

GEOECOLOGY AND ITS MEDICAL ASPECTS

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The geoecology is considered as a new scientific direction in natural sciences. In turn, the geoecology, in view of its cross-disciplinary character includes, according to C.Troll, various aspects: geocomplex, geosystem, equally-componential, ecosystemic and biocentric. In view of increase of the person's role in technical transformation of biosphere, and as a result of developing of diseases of civilization and other ecopathology of the person, the research of medical aspects of geoecology has become relevant. When studying the connection between human activity, technogenic constructions and geological environment, it is necessary to take into account that in the system "the person, the technogenic construction and the geological environment" it is important to pay attention to the mechanisms and the consequences of impact on the person of the dangerous striking factors of dangerous natural (geological) processes. As the geoecology is also considered as a synthesis of "vertical" (system biology) and of "horizontal" approaches, nowadays, even taking into account the biological component of the person as bio-social beings, the medical ecology also can apply for the certain "geoecological" attention. When examining, in the system aspect, geoecology as a science, it is possible to note the criteria of expediency and of the level of the system organization as backbone. From the expediency positions it is necessary to reflect a medical and biological component in the structure of geoecology that will expand the section of natural geoecology and will allow to consider the vertical approach more widely than within the system biology. The issues of the influence on the person of chemical pollution, researches of natural and focal infectious diseases, studying of features of distribution of noncontagious pathological changes among people, accounting of dynamics of the migration processes caused by the geoecological reasons, etc. belong to the problems of medical geoecology. Characteristic of the environment as a sphere of the activity of people causes the necessity of purposeful activity in the solution of local, regional, global geoenvironmental problems. While analyzing some local (regional) geoenvironmental problems of the Russian seaside territory of the Black Sea region influencing the level of life support and health of the population it is noted: 1) near Novorossiysk the distribution of pollution of H₂S, NO₂, NO and CO happens in the air way while the pollution by oil products covers ground waters of the area and also sea water of the Novorossiysk bay. In the territory of the Republic of Crimea there is a risk of chemical environmental pollution in the case of accidents at the chemical enterprises, producing iodine, bromine organic compounds, compounds of manganese and magnesium, agents of fire retarders, mineral fertilizers, sulfuric acid, aluminum sulfate, sodium water glass, etc. 2) in the Crimea the spread of various natural and focal infections of bacterial, virus and rickettsial genesis is possible.

Keywords: geoecology, medical ecology, countries of the Black Sea region, environmental pollution.

[В.М. Евстропов Геоэкология и ее медицинские аспекты]

Геоэкология рассматривается как новое научное направление в естественных науках. В свою очередь, геоэкология, ввиду ее междисциплинарного характера включает, по данным К. Тролль, различные аспекты: геокомплексный, геосистемный, равнозначнокомпонентный, экосистемный и биоцентрический. Ввиду возрастания роли человека в техносферизации биосферы, и как следствие возникновения болезней цивилизации и иной экопатологии человека, становится актуальным исследование медицинских аспектов геоэкологии. При изучении связи между деятельностью человека, техногенными сооружениями и геологической средой, следует принимать во внимание, что в системе «человек – техногенное сооружение – геологическая среда» важно обратить внимание на механизмы и последствия воздействия на человека опасных поражающих факторов опасных природных (геологических) процессов. Поскольку геоэкология рассматривается также как синтез «вертикального» (системная биология) и «горизонтального» подходов, в настоящее время, даже с учетом биологической составляющей человека как существа биосоциального, на определенное «геоэкологическое» внимание может претендовать и медицинская экология. При рассматривании в системном аспекте геоэкологии как науки, можно, как системообразующие, отметить критерии целесообразности и уровня организованности системы. С позиций целесообразности необходимо отразить в структуре геоэкологии медико-биологическую составляющую, что расширит раздел естественной геоэкологии и позволит шире, чем в рамках системной биологии рассматривать вертикальный подход. К проблемам медицинской гео-

экологии относят вопросы влияния на человека химических загрязнений, исследования природно-очаговых инфекционных заболеваний, изучение особенностей распространения незаразных патологических изменений у людей, учет динамики миграционных процессов, вызванных геоэкологическими причинами и др. Характеристика окружающей среды как сферы жизнедеятельности людей вызывает необходимость целенаправленной деятельности в решении локальных, региональных, глобальных геоэкологических проблем. При анализе некоторых локальных (региональных) геоэкологических проблем Российской приморской территории Черноморского региона, влияющих на уровень жизнеобеспечения и здоровья населения отмечено: 1) распространение загрязнения в районе г. Новороссийска H_2S , NO_2 , NO и CO происходит воздушным путем, в то время как загрязнение нефтепродуктами охватывает грунтовые воды района, а также морскую воду Новороссийской бухты. На территории республики Крым существует риск химического загрязнения окружающей среды в случае аварий на химических предприятиях, производящими йод, броморганические соединения, соединений марганца и магния, антипиренов, минеральные удобрения, серную кислоту, алюминия сульфат, жидкое натриево-стекло и др. 2) В Крыму возможно распространение различных природно-очаговых инфекций бактериального, вирусного и риккетсиозного генеза.

