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Submarine landforms reveal varying rates and styles of deglaciation in North-West Greenland fjords

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The North-West margin of the Greenland Ice Sheet is drained by more than 80 fast-flowing outlet glaciers. An understanding of the former extent and dynamics of these outlet glaciers is needed to constrain numerical ice-sheet models and provide a context for present-day observations of outlet-glacier retreat. Whereas previous geophysical investigations of the North-West Greenland margin have focused on the mapping of full-glacial and deglacial landforms on the mid to outer shelf, relatively little is known about more recent ice-sheet dynamics in the fjords and on the inner shelf.

We use swath-bathymetric data from the fjords and inner shelf of North-West and West Greenland to map and interpret the landforms that are preserved on the seafloor. Streamlined subglacial landforms reveal the former ice-flow direction across the margin. Landforms that are transverse to the ice-flow direction show the locations of former still-stands in the grounding zone during regional deglaciation and terminus re-advances linked to the Little Ice Age. Sinuous channels in fjords are interpreted as turbidity-current channels that were probably generated by the down-slope flow of dense, sediment-laden water released at the ice margin. The distribution of submarine landforms suggests that the outlet glaciers of North-West Greenland experienced varying rates and styles of ice retreat during the late Holocene, which was probably controlled mainly by fjord water depth. Inner-fjords that have contemporary water depths of less than 350 m are characterised by groups of small recessional moraines, which indicate the slow retreat of a grounded ice margin. In contrast, recessional moraines are absent from inner fjords that have water depths of greater than 350 m, in which ice retreat during the late Holocene is interpreted to have been more rapid.