ARISTARCHUS PLATEAU SPECTRAL MAPPING FROM CLEMENTINE AND TELESCOPIC HIGH RESOLUTION SPECTRO-IMAGING DATA.

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A detailed remote sensing survey of the Aristarchus Plateau has been made in the UV-visible-near infrared domain by means of earth-based telescopic and Clementine (1) CCD spectro-imaging techniques and the distribution of the main types of materials is proposed on the basis of their spectral characteristics, revealing that the Plateau contains a widespread mare basalt component, underlying pyroclastic deposits.

The telescopic dataset (case 1) (CCDTHX 384x576 array)), obtained from the Pic-du-Midi Observatory under 15° phase angle during the October 1989 full Moon period comprises respectively 10 narrow spectral bands (0.4, 0.56, 0.73, 0.91, 0.95, 0.97, 0.98, 0.99, 1.02, 1.05 μm), with a 100 Å bandwidth, a 0.8-1km true spatial resolution and a SNR of 70 to 80. The Clementine data (case 2) (CCDTHX 384x288 array) comprise 5 bands (0.41, 0.75, 0.90, 0.95, 1.00 μm), with a 50 to 200 Å bandwidth and a 200 m spatial resolution (1). The two spectral datasets have been instrumentally calibrated and two mosaics have been completed which cover a part of the Aristarchus Plateau (fig. 1) , the telescopic one (frame B) comprising two images and the Clementine strip (frame A) resulting from a sequence of 8 overlapping frames. A radiometric calibration has been made using telescopic and Galileo spectra (2,3,4). It results in the production of absolute reflectance spectra and relative reflectance spectra scaled to unity at 0.73/0.75 μm. The consistency between the two datasets is within 2-3%.

A principal component analysis (PCA)is carried out on both datasets; the first two principal axes bear respectively 99.2 (case 1) and 98.5% (case 2) of the spectral variance (figs. 2b, 3b). From this analysis, mean spectra are produced for the main spectral components which are showed with their spatial distribution (figs. 2a, 3a). It reveals that:

(i) the spectral characterization and associated mappings from both datasets are extremely consistent; it is to be noted however that the 0.56 μm band available in the telescopic dataset is very important for the characterization of the visible continuum of the spectra and lacks in the orbital dataset;

(ii) the common spectral units within the two windows consist in: -1) a mature mare basalt unit (unit 1 in figs. 2 and 3) embaying the Aristarchus Plateau and locally detected across the Plateau, in particular in Vallis Schröteri and some rilles walls (fig. 3; unit and spectrum1' corresponding to a fresher material); -2) a specific Aristarchus Plateau unit which is however spectrally very close to the surrounding mare unit 1 and consequently calls for the presence of a significant mare basalt component in the material covering the Plateau; -3) local patches distributed across the Plateau and corresponding to very low albedo areas; unit 3 presents a very steep slope in the UV-VIS domain and is spectrally very similar to Gruithuisen domes unit (5); it is related to the presence of pyroclastic dark mantling deposits; -4) unit 4 may be indicative of highlands material (ejecta, ...);

iii) units 5,6,7 do not correspond to the same units depending on the considered mapping. In case 1 (figs. 3a and c), these units are spectrally characterized by a negative slope longward 0.56 μm and a rather pronounced absorption feature in the 1 μm. They map respectively the Aristarchus ejecta, the Herodotus and Cobra Head region. In case 2 (fig. 2a), it relates to Herodotus χ (unit 5), Herodotus A and a mare area eastward of it (unit 6), and to a part of Agricola Mountains (upper left corner in fig. 2 a, high albedo markings).

This first analysis reveals the complexity of the Aristarchus plateau and agrees with some of the results recently presented (6). It clearly shows that there is a prevailing mare basalt component present within the Plateau, underlying the pyroclastic deposits. It also shows that the region near Herodotus E, in Agricola Straits belongs to the same spectral unit than the overall Plateau.

Finally, this study verifies the high level of consistency between UV/VIS Clementine and earthbased telescopic high resolution spectro-imaging data.

References: (1) Nozette, S. et al., Science, 1835 (1994); (2) Lucey, P.G. et al., J.G.R., 91, B4, 344 (1986); (3) Pieters, C.M., Rev. of Geophys., 24, 557 (1986); (4) Pieters, C.M. et al., JGR 98, E9, 17127 (1993); (5) Chevrel, S.D. et al. (1995), this issue; (6)McEwen, A.S. et al. (1994), Science, 266, 1858.

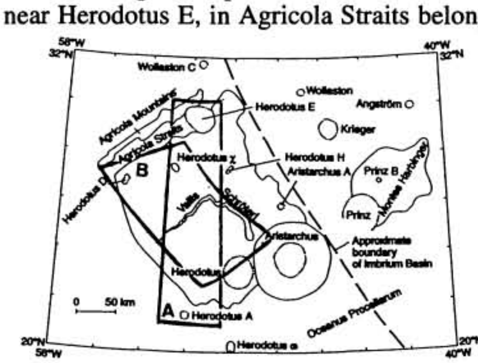

Figure 1. Location map of the Aristarchus region (adapted from (6)).

