

## Short communication

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# Diatom analysis of sediments of Lake Big Miassovo of South Ural (Russia)

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**ABSTRACT.** Diatoms are generally used to infer environmental changes. The purpose of this work is to study the taxonomic composition and ecological features of diatoms in the palaeoarchives from Lake Big Miassovo (South Ural, Russia). A core was taken in the deepest part of Lake Big Miassovo in July 2018. The core covered the time span in 13 500 years. The diatom analysis of 51 samples revealed 124 taxa from 47 genera. The highest number of species was observed for *Epithemia*. The analysis of the ecological structure of this diatom assemblage shows that it is dominated of cosmopolitan, alkaliphilic benthic, and oligogalobic species with the growth under the moderate temperatures. The prevalence of *Handmannia comta* (Ehren.) Kociolek & Khursevich emend. Genkal in the sediments was established. The sub-dominant species were *Amphora pediculus* (Kutz.) Grun., *Karayevia clevei* (Grun.) Bukht., *Aulacoseira ambigua* (Grun.) Simon., *Pseudostaurosira brevistriata* (Grun.) D.M. Williams & Round, *Stephanodiscus alpinus* Hust. in Hub.-Pest.

**Keywords:** Diatoms, Big Miassovo Lake, bottom sediments, South Ural, climate

## 1. Introduction

Lake sediments are the most trustworthy archives containing data on environmental changes. The study of lake sediments allows us to reconstruct abiotic and biotic conditions of lake and its surrounding area (Evans and Heller, 2003). Biological paleoindicators such as diatoms, remains of vascular plants and invertebrates (cladocera, chironomidae, ostracoda), spores and pollen used for more accurate qualitative and quantitative reconstruction of past conditions in lakes (Frolova, 2018). The border location of the Urals, as the climate divide, makes paleoecological and paleoclimatic investigations of Big Miassovo lake especially important (Maslennikova et al., 2014). Lake Big Miassovo is located on the territory of the Ilmensky Nature Reserve. It is a tectonic lake stretching from north to south along the eastern foot of the Ilmensky Ridge. Its total area is 11.4 km<sup>2</sup>, length – 8 km, average width – 1.5 km. A large number of bays and diversity of coast shapes determine the highly indented coastline. The maximum depth of the lake is 25 m (the average depth is 11.2 m). The water volume is 128.5 million m<sup>3</sup>. The lake waters are fresh, their mineralization does not exceed 200 mg/l (Nurgaliev et al., 2018).

## 2. Material and methods

A core no. 3 (55°09'51.1"N; 60°17'21.9"E) from Lake Big Miassovo was collected in the deepest

part of the lake (at the depth of 24 m.) in July 2018. A core of 498 cm was obtained in the field conditions. The absolute dating of sediments was carried out by radiocarbon in the NTUAMS Lab (Department of Geosciences, National Taiwan University). All samples were processed by the standard methods using 37% hydrogen peroxide as an oxidant of the organic matter present in the samples, including 10% HCl treatment in order to remove calcium carbonate, followed by rinsing with distilled water (Battarbee, 1986). The slides were prepared with the help of high refracting Naphrax® resin (RI=1.7). Diatoms were identified under a Zeiss Axio Lab. A1 microscope using oil immersion at an objective magnification of 100× (1.4 n.a.). The total number of valves was considered 100%. Dominant species were those, which accounted for 10% of the total amount or more; subdominants were species which accounted for 5–10%. Diatom identification and taxonomy was based mainly on the Russian and foreign publications.

## 3. Results

The diatom analysis of 51 sediment samples revealed 124 taxa comprising the following 47. The highest number of species was observed for *Epithemia*. The dominant species was *Handmannia comta* (15.53% of the total number of species). The subdominant species were *Amphora pediculus*, (9.00% of the total number of

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taxa under study), *Karayevia clevei* (5.16%), *Aulacoseira ambigua* (6.93%), *Pseudostaurosira brevistriata* (6.30%), and *Stephanodiscus alpinus* (5.93%) The ecological and geographical analysis of the species composition showed the dominance of cosmopolitan, benthic, and alkaline species with the growth under moderate temperatures. With respect to pH, the majority of the studied taxa represented the inhabitants of waters with an alkaline water reaction (94.12% of the total number of taxa under study); pH-indifferent and acidophilic species accounted for 2.94% of the total number of taxa under study, respectively. Considering the geographical distribution, most of the species were assigned to cosmopolites – 62.50% of the total number of taxa under study – and 37.50% of the taxa belonged to the Holarctic species. In terms of the temperature factor, the analyzed diatoms were characterized as favoring moderate temperature conditions; the only cold-loving species were *Stephanodiscus alpinus* and *Halamphora oligotrappenta* (Lange-Bertalot) Levk. With respect to the trophic status, mesotrophic-eutrophic (30.49% of the total number of taxa under study) and oligotrophic-mesotrophic species (26.83%) were dominant, oligotrophic species made 13.41%, indifferent species represented 14.63%, oligotrophic-eutrophic species – 6.10%, mesotrophic species made 4.89% and eutrophic taxa were the least numerous – 3.66%. Among diatom algae, benthic species prevailed in the habitat – 52.46%. They were followed by plankton-benthic species – 39.34% and plankton species – 8.20%.

#### 4. Conclusions

As a result of the study, 124 diatom taxa comprising 47 genera were identified in the fossil diatom flora. The ecological and geographical analysis of the species composition showed the dominance of alkaline, benthic, and cosmopolitan species. The characteristics

of the described diatom communities show that Big Miassovo lake was a shallow oligotrophic-mesotrophic water body in the early stage of sedimentation. Then, under the conditions of climate warming and lake deepening, the abundance and diversity of diatoms in the communities and the proportion of planktonic species increased.

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