

GLOBAL GEOLOGICAL MAPPING OF ENCELADUS. E. N. Crow-Willard^{1,2} and R. T. Pappalardo²,
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Saturn's moon Enceladus is a 500 km diameter satellite with complex geology and a currently active South Polar Terrain (SPT) that is intensely tectonized. Other portions of the surface of Enceladus have also been intensely tectonized, inviting comparisons to the SPT. We have embarked on an effort to globally map Enceladus, in order to define and understand the relationships among its geological units, especially to understand similarities and differences of its units to those in the SPT. This will lead to better understanding the satellite's evolution as a whole.

We recognize 11 different geological units, described here in tentative order of their relative ages, from oldest to youngest.

Heavily cratered terrain (cp₁) is characterized by high crater density including overlapping craters and subdued topography, cut by sets of sub-parallel and intersecting sets of fine fractures. This unit is present in the north polar region, as well as equatorially and some southern latitudes near longitudes 20°W and 180°W.

Moderately cratered terrain (cp₂) is present in the equatorial region between 50° W and 40° E. It is characterized by bowl-shaped craters and lesser crater density than cp₁, and wide shallow ~2 km wide curvilinear troughs in sub-parallel sets with intersecting orientations.

Finely striated ridge and trough terrain (sp), make up the bulk of Sarandib and Diyar Planitiae. At a larger scale, the ridges and troughs form sigmoidal patterns, and striations tend to get wider and longer toward the north. This is especially the case in the eastern occurrence, where for the most part troughs are wider and longer. There occur sub-parallel, larger-scale troughs ~8 km wide and up to 65 km long hills, which trend transversely across the unit.

Curvilinear terrain (ct₁) frames the finely striated ridge and trough terrain unit and is characterized by subdued ridges and troughs. It is similar in shape and structure to the southern curvilinear terrain unit (ct₂) that frames the south polar terrain, but with more shallow sulci. Unit ct₁ is composed of Samarkand, Hamah, and Harran Sulci.

Ridged terrain (rt), composed of the Cufa Dorsa and Ebony Dorsum, is characterized by rounded and convex, bulbous, branching ridges roughly 5 km in width and semi-parallel facing in a northwest-southeast direction. Also included in this unit are domes of similar height and width as the ridges.

Wide shallow trough terrain (wst) of the leading

hemisphere is located just north of unit clh and is characterized by wide sub-parallel troughs trending in a west-east direction. The unit contains some smaller scale ridge-and-trough terrain paralleling that found in unit sp.

Central leading hemisphere terrain (clh) is curvilinear with anastomosing and interwoven troughs very similar to the south polar terrain. Two islands of cratered terrain in the southern portion of the clh are surrounded by clh terrain.

Smooth terrain (st) of the trailing hemisphere is characterized by linear shallow depressions, located in the southern portion of the trailing hemisphere, equatorward of the southern curvilinear terrain. These depressions are in subparallel and cross cutting patterns, and are very similar, though shallower, to depressions on the outer edges of the SPT.

Leading edge curvilinear terrain (ct₂) is characterized by long shallow troughs, very similar to curvilinear terrain on the trailing hemisphere (ct₁), but it surrounds the central leading hemisphere terrain unit and the unit just north of it, the wst leading hemisphere unit.

Southern curvilinear terrain (ct₃) unit of Cashmere Sulci is a circumpolar deformation belt bordering the spt, composed of long curvilinear troughs and associated hummocky material. In some regions, it consists of sub-parallel arcuate ridges and troughs, convex toward the north, from which prominent troughs emanate and transect terrains to the north. There is a steep drop across the boundary from ct₂ into ct₃ indicating ct₃ is lower than the surrounding terrain.

South polar terrain (spt) is characterized by prominent troughs known as the tiger stripes which emit vapor and fine particles, and by an overall higher surface temperature compared to the rest of the satellite. There are sub-parallel linear depressions similar to the tiger stripes but not as deep, which are similar to the depressions of the st unit. Between the tiger stripes are curvilinear smaller scale troughs similar to those found in the clh unit.

We will present a global geological map of Enceladus, and interpretations of the stratigraphy and geological history that our mapping implies. We will address geological and relative age comparisons, with implications for whether similar or different processes have shaped the tectonized terrains of Enceladus.

