NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Technical Report 32-1264

Surveyor VII Mission Report

Part III. Television Data

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National Aeronautics & Space Administration

Preface

The work described in this report was performed under the cognizance of the *Surveyor* Project of the Jet Propulsion Laboratory.

This three-part document constitutes the Project Mission Report on *Surveyor VII*, the last spacecraft 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 VII* 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 VII* and appropriate explanatory material.

Acknowledgment

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

Contents

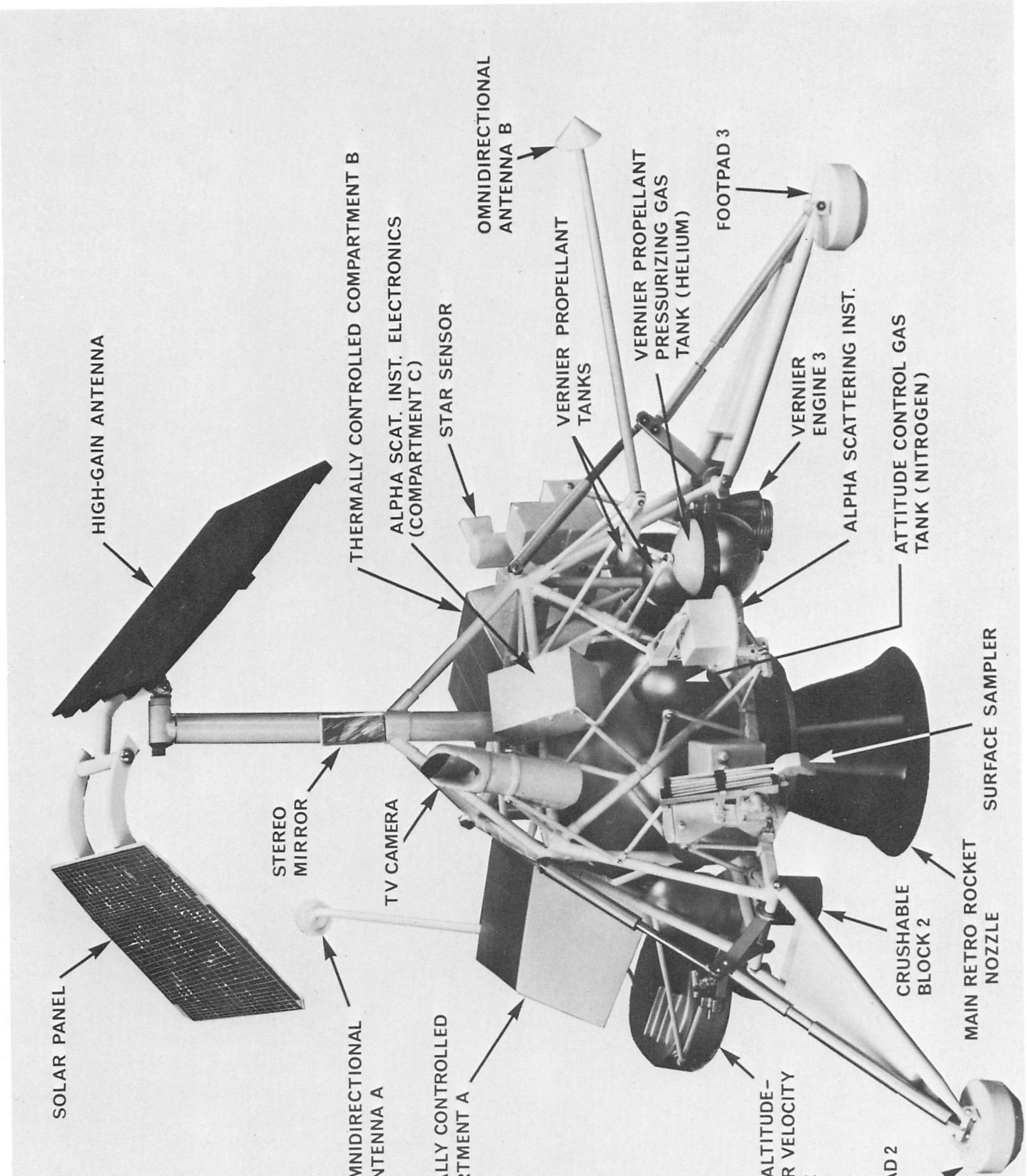

Fig. I-1. Model of *Surveyor VII* spacecraft

I. Introduction

T. H. Bird

This document contains a selection of 290 pictures relating to the *Surveyor VII* mission. A total of more than 21,000 individual frames was obtained during the television activities.

In addition to the individual frames, copies of 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 mosaic 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.

Figure I-1 shows a model of the *Surveyor VII* spacecraft. Figure I-2 presents three stereograms assembled from photographs obtained on this mission.

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

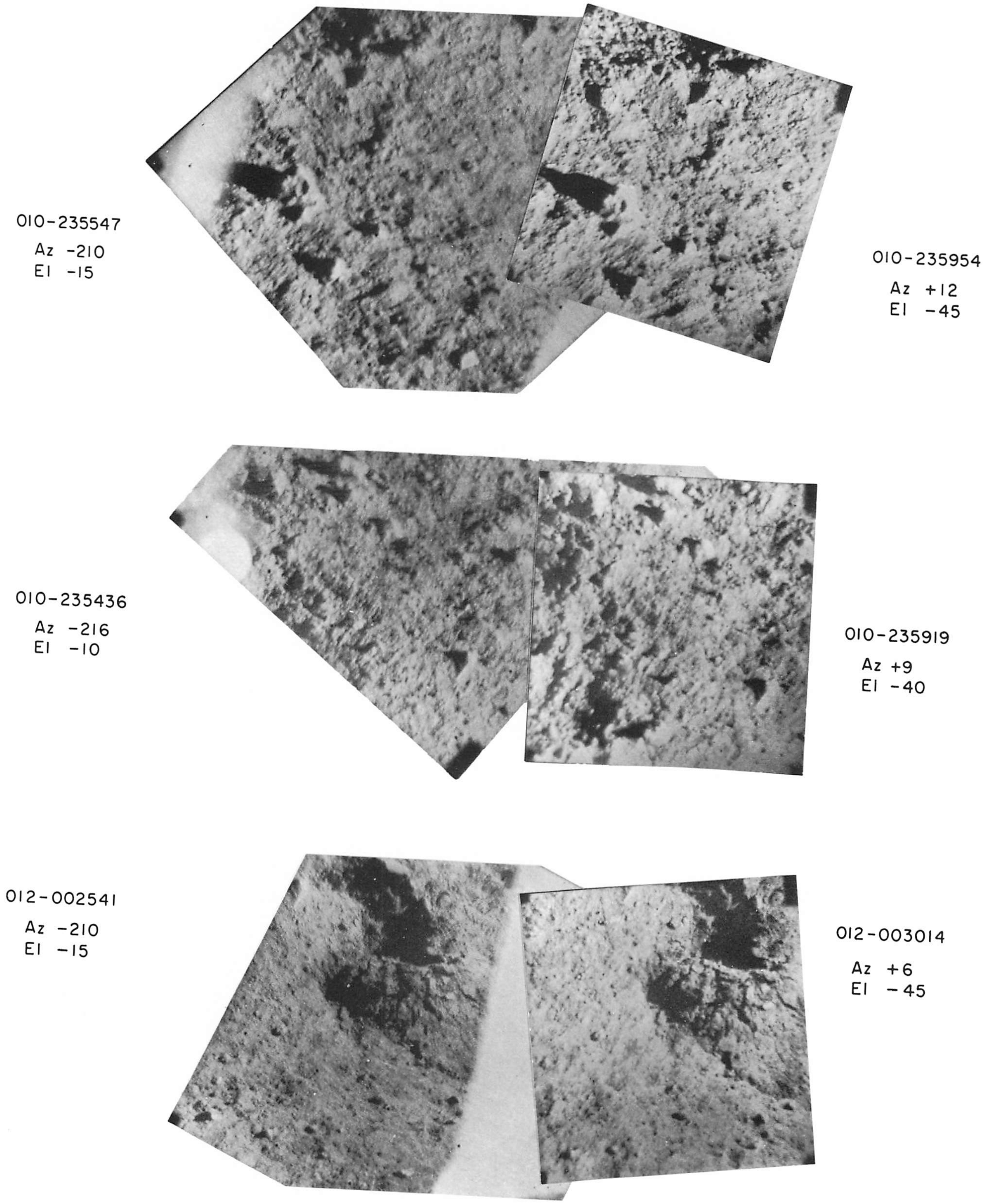

Fig. I-2. Stereograms

(Pictures on the right are direct camera views; pictures on the left are auxiliary stereo mirror views and were printed by reversing the negatives and enlarging to compensate for the stereo mirror and the additional mirror distance, respectively. The stereo mirror is shown in Fig. I-1.)

II. Television System

M. I. Smokler

The *Surveyor VII* television system is designed primarily to obtain video pictures of the lunar surface, lunar sky, and portions of the landed spacecraft. It includes a survey camera capable of panoramic viewing, and a TV auxiliary that serves to process commands and identification signals and to provide appropriate video mixing.

A. Camera Description

The slow-scan survey television camera (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. 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 approximately 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 selected views. 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 (Fig. II-3) contains 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 $\lambda = 550\ \mathrm{m}\mu$ and exhibits an average specular reflectivity in excess of 86%. The mirror is 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 mechanical step size of 2.5 ± 0.1 deg in elevation and 3.0 ± 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.

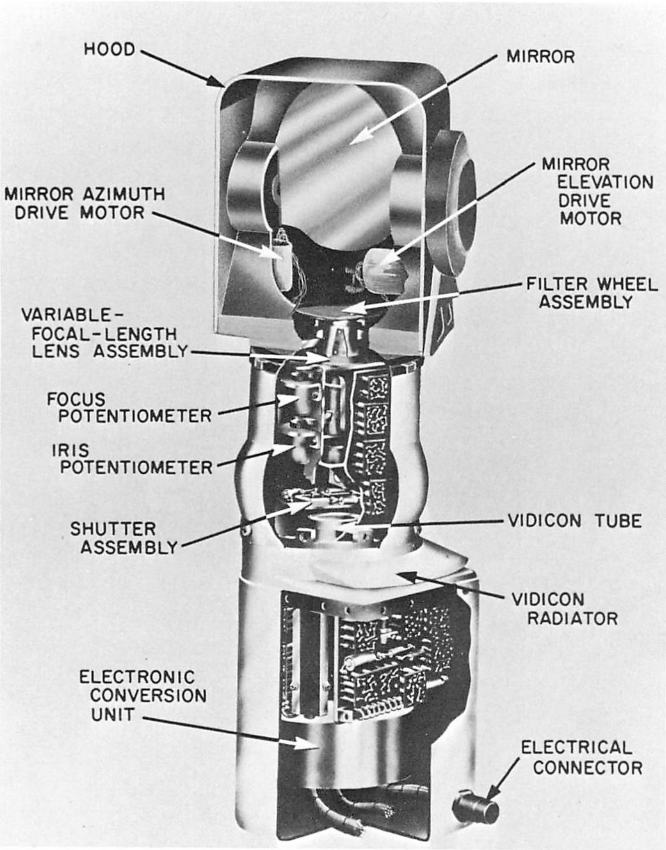

Fig. II-1. Cutaway view of survey camera

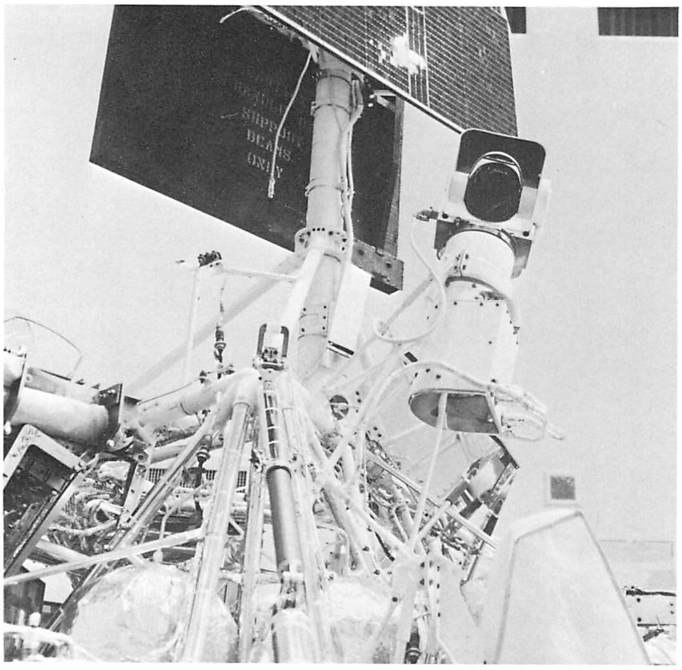

Fig. II-2. Survey camera on spacecraft

The mirror assembly used on *Surveyor VII* is the same as that used on *Surveyor VI,* with the minor difference that additional surfaces of the assembly were painted black to reduce glare.

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.

The mirror assembly also contains a four-section filter wheel (Fig. II-4). Three sections contain polarizing filters and one section contains a neutral density filter for non-polarized observations. Using the mission operations designations of filter positions as Nos. 1, 2, 3, and 4, No. 1 is the neutral density filter. Its transmission characteristic is selected so that the camera's response to non-polarized light is 38%, which is identical to its response when using the polarizing filters to view a non-polarized light source.

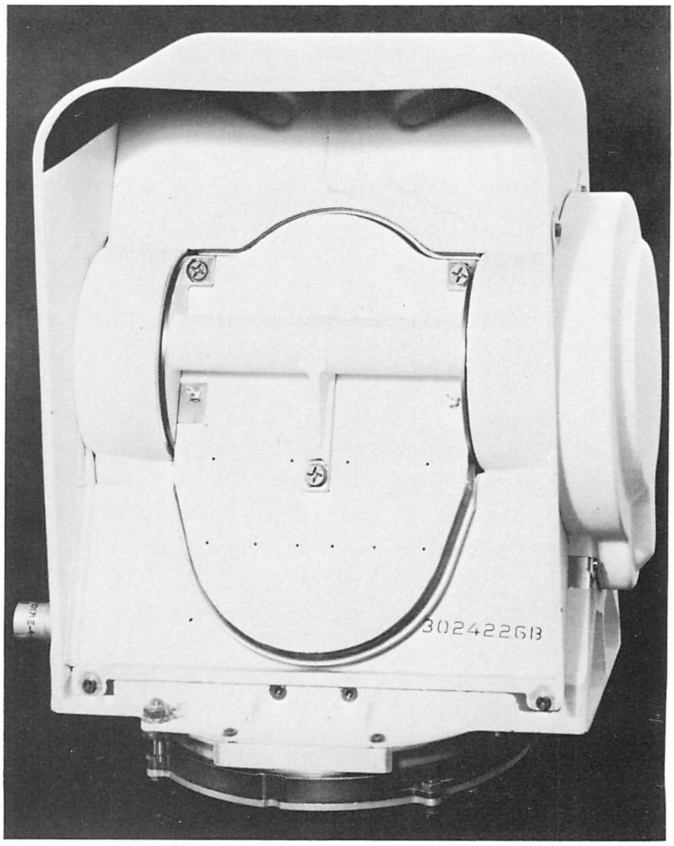

Fig. II-3. Mirror assembly

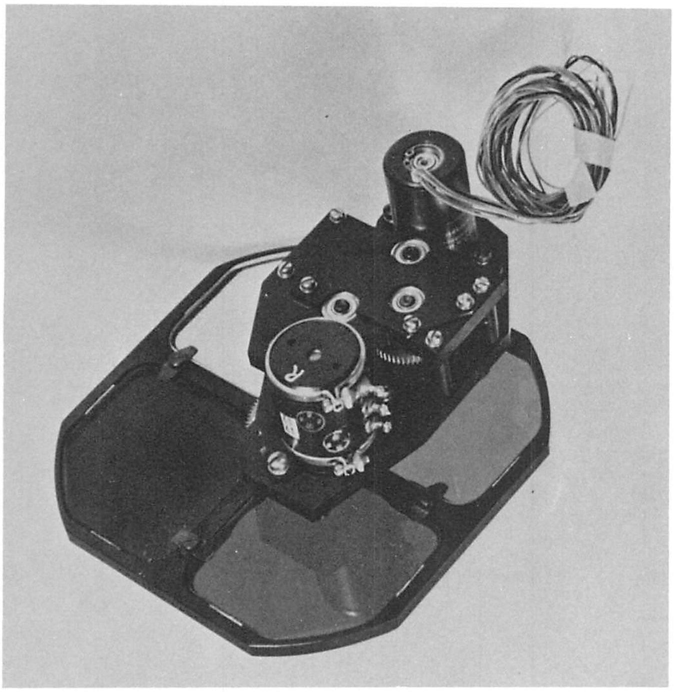

Fig. II-4. Filter wheel assembly

The transmission axes of the polarizing filters, in positions 2, 3, and 4, are at relative angles of 0, 45, and 90 deg, respectively. In the calibration data (Figs. II-5, II-6, II-7, and II-8) these are coded as *N*, *P*, and S, respectively, using identification derived from the manufacturing drawings and etched on the filters. For the 0-deg filter, the plane of polarization accepted is parallel to the elevation axis of the camera mirror. The 45- and 90-deg angles of the transmission axes of the other two filters are angles measured in the counterclockwise direction, looking out of the camera, relative to the above 0-deg reference plane.

In spacecraft coordinates, for the nominal attitude of a spacecraft, the 0-deg filter would accept horizontally polarized light when the optical axis of the camera is in the plane of the 16-deg camera tilt. Under the same conditions, the 90-deg filter would accept vertically polarized light.

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 assembly (Fig. II-9) was capable of providing either a 100- or 25-mm focal length, resulting in a field of view of approximately 6.43 and 25.3 deg, respectively. The aspect ratio was 1:1 rather than 1.1:1 as was the case on *Surveyor VI*.

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*/22 to *f*/4 in half *f*-stop increments. This resulted in an aperture-area change of $\sqrt{2}$ for each *f*-stop increment.

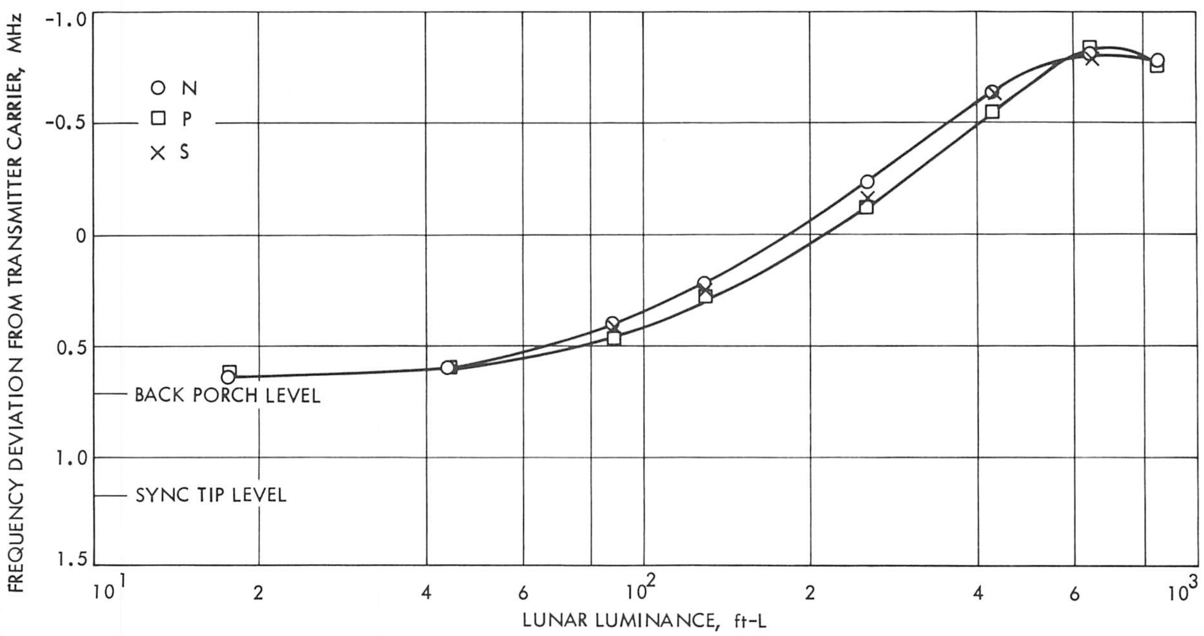

Fig. II-5. *Surveyor VII f/4* polarizing filter light transfer characteristics, 600-line scan mode, transmitter A

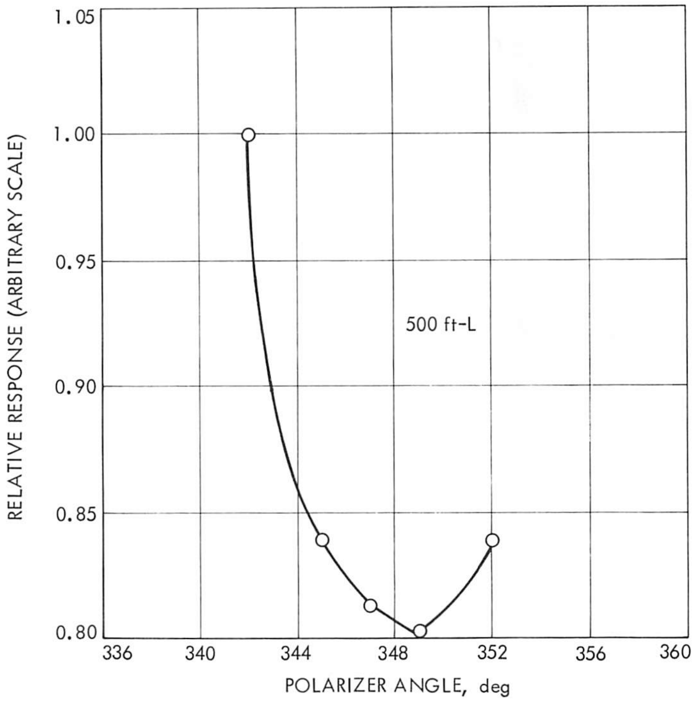

Fig. II-6. *Surveyor VII* polarization null P-filter, *f*/4, open shutter 600-line scan mode, transmitter A

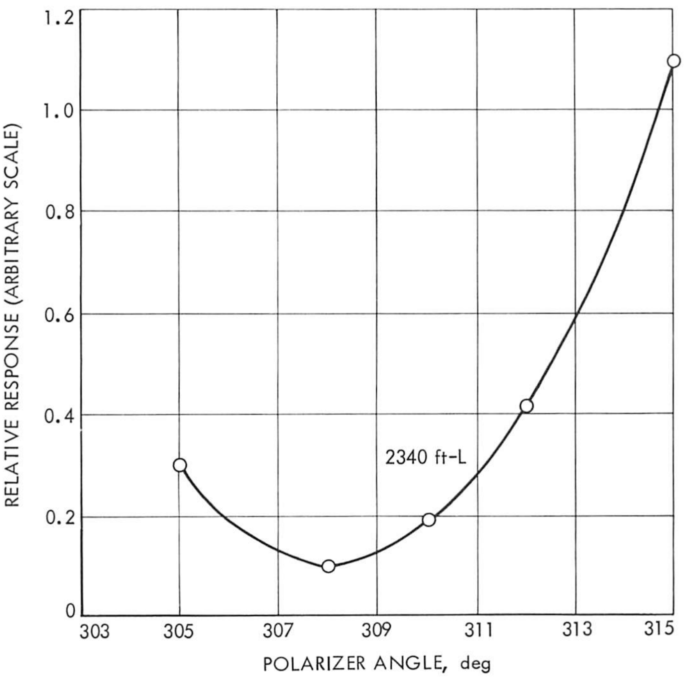

Fig. II-7. *Surveyor VII* polarization null S-filter, *f*/4, open shutter 600-line scan mode, transmitter A

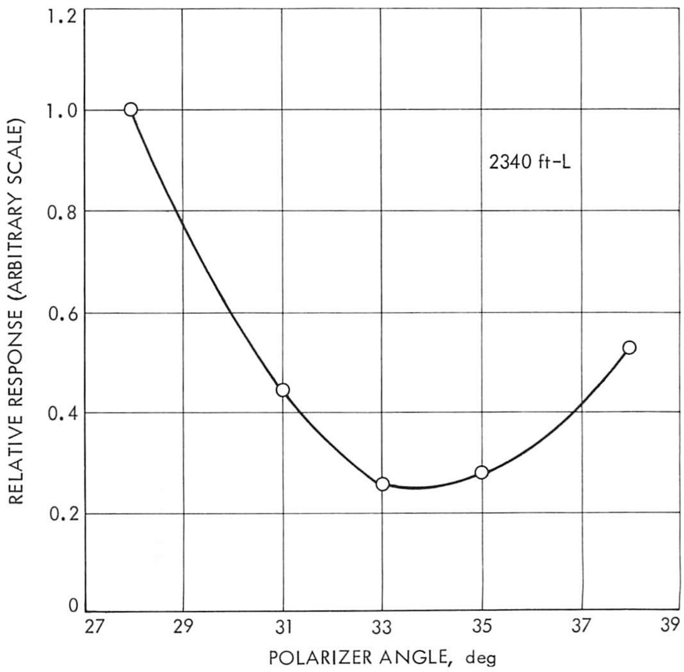

Fig. II-8. *Surveyor VII* polarization null N-filter, *f*/4, open shutter 600-line scan mode, transmitter A

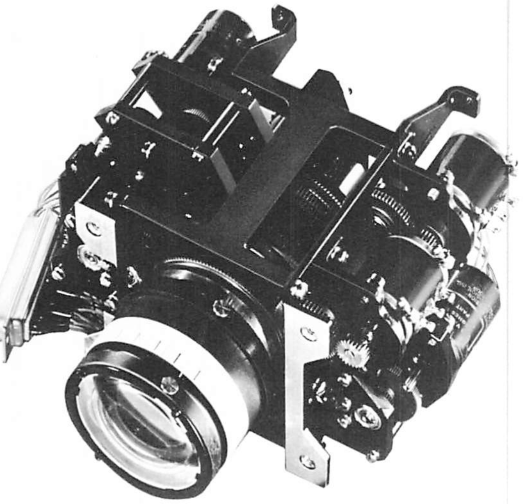

Fig. II-9. Variable-focal-length lens assembly

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.

Three modes of exposure control are afforded the camera by means of a mechanical focal plane shutter (Fig. II-10) located between the lens assembly and the vidicon image sensor. In the *normal shutter* mode, upon earth command, the two shutter blades are sequentially driven by solenoids across an aperture in the shutter base plate, with appropriate delay between blades. The time interval between the blade motions determines the exposure interval, which is nominally 150 ms.

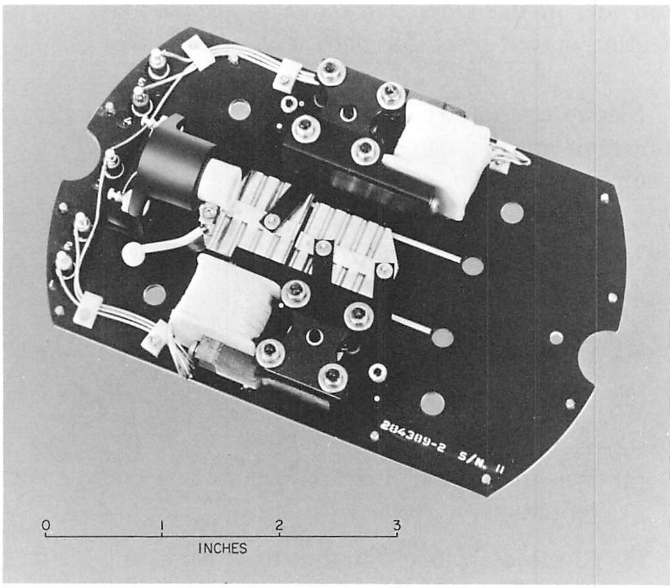

Fig. II-10. Shutter assembly

In the second shutter 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 observation 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. Scene luminance on the order of 0.008 ft-L is easily reproduced in this mode of operation, thereby permitting photographs under earthshine conditions. Detection of sixth-magnitude stars has been accomplished using this mode of operation with an exposure time of 5 min.

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-11) uses electrostatic focus and electromagnetic deflection. The principle by which the video signal is produced from the photo-conductive surface is illustrated in Fig. II-12. 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 conductivity 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.

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

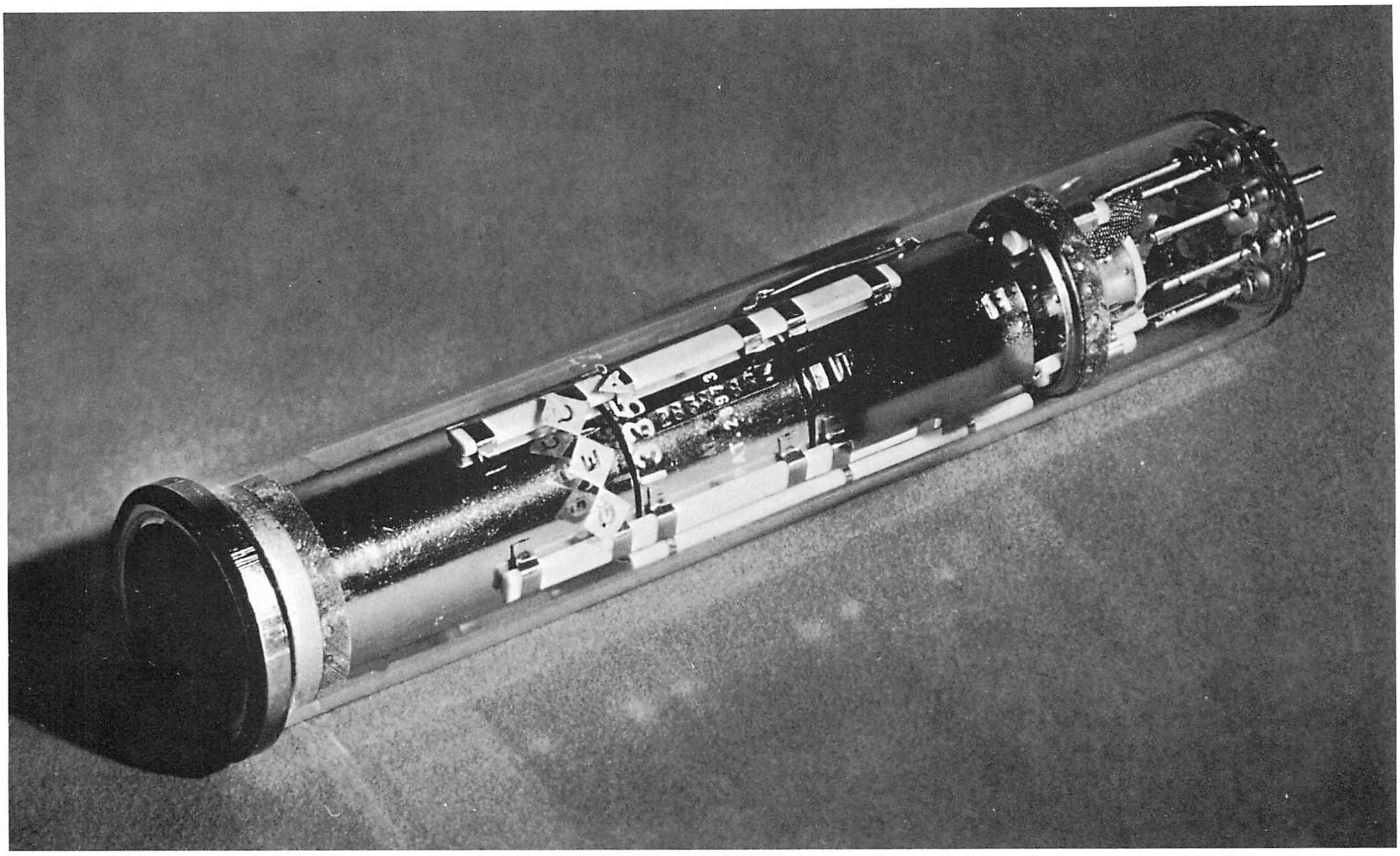

Fig. II-11. One-inch vidicon for survey camera

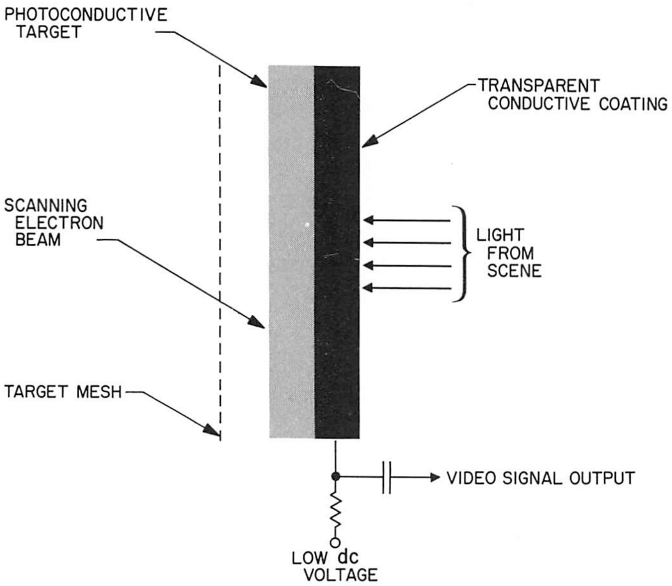

Fig. II-12. Vidicon functional diagram

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-13. The 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.

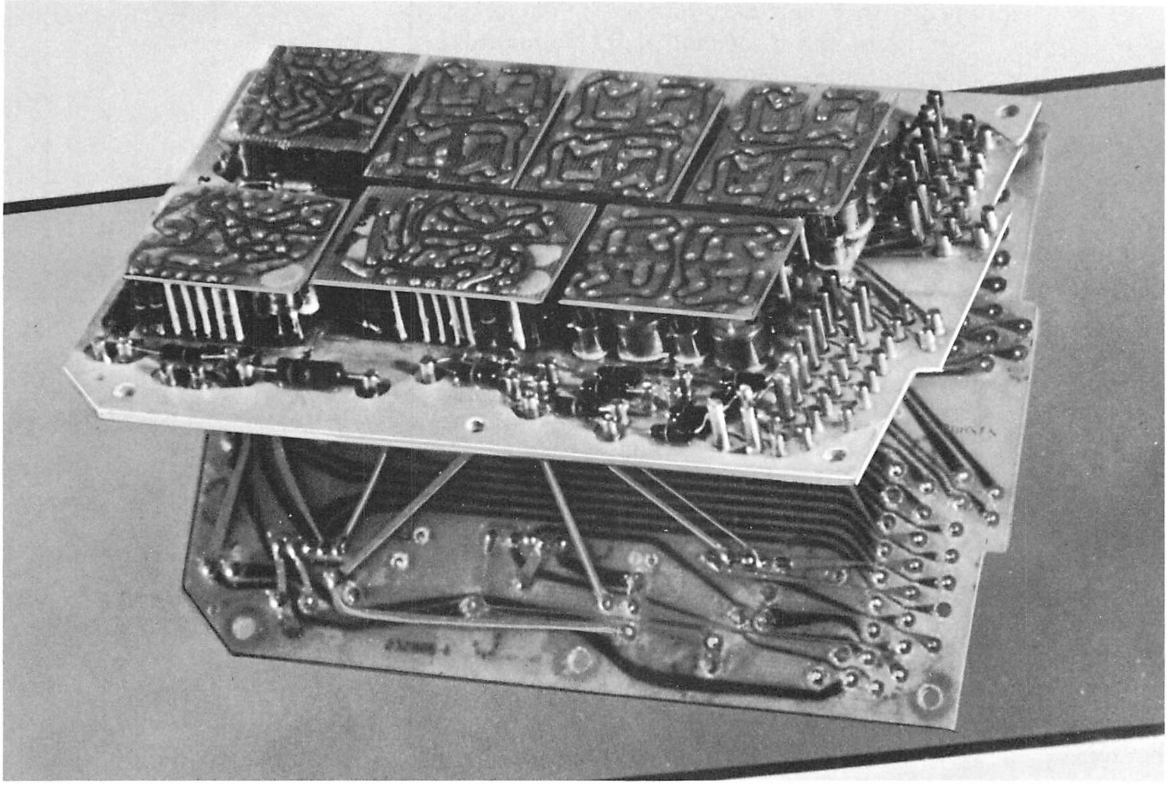

Fig. II-13. Electronic module configuration

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 operated 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 several 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 video bandwidth required is 220 kHz.

A second scan mode of operation in the camera provides a 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 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 three photometric/colorimetric reference charts. These charts are located on each of the omnidirectional antennas and on a spacecraft leg adjacent to the footpad, so that the line of sight of the camera in viewing each chart is normal (± 3 deg) to the chart plane. The charts 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 chart center. A series of radial lines incorporated to provide a gross estimate of camera resolution. Finally, each chart contains a center post to help determine solar angles, by means of the shadow information, after the lunar landing. Prior to launch, the charts were calibrated gonio-photometrically to allow an estimation of postlanding camera dynamic range.

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

Surveyor VII was equipped with 11 auxiliary mirrors. One of the mirrors was mounted on the spacecraft mast to view, effectively from an additional position, a portion of the lunar surface upon which surface sampler operations were being conducted. The base line separation provided stereoscopic sets of pictures for photogrammetric purposes (see frontispiece).

Three auxiliary mirrors were installed on the spacecraft for viewing obstructed areas of interest beneath the spacecraft. The largest of these mirrors was mounted for viewing of the area beneath Vernier Engine 3 and Crush Block 3, the next largest was mounted for viewing the area beneath Vernier Engine 2 and Crush Block 2, and the smallest was mounted for viewing the alpha scattering instrument deployment area on the lunar surface.

Seven small "dust" mirrors were mounted at various locations so as to be mutually positioned within the line-of-sight of both the TV camera and an exhaust plume of one of the vernier engines. Their purpose was to present, as a function of the ratio of diffuse light scattering relative to the remaining specular reflectivity, a relative indication of each mirror's contamination by particle deposition or by erosion.

B. Camera Calibration

To derive maximum scientific information from a picture, it is necessary to have precise quantitative information about 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 VII* 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 November 16 through 18, 1967.

Calibration information was used both prior to the mission and during the post-mission data analysis period. Prior to launch, the entire television 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, fall-off of spatial frequency response, photometric non-uniformities, and coherent noise.

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

(1) Dynamic range or light-transfer characteristic.

(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-14 and II-15. Figure II-14 is a sine-wave slide for determining the modulation transfer or spatial frequency response of

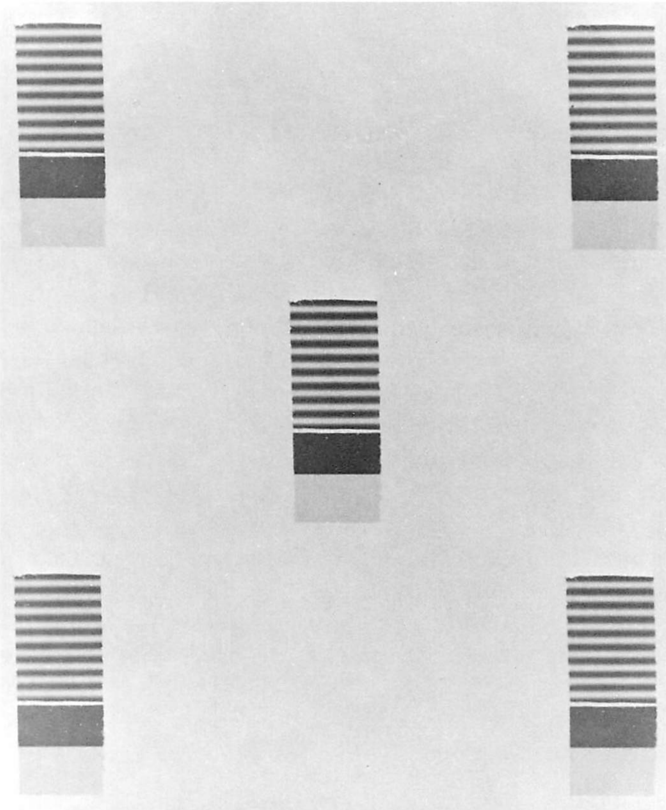

Fig. II-14. Sine-wave target used in determining spatial frequency response of camera during calibration

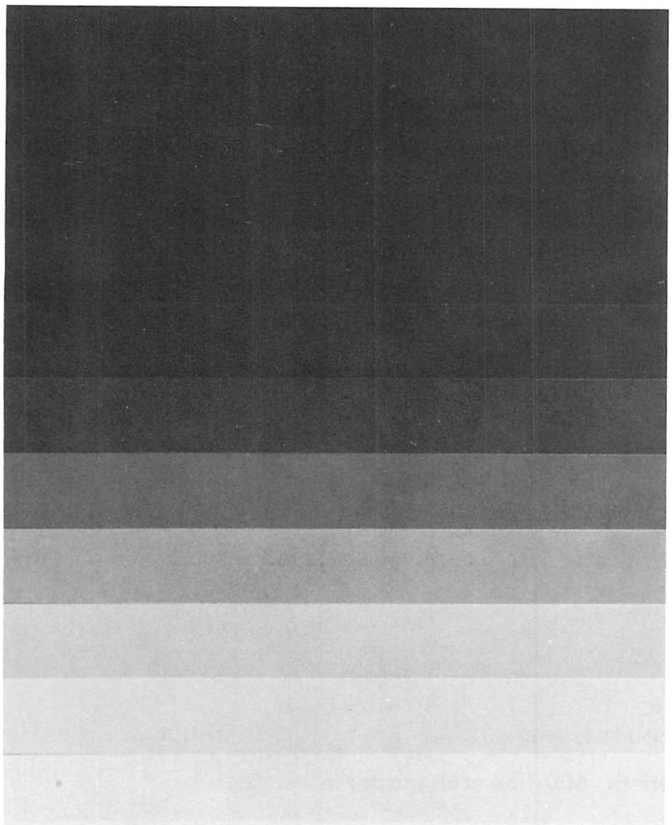

Fig. II-15. Grey-scale calibration target for erasure-characteristic calibration

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-15 has a series of gray scale wedges that determines the vidicon erasure characteristics, thereby enabling a correction to be applied as a function of latent image level resulting from previous exposures. Additionally, there is a grid pattern which, by 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.

Data of the type obtained during camera calibration are presented in Figs. II-16 through II-18 and II-5 through II-8.[2] The ordinate in the light transfer 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. Therefore, the ordinate scale can be viewed as a measure of relative video voltage. Figures II-16, II-7, and II-5 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. Figures II-6, II-7, and II-8 show the effect of varying the polarization angle of the incident light using each of the three polarizing filters. Figure II-18 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 width.

C. Mission Performance

Surveyor VII TV camera performance was excellent in quality and quantity of pictures, as well as in the extent of operations which could be conducted unrestricted by camera problems. The camera performed perfectly throughout the first lunar day. Picture quality was excellent primarily because the camera characteristics exhibited good dynamic range. A contributing factor was that the optical surfaces remained the cleanest for any mission, principally because the redesigned mirror assembly permitted the camera mirror to be fully closed during the touchdown phase. During the first lunar day, in addition to DSS 11 (Goldstone) operations, the camera was operated from DSS 42 (Canberra) and, to a lesser extent, from DSS 61 (Madrid). A total of 20,993 pictures was taken.

The *Surveyor VII* pictures included views of (1) parts of the spacecraft, (2) of the area beneath the spacecraft using the auxiliary mirrors, (3) panoramic-narrow- and wide-angle surveys of the lunar landscape in azimuth and elevation, (4) photometric surveys of specially selected objects, (5) stereoscopic views, (6) star surveys, (7) focus ranging sequences for mapping of the surrounding lunar surface, (8) shadow progressions, (9) views through different polarization filters, and (10) a post-sunset 16-h sequence that included star and solar corona observations and earthshine pictures.

Because *Surveyor VII* landed at approximately 40°S latitude, it was the first of the seven spacecraft which

[2]For more extensive data see *Surveyor VII* Spacecraft Survey Camera Science Calibration Report, JPL Project Document 602–65, Jan. 1, 1968.

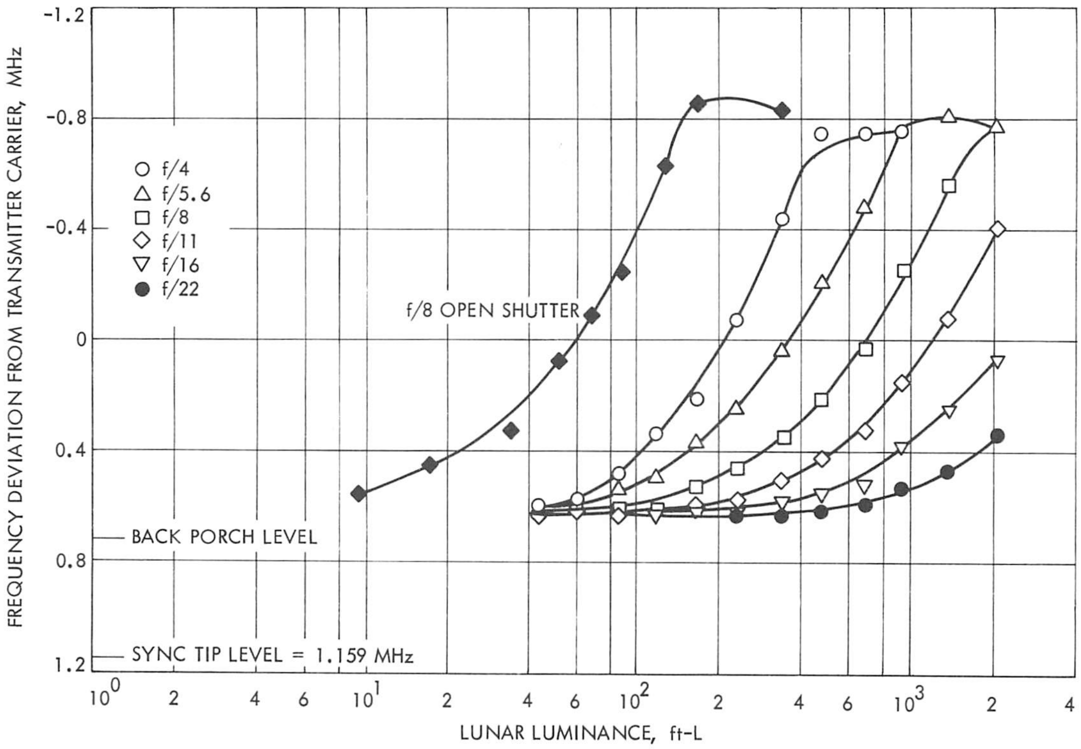

Fig. II-16. *Surveyor VII* **light transfer characteristic, 600-line scan mode, transmitter A**

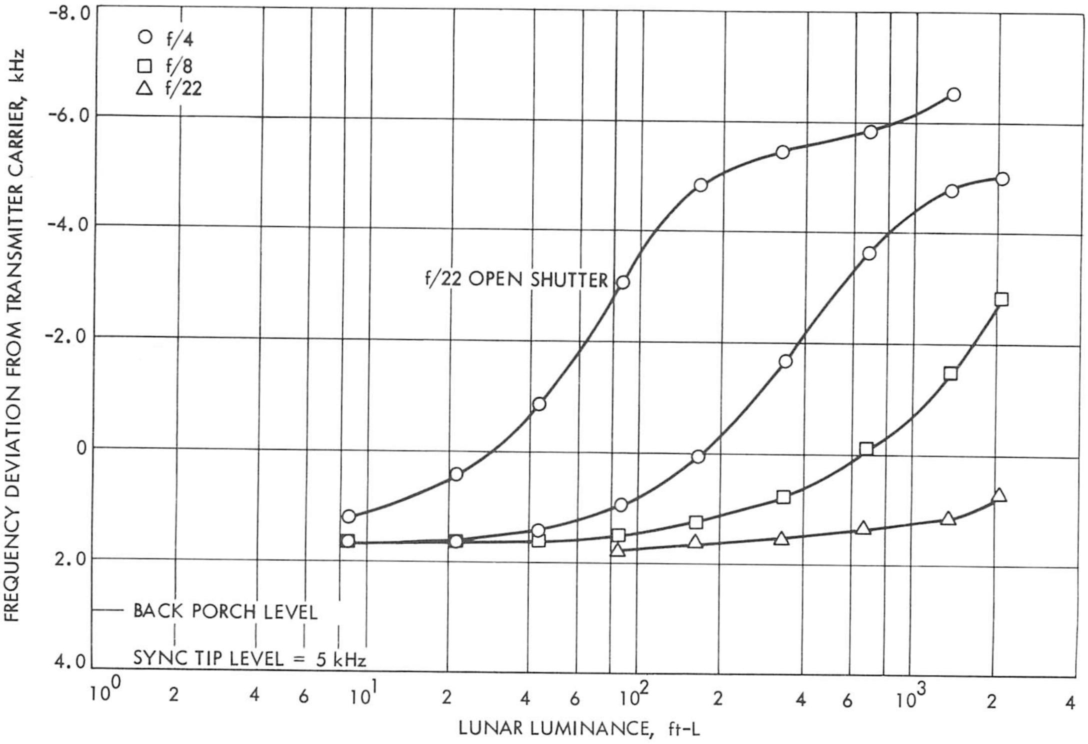

Fig. II-17. *Surveyor VII* **light transfer characteristic, 200-line scan mode, transmitter A**

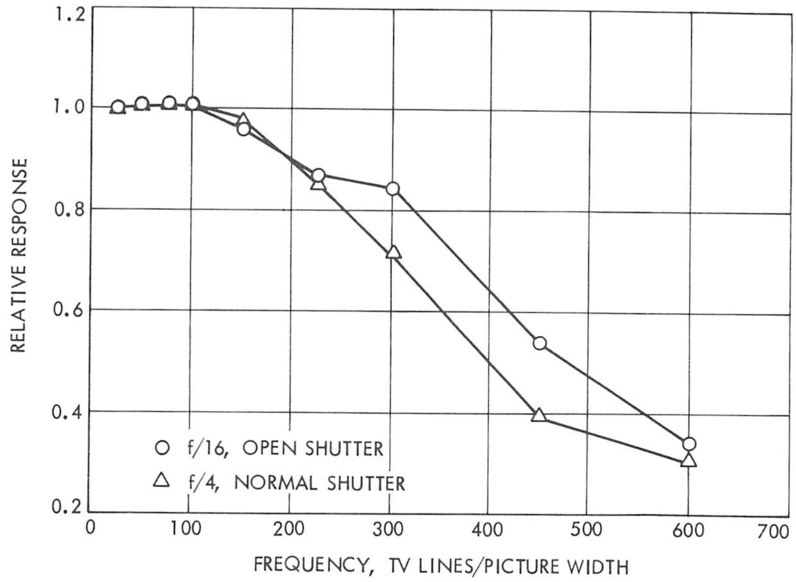

Fig. II-18. *Surveyor VII* frequency response, 600-line scan mode, transmitter A

could take frequent, unobstructed, narrow-angle views of the earth. Earth pictures, with and without polarizing filters, were taken throughout the lunar day.

The camera was used to observe particle accumulation on the bar magnets and on the seven "dust" mirrors. It provided the visual aspect of the surface sampler experiment. It assisted in relocation and in ascertaining surface contact of the alpha scattering instrument (ASI). It was of particular value in interpreting the difficulties in deploying the ASI and in guiding successful deployment by manipulation of the surface sampler.

The camera was also used to detect, for the first time, laser beams transmitted from the earth. Pictures of the earth were taken in which two laser beams can be seen. The beams, originating from argon ion lasers, were transmitted through telescopes at the JPL Table Mountain Observatory, Wrightwood, Calif., and at the Kitt Peak National Observatory, Tucson, Ariz.

Operations attempted during the second lunar day were limited. The 600-line pictures could not be transmitted because high-power transmission was inoperative. However, camera performance in the 200-line scan mode was normal; therefore, this mode was used.

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III. Orientation of Camera and Sun

T. H. Bird

The application of *Lunar Orbiter V* high-resolution frame H-128 and correlation of surface features recorded by the *Surveyor VII* TV camera provided the data for determination of the final landing site location for this mission. Careful association of the noted landmarks and relation to the Orthographic Atlas of the Moon resulted in the following coordinate locations for *Surveyor VII:* 40.88°S latitude and 11.45°W longitude. This is estimated to be less than 1 km from the location indicated by tracking data.

The orientation of the spacecraft on the lunar surface was determined from measurement in the TV pictures of the positions at the earth, Jupiter, and the star Rigel in Orion, from the angular settings of the solar panel sun sensor, from the positional tuning of the spacecraft's planar array antenna, and from gyro data at touchdown. Reduction of these data indicates that the spacecraft was tilted 3.2 deg at an azimuth of 349 deg from lunar north during the first lunar day. The $-Y$ axis of the spacecraft was oriented 20.2 deg west of north. Because there is a slight difference (0.9 deg) between the camera 0-deg azimuth and the spacecraft $-Y$ axis, the 0-deg azimuth of the camera at a camera elevation of zero degrees, was oriented 21.8 deg west of north.[1] The camera was tilted down 13.6 deg on an azimuth 289 deg from lunar north. These estimated angles may have errors on the order of 1 deg.

The azimuth and zenith plots of the sun position for the *Surveyor VII* mission are shown in Fig. III-1. The indicated azimuth is in lunar coordinates.

[1]The camera optical axis was tilted 14.9 deg on a camera azimuth of +59.8 deg (relative to the spacecraft).

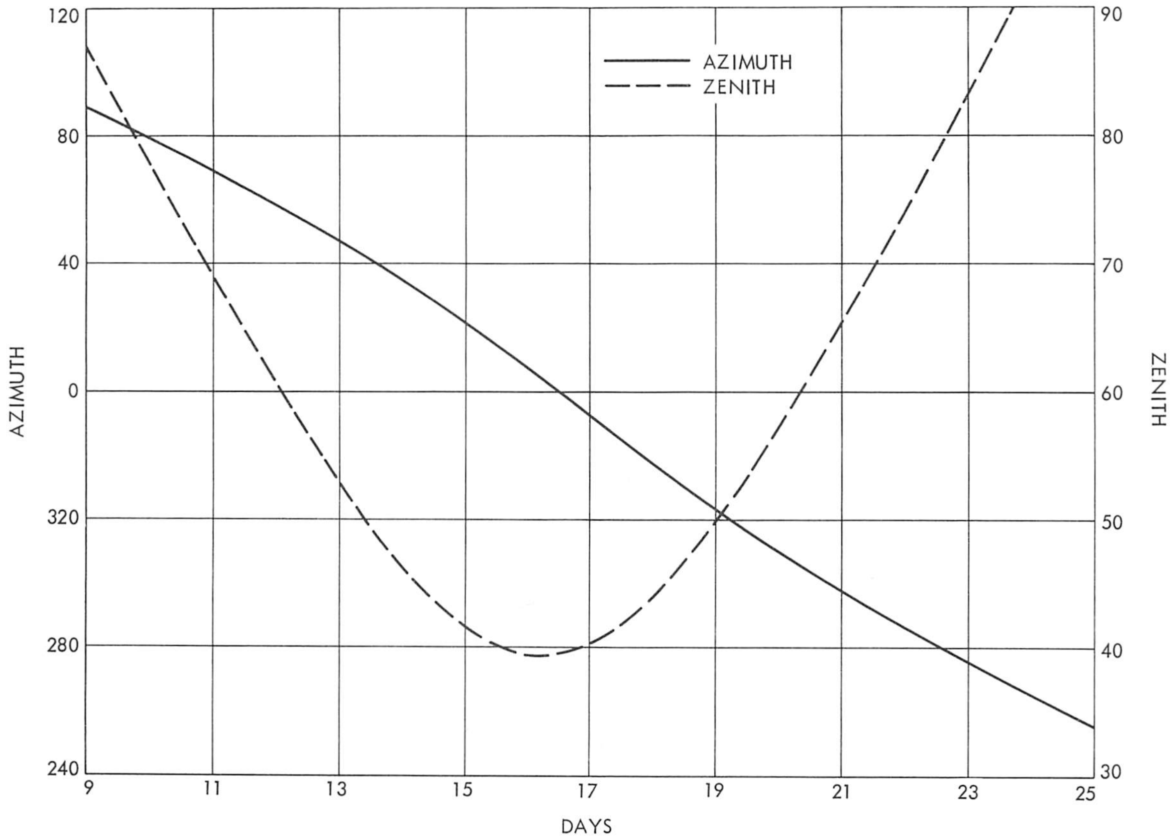

Fig. III-1. Azimuth and zenith plots of the sun position for *Surveyor VII* mission, January 1968

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, California, 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- 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 received at DSS 11 is transmitted to the JPL/SFOF via 6-MHz microwave, in real time, and recorded on FR-700 and FR-1400 magnetic tapes 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).[1, 2]

[1]The SC-TVGDS is described in *Surveyor I Mission Report, Part I: Mission Description and Performance,* Technical Report 32-1023, Jet Propulsion Laboratory, Pasadena, Calif., pp. 116–119, Aug. 31, 1966.

[2]A calibration report giving pertinent information for *Surveyor VII* will be available.

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V. *Surveyor VII* 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 on the picture captions have been validated by editing through the use of mission sequence logs, command data logs, and mosaic references. Table V-1 presents the picture index and identification data for each picture. Table V-2 presents a reference list of photographic subjects.

The format of the identification data is as follows:

(1) *Time.* The GMT of picture receipt by the tracking station is given as day of year, hour, minutes, and seconds.

(2) *Azimuth.* The camera mirror azimuth is given in degrees of mirror rotation. The azimuth range is +132.0 to −222.0 deg in nominal 3.0-deg increments. The positive azimuth being counter clockwise from zero camera azimuth, as seen from above. Negative azimuths are clockwise from camera zero azimuth.

(3) *Elevation.* The camera-mirror elevation is given in degrees of rotation about the axis parallel to the azimuth plane. The elevation range is from +70.0 to −222.0 deg, in nominal 5.0-deg increments. The usual viewing range is from +40.0 to −60.0 deg.

(4) *Focus.* The distance to the plane of principal focus is given in meters. The range of the focus is from 1.22 m to infinity for steps 0 to 49, respectively.

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

(6) *Lens focal length.* The focal length of the camera optic is 25 mm for wide angle and 100 mm for narrow angle.

(7) *Filter.* The filter position can be clear, horizontal, 45 diagonal, or vertical. These filter numbers express the direction of filter polarization.

(8) *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 (see also Table V-3 for additional information). The arrows in the vector diagram point up, indicating the direction of local vertical.

Table V-1. Selected lunar pictures

Picture	GMT Day	GMT Hour	GMT Minute	GMT Second	Azimuth	Elevation	Focus distance, m	Iris setting	Lens focal length[a]	Filter	Remarks
1	010	03	49	58	−54	−5	2.35	f/4.0	W	Clear	
2	010	03	52	05	−36	−20	2.35	f/4.0	W	Clear	
3	010	03	53	04	−36	−5	2.35	f/4.0	W	Clear	
4	010	04	01	35	18	10	2.35	f/6.3	W	Clear	
5	010	04	01	55	18	−20	2.35	f/6.3	W	Clear	
6	010	04	05	27	54	−20	2.35	f/9.5	W	Clear	
7	010	04	05	47	54	−50	2.35	f/9.5	W	Clear	
8	010	04	09	59	126	−5	2.35	f/9.5	W	Clear	
9	010	04	13	30	−54	−65	2.35	f/7.0	W	Clear	
10	010	04	14	58	−54	−65	2.35	f/4.2	W	Clear	
11	010	04	38	57	−51	−55	2.65	f/6.0	N	Clear	
12	010	04	39	29	−72	−55	2.91	f/6.0	N	Clear	
13	010	05	41	09	−204	−40	2.35	f/6.0	W	Clear	
14	010	05	44	57	−204	−35	2.43	f/7.0	N	Clear	
15	010	05	56	30	−183	−5	205.24	f/6.0	N	Clear	
16	010	06	01	45	−144	−30	7.76	f/6.0	N	Clear	
17	010	06	04	08	−156	−10	205.24	f/6.0	N	Clear	
18	010	06	04	17	−168	−10	205.24	f/6.0	N	Clear	
19	010	06	04	26	−177	−5	205.24	f/5.9	N	Clear	
20	010	06	07	18	−117	−55	3.07	f/6.0	N	Clear	
21	010	06	07	27	−108	−50	3.44	f/6.0	N	Clear	
22	010	06	08	31	−117	−45	4.21	f/6.0	N	Clear	
23	010	06	08	40	−108	−40	4.97	f/6.0	N	Clear	
24	010	06	09	17	−129	−35	6.05	f/6.0	N	Clear	
25	010	06	10	37	−129	−25	13.08	f/6.0	N	Clear	
26	010	06	20	27	−78	−60	2.91	f/6.0	N	Clear	
27	010	06	21	12	−75	−55	3.07	f/6.0	N	Clear	
28	010	06	27	19	−75	−15	205.24	f/6.0	N	Clear	
29	010	06	49	30	−48	−50	2.77	f/6.0	N	Clear	
30	010	06	52	24	−57	−25	6.81	f/6.0	N	Clear	
31	010	06	52	29	−51	−25	2.65	f/6.0	N	Clear	
32	010	06	52	33	−45	−25	5.44	f/6.0	N	Clear	Processed[b]
33	010	06	52	38	−39	−25	5.44	f/6.0	N	Clear	Processed
34	010	06	52	42	−33	−25	4.97	f/6.0	N	Clear	Processed
35	010	06	52	46	−30	−20	5.44	f/6.0	N	Clear	Processed
36	010	06	52	51	−36	−20	6.05	f/6.0	N	Clear	Processed
37	010	06	52	56	−42	−20	6.81	f/6.0	N	Clear	Processed
38	010	06	52	59	−48	−20	7.76	f/6.0	N	Clear	Processed
39	010	06	53	04	−54	−20	8.97	f/6.0	N	Clear	
40	010	06	53	09	−60	−20	8.97	f/6.0	N	Clear	
41	010	06	53	58	−51	−15	13.08	f/6.0	N	Clear	
42	010	06	54	02	−45	−15	10.68	f/6.0	N	Clear	Processed
43	010	06	54	06	−39	−15	7.76	f/6.0	N	Clear	Processed
44	010	06	54	11	−33	−15	7.76	f/6.0	N	Clear	Processed

[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	010	06	54	15	−30	−10	10.68	f/6.0	N	Clear	Processed
46	010	06	54	20	−36	−10	13.08	f/6.0	N	Clear	Processed
47	010	06	54	25	−42	−10	17.93	f/6.0	N	Clear	Processed
48	010	06	54	28	−48	−10	61.92	f/6.0	N	Clear	Processed
49	010	06	54	33	−54	−10	205.24	f/6.0	N	Clear	
50	010	06	58	25	−39	−5	205.24	f/6.0	N	Clear	Processed
51	010	06	58	30	−33	−5	205.24	f/6.0	N	Clear	Processed
52	010	06	58	34	−30	0	205.24	f/6.0	N	Clear	Processed
53	010	06	58	38	−36	0	205.24	f/6.0	N	Clear	Processed
54	010	06	58	43	−42	0	205.24	f/6.0	N	Clear	Processed
55	010	06	58	48	−48	0	205.24	f/6.0	N	Clear	Processed
56	010	06	58	52	−54	0	205.24	f/6.0	N	Clear	
57	010	06	59	28	−39	5	205.24	f/6.0	N	Clear	Processed
58	010	06	59	33	−33	5	205.24	f/6.0	N	Clear	Processed
59	010	07	00	58	0	−60	2.18	f/6.0	N	Clear	
60	010	07	01	47	−6	−50	2.43	f/6.0	N	Clear	
61	010	07	05	20	−27	−15	6.81	f/7.0	N	Clear	
62	010	07	05	24	−21	−15	6.81	f/7.0	N	Clear	
63	010	07	05	37	−3	−15	5.44	f/7.0	N	Clear	
64	010	07	08	48	−24	−10	8.97	f/7.0	N	Clear	
65	010	07	08	52	−27	−5	27.73	f/7.0	N	Clear	
66	010	07	08	57	−21	−5	13.08	f/7.0	N	Clear	
67	010	07	09	02	−15	−5	10.68	f/7.0	N	Clear	
68	010	07	09	07	−9	−5	10.68	f/7.0	N	Clear	
69	010	07	09	11	−3	−5	8.97	f/7.0	N	Clear	
70	010	07	09	33	−30	0	61.92	f/6.9	N	Clear	
71	010	07	09	38	−27	5	205.24	f/7.0	N	Clear	
72	010	07	09	55	−3	5	205.24	f/7.0	N	Clear	
73	010	07	10	05	−6	10	205.24	f/7.0	N	Clear	
74	010	07	10	10	−12	10	205.24	f/7.0	N	Clear	
75	010	07	14	32	3	−55	2.26	f/7.0	N	Clear	
76	010	07	15	56	27	−45	2.35	f/7.0	N	Clear	
77	010	07	16	50	15	−35	2.77	f/7.0	N	Clear	
78	010	07	17	58	18	−20	3.93	f/7.0	N	Clear	
79	010	07	18	43	18	−10	5.44	f/7.0	N	Clear	
80	010	07	20	08	9	5	205.24	f/7.0	N	Clear	
81	010	07	20	26	30	10	205.24	f/7.0	N	Clear	
82	010	07	20	53	9	15	205.24	f/7.0	N	Clear	
83	010	07	20	58	15	15	205.24	f/7.0	N	Clear	
84	010	07	26	11	60	−30	2.77	f/8.2	N	Clear	
85	010	07	26	33	45	−25	3.07	f/8.2	N	Clear	
86	010	07	26	51	54	−20	3.44	f/8.2	N	Clear	
87	010	07	27	17	45	−15	4.21	f/8.2	N	Clear	
88	010	07	27	49	36	−10	4.97	f/8.2	N	Clear	
89	010	08	12	45	66	−10	4.49	f/9.5	N	Clear	Processed
90	010	08	15	29	96	10	205.24	f/9.5	N	Clear	
91	010	08	16	18	93	15	205.24	f/9.5	N	Clear	

Table V-1 (contd)

Picture	GMT				Azimuth	Elevation	Focus distance, m	Iris setting	Lens focal length[a]	Filter	Remarks
	Day	Hour	Minute	Second							
92	010	08	16	36	78	20	205.24	f/9.5	N	Clear	
93	010	08	16	40	72	20	205.24	f/9.5	N	Clear	
94	010	08	21	35	111	−55	2.26	f/8.2	N	Clear	
95	010	08	25	46	126	−10	7.76	f/8.1	N	Clear	
96	010	08	25	51	120	−10	6.81	f/8.1	N	Clear	
97	010	08	26	13	105	−5	7.76	f/8.2	N	Clear	
98	010	08	27	19	126	10	205.24	f/8.1	N	Clear	Processed
99	010	08	27	22	120	10	205.24	f/8.1	N	Clear	
100	010	08	27	27	114	10	205.24	f/8.1	N	Clear	
101	010	08	47	57	−57	50	205.24	f/17.2	N	Clear	Processed
102	010	09	00	09	36	−50	2.12	f/8.2	W	Clear	Processed
103	010	22	50	22	51	−50	1.28	f/8.2	W	Clear	
104	010	23	54	36	−216	−10	3.23	f/7.0	N	Clear	
105	010	23	55	47	−210	−15	3.07	f/7.0	N	Clear	
106	010	23	59	54	12	−45	2.35	f/7.0	N	Clear	
107	011	01	50	00	27	−35	1.96	f/7.0	W	Clear	
108	011	01	56	36	24	−25	1.75	f/9.5	N	Clear	
109	011	03	40	33	3	−45	2.35	f/7.1	N	Clear	
110	011	03	47	31	3	−45	2.35	f/25.4	N	Vertical	
111	011	03	55	42	3	−45	2.35	f/6.7	N	45 diagonal	
112	011	04	27	06	12	−40	2.54	f/16.8	N	Clear	
113	011	04	52	24	12	−40	2.65	f/7.0	N	Clear	
114	011	06	14	44	−54	−60	2.54	f/6.0	N	Clear	
115	011	06	29	29	75	−20	3.07	f/9.5	N	Clear	Processed
116	011	07	39	02	36	−50	1.47	f/4.0	W	Clear	
117	011	07	45	07	36	−50	1.47	f/4.0	W	Clear	
118	011	07	48	26	36	−50	1.47	f/4.0	N	Clear	
119	011	09	01	15	−57	50	205.24	f/13.5	N	Clear	
120	011	10	11	26	−108	−40	3.66	f/6.0	N	Clear	Processed
121	011	13	41	24	69	−25	3.07	f/11.6	N	Clear	
122	012	00	04	46	33	15	205.24	f/9.5	N	Clear	Processed
123	012	00	25	41	−210	−15	3.23	f/9.5	N	Clear	
124	012	00	26	10	−213	−15	3.23	f/9.5	N	Clear	
125	012	00	30	20	3	−45	2.43	f/9.5	N	Clear	
126	012	02	38	23	−6	−50	2.18	f/15.8	N	Vertical	
127	012	02	44	16	−3	−50	2.18	f/8.4	N	Clear	
128	012	02	47	35	−3	−50	2.18	f/20.1	N	Vertical	
129	012	05	11	08	−57	50	205.24	f/16.4	N	Clear	
130	012	05	48	29	42	−50	1.43	f/3.8	W	Clear	
131	012	06	31	06	48	−50	1.43	f/9.5	W	Clear	
132	012	06	57	30	48	−45	1.43	f/8.6	W	Clear	
133	012	07	41	12	48	−50	1.43	f/3.8	W	Clear	
134	012	08	04	06	45	−60	1.43	f/10.5	W	Clear	
135	012	09	15	44	42	−50	2.35	f/7.4	W	Clear	
136	012	09	16	29	42	−50	2.35	f/7.4	N	Clear	
137	012	10	52	20	132	5	205.24	f/10.5	N	Clear	
138	012	10	53	22	132	−10	8.97	f/10.5	N	Clear	

Table V-1 (contd)

Picture	GMT				Azimuth	Elevation	Focus distance, m	Iris setting	Lens focal length[a]	Filter	Remarks
	Day	Hour	Minute	Second							
139	012	10	54	56	129	5	205.24	f/10.5	N	Clear	
140	012	10	58	20	−222	−10	10.68	f/10.5	N	Clear	
141	012	10	58	46	−222	−5	27.73	f/10.5	N	Clear	
142	013	00	51	54	−54	−35	4.49	f/8.6	N	Clear	
143	013	00	52	10	−54	−35	4.49	f/8.6	N	Horizontal	
144	013	00	52	24	−54	−35	4.49	f/8.6	N	45 diagonal	
145	013	00	52	40	−54	−35	4.49	f/8.6	N	Vertical	
146	014	10	23	40	−72	−60	2.18	f/9.0	N	Clear	
147	014	10	49	59	−54	−35	4.49	f/9.9	N	Clear	
148	014	10	50	14	−54	−35	4.49	f/9.9	N	Horizontal	
149	014	10	50	30	−54	−35	4.49	f/9.9	N	45 diagonal	
150	014	10	50	46	−54	−35	4.49	f/9.9	N	Vertical	
151	015	07	29	43	−216	−5	2.43	f/14.2	W	Clear	
152	015	11	51	31	87	−15	4.21	f/12.1	N	Clear	
153	015	11	51	36	93	−15	4.21	f/12.1	N	Clear	
154	015	11	52	02	66	−10	4.49	f/12.1	N	Clear	
155	015	12	15	11	90	0	8.97	f/11.6	N	Clear	
156	015	12	15	21	78	0	7.76	f/11.6	N	Clear	
157	015	12	15	24	72	0	7.76	f/11.6	N	Clear	
158	015	12	16	02	96	10	205.24	f/11.6	N	Clear	
159	015	12	16	06	90	10	205.24	f/11.6	N	Clear	
160	015	12	16	10	84	10	205.24	f/11.6	N	Clear	
161	015	12	16	15	78	10	205.24	f/11.6	N	Clear	
162	015	12	16	38	75	15	205.24	f/11.6	N	Clear	
163	015	12	16	41	81	15	205.24	f/11.6	N	Clear	
164	015	12	16	46	87	15	205.24	f/11.6	N	Clear	
165	015	12	16	51	93	15	205.24	f/11.6	N	Clear	
166	015	12	17	09	78	20	205.24	f/11.6	N	Clear	
161	015	12	17	14	72	20	205.24	f/11.6	N	Clear	
168	015	12	17	17	66	20	205.24	f/11.6	N	Clear	
169	016	09	05	36	−57	−60	2.12	f/12.1	N	Clear	
170	017	09	44	43	90	−15	4.21	f/11.6	N	Clear	
171	018	10	42	23	−54	55	205.24	f/17.2	N	Clear	
172	019	07	45	25	−210	−10	3.07	f/10.0	N	Vertical	Processed
173	019	07	51	00	6	−40	2.43	f/8.6	N	Vertical	Processed
174	019	07	54	21	−210	−10	3.07	f/8.6	N	Vertical	Processed
175	019	08	30	25	−51	55	205.24	f/17.3	N	Clear	
176	019	18	20	55	−168	−30	6.81	f/14.9	N	Clear	
177	019	19	42	37	−117	−55	3.07	f/12.8	N	Clear	
178	020	08	59	36	−51	50	205.24	f/17.2	N	Clear	
179*	020	09	12	58	−54	50	205.24	f/3.8	N	Clear	
180	020	11	02	23	−54	50	205.24	f/13.5	N	Clear	
181	020	13	01	37	−54	50	205.24	f/14.2	N	Clear	
182	020	14	50	02	−21	−40	1.62	f/3.8	N	Clear	
183	020	16	09	58	−54	50	205.24	f/14.9	N	Clear	
184	020	19	44	39	−48	−20	7.76	f/10.5	N	Clear	
185	020	19	46	44	−42	0	205.24	f/10.5	N	Clear	

Table V-1 (contd)

Picture	GMT				Azimuth	Elevation	Focus distance, m	Iris setting	Lens focal length[a]	Filter	Remarks
	Day	Hour	Minute	Second							
186	020	19	47	33	−33	5	205.24	f/10.5	N	Clear	
187	021	08	20	48	−54	50	205.24	f/16.4	N	Clear	
188	021	10	54	02	45	−45	1.25	f/3.8	W	Clear	
189	021	11	52	40	48	−35	2.18	f/3.8	N	Clear	
190	021	13	59	09	51	−35	2.12	f/3.8	N	Clear	
191	021	21	32	08	−33	0	205.24	f/9.5	N	Clear	
192	021	22	50	31	−126	−35	2.26	f/9.5	W	Clear	
193	021	22	53	01	−216	−5	2.26	f/7.0	W	Clear	
194	022	11	21	12	51	−45	1.25	f/3.8	W	Clear	Processed
195	022	16	10	01	−57	−60	2.35	f/13.5	N	Clear	
196	022	17	11	45	−51	45	205.24	f/16.3	N	Clear	
197	022	17	54	03	−54	−5	2.35	f/9.0	W	Clear	
198	022	17	55	09	−36	−5	2.35	f/7.0	W	Clear	
199	022	18	29	39	−42	−10	10.68	f/9.0	N	Clear	
200	022	18	31	00	−57	−5	205.24	f/7.7	N	Clear	
201	022	18	31	31	−42	0	205.24	f/7.7	N	Clear	
202	022	18	31	36	−48	0	205.24	f/7.7	N	Clear	
203	022	20	05	07	120	10	205.24	f/5.7	N	45 diagonal	
204	022	20	07	06	129	5	205.24	f/5.7	N	45 diagonal	
205	022	20	10	41	−51	45	205.24	f/16.3	N	Clear	
206	022	23	07	58	−111	−25	3.93	f/13.4	W	Clear	
207	022	23	21	21	−51	45	205.24	f/17.2	N	Clear	
208	023	01	04	55	−51	45	6.80	f/17.5	N	Clear	
209	023	03	05	25	−117	−20	205.24	f/12.8	W	Clear	
210	023	03	09	23	−51	45	205.24	f/16.3	N	Clear	
211	023	05	09	59	−51	45	205.24	f/15.6	N	Clear	
212	023	05	35	08	−111	−15	205.24	f/9.5	W	Clear	
213	023	06	18	32	69	20	205.24	f/4.0	N	Clear	
214	023	07	19	16	−153	−10	205.24	f/6.6	W	Clear	
215	023	07	35	42	−51	45	205.24	f/15.5	N	Clear	
216	023	10	03	54	−42	0	28.00	f/5.3	N	Clear	
217	023	10	07	35	−51	45	28.00	f/15.5	N	Clear	
218	023	12	12	36	−51	45	28.00	f/10.4	N	Clear	
219	023	14	13	16	−51	45	28.20	f/15.5	N	Clear	
220	023	16	29	01	−51	45	27.80	f/15.5	N	Clear	
221*	023	17	05	39	−111	35	28.00	f/4.0	W	Clear	
222	023	19	34	50	−51	45	28.00	f/15.5	N	Clear	
223	045	09	03	20	48	−45	1.43	f/16.0	W	Clear	200 lines, Second Lunar Day
224	045	11	11	55	−168	−35	1.43	f/16.0	W	Clear	200 Lines, Second Lunar Day

*Frame No. 179; exposure time was 8 min 41 sec.
Frame No. 221; exposure time was 30 min.

Table V-2. Reference list of photographic subjects[a]

Subject	Photograph number
1. 200-line mode	223, 224
2. Footpad 2	9, 10, 146, 169, 195
3. Area to east	20, 21, 22, 23, 24, 25, 120, 126, 177, 206, 209, 212
4. Area to northeast	1, 28, 29, 30, 31, 32, 38, 39, 40, 41, 42, 48, 49, 55, 56, 142, 143, 144, 145, 147, 148, 149, 150, 184, 197, 200, 202
5. Area to north	2, 3, 4, 5, 33, 34, 35, 36, 37, 43, 44, 45, 46, 47, 50, 51, 52, 53, 54, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 125, 128, 185, 186, 191, 198, 199, 201, 216
6. Area to northwest	76, 77, 78, 79, 80, 81, 82, 83, 85, 87, 88, 106, 122
7. Area to west	6, 84, 86, 89, 92, 93, 115, 121, 152, 154, 155, 156, 157, 159, 160, 161, 162, 163, 164, 166, 167, 168, 170, 213
8. Area to southwest	8, 90, 91, 94, 95, 96, 97, 98, 99, 100, 137, 138, 139, 153, 158, 165, 203, 204
9. Area to south	15, 104, 105, 123, 124, 140, 141, 151, 193
10. Area to southeast	16, 17, 18, 19, 176, 214
11. Alpha-scattering instrument	7, 102, 103, 116, 117, 118, 130, 131, 132, 133, 134, 135, 136, 188, 189, 190, 194, 223
12. Surface sampler instrument	107, 108, 109, 110, 111, 112, 113, 116, 117, 118, 126, 127, 130, 131, 132, 133, 135, 136, 151, 172, 173, 174, 182, 188, 189, 193, 194
13. Magnets	114, 169, 182, 195
14. Auxiliary mirrors	13, 14, 123, 124, 151, 172, 174, 193
15. Polarizing filters	142, 143, 144, 145, 147, 148, 149, 150
16. Laser images on earth	179
17. Earth (lunar a.m.)	101, 119, 129
18. Earth (lunar p.m.)	171, 175, 178, 179, 180, 181, 183, 187, 196, 205, 207, 208, 210, 211, 215, 217, 218, 219, 220, 222
19. Constellation Orion	221
20. Rock near footpad 2	9, 10, 11
21. Footpad 2 throw-out	12, 26, 27, 146
22. Compartment A	224
23. Omnidirectional antenna B, photo chart	6
24. Spacecraft shadow	192, 206, 209, 212
25. Second lunar day	223, 224

[a]Earth photographs have additional enlargement and show approximately 1/3 of a full frame. Because the spacecraft is located in the southern hemisphere of the moon, the earth photographs have an additional 180-deg rotation to establish normal North Pole orientation.

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	−150	+30	15	−7	−7	−105	+112	+22
132	−147	+33	12	−3	−3	−108	+114	+24
129	−144	+36	9	0	0	−111	+116	+26
126	−141	+39	6	+4	+4	−114	+119	+29
123	−137	+41	3	+8	+8	−117	+121	+31
120	−134	−44	0	+11	+11	−120	+123	+33
117	−131	−41	−3	+15	+15	−123	+125	+35
114	−128	−38	−6	+18	+18	−126	+128	+38
111	−124	−34	−9	+22	+22	−129	+130	+40
108	−121	−31	−12	+25	+25	−132	+132	+42
105	−118	−28	−15	+28	+28	−135	+134	+44
102	−114	−24	−18	+32	+32	−138	+136	−44
99	−111	−21	−21	+35	+35	−141	+139	−41
96	−107	−17	−24	+38	+38	−144	+141	−39
93	−104	−14	−27	+41	+41	−147	+143	−37
90	−100	−10	−30	+44	+44	−150	+145	−35
87	−96	−6	−33	+48	−42	−153	+148	−32
84	−93	−3	−36	+51	−39	−156	+150	−30
81	−89	+1	−39	+54	−36	−159	+152	−28
78	−85	+5	−42	+57	−33	−162	+155	−25
75	−82	+8	−45	+60	−30	−165	+157	−23
72	−78	+12	−48	+63	−27	−168	+159	−21
69	−74	+16	−51	+66	−24	−171	+162	−18
66	−71	+19	−54	+69	−21	−174	+164	−16
63	−67	+23	−57	+71	−19	−177	+166	−14
60	−63	+27	−60	+74	−16	−180	+169	−11
57	−59	+31	−63	+77	−13	−183	+171	−9
54	−56	+34	−66	+80	−10	−186	+174	−6
51	−52	+38	−69	+82	−8	−189	+176	−4
48	−48	+42	−72	+85	−5	−192	+179	−1
45	−44	−44	−75	+88	−2	−195	+182	+2
42	−40	−40	−78	+90	0	−198	+184	+4
39	−37	−37	−81	+93	+3	−201	+187	+7
36	−33	−33	−84	+95	+5	−204	+190	+10
33	−29	−29	−87	+98	+8	−207	+193	+13
30	−25	−25	−90	+100	+10	−210	+195	+15
27	−22	−22	−93	+102	+12	−213	+198	+18
24	−18	−18	−96	+105	+15	−216	+201	+21
21	−14	−14	−99	+107	+17	−219	+204	+24
18	−11	−11	−102	+109	+19	−222	+207	+27
						−225	+210	+30

[a]Camera azimuth.
[b]Rotation of lunar view.
[c]Angle between report view and lunar view.
Note: Negative rotations are counter clockwise in reference to top right corner of frame; positive rotations are clockwise.

VI. *Surveyor* Mosaics

D. L. Smyth

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

The semi-improved mosaics are prepared during the mission as better quality prints become 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 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	010	−216 to +126	W	Catalog No. 7-2-SI; 360-deg panorama—semi-improved, a.m.
2	010	−213 to −180	N	Catalog No. 7-6-SI; Segment 1—sectors 1 and 2, semi-improved
3	010	−177 to −144	N	Catalog No. 7-7-SI; Segment 1—sectors 3 and 4, semi-improved
4	014	−141 to −108	N	Catalog No. 7-30-SI; Segment 2—sectors 5 and 6, semi-improved
5	014	−105 to − 72	N	Catalog No. 7-31-SI; Segment 2—sectors 7 and 8, semi-improved
6	010	− 69 to − 36	N	Catalog No. 7-10-SI; Segment 3—sectors 9 and 10, semi-improved
7	010	− 33 to 0	N	Catalog No. 7-11-SI; Segment 3—sectors 11 and 12, semi-improved
8	010	+ 3 to + 36	N	Catalog No. 7-12-SI; Segment 4—sectors 13 and 14, semi-modified

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

Table VI-1 (contd)

Mosaic	Day	Azimuth, deg	Lens focal length[a]	Identification
9	010	+ 39 to + 72	N	Catalog No. 7-13-SI; Segment 4—sectors 15 and 16
10	010	+ 75 to +108	N	Catalog No. 7-14-SI; Segment 5—sectors 17 and 18, semi-improved
11	010	+111 to +126	N	Catalog No. 7-15-SI; Segment 5—sector 19, semi-improved
12	015	+111 to −216	N	Catalog No. 7-50-SI; Segment 5—sector 19 and end-stop[b] coverage
13	020	−216 to +126	W	Catalog No. 7-8-SI; 360-deg panorama—semi-improved, p.m.
14	010	− 30 to + 17	N	Catalog No. 7-16-SI; soil mechanics surface sampler area
15	013	− 30 to + 72	W, N	Catalog No. 7-24; soil mechanics surface sampler area
16	010	0 to + 18	W, N	Catalog No. 7-17-SI; stereo mirror and direct view
17	010, 011, 017, 018	−207 to −210	N	Catalog No. 7-SE-31 LM; 360-deg flat horizon
18	010, 017, 018	+ 9 to −171	N	Catalog No. 7-SE-20*; left portion
19	017, 018	+105 to −201	N	Catalog No. 7-SE-20A; rock pile behind the spacecraft
20	015	−216 to −222	N	Catalog No. 7-SE-12; rock pile—left portion is mirror view
21	013	+ 96 to −222	N	Catalog No. 7-SE-19; rock pile behind the spacecraft
22	018	+111 to −216	N	Catalog No. USGS 368164; rock pile behind the spacecraft
23	045	+114 to +132	N	Catalog No. USGS 368159; rock pile behind the spacecraft, second lunar day
24	020	0 to −192	W	Catalog No. 7-SE-13; close-in 180-deg panorama
25	010, 017	+ 66 to +117	N	Catalog No. 7-SE-20F; pad 3 area
26	015	+ 54 to +108	W	Catalog No. 7-SE-15; pad 3 area and throw-out, closeup
27	015	+ 63 to + 75	N	Catalog No. USGS 368163; rocks—vicinity of pad 3 area
28	017	+ 81 to +102	N	Catalog No. USGS 368165; large rock beyond leg 3
29	017	+ 84 to + 96	N	Catalog No. 7-SE-29; large rock beyond leg 3, closeup
30	010, 017	+ 66 to + 93	N	Catalog No. 7-SE-20E; pad 3 area
31	015	+ 66 to + 90	W	Catalog No. 7-SE-10; pad 3
32	017	+ 39 to + 51	N	Catalog No. USGS 368166; large rock west of spacecraft
33	013	− 30 to + 72	N	Catalog No. 7-SE-11; alpha scattering instrument and soil mechanics surface sampler area survey
34	015	− 24 to + 66	W	Catalog No. 7-SE-8; alpha scattering instrument and soil mechanics surface sampler area survey
35	010	− 30 to + 45	W	Catalog No. 7-SE-5; alpha scattering instrument and soil mechanics surface sampler area survey
36	021	+ 45 to + 72	N	Catalog No. 7-SE-26; closeup of alpha scattering instrument, position 1
37	022	+ 45 to + 54	N	Catalog No. 7-SE-25; closeup of alpha scattering instrument, position 2
38	019	− 30 to + 72	N	Catalog No. 7-SE-14; alpha scattering instrument and soil mechanics surface sampler area
39	020	+108 to −198	W	Catalog No. 7-SE-13A; mirror view of trench
40	021	− 30 to + 72	N	Catalog No. 7-SE-16; soil mechanics surface sampler area
41	010, 011	− 99 to − 33	N	Catalog No. 7-SE-20H; crater and rocks in vicinity of pad 2
42	014	− 90 to − 36	N	Catalog No. 7-SE-18; pad 2—throw-out area
43	010, 011	− 93 to − 48	N	Catalog No. 7-SE-20G; pad 2 area
44	018	− 69 to − 54	N	Catalog No. 7-SE-23; pad 2—throw-out area
45	010	− 69 to − 39	W	Catalog No. 7-SE-6; pad 2 and rock
46	011	− 66 to − 39	W	Catalog No. 7-SE-7; pad 2 and rock
47	020	− 64 to − 60	N	Catalog No. 7-SE-27; pad 2
48	010, 011	−174 to + 6	N	Catalog No. 7-SE-20*; right-portion mosaic
49	010, 011, 018	+105 to −117	N	Catalog No. 7-SE-20C; area behind the spacecraft
50	010, 011	−177 to −117	N	Catalog No. 7-SE-20B; area beyond compartment A
51	010	− 72 to − 18	N	Catalog No. 7-SE-3; crater and horizon

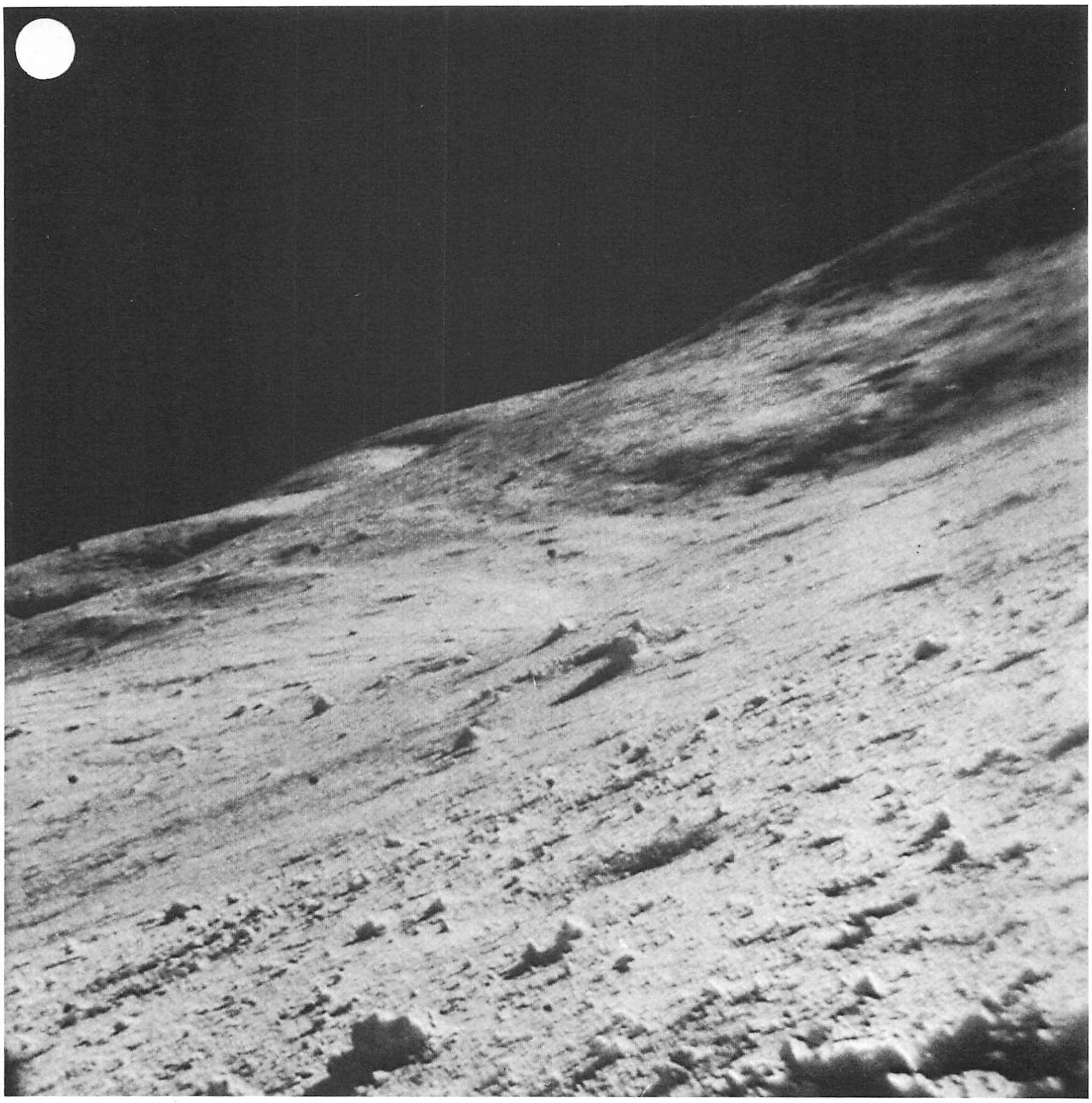
[b]End-stop = maximum left and right mirror azimuth positions.
*This mosaic is part of the one identified by the Catalog No.

VII. Selected Lunar Pictures and Mosaics

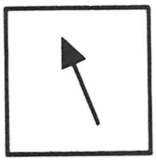
D. L. Smyth

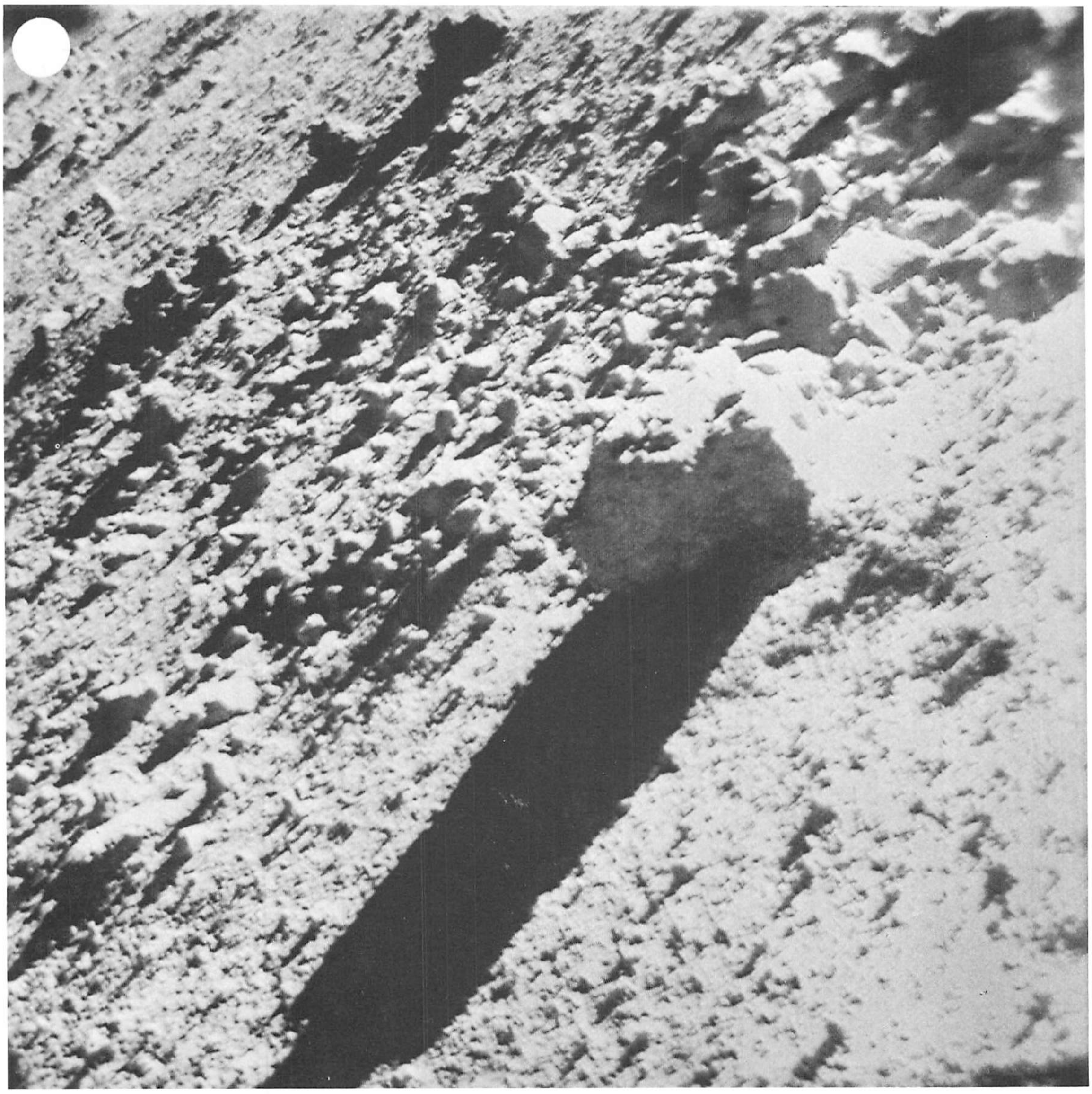
This section contains 224 selected pictures and 51 mosaics representing the *Surveyor VII* area. Each picture in this section is oriented such that the local lunar horizon or surface features appear near the proper perspective to the reader. The reader is assumed to be at the position of the camera mirror. For additional orientation, a white dot has been placed on the corner of the picture that corresponds to the top right-hand corner of the vidicon readout.

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



	GMT	Az	El	Focus, m	Iris	Lens	Filter
(1)	**Day 010, 03:49:58**	**—54**	**—5**	**2.35**	***f*/4.0**	**W**	**Clear**





	GMT	Az	El	Focus, m	Iris	Lens	Filter
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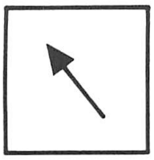

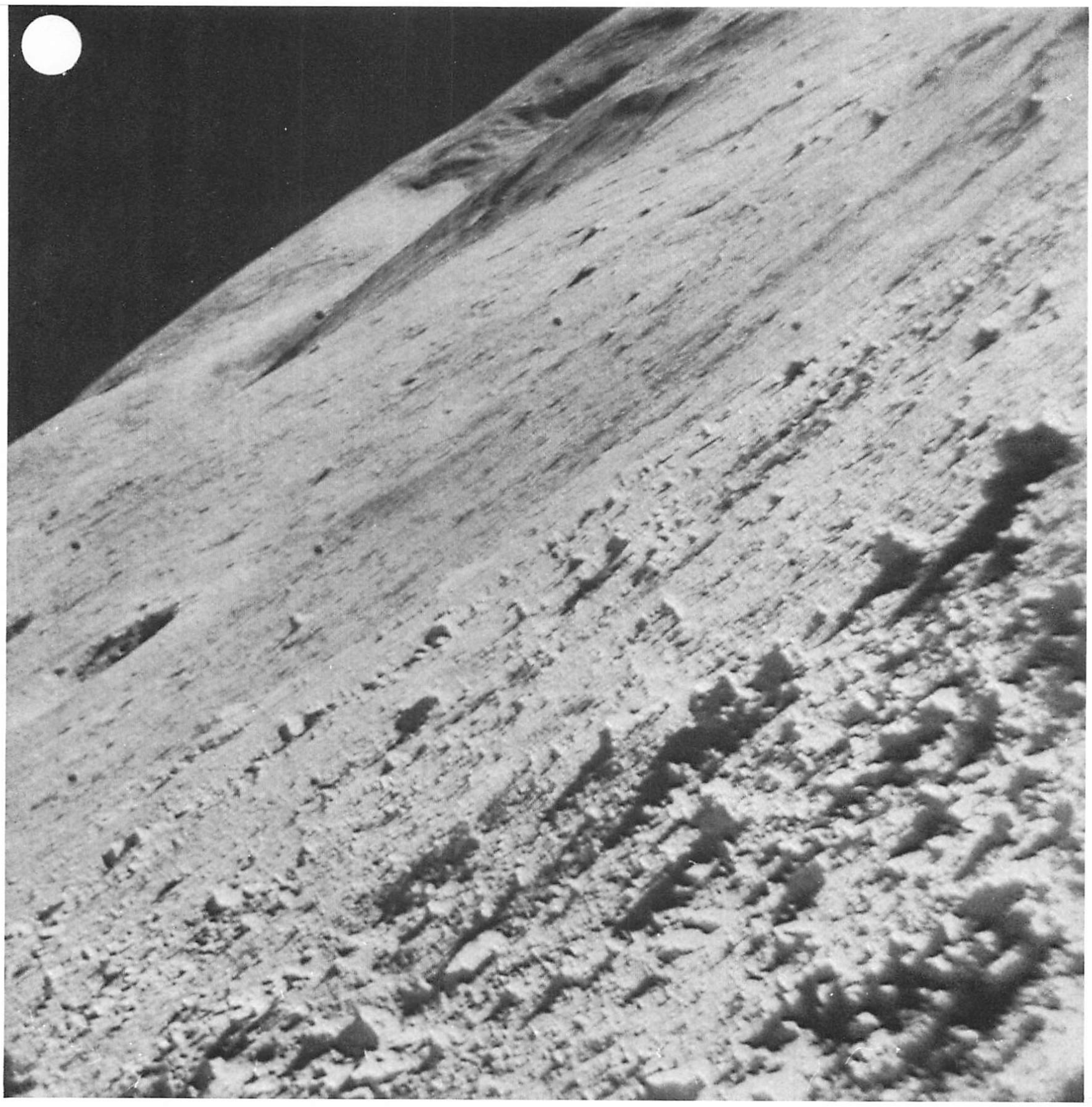

	GMT	Az	El	Focus, m	Iris	Lens	Filter
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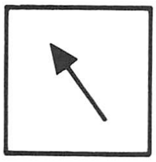

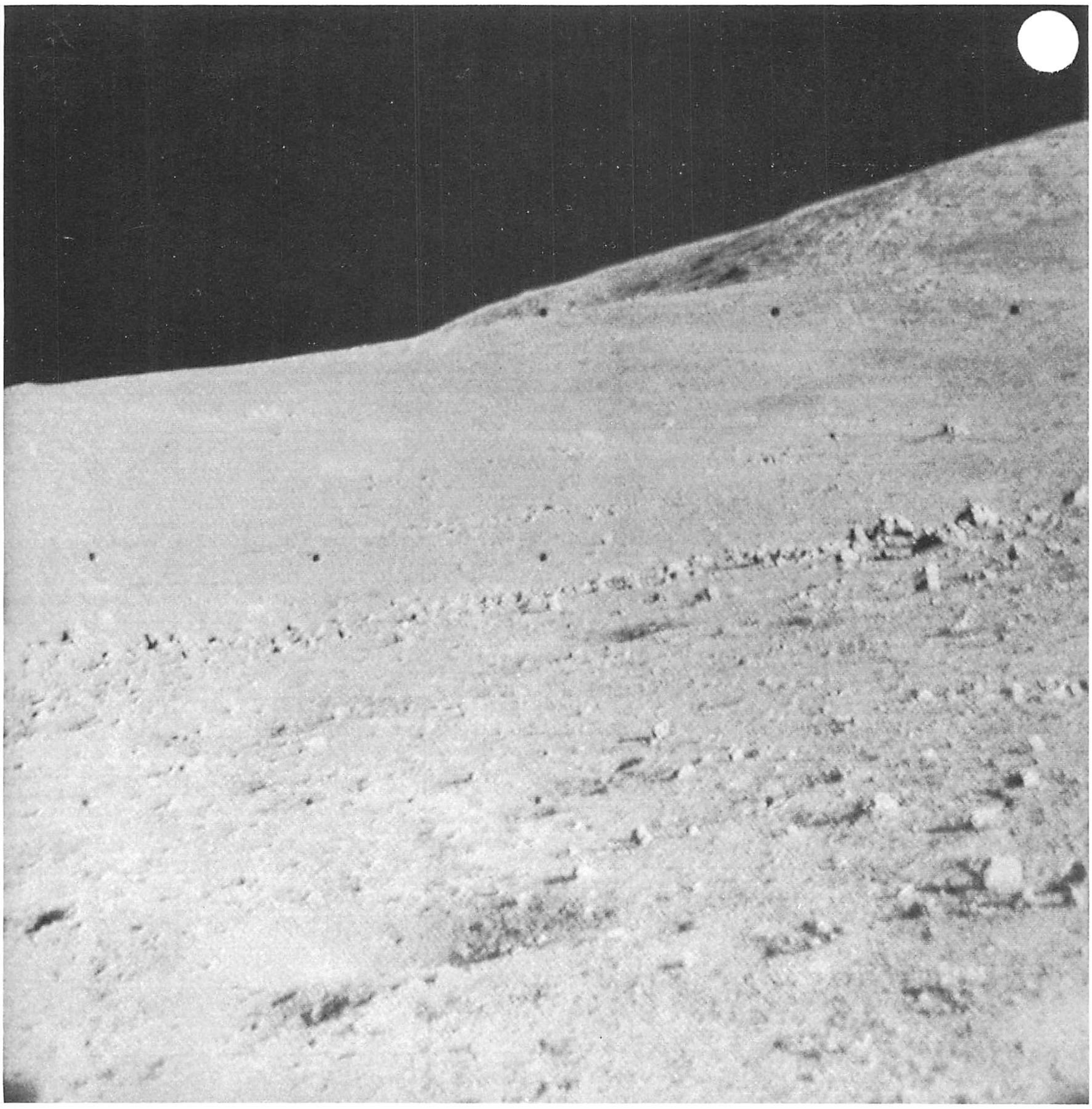

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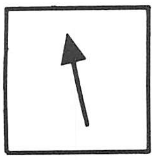
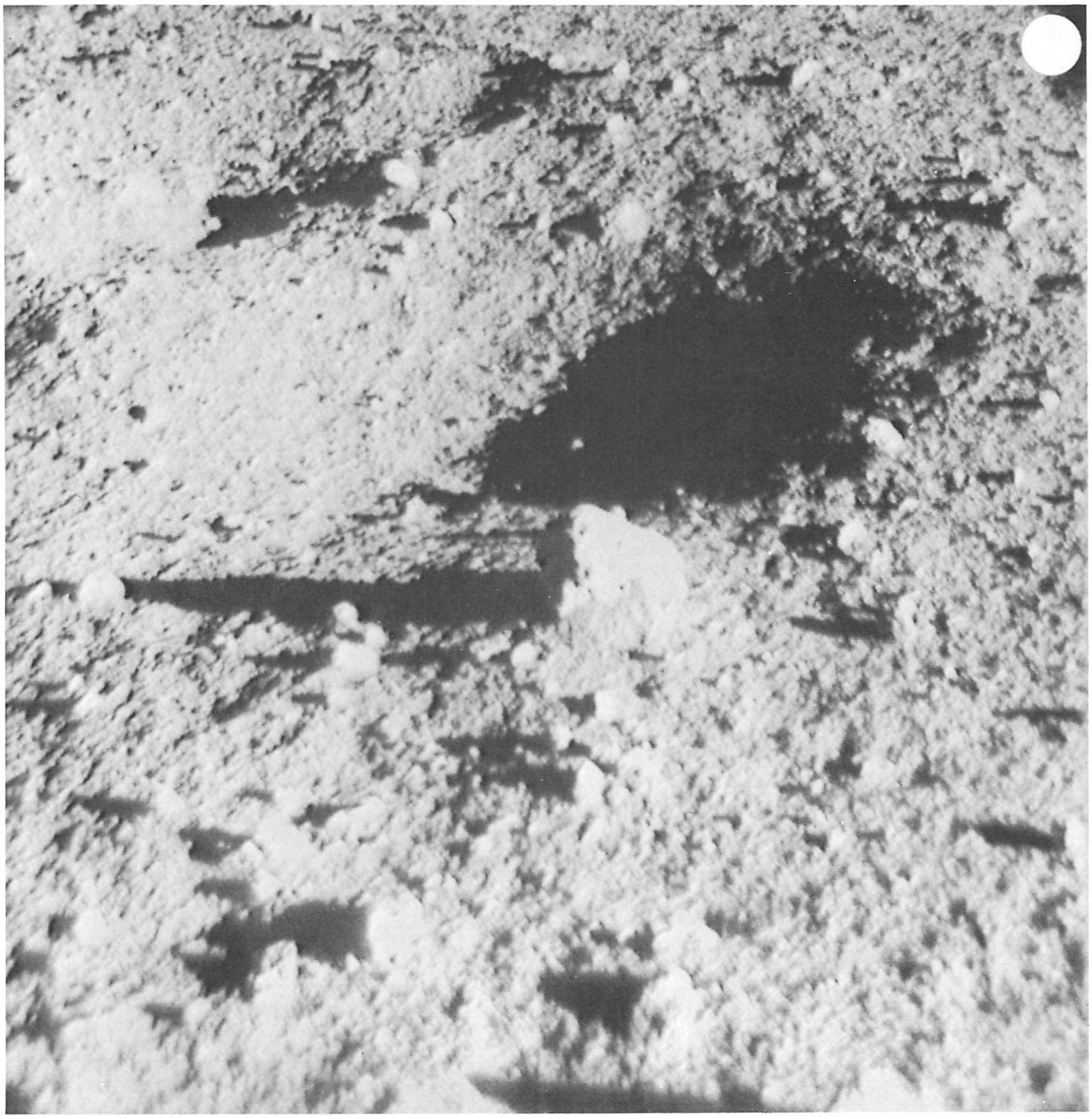
(4)	Day 010, 04:01:35	18	10	2.35	f/6.3	W	Clear





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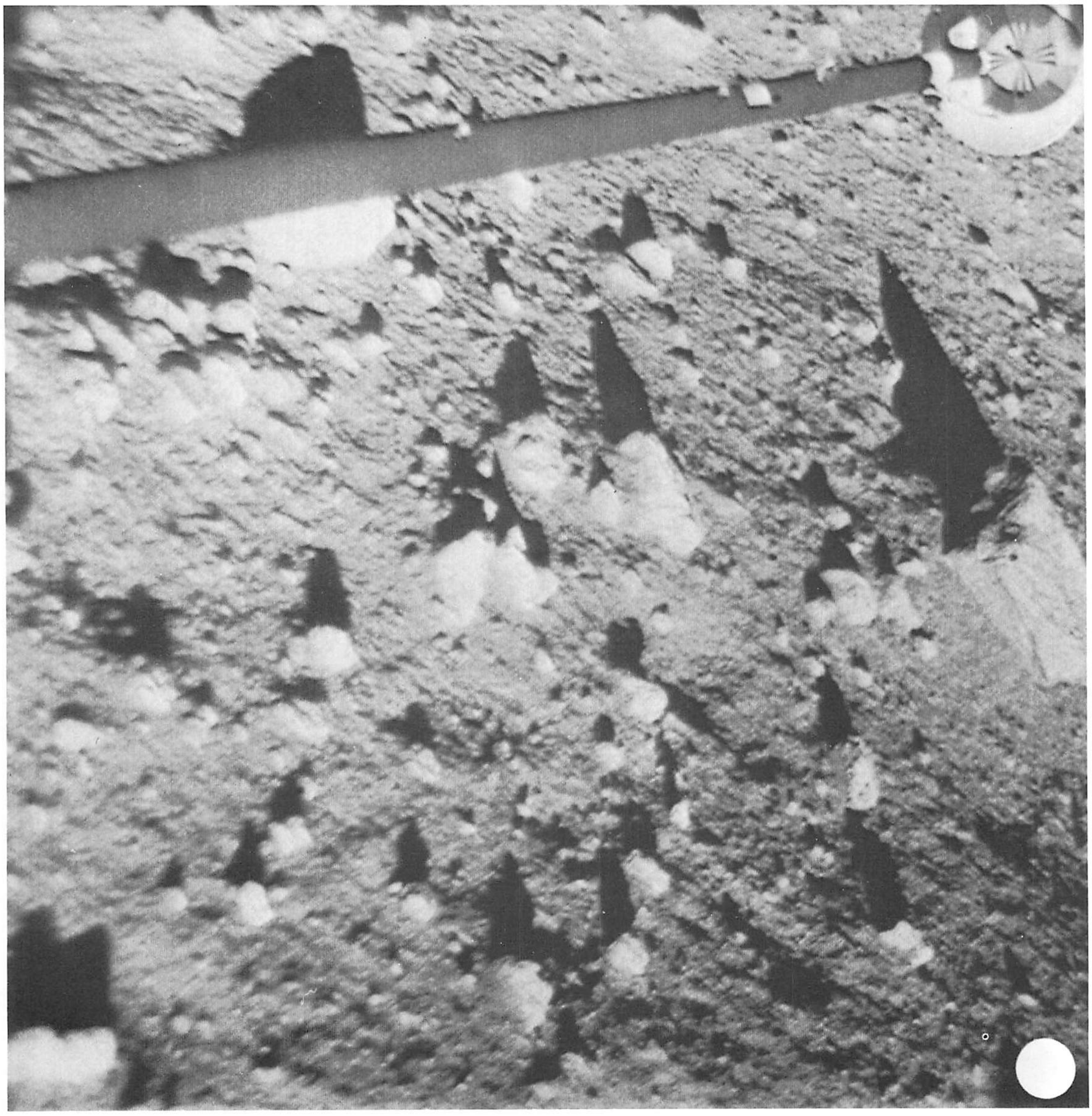
(5)	**Day 010, 04:01:55**	**18**	**—20**	**2.35**	**f/6.3**	**W**	**Clear**



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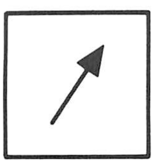
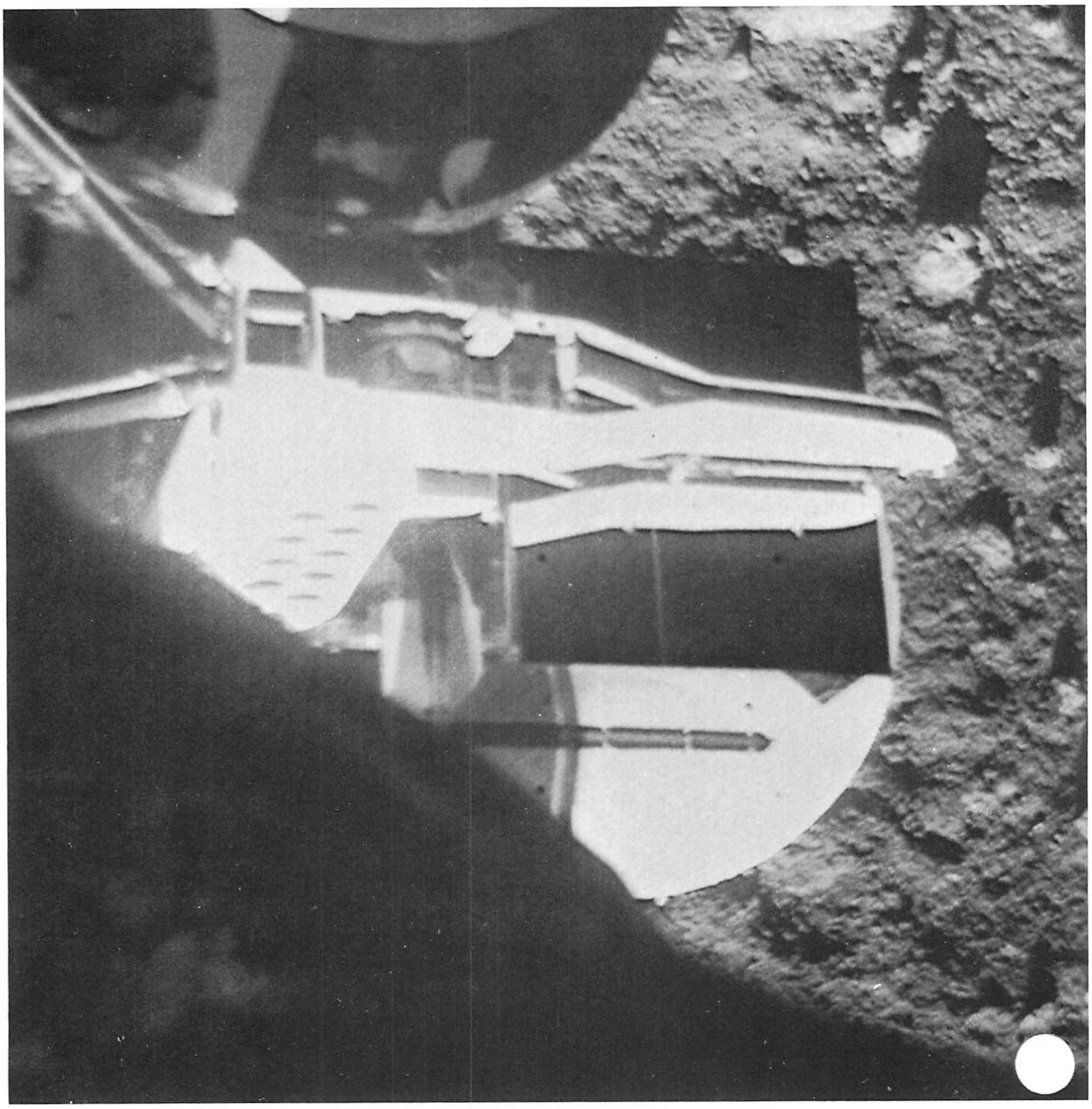
(6)	**Day 010, 04:05:27**	**54**	**—20**	**2.35**	***f*/9.5**	**W**	**Clear**





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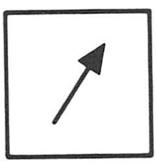

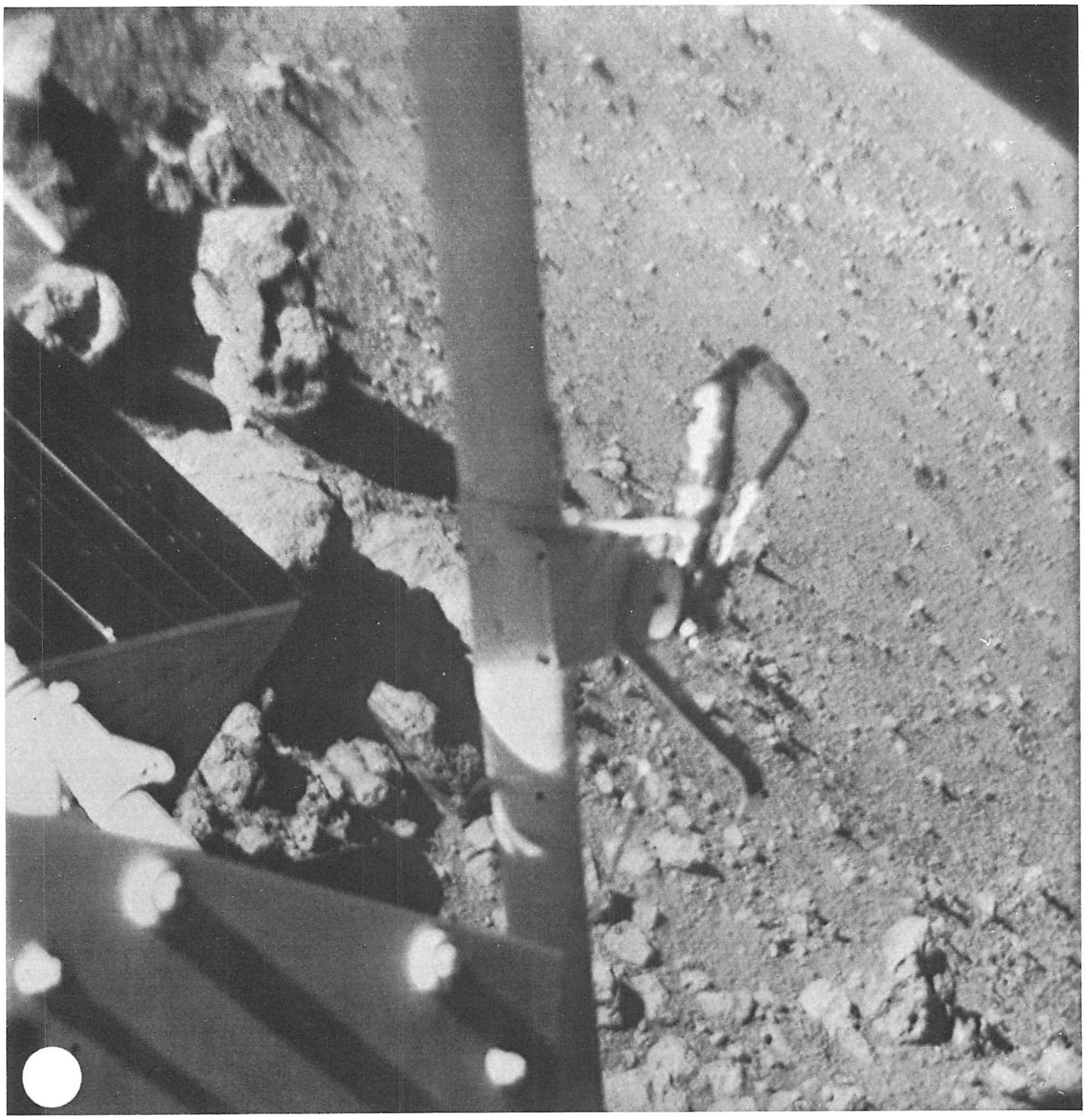

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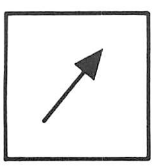
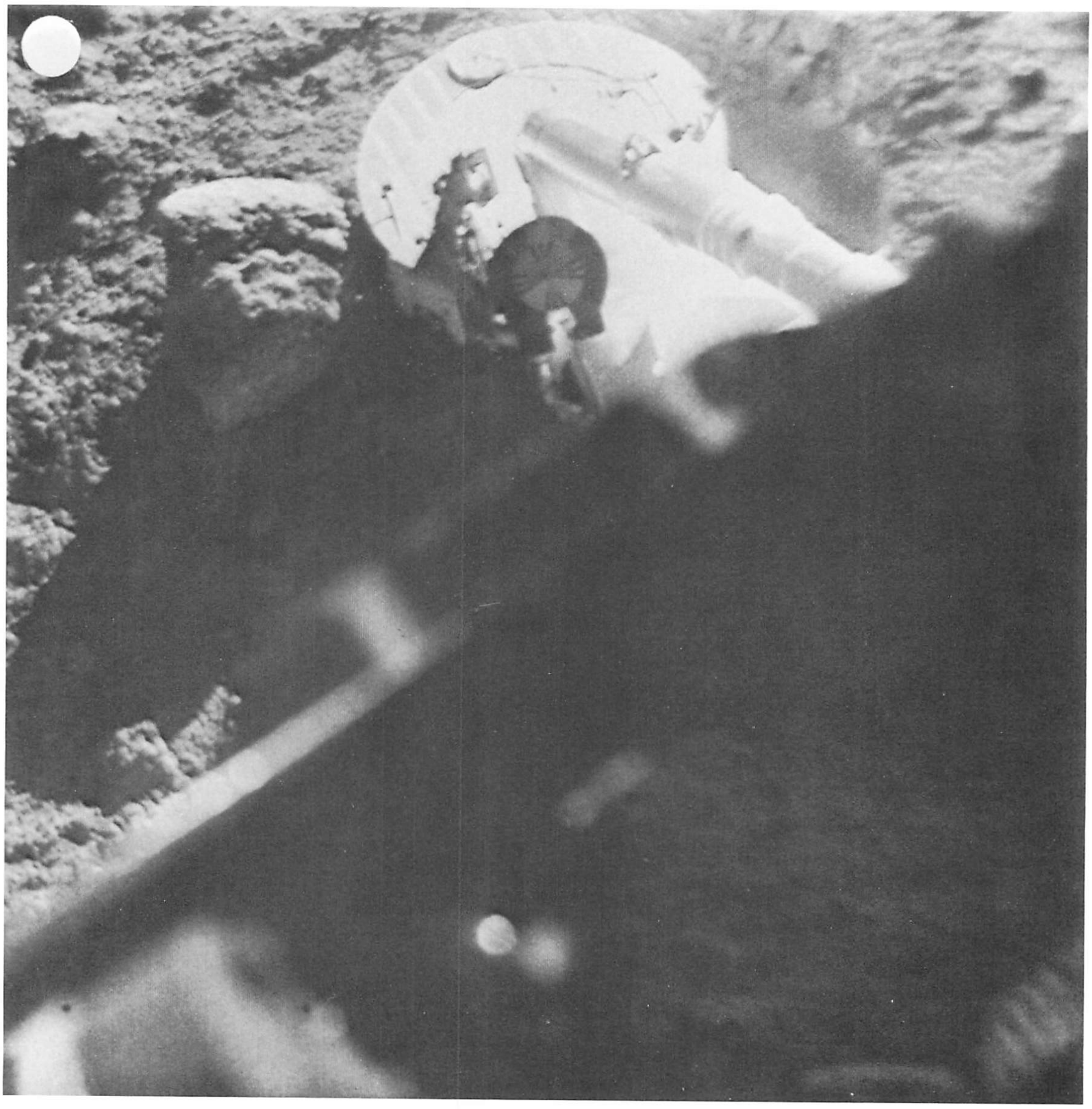
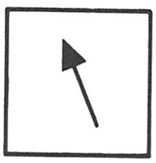




	GMT	Az	El	Focus, m	Iris	Lens	Filter
(9)	**Day 010, 04:13:30**	**−54**	**−65**	**2.35**	**f/7.0**	**W**	**Clear**



