

**PHYSICAL AND CHEMICAL CHARACTERISTICS AND GENESIS OF
QUATERNARY SEDIMENTS OF «KURAGINO» SECTION (SOUTH-MINUSINSK
BASIN)**

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The problem of investigation of changes in natural conditions that occurred in the past era, has long attracted the attention of researchers. Only by knowing these ancient processes, you can get closer to understanding the mechanism of the modern phenomena of nature and give a reasonable prediction of their future development. Quaternary period marked by global cataclysms associated with multiple development and degradation of extensive continental glaciations (Khotinsky, 1977) is of special interest in this respect.

Features and properties of sediments allow one to elucidate the dependence of their traits on physiographic conditions of accumulation. In this sense, the most important object of the study should be facies of sediment (Methods ..., 2010). The importance of studying the sediments of river valleys associated with their primary role in the stratigraphy of Quaternary deposits of extraglacial zones and the establishment of regularities change of physical and mechanical properties of terrace sediments valley slopes in geotechnical purposes; materials on the evolution of the valleys in connection with their most informative are an important material for geographical and environmental forecasts (Yamskihk, 1993). Quaternary sediments in the territory of South-Minusinsk basin are represented by different genetic types, characterized by diverse composition and mode of occurrence.

The aim of the study - to determine the granulometric composition and chemical characteristics of Quaternary terrace sediments of Irba river, identify the conditions of formation of sediments on the basis of the obtained data.

To achieve this goal it was necessary to solve the following problems:

1) to perform stratigraphic description of sediment section and to determine their granulometric composition;

2) to identify the chemical characteristics of sediments;

3) to explain the conditions of formation of sediments from the obtained data.

The object of the study was Quaternary sediments of «Kuragino» section. «Kuragino» section is located in the Kuraginsk District of Krasnoyarsk Region (1 km north-east of the Kuragino village: 53°54'143" N, 92°46'605" E). The study area is characterized by continental and tempered cold climate, low-mountain relief and an extensive river system. The study area is represented mainly by forest-steppe and meadow steppe, brown, gray forest soils and humus; most of the territory is underlain by loess-like sediments (Fig. 1).

We selected 49 samples of sediments from deposit thickness of 6-8 meter terraces of Irba river. Selection of samples was carried out from the bottom to the top and included all horizons of terrace sediments. The total capacity of the section is 6.62 m.

The study of physical and chemical characteristics of sediments was carried out by standard methods (Arinushkina, 1970). The determination of granulometric composition of sediments was carried out by the combined method (sieve and pipette).

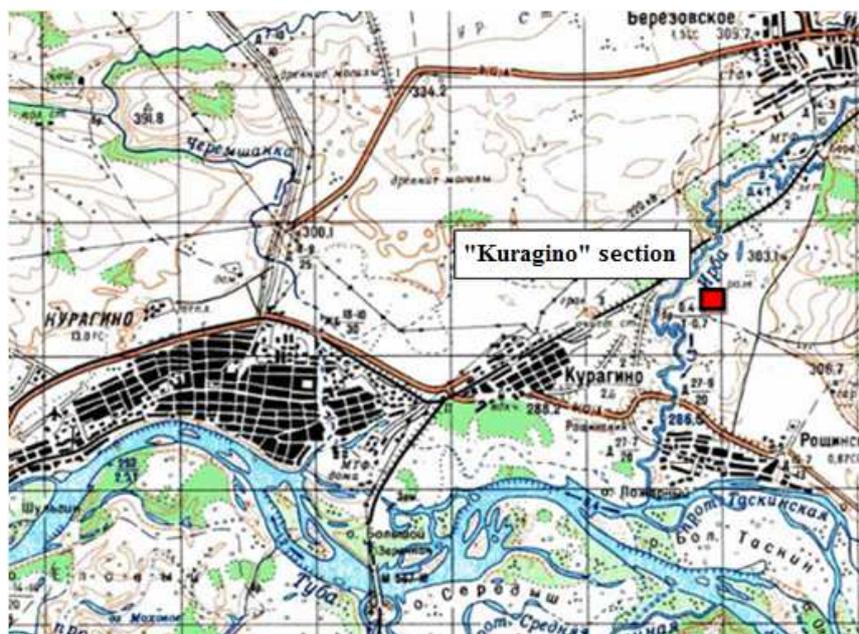


Fig. 1. The location of «Kuragino» section on a topographic map of Kuragino village N-46-078, Krasnoyarsk Region (scale 1: 100 000)

According to field observations, the sediment section on the stratigraphic description has a very heterogeneous structure (Table).

