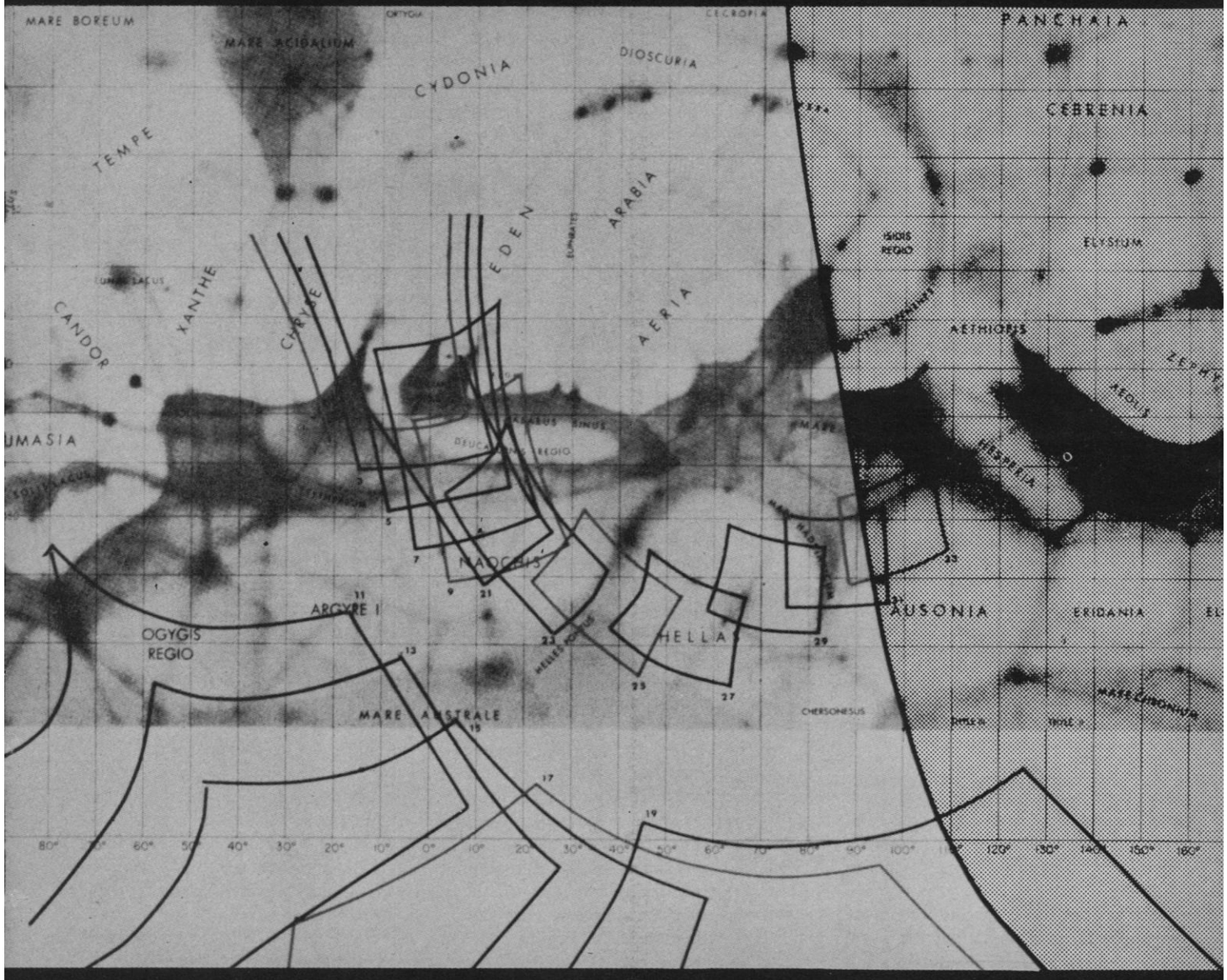


Fig. 1. Approximate locations of Mariner 7 near-encounter pictures. Heavy lines delineate the wide-angle frames. Small rectangles mark the narrow-angle frames.

Reports

Mariner 7 Television Pictures: First Report

Initial results of the television experiment carried by Mariner 6 were recently reported (*1*). This is a similar report of the television experiment aboard Mariner 7. These reports are presented primarily to communicate significant results to the scientific community as rapidly as possible. A more comprehensive, but still preliminary, review of the results of both experiments, and of their implications concerning the atmosphere and surface of Mars, is in preparation for submission to this journal.

The Mariner 7 television camera and data systems are essentially the same as those of Mariner 6. The relevant instrumental characteristics, and the rather complex nature of the returned signal information, have been described (*1*). Both Mariner 7 cameras operated normally. Compared with Mariner 6, the electrical noise (pickup by the camera system aboard the spacecraft) proved to be less, and the sensitivity of the high-resolution (narrow-angle) camera proved to be somewhat higher, as immediately apparent in the far-encounter mode of Mariner 7.

The mission profile of Mariner 7 permitted acquisition of 93 far-encounter pictures and 33 near-encounter pictures. In all, 126 pictures were acquired by Mariner 7, compared with 74 for Mariner 6.

The near-encounter picture fields superimposed on a "map" of Mars are shown in Fig. 1. They show that the instrument platform was slued after picture 9 onto a track leading across the south polar cap and slued again after picture 20 in order to provide a second limb-crossing for the ultraviolet spectrometer slit and so as to cross the classical dark area Hellespontus and the classical bright desert Hellas. During the initial traversal of the bright limb, the limb appeared in the field of the narrow-angle camera. Overlapping wide-angle coverage with the track of Mariner 6 was obtained in the vicinity of Meridiani Sinus.

Principal results of initial study of Mariner 7 pictures, in addition to confirming the first reported results of Mariner 6, are (i) additional physiographic interpretations of classically observed features are made; (ii) the surface of the south polar cap is generally visible and many large topographic forms are entirely coated with "snow"; (iii) the edge of the cap is apparently defined by local topographic configurations, but "snow"-free areas are apparent within the polar regions; and (iv) the Hellas region appears devoid of craters, thus implying the operation of more effective, more recent, and more geographically confined surface processes than heretofore evidenced.

The far-encounter sequence of Mariner 7 shows mottling within the maria, an effect noted in ground-based telescopic observations. It is here found that the mottled appearance is, in fact, caused by large numbers of craters with diameters of up to several hundred kilometers, most of which appear to have dark floors with lighter rims. Several examples can be seen in Figs. 2 and 3. The borders of the maria are sharply defined in some locations and diffuse in others. In one localized region, on the north edge of Sabaeus Sinus (left side of Fig. 3), the transition between mare and desert takes place within a few tens of kilometers. The borders of the maria occasionally show long, dark, fingerlike projections intruding into the bright areas. Several examples can be seen in both figures. Although this configuration suggests an association with craters or parts of craters, conclusive identification is not possible at this stage of picture processing.

