ICAM8 Abstracts
Lithosphere dynamics & seismology

New maps and transects of the crustal structure of Ellesmere Island

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Analysis of receiver function data acquired during the Ellesmere Island Lithosphere Teleseismic Experiment (ELLITE) resulted in a crustal velocity model along a ~460 km long NNW-SSE oriented transect crossing the major tectonic and structural domains of Ellesmere Island. This model, together with geological constraints, formed the basis of a gravity model following the same transect. The new models were integrated with existing seismic constraints and an existing gravity Moho model covering Ellesmere Island and adjacent areas to produce new maps of inferred depth to basement, thickness of the crystalline crust, as well as Moho depth.

Moho depths can be interpreted in terms of Eurekan (Cenozoic) and Ellesmerian (Palaeozoic) deformation. Thick metasediments throughout central Ellesmere Island correlates with areas of dominantly Ellesmerian accretion. The WSW-ENE orientated Hazen Stable Block, which displays upper crust strongly deformed in the Palaeozoic but essentially undeformed in the Cenozoic, correlates with shallow Moho with high velocity/density lower crust. This zone clearly separates a thick crustal block to the north from the North American-Greenland Craton to the south. High velocity/density lower crust may be related to igneous activity during various episodes of rifting in the area and/or the Cretaceous-Palaeocene High Arctic Large Igneous Province. A correlation appears to exist between topography, Moho depth and the presence of dykes in Nansen Sound suggesting a common tectono-magmatic origin. Lincoln Sea shows consistently thin crust likely related to rifting.

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.

Late Cretaceous-Cenozoic intraplate basin inversion in the North Atlantic-western Alpine-Tethys realm and plate boundary dynamics

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Intraplate basin/structural inversion is a good marker of ("far-field") tectonic stress regime changes that are linked to plate boundary reorganisations. The premise is well-established in the literature: how Late Cretaceous-Palaeocene inversion of sedimentary basins has occurred in north-central Europe, for example, can be linked explicitly with the timing and style of plate break-up in the North Atlantic. Periods of intraplate tectonics (marked primarily by structural inversion in initially extensional sedimentary basins) in the North Atlantic realm is here documented and correlated and interpreted in the context of plate tectonics kinematics and processes as well as global tectonics. Examples documenting intraplate tectonics are from published literature and are primarily interpreted seismic reflection profiles (more inferential examples will be permitted depending on robustness of timing where no such data exist but intraplate deformation seems in evidence from other kinds of observations). The focus is on the Late Cretaceous-Palaeocene, the Eocene and the Miocene. The aim is to establish a basis for investigating if/how regional intraplate deformation/inversion in the North Atlantic-western Alpine-Tethys realm may be linked to rapid plate dynamic changes in this tectonic realm (and globally).