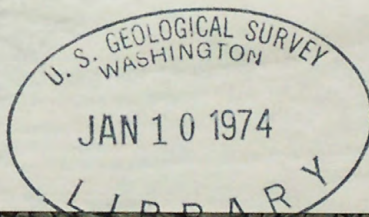
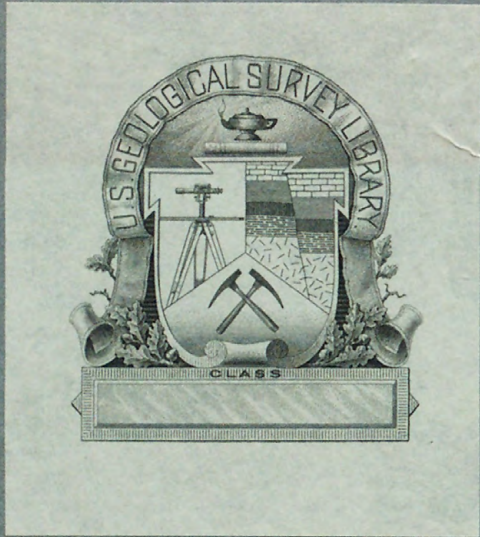


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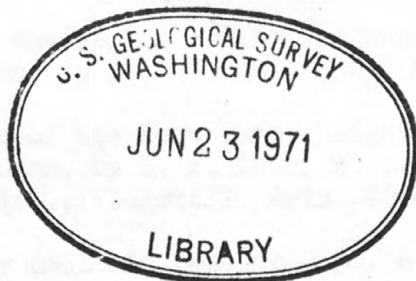
REVIEW AND ANALYSIS OF APOLLO 14 MASTER POSITIVES

by

J. R. McCord



U. S. Geological Survey
OPEN FILE REPORT



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9. Map showing structural features and dolomite occurrence in the Winchester quadrangle, Clark and Madison Counties, Kentucky, by Douglas F. B. Black. Map (1 sheet), scale 1:24,000. USGS, 710 West High St., Lexington, Ky. 40508; Kentucky Geol. Survey, 307 Mineral Industries Bldg., University of Kentucky, 120 Graham Ave., Lexington, Ky. 40506. [Material from which copy can be made at private expense is available in the office of the Kentucky Geological Survey.]
10. The vertical gradient of gravity in vertical and near-vertical boreholes, by L. A. Beyer. 229 p., 50 figs.; 14 tables.

REVIEW AND ANALYSIS OF APOLLO 14 MASTER POSITIVES

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The Apollo 14 photographs discussed in the preceding papers within this volume were reproduced from a set of positive transparencies, labeled "second generation", furnished to the U. S. Geological Survey by the National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Texas. The designation "second generation" was a misnomer because the master positives so designated are actually derived in the following manner: The original black and white film returned from space is processed so that the latent image becomes a negative. This negative is printed on a duplicating film and the resulting image is called a first generation master positive. The latter is used to produce a second generation master negative from which the so-called second generation master positive or release positive is developed.

Very few photographic data were available to the writer, and those obtained were by telephone conversation or by photometric measurements made on the film material received. Some of the more important data are listed for selected magazines in Table 1 or shown graphically (figs. 1 and 2). A set of true master positives was received subsequent to this report and the preceding papers.

The following restrictions apply to the photographic coverages used. 1) the master positives had intermittent scratches; 2) the images taken from orbit were processed to an extremely high gamma, resulting in an apparent loss of detail in highlight and shadow areas; 3) the resolution of many orbital photographs was less than expected and reseau marks were somewhat fuzzy suggesting that the contact between the master negatives and positives during printing was not perfect, or that the two emulsion surfaces were not placed face to face; and 4) all color transparencies had a strong magenta cast, resulting in an apparent loss of detail in highlight and shadow areas.

The following more specific comments are based on evaluation of a second set of master positive transparencies supplied to meet the demands for additional prints for geologic analysis.

(1) # Magazine P #SEB33100082215; Hasselblad camera, #SEB 33100102210; frames AS-14-69-9493 through 9656: Very coarse-grained structure and a high degree of grain clumping (fig. 3). Many small imperfections having irregular shapes and sharply defined edges indicate foreign matter on negatives during duplication process.

(2) # Magazine Q, SEB 33200082217; Hasselblad camera, #SEB 33100040305 frames AS-14-70-9657 through 9840: Excellent resolution and tone up to frame 9679 but frames 9680 through 9774 have poorer resolution and more restricted tonal range. Numerous blemishes indicate the presence of dust or other foreign particles during the reproduction process.

An example of lost image resolution is seen in fig. 4, the crater in the upper right corner of frame 9714, fig. 4 (a) is considerably less sharp than the same crater shown in the upper left corner of frame 9712 fig. 4 (b). In both frames the crater occurs at about the same angle from the optic axis of the lens, leading one to speculate that the camera was closer to the edge of the command module window in frame #9714 than in frame #9712, picking up more distortion from the window.

