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Research Article

ECOLOGICAL CONDITION OF THE ADJACENT TERRITORIES OF THE CHARVAK RESERVOIR IN THE AFTERMATH OF POSSIBLE EARTHQUAKES

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ABSTRACT
The region of the Charvak reservoir, the nature of which is the subject of national pride of the Tashkent region, is practically involved in international tourism activities. The Charvak reservoir is a recreation area for workers, serves as a supplier of agricultural products and the only raw source of bismuth. Reservoirs are the main reservoir of drinking, irrigation water, and a source of electrical energy. Gravitational processes and other types of disturbances occurring on the slopes, bring not only material damage, but also human casualties. Therefore, any changes, primarily in the relief, significantly destabilize the existing landscape, and thereby lead to irreparable damage to the environment, unsuitable condition of life providing buildings, structures and areas of farmland of the population in the research area. The territory of the Charvak reservoir is characterized by a high level of seismic activity, assessment of the stability of slopes due to seismic activity and the problem of ensuring the safety of the population and the ecosystem is the most urgent task. In modern conditions, with colossal industrialization and the most popular among tourists, the area of the Charvak reservoir is actively being equipped with boarding houses and recreation areas. An increase in population density, disruption in the functioning of natural ecosystems and anthropogenic systems, in particular, environmental protection management, the impact of earthquakes on the manifestation of geological and technogenic processes of the ecological crisis is becoming increasingly significant.

Keywords: *gravitational processes, landslides, landslides, rock avalanche, landslide body, abrasion, gully erosion, cracking, deformation, seismic activity, magnitude, ecosystem.*

INTRODUCTION

The studied territory of the Charvak reservoir is a recreation area for workers, serves as a supplier of agricultural products and the only raw source of bismuth. The reservoir itself is the main reservoir of irrigation, drinking water and a source of electric energy. The territory of the Charvak reservoir is characterized by a high level of seismic activity, and therefore the problem of ensuring the seismic safety of the population and the ecosystem of the research area is very relevant. As is known, gravitational slope processes occur most often during earthquakes: collapses, scree, landslides, and mudslides. During the most powerful earthquakes, cracks are formed in the Earth's surface, sometimes quite significant in size. In general, there is a certain change in both the mountainous and foothill landscape. It is known that the landscape is the result of a long geological and historical process affecting not only the main life-supporting elements of the relief, but also the vegetation covering it.

The total cost of annual losses caused by these processes on highways and railways, flooding of settlements in mountainous and coastal territories of reservoirs, is difficult to calculate due to the complexity of the definition. Gravitational processes and other types of disturbances occurring on the slopes, bring not only material damage, but also human casualties. Therefore, any changes, primarily in the relief, significantly destabilize the existing landscape, and thereby lead to irreparable damage to the environment, unsuitable condition of life providing buildings, structures and areas of farmland of the population in the research area.

Based on the above, the objective of the research is to establish the environmental consequences and manifestations of geological and technogenic processes in possible earthquakes on the shoreline of the Charvak reservoir and adjacent territories.

MATERIALS AND METHODS

Based on generalization and analysis of materials on the problem of the influence of seismicity, i.e. as a source of dynamic impact on rocks surrounding the coastline of the Charvak reservoir and adjacent territories, the role and nature of possible seismic effects on slope gravity processes were determined.

A significant risk of landslides along the coastline composing loess-like loams and sandy loams on irrigated terraced lands was taken into account. An earthquake is a powerful factor causing the landslide body to instantly liquefy and manifest the maximum seismic effect in the development of a landslide. Based on this, the studies are aimed at assessing the conditions in which landslides, collapses, abrasions, and other processes can form along the shoreline of the reservoir.

To assess the general condition of the studied territory, spaceplanes with electronic binding on a scale of 1:100 000 and 1:50 000 were compiled from satellite images from the free Google Earth server and satellite images were embedded in separate areas for individual manifestations of processes with subsequent comparison on the terrain of the studied territory. To identify potentially dangerous areas and zones, the nature of the influence of irrigated territories and the position of the reservoir water level were considered.

In addition, based on the analysis of the catalog of strong earthquakes recorded on the territory of the Tashkent region, the current seismic situation in the research area and adjacent territories was assessed.

RESULTS AND DISCUSSION

Theoretically, the work is based on ideas and approaches in the field of nature protection and environmental safety of coastal zones of reservoirs in the event of a possible earthquake impact on them. In the twentieth century, the destruction of slopes, the formation of collapses and a large number of catastrophic snow-stone avalanches are associated with earthquakes (magnitude more than 7.0) in Peru, Kyrgyzstan, Tajikistan, China, etc. seismically active regions. They are described in sufficient detail in the studies of N.N.Nazarov, Yu.B.Trzhtsinsky, S.A.Makarov, V.V.Kobyak, G.A.Mavlyanov, G.H.Umarova, R.A.Niyazov, A.M.Khankhodzhaev, G.A.Bimurzaev and many others (Adilov, 2021; Zakirov, 2019, 2021, 2022; Mavlyanov, 1982, Safyanov, Nikiforov, Ogorodov, Tarasov,2007; Kramareva, 2018).

