Geodynamic factors in the shaping of the environment for biological organisms in the Black Sea

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The ecological significance of the lithosphere as the foundation of the biosphere is defined, in particular, by the fact that its geological and geophysical character is significantly affected by tectonic and geodynamic factors (active faults, seismicity, modern crustal movements, etc.) that define aspects of sedimentation, chemical composition, environment, and energy structure. The effect of the lithosphere's unsteady geodynamic and astrogeophysical fields, as well as that of human technology on living organisms is particularly important and insufficiently studied.

Geodynamic anomalies of the lithosphere occur mainly over active deep faults. Geodynamic processes in fault zones are accompanied by the conversion of mechanical energy into electrical and electromagnetic energy.

In this case, the electromagnetic radiation is of impulsive character, manifested locally in the relaxation of the excited state of rocks. Areas with active deep faults are often accompanied by gas emanations and geochemical metal anomalies in modern sediments and waters, and these create natural areas of environmental disturbance for biological organisms.

The basic geophysical feature of deep tectonics in the northwestern Black Sea is its block structure, which is precisely displayed on a vertical seismic profile (Samsonov et al., 2001). In order to forecast processes of seismic activity and estimate the conditions of the geological system, research into the dynamic features of break zones is necessary to determine the conditions of their infrastructure in real time.

Tectonic processes and their result, a fractured zone, can be regarded as geological conditions from the standpoint of physics and mechanics (Khain and Mikhailov, 1985). Comprehensive use of methodological approaches from these disciplines allows almost full disclosure of the nature of the formation process and the dynamics of discontinuous structures (Nikolaev, 1988; Zonenshain et al., 1990). This circumstance necessitates the construction of a generalizing theory for monitoring the stress-strain state of the geological environment (Chepizhko, 1997). Such a theory must be capable of using information about the geological environment. Theoretical use of the geodynamic model should reflect the special features of the geological space, the details of its discreteness and continuity as a specific dynamic, general geological feature, and the evaluation of a range of spatial objects.

The study of deep geological structure, and in particular, detailed mapping of active deep faults, is a necessary and promising step in area environmental studies. It is very important to establish experimentally the energy activity of faults and fix their influence on biological organisms.

Tectonic and geodynamic factors are basic in eco-geological study, especially for the continental margins. These include the endogenous activity of the Earth, which is manifested in the ancient and modern faults and in the seismic activity of neotectonic and contemporary movements that define the topography of the continental margins, especially sedimentation, storage, and transit of the products of technogenesis. The state of the habitat of living organisms is due to the geology, tectonics, and geodynamics of the region. Especially important is the role of these factors in the formation of energy field anomalies that are harmful to biological organisms, including human health.

On the basis of modern ideas about the processes of structural formation in the lithosphere, one can argue that the evolution of fault zones has occurred cyclically (Zonenshain et al., 1990). Over relatively lengthy time intervals, stresses in destructive fields have increased monotonically, which has led to the formation of hot spots. Discharges accumulated at these sources of energy have led to the formation of new faults, often accompanied by catastrophic events. Immersion of the Black Sea basin

in Pliocene-Quaternary time contributed to the formation of the modern tectonic structure of the lithosphere in this region (Belov, 1981; Moroz et al., 1994).

Features of fault formation depend mainly on the structural and morphological, physical and mechanical parameters of the geological environment that are prone to failure, and that change the direction of their applied loads, their magnitude, and rate of application, as well as the evolution of the stress-strain state of the lithosphere. A defining feature of this dynamic structuring in major tectonic zones is its unevenness, which manifests itself even within a constant tectonic regime. A striking example of dynamic systems is the modern neotectonic movement of the Earth's surface. These processes are global, since we are talking about the surface of the Earth as a planet, and they take place continuously through time. Their nature is connected with the forces that balance the Earth's mass, in accordance with the dynamic equilibrium of the planet. The average rate of vertical tectonic movement in the northwestern shelf of the Black Sea in the Pleistocene-Holocene was uneven in some areas: from 0.1 to 1.0 mm/year.

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