Frames 9805 through 9811 are overexposed by at least 1 1/2 stops.

(3) # Magazine R, SEB 33100082217; Hasselblad camera, #SEB 33100040305
frames AS-14-75-10223 through 10330: Numerous defects including water spots and dust particles printed into many of the master transparencies of this magazine. In the oblique photographs all of the near field areas are considerably less sharp than the far field in the same frame. A definite 2 f/stop difference in exposure was noted between frames 10297 and 10298.

(4) # Magazine T, #SEB 3310082215; Hasselblad camera, #SEB 33100102210
frames AS-14-71-9841 through 9917: Frames 9848 and 9851 through 9917 are grossly underexposed (fig. 5) so that most of this magazine is useless for discerning fine detail.

(5) # Color magazine L, #SEB 33100082215; Hasselblad camera, #SEB 33100102210; frames AS-14-72-9918 through 10039: Resolution generally poor. Frames 9961 through 9974 are oblique photographs and appear to show image motion. Frames 9997 through 10004 are shaded diagonally from one corner to the other causing a loss of light transmission of approximately 39 percent. This shading could have been caused by the spacecraft window. However all frames, both black and white and color, show some vignetting, resulting in an average loss of light transmitted of about 12 percent.

Surface photography was processed differently than orbital photography (Table 1, fig. 1 and 2). All film exposed on the surface was processed to a gamma of approximately 1.0, whereas orbital film was processed to gammas in excess of 2.0. This resulted in considerable loss of detail in all orbital photographs containing any shadow.

In order to enhance some of the detail lost during the duplicating process described above, the following special handling methods are recommended for future work.

(1) The original negatives should be reprinted twice on a fine grain high actuanance duplicating film, first, printing with an exposure level calculated to correctly record the highlight or dense areas of the negative, and second, printing with a less intense exposure designed to reproduce the shadow detail. The two films should then be

processed in a fine grain chemical process at temperatures around 68° F. The lower processing temperatures would lessen grain clumping and allow for full utilization of the dynamic range of the duplicating film.

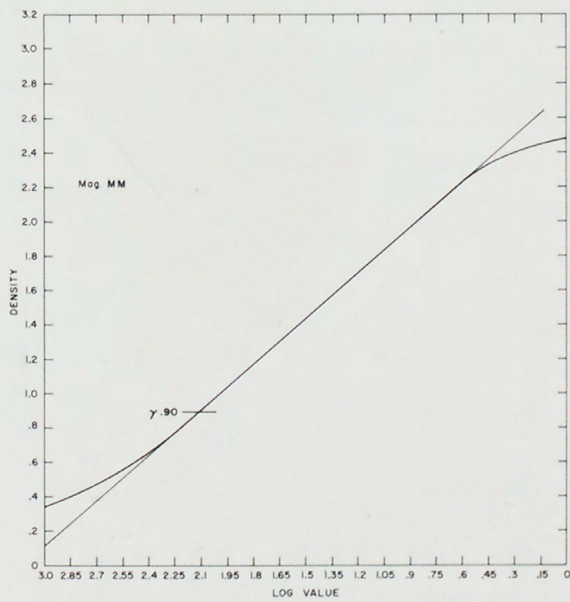
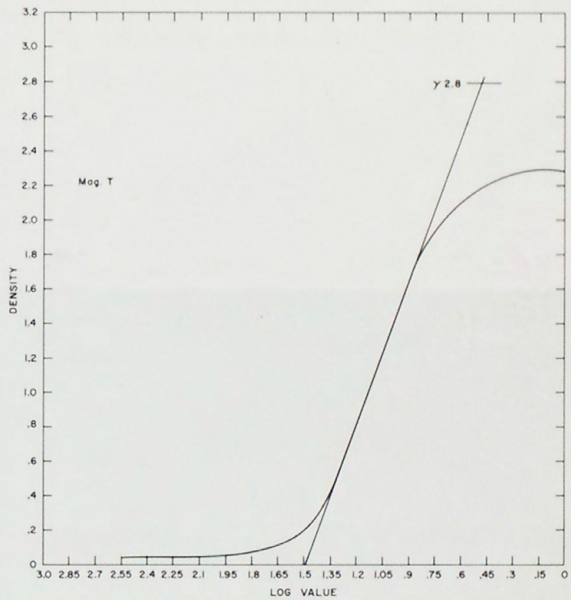
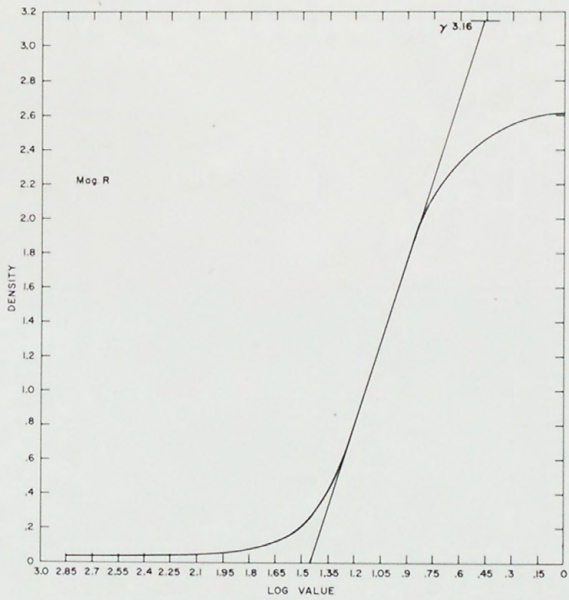
(2) The second possible method of enhancement is by electronic coding during printing of the original negatives. In this case the printer should be programmed to reduce the ratio between light and shadow differences to a ratio of 1 to 10. As in case (1) above the processing should also be controlled to a gamma of .9 to 1.0.

