Fig. 2. Dirt covered snowpacks within a gully channel in the Antarctic Dry Valleys, see Fig. 1a for context. During the winter, snow and fine sediments are redistributed by the wind and are concentrated within topographical hollows, including the gully channels. As the snow ablates the sediments are concentrated as a surface lag, significantly lowering the albedo of the snow and enhancing melting. This mechanism could occur on Mars as has been suggested by snowmelt models under martian conditions at high obliquity by Williams et al. (2009).

(Fig. 1c). Melting only occurs for a relatively short duration each day (maximum of 8 h) during periods of maximum insolation. As a consequence of ablation, the dust incorporated into the snowbanks during their formation becomes concentrated on the surface of the snow (Fig. 2) and further assists melting through the corresponding decrease in albedo. This processes is also considered important for snowmelt initiation on Mars (Williams et al., 2009). Gully activity ceased once all of the snow trapped within the channels had melted. During the 2006–2007 austral summer season this took approximately two weeks (Morgan et al., 2008; Dickson et al., 2007b; Levy et al., 2007).

3. Location and morphology of the gullies

The study site chosen for our investigation is within the 80 km diameter, Noachian-aged degraded Asimov crater located at 46°S, 5°E within Noachis Terra (Fig. 3). The floor of the crater is unusual in that it contains an annulus of deep valleys (~2 km maximum

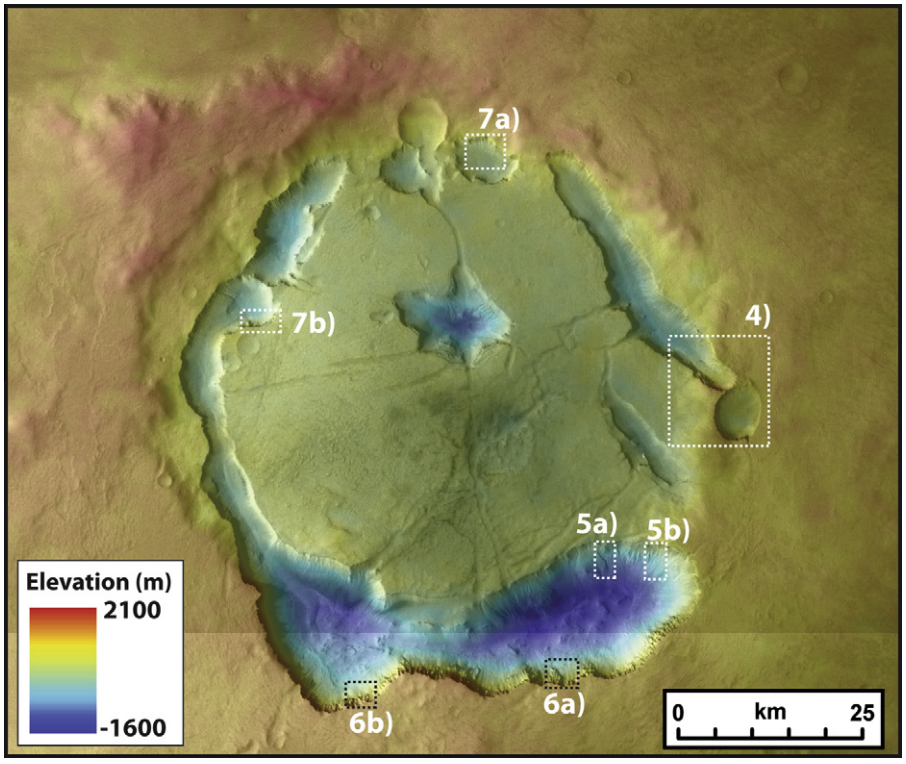

Fig. 3. Study region: Asimov crater, a moat crater in Noachis Terra. The boxes represent the location of the gullies in Figs. 4–7. HRSC orbit 1932_0000 (Image and DTM).

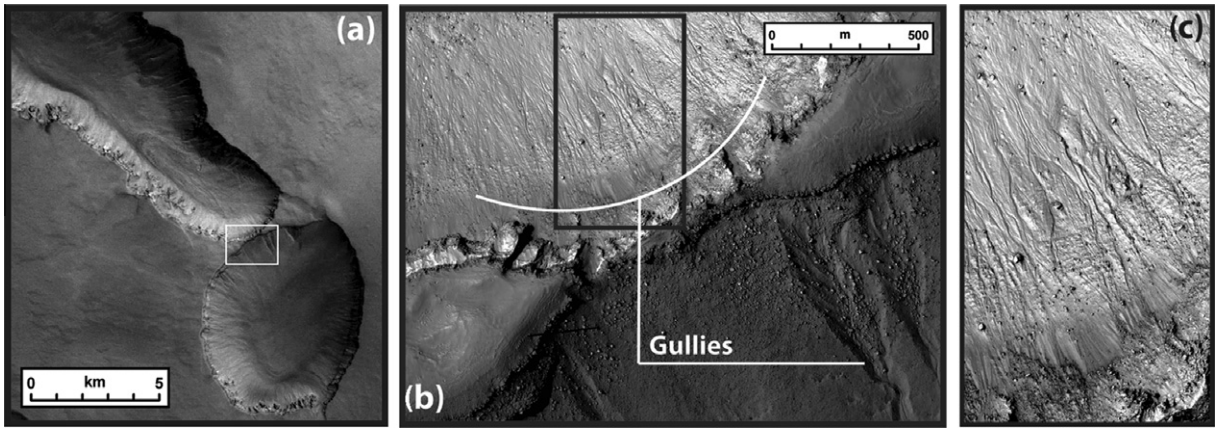

Fig. 4. Gullies located along the slopes of isolated ridges. This argues against a groundwater source for the gullies and instead supports a top-down source for gully activity.