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**Crimea's biogenic soils and related environmental problems**

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Аннотация:

Происхождение биогенных грунтов или биолитов связано с жизнедеятельностью биоты на Земле [1], роль которой в этом глобальном процессе и формировании биосферы еще не до конца определена. Соответственно сами биолиты в научных кругах рассматриваются, как отдельный тип осадочных горных пород редко. Им придают весьма малое значение. В связи с чем, актуальной является проблема изучения и систематизирования биолитов, а также – оценки их влияния на окружающую среду. Главная цель данной статьи – показать, что ошибочно отводить биогенным грунтам столь малую роль в истории формирования Земли, значимости для человека и, что не менее важно, их влиянию на экологическую обстановку и различные экосистемы. В качестве примера будут рассмотрены биолиты Крыма и их вклад в экологические функции литосферы (ЭФЛ).

Annotation:

The origin of biogenic soils or bioliths is associated with the activity of biota on Earth [1], whose role in this global process and the formation of the biosphere do not define normally yet. Accordingly, bioliths are considered in scientific circles, as a separate type of sedimentary rocks, very rare. Scientists attach them little importance. Due to, the problem of studying and systematizing bioliths, as well as assessing their impact on the environment, is relevant. The main goal of this article is to show that it is wrong to divert biogenic soils such tiny role in the history of Earth formation, since their influence on the ecological situation and various ecosystems. As examples, the bioliths of Crimea and their contribution to the ecological functions of the lithosphere (EFL) will be considered.

## **1. Introduction**

Biogenic soils or bioliths, as components of ecosystems, are one of the most widely spread among sedimentary rocks. In the geological history of the Earth, they were formed almost simultaneously with the formation of the biosphere, and their volume and diversity increased with the evolution of the biosphere [1,2,3,7]. It should be added that biogenic soils are the most important component of many ecological-geological systems and ecosystems as a whole. They have a number of specific properties that are not peculiar to other types of soils, due to their biogenic genesis. Bioliths have been the subject of study by lithologists, soil scientists, oil workers, mineral experts and ecogeologists for a long time, but not so seriously.

## **2. Sistematization**

Formed in different geological epochs, they are provided to the specificity of paleo-ecosystems during their formation, and also reflect successive postgenetic changes. Based on a genetic approach to the study of soils, biogenic soils can be divided into three types [5]: 1) "biogenic-post-mortal soils" - biogenic soils formed from animal, plant and microorganism remains; 2) "biogenic-formed soils" - syngenetic organogenic soils, formed or created by living micro- and macro-organisms; 3) "biogenically transformed soils" - epigenetic soils formed due to the influence of micro- and macro-organisms on other types of primary sedimentary, igneous and metamorphic rocks because of their biogenic epigenesis and other transformation processes (humification, etc.). It is important to add that the above systematization [5] covers only non-frozen biogenic soils, while bioliths are widely distributed among frozen soils. This point appeal us to research frozen biogenic soils in the future. In Crimea there are soils of all these written three types.

### **2.1 Biogenic-postmortem soils**

Biogenic-postmortem soils in the Crimea are widely represented mainly by organogenic carbonate and partly siliceous rocks and caustobioliths (oil, coal). Among carbonate rocks, brya limestones dominate here (P<sub>1d</sub>, the inner ridge of the foothills in the area from the town of Inkerman to the Alma river), nummulite limestones (P<sub>2l</sub>, the area of Simferopol and Belogorsk), shell limestones (N<sub>1s</sub>, 3rd ridge of the Crimea mountains, Evpatoria region), fluxing limestones (J<sub>3</sub>, Kerch Peninsula and the Main Ridge of the Crimean Mountains).

Organo-mineral post-mortem bioliths are represented by organic silts (Q<sub>IV</sub>, Rotten Sea, Lake Sivash), whose thickness is sometimes large (up to 5–15 m), and its significance is not less than of others representatives of biogenic soils.

