IDENTIFYING SHORELINE MORPHOLOGIES AND MAPPING OF SPUTNIK PLANITIA. C. J. Ahrens[1], [1]NASA Goddard Space Flight Center, Solar System Exploration Division, Greenbelt, MD (Caitlin.ahrens@nasa.gov).

Introduction: In this preliminary work, a geomorphological analysis of LORRI (Long Range Reconnaissance Imager) images from the New Horizons spacecraft at Pluto was made to identify and understand the different morphologies of shorelines across Sputnik Planitia. Identifying differences in the morphology of shorelines can relate to various exogenic and endogenic processes, such as nitrogen convection, valley network creation, sublimation, or glacial activity [1 – 5]. A geological map of Sputnik Planitia has been produced by [3/Scipioni], mapping 15 distinct geological units. However, this analysis only focused on the shoreline geology, noting additional geologic structures. The main composition of Sputnik Planitia is a "cold trap" of nitrogen and carbon monoxide [6], with water ice and methane on the mainland surrounding the shorelines. These various processes that could potentially influence the geological evolution of the surface at Pluto and some with latitudinal dependence (based on Pluto's obliquity; up to 126 degrees over a period of ~ 3 million years) [7], can also provide insight into structural differences (on a material aspect) across each of these shoreline regions.

Methods: LORRI images at the close-encounter hemisphere of Pluto (~300 m/pixel) resolution images and Digital Terrain Models (DTMs) were obtained using the Java Mission-planning Analysis Remote (JMARS) program.

Results:

Region 1: Krun Macula is found on the southeastern shores of Sputnik Planitia (Figure 1A). The shores at Krun Macula consist of more dark materials (presumably tholin organics) more inland with large complexes of deep pits [1, 4, 8], with elevated shores going inward to Sputnik Planitia basin. The darker Krun Macula region has large, rough surfaces, then transitions to a lighter-albedo shoreline. This transition from Krun Macula to the shoreline is averaged at ~ 558.2 m, with elevation changes from the shoreline to Sputnik Planitia at 939.8 m. Interestingly, this region has three distinct stepwise regions going westward into Sputnik Planitia.

Region 2: Bright Uplands is located just north of Krun Macula (Figure 1B). The Bright Uplands consists of very rough high-albedo uplands with convecting nitrogen flowing into Sputnik Planitia. Nitrogen ice is observed to accumulate in small ponds within depressions [1]. The elevation change is estimated ~3345 m. This is observed to have the largest elevation difference compared to the other shoreline regions reported here.

Region 3: Southwestern Hayabusa Terra (Figure 1C) has numerous large and shallow sublimation pitting and dendritic trough shorelines cutting into Sputnik Planitia [4]. There are also small pieces of exposed upland material surrounded by glacial ice, also called nunataks [1, 2, 5]. The elevation difference is on average ~1866.1 m.

Region 4: Northern Sputnik Planitia (Figure 1D) does not show observable dendritic patterns, mountainous or glacial terrains or different-albedo shorelines. This area does have very small sinuous channels. The difference in elevation, however, is ~ 1239.6 m.

Region 5: The Al-Idrisi region (Figure 1E) consist of large, chaotic blocky mountainous terrains [9]. These chaotic blocks are hypothesized to be floating nitrogen and water ice blocks. These have also been observed to have lobate debris aprons [10], or rather mass wasting processes into Sputnik Planitia. Larger convection cells within Sputnik Planitia are also found near this region [3]. The elevation between the chaos mountain shoreline and the basin is ~1027 m.

Region 6: Moving south of the Al-Idrisi mountains is the Hillary region (Figure 1F). These also consist of similarly chaotic blocks of ice like Al-Idrisi but are not connected to the mainland and instead flowing near methane slurry material [11]. Measuring the slurry area to the Sputnik Planitia basin had an elevation change of ~318.6 m.

Region 7: The final shoreline region on Sputnik Planitia is the Tenzig region (Figure 1G). This area has large, pointed glacial mountains, with smaller, knobby-textured shores outlining the base of the glaciers. This knob-like shoreline and Sputnik Planitia have an elevation difference of ~153 m, the shortest elevation change compared to the other shoreline regions stated here.

Conclusions: Sputnik Planitia consist of various morphologies. Each shoreline throughout this large impact basin has distinct geology and elevation differences. This work will further our understanding in Plutonian geology and how the effects of subsurface convection, glacial processes, and sublimation can all influence the evolution of these regions. The compositions across Sputnik Planitia, such as nitrogen and carbon monoxide, and their latitudinal dependence (based on Pluto's obliquity) can also provide interesting insight on the structural differences of these shorelines.

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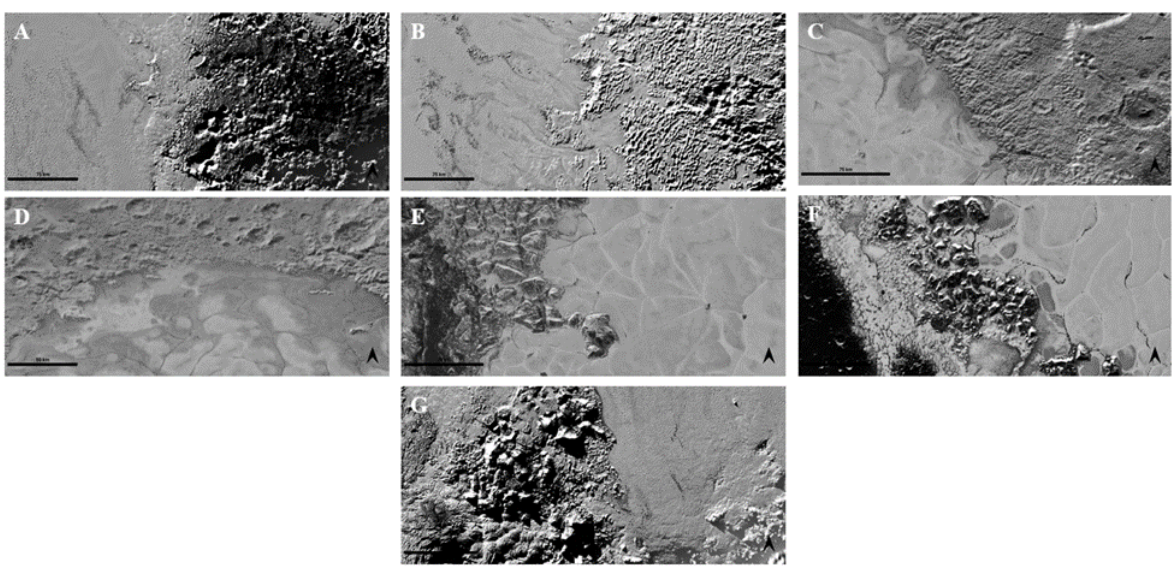

Figure 1: Different shoreline morphologies identified. A) Krun Macula; B) Bright Uplands; C) Hayabsua; D) Northern Sputnik Planitia; E) Al-Idrisi; F) Hillary; G) Tenzig. Arrows point north.