

TELESCOPIC OBSERVATIONS OF MARS: A SEARCH FOR CARBONATES AND OTHER SALTS IN THE 4 μm REGION: Diana L. Blaney and Thomas B. McCord, Planetary Geosciences Division, Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822

A search for carbonates and other salts on Mars was made by making telescopic observations of areas of Mars in the 2.5 to 4 μm spectral region using the University of Hawaii 2.2m telescope. Carbonates are predicted on theoretical grounds (1,2) and are discussed as a major reservoir of carbon dioxide (3,4). There is a strong molecular absorption feature diagnostic of the carbonate ion at 3.9 μm . This feature is much more sensitive to the carbonate ion than the features found at approximately 2.3, 2.5, and 3.3 μm . Measurements of Mars made in the 2.0 to 2.5 μm region show no evidence of carbonates (5).

During the night of September 19, 1986, the 2.2 m University of Hawaii telescope, at the Mauna Kea Observatory, Hawaii, was used to observe Mars. A circular variable interference filter (CVF) was used with a cooled InSb detector to measure radiation at 2% ($\Delta\lambda/\lambda \times 100$) spectral resolution consecutively from 2.35 to 4.17 μm . For each observation the CVF was scanned through the spectrum six times over a period of approximately 15 minutes while the telescope was manually guided on areas of Mars. The signal was digitized and recorded on magnetic disc and transferred to magnetic tape for later analysis. The observing conditions appeared to the observers to be excellent, with no clouds, low atmospheric water vapor and good seeing; the quality of the data obtained also indicate these conditions.

The best measurements are for four regions on Mars with diameters of approximately 3000 km. A beam splitter was used to send light to the guide camera and to the instrument. A star was used to map out the aperture of the instrument. The image from the guide camera was video taped along with electronic cross hairs that marked the aperture. The video tape was used to determine the areas observed and to prepare Figure 1. The four locations of the aperture cover approximately the regions of Syrtis Major, Arabia, Hellas, and an area of the southern highlands north-east of Hellas, which is labeled North-East Highlands.

The star Tau Sagittarius was observed to remove atmospheric extinction from the Mars data. Tau Sagittarius is a K1 III spectral type with a visible magnitude of 3.32. The star was separated from Mars by approximately 20 minutes in right ascension and 1 hour 30 minutes in declination.

The data were reduced by averaging the spectra taken for each location or the star after removing any spurious data point. The Mars observations were divided by the measurements of Tau Sagittarius. Interpolation to exact airmass did not yield improvement in the data calibration. The resultant spectra are shown in Figure 2.

The reduced spectra show no sign of carbonate or any other salt, such as a sulfate, absorption features. The Mars reflectance spectra in Figure 2 can be compared with the laboratory reflectance spectra of calcium carbonate in a mixture of Mauna Kea Palagonite, a Mars dust analog, [abstract this volume (6)] to estimate the detection limit on carbonates that could exist, on average, in the upper few millimeters of the Mars soils at these locations. These laboratory measurements put an upper limit of 3-5 wt% carbonate in these areas given the signal to noise of the measurements. These measurements do not rule out carbonates at depth or outcrops that are only a few percent of the areal coverage of the spot measured.

REFERENCES: (1) Clark V.C. and Van Hart D.C. (1981) *Icarus* 45, 370-378. (2) Gooding J.L. (1978) *Icarus* 33, 483-513. (3) Baird A.K., Toulmin P., Clark B.C., Rose H.J., Keil K., Jr., Christian R.P., and Gooding J.L. (1976) *Science* 194, 1288-1293. (4) Fanale F.P., Salvail J.R., Banerdt W.B., and Saunders R.S. (1982) *Icarus* 50, 381-407. (5) Khan R. (1985) *Icarus* 62, 175-190. (6) McCord T.B., Clark R.N., and Singer R.B. (1982) *J. Geophys. Res.*

CARBONATES ON MARS
OBSERVATIONS OF MARS FOR CARBONATES
BLANEY, D.L. AND MC CORD T.B.

