

Internal Structure of the North Polar Layered Deposits on Mars From SHARAD Observations

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The Shallow Radar (SHARAD) instrument onboard the Mars Reconnaissance Orbiter is revealing detailed layering patterns within the North Polar Layered Deposits (NPLD) in Planum Boreum. Since the beginning of its primary science mission in November of 2006, SHARAD has acquired over 400 subsurface sounding observations (radargrams) that cross the NPLD. Each radargram consists of a two-dimensional profile beneath the instrument's ground track and shows a series of returns corresponding to dielectric contrasts in the subsurface to depths of 2 to 3 km. We have imported a subset of these data together with associated location information into an interactive subsurface data interpretation software package, thereby allowing us to delineate and map horizons and faults within the NPLD in three dimensions. Our initial results show: 1) several discrete units of sub-parallel reflections separated by regional unconformities and situated above a diffusely reflective zone (DRZ) that extends throughout the main lobe of the NPLD and appears to correspond to a previously identified Basal Unit (Byrne and Murray 2002, JGR 107 E6, 5044); 2) apparent large-scale faulting or imbrication of the DRZ in portions of the main lobe to the east of Chasma Boreale; 3) the absence of the distinct basal reflections beneath the main lobe and Olympia Planum that have been identified in MARSIS results (Picardi et al. 2005, Science 310, #5756, pp. 1925-1928; Phillips et al. 2007, LPSC XXXVIII, Abstract 1925); and 4) shallow subsurface layering in portions of Olympia Planum that are proximal to the main lobe. These findings have significant implications for the history of accumulation and erosion of the NPLD, which may provide a record of the global climate history for much of the Amazonian epoch. Efforts to correlate the internal units unveiled by SHARAD with those mapped on the basis of images and other surface data are in progress.

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