In 1967 Leningrad state University published an Atlas of Leningrad region with 125 maps, including the soil map 1: 500000, compiled by the Central Soil Museum by V.V. Dokuchaev. The new soil map at a scale 1:300.000 was published by the Central Soil Museum by V.V. Dokuchaev in 1971.

In the next years, the region was severely influenced by anthropogenic impact. Industrial enterprises, road constructions and pipelines considerably reduce the area of virgin soils. Currently agricultural lands include extensive areas of drained soils. Anthrosols and Technosols are widely spread. In 2018 the Central Soil Museum by V.V. Dokuchaev together with the Cartography Department of Saint-Petersburg University presented a new digital soil map at a scale of 1:200.000 with a special focus on Anthrosols and Technosols. New approaches to their classification and mapping techniques were tested in this map. E.g., the following soil patterns were outlined on the map: drained forest, cultivated forest, forest logging, fire-prevention, recreational forest, agricultural, drained agricultural, park, residential soil patterns, together with soilscapes of urban areas and highways.

APPLICATION OF GROUND PENETRATING RADAR TO STUDY OF BOTTOM-SEDIMENT STRUCTURE IN LAKES

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As far as shallow water objects research is concerned, bottom-sediments are of no less interest than the water column. Data on the composition and texture of lake sediments are a source of information about the life cycle of the waterbody, possible climate change during its life time, and the current ecological situation in the region (Subetto et al., 2017). The prospecting for bottom-sediment in lakes is done by direct bottom sampling, i.e. drilling. Reserve calculation based on drilling data is not always accurate, considering the spotty nature of such surveys. It is therefore necessary to introduce new, highly informative research methods, including geophysical ones.

Seismoacoustic profiling is a traditional geophysical method for sub-bottom surveying (Shalaeva, Starovoytov, 2010). However, it is often inexpedient to apply this method to shallow waterbodies. An alternative to seismoacoustic profiling is the ground penetrating radar (GPR) method, which is less deep-reaching, but with a higher resolution capacity, which is essential when working with thin bottom sediments (Starovoytov et al., 2016). For example, GPR is used for estimating bottom-sediment variability and bathymetric mapping (Sambuelli, Bava, 2012). A GPR survey the bedding of lake slope deposits and lake sediments is described in (Gomez et al., 2017). It enabled the authors to detect how layers of different geneses appear in the GPR wave field. The principles of the GPR method are set out in several books, such as (Jol, 2009).

Within this study, the GPR method was applied to several small- and medium-size lakes in the Republic of Karelia. The surveyed lakes are of fluvioglacial genesis, and emerged during the Valdai Glaciation. Shoreline paludification is underway at all the lakes – the lake basins are gradually getting overgrown with vegetation. The surveys were done by an OKO-2 GPR, a 150M antenna unit with 12 m effective depth range and 30 m resolution. The data were processed using GeoScan 32 software. The surveys were conducted from a boat in the summer and from ice surface in the winter. In waterborne studies GPR parameters permittivity of the medium (ε) and the conductivity of the medium (σ) have been defined.

As an example informative of method Fig. 1 shows the layer-by-layer interpretation of the GPR profile from Lake Gankovskoye. The assigned ε values were 81 for the water column, 63 for to the sapropel layer, and 20 for the underlying mineral bed. The sheath of sapropel deposits was localized at a depth between 25 and 73 cm. The sapropel layer contains extensive wave patterns correlated with boundaries at which local conductivity changes or the layer gets compacted. The bottom of the sapropel layer follows the configuration of the top surface of the mineral bed. The boundary between them is discrete, and clearly recorded in profile.

Except for the main GPR boundaries, additional ones are found in bottom-sediment. This allows us to identify three separate layers of internal structure of deposit. The first layer one is characterized by frequent intense axes GPR signal. This indicates variability of density and decomposition sapropel. The second layer has not clear GPR signal reflections in internal structure. Probably this sapropel is well-condensed and includes aleurite. In the third layer the structure of the GPR wave field changes and reflectors appear again. This indicates the presence of aleuritic deposits. In addition, an area of anomalous GPR signal attenuation is identified at the interval pickets 50-100. This may be due to several causes, such as the arrival of mineralized water from the lower layer or clay substance.

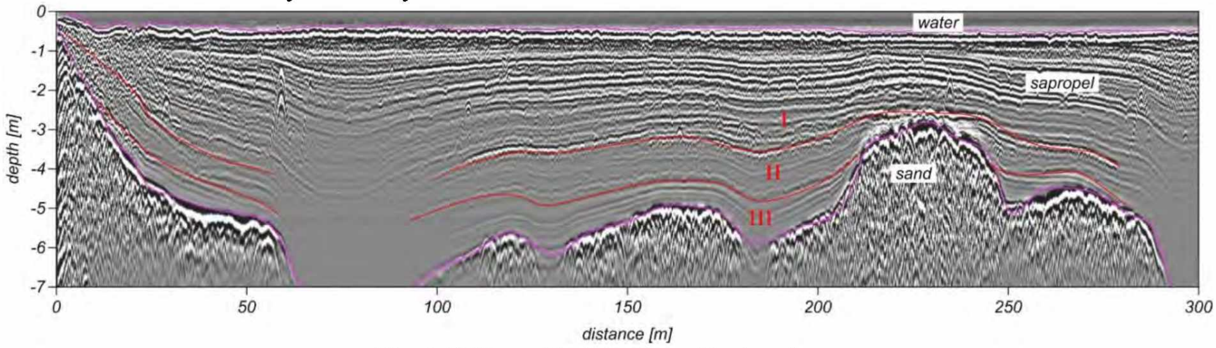

Fig. 1 GPR profile from Lake Gankovskoye

Data collected from GPR surveys of waterbodies are highly informative. Apart from water column thickness, GPR provides a detailed picture of the characteristics of bottom sediments and lake bed. With these results, the error in estimating sapropel reserves can be reduced compared to calculations based on drilling. By analyzing the characteristics of the reflected signal one can draw conclusions about the conductivity of bottom sediments and mineral characteristics.

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MAY DUST BE ABLE TO PROTECT AGAINST GLOBAL WARMING?

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It is known that the space, volcanic, desert and technogenic dust globally spreading in the Earth's atmosphere, like clouds, increases the albedo. This automatically leads to cooling of the earth's surface. The content of continental dust in the ice cores from Antarctic Vostok station was determined in the time interval of 420–4.5 thousand years ago (ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/vostok/dustnat .txt). These data, together with the data on the anomalies of the Antarctic temperatures (ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/vostok/deutnat.txt), were used to