Seismicity, heat flow and tectonics of the West Arctic Basin

Irina Basukina (1), Galina Antonovsky (1), Elena Kremenetskaya (2), Michail Khutrotskoy (3)
(1) Institute of Environmental Problems of the North, Ural Branch of RAS, Arkhangelsk, Russian Federation
(2) Kola Branch of Geophysical Service, Russian Academy of Sciences, Russia
(3) Geological Institute, Russian Academy of Sciences, Moscow, Russia

European Geosciences Union
General Assembly 2016
Vienna | Austria | 17-22 April 2016

Heat flow of the Arctic Basin

The data shows that the West Arctic basin is characterized by low seismic structures and a weak seismic activity. This conclusion is based on the data of the Arctic seismic networks for the years 2011-2014 presented in Fig. 2. The seismic activity is the lowest in the North of the Barents Sea, the Central Kara Sea, and the central area of its mouth part. The highest seismic activity is observed in the northeastern part of the Barents Sea and the shelf off the west coast of the Franz Josef Land islands. The epicenters are usually confined to the sides of the graben and the seismic activity on the continent is very low.

An interesting area for the investigation of intraplate seismicity is the central area of its mouth part. The highest seismic activity is observed here. There are several neotectonic faults on the Franz Josef Land islands. Some events are confined to the boundary of the rising shelf and the main tectonic faults; the Northern Eastlandet-Bely Island Basin, the Southern Barents Sea Basins, the North-Kola Horst and the Kara Basin. There are several neotectonic faults on the Franz Josef Land islands. There are several neotectonic faults on the Franz Josef Land islands. Some events are confined to the boundary of the rising shelf and the main tectonic faults; the Northern Eastlandet-Bely Island Basin, the Southern Barents Sea Basins, the North-Kola Horst and the Kara Basin.

The result of the thinning of the lithosphere was the emergence of rifts and grabens. Tectonic processes are reduced or almost absent in the area of the micro plate and the Baltic Shield, the heat flow averages 54 mW/m² and amounts to 70 mW/m² in the region of the North Sea shelf. The distribution of heat flow data (a) and recent seismicity (b) have been made for clarify the complex spatial structure and connection between the localization of hydrocarbons and high heat flow is obvious.

The cross-sections A-B and C-D show the distribution of heat flow density, seismicity and the rate of crustal movement. A relatively high level of heat flow is observed on the west of the Yamal Peninsula and in the South East coast (Fig. 2). The cross-section A-B is made for the Central Arctic region and in the South Barents Sea basin. The cross-section C-D was made for the South-West Barents Sea basin. In this area, the lithosphere is reduced to 65 km and in some places to 40 km. This data confirms the connection of high heat flow with a maximum dipping of the foundation (see Figure 4).

The Gakkel Ridge lithosphere is decreasing to 30 km or less, the crustal movement is about 10 km. The heat flow fluctuates between 484 and 550 mW/m² in the area of the micro plate and the Baltic Shield. The heat flow increases up to 60 km. The heat flow values are reduced to 70 mW/m² and the seismic activity is increased. The trend of the seismic activity is towards a higher heat flow.

To the South-East, is the passive continental margin, and also because the archipelago, as well as the surrounding ocean area, is characterized by a high level of seismic activity. Thus an earthquake of magnitude 6 which occurred in 2011 was followed by thousands of aftershocks, and the activity continued for last 100 years, and was followed by thousands of aftershocks. The rate of heat flow data is presented in Fig. 4. Such contrasting values measured at very close distances (at the northern direction).

The Federal Research Center for Integrated Research of the Russian Arctic academy of sciences

Introduction

The aim of this work consist to establish the relationship between a model of the offshore basins structure, the latest earthquakes for 2011-2014 and the heat flow values at the Western Arctic basin. We have made an interpolation of values and linked bedforms to seismotectonic structures (Fig. 2).

A system of rifts with magmatites 2-3-5 has been observed surrounding the small island White, located between the Spitsbergen and Frantz Josef Land islands. Some events are confined to the boundary of the rising shelf and the main tectonic faults; the Northern Eastlandet-Bely Island Basin, the Southern Barents Sea Basins, the North-Kola Horst and the Kara Basin. The Arctic basin by seismotectonic systems have occurred 2000-2010, with a pattern of tectonic blocks with a hierarchical composition. These tectonic blocks have a width of 200-300 km. There were areas of seismotectonic activity in the central part of the basin. The heat flow values in the central part of the basin are above average (from 50 mW/m²). The lithosphere is reduced to 65 km, and in some places to 40 km. The heat flow values in the central part of the basin are above average (from 50 mW/m²). The lithosphere is reduced to 65 km, and in some places to 40 km. A significant contribution to the study of seismicity of the Arctic was made by the research of the European Arctic region. In the northeastern part of the Barents Sea, the heat flow values are above average (80 mW/m²).

The continental part of the Eurasian plate is characterized by low tectonic and volcanogenic processes, low seismic activity and uniform distribution of heat flow values (ZFI), 2011. A summary map of seismicity based on the data of the European Arctic region is presented in Fig. 2. The Gakkel Ridge lithosphere is decreasing to 30 km or less, the crustal movement is about 10 km. The heat flow fluctuates between 484 and 550 mW/m² in the area of the micro plate and the Baltic Shield. The heat flow increases up to 60 km. The heat flow values are reduced to 70 mW/m² and the seismic activity is increased. The trend of the seismic activity is towards a higher heat flow. The cross-section A-B is made for the Central Arctic region and in the South Barents Sea basin. The cross-section C-D was made for the South-West Barents Sea basin. In this area, the lithosphere is reduced to 65 km and in some places to 40 km. This data confirms the connection of high heat flow with a maximum dipping of the foundation (see Figure 4).