

# MICROSCOPIC STUDIES OF WATER HORIZONS OF FIVE LAKES OF THE WHITE SEA

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## Introduction

It is very important to understand the mechanisms of formation of ecosystems in new lakes originated from the sea bays by the shore uplift. White Sea coast is fortunate region to study this evolution because there are many lakes at different stages of isolation there. During an expedition in August-September 2014 five the reservoirs were studied using different optical methods. The goal is to develop quick method of phytoplankton identification by fluorescence and absorption spectra. To check spectral bands data on the microorganisms are nesesseary. This work represents the microscopic study of five different stratified lakes, which are located on the Rugozerskaya Gulf shore of the Kandalaksha Bay of the White Sea [1-3].

## Objects and methods

Water samples were collected with a submersible pump from the surface down to the maximum depth with a step of 0,5 m. Samples were studied with microscopic-fluorescent methods, using advanced ergonomic system microscope with 100W illumination Leica DM2500.

Salty lagoon on the Green Cape is partially isolated from sea water, the sea water enters over a dam from Kislaya Guba every tide cycle. Maximum water depth is 6,5 m; the amplitude of tidal oscillations is about 10 cm. Water salinity in the lower layers of the lagoon is higher than in the adjacent part of the sea: at the depth of 3 m, it is 27 ‰, and at the bottom it rises to 28 ‰, pH changes from 6.8 to 8.

Lake Kislo-Sladkoe - a salty lake with a maximum depth of 4,5 m located 1,5 km from the biological station and connected to the sea by a shallow channel, so that sea water can enter the lake during high tide.

Lake Trehtsvetnoye in Pekkelinskaya Bay has a depth of 6.5 m and has a clear vertical stratification. From the surface to the depth of 1 m water is practically fresh, and from the depth of 1,5 m, salinity increases to 22 ‰ at the bottom . Surface water is yellow, odorless, pH is greater than 8, the temperature in July was 20 °C. The middle layer - from 1,5 to 2 m - with a salinity of 15-20 ‰, a temperature of about 15 °C, colored green , the pH falls from 8 to 6. The deep layer - salty and cold with a strong odor of hydrogen sulfide, the temperature of the bottom drops to 6 °C, salinity increases to 22 ‰, the reaction medium is acidic, pH is 6.

Lake Yelovoe (Yelovy Navolok on the shore of the mainland near the island Elovy in Kuzokotski archipelago) – fresh on the surface and salty , starting at the depth of 1,5 m to a maximum depth of 5 m and is connected with the White sea by a creek so that sea water hardly enters it.

Most of the water column of Lake Niznee Yershovskoe is almost fresh, but bottom recesses, from 2 m down are filled with brackish water with a salinity of 5,9-7,7 ‰. A freshwater stream flows into the sea from the lake; salt water does not enter it. Lake N.Yershovskoe is the lower of two lakes formed on the site of an ancient strait, it is connected by

a freshwater stream with Lake Verhnee Yershovskoe, from which it receives fresh water. The maximum depth of the reservoir is 2,5 m.

In all water bodies hydrogen sulfide near-bottom water mass was discovered: in the lake Trehtsvetnoe at the depth of 1,7 m, in the lake Kislo-Sladkoe - 3.2 meters, in the lake Yelovoe – 2,9 m, in the lake Yershovskoe – 2,3 m and in the lagoon at the Green Cape - 4.6 m.

## Results

In all the lakes upper layers (mixolimnion) was lack of organisms. The abundance increased in the salt layer saturated with the oxygen where usually the biota is presented by some green cells, and the water was colored in greenish. Most affluent in all lakes was redox zone where blooming of the algae stains water leading to bright color.

At a certain depth in each of the studied reservoirs was a layer with a bright color. In Lake Trehtsvetnoe at the depth of 1,5-1,75 m a bright green layer was located, in Kislo-Sladkoe at 3,0-3,1 m - a red layer, in Yelovoe at 2,7-3,0 m - a dull green layer, in N.Yershovskoe at 2-2,5 m - a dull green layer and in the lagoon at the Green Cape - a pink layer at 4,1-4,6 m. The red layers in Kislo-Sladkoe lake and lagoon on the Green Cape are caused by Cryptophytic algae *Rhodomonas* sp. [4, 5]. What organisms strain the green layers was unknown.

In lagoon on the Green Cape red layer was found at the depth 4.6 m full of *Rhodomonas*.

Studies of red layer in Lake Kislo-Sladkoe confirmed a huge amount of cryptophytae algae *Rhodomonas*. The layer distribution is:

0 -1.9 m – organisms are virtually absent

2.0 m – appearance of cryptophytae algae (genus *Rhodomonas*) and green cocci

2.1-2.5m – huge amount of *Rhodomonas* and different species of Infusorians. The maximum of the *Rhodomonas* concentration is on the depth of about 2.2 m.

2.6-3.5m – decrease of cocci concentration

This stratification is in accordance with the hydrological structure of the Kislo-Sladkoye lake.

Microscopy studies of Lake Trehtsvetnoe showed a huge amount of *Euglena* starting from the depth 1.5 m up to 1.9 m and a huge amount of tiny green bacteria at the depth of 2 m.

In Elovoe lake middle part of the lake was greenish because of the development of green flagellates. Near the chemocline infusorians and dinoflagellates appeared. Colored layer was situated at 2.9 m, it was brown and smelled of H<sub>2</sub>S, Eh changed from positive to negative, the only inhabitants in the brown layer were bacteria.

Studies of green layer sample from Lake Niznee Yershovskoe showed the presence of green mixotrophic algae *Euglena* sp. (1.7-1.9 m) and huge amount of green-colored cocci. There were many infusorians fed on the cocci with fluorescent inclusions inside the cells. Downwards beginning with the depth of 2.0 m the smell indicated the presence of hydrogen sulfide, purple sulfur bacteria were accounted.

## Conclusions

Microscopic studies of 5 different lakes were performed. Results showed the presence of different microorganisms at different layers, including green algae, cyanobacteria, and sulfur bacteria - anoxygenic phototrophic bacteria.

## References

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