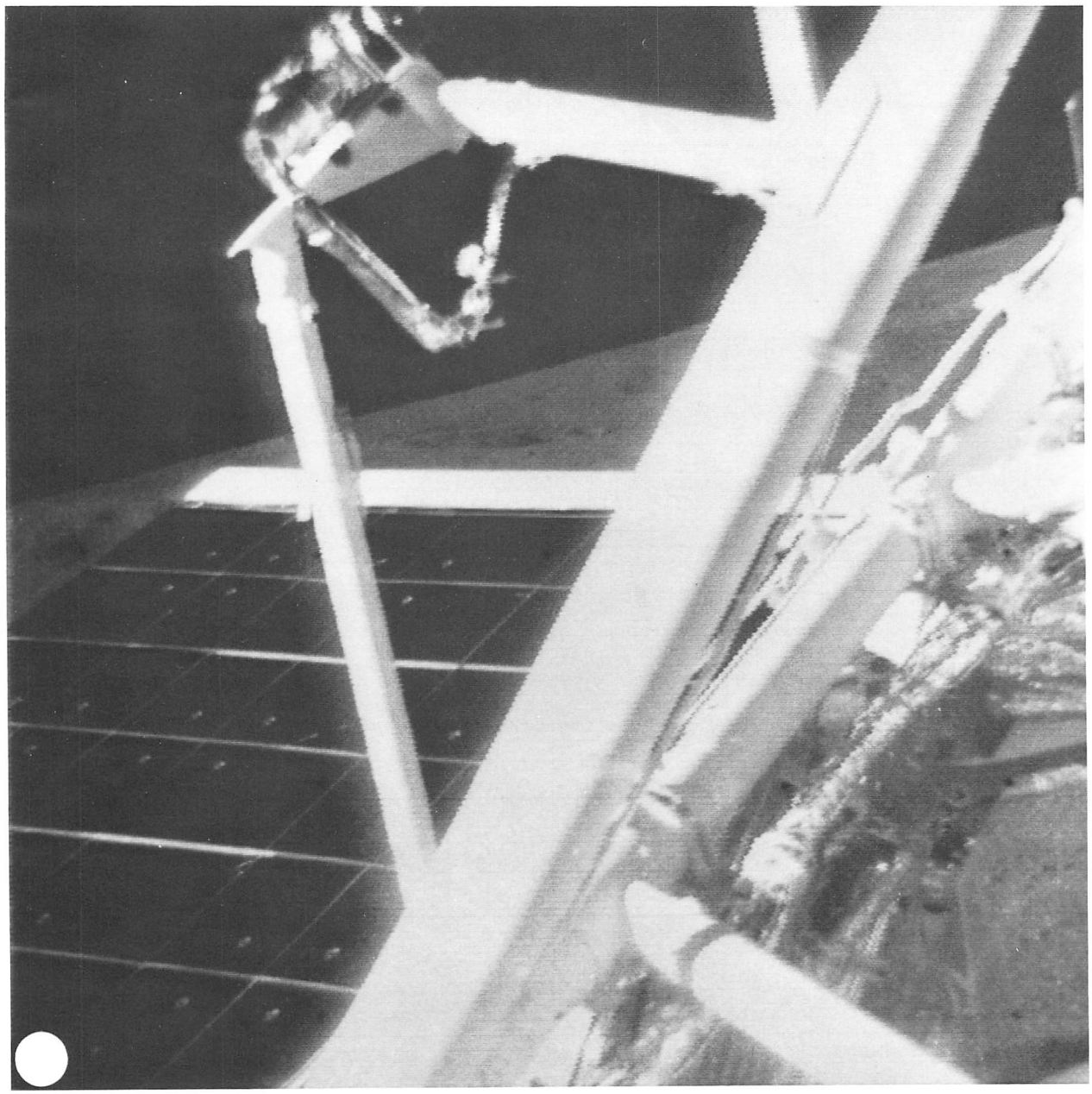


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(18)	Day 254, 07:09:53	−147	−30	2.3	f/14.7	W	Clear





	GMT	Az	El	Focus, m	Iris	Lens	Filter
(19)	Day 254, 08:15:33	−165	−30	2.3	f/20.8	W	Clear



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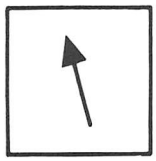
(20)	Day 254, 08:19:56	−183	−30	2.3	f/20.8	W	Clear



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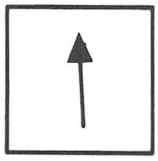
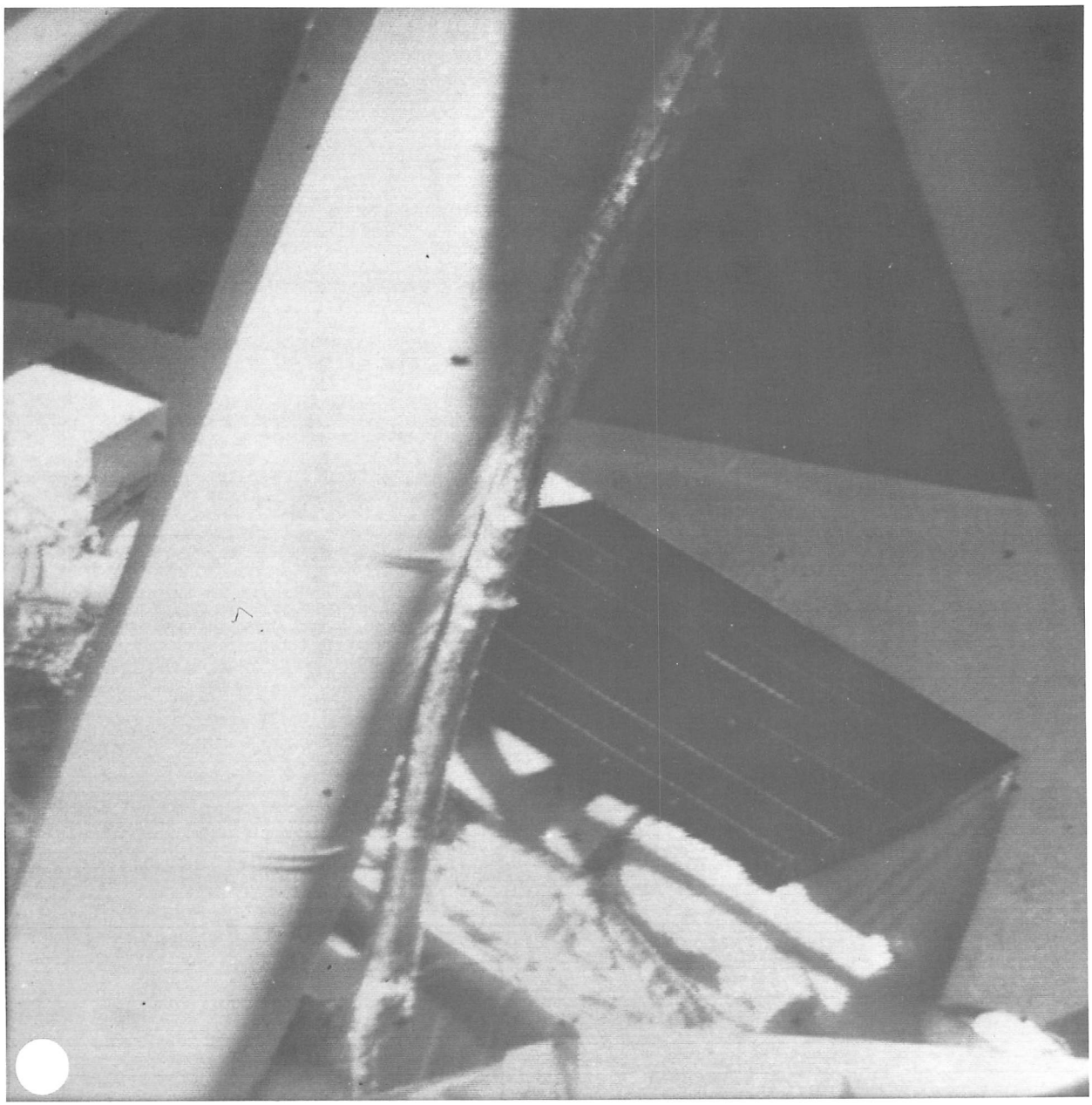
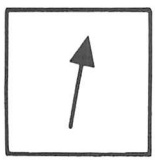
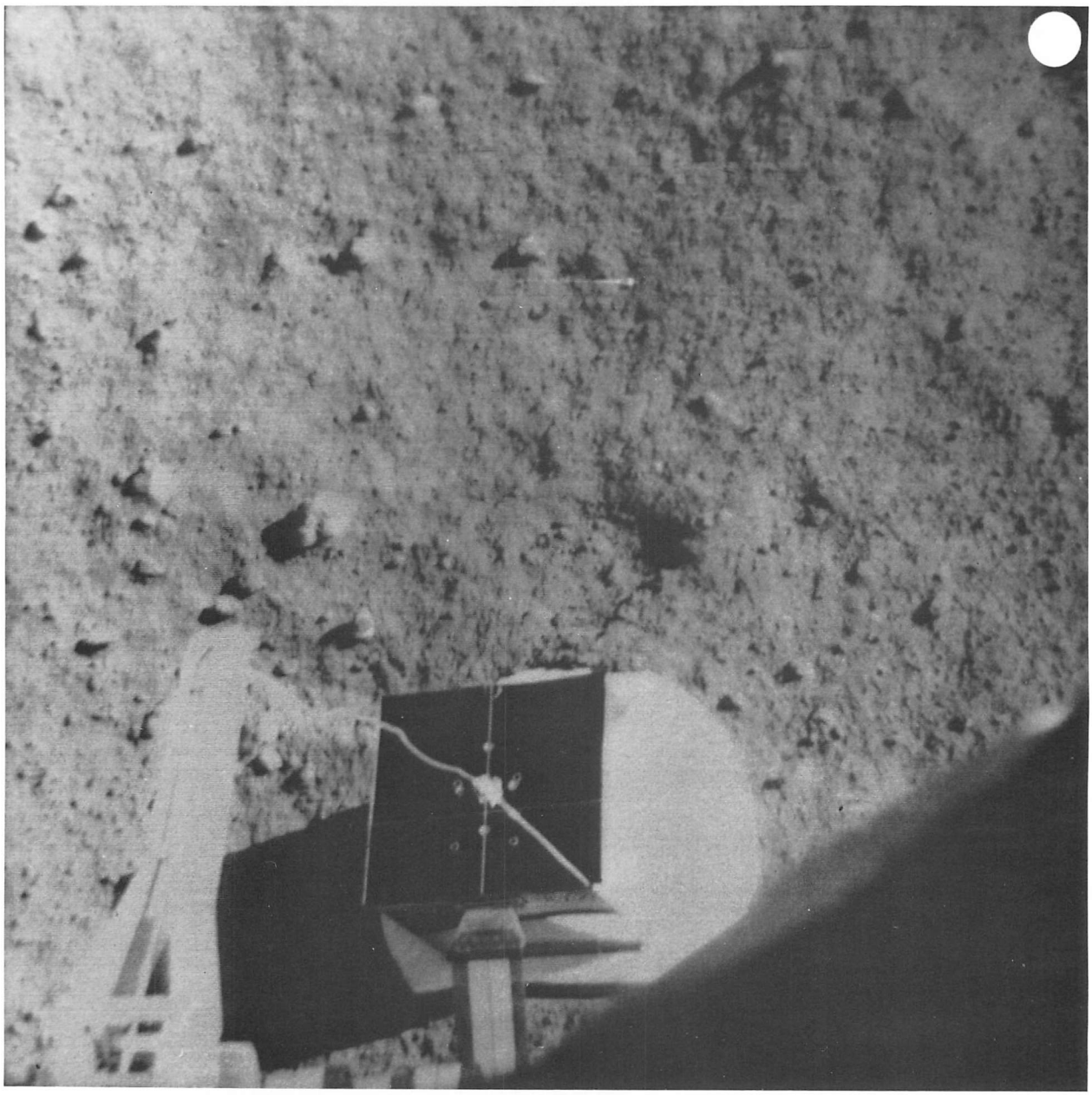
(21)	Day 254, 08:26:08	−201	−30	2.3	f/23.6	W	Clear	Processed



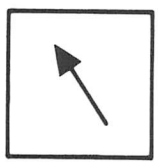


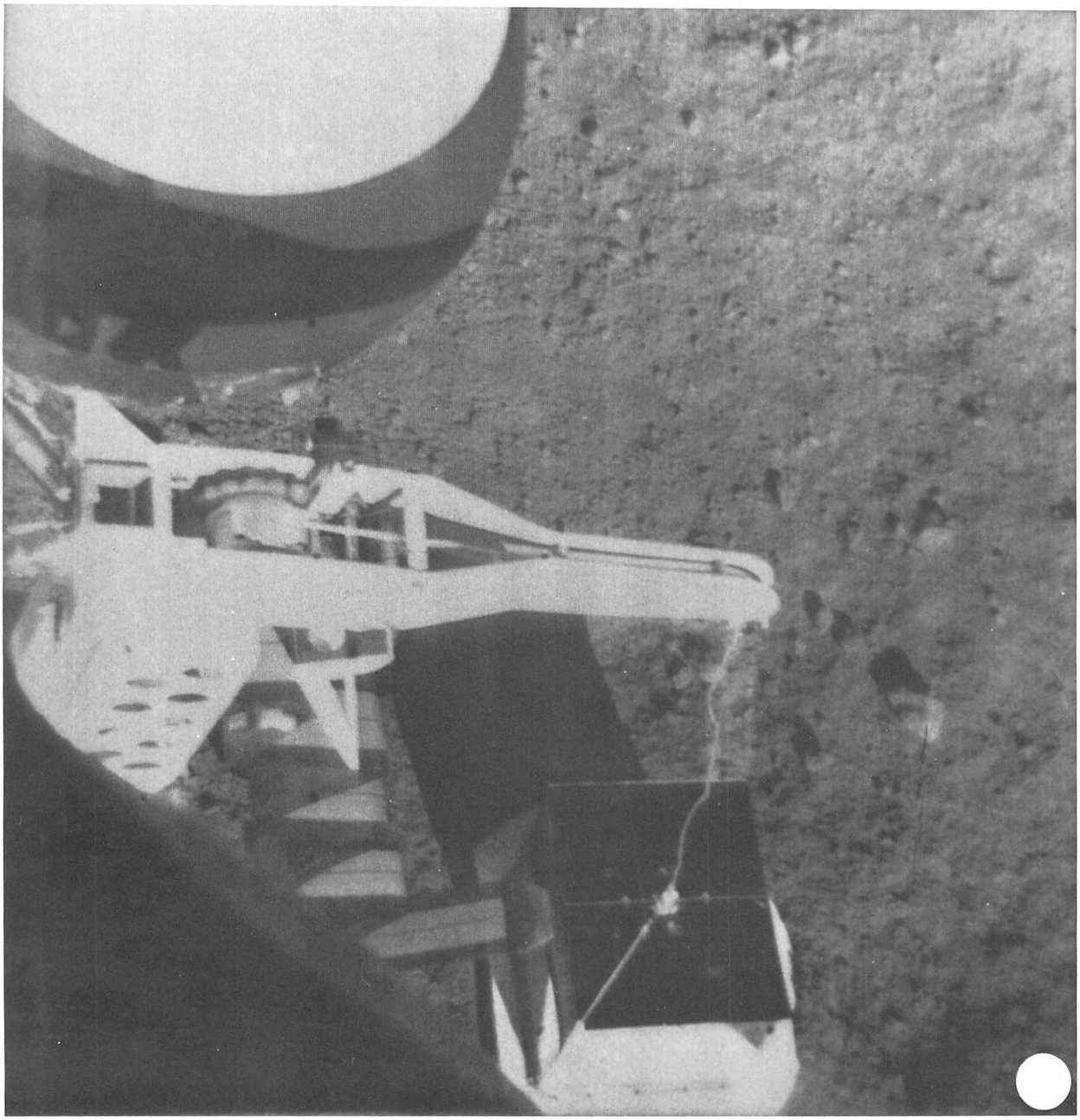
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(22)	Day 254, 08:29:27	−219	−15	2.3	f/23.6	W	Clear



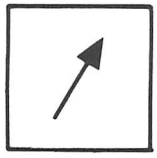


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(23)	Day 254, 23:49:27	33	−45	2.4	f/17.3	W	Clear

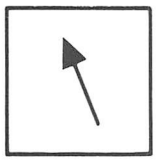


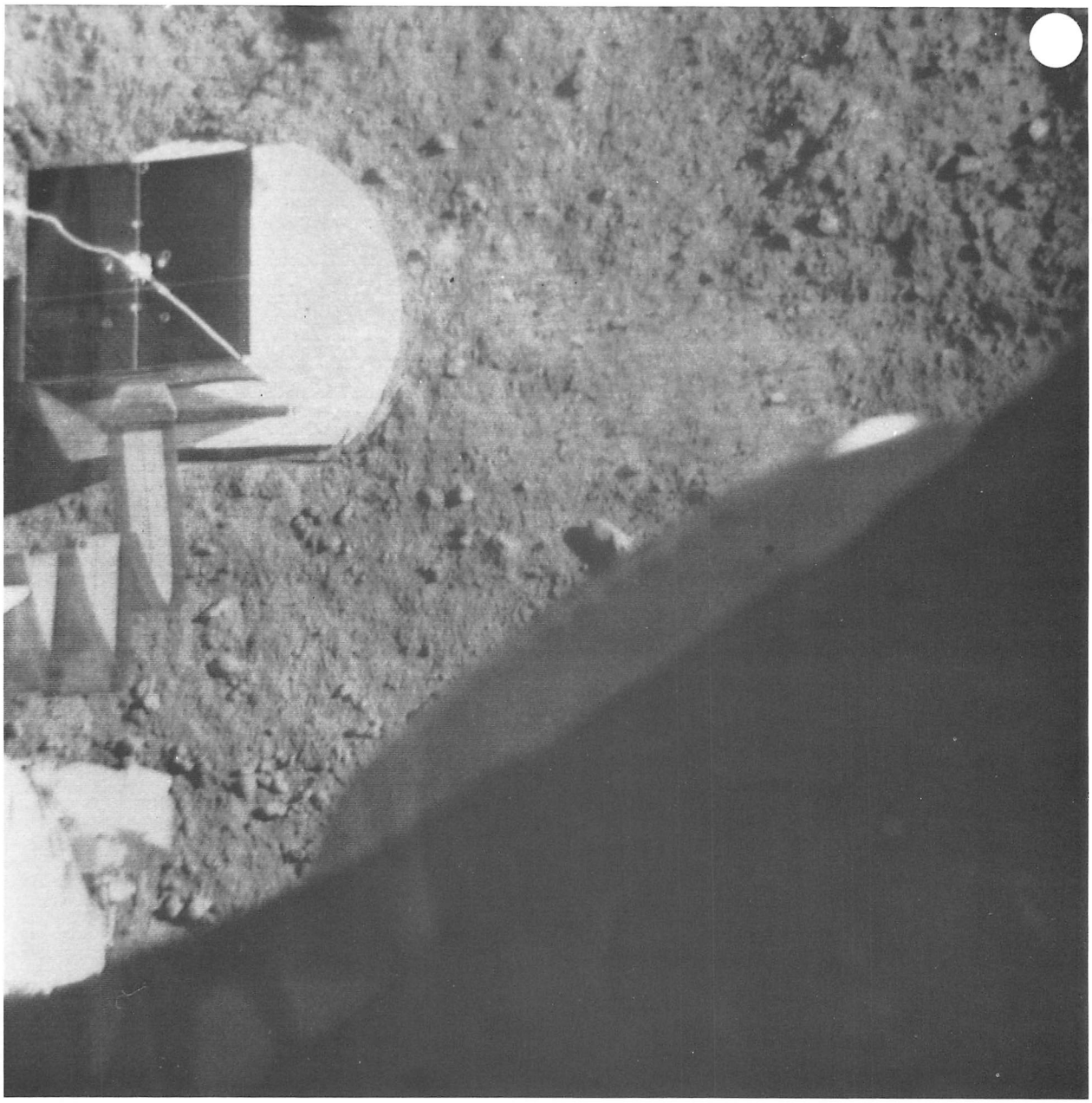


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(24)	Day 254, 23:50:17	51	−45	2.4	f/17.9	W	Clear

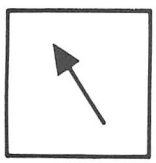


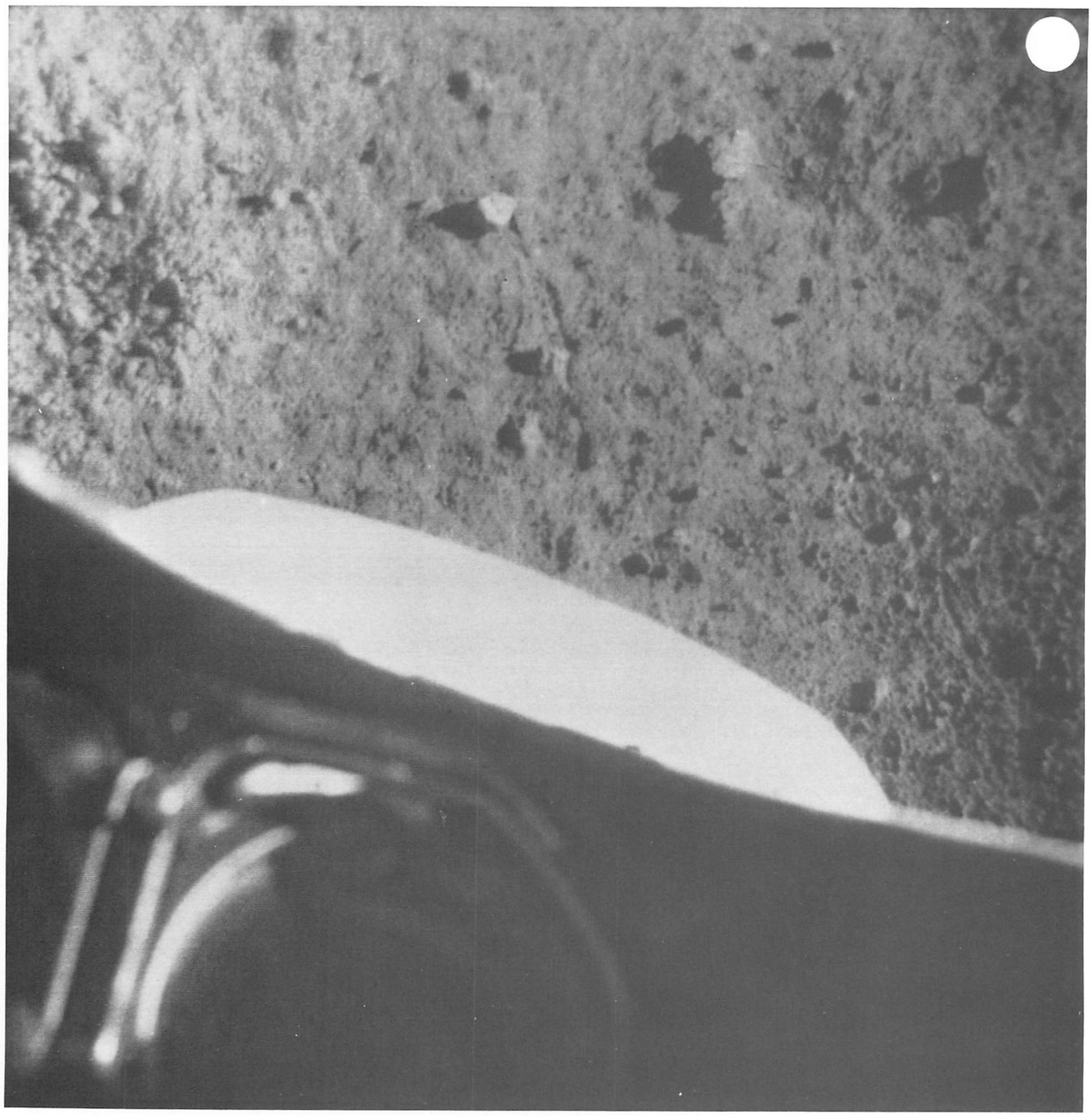
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(25)	Day 254, 23:51:09	87	−30	2.4	f/23.6	W	Clear



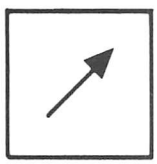


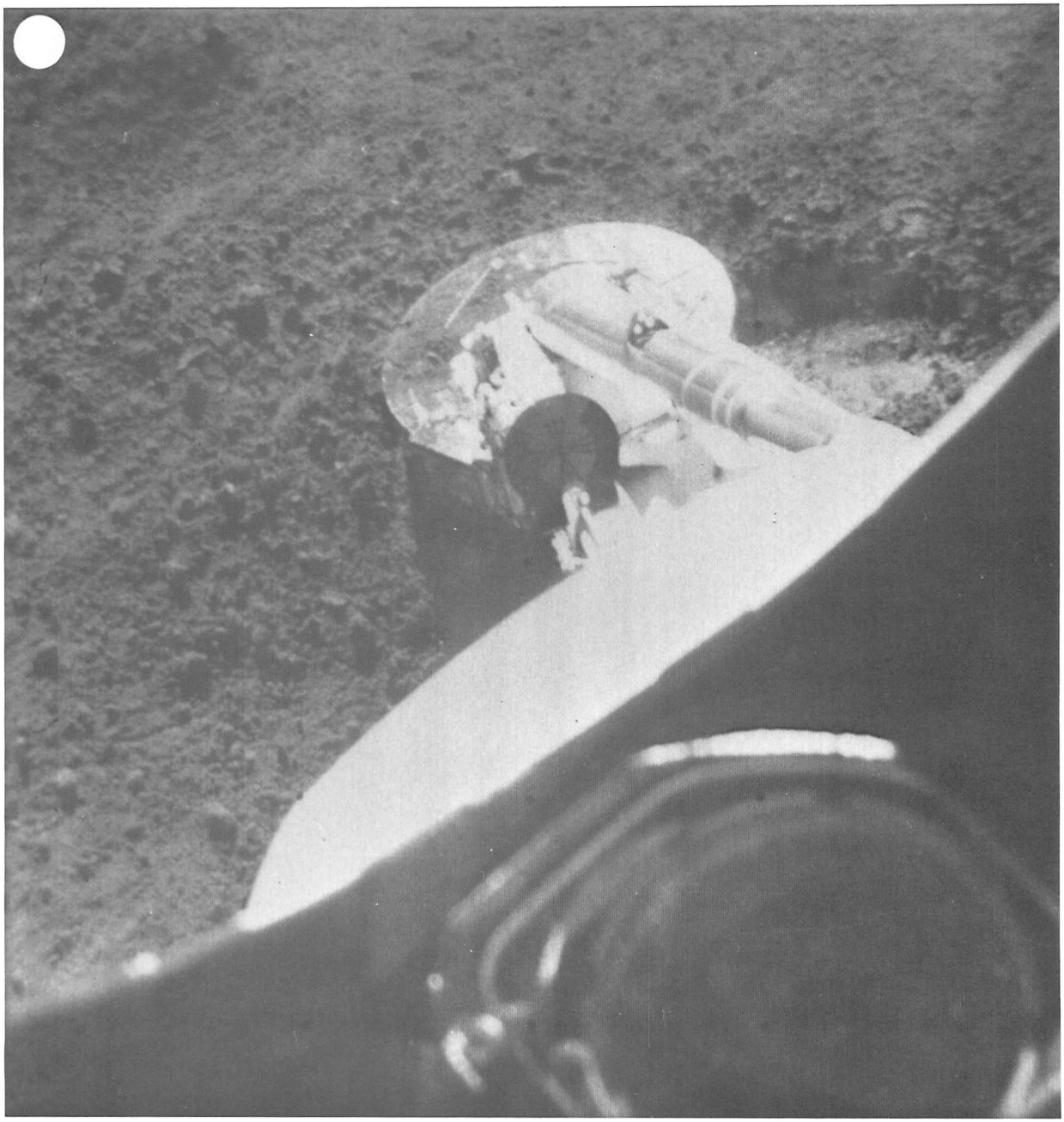
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(26)	Day 254, 23:52:36	33	−60	2.4	f/14.6	W	Clear



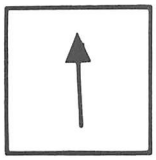


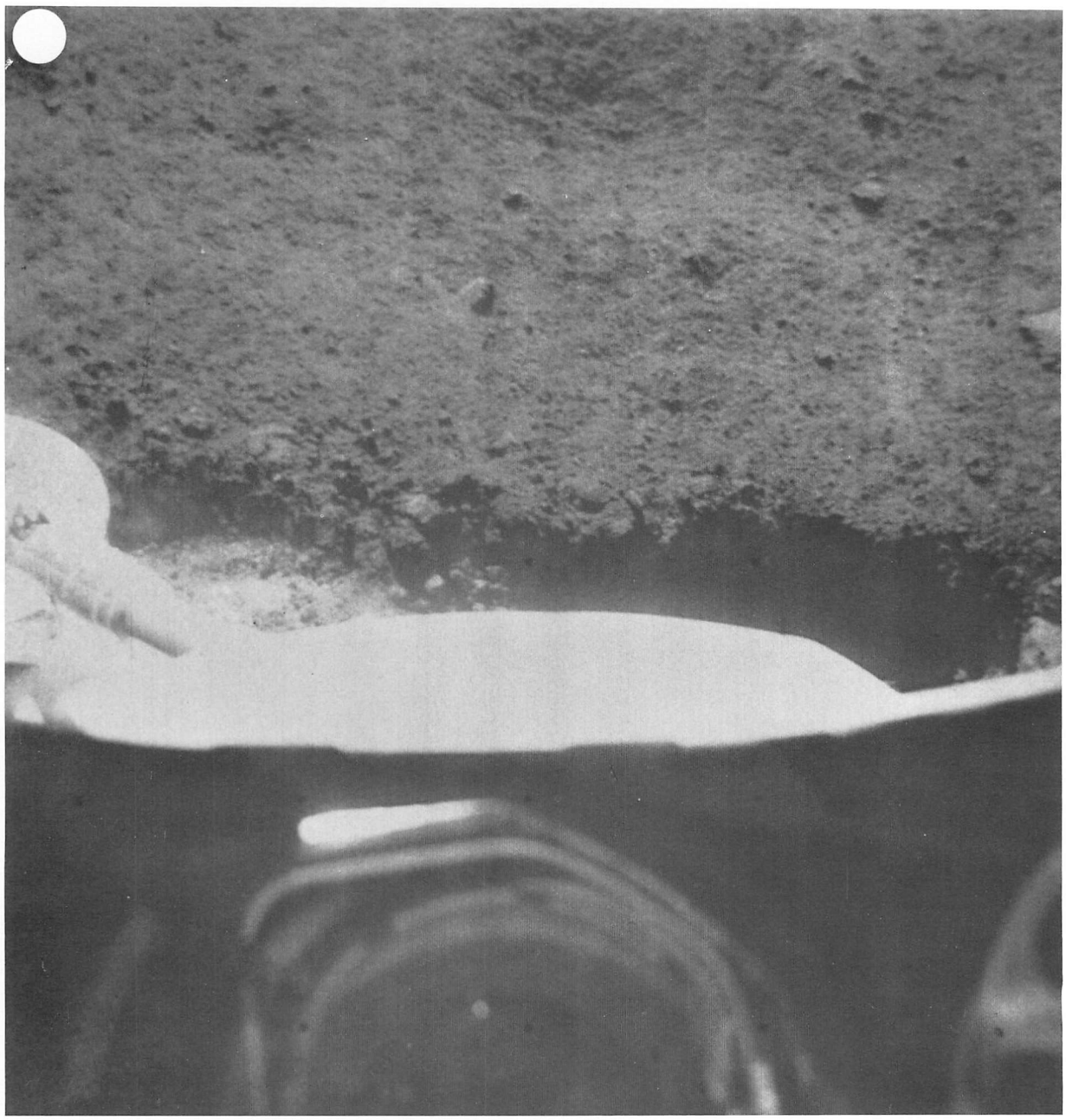
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(27)	Day 254, 23:52:53	−21	−60	2.4	*f*/13.7	W	Clear



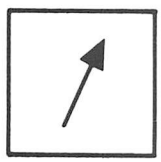


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(28)	Day 254, 23:53:03	−57	−60	2.4	*f*/15.9	W	Clear

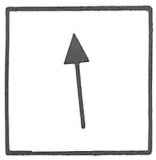


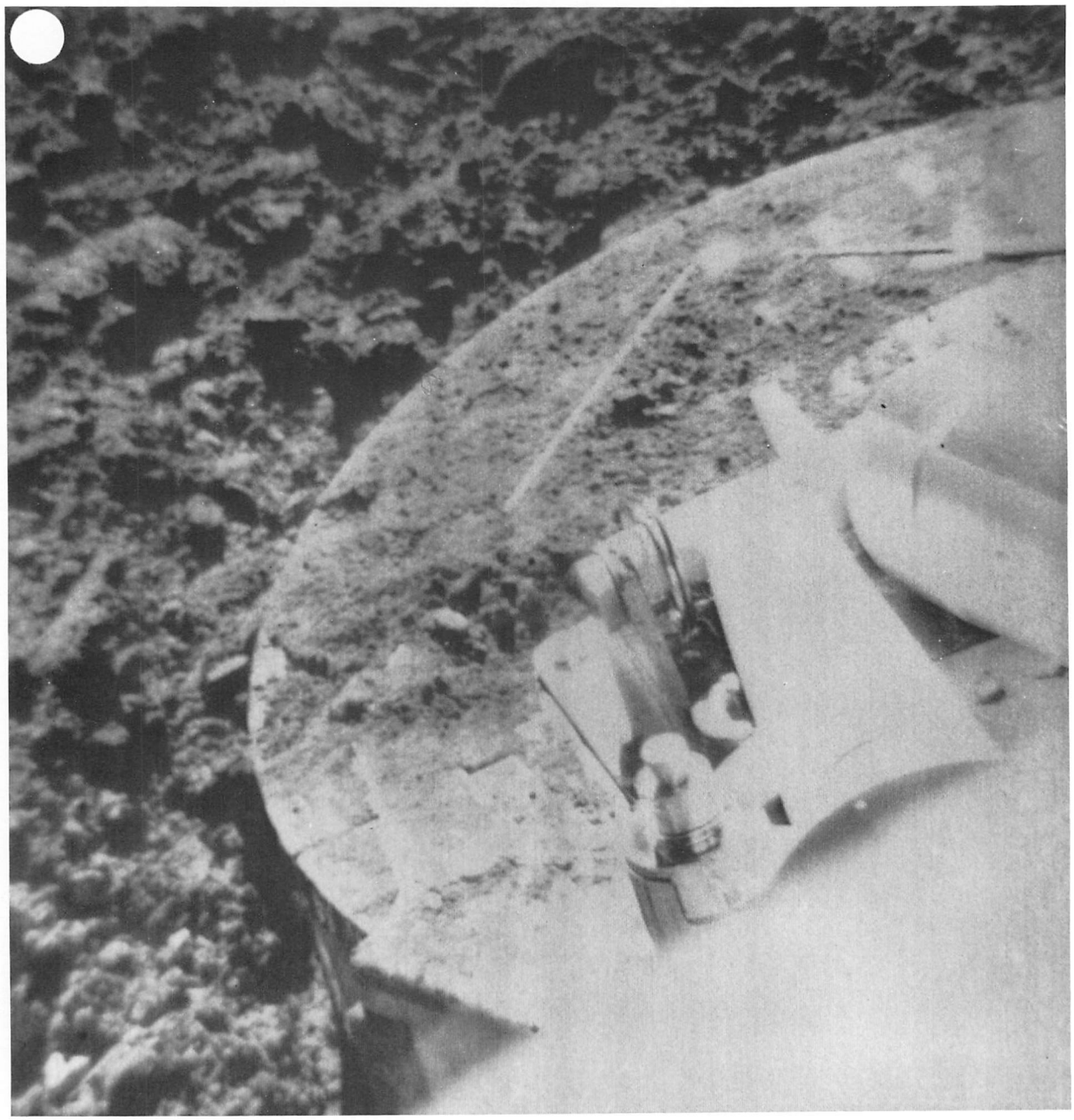


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(29)	Day 254, 23:57:52	−90	−60	2.4	f/15.3	W	Clear

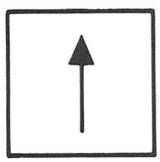


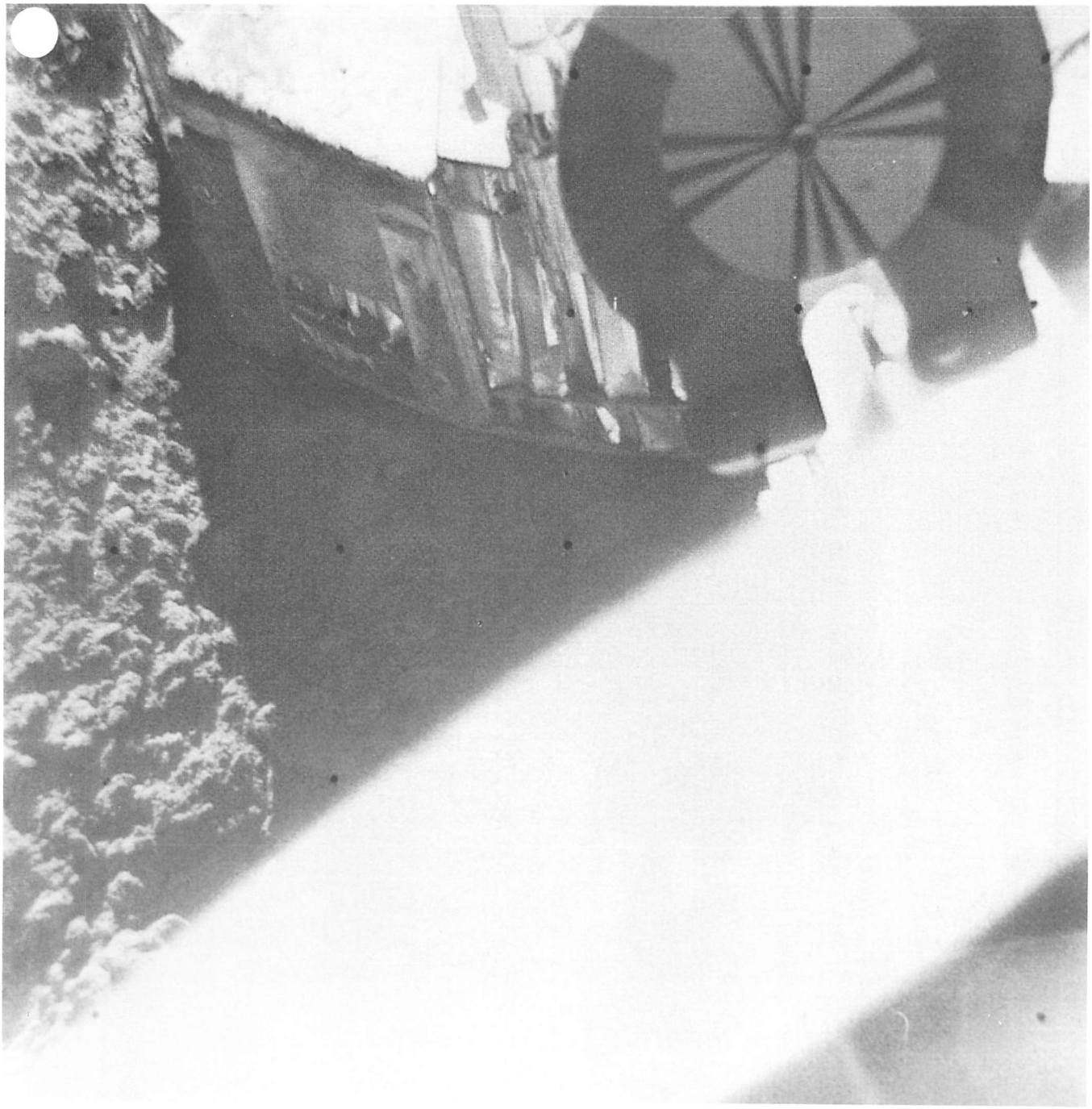
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(30)	Day 254, 23:58:01	−54	−60	2.4	f/16.6	W	Clear



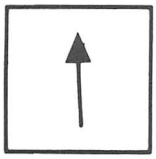


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(31)	Day 255, 00:03:26	−60	−55	2.2	f/12.3	N	Clear

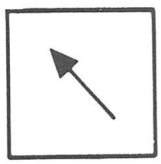




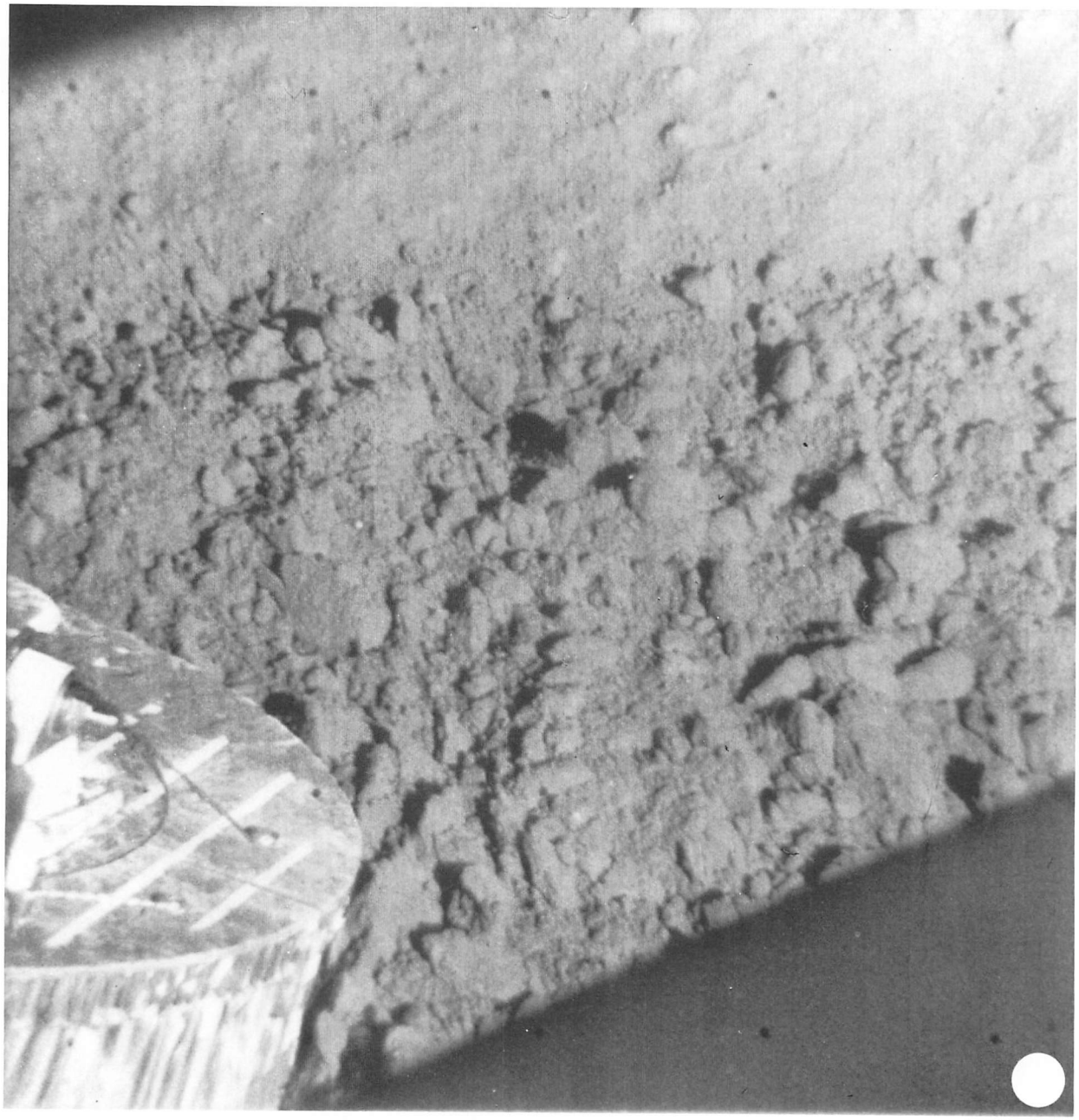
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(32)	Day 255, 00:33:33	−57	−60	2.4	f/12.3	N	Clear	Processed



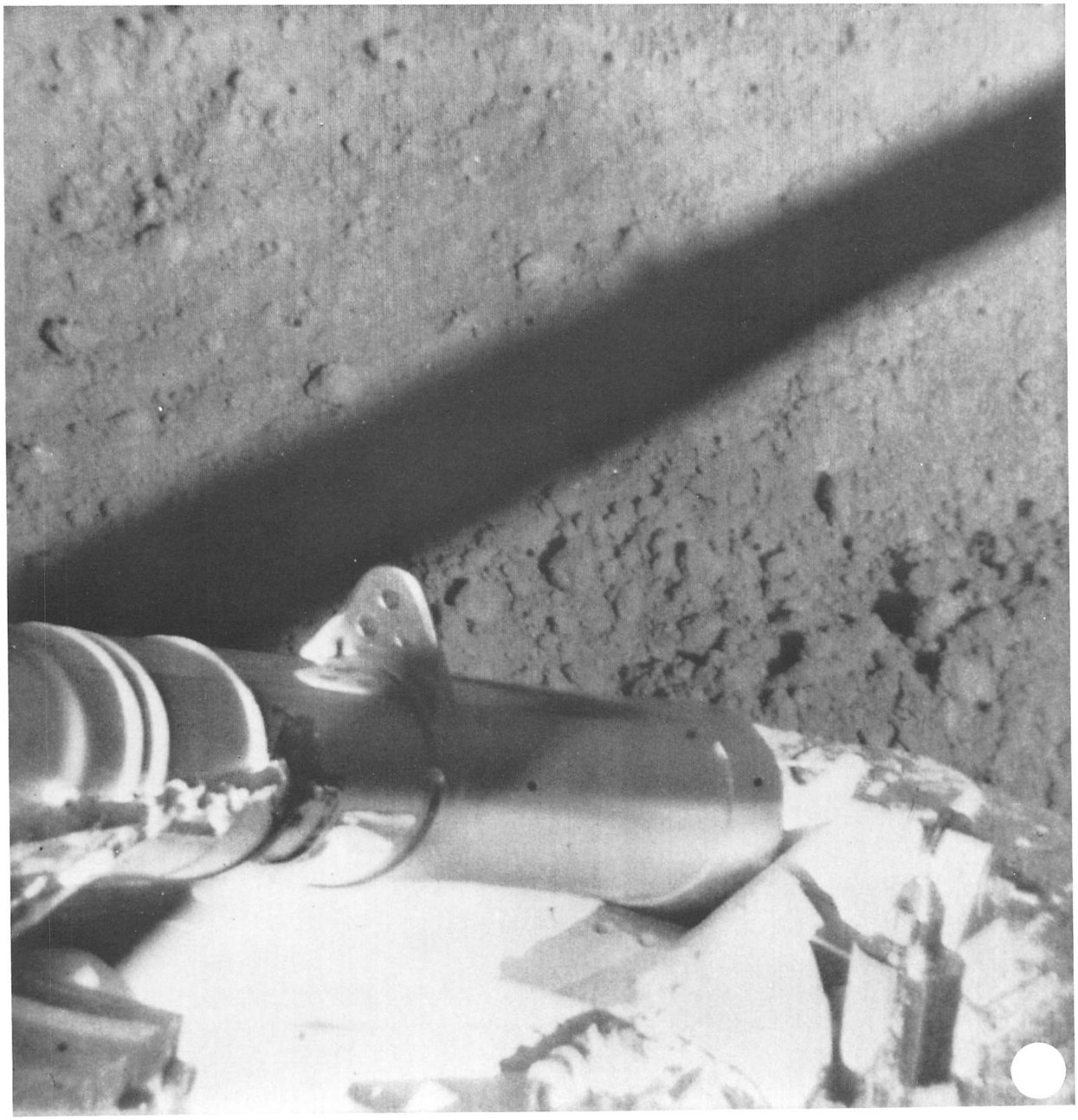
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(33)	Day 255, 00:39:53	39	−50	1.3	f/17.6	W	Clear	Processed



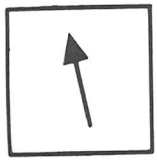
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(34)	Day 255, 02:02:48	78	−20	2.7	*f*/16.8	N	Clear

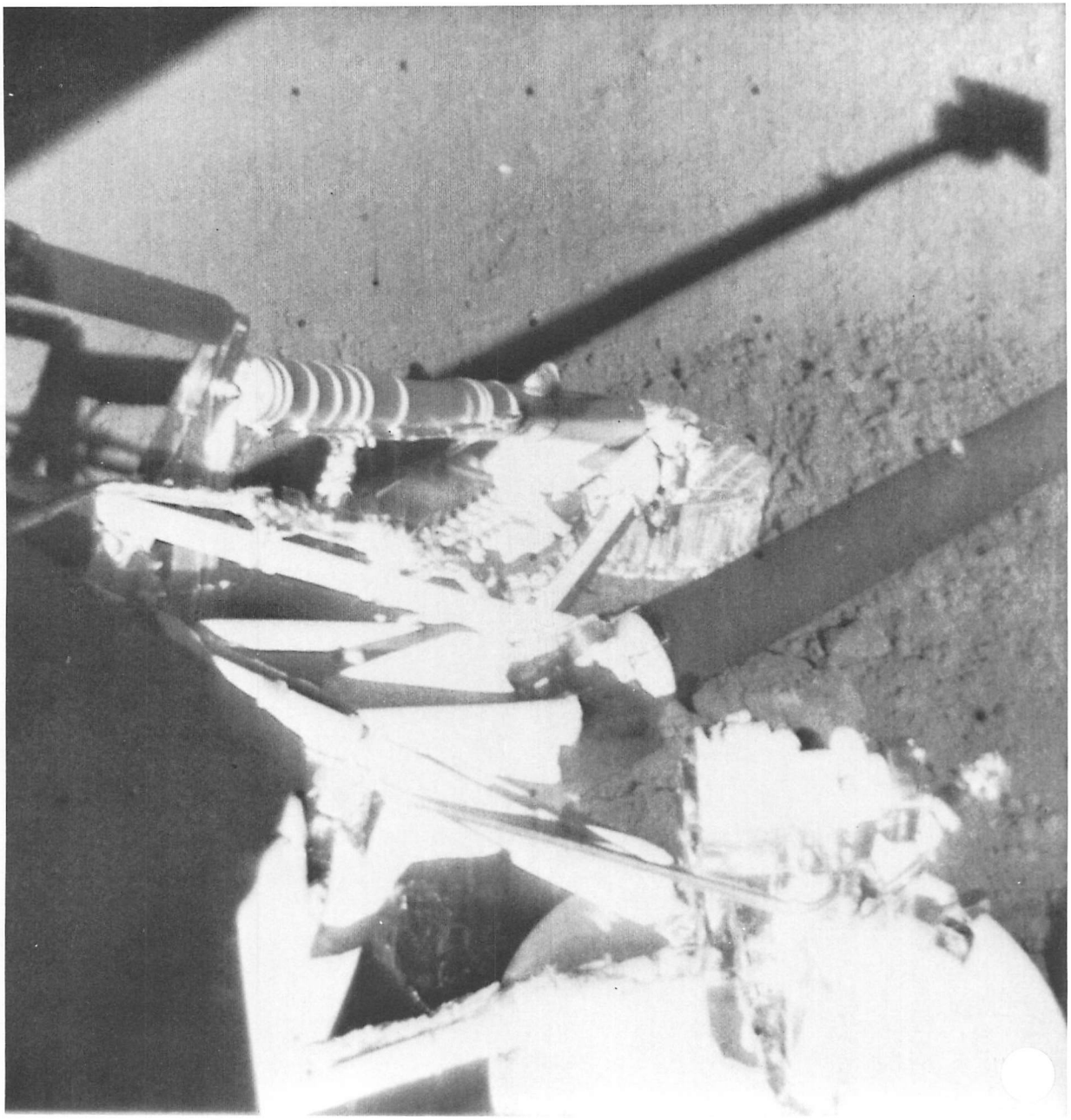


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(35)	Day 255, 02:04:04	75	−20	2.6	f/23.5	N	Clear

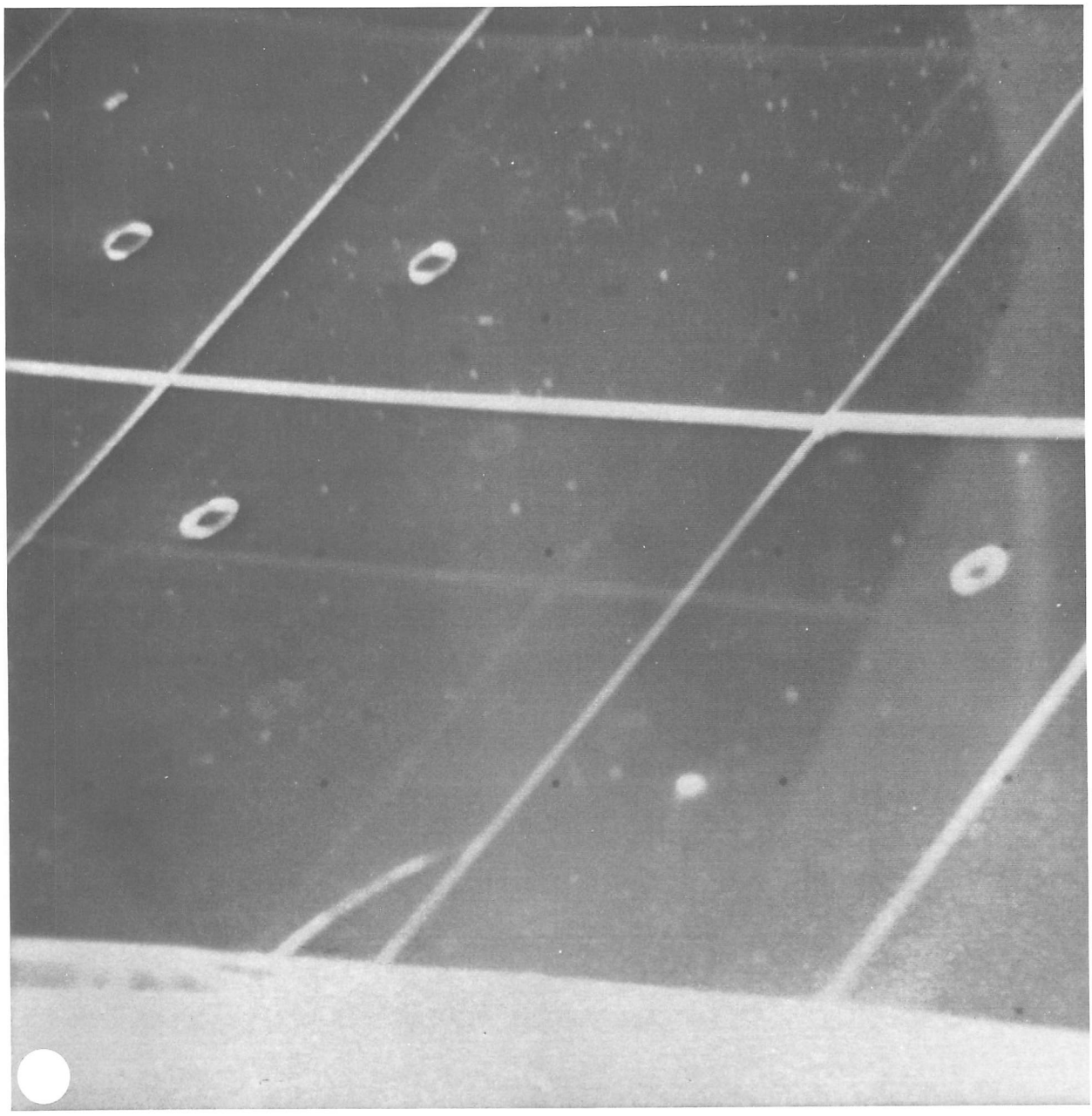


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(36)	Day 255, 02:04:27	81	−20	2.6	*f*/23.5	N	Clear

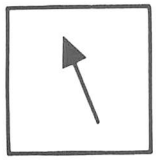


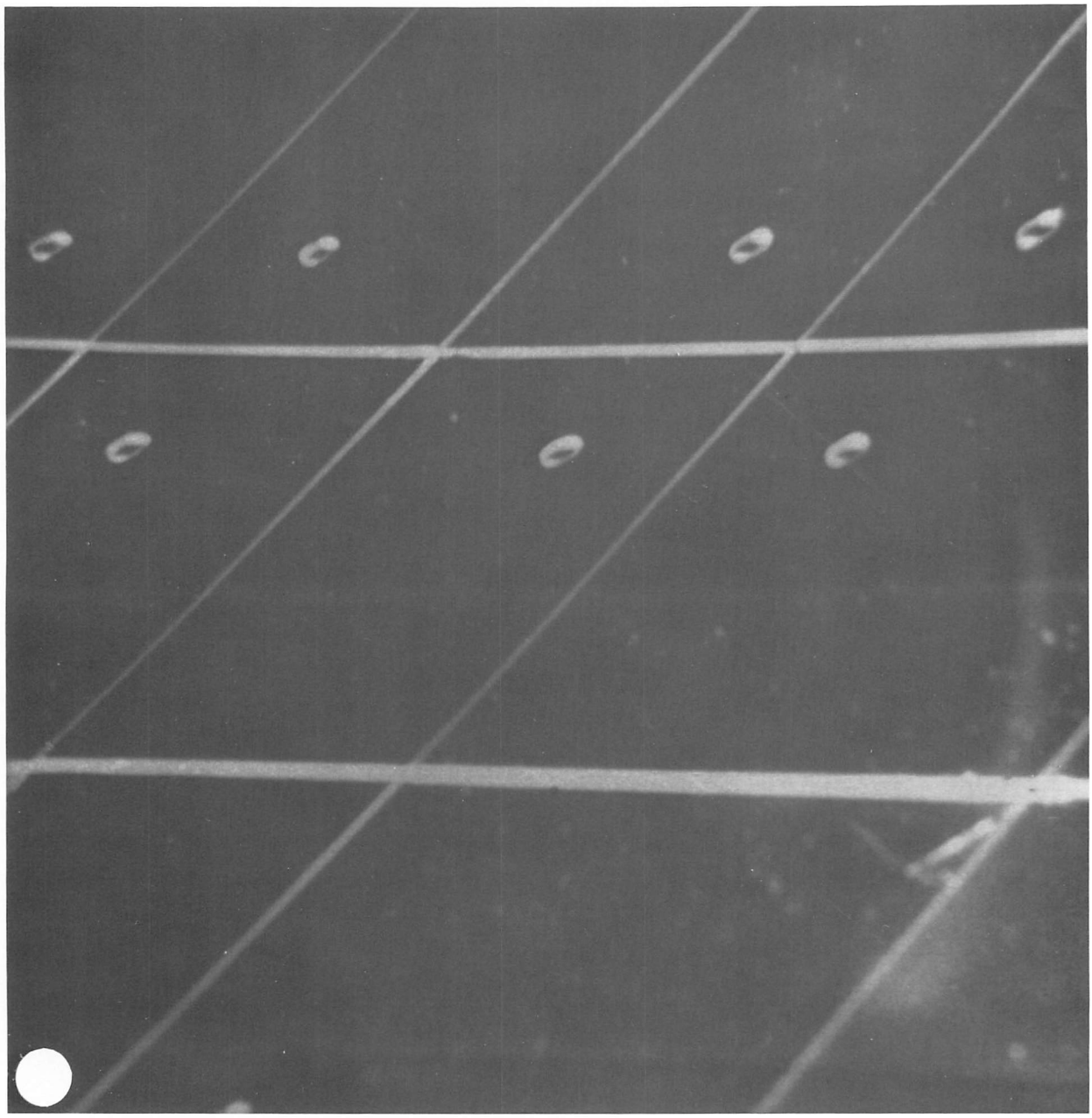


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(37)	Day 255, 02:08:31	81	−25	2.9	f/23.5	W	Clear

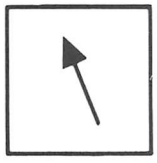


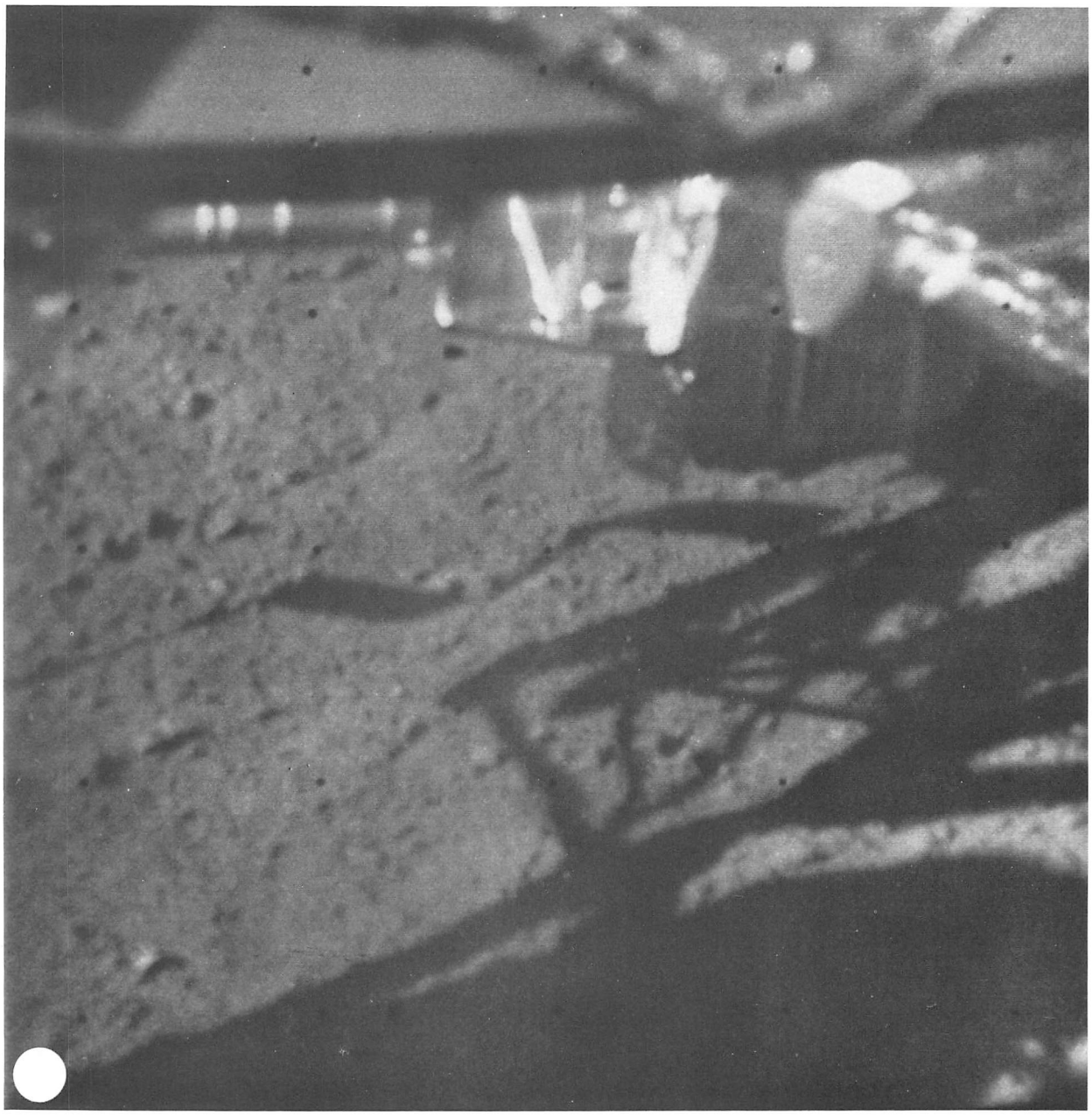
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(38)	Day 255, 02:37:25	−168	−40	1.3	f/11.6	N	Clear



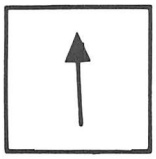


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(39)	Day 255, 02:37:58	−171	−35	1.5	f/11.6	N	Clear

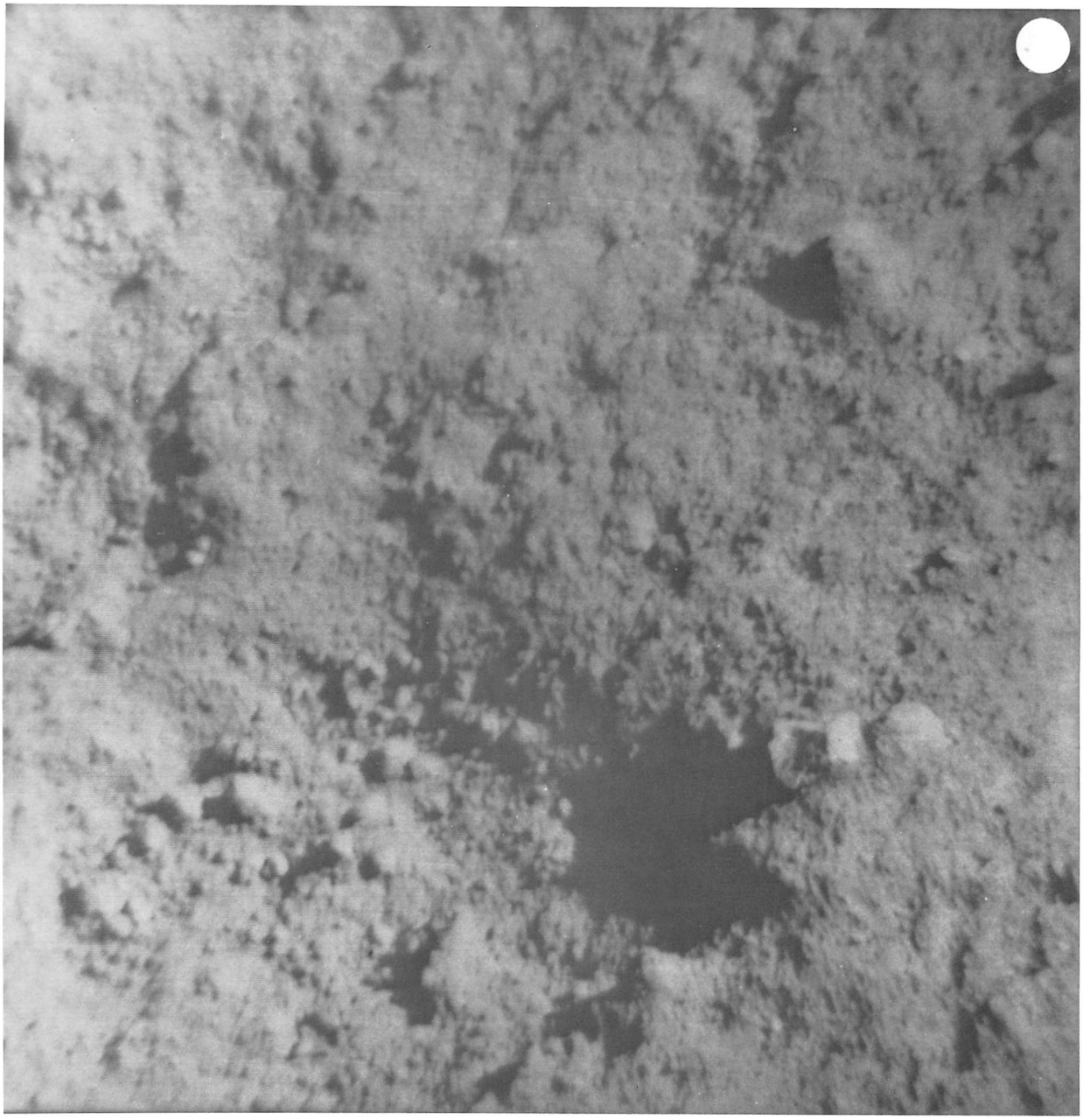




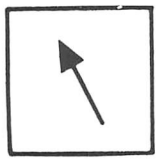
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(40)	Day 255, 02:47:42	−201	−35	3.0	f/10.1	N	Clear

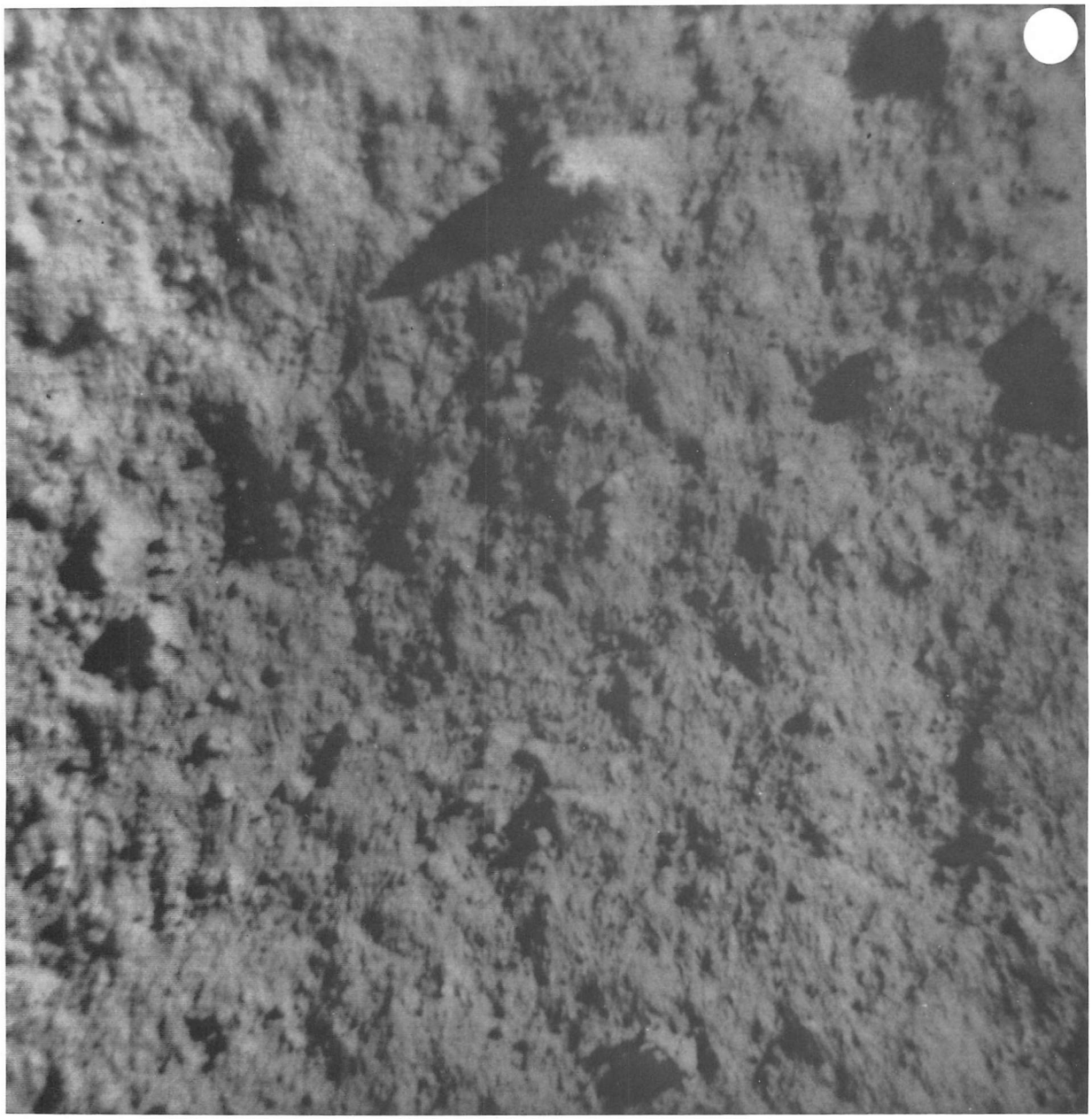


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(41)	Day 255, 02:50:31	−210	−35	2.4	f/16.5	N	Clear	Processed

