PALEOLANDSCAPE RECONSTRUCTION OF THE WESTERN PRECASPIAN BASIN IN THE SECOND HALF OF THE HOLOCENE ACCORDING TO GEOARCHAEOLOGICAL DATA

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ABSTRACT

In order to identify the evolution stages of the natural environment of the Western Caspian Sea Area in the second half of the Holocene, the burial mound soils were analyzed in the main and intake burials of the Bogomolnye Peski Mound. The soil samples were studied with the help of spore-pollen and phytolith analysis.

Keywords: archaeological pedology, burial mounds, paleogeography

INTRODUCTION

The ancient ethnic groups migration and changes in economic activities of various population groups are frequently associated with climatic changes. Adaptation to changing living conditions, a change in food sources led both to the formation of new signs of human body and to a new socio-cultural turn of the history: new tools, different types of housing, construction of the first settlements, etc. The use of a set of natural-scientific methods allows both reconstructing the features of the natural environment in the past and the related features of migration, resettlement, changes in the type of economic activity and lifestyle of ancient peoples. The most striking and frequently the only evidence of the identity of the culture of ancient people are burial complexes, mounds. One of the natural archives that can save information about the environmental conditions of the past are soils buried under the mounds of these burial complexes. Isolation from external environmental factors ensures good conservation of the buried soils. A comparative analysis of the properties of soils buried under archaeological sites of different ages allows us to examine in detail the changes in the natural environment and its individual components over time. In addition, soils are able to store a whole range of additional features of non-pedogenic origin, which can be used for a more detailed reconstruction of the features of the palaeoenvironment. Thus, spores and pollen of plants, phytoliths, faunal remains, etc., are preserved in the soil profile. Consequently, the soil

profile can be considered as a kind of data archive containing unique information about the features of the past conditions.

LOCATION

The western part of the Caspian lowland is located in the southeast of European Russia and is a young accumulative sea plain, lowering from the foot of the Ergeni hill to the coast of the Caspian Sea from heights of + 48- + 50 meters to -26- - -28 meters above sea level.

To study the main stages of the evolution of the natural environment in the second half of the Holocene within the Western Caspian, joint soil-archaeological studies of the burial mantis Bogomolnye Peski were conducted in the Enotaevsky district of the Astrakhan region.

The mound occupied a mesoscale elevation in the relief - a sand dune. Dunes were located in the relief chain, stretching from the church in Prishib village to the church in Nikolsky village, which is why the area was called Bogomolnye Peski (Praying Sands) (Pic. 1). Between the dune chains there are mesoscale recessions in the relief represented by dry channels.

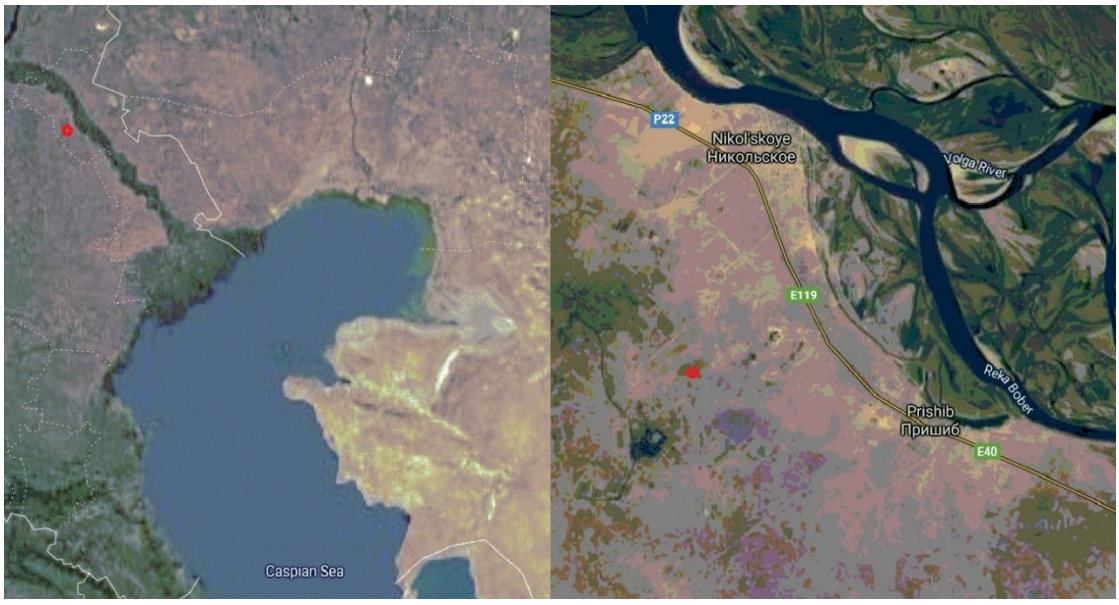

Figure 1. Location of the mound in the mound burial ground Bogomolnye Peski.

