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INDICATORS OF THE INTENSITY OF GEODYNAMIC PROCESSES ALONG THE ATLANTIC–ARCTIC RIFT SYSTEM

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Indicators of geodynamic activity of processes along the AARS axis (Fig. 1), investigated in this paper, are seismicity and heat flow. Section δ(Vp/Vs) (Fig. 2) is used as the only parameter for continuous geodynamic characteristics of the entire depth of the mantle, which is compared with these indicators for different age segments. The aim of the work is to establish a connection between the intensity of indicators with their position and age of segments, the geometry of the active boundary and the manifestations of plumes. The Arctic part of the AARS is a small part of it, but the processes taking place in it should fit into the General logic of the development of the entire rift system.

In the section δ(Vp/Vs) the main demarcation faults and "cold" anomalies of the upper mantle are located in the places of the maximum sublatitudinal displacement of the AARS (Fig. 1), which has a left strike slip morphology. The most striking example of this shift is the group of faults of the Equatorial segment, the double fault system of Charlie-Gibbs and the shift of the AARS along the Knipovich ridge and the Lena trough to the transition to the Gakkel ridge.

The distribution of the total seismic moment shows that the main geodynamic activity of AARS is concentrated in almost point zones – either shear or plume – a ~90% of the length of AARS contains the epicenters of weak seismic events associated with spreading processes. The maximum energy deposition, therefore, occurs in geodynamic settings, are not associated with the generation of new crust at divergent plates divergent from the long border. The main demarcation zones – Equatorial and the transition from the North Atlantic to the Arctic – are characterized by maximum energy release with events of the shear mechanism (Boldyrev, 1998). A comparison of the heat flux with the age of the segments shows that the thermal evolution along the AARS with age is subject to a similar trend, as the evolution of the normal tension of the rift system – the Sclater-Sorokhtin Law. The similarity lies in the gradual cooling of the mantle under the AARS axis after the start of plate drift as space for spreading accretion becomes available.

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References:

1. *Boldyrev S.A.* Seismogeodynamics of Mid Atlantic Ridge // M.: MGK, 1998. 124 p.
2. *Sokolov S.Yu.* The state of geodynamic mobility in the mantle according to seismotomography and the ratio of velocities of P and S waves // Bulletin of Kamchatka Regional Association "Educational-Scientific Center". Earth Sciences. 2014. № 2 (24). C. 55-67.
3. *Khutorskoi M.D., Polyak B.G.* Heat flow in transform faults of the North Atlantic and Southeastern Pacifica // Geotectonics. 2017. №2. P. 55-66.
4. ANSS Earthquake Composite Catalog. 2014. (http://quake.geo.berkeley.edu/anss/, выборка 11.02.2014.).
5. Global Heat Flow Database. 2018. University of North Dakota. (https://engineering.und.edu/research/global-heat-flow-database/data.html).
6. *Grand S.P., van der Hilst R.D., Widiyantoro S.* Global seismic Tomography: A snapshot of convection in the Earth // GSA Today. 1997. V. 7. № 4. P.1-7.
7. *Van der Hilst R.D., Widiyantoro S., Engdahl E.R.,* Evidence of deep mantle circulation from global tomography // Nature. 1997. V. 386. № 625. P. 578 –584.