Table 1. --Film type and processing characteristics for selected magazines of orbital and surface photographs.

Orbital magazine	Flight film type	Original H & D curve	Film type of master positive (2d generation)	H&D curve of master positive (2d generation)
P	3400	2.2	2430	2.24
Q	3400	2.2	2430	2.68
R	SO349	1.8	2430	3.16
T	SO349	1.55	2430	2.80
Surface magazine MM	SO174	1.0	2420	0.90

Figure 1. --Curves of processing characteristics of B/W orbital magazines.

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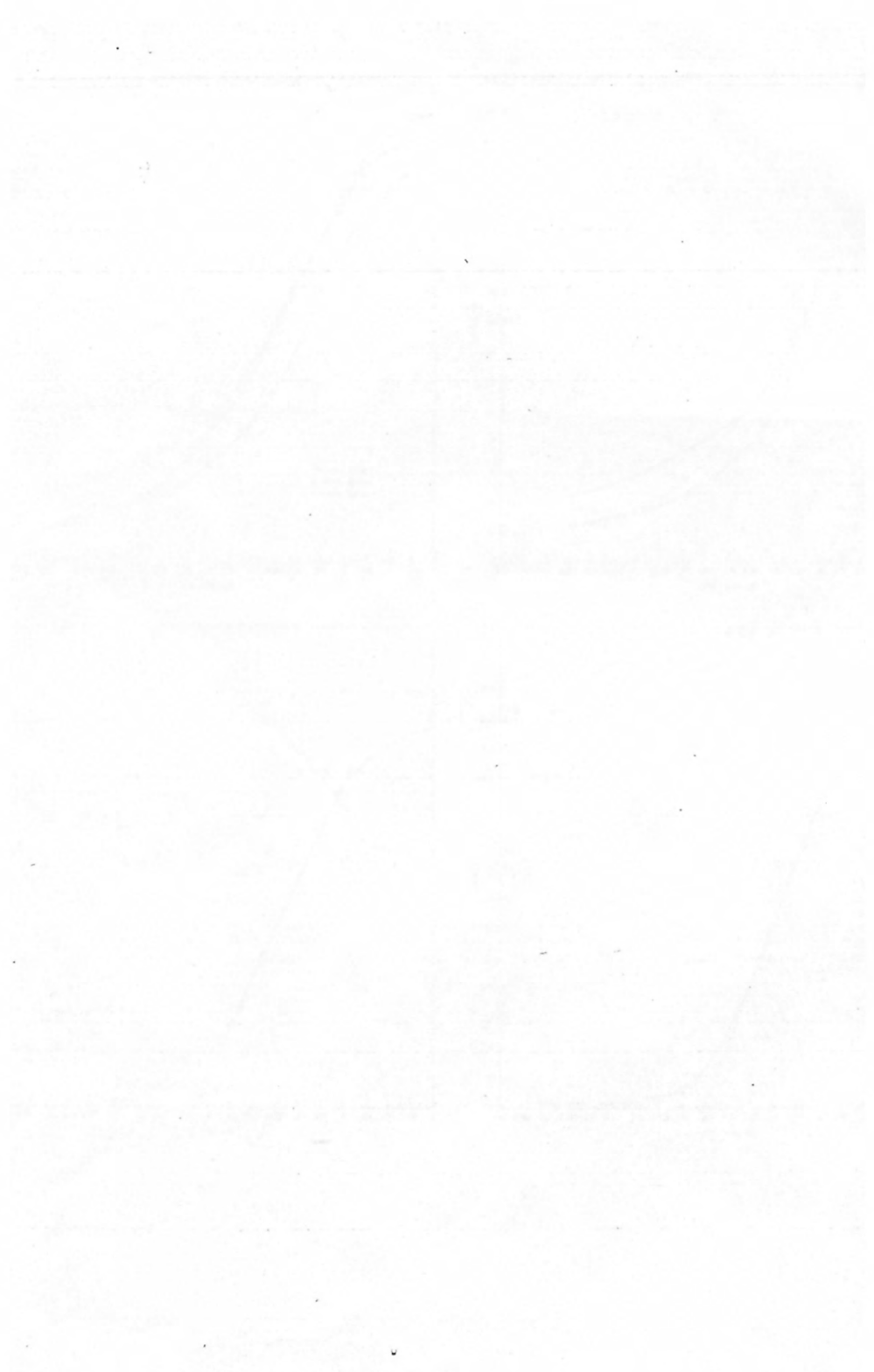
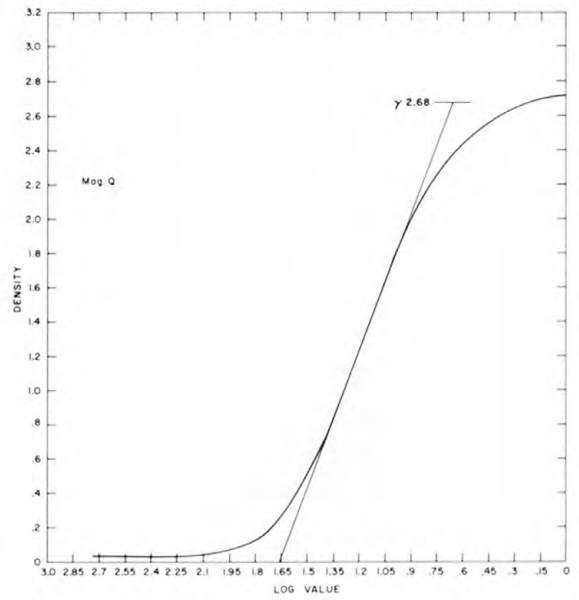
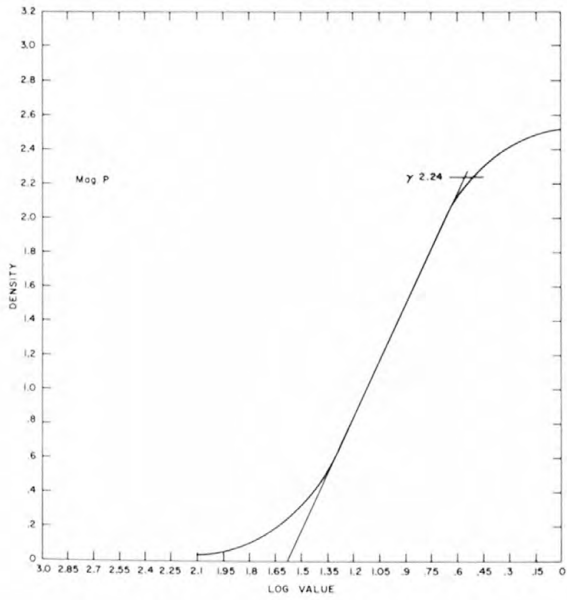
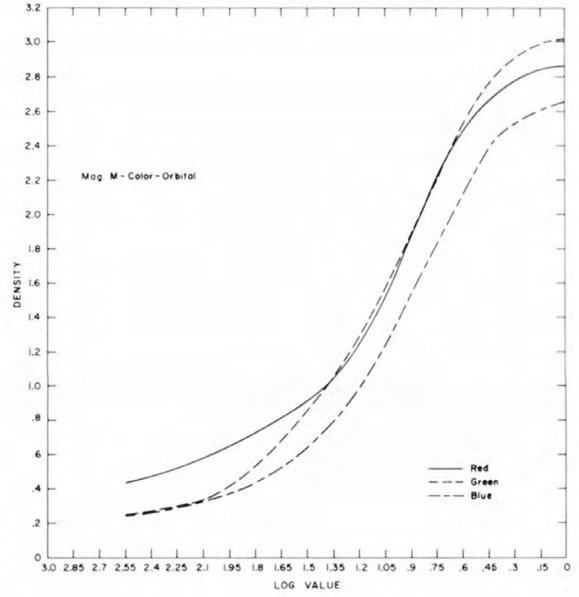
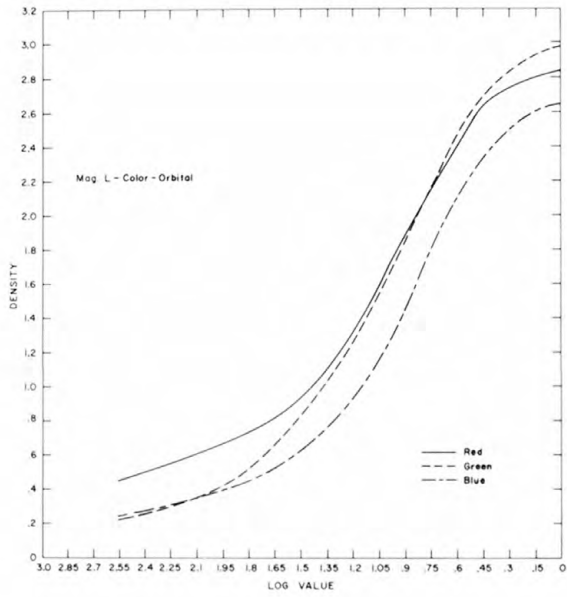


Figure 2. --Curves of processing characteristics of a typical magazine of B/W surface film and of two color orbital magazines.

