Permafrost researchs report of Russia 2016

*****

Earth Cryosphere Institute (ECI SB RAS) (Earth Cryosphere Institute, Siberian Branch, Russian Academy of Science, Tyumen)

The main results

1. The main stages and conditions of permafrost zone formation and evolution in the Western segment of Russian Arctic have been established (under supervision of Prof. Dr. A.A. Vasiliev)

Two types of subaquial perennially frozen rocks (SPFR) have been specified on the continental shelf: relict and stock-shaped permafrost with the temperature close to phase transition one (-0.8...-2.0°C) and low-temperature permafrost (with the temperature as low as -5°C). A map has been constructed which reflects the paleogeographical conditions of SPFR formation 20 000 years ago and depicts shelf boundaries, bioclimatic zones and climatic characteristics (Fig.1).

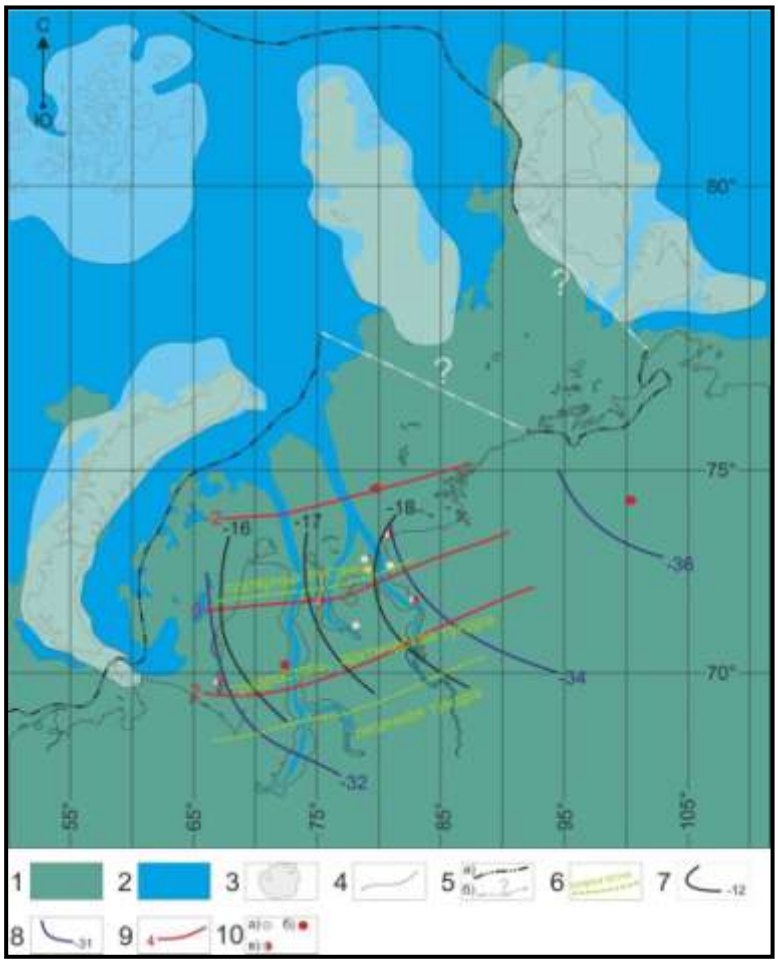

Fig.1. Paleogeographical situation at the shelf of the Kara sea 20000 years ago.

1- onshore territory with subaeral conditions, 2 – offshore territory, 3- suggested areas of glaciation development, 4- present day shoreline, 5- glaciation boundaries according to Svendsen et.al.,2004, 6- boundaries and names of bioclimatic zones (from the North to the

South: polar desert; tundra-steppe, arctic tundra; typical tundra), 7- reconstructed average annual air temperatures, 8-reconstructed average winter air temperature, 9-reconstructed average summer air temperature,10-a) locations with authors' data on Sartan deposits, b) locations with the data on the isotopic content in massive wedge ice of MIS 2, known from literature, c) the same as (b) but with authors' data.

2. The complete set of actualized geocryological overview small-scale maps (1:25000000 … 1:16000000 scales) has been compiled for Arctic zone of Russian federation and for permafrost zone of Eurasia, which describes the cryogenic conditions at the beginning of the XXI century (under supervision of Prof. Dr. Drozdov D.S):

- Distribution, thickness and ice content of perennially frozen rocks (Fig.2).
- Temperatures of perennially frozen rocks and exogenic processes in permafrost zone.
- Regionalization of permafrost zone according to human activity conditions.
- Variation trends of permafrost conditions in the XXI sentury.
- Arctic glaciation and permafrost (Circumpolar Geocryological map)

The graphical background in the scale of 1:2500000 was used for the transition to the actualized Geocryological map of Russia in the same scale.

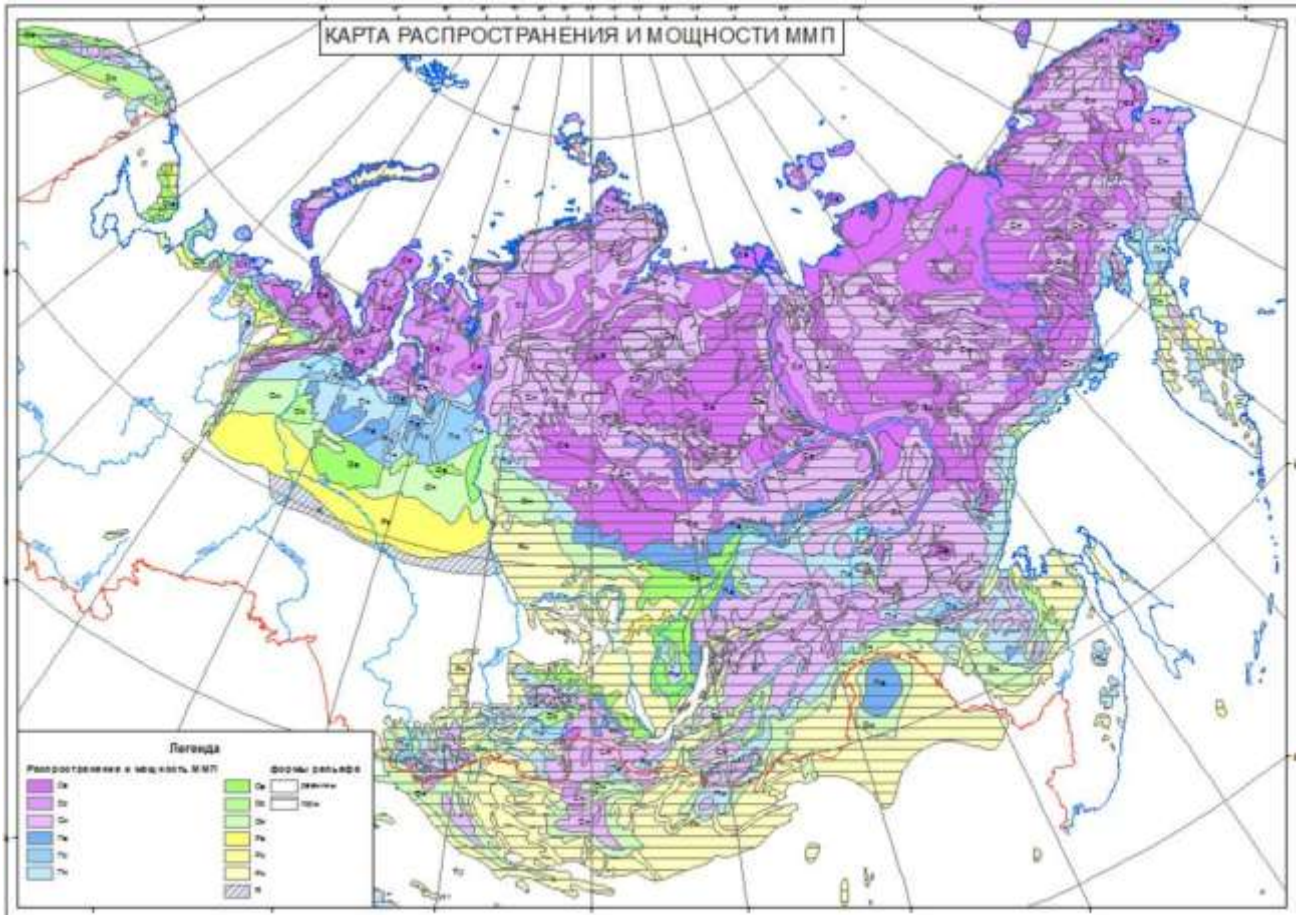

Fig.2. The map of permafrost distribution and thickness. *Distribution: С – continuous, П – discontinuous, О – insular, Р – rarely insular. Ice content: в – high, с – moderate, н – low; slanting shading – relict permafrost at the 100 m depth and deeper; horisontal shading – mountaneous regions.*

3. The results of 5-year observations of the evolution of the thermo-cirque with massive ice bedding and massive wedge ice on Yamal Peninsular have been generalized (under supervision of Prof. Dr. Leibman M.O., Dr. Khomutov A.V.)

