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THE EVOLUTION OF GEOGRAPHICAL ENVIRONMENT AND CONTEMPORARY GEOGRAPHY

key words: geography, system approach, methodology, evolution, geographical environment, abiosphere, biosphere, noosphere, globasteme

INTRODUCTION

According to many scientists, geography is going through a serious crisis[1]. Some of them are even wondering: "Does geography – as a science – still exist?" And if the answer is "Yes" –What the geography is and what does it research? What does the identity of geography as a separate discipline mean? Such questions have bothered the geographers - conscious of the scale of the problem for 150 years. They are extremely important for geography itself but also for the whole system of knowledge where it should find its own "natural" place. There are the complex and multi-faceted questions. There are also the questions that affect to a large extend the future of geography as a science but also the future of mankind in general. It is connected with indisputable significance of social contemporary environmental problems. And obviously geography, both from a synthetic perspective and from a point of view of the

[1] There are so many geographers' works devoted to this problem that citations, in the author's opinion, seem useless. At present, such a standpoint has become widely accepted. The researchers' opinions differ when the scale of the problem is being estimated. Even the optimists share the view that the problem does exist and its source, to a high extent, is the methodological sphere of contemporary geography.

system of particular disciplines composing it is a science strictly connected with environment. It is just a science of the environment.

Those problems are regarded in exhaustive literature referring to the history of geography (geographical thought), its methodological bases or theoretical conceptions. More and more interest in methodological problems has been observed, e.g., in Poland when taking into account a number of recent publications by outstanding Polish geographers, among others the monographs (like Wilczyński 2003), collections of articles (*Geography as a science..., 2005*), Polish geographers' forum (e.g. 2004-2005) and scientific events, like the conference in Krynica (Poland, March, 2008) devoted to methodological problems on the landscape research.

One could suggest that another wave of the growth of interest in methodological geographical bases is, above all, a result of expressing the actual state of its crisis. So what does this state of crisis mean?

THE CRISIS OF CONTEMPORARY GEOGRAPHY

According to many geographers, concentrated on the crisis or problems of geography, it is the crisis of the *science identity*. As a result, one could observe a real necessity of posing the questions on the object and the subject of geographical research, its internal structure, its relationships with other disciplines, place in the system of contemporary knowledge and its role played for human being. The "litmus paper" indicating the problematic state of geography can be fulfilled by a reviving discussion on the *unity* of geography. The crucial questions posed in this context are: Do physical geography and social-economic geography compose a unity, or, Do they represent the complexes of separate, mature scientific disciplines based on common chorological but not genetic aspect of the phenomena under consideration?

Therefore, we face serious problems while trying to describe the structure of geography, that is identifying the character, number and mutual relationships of the disciplines composing the geography. Such a state of affairs results in the lack of understanding the *geographical research scope*, or, in other words, the *object* and *subject* of geographical research (I mean here geography as a whole and not its particular disciplines).

The crisis of geography has been proven not only by methodological discussions among geographers and divergences in their opinions on the crucial issues, but also when regarding the planes of *geographical education* (inconsistency) and *social role of geography* (lowering) in both the terms of *outlook* and *application perspective* (Liszewski, 2005; Liszewski, Suliborski, 2005; Jędrusik, Kałuski, Plit, 2005; Pulinowa, 2005; Widacki, 2005; Wojtanowicz, 2005; *Geography as ..., 2005* and others). When regarding the planes identified above, both those mentioned and other authors enumerate a number of convincing facts. While discussing the geographical education on all the primary, secondary and higher school levels, there has been observed a lack or weakness in the general educational conception referring to the essence of geography as a *synthetic science of environment.* This assumption particularly concerns the higher level of education where geographers' training has been realized in an *eclectic* and not a *conceptual* way (Liszewski, 2005). When taking into account the outlook on life (environment) geography has been replaced by widely and inappropriately considered ecology. While solving practical problems, connected with human life and his environmental activity, geographical output, particularly theoretical, is often unknown or has been simply ignored. Here one should mention the paradox of "lack of demand for geography" (Bagrov, 2005).

One should notice that the problems identified above could be acknowledged as the indicators of the crisis of geography. They are strictly connected with each other and they are the links of the same chain. However, the reasons of such a state of affairs should be searched for in the methodological bases of geography. What are, then, the primary and derivative reasons of such a crisis?

REASONS OF THE CRISIS OF GEOGRAPHY

Overwhelming number of geographers identifies *disintegration of geography* (science synthetic as a rule) as the main reason for blurring the subject of its interest and exacerbating the problem of identity. Its entire image developed as long ago as in the ancient times. After having reached its "holistic apogee" in the classical period (works by A. Humboldt, K. Ritter and others), it has gradually started to suffer disintegration owing to division into separate, more and more narrow scientific disciplenes. This division has been connected with an unavoidable and natural process of *science differentiation* (not only geography) due to the growth of knowledge amount. According to W. Wilczynski (2005), incorporating into science the elements of positivist methodology (second half of the 19th century) and accepting the subject criterion of scientific knowledge organization has resulted in the specialization in geography and its disintegration.

However, it seems that objective process of the growth of knowledge of the world and environment is mainly responsible for progressive branching of the "tree of knowledge" and its geographical branch. In the 20th century owing to gradual exponentiating of analytical powers of the research methods (through maths and technology development to computers), the data gathering took on an expansive character. Then one mentioned the "scientific-technological revolution", now the "information explosion" has been mentioning about. In the first half of the last century geographical synthesis still kept up with the empirical development of geography what was proven by interesting integration conceptions (above all "geospherological" ones) from that period. After the World War II the tendency of more and more visible falling behind the integration component responsible for consolidating the collected data has been evidently noticed. In the information era (2-3 last decades) the situation has almost got out of control forcing most of the geographers to "escape in panic" into the problem-thematic empiricism. It is precisely from their point of view that the geography as an integral scientific discipline has not existed anymore. Therefore, the problem of its identity has not existed anymore. However, there are problems, including the ones underlined in the previous paragraph that "specialised" geographers also recognise as the real ones! They often find a real need to localise themselves in developing scientific space, but while not having at their disposal the "geographical compass" they moor to the foreign shores creating new "sciences on the borderland".

One should bear in mind that the process of science differentiation, including geography, is a natural-developmental process and it should not be considered explicitly in the "positive-negative" terms. There is no doubt that it is a positive one. The analysts in science always find themselves on the verge of the unknown and they fight for every seed of new knowledge. However, the data obtained sometimes with a huge effort are chaotically collected (due to what reasons it is another question) "into piles" causing chaos and confusion instead of their proper arranging according to the conceptual plan into the appropriate theoretical or methodological construction. There are the conceptual plan and methodological construction that the geography in the last decades has been deprived of (?). This state of affairs can be described as the crisis of contemporary geography. So what kind of lack are we talking about?

THE MAIN REASON AND RESULTS OF THE CRISIS

According to the author, the main reason standing behind this state of affairs is *the lack of homogeneous fundamental theory*, that geography could have based upon. This fact differs geography from other, first of all, fundamental sciences. Physics, for example, has at its disposal the theory of atomic structure of the matter, chemistry is based on the molecular theory, biology – on the cell theory, geology – on the plate tectonics etc.

Lack of coherent geographical theory causes serious divergences in the course of understanding *the essence* of geography by different researchers. But it is widely known that good theory provides the knowledge with consistency, internal logic and harmony, it serves as a key to solve its riddles, it has a significant forecasting power, indicates prospective research problems and so on.

Is it possible to interpret the problem as possible to be "made up for"? Does geography lack the "fundamentalism" enabling the theory to come into being or function (find itself)? Before we answer such a question, let us concentrate on the negative results of the lack of general geographical theory that complements or crystallises the results of the crisis mentioned above.

It is generally widely known the Einstein's saying: "there is nothing more practical than a good theory". Since we do not have such a theory, we often face a problem when trying to put our ideas into practice. It seems a paradox that under the conditions of intensifying the crisis in the relation between man and nature geography has been left behind. Geographical elaborations, sometimes excellent, like those on geographical sphere, research on the landscape or other holistic conceptions still remain the conceptions "in themselves". Owing to internal dilemmas and lack of homogeneous holistic theory, the social role of geography has deteriorated. It has been pushed back from "the paths of responsibility" for environmental problems and replaced by more thriving and understandable conception – *the ecological one*. For us – the geographers – it is sad that the ecology – discipline belonging to biological sciences – has taken on the burden and responsibility for resolving the relations between man and nature. We have given up. Moreover, in order to situate ourselves among contemporary developmental trends in environmental sciences we tack on the *eco*-element to our sciences, or the *geo*-element to biological sciences creating bizarre scientific hybrids of the types: *ecology of the landscape* or *geoecology* characterised by blurred and indefinite methodological status.

Regrettably, it is a serious problem that soon will result in serious consequences when considering both the theoretical and practical aspect. Is the ecology really able to meet the contemporary environmental challenges? In the long run – the question is "No". The point is that ecological (ecosystemic) approach to environmental problems is definitely not sufficient enough – less comprehensive than geographical (geosystemic) approach, what could be easily observed in fig. 1 – a simple and well-known comparison of those two research models.

