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Discussion of the characteristics and origin of a high density lower crustal body on the Møre volcanic margin, offshore Norway, from 3D density and magnetic modelling

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Volcanic margins are characterized by transient, voluminous basaltic volcanism that impede imaging of deeper structures. The Møre volcanic margin, offshore Norway, has been extensively studied, but significant controversies still exist in relation to the deeper part of the margin. The nature of the lower crust plays a key role in understanding the evolution of the margin.

A 3D density and magnetics model constrained by petrophysical and seismic data was constructed to map the main regional structures of the Møre margin. Due to the imaging problems on the margin only the shallower part of the model was sufficiently constrained. In order to address the modelling ambiguity of the deeper part of our model four different model setups were tested. In the first model no lower crustal body was included nor intra basement variations. The second model included a lower crustal body without magnetic properties and varying basement magnetic properties. The third model included a lower crustal body with magnetic properties. In the fourth model magnetic properties were allowed to vary laterally both in the basement and in the lower crustal body. Observations on the different models indicate the presence of a high density body with magnetic properties below the Møre Basin. The models also suggest that the high density body has at least twofold magnetic properties.

The geometry of the high density body and its relation to other geological features provides insight into its origin. The thinnest crust in the basin coincides with the occurrence of the high density body below the basin. About 90% of the crust immediately overlying the body is thinner than 10 km. A considerable part of the high density body correlates spatially with deep-seated sill complexes and shallower volcanics.

The basin experienced maximum extension in Jurassic-Early Cretaceous times but the volcanic emplacement occurred at the time of breakup in Early Tertiary. If the high density body is related to both these episodes it has to be explained by two distinct processes. Mantle serpentinization could have produced some of the body when the crust was the thinnest and much later underplating may have been added to the body.