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Continent-ocean transition at the northern Vøring Margin, Norway, Euromargins 2003 OBS Experiment

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The continental margin off mid-Norway is a volcanic passive margin created during the earliest Eocene, and large volumes of magmatic rocks were emplaced during and a few M.y. after continental breakup. In 2003, an ocean bottom seismometer/hydrophone survey was acquired on the Vøring and Lofoten-Vesterålen Margins. The main targets are continental breakup processes, early seafloor spreading, and along-margin variation of magma productivity. The profile presented here is one of five profiles from the survey crossing the continent-ocean boundary. It crosses the northern part of the Vøring Plateau and continues into the oceanic basin out to magnetic anomaly 21 ($\sim$47 Ma). The P-wave data were modeled by a combined forward ray-tracing and inversion into a 2D velocity model. Strong lower crustal reflectivity in the thick igneous section imparted ambiguity on Moho interpretation from the OBS/H data. Gravity modeling was used interactively with the ray-tracing to obtain a consistent model. The forward gravity model was corrected by a lithospheric mantle density model based on estimated thermal expansion. The thermal model was calculated by a 2D finite-element program, using the opening history of the oceanic basin. This procedure removed a $\sim$70 mGal regional misfit, and the final fit between observed and calculated gravity is good. Also upper mantle reflectivity is abundant under the thick igneous crust, limited mostly to a zone 2-4 km below the Moho. This indicates a Moho transition zone where mafic and ultramafic rocks interfinger. The profile shows a rapid transition over a distance of 15-20 km from continent to oceanic crust (COT), similar to earlier results. Maximum igneous crustal thickness was found to be 18 km, and from the COT the thickness decreases to $\sim$6.5 km over a distance of 120 km, indicating magmatism abating over a period of at least $\sim$6 M.y. after continental breakup.

Lower crustal P-wave velocities of up to 7.3 km s^{-1} were found at the bottom of the crust. Combined with modeling of the S-wave data, we conclude that the crust is primarily of igneous origin here, though some continental contamination may exist at middle-lower crustal levels in a $\sim$30 km wide zone underneath the continental slope.