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QUATERNARY STRATIGRAPHY AND PALEONTOLOGY OF THE SOUTHERN RUSSIA: connections between Europe, Africa and Asia

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The conference is devoted to the memory of Andrey Dodonov – geologist, colleague, friend and teacher

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The book presents the materials of the International Conference held in Rostov-on-Don (Rostov Region, Russia). Reports concern a wide spectrum of issues connected to the study of Quaternary marine and continental deposits of Eastern and Western Europe, Asia, and Africa. Paleobiological record of the Eastern Europe, faunal connections with Asia, Africa, and Western Europe are considered. The special attention is given to questions of paleogeography, climatic changes in the Quaternary, stratigraphy and sedimentology of Eastern Europe. Also presented are the newest data on the tectonics and climatic record. Questions of distribution and chronology of Paleolithic sites, adaptations of the ancient people to paleoenvironment are discussed.

Addressed to geologists, stratigraphers, paleontologists, paleogeographers, and archaeologists.

Materials are published with the maximal preservation of the authors’ texts

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INQUA SEQS

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ЧЕТВЕРТИЧНАЯ СТРАТИГРАФИЯ И ПАЛЕОНТОЛОГИЯ ЮЖНОЙ РОССИИ:

взаимосвязи между Европой, Африкой и Азией

Материалы международной конференции
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При поддержке INQUA, грантов РФФИ № 10-05-06045-г, 09-05-00307а, Программы фундаментальных исследований Президиума РАН «Происхождение биосферы и эволюция геобиологических систем», Программы фундаментальных исследований ОНЗ РАН «Состояние окружающей среды и прогноз ее динамики под влиянием быстрых глобальных и региональных природных и социально-экономических изменений»

Конференция посвящена памяти Андрея Евгеньевича Додонова – геолога, коллеги, друга и учителя

Редакционная коллегия: В.В. Титов, А.С. Тесаков

Четвертичная стратиграфия и палеонтология южной России: взаимосвязи между Европой, Африкой и Азией: Материалы международной конференции INQUA-SEQS (Ростов-на-Дону, 21–26 июня 2010 г.). Ростов-на-Дону, 2010. 228 с.

Книга содержит материалы международной конференции INQUA-SEQS 2010, проведенной в г. Ростов-на-Дону (Ростовская область). Сообщения касаются широкого спектра проблем, связанных с изучением четвертичных морских и континентальных отложений Восточной Европы, Западной Европы, Азии и Африки. Рассматриваются палеобиологическая летопись Восточной Европы, фаунистические взаимодействия с Азией, Африкой и Западной Европой. Особое внимание уделяется вопросам палеогеографии, климатических изменений в четвертичном периоде, стратиграфии и седиментологии в Восточной Европе. Показаны новейшие данные изучения тектонической и климатической летописи. Обсуждаются вопросы распространения и хронологии палеолитических стоянок, адаптации древнего человека к палеосреде.

Издание предназначено для геологов-стратиграфов, палеонтологов, палеогеографов и археологов.

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ABSTRACTS

EVOLUTION AND DISTRIBUTION HISTORY OF ARVICOLINE FAUNA: CONTRIBUTION FROM MOLECULAR DATA

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Voles and lemmings (subfamily Arvicolinae Gray, 1821) are one of the most young and species rich groups of Muroidea (nearly 150 known species). These rodents are widely distributed in all landscape types in the temperate and arctic zone of the Northern Hemisphere. Due to the unprecedented paleontological record, rapid evolution rate, and continuous diversification, arvicolines are among the keystone groups in the Late Cenozoic terrestrial biostratigraphy. A number of features make this group especially attractive for testing evolutionary and phylogenetic hypotheses and approaches to phylogeny recovering. The detailed fossil record for this group in the Old and New Worlds (Erbajeva 1970; Gromov and Polyakov 1977; Topachevsky et al. 1978; Zazhigin 1980; Zakrzewski 1984; Repenning 1987; Nesin 1996, and others) provides an excellent opportunity for molecular clock calibration.

Earlier, approaches to phylogeny and classification of the subfamily were mainly based on comparative morphology of recent and fossil forms. However, the composition of the tribes and their phylogenetic relationships remain disputable. Despite of invaluable contribution of morphological approach involving comparison of fossil and recent forms such approach initially limiting the number of possible characters for analysis. For arvicolines such characters conventionally are molar patterns, mostly m1 and M3. Undoubtedly it apply certain limitations on the reconstruction of evolutionary history and phylogenetic relationships in such a young and rapidly evolving group due to high probability of multiple parallelism (homoplasy). However, the data obtained during this period uncovered the morphological adaptations and revealed morphological trends within subfamily. The molecular data allow new insights into the evolutionary history basing totally on genealogical dimension. Moreover, studying the genetic variation within the recent populations we can penetrate into past demographic history and trace the possible colonization routes from putative refugia what is impossible to recover from morphological data. Thus these two approaches (morphological and molecular) to the study of evolution are not in conflict but supplement each other. Within this communication we want briefly to summarize the latest data of molecular phylogenetic analysis of the of arvicoline taxa and to show where and how they contribute our knowledge based on paleontology.

Summing up the molecular data known up to day the evolution of main groups of arvicoline rodents looks like follows. The most early derivatives from the main stem are tribes true lemmings (Lemmini), collared lemmings (Dicrostonychini including *Phenacomys*), *Prometheomys* and *Ondatra*. It is important to underline here that both the molecular dating and composition of these groups as well as and the branching pattern within it are consistent with the paleontological and morphological data. The phylogenetic relationships and the order of cladogenetic events of this first radiation within arvicolines is still obscure. The origin and further diversification of the second radiation is related to tribe Clethrionomyini. These voles were forming in forest and mountain landscapes of South-East regions of Siberia and China. The composition of the tribe and relationships of main lineages are consistent with conventional views. The only intrigue here is the origin and further evolution of genus *Alticola*. Up to the present there is dramatic discordance in the mitochondrial and nuclear gene trees. Another interesting fact here is that despite that fossil remains of the genus *Clethrionomys* are known as early as 2.5 Ma, the genetic structure of the recent populations of the genus indicate that the current wide distribution throughout Palaearctic forest zone took place in the Holocene simultaneously with the advancing forests very rapidly from the few refugia located in the South Ural, Central Europe and eastern Transbaikal area.

The most unexpected contribution of molecular data which contradicts to all conventional concepts is the position of tribe Ellobuisini which appear to be the sister group to tribes Lagurini and Arvicolini (Abramson et al., 2009) and this yet unresolved trichotomy constitutes the last, third radiation event.

Three genera comprise the tribe Arvicolini: *Arvicola*, *Chionomys* and *Microtus*. The genus *Arvicola* is the most early derivate within the tribe, next is the genus *Chionomys* which is basal in relation to *Microtus*. Despite the numerous fossil remains and being relatively well explored the most specious genus *Microtus* always was and the most complex as from the point of taxonomic structure so and in relation to very intricate evolutionary history.

Molecular data indicate on the early split of *Microtus* line into two lineages, therewith most likely this split occurred already at the *Mimomys*-like stage. One of these lineages lead to the formation of the *Stenocranius*-*Lasiopodomys* phylum and group of species united in the subgenera *Alexandromys* (including *Pallasiinus*). Proceeding from the genetic data this event may took place in southern Trans Baikal region (including northern China). We still observe the most high genetic variation in this region in combination with unique haplotypes with most basal position at the genus tree. The other lineage gave origin to a very wide and diversified group of recent species, the most ancient within it are the species currently referred to subgenus *Agricola* and *Neodon* (including *Blanfordimys*). Ancestor species within this lineage penetrates to the North America continent and demonstrate very fast explosive diversification into numerous species of *Microtus* (subg. *Volemys*). Subgenera *Terricola*, *Sumeriomys* and *Microtus* s. str. appear to be the late derivatives within this lineage therewith most close relationship demonstrate subgenera *Sumeriomys* and *Microtus* (arvalis species group).

DEVELOPMENT OF SMALL MAMMAL COMMUNITIES IN THE DON RIVER BASIN DURING THE PLIOCENE AND PLEISTOCENE

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The earliest faunas from the Don River Basin come from Antipovka and Chugunovka. They are dominated by Lagomorpha, accompanied by hamsters and the vole *Polonomys insuliferus* (Kowalski). The mole rat *Nannospalax odessanus* is abundant; *Prospalax,* mice and dormouse are also present. This fauna is similar in composition to the fauna from the Kuchurgan gravel (Black Sea Region), Nurnus (Armenia), Vendarg and Terrat (France). The bone beds of Antipovka and Chugunovka are confined to the Antipovka Alluvial Formation, which corresponds to the upper (ancient) Neogene terraces of the Don River Basin.

Subsequent stage reflects the first radiation of microtids. It is recorded in the Gerasimovka locality, which has yielded abundant Lagomorpha (more than 20 %), the voles *Dolomys* and *Pliomys* (45 % of the total number of specimens) and rare *Promimomys*, represented by the least specialized species *P. moldavicus*. It is close in the evolutionary level to faunas from Etulia (Moldova) and Wę e (Poland).

A new stage of small mammal development is displayed by assemblages of the Korotoyak and Uryv localities. They come from the Uryv alluvial Formation, which is assigned to the Krivoborskaya Group. The Korotoyak-2 bone-bearing horizon is positioned in the section just above the Korotoyak-1 horizon and the Uryv-2 Bed is located above the Uryv-1 Bed. The faunas from these beds are dominated by the Pliocene rhizodont vole genera *Promimomys, Mimomys,* and *Villanyia* accompanied by abundant Lagomorpha. They are correlated with small mammal communities of the Akchagyl Time of the Stavropol Region, Azov Region, western Black Sea Region and Bashkiria, faunas from the Villanyian of Hungary, Poland, Austria: Arondelli, Hainachka, Beremend-5, Rebelice Krolewski, Deutsch-Altenburg 20, 21, Stranzendorf A–C etc.

The next stage of faunal development is displayed by the Korotoyak-3, Log Denisov and Uspenka localities. They contain deposits of the Goryanskaya Formation, which, in the Korotoyak and Uryv sections overlies the Uryv and Belogorsk formations and, in the Log Denisov section, it is overlain by ancient reddish brown clays. In the faunal assemblage, the arhizodont vole genera *Prolagurus, Eolagurus,* and *Allophaiomys* prevail. The number and diversity of rhizodont voles are reduced; they are represented mostly by cement-bearing taxa. Similar faunas A.K. Markova described from the lower reaches of the Dnieper River, including the Roksolany, Western Kairy, Ushkalka, and other localities.

The earliest fauna of the Tiraspol type, i.e., Bikharia, is known on the upper Don River from the Petropavlovka-2 locality, the deposits of which belong to the Matuyama epoch. This fauna is distinguished by a small proportion of Lagomorpha, abundant *Mimomys* (more than 50 %), which are poor in species composition, and a number of arhizodont voles, which are dominated by primitive *Terricola* and include the first representatives of *Microtus*. All other faunas of the Tiraspol type from the Don River Basin come from deposits with normal polarity, i.e., correspond to the Brunes Epoch. They include abundant *Mimomys* and arhizodont voles; the genus *Mimomys* is represented mostly by *M. pusillus* Mehely, accompanied by *M. intermedius* Newton. The genus

Terricola is represented by *T. hintoni–gregaloides*, although individual *T. arvaloides* are already present. Lemmings of these faunas are *Lagurus transiens* Janossy of archaic morphotypes, with an admixture of more ancient *Prolagurus pannonicus* (Kormos). In Germany and England, they correspond to the Kärlich C-F and Sugworth faunas.

The next stage falls on the post-Don Time, i.e., the Muchkap Interglacial. It is characterized by abundant *Mimomys intermedius* Newton combined with the absence of other ancient rhizodont voles. In almost all communities, *Microtus arvalinus* is recorded, and some include abundant *M. (Stenocranius) gregalis*. It corresponds to faunas from Süßenborn of Germany and West Runton in England.

The first typical lemming fauna of the Russian Plain is known from the Mikhailovka-2 locality. It corresponds to the Oka Glaciation. It is dominated by archaic *Dicrostonyx simplicior*.

Small mammals of the first half of the Middle Neopleistocene are found in the Oka River Basin in the stratotypic Likhvin deposits at the town of Chekalin, on the Upper Don in the Vladimirovka, Strelitsa, and Donskaya Negachevka localities. They overlie the Oka moraine in the Likhvin glacial strata. These faunas are typical for interglacial. They include the earliest known on the Don River members of the *Arvicola* group, which is represented by archaic *A. mosbachensis*. *Terricola* abruptly decreases in number and approaches in morphology to extant *T. subterraneus*. The appearance of lemmings is intermediate between *Lagurus transiens* and living *L. lagurus*.

Faunas from the second half of the Middle Neopleistocene, which correspond to the Dneprovian–Moscovian glacial epoch, are thoroughly investigated in the Upper Oka Basin, which was included in the united system with the Don River Basin during the first half of the Pleistocene. Near the town of Chekalin, a bone-bearing horizon with the lemming fauna is recorded in fluvioglacial deposits underlying the Dneprovian moraine and overlying the Likhvin lacustrine strata. The fauna is dominated by *Dicrostonyx simplicior* Fajfar and contains abundant gray lemmings, root voles, and narrow-skulled voles; *Lagurus transiens* is scarce.

Late Pleistocene faunas of the Don River Basin show a number of distinctive features. The water vole of these communities is similar in morphology to Recent *Arvicola sapidus* of the Pyrenean Peninsula. *Microtus agrestis* L. which differs somewhat in tooth structure from the living field vole is recorded almost everywhere. *Terricola subterraneus* occurs in the majority of faunas, but it is relatively infrequent. In the Late Pleistocene of the Don River Basin, *Stenocranius gregalis, Eolagurus, Lagurus lagurus, Ochotona pusilla,* and *Desmana* were widespread.

Communities of the Mikulino Interglacial, such as the Okuni-1, Okuni-2, Ninovka, Staryi Oskol, Uryv-5, Pavlovka, Cheremoshnik (peat) include shrews, desmans, common field mice, bank vole, forest dormouse and show relatively diverse species composition. Communities of the second half of the Late Pleistocene, i.e., the Valdai Time, (Nikonovka, Levinka, Cheremoshnik-fluvioglacial) show poor species composition and combine tundra and steppe taxa: lemmings, ground squirrel, lemmings, and, in southern regions, jerboas. The boreal element is represented here by the genus *Lemmus*. On the Upper Volga River, these communities include scarce ground squirrels and lemmings, diggers (*Ellobius* and *Spalax*) are absent, whereas lemmings are common. In faunas of the maximum glaciation, *Dicrostonyx henseli* prevails.

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DYNAMICS OF PALEOGEOGRAPHICAL EVENTS IN THE DON RIVER BASIN IN THE PLEISTOCENE

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Long-term integrated analysis of sedimentation, dynamics of vegetation, faunas of mollusks and small mammals enables the establishment for the Don River Basin of distinct climatic rhythms, which provide the basis for stratigraphic division.

The Khokholskii horizon is the earliest well-characterized horizon of the Pleistocene of the Don River Basin. It was described based on the Strelitsa-1 locality, with a mollusk fauna containing elements characteristic of loess complexes, including *Succinea oblonga*, *Pupilla triplicata,* and *P. muscorum*. The small mammal fauna includes *Lemmus, Villanyia* aff. *hungaricus, Mimomys pliocaenicus, Mimomys pusillus, Allophaiomys pliocaenicus,* and *Prolagurus praepannonicus*. This is a unique community of the first arhizodont voles of the Russian Plain.

The next well-characterized stage is the Uspenka horizon, described based on the Korotoyak-3a, Uspenka, etc. localities. It is characterized by a moderately thermophilic forest–steppe community with North American and Levantian elements of *Vertigopsis*. The later Korotoyak-3c phase shows typical steppe plant assemblages, with *Artemisia* (up to 54 %) and seeds *Betula nana*. The mammal fauna contains rare *Mimomys pliocaenicus* and common *Mimomys pusillus*, *Allophaiomys pliocaenicus, Eolagurus simplicidens,* and *Prolagurus praepannonicus*.

The Ostrogozhsk horizon (Korotoyak-3c) developed later and differs in the mollusk fauna of a moderately warm forest-steppe type, with extinct species of *Gastrocopta*.

The Port-Katon horizon, which was described by A.K. Markova based on the Port-Katon locality, is represented in the Don Basin in Moiseevo-1, Korotoyak-4, etc. Vegetation of that time displays alternating pine forests and steppes; *Selaginella selaginoides, S. sibirica,* and *Ephedra* are recorded. The boreal fauna includes mollusks of the modern type, with a small admixture of thermophiles, such as *Theodoxus, Fagotia,* and *Vallonia tenuilabris*. Small mammal communities retain archaic features, include *Allophaiomys pliocaenicus, Terricola hintoni,* and *Prolagurus pannonicus*.

All the horizons listed are in the zone of the reverse polarity Matuyama. This is also true of the Petropavlovka horizon, which was described at the village of Petropavlovka, Log Krasnyi, etc. This time is characterized by a forest mollusk fauna with *Vitrea cristallina*. However, the small mammal assemblage differs in composition; *Mimomys intermedius, Terricola hintoni,* and *T. gregaloides* prevail, *Microtus oeconomus* appears for the first time in the Don River Basin.