It is a well-known example. When using the ecological approach (in fact – the "cen-tric" one) we examine only the relations of the type: "man – environment", from the geosystemic point of view we consider the relations between all the elements of environmental system. One can easily notice that although the number of the examined elements of both systems is the same (5) – in case of the ecosystemic approach we examine only 4 environmental relations, while in case of the geosystemic approach – we find 10 relations. Therefore, using the *geographical methodology*, we have a possibility of collecting more precise knowledge on the subject of our research, that is environment and man as a part of it. When incorporating the ecosystemic approach of its anthropocentric type, such a precision is not possible[2].

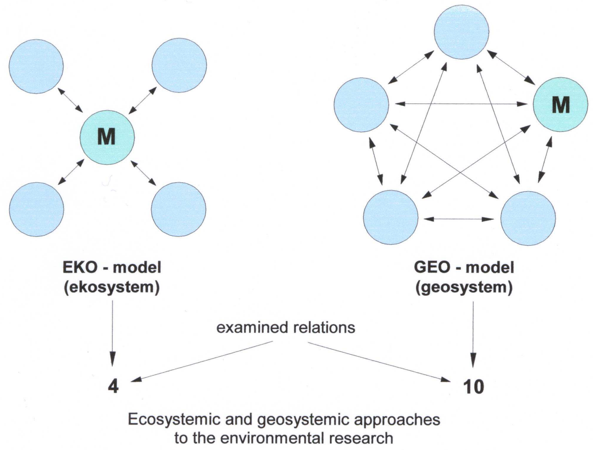

Fig. 1. Ecosystemic and geosystemic cognitive-research model. M – man (society).

Certainly, in the aspect of particular geographical sciences – geomorphology, climatology, glaciology or pedology for example, we do formulate a number of advice on solving fragmentary problems useful from the society's point of view. Unfortunately, having such a complex tool as the geosystemic approach at our disposal, the responsibility for solving contemporary environmental problems in their entirety is not on our side. But geographical environment is exactly a complex *megasystem* demanding appropriate theory and appropriate scientific approach!

Why have we lost a chance to render a practical service to the society?[3] The answer is lack of good geographical theory. The "circle has been closed up". *Lack of consistent geographical theory leaves geography out of the contemporary science.*

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[2] Well, we could try to persuade ourselves and the others that our – geographers' approach is better, more comprehensive, but the fact is that there are the ecologists who convinced society of the rightness of their environmental approach which has become an element of the social consciousness (so called ecological consciousness). Anthropocentric ecologists accepted the role of the environmental emergency service. Starting from a narrow biological discipline, researching the relations between the organism and environment, ecology is becoming a metascience what also brings negative consequences for the ecology itself. Ecologists-scientists are appealing for "coming back to the roots", because they are aware of the danger of their own science "dispersing" and of losing its identity. Unfortunately, instead of propagating the geosystemic ideas geographers "sin" while disseminating the "ecologisms" of a different kind.

[3] Geography, as a synthetic science, has once lost its big chance to fulfill an appropriate social role. This chance was created by intensifying the environmental problems, particularly of those from the second half of the 20th century. We have in mind the alert caused by Great Lakes biota destruction, Rhine polluting or wearing oxygen masks by the Tokyo streets and so on. It was the period of sharp social reactions – common fear, formation of international organizations, the “Rome Club” of environmental futurists, forecasting development and other social and scientific phenomena.

GEOGRAPHICAL ENVIRONMENT – BASIC GEOGRAPHICAL CATEGORY

Getting a bit ahead of oneself, I state firmly that from its beginning geography has found itself very close to such a theory. The old geography's eternal and fundamental postulate on the *environment that has been composed by the elements of different nature and size strictly (genetically, functionally, spatially etc.) connected with each other* is a basis of such a theory. The point is to comprehend (perceive, present, research and so on) appropriately the environment, discern it as *a whole* (its systemic and structural character), its *place in space-time and fundamental identity*.

Overwhelming number of both classical and contemporary geographers (represent-tatives of its "synthetic wing") considers the geographical environment and processes taking place in it (in their connection and dissemination) as an object and subject of geographical research – and they have reached an agreement here. There appear di-vergences when one tries to define the environment and concern, first of all, its spatial dimensions, "contents volume" (its components and their mutual relations) and perception (reception, perceiving, research). Most often those divergences are not of a primary type, but they have always created an obstacle to "round off" and lo-gically structuralize the knowledge of environment in its basic (and even fundamental) theory.

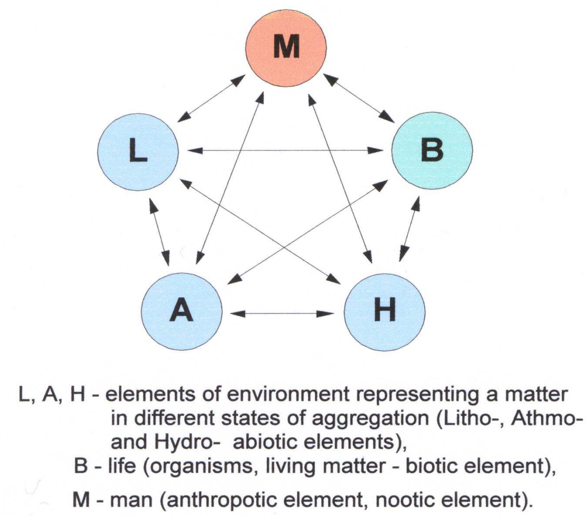

Fig. 2. Simplified geosystemic model of contemporary geographical sphere (geographical environment).

According to contemporary philosophers and geographers-theoreticians, in the given stage of science developpment, from the heuristic point of view the most productive is to perceive the complicated reality surrounding us in *a systemic way (outlook)*, including us as a natural part of this reality. Such an approach allows, on the one hand to perceive its composition (elements) and structure (connections between elements, hierarchy) and, on the other hand, to explain the entirety and differences between objects and phenomena what is of crucial cognitive and practical importance (systemic behaviourism, system constructing and so on).

Based on the systemic approach, let us introduce a simplified definition of the geographical environment as *a very complex system, geosystem, composed of the elements of a different nature (abiotic, biotic, anthropotic), connected with each other in many different ways, and creating the hierarchical entity of the "reality" – the state of nature within the geospace called the geographical sphere* (fig. 2).

GEOGRAPHICAL SPHERE – FOCUS OF GEOORGANIZATION

As it is known, sustained reciprocal interacting of the basic block-elements occurring in various forms of circulation of the matter, energy and information take place in geographical sphere. Our life goes on and our future is shaped there. But, as it is also known, there is no future without the past. Let's have a look at a simple scheme representing *the most complicated system of the Universe* in its evolutionary, developmental aspect. Let's define this approach as the *macroevolutionary conception* referred to by the following authors: Teyar de Chardin, Vladimir Vernadski, in the West - Houle (1977), Lovelock (1979), Oberg (1983), Sagan (1984), Grant (1985), Synder (1985), Allen & Nelson (1989) and others. There are also the authors from the former USSR countries – Kamshilov (1974), Lapo (1979), Obshchestvo i prirodnaya sreda (1980), Shipunov (1980), Budyko (1984), Kibernetika i noosfera (1986), Kolchinski (1990), Moiseyev (1990), Rodin (1991), Krysachenko (1998), Kovalov (2008) and others. In fact, it is *the evolutionary approach to the development of geographical sphere as a system (geosystem)* makes possible, according to the author, to comprehend the essence of geography as science of the geographical environment and as science of a fundamental nature. As a result, there appears a possibility to formulate main geographical assumptions and create basic, principal geographical theory.

As it has been already known, in cosmic spatial-time scale, over the last several dozen billion of years, after the primal radiation had gradually evolved into the matter, it was transforming from *simple states and forms to more complicated matter-energy creations*[4]. One could present this process as a "chain" – gradual-qualitative growth of its complexity (organization) (fig. 3):

[4] It is the general direction of the Universe evolution. If the theory of Great Explosion (Big Ben) is correct (what has been confirmed by a number of evidence), the macroevolutionary process, based on incessant growth in the Universe complexity, is a forced energy-matter reaction to the ceaselessly changing Universe. Spreading of the "explosion balloon", which the Universe is, has caused continual energy-matter reorganization in its scope due to its adaptation to lowering density, temperature etc. (matter is a "condensed energy") inside the explosive balloon.

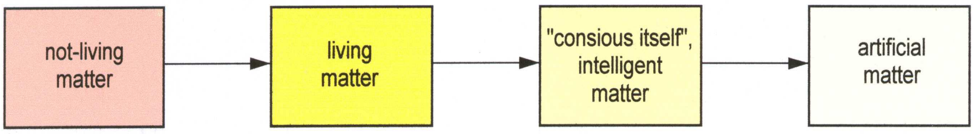

Fig. 3. Gradual-qualitative (macro-evolutionary) growth of the complexity (organization) of the matter in the Universe.

