Limnology and Freshwater Biology 2022 (4): 1438-1440 DOI:10.31951/2658-3518-2022-A-4-1438

SI: «The 5th International Conference Paleolimnology of Northern Eurasia»

Short communication

ISSN 2658-3518

LIMNOLOGY FRESHWATER BIOLOGY

www.limnolfwbiol.com

Paleoecological reconstruction of Lake Sargul in Holocene based on ostracod analysis

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ABSTRACT. The ostracod record from Lake Sargul infers details of two-stage development of the lake ecosystem during the Holocene.

Keywords: ostracods, lake ecosystem, Holocene

1. Introduction

The freshwater lake Sargul is located in the Baraba Steppe lowland region in the southern part of the Western Siberian plain and belongs to the Chany lake system. Reconstruction of Lake Sargul sedimentation conditions is one of key questions both in understanding the history of the hydrological system of the Baraba and in the evolution of the regional Holocene climate. A number of papers on this issue describe distant relations of Lake Sargul ecosystem with the Central Asian ones, especially findings of the Aral Sea foraminifers (Gus'kov et al., 2008; 2011; Khazin et al., 2016; Krivonogov et al., 2008; 2018), and this question has not yet been resolved. Our publication highlights these paleoecological and paleogeographic problems with data of ostracod analysis of the Lake Sargul sediments.

2. Materials and methods

The Lake Sargul basin includes older lake terrace and the body of the modern lake (Krivonogov et al., 2018). The terrace sediments were investigated in the 150 cm deep pit continued by borehole to the depth of 300 cm, site Sargul_pit_2015 (N 54.58724°, E 78.92059°), in 2015 (Krivonogov et al., 2018). The lake sediments were investigated in the 336 cm long borehole, site Sargul_BH-2019 (N 54.592889°,E 78.873833°), in 2019 (Fig. 1). Both sites were sampled for microfaunal analysis with the interval of 10 cm, totally 56 samples. The analysis was performed with a standard technique. Radiocarbon dates were obtained from shells of mollusks, which are abundant in the sediments.

3. Results and discussion

Ostracods were found in all samples from the Sargul_pit_2015 section together with shells of gastropod and bivalve mollusks and oogonia of Chara green algae. In addition, single shells of foraminifers were found in 5 samples (Fig. 2). The ostracod fauna is presented by 39 species belonging to 21 genera. The dominated species is *Cyprideis torosa* (Jones). The most diverse and abundant complexes are in the interval of 0-190 cm, below the diversity and abundance significantly reduce almost to extinction, and ostracods reappear at a depth of 297-300 cm. We recognize two ostracod zones in the section. The lower Zone I (before ca. 8 ka BP) shows changeable hydrodynamic and temperature

Fig.1. Map of the Sargul Lake and sites.

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Received: May 30, 2022; ***Accepted:*** July 25, 2022;
Available online: September 02, 2022

regimes of the lake, which is indicated by episodic occurrence of *Fabaeformiscandona rawsoni* (Tressler), the rheophilic species also used as an indicator of warm-to-cool temperature transition (Fuhrmann, 2012). The upper Zone II (8-4 ka BP) shows regular changes of hydrodynamics, temperature and salinity in the lake; the general trend - increased mineralization, which was favorable for the development of ostracod fauna.

The 260 cm long lacustrine part of the Sargul_BH-2019 core contains ostracods in all samples. Besides, there are shells of gastropod and bivalve mollusks, oogonia of Chara, and single shells of foraminifers in 2 samples (Fig. 2). The ostracod fauna is presented by 26 species belonging to 15 genera. *Cyprideis torosa* (Jones) is the dominant species as well. The ostracod complexes are diverse and abundant in the 0-180 cm interval and sharply deplete below. The data shows two ostracod zones. Zone I (ca. 9-4.3 ka BP) represents changeable hydrodynamic and temperature regimes of the lake, but generally the lake water was warm and mineralized. Zone II (4.3-0 ka BP) reflects fluctuating lake level and salinity, and the water was oxygen-saturated. Generally, the lake was more stagnant, less mineralized and colder in this zone.

