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ENVIRONMENTAL-HISTORICAL DIMENSION OF ANTHROPOGENESIS

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Abstract

Human history arose at a certain developmental stage the physical world, which was characterized with several bifurcation processes. One of them was a large anthropogenic explosion, characterized by appearance of ancestors of anatomically modern humans 2.6 million years ago. A new, qualitatively different component of the Earth's biosphere gradually formed as a result of evolution – anthroposphere. In historical dynamics of interaction between humans and environment, a special role was and still is played by a phenomenon of environmental adaptation. Its study is relevant as human and Nature create history by interacting with each other. The environment includes both natural and anthropogenic components. The environment is a result of activity of separate individuals, as well as the whole communities of people. The Nature serves as an inert element in the environment, not as a necessity, but as a possibility that may be actualized or may remain unactualized. Human is its active element, master of possibilities. However, it is not about anthropocentrism in history. It is overcome from the positions of environmental history, in the context of which the appeal to the phenomenon of environmental adaptation allows observing that nature and human are competent co-authors of the historic process from the times of the most ancient past of the humankind. Humankind's ability to adaptation in the environment is an attribute of its stable development; and vice versa, loss of such ability is the main historical cause of biological and demographic catastrophes and destruction of cultural and geographic landscapes.

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1. Introduction

Genesis and initial development of human closely depended on human ability to adapt in surrounding natural environment. The phenomenon of environmental adaptation during the anthropogenesis, as it is evident from historical experience, was multi-faceted. It may be ranked applying the attributes of productivity and anti-productivity in analysis of interactions between human and surrounding natural environment. On that foundation, it is practical to define two types of environmental adaptation, positive (productive) and negative (antiproductive).

The positive environmental adaptation served as a kind of *adapter* in interactions of human ancestors with the natural environment. It was such a form of hominids' interaction with the nature that led to formation of new morphophysiological characteristics of organism and psychological behavior that facilitated appearance of *Homo sapiens*.

Negative environmental adaptation served as a kind of interaction between human and the nature that was characterized with disturbance of biological and demographic equilibrium. Sometimes, during a prolonged adaptation of ancestors of *Homo sapiens* to a changed natural landscape, there were environmental disasters. In these conditions, communities of primitive humans became decimated and disappeared early. The negative environmental adaptation blocked appearance of different species of intelligent humans within the genus *Homo*.

The main idea of this paper is to present the phenomenon of environmental adaptation in the context of analysis of natural and landscape characteristics of anthropogenesis.

2. Problem Statement

Interaction of humans with the environment at the primordial stage of their development included a number of different aspects. In this paper, we are going to concentrate only on some of them:

- Analysis of geographic parameters of environmental measure of anthropogenesis. Anthropogenesis happened in a certain geographical setting. Reconstruction of the reality of primitive humans assumes scientific comprehension of the total of natural factors that defined human prehistory;
- Revealing mechanisms and factors of environmental adaptation dynamics during the anthropogenesis. Analysis of territorial movements of humans over long distances when food resources became depleted in their previous locations allows tracing how morphophysiological characteristics of the human organism adapted to conditions of new environments;
- Determining role, place and direction of human migration in the environmental adaptation in the early period. This resort to population migration at the early stages of human history allows delineating geographic parameters of the anthropogenesis.

3. Research Questions

Historical experience shows that environmental adaptation serves as a global law in interactions between human and the environment. Keeping that in mind, we propose the following questions to be concerned in this research:

- Defining the means of environmental adaptation. The cultural phenomena used in environmental interactions are being analyzed in this context. Simultaneously, attention is paid to the methods of human adaptation to the environment and the nature of environmental interactions;
- Consideration of mechanisms of the environmental adaptation. In formulation of this question, it is important to discuss in what what getting new knowledge, skills and experiences promoted changes in the humans themselves and in their environment;
- Identifying the results of the environmental adaptation. Their analysis assumes finding new morphophysiological characteristics of organism and behavior facilitating appearance of intelligent humans.

