

ECOLOGICAL GEOLOGICAL CONSEQUENCES OF MINERAL DEPOSITS BY QUARRY METHOD IN BELARUS

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Abstract

The areas of exploitation of the various kinds of raw materials by quarry method in Belarus are distinguished by a high degree of environment transformation. As the result, complicated ecological-geological situation occur. They conduct to irreversible changes of the base natural components both inside and outside of exploitation area. Particularly, the transformation of relief, changes of rocks conditions and properties, disturbances of hydrological and hydrogeological conditions and hydrogeodynamic balance take place in quarry zone. The exploitation of mineral deposits, as a rule, is conducted with permanent pump out of water, which leads to noticeable lowering of underground waters level and change of water regime in the vicinity of quarry territories. The direct consequences of that technological operation are disturbance of natural hydrodynamical conditions, drying of soils and grounds, destruction of wood vegetation and reduction of quality of agricultural lands. The waters of quarries are often enriched with a number of toxic chemical elements. Their casting in natural water streams results to noticeable oppression of number of dominant species of local flora and fauna.

Introduction

Exploitation of deposits of raw materials by quarry method is spread widely in the territory of Belarus. Dolomite in Vitebsk region, calcareous rocks in Grodno and Mogilev regions, sand-gravel material, building stone and other are extracted by this way. Extraction of these kinds of raw materials is accompanied by a high degree of environment transformation.

Ecological-geological consequences of exploitation of mineral deposits by quarry method can be considered on an example of the largest deposit of building stone in Belarus – “Micashevichy”. The mineral deposit is situated in Brest region (2 km to the west of town Micashevichy). The rocks of crystalline basement are the main object for extraction. These rocks lie on depth up 10 to 60 meters from a surface. At present the sizes of quarry are 1.5 - 1.3 km and his depth is more 120 meters. Annually it is extracted 7.5 million tons of building stones.

Methods

During conducting of researches were used the general geological methods of observation and also standard chemical and physical methods of quantitative analyses.

Results

During exploitation of quarry are appear complex ecological-geological situations which can lead to irreversible changes of natural components both inside of quarry and in the whole region of central Polesye. The problems connected with construction and exploitation of quarry, with petrological composition of rocks, which are extracted and also with penetrating of underground mineralize waters. Among transformations of environment characterizing ecological-geological conditions in the quarry area are distinguished the following: 1) changes of relief; 2) disturbances of hydrological and hydrogeological conditions; 3) transformation of condition and properties of rocks; 4) disturbance of hydrodynamic and hydrogeodynamic balance in the quarry zone. As a result of long-term extraction of stone a huge depression (more 120 meters) was formed. The rocks locating upper basement are removing in waste. Their highs already research 20 meters.

The exploitation of mineral deposit is conducted with permanent pump out of water, which leads to noticeable lowering of underground waters level and change of water regime in the quarry vicinities. Considerable quarry size creates lowering of underground waters almost all water-bearing horizons.

The disturbance of natural hydrodynamical conditions, drying of soils and grounds, destruction of wood vegetation and reduction of quality of agricultural lands are the nearest consequences of the given technological operation. Lowering of level of underground waters on 2-8 m has conducted to drying of two small rivers on the quarry vicinity. By 2000 the level of underground waters has been lowered to 11 meters on distance of 2 km from the quarry and to two meters on distance of 3 km.

The quarry waters were polluted by chloride, sulfate, compounds of Fe, Zn, Ni, Cu, Pb, Cr, oil products. As a result of permanent pump out of water the polluted quarry waters get in natural basins. So, the Sitnitsky canal, located not far from the quarry was polluted by sewage, which are getting in Prip'yat – the biggest river of Belarus.

The average concentrations of chemical elements and compounds in the sewage of quarry were counted (milligram/litre): the weighed substances – 26.6 (extreme allowable concentration 15.0); chloride – 2075.4 (EAC 1800.0); the dry rest – 3801.0 (EAC 3400.0); oil products – 0.97 (EAC 0.3); Fe – 0.86 (0.5); Zn – 0.076 (0.01); Ni – 0.06 (0.01); Cu – 0.01 (0.004). During the period since 1981 until nowadays the concentration of chemical elements in the quarry waters has been increased in 1.5 – 2 times.

The water and air transfer of chemical elements has formed technogeochemical anomalies Ba, Sr, Zn, Cr, Pb, Zr, Fe, Mr, Ti in the soils in radius until 10 km from the quarry. The pollution of waters and soils by toxic components has conducted to noticeable oppression and locally – to total disappearance of flora and fauna species.

The activity of quarry also conducts to considerable technogenetic load of its adjacent territories. Because on the closest neighborhoods difficult infrastructure is formed, the population is increased, the borders of town “Micashevichy” are widen, new agricultural lands are mastered, the forests are cut down and the roads and canals are built. Besides, the strong noisy effect is created as a result of realization of explosion works in the quarry.

Conclusion

For prevention of the quarry negative influence on environment the complex of natural protection measures were elaborated. They are cleaning of the quarries waters from harmful components, utilization of waster, decrease of noisy influence during explosion works and others. However it is necessary to note, that because of insufficient financing of nature protection measures at present it is possible to point out only on conducting of observation carrying only “recording” character.

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