The Smith of the Gods

25 - « Historical Materialism brings us the keys of the equation. Think Global and live Local! »

250- In 1926, with Vladimir Vernadsky, we can properly speak of an “ insight ”, a magnificent insight, that of a blue planet lost in the universe, the sole abode of life known until now. We know this vision: it is the superb original cover of the “ Whole Earth Catalog ” of 1975, under the impetus of Stewart Brand and recounted by Fred Turner, showing us on the front page the first satellite photo of our blue planet. Vernadsky is the inventor of the biosphere. Before Vernadsky, the word biosphere had been created by the Austrian geologist Eduard Suess, author of the work “ The Face of the Earth ”, published in Vienna between 1883 and 1900. But it is to Vernadsky that we owe, in the years 1925, the invention and the definition of the concept in its modern sense. The biogenic principles were brought to light for the first time by Lavoisier in 1789: “ Animals nourish themselves either on plants or on other animals, themselves nourished by plants. Finally, putrefaction and combustion restore perpetually to the air and to the mineral kingdom the principles that plants and animals have borrowed from them. By what processes does Nature accomplish this marvellous circulation between the three kingdoms? ”. This question opens the door to the study of biogeochemistry. The concept of the biosphere introduced by Vernadsky has the merit of taking into consideration the reciprocal interactions uniting living beings, their terrestrial environment and the flows of energy coming from the cosmos and, essentially, from our solar star. Vernadsky relies for this on results established in disciplines as varied as geology, chemistry, biology, thermodynamics, etc., but in a transdisciplinary vision which conceptually unifies them. Vernadsky is the cantor of the global spirit. He develops for us the idea and the elements of a meta-ecology still to be established. Thus, he explains to us that we are undergoing a new geological change bringing us into the period of the “ Anthropocene ”, constitutive of the psychozoic era of the burrowing animals, that is to say of the era of the noosphere. This vision, inherited from Teilhardian metaphysics and from the long discussions of the years 1925 with the Bergsonian philosophers, allows the reintroduction into ecological reflection of the role of living beings in their own environment and that of a new ecological actor: the human species.

251- Silvano Tagliagambe compares the Vernadskian spheres and the cosmos to the relation maintained by the figures and the background in the work of the painter M.C. Escher. In both cases it is a representation of communities where each subject conquers its autonomy only insofar as it remains an element of the background, that is to say of the cosmos itself. The structure of the biosphere receives, as a consequence of cosmic radiations, new, singular properties, unknown for the original terrestrial matter. The face of the Earth which corresponds to it in the cosmic medium reveals there a new picture of the terrestrial surface, a surface transformed by cosmic forces. It is the biosphere; it can, by its essence, be considered as a region of the terrestrial crust, occupied by transformers which change cosmic radiations

into active terrestrial energy: electrical, chemical, mechanical, thermal energy, etc. The cosmic radiations which spring from all the celestial bodies embrace the biosphere, penetrate it from all sides, as well as everything found there. Thus, the ocean, by reason of the thermal properties of water, specific properties determined by the character of the molecules, fulfils the role of heat regulator, an important role which makes itself felt at every step in the innumerable phenomena of climate, of seasons, of the processes of life and of the superficial alteration linked to them. The ocean warms up quickly by reason of its great specific heat, but only slowly restores the accumulated heat by reason of its weak thermal conductivity. It transforms the absorbed radiant heat into molecular energy through evaporation, into chemical energy through the living matter which penetrates it, into mechanical energy through its breakers and its marine currents.

252- The thermal role of rivers, of meteors, of air masses, of their warming and their cooling is a spring of an analogous scale. The ultraviolet and infrared rays exert only an indirect influence on the chemical processes of the biosphere. It is not in them that reside the essential sources of its energy. It is the whole of the living organisms of the Earth, living matter, which transforms the radiant energy of the sun into the chemical energy of the biosphere. Living matter creates in the biosphere, through photosynthesis, through the rays of the sun, an infinite number of new chemical compounds, millions of different combinations of atoms. Living matter incessantly covers the biosphere with inconceivable speed (up to 330 metres per second for certain phenomena, that is to say the speed of sound) with a thick layer of new molecular systems, easily giving new compounds, rich in free energy in the thermodynamic field of the biosphere. These compounds are unstable and convert themselves ceaselessly into new forms of stable equilibrium. These sheets of bacteria and plankton are graded into layers in the ocean at regular depths by their own metabolisms and present aspects of different colours, regularly harmonized to form a harmony from the surface green to the quinacridone of the great depths, passing through the cyanolite blue, the ferric yellow and the pyrimidine red, constituting in fact a lamellar process of interferential imagery as in the iridescences of hydrocarbons, reflecting at the level of cosmic space a quasi-instantaneous but interferential image of its internal state.