4. Purpose of the Study

The main idea of this paper is to present the phenomenon of environmental adaptation in the context of human genesis and early development. Implementation of this idea assumes resolving a number of research problems:

- Analysis of exact historical conditions of the environmental adaptation at the earliest stages of human development;
- Establishing links between a positive (productive) and negative (antiproduktive) environmental adaptation;
- Substantiating a conclusion that the positive environmental adaptation promoted formation of new morphophysiological characteristics of organism and psychological behavior of hominids, which resulted in appearance of *Homo sapiens*;
- Arguing in favor of a hypothesis that the negative environmental adaptation blocked appearance of different species of intelligent humans within the genus *Homo*.

5. Research Methods

Theoretical-methodological conceptualization of environmental historical thought originates primarily from acknowledging fruitfulness of the idea of geographic determinism, that the natural environment serves as a set of factors that regulate human behavior. However, the problem of the kind and forms of human-nature interactions is not being resolved unambiguously in contemporary humanities (Alexandrov et al., 2008).

Nowadays, there is a rejection of understanding the natural environment as something external with respect to human, as it was typical of representatives of classical geographical determinism. Nature-centric theory stopped being the main direction in resolving the problem of human-nature interactions. Understanding that the nature favors, not forces human is getting ground. Human activity and will are proclaimed as independent developmental factors, whose action dismantle the predetermined nature of the development as defined by nature.

Simultaneously, the anthropocentric concept holding human as a demiurge of nature is being critiqued. This approach pits the human and nature, seeing the latter as only a means for attaining human goals.

As a result, the environmental-historical methodological approach allows talking about inevitable harmony of human and nature, about global interlinks between the biosphere and the anthroposphere.

Such point of view being applied to the environmental-historical interpretation of anthropogenesis allows substantiating a conclusion that during the evolution of hominids, the species able to increase energy of the biosphere were able to survive. Only *Homo sapiens* could play this role, while the culture they created has in all its manifestations become the principal human adaptive mechanism to natural environment.

6. Findings

At a very early stage, an important mechanism of the environmental adaptation as a form of human-nature interactions was human migrations. In a period from 2.000.000 BP to 10-12 000 BP, geologic history of the Earth was characterized by great glaciation, when a significant portion of its surface was covered with glaciers. The glaciers periodically expanded and reduced. In the condition of global cooling, glacier tongues increased in size and covered a large portion of water surface of the Earth. This led to decrease in ocean level and appearance of land bridges between previously separate parts of dry land. When the global temperature increased, the situation reversed. During this time interval, from 80 to 10 thousand years ago, the Last Glacial Period took place (Imbri & Imbri, 1988).

During population migration in the prehistoric era, on the one hand, there was diffusion into a wider population of morphological and genetic traits previously formed under the influence of local natural landscape. This stage of the environmental adaptation may be defined as a positive (productive) adaptation. On the other hand, isolation of a small local population within the boundaries of a local natural landscape promoted changes in morphological and genetic traits of the population, finally leading to its extinction. This type of environmental adaptation shall be called a negative (antiproduktive) adaptation. Formation of positive and negative types of environmental adaptation happened mainly as a result of influence from geographic factor.

Geography of population migrations in prehistoric times determined by the fact that its initial region was in Africa, which was the origin of three fundamental migration streams of prehistoric humans. The first one related to territorial movement of human ancestors (hominids), namely early *Australopithecus* about 3 million years ago (Johanson & Idi, 1984). Their distinctive feature was bipedalism. It played a crucial role in the entire subsequent human evolution. Without bipedalism, intelligent life would not have appeared on Earth.