Ключевые слова: геоэкология, медицинская экология, страны Черноморского региона, загрязнение окружающей среды.

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The term "geoecology" was coined in 1939 by C. Troll [31], that was the beginning of the creation of the new scientific direction in natural sciences. This direction, which object is called "ecogeosphere", gained the cross-disciplinary character and included various aspects: geocomplex, geosystem, equally-componential, ecosystemic and biocentric.

Though C. Troll used the term geoecology in relation to the geological direction on the joint of geography and ecology, some researchers treat this term as reflecting the field of knowledge studying the connections between living organisms including the person, technogenic constructions and the geological environment [29.30]. As for studying of connection between human activity (an anthropogenic factor), technogenic constructions and the geological environment, it should be noted that in the system "the person, the technogenic construction and the geological environment" the studying not only the designing human activity as a result of which the technogenic constructions influencing the geological environment are being created, but also the research of mechanisms and consequences of the impact on the person of the dangerous striking factors of dangerous natural (geological) processes directly or indirectly (through the striking factors of dangerous industrial facilities) are possible [10].

According to V.L. Bocharov, in the structure of geoecology it is possible to select three sections: natural geoecology (synthesis of knowledge about the evolutionary ecoparameters of structure, quality and comfort for a biota and the person of regional ecospheres and of the global ecosphere, etc.), anthropogenic geoecology (synthesis of knowledge of depth, scales of anthropogenic change of reference ecoparameters in separate components, ecosystems, landscapes, stability of quality and comfort of the geocosphere and zone and regional ecospheres), applied geoecology (synthesis of knowledge of strategy and tactics of the greatest possible preservation of evolutionary parameters of the geocosphere and zone and regional ecospheres, prevention of crisis, critical and catastrophic violations of ecoparameters [4].

C. Troll [31] also considers geocology as a synthesis of "vertical" and "horizontal" (landscape geography) approaches, where the "vertical" approach is understood as a system biology, the biology studying functional relationship in ecosystems. However, in our opinion, nowadays, even taking into account the biological component of the person as bio-social beings, the medical ecology also can apply for a certain "geocological" attention.

According to L.L. Rozanov [22], it is possible to carry to the problems of medical geocology the issues of influence on the person of chemical pollution, researches of natural and focal infectious diseases, studying of features of distribution of noncontagious pathological changes among people, monitoring of consequences and the prospects of creation of transgene organisms, systematization of knowledge of direct and indirect manifestations of influences of plants and animals on health and activity of the person, accounting of dynamics of the migration processes caused by the geocological reasons.

The essence of medical geocology is defined considerably by the characteristic of connections between the environment and the people`s diseases caused by the geocological processes, and representing direct or indirect impacts of the dynamic environment on health and activity of the person. Geocological processes in the environment are interconnected, and natural and technogenic pollution of this sphere is formed owing to introduction or emergence of these or those substances, bodies, power sources, biological organisms.

Considering the cross-disciplinary nature and the complexity of geocology, I.I. Klementyev with the coauthors [17] characterize the system, from the positions of the system analysis concerning geocology, by the following criteria:

1. Stability of the system (ability to resist to external influences for the purpose of self-preservation).
2. Survivability (active suppression (elimination) of harmful factors by the system).
3. Emergence (degree of difference of the properties of the system from the properties of separate elements).
4. Dynamism (dependence of structure and the nature of behavior of the system on time).
5. Stochasticity (existence of the probabilistic mechanisms determining the behavior of the system in the external environment).
6. Expediency (the purpose defining the system behavior in the external environment).
7. The level of the system organization determined by the level of emergence, stability and expediency.

If geocology as a science is considered in the system aspect, then, in our opinion, it is possible to note the criteria of expediency and of the level of organization of the system as backbone. From the positions of expediency, it is necessary, in our opinion, to reflect in the structure of geocology the medical and biological component that will expand the section of natural geocology [4] and will allow to consider the vertical approach more widely, than within the system biology.

From the point of view of the process and environmental approach the geocology is considered as the cross-disciplinary science studying geocological processes (changes of health and activity of the person, changes in the condition of vegetable and animal organisms under the impact of the environment) of the natural and technogenic entire, in space-time concreteness [23]. From the positions of studying of changes of health during the research of geocological processes, except medical ecology, it should be noted the importance of such scientific directions as geopathology and geographical pathology [21].

The studying about the natural focality of diseases of the person is closely connected with geopathology. Tick-borne encephalitis, hemorrhagic nephrosonephritis and a group of

hemorrhagic fevers, tick-borne sapropyras of Northern Asia, paroxysmal rickettsiosis, alimentary toxic aleukia, heliotropic toxicosis, alimentary myoglobinuria, molybdenic gout, strontium chondrodystrophia, goiter etc. are related to such diseases. These diseases can be classified by the ethiopathogenetic specifics as infectious, parasitogenic, alimentary, endocrine, hereditary or biogeochemical diseases [3,6,18].