Far-encounter photographs have been examined for evidence of martian canals, defined here as those dark, diffuse, more or less linear features, generally of low contrast, which have been recorded by visual observers and telescopic photographs. Although the Mariner pictures are still in a relatively rough form, several previously identified canals appear as well-defined features. Examples include Agathodaemon, the dark linear feature halfway between the center and the evening (right) limb of Fig. 4 and Cerberus, the large dark feature above and to the right of center in Fig. 2. Other canals appear to be resolved into a sequence of dark patches of varying size and contrast. In some cases the individual dark areas seem unrelated, suggesting that many canals involve the chance alignment of randomly distributed dark patches. Variegated shading has been noted in some of the well-defined canals, but the true physical nature of these features is still unknown.

Figure 5 shows two successive far-encounter frames arranged for stereoscopic viewing. Nix Olympica and the curious bright streaks mentioned in the Mariner 6 report (see *1*) are clearly seen.

The boundary of the south polar cap was seen at longitude 335°E, latitude 61°S, at a solar elevation of 33° (Fig. 6). The area is heavily cratered, and the cap edge is strongly influenced by local topographic features. Even so, the transition between bare ground and complete coverage by "snow" is remarkably sharp: the entire transition spans only about 2° of latitude. This suggests that the slopes at and even below the scale resolved by the wide-angle camera are of this same order and are thus similar to those seen at lower latitudes. This comparison, when evaluated more quantitatively, will be important in singling out mechanisms of surface modification most active on Mars. No indication of a dark "polar collar" is found.

Several wide- and narrow-angle views of the cap itself were obtained (Figs. 7 to 10). Since these show craters entirely covered by "snow," the cap material generally must be thick enough not to evaporate away during the day on sunward-facing slopes. At the same time, dark areas well within the cap (particularly on crater floors) suggest a deposit thin enough to be removed by surface winds or other meteorological factors in some places.

(Continued on page 794)

← Fig. 2

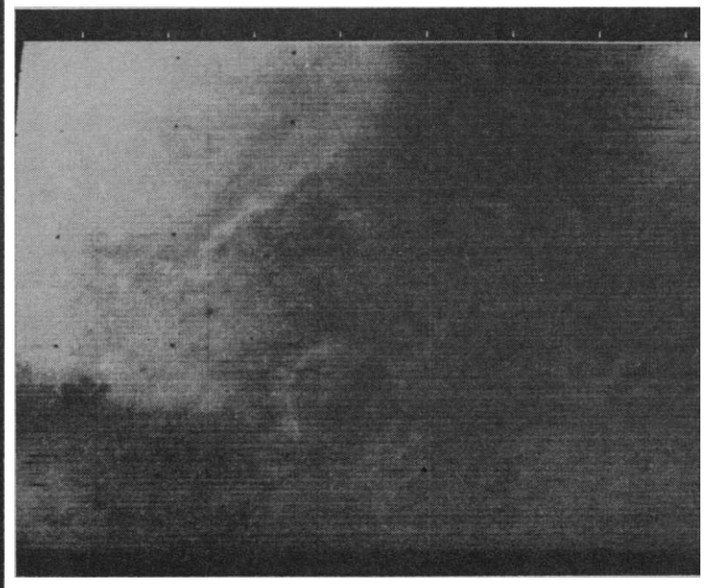


Fig. 3

Figs. 2 to 5. The phase angles are 25°. The approximate subspacecraft latitudes are −4°.

	Far-encounter frame number	Distance to martian surface (km)	Time of picture G.M.T. 8/4/69 (hr : min)	Central meridian east longitude (*2*) (deg)	Typical features
Fig. 4	72	492,000	09:41	256.2	Solis Lacus, Tharsis
Fig. 5 (left)	74	452,100	11:15	233.3	Tharsis, Mare Sirenum
Fig. 5 (right)	75	432,600	12:01	222.0	Tharsis, Mare Sirenum
Fig. 2	81	292,000	17:31	142.2	Cerberus, Elysium, Mare Cimmerium
Fig. 3	92	131,500	23:48	50.9	Syrtis Major, Deltaton Sinus

