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# THE COMPOSITION AND PROPERTIES OF THE OB FLOODPLAIN (СОСТАВ И СВОЙСТА ПОЧВ ПОЙМЫ Р. ОБЬ)

*Particle-size distribution and mineralogical composition of soils were studied for each mineral soil horizon of each soil pit (the total number of samples is 13).*

*The mineralogical composition of soils near Nizhnevartovsk is represented mostly by primary minerals of the silica group including quartz, chalcedony, opal. Their content is 80–90%. Secondary clay mineral content is insignificant (1–5%). Soils formed on smooth relief minerally differ from those of floodplains.*

*Soils near Nizhnevartovsk compare favourably with background characteristics of zonal podzol soils, including $pH_{KCl}$ reactions, hydrolytic soil acidity, total exchangeable cations, soil saturation, phosphorus and potassium content. This is due to the alleviation processes, such as silt particle accumulation in parent rock.*

*Agrochemically, gley podzol soils are between representative podzol soils and soddy gley soils, where soddy gley soils have the highest trophic factor.*

*Изучение гранулометрического и минералогического состава почв производилось для каждого минерального почвенного горизонта каждого почвенного шурфа (общее количество образцов 13).*

*Минералогический состав почв Нижневартовского района представлен в основном первичными минералами группы кремнеземов, в том числе кварцем, халцедоном, опалом. Они составляют до 80–90%. Вторичные глинистые минералы представлены незначительно (1–5%). Почвы, сформированные на ровных поверхностях, в минеральном отношении отличаются от пойменных почв.*

*Показатели почвы Нижневартовского района отличаются от фоновых показателей для зональных подзолистых почв, в том числе реакциями $pH_{KCl}$, гидролитической кислотностью, суммой обменных катионов, степенью насыщенности почв и обеспеченностью фосфором и калием в лучшую сторону. Данный факт обусловлен аллювиальными процессами, в том числе накоплением илистых частиц в материнских породах.*

*В целом глеево-подзолистые почвы по своим агрохимическим показателям занимают промежуточное положение между типичными подзолистыми и глеево-дерновыми. Наиболее высокотрофными из них являются глеево-дерновые.*

Particle-size distribution and mineralogical composition of soils were studied for each mineral soil horizon of each soil pit (the total number of samples is 13).

The Rutkovsky's method was used to analyze particle-size distribution of the soil samples from key sites. The method is based on the swelling capacity of clay particles of soils and grounds when put in water. The clay particle content of the analyzed samples can be calculated using the following empirical formula:

$$x = 22.7K, \quad (1)$$

where $x$ is clay particle content;

$K$ is increased soil volume per 1 $cm^3$ compared to the original soil volume.

After the volume has been calculated the bottom sediment is put into a porcelain dish and dried using an asbestos-covered electric heater. Then the 0.5–0.05 mm fraction material is examined using a binocular microscope (or magnifier). Then the fraction material of less than 0.05 mm is examined and the mineralogical composition of these fractions is determined.

Clay fraction content (particle size is less than 0.005 mm) is calculated using the following formula:

$$K_v=(V_1 - V_0)/V_0, \quad (2)$$

where $K_v$ is increased volume per 1 $cm^3$;

$V_0$ is the original volume of the analyzed material;

$V_1$ is the swell volume after 24 hours.

The content of the silt fraction (0.05–0.005 mm) is determined by subtracting the amount of clay and sand particles from 100 percent [1].

Key site 1 is located on the terrace above the flood-plain near Dolgoye Lake, Sibirskiye Uvaly Nature Park. Tab. 1 shows the results of particle-size distribution analysis.

The main soil skeleton-forming particles are those between 0.5 and 0.05 mm in size. They can be identified as fine sand. Since the amount of very fine particles less than 0.05 mm in size is low, except for the $B_1$ horizon, one can assume that the soil is formed by primary minerals: 54% quartz, 18% chalcedony, 14% opal, 9% iron-titanium oxide.

Secondary minerals – 5% kaolinite – are formed in the upper illuvial horizon ($B_1$), which is proved by the presence of fine clay particles.

Key site 2 is located on the left bank of the Ob river, near Bylino settlement. Its particle-size distribution is show in Tab. 2.

The particle-size of this soil is mostly 0.5–0.05 mm. There are almost no silt particles less than 0.005 mm in size in the soil, which means that secondary minerals form in very small quantity (1%). It proves that in terms of mineralogical composition the soil contains mostly primary minerals: 50% translucent silica, 30% milk quartz, 10% opal, 5% chalcedony, 4% mica. Secondary mineral – kaolinite (1%) – was found only in humus and illuvial horizons, which can be explained by the fact that floodplain surface is formed by the river. During high flood the river deposits sand and the amount of secondary minerals formed between floodings is insignificant.

Key site 3 is located on the left bank of the Ob river opposite Nizhnevartovsk. The crest-broken character of the floodplain contributes to the podzol-forming process. Tab. 3 shows particle-size distribution of the soil from the site.

In terms of particle-size the floodplain gley-podzol sandy loam soil on alluvial sand contains mostly fine sand. Its mineralogical composition is represented by 62% translucent silica, 12% opal, 10% kaolinite, 9% iron-titanium oxide, and 7% chalcedony.

