Paper Number: 1948

Burial and exhumation history of southernmost Norway: epeirogenic uplifts before and after NE Atlantic break-up

Japsen, P. [1], Green, P.F. [2], Bonow, J.M. [3], Chalmers, J.A. [1] and Rasmussen, E.S. [1]

[1]Geological Survey of Denmark and Greenland (GEUS), 1350 Copenhagen, Denmark (pj@geus.dk)
[2]Geotrack International, Victoria 3055, Australia
[3]Mid Sweden University, SE-83225 Östersund, Sweden

The age and origin of the elevated Norwegian margin is a matter of controversy. Here we present new apatite fission-track analysis (AFTA) data from 27 basement samples from Norway south of ~60°N that define three episodes of cooling and exhumation that overlap in time with events defined in southern Sweden [1]. The samples cooled below palaeotemperatures of >100°C in a major episode of Triassic cooling as reported by previous studies [2]. These palaeotemperatures reflect heating below a Palaeozoic–Triassic cover because our samples were near the surface in the Cambrian as Cambrian sediments crop out within the study area. By Late Triassic, this cover had been removed over wide areas as demonstrated by Triassic K-Ar ages of epigenetic mineral deposits just east of our study area [3]. Our samples were therefore again at or close to the surface in the Late Triassic.

Our samples reached palaeotemperatures of ~80°C prior to a Jurassic phase of cooling and exhumation following a phase of Late Triassic – Jurassic burial. Upper Jurassic sandstone rests on basement near Bergen, NW of our study area [4], and we infer that this event led to complete removal of any remaining Phanerozoic cover adjacent to the evolving rift prior to Late Jurassic burial. The AFTA data reveal a third phase of cooling in the early Miocene when samples that are now near sea level cooled below palaeotemperatures of ~60°C. For likely values of the palaeogeothermal gradient, such palaeotemperatures correspond to burial below rock columns that reach well above the present landscape where elevations rarely exceed 1 km above sea level. This implies that the early Miocene surface lay well above the level of the present landscape, which must therefore have been shaped by Neogene uplift and erosion.

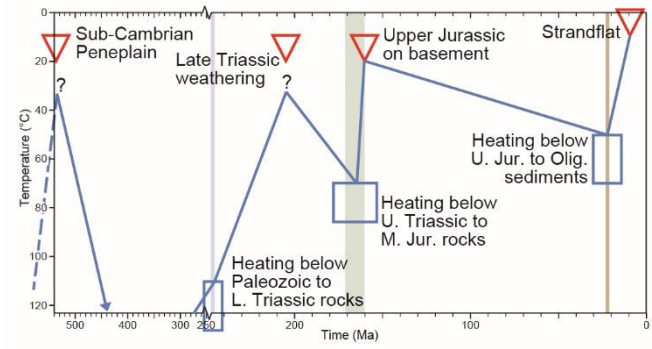

Figure 1: Heating-cooling history of Precambrian basement along the coast of SW Norway. Vertical bands: Onset of regional cooling from AFTA. Boxes: Local constraints.

This is consistent with the onset of progradation of major, braided river complexes southwards from Norway in earliest Miocene [5] and with suggestions that the near-horizontal 'Palaeic' surfaces of southern Norway are the result of Cenozoic erosion to sea level followed by later uplift to their present elevations [6]. The AFTA data do not resolve this most recent event, but the timing of the uplift

corresponds to the pronounced tilt and truncation of pre-Pliocene strata off Norway [7]. Our results demonstrate that epeirogenic burial and exhumation shaped southern Scandinavia.

References:

[1] Japsen P et al. (2015) Gondwana Research, in press.
[2] Rohrman M. et al. (1995) Tectonics 14: 700-714.
[3] Ineson PR et al. (1975) Economic Geology 70: 1426-1436.
[4] Fossen H et al. (1997) Norsk Geologisk Tidsskrift 77: 269-287.
[5] Rasmussen ES et al. (2010) GEUS Bulletin 22: 92 pp.
[6] Lidmar-Bergström K et al. (2013) Global and Planetary Change 100: 153-171.
[7] Stoker MS et al. (2005) Marine and Petroleum Geology 22: 977-1005.