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The continent ocean transition at the Norwegian Margin - constraints from 3D structural and gravity modelling

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The Norwegian continental margin is a well-explored passive volcanic margin that experienced a long pre-break up rifting history. Two major rift phases with different rift axes caused post-Jurassic subsidence but also post-depositional deformation of the pre-Cretaceous: (1) Late Jurassic-Early Cretaceous and (2) Late Cretaceous-Early Tertiary. The major pre-break up rifting in the Late Jurassic-Early Cretaceous initiated the formation of the deep Vøring and Møre Basins with more than 10 km of Cretaceous sediments. Final continental break up in the Late Paleocene - Earliest Eocene (˜55 Ma) culminated in the formation of oceanic crust and was followed by post-breakup subsidence. We present a regional, crustal scale, 3D structural model of the Norwegian continental margin integrating sedimentary and crustal layers from the continental and the oceanic domain. The model includes six sedimentary units (post-Mid-Miocene, pre-Mid- Miocene, Paleocene, post-Cenomanian Cretaceous, pre-Top Cenomanian Cretaceous and pre-Cretaceous), underlain on the continental side by a thinned crystalline crust and a lower crustal high velocity body. In the oceanic domain, three crustal layers (2AB, 3A and 3B), thickened at the continent-ocean transition (COT), are modelled below the post-break up deposits. Validation of the 3D structural model by 3D gravity modelling requires the presence of a high-density body in the lower continental crust adjacent to the continent ocean boundary at the western margins of the Vøring and Møre Basins which is partially in continuous transition with ocean layer 3B. The modelled structure at the COT suggests that the Late Cretaceous-

Early Tertiary rifting was related to differential stretching at the outer margin and that break up took place in a ‘base-up’ magmatic process as a continuation of underplating. Furthermore, 3D gravity modelling shows that the oceanic mantle is less dense than the continental mantle which could be related to different ages and temperatures of the mantle below the ocean and below the continent. Isostatic modelling carried out independently to determine the lateral variations in mantle density consistent with the load distribution of the crust confirms that the mantle below the ocean is less dense than below the mantle and indicates that isostatic compensation is achieved from a depth of 60 km downward.