VOLCANIC COLOR UNITS ON THE SURFACE OF IO

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McEwen [1] did an intensive low resolution study of the global color and albedo variations on Io with a high resolution study of Ra Patera. We have reproduced McEwen's work on Ra Patera and found more detailed color units for this area. Using medium resolution images we have attempted to expand this to other volcanic areas focusing on Mbali, Talus, Maasaw, and Agni Pateras. Our goal was to see to what degree the units defined in the high resolution study of Ra Patera can be distinguished at medium resolution and what is the variation in color units between Ra Patera and other volcanic regions. Preliminary analysis shows that the units seen at medium resolution correspond well with those at higher resolution. Initial examination indicates that the color units defining the Ra flows have similarities to those that describe Mbali and Talus Pateras. Maasaw and Agni Pateras show slightly less structure and there are distinct variations between them.

The Voyager images used in our study were processed similarly as those used by McEwen [1]. We radiometrically calibrated the images using PICS, a USGS calibration software based on the calibration factors of Danielson et al. [2]. After calibration we updated the camera pointing on the image labels to give us more accurate map geometries. When the Voyager spacecraft traveled through the Io plasma torus the vidicon detectors were exposed to ionized radiation which resulted in dark current buildup which is not taken into account by the calibration factors of Danielson et al. [2]. McEwen [1] describes the phenomena and a calibration method to correct for the effects. We followed his method of calibration for these effects using a ramp function correction. Photometric normalization of each image consisted of two steps. First, each DN value was normalized to i=0 and e=0. For Ra Patera this normalization was done using Minnaert's function since the images involved were taken at phase angles less than 15 degrees. For the other volcanic areas a lunar-Lambert function was used. Next, a multiplicative correction was applied to each image in order to normalize DN values to a standard phase angle condition (namely α=0). McEwen's [1] formula were used to derive the Minnaert k values and the phase angle correction factors. The two-image technique described by McEwen [1,3] was used to find the B values for the lunar-Lambert function. In addition empirical calibration factors were applied to the resulting images in order to achieve agreement with ground-based telescopic observations. The filter-dependent factors used are listed in table I of McEwen [1]. After this series of image processing was complete, the following spectral ratios were constructed: violet/blue, ultraviolet/blue, and blue/orange.

An unsupervised clustering program called ISOCLUS (part of the PCI software package) was used to identify spectral units given based on blue filter albedo, and the above three spectral ratios. Using his low resolution global mosaics and an unsupervised nonparametric clustering algorithm called HINDU, McEwen [1] defined five spectral units. Using the high resolution mosaic of Ra Patera and the ISOCLUS algorithm we found ten distinct spectral units for the Ra Patera region. (figure 1).

[1] A. S. McEwen (1988) *Icarus*,**73**,385-426. [2] Danielson et al. (1981) *JGR*, **86**, 8683-8657. [3] A. S. McEwen (1986) *JGR*, **91**, 8077-8097.