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Influence of stratigraphic development on subsurface focussed fluid flow and Mid-Norwegian margin stability

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Cenozoic seismic stratigraphy and geological development of the south Vøring Plateau, Mid-Norwegian margin, are analyzed to understand their relation to fluid flow and margin stability. Regional stratigraphy and palaeo-morphology of the Mid-Norwegian margin indicate gradual changes in depositional environment and tectonic compression between 55 Ma and 2.8 Ma, i.e. during deposition of the Brygge and Kai Fms, and also abrupt changes associated with glacial-interglacial cycles from 2.8 Ma when the Naust Fm was deposited. These changes resulted in deposition of various types of sediments and led to processes such as polygonal faulting, formation of contourites and continental shelf progradation.

Gas hydrate related bottom simulating reflectors (BSR) occur at Nyegga and within the central Vøring Basin while pockmarks are observed at Nyegga only. The BSRs are concentrated above Eocene depocenters, in hemipelagic and contouritic sediments deposited during Late Plio-Pleistocene. They overly polygonal faults and diagentic reflectors (DBSR) due to Opal A - Opal CT conversion but are confined to the slope of anticlines indicating its formation being related to fluid pathways from methanogenic rocks through focused fluid flow. The DBSRs are located in oozes within the Kai and upper Brygge Fms. We propose a model where fluid expulsion due to DBSR formation and polygonal faulting in oozes created overpressure in permeable layers belonging to the Naust Fm. Slide headwalls are observed close to the anticlines, implying that the over-pressured oozes and the focussed fluid flow may have been important in creating weak surfaces in the Naust deposits, promoting conditions for failures to occur.