Detailed, evolutionary-progressive part of cosmic space in which macro-evolutionary process (understood as the growth of complexity-negentropy) has been realized, are the *external spheres of the planets* (where the particular geospheres are penetrating each other) *in which the matter is taking on the most diversified states of aggregation and is including the biggest number of organizing levels (atomic, molecular, mineral, rock, formation and so on)* (fig. 4).

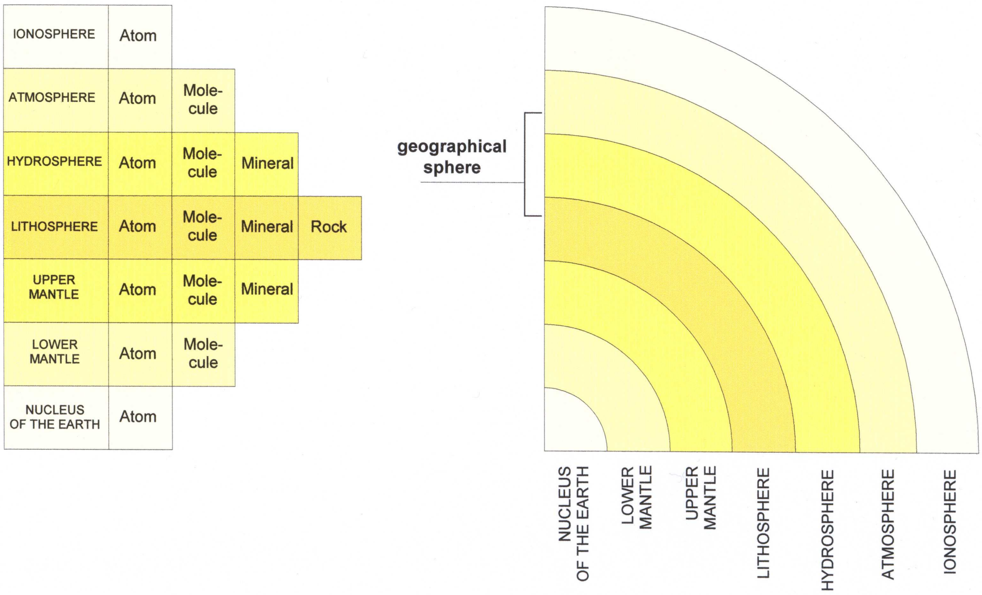

Fig. 4. Localization of the geographical sphere compared to the levels of matter organization and Earth geospheres.

One could notice that together with moving away from the ionosphere (from the outside) or the nucleolus of the Earth (from the inside) and approaching its surface, *material organization* of the geospheres is gradually increasing reaching its highest (geological) level in the lithosphere. Life and man, representing by themselves even higher organizing levels of the matter, are functioning at present in the sphere-layer contacting the lithosphere, atmosphere and hydrosphere.

In the ionosphere the matter occurs only in the atomic state, in the atmosphere – in higher – the molecular state. Hydrosphere and the matter of the upper mantle have been already organized on the mineral level (water is the most common mineral), while in the lithosphere the matter has created the most complex rock material creations (it concerns the organization on abiotic level).

Here, *where the most complex geospheres contact each other*, the energy-material circulations come into being, owing to the qualitatively different forms of the matter and different states of aggregation. The sphere of those circulations, that is contacting the geospheres, can be defined as the *geographical sphere* (*globasteme*). This is here, in this sphere that we have observed maximal differentiation of states of the matter. The sphere is *the focus of geoorganization* in *the geonomic respect* (Earth as a whole).

That is why the geographical sphere (we can also call it the geographical environment) is the environment of the evolution of the matter of the Universe where – due to diversification of the states of the matter – its largest and most diversified transformations have taken place. This is here where one could notice a specific "natural selection" – aspiring the matter – through different processes (energy, information, geochemical ones and so on) – and creating different mineral and organic substances – to achieve the most stable states of the evolutionary-environmental balance. And this is the law of physics-evolution, and not just a co-incidence.

Concluding, the geographical layer/sphere of the planets is the most unstable, injured, symmetry-disturbed environment of the Cosmos and this is precisely here where the "internal", qualitative development of the Universe has taken place.

EVOLUTIONARY STATES OF THE GEOGRAPHICAL SPHERE

Referring to the geographical sphere, the evolutionary "chain" of stadial-qualitative growth of complexity (organization - self-organization) of the matter (*not-living* matter – *living* matter – *"conscious itself"* matter – *artificial* matter) has been brought to fruition as a stadial transformation of its structural-organizing (evolutionnary) states: abiosphere – biosphere – anthroposphere – technosphere - ? The overall character of the processes causing evolutionary changes can be named as follows: *abiospheregenesis, biospheregenesis, anthropogenesis, technogenesis* and so on (fig. 5).

Let's have a closer look at the mechanisms of transformational processes regarding the transformation of the abiosphere into biosphere, the biosphere into noosphere[5] etc. They are characterized by universal regularities composing the *evolutionary cycle* (fig. 6).

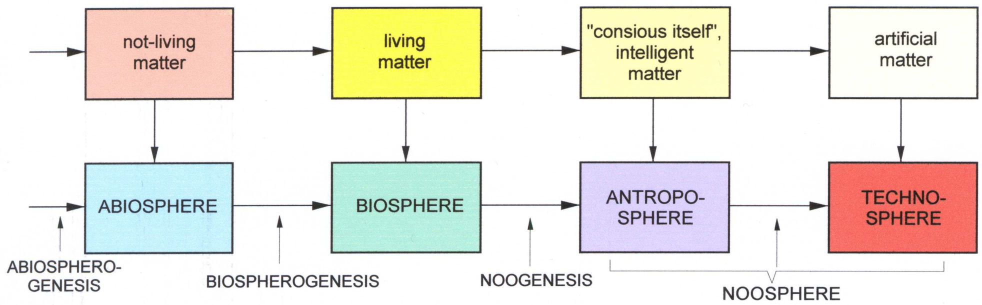

Fig. 5. Evolutionary states of the geographical sphere (and transformation processes) corresponding to evolutionary-organizing states of the matter.

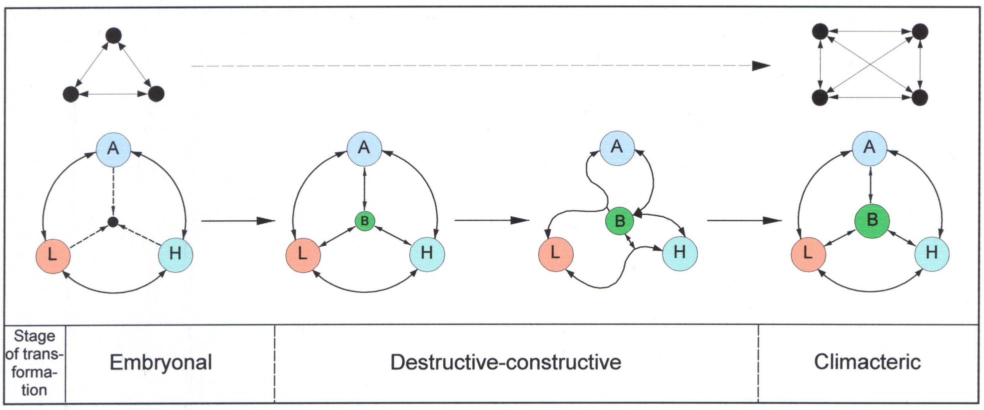

Fig. 6. General scheme of transforming the system of lower organizing level into the system of higher level. Developmental geosystem cycle (based on the example of transformation of abiotic system into the biotic one).

[5] The anthropogenesis and technogenesis processes are usually joined into the one process of noogenesis where anthropogenesis and technogenesis represent themselves different stages of noogenesis.

During material-energy circulations (interactions between the elements), a *qualitatively new (progressive) element*, representing the higher organized matter, has been developing in the environment. It is the *embryonal* stage. As far as a new element – characterized by *higher self-organizing abilities* - has been forming, it has increased its presence in the system. Being connected with the system by different circulations (the system is the environment of this element), the element is gradually joining the circulations, closing up those or other material-energy streams and disturbing the functional structure of the parent (initial) geosystem (*evolutionary expansion*). At this stage, *destruction* of the existing so far arrangements-connections (or circulations) in the system is taking place and forming of their new configuration has started. It is *the destructive-constructive stage* of the evolutionary cycle finding its equivalents in *the quasi-stable* systems. The new-created element, with the time being, is becoming an intermediary, transitory link in all the material-energy circulations of the system. It is gaining control over them and is becoming not only lawful (dominating) element – of *de facto* the new system – but also its *driver* due to its higher organizing-evolu-tionary (adaptative) level. One could say that the geosystem has reached a new, rela-tively stable state, defined as the *climacteric stage*.

THE EVOLUTION OF GEOGRAPHICAL SPHERE (LAYER) AS A METAGEO-SYSTEM

During development of the geographical sphere, there occurred three *evolu-tionary cycles* so far: *initial (abiogenesis), biogenesis (living creations coming into being and shaping the abiosphere into biosphere*) and *noogenesis (man's coming into existence and shaping the biosphere into noosphere*). The latter circle has lasted up till now and has found itself in the stadium of its apogee, that is the destructive-constructive one. Let's have a look at the scheme that shows the evolution of geographical sphere both in the "geosphereology" and "geosystemology" categories (fig. 7).

