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Burial and exhumation history of Jurassic sediments on Andøya, northern Norway, based on AFTA and VR data

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Middle–Upper Jurassic sediments rest on basement onshore and nearshore Norway near Bergen and Trondheim. The only outcrop is on the island of Andøya in the Lofoten archipelago (Bøe et al. 2010), where a Middle Jurassic – Lower Cretaceous succession of 900 m occurs in a small, partly fault-bounded basin. We have measured vitrinite reflectance (VR) on samples from Norminol well A (courtesy of the Norwegian Petroleum Directorate) that penetrated the Andøya Mesozoic sequence (Petersen et al. 2013). The mean VR value is 0.48% for 6 samples from depths between 220 and 520 m below sea level. This value corresponds to a palaeotemperature of 80°C which, for any reasonable palaeogeothermal gradient, implies that a km-thick cover of Cretaceous and younger sediments accumulated and was removed from above the presently-exposed sediments; e.g. ∼2 km for 30°C/km and a palaeo-surface temperature of 20°C.

New apatite fission-track analysis (AFTA) data from samples of Jurassic sediments and basement from the Lofoten region provide evidence for cooling episodes that are synchronous with events that affected southern Scandinavia (Japsen et al. 2016). The new results thus show that the basement was exhumed during the late Carboniferous, Middle Triassic and Middle Jurassic with intervening phases of reburial documented by the stratigraphic record offshore Lofoten (Færseth 2012; Henstra et al. 2016).

Thermal subsidence following Late Jurassic rifting (Henstra et al. 2016), led to burial of Lofoten and the adjacent region. Our AFTA and VR data show that the maximum thickness of this sedimentary cover was in the mid-Cretaceous prior to a phase of exhumation; a thickness equivalent to the altitude of the highest peaks of Northern Scandinavia. A Miocene phase of uplift and erosion then led to exhumation of the Jurassic rifts in parts of Lofoten.

The Atlantic margin of northern Scandinavia thus formed during several phases of burial and exhumation during the Phanerozoic, leading to the formation of the present-day landscape that contains exhumed Mesozoic rift systems as well as features shaped during late Cenozoic fluvial and glacial erosion.

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