OBSERVATIONS OF PHOBOS FROM .8 TO 3.15 µm WITH THE ISM EXPERIMENT ON-BOARD THE SOVIET "PHOBOS II" SPACECRAFT. Y. Langevin, J-P. Bibring, B. Gondet, *I.A.S., 91406 Orsay, France,* M. Combes, *DESPA, 92110 Meudon, France,* A.V. Grigoriev, B. Joukov, Y.V. Nikolsky, *IKI, Moscow, USSR.*

The ISM experiment on board the "Phobos" spacecraft (1) performed two observations of the satellite Phobos on the 25th of March 1989, from a distance of 200 km. During the same session, the two cameras of the VSK imaging system (2) obtained filtered images of Phobos. Phobos was first observed against the background of the Martian disk, with a fixed position of the scanning mirror. The 200 obtained spectra constitute a track extending over more than 90° in longitude, near the equator of Phobos, which has already been discussed (3). For the second observation, a scanning mode was selected, so as to obtain a spectral image of Phobos. This image is constituted of 24 x 25 pixels. The projected size of the pixel is .7 x .7 km^2, about 3 times lower than the resolution of the medium resolution camera of the VSK imaging system.

The scientific interpretation of the ISM image of Phobos first required projecting as accurately as possible each pixel on the surface of Phobos. The scanning motion of the mirror provides one dimension of the image. The cross-scan motion results from both the drift of the spacecraft and its changes in orientation. During the observation of Phobos, the velocity of the spacecraft in a fixed Phobos coordinate system changed rapidly, and there were also small changes in orientation. The evaluation of the projected image in terms of longitude and latitude of each pixel has been performed from the navigation information. Furthermore, a medium resolution image of Phobos was obtained by VSK in the same time frame as the ISM observations. The VSK image was smoothed to bring it closer to the resolution of ISM (Fig. 2). It was compared with a monochromatic image obtained by ISM at .9 µm (Fig. 3), and processed using navigation data. The rectangular shape of the ISM pixels results from oversampling by a factor which decreases from 4 to 2. The correlation obtained is satisfatory, for prominent features such as the crater at the upper left of the ISM image, with its interior partly in shadow, and its illuminated rim standing out against a dark background to the west and south. Similarly, a conspicuous vertical ridge constituted of two arcs can be observed in both images. This good match allowed us to project our image on the Phobos coordinate system (Fig. 1) using the geometrical model provided to us by T. Duxbury (4). As the Sun had a phobocentric longitude of nearly 180°, meridian 270 constitutes the terminator. ISM observations ranged from less than 180° to 270° in longitude, with good coverage of the region between the equator and 30° N. There are small but significant differences between the VSK and ISM images (such as the brightness ratio of the two arcs of the vertical ridge). These can be attributed in part to the long acquisition time of ISM (300 sec) during which both the Sun and the spacecraft moved by a few degrees relative to Phobos. The most likely interpretation is however that there are color variations on the surface of Phobos. Such spectral variations are also observed in the infrared range: Fig. 4 is a smoothed image of the color ratio between 1.06 and .98 µm, which shows significant variations even on such a small spectral range, with low correlation with albedo. The hydration feature is much weaker than on Mars. However, significant variations are also observed in the long wavelength part of the range. At longer wavelengths (> 2.8 µm) it is possible to map the thermal contribution, which reaches nearly 25 % near the subsolar point.

As a conclusion, it is now possible to correlate the spectral image obtained by ISM with other observations (Mariner 9, Viking Orbiter, VSK on "Phobos") and topographical features. Significant spectral variations are observed at a kilometric scale. This small scale is surprising given the efficiency of lateral transport processes on such a small body.

References: (1) Avanesov et al. (1989) Nature, 341, p. 582. (2) Bibring et al. (1989) Nature, 341, p. 591. (3) Bibring et al. (1989b) Proc. 20th Lun. Plan. Sci. Conf. (in press). (4) T. Duxbury (1989) Proc. " Phobos " meeting, Paris (in press)

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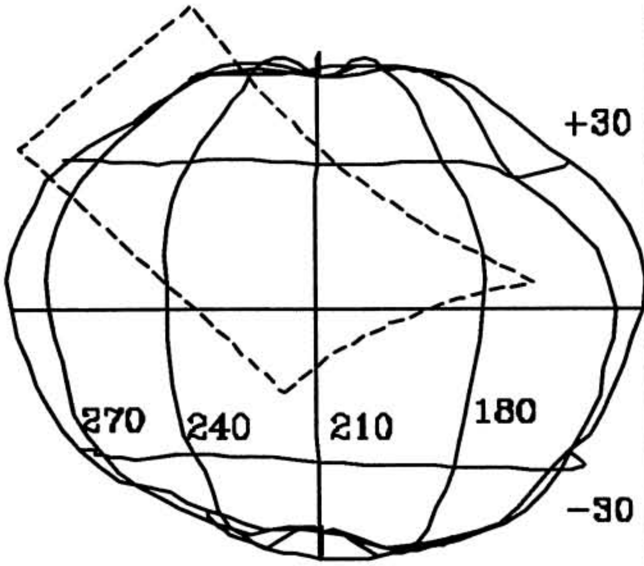

Fig. 1 Longitudes and latitudes on Phobos (from the geometric model of Duxbury, 1989) with the viewing conditions of the ISM image

