



Fig. 3. Distribution of polygonally patterned ground, gullies, and gully–polygon systems mapped using HiRISE images. Small black dots indicate HiRISE images which do not contain gullies or polygons. (Top) HiRISE images containing polygonally patterned ground (triangles). (Middle) HiRISE images featuring gullies (circles). (Bottom) HiRISE images with gully–polygon systems (circles with black and white fill). Gully–polygon systems tend to occur in the region between regions with gullies and regions which have polygonally patterned ground.

outcrops have been interpreted to indicate a rock–glacier origin for pasted-on terrain (e.g., McEwen et al., 2007); however, the wasting of fractured crater-rim materials located upslope from pasted-on terrain may also account for the presence of boulders atop pasted-on surfaces. Polygons present in pasted-on terrain and on mantle surfaces are commonly flat-topped, with elevated interiors and depressed troughs. This morphology is consistent with sand-wedge polygon or sublimation-polygon structures that form preferentially in fine-grained and ice-rich substrates (Lachenbruch, 1962; Washburn, 1973; Maloof et al., 2002; Marchant et al., 2002; Marchant and Head, 2007). Analysis of 136 alcove polygons on Mars, in 8 HiRISE images, indicates a mean martian alcove polygon diameter of ~ 11 m, spanning ~ 5 – 21 m, with a standard deviation of 3.4 m.

Some martian alcove polygons are outlined by bright deposits that are present preferentially in polygon troughs (Fig. 7). “Bright”

indicates pixel DN values in processed HiRISE images that are several times higher than proximal pixels sampled from polygon centers or gully channels. These deposits may be water-ice deposited seasonally as frost (for images taken during winter periods; Mangold, 2005), salt deposits (Burt and Knauth, 2007), dusty lag deposits (Williams et al., 2008), or some other form of high-albedo, particulate deposit, such as snow, that accumulates preferentially in shielded topographic lows (Head et al., 2008). In some images, bright material is distributed broadly over surfaces containing gully–polygon systems (Figs. 7a–7b); in others bright material is present in polygon troughs within gully alcoves (e.g., Fig. 7c). Dust cover is not pronounced in the analyzed images (e.g., dust ripples are uncommon and boulders are clearly visible), and no salts have been spectroscopically detected in the examined HiRISE images (e.g., Osterloo et al., 2008). Rather, these deposits are seasonally present, and are commonly blue-toned in HiRISE color data: ob-