The same distribution of life existed in the hydrosphere across all the geological periods, and the manifestation of life in planetary chemistry during these times has always been the same. The same vital pellicles, of plankton and of the bottom (forming the plates of an oxydo-reduction process of a bioelectrical energy pile), as well as the same vital concentrations, have existed across all the geological periods, forming part of the same biochemical apparatus which has functioned incessantly for hundreds of millions of years. There is invariability of the quantity of vital protoplasmic formations in the biosphere in the course of geological times. Living matter can be considered as an appendix of the atmosphere. During its life it builds the body of organisms from the gases oxygen, carbonic acid, water, compounds of nitrogen and sulphur; it converts these gases into fuels, liquids and solids, amassing in this form the cosmic energy of the sun. After its death and during the vital cycle, during the gaseous exchange, it restores to the atmosphere the same gaseous elements.

253- The change of the rhythm of the multiplication of living matter is characteristic, constant and distinct for each organism; it repeats itself year after year with the immutable precision proper to all phenomena proceeding from cosmic causes. It is known that the multiplication of species is not in constant link with the range of the four octaves of the electromagnetic cosmic radiation that our planet absorbs, and that there exists in the surrounding universe a determined succession corresponding to these phenomena, whose order is linked by a close relation to the astronomical phenomena. This multiplication depends on the intensity of the light and of the heat of the sun, on the quantity of life, on the character of the environment. The intensity of the multiplication of organisms, specific to the species, is linked to the migration of atoms, which are all the more necessary to the life of the organism as they enter in greater number into its composition. The change provoked by the multiplication always takes place in a rhythmic way. This change corresponds to the oscillations of the vital environment which repeat themselves cyclically. These movements of the ocean, tides, changes of temperature, salinity of evaporation, intensity of the sunlight are all of cosmic origin. One and the same chemical apparatus has ceaselessly functioned in the biosphere across all geological times, driven by the uninterrupted current of the same radiant solar energy, an apparatus created and maintained in activity by living matter. This apparatus is composed of " determined vital concentrates " (the planet is constituted in concentric spherical layers), which, while transforming themselves ceaselessly, nevertheless occupy the same places in the terrestrial envelopes corresponding to the biosphere. These concentrates of life, vital pellicles and concentrations, form determined secondary subdivisions of the terrestrial envelopes. All in all, their concentric character is sustained, although they never cover with a single uninterrupted layer the whole surface of the planet. They constitute the chemically active regions of the planet; it is there that are concentrated very diverse stable static systems of dynamic equilibria of the terrestrial chemical elements. They are the regions where the radiant energy of the sun, which penetrates the whole globe, takes the form of free terrestrial chemical energy. Solar energy is transformed into terrestrial energy by different degrees for different chemical elements. The existence of these regions of the planet is linked on one hand to the energy that it receives from the sun, on the other hand to the properties of living matter, fulfilling the role of accumulator and of transformer of this energy into terrestrial chemical energy. The properties and the distributions of the chemical elements themselves play an important role there. Life is thus a powerful, permanent and continuous disturber of chemical inertia on the surface of our planet. In reality, not only does it create, through its colours, its forms, through the associations of plant and animal organisms, through the labour and the creative work of civilized humanity, the whole picture of the surrounding nature, but it penetrates the most profound and most grandiose chemical processes of the terrestrial crust. There is no great chemical equilibrium on the terrestrial crust where the influence of life does not manifest itself, marking all chemistry with its ineffaceable seal.

254- Thus, life is not an exterior or accidental phenomenon on the surface of the Earth. It is linked by a close bond to the structure of the terrestrial crust, forms part of its mechanism and fulfils there functions of first importance, necessary to the very existence of this mechanism

of which we form part. From the morphological point of view, the world of the living has become unrecognizable in the course of time. Its evolution has evidently had no sensible influence either on the quantity of living matter, or on its average chemical composition: Morphological evolution had to take place within determined frames, not hindering the manifestations of life in the chemical picture of the planet. Certain of the Precambrian layers have been less metamorphosed than those of the Cambrian era and of the more recent layers. The geologists thus admit a brusque change of the biogenic migration of the calcium atoms. It is the first phenomenon of this kind that we have been able to observe. This phenomenon, having had no repercussion on the geochemical history of phosphorus, calcium, magnesium, it is fitting to admit that prior to the creation of the metazoans endowed with skeletons, there had taken place at the same scale the formation of the very compounds of these elements thanks to the vital activity of the protists, among others of the bacteria; such a process still takes place today, but its role, formerly, must have been far more important and more universal. If these two phenomena, different from the point of view of geological times and of their mechanisms, have provoked the biogenic migration of the same atoms in identical mass, the morphological change, however important it may be, will have no repercussion on the geochemical history of calcium, of magnesium and of the parameter Pv (Pressure times Volume). The oxidizing environment of the pellicle of the bottom of the oceans manifests itself clearly in the history of many chemical elements other than oxygen, nitrogen or carbon. First of all, this environment completely changes the terrestrial history of calcium. It is very characteristic that calcium is the predominant metal in living matter. Its content probably exceeds one hundredth by weight of the average composition of living matter, and, in many organisms, principally marine, the calcium content exceeds 10 and even 20 per 100.