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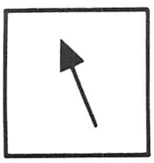
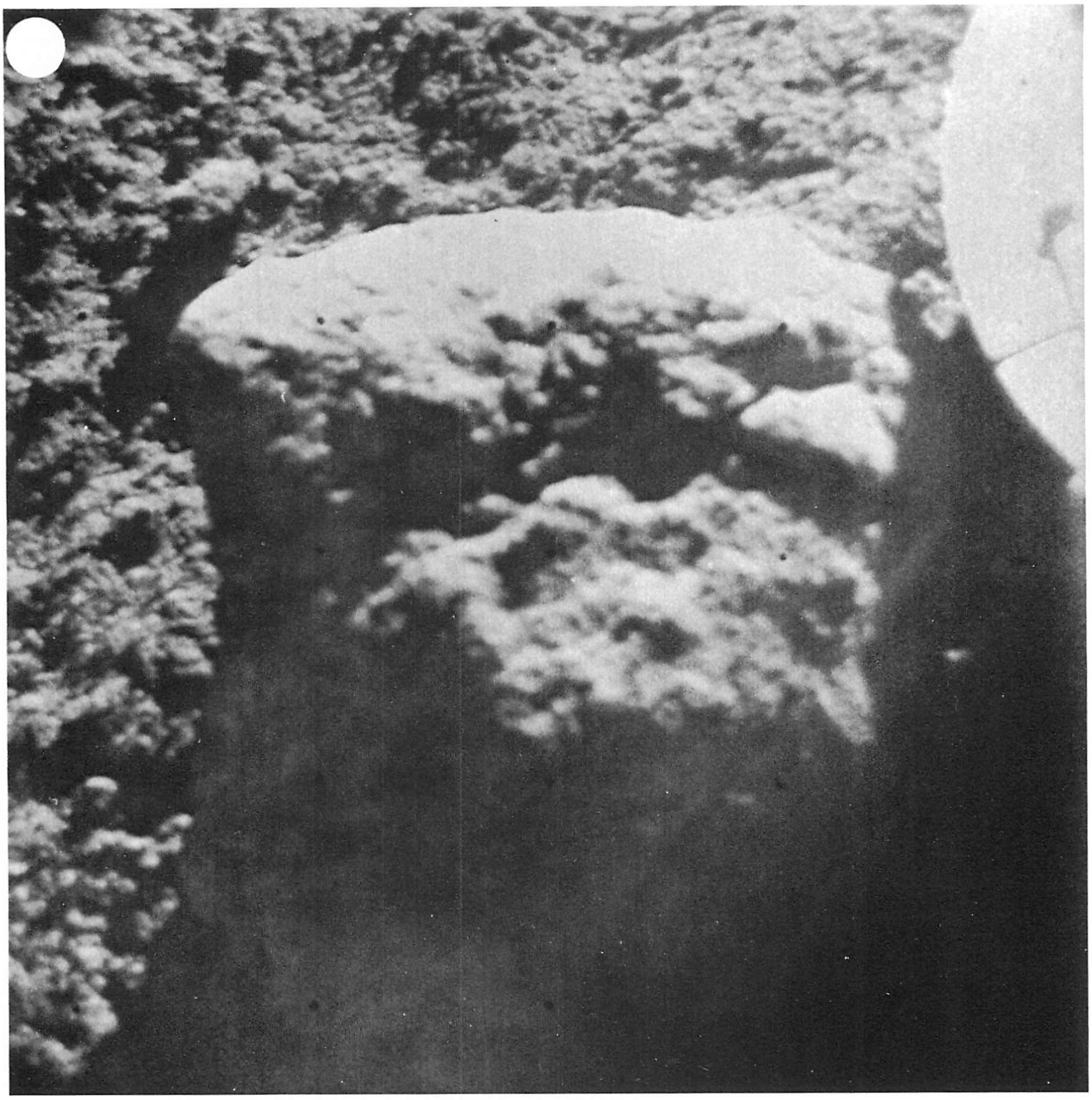
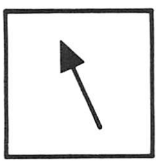
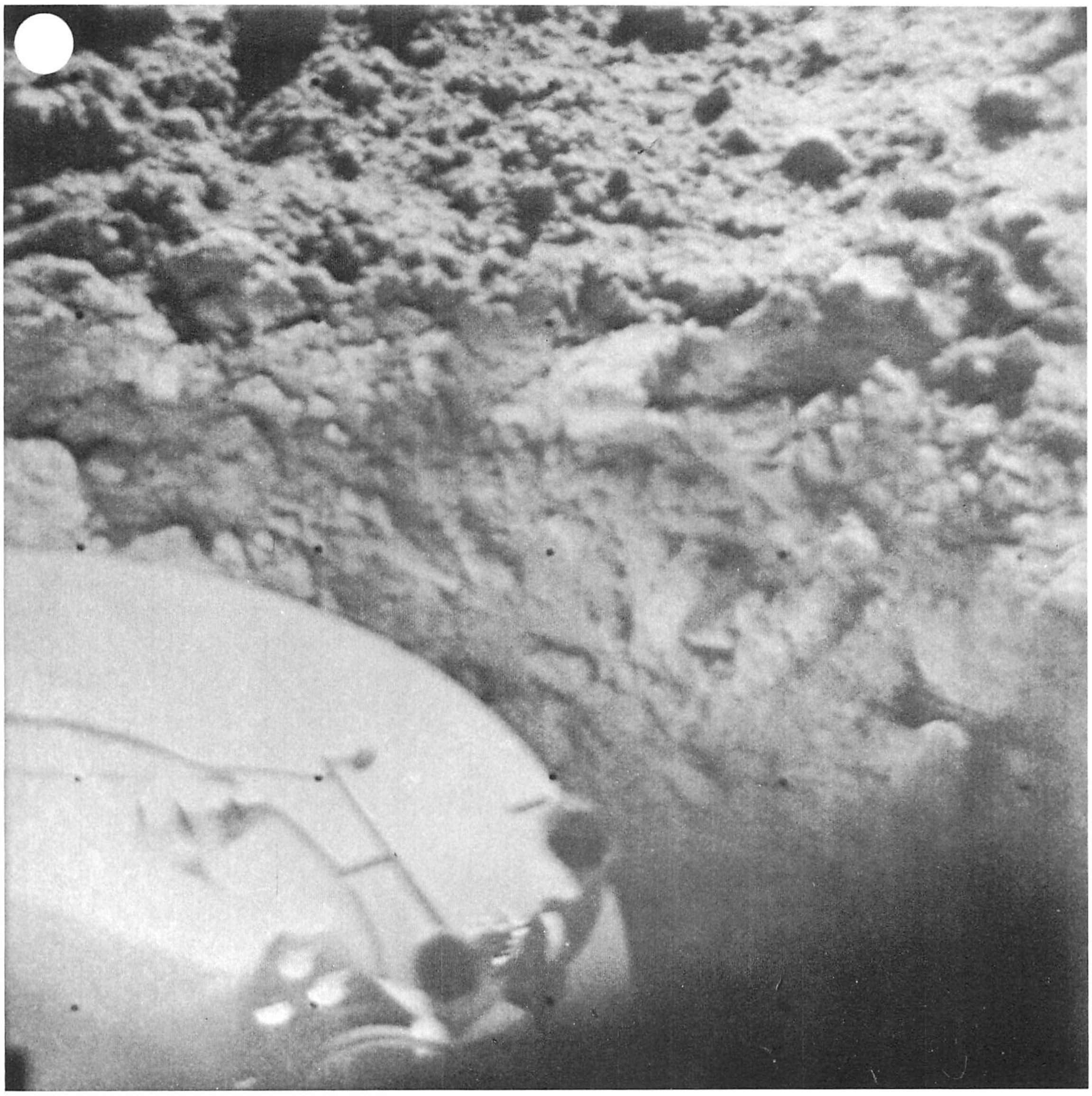
(10)	Day 010, 04:14:58	−54	−65	2.35	f/4.2	W	Clear



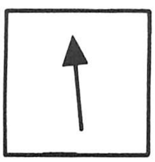


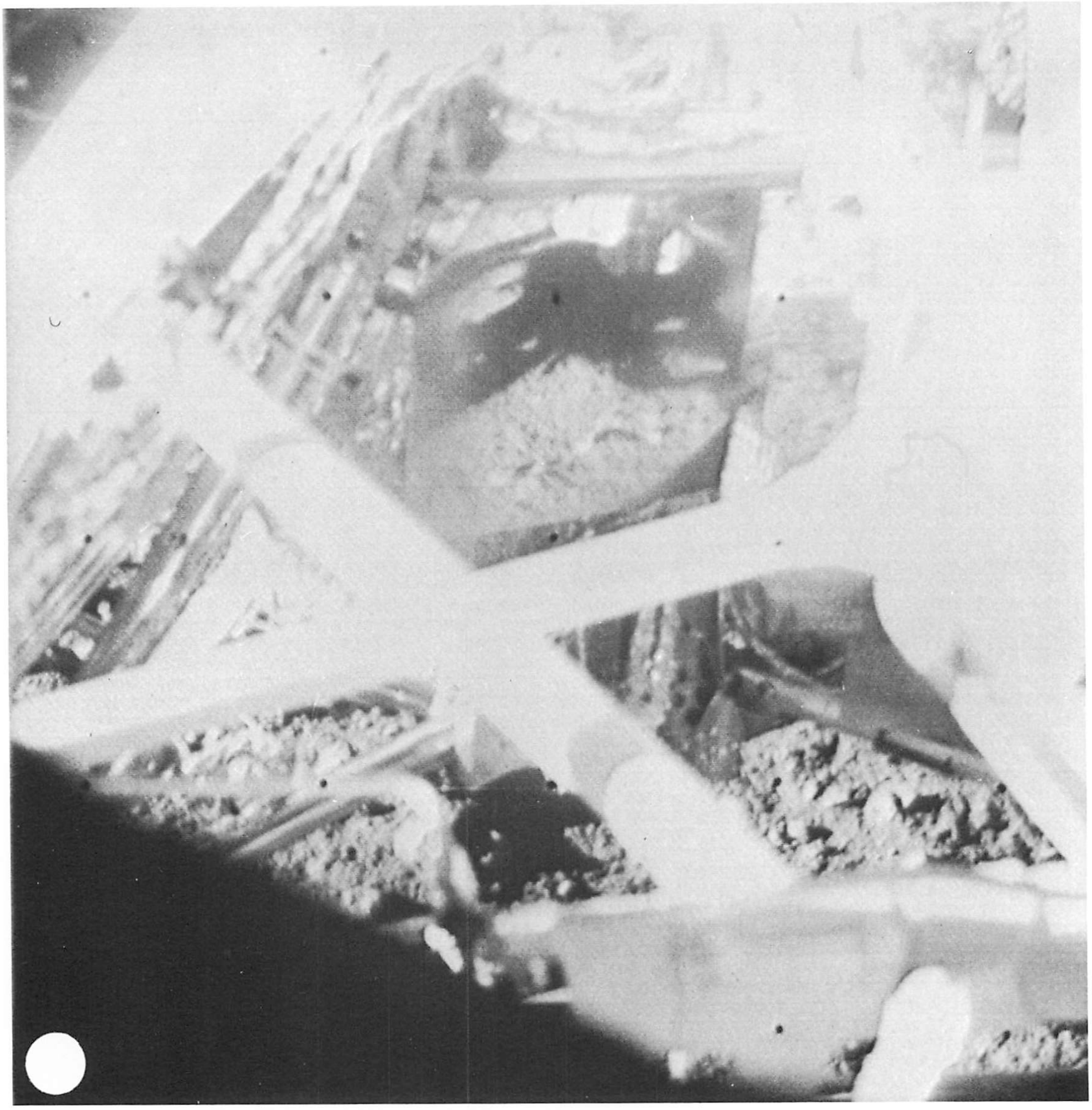
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(11)	**Day 010, 04:38:57**	**—51**	**—55**	**2.65**	***f*/6.0**	**N**	**Clear**



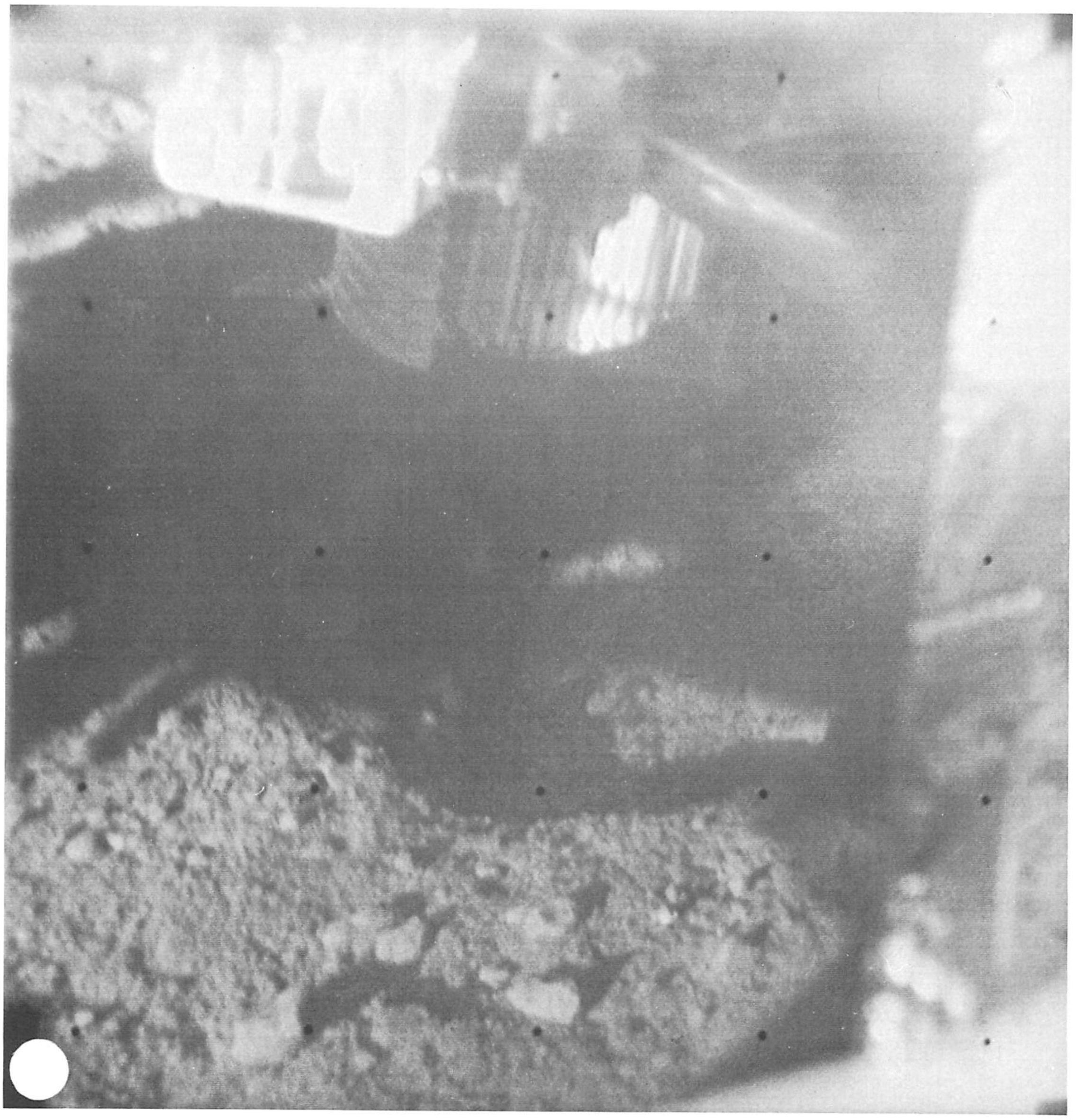


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(12)	**Day 010, 04:39:29**	**−72**	**−55**	**2.91**	***f*/6.0**	**N**	**Clear**

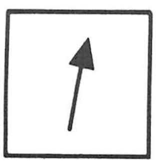


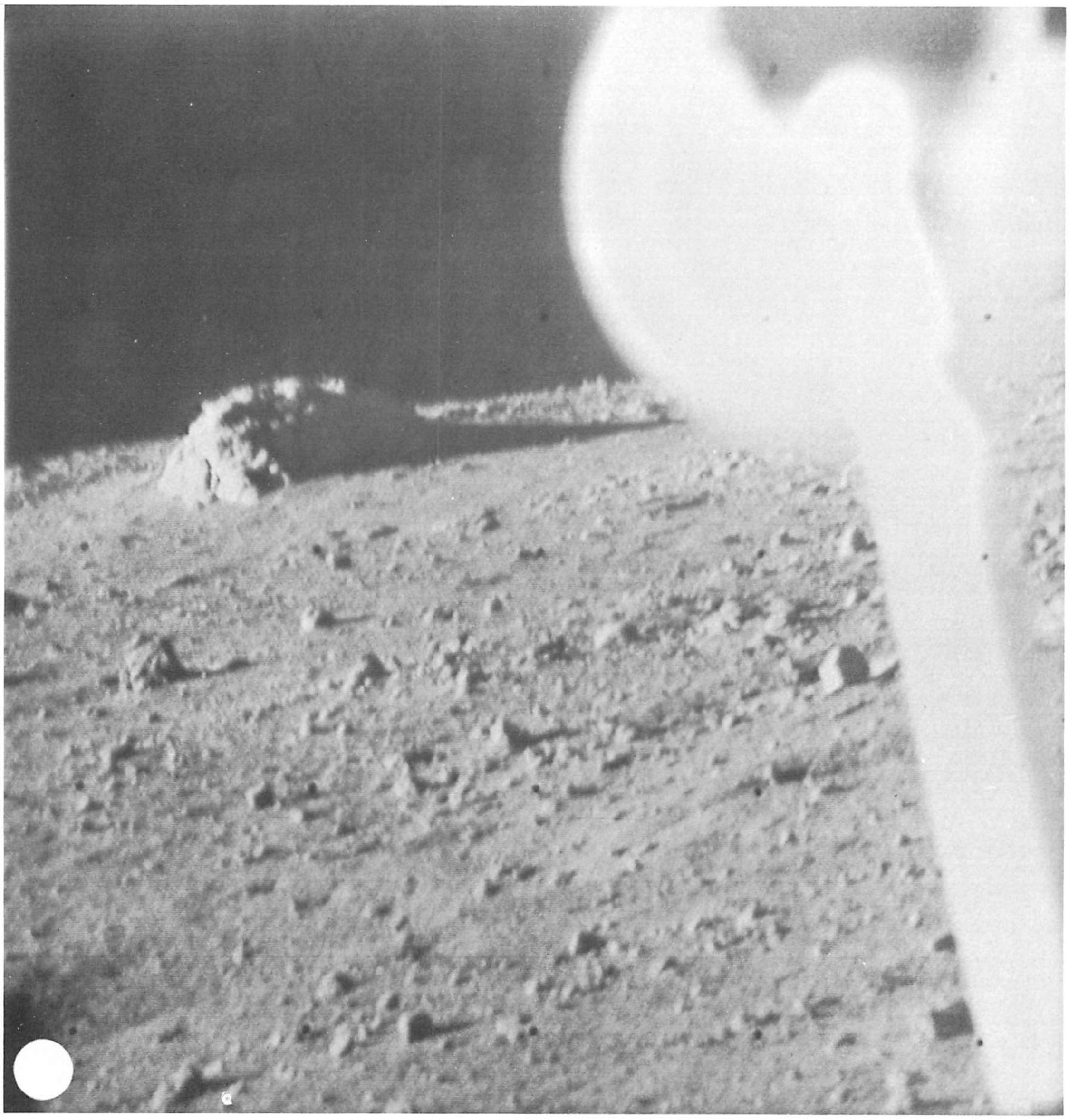


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(13)	**Day 010, 05:41:09**	**—204**	**—40**	**2.35**	***f*/6.0**	**W**	**Clear**

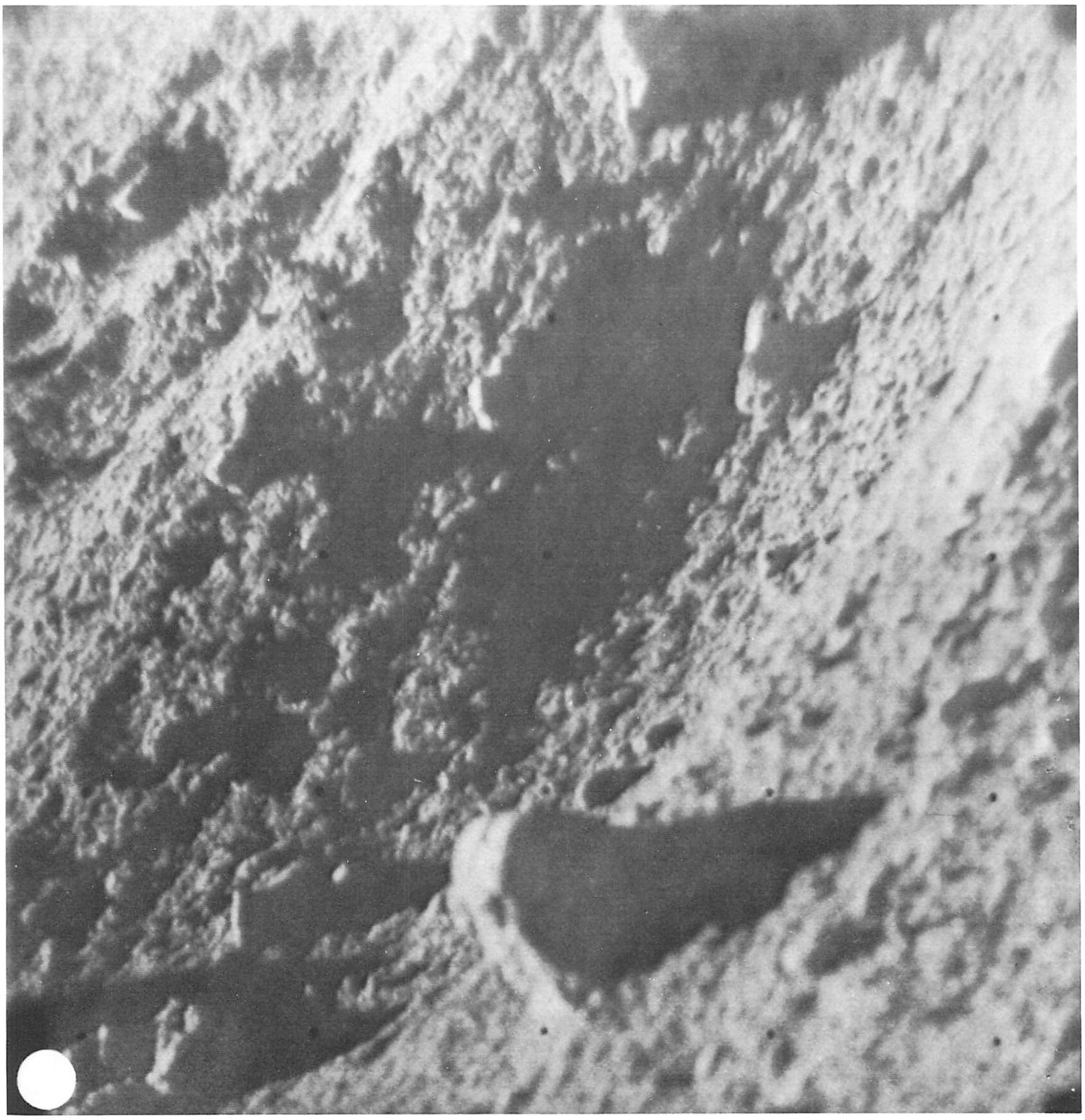


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(14)	Day 010, 05:44:57	—204	—35	2.43	f/7.0	N	Clear

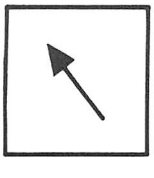


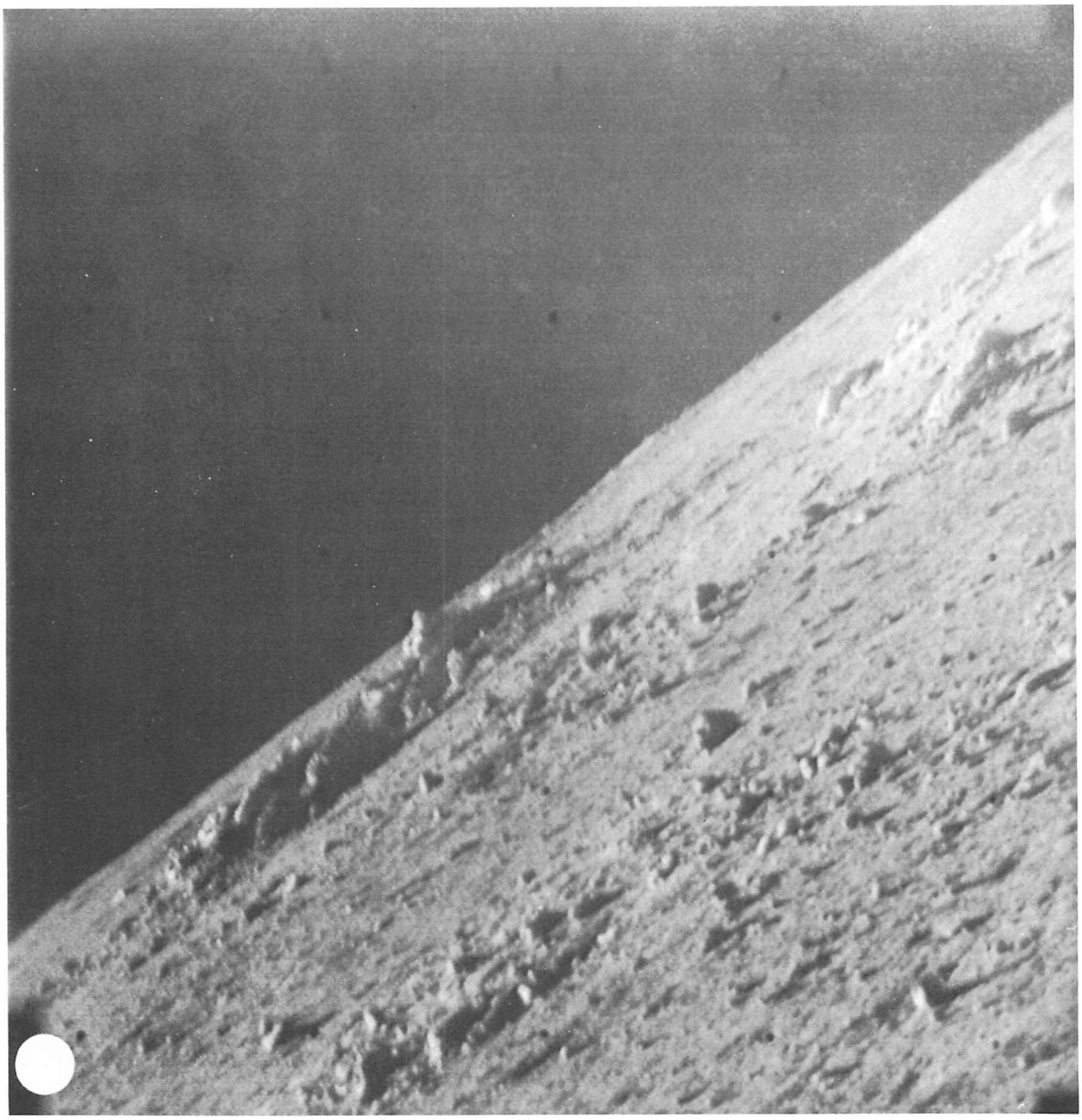


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(15)	**Day 010, 05:56:30**	**—183**	**—5**	**205.24**	**f/6.0**	**N**	**Clear**

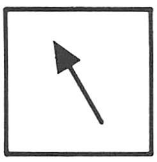


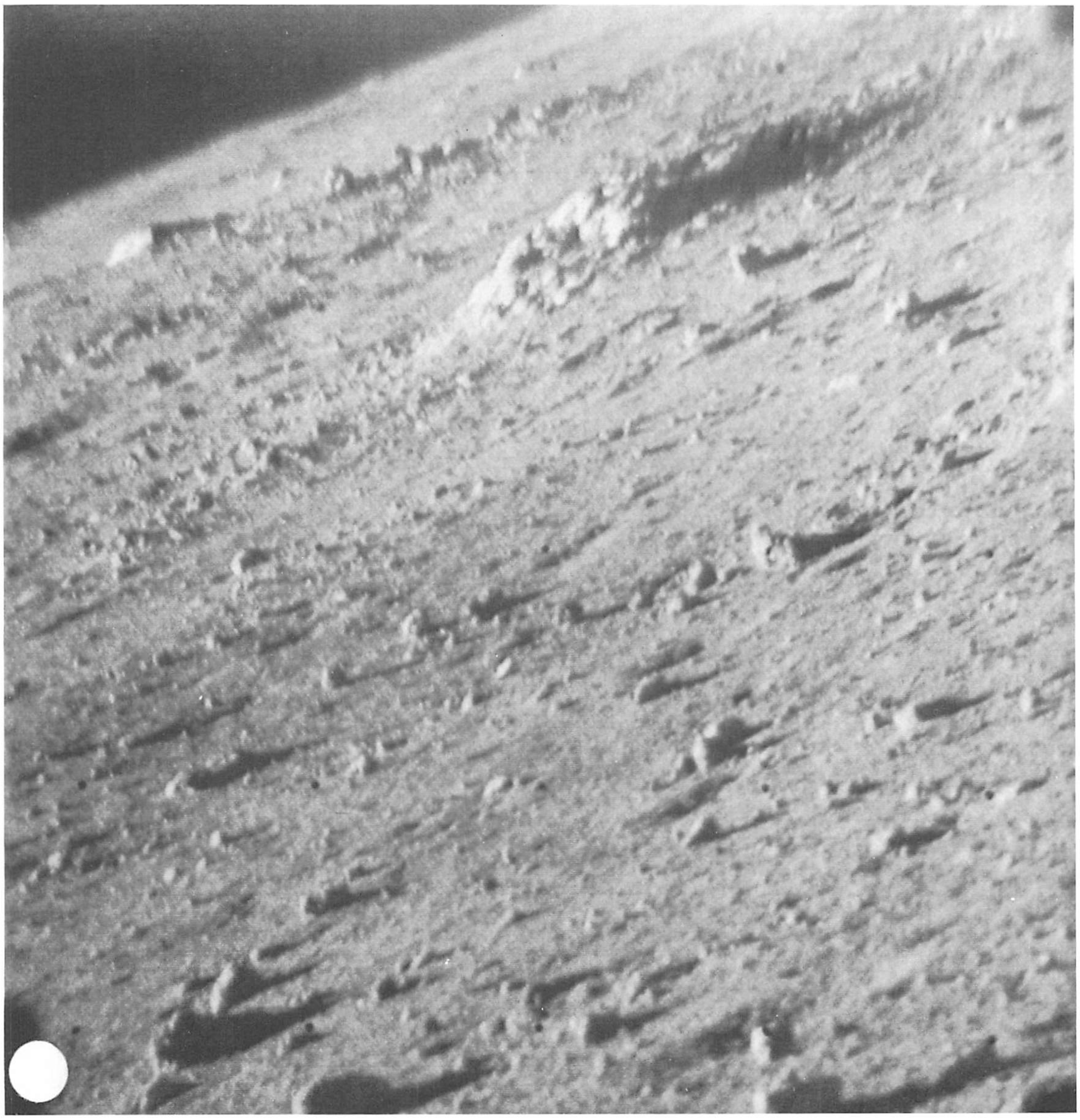
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(16)	Day 010, 06:01:45	−144	−30	7.76	f/6.0	N	Clear



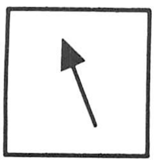


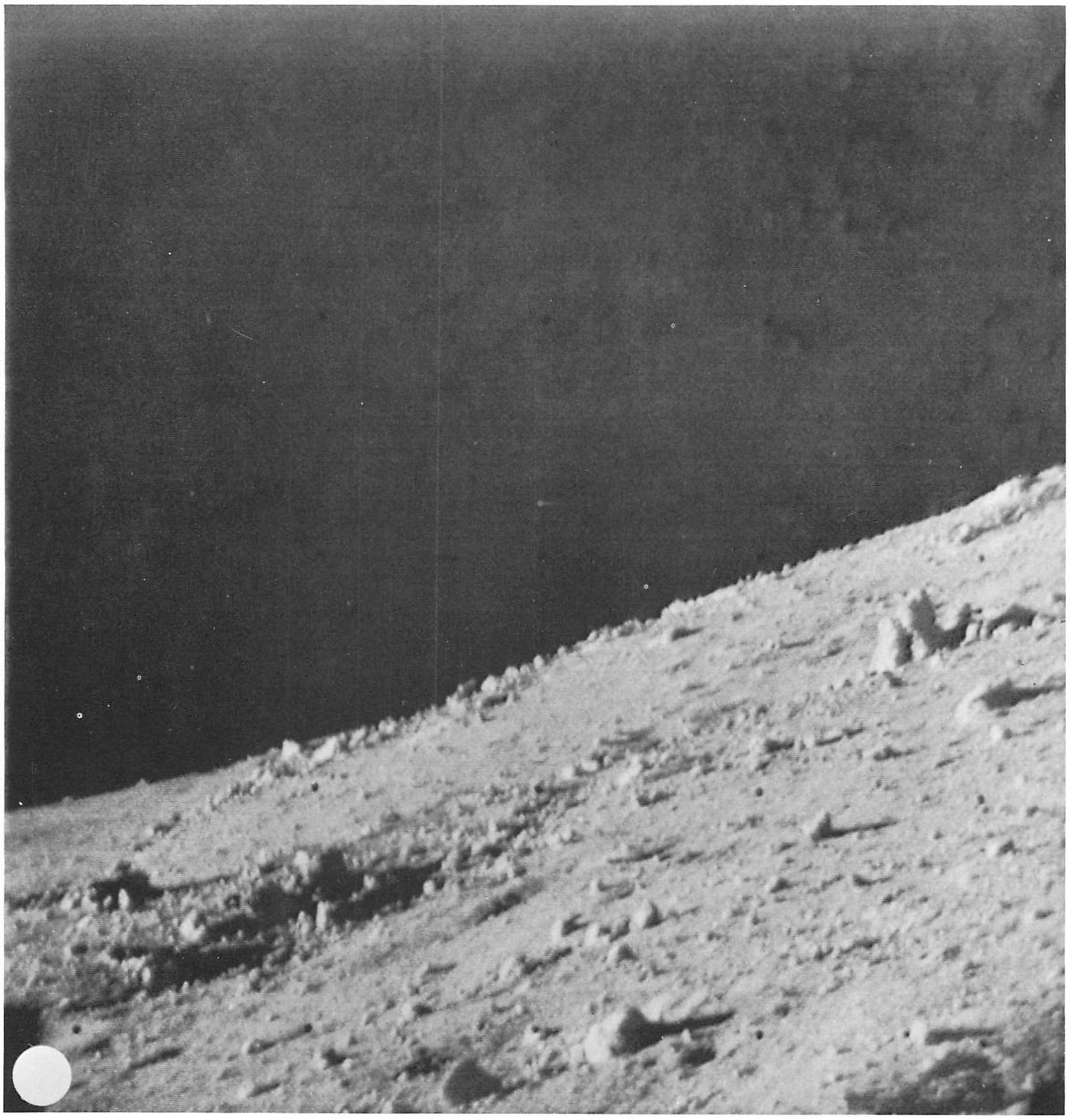
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(17)	Day 010, 06:04:08	—156	—10	205.24	f/6.0	N	Clear



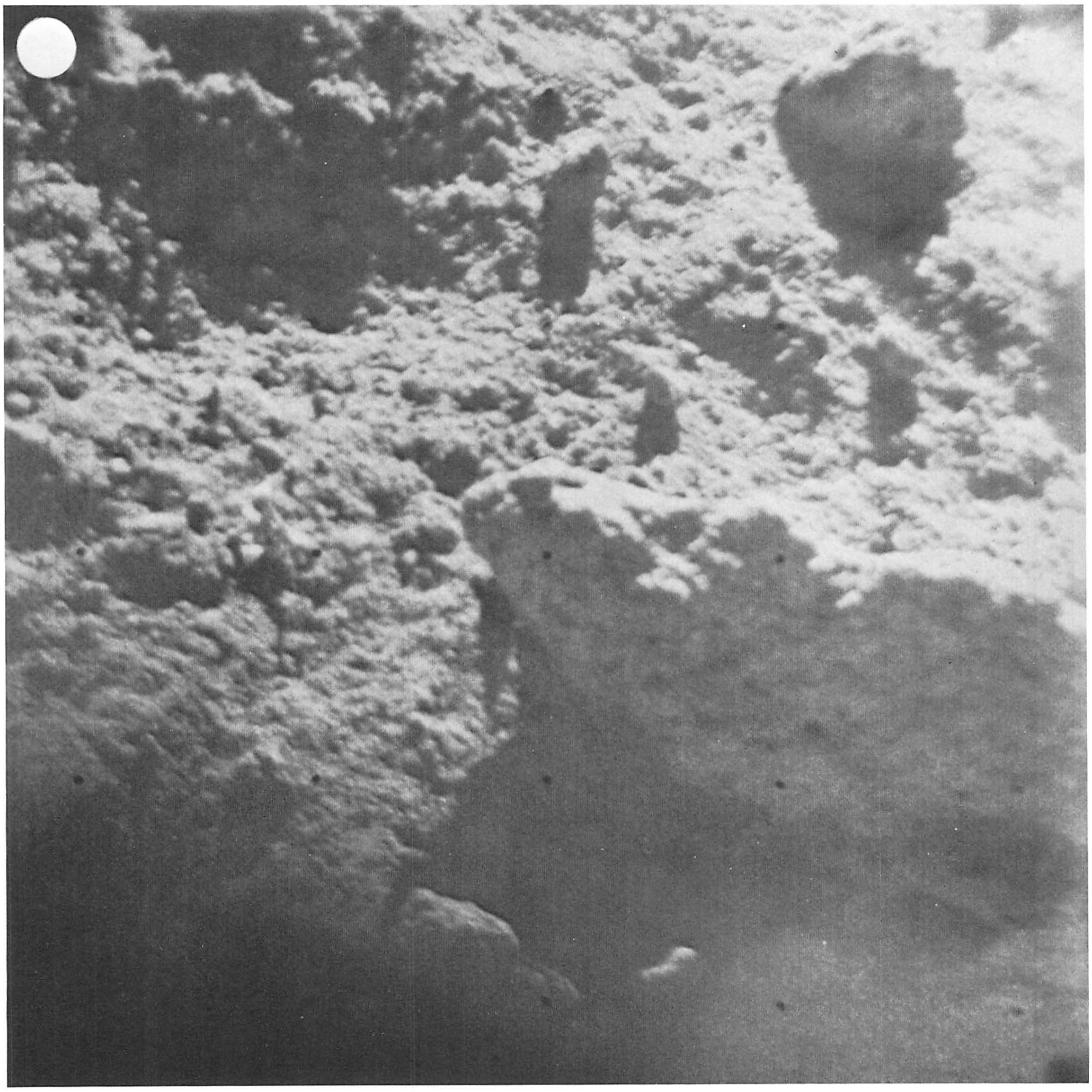


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(18)	**Day 010, 06:04:17**	**—168**	**—10**	**205.24**	**f/6.0**	**N**	**Clear**

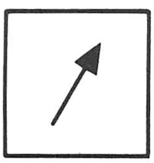


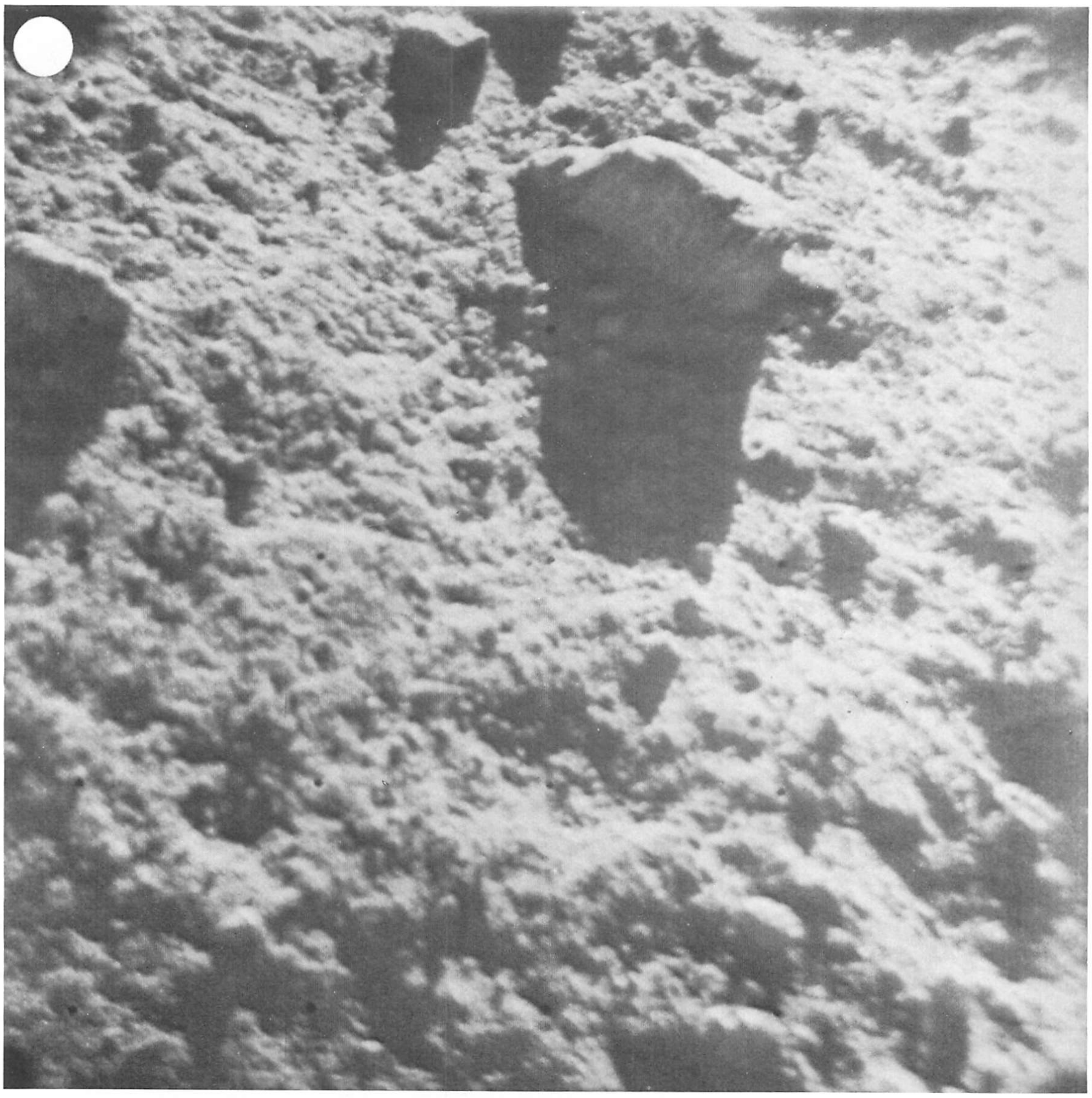


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(19)	**Day 010, 06:04:26**	**—177**	**—5**	**205.24**	**f/5.9**	**N**	**Clear**

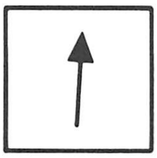


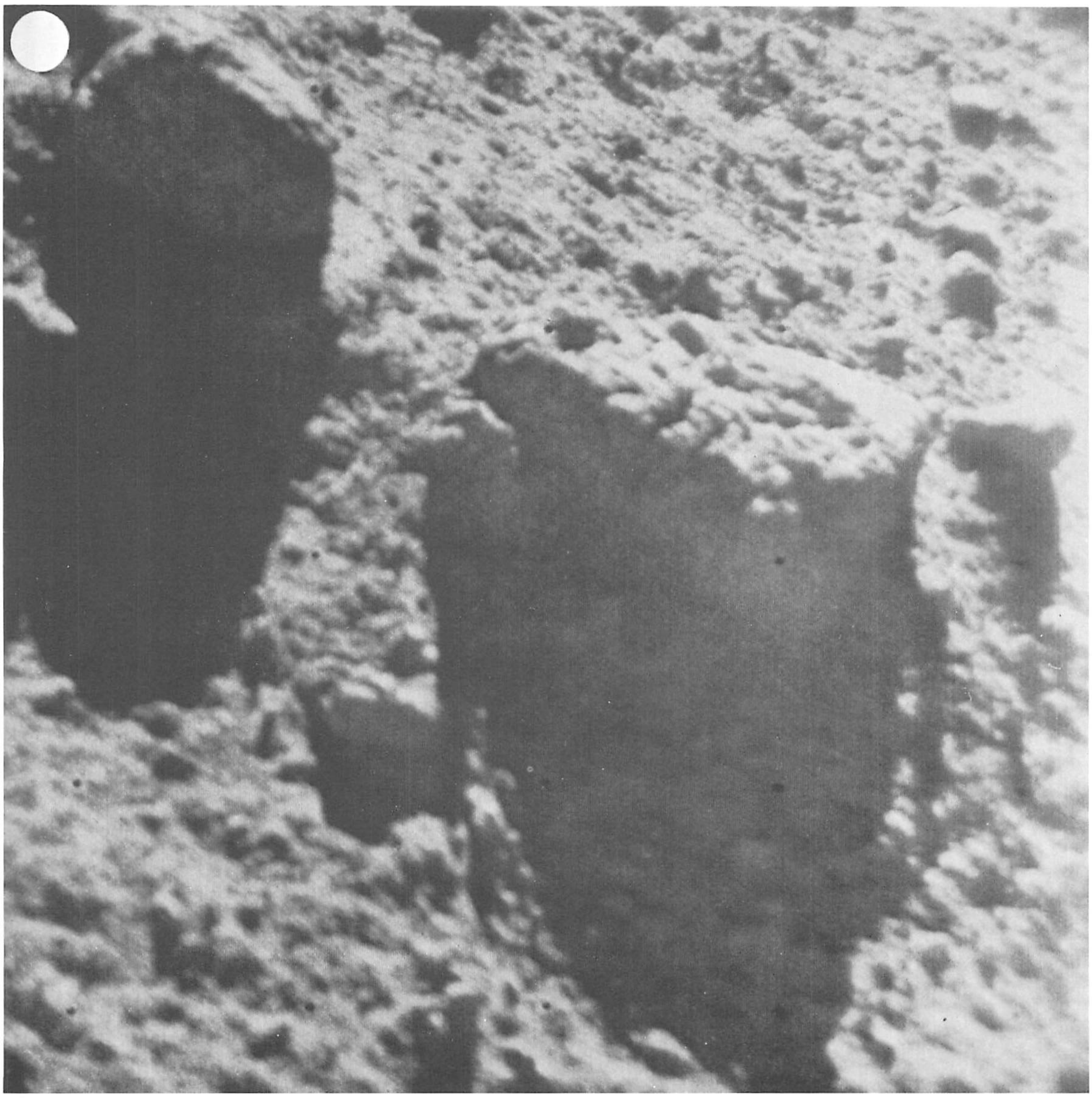
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(20)	**Day 010, 06:07:18**	**−117**	**−55**	**3.07**	***f*/6.0**	**N**	**Clear**



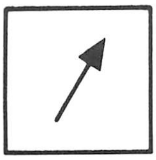


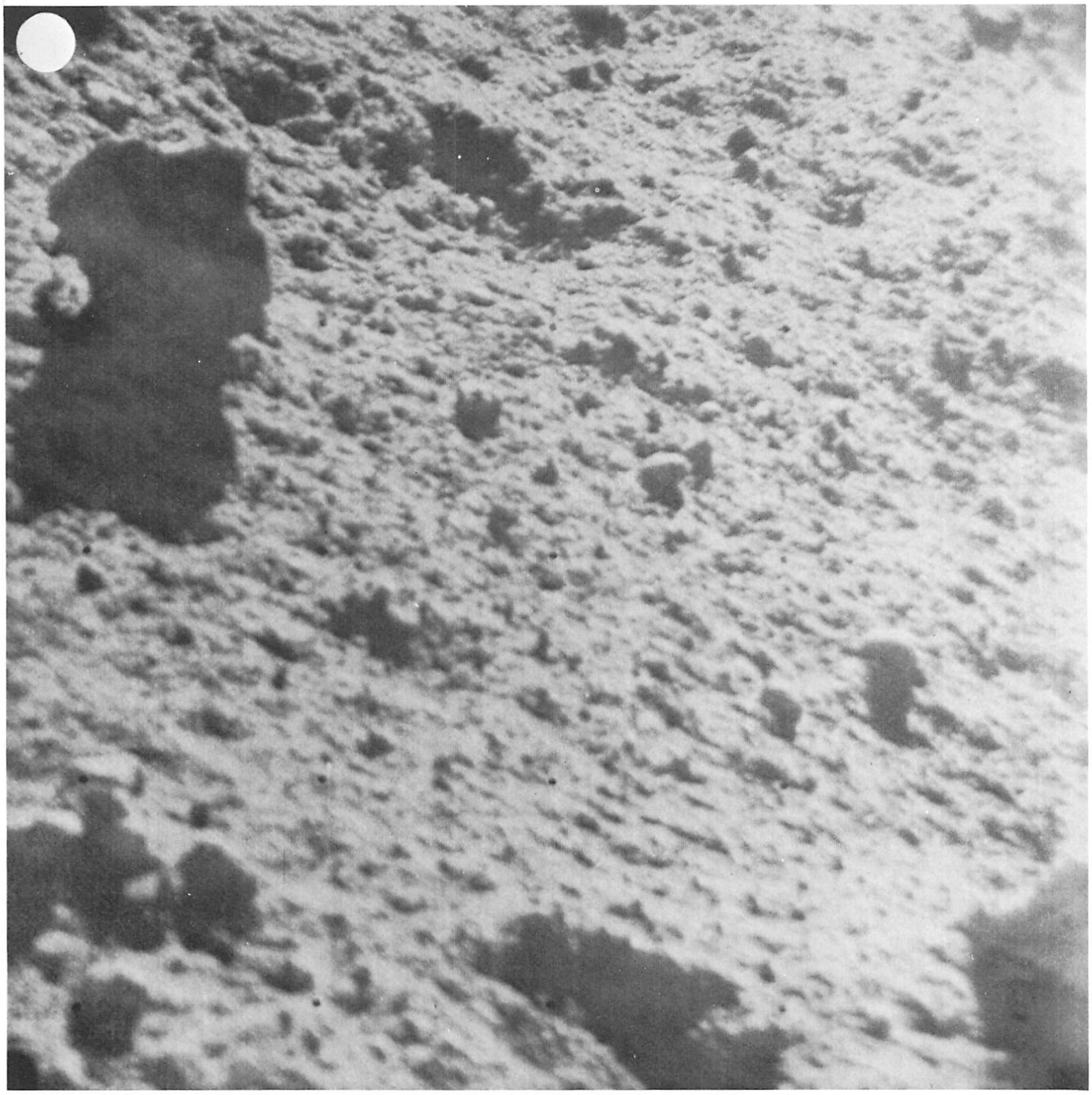
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(21)	Day 010, 06:07:27	—108	—50	3.44	*f*/6.0	N	Clear



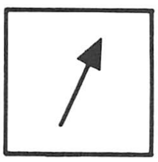


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(22)	Day 010, 06:08:31	—117	—45	4.21	f/6.0	N	Clear

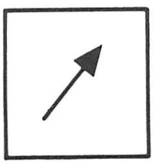




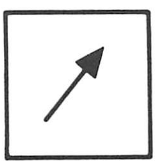
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(23)	Day 010, 06:08:40	—108	—40	4.97	f/6.0	N	Clear

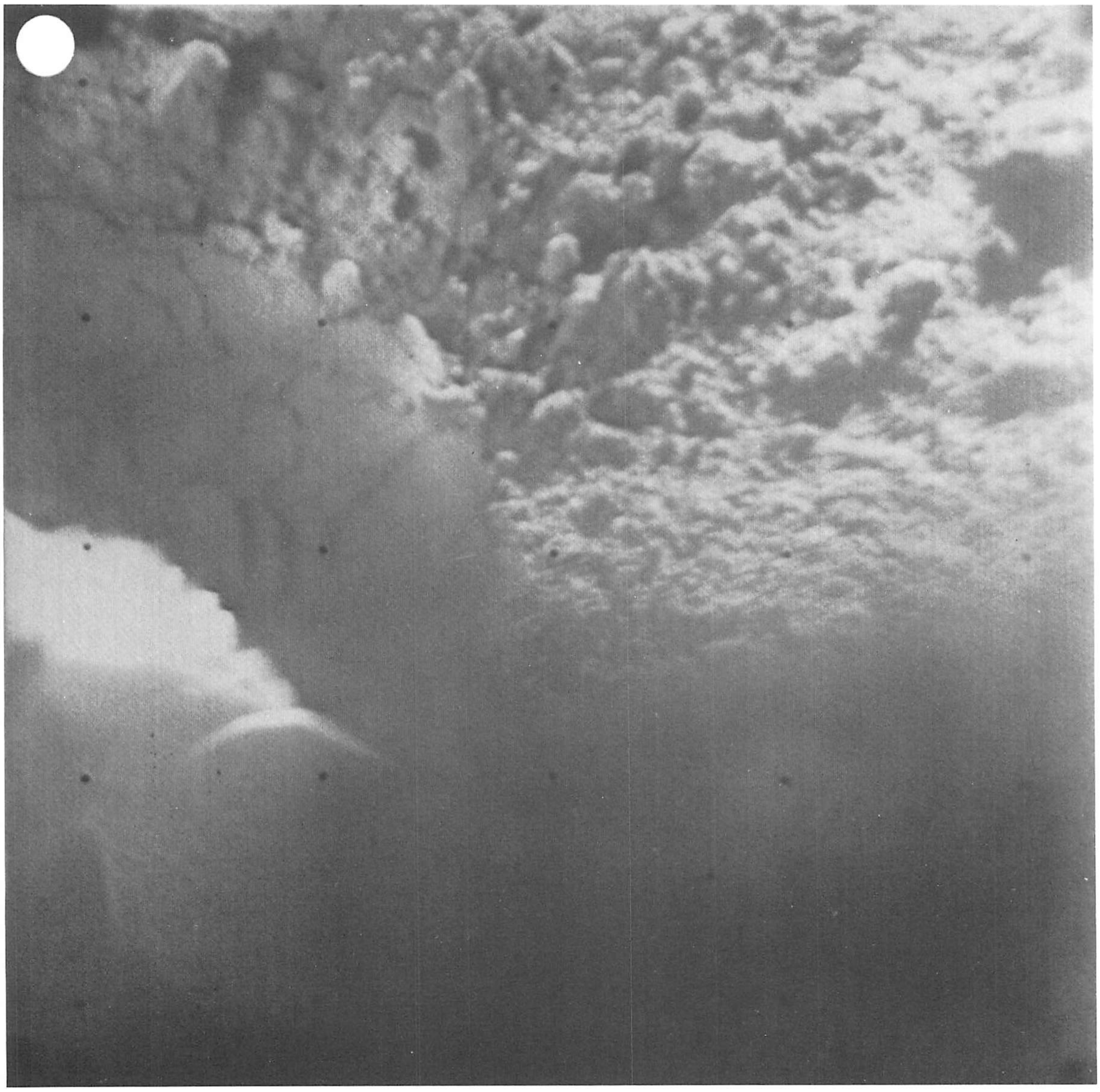


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(24)	**Day 010, 06:09:17**	**—129**	**—35**	**6.05**	**f/6.0**	**N**	**Clear**

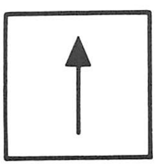


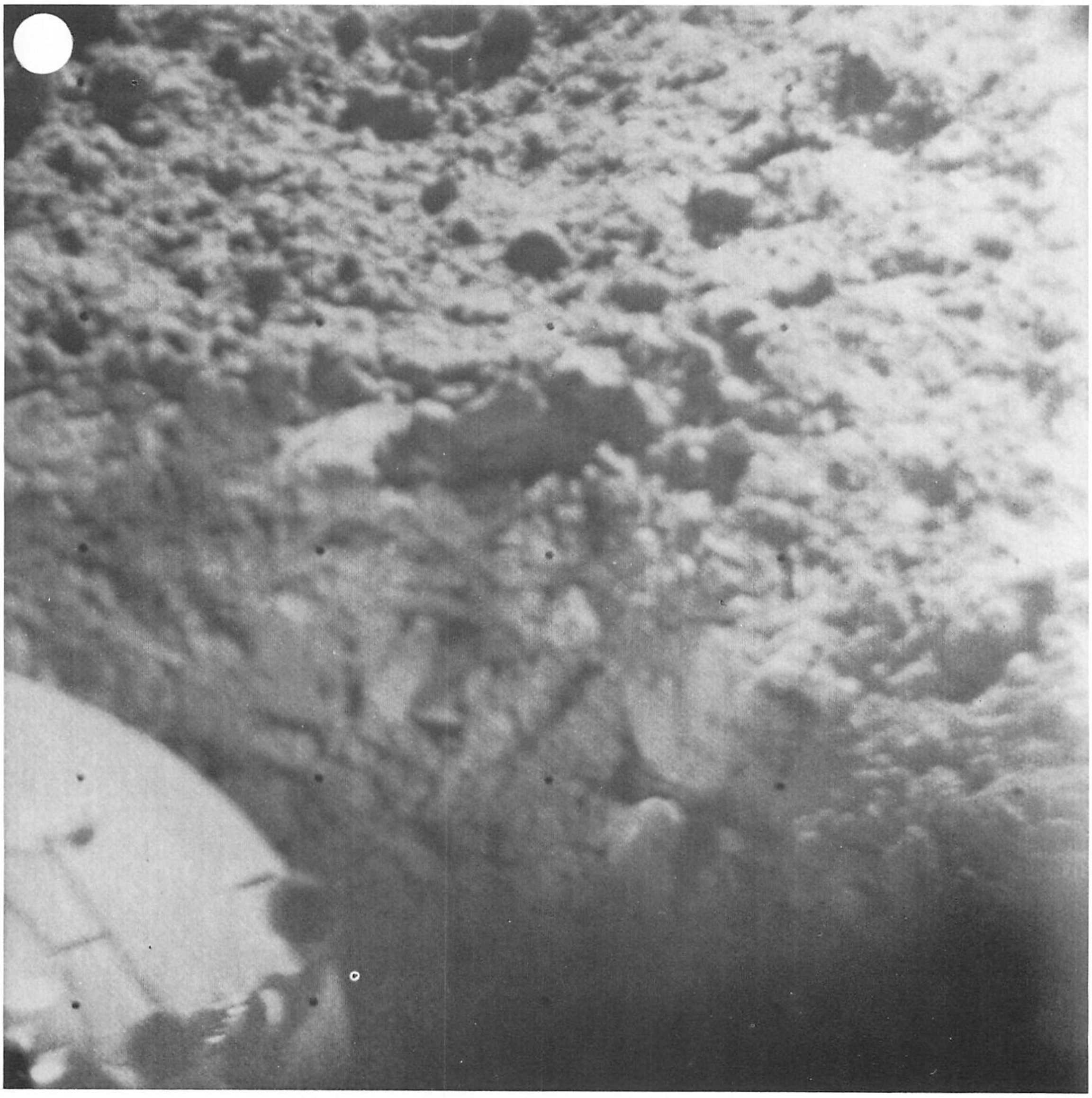
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(25)	Day 010, 06:10:37	—129	—25	13.08	f/6.0	N	Clear



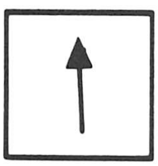


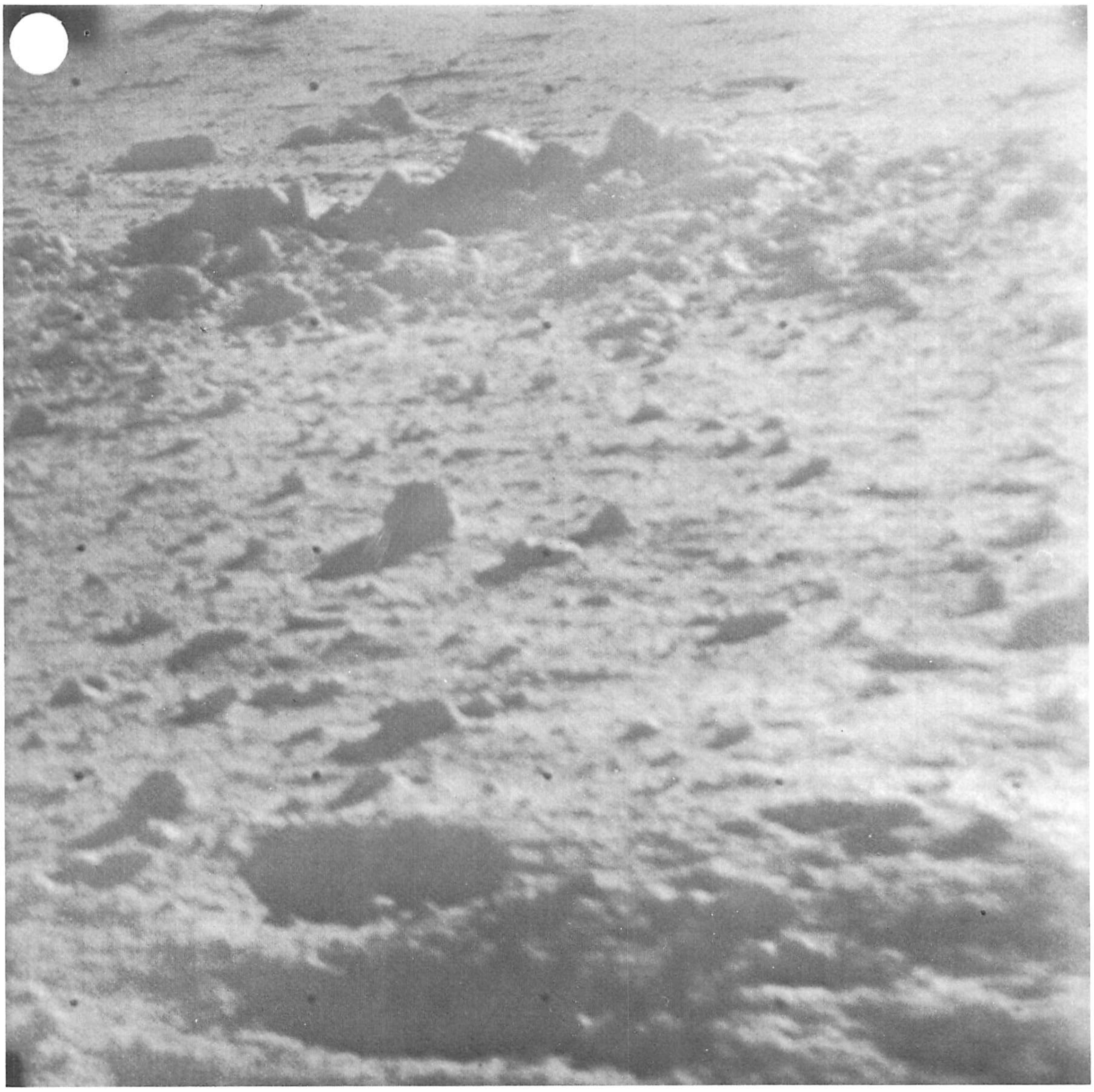
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(26)	Day 010, 06:20:27	—78	—60	2.91	*f*/6.0	N	Clear



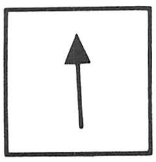


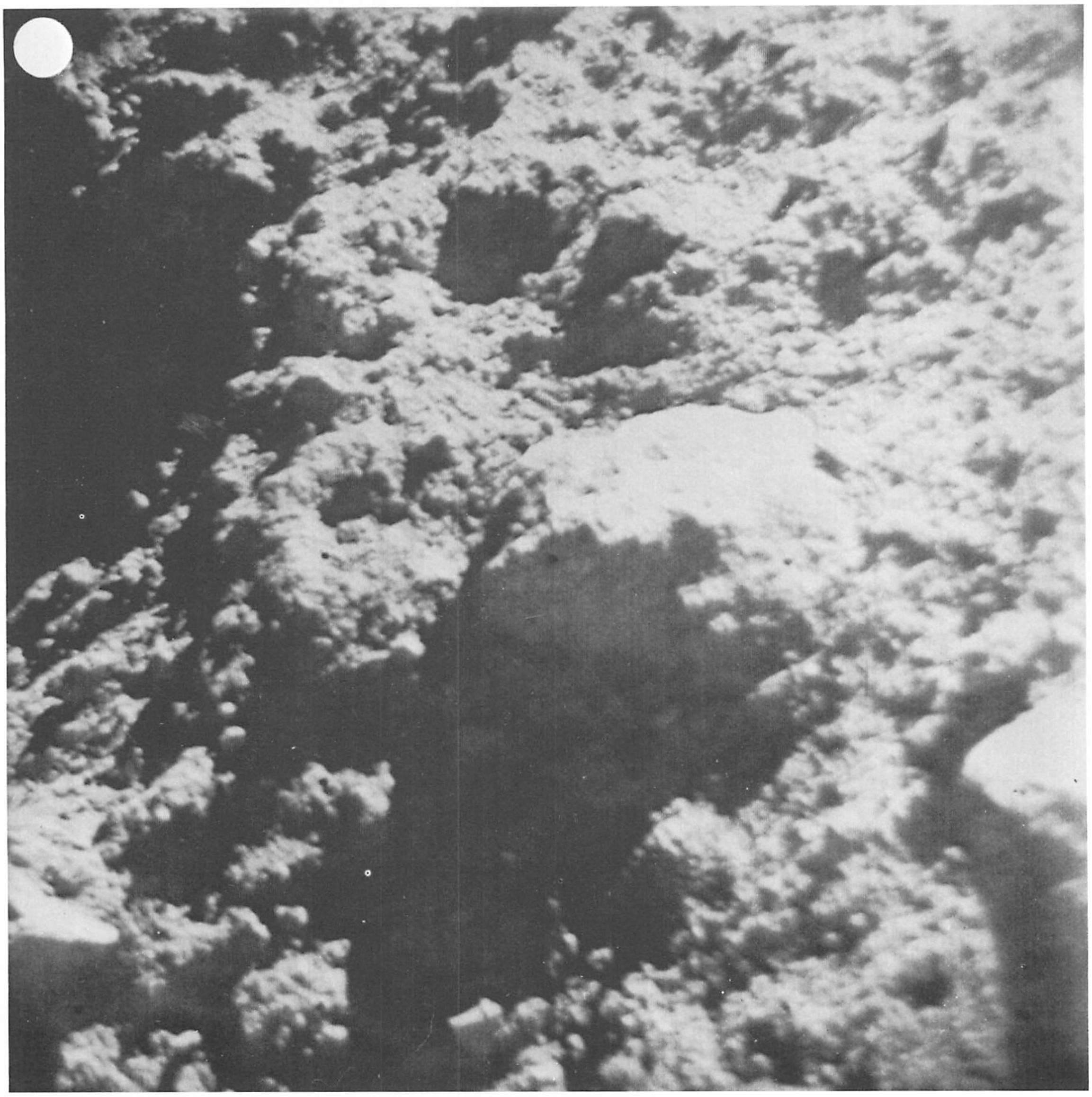
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(27)	**Day 010, 06:21:12**	**—75**	**—55**	**3.07**	***f*/6.0**	**N**	**Clear**



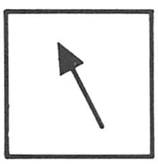


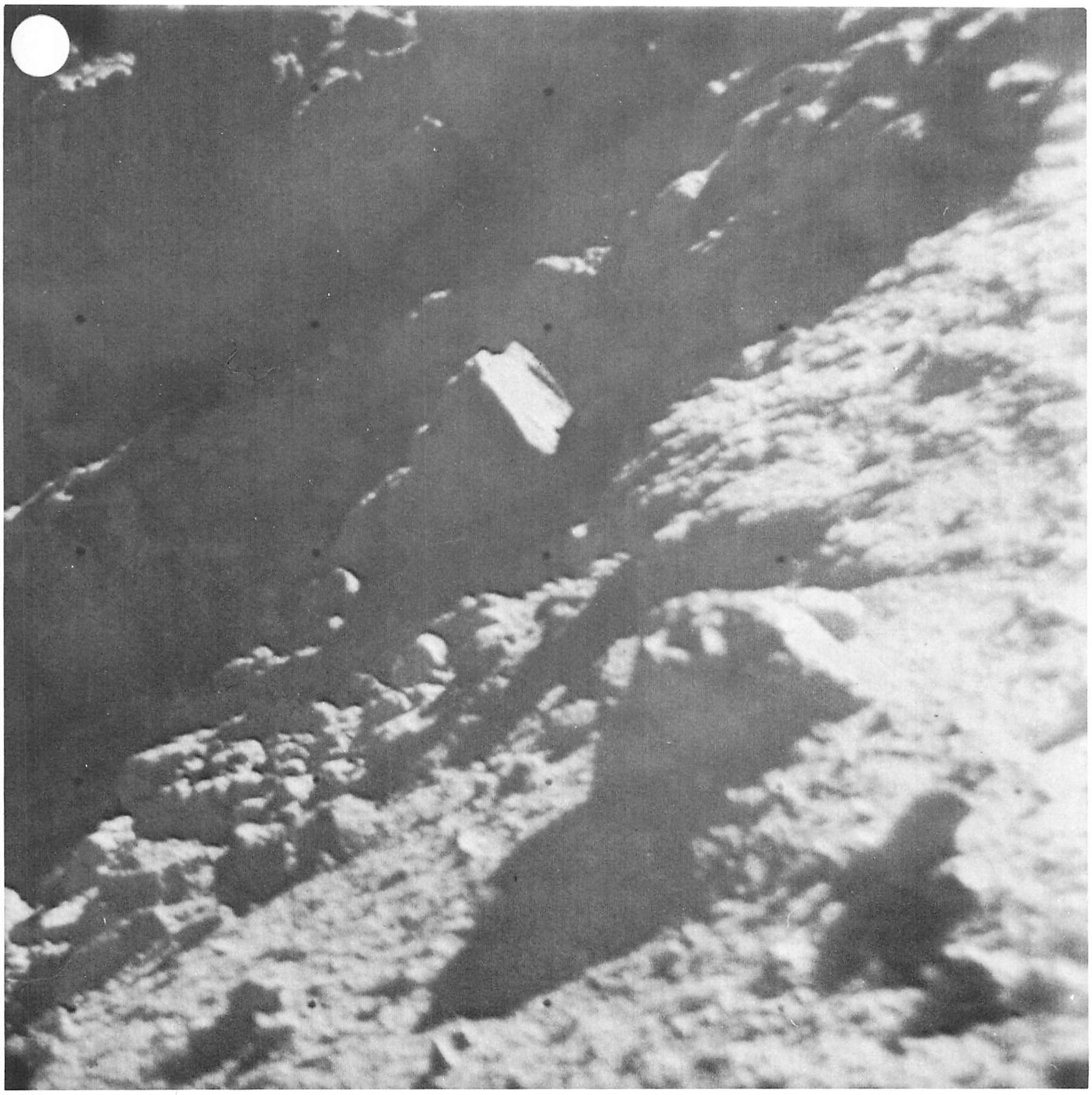
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(28)	Day 010, 06:27:19	−75	−15	205.24	f/6.0	N	Clear



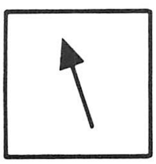


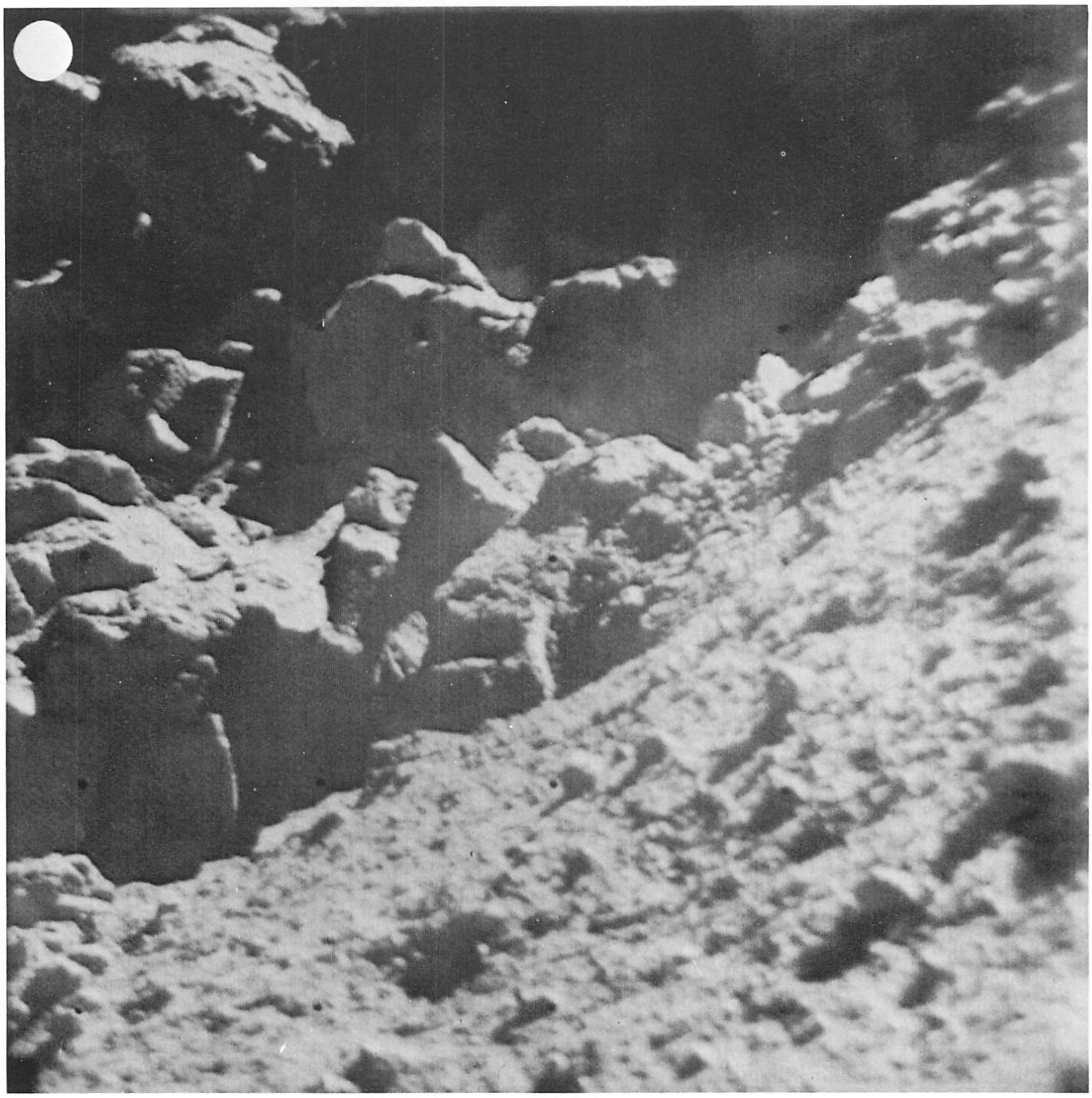
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(29)	**Day 010, 06:49:30**	**—48**	**—50**	**2.77**	***f*/6.0**	**N**	**Clear**



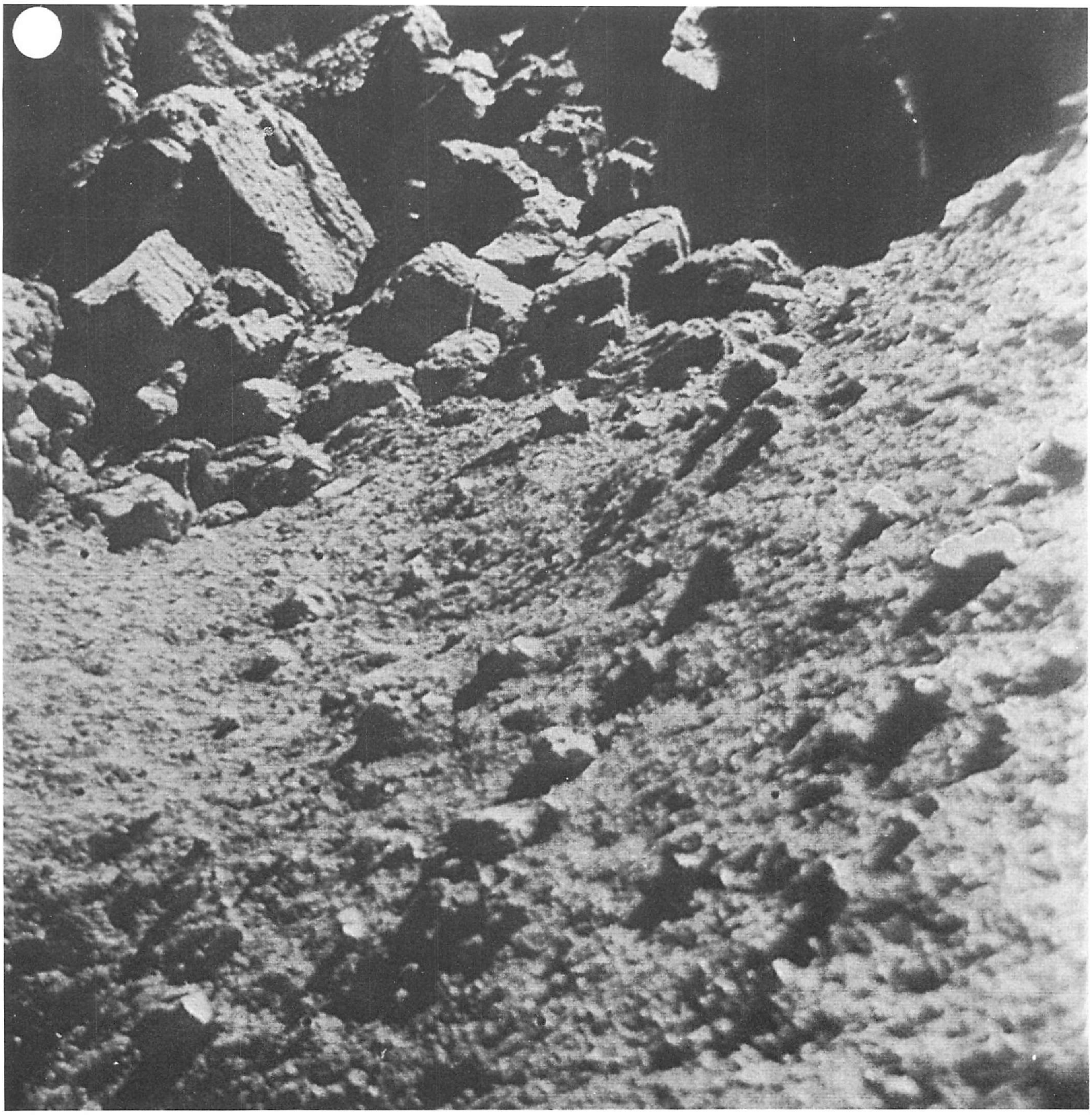


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(30)	**Day 010, 06:52:24**	**—57**	**—25**	**6.81**	***f*/6.0**	**N**	**Clear**

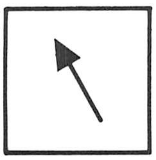


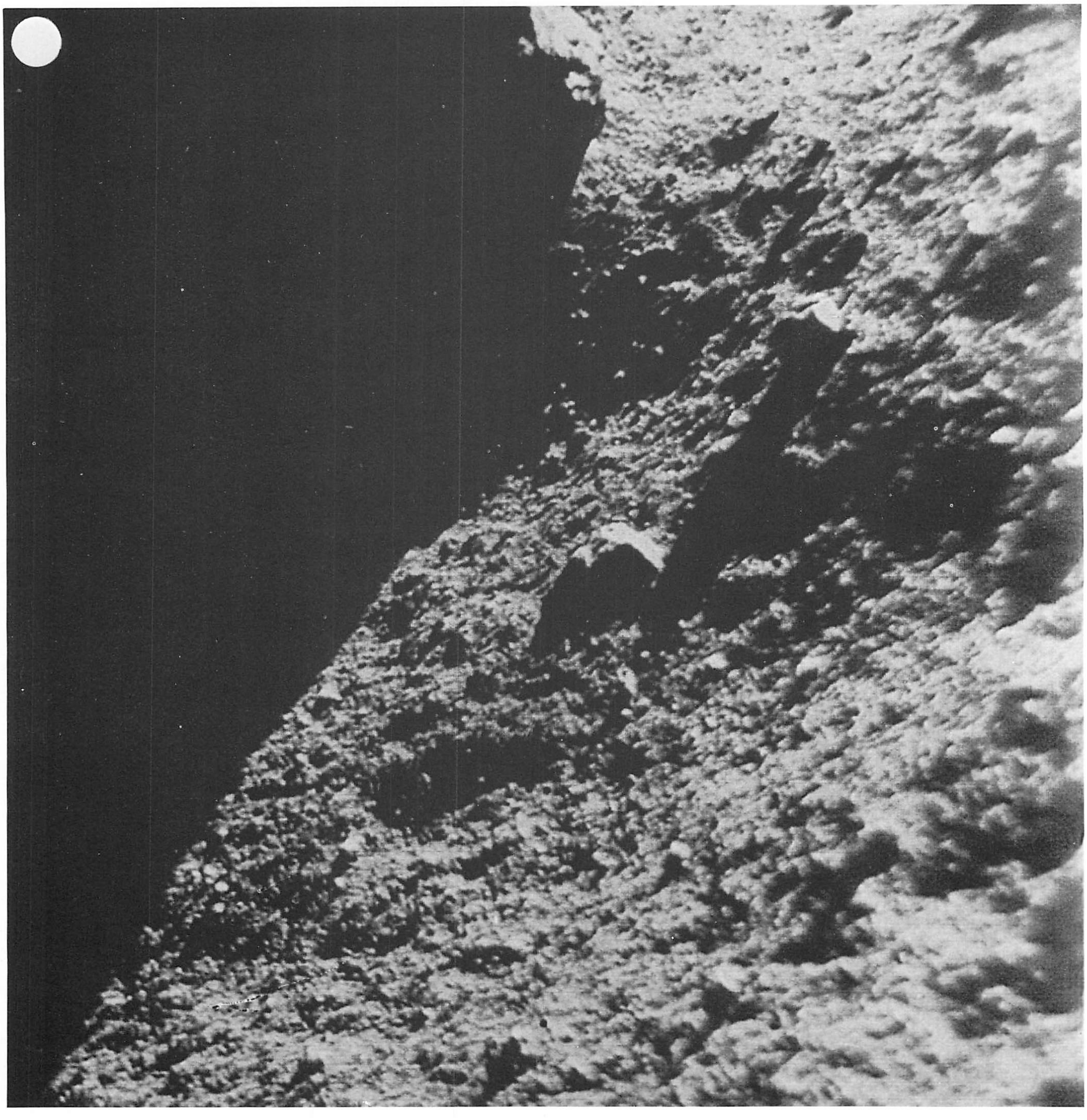


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(31)	**Day 010, 06:52:29**	**—51**	**—25**	**2.65**	***f*/6.0**	**N**	**Clear**

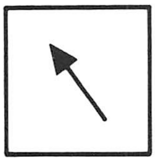


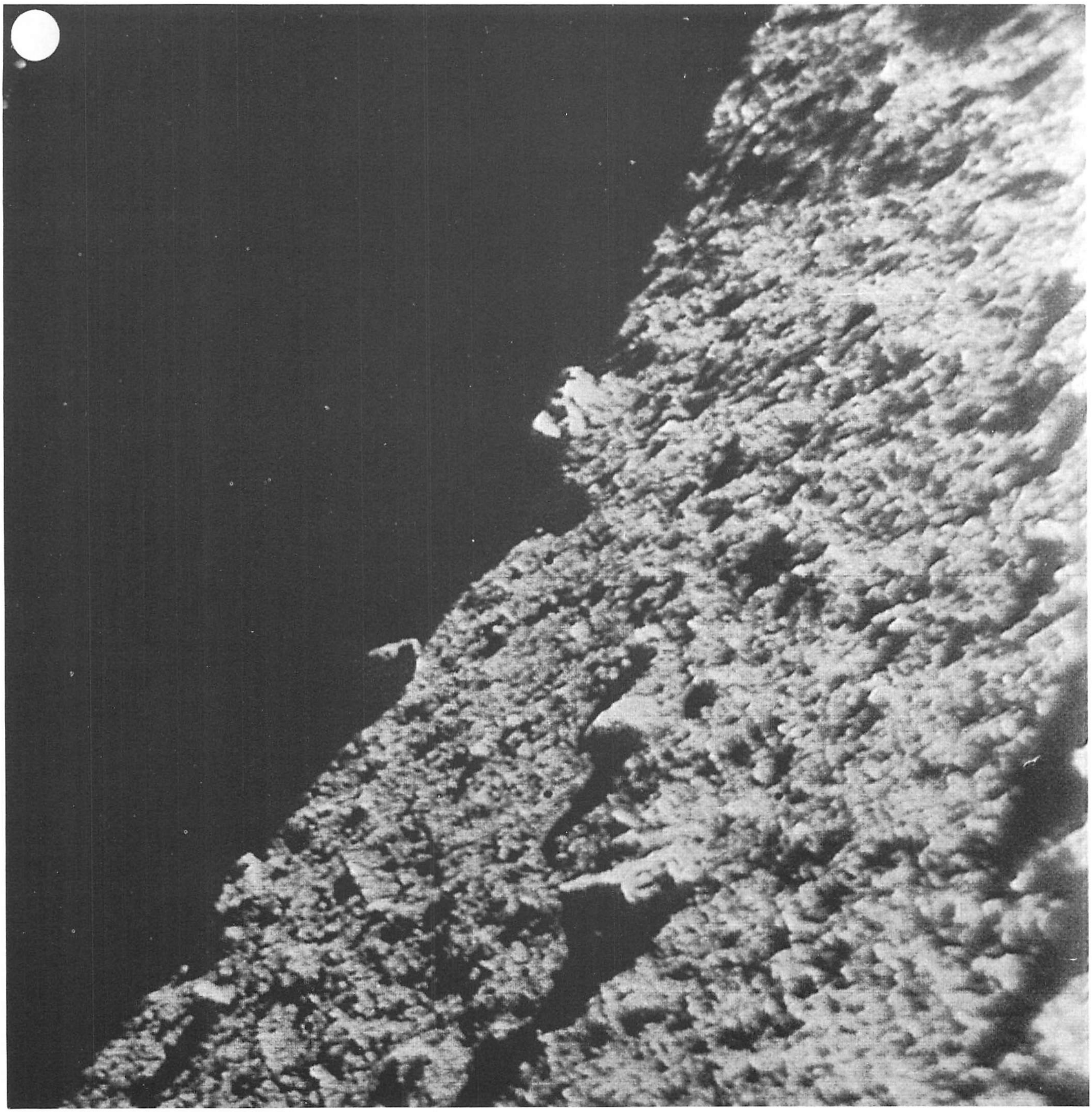
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(32)	**Day 010, 06:52:33**	**—45**	**—25**	**5.44**	***f*/6.0**	**N**	**Clear**	**Processed**



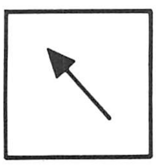


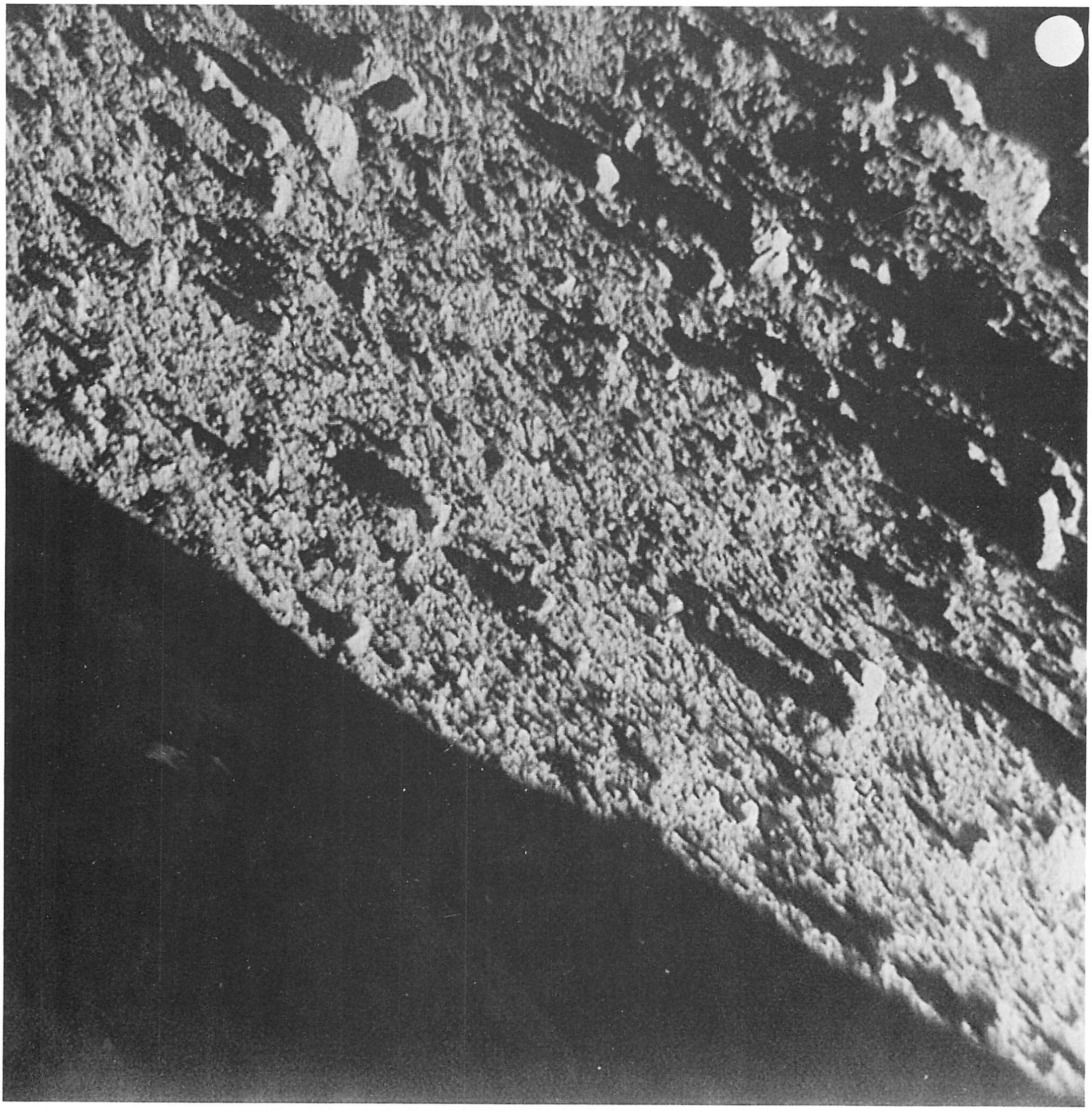
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(33)	**Day 010, 06:52:38**	**—39**	**—25**	**5.44**	***f*/6.0**	**N**	**Clear**	**Processed**



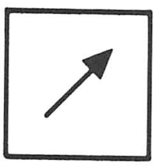


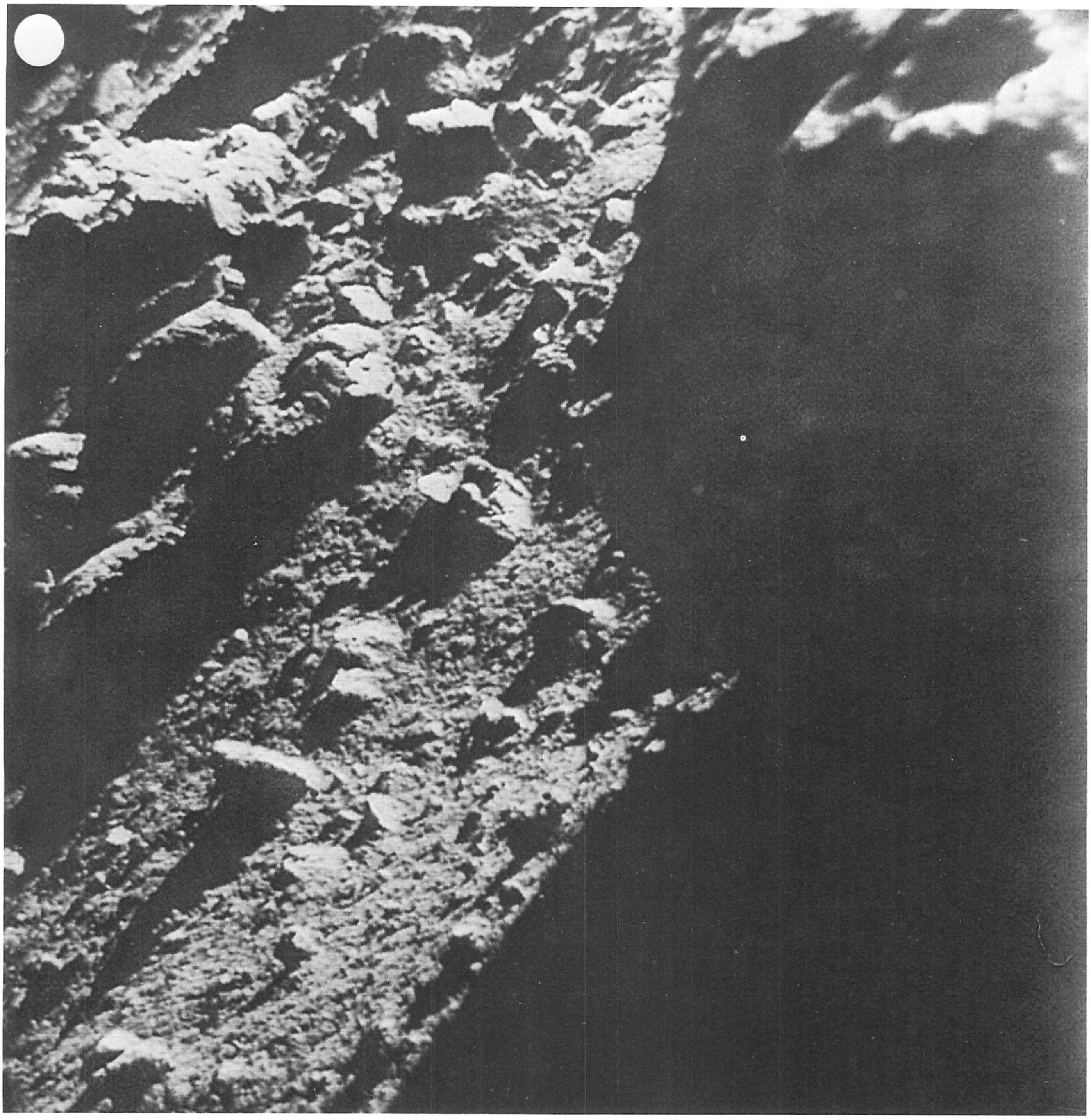
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(34)	Day 010, 06:52:42	—33	—25	4.97	f/6.0	N	Clear	Processed



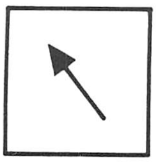


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(35)	Day 010, 06:52:46	−30	−20	5.44	*f*/6.0	N	Clear	Processed

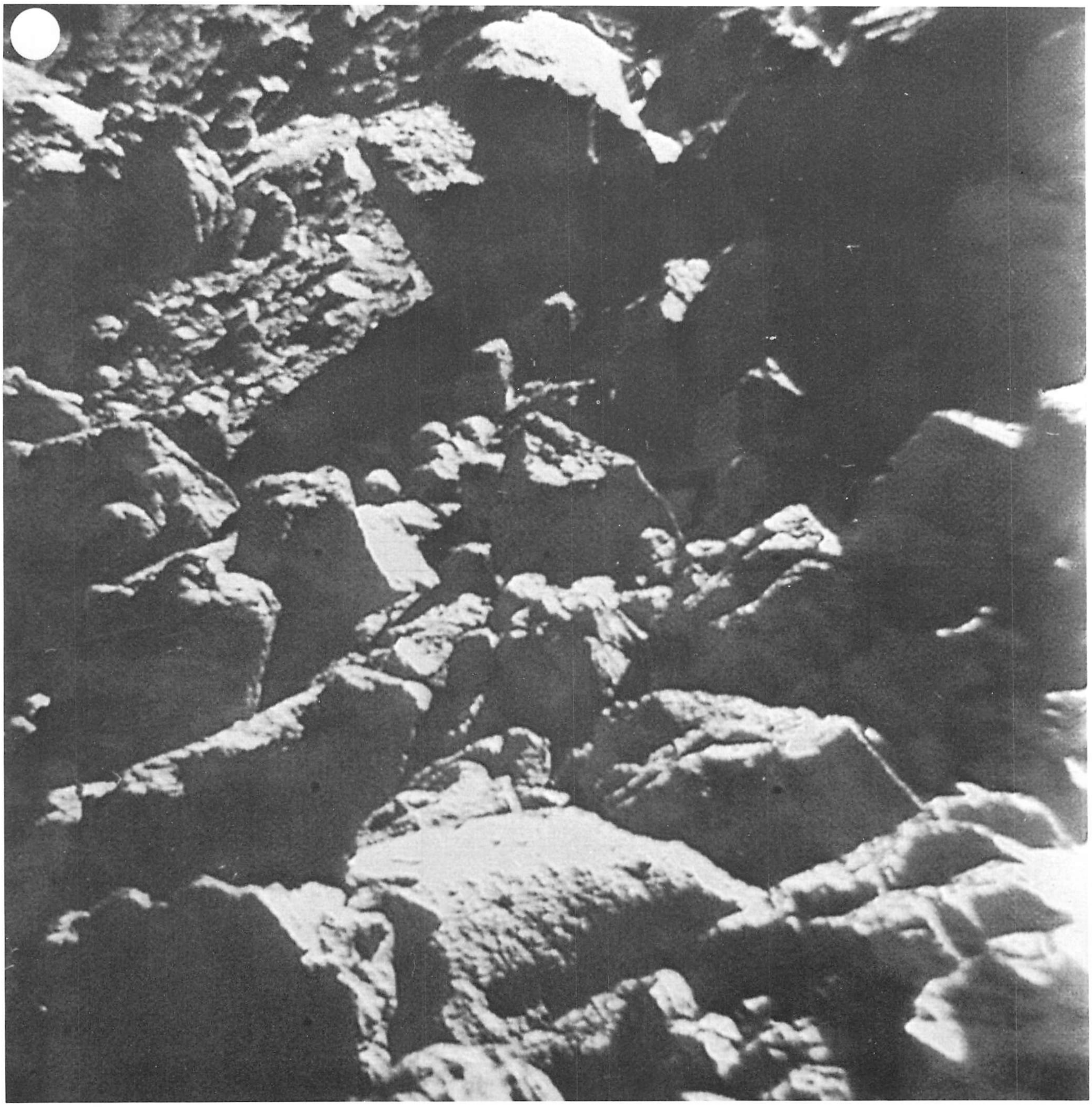




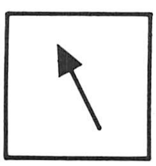
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(36)	**Day 010, 06:52:51**	**—36**	**—20**	**6.05**	**f/6.0**	**N**	**Clear**	**Processed**

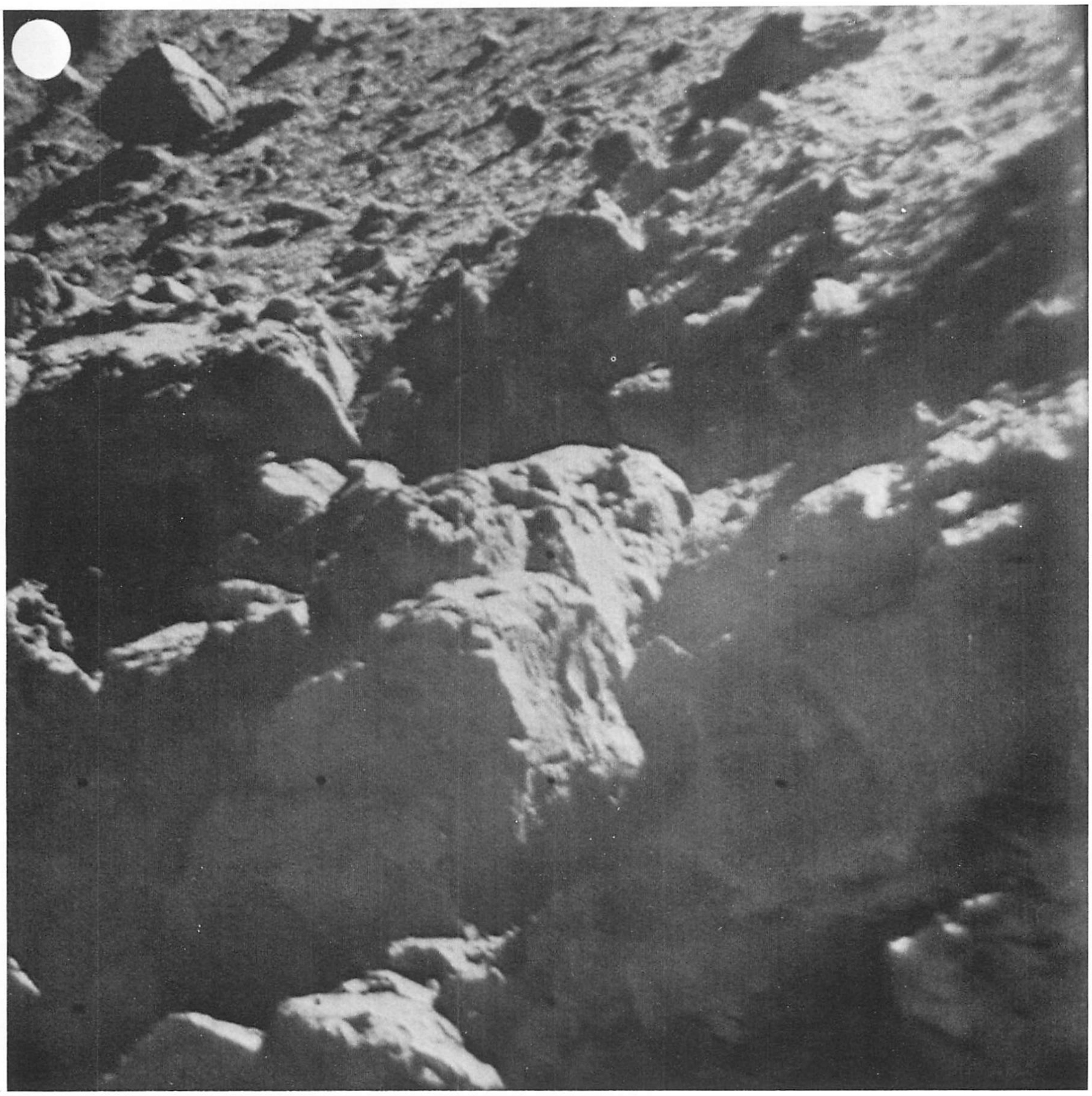


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(37)	**Day 010, 06:52:56**	**—42**	**—20**	**6.81**	***f*/6.0**	**N**	**Clear**	**Processed**

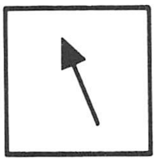


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(38)	**Day 010, 06:52:59**	**—48**	**—20**	**7.76**	**f/6.0**	**N**	**Clear**	**Processed**

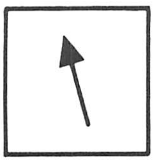


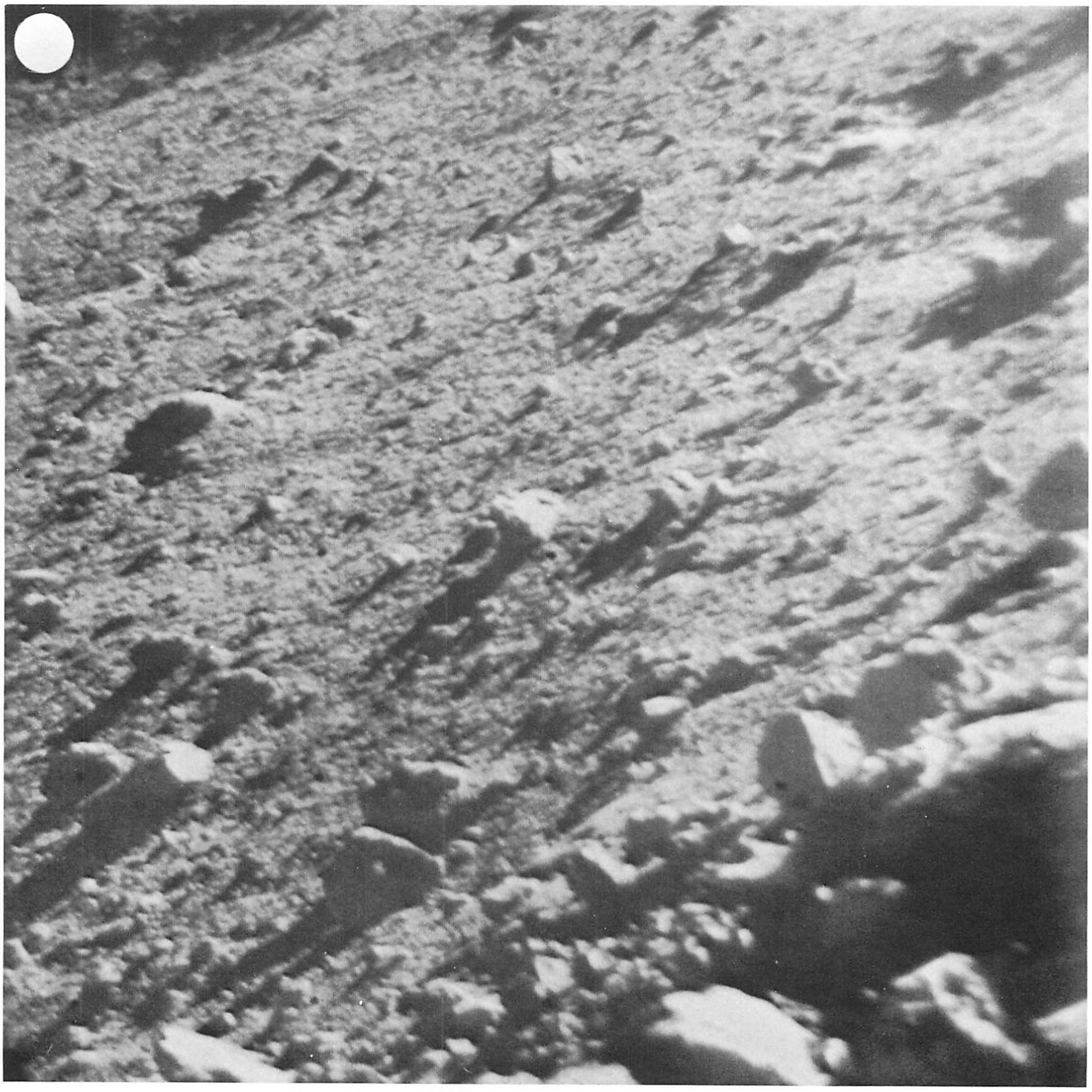


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(39)	**Day 010, 06:53:04**	**—54**	**—20**	**8.97**	**f/6.0**	**N**	**Clear**

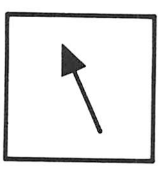


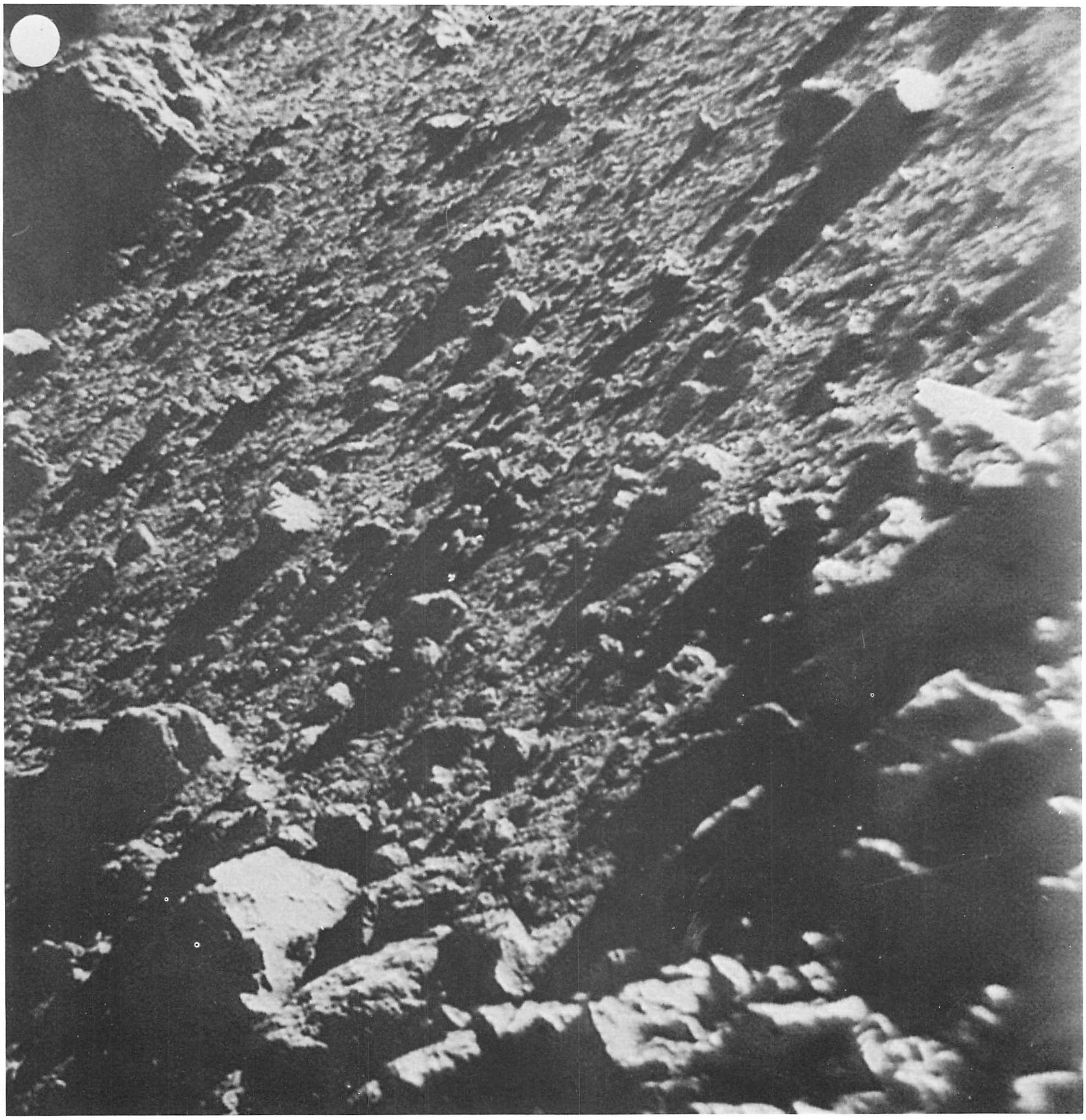
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(40)	**Day 010, 06:53:09**	**—60**	**—20**	**8.97**	***f*/6.0**	**N**	**Clear**



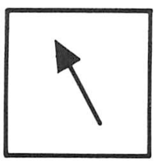


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(41)	**Day 010, 06:53:58**	**—51**	**—15**	**13.08**	***f*/6.0**	**N**	**Clear**

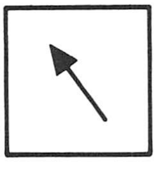


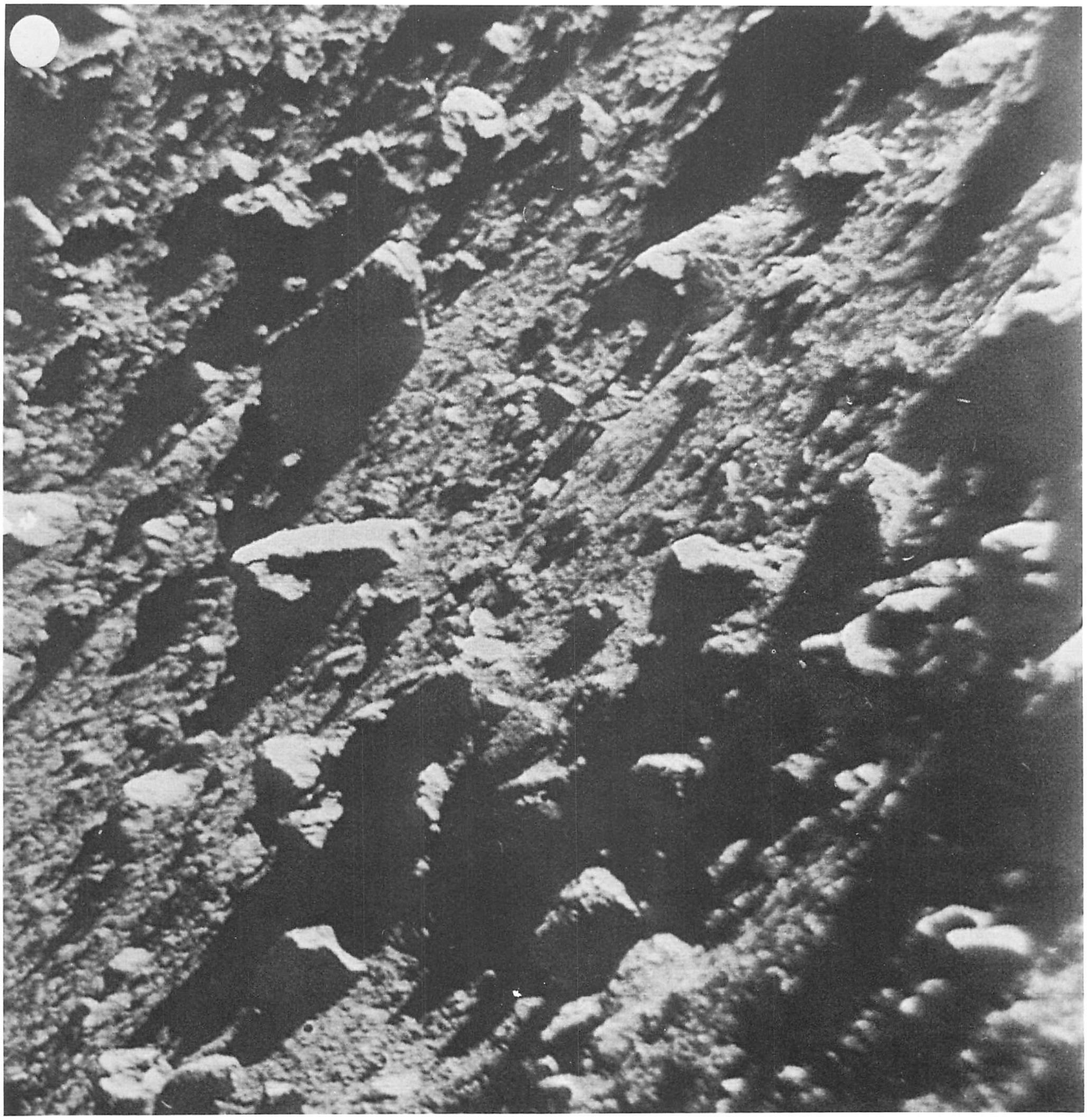


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(42)	**Day 010, 06:54:02**	**—45**	**—15**	**10.68**	***f*/6.0**	**N**	**Clear**	**Processed**

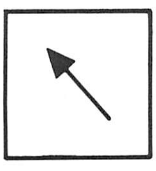


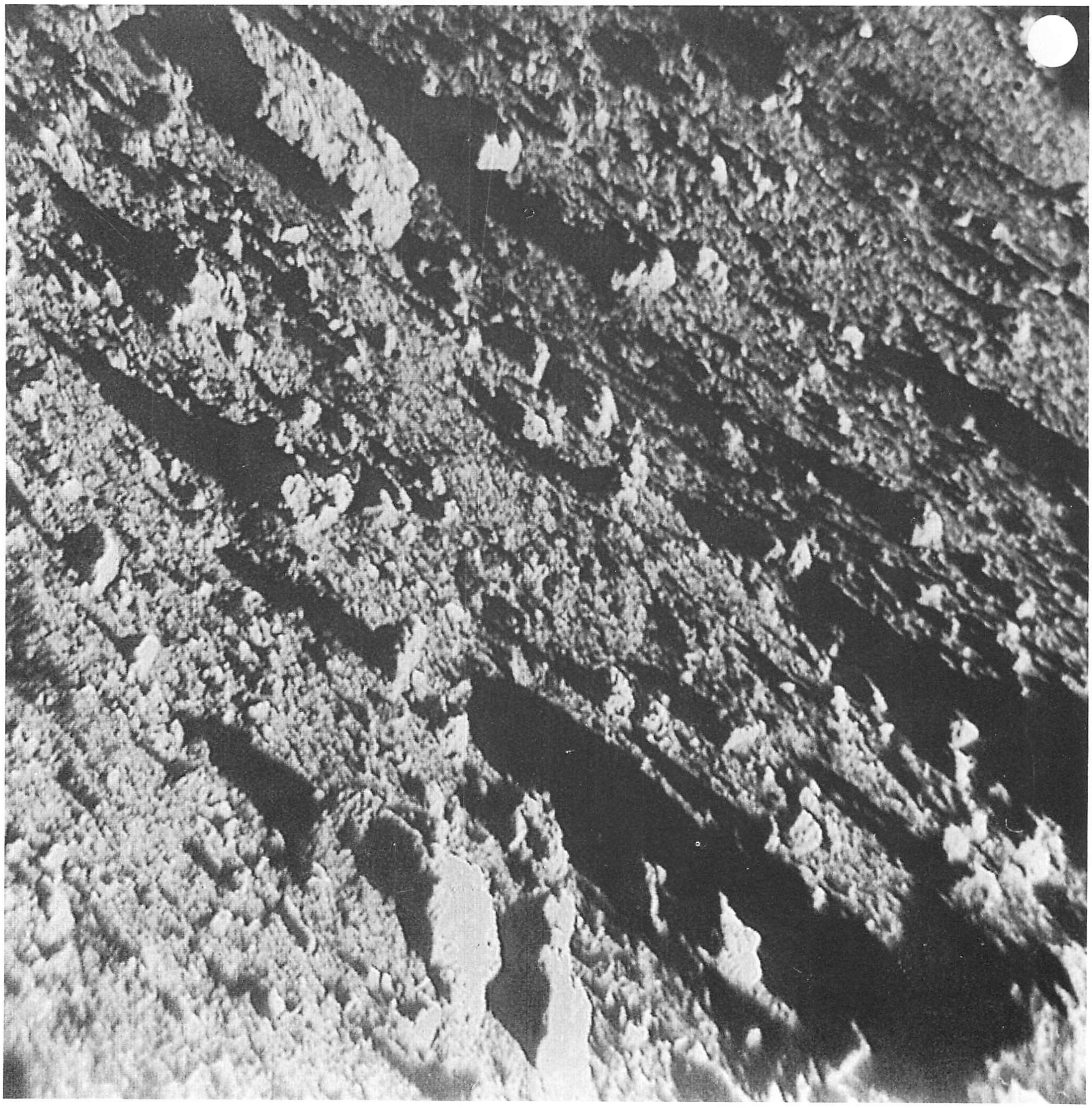
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(43)	**Day 010, 06:54:06**	**—39**	**—15**	**7.76**	***f*/6.0**	**N**	**Clear**	**Processed**



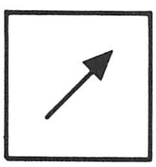


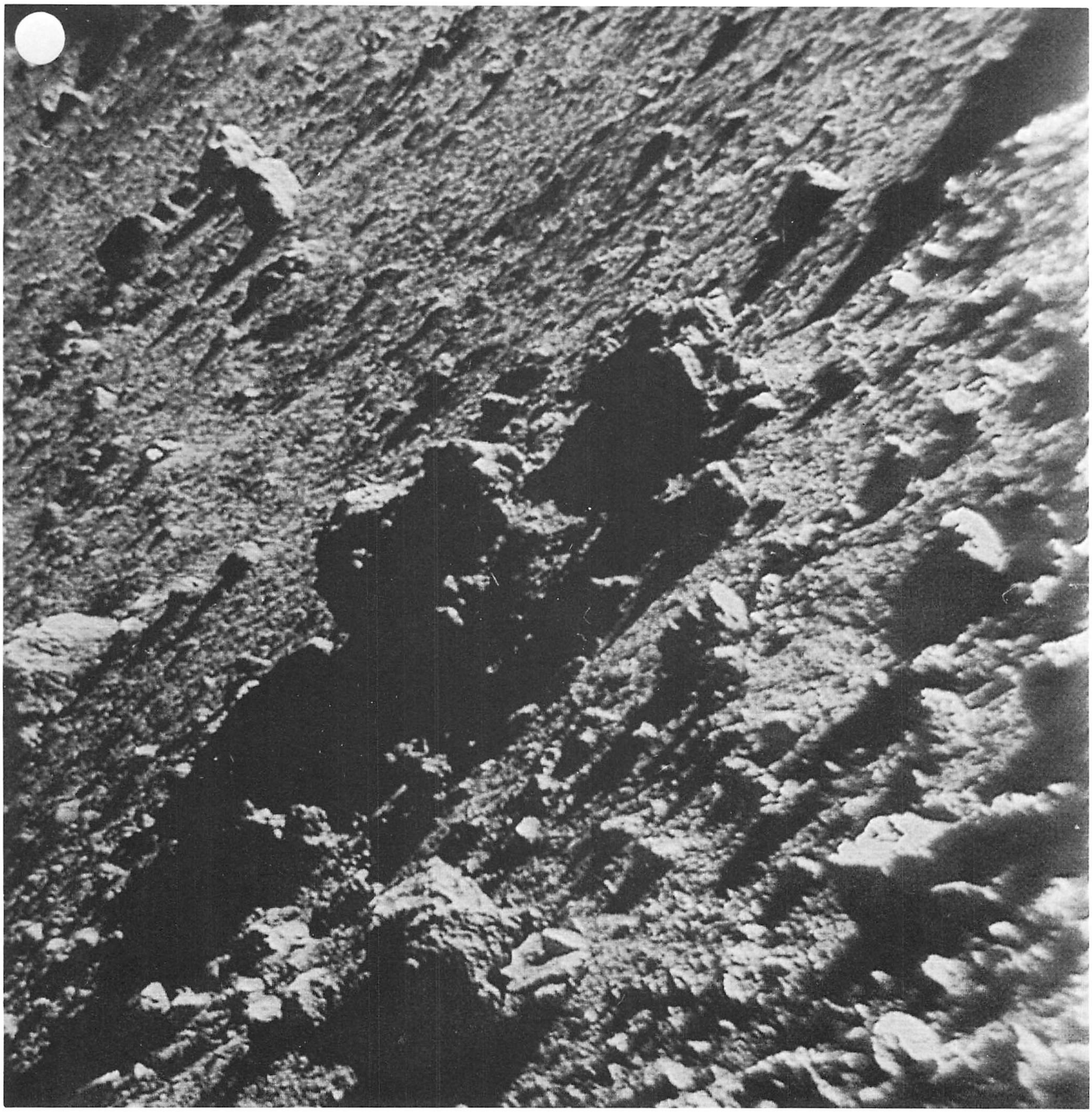
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(44)	**Day 010, 06:54:11**	**—33**	**—15**	**7.76**	***f*/6.0**	**N**	**Clear**	**Processed**



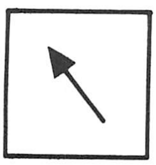


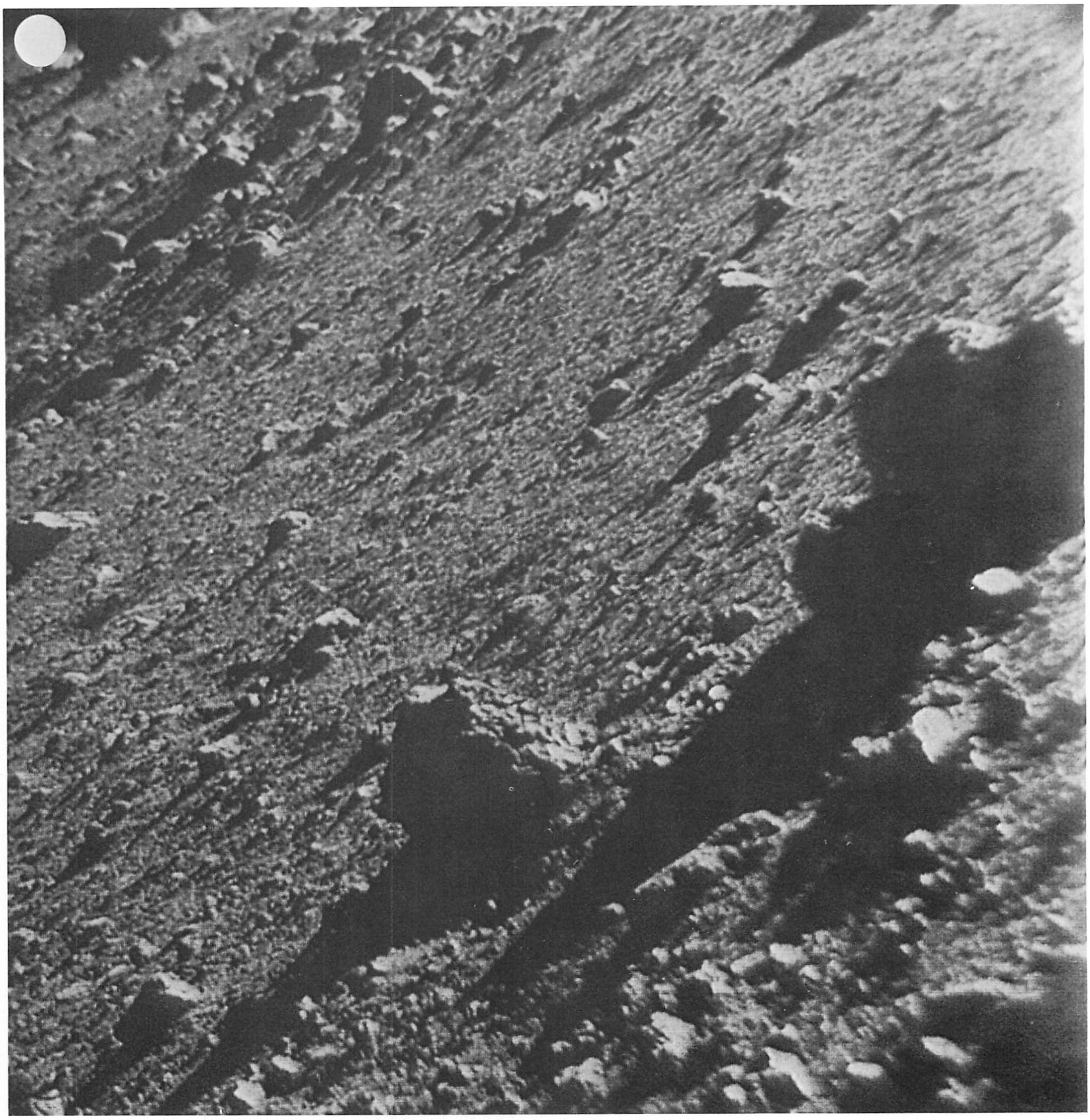
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(45)	Day 010, 06:54:15	—30	—10	10.68	f/6.0	N	Clear	Processed



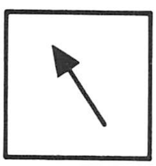


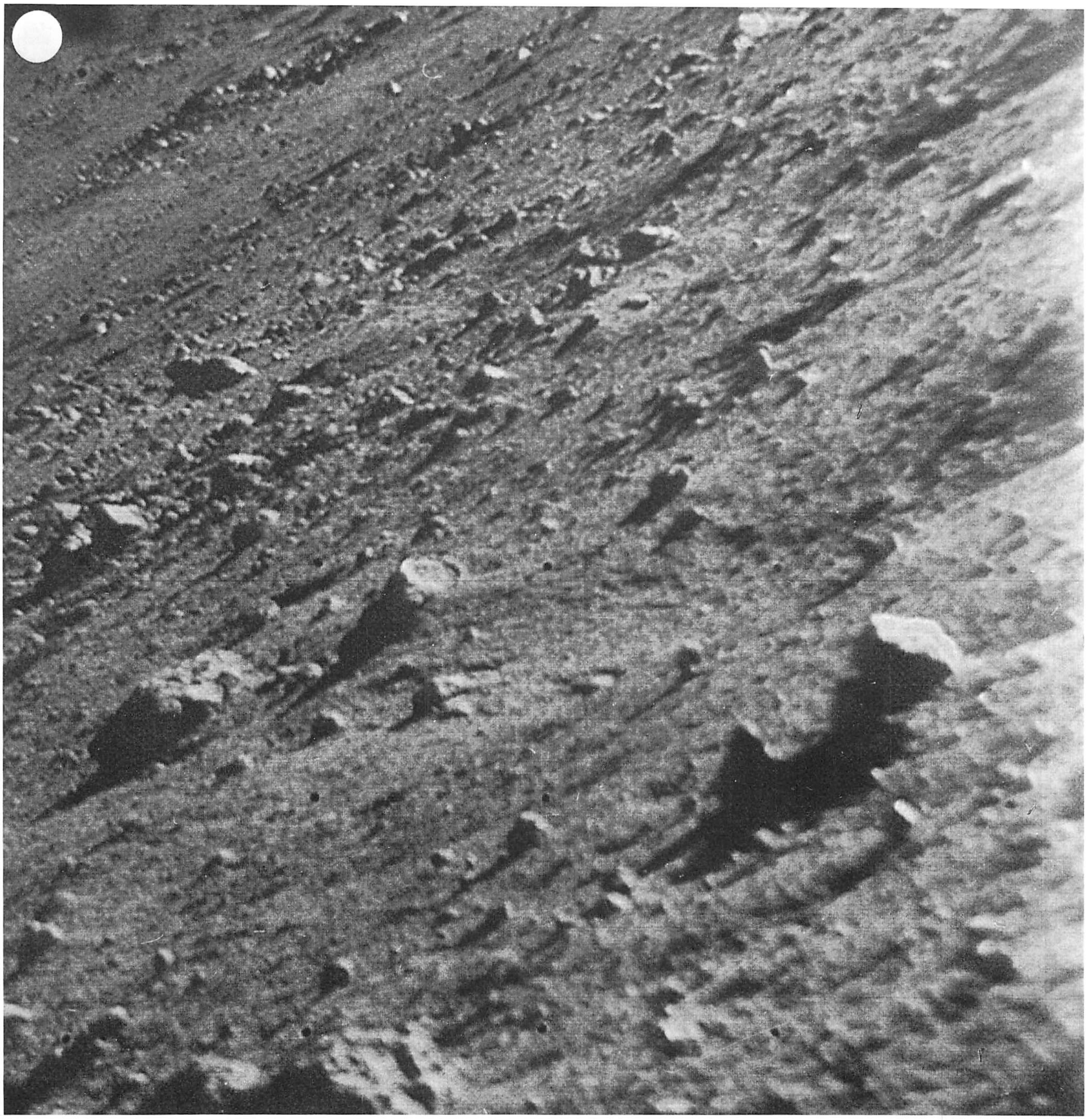
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(46)	**Day 010, 06:54:20**	**—36**	**—10**	**13.08**	***f*/6.0**	**N**	**Clear**	**Processed**



