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CHARACTERIZATION OF SAPROPELIC DEPOSITS OF NOVOSIBIRSK REGION, SOUTH-WESTERN SIBERIA

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Sapropel is an important biogenic resource usable in agriculture and industry, and it is an alternative to hydrocarbon resources. There are few examples of sapropel explorations in the south of Western Siberia: Lake Puchay on Omsk region (liquidated in 2016) and Lake Beloye in Novosibirsk Region. Experts explain low effectiveness of these enterprises by relatively high net costs and limited product market. Our project run in 2017 is aimed to investigate perspective of sapropelic business in Novosibirsk Region in terms of Earth science research: structure of sapropel deposits, regularities of their accumulation, composition, valuable properties, and also to propose new technologies of their processing. There were several lakes investigated by our team in Novosibirsk region; among them, the largest deposits are Lake Minzelinskoe, Lake Bolshie Toroki, Lake Itkul, Lake Malye Chany, and a minor deposit is Lake Beloye (Fig. 1).

Our field investigations allowed us to recalculate reserves of sapropel in Lake Minzelinskoe, which the geological survey (1998) claims as the largest, 8 million tons, sapropel deposit of the region. According to our data, total stock of sapropel in this lake is no larger than 3 million tons. Consequently, Lake Bolshie Toroki seemingly hosts the largest sapropel deposit of Novosibirsk Region.

Our investigated lakes show the following regularities of their sediment structure and development. Biogenic sedimentation started in the lakes since the beginning of middle Holocene, 8-7 cal. ka BP according to the radiocarbon dating. The sediments include several layers of different origin indicating variations of the sedimentation environments. Usually brown color peaty sapropels lay in the bottom parts and greenish color macrophytogenic sapropels occur in the upper parts of the sediment sequences. This suggests boggy or marshy (wetland) stage in the beginning of the lakes history followed by lacustrine stage. Change of the sedimentation environments is individual for each lake and its time vary from ca. 6 to 4 cal. ka BP. Dating gives estimates of sedimentation rates of these two parts

of the sapropel deposits as 1.4-2.6 и 0.2-0.4 mm/yr., respectively, i.e., sedimentation (bioproductivity) in marshy environment was much higher than in lacustrine one.

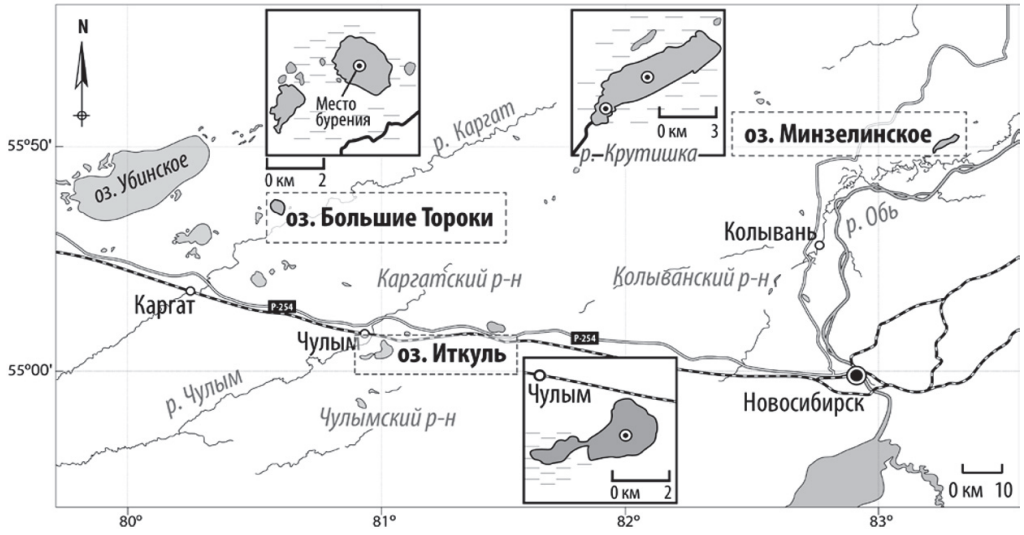

Fig. 1. Three largest sapropelic deposits of Novosibirsk region.
Frames in the map are spy-glass views of the lakes

Our sedimentological and geochemical investigations show the following average sapropel composition (measured from dry weight of the samples): 30-36 % of organic matter, 13-31 % of Ca-carbonate matter and 6-27 % of silicate matter. Volumetrically, the organic matter is the main component of the sediments which proportion is 60-72 %. Variations of proportions of the carbonate and silicate matters describe differences between layers which can be interpreted as alternations in precipitation of authigenic components and transportation of terrigenous ones. Additionally, in some layers enriched by mollusk and ostracod shells, carbonates have biogenic origin. In fact, all labile carbonates appear in the lakes in water solution forms sourced (leached) from carbonate-rich loess-like sediments of the lake catchments. High carbonate content is a typical feature of the lake sapropels in the south of West Siberia which is considerably different from the low-carbonate sapropels of the Baikal area (Leonova et al., 2015).

Detailed biogeochemical study gave us valuable information about distribution of organic components and chemical elements along the sediment sequences (Leonova et al., 2018). Pyrolisis of the sediment samples indicates stages of the early diagenesis of the organic matter, removal of the protein components and appearance of the kerogen components with depth (Melenevsky et al., 2011, 2015). Additionally microbiological treatment of the organic matter is investigated. Finally, the obtained data highlights a complex of biological, chemical and hydrological processes in the lakes which combination predetermine the sapropel qualities important for its utilization and elaboration of its treatment technologies.

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