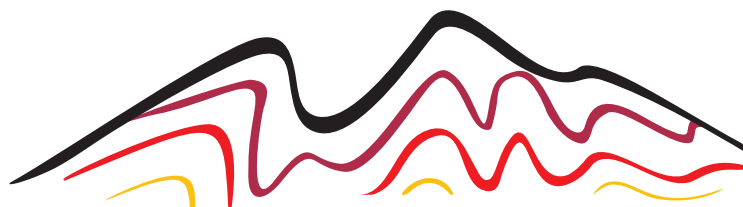


Sobolev Institute of Geology and Mineralogy SB RAS (IGM SB RAS)
Trofimuk Institute of Petroleum Geology and Geophysics SB RAS (IPGG SB RAS)
Novosibirsk State University (NSU)



X INTERNATIONAL SIBERIAN EARLY CAREER GEOSCIENTISTS CONFERENCE

13-17 June 2022, Novosibirsk

PROCEEDINGS OF THE CONFERENCE



MINERALOGY
2022



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УДК 55(061)
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A HOLOCENE CLIMATIC RECORD INDICATED BY GEOCHEMICAL INDICATORS AND GRANULOMETRY FROM BANNOE LAKE IN THE SOUTHERN URAL

Yusupova A.R., Nourgalieva N.G., Kuzina D.M.

Institute of Geology and Petroleum Technologies, Kazan Federal University, Kazan, Russia,
yusupovaanast095@gmail.com

Abstract. The work is devoted to the geochemical and granulometry study of the Bannoe lake sediments. The main aim of this investigation is to identify the events and trends of environmental and climate changes in the Late Quaternary. The present study of grain size and organic geochemistry of core sediments from Bannoe Lake provides paleoclimatological record of South Ural for the Holocene Period.

Key words: geochemical indicators, lacustrine sediments, particle size content, Holocene

The Bannoe Lake (53°35'48.13" N 58°37'47.28" E) is in the Southern Urals. The altitude of the lake is 438 m, the length is ~4.2 km, the width is ~1.9 km, and the basin area is 36.3 km² [1; 2; 3]. According to the radiocarbon dating the age of the lake is 12.5 thousand years [4]. For a detailed complex analysis, core No. 3 was selected according to the results of seismoacoustic studies [5]. The total core length is 508 cm. The sediment was sliced at 2 cm thick samples.

High resolution analyses of lake sediments retrieved from Bannoe Lake were conducted using a combination of variables including particle size content, total organic carbon (TOC), total nitrogen (TN), total inorganic carbon (TIC) and total sulfur (TS) contents, $\delta^{13}\text{C}$ value of organic matter ($\delta^{13}\text{C}_{\text{org}}$), and $\delta^{18}\text{O}$, $\delta^{13}\text{C}$ values of carbonate content ($\delta^{18}\text{O}_{\text{carb}}$ and $\delta^{13}\text{C}_{\text{carb}}$). The C/N ratio (TOC/TN) is regarded as an effective indicator of the origin of organic matter in sediments [6; 7]. Endogenous organics, rich in proteins and poor in cellulose, are characterized by C/N values from 4 to 10. Exogenous organics, poor in proteins and rich in cellulose (the remains of cell walls of higher (terrestrial) plants), are characterized by C/N values of more than 20 [8].

The result of particle size analysis is showing that the content of clay fraction in the sediment varies in the range (9.54-26.27) %, silt fraction are dominant at 56.39%-78.12%, sand - (2.76-26.71) % (Figure 1).

The TOC values changes from 1.56%-16.41%, the TN content ranged from 0.23%-2.23%. The TOC and TN indices increase up the section, which is explained by the increasing the biota activity and the organic matter accumulation. The TS values varied from 0.057% to 0.78%, which is typical for freshwater lakes [9]. The ratio C/N values vary between 5.98-17.79%; average value of C/N is 8.86 and indicates the dominance of endogenous biota. The greatest contribution of exogenous plants is noted at 408 cm (C/N=17.79) and 188 cm (C/N=13.00). The values of $\delta\text{C}_{\text{org}}$ vary from -27.65 ‰ to -24.22 ‰, which in combination with data on the C/N indicator (C/N~9), makes it possible to verify the mixed origin of organic matter in the studied lake sediments. The $\delta^{18}\text{O}_{\text{carb}}$ ranges from -22.25‰ to -5.31‰, the $\delta^{13}\text{C}_{\text{carb}}$ varies from -18.4‰ to 2.39‰, and the TIC values vary from ~0.03% to 4.86%. An increase in the values of $\delta^{18}\text{O}_{\text{carb}}$ (a rapid increase in the dryness of the climate) and $\delta^{13}\text{C}_{\text{carb}}$ (an increase in biomass) recorded at depths of 308-298 cm and 198-178 cm, indicating a decrease in the lake level.

The periods of high and low humidity in the Southern Urals identified during the study are consistent with the Blytt–Sernander classification [10; 11; 12]. The results of geochemical and particle size investigations made it possible to reveal the features of climatic and other environmental changes for the Holocene Period of South Ural.

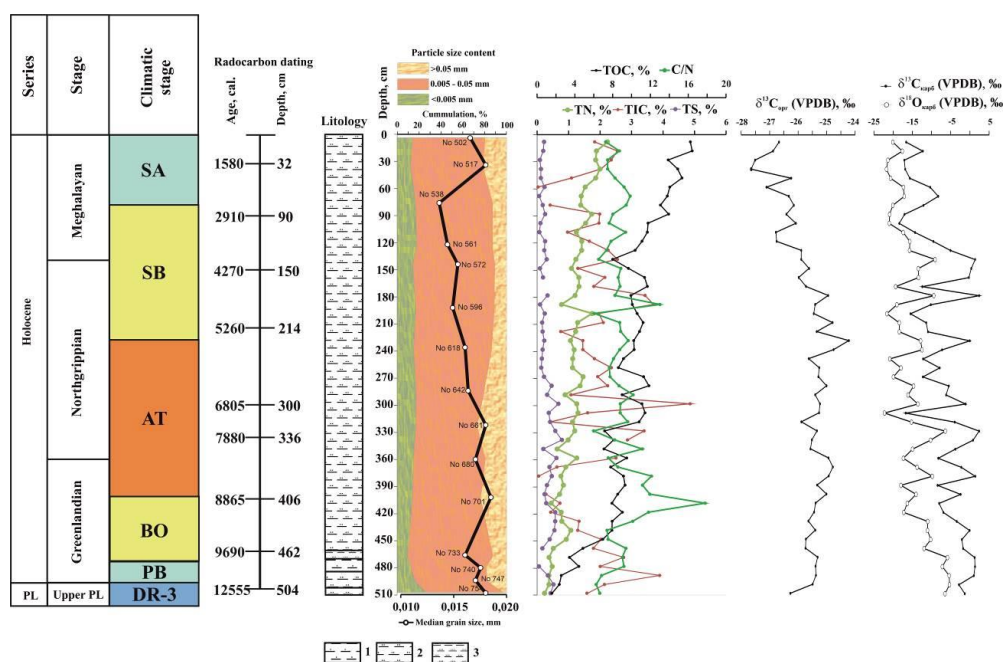


Figure 1 – Results of particle size and isotope analysis of Lake Bannoe sediments. Legend: 1 – clayey silt, 2 - silt, 3 – sandy silt

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