Adaptation of hominids to bipedalism happened under influence of relevant natural conditions. Initial region inhabited by human ancestors was tropical forests of East Africa with their mild and humid climate. As time wore on, these forests depopulated and receded north, increasing the area of grass-covered savanna and dry steppe. Changes in the habitat of human ancestors happened as a result of geological transformation related to movement of lithospheric plates. Approximately 50 million years ago, Eurasian and Indian plates collided, which led to formation of the highest mountain range in the

world, Himalayas, where 96 of 100 tallest mountains on Earth are located, including Everest (8,848 m). The length of Himalayas is one tenth of Earth's circumference. This gigantic formation of rock and ice influences climate formation throughout the planet. Warm, humid streams of air from India approach Himalayas and go up. Ascending air is cooled, resulting in clouds and monsoons. In the summer, tremendous streams of dry air spread towards Africa, which in the past promoted reduction of East African tropical forests. Besides, about 25 million years ago, African continental plate drifting north collided with the Eurasian plate, thus disconnecting the Mediterranean Sea from the Atlantic Ocean, which lead to drying out of the former. This resulted in increased glaciation of Antarctic. As time wore on, Gibraltar strait appeared and Mediterranean Sea filled with water again, but massive glaciers in Antarctica remained. Movement of lithospheric plates led to climate change and reduction of tropical forests in East Africa. Human ancestors were forced to leave their habitat and move to open pastures or savannas (Lebedev, 2012).

There were two waves in migration of *Australopithecus*. One of them had proceeded in westerly direction, where *Homo ergaster* later appeared. A division line between *Australopithecus* and genus *Homo* is a skill in manufacture of stone implements. Remains of *Homo ergaster* together with manufactured basalt implements were discovered by D. Lordkipanidze in Georgia, near the town of Dmanisi in 2001. The remains are about 2 million years old. It is the most ancient find of hominids (and humans) outside Africa. *Homo ergaster* were first humans showing ability to adapt to the environment.

The second wave of territorial migrations of early *Australopithecus* proceeded to the east, where they were the foundation for another species within the genus *Homo*, Java Man, *Homo erectus* (formerly known as *Pithecanthropus*). The first finds of this species were made by Dutch doctor Eugène Dubois on the island of Java in 1892.

Simultaneously, new species of the genus *Homo* developed from early *Australopithecus* in Africa: *Homo habilis* and African population of *Homo erectus*. The latter was found by English archaeologists Louis and Mary Leakey in East Africa in 1960. *Homo habilis* lived from 2.4 to 1.5 million years ago and was the first hominid to demonstrate tool use, that is, a capability to apply one object to another in order to change the form of the latter (Lambert, 1991), and thus may be considered primal creator of culture.

African evolution of humans continued with *Homo erectus* that demonstrated their advantages over *Homo habilis*, as they were able to provide different answers to challenges of their natural environment. Neither *Homo habilis*, nor *Homo erectus* were involved in hunting, even less so large game hunting. In dry climate conditions, *Homo habilis* preferred vegetarian diet, digging out tree roots for food. *Homo erectus* switched to meat-based diet that largely consisted of leftovers after large carnivores (the latter preferred more tender pieces of soft tissues and left hard-to-get bone marrow intact). Bone marrow of herbivores constitute about 5 % of their mass, so a mammoth or an elephant had about 200–300 kg of it (Golubchikov, 2003). Thanks to the meat-based diet, brain of *Homo erectus* got animal protein, i.e., necessary energy. This led to increasing the brain volume of *Homo erectus* to 1100 cm³. Increased brain volume in early hominids meant that their mental capabilities and learning skills started to progress. *Homo erectus* was the first of *Homo* to intentionally use fire. This jump-started a whole range of skills. Use of fire gave prehistoric humans an ability to cook higher quality food, which in its turn promoted change in body template. Fire allowed overcoming inherent fear, it was used as a weapon with a deterrent

effect. *Homo erectus* existed during the period from 1.8 million years to 400 000 years ago; its demise is connected to climate change.