The activation of cryogenic processes observed during recent years is caused by anomalously warm spring-summer season of 2012y. By the end of this season a thawing of upper part of permafrost with high ice content as well as massive ice bedding took place at some slopes and provoked cryogenic stream landslides and further development of thermo-cirques. 85 new thermo-denudation features have appeared till 2013y. over the area of 345 km^2. The maximal retreat of thermo-cirques walls reaches 25-30 m per year, with the average values being 15 m per year. Due to this process the topography of the area is changing. The process also has a significant influence on the conditions of human life and the territory exploration. Thermo-cirques disturb the integrity of constructions, in particular, break the embankment of new railway from Obskaya location to Bovanenkovo (Fig. 3, 4).

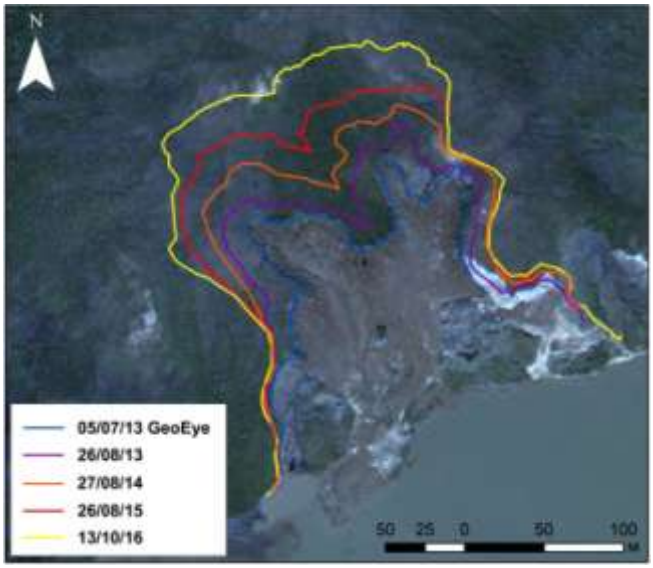

Fig.3. Retreat of the edge of the thermo-cirque with massive ice bedding at the Central Yamal. Cartography background: space image GeoEye-1 dated 05.07.2013 y. (Digital Globe Foundation)

a

b

Fig.4. The evolution of the thermo-cirque with massive ice bedding and massive wedge:

a – 2012 y., ***b*** - 2015 y. Pictured by A.V. Khomutov

4. Cryogenic landscapes of the Northern taiga and the Southern wooded tundra influenced by directional climate changing are now at the initial stage of degradation (under supervision of Prof. Dr. Drozdov D.S. and Dr. Ponomareva O.E.)

- Degradation of the Northern taiga landscapes is manifested by the destruction of individual frost mounds, the increase of permafrost temperature up to 0°C in the layer of seasonal fluctuations, avalanche-style expansion of the residual thaw layer area for all landscape patterns. In the Southern wooded tundra the permafrost top decreases mostly in forest stows.
- In the Southern tundra the tendency of permafrost temperature increase is preserved with boom acceleration of this rise being observed in the areas of cryogenic or man-caused processes activation.

5. The main trends of transformation of cryogenic landscapes (including ones containing ground ice) going in the climate warming conditions have been found for European North (under supervision of Dr. Malkova G.V.)

- The highest annual average air temperature in the region in 2015/2016 years has riched -0,4°C. The gradient of annual average air temperature change for 32-years term has constituted 0,09°C per year, with the warm period duration having been prolonged for 10 days and total annual precepetation ammount having increased on 100 mm.
- Despite the fact that in the Southern tundra the permafrost tempereture growth rates are slower by factors of 2-8 in comparison with climate warming rates (0,01…0,04°C per year for different landscapes), the occurred climate changes have led to the start of a preparation of permafrost degradation from the surface. According to the stationary observations in Bolvanskiy and Shapkina locations the annual average permafrost temperature at the depth of 10 m has become equal to/or higher then -1°C. Further tempereture increase has been slowed down because the phase transitions and permafrost thawing started in the upper part of the section.
- In all the inspected boreholes the quasi-stationary tempereture regime has been observed, which is characteristic for the transient unstable state of permafrost (Fig.5). In landscapes of drainaged tundra the formation of closed taliks (up to 3-5 m depth) has started (Fig. 6).

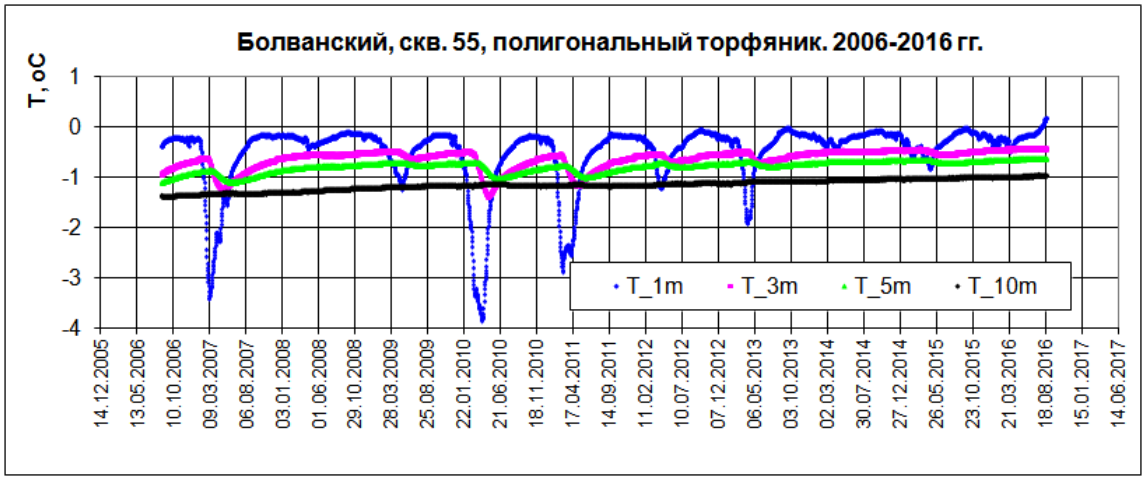

Fig. 5. The results of temperature monitoring in the borehole 55, remnant block of polygonal peat. The site of stationary observations Bolvanskiy.

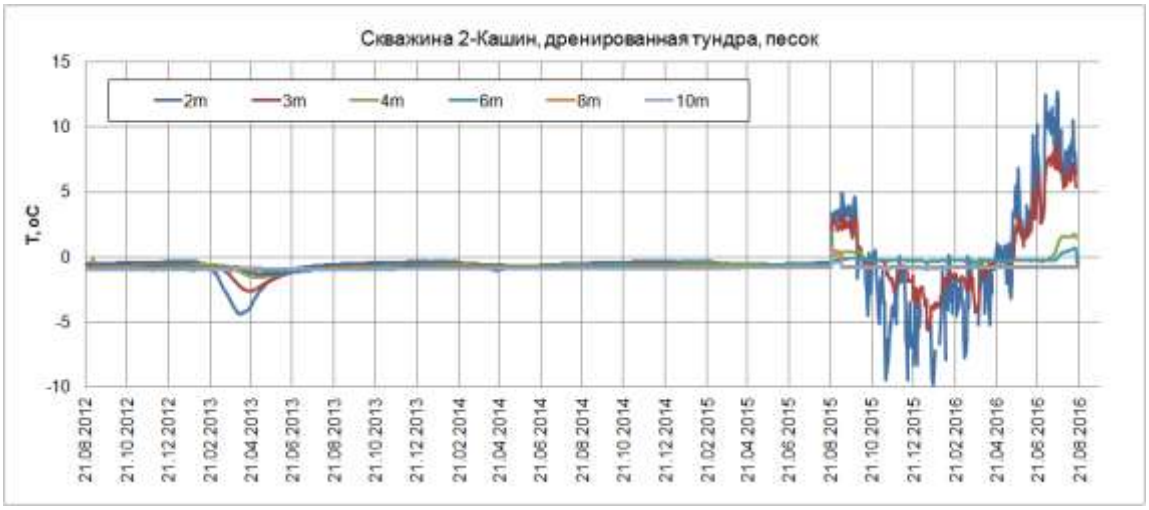

Fig. 6. The results of temperature monitoring in the borehole 2-К, flat terrain surface of drainaged tundra. Island Kashin.

6. Modern system of seismic and georadiolocation (GPR) methods for reliable location of permafrost bodies on land and in the transitional onshore/offshore zone has been developed, tested and verified (under supervision of Dr Skvortsov A.G.).

Repetitive or regime schemes of observations with this system permit to monitor the changes in the distribution, configuration and depth position of permafrost bodies caused by natural or man-made dynamics. It has special significance for the investigations of hard-to-reach and/or restricted areas (Fig. 7, 8).

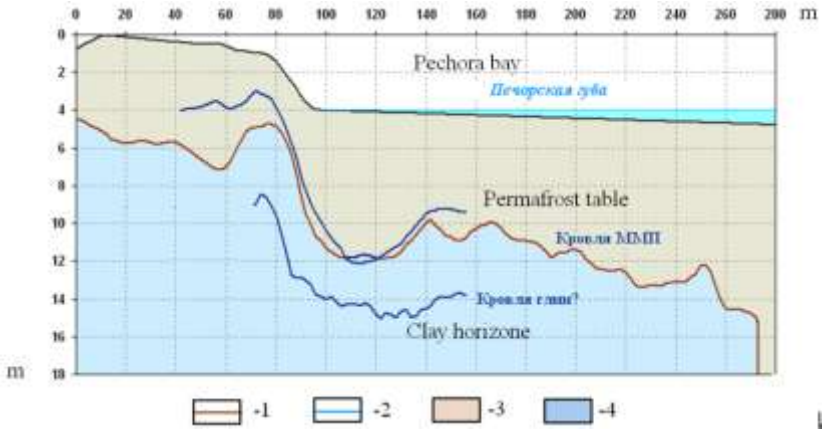

Fig.7. Results of integrated geophysical investigations at the island Kashin in the delta of the Pechora river.

