MULTISPECTAL IMAGING OF CRATER GASSENDI IN TEN BANDS (UV TO NEAR-IR) . S.Chevrel and P.Pinet , G.R.G.S. , Observatoire Midi-Pyrenees, Toulouse , France

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 A, 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 µm (low) and 0.73/0.56 µm (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 µm.
In agreement with previous (3) spectral measurements at 0.97/0.56 µm , 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 µm than at 0.91 µm , 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 µm 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 µm spectral feature than the adjacent portion of Mare Humorum and appears connected to it through the existing rim breach.

REFERENCES.
(1) McCord T.B et al.(1981),J.Geophys.Res.,86,10883-10892.;(2) Pieters C.M (1986),Rev.Geophys.,24,557-578.;(3) Chevrel S. and Pinet P. (1989),Proc. Lunar Planet Sci. Conf. XXth ,in press;(4) Schultz P.H (1976),Moon Morphology, Univ. of Texas, Austin,826 pp;(5) Schultz P.H (1976),The Moon,15,241-273.