This is a "collective picture". Referring to the time axis (the upper part), there are indicated developmental stages of the globasteme, cyclic stages of this development and suitable structural-evolutionary states of the geographical sphere. Below (under a thick line), there are underlined *the evolutionary types of geosystems* corresponding to *the evolutionary states of geographical sphere and geosystems formation*.

Let's concentrate for a while on the evolutionary content of the table (fig. 7). We are not going to discuss the stage of planet-genesis, because at that time there was no the geographical environment as such and – subsequently – the subject of geo-graphical research. The analysis of that stage brings the problems concerning cosmology and planetology. Let's start then from the stage of a biogenesis.

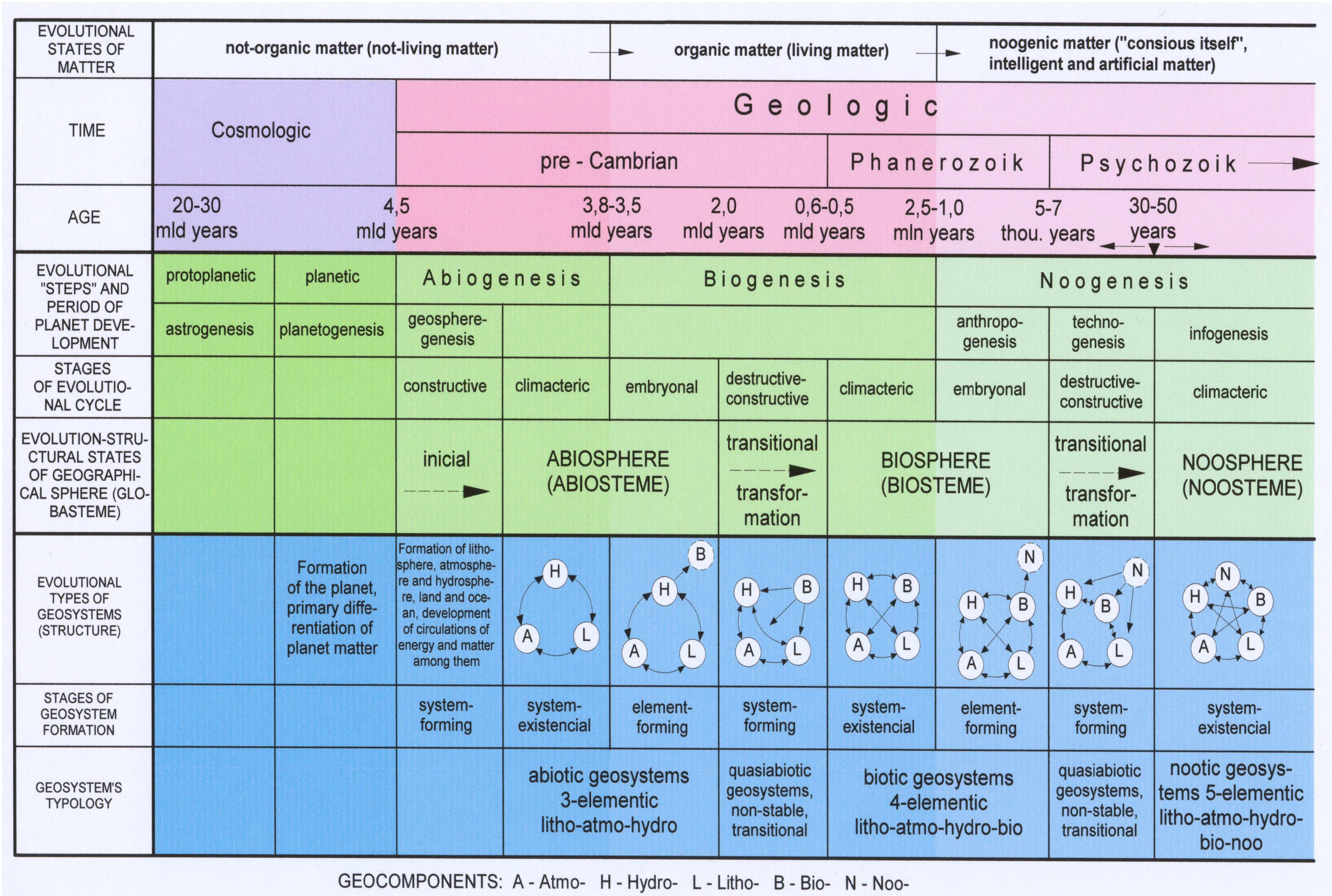

Fig. 7. General scheme of evolution of the geographical sphere and geosystems corresponding to its evolutionary states.

This stage comprises the period from 4,5-5,0 to 3,8 billion years, i.e. from the planet's creation – till the life's creation. This is the period when *lithosphere*, *atmosphere* and *hydrosphere* came into existence. We are deeply convinced that from a geological point of view it must have happened relatively quickly. While the lithosphere was getting cold, its degasification was taking place and creating of the atmosphere. Then, the hydrosphere came into existence due to the atmosphere getting cold and the steam condensing[6]. What is of vital importance here it is the fact that while they were forming, the material-energy circles started to come into being among those three initial substances of the geographical sphere (layer): *gaseous, liquid* and *solid*. In fact, these circles (of water, chemical elements, energy) caused the geographical sphere coming into existence and provided it with functional stability, or in other words – the permanence. In such a way, the abiosphere, that is the *primeval geographical sphere* was created. Speaking in terms of the "systemic language", there was created the geosystem, composed of the three elements interacting with each other: litho-, hydro- and atmo- (*abiosteme*)[7] (fig. 8).

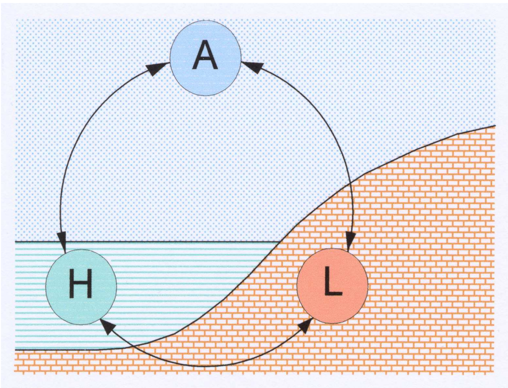

Fig. 8. Geographical sphere during abiospheric stage of its organization (abiosteme).

Based on geological research, about 3,8 billion years ago, initially primordial (*prokaryotes*), then more complex (*eukaryotes*) forms started to develop[8] in this abiotic system. About 2,5-2,0 billion years ago, there appeared *unicellular* organisms and *blue-green alga* characterized by the photosynthesis and oxygen-creating abilities. Life was given a huge developmental impulse. The atomsphere changed geologically – from carbon dioxide to oxygen one. The ozone layer came into existence, the reducing geochemical conditions in the sphere were replaced by the oxidating ones.

[6] It's an interesting detail that an order of the geospheres forming generally corresponds to the version of world creation (compare *the Book of the Genre...).*

[7] The author has used the terms-synonyms: *biosphere-abiosteme, biosphere-biosteme, noosphere-noosteme, geographical sphere – globasteme* to emphasize the systemic nature of those creations.

[8] Exactly – to "develop" because simple or even more complex (highly-molecular) organic compounds, based on coal, have been already created during the stage of formation of the clouds of cosmic dust. The Earth has been "provided with" them by comets and meteorites.

Multicellular organisms appeared. Another, even more powerful explosion of life was observed. While struggling for survival and mineral substances, living creations "were adapting" every fragment of the geographical sphere. They were intercepting and "putting through themselves" the material-energy streams. They were indirectly interfering into the circulations of chemical elements, selecting the most useful for themselves (*biophiles*). The *geochemical* circular *cycles* became more complex, *biogeochemical ones* where the biota participated in. Thanks to this participation, the biogeochemical cycles connecting the abio- and bio-segments became stable ones providing the biosphere (biosteme) with balance. One of well-known examples of the "counter-balancing" abio-biotic connections in the biosteme is the carbon cycle in which biota binds an excess of the volcano-derivative carbon dioxide in the atomsphere in the form of carbonate rocks and caustobiolites. Life as a new state of the matter characterized by its own geochemical preferences has considerably changed geochemistry of the globasteme in its entirety. No surprise then that the geochemistry of Phanerosoic, with its deposits and coal reserves, limestone and chalk deposits has been significantly differentiated from the early, “ironstone” pre-Cambrian.

Certainly, according to the transformation mechanism (fig. 7), during its first evolutionary stages the life's interference into abiotic cycles and circulations was of a destructive character and interferes into the functional structure of *abiotic geosystems*. Simultaneously, it was the *biogenesis apogee*, its central point or stage. In terms of the geographical environment, it was *the destructive-constructive stage*. It was the transitory period from the abiosphere into biosphere, that is the transition of the geographical sphere to next evolutionary state. In the geosystemic respect, this is the period of the formation of new complex geosystems composed of, among others, by living elements, such as *the biota*. Abiotic three-element systems going through *the destructive-constructive stage of quasi-stable abio-biotic geosystems* transform themselves into *the stable four-element biotic systems* (fig. 7).