Table. Stratigraphic description of sediment section

Depth , m	Description
0-0,8	Loam with brownish-black, light brown and yellowish-brown color; lumpy and fine-grained structure; the presence of plant roots.
0,80-2,95	Pulverescent loamy sand with pale yellow color with interlayers of brown sand (1.45-2.90 m); inclusions of shells (2.0-2.5 m) and concretions (2.75 m); at a depth of 2.95 m been found fossil remain of large mammal.
2,95-4,27	Horizontally layered thickness of light loam and sand with creamy-gray color with inclusions of concretions at 3.5 m
4,27-4,50	Sand with light brown, coarse, ferruginized, loose.
4,50-4,75	Layered thickness of ferruginized light loam and sand with brown, brownish and grayish color.
4,75-6,62	Layered thickness of medium-grained ferruginized sands with inclusions of pebbles.

The results of the analyzes to determine the granulometric composition, magnetic susceptibility, humus, carbonates, sum of exchangeable bases, etc. showed the following picture (Fig. 2). The data on the granulometric composition and the stratigraphic description are identical and well correlated with the data on the magnetic susceptibility χ .

Thickness of sediments varies from top to bottom in the direction of weighting of granulometric composition: from clay loam to sandy loam and sand. The upper 0.4 m layer is composed with heavy loam with a predominance of fine sand fraction (0.25-0.05 mm) 25.9-30.2% and fine dust (0.005-0.001 mm) 32.4-37.2%; 0.4-0.8 m depth interval is characterized by a lightweight structure, namely medium and light loam with a predominance of the same faction, which is typical of the overlying layer, but in this interval there was a relative

increasing the number of fine sand fractions to 46.8%. Underlying sandy loam horizon (0.8-3.1 m) contain high fractions of fine sand to 59.9% and medium sand (7.4-30.1%).