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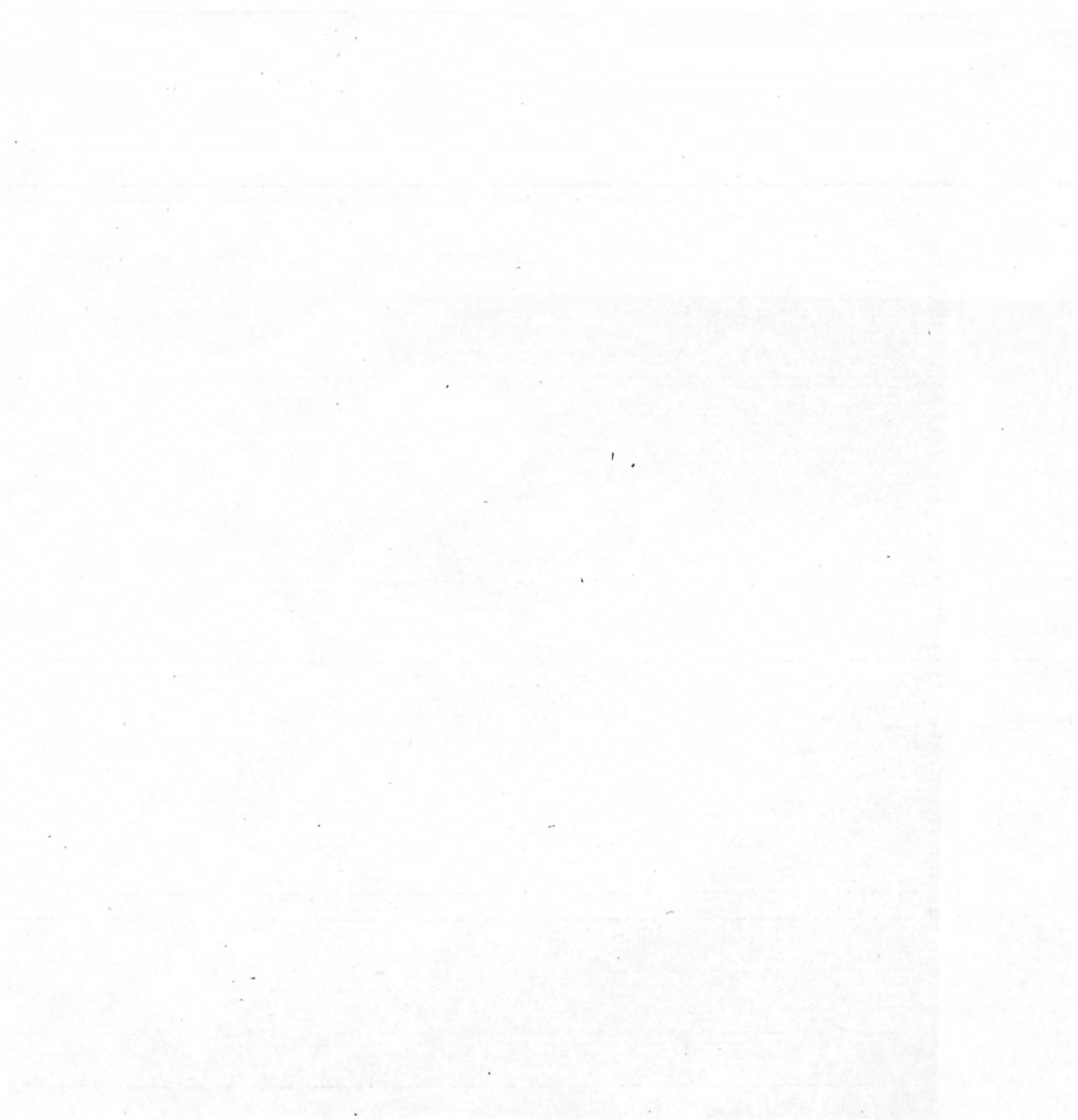
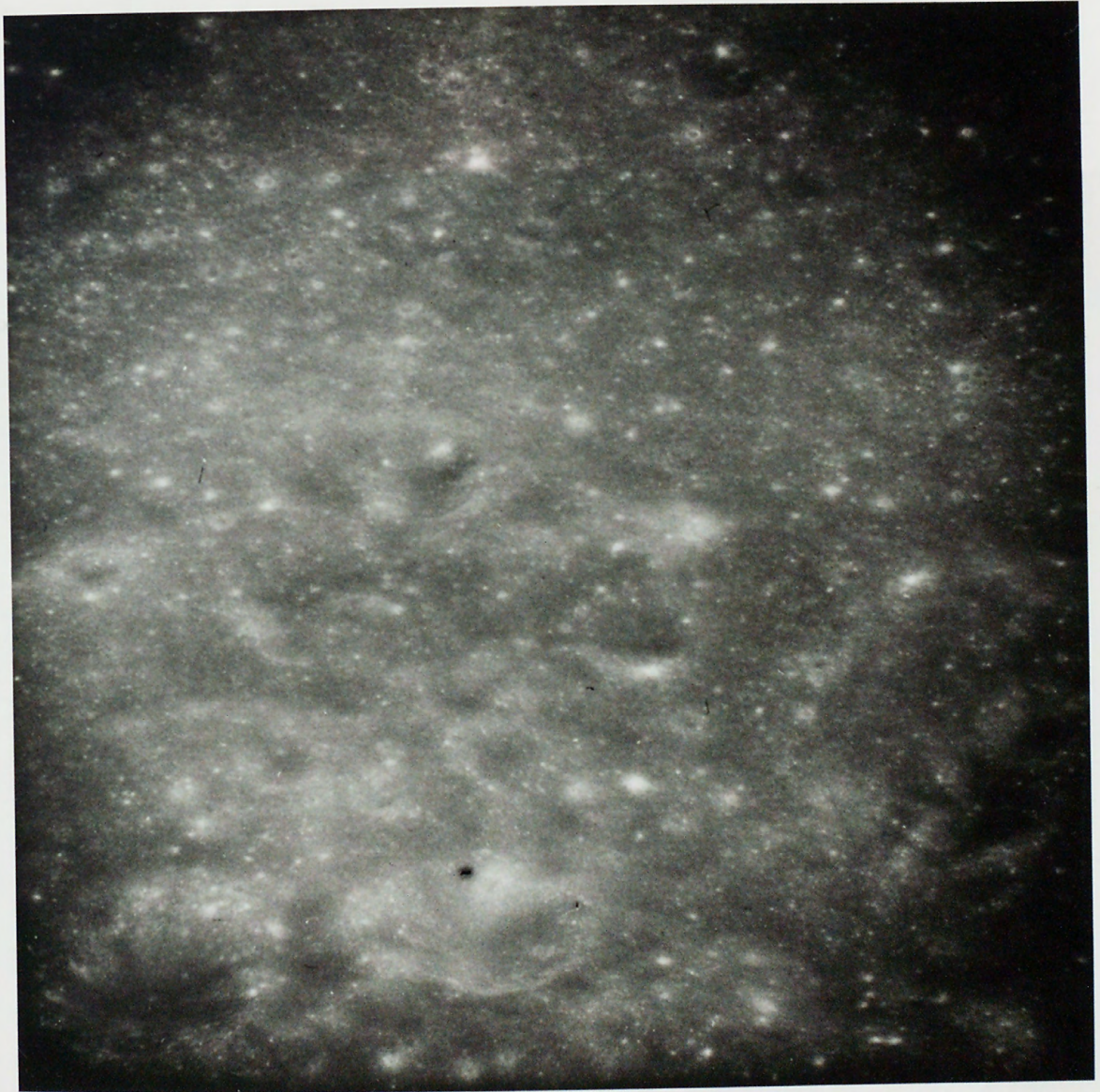


