

Isostatic and dynamic support of high passive margin topography in southwestern Scandinavia

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Substantial controversy surrounds the origin and recent evolution of high topography along passive continental margins in the North Atlantic, with suggested age of formation ranging from early Paleozoic Caledonian orogenesis to Neogene uplift of a Mesozoic peneplain. Here we focus on the well-documented high passive margin in southwestern Scandinavia, and quantify the relative contributions of crustal isostasy and dynamic topography in controlling the present topography. We find that most topography is compensated by the crustal structure, suggesting a topographic age related to ~ 400 Myr old Caledonian orogenesis. In addition, we infer that dynamic uplift (~ 300 m) has rejuvenated existing topography locally in coastal region within the last ~ 10 Myr due to mantle convection. Such uplift has, in combination with a general eustatic sea-level fall and concurrent erosion-driven isostatic rock-column uplift, the potential to increase erosion of coastal-near regions and explain observations that have traditionally been interpreted in favor of the peneplain uplift model. We conclude that high topography along the Scandinavian margin cannot represent remnants of a peneplain uplifted within the last ~ 20 Myr. Topography must have been high since the Caledonian orogeny.