GEOMORPHOLOGICAL MAPPING OF SPUTNIK PLANITIA AND ITS SURROUNDINGS, AND HOW IT IS SHAPED BY PLUTO INTERNAL AND EXTERNAL PROCESSES. J. Suárez[1], L. Ochoa[2], C. Delgado[3], F. Saavedra[4], 1National University of Colombia (jaesuarezva@unal.edu.co, Calle 45 Sur #72r-49, Bogotá, Colombia), [2,4], National University of Colombia, [3]Distrnital University Francisco José de Caldas.

Introduction: In this work we made a geomorphological analysis of LORRI data in the New Horizons flyby over Pluto, in order to understand the geological processes that have shaped his gelid crust and to make an observational evaluation of a convective model as the endogenic source of Sputnik Planitia (SP) geologic activity. Sputnik Planitia.

The first results of the flyby were analyzed by [1] and [2]; these authors made an initial division of Pluto observed hemisphere surface, they stablished differences between the dark area Cthulhu Regio (CR), his brighter counterpart Tombaugh Regio, containing SP, and other big scale features. Since this early interpretation was evident that SP is younger than its surroundings due to the lack of impact craters, and that this phenomenon may be related with the polygonal patterns dissecting SP. [3] Made a more detailed analysis of Sputnik Planitia, identifying and describing geological units across the plain. The global composition of Pluto has been known prior to the arrive of New Horizons, with its main components being CH_4, CO and N_2 [4]. But when the spacecraft arrive another major compound was discovered, H_2O spectral signature was encountered in big areas across Pluto surface [5].

SP origin is a primary topic in Pluto studies, [6] and [7] made numerical simulations of SP considering N_2:CH_4 mix rheology and viscosity, their results suggest that convection is achieved if the basin deep exceeds one kilometer and the basal temperature is 63 K [6]. In this work we analyze the surface geomorphology and processes interactions that could sustain or oppose this convective model from a geological point of view.

Data and methods: All the imagery data was downloaded from the Planetary Data System (PDS) in the small bodies noddle, mainly LORRI data consisting of panchromatic images of scaling resolutions. The 300 meters/pixel resolution DEM use in this work was created by the New Horizons team, published by the Johns Hopkins University Applied Physics Laboratory and obtained in the USGS webpage.

Results: With these images were defined and described six geological terrains based on their geomorphological properties. Sputnik Planitia was examined in more detail using the higher quality images, and within it were defined eighteen geomorphological units **(Figure 1)** that provided key information about the distribution and geometries of the various ices that compounds the plain; emphasizing on describing the polygonal features of the plain and the lineal geoforms that delimit them.

These maps, added to the morphometric information derived from the DEM allowed a better description of the blocks shapes that conforms the mountain ranges within Sputnik Planitia, and to estimate their height of over 3000 meters over the base level, comparable to the highest lands of Pluto.

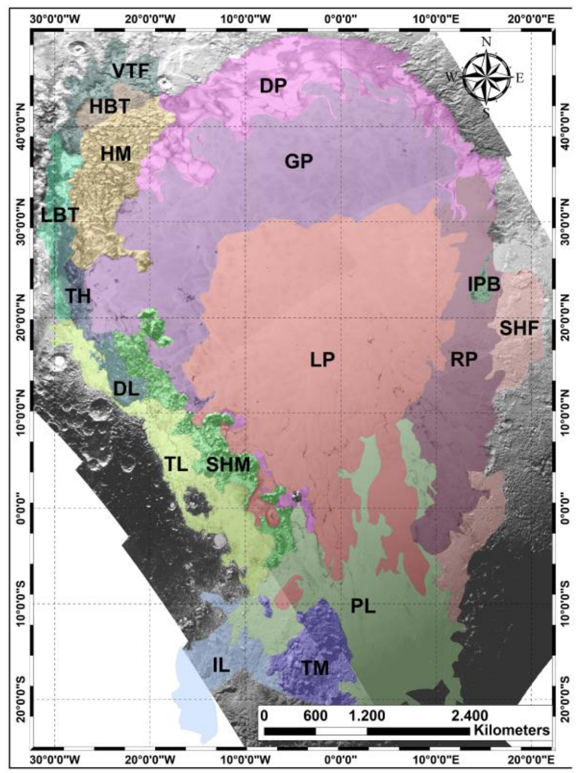

Figure 1: Geomorphological units of Sputnik Planitia.

Discussion: Analysis made in this work leads to the composition as the main controlling factor in Pluto geology and geomorphology, this is evidenced in surface by the rheologic properties of the materials and their response to the few geologic processes acting in Pluto. CR and SP mountain ranges blocks are dominated by H_2O compositions, in both cases morphologies are consistent and high, the three volatile substances of Pluto control the surface as they dominate over H_2O. CH_4 is the less volatile by difference, their structures support time and do not sublimate as quickly as N_2 (Moore et al., 2017), in SP dominates the last, which accounts for its low topography.

We made a correlation between the convective theory and the surface interpretation realized in this work. Surface expression of this process is related with cellular pattern, [8], [6] and [7] had proposed that the criomagma emanations occurs in the center of the cells and subdues in the ridges that defines cells limits, this interpretation lays in a measured decrease of 50 meters in altitude form the center to the border of the cell and a minor concentration of pits in cells center, suggesting younger ices in this position. We share the interpretation made by this authors about the convection configuration. We were not able to estimate an altitude gradient inside the cells with the available DEM, but the difference in sublimation pits concentration is clearly seen, added to this, SP morphology resembles Benard cells, a convective process of liquids with a plain surface that generates hexagonal and polygonal cells [9]. Although this interpretation is the most likely to happen, there are some problems regarding this theory, there is no evidence of cryovolcans inside SP cells, this could be due to a limitation of images spatial resolution, if this is the case the criomagmas sources should be smaller than 73 m wide, suggesting a fissure magmatism. The last concern is about subduction itself, this process has not been seen in the solar system outside Earth and Europa [10], in both cases subduction is related to brittle and solid crust, almost opposite to SP case. These topics should be asserted in the future in order to completely probe this theory.

Conclusion: Pluto shows a variety of surfaces that is not common in the outer solar system, the amount of terrains identified and how they interact is a reflection of an active and different geology, this proves that even under extreme cold conditions geologic processes are key in icy bodies surface evolution. Thanks to N_2 and CO volatile characteristics, sublimation is the main atmospheric process changing Pluto and represents an interesting method to stablish relative ages inside these terrains. Ices rheology also plays an important role, CR shows a different geology thanks to the presence of water ice, allowing the formation of vast mountain ranges and big fractures showing a distension process; in the other hand, plastic ices condition SP topography and its relation with other terrains.

Regarding internal processes, a convective system is acting under SP, driving N_2:CH_4:CO mixes and H_2O blocks to the surface and generating the complex cellular terrain unique of Pluto; this activity may be decreasing over time as seen in cells disappearance and sublimation pits development.

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