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INTERDISCIPLINARY APPROACH IN THE STUDY OF THE YAKUT DIET IN THE 17TH AND 19TH CENTURIES

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This article investigates the reconstruction of the diet of the ancient Yakuts using ethnographic, archaeological and biological approaches. A synthesis of historical and ethnographic literature on the food of the Yakuts since the 17th century was made. It indicates the importance of dairy and plant foods. Funeral food, consisting of the remains of meat and dairy products, was found in one third (55/145) of the studied burials. Analysis of stable carbon isotopes δ13C and nitrogen δ15N on bone collagen of 61 humans indicates mainly meat and milk nutrition. Significant fish consumption was identified in the Viluy district and Central Yakutia.

A comparative analysis of stable isotopes between the male and female did not show differences in their diet. Individuals with rich burials have low variability of stable isotopes, which indicates that they had a stable diet. Finally, we present the theoretical background of the detection of toxic substances in the hair.

An analysis of 47 buried samples shows an irregular consumption of tea and tobacco by Yakuts from the end of the 17th century.

Keywords: Yakutia, 17th-19th century, food, funeral meal, stable isotope analysis, toxin detection, methodological approaches in food studies.

Introduction. Anthropology of food has been developing since the 30s of the last century and is today an actively developing field of science characterized by an interdisciplinary approach that uses the methods of both the social and biological sciences. Food is an essential element of the people's material culture and is considered a sociocultural phenomenon. Its evolution can be understood in the broader historical, socio-economic, cultural and political context that accompany the development of societies through the centuries. The study of food allows us to infer modifications in lifestyle as well as developments in trade, economy, social structure and relationships, changes in tastes and eating behaviour, popular medicine and traditional customs, the worldview of the people and their interaction with their environment. As such, diet is a fertile study subject from the point of view of both the social and biological sciences.

The case of Yakutia is of particular interest because, on one hand, the exceptional preservation of the tombs makes possible not just the study of artefacts but also biochemical analyses, and on the other hand, a high number of ethnographic and historical documents can be compared to these results. The most important changes in the history of Yakutia occurred in 1620-1630, when Russian Cossacks penetrated the Middle Lena and annexed this new territory to the Russian Empire. This led to the development of local trade with Russians, and through them to international exchange, in particular through Sino-Russian trading points in Kyakhta, and then in Nerchinsk. As a result, the Yakuts, whose food was based on products of animal husbandry, hunting, fishing and gathering, gained access to a variety of goods, including flour, sugar, tea and tobacco. Over the next centuries, under the influence of new products, the role of some traditional food and its preparation was reduced or completely disappeared (for example, with the advent of cereals, the production of flour from pine bark lost its significance, the production of koumiss from mare's milk was significantly reduced, and instead consume large amounts of tea). Changes in nutrition led not only to the evolution of food models, but also to the symbolic meaning of food, its use in religious rituals (for example, salamat, porridge based on flour and cream, became an integral element of the rite of feeding the fire). To date, the study of the nutrition of ancient Yakuts is descriptive, while archaeological and biological approaches will determine the dietary features of specific individuals.

Yakutia underwent an important transformation beginning in 1620-1630, when Russian Cossacks invaded its territory and annexed it to the Russian empire. This led to the development of local trade with Russians, and through them to international contact, via the Sino-Russian trading posts in Kyakhta and Nertchinsk. As a result, the diet of Yakut tribes evolved from its reliance on horses and bovines to a more varied diet including flour, sugar, tea, and tobacco. Previously unknown food products became first accessible to the highest social classes, and then widely integrated in the general diet. Conversely, under the influence of new food products, the role of certain foods and food preparations was reduced (such as kumys, a fermented dairy product traditionally made from mare's milk was significantly reduced and instead tea is widely consumed) or even disappeared (for example, with the development of agriculture, the production of powder from pine bark lost its significance, and was replaced by wheat flour) over the course of the next centuries. Change in modes of food consumption led to changes in consumer tastes as well as in the symbolic value given to different foods and their use in religious rituals (for example salamat, a type of porridge made with flour and cream, was subsequently used in the rite of feeding the spirit of fire). Nowadays, the study of the food of ancient Yakuts is mainly descriptive, while archaeological and biological approaches will determine the dietary features of specific individuals.

