Engineering geology as a basis for environmental management and protection of the geological environment

I I Verhozin

Irkutsk National Research Technical University, Russia

E-mail: iverhozin@istu.edu

Abstract. Modern engineering Geology, as a science that studies the geological environment, is of great importance for the justification of environmental management. Nature management involves the regulation of human activities to engage in the consumption of natural resources: land, forests, minerals, water and other objects. Nature management is contradictory: creating and consuming, it often violates the natural balance and causes the development of man-made geological processes and phenomena that change, destroy and pollute the geological environment. These changes lead to the depletion or even to the complete degradation of the existing biocenoses in a particular territory, deterioration of the quality of the environment. All this has a negative impact on the quality of life. Therefore, any activity in the field of environmental management, ecology and protection of the geological environment should be based on the study of specific engineering-geological conditions of a territory, and therefore be based on the laws and basic provisions of engineering Geology.

1. Introduction

Modern engineering Geology, as a science that studies the geological environment, is of great importance for the justification of environmental management. It develops a wide range of theoretical geological problems and solves practical problems arising in the design, construction and operation of civil buildings and a variety of engineering structures, in the work to improve the territories, in the performance of mining operations on mineral deposits, protection and rational use of the geological environment.

Conditions of suitability of territories, selected for construction or other economic their use, is primarily determined by their geological structure and geological conditions, which in this case is called geological engineering as they investigate and evaluate the engineering aspect. Under the engineering-geological conditions refers to a set of natural geological conditions that determine the planning of placement on them of different types of construction, rational use of certain areas, stability and normal operation of various structures, conditions of construction and mining. The most important element of the engineering-geological conditions of a territory are rocks involved in its geological structure, as they determine the nature of the terrain, the development of geological processes, the spread of groundwater and mineral deposits. Geological processes occurring in different areas are the most dynamic component of these conditions. They are manifested in the formation and destruction of rocks, in changing their composition, physical condition and conditions of occurrence, in the formation and change of the relief of the earth's surface and the structure of the Earth as a whole [4]. Geological processes determine the stability of various areas and engineering structures built on them, as well as the living conditions and activities of people.
2. Materials
Nature management implies a rational regulation of human engineering activities to involve in the consumption of a variety of natural resources: land, forests, minerals, water and other objects. It is closely connected with the construction and operation of various engineering structures intended for human life and activity, the development of mineral deposits, work on the rational use and improvement of territories. In addition, nature management includes the protection of the natural environment, including geological environment as the basis on which the habitat of humans and living beings.

Engineering Geology is the science of the formation and change of engineering-geological conditions of the territories (geological environment), its rational use and protection in connection with the development of various geological processes and phenomena. Therefore, the object of engineering Geology, as well as all other geological Sciences, is the lithosphere, and it - the subject of engineering-geological conditions of the territories, their formation and changes occurring under the influence of geological processes, construction and operation of various structures, and, consequently, the rational use of the geological environment and its protection. It should be noted that the section of engineering Geology, studying the geological processes and phenomena of different areas and conditions of construction of structures in the areas of their distribution, called engineering geodynamics.

Under the geological environment refers to the natural sphere of human life and activity. It is each territory of the Earth with its relief, geological formations, processes and phenomena, water and mineral resources. According to the figurative definition of Professor V. D. Lomtadze, the geological environment is the surrounding geological conditions [4]. The upper boundary of the geological environment is the surface of the Earth, and its lower boundary is due to the depth of penetration into the lithosphere of human engineering activities in the process of nature. The geological environment is objectively and existed before us the reality that unfolds various engineering activities of a person associated with environmental management.

The geological environment is often called the bowels of the earth, because it contains deposits of solid minerals, groundwater, oil, gas, there are various underground engineering structures, here often dump (place) industrial waste, lay a variety of underground structures, such as tunnels, subways, mines and other mining. The earth's interior is studied by various geophysical and geological methods to solve geological and engineering-geological problems. Consequently, the geological environment is part of the natural environment, where the interaction of the four main surface areas of the Earth: the lithosphere, atmosphere, hydrosphere and biosphere. According to academician E. M. Sergeev[8] all these spheres are subsystems of the environment surrounding us as a global system. However, in a narrower, regional aspect, emphasizes V. D. Lomtadze [4], each subsystem can be considered as an independent integral system, the study of the laws of development, each of them, engaged in certain areas of knowledge. In a specific consideration, especially in the engineering aspect, all spheres of the Earth are delimited and their study is carried out by the relevant Sciences, taking into account that the development of each sphere of the Earth is naturally connected with others.