The next stage is the Pokrovka horizon, which is observed in the Uryv-4 and Ilinka-6 localities. It is characterized by a steppe flora, with glacial elements (Novokhopersk); small mammals include typical late *Mimomys* faunas.

The Ilinka superhorizon, which comprises three horizons (localities): Veretie, Ilinka-2, etc. Plant associations include many Pliocene relicts, taxa characteristic of

North America, Balkan Mountains, and eastern Asia (Moiseevo). The mollusk fauna is of forest-steppe type, with thermophilic species of *Unio, Fagotia,* and *Gastrocopta*. Some localities are rich in small mammals, including *Mimomys intermedius, M. pusillus, Terricola gregaloides, Prolagurus pannonicus*, hedgehogs, and abundant desmans and shrews. It is one of the warmest stages in the Don River Basin.

It is followed by the Don horizon, which corresponds to the Don moraine in the Upper Don Region, and loess horizon in the southerly areas. This stage is characterized by a loess mollusk assemblage. The Zmeevka and Klepki localities have yielded a small mammal fauna, including late *Mimomys*, *Lemmus,* and *Microtus hyperboreus*.

The Muchkap horizon overlies the Don moraine. This period is characterized by polydominant coniferous–broad-leaved forests, with *Quercus, Tilia,* and *Ulmus*. The pollen diagrams include two distinct optima. The Kuznetsovka, Verkhnyaya Vershina, etc. localities have yielded rich mammal faunas, dominated by *Mimomys intermedius, Terricola arvaloides,* and *Prolagurus posterius* and including forest mice, diverse shrews, and desmans. All paleontological data suggest warm interglacial conditions.

The next well-characterized unit is the Ikoretskii horizon, described based on the Mastyuzhenka locality. It is distinguished by the abundance and diversity of amphibians and, partially, reptiles. V.Yu. Ratnikov has recorded both typical steppe (green toads) and forest (*Salamandrella*) taxa; toad frogs are common. In the small mammal assemblage, *Arvicola mosbachensis* and *Microtus oeconomus* prevail; *Apodemus sylvaticus* and *Lagurus posterius* are recorded; insectivores are common. This is a typical interglacial community. However, lacustrine deposits of this bone beds are crumpled by pronounced cryoturbations and, upwards in the section, overlain by Likhvin soil. This is evidence that the first *Arvicola* appeared in the Don River Basin at the pre-Likhvin stage.

The Oka horizon is insufficiently represented in the Don Region; however, it has been investigated in westerly areas, in the Svapy River Basin in the Mikhailovka-2 locality. The fauna is dominated by *Dicrostonyx simplicior okaensis*; *Microtus (Stenocranius) gregalis, Lagurus transiens*, individual *Lemmus* and *Clethrionomys* are recorded.

The Likhvin superhorizon has been investigated in the Likhvin, Strelitsa, and Vladimirovka localities, displaying polydominant coniferous-broad-leaved forests, dominated by *Carpinus*, which is accompanied by *Tsuga, Juglans,* and *Pterocarya* (Demshinsk). Mollusk communities are forest moderately thermophilic, with *Gastrocopta theeli, Corbicula fluminalis*, and *Cepaeae*. The mammal fauna includes *Arvicola mosbachensis, Microtus malei, Apodemus silvaticus,* and *Clethrionomys*. Paleontological data are indicative of a well-pronounced interglacial. The flora shows the last occurrence Manchurian and North American relicts. The fauna irreversibly acquires modern appearance.

The Kamenskii superhorizon corresponds to a brief but strong warming (9c, MIS) after an abrupt fall in temperature at stage 10 of MIS. Based on the Rasskazovo locality, it is shown that the forests of that time included broad-leaved elements, such as *Quercus, Carpinus, Tilia, Ulmus,* and *Myrica*. The Dneprovian and Moscovian superhorizons are only characterized in the Don River Basin by the loess strata. However, in the Oka and Desna basins, there are a number of localities (Chekalin, Volzhino, Strigovo, etc.) with small mammal faunas, which are dominated by *Dicrostonyx simplicior* and include *Lemmus, Lagurus transiens,* and *Microtus (Stenocranius) gregalis.*

The Mikulino horizon, which corresponds to the latest interglacial, is most completely represented in a number of localities (Okuni-1, Okuni-2, Uryv-5, Pavlovka, Mikhailovka-5, etc.). The mammal fauna includes *Arvicola* cf. *sapidus, Clethrionomys glareolus, Apodemus sylvaticus,* and *Terricola* ex gr. *subterraneus*. Forest thermophilic mollusks are recorded.

The Valdai stage is represented in the Cheremoshnik (fluvioglacial) section. The fauna is dominated by *Dicrostonyx hensely, Lemmus,* and *Stenocranius gregalis*. This is a typical community of the periglacial tundra. Thus, climatostratigraphic data on the Don River Basin mark stratigraphic boundaries of different scales, which outline units of different rank.

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LOCALITY OF UPPER PLIOCENE MAMMALS AND EARLY PALEOLITHIC IN CISCAUCASIA

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Marine Cenozoic deposits of Ciscaucasia are relatively thoroughly investigated, in contrast to continental deposits. The Quaternary small mammal faunas from the Cis-Caucasian Depression are poorly understood. Therefore, the data on taphocoenoses of this age are of great importance. The accumulation of these data is promising for further complete and precise correlation of marine and continental stratigraphic scales of the Russian Platform.

Recent studies of Early Paleolithic sites in southern Russia resulted in the discovery of new objects of the earliest Paleolithic and mammal localities. One locality is at the village of Zhukovskii in the Novosel'tsevskii District of the Stavropol Region. The section examined is in the apical part of a dry meadow, which cuts the right slope of the Tomuzlovka River valley 0.5 km east of Zhukovskii. In this area of the Stavropol Highland, the Tomuzlovka valley has a wide floor (more than 4 km) and weakly convex axial part. The slopes are formed of loamy sand and sand agglutinated in places by travertine cement, with thin interlayers of pebble–gravel matter. The sand and loamy sand are overlain by loessial loam. The absolute altitude of the modern shoreline of the Tomuzlovka River is 230 m, the marks of interfluvial surfaces on the right slope reach 340–380 m.

In the site with coordinates 44°46'14,4"N; 43°09'52,6"E, at the mark 66 m above the shoreline (296 m of absolute altitude), a sequence of continental deposits outcrops. Their upper part is formed of young soils and loesses, which fill the area near the slopes of the valley. They taken together are about 2 m thick, contain detrital and pebble-gravel matter, which comes from the marginal area of the valley as a result of weathering of Sarmatian sandstones and conglomerates composing the interfluvial surfaces.

Underlying sandy fluvial deposits were produced by streams with stable moderately flush hydrological mode. The existence of gradually shoaling, slightly saline estuary is evidenced by subhorizontal sandy interbeds of different mechanical structure and several horizons of travertines. These deposits are about 2 m thick.

They are underlain by medium- and coarse-grained sand with lenses of shingle, corresponding to deposits of a river mouth, passing from a true delta to marine (underwater) part, in the zone combining the deposits of mouth bars, coastal banks, closed nearshore basins, such as an estuary or lagoon and streams. In total, these strata are about 6 m thick. Their upper part, at a depth of 4.5 m has yielded remains of small mammals.

The taphocoenosis from alluvial sands includes about 10 % of bones of amphibians (frogs) and reptiles. Most of the material is bones of mammals, about 12 % of which are lagomorphs and remaining specimens are insectivores and rodents. Insectivores played a significant role in the community, composing 29 % of the taphocoenosis. They are dominated by bones and jaw fragments of the small mole *Talpa minor*. A large soricid, *Blarinoides,* and an unusual shrew resembling *Drepanosorex* are also recorded.

The hare is assigned to the genus *Pliolagus* based on one P3. Judging from the size and structure, other specimens also belong to this genus.

Among rodents, the upper molar of the large flying squirrel *Miopetaurista* is of great interest. Other rodents belong to rhizodont voles of the genera *Promimomys* and *Mimomys*. All vole teeth have roots and well-pronounced dentin tracts. These morphological features and the composition of community enable dating. The absence in the oryctocoenosis of arhizodont voles is evidence that its upper age boundary is the Olduvai paleomagnetic episode. The taxonomic composition and evolutionary level of rhizodont voles indicate the lower chronological boundary of the oryctocoenosis as the beginning of the Upper Pliocene (stratigraphical mammal zone MN16).

Table 1

Small vertebrates from the Zhukovskii locality

No.	Taxon	N of specimens
1	Amphibia (Anura)	2
2	Reptilia	2
	Mammalia	
	Insectivora	
3	*Blarinoides* sp.	2
4	cf. *Drepanosorex* sp.	1
5	*Talpa minor*	9
	Rodentia	
6	*Miopetaurista* sp.	1
7	*Promimomys baschkirica* Suchov	6
8	*Promimomys* sp. (small form)	2
9	*Promimomys* sp.	4
10	*Mimomys* sp.	6
11	Rodentia gen.	1
	Lagomorpha	
12	*Pliolagus* sp.	1
13	Leporinae gen.	4
	Sum	41

Judging from the composition of small mammal community, paleogeographical conditions of that time were rather favorable. The abundance of moles and the presence of large shrews suggest that there was a rich fauna of land and soil invertebrates, including worms and insects. The presence of flying squirrels, which are similar to the Asiatic giant squirrel, presently inhabiting forests of southeastern Asia, is indicative of forestlands under temperate-subtropical climatic conditions. They are common in the Upper Miocene and Pliocene of the Mediterranean, in the Dniester Basin and the lower reaches of the Dnieper River. They are also common in the Pliocene of China.

Pebble-gravel interbeds have yielded several artifacts of Paleolithic appearance, i.e., small shingle with a series of artificial treatment with two chips. They are probably single-face nuclei, a sharp piercing tool, and a chip. They were produced from well-rounded (up to 3-rd class) shingles of chalcedonic flint. The pebble surface suggests intense transportation of specimens. Paleolithic artifacts co-occur with bones of small vertebrates, which are dated to at least Upper Pliocene, i.e., about 2 Ma.

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THE LATE PALEOLITH STUDY OF THE DERBINA BAY (KRASNOYARSK RESERVOIR, SIBERIA)

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The first Paleolithic locations at the Krasnoyarsk reservoir Derbina bay were found simultaneously by the Archeology and Ethnography Institute of the Siberian Department of Russian Academy of Science team, composed of E.V. Akimova, V.P. Cheha, N.G. Usaninoy and local history explorer from Divnogorsk M.U. Tihomirov in 1993. The permanent work was started in 1998. S.A. Lauhin, S. V. Gubin (from Moscow city), A.F. Sanko, A.N. Matuzko (From Minsk city) conducted the natural-science study of the Derbina Paleolith.

At the Derbina archeological region there are 2 kindred not clearly linked periods: Late Sartan (Blizhniy Log, Konzhul, Maltat, Derbina IVA, VI, IX and probably Derbina I, III, VIII et. el.) and Late Karga or Early Sartan (?) (Derbina IV,V, Ust-Maltat I, II, III, Pokrovka I, II, Truphanovo, probably, Derbina II, VII, Kizhart and Tatarka).

The Late Sartan period is represented by the sites, which make it possible to consider the coexistence of different cultural traditions bearers, within the bounds of the given period. Evidently, the typological map of the Late Paleolithic Yenisey was much more heterogeneous, than it was accounted not long ago. According to the Derbina bay material, 2 groups of Finally Sartan sites can be singled out: Maltat group (Maltat, Blizhniy Log) (fig. 1) and Kopylov group (Derbina IVA, Derbina IX). As for Maltat sites group, the dates, referring these sites to the very end of the Sartan period, have been obtained: Maltat (9475±110 (COAH-5521), 10680±170 (COAH-6726), Konzhul (11980±150 (COAH-4953), 12160±175 COAH-4954). Results of natural science study generally match the obtained data [Akimova, Stasyuk et. al., 2005, Akimova, Motuzko, Kravchenko, 2004; Motuzko, 2005][1]. Solitary sites of the Derbina bay right (Derbina VI, Lysy Log I, II, Zeleny Log) and left (Derbina I, III, Podsnezhnaya et. al.) banks are of absolutely other industry type.

Early complexes on the background of Finally Paleolithic industries seem to be less diverse. Today, it can be asserted that the most impressive and representative set of sites, referred to the early stage of the Late Paleolith industries forming on the Yenisey, is situated at the Derbina bay.

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[1] In A. N. Motuzko opinion the age of Maltat should be considered to be more ancient up to 13,6 – 14 thousand B.C.

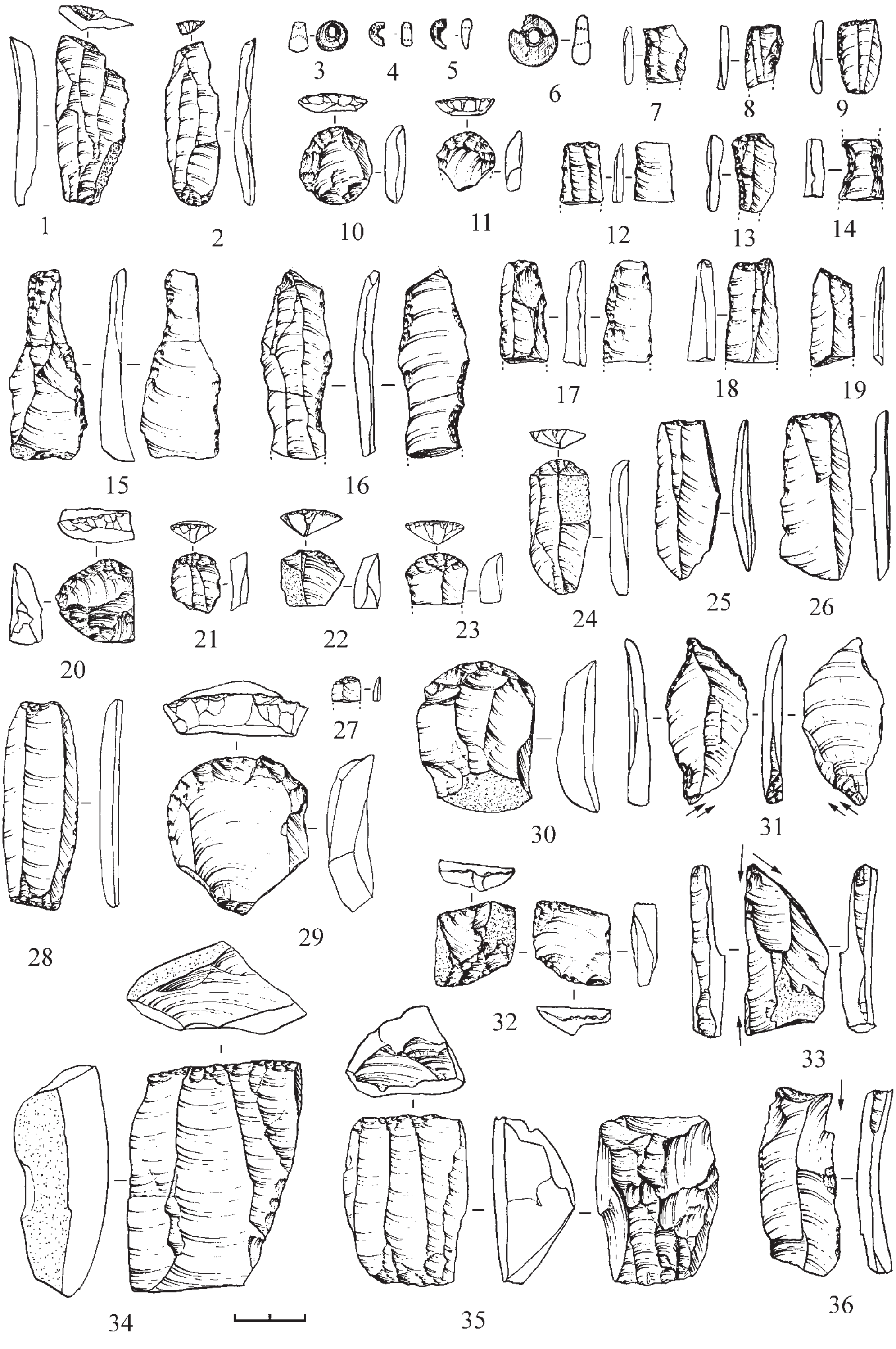

Fig. 1. Maltat site. Stone artifacts

Ust-Maltat II has the most archaic appearance of the archeological material together with cultural horizon occurrence in the sediments series of slightly redeposited, in A.N. Motuzko opinion, pedosediment (hydromorphic soil?). The features of the Derbina industries "archaism" are clearly displayed at this site – Le Vallua traditions in the initial splitting technique, biface ruggedness and practically total absence of microsplitting. Probably, Kizhart site industry was synchronous to the Ust-Maltat II, however this idea is mostly based on analyses of the initial splitting technique, as there are not enough tools at the this site. Localization of the site on the ancient terrace capelike prominence with a plenty of andesite and trachyte rubbles in the watercourse alluvium – the main raw material for Derbina industry, can be the evidence of workshop existence at this place. This fact could influence on the archaic appearance of the splitting objects.

