

New data about small-magnitude earthquakes of the ultraslow-spreading Gakkel Ridge, Arctic Ocean

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The Gakkel Ridge forms the North America-Eurasia plate boundary in the Arctic. The ridge strikes approximately for 1800 km from 7° W near the intersection of the Gakkel Ridge and the Lena Trough to 125° E near the Siberian continental margin. The spreading rate of the ridge varies from 15 mm/yr to 6-7 mm/yr. The Gakkel Ridge is the slowest spreading section of the global mid-ocean ridge system. The Western Volcanic Zone (WVZ), the Sparsely Magmatic Zone (SMZ) and the Eastern Volcanic Zone (EVZ) are distinguished in the Gakkel Ridge on the basis of morphological, geological, and geophysical features.

At the present time there is available detailed bathymetry, gravimetric, magnetometer, petrological, and seismic ($m_b > 4$) data for the Gakkel Ridge. However, so far not enough information has been obtained on the distribution of small-magnitude earthquakes (or microearthquakes) within the ridge area due to the absence of a suitable observation system.

The renewal of instrumental seismological observations in 2011 (station ZFI (80.8°N, 47.7°E)) on Alexandra Land Island in the Franz Josef Land archipelago combined with other modern regional stations has created favorable conditions for the seismic monitoring of small-magnitude earthquakes the Gakkel Ridge, and studying of the differences in seismicity between the WVZ and the SMZ. We can now register small-magnitude earthquakes down to 1.5 ML within the Gakkel Ridge area.

Seismic monitoring of the Gakkel Ridge took place from December 2011 to January 2016. In order to improve the accuracy of the earthquakes epicenter locations, velocity models and regional seismic phase travel-times for spreading ridges in areas within the Euro-Arctic Region have been calculated.

The Gakkel Ridge is seismically active, regardless of having the lowest spreading velocity among global mid-ocean ridges. Quiet periods alternate with periods of higher seismic activity. Earthquakes epicenters are unevenly spread across the area. Most of the epicenters are assigned to the Sparsely Magmatic Zone, more specifically, to the area between 1.5°E and 19.0°E. We hypothesize that assignment of most earthquakes to the SMZ segment can be explained by the amagmatic character of the spreading of this segment. The structuring of this part of the ridge is characterized by the prevalence of tectonic processes, not magmatic or metamorphic ones.

The number of recorded earthquakes within the Gakkel Ridge has varied during the year. There were periods of quiescence and seismically active periods. Some of the ridge's sections are characterized with earthquake swarms, which seem to reflect some active process, proceeding at the given time at the place.

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