THE USAGE OF MODERN TECHNOLOGIES (GIS) IN THE CREATION OF THE LAKE GEOLOGICAL PROSPECTING MODEL AND THEIR USAGE IN PALEOLIMNOLOGY

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Lakes Peschanoe and Kambala are located in the central part of Baraba lowland in the South of Western Siberia in the forest-steppe zone. The nature of the territory surface is typical for the Central Baraba: the southwestern part of the surface is complicated strictly parallel, elongated from Southwest to Northeast, alternating manes and hollow. The landscape integral part is abundant of small and large lakes, swamps and dry valleys [Ilyin, Syso, 2001; Strakhovenko et al., 2016]. Lacustrine bottom sediments belong to the modern and Quaternary sediments deposited on the modern lacustrine-swamp deposits (Lake Peschanoe) and middle Quaternary sediments Fedoseevskaya Suite (Lake Kambala) [Explanatory..., 1967].

Currently, there are no methodological materials on sapropel lake deposits exploration, which would take into account modern GOST, modern analytical methods and devices. Recent work with methodical manual was conducted almost 50 years ago [Instructions…, 1975; Guidelines..., 1976]. In connection with the necessity of using the old methods, the high cost of works multiplied. Therefore, at issue of the license demand to carry out works by outdated methods and on the technique, which demands correction in connection with the scientific knowledge gained for these years.

We have proposed the idea of using modern computer technologies (GIS) to build geological prospecting models of lakes, as it is done for oil fields or mineral deposits.

During the research and exploration works on lakes Peschanoe and Kambala we used software packages ArcGis (10.2.2) and Qgis (2.18.16) to build models of deposits (Fig. 1.), as well as layer-by-area models of element contents distribution in sapropel deposits (Fig. 2.).

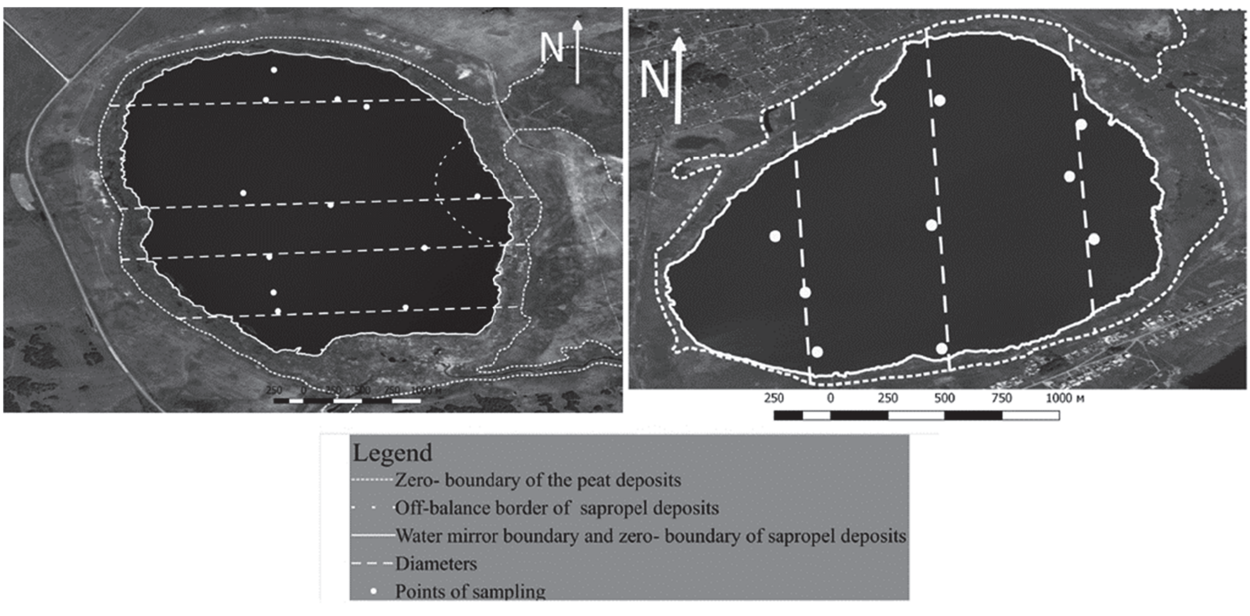

Fig. 1. Scheme of Peschanoe and Kambala lake deposits

Layer-by-area models have shown that most of the elements are distributed uniformly with the range of ± one standard deviation, but some of the elements of the range can vary from -2 to +3 standard deviations (Al, Si, Ca, Mn, K, etc.).

The models of ash content distribution were given the opportunity to identify eolian sources of terrigenous material. Positive anomalies of ash content (Fig. 3) are located in the Northern and Eastern parts of the lakes and coincide with the direction of the wind rose of the area. At the same time, there are no anomalies in the modern places of the confluence of streams, which indicates the decisive role of the eolian material over the alluvial in modern times.