Materials and methods. ***Ethnographic studies.*** The Yakut diet has been described in ethnographic publications concerning this region and travellers' records since the 17th century. At the end of the 19th century, the number of ethnographic literature on food increased. They specify the food in certain geographical areas [3] and differences of eating behaviour in social groups (poor and rich) [5]. Food is studied

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as an offering to spirits and in funeral rites [11]. The development of agriculture [8, 10] and traditional activities [9] are described. Two noteworthy studies on the Yakut diet have been conducted by ethnographers more recently. The first focuses on the diet of Yakuts before the development of tillage [6]. The second publication describes rituals and modes of consumption of traditional foods, including foods introduced by the Russians, in particular wheat flour. This study notably compares the Yakut diet with that of other turko-mongol populations [4].

Analysis of archaeological data. In our work, we studied 145 graves excavated by the Sakha-French archaeological expedition from 2002 to 2015 in the Republic of Sakha (Yakutia). All burials were divided into four geographical zones: Central Yakutia, Viluy, Verkhoyansk and Indigirka. Four chrono-cultural periods were defined on the basis of C14 dating, dendrochronology and the study of artefacts: 1) before 1700, when the Russian presence was undetectable; 2) from 1700 to 1750, called the "golden age" characterized by increasing number of artefacts commonly put with the deceased in tombs; 3) from 1750 to 1800, a decline in the population following most likely devastating epidemics and the extermination of fur-bearing animals, which served as goods for trade and for paying yasak, a fur tax. 4) after 1800, when Christianization was widespread if not total, which caused a transformation of funerary practice: burials of this time, apart from some exceptions, do not include any artefacts [15]. The object of our study is the meat and milk residues found in these burials. The presence of permafrost throughout Yakutia contributes to the satisfactory preservation of biological material in burials, which, in turn, allows obtaining complete samples for biochemical analyzes to determine the nutrition of Yakuts.

Analysis of stable carbon and nitrogen isotopes (δ13C and δ15N). The essence of this method is the expression "we are what we eat", in other words, the individual is considered within the food chain. The methodology consists in the extraction of the bone collagen (from the femur in our case) which is then analysed by mass spectrometry. Bone collagen is renewed very slowly, especially in adults, which mean that isotopic data represent the average diet of 5-7 years before the death of the individual [25]. Carbon and nitrogen have two stable isotopes: "light" isotopes containing less neutrons in the nucleus (C12 et N14) and "heavy" isotopes (C13 et N15). The concentrations of heavy isotopes are used to reconstitute the diet of an individual. Differences in the isotopic composition are transmitted along the food chain, with enriching with nitrogen by 3-5 ‰ and carbon by about 1-2 ‰ on each level [13, 14, 16, 19, 20]. Carbon absorption is determined by the type of photosynthesis: plants that use C3 photosynthesis have a lower concentration of the carbon isotopes: their isotopic signature ranges from -24‰ to -34‰, while in C4 plants this ranges between -6‰ and -19‰ [23]. The isotopic value is different for marine and terrestrial plans as the concentration of C13 in ocean water is 7‰ higher than in sedimentary water. As a consequence, C13 concentration is higher in marine plants than in C3 photosynthesis plants [20]. The values of fresh water plants, and hence freshwater fish, can be very diverse depending on local conditions [14, 17]. Variations are due to differences in water temperature, especially in deep lakes, and sunlight [18]. The most commonly measured values are: 2 to 7‰ for terrestrial herbivores, 7 to 12‰ for terrestrial carnivores, and 12 à 20‰ for marine vertebrates [14].