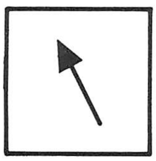


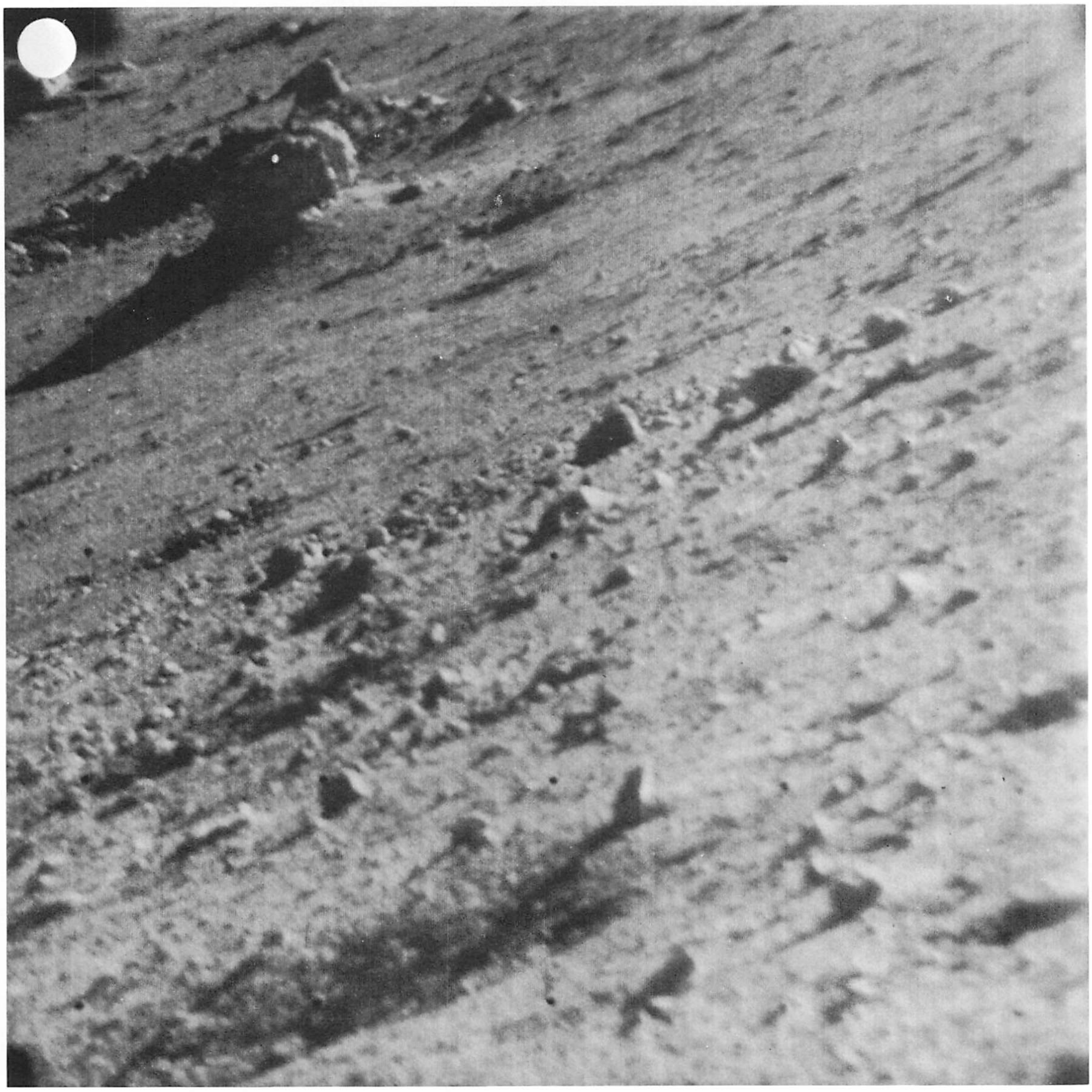
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(47)	**Day 010, 06:54:25**	**—42**	**—10**	**17.93**	**f/6.0**	**N**	**Clear**	**Processed**



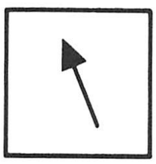


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(48)	**Day 010, 06:54:28**	**—48**	**—10**	**61.92**	**f/6.0**	**N**	**Clear**	**Processed**

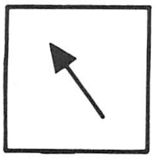


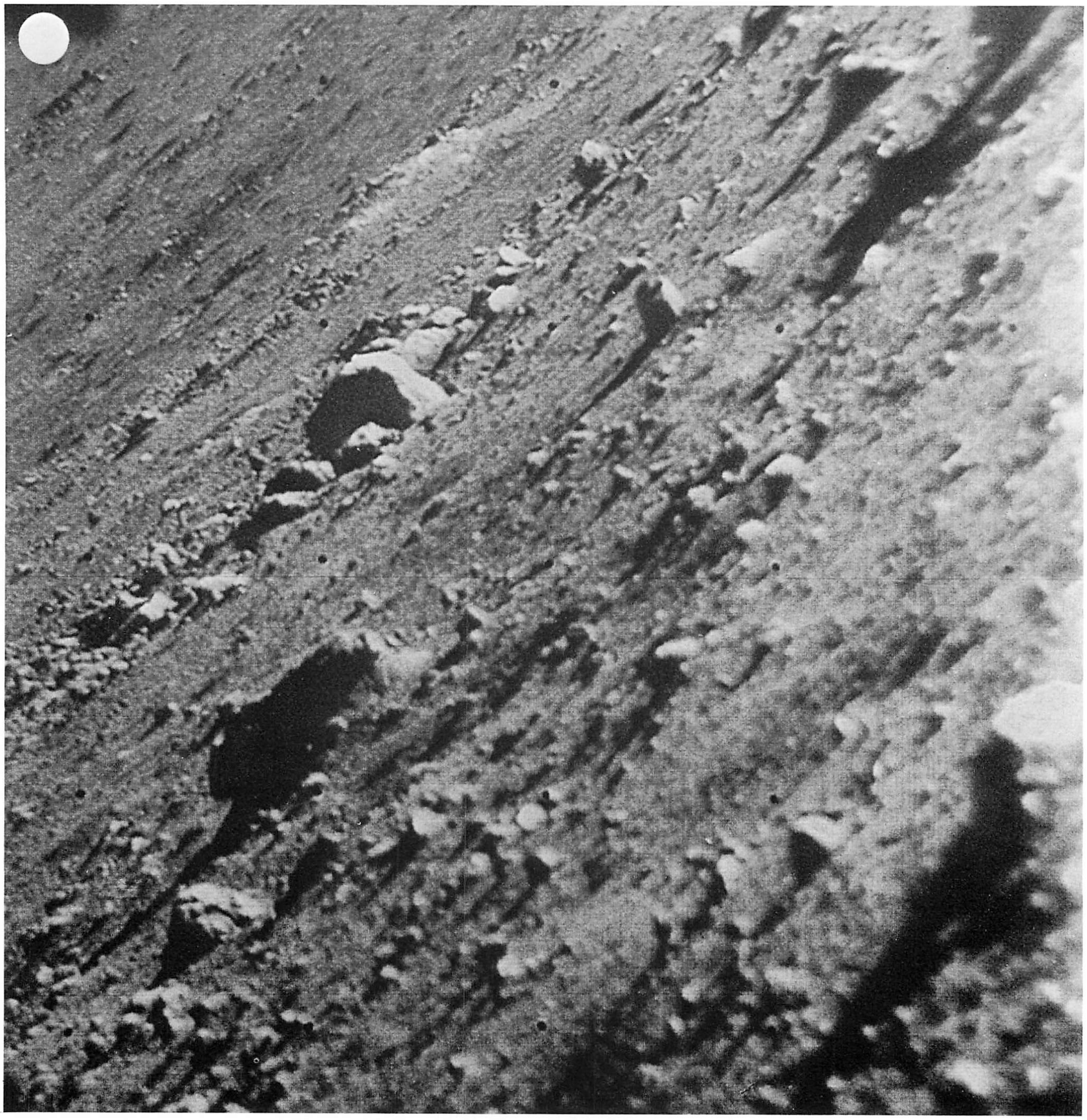


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(49)	**Day 010, 06:54:33**	**−54**	**−10**	**205.24**	***f*/6.0**	**N**	**Clear**

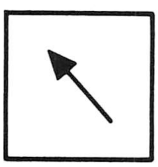


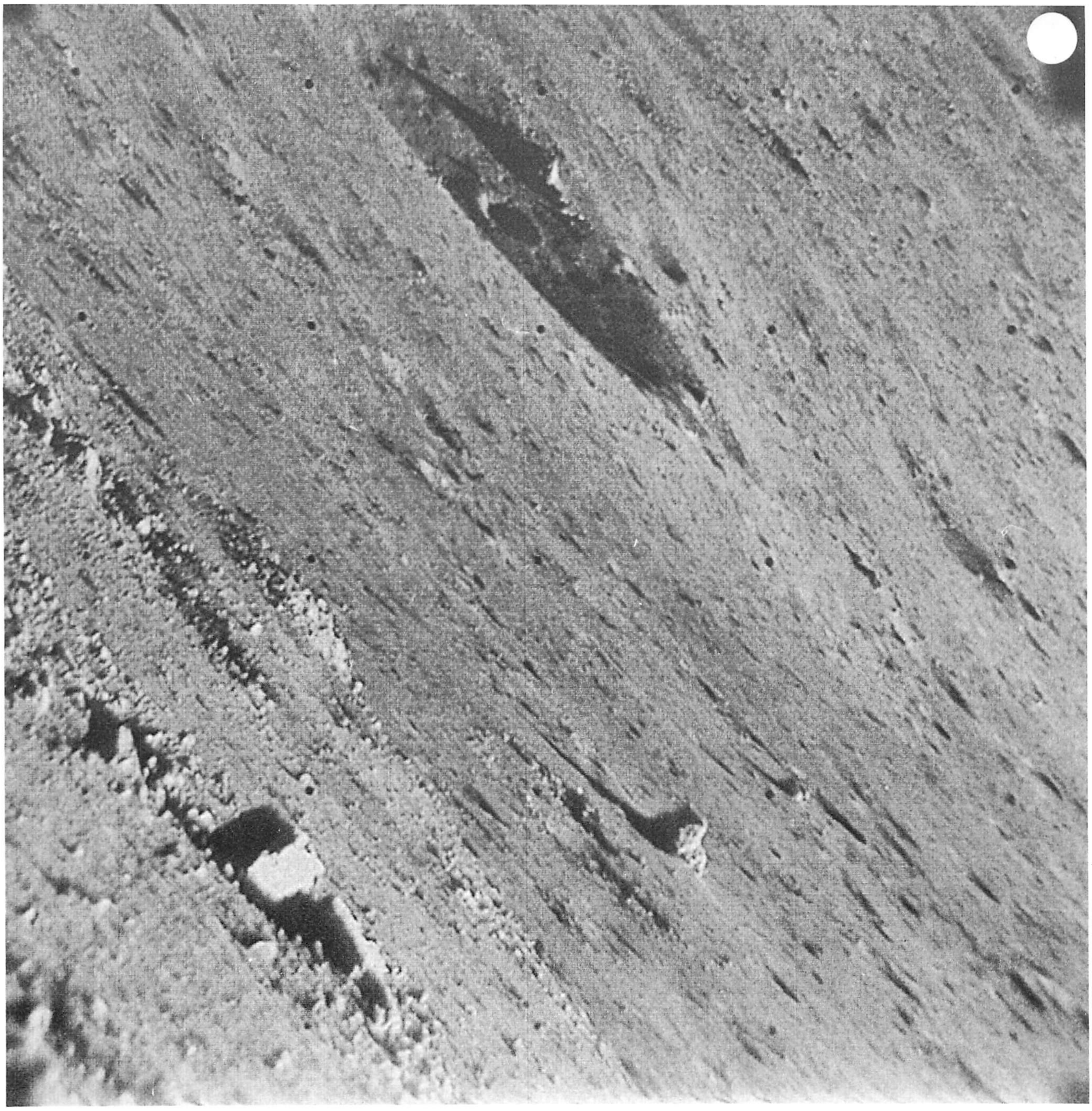
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(50)	**Day 010, 06:58:25**	**—39**	**—5**	**205.24**	***f*/6.0**	**N**	**Clear**	**Processed**



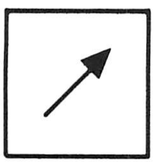


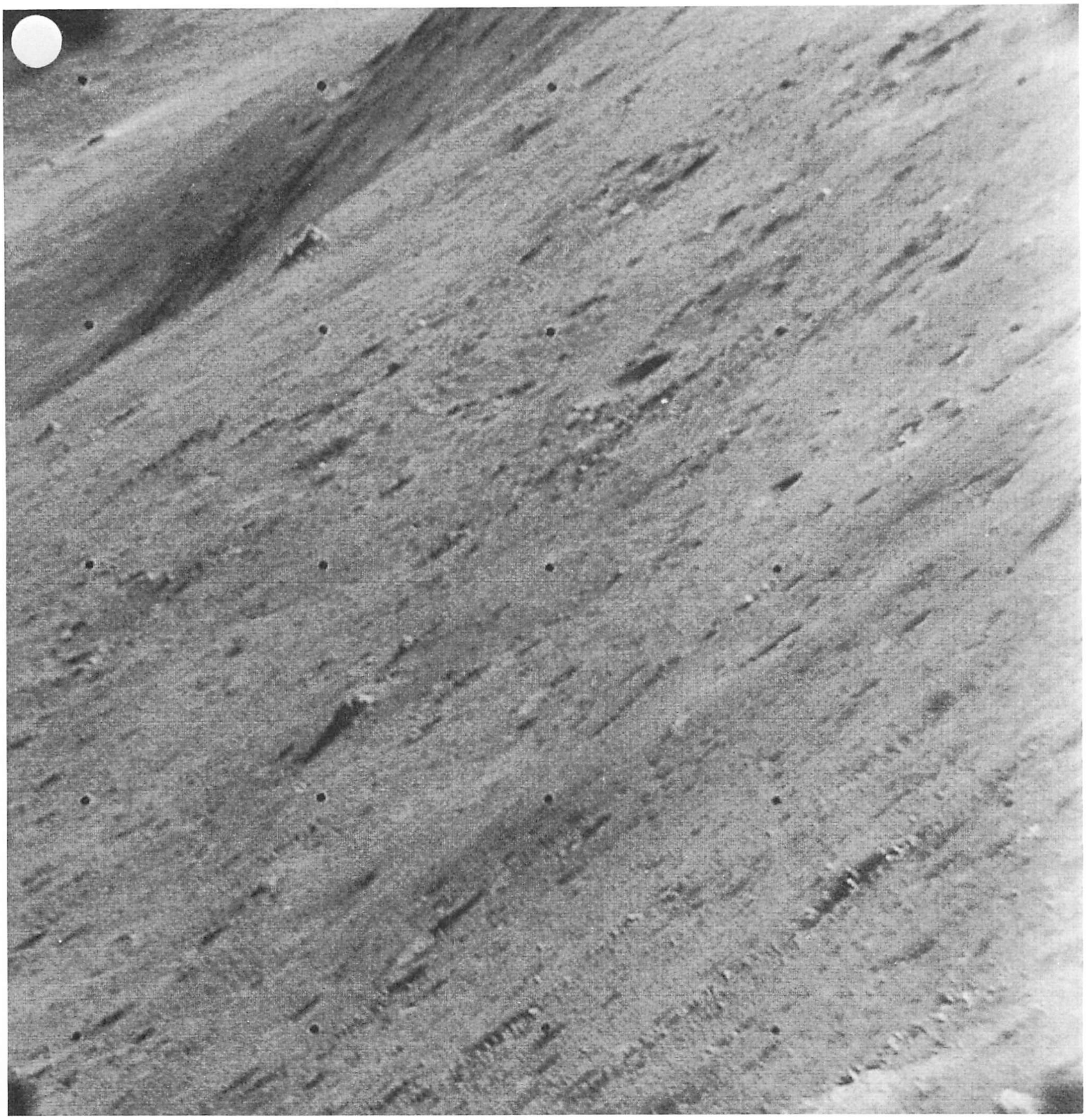
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(51)	Day 010, 06:58:30	−33	−5	205.24	*f*/6.0	N	Clear	Processed



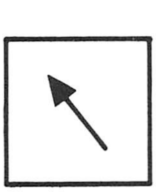


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(52)	**Day 010, 06:58:34**	**—30**	**0**	**205.24**	***f*/6.0**	**N**	**Clear**	**Processed**

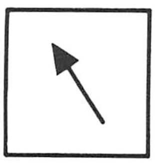




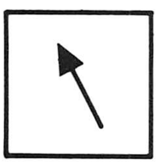
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(53)	Day 010, 06:58:38	−36	0	205.24	f/6.0	N	Clear	Processed

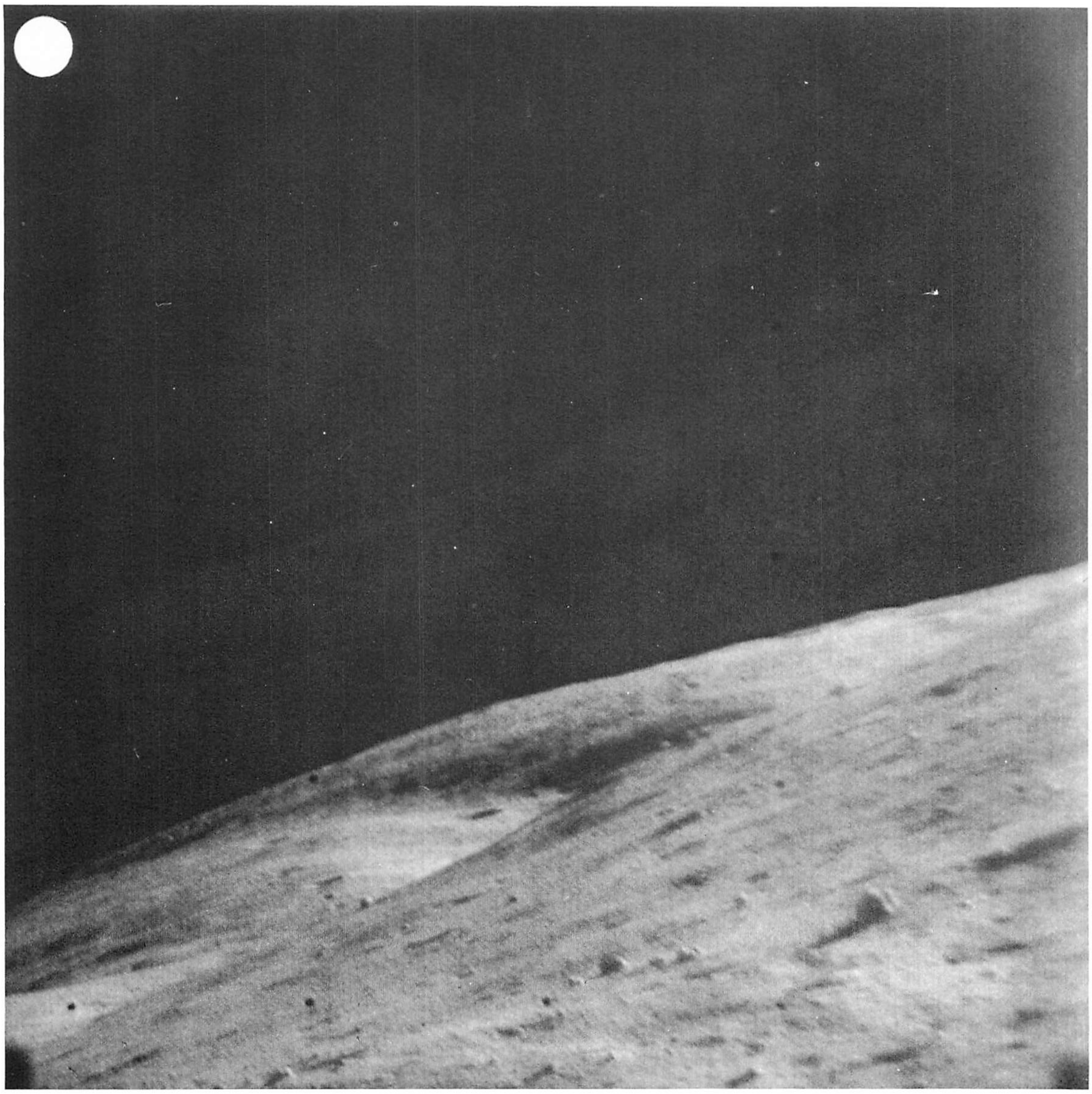


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(54)	**Day 010, 06:58:43**	**—42**	**0**	**205.24**	**f/6.0**	**N**	**Clear**	**Processed**

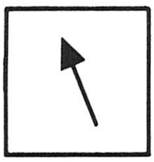


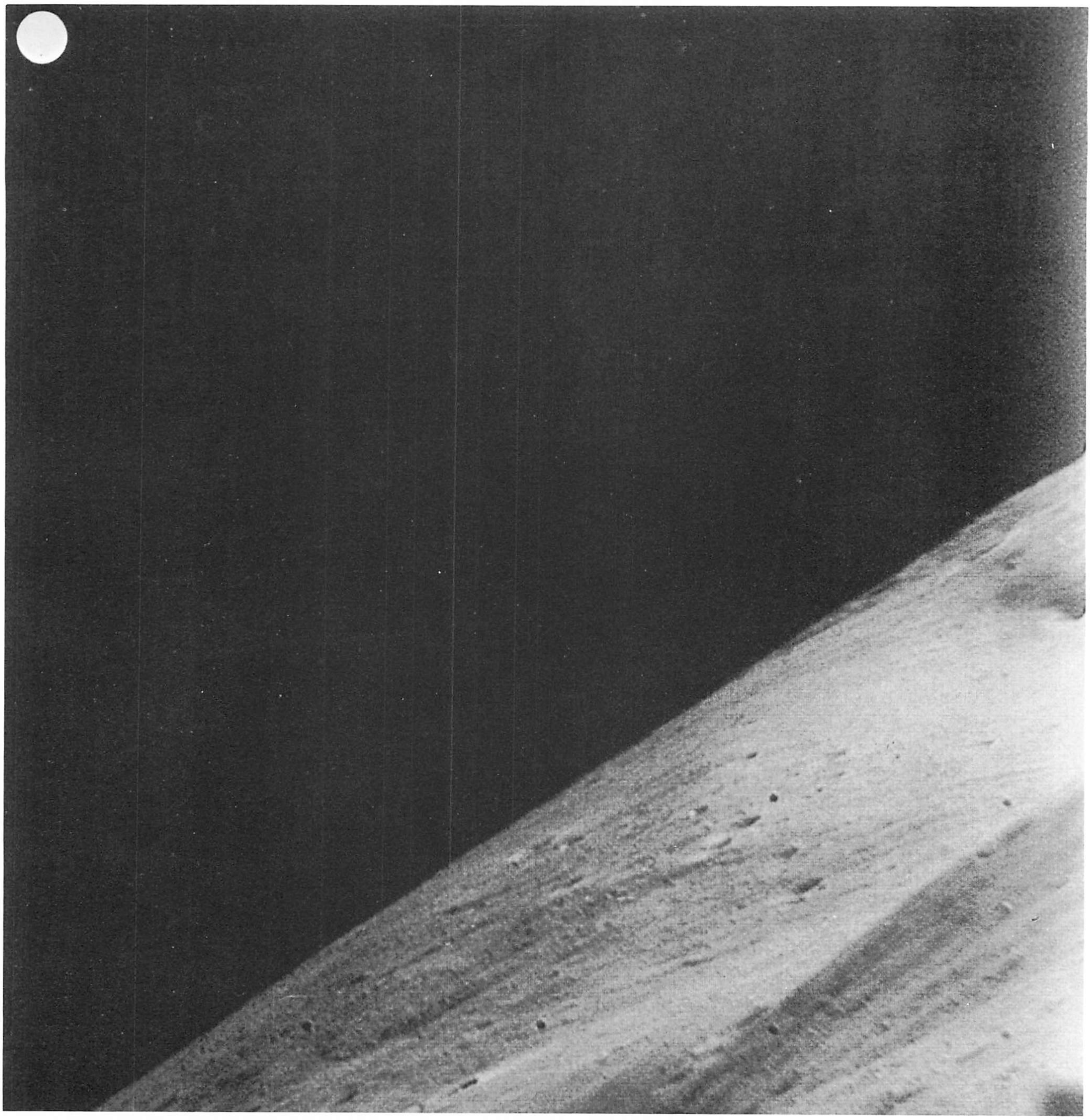
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(55)	Day 010, 06:58:48	—48	0	205.24	*f*/6.0	N	Clear	Processed



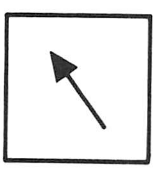


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(56)	**Day 010, 06:58:52**	**—54**	**0**	**205.24**	***f*/6.0**	**N**	**Clear**

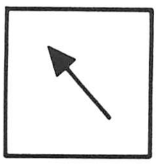


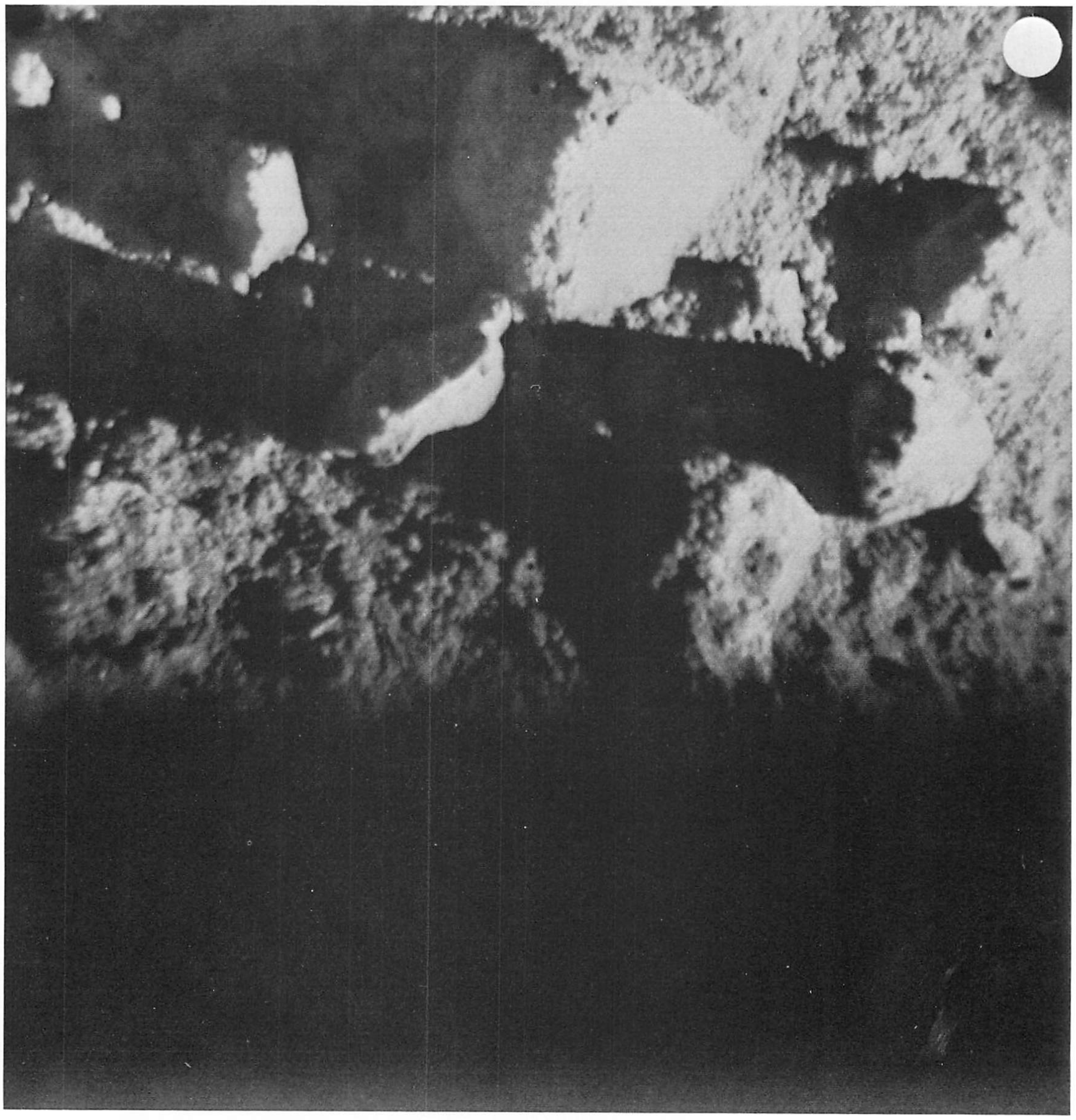


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(57)	**Day 010, 06:59:28**	**—39**	**5**	**205.24**	**f/6.0**	**N**	**Clear**	**Processed**

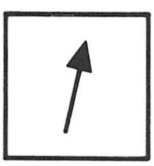


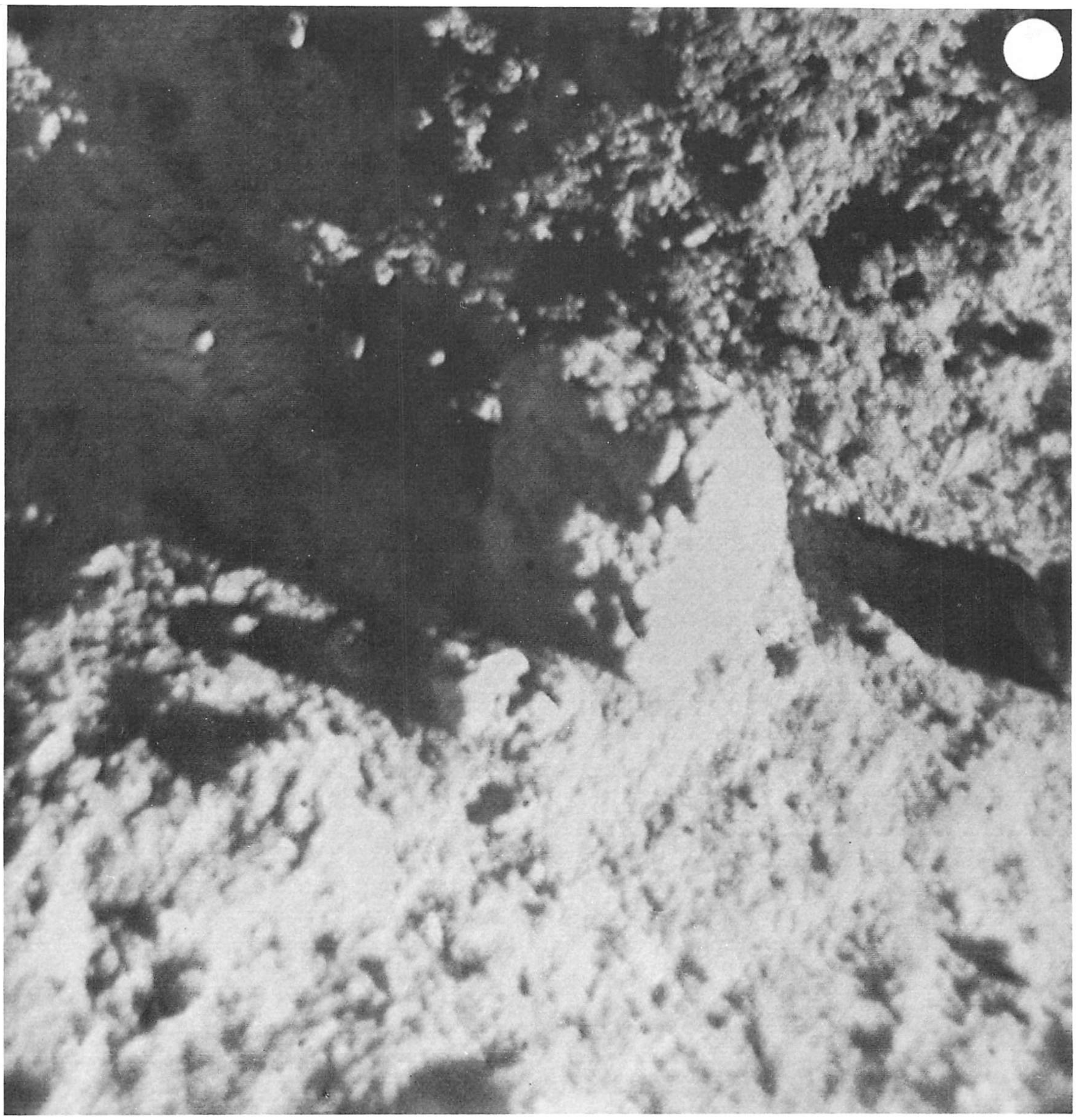
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(58)	**Day 010, 06:59:33**	**—33**	**5**	**205.24**	**f/6.0**	**N**	**Clear**	**Processed**



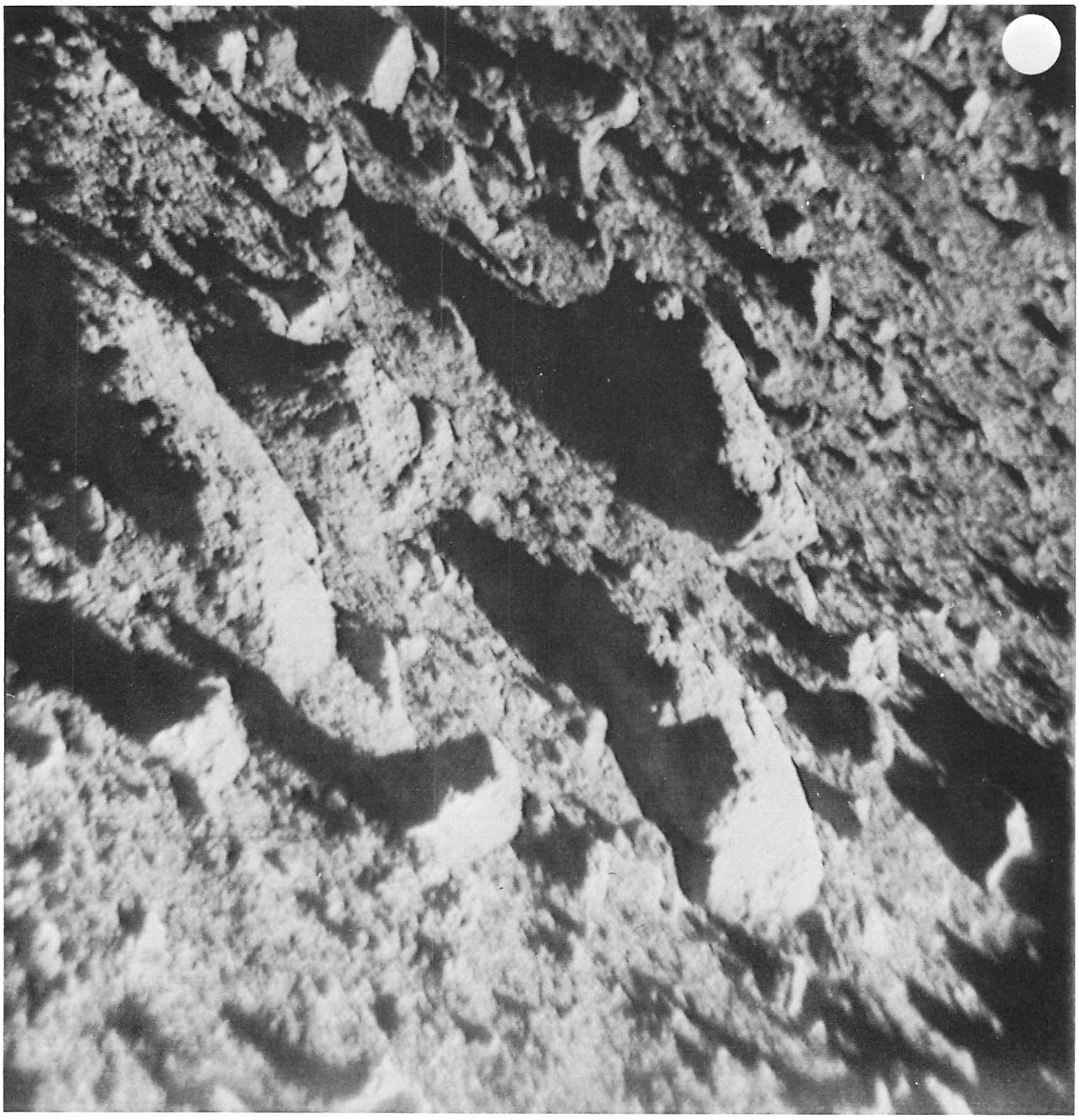


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(59)	Day 010, 07:00:58	0	−60	2.18	f/6.0	N	Clear

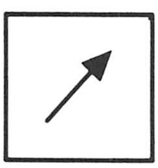


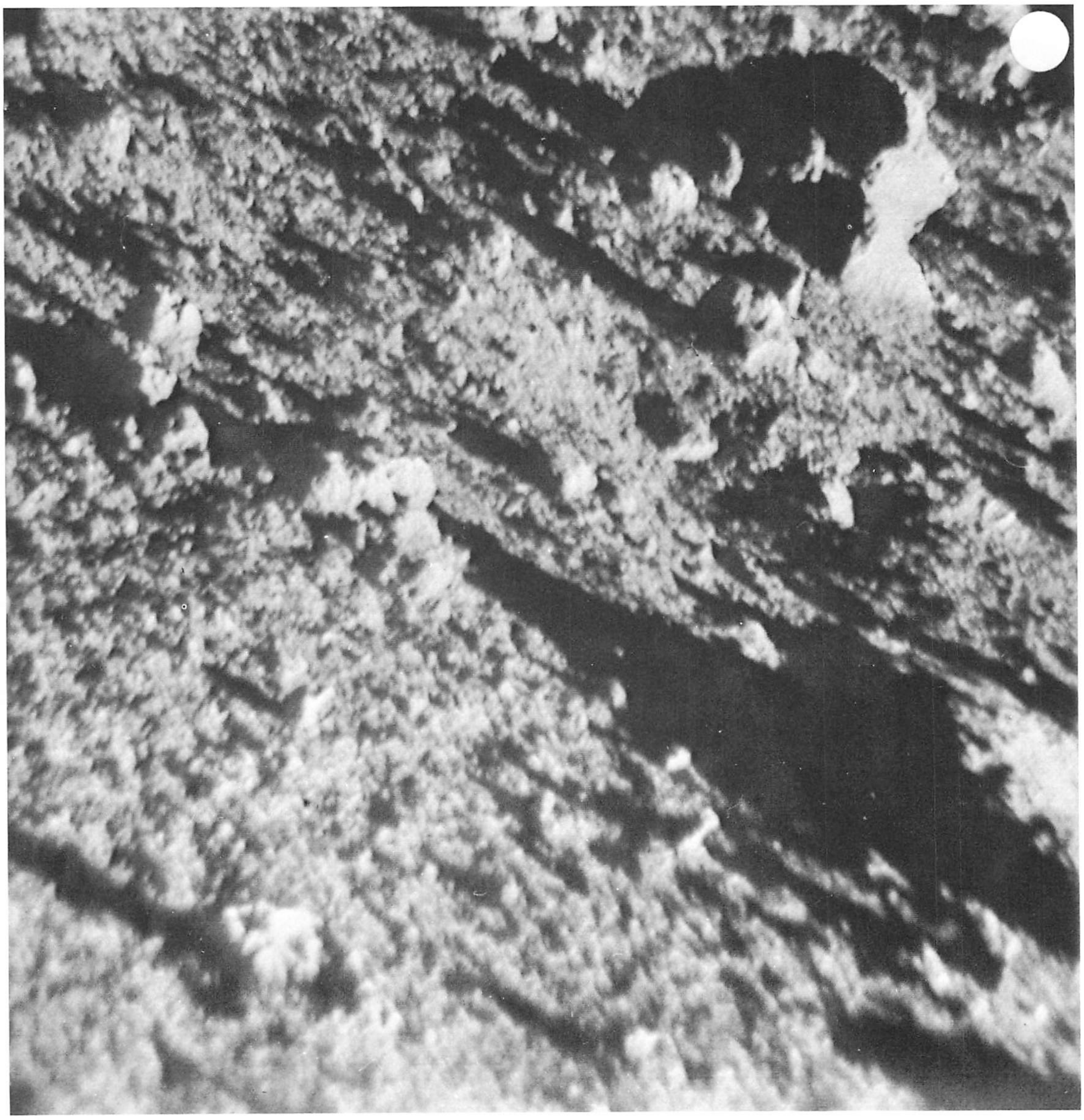


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(60)	**Day 010, 07:01:47**	**−6**	**−50**	**2.43**	***f*/6.0**	**N**	**Clear**

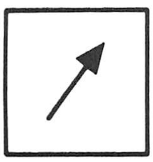


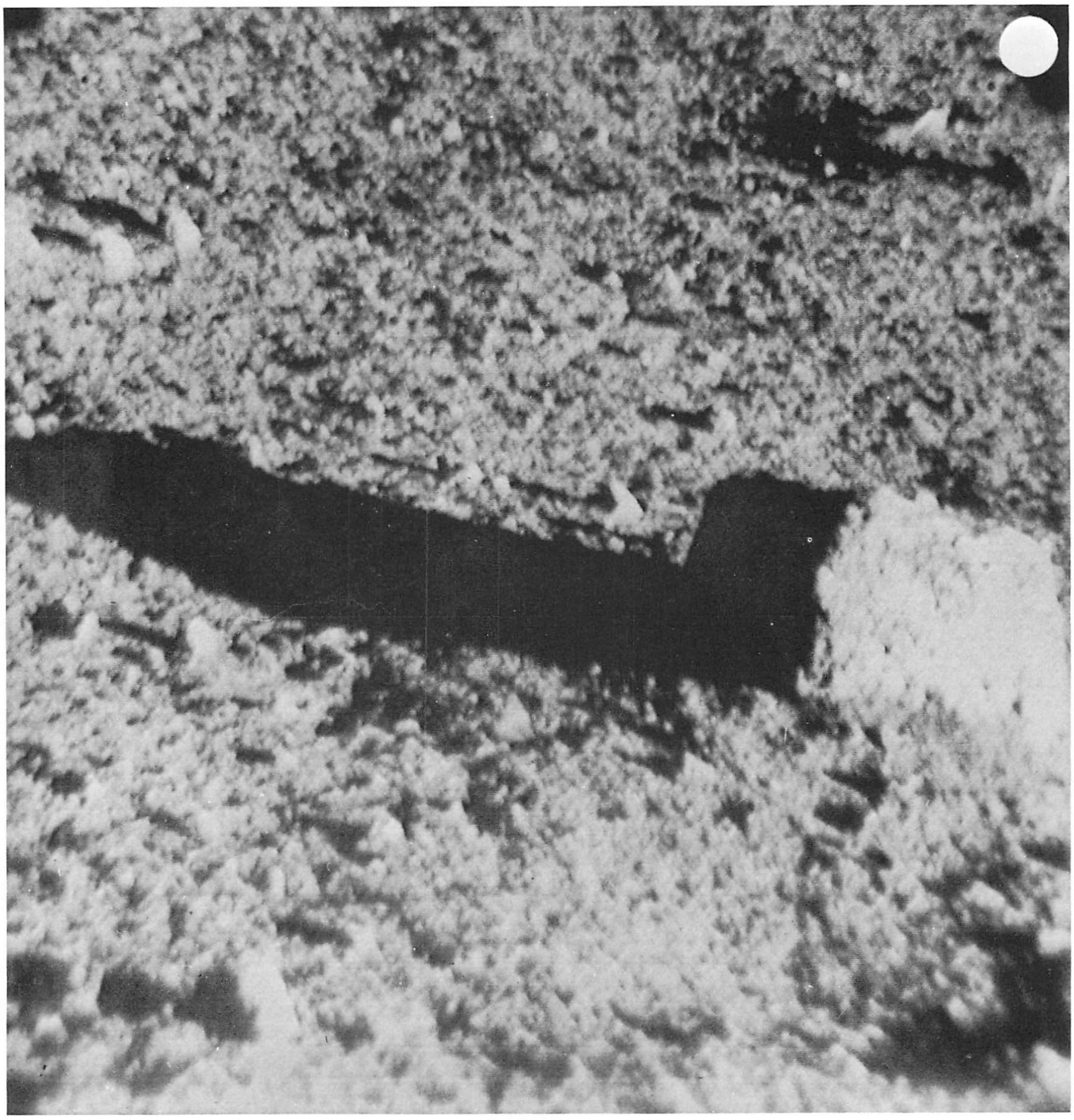
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(61)	Day 010, 07:05:20	−27	−15	6.81	f/7.0	N	Clear



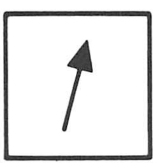


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(62)	**Day 010, 07:05:24**	**—21**	**—15**	**6.81**	**f/7.0**	**N**	**Clear**

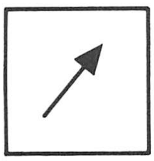


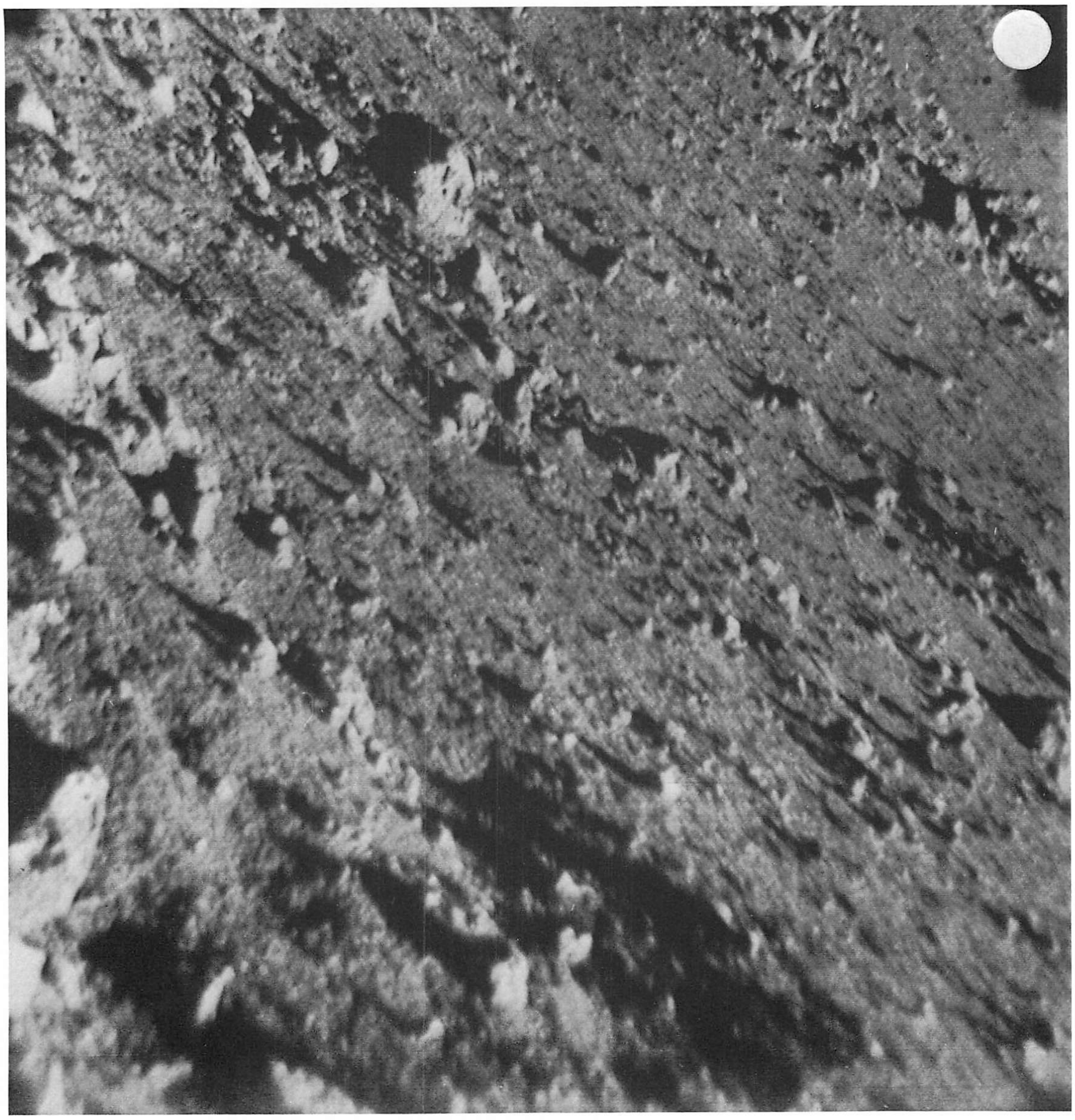


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(63)	**Day 010, 07:05:37**	**—3**	**—15**	**5.44**	***f*/7.0**	**N**	**Clear**

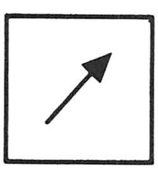


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(64)	**Day 010, 07:08:48**	**—24**	**—10**	**8.97**	***f*/7.0**	**N**	**Clear**

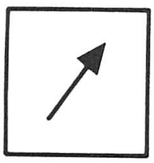


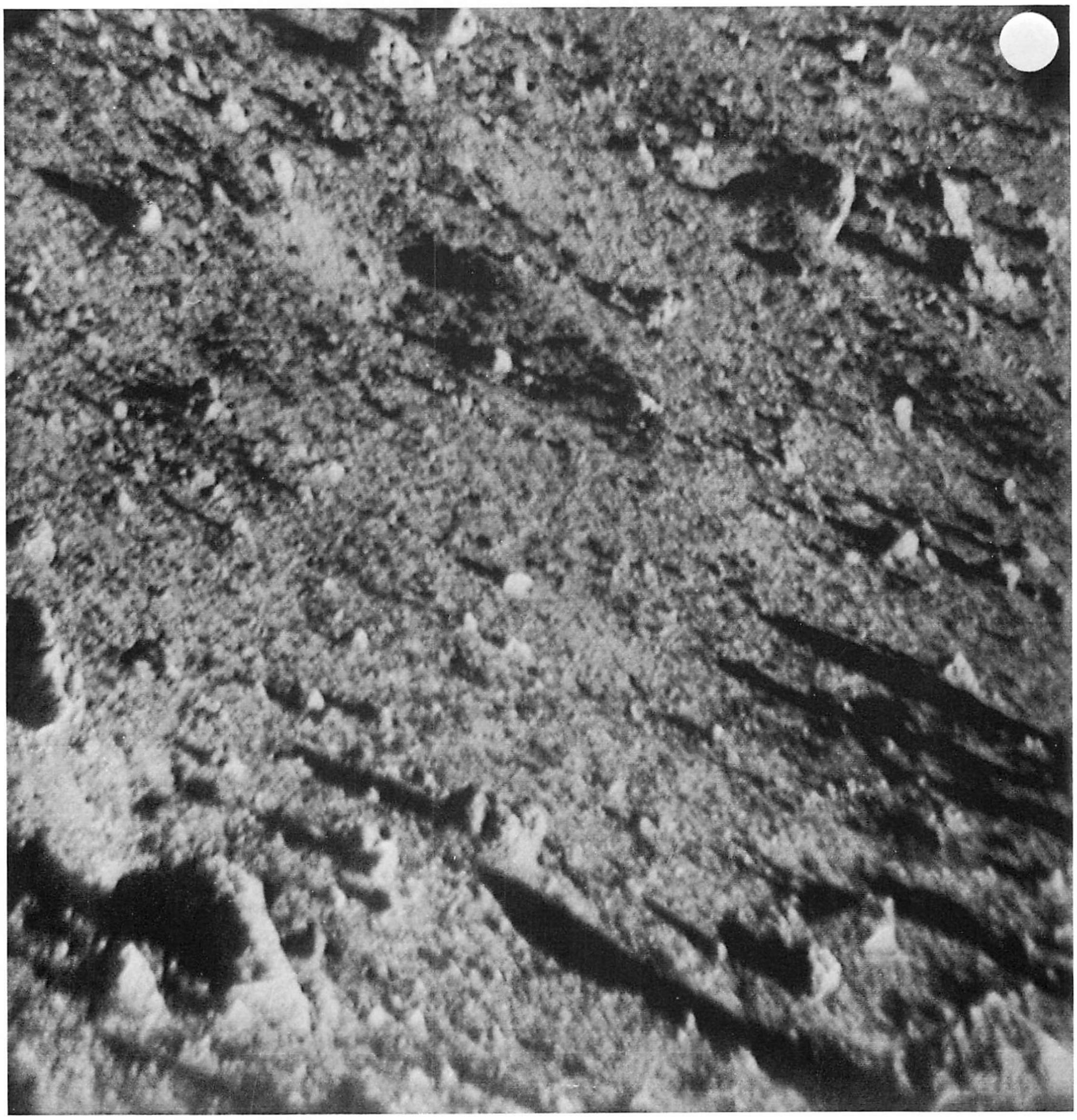


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(65)	Day 010, 07:08:52	−27	−5	27.73	f/7.0	N	Clear

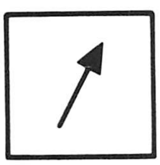


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(66)	**Day 010, 07:08:57**	**—21**	**—5**	**13.08**	***f*/7.0**	**N**	**Clear**

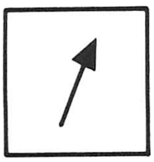




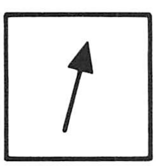
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(67)	**Day 010, 07:09:02**	**−15**	**−5**	**10.68**	***f*/7.0**	**N**	**Clear**

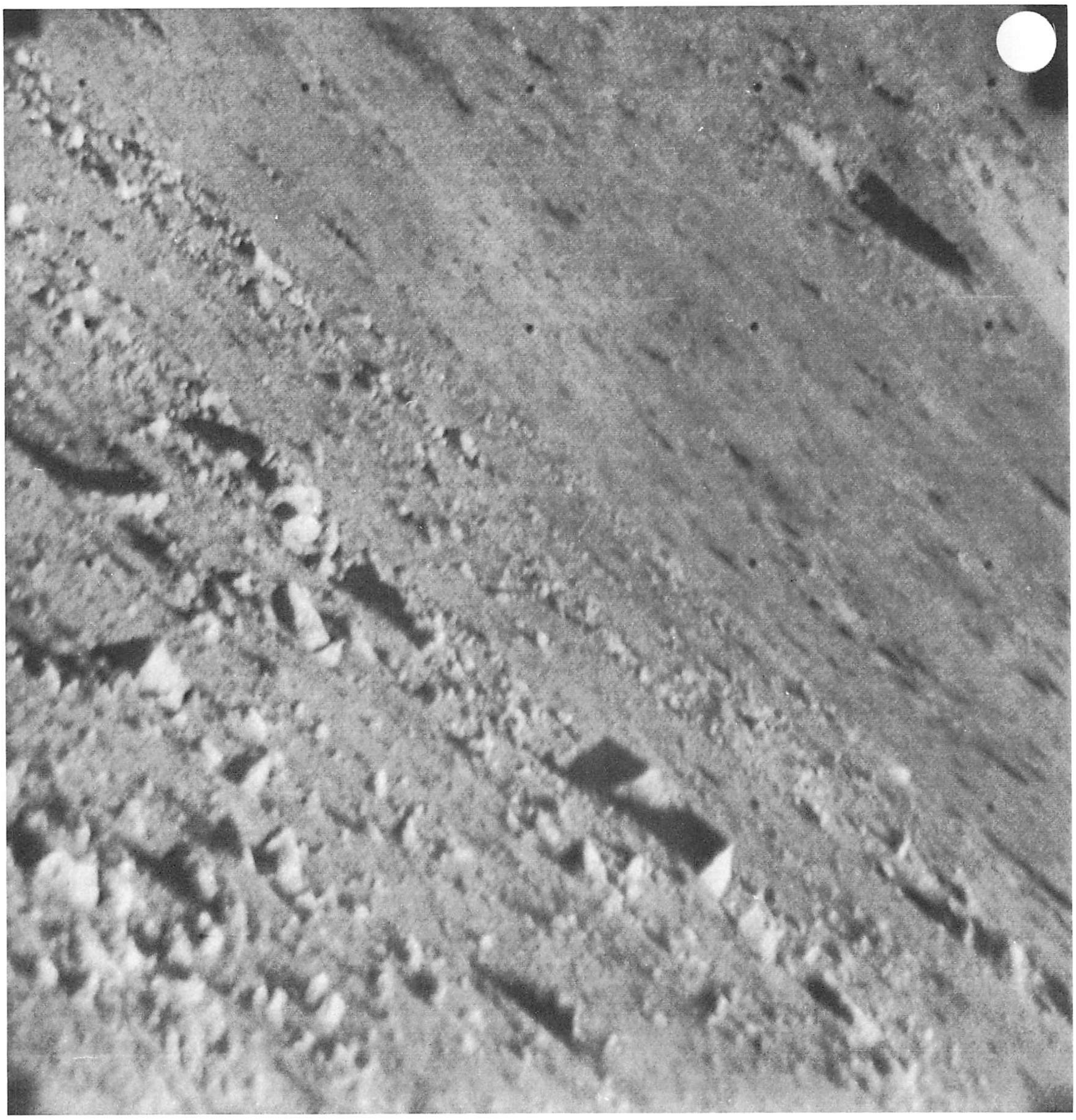


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(68)	**Day 010, 07:09:07**	**—9**	**—5**	**10.68**	**f/7.0**	**N**	**Clear**

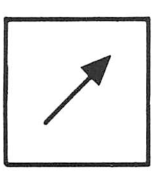


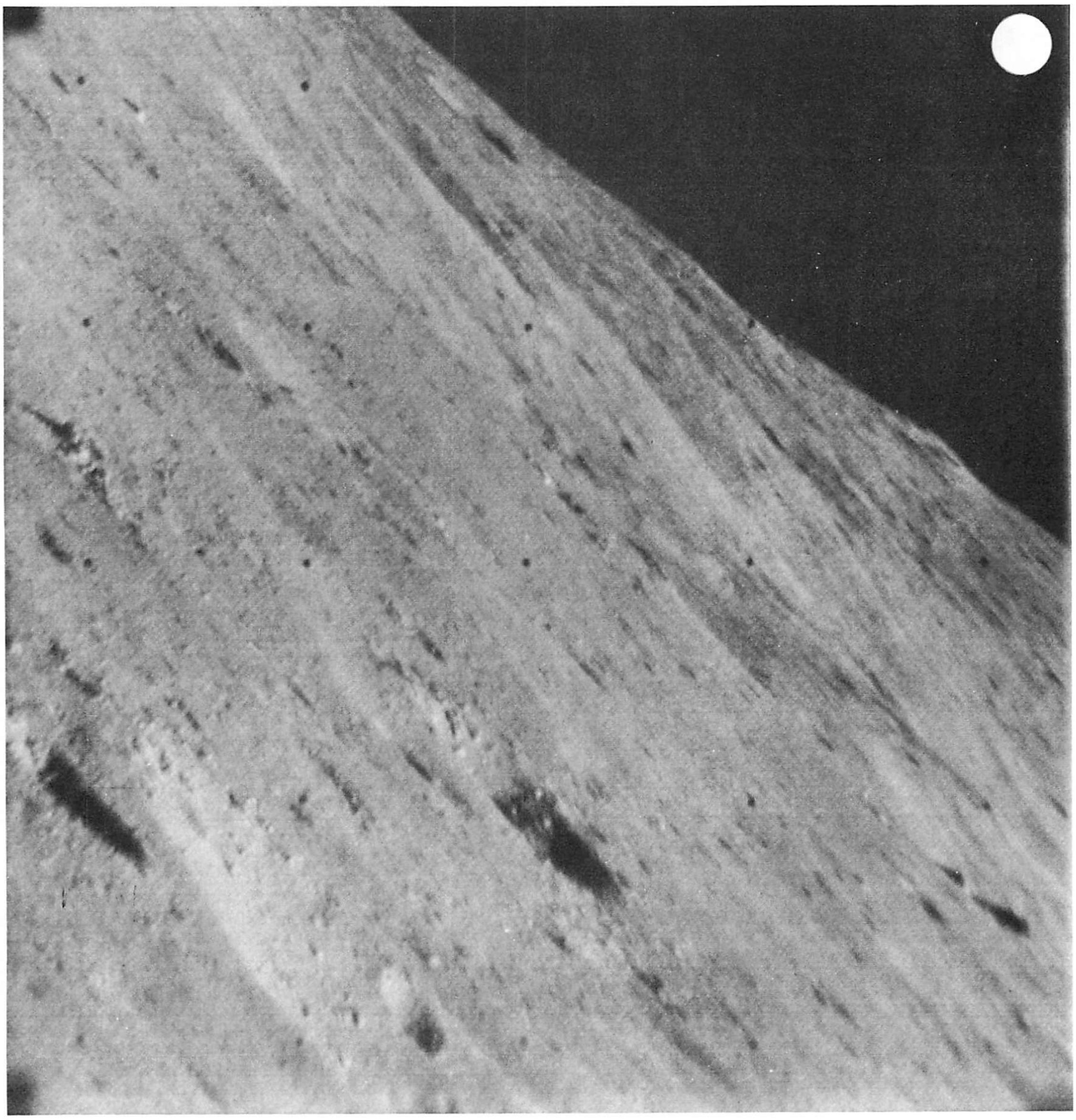
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(69)	**Day 010, 07:09:11**	**—3**	**—5**	**8.97**	***f*/7.0**	**N**	**Clear**



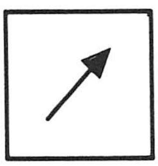


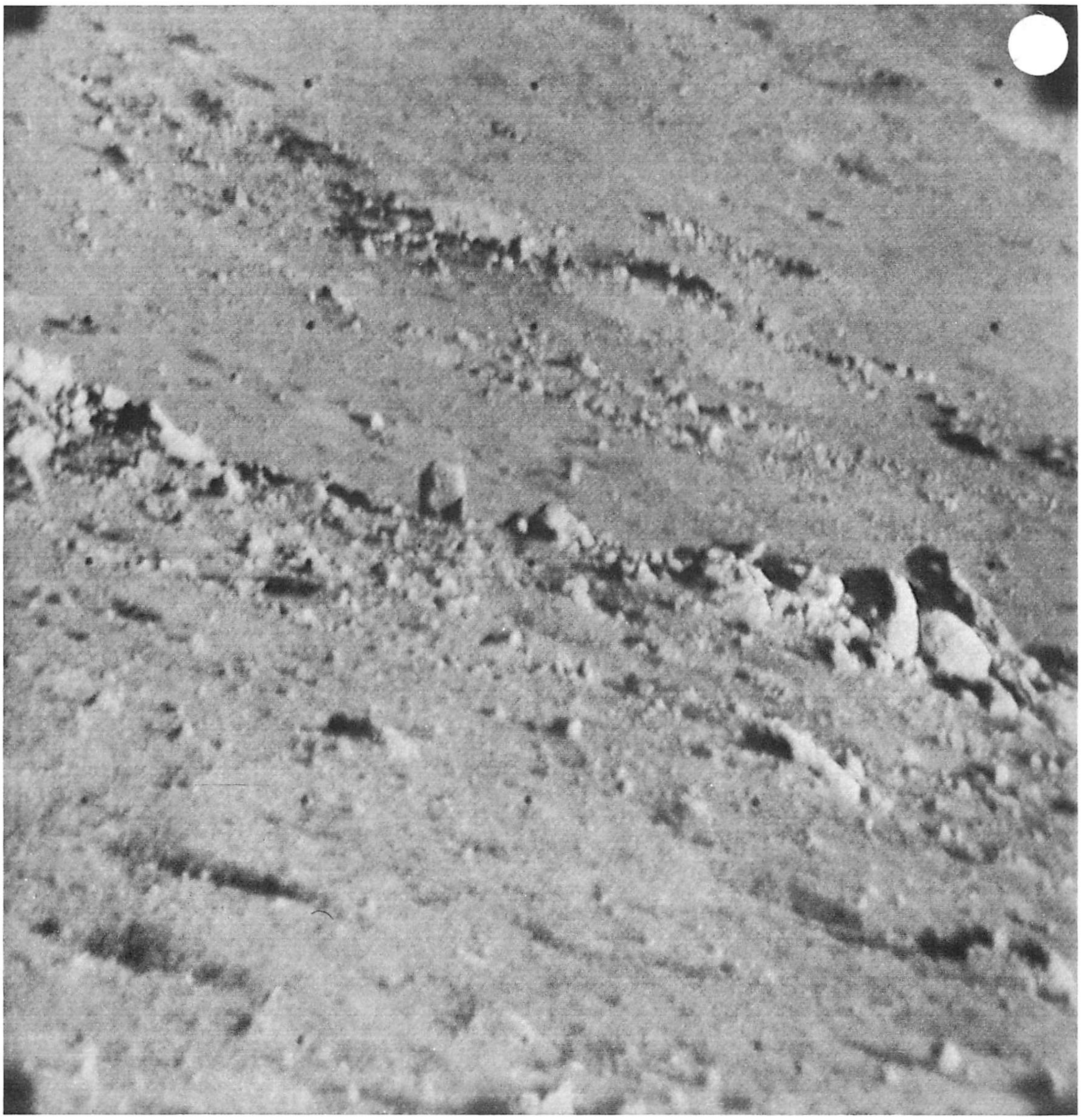
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(70)	**Day 010, 07:09:33**	**—30**	**0**	**61.92**	***f*/6.9**	**N**	**Clear**



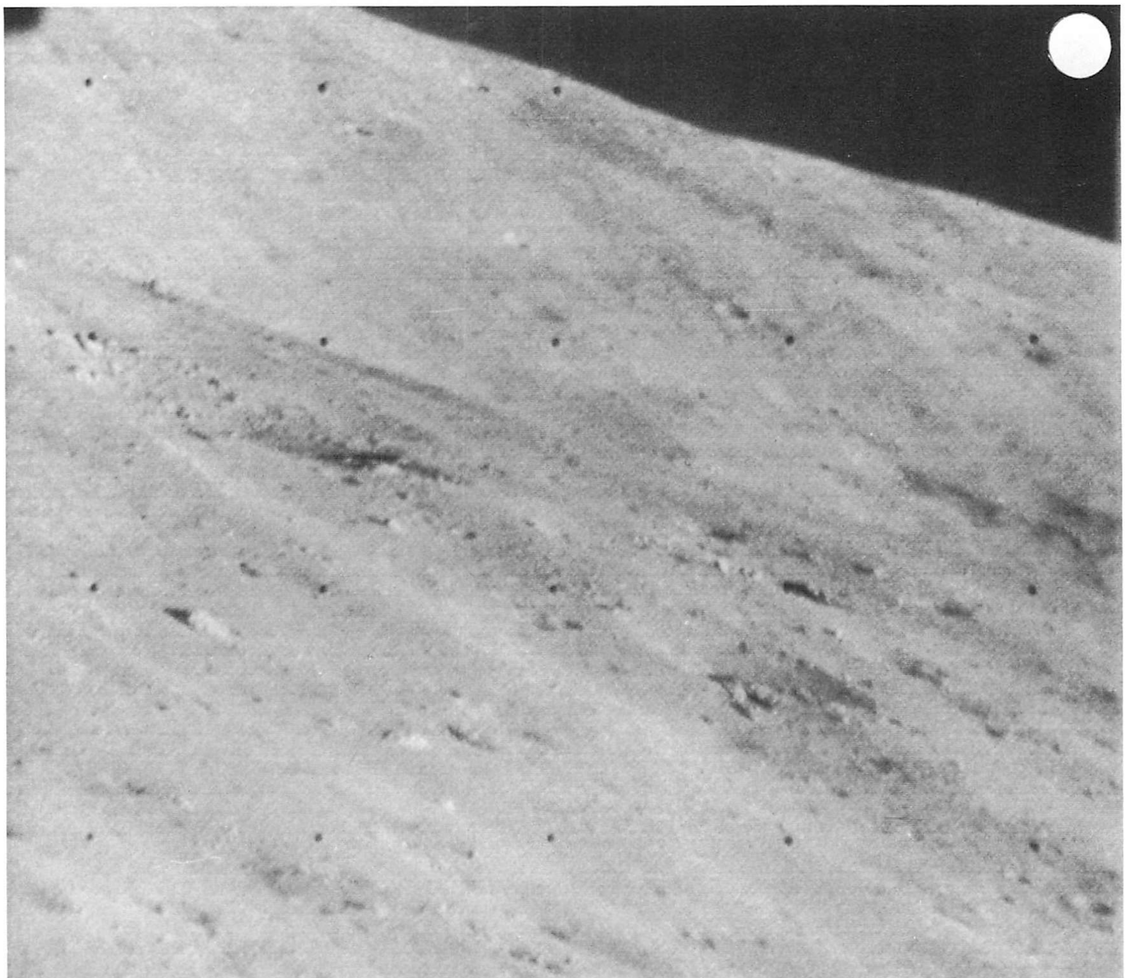


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(71)	**Day 010, 07:09:38**	**—27**	**5**	**205.24**	***f*/7.0**	**N**	**Clear**

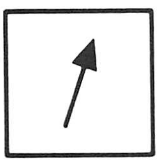


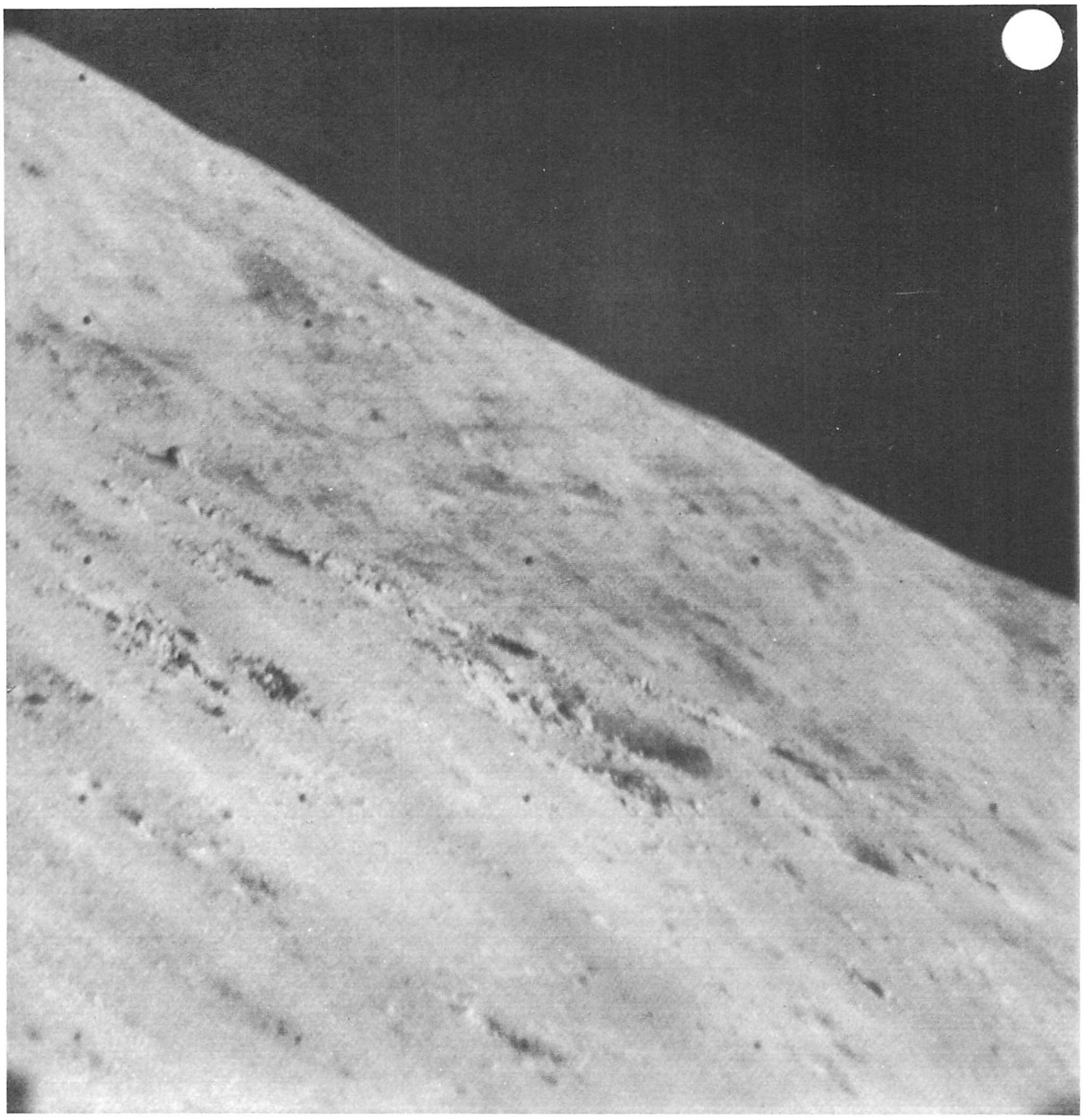


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(72)	Day 010, 07:09:55	—3	5	205.24	f/7.0	N	Clear

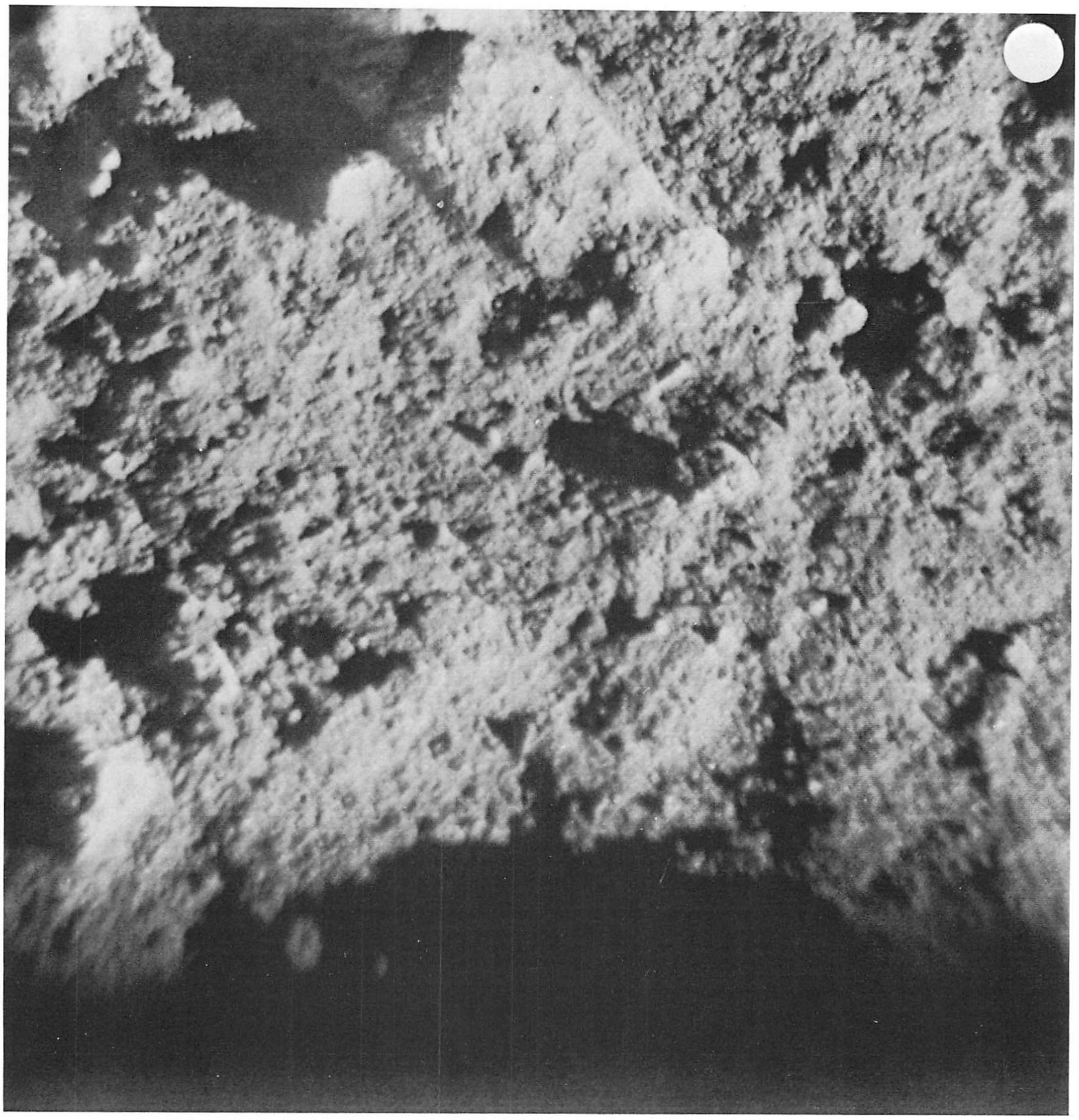


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(73)	Day 010, 07:10:05	—6	10	205.24	f/7.0	N	Clear



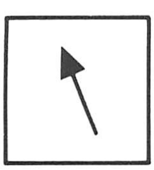


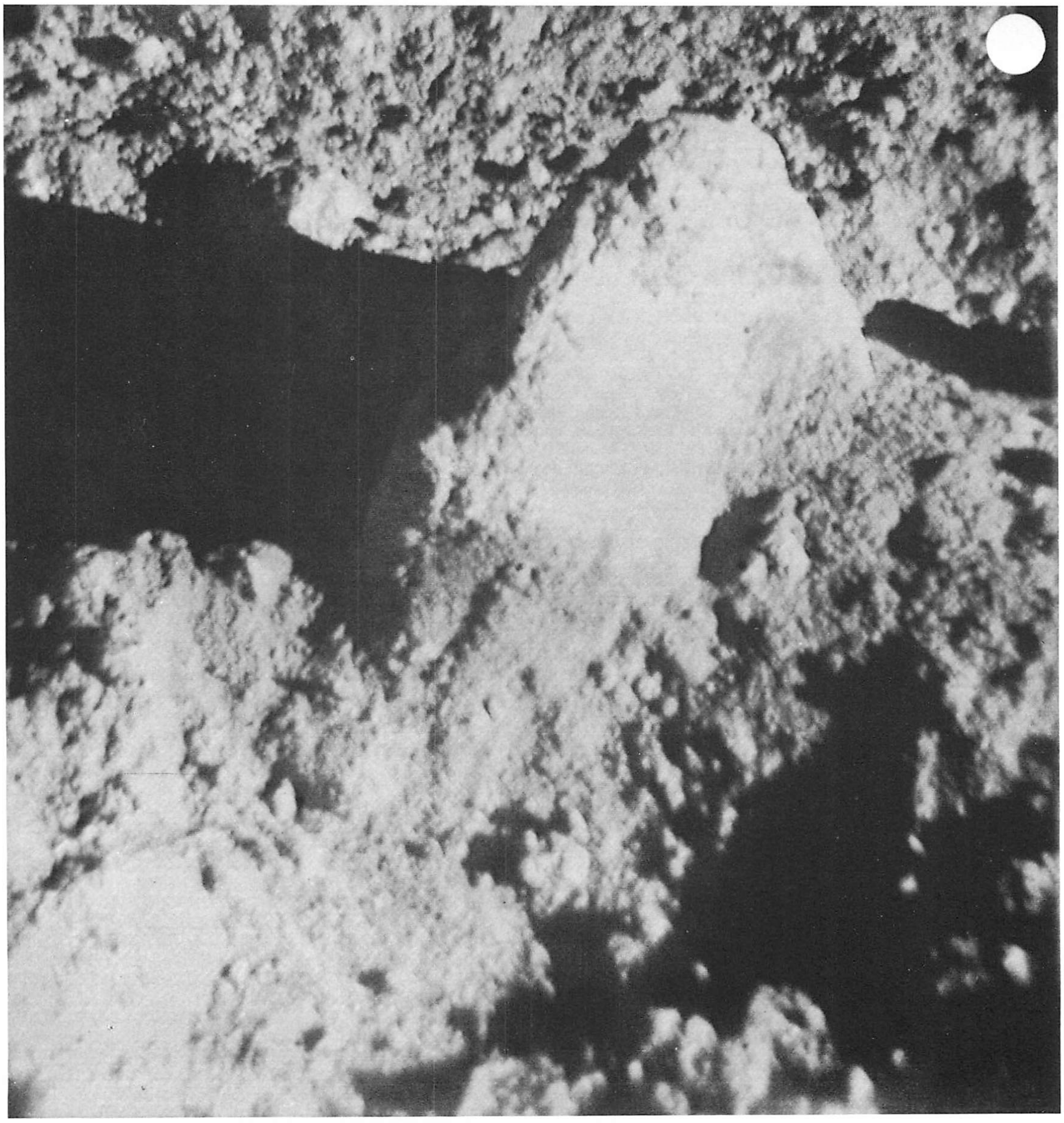
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(74)	Day 010, 07:10:10	—12	10	205.24	f/7.0	N	Clear



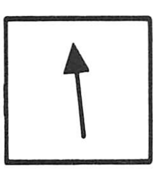
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(75)	**Day 010, 07:14:32**	**3**	**−55**	**2.26**	***f*/7.0**	**N**	**Clear**

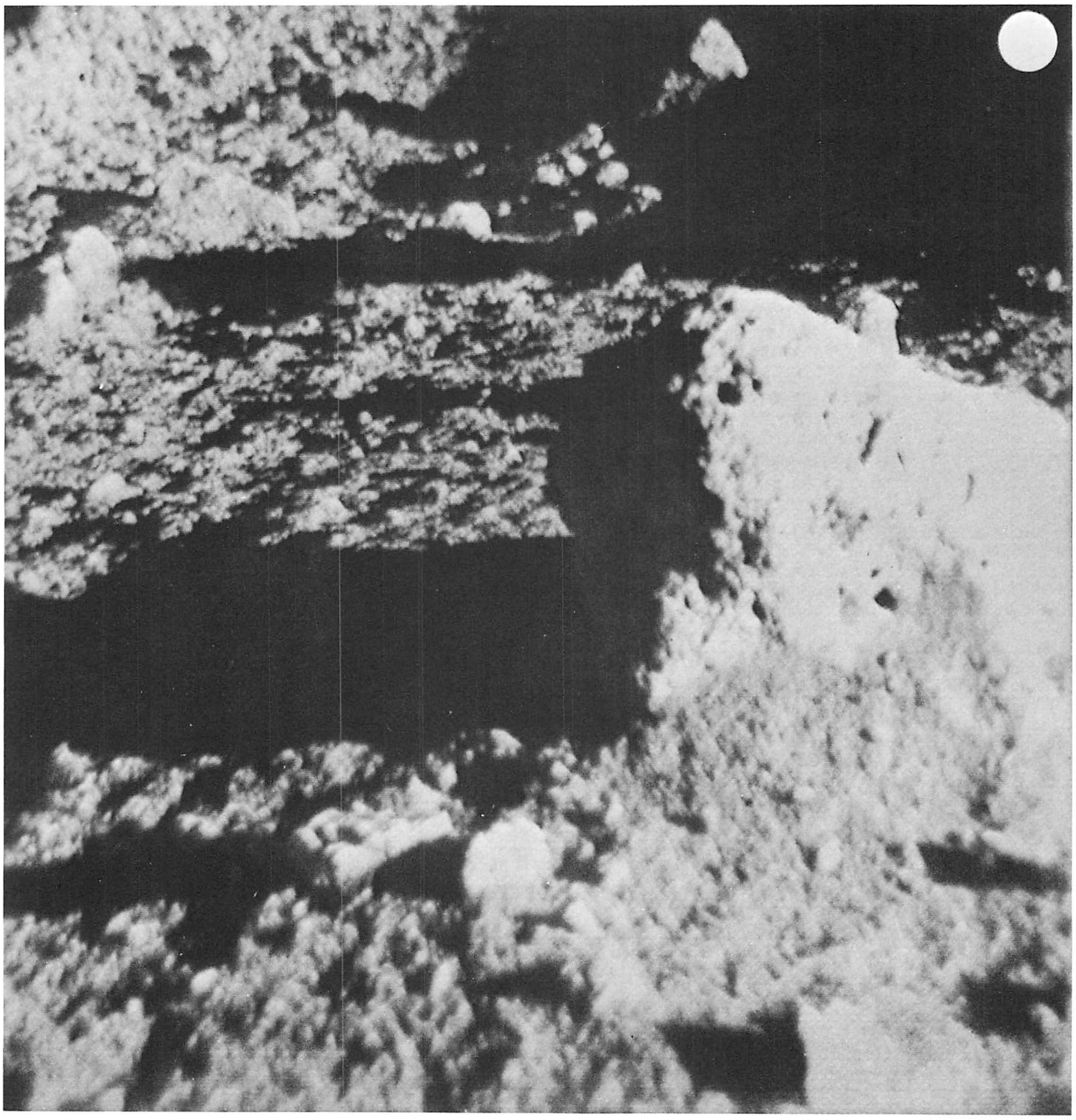
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(76)	Day 010, 07:15:56	27	—45	2.35	f/7.0	N	Clear



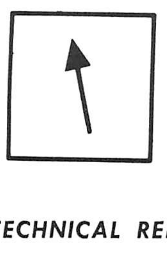


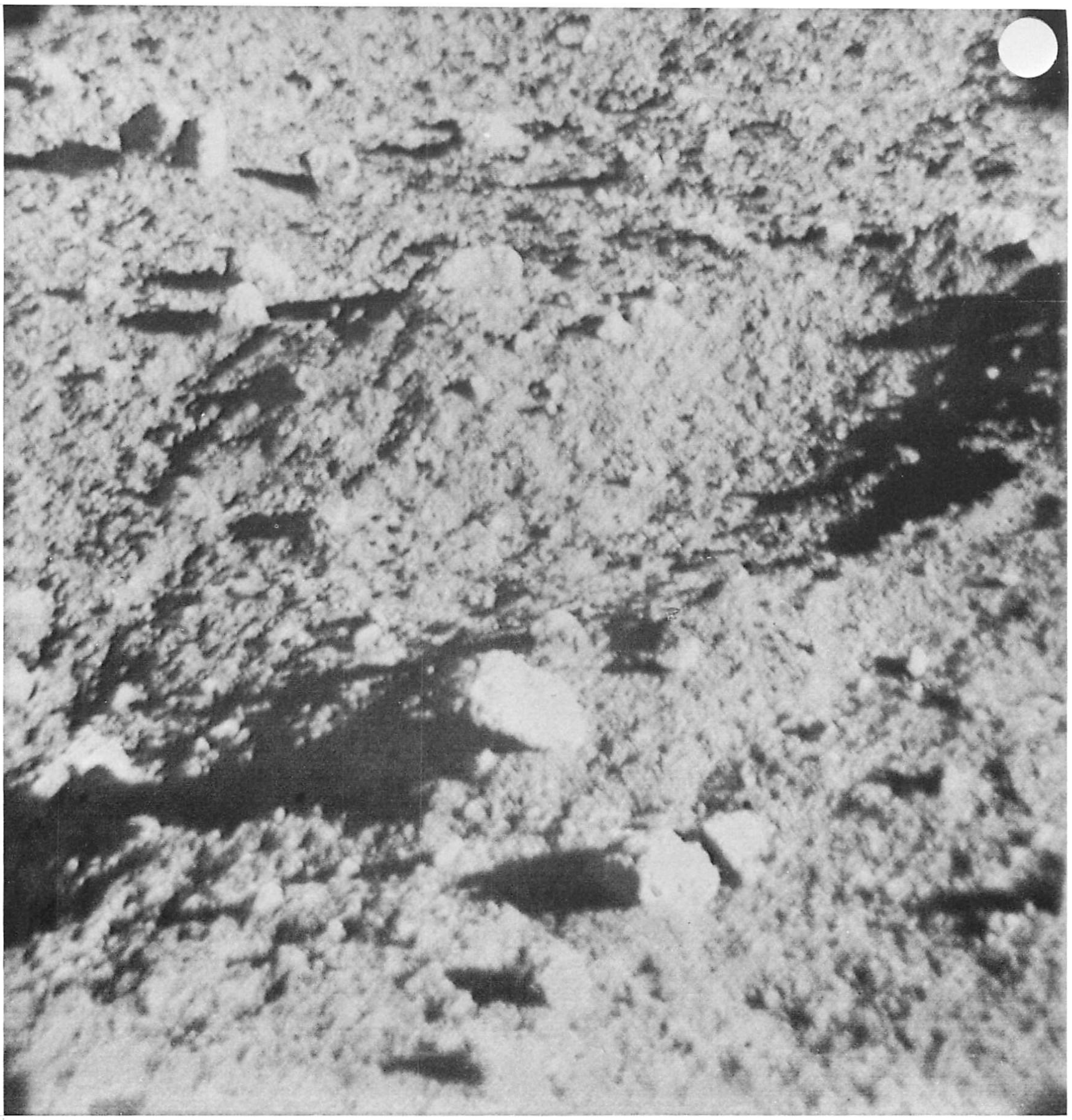
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(77)	**Day 010, 07:16:50**	**15**	**−35**	**2.77**	**f/7.0**	**N**	**Clear**



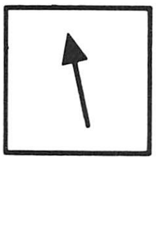


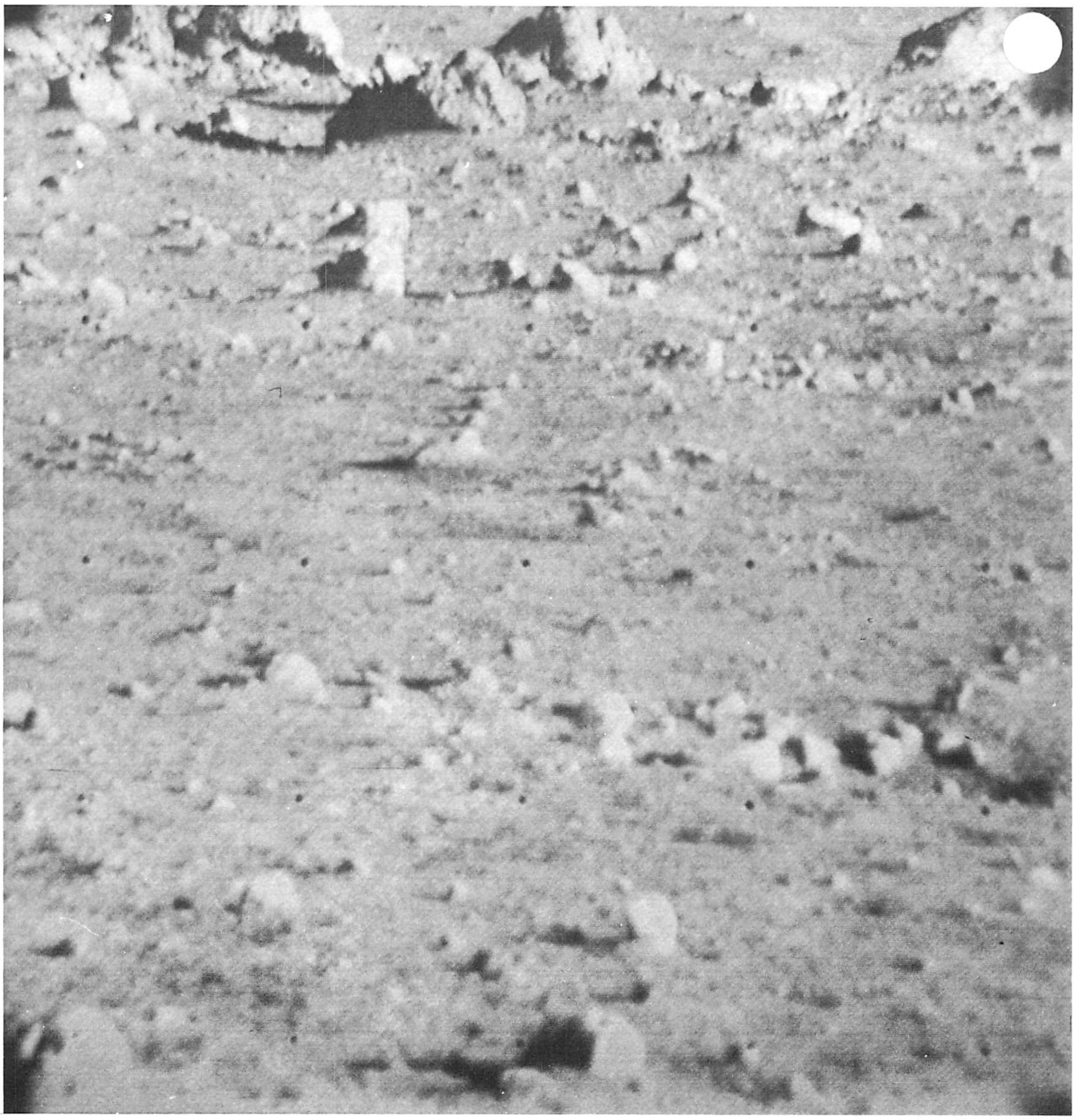
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(78)	**Day 010, 07:17:58**	**18**	**—20**	**3.93**	**f/7.0**	**N**	**Clear**



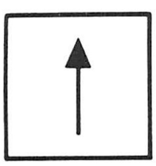


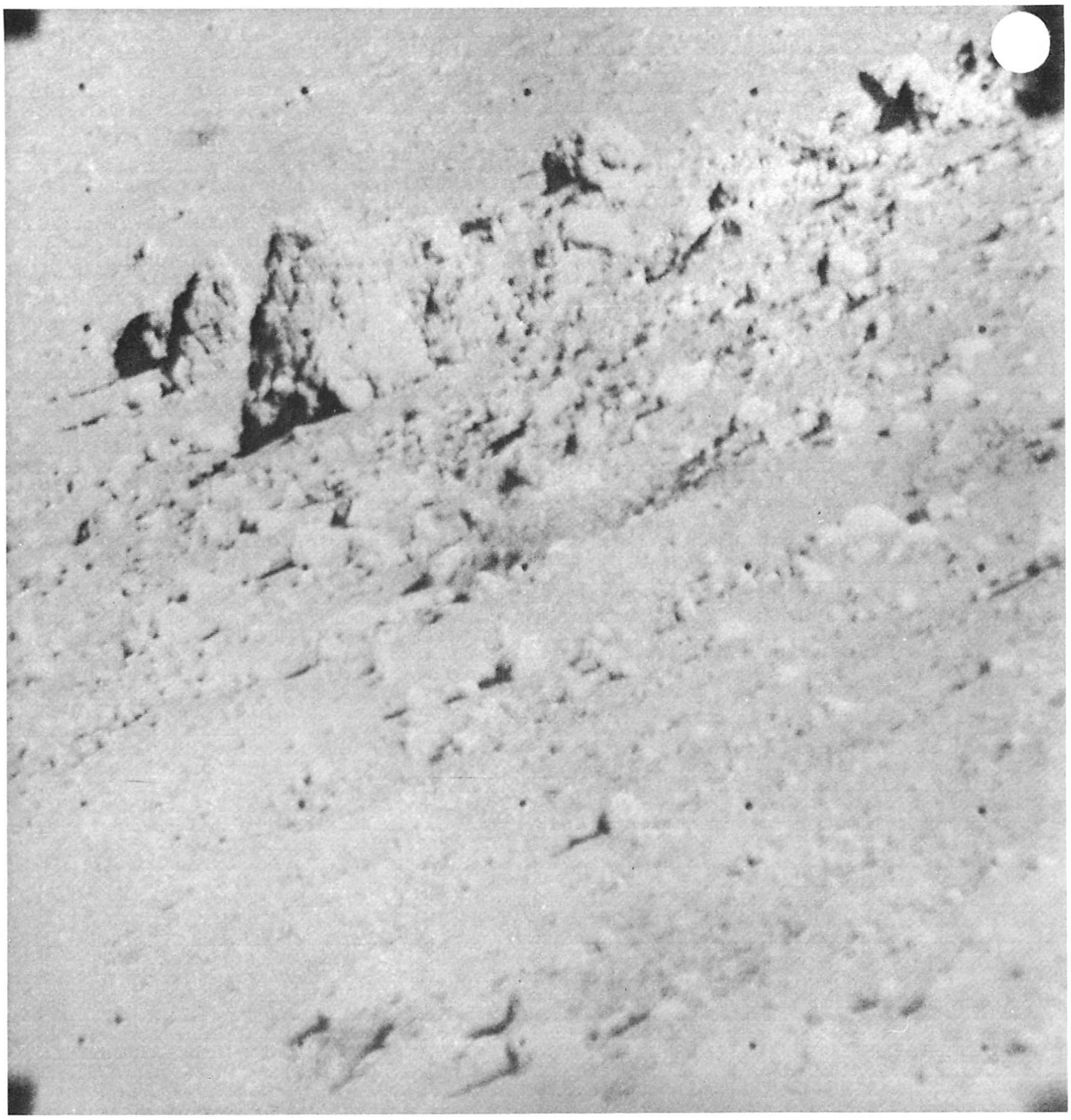
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(79)	Day 010, 07:18:43	18	—10	5.44	f/7.0	N	Clear



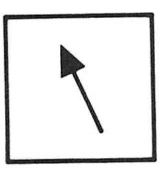


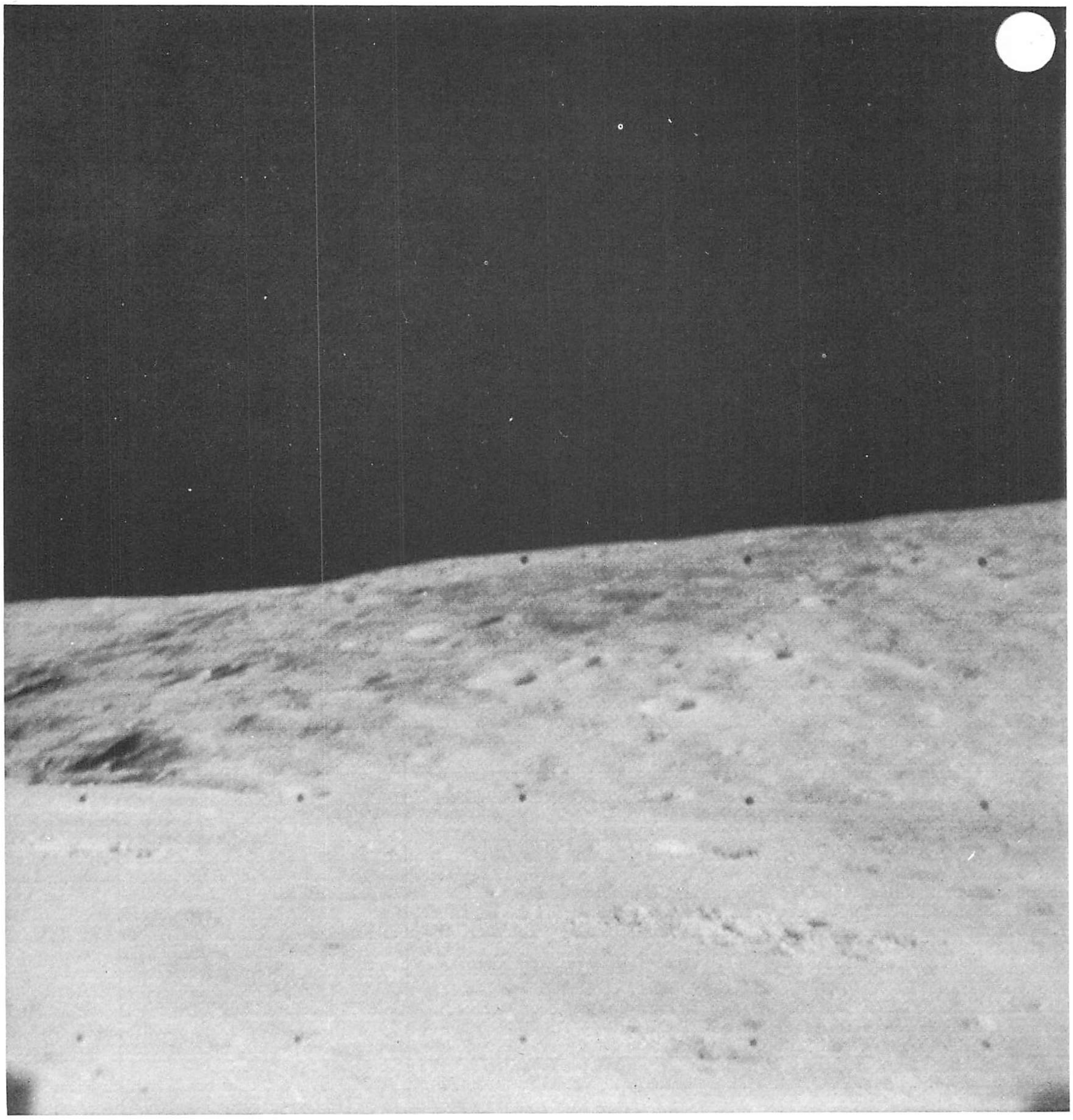
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(80)	Day 010, 07:20:08	9	5	205.24	f/7.0	N	Clear



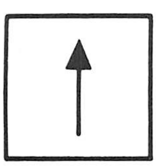


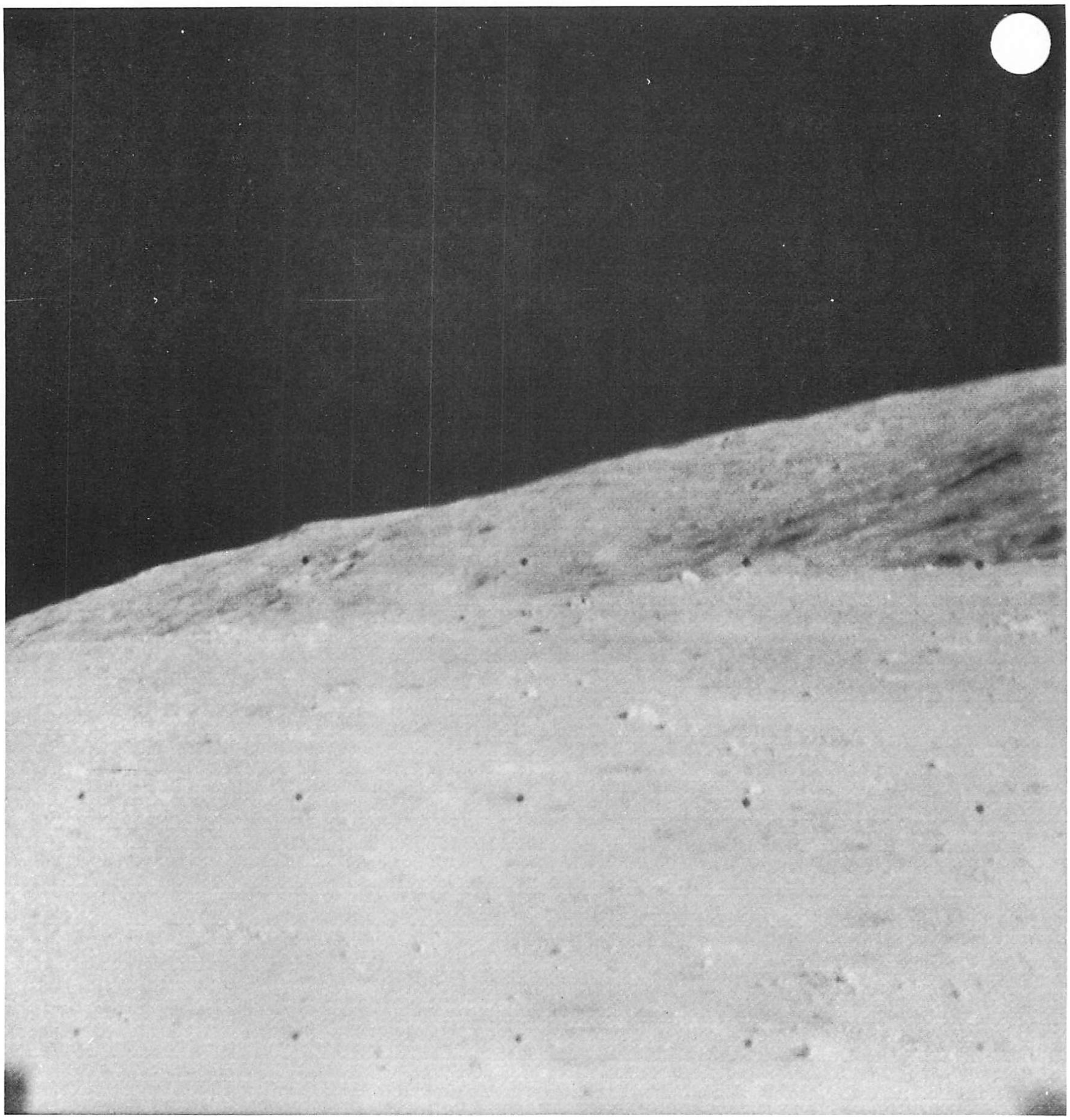
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(81)	**Day 010, 07:20:26**	**30**	**10**	**205.24**	***f*/7.0**	**N**	**Clear**



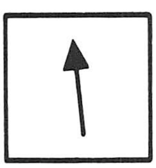


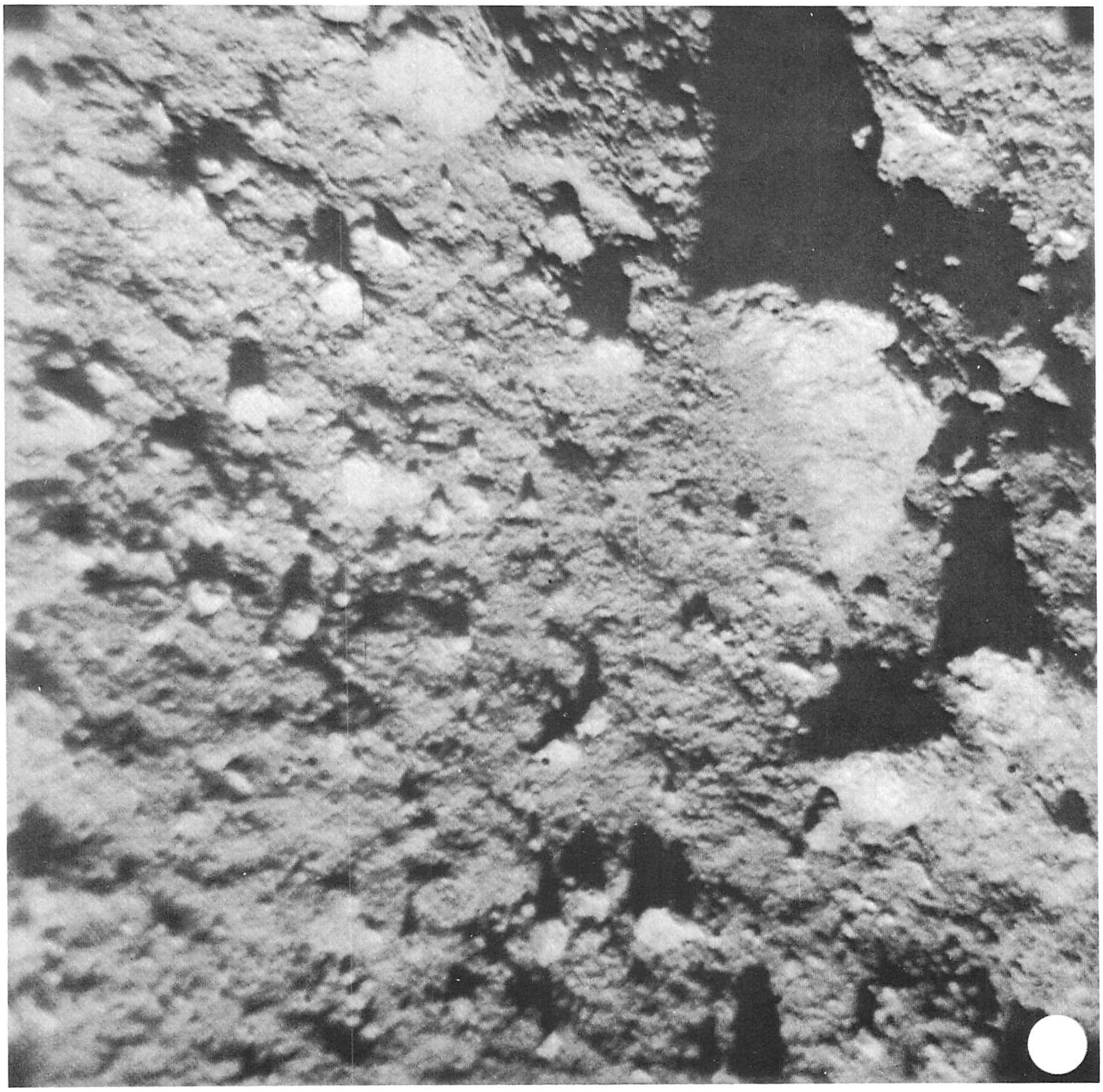
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(82)	Day 010, 07:20:53	9	15	205.24	*f*/7.0	N	Clear



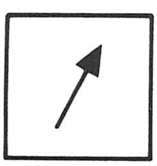


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(83)	**Day 010, 07:20:58**	**15**	**15**	**205.24**	***f*/7.0**	**N**	**Clear**

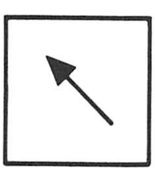


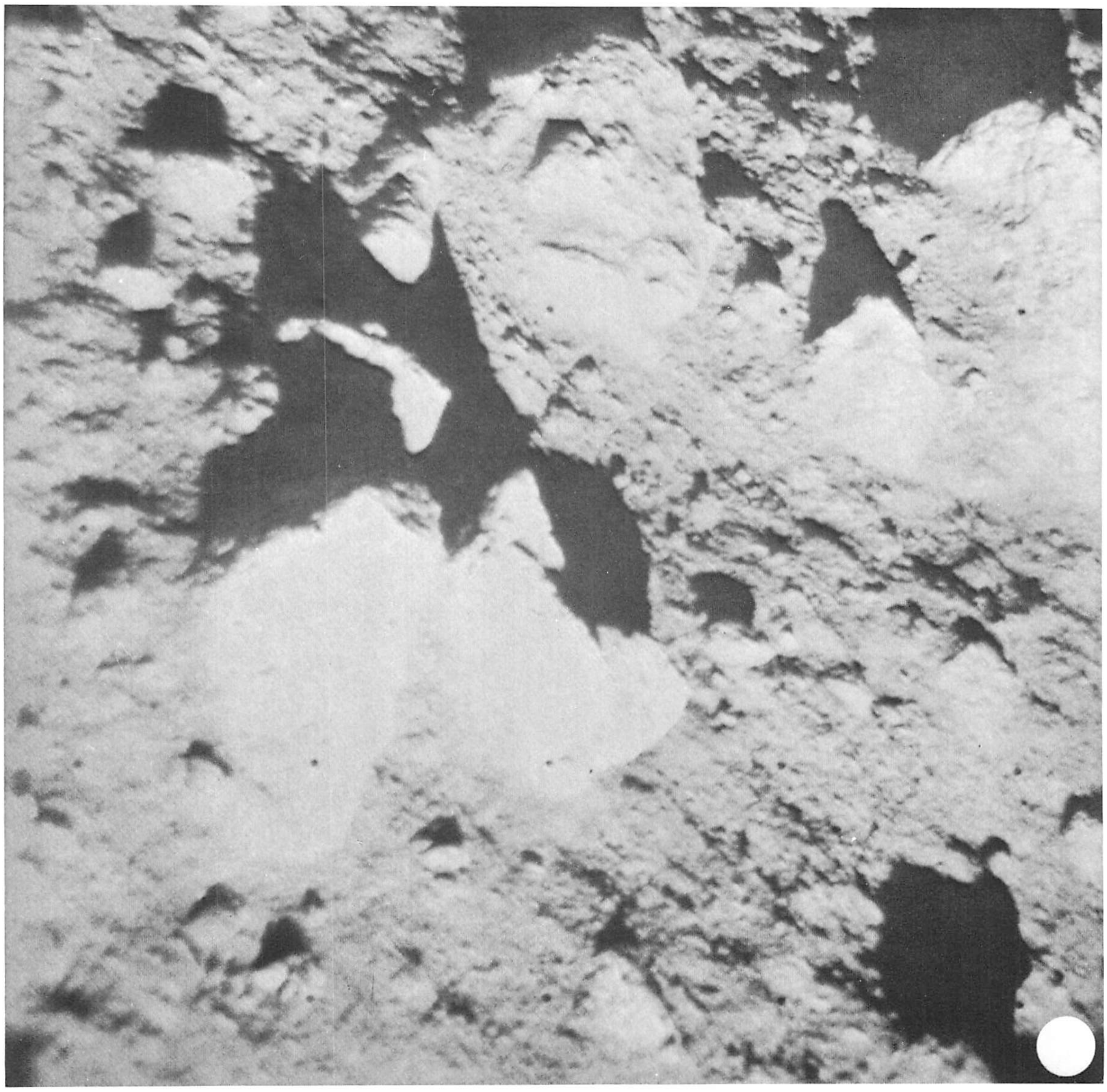


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(84)	**Day 010, 07:26:11**	**60**	**—30**	**2.77**	***f*/8.2**	**N**	**Clear**

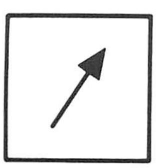


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(85)	**Day 010, 07:26:33**	**45**	**−25**	**3.07**	***f*/8.2**	**N**	**Clear**

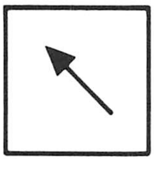


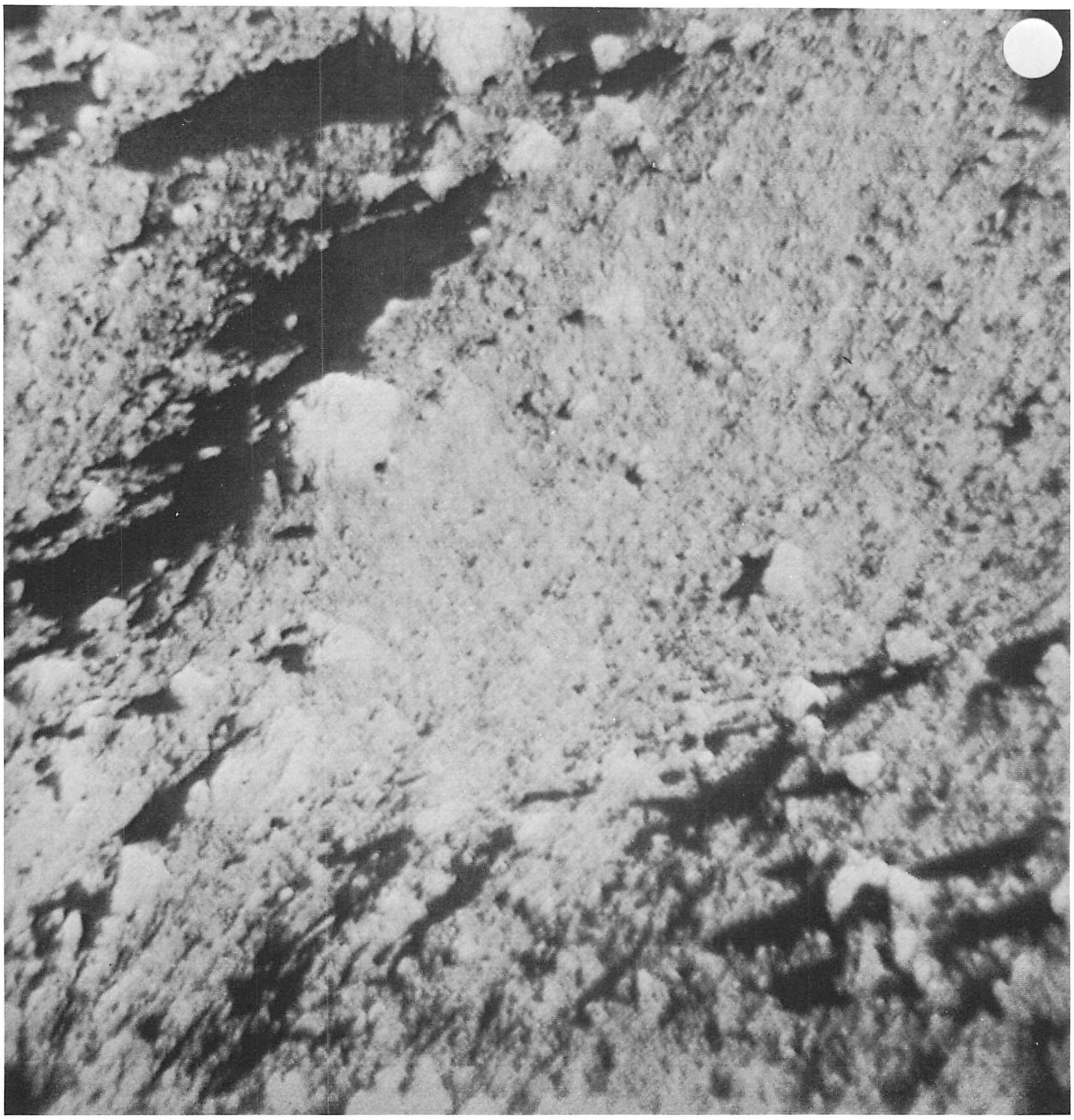


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(86)	Day 010, 07:26:51	54	—20	3.44	f/8.2	N	Clear

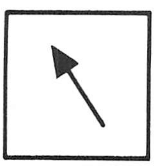


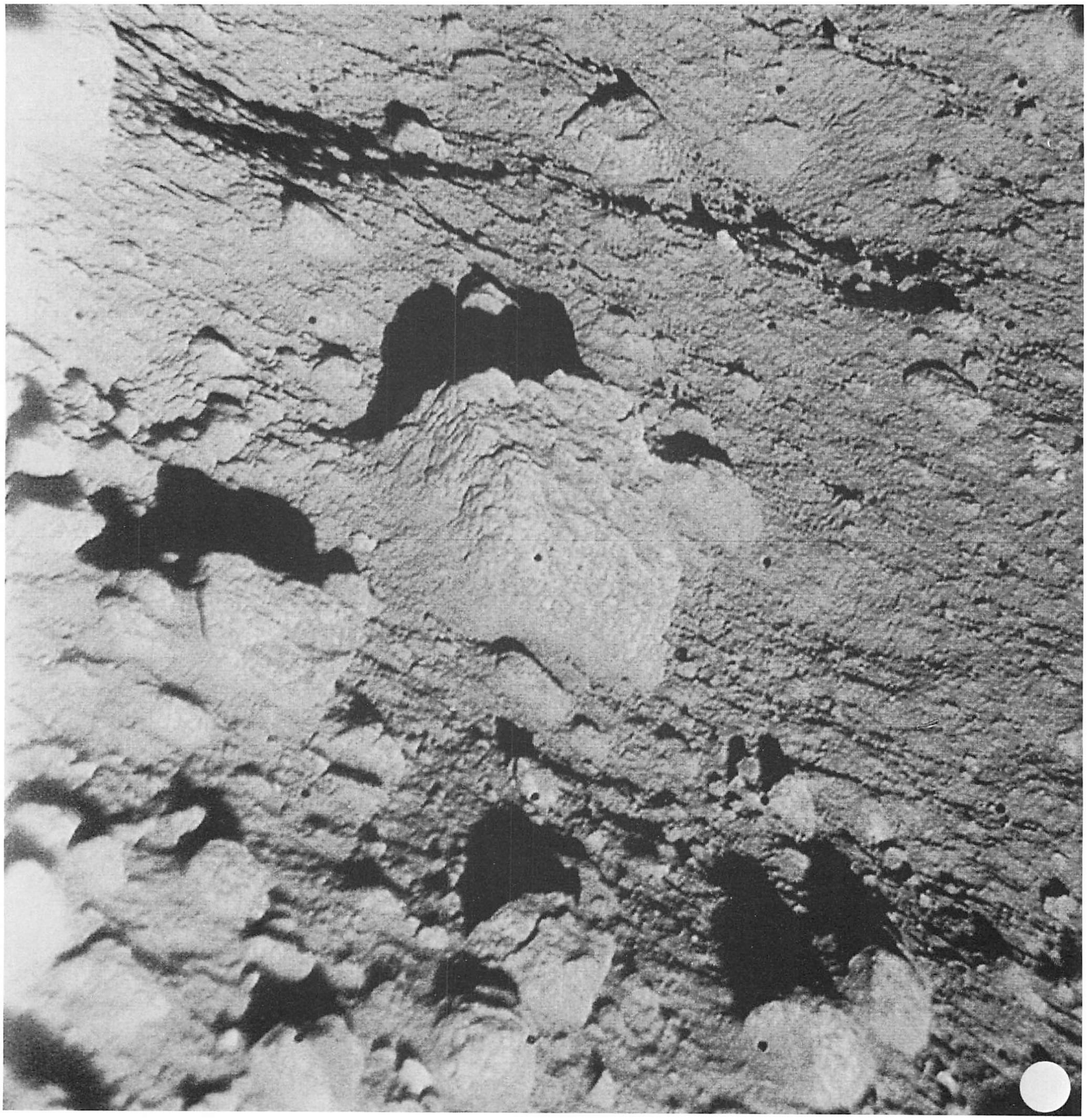
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(87)	**Day 010, 07:27:17**	**45**	**−15**	**4.21**	***f*/8.2**	**N**	**Clear**



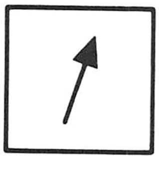


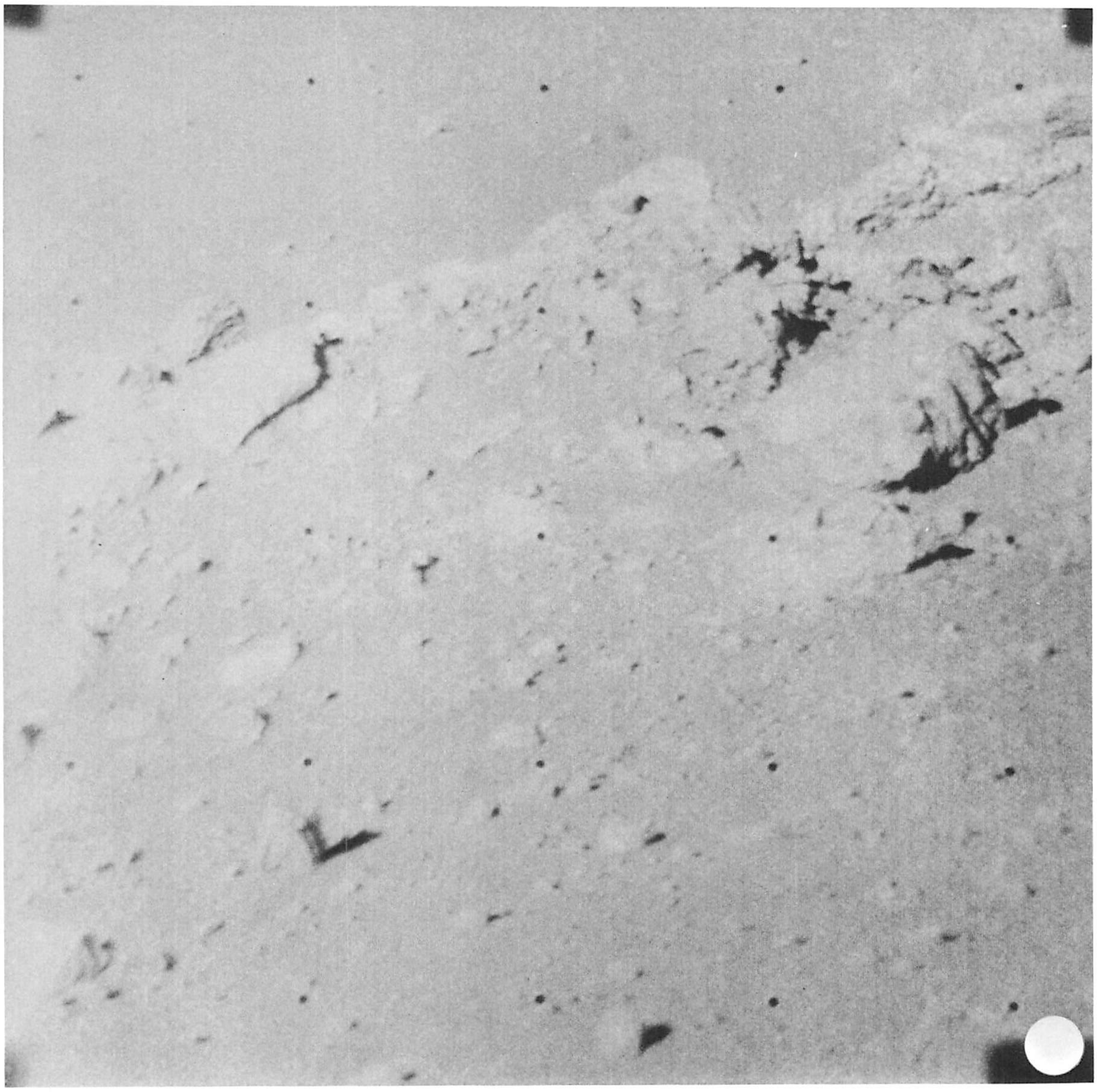
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(88)	**Day 010, 07:27:49**	**36**	**−10**	**4.97**	***f*/8.2**	**N**	**Clear**



