UV-VIS-NIR SPECTRAL CLASSIFICATION IN THE GRUITHUISEN DOMES REGION.

S. D. Chevrel (1), P. C. Pinet (1), J. W. Head (2) and F. Bellagh (1).
(1) UPR 234/CNRS, Observatoire Midi-Pyrénées, 31400 Toulouse, France;
(2) Brown University, Providence, R.I. 02912, USA.

The Gruithuisen domes δ and γ are relatively high albedo features located in the northwestern border of Mare Imbrium, about 250 km south of Sinus Iridum. These domical features are topographically distinct from adjacent highland and mare terrain, and show unique surface morphology, different from those of typical domes associated with mare basalts (1). The morphology of the flows that are on and surrounding the domes clearly indicates that these flows are highly viscous in their emplacement and may also have been explosive in places. The Gruithuisen domes are similar in shape and surface texture to many terrestrial domes of dacitic and rhyolitic composition characterized by extrusions of more viscous lavas at low rates (1, 2). Principal Component Analysis (PCA) applied to a spectral UV-VIS-NIR dataset of this region permits the derivation of a spectral classification with its related spatial distribution in the image (3).

High spatial (sampling: 0.7 km/pixel) and spectral (R=100) telescopic CCD images have been obtained of the Gruithuisen γ and δ domes and their surroundings (see figure 1) during the October 1989 full-moon period (15° of phase angle)(4). The Gruithuisen CCD images have been calibrated to telescopic spectra taken from previous work (1) and corrected to absolute reflectance. The representation of the image in the PCA space is given in figure 2. We identified several domains (or boxes) in the PCA diagram, which are referenced by numbers. Figure 3 shows the mean spectrum (% absolute reflectance (A) and relative reflectance to MS2 (B)) of all the pixels represented in a given box in the PCA diagram. Figure 4 shows the spatial distribution of those pixels in the image. Domains 1, 2 and 3 in the PCA data cloud are found to coincide with the mare region of the image. Mare unit 1 is widespread within the image (fig.4) and appears to be spectrally very homogeneous. This mare unit is characteristic of the regional mare material, while mare units 2 and 3 are related to Imbrium basalts.

Domain 4 in the PCA diagram coincides with the δ dome (except its eastern part), the γ dome (except its summit) and the Northwest (NW) dome (see fig.1 and 4). The mean spectrum for unit 4 (spectrum 4 in fig.3) typically shows the properties of high albedo lunar regions known as red spots. Such spectral characteristics were previously recognized on the basis of two reflectance spectra taken on the δ and γ domes respectively (e.g. (1)). Although unit 4 displays albedo variations, reflectance spectra relative to MS2 taken within this unit are very close to the mean spectrum. Variations in the NIR domain are less than 1-2% and changes in the UV-VIS slope are slight (the 0.40/0.56 μm ratio relative to MS2 shows variations less than 2% around a mean value of 0.91). The unit 4 is therefore spectrally homogeneous and can be regarded as a reference spectrum for dome-like material. The γ dome is topped by two small impact craters with high albedo ejecta (unit 9). Spectra for these craters display the strongest UV-VIS slope within the domes (0.40/0.56 μm ratio relative to MS2 is equal to 0.89) and a marked decrease in reflectance towards 1.00 μm. It is likely that these craters have exposed fresh dome-like material.

Units 5, 6 and 7 tend to reveal a progressive spatial evolution characterized by an overall UV-VIS-NIR slope decrease, with respect to the unit 4 spectrum (fig.3 A). These spectra are neither typical of highland material nor dome-like material. However the observed spectral trend suggests they might be the result of a progressive combination of both types of materials. It is indeed worth noting that nowhere within the image (at the exception of the fresh impact craters (unit 8)), can highland material be detected. A final unit (unit 10) refers to Mairan A crater ejecta and is not discussed here. These observations are presently being analyzed and compared to Clementine high resolution spectral data, and the relations with morphological units within the domes being explored.

SPECTRAL CLASSIFICATION IN GRUITHUISEN, Chevrel S.D. et al.

Figure 1.

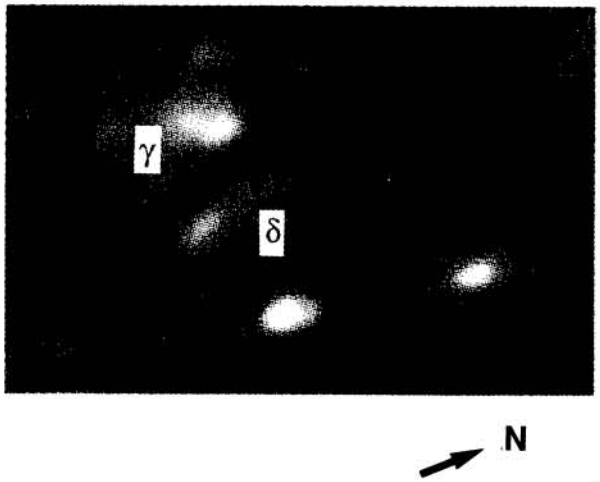

Figure 2.

