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On structural style, deformation coupling and the incision of Mesozoic to Quaternary bedrock surfaces in coastal Norway

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The Quaternary strandflat along the Norwegian coast is normally considered to be controlled by combinations of inherited Late Paleozoic- Mesozoic weathering and Quaternary erosion. We demonstrate that 1) the distribution of this important geomorphological element was controlled by the inherited structure of the necking domain and proximal margin and 2) that the width of the strandflat changes with crustal taper and thus reflects the tectonic evolution of the margin from the Paleozoic to present day. In particular, the distribution of the strandflat reflects the structural configuration developed during the phase of deformation coupling. Where coupling structures combine to produce the main breakaway complexes along the margin, structural style will reflect the thickness, rheology and inherited structure of the crust and, tentatively, the efficiency of the coupling process. During deformation coupling, large-magnitude faults cut previously extended crust, resulting in laterally variable footwall uplift and variable erosional incision. Along the Mid-Norwegian margin this led to stacking of incised erosional surfaces along the most sharply tapered margin segments, whereas the footwall uplifts associated with more gently tapered margin segments were characterized by shorter wavelengths. Later Cenozoic uplift rotated earlier incised surfaces and caused coastwards incision by younger ones; the youngest is the so-called Quaternary strandflat. It has been proposed that the strandflat represents, wholly or in part, reworking of a Mesozoic or older basement weathering surface. We show that in sharply tapered margin segments, the preservation potential for such a surface inboard of the basement-sediment contact is controlled by the angle between that surface and the incising strandflat. This angle depends on inherited fault-block tilt, plus or minus the tilt superimposed by Cenozoic uplift. In sharply tapered margin segments, preservation of these old surfaces in the coastal zone is less likely due to more widely distributed Jurassic-Cretaceous footwall uplift and the successive incision of younger surfaces of Cretaceous and Cenozoic age. In some of the sharply tapered margin segments (notably the Møre area), strands of large-magnitude, Jurassic-Cretaceous faults, once the agents of deformation coupling, reach the present-day seafloor, where they constitute the contact between sedimentary rocks and crystalline basement. In these areas, the strandflat does not extend outboard of the faults. Thus, inboard of gently tapered margin segments in the Trøndelag Platform area, the width of the Quaternary strandflat reflects a reworked submesozoic surface whereas inboard of sharply tapered margin segments in the Møre region, it reflects the extent of eroded crystalline rocks in the footwalls of coupling faults.