UNCONFORMITIES REVEALED BY MRO CONTEXT IMAGES IN THE POLAR LAYERED DEPOSITS OF PLANUM BOREUM, MARS. C. M. Fortezzo[1,2] and K. L. Tanaka[1], [1]Astrogeology Team, U.S. Geological Survey, Flagstaff, AZ, cfortezzo@usgs.gov, [2]Geology Department, Northern Arizona University, Flagstaff, AZ.

Introduction: We are mapping unconformities in the exposed polar layered deposits (PLD) of Planum Boreum in order to detail gaps in the stratigraphic record due to non-deposition and/or erosion. Unconformities are typically identified by angular truncations of older beds at the contact with younger stratigraphy. Parallel unconformities, also termed disconformities, also exist, but are more difficult to discern through remote sensing techniques. In this study, disconformities are inferred where they connect two or more angular truncations.

Detailed identification of layer truncations is possible by using an MRO Context (CTX) image mosaic (6.23 m/pixel) that covers ~65% coverage of the current study area (**Fig, 1**). Mapping began within the troughs of Gemina Lingula (termed Gemini Scopuli, ~330°E) and is progressing east around the polar plateau. Currently, we have delineated and described the unconformities as far east as western Borealis Scopuli.

Stratigraphy: The troughs within the study area expose four previously-defined stratigraphic units [1], described below from oldest to youngest. The Planum Boreum 1 (PB1, mostly equivalent to the informal "lower layered deposits") unit formed during the Middle to Late Amazonian and consists of variably thick, horizontally extensive layers with moderate ice content. The Planum Boreum 2 (PB2) unit formed during the Late Amazonian and consists of meters to tens of meters thick layers and discontinuous lenses of low-albedo, sand-sized material. The PB2 unit is not everywhere present within the troughs of the current study area. The Planum Boreum 3 (PB3, ~"upper layered deposits) unit formed in the Late Amazonian (<5 Ma; [1]) and consists of horizontally extensive, decameter-thick layers interpreted to contain a higher ratio of ice to dust than the PB1 unit [1]. The Planum Boreum 4 unit is the decimeters thick, high-albedo residual ice cap.

Preliminary Results: Thus far, we have identified 98 unconformities and have categorized them based on relative stratigraphic position (**Fig. 2**). Thirty-five of the unconformities are located within the PB1 unit, and another 19 unconformities are located within the PB3 units. The remaining 44 demarcate the contact between the PB1 and PB3 units (hereafter referred to as the "Olympia Hiatus unconformity" [2]) and are sometimes accompanied by the PB2 unit. Previous unconformity mapping using MOC data revealed only 36 unconformities [3] within the current study area.

The unconformities within PB1 increase in frequency near the margin of the plateau where troughs generally have more relief, thus exposing a larger section of the PLD. These unconformities typically have angular truncations, with variable lengths and are often only traceable for short distances (0.7 - 29.8 km, mean = 10.2 km, σ = 8.4 km). The unconformities within PB3 have variable lengths (2.0 km – 33.5 km, mean = 11.9 km, σ = 7.2 km) and sometimes are manifested as complex stacked unconformities.

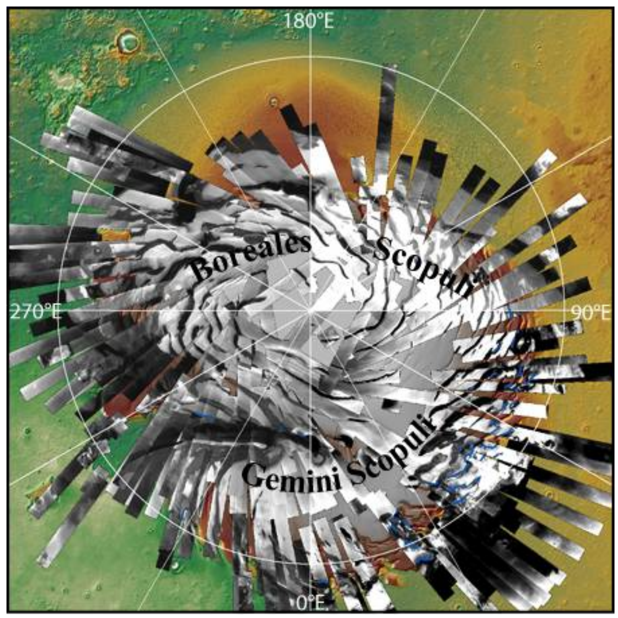

Figure 1: Color-coded MOLA shaded relief (128ppd) overlain by a CTX mosaic (6.23 m/pixel) of Planum Boreum. The blue lines (lower left quadrant) represent the 98 unconformities mapped thus far. Troughs in northern Gemini Scopuli where no unconformities are mapped do not contain angular unconformities, but it is possible that disconformities are present within the layers.

