EARTHBASED TELESCOPIC NEAR-INFRARED PROBING OF MARS BY CCD-IMAGING; P.Pinet and S.Chevrel, E.R.234/GRGS, Centre National d'Etudes Spatiales, Toulouse, 31055, France.

Determination of the mineralogies of altered and unaltered primary rocks and how they vary across the surface of a planet is a major goal of reflectance spectroscopy. In the past years, a number of reflectance spectroscopic observations (e.g.,1,2,3,4) has been achieved to constrain the nature, the composition and the mineralogy of the surface units of Mars and spectral measurements of Mars have been made by both groundbased and spacecraft instruments from the visible to the mid-infrared spectral regions (0.3 to 5.0 µm). However, the Viking multispectral imagery is limited to the spectral range : 0.30 - 0.65 µm (5), and the Viking Infrared Thematic Mapper provides only with broadband reflectance measurements (6). Visible and near-infrared (0.3 to 2.6 µm) reflectance spectra obtained from earthbased telescopic measurements show that the spectral response of mars is dominated from 0.3 to 0.75 µm by broad Fe^{3+} absorptions, lacking fine structure, which indicates that the Fe^{3+} ion is in poorly defined crystallographic sites (1,4,7,9). To first order, Mars has two classes of surface materials : bright, heavily altered materials and dark, less altered materials. On the scale of the usual telescopic spatial resolution (>300 km), regional variations have been observed (8) within both bright and dark regions, but no simple correlation with regional geomorphological units has been established. Basically, the martian crust appears to be dominated by basaltic rock (8) and much of the observed mafic material is crystalline and relatively unaltered, as evidenced by unambiguous Fe^{2+} absorptions in the 1 µm spectral region for most dark region observations. These absorptions are interpreted as being due to olivines and pyroxenes (4,7,8,9).

However, the recent near-infrared spectra (0.7-2.5 µm), obtained during the 1986 opposition (10), of several martian locations taken in distinct geologic regions, using a continuously variable filter (CVF) spectrometer with a spectral resolution of 1.25% ($\Delta\lambda / \lambda$) and a spatial resolution on Mars of ~ 220 to 460 km, did not reveal obvious mineralogic differences between areas under consideration when producing spot-to-spot ratios. Rather, these observations exhibited some degree of time- and space-variable behavior. Although the spatial resolution of the spots observed on Mars may have been not high enough, it has been proposed that these regions look the same spectrally because a layer of fine dust, due to a single composition global weathering product, blankets much of the observed surface, at least down to 200 km resolutions. This is in some contrast with the results concerning the spatial distribution of rocks exposed at the surface of Mars (12), derived from Viking IRTM observations, and stating that there are no regions at a scale of 1°x 1° in longitude and latitude (i.e. 60x60 km²) that are rock free, the modal value of rock abundance being 6% areal coverage and some dark areas having up to 30-35% rock cover.

The proposition of a global layer of dust has a lot of implications and the last opposition of Mars in 1988 was a unique opportunity to test it further. Consequently, we focused intentionally on the absorption bands, due to the presence of silicates, occurring in the spectral domain between 0.9 and 1.0 um, and imaged the visible disk of Mars in narrow spectral bandpasses (~ 100 Å), respectively centered at 0.73 µm, 0.91, 0.97, 0.98 µm, with additional information provided at 0.95, 0.99, 1.02 µm. The observational dataset was achieved from 23rd to 29th September (phase angle < 5°), using , as recommended earlier (11), a Thompson CCD (Charge Coupled Device) two-dimensional (384x576) array detector, placed at the focus of the two-meter aperture telescope (f/25) of Pic du Midi Observatory in France. The very close approach of Mars and good atmospheric and night seeing conditions allowed to obtain a spatial resolution on Mars around 100-150 km. The martian surface, which has been covered usefully, lies between 170°W and 10°W longitude, and between 30°N and 85-90°S latitude.

These data are currently being processed in order to :
-(i) assess the stability of the spectral information, obtained in each bandpass during this period,
-(ii) look at the regional variability, at the 100-150 km resolution, in each bandpass,
-(iii) intercompare the spectral bands by ratioing the images.

As a preliminary result, the variability of the images indicates that the dark areas (e.g., Syrtis Major) are spectrally more heterogeneous than the bright ones. The results of this analysis and their implications with respect to surface processes and mineralogy (12,13,14,15) will be presented.

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