According to the macro-evolutionary rule, or even the law of widely understood evolution, with the time being in the biotic system a new element is gradually developing - characterized by its higher organizing status. For 2,5-1,0 million years from the biosphere there started to emerge, more and more clearly, a qualitatively new material carrier – the carrier of the matter organized on a higher evolutionary level – the *rational matter conscious of itself*. It's about man and the beginning of a new stage in the evolution of geographical sphere – the stage of *noogenesis* (fig. 9).
Thought (knowledge, science), that is *noos*, is becoming - according to V.Vernadski (1977) – the main driver creating a "new world".

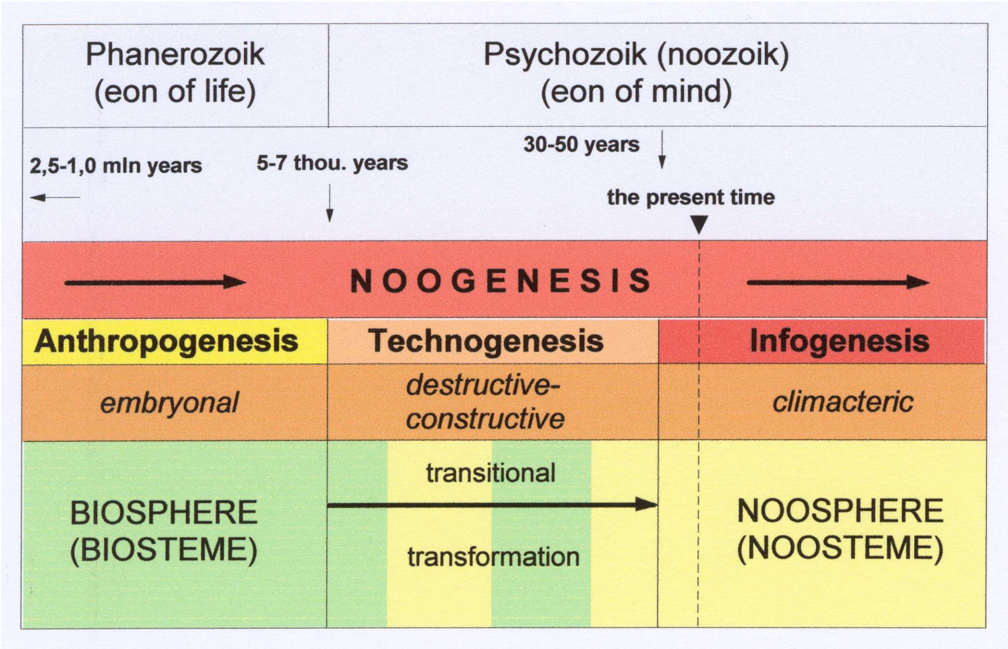

Fig. 9. Noogenesis and its main stages.

Initial – *embryonal (passive)* stage of noogenesis is *anthropogenesis* (fig. 9), that is man's formation. That stage lasted at least several billion of years. About 5-7 thousand of years ago, in the Neolith, together with agricultural activity, initiation of productive economy (Neolithic revolution) and growth in the number of population, anthro-pogenesis entered *the active transformational stage.* This stage has lasted up to now. It is characterized by active interference of a newborn element – the destructive one into its home environment, this time – biotic environment. Different destructive processes have been accompanying this interference. As in case of biogenesis, the interference is characterized by gradual escalation – from mild *agrogenesis* to contemporary *technogenesis*.

For a few hundred years man has affected the environment by means of technique. Technical reserves have particularly enhanced his impact on the environment, the biosphere. This impact has been so significant that we can discuss technogenesis as the destructive-constructive stage of noogenesis, that is its apogee. Some geologists suggest that man's impact on the environment, starting from the technogenesis period has been so significant that the period that we have lived in for last 200 years should be expressed as the *anthropocene* (*man's era*)[9].

Most of the areas of contemporary globasteme have been significantly affected by anthropogenic activity intensified by technological tools. Thanks to technological processes, the geographical sphere has been actively filled up by different artificial creations, a number of which (the "species") has been reached the billions, that is biospecies differentiation (biodiversity) in the biosphere. There is no doubt that in terms of diversity, artificial matter will exceed everything what has been created up to now by abiosphere and biosphere.

Certainly, with every year passing technological tools are becoming more and more sophisticated and complex. Man creates *technological systems* and *economic infrastructures* of a different kind. This process demands *communication, regulation* and *control*. Therefore, for several dozen of years cybernetics and information science have been actively developing. We have been witnessed a fast process of the environmental *informatization* – of the geographical sphere (computers, Internet, mobile telecom) as a whole. This process has reached so enormous dimensions that the globasteme is entering its new stage – *infogenesis*. Thanks to there are the information processes that are responsible for control in the systems, progressive electronics and information science development create a chance to stabilise destructive processes (disturbed circulations resulted in huge amount of rubbish, that is the matter, energy, information excluded from circulations) in geographical environment.

As a result, there are going to appear soon the geosystems of new generation – *the nootic ones* controlled by man and computers. Such a situation has already happened in some places of our Globe, e.g. in Holland where the natural environment together with its anthropogenic burden has been controlled by computer systems. It's about automatic regulation of the channels irrigation-drainage systems by water moved by wind energy. Windmills are the commonest element of the cultural landscape of the Netherlands and the channels, as is widely known, are the system of blood vessels in the economic organism of this country.

We also know the examples of environmental technical regulation through creation of geotechnical systems from Japan, USA and other countries. In most cases, modern geotechnical systems spread over local areas, they have a limited (object) range - they do not exceed the geographical units of topological level of organization. However, we can presume that the infogenesis in-progress is signalling the

[9] A group of American geologists directed such a proposal to the International Stratigraphic Committee (*GSA Today*, February 2008).

evolutionary introduction of noosphere and nootic geosystems into the *climacteric stage*. Certainly, from the planetary view as a whole it will last 50-100 or more years. In the spatial aspect, noogenesis (as biogenesis before) is characterized by the regularity in spreading the transformational phenomena on a larger and larger scale within the globasteme. One should notice that anthropogenesis spread over within a *local* range (Eastern Africa), technogenesis – within a *regional* range (industrial regions), while infogenesis has already spread *globally* (Internet, mobile telecom etc.).

What pushes the evolution forward from the inside? Undoubtedly - the striving of the systems (mineral, sedimentary deposit, cell, organism, organ, biogeosenosis, biosphere, region, man, society, noosphere etc.) to reach the state of balance with the environment (sedimentary, organismic, state, cosmic etc.) according to the second law of thermodynamics[10]. What creates favourable conditions for evolution to take place, that is the creation of adaptation mechanisms? It is every single item that forces the system to adapt to changing (in respect of its mass, energy, information) environmental conditions. Long-term environmental changes are more important in the long run, but the destructive elements of nature, catastrophs are also of some evolutionary significance. It all depends on the size of a system that is subjected to given environmental influence of a permanent or short-term character. The vital is that the phenomenon of evolution is of systemic nature. The subordinate system (or element) is not evolving without the environment (superordinate system) participation (Tolmachov, 1959)[11].

Therefore, in the macroevolutionary process one could differentiate three separate developmental states of the geographical sphere: abiosphere (abiosteme), biosphere (biosteme) and noosphere (noosteme) (fig. 7). Each stage corresponds to specific types of geosystems – more and more complex and generally more stable. *The highest organized element* and its relations with other elements of the system affect

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[10] Not long ago the specialists were of the opinion that the second law of thermodynamics cannot be applied to describe the phenomena and processes concerning flora and fauna or biosphere. However, further research proves that the environment functioning according to this rule makes the organisms participate in progressive evolution. It is just adapting to the entropic environment that forces living systems to deepen their complexity and organization (negentropy) (Chilmi, 1975).

[11] The role of the "environment" is particularly important on higher levels of the organization of the matter. Although elementary particles or electrons are able to function as such in separation from their environment, complex organic molecules or protein outside the organism quickly undergo chemical decomposition. Moreover, the more highly organized organism – without the matter-energy links with environment (e.g. by breathing) - is entirely helpless. Man as a biosocial creature – without interacting with other people – gets back to the biological organizing level (similarly to the biochemical structures submitting to disintergration – to basic (simple) chemical compounds.

the complexity and stability of the system. It's mainly about the *information relations* that influence the self-regulation processes in the systems. So what do self-regulation and stability mean in the systems of different organizing level?

EVOLUTION OF THE GLOBASTEME AND INFORMATION

Growth in the system complexity from the entropic point of view is also the growth in the information number and quality in the system. Due to develop, evolve the system has more and more effectively to collect (and process) information from its environment. It is the information, being at the same time, the reason and cause (essence!) of negentropy provides the growth in the organization (and then also self-organization) of the system.

