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CRYOSOPHY

HUMANITARIAN ASPECTS OF CRYOSOPHY

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The paper presents a perspective of humanitarian aspects in cryosophy, an interdisciplinary system of knowledge and ideas of the cold world. It is suggested to extend the scope of subjects in geocryology with issues concerning cultural effects of the cryosphere, in addition to the conventional environmental and engineering approaches. Both approaches that concern, respectively, the risks posed to the vulnerable nature and the efficient and safe uses of resources in the high latitudes are intimately related with processes in the human society. The three jointly represent a complex interaction between people and the world of cold. The experience of adaptation to living in cold regions gained by local people, which is recorded in the traditional ways of different northern cultures, can make basis for successful nature management, public healthcare, and energy conservation.

Cryosophy, cryospheric resources, geosciences, human sciences, interdisciplinary research, convergence of knowledge, anthropogenesis, ethnoecology

INTRODUCTION

Homo humans and their ancestors lived in permafrost conditions for at least 100,000 years since the onset of the Würm glaciation. That cold period spanning the lifetimes of about 6000 generations caused a major effect on the genotype, phenotype, culture, and social instincts of the modern man.

It seems strange why the cold, which has been an inalienable element of everyday life, has not become a subject of the millennia-old philosophical theories. As the history of science has demonstrated, the views of the world evolve from philosophy, which stems from watching (Anschauung) or creating and interpreting images, to experiments and scientific knowledge. Various fields of knowledge, such as physics, chemistry, or biology, derived from philosophy and placed constraints on deductions based on visual experience.

Unlike other sciences, geocryology had no phylosophical past but rather rooted from a solid background of pure and natural sciences. It originally borrowed concepts from geography and geology and largely remained within the scope of their goals and objectives. This strategy, however, poses problems, and the solutions require much effort [*Melnikov, 2015*]. In the case of geocryology, science came before philosophical concepts of the cold world, which are currently being created in the form of cryosophy, a holistic perspective of the cold world [*Melnikov and Gennadinik, 2011*]. The new field of philosophy has progressed through the recent decade [*Melnikov and Gennadinik, 2012, 2013; Melnikov et al., 2013; Melnikov, 2014*] but many knowledge gaps still remain, especially in understanding the role of cryospheric objects in the history of humans.

The scientific approach to the world of cold originally aimed at creating means and tools for its safe use. Later, as anthropogenic loads on the vulnerable northern nature were progressively increasing, its conservation became the top priority. Both approaches are useful for understanding the dialectics of interactions between the man and the nature as a single complex process.

The humanitarian aspects of cryosophy proceed from the fact that different elements of the cold world build an environment which leaves imprint on almost all spheres of the human life: physiology, psychology, behavioral strategy, economy, and culture. This influence has to be taken into account in studies of anthropogenesis, ethnogenesis, ethnoecology, social and economic processes, healthcare, climatic adaptation, etc.

Research in this line primarily focuses on mechanisms responsible for the influence of periglacial conditions and resources on man and society. The problem would appear simple and obvious, but it is hard to solve for methodological reasons, because many complex interactions of humans with the cold world cannot be properly understood within the narrow limits of any specific science. For instance, recent experiments have demonstrated that meltwater utilized commonly by people native to highlands and nor-

thern countries is beneficial for human health. However, official medical practitioners doubt about this effect because meltwater has been a subject of multiple pseudo-scientific myths. In this respect, joint efforts of experts in physicochemical phase transitions, physiologists, ecologists, anthropologists, and others would be helpful to clear up the problem. Another issue requiring interdisciplinary studies concerns viable relict bacteria preserved in permafrost which fall into the food of people and maintain adaptation of their immune system to living in the polar regions [*Kalenova et al., 2010, 2011; Brouchkov et al., 2011; Melnikov et al., 2011; Mamaeva and Petrov, 2013*]. Joint work by biologists, anthropologists, medical scientists, ethnographers, and other specialists is indispensable for investigating, with advanced methodological approaches, the potential of permafrost biological resources.

It is becoming ever more evident that the physiology and adaptation potential of human communities in harsh cold and warm (presumably favorable) climate conditions are different. Below we discuss some important topics in the humanitarian aspects of cryosophy.

