GEOMORPHOLOGIC MAP OF THE AFEKAN CRATER REGION, TITAN. M.J. Malaska[1], R.M.C. Lopes[1], A. Schoenfeld[1], D.A. Williams[2], S.B.D. Birch[3], A.G. Hayes[3]. [1]Jet Propulsion Laboratory / California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 98109. [2]School of Earth and Space Exploration, Arizona State Univeristy, Tempe, AZ 85281. [3]Department of Astronomy, Cornell University, Ithaca, NY 14850. (Michael.J.Malaska@jpl.nasa.gov).

Introduction: Cassini has revealed Saturn's moon Titan to be a world with a rich variety of landforms [1]. Titan has a thick atmosphere, surface liquids of cryogenic hydrocarbons, and a meteorological cycle that allows fluivial, aeolian, and lacrustine processes to occur. Although technically an icy moon, Titan appears mantled by a thick layer of organic materials that are carved by similar processes that exist on Earth. Our mapping efforts are to inventory and characterize the surface experession of different geomorphologic units in an effort to understand the organic sedimentary cycle on Titan. Our initial geomorphologic map describes an area in Titan's equatorial and mid-latitude region [2].

Study Area: The Afekan Crater region extends from 170º to longitude 240ºW and from latitude 0 to 50ºN (Fig. 1.). This area contained in this region amounts to 8.6% of Titan's surface. It is located to the north of the Huygen's landing site.

Mapping technique: Mapping was done at a spatial scale of 300 m/pixel, which corresponded to a map scale of 1:800,000. We used a mosaic of individual Cassini Synthetic Aperture Radar (SAR) swaths as a base map. We also used microwave radiometry, relative topography from the SARTopo technique, infrared response at 0.93 micron (ISS instrument), and infrared wavelength responses from the Cassini VIMS instrument. We classified the landscape into terrain classes, which were subdivided into terrain units (Fig. 2) [2].

Terrain classes and interpretation: The terrains in the Afekan Crater region were broken into five broad classes: crater, labyrinth, hummocky/mountainous, plains, and dune terrain classes.

Crater terrains. Craters are relatively rare on Titan [3, 4]. In the Afekan region there were four identified craters: Afekan, Selk, Mystis, and an unnamed crater on the western boundary of the region. We mapped the crater rims, ejecta units, and interior fill units. Crater rims are high-backscatter in radar and are consistent with icy crustal materials. Inside the crater we identified plain and dunes units if those units had similar characteristic to those terrains found beyond the crater in the surrounding region.

Hummocky/mountainous terrains. Hummocky and mountainous terrains are high-backscatter regions that are locally topographically elevated. Mountainous terrains show a radar bright-dark pairing consistent with an elevated crest [5]. Many mountain and hummocky regions are in eleongated chains consistent with global tectonic patterns [6]. The emissivity of mountainous and hummocky terrains is consistent with water ice-rich materials.

Labyrinth terrains. The labyrinth terrains are elevated highly dissected plateaux with a valley density significantly higher than surrounding areas [7]. The radar emissivity of these areas is consistent is consistent with organic materials.

Plains terrains: By surface area, plains are the dominant terrain class on Titan. The most extensive are the enigmatic undifferentiated plains, noted for their blandness and low radar emissivity, radiometry, and bright ISS infrared response [8]. The emissivity of undifferentiated plains is consistent with a composition of of organic materials. Other plains units include streak-like plains, consistent with windblown deposits of icy materials and lineated plains which are interpreted as yardangs [9]. Variable featured plains make up the third largest unit on Titan; these have measured properties that are between hummocky/mountainous terrains and undifferentiated plains.

Dunes terrains: Most of the equatorial region is composed of vast areas of low backscatter, ISS-dark linear dunes, although some rare isolated patches of "reticulated" or transverse dunes also exist [10,11]. There are two areas of "reticulated" or transverse dunes in the Afekan Crater region. At mid-latitudes, featureless areas consistent with sheets or patches of sand without obvious dune morphology at 300 m/pixel are found. Many of the sand sheets are found in plains areas where mountains may focus deposition of sands into sheets. All dune areas have properties that are consistent with organic materials.

Interpreted geologic history. From superposition analysis, mountain and hummocky terrains are the oldest units on Titan, along with labyrinth terrains [2]. Undifferentiated plains are intermediate in age, with streak-like plains coming later. The youngest units are dunes units. Our interpreted history of the Afekan Crater region is of a fractured icy crust that has been subjected to aeolian deposition and burial by organic materials, with perhaps some uplift and fluvial erosion of the organic labyrinth terrains that have a sedimentary origin.