Detection of nicotine and theine in hair. Hair presents a record of molecules with which we are and have been in contact. During its growth, it stores data on our diet and environment within its protein structure. One centimetre of hair gives information on a month of the subject's life [21]. In recent years, hair analysis has been used successfully for the detection of the consumption of drug and other toxic products in clinical and judicial expert reports [24].

Results and discussions. ***Ethnographic data on the Yakuts' food.*** In the first records of travellers, plants, pine bark, game, including a variety of birds and rodents, fish and dairy products are described as food [2]. They remarked on the popularity of tobacco and alcohol in the local population [1, 7]. The end of the 19th century saw an expansion of the ethnographic literature describing the foods consumed (bread, meat, dairy, fish and tea) [12]. Kumys stands out from other dairy products. An important role of plants is highlighted. The widespread of tea and bread is noted [9]. Lake fish (crucian carp and minnow) is considered as food for the poor people while mare meat is the most honorable [5]. Noting the wide variety of geographic conditions in the vast territory of Yakutia, A. Savvin proposes to distinguish four regions according the diet of their inhabitants: 1) The southern regions: Central Yakutia, the Vilui Basin, and the Olyokma Basin. The principal activity is cattle and horse breeding, hence the predominance of dairy products and meat in the diet. 2) The lower plains of Lena and Viluy, as well as the Indigirka and Kolyma rivers. In this region, fishing supersedes herding. Fish and dairy products form the basis of the diet. 3) The mountainous region covering the territories of Verkhoyansk, Moma, Oymyakon and a part of Sakkyryr. The main activities in this region are herding and hunting. Meat and dairy products are consumed more often, but fishing and plant gathering are also important. 4) The extreme North covering the coastline from 68-70° northern latitude. The main foods are fish and game [6].

Funeral food. Food residues were found in one third of all burials studied (55/145). Before the 19th century, food was found from 43 to 69% of burials, then after 1800 only 7% of burials contain food remains. Generally, meat and dairy products placed directly on the soil or in dishes. They could be found either inside or outside the coffin, more commonly near the feet of the deceased but sometimes near their heads. In most cases, meat is put with bones, sometimes pieces of meat without bone are found in dishes or on a wooden skewer. This is generally horse meat, with some cases of bovine or game meat: hare, duck or crane. Dairy products have a thick and / or fatty consistency: fermented milk called *souorat* or *tar* found in *kytyia*, fresh cream, or melted butter poured in birch bark, *mataarchakh* or *tchoron*. Dishes can be covered with leather, birch bark or a plank. Often a wooden spoon is put in a *kytyia*. The Omouk 1 tomb dating from the 19th century, contained a metal plate with a mixture of dairy product and berries. In three children's tombs of the same site a tiny quantity of fish bones was uncovered in the Djarama site.

Food remains in tombs allow us to talk about food as part of the funeral ritual. Yakuts believed that the soul of the deceased had to undergo a dangerous journey to reach the other world where there is life after death, which resembles life on earth, with its material needs. However, it is necessary to take into account the fact that the archaeological finds present a selective picture, and were not necessarily representative of the diet of the living subject. We also don't have access to the totality of the food products originally deposited. In particular, some vessels intended for dairy products were found empty. They

could initially contain milk products of liquid consistency, evaporated over time and did not reach our days.