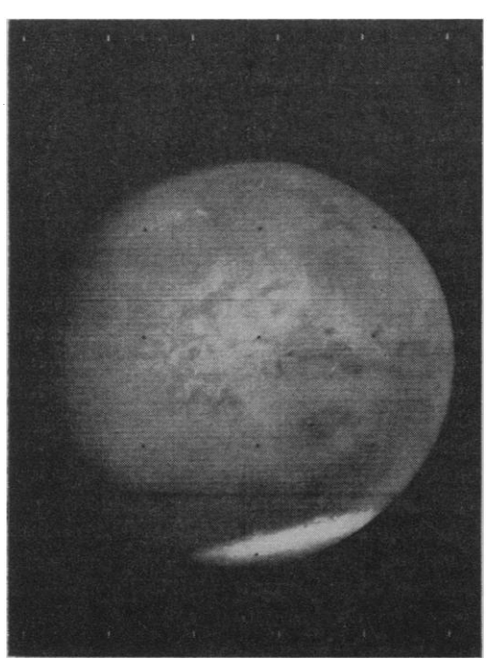


Fig. 4

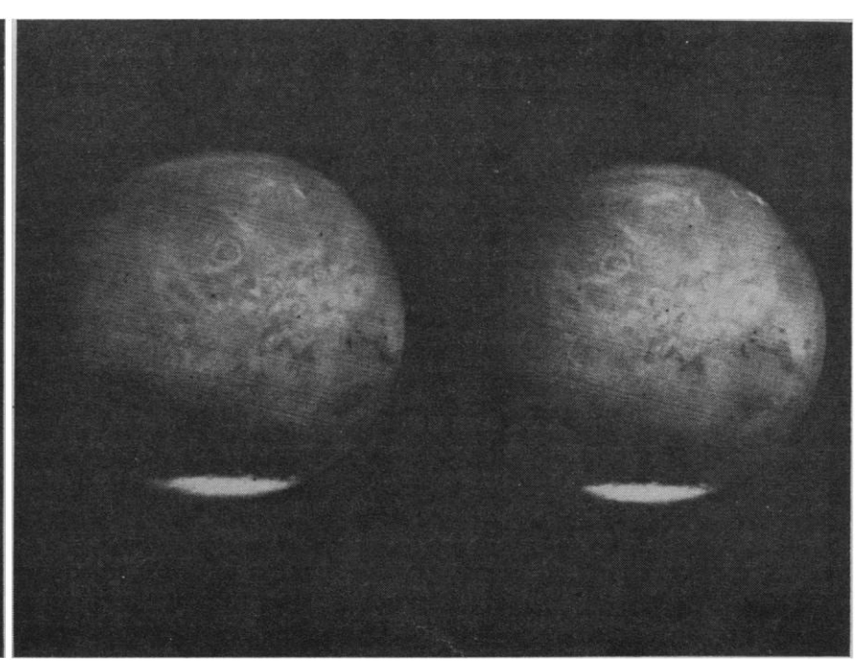
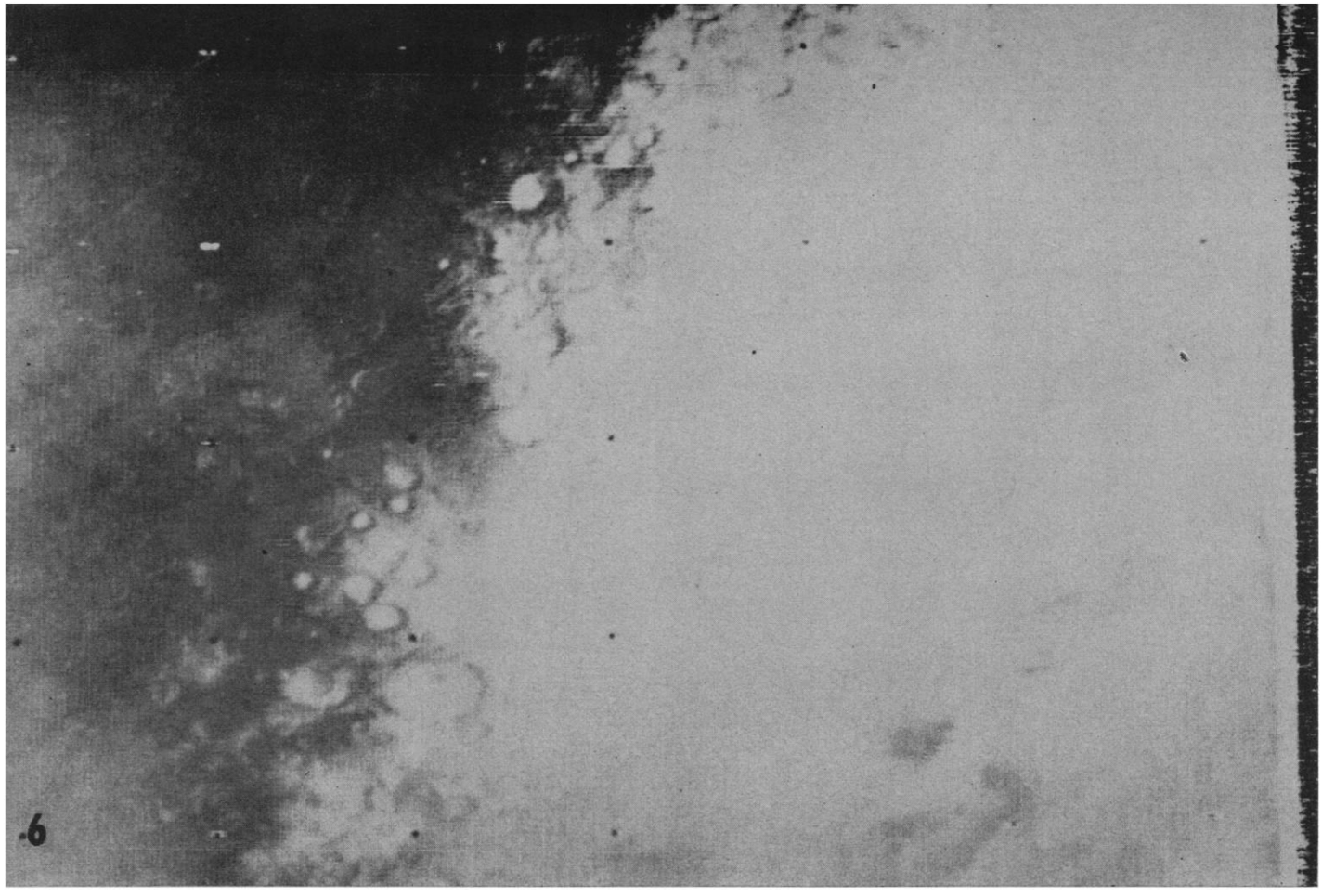


Fig. 5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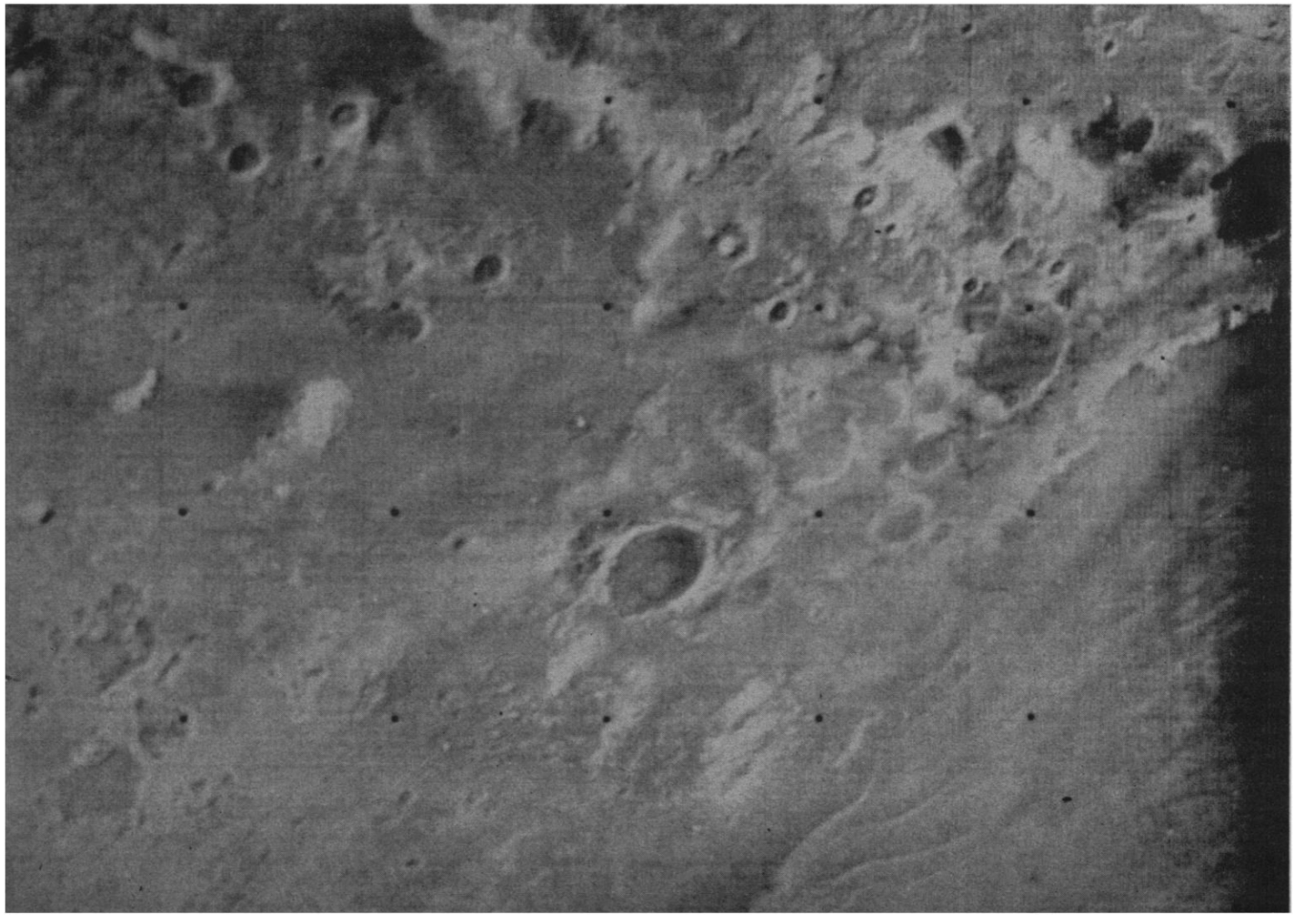