Figure 3. --Apollo 14 frame AS-14-69-9498 from magazine P.
Very coarse-grained structure and pronounced
clumping obscure fine detail of the lunar surface.

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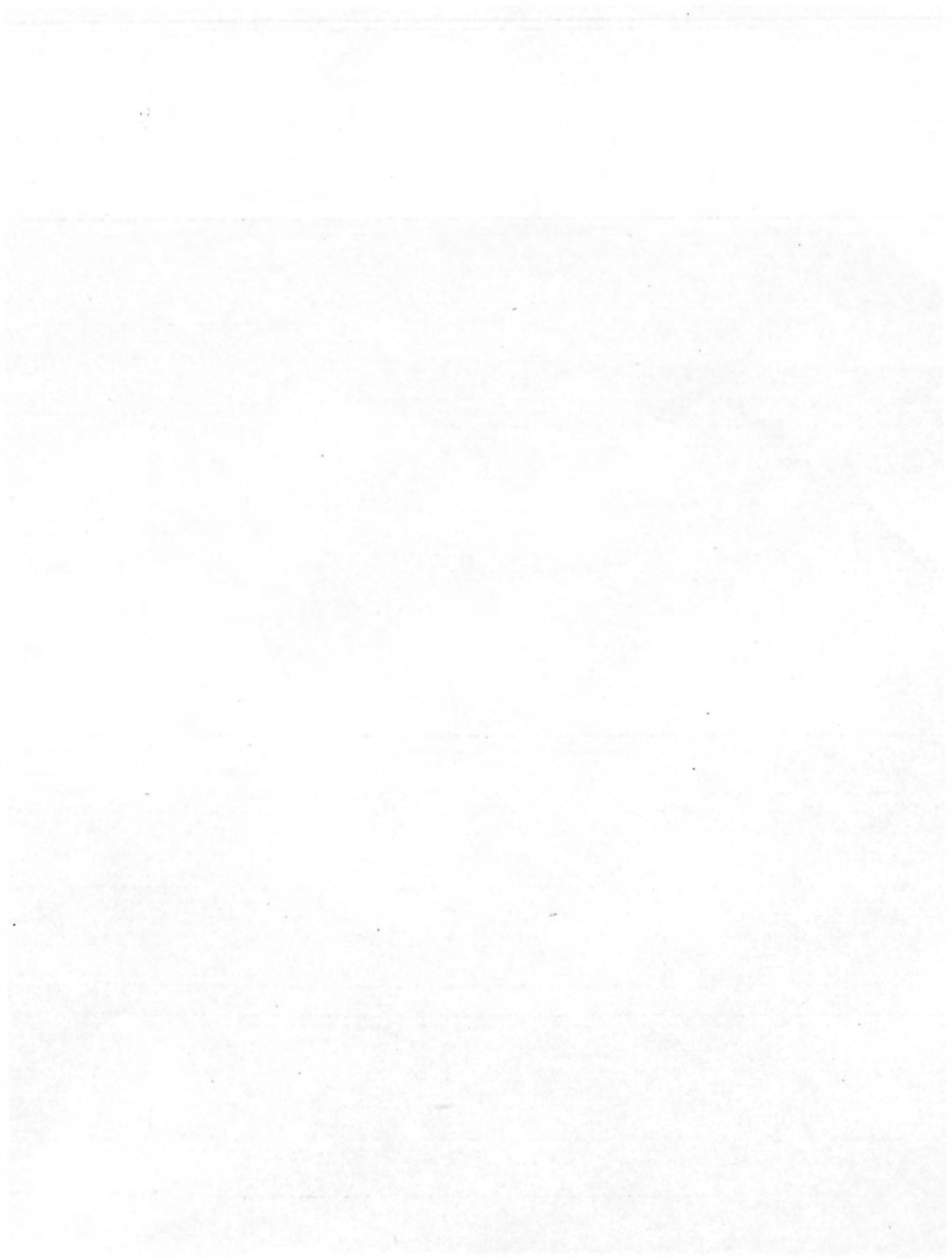
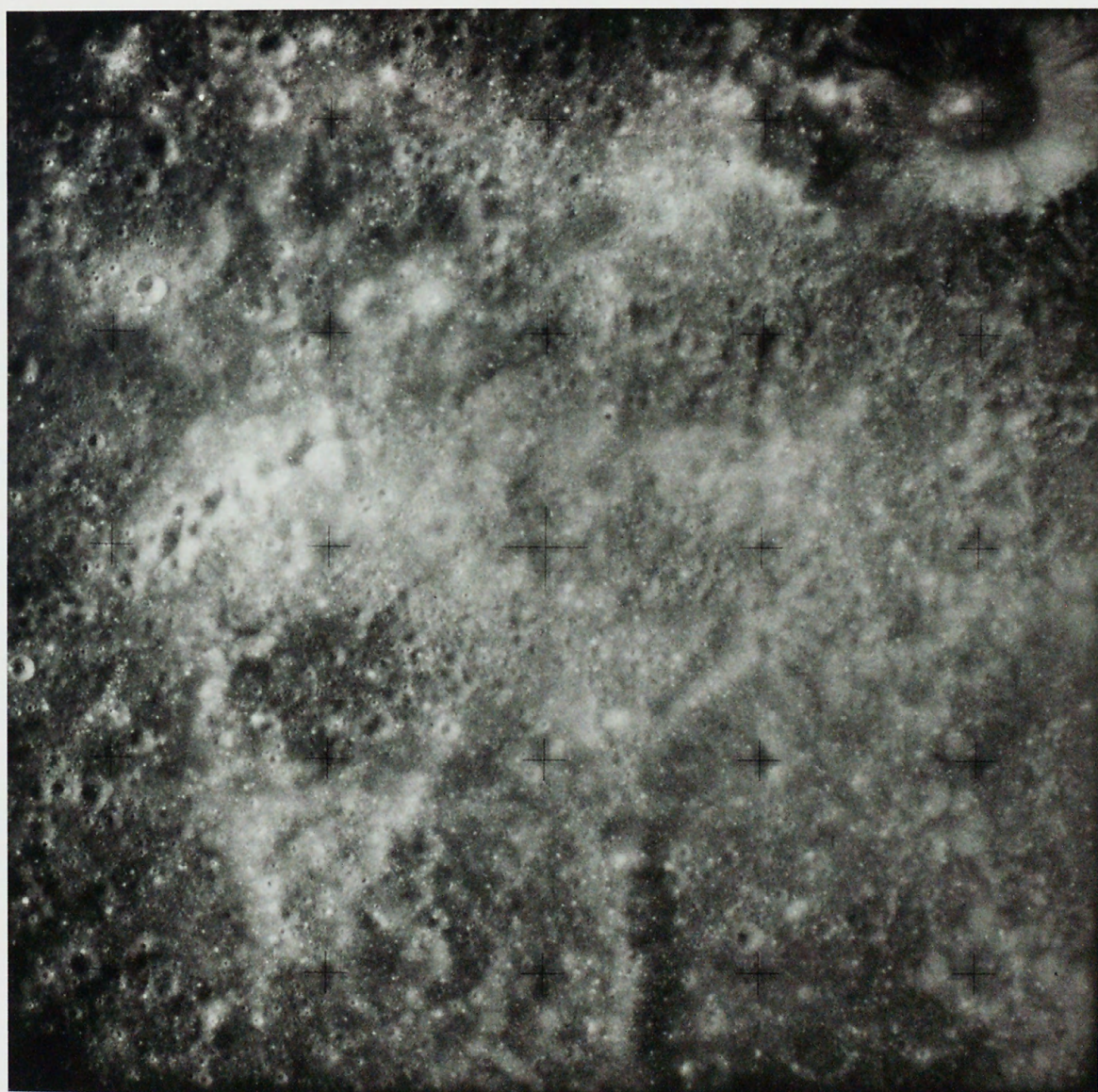


