



Crustal structure of the Lofoten-Vesterålen margin, off Norway, constrained by new OBS data

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A new ocean bottom seismometer/hydrophone (OBS/OBH) survey, as part of the Eurromargins 2003 OBS Experiment, was performed along the ~400-km-long Lofoten-Vesterålen margin off Norway. Analysis of the new data and compilation of earlier wide-angle seismic velocity profiles, integrated with an extensive seismic reflection data set and crustal-scale two-dimensional gravity modelling, constrain the margin crustal structure. The analysis shows that the continent-ocean transition (COT) zone, which decreases in width northward along the Lofoten-Vesterålen margin, is underlain by an increasing depth to Moho from typical oceanic crust near magnetic anomaly 23 at the oceanic Lofoten Basin to a 20-26-km continental crustal level at the shelf edge. Furthermore, there is convincing evidence for sedimentary sequences below the breakup lavas east of the continent-ocean boundary, which is identified close to the foot of the continental slope by a persisting magnetic and seismic signature along the margin. Close to the continental slope, a steep and relatively narrow, 10-40-km-wide, Moho-gradient zone exists within the COT. To the south, the Moho-gradient zone continues along the Vøring margin, however it becomes offset 70-80 km to the northwest along the Bivrost Fracture Zone/Lineament. The modelled profiles exhibit typical seismic velocities for the continental and oceanic crust. Within the COT and restricted mostly seaward of the continent-ocean boundary, increased lower crustal velocities were modelled to be up to 7.1-7.2 km/s at the bottom of the crust, defining a possible limited lower crustal body. The lateral and vertical extent of this body is diminishing northward along the Lofoten-Vesterålen margin. We interpret the crustal

structure and properties of the Lofoten-Vesterålen margin, and its contrast with adjacent margin provinces, to be governed by the oblique position of the Early Tertiary line of opening relative to the Late Jurassic-Early Cretaceous central rift zone. In a regional sense, the Lofoten-Vesterålen margin is located on the east flank of the Late Jurassic-Early Cretaceous rift, which may explain the relatively small Cretaceous subsidence. The margin may also be considered the elevated footwall of a hanging wall basin below the lavas west of the shelf edge continuing onto the conjugate NE Greenland margin. Within this framework, the southern boundary of the Lofoten-Vesterålen margin, the Bivrost Fracture Zone and its landward prolongation, appears as a major across-margin magmatic and structural crustal feature governing the margin evolution.