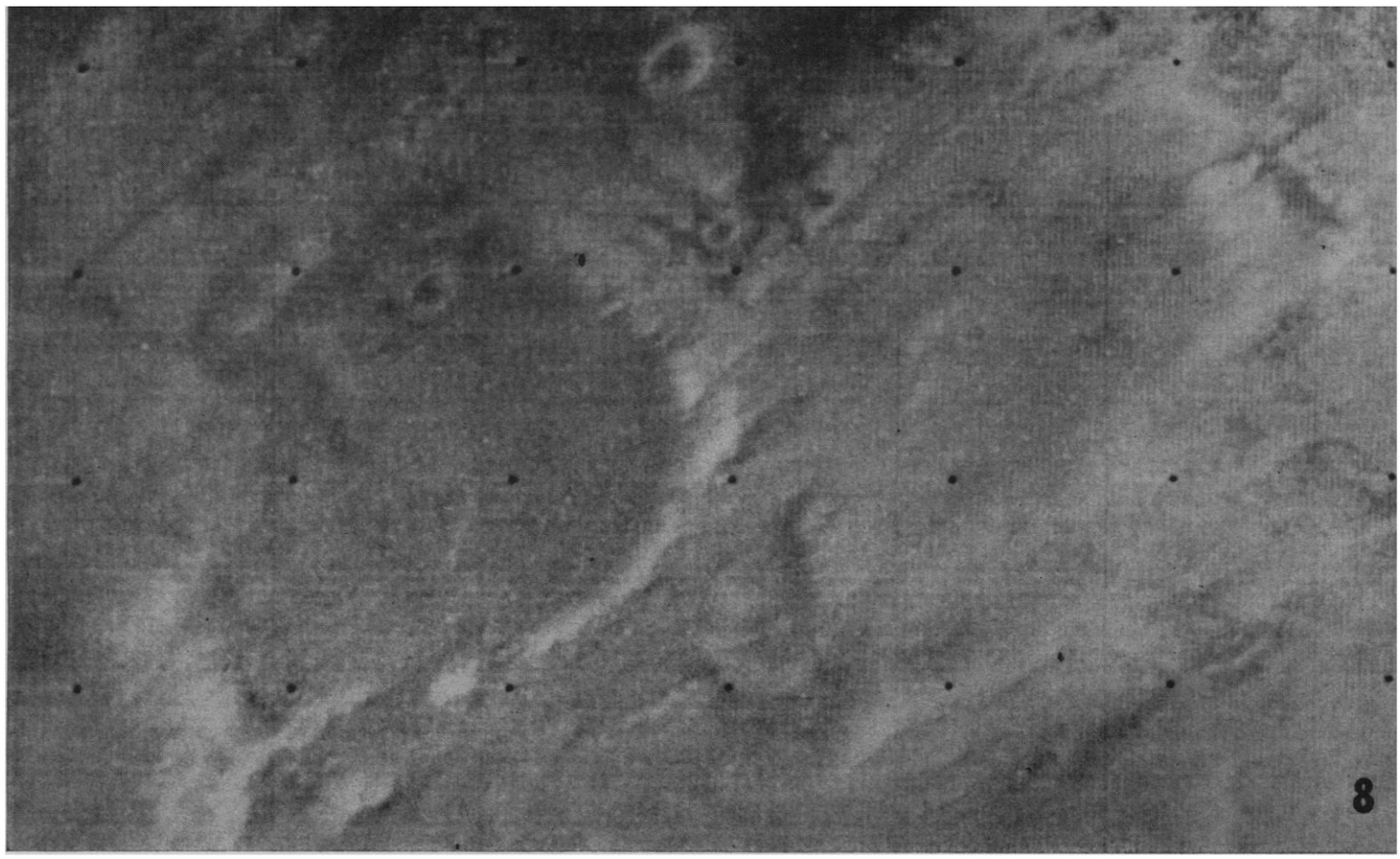
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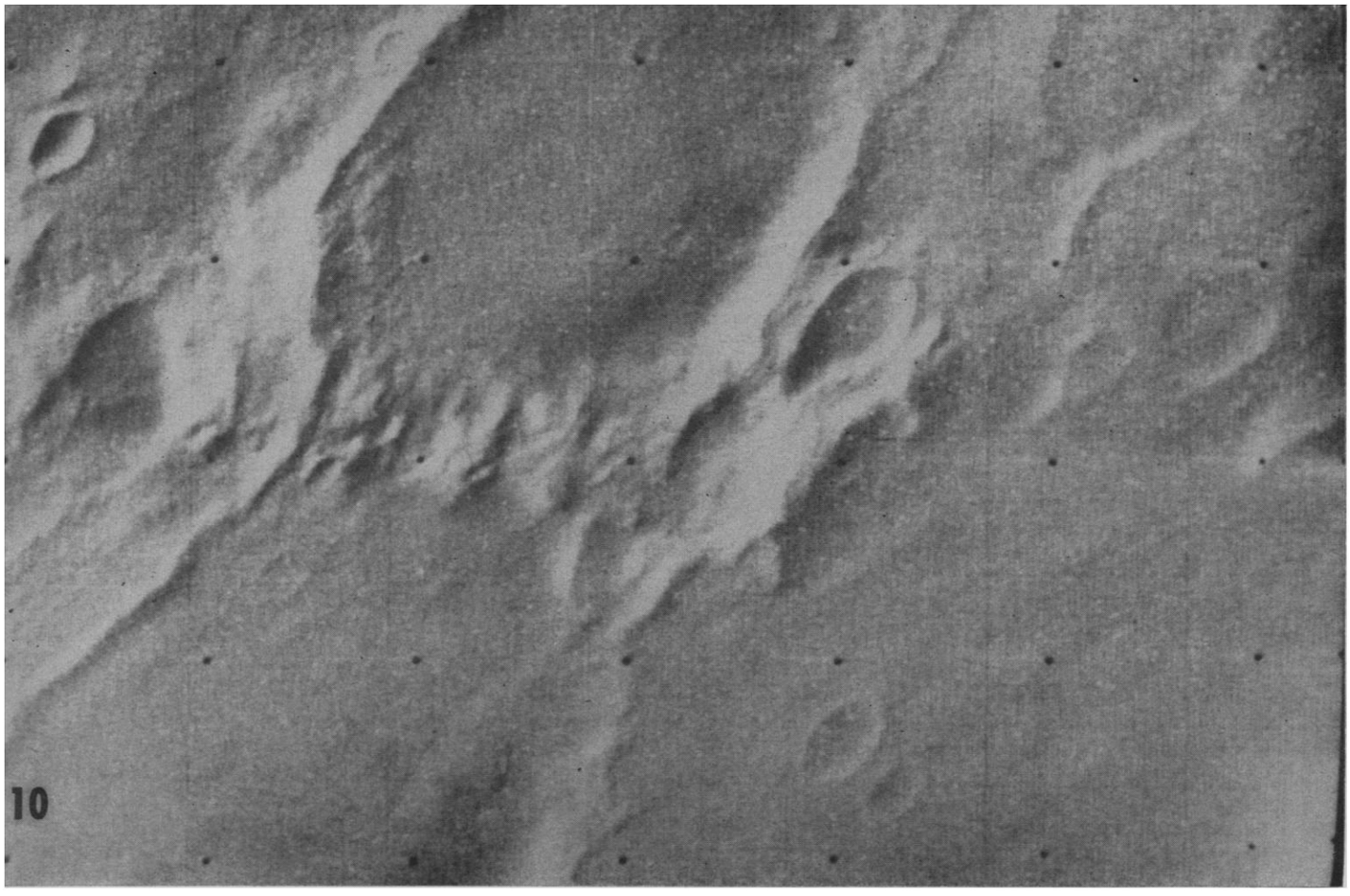

