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Basin infills at Ma'adim Vallis as seen by MARSIS subsurface sounding radar

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MARSIS is a multi-frequency synthetic aperture orbital sounding radar on board ESA's Mars Express spacecraft. In its subsurface modes, MARSIS operates at four frequency bands between 1.3 and 5.5 MHz, with a 1 MHz instantaneous bandwidth that provides free space range resolution of approximately 150 m. Lateral spatial resolution for the cross-track footprint is 10-30 km, and for the along-track footprint, narrowed by on-board synthetic aperture processing, 5-10 km.

Recent data acquired by MARSIS over Terra Cimmeria, southwest of Ma'adim Vallis and south of Zephyria Tholus and Apollinaris Tholus, have revealed a subsurface interface which runs a few hundred meters below the surface for several hundred kilometers, then dives to depths of more than two kilometers for several tens of kilometers along the ground track of the spacecraft, before finally returning close to the surface. This gives the appearance of a basin structure that is located in the southernmost sec-

tion of Ma'adim Vallis where an evident structural control constrains the valley's path.

The strong subsurface reflection observed even for large depths implies either that the basin is filled with weak loose medium, or that a strong dielectric contrast exists between the infilling material and the material at the bottom of the basin. Quantitative determination of the dielectric properties of the surface and subsurface materials are affected by the roughness of the surface which causes a diffuse scattering of the radar signal.