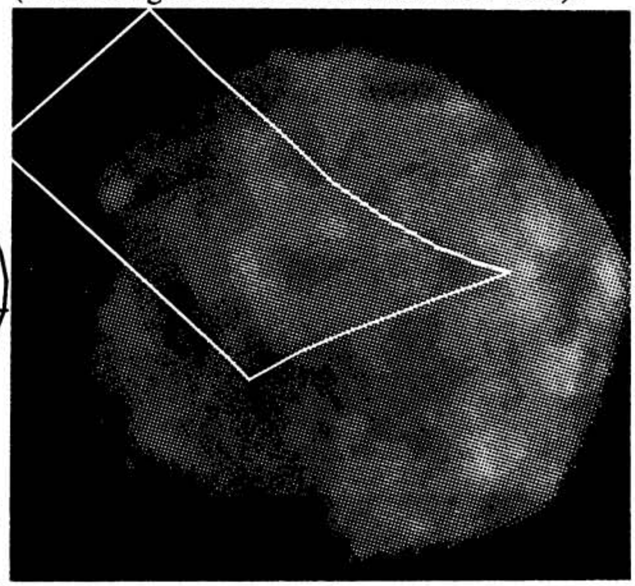

Fig. 2 Medium resolution image derived from VSK, with similar viewing conditions as ISM the contour shows the region observed by ISM (from navigation and correlation with VSK).

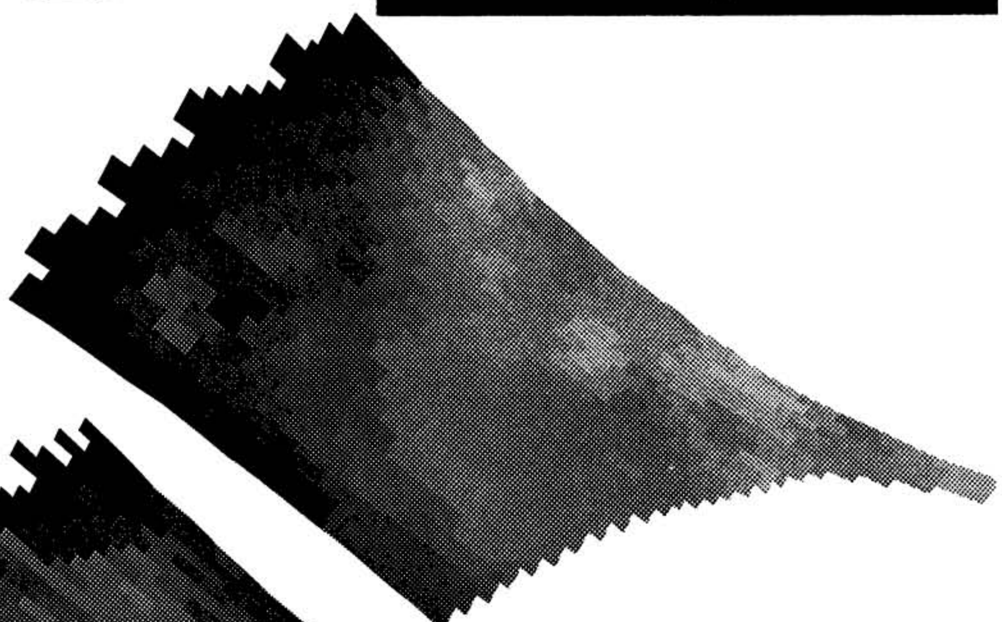

Fig. 3 Image of Phobos obtained by ISM at .9 µm. The scale ranges from.016 to .035 (relative to the solar flux)

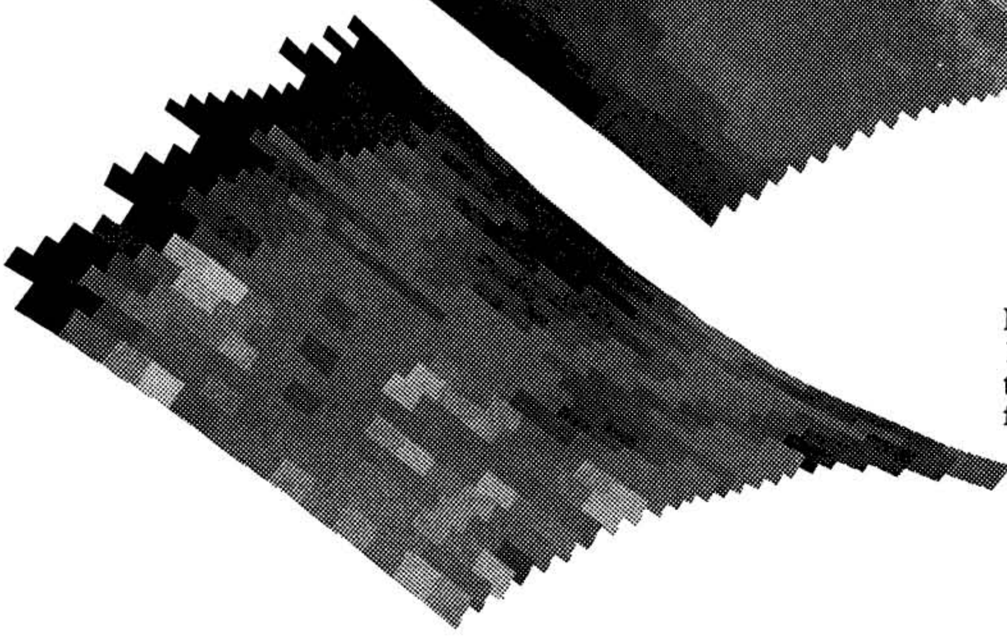

Fig. 4 color ratio 1.06 µm / .98 µm the scale ranges from 1.03 to 1.07