

THE MASS BALANCE OF STRATIGRAPHIC ANOMALIES IN THE MARTIAN NORTH POLAR LAYERED DEPOSITS. A. V. Pathare¹ and F. C. Chuang¹. ¹Planetary Science Institute (1700 E. Ft Lowell, Suite 106, Tucson AZ 85719; pathare@psi.edu).

Introduction: We have identified the widespread presence of stratigraphic anomalies throughout the North Polar Layered Deposits (NPLD). Fig. 1 shows the results of our recently completed survey of the ~150 largest NPLD troughs [1]. Approximately 46% of these troughs exhibit either poleward-facing (PWF) layered terrain or equatorward-facing (EWF) banded terrain, both of which are incompatible with the standard model of NPLD stratigraphy [1]. We concluded that these anomalies preserve the slope-dependent mass balance pattern that prevailed prior to the deformation of internal ridges within these troughs [1], which would mean that there has been little ablation or accumulation within the NPLD since the formation of these anomalous PWF Layers and EWF Bands. Such quiescence is consistent with Langevin et al. [2], who found that net deposition of H₂O is inconsistent with early summer OMEGA observations of the NPLD.

Mass Balance: We will more precisely constrain the NPLD mass balance by incorporating CRISM spectral observations of surface water ice and atmospheric water vapor into our NPLD sublimation model [3], focusing on targeted CRISM observations of the NPLD taken in conjunction with HiRISE. Fig. 2 shows an example of coordinated CRISM and HiRISE observations taken at L_s 138° of a North PLD trough centered at 86.5°N and 80°E. The false-color image (top) is a map-projected high resolution infrared browse product (“ir_ice”) derived from CRISM hyperspectral targeted data that has been corrected for atmospheric and photometric effects [4]. The red channel is obtained from the 1900-nm band depth summary product BD1900, which is an indicator of water ice on the surface; the green channel is derived from the summary product BD1500, higher values of which indicate greater content or larger particle size of water ice frost; and the blue channel produced from BD1435 corresponds to the presence of carbon dioxide ice [4]. The overall greenish tinge indicates that late summer recondensation of H₂O frost has begun across most of this trough (Fig. 2). We will utilize such coordinated CRISM + HiRISE observations to better inform our modeling of the present-day localized mass balance (i.e., accumulation and ablation rates) in the vicinity of stratigraphic anomalies in the NPLD (Fig. 1).

References: [1] Pathare A. V. et al. (2008) *LPSC XXXIX*, Abs # 2315. [2] Langevin Y. et al. (2005) *Science*, 307, 1581-1584. [3] Pathare A. V. and D. A. Paige (2005) *Icarus*, 174, 419-443. [4] Pelkey S. M. et al. (2007), *JGR*, 112, E08S14.

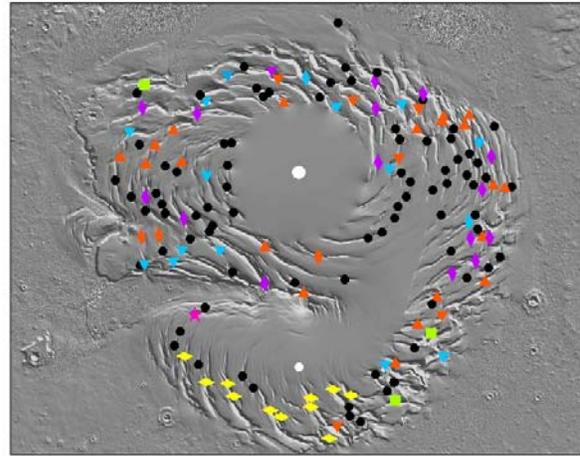


Figure 1: NPLD Trough Survey. Black and green symbols indicate no observed stratigraphic anomalies. Red, blue, and purple symbols represent exposures of PWF Layers (up arrows) and/or EWF Bands (down arrows). Yellow symbols connote anomalous stratigraphy in E-W trending troughs.

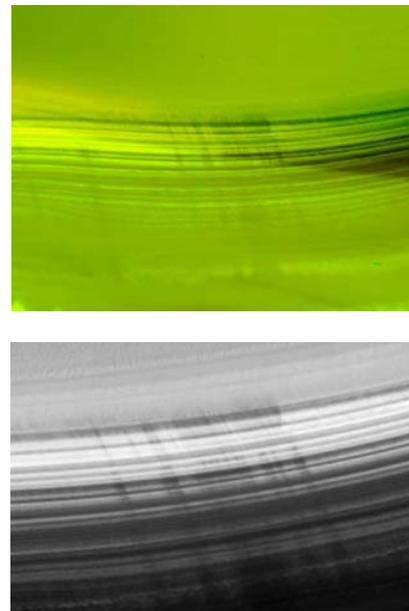


Figure 2: MRO Coordinated Observations of North PLD Trough centered at 86.5 N and 80 E. (a) Top: Detail of CRISM Infrared (IR) browse product FRT00003127_07_IF168L_ICE1.png: see text for channel information. (b) Bottom: Detail of HiRISE image PSP_001488_2665 focused on center of trough. North is to the top of both figures.