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Gravity gradient for Greenland and its tectonic interpretation

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Gravity gradient is the indicator of the stress conditions in the lithosphere.
The axis of gradient signs changing indicates the boundary of blocks exposed to different tensions. The lines of maxima and minima of gravity gradient correspondingly marked the boundary of zones of compression and expansion.
Four various types of the gravity anomalies was calculated: in free air, Bouguer's, Glennie's and isostatic. And then was calculated their gradients.
The preliminary analysis of gradients shows, that its qualitative behavior for all types of gravity anomalies is very closely and, therefore, conclusions about the stress conditions in the lithosphere of the considering region are definite.
Range of the changing for gradients of gravity in free air anomalies – from –96.1 to 135.8 eötvös, and for gradients of gravity Bouguer's anomalies – from –122.6 to 141.9 eötvös.
Range of the changing for gradients of gravity Glennie's and isostatic anomalies are substantially smaller, for gradients of gravity Glennie's anomalies – from –27.6 to 25.5 eötvös, and for gradients of gravity isostatic anomalies – from –19.2 to 21.2 eötvös.
This difference in the gradient values, evidently, connects with the difference in the thoroughness and the degree of averaging of the anomalies.

Analysis of gravity gradient shown the following:

1. In the western part of the researching region are distinguished three linear structures (two maxima and one minimum), which marked rift zone of the Baffin Bay and Davis Strait. This disappeared rift characterized by depressed zone, lengthened from Nares strait along the west sea coast of Greenland. In the south part of this zone localized deep fault, which northward become lesser expressed.
To the north and north-east from the Nares strait lengthened to the North Pole zone of compression, blocked up existing previously rift, by which the rotation of the Greenland part of Canadian shield from its cardinal part happened. Center of this rotation, evidently, was the Nares strait.
To the south-west of the Nares strait observed axis of gravity gradient maximum, which lengthened along the shore of islands of Canadian Arctic Archipelago and proper Canada. It marked the narrow lengthy compression zone, arised, probably, from the character of the considering rift zone (its incomplete disclosure), which was not allowed free shifting of Canada and Canadian Arctic Archipelago from Greenland.

2. The fading of the west rift began after disclosure of the rift zone of northern part of the Mid-Atlantic ridge. Meanwhile arising east rift zone lead to the changing of the Greenland moving direction, that, probably, offer to origin compression zones in all coastal zone of Greenland, lead to orogeny. At the same time the central part of the Greenland plate was not compressed and remained weakly strained. Now the central part of Greenland was subjected to small extension, caused by glaciation.

3. The Mid-Atlantic ridge is exhibited in the gravity gradients much weaker than the west rift zone. The linear structure (axis of the gravity gradient minimum) was not observed, but then the changing and character of the gravity gradient on the different side of the rift are different. Region to the west of the rift characterized by the negative gravity gradient, while region to the east of the rift, gravity gradient are positive. One from the possible explanations of such picture can be the different petrological composition of these blocks with the different mechanical and reological features.

4. Region northeasterly of the central part of the Greenland shore have a complex enough picture of the changing compression and expansion zones, and Svalbard Archipelago from west and south bordered by zone of weaken rock.