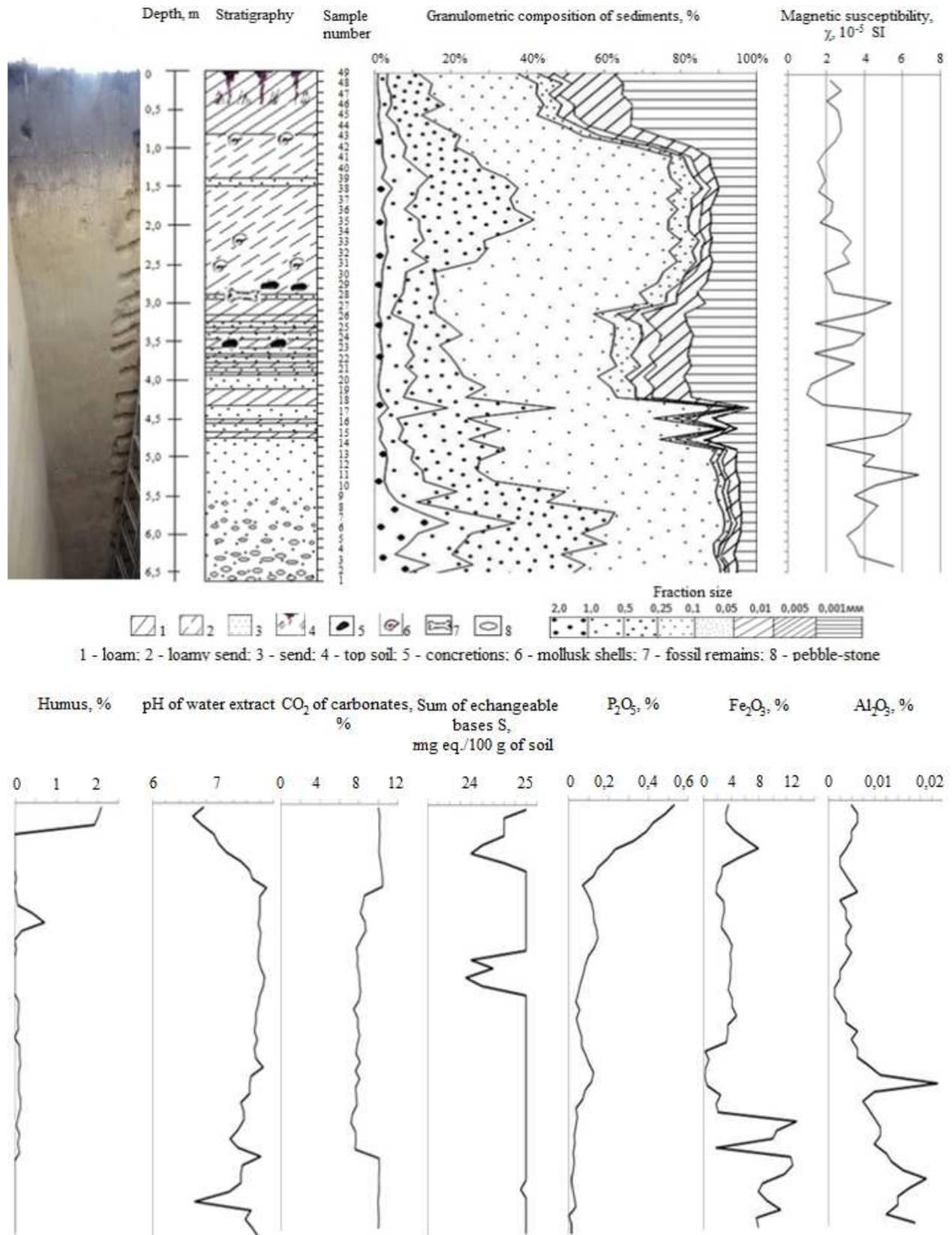


Fig. 2. Stratigraphy and basic physical and chemical characteristics of terrace sediments of Irba river

Under the loamy horizon is located meter horizon with more or less equal value fractions and the content of fine sand fraction remains high 32.7-56.0%. Lower sandy horizon (4.27-6.62 m) with two thin layers of light loam is characterized by increased content of thin (0.25-0.05 mm), medium (0.5-0.25 mm) and coarse sand (1-0.5 mm) and by the emergence of gravel (1-3 mm) and pebble (> 3 mm) fractions. The indicators of magnetic susceptibility tend to increase towards the lower sandy loam-sandy part of the section, which confirms the formation of these sediments in warmer and more humid climate conditions under the influence of riverbed activity than in the overlying loamy horizons. The presence of light loam layers in sandy horizon says that during a warm climate with favorable hydrological conditions the processes of climate aridization underwent.

According to chemical parameters sediment section is characterized by neutral (6.5-7.5) and weakly alkaline pH (7.5-8.5). Upper soil horizon is characterized predominantly by neutral pH. Sediments are very poor in humus and P₂O₅, the content increases only in the upper thin horizon: humus - to 2% (little humified) and P₂O₅ - to 0.6%, which indicates the existence of a relatively warm climate during the formation of sediments, it is well confirmed by a decrease in grain size of sediments and the presence of a neutral pH.

In general, sediments are characterized by a high content of carbonates 6-10%, which are spread over the entire profile more or less evenly. Maximum values 8-10% are observed in the top and lower horizons. Increased content of carbonates indicates the existence of a cold and dry climate during the formation of these sediments.

Extremely low content of Al₂O₃ and Fe₂O₃ is observed all through the section, a slight increase in their bottom sandy loam-sandy horizon indicates the existence of a hot and humid climate.

Thus, «Kuragino» section has a predominantly loamy-loamy sand granulometric composition, which in the lower horizon becomes sandy and ferruginized. Sediments are poor in humus and P₂O₅ and, in contrast, are rich in carbonates, which gives an idea of the domination of prolonged cold and dry climate that followed the warmer and more humid, which can be seen by increased size of fractions and content of Al₂O₃ and Fe₂O₃ in the lower horizon.

It is seen that during the formation of sediments forming the terrace of Irba river there has been a repeated changing of the climate regime.

It is planned to carry out the biochemical analysis, radiocarbon dating and determination of the micromorphological structure of sediments in order to determine the genesis of these sediments more accurately. And also spore-pollen analysis of these deposits was carried out by our colleague, which will provide a more complete picture of past climate regimes in the future and give the forecast of future climate changes.

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