GC2024-SG017

Lithospheric magnetic sources in the East Arctic region

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We consider the thermal regime of the lithosphere under the East Arctic region (Northern Eurasia, marginal seas and the Arctic Ocean) based on geomagnetic data. Firstly, we calculate the depth to the bottom of the lithospheric magnetic sources using the EMAG2v3 model of the lithospheric geomagnetic field. A modified centroid method, developed for a fractal character of magnetization, is applied for the Eurasia Basin. For other areas, a centroid method, assuming a magnetization to be uncorrelated, is used. This bottom depth to some extent can be regarded as the Curie point depth (CPD). Secondly, taking into account that the temperature at the CPD is 578° C (CPD of magnetite), we suggest that our results provide some insights into the lithospheric thermal state under the considered territory and we estimate surface heat flow on their basis. We consider a case when the thermal field is steady-state and 1-D, the convection at all the depths is negligible, and only the radioactive sources of heat production exist in the crystalline crust. The CRUST 1.0 model is used to constrain the crustal structure.

The obtained distributions of the bottom depth of the lithospheric magnetic sources and surface heat flow show that the hottest lithosphere within the study area is attributed to the Eurasia Basin of the Arctic Ocean, where the modern spreading along the Gakkel Ridge is observed. Relatively high lithospheric temperatures are also seen under the East Siberian Sea and eastern part of the Laptev Sea, while the lithosphere is cold under the western part of the Laptev Sea including the Lena River delta and Buor-Khaya Bay. On the continent, the eastward lithospheric heating is traced from the Siberian Platform to the Koryak-Kamchatka fold belt. The most large-scale revealed tendencies are confirmed by independent geophysical data (available surface heat flow values and lithospheric temperature distributions based on seismic tomography data). The obtained results are of great value due to the lack of surface heat flow measurements within the study region.

The study was supported by the Russian Science Foundation, Grant No. 21-77-10070.