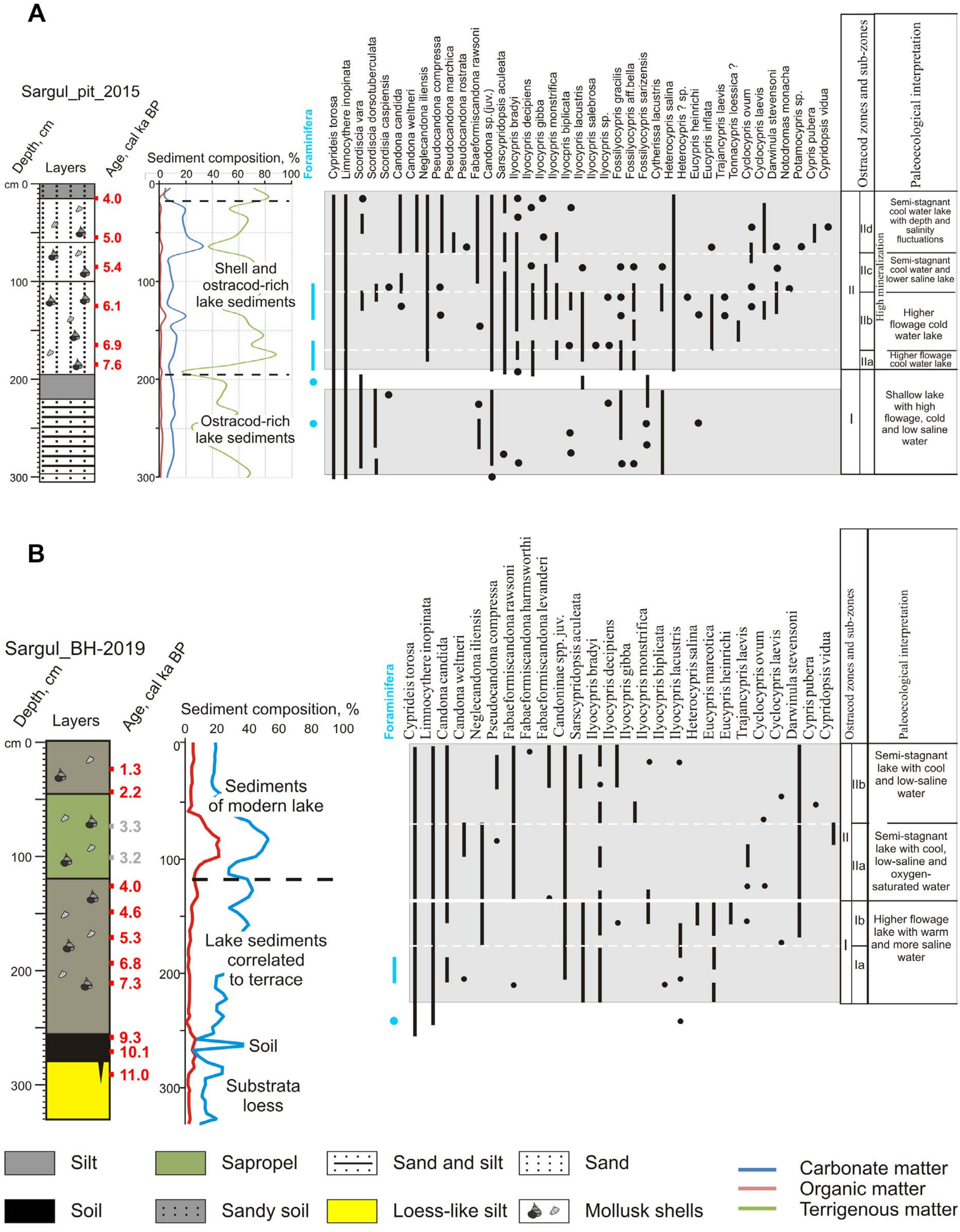

Fig.2. Distribution of ostracods and paleoecological interpretation for the sections Sargul_pit_2015 (A) and Sargul_BH-2019 (B).

