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The Biogeochemical Principles of Vernadsky as the Basis for a New Field of Science – Biospherics

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The use of the biogeochemical principles of V.I. Vernadsky for quantitative description of life development are discussed in the paper. Two examples were examined. First the so-called «Darwin – Vernadsky paradox» connected with the complicated hierarchical structure of ecosystems and the biosphere. The second example is connected with the more qualitative than quantitative character of Vernadsky's biogeochemical principles of the biosphere and ecosystems development. Quantitative criteria to evaluate the development of multi-organismic systems need to account for energy fluxes and their use in biosystems of different hierarchical levels. Some energy criteria (principles) were presented and analyzed: EPED – Energy Principle of Extensive Development; EPID – Energy Principle of Intensive Development; MUC – Main Universal (generalized) Criterion. The two first principles are mainly connected with the behavior (development and evolution) of multi-organismic systems, belonging to the lower levels of bio-hierarchy, population/community levels. The third functional principle – MUC – deals with the behavior of more complicated multi-organismic systems of the higher levels of bio-hierarchy, including ecosystems, biomes and the biosphere as a whole. The main characteristics of Biospherics as a new field of natural science are presented and discussed: 1) to create working models of the Earth's biosphere and its ecosystems; 2) to create artificial biospheres for human life support beyond the limits of the Earth's biosphere; 3) to create ground-based life-support systems that provide a high quality of life in the extreme conditions of the Earth's biosphere; 4) to use artificial ecological systems to offer the prospects of developing technologies for the solution of pollution problems.

Key words: Biosphere, Vernadsky, Biospherics, energy

1. Introduction

Extensive studies of the biosphere were done by Russian academician, Vladimir Vernadsky, during the first half of the 20th century. He developed and used «empirical generalizations» based on myriad observations of different researchers, along with his own comparisons and reflections (Vernadsky, 1926, 1929, 1986, 1989, 2004). But his generalized

biogeochemical principles of biosphere and ecosystem development have a more qualitative than quantitative nature. To quantify Vernadsky's «empirical generalizations» for the evaluation of ecosystems and biosphere development, it is necessary to take into account energy fluxes and their use in multi-organismic systems of different hierarchical levels. (Pechurkin, 2005; Pechurkin, Shirobokova, 2001; 2003). Biological

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