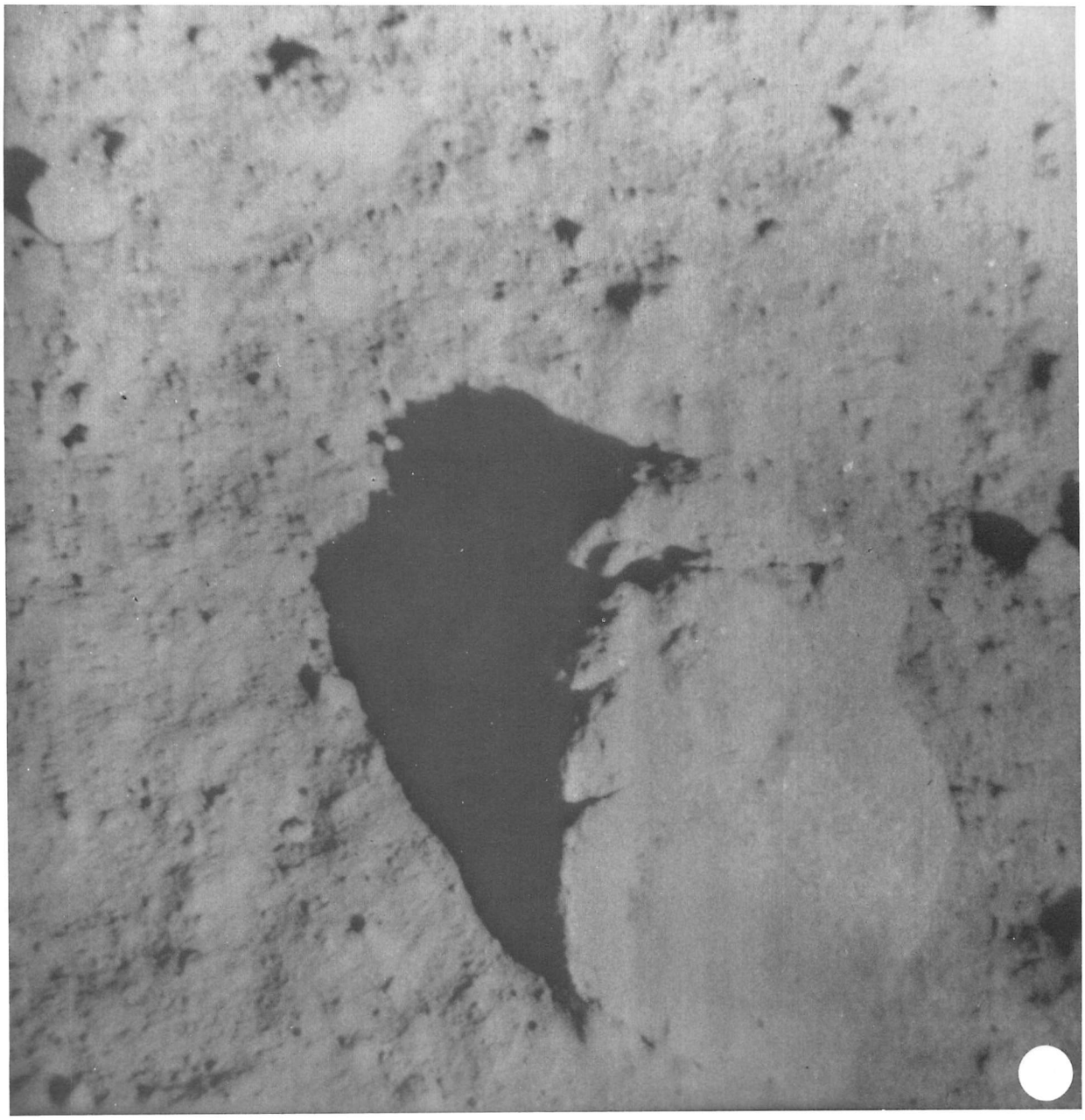


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(42)	Day 255, 04:54:01	30	−45	2.1	*f*/12.3	N	Clear

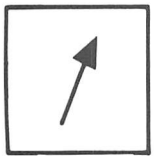


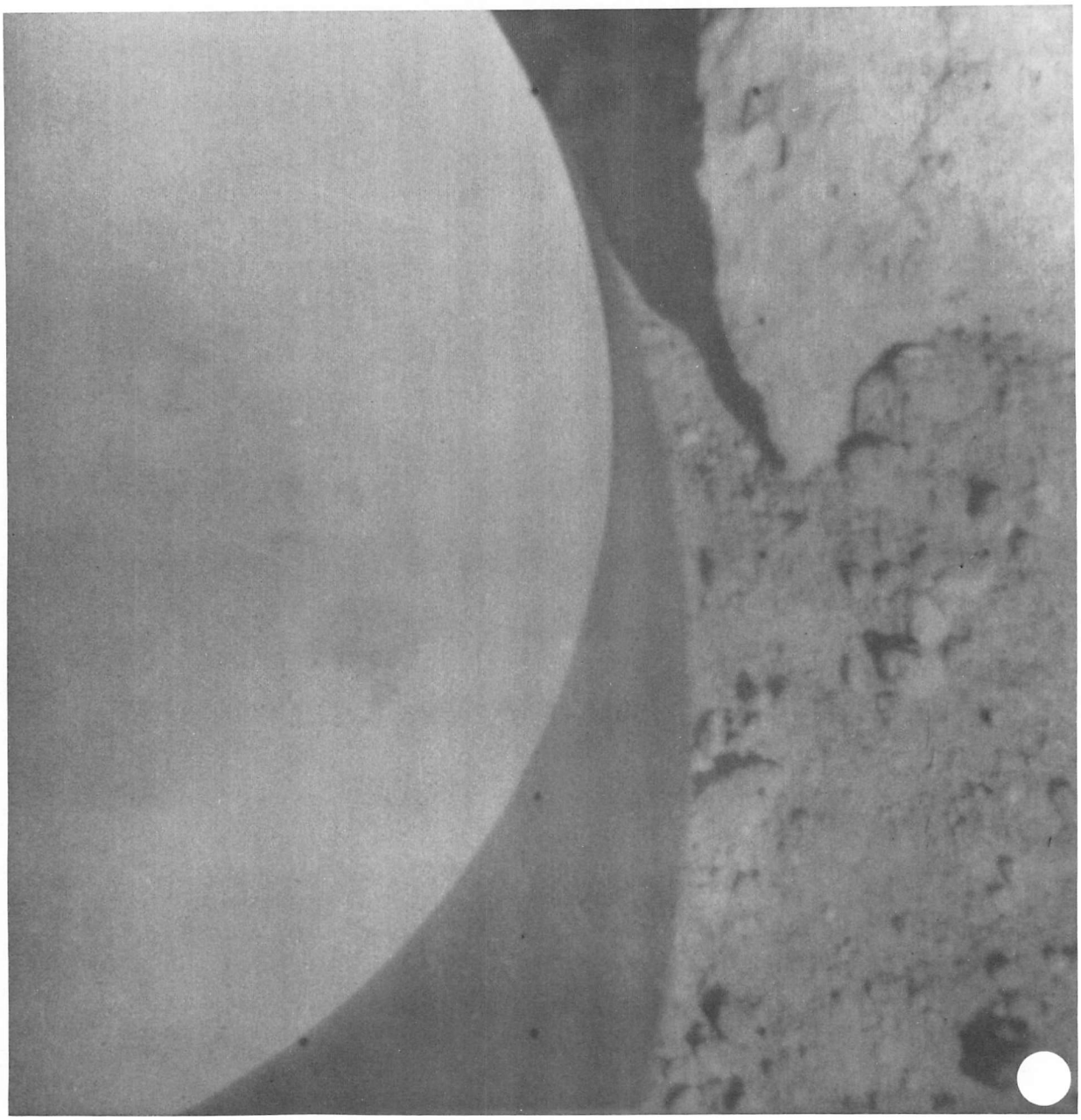


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(43)	Day 255, 04:54:37	21	−40	2.2	*f*/12.3	N	Clear

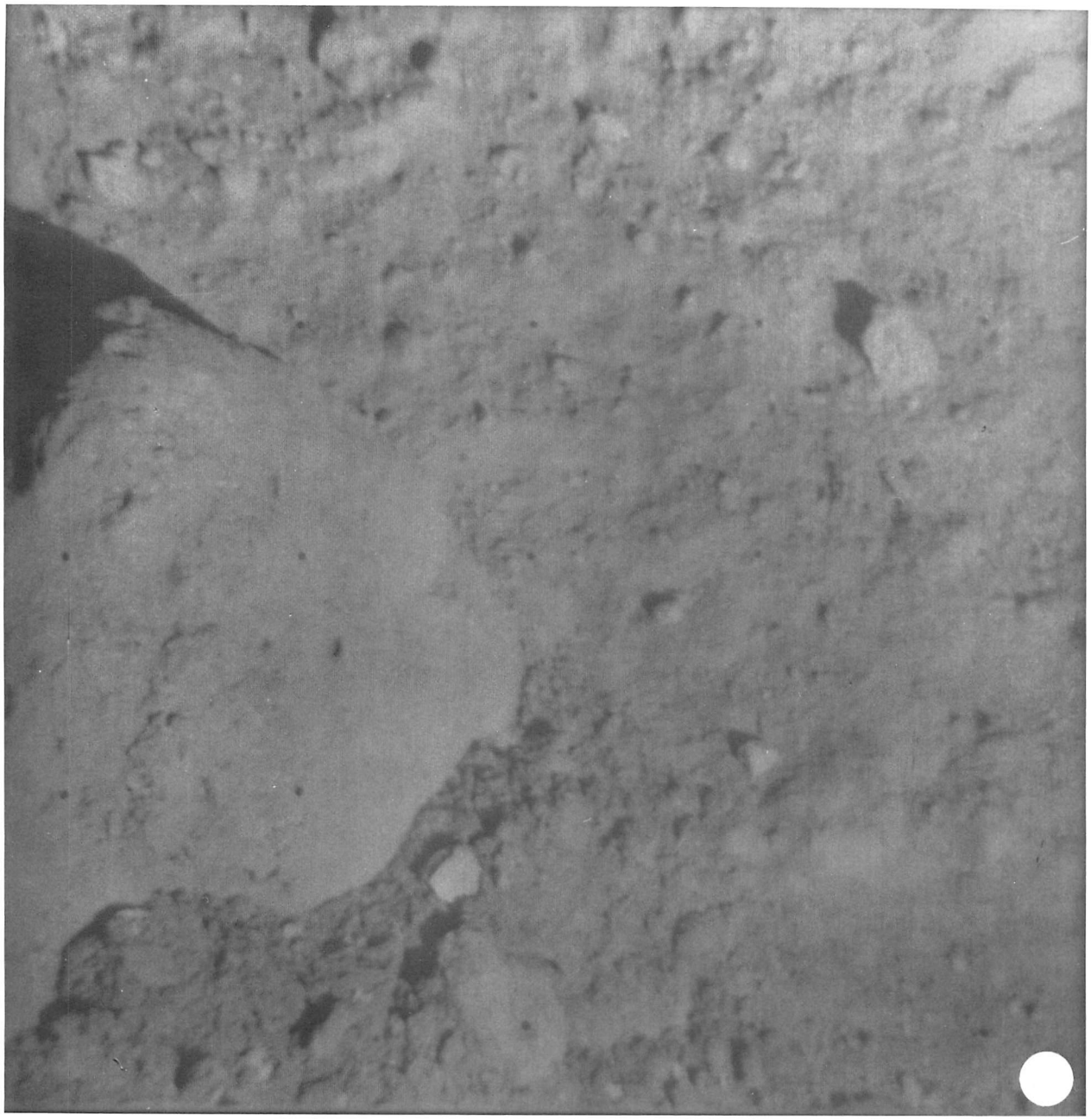


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(44)	Day 255, 05:09:25	57	−20	2.5	f/12.3	N	Clear

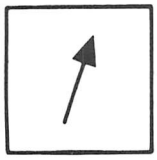




	GMT	Az	El	Focus, m	Iris	Lens	Filter
(45)	Day 255, 05:26:17	63	−35	2.1	*f*/17.7	N	Clear

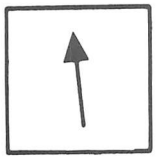


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(46)	Day 255, 05:26:23	60	−30	2.2	*f*/17.7	N	Clear

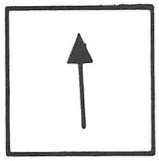


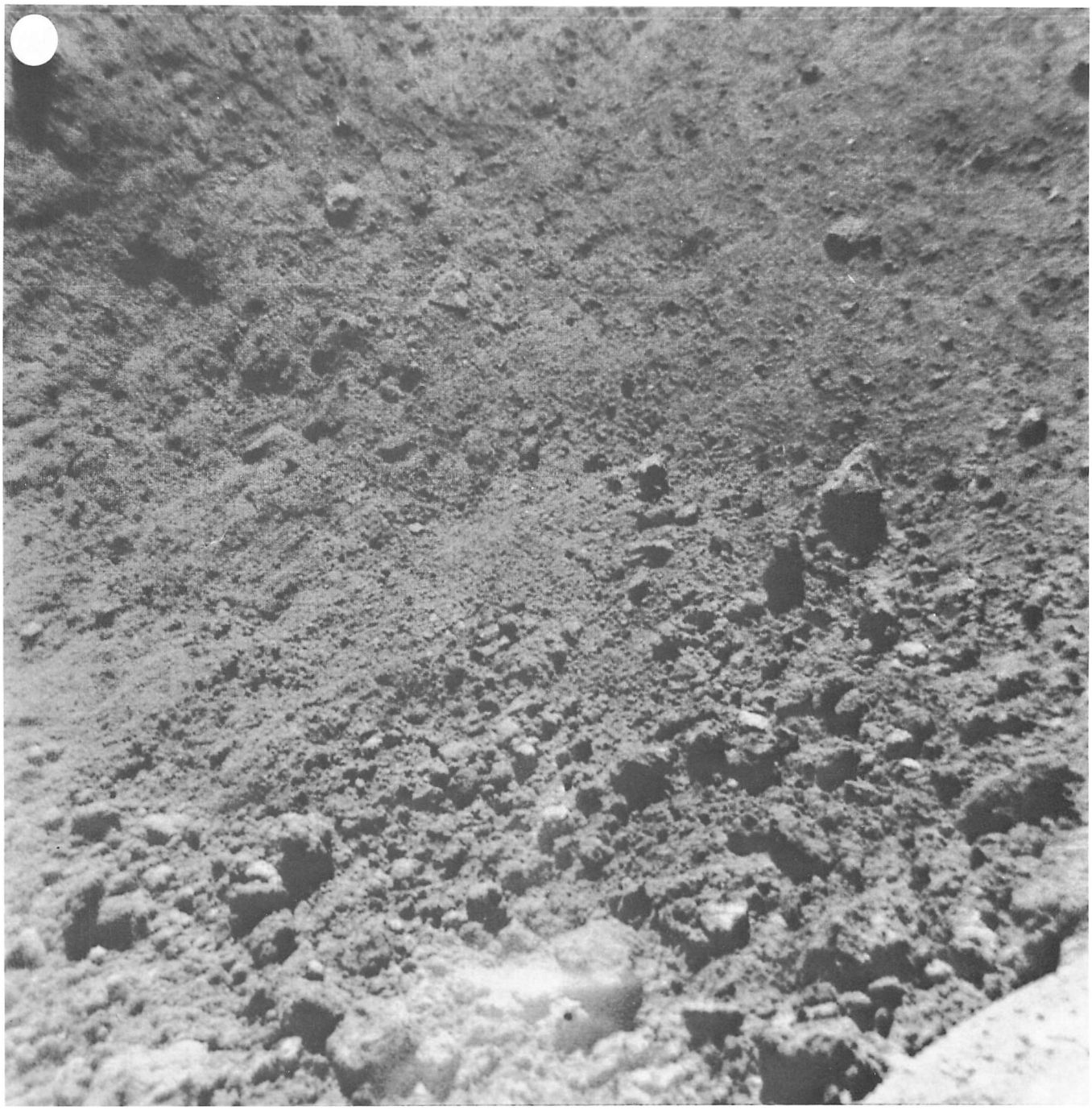
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(47)	Day 255, 05:26:28	66	−30	2.2	f/25.4	N	Clear

	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(48)	Day 256, 00:36:15	−54	−55	2.5	f/12.3	N	Clear	Processed

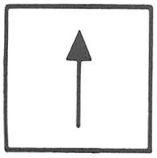


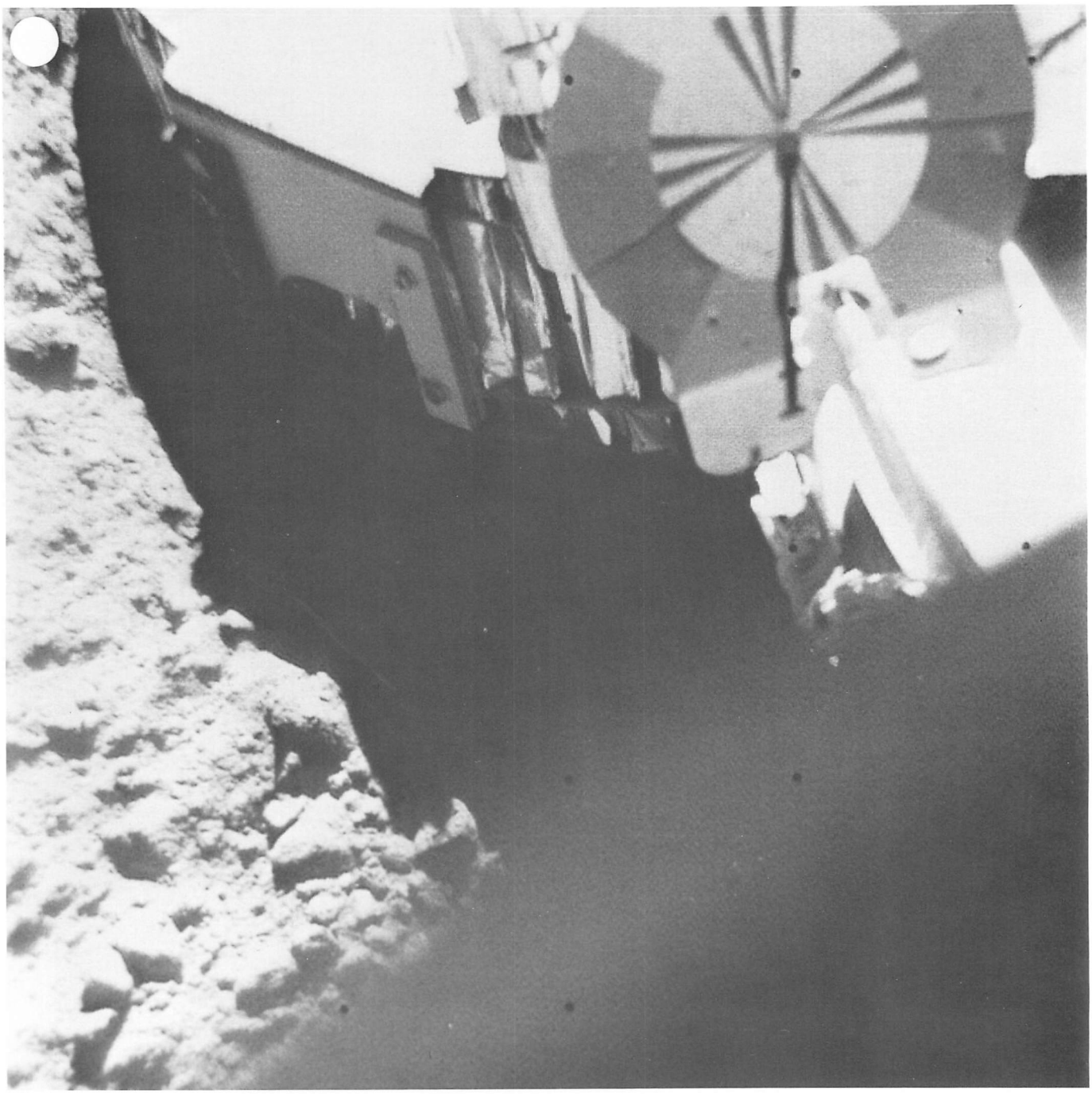
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(49)	Day 256, 01:14:44	−201	−40	3.0	f/16.8	W	Clear



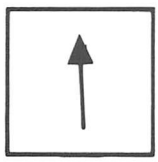


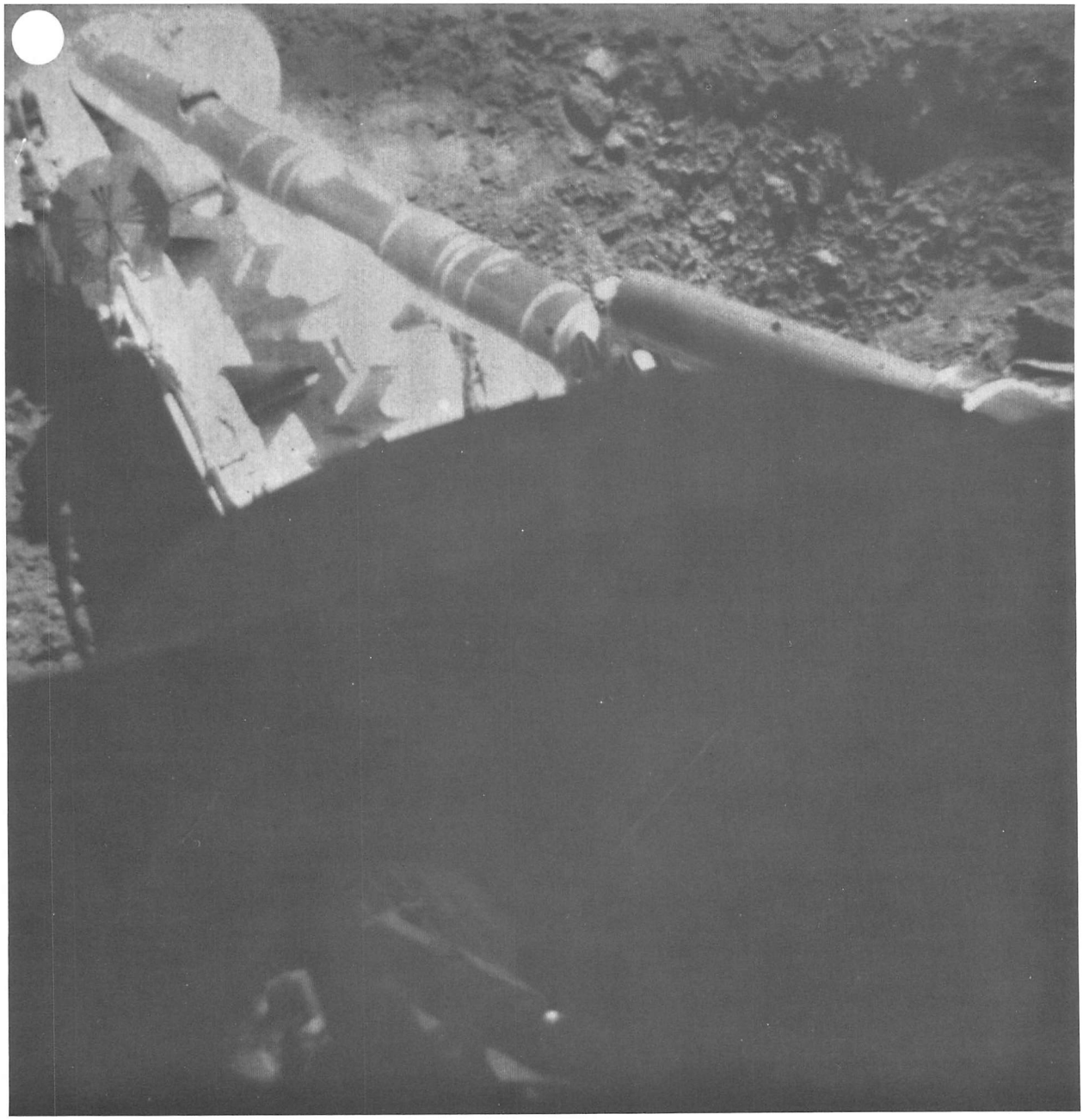
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(50)	Day 256, 06:32:34	−60	−50	2.5	f/16.9	N	Clear	Processed



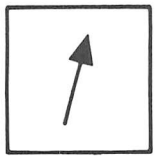


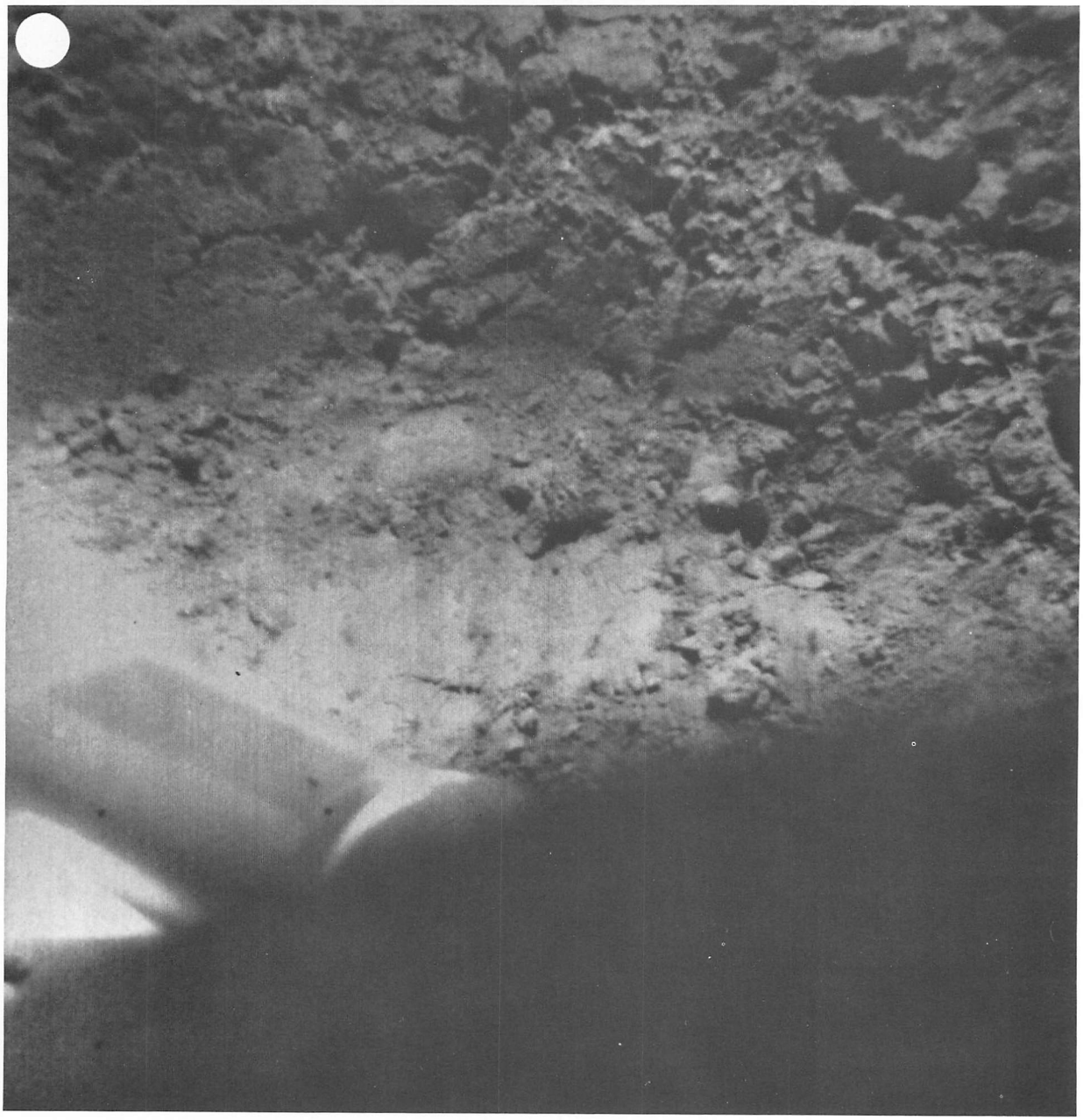
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(51)	Day 257, 01:07:36	−57	−60	2.4	*f*/12.2	N	Clear	Processed



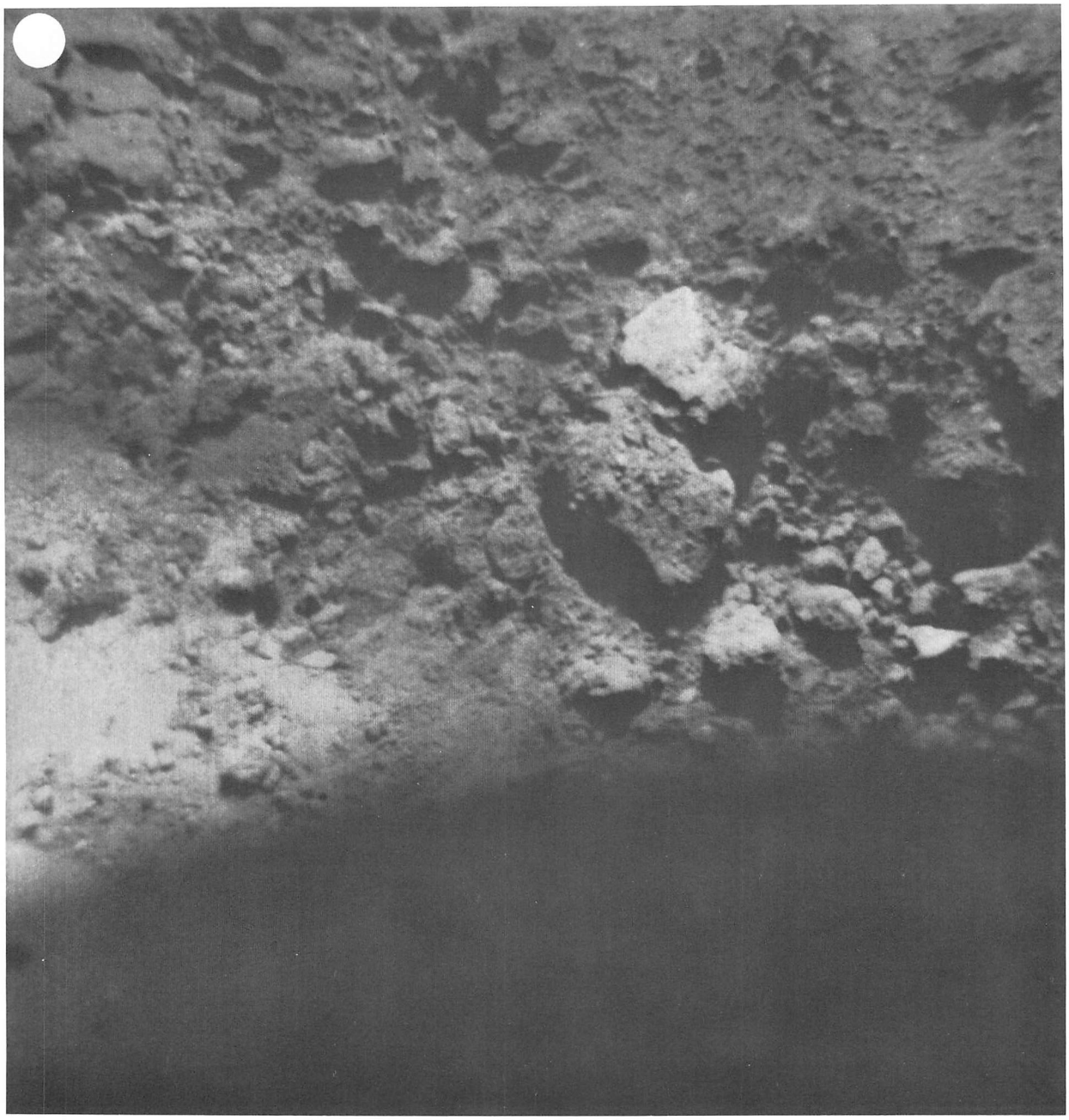


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(52)	Day 257, 04:41:24	−78	−70	2.4	f/16.5	W	Clear

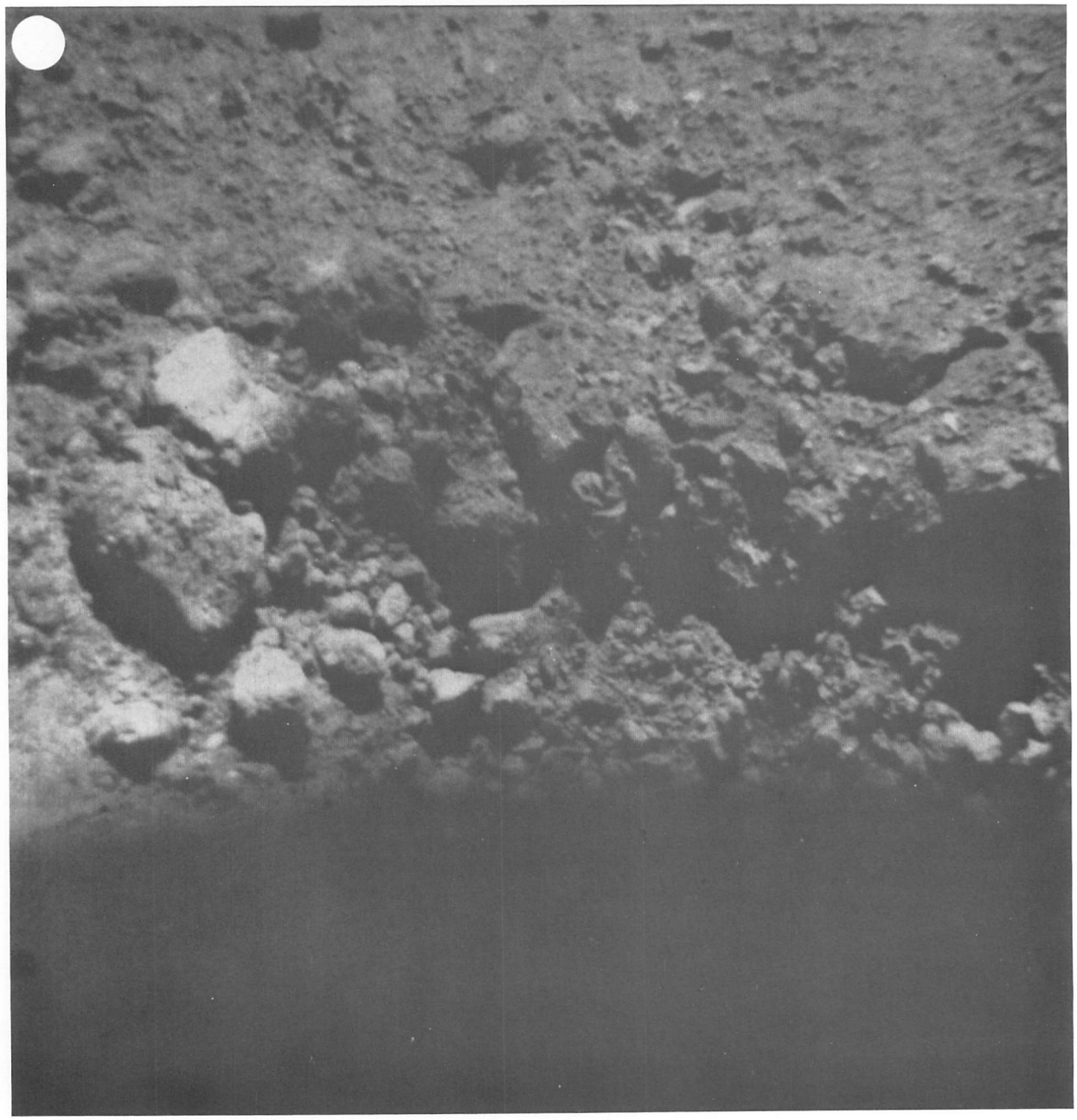




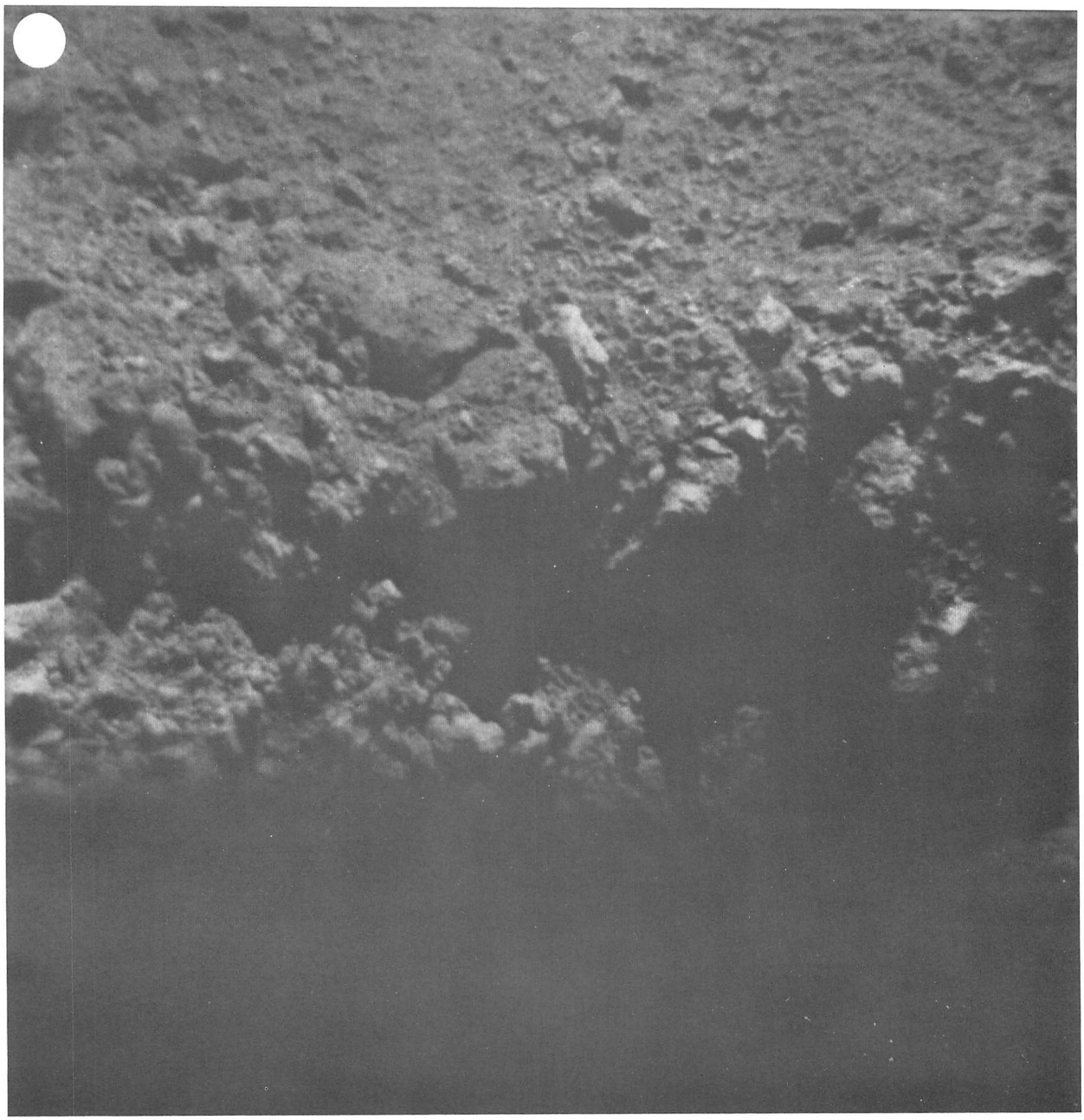
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(53)	Day 257, 04:42:06	−78	−60	2.5	f/16.5	N	Clear



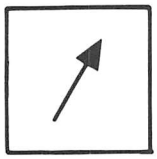
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(54)	Day 257, 04:42:28	−84	−60	2.6	*f*/16.5	N	Clear



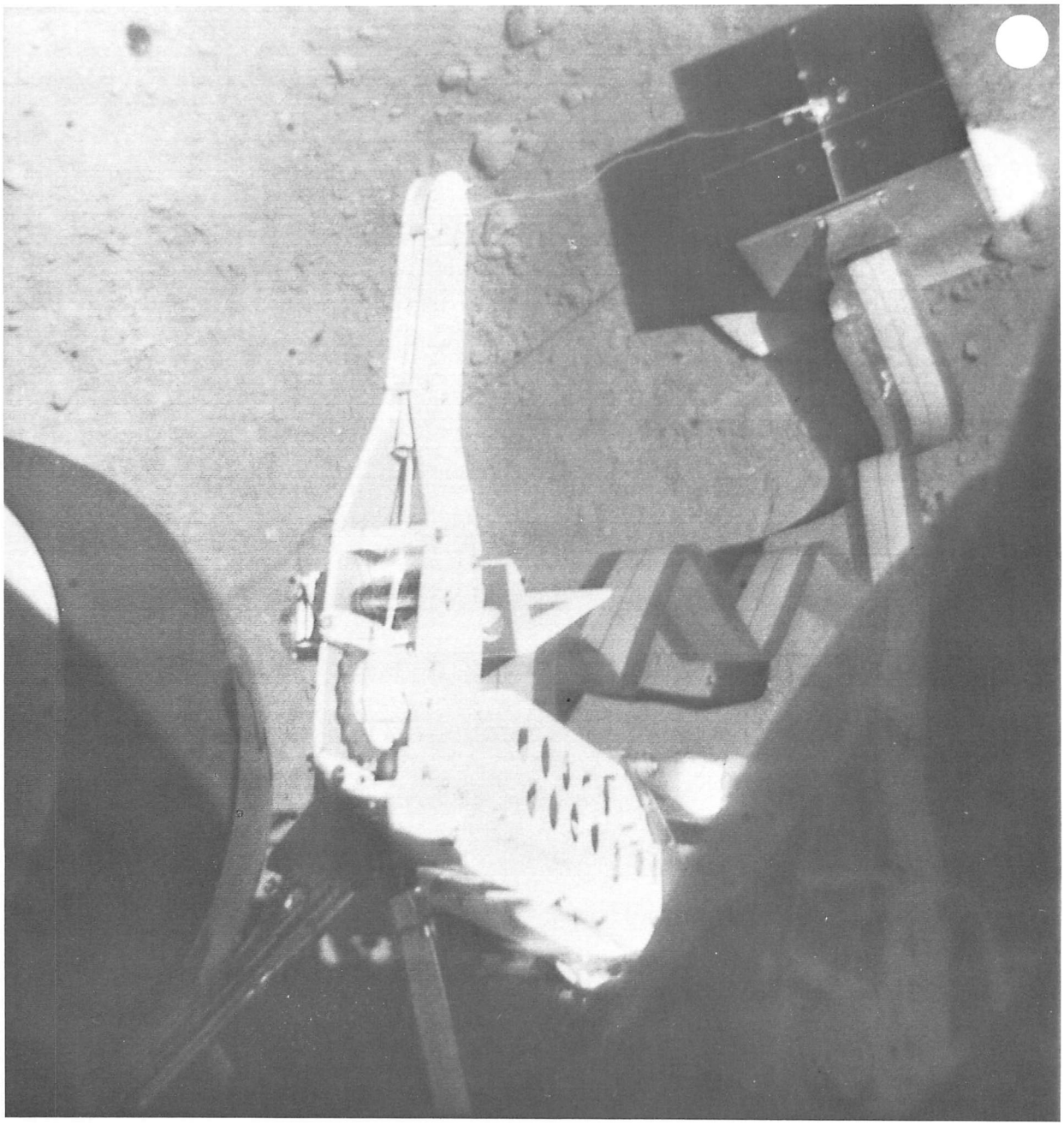
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(55)	Day 257, 04:42:44	−90	−60	2.6	f/16.5	N	Clear



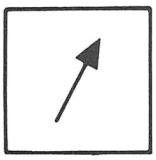
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(56)	Day 257, 04:43:02	−96	−60	2.6	f/16.5	N	Clear

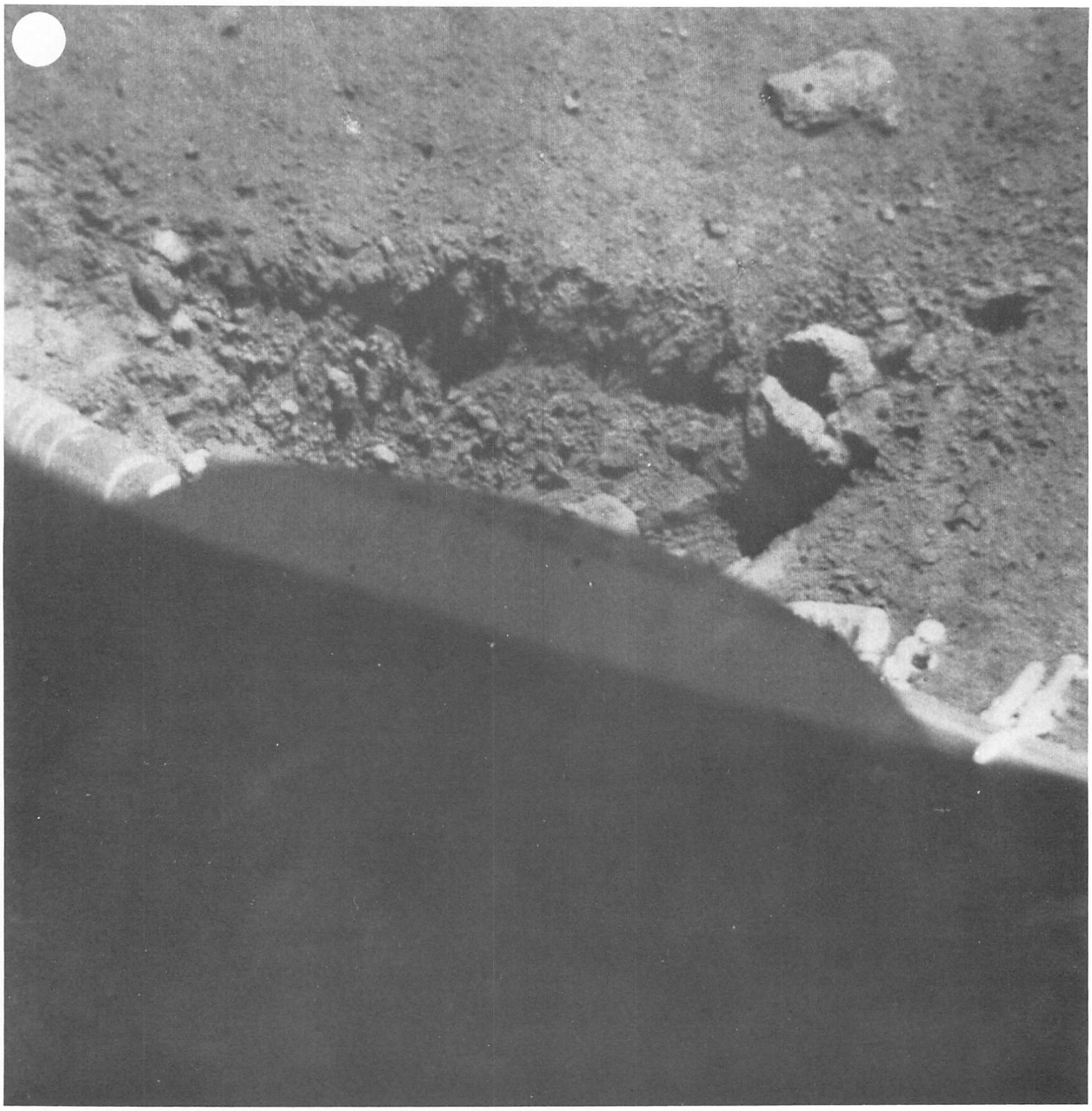


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(57)	Day 257, 05:59:57	36	−50	2.3	f/16.9	W	Clear

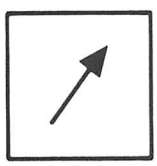


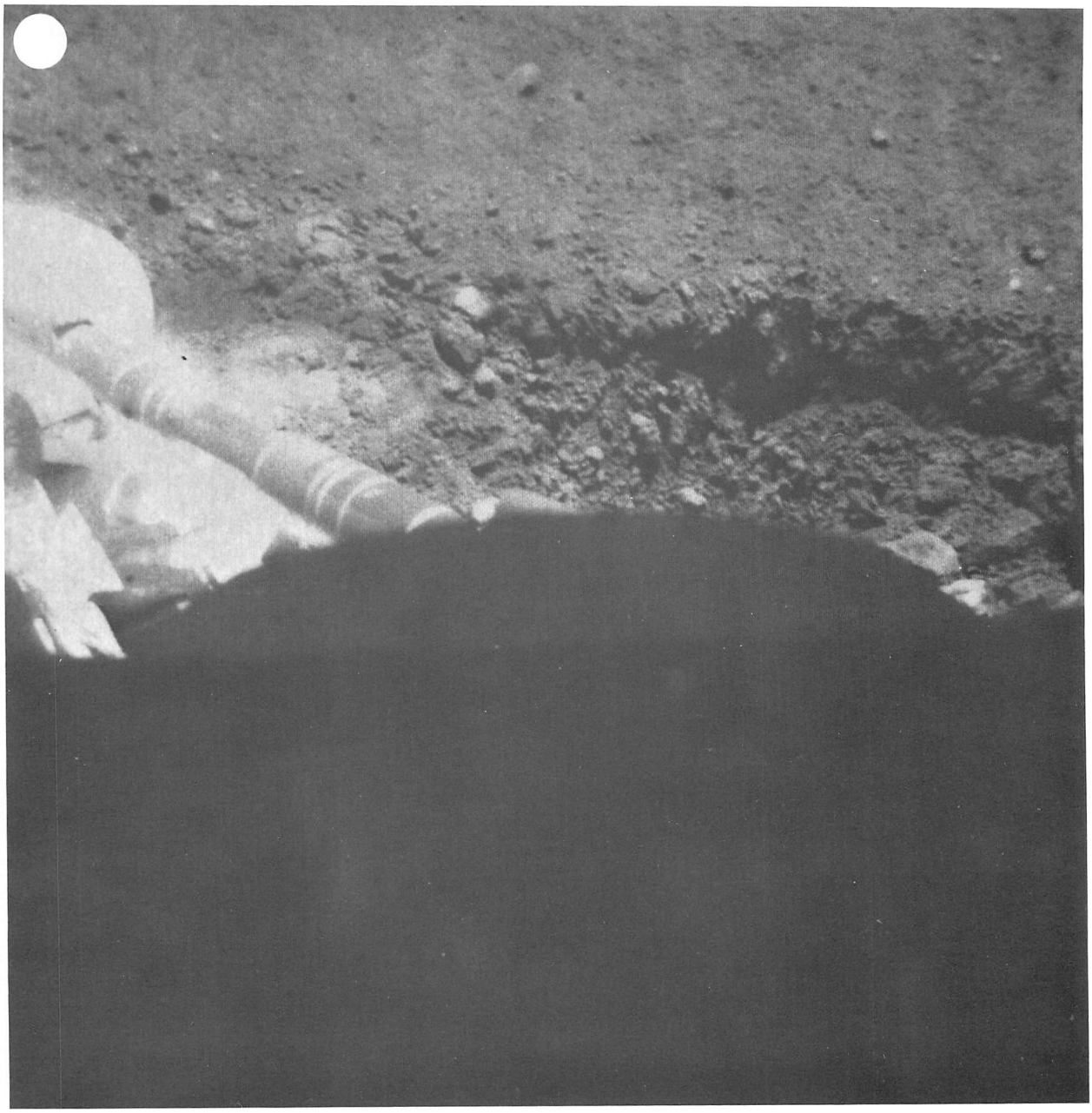
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(58)	Day 257, 06:02:32	54	−50	2.3	f/23.7	W	Clear



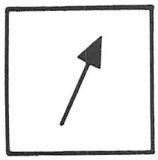


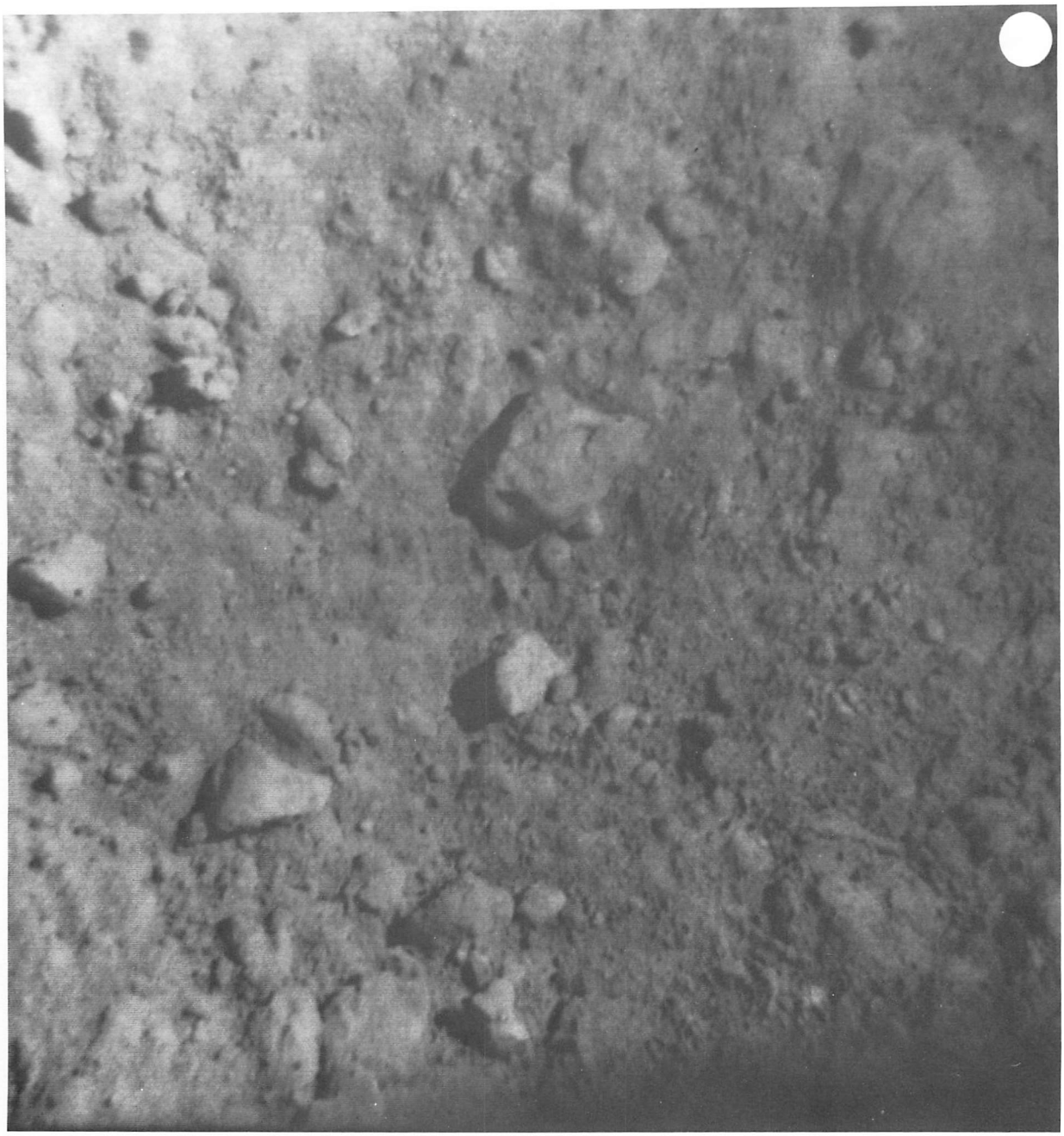
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(59)	Day 257, 06:11:31	−108	−65	2.3	*f*/16.5	W	Clear



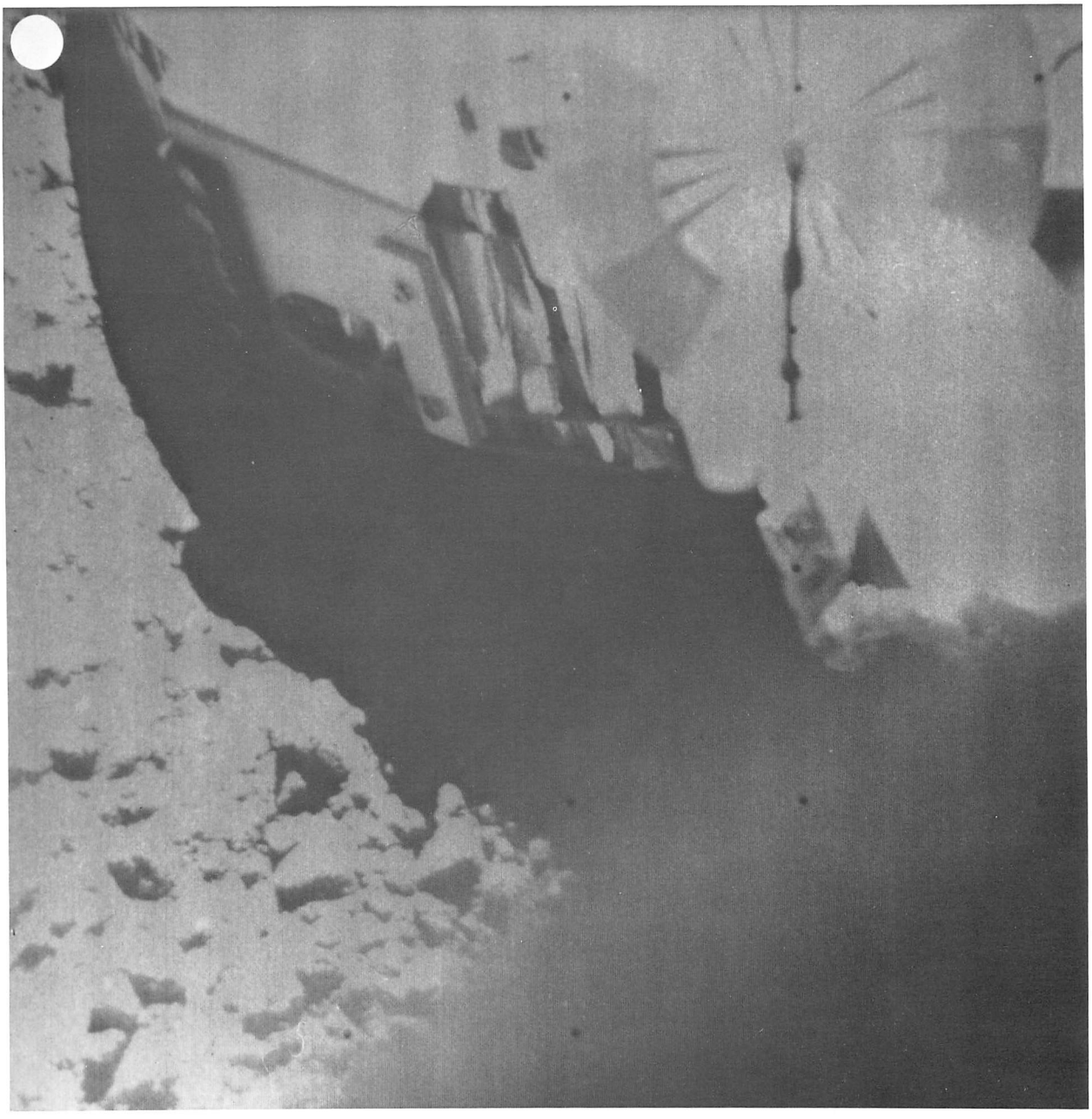


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(60)	Day 257, 06:11:37	−90	−65	2.3	*f*/16.5	W	Clear

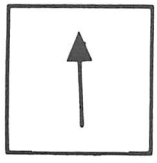


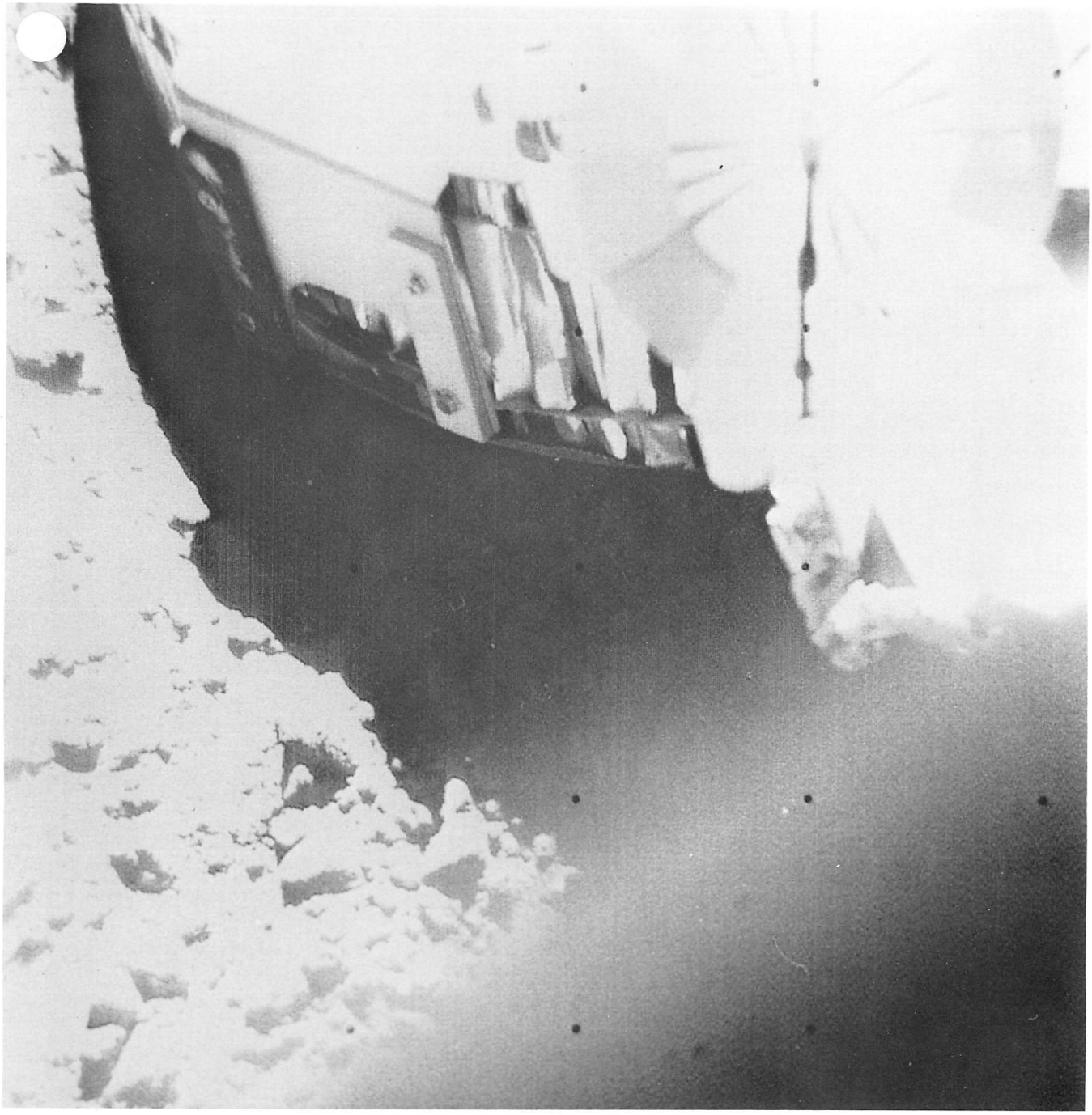


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(61)	Day 257, 06:59:16	6	−55	2.1	*f*/17.7	N	Clear

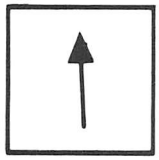


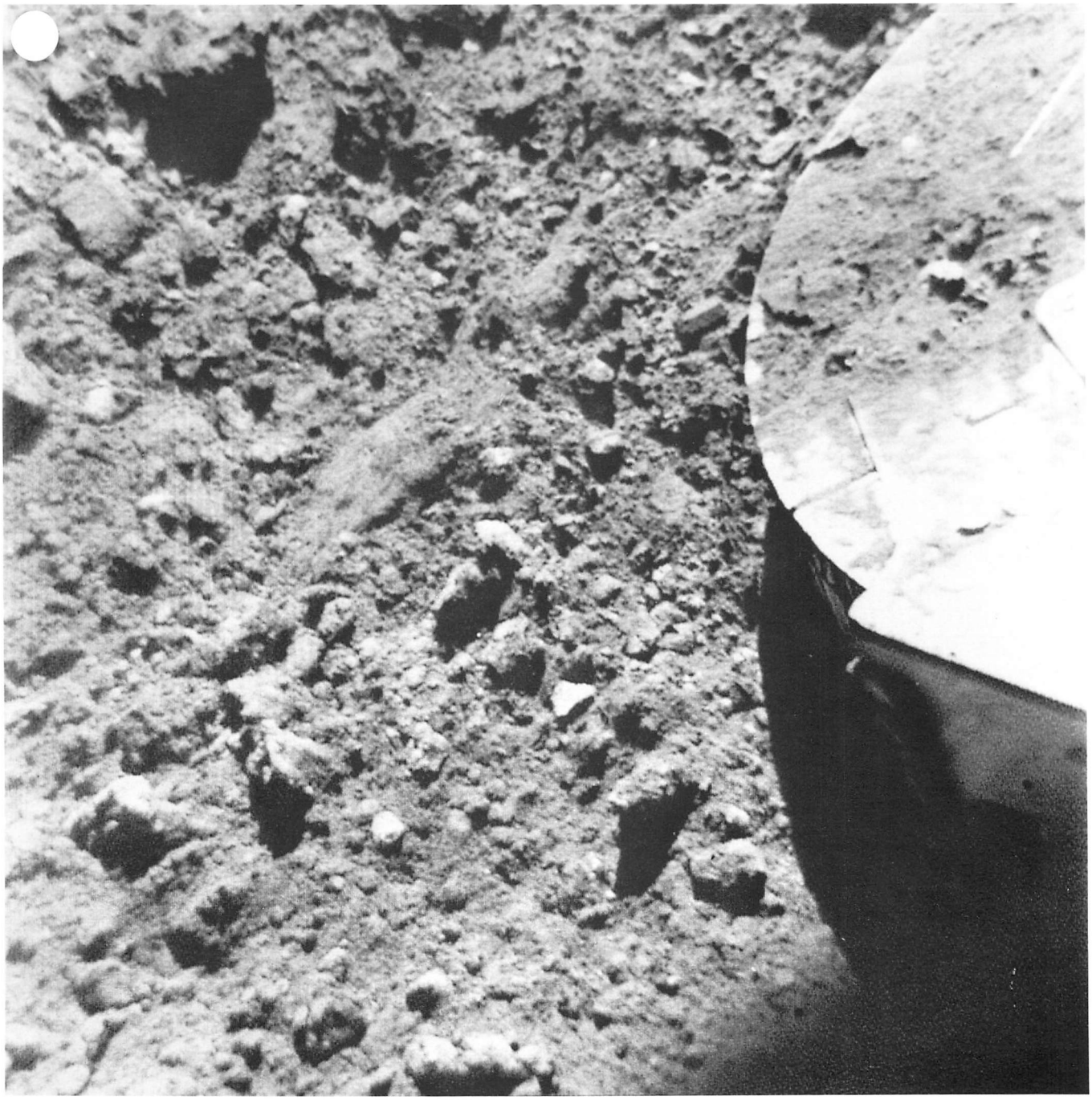
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(62)	Day 257, 08:02:05	−57	−60	2.4	f/8.1	N	Clear



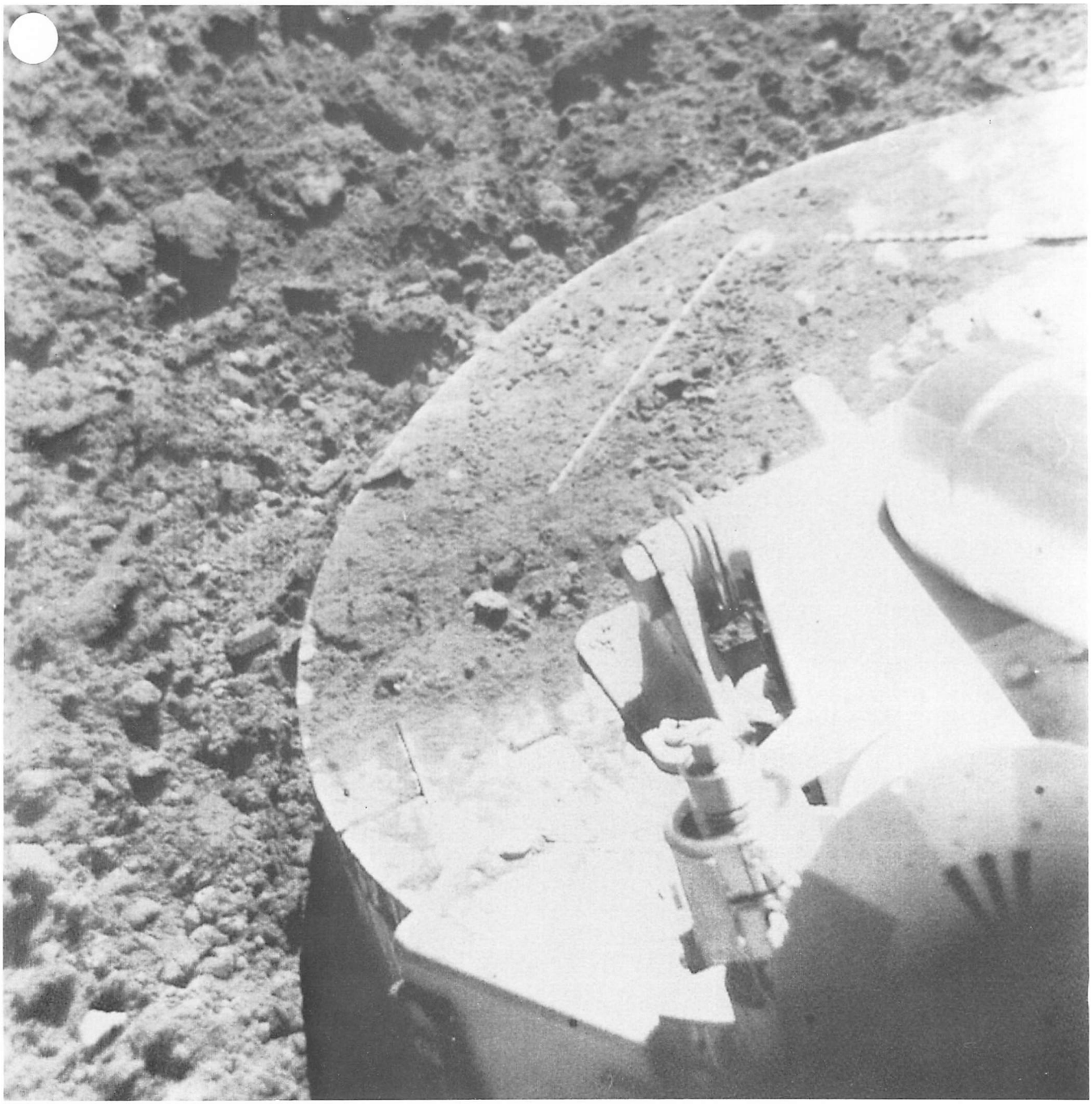


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(63)	Day 257, 08:02:05	−57	−60	2.4	f/8.1	N	Clear	Processed

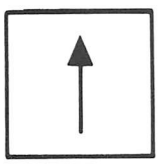




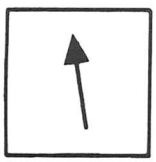
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(64)	Day 257, 08:08:41	−54	−55	2.5	f/16.9	N	Clear	Processed