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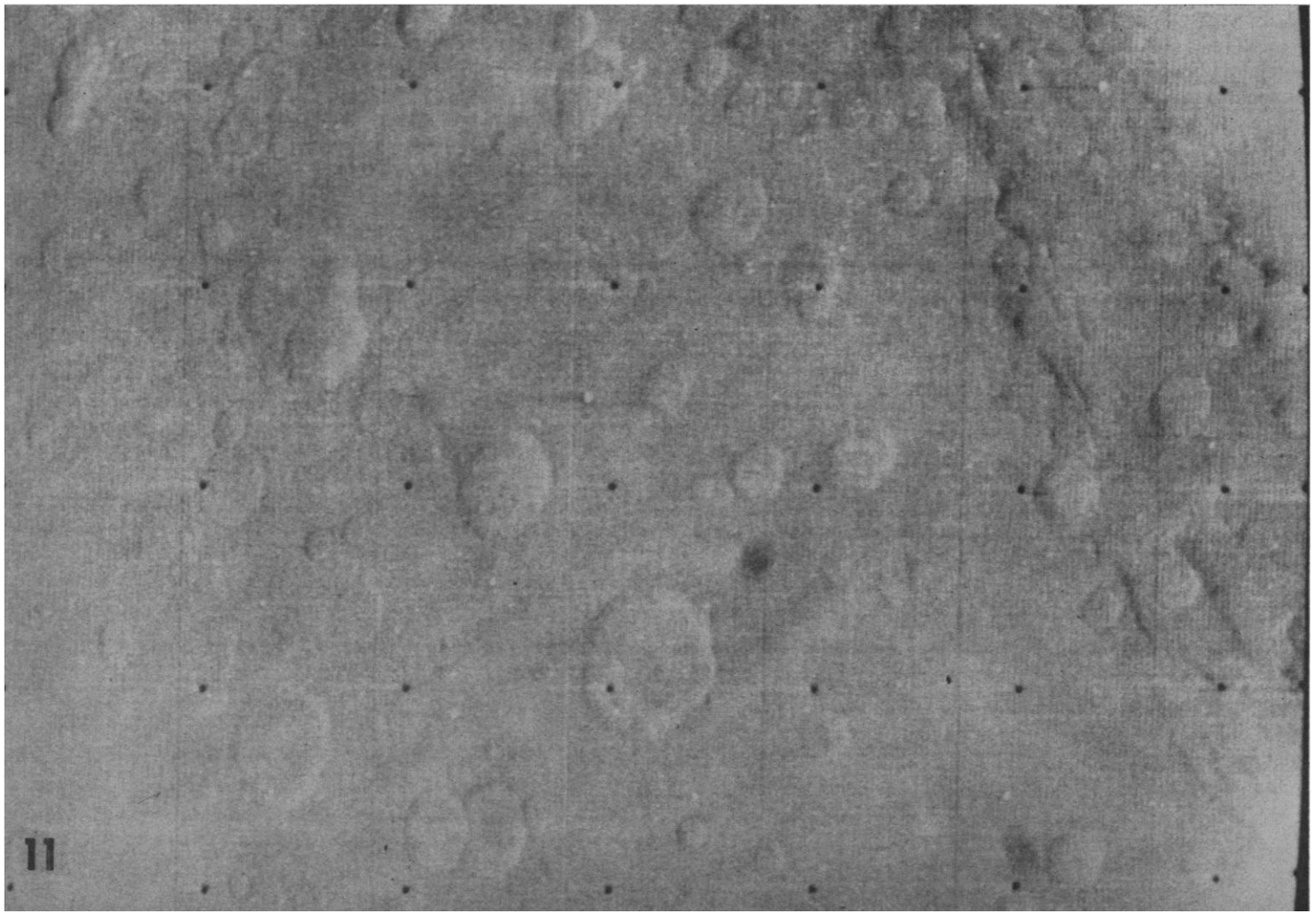

