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Unusual Radar Backscatter Properties Along the Northern Rim of Imbrium Basin.

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Outline

- Introduction
- Data
- Interpretation
- Future Work
- References

Introduction

General Rule

Earth-based radar backscatter from the lunar terrae is 2-4 times that of the maria.

The largest (most conspicuous) exception

The terra along the northern rim of Imbrium Basin, where the highlands that surround Sinus Iridum and crater Plato have long-wavelength (70-cm) radar backscatter that is comparable to(and sometimes weaker) the mare

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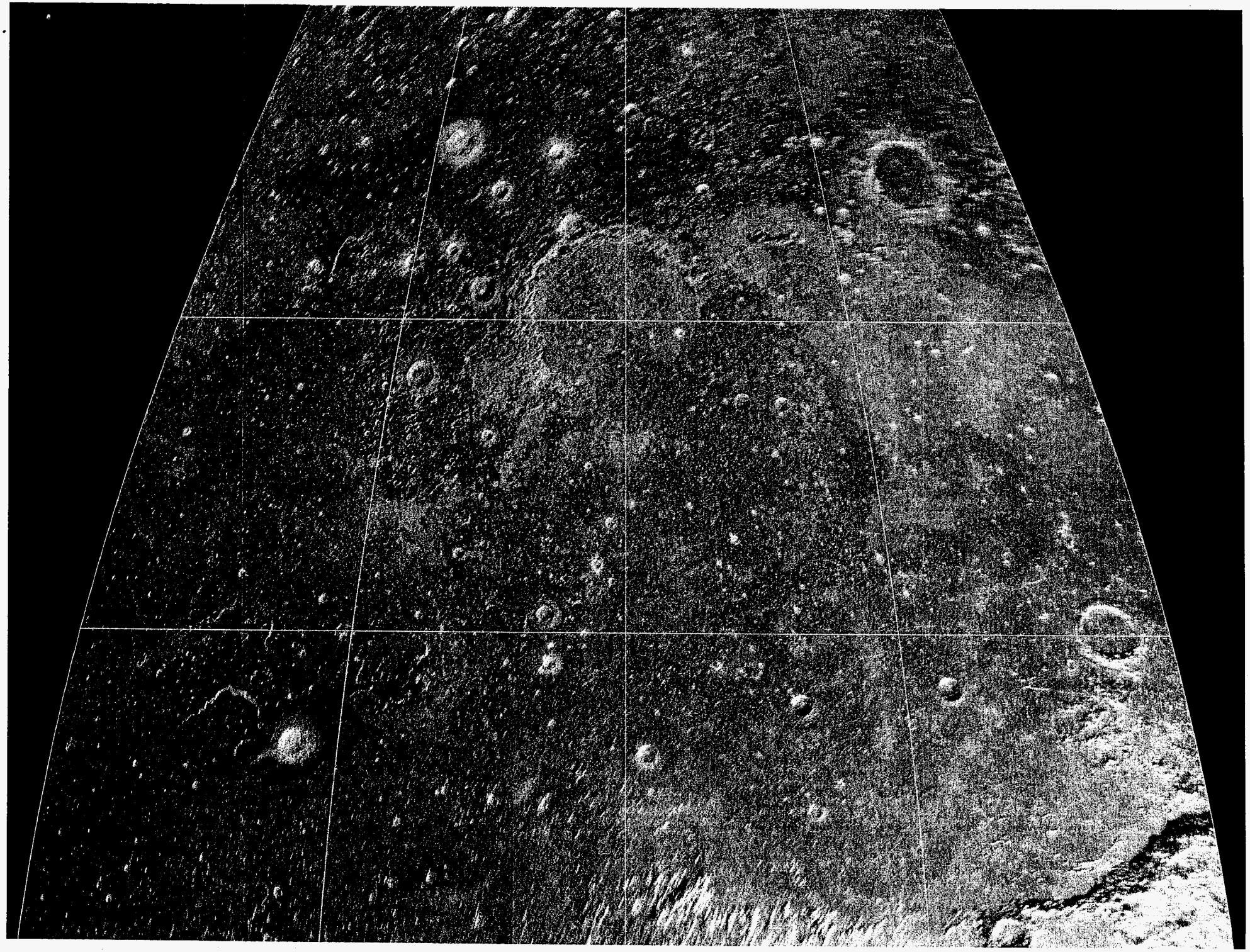
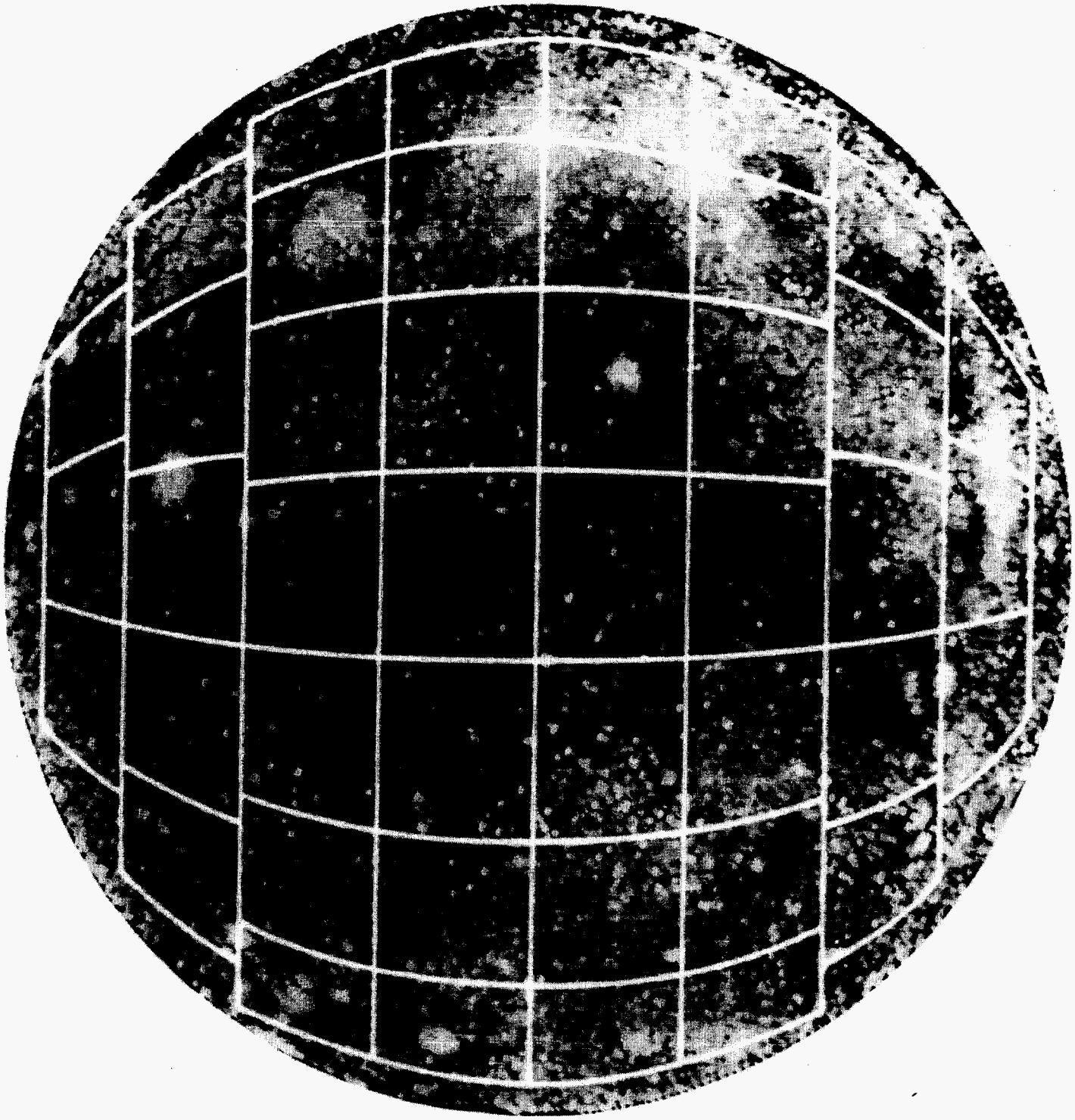
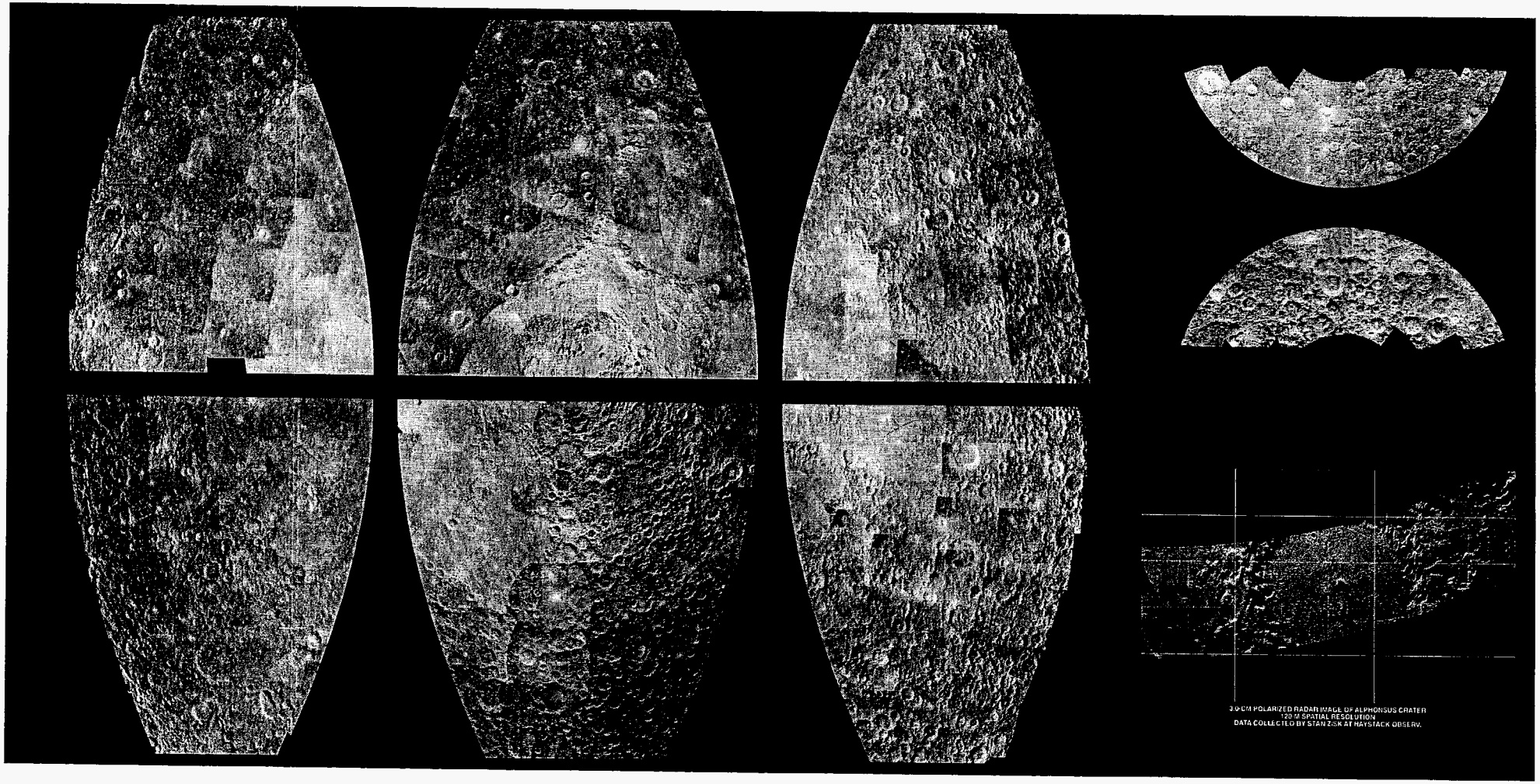
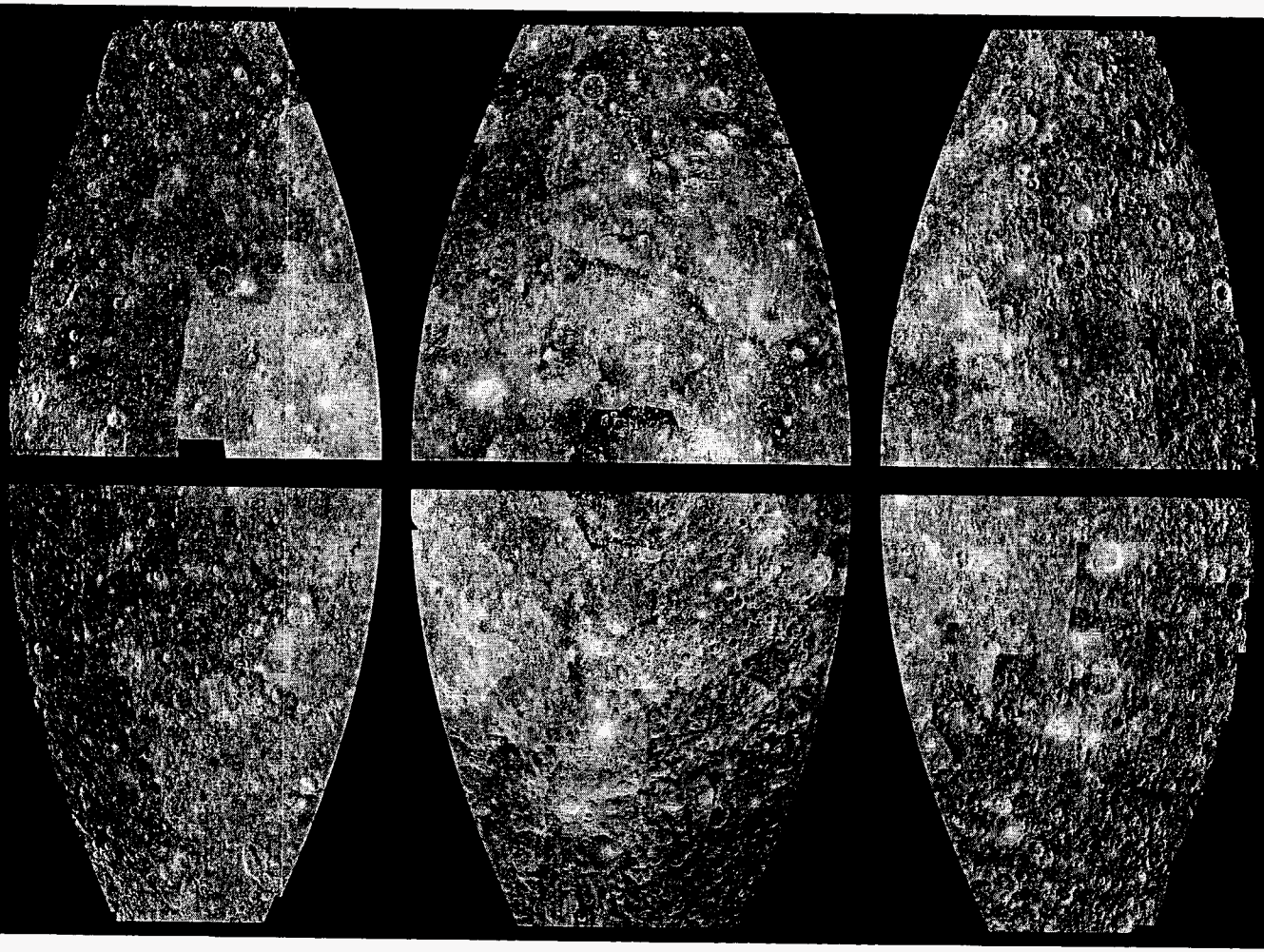
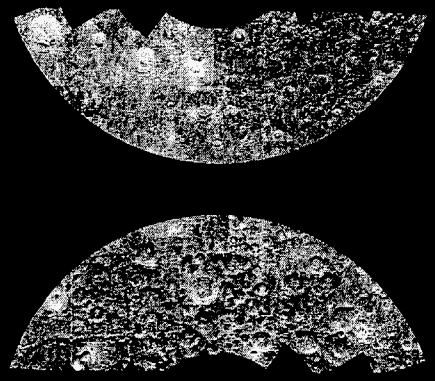