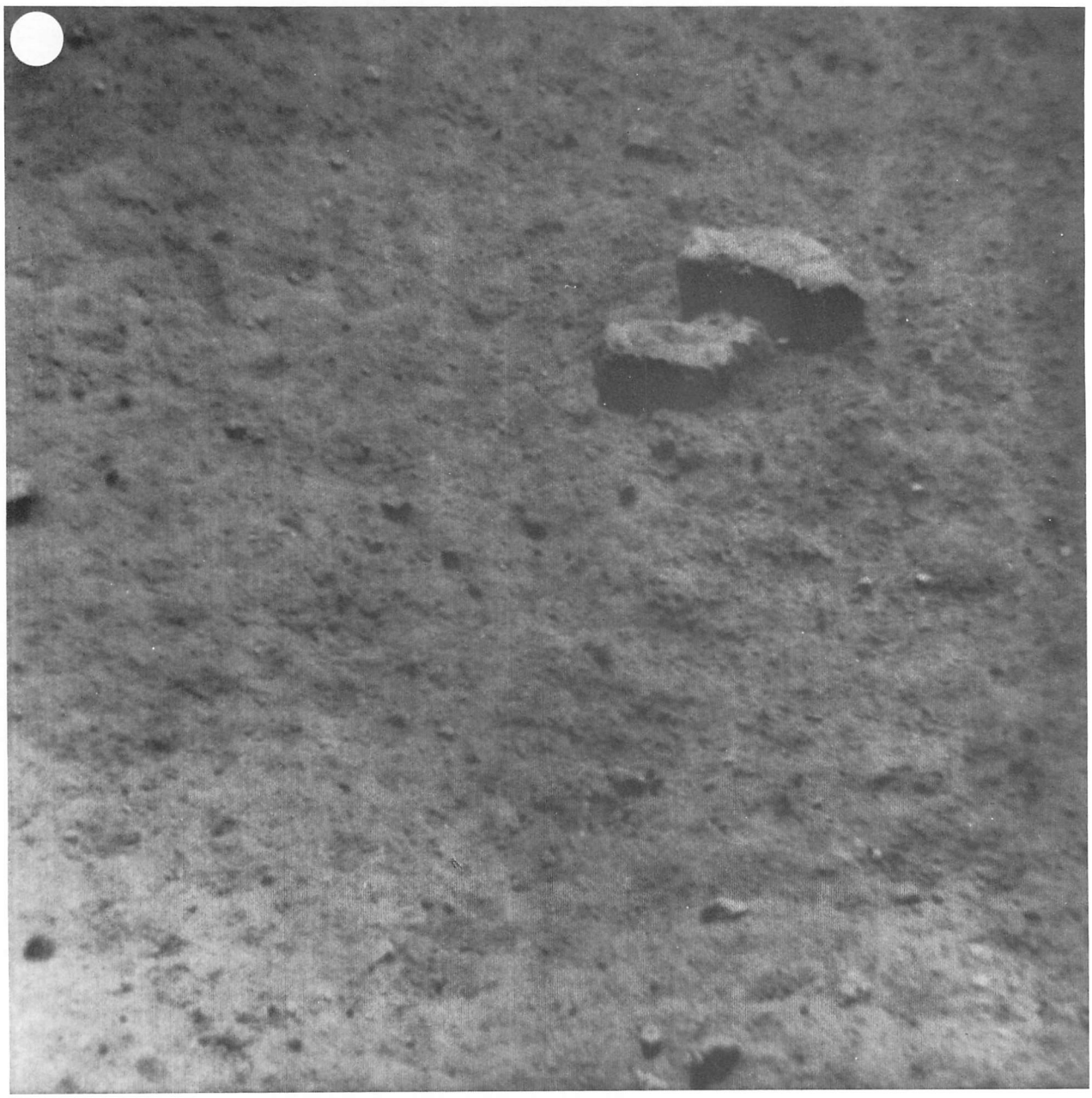


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(65)	Day 257, 08:08:46	−60	−55	2.5	*f*/16.9	N	Clear	Processed

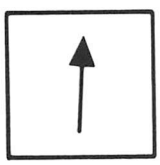


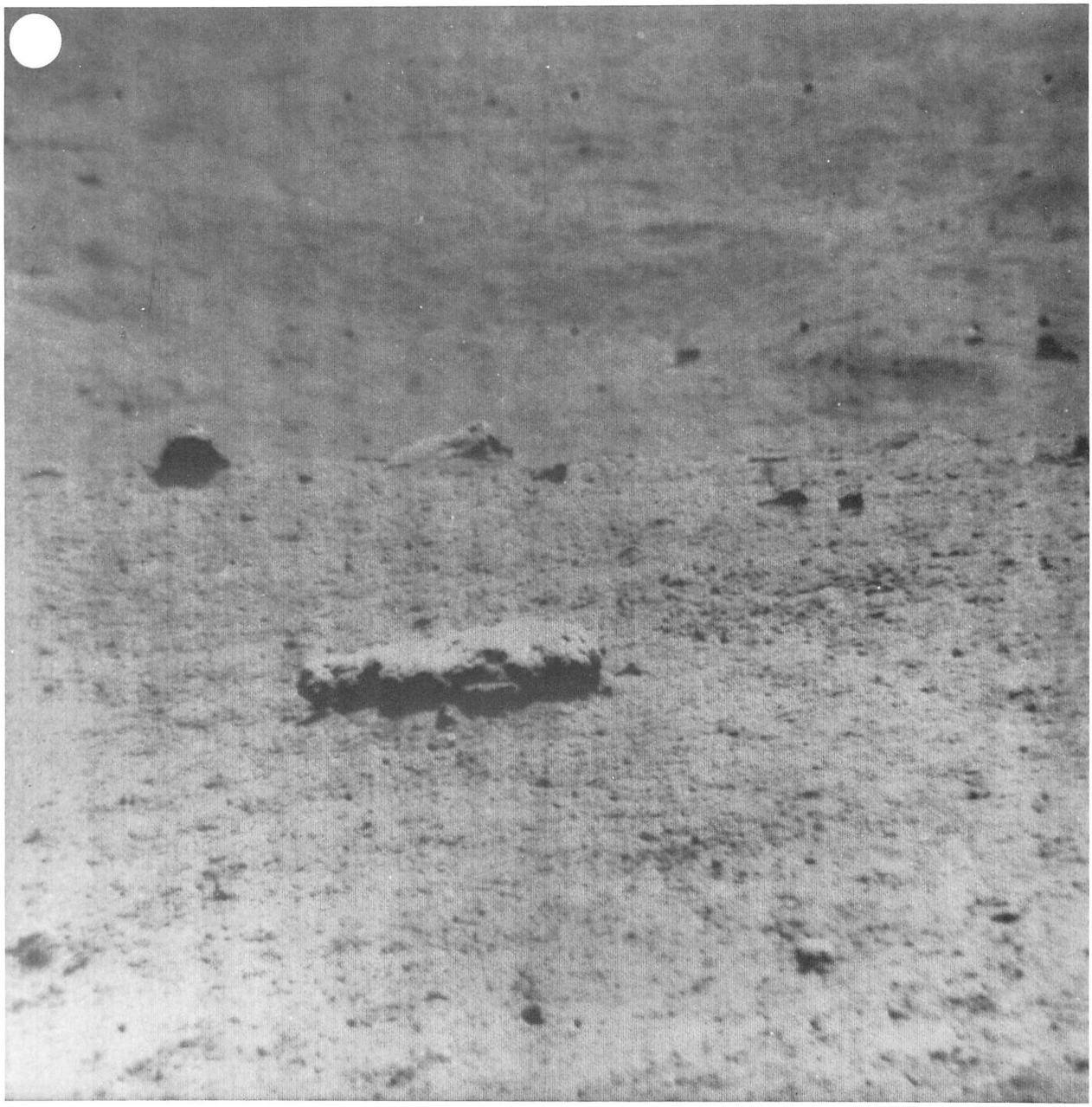
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(66)	Day 257, 08:09:09	−51	−50	2.5	f/16.8	N	Clear



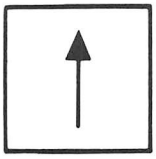


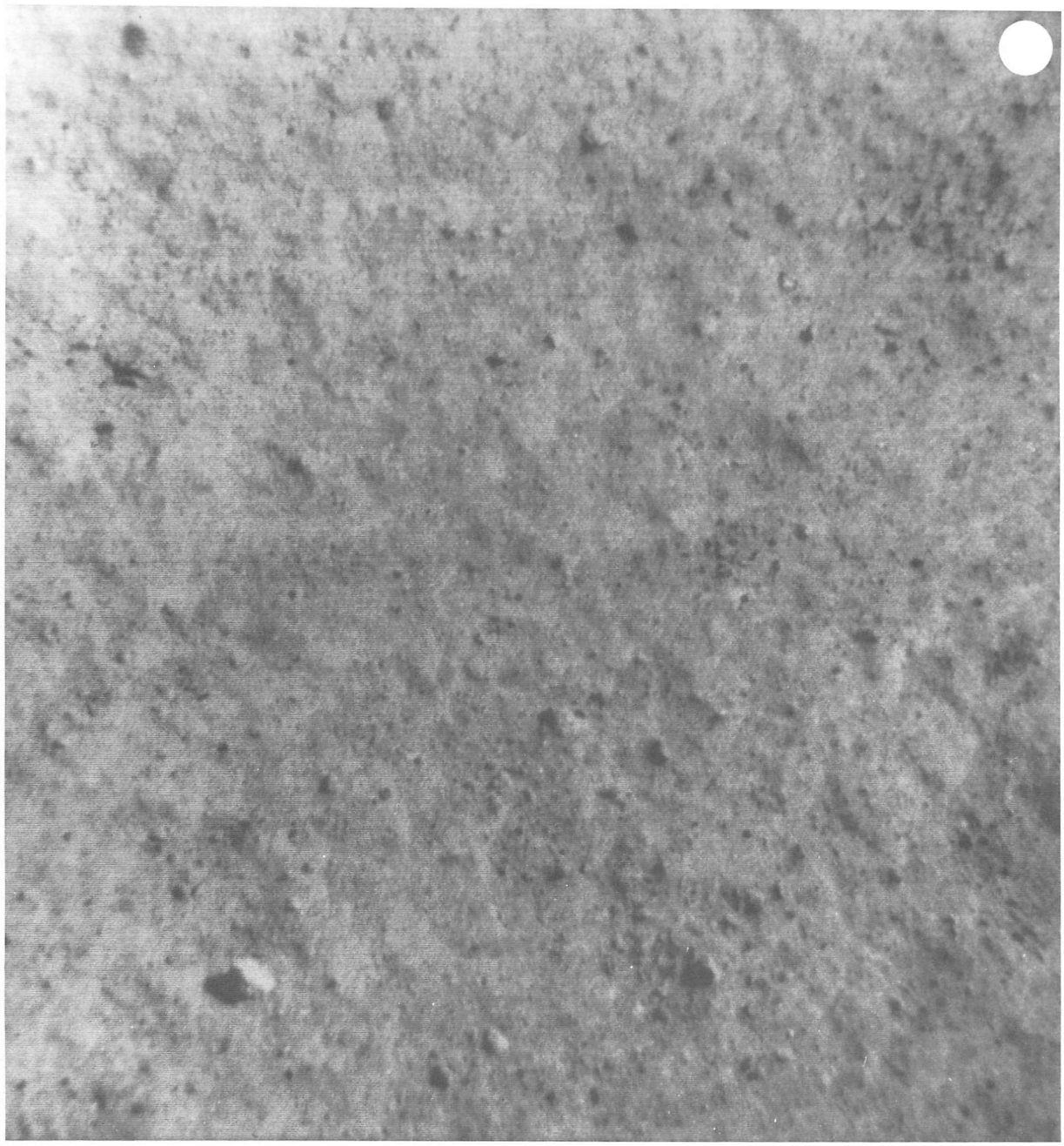
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(67)	Day 257, 08:10:02	−63	−40	3.1	f/16.9	N	Clear



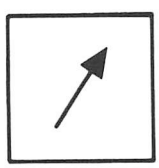


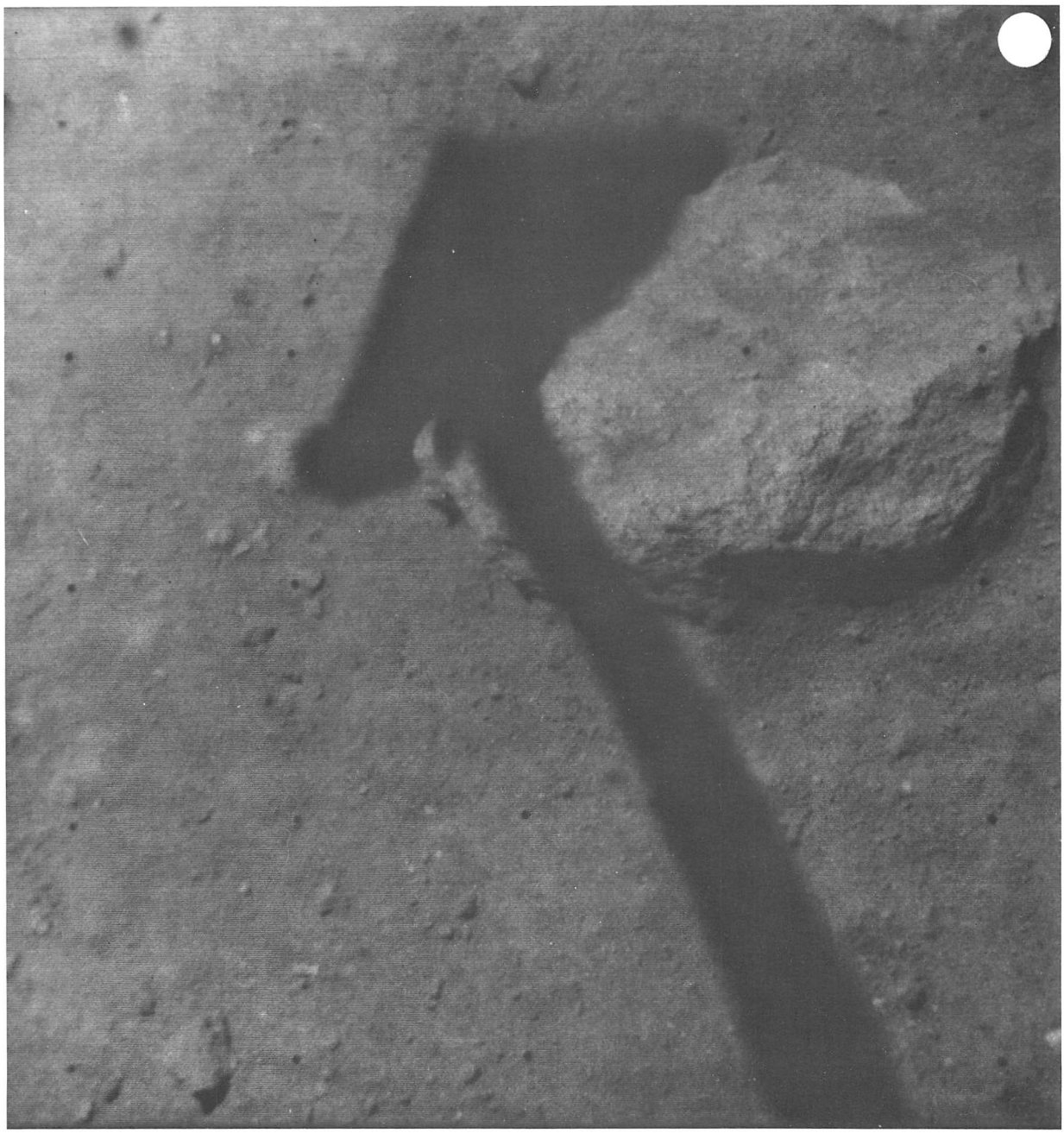
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(68)	Day 257, 08:16:44	−60	−5	10.4	*f*/11.5	N	Clear





	GMT	Az	El	Focus, m	Iris	Lens	Filter
(69)	Day 257, 08:30:03	−12	−5	3.2	f/16.9	N	Clear

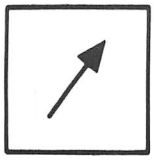


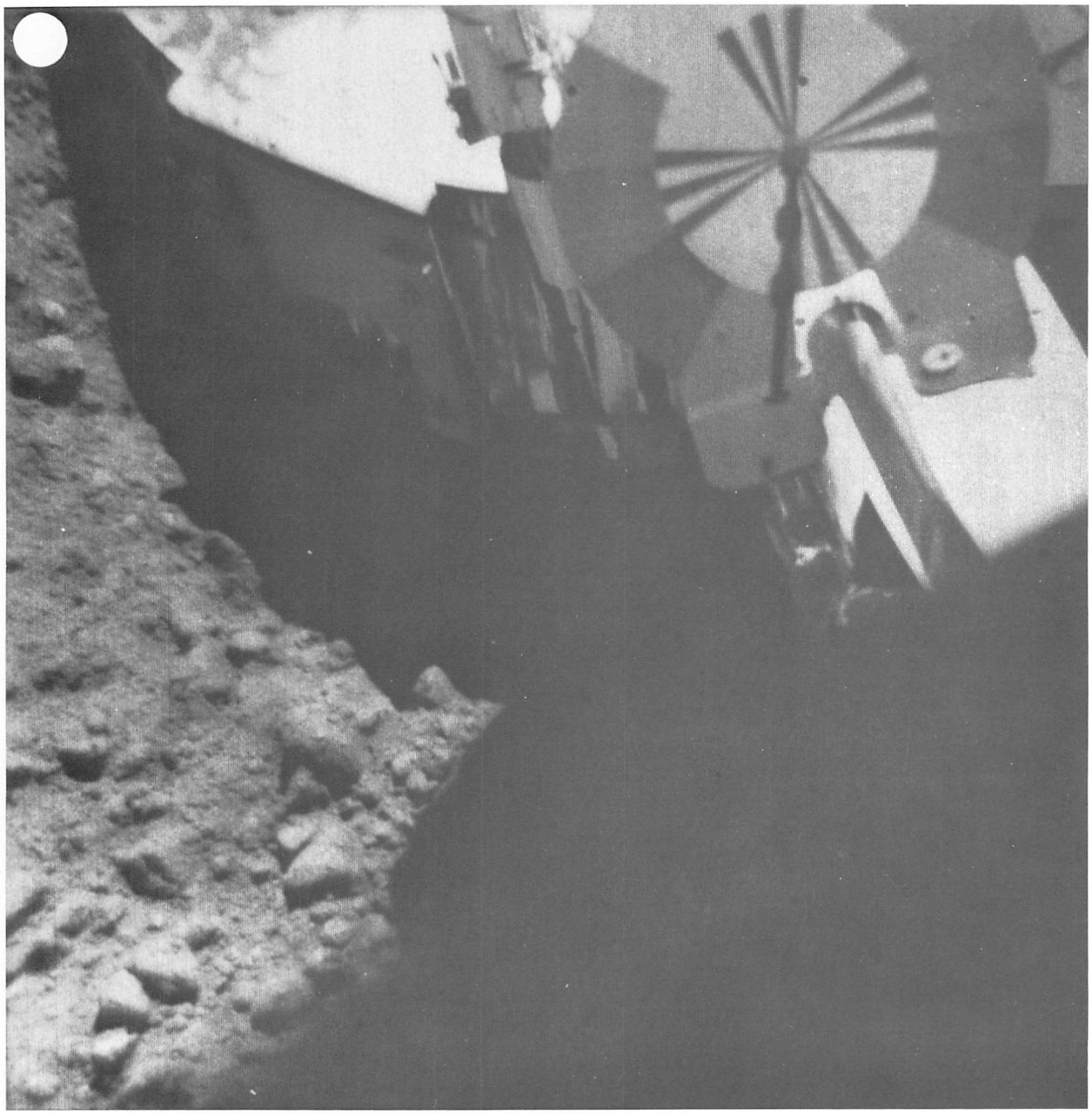


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(70)	Day 258, 02:45:59	57	−20	2.5	*f*/8.2	N	Green

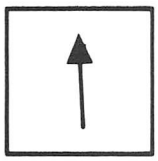
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(71)	Day 258, 03:30:19	54	−20	2.3	*f*/23.7	W	Clear

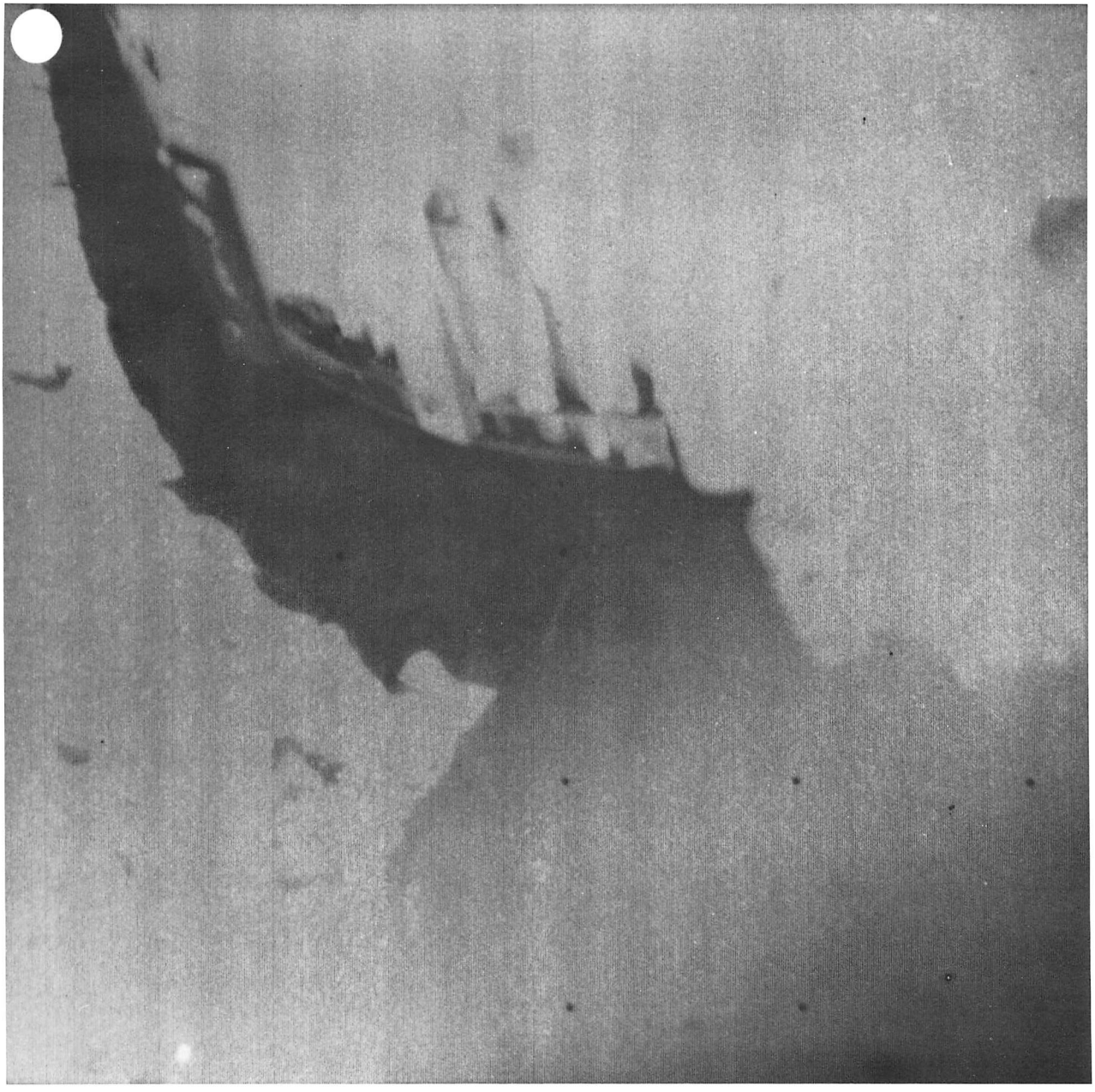
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(72)	Day 258, 03:40:28	−108	−65	2.3	f/16.5	W	Clear



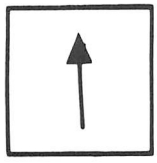


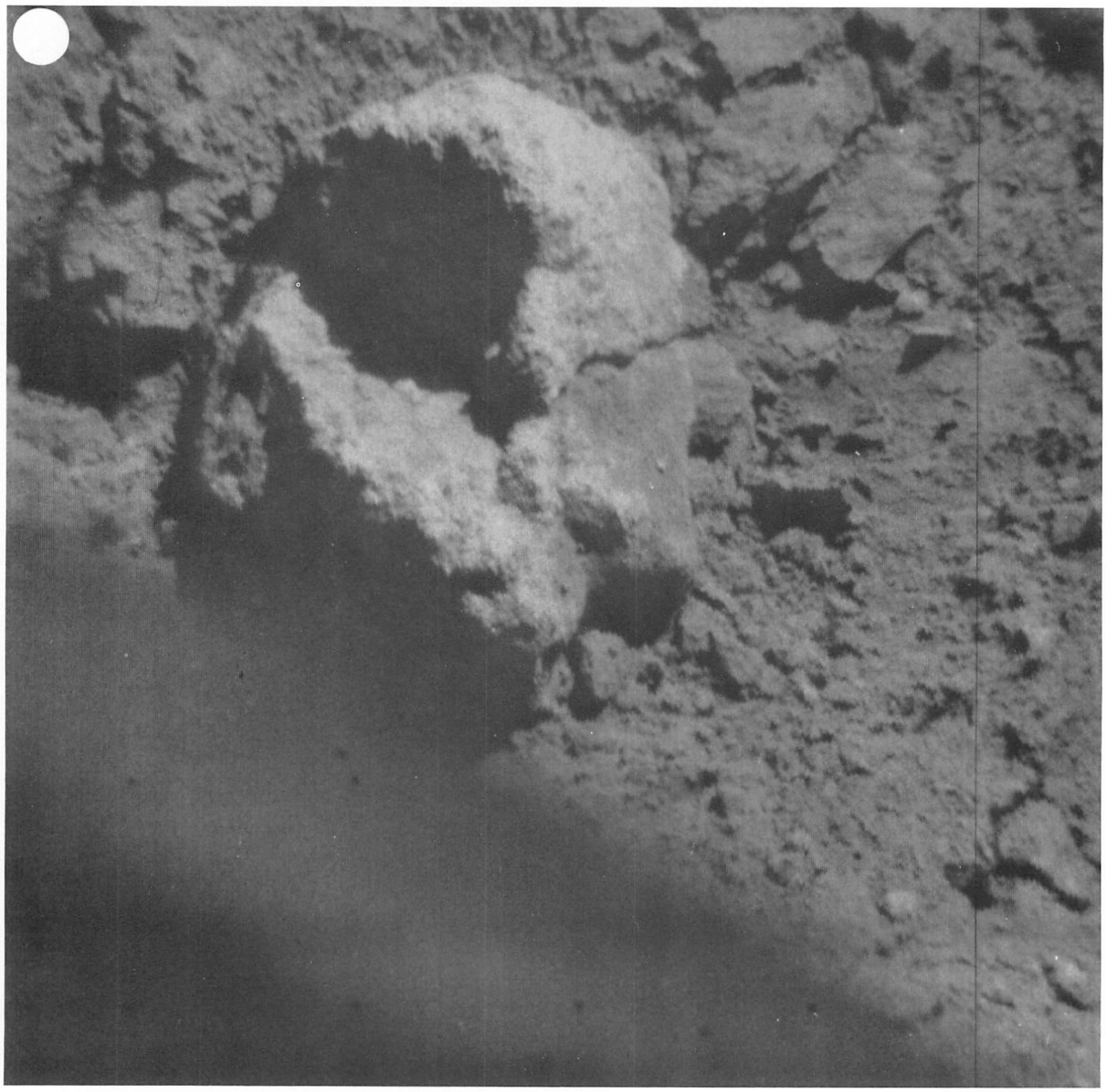
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(73)	Day 258, 03:48:09	−57	−60	2.4	f/16.6	N	Clear



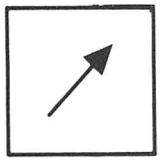


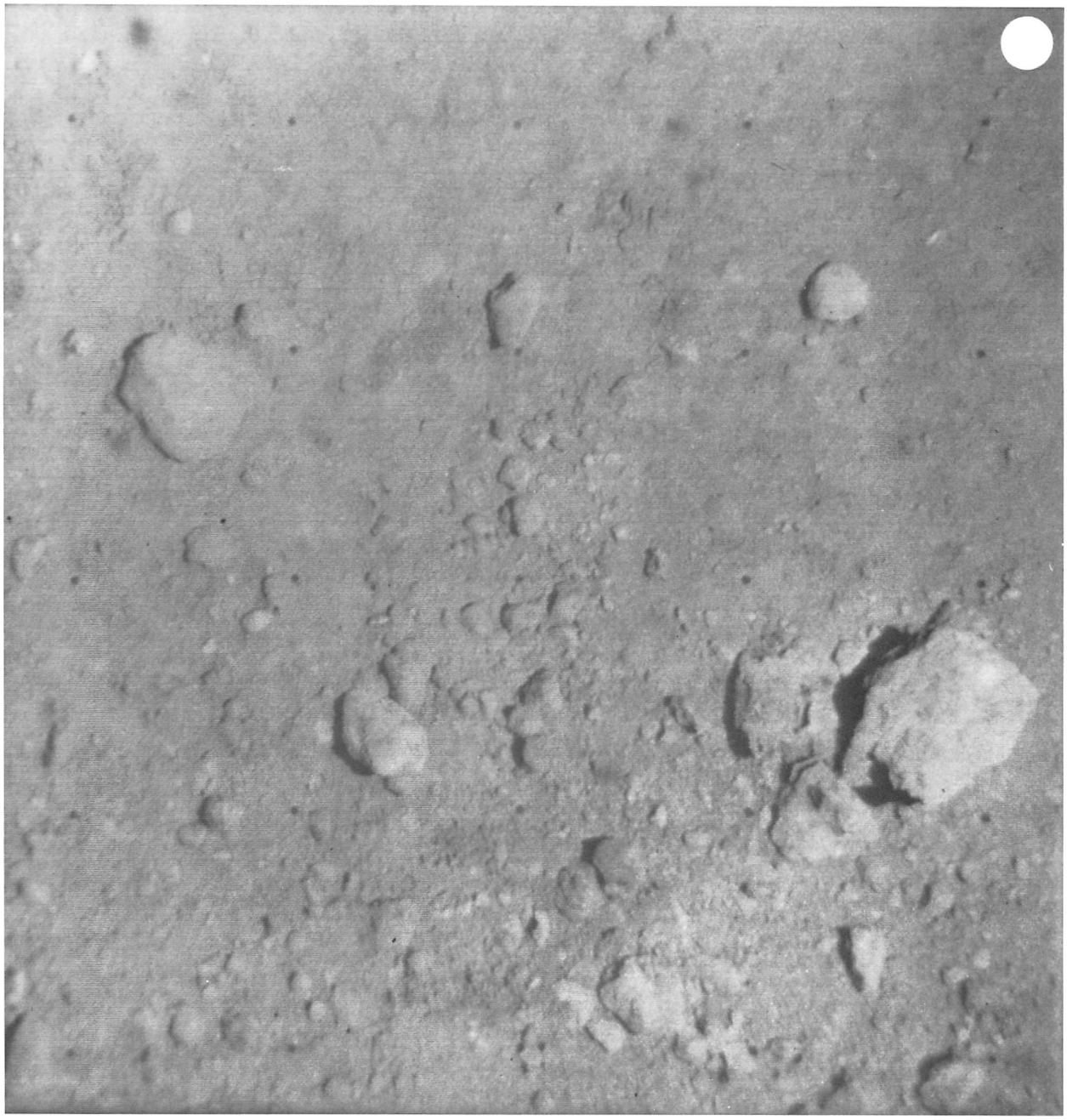
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(74)	Day 258, 03:53:11	−57	−60	2.4	*f*/5.9	N	Clear



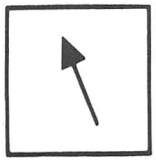


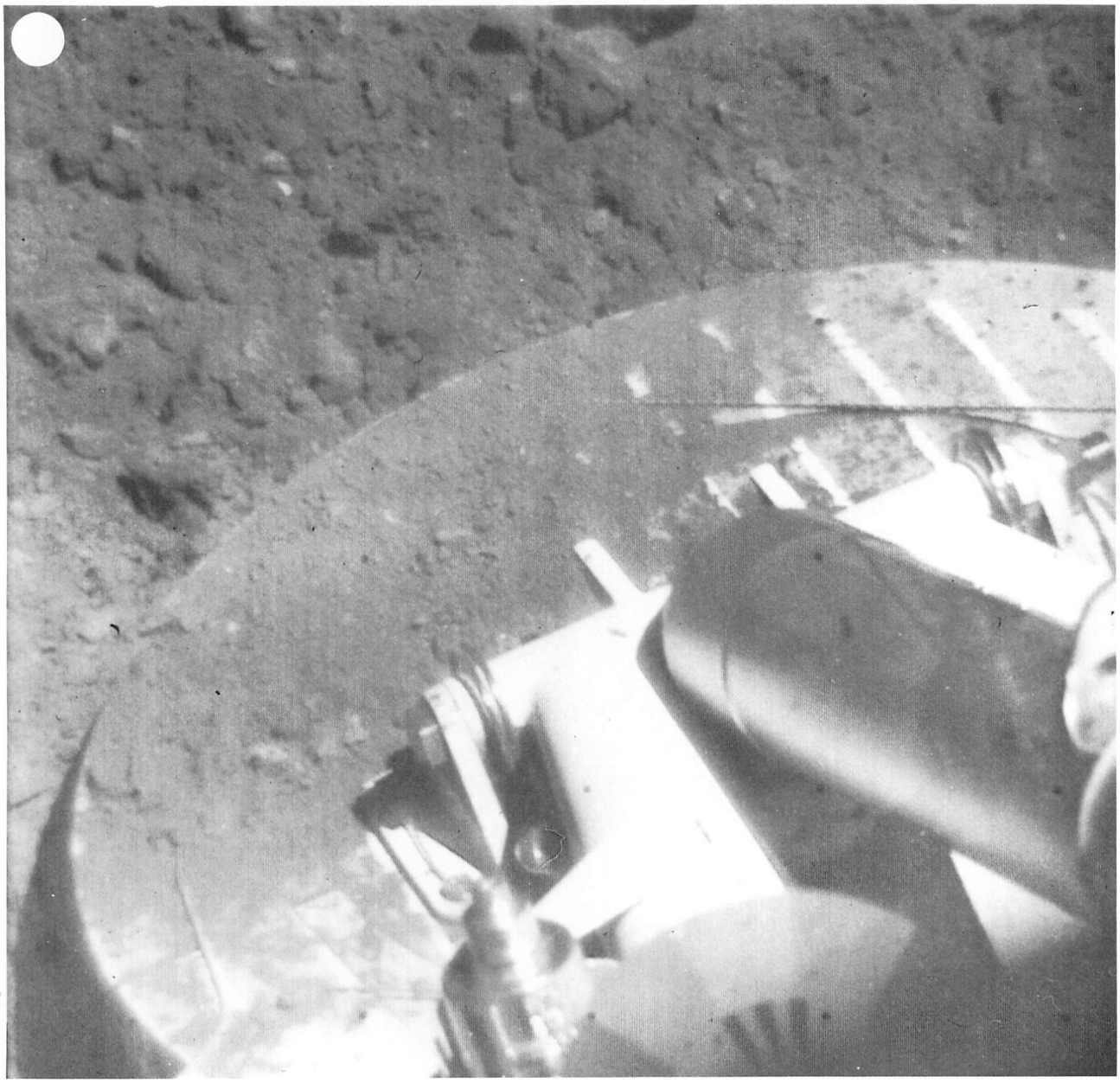
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(75)	Day 258, 08:30:02	−120	−60	2.5	*f*/17.8	N	Clear



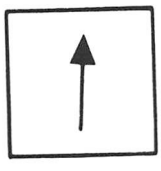


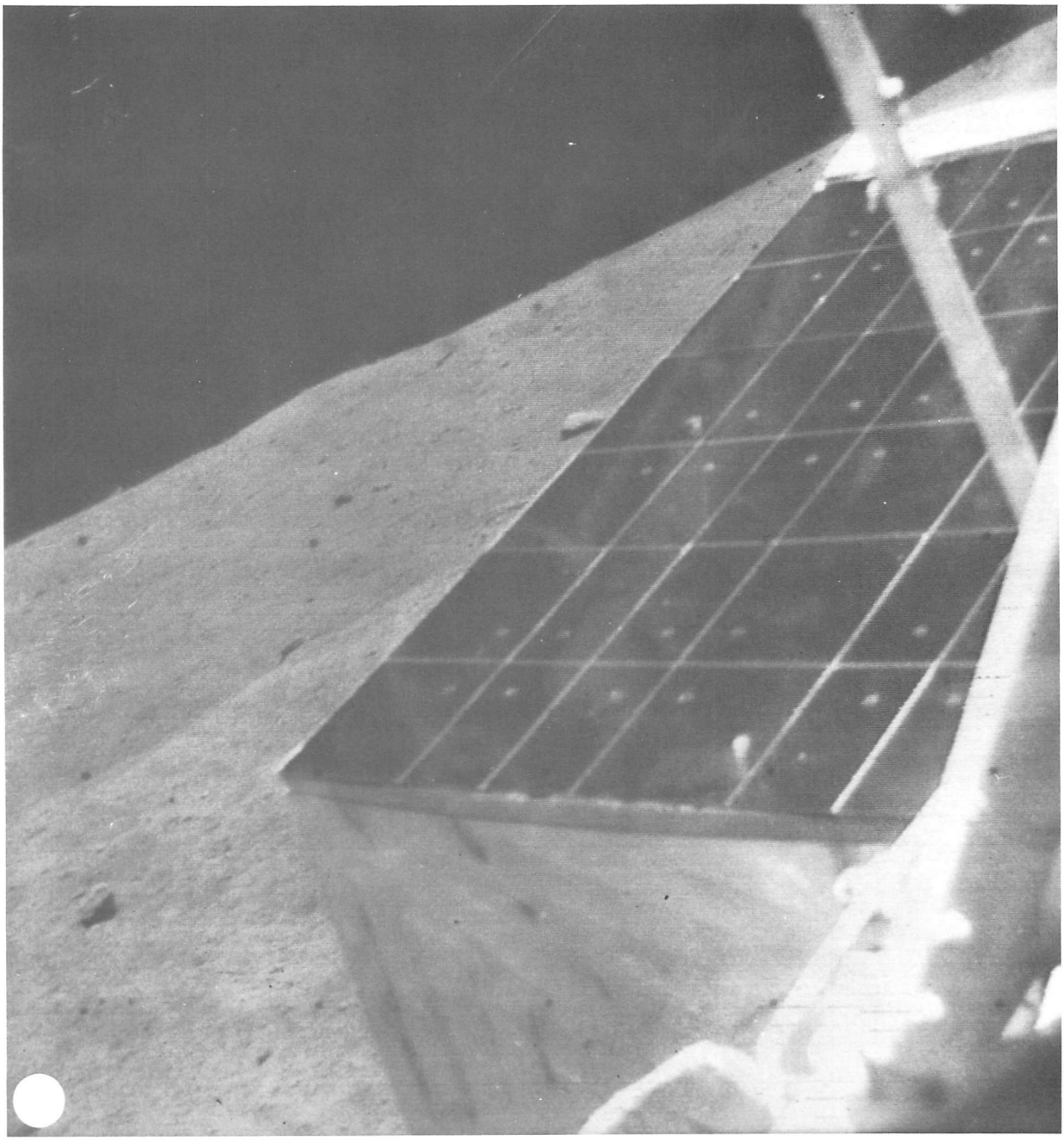
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(76)	Day 261, 03:41:52	−39	−45	2.5	*f*/8.3	N	Green



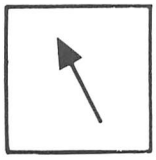


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(77)	Day 261, 05:29:42	−63	−55	2.5	*f*/14.5	N	Green

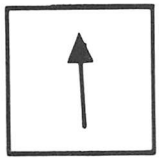


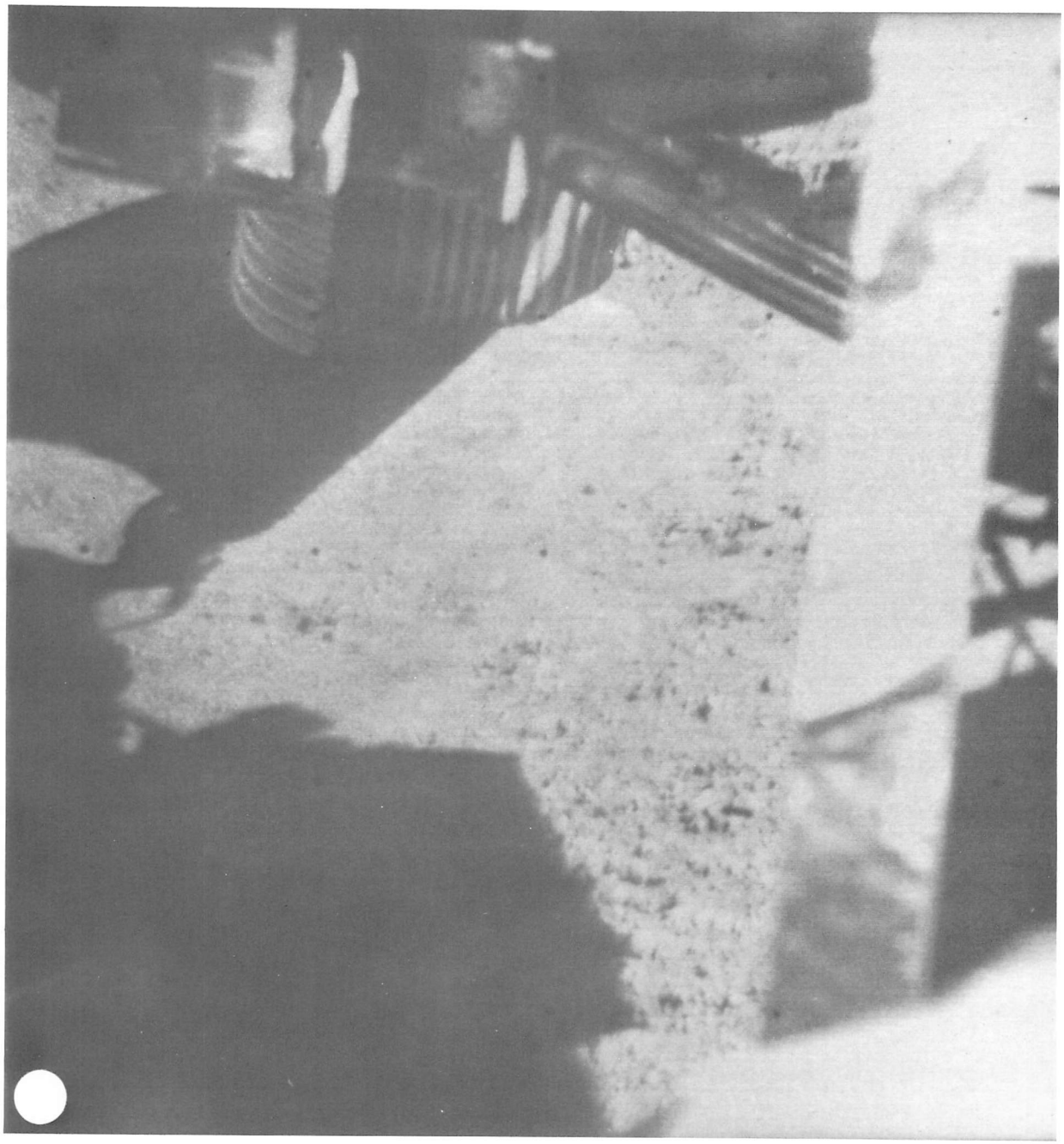


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(78)	Day 261, 07:16:55	−162	−35	2.3	f/7.2	N	Green

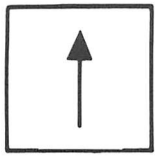


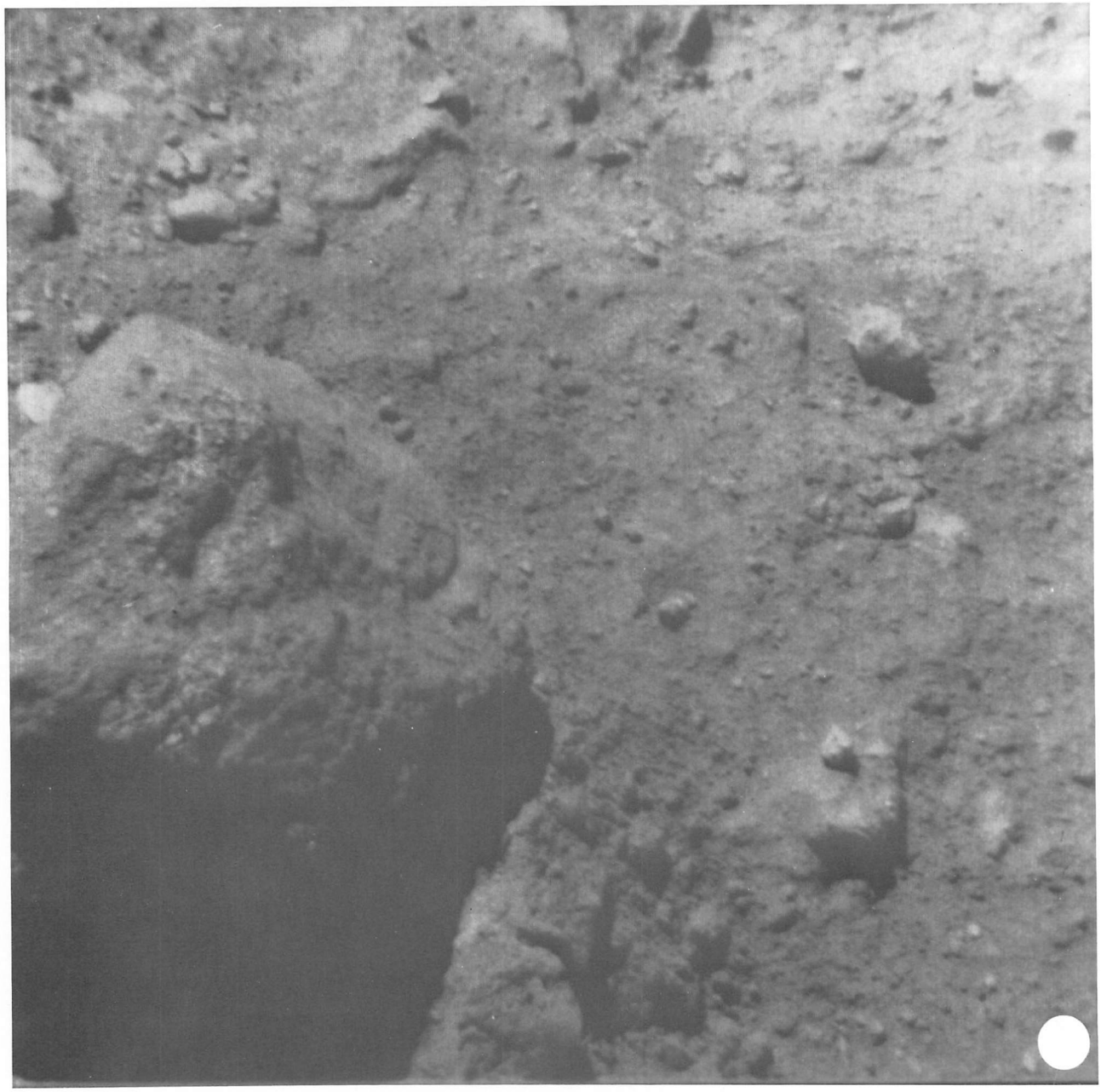
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(79)	Day 262, 06:20:03	−201	−40	2.2	f/6.0	N	Green



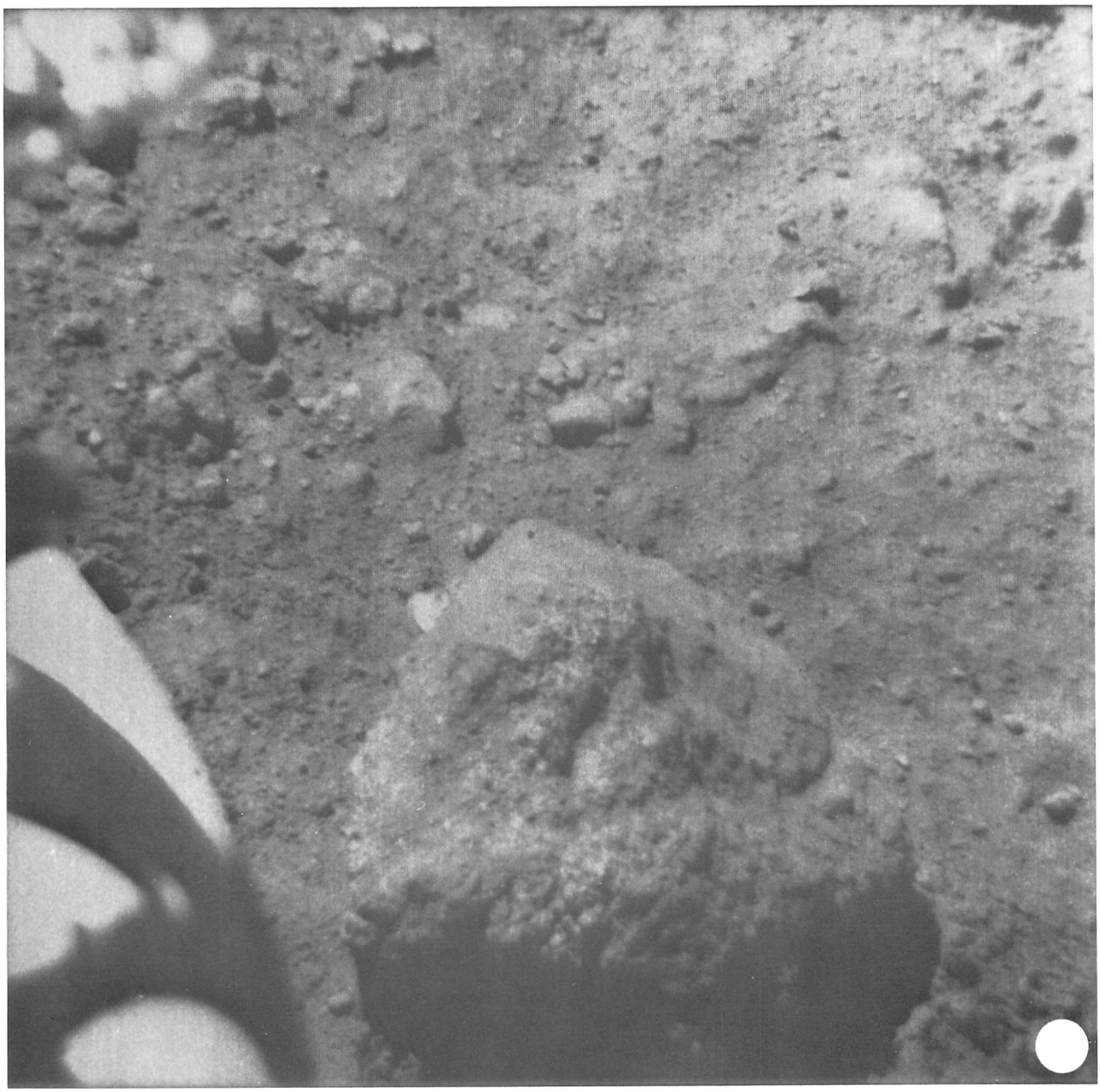


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(80)	Day 262, 06:21:28	−204	−35	2.3	*f*/25.4	N	Green

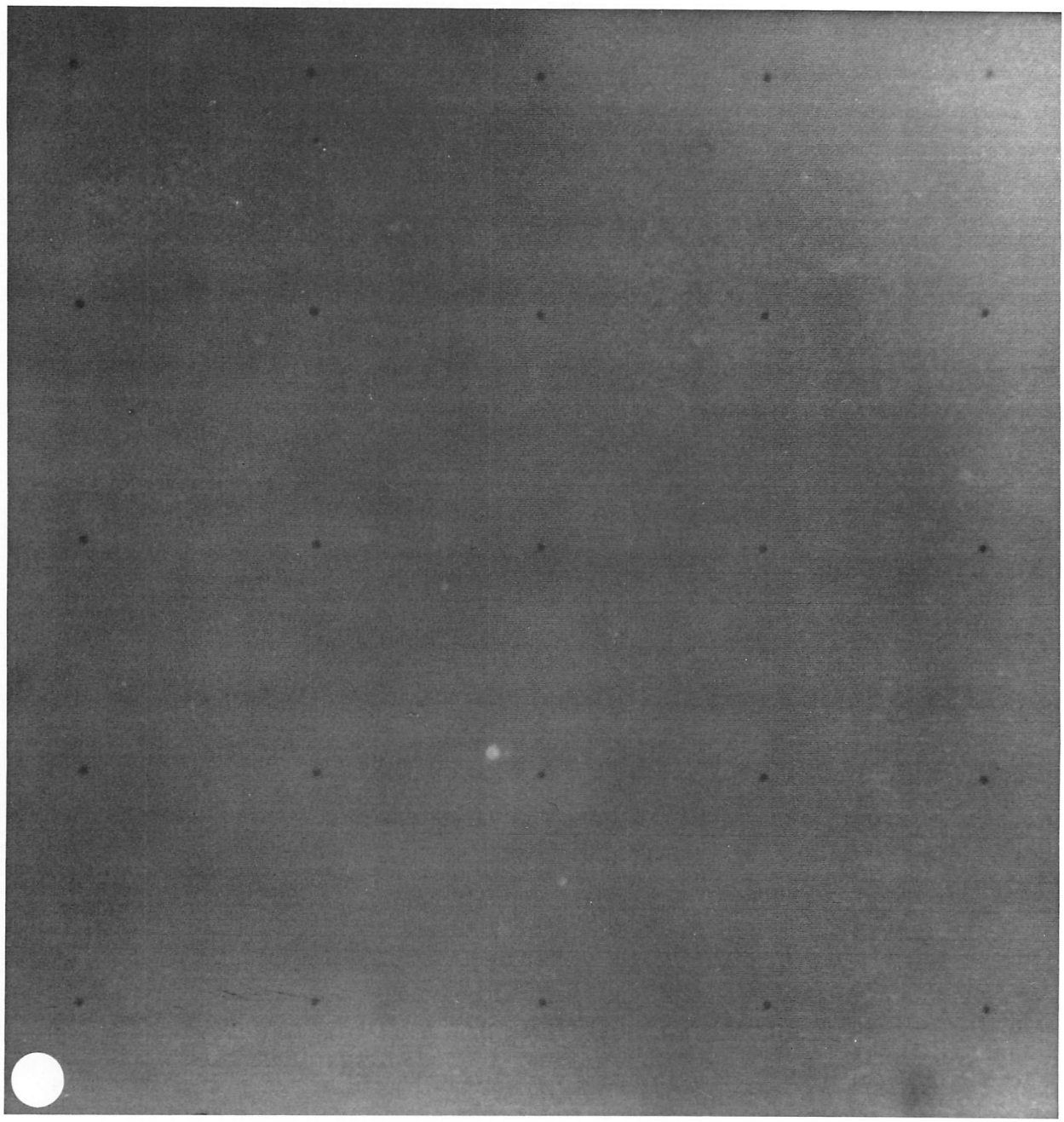




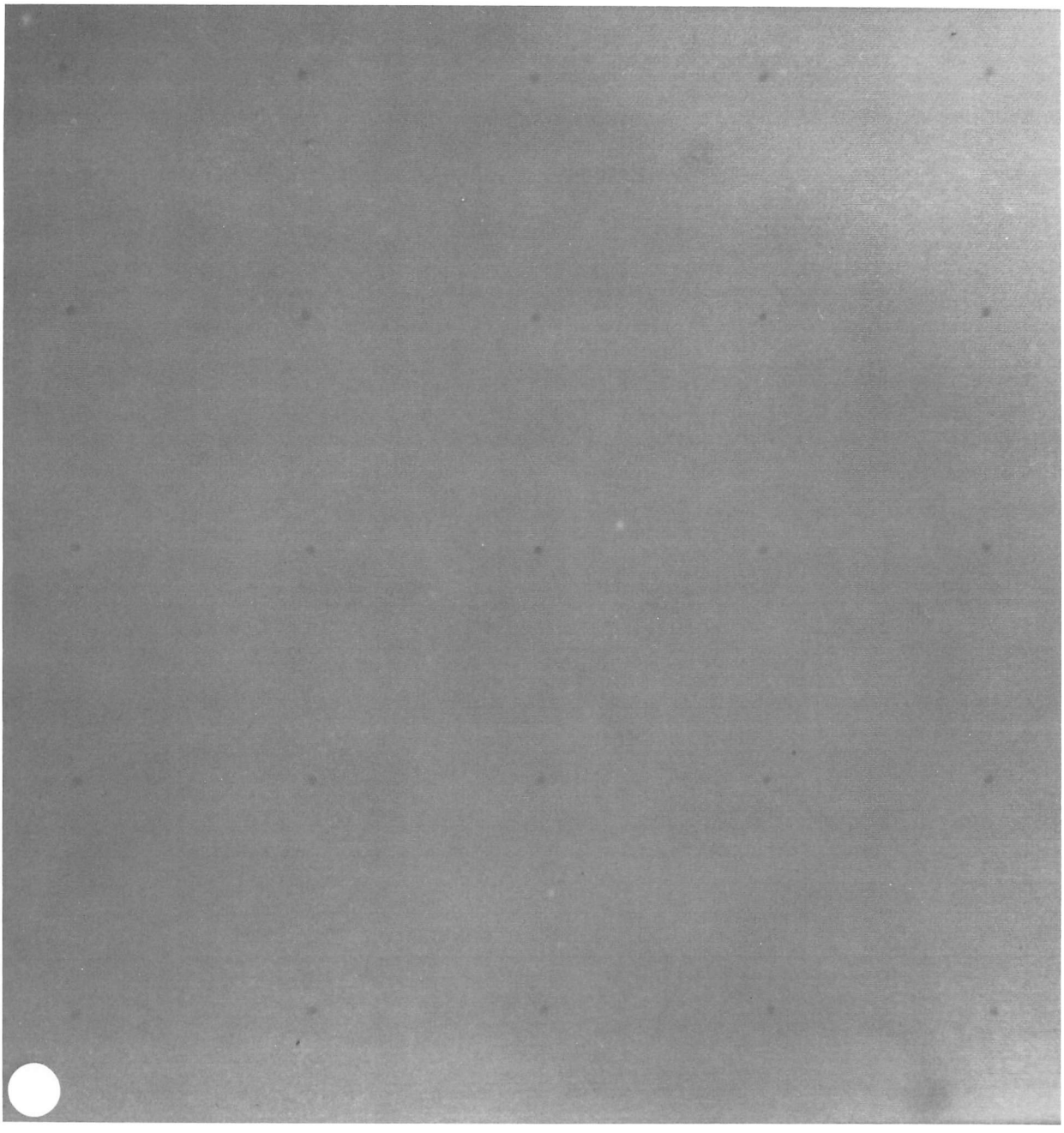
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(81)	Day 262, 07:33:07	60	−30	2.5	*f*/16.8	N	Clear



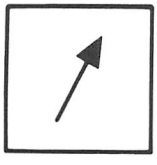
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(82)	Day 262, 07:36:05	63	−30	2.5	f/16.8	N	Clear

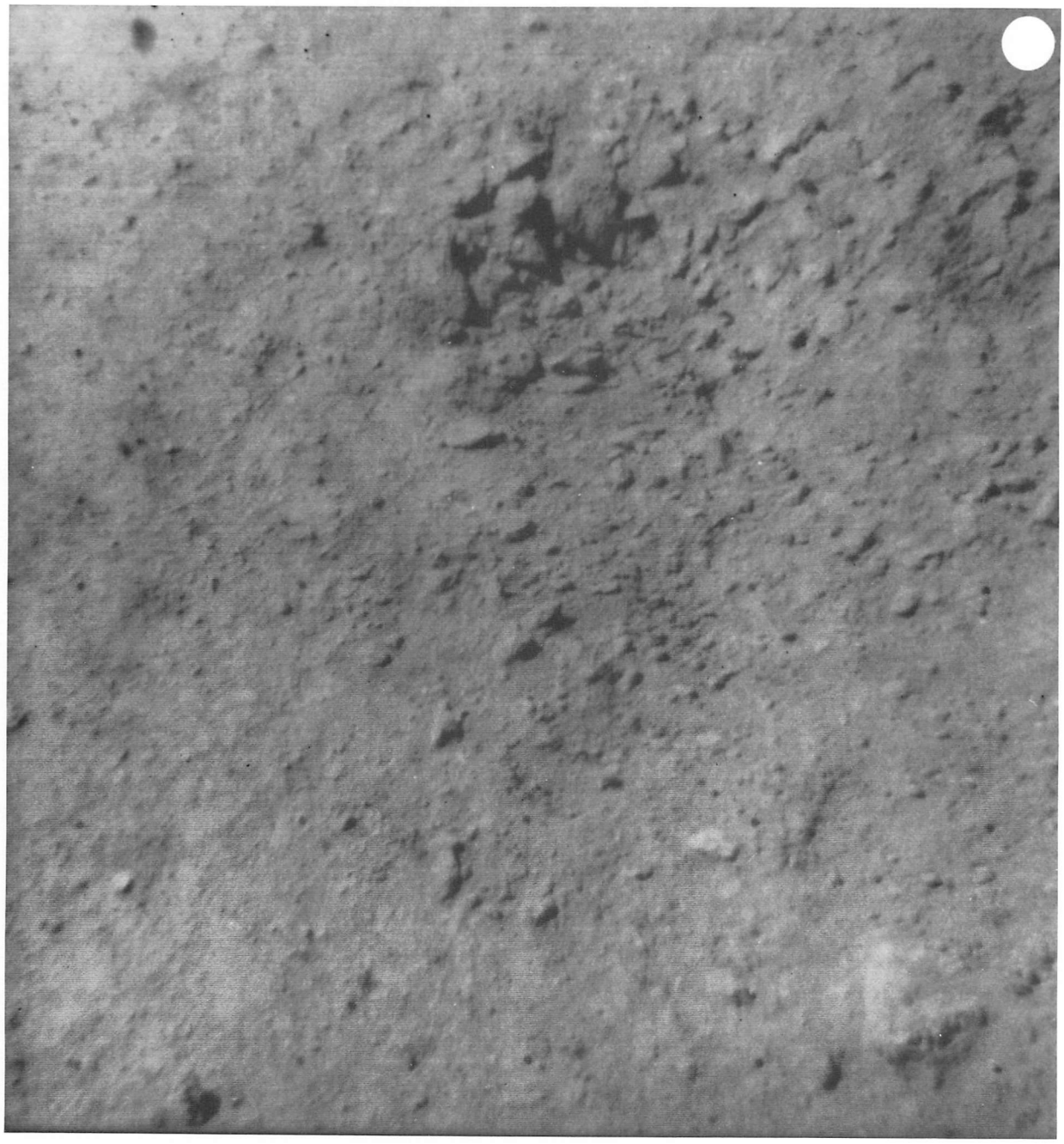


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(83)	Day 263, 07:04:25	132	20	25.2	*f*/4.1	N	Clear

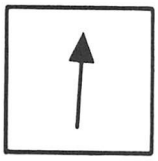


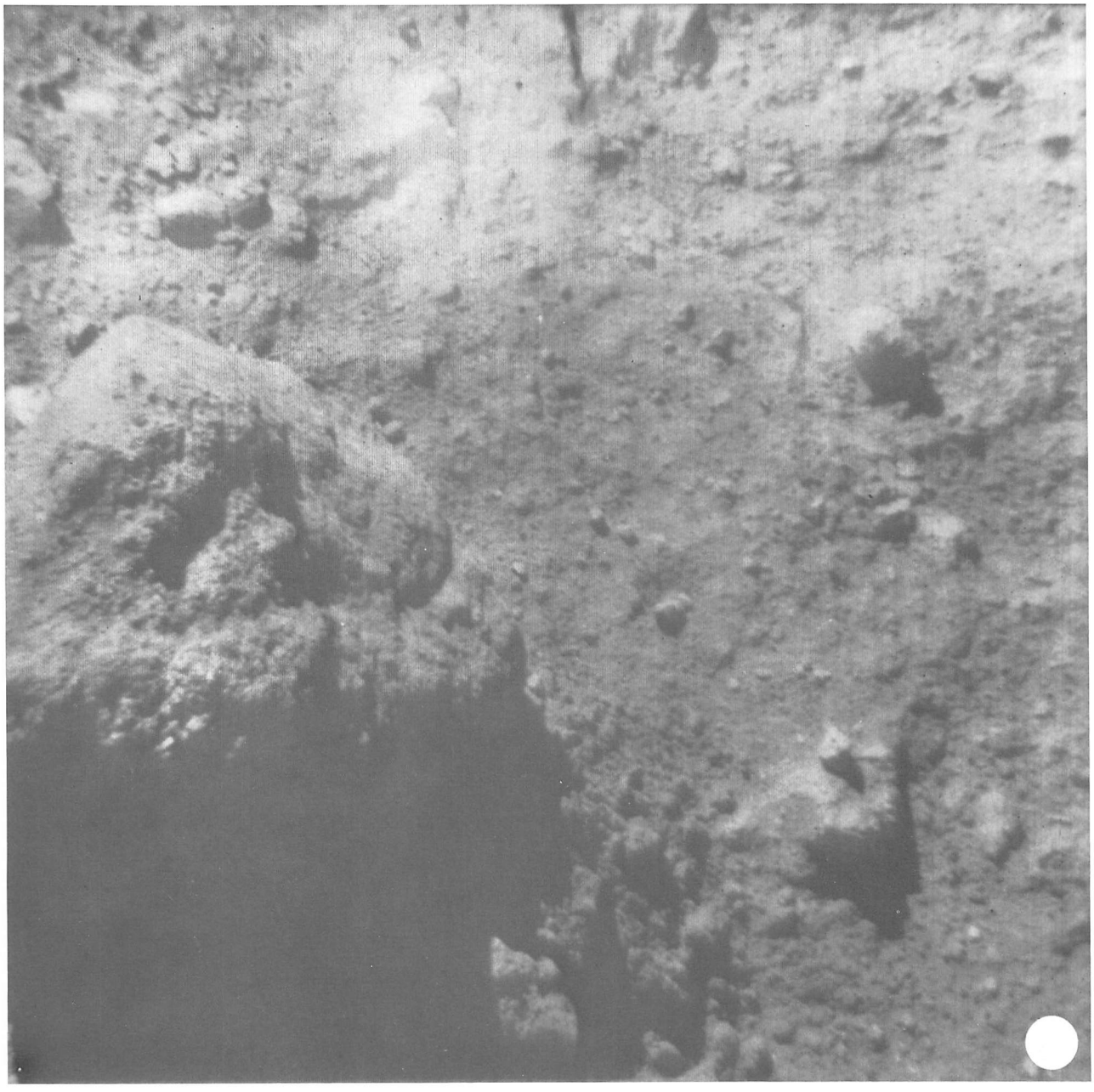
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(84)	Day 263, 07:10:15	123	20	25.2	f/4.1	N	Clear



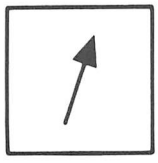


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(85)	Day 263, 09:30:54	9	5	3.9	f/16.6	N	Clear

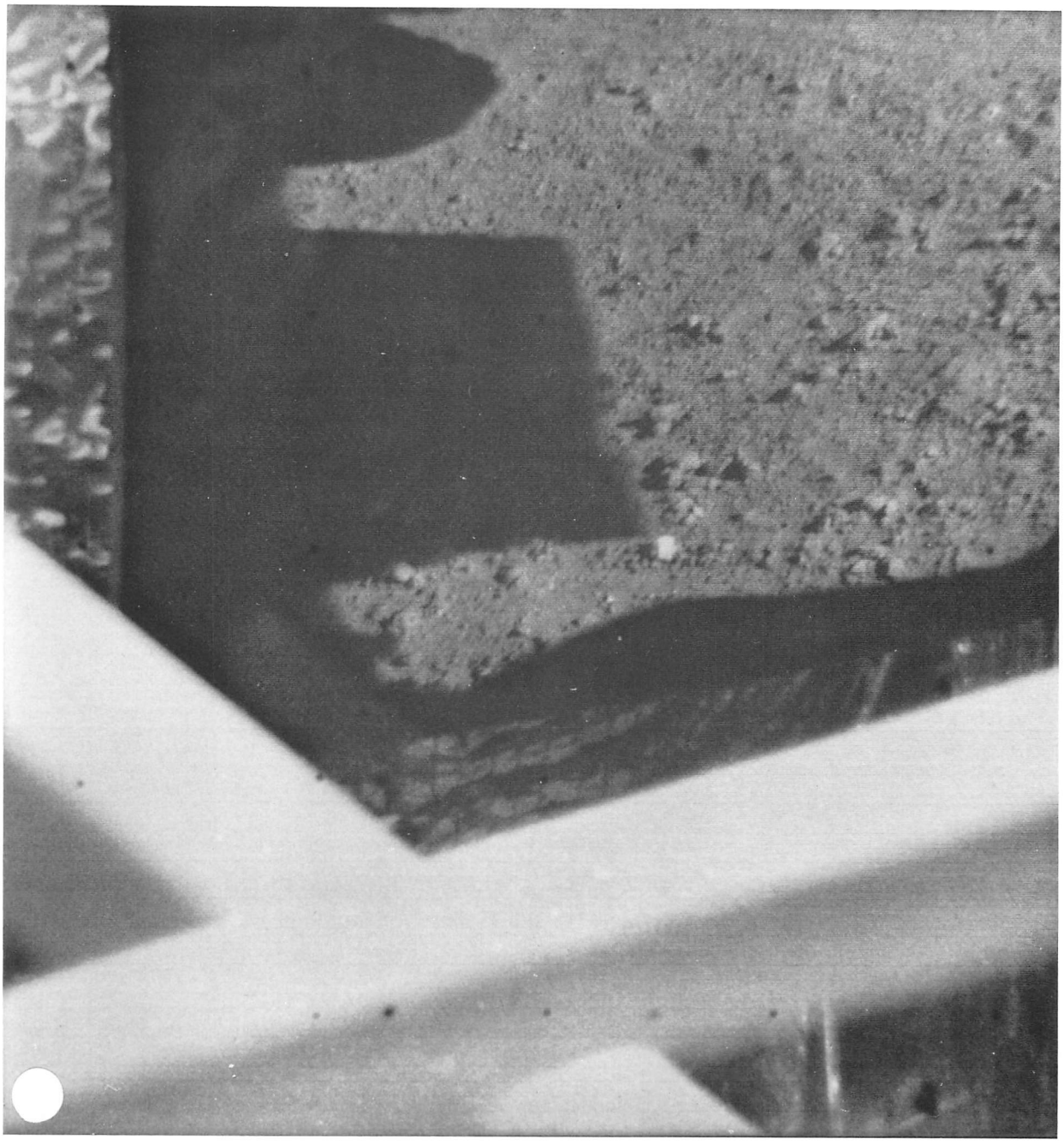




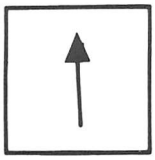
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(86)	Day 263, 09:38:48	60	−30	2.4	f/16.6	N	Clear

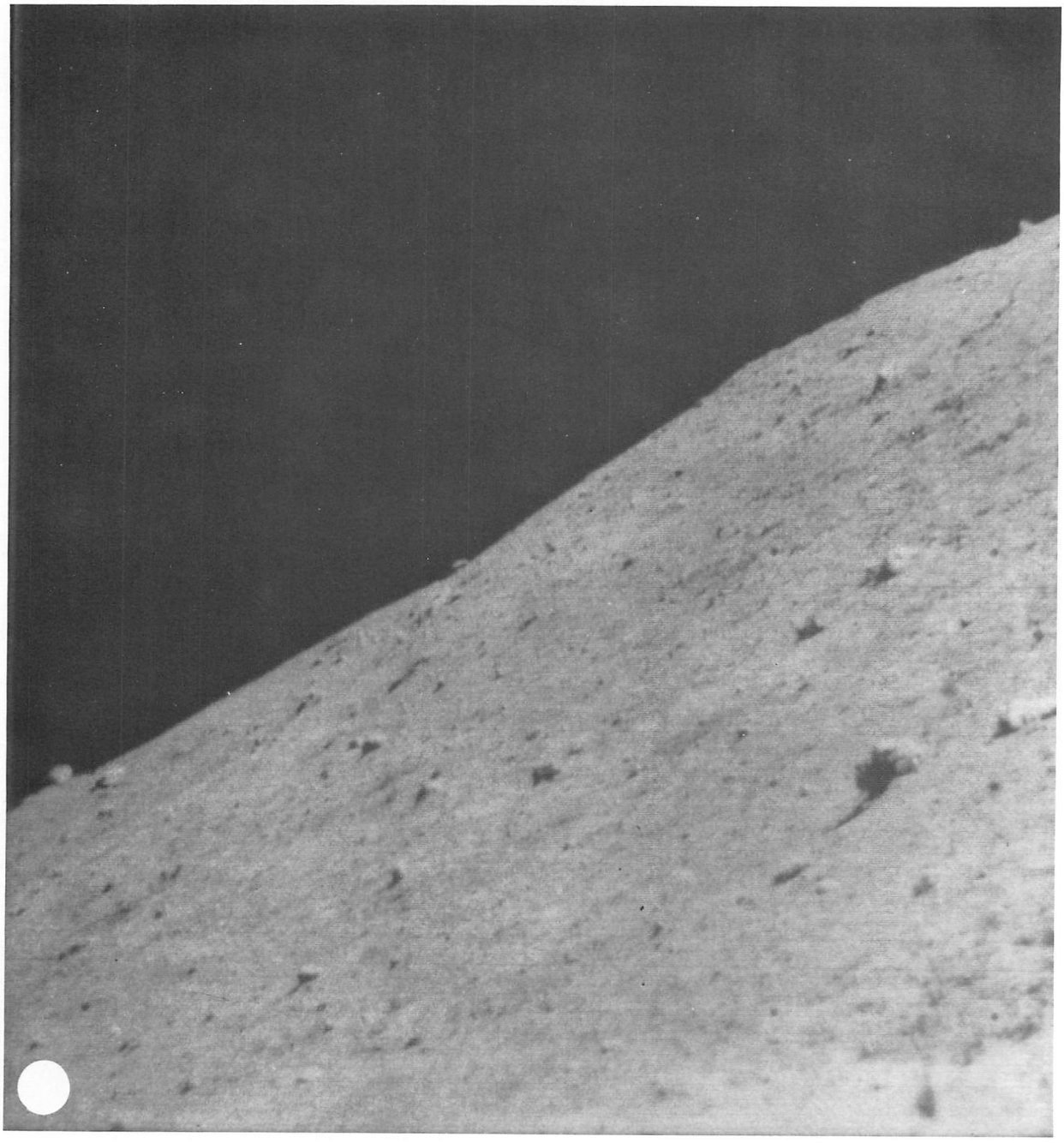


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(87)	Day 263, 11:46:49	−207	−40	2.2	*f*/16.7	W	Clear	Processed