1 – seismic boundaries, 2 – boundaries according to GPR data,

3 – thawed rocks, 4 – permafrost.

Fig.8. The map of permafrost distribution on the island Kashin and neighboring water area.

1 –defined boundaries, 2 – suggested boundaries

7. The calculation methods have been developed for the individual thermo stabilizers with vertical evaporating system and possibility of their application for the stabilization of the natural and man-maid permafrost degradation processes has been defined (under supervision of Prof. Dr. Gorelik Ya. B.).

- Essential dependence of evaporating system length on the cryogen agent type has been found;Distribution, thickness and ice content of perennially frozen rocks.
- The ways to rise the effectiveness of thermo stabilizers are proposed. They address clustered application of thermo stabilizers to increase the remnant cooling effect (in the end of summer) and constructive combination of stabilizers' cases with supporting elements of the construction foundation for essential decrease of labor and money cost. These measures permit to exclude drilling and necessity of capacitor ribbing, to decrease a probability of a damage in the course of the exploitation and to improve the esthetic image of constructions.

*****

Melnikov Permafrost Institute, Siberian Branch, Russian Academy of Science (MPI SB RAS, Yakutsk) http://mpi.ysn.ru

Field Work and Meetings

During 2016, the Melnikov Permafrost Institute conducted large-scale field studies in the permafrost regions of East Siberia, Northern Tian-Shan, and the Russian northeast. Three field teams worked along the 1,500 km stretch of the Power of Siberia Pipeline project to describe terrain conditions, locate geohazard features, collect hydrological and thermal data, and establish monitoring sites. Permafrost thermal and terrain monitoring studies were continued in Central Yakutia (Churapcha, Neleger, Umaibyt, Syrdakh) and Arctic Yakutia (Tiksi). The thermal monitoring network sites across East Siberia and in Kazakhstan were visited to retrieve data and upgrade instrumentation. Investigations were carried out on tukulans along the Lena and Viluyu Rivers in central Yakutia as part of the RFBR-supported program "Pleistocene Cryodeserts (Tukulans) in Central Yakutia". A new project was initiated in the Aldan-Stanovoy Shield area to study relationships between permafrost and tectonic activity. In Arctic Yakutia, research was continued to study subsea permafrost, sub-channel taliks, and coastal erosion.

A post-conference field excursion in Central Yakutia was organized from June 28 to July 5, 2016 for participants of the XI International Conference on Permafrost. The excursion observed typical permafrost-related forms and processes, including icings at Buluus, Ulakhan and Eruu sites, thermokarst landforms and alasses at the Yukechi monitoring site, and degrading ice-rich permafrost in the town of Churapcha. A visit was made to the Spasskaya Pad Station which provides a base for a number of international projects concerned with global change effects on northern ecosystems. The trip completed with a Lena River cruise to the Lena Pillars Nature Park, a UNESCO World Heritage Site.

In October 2016, MPI organized a training program on permafrost regions hydrogeology and hydraulic engineering for professors from the Heilongjiang University, School of Hydraulic and Electric Power (Harbin, China). The program included classroom lectures and field trips, covering various topics such as problems of urban construction on permafrost; frost-related metamorphism of groundwater and soils; cryopegs; permafrost hydrology in a changing climate; precipitation geochemistry and environmental effects; toxic chemical elements in the environment of Yakutia; construction of hydroengineering structures in cold regions; and experience in the establishment and management of a frozen soil laboratory. Field trips provided an opportunity to observe groundwater springs and icings on the Bestyakh terrace of the Lena River, to learn about hydrogeology of small river basins on permafrost while visiting the Malaya Chabyda monitoring site, and to better understand the water drainage problems for open-pit mining in permafrost regions during a tour of the Kangalassy Coal Mine.

MPI participated in organizing the IXth International Symposium titled "C/H2O/Energy Balance and Climate over the Boreal and Arctic Regions with Special Emphasis on Eastern Eurasia", held at the Institute for Biological Problems of Cryolithozone (Yakutsk) in November 1-4, 2016. This conference celebrated the 25th anniversary of the Russian-Japanese research collaboration on global change studies in Russian permafrost, in which MPI researchers have been actively involved.

Field team on a tukulan along the Lena River

Heading from Tiksi to Samoylov Island

International Cooperation

During the last year, MPI continued its involvement in eight international projects and programs, including cooperative projects with the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Potsdam, Germany (AWI), the University of Paris Sud, Orsay, and the Department of Environmental Geochemical Cycle Research, JAMSTEC. In August 2016, MPI hosted a delegation from the State Key Laboratory of Frozen Soil Engineering (Lanzhou, China). This visit resulted in an agreement signed between the Northwest Institute of Eco-Environment and Resources and the Melnikov Permafrost Institute to establish an International Research Center on Asian Cold Regions Environment and Engineering. The Center, abbreviated as IRC–ACEE, will be based at SKLFSE in Lanzhou and MPI in Yakutsk. In September 2016, an agreement was signed with the Alfred Wegener Institute to establish an isotope analysis laboratory based at MPI and equipped with necessary instruments for stable isotope analysis of water and ice melt samples. In October 2016, discussions were held with the Heilongjiang University, School of Hydraulic and Electric Power (Harbin, China) to establish a joint laboratory of cold regions hydrology and hydroengineering.

This year MPI researchers participated in twenty international conferences, including ICOP 2016 in Potsdam, EGU General Assembly 2016 in Vienna, and XVI Glaciological Symposium in St. Petersburg. Planning is now underway for the XI International Symposium on Permafrost Engineering (http://mpi.ysn.ru/en/permafrost-engineering-symposiums). This meeting will be held from 5-8 September 2017 in Magadan where MPI, at its North-Eastern Permafrost Station, is continuing fundamental permafrost studies and providing a research service for the mining and building industries in the Magadan Province.

Housing on degrading permafrost, Churapcha

Quick march to the center of 450 sq.km Mahatta tukulan

Publications

Theoretical, experimental and field investigations carried out by MPI researchers resulted in about 300 publications, including eight books (monographs, guidelines, textbooks and

brochures), twenty one articles in international journals, and fifty five articles in journals included in the VAK list of the Russian Ministry of Education and Science. A 232-page monograph titled “The Ecogeochemistry of Yakutsk Urban Lakes” by V.N. Makarov and A.L. Sedelnikova summarizes the results from long-term investigations of the hydrogeochemistry of urban lakes in the city of Yakutsk. It presents data on the concentration of chemical elements in various environmental compartments (air, snow, natural waters, and sediments). The authors attribute the environmental degradation of the lake systems to the high contamination of bottom sediments.

*****

Cryolithology and Glaciology Department, Geographical Faculty, Lomonosov Moscow State University

In 2016 fundamental studies of changes in the Earth’s cryosphere under the influence of natural factors and technogenesis were carried out at the Department of Cryolithology and Glaciology, Faculty of Geography, Lomonosov Moscow State University.

Cryolithological analyzes of the sediments in loess-soil formations which are located on the southern edge of the European area of loess sediments (Beglitsa and Srednyaya Akhtuba) and on the Loess Plateau of China (Caoxian) were conducted by Konishchev V.N and Rogov V.V. The role of cryogenesis in the loess soil formation was revealed.

Preliminary results of the of long-term cryolithological studies of the Western Siberia cryosphere and Yamal gas-bearing structures were summarized by Badu Y.B.

Kizyakov A.I. and Streletskaya I.D. with colleagues from the Earth Cryosphere Institute (ECI SB RAS) continued studies of environmental conditions of the formation and relief dynamics of new permafrost phenomena – gas-emission craters in the Central Yamal.

Result of the comparison of chemical and isotopic composition of the ice walls in the gas-emission crater with underground ice, surface and atmospheric water showed that the water from modern lakes could not form ice in this gas-emission crater. It is assumed that the methane was in the crater before its destruction and was concentrated in the cavity ("a grotto") at a depth of 20 m, where mineralized water – cryopeg was located.

Streletskaya I.D. with colleagues from the Earth Cryosphere Institute (ECI SB RAS) continued researches of temperature conditions in the permafrost growth areas at low accumulative surfaces on the coast of Western Yamal; heat fluxes, which are warming or cooling newly formed permafrost, were estimated. Climate warming in the north of Western Siberia (Western Yamal) causes accelerated degradation of permafrost within retreating thermoabrasive banks and hinders the formation of new permafrost in the modern marine accumulation area. Temperature threshold value of permafrost -3,5 ÷ -4,0 ° C for bacterial methanogenesis in modern marine accumulative sediments was established for the first time.

Maslakov A.A. studied the mechanism of seashore area destruction in Eastern Chukotka and revealed its rate of retreat for 47 years. The investigations of paleogeocryological conditions of Late Pleistocene and Holocene ice wedges formations on Kotelny Island and Eastern Chukotka were conducted.

Kizyakov A.I. collected field data on the sea ice structure and forms of floating ice of the Sea of Okhotsk.

