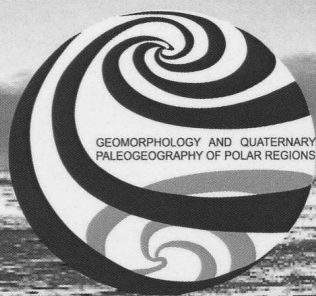


СБОРНИК МАТЕРИАЛОВ

Международной конференции
«Геоморфологические и палеогеографические
исследования полярных регионов»

Симпозиума Германской академии
естествоиспытателей «Леопольдина»

Международного полевого
симпозиума INQUA PeriBaltic WG



9-17.09.2012 г.

Санкт-Петербург, СПбГУ

САНКТ-ПЕТЕРБУРГСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

**«ГЕОМОРФОЛОГИЯ И
ПАЛЕОГЕОГРАФИЯ
ПОЛЯРНЫХ РЕГИОНОВ»**

Материалы

совместной международной конференции

«ГЕОМОРФОЛОГИЯ И

ПАЛЕОГЕОГРАФИЯ

ПОЛЯРНЫХ РЕГИОНОВ»,

симпозиума «Леопольдина» и

совещания рабочей группы INQUA Peribaltic

Санкт-Петербург, СПбГУ, 9 – 17 сентября 2012 года

Санкт-Петербург, 2012

**“GEOMORPHOLOGY AND
PALAEOGEOGRAPHY
OF POLAR REGIONS”**

Proceeding

of the Joint International Conference

**“GEOMORPHOLOGY AND
PALAEOGEOGRAPHY
OF POLAR REGIONS”,**

Leopoldina Symposium and

INQUA Peribaltic Working Group Workshop

Saint-Petersburg, SPbSU, 9-17 September, 2012

Saint-Petersburg, 2012

УДК 551.4

Ответственные редакторы: А.И. Жиров, В.Ю. Кузнецов, Д.А. Субетто, Й. Тиде

Техническое редактирование и компьютерная верстка: А.А. Старикова, В.В. Ситало

Обложка: К.А. Смыкова

«ГЕОМОРФОЛОГИЯ И ПАЛЕОГЕОГРАФИЯ ПОЛЯРНЫХ РЕГИОНОВ»: Материалы совместной международной конференции «ГЕОМОРФОЛОГИЯ И ПАЛЕОГЕОГРАФИЯ ПОЛЯРНЫХ РЕГИОНОВ», симпозиума «Леопольдина» и совещания рабочей группы INQUA Peribaltic. Санкт-Петербург, СПбГУ, 9 – 17 сентября 2012 года / Отв. ред. А.И. Жиров, В.Ю. Кузнецов, Д.А. Субетто, Й. Тиде. – СПб., 2012. – 475 с.

ISBN 978-5-4391-0029-3

Сборник содержит материалы совместной международной конференции "Геоморфологические и палеогеографические исследования полярных регионов", симпозиума «Леопольдина» и совещания рабочей группы INQUA Peribaltic. Обсуждается целый ряд актуальных вопросов, связанных с изучением проблем теоретической геоморфологии и практики геоморфологического картографирования и исследования полярных областей Земли, палеогеографической реконструкции событий среднего и позднего неоплейстоцена, а также голоцена Арктики и Субарктики, практическими изысканиями на срединно-океанических хребтах в связи с их рудными ресурсами. Сборник представляет интерес для широкого круга специалистов, изучающих геоморфологию, геологию и палеогеографию четвертичного периода.

Материалы публикуются в авторской редакции

Работа выполнена при финансовой поддержке Санкт-Петербургского государственного университета и Мега-гранта Правительства РФ, No. 11.G34.31.0025.

“Geomorphology and Palaeogeography of Polar Regions”: Proceedings of the Joint Conference “Geomorphology and Quaternary Palaeogeography of Polar Regions”, Symposium “Leopoldina” and the INQUA Peribaltic working group Workshop. Saint-Petersburg, SPbSU, 9-17 September 2012 / Eds. A. Zhiron, V. Kuznetsov., D. Subetto, J. Thiede. – SPb., 2012. – 475 p.

ISBN 978-5-4391-0029-3

The volume presents proceeding of the joint international conference “Geomorphology and Quaternary Palaeogeography of Polar Regions”, Symposium “Leopoldina and the INQUA Peribaltic working group Workshop. Discussed is a wide range of issues related to the study of theoretical problems of geomorphology, geomorphological mapping, research in the field of Polar Regions, palaeogeographic reconstructions of Middle and Late Pleistocene and Holocene events, and applied studies of ore resources of mid-ocean ridges (MOR). The book is topical for specialists studying geomorphology, geology and palaeogeography of Quaternary period.

