The Geology of the Pluto System

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ABSTRACT:

NASA's New Horizons mission acquired a large set of images and other data making possible thorough geological analysis of landscapes in the Pluto System. Pluto and Charon exhibit strikingly different surface appearances, despite their similar densities and presumed bulk compositions. Systematic investigation, modelling and mapping revealed that much of Pluto's surface is attributed to surface-atmosphere interactions and the mobilization of volatile ices by insolation. Many mapped valley systems appear to be the consequence of glaciation involving nitrogen ice. Other geological activity requires or required long periods of internal heating, such as Pluto's extensive tectonic fabric. The convection and advection of volatile ices in Sputnik Planitia are thought to be powered by present-day radiogenic heat loss. The prominent mountains at the western margin of Sputnik Planitia, and the strange, multi-km-high mound features to the south, probably composed of H_2O, are young geologically as inferred by light cratering and superposition relationships. These multi-km-high mound features might be cryo-volcanoes. Their origin, and what drove their formation so late in Solar System history, is under investigation. East of Sputnik Planitia are large fields of aligned ranks of sharp-crested ridges found only at high altitude that are apparently composed of massive deposits of CH_4 ice, referred to as Bladed Terrain. New Horizons found evidence that Bladed Terrain may cover much of Pluto's low latitudes and may have originally formed there as a consequence of Pluto's very high obliquity. Currently Bladed Terrain is undergoing net erosion. This observation, along with evidence for formally more extensive nitrogen glaciation implies that Pluto undergoes significant climate evolution. The dynamic remolding of landscapes by volatile transport seen on Pluto is not unambiguously evident in the mapping of Charon. Charon does, however, display a large resurfaced plain and globally engirdling extensional tectonic network attesting to its early endogenic vigor.