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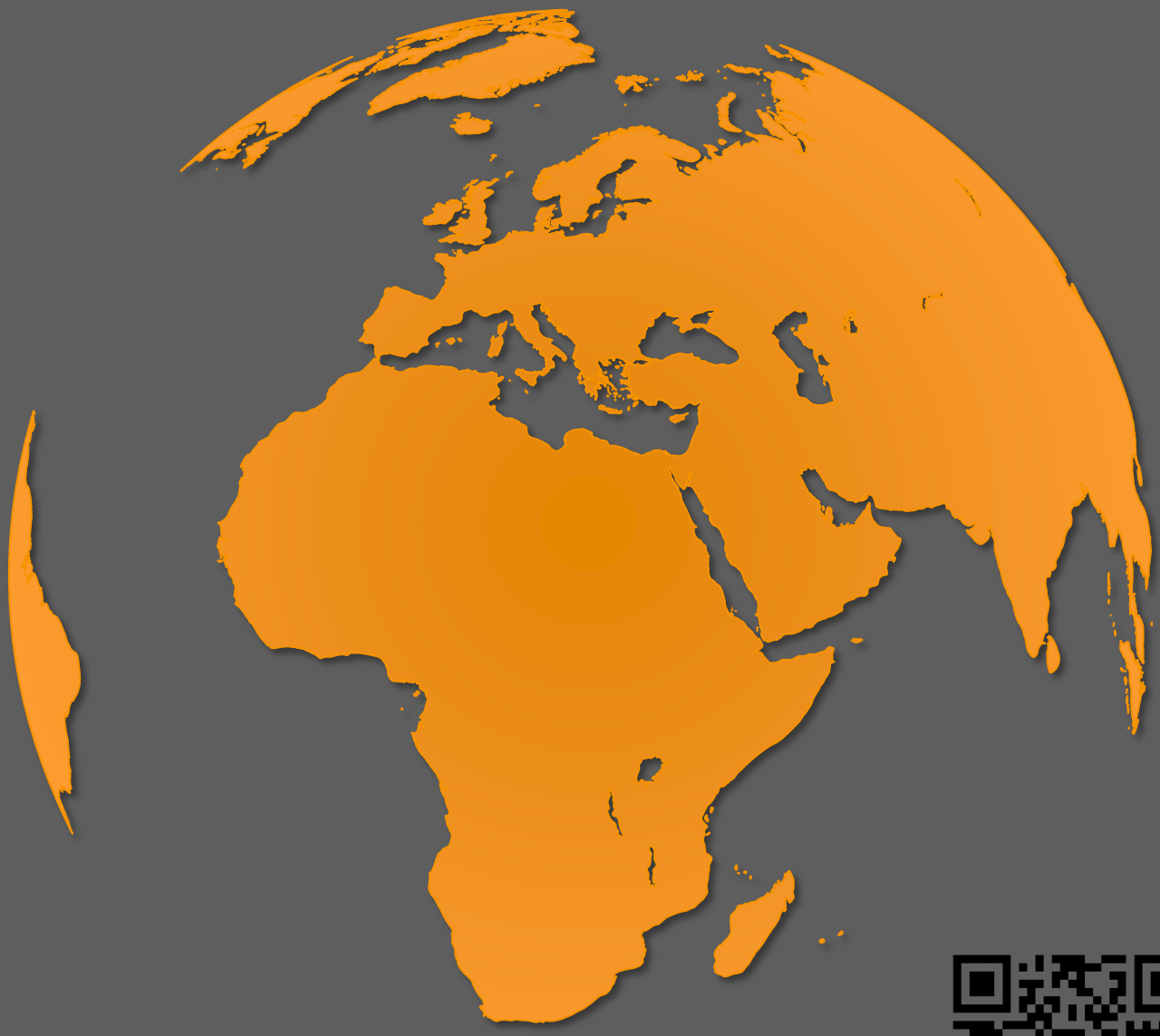

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ЖУРНАЛ ФУНДАМЕНТАЛЬНЫХ ИССЛЕДОВАНИЙ | JOURNAL OF FUNDAMENTAL STUDIES

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THE ROLE OF GERMAN SCIENTISTS IN THE STUDY OF CLIMATE CHANGES AND NATURAL CONDITIONS DURING THE BRONZE AGE IN CENTRAL ASIA

