

New evidence for exposed water ice in micro-cold traps and four large craters at the north polar region of Mercury

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Abstract. The Mercury Laser Altimeter (MLA) measured surface reflectance, r_s , at 1064 nm at zero phase angle over the northern hemisphere¹. On Mercury, most water-ice deposits have anomalously low r_s values indicative of an insulating layer of low-reflectance materials beneath which the water ice is buried¹. Previous detections of surficial water ice were limited to the 112-km Prokofiev crater (85.8°N, 62.9°E)^{1,2}. Here we map r_s and density of energy returns in four additional permanently shadowed craters that host extensive radar-bright deposits³. Each crater has a mean r_s value > 0.3 , suggesting that water ice is exposed at the surface. Thus there is a suite of five large craters that hosts exposed water ice at Mercury's north pole. Furthermore, we identify micro-cold traps (< 5 km) where $r_s > 0.3$ and permanent shadows have biannual maximum surface temperatures < 100 K (Fig. 1). We suggest that a substantial amount of Mercury's water ice is not confined to large craters, but exists within micro-cold traps as well, within rough patches and inter-crater terrain.

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