255- By this route, through the action of living matter, calcium separates itself in the biosphere from sodium, magnesium, potassium and iron, to which it can be compared by its abundance and with which it is found in common molecules throughout the raw matter of the terrestrial crust. Calcium is released through the vital processes of organisms in the form of carbonates and complex phosphates, more rarely of oxalates; it also maintains itself in this same slightly modified form in the vadose minerals of biochemical origin. In the aqueous basins one observes phenomena largely analogous to the pellicles and to the vital concentrations of the hydrosphere; one can distinguish there at a smaller scale the vital pellicle of the plankton, that of the bottom, and the littoral vital concentrations.

• One observes there not only the processes proper to the oxygenated environment, but also chemical reactions in a reducing environment.

• Finally, the emigration of chemical elements out of the vital cycle plays an important role there, as well as the formation of solid products, later entering into the composition of the sedimentary rocks of the terrestrial crust. It seems that the process of the release of solid bodies in the biosphere is, as in the hydrosphere, linked to the phenomena of the reducing environment, to the rapid combination of free oxygen and, lastly, to the disappearance not only of the aerobic life of the protists, but also of their anaerobic life. The species is usually

considered in biology from the geometrical point of view; form, morphological characters occupy the first place there. In the biogeochemical phenomena, on the contrary, that place is reserved for number, and the species is considered from the arithmetical point of view. Different species of animals and plants must, like chemical phenomena and physico-chemical systems, be characterized and determined in geochemistry by numerical constants. The morphological indices noted by the ecologists and the biologists which are necessary for the determination of the species are replaced in the practices of the geochemists by constants.

256- In the biogeochemical processes, it is indispensable to take into consideration the following numerical constants: the average weight of the organism, its average elementary chemical composition and the average geochemical energy proper to it, that is to say its faculty of producing displacements, in other words " the migration " of the chemical elements in the vital environment. In the biogeochemical processes, it is matter and energy which are in the foreground instead of the form inherent to the species. From this point of view, the species can be considered as a matter analogous to the other matters of the terrestrial crust, like the waters, the minerals and the rocks, which, together with the organisms, are the object of the biogeochemical processes. Seen from this angle, the species of the biologist can be envisaged as a homogeneous living entity, characterized by the mass, the elementary chemical composition and the geochemical energy. The homogeneous living matter of the geochemist and the species of the biologist are identical, but the modes of expression are different. The biosphere, in its fundamental traits, has not changed in the course of the geological epochs since the " Archean " archeozoic era, consequently for at least two billion of the four and a half billion years that the Earth counts. There exist several absolutely diverse forms of biogenic migration. On one hand, the biogenic migration linked genetically and in the most intimate way to the matter of the living organism, to its existence. Cuvier gave a precise and just definition of the living organism during its life, as of an incessant current of a whirlwind of atoms which comes from the outside and returns there. The organism lives as long as the current of atoms subsists. This current embraces the whole matter of the organism. Every organism, by itself or all the organisms together, creates continually, through respiration, nutrition, internal metabolism, reproduction, a biogenic current of atoms, which builds and maintains living matter. In short, this is the essential and principal form of biogenic migration, whose numerical importance is determined by the mass of living matter existing at a given moment on our planet. Biogenic migration does not depend directly on the mass of living matter. It depends more on the quantity of free atoms than on the intensity of their movements in close relation with life. The biogenic migration will be all the more intense as the atoms circulate faster.

257- This migration can be very diverse, although the quantity of atoms embraced by life is identical. This is the second form of biogenic migration, in relation with the intensity of the biogenic current of atoms. There exists yet a third one. This third form begins to manifest itself in our " Psychozoic " era and takes an extraordinary importance in the history of our planet. It is the migration of atoms, provoked likewise by the organisms, but which is not linked genetically and immediately to the penetration or the passage of atoms through their

body. This biogenic migration is provoked by the development of technical activity. It is, for example, determined by the work of the burrowing animals, of which traces are found since the most ancient geological epochs, by the repercussion of the social life of the building animals, of termites, ants, beavers, humans. These equilibria, studied outside this influx of exterior energy, are mechanical systems which necessarily arrive at a stable state. Their free energy will be null or close to zero at the end of the process, for all the work capable of being accomplished in this system will, in the end, necessarily be exhausted. In equilibria of this kind, the work always reaches a maximum, while the energy in free state tends towards a minimum. These transformations are in conformity with the data of the second biogeochemical and thermodynamic principle; the change leads to an extreme increase of the intensity of the migration of the atoms of the biosphere. According to Hutchinson, “ it is absolutely certain that the last of the humans, if he wishes to avoid dying of hunger, will have to be capable of closing the phosphorus cycle on a very large scale. And that is a problem far more complex than that of the nitrogen cycle ”.

258- If the activity of the autotrophic organisms came to a stop, life would perhaps be quantitatively reduced, but it would remain a powerful mechanism in the biosphere, for the same vadose compounds, nitrates, sulphates and the gaseous forms of nitrogen and sulphur, ammonia and sulphured hydrogen, are created in it in great quantity independently of life, making up for the quantity through a phenomenon of vicariance. In other words, for the pessimists who already announce to us the end of our species, effectively, the “ Pachamama ”, while being a good Mother, evaluates us as a reservoir of abiogenetic components capable of compensating by putrefaction this phenomenon of vicariance following the consequences of the drifts of our species with a view to its own rebalancing, favouring for the occasion the rest of its elements.