



Fig. 1. A typical martian gully located at 52.1°S, 246.8°E. Note the presence of a large alcove with multiple emanating channels. Channels coalesce from tributaries into a main trunk channel that grades into a fan. The fan is dissected in places by distributary channels. Typical gullies form in thick deposits of latitude-dependent mantle material (Head et al., 2003) (polygonally patterned in this image) and erode through to underlying rocky surfaces. Portion of PSP_002368_1275. North is to image top, indicating that the gully is pole-facing, typical of gullies at this latitude (Dickson et al., 2007a). Illumination is from the lower left.

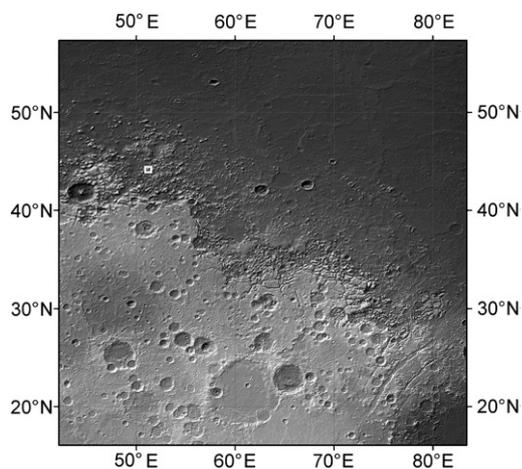


Fig. 2. Regional view of Protonilus Mensae fretted terrain and the martian dichotomy boundary. The study region is indicated by the white box. The map is composed of MOLA shaded relief overlying MOLA topography—lighter tones are higher in elevation than darker tones.

2006a,b, 2010). The mesa itself is incised by gullies, mostly on the southern (equatorwards) slope face (Figs. 3–5). High Resolution Stereo Camera (HRSC) topography data provides context and geometry in this region (Neukum et al., 2004).

Gullies (Malin and Edgett, 2000) are present at the margins of the latitude-dependent mantle (Head et al., 2003) in “pasted-on terrain” (Christensen, 2003) occurring along the south flank of the mesa (Figs. 3a and 5). The gullies have small alcoves or lack them entirely (Malin and Edgett, 2000) (Figs. 3a and 5). Over 300 gully channels are present along the ~5 km mesa scarp (Fig. 3). Gully channel widths are typically 5–20 m, and are narrower high on the mesa (Figs. 3 and 5a). Shadow measurements indicate gully channel depths of ~5–6 m (Fig. 5a, b). Gully channel lengths are typically ~200 m, ranging from ~100–500 m. Gully channels initiate high on the mesa slope as fine, linear depressions

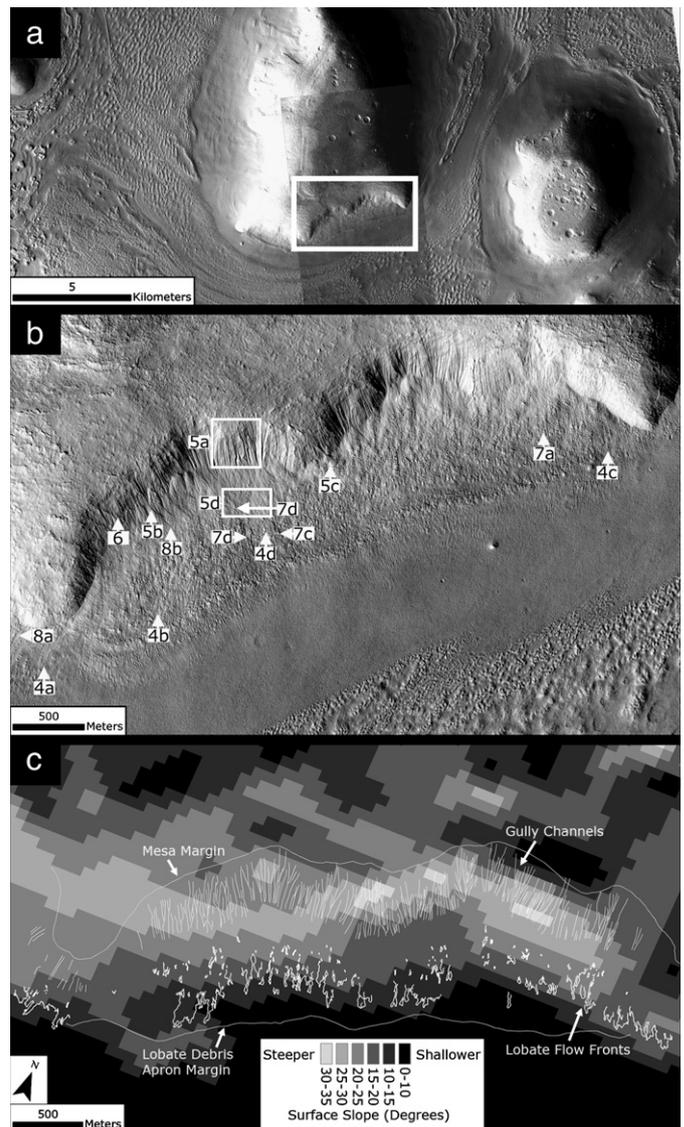


Fig. 3. The Protonilus Mensae study site. a) Context view of mesas, lobate debris aprons, and linedated valley fill. Box indicates area shown in part b. Portion of HiRISE image PSP_007148_2445 overlain on CTX image P03_002401_2246. North is to image top and illumination is from the lower left. b) View of the Protonilus Mensae mesa scarp. Gullies with well-formed channels and fans dissect the southern flank of the mesa. The locations of subsequent images are marked. c) Sketch map showing the locations of gully channels and the furthest down-slope extents of lobate flow fronts. Basemap is local slope derived from HRSC topography data. The occurrence of gully channels on steep slopes and lobate flows on shallow slopes is illustrated. Note, however, that channels and lobes are sub-grid features and that background slopes are measured. HRSC topography from image h1523_000.