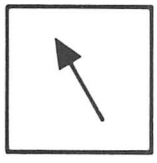


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(88)	Day 263, 11:47:37	−201	−40	2.2	f/16.7	N	Clear

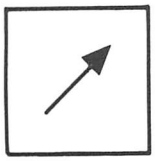


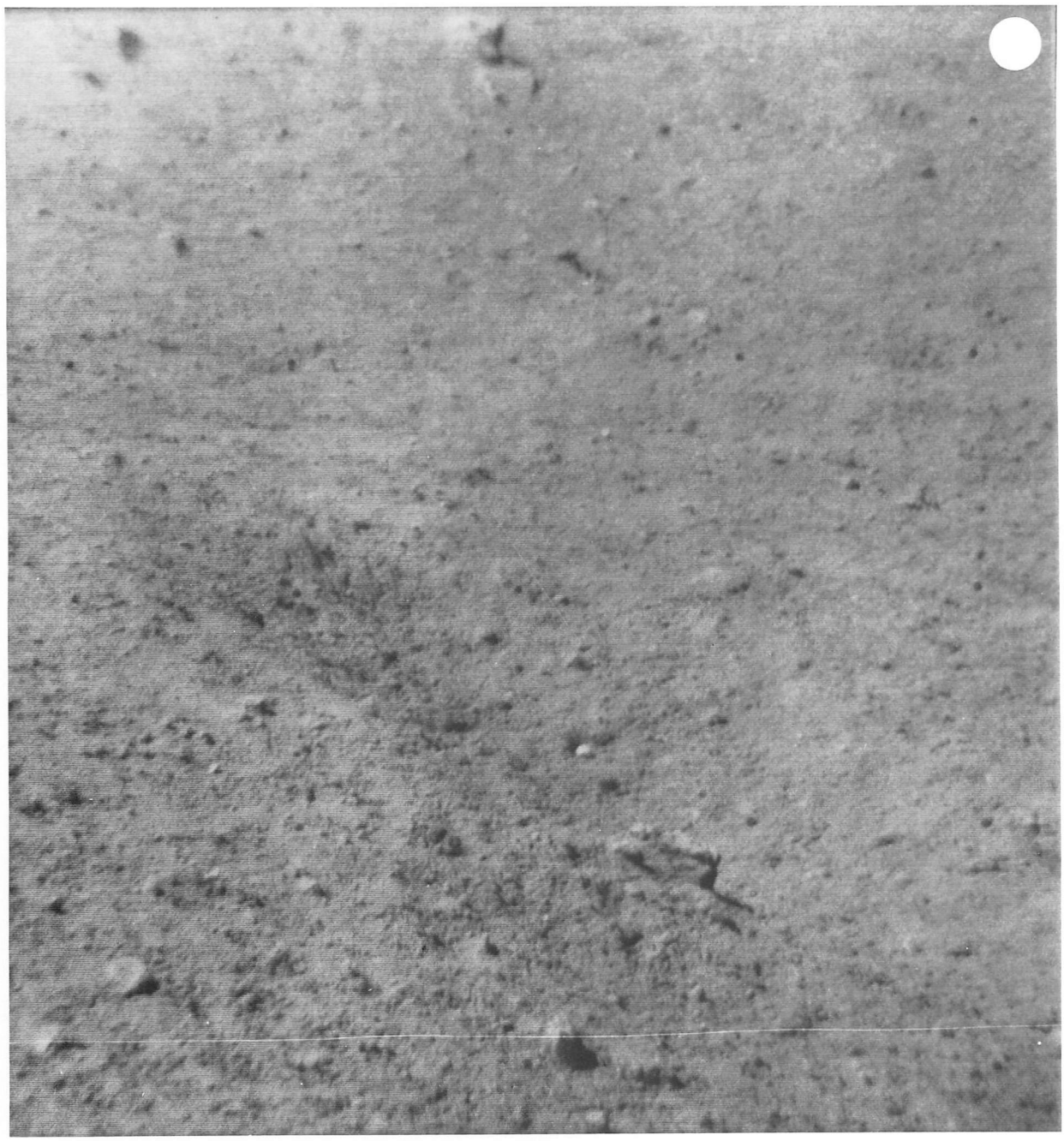


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(89)	Day 264, 10:43:24	−156	−30	19.4	*f*/11.8	N	Clear

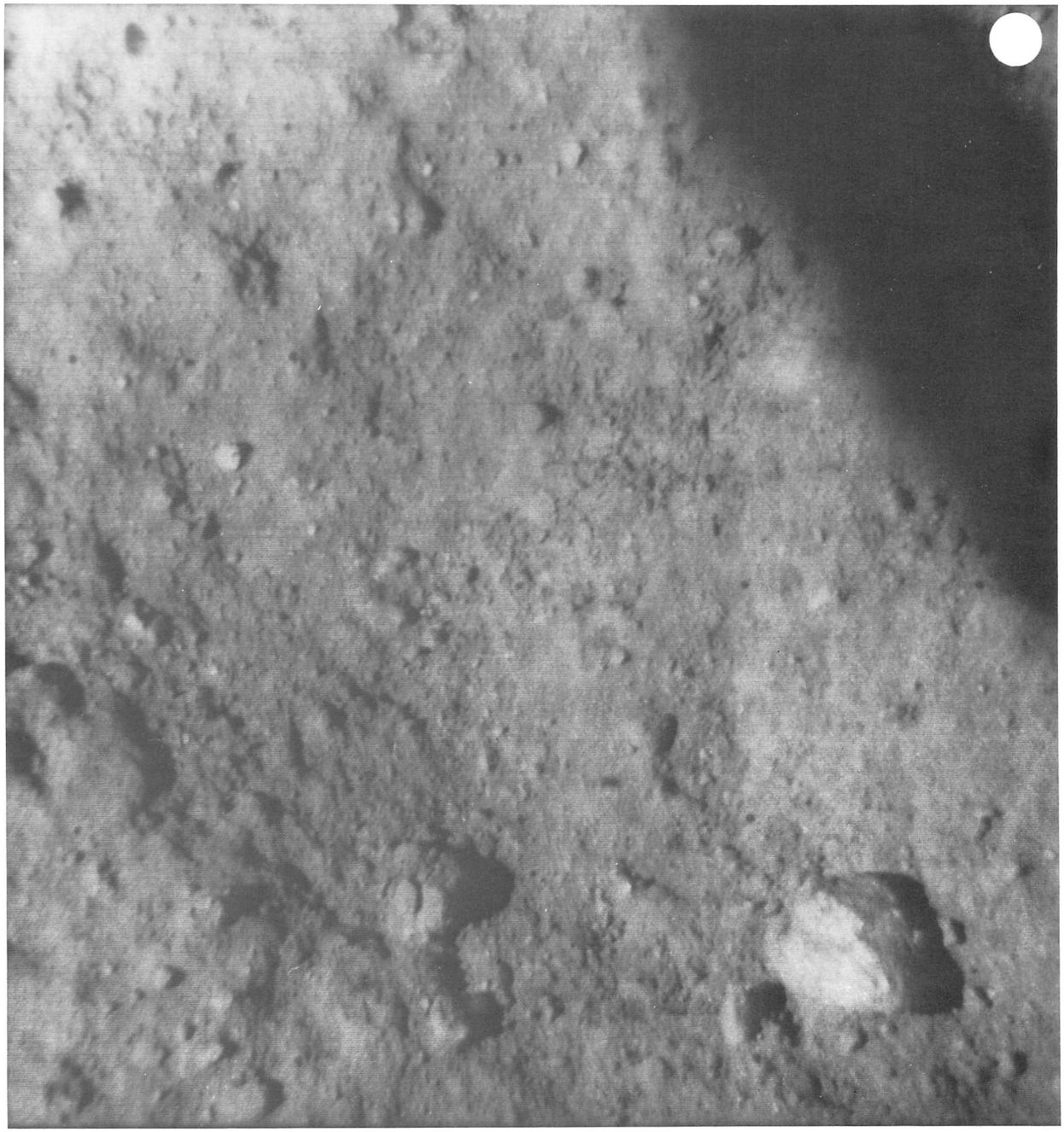


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(90)	Day 264, 10:49:04	−123	−55	2.6	f/16.5	N	Clear

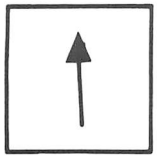


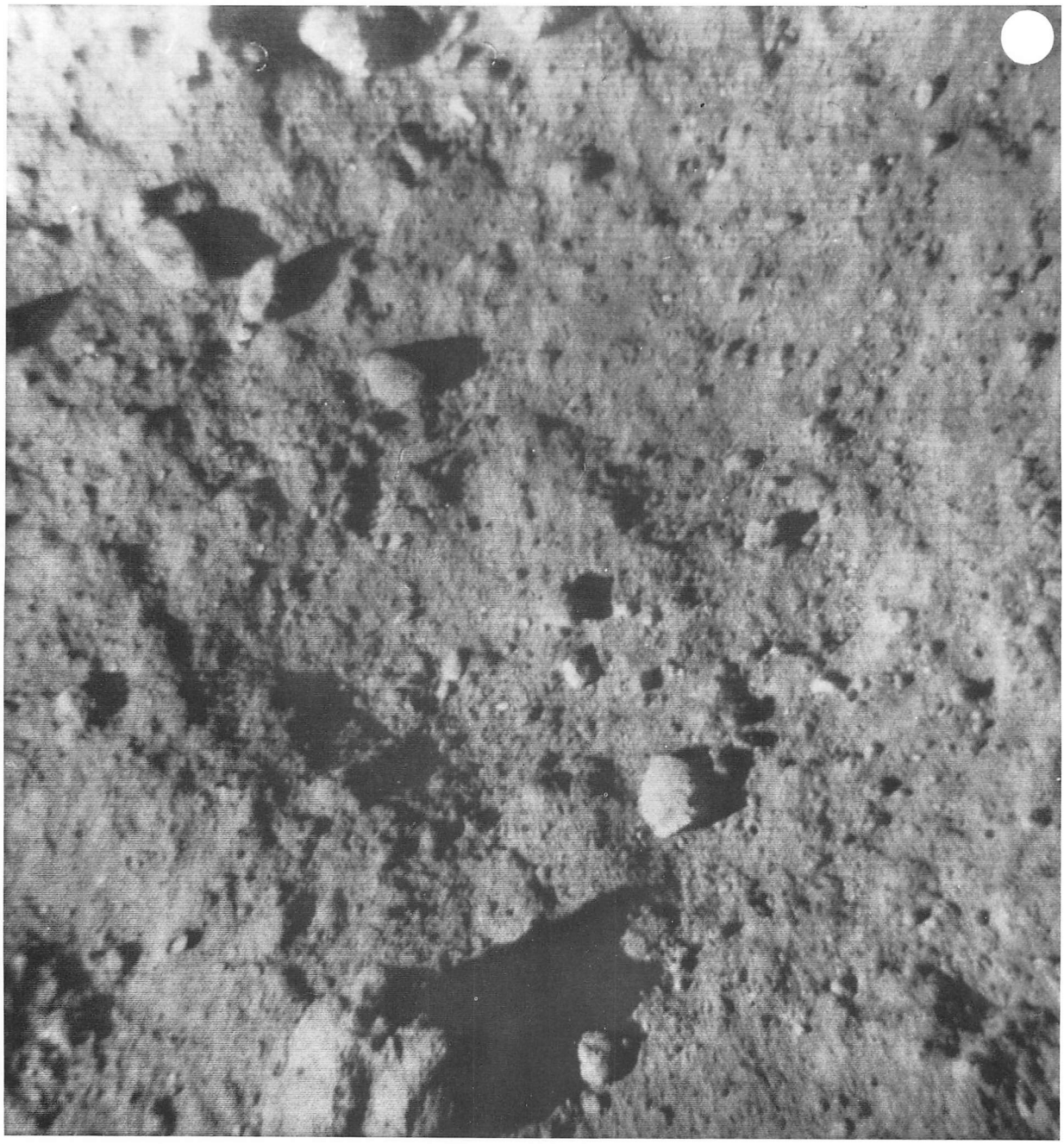


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(91)	Day 264, 11:57:23	−3	15	4.3	f/16.5	N	Clear

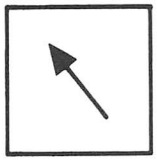


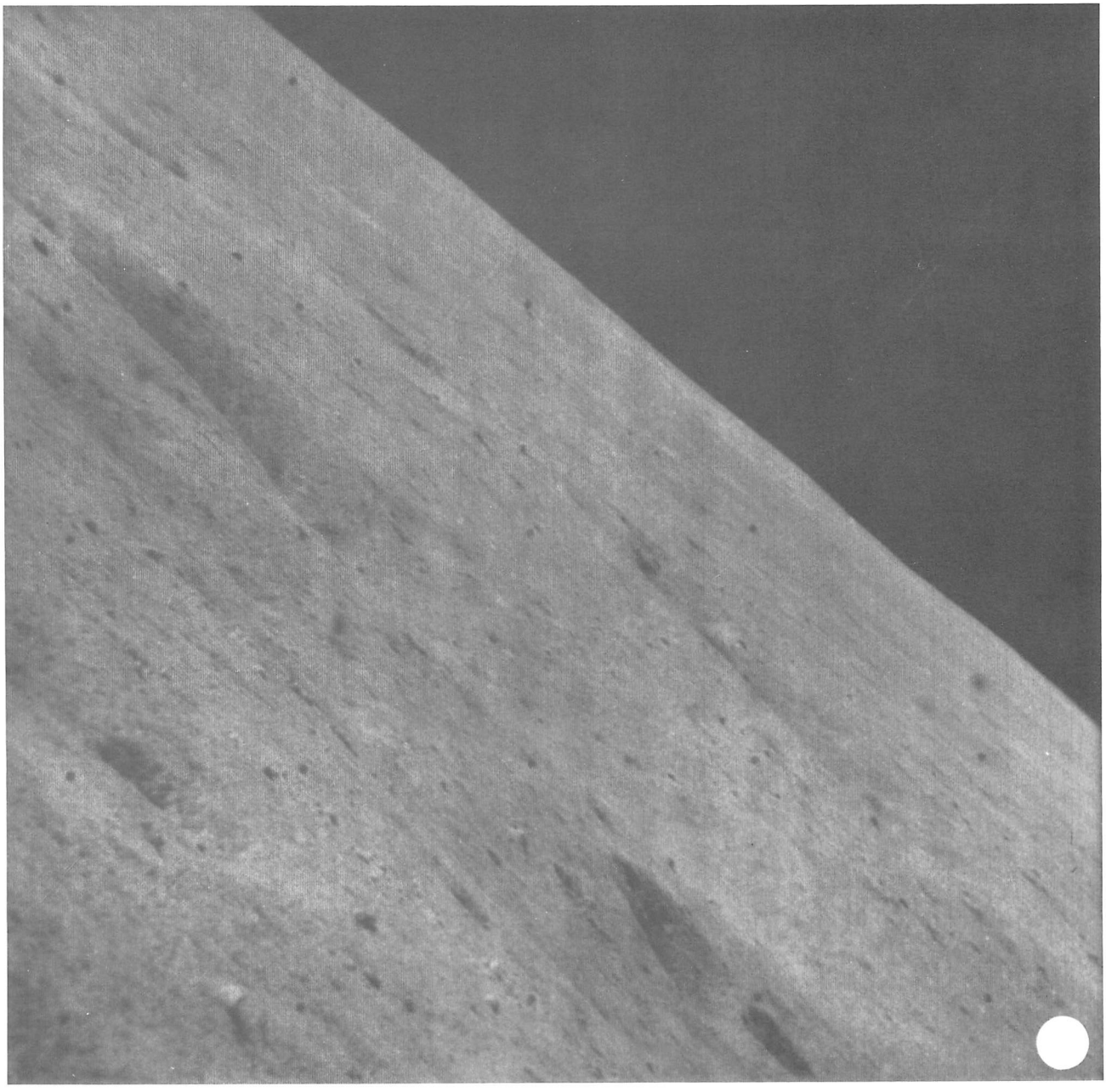
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(92)	Day 264, 12:08:31	12	−40	2.3	f/16.5	N	Clear



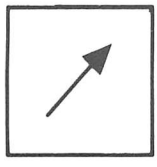


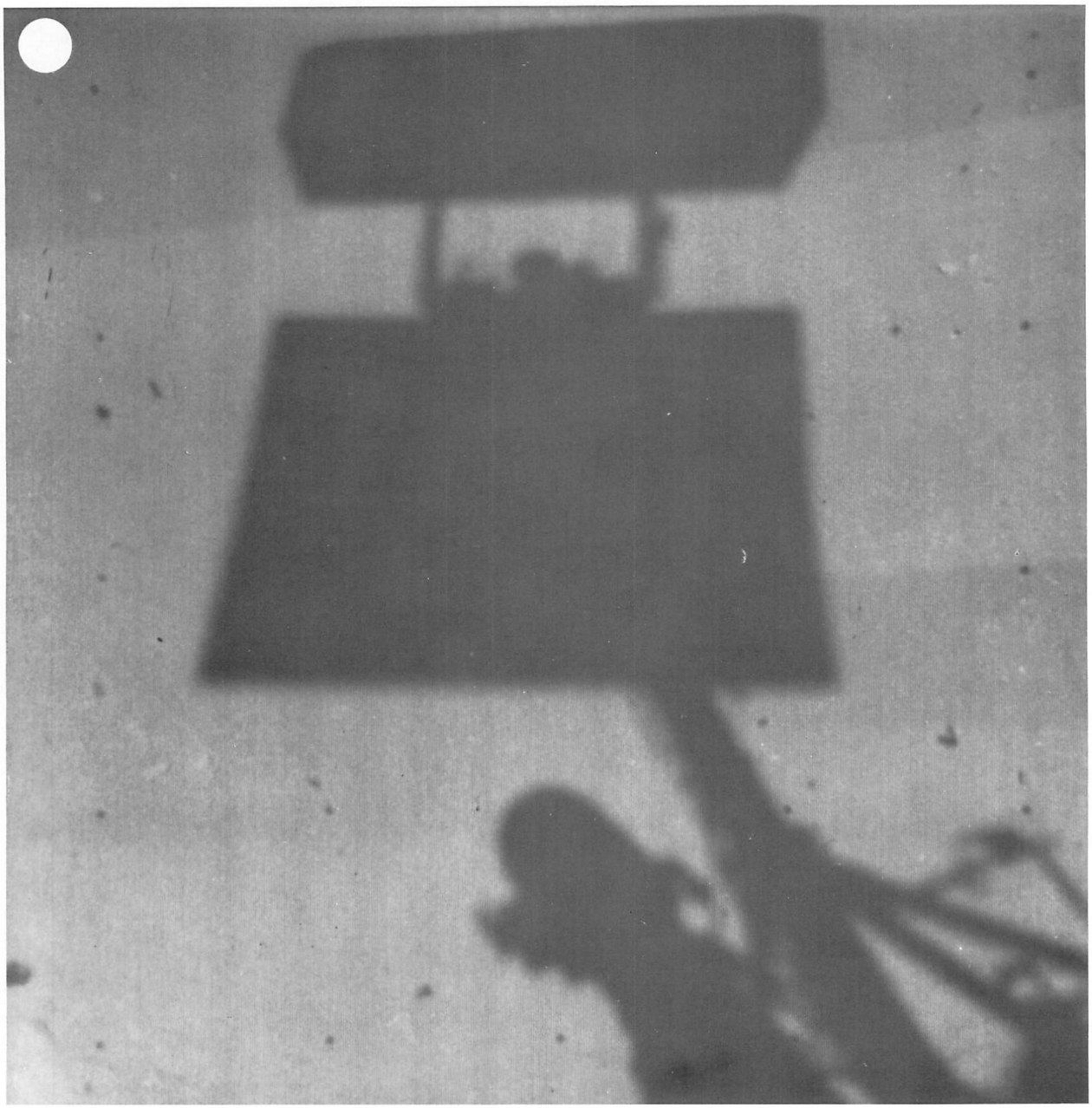
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(93)	Day 264, 12:22:48	36	−40	2.3	f/16.5	N	Clear





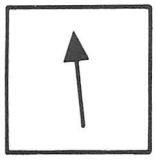
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(94)	Day 264, 12:48:03	42	30	25.0	f/11.5	N	Clear

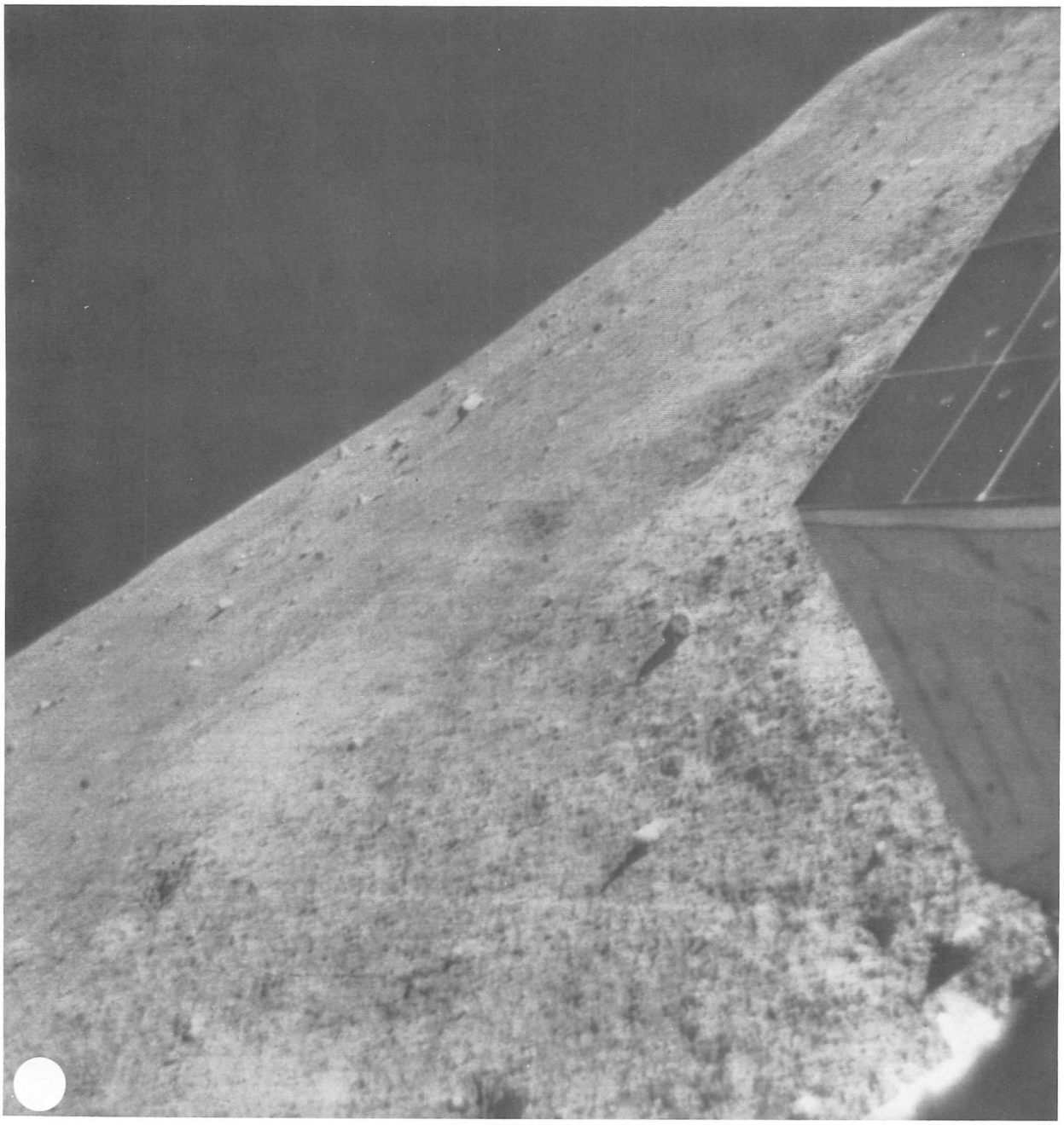




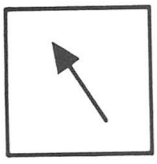
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(95)	Day 265, 04:46:10	−54	−20	2.3	f/23.6	W	Clear

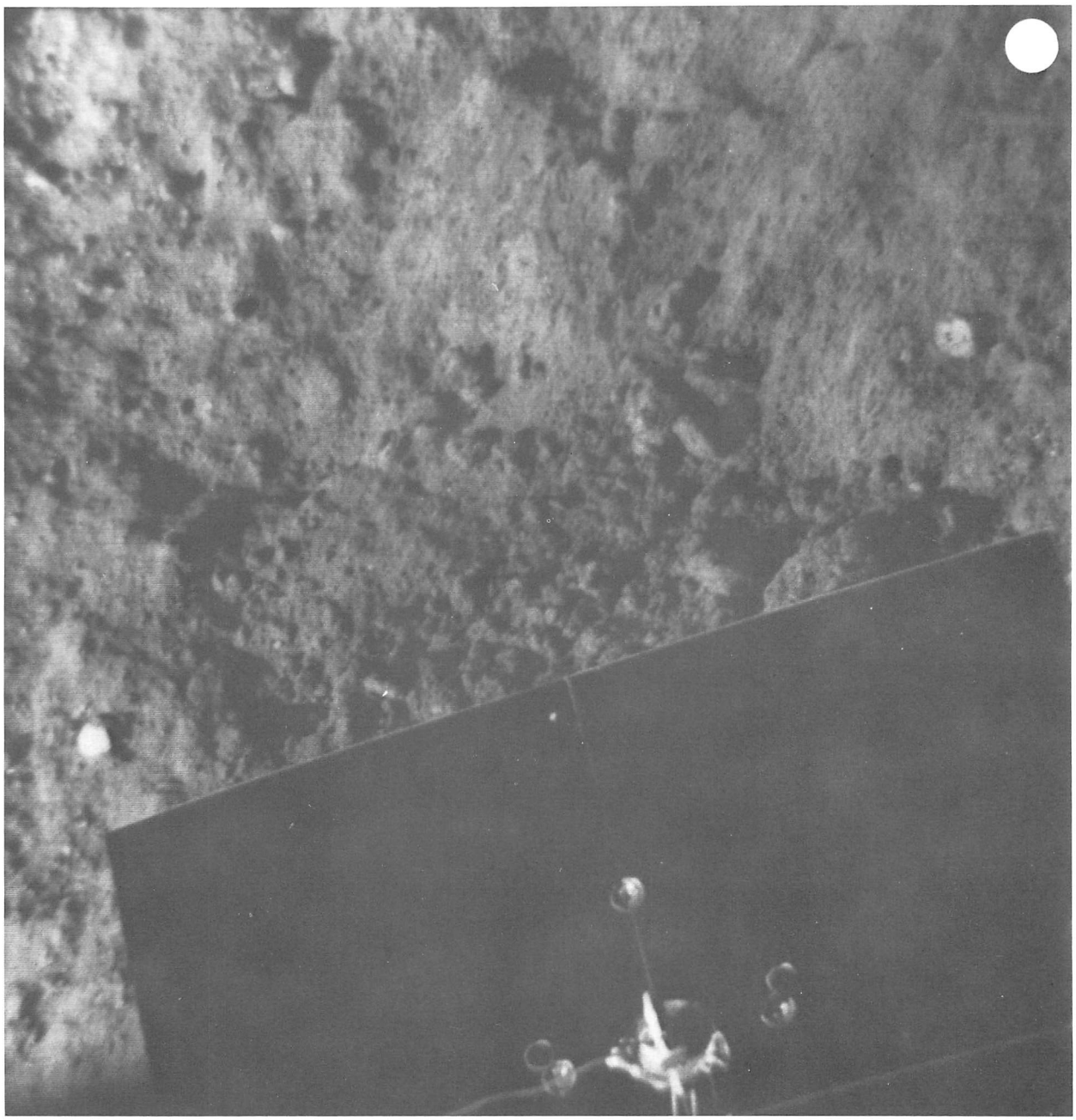
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(96)	Day 265, 04:46:15	−54	−35	2.3	f/23.6	W	Clear



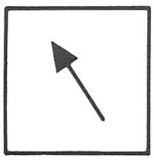


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(97)	Day 265, 05:03:56	−144	−35	2.3	f/11.6	W	Clear

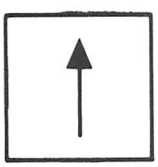


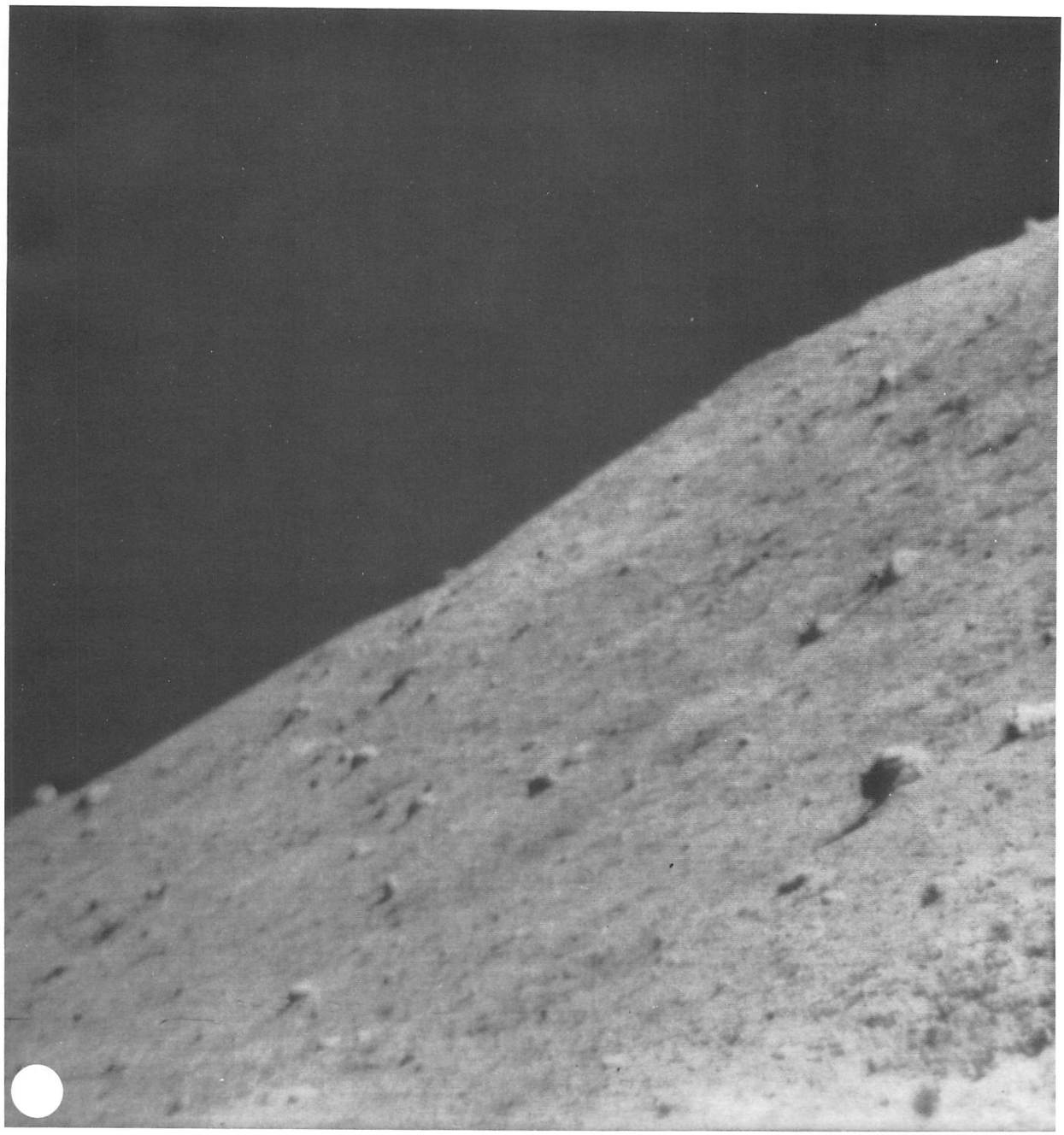


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(98)	Day 265, 05:34:40	33	−45	2.2	*f*/16.7	N	Clear

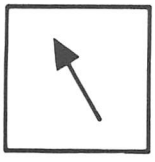


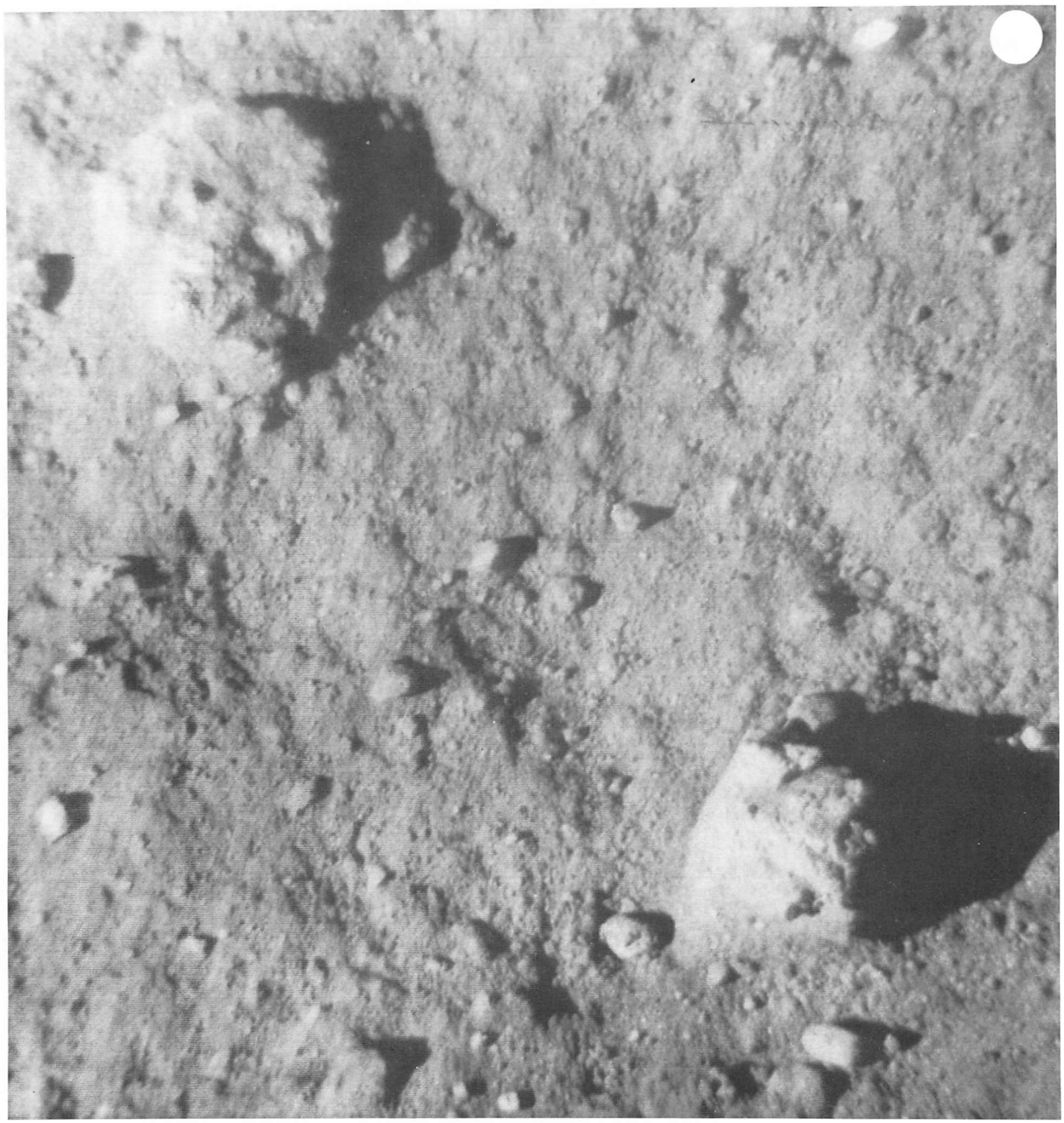
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(99)	Day 265, 06:05:52	−204	−35	2.3	*f*/11.6	N	Clear



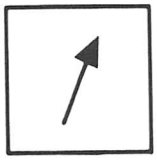


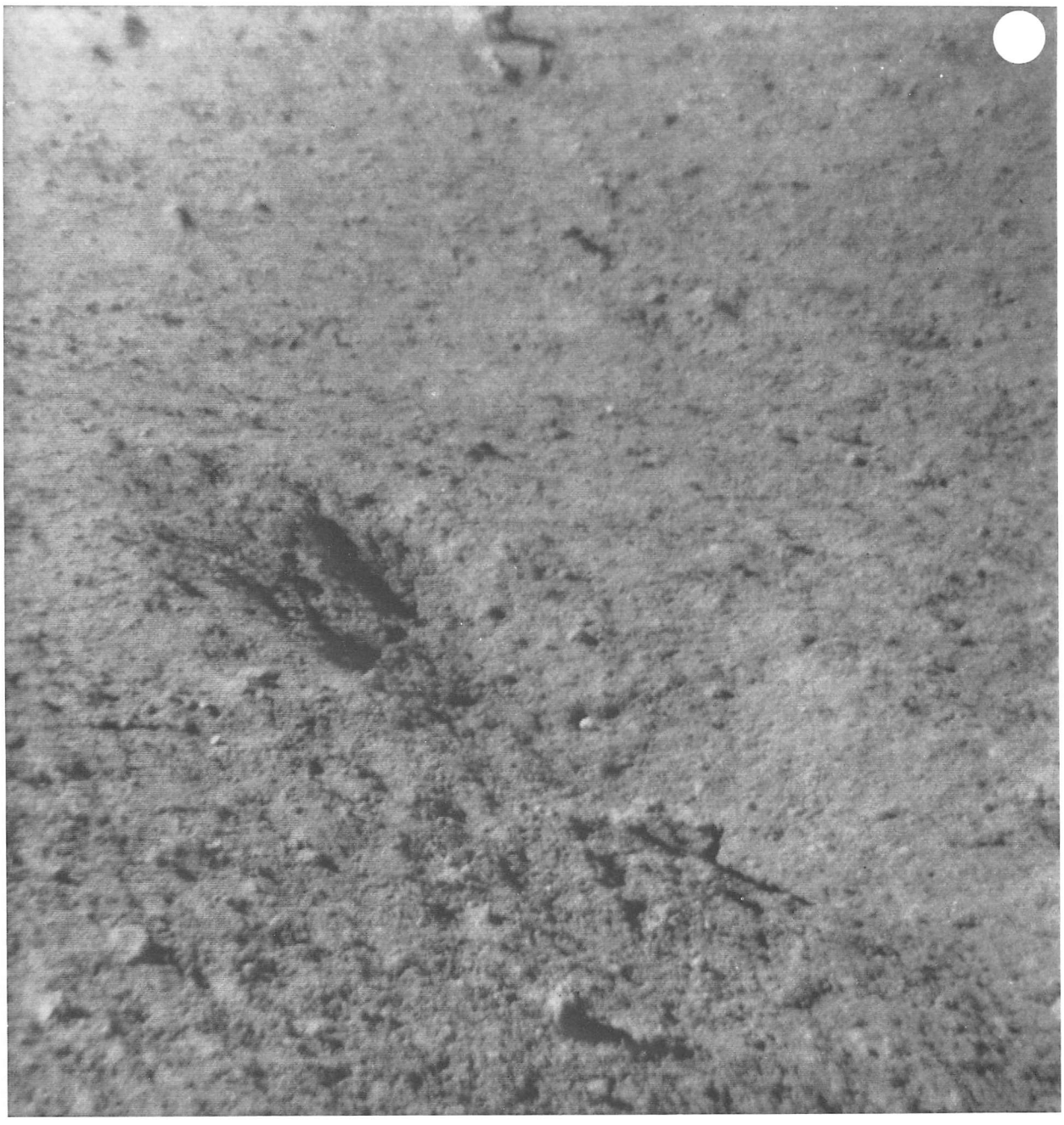
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(100)	Day 265, 06:27:13	−156	−30	8.8	*f*/11.6	N	Clear



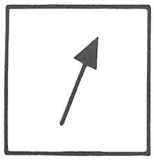


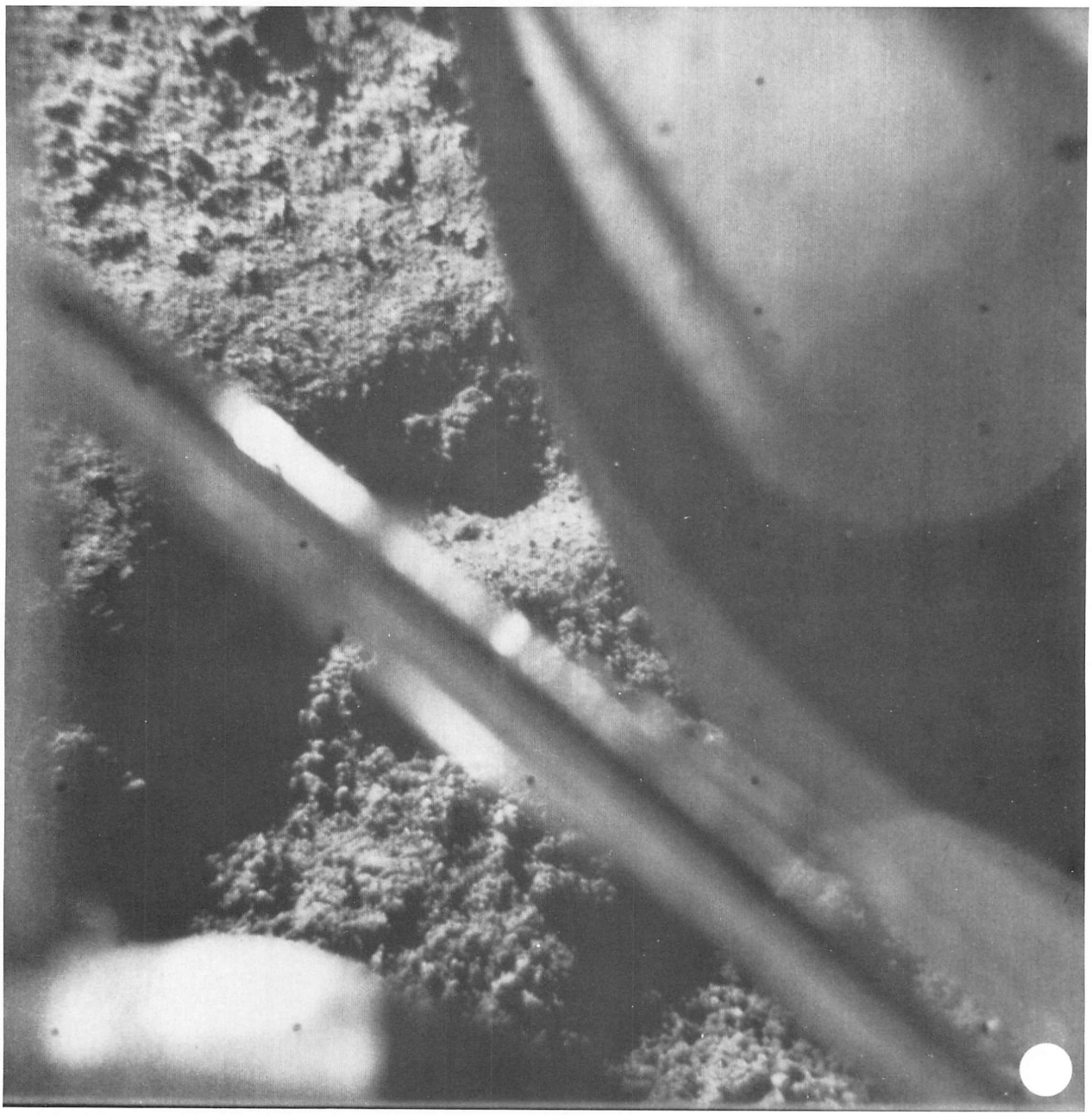
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(101)	Day 265, 12:15:52	−3	−45	2.3	f/16.7	N	Clear



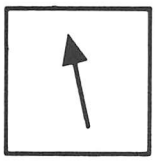


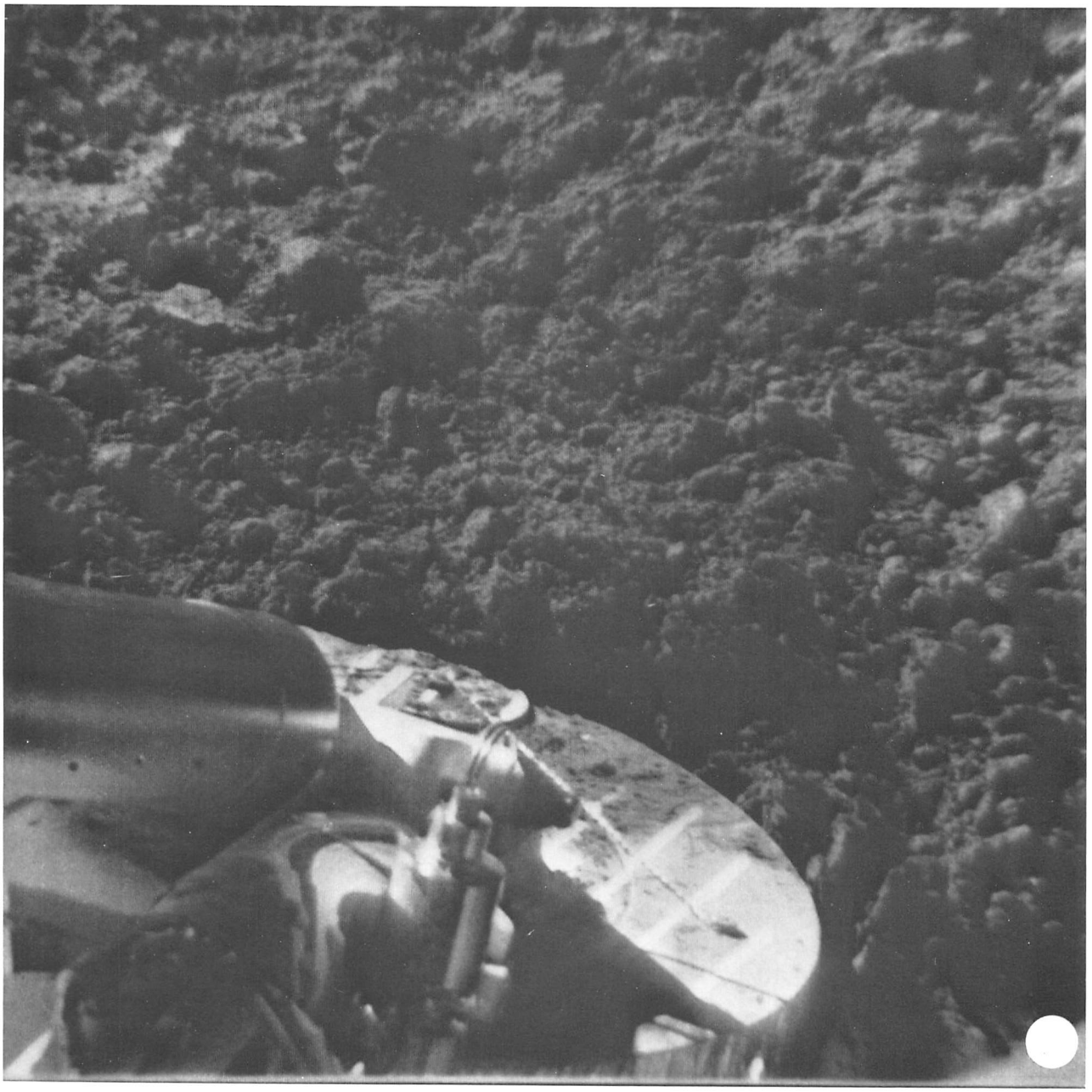
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(102)	Day 265, 12:31:59	−3	15	4.3	*f*/16.7	N	Clear



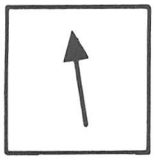


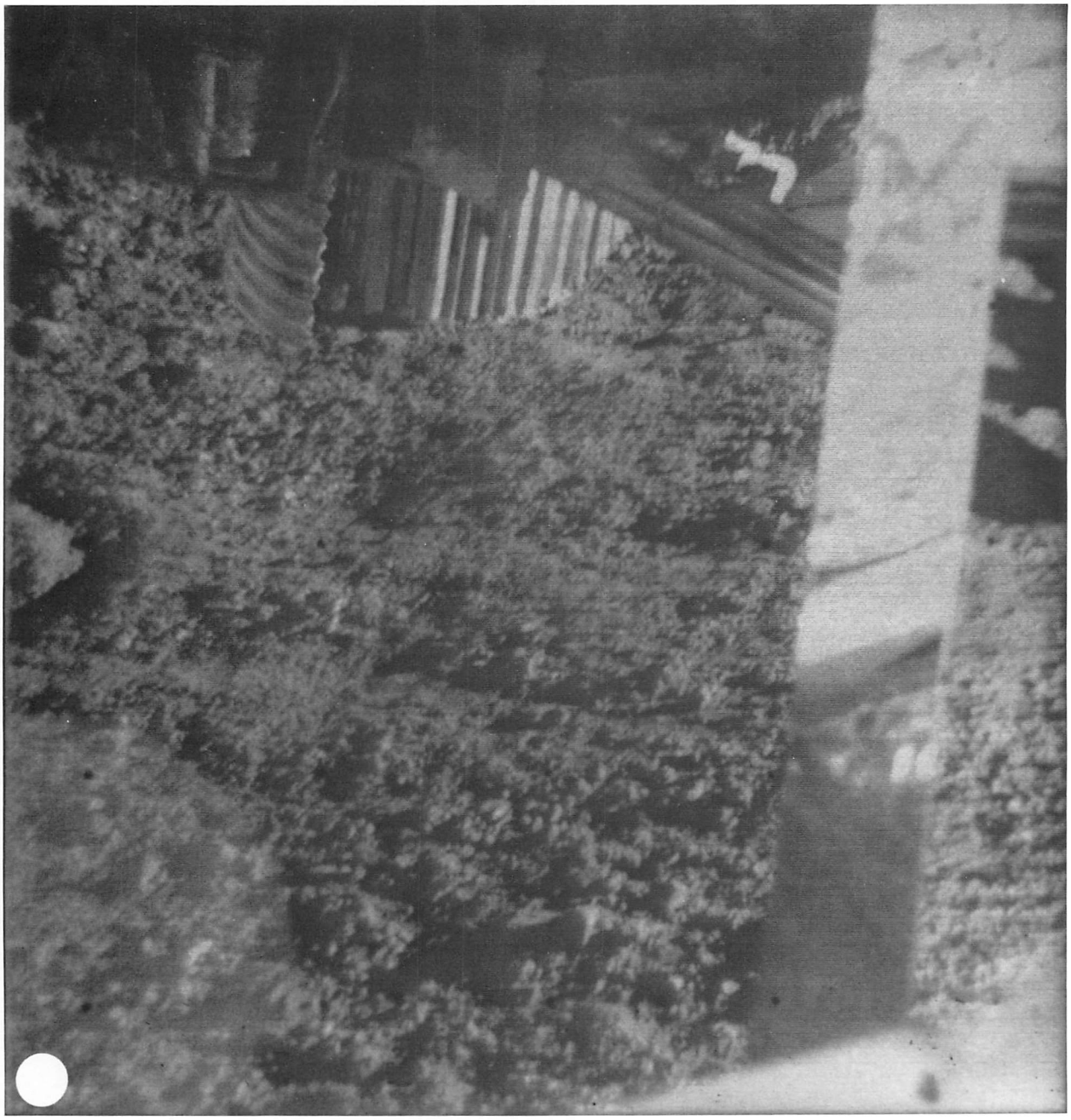
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(103)	Day 265, 13:36:49	81	−45	2.3	f/12.3	N	Clear



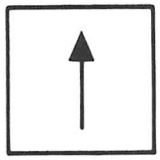


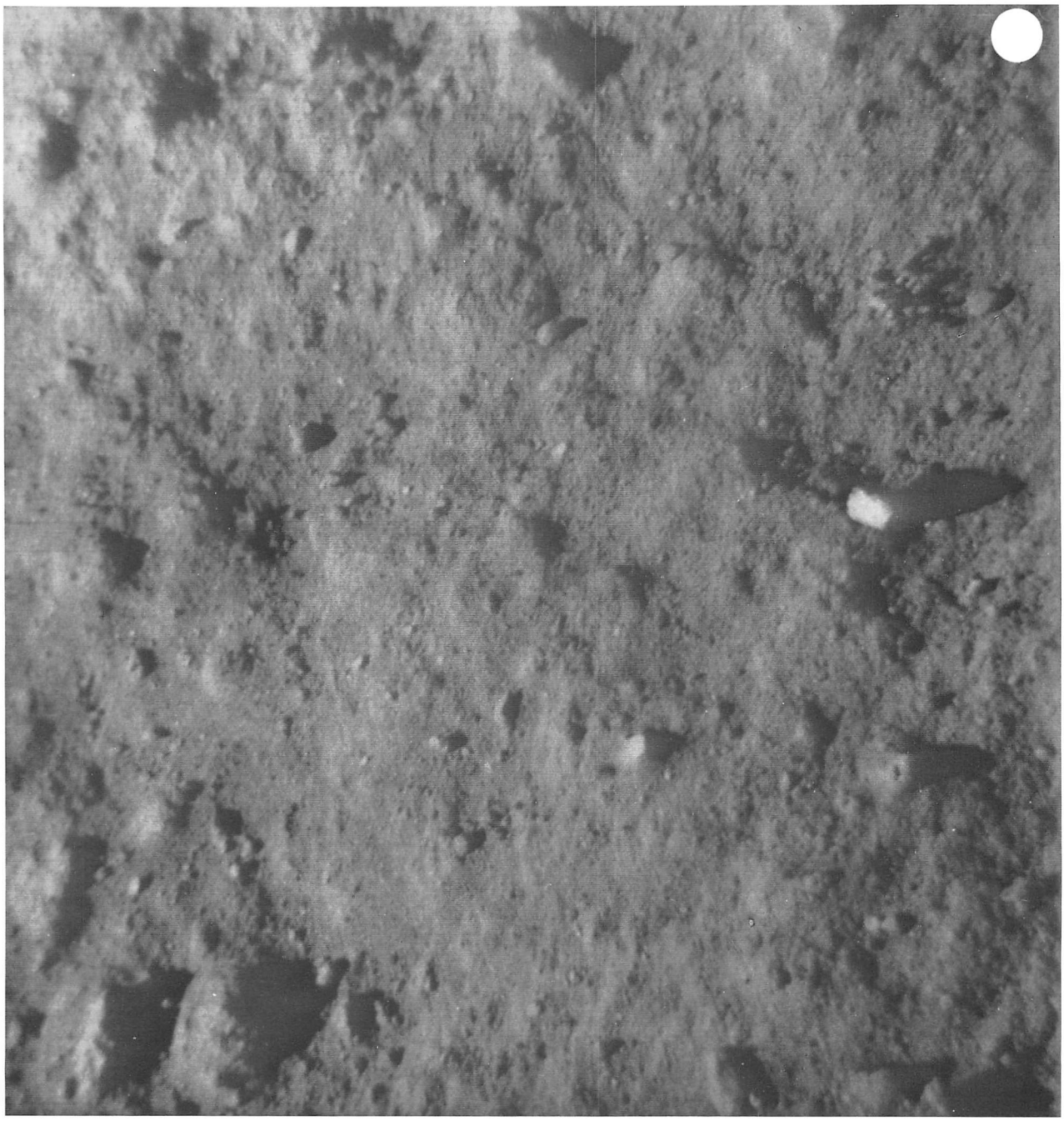
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(104)	Day 265, 13:48:13	78	−20	2.7	f/17.5	N	Clear



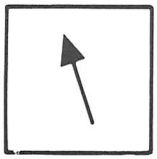


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(105)	Day 265, 14:09:07	−204	−35	2.3	f/12.3	N	Clear

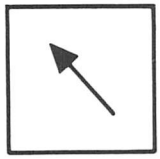


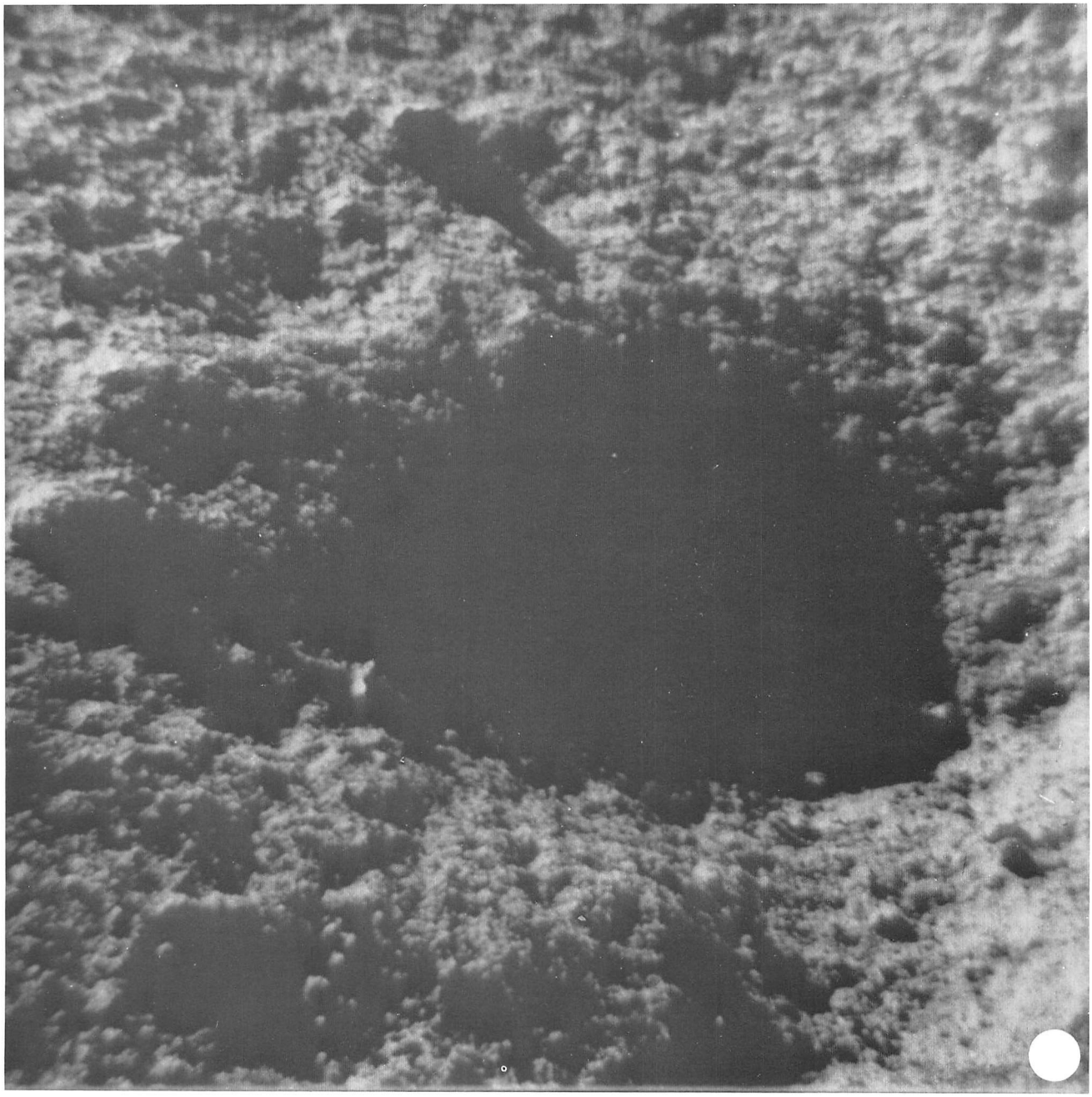


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(106)	Day 265, 15:02:26	24	−30	2.4	f/16.6	N	Clear

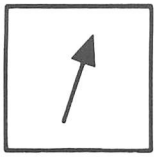


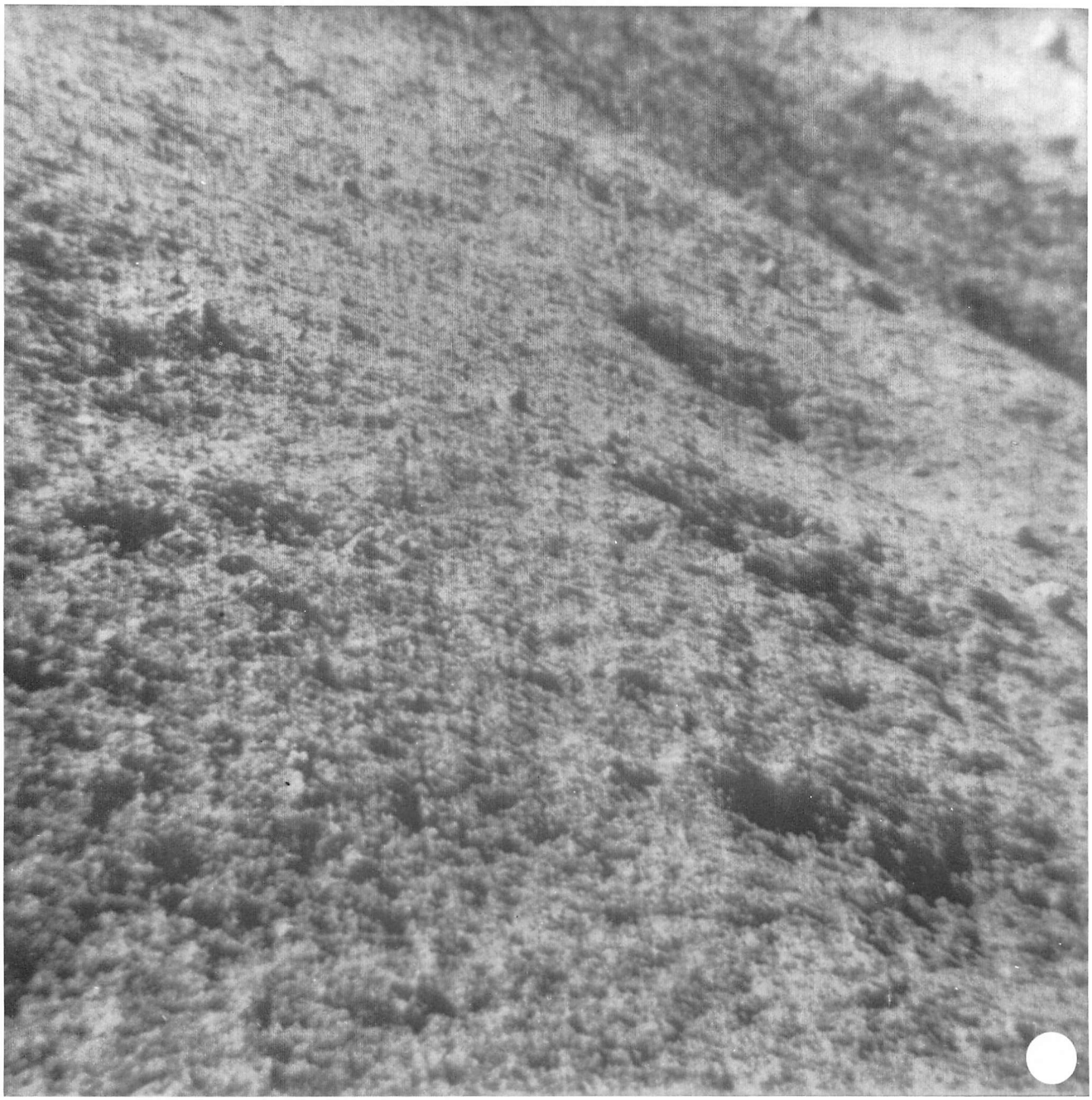
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(107)	Day 265, 15:16:15	39	−35	2.3	f/16.7	N	Clear



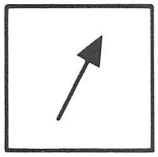


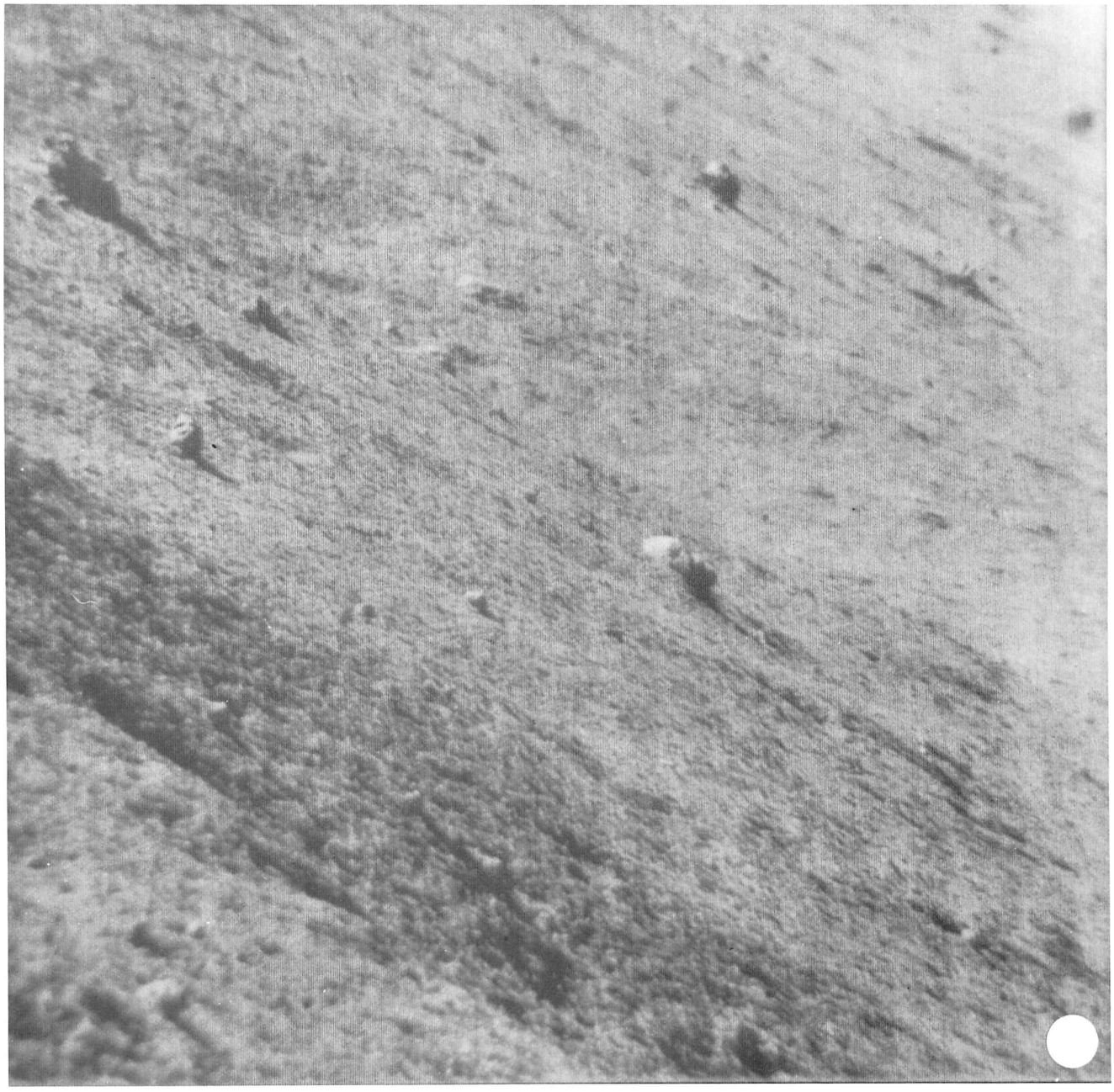
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(108)	Day 265, 15:26:21	60	10	3.6	f/11.6	N	Clear



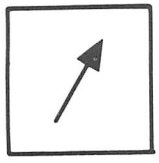


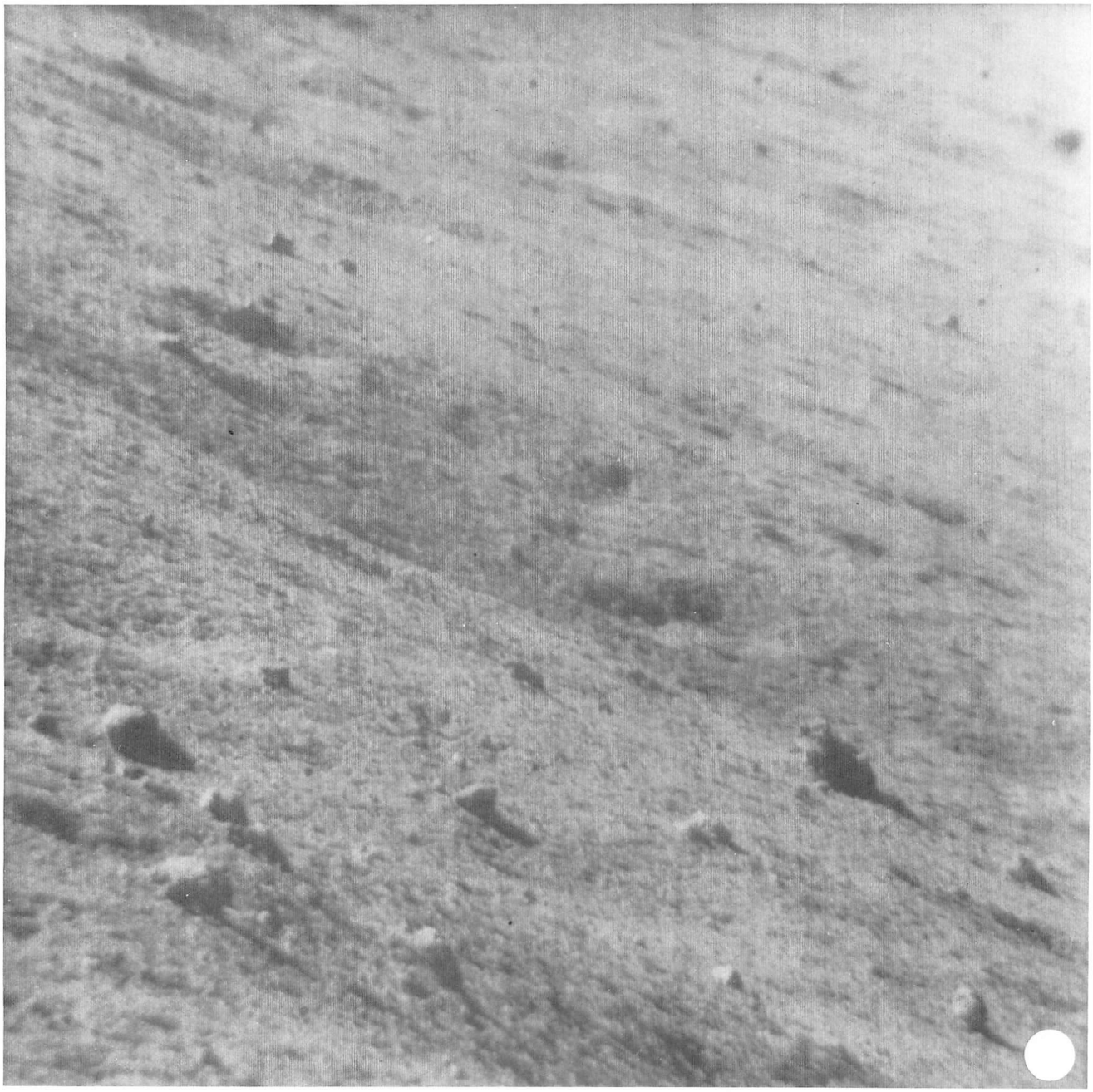
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(109)	Day 265, 15:27:58	54	20	6.4	f/11.6	N	Clear



