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Stealth Crater

► Ghost Crater

Stealth Feature (Radar, Mars)

Henrik Hargitai[1] and Jim Zimbelman[2]
[1]NASA Ames Research Center / NPP, Moffett Field, CA, USA
[2]National Air and Space Museum, Center for Earth and Planetary Studies, Smithsonian Institution, Washington, DC, USA

Definition

Regions on Mars showing unusual, extremely low return (nearly zero, or below the 1-sigma noise value) when probed with 3.5- and 12.6-cm Earth-based radar data.

Interpretation

A deposit of unconsolidated, granular fine-grained (<1 cm) dust or ash or other material with a density less than about 0.5 g/cm^3, with a minimum thickness of several meters. Radar absorption is caused by a material without any volume scatterers (rocks > few cm). The characteristic of microwave observations suggests it has very low density (Ivanov et al. 1998, 2006). Some parts of the low-return radar units correlate with portions of the Medusae Fossae Formation (MFF) that are large accumulations of fine-grained, friable deposits. Several hypotheses have been proposed about the origin of the material of the MFF that includes ash flow tuffs or ignimbrites, pyroclastic or aeolian materials, paleopolar deposits or loess, carbonate platforms, ice-rich dusty mantling deposited during high obliquity, or ash fall (Edgett et al. 1997; Kerber and Head 2010; Zimbelman and Griffin 2010).

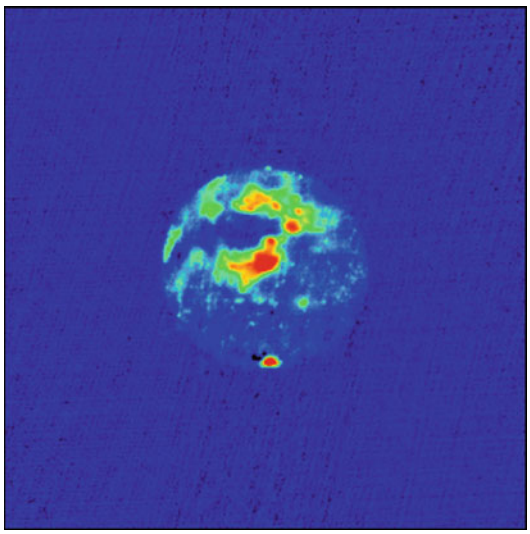
MARSIS data show that the MFF material in general is poorly consolidated and comprised of non-ice material with low dielectric loss; it can be either an ice-poor ash or aeolian deposit that has an unusually high porosity or an ice-rich material (Watters et al. 2007a, b). HiRISE images of the Tharsis region, which includes portions of the radar stealth terrain, show m-scale aeolian bedforms that are interpreted to consist of dust aggregates, which may contribute to both the low density and the low radar scattering properties of this region (Bridges et al. 2010).

Formation

► Friable layered deposits

Distribution

The stealth feature extends westward of Arsia and Pavonis Montes between Arsia Mons and Nicholson Crater, covering 2,000 km in the east-west direction, along the Martian equator – although there are some other low radar echo features such as near Argyre and Hellas Planitiae – and a region

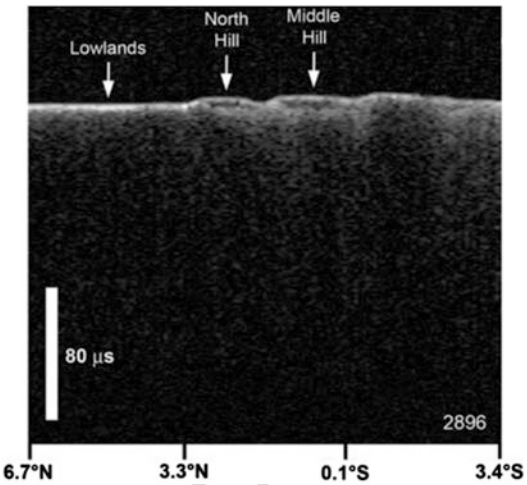


Stealth Feature (Radar, Mars), Fig. 1 Stealth feature on Mars (*dark blue* areas) west of the high-reflectivity volcanic flow covered Tharsis region. The other reflective feature is the residual south polar ice cap. This image was made with the Goldstone-VLA radar system in 1988 (Image courtesy of National Radio Astronomy Observatory/Associated Universities, Inc.)

to the west of the Elysium Mons caldera (Butler et al. 2006; Butler 1994).

History of Investigation

The stealth feature was discovered in 1988 by Muhleman et al. (1991) in 3.6 cm/8.4 GHz/350 kW JPL/DSN Goldstone radar images (Fig. 1). It was named stealth because "this region displays no detectable cross section" (Butler 1994). Radar imaging results from Arecibo 12.6-cm observations showed correlation between stealth regions and MFF deposits (Harmon et al. 1999). Longer-wavelength MARSIS (Mars Advanced Radar for Subsurface and Ionospheric Sounding) data confirmed that dielectric properties of the MFF are consistent with either relatively clean water ice or dry, low-density materials (Watters et al. 2007a, b; Fig. 2).



Stealth Feature (Radar, Mars), Fig. 2 Radargram showing MARSIS radar sounder data of the MFF for orbit 2896 (Watters et al. 2007b)

See Also

- Friable Layered Deposits
- Radar Feature

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Steep-Sided Dome (Io)

Henrik Hargitai
NASA Ames Research Center / NPP, Moffett Field, CA, USA

Definition

Circular, relatively flat mesa with a central depression and basal scarp.

Category

A type of ▶ volcanic mountain, Io; ▶ shield volcano, Io

Synonyms

Dome (Io); Discoid shield; Unusual shield volcano (Schaber 1980)

Morphometry

The more pristine dome (Inachus) is ∼150 km wide and ∼1.5 km high (Schenk et al. 2001, 2004) with a central pit 2.5–3 km deep (Wilson and Schenk 2002).

Interpretation

Possible shield volcano (Wilson and Schenk 2002) or volcanic dome (Williams et al. 2011).

Formation

Formation models (Schenk et al. 2004):

(1) High viscosity flows.
(2) Erosional remnants of armored circular, radially emplaced lava flows or ash deposits that prevented sublimation or devolatilizing of the underlying material.

Prominent Examples

Inachus and Apis Tholi (Fig. 1).

Distribution

Only two adjacent examples found on Io (Schenk et al. 2004).

Significance

Might indicate different, more evolved, higher silica composition and/or emplacement conditions from those in other volcanic centers.

Planetary Analog

They are similar to steep-sided domes on Venus, but without modifications due to slope failure.