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Geology Before Pluto: Pre-encounter Considerations

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Pluto, its large satellite Charon, and its four small known satellites represent the first trans-Neptunian Kuiper Belt objects populating the outer-most solar system beyond the gas giant planets to be studied in detail from a spacecraft (New Horizons). A complete picture of the solar nebula and solar system formation cannot be confidently formulated until representatives of this group of bodies at the edge of solar space have been examined. The Pluto system is composed of unique, lunar- and intermediate-sized objects that can tell us much about how objects with volatile icy compositions evolve. Modeling of the interior suggests that geologic activity may have been significant to some degree, and observations of frost on the surface could imply the need for a geologic reservoir for the replenishment of these phases. However, these putative indicators of Pluto's geologic history are inconclusive and unspecific. Detailed examination of Pluto's geologic record is the only plausible means of bridging the gap between theory and observation. In this talk I will examine the potential importance of these tentative indications of geologic activity and how specific spacecraft observations have been designed and used to constrain the Pluto system's geologic history. The cameras of New Horizons will provide robust data sets that should be immanently amenable to geological analysis of the Pluto System's landscapes. In this talk, we begin with a brief discussion of the planned observations by the New Horizons cameras that will bear most directly on geological interpretability. Then I will broadly review major geological processes that could potentially operate on the surfaces of Pluto and its moons. I will first survey exogenic processes (i.e. those for which energy for surface modification is supplied externally to the planetary surface): impact cratering, sedimentary processes (including volatile migration), and the work of wind. I will conclude with an assessment of the prospects for endogenic activity in the form of tectonics and cryo-volcanism.