АННОТАЦИЯ

Ўрта Осиёнинг жанубий ҳудудларида сўнгги бронза даврида турли соҳаларда катта ижтимоий ўзгаришлар рўй беради ва бу ўзгаришлар натижасида милоддан аввалги 2-минг йиллик ўрталарида ҳам чуқур маданий ўзгаришлар рўй беради. Ушбу ижтимоий-маданий ўзгаришларни тушунтириш учун таклиф этилаётган турли сабаблар орасида турли олимлар томонидан милоддан аввалги 2-минг йиллик бошларида Ўрта Осиёда глобал иқлим ўзгариши ҳақидаги гипотеза алоҳида ўрин тутади. Ушбу мақолада Европа ва Германия олимлари томонидан ўрта ва кеч Голоцен давридаги иқлим ўзгариши билан боғлиқ палеоэкологик маълумотларни кўриб чиқилади.

Калит сўзлар: Ўрта Осиё, бронза даври, Окс цивилизацияси, немис олимлари, иқлим ўзгаришлари, Голоцен.

АННОТАЦИЯ

В южных районах Средней Азии в эпоху поздней бронзы произошли большие социальные изменения в различных областях, и в результате этих изменений до н.э. В середине 2-го тысячелетия произойдут и глубокие культурные изменения. Среди различных причин, предлагаемых для объяснения этих социокультурных изменений, особое место занимает гипотеза глобального изменения климата в Центральной Азии в начале II тыс. до н.э. разными учеными. В статье представлен обзор палеоэкологических данных европейских и немецких ученых об изменении климата в среднем и позднем голоцене.

Ключевые слова: Центральная Азия, бронзовый век, цивилизация Окса, немецкие ученые, изменения климата, Голоцен.

ANNOTATION

In the southern regions of Central Asia, during the Late Bronze Age, great social changes took place in various fields, and as a result of these changes, BC. In the middle of the 2nd millennium, profound cultural changes will also take place. Among the various reasons proposed to explain these socio-cultural changes, the hypothesis of global climate change in Central Asia at the beginning of the 2nd millennium BC by various scientists has a special place. This article reviews paleoecological data related to climate changes during the middle and late Holocene by European and German scientists.

Key words: Central Asia**,** Bronze age, Oxus civilization, German scientists, climate changes, Holocene.

A critical assessment of the hypothesis of climate change in Central Asia at the beginning of the 2nd millennium BC allows for a new study of the discussion. The role of climatic factors in the destruction of the Oxus civilization has been extensively studied in the research of Elise Luneau, a scientist of the German Archaeological Institute. According to the currently collected scientific data, the sharp climate changes in the first half of the II millennium BC cannot be the main factor for the crisis of the Oxus civilization, however, the environmental and ecological changes should not be ignored, and the evolution of man and society should be studied from a more integrated point of view.

The question of the variability of the climate system, its influence on socio-cultural conditions, and the influence of man on the climate is currently being intensively discussed by the European scientific community. Many scientists put forward the idea that environmental changes can be the main vector of social changes, or at least a factor for the development and strengthening of internal tensions within society. More specifically, climatic causes are often assumed to be a major factor in the extinction of past societies and cultural processes, revealing the resilience and vulnerability of existing societies to climate change [7].

World climatological researchers have conducted paleoecological research on a number of civilizations, including Akkad, Indus, Mayan or Tiwanaku, and have emphasized that the climate factor plays a major role in the development of civilizations. This also applies to the Oxus civilization, which occupied southern Central Asia and the northeastern part of Iran during the Bronze Age between the second half of the 3rd millennium BC and the middle of the 2nd millennium BC. Some scientists try to explain the decay of this civilization with "the imbalance in the ecological-social system caused by the growing aridity of the climate and, as a result, the decrease in the agro-climatic potential." Climate change is a crucial process for understanding the interaction of environmental and anthropic factors in the evolution of the Oxus civilization [9, P.335].

In our opinion, the issue of the connection between climate, environment and social changes and the impact of climate changes on human activities and great migrations of peoples has not been clearly and clearly explained in science. It is worth noting that the intersection of sciences and scientific approaches, more precisely, the study of ecology and anthropology together, sheds more light on the issues of interaction between man and the environment.