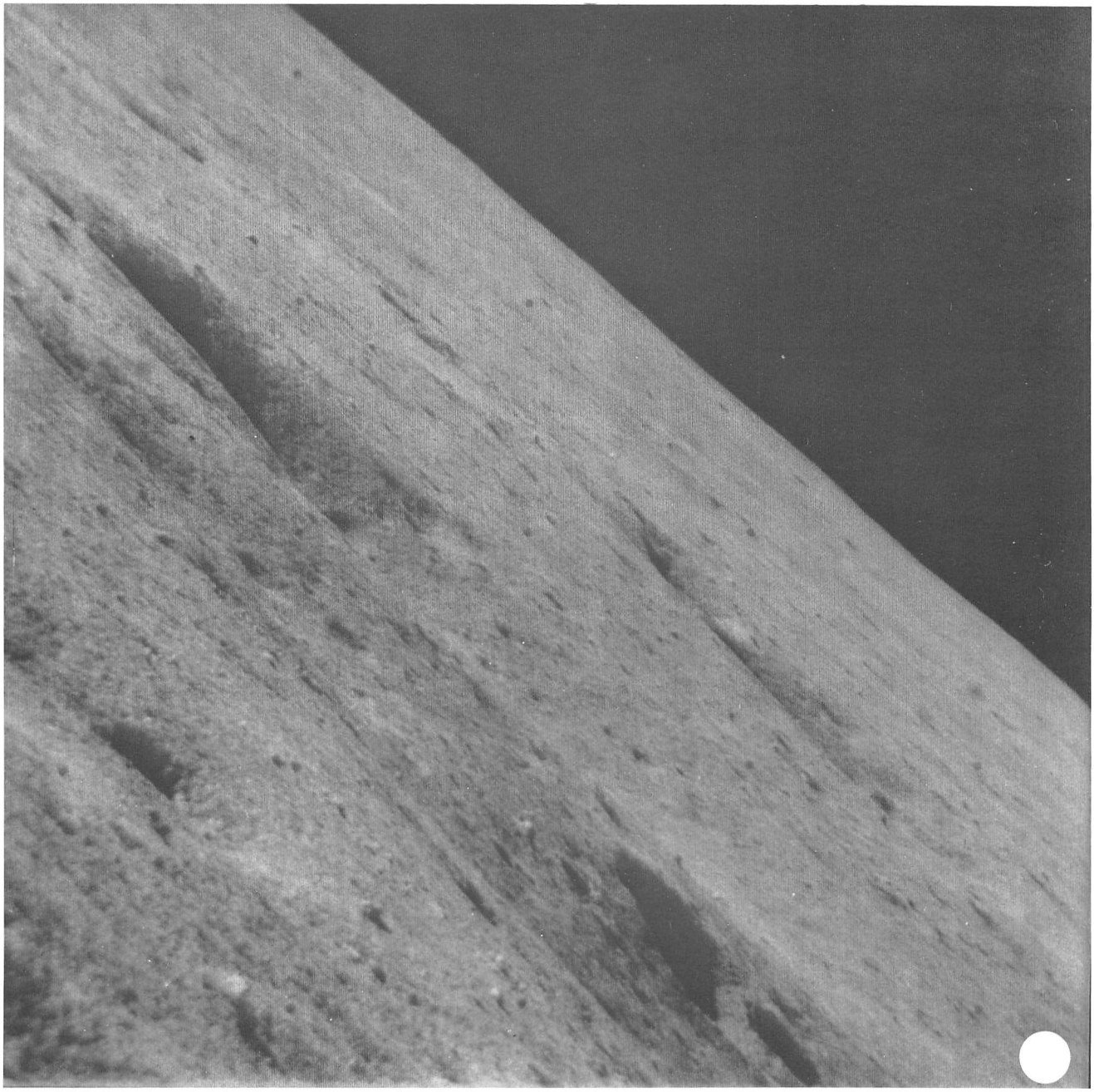


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(110)	Day 265, 15:29:13	51	25	14.3	f/11.6	N	Clear

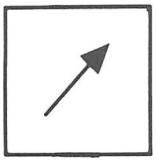


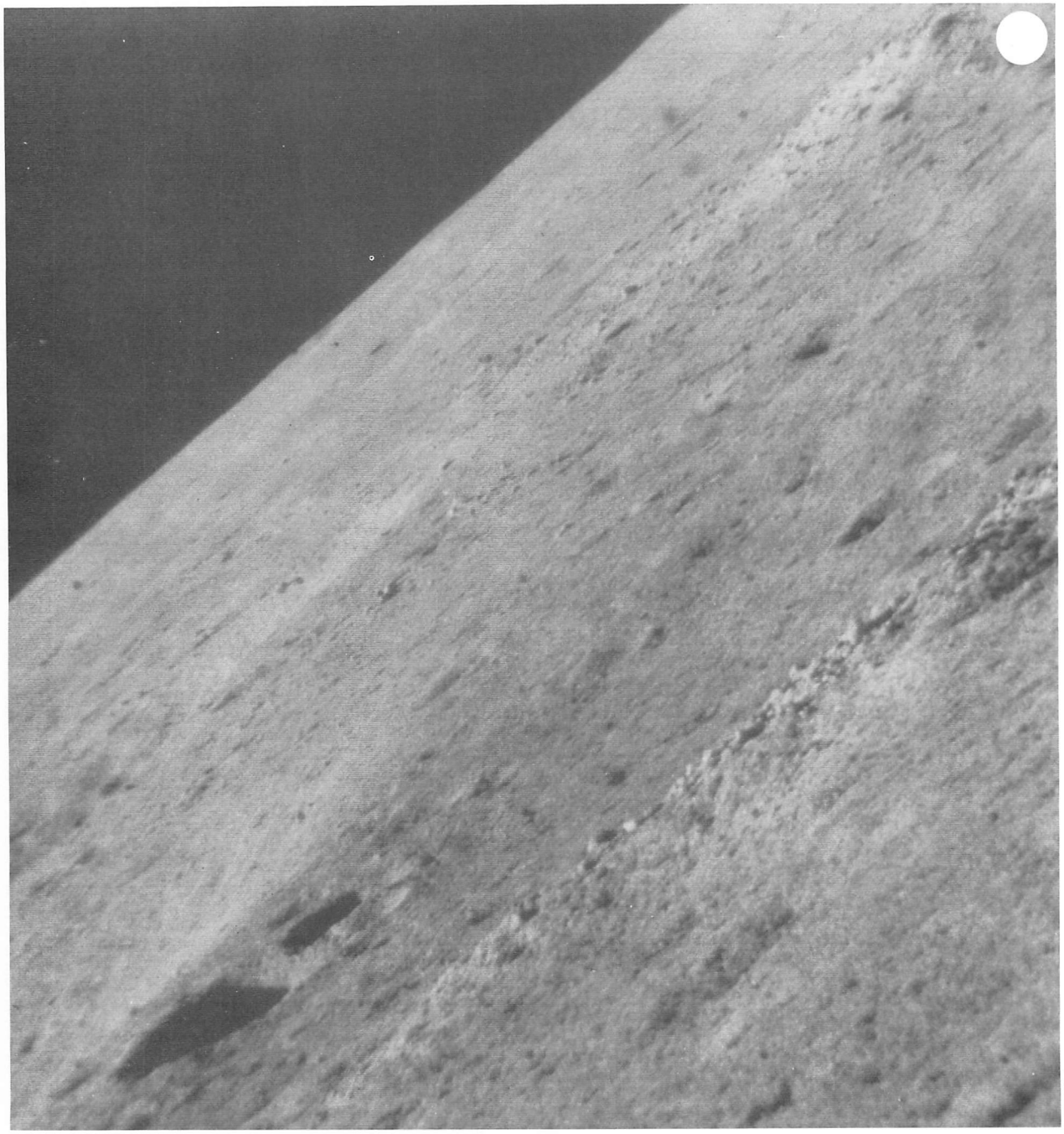


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(111)	Day 265, 15:29:17	57	25	14.3	f/11.6	N	Clear

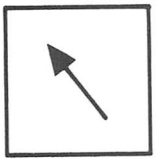


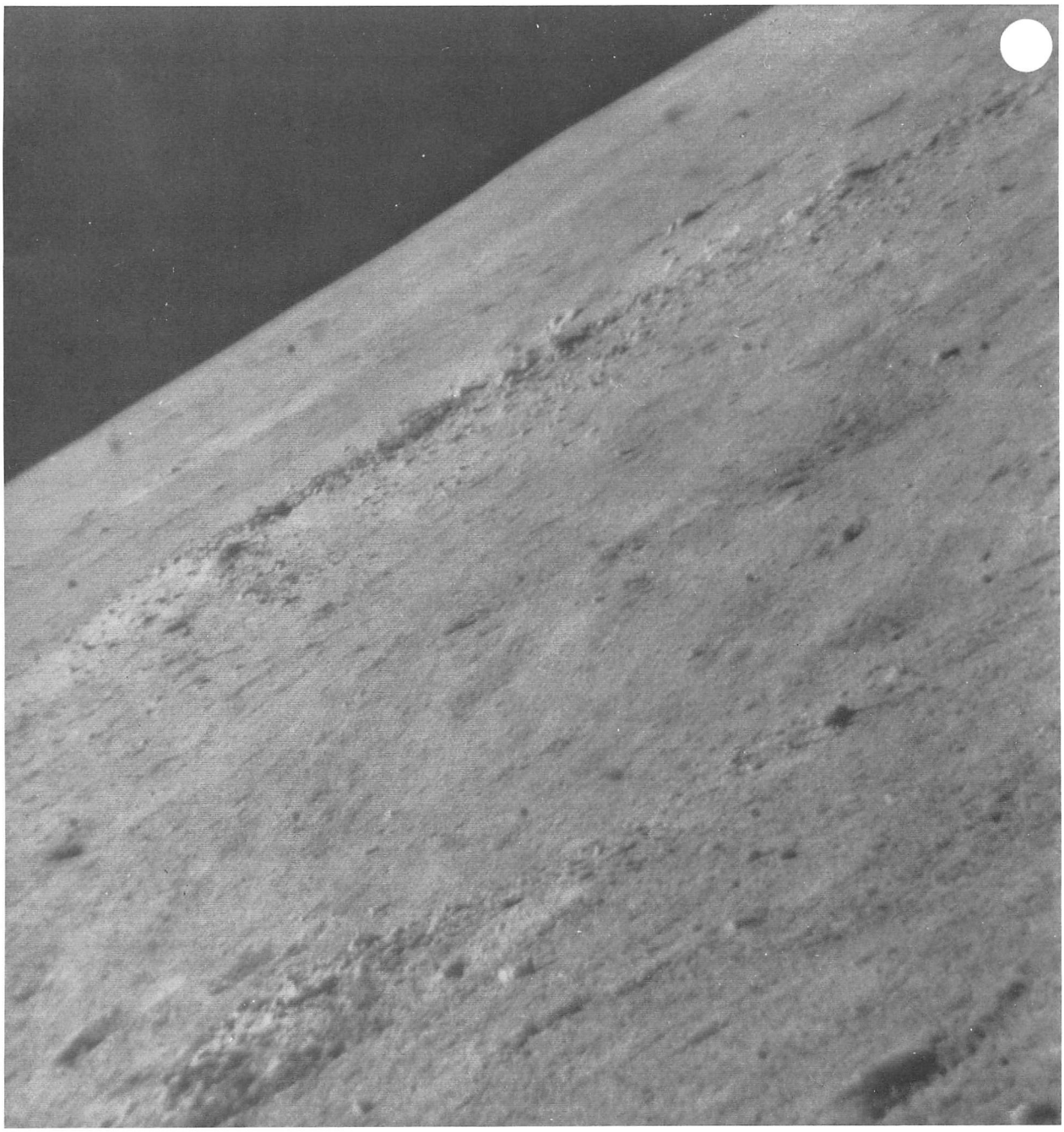
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(112)	Day 265, 15:30:22	42	30	22.7	f/5.0	N	Clear



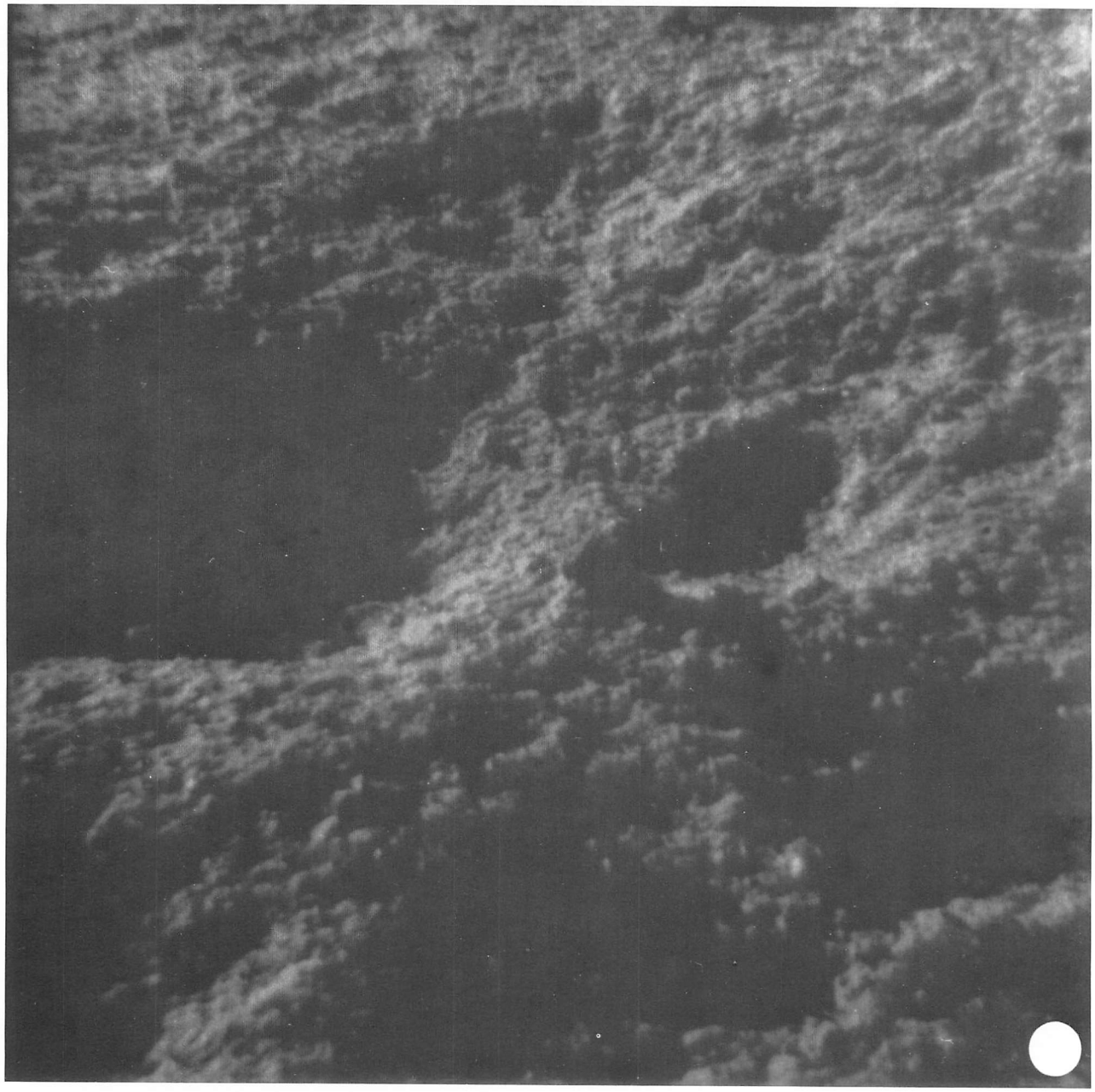


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(113)	Day 265, 15:30:32	36	30	22.5	f/11.6	N	Clear

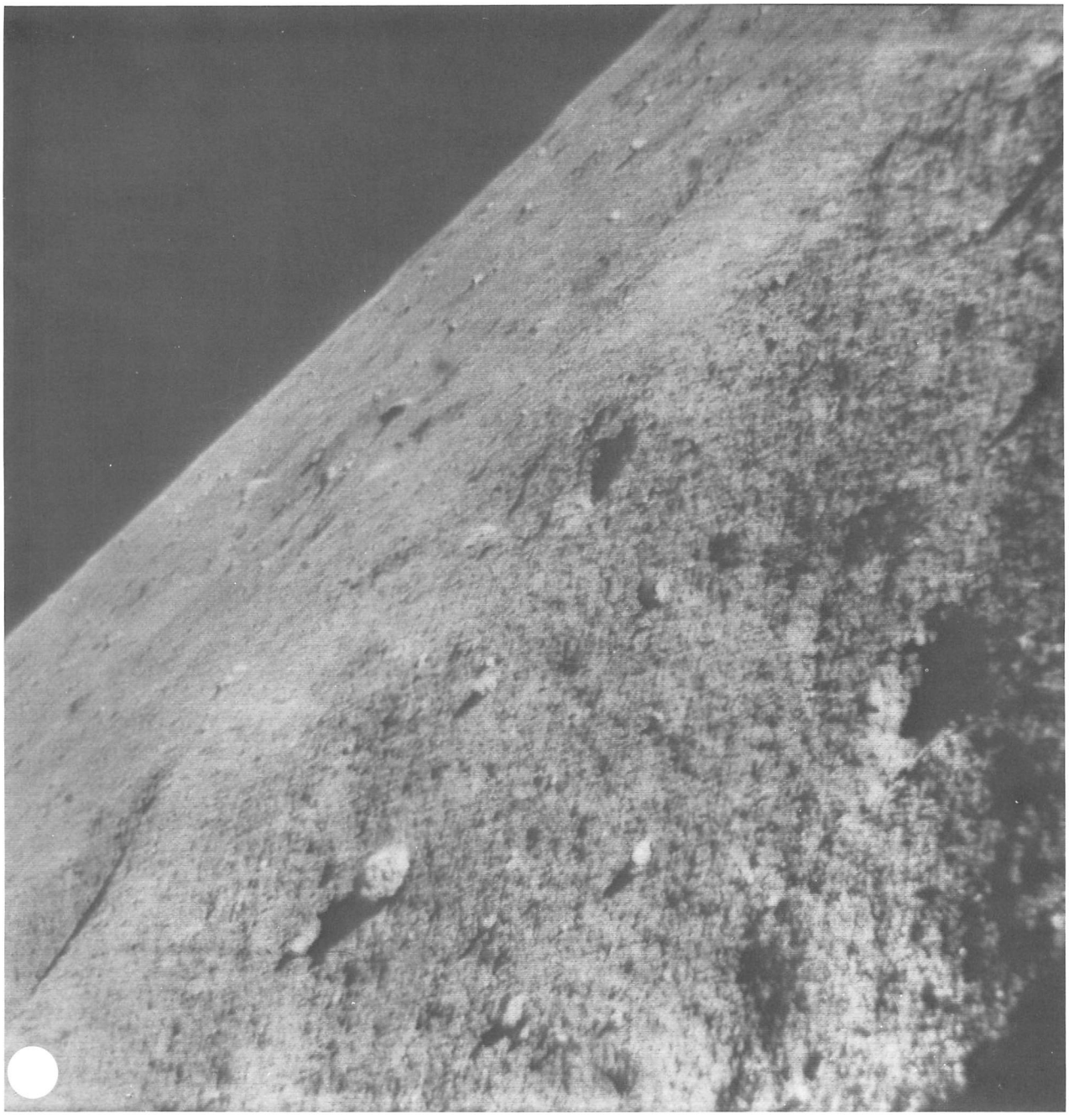




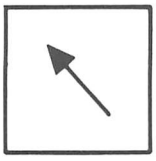
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(114)	Day 265, 15:30:48	30	30	22.7	f/11.6	N	Clear

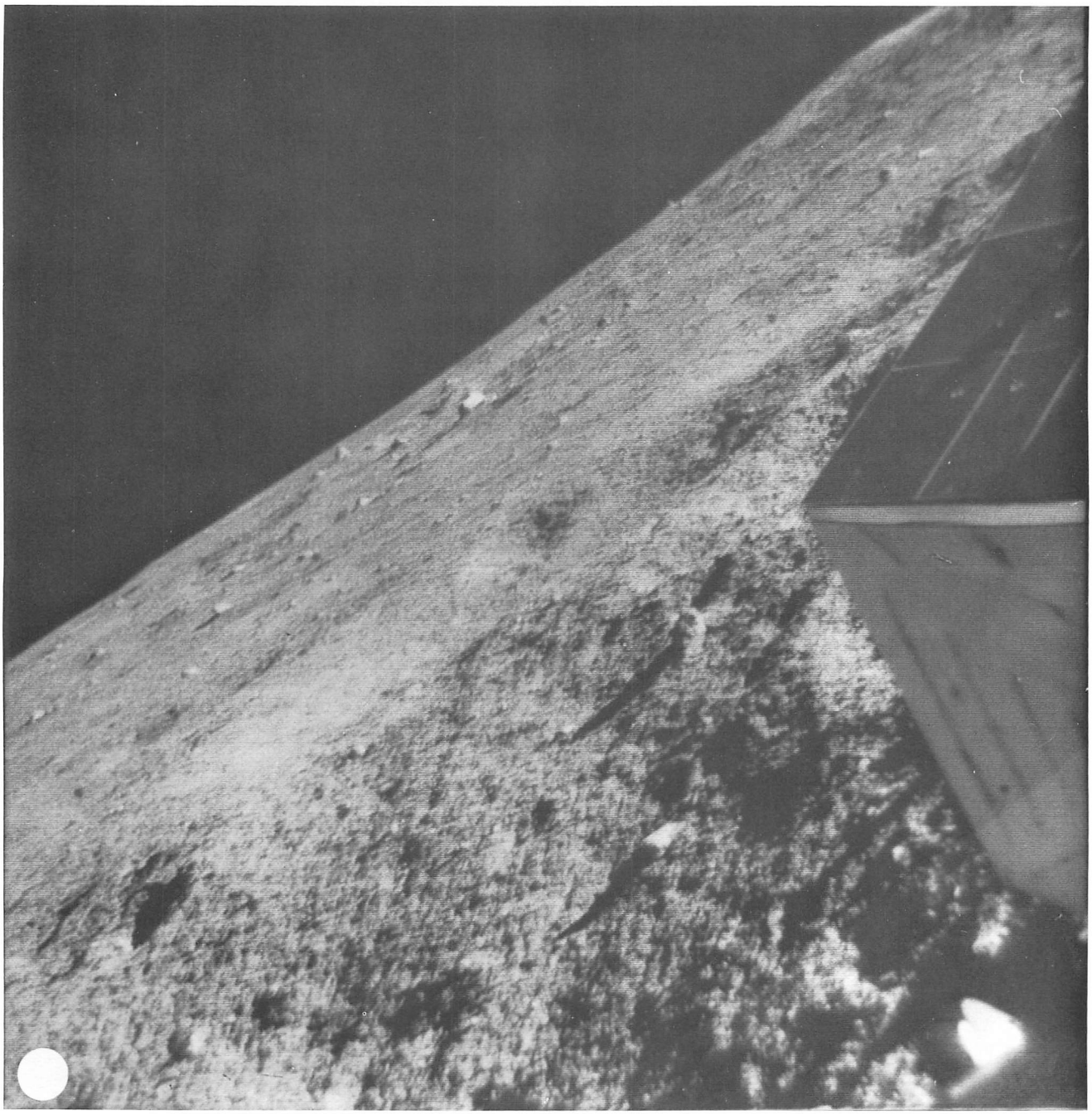


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(115)	Day 265, 15:46:14	78	10	8.7	f/11.6	N	Clear

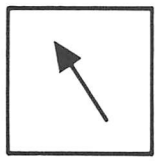


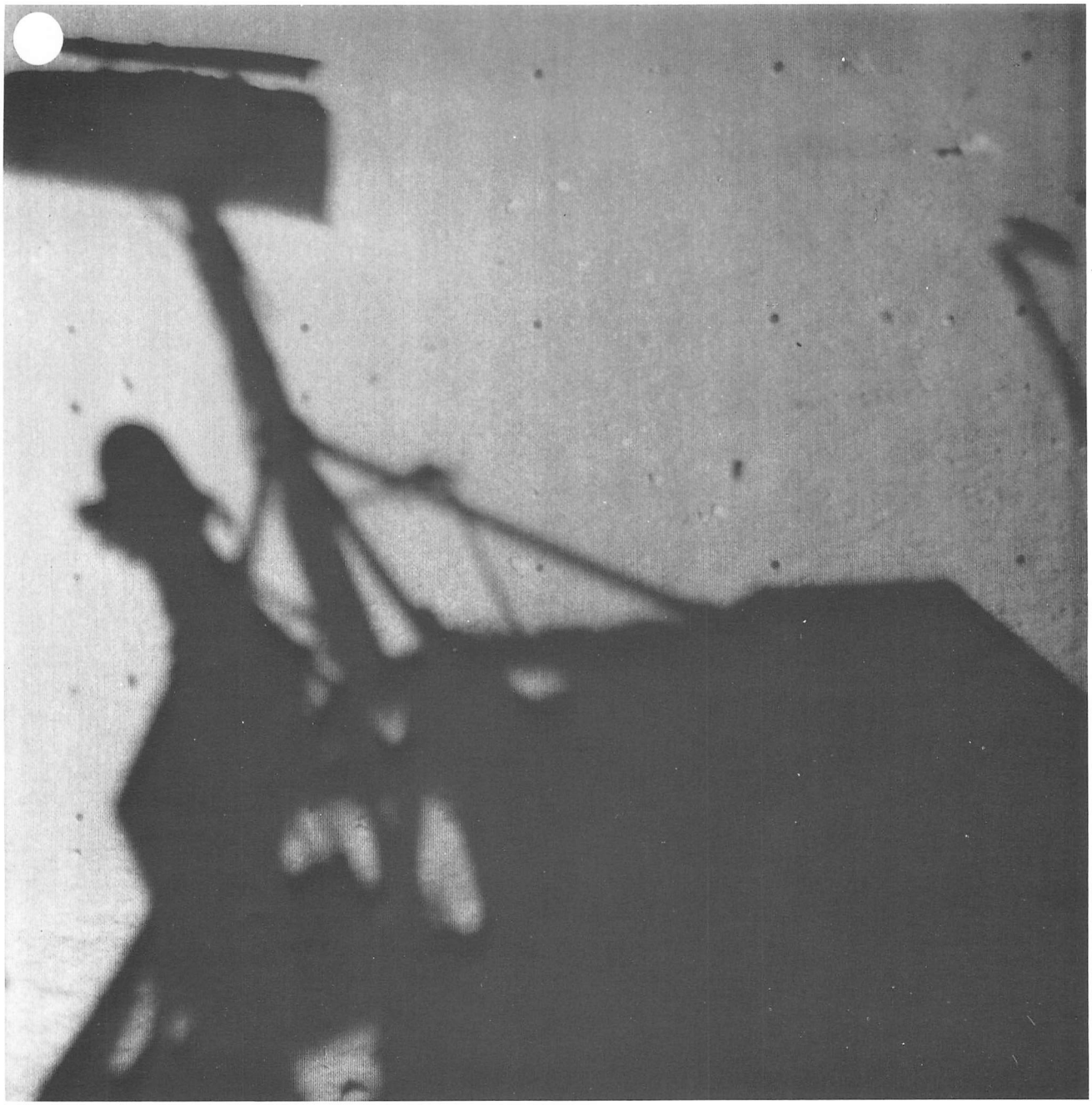
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(116)	Day 266, 05:49:34	−129	−30	2.3	f/11.2	W	Clear



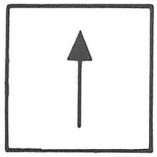


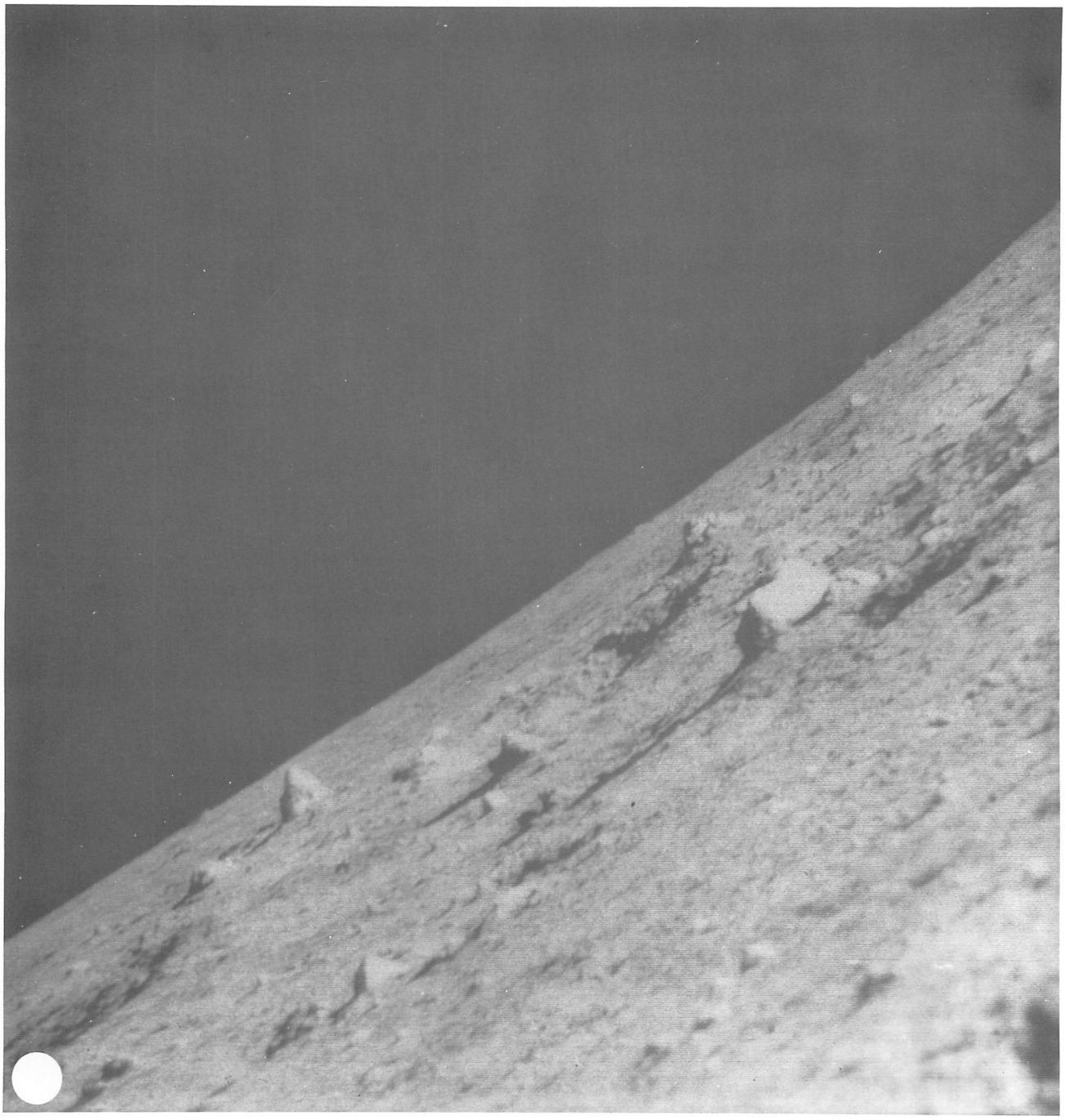
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(117)	Day 266, 05:49:58	−150	−35	11.1	f/25.4	W	Clear



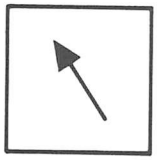


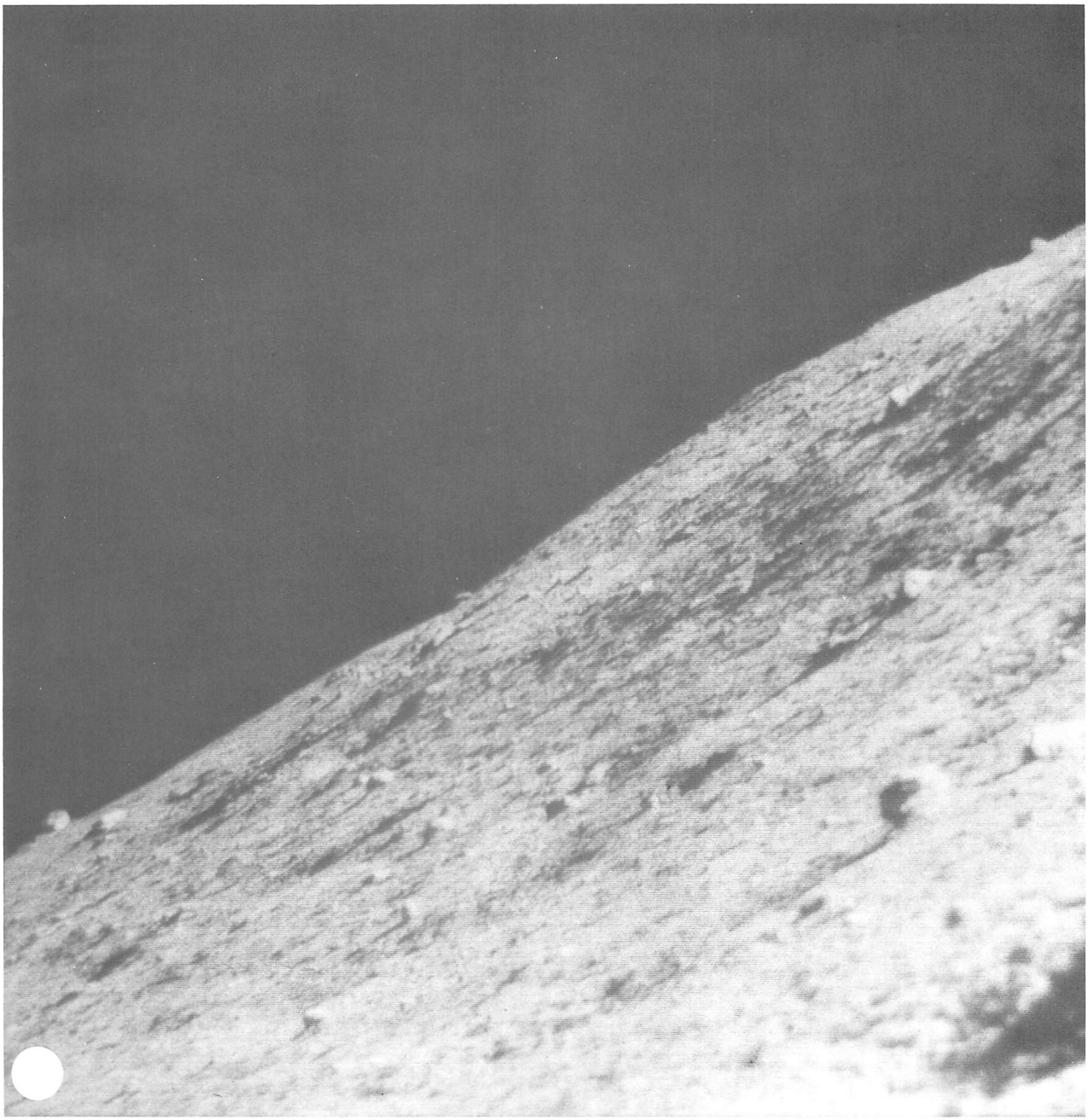
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(118)	Day 266, 08:32:13	−60	−20	3.9	f/16.4	W	Clear



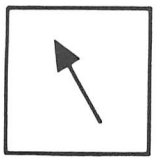


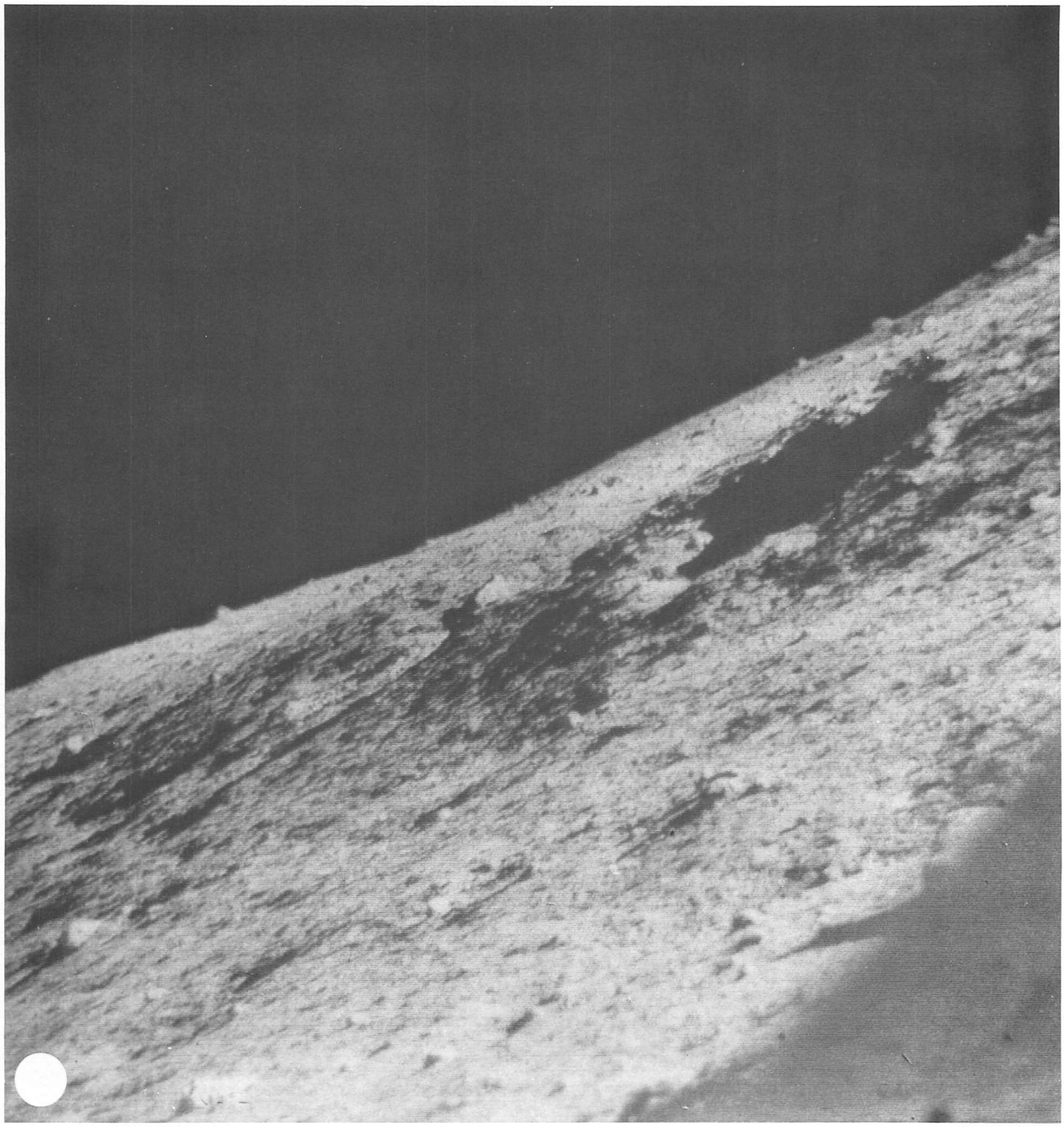
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(119)	Day 266, 09:17:15	−144	−30	16.8	f/8.0	N	Clear



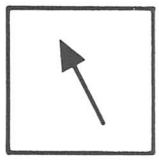


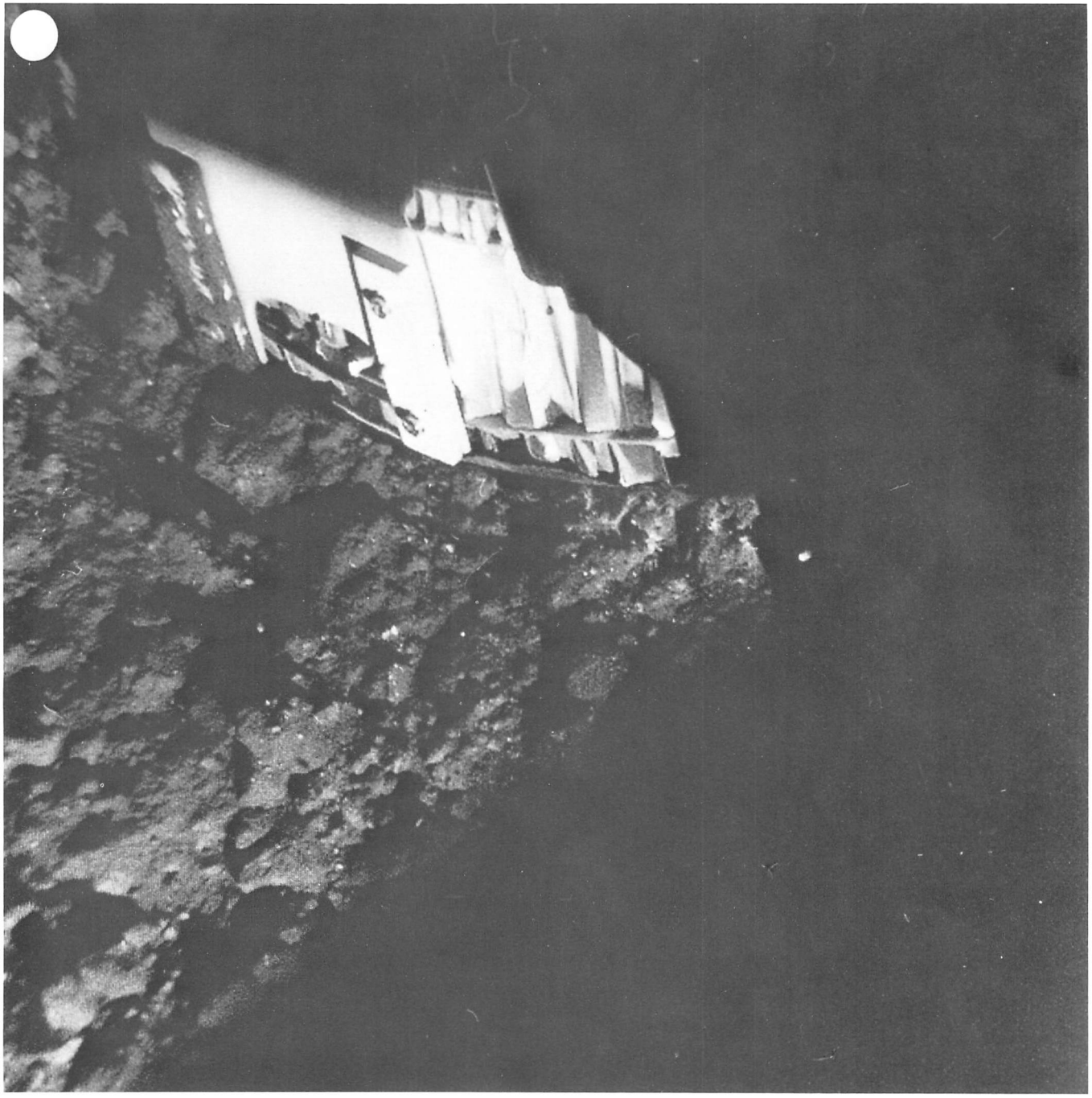
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(120)	Day 266, 09:17:49	−156	−30	45.6	*f*/8.1	N	Clear



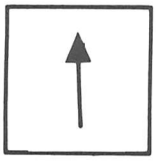


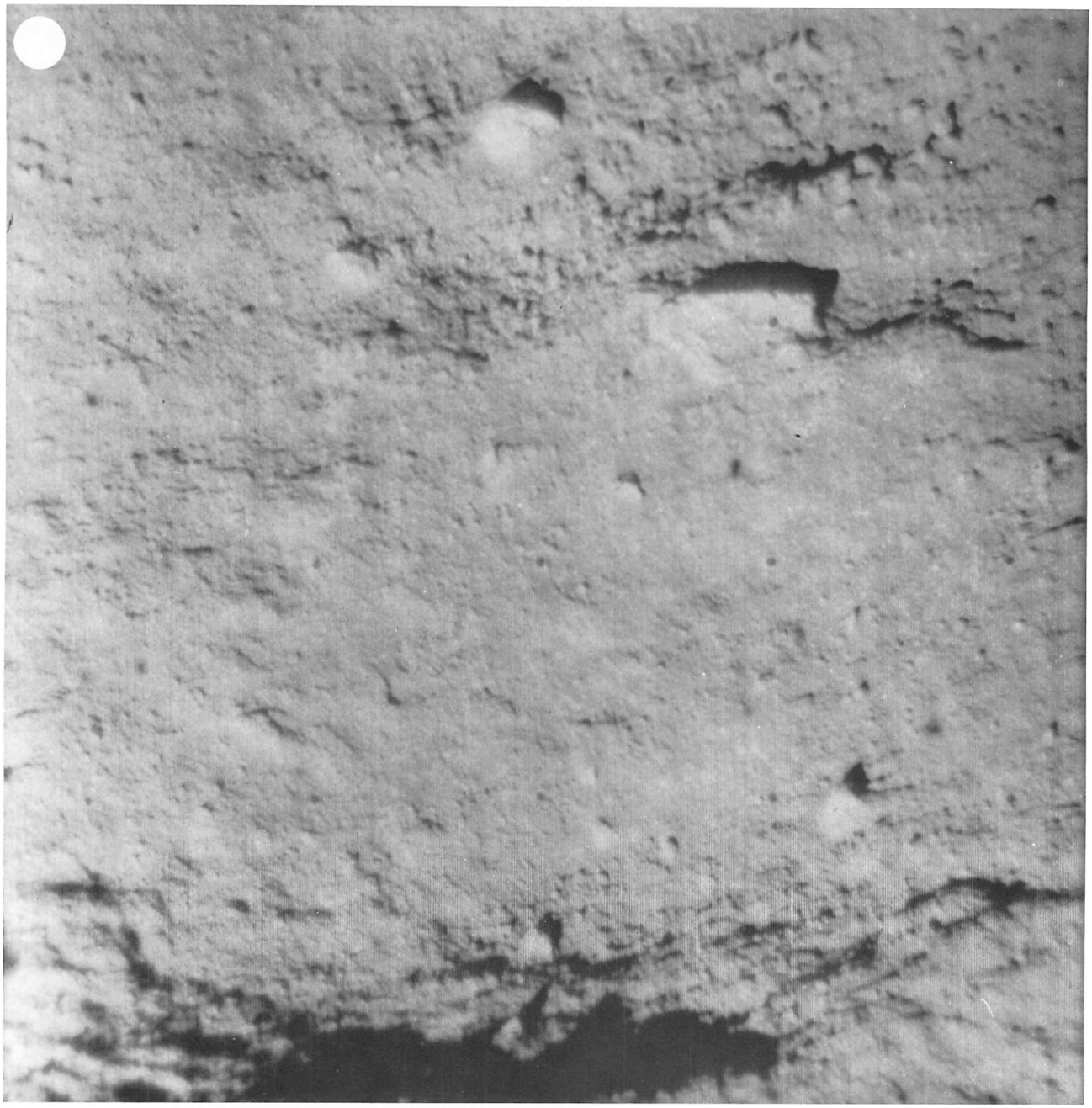
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(121)	Day 266, 09:17:54	−162	−30	16.4	f/8.1	N	Clear



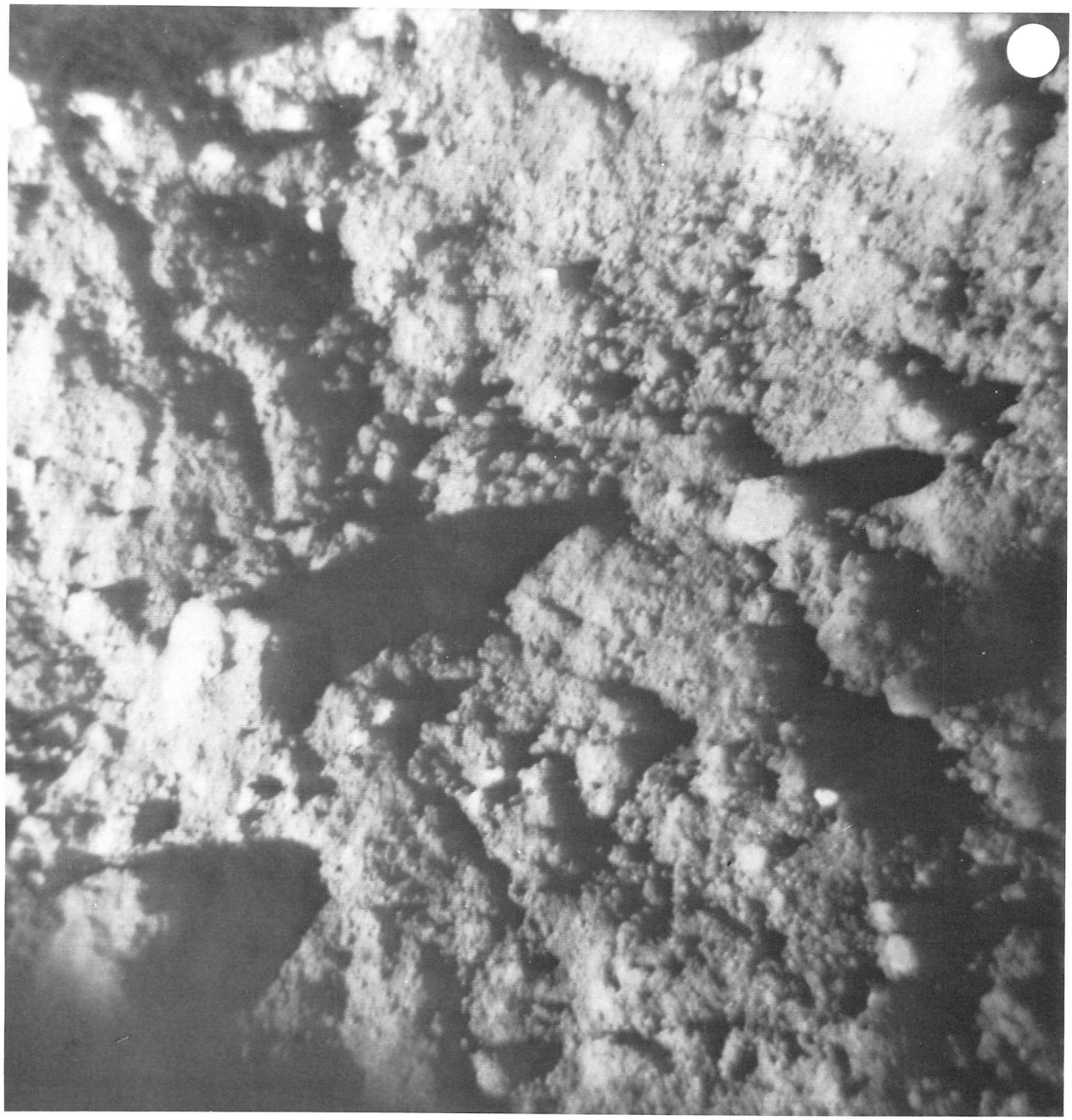


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(122)	Day 266, 09:52:49	−57	−60	2.3	f/23.3	N	Clear	Processed

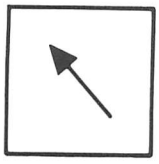


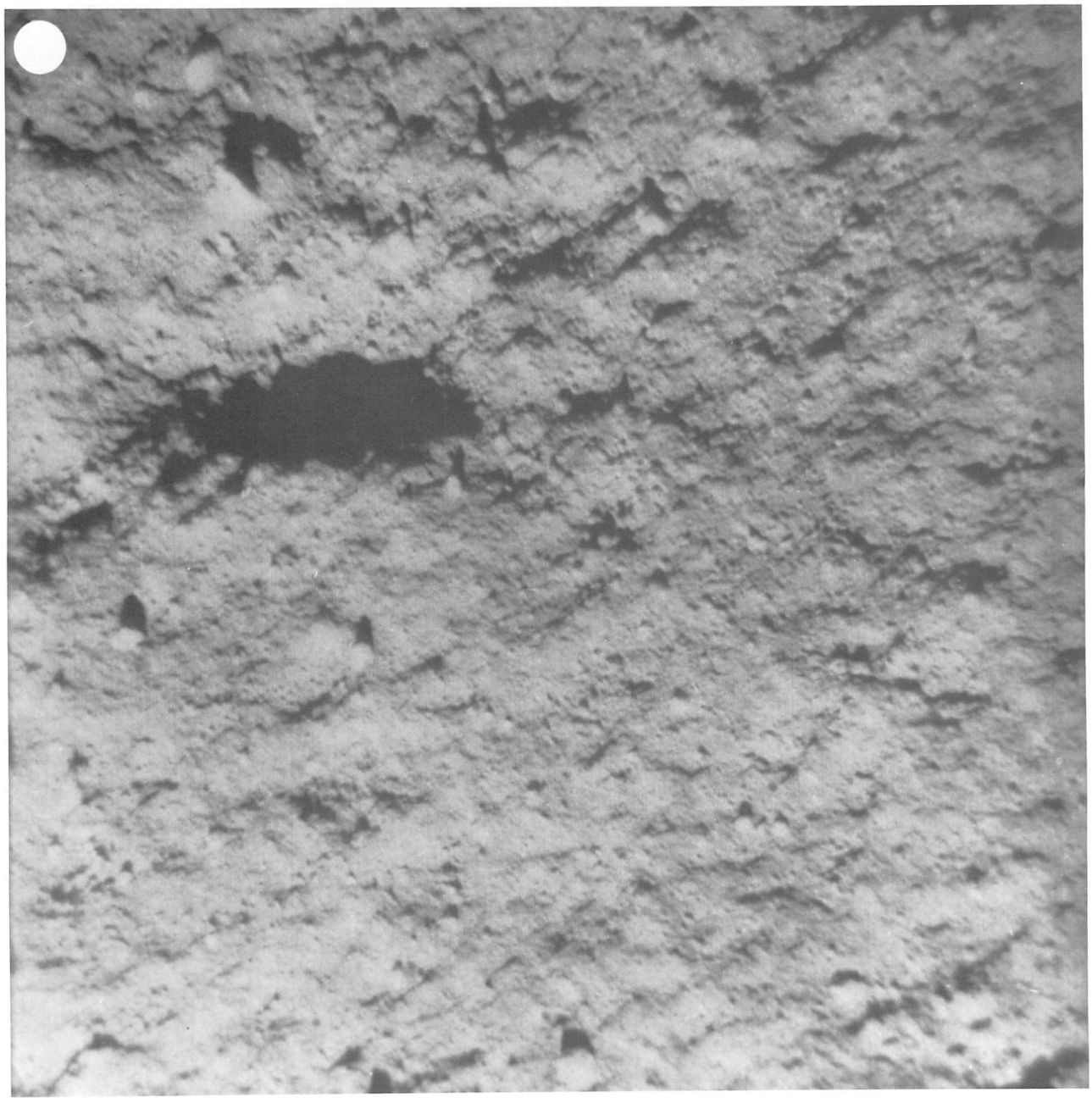


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(123)	Day 266, 10:09:52	−36	−10	3.8	f/16.5	N	Clear

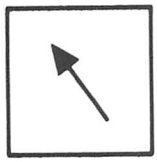


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(124)	Day 266, 10:59:41	−24	−55	2.2	f/11.5	N	Clear

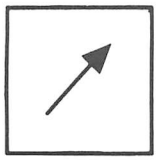




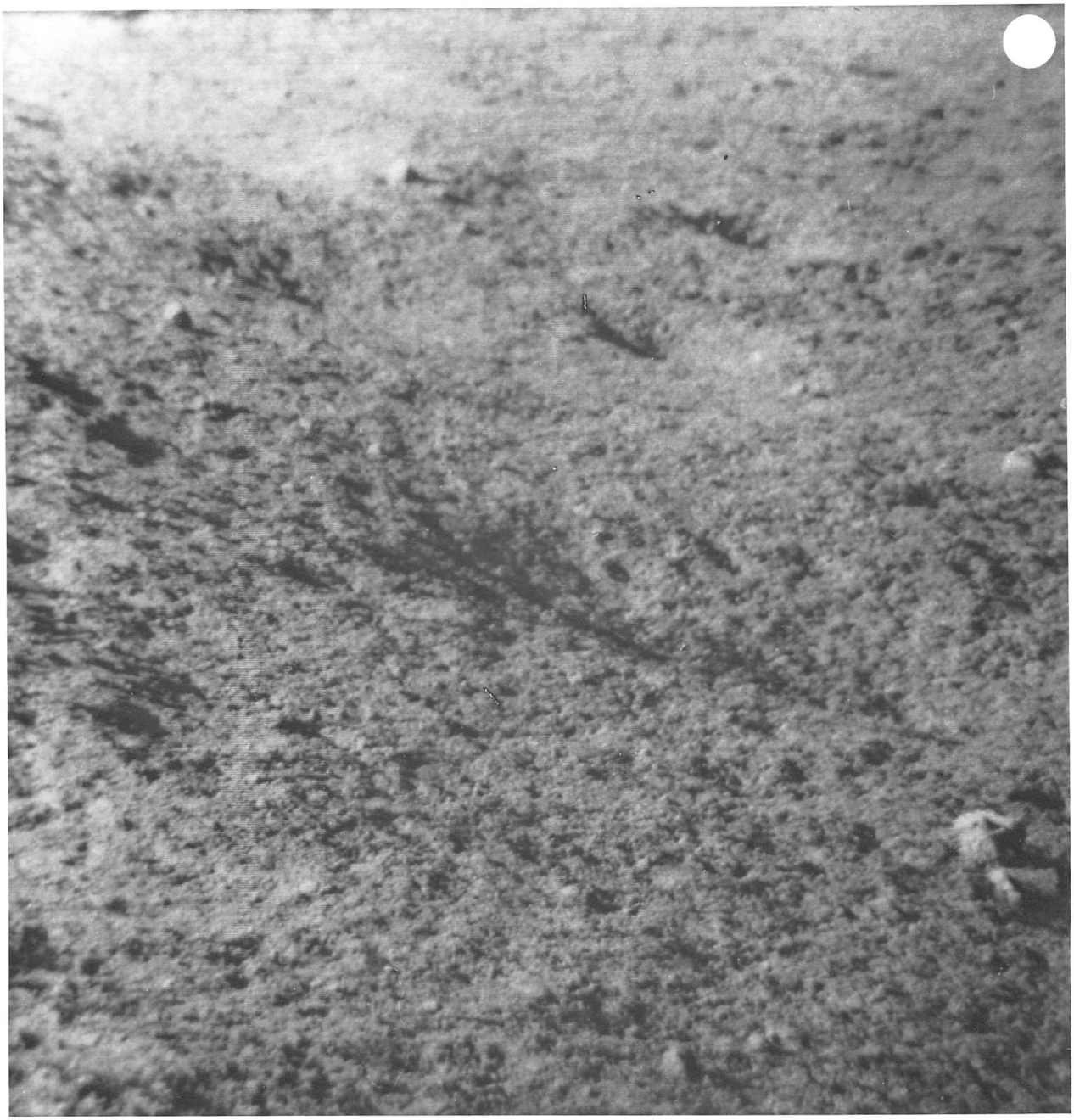
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(125)	Day 266, 11:02:47	−27	−25	46.9	f/11.5	N	Clear



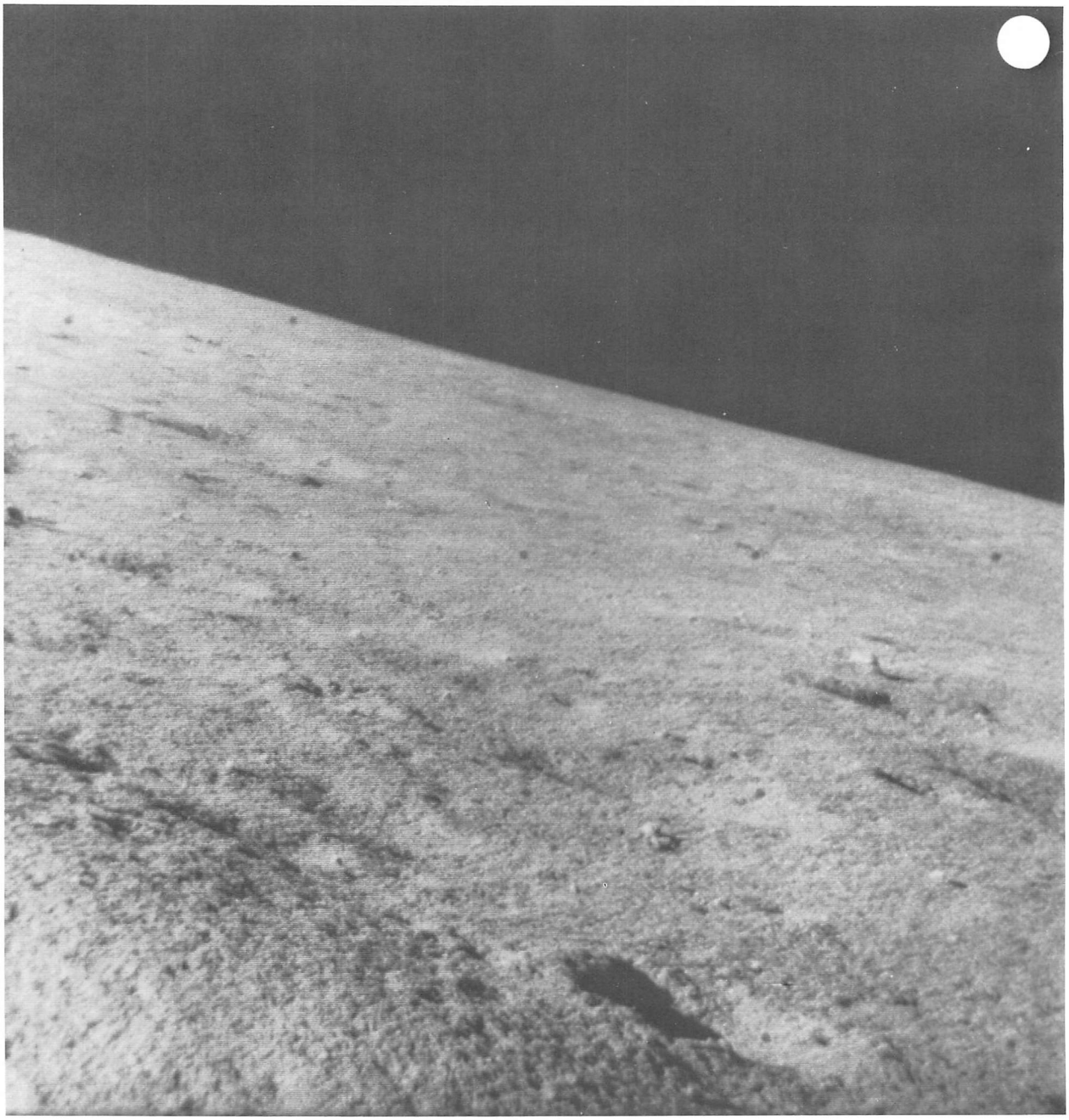
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(126)	Day 266, 11:10:34	−18	5	3.2	*f*/11.5	N	Clear



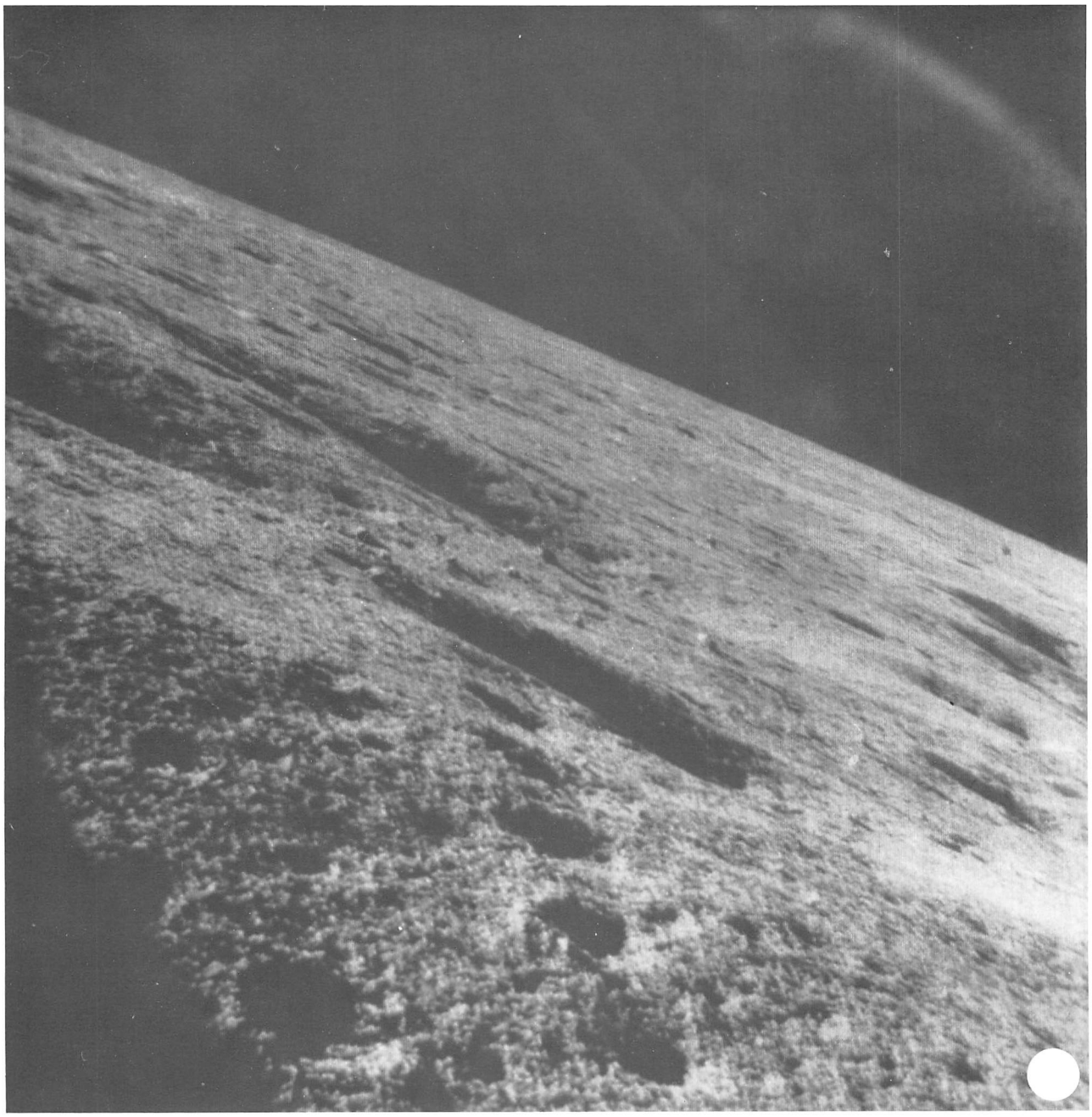
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(127)	Day 266, 11:14:03	−3	15	4.2	*f*/11.5	N	Clear



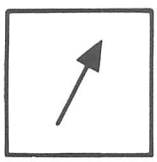
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(128)	Day 266, 11:14:39	0	20	6.2	f/4.7	N	Clear

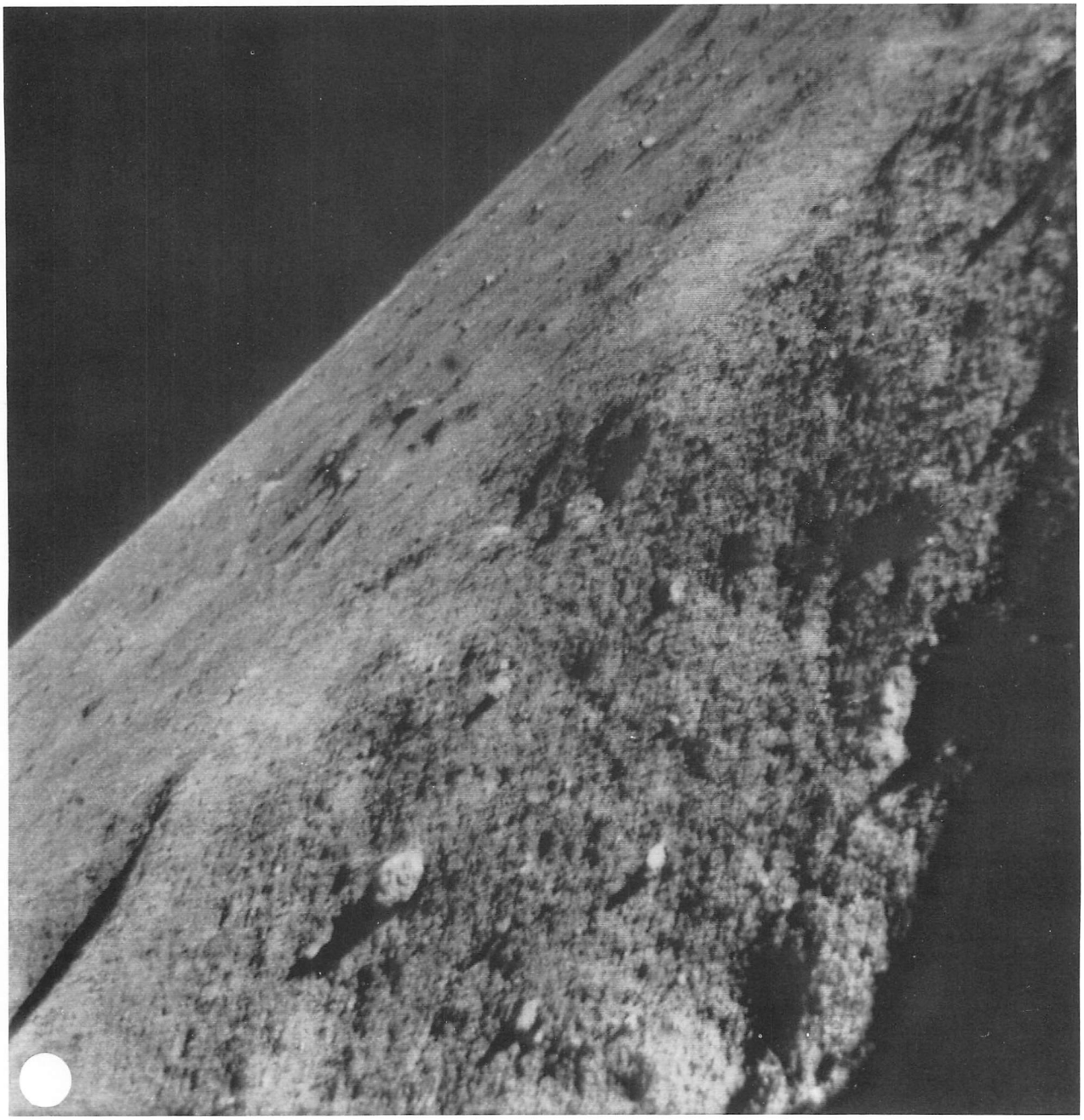


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(129)	Day 266, 11:24:40	0	25	2.3	f/11.5	W	Clear

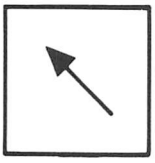


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(130)	Day 266, 11:26:28	54	25	2.3	f/8.1	W	Clear