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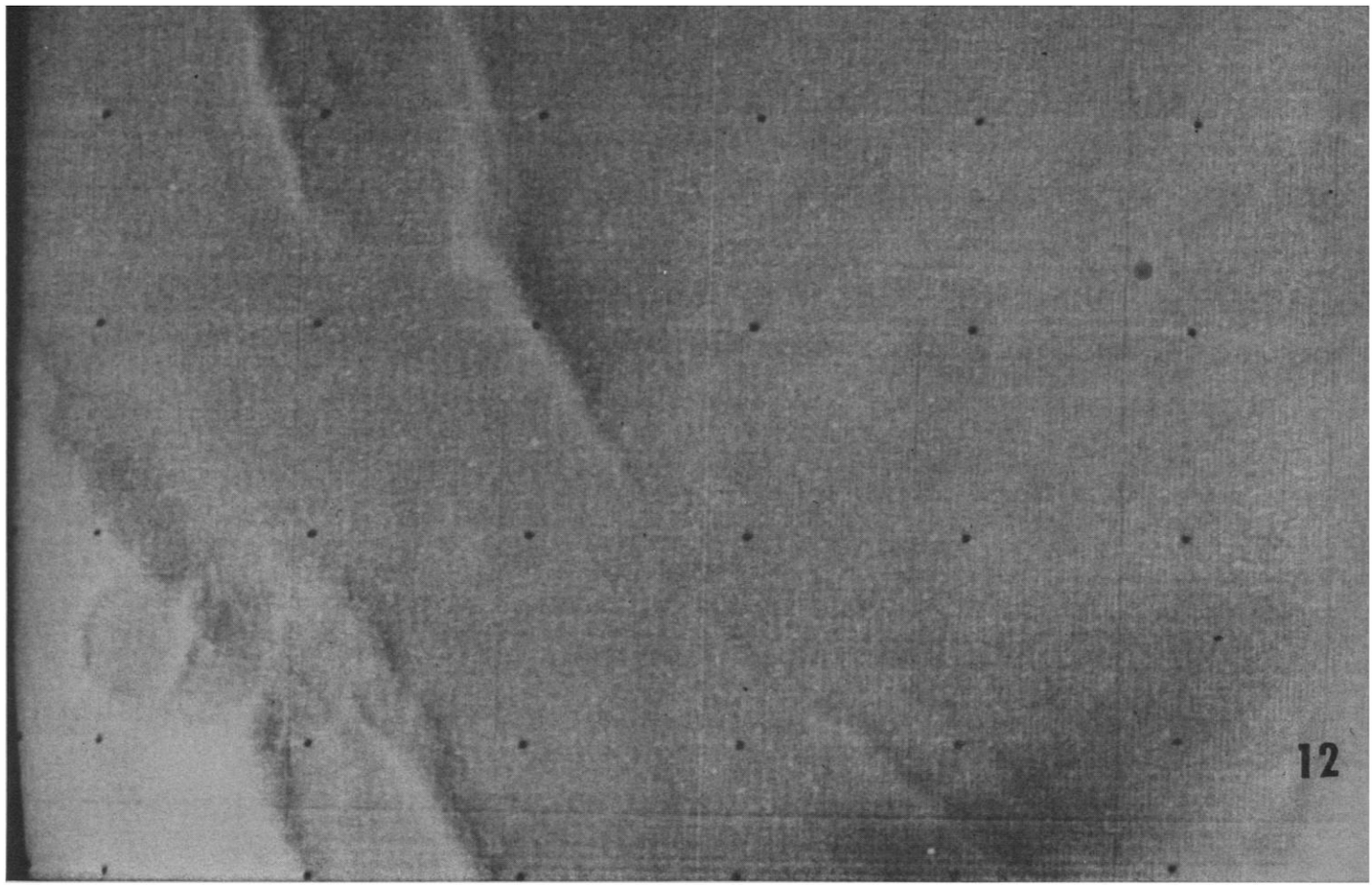
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