Possibilities of biochemical analysis in the study of food. When reconstructing human diet, it is first necessary to analyse the isotopic composition of possible participants in the trophic chain. To do this, we have analysed the remains of animal bones from burials, as well as modern river and lake fish. Collagen extracted from the human femur was studied for 61 individuals. The advantage of the stable isotope method consists in a precise quantitative evaluation of the diet of humans and animals. It allows to determine the type of environment in which the subjects lived and their main food sources: plant, fish or terrestrial animal. It doesn't however allow us to distinguish different types of animal protein consumed by a subject, as meat and dairy products have the same isotopic value. It is also difficult to detect a diet based on freshwater fish as the isotopic value of freshwater fish is close to that of terrestrial animals [19]. Analyses confirmed mainly meat and milk based diet of the ancient Yakuts, with some regional features. Thus, the lowest stable nitrogen isotopes were found in the Verkhoyansk and Oymyakon regions, where δ15N is 10.0 10 ± 0.5 (1SD, n = 15), which indicates diet based on animal meat and milk. In contrast to the northern regions, in the Viluy district, high values of δ15N were noted (11.7 ‰ ± 0.9, 1SD, n = 9). Samples from Central Yakutia show a wide range of δ15N values, which varies from 9.5 to 11.9 ‰ (δ15N = 11.0 ‰ ± 0.7, 1SD, n = 34). These data indicate the important role of fish in the nutrition of individuals from these two regions. A comparison of the diet between adult men and women showed no differences. The mean values of both δ15N and δ13C turned out to be the same for men (δ13C = −20.4 ‰ ± 0.4 and δ15N = 10.8 ‰ ± 0.8, 1SD, n = 25) and for women (δ13C = −20.4 ‰ ± 0.3 and δ15N = 10.8 ‰ ± 0.8, 1SD, n = 21), which confirms similar food practices for both sexes. Contrary to ethnographic data, claiming predominantly fish consumption by poor people, isotopic data do not show this. However, the variability of stable nitrogen and carbon isotopes is much lower in individuals from rich burials with a large number of artefacts (δ13C = −20.4 ‰ ± 0.1 and δ15N = 11.2 ‰ ± 0.5, 1SD, n = 9). This suggests that they had a more stable diet than individuals from other social groups [22].

To identify tea and tobacco consumption, we analysed 47 hair samples. We used hair analysis to detect the presence and/or measure the concentration of (i) nicotine or cotinine, its primary metabolite and (ii) three methylxantines (caffeine, theophylline and theobromine). The first analysis allows to determine if the subject smoked or was exposed to tobacco smoke. The three methylxantines are stimulants present in tea which allow to detect and/or measure the consumption of tea by ancient Yakuts. The good preservation of the material and the application of specific detection methods allow us to precisely and reliably detect these toxins. At this stage of the work, we can argue about the occasional consumption of tea and tobacco by Yakuts from the end of the 17th century.

Conclusion. Anthropology of food, situated at the intersection of social and biological sciences, is today an actively developing field of science. Traditionally, the food of past populations was studied by historians and archaeologists relying on written and material sources, but today the possibilities of biological and biochemical analyses on human samples open up a new perspective in the study of living conditions and food practices in the past. Ethnographic literature from the 17th to the 20th centuries testifies to the diet of Yakuts, based on livestock products. Hunting, fishing and gathering have a supporting role and their importance depends on the geographical area. The literature emphasizes the importance of dairy and plant foods. There is a change in the diet of Yakuts with the Russian colonization, when new products were introduced and the agriculture started to develop. An analysis of archaeological material indicates the importance of food in funeral rite before mass christianization in the 19th century. It consists mainly of horse / foal meat and dairy products. Analysis of stable nitrogen and carbon isotopes on bone collagen indicates the trophic level of the individual, i.e. its position in the food chain. The samples studied show the consumption of meat, milk and fish. Finally, for the first time, the consumption of tea and tobacco is becoming the subject of special study. This article provides the methodological basis for the analysis of toxic substances in the hair of the buried, which shows the occasional consumption of these products by Yakuts from the end of the 17th century.

Each of these methods has its advantages and disadvantages, which justifies the interest in a comprehensive study of food. Thus, ethnographic literature provides general information, gives context and is necessary for the interpretation of analysis results. When analysing archaeological material, it is necessary to remember its selective nature, which does not always reflect the daily nutrition during the lifetime of individuals. The method of stable isotopes allows us to determine the diet of specific individuals, and the comparison inside of the group shows differences between sexes and social status. However, he does not distinguish the consumption of meat from the milk, does not show the role of plant foods either. The diversity of these products consumed by Yakuts we can learn only from ethnographic sources. Therefore, comparison of the results of various disciplines helps to trace the evolution of food of Yakuts in all its complexity and diversity.

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