Derbina IV, V, Ust-Maltat III with leaf-shaped bifaces and Pokrovka I, II, where wedge-shaped bifaces were not found (fig. 2), look younger, if to compare them with complexes mentioned above. Ust-Maltat II, due to stratigraphic position and tool morphology peculiarities, takes a special status. These peculiarities are shown: in initial splitting technique by the smaller quota of blade-based blanks, their small oblongness, the higher level of microsplitting standardization; in the tool set by significant role of flake blanks, typical exactly for this site pointed tools, "irregular" shape of bifaces. The nature of Ust-Maltat industry distinctions from the other "early" Derbina sites, hasn't been identified currently. As a probable variant, the nature of distinctions can be chronological, connected with blade-based blanks usage degradation or it can be local-cultural, synchronous to Derbina IV–V or Pokrovka I–II. It is indubitable, however, that the given complex is more archaic than both "microblade" industries and "classic" Afontovo and Kokorevo upper Paleolithic Yenisey cultures.

Derbina Paleolithic study determined a set of problems, associated with absolute and relative chronology identification. During the first years of the Derbina examination, it was considered that the all sites of early upper Paleolithic character were related to the Derbina pedosediment forming period of the Konoshel time. A number of dates, obtained from Derbina V sections – 29230±940 (COAH-4200), 32430±1540 (COAH-4201) and from Zeleny Log – 31480±1650 (COAH-4202) [Lauhin, Sanko et al., 2002; Stasyuk, Akimova et al., 2003]. Later, by excavating, new dates were obtained, testifying finally Karga – early Sartan cultural deposits: Derbina V – 21100±200 (COAH-4346), 21320±300 (COAH-4346A), 18690±220 (COAH-6007), Derbina IV – 21930±220 (COAH-4955). Then, microtheriological and malacological data made it possible to reveal more complex structure: morphological type of sediments, indicated earlier as Derbina pedosediment, appeared to be not homogeneous and not uniform. The Karga soil redeposition process in bounds of the Derbina region, is registered during Sartan time also. It makes us to pay attention on the taphonomy of fossil fauna remains and archeological material, peculiarities of slope and ravine different variants, redeposition of various fauna and artifact complexes.

Work at the Derbina bay made it possible to get anthropological remains of Paleolithic age – extremely rare on the Siberian territory. In 2002 on the shore shallow of the Pokrovka II site human front was found [Akimova, Stasyu et al., 2002].

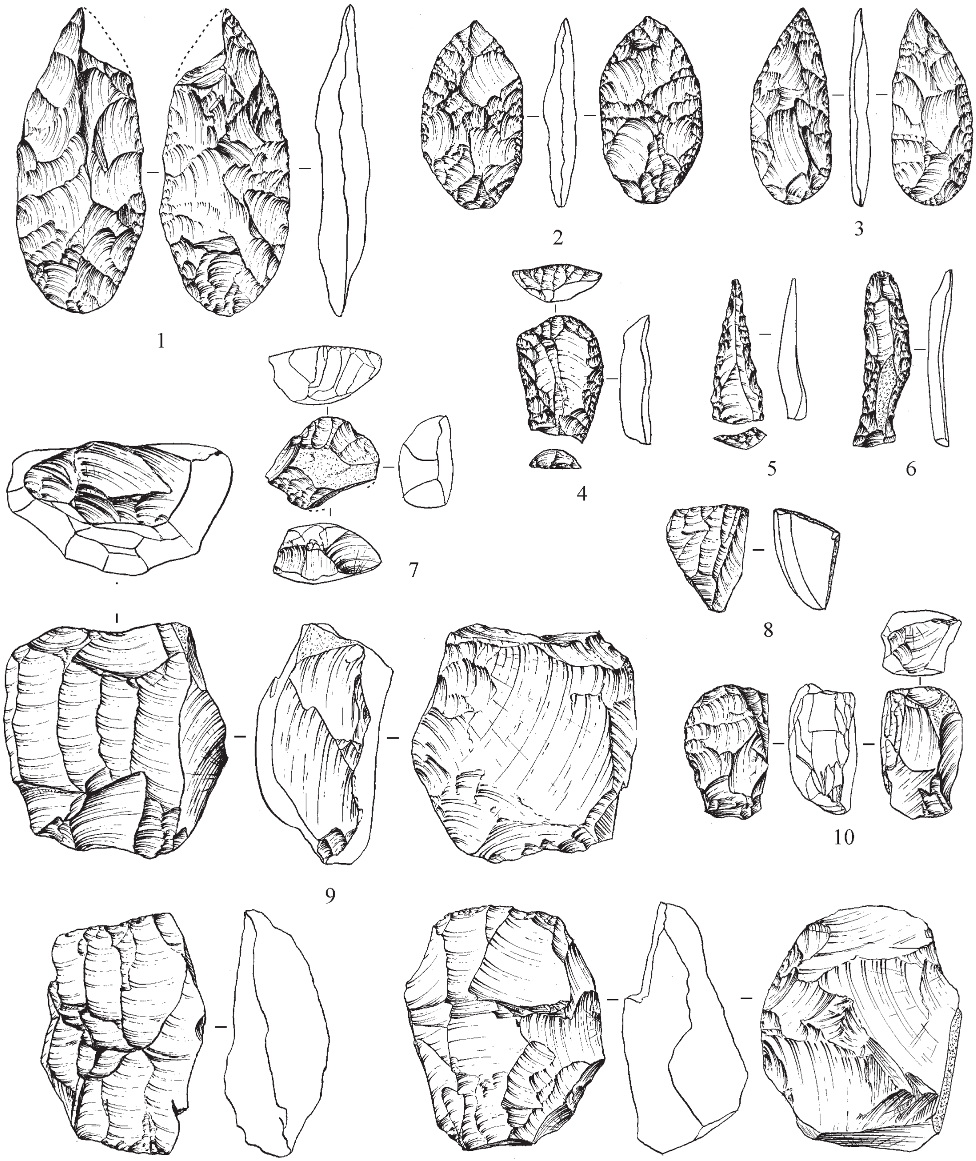

Fig. 2. Derbina V site. Stone artifacts

Summing up archeological study of the Derbina bay it is important to single out the following:

1. Shore shallow and contiguous cliffs inspection, conducted in regular, systematic, annual way, should be considered as optimal strategy for study of archeological region, situated at the Krasnoyarsk reservoir shore. Nonpresumable correlation of "accidental" and "predictable" in the emergence of archeological material local assemblages, caused by unstoppable process of deposits, containing archeological complexes, destruction, makes it the only possible way to consider. Sporadical inspection leads to information loss concerning: positioning "spots" of exposed complexes, correlation of their emergence with processes of abrasion, erosion, burial in the contemporary beach deposits layer.

2. Today, it is evident that search of archeological sites, by application of “suitable place” approach doesn’t correspond the real situation. There were almost not “inconvenient” regions for settlement in Late Paleolithic, this fact correspondingly, doesn’t permit to detect Paleolithic sites on the basis of the contemporary relief and landscape peculiarities analyses.

3. Sediments series structure of the Quarternary deposits at the Derbina bay, during the first exploration years seemed to be less complex, than we see it today. It became evident that under East Sayan Mountains spurs conditions, the more microrelief ruggedness leads to the fact that the separate parts of geological structure are conditioned by various factors, including such as activity of valley shores and ravine slopes, ravines, alases lakes et. al., while correlation of lithologic horizons, their thickness and sequence is outwardly homogenous.

4. Derbina bay study made it possible to draw a conclusion that the general situation of Late Paleolithic industries development on Yenisey appeared to be also more complex than it was considered earlier. Derbina early complexes examination demonstrated that the Middle Yenisey along with Gorny Altai, Transbaikalia and Pribaikalia was the territory, where Upper Paleolithic “Aurignac” type industries formation took place. Late Derbina complexes testify that the upper Paleolithic industries development at the final of Pleistocene did not have clearly expressed stage content, but still can be considered in strongly pronounced local – cultural aspect. The total material analyses, devoted to the so-called “middle stage”, enabled authors to single out Tarachiha archeological culture. Such Derbina bay sites as Maltat, Konzhul, Blizhniy Log and 2 points at the Volchiha ravine (Volchiha I, II), situated 5 km. above Derbina bay mouth [Akimova, 2006].

Prospects of the Derbina area further research depend on a set of factors and circumstances. Undoubtedly, the work at the area is far from completion. Cyclic fluctuations of the reservoir level lead to replenishment of exhibited material collections on the well-known sited. Besides the replenishment of new collections itself, it makes possible to specify sites bounds, to identify archeological and paleofaunistic materials in situ, to find new sites (ideally, not touched by the destructive impact of reservoir). Geological, paleoecological and paleogeographical studies of the area and it’s local parts can’t be considered to be complete as well. The main, desirable result of this work is creation of the full and detailed local chronostratigraphy, correlated with geochronology of the Middle Yenisey and contiguous territories.

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DEVELOPMENT OF THE ARIDITY IN THE TRANSBAIKAL AREA IN CONTEXT OF GLOBAL AND REGIONAL EVENTS BASED ON THE STUDY OF SMALL MAMMAL FAUNAS

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The Transbaikal area is a part of the Baikal rift zone which is located in the middle of the continental interior of Asia. During the Late Cenozoic this region experienced a complicated geological history. Tectonic evolution of the Northern Hemisphere, especially the progressive uplift of the Himalaya and Tibetan plateau induced climatic changes in the Central Asia and in particular in Baikalian region. As a result in the nature of the region occurred considerable changes both in landscapes and biocenosis.

During the Neogene the region was characterized by warm and rather humid climate with the predominance of the broadleaved-coniferous forests. At the end of Pliocene the climate changed towards warm and moderately arid, woodland gradually reduced. The most thermophilic elements of the flora disappeared and the considerable changes in the mammal faunas is traced.

A significant re-organization in the biogeocenosis of the region occurred at the beginning of the Pleistocene when the global cooling is registered in several regions of Northern Hemisphere and in the Baikalian region too at the 2.82–2.5 Ma. This time interval of the Transbaikal area is characterized by the fauna of Itantsinian Complex with *Equus* which replaced *Hipparion*, with *Allactaga* appeared for the first time indicating the first desertification evidence approximately 2 million years ago. Abundance of ground squirrels, existence of progressive type-high crowned vole of the genus *Villanyia* and *Prosiphneus,* pollen flora and geological data clearly indicates the spreading of steppes and grassland. The further intensive cooling of the Early Pleistocene was registered in the Baikalian region at the time interval 1.75–1.45 Ma when alpine glaciers occurred in higher mountains while low mountains, foothills and valley floors featured permafrost. Significant reorganisations occurred in faunal assemblages and paleoflora. For the mammal faunas the predominance of the Central Asian elements known from contemporaneous faunas of China and Mongolia is characteristic. At that time fast alternation of small mammal faunas occurred. Dodogolian fauna is characterized by the first appearance of *Borsodia* which replaced *Villanyia* and of archaic type *Allophaiomys deucalion*, which continued to exist in Ustoborian fauna parallel with *Lagurodon* and *Prolagurus* that replaced *Borsodia* and they represented the next evolutionary stage in lagurini lineage. In Kudunian and Zasukhinian faunas advanced *Prolagurus* continued to exist and the genus *Eolagurus* appeared, *Allophaiomys* was replaced by *Terricola.* At that time cemented and rootless voles *Lasiopodomys* and *Microtus* appeared too.

At the beginning of the Middle Pleistocene the progressive cooling led to significant reorganisation in the paleoenvironment and biota of the Baikalian region, the climate changed towards cooler and more drier conditions. This time interval was characterized by the high aridity of climate and by the predominance of inhabitants of desert, semidesert and dry steppes, small mammal faunas resembled the recent one of southern Mongolia known as fauna of Tologoi Complex. The most characteristic species are: *Ochotona gureevi, O. dodogolica, Spermophilus gromovi*, *Marmota nekipelovi*, *Cricetulus barabensis*, *Allactaga sibirica transbaikalica*, *Ellobius tancrei*, *Meriones unguiculatus*, *Myospalax wongi*, *Eolagurus simplicidens*, *Microtus (Stenocranius) gregalis*, *Microtus mongolicus*, *Lasiopodomys brandti*.

To the Late Pleistocene the paleoenvironment of this region have changed towards more or less periglacial. Dry steppes with the dominance of wormwood plants widely expanded in the Transbaikal area. Small mammals of the region contain a number of Central Asian species widely distributed in Northern China and Mongolia.

NEW DEVELOPMENTS IN THE UPPER PLIOCENE-PLEISTOCENE STRATIGRAPHIC UNITS OF THE DACIAN BASIN (EASTERN PARATETHYS), ROMANIA

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The Pliocene-Pleistocene deposits of the Dacian Basin, developed in a wide range of sedimentary environments, provide a valuable record reflected in a variety of facies and faunal content.

A lot of new data provided by detailed mapping and coal or hydrogeological boreholes, drilled especially in the central area of the Dacian Basin, allowed facies analyses and faunal content improvement of the Pliocene-Pleistocene deposits.

One of the most outstanding result of those investigations consisted in refining the biochronology (molluscs) of the Dacian (Early Pliocene) – Pleistocene time span. Several new Dacian sub-zones, characterizing the freshwater environments have been pointed out.

A new subzone, ***NSM12a-Euxinicardium ebersini-E. motasi*** has been outlined in the eastern area of the Dacian Basin, based on so called „Pleshcoi Lymnocardiids”, located between Pelendavian and Valahian Substages (tab. 1). The base of this subzone, magnetostratigraphically dated at **3.2** Ma, heralded the westernmost echo of the mid-Akchagylian transgression, which was the last Pliocene retrogradational delta environment in the Dacian Basin.

Early Romanian substage is biochronologically defined by the Zone ***NSM11-Moldavunio lenticularis***, while the Upper Romanian is characterized by ***NSM12-Ebersininaia milcovensis-Bogatschevia pretamanensis*** Zone.

In agreement with the **ICS** decision (**2009**) concerning the definition, geochronologic rank and lower Quaternary boundary, the zones ***Unio kujalnicensis*** and ***Bogatschevia tamanensis***, which defined the Uppermost Pliocene in the Dacian Basin, have now to be assigned to the Earliest Pleistocene (Milcovian Substage) together with the ***U. apscheronicus*** Zone (fig. 1).

Consequently, according to the new temporal position (**2.6 Ma**) of the lower boundary of the Quaternary, **the Pliocene-Pleistocene boundary in the Dacian Basin is to be located between *NSM12*** and ***QM1-U. kujalnicensis* zones and between Mammal sites Clocociov** and **Slatina 1**.

As the former **Clocociov, Milcovu din Vale** and **Slatina** sites are no more available, we tried and finally were able to relocate the new position of the Pliocene-Pleistocene boundary in the same stratotypical area, by taking into consideration the data provided by **H4-Slatina** borehole and correlating them with the former outcroping sites.

Table 1

Ages, Stages and Molluscs Zonation of the Pliocene-Pleistocene in the Dacian Basin

Ma	STAGES/ SUBSTAGES		MOLLUSCS ZONATION (ANDREESCU,1979,1981,1983 etc.Revised)		EPOCH
			ZONES	*Subzones*/**Fm./Type Localities**	
0.13	ILFOVIAN				PLEISTOCENE
	DINOGET.	MUSAISIAN	*QM9-U.pictorum-U.tumidus*	**Mostistea Sand** (=T3-Prut)	
0.5			*QM8-D.pontocaspia-A.plicata*	**Barbosi-Babele Fm.**(=T5-T4-Prut)	
		NETINDAVIAN	*QM7-D.crassa-M.pontica*	**Vanatori Fm.**(=T6-T5-Danube)	
0.8 1.0	ARGEDAVIAN	UZUNIAN	*QM6-Pseudosturia caudata*	**Copaceni Beds (Lower Coconi Fm.**=T8-Prut)	
			QM5-Bogatschevia scutum	**Uzunu Beds**	
			QM4-Bogatschevia sturi	**Izvoru Beds** (=T9-Danube)	
1.6		MILCOVIAN	*QM3-Unio apscheronicus*	**Slatina 3**	
2.0			*QM2-Bogatschevia tamanensis*	**Slatina2** (=T10-Prut)	
			QM1-Unio kujalnicensis	**Slatina1**	
2.6 3.0	ROMANIAN	VALAHIAN	*NSM12-Ebersininaia milcovensis-Bogatschevia pretamanensis*	*12d-E. geometrica- B. bugasica* *12c-E.milcovensis-Valah.orientalis* *12b-Valahunio iconomianus* *12a-Euxinicardium ebersini-E. motasi*	PLIOCENE
3.2		PELENDAV.	*NSM11-Moldavunio lenticularis*	*11c-Pelendunio bielzi* *11b-Pristinunio pristinus* *11a-Rytia brandzai*	
3.7 4.0	DACIAN	SIENSIAN	*NSM10-Malvensinaia psilodonta-Viviparus bifarcinatus*	*10b-Bittneriella mrazeci-V.bifarcinatus* *10a-M.psilodonta-V.rumanus*	
4.2		PARSCOVIAN	*NSM9-Horiodacna rumana-Euxinicardium limanicum*	*9b-Prosodacnomya sturi-Bittneriella bittneri/* *9a-Pachyprionoleura haueri-Prosodacnomya stenopleura*	
4.7 5.0		GETIAN	*NSM8-Prosodacnomya sabbai*	*8d-Zamphiridacna orientalis-Prosodacnomya sabbai/* *8c-Pachydacna mirabilis*	
5.25 5.5 6.0	UPP. PONT.	BOSPHORIAN		*8b-Phyllocardium planum*	

All the Pleistocene stages and substages in the Dacian Basin (**Argedavian, Milcovian, Uzunian, Dinogetian, Netindavian, Musaisian and Ilfovian**) are new names and have been outlined in this contribution.

