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The evolution of the passive continental margin of Norway and its adjacent mainland – using the sub-Cambrian peneplain as a reference surface.

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The structuring, uplift and subsidence of the passive margin and shelf of Norway and its adjacent mainland were affected by several profound geological processes, including inherited basement structural grain related to the Proterozoic and Caledonian orogens and also including the extensional collapse of the Caledonides (Gabrielsen et al. 2000). This has been followed by several stages of late Palaoezoic – Cenozoic rifting and associated thermotectonic activity, Cenozoic accelerated uplift of uncertain origin of the hinterland, creating an irregular pattern of upheaval and, finally Pleistocene – Holocene glacial loading and unloading (Gabrielsen et al. 2010). These processes have strongly influenced the topography of the hinterland, thus causing and acting in concert with climate fluctuations (Nielsen et al. 2009).

The correlation of erosional surfaces of regional significance on the shelf and on the mainland is a key to the evaluating the total topography of the margin. Because of the lack of datable surfaces on the mainland, this is problematic. The so-called Paleic surface has been used in this context, but its age and nature is not well constrained and the absence of post-Caledonian rocks in the western and central mainland of southern Norway adds to this complexity. In contrast, the sub-Cambrian peneplain, which is found in larger parts of Scandinavia, is well established when it comes to dating and development (e.g. Strøm 1948). It is generally accepted that this surface had only a minor topography, if any, throughout Scandinavia at the earliest Cambrian. Hence, its present relief is the result of the accumulated vertical displacements from the Caledonian to the Present. Still, even though it was well established through regional mapping already in the late 19th century, much remains in the detailed documentation of this important surface. To improve the topographic accuracy in its characterization, fieldwork has been initiated to establish a detailed WNW-ESE-trending profile across south Norway. Simultaneously a detailed mapping to establish a full map of the sub-Cambrian peneplain for southern Norway has been initiated, using automatic correlation techniques based on digital topographic data.

A WNW-ESE-oriented profile across southern Norway displays a pronounced asymmetry with an eastern flank dipping moderately to the ESE, a strikingly flat to slightly undulating central part with a minor ESE-erly dip and a steepened westerly crest, and a faulted, steep WNW-flank. The fault throw along the western flank of the Hardangervidda Plateau is in the excess of one kilometer. This fault system is associated with the collapse of the Caledonides, but bear the signs of multiple stages of rejuvenation. Even farther to the west, the sub-Cambrian peneplain is broken by the Mesozoic external fault systems of the Jurassic-Cretaceous offshore graben systems, which also offsets the peneplain (down-to-east extension) by several kilometres. Also this system bears indications of reactivation.

The sub-Cambrian peneplain itself displays a variety of configurations, including an undisturbed basal conglomerate, a weathered and mineralized, undulating surface with small pockets of alun shale or siltstone, a tectonically disturbed primary contact with parauthochtonous black shale or black sandstone and a more strongly tectonized contact with mylonite and rejuvenated basement lenses. The present analysis utilized the sub-Cambrian peneplain as a reference surface, because its present topography resulted from several elements of deformation accumulated throughout the Caledonian to the Present. Hence, it can be used as a reference surface for younger erosional surfaces onland Norway, whether this are of regional or local origin.

In section of southern Norway including the (present) inner shelf and the hinterland, several morphological elements can be identified, from west to east: 1) The eastern, stable platform of the Mesozoic Viking Graben, 2) the external fault complex of the graben system, 3) the strandflat, 4) the western mainland slope between the two master fault systems, the mountain platform of Hardangervidda 5) the eastern slope. Although this scheme

seems to be generally valid for large parts of the western margin of Scandinavia, large elevation fluctuations are evident along the margin, having wavelengths in the order of 100 – 500 km and amplitudes in the order of 1 km.

References

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