

VLADIMIR VERNADSKY: TWO WAYS OF SYNTHESISING THE UNIVERSE

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Vladimir Vernadsky did not care for hair way he looked. He was constantly absorbed in scientific and philosophical quest.

And at once our imagination conjures up the figure of a nice and somewhat eccentric professor of the 19th century, an absent-minded scholar who was always somewhere else, entirely styles or thought, divorced from our tough, businesslike, fast-moving "computer" epoch. Indeed, Vernadsky combined many features of the Russian intellectual of the days of Leo Tolstoy, Anton Chekhov and Fedor Dostoyevsky (It is indicative that in a conversation with Leo Tolstoy about the essence of life and immortality of the soul, the young Vernadsky expressed ideas which the writer thought were close to mysticism and not science). In addition, Vernadsky took up many, things at once, working at the same time on more than a dozen highly complex scientific problems—The trait of an unpractical man.

But the image of the scientist has remained in the history of science as that of a scientist of the future. And his scientific and philosophical insights to this day remain keen, topical and promising.

The range of his scientific interests was extremely wide: the dynamics of minerals and planetary cycles of matter; space time and symmetry (he was the first to advance the idea of a possible disturbance of symmetry in the microcosm); the terrestrial and cosmic essence of life; the place of the human being and reason on our planet and in the Universe. He was the first to grasp and show the unity of living and non-living matter, of terrestrial and cosmic elements in the biosphere— a unique side of life. In order to complete the list, I might add that he specialized in mineralogy, crystallography, soil science, general geology, geochemistry, radio geology, biogeochemistry, hydrogeology, meteoritics, theory of knowledge, the history of science ... The list is not complete. And the most important thing is that in each of these areas he made a fresh contribution, and even founded some of them. He was a major organizer. He set up (and was the first to head) the Ukrainian Academy of Sciences and about a score (!) of scientific commissions and institutes.

Sometimes he is described as an encyclopaedist of the 20th century. This is perhaps true, but all too general. After all he was a natural scientist first and foremost, a geologist and then a historian. But the history of society and science is part of the history of the Earth's environment. And even our thoughts are not just personal or social property, but the product of evolution of the terrestrial environment, of the biosphere—so said Vernadsky. He studied humanity as a special geological (cosmic) force transforming the domain of life. He attached particular

importance to the spiritual life of people. One of his works has an indicative title: "Scientific Thought as a Planetary Phenomenon".

His philosophy of science turned out to be so unexpected for specialists that they still have not understood and appreciated the novelty of Vernadsky's concepts.

Alas, such is the fate of nearly all of his boldest scientific insights.

With ease and determination, he tore off all fetters constraining theories and methods, scientific subjects and possibilities of scientific endeavor. With amazing skill he synthesized knowledge. He sought truth as a green shoot seeks the sun. He was irresistibly attracted to cognition of nature, not to formalized scientific activities.

In the work of Vernadsky there is one central core, the basic concept. It is his teaching on the biosphere. In our time this teaching looks almost trivial, but before the 1920s there was no theory concerning the biosphere. Vernadsky developed it gradually and gave it final shape in the mid-20s, reading lectures on geochemistry at the Sorbonne.

The biosphere of an all-planetary area where air, water, rocks, living organisms and radiant energy of the sun interact between themselves. A special role here is played by the community of organisms—living substance. This substance is the product of terrestrial nature and at the same time—as a great geochemical force—creates the face of the Earth, transforming the atmosphere, natural waters, and the Earth's crust. The continuer of this global activity is Homo sapiens equipped with technology.

In astronomical or rather astrophysical terms, our planet is a tiny part of the gigantic and smoothly operating mechanism of the Galaxy, which in turn constitutes the smallest "screw" in the Universe (Metagalaxy). In the grandiose cosmic vortices the infinitesimal speck of the Earth is lost. And the whole of mankind residing on this speck of matter is just an infinitely small magnitude. There is nothing to say about the fleeting life of one human being after this.