The second fundamental migration stream of prehistoric humans from Africa was related to migration of *Homo erectus*. Territorially, the migration of *Homo erectus* proceeded in two directions. One of them, eastern, led to formation of *Sinanthropus* subspecies in China on the basis of African population of *Homo erectus*. Morphological and genetic features of the African population of *Homo erectus* become distributed onto a wider population, witnessing to positive (productive) adaptation of the prehistoric humans.

A classic example of negative environmental adaptation is change in morphological and genetic traits of the African population of *Homo erectus* having migrated from South East Asia towards Australia through a chain of islands connected with isthmuses (ocean level was about 120 m lower 2 million years ago, due to higher glaciation). In 2004, on the island of Flores, one of thousands island in Malay archipelago, Australian scientists M. Morwood and P. Brown found remains of a dwarf type of human, named *Homo floresiensis*. The isolated islands served as a kind of natural laboratory, where living organisms were transformed. In comparison with the African population of *Homo erectus*, height of *Homo floresiensis* decreased to one meter, body weight reduced to 30 kg, while brain volume was no more than 380 cubic cm.

Evolution of representatives of African population of *Homo erectus* migrating to Europe was different; there, they served as a foundation for *Homo antecessor*, whose remains were found in northern Spain in 1994 and 2007. Its age is 780 thousand years. It is considered the most ancient representative of the genus *Homo* in Europe and is defined as the ancestor of archaic *Homo sapiens* and another early form, Neanderthal (*Homo sapiens neanderthalensis*). The latter dominated in Europe for tens of thousand years, in the period from 140 to 28 thousand years BP. In 1856, its remains were found in western Germany (Lambert, 1991), and new fragments were found in 1997-2000. Computer graphics was used to reconstruct Neanderthal's face. German and American scientists are currently working on sequencing the complete Neanderthal genome.

Neanderthals demonstrated ability to adapt to severe climate conditions. During their time, Europe was largely covered by ice. Neanderthals inhabited its southern part, where iced tundra gradually gave way to steppe and then to sparse taiga forests. Long living in cold climate promoted stocky body build and shortened body proportions, allowing keeping warm better.

Neanderthals were first prehistoric humans who started to use tar glue in production of implements and in medicine, to control toothache (there are no bad teeth found in Neanderthal remains). Neanderthals were inquisitive about themselves and their environment, learned and transmitted their knowledge according to their level of intellectual development.

Evolution of Neanderthals in Europe happened concurrently with evolution of ancestors of anatomically modern *Homo sapiens* in Africa. Modern humans appeared 100–200 thousand years ago. Their larynx was located lower, facilitating development of articulated speech. It marked the start of the human cultural evolution, defined by transmission of ideas.

Approximately 60–75 thousand years ago, anatomically modern *Homo sapiens* started their great expansion. It was the third fundamental migration flow of prehistoric human from Africa. First, they

moved towards South East Asia and Australia. There, their competitors could be relic Sinanthrops and pigmy species of *Homo floresiensis*. Approximately 18 thousand years ago, violent volcanic activity in the region led to extinction of *Homo floresiensis* and modern *Homo sapiens* who had migrated there.

About 40–45 thousand years ago, anatomically modern humans (Cro-Magnon) expanded to Europe, into Neanderthal heartland. For a long time (during the period of 40–28 thousand years ago), Cro-Magnons and Neanderthals lived at adjacent territories. Neanderthals did not endure in this competition for a number of reasons.

First of all, they had different social organization. Neanderthals lived in isolated populations, separate groups of hunter-gatherers with no more than 30 people. Cro-Magnons were integrated into larger communities, which facilitated exchange of experience. Food strategies that had formed under corresponding natural conditions were also different. Cro-Magnons were not limited to meat of mammals, their diet also included fish, waterfowl and mollusks. Foundation of Neanderthal diet was exclusively meat of large herbivores (deer or mammoth). However, 20–25 thousand years ago, a significant worsening of climate took place, which led to decreased plant cover and, as a result, reduced number of animals available for hunting. Being highly-specialized animals, Neanderthals were unable to change their diet. Phosphorus in marine and river-borne food sources facilitated further development of brain in Cro-Magnons. They were becoming more flexible and capable of adapting to difficult situations. Besides, Cro-Magnons could bring new diseases from Africa, that decimated previous inhabitants of Europe (Kravchenko, 2003).