Unlike geopathology, geographical pathology investigates, first of all, the adaptive reorganizations of an organism during the change of the environment caused by the influence of local natural and anthropogenic factors [2,26].

The characteristic of the environment as a sphere of activity of people causes the necessity of purposeful activity in the solution of local, regional, global geoenvironmental problems. Nowadays, the following global problems of life support are of high-priority: deficiency of fresh water, the environmental pollution (mainly chemical), weakening of immune system and of resilience to diseases among people, a lack of food stuffs [23].

Let's consider as an example some local and regional geoenvironmental problems of the Russian territory of the Black Sea region influencing its level of life support and health of the population.

Due to the technogenic transformation of the biosphere there is a transformation of chemical composition of the environment. In the soils of landscapes of Krasnodar Krai and of the Rostov region during observation from 15 to 25 years the concentration of Ni and Cr increased by 1.5-2.5 times, the concentration of Cu and Pb increased to a lesser extent by 1.4-1.7 times [8]. The analysis of distribution of pollution near Novorossiysk showed that the air way is the most characteristic for this process. In particular, the excess of admissible concentration limit of H₂S, NO₂, NO and CO is revealed in atmospheric air of this area. Pollution by oil products covers ground waters of the area and also the sea water of the Novorossiysk bay [9].

As for the Republic of Crimea, there is a risk of chemical pollution in its territory. According to data of A.V. Vereskun and the coauthors [5], chemical industry of the Crimea is provided by the numerous enterprises. The scientific and production association "Iodobrom" is engaged in production of iodine, bromine and their derivatives; of bromine and organic compounds, compounds of manganese and magnesium, agents of fire retarders. The Perekop bromic plant also specializes in production of bromine, its inorganic salts and bromine and organic compounds. The enterprise "Crimean Titanium" produces dioxide titanium, mineral fertilizers, sulphuric acid, aluminum sulfate, sodium water glass, iron vitriol.

Among the main natural threats of the territory of the Republic of Crimea it should be noted the risk of the emergency situations connected with earthquakes [5] which, in turn, can lead to adverse ecological and medical effects owing to emergency situations at the facilities of gas and oil-extracting complex and main gas pipelines, and also accidents with emission of emergency and chemical dangerous substances [11,12,13].

It should be also noted the existence of risk of emergence of natural and focal infections. According to A.V. Moskalyov and the coauthors, the natural and focal infections in the Crimea include the following: bacterial (tularemia, leptospirosis, intestinal yersiniosis, hemorrhagic septicemia, pseudotuberculosis, salmonellosis, colibacillosis, brucellosis), virus (the Crimean hemorrhagic fever, tick-borne encephalitis, hemorrhagic fever with a renal syndrome, lyssa) and rickettsial (Q fever pneumonia, Marseilles fever) [19, 25]. Researchers also note that some factors of the environment are favorable for distribution in the Crimea of a malignant anthrax, cholera, brucellosis, etc. [16].

It is known that among the priority problems of geoecology there are tasks which are directly connected with human health: a) under the objective noting of socio-economic factors (working conditions, health care system, welfare, etc.) the definition of geoecological processes changing health and activity of people under environmental impact; b) organiza-

tion of geoenvironmental monitoring of the state of health of the population; c) improvement of the environment in the habitable areas; g) modeling of the optimum environment in the areas of new reclamation [24].

Owing to the influence of exogenous factors including geoecological, there are about 60% of all pathology of the person. From the positions of interrelation in the "ecology-health" system, the dynamics of the state of health and the features of pathology of the person are quite often considered as a functional element of one anthropological and ecological system [18,14]. This system is integrally connected with other systems, making technosphere space in its artificial and natural essence.

It is known that the air pollution share among the reasons of deterioration in health of the population makes 43-45%. The general diseases of the population of industrial centers are caused by about 20-30% of air pollution. This problem is relevant because disturbances of biospheric balance cause changes in the structure of disease incidence. In particular, there are changes of old "classical" forms of pathology, and at the same time the developing of new diseases, the so called "civilization diseases" is observed: allergic, toxic, radial, toxic and allergic. The number of diseases of upper airways, cardiovascular, psychological, oncological diseases grows [27].

Modern researches reveal the convincing connection between the indicators of environmental pollution and increase of frequency of diseases of a system of respiratory organs, digestion, skin, endocrine diseases, allergic processes and immunodeficiency; increase of number of complications of pregnancy, spontaneous abortions, congenital pathology, perinatal and child mortality, mortality from diseases of blood, liver, oncological diseases, etc. [1,15]. Environmental pollution accelerates aging of the population and reduces life expectancy. In general, the share contribution of the ecological component to the deterioration in health and development of the main pathologies makes 40-60% and above [7].

Thus, the modern geoecology, in connection with its cross-disciplinary character, is closely connected with the industries of knowledge having medical focus: medical ecology, geopathology, geographical pathology that can be added by the vertical approach in geoecology as the methodological strategy of the research in geoecology.

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