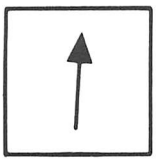


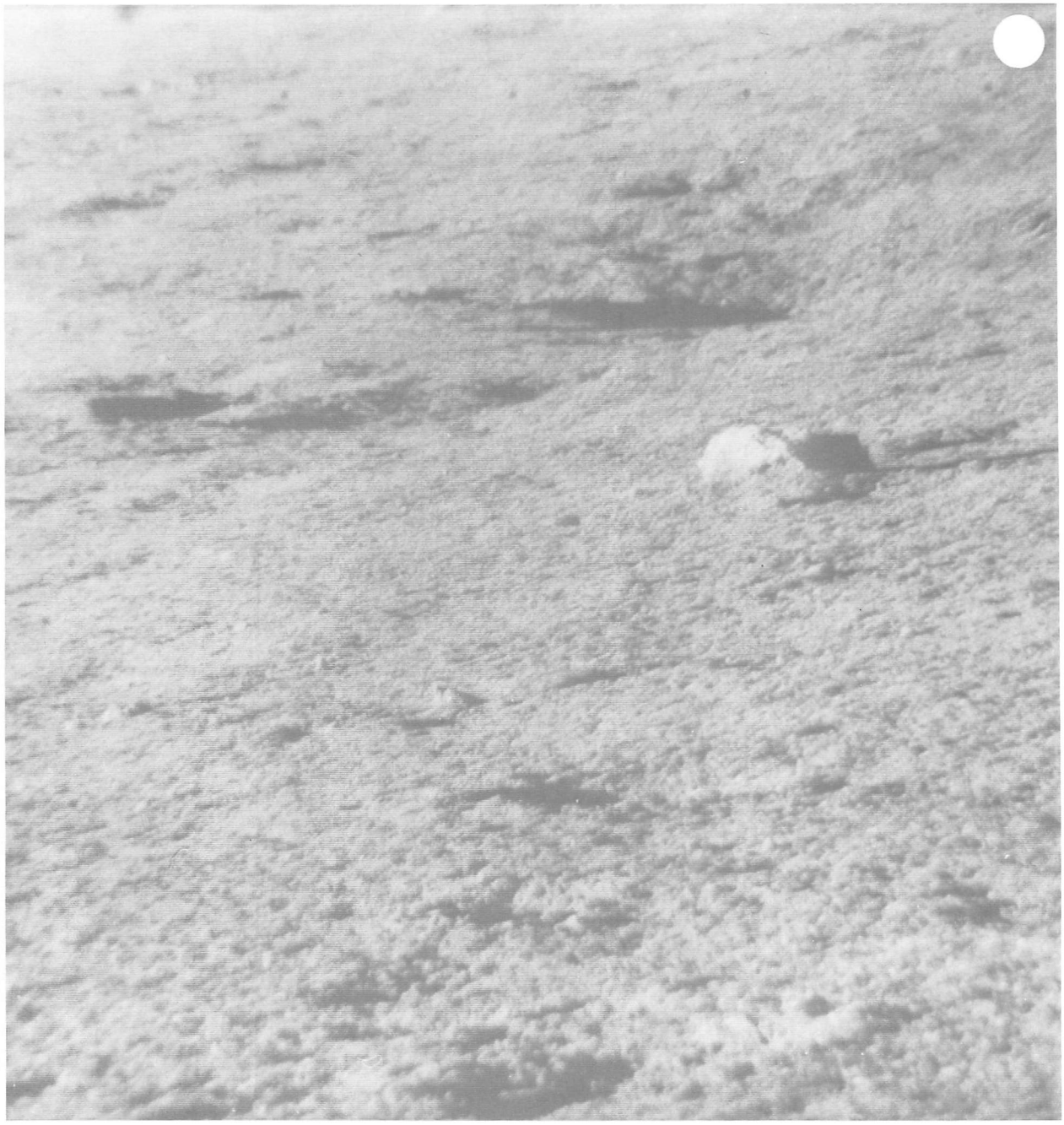


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(131)	Day 266, 11:33:49	−126	−35	2.3	f/11.5	W	Clear

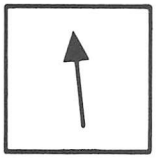


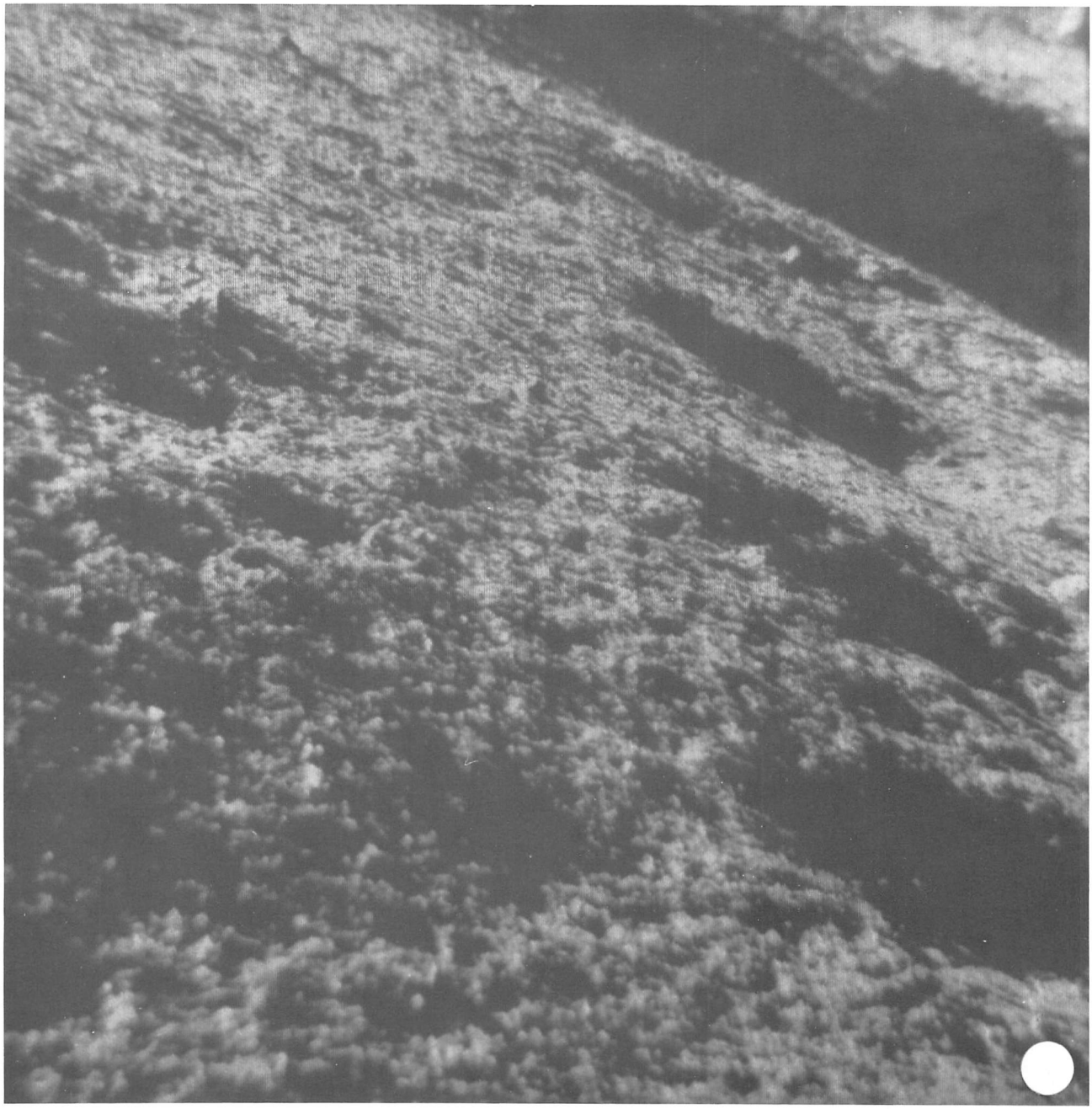
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(132)	Day 266, 12:09:50	9	25	11.9	f/11.5	N	Clear



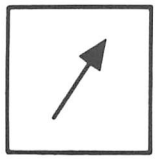


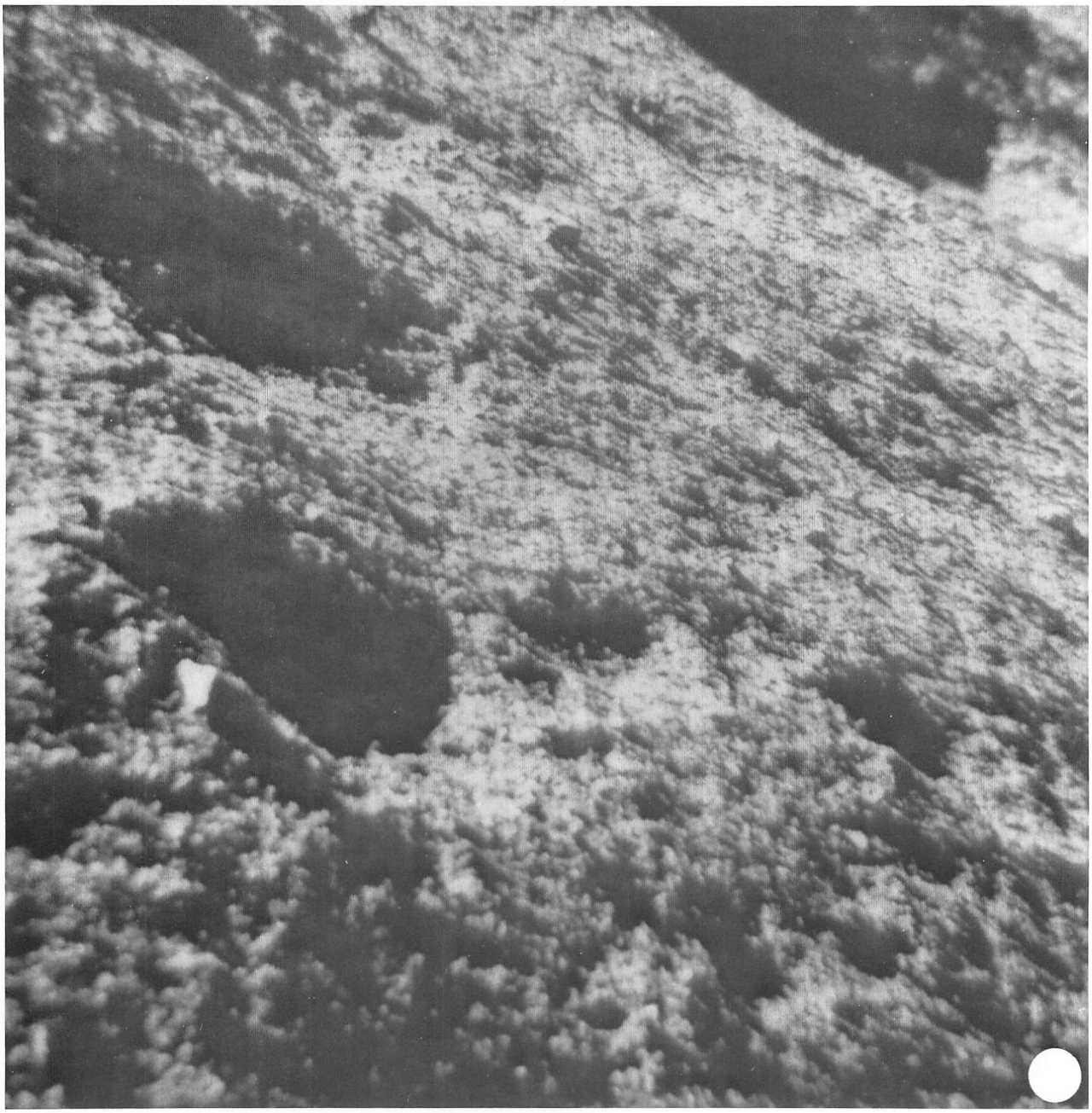
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(133)	Day 266, 12:09:53	15	25	11.9	f/11.5	N	Clear



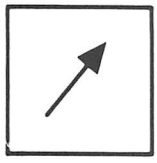


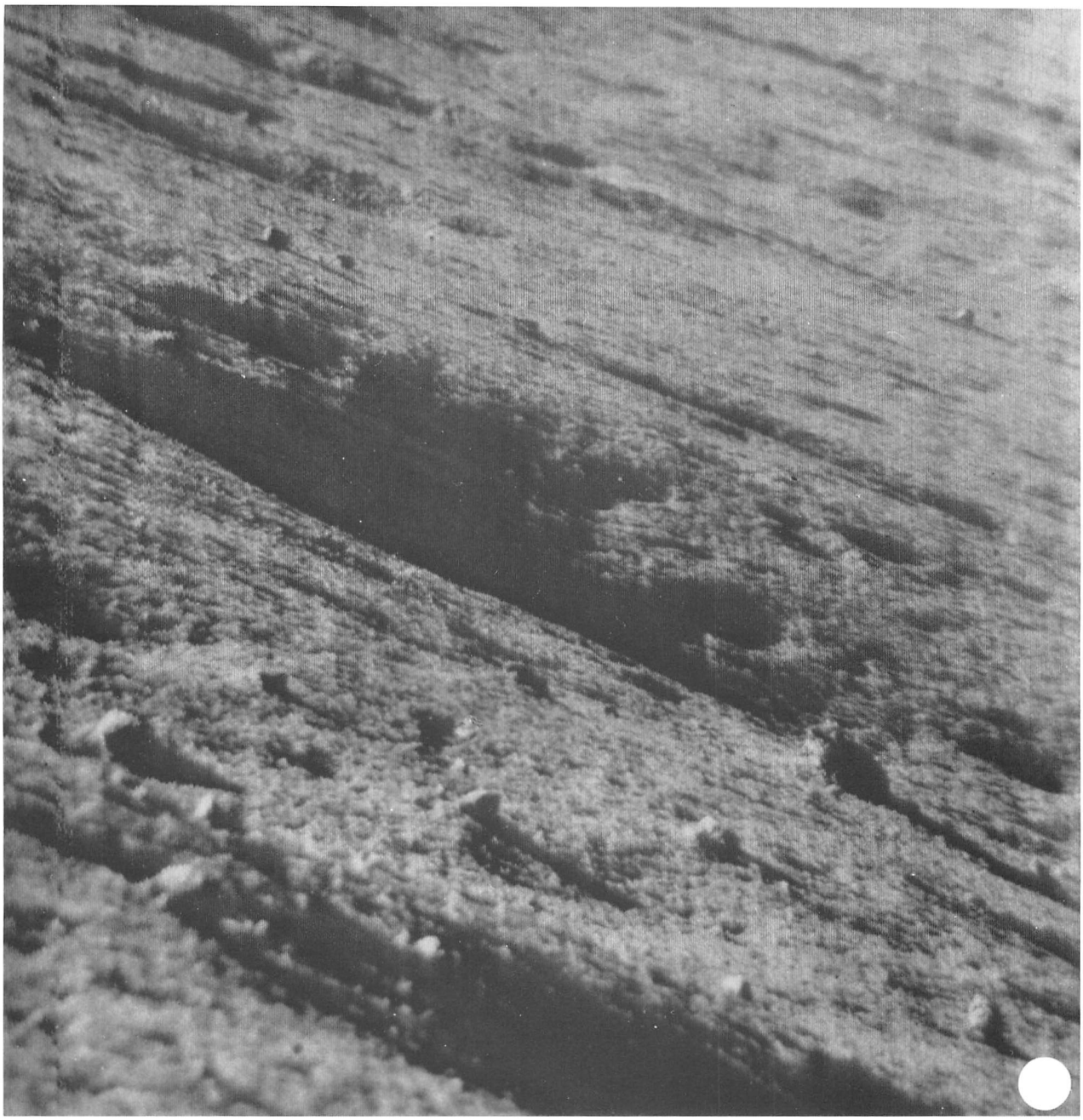
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(134)	Day 266, 12:23:31	48	20	6.5	f/8.1	N	Clear



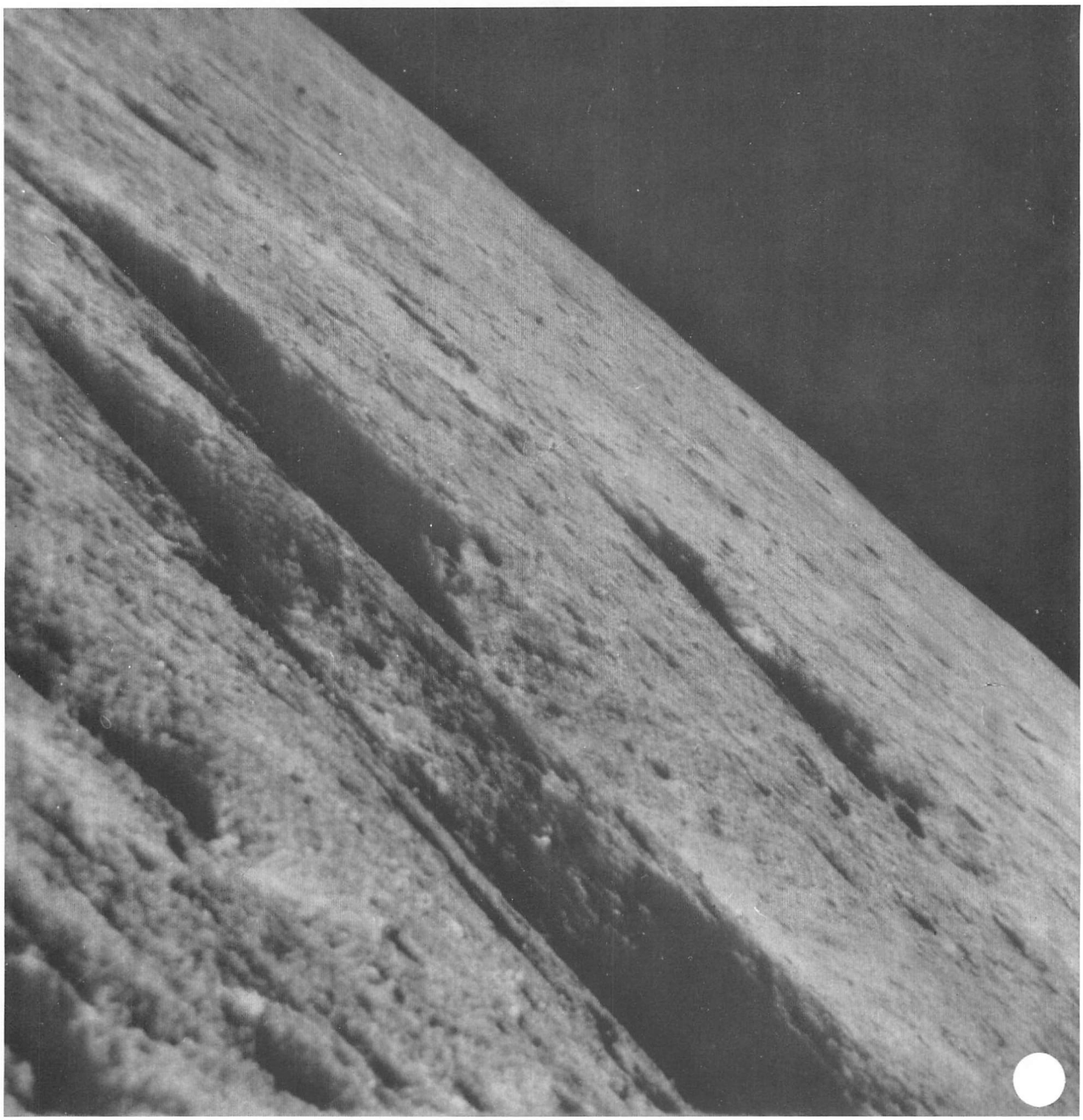


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(135)	Day 266, 12:23:35	45	20	7.3	f/8.1	N	Clear

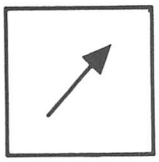


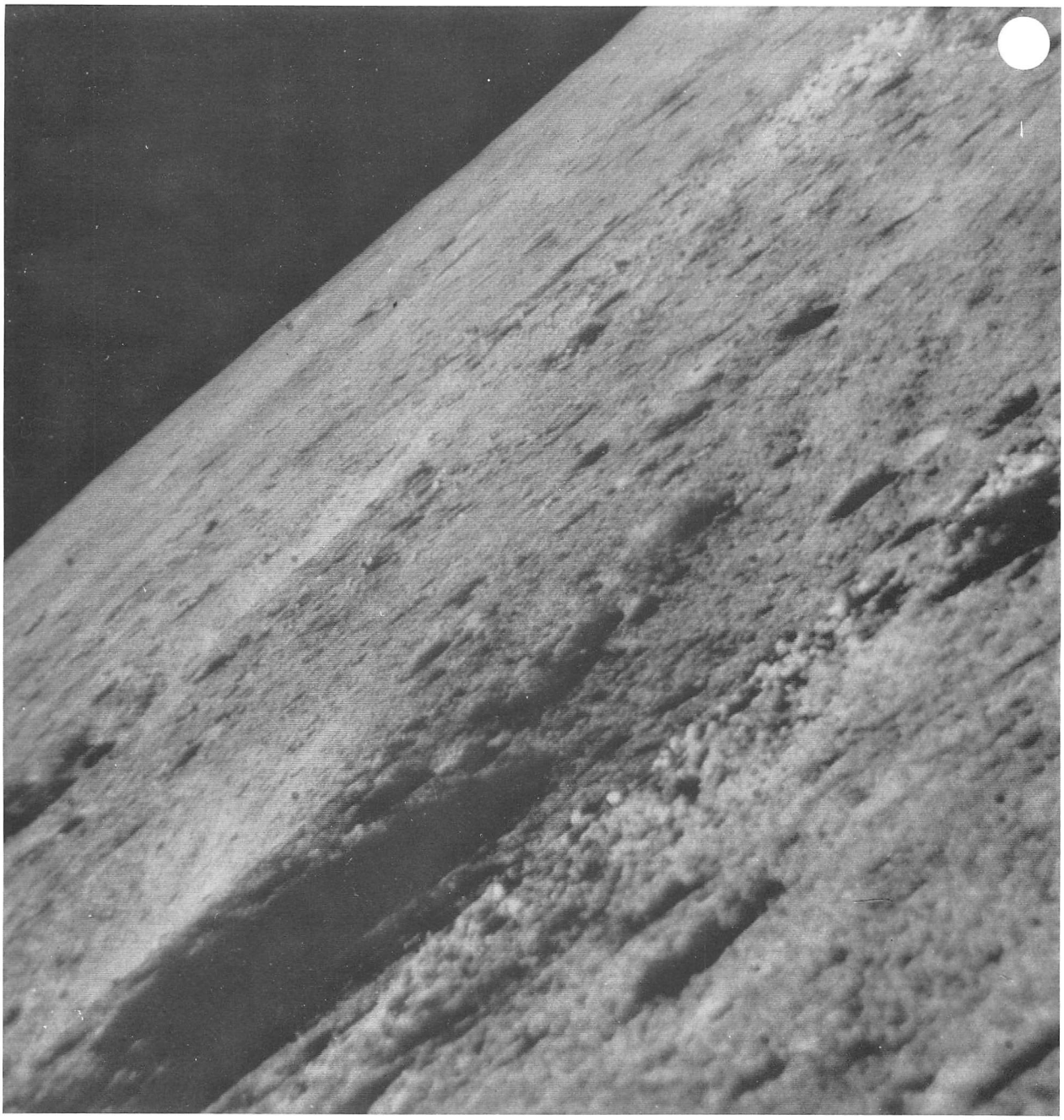


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(136)	Day 266, 12:24:43	57	25	16.3	f/8.1	N	Clear

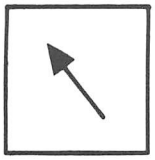


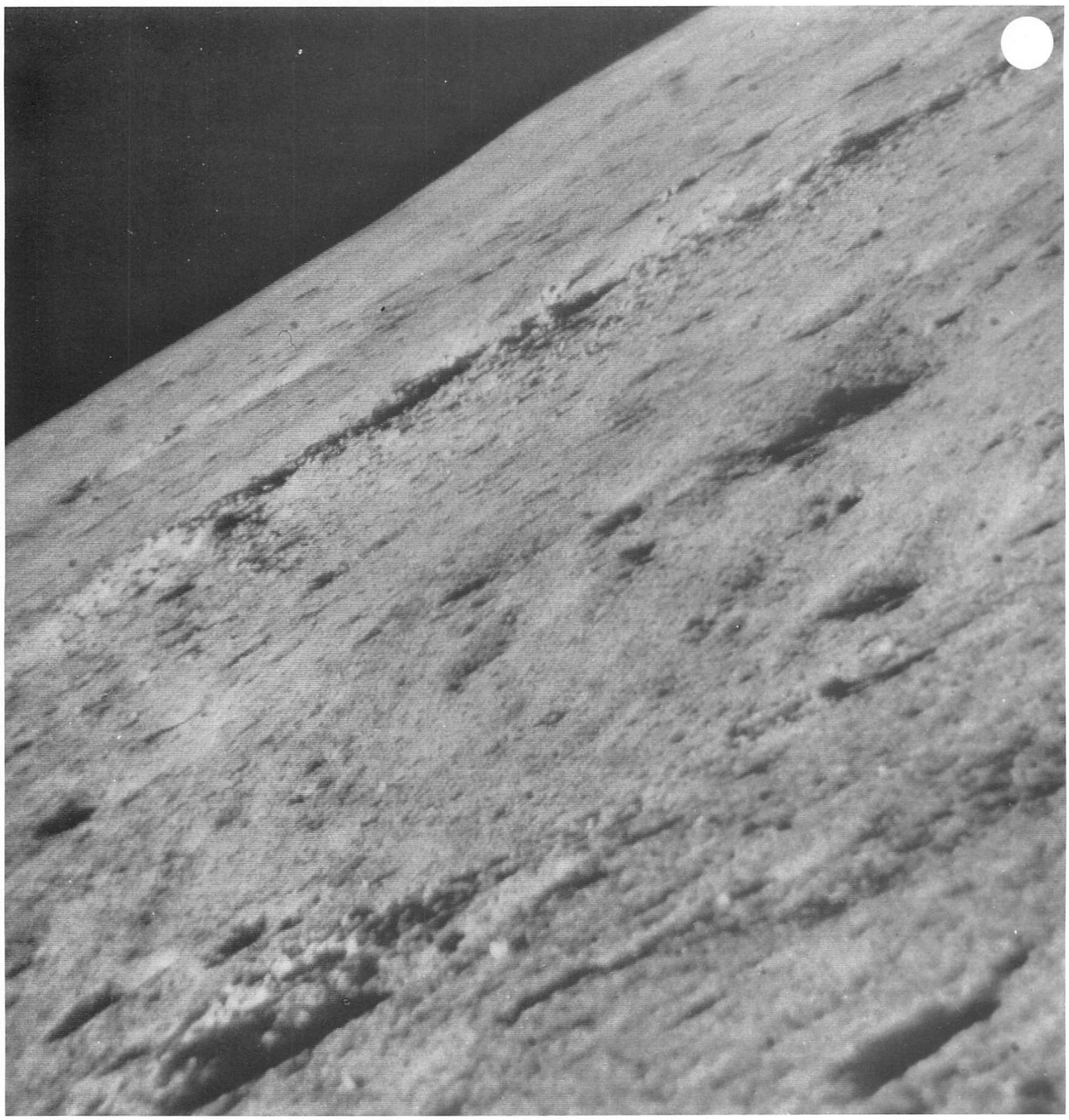
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(137)	Day 266, 12:37:37	42	30	24.9	f/8.1	N	Clear



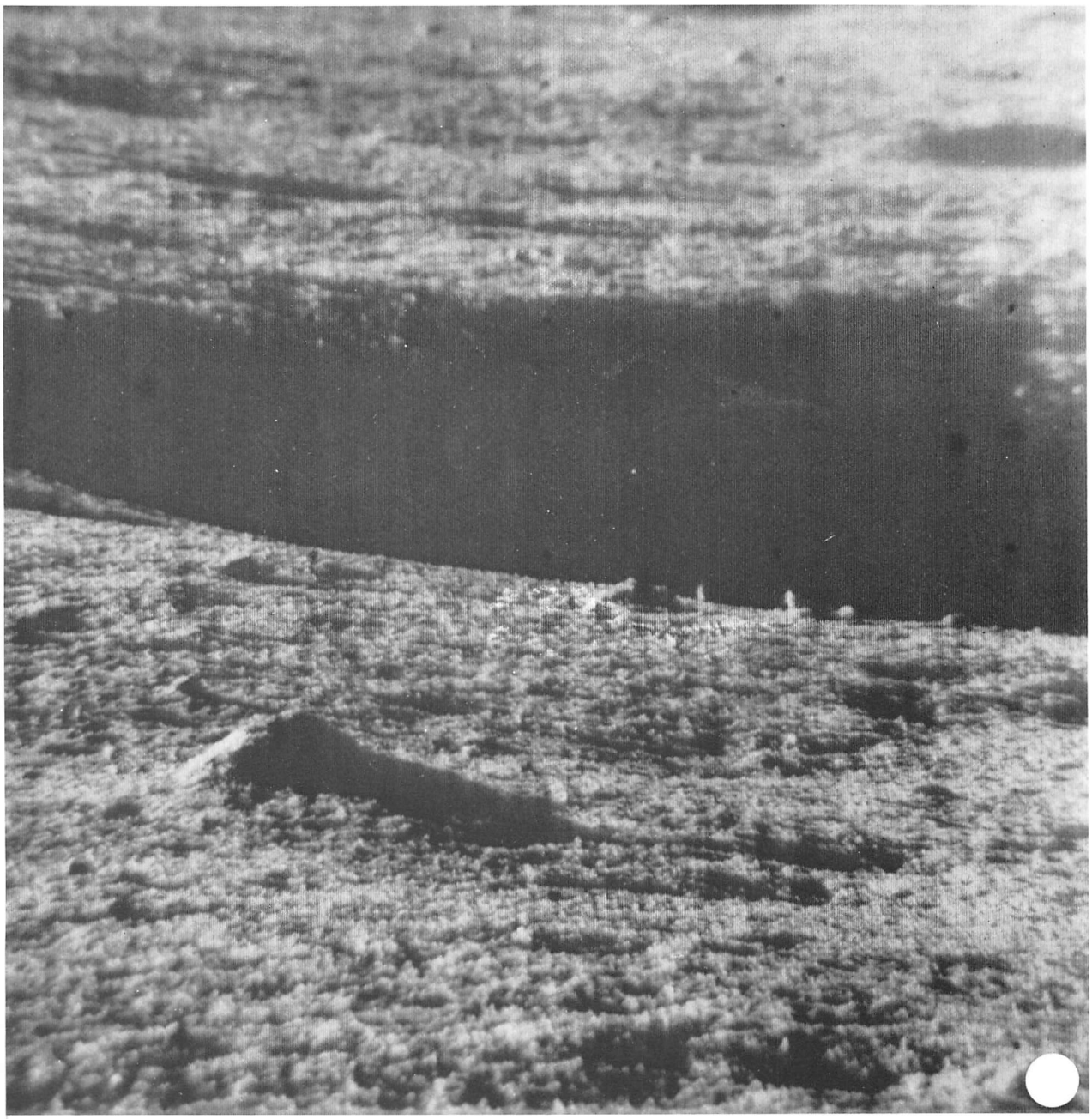


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(138)	Day 266, 12:37:51	36	30	24.9	f/8.1	N	Clear

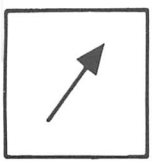




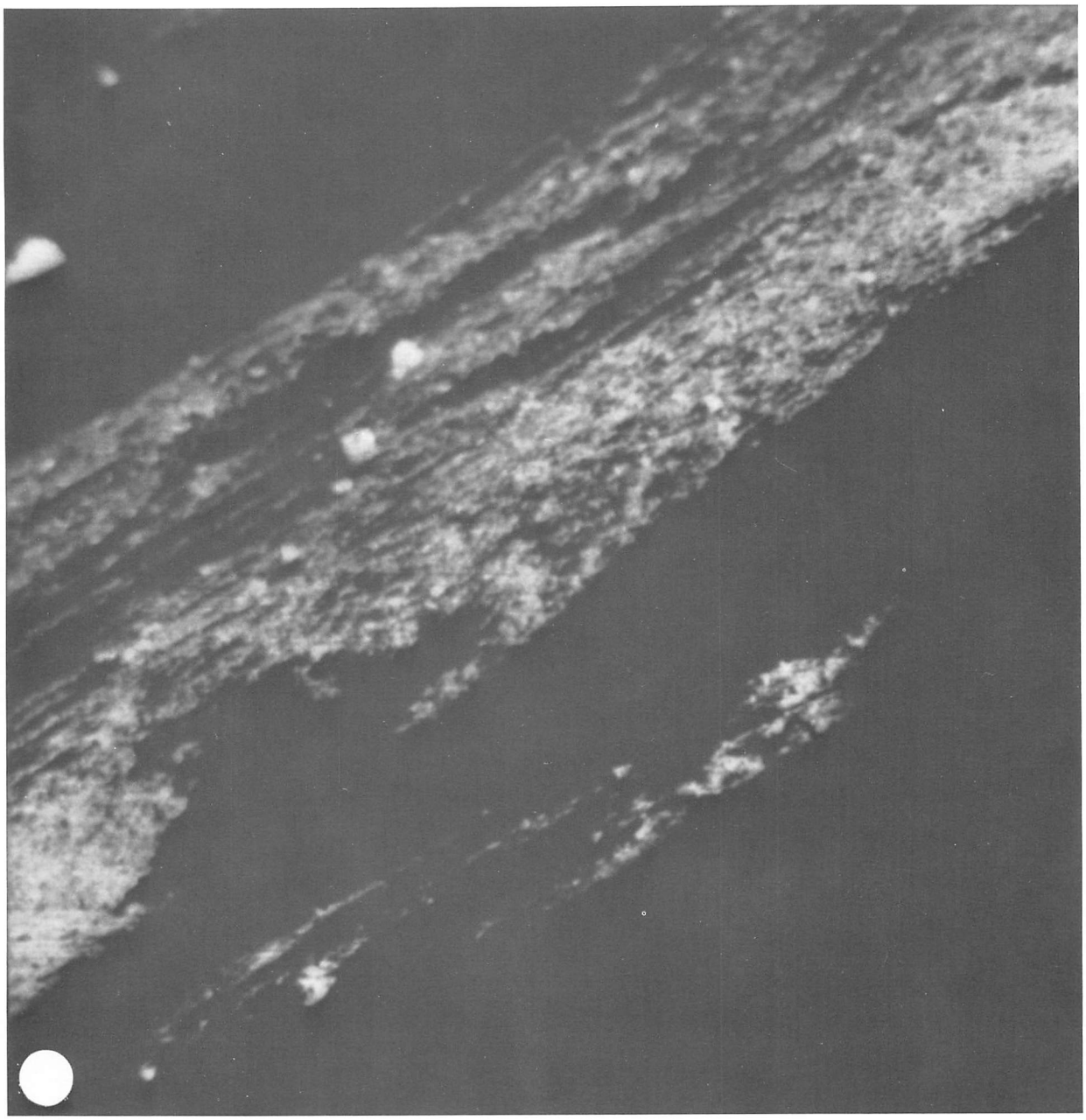
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(139)	Day 266, 12:38:04	30	30	24.9	f/8.1	N	Clear



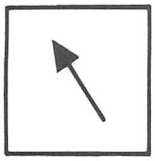
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(140)	Day 266, 14:04:41	114	20	8.2	f/8.1	N	Clear

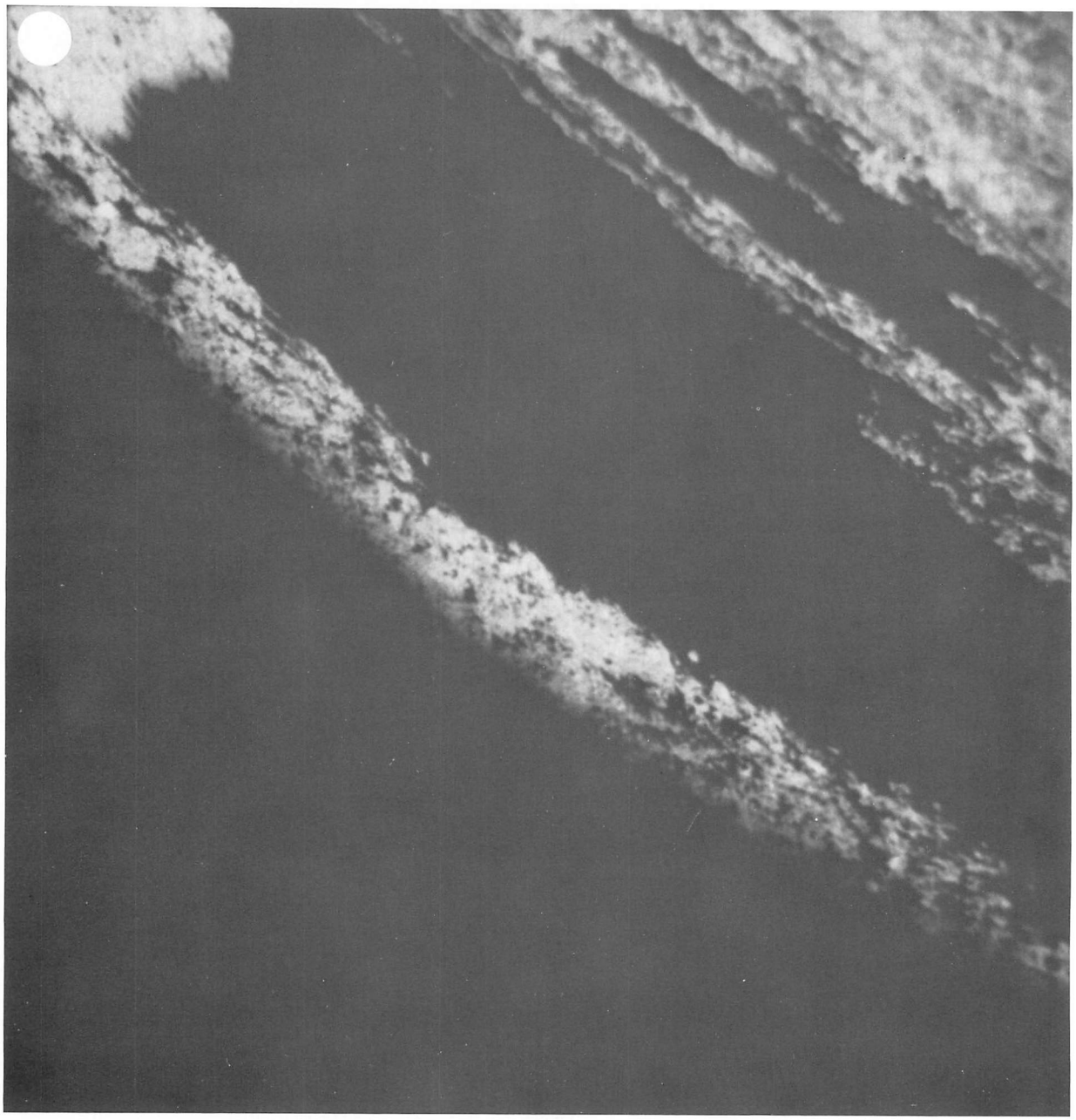


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(141)	Day 266, 14:19:44	−66	−20	3.5	f/16.3	W	Clear

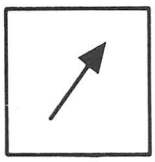


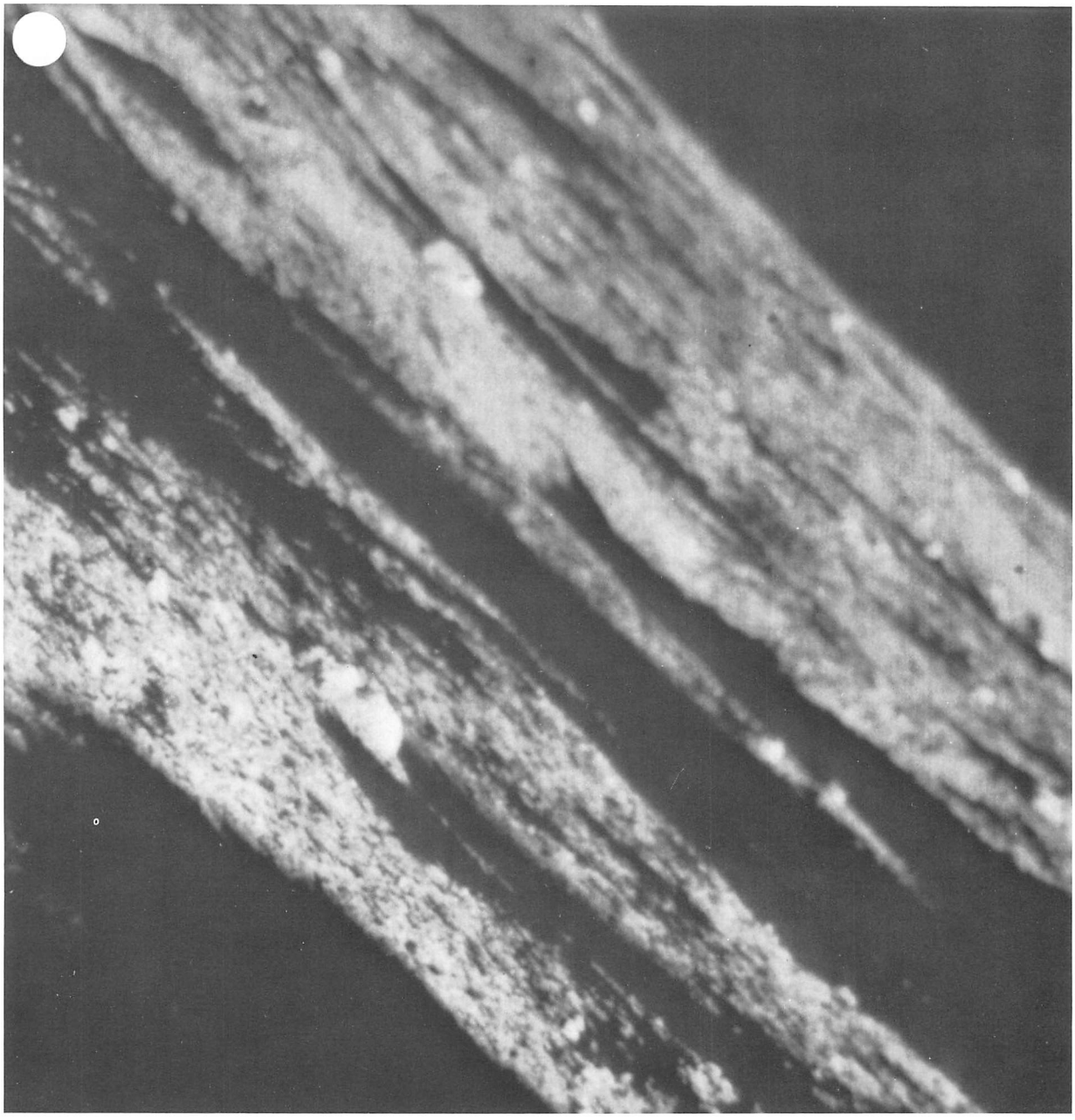
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(142)	Day 267, 06:32:34	−147	−35	4.6	f/12.1	N	Green



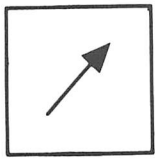


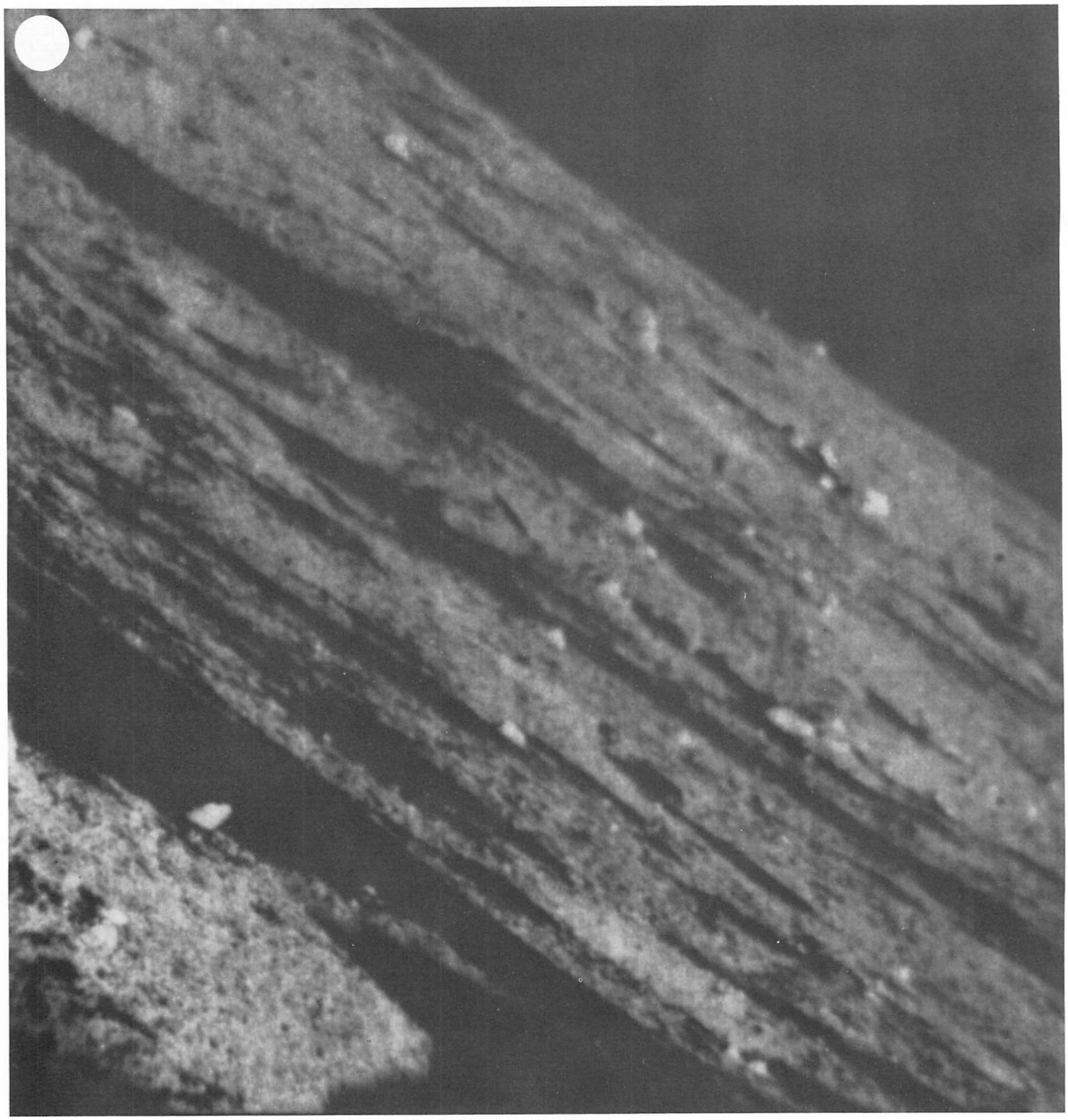
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(143)	Day 267, 06:37:55	−108	−30	4.6	f/12.1	N	Green



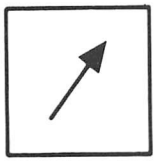


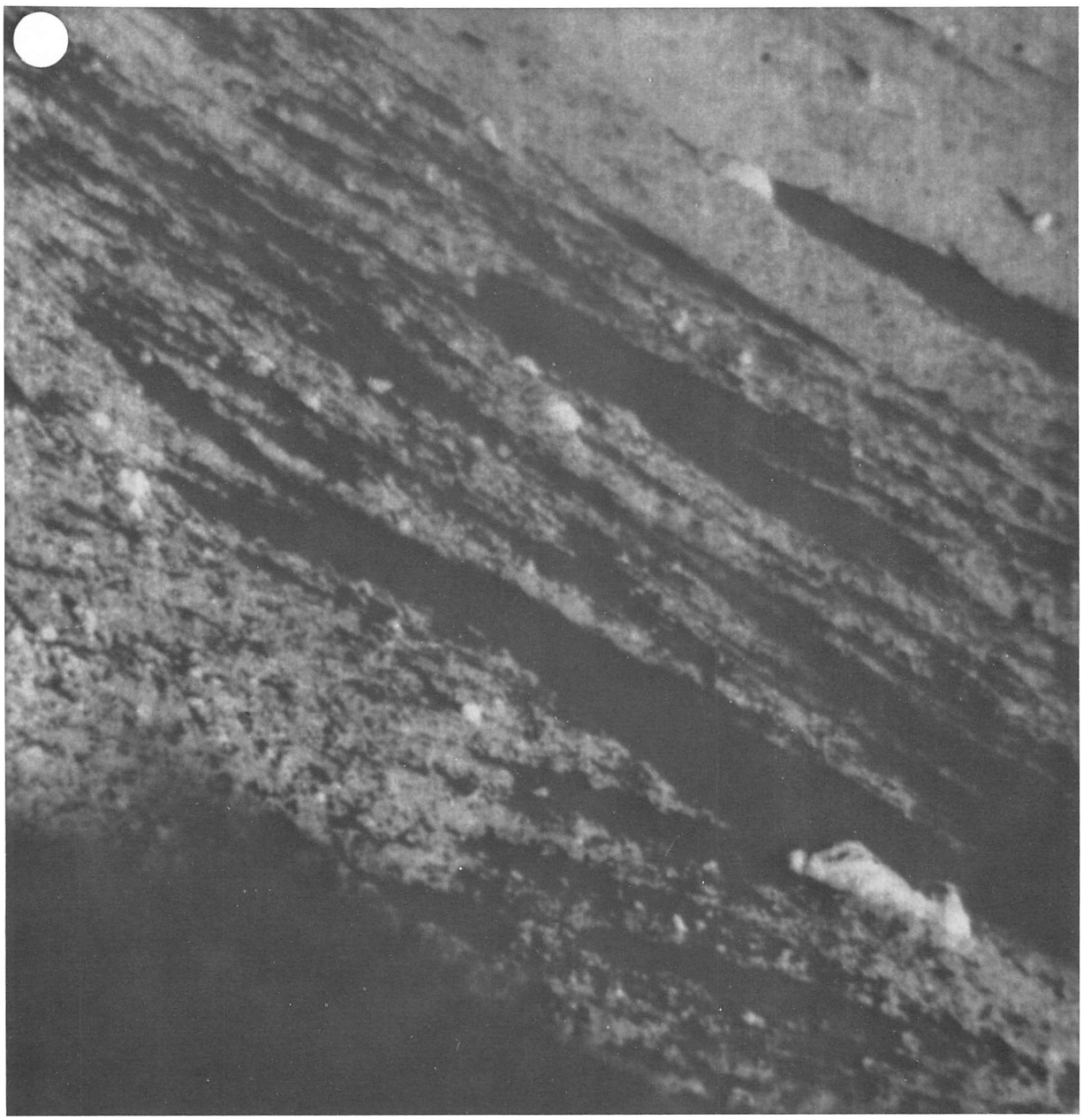
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(144)	Day 267, 06:38:05	−120	−30	4.5	f/12.1	N	Green



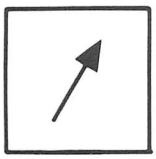


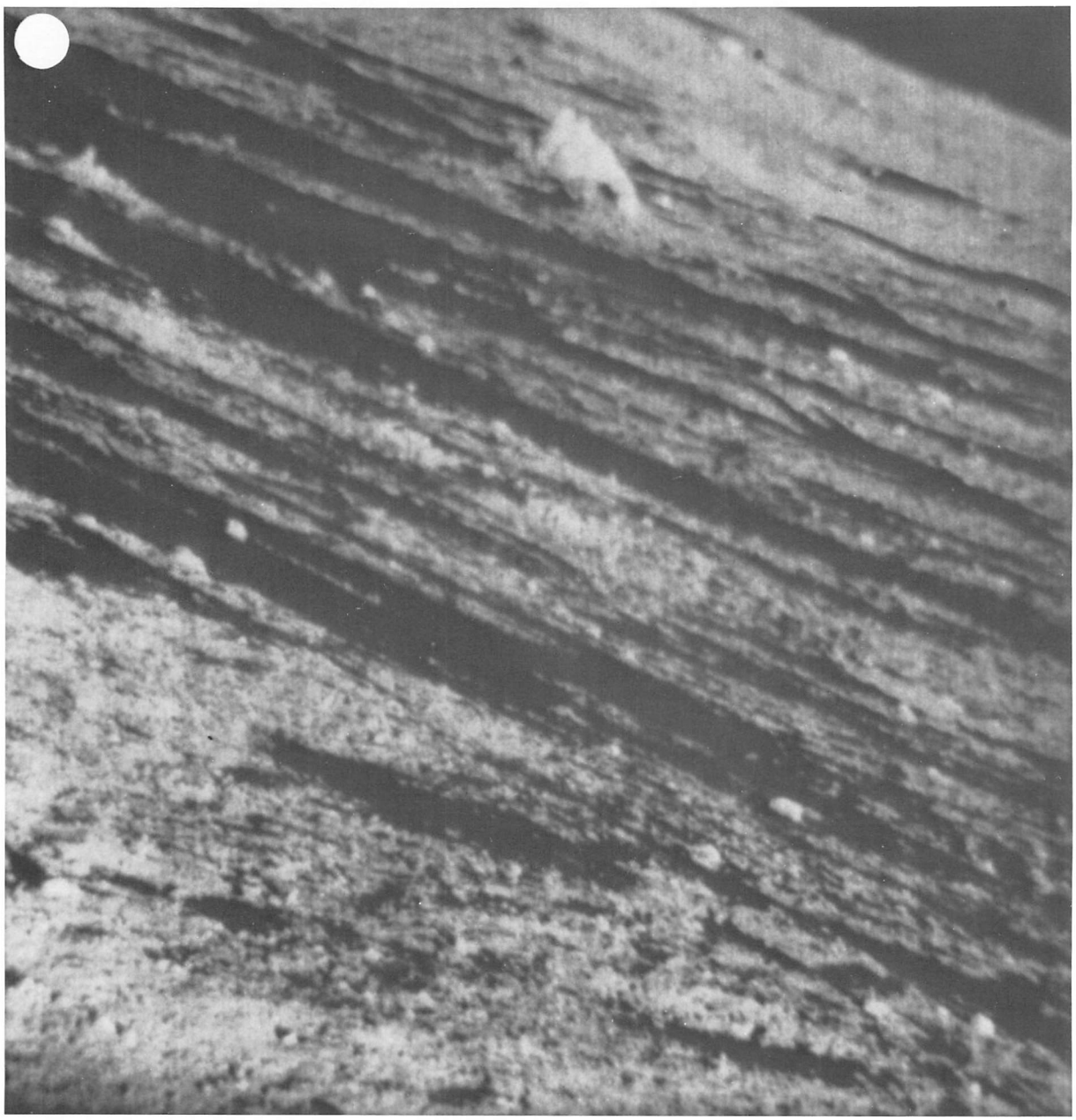
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(145)	Day 267, 06:41:37	−105	−25	4.5	f/17.3	N	Green



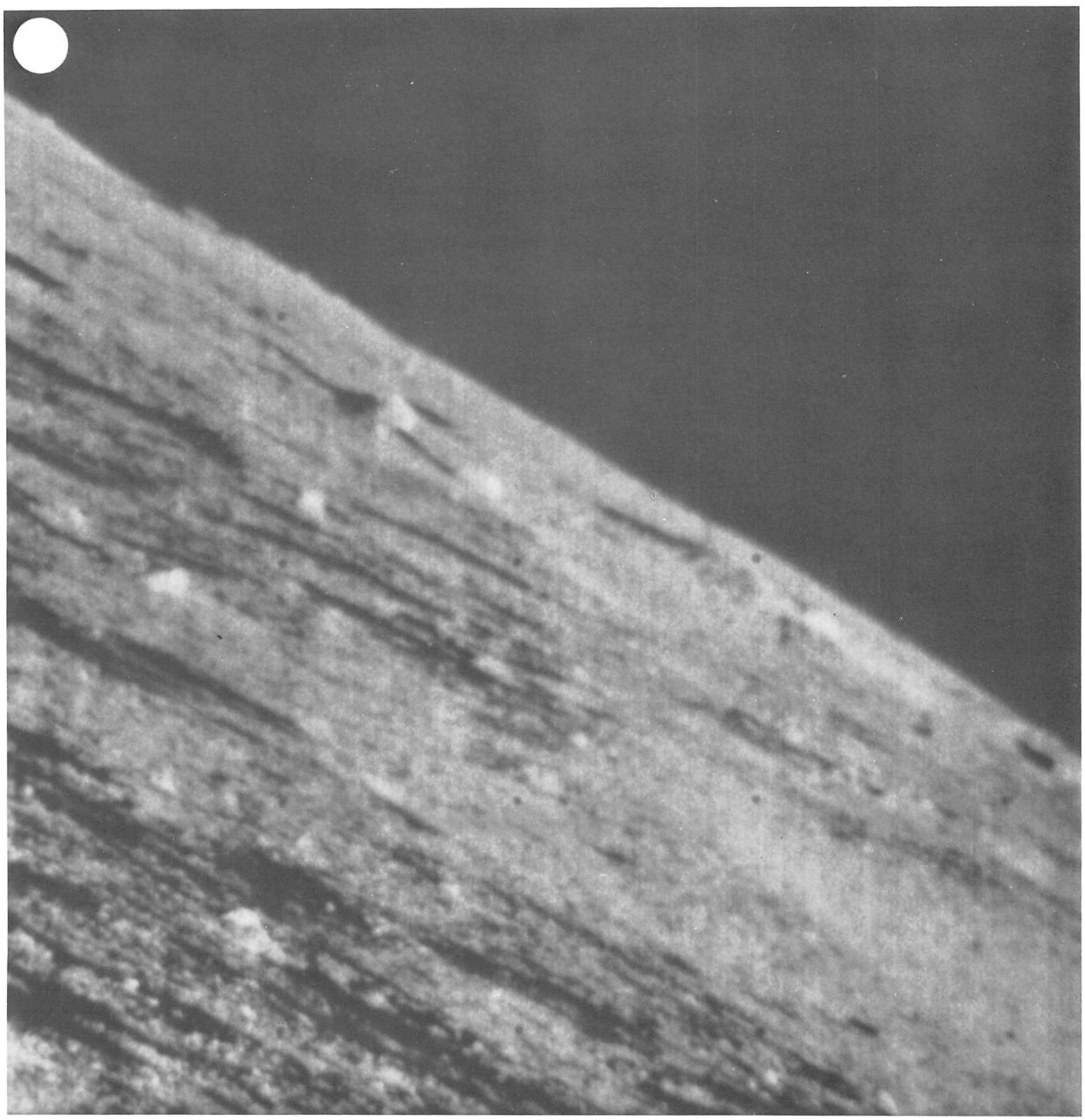


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(146)	Day 267, 06:41:41	−99	−25	4.6	f/17.3	N	Green

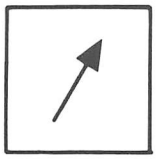


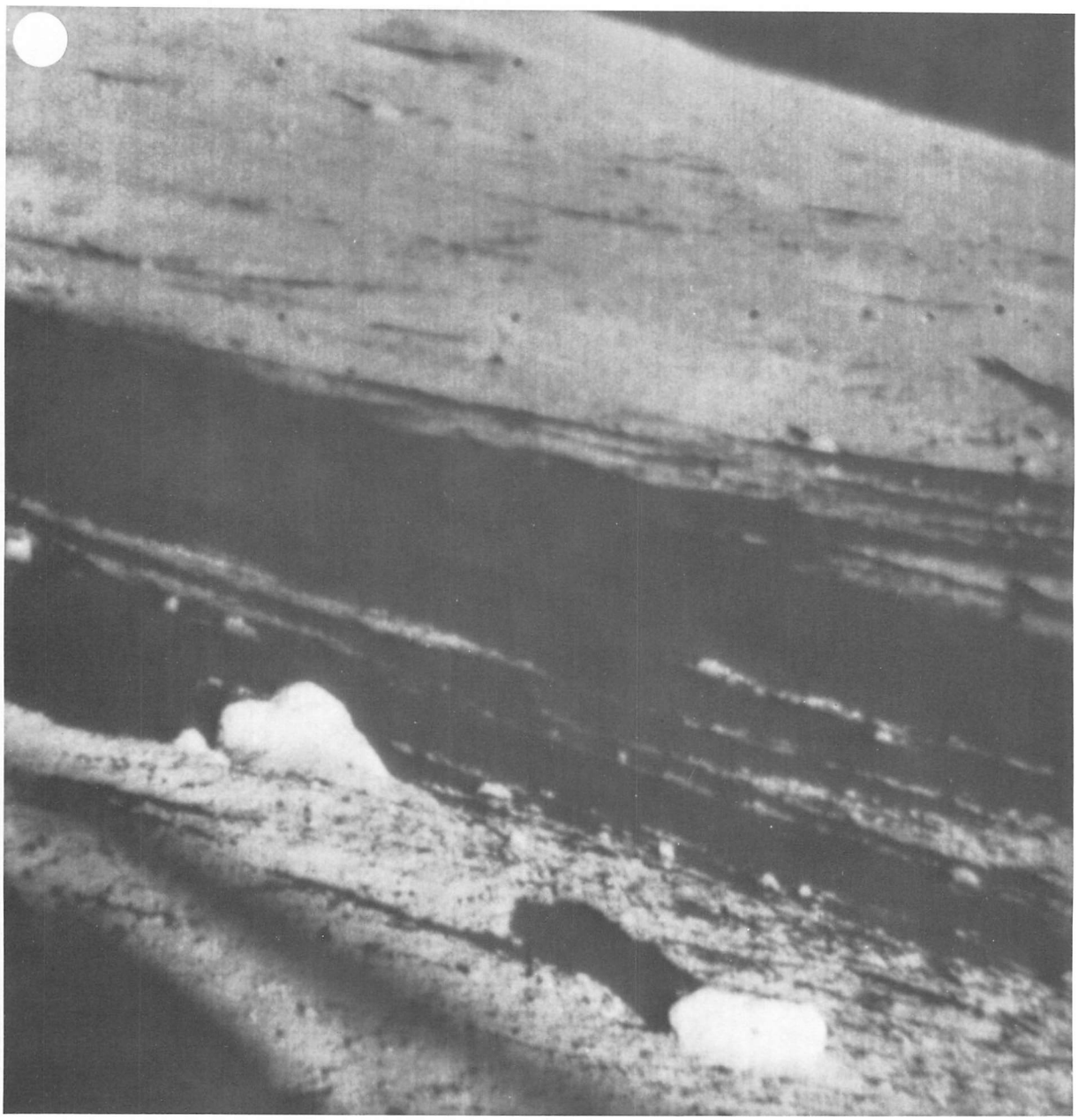


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(147)	Day 267, 06:42:17	−90	−20	4.5	f/17.3	N	Green

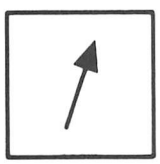


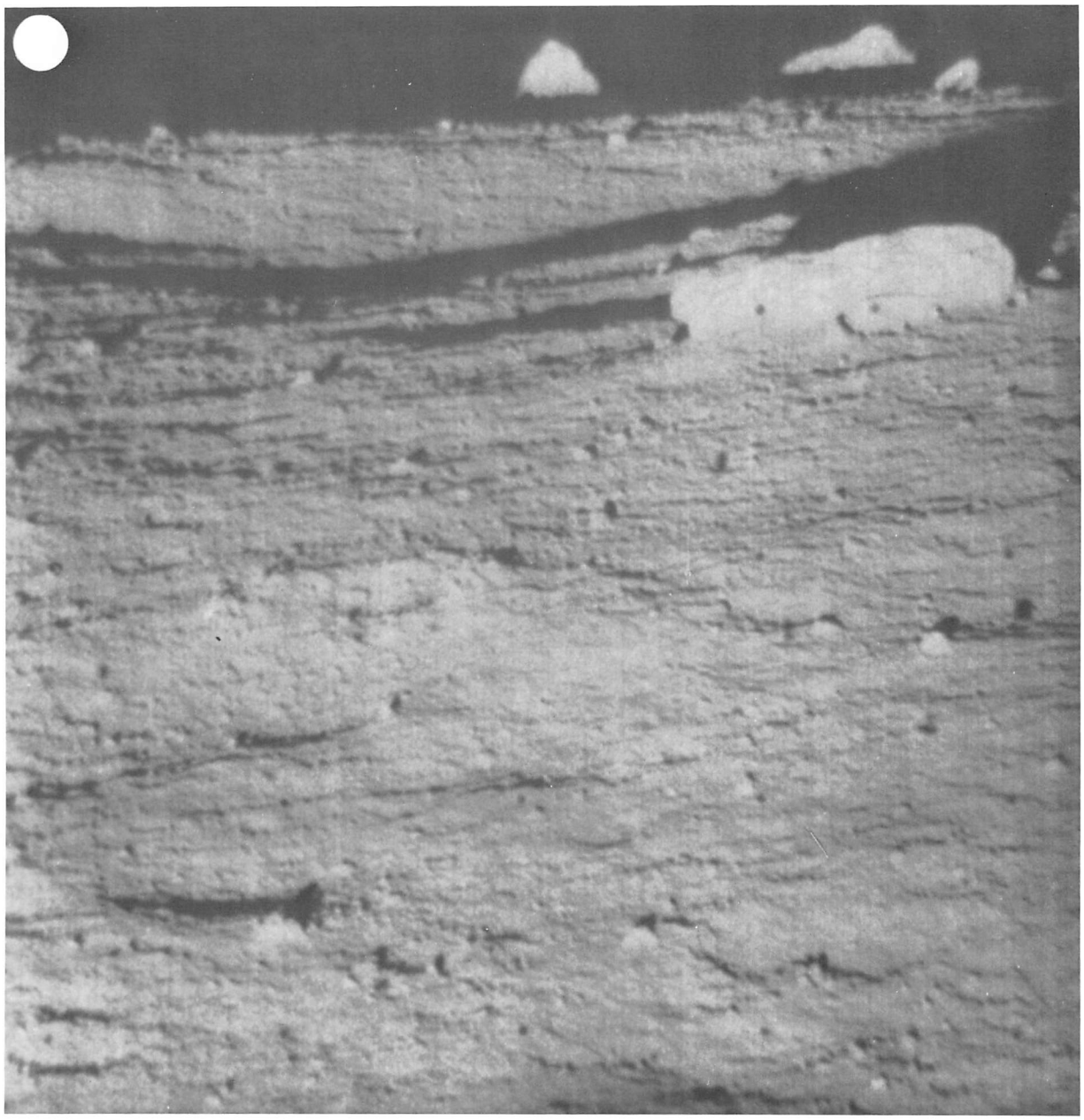
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(148)	Day 267, 06:42:22	−96	−20	4.6	f/17.3	N	Green



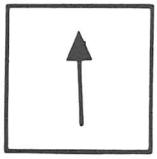


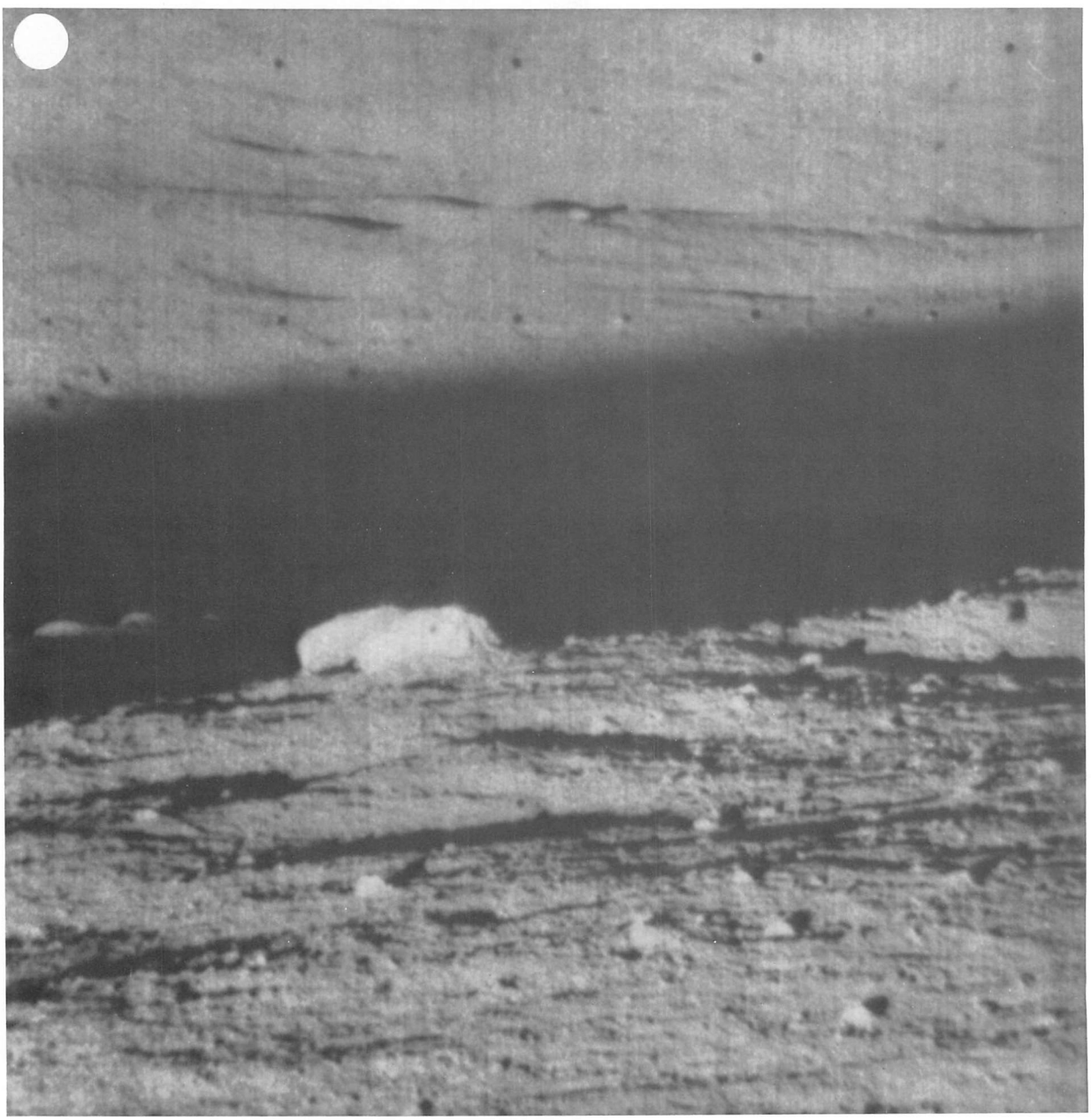
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(149)	Day 267, 06:42:49	−81	−15	4.6	f/24.9	N	Green



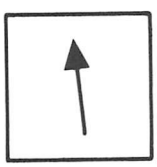


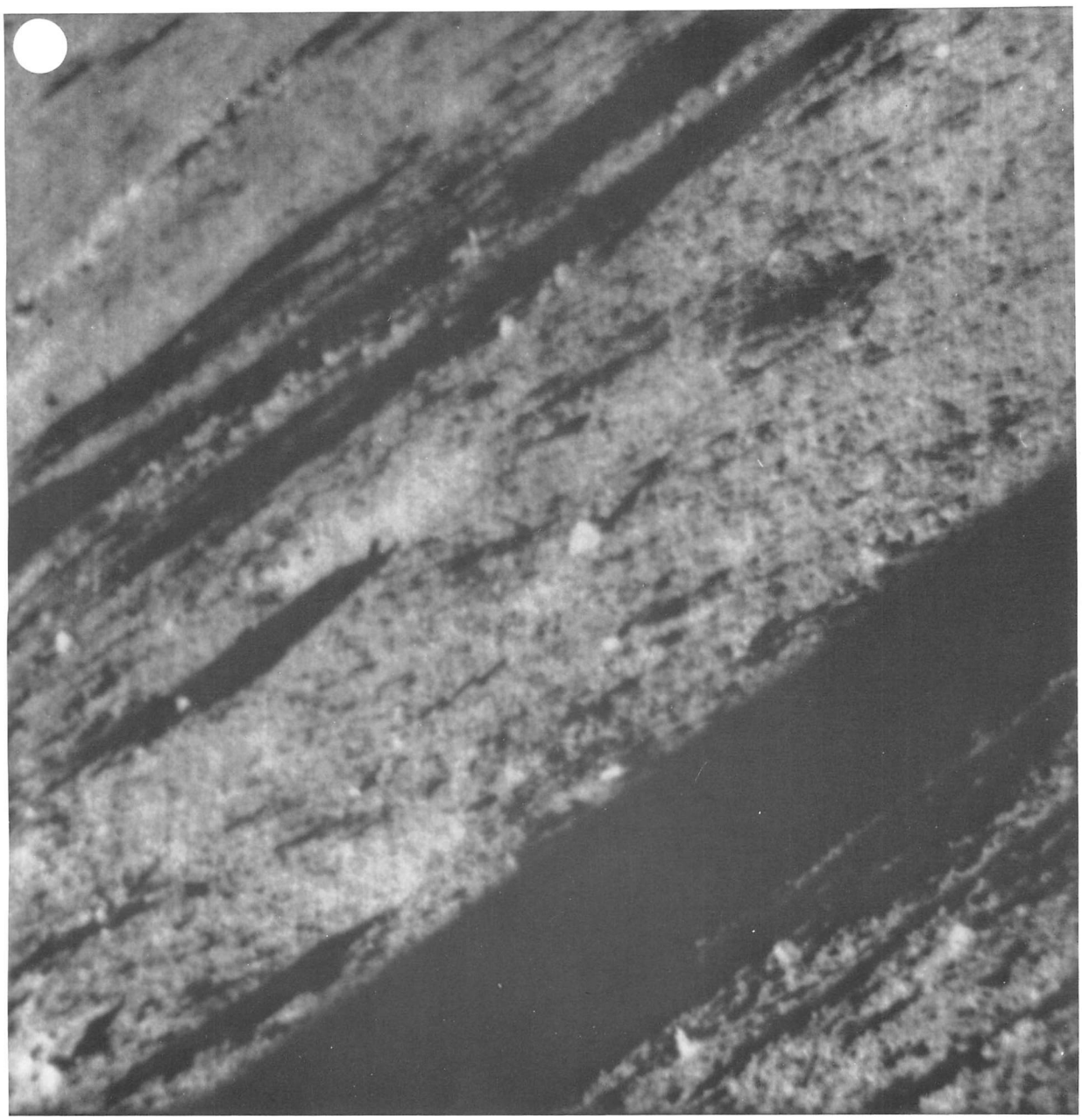
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(150)	Day 267, 06:47:41	−57	−5	4.6	f/23.4	N	Green