The new stratigraphic units (chrono, bio and litho) are to be fully described in the paper in extenso.

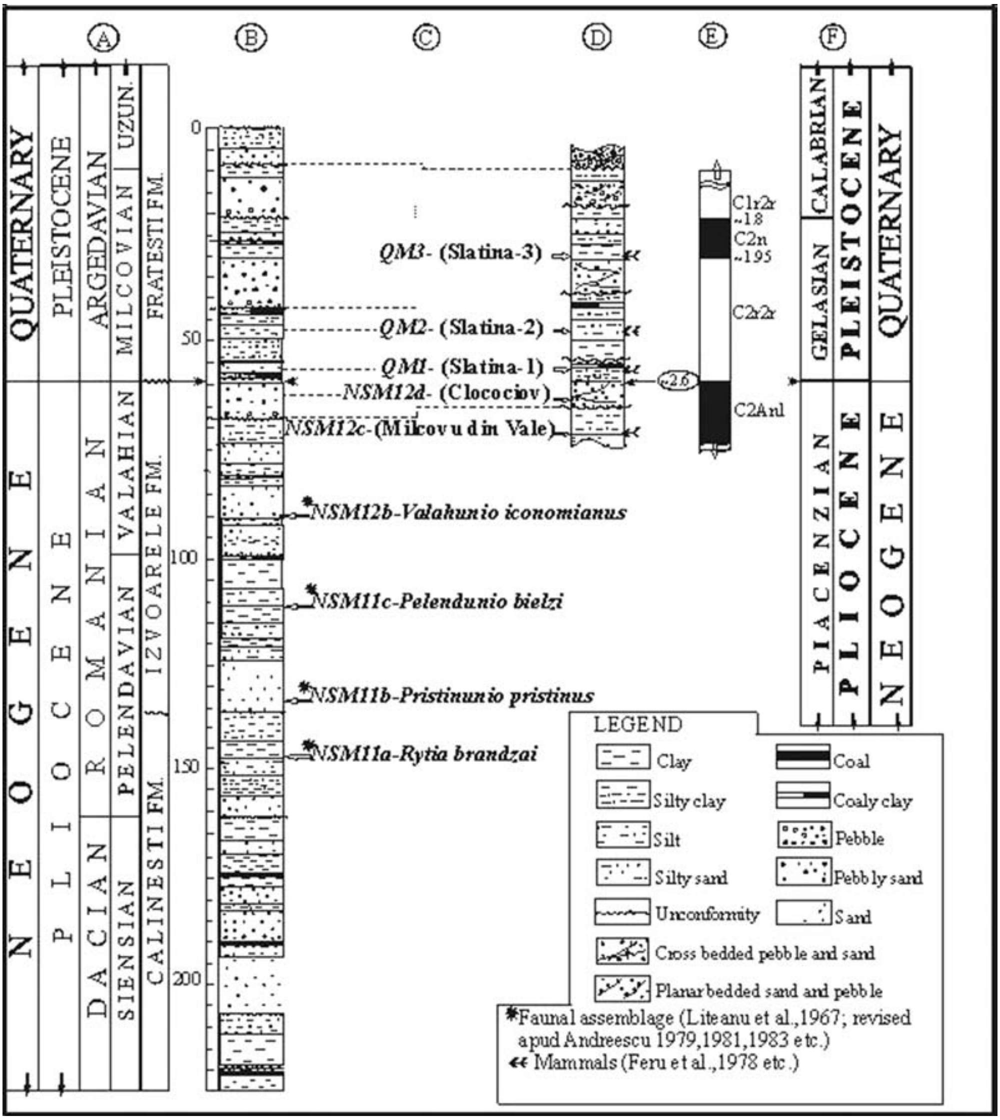

Fig. 1. Reassessed Pliocene-Pleistocene boundary in the Slatina Area (Central Dacian Basin):

A = Upper Pliocene-Pleistocene Chronostratigraphic and Lithostratigraphic Units in the Central Dacian Basin applied to the Slatina area;
B = Lithology of the Upper part of the H4-Slatina Site (after Enciu, 2007);
C = Molluscs zonation: NSM 11a to NSM 12b inferred, according to Liteanu et al., 1967, based on mollusc assemblages recorded in a nearby site drilled in the floodplain of the Olt River; Zonez NSM 12c to QM 3 are coming from the former Slatina and Milcovu din Vale (Andreescu et al., 1981);
E = Slatina-Milcovu din Vale magnetostratigraphic column (Andreescu et al., 1981);
F = Upper Pliocene-Early Pleistocene Mediterranean Stages

PLEISTOCENE LARGE MAMMAL ASSOCIATIONS OF THE SEA OF AZOV AND ADJACENT REGIONS

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Different levels of Pleistocene deposits are widely distributed in the south of Eastern Europe. Ample materials from a number of reference sections from this area were used for definition of Pleistocene Faunistic complexes (Gromov, 1948; Alexeeva, 1990).

Middle Villafranchian Eastern European animal associations correlated to zone MN17, determined as the **Khapry Faunistic Complex**, were characterized by the prevalence of *Archidiskodon meridionalis gromovi,* late *Anancus*, an abundance of large and slender *Equus (Allohippus) livenzovensis,* early *Elasmotherium chaprovicum, Paracamelus alutensis, Arvernoceros* and *Eucladoceros, Libralces,* and *Gazellospira*. In type localities of the complex Khapry and Liventsovka the following ratio of large mammal's remains was recorded: *"Archidiskodon"* – 23 %, *Equus* – 24 %, *Paracamelus* – 9 %, *Eucladoceros* – 10 %, *Anancus* – 9 %, *Arvernoceros* – 9 %, and Carnivora, Bovidae, Rhinocerotidae and others account for approximately 2 %, each (Baigusheva, 1971; Titov, 2008). This assemblage includes abundant forms adapted to open steppe and forest-steppe landscapes. Many thermophilic forms characteristic for humid and wooded conditions, as lophodont mastodons, tapirs, and hippopotamuses, disappeared. The combination of European and Central Asian elements was typical for Eastern European associations due to the position of this area at a junction of paleozoogeographic regions (Bajgusheva et al., 2001). The megafauna is accompanied by a rich small mammal association, including *Mimomys praepliocaenicus, Borsodia praehungaricus cotlovinensis*, *Mimomys* ex gr. *reidi,* correlated with Late Villanyian and regional zone MNR2 (Tesakov, 2004).

Securely dated Late Villafranchian large mammal localities that yielded abundant material are few in Eastern Europe. Terminal middle to late Villafranchian faunas of the region are assigned to the **Psekups (Odessa) Faunistic Complex,** which can be considered as a later stage of the Khapry Complex. The main criteria of this unit include the presence of *Archidiskodon meridionalis meridionalis*, *Stephanorhinus* cf. *etruscus*, *Equus (A.)*. cf. *major*, *Eucladoceros orientalis orientalis*, and *Pseudodama nestii*. Bunolophodont mastodons *Anancus* and camels *Paracamelus alutensis* became less numerous during this time. The locality Palan-Tukan (Transcaucasia), dated to the early Late Villafranchian, yielded the latest find of *Nyctereutes megamastoides* (Sotnikova, Sablin, 1993). This time was likely witnessed increasing aridification and extension of steppe-like areas. In comparison with the previous stage, no drastic reorganizations occurred in composition of mammal associations. Large mammal fauna of the Psekups assemblage is correlated to the regiozone MNR1 with predominance of *Borsodia* gr. *newtoni-arankoides, Mimomys* spp., and *Clethrionomys kretzoii* (Tesakov, 2004).

Early Pleistocene. Terminal Late Villafranchian, Early Galerian, and Early Biharian animal associations of Eastern Europe are assigned to the **Taman Faunistic Complex**. They commonly include index forms of large mammal, as *Archidiskodon* *meridionalis tamanensis*, *Elasmotherium caucasicum, Eucladoceros orientalis*, *Bison tamanensis,* and *Pontoceros ambiguus*. Tamanian association also includes *Canis tamanensis, Canis (Xenocyon) lycaonoides, Ursus* sp. *Lutra simplicidens tamanensis, Pachycrocuta brevirostris, Panthera* sp.*, Homotherium latidens, Equus (Allohippus)* cf. *major, Stephanorhinus* cf. *etruscus, Tragelaphus* sp.*, Gazella* sp., and other forms (Verestchagin, 1957; Forsten, 1999; Sotnikova, Titov, 2009). This animal spectrum indicates a variety of biotopes typical for steppe and forest-steppe landscapes, and does not contain mesophilic elements. Taphocoenoses of the Taman assemblage were dominated by remains of animals typical for half-open and open habitats, as elephants, deer, horses, and bisons. The fauna of the Tsymbal locality associated with alluvial deposits (Taman peninsula) shows the following ratio of forms: *Archidiskodon* – 42 %, Cervidae gen. – 34 %, *Equus* – 12 %, *Bison* – 5 %, *Stephanorhinus* – 3 %, Castoridae gen. – 2 %, Tragelafini gen. – 1 %, and *Elasmotherium, Canis, Panthera,* and *Sus* – less, than 0,01 % each (by Vereschagin, 1957). Most localities of Taman large mammals occur in alluvial, deltaic, and lagoon deposits. It indicates an important presence of flowing waters in these areas. These localities were likely formed during the first half of this period which was characterized by a warmer, relatively humid climate approaching the subtropical type. The Taman megafauna is be accompanied by *Prolagurus pannonicus, Lagurodon arankae,* and *Allophaiomys pliocaenicus* which characterize MQR 8 regiozone. A climatic cooling that occurred in the second half of Early Biharian (the period of a cold phase of development of the Taman Faunistic Complex), and also the general tendency to aridification have brought to a significant reduction or extinction of some mostly thermophilic forms of animals. In general, for pre-Galerian period of the East Europe there was typical a prevalence of steppe regions above forest-steppe ones. From this time onwards the savanna-like landscapes characteristic for the Khapry and Psekups complexes are replaced in this area by steppe landscapes.

Eastern Europe faunas of early Middle Pleistocene belong to the **Tiraspol Faunistic Complex.** The most part of the known localities of large animals are pertained for alluvial and deltoid deposits and are ascribing to the periods of warm phases of Middle Pleistocene. A basis for its choosing is the presence of steppe elephant *Mammuthus trogontherii,* large horse *Equus süssenbornensis*, small and slender *Equus* cf. *altidens*, *Stephanorhinus* cf. *etruscus*, *Stephanorhinus kirchbergensis*, *Praemegaceros verticornis, Alces latifrons, Bison schoetensacki* (*B*. aff. *priscus* by Sher, 1997) and earlier cave predators *Ursus (Spelaearctos) deningeri, Panthera spelaea* (Pleistocene of Tiraspol, 1971; Forsten, 1999). This association is considered as relatively cold resistance. It consists mainly of descendants of those animals who could survive through epoch of cold snaps. The inhabitants of open landscapes (steppe and forest-steppe) prevailed in it. The most part of the information about the animal association of the first half of this time period gives the stratotype locality Kolkotova Balka (Tiraspol gravel) whence occurs the most various fauna. Finds of two practically complete skeletons of *Mammuthus trogontherii* from Kagalnik sand pit are synchronous to it (Tesakov et al., 2007). During the interglacial period (which is correlated to the Muchkap interglacial), which was accompanied by the expansion of a forest zone, elephants *Elephas (Palaeoloxodon) antiquus* reached up to the Urals, into a lower course of Volga River, and to Transcaucasia (Alexeeva, 1990). This large mammal association is correspondence with MQR5 regiozone with predominance of *Stenocranius gregaloides* (Tesakov, 2004).

Post Tiraspolian faunal communities are known from cave sediments of Northern Caucasus. They evidence the presence of forest-steppe landscapes, and dry and warm climate similar to the modern one. The specific structure from the lower horizons of Early Paleolithic site of the Treugolnaya Cave includes *Canis mosbachensis, Ursus (Spelaearctos) deningeri, Crocuta spelaea, Panthera spelaea, Equus altidens, Stephanorhinus hundsheimensis, Capreolus* cf. *süssenbornensis, Cervus elaphus, Bison schoetensacki*. This association is allocated as independent Urup Faunistic Complex and interpreted as early regional Caucasian stage of the next Middle Pleistocene **Singil Faunistic Complex** (Baryshnikov, 2007).

Separate finds of large mammals of late Middle Pleistocene **Khazar Faunistic Complex** originate from the Don River alluvium, and have no exact stratigraphic situation. *Mammuthus chosaricus, Stephanorhinus kirchbergensis, Elasmotherium sibiricum, Camelus knoblochi, Bison priscus longicornis, Saiga tatarica, Megaloceros giganteus,* and *Cervus elaphus* were typical for that association. The mammal association of the Likhvin interglacial in the south of the Russian Plain indicates the presence of forest–steppe conditions with the prevalence of steppe forms. The megafauna correlates with MQR2 regional zone with the prevalence of *Lagurus lagurus* and *Arvicola mosbachensis*.

From Mikulino interglacial (Eemian) deposits of Don River Region early Late Pleistocene **Shkurlat Faunistic Complex** is known. Fluviatile deposits of the Veshenskaya locality in middle course of Don River, not associated with a archaeological site, produced remains of *Canis* sp., *Ursus (Spelearctos) savini rossicus*, *Leo spelaea,* archaic form of *Mammuthus primigenius*, *Coelodonta antiquitatis*, *Equus hydruntinus* и *Equus* cf. *latipes, Cervus elaphus, Megaceros giganteus*, *Alces alces*, and *Rangifer tarandus*. This association indicates forest-steppe conditions.

Elements of the **Mammoth (Upper Paleolithic) Faunistic Complex** are mostly known from Upper Paleolithic sites. This association typically includes *Canis lupus, Ursus arctos, Mammuthus primigenius, Equus caballus latipes, Equus hydruntinus, Cervus elaphus, Megaloceros giganteus, Alces alces, Rangifer tarandus, Bos* cf. *primigenius, Bison priscus,* and *Saiga tatarica*. This large mammal association was mainly characteristic of interglacial stages of the region. This fauna is correlated with MQR1 regional zone by small mammals (Tesakov, 2004).

Megafaunas record of the Sea of Azov Region is relatively complete. It allows to trace the development of faunal communities in the south of Eastern Europe related to climatic and zoogeographic changes. Being on the border of the European and Asian faunas, the communities of this territory had specific characteristics that distinguish them from other regions.

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THE UPPER PLEISTOCENE MAMMAL RECORD FROM CAVERNA DEGLI ORSI (San Dorligo della Valle – Dolina, Trieste, Italy): A FAUNAL COMPLEX BETWEEN EASTERN AND WESTERN EUROPE

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Caverna degli Orsi is located near S. Dorligo della Valle – Dolina in the Trieste Karst (NE Italy), at 360 m a.s.l. on the western slope of Monte Carso in Rosandra valley.

The cave is tunnel-shaped, about 130 m long and 5–10 m wide. The present day access is an 11 m deep vertical passage found by cavers during systematic surveys in the area, while the original one is at present completely buried by a debrisfall deposit that covers a wide area of the mountain side.

Since the cave entrance closed, sedimentation rate and weathering processes have been very low inside the cave; therefore a paleosurface, especially in the inner of the cave, has been preserved with minor changes. Typical traces of the presence of *Ursus spelaeus* are evident on the floor surface and on the walls: mostly scattered and unarticulated bones, hibernations hollows, scratches and polished rocks.

Two excavation sondages were carried out by the Department of Archaeological Sciences of Pisa University between 1992 and 2006. Sondage "A" is the inner one, while sondage B is situated in the outer part of the cave, where the tunnel entrance is obstructed by a debrisfall coming from the slope.

The preliminary results of the faunal analysis, related to the possible connections with the faunal assemblages of Eastern Europe, are presented.

Both stratigraphical sequences start from a flowstone, not dated but reputedly assigned to Eemian (MIS 5e). In the lowest layers there are large mammals with warm indicators such as cf. *Stephanorhinus kirchbergensis* in sondage "B" and *Dama* sp. in both sequences, in an association dominated by *Ursus spelaeus*. Among small mammals, common vole (*Microtus arvalis*) is dominant. In the upper layers animals of high mountain environments, such as *Marmota marmota* and *Capra ibex* and are quoted. Snow vole (*Chionomys nivalis*) is very abundant.

The presence of *Dama* sp. in the lowest levels, together with the change in the micromammals frequency and stratigraphic considerations, allow a calibration of the two sequences from 5 to 2 Marine Isotopic Stages (Late Pleistocene). In both sondages 26 *taxa* of small mammals and 24 ones of large mammals have been found.

