THE COLORS OF ENCELADUS: FROM PLUMES AND PARTICLES TO ACTIVE FRACTURES. P. Schenk[1], [1]Lunar & Planetary Institute, Houston TX (schenk@lpi.usra.edu).

Introduction: Cassini mapping of the midsize icy satellites has revealed complex icy worlds, and global color mapping [1] has been a key resource in this effort. IR-UV mapping [1] has revealed the 'painting' of satellites by E-ring dust, magnetospheric alteration of the surface, high-energy electron bombardment (creating the Pac-man features on Mimas and Tethys [2]), and equatorial spots on Rhea (formed by a thin ring reimpacting on the surface and strengthening the case for a ring origin of the Iapetus ridge [3]).

Enceladus: At the center of much of this color variability is Enceladus and its ongoing icy plumes. In this report I focus on the surface colors of this active moon at global and local scales, and at a full range of phase angles. One focus of our effort has been to determine whether the global color pattern matches that predicted for plume material being redeposited onto the surface [4]. Another focus has been to assess whether color variability correlates with geology.

Color Mapping: All Cassini ISS color filter images have been examined, with the best used to produce new color maps of the surface at resolutions from 50 meters to 4 km. These mosaics and maps are correlated to a new 150-meter res. global base map (Fig. 1 [bottom Page 2]).

Low-Phase Color. Resolved color imaging at phase angles <10° is limited to ~65% of the surface. However, these data reveal that irregular areas surrounding the margins of the South Polar Terrains (SPT) are anomalously low in albedo, compared to their higher phase appearance (Fig. 2). These contrast reversals are likely a particle size or opposition surge effect related to regolith properties.

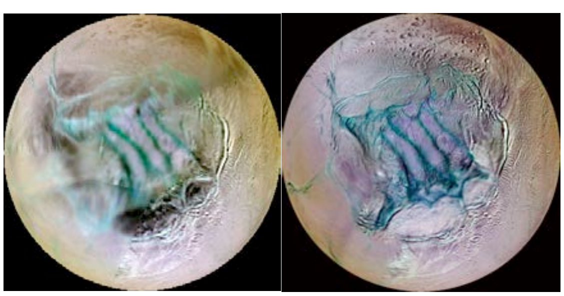

Figure 2. IR3-G-UV3 color maps of the southern hemisphere of Enceladus. Left) <10° phase angle, (right) 10-40° phase angle. Note dark regions in left mosaic.

Global Medium Phase Angle. Global mapping at 10-40° phase angles confirms that the global-scale IR/UV ratio map [1] (Fig. 2) correlates very well with the modeled plume fallout distribution map [4]. Although the north polar coverage (>70°) is incomplete, the maps appear to confirm an eastward deflection in the predicted pattern.

The IR/UV color pattern deviates from the predicted fallout pattern locally. A prominent arc of high IR/UV ratio material appears to be centered at 55°S, 265°W, an area centered on a lobate extension of the SPT region. This area may have been tectonically active recently and produced a spurious outburst of plume-like material, resulting in the IR/UV bright arc. A simulation to test this hypothesis is in progress.

Geologic Features in Color. Despite the now confirmed and ongoing deposition of micron-sized plume material on the surface, geologic units can be discerned on the color maps of Enceladus!

We examine three cases. An area of tectonized ridge material centered on the leading hemisphere shows several distinct color units. Ridges have a bluish tint, whereas elongate raised mesa-like plateaus have a more reddish color (Fig. 3). The edge of the tectonized terrains covering much of the leading hemisphere also have a distinct color boundary, suggesting tectonic resurfacing has exposed ices of different colors. The general correlation of color with geology supports ongoing geologic mapping [e.g., 5].

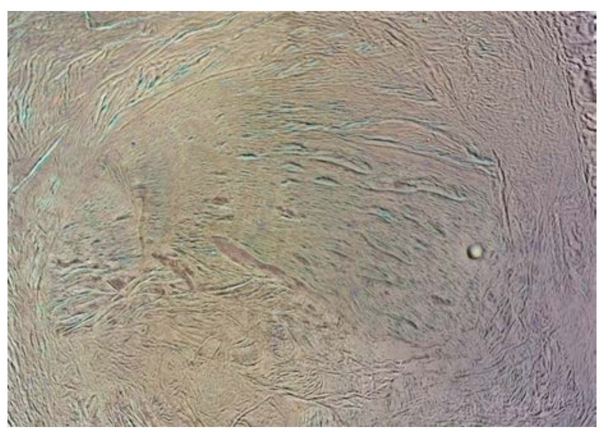

Figure 3. Center of leading hemisphere of Enceladus.

A second example of prominent color patterns is the low-IR signature of geologically recent fractures on Enceladus. Examples include the large N-S trending extension fractures running north from the edge of the SPT (Fig. 4), and several E-W trending fractures near the equator. Using these color patterns as a proxy for the identification of recently active tectonics, we find that the leading hemisphere is relatively depleted in such low-IR fractures and may have been quiescent.

