MULTISPECTRAL IMAGING OF CRATER GASSENDI IN TEN BANDS
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Lunar surface compositional information of highland regions
and complex morphological units such as impact craters has
been mainly retrieved, in the past, by means of visible and
near-infrared reflectance spectra from selected spots (4-10
km in diameter) (1)(2). Rapid progress in the development of
CCD-imaging technique allows a complementary approach by high
spatial resolution (0.5 Km/pixel) multispectral mapping.
Following a preliminary work (3), a selected zone of
investigation located at the border of Mare Humorum,
including the Nectarian impact crater Gassendi and the
adjacent northwestern part of the mare, has been covered in
UV, visible and near-infrared spectral domains by means of a
Thomson CCD-camera (576 x 384 pixels) placed at the focus of
the 2-meter telescope (F/D = 25) of the Pic du Midi
Observatory. Given the optical system and the pixel dimension,
the field of view is 54 x 36" and corresponds to a target of
96 X 64 km on the lunar surface at the subterrestrial point
and to a theoretical spatial resolution of 0.2 km/pixel.

The crater Gassendi (110 km in diameter), as with many
craters on the margins of large mare-filled basins displays a
shallow, flat, fractured floor, with a central peak complex
and a partial inundation by mare-like material (4). Such
craters have significance for studying the style of crater
modification, the type of lunar volcanism, the sequence of
inundation of the maria (possible interconnected sources
responsible for partial inundation within the crater and of
adjacent mare), and the thermal history of the Moon (5).

An extensive mosaic of the area was performed during the full-
moon periods of September and October 1989 under stable
weather and very good visibility conditions (0.3 to 0.5 arcsec),
with a phase angle ranging between 2° and 6°. The
multispectral acquisition run, for a given area on the Moon,
comprises a sequence of ten spectral images (obtained within a
15 mn time-interval), taken at the following wavelengths:
4000 Å, 5600 Å, 7300 Å, 9100 Å, 9500 Å, 9700 Å, 9800 Å, 9900
Å, 10200 Å, and 10500 Å. This run was repeated several times.
Multispectral UV/VIS and IR/VIS ratios are derived from these
observations using the same processing method as in a previous
work (3), leading to spectral ratio images normalized to a
standard area, chosen on the floor of Gassendi on the basis of
its spectral homogeneity at all wavelengths.

The analysis of the ratio images obtained during
independent acquisition sequences during the same or separate
nights shows a good internal consistency for the overall
dataset. The significant spectral features identified from the image
ratios correspond to:

(i) relatively freshly exposed surfaces of: small craters or
mounts distributed on the floor; the interior wall of
Gassendi rim; the steep central peaks of the detailed central
peak complex. All these areas have a higher albedo than the
surrounding material and their detected low IR/VIS spectral
ratios agree with the fact that absorption bands are stronger
for rocks and fresh craters than for mature soils.
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(ii) specific zones, either associated with photogeological
units clearly identified (4), such as floor fractures and
mare-like units, or distributed on the floor without any
obvious relation to the crater morphology.

The interpretation of the spectral variations is relative to
the chosen standard region, noted NR. The mineralogical
composition of NR is unknown but two arguments are in favor of
a relatively non-absorbing mature surface:

(i) while all the fresh exposed or immature surfaces
described above exhibit clearly anticorrelated 0.40/0.56 \( \mu \text{m} \)
(low) and 0.73/0.56 \( \mu \text{m} \) (high) ratios, the whole floor of
Gassendi, inclusive of NR and at the exception of the southern
mare-like unit (4) adjacent to Mare Humorum border, does not
exhibit any significant variation for the two ratios, calling
for its maturity.

(ii) among all the investigated IR/VIS multispectral ratios,
very few areas within the crater display higher ratio values
than NR and these values are only slightly higher.

The central peak complex display low IR/VIS spectral ratios
at all wavelengths, indicative of the presence of a mafic
pyroxene component, possibly orthopyroxene on the basis of the
lowest ratio value for 0.91 \( \mu \text{m} \).

In agreement with previous (3) spectral measurements at
0.97/0.56 \( \mu \text{m} \), the spectral unit ST ("Spectral Trough"),
located along a portion of Rima Gassendi II exhibits
significantly lower spectral ratios at 1.02, 0.98 and 0.97 \( \mu \text{m} \)
than at 0.91 \( \mu \text{m} \), calling for a major clinopyroxene mafic
component, not excluding the presence of olivine. This 10 km-
long unit may be related to photogeological volcanic evidences
(4)(5).

Gassendi N and M craters also display very low IR/VIS spectral
ratios at all wavelengths, indicative of a pyroxene component,
possibly clinopyroxene. The small craters distributed on the
floor of Gassendi have homogeneously IR/VIS ratios, but less
depleted than for Gassendi N and M, calling for the presence
of a pyroxene component.

Of interest, is also a low albedo zone, characterized by low
IR/VIS ratios characteristic and located in the close vicinity
of the southwestern rim of Gassendi, near the edge of Mare
Humorum. The very low ratios at 1.02, 0.98 and 0.97 \( \mu \text{m} \) may
again call for the presence of clinopyroxene.

A last striking observation concerns the mare-like unit which
displays the same 0.73/0.56 \( \mu \text{m} \) spectral feature than the
adjacent portion of Mare Humorum and appears connected to it
through the existing rim breach.

REFERENCES.
Pieters C.M (1986), Rev.Geophys., 24, 557-578.;(3) Chevrel S. and
press; (4) Schultz P.H (1976), Moon Morphology, Univ. of Texas,
Austin, 826 pp; (5) Schultz P.H (1976), The Moon, 15, 241-273.