Environmental Problems Mining Industry in the Arctic

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Abstract. In this article characteristics and indicators of climatic conditions of a North taiga subzone where works on extraction of alluvial diamonds from alluvial deposits of the northern rivers are intensively carried out are considered. Mining works are conducted in the open career way with full transfer of the natural bed of the rivers. It is followed by pollution of the rivers and adjacent territories. For assessment of state of environment monitoring researches with studying of contents and migrations of minerals in a soil cover were conducted. Results of a condition of the chemical composition of soils before technogenic influence are given in work.

1. Introduction
Natural resources of the Arctic and subarctic latitudes, test an escalating press of a influence from objects of the mining industry now. Specific soil climatic conditions, big extent from the North on the South and from the East on the West, heterogeneity of a relief cause a considerable variety of a vegetable cover and change of zone soil and vegetable associations. In Northern Yakutia two botany-geographical zones are allocated: tundra and taiga, and several subzones, the border between which aren’t always accurately traced, and in places have a difficult configuration owing to imposing of vertical belt on the width zone [1]. The complexity of division into districts causes difficulty of elaboration of regional approach to the concept of environmental monitoring and land reclamation. The relevance of ecological researches of the environment of the vulnerable Arctic zone at technogenic influence doesn’t raise doubts [2, 3]. In this regard, the purpose of researches was collecting background materials of a condition of North taiga landscapes before large-scale development of fields.

2. Object of researches
One of the northern rivers of Yakutia which are most submitted technogenic influence is the Anabar River located in the Northwest of the republic. An object of researches is the pool of a stream Chara-Mas (fig. 1), the Anabar River which is the left inflow of an average current where now there is an intensive production of the loose diamond field.

On heat resources during the vegetative period the territory of northwest Yakutia is included into the cold climatic area. Climate of the region sharply continental with long (7-8 months) in the winter and in moderately warm short summer (2-2,5 months). Average temperature in the winter-35,50 °C, in the summer +11,70 °C. Average annual temperature is-140 °C. The maximum value of air temperature in the summer +350, the minimum value can fall to in the summer – 50°, in the winter – to - 60-
65°C. Average annual speed of wind for the area is equal to 3-5 m/s. During the summer winds of the southwest and northeast directions, in the winter – northwest prevail. During the winter period is up to 50 days with blizzards. Vegetative period continue no more than 60-80 days. Frosts are possible in any month to -3 °C in June, July and minus-7-10 °C in August. The annual amount of precipitation fluctuates from 130 to 220 mm; their most part drops out from April to October.

Permafrost, everywhere widespread in northwest Yakutia renders on development micro and a middle relief and a vegetable cover. In this area as the cryogenic processes which are an integral part of soil formation in a zone of the tundra and in a subzone of a northern taiga are very brightly shown anywhere [4]. River-bed of the Hara-Mas is twisting, from 2 to 25 meters wide. Total length of the valley of the Hara-Mas River is 26 km. Water depth on reaches of 2.0 - 3.0 m, on rifts doesn't exceed 0.1 - 0.5 m. The river has three large inflows - streams Yuryung-Yuryakh, Uoran and Ottuktaakh. The longitudinal profile of the Hara-Mas River is characterized by an uneven bias. Low and high floodplains in the basin of the Hara-Mas River are developed fragmentary, in the form of narrow (up to 5 m) strips they are traced on both river banks.

3. Technology of works
On technology mountain preparatory work, overburden and mining works are conducted within the water protection zone of the Hara-Mas River in the open separate way, with stage-by-stage withdrawal of the bed of the river and full processing of the valley of all stream. During the winter and spring period, in the absence of a drain, mining operations without withdrawal of the bed of the Hara-Mas River, and in the summer – in the period of open water are carried out, mining works stop and the course is brought to the fulfilled scattering space. Work of the site is provided in the seasonal mode by a shift method. Productivity of the mountain site on extraction of sands is making by 200 thousand m³/year. Mining operations within a year are conducted during two periods. 1. The winter and spring period including carrying out mountain preparatory work, dredging of frozen breeds of overburden, extraction of sands and their transportation on the ore yard of seasonal concentrating factory, conducting exploration works. 2. The summer-autumnal period, includes continuation of mine-preparatory, overburden and exploration works, a technical mined-land reclamation of the fulfilled areas and also processing sands at seasonal concentrating factory of the site.

Figure 1. The River Hara-Mas, estuarial part (A.P. Pesterev's photo).
4. Discussion of results
Mining assumes in the open way make of works directly in line with the Hara-Mas River and in proximity from him that leads to elimination of the natural course of a waterway throughout about 5 km and more during the season, is followed by violation of land on the area and depth. Similar violations, in turn, attract change of the hydrodynamic mode of the river, cause damage to hydrobiontes and fish, lead to pollution of the water basin, considerably influence on the population and fauna of region [5, 6].

The negative impact on the biosphere by production of mining operations is essential, and for his decrease it is necessary to provide for a complex of organizational and technological actions [7]. One of such actions is the organization of environmental monitoring in a river basin Hara-Mas with detailed researches of a natural soil and vegetable cover [8, 9]. Observation of components of ecosystems, their states can be made only taking into account actual state of an object in the past and the present, and have to include data on pollution sources, on structure and the nature of pollution, on reaction of living organisms and change of a condition of land ecosystems [10-13]. Materials of these observations have to be compared with data on a natural state of objects prior to noticeable anthropogenic influence, i.e. it is necessary to have data on "background" characteristics of quality and quantity of flora and fauna for comparison to the changes observed now.

At assessment of an ecological condition of the environment one of methods is the research of maintenance of forms of stay and a way of migration of minerals. It is known that in the habitat the leading role in change of a geochemical situation belongs to mechanical and biogenous migrations, and at anthropogenic influence physical and chemical and technogenic migrations are added. The general geochemical situation of a soil cover is closely connected with geology and a land relief. The soil cover of the region is presented by permafrost North taiga gley soils with heavy particle size distribution and sour reaction of medium [14-16]. These conditions cause considerable mobility of heavy metals.

So, on the valley of the Anabar River in an estuarial part of the Hara-Mas River the zone of a primary prevalence of anomalies of lead which gross concentration makes from 1,5 to 2,3 maximum allowable concentrations in a layer of 0-10 cm is allocated. At the same time, the maximum of accumulation reaches up to 70 mg/kg (maximum allowable concentration of lead of 30 mg/kg). An overall picture of distribution of minerals, in the explored region following: lead is present at upper courses and the middle of a current and it isn't found in an estuarial part as in the mouth the shingle who is periodically washed out by high waters is developed. Chrome is distributed evenly, copper gradually decreases downstream. Manganese concentrates in an estuarial part. Cadmium in inflow Ottuktakh is present at small amounts, is rather high in upper courses of the Hara-Mas River and decreases downstream.

At the same time, it is necessary to consider low resistance of northern soils to external influences, their ability to fast degradation at the slightest influence [17-21].

5. Conclusions
At the wrong development of these sites, considering the small thickness of an active layer (30-40 cm), the impenetrable permafrost screen promoting accumulation of pollution, the raised geochemical background of the territory and poor development of a protective vegetable cover, at peculiar to North taiga soils of a thixotropy and drift, there can be a difficult ecological situation in environments of the basin of the Anabar River where the small peoples of the North which are engaged in fishery and reindeer breeding compactly live.

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