THE COMPLETE GEOLOGIC MAP OF NEPTUNE'S MOON TRITON AT A 1:5M SCALE.
E. S. Martin[1], D. A. Patthoff[2], M. T. Bland[3], G. C. Collins[4] [1]Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution (martines@si.edu), [2]Planetary Science Institute, [3]USGS Astrogeology Science Center, [4]Wheaton College, MA.

Introduction: In 1989, Voyager 2 encountered the Neptune system and returned images of its largest moon (~1350 km radius), Triton. These images remain the primary data for our understanding of the geology of the satellite. Triton was revealed to be a geologically active moon [1], and its activity has been linked to its dynamical history as a captured Kuiper Belt Object (KBO) [e.g. 2]. Triton contributes to the diverse population of icy satellites, with a unique origin relative to other icy satellites contributing to its young surface and exotic terrains [*Schenk & Jackson,* 1993].

Voyager 2's closest approach to Triton was 39,800 km (~30 Triton radii) [3, 4], and the inherent challenge with flyby missions, especially in the outer solar system, means extremely limited data sets with long time lapses between missions. The production of a geologic map of Triton in the new age of ocean worlds provides a geological foundation to facilitate and foster resurging interest in KBOs, support the planning of future missions [e.g. 5] and provide endmembers to the diverse array of ocean worlds in our solar system.

Restored Photomosaic: The Triton image data set includes 43 images with resolutions better than 2 km/pixel (ranging from 338 m/pixel to 1.6 km/pixel). The images cover large portions of Triton's Neptune-facing hemisphere. The average incidence and emission angles for these images range from 27°-90° and 12°-73°, respectively. The majority of the images (n=32) are clear filter (497 nm), and the rest include UV (346 nm wideband), violet (416 nm), blue (479 nm), green (566 nm) and orange (591 nm) filters. Image quality was improved by correcting line-drops, reseaux removal, and correcting image locations. An orthographic mosaic of 16 of the Voyager 2 Triton images was created with the new photogrammetric control. The new orthographic mosaic served as the basemap for geologic mapping [See 6].

Mapping Results: The production of geologic maps builds context for understanding the geologic history of a planetary body with a standardized set of criteria that conveys a geologic history in a way that is consistent across planetary bodies. Our mapping of Triton builds upon existing maps of Triton [e.g. 7] by using updated computer-aided digital mapping techniques that enable much finer details to be identified and easily shared with the community. We have completed a 1:5M geologic map of the Neptune-facing side of Triton (Fig. 2).

We identify 21 individual geologic units. The two largest units are comprised of three types of cantaloupe terrains (Can) and the division of the Southern Hemisphere Terrains (Tsh) into three units. We also include digitized fans (deposits from prior plume activity) from [8] and craters [9] corrected to the new control network [6].

Table 1: Summary of Triton geologic unit names and their abbreviations.

Abb.	Unit Name
Can 1	Cantaloupe Terrain 1
Can 2	Cantaloupe Terrain 2
Can 3	Cantaloupe Terrain 3
Ce	Crater Ejecta
Cr	Craters >12km
Ct 1	Cellular Terrain 1
Ct 2	Cellular Terrain 2
Gd	Guttae
Gl	Aureole
Lr	Linear Ridges
Lt	Lobate Terrain
P	Patera
Pt	Pitted Terrain
Sd	Smooth Dark Terrain
Smt	Smooth Terrain
Spt	Smooth Pitted Terrain
Tsh 1	Southern Hemisphere Terrain 1
Tsh 2	Southern Hemisphere Terrain 2
Tsh 3	Southern Hemisphere Terrain 3
Wct	Walled Centered Terrain
Wst	Walled Smooth Terrain

We identify the Smooth Dark Terrains (Sd) as the oldest terrain unit (Fig. 1), consistent with the few large craters on the surface of Triton being found primarily on the Smooth Dark Terrains (Sd) and the Cellular Terrains 2 (Ct 2). The dearth of craters suggests that overall, Triton's surface is young [e.g. 9], and in the context of the preserved geologic history, cratering is interpreted to be an ongoing geologic process. The Cantaloupe terrains (Can) are interpreted as three separate units, with the younger Cantaloupe terrains further east near the Walled terrains (Wct & Wst) and the Lobate Terrains (Lt).

We also identify three Southern Hemisphere Terrain units (Tsh), where the Tsh 1 is dominated by features we classify as lacus defined by the IAU as a 'small plain'. Tsh 2 is dominated by lacus and fans, and Tsh 3 has no lacus and only fans.

