Evidence for Recent Wet-Based Crater Glaciation in Tempe Terra, Mars.

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Evidence for recent wet-based crater glaciation in Tempe Terra, Mars?

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The two sinuous ridge populations are morphologically distinct, supporting different origins.

- The esker-like ridges are younger, more sinuous, and have sharper crests than the inverted channel-like ridges (Fig 5).
- However, the ridges have similar dimensions, so differences in crest morphology could be due to differences in degradation state rather than formation mechanism.

The esker-like ridges ascend valley walls.

- Esker-forming meltwater can ascend bed slopes under hydraulic pressure in subglacial tunnels \cite{8}. Ascent of valley walls (Fig 6b) is inconsistent with deposition under gravity-driven flow in subaerial fluvial channels.
- However, ascent of slopes could be inherited from differential erosion under the alternative inverted channel hypothesis, rather than a primary feature.

Fig 5: (a) Esker-like ridge (Sr) superimposing inverted channel-like ridge (Usp) (extent in Fig 3). CTX image P04_003577_2186_XN_38N072W, and (b) topographic profiles AA' and BB' from (a) extracted from digital elevation model generated from HiRISE images ESP_017477_2190 and ESP_018545_2190.

There are challenges for the esker hypothesis.

- The esker-like ridges could be a second population of inverted channels.
- Glacial deposits (Vff, Gtr, Rpu) covering the southern crater floor hinder scrutiny of the relationship of the esker-like ridges to pre-glacial fluvial deposits.
- Eskers are ice-contact deposits but there is no additional evidence for past glaciation northward of the moraine-like deposits (Gtr & Rpu).
- There is one esker-like ridge system on the northern floor, where there is no evidence for glaciation.

Lessons from Chukhung Crater.

- Even where sinuous ridges emerge from existing glaciers, and where they have esker-like non-slope-conforming topographic signatures, conclusive identification as eskers is complicated by similarities in form between inverted channels and eskers \cite{8}.
- Regional mapping and quantitative 3D morphometric analyses \cite{2,9} should always be performed before an esker origin can be concluded. Such analyses are ongoing for Chukhung Crater.