

The Formation of The Sintashta Culture and Its Influence on Other Bronze Age Cultures

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ABSTRACT

This article examines the social, economic, and technological development processes of the Sintashta culture. This culture is distinguished by its advancements in metallurgy, chariot technology, and the complex production of ceramic goods. The influence of the Abashevo and Petrovka cultures, as well as the role of interactions with other regions of Eastern Europe, is explored in the formation of the Sintashta culture. The article also highlights the pastoral and economic activities of Sintashta society based on the analysis of archaeozoological materials. Furthermore, archaeological findings and written sources are used to investigate the influence of the Sintashta culture on the regions of Asia and Europe. The research identifies the significant role of the Sintashta culture in the development of Eurasian civilization.

Keywords: Sintashta culture, chariots, metallurgy, archaeozoology, Abashevo culture, Petrovka culture, Eurasia, ceramic artifacts.

INTRODUCTION

The Sintashta culture, which emerged in the early second millennium BCE in the Southern Ural region and adjacent areas, is considered one of the major archaeological cultures of the Bronze Age. Based on archaeological, genetic, and philological evidence, many researchers recognize this culture as the homeland of the Proto-Indo-Iranian languages. The relevance of this article lies in its analysis of the distinctive features of the Sintashta culture, including its ceramic traditions, necropolises, pastoral economy, and the cultural significance of chariots.

The main objective of this study is to explore the economic, social, and cultural characteristics of the Sintashta culture through archaeological findings.

The article aims to systematize various archaeological data related to the Sintashta culture and, based on this, to draw general conclusions about the main aspects of its formation and development. In addition, it highlights the genetic and cultural connections between Sintashta and its subsequent cultural phases, such as the Petrovka and Alakul cultures.

This article raises several important research questions:

1. What were the key factors in the formation of the Sintashta culture?
2. How did its economic activities—particularly animal husbandry and pottery—develop?
3. What roles did necropolises and chariots play within this culture?

4. To what extent did the Sintashta culture influence other Bronze Age cultures?

The findings of this research contribute to the development of new approaches in the study of Bronze Age societies.

METHODS

The first information about the Sintashta culture was discovered as a result of archaeological excavations in the 1920s–30s. Later, in the second half of the 20th century, Russian scholars such as V.P. Shilov and G.B. Zdanovich studied the main characteristics of this culture. Zdanovich focused on the military-technological and social aspects of the Sintashta culture, highlighting its distinction through war chariots and fortified constructions [1]. These works are of great importance in identifying the specific stages of development of the culture.

The military technologies and metallurgical achievements of the Sintashta culture are attracting international scholarly attention. However, its economic activities and social structure remain topical areas of ongoing research. In the field of architecture, the studies of N.B. Soldatkin [2] are of particular significance.

According to the periodization proposed by E.N. Chernykh [3], the sites in Eastern Kazakhstan belong to the Late Bronze Age and are included within the first (Seima) stage of the Eurasian metallurgical province. However, this region displays features that differ from the periodization of Western Siberia. Especially, the uniqueness of local ceramic wares and metal assemblages clearly sets them apart from the influences of the Abashevo, Sintashta, and Petrovka traditions.

The development of the Sintashta culture holds a significant place in the evolution of nomadic civilizations. Its role in the formation of the Altai cultural center during the final quarter of the 3rd millennium BCE can be evaluated as a result of indigenous development.

The study employed several methods to investigate the social and technological aspects of the Sintashta culture, including systematization, archaeozoological, anthropological, genetic, cartographic, and comparative approaches.

Through the method of systematization, excavation materials from Sintashta and related cultural sites were analyzed. This process focused particularly on identifying the morphological and decorative features of ceramic vessels, especially pots and jars. As a methodological basis, the analytical frameworks of Pantelejakov and Drish for pottery analysis were utilized. A total of 779

osteological materials from the Konoplyanka site were examined, with attention given to the age and pathological conditions of the animals.

To determine the genetic composition of the Sintashta population, ancient DNA analysis results were used. The genetic method revealed links with steppe and Central European Neolithic groups and helped clarify the social dynamics of the society.

The cartographic distribution of Sintashta settlements and necropolises was studied, with special attention given to the relationships between habitation areas and burial structures. Additionally, scientific literature related to the Sintashta culture—including archaeological reports, historical sources, and anthropological studies—was reviewed. This helped identify cultural connections between the Sintashta culture and other Bronze Age cultures.

The integration of these methods allowed for a comprehensive analysis of the economic and social aspects of the Sintashta culture.