Grebenets V.I. analyzed and summarized the results of field investigations of roads and railways on the Taimyr Peninsula for the first time. It was found that the main reasons of longitudinal and transversal deformations of the roadbed and the slopes destruction are the intensification of cryogenic processes and the formation of special temperature fields in the body of embankments. Configuration of temperature fields and soil temperatures fundamentally differs from natural conditions and estimated design characteristics.

A methodical approach of permafrost-environmental assessment for geo-ecological hazardous situations during the economic development of cryolithozone was developed by Zotova L.I. and Tumel N.V.

Zotova L.I. and Dedyusova S.Yu. performed the analysis of the leading anthropogenic factors which affects the quality decrease of forage lands during oil and gas fields exploitation. Indexes that estimate pasture quality reduction on pastures within four oil and gas fields of Tyumen north Cryolithozone were calculated.

Regime studies of the dynamics of seasonal thawing continued (in the framework of the International program CALM - Circumpolar active layer monitoring) on experimental sites near Talnakh (the R32) and in the south of Taimyr (Grebenets V.I.), in the villages Lorino (R41) and Lavrentiya (the R27) in Chukotka (Maslakov A.A.). Two new CALM sites were organized near the foothills of the Polar Urals (Harp village) and downstream of Ob river (Salekhard).

For the first time in July 2016 Grebenets V.I. with the support of the Russian Centre of Arctic exploration (Salekhard) carried out student practice for the landscape and permafrost conditions research of the Polar Urals, the downstream of the Ob river and Taz peninsula.

Long-term series of observations on the Dzhankuat glacier was continued by Popovnin V.V. Its mass balance (in a 2015-2016) was calculated: a negative value was received again that extended continuous unprecedented series of such values up to 10 years. Field works in Kyrgyzstan were carried out to restore interrupted after the dissolution of the USSR mass balance monitoring of glaciers Karabatkak and Sarytor, also such monitoring for glacier Bordeaux was organized. These glaciers can be characterized by the unfavorable conditions for glaciation. An expert opinion on the impact of the gold mining company “Kumtor Gold Company” on the regime of Akshiirak glaciers located in concession zone was prepared.

Petrakov D.A. clarified the time of Late Pleistocene glaciers maximum expansion in the Inner Tian Shan based on the absolute dating materials. It was revealed periods of glacial debris flows activity in the Northern Tian Shan from the late 19th century based on dendrochronological data. The first catalog of the mountain lakes of Uzbekistan was complied with usage of high resolution satellite images.

Results of materials generalization of long-term stationary researches in the Elbrus region (Central Caucasus) established that in the last 20 years as a result of the thermal instability of the winter period there was a reduction of snowfalls during winters, weakening of the intensity of avalanche forming snowfalls and growth of average winter temperatures (Volodicheva N.A. and Oleynikov A.D.). There has been an increase in the number of advection avalanches with smaller volumes and shorter avalanches paths.

*****

Geocryology Department, Geology Faculty, Lomonosov Moscow State University

1. Fifth Russian Conference on Geocryology «Geotechnics on permafrost» was held in the Moscow State University at June 14-17, 2016. The conference was organized by Geocryology department, Faculty of Geology (MSU) with support of Tyumen scientific center of SB RAS, Institute of Earth`s Cryosphere of SB RAS, Melnikov Permafrost institute of SB RAS, Total and some other institutions. In the frames of 12 conference topics were presented results of new geocryological investigations and made estimation of the perspectives for development scientific studies of permafrost. In the conference participated 293 scientists from 65 organizations, including MSU and other university and institutes, Russian Academy of Science, state manufacturing companies. More 10 researchers from USA, Germany and Canada participated in conference.

2. The scientists of the geocryology department continued offshore permafrost research on the East Siberian arctic shelf in 2016. Results of investigations in oceanology, geology, geocryology, geophysics and biogeochemistry were discussed at the International conference "Cryosphere-Carbon-Climate Interactions in the Siberian Arctic Ocean: Current State and Future Directions", which held 21-24 November 2016 in the National Research Tomsk Polytechnic University. More 50 scientists from 12 universities and institutes in Russia (35 men, including 3 permafrost researchers from Geocryology faculty), Sweden, the Netherlands, Great Britain and Italy discussed the questions associated with thawing offshore permafrost and collapsing methane hydrates.

*****

Sergeev Institute of Environmental Geoscience RAS (Moscow)

Geocryological monitoring in undisturbed condition was continued. The 2015-year data were submitted to the GTN-P database. Sergeev Institute of Environmental Geoscience RAS supports 11 monitoring TSP-sites in Northern Transbaicalia Region (Chara). Also the geocryological monitoring was supported in Olkhon Island, in cooperation with Institute of Earth Crust SB RAS Irkutsk, and in Vorkuta Region in cooperation with Moscow State University.

*****

Institute of Physicochemical and Biological Problems in Soil Science, RAS (Soil Cryology Laboratory)(Pushchino, Russia)

1. Six viable strains of amoebae belonging to the genus Flamella (Amoebozoa, Variosea) were isolated from permafrost sediments sampled in the Russian Arctic region. Two of them are from late Pleistocene permafrost in North-East Siberia, and four - from Holocene and late Pleistocene in North-West Siberia. Light- and electron-microscopic study and molecular phylogeny show that these isolates represent two new species belonging to the genus Flamella. Both species are cyst-forming. This study directly shows for the first time that amoeba cysts can be conserved not only for years and decades but for many thousand years and then recover, contributing to the formation of

an active microbial community. We propose to name the new species as *Flamella pleistocenica* n.sp. and *Flamella beringiania* n.sp. Phylogenetic analysis shows that the genus Flamella is a robust and potentially species-rich group of Variosea.

2. Studies of modern permafrost soils on Kolyma lowland showed that the separate zones are formed in CRYOSOL profiles, where there are the specific environmen conditions that provide conservation of soil microfauna. The taxonomic analysis has identified 32 species of soil ciliates and more than 40 species of heterotrophic flagellates, and significant part of the community (41% of ciliates and 52% flagellates) remain viable in buried fragments of litter and organic horizons.
3. The work on the study of metagenomes permafrost is continued. As a result of construction and screening of a metagenomic library prepared from a permafrost-derived microcosm, we have isolated a novel gene coding for a putative lipolytic enzyme that belongs to the hormone-sensitive lipase family. It encodes a polypeptide of 343 amino acid residues whose amino acid sequence displays maximum likelihood with uncharacterized proteins from Sphingomonas species. The resulting protein preferably utilizes short-chain p-nitrophenyl esters (C4 and C8) and therefore is an esterase. It possesses maximum activity at 45◦C in slightly alkaline conditions and has limited thermostability at higher temperatures. Activity of PMGL2 is stimulated in the presence of 0.25–1.5 M NaCl indicating the good salt tolerance of the new enzyme. The results of the study demonstrate the significance of the permafrost environment as a unique genetic reservoir and its potential for metagenomic exploration.
4. It is already 20 years past from the beginning of active layer monitoring at Kolyma lowland area. The active layer thickness is deepening on the majority of sites, the mean value for 2006-2016 is 15% deeper (average, from7 to 36%) comparing with 1996-2006 for the 7 sites established in 1996. At Kamchatka peninsula (Klyuchevskaya volcano group) for 2006-2016 period the active layer thickness at 1600 m a.s.l. is 3% deeper. At King George island (subantarctica) the new 12 m deep borehole have been drilled for the full permafrost thickness, we plan to instal the temperature logging equipment in the frame of 62 Russian Antarctic expedition.

Most important publications:

Shmakova L., Bondarenko N., Smirnov A. Viable Species of Flamella (Amoebozoa: Variosea) Isolated from Ancient Arctic Permafrost Sediments // **PROTIST**, 2016 , 167(1):13-30.

Petrovskaya, L., **Novototskaya-Vlasova, K., Spirina, E., Durdenko, E.**, Lomakina, G., Zavialova, M., Nikolaev, E., **Rivkina, E.**(2016). Expression and characterization of a new esterase with gcsag motif from a permafrost metagenomic library // **FEMS MICROBIOLOGY ECOLOGY**, 92 (5): fiw046 DOI: http://dx.doi.org/10.1093/femsec/fiw046 First published online: 28 February 2016.

Rivkina Elizaveta, Lada Petrovskaya, **Tatiana Vishnivetskaya, Kirill Krivushin, Lyubov Shmakova**, Maria Tutukina, Arthur Meyers, and Fyodor Kondrashov (2016). Metagenomic analyses of the late Pleistocene permafrost – additional tools for reconstruction of environmental conditions **// BIOGEOSCIENCES**, 13(7): 2207–2219

Shcherbakova Victoria, Yoshitaka Yoshimura, Yana Ryzhmanova, Yukihiro Taguchi, Takahiro Segawa, Victoria Oshurkova, **Elizaveta Rivkina** (2016). Archaeal communities of Arctic methane-containing permafrost // **FEMS MICROBIOLOGY ECOLOGY**, 92 (10): DOI: http://dx.doi.org/10.1093/femsec/fiw135 fiw135 First published online: 15 June 2016.