These two sites are well correlative by the ecological characteristics of the ostracod complexes. Thus, maximal mineralization falls to the intervals of 230-140 and 190-110 cm in the Sargul_BH-2019 and Sargul_pit_2015, respectively, i.e., to the time periods of 8-4.3 and 8-5.7 ka BP, respectively. The water temperature below 15^{0}C was inherent to 190-10 cm (from 7.6 to 4.0 ka BP) interval in Sargul_pit_2015 and 140-0 cm (from ca. 4.3 ka BP) in Sargul_BH-2019, i.e., this temperature was typical for the whole 7.6-0 ka BP interval. Short events of warmer water environment probably occurred around 5.7 and 2.6ka BP. The lake level lowered 5.1-4.7 and 3.5-2.7 ka BP. A content of rheophylic components of the ostracod complexes decreased since 5.7 ka BP and increased again since 2.7 ka BP.

4. Conclusions

Lake Sargul appeared ca. 9 ka BP and developed in two stages. In the early stage (9-4 ka BP) the lake was larger in area and intensively eroded the shores to form the sandy lake terrace (Krivonogov et al., 2018). It was shallower prior to 7.6 ka BP with water salinity 5-10‰ and water temperature 10-16^{0}C, and deeper 7.6-4 ka BP with increased mineralization and water flow. The water temperature may decrease around 7.3 and 5.3-4.3 ka BP. The salinity and temperature of the water decreased, and the water in the lake became more saturated with oxygen after 4.3 ka BP. The lake level dropped and the water temperature increased 3.3-2.2 ka BP. Later, the lake had low level of water transit, the water salinity fluctuated, and the water oxygen saturation remained high.

Our research confirmed the presence of foraminifera in the lower part of the Lake Sargul section in the period of ca. 9-5.5 ka BP, when the ostracod fauna shows spread of distinctly halobiontic species.

Acknowledgements

The research was supported by RFBR grant 19-29-05085 and RFBR-NSFC grant 21-55-53037.

Conflict of interest

The authors declare no conflict of interest.

References

Fuhrmann R. 2012. Atlas quartärer und rezenter Ostrakoden Mitteldeutschlands. Altenburg: Naturkundliches Museum Mauritianum.

Gus'kov S.A., Kanygin A.V., Kuz'min Ya.V. et al. 2008. Ingression of the Aral Sea water to southern west Siberia in the Holocene: paleontological evidence and chronology. Doklady Earth Sciences 418(1): 24-27. DOI: 10.1134/S1028334X08010066

Gus'kov S.A., Zhakov E.Yu., Kuz'min Ya.V. et al. 2011. New data on evolution of the Aral Sea and its relations with the West Siberian plain through the Holocene. Doklady Earth Sciences 437(2): 460-463. DOI: 10.1134/S1028334X11040167

Krivonogov S., Gusskov S., Khazin L. et al. 2008. A Holocene connection between the Aral-Caspian Basin and south West Siberia evidenced by aquatic microfauna: probable paleogeographic scenarios. Bulletin of the Tethys Geological Society 3: 11-18.

Krivonogov S.K., Gusev V.A., Parkhomchuk E.V. et al. 2018. Intermediate lakes of the Chulym and Kargat river valleys and their role in the evolution of the Lake Chany basin. Russian Geology and Geophysics 59: 541-555. DOI: 10.1016/j.rgg.2018.04.007

Khazin L.B., Khazina I.V., Krivonogov S.K. et al. 2016. Holocene climate changes in southern West Siberia based on ostracod analysis. Russian Geology and Geophysics 57(4): 574-585. DOI: 10.1016/j.rgg.2015.05.012