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Seismological investigation of lithosphere processes in the European Arctic

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The main objective of this work is to investigate the relationship between the offshore basin structure, the most recent seismicity (2011-2014), and heat flow in the European Arctic region. For this, we have created a generalized database of heat flow values for the Western Arctic Basin according to (Khytorskoy et al, 2013; Davies, 2010; Sundvor, 2000; The Global Heat Flow Database of the International Heat Flow Commission). Data analysis shows a wide scatter of geothermal measuring points in this sector of the Arctic Basin and its surroundings. We interpolated these values and then correlated the map with neotectonic structures of the Western Arctic Basin (Grantz, 2011; Alekseev et al, 2004).

The next step of the investigation is the creation of a General Seismic Bulletin above 70°N by combining the databases of the project participants (NORSAR, Kjeller, Norway; Kola Department Geophysical Survey of RAS, Apatity, Russian Federation; Federal Center for Integrated Arctic Research of RAS, Arkhangelsk, Russian Federation). An analysis of the spatial distribution of the epicenters of seismic events shows that each seismic network has its own monitoring areas and "zones of shadows" (Polar Science, 2014). The priority areas of each network have been determined. For example, Mohns Ridge, Knipovich Ridge and Svalbard are prioritized areas for the NORSAR network, Gakkel Ridge and the Archipelagos of Franz Josef Land and Novaya Zemlya are prioritized areas for the Arkhangelsk network.

The regional catalog of NORSAR contains about 4,200 earthquakes for the time period 1998 – 2015. The regional catalog of the Arkhangelsk seismic network includes about 1,200 earthquakes in the years 2004 – 2015. A significant contribution to this study of the seismicity in the European Arctic was the installation of new stations located directly in the Arctic.

Recent seismicity shows tectonic activity in the Arctic Basin caused by rifting, stretching lithosphere blocks and volcanic activity along the mid-oceanic ridges, the continent-ocean transition zones and graben structures in the Barents and Kara Sea. The weak seismicity of the Barents and Kara shelves can be explained by intraplate processes occurring in the continental lithosphere. Higher values of heat flow in the North- and South-Barents Basins and in the South-Kara Basin, in which hydrocarbon deposits are located, are consistent with a thinner lithosphere in these areas.