****

The journal «Earth's Cryosphere» («Kriosfera Zemli»)

The results of the most interesting researches of Russian geocryologists have been published in the journal «Earth's Cryosphere» issued by the Earth Cryosphere Institute Siberian Branch, Russian Academy of Science (ECI SB RAS). The abstracts of the 25 best papers published in 2016 are submitted for the consideration of readers. Full texts would be available at the website of the journal: http://www.izdatgeo.ru/index.php?action=journal&id=8

Melnikov V.P. [1,2,3], **Gennadinik V.B.** [2], **Fedorov R.Yu.** [2,3] Humanitarian aspects of cryosophy**.** *Earth's Cryosphere* 2016, Vol. XX, 2, p. 112-117.

[1] *Tyumen Scientific Center, SB RAS, Tyumen, Russia; melnikov@ikz.ru*; [2] *Tyumen State University, Tyumen, Semakova str., 10, Russia;genugend@gmail.com*; [3] *Institute Cryosphere Earth, Tyumen, Russia; r_fedorov@mail.ru.*

The paper presents a perspective of humanitarian aspects in cryosophy, an interdisciplinary system of knowledge and ideas of the cold world. It is suggested to extend the scope of subjects in geocryology with issues concerning cultural effects of the cryosphere, in addition to the conventional environmental and engineering approaches. Both approaches that concern, respectively, the risks posed to the vulnerable nature and the efficient and safe uses of resources in the high latitudes are intimately related with processes in the human society. The three jointly represent a complex interaction between people and the world of cold. The experience gained by people in their adaptation to living in cold regions, which is recorded in traditional ways of different northern cultures, can make basis for successful solutions in nature management, public healthcare, and energy conservation.

Fotiev S.M. Climatic and geocryological conditions of formation of massive layers of ultra-fresh ice, Yamal Peninsula**.***Earth's Cryosphere* 2016, Vol. XX, 3, p. 51-62, DOI: 10.21782/KZ1560-7496-2016-3(51-62)

Earth Cryosphere Institute, SB RAS, Tyumen, Russia; kriozem@gmail.com

The conditions of formation of massive layers of ultra-fresh ice inside the marine saline sediment strata have been studied by geocryologists for several decades. Numerous hypotheses provided different interpretations of their origin and formation mechanisms. Based on the analysis of works of his predecessors, the author has depicted the natural conditions ensuring formation of massive layers of ultra-fresh ice and substantiated possibility of massive ice layers formation under specific climatic and permafrost conditions of different periods during the Middle and Late Neopleistocene.

Konishchev V.N. [1], **Rogov V.V.** [1,2,3] Phenomena of the processes of cryogenesis in loess composition. *Earth's Cryosphere*2016, Vol. XX, 4, p. 37-44.

[1] *Lomonosov Moscow State University, Department of Geography, Moscow, Russia; vkonish@mail.ru*; [2] *Earth Cryosphere Institute, SB RAS, Tyumen, Russia;* [3] *Tyumen State University, Tyumen, Russia, rogovvic@mail.ru*

On the example of two loess sections the perspective of application of methodology of cryolithogical analysis of mineral substance has been demonstrated. It has been revealed that the processes of cryogenic transformation of sediments had occurred in the limits of permafrost zone as well as in the conditions of seasonal freezing in Pleistocene. These processes controlled the formation of the composition and properties of thick loess strata.

Bushueva I.S.[1], Solomina O.N.[1,2], Volodicheva N.A.[3] Fluctuations of Terskol Glacier, Northern Caucasus, Russia.*Earth's Cryosphere* 2016, Vol. XX, 3, p. 95-104, DOI: 10.21782/KZ1560-7496-2016-3(95-104).

[1] Institute of Geography, RAS, Moscow, Russia, irinasbushueva@gmail.com; [2] Tomsk State University, Tomsk, Russia; [3]Lomonosov Moscow State University, Department of Geography, Moscow, Russia;

Reconstruction of fluctuations of Terskol Glacier situated on the south-western slope of Elbrus is presented. The reconstruction is based on remote sensing images of 1957, 1971, 1987, 1997, 2001, 2007 and 2009, maps, plans and photographs of the late 19th–20th centuries, as well as on modern photographs of the late 20th – the beginning of 21st centuries. As a result, 13 positions of the glacier's edge have been created and 10 moraines have been identified. Behind the last moraine complex (at the height of 2,550 m), indistinct remnants of the older moraines partly covered by a debris-flow have been revealed. Dating of junipers growing on these surfaces demonstrated that over the last 300 years Terskol Glacier had not moved below these levels. Therefore, over the last 300 years Terskol Glacier has fluctuated not more than 1,150 m in plane and 460 m in elevation. The glacier's area has decreased over this time by 0.74 km^2.

Kizyakov A.I.[1], Leibman M.O.[2,3] Cryogenic relief-formation processes: a review of 2010-2015 publications. *Earth'sCryosphere* 2016, Vol. XX, 4, p. 45-58.

[1] Lomonosov Moscow State University, Faculty of Geography, Moscow; akizyakov@mail.ru; [2] Earth Cryosphere Institute SB RAS, Tyumen, Russia; [3] Tyumen State University, Tyumen, Russia

The paper presents a review of 110 publications, almost 40 in Russian and more than 70 in international journals, devoted to the study of cryogenic relief-forming processes and published mainly during the last 5 years. This review focuses primarily on research trends and methods, as well as results obtained by Russian and international research teams. A substantial part of recent publications is based on the integrated interdisciplinary studies in the permafrost regions, involving groups of researchers with different expertise, and representatives of various scientific schools. Ambiguous interpretation of the scope of concepts and definitions, determining specific cryogenic process, is noticed in the analyzed publications. Accordingly, in their considerations of the cryogenic processes, the authors of the paper rely on the multilingual Glossary on permafrost adopted by the International Permafrost Association (van Everdingen, 2005). The results obtained in the course of studies of thermokarst, thermoerosion, thermoabrasion, thermodenudation, frost heaving, and cryogenic slope processes are considered in the paper.

Kravtsova V.I., Rodionova T.V. Investigation of the dynamics in area and number of thermokarst lakes in various regions of Russian cryolithozone, using satellite images. *Earth's Cryosphere* 2016, Vol. XX, 1, p. 81-89, http://izdatgeo.ru/pdf/earth_cryo/2016-1/75_eng.pdf

Lomonosov Moscow State University, Department of Geography, Moscow, Russia; valentinamsu@yandex.ru

We have developed a reliable method to determine changes in the area of thermokarst lakes, which is based on comparison of multitemporal imagery from Landsat satellites. These were acquired during the warming period since the 1970s. The method takes into account the difference in spatial resolution for MSS (Multispectral Scanner) and TM (Thematic Mapper) scanning systems. We have investigated 39 test sites which cover nearly 300,000 lakes in six regions of the Russian cryolithozone: the North of European Russia, Western Siberia, Eastern Siberia and Far East, Central Yakutia, Transbaikal hollows. As a result, we have identified very small and contradictory changes in 1970–2000: areas of some lakes reduced by 2.9 % and areas of others enlarged by 1.2 %. Mass reduction in lake areas occurs when they are drained by rivers. Increase in lake areas is widespread due to influx of water with rivers, cyclical changes in precipitation (Central Yakutia), anthropogenic pressure (West Siberia), and activation of thermokarst in highly icy permafrost (Yamal, Yana-Indigirka lowland). We conclude that the dynamics of the area and number of thermokarst lakes is controlled by a complex set of factors and so they cannot be used as indicators of climate warming impact on cryolithozone.

Drozdov D.S., Dubrovin V.A.* Environmental problems of oil and gas exploration and development in the Russian Arctic.*Earth's Cryosphere* 2016, Vol. XX, 4, p. 16-27.

*Earth Cryosphere Institute SB RAS, Tyumen, Russia; ds_drozdov@mail.ru; Russian State Geological prospecting University MGRI-RSGPU, Moscow, Russia; Tyumen Industrial University, Tyumen, Russia; Tyumen State University, Tyumen, Russia; * All-Russia Scientific and Research Institute of Hydrogeology and Engineering Geology VSEGINGEO, Moscow distr., Russia; E-mail: dva946@yandex.ru*

Permanent frozen ground poises a core environmental issue for exploitation of natural resources in the Arctic and sub-Arctic. Different technogenic impacts are capable of triggering new manifestations of geocryological processes or essentially enhancing them up to hazardous or even catastrophic ones. The active advancement of oil and gas industry into the northern territories and further to the continental shelf requires the development of a system of ensuring the geo-ecological security of the permafrost regions. A specialized state geocryological observational network comprising polygons, stationaries and sites for periodic observations will provide monitoring of natural dynamics of the geosystems at various level of detail as well as their interaction with engineering activities. This observational network will ultimately allow to optimize the process of executive decision-making, strengthening thereby responsibility of subsoil users and related state agencies.

Dereviagin A.Yu., Chizhov A.B., Meyer H.*, Opel T.* Comparative analysis of isotopic composition of ice wedges and texture ices at the Laptev Sea coast. *Earth's Cryosphere* 2016, Vol. XX, 2, p. 15-24.

*Lomonosov Moscow State University, Geology Department, Moscow, Russia; dereviag@gmail.com;*Alfred Wegener Institute for Polar and Marine Research, Potsdam, Germany*

On the basis of large-scale sampling of syngenetic ice wedges and texture ices at Laptev Sea coast the differences of their isotopic composition ($\delta^{18}O$, δD) throughout the past 50 ka have been determined. The transformation of isotopic composition in the contact zone between ice wedges and texture ice has been considered. The analysis of ^{14}C-dated samples demonstrated that the isotopic composition ($\delta^{18}O$, δD) both of ice wedges and of texture ices reacts similarly to the well-pronounced paleoclimatic events.

