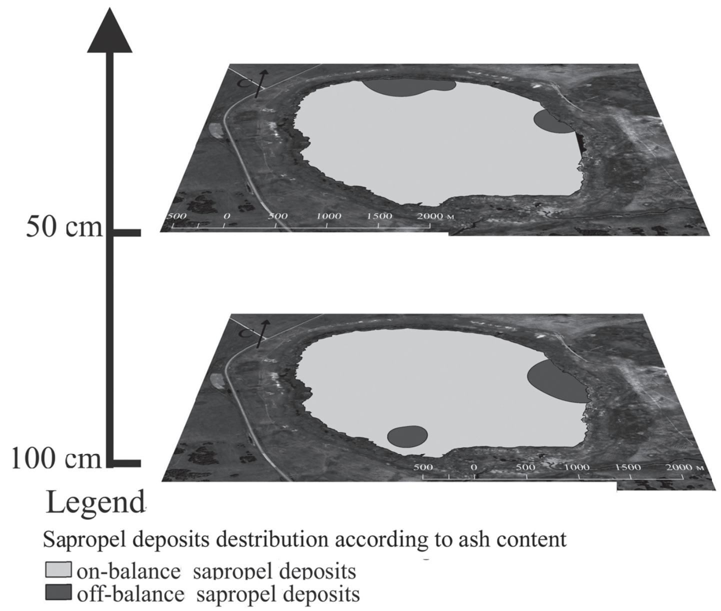

Fig. 3. Sapropel deposits distribution according to ash content in Lake Kambala

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GEOCHEMICAL MULTIPLE REGRESSION MODEL FOR LAKE CONDUCTIVITY RECONSTRUCTION

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The understandings of current environmental changes and the predictions of future climatic processes need accurate and precise reconstructions of the Holocene paleoenvironment. The electrical conductivity (EC) is a zonal characteristic of a water regime of the Urals lakes (Andreeva, 1973). EC increases from north-west to south-east of the territory with a decrease of effective moisture. These changes are reflected in the chemical composition of the lake sediments. In the southern regions, climate fluctuations can directly cause changes in salinity and electrical conductivity of water by increasing evaporation in enclosed lakes (Andreeva, 1973). Other mechanism of climate driven EC changes is increase in chemical weathering intensity due to a temperature increase (Moiseenko and Gashkina 2010).

Previous research showed correlations between salinity and losses on ignition (LOI) for lakes with EC less than 1012 μS/cm (Maslennikova et al, 2018 (in press)). New data on chemical composition of

56 Urals lakes (EC=55-3780 µS/cm) allow to calculate the multiple regression equation for the EC reconstruction. Parametric (Pearson correlation coefficient – r) and nonparametric (Spearman rank correlation coeficient – R_{sp}) correlation analysis showed positive relationships between log-transformed EC-data and $LOI_{950°C}$ (R_{sp}=0.66, r=0.38), CaO (R_{sp}=0.75, r=0.53), Sr (R_{sp}=0.74, r=0.49), and MgO (R_{sp}=0.7, r=0.76). Negative relationship was determined for EC and $LOI_{550°C}$ (R_{sp}=—0.49, r=—0.49).

All variables were included to the primary multiple regression model. Sr and $LOI_{950°C}$ were excluded from the model after checking it for multicollinearity due to the high correlation with CaO content (r>0.9). The organic-matter variable ($LOI_{550°C}$) was removed after p-values checking. Summary model consists of two variables (tab. 1) and characterizes by the following equation:

$$lgEC=1.93+0.22MgO+0.0165CaO$$

Table 1

Regression summary of dependent variable (lgEC)

	Beta	SD (Beta)	b	SD(b)	t(53)	p-value
Intercept			1.934	0.061	31.4	$0.0059\ 10^{-26}$
MgO	0.65	0.09	0.222	0.03	7.17	$0.0023\ 10^{-6}$
CaO	0.267	0.09	0.0165	0.0056	2.95	0.004652

The root-mean-square error (RMSE) of the model is 0.23 lg µS/cm. Analysis of residuals show their normal distribution and the absence of dependence on the predicted values. The values of the Fisher test (F (2.53) = 46.73) and t-statistics for the regression coefficients (tab. 1) exceed their tabulated values for available degrees of freedom. The coefficients of correlation (r = 0.8) and determination (r^2 = 0.64) between measured and predicted EC values were relatively high which confirms the reliability of the model (fig. 1).