In *abiotic* geosystems information relations almost do not occur[12]. According to most reliable opinions, the information as such is appearing when, simultaneously, the recipient is coming out, that is the element able to receive it and make appropriate use of it (react). However, in general abiotic elements are not equipped with the ability to recollect and analyse the information, self-regulation in abiotic geosystems is *impetuous* – based on *random negative feedbacks.*

Biotic geosystems are characterized by, among others, the presence of living organisms, that is the element having at its disposal the ability to recollect the events and environmental factors influencing it and, based on it, the ability to undertake proper vital decisions. Thanks to the living matter participating in all circulations in the biosphere, this ability considerably improves the adaptation abilities of the system in its entirety. There is no surprise then that it is the living matter in biosteme that controls the system as a whole from its elementary to global level. In this context a big number of examples could be given by ecology to prove the biota controlling (regulating) impact as an element of the geosystem (ecosystem) on the system in its entirety.

In *nootic* geosystems it is man, as the most highly organised system element, is responsible for controlling functions in geosystems (fig. 10). Such a state of affairs is acceptable and indispensable from the evolutionary point of view. Man possesses *large reserves of operational memory* and *large analytical abilities (logical thinking).* He is aware of his advantages and has a huge spatial area while undertaking decisions and activities aiming at survival. At present he is supported by information technology

[12] This problem has been discussed for many years – the way of reasoning has depended on the perception of the *information category* by different researchers.

which is nothing more than widening man's (geosystem element) operational (evolutionary) possibilities in eternal struggle of the matter for survival.

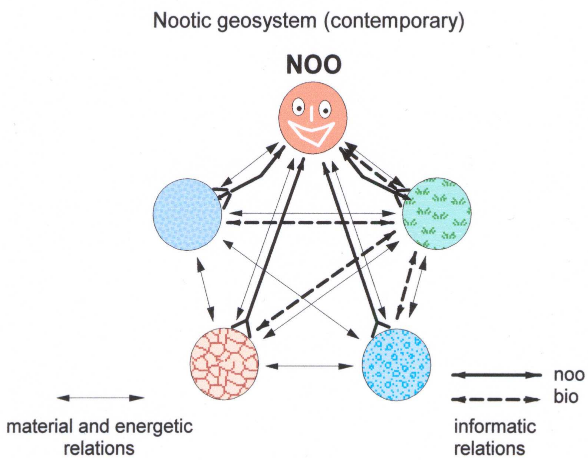

Fig. 10. Model of contemporary nootic geosystem with its typical connections between the elements of a different nature.

This evolutionary thought on man's leading role in managing the contemporarily forming geosystems (nootic) distinctly corresponds to his divine vocation expressed in the Old Testament (verses 27-28).

One should emphasize huge *transformational* (evolutionary) *power* of information during present stage of globasteme development. More evolutionnary chances are faced by those contemporary systems (social etc.) which guarantee more information and not factories, as in the industrial epoch (technogenesis). Information (knowledge) is becoming a measure of wealth and developmental possibilities.

In such respect, evolution appears as gradual information collecting in the system and shaping the mechanisms of its processing. From the organization point of view, the "phenomenon" could be understood as better and better information management, synthesis of the information "dispersed" in environment.

EVOLUTION OF THE GLOBASTEME AND ENERGY

Another regularity typical of the evolution of geographical environment and geosystems concerns the *energy of evolution*. Growth in complexity and organization predicts indispensable changes in the energy economy of the systems concentrated on its more and more effective taking from environment and making use of it in order to support satisfactory state of affairs (structural-evolutional state). In the evolutionary aspect, better developmental opportunities are faced by those systems which are characterized by the ability to acquire new forms of energy or take it more effectively from environment. System development (starting from biotic ones) is usually directed at bigger (per structural unit) energy consumption (Pechurkin, 1988).

Growth in organization and keeping it on an appropriate level is conditioned by additional energy supply. Therefore, as in case of information, system development is dependent on energy amount, while in case of new, progressive solutions (e.g. photosynthesis, nuclear energy), its excess serves further system development. Geosystem stability needs suitable "energy base" – the higher, the higher its organizing level (internal order) is. Whereas energy capabilities of the system (energy taking, processing, using) are of vital importance in maintaining its stability: the system will always "try" to reach state (stable), which is characterized by maximum energy taking from environment.

Abiosteme and abiotic geosystems composing it are characterized by impetuously "arranging" energy and possess weak storing capabilities (the most widely known example of energy accumulation in abiotic environment is its storage in sedimentary rocks due to weathering processes). Abiotic energy circulations are usually accompanied neither by conservation nor by considerable storage. The "economy" of abiotic geosystems, including its highest size level – abiosteme, is generally characterized by wastage of energy: in fact all the energy reserves (except for those returned to cosmic space) absorbed by geosystem (i.e. solar and geothermal energies) have been consumed (according to the second law of thermodynamics) during the process of abiotic elements interacting with each other, that is in different processes-links of the denudative-sedimentative cycle. Abiosteme energy is of an unstable character. The function of energy regulator in abiotic systems is fulfilled by the water element.

The more highly organized *biosteme* together with biotic geosystems is more effective from the point of view of the energy processes – *taking (acquiring and making use of) an indispensable energy from environment and its storage.* Let's mention, e.g., an example of photosynthesis. Influenced by solar energy, from energy-poor carbonate compounds (e.g. CO_2) plants produce energy-rich organic compounds (e.g. glucose). Biosphere "manages" the energy in a more effective way, what has been proved by its excessive production and ores formation: peat, oil, gas, coal and other deposits. Energy biosteme economy has been localized itself on an incomparably higher – in relation to abiosteme – level, but, in general terms (on a globasteme scale), it has been not particularly effective, for example only 0, 12% of the solar energy reaching the Earth has been consumed by flora (Erdei-Gruz, 1974). This indicates the existence of huge reserves in solar (apart from others) energy use in the future globasteme.

Noosteme, together with man and nootic geosystems, has been even more efficient. Man has learnt to extract the energy from environment, convert it in differrent ways and make use of it to realize different aims. Comparing it to biosphere (chemical energy), man makes use of more types of energy, while this use is of an evolutionnary character. G.N. Alekseyev (1983) has differentiated 5 stages of "domesticating" the following types of energy by man: “muscle”, fire (thermal), water and wind (mechanical), fossil fuels (chemical), electricity, nuclear energy. The feature typical of each of the stage is more and more effective energy extracting and its converting.

Energy balance of the noosphere is considerably bigger than that of the more economical biosphere. Man released the energy of, among others, the nucleus of an atom and he is on the verge of a thermonuclear synthesis which can open the doors to virtually inexhaustible energy resources (and another developmental evolutionary step, respectively). Thermal energy stored during hundred millions of years by biosphere (coal, oil, gas and so on) has been released in huge amounts.

Unfortunately, as in case of geochemical circulations, on a given developmental stage man has produced big amounts of "energy rubbish" in the form of industrial heat, combustion etc. not adapted in functional circulations of nootic geosystems (in fact, up till now spread on a limited scale). As in case of environmental pollution (disturbances in geochemical circulations), man actively disturbs the energy balance of the biosphere causing its destabilisation (let's mention at least climate changes).
In the aspect of *integrated energy* (complex energy of the system and of the information), the regularity is that every next geosystem possesses its bigger amounts.

One should also bear in mind that in open systems[13], created hierarchically which the geosystems are, the integral energy is responsible for system stability. However, this stability is not a thermodynamic result of approaching the system to maximum entropy but a result of the permanent inflow of free energy from environment compensating internal functional losses. In other words, each system is vitally (in terms of its existence – non-existence) dependant on external environment in such a way that the bigger functional (circulating) energy the system has at its disposal, the more energy from the outside it needs[14]. Nootic geosystems, in terms of their stability, are the most sensitive ones when regarding the energy aspect (cut off or energy supply from the outside). It is a well-known fact that the areas left by man, irrespective of a kind of their development, return quickly to their former (lower) organizing levels with reduced integral energy and, simultaneously, simplified structure that the system is able to adopt on a given level of energy security (e.g. multi-coloured plot-area is changing into homogeneous meadow covered with dominating weed).

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[13] The systems openness is an indispensable condition of their evolution. Any closed or isolated system, according to the second law of thermodynamics, cannot develop progressively (Kacura, 1975).
[14] This is to some extent a reflection of the principle of necessary diversity by U.R. Eshbi (1959).

EVOLUTION OF THE GLOBASTEME AND GEOCHEMISTRY

Every next state of the globasteme is also characterized by *geochemical specificity* based on domination in the circles of one or the other the most important chemical elements. During the globasteme restructuring, the element-constructor (water, biota, man) is activating in environment those or other chemical elements selected by him on the basis of the "evolutionary physiology" (*biophile, noophile elements*). In such a way, he is changing, sometimes quite radically, the chemical composition of the globasteme. This process took place during the biogenesis stage when – as a result of photosynthesis – the algae changed the carbonate atmosphere into the oxygen one and, then, the globasteme reducing environment into the oxidating one (together with its litho-element – rock oxidation and waste-mantle formation). This process has been recently observed because there are more and more chemical elements included by man into the "noogenic metabolism".