3.9-CM POLARIZED RADAR IMAGE OF ALPHONSUS CRATER
120 M SPATIAL RESOLUTION
DATA COLLECTED BY STAN ZISK AT HAYSTACK OBSERV.





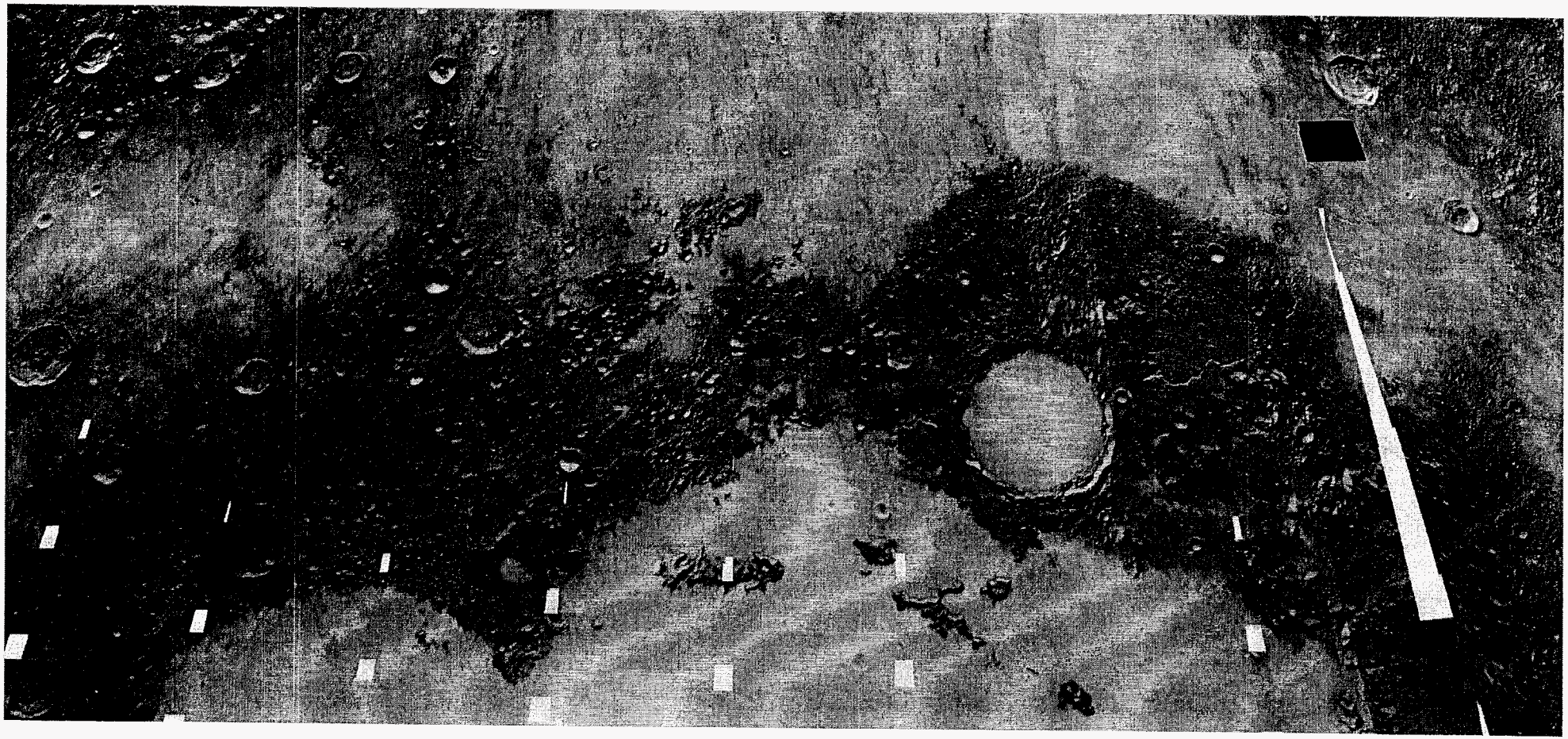
THE MOON

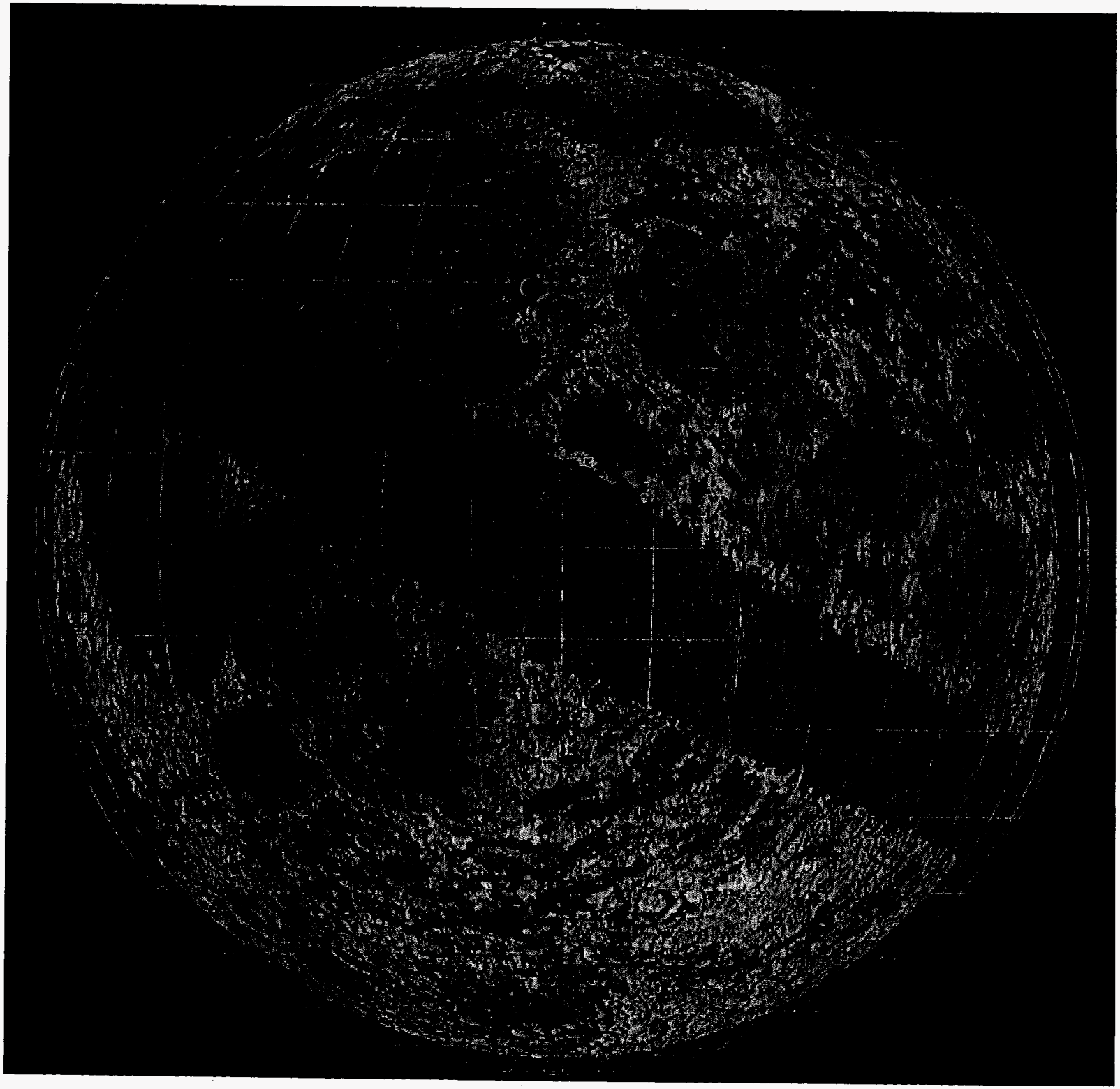
3.8-CM RADAR DATA

SINUSOIDAL PROJECTION OF 60x60 DEGREE REGIONS
ORTHOGRAPHIC PROJECTION FOR POLAR AREAS

RADAR BRIGHTNESS RELATIVE TO MEAN SCATTER LAW

DATA COLLECTED BY STAN ZISK AT HAYSTACK OBSERV.
IMAGE MOSAICKING BY BRUCE CAMPBELL





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Interpretation Matrix

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RADAR POSSIBILITIES	GEOLOGIC IMPLICATION	LIKELYHOOD
A - Fewer m-sized blocks-rocks on the surface and in uppermost 10-m of subsurface	Possible consequence of Plato and Sinus Iridum impact events	**UNLIKELY** - Expect abundant m-sized blocks in S-Iridum/Plato ejecta
B- Higher electrical loss in ejecta from Plato and Sinus Iridum impact events	Preexisting and deep (10-km) mares at S-Iridium and Plato impact sites	**IMPROBABLE** - Expect preexisting mare to be thin (about km thick)
C- Higher electrical loss in post Plato and Sinus Iridum mantling event	High electrical loss pyro-clastics blanket the terra to depths of 10-100 meters	**UNLIKELY** - FeO/TiO are low (Clementine data) not high
D - Fewer m-sized blocks-rocks in post Plato and Sinus Iridum mantling event	**Relatively rock-block poor pruoclastics blanket the terra to 10-100 meters depth**	**LIKELY - BEST FIT to radar, visual, IR and Clementine FeO and TiO data**