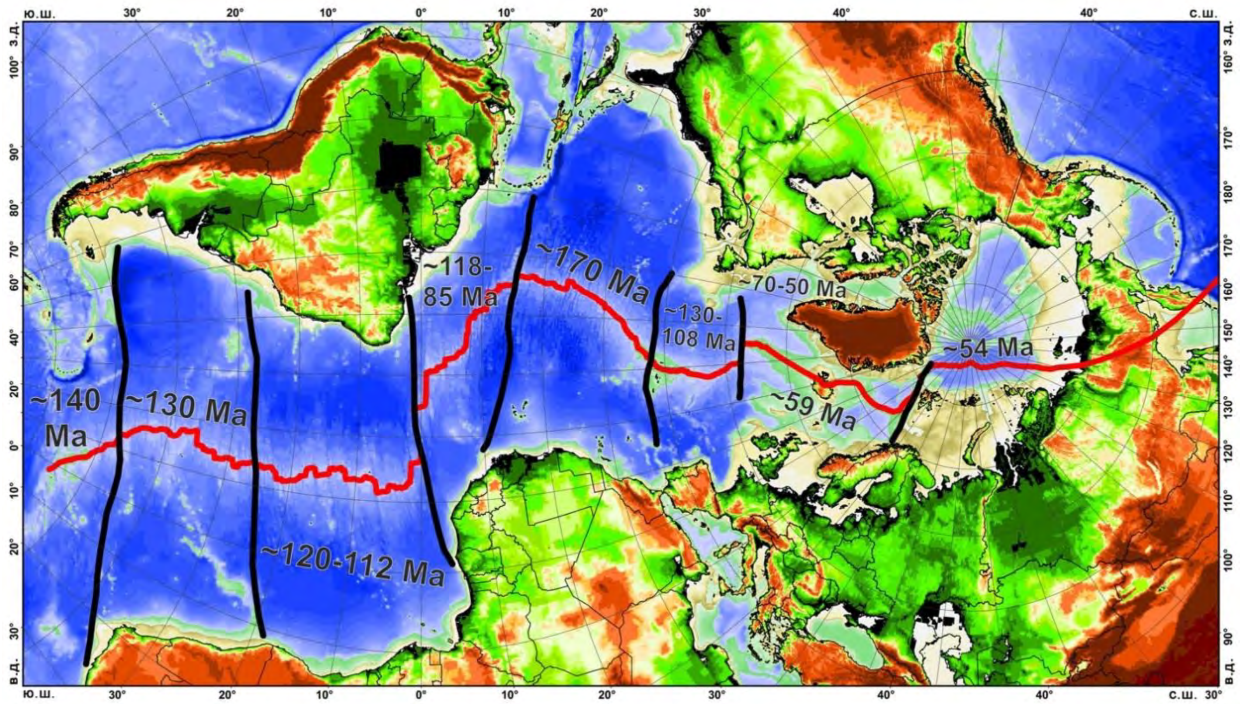

Fig. 1. Atlantic-Arctic rift system (AARS), along which (red line) the comparison of geological and geophysical parameters (Fig. 2) having geodynamic interpretation. The black lines are boundary faults, the AARS is segmented into blocks with different age of onset of spreading (the age specified in figures).

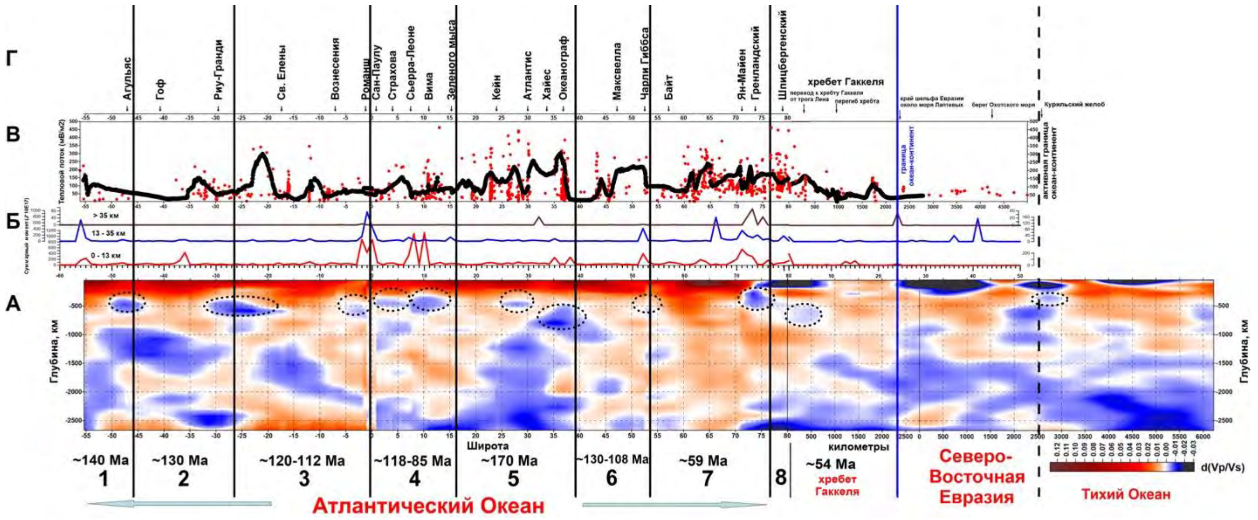

Fig. 2. Geological and geophysical characteristics along the AARS (the position of the profile and demarcation faults is shown in Fig.1). Vertical lines delineated blocks the demarcation between a fault indicating time start spreading processes and the sequence number of the segment having a descriptive meaning.

А – The section of the attribute δ(Vp/Vs) along the AARS calculated from the data (Grand et al., 1997; Van der Hilst et al. 1997) by the method (Sokolov, 2014). Section from 55°S to 80°N shown in projection on the axis of latitudes, then through the pole of the incision is shown along a profile line with horizontal coordinate, measured in kilometers. The areas of strong amplification of "cold" anomalies on the attribute section are outlined with a dotted line in comparison with cold anomalies on the initial section of S-waves.

Б –Total seismic moment along the axial zone of the AARS calculated from data (ANSS, 2014) for all types of magnitudes by the method (Boldyrev, 1998) for three depth ranges: 0-13, 13-35 and >35 km.

В – Values of the heat flow along the AARS according to (Podgornykh, Khutorskoy, 1997; Global..., 2018) (red dots) and the cross-section of the grid calculated by this data krigging method, the profile of the AARS (black dots).

Г – On the top of the Assembly characteristics are signed the names of the main faults crossing the MAR, and the morphological areas through which the profile passes.