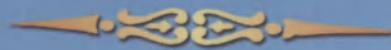


# ОСТРІВ ЗМІЇНИЙ



Абіотичні характеристики



## Summary

The main part of the monograph contains generalised data on the state of the Zmiinyi Island ecosystem collected by the researchers of Odessa National I. I. Mechnikov University. The main attention was dedicated to the analyses of abiotic characteristics (physical & chemical, meteorological and climatic, atmospheric & chemical and optical, geological and soil). The monograph is dedicated to the matters of unique geological structure of the island, soil forming processes, certain properties of atmosphere over the island, i. e. focused at the studies of the island ecosystem's abiotic component peculiarities. Besides, the monograph is considering promising uses of the island to conduct astronomic observations.

As the result of the studies the following results and conclusions were achieved:

1. Historical materials available on the main physical and geographical characteristics of the island are generalized and analysed. It is shown that as the result of imprecise data inaccurate figures are often used in the literature and by the media. Using the results of authors' observations and the official information the precise data were collected and presented, part of them were collected using recent space images.

2. Peculiarities of geological construction of the island were considered based on the historical researches. It is shown that the main rocks the island is comprising belong to the Palaeozoic and Cainozoic periods. Stratigraphic and lithological characteristics of the island are given. It is proved that the depth of the island in general is flysch-like with interchanging thick layers of significantly changed conglomerate-breccia with the layers of conglomerates and, more rarely — sandstone and clay. Studies of grain size and mineralogical composition of clays and aleurites have shown that the clay fraction consists of montmorillonite with some hydrobiotitic and ferruginous minerals and the aleurite fraction comprises layers and partings in the thickness of silicite rocks. At that the aleurite fraction consists of quartz, feldspar, chalcedony and biotite grains, Presence of singular isotropic inclusions consisting of opal or rock glass was also established. Revealed was rather unexpected for the sedimentary rock spectral analyses result which showed abnormally high content of chalcophylic group of elements. This fact, as well as the rock glass presence and thermal inertness of the rocks are the evidences of volcanogenic

& sedimentary origin of the rocks comprising the island. The results of coastal processes studies are shown. Perspective tasks of the next geological studies of the island rocks are formulated.

3. According to the results of soil conditions and state studies the on the island carried out for the first time, it is shown that unique process of specific sod soil forming are going on there under the conditions of permanent aerial input of salts on the island from the adjacent water area. Morphology of soils is studied. The main characteristic features of the soils are their noncarbonated and rubbly character and their weak structure. Black soils of the island were diagnosed according to thickness of their humus horizon as incompletely developed and short profile. It is shown that the lithological profile of soils on the island is completely inherited from the source thickness of rock & broken stone eluvium of dense rocks. Revealed are the specific peculiarities of the soils: a) superfine particles are in free (uncoagulated) state and form only an insignificant part of microaggregates; b) humus particles in the soils are practically not connected with mineral basis; c) humus content in the upper horizons makes 9–7 %, which is significantly more than its content in the zonal black soils on this latitude. At that, humic acids prevail in the humus; d) provision of the soils with nitrogen and potassium compounds is high, while provision with phosphorus compounds is very high. Based on the studies the conclusion is made that there are no other similar soil-forming processes taking place in Ukraine.

4. Climatic and meteorological conditions under which the island ecosystem exists and functions are described. Detailed analyses of daily meteorological observations' results are made year after year. Result of the analyses show that seasonal changes are characteristic of practically all the meteorological parameters.

Their average, minimum and maximum values are given. Compared are air temperature data received on the island and the sequences of air temperature data from the Ust-Dunaisk meteorological station, as the result of which it is shown that simultaneous seasonal changes and positive trends are observed at both measuring sites, but the average annual air temperature values on the Zmiinyi Island are 1– 1,5 °C higher than at the Ust-Dunaisk station. Simultaneous decrease in the amounts of atmospheric precipitation was also observed. This means that according to all the observation data for a number of recent years the climate of the area became somewhat dryer. Revealed is the significant influence of orographic peculiarities of the island on formation of wind regime in different parts of the island. It is shown that the current observation point of the State Hydro-Meteorological Service of Ukraine is

not representative as for wind speed and wind direction, and does not provide objective information; hence there is a need for more sound selection of meteorological site location on the island. Characteristics of radiation regime of the island are studied. The results show that the accessible potential of solar energy on the Zmiinyi Island makes 1337 kW-month/m which exceeds the potential of city Odessa and town Bolgrad. Based on the above, the recommendation was made to develop solar energetics on the island. Using the historical data available an attempt was made to assess the trends of climatic changes in the Zmiinyi Island area. The results showed that during recent years the trends of wind speed and relative humidity decrease were observed, as well as the positive trends of air temperature and amount of atmospheric precipitation increase, which was the evidence of global climatic changes' influence on the north-western part of the Black Sea.

5. As the result of atmospheric chemistry studies the data on chemical composition of atmospheric precipitation and depositions to the surface of the Zmiinyi Island were received for the first time, first of all on nutrient nitrogen and phosphorus containing compounds transported from the European Continent to the north-western Black Sea water area. Concentrations of many ions in atmospheric precipitation and depositions are assessed, as well as their flows to the surface of the island with wet and dry depositions. It is shown that in 2003–2007 intensity of total deposition of nitrate and sulphate to the island surface increased 1.9 and 2.6 times respectively compared to the values in 1990–1992. Revealed are the trends of chloride, sulphate and bromide concentrations increase in atmospheric precipitation. Assessment of average annual values of nitrogen and phosphorus compounds' total atmospheric flows in the Zmiinyi Island area was made for the first time. They totalled to 405; 1.76; 243; 41.5 and 1225 kg/(km<sup>2</sup>\*year) of ammonium, nitrite, nitrate (in nitrogen equivalent), phosphate (in phosphorus equivalent) and sulphate (in sulphur equivalent) respectively. It is proposed to expand the current programme of atmosphere monitoring at the account of additional observations of aerosols and gases chemical composition.

6. Astronomical studies were carried out on the Zmiinyi Island for the first time, which gave us essentially new information about meteor streams and optical properties of the upper layers of atmosphere over the Black Sea. Regime of meteor patrolling of the main meteor streams was implemented and basic meteors registered. A meteor flow unknown before was registered in July 2007. Results of day, twilight and night airglow spectra monitoring are presented. It is planned to study their following characteristics: transparency, chemical composition, altitude distribution of separate atmo-



spheric components. Proposal to organise a permanent station to observe meteor streams and atmosphere optical properties on the Zmiinyi Island is grounded.

To conclude, it is worthwhile to point out that there are unique abiotic conditions formed on the Zmiinyi Island that require care and protection. First of all, there is a need for severe restriction of all economic activities that could damage the geological structure and the coastline, as well as the soil cover formed on the island. Besides, there is a need for more active studies and integrated monitoring system improvement, first of all towards perfection of the system of hydro-meteorological, atmospheric chemistry and astronomical measurements and observations. This is especially about more representative choice of meteorological site location, expanding the list of atmospheric chemistry parameters measured and establishing of permanent astronomical observation station on the island. Besides, the compulsory element of the long-term changes in abiotic factors monitoring should be the continued regular observations of changes in the state of coastline and soil cover, which will take place under the economic infrastructure development conditions, as the development is ever intensive on the island in the recent years.