Among caustobioliths, there are insignificant reserves of oil (the Kerch Peninsula) and coal (Balaklava, the upper reaches of the Kachi River), and an industrial natural gas deposit is located here (P<sub>3</sub>, Arabatskaya Strelka). Peat reserves in the Crimea are rather slight, since swamps on the peninsula are developed only locally (Q<sub>IV</sub>, okrug. Theodosia, Balaclava, etc.).

### **2.2 Biogenically-formed soils**

Biogenically-formed soils in the Crimea are represented by stromatolites, phytogenic bioherms, reef limestone, etc. Stromatolites (N<sub>1</sub>) are found on the Kerch Peninsula. Reef limestones (J<sub>3</sub>km-tt) are common on the Main Ridge of the Crimean Mountains. In the Crimea, there are small deposits of guano (Q<sub>IV</sub>). This type of biogenic soils is quite rare, and is observed only in some caves (for example, on the Chatyrdag plateau).

### **2.3 Biogenically transformed soils**

Biogenically transformed soils are represented on the Crimean peninsula by various types of soil, as well as rocks biogenically weathered by lichens, plants and animals. In Crimea, there are 22 types of soil [4]. The most widespread are chernozems and dark chestnut (flat Crimea), brown mountain forest, and on the summit (jaylah) mountain-steppe and mountain meadow chernozem-shaped (mountain Crimea), brown (southern and south-western coast of Crimea) soil. Biogenic weathered soils in the Crimea are represented in the weathering crust and have a local distribution, mainly in areas of the first weathering stages of soils by lichens and plants. In addition, biogenic-weathered sandstones (K<sub>1v-g</sub>, School pit) are also common in Crimea. Besides to the direct impact of living organisms on the rocks (traces of crabs and silt-eaters, burrows of sand wasps, etc.), abundant fauna (ammonites, belemnites, etc.) is found in these soils too.

### **3.1 Ecological functions of biolithes in lithosphere**

Ecological and geological features of biogenic soils are associated with their specific contribution to EFL [5]: resource, geodynamic, geochemical, and geophysical.

The most pronounced one is resource EFL of biogenic soils: many of them are used by people as fossil stores (construction, fuel, fertilizer, etc.). Geodynamic EFL of biogenic soils of the Crimea is due to the peculiarities of the development with their participation of various geodynamic processes, primarily exogenous: karst, landslides, erosion, biogenic weathering, etc. The geochemical EFL of biogenic soils is expressed here by the wide development among them of carbonate differences and the formation of carbonate geochemical barriers, which largely determine the geochemical migration of elements in the upper horizons of the lithosphere, as well as numerous protective barriers against technogenic acid pollutants. The geophysical EFL of biogenic soils of the Crimea has not been studied enough. It is mainly presented by the characteristics of natural radioactive fields in biogenic carbonate soils.

#### **4. Related with biogenic soils environmental problems**

Ecological problems affect many aspects of biogenic soils. First, the excessive and unreasonable use of biolith resources depletes the earth and also has a detrimental effect on the local animal ecosystems. But this applies to all soils in general. Secondly, with different geodynamic processes, for example, abrupt destruction and biolith creeps, people can suffer great material damage. We should also not forget about the possibility of soil clearing during the construction of new facilities. These circumstances in their global manifestation can increase into environmental disasters. Thirdly, we cannot say about soil pollution. All waste in the form of sewage discharges, garbage, industrial waste is often not recycled, but simply deposited in the ground. It pollutes the environment and also spoils the peaceful existence of the surrounding flora and fauna. Moreover, it can be said that most of the associated with biogenic soils environmental problems are created by people himself.

#### **5. Conclusion**

Thus, the bioliths of the Crimea are widely distributed on the peninsula. They play a major role in ecological-geological systems, ensure the implementation of the ecological functions of the lithosphere, and are closely related to various current environmental problems which should be solved in the near future.

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