ROLE OF COLD RESOURCES IN ANTHROPOGENESIS

Anthropologists and archeologists recognize that the resources of the cold world played a key role in the evolution of humans. Already Aristotle noted that temperate climate motivates learning and development of working skills, and later theories attributed the origin of humans to challenges of cold climate. In terms of biology, *Anuchin* [*1927*] suggested that dramatic changes in the living conditions, including climate cooling, can cause formation and transformation of species.

The very existence in a cold climate is a driving force of anthropogenesis as it commands progress in technology: making clothes, building houses (instead of caves which are hard to warm even with fire), mastering new ways of hunt and transportation, etc.

Cold climate stimulates development by creating challenges and, on the other hand, it gives rise to new potentialities. Neanderthals who lived near ice sheets in Europe could hunt large mammals (mammoths and rhinoceros) and stored meat in permafrost. Meat eating was favorable for culture formation by boosting brain and intellectual abilities [*Burovskiy, 2011*].

The modern Cro-Magnon man has been inferred recently to derive from Neanderthals mixed with gracile Sapiens who came from Africa and Middle East. Neanderthal DNA fragments that formed in periglacial conditions may reach 20 % in the genome of modern man [*Sankararaman et al., 2014; Vernot and Akey, 2014*].

ROLE OF CLIMATE RHYTHMS IN SOCIAL AND ECONOMIC PROCESSES

There are two conflicting views of the man-nature interaction. Partisans of geographic determinism, a theory which appeared in the 18th century after the publication of *De l'Esprit des Lois* (*The Spirit of the Laws*) by Montesquieu, suggested nature to drive the social evolution. Contrary to that idea, the theory of possibilism in cultural geography (Schlüter, Sauer, Voeikov) implied that the environment imposed constraints or limitations, but culture was otherwise determined by social conditions and that the man could influence the nature. The two views obviously should be dialectically combined. For instance, the coming cycle of natural cooling reduces the consequences of man-induced global warming. This reciprocal influence of nature and society explains the growing interest to climate change as a control of historic events [*Nikonov, 2007; Klimenko, 2009*]. A number of events in the history of Russia in the 16–17th centuries may be explained in the context of the early Little Ice Age. Low crops as a consequence of a very cold summer led to mass hunger and the ensuing disaffection against Boris Godunov, unrest, and the Time of Troubles.

Considerable cooling in the middle 17th century was possibly an underestimated cause of the decay of Mangasea, the first high-latitude town in Siberia, in which the economy declined when the period of summer navigation along river routes commonly used by explorers became shorter. On the other hand, cooling mobilized state powers and motivated geographic expansions and formation of empires. Correlation of climate curves with social and political dynamics of some countries shows that the long rule of Louis XIV, stability and reforms by Peter the Great in Russia, as well as the prosperous period of Kangxi in China, who was the longest-reigning emperor in Chinese history and one of the longest-reigning rulers in the world, coincided with the Maunder sunspot minimum [*Zlatev, 2016*].

Karl Jaspers, a German-Swiss psychiatrist and philosopher, developed the theory of an Axial (or Axis) Age [*Jaspers, 1953*], a "pivotal age" characterizing the period of ancient history during the 8th to the 3rd century BC. Then, according to Jaspers' concept, new ways of thinking in religion and philosophy appeared strikingly synchonously in Persia, India, China and in the Greco-Roman world, when the fully mythological thinking gave way to elements of materialism as a basis for scientific knowledge. Note that the axial age corresponded to the Subboreal cooling peak. However, some pre-axial civilizations (Egypt, Ancient Greece, Sumer and Babylon) failed to adapt to the climate change and became eventually assimilated by new cultures.

Unfortunately, as in many other cases, the lack of interdisciplinary cooperation between scholars of hu-

manitarian and natural sciences impede goal-oriented studies of climate cooling effects on social history. Interest to history in this respect is not a trivial curiosity: the revealed correlations between climate and social events may be used as reference to predict possible consequences of future changes.

ROLE OF CRYOGENIC RESOURCES IN ETHNOECOLOGY AND LIFE SUPPORT CULTURE

Ethno-ecology is a relatively new science that appeared in the 1950s as an overlap of ecology, ethnography, ethnic geography, anthropology, and demography. *Ethno* refers to human culture and *ecology* refers to interactions between organisms and the physical environment. Ethnoecology focuses on the ways how people conceptualize elements of the natural environment and human activity within it. Its subjects include effects of ecological links on human health; ways of using the environment by different cultures and their impacts on the nature; traditions of rational land use; patterns of ethno-ecosystems, etc. [*Kozlov, 1983*]. The first serious Russian publication in this field was called *Arctic Ethnoecology* [*Krupnik, 1989*]. The interest to indigenous Arctic inhabitants was not fortuitous: they conceive the nature as part of themselves rather than as something external, and the notion of *environment* even lacks from their cognition. Man, as a microcosm, faces-off himself, while nature is nothing but a cosmos integrated into one's life [*Fedorov, 1995*].