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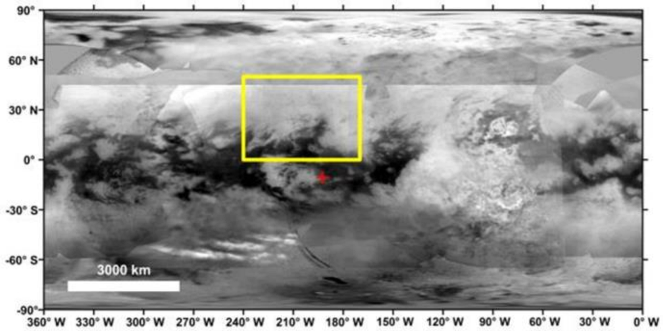

Fig. 1. Titan global ISS mosaic showing Afekan Crater region as a yellow square. The Huygens Landing site is indicated with a red cross

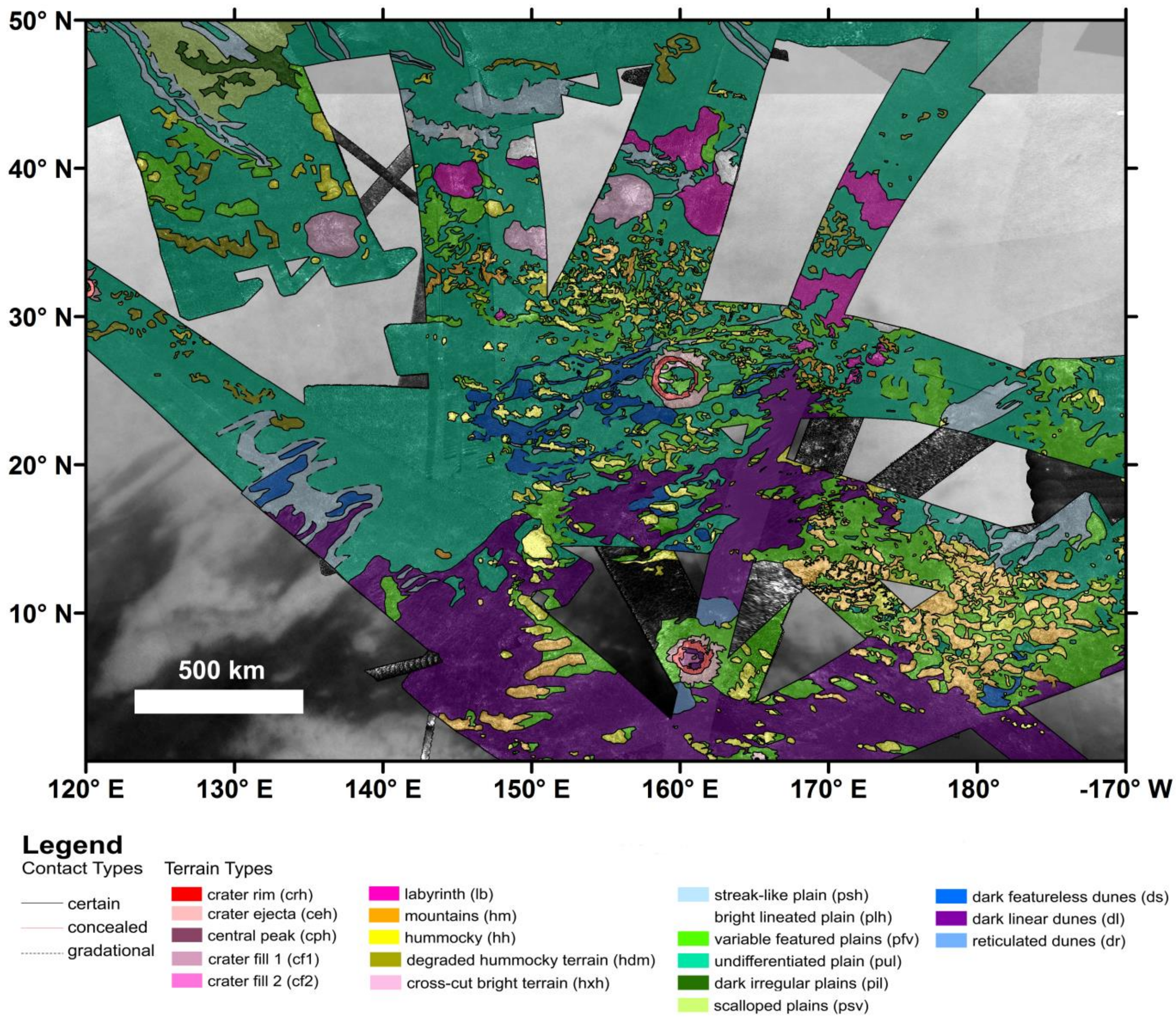

Fig. 2. Afekan Crater region geomorphologic map. Image is centered at Afekan Crater. To the S is Selk Crater.