According to natural zoning, the study area is confined to the South Sarpinsky lowland [1]. In the eastern part, the study area is adjacent to the Volga, in the western part it is crossed by the southern part of the Sarpinsky shallow gully. Hypsometric marks were about 0 meters above sea level. A speciality of the Late Khvalynsk marine and delta-marine plain is the presence of aeolian sand dunes and wind-scoured basins. The parent rocks are the Late Khvalynsky marine and alluvial-marine sands and sandy loam, underlain by the Khvalynsky sandy clay deposits.

The Sarpinsky trough stretches from north to southeast and is an ancient Volga branch formed by the last transgressive phases of the Caspian Sea. According to some geomorphologists, the ancient arm of the Volga may have acted during the most powerful phases of the New Caspian transgression. At present, a series of Sarpinsky lakes connected by lintels, lakes and estuaries of the Davan Valley and the famous Baire

hillocks located within the delta of the former branch reminds about the existence of the Volga branch in the Western Caspian in the past.
The climate is characterized as temperate, sharply continental, with high temperatures in summer, low temperatures in winter, large annual and summer daily amplitudes of the air temperature, low precipitation and high evaporation. On the research area brown desert-steppe soils are zonal.

Figure 2. Landscapes of the research area

METHODS AND AIM OF STUDY

Caspian lowland cover the period of the second half of the Holocene (5000 years) when an ancient burial rite of the dead appeared among ancient ethnic groups. The first mound was built in the early Bronze Age by representatives of the Poltava stage of the Pit Grave culture (~4,500 yrs BP).
The studied mound “Bogomolnye Peski - 1” is a vivid example of a unique monument since it was originally built in the Bronze Age, then it was completed in the Early Iron Age, and in the Middle Ages nomadic tribes also made burials there.
Archaeologists discovered in the mound a rich burial of an elderly elite representative of the Sarmatian society. His height was almost two meters. Gold jewelry was found in the burial. The burial is dated the second century AD - the Middle Sarmatian period of Sarmatian culture. The grave pit was covered with wooden flooring. The skeleton was found at the depth of about 1.5 m from the ceiling in the elongated position on the back. The body was covered with a canopy, embroidered with gold plaques. Also, in the burial were found ornaments in the shape of a horse's head, a belt buckle and a belt tip. All the jewelry made of gold, some of the items inlaid with turquoise. The found artifacts

obtained during the mound excavations will replenish the collection "Gold of Sarmatians" of the Local History Museum in Astrakhan.
The height of the studied mound was 85 cm and its diameter was 35–40 (43) m. As noted earlier, the mound was built in the early Bronze Age by representatives of the Poltava stage of the pit culture (about 4500 years ago). The first construction of the mound dates back to that time. The second mound construction, overlapping the first and extending beyond the main mound, was built in the early Iron Age by representatives of the Middle Sarmatian culture in the interval of the 1st – 2nd centuries AD (about 2000 years ago). During the field studies, 6 soil profile cuts were made within the limits of burial mound soils of different age and 3 profile cuts in similar topolithological conditions (Pic. 3).

