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Crustal structure and evolution of the southern Vøring Basin and Vøring Transform Margin, NE Atlantic

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Abstract

The dominantly passive volcanic Vøring and Møre Margins, NE Atlantic, are separated by the 200 km long Vøring Transform Margin (VTM). The southern Vøring Basin and the VTM have been studied by use of four regional Ocean Bottom Seismograph (OBS) profiles, combined by gravity modelling. The models demonstrate a complex pattern of magmatism along the transform margin. The distribution of magmatism seems to be related to the existence and trend of a lower crustal 8+ km/s body, interpreted as eclogitized rocks, present in the southern Vøring Basin. Early Tertiary breakup related magmatic 'leakage' across the Continent–Ocean-Transition (COT) appears to be facilitated where this layer is absent. These results support earlier workers who have concluded that the Jan Mayen Fracture Zone originated from a Caledonian zone of weakness. We propose that partly eclogitized rocks were uplifted into the lower crust close to this zone during the Caledonian orogeny and that this body acted as a barrier to magma emplacement during the Late Cretaceous–Early Eocene phase of rifting/breakup. The eclogitized terrain also appears to have caused northeastward channeling of the Late Cretaceous–Early Tertiary intrusions within the Vøring Basin. An up to 10 km thick pre-Cretaceous sedimentary basin in the southern Vøring Basin may be genetically related to the NS-trending Late Paleozoic and Mesozoic rift basins in North-East Greenland.

Keywords: Wide-angle refraction; Eclogitized rocks; COT

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1. Introduction

The Early Tertiary continental breakup and initial seafloor spreading between Eurasia and Greenland was characterized by massive emplacement of magmatic rocks. On the mid-Norwegian Vøring and Møre Margins (Fig. 1), these rocks were partially extruded on the surface as flood basalts and partially intruded as sills into the sedimentary rocks in the Vøring and Møre Basins and presumably also into continental crust extending seaward at least to the inner part of the seaward dipping volcanic layers manifested as seaward dipping reflectors in multichannel reflection data (SDRs) (Dickin, 1988; Skogseid and Eldholm, 1989; Zehnder et al., 1990; Olafsson et al., 1992; Planke and Eldholm, 1994; Mjelde et al., 1997, 2001).

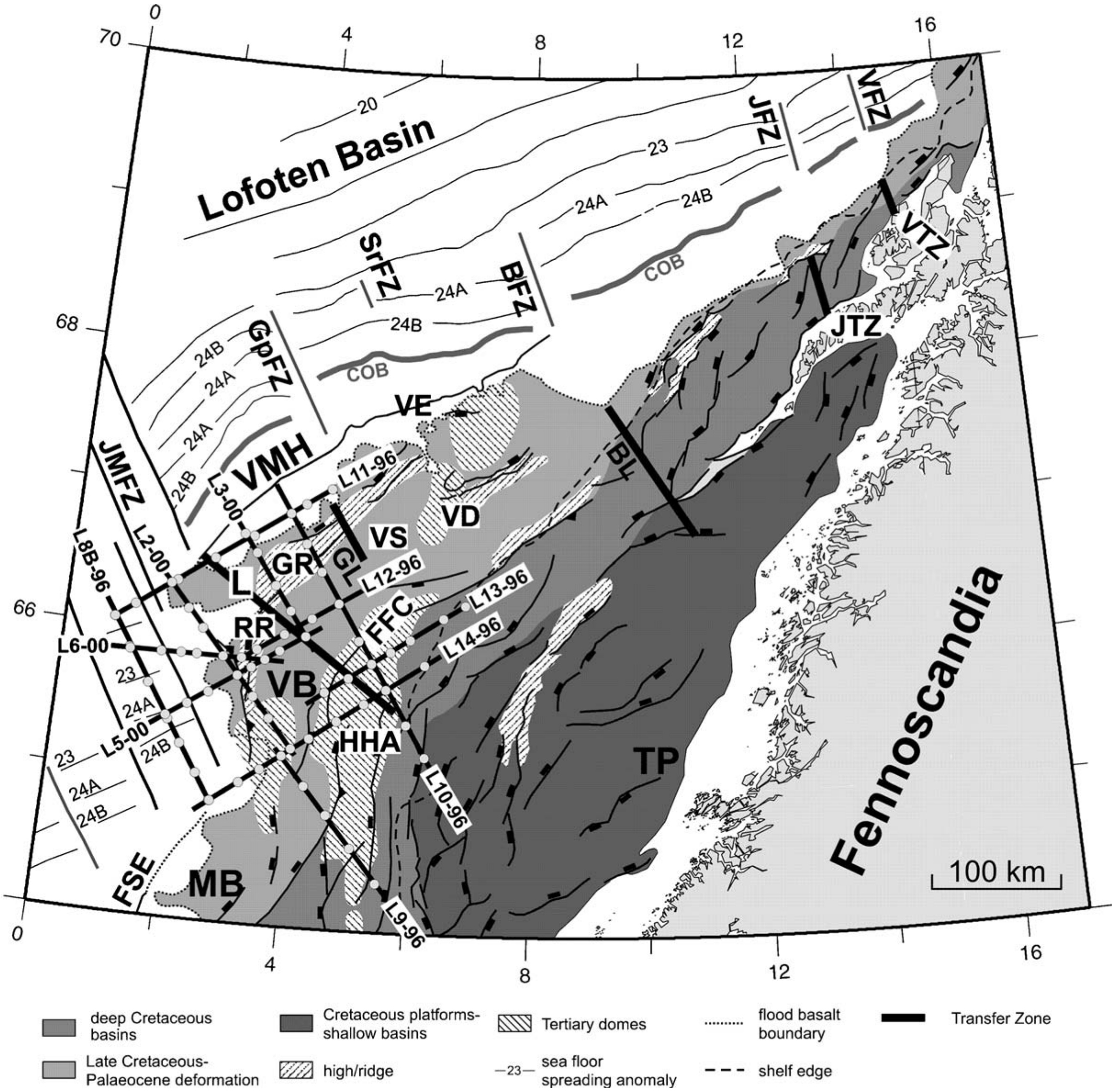

Fig. 1. The study area in the southern Vøring Basin and across the Vøring Transform Margin, off mid-Norway. The profiles discussed in the present paper are shown as bold lines and dots on the lines refer to OBS positions. The geological structures are from Blystad et al. (1995) and Tsikalas et al. (2002). MB: Møre Basin, FSE: Faroe-Shetland Escarpment, VB: Vøring Basin, HHA: Helland-Hansen Arch, JMFZ: Jan Mayen Fracture Zone, L: lineament L, TP: Trøndelag Platform, FFC: Fles Fault Complex, VMH: Vøring Marginal High, GR: Gjallar Ridge, RR: Rån Ridge, GL: Gleipne Lineament, VS: Vigrid Syncline, VD: Vema Dome, VE: Vøring Escarpment, COB: Continent–Ocean Boundary, BL: Bivrost Lineament, GpFZ: Gleipne Fracture Zone, SrFZ: Surt Fracture Zone, BFZ: Bivrost Fracture Zone, JFZ: Jennegga Fracture Zone, JTZ: Jennegga Trannsfer Zone, VFZ: Vesterålen Fracture Zone, VTZ: Vesterålen Transfer Zone.