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PALAEOLANDSCAPES OF THE LATE SARMATIAN *HIPPARION* FAUNA STAGE OF THE UKRAINE (USING PALYNOLOGICAL DATA)

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ABSTRACT. The results of palynological studies of deposits obtained from outcrops near Grebenniki and Novoelisavetovka II villages of the Odessa region are presented. On the basis of palynological analysis, the age of these deposits with *Hipparion* remains was determined as Sarmatian. The results have made it possible to determine the climate, changes in vegetation, and the nature of the landscape at the time, as well as to characterize the ecological peculiarities of the fauna.

KEY WORDS: Sarmatian, palynocoplexes, *Hipparion*, palaeolandscape

INTRODUCTION

The study area is situated in the south of the Ukraine. It lies in the Prichernomorskaya depression in the Odessa region near Grebenniki and Novoelisavetovka villages, which old Kubanka and Novoukrainka, form a group of localities containing remains of the same type. Grebenniki is one of the most interesting localities and is considered as the main type. Fauna finds (Belyaeva 1948, Gabuniya 1959, Korotkevich 1976, 1988) have been very numerous. They belong to the Grebenniki fauna subcomplex of the second (Berislav) evolutional stage of *Hipparion* existence in the Western part of the Eastern Paratethys.

At the Grebenniki site, the lens with mammal bones occurs on the left slope of the Frolovsky ravine and extends for about 30 m. The rocks underlying the lens consist of gritstones containing pockets of sand, abundant carbonaceous concretions, small *Mactra caspica* and diverse Unionida. Pistachio-grey, fine-grained, striped, ferruginous sands with lenses of silt and laminated carbonaceous clay occur further down. The bone lens itself is composed of sandy, massive, ferruginous marl with an abundance of bones and molluscs. Immediately above it occurs a layer consisting of alternating sands and compact aleurites. The upper part of the section has been covered by a landslide.

Near the Novoelizovetovka II site the ravine slope has been excavated and the lens with bones exposed to the south. Beneath it occur gritstones, white thin-grained sand and grey marly close-cemented sandstone. The layer containing the bones consists of alternating aleurites and yellow ferruginous sands with lenses of marly concretions. The bones are abundant and well preserved. The overlying deposits outcrop on the eastern side of the excavation and are composed of pistachio-grey sands, coal marls, grey carbonaceous aleurites and silty aleuritic carbonaceous clays with carbonate concretions.

The ages of the bone deposits at the two sites has now been determined as Upper Sarmatian and Lower Meotian respectively.

RESULTS

The deposits from above and below the bone lenses at the Grebenniki and Novoelisavetovka II sites have been analysed, as well as those in the lenses themselves. The palynocomplexes from the deposits at the two sites were very similar. Both revealed angiosperm and coniferous tree pollen, shrub and herb pollen. The relative proportions of the pollen of these groups of plants changed along the section.

The palynocomplex from the underlying deposits was characterized by the predominance of tree pollen, principally coniferous. Pinaceae pollen was the most abundant and contained *Pinus Haploxylon* type and *P. Diploxylon* type (the latter dominant), *P. mirabilis* Anan. and *Picea* (some pollen identified as *Picea* cf. *obovata* Ledeb. and some grains referred to the *Eupicea* section). *Tsuga* was represented by a single grain. Coniferous pollen was mainly concentrated in the lower part of the section. Among the angiosperms deciduous tree pollen (*Juglans, Carya, Betula, Fagus, Quercus, Ulmus, Tilia, Acer* and *Parrotia*) comprised no more than 25%, shrub pollen represented by *Euonymus, Elaeagnus, Diervilla, Vibur-*

num and *Buxus* up to 15%, and the pollen of herbaceous plants belonging to representatives of the Caryophyllaceae, Lamiaceae, Convolvulaceae, and Asteraceae families 10%.

Within the lens containing bones at the Grebenniki site, the relative proportions of the pollen of the diffrent groups showed changes in comparison with those found beneath it. The overall amount of tree pollen decreased with that of broad-leaved trees becomong dominant: *Carpinus, Quercus, Acer, Alnus, Betula* and single grains of *Carya* and *Fagus.* The amount of shrub pollen increased and its composition became more diverse: Celastraceae, Moraceae, Caprifoliaceae, Rhamnaceae, Rosaceae, Ericaceae, and *Salix.* The herbaceous group increased as well and was represented by Ranunculaceae, Iridaceae, Lamiaceae, Violaceae, Poaceae, Asteraceae, Polygonaceae, Chenopodiaceae, Liliaceae, Apocynaceae and the pollen of hydro- and hygrophilous plants. It should be noted that the pollen spectra from the bone layer from the section near Novoelizavetovka II showed the site to have been more arid with smaller amounts of pollen of hydrophilous plants.

The palynocomplexes from the overlying deposits were characterized by the rapid sharp growth and diversity of herbaceous plant pollen (75%). Represented were the Ranunculaceae (*Thalictrum, Ranunculus*), Asteraceae (*Aster, Bellis, Helichrysum, Tanacetum, Artemisia* – in amount of 4–5% forever taxa), Poaceae, Polygonaceae (*Fagopyrum* up to 3%), Chenopodiaceae (10–12%), Liliaceae, Apocynaceae, Iridaceae, Lamiaceae, Fabaceae (*Astragalus*), Geraniaceae and some hydro- and hygrophytes. *Ephedra* was found only once. All spectra contained *Lycopodium*, *Selaginella* and freshwater alga. In spite of the redistribution of the tree, shrub and herbaceous pollen in the palynocomplexes, the amounts of hydrophilous plant pollen (ie of members of river margin communities and freshwater lakes) were almost equal in every palynocomplex.