Коллектив авторов, 2012

СПбГУ, 2012

СИМПОЗИУМ «ЛЕОПОЛЬДИНА»

Antcibor I., Eschenbach A., Kutzbach L., Bolshiyarov D. and Pfeiffer E-M. CONTENT AND DISTRIBUTION OF TRACE METALS IN PERMAFROST-AFFECTED SOILS OF NORTHERN SIBERIA, RUSSIA	339
Baranskaya A.V. THE LATEST TECTONIC MOVEMENTS IN KEY AREAS ON THE COASTS AND ISLANDS OF THE LAPTEV SEA.....	342
Bauch H.A., Ovsepyan Ya., Taldenkova E., Stepanova A., Rudenko O. A MULTIPROXY RECONSTRUCTION OF LAST INTERGLACIAL ENVIRONMENTAL CONDITIONS IN NORTHERN RUSSIA	346
Chetverova V.A., Derevyanko L.G., Gusev E.A. PALYNOLOGICAL CHARACTERISTICS OF LOWER YENISSEY QUATERNARY DEPOSITS	347
Evgrafova S., Wagner D. MICROBIAL METHANE DRIVING PROCESSES IN SIBERIAN ARCTIC AND SUB-ARCTIC CRYOSOLS	350
Fedorova I.V., Chetverova A.A., Bolshiyarov D.Yu., Makarov A.S., Boike J., Morgenstern A., Heim B. HYDROLOGY OF THE LENA RIVER DELTA	351
Frolova L.A., Gafiatullina L.I., Nazarova L.B., Pestryakova L.A. PALAEOENVIRONMENTAL INVESTIGATIONS AND RECONSTRUCTIONS IN NORTHERN RUSSIA USING SUB-FOSSIL CLADOCERA (BRANCHIOPODA, CRUSTACEA)	352
Grigoriev M.N. EROSION RATES AND TERRIGENOUS SEDIMENT FLUXES IN THE LENA DELTA REGION (EAST SIBERIAN ARCTIC)	354
Grigoriev M.N., Hubberten H.-W. THE NEW ARCTIC RESEARCH STATION "SAMOYLOV ISLAND" IN THE LENA DELTA: PROSPECT OF JOINT RUSSIAN-GERMAN STUDIES	357
Heimann M., Winderlich J., Andreae M. O., Chi X., Gerbig C., Kolle O., Lavric J., Panov A., Rödenbeck C., Skorochood A., Trusilova K. THE ZOTINO TALL TOWER OBSERVATORY (ZOTTO): QUANTIFYING LARGE SCALE BIOGEOCHEMICAL CHANGES IN CENTRAL SIBERIA.....	359
Ivanov V.V., Chernyavskaya E.V., Maslov P., Aksenov Y., de Cuevas B. SHELF-BASIN EXCHANGE IN THE LAPTEV SEA IN THE WARMING CLIMATE: THE JOINT ROLES OF ATMOSPHERIC FORCING AND HYDROGRAPHY.....	362

References

- [1] Fedorova I.V., Chetverova A.A., Potapova T.M., Charkin A.N. Particularities of geochemical processes in the Lena River delta. Materials of All-Russian conference "Seliverstovskie chteniya". St. Petersburg, Russia, 19-21 November, 2009. p. 333-337.
- [2] Morgenstern, A., Ulrich, M., Günther, F., Roessler, S., Fedorova, I. V., Rudaya, N. A., Wetterich, S., Boike, J., Schirrmeyer, L. Evolution of thermokarst in East-Siberian ice-rich permafrost: A case study. Geomorphology, under review.
- [3] Abnizova A., Siemens J., Langer M. and Boike J. Small ponds with major impact: The relevance of ponds and lakes in permafrost landscapes to carbon dioxide emissions. Global Biogeochemical Cycles. In press.
- [4] Chetverova A.A., Fedorova I.V., Potapova T.M., Bojke J. Hydrological and Hydrochemical Features of Lakes of Polygonal Wetlands Area of The Lena River Delta, Eastern Siberia, Russia. X international conference of permafrost TICOP. Salekhard, Russia, 25-29 June 2012, in press.

