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

Conference or Workshop Item

How to cite:


For guidance on citations see FAQs.

© 2018 The Authors

Version: Poster

Link(s) to article on publisher’s website:

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online’s data policy on reuse of materials please consult the policies page.
Evidence for recent wet-based crater glaciation in Tempe Terra, Mars?

Frances E.G. Butcher1, M.R. Balme1, C. Gallagher2, N.S. Arnold3, S.J. Conway4, R.D. Storrar5, A. Hagemann1, S.R. Lewis1

1The Open University, UK (frances.butcher@open.ac.uk), 2University College Dublin, Ireland, 3University of Cambridge, UK, 4CNRS, Laboratoire de Planétologie et Géodynamique, Nantes, France, 5Sheffield Hallam University, UK.

Evidence for basal melting of putative debris-covered glaciers in Mars’ mid-latitudes is extremely rare.

- The glaciers are currently frozen to their beds, but has this always been the case?
- Eskers (Fig 1) emerging from two mid-latitude glaciers [1-2] indicate at least two localized melting events beneath existing glaciers ~110-150 Myr ago (Fig 2).

Eskers indicate past glacial melting.

1Ice at glacier bed melts.
2Meltwater carves a tunnel through the ice.
3Meltwater deposits sediment in the tunnel.
4A ridge of sediment (an esker) is left when the ice retreats.

Are glacier-linked sinuous ridges in Chukhung Crater eskers?


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 [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.

Chukhung Crater hosts two populations of sinuous ridges.

- Esker-like ridges (Sr, Fig 3) emerge from moraine-like deposits (Gtr & Rpu, Fig 3) bounding the termini of putative debris-covered glaciers (Vf, Fig 3) on the southern crater floor.
- Inverted channel-like ridges (within Usp, Fig 3) extend from fluvial valleys on the northern crater wall. They formed prior to glaciation of the crater, their formation does not require glacial meltwater (Fig 4).

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 [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.

Chukhung Crater hosts two populations of sinuous ridges.

- Esker-like ridges (Sr, Fig 3) emerge from moraine-like deposits (Gtr & Rpu, Fig 3) bounding the termini of putative debris-covered glaciers (Vf, Fig 3) on the southern crater floor.
- Inverted channel-like ridges (within Usp, Fig 3) extend from fluvial valleys on the northern crater wall. They formed prior to glaciation of the crater, their formation does not require glacial meltwater (Fig 4).

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 [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.

Chukhung Crater hosts two populations of sinuous ridges.

- Esker-like ridges (Sr, Fig 3) emerge from moraine-like deposits (Gtr & Rpu, Fig 3) bounding the termini of putative debris-covered glaciers (Vf, Fig 3) on the southern crater floor.
- Inverted channel-like ridges (within Usp, Fig 3) extend from fluvial valleys on the northern crater wall. They formed prior to glaciation of the crater, their formation does not require glacial meltwater (Fig 4).

Chukhung Crater hosts two populations of sinuous ridges.

- Esker-like ridges (Sr, Fig 3) emerge from moraine-like deposits (Gtr & Rpu, Fig 3) bounding the termini of putative debris-covered glaciers (Vf, Fig 3) on the southern crater floor.
- Inverted channel-like ridges (within Usp, Fig 3) extend from fluvial valleys on the northern crater wall. They formed prior to glaciation of the crater, their formation does not require glacial meltwater (Fig 4).

Chukhung Crater hosts two populations of sinuous ridges.

- Esker-like ridges (Sr, Fig 3) emerge from moraine-like deposits (Gtr & Rpu, Fig 3) bounding the termini of putative debris-covered glaciers (Vf, Fig 3) on the southern crater floor.
- Inverted channel-like ridges (within Usp, Fig 3) extend from fluvial valleys on the northern crater wall. They formed prior to glaciation of the crater, their formation does not require glacial meltwater (Fig 4).

Chukhung Crater hosts two populations of sinuous ridges.

- Esker-like ridges (Sr, Fig 3) emerge from moraine-like deposits (Gtr & Rpu, Fig 3) bounding the termini of putative debris-covered glaciers (Vf, Fig 3) on the southern crater floor.
- Inverted channel-like ridges (within Usp, Fig 3) extend from fluvial valleys on the northern crater wall. They formed prior to glaciation of the crater, their formation does not require glacial meltwater (Fig 4).