K, Si, Al and ash content distribution models qualitatively showed the role of biota in the formation of silica sediments. The ash distribution of K and Al are the same, which corresponds to X-ray diffraction analysis and shows that K and Al are only in the terrigenous part, namely in feldspar and mica. At the same time, the Si distribution is not connected with K and Al distribution, and shows that Si has different source (not an eolian). The answer was found in a detailed mineralogical study on the scanning electron microscope TESCAN MIRA 3, the main source of Si is diatoms. Therefore, the main source of Si in lacustrine bottom sediments is represented by chalcedony of biogenic genesis (diatoms).

Si and Ca distribution models in the lacustrine bottom sediments of Lake Kambala change symmetrically with depth, indicating a possible species change in the lake biota, as well as a change in abiotic habitat. Thus, we can use the layer-by-area models to perform an environmental study (assessment of individual elements contamination). Qualitatively estimation of sapropel mineral material sources (their changing, migration, etc.) can be used in paleolimnological researches. In addition, modern computer technology is much easier topographic work in exploration.

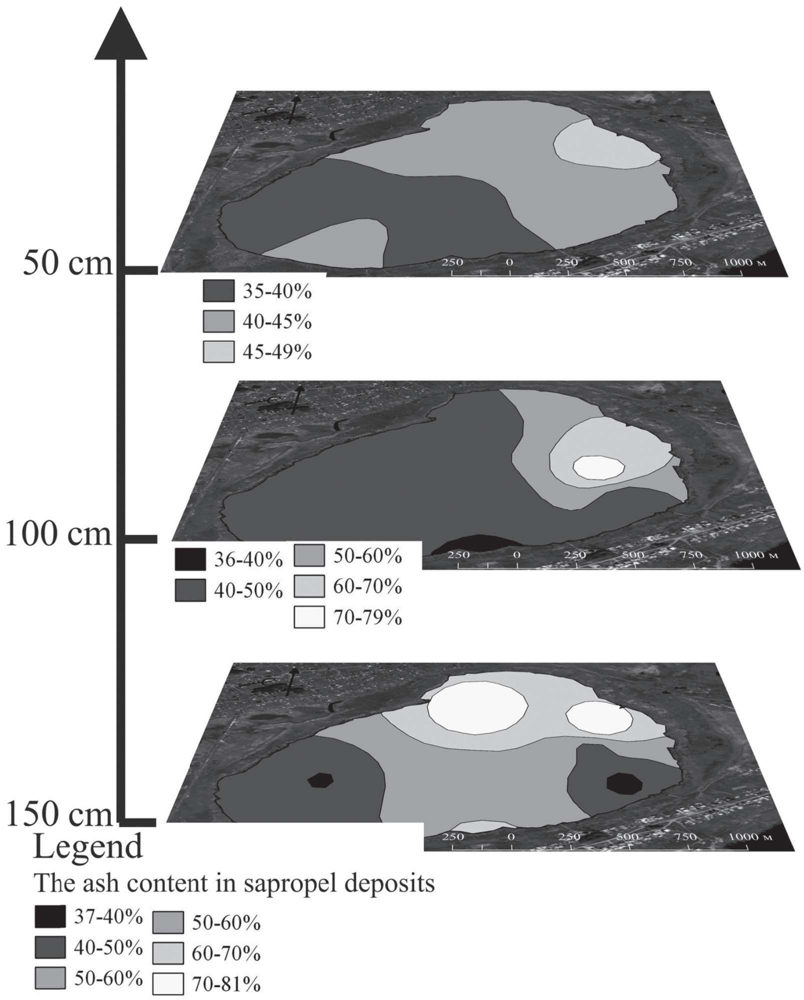

Fig. 2. Layer-by-area models of ash content distribution in Lake Peschanoe

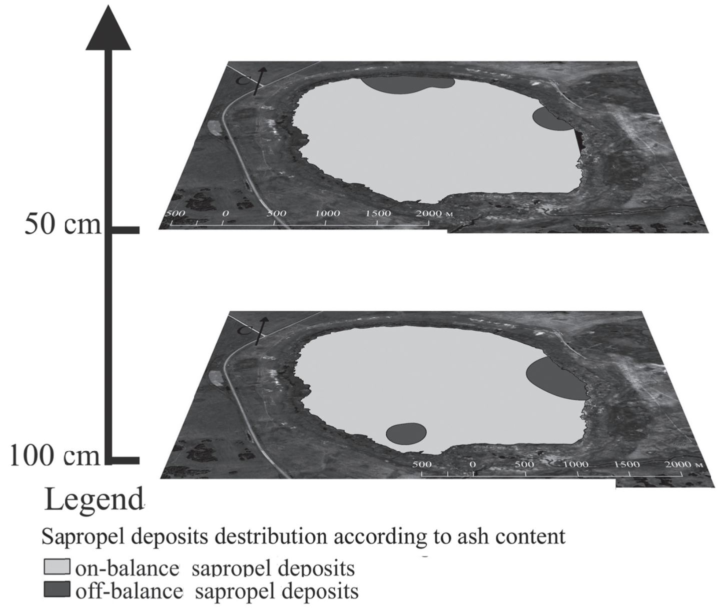

Fig. 3. Sapropel deposits distribution according to ash content in Lake Kambala

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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