There could be noticed distinct stages (phases of geochemical activation) corresponding to the main phases of noogenesis. One could mention such examples as: carbonate phase (it corresponds to anthropogenesis – making use of fire or cultivating plants), black and non-ferrous metals phase (technogenesis – so called technophile elements), silicon phase (info-genesis) and so on. Similarly, it could be described when referring to chemical compounds (from the simplest to the contemporary composites). The general regularity is the gradual geochemical distancing of the forming systems from their home (parent) geochemical background. Speaking in geochemical terms, agrogenesis has not considerably differed from - the based on carbon - biotic geosystems - consuming carbon in the form of organic compounds obtained from growing plants. The technogenesis has already "enriched" environment with heavy metals (*meta-lization of the environment*), and the present and future are shaping the geochemical world still unknown to us, which will be dominated by "plastics".

There is another aspect of evolutionary geochemistry that concerns the speed of chemical elements' circulation in environment. According to V. Vernadski (1967), evolutionary "promotion" of the system is a result and expression of speed of atom migration of the matter (in circulations, inside the system etc.). Stable, i.e. the most environmentally adapted are those systems and organisms that speed up the atom migration. Evolutionary direction (e.g. biological) can be defined as speeding up of biogenic migration, intensification of biogenic atom circulations. Technogenesis, then, should be characterized by more faster exchange of the matter, energy, information. Well, computer technology confirms this thesis…

One could enumerate a number of other interesting developmental regularities of the globasteme (e.g. evolution of symmetry-disymmetry of environment and others), but it digresses from the main point of a given article.

EVOLUTION OF THE GLOBASTEME AND ITS LIMITS

According to some researchers, together with the development of geographical sphere, its size and borders are changing (growing). Globasteme is – as though – "expanding". Its external border is usually shifted upwards – into the "Near Cosmos" and is located in the cosmic space possible to be reached by the man himself. The edge of cosmic space has acknowledged as the edge of cosmic space reached by man. In such a way, the Near Cosmos (e.g. Afanasyev, 1986) has been included into the geographical sphere (geographical environment).

Such an inclusion is unjustified. From the systemic approach, the "escape" (actually – of a temporary character) of one of the elements outside the system borders should not be perceived as the change in its size. It is rather the dynamic fluctuation proving the system internal activity – the processes (the most often – destructive ones – the transformational stage!) taking place in the system. It would have been different if it was about the "structural expansion" of the system, i.e. spreading of the whole arrangement of the elements together with their connections[15]. Therefore, during evolution the size of globasteme has in fact not changed (or is changing on a limited scale). However, its qualitative parameters have distinctly changed (its complexity is developing together with its entering new qualitative states).

TRANSITIONAL STAGES AND ADVANCING OF THE ENVIRONMENTAL EVOLUTION

In the pattern of evolutionary development (fig. 7), there occur interesting transitional ("revolutionary") stages – like the transformation of initial abiotic geosystems into the biotic ones, biotic – into the nootic ones and so on - which are of special importance. The permanence of "jumping", transformational stages is usually weaker than that of the evolutionary stages, at the same time, every next "perestrojka" lasts shorter. While the "biotization" of abiosphere took almost a *billion of years*, the "anthropogenization" of biosphere has lasted only *millions of years*. Its destructive stage – "technization" has only taken *a thousand or hundreds of years*. One

[15] The same tendency has been observed while constructing so called artificial biospheres. For years ecologists have carried out the experimental research aiming at creating artificial environments (including man), functioning autonomously, mainly to colonize the closer planets of the Solar System, or the sea bed (Allen, Nelson, 1989).

should search for the reasons of *developmental speeding up* in more and more effective energy converting and information processing (by geosystems of subsequent evolutionary types)[16]. Growing "arming" – in the respect of energy converting and information processing – of contemporary geosystems of the nootic organizing level creates huge evolutionary possibilities for them. Bigger and bigger number - year by year – of scientific discoveries and technical solutions (scientific-technological revolution) are nothing more than advantageous "mutations" enabling further development of the globasteme.

Step-by-step structural transformations are always accompanied by destructive phenomena. Interfering into the structure of initial geosystems, newborn "revolutionary" element (more highly organized and more "plastic" – biota, man etc.) breaks down present relations (cycles, circulations) and causes different disturbances and functional changes in them. We face such a situation on a given stage of macroevolutionary process. We are experiencing transformation of the biosphere into the noosphere. When describing the phase of transformational process, we are facing the very end of the industrial epoch passing away - connected with technogenesis and characterized by *regional* industrial differentiation - and we are entering the post-industrial phase - the phase of infogenesis (within the planetary scope – *globalization*) and creation of "wise" and stable nootic geosystems (fig. 8).

Evolutionary development of the globasteme expects joining it (as in the system) by more and more features of the *comprehensive* type, sometimes contrary (revolutionary) to their former systemic states. Biosteme (as its smaller geosystems) is characterized by the ability of "ecological self-protection" what is not typical at all of the abiosteme. The "altruistic consciousness" rejecting the "rational biologism" is one of the features typical of the noosphere. There are those qualities – "illogical" from the point of view of former globastemes – which are extremely important for development of the succeeding ones. The ability to "feed oneself" (small or large biological circles, organic cycles of production-destruction and so on) of biotic geosystems is an indispensable condition of their development and the height of their adaptation abilities (creation of friendly environment, becoming independent, in a way)! By the same token, developing *humanization of the noosteme* is conditioning its progress. There is no possibility to build up the real and stable noosphere ignoring man's development (in spiritual, moral, intellectual sense)!

[16] According to N. Viner – the "Father" of cybernetics – the ability to information integration is proportional to the system complexity (1958).

Next, evolutionary periods in the globasteme and its systems development do not appear as the periods of complete balance or stagnation. In the globasteme, there are incessantly taking place the processes of maturing and creating the new, evolutionarily progressive phenomena and mechanisms, until there occurs the carrier with high abilities to convert energy and process information enabling it to start up its new developmental revolution (that is new evolutionary epoch). Let's give an example of the "biospheric era" with its different "biologization" processes, that is deepening the developmental-adaptational abilities of organisms and biotic geo-systems (occupying the land by flora, amphibians' flying up, appearance of angio-sporous plants, mammals development, primates formation etc.). As another example – this time for the "noospheric era" – can serve the processes of noosphere "humanization" which, during a given initial period, take the form of technization, informatization, spiritization and others. Maybe it is going to be the noosphere where the matter will gradually shape itself into even more progressive substance – *the spiritual one* (the cycle closure by returning of the matter into the form of energy of higher quality!), and the geographical sphere will enter – according to Teyar de Chardin (1987) - the state of teosphere (teosteme?).

CONCLUSION

The evolutionary course of geoenvironmental reasoning has given birth to a number of proposals of the methodological nature. Let's point to some of them.

1. Geography has been (was and still is) the science of environment in which man lives and which natural organic part man is. This environment – globasteme – is developing according to the general rule of the Universe evolution – growth in its complexity (organization). This development is characterized by gradual reaching by globasteme the more and more complex organizing levels (abiosteme – biosteme – noosteme). The globasteme has at its disposal all the characteristics of the system (e.g. structural and functional identity) and is a hierarchically constructed *metageosystem* composed of the elements of a different nature – strictly (structurally, genetically and functionally) connected with each other. Regarding a given scientific developmental stage, it is the *systemic perception of the geographical environment* that is the most productive in heuristic and practical terms.
2. As the globasteme is *the evolutionary centre* (focus) of the Universe where the evolutionary process has concentrated on (from radiation – through stars and galaxies to planets and geographical sphere, and next – to life and man), geography – as a science on globasteme – is *a fundamental science* referring to a given (last) stage of the Universe evolution, likewise other sciences (physics,

chemistry, geology, biology and so on) concern the research on other evolutionary-organizing states. Referring to the bases, that is the evolution and organizing levels of the matter – according to the organizing levels researched by appropriate sciences – geography is the science of the highest and most complex of them – *geographical organizing level of the material systems* (Certainly, this assumption applies when taking into account that we will not identify physics, chemistry or biology as the sciences of atoms, molecules or organisms and we will consider them in the context of the material systems in which *the element can not be separated from its system environment*). This rule is of vital importance, because the elements of that or the other nature (organizing level) cannot exist without their environment[17]. Therefore, considering it in the categories of the systemic-hierarchically organized nature, it is the geographical organizing level of the nature (i.e. geosystems) that is the subject of geographical research.

Obviously, *the space* of the systems of geographical (the highest) organizing level (globasteme) is relatively small when comparing it to the base of the "evolu-tionary cone" composed by physical systems (stars and black holes), its central point – chemical systems (dust-gaseous clouds), or even its top – geological sys-tems (planets, asteroids, comets). In the spatial aspect, geosystems are the com-plex creations situated at the end of the "needle" of the evolutionary cone.