87, 3021-3032. (7) Blaney D., Walsh P., and McCord T.B. (1987) Abstract submitted to XVIII Lunar and Planetary Science Conference

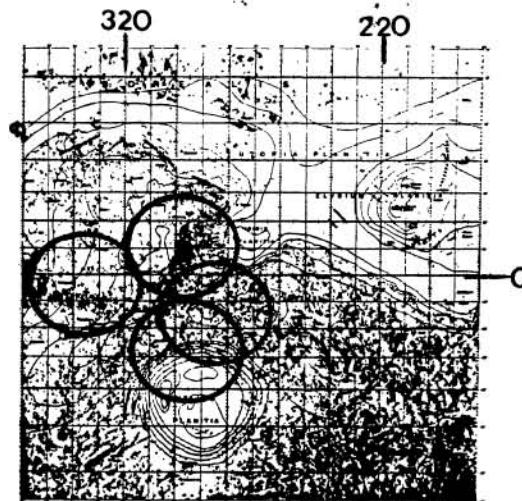


Figure 1. Mars locations observed on Sept. 19, 1986. (Base map from U.S. Geologic Survey.)

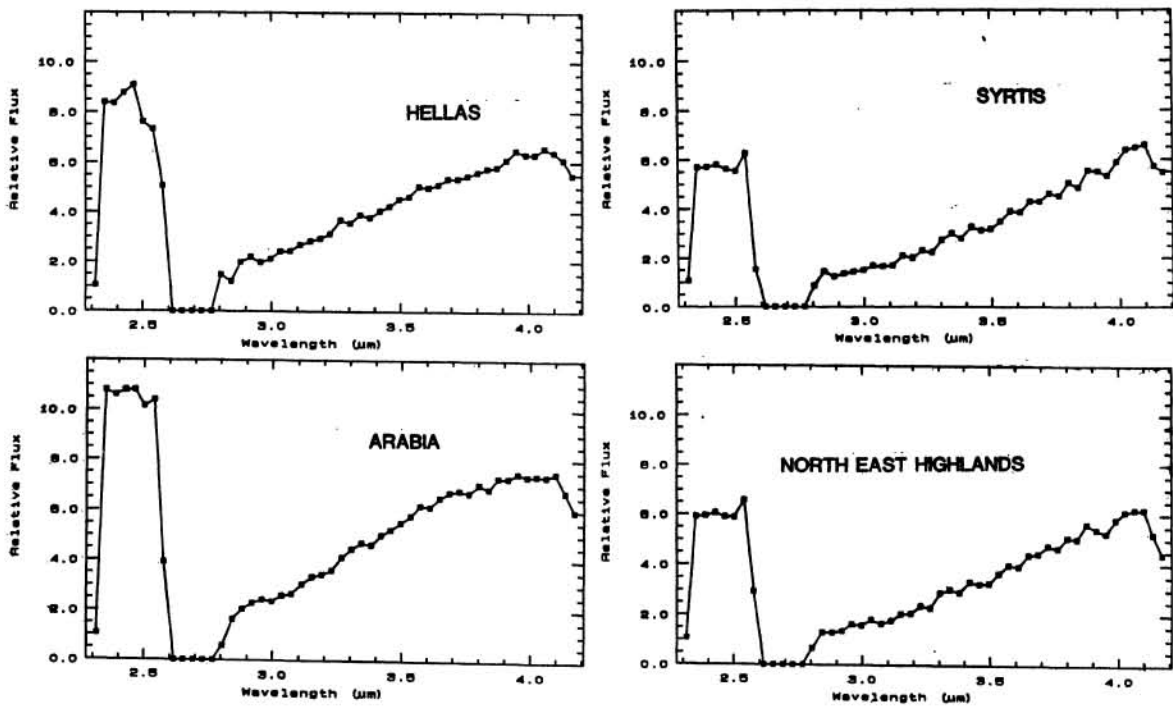


Figure 2 Relative Reflectance Spectra for Hellas, Syrtis Arabia, and North-East Highlands