For Vernadsky the tiny inhabited space islet was dear and infinitely close to his heart. Not a screw in a super-mechanism, but the organism of a super-organism—that was how Vernadsky visualized living matter. And he compared the entire domain of life—the biosphere—not to a mechanism, but to an organism: "There always are scientists who keenly feel and encompass this living and real nature of our planet, all vibrant with the eternal beating of life, for whom this understanding of unified Nature is the thread running through all their scientific work," wrote Vernadsky.

For him a model of the Universe was not clockwork, but a living organism, not the mechanism of the solar system, but the organism of the biosphere.

Man explores the Universe indirectly, by means of instruments (space technology) and using very few parameters (mass, distance, radiation intensity, average content of chemical elements...). "In effect," wrote Vernadsky, "this world of the Universe gives us quite an alien and indifferent impression and probably represents a scheme far from reality even when we turn it into a sort of chaos of irregularly moving parts or on the contrary into a kind of machine regulated by some kind of world wisdom."

Such are two ways of synthesizing the Universe according to Vernadsky: the mechanical and the organic. On the one hand, it is an utterly ordered, mathematical and simplified world. On the other, it is a living world, inexhaustibly complex, not reducible to geometric schemes and physical formulas, or to mechanical models. Natural scientists, stressed Vernadsky, "Were little influenced in their work by a physical world outlook and as little by philosophical simplifications of the Universe or mystical ideas about it."

He understood that physical-mathematical models, which simplify nature, did exist. But he believed that with time the outlook of natural scientists would prevail. But unfortunately we are still far from the "organic synthesis of the Universe." We continue along a different road from the one blazed by Vernadsky.

It may seem that this world outlook issue is too abstract and general, and therefore not applicable to specific problems of science or practice. This impression, however, is deceptive.

Of course, nowadays the ideas of subjugating nature are not popular: we see too plainly the ecological crisis of the society moving along this theoretical path. But the mechanical synthesis of the Universe still continues to determine the main features of the scientific world outlook, the style of modern science, or, in the words of Thomas Kuhn, an American philosopher and historian of science, the paradigm of contemporary natural science. Isn't that the reason why we are still unable to create a system of rational nature management that does not do irreparable damage to the environment? In other words, we are still unable to "incorporate" our technical civilization into the biosphere.

Or take another example of now popular scientific views that run counter to the "organic synthesis of the Cosmos": global tectonics of platforms. This hypothesis (theory) is now widespread. In essence it is simple. The Earth's entire crust (or rather the lithosphere) represents a mechanical system of gigantic platforms like the ice shield covering the surface of the Arctic Ocean. The platforms are in themselves inert. They are moved by the energy of the planet's deep interior (according to one of the variants, by gravitational effects from outside), by the flow of the super dense matter of the mantle. These platforms collide with each other, get warped, slide over or move away from each other, and are involved in deep-seated mantle eddies.

Now let us recall how Vernadsky visualized the dynamics and driving forces of the lithosphere: "There is no large-scale chemical balance in the Earth's crust, in which one could not perceive the fundamental effect of life, which leaves it indelible imprint on the entire chemistry of the Earth's crust. Life ... is most intimately linked with the structure of the Earth's crust, forms part of its mechanism and performs in this mechanism the most important functions, without which this mechanism could not exist." In his opinion, organisms introduce "radiant solar energy into the physico-chemical processes in the Earth's crust."

Proceeding from this assumption, Vernadsky believed that the Earth's interior was inert so that "deep-lying layers of the planet—below 1,000 km— ... in no way manifest themselves in any geological phenomena whatsoever."

Lastly, in his works Vernadsky emphasized one fundamental trait of the Earth's face: dissymmetry (steady violation of the symmetry typical of living organisms alone). It expresses itself in the existence of a predominantly oceanic hemisphere (the Pacific Ocean and its environment) and of a continental one. This external difference between the hemispheres is intensified by the existence of two types of crust: the continental, with its thick layers of sedimentary and so-called "granite-like" layers, and the oceanic, a relatively thin one, with a small sedimentary cover and without a "granite" section. This dissymmetry is unusually stable and has been in existence for more than a billion years.