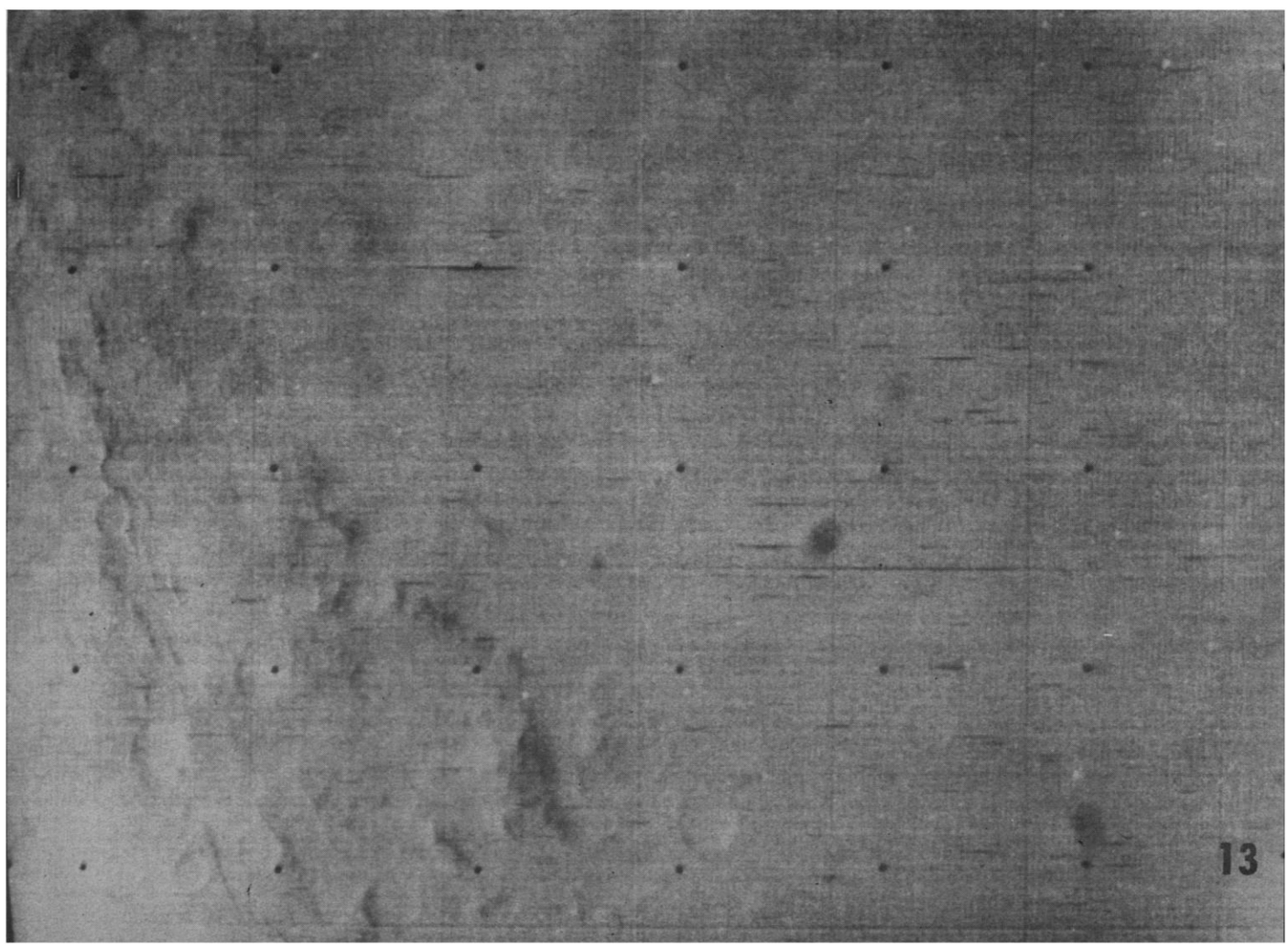
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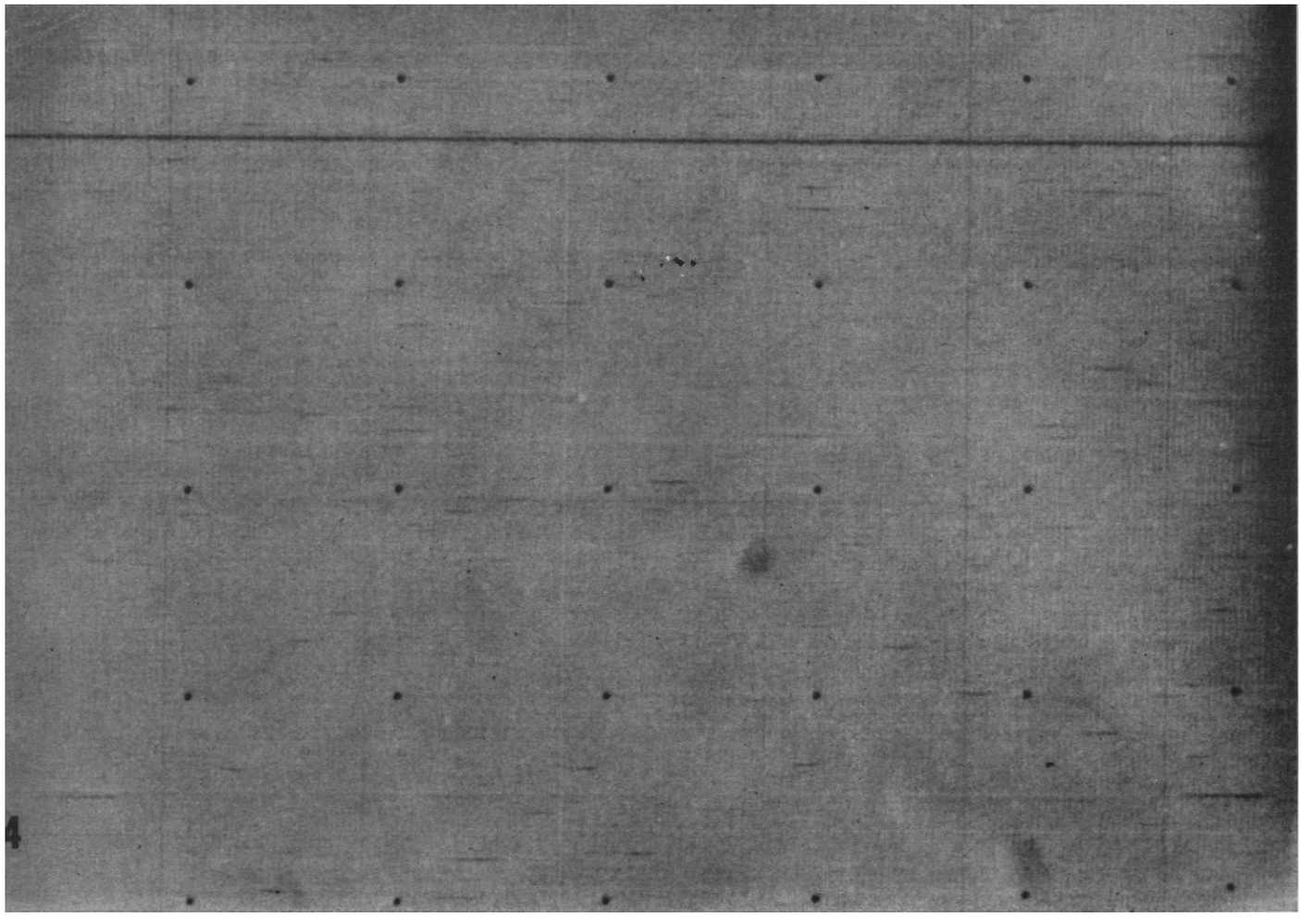

