



MARSIS subsurface sounding observations of the south polar layered deposits of Mars

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The Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) on the Mars Express orbiter obtained data over the North Polar Layered Deposits (NPLD) and found that they were easily penetrated to their base by the radar signal, and that the deposits must be nearly pure ice. In addition, there was no evidence for deflection of the lower contact of the NPLD with the substrate, implying a thick elastic lithosphere beneath that sector of the NPLD. Here we report on new MARSIS

observations of the South Polar Layered Deposits (SPLD). The radar echoes from the surface of the SPLD are typically comparable in strength or weaker than those from surrounding smooth Mars surfaces. The signals clearly penetrate deep into the deposits at all frequency bands. In most cases, a strong reflection is seen at a time delay consistent with the expected depth of the contact of the SPLD materials with the substrate, as observed on the NPLD. Over the highest elevation SPLD surfaces, near 0° longitude, the estimated depth to the lower interface is about 3 km. In some areas, the lower interface is not clearly detected. Multiple internal interfaces are common. These can be quite continuous, over several 100 km in many cases. Some internal interfaces are substantially brighter than others, and some differences are seen in the apparent internal structure at different MARSIS frequencies. Certain regions observed multiple times consistently show a strong local brightening of the echo from the lower interface. Many areas show a gradual, rather than abrupt, decline in echo strength at time delays beyond the lower interface. Thin layered units off the main SPLD are also penetrated by MARSIS, with a second interface detected at their lower boundaries.