DISCUSSION AND RESULTS

The geographic location and distribution of the Sintashta culture plays an important role in studying the interactions between its peoples and other cultures. The Sintashta culture is mainly widespread in the northern regions of Kazakhstan, as well as along the Ural and Volga river basins. Archaeological finds, especially graves and underground structures, reflect the rich heritage of this culture. Studying the regions where the Sintashta culture is spread is of great importance for determining its geographic boundaries and analyzing its distribution.

Although the Sintashta culture contains local substrata, its representatives were formed by peoples who were foreign to the regions of Eastern Europe and the Urals. Research shows that the homeland of these tribes was the Syria-Anatolia region, occupying the same area as the early cultural centers of Iranian peoples in the Margiana and Bactria regions. The emergence of the Sintashta culture in the Urals dates back to the 18th century BCE (based on an uncalibrated system). During this period, the Abashevo culture, related to Sintashta, emerged in the area between the Don River and the Ural Mountains. Later, by the 16th century BCE, the Sintashta and Abashevo cultures formed the basis for the development of the Timber-grave, Petrovka, and Alakul cultures. These new cultural forms spread across a vast area from the Dnieper River to Central Kazakhstan. Some researchers include the Petrovka and Alakul cultures as part of the Andronovo culture. Their

formation is closely linked to the process of the steppe lands becoming more Iranianized. However, the emergence of the Scythian and Sarmatian tribes is noted not to be directly related to these cultures [4].

The Sintashta culture (2100–1800 BCE), located to the east of the Southern Ural Mountains, is considered the homeland of the Proto-Indo-Iranian languages based on archaeological, philological, and genetic research. Scholars like Anthony view this culture as a representative of the Proto-Indo-Iranian phase and link it with archaeological finds and genetic studies. Ancient DNA analyses have determined the genetic composition of the Sintashta population: 68% steppe ancestry, 24% European Early Neolithic ancestry, and 8% from Western Siberian hunter-gatherers. This genetic profile distinguishes Sintashta from the Yamnaya and Afanasevo cultures, as they lack European Early Neolithic ancestry. This suggests that the Sintashta population was not formed by migration of Yamnaya groups from the Pontic-Caspian steppe but through the intermingling with European Early Neolithic groups.

The Abashevo population, who migrated eastward, is considered the founder of the Sintashta culture [5].

During the research conducted by Vinogradov and Alaeva in the Ustye region, the pottery collection was analyzed. In classifying them, Vinogradov's previous studies were used, distinguishing Sintashta and Petrovka ceramics from each other. Petrovka ceramics are sometimes referred to as Early Alakul. The analysis was based on the morphology of the vessel necks and the characteristics of their decorations. Sintashta pottery is more complex and has a variety of decorative styles, while Petrovka vessels are characterized by narrow neck shapes and smooth surfaces under the edges. Excavations in the Ustye region have revealed walls of Sintashta houses and ceramic fragments from the Petrovka period. This confirms that Sintashta pottery traditions existed before the Petrovka period [6].

The burial structures and cemeteries of the Sintashta culture have distinctive archaeological characteristics. Almost all of the wall-related cemeteries, with the exception of the Knyazhenskiy barrows [7], are directly associated with settlements, indicating a close connection between the lives of the inhabitants and their burial traditions. For example, each settlement has

only one cemetery, but two cemeteries have been identified at Arkaim: the Bolshoykaraganskiy and Aleksandrovskiy IV. The locations and geomorphic features of these burial structures are organized in accordance with the settlements.

In the Zauralye region, the barrow tradition was widespread during the Sintashta period, but the situation was different in the Priuralye region. In the Priuralye cemeteries, Sintashta-era burial sites are often layered with multiple periods, indicating that earlier cultural influences persisted in this region [8]. The height and size of the earth structures varied in accordance with the number of cemeteries surrounding the settlements. The surface structures were typically located in large, collective cemeteries, confirming the presence of communal burial practices.

Twenty-two ancient settlements, including Konoplyanka, have been identified in the southern Ural region [9]. These settlements and cemeteries reveal the extensive geographic distribution of the Sintashta culture and its complex social structure. The Konoplyanka settlement is an important source for studying the distinctive aspects of livestock farming in the Sintashta culture. Research in this area was carried out within the framework of a multidisciplinary project dedicated to the Bronze Age monuments in the Karygali-Ayat River Valley by Russian and German scholars. Excavations conducted in 2012–2013 resulted in significant progress in reconstructing livestock farming based on the archaeological and zooarchaeological materials collected [10]. These studies allow for the identification of the economic significance of different livestock species, the use of pathological analysis methods, and the delineation of the economic zones designated for livestock farming. This research is key to gaining a complete understanding of livestock farming practices in the Sintashta culture. However, certain aspects, such as pathological analyses and economic reconstructions, still require deeper study.