The issues of human interaction with the natural environment and its geological component was considered well-known scientists geologists: V. I. Vernadsky [2] A. V. Sidorenko [9] E. M. Sergeev [7,8], V. D. Lomtadze [4,5], G. K. Bondarik [1] I. P. Ivanov and J. B. Trzciński [3] and many others. Academician V. I. Osipov in 1993 justified the formation of a new interdisciplinary earth science – Geoecology [6]. He outlined the main objectives of this direction, which are reduced to solving three main problems: 1) analysis of changes in the Geosphere under the influence of natural and man-made factors, 2) rational use and protection of water, land, mineral and energy resources, 3) reducing environmental damage from natural and man-made disasters and ensuring the safety of human habitation. Solving environmental problems, Geoecology uses existing geological disciplines such as engineering Geology, hydrogeology, Geophysics, Geocryology, etc. However, the leading role in the protection and rational use of the geological environment, in various types of human engineering and environmental management belongs to engineering Geology [1,4,7, etc.].
3. Results and Discussion

The development of the geological environment in interaction with the atmosphere, hydrosphere, biosphere and internal spheres of the Earth, create certain global, regional and local equilibria, both on its surface and in the bowels. But they also create contradictions and determine the inevitability of the emergence and development of geological processes that change and destroy the geological environment and transform it in an updated form. Today, the impact of human production activities on the geological and the environment in terms of its scale, diversity and results, has reached values comparable to natural geological processes. Creating and consuming, people often violate the existing natural balance and causes the development of a certain group of artificial, man-made geological processes and phenomena that change, destroy and pollute the natural geological environment. These irreversible, for the most part, changes in the geological environment associated with the development of natural resources, lead to the depletion or even complete degradation of the existing biocenoses in a particular territory, deterioration of the quality of the surrounding nature. Therefore, any engineering and economic human activity in the field of environmental management, should be considered as an activity in which a large geological work. Such activities should be based on the study of specific engineering-geological conditions of a territory, and therefore be based on the laws and basic provisions of engineering Geology.

It is impossible to imagine the natural environment of us and to carry out measures for its protection outside of connection with the geological environment. The ultimate goal of engineering Geology is the forecast of occurrence and development of natural and technogenic processes and phenomena, development of scientific bases and methods of managing these processes for different species of wildlife: construction and operation of various engineering structures, mining, rational use of territories and the depths of the Earth, reproduction of natural resources.

4. Summary and Conclusion

Thus, engineering Geology, as the science of the geological environment and engineering-geological conditions of the territories, is the leading methodological basis for solving various practical problems related to environmental management, protection and replenishment of natural resources, security and improvement of living conditions and human activities.

References

[1] Bondarik G K 1981 General theory of engineering (physical) geology (Moscow: Nedra) p 256
[2] Vernadsky V I 1989 Biosphere and noosphere (Moscow: Science) p 261
[3] Ivanov I P, Trzhtsinsky Y B 2001 Engineering geodynamics (Saint Petersburg: Science) p 416
[4] Lomtadze V D 1977 Engineering Geology. Engineering geodynamics (Leningrad: Nedra) p 479
[5] Lomtadze V D 1986 Introduction to engineering Geology (Leningrad: LIE) p 86
[6] Osipov V I 1993 Geocology is an interdisciplinary science about the environmental problems of geospheres Geocology. Engineering geology. Hydrogeology. Geocryology 1 pp 4–18
[7] Sergeev E M 1979 Engineering Geology – the science of the geological environment Engineering geology 1 pp 3–19
[8] Sergeev E M 1984 Scientific and technical progress and environmental protection 27th international geological Congress. Summary volume of materials pp 54–59
[9] Sidorenko A V 1967 People, machinery, Land (Moscow: Nedra) p 57