The high biodiversity in the small mammals assemblage confirms the presence in this geographical area of an ecotone, with Balcanic and Western Mediterranean biocoenoses in the Late Pleistocene. In fact, the occurrence of *Dinaromys bogdanovi*, Balkan snow vole, together with *Chionomys nivalis* and northern and eastern European species, such as *Microtus oeconomus*, *Sicista betulina*, *Cricetulus migratorius* and *Mesocricetus* cf. *newtoni* mixed together with western ones, suggests that in this area animals of Pannonian and Western Mediterranean basins met.

PALYNOSTRATIGRAPHY OF THE UPPER PLEISTOCENE DEPOSITS (RISS–WÜRM INTERGLACIAL AND EARLY WÜRM INTERSTADIALS) IN THE UNIQUE SECTION KOLODIIV–5 (GALYCH DNISTER AREA, WESTERN UKRAINE)

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Kolodiiv–5 (49˚10'N, 24˚32'E) is a loess sections located on the right bank of the Sivka River (Galych District, Ivano-Frankivsk Region), which is unique for the purposes of paleobotanical and phytostratigraphical research. It is one of a few Upper Pleistocene sections in Ukraine, in which deposits of the Riss–Würm [= first phase of the Gorokhov paleosol complex, Mikulino (= Eemian) interglacial, OIS 5 a–c] are represented by almost a meter-thigh peat layer. Over the peat layer there are three paleosols (Kolodiiv 1, Kolodiiv 2, and Kolodiiv 3), formed during warm periods of the Early Valdai (Early Vistulian) (OIS 5 a–c) (= the second phase of the Gorokhov paleosol complex) (Janczont, Boguckyi, 2002). It should be noted that palynological studies of fossil peat deposits in the Kolodiiv section have quite a long history (Demedyuk, Hristoforova, 1975; Artiushenko et al., 1982; Gurtovaya, 1983; Kalinovych, 2001, 2002; Bezusko, Bezusko, 2003; Bezusko, Bezusko et al. 2005 et al.). We have carried out a spore-pollen analysis of the samples (fossil deposits of peat, and three paleosols) derived from the Kolodiiv–5 section. The summarized results of palynological (original) and paleocarpological (identifications by F.Yu. Velichkevich) studies of the fossil peat are also presented. The collective Riss–Würm flora consists of 200 taxa of different ranks. The species composition of flora was determined (more than 110 taxa) and it's ecological and cerotic analysis was conducted. The detailed pattern of vegetation changes in the second half of the Riss–Würm interglacial on the territory of Galych Dnister region (*Halych Prydnistrov'ja* in Ukrainian, in the Cis–Carpathian area) was reconstructed. Both local and regional characteristics of the flora and vegetation of the studied territory in the second half of the Riss–Würm [phases M4, M5, M6, M7, M8 of Grichuk (1989) scheme] are considered. Results of a comparative analysis of macro- and microfossils testify that the indicator taxa of the Riss–Würm flora of Kolodiiv–5 were *Taxus baccata*, *Tilia cordata*, *T. platyphyllos*, *T. tomentosa*, *Ilex aquifolium*, *Hedera helix*, *Viscum album*, *Humulus lupulus* etc. The results of comparative analyses of compositions of indicator species of the optimum phase of the Riss–Würm interglacial for the territory of Poland, western regions of Ukraine (Central and Galych Dnister area) and central regions of the Russian Plain are also demonstrated. The composition of vegetation of Galych Dnister area region during the optimal phases of Riss–Würm included some species that are currently absent in the native flora of Ukraine (*Corylus colurna*, *Juglans regia*, *Ilex aguifolium*, *Osmunda cinnamomea*). For the first time there are given the spore-pollen analysis results for samples from sediments of the second phase of the Gorokhov paleosol complex in Kolodiiv–5. Palynological materials of varying detail levels characterize the sediments that were formed during two warm periods of the Early Valdai. It is shown that, during the mentioned warm periods of the Early Valdai, the periglacial type of vegetation dominated. Basically it was formed by the forest, steppe and tundra plant communities. The vegetation cover of the primary and final phases of the Early Valdai warm periods contained the microthermic species (*Alnus (Alnaster) fruticosa*, *Betula nana*, *B. humilis*, *Botrychium boreale*, *Selaginella selaginoides*, *Diphasiastrum alpinum* etc.). The role of plant communities commonly occurring in disturbed (*Chenopodium album*, *Blitum* (*Chenopodium*) *rubrum*, *B.* (*Ch.*) *glaucum* etc.) and saline (*Atriplex tatarica*, *Bassia sedoides*, *Bassia hirsuta*, *Blitum* (*Chenopodium*) *chenopodioides*, *Atriplex* (*Halimione*) *verrucifera*, *Halocnemum strobilaceum*, *Salicornia prostrata* etc.) substrates were well-marked. In the context of possible existence of the thermophilous tree refugium within the territory during the Late Pleistocene, it should be noted that composition of the vegetation cover of the optimal phase of the Early Valdai warm periods insufficiently included some broad-leaved trees (*Quercus* spp., *Ulmus* spp., *Tilia* spp., *Carpinus* spp.). In the forests, the conifer species (*Picea* spp., *Abies* spp.) also occurred. Results of our spore-pollen studies of the Riss–Würm and Early Valdai deposits of Kolodiiv–5 section are also considered in the context of the newly emerged debate in Ukraine, concerning the lower boundary and extent of deposits of the Upper Pleistocene (Veklich et al., 1983; Gerasimenko, 2000, 2004; Bezusko et al., 2005; Komar et al, 2007, et al.).

QUATERNARY RODENT AND INSECT FAUNAS OF THE URALS AND WESTERN SIBERIA: CONNECTION BETWEEN EUROPE AND ASIA

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Nowadays, the Urals and Western Siberia represent a biogeographic crossroads where the ranges of European, Siberian and trans-Palearctic insect and rodent species intersect (Bolshakov et al., 2000; Ravkin et al., 2009, etc.). Zoogeographic peculiarity of the region is defined by coexistence of European and Asiatic species, and by interosculation of southern and northern faunal elements along the flanks of the Ural Mountain range stretching meridionally, and in the big river valleys in the West Siberian plain.

In modern rodent fauna, the European faunal elements tend to occur mainly in the south, whereas Siberian faunal elements are more typical for the northern part of the region.

The core of insect fauna is formed by transpalearctic and Euro-Siberian species, and the main peculiarity of the region is the intersection of the ranges of eastern trans-Palearctic, European (along with Euro-Obian), and Uralian endemic insect species.

The Urals has been suggested by Hewitt (1996; 2004) as a possible suture zone i.e. an area with a clustering of contact zones (Remington 1968), and phylogeographical studies in different rodent species (Fedorov et al., 1999; Brunhoff et al., 2003; Haynes et al., 2003) corroborate this hypothesis.

The history of fauna of the region could be divided into three stages (Krasheninnikov, 1954; Gorchakovsky, 1953; 1963; 1969; Smirnov, 1992; 1994; 2001): 1) gradual transformations of biomes during the Pleistocene; 2) revolutionary biotic changes (Upper Pleistocene), and 3) recent (Holocene) stage of development of the biomes. Factors that affected development of the faunal complexes in the region during the Quaternary were as follows: 1. central geographical location in Northern Eurasia providing transcontinental faunal interchange; 2. latitudinal zonality and its dynamics as a response to global environmental change (Borodin, 1996); 3. altitudinal gradient of environmental conditions in the Ural Mountains; 4. intrazonal landscapes of the large river valleys as dispersal pathways in the West Siberia.

The study is aimed to outline directions and extent of transcontinental and regional faunal interchange through the territory of the Urals and Western Siberia during the three stages of development of present-day biomes of the regions (based on the key rodent and insect taxa).

During the Pleistocene, no eastward expansion of European insect species revealed, whereas some eastern Siberian representatives of the insect fauna were spread much further west. For example, the finds of some Eastern Siberian insect species are known from the late quaternary deposits in Belarus – *Poecilus major, Stephanocleonus eruditus* (Nazarov, 1984), and in England – *Carabus maeander* (Buckland, Coope, 1991).

European rodent species were detected in the Southern Urals (*Clethrionomys glareolus, Eliomys quercinus*), whereas *Microtus middendorffii, M. gregalis, C. rutilus,* and steppe lemmings (*Lagurus*) were included in the European Pleistocene faunas (Nadachowski, 1982; Rekovets, 1994; Markova et al., 2007).

All the species known in the present-day fauna of the region could be divided into the three groups – 1) taxa that have been present in the region at all the three stages of the modern fauna development (remained here as a part of the Pleistocene communities), 2) the species that have dispersed into the region in Holocene in a natural way, 3) the species that appeared in the region during the time of significant anthropogenic transformation of biota.

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HUMAN ADAPTATION TO THE LAST GLACIAL ENVIRONMENTS IN THE CENTRAL TRANS-URALS

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The Ural region and the adjacent territory of West Siberia (Zauralye) represents a key area for elucidating migration processes and cultural adaptation strategies of Palaeolithic people in the context of climate history and environmental transformations during the Last Glacial because of its particular geographic location linking the southern (parkland-) steppe zone of the northern the Black Sea – Azov regions and the forest-tundra zone of Siberia. This extensive and biotically diverse territory reflects large-scale palaeogeographic changes, affected by the Arctic and mountain Pleistocene glaciations.

Systematic Quaternary and geoarchaeology studies from the eastern limits of the Ural Mountains provide multiple lines of evidence of Palaeolithic peopling of this geographically marginal and still poorly explored part of West Siberia, following the mid-last glacial (MIS 3) warming (50–24 ka BP). A complex of open-air localities in the Sosva River basin (the north-central Trans-Ural area) at the periphery of the West Siberian Plain, distinguished by very high concentrations of Pleistocene megafaunal remains previously regarded as "mammoth cemeteries", indicate, in conjunction with the associated diagnostic ivory/bone and stone industry, human occupation sites during the Last Glacial (MIS 2). Opened northern tundra and sub-polar ecosystems provided a productive natural habitat for the Late Pleistocene biological communities, particularly megafauna, as indicated by the enormous quantities of well-preserved fossil skeletal remains. Large mammals, dominated by mammoth (up to 98 %), together with bird and fish species, indicate a diversity of exploitation of the West Siberian natural resources and successful behavioural adaptation of humans to the last glacial sub-polar tundra-steppe environments. The taphonomy and composition of the well-preserved skeletal remains from the main occupation sites suggest both active hunting and anthropogenic "scavenging" practices in the local periglacial riverine, lake and boggy settings.

The contextual geology and the cultural and biotic multi-proxy records from the investigated sites dated between ca. 28–11 ka BP provide new insights into the timing and palaeoecological conditions of human occupation of the Pleistocene north-central Asia. Despite the parallels with the Palaeolithic milieu of the East European Plain, the Central Trans-Ural Upper Palaeolithic Complex, best documented in the Sosva River basin, represents a specific cultural entity linked to the last glacial West Siberian tundra-steppe/tundra-forest natural habitats and based on the diverse adaptive exploitation of the Late Pleistocene sub-polar biotic resources. Establishment in an open and seasonally inundated landscape further demonstrates environmental adjustment of people in the historical process of colonisation of the northern periglacial territories adjacent to the retreating Arctic ice sheet. The climatically protected and biotically rich eastern foothills of the southern and central Urals, representing a vital transitional and passable zone between the high mountains and the watered swampy lowlands, may have served as one of the main corridors for Palaeolithic migrations from the southern parts of the East European Plain and West Siberia into the northern sub-arctic and arctic regions of Asia.

Fig. 1. Location of study area

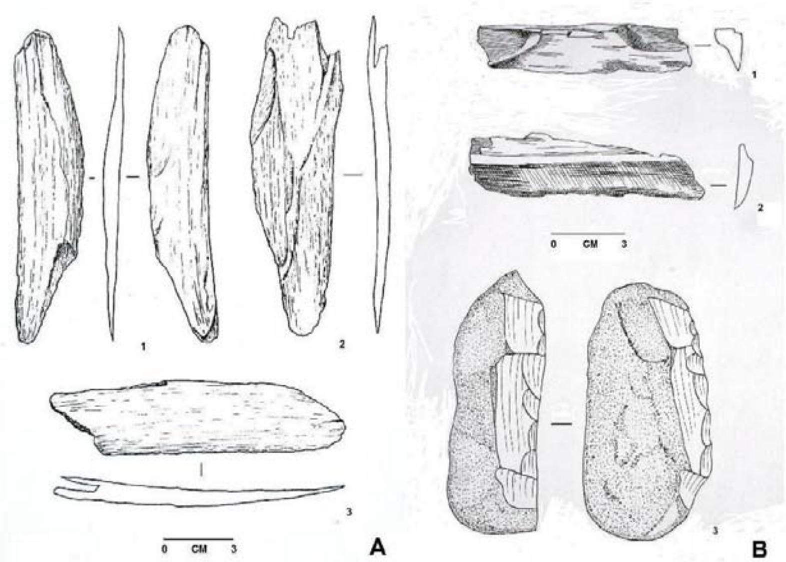

Fig. 2. A. Mammoth tusk flakes, attesting to exploitation of Pleistocene fauna (hunted and/or scavenged) and reflecting complex behavioural activities and human adaptation to the Last Glacial environments of the Tran-Urals; B. A massive quartzite cobble core.

UNCONFORMITY BOUNDED STRATIGRAPHIC UNITS (UBSU) AND THEIR APPLICATION TO CENTRAL ITALY AND SARDINIA

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During the last two decades the Italian Geological Survey carried out a renewed activity of geological mapping at 1:10.000 scale aimed to the publication of the new Geological Map of Italy at 1:50.000 scale. In this project particular attention was paid to the Pliocene and Pleistocene deposits, including continental terrains that in the former times were usually not much differentiated. The mapping activity was carried out in very different geological and structural settings that characterize the complex history of the Italian peninsula. The Italian Geological Survey (Servizio Geologico Nazionale 1992; 1996) recommended the use of Unconformity Bounded Stratigraphic Units (UBSU) or Synthems (Salvador, 1994), for the stratigraphical subdivision of the Quaternary units and especially for the more recent terrains. However, due to the lack of very strict rules, UBSUs have been applied in many different ways according to the experience and sensitivity of the different working groups. In northern Italy, and especially in the Alpine range, different UBSUs were created for each single main valley where glacial advances and retreats played a major role. This was based on the assumption that deposition, erosion and related unconformities were not synchronous moving from one valley to another. Also in central Italy the geological survey was carried out in areas with different tectonic settings: sinking basins (i.e. Po plain), the slowly rising Periadriatic area to the east of the main Apennine chain (i.e. Jesi, S. Marino, Ancona and Osimo Sheets, Marche Region; APAT in press a,b,c,d), the rapidly uplifting Apennine chain (i.e. Torre de Passeri and Gran Sasso Sheet, Abruzzi Region; APAT, 2006b and APAT in press e), the intra-montane tectonic depressions (i.e. Avezzano, Sulmona, L'Aquila and Gran Sasso Sheets; APAT 2006a,c,d and APAT in press e), as well as the Sardinia Island considered as the more "stable" Italian area (Arzachena, Cagliari, Capoterra, Carbonia, Sheets; APAT, 2005a and b; APAT in press f). The authors have been in charge for geological mapping of mainly Plio-Quaternary units for most of the previously mentioned Sheets. Particular attention was paid to create the minimum number of UBSUs assuming that during the Quaternary, in the continental areas, sedimentation was mostly climatically driven as ascertained for the Late Pleistocene deposits. The UBSUs and related unconformities have been defined using litho-, morpho-, chrono- and pedostratigraphical criteria. The single UBSUs were characterized according to the sedimentary facies in order to differentiate sedimentological characteristics and depositional environments. The investigations revealed as the mainly glacial, crionival, slope, lacustrine, glacio-fluvial and fluvial sedimentation was mostly linked to the colder period of the Quaternary when only minor pedogenesis occurred. In the uplifting and more internal areas, far from sea level changes influence, erosion/valley downcutting with associated paleosoils or pedocomplexes occurred during the Interglacial periods and possibly until the beginning of the subsequent cold event (Coltorti and Pieruccini, 2006). In the coastal areas unconformities corresponds to marine erosional surfaces, a ravinement, sometimes buried under a thin veneer of marine sediments deposited during the transgressive event. The Late Quaternary-Holocene UBSUs were better constrained due to radiometric dating, differentiating between late Middle-Pleistocene-Late Pleistocene and Holocene units. However, the Holocene is more complex due to the shorter time involved and the strong human induced sedimentation. The use of UBSUs was limited during the Early-Middle Pleistocene especially in the areas closer to the coastline. At that time sedimentation occurred in sinking marine and coastal basins on both sides of the Peninsula. In these areas alluvial fan, fluvial, lacustrine, fan deltas and coastal sediments are piled one on top of the other and the lithological criteria was mainly used (Coltorti et al., 1997; 2007; 2008; APAT, in press d).

Therefore in the geological record of Italy, UBSU boundaries mainly correspond to climatostratigraphic events while tectonics only generated the accumulation space.