Figs. 6 to 14. Figures 6, 7, 9, 11, and 13 (frames 13, 17, 19, 25, and 27 of the Mariner 7 near-encounter series) are wide-angle photos, often with overlap, and a resolution of about 3 km. Figures 8, 10, 12, and 14 (frames 18, 20, 26, and 28) cover small areas within the wide-angle photos with a resolution of about 300 m. Figures 6 to 10 are within the south polar cap. Figures 11 to 14 are within the areas Hellespontus and Hellas in the eastern part of the Mariner 7 near-encounter path, approaching the evening terminator. North is approximately toward the top. The south pole of Mars appears in Fig. 7 near the lower edge and about one-third of the picture width from the right edge.

	Near-encounter frame No.	Filter	Distance to martian surface (km)	Mars coordinates (deg)	Approximate north-south by east-west dimensions (km)	Viewing angle from vertical (deg)	Solar zenith angle (deg)
Fig. 6	13	Green	5909	65 S 341 E	1500 × 1700	44	57
Fig. 7	17	Blue	5210	77 S 25 E	1400 × 1600	46	69
Fig. 8	18	Minus blue	5092	78 S 46 E	130 × 145	47	73
Fig. 9	19	Green	5040	79 S 71 E	1350 × 1850	51	78
Fig. 10	20	Minus blue	4998	76 S 94 E	130 × 170	54	82
Fig. 11	25	Blue	3913	43 S 36 E	770 × 1220	33	48
Fig. 12	26	Minus blue	3755	45 S 44 E	75 × 100	27	54
Fig. 13	27	Green	3636	46 S 52 E	720 × 990	23	60
Fig. 14	29	Red	3619	40 S 69 E	780 × 940	27	62

(Continued from page 788)

Several areas of relatively thin "snow" cover within the cap are indicated by lower surface brightness or by the configuration of their boundaries, or both (Figs. 7 and 9). Often these are of irregular outline and differ from craters and other topographic features seen outside the polar cap in the picture series of either spacecraft. If the boundaries of these areas are produced by variations of "snow" depth, local depths of many meters may be indicated. No effects clearly identifiable with haze or clouds were seen over the polar cap, although several features suggestive of low clouds are present (Figs. 8 and 9). Definitive analysis requires merging of the digital and analog video data.

The sequence of frames shown in

Figs. 11 to 14 illustrates a striking change in surface morphology eastward from the elongate dark area, Hellespontus, into the large circular bright area, Hellas. In Figs. 11 and 12, Hellespontus and the intervening scarped and ridged transition zone to Hellas display abundant craters of good size, but in Figs. 12 and 14 the floor of Hellas is seen to be virtually devoid of discernible craters, except within a narrow marginal zone where they are faintly visible. Small craters disappear even earlier, being unrecognizable in the transition zone and on the near edge of Hellespontus, even in high resolution photos (Fig. 13).

Various considerations suggest that this disappearance of craters is not the result of an atmospheric haze or fog hanging over the Hellas area, but rather the product of some difference in processes acting, or materials present (or both), which results in abnormally rapid obscuration of craters on the floor of Hellas. The transition area between Hellespontus and Hellas with its short en echelon scarps and ridges constitutes the most distinct structural border yet seen between a light and dark area on Mars.

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References and Notes

1. R. B. Leighton, N. H. Horowitz, B. C. Murray, R. P. Sharp, A. R. Herriman, A. T. Young, B. A. Smith, M. E. Davies, C. B. Leovy, *Science* **165**, 684 (1969).
2. Longitude measured eastward on Mars from the standard ephemeris zero meridian. Ephemeris longitude is measured westward from this meridian.
3. We acknowledge the support and encouragement of the National Aeronautics and Space Administration. We also thank the Mariner Mars '69 project manager, H. M. Schurmeier, and his staff at the Jet Propulsion Laboratory, California Institute of Technology, without whose skill, expert knowledge, and devoted labor Mariner 7 could not have succeeded.

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Glacial Age Marsh, Lafayette Park, Washington, D.C.

Abstract. *Organic sediments beneath historic Lafayette Park mark the site of a freshwater marsh which bordered the Potomac River when it was 15 meters above its present level. Plant microfossils and ice-rafted boulders indicate a climate much colder than now. The carbon-14 age of more than 45,000 years and palynological studies suggest an early Wisconsin age.*

In 1964 workmen uncovered a peat deposit while excavating for a foundation of the new U.S. Court of Claims building adjacent to the Dolly Madison House on the northeastern corner of Lafayette Park, just north of the White House (Fig. 1). The peat lies about 3 m below street level, is 1 m thick, and consists of a brown compacted mass of plant remains. Below the peat layer is 4.3 m of dark gray organic silt and sand containing occasional subangular boulders, one of which was reported to be more than 2 m long. Below these sediments test borings revealed 23.6 m of silt, sand, and gravel extending down to bedrock, which at this locality is 13.7 m below sea level.

The peat was best exposed in the northwest corner of the excavation, just below the foundation of the Dolly Madison House. I found it again in 1967 at the same horizon in an excavation just east of the Court of Claims building. However, the deposit is small, as indicated by the fact that I did not find it in a test pit 20 m deep dug in 1966 at the north end of Lafayette Park, or in other nearby building excavations.

The upper part of the peat is finely laminated and contains recognizable remains of sedges and other marsh plants, including numerous seeds of *Cyperus* similar to those of *C. aristatus*. The lower part is massive and silty, and, except for pieces of wood, contains no megascopic remains. A sample of the upper peat (sample W-1542) yielded a radiocarbon age greater than 45,000 years (*1*).

The organic sediments below the peat contain no shells or other megafossils except occasional pieces of wood, which appear to be mainly alder. These sediments also contain subangular boulders, which average about 25 to 50 cm in diameter. The boulders, mostly quartzite and other rocks not native to the area, were apparently rafted downstream by river ice at a time when Washington's climate was much colder and when the Potomac River was 10 to 15 m higher than it is at present.

Microscopic examination of the peat and underlying silt and sand from the Court of Claims excavation and other excavations near the park revealed pollen grains and, in places, freshwater diatoms and sponge spicules.

These microfossils are most numerous in the locality of the Court of Claims; here they are most abundant in the peat, decrease in number downward, and become very scarce in the lower sands. The most frequent microfossils found in the sediments exposed in the Court of Claims excavation are pollen grains, mostly from pine, spruce, and fir, and a few from deciduous hardwood trees such as oak. This pollen assemblage and the low percentages of nonarboreal pollen grains and spores indicate that dense coniferous forests covered the Washington area during most of the time involved.

Darton (*2*) and others thought, on the basis of lithology, that Cretaceous beds underlay the Pleistocene deposits at this locality. However, pollen grains in samples that I obtained from the bottom of the test pit in Lafayette Park and from borings in the vicinity indicate that all the sediments below Lafayette Park are of Pleistocene age and that they were deposited during two warm and two cold periods (Fig. 2). The warm periods, represented in Fig. 2 by zones *Y* and *S*, are inferred from the presence at these levels of pollen grains which show that deciduous forests, indicative of warm climatic conditions, covered the Washington area during the time involved. The cold periods, represented by zones *I* and *WA–WD*, are inferred from the pollen grains at these horizons, which show the former presence of boreal coniferous forests.

This evidence and recent excavations just north of Lafayette Park (Fig. 1) show that the Pleistocene deposits abut against a buried cliff, in places more than 20 m high, cut in lignitic Cretaceous beds and weathered Pleistocene gravels. This cliff, which roughly parallels H and Eye Streets, extends eastward from Washington Circle, 1 km west of the White House, to Judiciary Square, 1.5 km east of the White House. The cliff, which marks a former shoreline of