

Catastrophic meltwater floods vs. ice deformation: What's happening under the ice sheets?

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The methods of formation for subglacial landscapes and streamlined sedimentary geomorphological landforms have been debated for several decades and remain unresolved. Two opposing theories exist for the genesis of subglacial formations, particularly drumlins, fluted terrains, mega scale glacial lineations (MSGSL), and ribbed moraines. The meltwater hypothesis is based on the argument that the formation of these streamlined subglacial landforms is associated directly with glacial processes, generated from the discharge of catastrophic basal sheet floods. This hypothesis has been supported by the concept of form analogy, which is used to associate similar landforms with processes, regardless of scale. An example would be associating sole marks, which are related to turbidity currents, with erosive features associated with known major outburst floods such as those associated with glacial lake Missoula. The opposing perspective relies on more traditional processes related to subglacial ice deformation and erosion, which can be shown to be occurring at present explaining soft-sediment deformation in Antarctica. The ice flow moulds landforms into streamlined fluted and drumlinized subglacial terrains. Supporting evidence for both theories has been found during extensive studies of subglacial landscapes in southern Ontario and Alberta. It appears likely that the subglacial landscape is influenced both by fluvial and subglacial ice deformation at a wide variety of scales. What now appears unlikely is that either theory of streamlined feature formation is the only option for the development of these landscapes. The ongoing debate shows the importance of continuing research on the genesis of subglacial landforms which is critical to effective resource exploration in glacially influenced terrains.