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RECENT ADVANCE IN THE STRATIGRAPHY OF THE UPPER PLESTOCENE OF NORTHERN BRITTANY (FRANCE)

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The Pleistocene deposits of Northern Brittany outcrop now close to the seashore, they either form marine cliffs, fill coastal depressions or river valleys and are often coating the granitic massives. There are usually no long Pleistocene sequences of sediments but stratigraphic series can be "built" using separate sections taken in different areas. The sediments are both, of continental and marine origin and are represented by loess-like loams, loams, sandy loams, sand, pebble, layers and soils.

From a geological point of view, one of the most interesting places of Northern Brittany is located on the coast of Saint Brieuc Bay where several localities are known (Field trip guide, 2008). Four main formations of Middle to Upper Pleistocene age have been recognized in the Pleneuf-Val-André area situated in the eastern part of the Bay. They correspond to the Nantois Formation, La Haute-Ville Formation, Port Morvan Formation and Sables-d'Or-les-Pins Formation (Hallégouet and Van-Vliet-Lano , 1986; Monnier and Van Vliet-Lano , 1996; Monnier and Bigot, 1987; Bigot and Monnier, 1987; Loyer et al., 1995) (tabl. 1).

Table 1

Comparison of the Middle-Upper Pleistocene stratigraphic units of Northern Brittany with known successions of Westernmost Europe

Global Quaternary scheme Gibbard et al. (2004)			West European stratigraphic divisions (The Netherlands) Turner (1998), Zagwijn (1998)	Northern Brittany Monnier, Van Vliet-Lanoe, Hallegouet, Frechen, 1997	Marine Isotope Stages
System	Series	Subseries, stages/Ma			
QUATERNARY	HOLOCENE	UPPER	Upper		
		MIDDLE	Middle		1
		LOWER	Lower 0,01		
	PLEISTOCENE	UPPER	Upper Weichselian	Sable-d'Or-les-Pins Formation	2
			Middle Weichselian	Port Morvan Formation	3
			Lower Weichselian		4
				La Haute-Ville Formation	5a-d
			Eemian 0,127		5e
		MIDDLE	Drenthe glaciation Cold Interval with permafrost	Nantois Formation	6
			Bantega interstadial		7
			Cold Interval		8
			Hoogeveen Interstadial		9
			Cold interval with permafrost		10
			Holsteinian Interglacial 0,43		11
			Elsterian		12

The three upper formations can be seen in the locality of La Haute-Ville which has been taken as the stratotype of La Haute-Ville Formation. The outcrop is now constituted by loam deposits which are continuously eroded by the sea and which can be seen in two little neighboring bays. On the western side a little brook cuts across the soft sediments. In the East on the contrary there is no running water but the continuous crumbling of the cliff associated with the rising level of the sea is reinforced by the rapid erosion of the surfaces exposed to the action of the rains (fig. 1).

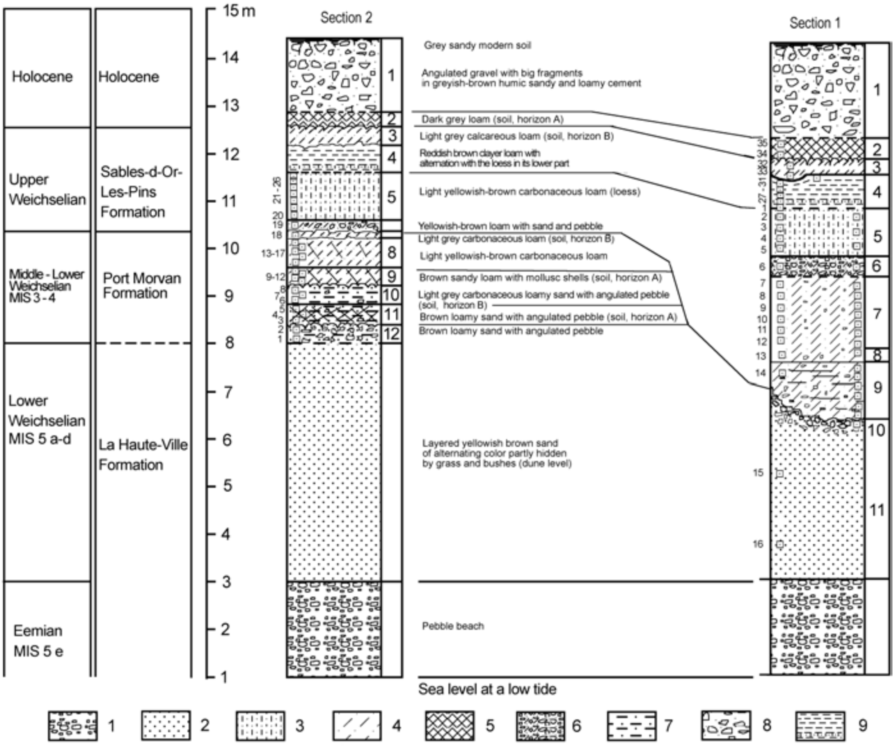

Fig. 1. Schematic correlation between the two sections studied in La Haute-Ville site (eastern part) (by G. Danukalova and J.-P. Lefort, 2007–2010).

Legend: 1 – pebble, 2 – sand, 3 – loess, 4 – loam, 5 – soil, 6 – loam with sand and pebble, 7 – loamy sand, 8 – angulated gravel in loamy and sandy cement. Arabic numbers given on the right side of the sections correspond to the described layers. Doted squares correspond with samples taken for malacological study. Arabic numbers on their left side is the numbers of samples

Contrary to the dune which is completely decalcified the upper part of the section has been well preserved and display many gastropods. It is why a complete study of the fauna has been developed.

The results of the study of the continental mollusc shells will be published elsewhere in detail but we can already evidence the existence of a drier and cooler climate from the bottom to the top of the sections, cut in places by a milder climate.

During the cold intervals *Pupilla muscorum* L. were widespread and numerous. *Trichia hispida* (L.) in association with other species is on the contrary an indicator of warmer climate.

All the results of this study will be presented more in detail to the participants of the SEQS conference at Rostov-on-Don, Russia in 2010.

PALAEOENVIRONMENT OF THE BRONZE AGE SETTLEMENT TANALYK LOCATED IN THE TRANS-URALS REGION (RUSSIA)

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Palaeoenvironmental reconstruction of the Tanalyk River valley (Trans-Uralian area, Bashkortostan Republic, Russia) between the Late Glacial period and the Late Holocene was established on the basis of complex biostratigraphical investigations. The Tanalyk Bronze Age settlement is located on the first overflooded terrace of Tanalyk River which was studied during field work excavations. From the base to the top this terrace consists of fluvial and lacustrine deposits of the Tabulda horizon, water-slope deposits of the Kudashevo horizon of the Late Pleistocene and of subaerial deposits of the Middle and Upper Holocene.

During the Late Pleistocene open landscapes covered by herbage-*Artemisia*-Chenopodiaceae meadow-steppe associations with *Ephedra* sp. admixture dominated (Danukalova et al., 1997). *Betula* and *Pinus* forests grew in small areas, *Picea* trees with Polipodiaceae under their cover grew in humid valleys. The climate was warm and dry during Tabulda time and cold during Kudashevo time.

The subaerial Holocene deposits (soil and cultural layer) were correlated with the Subboreal and Boreal periods of the Blitt-Sernander scale. The late Subboreal climate was cold and dry. The vegetation of this period of time was represented by Artemisia-Chenopodiaceae steppe and by small *Pinus* forests with *Betula*, *Tilia* and *Alnus* admixture. The climate of the Subatlantic phase was moist at the beginning and dryer at the end. The vegetation of this period was represented mainly by the Artemisia steppe associations.

Small mammals, land and freshwater mollusc remains have been discovered in the same deposits and complete the palaeoecological characteristic of the above discussed periods.

A cultural layer (layer 2, depth 0.3-0.4 m) has been dated by radiocarbon at 2830±110 yr BP LU-3713 on bones of *Equus* sp.

Numerous Holocene large mammal remains have been found in the deposits of the cultural layer deposits; they were dated of the Subboreal 3. Holocene large mammal fauna is constituted by eurybiotic species and species of the semi-open landscapes. Bone remains of domestic animals are dominating in the collection. Pastoral farming constituted the base of the economy of the ancient people and the role of hunting was small.

The investigated area is now covered by the waters of the Tanalyk water reservoir.

The study of large mammals was supported by the RFBR, project no. 08-06-00380.

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PALEOECOLOGICAL PATTERNS FORMING OF THE LOWER DON VEGETATION

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Change of the paleogeographical situation during the transition from the last glacial to the Late Glacial and Holocene, and connected with significant climate changes adjustment in the structure of vegetation in the Lower Don, where accompanied by adaptive changes in the economy and material culture of primitive man. Accumulated over the past decade, a large paleobotanical material obtained using radiocarbon dating and the data on the nature of Late Pleistocene vegetation in the areas of Upper Paleolithic sites make it possible to reconstruct the geographic shift and successional changes of vegetation in some chronological gaps.

On the one hand, such reconstruction paleoflora are an important section of the integrated study of archaeological sites in the study of the interaction of primitive society and the environment that have been investigated rather often in regions where there are few natural geological faults suitable for spore-pollen analysis (Velichko, Gvozdover, 1969; Spiridonova, 1991; Kremenetsky, 1991, 1997; Leonova et al., 2006), on the other – are of great importance in understanding the history of the formation of the flora and vegetation on the basis of florogenetic and filocenogenetic research, through synthesis of paleobotanical data and knowledge about modern vegetation (Kamelin, 1973).

The main purpose of our research was to conduct the paleophitocenological reconstructions and comparisons of the correlation of the data obtained in the study of archaeological sites in the Lower Don (fig. 1).

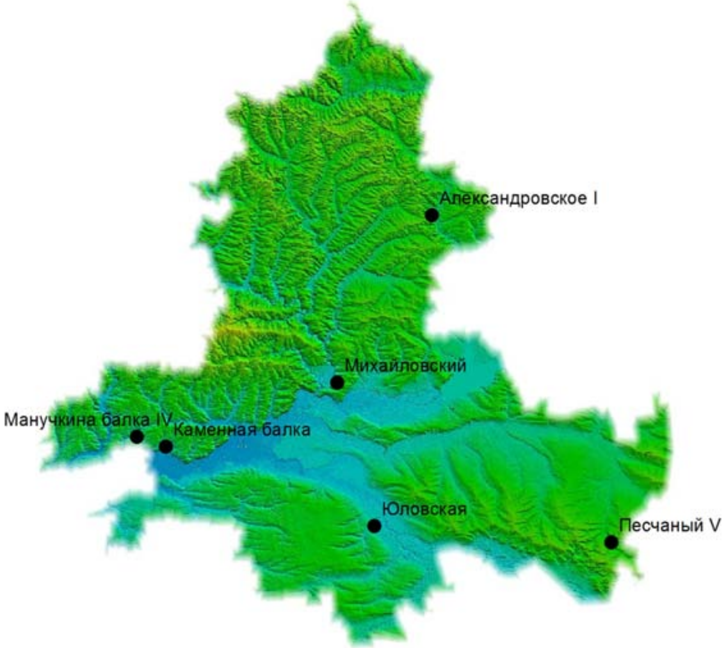

Fig. 1. Location of the investigated archaeological sites

Analysis of palynological material made by E.A. Spiridonova based on a study of more than 350 samples (12 total columns) and data on the age-dating of Late Pleistocene sediments of the section in the North-East Sea of Azov (the tract stone beam, archaeological sites Stone Beam 1, 2, 3, have been investigating since 1957), formed the basis of the Detailed paleoecological reconstructions in the study area, that enabled the authors to make a local (regional) biostratigraphic schemes and to develop judgments about the flora and vegetation of the study area during the late Pleistocene and partly Holocene (Leonova et al., 2006). In our study this scheme we took as a basis for correlation comparisons.

The importance of coordination of taxa in ecological phytocenotic space on the level of a system analysis was justified in the middle of the last century, by E.M. Lavrenko (1959) and A.P. Shennikov (1962). Therefore, even though it is not always rightful to correlate paleoflora with modern vegetation and the beginning of the last glacial period until the early Holocene in Europe there were peculiar periglacial vegetation communities, which have no analogies in the present (Evolution ecosystems... 2008), we used analogue method while reconstructing paleovegetation (Demina et al., 2009). For cuts in the area of archaeological sites top cover deposits and buried soils (103 samples have been investigated) were studied by the spore-pollen analysis.

The incision in the stay Yulovskaya is our main reference section for the entire southern part of the region (75 samples studied) as the most thoroughly studied at present. Stratigraphically, judging by the data set, the interval of the test sections – from the interstage Bryansk Valdai glaciation, with a maximum of glaciation and deglaciation phase of its multiple climatic oscillations, up to and including the Holocene (Demina et al., 2009). In our opinion, it is likely that not only in river valleys, but in the vast terraced complexes, and even on watershels, in cold weather and moisture, there could be distributed conifer forests of *Pinus sylvestris, Pinus sibirica* and *Picea*, and sometimes, with the maximum cooling, under participation of *Larix*. In the harsh and arid climate, forest communities reduced their size and halophytic and semi-shrubs gemihalophyte cenoses on saline soils got distribution of priority which was connected also with the regression of the lake-swamp complex of the Manych Valley. According to the palynological data, interstadial warming is characterized by the increase of the role of gemiboreal and unmoral elements and decreasing of the role of halophytes.

At the maximum warming in the sediments the peaks of redeposited pollen *Cedrus, Tsuga, Podocarpus, Juglans* are recorded, that could be associated with slope erosion and the erosion of Neogene deposits in the conditions of high humidity. At the same time on the segments of the spectrum with a high content of *Pinus sylvestris, Pinus sibirica* and *Picea* sp. redeposition of pollen is observed in a minimum amount, or absent, that indicates the reliability of the participation of these types being a part of existing forest phytocenosis at the examined time.

In the Holocene, with the warming and drying, the percentage of forest-forming element is reduced, *Chenopodiaceae, Artemisia* and grasses, acquire the prevailing value and forest-steppe and steppe landscapes are widely developed. It should be clarified that this characteristic of specific change in the vegetation belongs to the local changes confined to the terraced complexes of the ancient valley of the Manich. In zonal positions these changes could have less pronounced and more subdued character. Sections considered and palynological data obtained are of great importance in understanding the patterns of formation of paleoflora and modern dynamics of vegetation in the conditions of climate change, since the location of the stay Yulovskaya is attended by botanic-geographical boundary determining the modern border of spreading of the motley-sod-grass and sod-grass steppes (Demina et al., 2009).

In a comprehensive study of multilayer archaeological monument of Manuchkina beam IV (NPO expedition Heritage Don, under the leadership of M. Bakuscev), in the valley of Sambek river the palynological data, which reveal the whole picture of the forest-steppe landscape for a temporal interval of the Late Pleistocene were obtained (fig. 2).

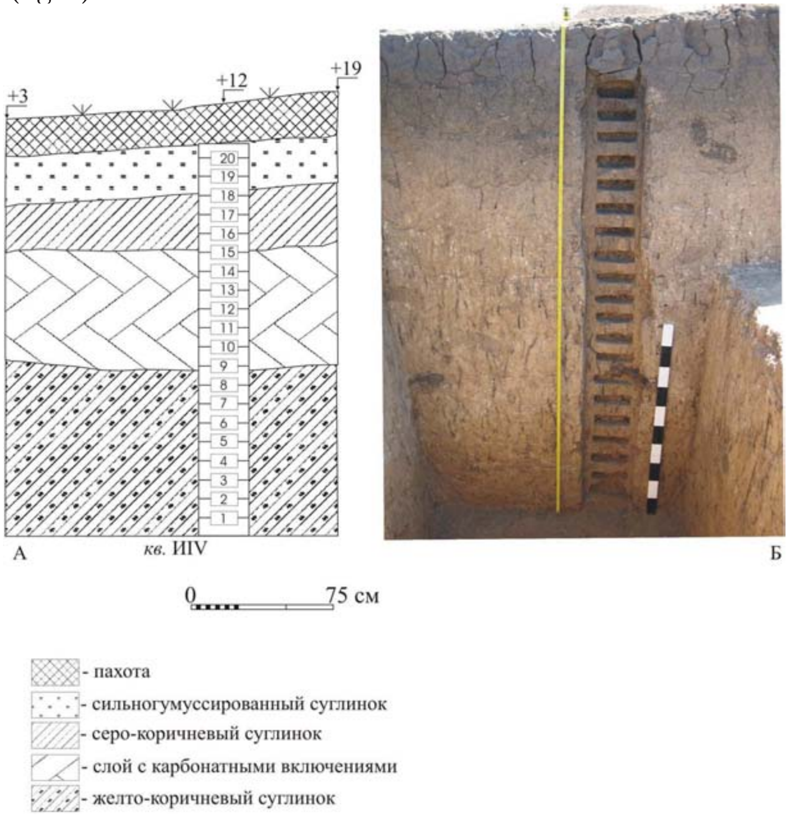

Fig. 2. The scheme of the section, column specimens of soil and spore-pollen diagram in the vicinity of the archaeological monument "Manuchkina beam IV».

For the parking area Aleksandrovskoe I – the archaeological site of Eneolithic and Early Bronze Age, on the right bank of the river Chir, we also reconstruct forests of *Pinus* subgen. *Haploxylon* with *P. sylvestris* and *Carpinus*, but above the cut, by the end of the examining period, a sharp decrease of the role of woody species is observed (fig. 3).