Figure 3. Excavation of "Bogomolnye Peski" mound

As it is known, transgressions and regressions of the Caspian Sea play a significant role in the formation of the peculiarities of the Caspian lowlands. The most complete diagram of the climatic fluctuations in the Holocene in the Western part of the Caspian lowlands and, calculated according to these data, displacements of the landscape zones are presented by E.A. Spiridonova [2]. According to her research, pre-boreal (10200-9500 years ago) and boreal (9500-8000 years ago) periods are characterized as a stage of semiarid environment with a tendency to increase aridization. The Atlantic period (8000-4500 years ago) is characterized by frequent changes in hydration and heat supply. Thus, the beginning of the Atlantic period (7800-5500 years ago) coincides with the sharp aridization of the climate, resulting in the change of northern semi-deserts and steppes into the southern deserts. The period 5200 - 4500 y.a. is singled out as a climatic optimal holocene, which was caused by a decrease in heat supply and increased hydration and led to widespread distribution of grassland steppes at that time. The amount of precipitation

during this period increased by 75-100 mm. The subboreal period (4500-2500 y.a) features two main peaks of climate aridization: 4200-3900 and 3200-2900 years ago, when the first segment of time is characterized as the most xerothermal phase, which entailed the change of cereal and grassland steppes to ceral-haze deserts. The sub-Atlantic period (from 2500 years ago to the present) is characterized as the stage of the most stable climatic situation, it was complicated by small changes of landscape zones towards desertification under the impact of increasing heat supply in the time segments 2000-1900 y.a and 1100-900 y.a against the background of prevailing landscape zones (Picture 4).