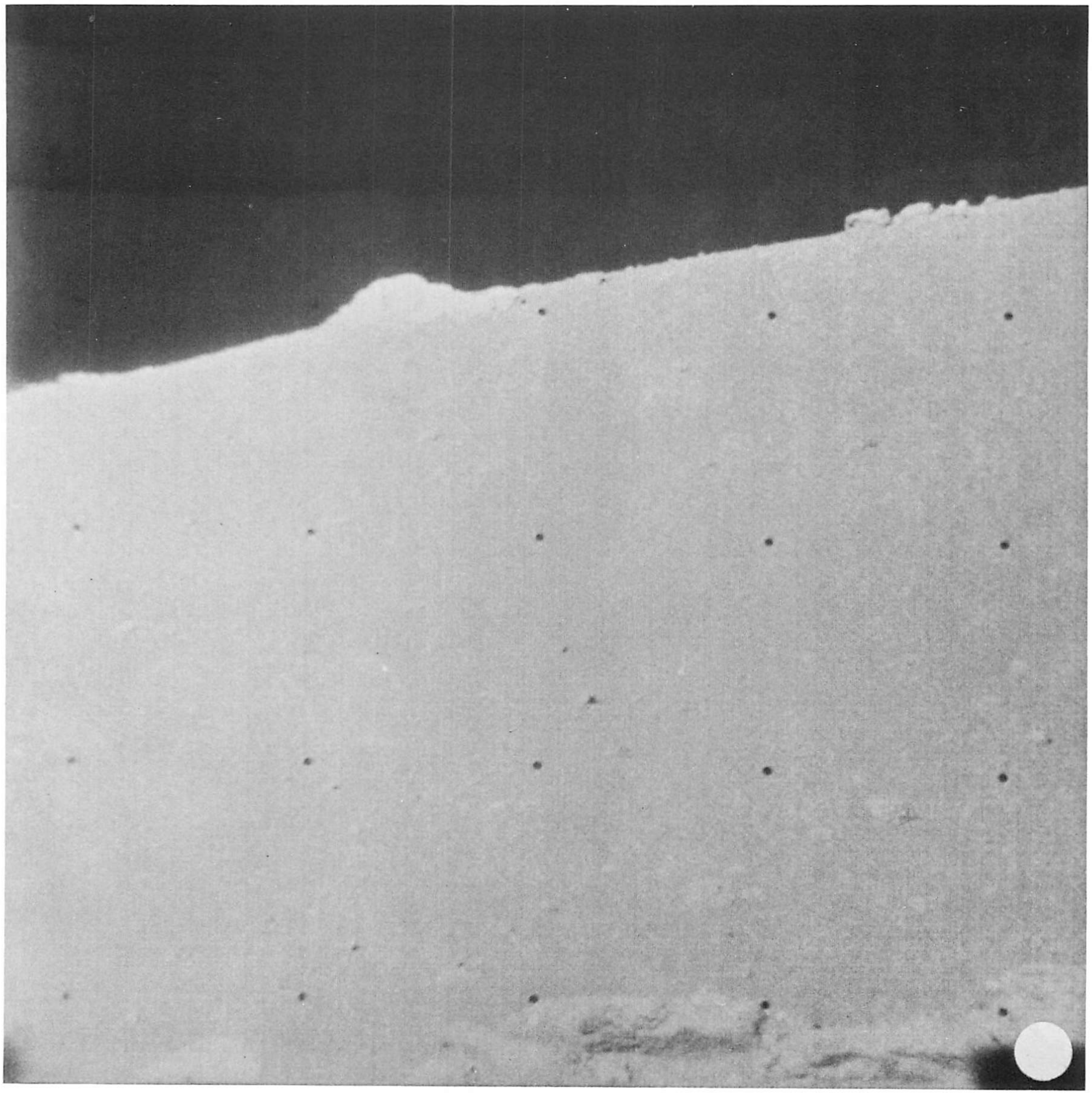


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(89)	Day 010, 08:12:45	66	—10	4.49	*f*/9.5	N	Clear	Processed

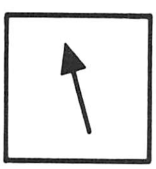


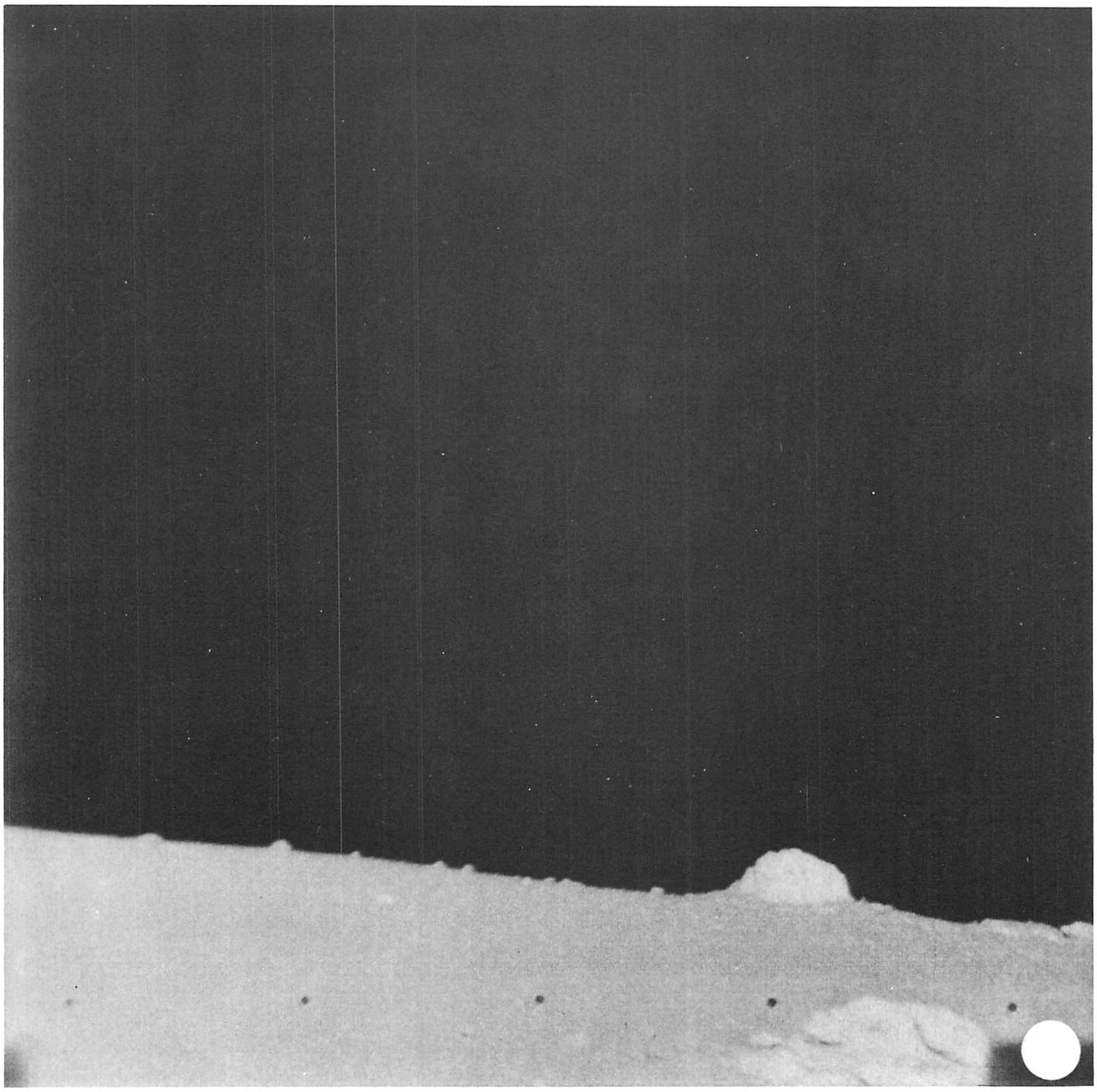


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(90)	**Day 010, 08:15:29**	**96**	**10**	**205.24**	***f*/9.5**	**N**	**Clear**

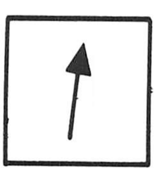


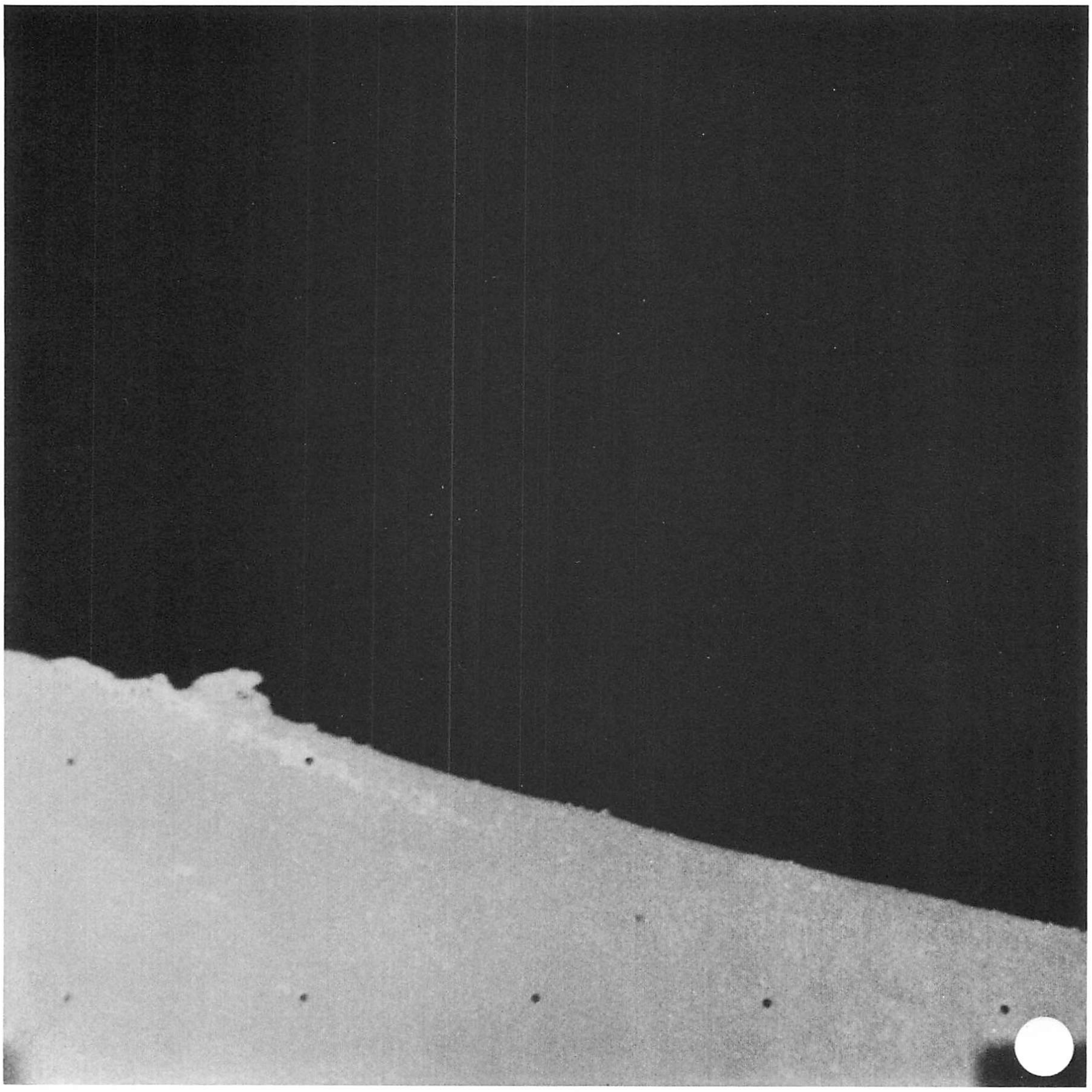
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(91)	**Day 010, 08:16:18**	**93**	**15**	**205.24**	***f*/9.5**	**N**	**Clear**



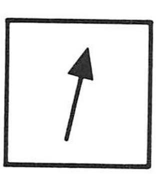


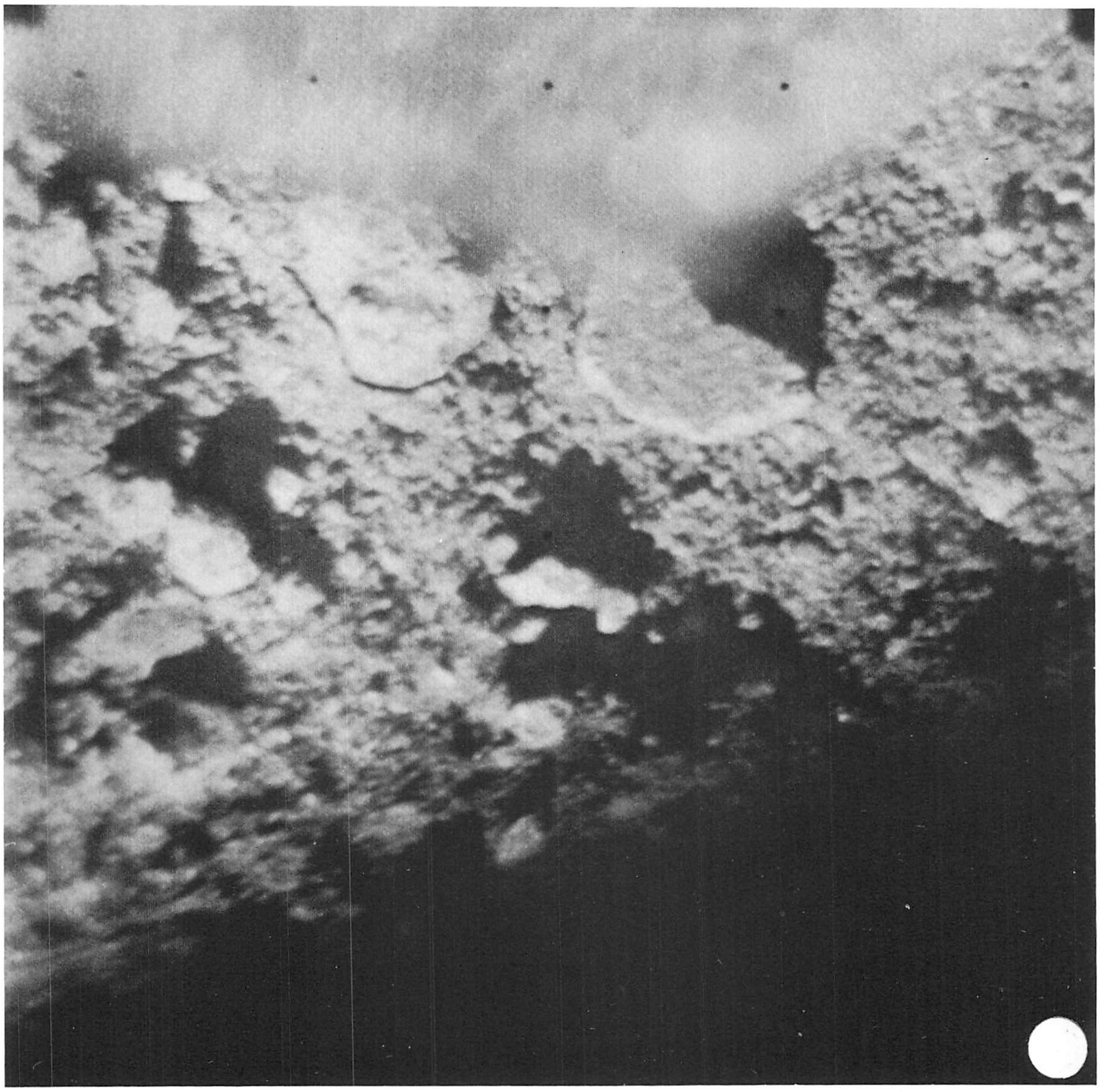
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(92)	**Day 010, 08:16:36**	**78**	**20**	**205.24**	**f/9.5**	**N**	**Clear**



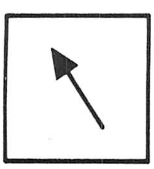


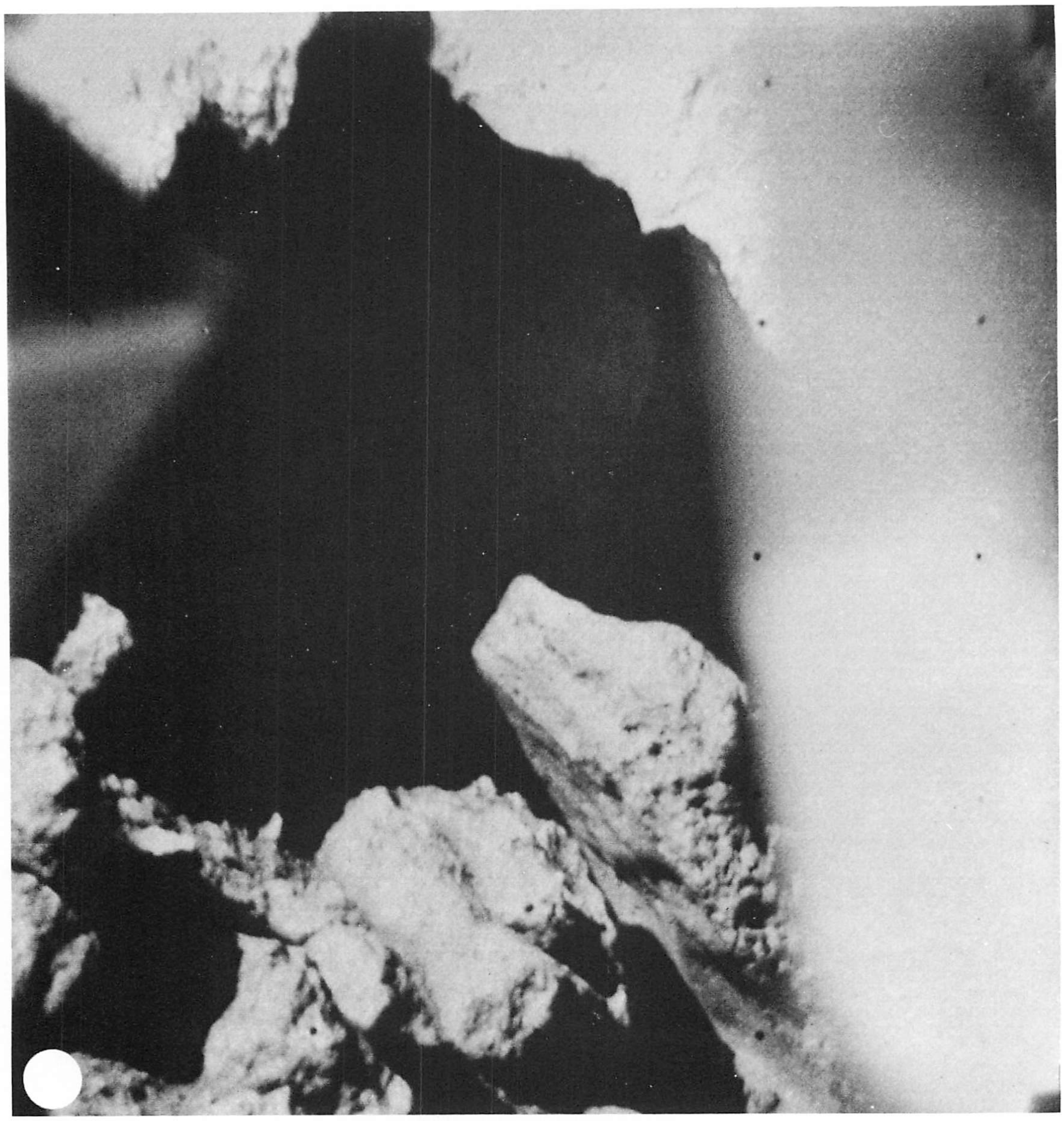
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(93)	**Day 010, 08:16:40**	**72**	**20**	**205.24**	***f*/9.5**	**N**	**Clear**



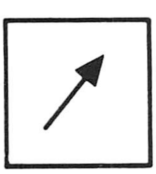


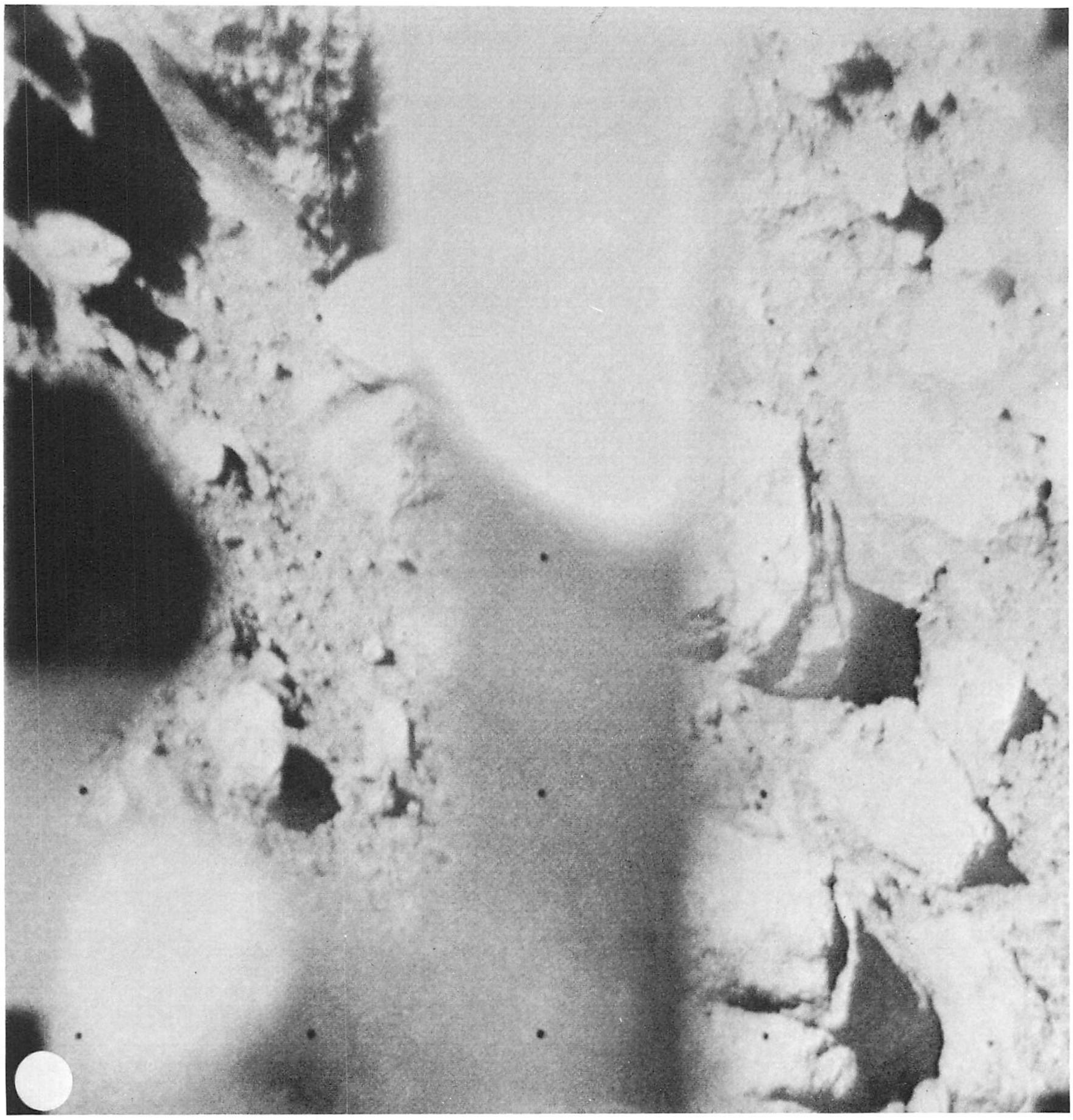
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(94)	**Day 010, 08:21:35**	**111**	**—55**	**2.26**	***f*/8.2**	**N**	**Clear**



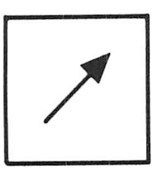


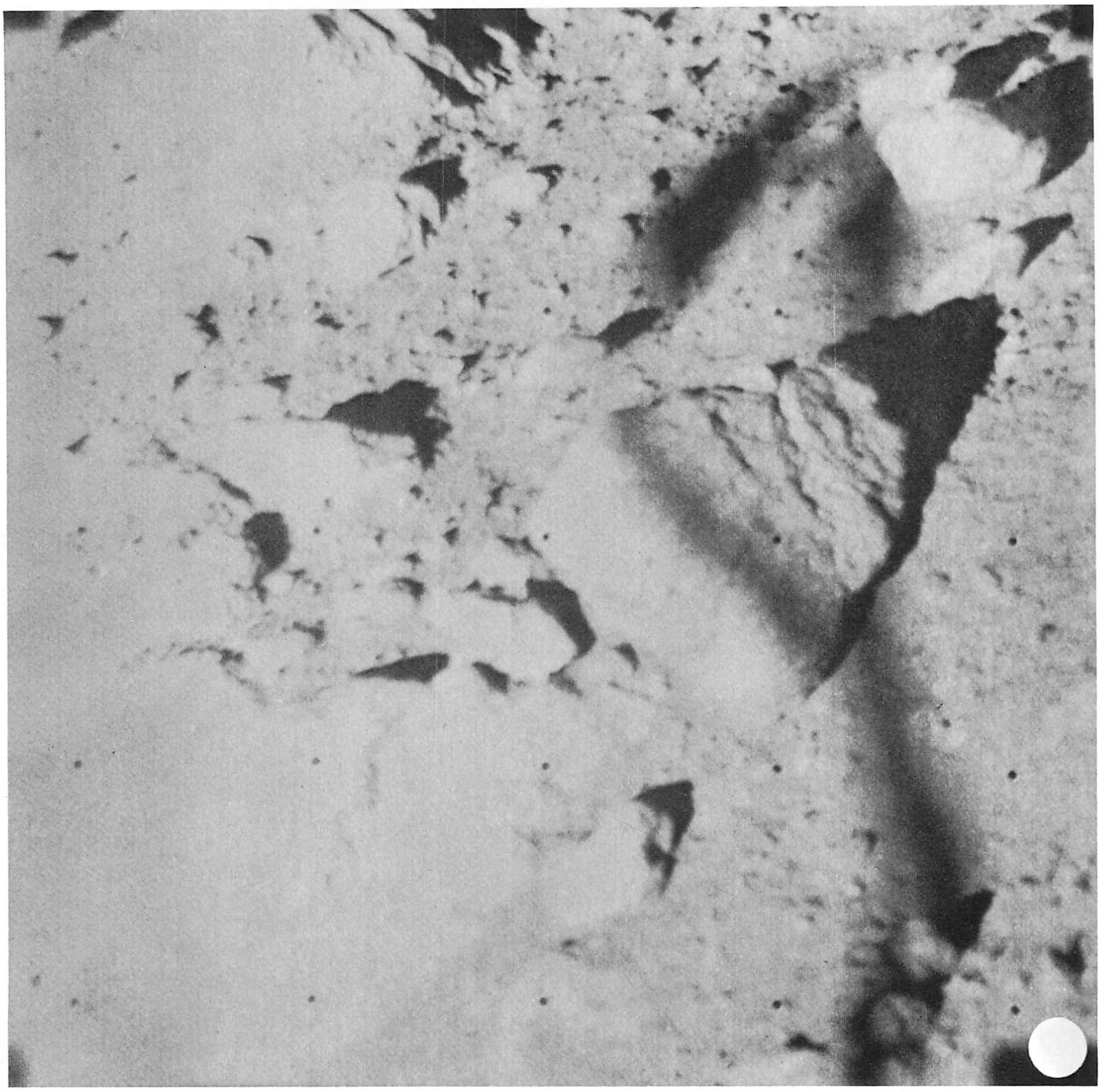
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(95)	**Day 010, 08:25:46**	**126**	**—10**	**7.76**	***f*/8.1**	**N**	**Clear**



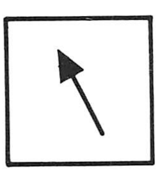


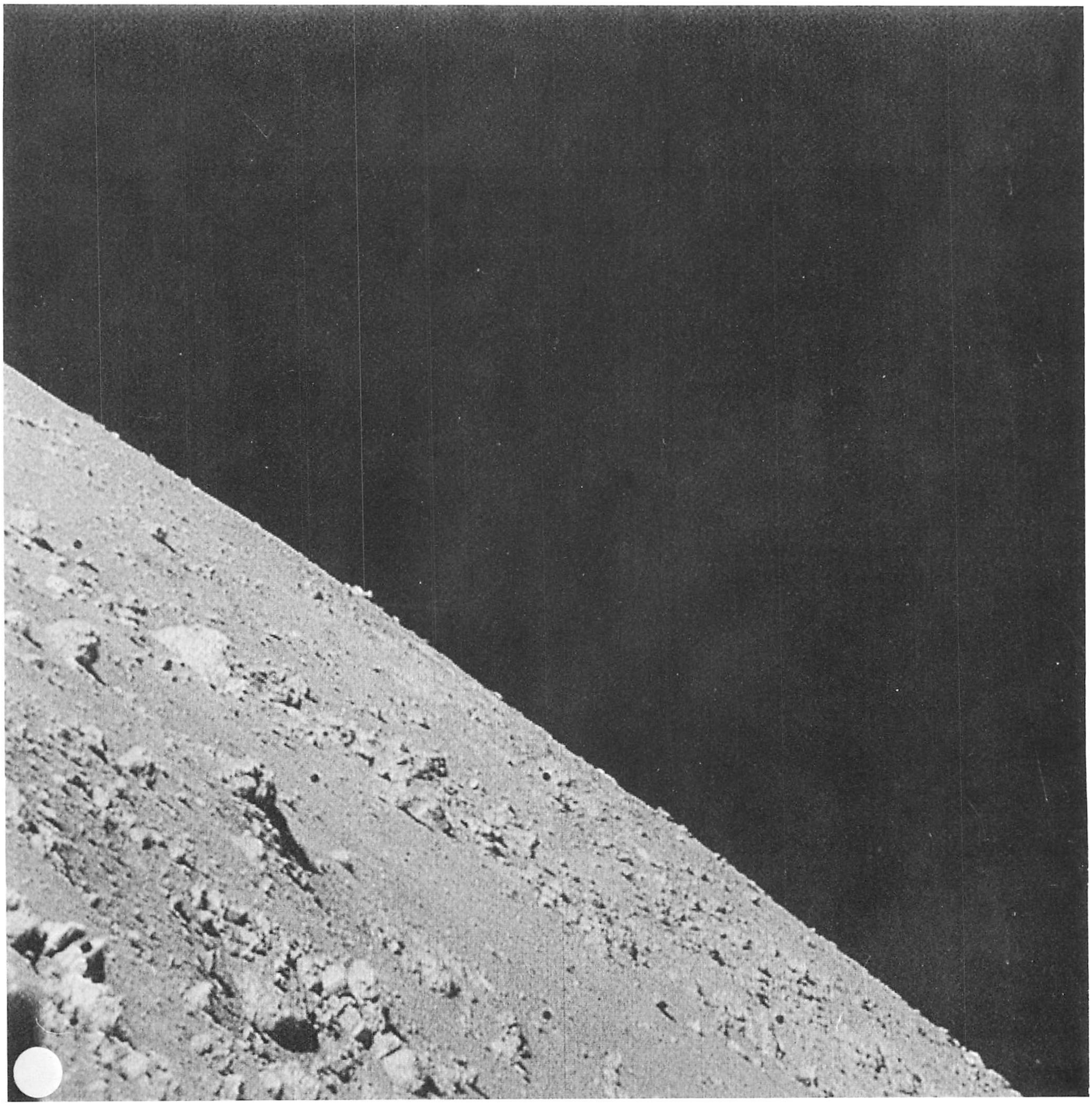
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(96)	**Day 010, 08:25:51**	**120**	**—10**	**6.81**	***f*/8.1**	**N**	**Clear**



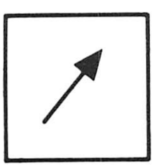


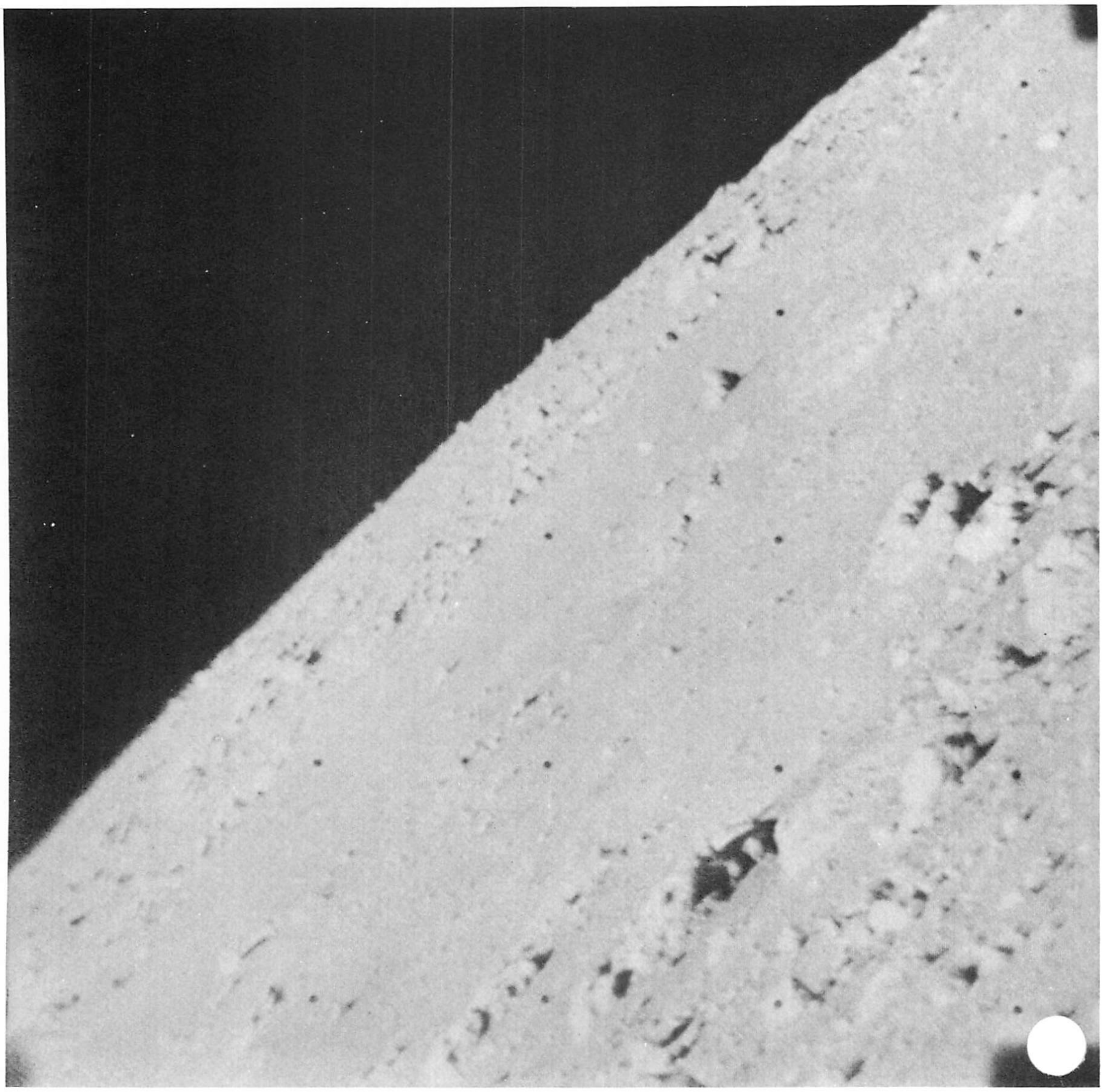
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(97)	**Day 010, 08:26:13**	**105**	**—5**	**7.76**	**f/8.2**	**N**	**Clear**



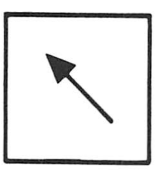


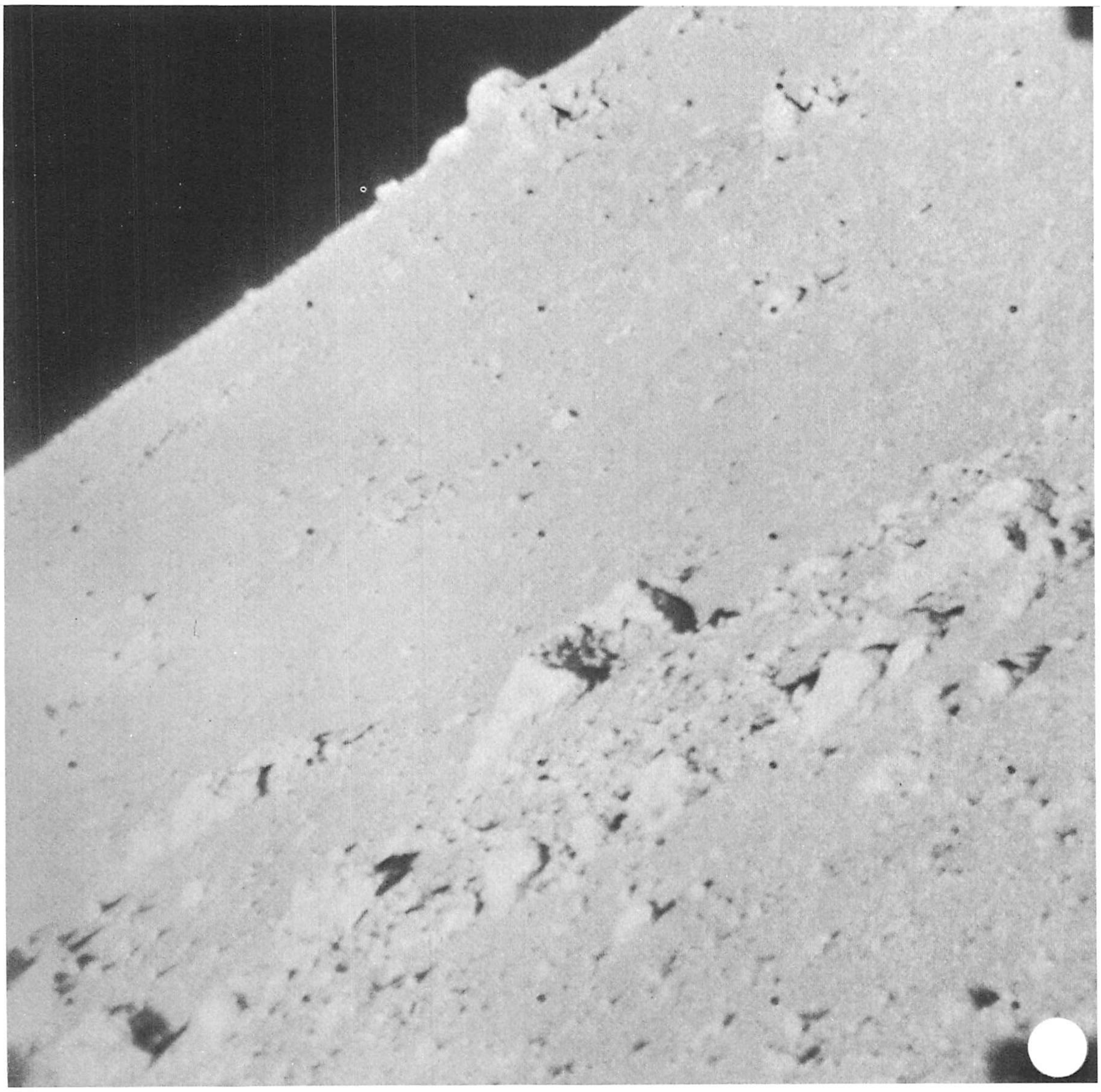
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(98)	**Day 010, 08:27:19**	**126**	**10**	**205.24**	**f/8.1**	**N**	**Clear**	**Processed**



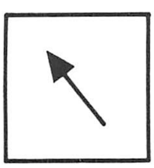


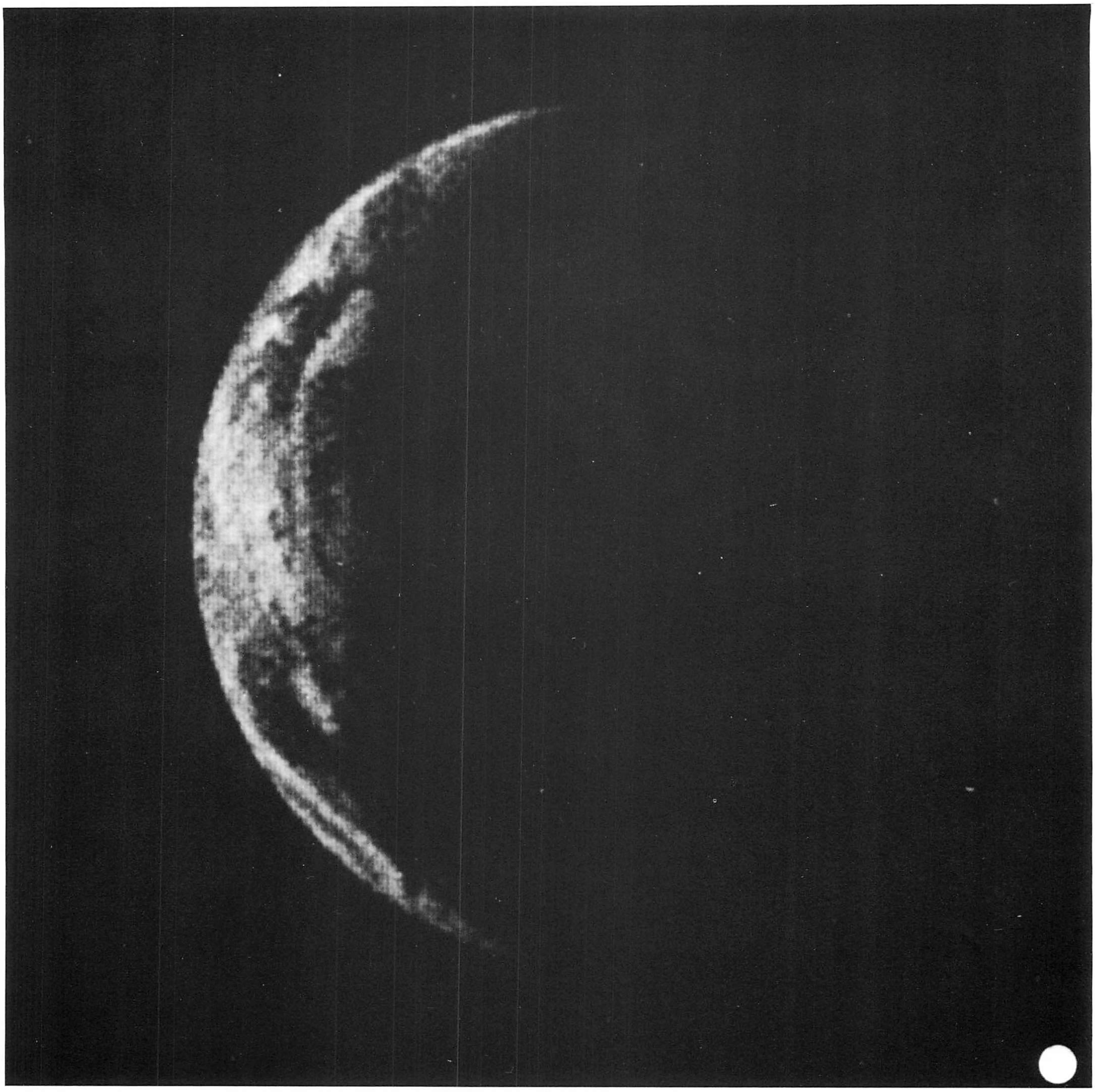
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(99)	**Day 010, 08:27:22**	**120**	**10**	**205.24**	***f*/8.1**	**N**	**Clear**



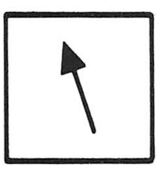


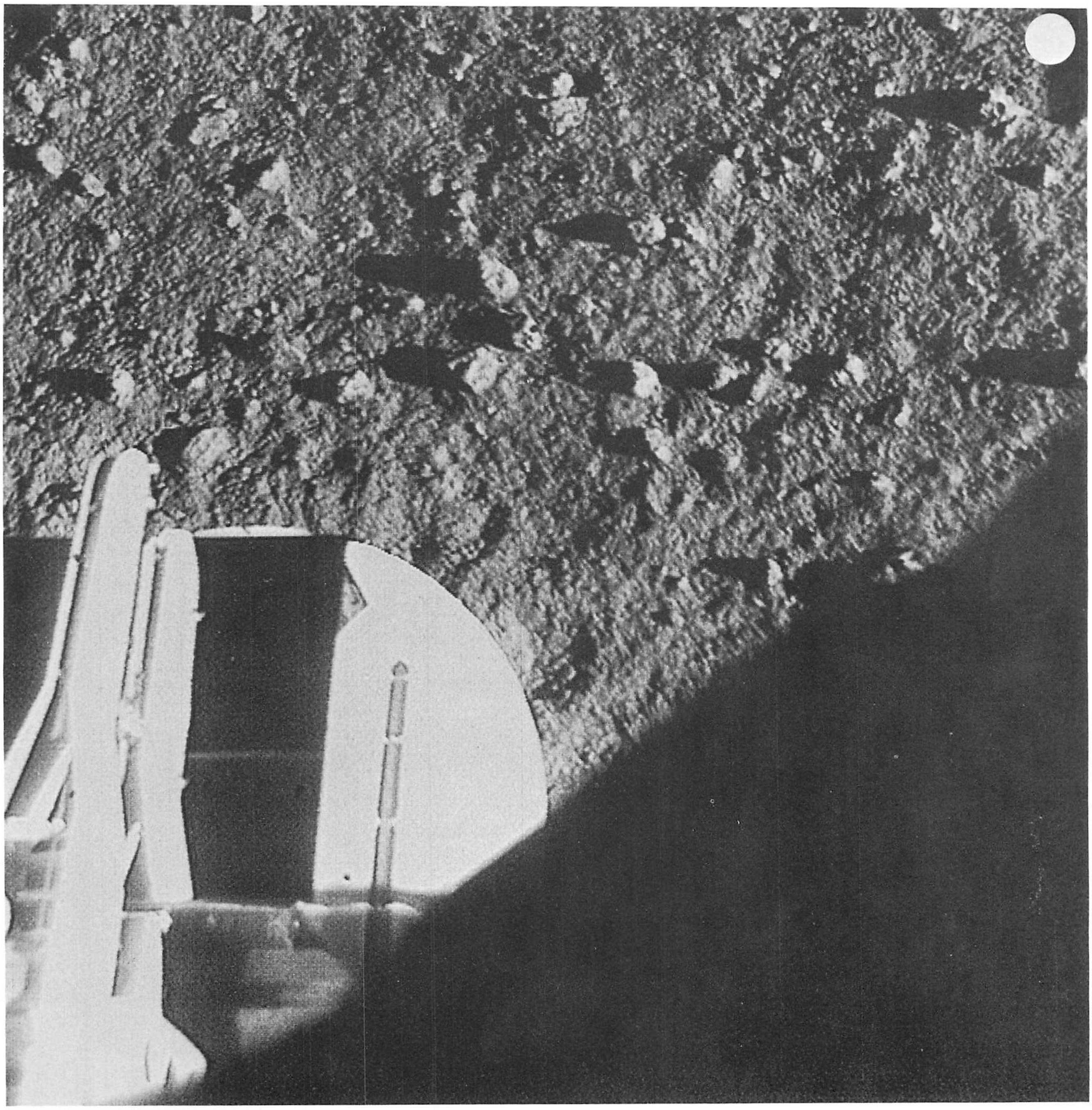
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(100)	**Day 010, 08:27:27**	**114**	**10**	**205.24**	**f/8.1**	**N**	**Clear**



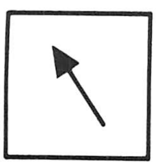


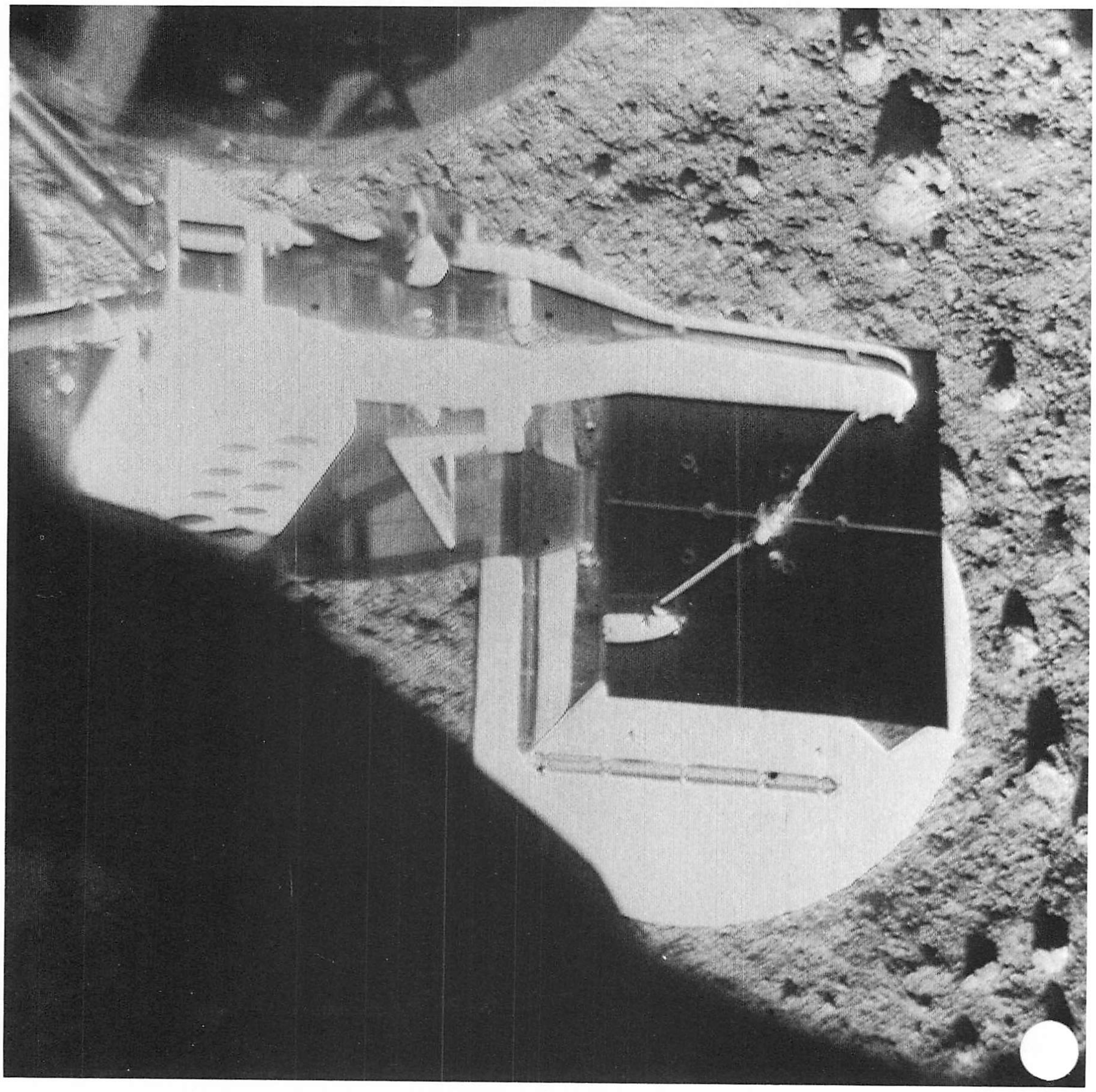
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(101)	**Day 010, 08:47:57**	**—57**	**50**	**205.24**	***f*/17.2**	**N**	**Clear**	**Processed**



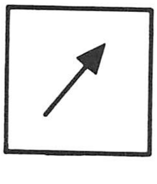


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(102)	Day 010, 09:00:09	36	—50	2.12	f/8.2	W	Clear	Processed





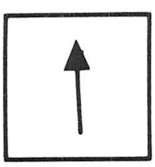
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(103)	Day 010, 22:50:22	51	−50	1.28	$f/8.2$	W	Clear

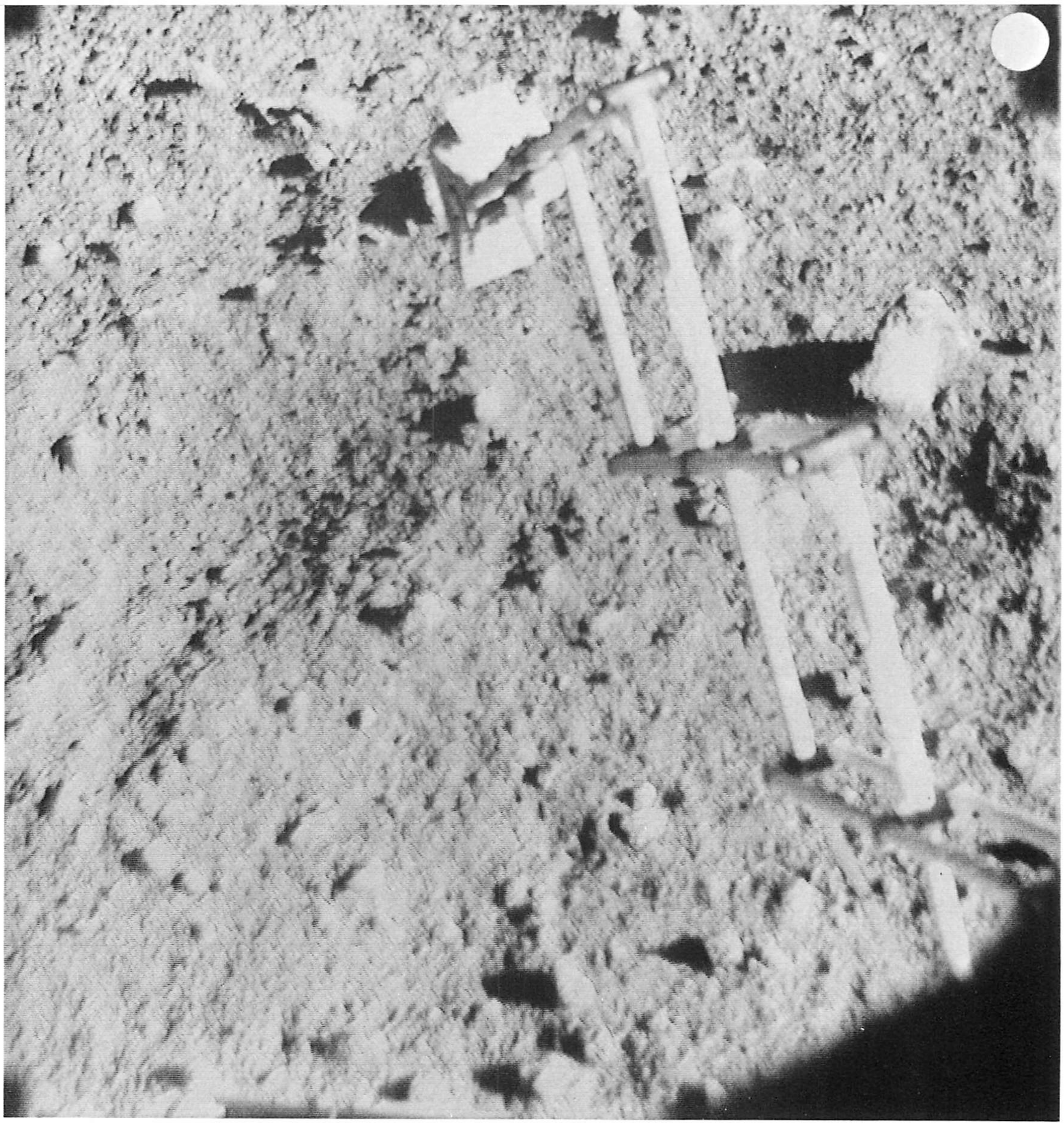


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(104)	Day 010, 23:54:36	—216	—10	3.23	*f*/7.0	N	Clear

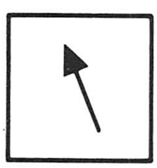
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(105)	Day 010, 23:55:47	−210	−15	3.07	f/7.0	N	Clear

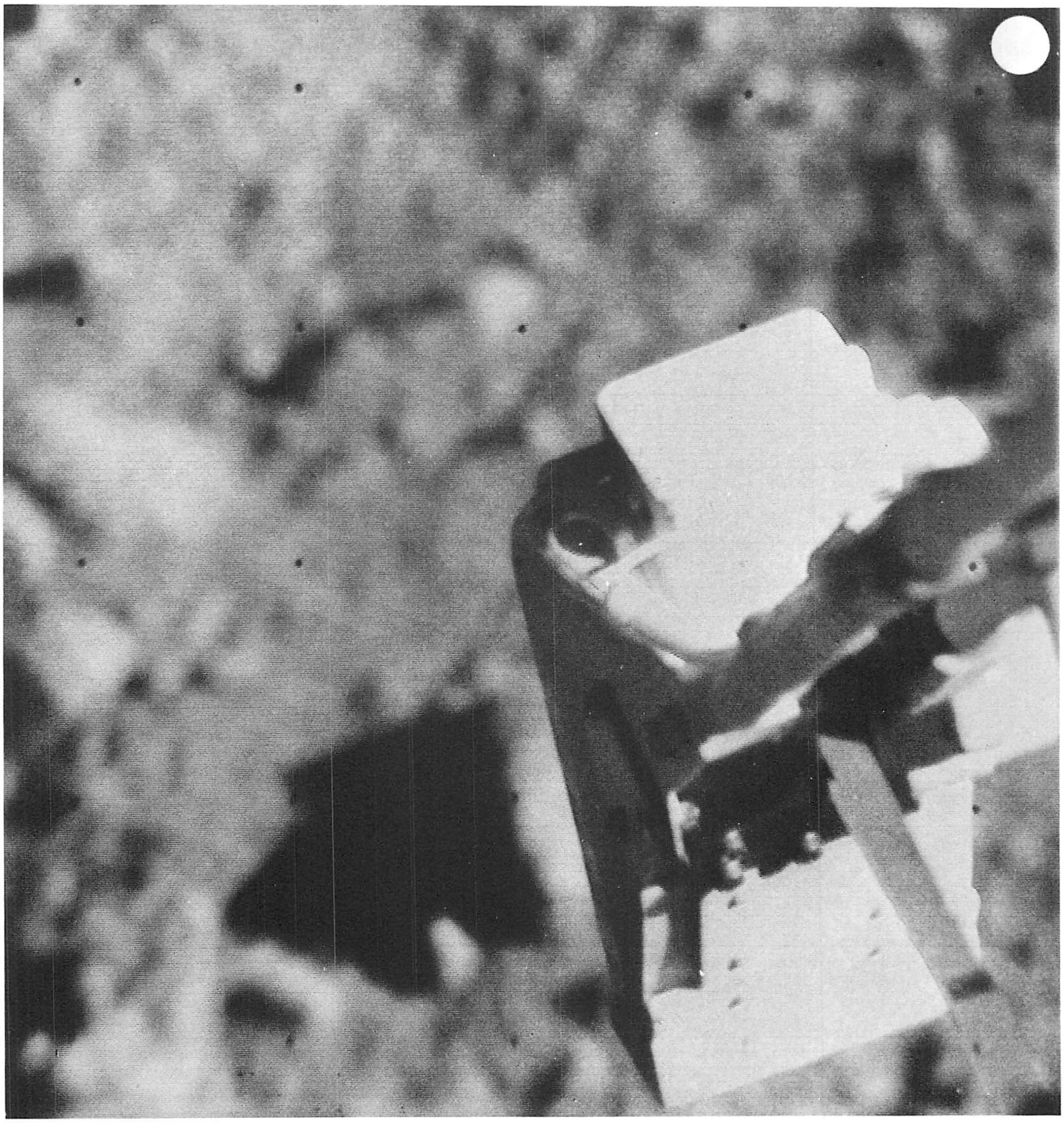
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(106)	**Day 010, 23:59:54**	**12**	**—45**	**2.35**	***f*/7.0**	**N**	**Clear**



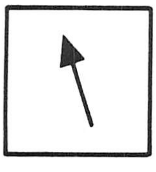


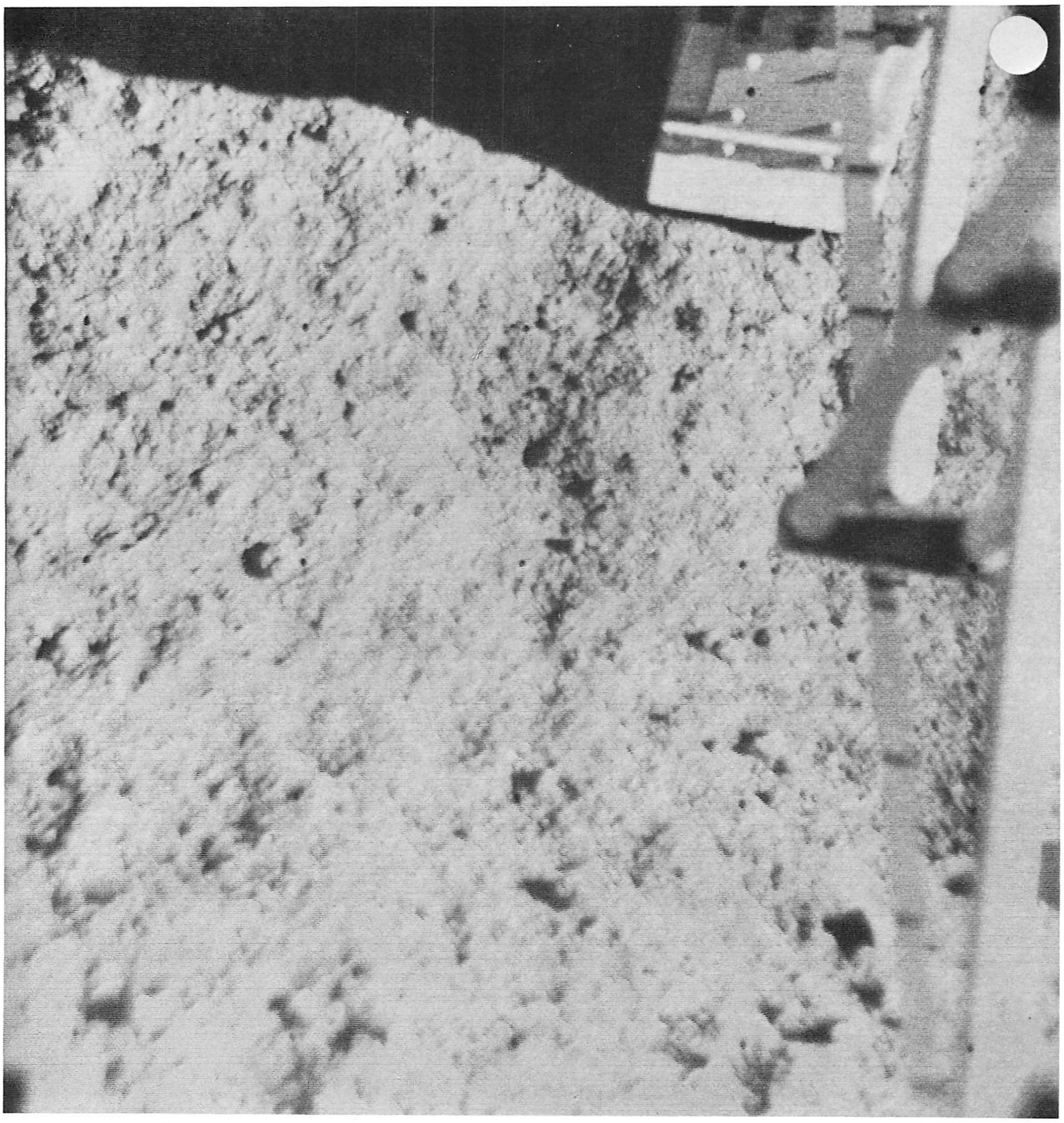
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(107)	Day 011, 01:50:00	27	—35	1.96	$f/7.0$	W	Clear



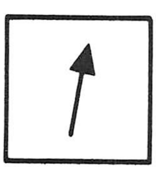


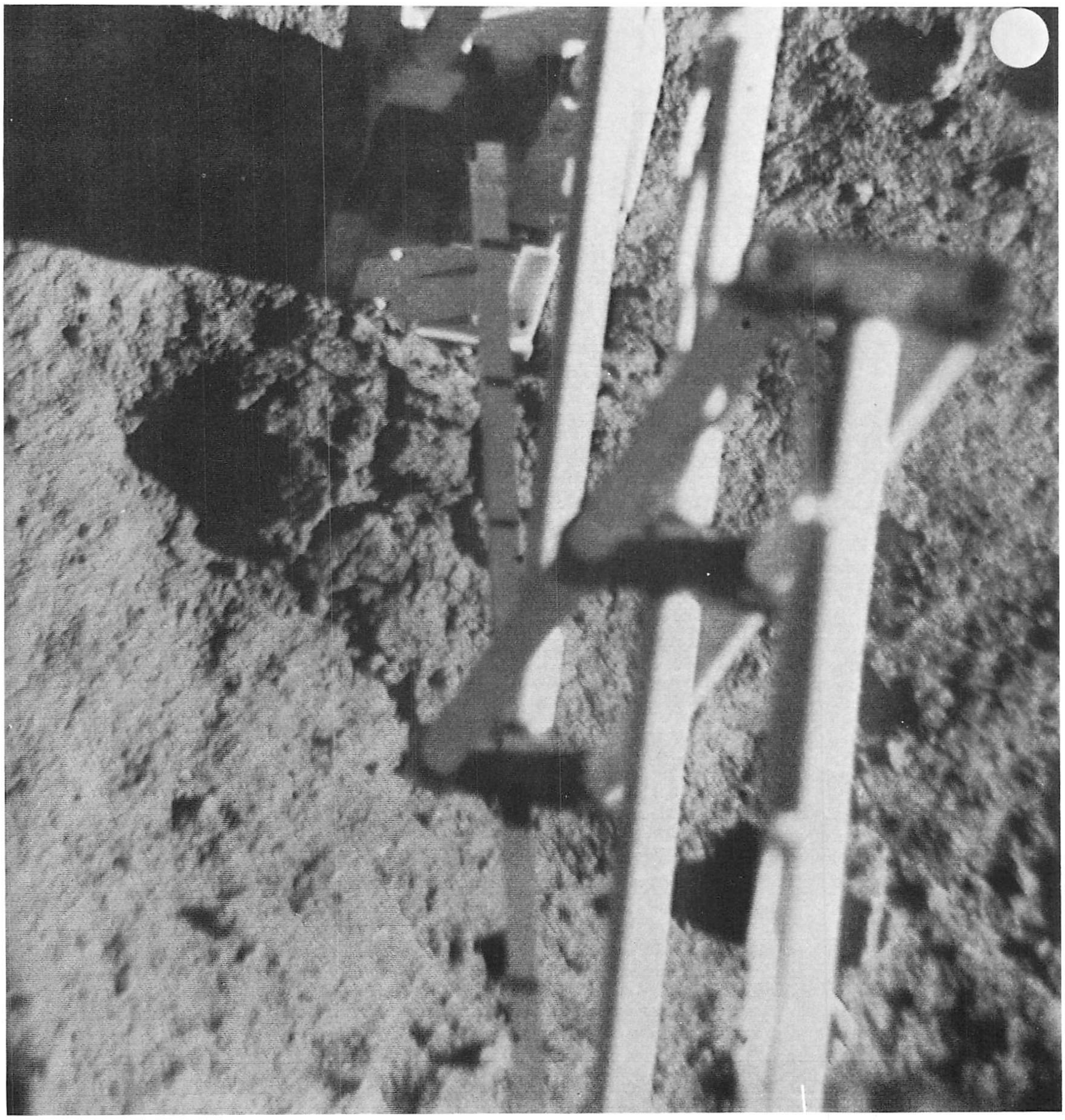
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(108)	Day 011, 01:56:36	24	−25	1.75	$f/9.5$	N	Clear



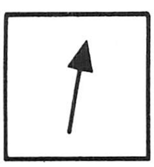


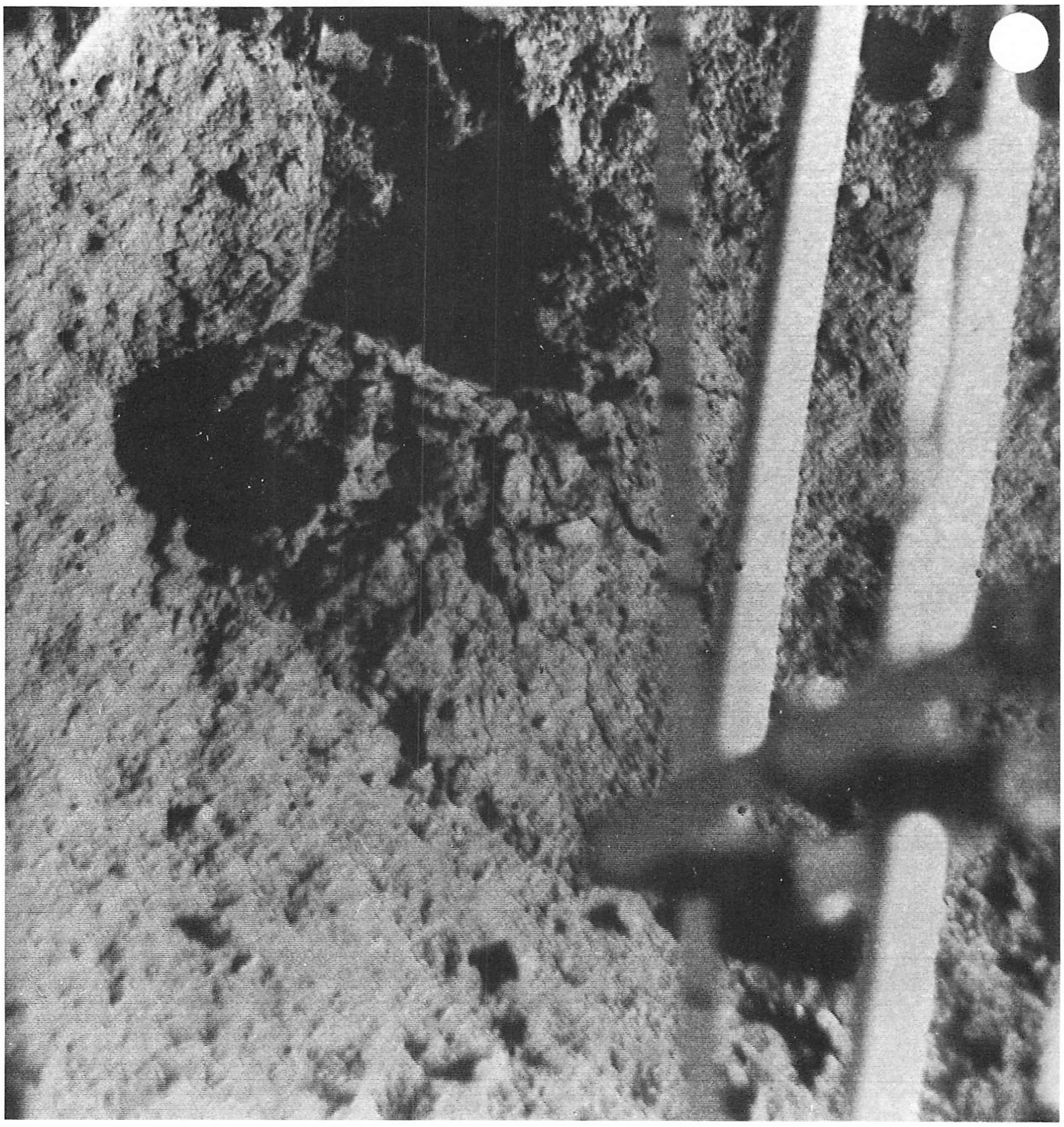
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(109)	**Day 011, 03:40:33**	**3**	**—45**	**2.35**	***f*/7.1**	**N**	**Clear**



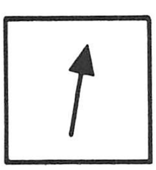


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(110)	Day 011, 03:47:31	3	—45	2.35	f/25.4	N	Vertical

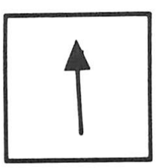


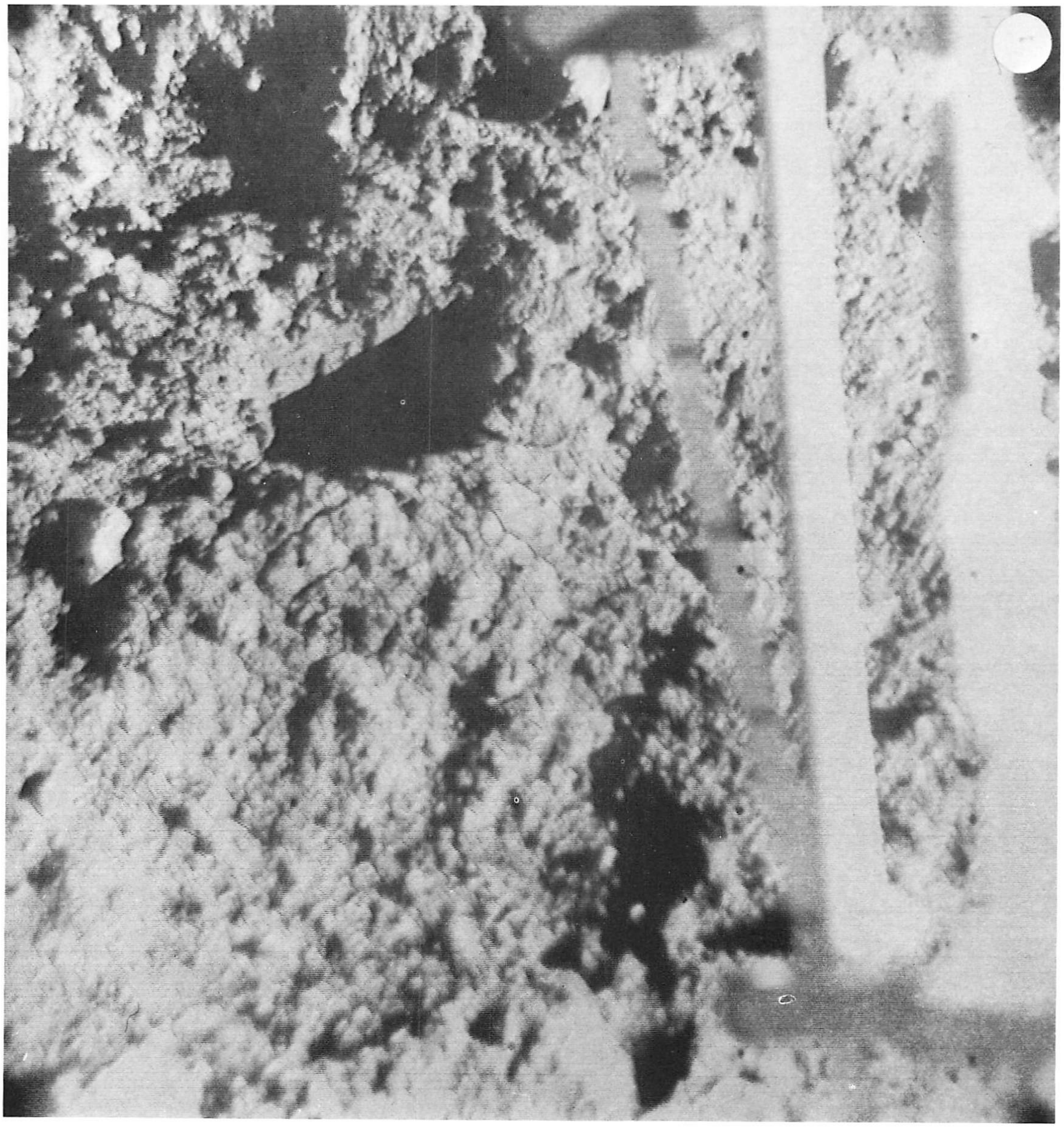


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(111)	**Day 011, 03:55:42**	**3**	**—45**	**2.35**	***f*/6.7**	**N**	**45 Diagonal**

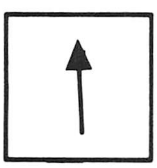


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(112)	**Day 011, 04:27:06**	**12**	**—40**	**2.54**	***f*/16.8**	**N**	**Clear**

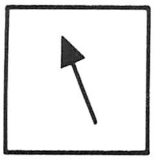


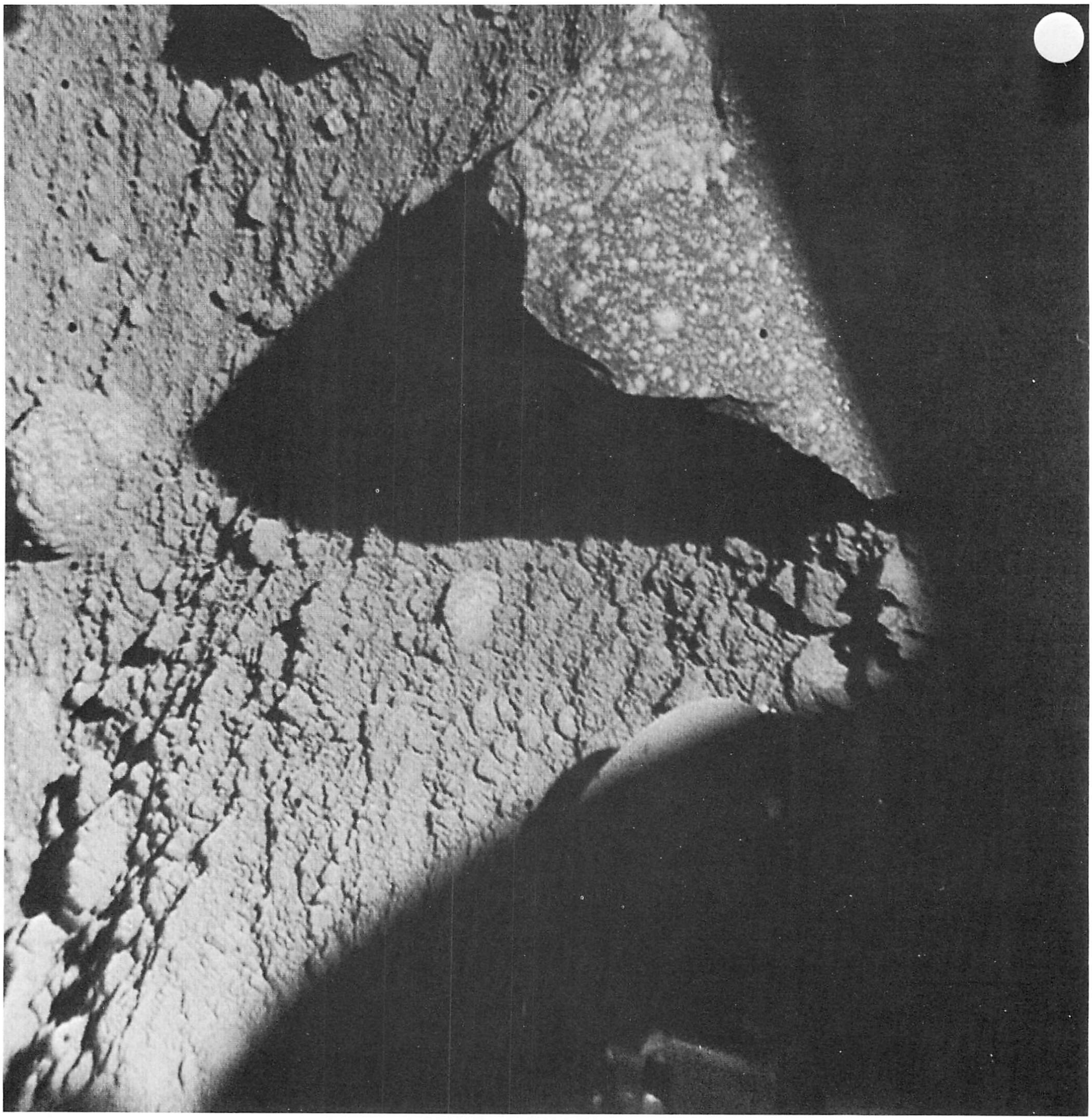


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(113)	**Day 011, 04:52:24**	**12**	**—40**	**2.65**	***f*/7.0**	**N**	**Clear**

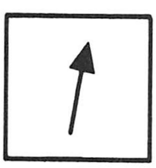


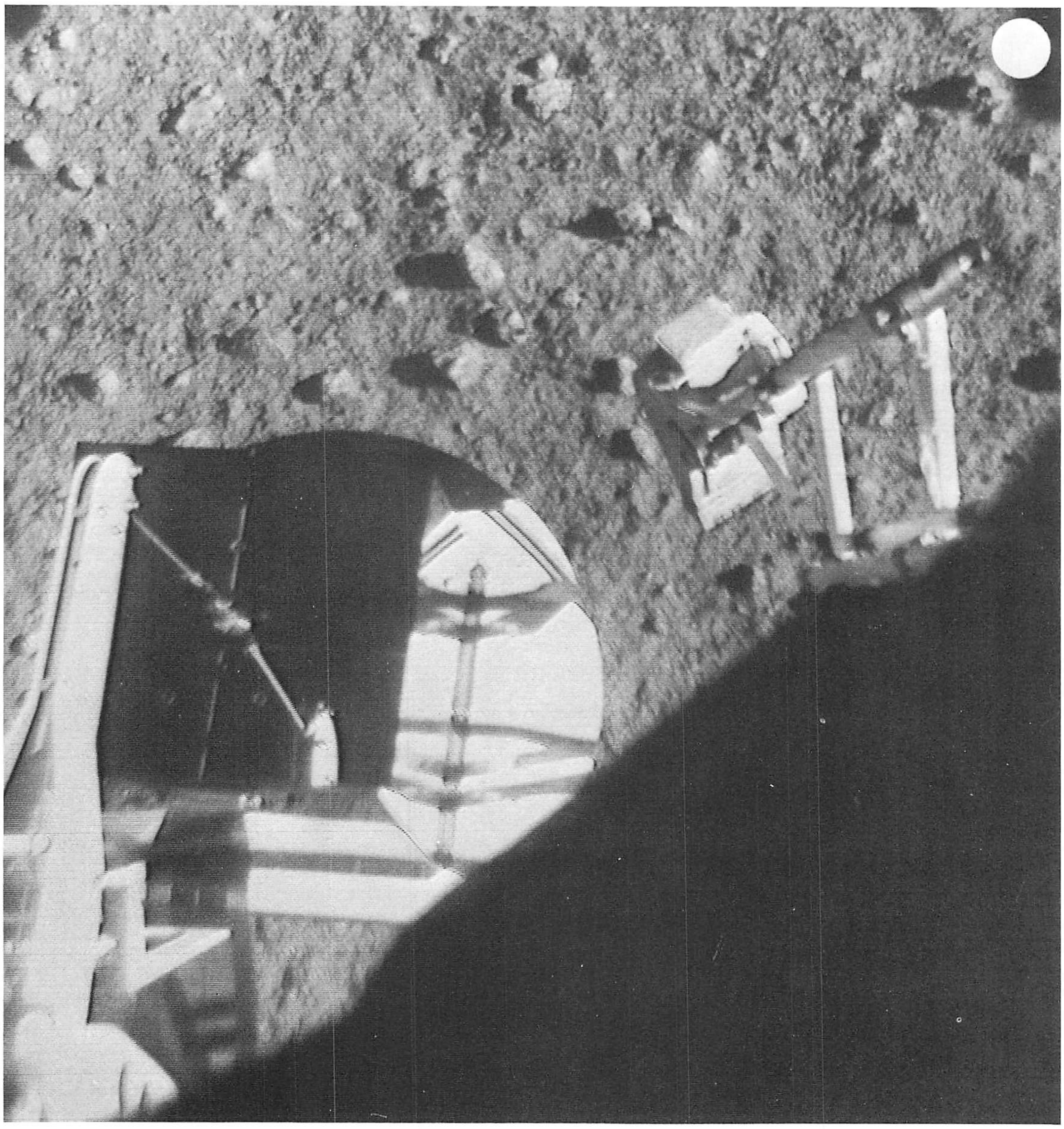
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(114)	**Day 011, 06:14:44**	**—54**	**—60**	**2.54**	**f/6.0**	**N**	**Clear**



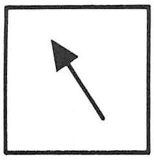


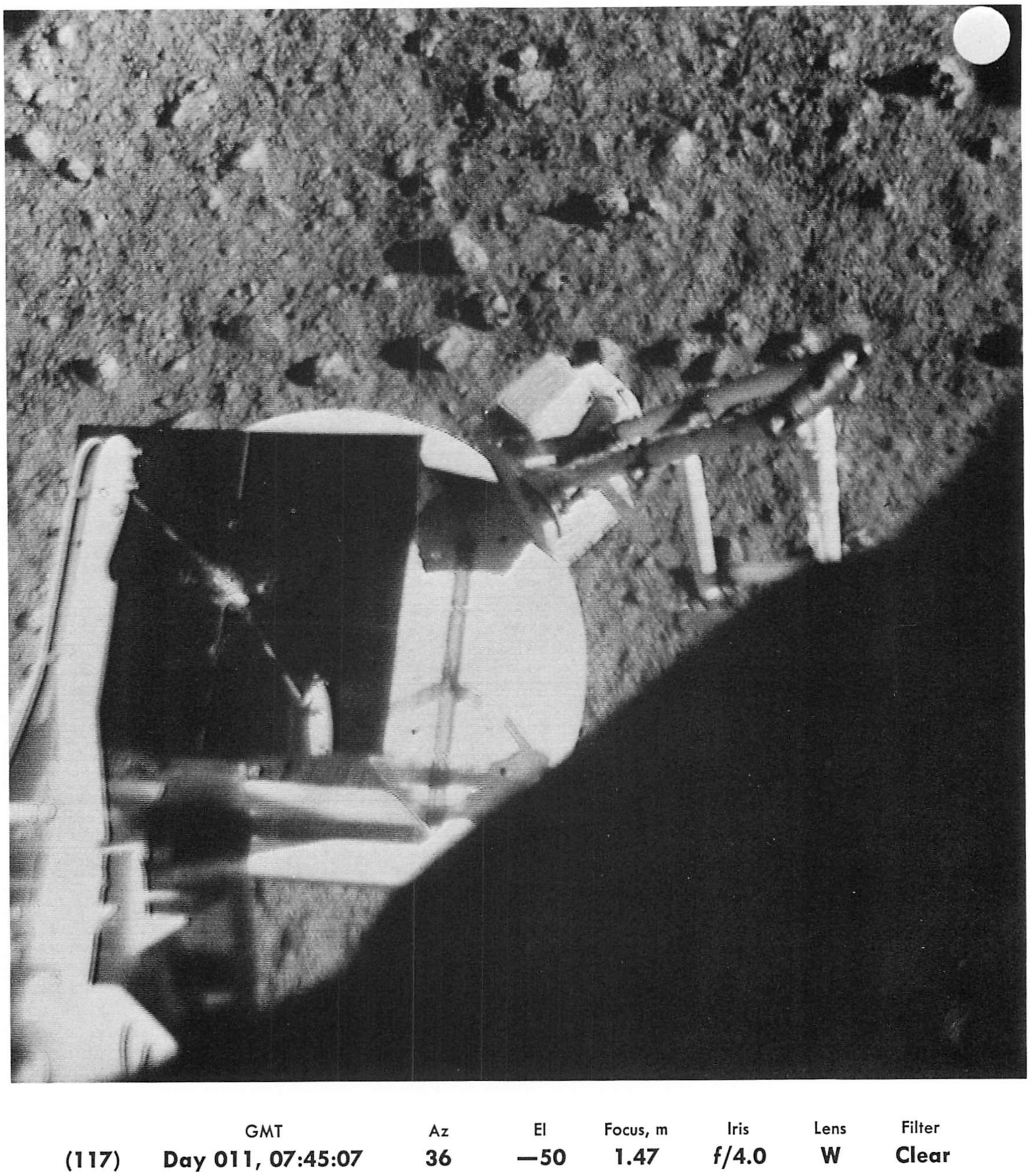
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(115)	**Day 011, 06:29:29**	**75**	**−20**	**3.07**	***f*/9.5**	**N**	**Clear**	**Processed**



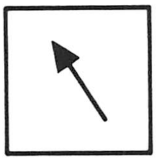


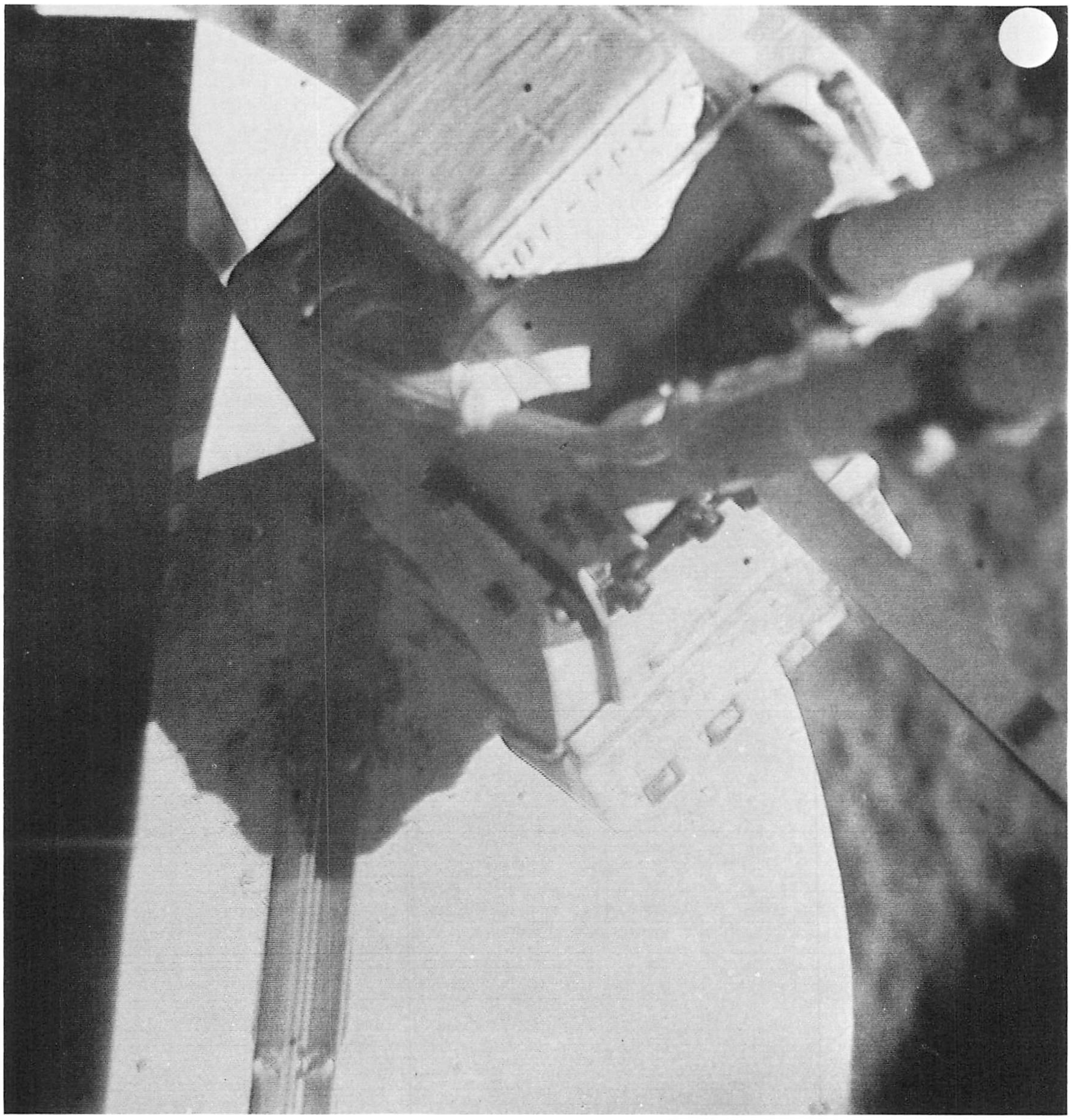
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(116)	**Day 011, 07:39:02**	**36**	**—50**	**1.47**	**f/4.0**	**W**	**Clear**



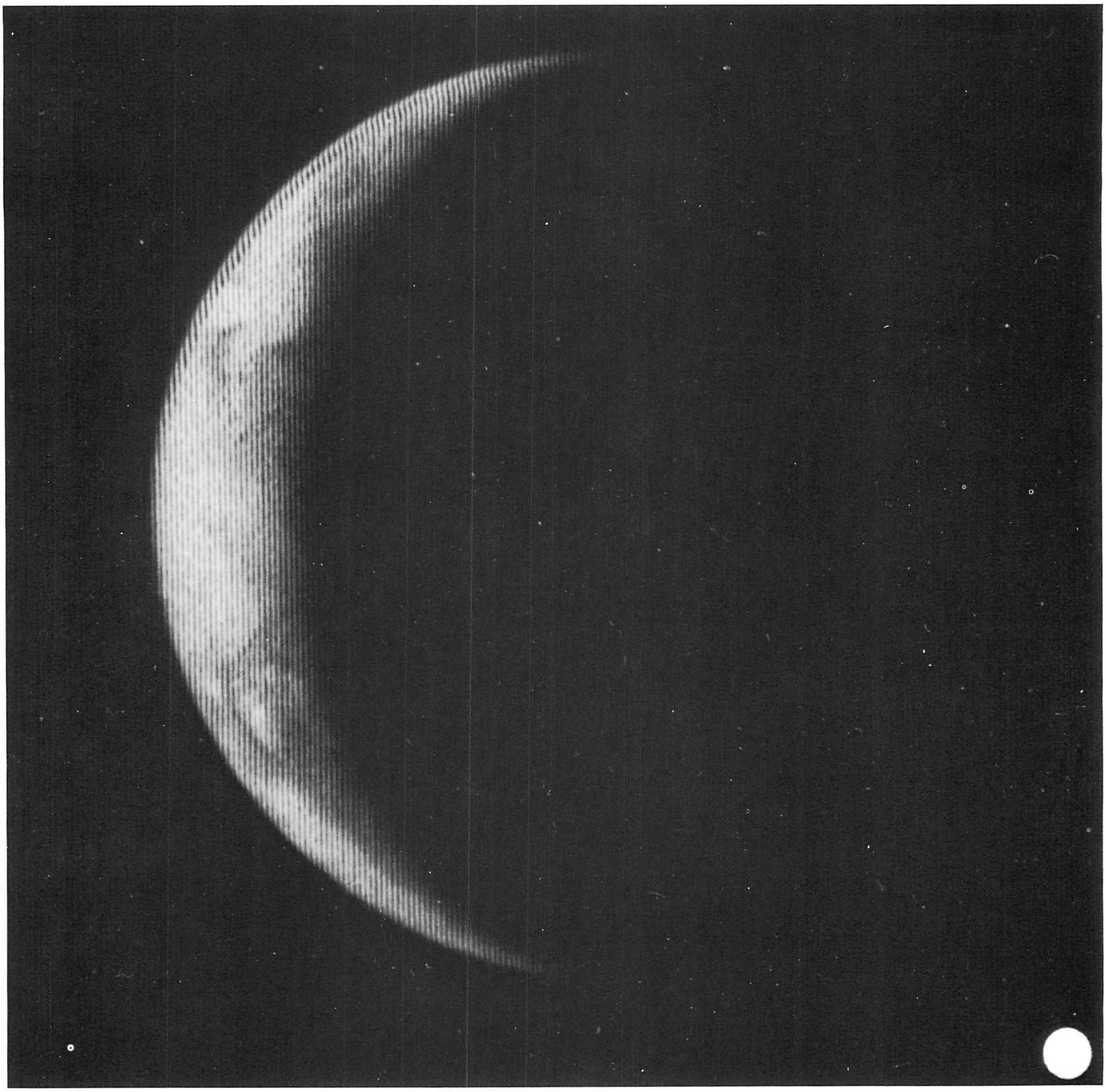


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(117)	**Day 011, 07:45:07**	**36**	**—50**	**1.47**	***f*/4.0**	**W**	**Clear**

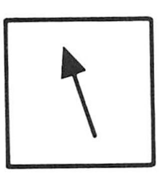


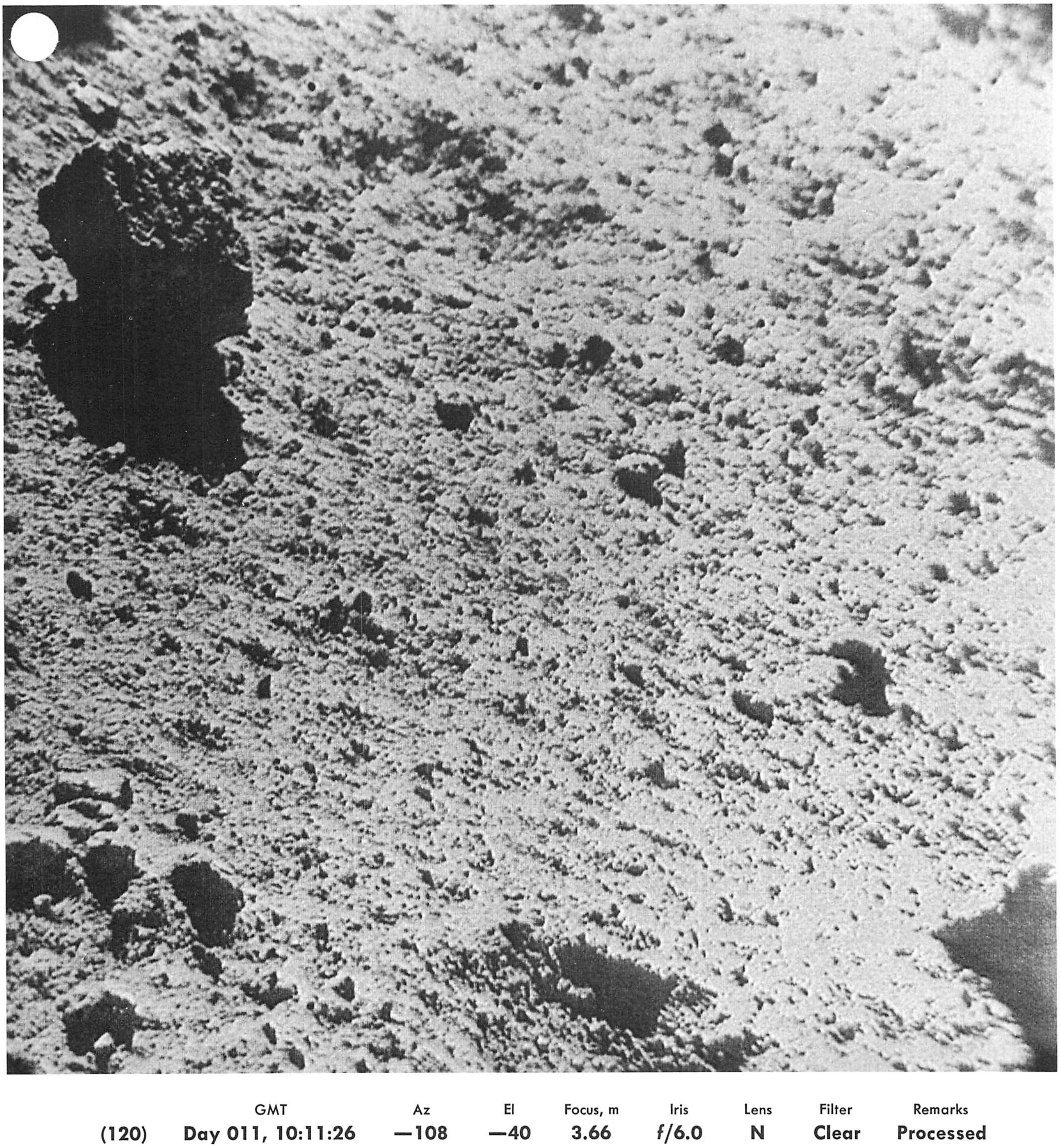


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(118)	**Day 011, 07:48:26**	**36**	**—50**	**1.47**	***f*/4.0**	**N**	**Clear**

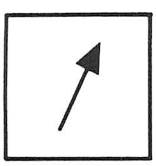


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(119)	**Day 011, 09:01:15**	**—57**	**50**	**205.24**	***f*/13.5**	**N**	**Clear**

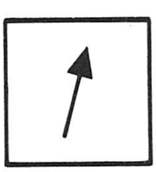


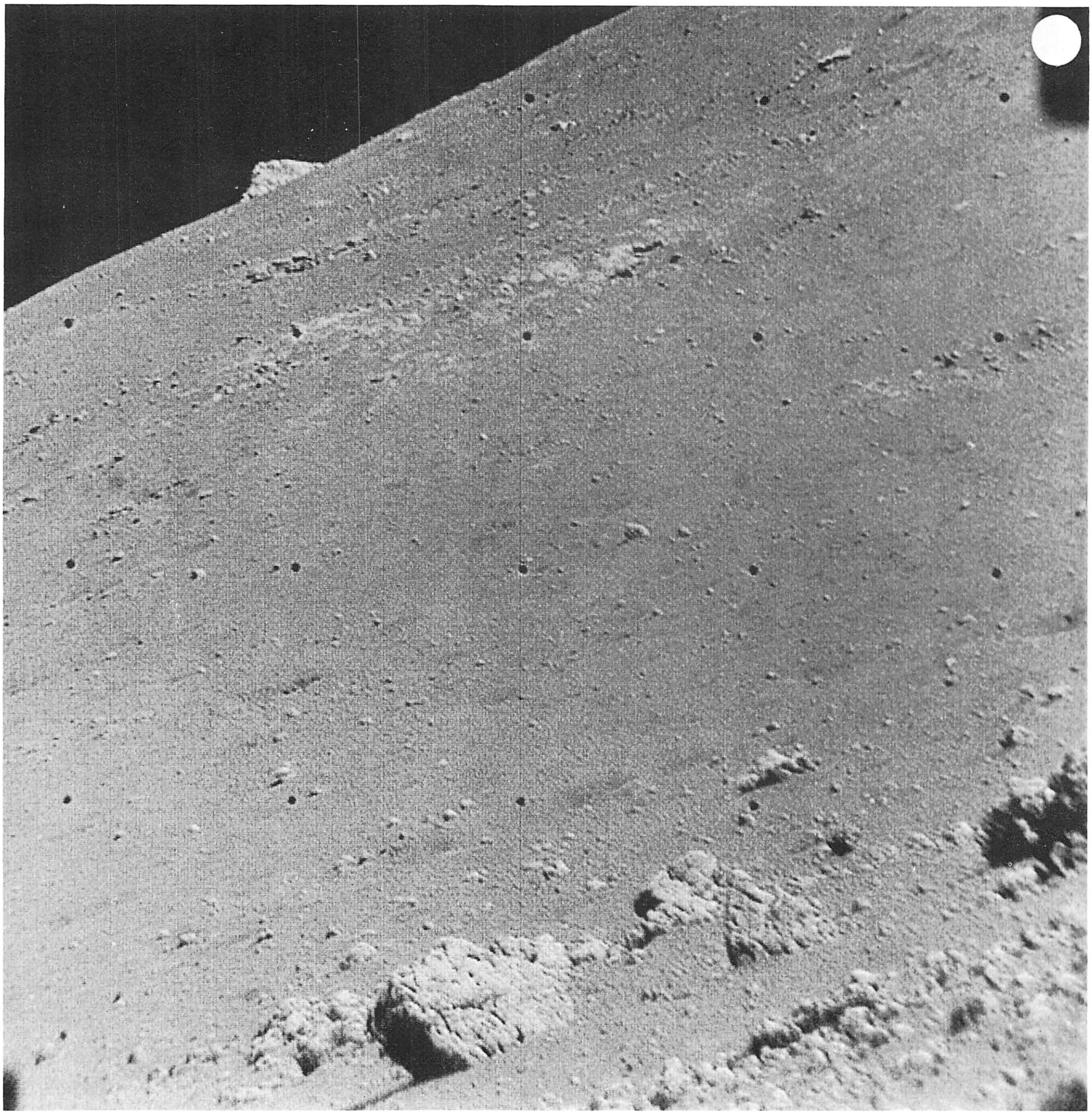


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(120)	Day 011, 10:11:26	−108	−40	3.66	*f*/6.0	N	Clear	Processed

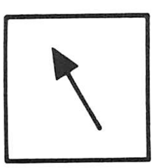


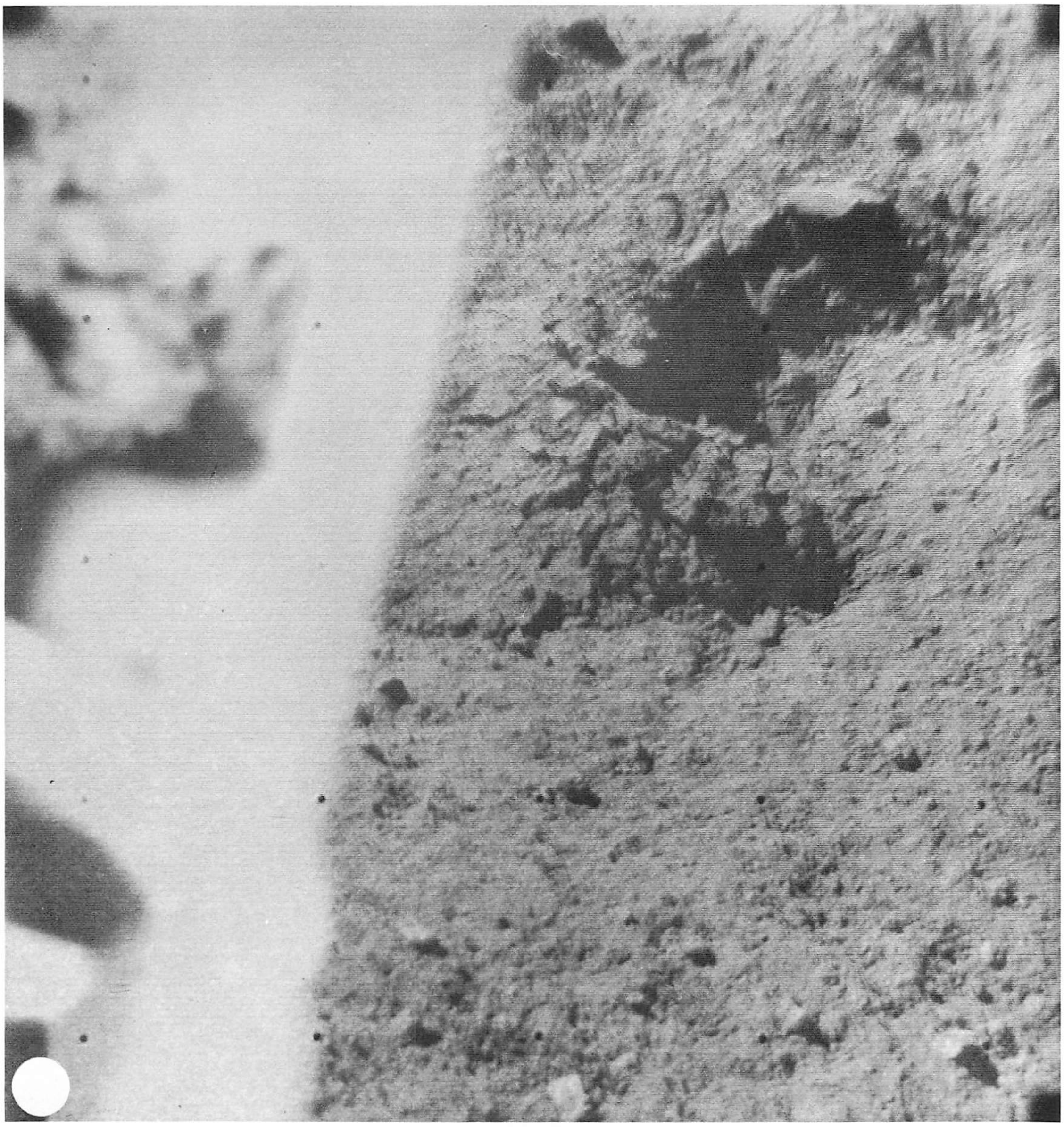
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(121)	Day 011, 13:41:24	69	—25	3.07	f/11.6	N	Clear



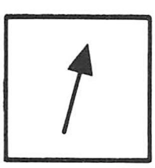


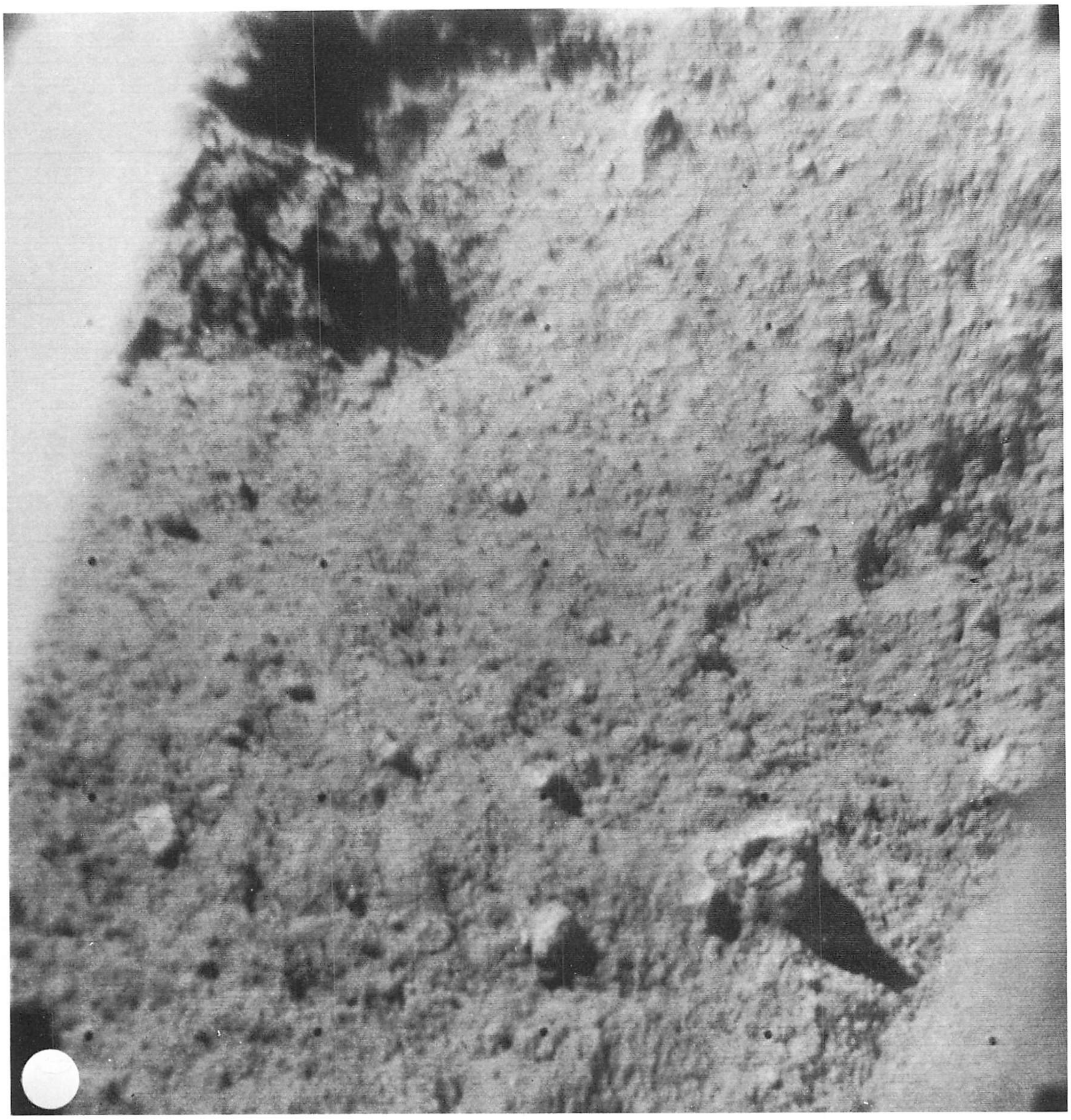
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(122)	**Day 012, 00:04:46**	**33**	**15**	**205.24**	**f/9.5**	**N**	**Clear**	**Processed**



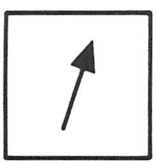


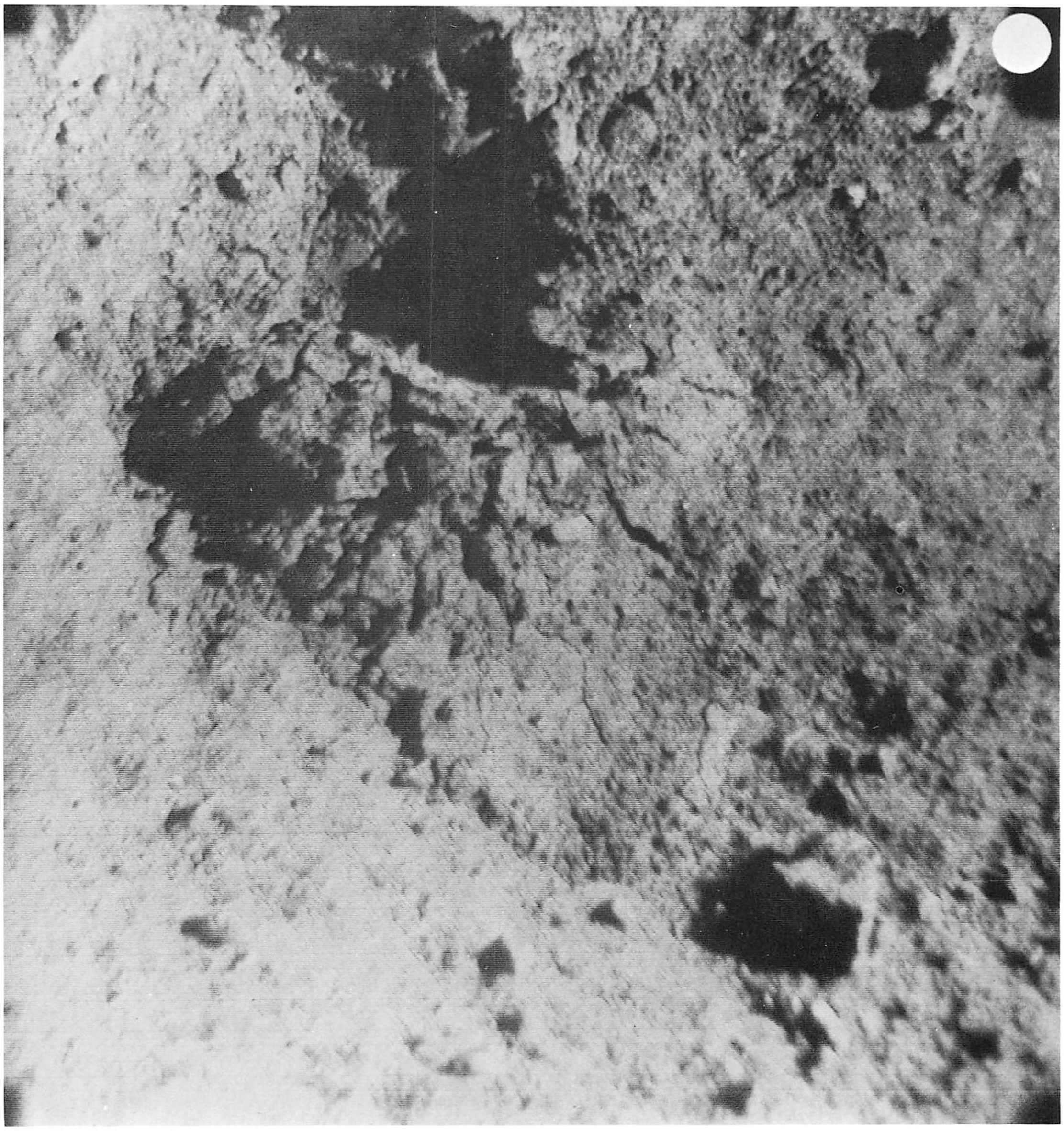
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(123)	**Day 012, 00:25:41**	**—210**	**—15**	**3.23**	**f/9.5**	**N**	**Clear**



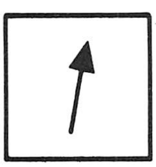


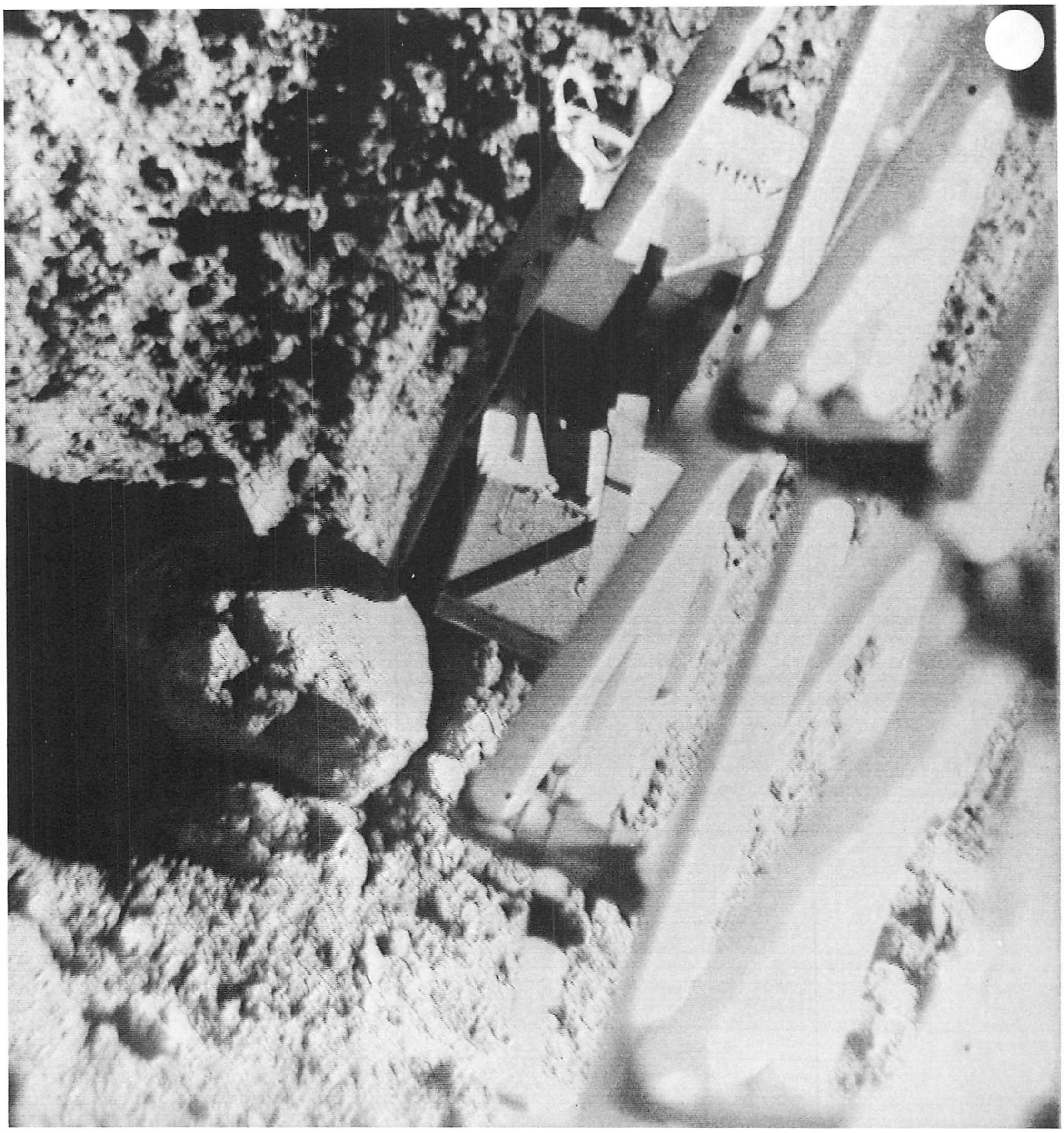
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(124)	**Day 012, 00:26:10**	**—213**	**—15**	**3.23**	**f/9.5**	**N**	**Clear**



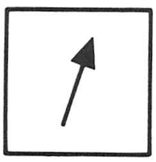


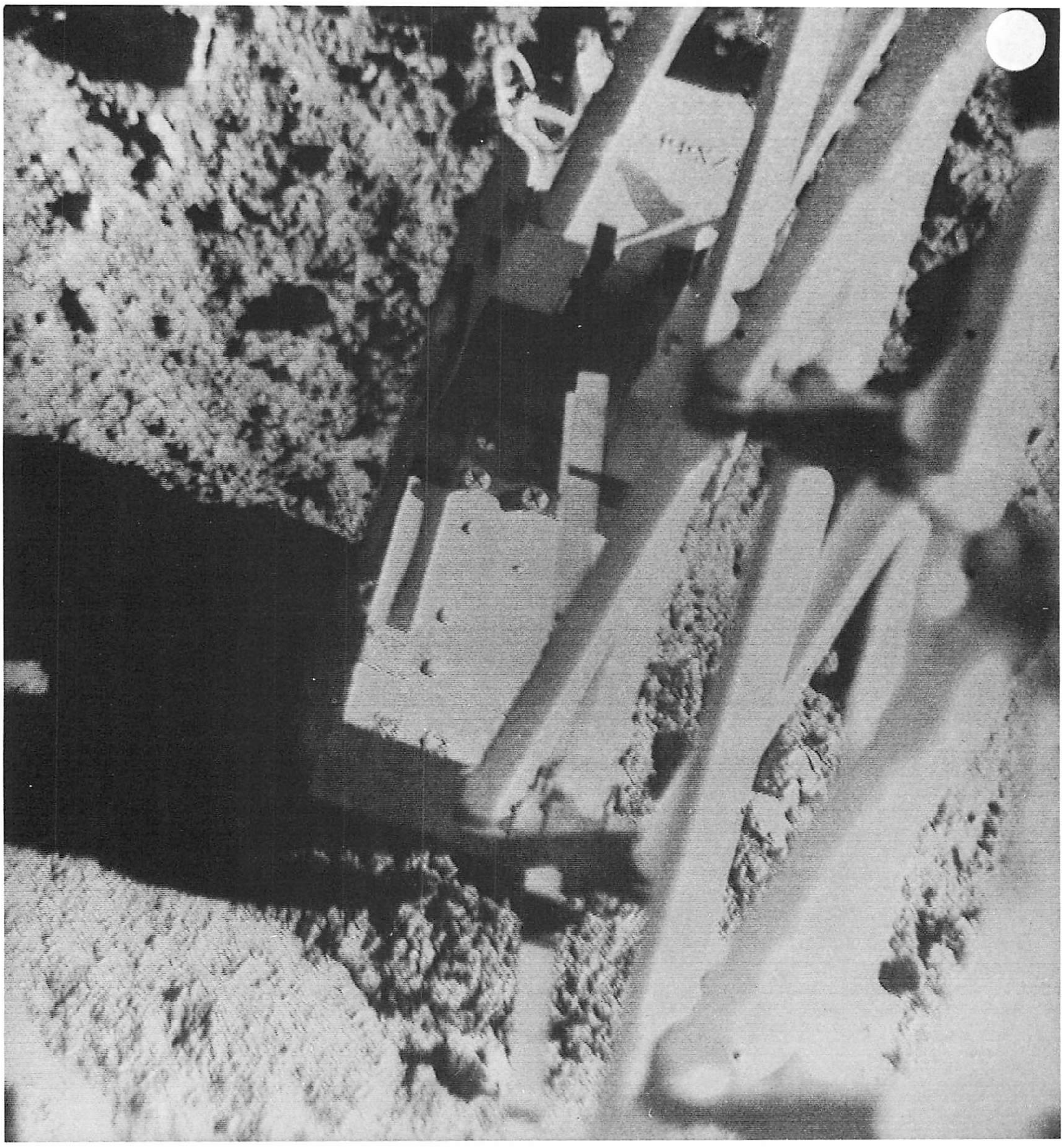
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(125)	**Day 012, 00:30:20**	**3**	**—45**	**2.43**	***f*/9.5**	**N**	**Clear**



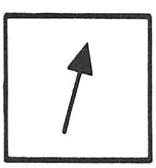


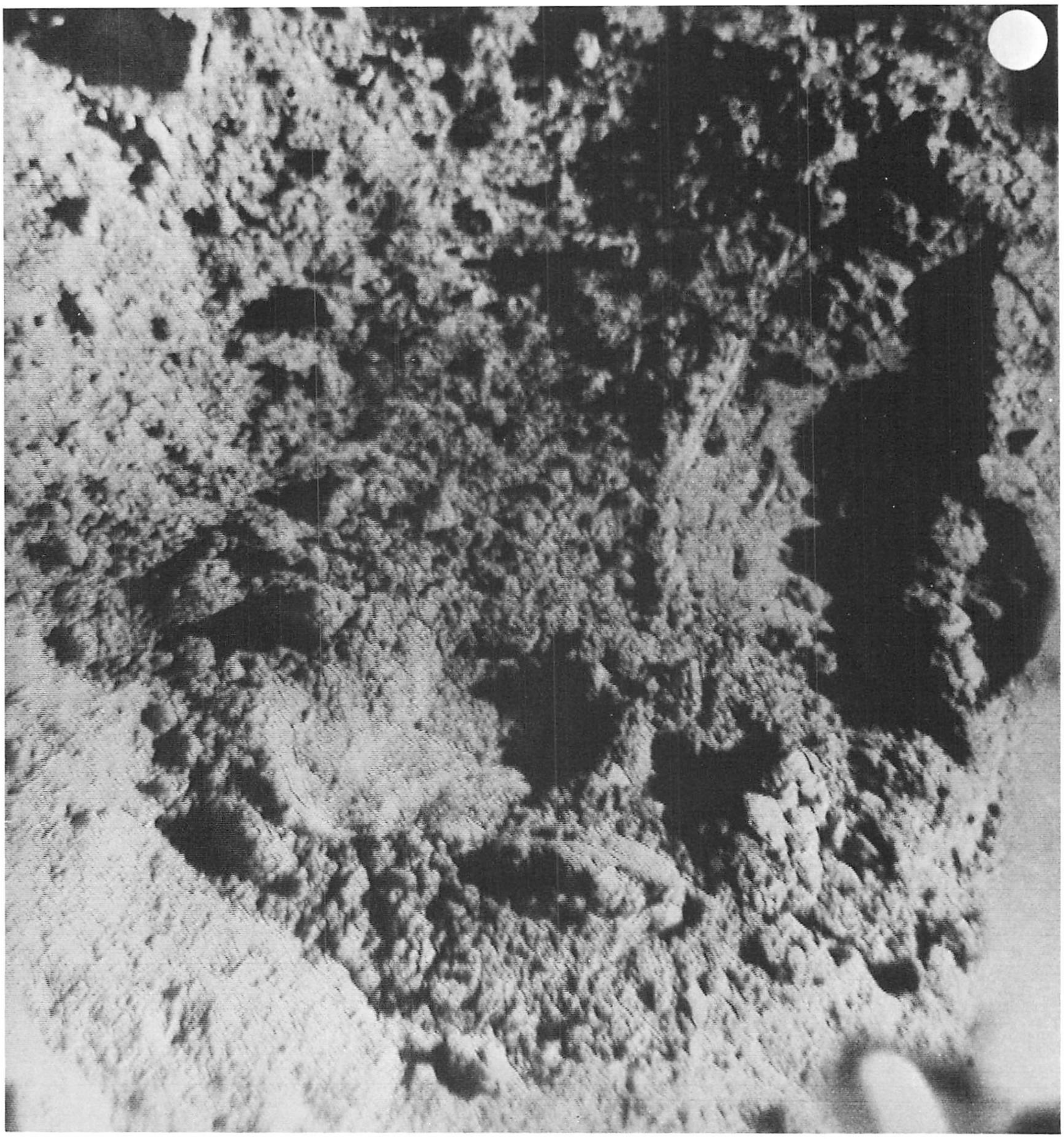
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(126)	Day 012, 02:38:23	—6	—50	2.18	f/15.8	N	Vertical