There are numerous cases in the world associated with gravitational processes on slopes, the consequences of which are not comforting. For example, the Sarez Lake, which belongs to the blockage lakes, arose as a result of the catastrophic overlap of the high-altitude Pamir channel of the Bartang River, which occurred on March 3, 1911. In 1913, the length of the Sarez Lake reached 28 km, and its depth was almost 130 m. Nowadays, its length is already 75 km, and its depth is about 500 m. And like this landslide on December 11, 2018, an incredible natural disaster occurred in the Khabarovsk Territory (Safyanov, Nikiforov, Ogorodov, Tarasov, 2007). At 14:48 local time, a large landslide descended from the steep left slope of the valley of the Bureya River. At the place of the landslide, its valley is a deep gorge. The left bank of the river is high (about 400 m) and steep (with a slope of 30-35 °), and the right is a gently sloping terraced slope with a width of more than 1 km and a height in the rear up to 50 m above the current water level.

The landslide occurred in the rock column, represented by Proterozoic metamorphosed igneous rocks penetrated by young dykes. The steep slope here is crossed by a zone of tectonic disturbances, the rocks are strongly fractured, weakly resistant to the processes of destruction. The filling of the reservoir played a significant role in creating conditions for the disruption of the array. Groundwater penetrated under the base of the slope, increasing the water content and reducing the stability of the overlying strata (Safyanov, Nikiforov, Ogorodov, Tarasov, 2007). The wall of the breakdown is cut into the slope by a huge amphitheater and has a rectangular shape of considerable size - 600 m long, about 500 m wide. Ledges up to 30 m high stretch along the upper edge of the amphitheater and its western part. A natural disaster is characterized by the fact that with the manifestation of a landslide, it was accompanied by a splashing water wave - a tsunami.

Another disaster of a large landslide with a volume of 38 million cubic meters, rolled down the southern slope of the mountain Spike. A huge mass of dirt, rocks and other debris with a total weight of 80 million tons broke into the peaks and rushed at a speed of 160 km / h to the valley of the Madison River. At that time, campsites were located near the shores of Lake Hebgen and along the riverbed, where tourists spent the night. The mudflow hit houses and tents and killed 28 people, and then blocked the river flow and during the next month formed a lake called Quake. This was the result of an earthquake in 1959 in the state of Montana

with a force of 7.8 on the Richter scale. During the earthquake, the surrounding landscape dropped by about 6 meters, and shock waves caused numerous fluctuations of Lake Hebgen, which lasted for 12 hours.

The research area belongs to the XII-Pskom-Tashkent seismogenic zone, where earthquake foci have not manifested themselves since 2013. In general, over the past 70 years, seven strong earthquakes have occurred in the research area, and the entire territory belongs to the zone of possible earthquakes with an intensity of 8 points. However, stronger earthquakes are possible in some focal zones. The interaction and deformation of the blocks of the Earth's crust of the territory of Uzbekistan is directly related to the dynamics of the Tien Shan lithosphere. This, in particular, is evidenced by certain patterns of migration over the area of local earthquake foc, features of rock movements in seismic foci and other geodynamic processes. Considering the positions of seismic impacts on the slope loess-like loam and sandy loam with inclusions of poorly rounded gravel-pebble deposits, explains the fact that even with not strong earthquakes, which do not manifest themselves in the form of large cracks, deformations, can lead to the manifestation of landslide, collapse phenomena along the coastline and adjacent territories of the Charvak reservoir (Khankhodzhaev, 1990; Shuysky, 1986; Zakirov, 2019).

It is in mountainous terrain that gravitational processes, and, in fact, earthquakes themselves, especially strongly change the relief, provoking a change in the position of watercourses, the configuration and size of reservoirs, their depth, the speed of water movement, the mode of formation of river valleys changes and affects the manifestations of processes such as abrasion, landslides on the shoreline of the reservoir. Everywhere the riverbed of the Paltau and streams before the confluence of the Chatkal River are blocked by landslide bodies, collapse masses, scree and mudflow material on the removal cone.

On this territory, in the right side of the confluence of the Chatkal River with the flow of soil material into reservoirs, wetlands are formed, which entails soil degradation, changing the deposits of destroyed hard rocks along the bottom of the Chatkal River (Zakirov, 2021; Ismailov, Khusomiddinov, Yodgorov, 2020; Yadigarov Ivanov, Trjsinsky, 2001). If we take into account the fact that the high level of the reservoir has reached the level of 890 m, since that time, abrasion, gully erosion, ancient and young landslides have intensified under the influence of the reservoir's groundwater backup. The development of the backwater contributed to siltation, flooding of riverbeds, represented in the form of a canyon, which served as natural drains of underground and surface waters before flooding.

Thus, based on the above, in the research area with widespread slope gravitational processes, characterized by various engineering - geological conditions that are influenced by the operating mode (the difference in the reservoir level absolute marks from 890 to 850 m) of the reservoir and seismic impacts identified areas (Mingchukur, Sijjak, Beshkayragach, Shungak, Bakachul, Ishakkupryuk, Yusufkhona and Yalauly) with different types and parameters of slope gravity processes (Zakirov, 2019; 2021; Kramareva, Lupyan, Amelchenko, 2018).