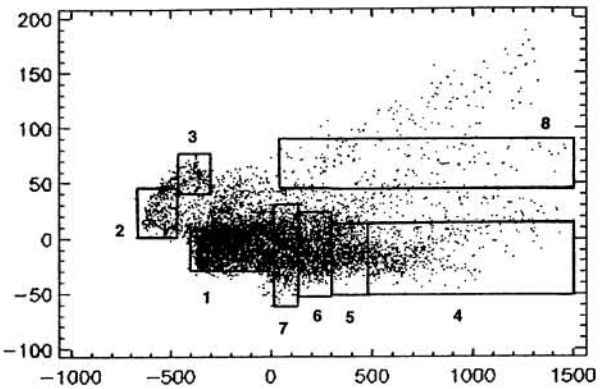

Figure 3.

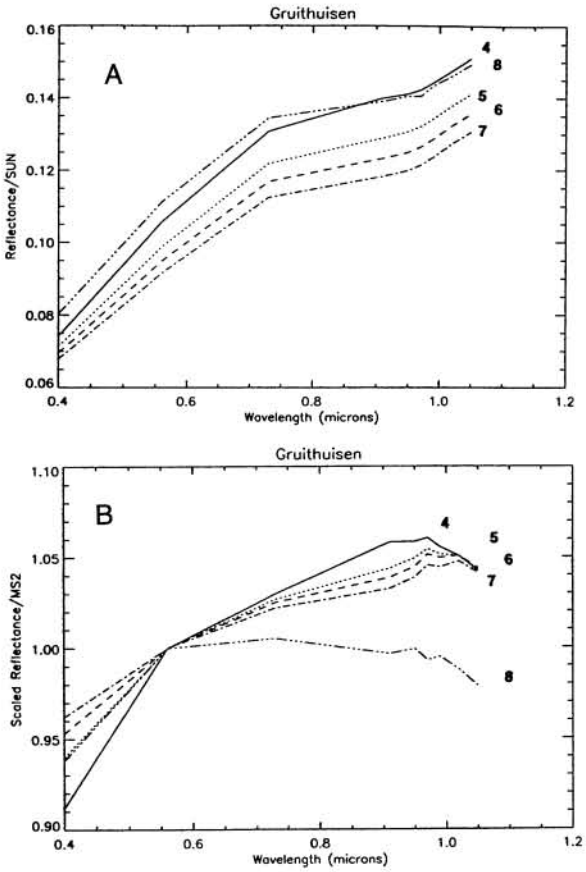

Figure 4.

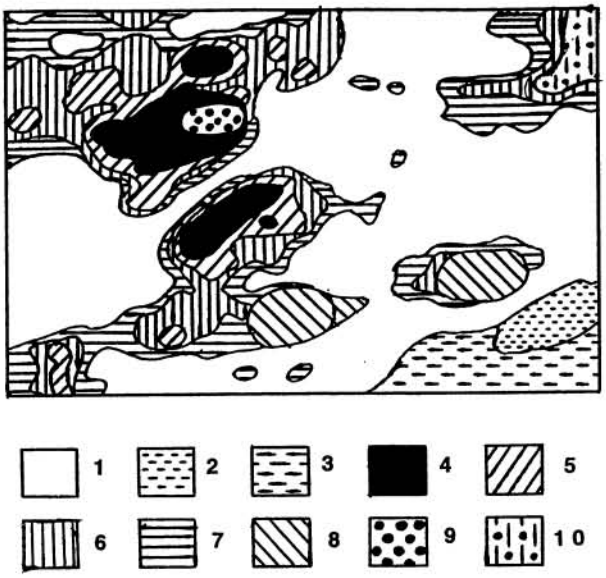

Fig.1 Albedo image at 0.73μm of the Gruithuisen domes region. **Fig. 2** PCA diagram plotted for the two first principal axes of variation. **Fig. 3** Mean spectra for the points of the PCA cloud (fig.2) for the boxes 1 to 8. (A) % absolute reflectance, (B) reflectance spectra relative to MS2; spectra are scaled to unity at 0.56 μm. **Fig. 4** Sketch map showing the spatial distribution of the pixels in boxes 1 to 8 (fig.2).

References: **1.** Head, J. W., and T. B. McCord (1978), Science, 199, 1433-1436. **2.** Head, J.W., P. C. Hess, and T. B. McCord (1978), LPSC IX, 488-489. **3.** Johnson, P.E., P.C. Pinet and S.D. Chevrel (1994) Actes Colloque National de Planétologie, Toulouse, Vol.2, S8-51. **4.** Chevrel, S. D., P. C. Pinet, and J. W. Head (1994), LPSC XXV, 249-250.