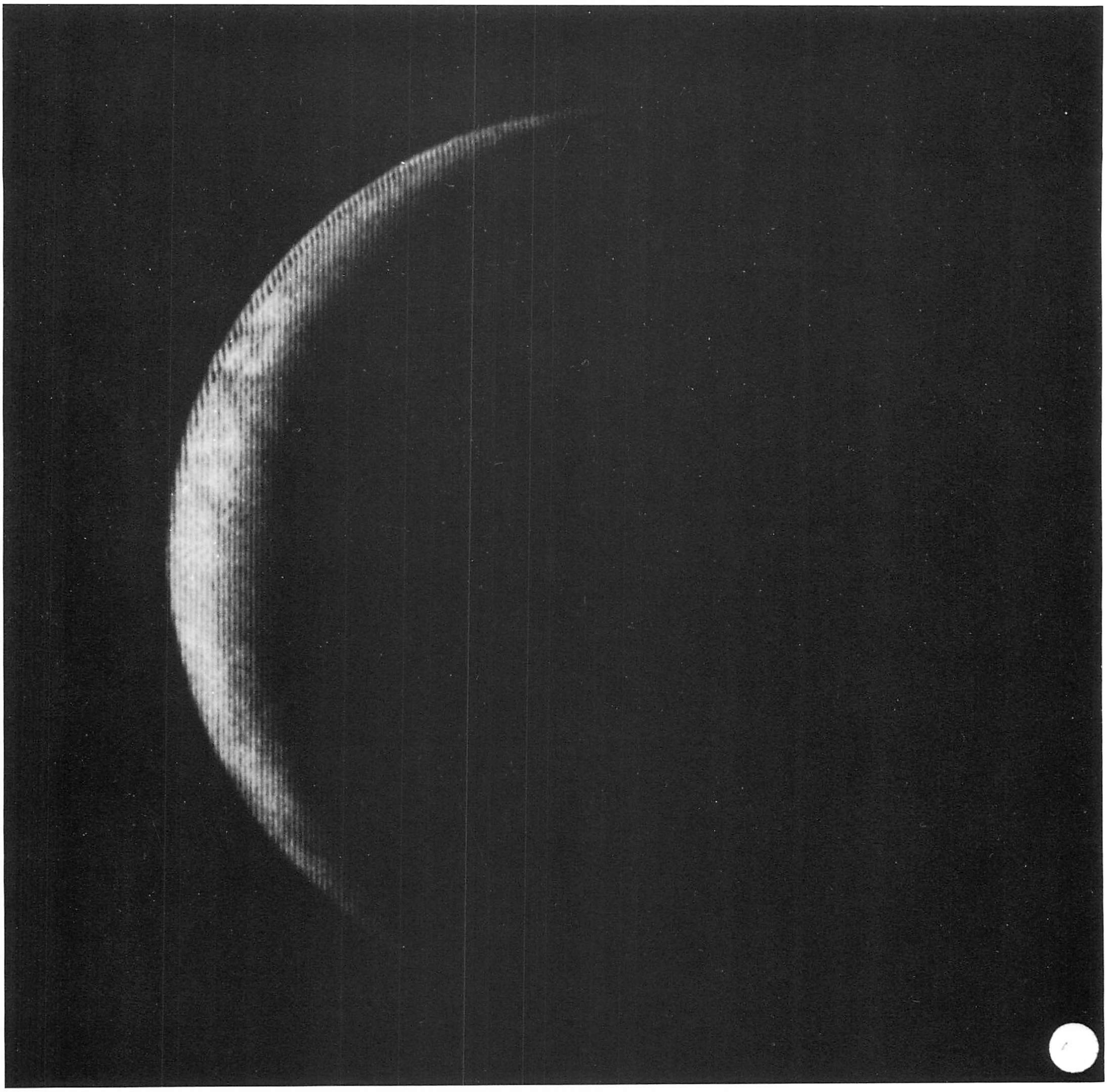


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(127)	**Day 012, 02:44:16**	**—3**	**—50**	**2.18**	***f*/8.4**	**N**	**Clear**

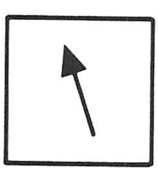


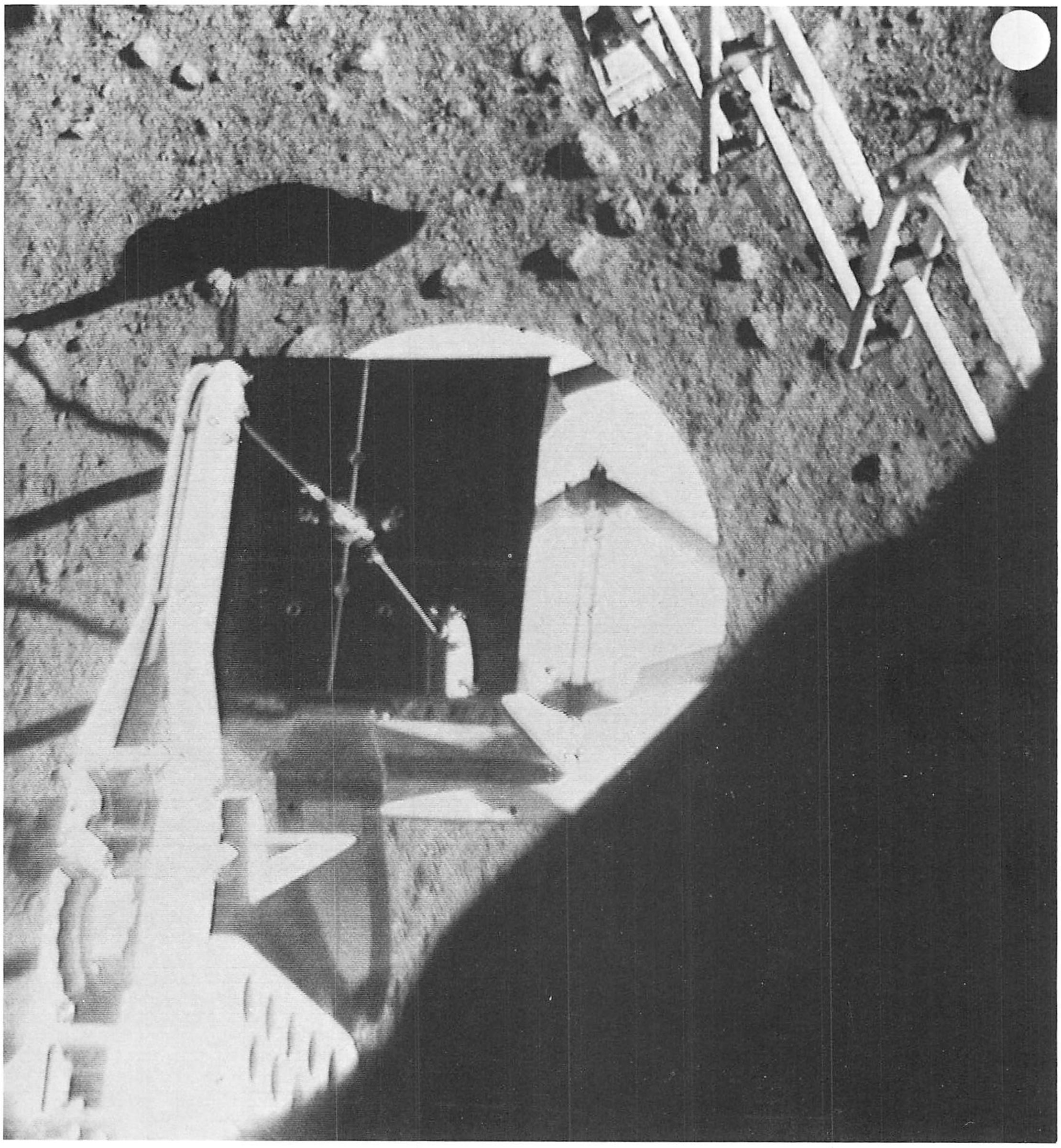


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(128)	**Day 012, 02:47:35**	**−3**	**−50**	**2.18**	***f*/20.1**	**N**	**Vertical**

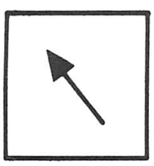


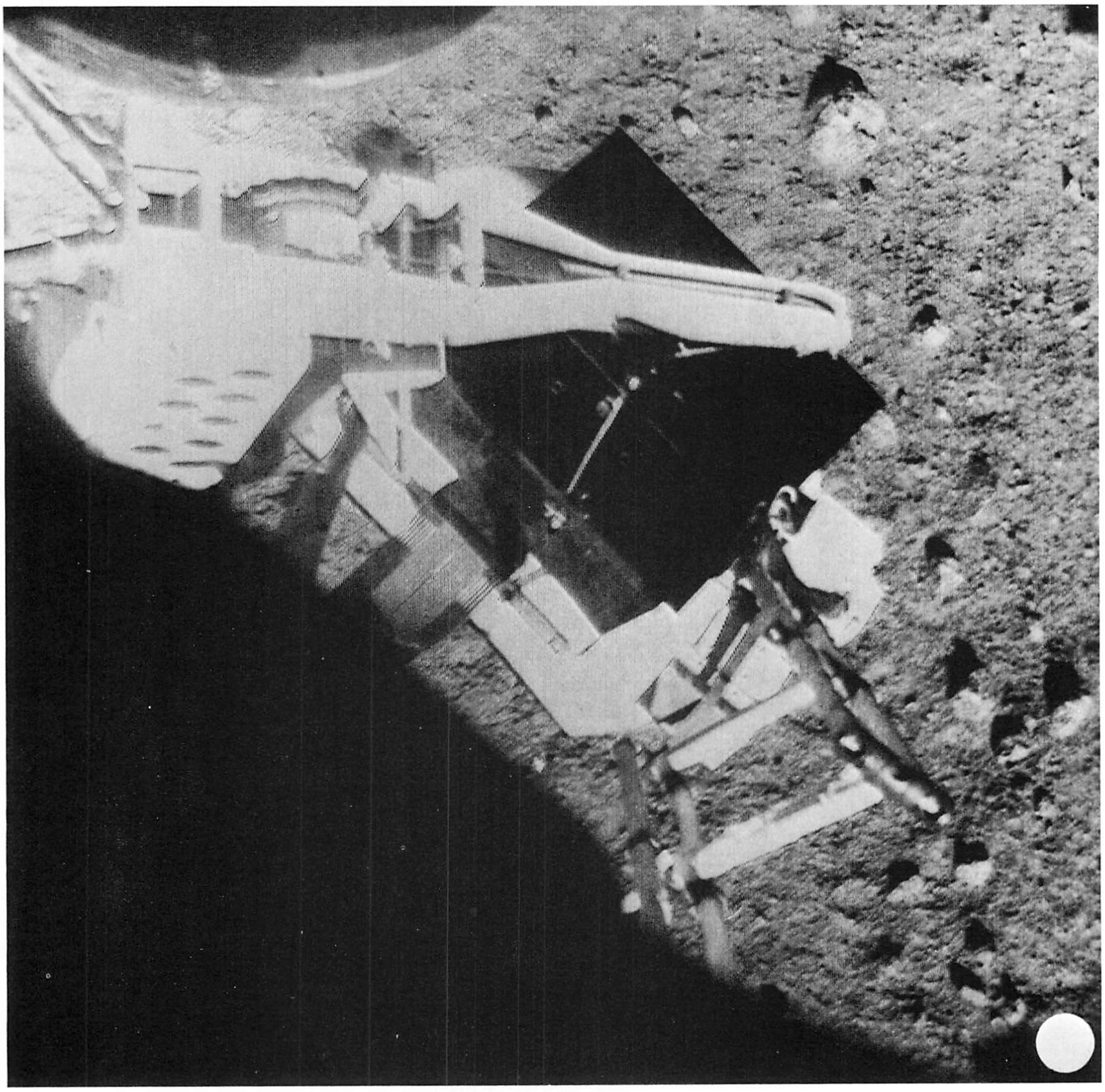
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(129)	**Day 012, 05:11:08**	**−57**	**50**	**205.24**	***f*/16.4**	**N**	**Clear**



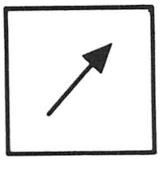


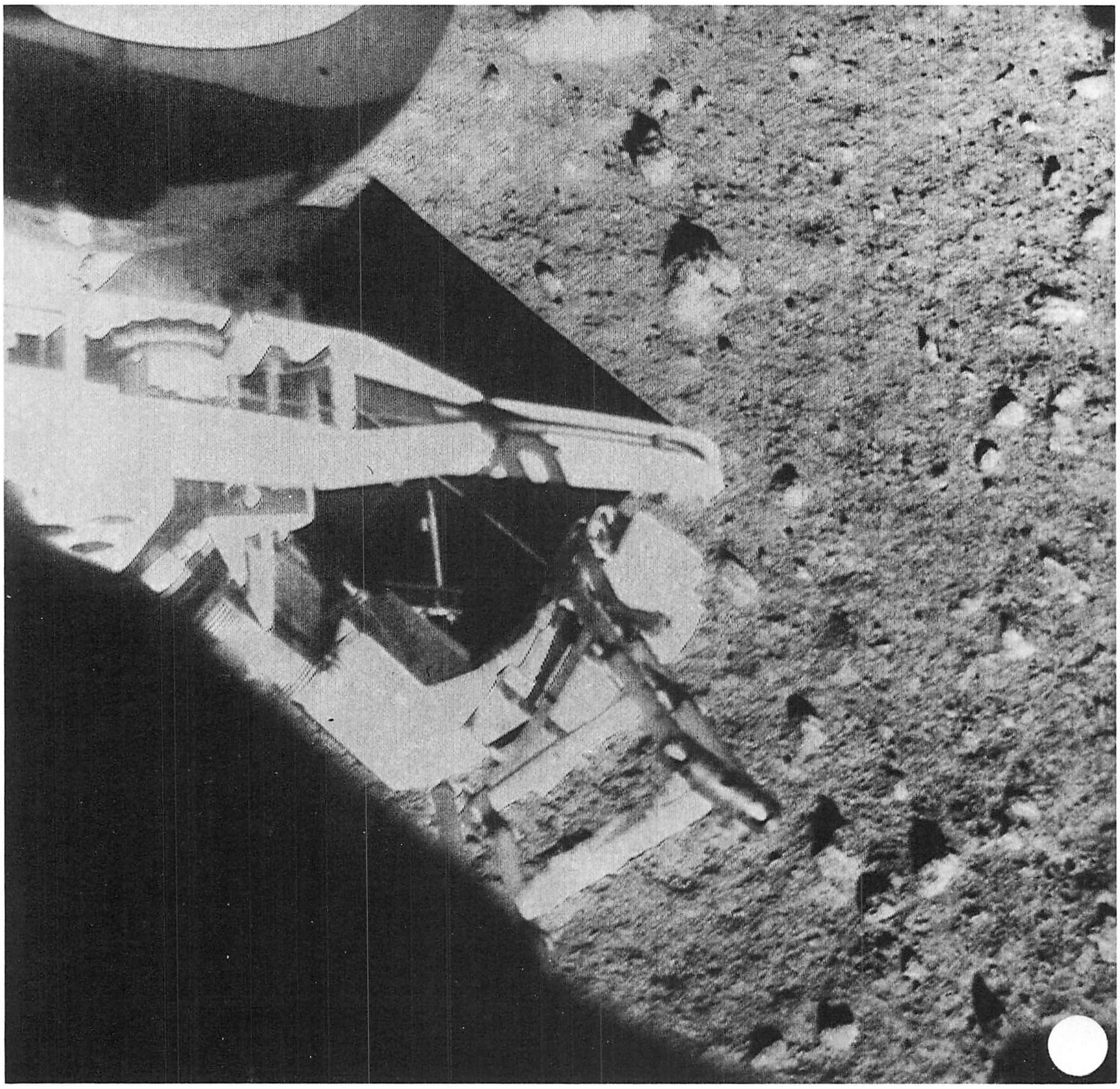
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(130)	Day 012, 05:48:29	42	−50	1.43	f/3.8	W	Clear



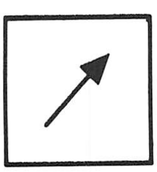


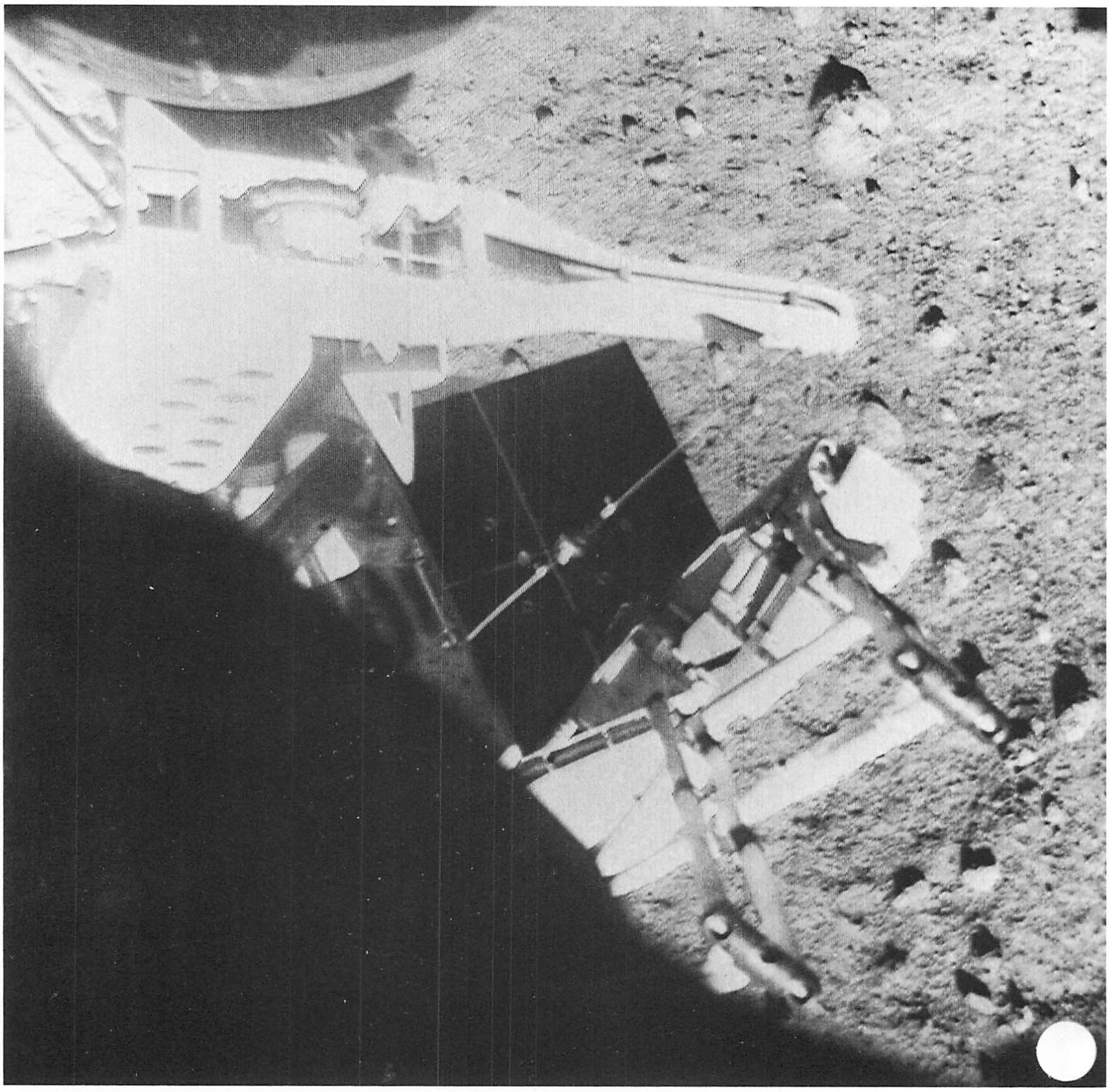
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(131)	Day 012, 06:31:06	48	−50	1.43	*f*/9.5	W	Clear



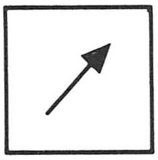


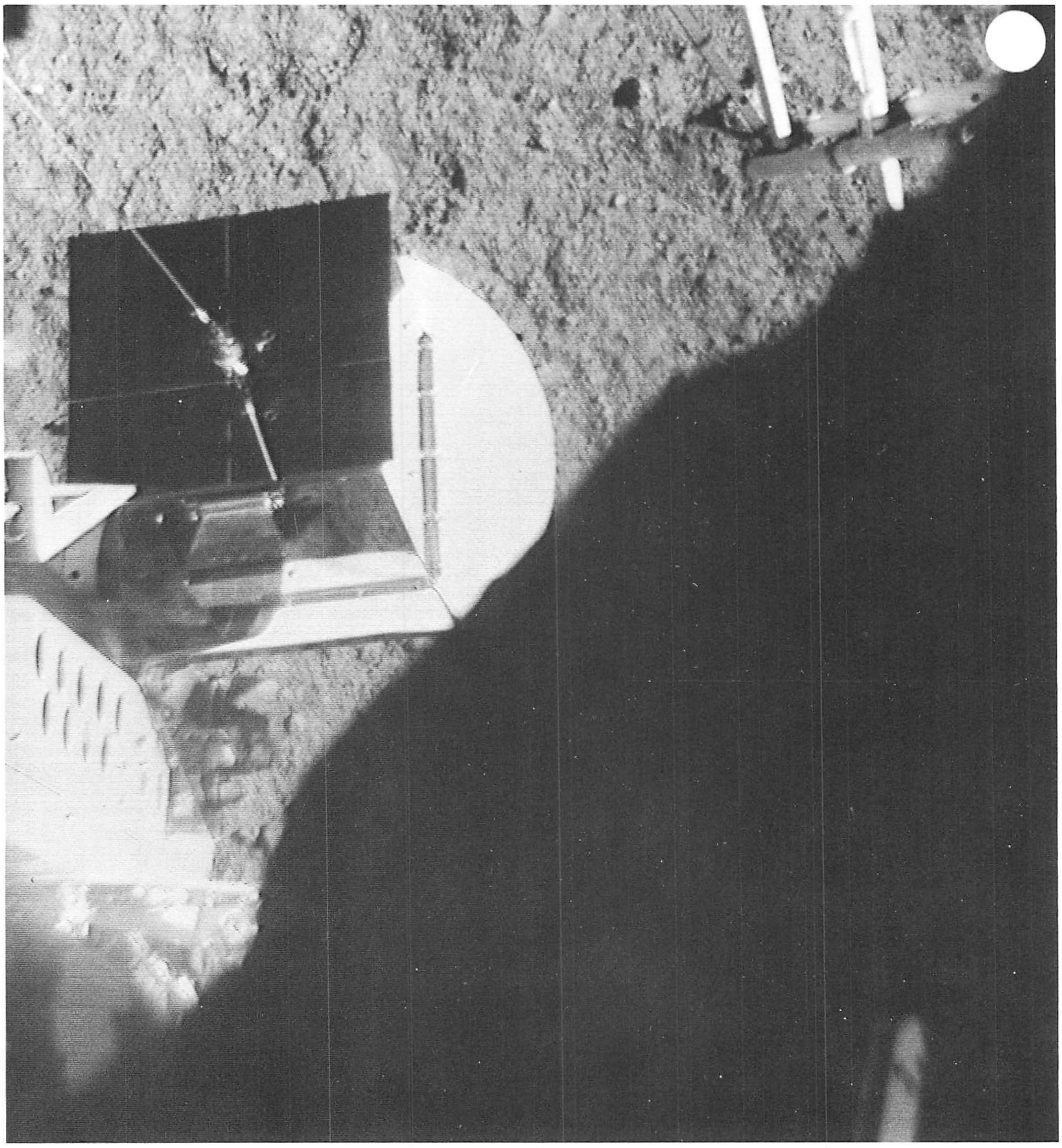
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(132)	**Day 012, 06:57:30**	**48**	**—45**	**1.43**	***f*/8.6**	**W**	**Clear**



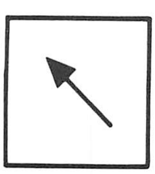


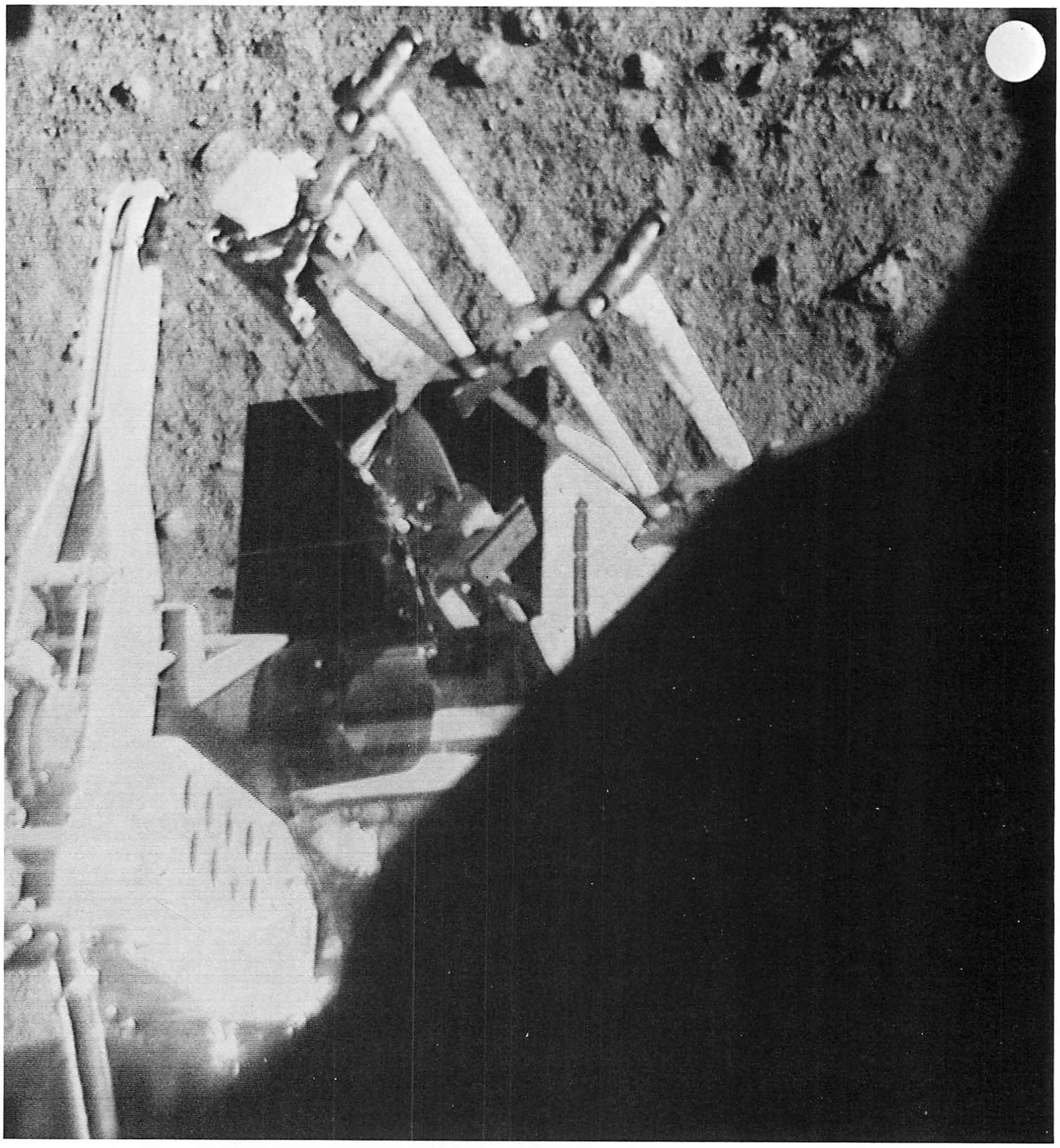
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(133)	Day 012, 07:41:12	48	—50	1.43	f/3.8	W	Clear



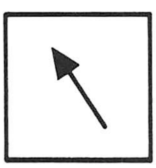


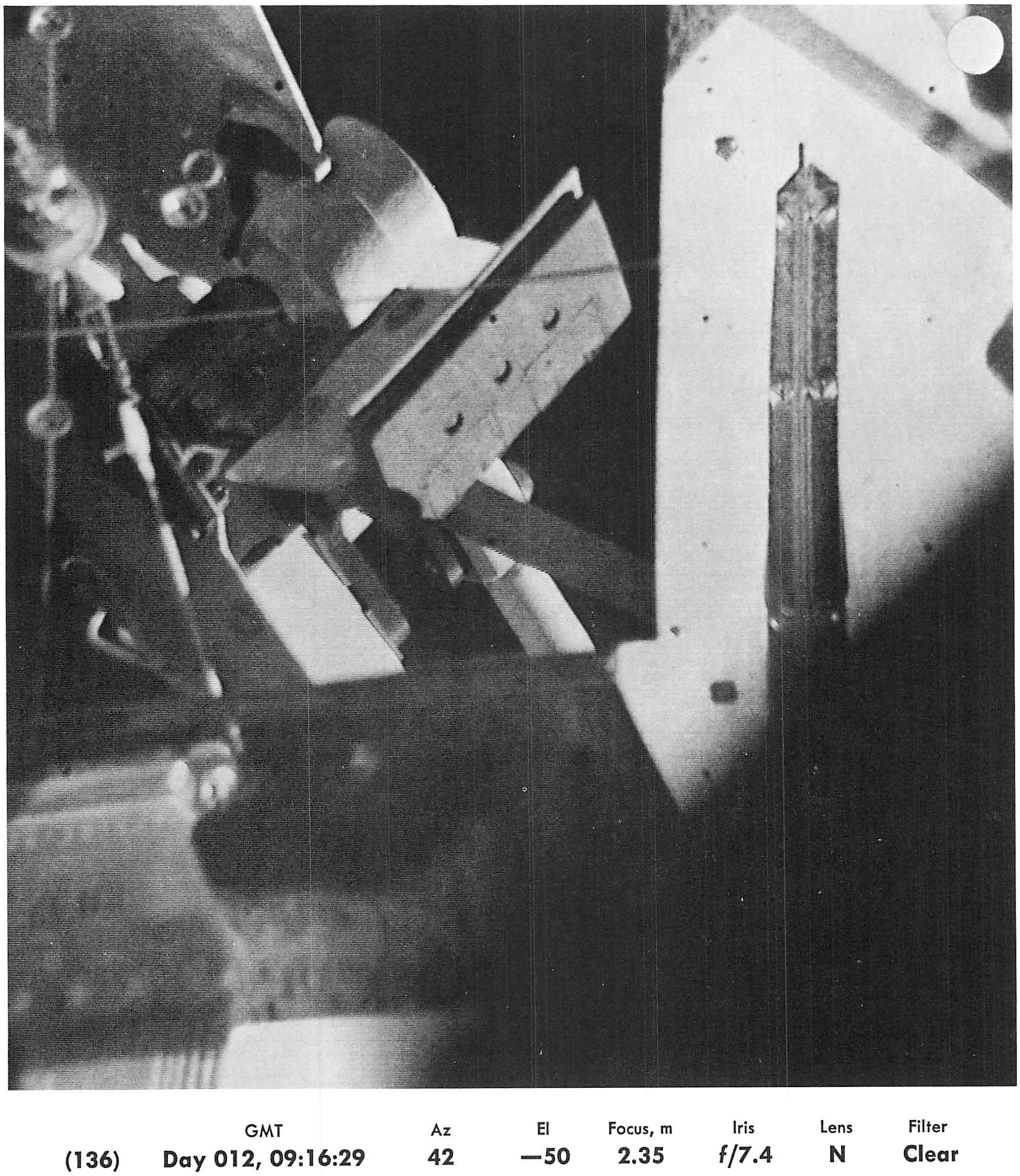
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(134)	Day 012, 08:04:06	45	—60	1.43	f/10.5	W	Clear



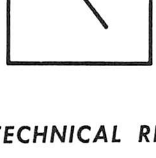


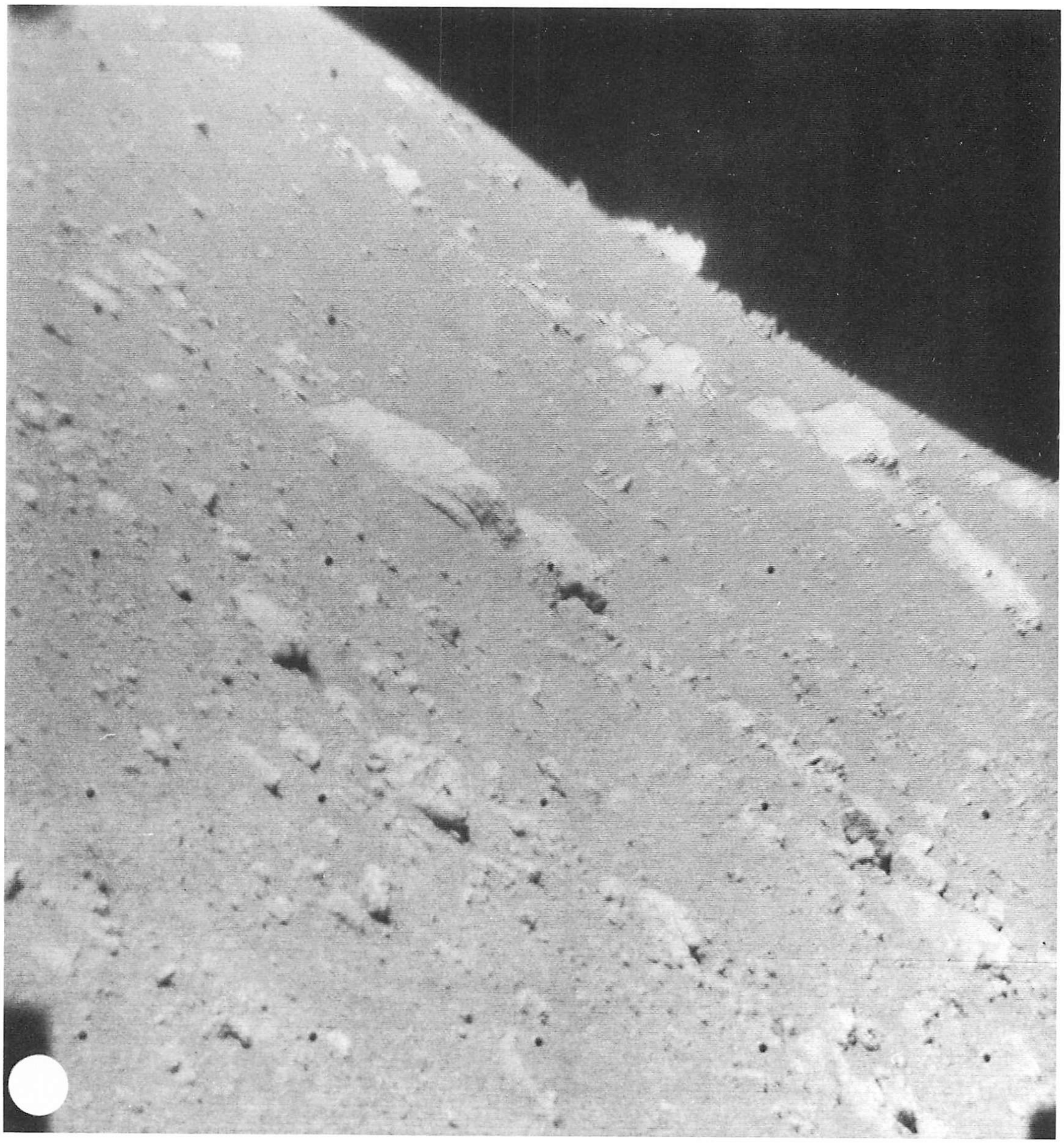
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(135)	**Day 012, 09:15:44**	**42**	**—50**	**2.35**	***f*/7.4**	**W**	**Clear**



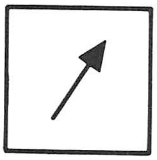


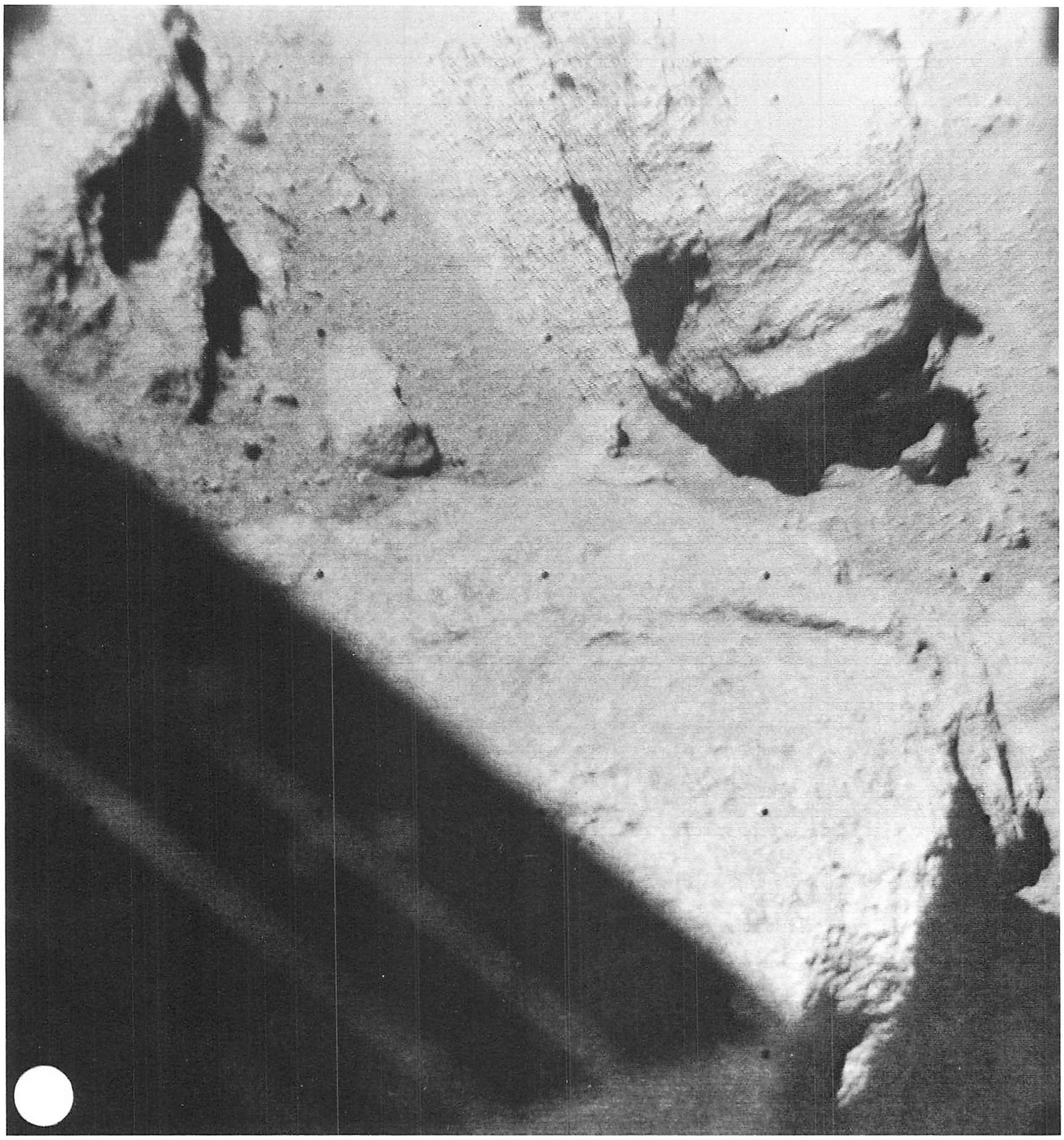
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(136)	**Day 012, 09:16:29**	**42**	**—50**	**2.35**	**$f/7.4$**	**N**	**Clear**



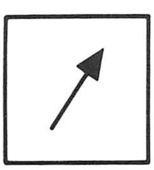


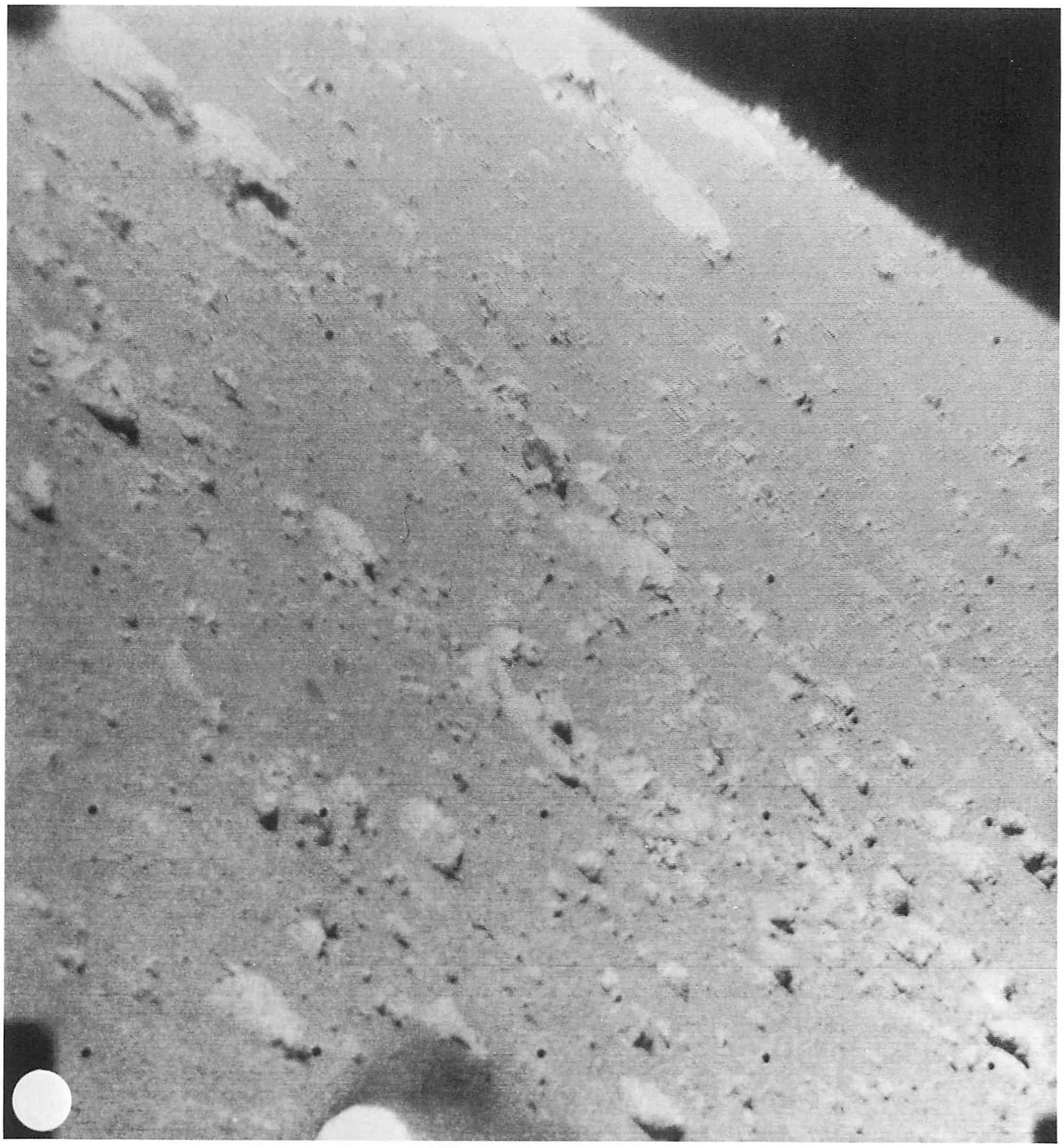
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(137)	Day 012, 10:52:20	132	5	205.24	$f/10.4$	N	Clear



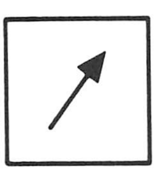


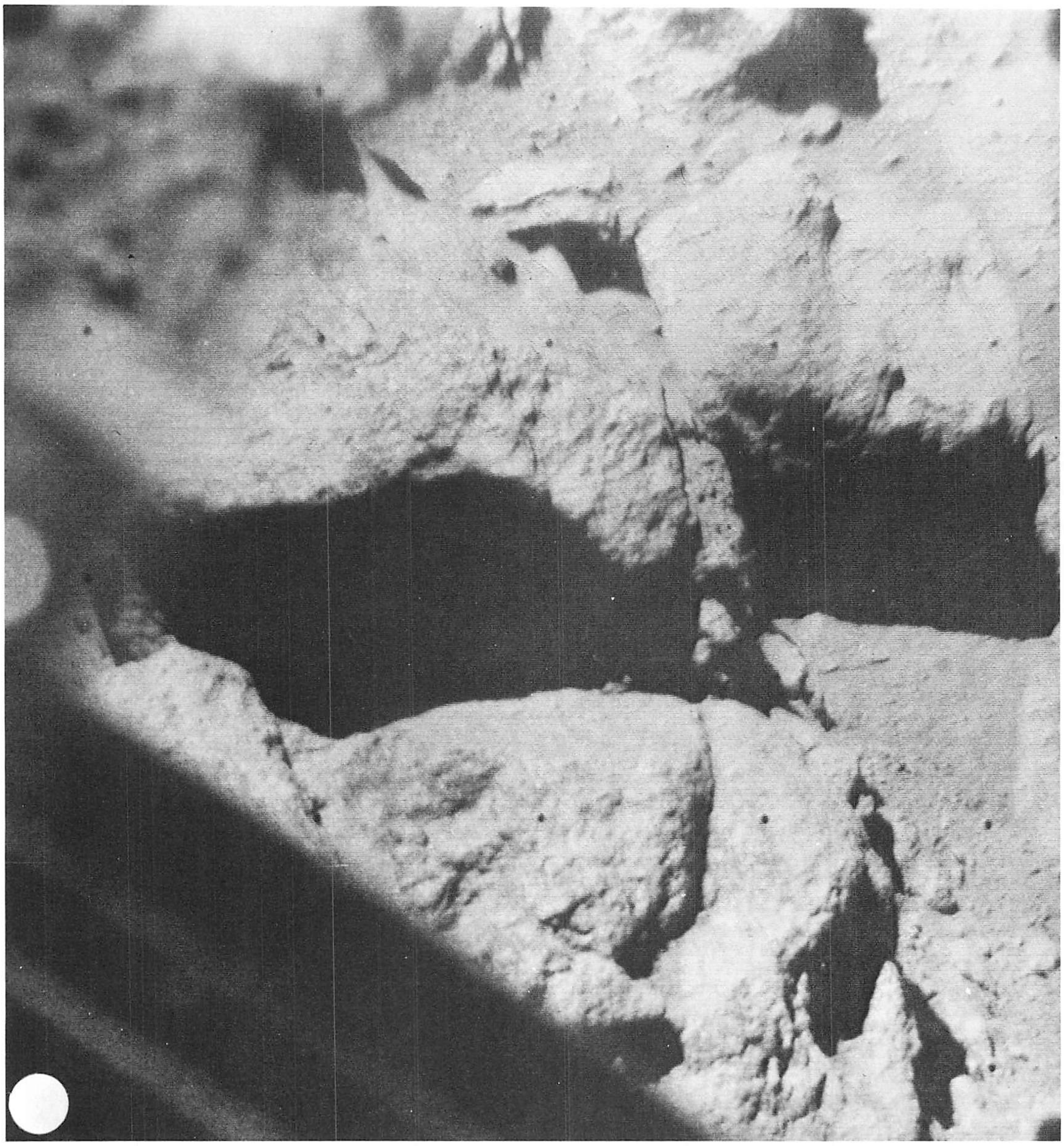
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(138)	Day 012, 10:53:22	132	—10	8.97	f/10.5	N	Clear



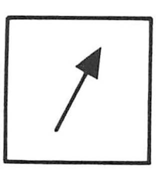


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(139)	**Day 012, 10:54:56**	**129**	**5**	**205.24**	***f*/10.5**	**N**	**Clear**

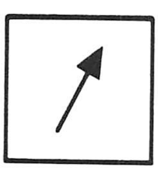


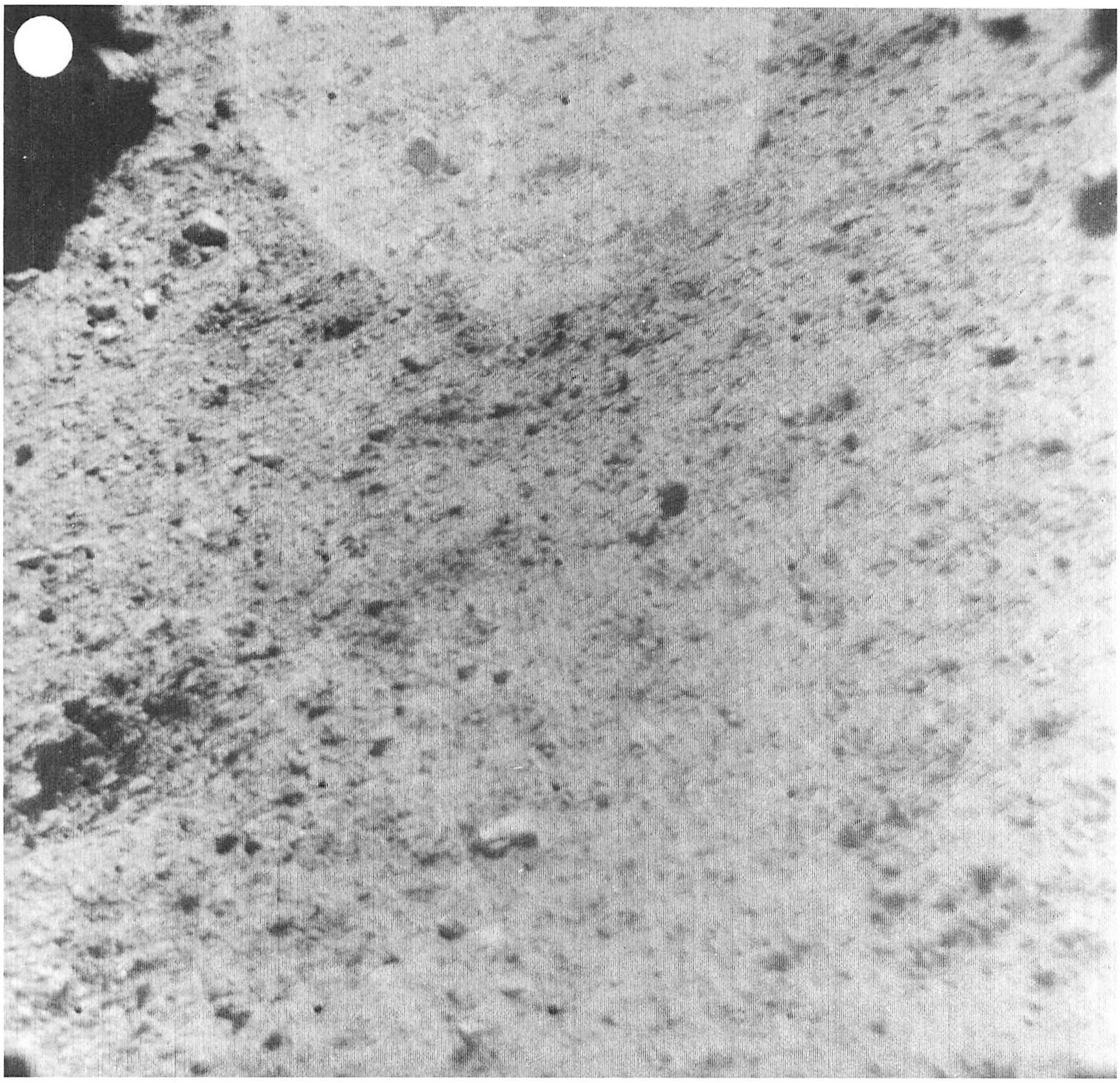


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(140)	Day 012, 10:58:20	−222	−10	10.68	f/10.5	N	Clear

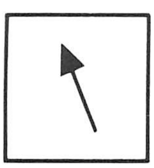


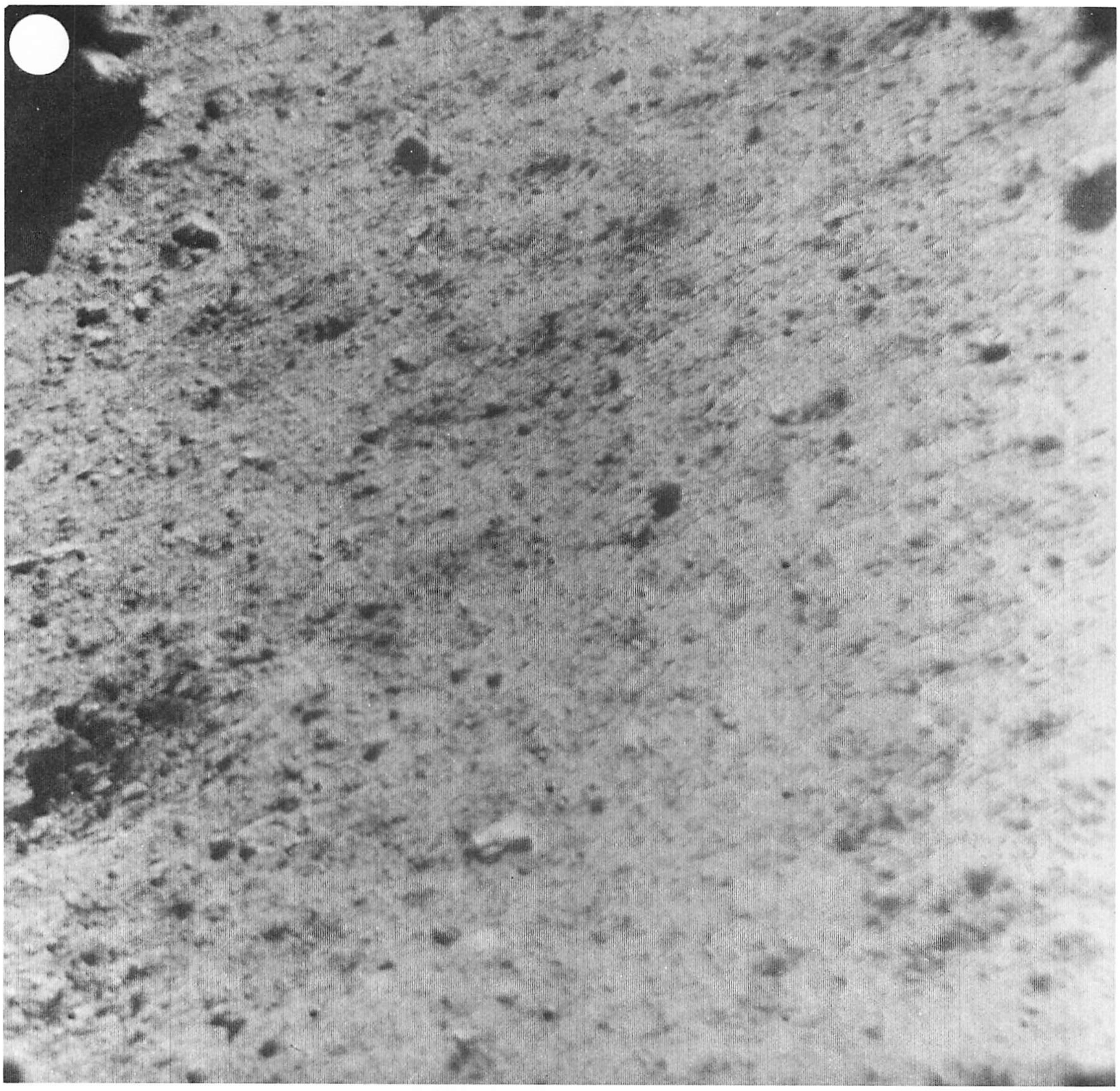
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(141)	**Day 012, 10:58:46**	**—222**	**—5**	**27.73**	***f*/10.5**	**N**	**Clear**



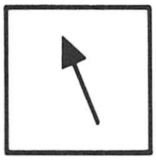


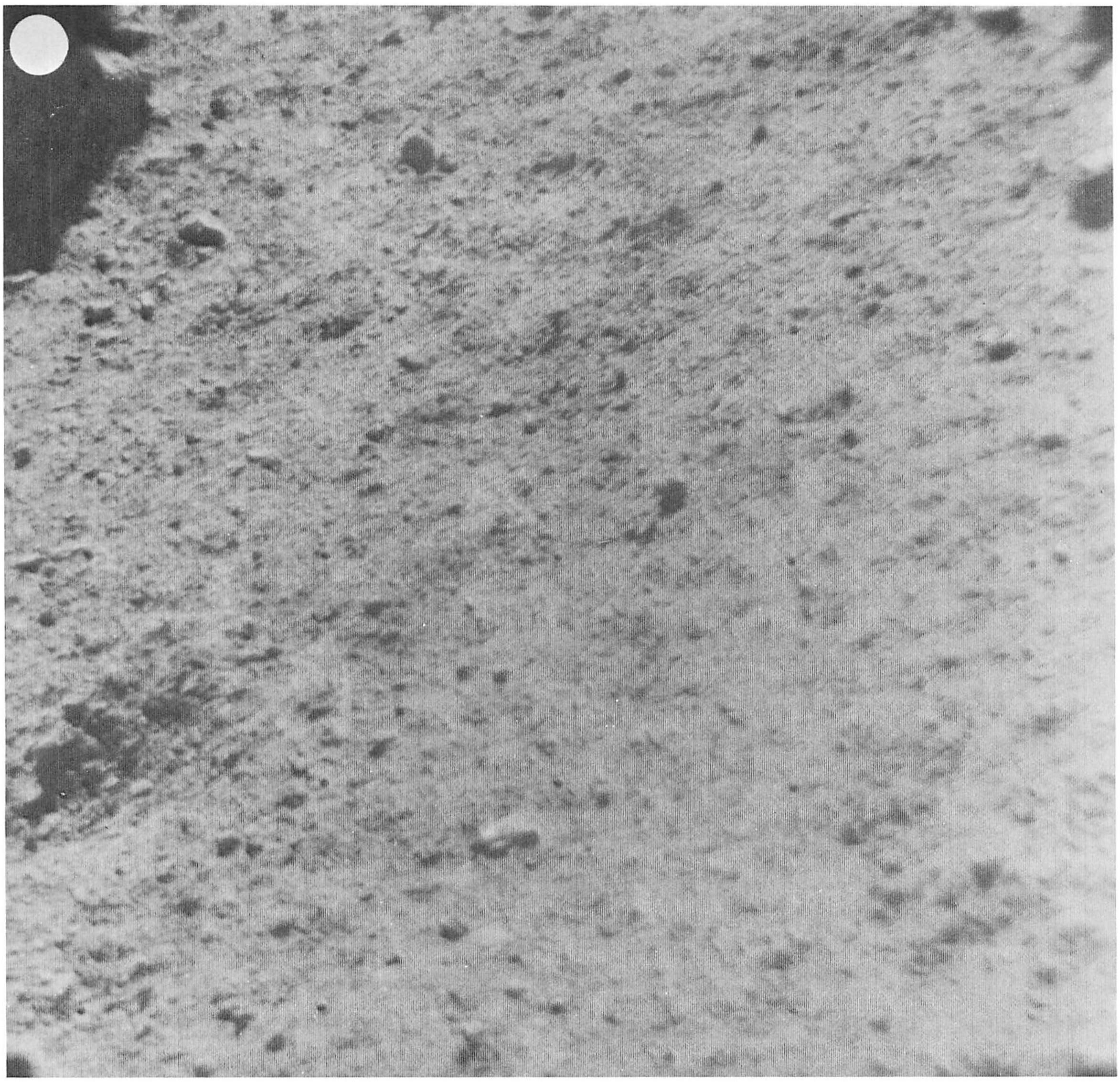
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(142)	Day 013, 00:51:54	—54	—35	4.49	*f*/8.6	N	Clear



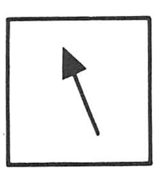


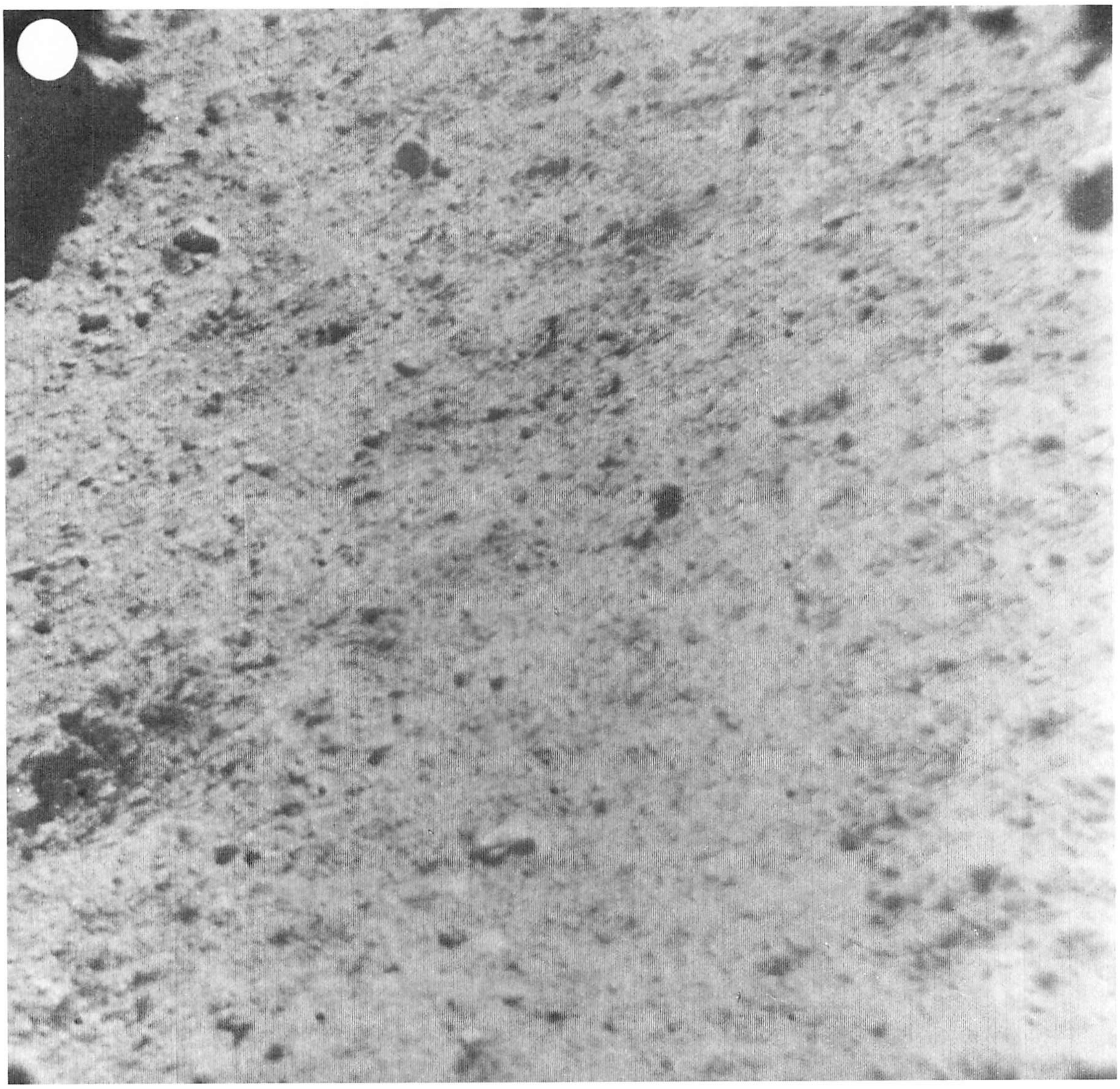
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(143)	**Day 013, 00:52:10**	**—54**	**—35**	**4.49**	***f*/8.6**	**N**	**Horizontal**



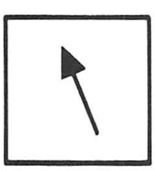


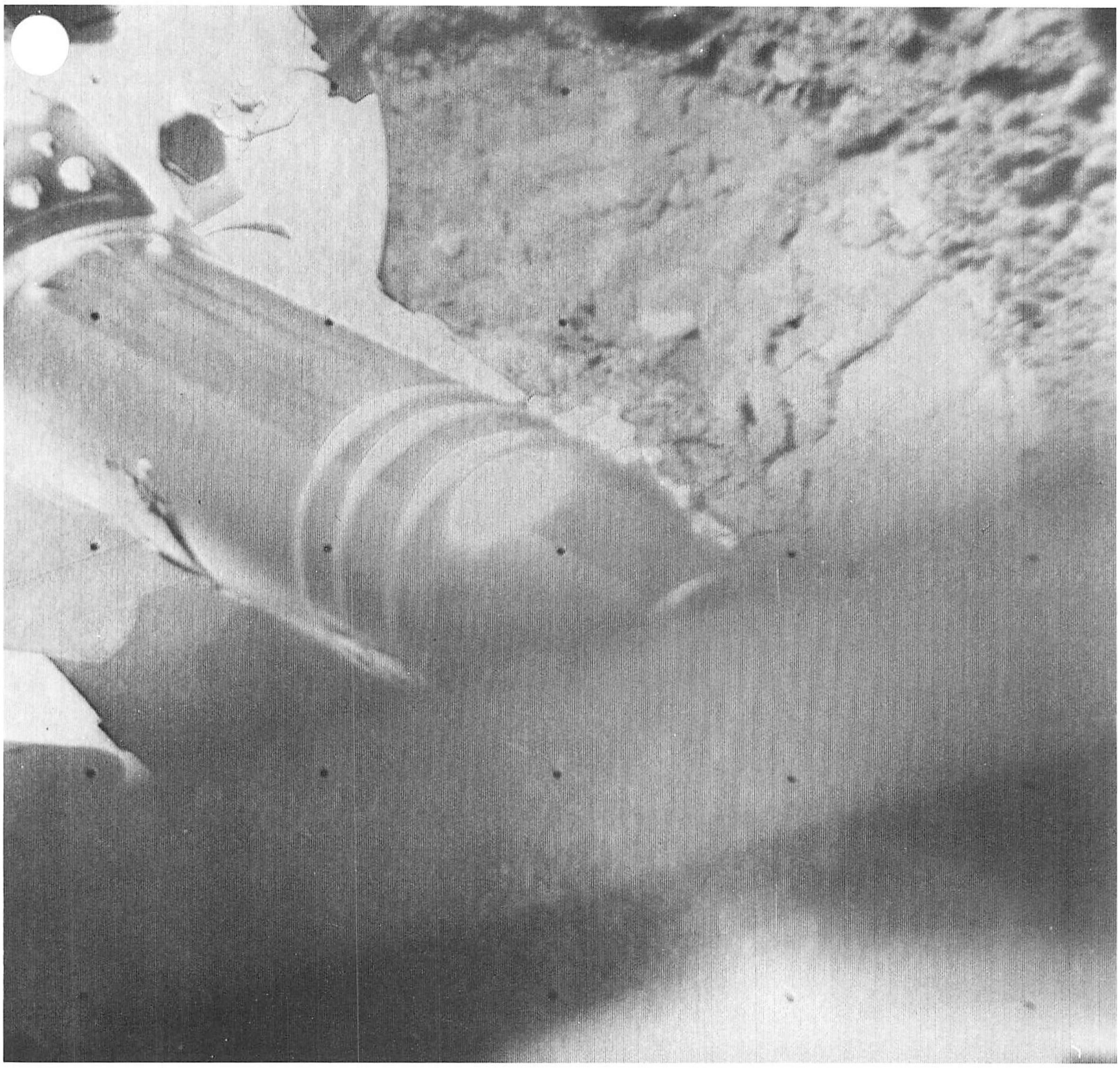
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(144)	**Day 013, 00:52:24**	**—54**	**—35**	**4.49**	***f*/8.6**	**N**	**45 Diagonal**



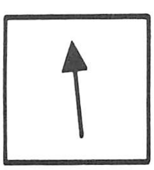


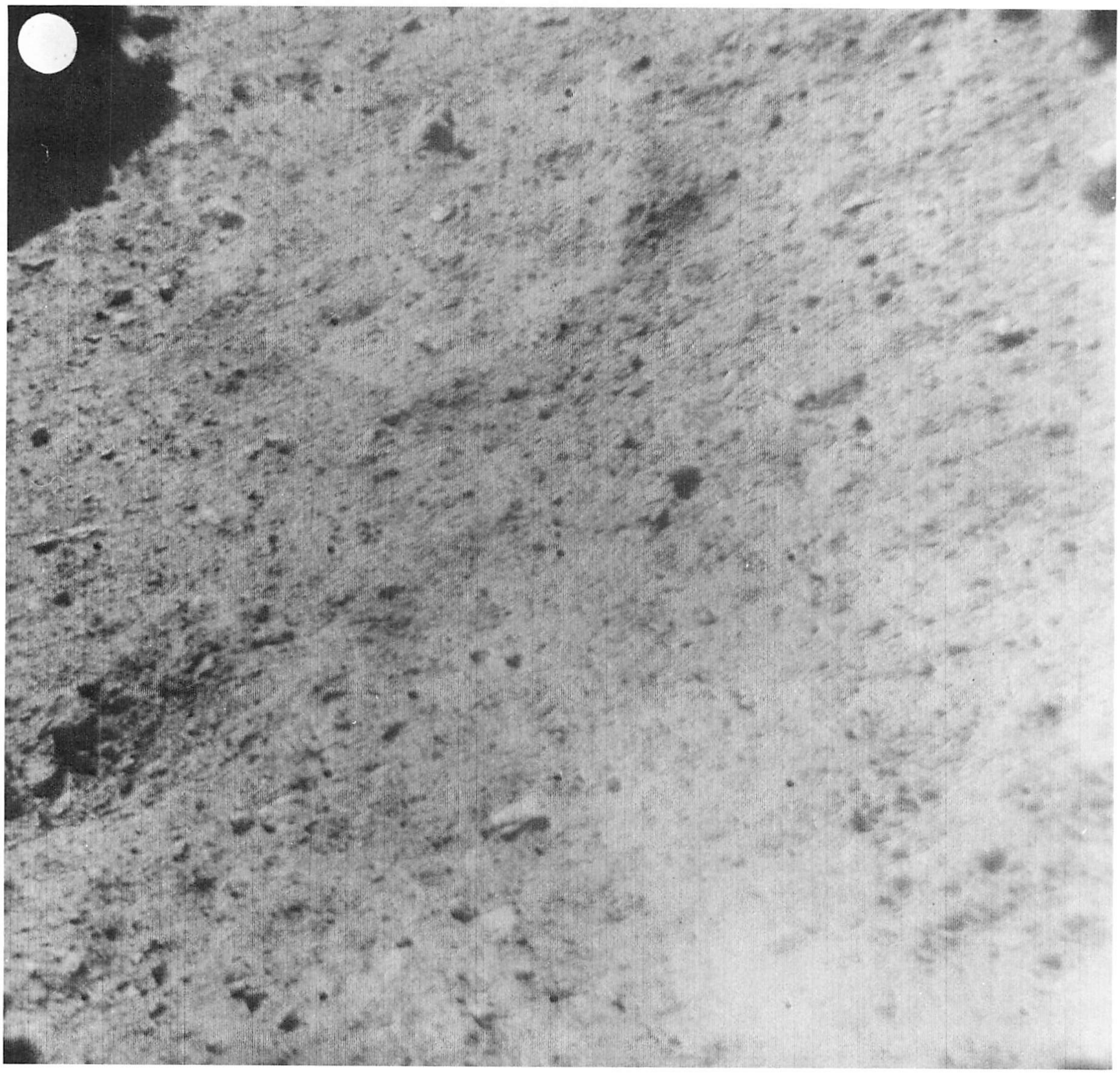
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(145)	**Day 013, 00:52:40**	**—54**	**—35**	**4.49**	***f*/8.6**	**N**	**Vertical**



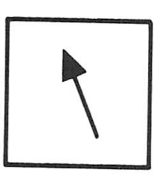


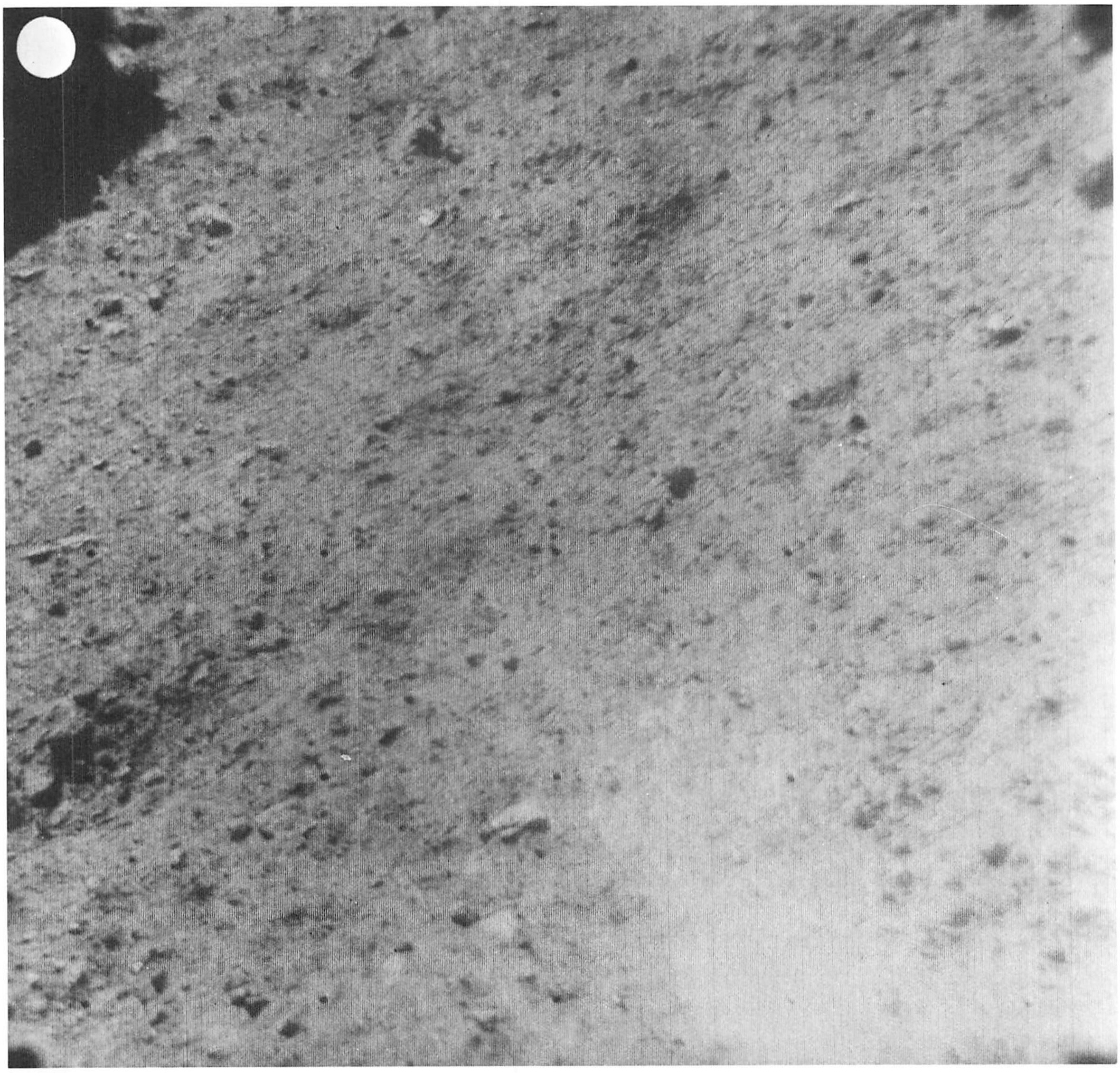
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(146)	Day 014, 10:23:40	−72	−60	2.18	f/9.0	N	Clear



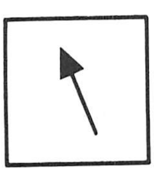


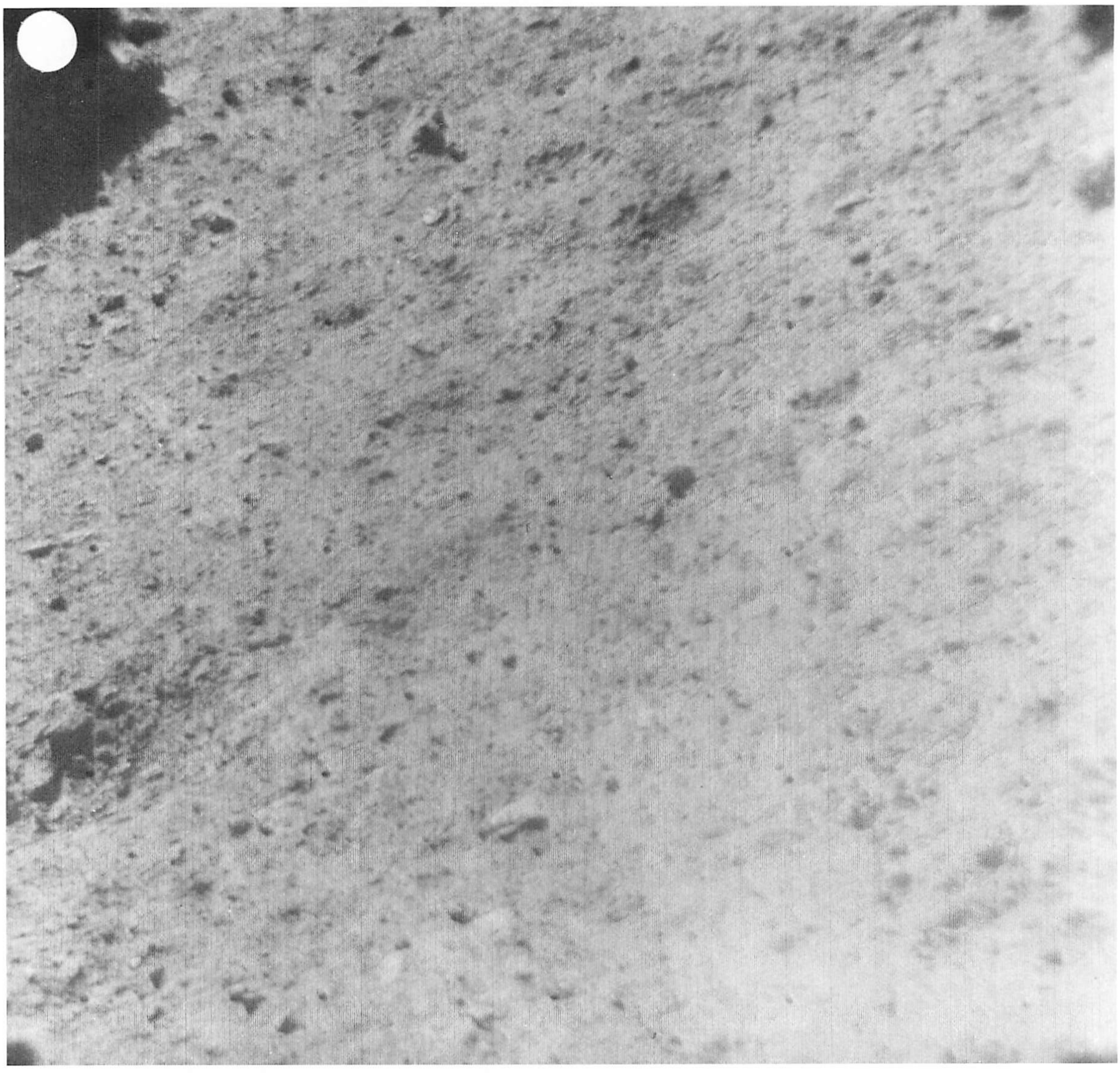
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(147)	Day 014, 10:49:59	−54	−35	4.49	f/9.9	N	Clear



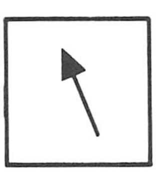


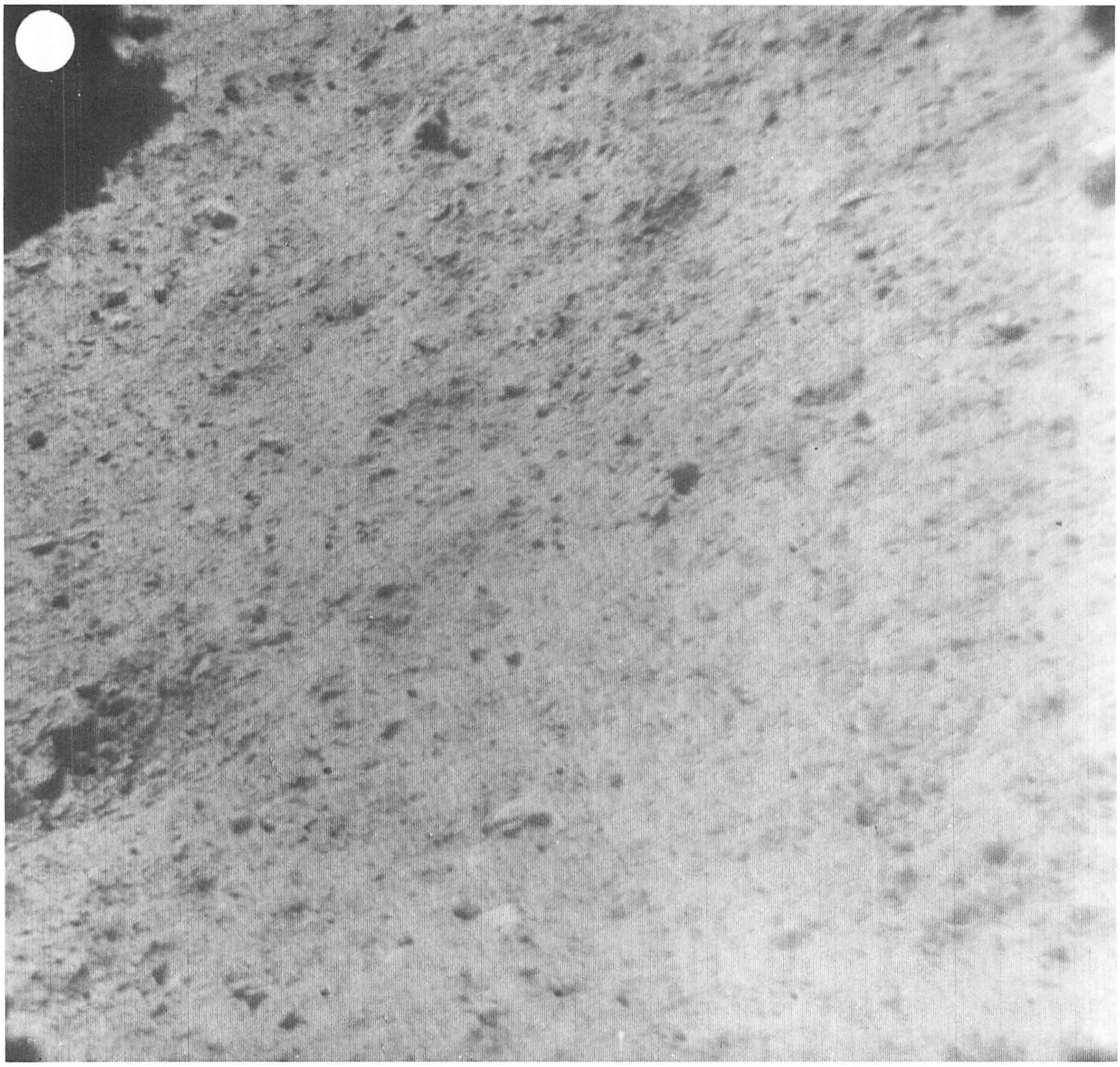
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(148)	Day 014, 10:50:14	−54	−35	4.49	f/9.9	N	Horizontal



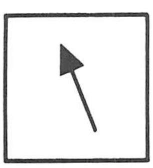


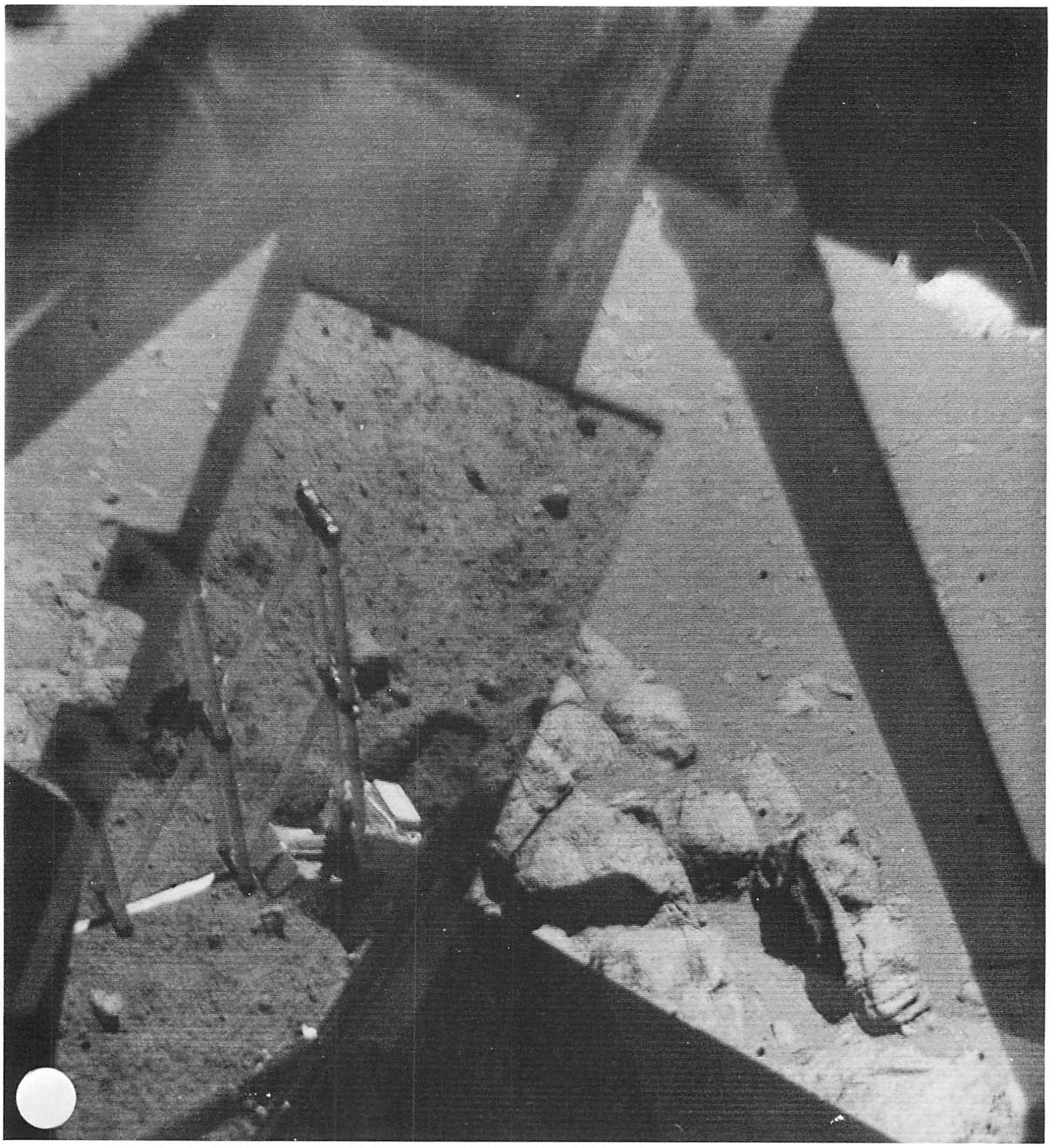
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(149)	**Day 014, 10:50:30**	**—54**	**—35**	**4.49**	**f/9.9**	**N**	**45 Diagonal**



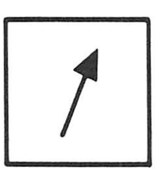


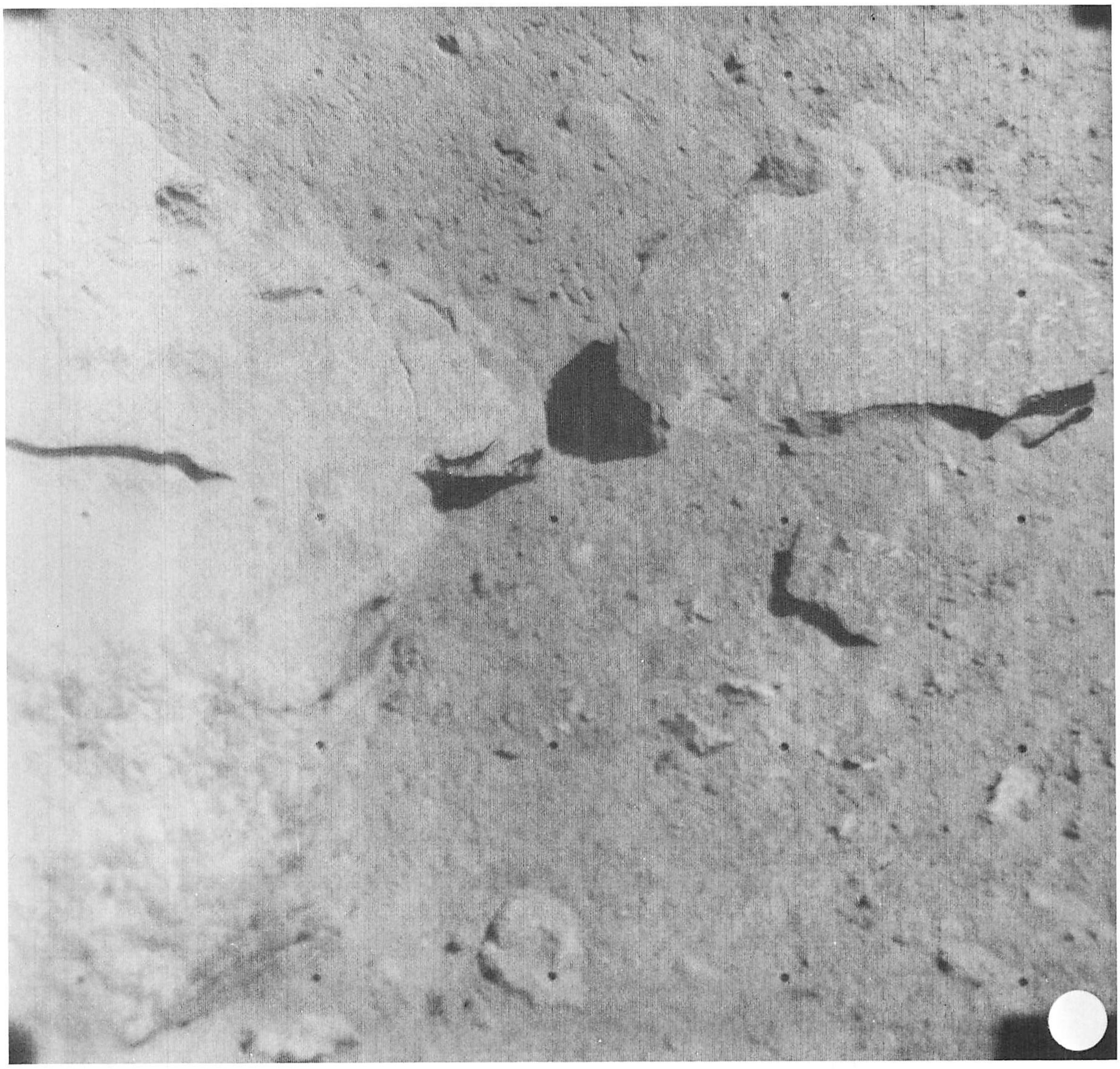
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(150)	Day 014, 10:50:46	−54	−35	4.49	f/9.9	N	Vertical



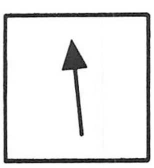


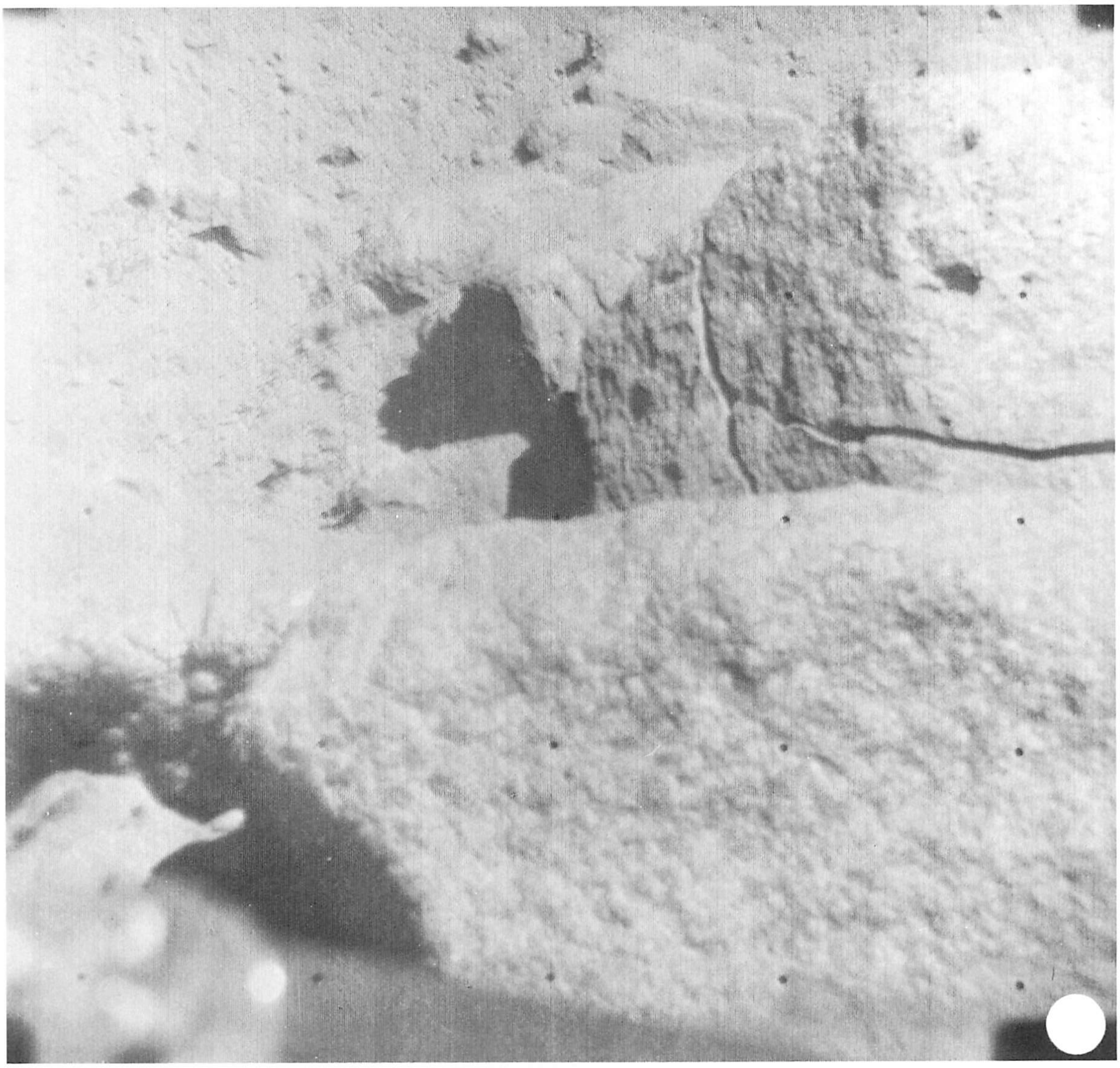
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(151)	Day 015, 07:29:43	−216	−5	2.43	f/14.2	W	Clear



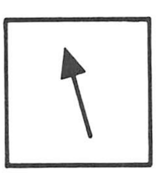


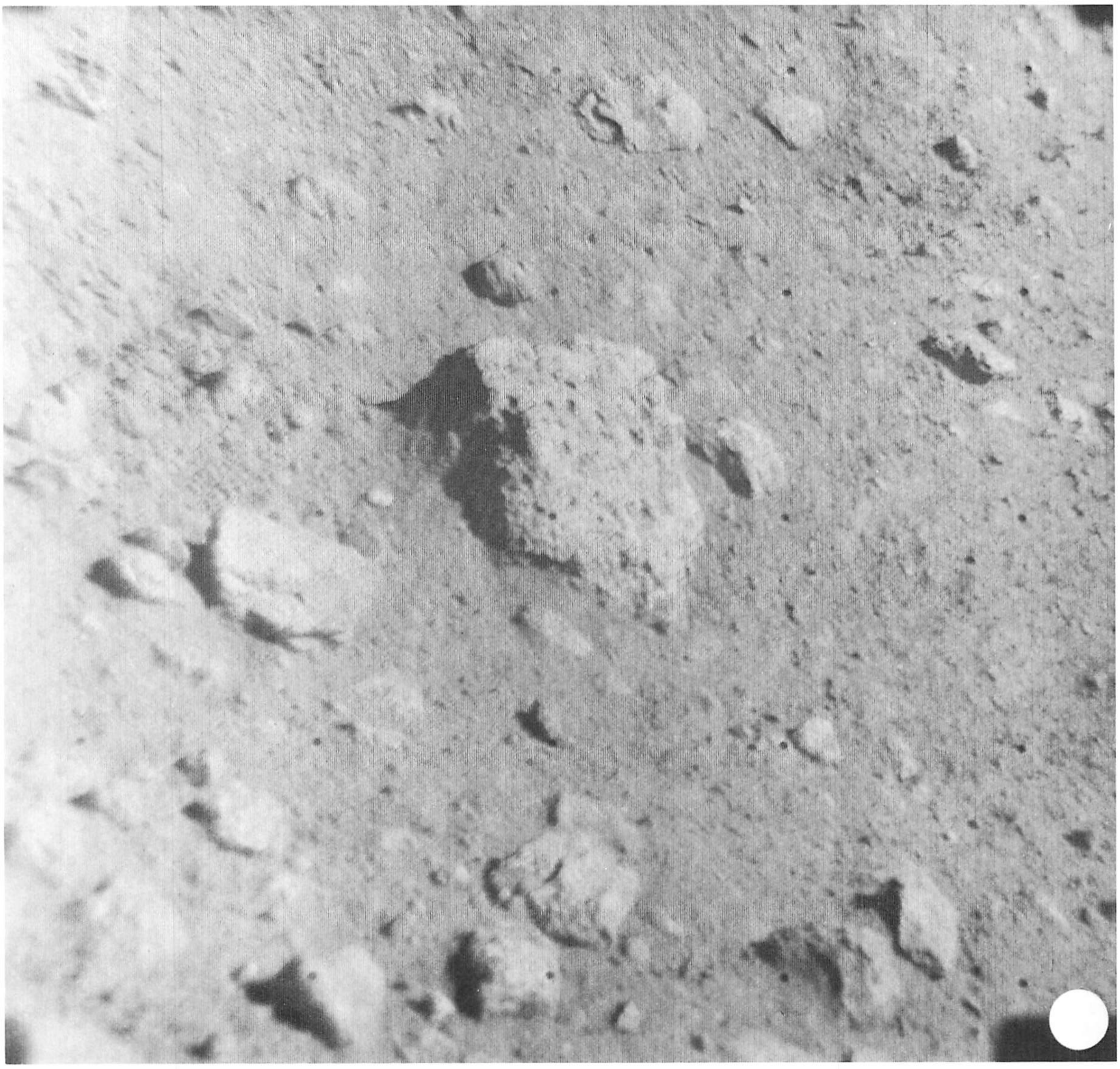
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(152)	Day 015, 11:51:31	87	−15	4.21	f/12.1	N	Clear



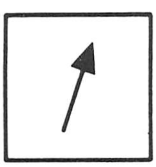


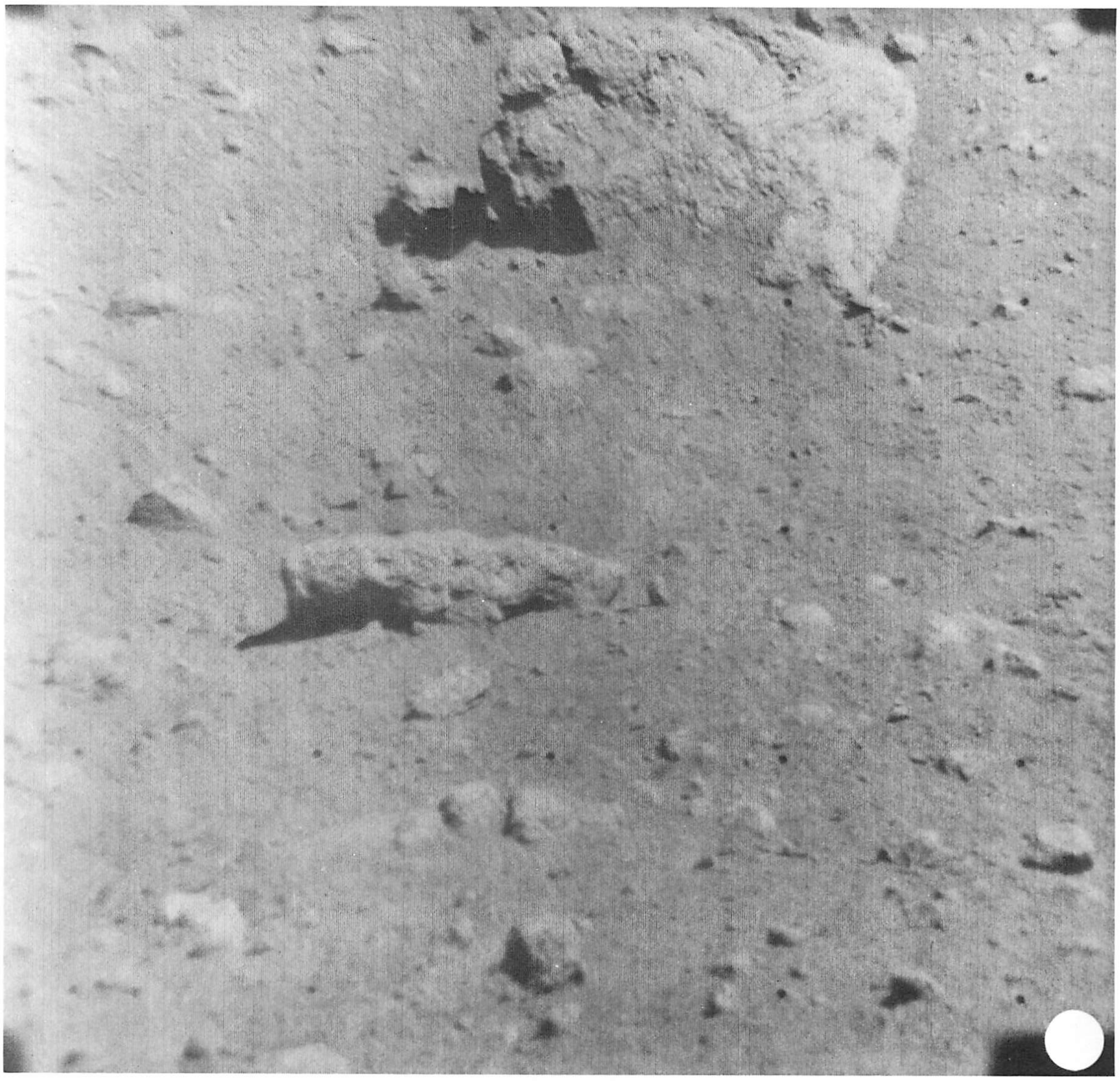
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(153)	Day 015, 11:51:36	93	—15	4.21	f/12.1	N	Clear



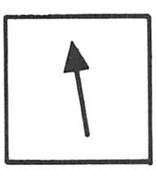


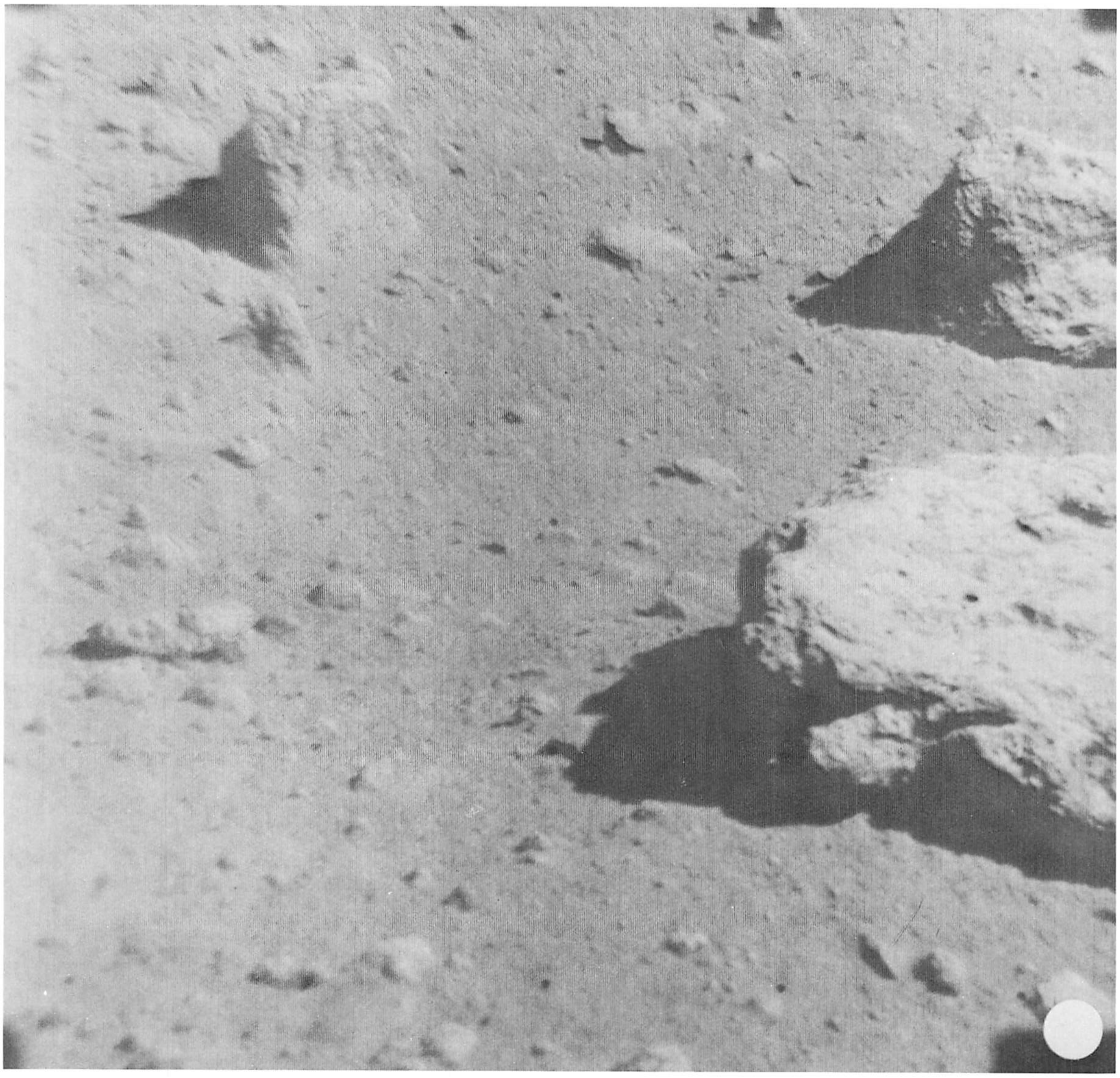
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(154)	**Day 015, 11:52:02**	**66**	**—10**	**4.49**	***f*/12.1**	**N**	**Clear**



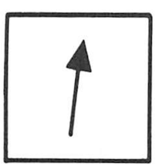


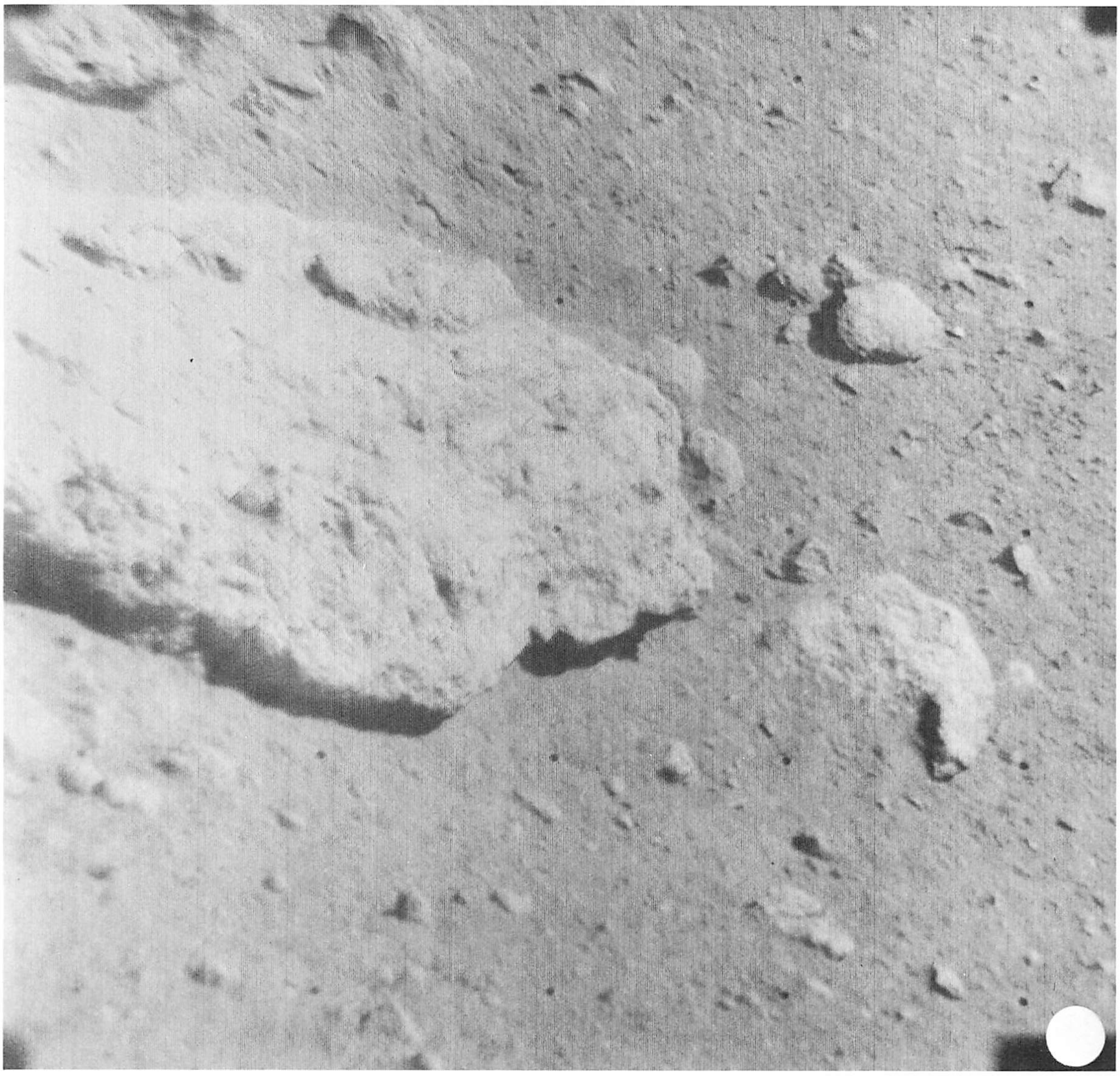
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(155)	Day 015, 12:15:11	90	0	8.97	f/11.6	N	Clear



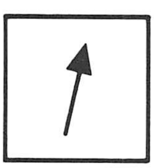


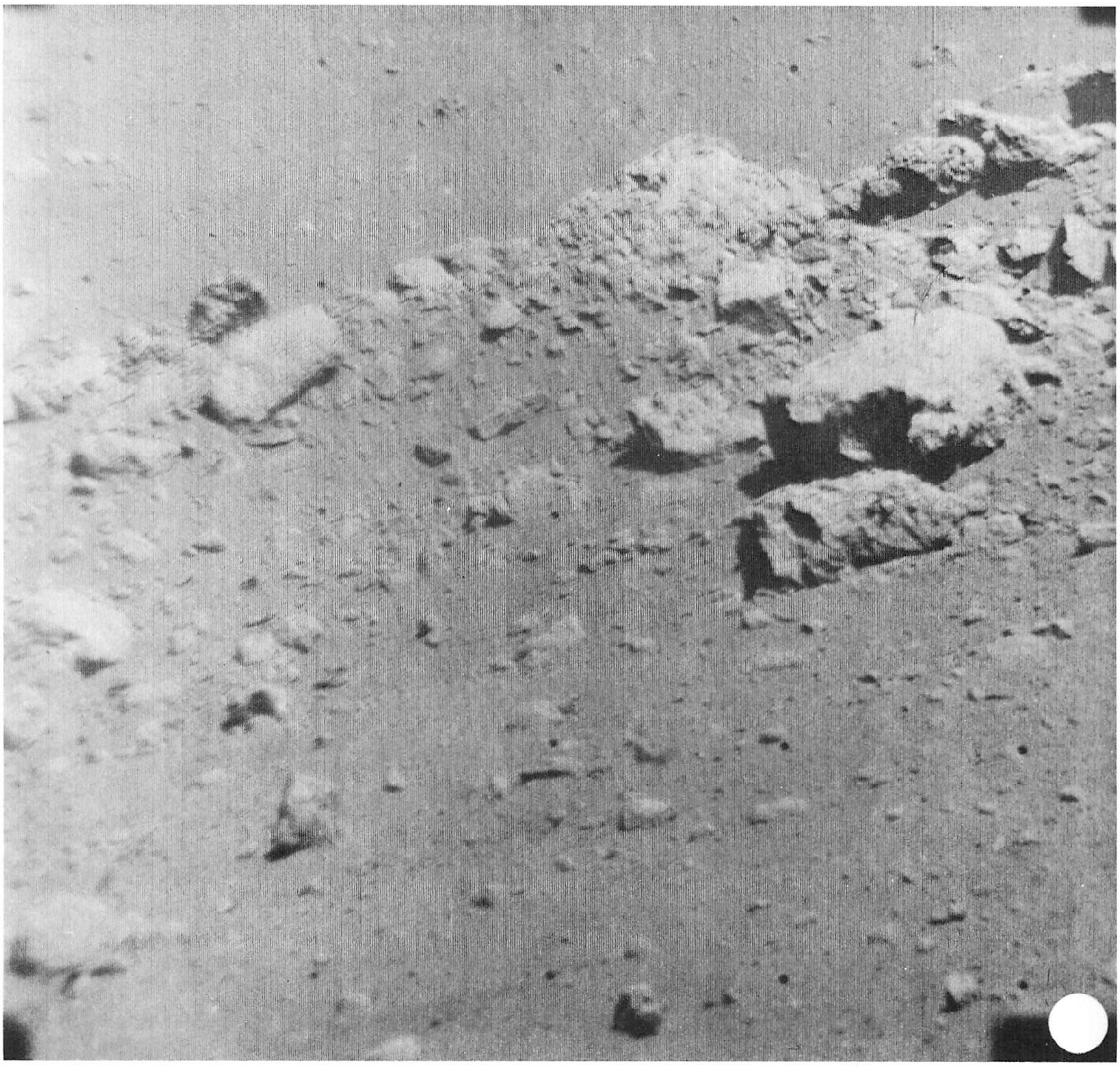
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(156)	Day 015, 12:15:21	78	0	7.76	f/11.6	N	Clear



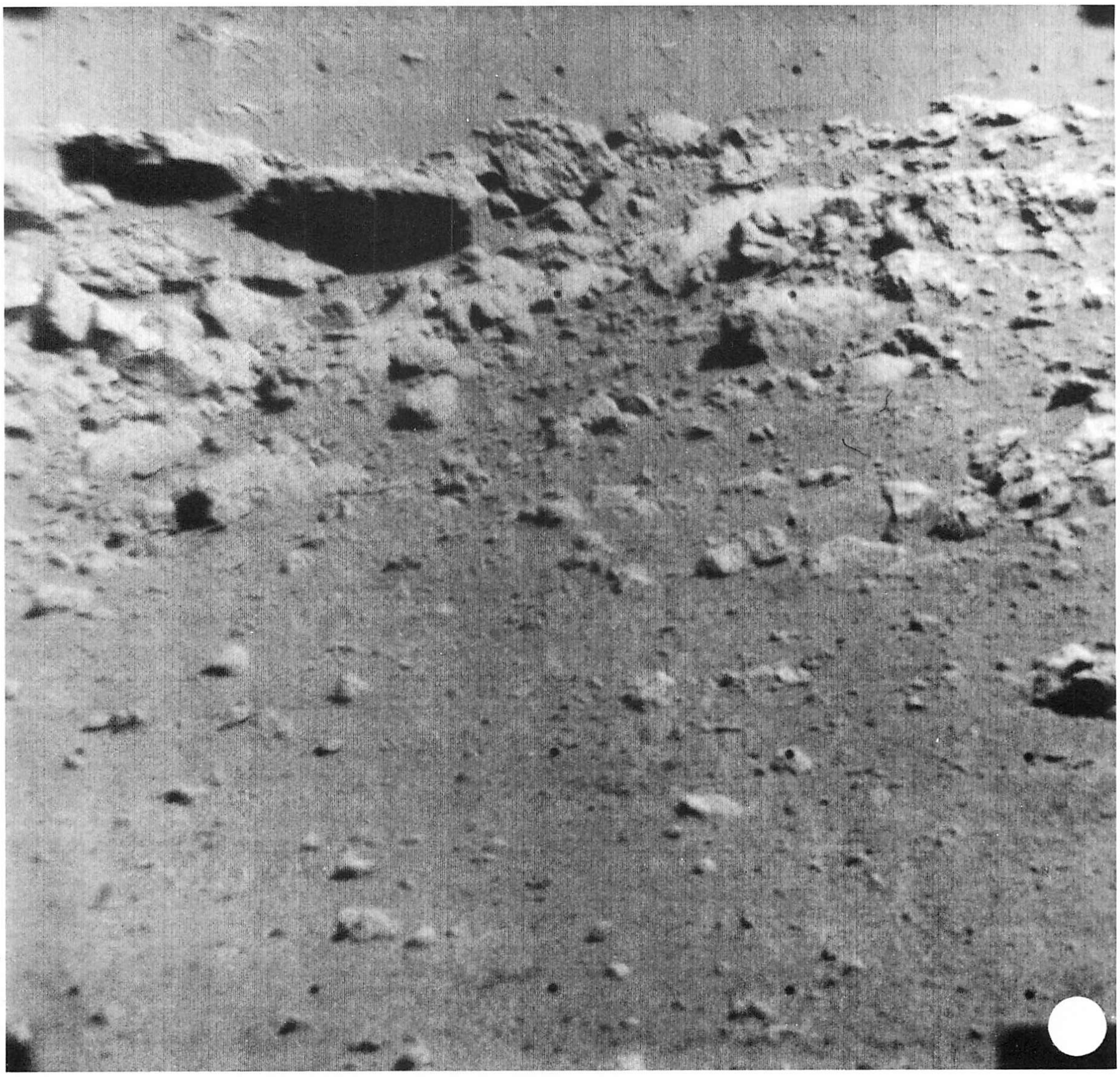


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(157)	Day 015, 12:15:24	72	0	7.76	f/11.6	N	Clear

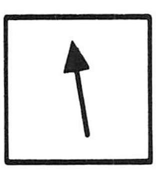


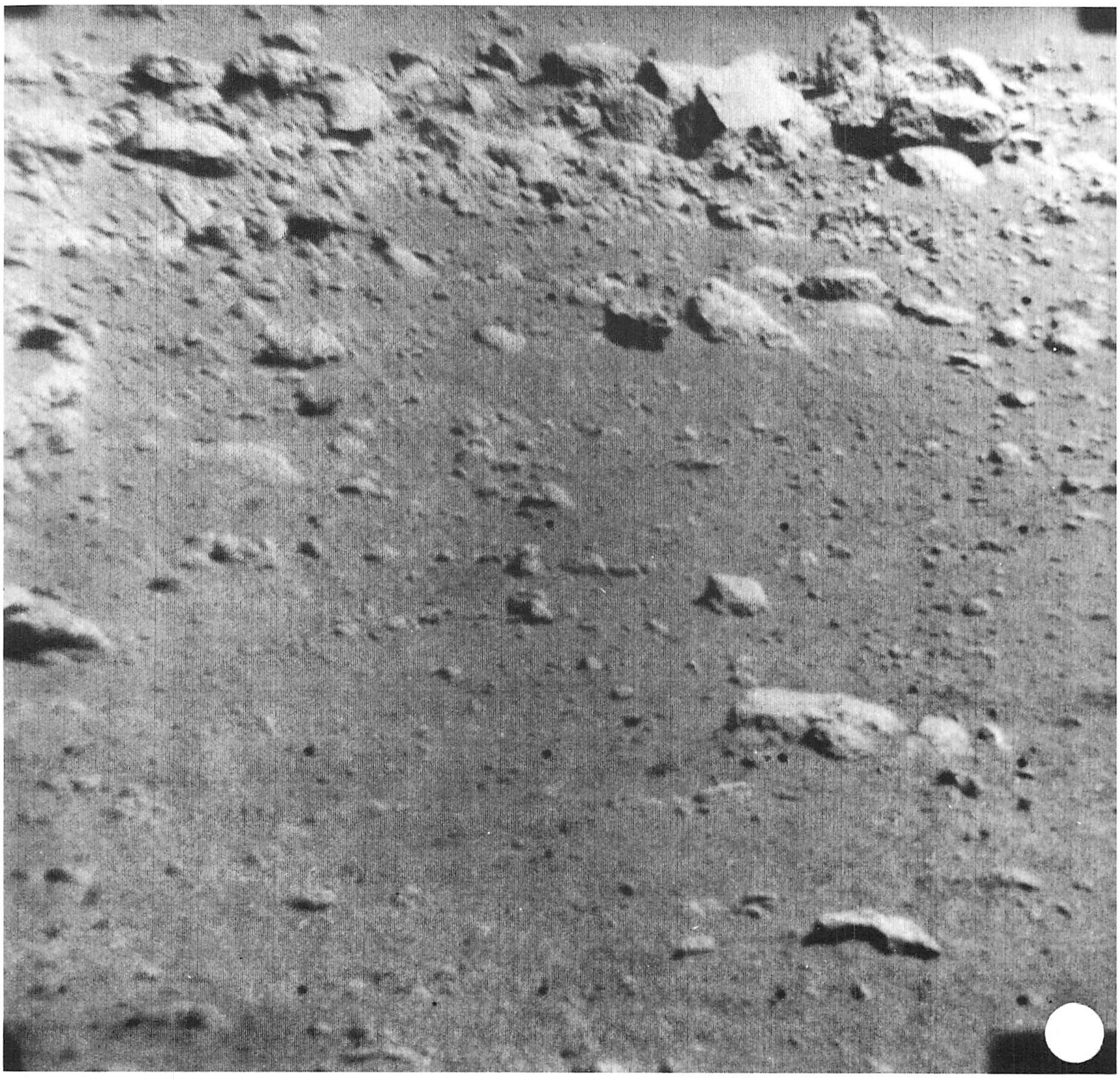


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(158)	Day 015, 12:16:02	96	10	205.24	f/11.6	N	Clear

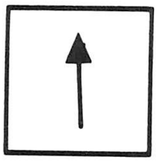


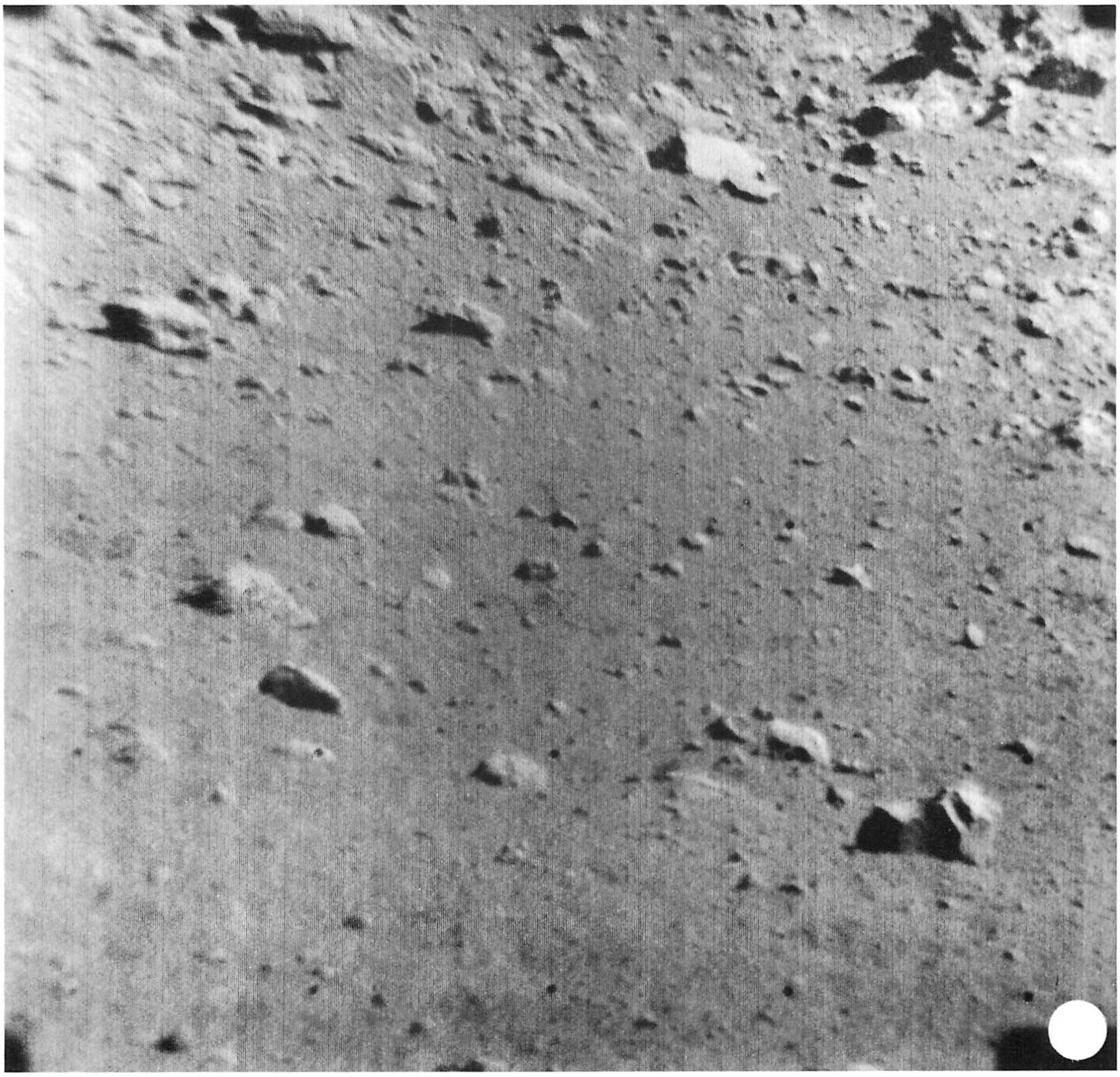
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(159)	**Day 015, 12:16:06**	**90**	**10**	**205.24**	***f*/11.6**	**N**	**Clear**