Neanderthals played only the role of doubles to anatomically-modern *Homo sapiens* (Vishnyakov, 2010). The negative environmental adaptation blocked appearance of different species of intelligent humans within the genus *Homo*.

The considered model of environment adaptation dynamics in the process of anthropogenesis is usually defined as a population substitution model. According to its main provisions:

- about 2 million year ago, *Homo erectus* left Africa and expanded to other regions, including Europe. There, on its basis and under influence of natural landscape ancient and modern forms of *Homo sapiens* were formed;
- In the period of 100-200 thousand years ago, anatomically modern *Homo sapiens* appeared in Africa. Some of this population migrated north, first to Asia and then to Western Europe;
- In Europe, early and late forms of *Homo sapiens* co-existed with minimal interbreeding and the former were substituted with the latter.

As a result, anthropogenesis was uneven, without a gradual shift from ancient populations to the modern ones (Meyer, 2006).

At the same time, there is also a multiregional model with the following provisions:

- about 2 million year ago, *Homo erectus* left Africa and expanded to other regions, including Europe.
- starting from this time, *Homo erectus* continued their development within continental regions – first to ancient and early *Homo sapiens* forms, and then to anatomically-modern forms. Continental regions were not isolated from each other: individuals interacted and exchanged genetic material;

- There was interbreeding of various human subspecies and movement of genes between Africa and Eurasia (Ridley, 2008).

As a result, anthropogenesis was not sudden, but had a regional sequence, that is why some features of *Homo erectus* may be seen in quite recent *Homo sapiens*.

It should be noted that neither of the models completely explains origin of anatomically modern humans. Researchers note that the population substitution model is better supported with data in Western Europe and Africa. However, the multiregional model is better in description of situation in Eastern Europe, Far East and in Australia. A single model cannot be applied to all regions.

However, whether human groups lived in Europe, China or Ethiopia, they saw development of cultural foundations that facilitated reduced need in biological and genetic changes. Culture in all its forms served as the main adaptive mechanism that humans use with respect to surrounding natural environment. Having mastered cultural adaptation, hominid groups reduced or “damped” the extent of differences. However, it could increase as a result of prolonged separation of groups living in different natural landscape areas of the planet.

The main research result related to substantiation of the assumption about environmental influence onto environmental adaptation in the context of historical dynamics is in accordance with the hypothesis. The hypothesis is that environmental adaptation serves as a global law in interactions between human and the environment. At that, additional research is needed in order to study how new knowledge, skills and experiences facilitated change in human communities and external world.

7. Conclusion

Environmental adaptation is a complex phenomenon that appears during interaction and mutual influence between the fundamental factors in human life: the nature and society. Essence of environmental adaptation is in mutual adaptation of humans and their environment, while its mechanisms are determined by exact historical conditions. Thus, this mutual adaptation is a result of both, history of people and history of nature. Approach to the phenomenon of environmental adaptation is impossible without considerations for its historical dynamics, where both positive and negative experience are revealed. This experience is absorbed by learning lessons from interactions between humans and the nature. Among them are:

- Environmental dimension of anthropogenesis was largely defined by spacial-geographic parameters of the phenomenon;
- Changes in morphological and genetic traits of prehistoric human served as a kind of indicators for interaction between humans and the nature;
- Human behavioral stereotypes were formed during their adaptation to natural landscape;
- Positive environmental adaptation found its manifestation not only in adaptation of humans to the natural landscape, but in adaptation of the landscape to humans, thus, it serves as a certain ‘adapter’ in interactions between humans and the natural environment.

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