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Glacial geomorphology of the Northeast Newfoundland Shelf

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Off northeast Newfoundland, submarine banks that are relatively deep compared with those elsewhere off Atlantic Canada are dissected by the shelf-crossing troughs of Hawke Saddle, Notre Dame Channel, and Trinity Trough. Till tongues and glacigenic debris flows (GDF) at trough mouths indicate ice margins reached the upper slope during the last glacial cycle. Mega-scale glacial lineations (MSGL) detected in Olex data in Hawke Saddle and at the head of Trinity Trough indicate fast flowing ice in the troughs. Close to modern coasts, convergent systems of streamlined glacial landforms are interpreted as evidence of ice stream onset areas. The oldest ice margins on the upper slope, identified from GDFs or proximal diamicts, are ∼30 ka off Notre Dame Channel, 23.5 ka off Hawke Saddle, and ∼21 ka off Trinity Trough, where four earlier advances are recognised from GDFs between 23.5 ka and 28.5 ka. Retreat across the shelf was punctuated by halts, creating moraines and grounding line wedges in the troughs, notably the Trinity Moraine dated at ∼ 19 ka. Open water conditions off modern coasts predate c. 16 ka. Unlike elsewhere on the island, arcuate fjord-mouth moraines typical of south and west Newfoundland are absent; ice retreat did not halt at fjord mouths. However, still-stands within fjords are indicated by numerous isolated basins with thick sediment fill and transverse moraines, one of which predates c. 14 ka. In two fjords, pitted terrain not found elsewhere on the island may indicate stagnant ice. A 100 m thick, stacked till sequence aggraded to form Belle Island Bank but subsequent ice stream(s) flowing down Notre Dame Channel have eroded much of this. This contrasts with Funk Island Bank, on the opposite channel flank, an erosional remnant evolving though ice-stream cutting of Cenozoic/Mesozoic strata. This and tentative evidence of MSGL, together with extensive glaciotectonic mass transport in outer Notre Dame Channel, suggests large-scale ice-stream switching has contributed to the major geomorphic elements.