Gorelik J.B., Soldatov P.V. Loss of axial stability of casing in permafrost production wells with a lateral support on thawing ice-rich ground. *Earth's Cryosphere* 2016, Vol. XX, 4, p. 93-104

Earth Cryosphere Institute SB RAS, Tyumen, Russia, gorelik@ikz.ru

Rzhanitsyn's general method for calculating the stability of an axially loaded column embedded into an elastic medium has been used to develop a calculation scheme and to estimate the critical load that leads to buckling of production well casing supported laterally by thawing ice-rich ground. In the suggested model, casing deforms within a thin layer of ice-rich ground with enhanced deformability under thawing; thawing ground resists elastically. The critical load depends on the thickness of the ice-rich layer, the stiffness of unfrozen ground, and the flexural rigidity of casing. The minimum critical load is a complex function of ice-rich layer thickness, while buckling can be either symmetrical or anti-symmetrical. Symmetrical buckling has been detected instrumentally in an accidental well at the Yamburg gas-condensate field. Using of the well casing with higher rigidity of its construction is suggested to optimize well completion designs and reduce buckling risks in areas of deep bedding of permafrost.

Nosenko G.A.[1], Lavrentiev I.I.[1], Glazovskii A.F.[1], Kazatkin N.E.[2], Kokarev A.L.[2] The Polythermal structure of Central Tuyuksu glacier. *Earth's Cryosphere* 2016, Vol. XX, 4, p. 105–115.

[1] Institute of Geography RAS, Moscow, Russia; gnosenko@gmail.com;[2] Institute of geography, Almaty, Republic of Kazakhstan

The article presents the results of field research carried out on the Central Tuyuksu glacier in 2013 by the scientists from the Institute of Geography of the RAS and from the Institute of Geography of Kazakhstan. The position of the glacier's contemporary boundaries has been defined using satellite imagery. Based on the obtained data on the terrestrial radio-echo sounding and DGPS-survey, the thickness of the ice has been determined. The ice thickness, the surface topography and the bed of the glacier have been mapped. The results of these studies confirm the previously made assumptions about the polythermal structure of the Tuyuksu glacier. Warm water-containing ice has been determined to occupy more than 40 % of the total volume of the glacier.

Popov S.V.[1], Polyakov S.P.[2] Ground-penetrating radar sounding of the ice crevassesin the area of the Russian stations Progress and Mirny (East Antarctica) duringthe field season 2014/15. *Earth's Cryosphere* 2016, Vol. XX, 1, p. 90-98,http://www.izdatgeo.ru/pdf/krio/2016-1/90.pdf.

[1] Polar Marine Geosurvey Expedition (PMGE), St. Petersburg, Lomonosov, Russia; spopov67@yandex.ru;[2] Arctic and Antarctic Research Institute, St. Petersburg, Russia

The results of the experimental ground-penetrating radar investigations in the area of Russian Progress and Mirny winter stations have been discussed. The tests were carried out during the austral summer field season of 2014/15. The scientific works were aimed at identifying and localization of the crevasses in the near-surface glacier. The soundings were carried out at frequencies of 270 MHz, 400 MHz and 900 MHz. It has been founded that the most promising is sounding at the frequencies from 400 MHz to 900 MHz. The works have also demonstrated that the cracks located inside the snow-firn can form very weak diffracted waves. In addition, the diffracted waves formed by the crevasses could be the reliable basis for the creation of the

velocity model to recount travel time into the depth. It becomes especially important when the ice core data are unavailable or the multi-offset sounding is possible.

Volokhov S.S. Mechanocalorical effect in frozen ground under uniaxial compression. *Earth's Cryosphere* 2016, Vol. XX, 1, p. 30-35, http://www.izdatgeo.ru/pdf/krio/2016-1/30.pdf.

Lomonosov Moscow State University, Department of Geology, Moscow, Russia; volokhov@geol.msu.ru

Results of research of mechanocalorical effect occurring at the uniaxial compression testing of frozen ground are reported. The conditions of its occurrence are revealed. An assumption about the leading role of crack formation in this process is made.

Chuvilin E.M., Grebenkin S.I., Sacleux M.* Influence of moisture content on permeability of sandy soils in frozen and unfrozen states. *Earth's Cryosphere* 2016, Vol. XX, 3, p. 71-78, DOI: 10.21782/KZ1560-7496-2016-3(71-78).

Lomonosov Moscow State University, Department of Geology, Moscow, Russia; chuvilin@geol.msu.ru; Total EP exploration, La Défense, France*

Results of experimental studies on the estimation of the permeability of sandy soils with different moisture content in frozen state and after thawing have been presented. The experiments have been performed in a specially designed device allowing the evaluation of gas permeability of samples (3 cm diameter and 3–5 cm length) at various temperature and pressure conditions. During the experiments, the dependencies of the permeability of the sand samples in frozen and thawed states from the degree of saturation by ice or porous water have been obtained. It has been revealed, that the gas permeability is reduced by several orders of magnitude above the critical degree of saturations (40–50 % and 50–55 % for frozen and thawed samples, respectively). The character of dependence of the gas permeability of sandy frozen soils on the degree of saturation is largely determined by their structural features, and first of all by the dependence of ice-cement type on the moisture content. It has been demonstrated that the gas permeability of the sandy samples goes up during thawing. The difference in permeability between the frozen and thawed samples increases proportionally to saturation.

Lupachev A.V.[1,3], Gubin S.V.[1], Veremeeva A.A.[1], Kaverin D.A.[2], Pastukhov A.V.[2], Yakimov A.S.[3] Microrelief of the permafrost table: structure and ecological functions. *Earth's Cryosphere* 2016, Vol. XX, 2, p. 3-14.

[1] Institute of Physhico-chemical and Biological Problems in Soil Science, RAS, Puschino, Russia; a.lupachev@gmail.com;[2] Institute of Biology, Komi SC, UB RAS, Syktyvkar, Russia; [3] Earth Cryosphere Institute, SB RAS, Tyumen, Russia

Surface microrelief structure, complexness of soil-vegetation cover, lithological heterogeneity of the active layer, spatial differences of thermal properties of different elements of transient layer and other factors are responsible for the complicated pattern of permafrost table microrelief. This relief determines accumulation, redistribution and removal of matter and energy from the ecosystem. Spatial difference in structure and properties of the upper layer of permafrost may lead to the cryoconservation of organic matter, biophylic elements, contaminants, viable biota or, contrarily, this material may thaw and contribute into the modern biogeochemical cycle.

Zhang R.V. Hydrosystems in the Arctic zone of Russia. *Earth's Cryosphere* 2016, Vol. XX, 4, p. 79–92.

Melnikov Permafrost Institute SB RAS, Yakutsk, Russia; zhang@mpi.ysn.ru

An overview of the almost 70-years' experience of construction and operation of hydrosystems in the Arctic zone of Russia is provided. Over 20 hydrosystems of waterworks and power facilities have been built in this region, which is situated in the zone of continuous permafrost and has an extremely severe climate. The specific feature of hydraulic engineering in the Arctic is the dramatic changes in the permafrost conditions of the territory due to the construction of man-made engineering facilities (hydrosystems). The guarantee of static and filtration stability of hydrosystems is the conservation of their body and foundation in the frozen state. This aim can be attained by using special engineering techniques. However, the investigations carried out during the last decades have confirmed that the hydrosystems can maintain stability even if the thermal condition is changing.

Pizhankova E.I. Modern climate change at high latitudes and their influence on the coastaldynamics of the Dmitriy Laptev Strait area**.** *Earth's Cryosphere* 2016, Vol. XX, 1, p. 51-64, http://www.izdatgeo.ru/pdf/earth_cryo/2016-1/46_eng.pdf.

Lomonosov Moscow State University, Department of Geology, Moscow, Russia; eipijankova@rambler.ru

The long-term data series of the ice cover area of the Arctic sea during the whole period of observations (since 1935–1940 to 2014) have been analyzed. It has been demonstrated that the last decade in all seas is characterized by a sharp drop in ice cover. The data on ocean weather stations confirm an increase in air temperatures over the same period. It is accompanied by a significant increase in the rate of coastal retreat and the rates of thermal denudation of icy coasts. The ratio of the rates of thermal denudation and thermal abrasion on the eroded ice complex has been estimated.

Slagoda E.A.[1,2,3], Narushko M.V.[1,4], Preis Y.[5], Opokina O.L.[1,3], Kurchatova A.N.[1,3] Reconstruction of thermokarst in the Late Pleistocene - Holocene from geocryological and botanical data (Area of Lake Sokhonto, Central Yamal). *Earth'sCryosphere* 2016, Vol. XX, 4, p. 59–68.