PALAEOENVIRONMENTAL INVESTIGATIONS AND RECONSTRUCTIONS IN
NORTHERN RUSSIA USING SUB-FOSSIL CLADOCERA (BRANCHIOPODA, CRUSTACEA)

L.A. Frolova*, L.I. Gafiatullina**, L.B. Nazarova***, L.A. Pestryakova****

* KFU, Kazan, e-mail: larissa.frolova@mail.ru

**KFU, Kazan, e-mail: lilyagafiatullina@yandex.ru@inbox.ru

*** AWI, Potsdam; KFU, Kazan, e-mail: larisa.nazarova@awi.de

****NEFU, Yakutsk, e-mail: lapest@mail.ru

Climate change is emerging as the most far reaching and significant stressor on Arctic biodiversity (Arctic biodiversity 2010). It is expected that the climate warming will cause changes or even decrease of areas of distribution of the animals living in the Arctic regions. Continued thawing of the permafrost can lead to the drainage and eventual disappearance of these lakes, as can erosion and lake coalescence [1].

Earlier melting of ice and snow, flowering of plants, and emergence of invertebrates can cause a mismatch between the timing of reproduction and food availability. Furthermore, recent climate warming is expected to support biological invasions by species originating from warmer regions [2]. Hence, biological observations based on the best available scientific methods are required to identify changes in biodiversity, to assess the implications of observed changes, and to develop adaptation strategies.

Cladocera (Crustacea: Branchiopoda) is a key component of aquatic ecosystems, their community structure reflects combination of physical, chemical and biological characteristics of the system they inhabit [3, 4].

The period of open water and, respectively, the vegetation period for the majority of the water organisms are limited in the Arctic by a short temporary interval of one or two months. Samples of zooplankton collected with standard hydrobiological methods one or at most two times during a season, don't allow tracing presence of many species and therefore the real species richness of the water body because of unknown seasonal dynamics of their life cycles in the arctic water bodies. As in the lake sediments the remains of the animals for the entire vegetative period are deposited, paleolimnological techniques can give a better understanding of a taxonomic diversity, at least, for some selected families (Chydoridae, Bosminidae)

The aim of the present investigation was to examine the taxonomic and ecological diversity of cladoceran microfossil assemblages from north-west of Yakutia, north-eastern Siberia, to determine their distribution within the region with regards to environmental gradients and to reveal the influence of environmental factors in structuring the cladoceran communities in the region with special regard to climate-dependent environmental parameters.

We study subfossil remains of Cladocera (Branchoptoda, Crustacea) from the lakes, located in different regions of Russia (Northern Karelia and Northern-eastern Siberia). According to the Cladocera abundance in the lake sediments, they were divided into three groups: dominant taxa (> 50% in each sample), subdominant (from 25-50%) and seldom (<25%) taxa. We determined their biotopic and zoogeographic features, calculated indexes of species diversity, community evenness, also statistical analysis with identification of preferences of species for hydrological parameters. Our analysis allows obtaining a more complete picture of the species composition of cladoceran community in comparison to regular sampling over several vegetation seasons using standard hydrobiological methods.

The material for this study was surface sediment samples from 18 lakes in BolshoyLakhovskiyIsland, OyogosYar, sediments from 24 Central Yakutia lakes and 55 lakes on White sea region. In general, most of the lakes are small, shallow and were formed by thermokarst processes with maximal depths of about 4 m. Ion concentrations show that cation compositions for lake waters are dominated by Ca²⁺ and Mg²⁺. We found differences in hydrochemical composition. In Central Yakutia lakes had high salinity, while in the northern meltwater ponds we observed decline in salinity. Al ion content was higher in waters of the B. LakhovskiyIsland, compared with those in C. Yakutia. Reservoirs in B. Lakhovskiy island also have high rates of Fe, compared with reservoirs C. Yakutia.

Among the leading species, common for all sampling sites in the region of northern-eastern Siberia, it should be noted Chydorussphaericus, Alonaguttata, Bosminalongirostris. The composition of the dominants was similar, but it was replenished in reservoirs of C. Yakutia with such species as: Alonella nana, Bosminalongispina. In taxonomic terms the highest species diversity of Cladocera was in lakes of C. Yakutia (34 taxa), in the waters along the coast of the Laptev Sea: 20 species in the lakes of the B. Lakhovskiy island and 9 in OyogosYar.

According to zoogeographic zoning, the bulk of the cladocera community, typical of present-day conditions, were species characterized by universally geographical distribution, except for lakes from the White sea region, where more northern species were found. The major part of the found species belonged to the littoral taxa, but in the lakes on White Sea region more littoral-planktonic taxa were found.

