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New maps of (intra)crustal structure of Ellesmere Island and environs

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A velocity model of the crust of Ellesmere Island determined from receiver functions from earthquake data acquired during the deployment of the Ellesmere Island Lithosphere Teleseismic Experiment (ELLITE) was used as the basis of a geologically constrained crustal gravity model crossing the major tectonic/structural domains of Ellesmere Island, running some 460 km NNW-SSE from the vicinity of Yelverton Bay in the north to the vicinity of Bache Peninsula in the south. This profile was integrated with pre-existing crustal structure information in the vicinity of Ellesmere Island to produce thickness maps of young, supracrustal, and inferred metasedimentary upper crustal layers as well as Moho depth, crustal thickness, and the distribution of high velocity/density lower crust in the area.

Moho depths can be interpreted in terms of Eurekan (Cenozoic) and Ellesmerian (Palaeozoic) tectonic history. Thick metasedimentary strata throughout central Ellesmere Island correlate 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, is underlain by a zone of shallow Moho with high velocity/density lower crust. The Hazen Stable Block clearly separates a thick, crystalline crustal terrane in the north of Ellesmere Island from the North American-Greenland Craton to its south. High velocity/density lower crust is interpreted to be related to igneous activity during various episodes of rifting in the area and/or the impact of so-called High Arctic Large Igneous Province magmatism in the Cretaceous and Palaeocene. A correlation may exist between topography, Moho depth and the location of dykes in the area of Nansen Sound suggesting a tectonic role in the origin of this major physiographic structure. Lincoln Sea shows consistently thin crust likely related to rifting.