Comparison of the electrical conductivity values, calculated on the basis of the diatom transfer function (Maslennikova, in press) and obtained with the geochemical model confirms their good agreement (r = 0.77; r^2 = 0.6) (Fig. 2). The relationship was disturbed for lakes with presense of serpentinites in the source area (i.e. Lakes Aushkul and Arakul).

Although the diatom-inferred model is characterized by lower mean-square error (RMSE= 0.06-0.13 lg µS cm-1), the proposed geochemical model has the advantage of simplicity allowing to quickly assess the lake water EC, even in an absence of diatoms in the lake sediments.

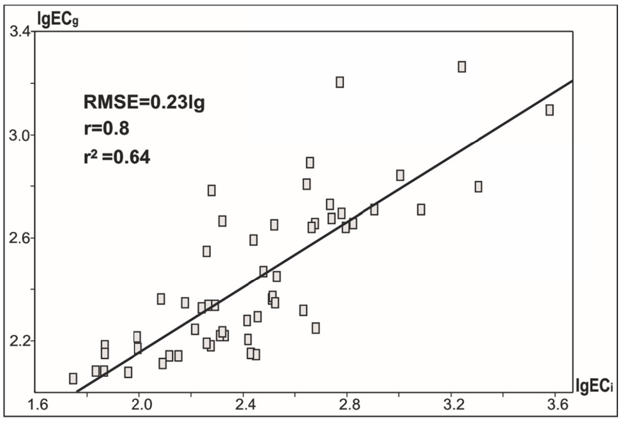

Fig. 1. Relationship between measured (lgECi) and modelled (lgECg) values of lakes electroconductivity

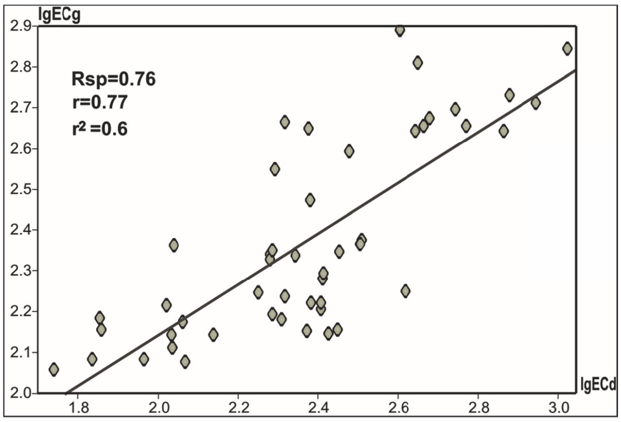

Fig. 2. The relationship between diatom-inferred (lgECd) and geochemical-inferred (lgECg) conductivity of the lakes waters

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THE PROJECT PLOT (PALEOLIMNOLOGICAL TRANSECT) - OVERVIEW AND PRELIMINARY RESULTS ON THE PREGLACIAL TO POSTGLACIAL HISTORY OF THE RUSSIAN ARCTIC

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The effects of global warming are documented and predicted to be most pronounced in the Arctic, which plays a crucial, albeit not yet well-understood role within the global climate System. This so-called “Arctic Amplification” is traced back to interplays of temperature, water vapour, cloud cover, Arctic Ocean sea ice, and associated feedbacks, and is hypothesised to trigger mid-latitude climate variations. The reliability of climate projections for high northern latitudes is, however, hampered by the complexity of the underlying natural variability and associated feedback mechanisms. A prerequisite for the improvement and validation of climate projections is a more thorough understanding of the natural variability of past Arctic climate change on a range of geological timescales, when external forcings and boundary conditions have been different. A key record of the climate history in the Arctic has recently become available from Lake El´gygytgyn, NE Russia (e.g. Melles et al. 2012, Science 337, p. 315-320). This record covers the entire Quaternary and penetrates down to 3.6 Ma BP into the Pliocene. Its investigation has provided a number of key findings concerning the long-term climate variability of the Arctic, however, it partly remains an open question, how representative the information is for the circum-arctic history.

As a consequence, we established the project ´PLOT – Paleolimnological Transect´, which aims to recover lake sediment sequences along a >6000 km long longitudinal transect across the Russian Arctic in order to investigate the Late Quaternary climatic and environmental history. The PLOT