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Palaeo-fluvial origin for Jakobshavn Isbrae catchment

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Subglacial topography exerts strong controls on ice dynamics, influencing the nature of ice flow, and modulating the distribution of basal waters and sediment. Bed geometry can provide a long-term record of geomorphic processes, allowing insight into landscape evolution, the origin of which, in some cases, can pre-date ice sheet inception.

Here, we present evidence from ice-penetrating radar data for a large dendritic drainage network, radiating inland from Jakobshavn Isbrae, Greenland's largest outlet glacier. The size of the drainage basin is ∼450,000 km-squared, comparable with that of the Ohio River in the United States, and accounts for ∼20% of the land area of Greenland. Topographic, and basin morphometric analysis of isostatically compensated (ice-free) bedrock topography suggests that this catchment pre-dates ice sheet inception (∼3.5 Ma), and will have been instrumental in influencing flow from the island's interior to the margin.

The geological setting, and glacial history of Greenland lends itself well to the preservation of such landscapes; the island is dominated by erosion-resistant, Precambrian crystalline rocks with few sedimentary deposits, and has only been extensively ice-covered for ∼3.5 million years (Ma). Despite this, most analysis of subglacial geomorphology, and of 'pre-glacial' landscapes, has been focused on Antarctica (e.g. the Ellsworth Subglacial Highlands and, 'pre-glacial erosional surfaces' of the West Antarctic Ice Sheet (WAIS)), with little consideration for such associations in Greenland. However, a large subglacial 'mega-canyon' in northern Greenland, thought to of palaeo-fluvial origin, has recently been discovered.