Abstracts

Arctic entrepreneurship: the conditions and opportunities for development

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The features, problems and prospects of entrepreneurship in the Arctic, its social importance and the necessary support measures are characterized. The level of development of business in some Arctic regions of Russia is analyzed.

Keywords: *small-scale and medium business, Arctic enterprise, the Arctic, social entrepreneurship, public policy.*

Mining Projects for the Eastern part of the Russian Arctic, the Far East and Transbaikalia: Is there a way to solve the old problems?

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Overview description of the main problems of large mining projects in the eastern part of the Russian Arctic, the Russian Far East and Transbaikalia is given. The necessity to develop mutually beneficial forms of co-participation of the state and investors in the projects is noted.

Keywords: *the Arctic, the Far East, Transbaikalia, mineral resources, extraction of raw materials, development of infrastructure, the territory of priority development, mining projects.*

Assessment of current geo-ecological status of the Kola Bay based on geochemical data

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The data on geochemistry of modern bottom sediments of the Kola Bay are generalized. Their baseline geochemical characteristics are determined. Comparison of the data shows that modern sediments in the Kola Bay are characterized by the highest concentration of chemical elements in the northwest Russia. Geochemical zoning of the bottom of the Bay is performed, and the different regions are characterized by the content of Cu, Zn, As, Cd, Pb, Hg and hexane-soluble petroleum in the bottom sediments. These geochemical data show that intensive economic activity within the southern knee of Kola Bay and functioning of the main base of the Northern Fleet of Russia impacts on the features of distribution of chemical elements.

Keywords: *Kola Bay, geo-ecology, geochemical zoning.*

Low-sulfide platinum ores of Norilsk area — promising sources of precious metals

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Low-sulfide platinum horizons in the profile of ultrabasite-basite intrusions take quite an isolated position in relation to the main ore bodies and are located in the areas of the upper endocontacts of these massifs. The main ore-bearing rocks are taxitic chromite-bearing gabbro. Cu and Ni content in the low-sulfide ores does not exceed 0.20-0.40. mas% in sum. The concentration of platinum group elements reaches 20-40 g/t, and in some intersections and pieceы of ore - 60-70 g/t. The main forms of these elements in the ores are their own minerals: sperrylite, sulfides of platinum and palladium, iron-platinum alloys, stannides, stibnidy, arsenides, plumbides, bismuth-tellurides of palladium.

Keywords: *low-sulphide platinum ore, chromite-bearing taxitic gabbro, platinum group elements.*

Destabilization of relict methane hydrates with observed changes of regional climate

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The calculations of the thermal state of soil of the Yamal Peninsula and adjacent regions for the last 90 thousand years are performed. According to the results, the depth of the upper boundary of stability zone of methane hydrates in the region could reach the surface under the climatic conditions of maximum glaciation about 90 thousand years ago. The estimates of the impact of current climate change on the strength of permafrost and stability of relict methane hydrates on the Yamal Peninsula are given. The formation of craters after gas emissions on the Yamal Peninsula may relate to destabilization of relict methane hydrates by increasing the surface temperature in recent years.

Keywords: *climate change, permafrost, relict gas hydrates, ice ages.*

Reconstruction of paleoclimate indicators and biota by group palynospectra in the north of Western Siberia

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A method for determining the main climatic and biotic indices (richness, diversity, productivity and biomass of vegetation) by three group of palynospectra is developed. The correlation formulas for majority of dimensionless and dimensional climate characteristics are found. The form of climate and biotic dependence of dominant of surface pollen spectra is determined. The examples of dominant distribution in depth and in time during the Holocene are given. The basic indicators of climate and biota for natural areas of the north of Western Siberia during the Holocene are calculated.

Keywords: *north of Western Siberia, the Holocene, paleoclimate, biota, reconstruction.*

Modern geodynamics of Gakkel Ridge according to seismological data

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The modern geodynamic regime of the Mid-Arctic Ridge in general, and the Gakkel Ridge in particular, is considered on the basis of analysis of seismicity, focal mechanisms of earthquake sources, directions of slip vectors of rock masses in earthquake centers. Complex stress-deformed state of the Earth's crust within the Mid-Arctic Ridge is established. The fields of stresses and deformation from the south-east to north-west change three times. That is, the stress-deformed state of the lithosphere, which depends on directions of the axes of compressive stresses, changes in the layered block medium by layers, and in some blocks varies with time.

Keywords: *the Arctic, geodynamics, the Mid-Arctic Ridge, the Gakkel Ridge, seismological data, the focal mechanisms of earthquakes.*

Comparison and use of observations and modeling of level in the Kara Sea

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The results of the comparison of model level of the Kara Sea calculated using a numerical mathematical INMOM model with observations data of sea level received by automatic recorders in the summer of 2015 are given. The observations were carried out on two buoy stations for a month. The level recorders were set at an intermediate depth of 113 m on the first station and on the bottom (35 m) on the other. To compare the series of observations made at various ways of registers setting, the data of specific observations, carried out at the same station in 2014 were used. Comparison of model series of level with observations data was carried out using the method of frequency-phase demodulation and remodulation which allows selecting the control periodic components corresponding to the period of effect of formative forces. It is shown that the main contribution to discrepancy between the compared series at random times is made by the errors associated probably with modeling of basin response to the predicted atmospheric wind impact.

Keywords: *level of the Kara Sea, time series, demodulation method.*

Development of advanced patterns of cryogenic steels for gas vessels and stationary storage tanks of liquefied natural gas designed for Arctic conditions

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Chemical composition and experimental-industrial technology for production of structural steel alloyed economically with nickel of increased cold resistance for promising ice-class gas vessels and storage tanks for liquefied natural gas with operating temperature of -164°C are developed. The prospects of such materials in shipbuilding are shown. The microstructure of cryogenic steel is studied, for example, it is shown that impact toughness at cryogenic temperatures increases with proportion of austenite in the microstructure.

Keywords: *steel, liquefied natural gas, nickel, double normalizing, controlled rolling, cold resistance, durability, acicular ferrite, austenite.*

Forecast of emergencies at oil and gas facilities and elimination of consequences of emergency oil spills in arctic climate

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The results of accident risk analysis and assessment for tanks and pipelines operated in the North are presented, and the results of studies of biopreparation for elimination of oil pollution produced by native oil-destructor microorganisms extracted from arctic permafrost soils are given.

Keywords: *Arctic zone, low temperature, temperature inversion, destruction of equipment, frequency of accidents, scenarios of accidents, individual risk of fires, oil pollution, the elimination of oil, degradation, microorganisms.*

Prospects for development of aquaculture in the western part of the Russian Arctic

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The possibilities and prospects of development of aquaculture in the western part of the Russian Arctic are analyzed. An algorithm for development of fish farming using the native species, primarily whitefish, is proposed. The possibility of utilization of associated petroleum gas for aquaculture is noted.

Keywords: *aquaculture, fish farming, whitefish farming, whitefish.*

Icebreaker support for the largest national Arctic hydrocarbon projects

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The prospects of expansion of traffic along the Northern Sea Route for the coming years and the need to use nuclear icebreaker fleet in the largest hydrocarbon projects in the Arctic are shown. The analysis of the International Gas Union on the world market of liquefied natural gas are given. The International Gas Union expects a high level of competition, where one of the key factors is the cost of transportation.

Keywords: *nuclear icebreakers, hydrocarbons, liquefied natural gas, "Yamal SPG", the Northern Sea Route, the Suez Canal, the Panama Canal, the Asia-Pacific region.*