According to paleoecologist K. Butzer, climate change is a complex, multifaceted phenomenon, and to explain the interaction between climate change and social evolution, the question of the interaction of human communities is also important[2,P.3632,3639].The area of the Oxus civilization covers the southern part of Central Asia and northeastern Iran, roughly the Aral Sea basin and the Dashti Kavir desert island of the Iranian plateau, mainly located between 35° and 40° latitude, one of the driest regions in the world. Currently, in modern research, there are studies about the so-called "west winds", that is, the nature of these regions is dominated by western winds [5, P.39].

It belongs to the desert climatic zones and has a semi-arid climate characterized by relatively low rainfall from late autumn to mid-spring and maximum exposure to the sun and high temperatures during the rest of the year. 90% of this area receives less than 400 mm of precipitation per year [8, P.12].

Despite the drought, southern Central Asia has a long history of agro-nomadic economy since the Neolithic period, which is definitely determined by water economy. Most of the population lived on the banks of rivers or in the foothills, which were more suitable for agricultural use, and in the mountainous regions, the climatic conditions were sufficient and favorable for livestock and dry farming [11, P.101]. The heyday of the Oxus civilization is defined as approximately 2250–1750 BC, when a distinctive material culture was manifested with great uniformity over a vast area such as present-day northern Iran, southeastern and central Turkmenistan, northern Afghanistan, southern Uzbekistan, and southern Tajikistan.

The Oxus civilization mastered the use of natural raw materials (gold, lapis lazuli, turquoise, alabaster, tin, etc.) available in Central Asia and the production of finished products from them, and played an important role in the exchange system. Specific items belonging to this culture were also recorded in the neighboring regions (Zaravshan Valley, Ferghana Valley, Indo-Pakistan Region, Gorgon Plain, Arabian Peninsula, etc.).

In addition to long-distance trade, as a result of cultural contacts, it developed to the level of a proto-city, experienced social stratification, specialization of tasks, and territorial expansion. The inhabitants lived in settlements of various sizes in houses built of raw bricks or boards. Monumental architecture, unique methods of burial, as well as prestige and luxury items reflect a hierarchical society, perhaps organized as a proto-state. Although many aspects related to the use of natural resources require additional research, the population was engaged in agro-nomadism, a complex socio-economic form, with the production of rich and diversified agricultural products, as well as raising various animals. Ceramics, metal and stoneware were the skills of specialist craftsmen associated with the Middle East. The language(s) spoken by the population is thought to be Indo-Iranian, Proto-Tochar or Elamite.

The climate factor may also be the primary reason for the collapse of the Oxus civilization. Many scholars argue that the climate in Central Asia became wetter between 2250 and 1950 BC. Then, a dramatic drying of the climate occurred around 1950-1750 BC, causing significant ecological changes and affecting human societies. This phenomenon can be illustrated by the example of the change in the hydraulic system of the Murgob valley in the central part of Turkmenistan. As a result of the desertification of the distal part of the canal networks, the oasis habitats have decreased over time [6, P.15]. On the one hand, it may have been caused by the gradual decrease of the waters of the Murgab River, and on the other hand, by the continuous movement of sand in the Karakum desert as a result of the northern winds.

As a result, the drought process alters the flow of rivers, reducing water supplies and reducing the potential of agricultural land. This creates demographic pressure that leads to a decrease in population density, resulting in population decline and migration.

The spread of settlements from the early Bronze Age to the Iron Age proves the impact of environmental change, as monuments show migration in relation to water resources [13]. According to M. Cattani, this hypothesis is also the basis for explaining the arrival of the "Andronovo" tribes from the north, who occupied the lands abandoned by the local population due to the reduction of irrigation and the rise of desert sands [3, P.151]. In general, the dry climate that began at the beginning of the 2nd millennium BC can be the basis for the "crisis" of the urban system of the Oxus civilization.

On the contrary, other German and American scientists do not agree with the main environmental changes of the III and early II millennia BC [15, P.487]. They argue that environmental dynamics related to water supply are not limited to climate and water issues, but may be a combination of several factors, such as geomorphological and geological phenomena.

In recent years, the number of paleoclimate studies on the Eurasian region is increasing. In particular, in the studies of the paleoecologist F. Chen, a synthesis of arid climate from the borders of the Caspian Sea to Mongolia and paleoclimate processes in Central Asia reveals global trends, in which the dry climate in the early Holocene (6000 BC), then the maximum humidity, the middle Holocene (6000-2000 BC) and a decrease in moisture was observed during the late Holocene [4, P.359]. These processes influence the Central Asian summer monsoon and indicate the differential evolution of the regions.