The pollen spectra from the deposits overlying the bone layers were identical to the first ones from the Sarmatian deposits with hipparion fauna remains of Novaya Emetovka (Syabryaj *et al.* 1993), and so the question of whether the bone deposits are of Meotian age is seltled. They belong to the end of the Sarmatian.

Near Grebenniki village the megaflora remains were studied by Kryshtofovich (1914). He had described the leaf imprints of *Ulmus braunii* Heer, *Carpinus grandis* Ung., *Juglans acuminata* A. Br., *Carya bilinica* (Ung.) Ett., *Salix varians* Goepp., *S. macrophylla* Heer, *Populus latior* A.Br., and *Alnus kefersteinii* Ung.. All the genera except *Populus* were presented in our pollen spectra. According to Kryshtofovich this flora belongs to the Sarmatian and in her later work Korotkevich in her latter work (1988) also wrote about the Late Sarmatian age of the Grebenniki subcomplex.

DISCUSSION

Analysing the composition of our pollen spectra we noted that the forest-steppe landscape with more or less large communities such as valley and ravine forest existed during the accumulation of the bone deposits. The compositions of three palynocomplexes indicate changes in the vegetation – fresh plant assemblages – and the changes in landscape by reason of humidity changes both in the soil and in the air. At the beginning of the accumulation of these deposits deciduous valley forest was present. The tree assemblages on the higher slopes contained sparsely distributed *Quercus, Ulmus, Tilia*, and *Carpinus*.

Toward the end of the Sarmatian, the area covered by the sea shrank considerably and substantial stretches of dry land appeared. The reduction of the sea basin brought about changes in landscape. The climate became drier, forest communities contracted their place taken by shrubs. Among the thinly scattered trees, members of the Rhamnaceae, *Euonymus*, *Elaeagnus* and others formed the undergrowth and the so-called shrub forest-steppe appeared. In due course the amount of open ground increased and the plant communities of wet meadow biotopes and assorted mesophytic grass-steppe vegetation moved in. Drier steppe communities with *Astragalus,* Apocynaceae, *Artemisia* and other xerophilous herbs together with saltmarshes containing diverse Chenopodiaceae appeared. The latter plants spread on the mud exposed by the retreating sea. The remains of aquatic and shoreline vegetation and those of fresh-water algae provide clear evidence of existence of freshwater lakes. The climate was warm-temperate but drier than in the western part of Prichernomorya.

Analysis of the abundant fauna remains of the Grebenniki subcomplex allows us to describe the ecology of the animal life. The remains in the lower parts of the bone layer are those of inhabitans of wet forest biotopes.

In the middle and upper parts of the bone layers many bones were identified as those of *Chiloterium schlosseri* (29%) – a species of the most specialized group of rhinoceroses. These animals were characterized by the texture of an individual's teeth, peculiarities of the lower jaw, dilated from the front to form a snout, and pointed incisors directed upward, forward and slightly exserted. They fed on coastal and riverside or water plants. Very short distal *Chiloterium*'s extremities testify to its ability to live on soft ground (Korotkevich 1988). Belyaeva (1948) considered that these animals inhabited in low lying wet localities. The decreasing amounts of *Chiloterium* embedded in the Grebenniki subcomplex (Korotkevich 1988) is thought to have been the result of influence of the drier period which succeeded the regression of the sea at the end of the Sarmatian. A second

member of this group, *Microstonyx major,* had an extended snout with long protruding incisors but otherwise, small feeth and a thick occiput. These morphological peculiarities of its skull and dentition give the reason to suppose that this animal existed in coastal localities and in low lying meadows with soft ground which it could nuzzle. The remains also contain bones of *Tragoceros frolovii,* known from the Middle Sarmatian as an inhabitant of semi-open spaces with soft ground, and *Hipparion giganteum* which lived in the wetter places. Also present were the remains of other Equidae in particular *Hipparion verae,* an inhabitant of drier, perhaps steppe, slopes with thin tree communities. *Gazella schlosseri,* whose long slender legs were adapted to running and jumping, inhabited this type of landscape as well. It fed on the lush foliage of trees and shrubs and the succulent grass of valley meadows. Another member of this group was *Procarpa capricornis* which had strong neck muscles testifying to the continual erosion of its teeth, as in many herbivores.

By the end of the Sarmatian, genera and species of gazelle, antelope and others that had adapted to drier conditions and more open spaces, such as shrub forest-steppe, appeared. *Hipparion-Gazella* communities began to develop.

CONCLUSION

In the Late Sarmatian changes in the landscape were the cause of changes in the fauna groups. The areas of woodland decreased and deciduous forest with diverse shrubs and soft ground remained only in river valleys, and so the animals dependent on such habitats were confined to these places. The inhabitants of dry forest-steppe and steppe landscapes increased in numbers whereas those of swamp and watery biotopes became fewer in the later stages of the existence of the Berislav complex. In the Grebenniki subcomplex the bones of these animals accounted for 65% of the remains. The well-preserved bones contained an abundance of remains of young animals, some of which were preserved with joints intact. The good state of preservation of sculls in particular allows us to suppose that in many cases the dead bodies and skeletons were transported to the site. In major floods, river-water covered not only the flood-plain but also the surrounding higher ground. The animals which perished during the floods accompanied those which had died naturally and their dead bodies were swept by the torrent downstream to the river delta where they accumulated.

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