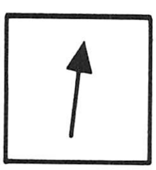


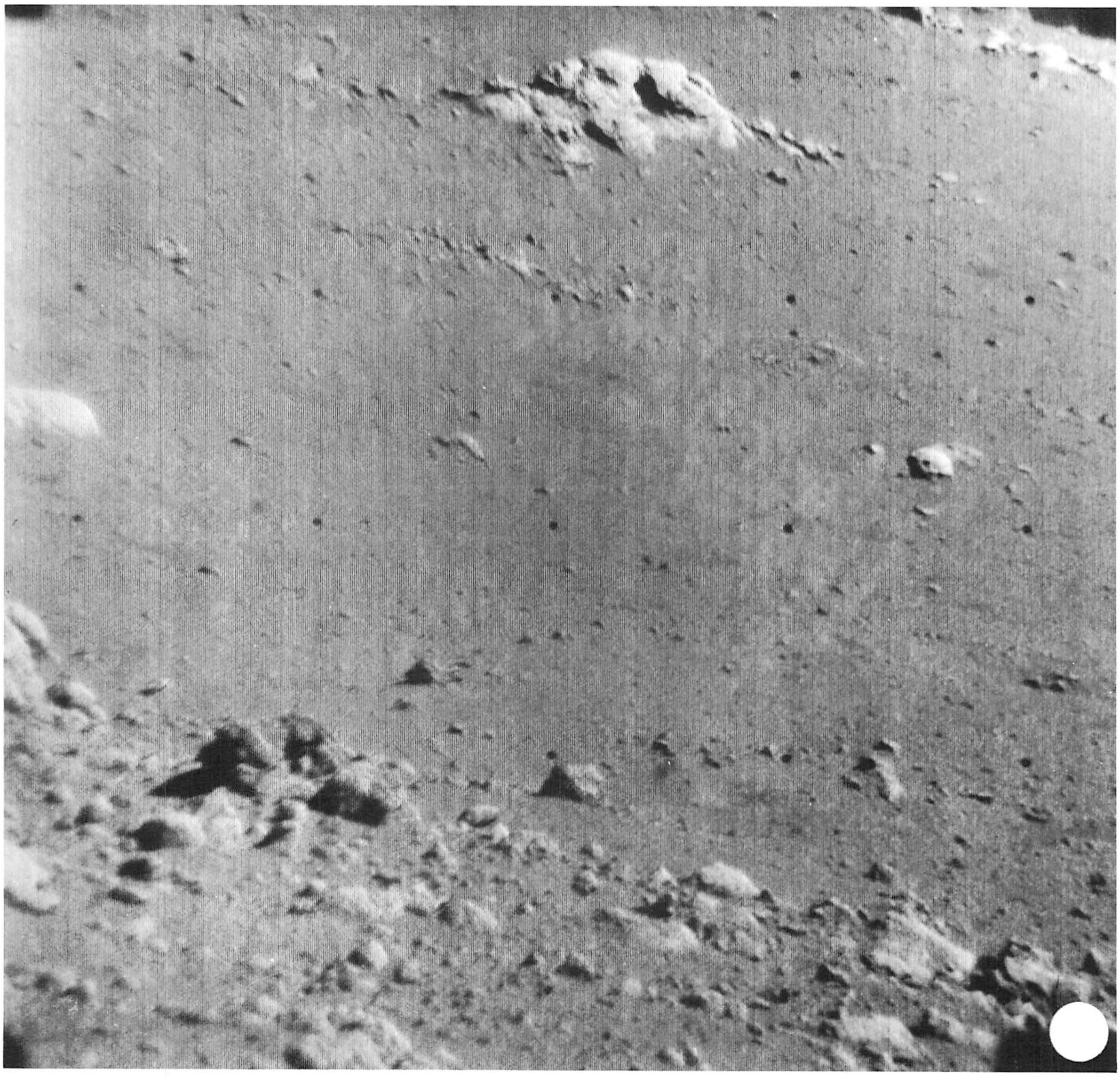
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(160)	Day 015, 12:16:10	84	10	205.24	f/11.6	N	Clear



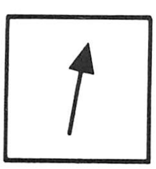


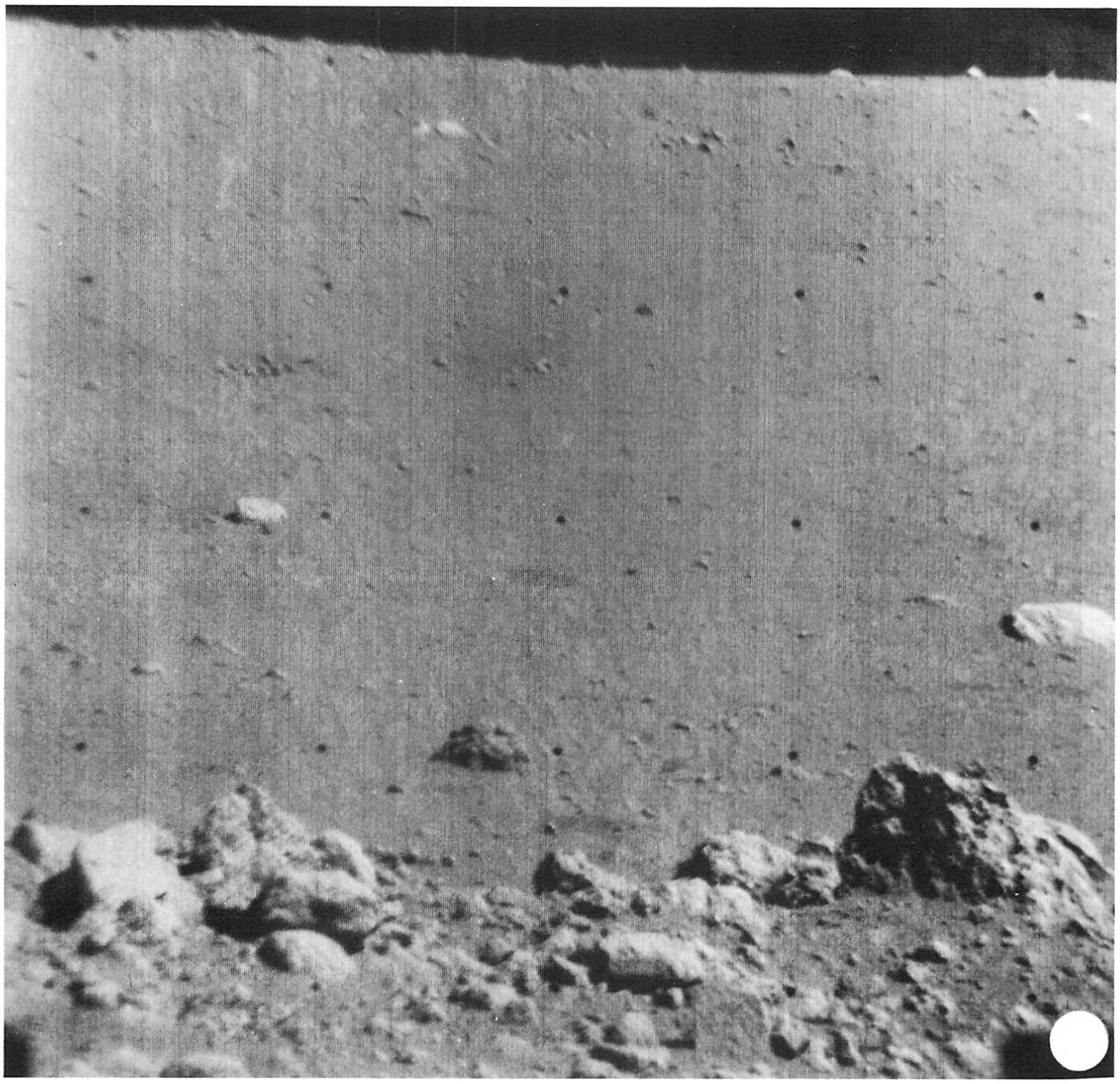
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(161)	Day 015, 12:16:15	78	10	205.24	$f/11.6$	N	Clear



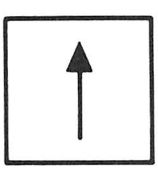


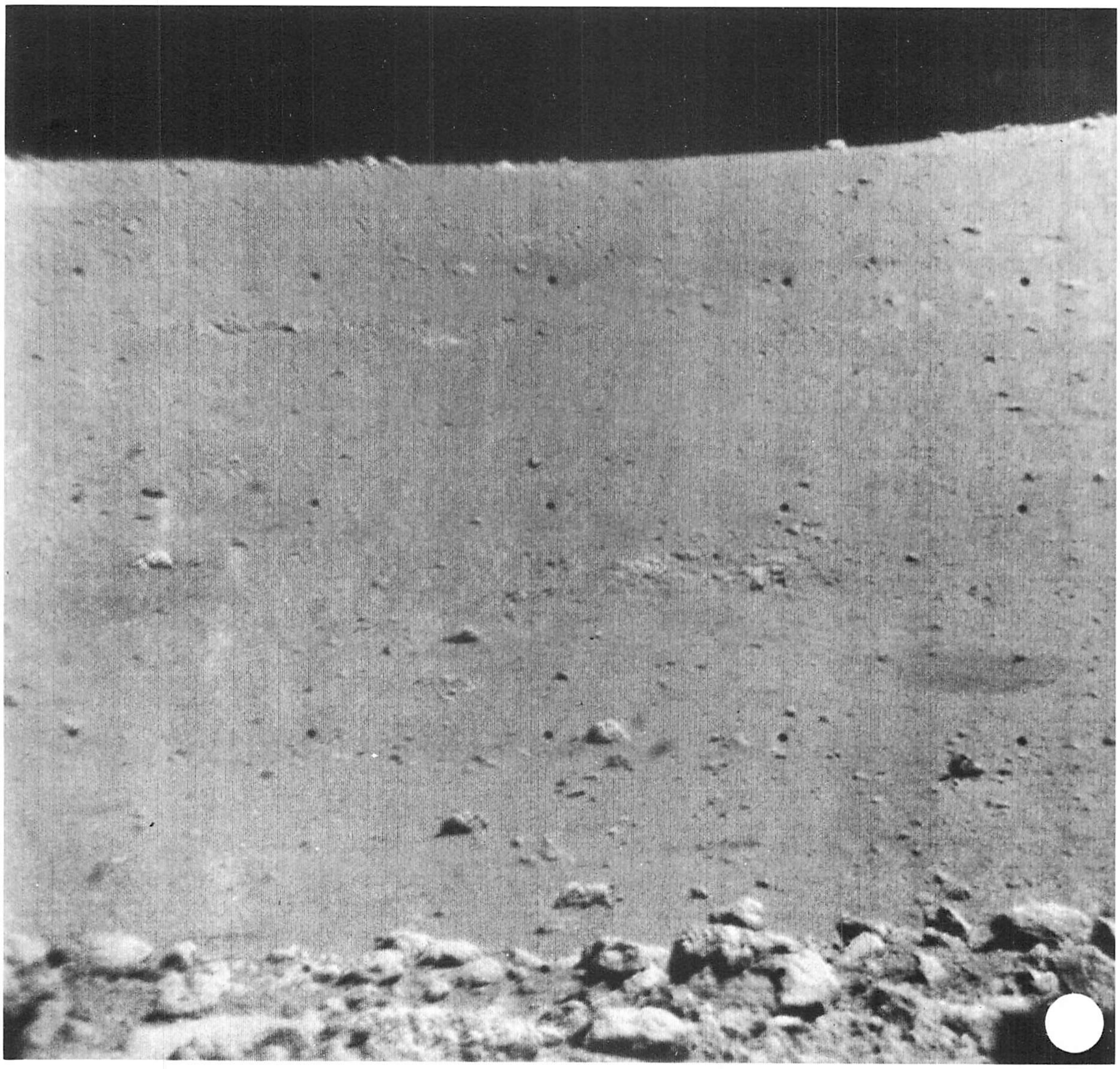
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(162)	Day 015, 12:16:38	75	15	205.24	f/11.6	N	Clear



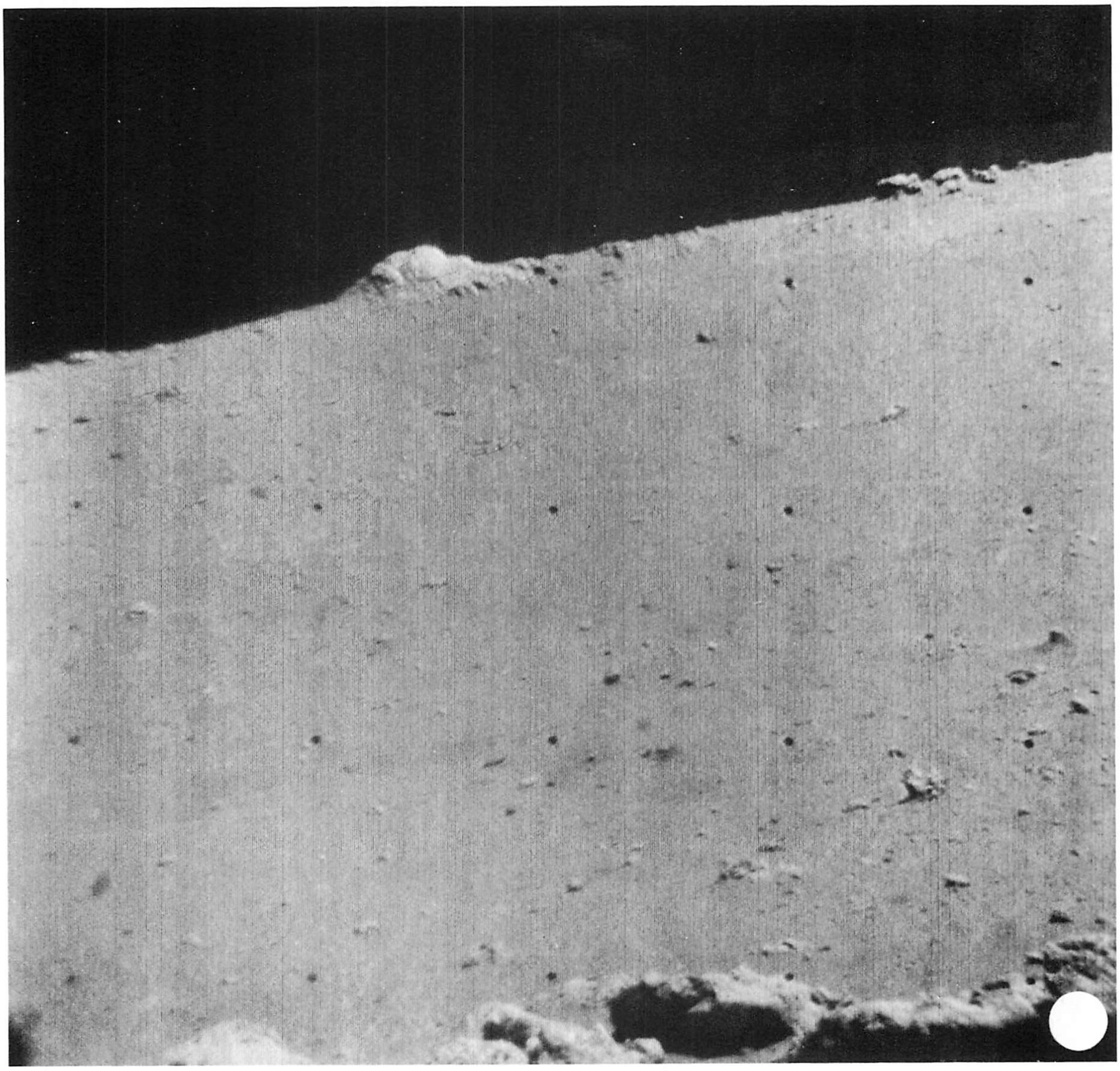


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(163)	Day 015, 12:16:41	81	15	205.24	f/11.6	N	Clear

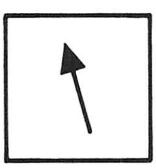


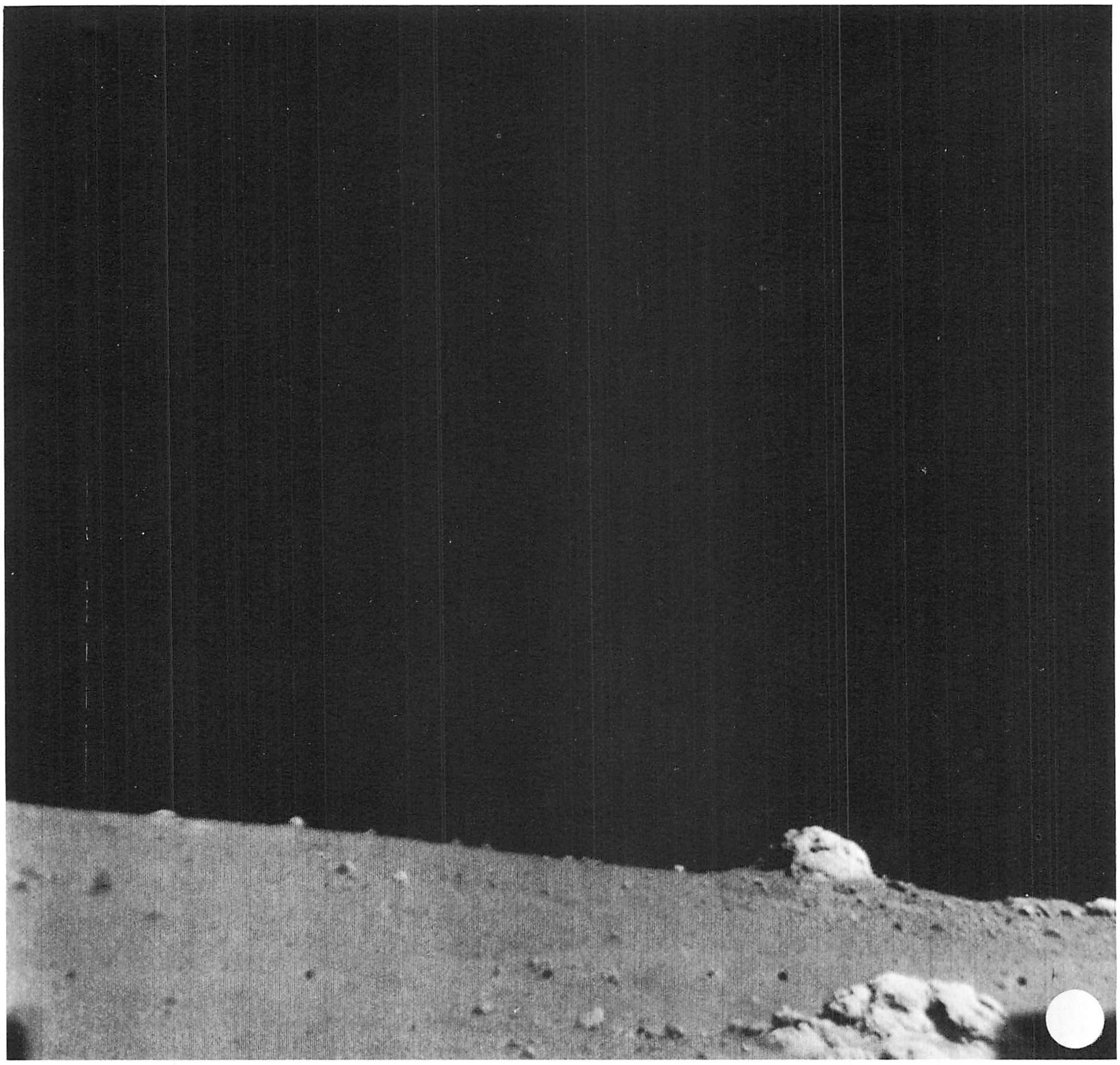


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(164)	**Day 015, 12:16:46**	**87**	**15**	**205.24**	***f*/11.6**	**N**	**Clear**

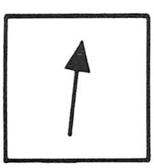


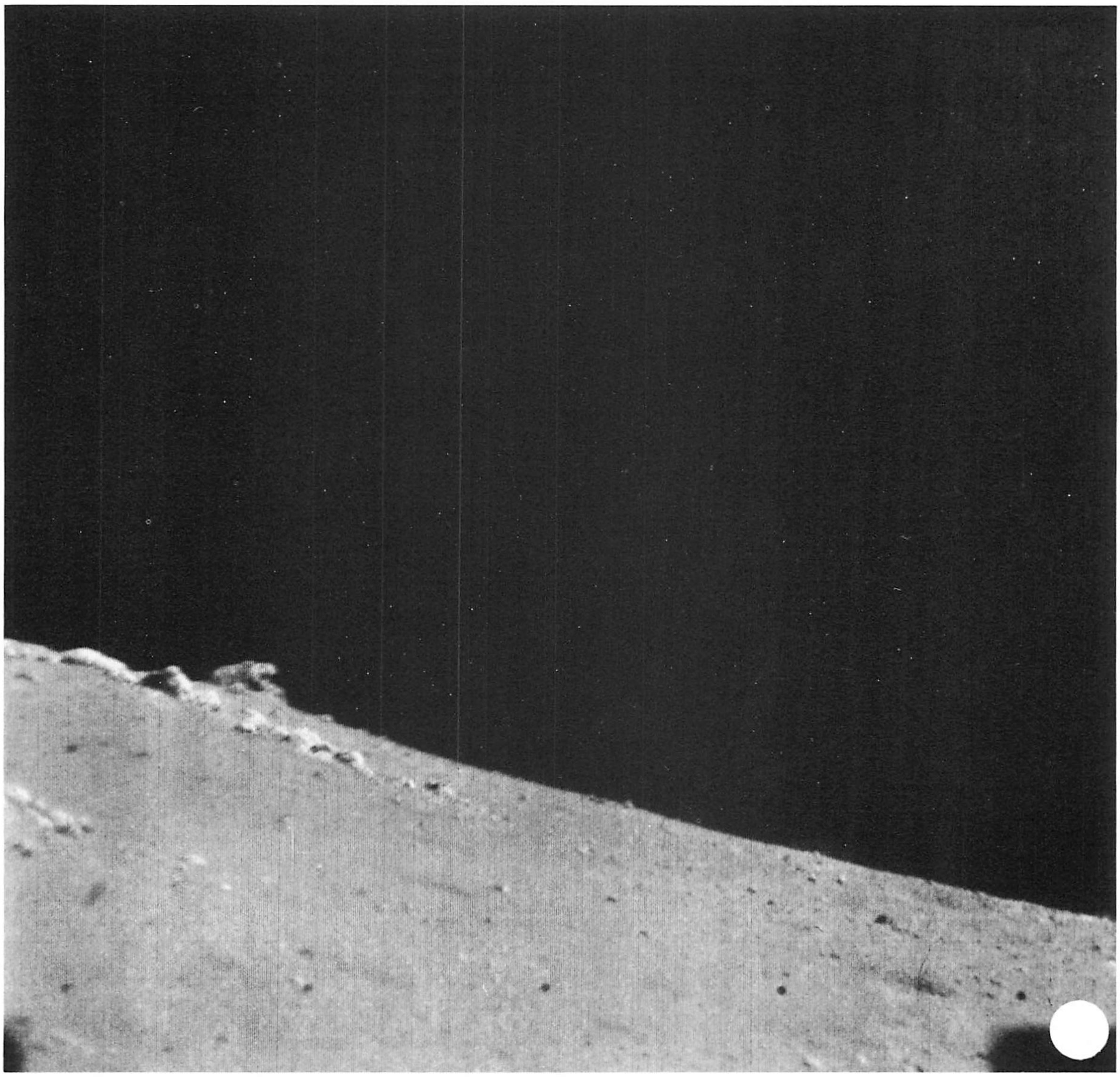
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(165)	**Day 015, 12:16:51**	**93**	**15**	**205.24**	***f*/11.6**	**N**	**Clear**



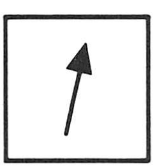


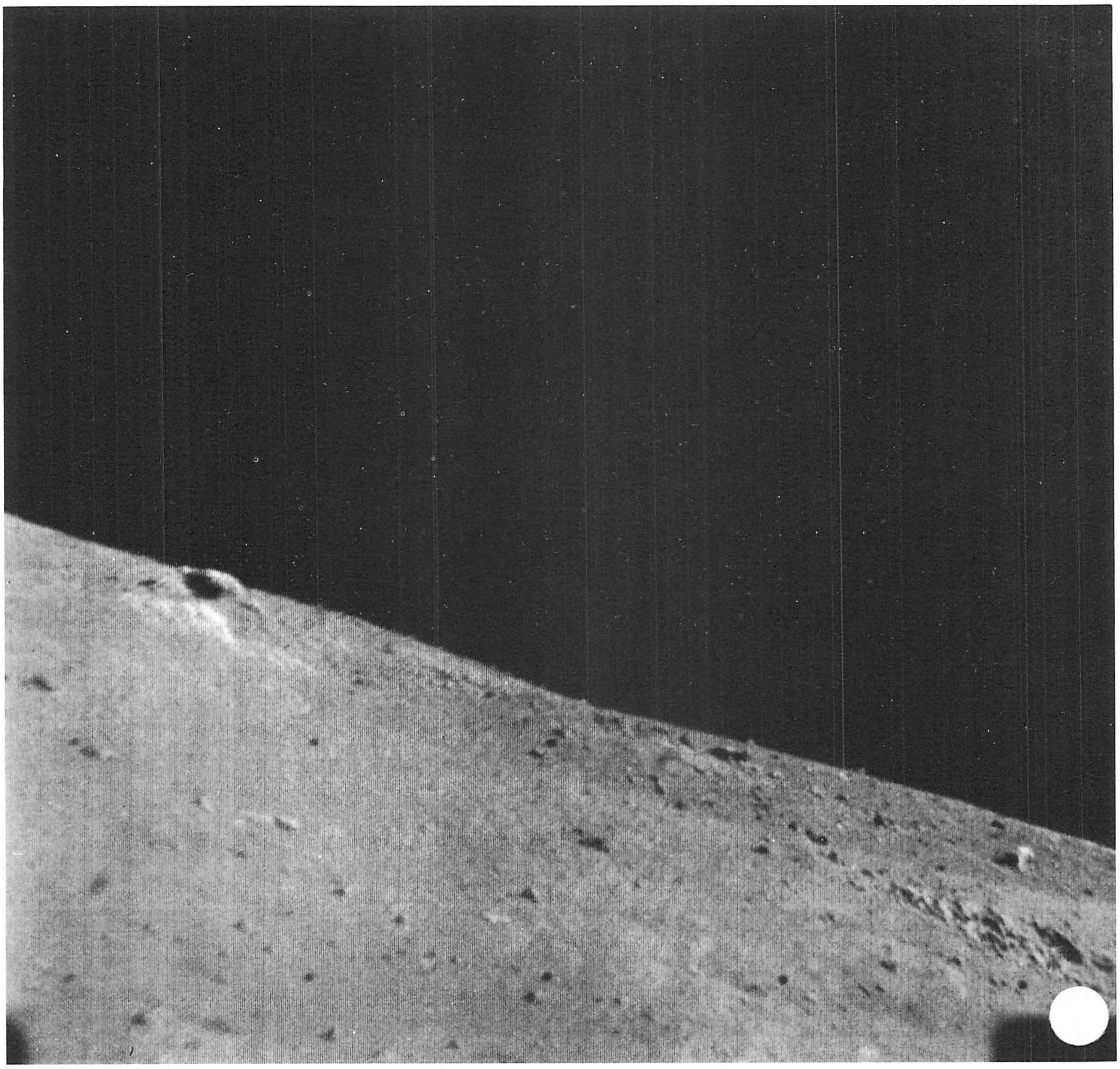
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(166)	**Day 015, 12:17:09**	**78**	**20**	**205.24**	***f*/11.6**	**N**	**Clear**



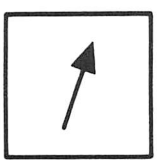


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(167)	Day 015, 12:17:14	72	20	205.24	f/11.6	N	Clear

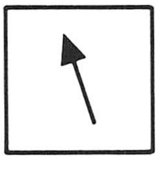


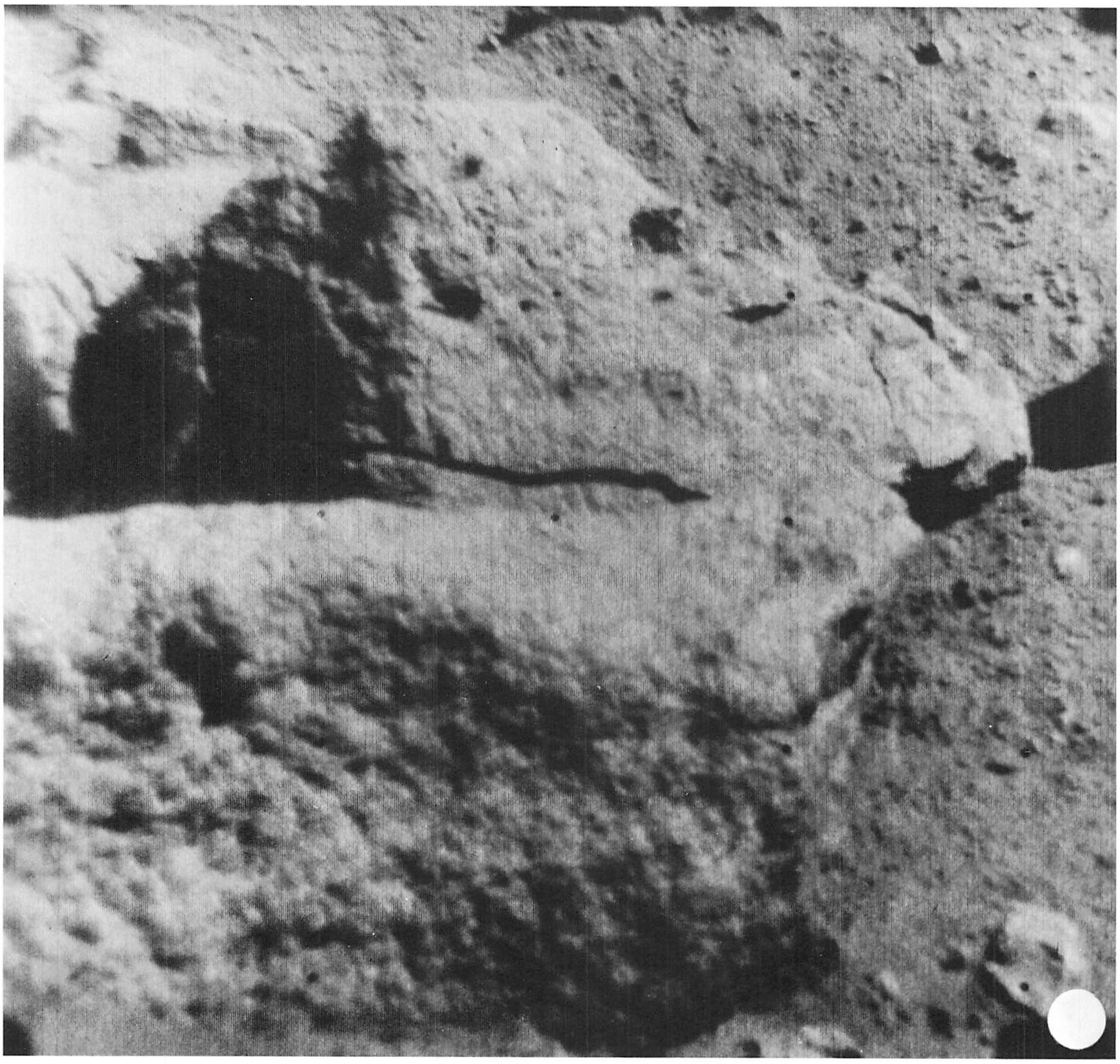


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(168)	**Day 015, 12:17:17**	**66**	**20**	**205.24**	***f*/11.6**	**N**	**Clear**

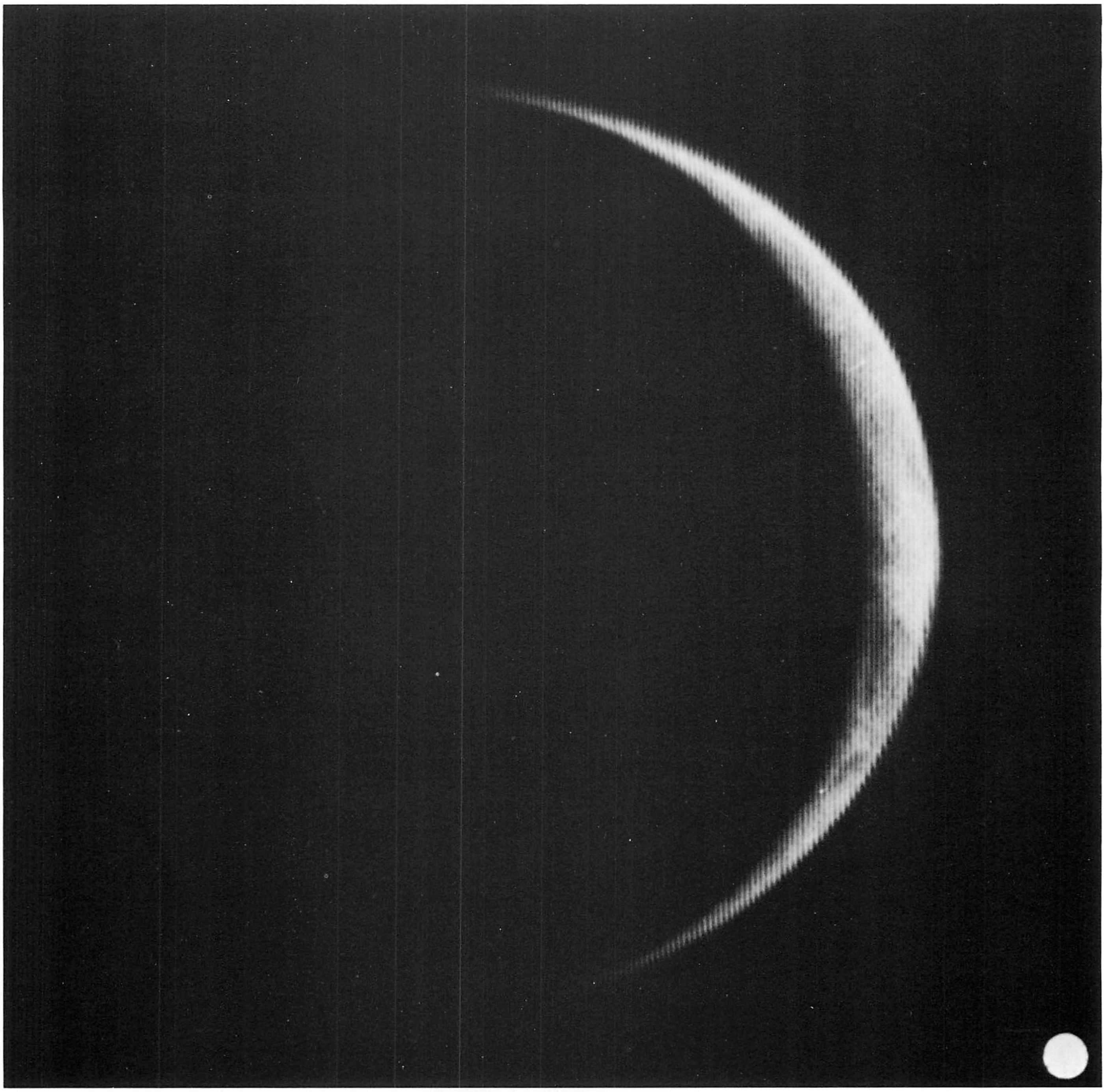


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(169)	**Day 016, 09:05:36**	**—57**	**—60**	**2.12**	***f*/12.1**	**N**	**Clear**

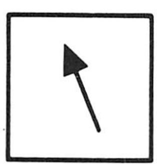


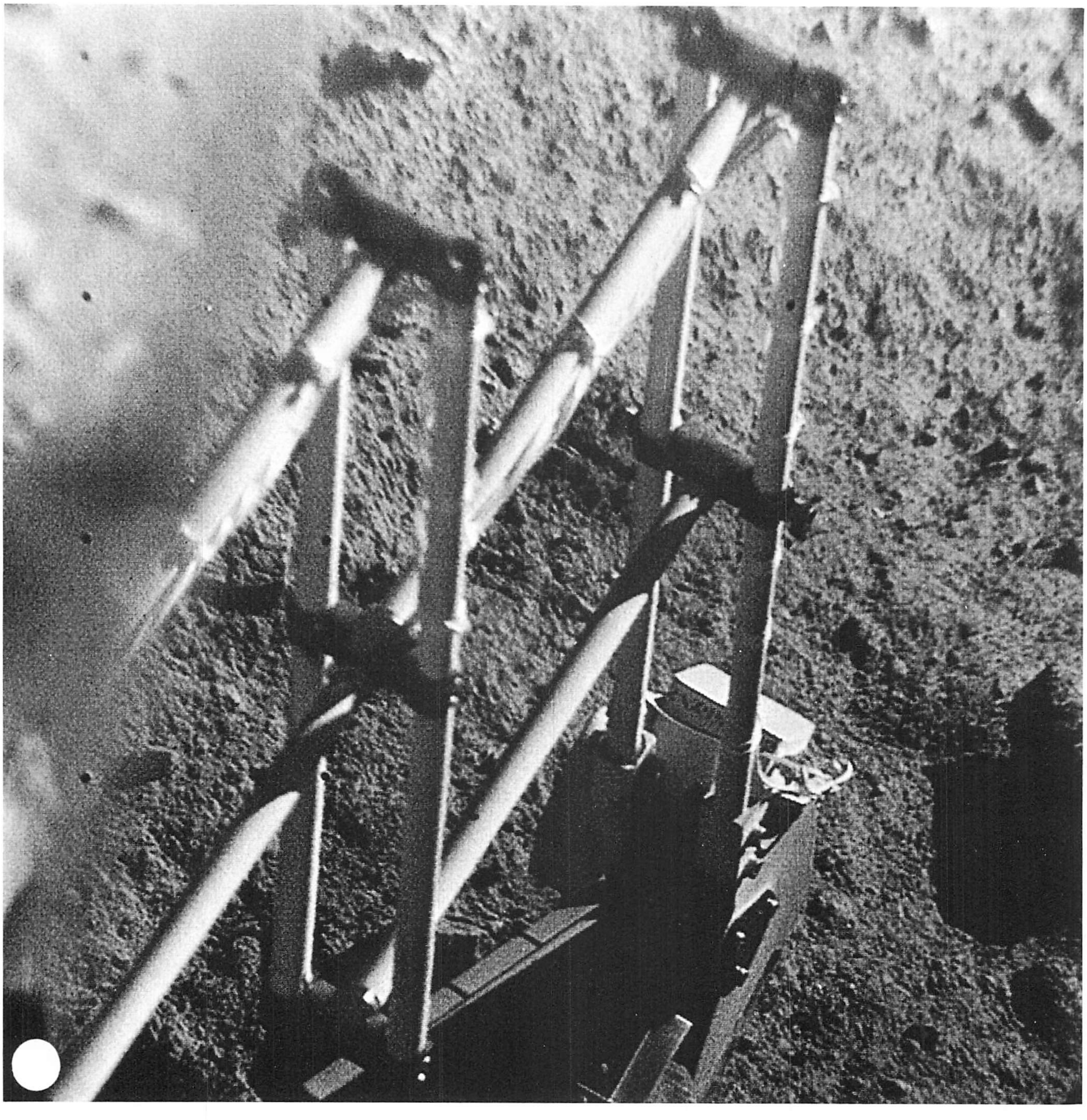


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(170)	**Day 017, 09:44:43**	**90**	**−15**	**4.21**	***f*/11.6**	**N**	**Clear**

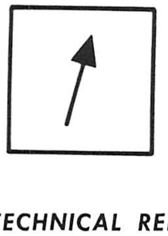


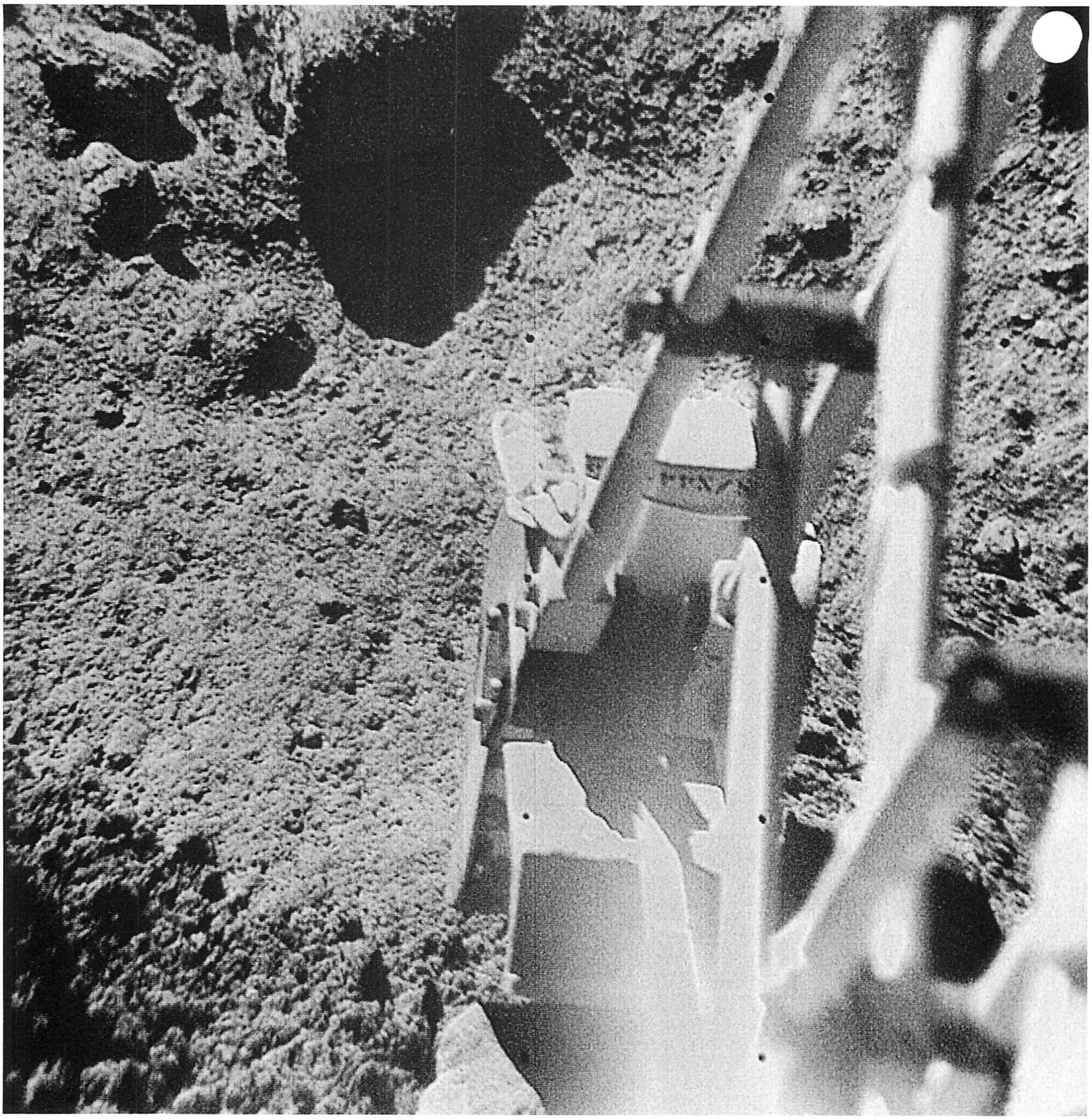
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(171)	**Day 018, 10:42:23**	**−54**	**55**	**205.24**	***f*/17.2**	**N**	**Clear**



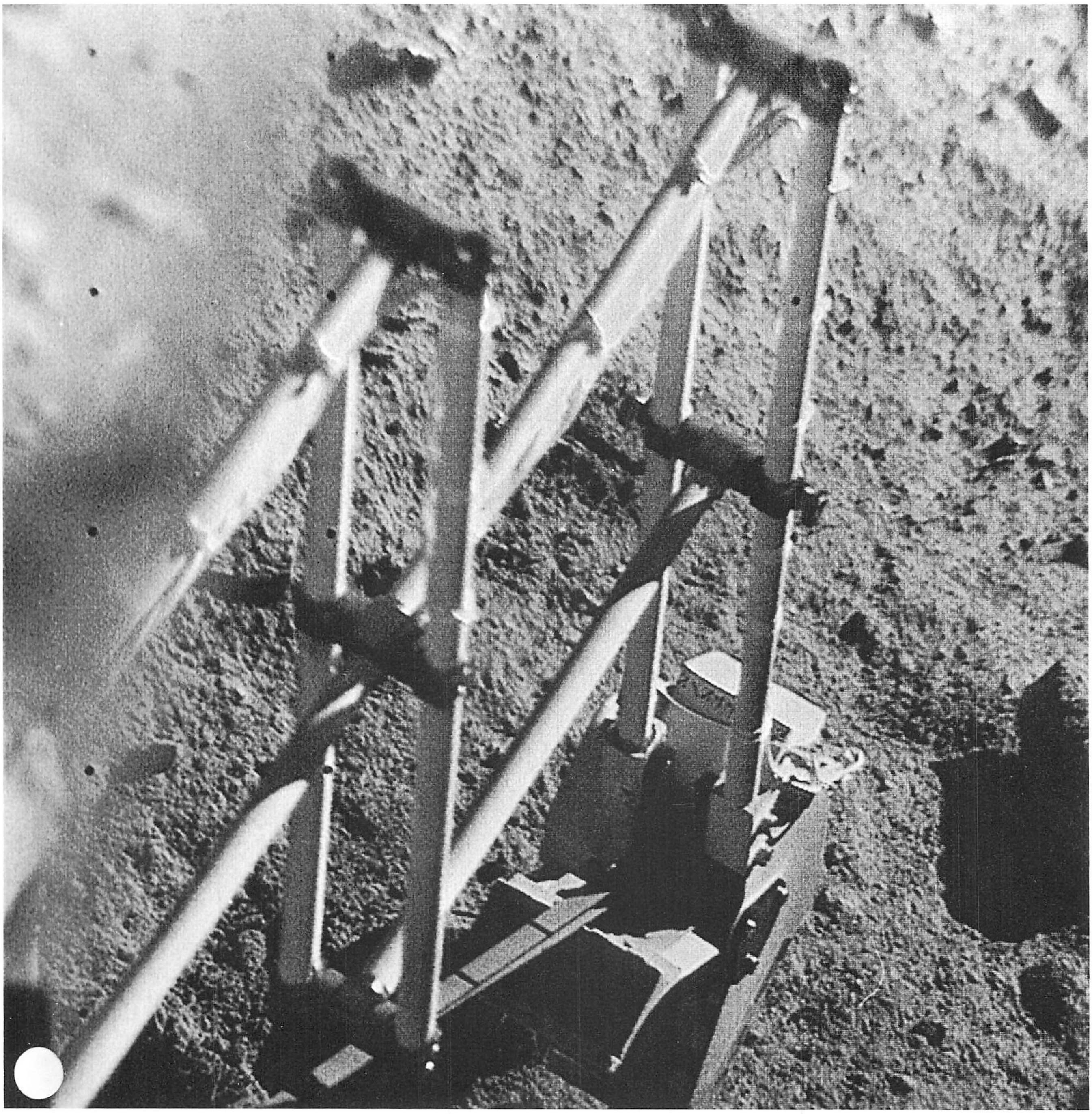


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(172)	Day 019, 07:45:25	—210	—10	3.07	f/10.0	N	Vertical	Processed

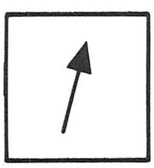


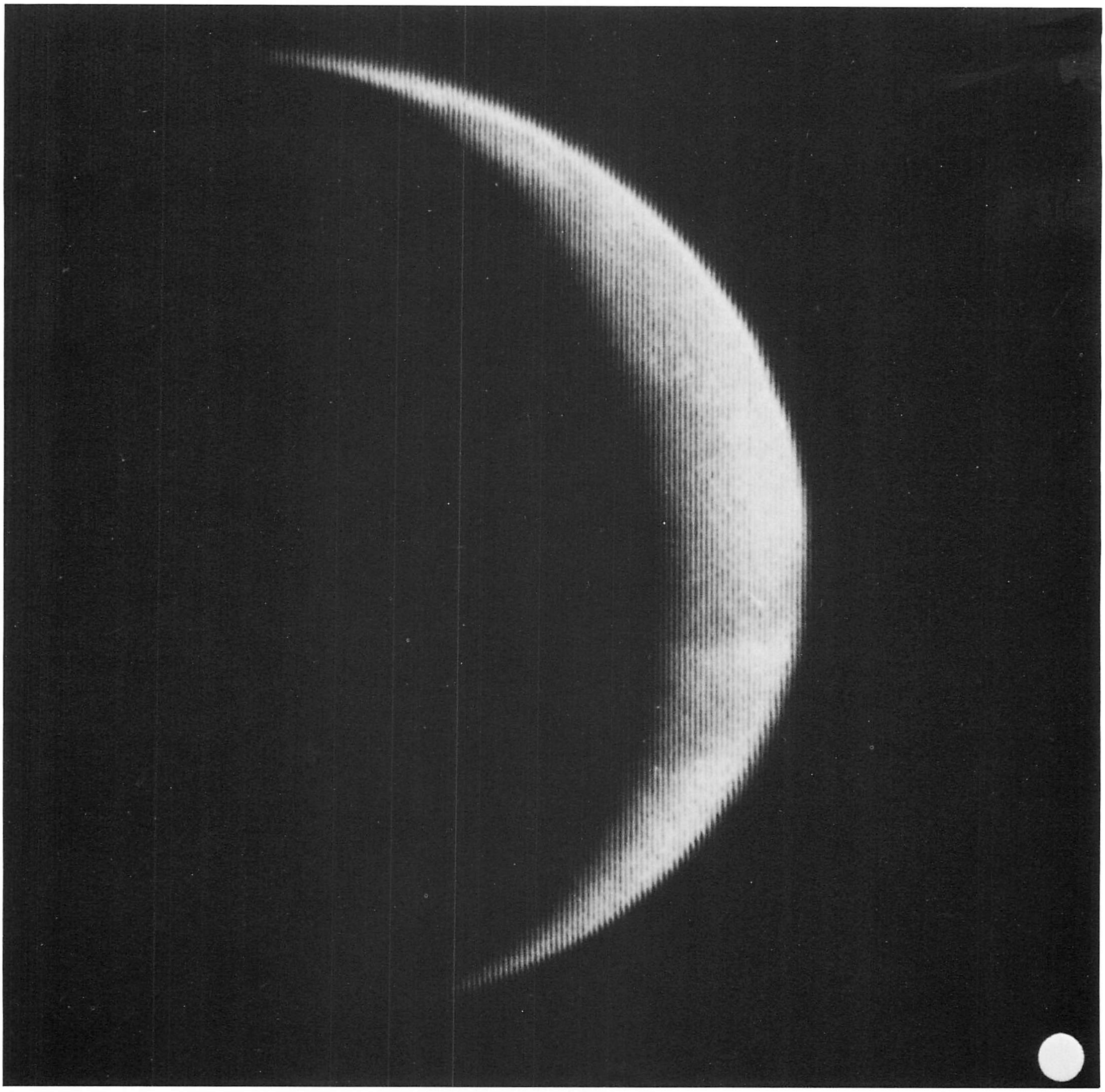


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(173)	Day 019, 07:51:00	6	−40	2.43	*f*/8.6	N	Vertical	Processed

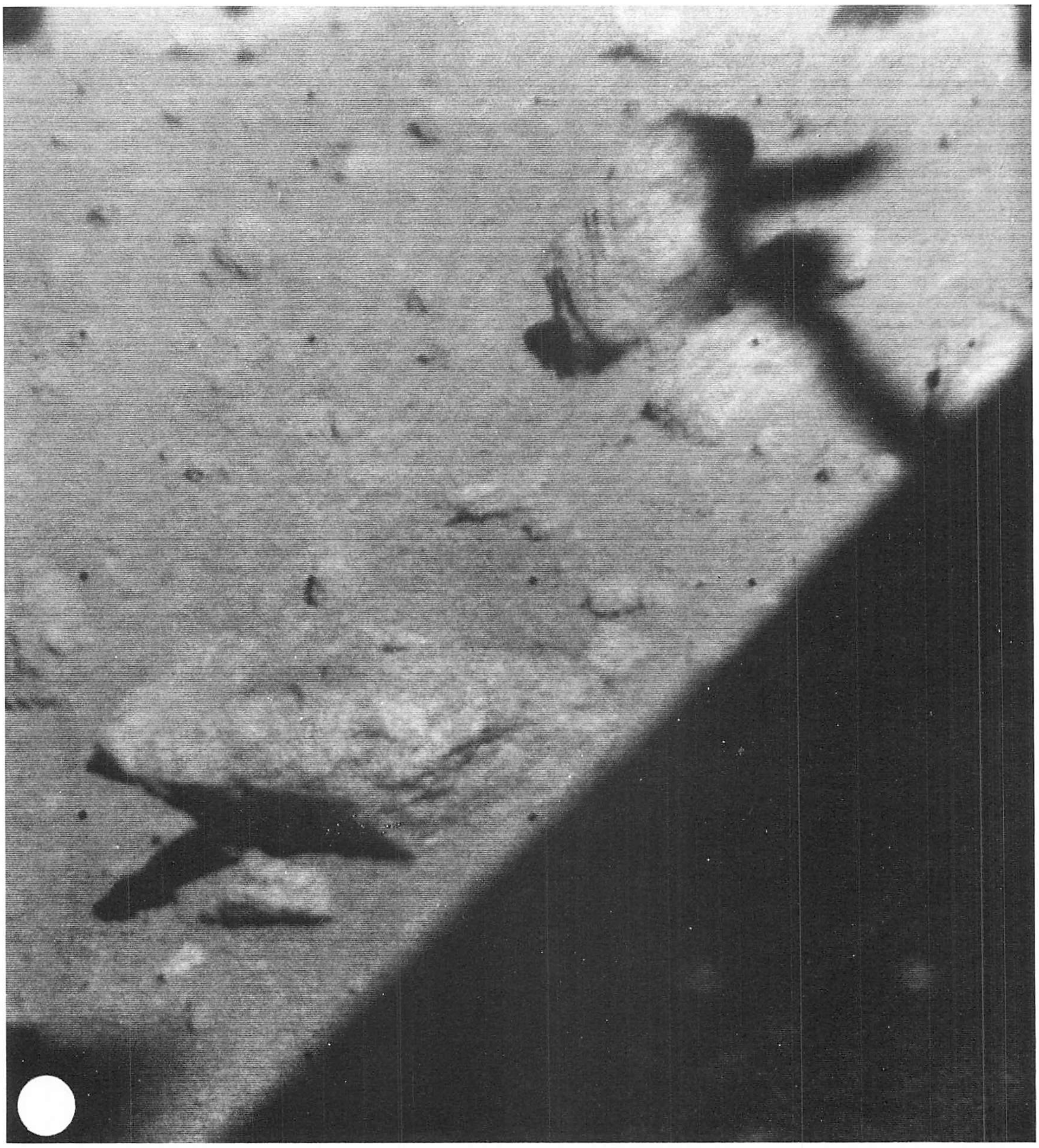


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(174)	**Day 019, 07:54:21**	**−210**	**−10**	**3.07**	**f/8.6**	**N**	**Vertical**	**Processed**

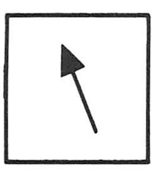


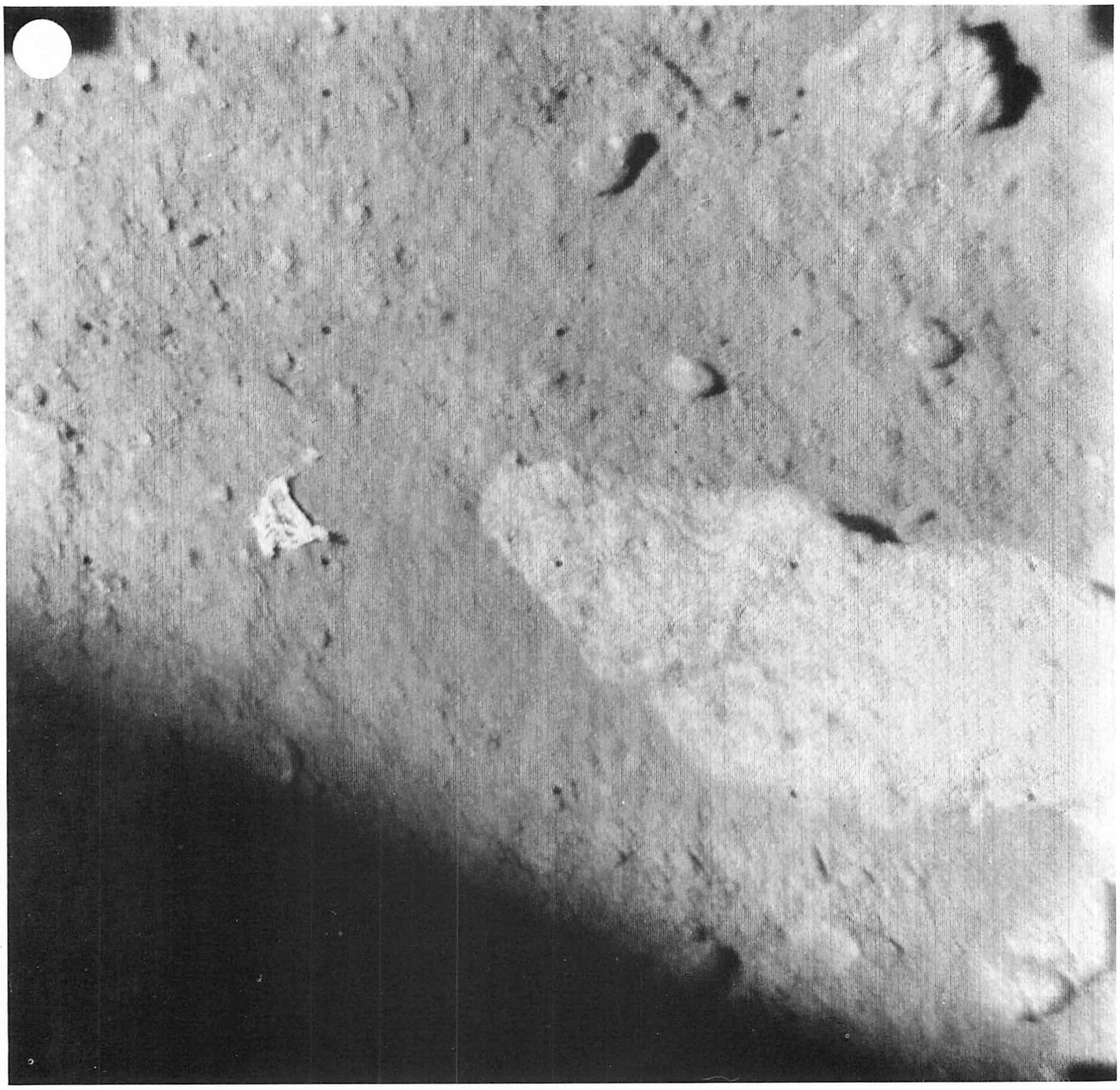


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(175)	**Day 019, 08:30:25**	**—51**	**55**	**205.24**	**f/17.3**	**N**	**Clear**

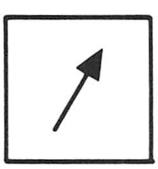


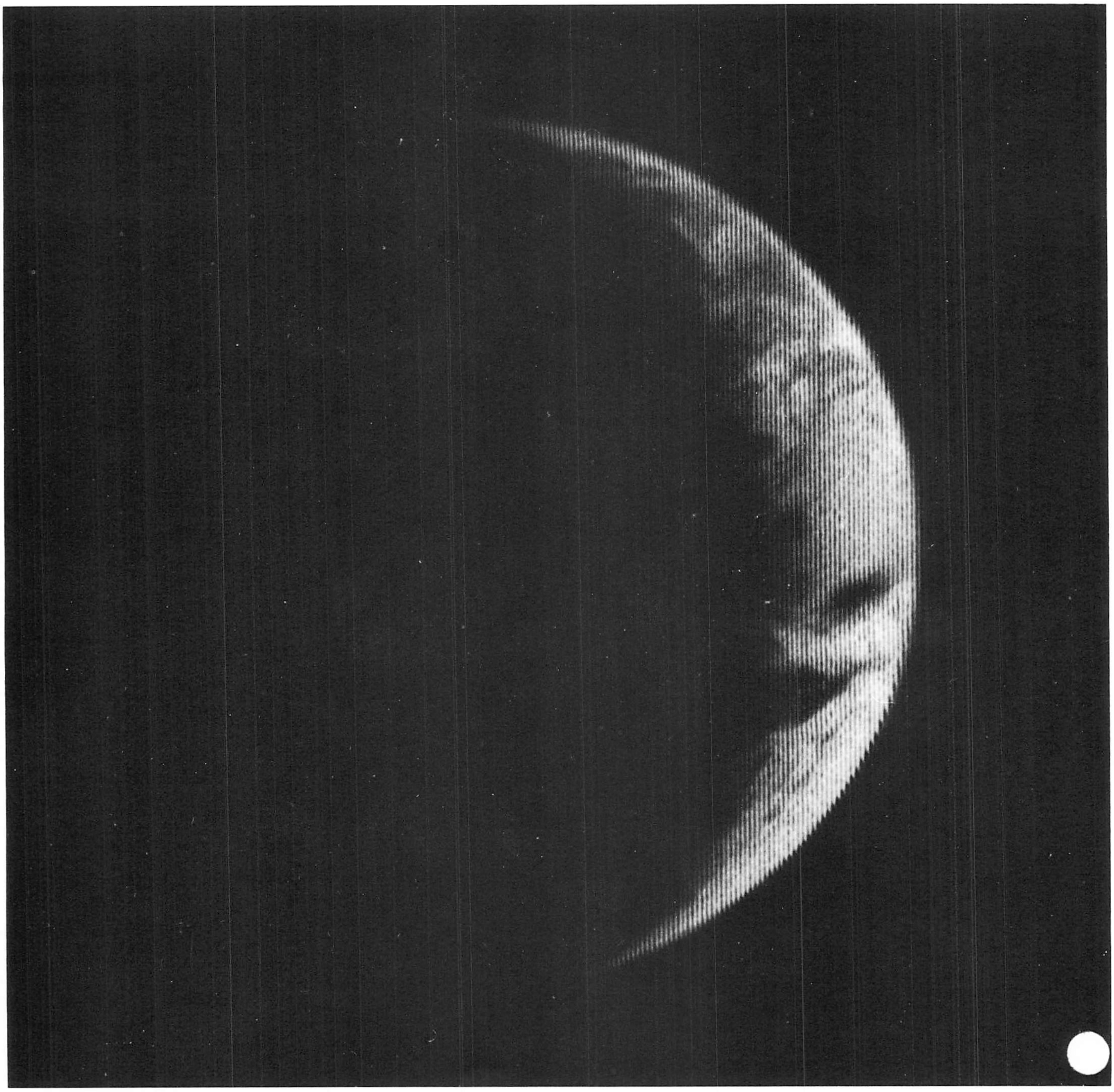
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(176)	**Day 019, 18:20:55**	**—168**	**—30**	**6.81**	**f/14.9**	**N**	**Clear**



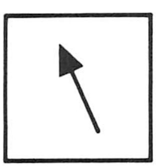


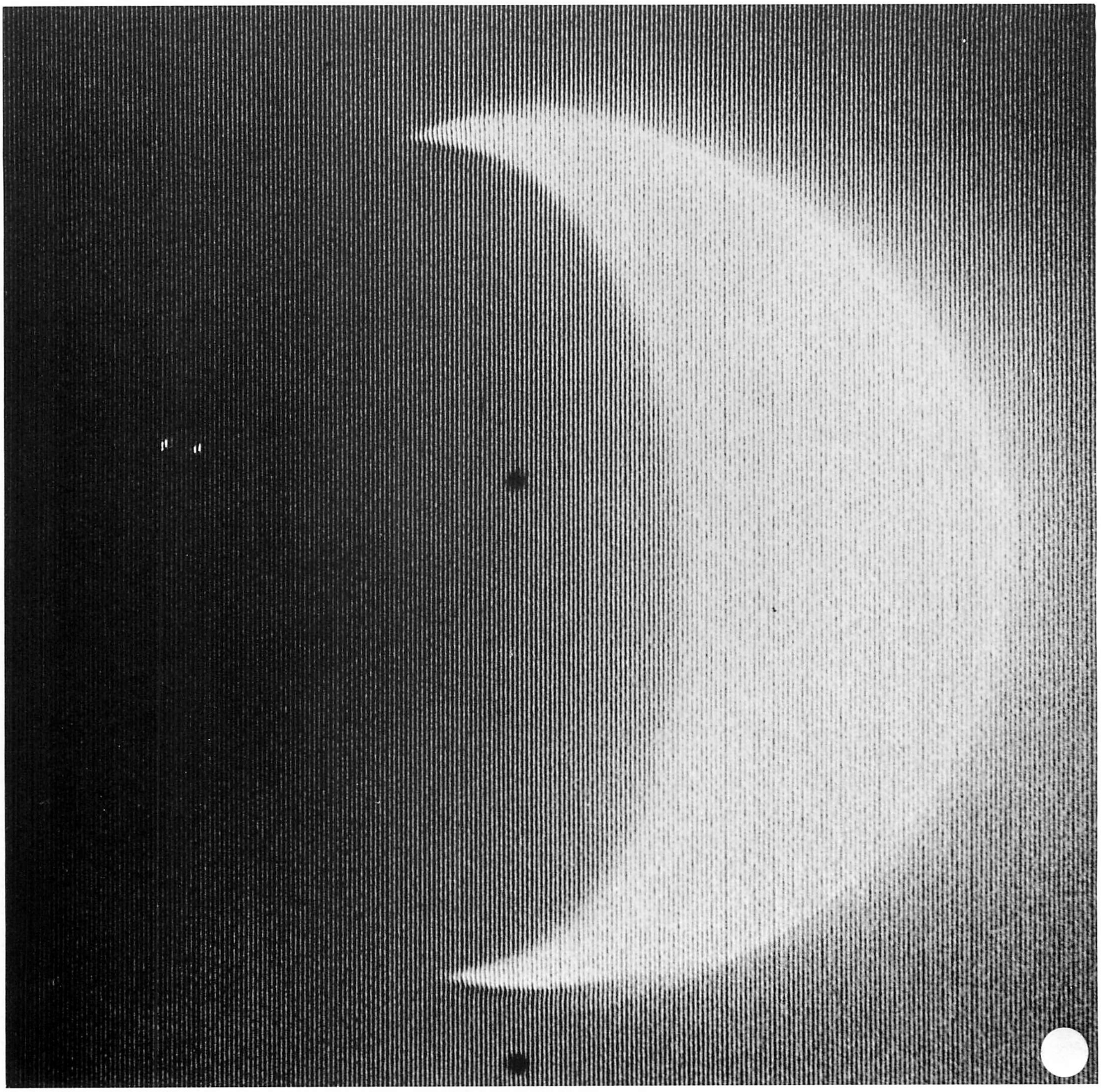
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(177)	**Day 019, 19:42:37**	**−117**	**−55**	**3.07**	***f*/12.8**	**N**	**Clear**



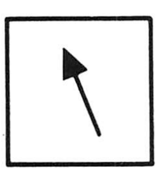


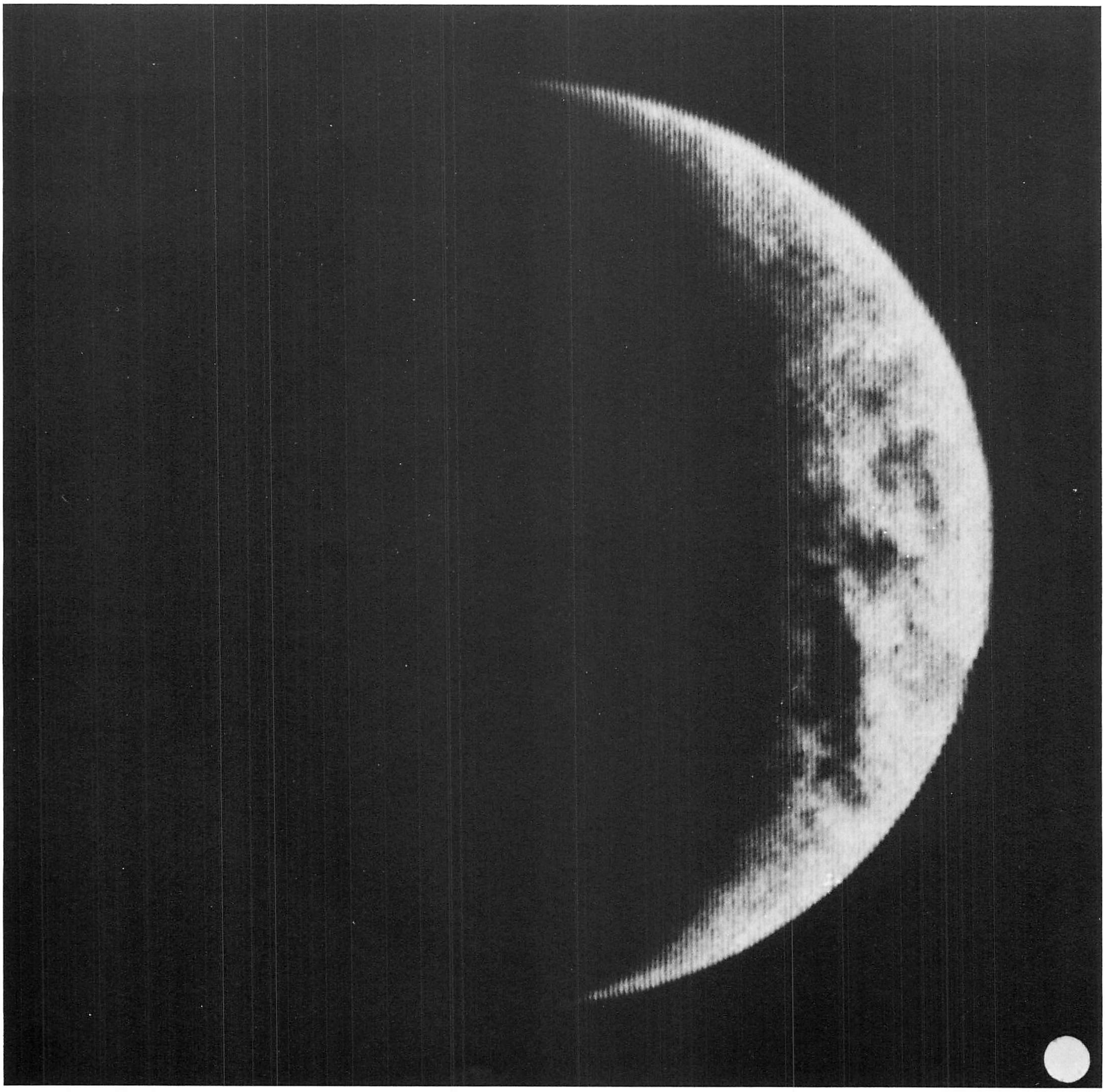
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(178)	**Day 020, 08:59:36**	**—51**	**50**	**205.24**	**f/17.2**	**N**	**Clear**



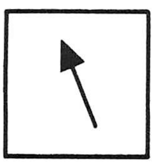


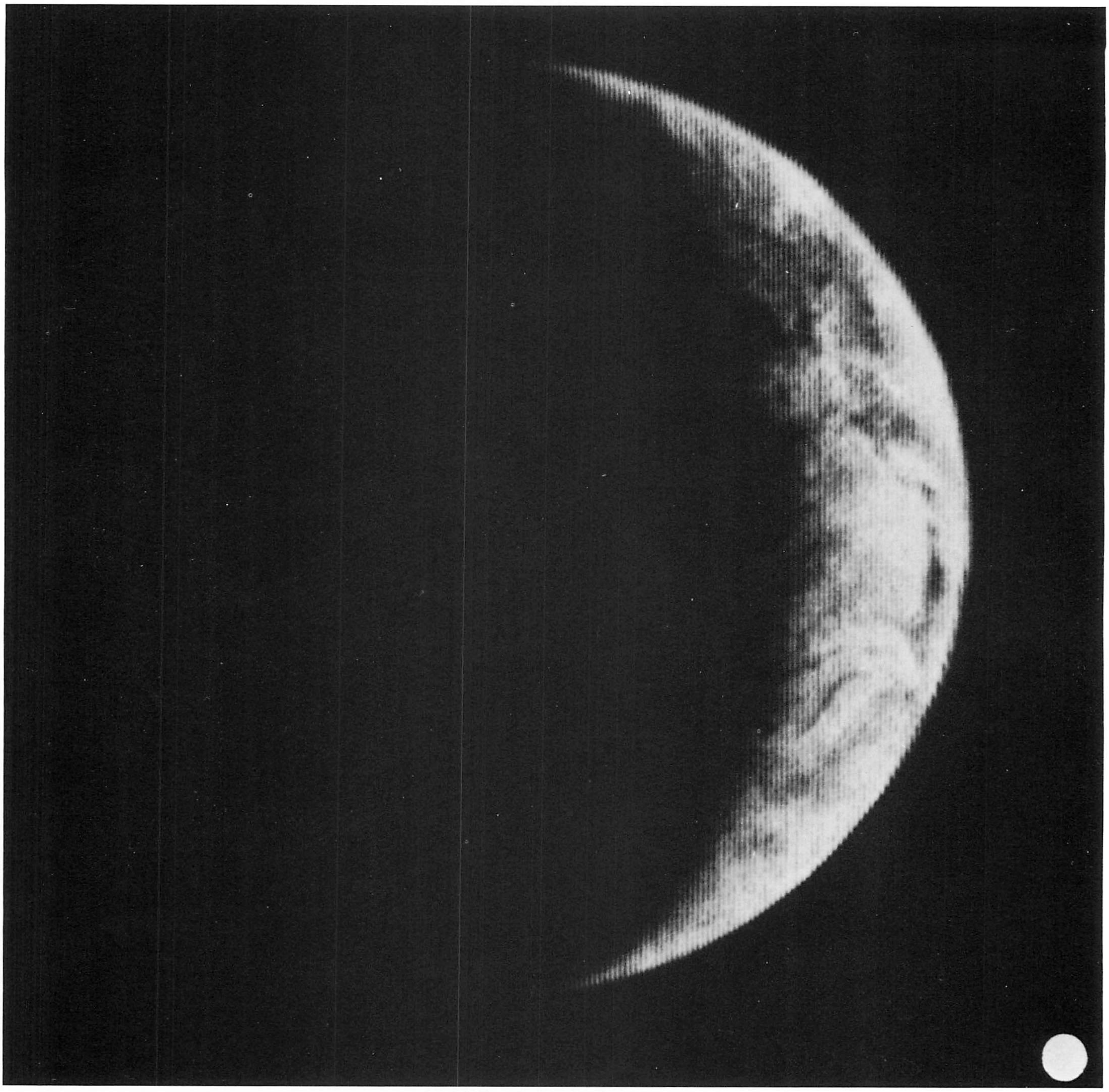
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(179)	**Day 020, 09:12:58**	**—54**	**50**	**205.24**	**f/3.8**	**N**	**Clear**



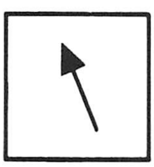


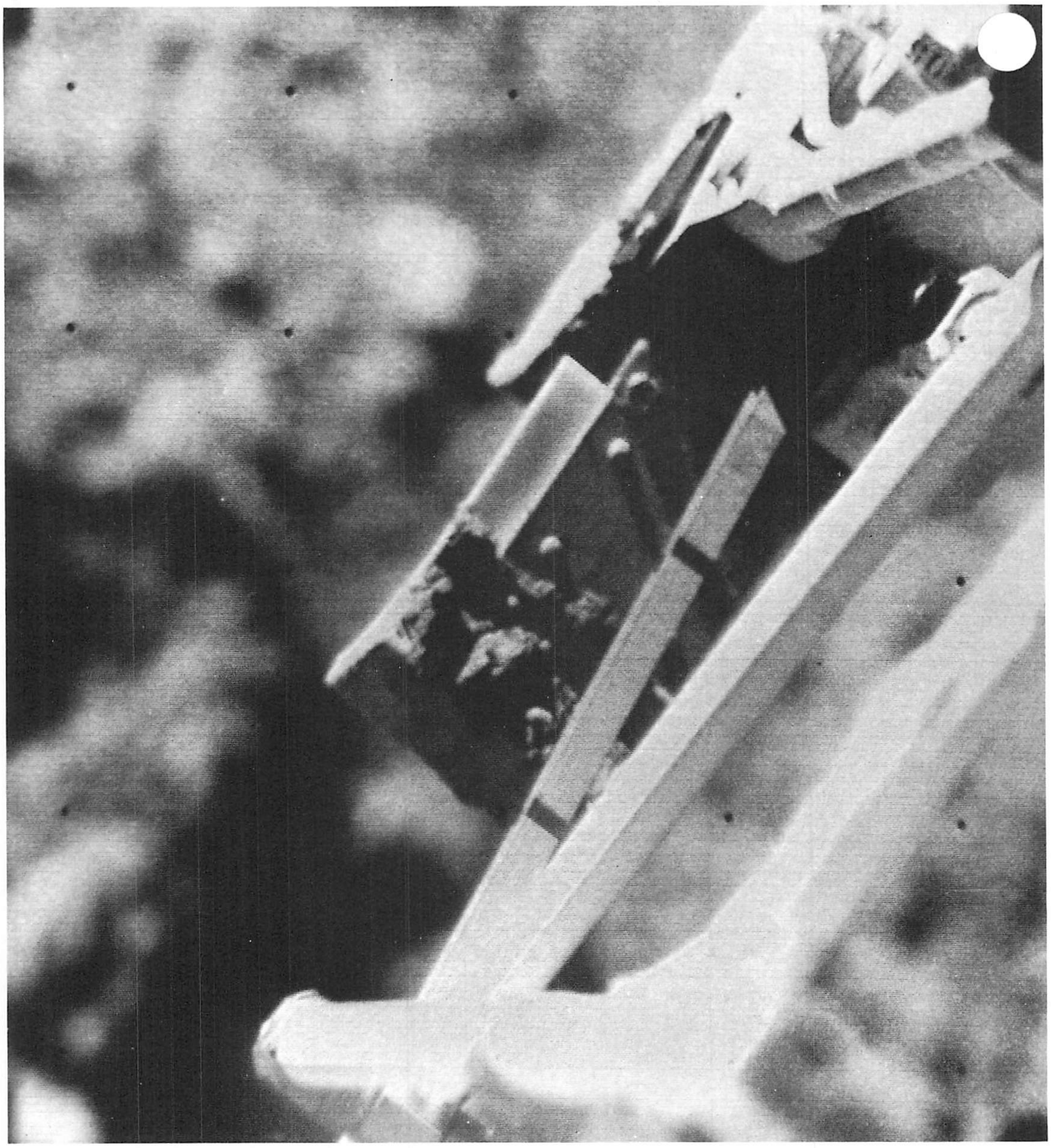
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(180)	**Day 020, 11:02:23**	**—54**	**50**	**205.24**	***f*/13.5**	**N**	**Clear**



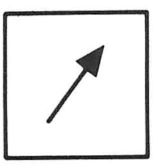


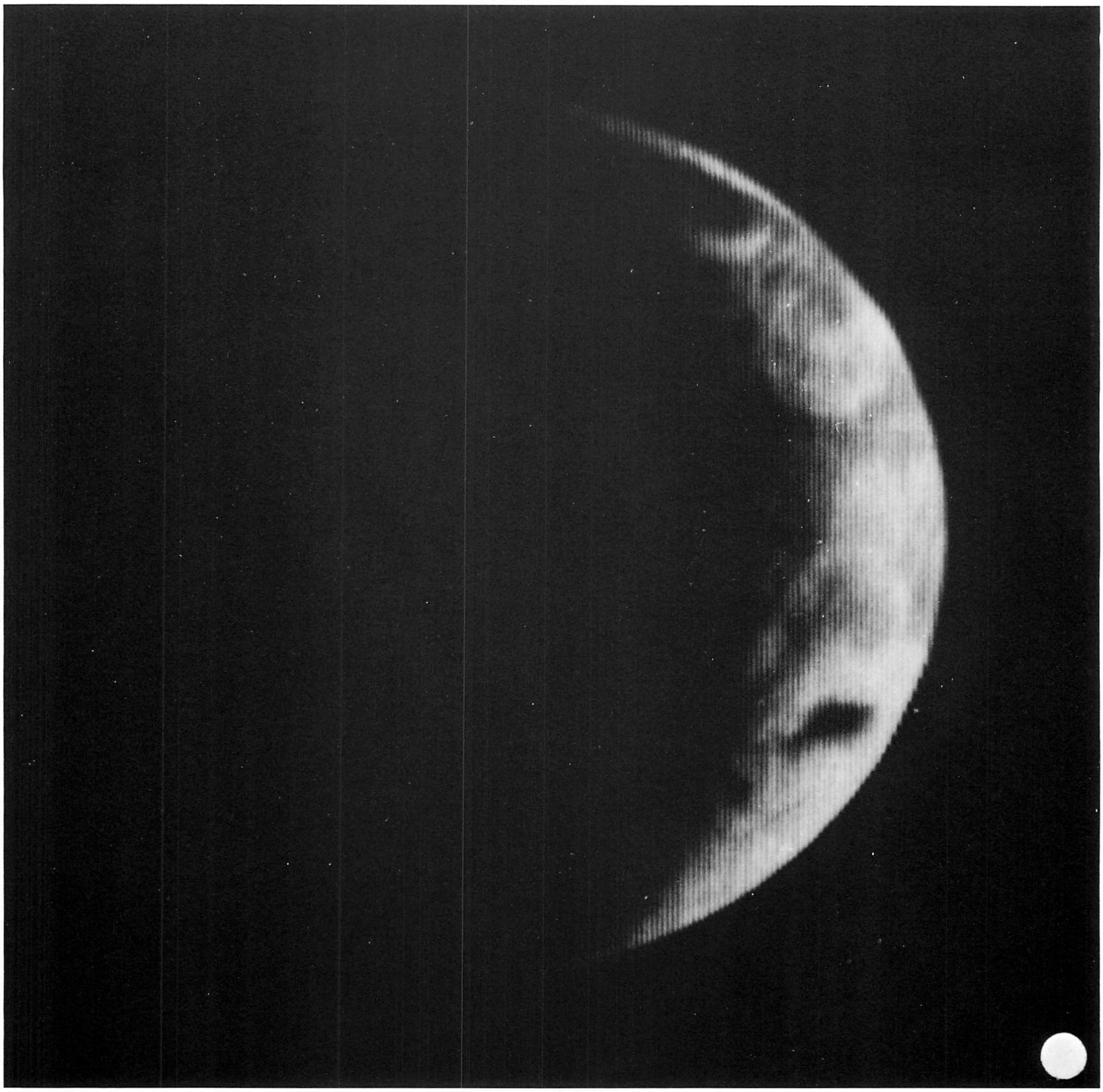
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(181)	Day 020, 13:01:37	−54	50	205.24	$f/14.2$	N	Clear



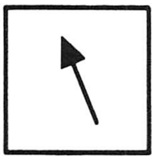


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(182)	Day 020, 14:50:02	−21	−40	1.62	*f*/13.8	N	Clear

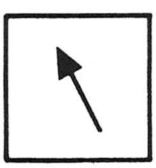


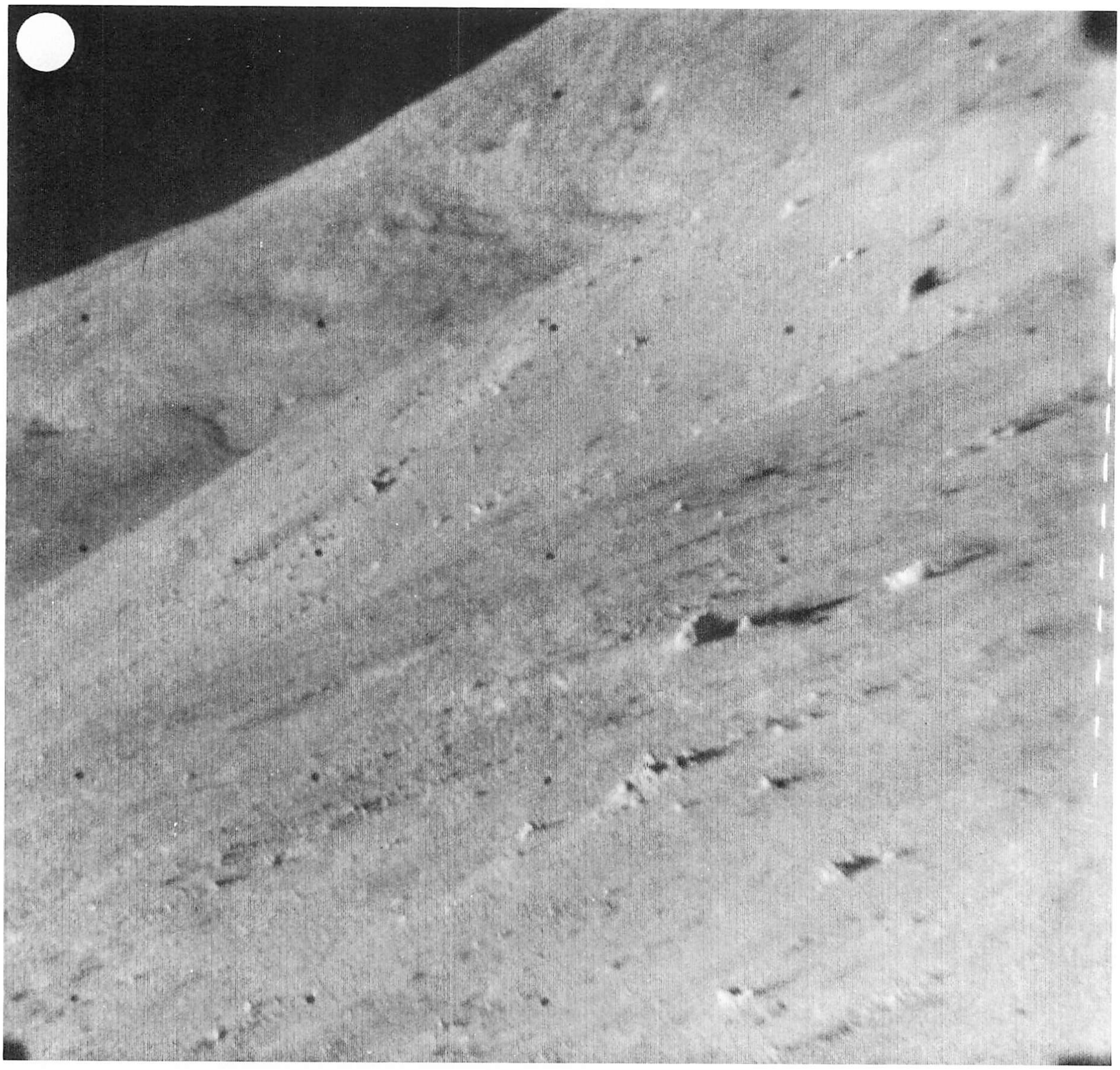


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(183)	Day 020, 16:09:58	−54	50	205.24	f/14.9	N	Clear

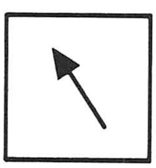


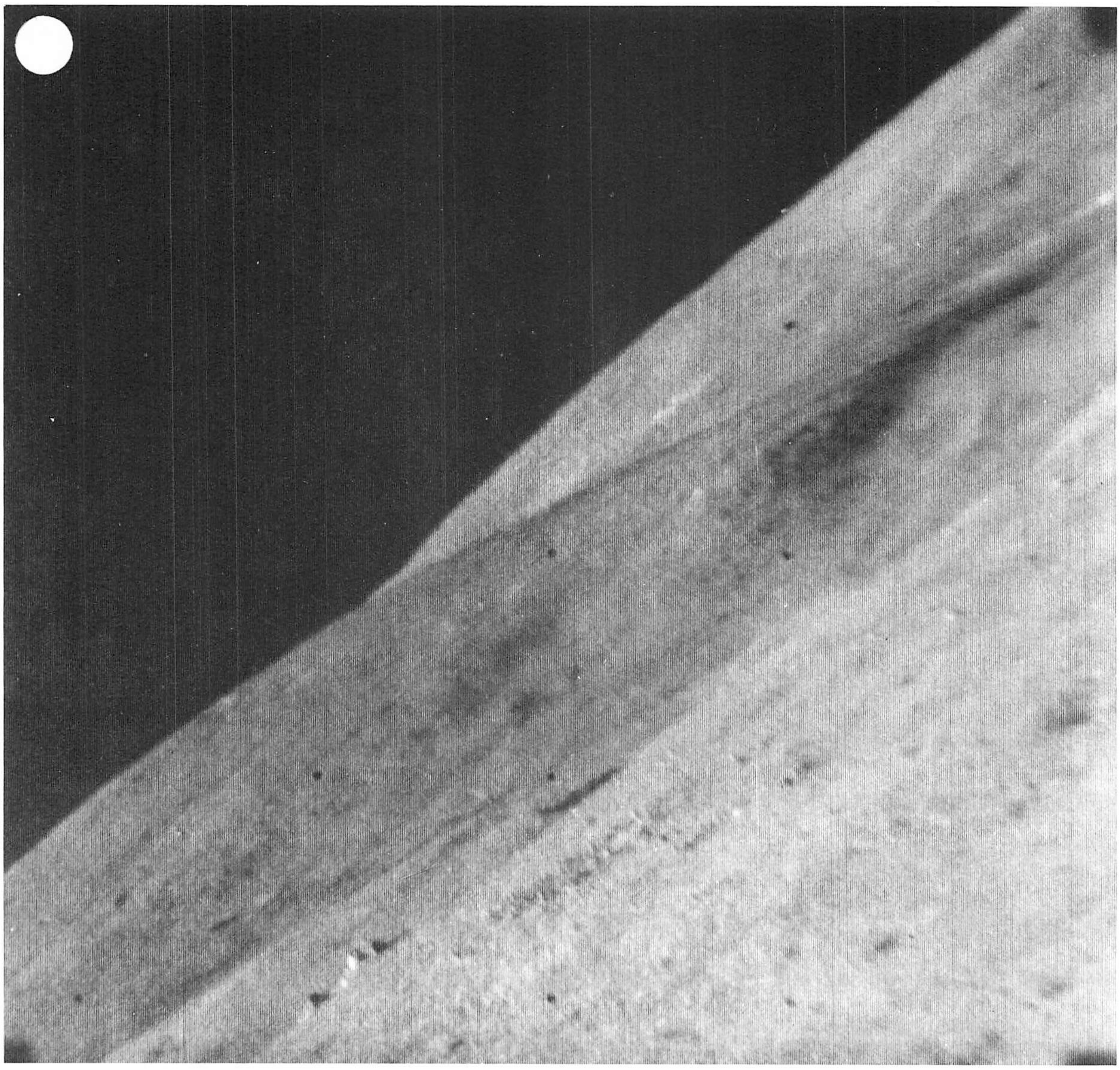
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(184)	Day 020, 19:44:39	−48	−20	7.76	f/10.5	N	Clear



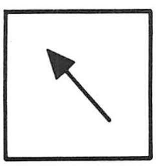


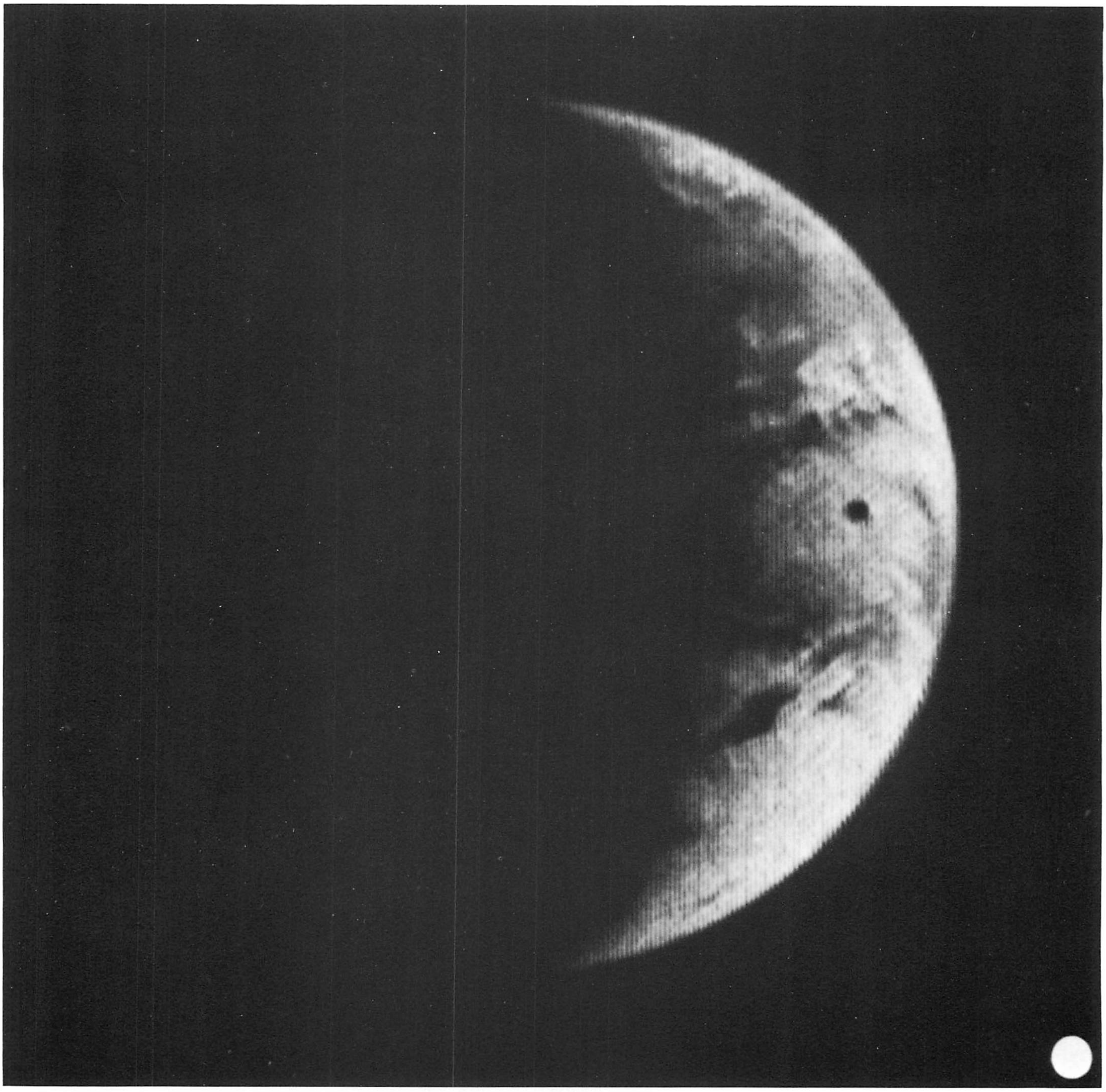
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(185)	Day 020, 19:46:44	—42	0	205.24	f/10.5	N	Clear



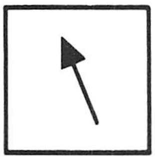


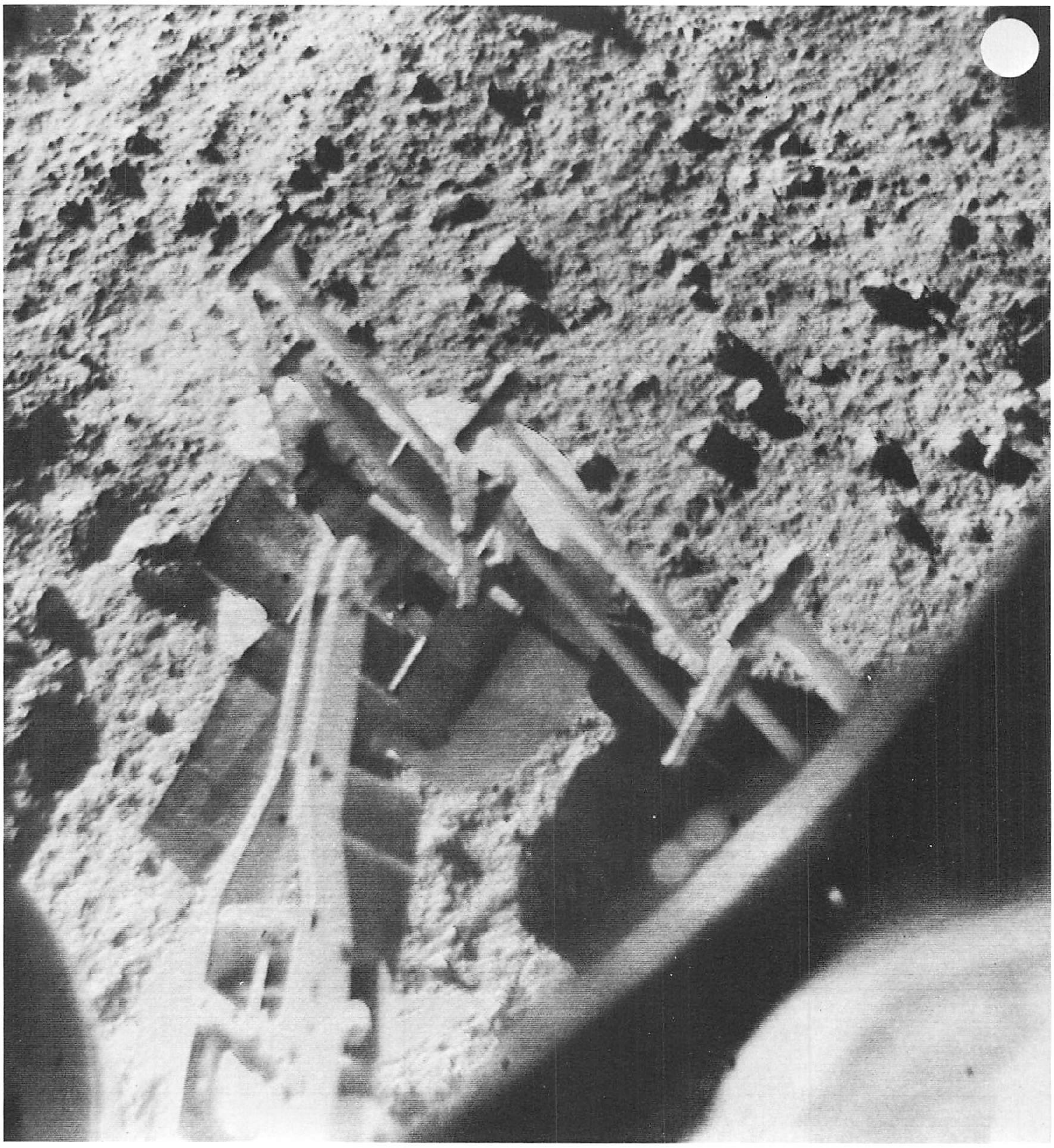
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(186)	Day 020, 19:47:33	—33	5	205.24	f/10.5	N	Clear



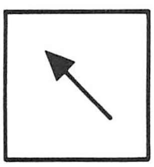


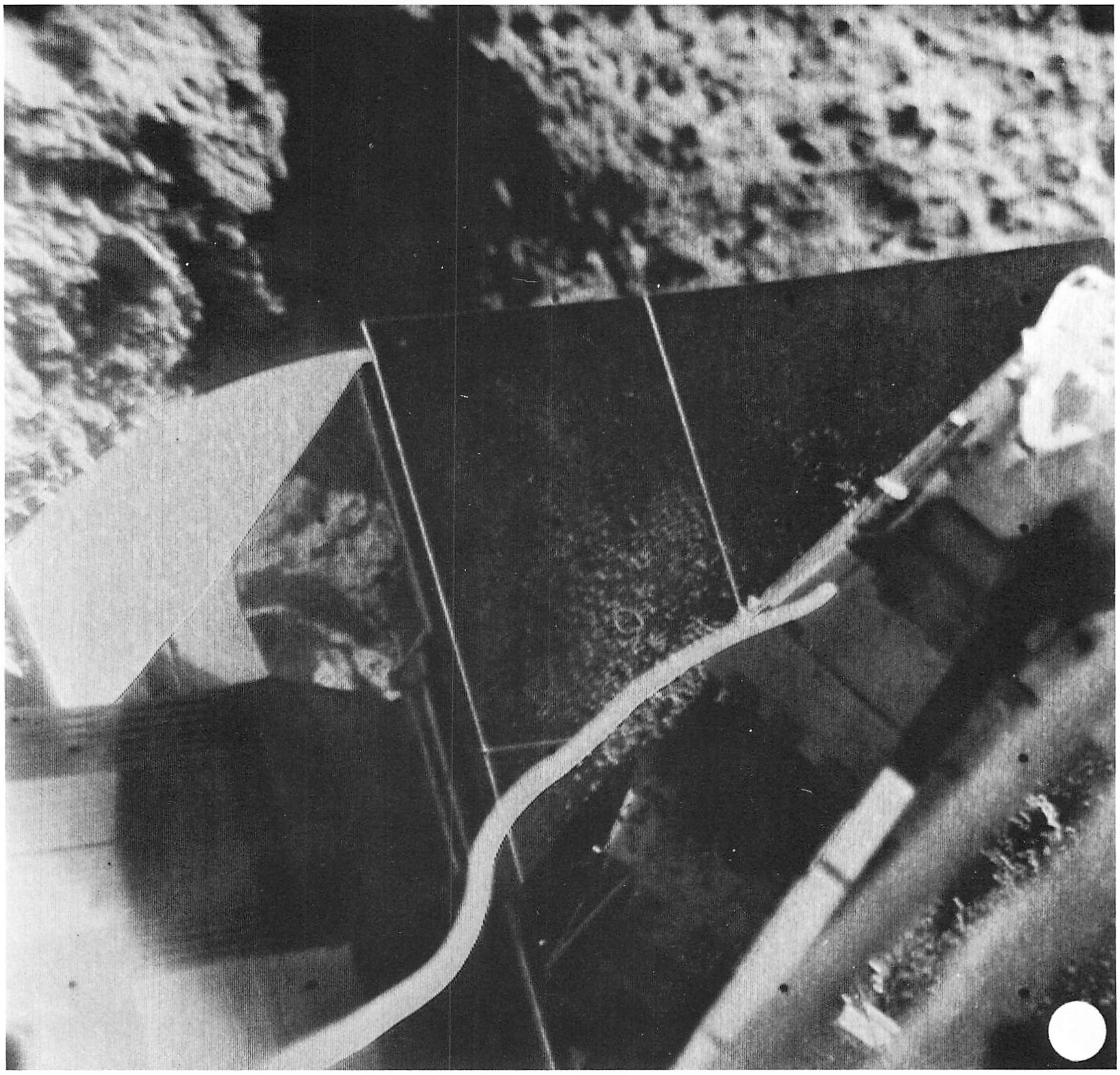
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(187)	**Day 021, 08:20:48**	**—54**	**50**	**205.24**	**f/16.4**	**N**	**Clear**



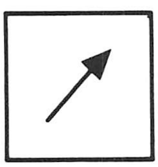


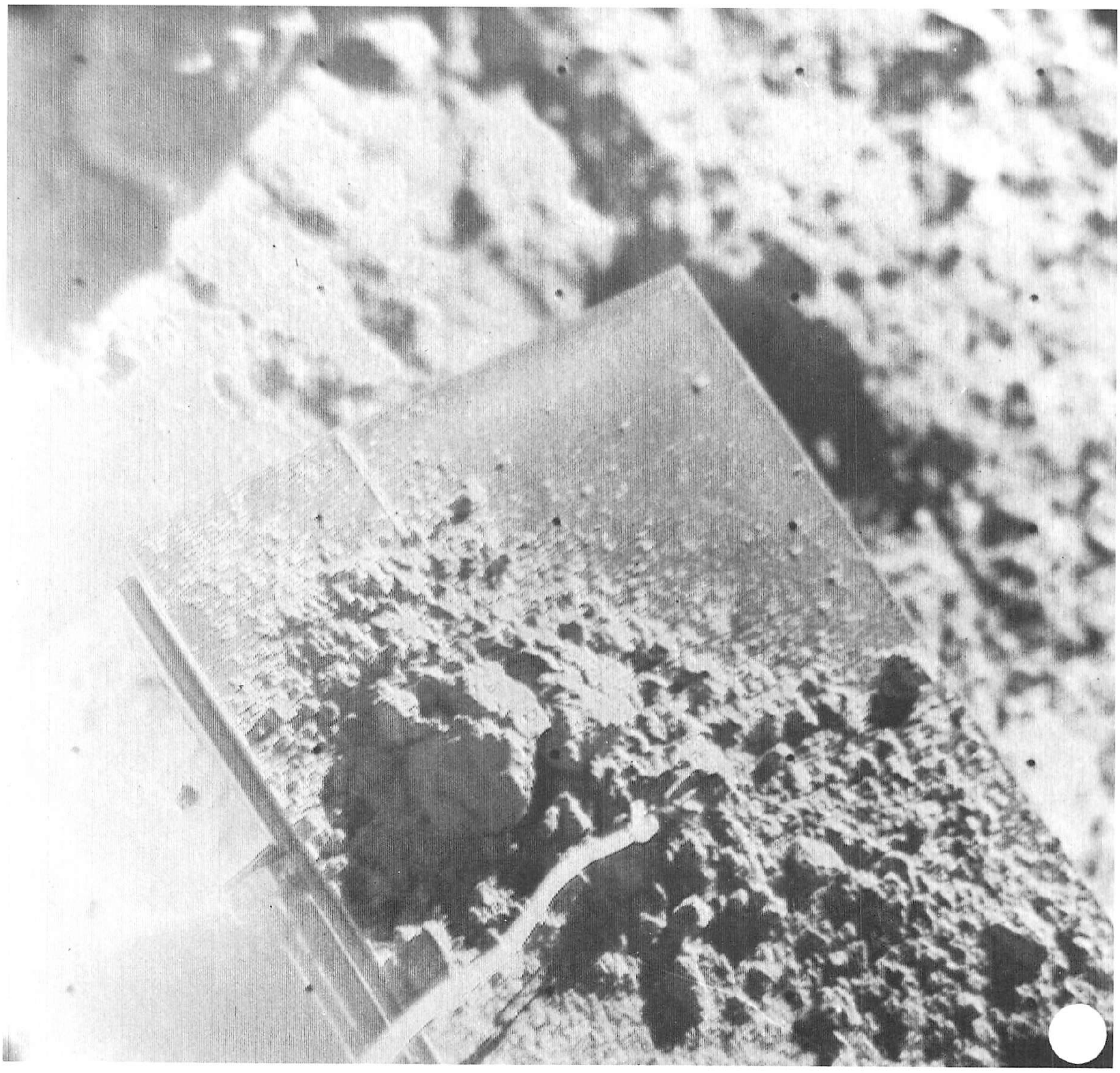
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(188)	**Day 021, 10:54:02**	**45**	**—45**	**1.25**	**f/3.8**	**W**	**Clear**



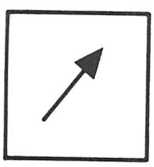


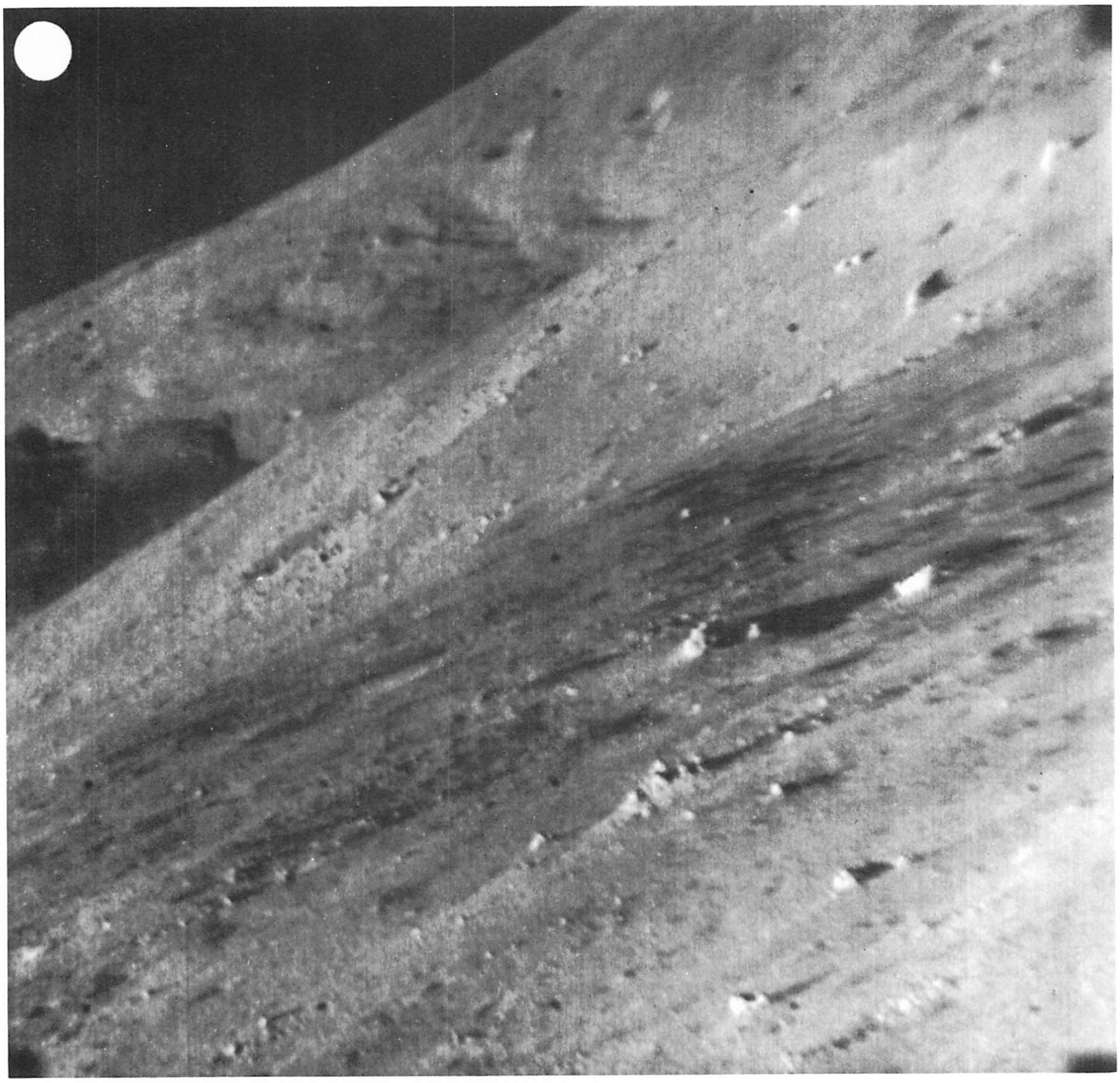
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(189)	**Day 021, 11:52:40**	**48**	**—35**	**2.18**	***f*/3.8**	**N**	**Clear**



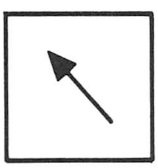


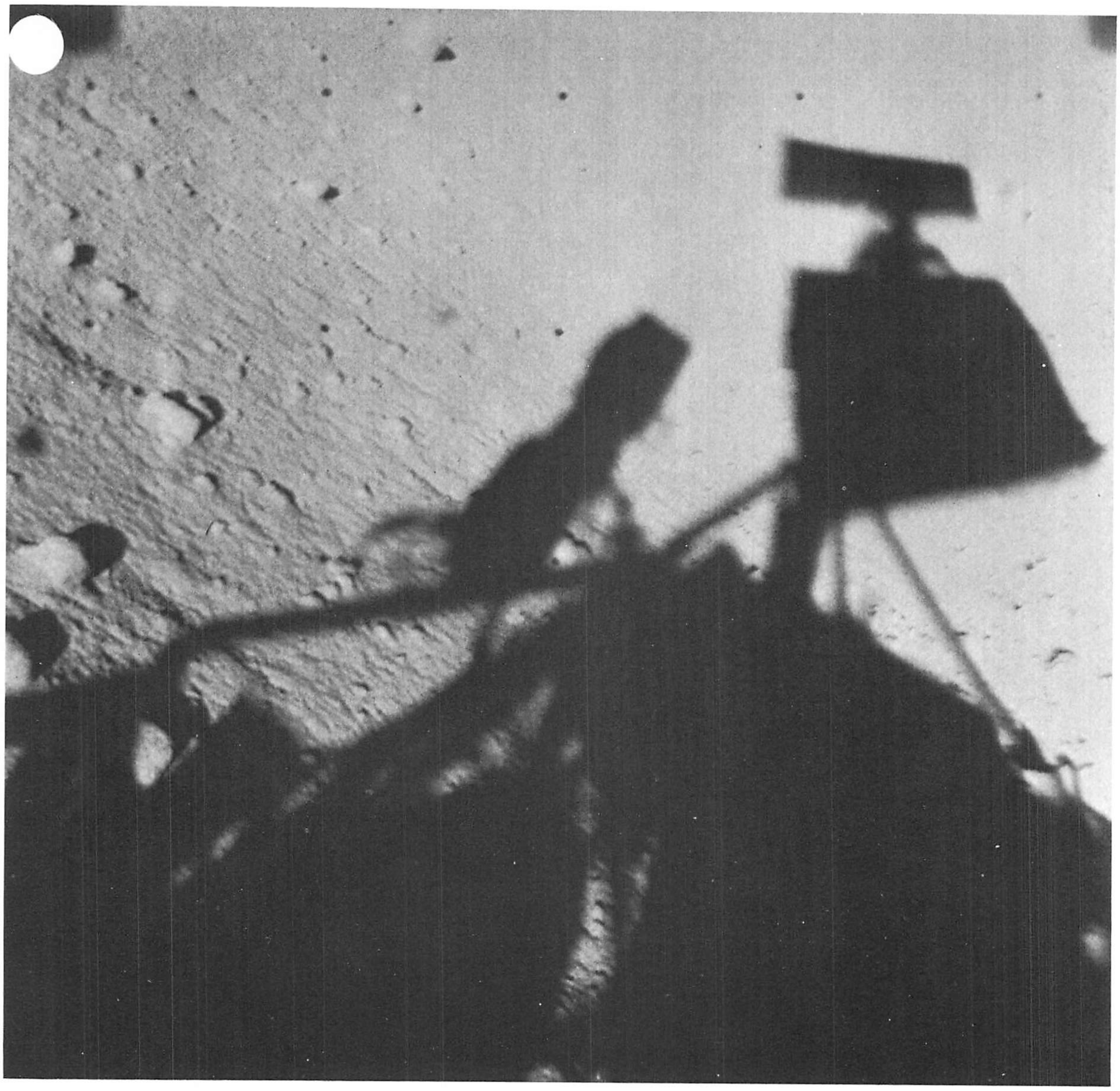
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(190)	Day 021, 13:59:09	51	−35	2.12	f/3.8	N	Clear



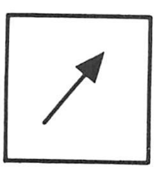


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(191)	Day 021, 21:32:08	—33	0	205.24	f/9.5	N	Clear

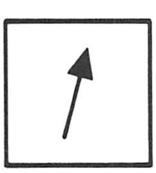


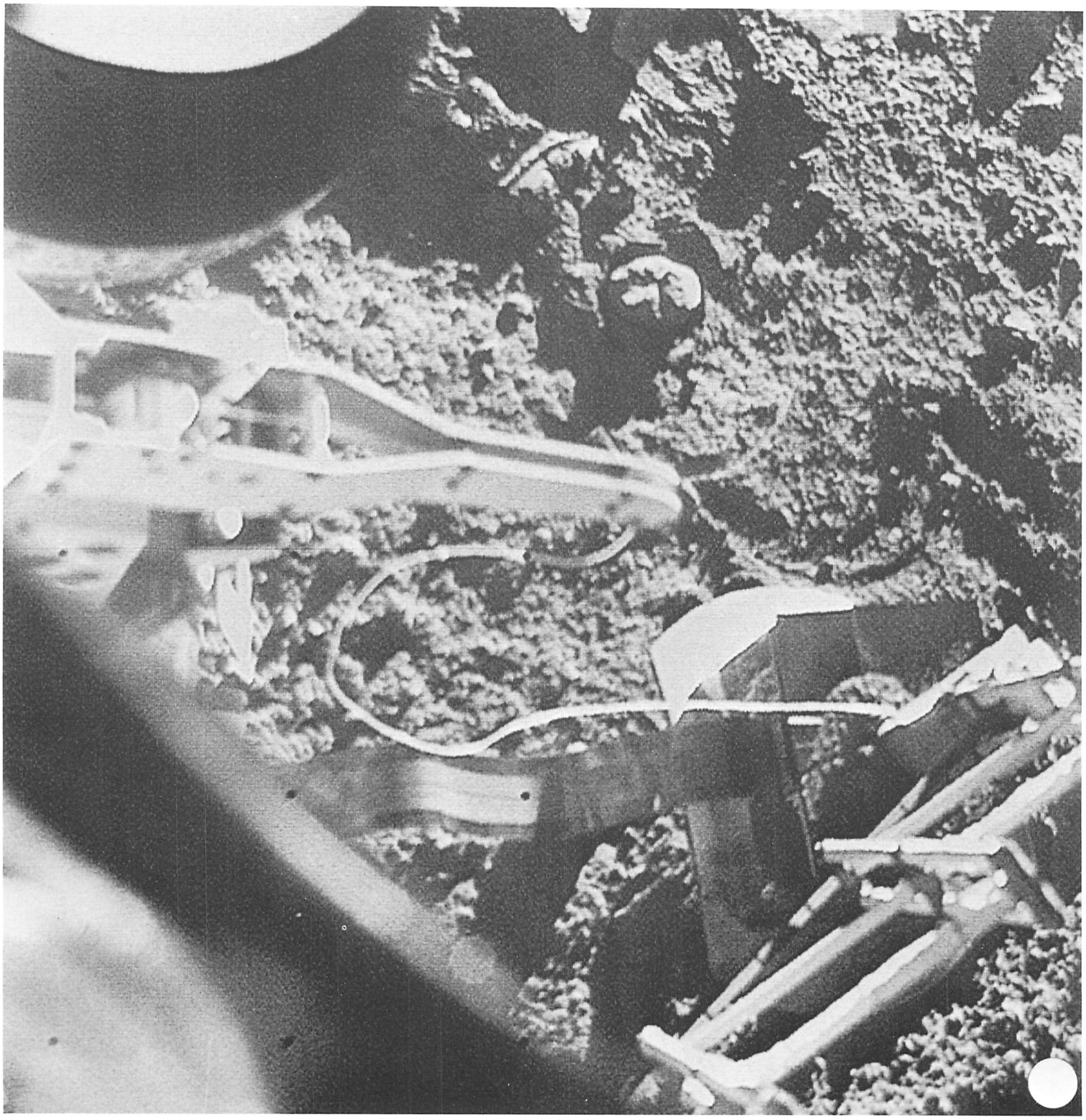


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(192)	Day 021, 22:50:31	—126	—35	2.26	f/9.5	W	Clear

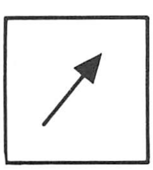


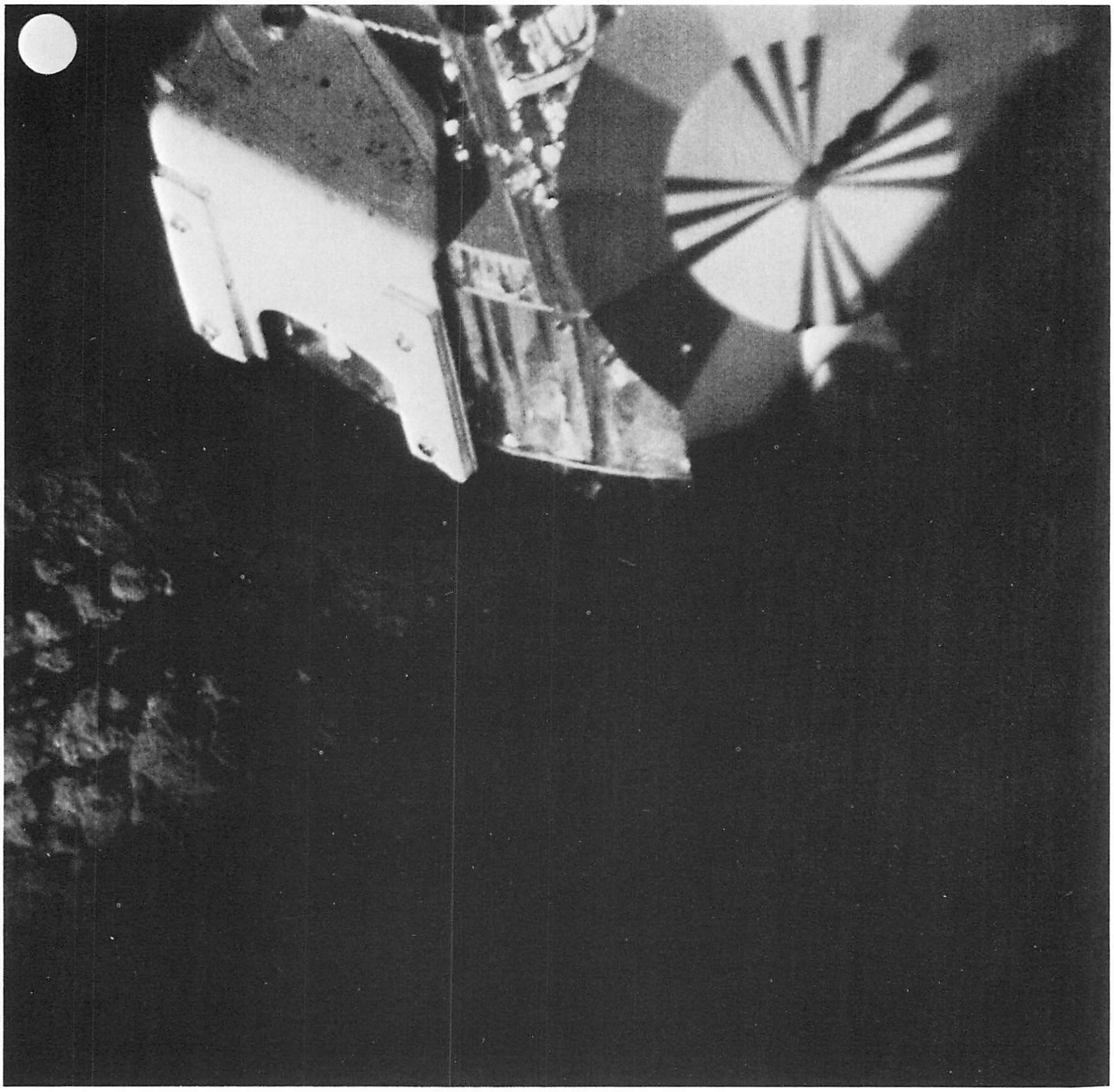
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(193)	**Day 021, 22:53:01**	**—216**	**—5**	**2.26**	***f*/7.0**	**W**	**Clear**





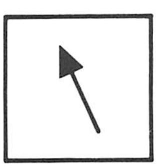
	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(194)	**Day 022, 11:21:12**	**51**	**—45**	**1.25**	***f*/3.8**	**W**	**Clear**	**Processed**

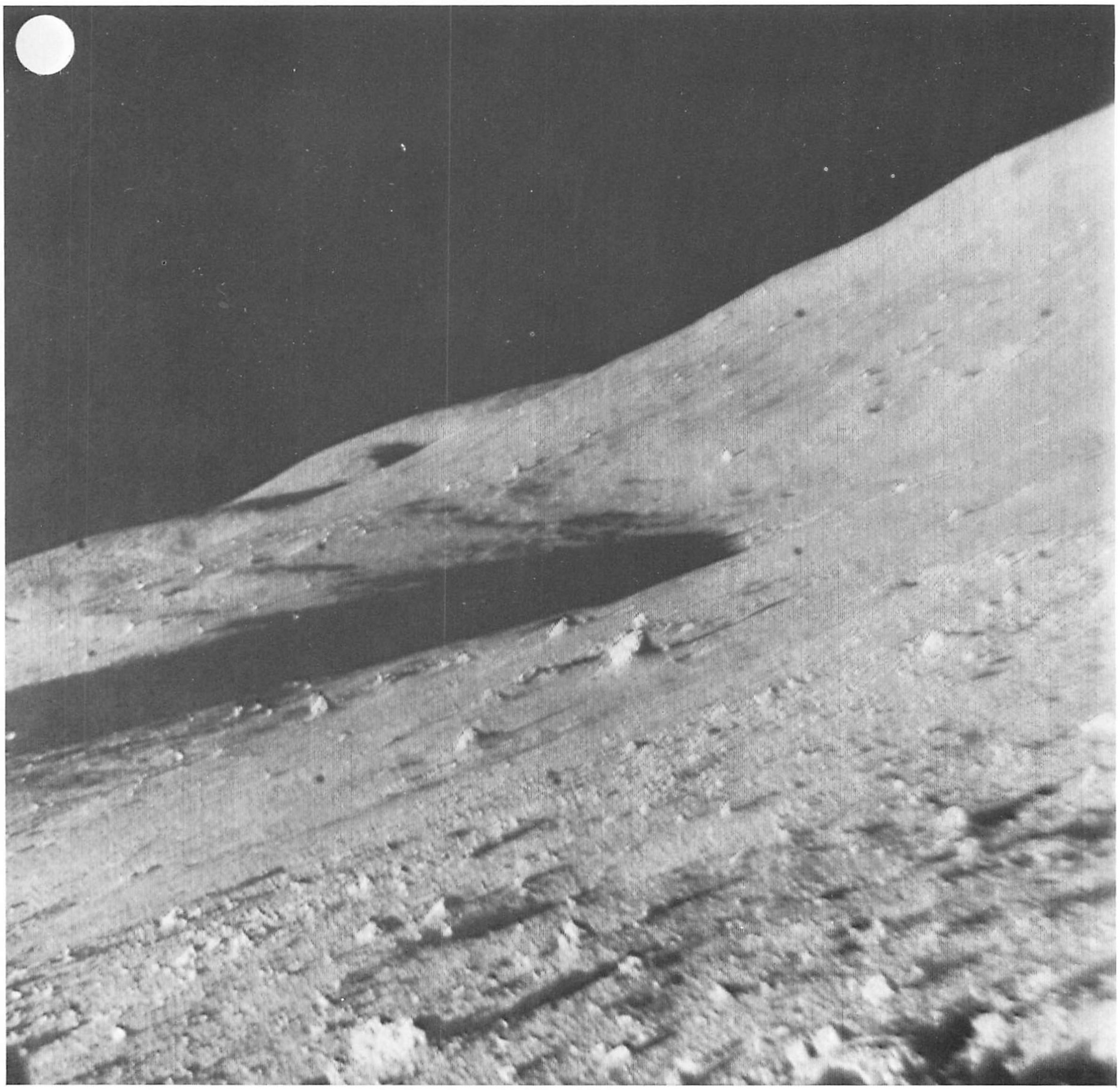




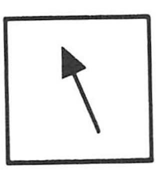
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(195)	**Day 022, 16:10:01**	**—57**	**—60**	**2.35**	***f*/13.5**	**N**	**Clear**

