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Structure and evolution of the northern Voring and Lofoten-Vesteralen margins, and their conjugate NE Greenland margin

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Late Mesozoic-Cenozoic tectono-stratigraphic correlations between the conjugate northern Voring, Lofoten-Vesteralen and NE Greenland continental margins are provided based on the recently refined structural and stratigraphic framework off mid-Norway, new early opening plate reconstructions of Eurasia versus Greenland between Jan Mayen and Senja fracture zones, and a sparse regional grid of seismic reflection profiles off NE Greenland. In addition, analysis of new ocean bottom seismometer (OBS) data and compilation of earlier wide-angle seismic velocity profiles, integrated with an extensive seismic reflection data set and crustal-scale 2D gravity modelling, provide a well-constrained and detailed, almost three-dimensional, image of the crustal structure for the northern Voring and Lofoten-Vesteralen margins. An increasing OBS data coverage exists for the conjugate NE Greenland margin. Regional transects across the conjugate margins reveal important vertical and lateral variations in crustal architecture as well as basin configuration and stratigraphy resulting from a complex history of rifting prior to and during the last rift episode in Late Cretaceous-Early Tertiary time, leading to breakup and volcanic passive margin formation. Although the composite Late Jurassic-earliest Cretaceous rifting is the dominant tectonic episode we also observe structural and stratigraphic relations that indicate an Aptian-?Albian rift phase, probably coeval with similar events elsewhere on the NE Atlantic margins. Late Cretaceous rifting, with onset in middle Campanian

time, is characterised by low-angle detachment faulting, culminating with regional uplift, intrusive igneous activity and subsequent erosion towards the end of the Paleocene. Thick seaward dipping reflector sequences manifest massive eruptions of lavas during breakup at the Paleocene-Eocene transition. The post-breakup conjugate passive margin development is characterised by two distinct phases of shelf outbuilding in Oligocene?/Miocene and Plio-Pleistocene times. Of special interest are a number of mid-Cenozoic intra-basin inversion features recognised both off Norway and off Greenland, revealing a regional compressive regime. We interpret the crustal structure and properties of the Lofoten-Vesteralen 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. 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. In comparison to the adjacent Voring margin, the Lofoten-Vesteralen margin was subjected to considerably reduced amounts of extrusive and intrusive breakup magmatism, making it more susceptible to initial post-opening subsidence. In this framework, the Bivrost Lineament separating the Voring from the Lofoten-Vesteralen margin has acted as a first-order, along-margin tectono-magmatic boundary, greatly influencing the pre-, syn- and post-breakup margin development.