3. While covering different evolutionary levels of material systems isn't geography becoming the "science of everything", that is "contemporary naturphilosophy"?[18] Isn't its object and scope of the research dispersing? One must confirm there occurs a problem at this point. The object of geography (as *a systemological* science) is contemporary globasteme, and its research subject – the processes (circles, interactions, structures etc.) taking place among their elements – abio, bio and noo composing the globasteme. However, those processes are so numerous and differentiated that geography, understood so widely, is obviously starting to change itself into *a metascience* with extremely complex structure.

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[17] The role of the "environment" is particularly important on higher levels of the organization of the matter. Although elementary particles or electrons are able to function as such in separation from their environment, complex organic molecules or protein outside the organism quickly undergo chemical decomposition. Moreover, the more highly organized organism – without the matter-energy links with environment (e.g. by breathing) - is entirely helpless. Man as a biosocial creature – without interacting with other people – gets back to the biological organizing level (similarly to the biochemical structures submitting to disintegration – to basic (simple) chemical compounds.

[18] In its evolutionary-world view aspect, the answer, to some extent, sounds "Yes".

4. Acceptance of such a thesis would disturb the already blurred status of geography and it would deepen the problem of its identity. Possibly, it would be worth to work out new classification of sciences regarding the organizing material levels of the systems of the Universe dividing each of the "system-level" (fundamental) sciences into two main parts: *analytic* (science of elements – composition, characteristics etc.) and *synthetic* (science of the connections between the elements – relations, structures, organization etc.) aiming at their "structural relieving". In such case, geography as a science (system of sciences) of the systems of geographical organizing level could be divided into, e.g., *geomatics* as a collection of sciences of the globasteme elements (atmosphere, hydrosphere, pedosphere and so on), and *geonics* as a collection of synthetic geographical sciences. The focus of interest of the latter would be pointed to the integrating geographical sciences like – according to the systemic levels of internal organization of geographical sphere – *geotopology, science of landscape, science of regions, science of globasteme).*
5. Getting back to the point, we should indicate that contemporary geography is a science of the globasteme of our times, that is the noosteme (noosphere) being created with our participation. In this context and as a result of the considerations presented above, the returning problem of "the unity of geography" seems to be artificial. Man is *the organic element* of contemporary natural system, and social (social-economic) geography is a natural part of contemporary geography dealing with the anthropotic (socio, techno) element of contemporary geosystems – the highest level of geoorganization (obviously, in relation with other elements). In the respect of the social-economic geographical research, one should treat as wrong and unproductive an attempt at detaching man from the environment. Moreover, from the point of view of physical geography, disregarding the anthropogenic factor (except for rare nature reserves) - while conducting the field research - is a mistake. This results in formulating the necessity of the geography *reintegration* (based on environmental conception).

Thanks to both theoretical-methodological (in order to fulfil the *integrated function* of consolidating diverse knowledge) and practical reasons (there is no possible to solve the "ecological" problems of the globasteme and its geosystems (of a complex structure) without employing a comprehensive look, incorporating only a narrow, specialist, one-sided etc. approach), the systemological integration of contemporary geography is crucial. Therefore, there is an urgent need today to work out a homogeneous, geographical theory based on *macroevolutionary metatheory* divided - through the prism of systemology - into spectrum of individual fundamental (systemological) sciences, including geography.

6. Contemporary relations between man and environment are antagonistic (destructive), but this antagonism is of an evolutionarily indispensable character. In this context, methodological ideas of the man and nature "coevolution" – assuming a certain condition of their co-functioning (Moisiejew, 1990; Rodin, 1991) - appear to be a mistake. Evolutionary antagonism should not be a reason "for despair" but, on the contrary, it should create the motivation to concentrate on the scientific issues of constructing (with our – as of the most highly organized element of environment – decisive participation) the geosystems of new generation composed of both the elements of geological features, flora and fauna, man and technology with IT tools. Those geosystems (geotechnical, geotechnoinformational) should be characterized by relative functional stability which energy-information implementation must be ensured by man. They should also possess closed (in terms of material, energy or information "rubbish") circles and circulations, that is not to produce "rubbish". Absence of waste is a criterion of the geosystems perfection.

   How to reach this goal becomes exactly the main substantive task of contemporary geography. It is not the yearning for "lost paradise" (i.e. intact biosphere what contradicts evolution), but active, conscious (of the heart of the matter) and highly responsible transformational activities are, simultaneously, task and challenge faced by contemporary geographers.

7. Contemporary geosystems are, in most cases, quasistable transitory geosystems (from the biotic to nootic ones). Although in the transforming globasteme of our times there is still quite a lot of biotic geosystems, there also occur some examples of nootic geosystems. They mostly include the geosystems of *lower spatial levels* of geographical organization (like agrogeosystems of a different kind – plots, fields, irrigation areas and so on). Geosystems of the *landscape* (so called cultural landscapes) or *regional level* are currently the "focal level" of the globasteme noogenic transformation ("anthropogenic changes"). There are considerably less examples of already formed nootic geosystems among them, similarly to initial (intact) biotic geosystems. However, destructive environmental changes are also becoming more and more perceptible on the *global organizing level* (the greenhouse effect, the ozone hole etc.) of the globasteme. This proves that there are not only the "cells" of the globasteme (topic geosystems) or the geosystems of a middle size (landscapes, regions and so on) that enter the developmental destructive-constructive stage, but even the globasteme itself - as

the largest (the most complex and stable) geosystem - has been subjected to those changes and take the quasistable form.

8. One should bear in mind that we must pay (first of all – for delivered functional energy) – literally and figuratively – for maintaining the nootic geosystem in appropriate state. Before man does not improve the energy (nootic-organizing) status of bigger geosystems and, finally, the globasteme as a whole, the transitory stage will still last. Even the perfectly organized geosystems will be characterized by high energy-losses and instability (disintegration-prone), if their superior environmental system is not properly organized (the latter will be an energy absorber – according to the thermodynamic, IT or "entropics" law). The point is to underline the question of social consciousness: one should understand *there is a vital need to invest into the environment, at the same time, putting special emphasis on the investments into regional and global projects* (concerning the participation of regions or countries). The crucial changes regarding the higher geoorganizing levels will create indispensable predispositions towards easier reorganization-restructurization of the geosystems of lower organizing levels (growth in the complexity of the superior system causes re-organizing activation of the subordinate system)[19]. It is just the essence of *geopolitics* understood as the relationship between man and environment on a given stage of its development.
9. Our attitude to the nature protection issues should be changed. Nature protection comprehended as the protection of reserves, parks or monuments has been, to a large extent, an anachronism of the 20th century. There is no possibility to prevent effectively the ecosystems (of the still weakly transformed "cells" of the biosphere) from acid rains, the ozone hole or climate warming. Their destruction in the environment subjected to continuous transformations is only a matter of time. Indeed, there is a real need to protect those "cells" as effectively as possible due to, above all, the gene pool. But, all in all, the best nature protection measures would be the properly understood land management taking into account the "environmental needs" of each of the geoenvironmental elements including man. It seems possible after having fulfilled an indispensable condition of further deepening our knowledge on the geosystems, their characteristics, functioning, their dynamics. This is another important task faced by contemporary geography, the geonics in particular. By the same token, a significant role of contemporary research methods, including the stationary, experi-

[19] It is *de facto* the evolutionary rule (accommodating oneself, adaptation etc.).

mental, modelling ones should be recognized. While solving *geocybernetic problems*, geography should become more and more exact science.

10. While teaching future geographers, higher education system should concentrate on the issues of *engineering geography* and teach the engineers-geographers – designers of geosystems of the future both from the point of view of subject ranges (construction engineer — housing estates in the environment etc., "geographer of water management" – water bodies, channels, restoring the water beds and so on, "transport geographer" – motorways, pipelines, energy providing lines) and comprehensive (planning and spatial management etc.) ones. Geographers should closely collaborate with technicians and managers making up the research teams and designers group (the final stage – the specialized technical university – Geopolitechnics). According to the conception of the higher education system, it would be necessary to clearly underline the distinction into two kinds of specialities: geomatic (climatologist, pedologist, biogeographer, hydrologist, geomorphologist, etc.) and geonic (geotopologist, landscape researcher, "regiographer" etc.) ones. There are the "geonics" that would be responsible for contemporary environmental management (on different levels of the organization of geographical space – from elementary geosystems through regions right up until the globasteme).

    More advanced level of contemporary specialist-geographer is the *geodesigner* – specialist in constructing the stable types of geosystems with fixed parameters of functioning (subject of geocybernetics, geosystemology and other still worked out geonic disciplines).

The author is aware of a disputable character of the considerations presented above, and the proposed solutions in particular. However, methodological works are in their essence arguable what could also provoke positive connotations.
Methodology points out or proposes the ways that could be followed by this science or the other. In order to choose a better, proper way that will not lead us to a cul-de-sac, we should discuss. There is no other way out.
21st century – geographers' era!

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SUMMARY

The author concentrates on the methodological bases of contemporary geography. According to his point of view, contemporary geography has been experienced an identity crisis. Based on the macroevolutionary conception, the author tries to find out the “comprehensive idea” of geography, identify its object and subject of its research, prove the fundamental character of geography as a science, consider it in the context of other “systemological” sciences and illustrate its theoretical (scientific, in terms of outlook) and practical significance.