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Phanerozoic burial and exhumation history of southernmost Norway estimated from apatite fission-track analysis data and geological observations

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We present new apatite fission-track analysis (AFTA) data from 27 basement samples from Norway south of ∼60°N. The data define three events of cooling and exhumation that overlap in time with events defined from AFTA in southern Sweden (Japsen et al. 2015).
The samples cooled below palaeotemperatures of >100°C in a major episode of Triassic cooling as also reported by previous studies (Rohrman et al. 1995). Our study area is just south of the Hardangervidda where Cambrian sediments and Caledonian nappes are present. We thus infer that these palaeotemperatures reflect heating below a cover that accumulated during the Palaeozoic and Triassic. By Late Triassic, this cover had been removed from the Utsira High, off SW Norway, resulting in deep weathering of a granitic landscape (Fredin et al. 2014). Our samples were therefore at or close to the surface at this time.
Palaeotemperatures reached ∼80°C prior to a second phase of cooling and exhumation in the Jurassic, following a phase of Late Triassic – Jurassic burial. Upper Jurassic sandstones rest on basement near Bergen, NW of our study area (Fossen et al. 1997), and we infer that the Jurassic event led to complete removal of any remaining Phanerozoic cover in the region adjacent to the evolving rift system prior to Late Jurassic subsidence and burial.
The 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-day landscape where elevations rarely exceed 1 km above sea level. This implies that the present-day landscape was shaped by Neogene erosion. This is in agreement with the suggestion of Lidmar-Bergström et al. (2013) that the near-horizontal Palaeic surfaces of southern Norway are the result of Cenozoic erosion to sea level followed by uplift to their present elevations in a fourth event that is not detected by the AFTA data.

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