All northern cultures use glacial resources for subsistence, and this tradition has its linguistic expression. Languages of different Arctic and Subarctic peoples contain many words which refer to different states of nature and do not exist in the thesauruses of other "more southern" peoples, but they lack the words *snow* and *ice*. They rather use multiple specific terms instead of these too general concepts [*Fedorov, 2013*]. Some examples are cited in the book "A Word about Words" by *Uspensky* [*1982*]: many peoples of the North (Laplanders, Chukchi, Nenets, and others) have more than twenty words for different kinds of snow, like our *crusted*, *granular,* or *drift snow*. The difference is that other languages have both the general word *snow* and specific words for its different modifications, while the northern people use specific terms only. For instance, separate words for falling or lying snow in the Eskimos or more than one hundred notions for different properties of snow and ice in the Chukchi. This diversity in calling cryospheric objects which share similar physical properties is evidence that these objects have different functional meanings in the traditional cultures.

As noted above, the use of ice and snow for food storage was a strong impetus for anthropogenesis. Nowadays some Arctic people (e.g., Nenets in the Polar Urals) still keep venison in snow which persists all year round in the highlands. In Siberia people traditionally used different kinds of cold underground food storages (called *lednik*, a word derived from *lod* which means *ice*) with their design features varying according to climate conditions and local practices: ventilated cellars, storages with ice and snow as coolants, or others. This way of keeping the food fresh would seem outdated, but it is worth attention for its great practical value. It can save much energy which is required for running the modern refrigerators and thus increases the prime costs of short-life products. For this reason, large food producers worldwide show growing interest to underground storage based on the cheap and environment-friendly natural resources.

Russian ethnographers have never studied the traditional ways of food keeping systematically. Meanwhile, it would be useful to organize joint trips by different specialists to investigate the designs and uses of natural cold storages in different peoples and in different geographic conditions, to study physicochemical mechanisms of their operation and find possible modern industrial applications.

The role of cryospheric objects in folk healing practices is another poorly investigated issue. There are reasons to believe that they were used, explicitly or implicitly, in the health culture of many peoples. Namely, a sort of "dialectic" alternation of hot bath (sauna) and ice-cold shower (snow or frost in traditional Russian practices) has been the oldest way of ill-health prevention. Some ethnographers suggest that the Epiphany bathing rites come from pre-Christian times in the history of East Slavs. Since ancient times, people have believed that the brief stress of cold is a good way of immunity mobilization. This is consistent with the idea of anti-fragility of organisms by *Taleb* [*2014*] implying that changes are beneficial for complex and stable objects while invariability is fraught with accumulation of risks. Medicinal uses of snow and ice are known in many traditional northern cultures. For example, the rites of purification from disease in Khanty include bringing lake ice, and the spells say "*snow to fall, illness to leave*".

Many indigenous people of high-latitude countries know that ice and snow can provide much information about the surrounding world: hunters use traces of animals as a guide; the state of ice and snow has implications for climate conditions, as well as for weather forecast.

CONCLUSIONS

Convergence of natural sciences and humanities within the paradigm of cryosophy can reveal systematic relationships between humans and the world of cold which otherwise remain hidden from strictly specialized research. There are several priority lines of studies in this respect. They may focus on the role

of cold in anthropogeneis and ethnogenesis; historic perspective of warming and cooling climate rhythms as controls of social life; modeling global change consequences for social and economic processes on this basis.

A new interdisciplinary approach is required to study the traditional cultural ways that express adaptation of peoples to living in cold regions. Their experience can be useful for nature management, public healthcare, and energy conservation.

Insights into the properties of relict bacteria preserved in permafrost can open new avenues for biomedicine and healthcare technologies.

These projects require joint efforts of scientists engaged in pure, natural, and humanitarian sciences and due regard for the synergic effect from the convergence of different fields of knowledge.

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