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Determination and implication of Lower Crustal Bodies in the Møre rifted margin (offshore Norway)

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The Møre margin is the result of a long period of rifting events influenced by different tectonic processes. The last extension phase of the Møre margin was accompanied by the onset of massive magmatic activity leading to the emplacement of seaward dipping reflector sequences (SDRS). However the previous events were probably characterized by a smaller amount of magmatism, like for a classic magma poor rifted margin. Several refraction studies across the Møre rifted margin have also revealed the occurrence of high velocity lower crustal bodies (LCB) under the distal SDRS wedge but also in more proximal positions of the margin (e.g. Kvarven et al., 2012). The nature, age and location of these LCBs are still questionable and represent key and primary parameters to understand the tectonic and crustal evolution of the volcanic rifted margin. Nature, age and geometry of these LCBs have major implications on the rheological and thermal evolution of the rift/margin system.
In light of 2D potential field modelling combined with reflection and refraction seismic data, we reinvestigated the crustal nature of the Møre volcanic rifted margin and adjacent Jan Mayen corridor. In the proximal domain of the Møre volcanic rifted margin, our study shows that the LCBs most likely represent inherited crustal bodies and are not necessarily made of rift-related serpentinised mantle as previously proposed. In the distal margin, our preferred interpretation suggests that the outer LCBs are still made of relics of pre-rift lower continental crustal rocks, more or less intruded and/or underplated by Tertiary magmatic rocks. The seismic, magnetic and gravity data do not easily support large scale exhumation of serpentinised mantle in the inner and outer parts of the Møre Basin. Our model suggests that the Møre rift system evolved through a significant Late Jurassic-Cretaceous thinning phase. This rift episode led to a thin continental crust with pre rift lower crustal rocks but without perennial domains of exhumed and serpentinised mantle. This significant extensional event preceded a Late Cretaceous-Early Tertiary rift episode which is characterised by different and independent magmatic and lithospheric processes leading to breakup (e.g. diking and lithospheric plumbing).