[1] Earth Cryosphere Institute SB RAS, Tyumen, Russia, eslagoda@ikz.ru; [2] Tyumen State University, Tyumen, Russia; [3]Tyumen Industrial University, Tyumen, Russia; [4] Tyumen Research Center SB RAS, Tyumen, Russia; [5] Institute of Monitoring of Climatic and Ecological Systems, SB RAS, Tomsk, Russia

The upper permafrost sequence of the third marine plain and the thermokarst-erosional valley near Lake Sokhonto in the Central Yamal Peninsula were studied in 2014-2015 for cryostratigraphy, radiocarbon ages, and peat botanical composition and properties. The upper section of the marine plain consists of the Sartan syncryogenic subaerial sediments with polygonal wedge ice affected by thermokarst. The early Holocene epicryogenic sediments compose the steps of the valley with different elevations. Thermokarst events of the first half of the Holocene optimum to the Present were determined from the lake deposits. The peatland plant diversity recorded in sediments of khasyrei (a former lake depression) provides evidence for paleoclimatic conditions and thermokarst pulses for the past 1400 years.

Vasil'chuk Yu.K., Budantseva N.A., Vasil'chuk A.C., Podborny Ye.Ye.*, Chizhova Ju.N. Holocene massive ice in north-west Siberia permafrost**.** *Earth's Cryosphere* 2016, Vol. XX, 1, p. 36-50, http://www.izdatgeo.ru/pdf/earth_cryo/2016-1/34_eng.pdf.

*Lomonosov Moscow State University, Geography and Geology Departments, Moscow, Russia; vasilch_geo@mail.ru; * Hydroecological Research Center, St. Petersburg, Russia; epodbornyy@yandex.ru*

Four stages of massive ice lens and three levels of cryopegs have been studied in the Holocene sediments near the Sabetta settlement. Contrast vertical and lateral distribution of $\delta^{18}O$ values in multi-stage massive ice near the Sabetta and Gyda estuaries provides the basis for the allocation of the isotopic composition as indicator type for the segregated or infiltration segregated multi-stage ice formations and their intra-sedimental origin. The ratio of the chloride and sulfate anions, pollen spectra and presence of algae in the ice of different types in the Sabettayakha estuary suggest that vertically layered brown ice had been accumulated during freezing of water saturated sands of the Ob Gulf; the brown non-laminated ice had been formed as a result of freezing of underlake talik water; the origin of the white ultra-fresh ice could also be linked with the lake and river waters. It has been demonstrated that massive ice occurrs both in pre-Quaternary deposits and in modern and Holocene sediments.

Grebenets V.I., Isakov V.A. Deformations of roads and railways within the Norilsk–Talnakh transportation corridor and the stabilization methods. *Earth's Cryosphere* 2016, Vol. XX, 2, p. 69-77.

Lomonosov Moscow State University, Faculty of Geography, Department of Cryolithology and Glaciology, Moscow, Russia;isakov.gc@gmail.com

The paper considers the key factors causing the deformations of the roads and railways between the city of Norilsk and Talnakh. The factors are deduced via the on-ground field surveying, thermophysical modeling and analysis of other topic related research materials. As the result, the authors have determined the main types of deformation, providing the explanation to their genesis. The authors also have suggested the geotechnical methods for controlling and stabilizing the road deformations. The main reasons, causing the road deformations in Norilsk–Talnakh area, are the processes of thermokarst and waterlogging along with geotechnical flaws of design.

Pastukhov A.V. Predicted changes in stocks of soil organic carbon under the moderate climate scenario for Northern European Russia. *Earth's Cryosphere* 2016, Vol. XX, 4, p. 28–36.

Institute of Biology, Komi SC UB RAS, Syktyvkar, Russia, alpast@mail.ru

Predictive assessment of the regional soil organic carbon stocks has been carried out for the tundra and forest tundra in the northeastern part of European Russia. The obtained regional matrices and maps account for 83 % of the changes in soil organic stocks depending on the environmental factors (combined soil taxa, terrain dissection, and climate characteristics - temperature and precipitation), with the calculations based on the moderate climate scenario E-GISS. According to the prediction model (excluding the environmental inertia) the resulting soil organic carbon stocks will decrease by 1.27 kg/m^2(–3.47 %) in 2050, i. e. soil organic carbon is predicted to be 35.29 kg/m^2, whereas current SOC stocks are estimated 36.56 kg/m^2.

Khomutov A.V., Leibman M.O. Rating of cryogenic translational landsliding hazard in tundra of Central Yamal. *Earth'sCryosphere* 2016, Vol. XX, 2, p. 49-60.

Earth Cryosphere Institute, SB RAS, Tyumen, Russia; akhomutov@gmail.com; University of Tyumen, Tyumen, Russia

Results of cryogenic landsliding hazard rating in different landscapes of Central Yamal are presented. Authors consider the degree of impact applied to landscape complexes by cryogenic landsliding to be determined by the relative area of the youngest landslide impact. The greater the area affected by modern landslides within the landscape complex, the more sensitive is this landscape complex to possible activation of cryogenic landslides. However, locations disturbed by the latest translational landslides within a landscape unit are considered non-hazardous because, according to our findings, the re-occurrence of landsliding on such locations in coming centuries is unlikely. Analysis of a landscape pattern shows that all modern cryogenic translational landslides are located on concave slopes. Modern landsliding impact differs within the same landscape complexes appearing on different geomorphic levels of Central Yamal. Generally, this impact increases from low to high geomorphic levels. Landscape complexes are associated into 5 groups according to rated cryogenic translational landsliding hazard degree. Expert evaluation of a landslide hazard is based on detection of landscape conditions more or less favorable for cryogenic landsliding and on the latest cryogenic translational landslide impact.

Vasil'eva Z.A., Efimov S.I., Yakushev V.S. Prediction of thermal interaction betweenoil/gas wells and permafrost rocks containing metastable gas hydrates. *Earth's Cryosphere* 2016, Vol. XX, № 1, p. 60-63, http://www.izdatgeo.ru/pdf/earth_cryo/2016-1/60_eng.pdf.

Gubkin Russian State University of Oil and Gas, Moscow, Russia; zoyavac@gmail.com

A model of thermal interaction between the production well and permafrost rocks containing the relic, metastable hydrates has been developed to evaluate the intensity of permafrost thawing and associated gas emission at oil and gas north fields. The self-similar solution and the analytical expression for estimation of the boundary of phase transition have been obtained. The formula of spreading of radius of the well's thermal influence has been derived. The dependence of the soil thawing radius on the hydrate saturation of the rock and the cement stone heat conductivity has been deduced on the basis of self-similar solution.

Sizov O.S., Lobotrosova S.A. Features of revegetation of drift sand sites in the northern taiga subzone of Western Siberia**.***Earth's Cryosphere* 2016, Vol. XX, 3, p. 3-13, DOI: 10.21782/KZ1560-7496-2016-3(3-13).

Earth Cryosphere Institute, SB RAS, Tyumen, Russia; kaba-nin@yandex.ru, ravilova85@mail.ru

Despite of the presence of large drift sand sites, the northern taiga areas of Western Siberia are currently experiencing a decrease in deflation processes and increase in self-regeneration of the vegetation cover. This paper discusses the drivers of the formation of sand arenas and analyzes the nature of changes in climatic conditions in the Nadym River downstream area. The results of interpretation of space images made at different times and field observations data allow assessing the vegetation cover and dune microrelief dynamics within the bounds of natural deflation basins widely developed in the study area. The particular characteristics and mechanisms of revegetation are demonstrated by the example of a model deflation basin.

Novikov E.A., Shkuratnik V.L., Oshkin R.O. Use of acoustic emission patterns in soilsto determine the degree of their frost penetration. *Earth's Cryosphere* 2016, Vol. XX, 1, p. 91-94, http://www.izdatgeo.ru/pdf/earth_cryo/2016-1/91_eng.pdf.

National University of Science and Technology (MISiS), Moscow, Russia; ftkp@mail.ru

We report results of experimental studies aimed at the determining the patterns of thermally stimulated acoustic emission in soil samples with different moisture contents during their freezing and subsequent local thawing. For the first time it is demonstrated that these patterns can be used for contouring of thaw zones in a mass of frozen soils, as well as for monitoring the amount of water contained in these zones.

Glotov V.E., Glotova L.P. Syncryogenic minerals in the Northeast of Russia. *Earth's Cryosphere* 2016, Vol. XX, 2, p. 25-31.

North-East Interdisciplinary Scientific Research Institute, FEB RAS, Magadan, Russia; geoecol@neisri.ru,glotova@neisri.ru

Formation and development of the permafrost zone in the Northeast of Russia provided the emergence of new types of minerals, called by the authors as syncryogenic. Among them there are: fossil coals partially oxidized due to oxygen and water deficits in the permafrost formations; placer gold formed at seasonal freezing and thawing; peat accumulated at the near-surface cryogenic aquifuge.

****

PYRN Russia

PYRN Russia members regularly organize local monthly meetings for gathering young researchers and discussing various permafrost-related issues. The most significant event organized by PYRN Russia in 2016 was youth program in the framework of The Fifth conference of Russian Geocryologists «Geotechnics in cryolithozone», which was held at Lomonosov Moscow State University on June. It was organized by the staff and students from the Geocryology Department of the Geological Faculty.

PYRN Russia, financially supported by Total E&P Russia, organized the program for students and young researchers attending the conference. It included travel grants, awards for the best presentations, buffet, quiz and memorial prizes. Before the conference, the most talented participants from the remote regions of Russia have been awarded travel grants.

In the framework of the roundtable «History, methodology and education in permafrost science», the report «Permafrost Young Researchers Network – new generation of XXI century scientists» was presented by PYRN Russia National Representative, Alexey Maslakov, and attracted much attention of the senior audience.

