
Multispectral image data from Voyager 1 and Voyager 2 have been calibrated and processed to produce registered photometric mosaics of the Galilean satellites. These global data sets have moderate spatial resolution (8 to 20 km per line pair) and a photometric accuracy in normal I/F values corrected to zero phase angle of 10 to 20% relative spectral accuracy (Johnson, et al., Lunar and Planetary Science XII, 1981; Danielson, et al., J. Geophys. Res., 1981). There are four spectral bands (0.35, 0.41, 0.48 and 0.59 μm) for each data set and these have been processed as an "image cube" (1 spectral and 2 spatial dimensions) at the Planetary Geosciences laboratory (McCord, et al., Lunar and Planetary Science XVI, 1980).

For the Europa data set, examination of two dimensional histograms, or correlation plots, between pairs of spectral bands showed that three independent variables (UV, Violet, Orange albedos) were sufficient to discriminate among the spectral differences on the satellite, the Blue and Orange albedo data being redundant to a large extent. We chose to use the combination of Orange albedo, Ultraviolet/Orange ratio and Violet/Orange ratio to define units. Figure 1 shows the Orange vs. Blue histogram and the individual histograms for the three chosen parameters. After some experimentation four "bins" were selected to separate variations in the albedo and color parameters (shown in Figure 1). The units defined by these regions in the albedo-color space are displayed in Figure 2 as four different gray tones in maps of Orange albedo, Ultraviolet/Orange and Violet/Orange ratio. A color composite image can be made from these three black and white versions which then displays the units as different color tones. In addition, four point spectra characterizing each of the units can be derived from the image cube and compared with each other and with ground based spectra, for hemispheres dominated by one or more of the units.

Among the preliminary conclusions we have drawn from this unit map are: (1) There are at least four distinct units which differ in both albedo and color. (2) The nature of the spectral variation among these four units suggests that the two units concentrated on the trailing side may be very similar to the corresponding bright and dark units on the leading side but with the addition of extra ultraviolet absorbing material. Although still an oversimplified picture, this is consistent with suggestions of exogenic modification by impacting magnetospheric sulfur ions (see Lane, et al., Nature, 1981; Eviatar, et al., Icarus, in press, 1982). (3) The darker fracture-like features crisscrossing the surface are not a distinct spectral unit themselves but show a spectral character similar to the adjacent darker mottled unit in both hemispheres. One hypothesis explaining these features is that the streaks are tension cracks which have been filled from beneath by locally-derived dark material welling up into the cracks.

Figure 1
SPECTRAL UNIT MAPS - EUROPA
McCord, T.B. et al.

Figure 2

ORANGE ALBEDO MAP

VIOLET/ORANGE ALBEDO RATIO MAP

ULTRAVIOLET/ORANGE ALBEDO RATIO MAP