CRATERS HOSTING RADAR-BRIGHT DEPOSITS IN MERCURY'S POLAR REGIONS. Nancy L. Chabot[1], Carolyn M. Ernst[1], John K. Harmon[2], Scott L. Murchie[1], Sean C. Solomon[3], David T. Blewett[1], Brett W. Denevi[1], [1]Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Rd., Laurel, MD, 20723, USA, Nancy.Chabot@JHUAPL.edu; [2]National Astronomy and Ionosphere Center, Arecibo Observatory, HC3 Box 53995, Arecibo, PR, 00612, USA; [3]Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DC, 20015, USA.

Two decades ago, Earth-based radar observations led to the discovery of radar-bright features near Mercury's poles that were hypothesized to be water ice trapped in cold, permanently shadowed locations [1-3]. Subsequent observations resolved numerous radar-bright features scattered near both poles. However, many radar-bright features could not be mapped to craters or other geologic features because spacecraft images of the polar regions were limited to those obtained during Mariner 10 flybys. In March 2011, MESSENGER became the first spacecraft to orbit Mercury and began to return data for the entire planet.

One of the early campaigns of the Mercury Dual Imaging System (MDIS) [4] was to image the south polar region repeatedly. Results of that campaign indicate that all radar-bright features near Mercury's south pole are located in areas of permanent shadow (Fig. 1) [4]. MESSENGER's highly eccentric orbit (minimum altitude is ~200 km in the north, and maximum altitude is ~15,200 km in the south) does not allow a similar imaging campaign for Mercury's north polar region. However, the lower altitude permits higher-resolution observations by MDIS that are not possible in the south. Examination of 6,566 wide-angle camera (WAC) images from MESSENGER's one-year primary mission shows that all radar-bright features near Mercury's north pole are confined to shadowed areas in images to date (Fig. 2) [5].

The identification of shadowed craters hosting Mercury's radar-bright deposits is consistent with the water-ice hypothesis. However, comparison of the newly identified host craters to previous thermal modeling results [6] indicates that a thin layer of insulation is required for the radar-bright material in many craters to be water ice and that low-latitude (<75°) and small (<10 km in diameter) craters that host radar-bright deposits provide challenging thermal environments for long-lived water ice.

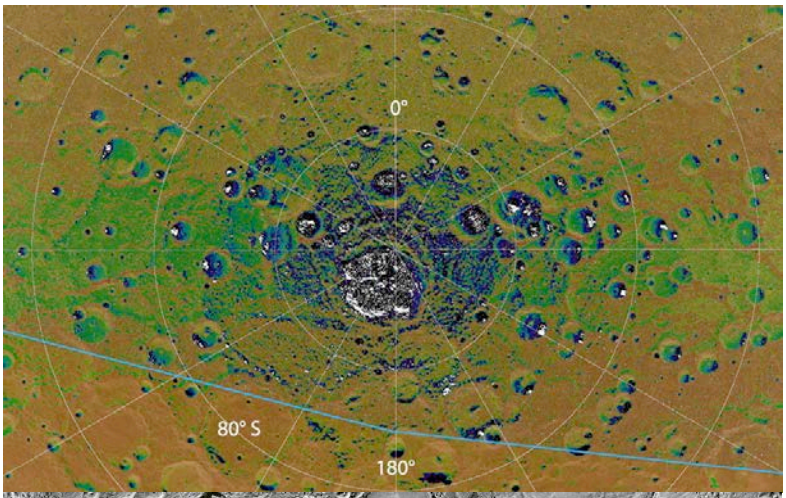

Figure 1. (Top) Mercury's south polar region. Highest-resolution radar image (white) [7] over illumination map [4].

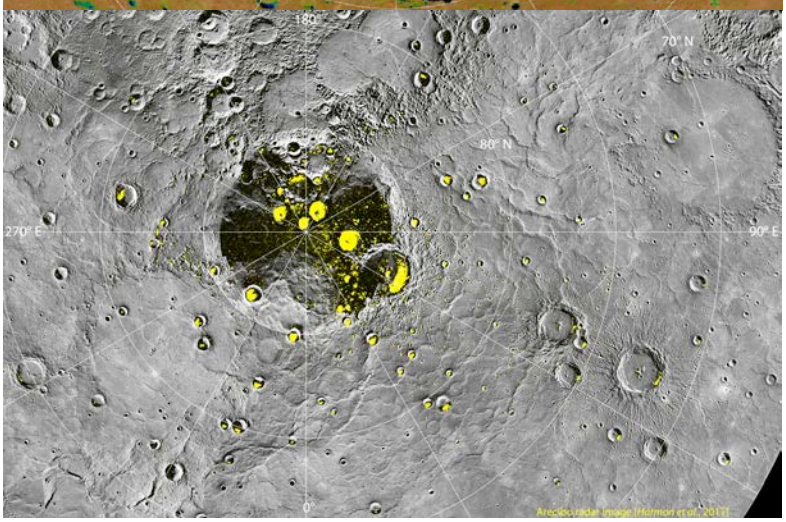

Figure 2. (Bottom) Mercury's north polar region. Highest-resolution radar image (yellow) [7] over MDIS base map.

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