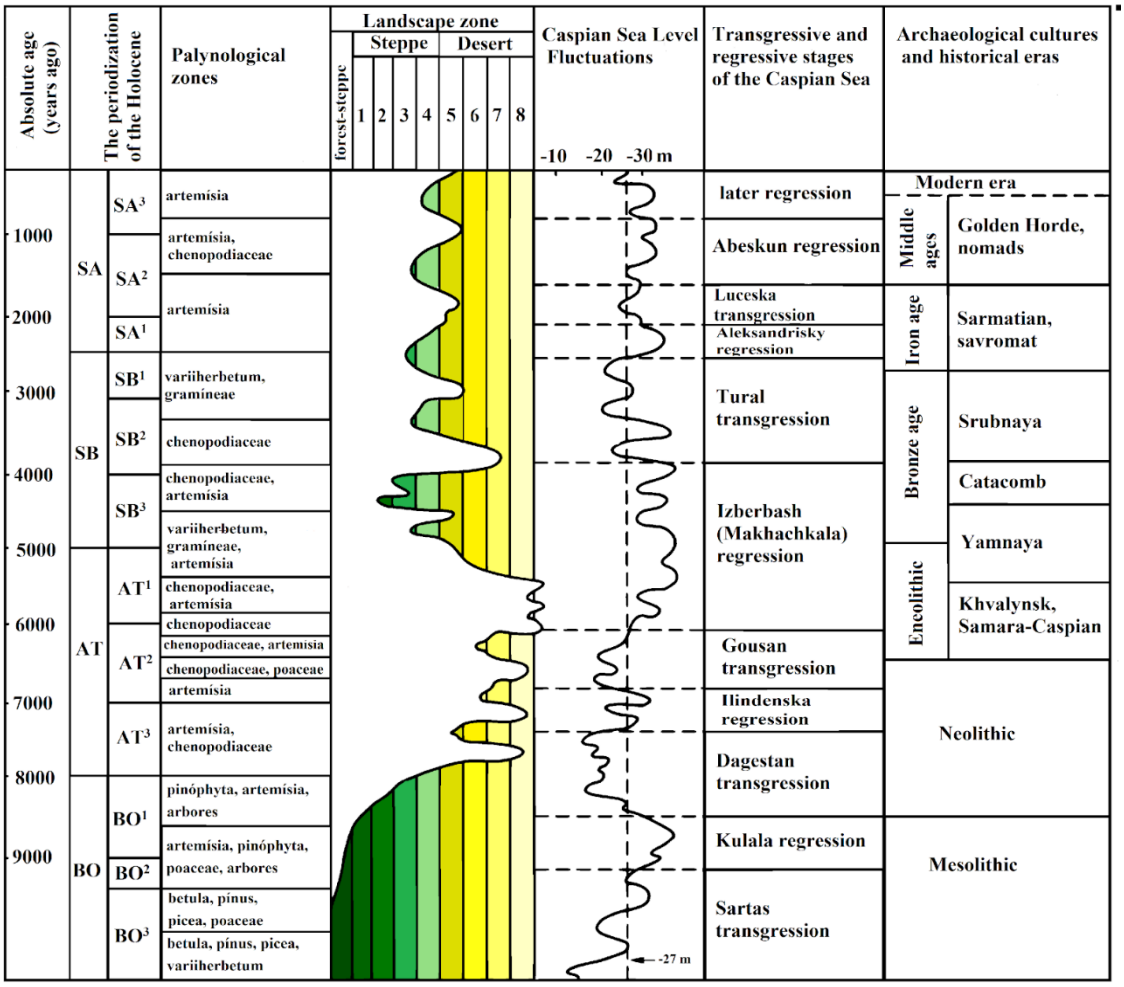

Figure 4. Chronology and synchronization of paleogeographic and archaeological events of the Western Caspian in the Holocene. Legend: steppe 1 - grassland, 2 - cereal, 3 – low bush; desert 5 - sagebrush, 6 - coniferous-low bush, 7 - halophytic-low bush, 8 - cereal-haze.

RESULTS

Palynological method was used to study background soil samples and two samples of burial soils of different ages. The palynological complex of the background soil reflects the semidesert type of landscape and is characterized by the absolute dominance of pollen from herbaceous plants (more than 90%), predominantly goosefoot (16.5%) and wormwood (more than 57%). In the woody part of the spectrum (in the amount of less than 10%), the most pollen is birch (2.9%) and pine (2.8%); pollen of pedunculate oak, willow, alder, and wahoo Euonymus verrucosus was found singly. With the exception of

pine pollen, which travels vast distances from the producing source, all the other plants listed above are found within the floodplain communities on the studied territory.

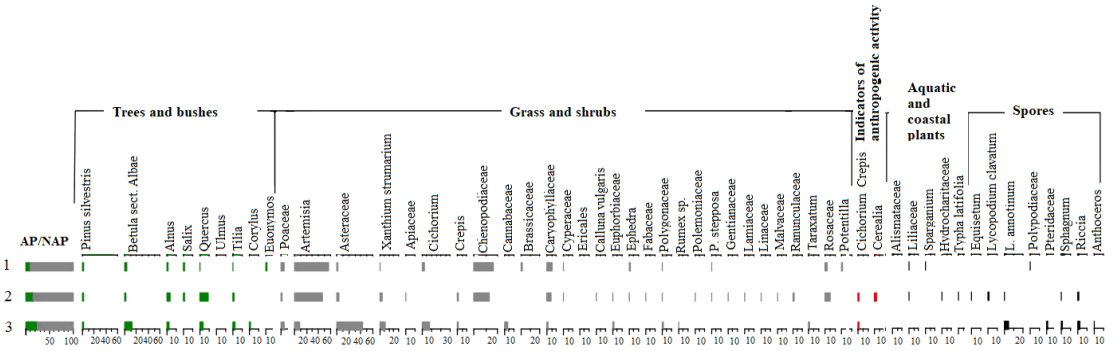

Figure 5. Soils spore-pollen diagram. 1- background (Ac-10f-19), 2 – burial soli of 2000-years of age (Ac-4p-19), 3 – buried soil of 4500-years of age (Ac-3п-19)

Analysis of the pollen spectrum revealed that in both fossil soils the tree pollen content is higher than in the background, which indicatin a significant reduction in the area of floodplain forests in the region at present. In the palyno spectrum which characterizes the paleo soil, formed 4500 y.a., was registered particularly large amount of birch pollen (more than 12%, 4 times more than in the background). The paleo soils buried 2000 years ago, contain large amounts of oak pollen (8.8%), which may indicate great participation of oak in floodplain forests at this time. In the same soil there is most of the pollen of coastal-aquatic and aquatic plants (bur reed, mace reed, lilies), spores of sphagnum and hypatic moss of the Riccia species, that live in stagnant water. The revealed spectrum indicates that the area of the point mound was flooded during the flood. In addition, in the paleo-soil of 2000 years of age, against the background of the dominance of pollen wormwood and gauze, there is pollen of cultural cereals and cornflower blue Centaurea cyanus, hard-core weed for cereal crops, which indicates the presence of agricultural activity. Comparison of pollen spectrums of the background soil and paleo soils shows that the vegetation cover of the territory xerophytized (pic.5).