The Olympia Hiatus unconformity, which marks the boundary between PB1 and PB2/PB3, is traceable for long distances (~4 km – 53 km, mean = ~18 km, σ = ~3 km), and in some cases is observed in multiple troughs. This set of unconformities includes distinct angular truncations of the underlying bedding. Commonly, the boundaries between the PB1 and PB3 units are so distinct that we infer that they are disconformities. The PB2 unit is sometimes visible within the currently examined troughs. In some occurrences, low albedo layers and discontinuous lenses are apparent along this boundary. In some locations along these unconformities, incipient depressions exist in the PB3 unit (**Fig. 3**) with no excavation into the PB1 unit. Along this unconformity there is a lower albedo layer (interpreted as the PB2 unit), which appears to be the unit at which these depressions are based. This appears similar to, albeit smaller scale, the effect of the cavi units of Planum Boreum.

Discussion: These preliminary results suggest that non-deposition or erosion episodically occurred during the formation of both the PB1 and PB3 units. The higher recognized frequency of unconformities at the PB1/PB3 contact, including within adjacent troughs and scarps, support our contention of a widespread Olympia Hiatus unconformity. This feature suggests an extensive period of regional erosion and perhaps local sites of non-deposition.

Future Work: We will complete the unconformity mapping using available and future releases of CTX data. At the completion of mapping, we will use the unconformities to build a triangular irregular network (TIN) to view the unconformities in 3-dimensional space. The TIN will be used, in conjunction with Mars Shallow Subsurface Radar (SHARAD) and Mars Advanced Radar for Subsurface and Ionsphere Sounding (MARSIS) data, to determine whether extensive to regional unconformities are mappable on Planum Boreum, including the Olympia Hiatus unconformity. Also, these 3-D datasets will help us to better understand the buried surface topography, and possible the erosional history, of the PB1 unit.

References: [1] Tanaka, et al., 2008. *Icarus*, doi :10.1016/j.icarus.2008.01.021. [2] Tanaka, et al., 2009, *LPSC XL*, this volume. [3] Fortezzo and Tanaka, 2006, *LPSC XXXVII*, abs. 2277.

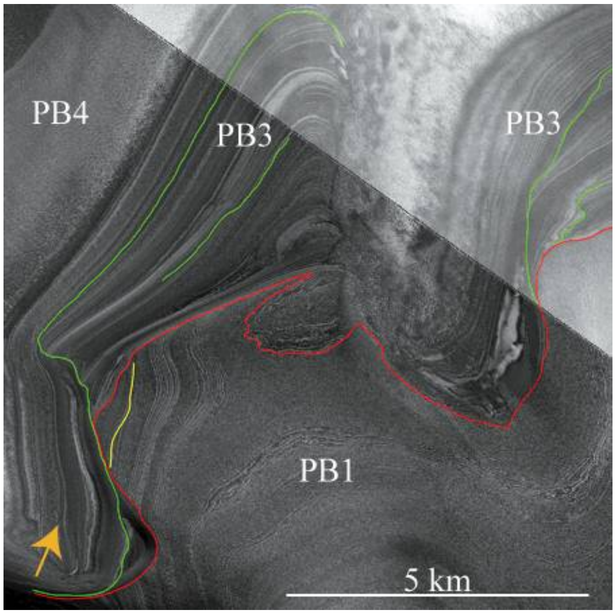

Figure 2: CTX mosaic (6.23 m/pixel) showing multiple unconformities (centered at 81ºN, 32.2ºE) within the Planum Boreum 1 (PB1) and Planum Boreum 3 (PB3) units, and overlain by the residual ice cap (PB4). Colored lines indicate the location of unconformities within PB1 (yellow) and PB3 (green), and the PB1/PB3 Olympia Hiatus unconformity (red). Orange arrow indicates the illumination direction.

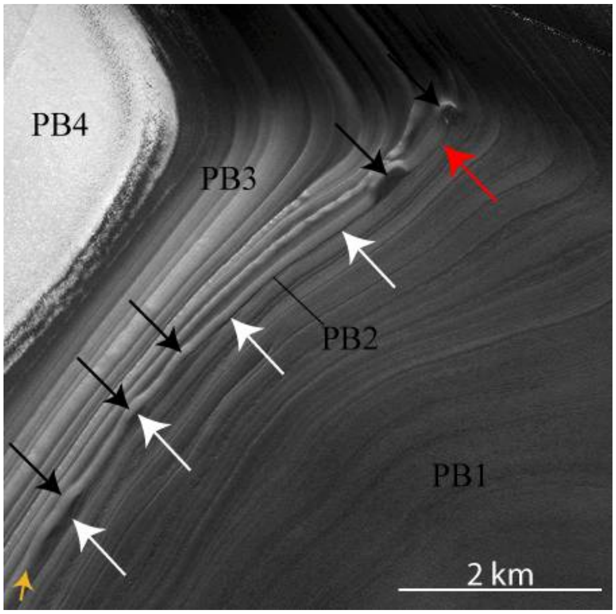

Figure 3: CTX mosaic (6.23 m/pixel) showing the Olympia Hiatus unconformity and the PB1, PB2 and PB3 units (centered at 81.25ºN, 45.5ºE). The black arrows point to small depressions eroded into the PB3 layer. The white arrows indicate the thin, low albedo materials of the PB2 unit and the Olympia Hiatus unconformity. The red arrow delineates the location of the angular truncation of the underlying PB1 unit. The unconformity continues along the PB2 unit for ~27 km.