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Onshore-offshore basement architecture on the North Norwegian Margin – influences of Mesozoic to early Palaeogene tectonics

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On the Lofoten and Vesterålen part of the Norwegian margin, a new combined offshore-onshore top basement map (i.e. depth to metamorphic and crystalline basement) has been created. This was done by gridding depth converted seismic interpretations, modelled basement, bathymetry and onshore digital elevation models. The basement map has been integrated with potential field data, seismic stratigraphy and existing thermochronological datasets to investigate the combined onshore-offshore margin evolution.

The observed basement relief on the offshore portion of the margin developed mainly as a result of Mesozoic to Early Palaeogene extensional tectonics, resulting in a complex network of dominantly N-S to ENE-WSW striking normal faults. Some of these tectonic lineaments can be traced onshore where they link up with major topographic lineaments. The overall geometry and trend of the offshore tectonic lineaments also bear striking similarity to the major onshore topographic lineaments. For example, a series of gently dipping planar topographical surfaces are bounded by normal faults and resemble similarly tilted fault blocks offshore. Major dislocations of potential field anomalies also seem to correlate with these offshore and onshore tectonic and topographic lineaments. On the islands of Lofoten and Vesterålen jumps in apatite fission track ages correlate well with the major dislocations on the potential field maps, and are, as well, characterised by distinct contrasts in landscape types.

The above observations indicate that not only the offshore basement architecture developed as a result of Mesozoic to Early Palaeogene tectonics but that the same processes may have exerted a major control in shaping the onshore topography on the Lofoten and Vesterålen islands. This implies that Palaeogene and Neogene exhumation and erosion on the Lofoten and Vesterålen islands was controlled by weakness zones developed as a result of Mesozoic and early Palaeogene fault movements.