Another study on the distribution of humans in the world is that climate change during the Holocene is characterized by late drought in the lowlands of Central Asia. The last global dry spell in Central Asia appears to have occurred around 2200-1750 BC. This "mega-drought" will cause a 30-50 percent reduction in precipitation and moisture across the Mediterranean, from west to east, and across Western Asia, Central Asia, Africa, and the Western Hemisphere. In the studies conducted on the paleoclimate of Central Asia, the relationship between the atmospheric circulation through the alpine and subalpine regions and the high-altitude environment was studied.

These studies show that the influence of the monsoon decreased and the weather dominated the western regions, where arid conditions in the second half of the middle Holocene came to natural conditions similar to today. A decrease in the water level in Lake Karakol in Tajikistan indicates the drying of the climate. Later, high water levels resulting from melting glaciers in the snowfields and mountains indicate warm climate conditions, with wetting and low water levels resuming around 3500-1600 BC [17, P.14].

Alternatively, a study of vegetation and lake development in subalpine lake Kichikkol in Kyrgyzstan confirms that the humidity gradually increases with the rise of the water level in about two steps. This is also interpreted as a weakening of the Central Asian High and Indian monsoon systems and an increase in the westerly moisture transport from the Mediterranean region. In the 2nd millennium BC, opposite events are detected, the rise of the water level (indicating more precipitation or a higher flow of meltwater) and a significant decrease in spruce pollen.

The authors note that the decline of previously dense spruce forests may be due to other causes, such as the local effects of climate change.

Outside the mountainous region, a study of the sea level of the Caspian Sea on the southeastern coast of Iran shows that the climate became drier between 3000 and 2300 BC. Finally, at the southern border of western Siberia, peripheral data from Kazakhstan indicate a dry continental climate in the region between about 2500 and 1600 BC, suggesting some stability during this period [14, P.351].

In conclusion, in addition to the absence of a clear dry climate at the beginning of the 2nd millennium BC, recent studies show the spatial variability and complexity of the climate system in Central Asia, as well as the variability and diversity of the environment. According to the palynological studies conducted in the Aral Sea and the similarities between Central Asia and the Middle East, the climate of Central Asia can be considered integrated in the eastern Mediterranean system [19, P.357]. The paleoclimate data obtained from this area can represent the conditions of Central Asia in a broad sense. They show the increasing drought in the second half of the third millennium BC. Therefore, taking into account the duration of the Oxus civilization, it can be said that the climatic drought at the end of the III millennium BC was confirmed in different regions of the world, and in the first half of the II millennium BC there was a period of relative climate stability.

The latest geomorphological research conducted in South Central Asia also contributes greatly to the understanding of the interaction between man and the environment. They were mainly carried out in low or high river beds, ecological niches. According to M. Kremaski's research conducted in the Murgob delta, the climate of the oasis during the Bronze Age was drastically different from today. According to him, Murgob was considered a fertile oasis plain, and the hydrological system near the Bronze Age settlements (Gonur and Takhirboy) was active until the end of the Bronze Age, that is, until the middle of the II millennium BC. Thus, the data presented show that there were no major changes in water sources during the period under discussion here. Other extensive geomorphological studies have been conducted in Afghanistan and Uzbekistan. Examination of the paleochannels of the Balkh River and the Zarafshan River revealed a strong dynamic of the hydrographic system with extreme mobility of the channels, a large range of movement, and a large number of changes. In parallel, the migration of the monuments in the last 10,000 years has been recorded. Dashli, which is located in the north of Afghanistan, and in the Surkhan-Sherabad regions of South Uzbekistan, the occupation of the lands by the people from the Bronze Age to the last Achaemenid period indicates the presence of constant water. On the contrary, in Iran, around the region of Sabzavor (Khorasan), another evolution is observed in the location of settlements according to water sources. Originally located along rivers or along natural channels during the Eneolithic and Early Bronze Ages, settlements gradually moved downstream, indicating less water. This evolution occurred in the range between 2450 BC and 1850 BC. Finally, as a result of water level studies based on archaeological data around the Aral Sea, humidity is significantly restored depending on the conditions.

The authors find that the Amudarya's flow changed and the sea level continued to rise in the following centuries, around 1950 BC [1, P.721].