It is quite apparent that the present variants of the tectonics of lithospheric platforms leave no room for the "highly important function" of living organisms and effects of the sun's radiant energy. Also, the dissymmetry of the Earth's crust was not expected to be of substantial significance to the mechanically moving platforms of the lithosphere, which are in constant motion, mixing with lower layers and becoming homogeneous in composition and structure; one wonders why the continental and oceanic types of crust have existed for so long (and even developed so differently).

To sum up: we have here a glaring contradiction between Vernadsky's teaching on the biosphere and popular geophysical theory. In this case it is worthwhile recalling his theory of knowledge. He believed that empirical generalizations of facts underlie the natural sciences: "their coincidence with our scientific conceptions of nature does not interest us; their contradiction of them constitutes a SCIENTIFIC DISCOVERY."

Both the teaching on the biosphere and the concept of dissymmetry of the Earth's crust are examples of empirical generalizations. Platform tectonics is a theory. Consequently, the contradiction we have established may be an earnest scientific discovery. Theoretical constructions of present-day geophysicists, judging by everything, need a substantial re-thinking from innovative (if old) positions of Vernadsky...

A lot will change in our views on the surrounding environment, society and the human personality, on the essence of our being, when there is a transition from a mechanical to an organic synthesis of the Universe. Only then will we be able to establish scientific foundations of interaction between technical civilization and the biosphere. Such a harmonious unity of society, the individual and nature was called by Vernadsky the noösphere—the sphere of reason. Will such an organic unity-come of itself? Is the noösphere destined to triumph?

No, nothing of the kind will occur automatically. Today even the most prosperous countries are openly or not so openly destroying the natural environment, the biosphere. And at the same time, related to this, there continues the process of "technicalization" of the human personality. Scientific and technological progress has become practically a magic "satisfier of material requirements," and also a supplier of "mechanical amusements", the basis of mass technogenic culture.

The impression is gathered that humanity is involuntarily creating on Earth a sort of "anti-biosphere" (technosphere), built on the principle of a mechanism and accordingly changing the spiritual world of man. What can be set in opposition to this spontaneous process?

In search of the answer to this question we must again turn to Vernadsky, and not so much to his ideas, as to the experience of his life, to his personality.

Someone may sigh: but then he was a genius, while we are ordinary mortals; he was an academician, a great thinker, an unusual erudite who combined the best features of the Russian intellectual of the 19th century and the scientist of the 20th century, a remarkable representative not only of Russian but also of European culture.

But the deeper we delve into his biography, the clearer it becomes that he did not possess any extraordinary "genetic" qualities. He was never a child prodigy. His scientific successes came to him as a result of a painstaking and dedicated search for truth. It is indicative that even in his youth, he often complained that he was not very gifted, and made nearly all his scientific discoveries on the wrong side of forty.

Incidentally, he never was able to finish most of his major scientific undertakings: a history of the minerals of the Earth's crust, a theory of crystallography, an "attempt at descriptive mineralogy", teachings on the biosphere and noösphere, a history of scientific thought as a planetary phenomenon ... What was that? An expression of scattered interests or poor organization of scientific work? No. He was always punctual, and kept his books, papers, and records in complete order, making detailed files.

Here is another seemingly paradoxical character trait. He was among the first to speak about the responsibility of scientists for their research, which could be used for anti-humane purposes. He also did more than anyone else to develop Soviet atomic weapons (stimulating the prospecting for radioactive raw materials and investigation of radioactivity long before the Second World War). Was it a contradiction? He knew about corresponding research abroad and feared that a monopoly on nuclear weapons might lead to a catastrophe. Also, he was confident that the Soviet Union would never be the first to use these terrible weapons.

He lived an honest life. He was a courageous and kind man (although he had a lot of difficulties and troubles). He loved his country, respected human dignity and believed in reason, conscience, and beauty. He was a handsome, harmonious and normal person!

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