In 2007, on the right bank of the river Don, in the mouth of the river Seversky Donets, we undertook the studies in the 4-th section of Paleolithic location of Mikhailovskoye – the archaeological site of the end of Neopleistocene (Severo-Paleolithic Expedition of IHMC RAS, under the leadership of A.E. Matyukhin).

12 samples selected point in the sequence were examined by the method of spore-pollen analysis. By and individual samples taken from the buried soils, the information indicating the presence of forest communities in the valley of the Severskiy Donets, was received.

As a result of the studies of the monument of the Bronze Age – Burial Peschany V, Mound 4, in the southeast of the Rostov region (Steppe archaeological expedition led by GMM N.I. Shishlina) the conclusion was drawn (a significant amount of the pollen Pinus sylvestris and Tilia is recorded in the spore-pollen spectra) about the presence at this time (about 5 thousand years ago) the valley of pine forests, with lime, along with prairie forbs-bunchgrass and bunchgrass gemihalophytic cenosis, taking into account the constant presence of semi-shrubs Artemisia in the spectra pollen. This time is compared with the climatic optimum of the Atlantic period, after which there were the pronounced drying and strengthening of continental climate on the Don.

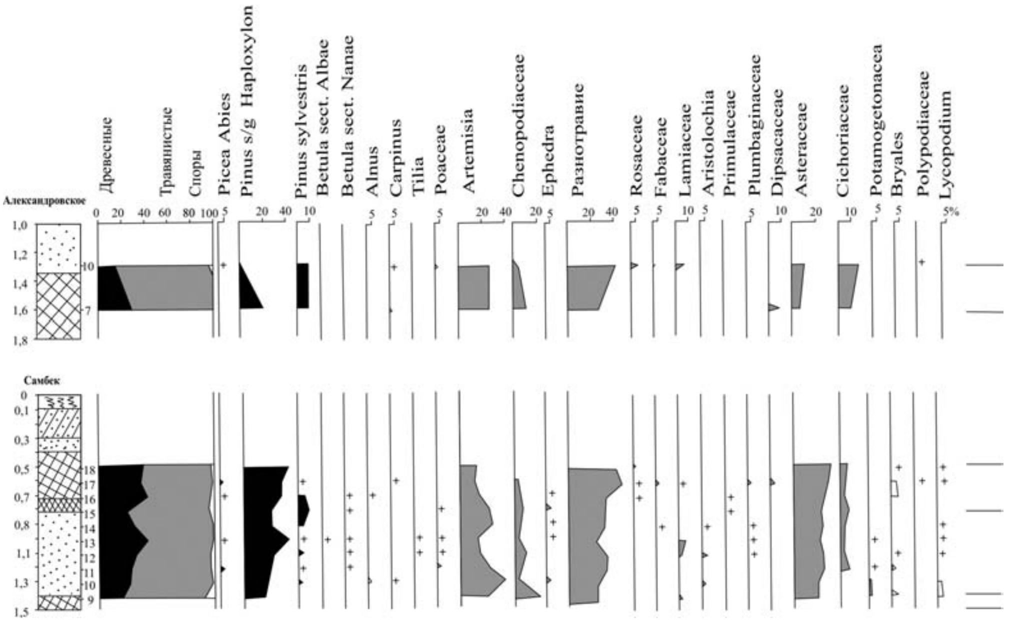

Fig. 3. The spore-pollen diagram of the cut in the archaeological site of Aleksandrovskoe I, and Sambek

On the whole, the obtained data are consistent with the point of view of the wide distribution of forests in the area of research (Neustadt, 1957; Kremenetsky, 1997) and significantly supplement these representations.

On the basis of analytical review undertaken, we consider the hypothesis of the existence of a giant forest refuge in the late Pleistocene and early Holocene (Demina, 2009; Demina et al., 2009), within the modern steppe zone, to be the most acceptable. Changes in the vegetation cover during the last glaciation were not as catastrophic as previously thought. Light coniferous forests of pine, oak and birch forests ("quercetalic and betularia" formation) were not destroyed by the influence of the last glaciation. However, in this time there also happened the geographical shift of the vegetation; under which the forest communities have evolved along with the shrub, semi-shrubs and grass cenosis.

Thus, the entire south of the Russian Plain and Ciscaucasia within the chernozem zone during the Valdai glaciation is becoming a giant forest refuges. Therefore, we tend to call this vegetation ekstraglacial forest vegetation, it located far from the edge of the ice sheets and being extrazone for modern steppe zone.

DISPERSALS OF EARLY PLEISTOCENE LARGE MAMMALS BETWEEN EAST ASIA AND EUROPE

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During the late Cenozoic, highly mobile and widely distributed large mammals frequently dispersed bewteen the east and west parts of Eurasia, i.e. East Asia and Europe, via Central Asia. Some of them originated in East Asia and dispersed westwards to Europe, some originated in Europe and moved to East Asia in the opposite direction, and some originated in North America and migrated across the Beringia to Eurasia from east to west. In the Pleistocene, we can find mammals in the three dispersal types respectively. We compare three roughly contemporary representative mammalian faunas of the Early Pleistocene in East Asia, Central Asia, and Europe, i.e. the Longdan fauna in China, the Kuruksay fauna in Tajikistan, and St. Vallier fauna in France. At generic level, 17 taxa of large mammals are shared by the Longdan and St. Vallier faunas, including *Macaca*, *Vulpes*, *Canis*, *Ursus*, *Meles*, *Chasmaporthetes*, *Pachycrocuta*, *Homotherium*, *Megantereon*, *Sivapanthera*, *Panthera*, *Lynx*, *Equus*, *Sus*, *Nipponicervus*, *Gazella*, and *Leptobos*. The Kuruksay fauna bears the sign of a mixture of the European and East Asian elements, including most of the shared mammals between Longdan and St. Vallier faunas, such as *Canis*, *Ursus*, *Chasmaporthetes*, *Pachycrocuta*, *Homotherium*, *Megantereon*, *Sivapanthera*, *Lynx*, *Equus*, and *Gazella*.

The mammals that migrated from East Asia to Europe included *Meles*, *Chasmaporthetes*, *Pachycrocuta*, *Homotherium*, *Sivapanthera*, *Sus*, *Nipponicervus*, and *Gazella*. For example, *Homotherium* originated in the Pliocene of Asia, from ~5 Ma deposits of the Yushe Basin in China, flourished during the Pleistocene in both Europe and Asia, and became finally extinct in the Late Pleistocene in North America. The mammals that migrated from Europe to East Asia included *Macaca*, *Ursus*, *Lynx*, and *Leptobos*. In Europe, the earliest record of *Ursus* is from the Montpellier marine sands (MN 14, 5.3–4.2 Ma). The earliest *Ursus* in Asia is from the top part of the Gaozhuang Formation of the Yushe Basin (4.5–4.1 Ma). The mammals that migrated from North America to Eurasia included *Vulpes*, *Canis*, *Megantereon*, *Panthera*, and *Equus*. *Equus eisenmannae* is one of the earliest species of the genus *Equus* in Asia. This species is based on several skulls and mandibles, and some postcranial bones from Longdan in the Linxia Basin, China. The first European *Equus* is *E. livenzovensis*, represented by fragmentary skulls, dentitions, and limb bones of Khapry and Livenzovka in southern Russia. They are close to the North American *Equus simplicidens*, the earliest fossils of which were found from the early Blancan Hagerman fauna of Idaho (3.4 Ma). At any rate, the first dispersal of *Equus* from North America to Eurasia should have occurred at 2.5 Ma.

PROBLEM OF PHANAGORIAN REGRESSION – COMPARING ARCHAEOLOGICAL AND PALEOGEOGRAPHICAL DATA

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The Black Sea and the Sea of Azov level change during last 5 KY still remains a debatable question. Most scientists of our country adhere to an opinion that two considerable transgressions separated by one regression took place during this period. First transgression so-called "New Black Sea transgression" began approximately 6 KY before present and had maximum sea level standing 4500–5000 years before present. Then a general regressive phase "Phanagorean regression" replaced it. Sea level dropped down to 4–5 meters below present, and on belief of some researchers to 10–12 meters below present. Phanagorean regression ended at the beginning of Common Era by the minor transgression called "Nymphaeon". During this transgression sea reached its present level and maybe standed a little bit higher for some centuries of the Middle Ages [4].

During our work at the Kerch and Taman peninsulas 2003–2009 years we came to a conclusion that there were no such considerable regression as "Phanagorean" during 1st millennium BC. Age of some coastal terraces is the first argument against it. We made several shafts 3 meters depth on the plain surface of most vast terraces and dated shells from different layers. Most presentable results are given it the Table. 1. As we can see from the table, no sufficient sea level drop occurs during 1st – 2nd millenniums BC. Moreover we may assume slow sea level rise beginning at the middle of 3rd millennium BC till the end of the 1st millennium BC. If such substantial regression as "Phanagorean" had place during this period we would have buried soils in our shafts, which showed that terraces got dry. We hadn't found buried soils layers in our shafts among marine sediments layers.

Table 1

Radiocarbon dating of terraces at the northern part of Kerch peninsula

Sample No.	Sediment position height above present sea level	Radiocarbon age	Calendar age (calibrated)
GIN – 13628	1,2–1,5 м	**3670±70 BP**	1625 ± 100 BC
MGU – 1712	1,3–1,5 м	**870±40 BP**	1460 ± 40 AD
MGU – 1711	0,3–0,5 м	**1100±50 BP**	940 ± 50 AD
GIN – 13629	1,2–1,6 м	**2480±60 BP**	200 ± 100 BC
GIN – 13627	0,25–0,4 м	**3980±100 BP**	2480 ± 145 BC

Second argument in favor of "Phanagorean regression" absence is ancient settlements at the northern shore of Kerch peninsula. There were rural settlements belonging to the Pontic Kingdom. Most of them situated much higher than the present sea level at the saddles between rocky capes in the distal parts of bays occupied by above mentioned terraces. Economic activity of ancient people points to close sea presence. A lot of sinkers were found during excavations. Also they had trade by sea with other settlements and capital of Pontic Kingdom "Panticapaeum". If we assume that sea level was at least 4-5 meters lower, these settlements must be far away from the sea and no fishery or trading by sea would be available.

Most interesting is the ancient settlement on the narrow cape of Chokrak lake (fig. 1). This settlement exists at III-IV centuries BC [3], exactly during the maximum of Phanagorean regression. Today lake is separated from the Sea of Azov by narrow spit. Radiocarbon dating of shell sediments from this spit shows that it was formed at 1st millennium AD. There is no doubt that lake was a convenient harbor for this settlement in classical antique time. So again if we assume sea level drop, lake must be a dry plain or silt closed water area not suitable for sailing.

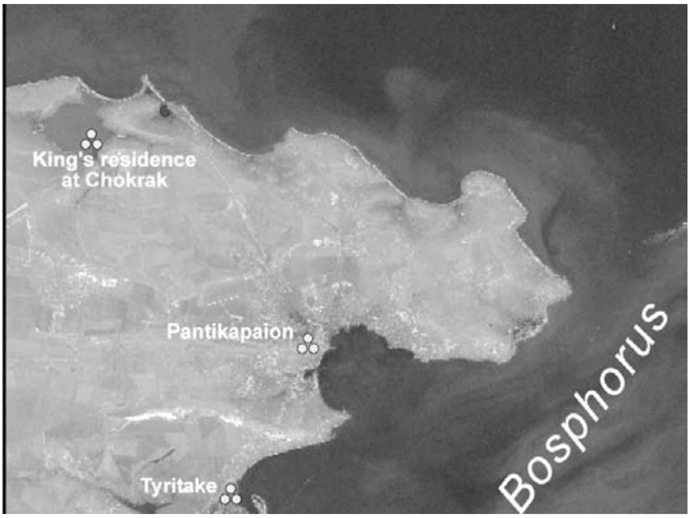

Fig. 1. Ancient settlement III–IV century BC at the Cape of Chokrak Lake

Ancient site Phanagorea and some other settlements on the Taman Peninsula now are partly submerged. On the base of this fact and drillings made in the seventies by Russian researchers Phanagorean regression was established [1]. Author also worked at Taman peninsula in Russian-German joint expedition at 2007–2008. A numerous drillings were made in different parts of investigated area. Shells and peat layers dating shows that Taman peninsula was a number of separate islands at 1st millennium BC [2]. Taman Bay existed as well as Kerch strait (Kimmerian Bosphorus) that means that sea level was close to present-day. Phanagorea site and other settlements of Taman bay submerging in our days can be explained by subsidence of Kerch-Taman flexure.

Conclusions. Phanagorean regression supported by Russian researchers probably was not so vast, deep and long-continued. Mediterranean Sea studies showed that certain regressive phase take place between 2nd and 3rd millenniums BC. This dating refers to the end of New Black Sea transgression. By our opinion Phanagorean regression represent sea level drop after New Black Sea transgression. It took place approximately 4500–3500 before present and was gradual and slow. We may assume sea level minimum 4000 years ago. May be it was 1–2 meters lower than present sea level. Then gradual sea level rise has begun. Sea reached its present level on time of Greek colonization beginning (VII century BC). During 1st millennium BC it was 1-2 meters higher than present. Chokrak Lake and bays at the northern part of Kerch Peninsula were covered with water. Greeks settled in well-defended bays of Meotis (the Sea of Azov) and had free access to the deep sea suitable for sailing and fishing. Sea level remained at this position until beginning of Common Era.

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STRESS MARKERS OF LARGE MAMMALS AND HUMANS. ENVIROMENTAL INFLUENCES RECONSTRUCTION

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The study of the mineral metabolism patterns of the large mammals and humans is the actual topic of paleoecology. It is well known that the Upper Paleolithic population in Europe was influenced by the environment (low insolation, cold stress). In particular, the characteristics of the mineral metabolism had important selective significance (Jablonskj, Chaplin, 2000; Dobrovolskaya, 2005). For example, the evidence of the subadult age rickets was shown for the mature (40–49 years) male from Sunghir' burial no. 1 (Buzhilova, 2000). The increased calcium content and abnormal femur shafts curvature were described for the girl from Sunghir' burial no. 2 (Buzhilova, 2000; Kozlovskaya, 2000; Nikitiuk, Kharitonov, 2000).

The cases of the mineral metabolic diseases of the mammoth fauna species are known too. The recently found mammoth specimen from the Kastykhtakh locality (west Taimyr Peninsula, Eastern Siberia) is of particular interest. This female shows numerous abnormalities including an obliterated arcus nervus of the first cervical vertebra (atlas), several healed fractures of the ribs, lingual displacement (crowding) of the last generation (M3) teeth by M2 teeth (fig. 1). These patterns can be considered as the metabolic disturbance evidence. M3 teeth of the modern elephants are erupting about 20 years old age (Garutt, 1977) and continue to work till the age of 60–70 years. According to the long bones epiphyses obliteration and dentition, Kastykhtakh mammoth female is about 40 years old. Hence, the M3/M2 displacement (crowding) was forming during 20 years.

Thus the comparison of the mineral metabolism disturbance evidence from animal and human skeletons of the Glacial period indicate similar adaptive reactions to similar environmental conditions.

It is important to note the long time period of the abnormalities development. Thus described cases let us to assume active forming of the mineral metabolism in large mammal and human populations of the glacial steppe landscapes.

Fig.1. Lingual shift of the last generation lower teeth of the Kastykhakh mammoth

STUDY OF EROSION IN THE QUATERNARY UNITS OF SHIRAZ AREA, MAHARLU BASIN – ZAGROS MOUNTAINS (SW IRAN)

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In the field, we encounter different forms of outcrops and observe these forms which are different in kind of understand rocks. So we discover that the rock erodibility is prominently different in kinds of rocks. The studies of geology, sedimentology and stratigraphy were done in Maharlu basin the weathering and different shapes of that and relation with rock weathering was investigated. The region is mainly composed of sedimentary deposition due to lower Cretaceous to recent. The environmental conditions and natural specification of rocks are effective factors in erodibility of rock units. In this study, the seven factors of B.L.M method were used for estimating erodibility of Quaternary rock units following, soil movements, surface littler, surface rock, pedestalling, rills, flow patterns, gullies, were the main factors for estimate the sensitivities of Quaternary geological units to weathering. The acquired data were put together and the units in basin, measured in base of acquired results and the sensitivity of each of them to weathering identified. Finally the sensitivity map of different Quaternary geological units of Maharlu Basin to weathering were assigned. The data resulted from laboratory and field tests, stated that Quaternary alluvial fan possess lesser sensitivity and higher resistance and place in rows of slight to weathering.

The young Quaternary deposits possess place in row of moderate to weathering and old Quaternary deposits place in row of critical to weathering.

PRELIMINARY RESULTS FROM AN INVESTIGATION OF PLEISTOCENE DEPOSITS AT HAPPISBURGH, NORFOLK, UK – EVIDENCE OF EARLY HOMININ ACTIVITY

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A fluvial channel deposit (part of the Cromer Forest-bed Formation) occurs below the modern beach to the south of Happisburgh, Norfolk, UK. In places the channel is overlain by the Happisburgh Till (the lowest member of the Happisburgh Formation). This locality has been called Happisburgh 1.