In summary, these ecological analyzes in Central Asia and Northern Iran mainly note constancy in occupation patterns and water availability, or in-depth analysis of climatic data that reveal climate change at the end of the 3rd millennium BC.

In general, the current paleoecological data obtained as a result of paleoclimatic and geomorphological studies do not allow connecting the progressive collapse of the Oxus civilization in the first half of the II millennium BC with a climatic event. However, these facts do not mean that environmental dynamics did not contribute to the final evolution of the Oxus civilization. The study of climate history requires special care and precision.

Climate changes can be long-term phenomena that may not be immediately noticeable. It is emphasized in the studies that the effects of more local changes should also be proven with the climate factor [20]. Climate events can also be limited to specific, sometimes small, areas. The impact of climate change on the environment may vary depending on the extent of exploration of the geographical area and different hydrogeological conditions. The same phenomenon may not have the same effect according to microscales. Many issues, such as the response of different geographical features to climate change or, conversely, the impact of changes in the ecological environment on the local global climate, need further investigation.

In addition, according to Fouache, E, natural factors, particularly tectonic movements such as earthquakes, sea surges, storms, etc., may have also played an important role in local disturbances [10, P.15]. Although the area records a high level of seismicity, very limited research has been done to date to highlight such changes.

The effects of environmental changes vary depending on the subsistence economy, the organization of urban-rural relations, settlement, and the size and type of archaeological sites, which are highly variable and the relationship between them is still unclear. Indeed, climate change does not always mean a crisis situation. The research challenge is to relate the climate scale to the human scale as well. Climate change is not a brutal event, but an evolution that shows the possibilities of adaptation to events. Tribes often have the ability to adapt to changes depending on the production system, social organization and interests of different social groups. Broadly speaking, resilience to climate change can take several forms, according to research.

The first is the migration or spread of the population to areas less affected by climate change (new ecological areas), and the second is economic adaptation through technological growth or change in economic strategy in order to increase production efficiency or increase the level of preservation of products in order to minimize the risk of shortages. Climate change can also be a factor in technological innovation to overcome challenges and maintain a certain threshold of vital harvest for the entire population, for example, adapting irrigation techniques or changing agrotechnics for the care of cultivated plants. It is worth noting that both events took place in the south of Central Asia during the Late Bronze Age. For example, researchers believe that the reason for the migration of the Bronze Age population from north to south in the Murgob region was due to the retreat of the delta [16, P.194].

The settlement scheme at the Murgob and Surkhan oasis monuments appears to be more complex than previously assumed, the geographical location and stability of the settlements being ensured. The data show that the system of monuments in the Bronze Age of Margiana and Bactria was created not under the influence of the ecological situation, but on the basis of the rules related to the dynamics of the human group and the structural complexity of the political and administrative forms of the region [18, P.55].

Another example of the spread of Late Bronze Age populations is the proliferation of settlements of this period in the foothills of Tajikistan, where environmental conditions did not require additional water intake. In Iran, Bronze Age populations also adapted to dwindling water resources through relocation. Adaptation to new environmental conditions also shows the possibilities of socio-economic transformation of the society. H.-P. Frankfort and O. Lecomte believe that agriculture and animal husbandry is the main occupation of the population in the settlements of Oxus, which is the result of natural climatic factors.

For example, the evolution observed at the end of the Bronze Age in the south of Uzbekistan has been interpreted as "adaptation to an environment that is not suitable for agriculture" [12, P.625].

In conclusion, studies of climate change suggest that communities experienced drought during the early Oxus civilization, while the latter phase (1750–1350 BC) was a period of relative climate stability. It can be concluded that there is no connection between certain climatic events and the "crisis" of the Oxus civilization. The drought at the end of the 3rd millennium BC shows the ability of the population to maintain a high agricultural and economic potential for the development of society.

Research shows that the relationship between water management and the development of the Oxus civilization is one of the relevant issues, the relationship between artificial irrigation and statehood, the model of hydraulic societies proposed by Wittfogel is also partially compatible with the society of the Oxus civilization.

Indeed, past human-environment relationships are a complex process that can have very diverse impacts on human society and ecology. Environmental changes and events may not be a factor in human innovation and cultural evolution. Therefore, the problem of climate change in nature relies on determining the impact on natural resources, flora and fauna, and communities dependent on the environment, concluding that climate factors alone cannot be the basis for the destruction of the Oxus civilization.

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