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CRUSTAL STRUCTURE OF THE NORWEGIAN VOLCANIC MARGIN FROM AN EXTENSIVE OBS-NETWORK

Thomas Raum And Rolf Mjelde
Univ. Of Bergen

The Vøring volcanic margin has been covered by ca. 5.000 km regional 2D Ocean Bottom Seismograph (OBS) profiles during several extensive surveys performed the last decade. The experiments have been conducted as cooperative efforts between the University of Bergen, Hokkaido University, NPD, Statoil, Norsk Hydro and TotalFinaElf. The main purpose with applying this method is its ability to map structures below the extrusives and intrusives related to the Late Cretaceous-Early Tertiary rifting phase, that lead to continental break-up in Early Eocene. The OBS-data have provided significant new insight on the thickness and extent of volcanic flows and sedimentary intrusions, the continent-ocean transition, the depth to crystalline basement, the lower crust and Moho. The modelling of the OBS horizontal components with regard to S-waves has contributed to lithological constraints, both for the sedimentary strata and the crystalline crust. Furthermore, azimuthal S-wave anisotropy suggest the presence of fluid-filled micro-cracks aligned vertically along the direction of the present day maximum compressive stress. The lower crustal Vp/Vs-ratio is consistent with a mixture of mafic intrusions (underplating) and older continental remnants, but for most of the area it is not consistent with serpentinized peridotite. Other factors that argue against the presence of serpentinized peridotite in the Vøring Basin are; the existence of Moho reflections, the observation of S-wave anisotropy but absence of P-wave anisotropy, uncertainties regarding supply of water to allow for significant serpentinization and very low stretching factors compared with non-volcanic margins where a high P-wave velocity layer is generally interpreted as serpentinized peridotite. It is found that the landward extent of the lower crustal intrusions is strongly correlated with the presence of crustal lineaments, of which one is newly discovered based on the OBS-data. The landward extent of the magmatic lower crustal layer decreases stepwise northeast-wards in the Vøring Basin, closely related to the Gleipne-, Surt- and Bivrost Lineaments. Evidence for an interplay between active and passive rifting components are found on regional and local scales on the margin. The active component is evident through the decrease in magmatism with increased distance from the Icelandic Plume, and the passive component is documented through the fact that all found crustal lineaments to a certain degree acted as barriers to magma emplacement. A strong link is also observed between the location of Cenozoic contractional domes and deeper high-velocity structures, which may act as rigid blocks during compression. It is proposed that the existence and trend of these deeper structures, subject to mild NW-SE compression, is the most important factor controlling the formation, spatial distribution and trend of the domes. Structures in the high-velocity lower crust seem to be the single most important element with this respect. The increased thickness of the continental crust on the seaward side of the Vøring Escarpment, as well as the up-warping of Moho and thinning of the lower crustal high-velocity layer in the western part of the Vøring Basin, can be explained by a lithospheric delamination model.