These circumstances and the ongoing intensive development of the territory by tourist complexes require the study of slope gravity processes and the environmental consequences of possible earthquakes of the Charvak reservoir coastline. Often, during earthquakes, both negative and positive relief forms of various heights and steepness arise. This, in turn, is due to the fact that soils in landslide bodies, talus and collapse masses have not fully undergone consolidation processes, in the presence of active wind and moving water, intense planar and gully erosion occurs, and in some cases mudflows form (Makarov, Ryashenko, Akulova, 2000; Kramareva, Lupyan, Amelchenko, 2018).

In most cases, mudflows are formed in areas of a mudflow channel or a mudflow basin that has a significant amount of loose soil or conditions for its accumulation, where, under certain conditions of flooding, mudflows arise. Mudflow foci are divided into mudslides, potholes and foci of dispersed mudflow formation. Compared to natural geomorphological processes, the role of man was considered insignificant for a long time. But now, as the population increases, and as technological progress increases, human relief-forming activity has increased significantly. The consequence of this is anthropogenic relief – a set of relief forms created or significantly modified by human economic activity. We can talk about the actual anthropogenic forms of relief, i.e. newly created by man, and about the forms of relief that arise as a result of a sharp change in natural processes under the influence of economic activity. By origin, all anthropogenic landforms are divided into two main groups: technogenic relief created during the construction of facilities, and agrogenic, created as a result of agricultural activity.

Technogenic relief includes various forms of relief in the study area as a result of mining, in places of construction of hydraulic structures (upper reaches of the Pskom and Chatkal rivers), during urban planning, when laying roads. These processes change the microclimatic conditions of the existence of biota and the animal world, and other living organisms. Ecological conditions in the ecosystems of surface reservoirs are also changing significantly to an equally large extent. First of all, this is expressed in changes in the depths, directions and speeds of the movement of underwater currents. Usually there is a movement of fish, temperature changes in reservoirs lead to changes in the species composition of hydrobiots (fish, coelenterates, echinoderms, most of the crustaceans, mollusks, etc.).

Since in the research area, in addition to slope gravity processes, there are industrial enterprises, hydraulic structures, a fairly widespread network of tourist complexes in the form of recreation areas, a special place in considering the impact of earthquakes on the ecological situation is affected by their role in the occurrence of man-made disasters. Almost any of the technogenic emergencies can be triggered by earthquake, even if it is not very strong. The destruction of a building or its serious deformations can cause disruption of the technologies functioning in it. From an ecological point of view, disruption of production processes at mining, processing and enrichment enterprises is particularly dangerous. As well as waste and biologically hazardous substances, during transportation and in places of their storage. In limited areas, there is almost always a slight pollution of the environment due to concentrated exposure to the pollutant.

Because of the huge accumulation of garbage, nature and the population suffer. Waste requires disposal, and instead is stored in landfills, polluting entire hectares of terrain. As mentioned above, the amount of garbage increases every year. Currently, garbage collection is organized in the study area and there are no processing enterprises.

The presence of a colossal amount of production and consumption waste, sewage, sludge, slag, agricultural fertilizers, in many cases improperly storage, stored and buried, can simply be destroyed during earthquakes. The «material» contained in them, or rather the pollutant, in a concentrated form can be released into the environment with far-reaching negative environmental consequences. Linear structures of roads and water pipelines, sewer structures, all types of underground structures are considered very vulnerable to earthquakes, but pipelines of various purposes occupy a special place among them.

CONCLUSION

Thus, earthquakes either directly or as a factor in the formation of complex multi-stage emergencies have a significant impact on the state of the environment. In general, they accompanied the entire geological history of our planet, in this regard, the natural environment largely adapted to the effects of earthquakes, although these adaptations were quite long from a human point of view, but the natural environment still «healed» the wounds inflicted by earthquakes. Studies on the shoreline of the Charvak reservoir and adjacent territories revealed areas with the manifestation of slope gravity processes (landslides, landslides), abrasion processes of the shoreline of the reservoir and ravine formation processes. And also, the accumulation of silty sediments with a capacity of 1.5-2.0 m within the starboard side of the reservoir, where wetlands are formed on the cone of the outflow of the riverbed Paltau within the confluence of the Chatkal River.

In modern conditions, with colossal industrialization and the most popular among tourists, the area of the Charvak reservoir is actively being equipped with boarding houses and recreation areas. An increase in population density, disruption in the functioning of natural ecosystems and anthropogenic systems, in particular environmental management, the impact of earthquakes on the manifestation of geological and technogenic processes of the ecological crisis is becoming increasingly significant.

As measures to carry out organizational and economic order in the area of the Charvak reservoir and adjacent territories, it is recommended to prohibit the felling of trees and shrubs, dredging in riverbeds near landslide and landslide massifs, as well as planting of forest plantations as protective strips.

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