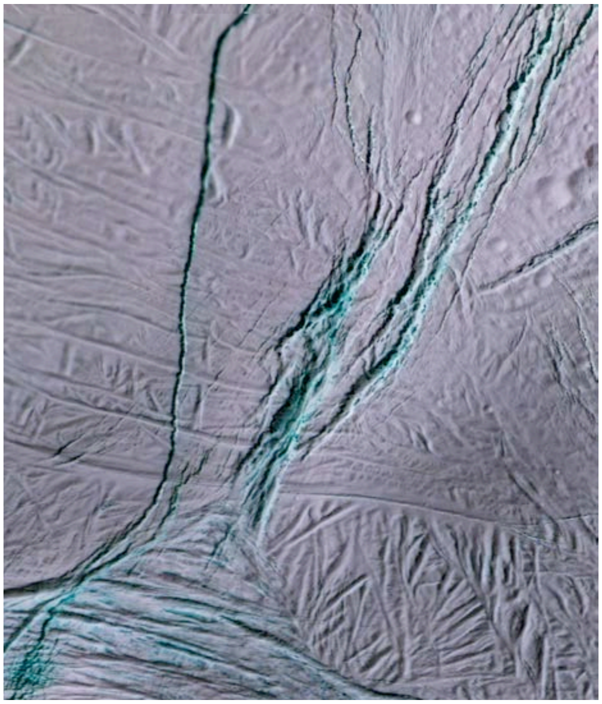

Figure 4. Recently active fractures near the edge of the SPT. Low-IR color (appearing bluish here) is probably due to exposure of deeper ices, which may have larger grain sizes or less plume fallout mantling.

A third case is the crenulated or funicular terrains between the 'tiger stripe' ridges from which the plumes erupt. This zone is characterized by and darkening in the green band and may be due to ongoing modification (resulting in less plume fallout or exposure of unmodified ices).

Another interesting finding is that the North Polar region (pending completion of mapping in 2015) has also experienced limited tectonism in the form of sets of parallel and en-echelon low-IR fractures cutting through cratered plains. This area will be examined in detail.

Conclusions: Enceladus is not only active but is one of the most colorful objects in the Outer Solar System. The large-scale patterns are controlled by plume redeposition (which may be more complex than simply ongoing plume generation at the current sources . . .) but local scale geologic features remain visible through the plume material. This feature may be due to the transparency of the plume particles and to their limited thickness.

References: [1] Schenk, P., and 5 others, (2011) *Icarus, 211,* 740. [2] Howett, C. et al., (2011) *Icarus, 216,* 221. [3] Ip, W. (2006) *Geophy. Res. Lett,* 10.1029/2005GL025386. [4] Kempf, S., U. Beckmann, and J. Schmidt (2010) *Icarus,* 2006, 446. [5] Crow-Willards, E., and R. Pappalardo (2011), *EPSC-DPS*2011-635.

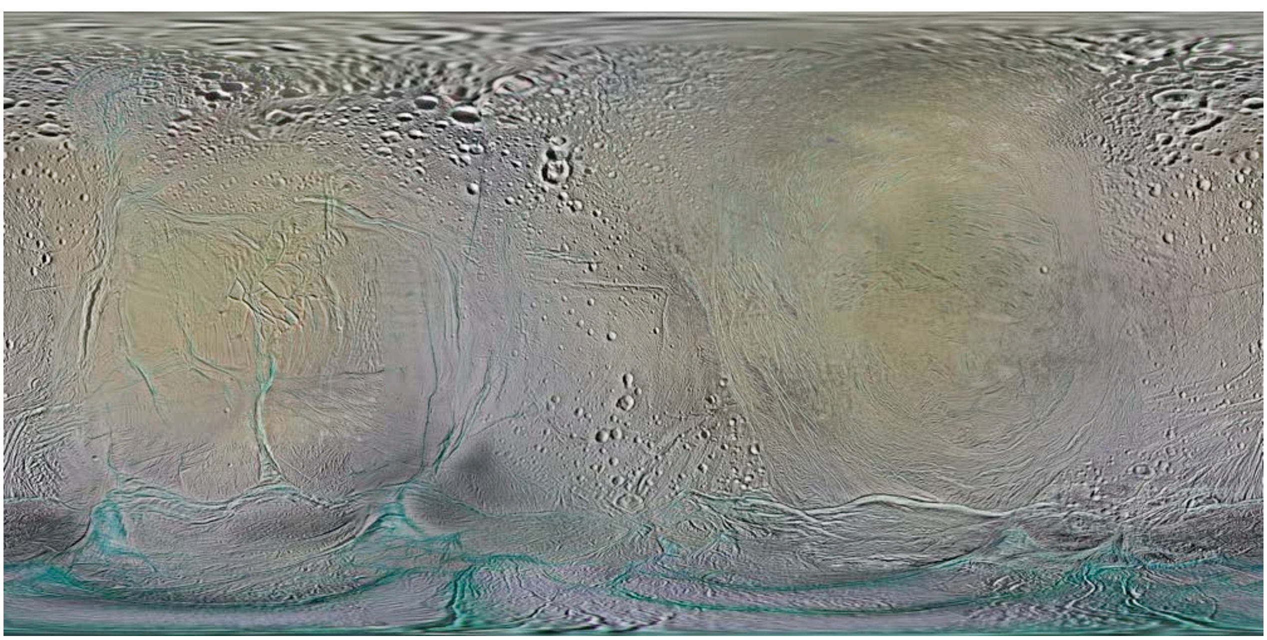

Figure 1. Global 150-m resolution IR3-Green-UV3 color mosaic of Enceladus.