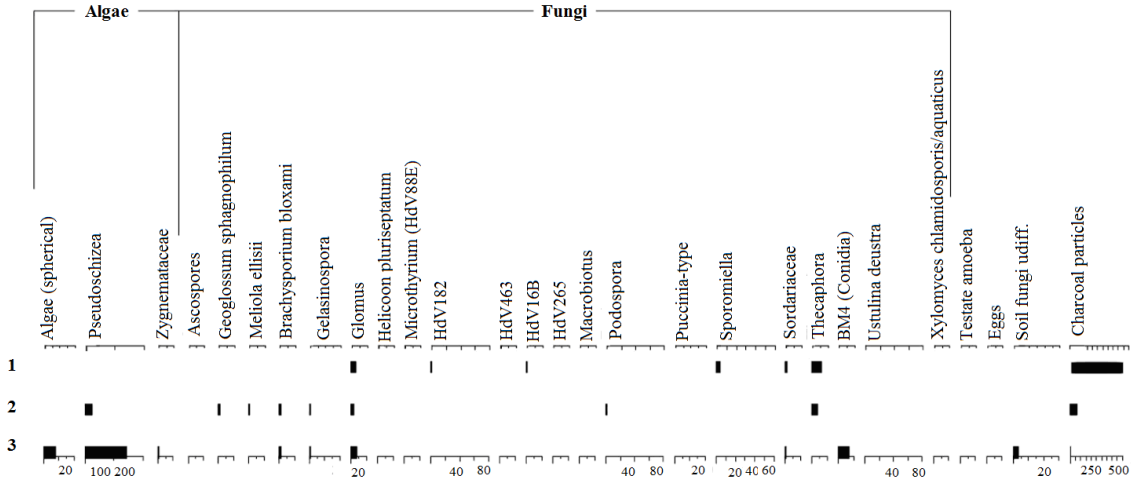

Figure 6. Diagram of non-pollen palynomorphs. 1-background soil (As-10f-19), 2 - buried soil of 2000 years of age (As-4p-19), 3 - buried soil 4500 years of age (As-3p-19)

The group of non-pollen palynomorphs is dominated by the spores Thecaphora, a parasite fungus of higher plants that causes them a disease called smut. Smut fungus are particularly harmful to cereals, affecting all parts of the plant and causing hypertrophy of plant tissues. Spores of coprotrophic fungus Sporomiella and Sordaria, which are reliable indicators of grazing areas, were also determined (pic.6).

The studied soils of the southern sandy semi-desert are brown arid sandy loamy soils with the following alternation of genetic horizons: AKL - BMK - BCca. According to the studies, the soils of the territory are characterized by low thickness and poor differentiation of the soil profile into horizons, weak humus accumulation, residual salinity of parent rocks and overall low intensity of soil formation and weathering. The sparse vegetation cover with high summer temperatures and abrupt fluctuation in the amount of precipitation over the seasons determine the short spring cycle of formation and decomposition of humic substances. The humus content in the upper horizons of the soils varies in the range of 0.8–1.2%. According to the international soil classification, the modern soils of the studies area belong to Brunic Arenosols Aeolic [3].

Morphological features of the soils buried under the first construction are characterized by a whiteish shade in the coloring of the horizons from the surface of the soil profiles, which indicates an increased carbonate and possible salinity. If in the first construction (4500 years of age) the process of carbonation is observed in the form of penetrating and white-eyed spots, the second structure did not have these features at all. The soil under the second construction (2000 years of age) was characterized by a more brown color, perhaps contained somewhat more humus than the soil under the first one, the whiteish shade in the coloring of the horizons was not observed.

CONCLUSIONS

Based on the studies of buried soils we can conclude, that at the turn of the early and middle subboreal period (4,500 years ago) within the studied territory there was a peak of climate aridization, which led to the change of herbaceous-grassy and cereal steppes to cereal-goosefoot deserts with a sharp decrease of the bio-productivity of the landscapes. Changes in land cover led to migration of ancient ethnic groups. Thus, thirteen burials were discovered in the Bogomolnye Peski burial complex.

The climatic conditions of the building periods of the first and second constructions in mound 1 were different. Due to the very small average annual precipitation, its intraannual redistribution becomes the most important. Winter precipitation and absence of seasonal freezing during the arid period, such as the average Sarmatian time in the Eastern European Plain was [4], contributed to the washing of salts in the sandy clay of the area during the Mid-Sarmatian period. Whereas in the relatively more humid and cool time of the Poltavka stage development of the pit culture [5], the soils froze in winter and in summer salts displaced to the surface.

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