Besides the scientific program, several cultural events were organized. In the evening of June 16th, young geocryologists were invited for an icebreaker, combined with buffet. During the first Permafrost Quiz, more than 50 permafrost-related questions were asked to the audience. After the quiz, a master-class on how to present your study was conducted. Finally, participants played a team game «One hundred to one» (Russian analogue of American «Family Feud») with permafrost-related topics. Memorial prizes were awarded to all the participants of the game.

Young permafrost researchers attended PYRN youth program of the Fifth conference of Russian Geocryologists «Geotechnics in cryolithozone»

Contact: alekseymaslakov@yandex.ru

****

DEATHS

Nikolay Nikitich Romanovsky

(14.05.1932–20.03.2016)

On March 20, 2016, Nikolay Nikitich Romanovsky, an outstanding Russian permafrost investigator and hydrogeologist, Doctor of geology and mineralogy, professor emeritus of the Faculty of Geology of the Lomonosov Moscow State University, passed away after a long illness.

N.N. Romanovsky was born on May 14, 1932 in the town of Rubezhnoye near the city of Lugansk. His parents, Nikita Vasilyevich Romanovsky and Anna Nikolaevna Belovitskaya, were chemical engineers. In the mid-1930s, the years of Stalin's repressions, Nikita Vasilyevich Romanovsky was imprisoned and to die in prison in 1937. After World War II, the Romanovskys settled in the vicinity of Moscow, and in 1950, Nikolay finished the secondary school in the town of Lubertsy, Moscow region, with a silver medal award. After the school graduation, Romanovsky was admitted to the Faculty of Geology of the Moscow State University, where he first studied at the department of ground science, and then at the department of permafrost studies, being among the first students of this department. In 1955, Romanovsky graduated from the department *cum laude*, and ever since then, his life was connected with it.

In 1955, Romanovsky has started his PhD at the permafrost department. Under scientific supervision of B.A. Savelyev, he conducted his first studies of the structure of ground ice in Tiksi laboratory and participated in the first expeditions to study Quaternary deposits in the area of Dmitry Laptev Strait. In 1959, he successfully defended a PhD thesis on "Quaternary Deposits of Bolshoy Lyakhovsky Island and of the Northern Part of the Yano-Indigirskaya Lowland (the Stratigraphy and the Frozen-ground and Facies Analysis)", and was awarded the PhD degree in geology and mineralogy.

The work at the university presupposes the combination of scientific and educational activities. Beginning in 1960 Romanovsky performed the scientific supervisory duties of the expeditions organized by Faculty of Geology, and in 1963 he started his career in the area of education.

The permafrost studies Romanovsky conducted strike the imagination by the vast geography of the studies and their practical application to the economy of the country. A large part of the studies was conducted in Central Siberia, Yakutia, in the North-East and Far East of the USSR, in Northern Transbaikalia, as well as in Alaska, Canada, Poland, and even in the South African Republic. Scientific interests of Nikolay Nikitich were always amazingly broad, while the scope and depth of his studies in fields of permafrost and related sciences only grew with the time. By his own admission he was always interested in the issues of general, regional and historical permafrost studies, development of cryogenic processes and phenomena, the problems of permafrost hydrogeology, the methodological aspects of the permafrost studies and survey; permafrost origin, the frozen-ground and facies analysis of Quaternary deposits, the environmental protection issues and rational nature use. A special place in his works was occupied by the evolution of offshore permafrost and the impact of gas hydrates on it, which was the subject of Romanovsky's researches for last 30 years.

The large field material obtained by Romanovsky himself and in cooperation with colleagues allowed him to develop a method of permafrost and hydrogeological and engineering permafrost survey, necessarily accompanied by permafrost forecast. In his opinion, this characteristic of the result of permafrost survey was a distinctive feature of the school of V.A. Kudryavtsev, whom Romanovsky considered to be his teacher. Later (from the beginning of 1980s), when the issues of environmental protection and rational nature use became topical, geocryological forecast became one of the foundations for their solution.

Romanovsky stated a balanced concept of thermal-contraction-crack structures development and related it to historical, climatic and geological features of the permafrost regions. As a result, he prepared and successfully defended a doctorate in 1975 on "Regularities of formation of polygonal wedge structures based on frost cracking". Two years after, he was offered the position of a professor at the department of geocryology.

Nikolay Romanovsky was the author of more than 300 papers and books, including monographs and textbooks. All his works, beginning with his first publications, which appeared in the second half of the 1950s, and up to his last paper published in 2011, were always known for the brilliant presentation of new ideas and approaches, concepts and deep consolidation of the material collected. His monograph "Formation of polygonal wedge structures" (1977), based on his doctorate, deserves a special mention. Even 40 years later, this monograph remains a fundamental book in this area. The name of Romanovsky is associated with the significant progress in investigating the regularities of frost cracking and the related formations and landscapes, in the study of block streams, icings, transformation of cryohydrogeological structures, and, in the recent years, interaction between gas hydrate cryogenic strata and formation of offshore permafrost.

In 1963, Romanovsky prepared his first university course "Ground waters of cryolithozone", which became the first course on this subject at the Moscow University. Later over the years, he prepared and delivered the following courses of lectures: "Cryogenic and hydrogeological features of permafrost regions", "Regional geocryology", "General permafrost studies (Geocryology)", and "Cryolithology and frozen-ground and facies analysis". Over a quarter of a century, beginning with the 1980s, he delivered a course of lectures "Foundations of the lithosphere cryogenesis", in which he first considered wholly the geographic and geological regularities of relief changes and the structure of the upper lithospheric horizons as a result of cryogenesis. His textbook under the same title published in 1993 still remains topical.

At his department of the Moscow University, Romanovsky took active participation in preparation of many monographs and textbooks: "General geocryology" (1978), "The methodology of permafrost survey" (1979), "Geocryologic Map of the USSR" of the scale of 1:2 500 000 and other publications. In 1993, Romanovsky was awarded the State Prize for his participation in the preparation of the five-volume edition "Geocryology of the USSR" (1989). In addition, he prepared a popular science book "Cold of the Earth" (1980), aimed at attracting schoolchildren to the permafrost studies. He was the scientific supervisor of 22 candidate thesis and 3 doctorates, but even more dissertations were defended due to the Professor's advice and consultations. Over many years, Romanovsky was the scientific secretary and later a member and a deputy chairman of specialized scientific councils for awarding scientific degrees of candidates and doctors of sciences in permafrost studies.

Over his entire life, Nikolay Nikitich was involved in the process of science organization and management. He was deputy chairman of the United Scientific council of RAS in the cryology of the Earth (1966), and from 1989 to 1995, he was a member of the Technology Council of the Ministry of Environmental Protection and Nature Use of the Russian Federation; he was always invited to take part in expert examinations of the state projects of State Planning Committee of the USSR and of State Committee for Construction of the USSR, and other ministries and agencies. In 1976, Romanovsky was appointed head of the complex Baikal-Amur Mainline Railway (BAM) expedition, he was deputy chairman of the council of Rector of MSU in development of the BAM region, and later he became the council's chairman to head it until 1990. Over many years, he was an expert of the Russian Foundation for Basic Research.

Romanovsky is one of permafrost scientists best known in the international community, a recognized specialist of an international level. Back in the late 1960s, he had internship at the universities of Poland and had closed relations with many scientists from Canada and USA. In 1987, Romanovsky became a member of the National Permafrost Committee of the International Permafrost Association (IPA); beginning with 1992, he was a member of the commission "Natural environments with permafrost processes" of the International Geophysical Union, and in 1993 he was elected Vice-President of IPA to serve for five years. In the early 1990s,

Romanovsky contributed to close cooperation between the permafrost experts of Russia and the permafrost scientists of Germany, which turned into many years' collaboration with the Alfred Wegner Institute for Polar and Marine Research (AWI) and other institutes and universities of Germany. Nikolay Romanovsky headed and supervised many field studies in the Russian Eastern Arctic; he supervised the permafrost studies of both Russian and German students, graduate students and young scientists. During 15 years, he was the scientific supervisor of the joint Russian-German interdisciplinary project "The Laptev Sea system".

Over many years, Romanovsky was involved in editing activities. From 1966 to 1992, he was the secretary-in-charge and then a member of the editorial board of the journal *Vestnik Moskovskogo Universiteta*, Geology series, and since 1997 to 2016 he was a member of the editorial board of the *Kriosfera Zemli* journal. For a long time, he was a member of the editorial boards of the international journals *Permafrost and Periglacial Processes*, *Biuletyn Peryglacjalny*, *Polar Geography and Geology*, as well as the consulting editor in permafrost studies of the Mining Encyclopedia (1986–1989).

For his achievements in the development of science and preparation of young scientists, Romanovsky was awarded the title of the honored representative of science and technology of the Russian Federation (1995), of a professor emeritus of MSU (1999), as well as of a Soros professor (1994). However, the award Romanovsky was most proud, is "The life achievement award" of the International Permafrost Association (2012), as only two persons in the world were awarded it.

The deep professional knowledge of Nikolay Romanovsky, his broad outlook, high demands for the quality of scientific results, his honesty and punctuality in relations with people – those were only few of the qualities that brought him respect and admiration of his friends and colleagues. They will always remember Nikolay Nikitich Romanovsky…

Colleagues, friends, and former students