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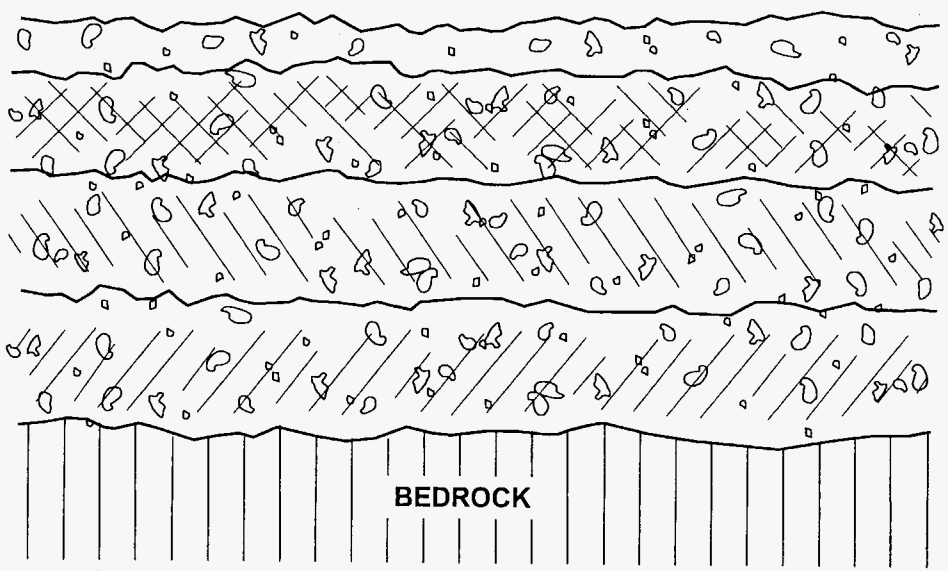
RADAR GEOLOGIC COLUMN
NORTHERN RIM OF IMBRIUM BASIN
(INCLUDING EJECTA OF PLATO AND SINUS IRIDUM)

GEOLOGIC UNITS	RADAR-GEOLOGIC IMPLICATIONS
POST PLATO SINUS IRIDUM PRE-PROCOLLARUM PYROCLASTIC	RELATIVELY ROCK/BLOCK FREE-AT LEAST 10 TO 100 M DEEP
PLATO/SINUS IRIDUM CRATER EJECTA	MANY 100 M'S DEEP-NUMEROUS ROCKS/BLOCKS-LIKELY LOW LOSS ANORTHOSITE
IMBRIUM BASIN EJECTA	KM-DEEP NUMEROUS ROCKS/BLOCKS-LOW LOSS ANORTHOSITE
PRE-IMBRIUM MEGAREGOLITH	KM- DEEP NUMEROUS ROCKS/BLOCKS-ANORTHOSITE



VERTICAL NOT TO SCALE

Future Work

Compare and Contrast with other large, conspicious radar-dark terra areas

(1)North of Humorum, west of Gassendi (Hawke et al, 1993)

(2)Eastern Limb, east of craters Langrenus and Petavius
- Possible Radar-dark crater ejecta (Ghent et al. 2005)

(3) Aristarchus Plateau (Zisk et al, 1977)