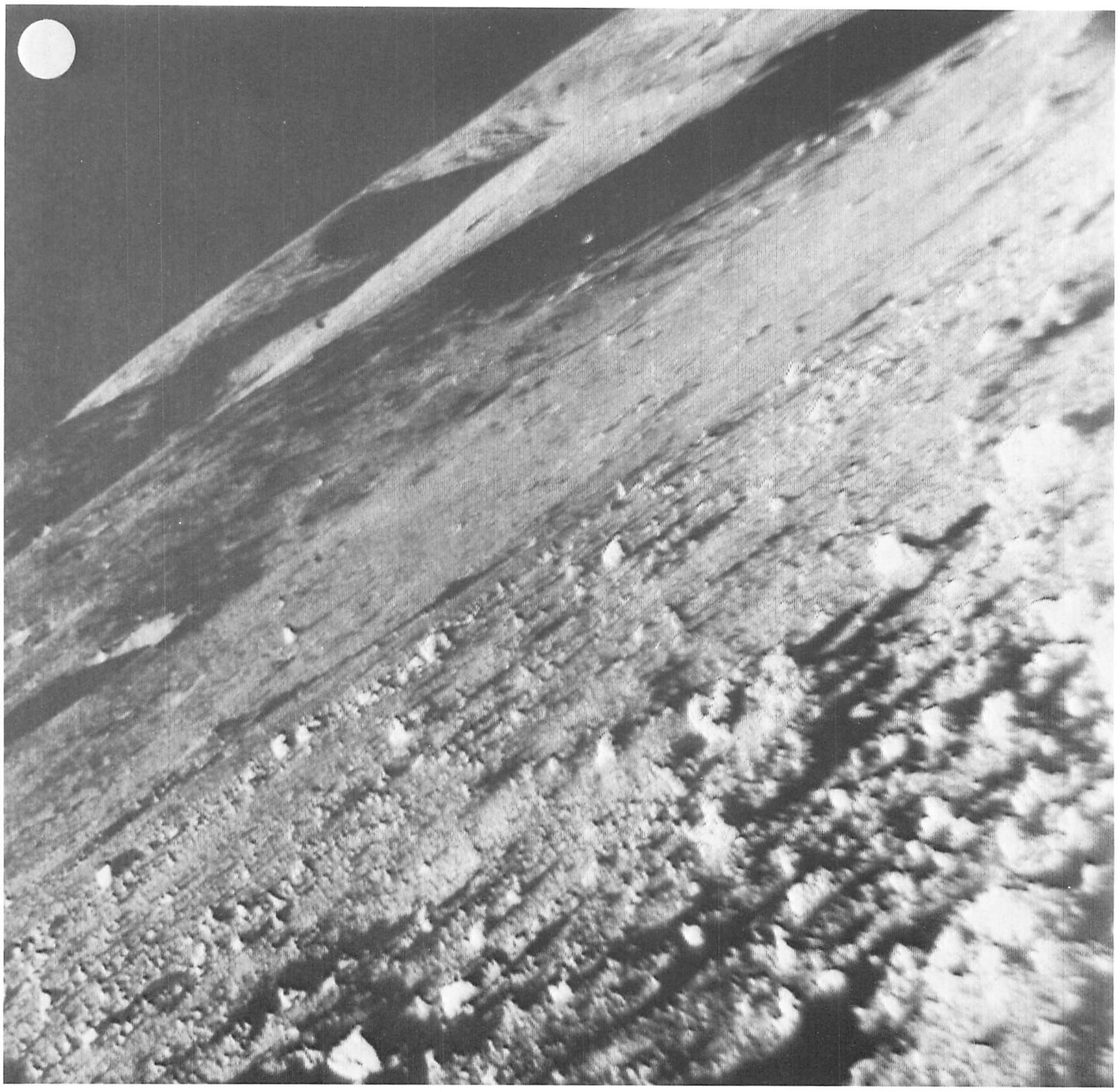
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(196)	**Day 022, 17:11:45**	**—51**	**45**	**205.24**	***f*/16.3**	**N**	**Clear**



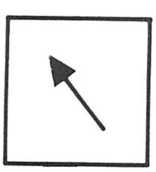


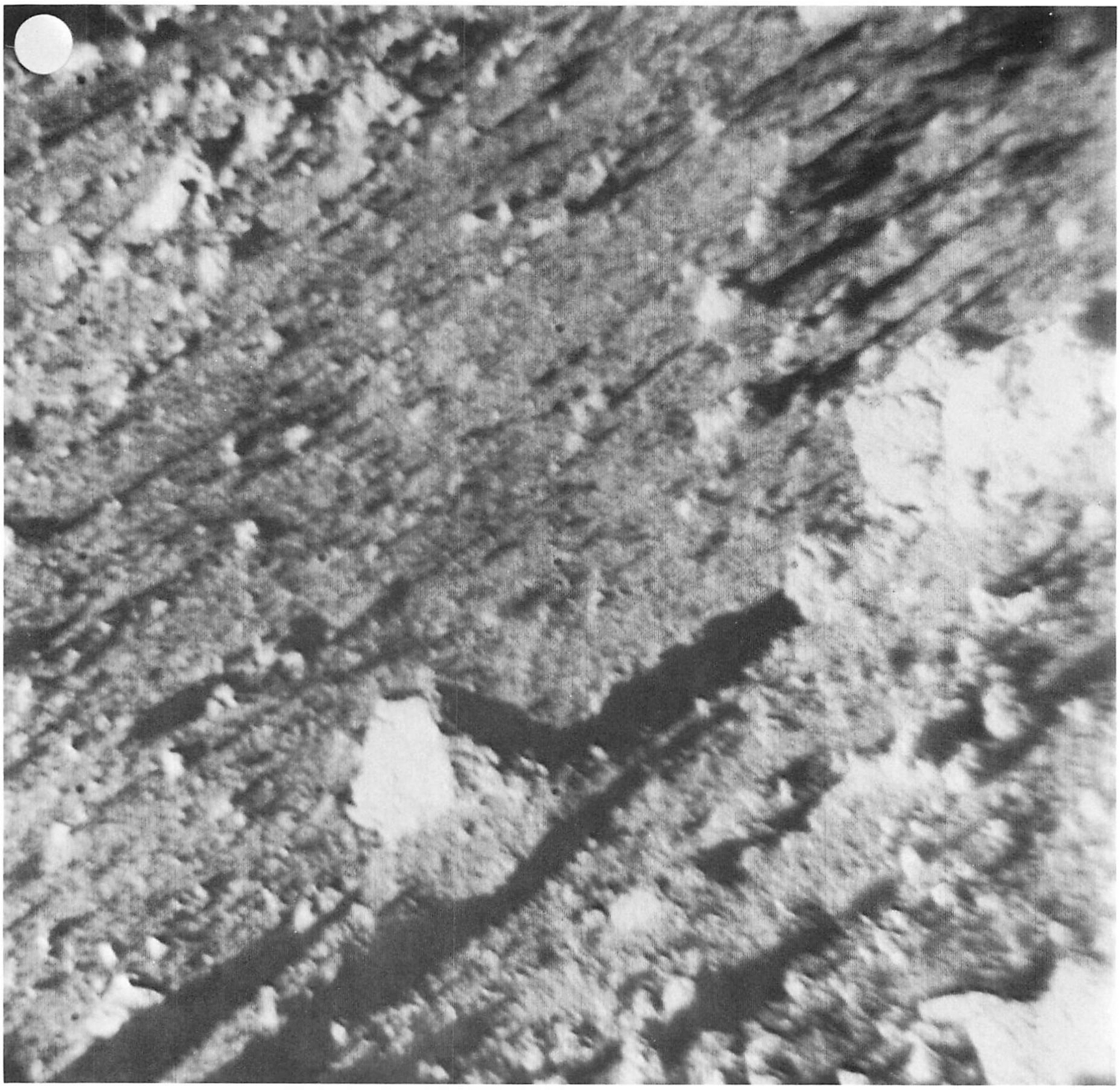
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(197)	Day 022, 17:54:03	—54	—5	2.35	f/9.0	W	Clear



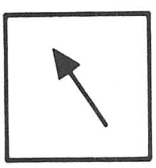


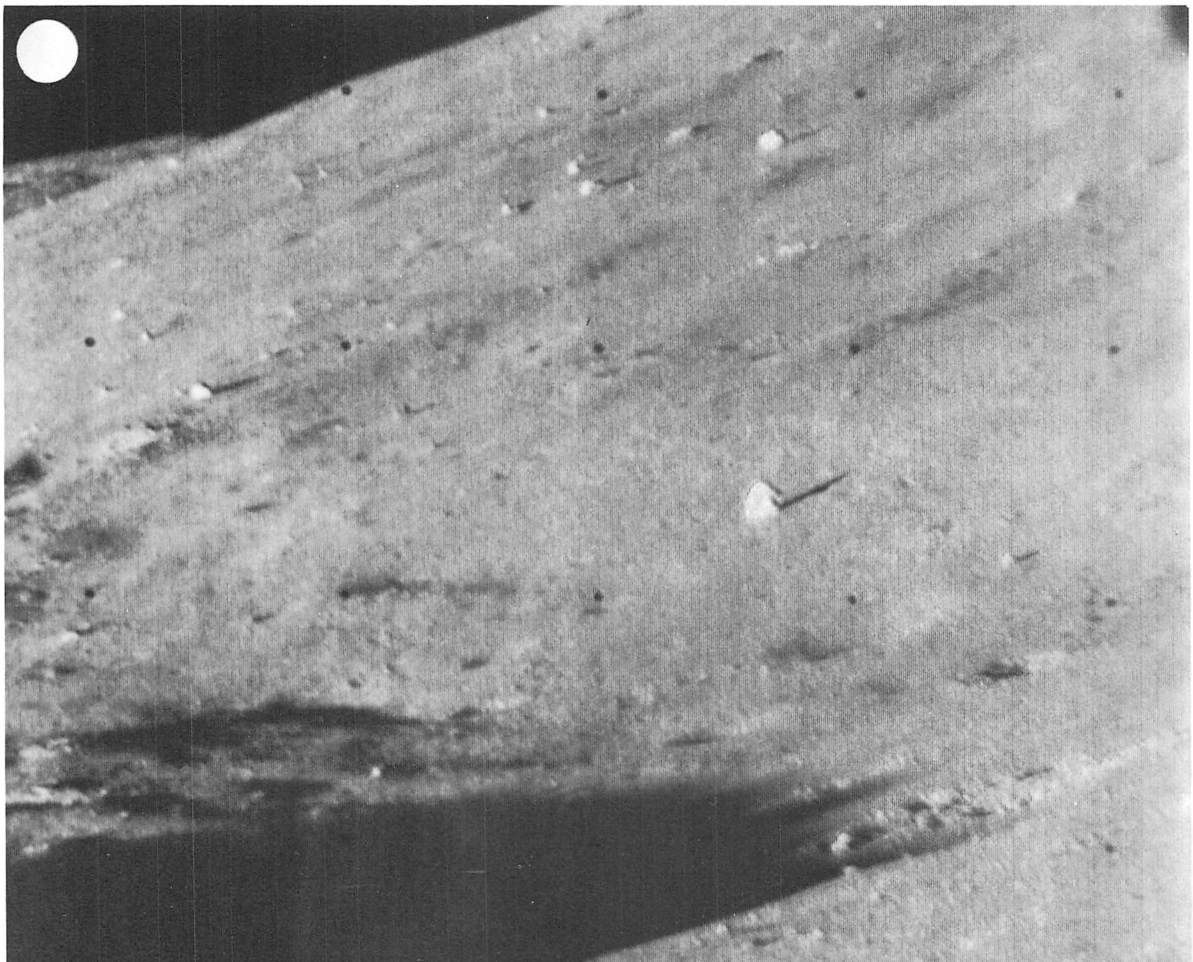
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(198)	**Day 022, 17:55:09**	**—36**	**—5**	**2.35**	**f/7.0**	**W**	**Clear**



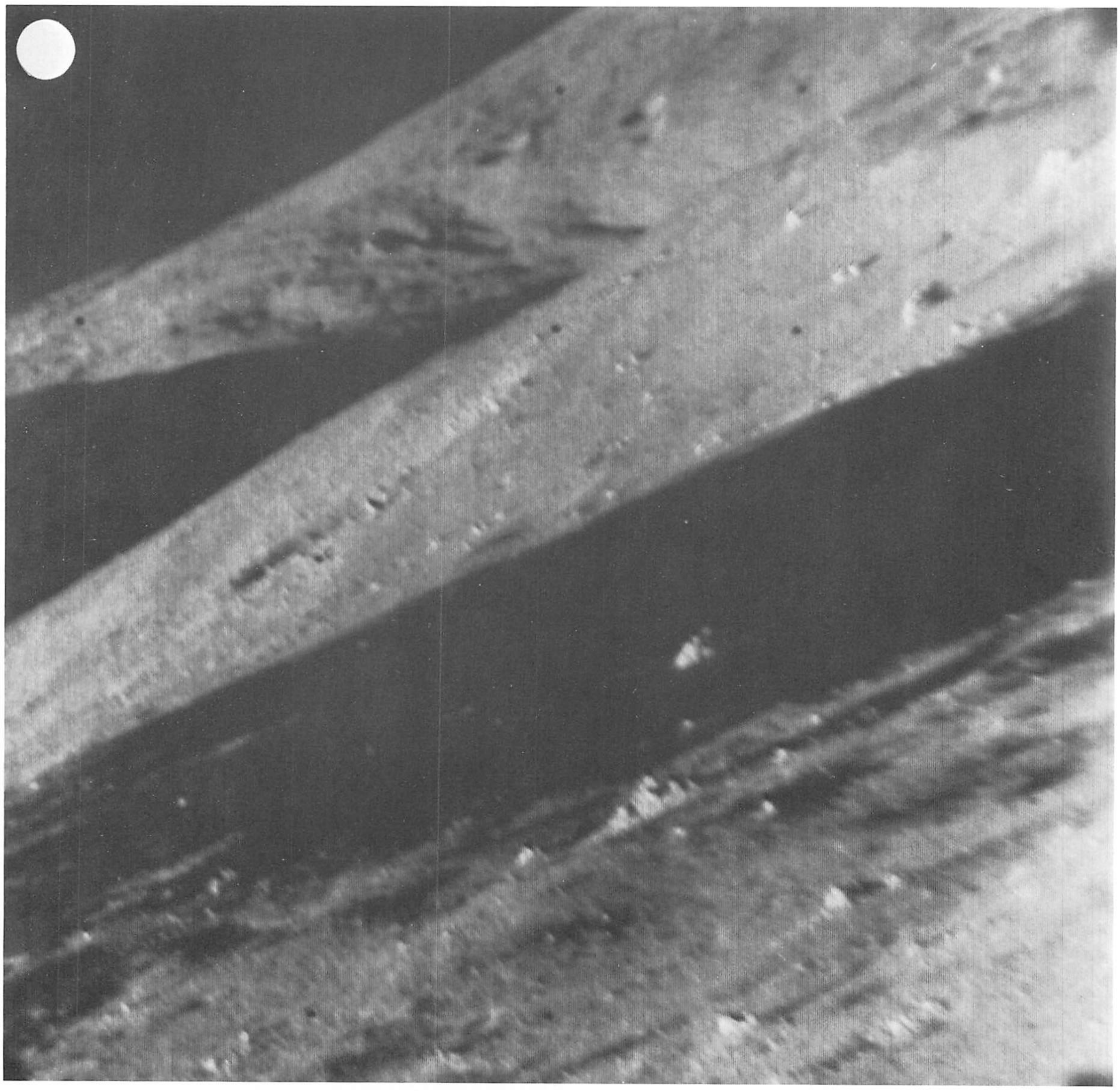


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(199)	**Day 022, 18:29:39**	**−42**	**−10**	**10.68**	***f*/9.0**	**N**	**Clear**

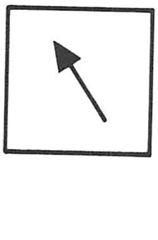


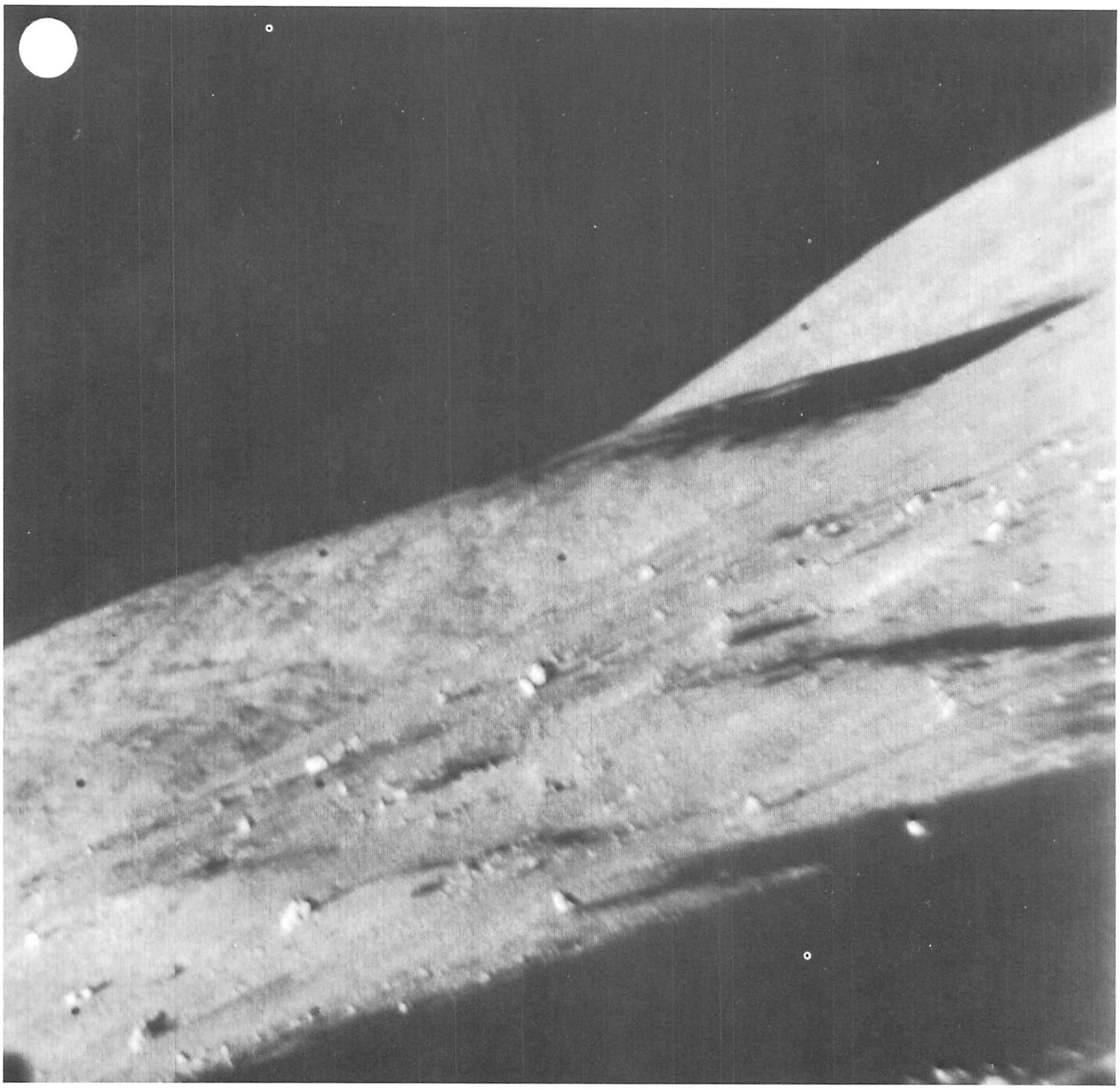


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(200)	**Day 022, 18:31:00**	**−57**	**−5**	**205.24**	***f*/7.7**	**N**	**Clear**

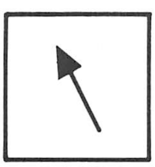


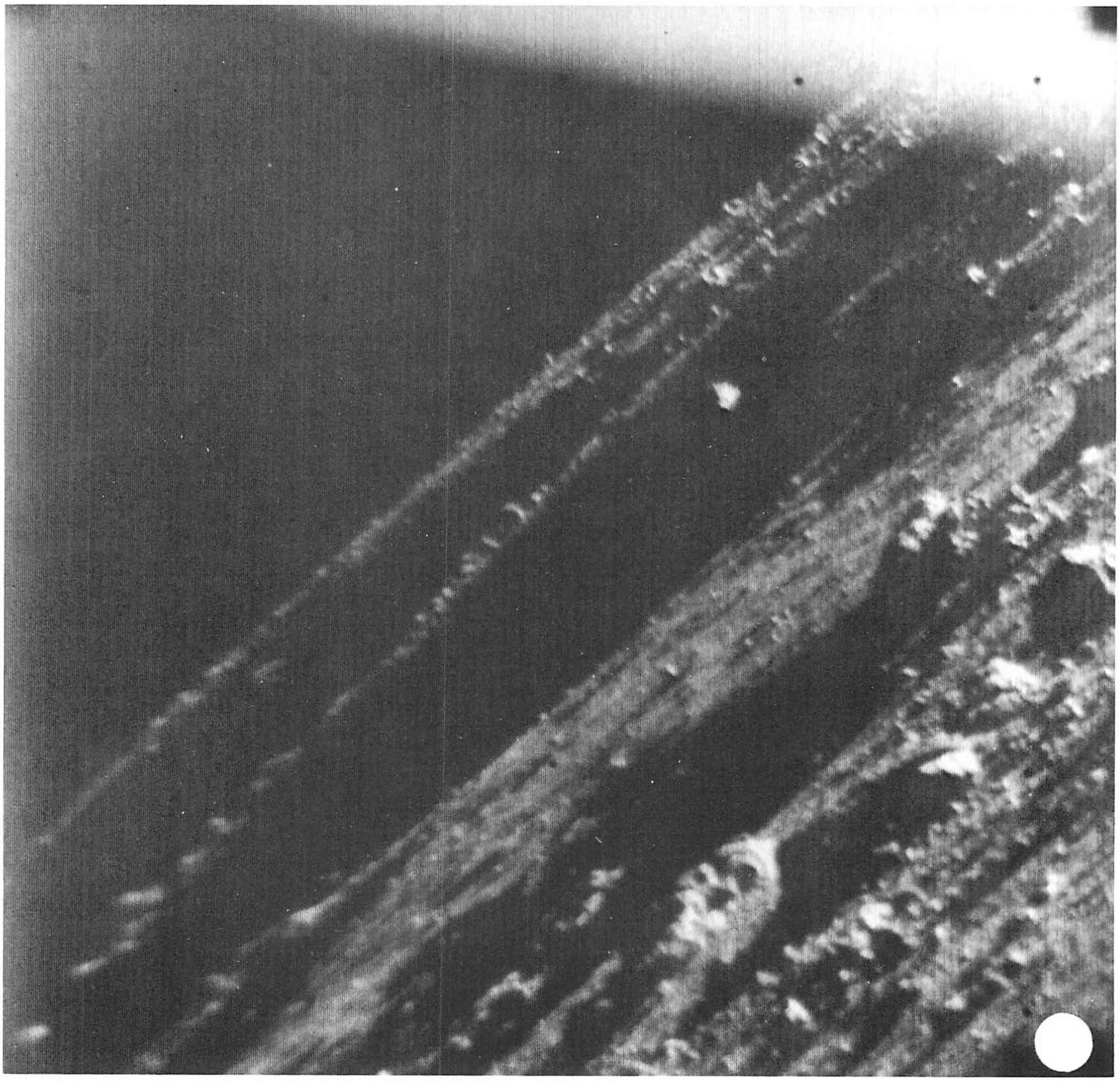
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(201)	Day 022, 18:31:31	—42	0	205.24	f/7.7	N	Clear



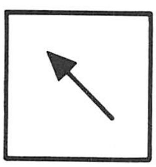


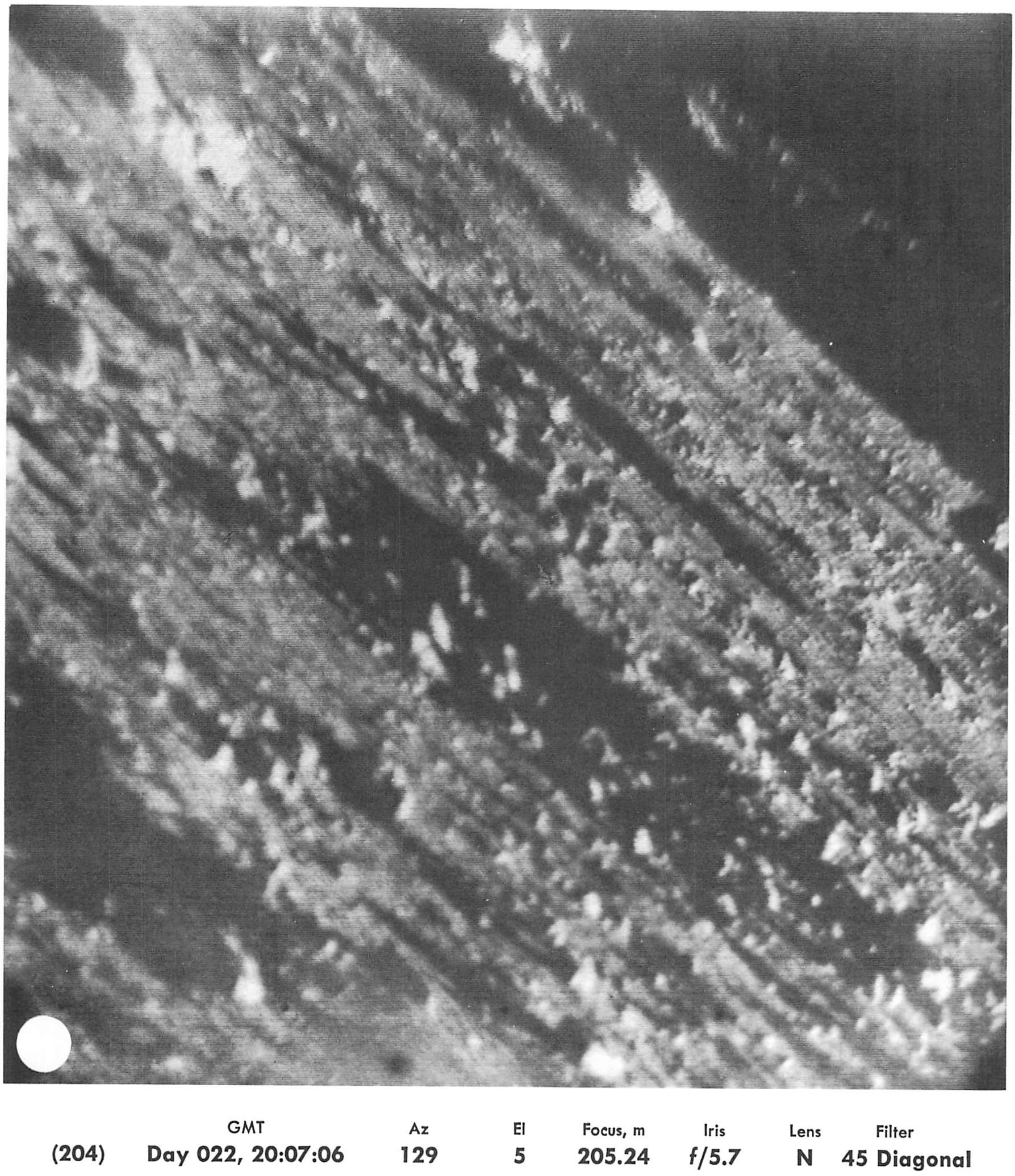
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(202)	Day 022, 18:31:36	—48	0	205.24	f/7.7	N	Clear



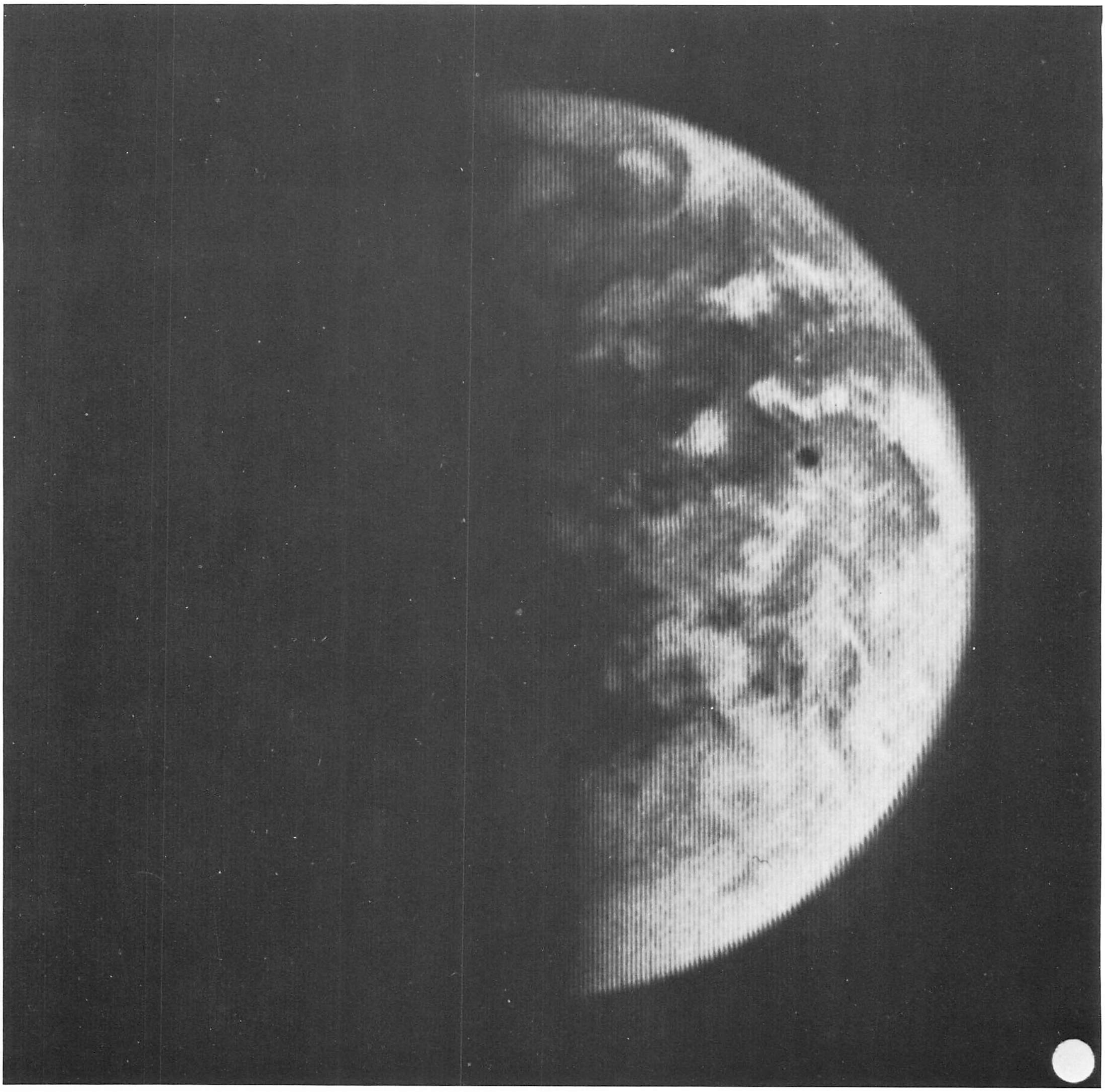


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(203)	**Day 022, 20:05:07**	**120**	**10**	**205.24**	***f*/5.7**	**N**	**45 Diagonal**

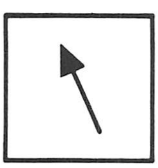


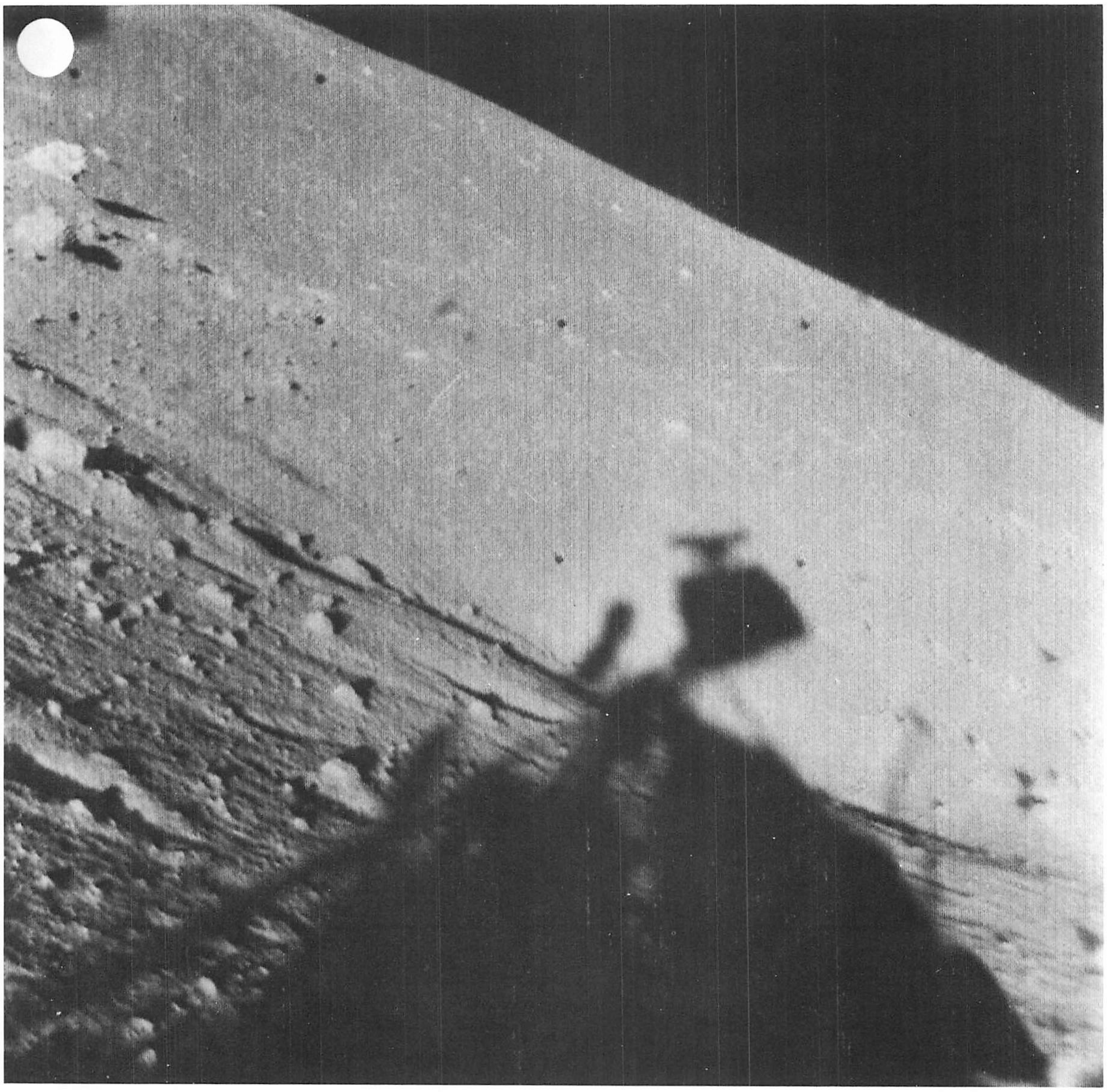


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(204)	**Day 022, 20:07:06**	**129**	**5**	**205.24**	***f*/5.7**	**N**	**45 Diagonal**

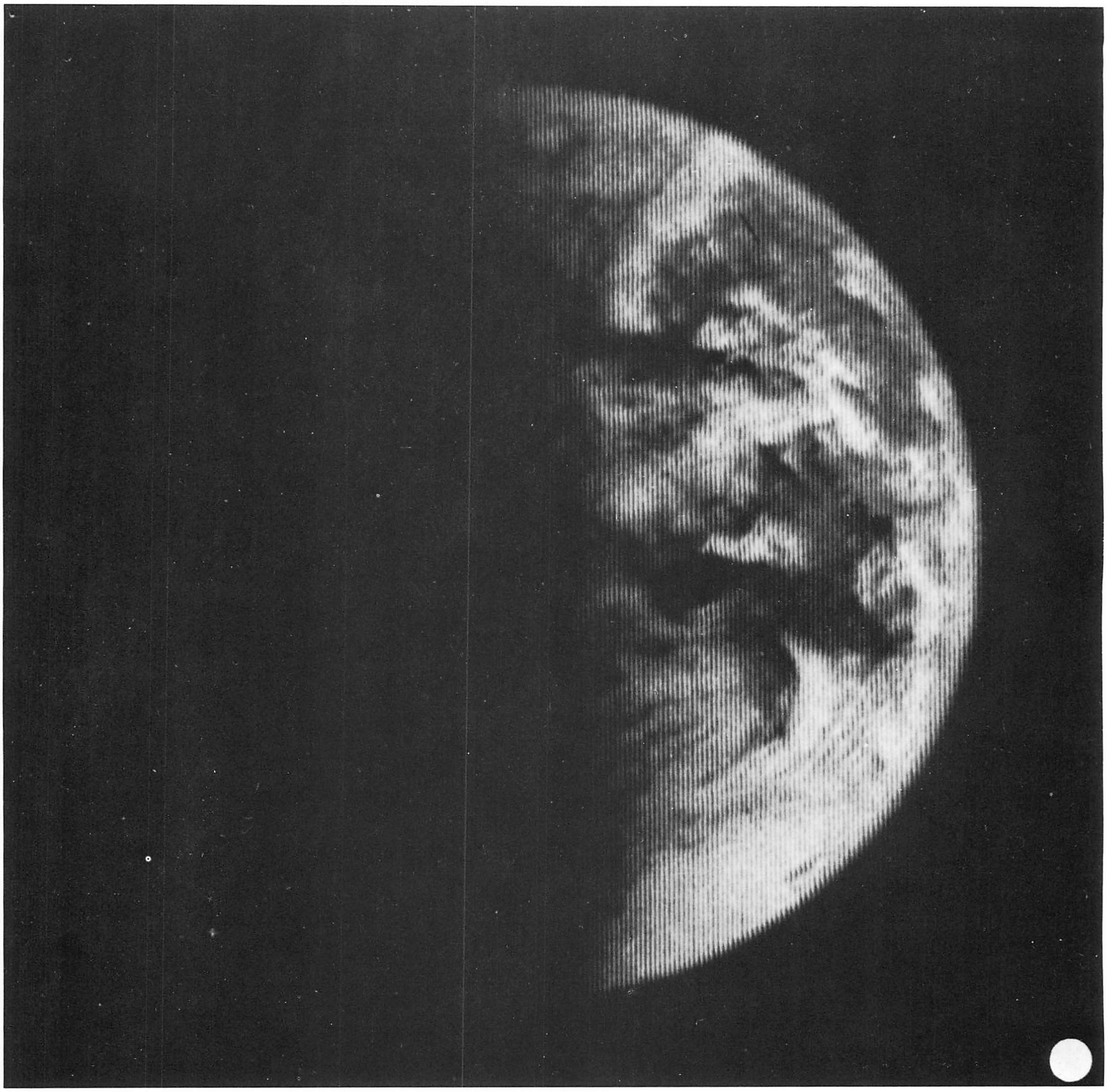


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(205)	Day 022, 20:10:41	−51	45	205.24	f/16.3	N	Clear





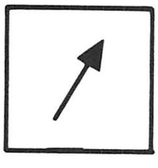
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(206)	**Day 022, 23:07:58**	**−111**	**−25**	**3.93**	***f*/13.4**	**W**	**Clear**

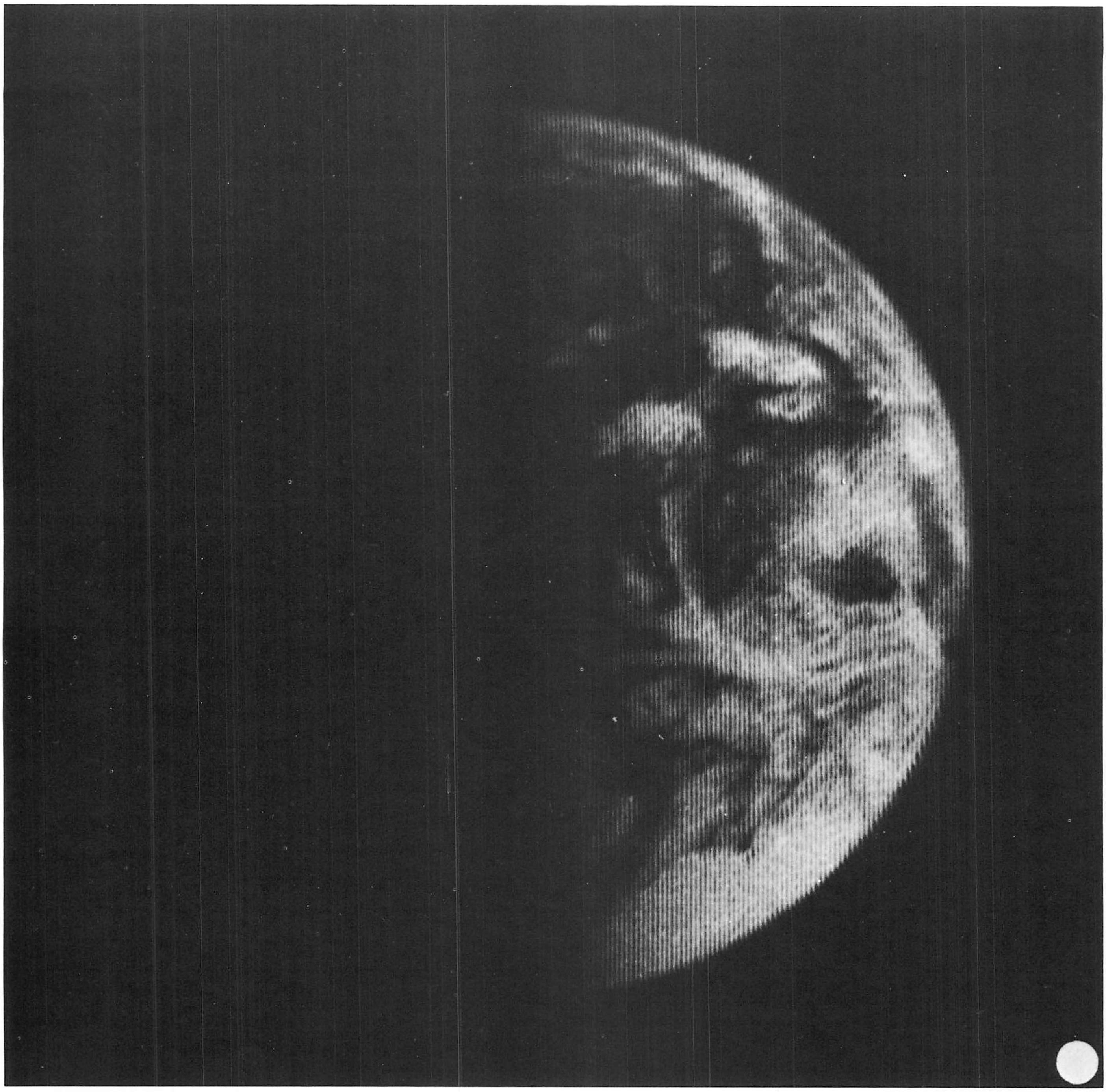


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(207)	Day 022, 23:21:21	—51	45	205.24	$f/17.2$	N	Clear

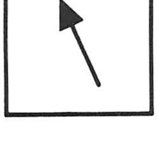
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(208)	**Day 023, 01:04:55**	**—51**	**45**	**6.80**	**f/17.5**	**N**	**Clear**

	GMT	Az	El	Focus, m	Iris	Lens	Filter
(209)	**Day 023, 03:05:25**	**—117**	**—20**	**205.24**	**f/12.8**	**W**	**Clear**

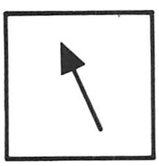


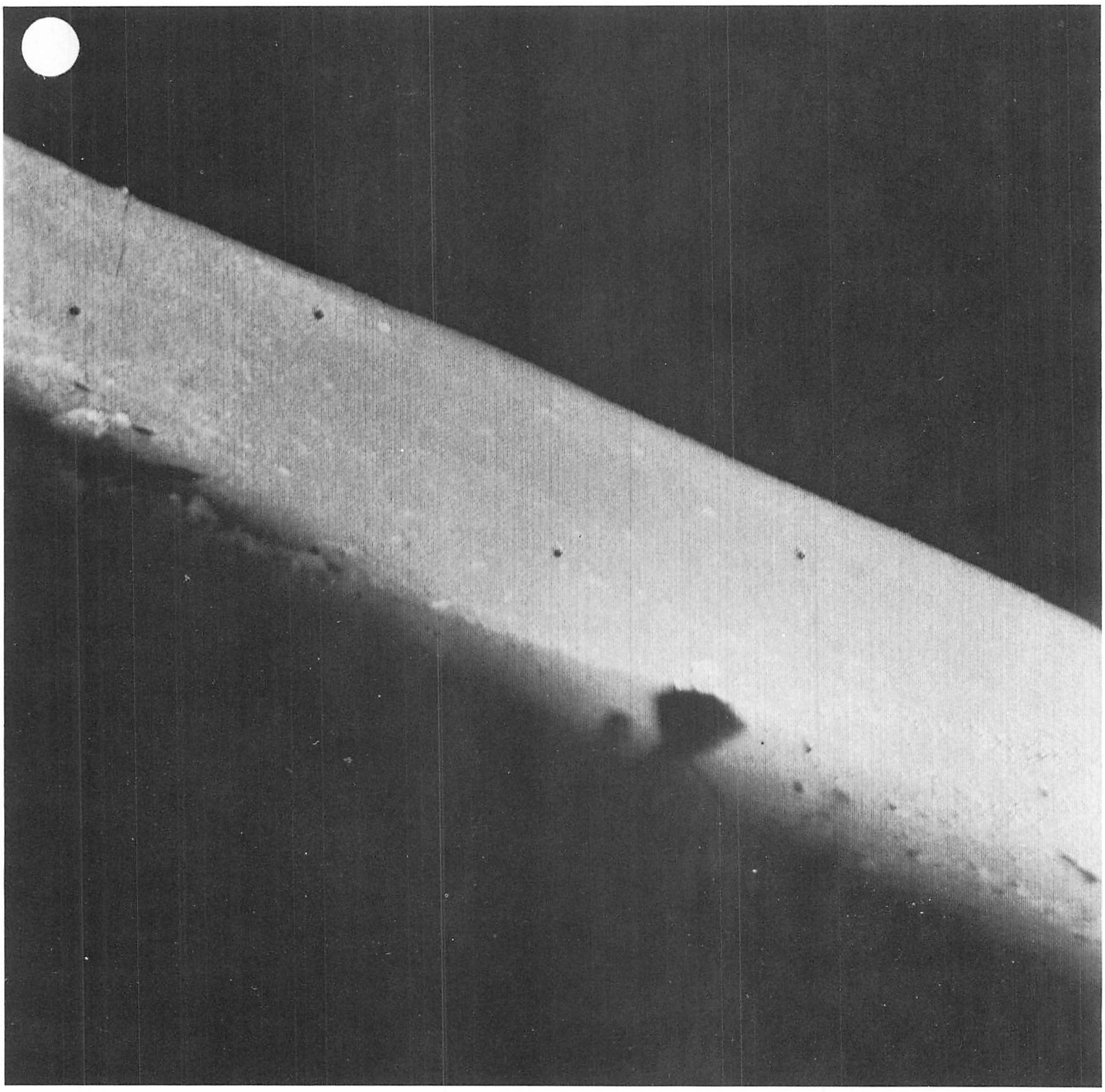


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(210)	**Day 023, 03:09:23**	**—51**	**45**	**205.24**	**f/16.3**	**N**	**Clear**

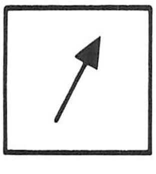


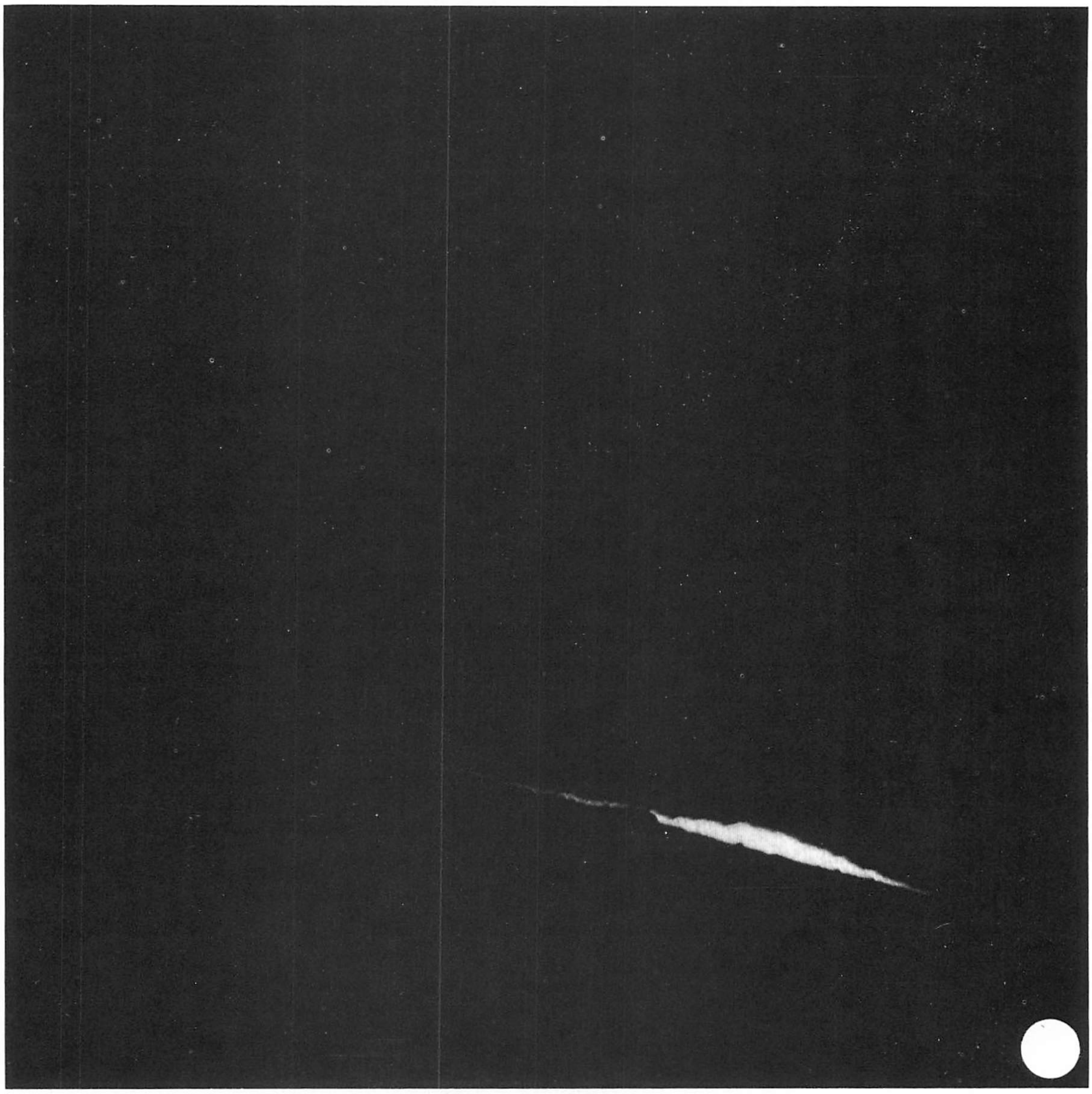
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(211)	**Day 023, 05:09:59**	**—51**	**45**	**205.24**	**f/15.6**	**N**	**Clear**



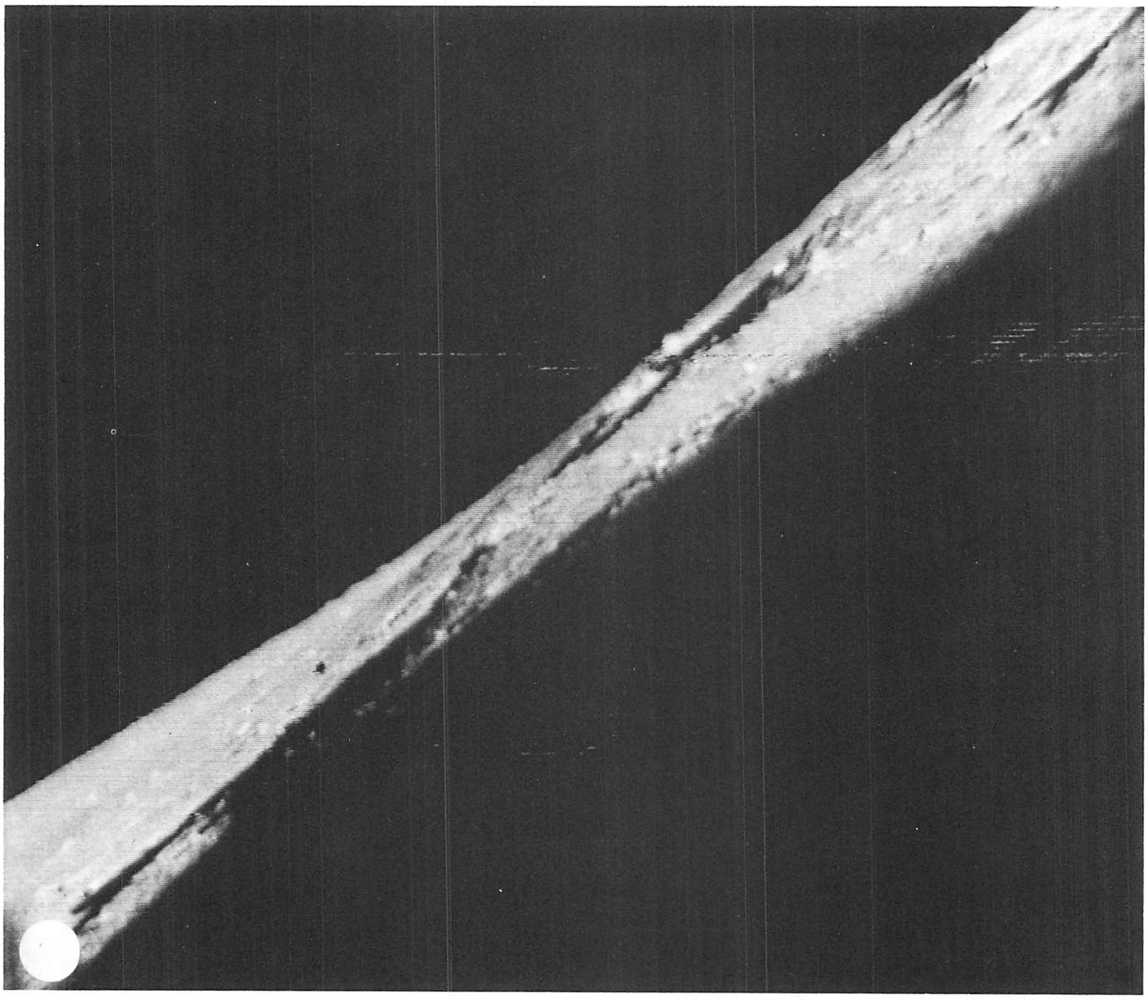


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(212)	Day 023, 05:35:08	—111	—15	205.24	f/9.5	W	Clear

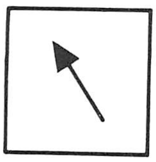


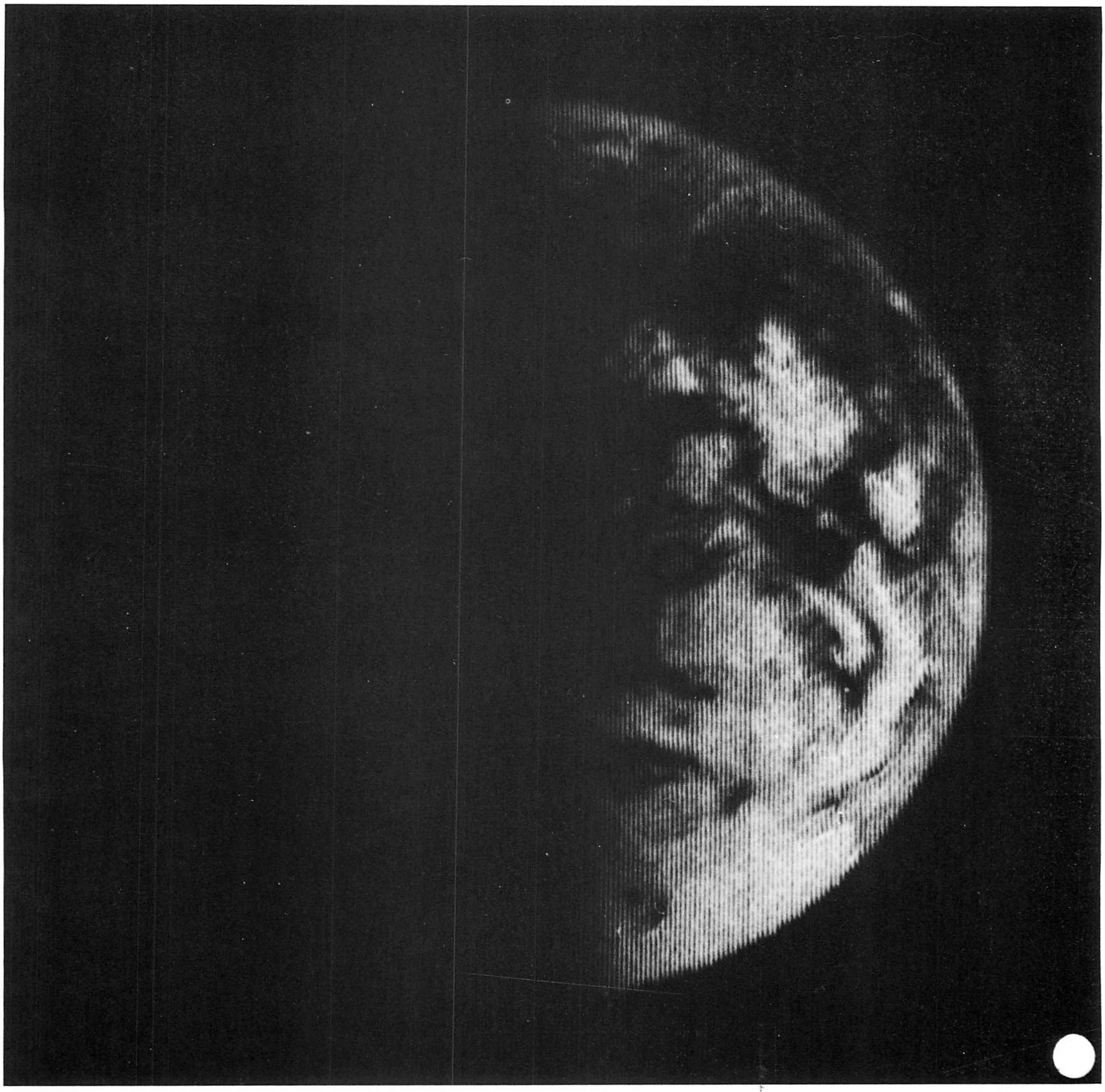


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(213)	**Day 023, 06:18:32**	**69**	**20**	**205.24**	**$f/4.0$**	**N**	**Clear**

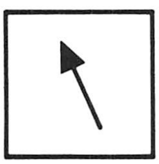


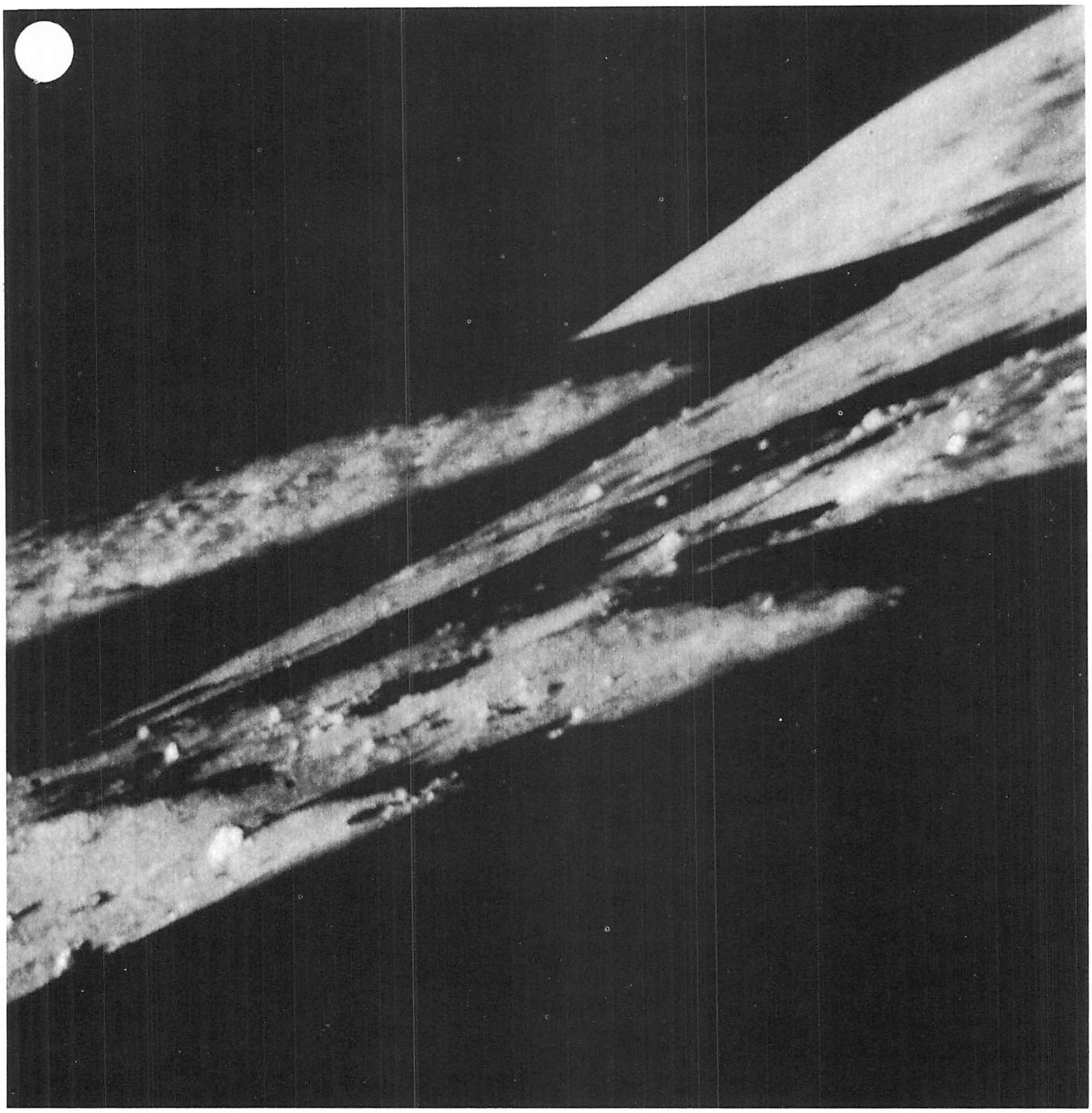
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(214)	Day 023, 07:19:16	−153	−10	205.24	f/6.6	W	Clear



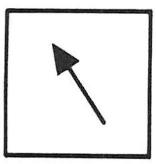


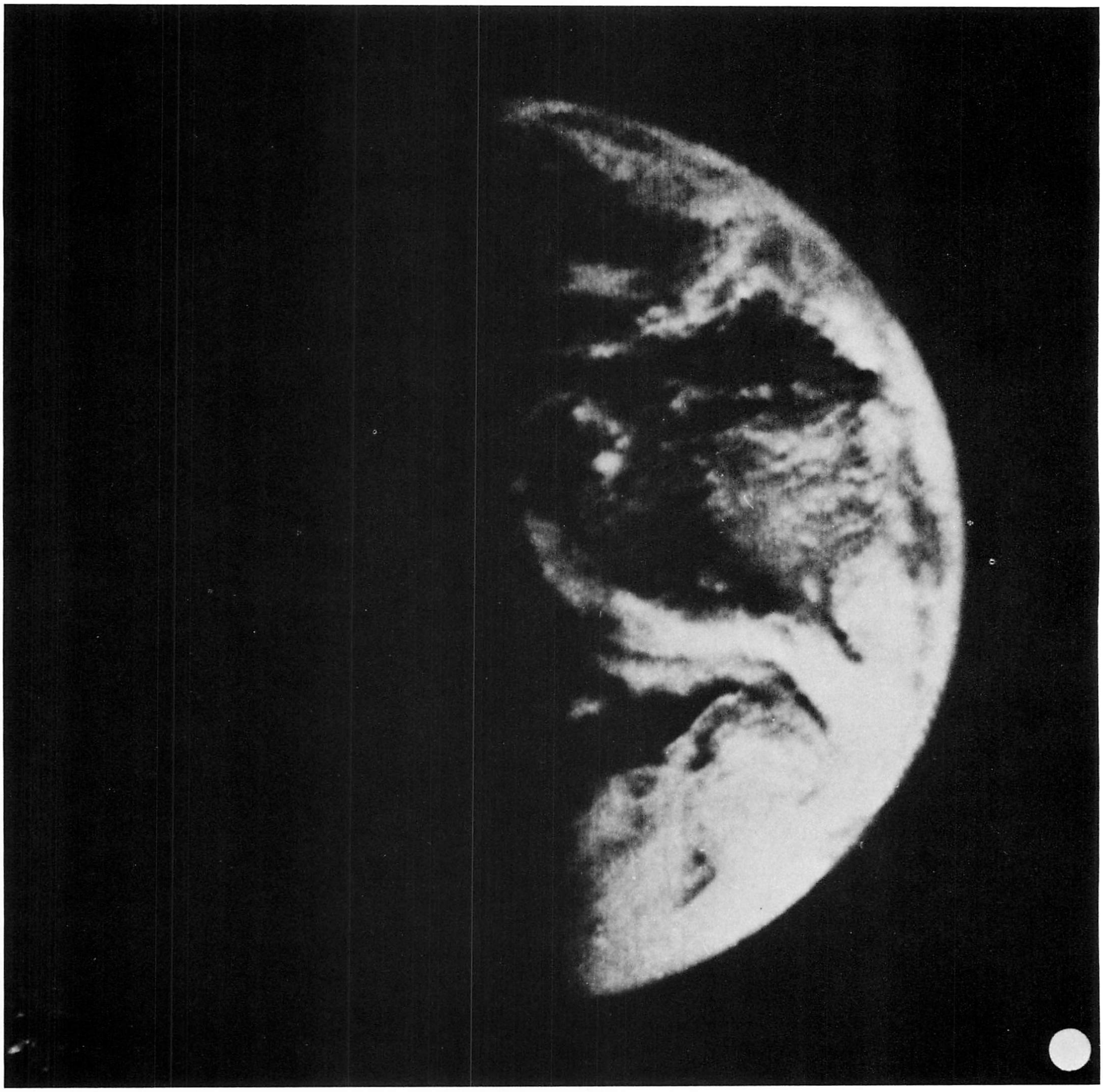
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(215)	**Day 023, 07:35:42**	**—51**	**45**	**205.24**	**$f/15.5$**	**N**	**Clear**



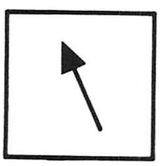


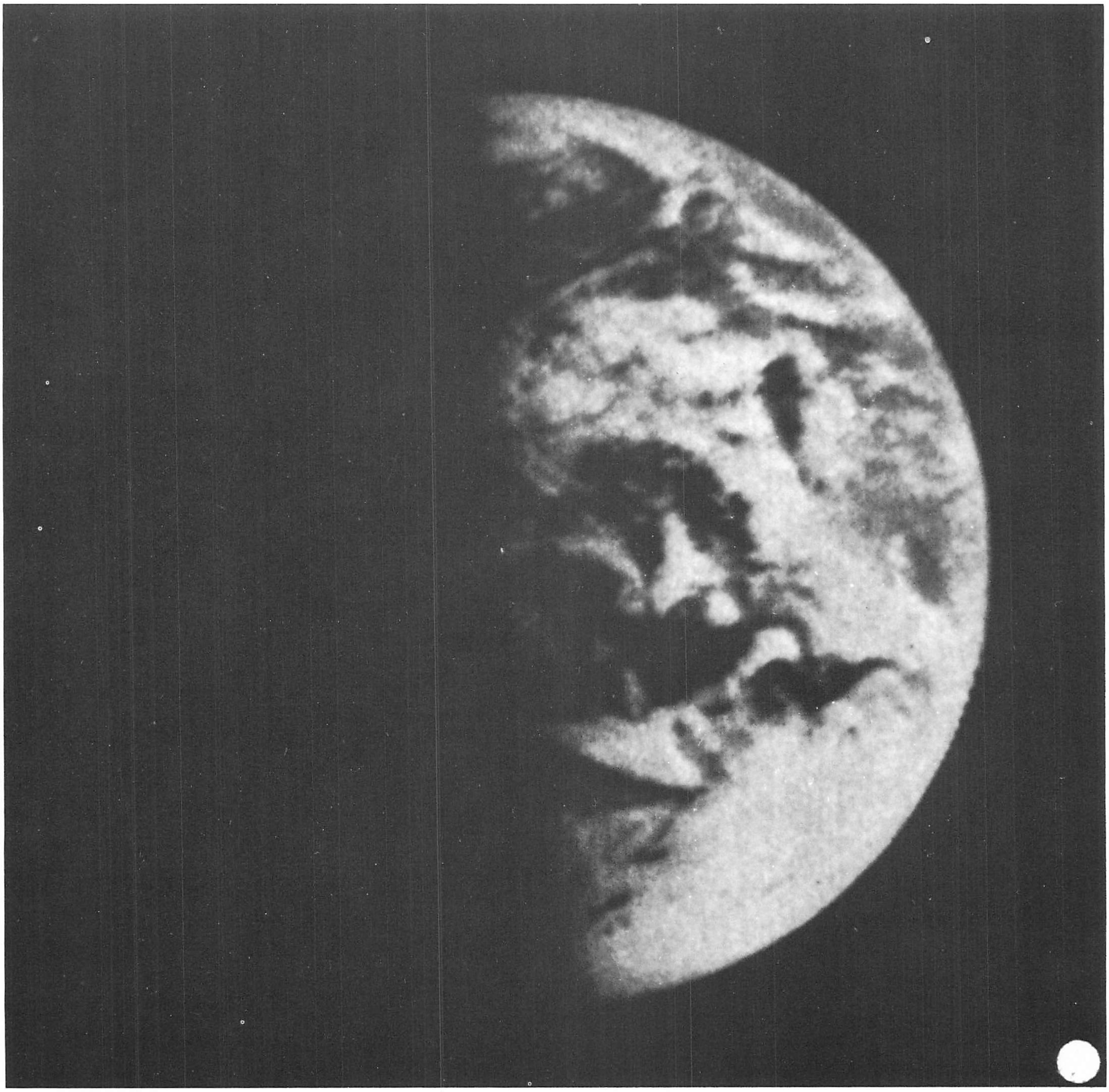
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(216)	**Day 023, 10:03:54**	**—42**	**0**	**28.00**	**$f/5.3$**	**N**	**Clear**



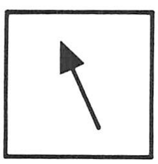


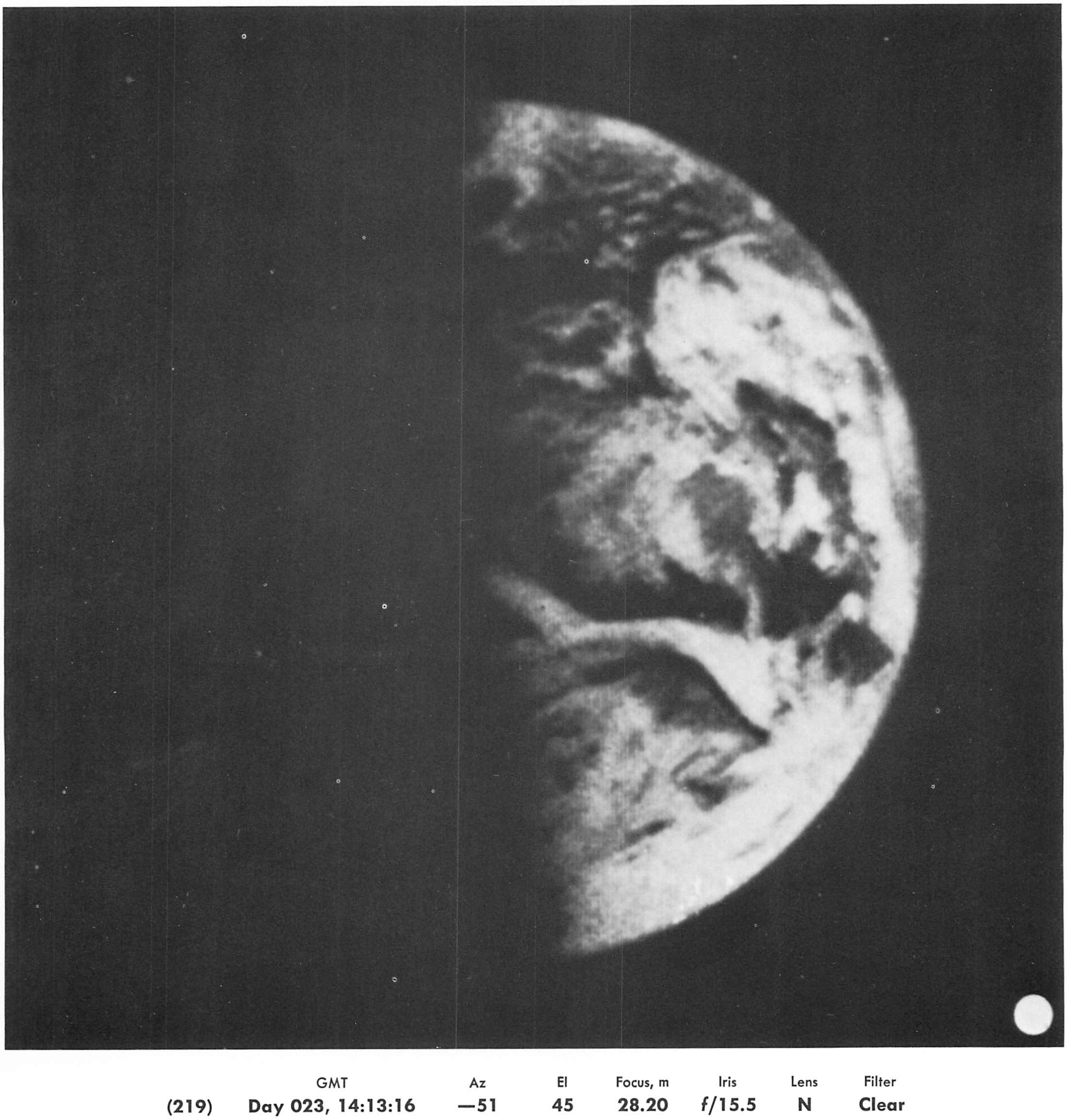
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(217)	**Day 023, 10:07:35**	**—51**	**45**	**28.00**	**f/15.5**	**N**	**Clear**



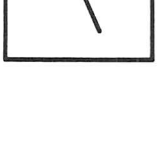


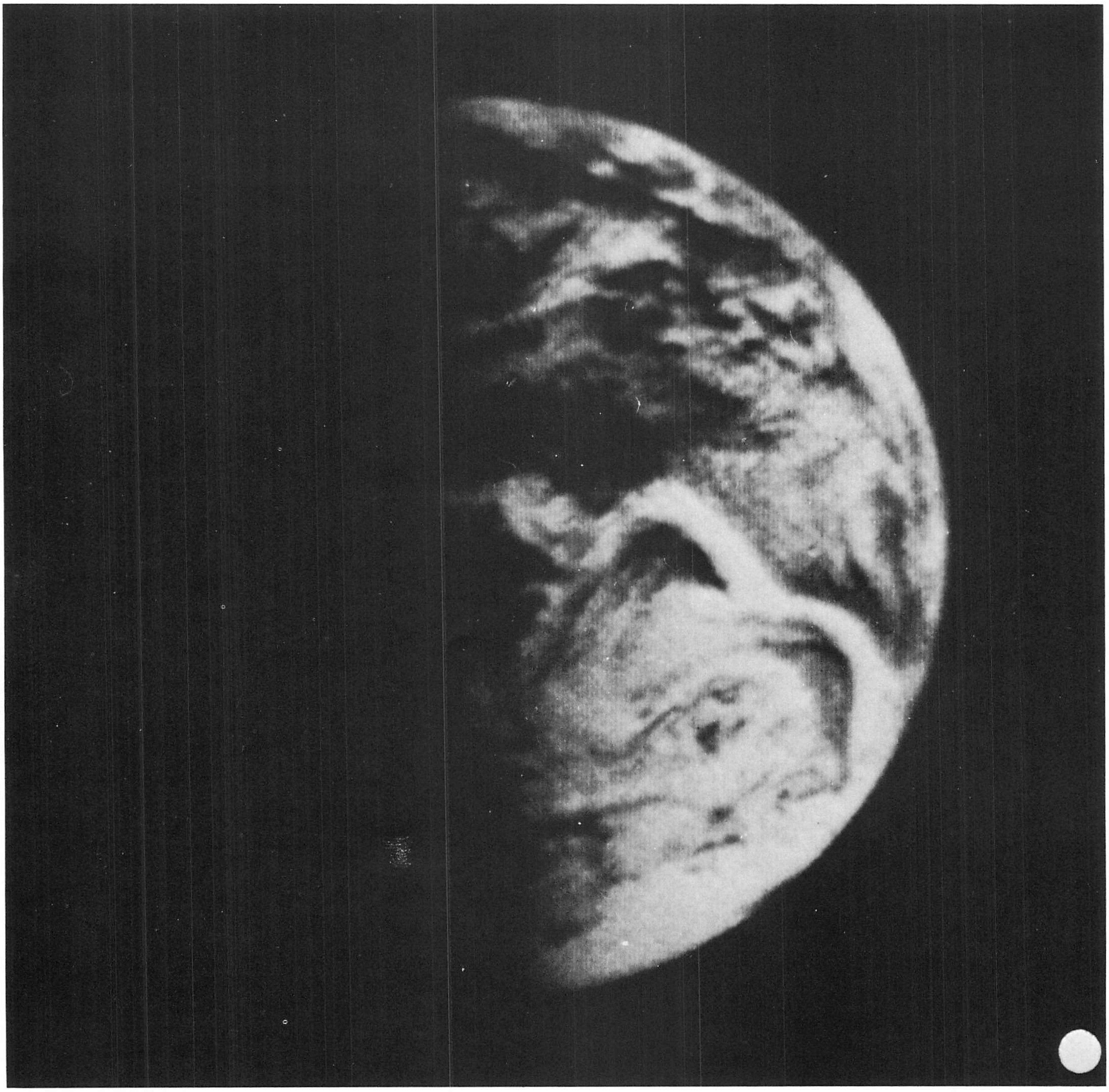
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(218)	**Day 023, 12:12:36**	**—51**	**45**	**28.00**	***f*/10.4**	**N**	**Clear**





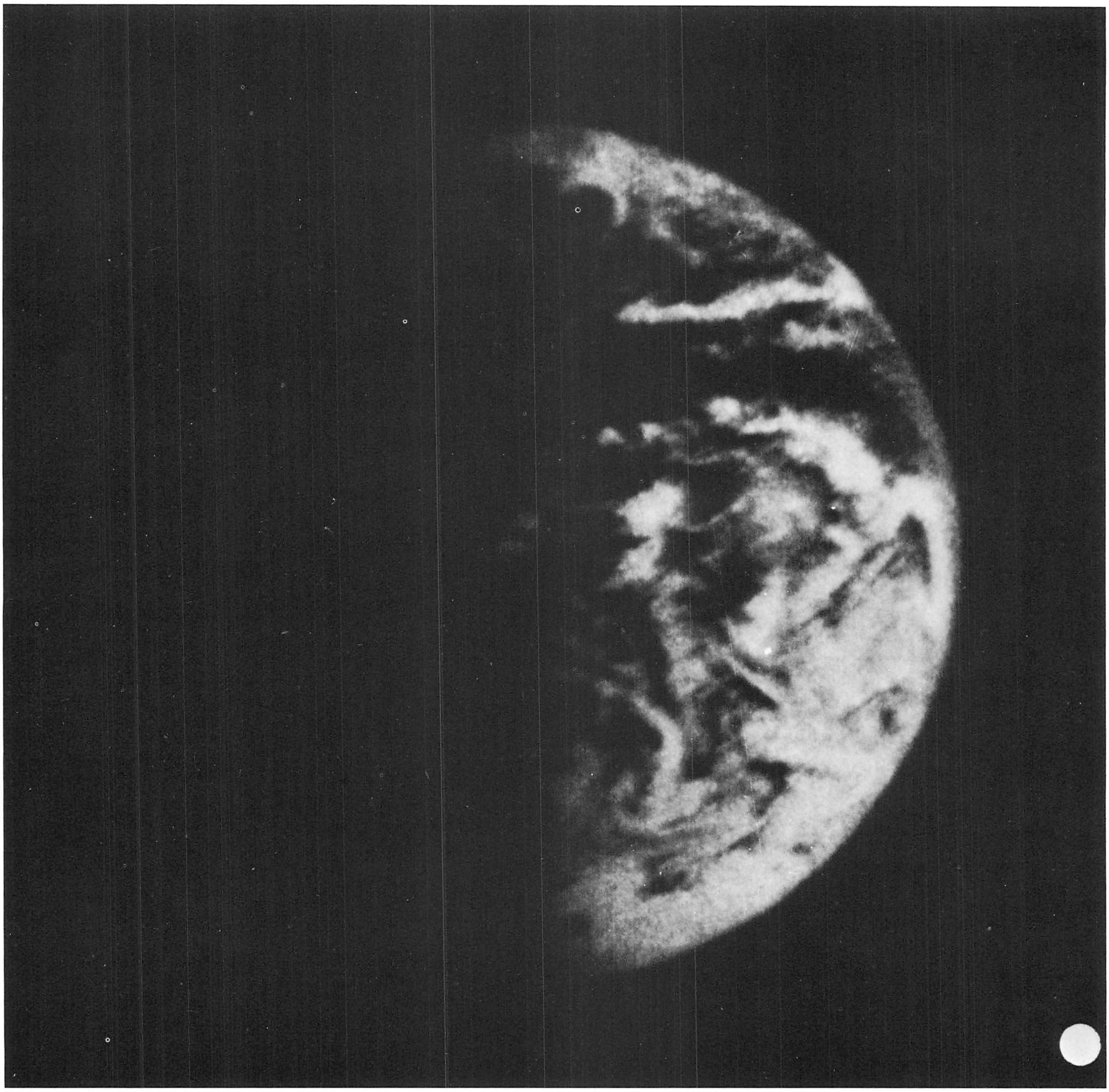
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(219)	Day 023, 14:13:16	—51	45	28.20	f/15.5	N	Clear



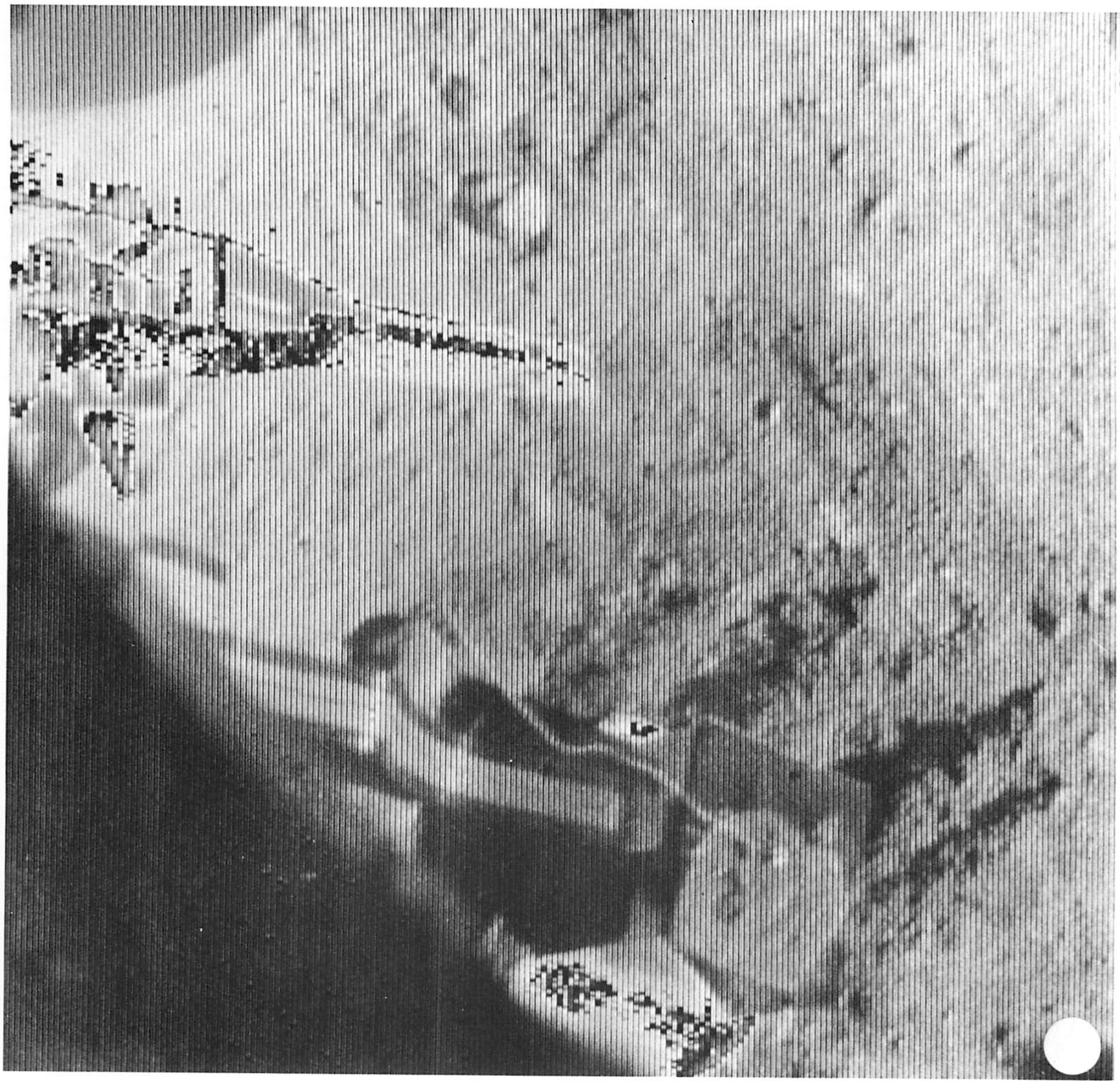


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(220)	**Day 023, 16:29:01**	**—51**	**45**	**27.80**	***f*/15.5**	**N**	**Clear**

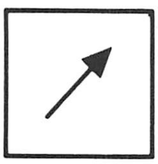
	GMT	Az	El	Focus, m	Iris	Lens	Filter
(221)	Day 023, 17:05:39	−111	35	28.00	f/4.0	W	Clear

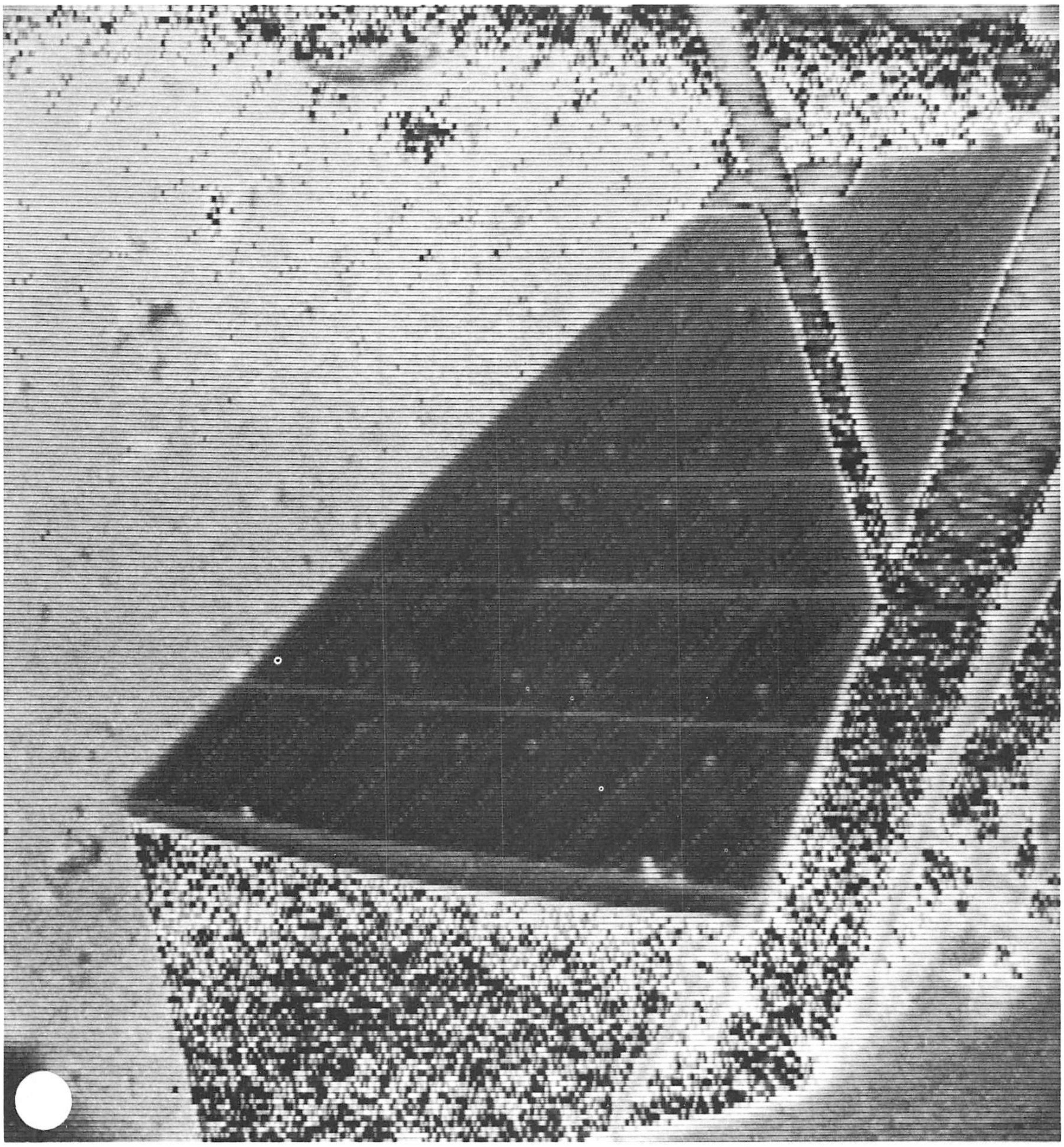


	GMT	Az	El	Focus, m	Iris	Lens	Filter
(222)	Day 023, 19:34:50	—51	45	28.00	$f/15.5$	N	Clear

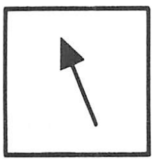


	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(223)	Day 045, 09:03:20	48	—45	1.43	f/16.0	W	Clear	200 Lines, Second Lunar Day





	GMT	Az	El	Focus, m	Iris	Lens	Filter	Remarks
(224)	Day 045, 11:11:55	—168	—35	1.43	f/16.0	W	Clear	200 Lines, Second Lunar Day



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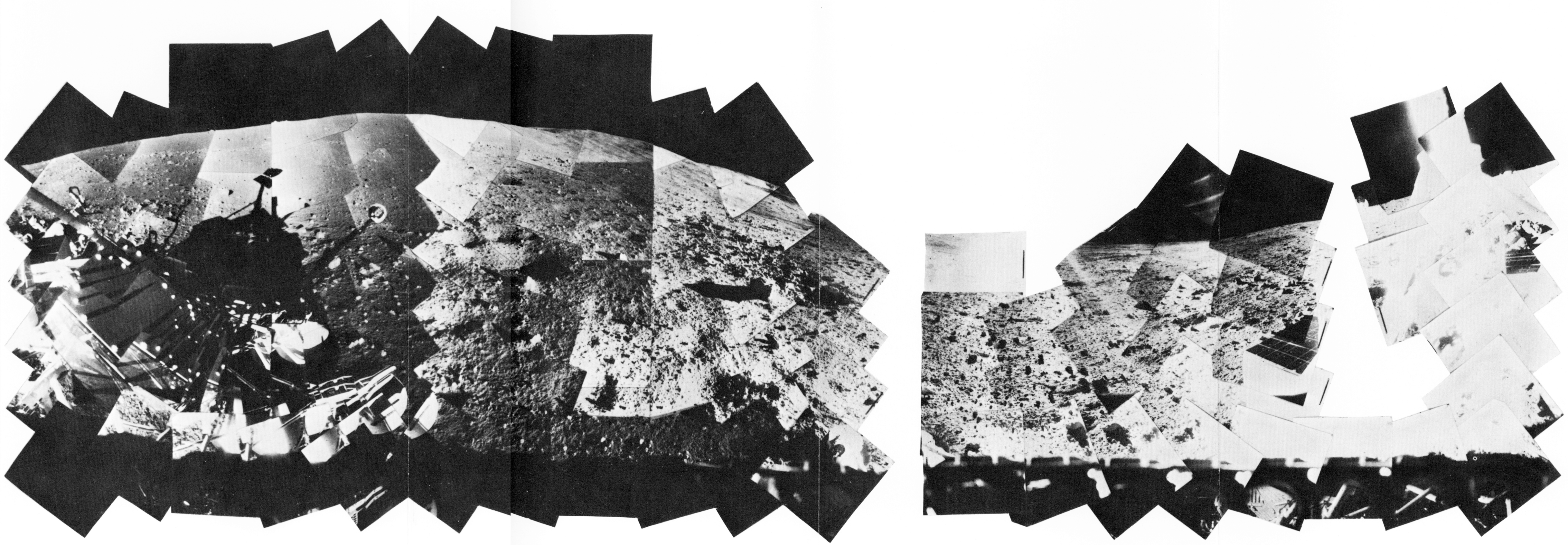
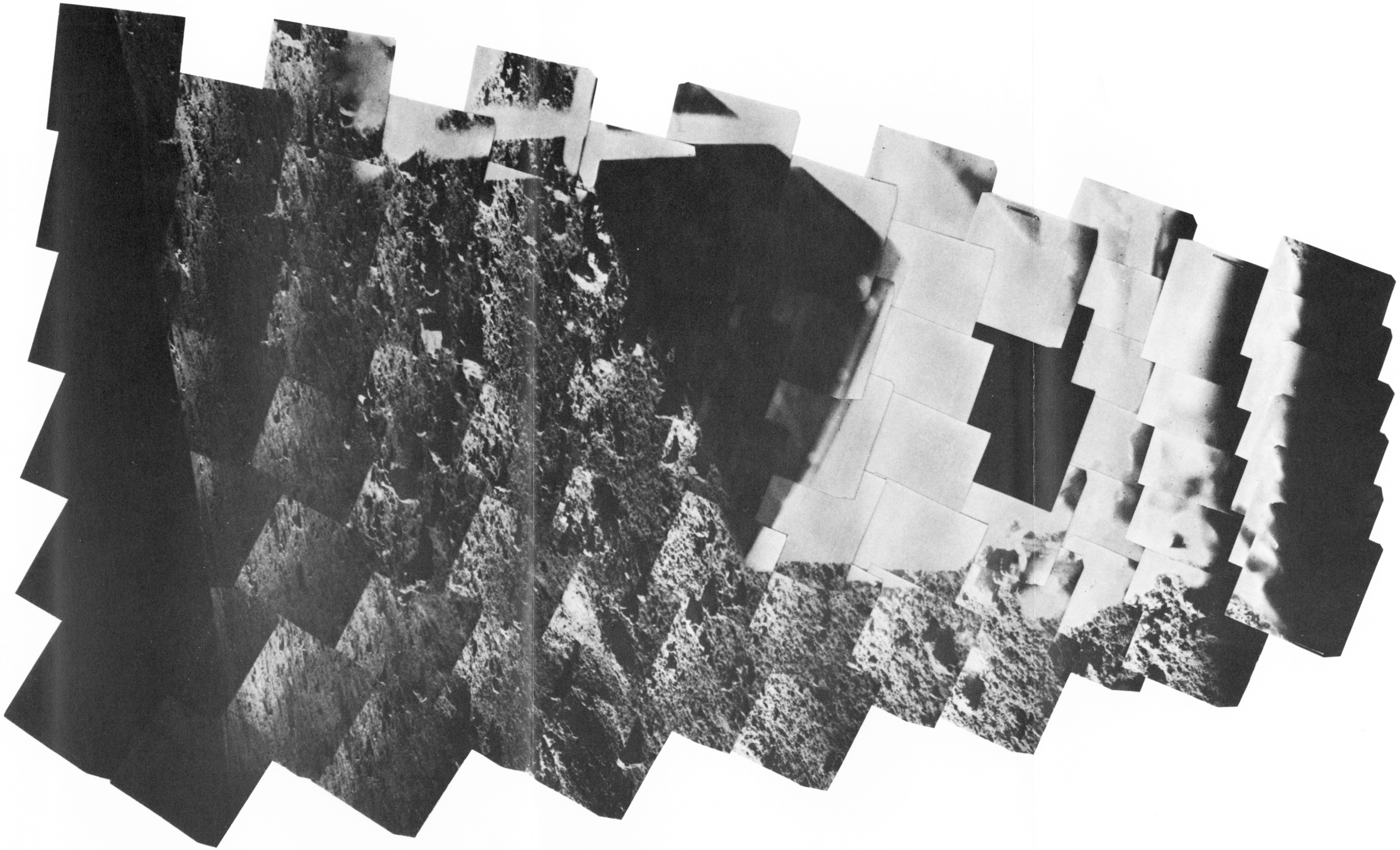
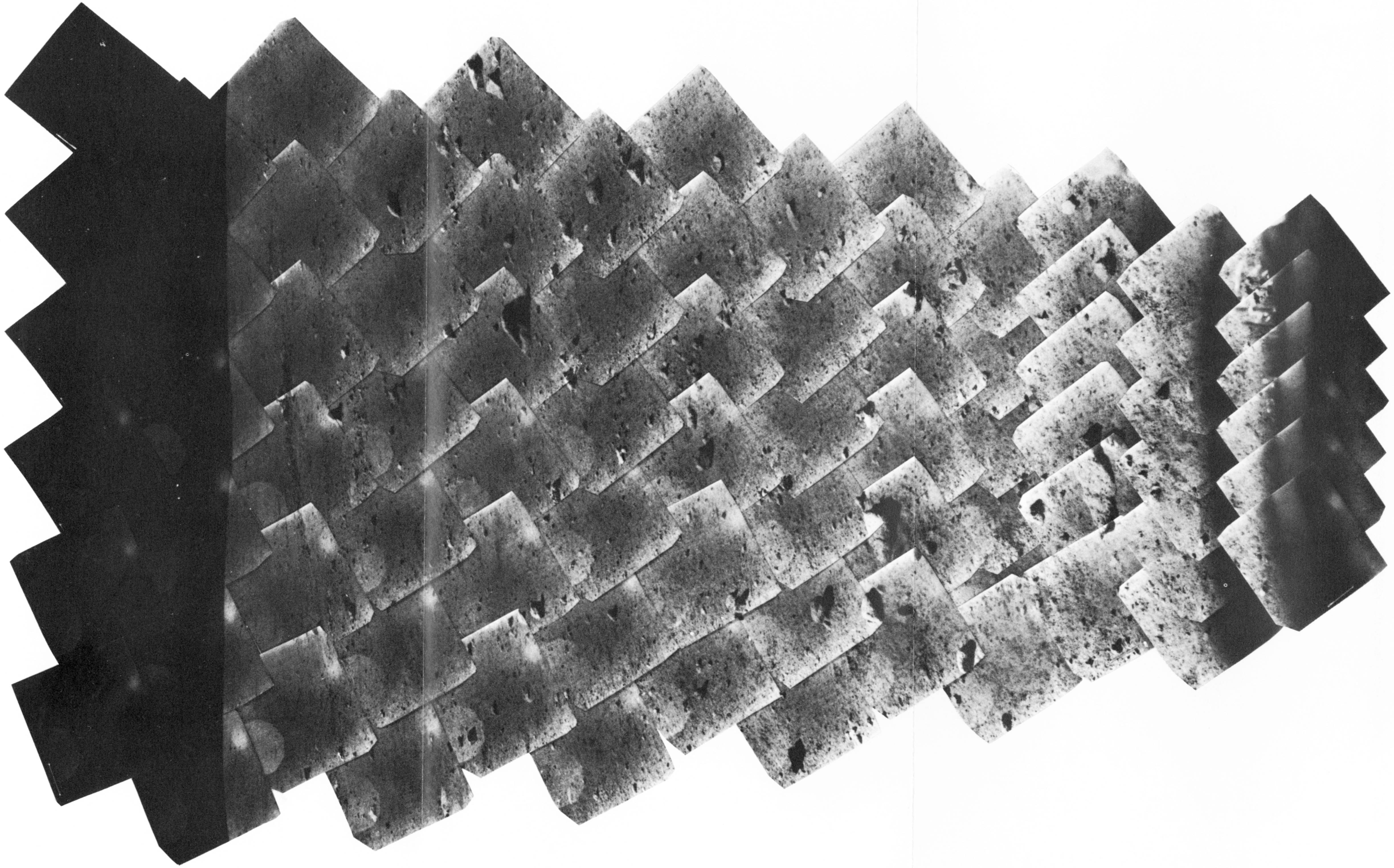


(1)	Day 010	Azimuth	Lens Focal Length	Identification
		−216 to +126	W	Catalog No. 7-2-SI; 360-deg Panorama—Semi-Improved

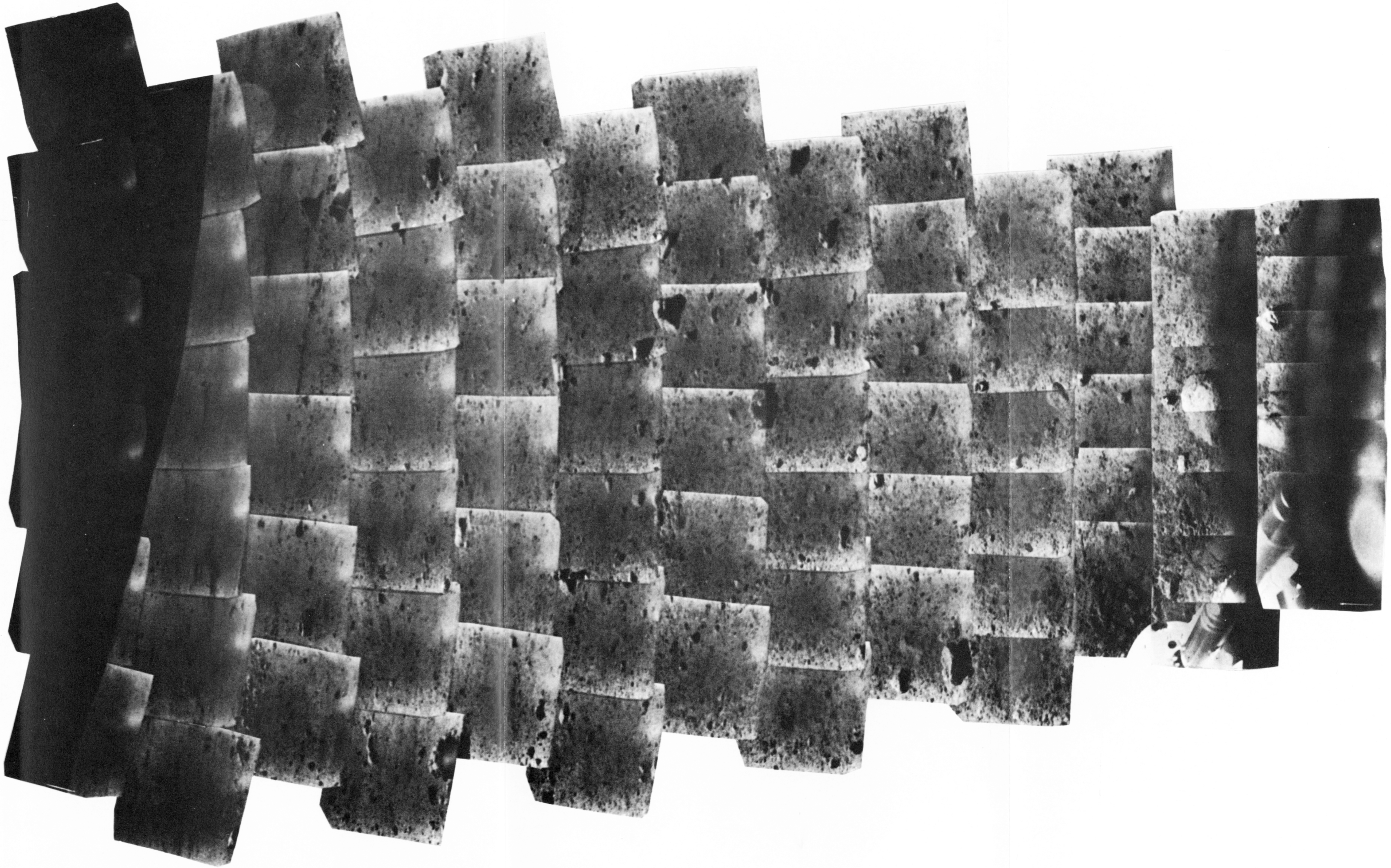
		Azimuth	Lens Focal Length	Identification
(2)	Day 010	—213 to —180	N	Catalog No. 7-6-S1; Segment 1—Sectors 1 and 2, Semi-Improved



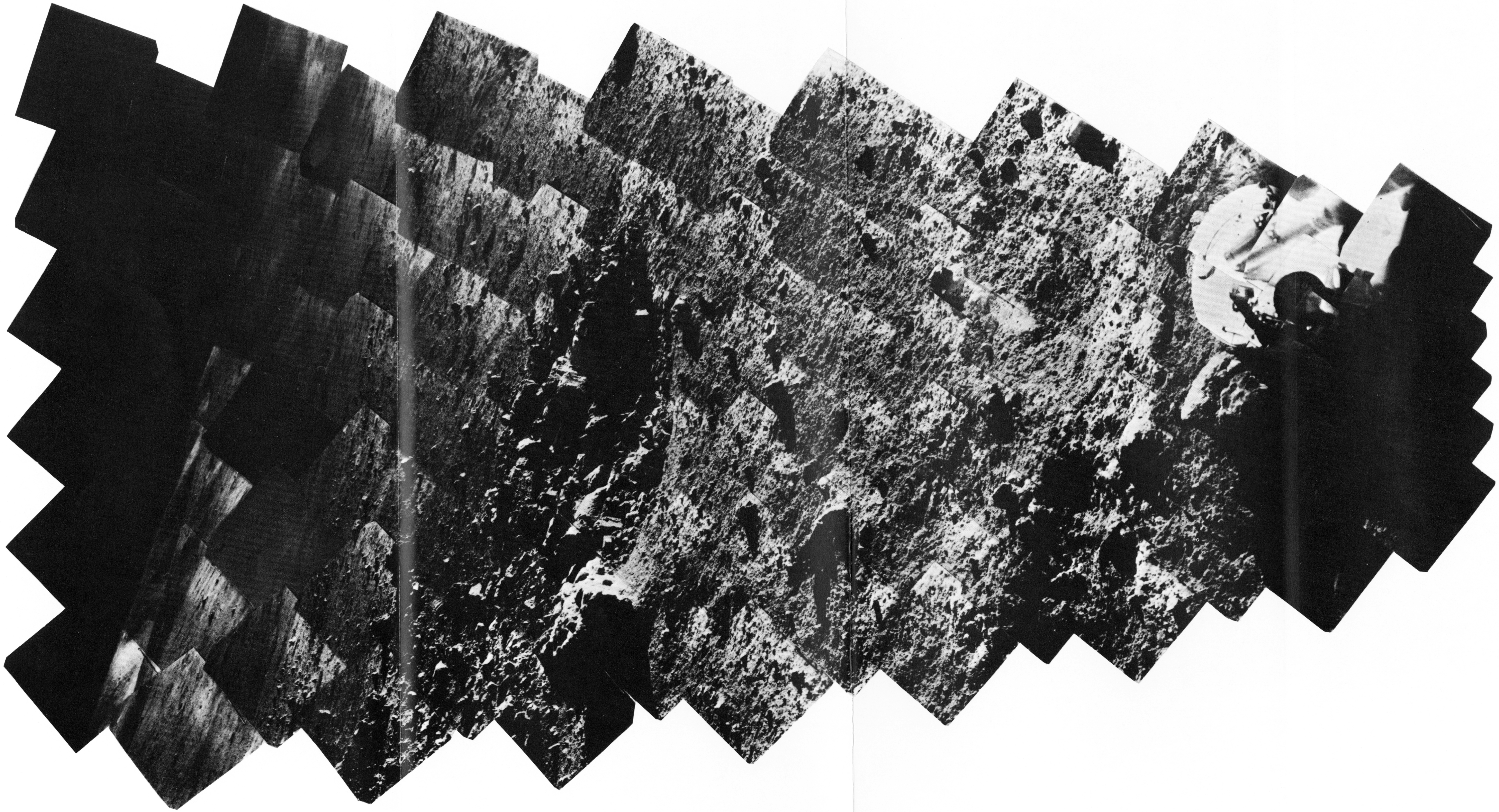
	Azimuth	Lens Focal Length	Identification
(3) Day 010	—177 to —144	N	Catalog No. 7-7-SI; Segment 1—Sectors 3 and 4, Semi-Improved



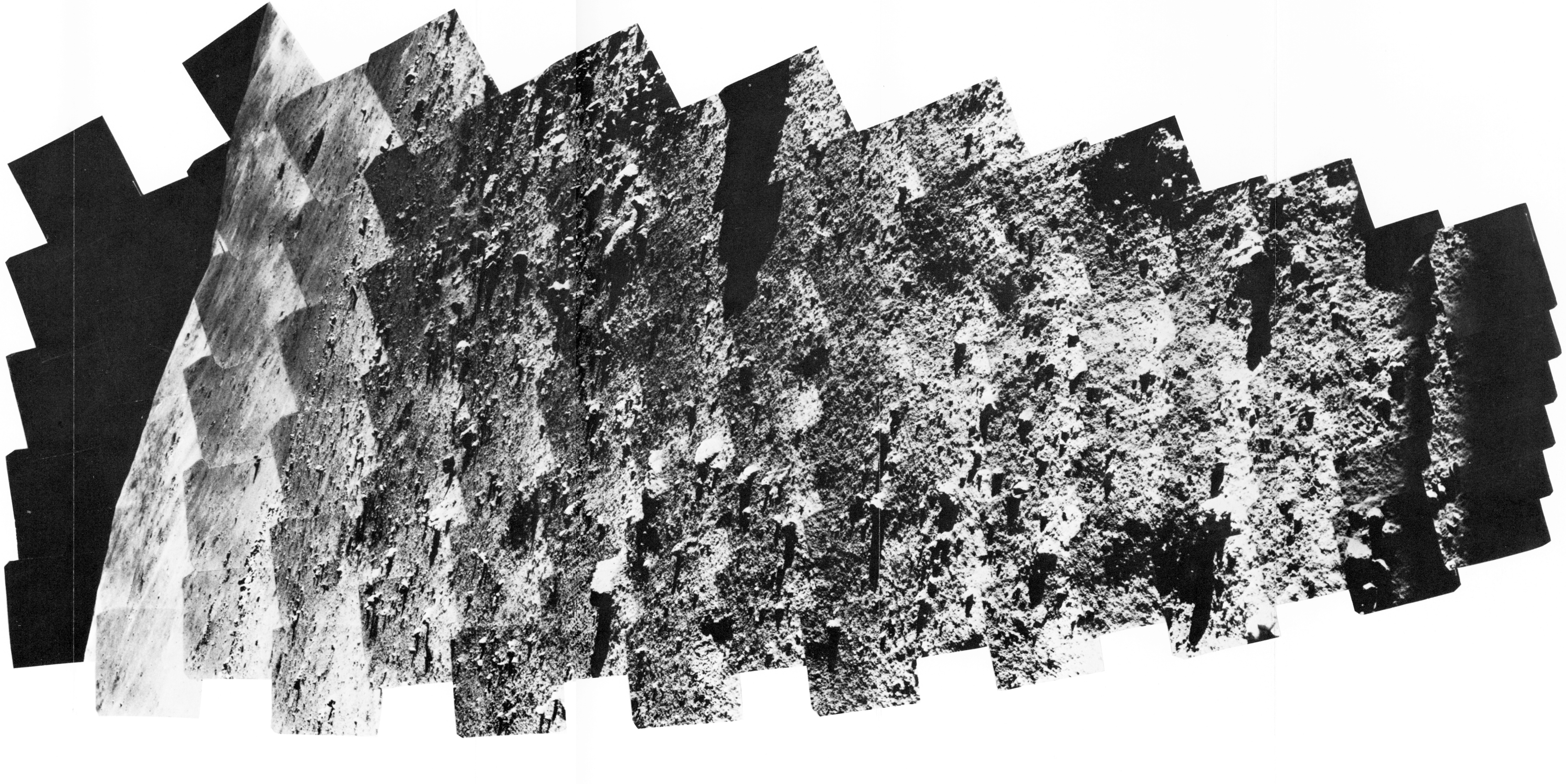
		Azimuth	Lens Focal Length	Identification
(4)	Day 014	—141 to —108	N	Catalog No. 7-30-SI; Segment 2—Sectors 5 and 6, Semi-Improved



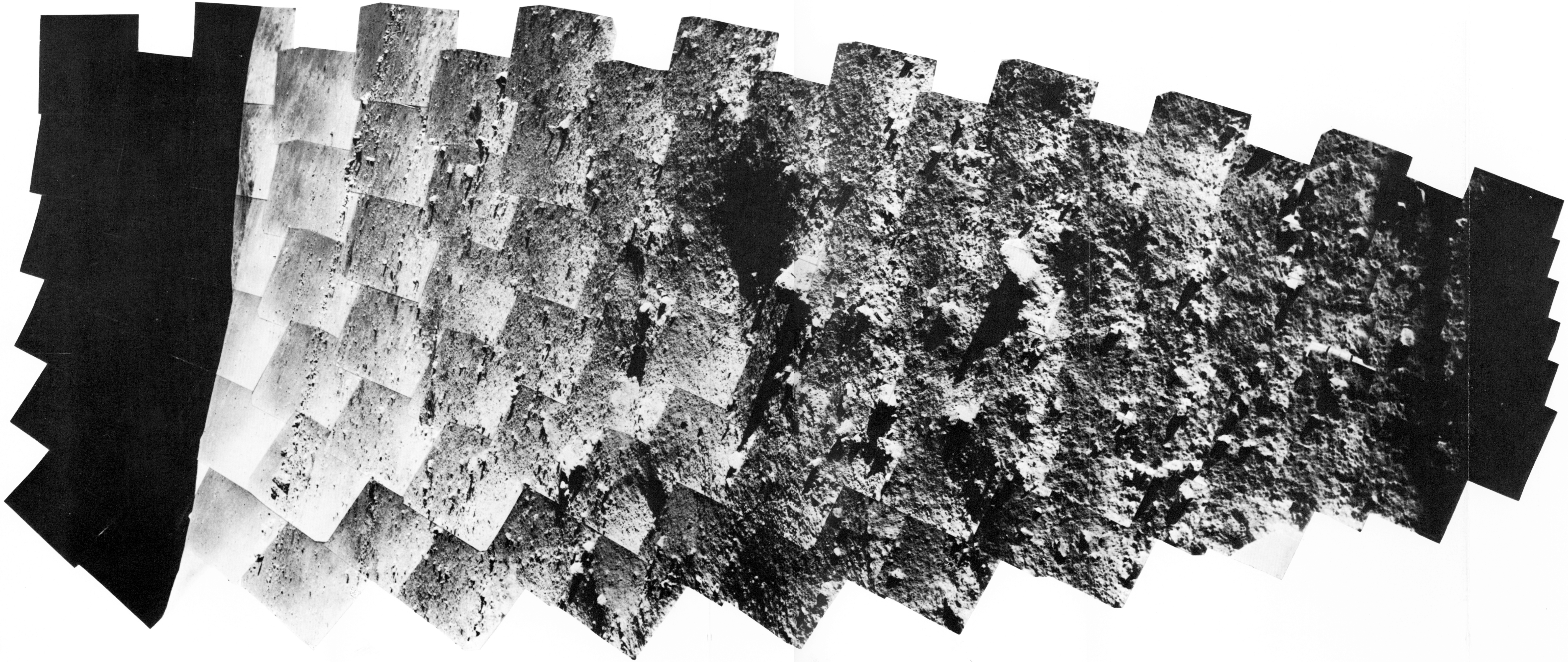
	Azimuth	Lens Focal Length	Identification
(5) Day 014	−105 to −72	N	Catalog No. 7-31-SI; Segment 2—Sectors 7 and 8, Semi-Improved



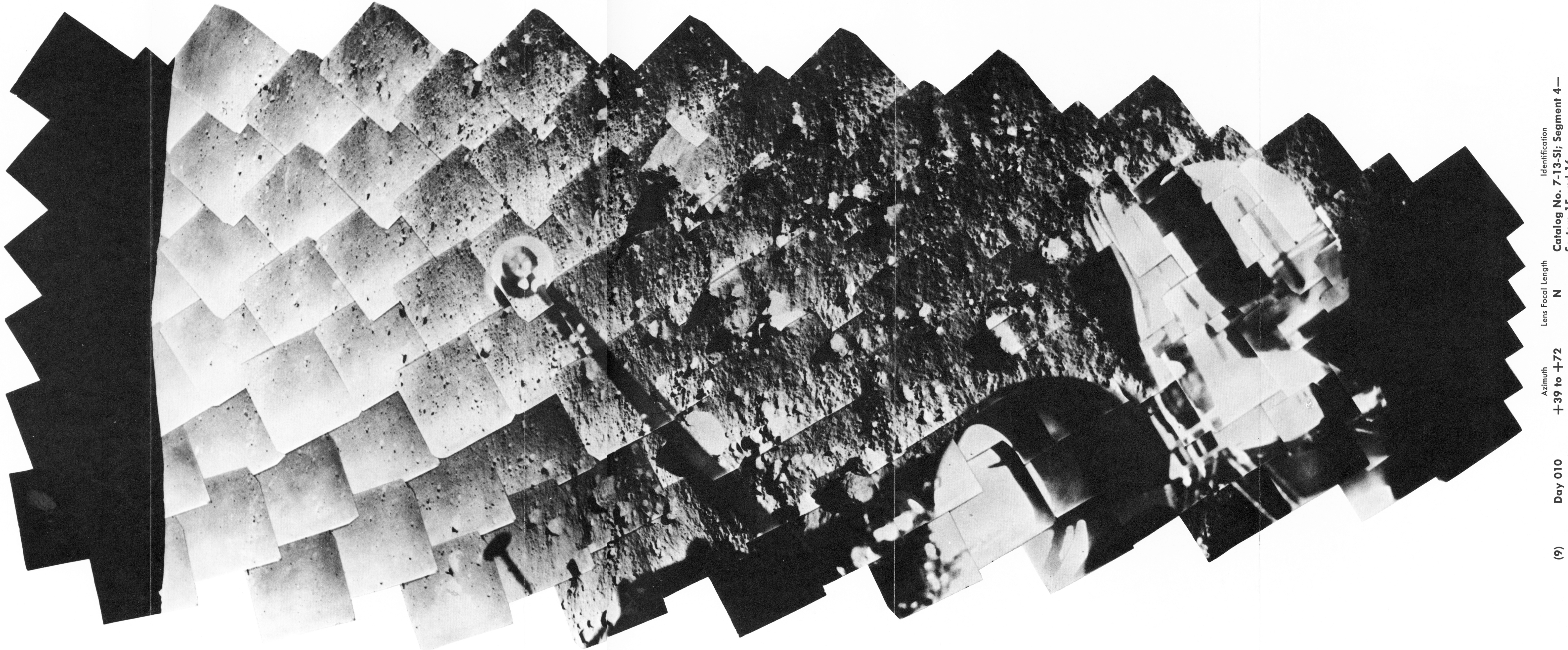
		Azimuth	Lens Focal Length	Identification
(6)	Day 010	−69 to −36	N	Catalog No. 7-10-51; Segment 3—Sectors 9 and 10, Semi-Improved



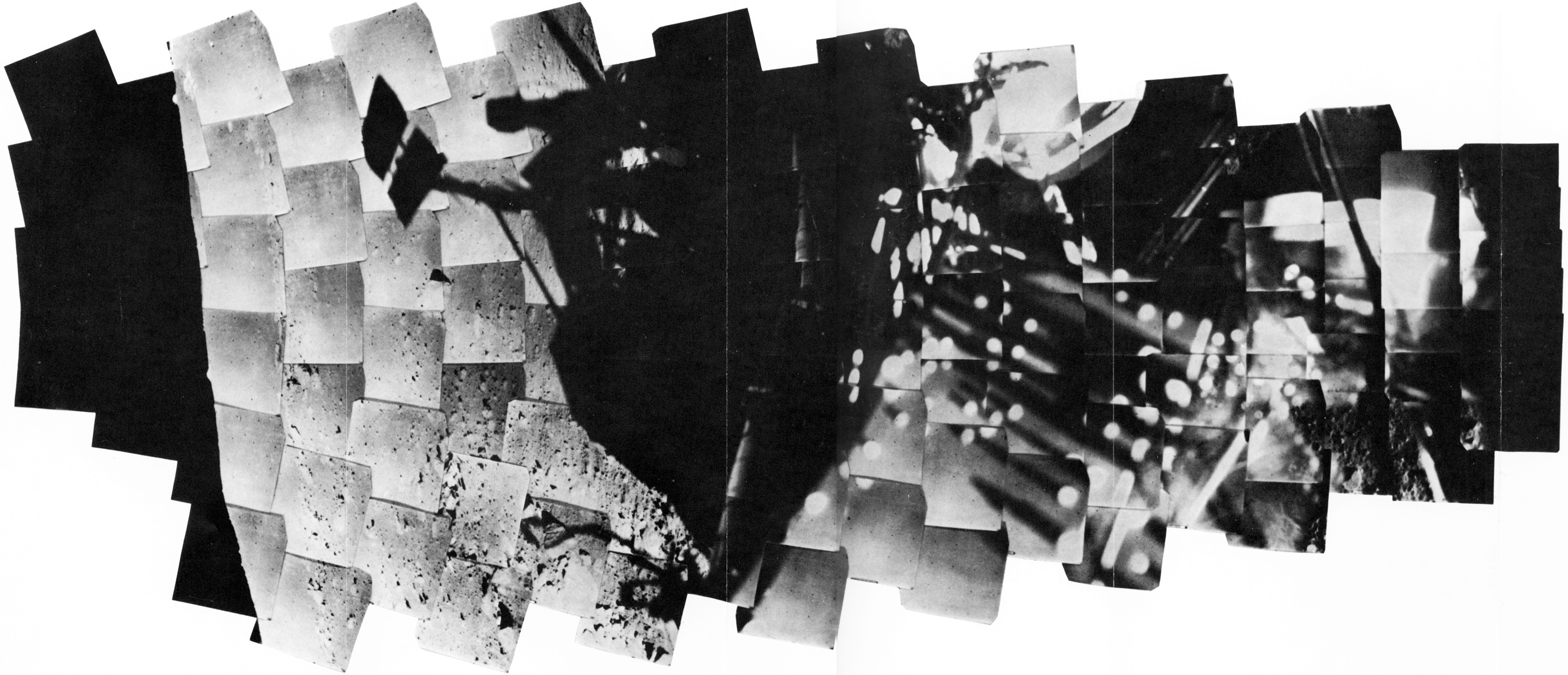
		Azimuth	Lens Focal Length	Identification
(7)	Day 010	−33 to 0	N	Catalog No. 7-11-SI; Segment 3—Sectors 11 and 12, Semi-Improved



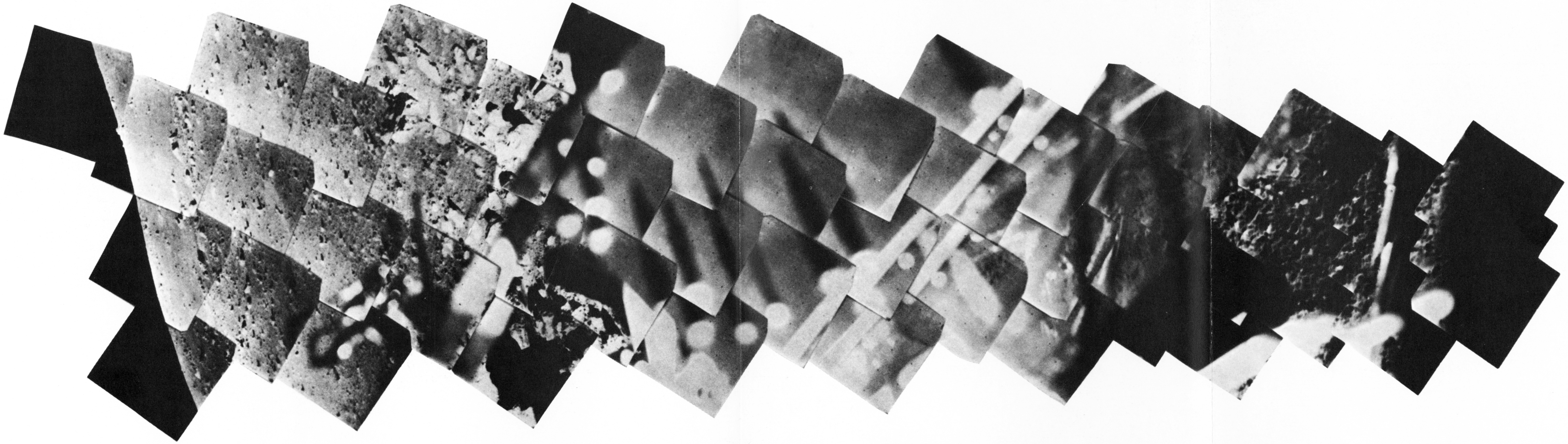
	Azimuth	Lens Focal Length	Identification
(8) Day 010	+3 to +36	N	Catalog No. 7-12-SI; Segment 4—Sectors 13 and 14, Semi-Modified



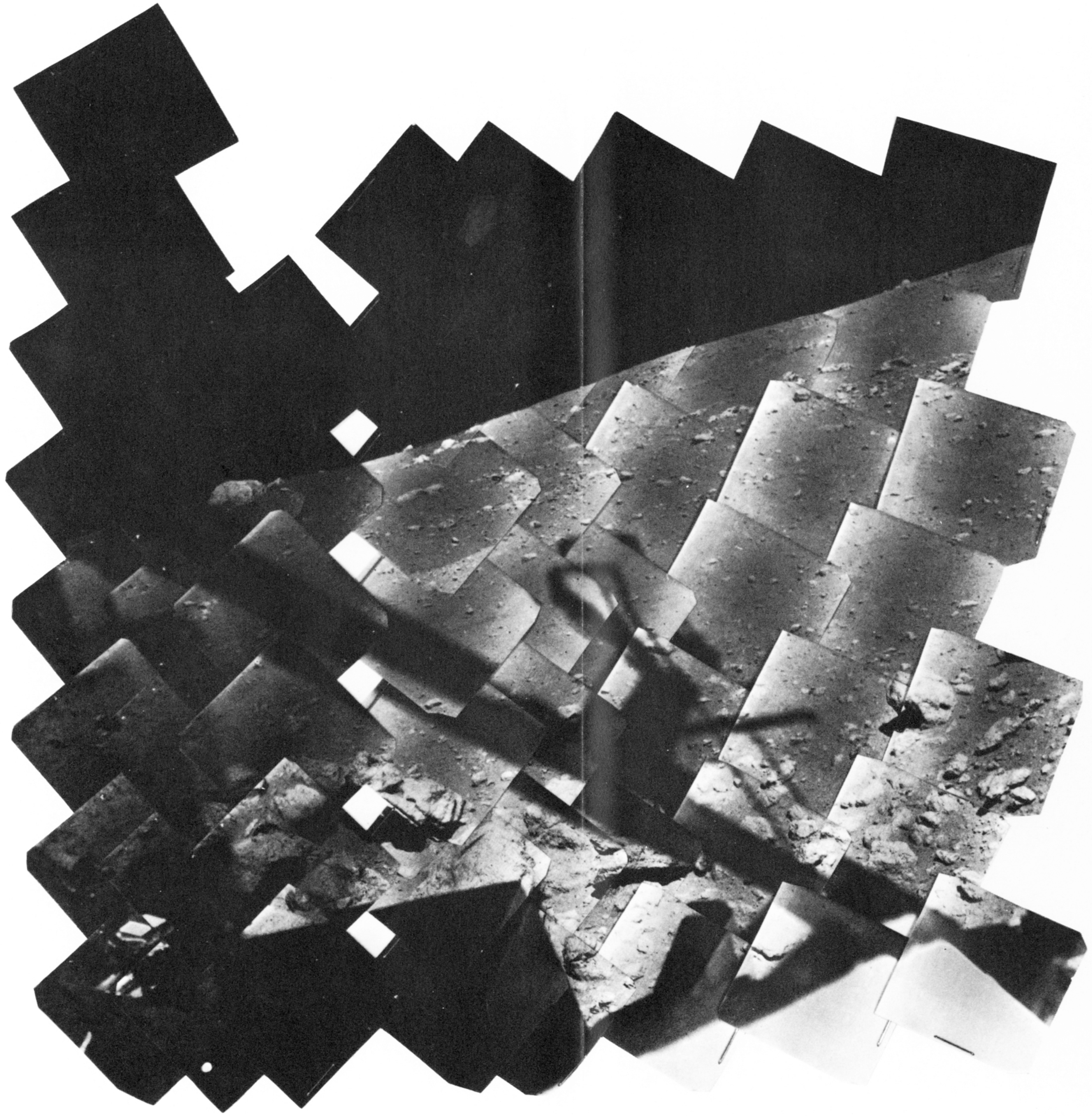
	Azimuth	Lens Focal Length	Identification
(9) Day 010	+39 to +72	N	Catalog No. 7-13-SI; Segment 4—Sectors 15 and 16



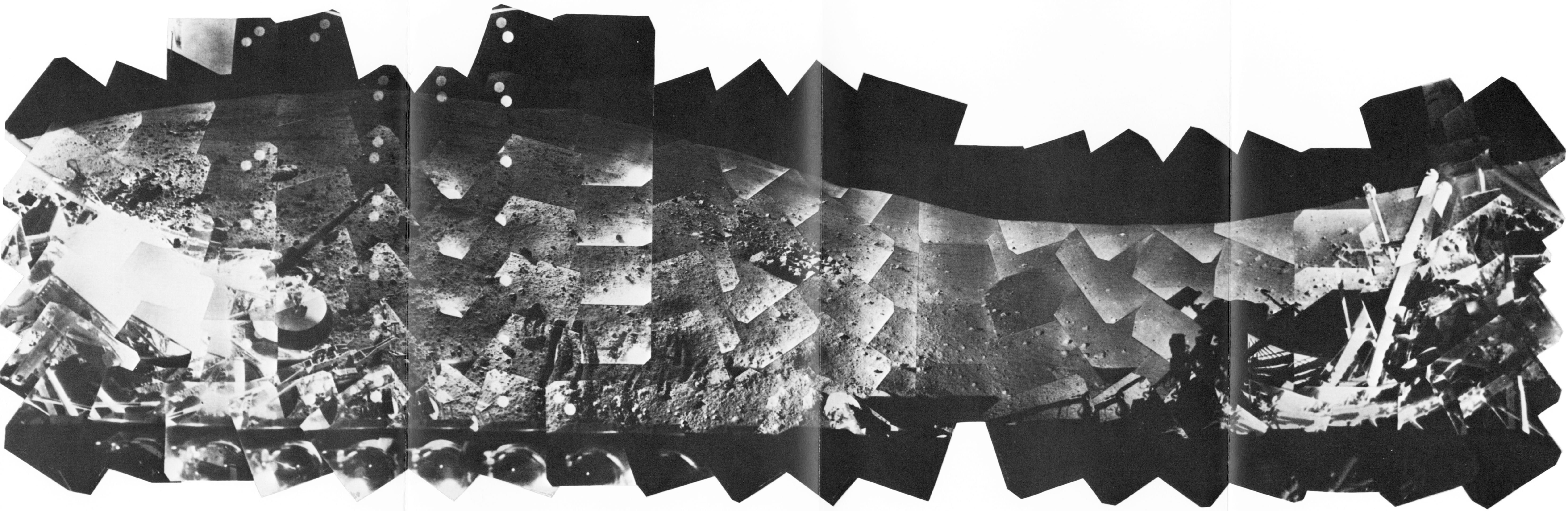
(10)	Day 010	Azimuth	Lens Focal Length	Identification
		+75 to +108	N	Catalog No. 7-14-SI; Segment 5—Sectors 17 and 18, Semi-Improved



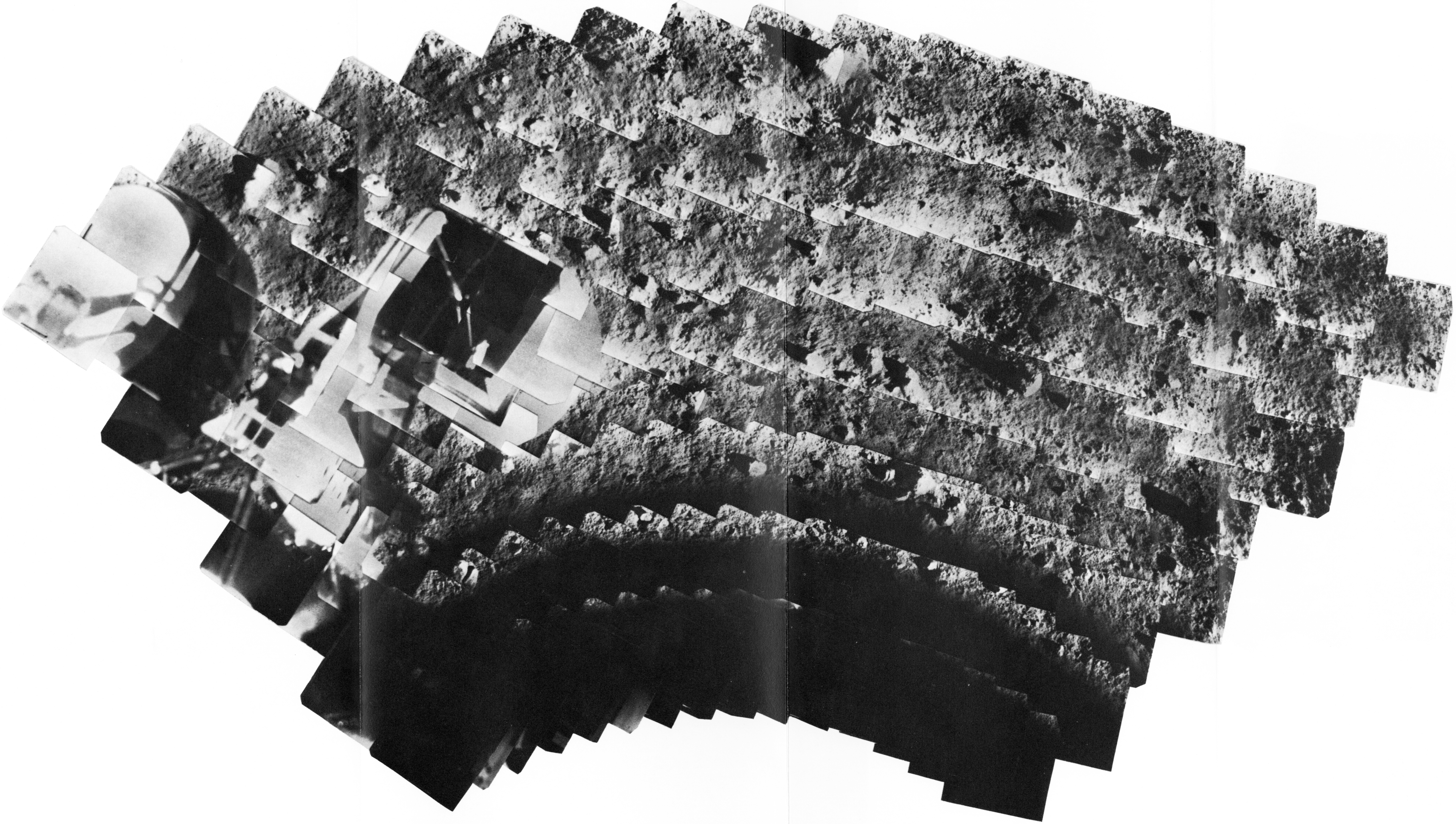
		Azimuth	Lens Focal Length	Identification
(11)	Day 010	+111 to +126	N	Catalog No. 7-15-SI; Segment 5—Sector 19, Semi-Improved



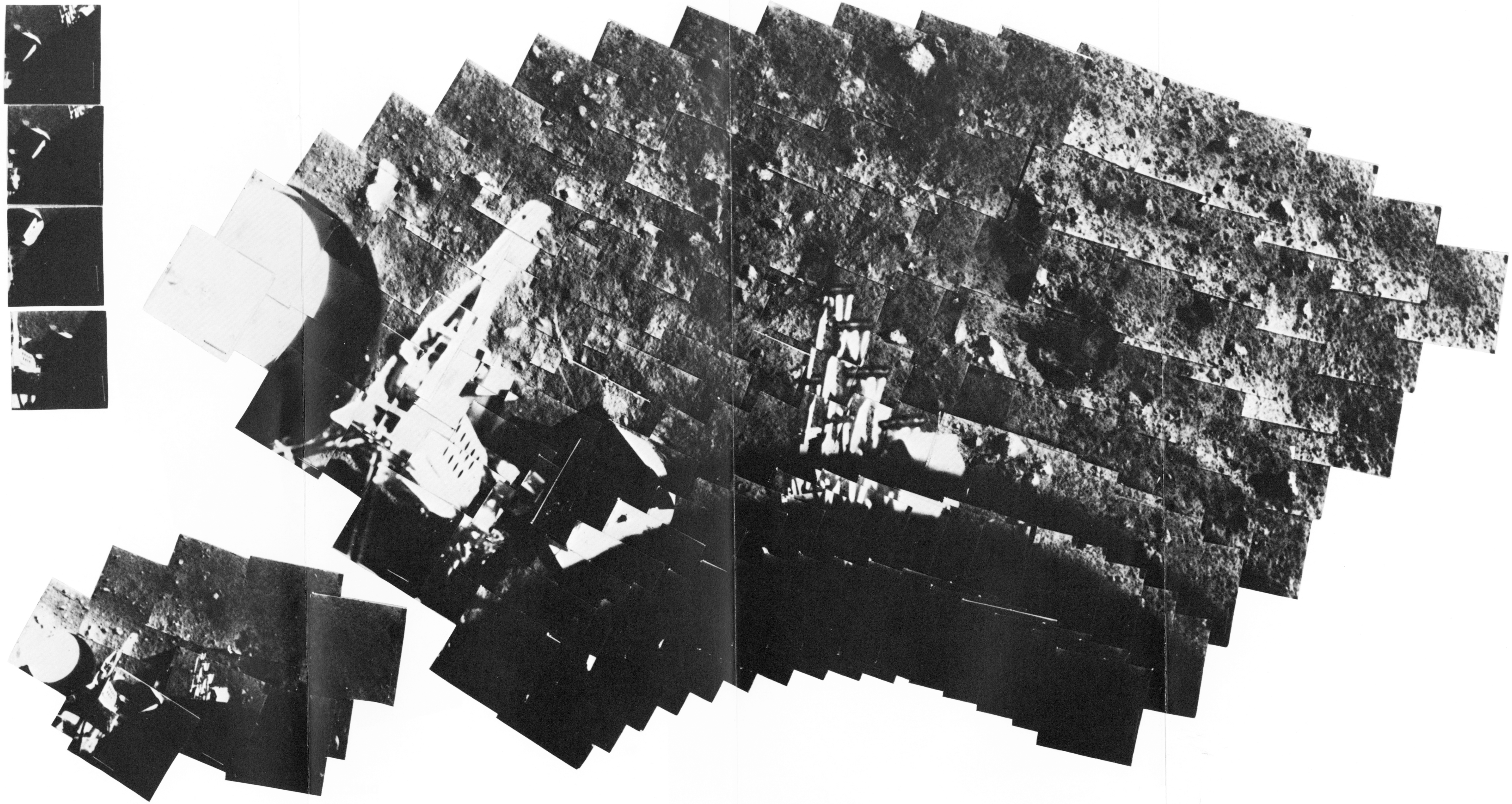
(12)	Day 015	Azimuth	Lens Focal Length	Identification
		+111 to −216	N	Catalog No. 7-50-SI; Segment 5—Sector 19 and End-Stop Coverage



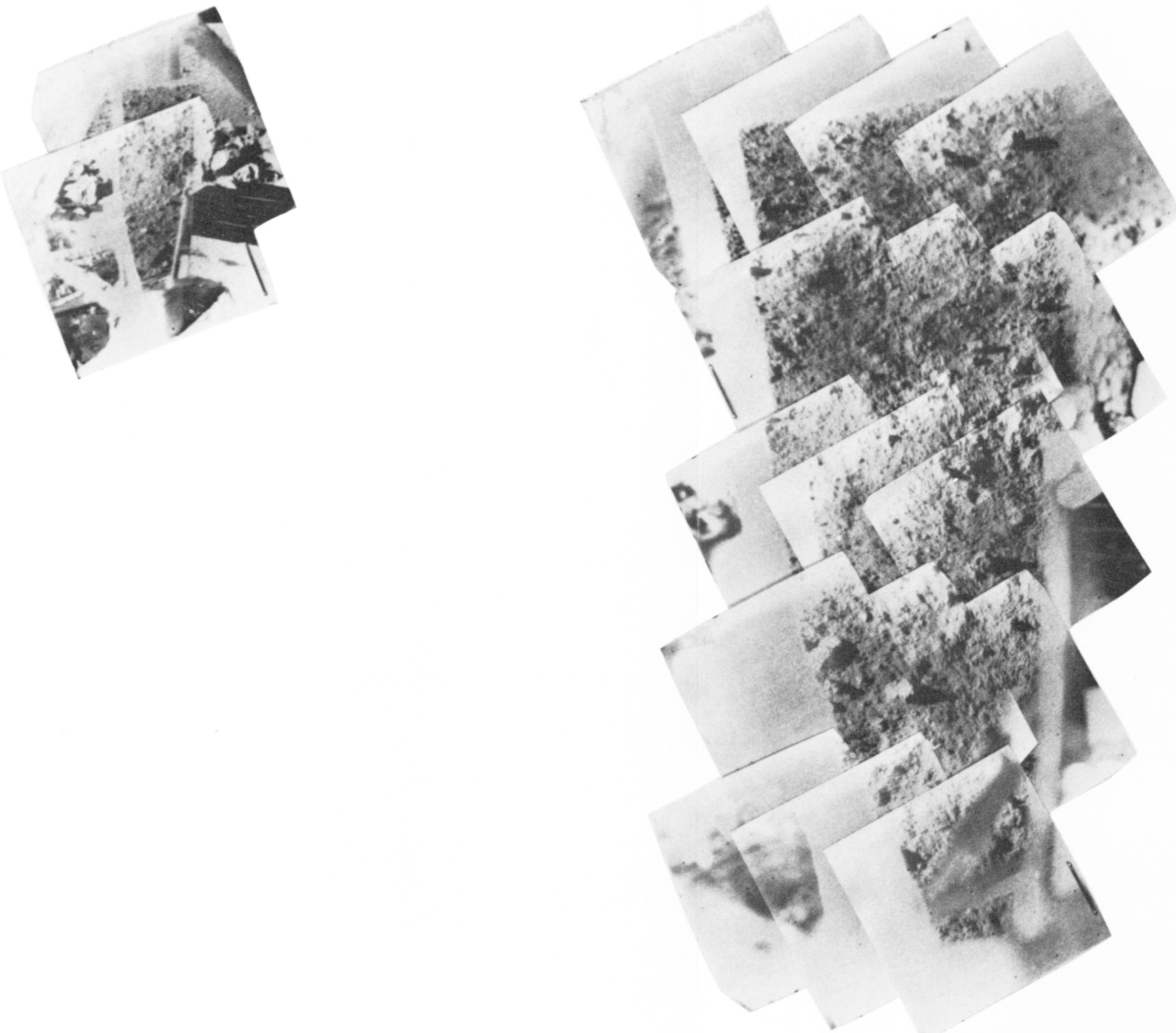
(13)	Day 020	Azimuth	Lens Focal Length	Identification
		−216 to +126	W	Catalog No. 7-8-SI; 360-deg Panorama—Semi-Improved, p.m.



