



U-Pb ID-TIMS geochronology of gneisses and metaintrusives in the pre-Caledonian magma-poor hyperextended margin of Baltica

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Hyperextended basins at magma-poor rifted margins that are partly floored by transitional crust exhibit a characteristic lithological assemblage including exhumed subcontinental mantle, basement slivers, syn-rift deep-marine sediments, coarse-grained sediments derived from pre-rift supracrustal rocks or basement, minor mafic intrusives/volcanics, and extensional allochthons detached from the non-rifted continental margins. A lithological assemblage similar to those found in the distal domains of hyperextended margins is preserved below the large crystalline nappes in South Norway, including the Jotun, Upper Bergsdalen, and Lindås nappes. This mixed unit, in the following non-genetically referred to as *mélange*, comprises metapelites, metasandstones, metaconglomerates, solitary serpentinite bodies, detrital serpentinite-soapstone conglomerates, thin discontinuous gneiss sheets, and minor late Scandian intrusives. The *mélange* can be traced almost seamlessly from Bergen to Otta. The Scandian metamorphic overprint is notably consistent along strike the *mélange* zone, which is shown by the peak metamorphic temperatures and pressures estimated at about 500 ± 50 °C (RSCM) and about 7.5 ± 2 kbar as well as unit-wide homogeneous $\delta^{18}\text{O}_{\text{Carb}}$ values between +11 and +15.5 ‰ (SMOW). The rock assemblage and the structural position below the crystalline nappes suggests that the *mélange* may have formed in the proximity of the ocean-continent transition zone of the pre-Caledonian magma-poor hyperextended margin of Baltica.

The constituents of *mélange* units formed in the distal domains of hyperextended margins, although heterogeneous, are not exotic or suspect with respect to the rifted margin. The slivers of basement and extensional allochthons match the pre-rift tectonothermal history of basement and supracrustal rocks from which they were detached during hyperextension. The tectonothermal “fingerprint” of the basement slivers and extensional allochthons may help to identify the origin of such heterogeneous units after they were incorporated in a mountain belt during inversion of the passive margin. Furthermore, later magmatic additions and tectonometamorphic overprints may provide important information on the post-rift geological history.

We present U-Pb ID-TIMS ages of eleven rocks from the *mélange* unit in south Norway. Four gneiss sheets crystallized in the Mesoproterozoic at about 1495 and 1229 Ma. Two gneisses contain secondary titanite that formed close to 1100 Ma. The ages of crystallization and metamorphism are similar to those of the Telemarkia Terrane in southern Norway and support a Baltican origin of the *mélange*. Three meta-igneous rocks yielded latest Cambrian–early Ordovician crystallization ages and may have been added to the rock assemblage either during shortening within a narrow basin floored by transitional crust or during hyperextension in a back-arc basin. Scandian thrusting and main inversion of the hyperextended margin began at c. 438–427 Ma, which is indicated by the formation of metamorphic titanite and zircon. At c. 420 Ma, the westernmost parts of the *mélange* were locally truncated by late Scandian granitoid intrusives.