Bladed Terrain on Pluto: Possible Origins and Evolutions

Jeffrey M Moore[1], Alan D Howard[2], Orkan M Umurhan[3], Oliver L White[1], Paul Schenk[4], Ross A Beyer[1], William B McKinnon[5], John R Spencer[6], Kelsi N Singer[6], William M Grundy[7], Francis Nimmo[8], Leslie Ann Young[6], Alan Stern[9], Harold A Weaver Jr[10], Catherine Olkin[6], Kimberly Ennico Smith[1] and Geoffrey C Collins[11], (1)NASA Ames Research Center, Moffett Field, CA, United States, (2)University of Virginia, Charlottesville, VA, United States, (3)SETI Institute Mountain View, Mountain View, CA, United States, (4)Lunar and Planetary Institute, Houston, TX, United States, (5)Washington University in St Louis, St. Louis, MO, United States, (6)Southwest Research Institute Boulder, Boulder, CO, United States, (7)Lowell Observatory, Flagstaff, AZ, United States, (8)University of California-Santa Cruz, Department of Earth and Planetary Sciences, Santa Cruz, CA, United States, (9)Southwest Research Institute, Boulder, CO, United States, (10)Johns Hopkins University Applied Physics Laboratory, Laurel, MD, United States, (11)Wheaton College, Norton, MA, United States

Abstract Text:

Pluto's Bladed Terrain (centered roughly 20°N, 225°E) covers the flanks and crests of the informally named Tartarus Dorsa with numerous roughly aligned blade-like ridges oriented ~North-South; it may also stretch considerably farther east onto the non-close approach hemisphere but that inference is tentative. Individual ridges are typically several hundred meters high, and are spaced 5 to 10 km crest to crest, separated by V-shaped valleys. Many ridges merge at acute angles to form Y-shape junctions in plan view. The principle composition of the blades themselves we suspect is methane or a methane-rich mixture. (Methane is spectroscopically strongly observed on the optical surfaces of blades.) Nitrogen ice is very probably too soft to support their topography. Cemented mixtures of volatile and non-volatile ices may also provide a degradable but relief supporting "bedrock" for the blades, perhaps analogous to Callisto. Currently we are considering several hypotheses for the origins of the deposit from which Bladed Terrain has evolved, including aeolian disposition, atmospheric condensation, updoming and exhumation, volcanic intrusions or extrusions, crystal growth, among others. We are reviewing several processes as candidate creators or sculptors of the blades. Perhaps they are primary depositional patterns such as dunes, or differential condensation patterns (like on Callisto), or fissure extrusions. Or alternatively perhaps they are the consequence of differential erosion (such as sublimation erosion widening and deepening along cracks), variations in substrate properties, mass wasting into the subsurface, or sculpted by a combination of directional winds and solar isolation orientation. We will consider the roles of the long-term increasing solar flux and short periods of warm thick atmospheres. Hypotheses will be ordered based on observational constrains and modeling to be presented at the conference.

Topic Selection: Geophysics of Satellites and Small Bodies

Submitter's E-mail Address: jeff.moore@nasa.gov
Abstract Title: Bladed Terrain on Pluto: Possible Origins and Evolutions
Requested Presentation Type: Assigned by Program Committee (oral, panel, poster, or lightning poster talk)
Previously Published?: No
AGU On-Demand: Yes
Abstract Payment: Paid [redacted]

I do not want to be involved in OSPA or the Mentoring program.

Scientific Team: The New Horizons Science Team

First Presenting Author

Presenting Author

Jeffrey M Moore

Primary Email: jeff.moore@nasa.gov
Phone: 6506045529

Affiliation(s):

NASA Ames Research Center
Moffett Field CA (United States)

Second Author

Alan D Howard

Primary Email: ah6p@virginia.edu
Phone: 4349240563

Affiliation(s):

University of Virginia
Charlottesville VA 22903 (United States)

Third Author

Orkan M Umurhan

Primary Email: orkan.umurhan@gmail.com

Affiliation(s):

SETI Institute Mountain View
Mountain View CA (United States)

Fourth Author

Oliver L White

Primary Email: oliver.l.white@nasa.gov
Phone: 650-604-0787

Affiliation(s):

NASA Ames Research Center
Moffett Field CA (United States)

Fifth Author

Paul Schenk

Primary Email: schenk@lpi.usra.edu

Affiliation(s):

Lunar and Planetary Institute
Houston TX (United States)

Sixth Author

Ross A Beyer

Primary Email: Ross.A.Beyer@nasa.gov
Phone: 6506040324

Affiliation(s):

NASA Ames Research Center