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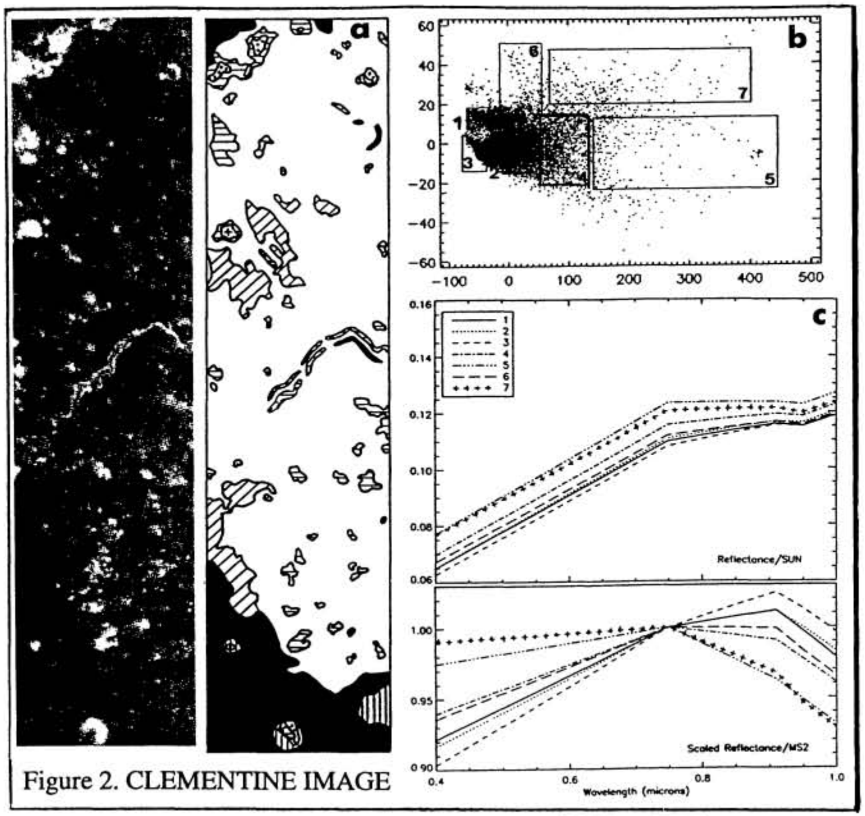
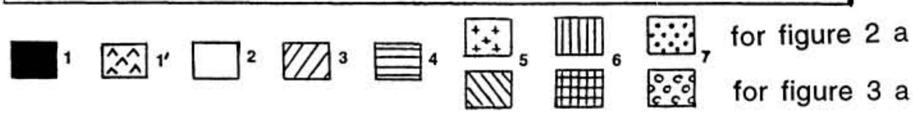


Figure 2. CLEMENTINE IMAGE



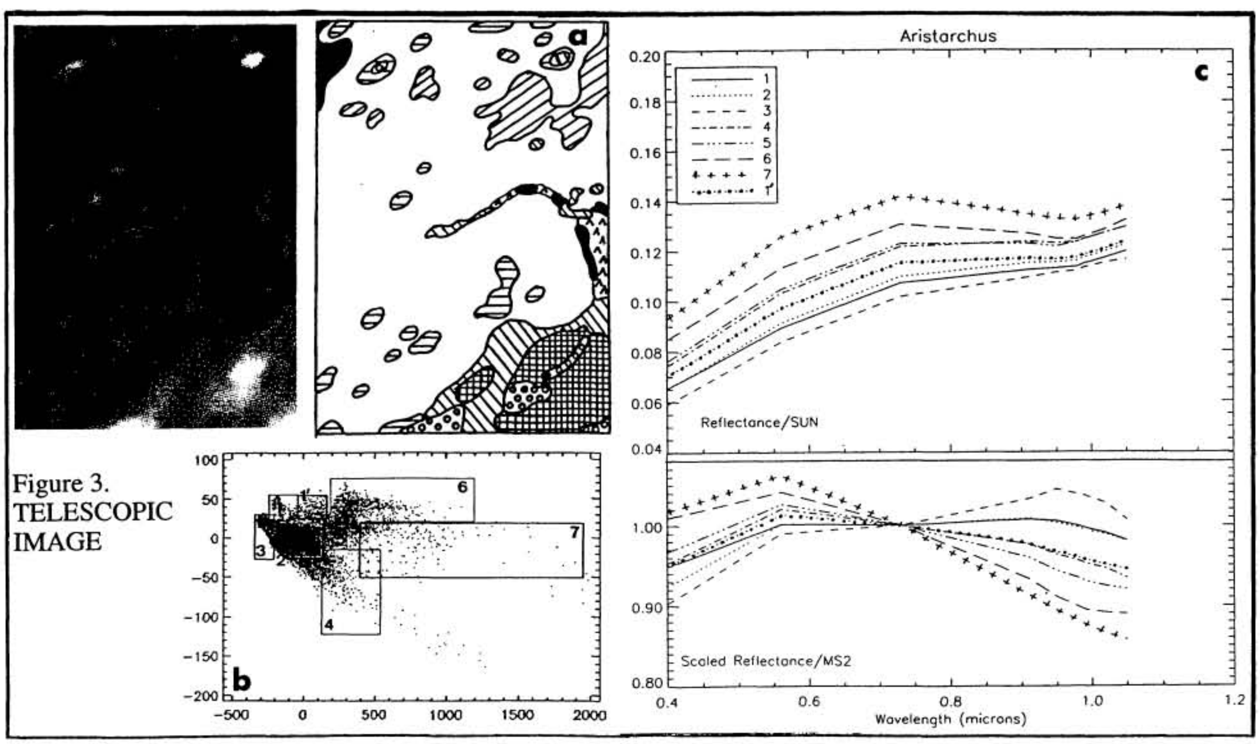


Figure 3. TELESCOPIC IMAGE