VOL. 99 • NO. 7 • JULY 2018

EOS

Earth & Space Science News

Geochemistry Gives Clues to Gold Treasure's Origins

Welcoming Women into the Geosciences

The Seismic Reach of Injection Wells

WHAT IS THE FATE OF

ARCTIC METHANE?

AGU 100

ADVANCING EARTH AND SPACE SCIENCE

Evidence of Extensive Ice Deposits near Mercury's South Pole

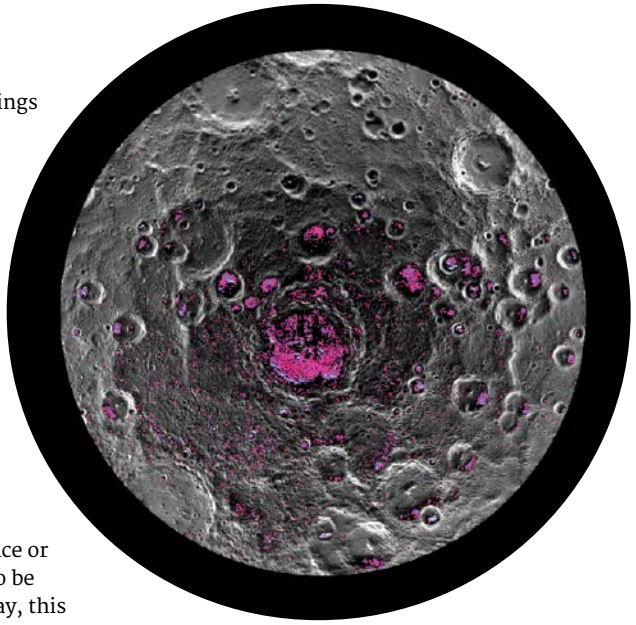
Earth-based radar and observations of Mercury by the Mercury Surface, Space Environment, Geochemistry, and Ranging (MESSENGER) spacecraft have revealed numerous, highly reflective "radar-bright" deposits near both of the planet's poles. Because of their correlation with permanently shadowed, low-temperature regions as well as distinctive characteristics associated with ice on other celestial bodies, these deposits have been interpreted as water ice deposits. However, imaging of the south pole has been limited and of lower fidelity than that of the north polar region, so comparisons between the two have not been possible—until now.

Chabot et al. present new radar observations of Mercury's south pole that significantly expand this coverage and, in combination with new solar illumination maps, allow the team to contrast the extent of radar-bright deposits and permanently shaded regions at both poles. By combining high-resolution data acquired at Arecibo in 2012 with previous radar observations, the researchers calculated that 4.4% of the area between 80°S and 90°S is radar bright—about twice the amount previously mapped in Mercury's north polar region.

The team also used standard and long-exposure camera images acquired by MESSENGER to estimate that 5.7% of Mercury's south polar region is permanently shadowed, roughly 50% more than the same area encircling the north pole. These findings are consistent with the southern region's older, more heavily cratered terrain, whose topography creates more permanently shaded areas with temperatures that are potentially low enough to harbor ice.

Although the researchers found that the radar-bright regions are consistently located in permanently shaded areas, they also discovered that nearly half of these nonilluminated regions do not contain radar-bright deposits. This discrepancy, they argue, could be because the shaded areas lack water ice or because the ice is too deeply buried to be detected in those locations. Either way, this uneven distribution implies that the polar water ice was not delivered by a steady source—like planetary outgassing or solar wind generation—but rather by an episodic event, such as a large comet impact.

These results support the observation that Mercury's south pole has a substantially higher volume of frozen water ice and other volatiles than Mercury's north pole and provide strong new evidence for a recent impact event as the source. In addition to offering exciting new evidence regarding the source of Mercury's ice deposits, these findings also provide additional resources to guide further exploration of the innermost planet's ice deposits by the upcoming BepiColombo mission, which is scheduled to launch in October. (*Journal of Geophysical Research: Planets*, https://doi.org/10.1002/2017JE005500, 2018) **—Terri Cook, Freelance Writer**



Mercury's south pole to 80°S, with an Arecibo radar image in pink indicating locations of water ice. Credit: Nancy Chabot