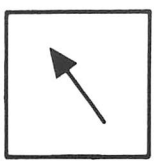


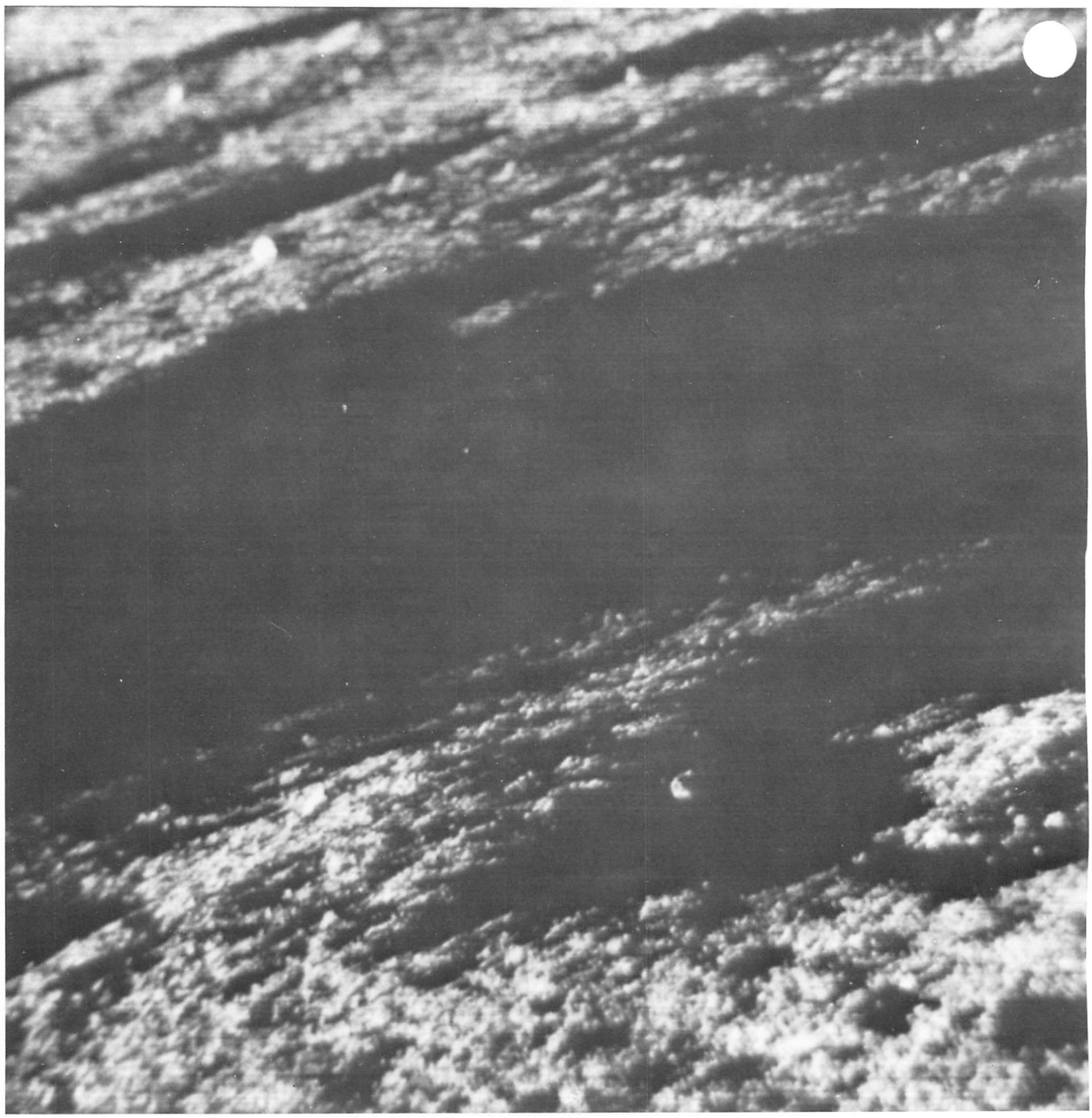
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(151)	Day 267, 06:48:21	−54	−5	4.7	f/23.4	N	Green



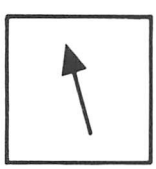


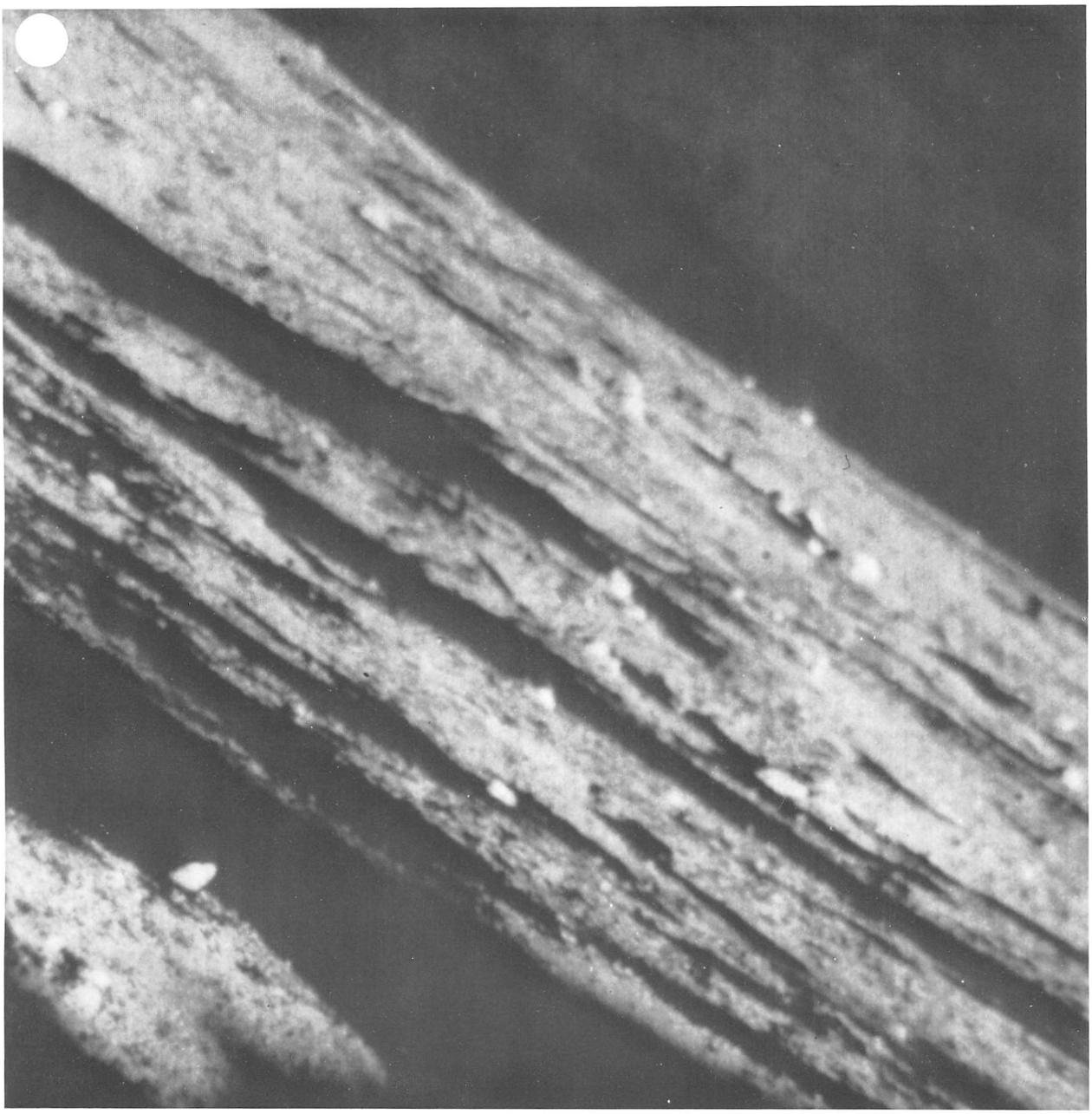
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(152)	Day 267, 06:55:18	−27	15	4.6	f/16.6	N	Green



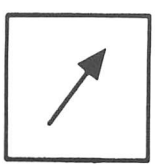


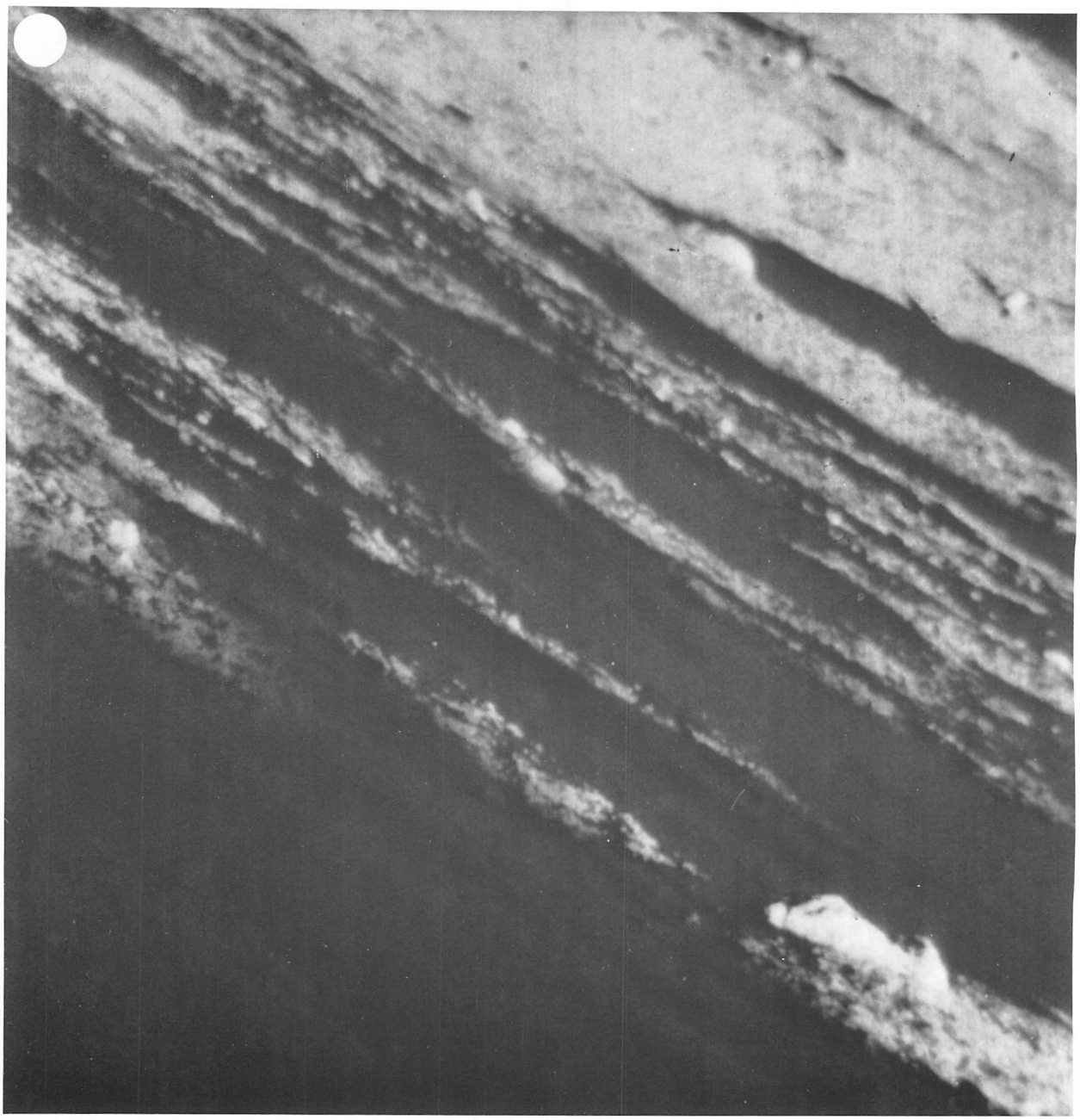
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(153)	Day 267, 07:00:53	21	25	4.6	f/11.6	N	Green



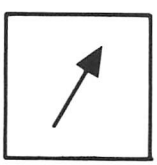


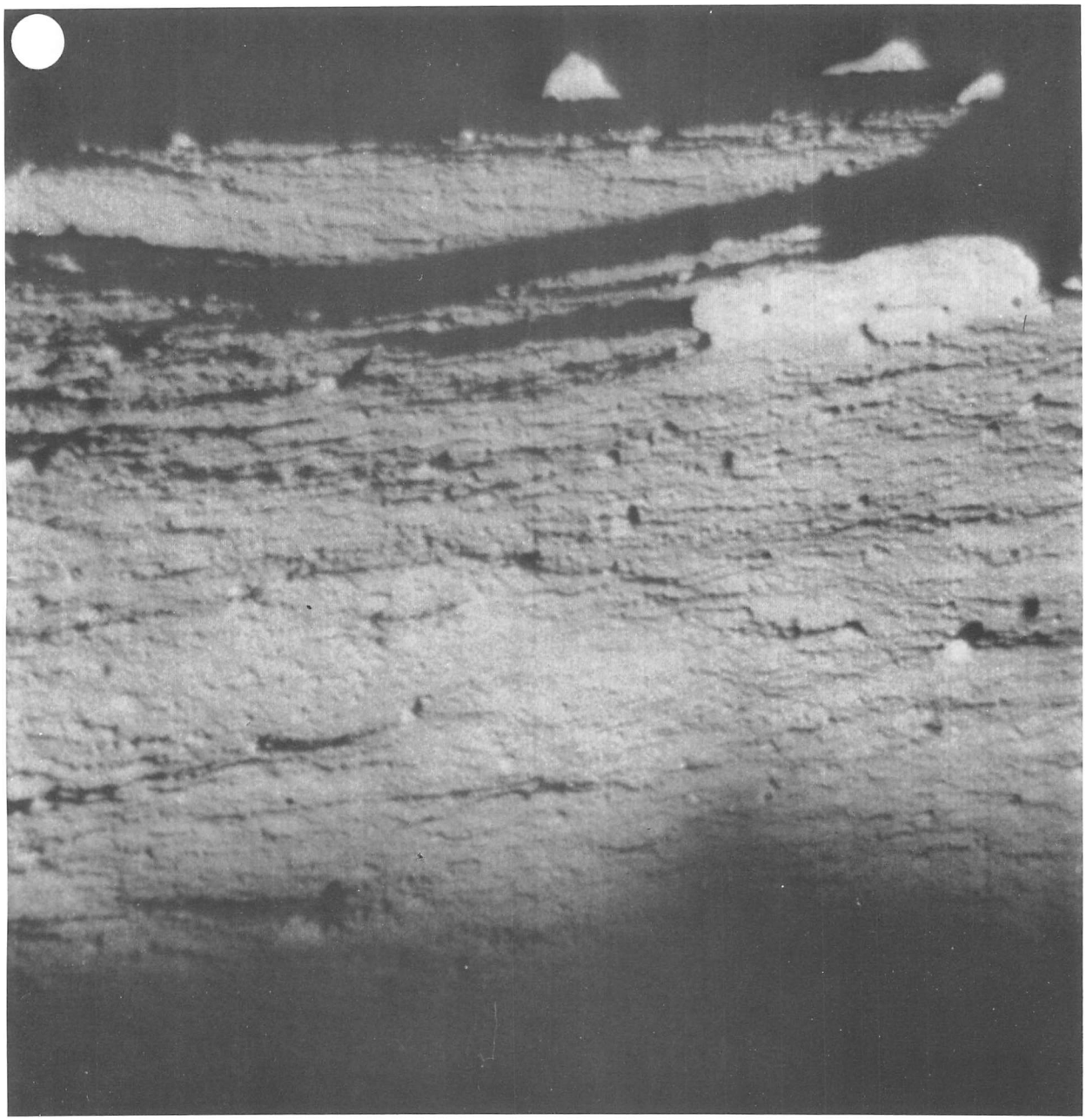
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(154)	Day 267, 08:10:39	−105	−25	4.6	*f*/16.5	N	Green



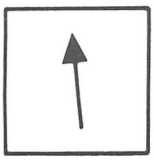


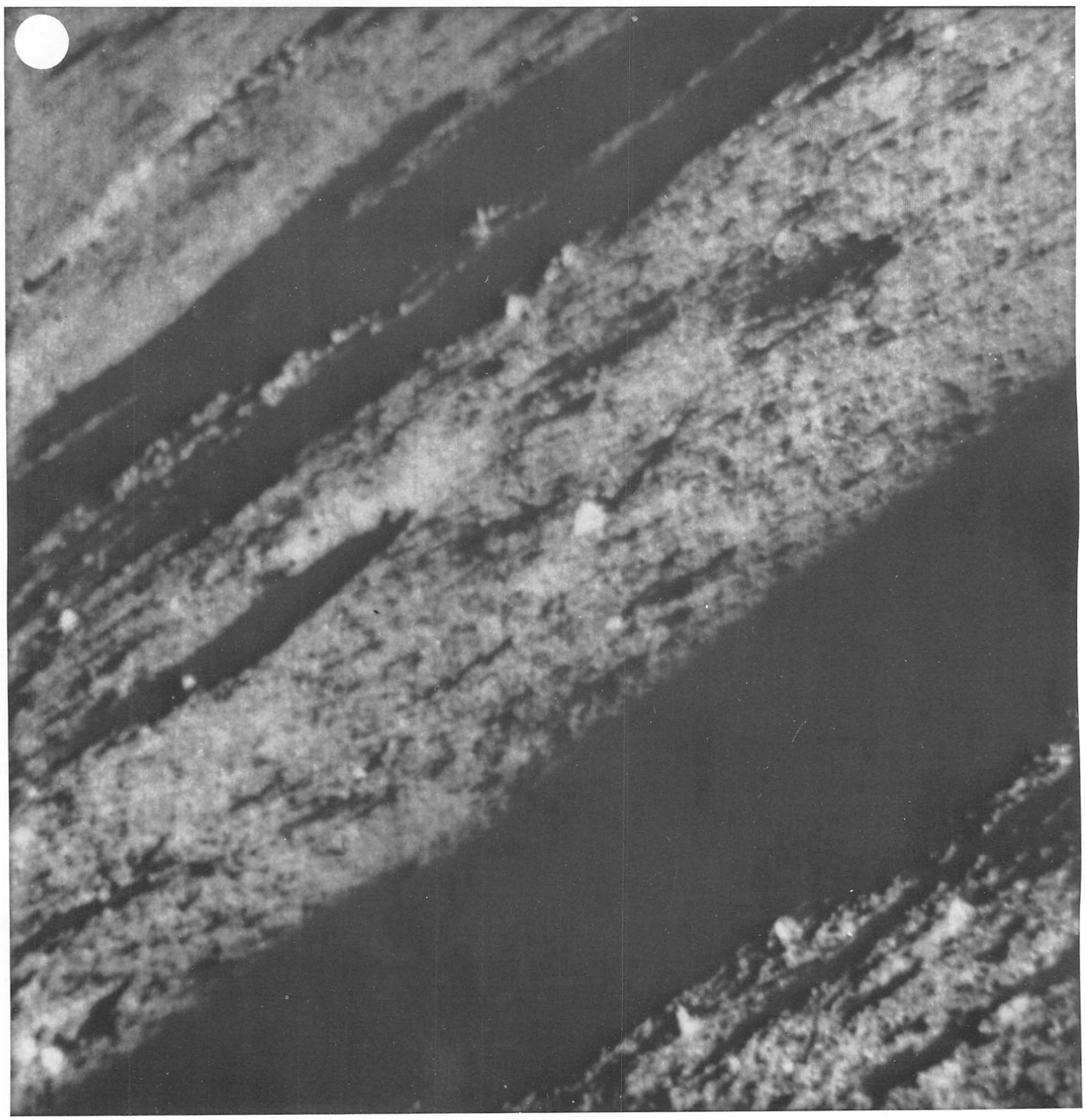
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(155)	Day 267, 08:10:44	−99	−25	4.1	f/15.8	N	Green



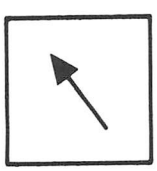


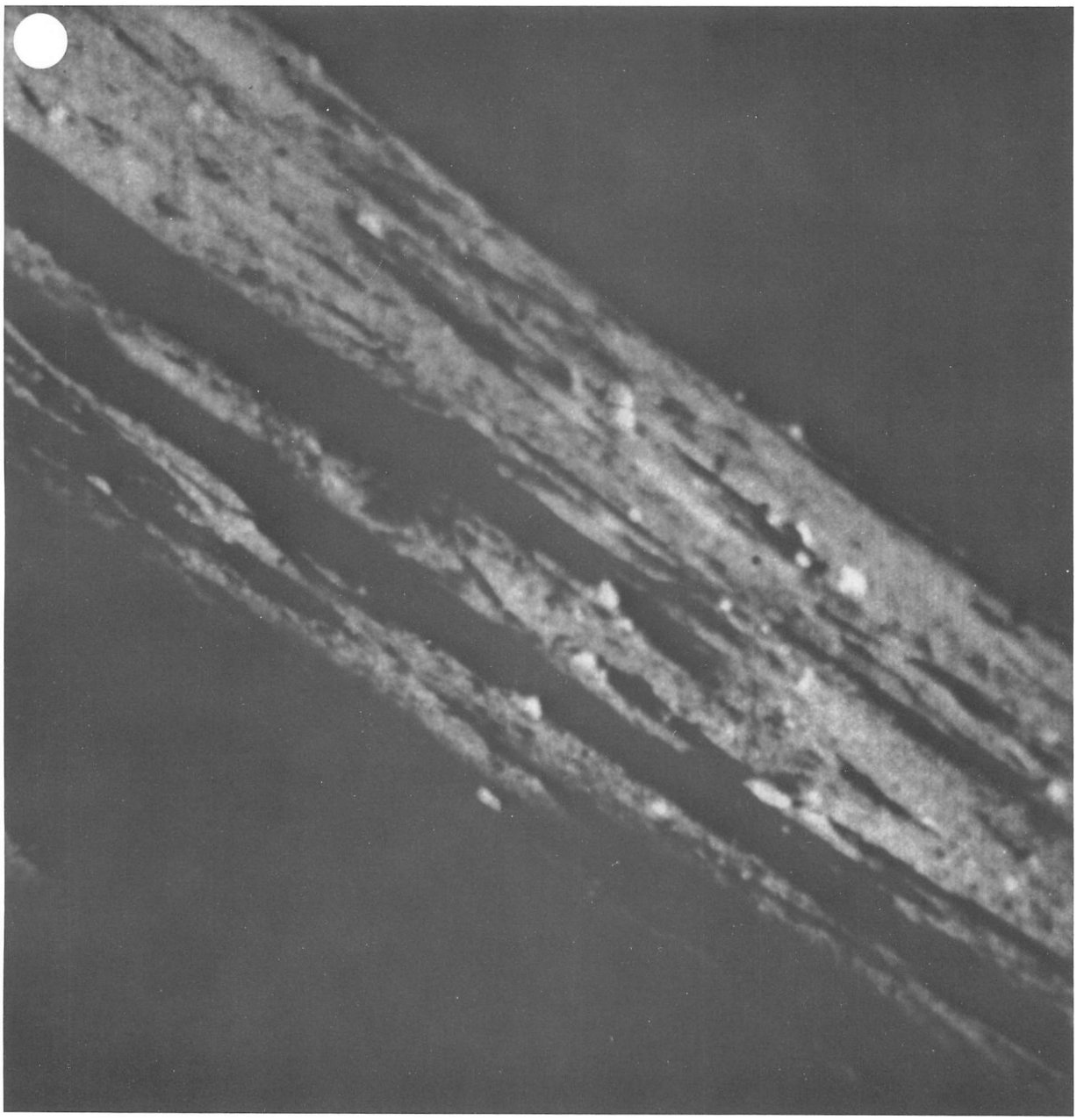
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(156)	Day 267, 08:16:34	−54	−5	4.6	f/23.2	N	Green



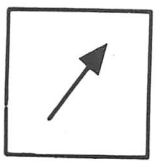


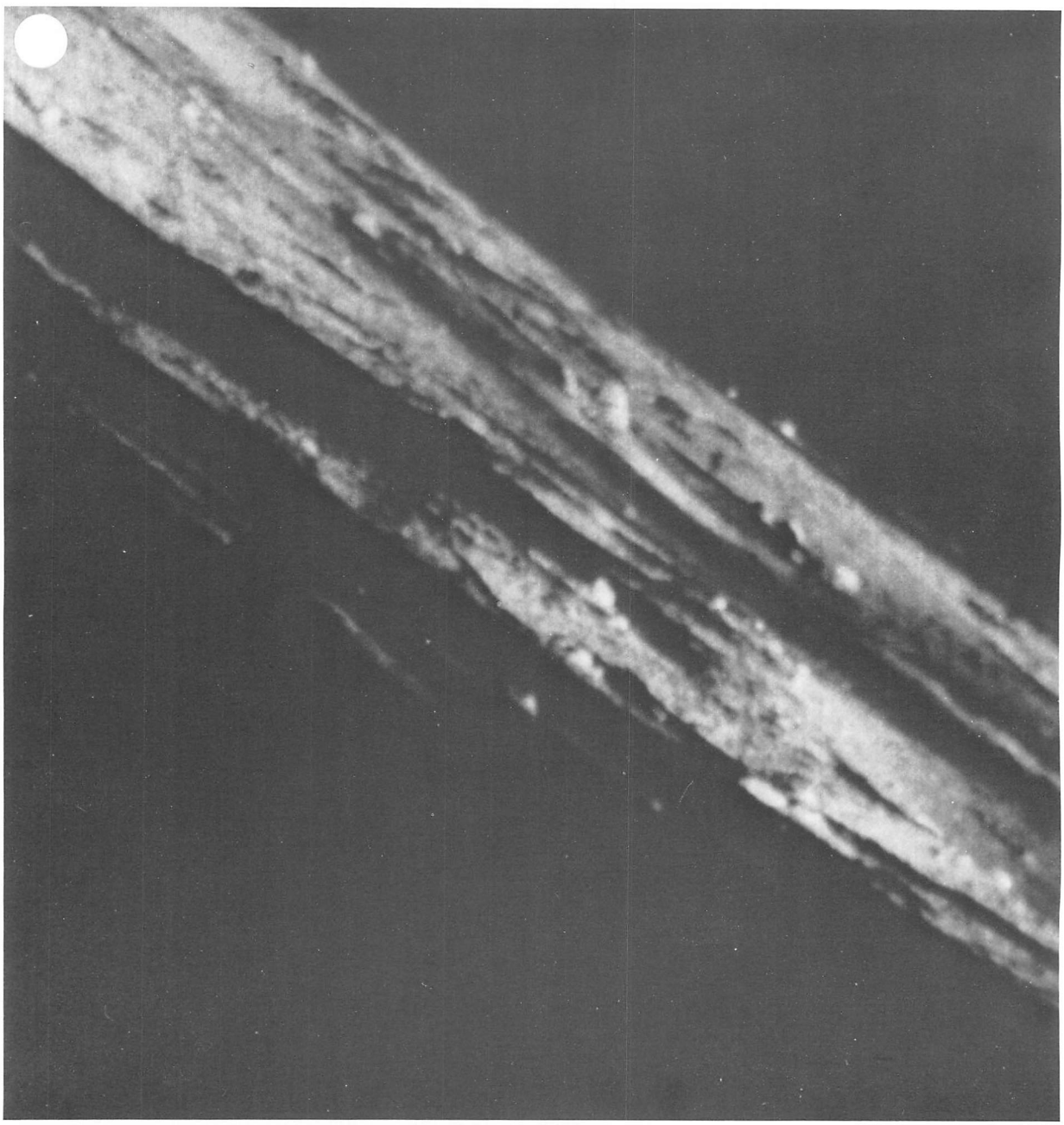
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(157)	Day 267, 08:25:32	−27	15	4.5	*f*/16.5	N	Green



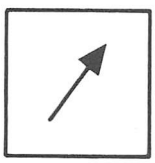


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(158)	Day 267, 09:10:39	−105	−25	4.5	f/16.5	N	Green

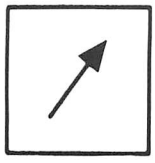




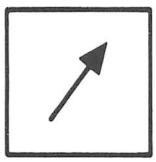
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(159)	Day 267, 10:02:52	−105	−25	4.5	f/16.5	N	Green



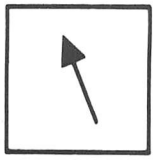
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(160)	Day 267, 11:08:32	114	5	4.5	f/23.2	N	Green

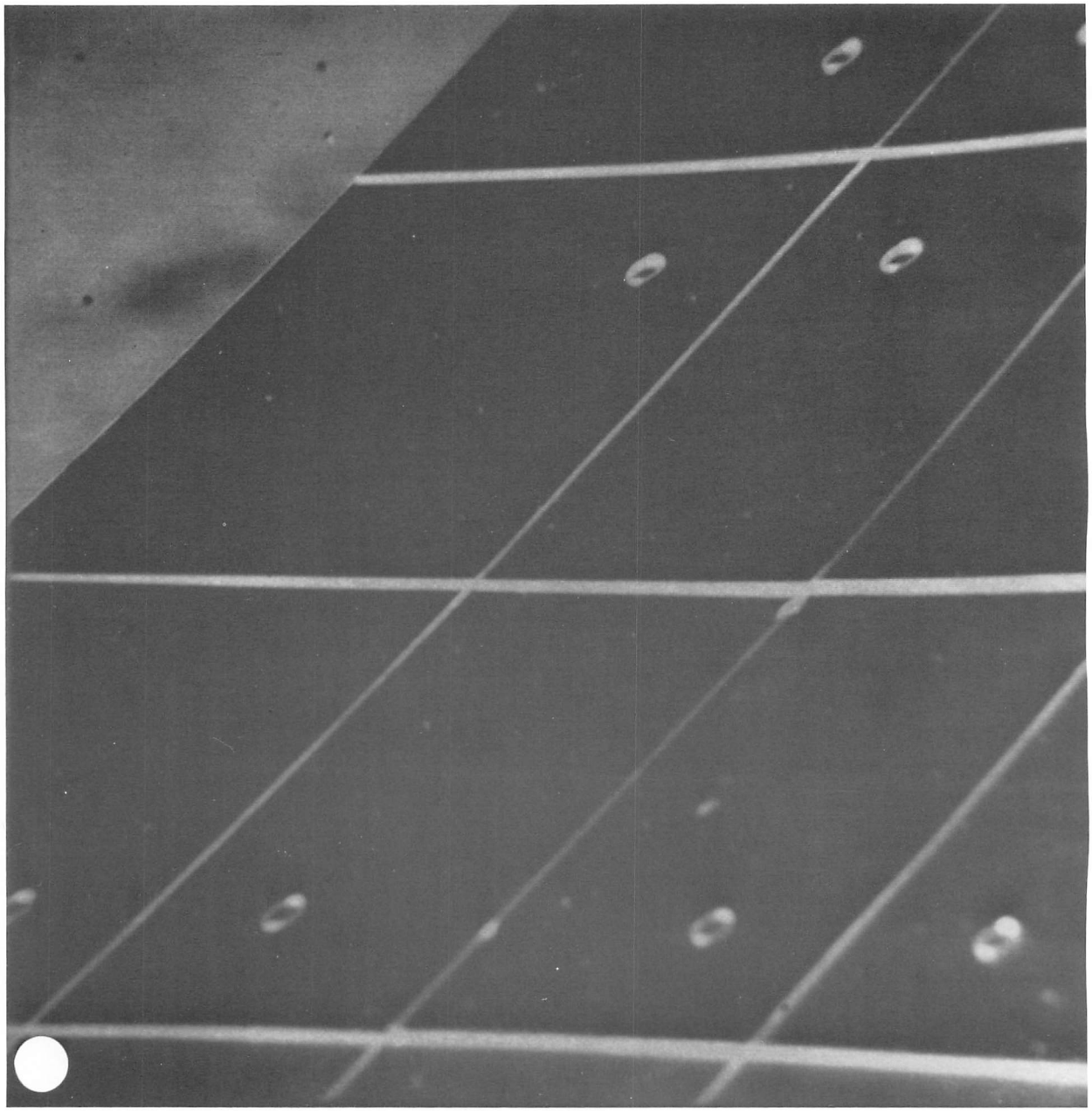


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(161)	Day 267, 11:12:42	114	5	4.5	f/23.2	N	Green

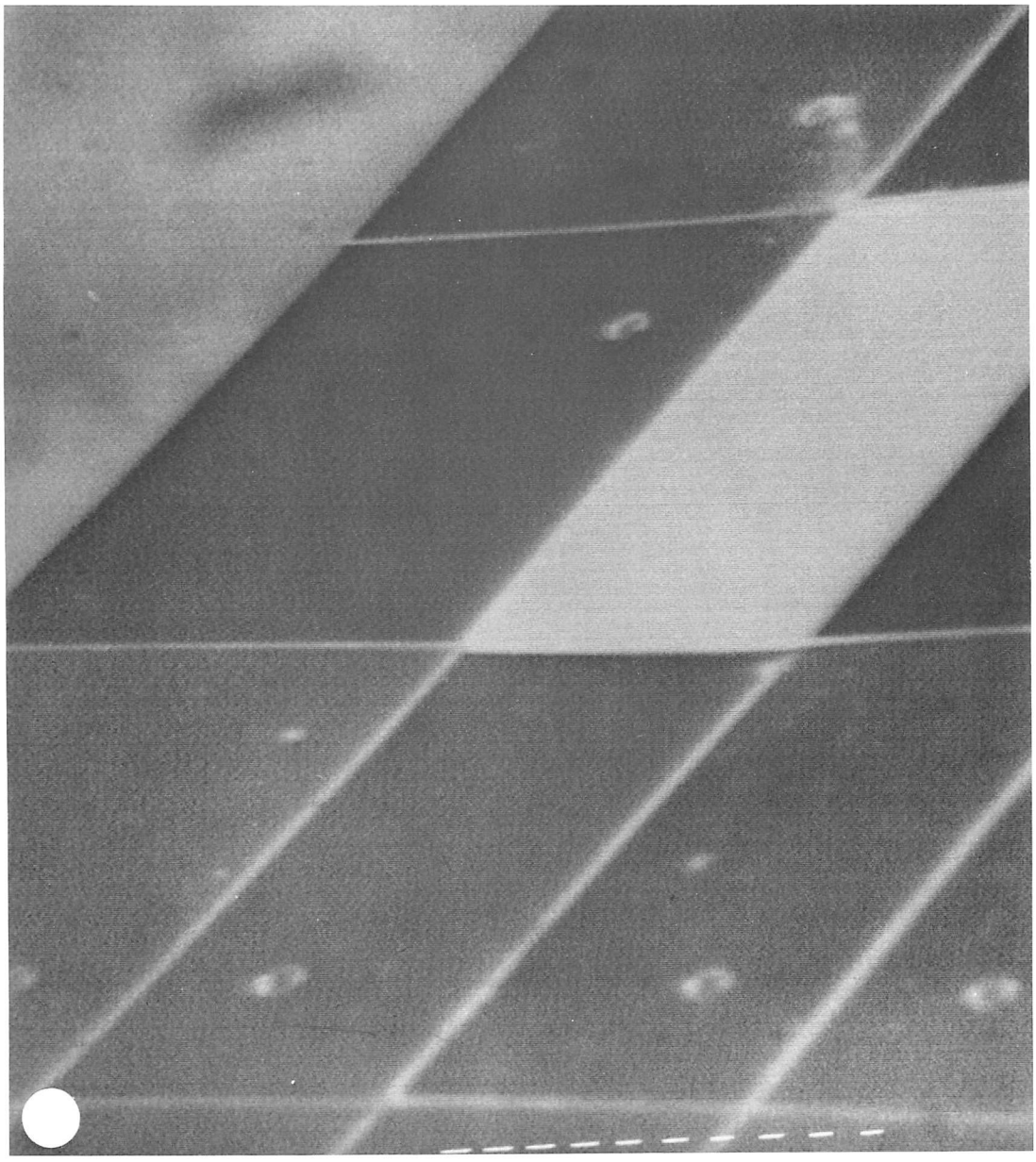


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(162)	Day 290, 03:15:06	−171	−45	1.3	f/11.5	W	Clear

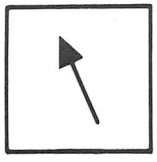




	GMT	Az	El	Focus, m	Iris	Lens	Filter
(163)	Day 255, 02:37:53	−165	−35	1.5	*f*/11.6	N	Clear



	GMT	Az	El	Focus, m	Iris	Lens	Filter
(164)	Day 294, 06:34:20	−165	−35	1.5	f/11.6	N	Clear



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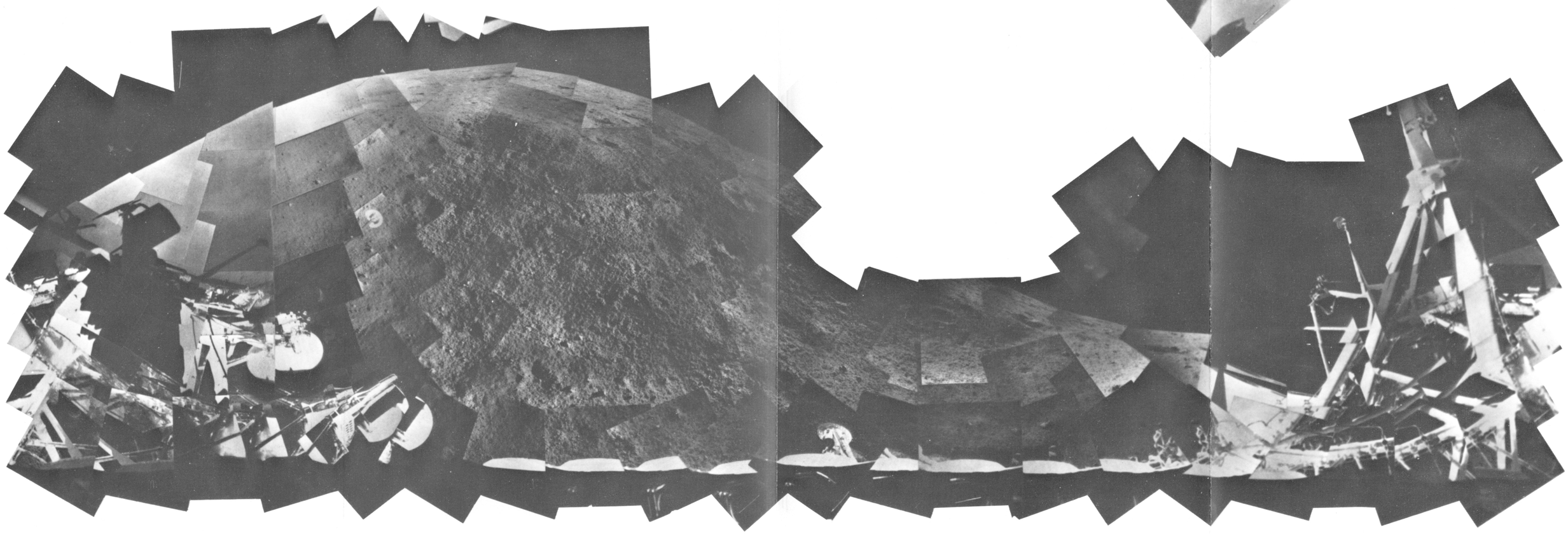
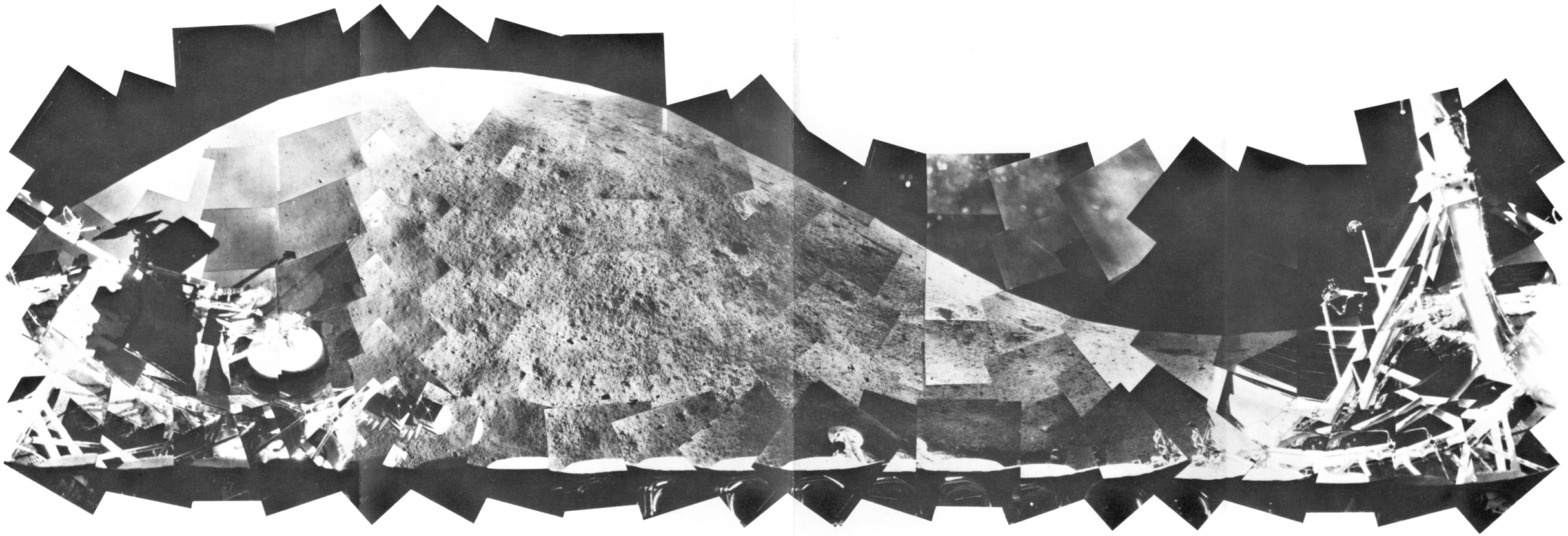


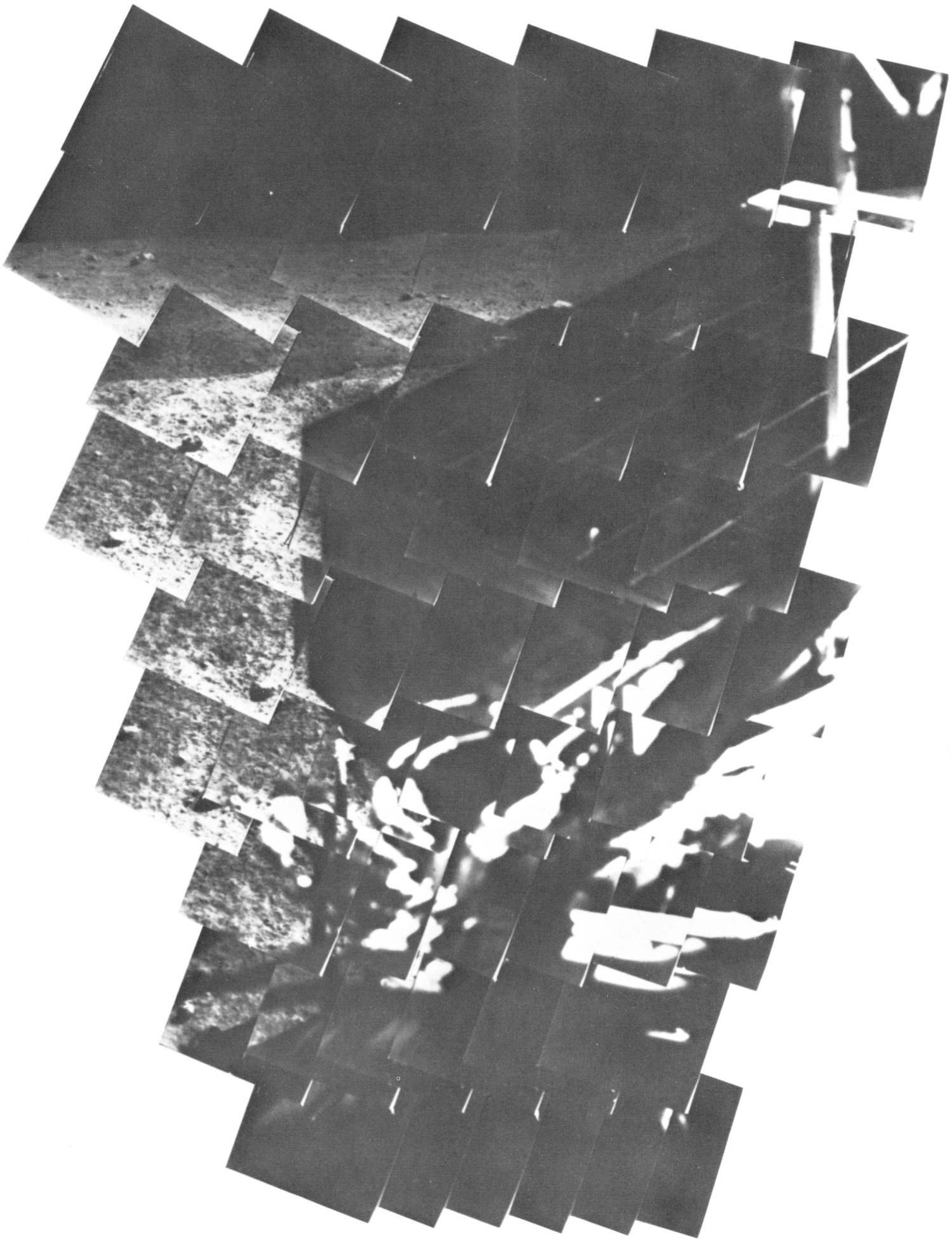
		Azimuth	Lens focal length	Identification
(1)	Day 254	−216 to +126	Wide angle	Catalog No. 5-26-SI; 360 pan; semi-improved mosaic



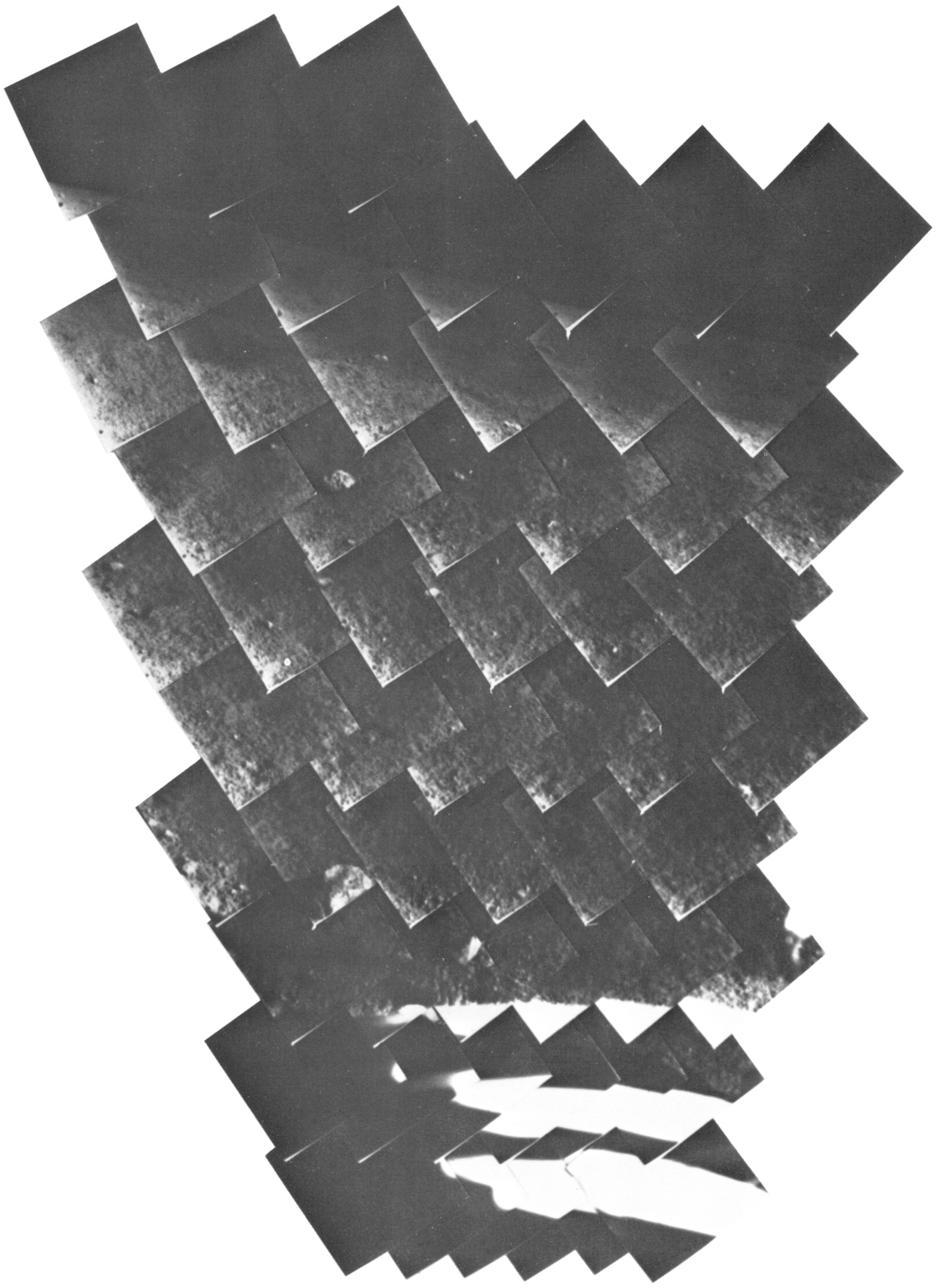
		Azimuth	Lens focal length	Identification
(2)	Day 254	−216 to +126	Wide angle	Catalog No. 5-3-SI; 360 pan; semi-improved mosaic

		Azimuth	Lens focal length	Identification
(3)	Day 258	−216 to +126	Wide angle	Catalog No. 5-35-SI; 360 pan; semi-improved mosaic

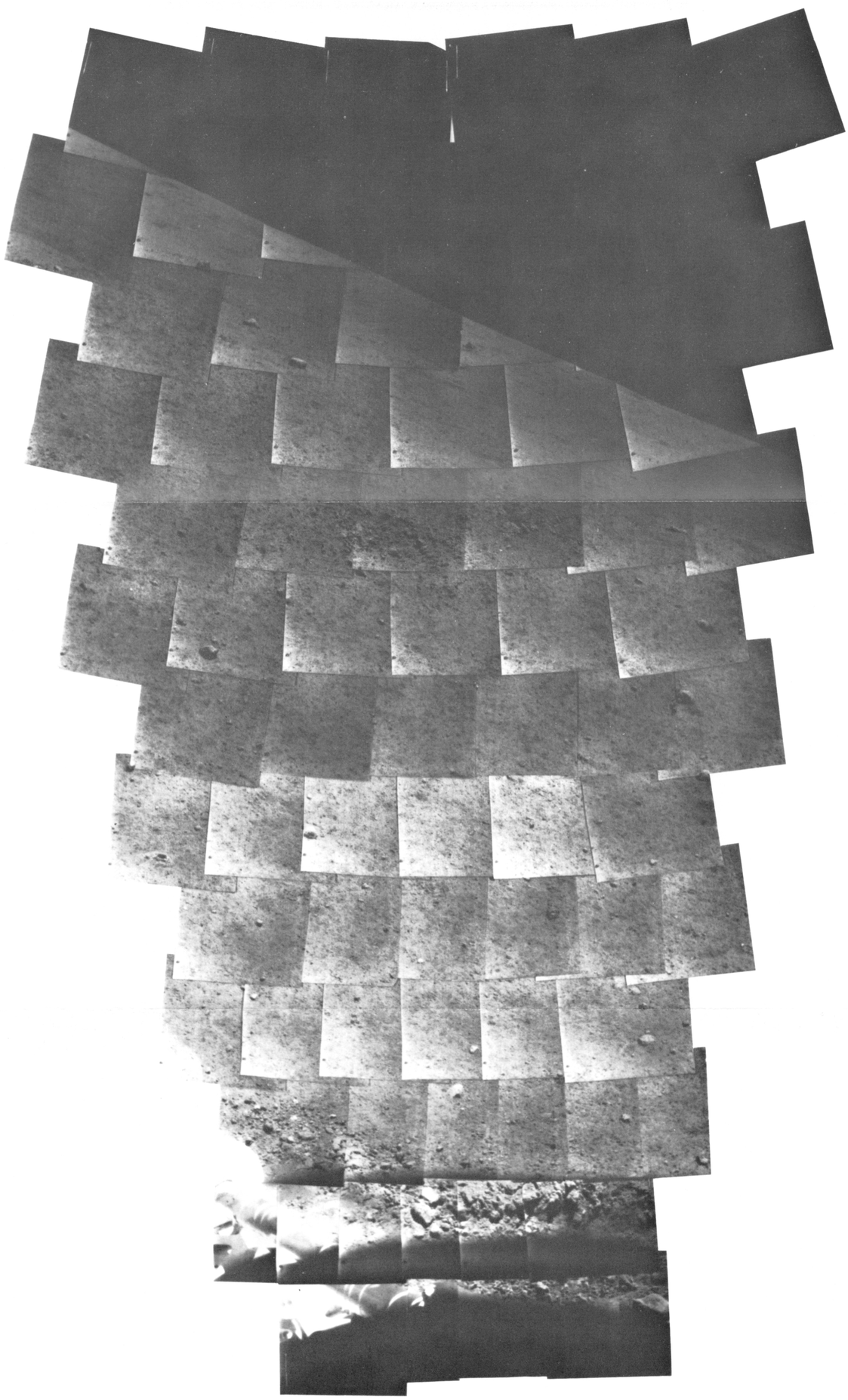
(4) Day 263 Azimuth −177 to −144 Lens focal length Narrow angle Identification **Catalog No. 5-66; operations mosaic**



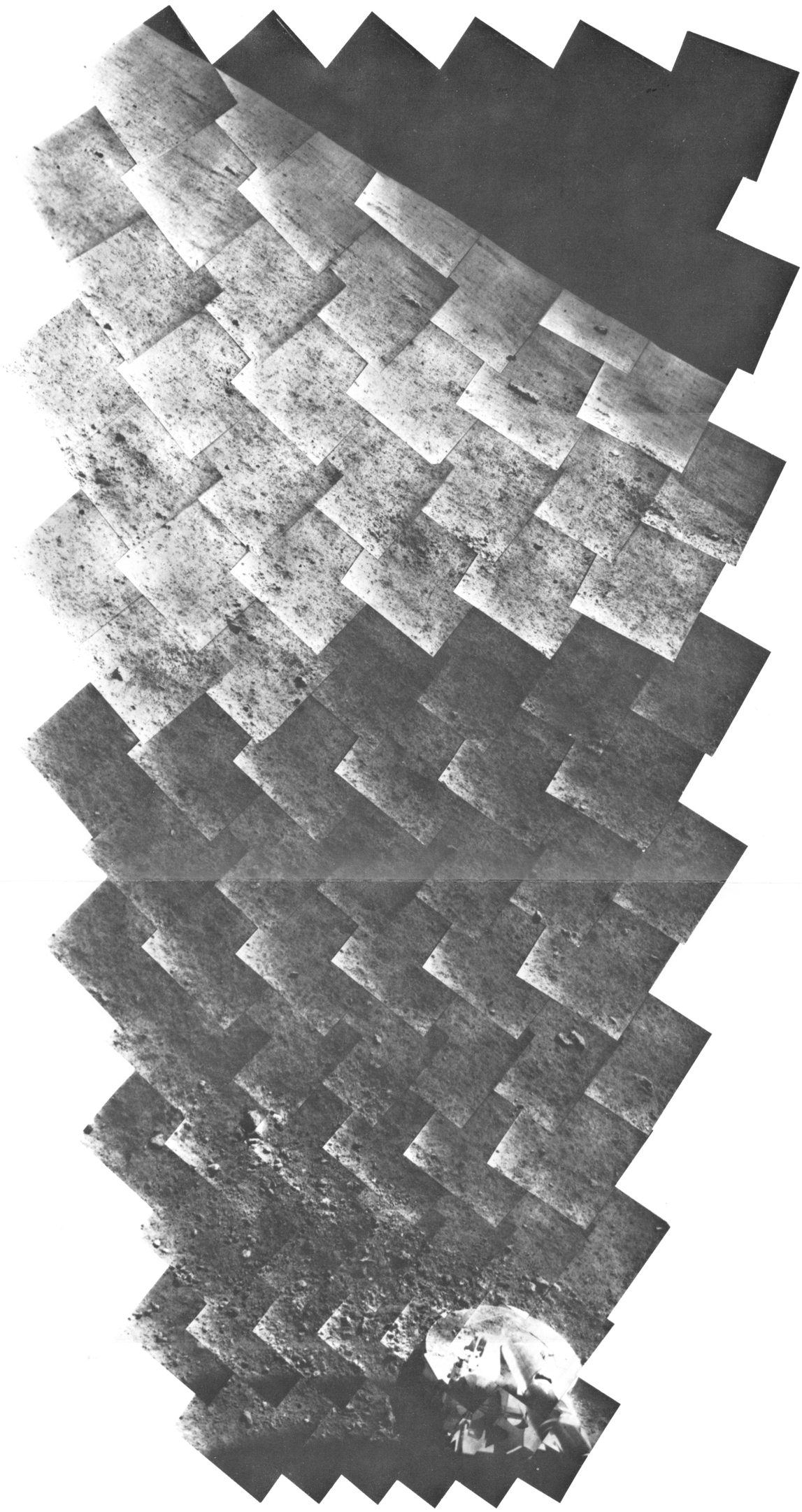
		Azimuth	Lens focal length	Identification
(5)	Day 264	−141 to −108	Narrow angle	Catalog No. 5-88; operations mosaic



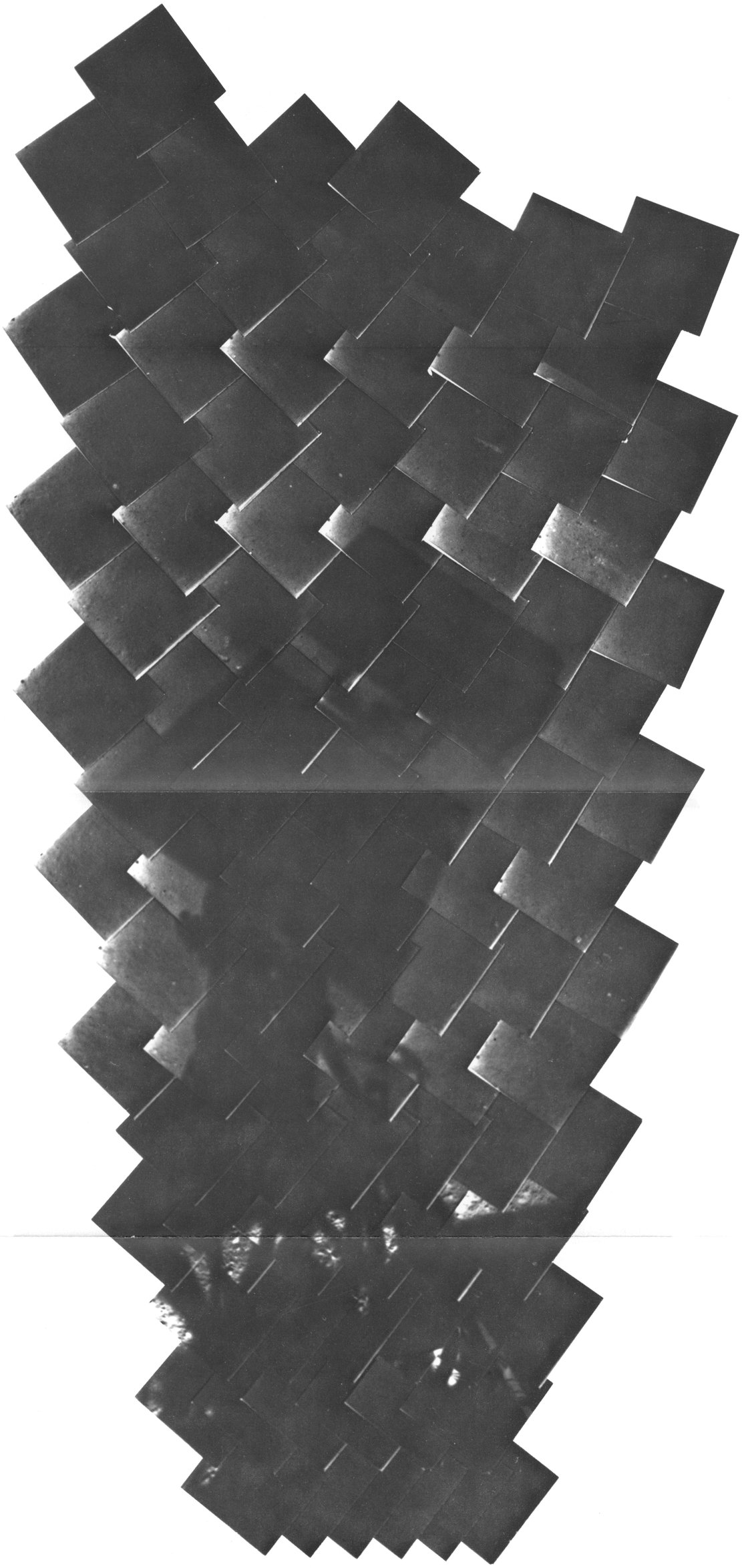
		Azimuth	Lens focal length	Identification
(6)	Day 258	−105 to −72	Narrow angle	Catalog No. 5-41-SI; semi-improved mosaic



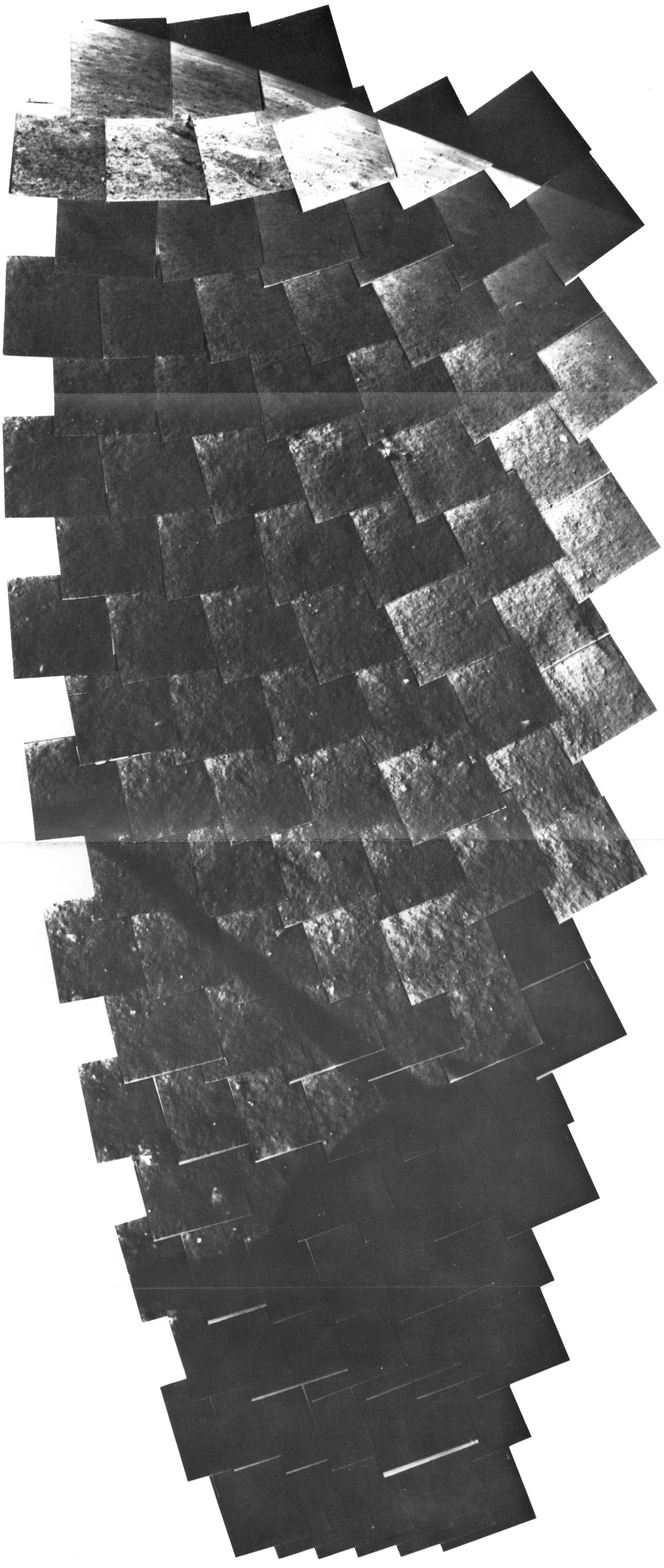
		Azimuth	Lens focal length	Identification
(7)	Day 264	−105 to −72	Narrow angle	Catalog No. 5-87; operations mosaic



		Azimuth	Lens focal length	Identification
(8)	Day 257	−69 to −36	Narrow angle	Catalog No. 5-33-SI; semi-improved mosaic

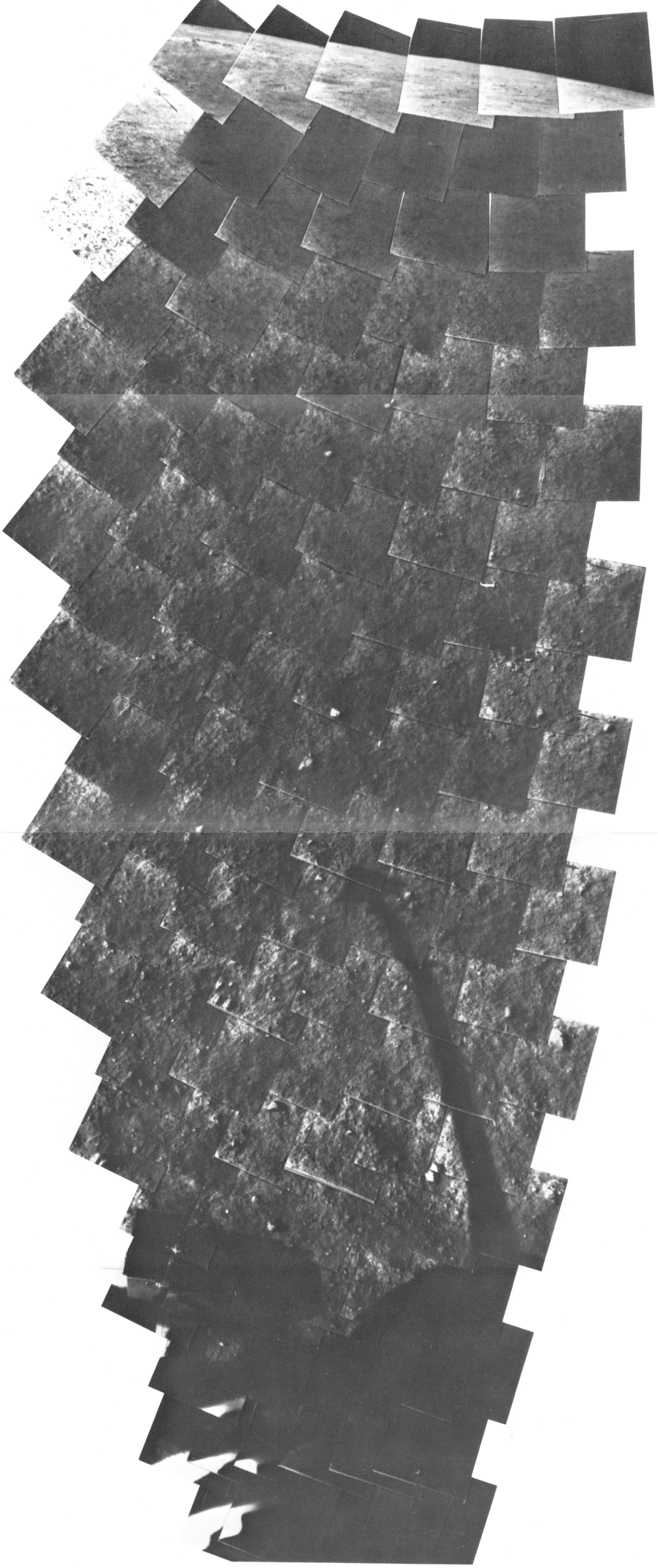


		Azimuth	Lens focal length	Identification
(9)	Day 264	−69 to −36	Narrow angle	Catalog No. 5-89; operations mosaic (zero phase)

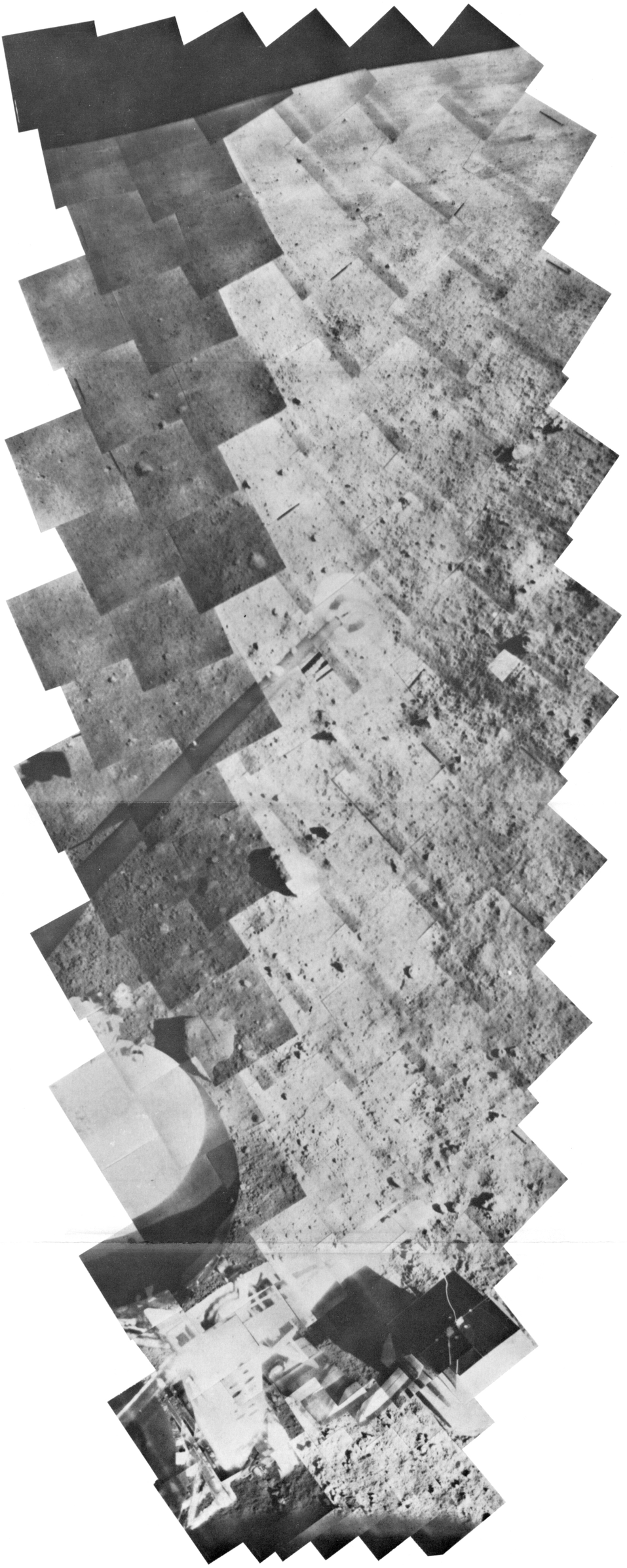


(10) Day 265 | Azimuth −33 to 0 | Lens focal length Narrow angle | Identification Catalog No. 5-111; operations mosaic

