

Glacial curvilineations: gradual or catastrophic origin?

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Glacial curvilineations (GCLs) are enigmatic landforms that have recently been discovered in Poland (Lesemann et al., 2010, 2014). They comprise parallel sets of sinuous ridges separated by troughs that are found in tunnel valleys and replicate the morphology and pattern of the valley sides. The sedimentology for some has been reported to indicate that the sediment composition relates to a pre-GCL phase. So far just one theory for their formation exists - erosion by longitudinal-vortices within high-energy subglacial meltwater flows (Lesemann et al., 2010).

Here, we provide an alternative hypothesis for their formation developed from observations of GCLs found along the southern sector of the Laurentide Ice Sheet. In all cases GCLs were found associated with tunnel valley widenings or hollows and occur as distinct parallel sets that mimic each other in terms of nicks and cusps. Using analogies from tree-rings and coral growth we take such mimicry as indicating either incremental growth or development from a template over time. Although without a strong physical explanation we find it much less likely that a series of parallel water channels would maintain such strong mimicry. We instead suggest that subglacial thawing of frozen ground in association with discrete water bodies (tunnel valleys or subglacial lakes) resulted in retrogressive bank failure, possibly along a glide plane provided by a frozen surface.

References:

Lesemann, J.-E., Piotrowski, J. a, Wysota, W., 2010. "Glacial curvilineations": New glacial landforms produced by longitudinal vortices in subglacial meltwater flows. *Geomorphology* 120, 153–161.

Lesemann, J.-E., Piotrowski, J. a, Wysota, W., 2014. Genesis of the "glacial curvilineation" landscape by meltwater processes under the former Scandinavian Ice Sheet, Poland. *Sediment. Geol.* 312, 1–18.