Thus the mineralogical composition of soils near Nizhnevartovsk is represented mostly by primary minerals of the silica group including quartz, chalcedony, opal. Their content is 80–90%. Secondary clay

Table 1

Particle-size distribution of representative podzolic soil on lacustrine-alluvial sand

| Horizon | Depth, cm | Fraction distribution, % | | | |
|---|---|---|---|---|---|
| | | >0.5 | 0.5-0.05 | 0.05-0.005 | <0.005 |
| $A_2$ | 10-32 | - | 85.0 | 13.2 | 1.8 |
| $B_1$ | 32-61 | - | 50.1 | 45.6 | 4.5 |
| $B_2$ | 61-85 | - | 70.1 | 18.7 | 11.4 |
| BC | 85-105 | - | 80.0 | 15.5 | 4.5 |
| C | 105 | - | 70.0 | 30.0 | 1.8 |

Table 2

Particle-size distribution of alluvial soddy gley light loamy soil on alluvial sand

| Horizon | Depth, cm | Fraction distribution, % | | | |
|---|---|---|---|---|---|
| | | >0.5 | 0.5-0.05 | 0.05-0.005 | <0.005 |
| $A_{1g}$ | 10-32 | - | 75.4 | 44.6 | - |
| $B_g$ | 32-74 | - | 80.0 | 20.0 | - |
| G | 74-91 | - | 60.4 | 39.6 | - |
| C | 91 | - | 90.1 | 9.9 | - |

Table 3

Particle-size distribution of floodplain gley-podzol sandy loam soil on alluvial sand

| Horizon | Deapth, cm | Fraction distribution, mm | | | |
|---|---|---|---|---|---|
| | | >0.5 | 0.5-0.05 | 0.05-0.005 | <0.005 |
| $A_2$ | 10-55 | - | 70.1 | 26.3 | 3.6 |
| $B_g$ | 55-80 | - | 40.2 | 55.5 | 4.3 |
| BC | 80-117 | - | 79.8 | 20.2 | - |
| C | 117-150 | - | 90.3 | 9.7 | - |

mineral content is insignificant (1–5 %). Soils formed on smooth relief minerally differ from those of floodplains.

Kaoline accumulation [2] indicates that the soils analyzed are poor. And their particle-size distribution points to their good aeration, water infiltration and drainage, that create favourable growing conditions for average productivity pine forest.

Table 4 shows comparative agrochemical characteristics of soils. Soils near Nizhnevartovsk compare favourably with background characteristics of zonal podzol soils, including $pH_{KCl}$ reactions, hydrolytic soil acidity, total exchangeable cations, soil saturation, phosphorus and potassium content. This is due to the alleviation processes, such as silt particle accumulation in parent rock.

Agrochemically, gley podzol soils are between representative podzol soils and soddy gley soils, where soddy gley soils have the highest trophic factor.

Table 4

Agrochemical properties of soils

| Horizon index | Depth, cm | $pH_{KCl}$ | Hydrolytic soil acidity (H), mg-eq ·100 g$^{-1}$ | Total exchangeable cations (S), mg ·100 g$^{-1}$ | Soil base saturation (V), % | Content | |
|---|---|---|---|---|---|---|---|
| | | | | | | Phosphorus ($P_2O_5$), mg ·100 g$^{-1}$ | Potassium ($K_2O$), mg ·100 g$^{-1}$ |
| Representative podzolic alluvial sandy loamy soil, modal podzol (cross section 1) | | | | | | | |
| $A_2$ | 10-32 | 4.2 | 2.04 | 2.9 | 58.7 | 2.75 | 5.2 |
| $B_1$ | 32-61 | 4.4 | 2.27 | 3.8 | 62.6 | 3.25 | 5.9 |
| $B_2$ | 61-85 | 4.8 | 2.11 | 2.17 | 50.7 | 2.75 | 4.8 |
| BC | 85-105 | 5.2 | 1.97 | 5.0 | 71.7 | 2.0 | 2.9 |
| Soddy gley alluvial light loamy soil, medium-deep (cross section 2) | | | | | | | |
| $A_1g$ | 10-32 | 4.4 | 3.18 | 6.82 | 68.2 | 5.75 | 10.8 |
| Bg | 32-74 | 4.8 | 2.87 | 6.08 | 72.7 | 6.85 | 7.7 |
| G | 74-91 | 4.4 | 2.12 | 6.05 | 74.1 | 5.75 | 7.7 |
| Gley podzol alluvial sandy loamy soil, deep (cross section 3) | | | | | | | |
| $A_0A_1$ | 5-10 | 4.0 | 7.04 | 4.2 | 51.4 | 6.25 | 8.8 |
| $A_2$ | 10-55 | 3.9 | 3.5 | 4.5 | 56.2 | 6.25 | 4.4 |
| Bg | 55-80 | 3.4 | 4.3 | 4.8 | 52.7 | 5.5 | 9.2 |
| BC | 80-117 | 5.0 | 1.88 | 7.0 | 58.2 | 3.75 | 4.4 |

*Literature*

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