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A Geomorphological Analysis of the Cenozoic Rejuvenation of the Southwestern Norwegian 'Passive' Margin

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Although the Norwegian and Greenland rifted margins underwent Early Paleocene breakup, the southwestern Norwegian continental margin exhibits 2 to 3 km-high, sharply asymmetric seaward-facing escarpments and a 250+ km long topographic displacement gradient, a morphology not consistent with simple margin evolution models that predict subsidence and cooling as the dominate processes in tectonically-quiescent regions. Such atypical margins present a paradox: How is high, rugged topography along rifted margins maintained for tens to hundreds of millions of years after the cessation of extension? Recent work indicates the offshore crustal thinning gradient, a measure of the length from the continental escarpment to the location of the maximum crustal thickness, may play a controlling role: where the gradient is sharp the topography is most elevated; where gentle, the escarpments are lower. Although controversy remains, it is generally accepted, based on offshore geophysical data and onshore geomorphology, thermochronology, and structural geology, that the southwestern Norwegian escarpment has undergone topographic rejuvenation during the Cenozoic. Although several mechanistic models invoking various contributions of active tectonism have been proposed, from remnant topography recently carved by extensive glaciation to active uplift along large-scale onshore margin-parallel faults, the rejuvenating mechanism has not been resolved.

Non-glacial components of rock column uplift may possibly be occurring today: tectonic control of major drainage patterns has been proposed and recent work in the Møre-Trøndelag Fault Complex provides compelling evidence for discrete fault-bound tectonic blocks with unique exhumation histories. We are seeking to constrain the primary mode of Cenozoic deformation along the western Norwegian continental rifted margin by utilizing a tiered approach with distinct but complementary techniques encompassing tectonic geomorphology, structural geology, and low-temperature thermochronology with the goal of rigorously testing the Møre-Trøndelag Fault Complex normal fault displacement gradient and constraining the most recent timing and rate of Møre-Trøndelag Fault Complex fault activity through coupled fluvial geomorphological knickpoints analysis and multichronometer dating.