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Tectonic topography on a glaciated margin: the role of inherited structure

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The effect of faulting on topography has been intensively studied in arid and semi-arid areas, where landscapes have not been affected by glacial erosion or high rates of chemical weathering. Recent studies suggest that post-Mesozoic reactivation of inherited faults and fabrics had a pronounced influence on the shape of western Fennoscandia throughout the Cenozoic. We have taken a multidisciplinary approach to address this theme. Below, we provide examples from the multiply glaciated Fennoscandian margin.

In Scandinavia, Caledonian mountain building was followed by post-orogenic extension and strike-slip, then by multiple phases of rifting until breakup around 54 Ma. Between collapse of the Caledonian orogen and onset of seafloor spreading, a change in relative plate motion of c. 90^o has been advocated by other workers. This change is consistent with the kinematics and architecture of reactivated faults as well as by geochronological age-patterns and by the present-day topography and geomorphology.

Fault architectures in the Møre-Trøndelag Fault Complex (MTFC) commonly comprise brittle normal faults with red hematite staining, zeolite mineralizations and gouge. These fault products commonly overprint subhorizontal, ductile mineral lineations and/or early fault planes with subhorizontal or oblique slickenlines and epidote-bearing cataclasites or mineralizations. In some cases, an apparent rotation of the tectonic transport direction away from the fault core likely reflects a tendency to abandon former damage zones during re-activation, and a focussing of deformation into the weaker fault core.

On the scale of the Fennoscandian margin, an inverse correlation between the asymmetrically distributed topographic elevation and (sea-level) apatite fission-track (AFT) ages reflects a post-Jurassic denudation pattern. AFT age-jumps across tectonic lineaments provide Late Cretaceous maximum ages for kilometre-scale fault movements in the Møre, Lofoten and Vesterålen areas. Analyses of topography and landscape, drainage patterns and the configuration of palaeosurfaces suggest 1) differential uplift normal and parallel to fault strike, 2) offset and rotation of palaeosurfaces, and 3) establishment of tectonically influenced drainage systems across and around reactivated faults. Glacial erosion modified the landscape significantly in the area of the ‘Great escarpment´ of western Norway, as well as in the Lofoten and Vesterålen areas. However, the pre-glacial topography can be reconstructed in some areas, from palaeosurface remnants and parallel arête that preserve common breaks in slope. Mesozoic basin remnants preserved inside fjords and sounds provide markers of pre-depositional basement surfaces. These markers can be extrapolated to, and compared with, adjacent basement topography, providing a glimpse of the Mesozoic landscape and its subsequent evolution.