The osteological collection found at the Konoplyanka settlement consists of a total of 779 bones, which play a significant role in studying livestock practices in the Sintashta culture. These materials were processed in the Paleoeology Laboratory of the Institute of Plants and Animals at the Ural Academy of Sciences, following widely accepted methods. The eruption sequence of the molar teeth and the degree of epiphyseal fusion were used as the main criteria to determine the

slaughter age of the livestock [11]. The measurements of the found bones were taken based on A. Drish's methodology, providing essential data for reconstructing the livestock practices of the Sintashta population [12]. These analyses offer a broader understanding of the various forms of livestock farming and the methods of animal exploitation in the Sintashta culture.

The monuments of the Sintashta culture are presented in two main types: fortified settlements and necropolises. Although these monuments are located in the steppe zone of northern South Ural, the fortified settlements have been better studied in the Middle Ural Plateau region. The necropolises, however, have been found outside this region, along the eastern and southwestern directions. Some monuments in the Middle Ural forests and steppe are associated with the Abashevo culture [13], showing significant similarities with Sintashta monuments. These similarities can be interpreted in two ways: first, as a result of synchrony [14]; second, as evidence that Sintashta traditions originated from the Abashevo culture.

Among the archaeological finds, the wheel traces and the remains of necklaces are of significant importance, as they have been found in the burial complexes of the Sintashta culture in South Ural and the Petrovka culture in Northern Kazakhstan. These finds are rare due to the rapid decay of wooden materials. However, there is evidence of the widespread use of two-wheeled chariots, particularly reflected in petroglyphs from Kazakhstan and nearby regions [15]. Although chariot remains dating back to the Bronze Age are rarely found in these areas, this does not indicate their absence. The petroglyphs in Kazakhstan depict war chariots drawn by two horses, and the burial of horses in pairs in Bronze Age cemeteries shows that these animals were used as "chariot horses."

In the Avestan texts, a region referred to as the "land of good chariots" (Xvanirata) is mentioned. This area is located between the rivers Ranha (Sirdaryo) and Vahva-Datya (Amudaryo). One of the distinctive traditions of the Aryans was their focus on war chariots. This tradition was even reflected in their burial rituals. The remains of war chariots found in one of the Sintashta cemeteries in the Chelyabinsk region confirm this idea. According to the well-known archaeologist V.F. Gening, the Sintashta cultural complex can be considered to correspond to the traditions of the

Aryan (Proto-Indo-Iranian) peoples before their migration to Iran and India [16].

The analysis of pottery samples belonging to the Sintashta culture revealed a complex system of classification. The 72 pottery samples analyzed were divided into two main categories: cauldrons (37 pieces) and jars (35 pieces). Further division was carried out using classification criteria. Despite the significant morphological differences in the shapes of cauldrons, which made it easy to categorize them, their ornaments were diverse, complicating the classification. Jars, on the other hand, were morphologically similar and were divided into four groups based on distinct ornamentation patterns. Thus, four types of cauldrons and four types of jars in Sintashta pottery were identified [17].

CONCLUSION AND RECOMMENDATIONS

This study provides new information about the industry, social, and technological development of the Sintashta culture. The Sintashta culture is distinguished by its military technologies, especially chariots. Archaeological materials, including the remains of chariots, indicate the presence of social stratification. High-level technological achievements are observed in metallurgy and pottery. The complexity of Sintashta ceramics, in terms of ornamentation and shape, demonstrates both technical and aesthetic development.

Animal husbandry was the primary economic sector of the Sintashta culture, with particular attention paid to the breeding of large cattle and horses. Archaeozoological analyses show that animals were bred in forms adapted to the local climate, which could be related to the unique ecological conditions of the region.

The Sintashta culture actively interacted with other cultures in the Southern Ural and Northern Kazakhstan regions, confirming the importance of cultural exchange.

Recommendations:

Further research on the military technologies of the Sintashta culture and their social roles within society is needed.

Detailed analysis of technological advancements in metallurgy and pottery is essential to identify the leading techniques that developed in these fields.

A more in-depth study of the economic significance of animal husbandry, particularly focusing on the breeding methods of animals adapted to the local climate, is important.

Further investigation of the cultural interactions between the Sintashta culture and others will

enhance understanding of cross-cultural exchanges.

To further study the social structure of the Sintashta culture, it is necessary to expand anthropological and genetic research. By broadening the geographic scope of studies on culture-related monuments, the boundaries of its distribution and influence should be identified. Through collaboration between archaeology, anthropology, biology, zoology, and history, it will be possible to determine the impact of the Sintashta culture on other cultures and the innovations it adopted from them. To ensure the Sintashta culture gains worldwide attention, it is essential to strengthen international scientific cooperation and promote the results in the media. The findings of this research will enrich the knowledge of the Sintashta culture and create a solid foundation for future studies.

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