The values of Shannon's Index (H) range from 0.90 to 2.75 in samples from the island of B. Lakhovskiy and from 2.64 to 2.7 in Central Yakutia waters, and for the lakes on White Sea region: 2.04-2.97. It indicates the presence of relative diverse cladocerans community. The values of Pielou index ranged from 0.35 to 0.87 in samples from the Laptev Sea coast lakes, from 0.6 to 1.0 in samples from Central Yakutia waters, and 0.41-0.91 for the lakes from White Sea region, indicating an even distribution of species in the cladoceran communities.

We revealed significant differences in preferences of species for certain environmental conditions using an analysis of variance (ANOVA). The data for this analysis was abundance of fossilized remains of each taxon that had been found in investigated waters from northeast of Yakutia. Using statistical analysis we revealed significant differences in abundance of certain species and values of hydrochemical parameters corresponding to the species-specific preferences for abiotic conditions.

Forward selection and Monte Carlo permutation tests (999 permutations), identified a minimal subset of four environmental variables that significantly ($p \leq 0.05$) and most effectively explained

variation in the species data: TJuly, water depth, SO4²⁻, Si4⁺. RDA axis 1 ($\lambda = 0.174$) and axis 2 ($\lambda = 0.157$) were both significant ($p \leq 0.05$) and explained 85.8% of the relationships between the cladoceran taxa and measured environmental variables.

From the four identified significant environmental variables, TJuly featured the highest percentage of explained variance, as well as the highest λ_1/λ_2 ratio (0.67). The latter measure, in particular, serves for indicating how effectively the variance in the species data is captured by a particular gradient [5, 6]. The results suggest that the relationship between cladoceran distributions and TJuly in this data-set is sufficiently strong and is promising for the future development of a regional transfer function that has the potential to be used to predict the mean July temperatures from the cladoceran data.

The investigation of cladoceran assembles of north-western Yakutian lakes has demonstrated a high potential of this group of hydrobionts as indicator of ecological state of the water bodies and of the changes taking place in the ecosystem caused by climate change (high level of correlation between the species composition and the air temperature). The obtained results encourage further work on making a regional cladoceran-based temperature model appropriate for the Arctic regions of Russia as a whole and Yakutia in particular.

References

[1] Samchyshyna L, Hansson L-A, Christoffersen K. Patterns in the distribution of Arctic freshwater zooplankton related to glaciation history // *Polar Biol* 31. 2008. P. 1427–1435 DOI 10.1007/s00300-008-0482-4.

[2] bijVaate A, Jazdzewski K, Ketelaars HAM, Gollasch S, Velde G. Geographical patterns in range extension of Ponto-Caspian macroinvertebrates species in Europe // *Can J Fish Aquat Sci* 59. 2002. P. 1159–1174.

[3] Jeppesen E, Jensen JP, Lauridsen TL, Amsinck SL, Christoffersen K, Søndergaard M, Michell SF. Sub-fossils of cladocerans in the surface sediment of 135 lakes as proxies for community structure of zooplankton, fish abundance and lake temperature // *Hydrobiologia* 491. 2003. P. :321–330. doi:10.1023/A:1024488525225

[4] Davidson TA, Sayer CD, Perrow MR, Bramm M, Jeppesen E. Are the controls of species composition similar for contemporary and sub-fossil cladoceran assemblages? A study of 39 shallow lakes of contrasting trophic status // *J Paleolimnol* 38. 2007. H. 117–134. DOI 10.1007/s10933-006-9066-x

[5] Weckström J, Korhola A, Blom T. Diatoms as quantitative indicators of pH and water temperature in subarctic Fennoscandian lakes // *Hydrobiologia*, 347. 1997. P. 171–184.

[6] Korhola A, Olander H, Blom T. Cladoceran and chironomid assemblages as qualitative indicators of water depth in subarctic Fennoscandian lakes // *J Paleolimnol.*, 24. 2000. P. 43–54.

EROSION RATES AND TERRIGENOUS SEDIMENT FLUXES IN THE LENA DELTA REGION (EAST SIBERIAN ARCTIC)

M.N. Grigoriev

Melnikov Permafrost Institute SB RAS, Yakutsk, Russia, e-mail: grigoriev@mpi.ysn.ru

The seacoasts and riverbanks in the Lena Delta region are still poorly studied. Especially, little information is available for the riverbanks along numerous tributary channels, whose total length exceeds many times that of the coastline. Erosion is active along approximately half of both the coastline and the riverbank.

In 1998-2011, coastal and riverbank erosion studies in the Lena Delta were conducted by the Lena Russian-German expedition at more than 60 key sites (figure 1). The results obtained indicate