		Azimuth	Lens Focal Length	Identification
(14)	Day 010	—30 to +72	N	Catalog No. 7-16-SI; Soil Mechanics Surface Sampler Area



		Azimuth	Lens Focal Length	Identification
(15)	**Day 013**	**−30 to +72**	**W, N**	**Catalog No. 7-24; Soil Mechanics Surface Sampler Area**



W N

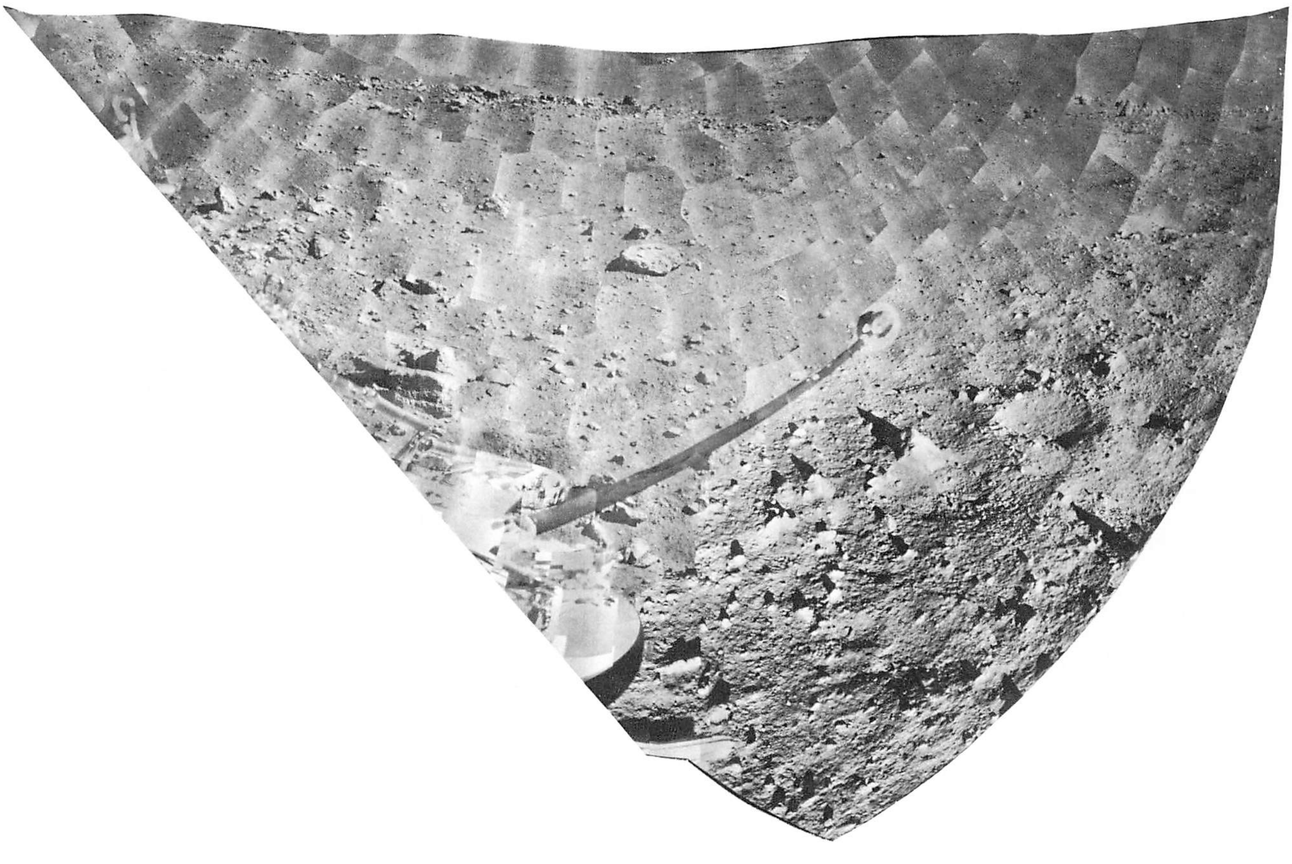
MIRROR VIEW
NOTE LEFT-RIGHT REVERSAL IN MIRROR

W N

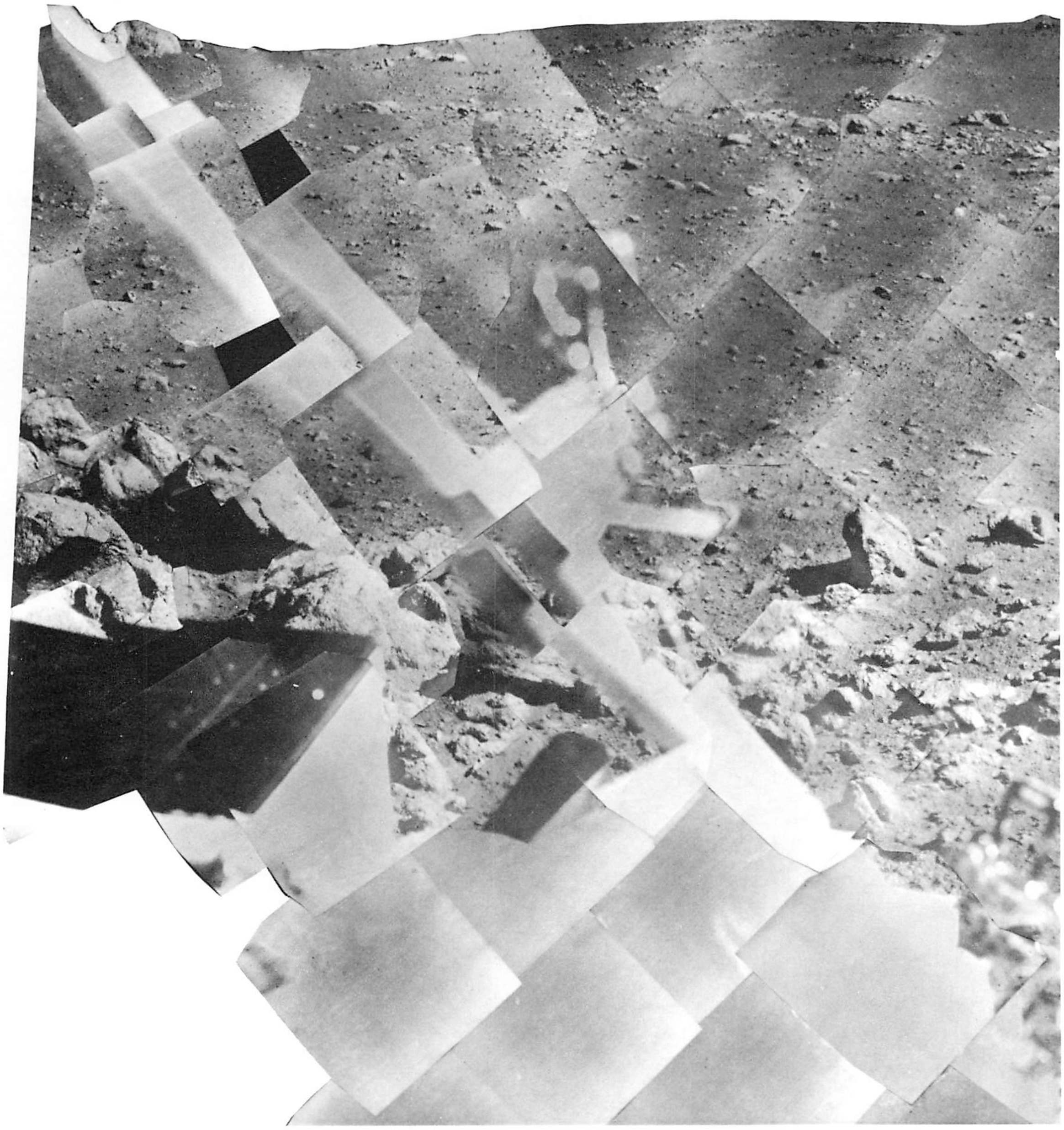
DIRECT VIEW

		Azimuth	Lens Focal Length	Identification
(16)	Day 010	0 to +18	W, N	**Catalog No. 7-17-SI; Stereo Mirror and Direct View**

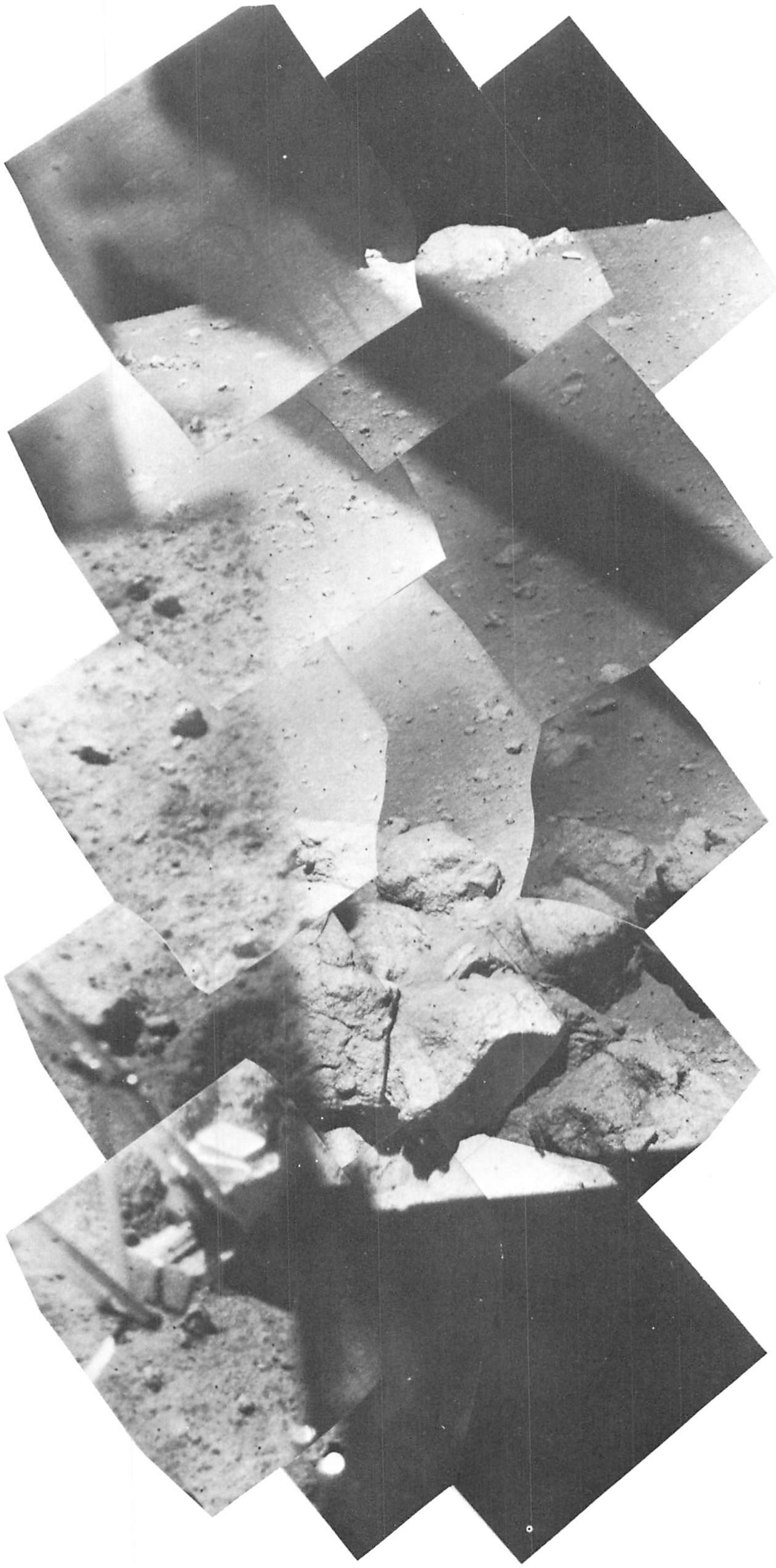
		Azimuth	Lens Focal Length	Identification
(17)	Days 010, 011, 017, 018	—207 to —210	N	Catalog No. 7-SE-31 LM; 360-deg Flat Horizon



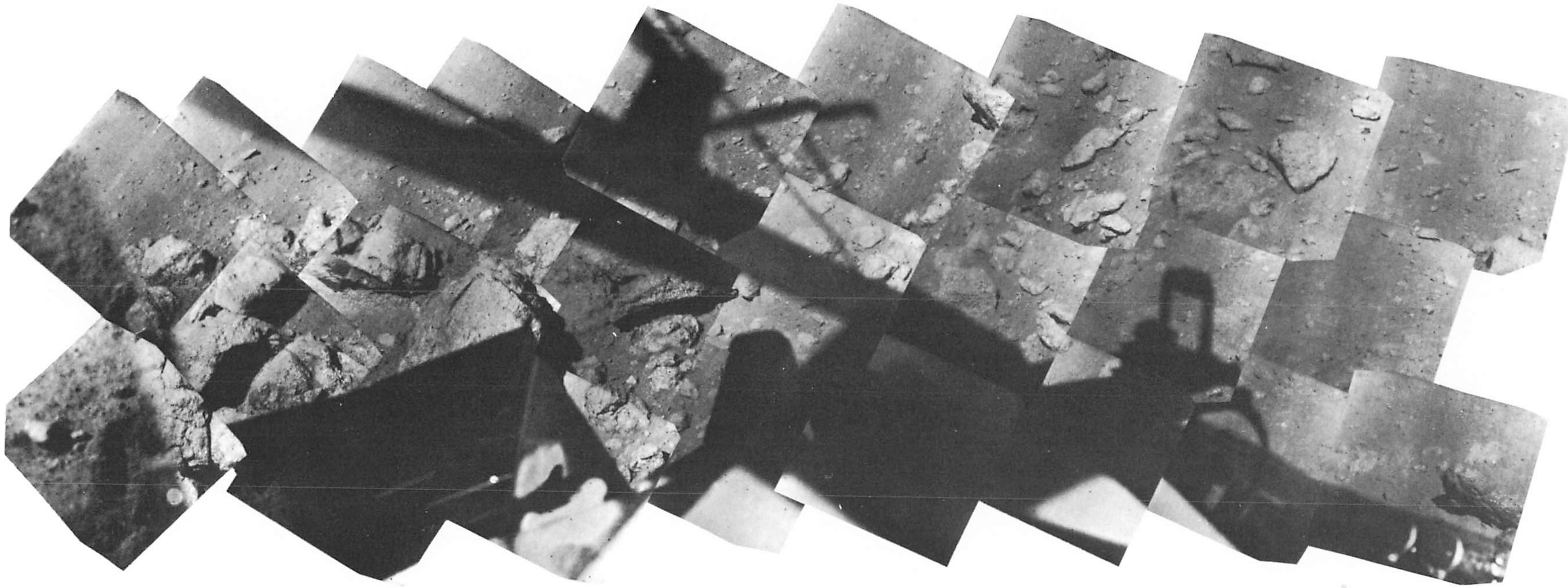
		Azimuth	Lens Focal Length	Identification
(18)	**Days 010, 017, 018**	**+9 to −171**	**N**	**Catalog No. 7-SE-20*; Left Portion**



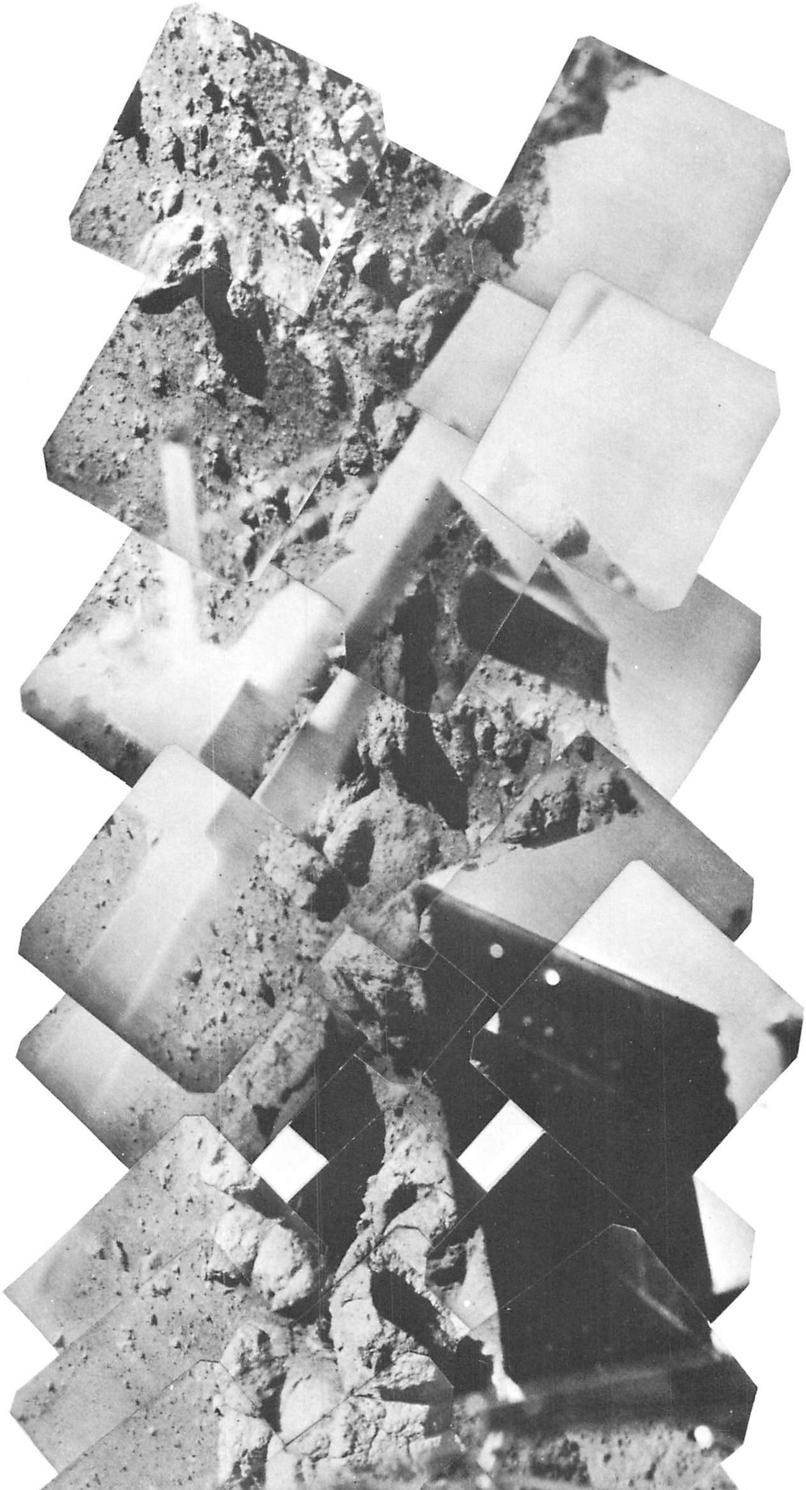
		Azimuth	Lens Focal Length	Identification
(19)	**Days 017, 018**	**+105 to −201**	**N**	**Catalog No. 7-SE-20A; Rock Pile Behind the Spacecraft**



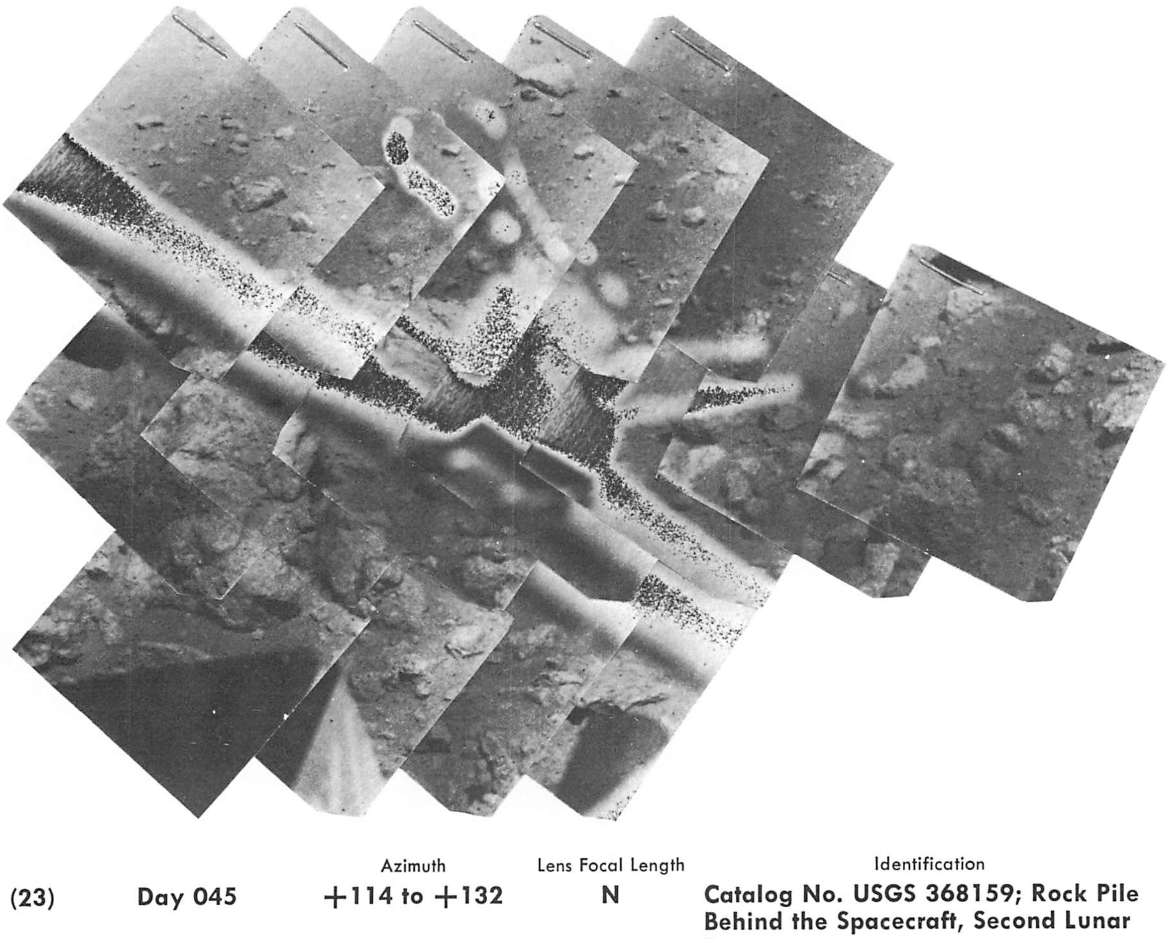
		Azimuth	Lens Focal Length	Identification
(20)	Day 015	—216 to —222	N	Catalog No. 7-SE-12; Rock Pile— Left Portion Is Mirror



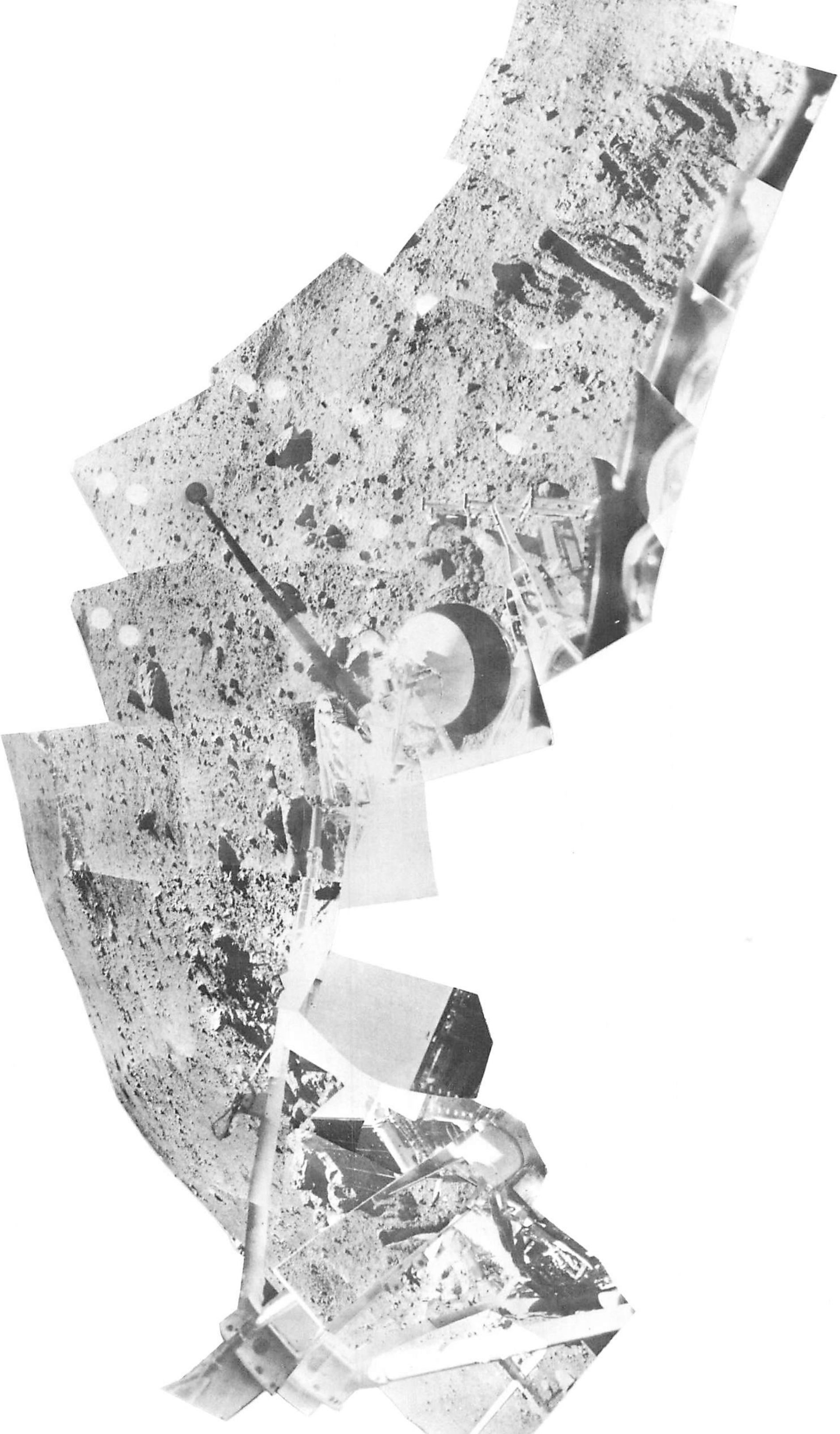
(21)	Day 013	Azimuth	Lens Focal Length	Identification
		+96 to −222	N	Catalog No. 7-SE-19; Rock Pile Behind the Spacecraft



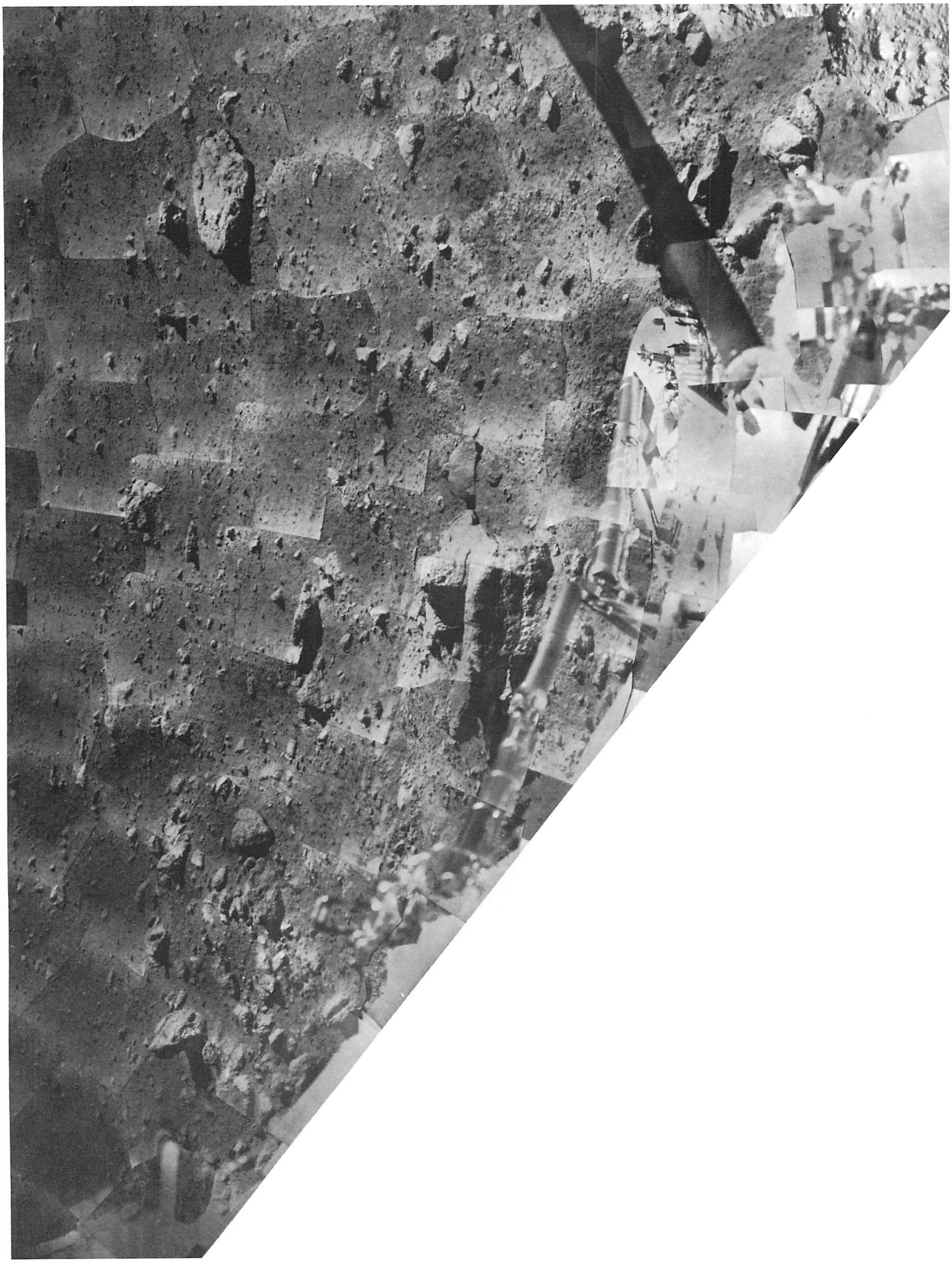
		Azimuth	Lens Focal Length	Identification
(22)	Day 018	+111 to −216	N	Catalog No. USGS 368164; Rock Pile Behind the Spacecraft



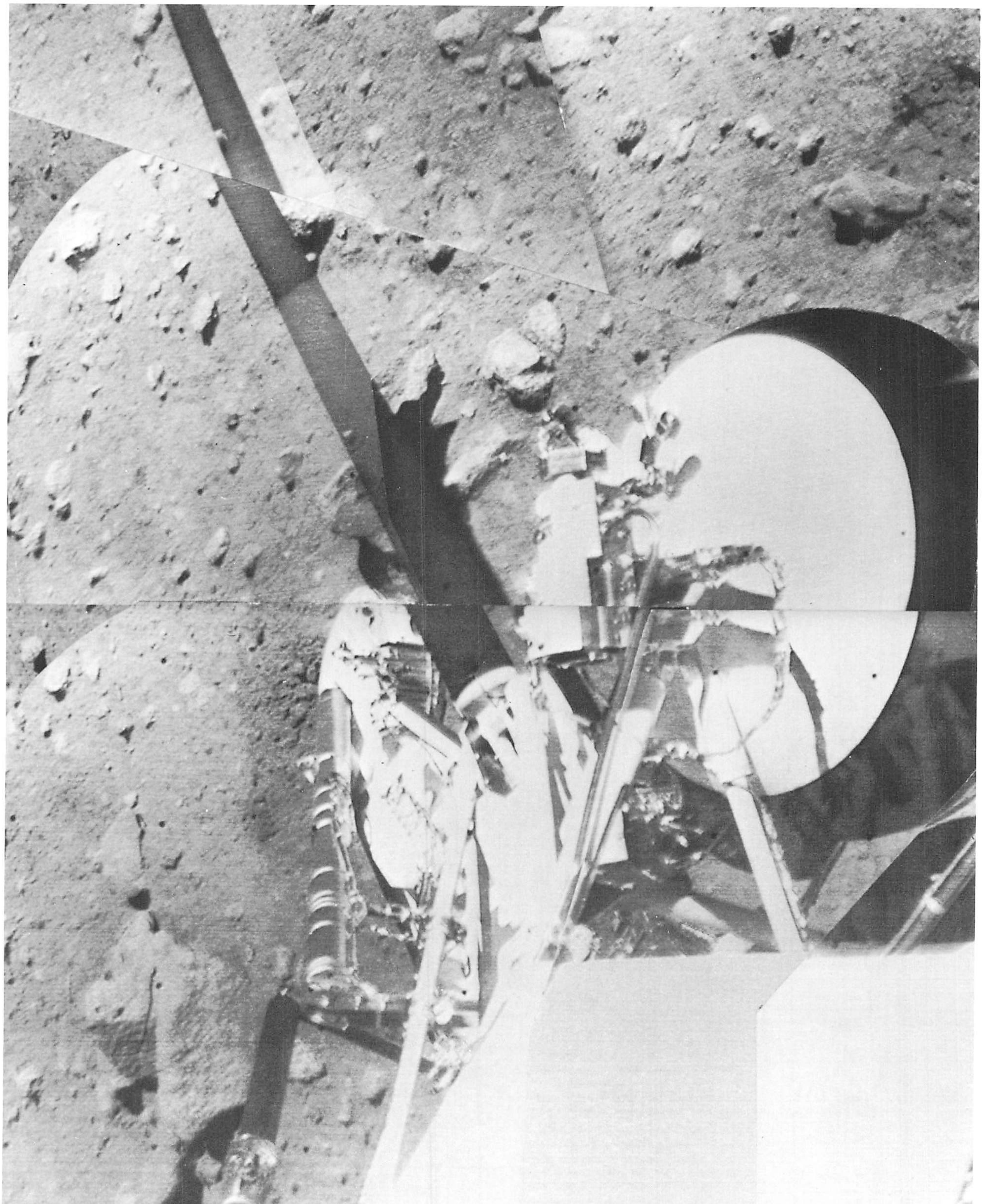
(23)	Day 045	Azimuth	Lens Focal Length	Identification
		+114 to +132	N	Catalog No. USGS 368159; Rock Pile Behind the Spacecraft, Second Lunar Day



		Azimuth	Lens Focal Length	Identification
(24)	Day 020	0 to —192	W	Catalog No. 7-SE-13; Close-in 180-deg Panorama



	Azimuth	Lens Focal Length	Identification
(25) Days 010, 017	+66 to +117	N	Catalog No. 7-SE-20F; Pad 3 Area

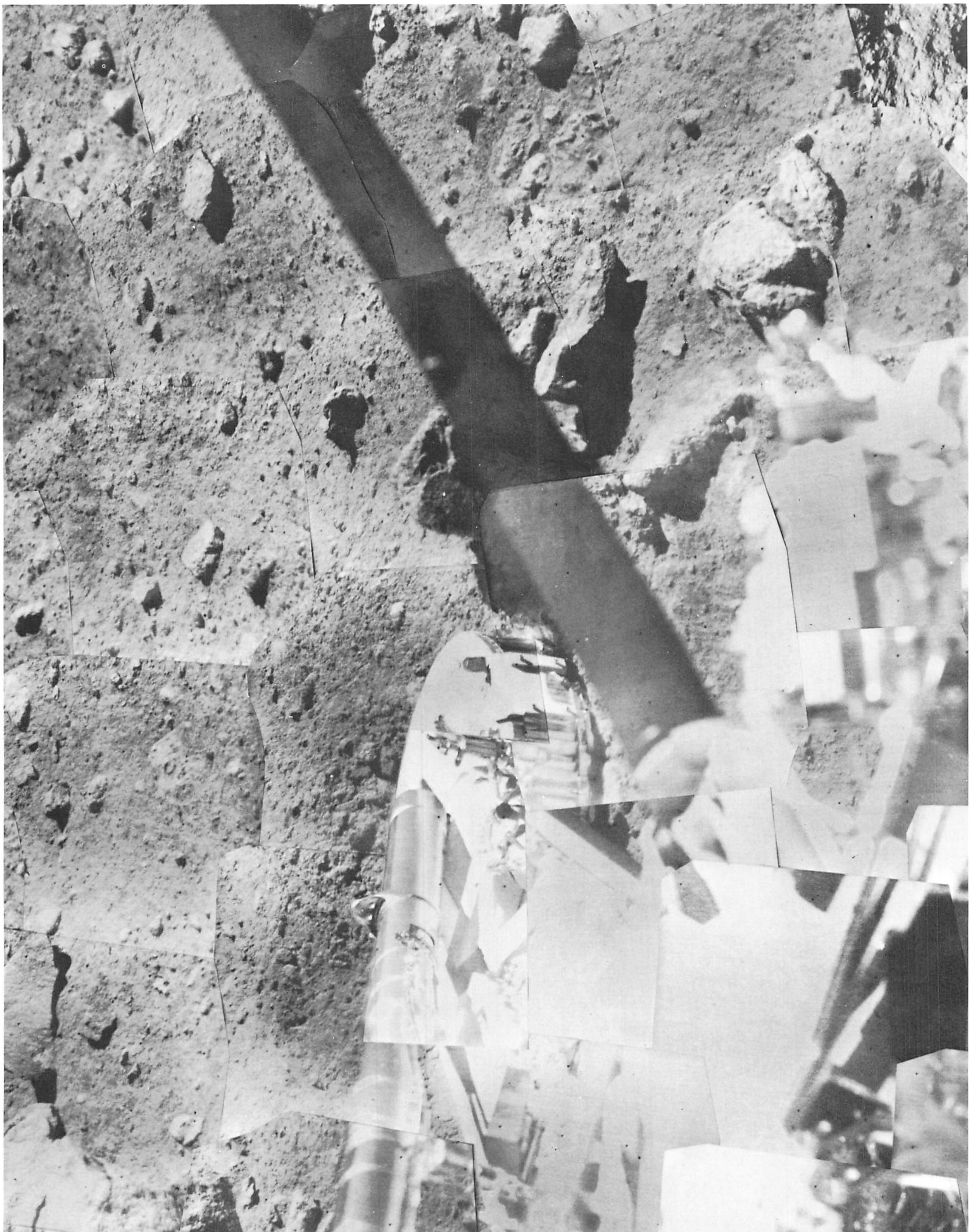


	Azimuth	Lens Focal Length	Identification
(26) Day 015	+54 to +108	W	Catalog No. 7-SE-15; Pad 3 Area and Throw-out, Closeup

		Azimuth	Lens Focal Length	Identification
(27)	Day 015	+63 to +75	N	**Catalog No. USGS 368163; Rocks—Vicinity of Pad 3 Area**

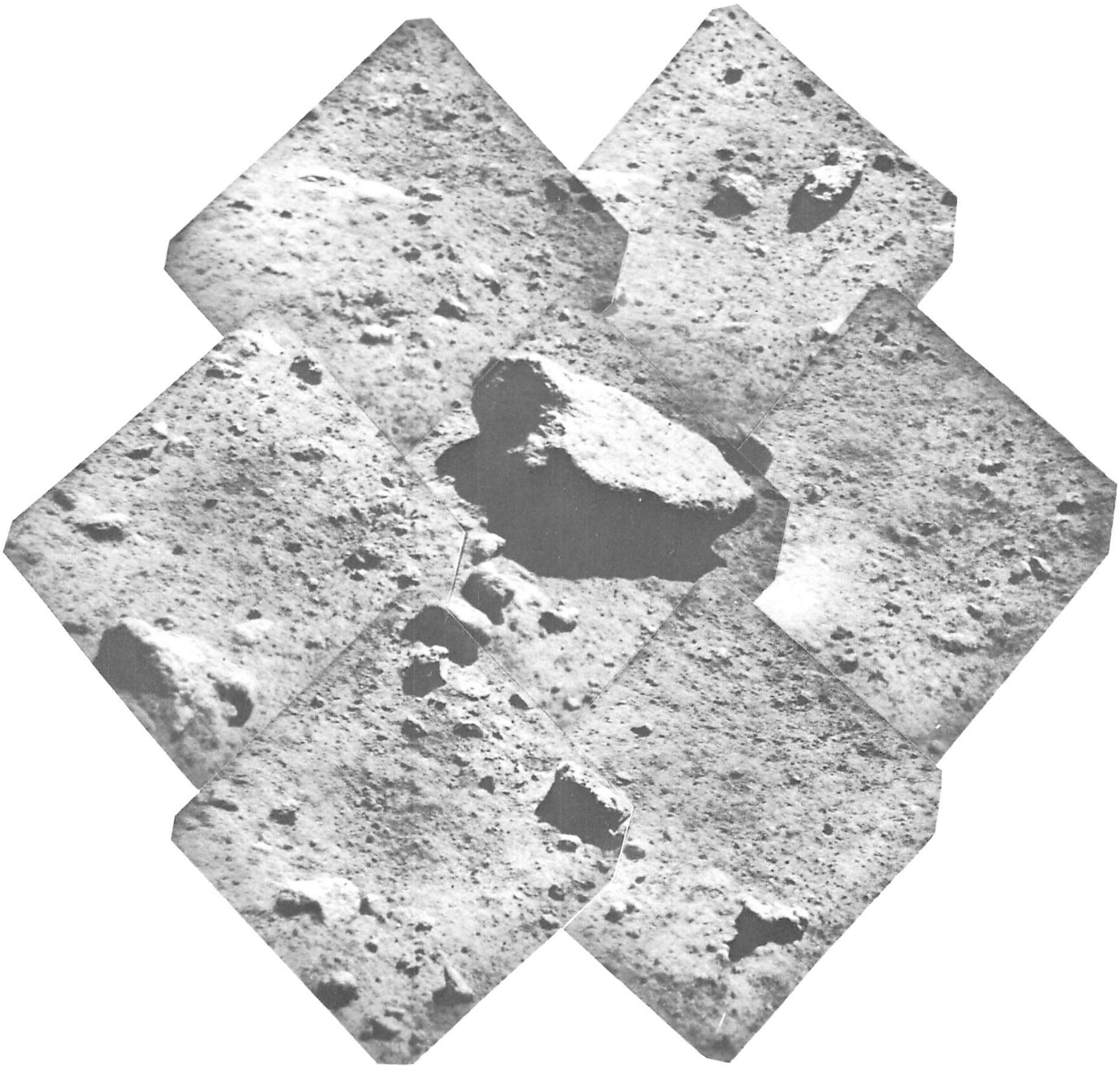
		Azimuth	Lens Focal Length	Identification
(28)	Day 017	+81 to +102	N	Catalog No. USGS 368165; Large Rock Beyond Leg 3

		Azimuth	Lens Focal Length	Identification
(29)	Day 017	+84 to +96	N	Catalog No. 7-SE-29; Large Rock Beyond Leg 3, Closeup

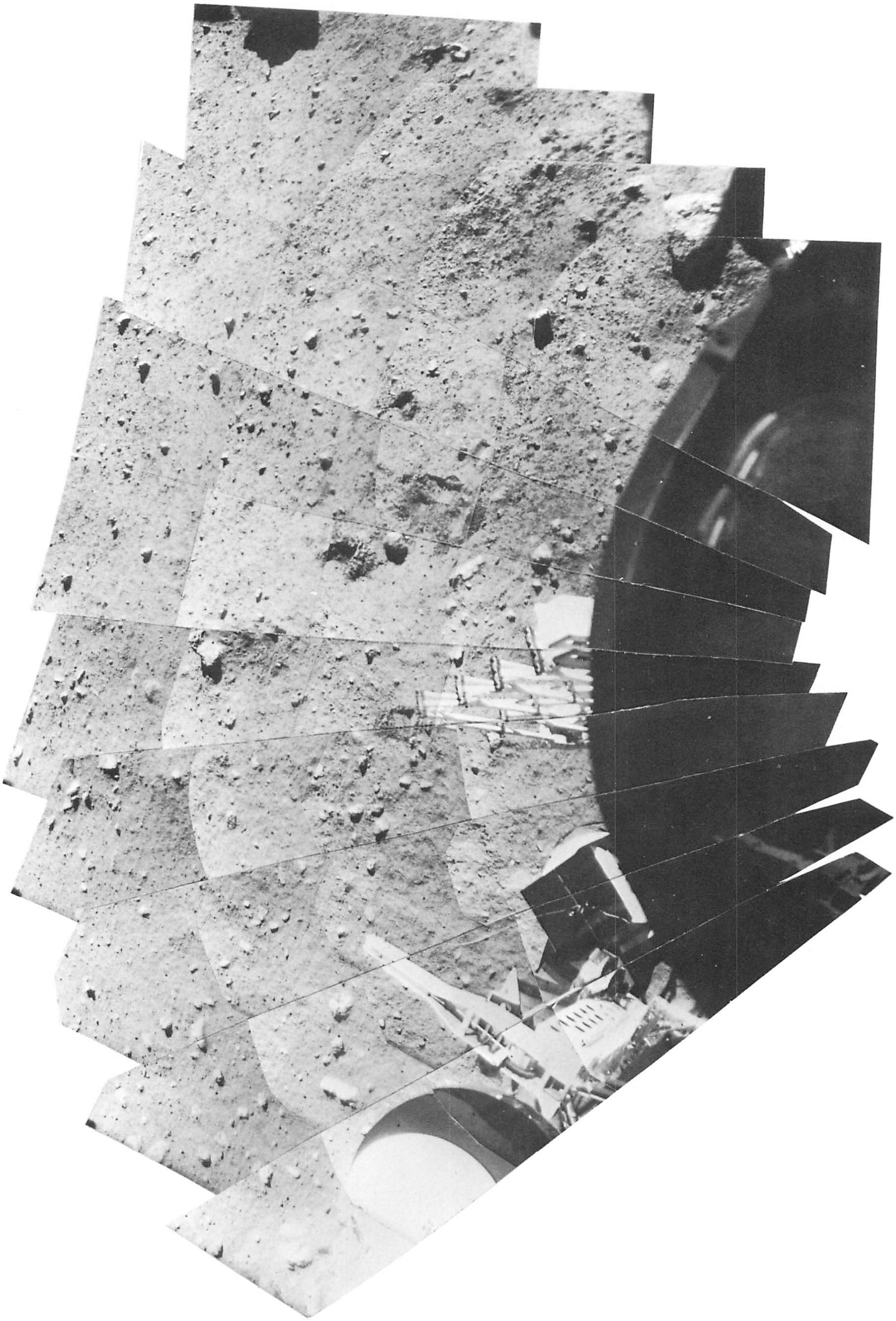


	Azimuth	Lens Focal Length	Identification
(30) Days 010, 017	+66 to +93	N	Catalog No. 7-SE-20E; Pad 3 Area

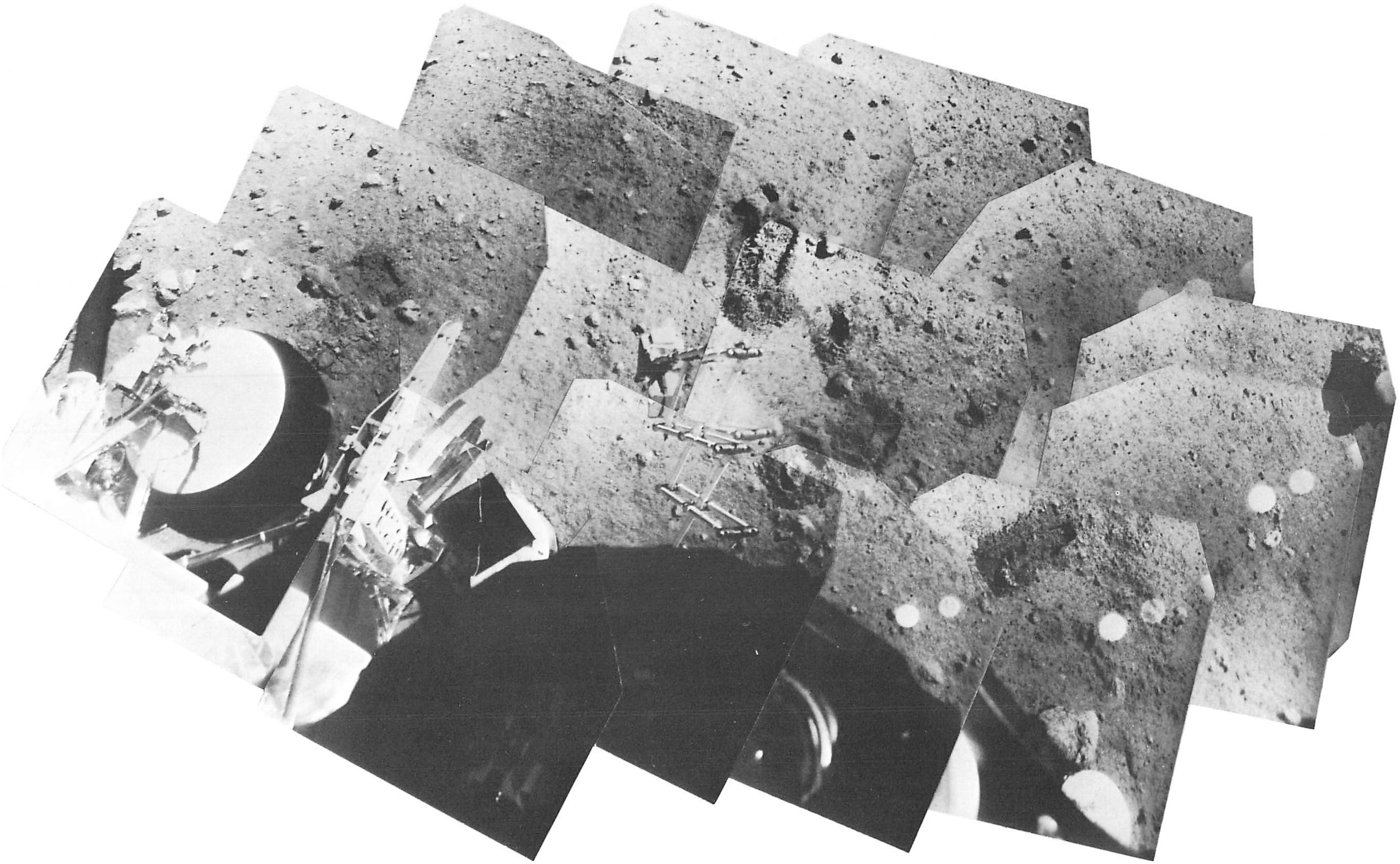
(31) Day 015 | Azimuth +66 to +90 | Lens Focal Length W | Identification Catalog No. 7-SE-10; Pad 3



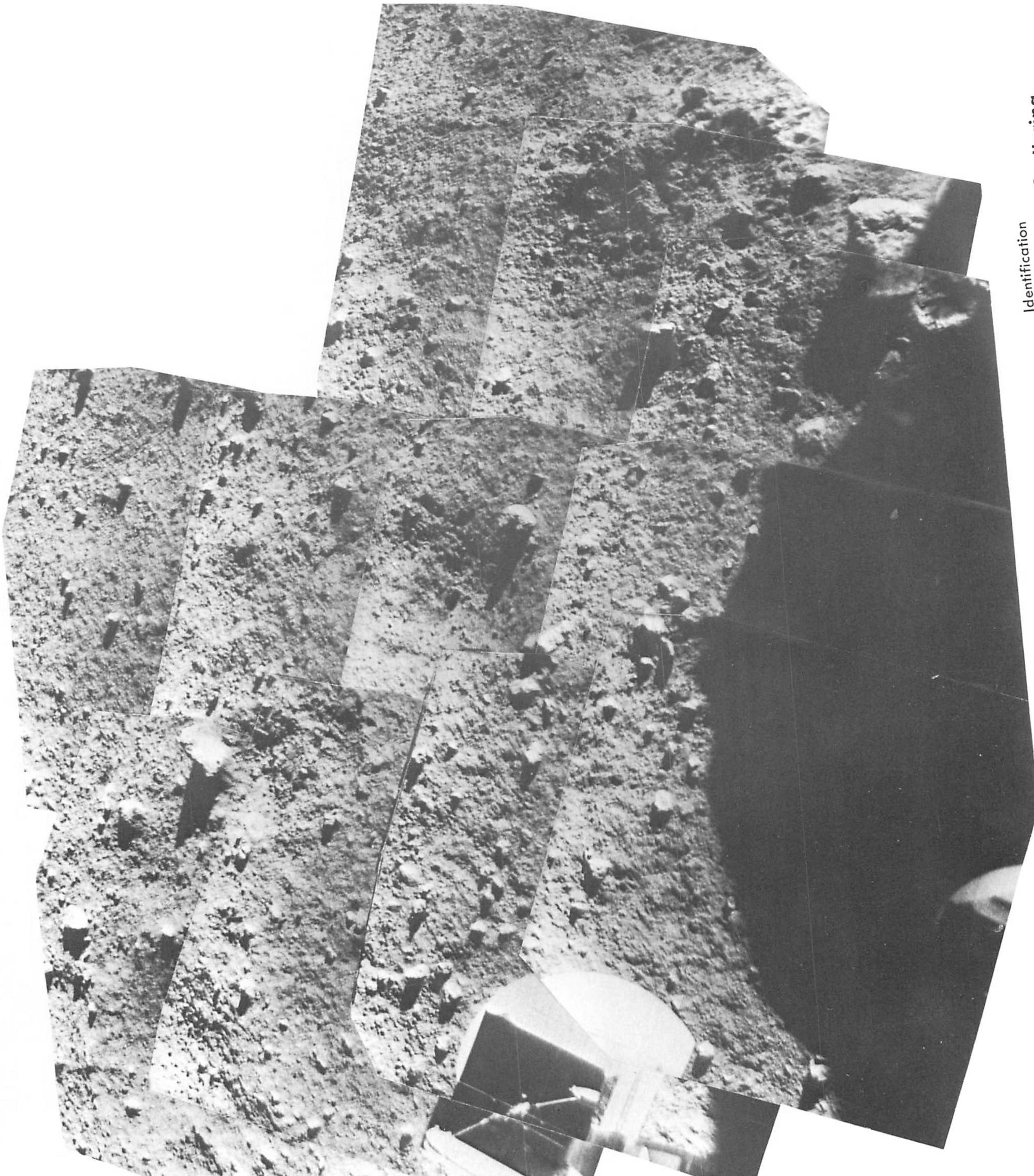
		Azimuth	Lens Focal Length	Identification
(32)	Day 017	+39 to +51	N	Catalog No. USGS 368166; Large Rock West of Spacecraft



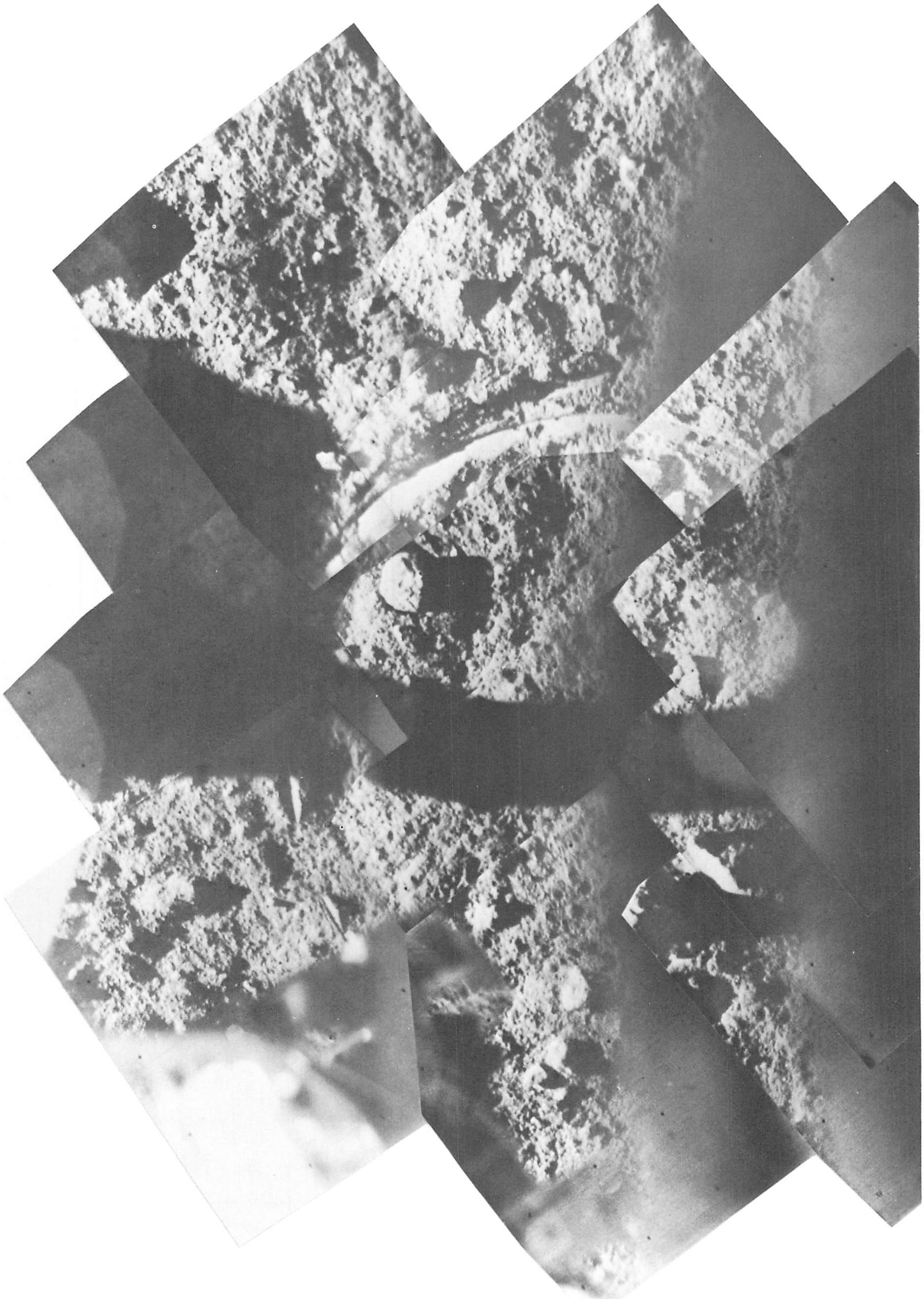
		Azimuth	Lens Focal Length	Identification
(33)	Day 013	−30 to +72	N	Catalog No. 7-SE-11; Alpha Scattering Instrument and Soil Mechanics Surface Sampler Area Survey



(34)	Day 015	Azimuth	Lens Focal Length	Identification
		−24 to +66	W	Catalog No. 7-SE-8; Alpha Scattering Instrument and Soil Mechanics Surface Sampler Area Survey

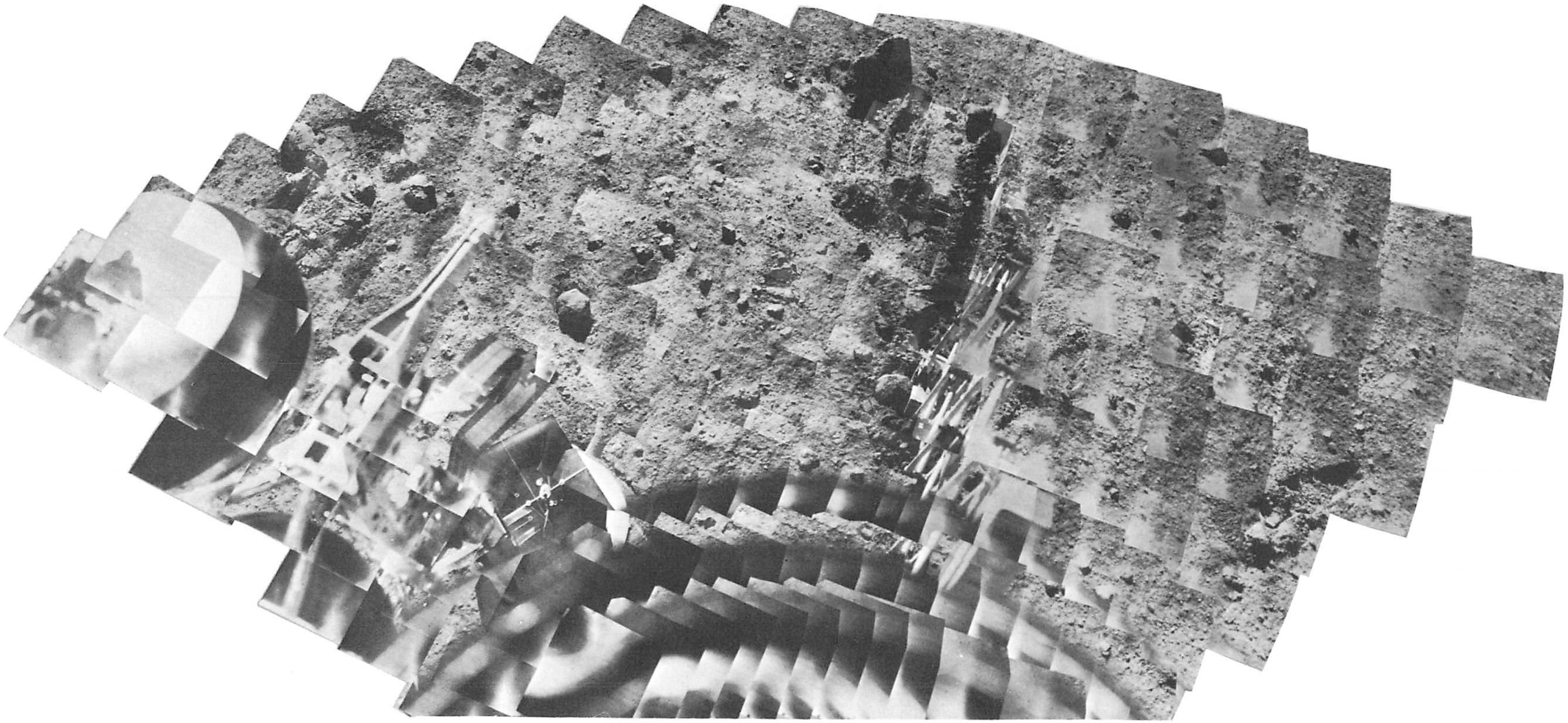


	Day	Azimuth	Lens Focal Length	Identification
(35)	Day 010	−30 to +45	W	Catalog No. 7-SE-5; Alpha Scattering Instrument and Soil Mechanics Surface Sampler Area Survey

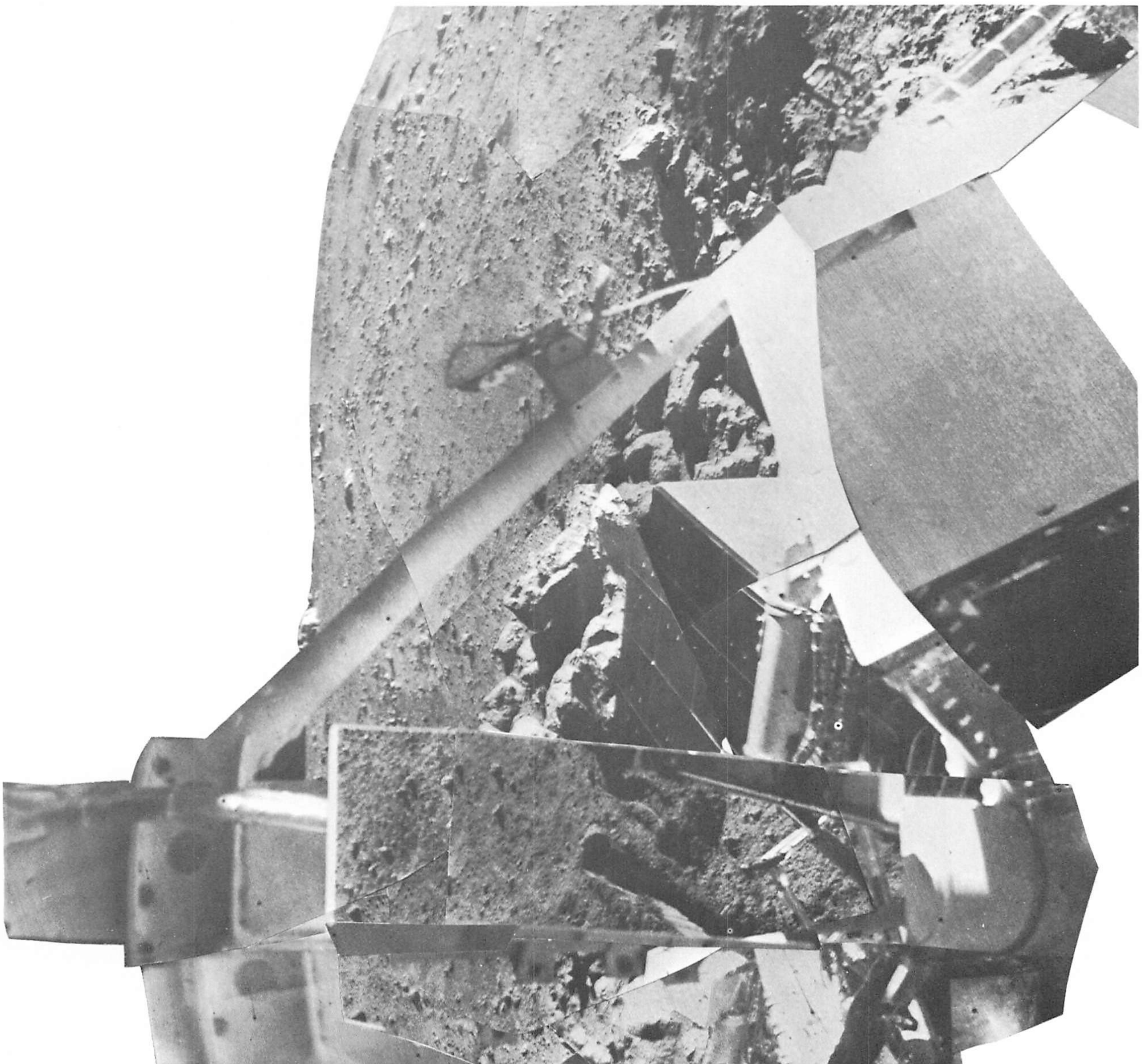


(36)	Day 021	Azimuth	Lens Focal Length	Identification
		+45 to +72	N	Catalog No. 7-SE-26; Closeup of Alpha Scattering Instrument, Position 1

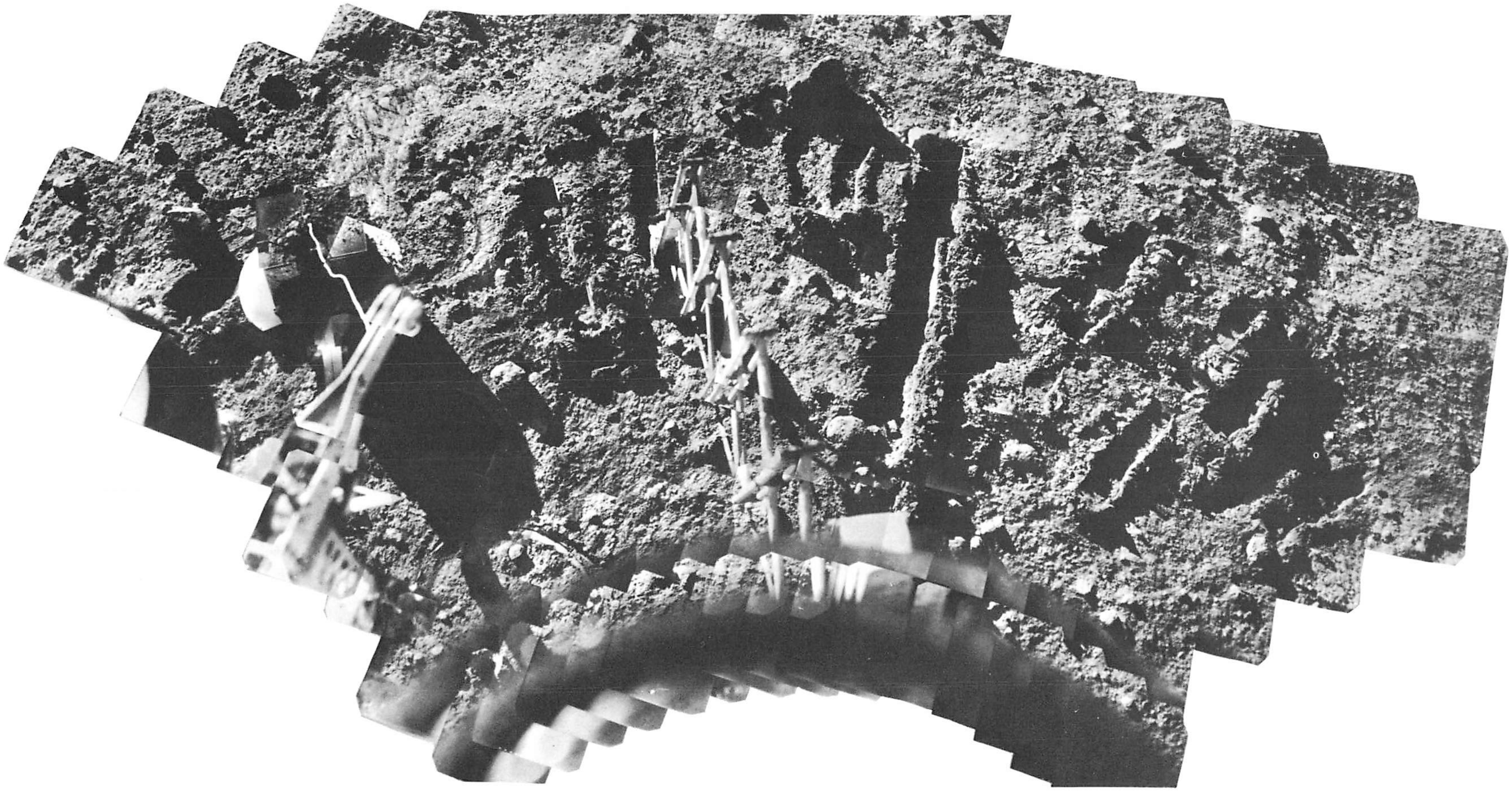
		Azimuth	Lens Focal Length	Identification
(37)	Day 022	+45 to +54	N	**Catalog No. 7-SE-25; Closeup of Alpha Scattering Instrument, Position 2**



	Azimuth	Lens Focal Length	Identification
(38) Day 019	−30 to +72	N	Catalog No. 7-SE-14; Alpha Scattering Instrument and Soil Mechanics Surface Sampler Area

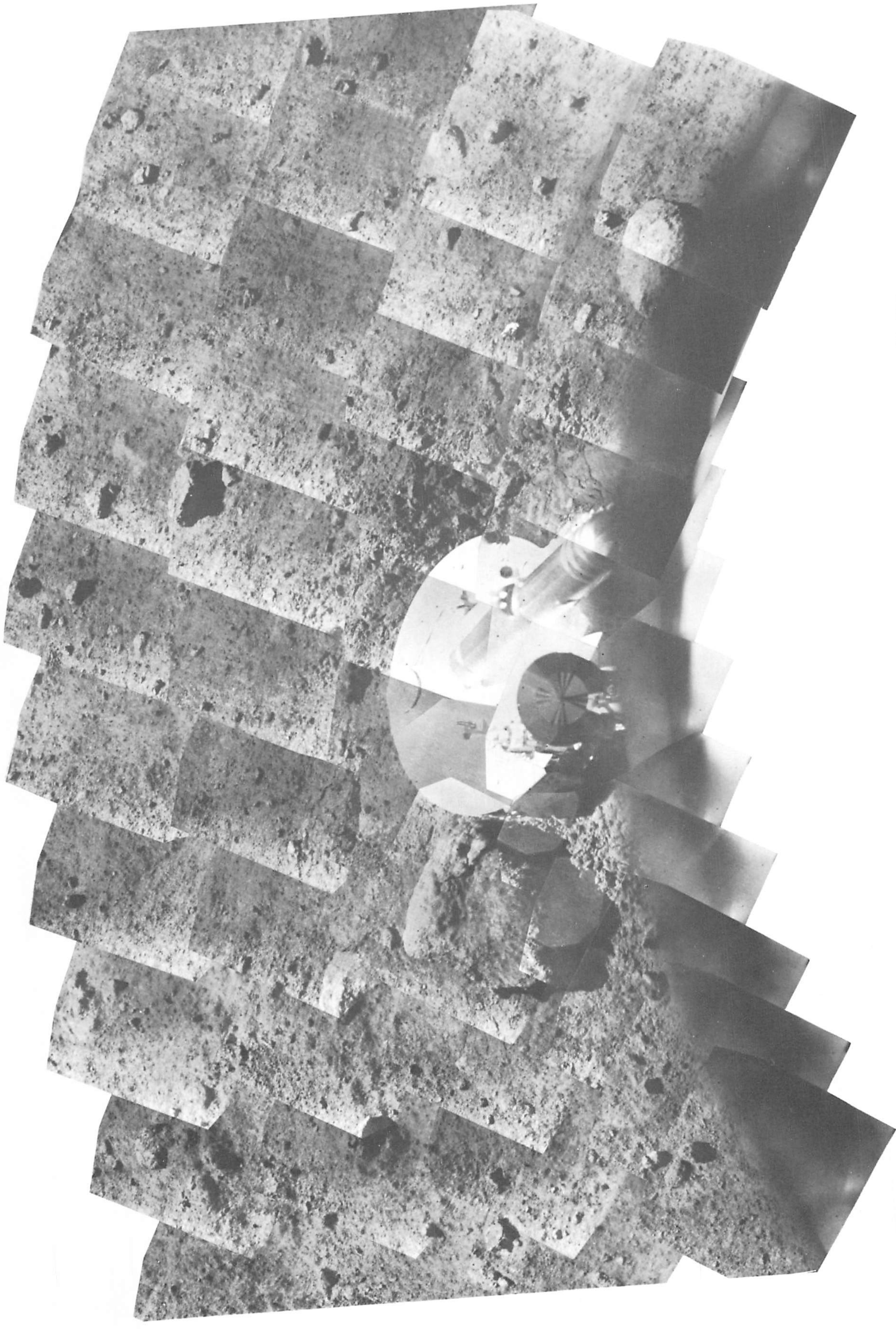


	Day	Azimuth	Lens Focal Length	Identification
(39)	Day 020	+108 to −198	W	Catalog No. 7-SE-13A; Mirror View of Trench

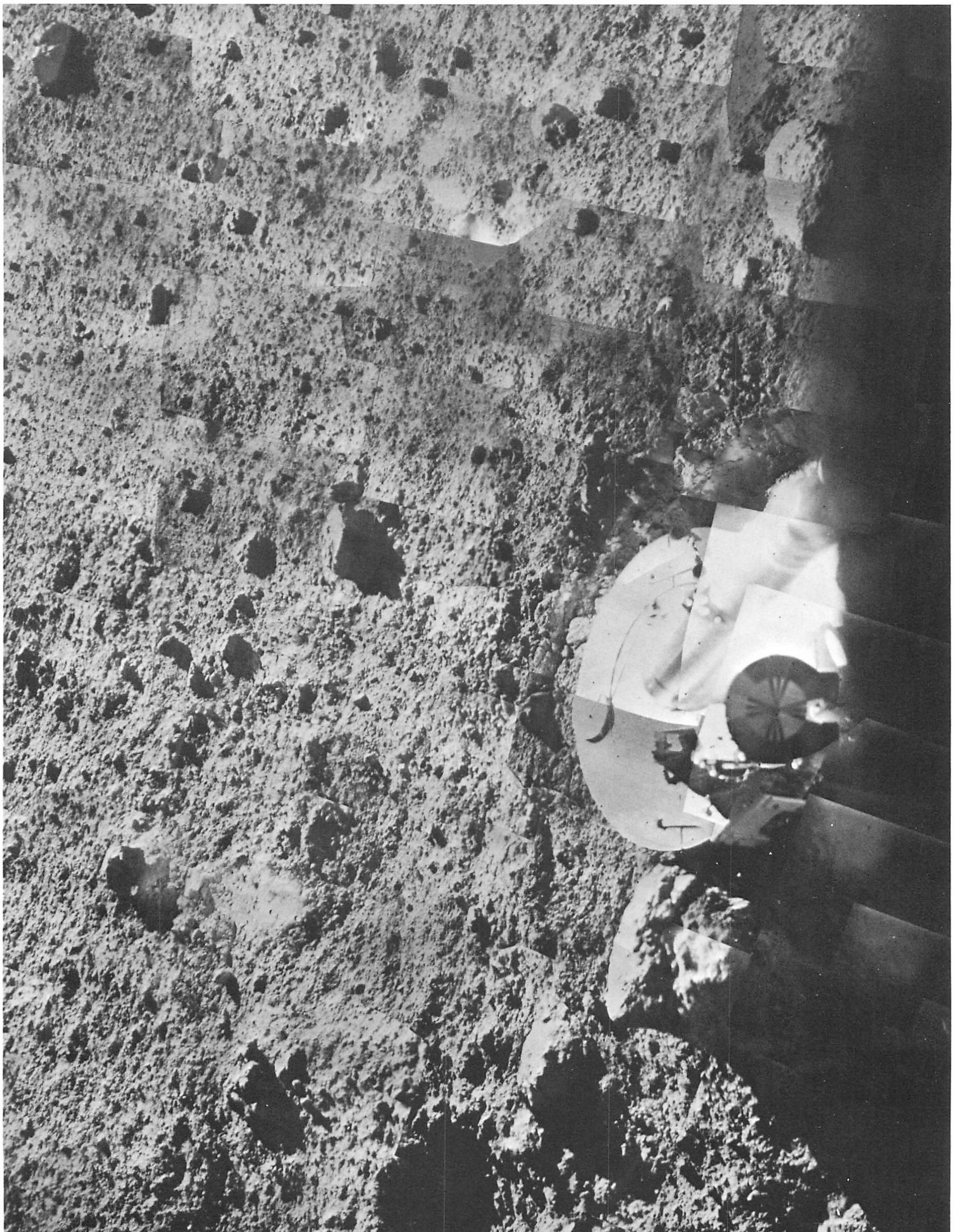


(40)	Day 021	Azimuth	Lens Focal Length	Identification
		−30 to +72	N	Catalog No. 7-SE-16; Soil Mechanics Surface Sampler Area

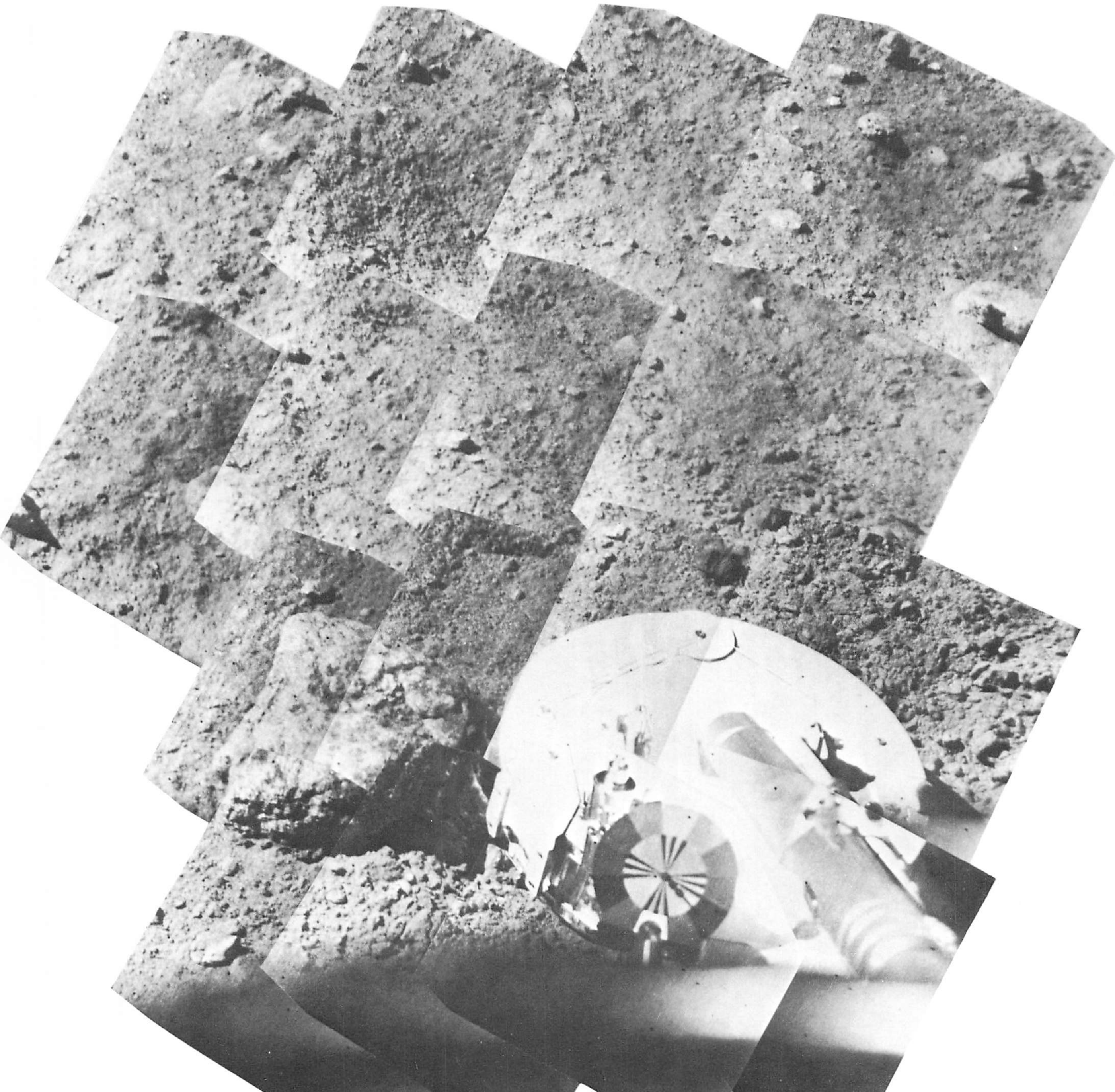
		Azimuth	Lens Focal Length	Identification
(41)	**Days 010, 011**	**−99 to −33**	**N**	**Catalog No. 7-SE-20H; Crater and Rocks in Vicinity of Pad 2**



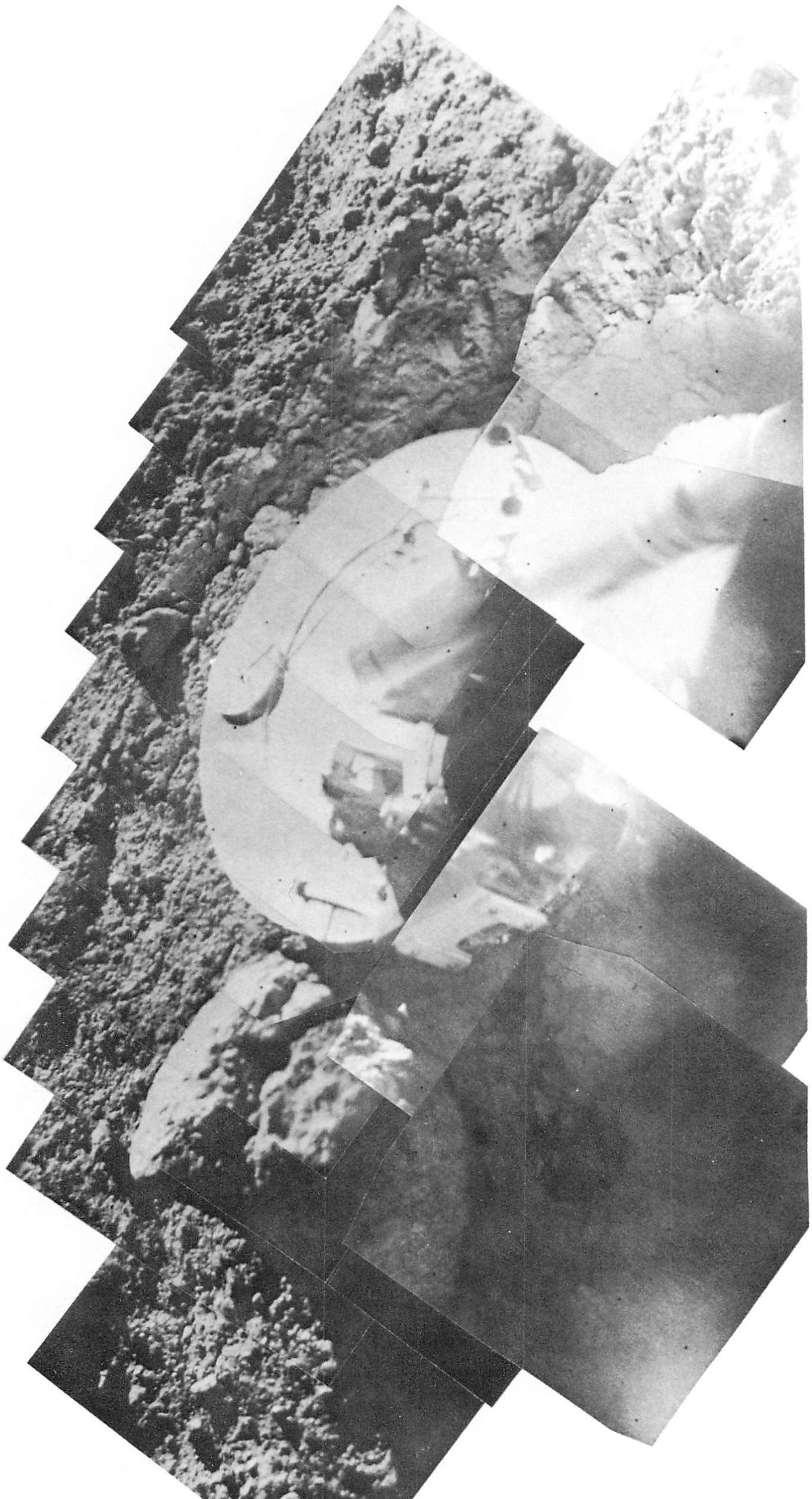
(42)	Azimuth	Lens Focal Length	Identification
Day 014	−90 to −36	N	Catalog No. 7-SE-18; Pad 2—Throw-out Area



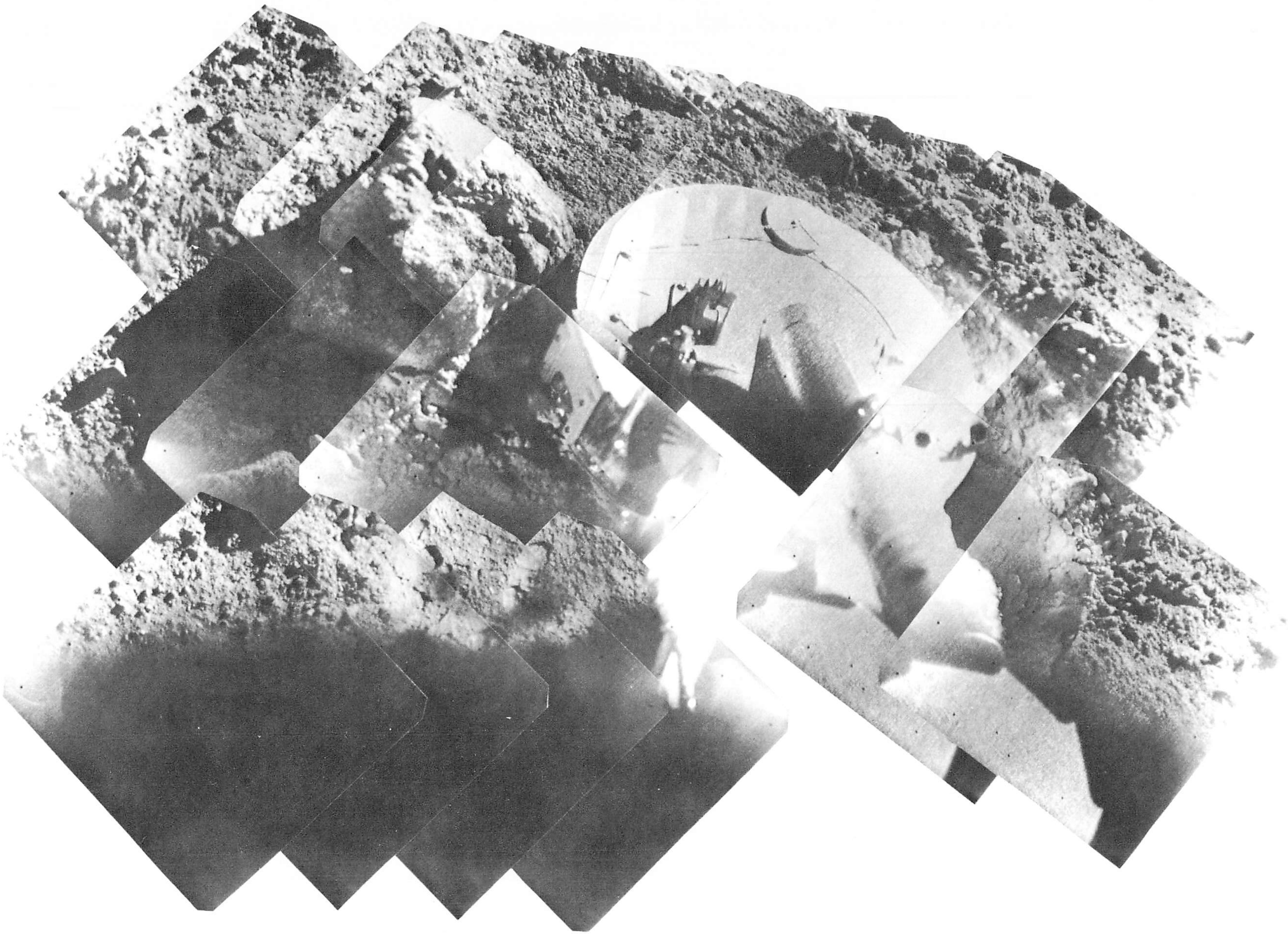
	Azimuth	Lens Focal Length	Identification
(43) **Days 010, 011**	**−93 to −48**	**N**	**Catalog No. 7-SE-20G; Pad 2 Area**



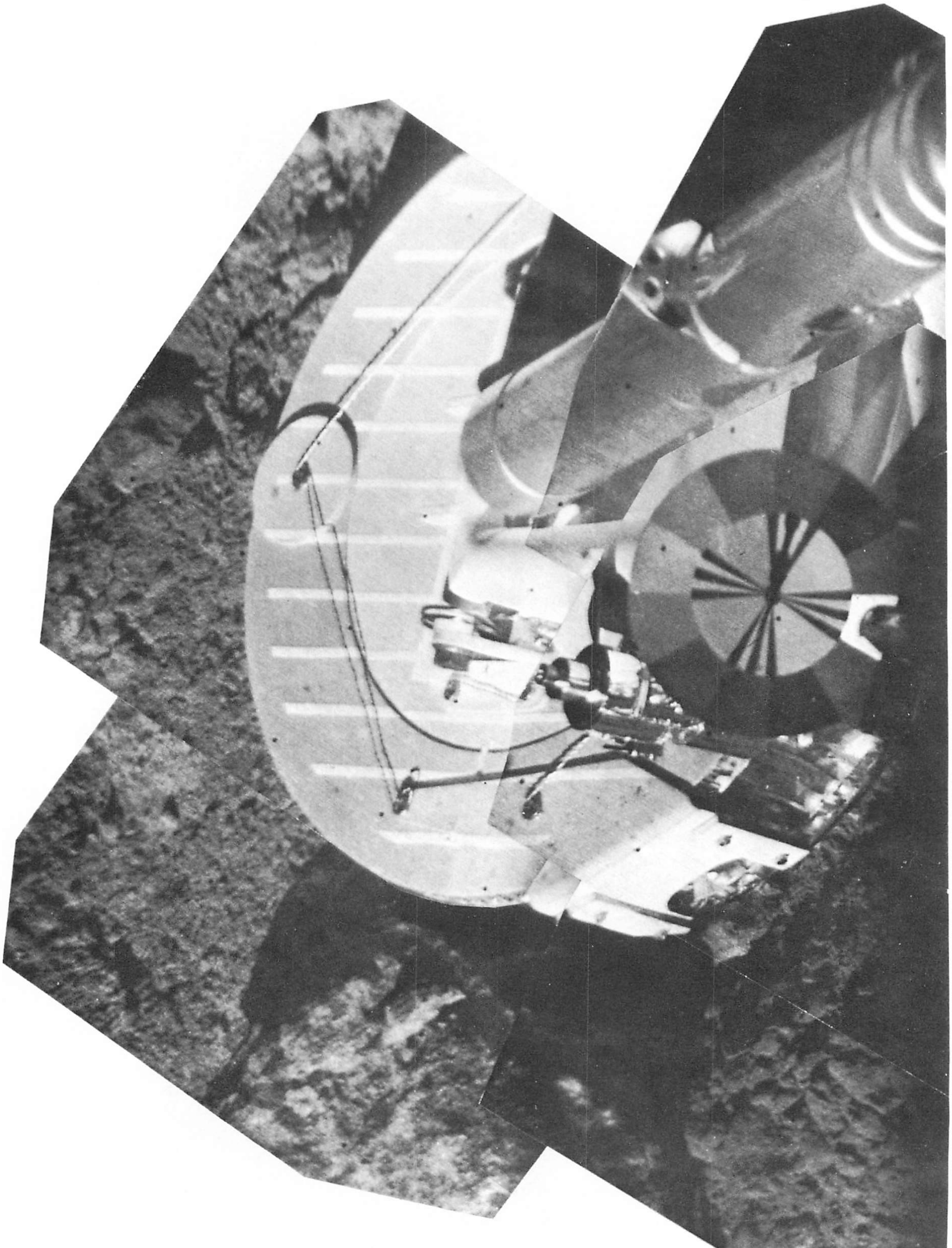
		Azimuth	Lens Focal Length	Identification
(44)	**Day 018**	**—69 to —54**	**N**	**Catalog No. 7-SE-23; Pad 2—Throw-out Area**



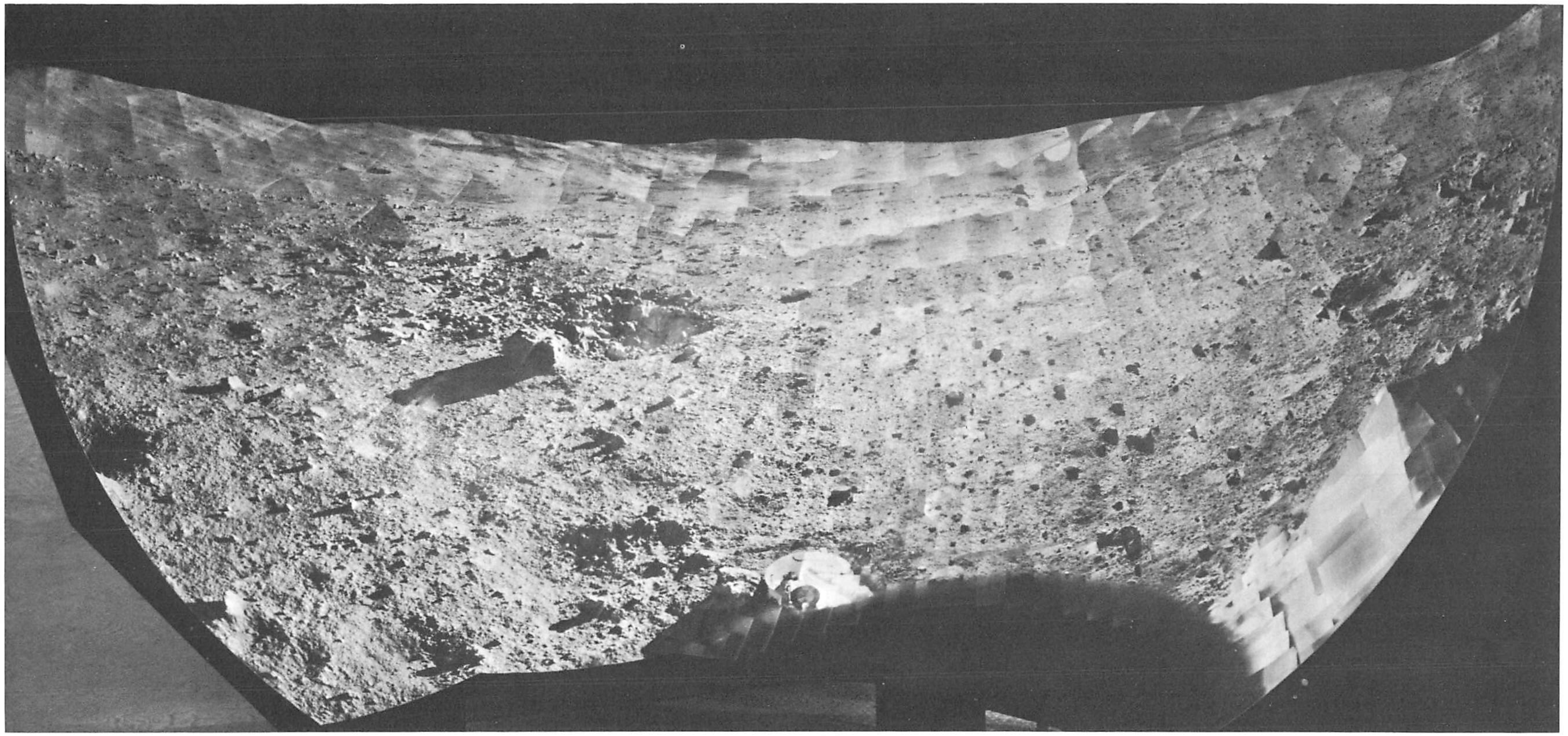
(45) Day 010 Azimuth —69 to —39 Lens Focal Length W Identification Catalog No. 7-SE-6; Pad 2 and Rock



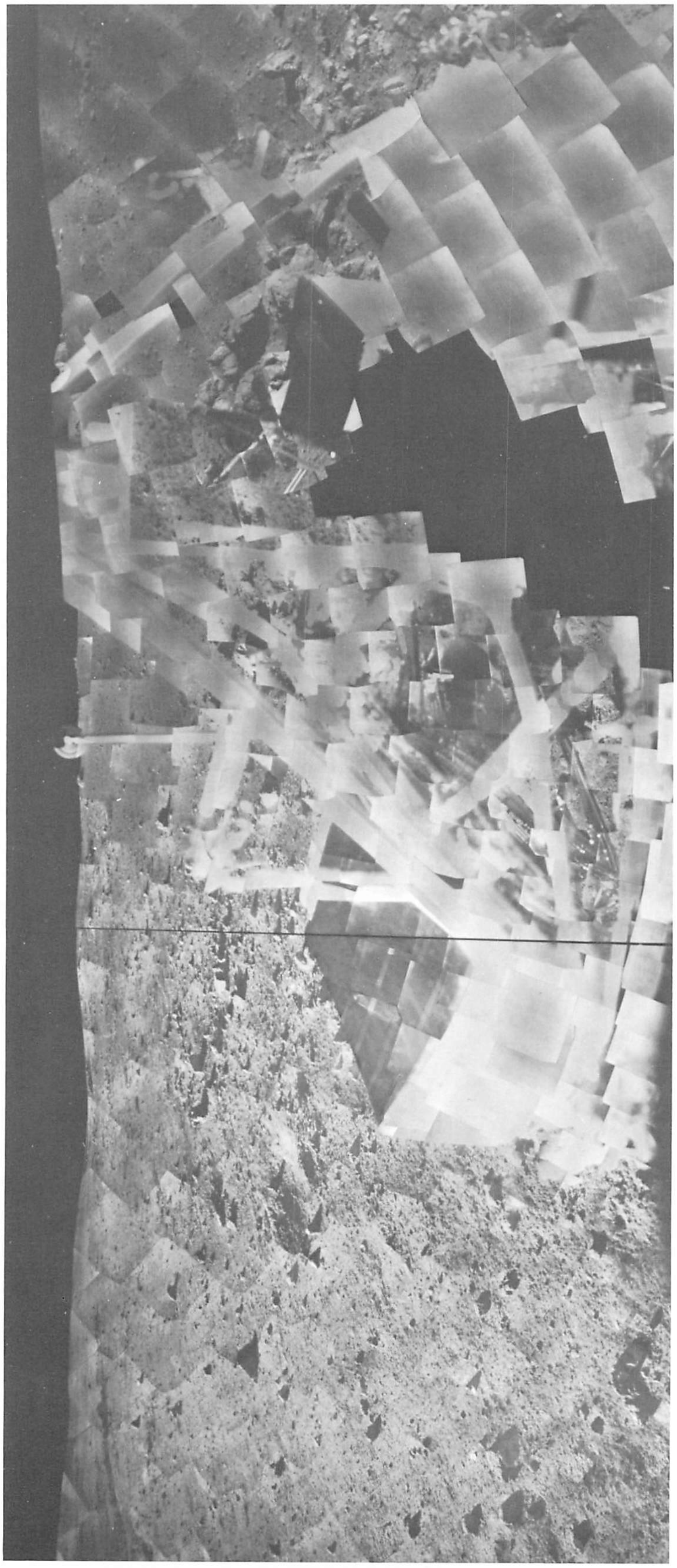
		Azimuth	Lens Focal Length	Identification
(46)	Day 011	−66 to −39	W	Catalog No. 7-SE-7; Pad 2 and Rock



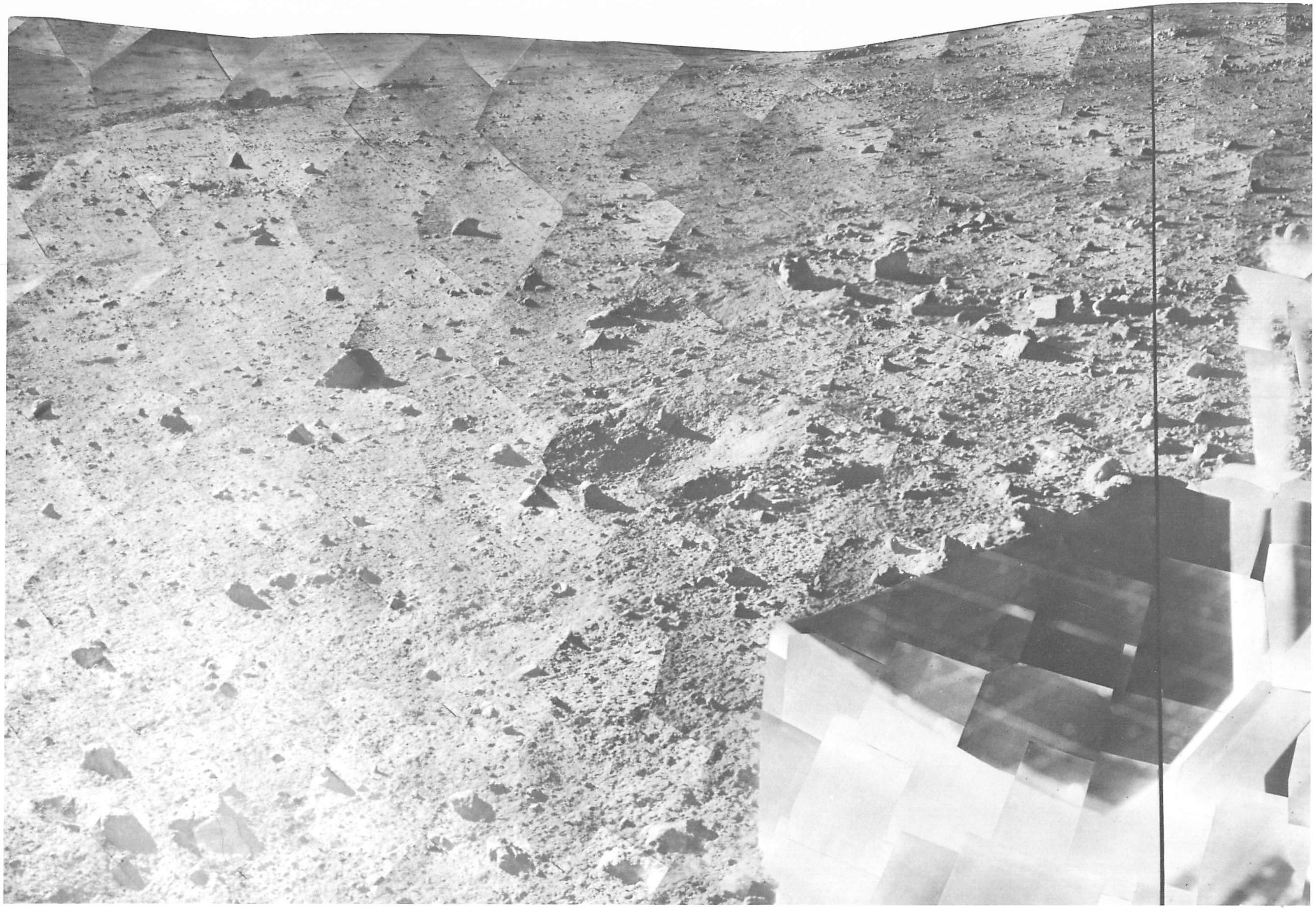
		Azimuth	Lens Focal Length	Identification
(47)	Day 020	−64 to −60	N	Catalog No. 7-SE-27; Pad 2



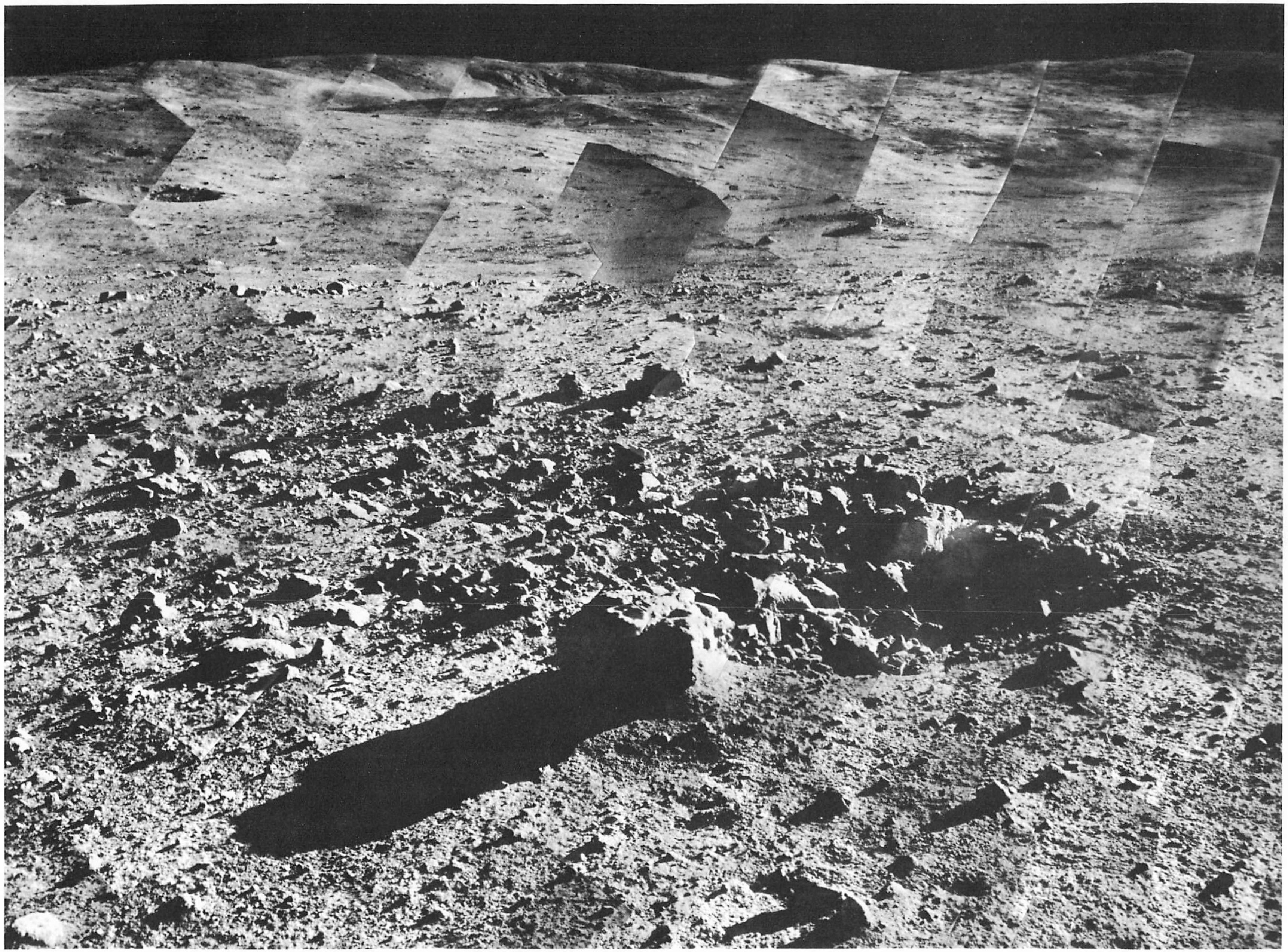
	Azimuth	Lens Focal Length	Identification
(48) Days 010, 011	−174 to +6	N	Catalog No. 7-SE-20*; Right-Portion Mosaic



(49) Days 010, 011, 018 | Azimuth +105 to −117 | Lens Focal Length N | Identification Catalog No. 7-SE-20C; Area Behind the Spacecraft



		Azimuth	Lens Focal Length	Identification
(50)	Days 010, 011	−177 to −117	N	Catalog No. 7-SE-20B; Area Beyond Compartment A



		Azimuth	Lens Focal Length	Identification
(51)	Day 010	—72 to —18	N	Catalog No. 7-SE-3; Crater and Horizon