Figure 4a, b. --Parts of Apollo 14 frames AS-14-70-9714 (a) and 9712 (b) from magazine Q, showing a high degree of variation in resolution. Largest crater in each frame is the same.

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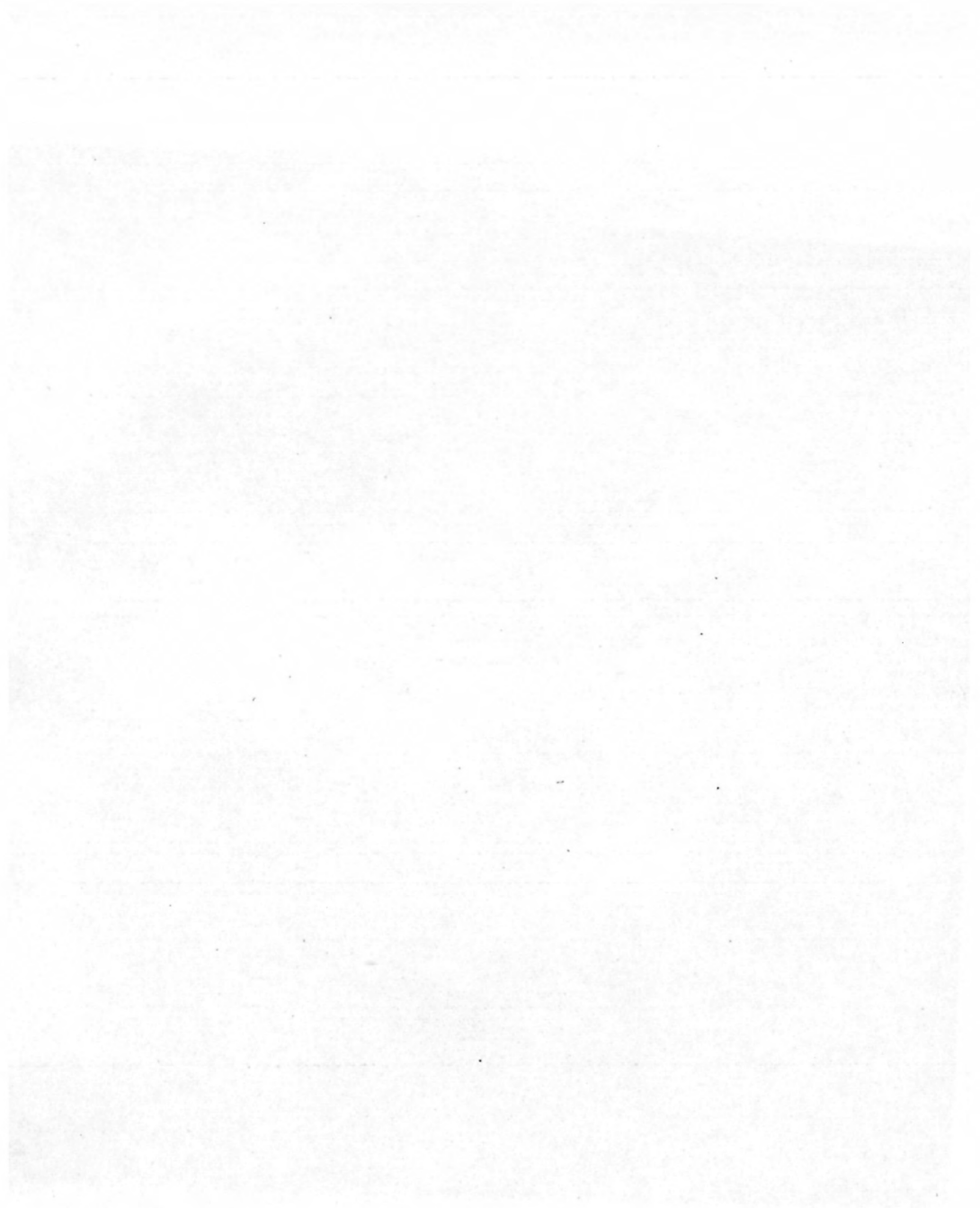


Figure 5. --Apollo 14 frame AS-14-71-9906 from magazine T. An example of underexposed frame; note absence of detail and of reseau marks.

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