Burial, uplift and erosion history of North-East Greenland based on thermochronological data, stratigraphic landscape analysis and the geological record

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We have undertaken a regional study of the thermo-tectonic evolution based on apatite fission-track analysis and vitrinite reflectance data and on stratigraphic landscape analysis of North-East Greenland. Our results reveal a long history of Phanerozoic burial and exhumation across the region with Mesozoic events of denudation during Middle Triassic, Early Jurassic, earliest Cretaceous and mid-Cretaceous times.

Following breakup at the Paleocene–Eocene transition, up to 2 km of post-rift section (including lavas and sediments) accumulated over the margin that began to be exhumed in the late Eocene, coinciding with a major plate reorganisation in the NE Atlantic. Uplift events in the late Miocene and in the early Pliocene then followed. Furthermore, local episodes of cooling related to igneous activity in the early Eocene and in the early Miocene affected the Jameson Land area.

Two elevated peneplains extent across the entire region: the Upper Planation Surface (UPS, at c. 2 km a.s.l.) that cuts across Palaeogene basalts and older rocks and the Lower Planation Surface (LPS, at c. 1 km a.s.l.) that formed by incision along valleys below the UPS.

We explain these post-basalt surfaces in terms of three phases of uplift and erosion/incision. The UPS was formed by erosion to base level subsequent to end-Eocene uplift, and the LPS was formed by incision below the UPS to a new base level after late Miocene uplift. Both surfaces were uplifted to their present elevations in the early Pliocene, leading to formation of the present-day landscape after fluvial and glacial erosion.