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Using submarine landforms to investigate glacial history, chronology and evolution during the Late Cenozoic: A 3D seismic case study of the mid-Norwegian shelf.

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The mid-Norwegian continental shelf and its succession through time has in places preserved a detailed geomorphological record of glacial and interglacial ice dynamics. Most work has concentrated on the most recent glaciations and therefore the full extent and dynamics of older glaciations is poorly understood. In this work several 3D seismic volumes, from across the mid-Norwegian shelf, are used together to image the glacial-interglacial sequences and piece together a chronology of shelf edge glaciation throughout the Late Cenozoic up until the most recent Weichselian glaciation. The 3D seismic data are supplemented with a large number of 2D seismic profiles and oil industry boreholes are used for calibration and horizon dating.

The work presented here will help in the effort to establish a better detailed and more tightly constrained chronology of the extent and timings of different glaciations throughout the Late Cenozoic. Developing a better chronology is of critical importance for helping to calibrate current models of ice sheet and landscape evolution so that contemporary changes may be better understood.

The basic geology of the system shows a progradation of the shelf edge towards the basin. The stratigraphical succession comprises evidence for several erosional events associated with the Elsterian, Saalian and Weichselian glaciations during the mid- to late Pleistocene. At depth the pre-glacial Neogene deposits are characterized by widespread polygonal faulting. Within the 3D seismic blocks several glaciogenic structures are visible. Most notably these include an abundance of linear and curvilinear mega-scale glacial lineations, which reach lengths of over 50 km, and iceberg scours that vary in length from 100 m to over 7 km. An array of different sized channels offer insight into the flow characteristics of pro-glacial and subglacial regimes during previous glaciations. Lateral moraines are also present in the seismic data and help to delineate past extent of grounded ice. Horizon mapping using the 3D seismic data is used to estimate the thicknesses of the different glaciogenic sequences and their varying sediment types and depocentre locations through the different glaciations.