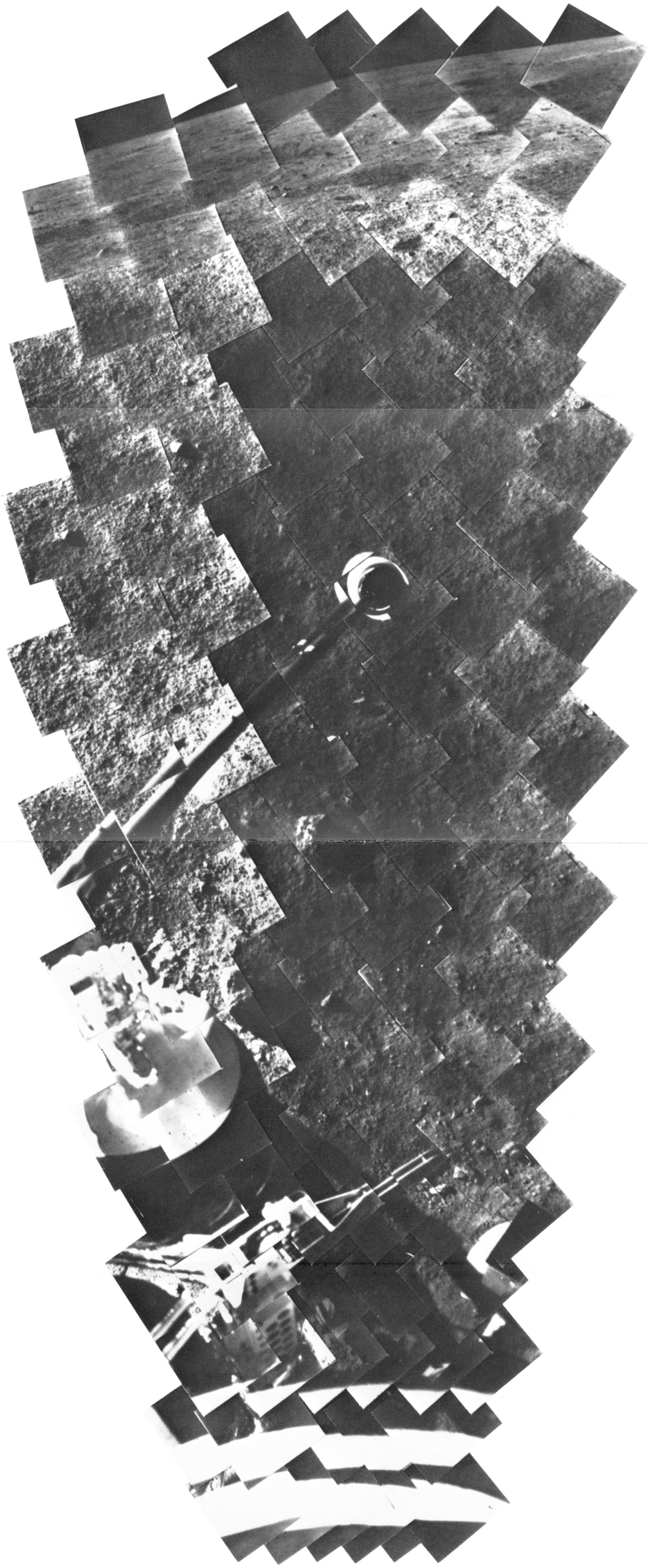
(11) Day 255 Azimuth +3 to +36 Lens focal length Narrow angle Identification Catalog No. 5-13-SI; semi-improved mosaic



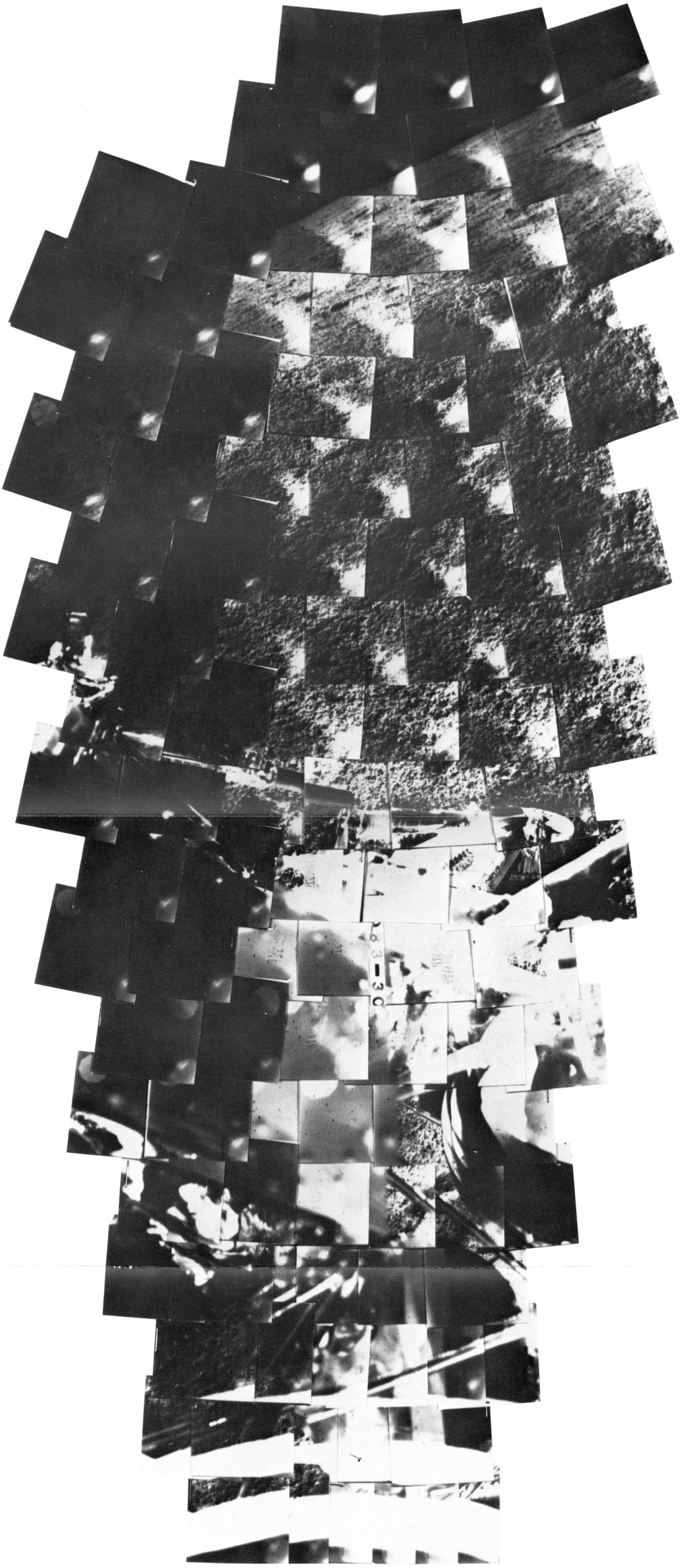
		Azimuth	Lens focal length	Identification
(12)	Day 264	+3 to +36	Narrow angle	Catalog No. 5-91; operations mosaic



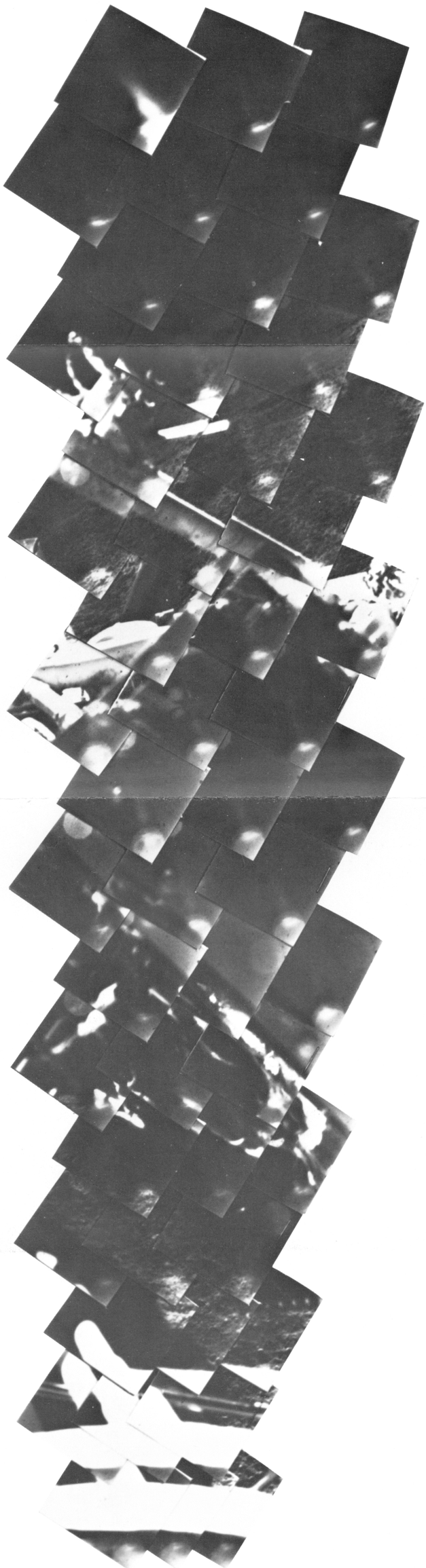
		Azimuth	Lens focal length	Identification
(13)	Day 255	+39 to +66	Narrow angle	Catalog No. 5-41-SI; semi-improved mosaic



		Azimuth	Lens focal length	Identification
(14)	Day 264	+39 to +72	Narrow angle	Catalog No. 5-92; operations mosaic

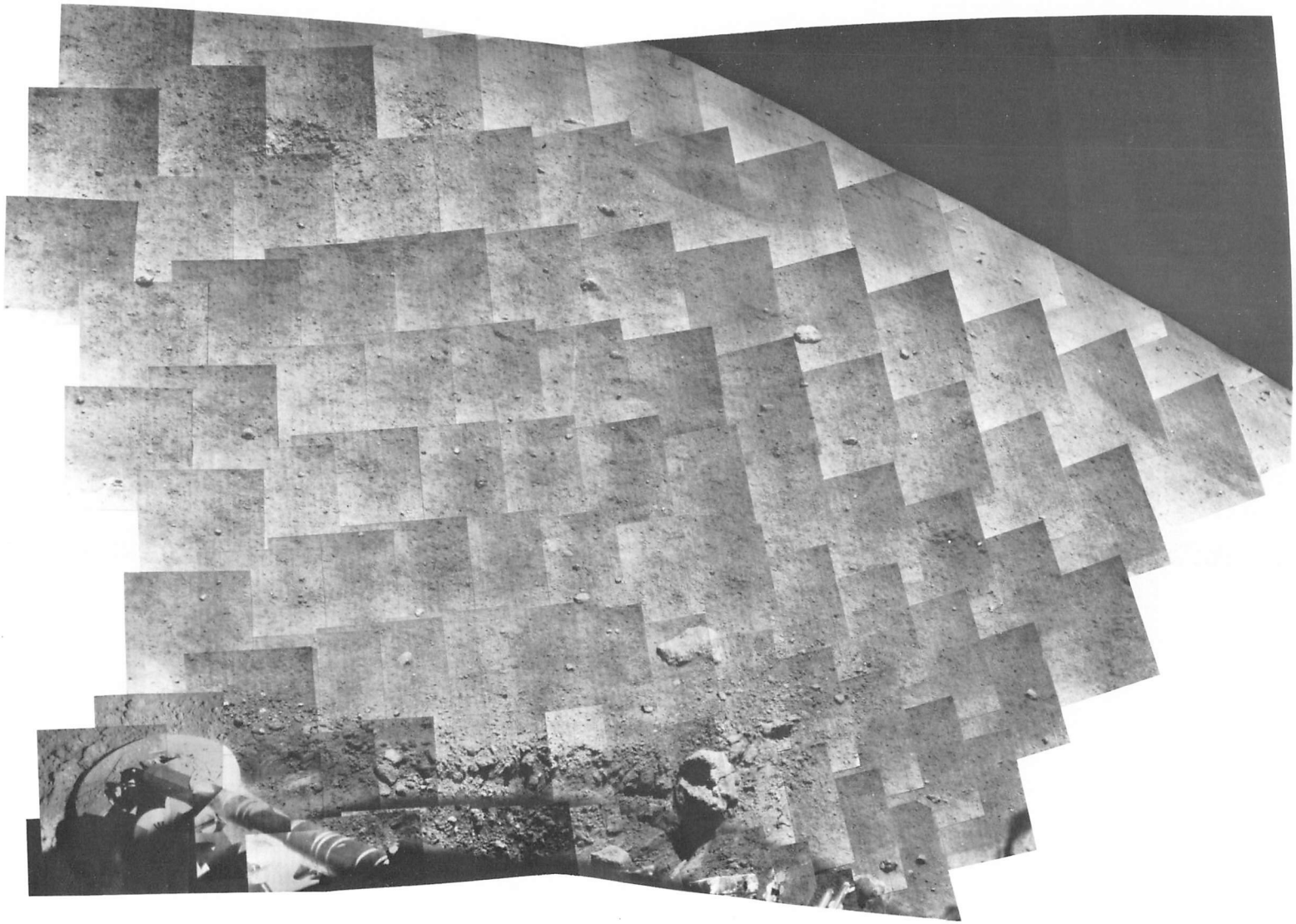


		Azimuth	Lens focal length	Identification
(15)	Day 264	+75 to +108	Narrow angle	Catalog No. 5-94; operations mosaic



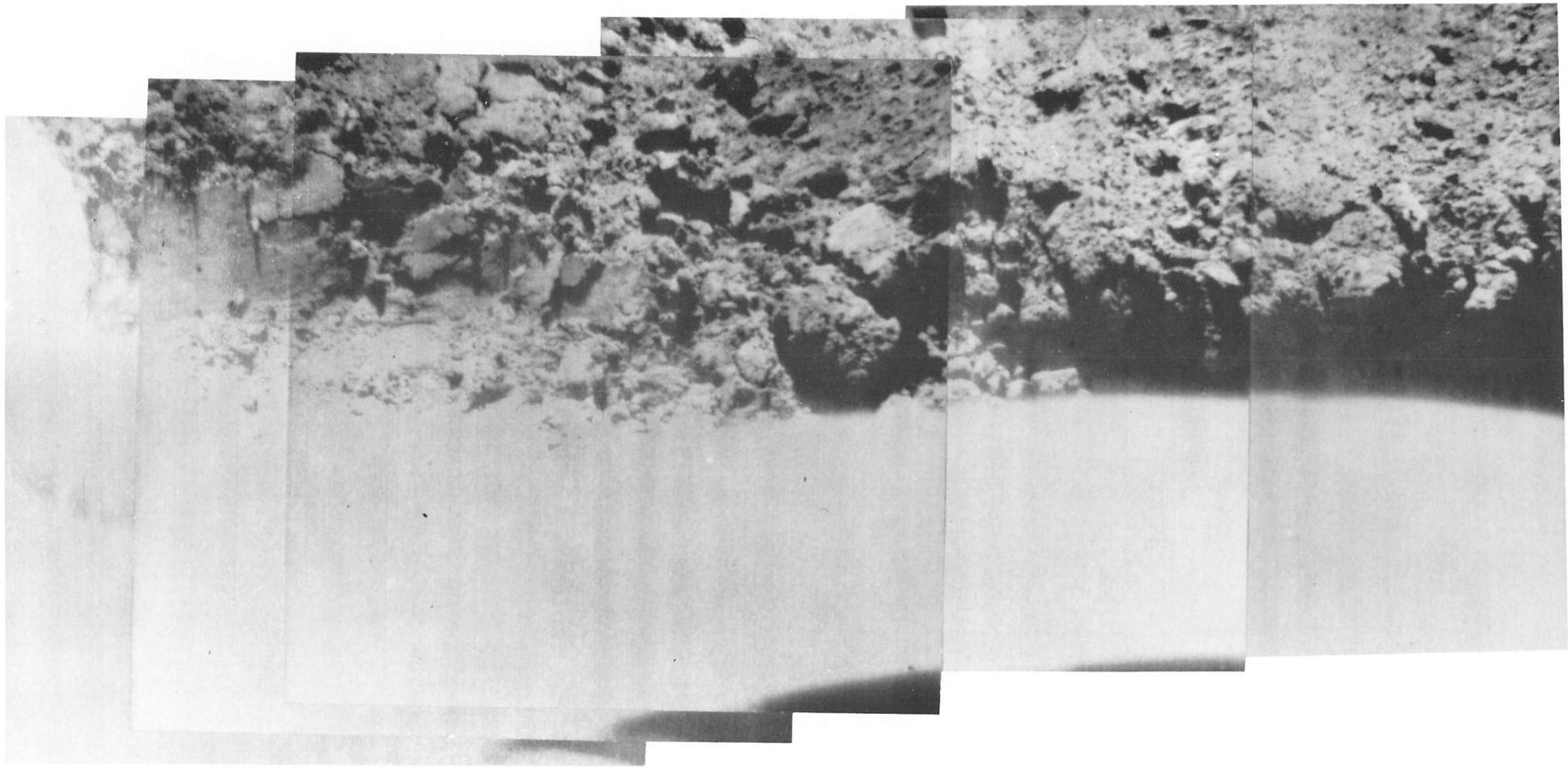
		Azimuth	Lens focal length	Identification
(16)	Day 264	+111 to +126	Narrow angle	Catalog No. 5-95; operations mosaic

		Azimuth	Lens focal length	Identification
(17)	Day 254	−156 to +90	Wide angle	Catalog No. 5-MP-9; pad 2 to pad 3 area mosaic



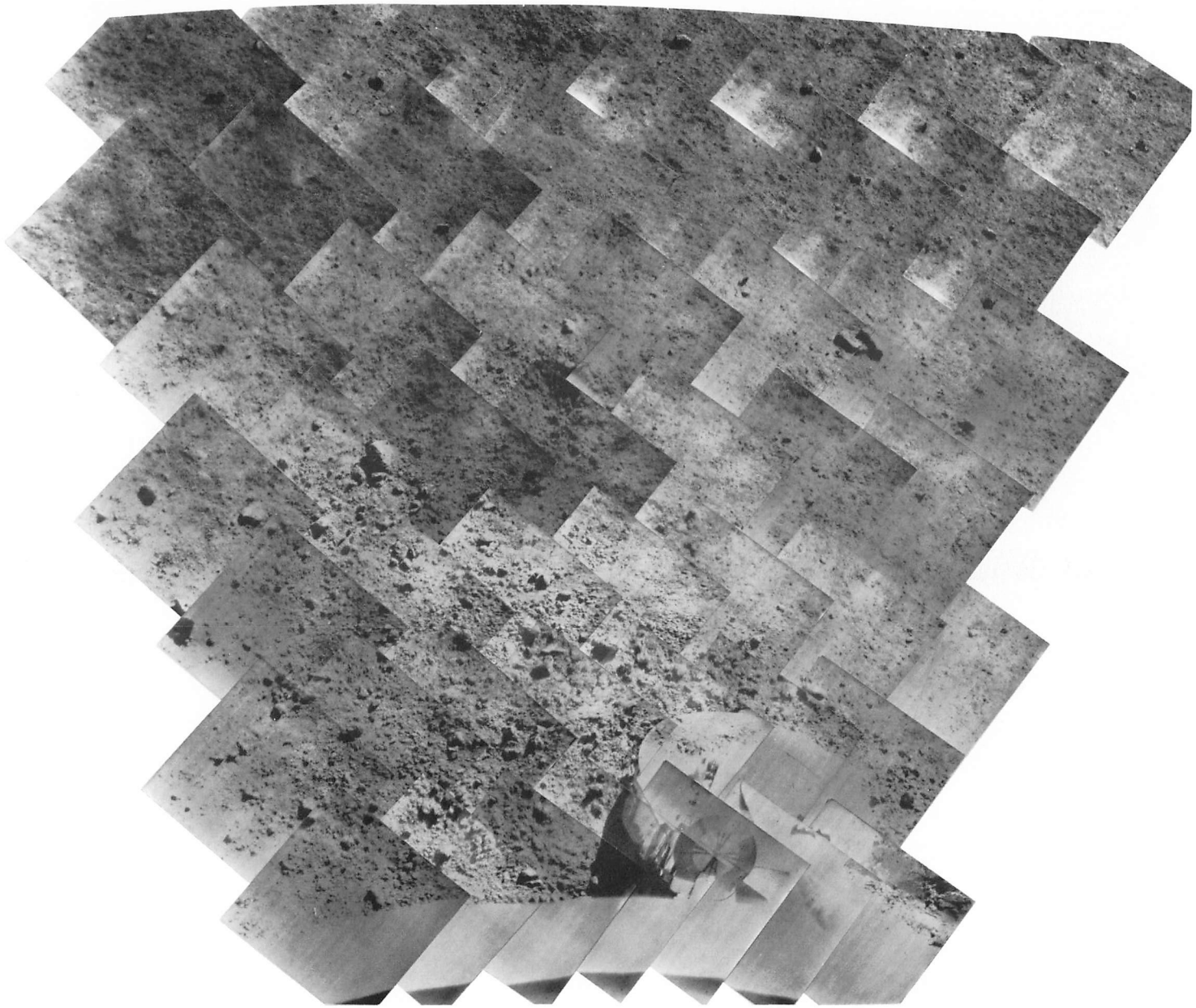
		Azimuth	Lens focal length	Identification
(18)	Day 258	−138 to −54	Narrow angle	Catalog No. 5-MP-34; pad 2 area and trench mosaic

		Azimuth	Lens focal length	Identification
(19)	Day 257	−108 to −60	Wide angle	Catalog No. 5-MP-19; pad 2 area and trench mosaic

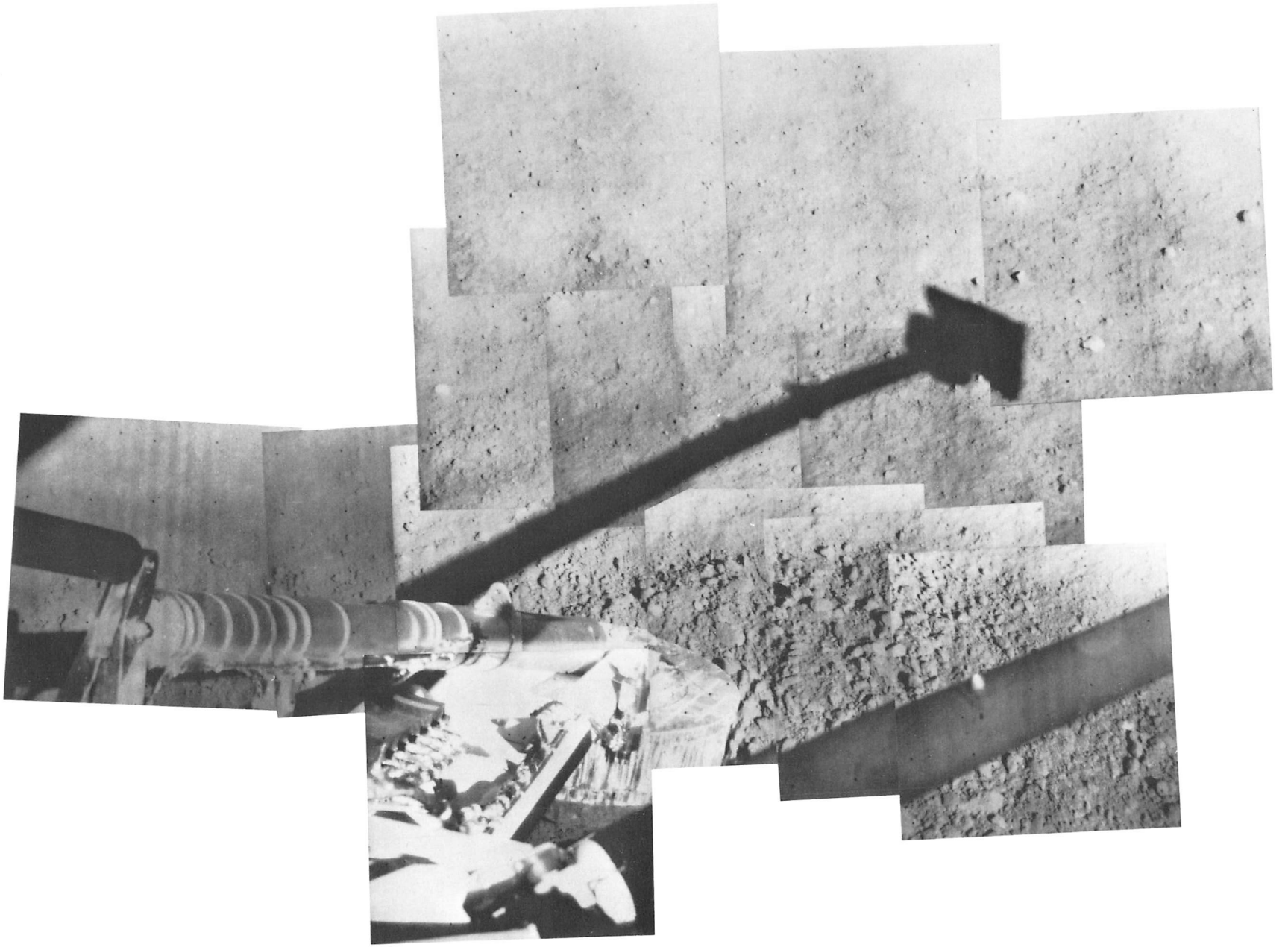


		Azimuth	Lens focal length	Identification
(20)	Day 256	−93 to −72	Narrow angle	Catalog No. 5-MP-36; pad 2 trench mosaic

(21) Day 255 Azimuth −72 to −36 Lens focal length Narrow angle Identification Catalog No. 5-MP-26; pad 2 area, pre-firing, mosaic



		Azimuth	Lens focal length	Identification
(22)	Day 256	−72 to −36	Narrow angle	Catalog No. 5-MP-27; pad 2 area, post-firing, mosaic



(23) Day 255 | Azimuth +72 to +93 | Lens focal length Narrow angle | Identification Catalog No. 5-MP-32; pad 3 area, pre-firing, mosaic

(24) Day 258 Azimuth +57 to +102 Lens focal length Narrow angle Identification Catalog No. 5-MP-29; pad 3 area, post-firing, mosaic

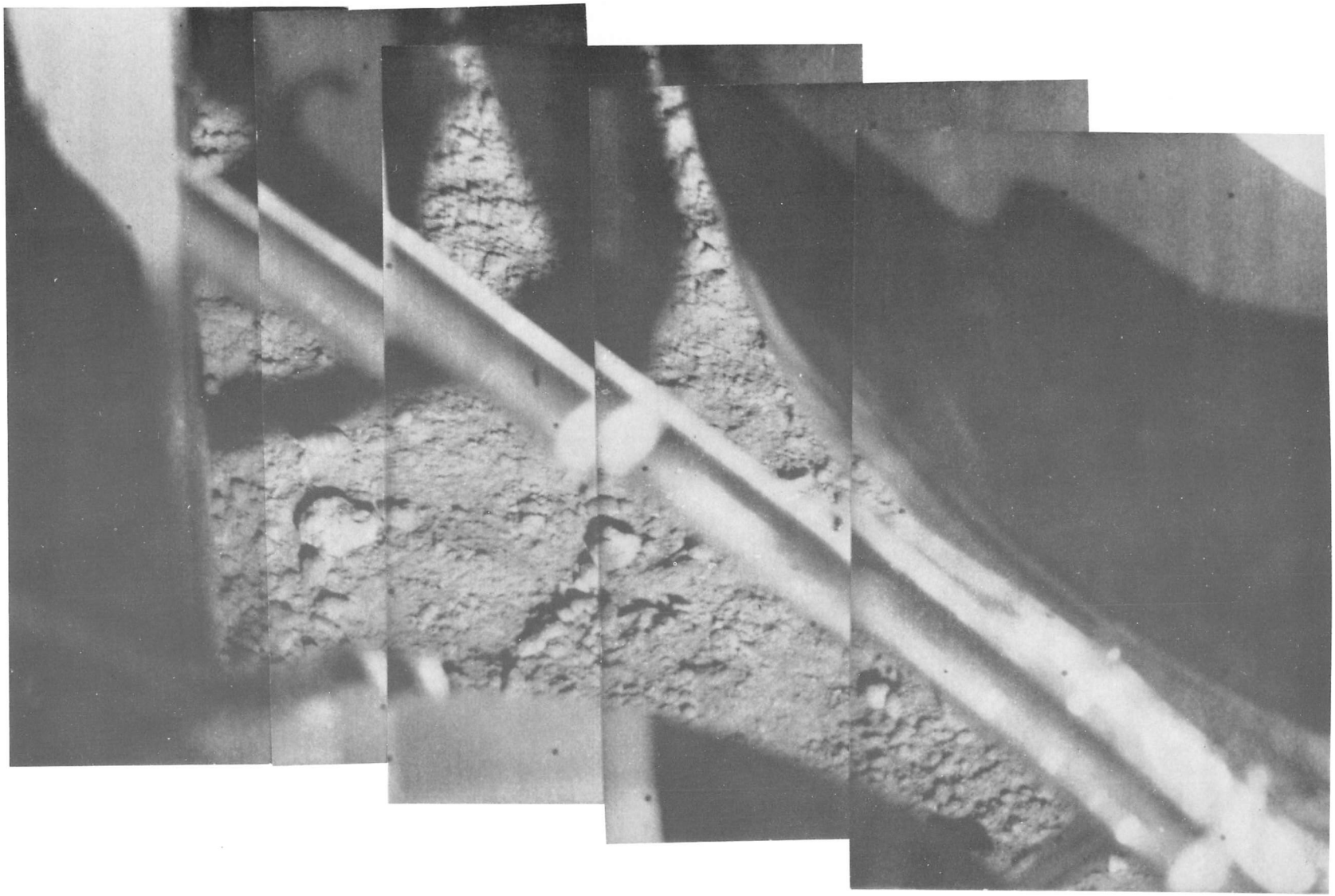
		Azimuth	Lens focal length	Identification
(25)	Day 263	+57 to +102	Wide angle	Catalog No. 5-MP-33; pad 3 area, post-firing, mosaic

Identification
Catalog No. 5-MP-30; pad 3 area, post-firing, mosaic

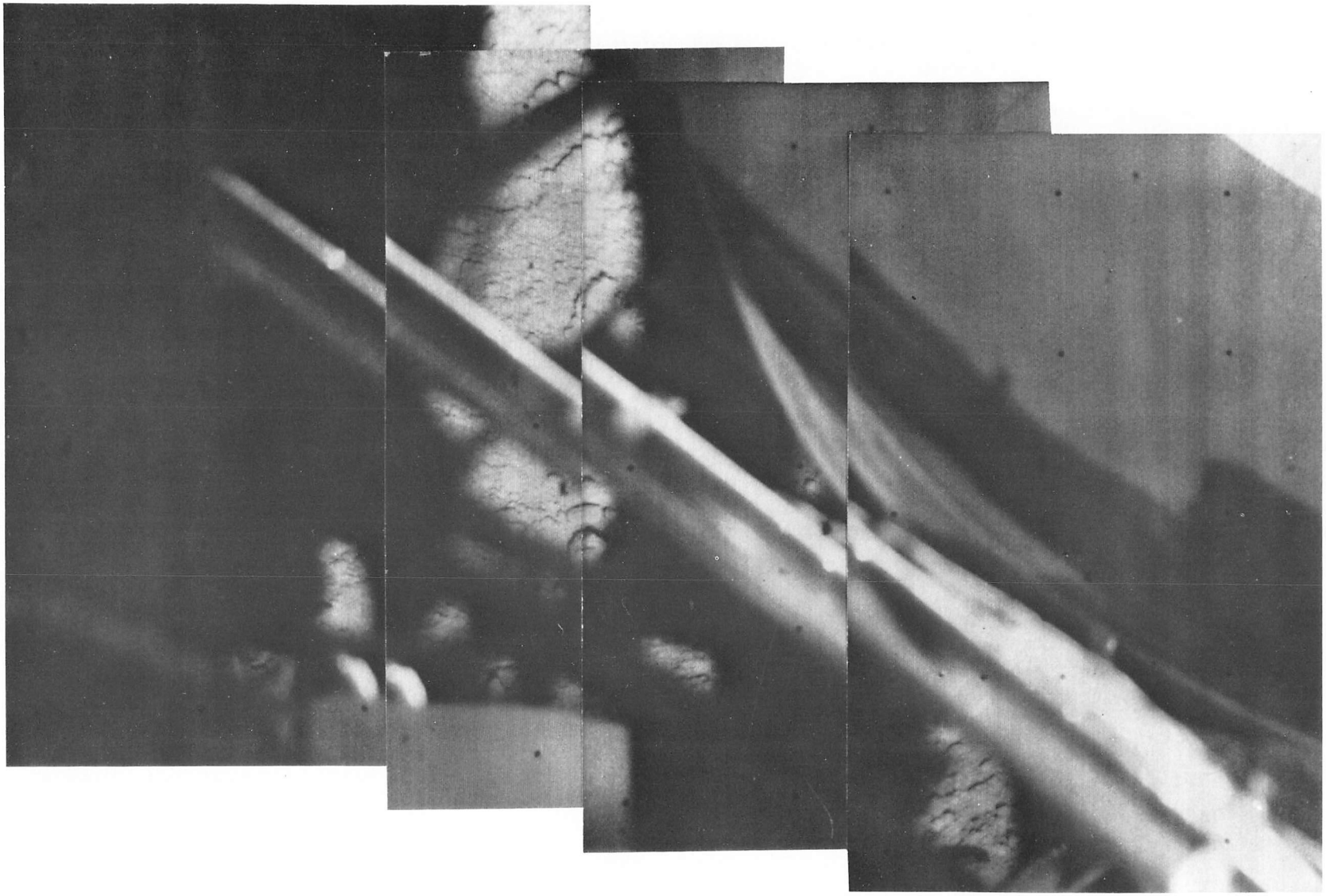
Lens focal length
Narrow angle

Azimuth
+57 to +102

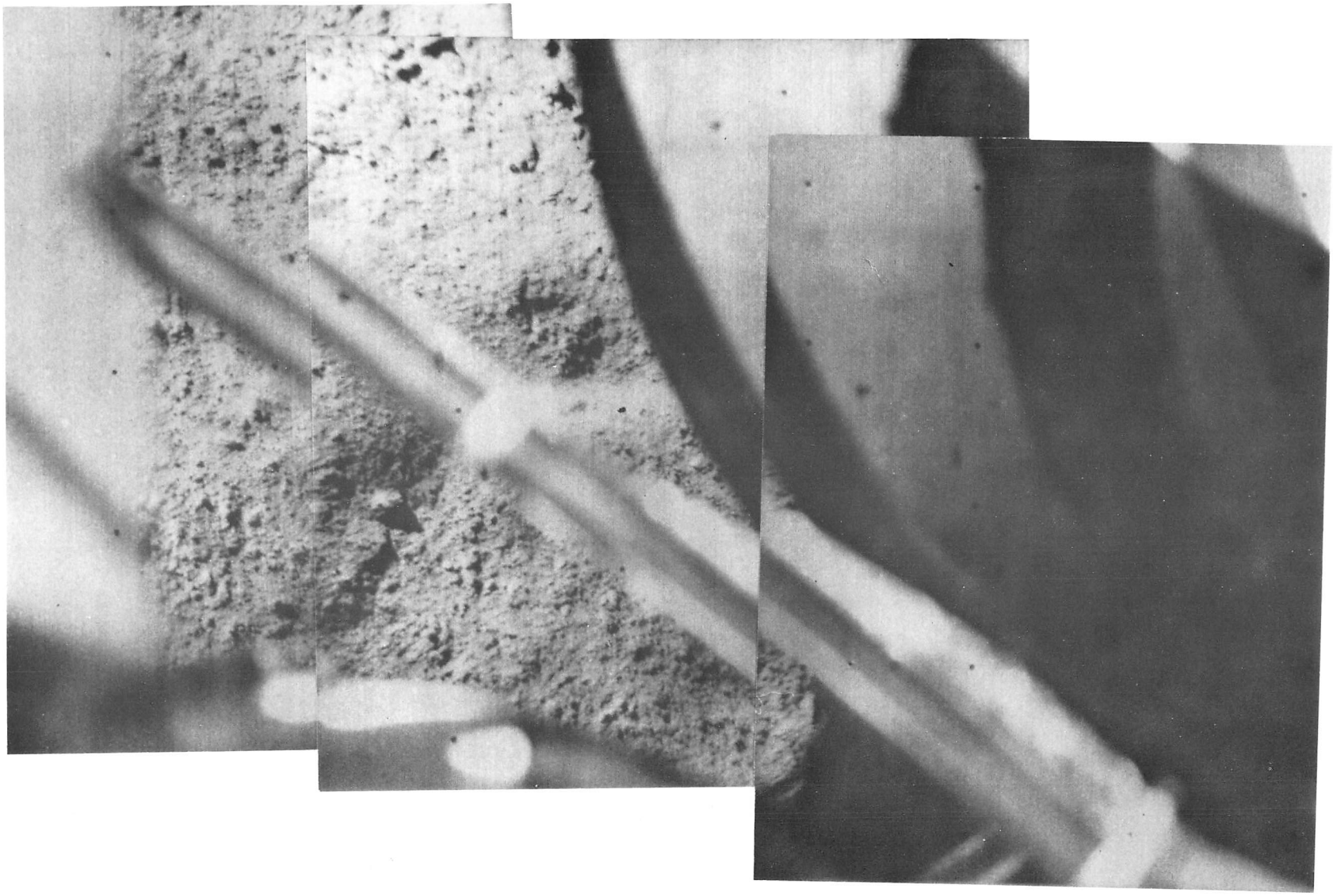
(26) Day 264



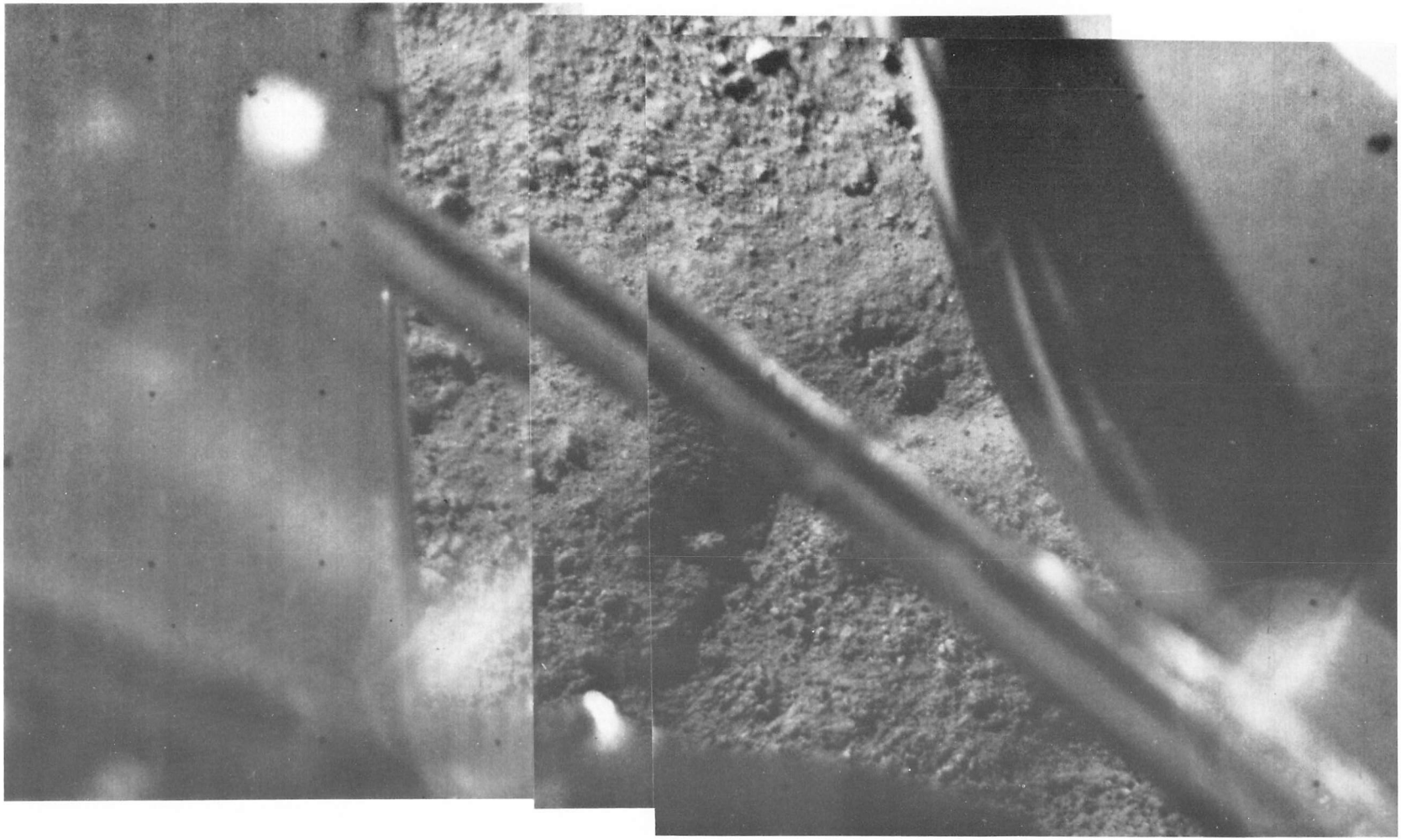
		Azimuth	Lens focal length	Identification
(27)	Day 255	+75 to +87	Narrow angle	Catalog No. 5-MP-37; vernier 3 area, direct, pre-firing, mosaic



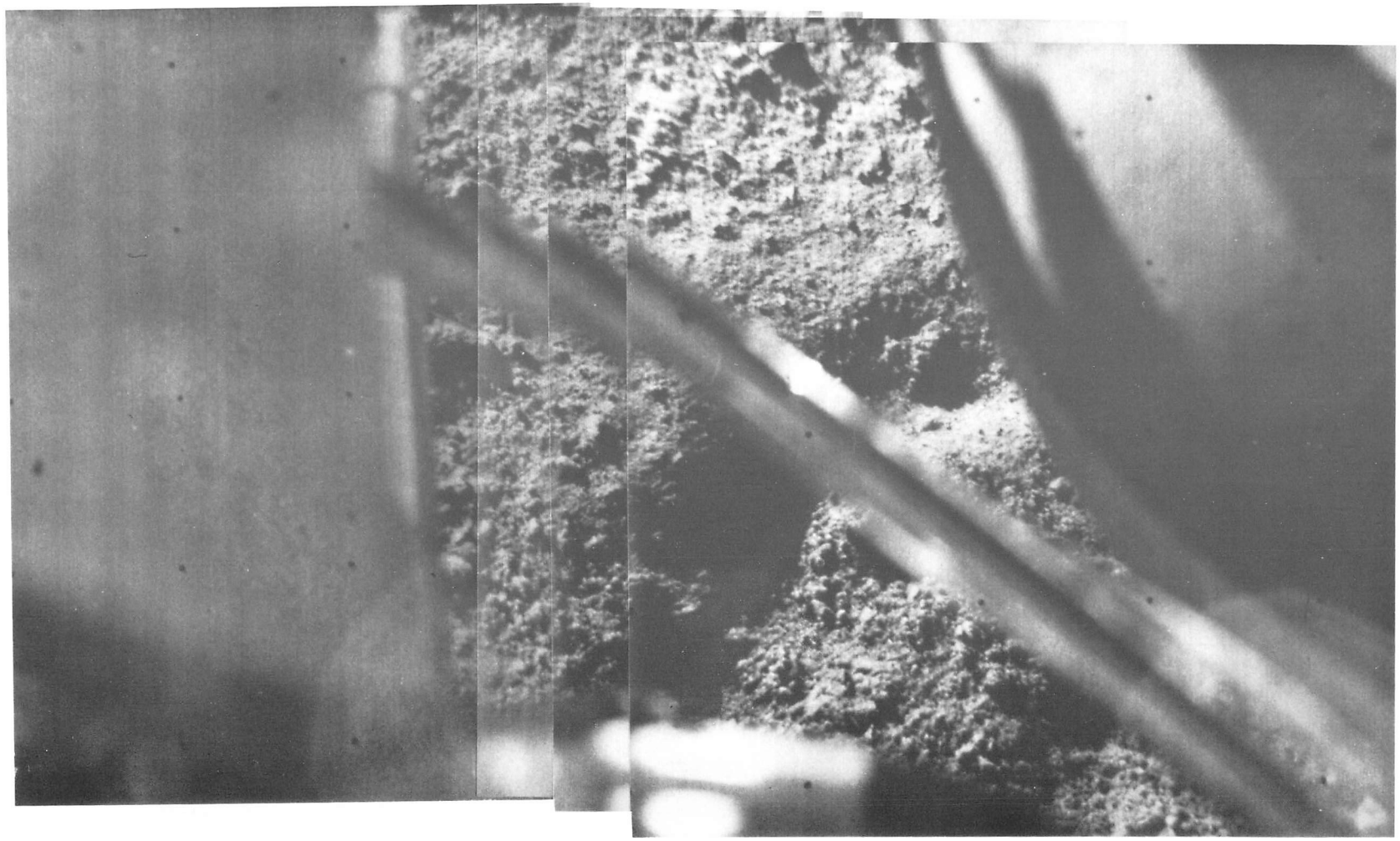
		Azimuth	Lens focal length	Identification
(28)	Day 256	+75 to +87	Narrow angle	Catalog No. 5-MP-38; vernier 3 area, direct, pre-firing, mosaic



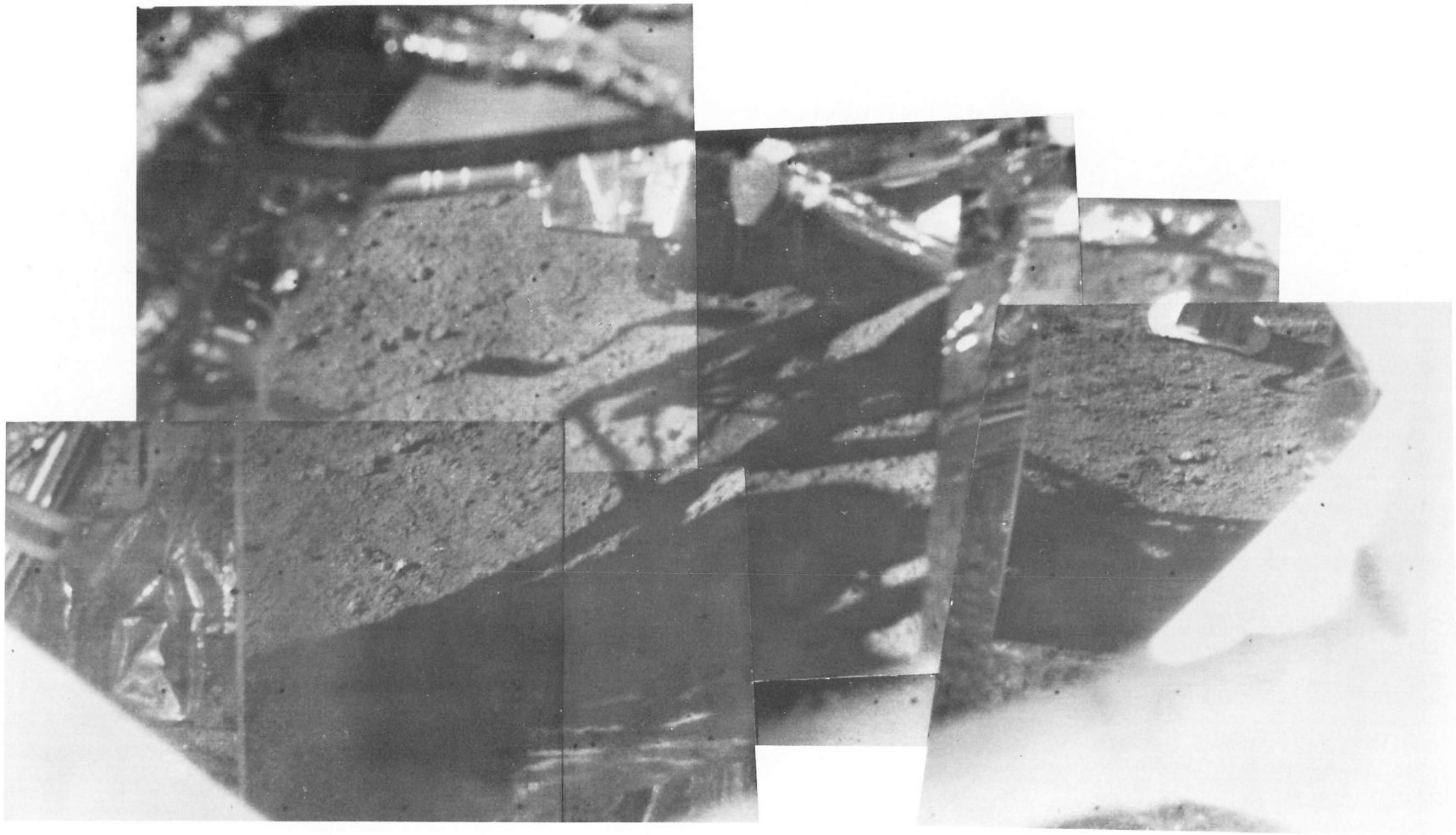
		Azimuth	Lens focal length	Identification
(29)	Day 263	+75 to +87	Narrow angle	Catalog No. 5-MP-39; vernier 3 area, direct, post-firing, mosaic



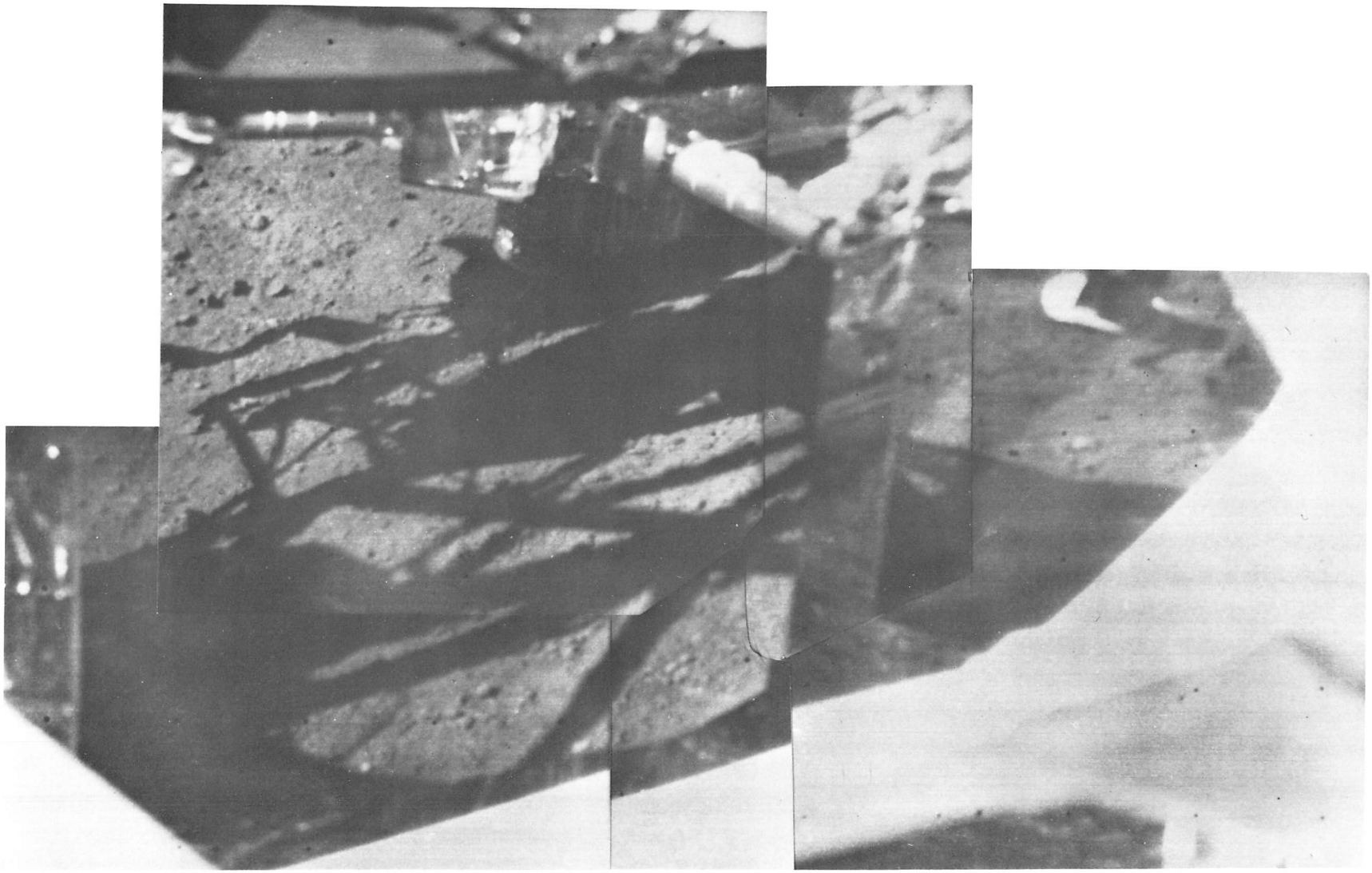
		Azimuth	Lens focal length	Identification
(30)	Day 264	+75 to +87	Narrow angle	Catalog No. 5-MP-40; vernier 3 area, direct, post-firing, mosaic



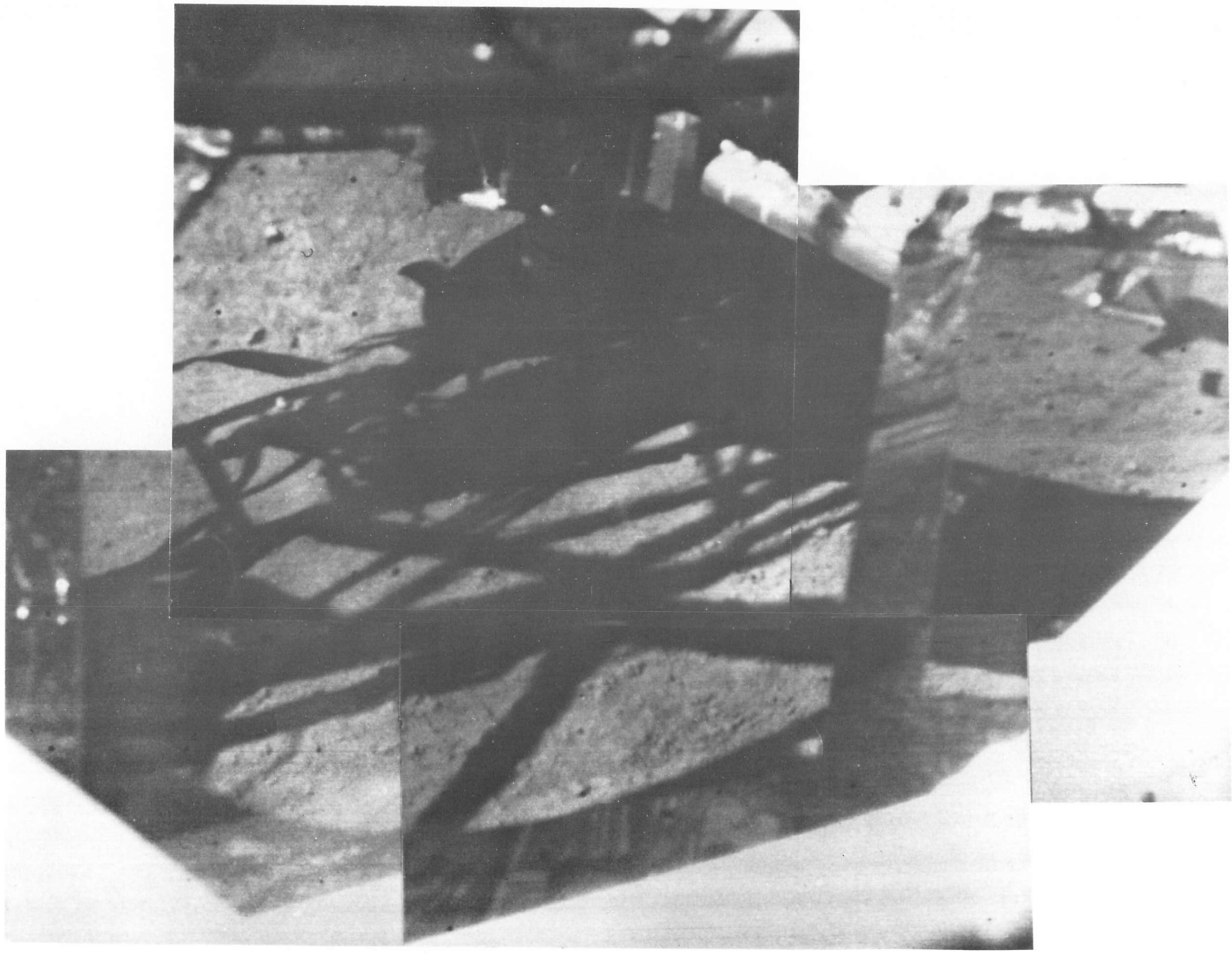
		Azimuth	Lens focal length	Identification
(31)	Day 265	+75 to +87	Narrow angle	Catalog No. 5-MP-41; vernier 3 area, direct, post-firing, mosaic



		Azimuth	Lens focal length	Identification
(32)	Day 255	−216 to −201	Narrow angle	Catalog No. 5-MP-32; auxiliary mirror, pre-firing, mosaic

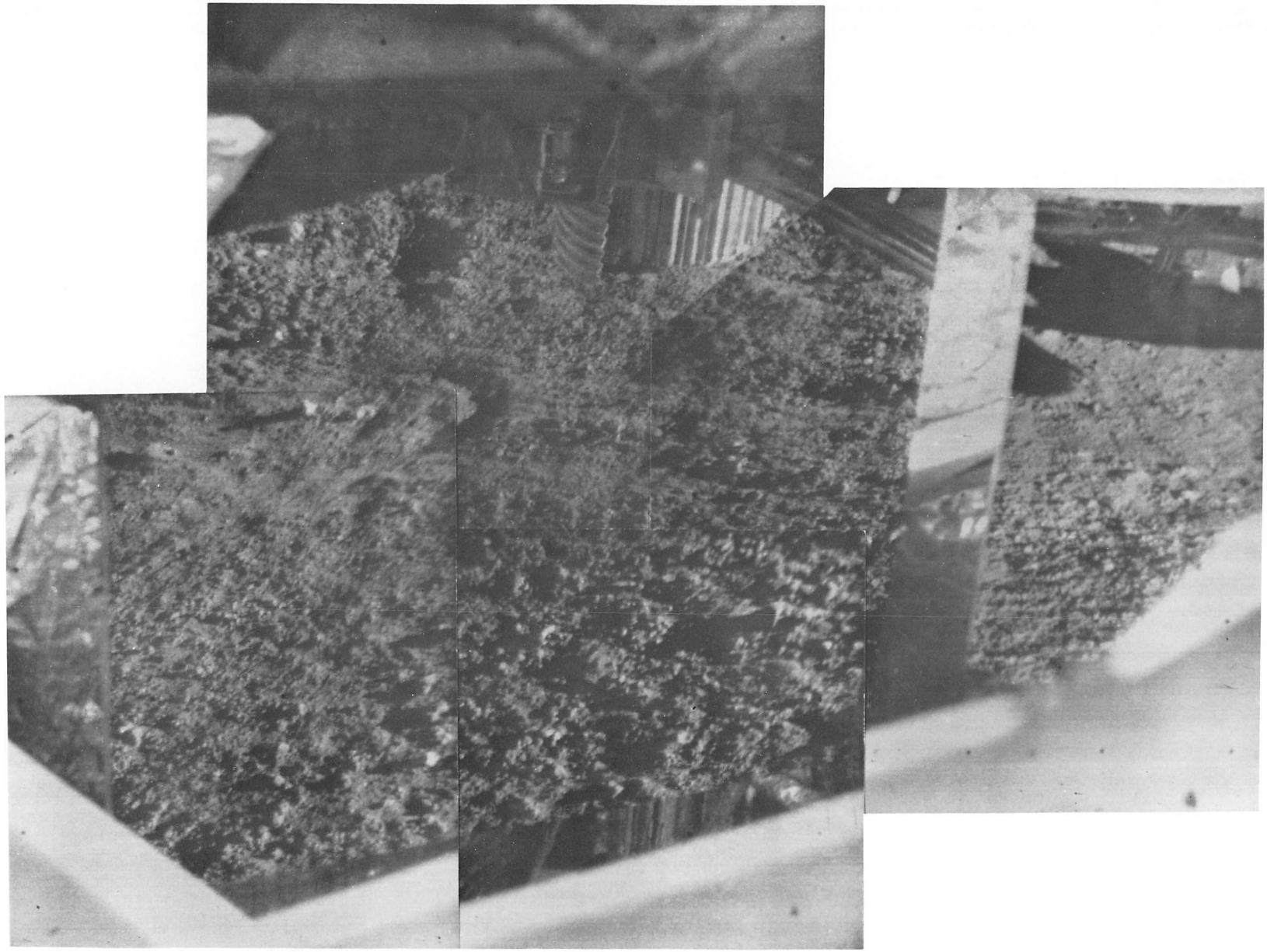


		Azimuth	Lens focal length	Identification
(33)	Day 256	−216 to −201	Narrow angle	Catalog No. 5-MP-17; auxiliary mirror, pre-firing, mosaic

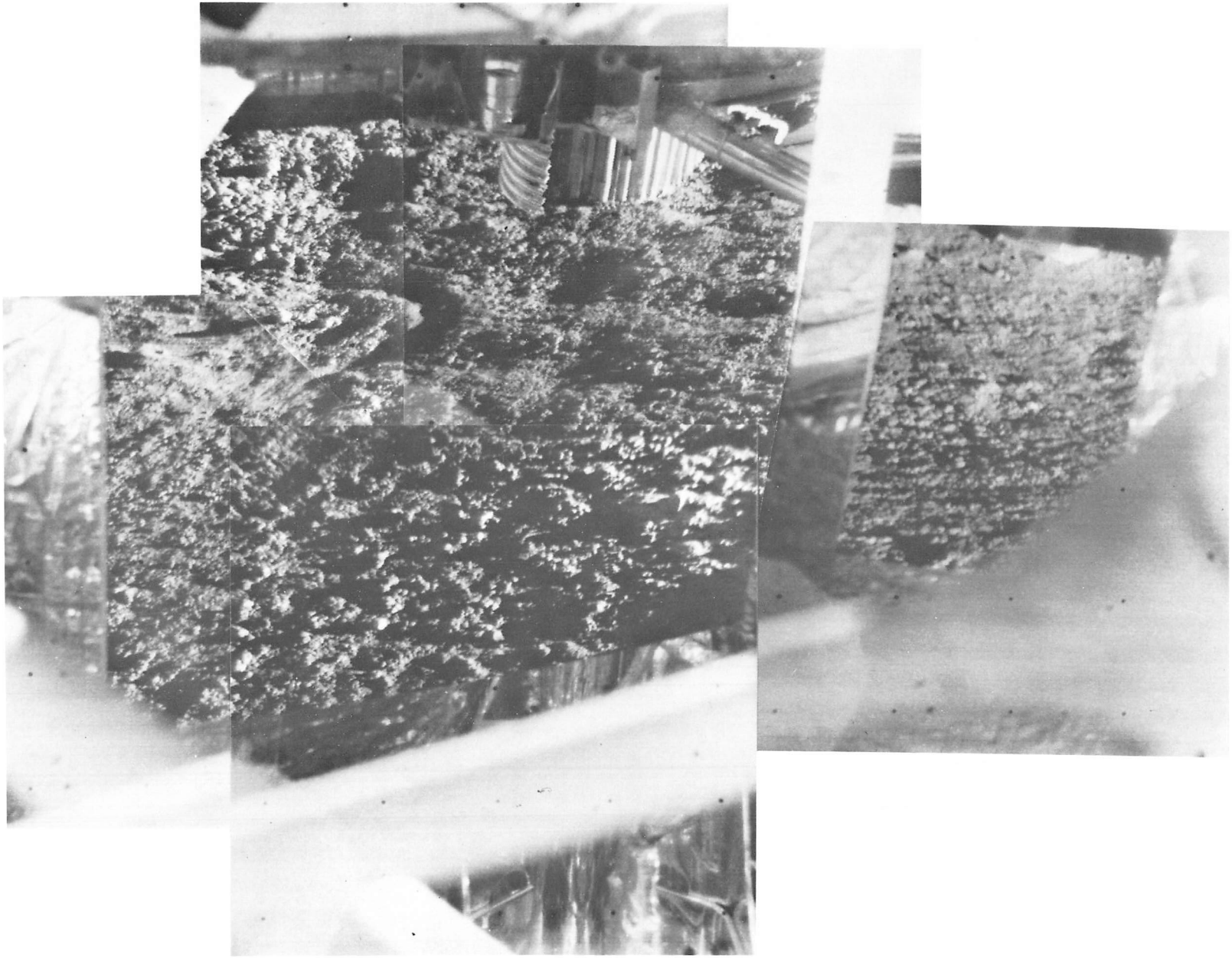


		Azimuth	Lens focal length	Identification
(34)	Day 256	−216 to −201	Narrow angle	Catalog No. 5-MP-18; auxiliary mirror, post-firing, mosaic

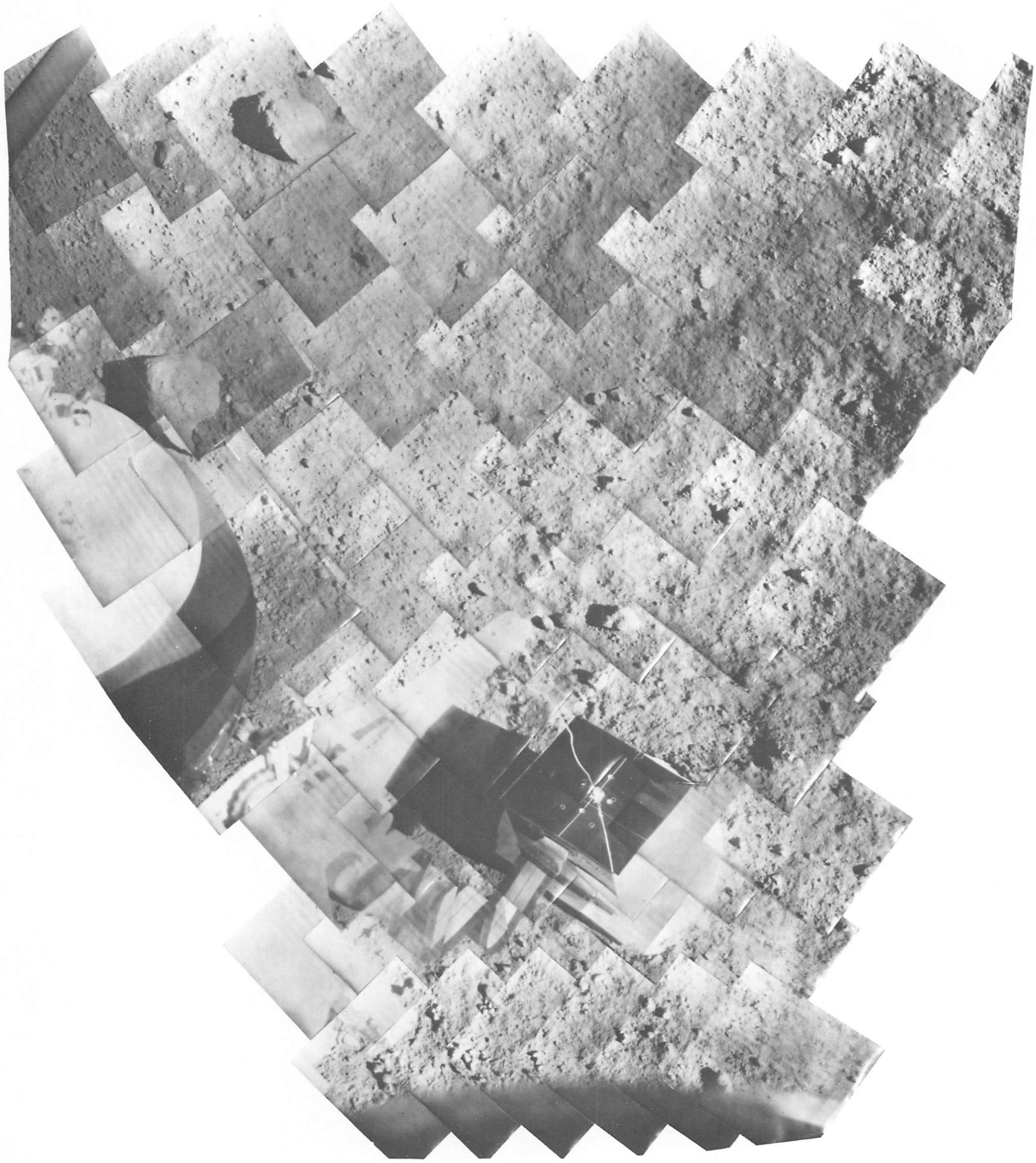
		Azimuth	Lens focal length	Identification
(35)	Day 265	−216 to −201	Narrow angle	Catalog No. 5-MP-28; auxiliary mirror, post-firing, mosaic



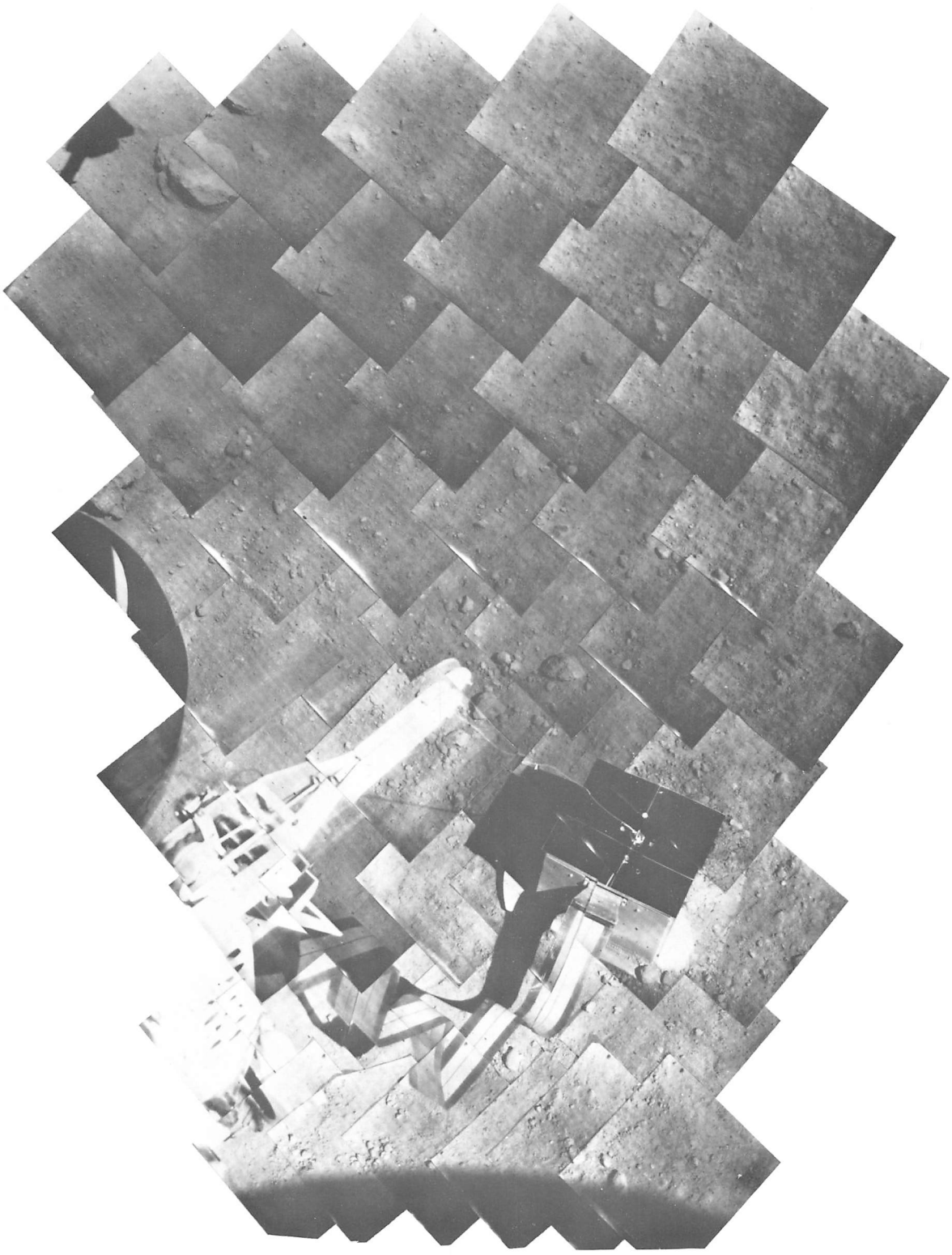
		Azimuth	Lens focal length	Identification
(36)	Day 263	−216 to −201	Narrow angle	Catalog No. 5-MP-22; auxiliary mirror, post-firing, mosaic



		Azimuth	Lens focal length	Identification
(37)	Day 266	−216 to −201	Narrow angle	Catalog No. 5-MP-35; auxiliary mirror, post-firing, mosaic



		Azimuth	Lens focal length	Identification
(38)	Day 255	+36 to +69	Narrow angle	Catalog No. 5-MP-24; alpha-scattering instrument area, pre-firing, mosaic



		Azimuth	Lens focal length	Identification
(39)	Day 257	+36 to +69	Narrow angle	Catalog No. 5-MP-25; alpha-scattering instrument area, post-firing, mosaic

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