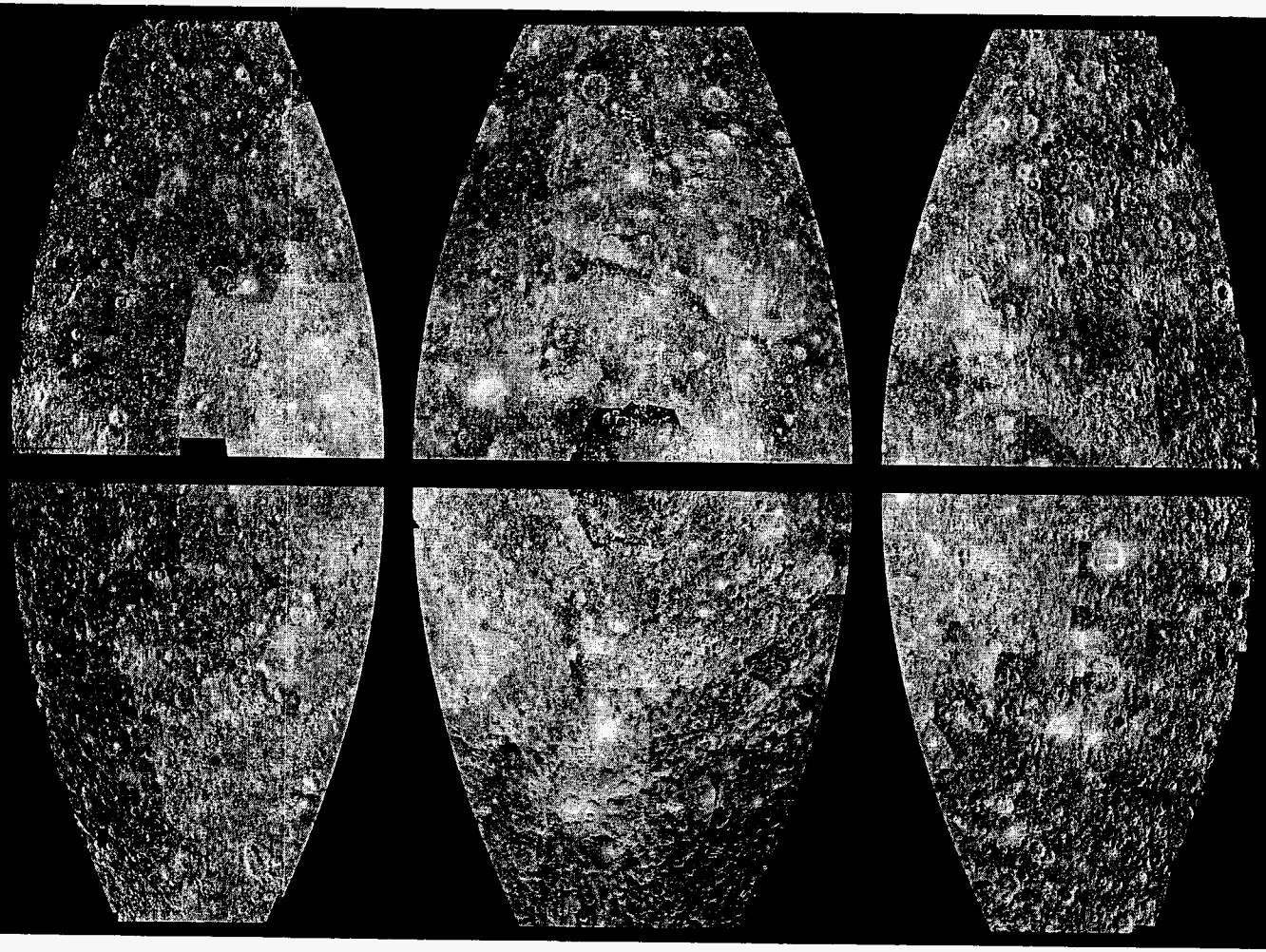
References

- Gaddis, L.R., Pieters, C.M. and Hawke, B.R. 1985. Remote sensing of lunar pyroclastic mantling deposits. Icarus, 61, 461-489.

- Ghent, R.R., D.W. Leverington, B.A. Campbell, B.R. Hawke, and D.B. Campbell, Earth-based observations of radar-dark crater haloes on the Moon: Implications for regolith properties, *J. Geophys. Res.*, in press, 2005.

- Hawke, B.R., Peterson, C.A., Lucey, P.G., Taylor, G.J., Blewett, D.T., Campbell, B.A., and P.D. Spudis, P.D., Remote sensing studies of the terrain northwest of Humorum Basin, *Geophys. Res. Letters*, 20, 419-422, 1993.

- Zisk, S.H. et al. 1977. The Aristarchus-Harbinger region of the Moon: Surface geology and history from recent remote sensing observations. The Moon, 17, 59-99.



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