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Plume-lithosphere interactions near a passive continental margin: a thermo-mechanical modelling study

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Plume head-lithosphere (PLI) interactions have important consequences both for tectonic and mineralogical evolution of the lithosphere and are often considered to be an important factor of continental break-up. Nevertheless, the interaction between plume and post break-up tectonics (i.e. evolution of passive margins) remain unclear. The passive margins represent important geometrical, thermal and rheological barriers that interact with the plume head material during its emplacement below the lithosphere. For example on the Scandinavia's North Atlantic passive margin the large Cenozoic uplift comprised uplift of basin margins as well as accelerated subsidence of basin centres adjacent to the uplifted landmasses while the compressional reactivation coincides with the postulated Iceland-plume events associated with massive magma emplacement. The goal of this study is to understand the role of the Iceland plume in the Cenozoic evolution of the Scandinavia's North Atlantic passive margin.
To investigate the interactions between the plume and passive margin we use fully coupled thermo-mechanical 2D numerical code (Flamar v12). The model area is 700 km deep and 1500 km wide comprising rheologically realistic lithosphere and the entire upper mantle
Our models have free upper surface boundary, surface erosion, account for the rheological stratification (upper crust, lower crust, lithospheric mantle and asthenosphere), brittle-elastic-ductile rheology, metamorphic phase changes (density and physical properties) and for the specific crustal and thermal structure of the Scandinavia's North Atlantic passive margin.
We have tested several parameters including the lateral position of the plume, the rate of extension and the thermo-rheological profile of the continental lithosphere.