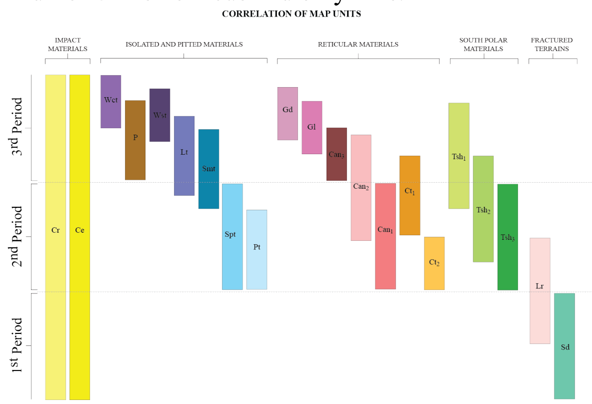

Figure 1: Correlation of Map Units (COMU) illustrating the relative age relationships of each geological unit.

Acknowledgements: Support for the creation of the Triton SIM comes from the NASA Planetary Data, Archiving, Restoration and Tools program Grant NNX17AK45G.

References: **[1]** Smith et al., (1989) *Science 246,* 1422-1449. **[2]** McKinnon et al., (1995) Neptune and Triton, ed. Cruikshank, U of A Press, pg. 807-877. **[3]** Chapman & Cruikshank, 1995; Neptune and Triton, ed. Cruikshank, U of A Press, pg. 3-14. **[4]** Stone & Miner, (1989) *Science 246,* 1417-1421. **[5]** Prockter et al. (2019) *EPSC-DPS* Geneva Switzerland, id. EPSC-DPS2019-1850. **[6]** Bland et al. (2019)) *4th Planetary Data Workshop*, LPI Contrib. No. 2152. Abs. No. 7055. **[7]** Croft et al., (1995) Neptune and Triton, ed. Cruikshank, U of A Press, pg. 879-947. **[8]** Hanson et al (1990) *Science, 250*, 421-424. **[9]** Schenk & Zahnle et al. (2007) *Icarus,* 192, 135-149.

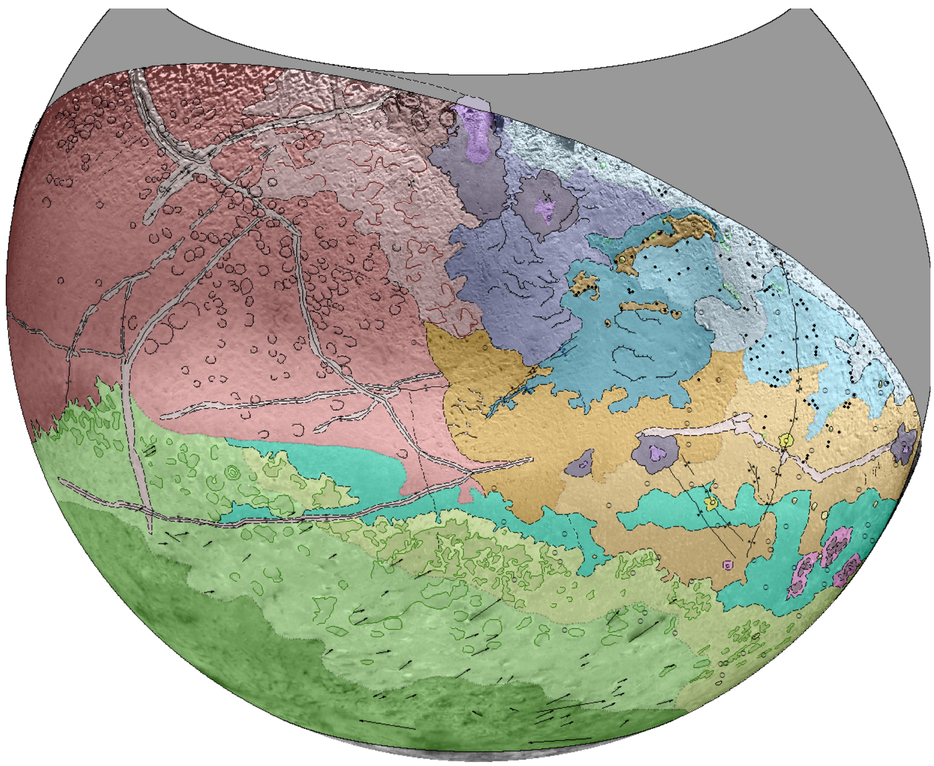

Figure 2: Geologic map of Neptune's moon Triton. Unit colors correspond to the Correlation of Map Units in Figure 1, and unit names in Table 1.