The discovery of a handax in the channel deposits in 2000 prompted a British Museum (BM) team to undertake a small excavation in 2004. The BM excavation recovered a small worked flint assemblage. Analysis of sediment samples suggested cooler conditions at the time of deposition than today. Cut marks on bone indicated butchery had taken place and the presence of *Arvicola* pointed to an age of between 500 to 600,000 years old.

In 2009 a team from Leiden University, The Netherlands dug at the Happisburgh 1 site in collaboration with British members of the Ancient Human Occupation of Britain project. The aim was to expand what was known about the geography of the channel deposits and the stratigraphy at the site, recover more artefacts, and undertake a palaeoenvironmental investigation (with a palaeobotanical bias). Preliminary results from the excavation and laboratory analyses are presented.

The Happisburgh Till / channel contact is probably an unconformity and is positioned just above sea-level. Directly below this contact a laterally discontinuous dark brown silt horizon exists which in places contains many wood fragments. Underlying the dark brown silt and till is a grey sand and silt horizon. In the upper part of the grey sand and silt sequences of fining upwards sediments are present. These may indicate deposition during flood events. After deposition these sediments were distorted possibly by the overlying ice. Approximately 1.3 m below sea-level yellow / orange course sand with clasts occurs and this may represent the bottom of the channel.

Despite an intensive sieving operation few vertebrate remains were recovered. However, the sediments yielded plant macrofossils and microfossils (pollen and spores). Initial results show that the grey sand and silts were deposited under brackish conditions because taxa such as *Salicornia* and Chenopodiaceae are well represented as well as Foraminifera. Palynological data show a coniferous forest consisting of *Pinus*, *Picea* and some *Abies*. *Carpinus* is recorded and traces of other thermophilous tree taxa are also present (*Quercus*, *Ulmus*, *Corylus*). Exotic taxa represented include *Azolla filiculoides* and the extinct ancestor of the Kiwi fruit *Actinidia faveolata*. The palynological assemblage from the dark brown silt with wood fragments also shows that a *Pinus* and *Picea* coniferous forest prevailed at the time of deposition. However, the plant macrofossil assemblages from this horizon indicate deposition under freshwater conditions with aquatics such as *Callitriche*, *Lemna*, and *Stratiotes aloides* represented. The top part of the grey sand and silt horizon yielded a relatively large number of unprepared core technology artefacts (thin flakes and multi-platform cores). Based on the refitting of some of the very well preserved flakes it is probable that the assemblage is in primary context.

The preliminary results suggest hominin activity at the margins of an estuary probably towards the end of an interglacial stage. The BM excavation concluded that deposition took place at the end of the Cromerian Complex, but the *Actinidia faveolata* find makes an age determination difficult because this taxon has only previously been recorded from Early Pleistocene deposits in the SE Netherlands.

Work on the Happisburgh 1 site is on going and another field season is planned in the summer of 2010.

NEOPLEISTOCENE MOLLUSCS FROM SINYI YAR LOCALITY (SEVERSKII DONETS RIVER, ROSTOV REGION, RUSSIA)

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The Sinyi Yar section is situated at the right bank of Severskii Donets River in 3 km downstream from the Ust'-Bystryanskaya village (Rostov Region, Russia). The section was mentioned by Popov (1947). Later Vasiliev (1969) discussed the stratigraphy of the Donets-Kundrychia sands. In recent years, the section was studied by A. Dodonov and his colleagues in 2003, and most recently by the field team headed by A. Tesakov in 2009. During these visits, the section was sampled for fossil mollusks, small mammals, and palynology.

The abrupt right-side turn of the river provides freshly eroded bank outcrops that expose about eight meters of deposits. At the base, there is a bed of dark gray, sometimes bluish clays of river origin (2.2 m, **bed 1**). Above, fine to medium grained light alluvial sands are exposed (1.5 m, **bed 2**). The overlying **bed 3** ((0.1-0.7 m) is represented by a layer of strongly boudinaged grayish clays of fluvial origin. The observed boudinage is interpreted as cryoturbation. Still higher **bed 4** (3 m) is composed of fine and medium grained light sands with reddish and ferruginous streaks. It occasionally contains sandstone pebbles. These sediments are of fluvial and aeolian origin. This bed is overlain by an interlayer of fine-grained, dusty sands with a more intense reddish color (**bed 5**, 0.2 m). The section is capped by sandy reddish modern soil (**bed 6**, 0.7 m).

Clays of the bed 1 yielded a rich material of aquatic and few terrestrial mollusks. This material includes *Bithynia leachi* (Sheppard, 1823), *Valvata pulchella* Studer, 1820, *Planorbis planorbis* (Linnaeus, 1758), *Planorbarius corneus* (Linnaeus, 1758), *Lymnaea (Galba) corvus* (Gmelin, 1778), *Lymnaea (Radix) peregra* (Müller, 1774), *Lymnaea* cf *stagnalis* (Linnaeus, 1758) juv., *Lymnaea (Galba) occulta* (Jackiewicz, 1959), *Lymnaea (Galba) turricula* (Held, 1836), *Anisus (Bathyomphalus) contortus* (Linnaeus, 1758), *Anisus (Anisus) spirorbis* (Linnaeus, 1758), *Anisus (Costorbis) strauchianus* (Clessin, 1886), *Gyraulus* sp., *Armiger crista* (Linnaeus, 1758), *Acroloxus lacustris* (Linnaeus, 1758), *Vallonia pulchella* (Müller, 1774), and *Succinea* sp.

The molluskan association, rich in stagnophilous species, permits reconstruction of sedimentary environment of a slow flowing river channel of a horseshoe type with muddy bottom, rich vegetation, and, possibly, periodic floods. Most species present in the fauna can stand drying common for variable conditions of abandoned channels and river meanders. This association has a modern appearance that could be typical for a time period with a temperate to warm climatic conditions.

The right bank sandy deposits of the Severskii Donets were variably interpreted either as third terrace of the Riss time (Middle Pleistocene) subsequently reshaped by aeolian processes or as Riss-Würm (Late Pleisocene) sediments (Vasiliev, 1969).

Based on the malacological evidence and the structure of the section with cryogenic features, the Late Pleistocene, and possibly Mikulian/Eemian age are tentatively suggested for the basal fossiliferous clays. The overlying sandy part then represents deposits of the Valdai/Weichselian time. This age model needs a further verification.

THE LATE PLEISTOCENE ENVIRONMENTAL CHANGES FROM THE NORTHERN UKRAINE TO THE SOUTHERN CRIMEA AS EVIDENCED BY POLLEN

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The Late Quaternary environmental changes have been detected on the base of pollen data from the sections located along the longitudinal transect in Ukraine. In northern Ukraine, Muzychi and Litvinovka sites are situated in the modern mixed forest belt. In central Ukraine, the Stari Bezardychi and Vyazivok sites are located in forest-steppe, and the Stari Kaydaky section is farther to the south in steppe zone. The southernmost sections of archaeological sites Kabazi II and V, Buran Kaya III and Rockshelter Skalisty are situated in forest-steppe of the foothills of Crimean Mountains. The Quaternary framework of Ukraine (Veklitch et al, 1993) is used to subdivide the stratigraphic sequences.

The Mikulino (Eemian) pollen succession is detected in **Kaydaky unit**, the first interglacial after the Dnieper glaciation (Rousseau et al., 2001; Gerasimenko, 2001). During the pre-temperate phase of the Last Interglacial, *Picea* and sedges (M1) were replaced by *Pinus*-*Betula* forest (M2) in the area of modern forest and forest-steppe belts. Pollen of *Picea* is detected even in the section of the northern steppe that indicates a spread of cold and wet environment to the south. During the early-temperate phase, Quercetum mixtum forest occupied northern Ukraine. In central Ukraine, Quercetum mixtum formed patches within the forest-steppe belt. The following increase in *Corylus* was parallel with reduction of forest and spread of mesophytic steppe. During the late-temperate phase, *Carpinus* formed the forest belt of northern Ukraine. It had a significant role in woods of the area of modern forest-steppe and steppe belts, as well as in the Crimean Mountains. The climate was less continental than nowadays. During the post-temperate phase, boreal forest (*Picea*, then *Pinus* and *Betula*) grew in the north, forest-steppe (*Betula-Pinus* forest with few *Picea*) occupied the area of modern forest-steppe, and mesophytic steppe existed in place of the modern typical grassland. The Crimean mountain foothills were covered by pine forest with small admixture of broad-leaved trees. Few *Abies* and *Picea* pollen grains (obviously wind-blown) subsequently occurred, demonstrating an extension of natural habitats of these trees in the west during the post-temperate phase of the Last Interglacial. In Crimea, the first Mousterian findings appeared at this time

The **Tyasmyn unit** corresponds to the first Early Glacial stadial. Periglacial forest-steppe existed in the north, whereas the rest of Ukraine was occupied by grassland. The **Pryluky unit** includes the two interstadials and the second stadial of the Early Glacial (Rousseau et al., 2001). During the first interstadial, mixed forest (pine, birch and broad-leaved trees including *Carpinus*) existed in northern Ukraine, and forest-steppe (with woods of the same composition) occupied central Ukraine including the area of modern northern steppe. The vegetation of the second Early Glacial interstadial was similar to that of the first interstadial but included much less broad-leaved trees. The role of *Betula* and *Alnus* strongly increased even in the Crimean mountain foothills. Presently birch does not grow in Crimea. The vegetation of the second Early Glacial stadial indicated much drier climate than during the first stadial (*Artemisia* steppe penetrated in the area of modern forest-steppe). The Mousterian cultures existed during all phases of the Pryluky time.

The **Uday unit** corresponds to the Early Pleniglacial. The area of modern forest and forest-steppe belts was covered by mesophytic steppe and shrub-birch communities. Dry *Artemisia* steppe occupied the area of modern typical grassland. In the Crimean mountain foothills, forest-steppe vegetation which did not include cryophytic elements still existed.

The **Vytachiv unit**, correlated with the Middle Pleniglacial, consisted of three 'warm' interstadials separated by stadials. During the first and second interstadials (47-41 ky BP and 38-36 ky BP), birch-pine forest and forest-steppe (with small admixture of broad-leaved trees and *Picea*) occupied northern and central Ukraine. During the third interstadial (34-30 ky BP), mesophytic steppe (with few *Tilia* in gully woods) occupied the area of modern forest and forest-steppe belts, and dry steppe spread in place of the modern grassland. Forest-steppe with a noticeable role of broad-leaved trees existed only in the Crimean mountain foothills. For the intervals of 36-35 and 28-27 ky BP, 'cool' interstadials characterized by spread of meadow herbs, *Pinus, Alnus* and arboreal *Betula,* were detected. During the Vytachiv stadials, periglacial steppe (with cryophytes) occupied northern and central Ukraine, and xeric *Artemisia* steppe dominated in place of the modern steppe belt. In western Crimea, the first stadial (41-38 ky BP) still had boreal forest-steppe vegetation, but during the stadial between 35 and 31 ky BP, a typical grassland firstly appeared in the mountain foothills. During the Vytachiv time, the Upper Paleolithic people lived in the plain area of Ukraine but in Crimea, they co-existed with the Mousterian population.

The **Bug unit** corresponds to the Early Late Pleniglacial. This time was characterized by a spread of shrub *Betula* and *Alnaster* in northern and central Ukraine. There, during the Early Bug phase, a role of mesophytic herbs was significant, and four short periods of a spread of forest-steppe (*Pinus*, arboreal *Betula, Alnus* and few *Picea*) occurred, marked by formation of incipient soils. The area to the south was occupied by grassland. During the Late Bug phase, the climate became more continental – periglacial grassland occupied northern and central Ukraine, and dry steppe existed in the south. Xerophytic steppe also spread in the Crimean mountain foothills, but cryophytic elements did not appear there. The Upper Paleoliyhic sites are not abundant in the Bug deposits.

The **Dofinivka unit** is the Middle Pleniglacial interstadial with ^{14}C-age between 18 and 15 ky BP. In northern Ukraine, birch forest with small admixture of *Picea* alternated with shrub birch communities and meadows. In central Ukraine, dry steppe vegetation occupied plateau, birch and shrub birch grew in valleys. In the Crimean mountain foothills, mesophytic steppe spread in the east and forest-steppe (with few broad-leaved trees) existed in the west.

The **Prychernomorsk unit** corresponds to the end of the Late Pleniglacial. In northern and central Ukraine, a proportion of both xerophytic and cryophytic elements increased in steppe communities. *Betula* sect. Nanae et Fruticosae dominated over arboreal birch. The area of modern grassland was covered by *Artemisia* steppe. Dry steppe existed in eastern Crimea, and boreal forest-steppe occupied the western foothills of Crimean Mountains. The Upper Paleolithic was replaced by the Final Paleolithic cultures at the end of this unit.

The Late Pleistocene latitudinal vegetational changes in Ukraine demonstrate that during all time units, proportion of arboreal and herbaceous mesophytes, as well as general proportion of arboreal vegetation decreased from north to south in the plain area of Ukraine, but it increased again in the Crimean mountain foothills. Thus, in the plains, climate became more continental to the south but in the mountain foothills (particularly in their western part), the humidity was constantly higher than in the plains. In the Crimean Mountains, a role of broad-leaved trees was higher than in the plains during the interstadials, and cryophytes did not exist during stadials. In the plains, a role of cryophytes became smaller to the south during cold phases, as well as a role of broad-leaved trees became smaller in this direction during warm phases. The last fact was connected with an increase in steppe vegetation, and, thus, it was controlled by a drop in precipitation. Mesophytic *Carpinus* reached the area of modern steppe belt only during late-temperate phase of the Last Interglacial and during the first Early Glacial interstadial. Xeric steppe has already occupied a place of the modern grassland during the second Late Glacial stadial, whereas in the north of Ukraine and in the eastern foothills of the Crimean Mountains, this vegetation type appeared only during the end of the Early Late Pleniglacial. The foothills of Crimean Mountains were permanently wetter and warmer than the plain area of Ukraine, and they provided refugia for arboreal and broad-leaved vegetation, as well as for survival of the Paleolithic population.

COCCOLITHS AND ASSOCIATED NANNOLITHS FROM MAEOTIAN (TAMAN PENINSULA)

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Calcareous nannofossil assemblages from the Maeotian and the Lower Pontian in Taman Peninsula have been studied. During the Maeotian connection with the open ocean basins has been limited and frequently changed. The Maeotian deposits contain brackish and fresh water microfossils. It makes the biostratigraphic dating of these sediments a difficult task. The nannofossil assemblages contain poor and bad-preserved nannofossils with specific calcareous elements of various modifications. In polarized light, these "fusiform" forms have high interference colors and sizes from 13 to 25 microns. Their surface is sometimes granulated, often observed longitudinal ridges or grooves, rimmed edges. Initially, most of these specific forms were attributed to the genus *Perfocalcinella* (?) (Radionova, Golovina, 2008), but it is not inconceivable that some of them belong to the genus *Micrascidites or Triquetrorhabdulus*. In opinion of the majority of researchers, theses calcareous elements are not produced by *Haptophyta* but represent ascidian spicules. The abundant ascidian spicules can be used for the paleoenvironmental reconstructions. They are excellent indicators of sublittoral and littoral zones of sedimentation.

At the same time, the abundant "fusiform" calcareous elements include the horseshoe-shaped nannoliths similar to the "dark" *Amaurolithus* (fig. 1–5) (Golovina, 2009). In our opinion, these nannoliths have resulted from dissolution of "fusiform" elements and cannot be identified as *Amaurolithus*.

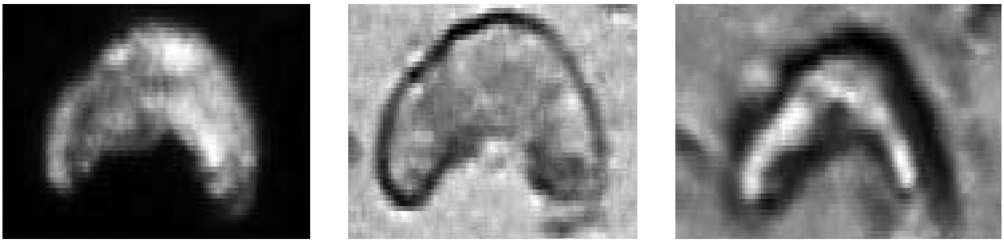

Fig. 1, 2, 3. Horseshoe-shaped nannoliths (samlple 55, Taman section)

Miocene and Pliocene calcareous nannofossils of the Eastern Paratethys are mostly represented the cosmopolitan species. In cases when the zonal taxa occur very rarely or sporadically and are poorly preserved, the correct identification of these finds will always remain uncertain and problematic.

Only the presence of other elements of a zonal complex may be a reliable signal for the correlation in case of scarcity or absence of index species. Raffi et al. (1998) documented likely evolutionary relationships between *Ceratolithus* and the fossil genera *Amaurolithus* and *Triquetrorhabdulus*. They presented evidence that *A. delicatus, A. amplificus,* and *C. acutus* all independently evolved from *Triquetrorhabdulus*. This is why reports of the presence of single specimens of the genera *Ceratolithus*, *Amaurolithus* along with abundant *Triquetrorhabdulus,* and the absence of other taxa of zonal associations may be a signal of possible incorrect determinations.

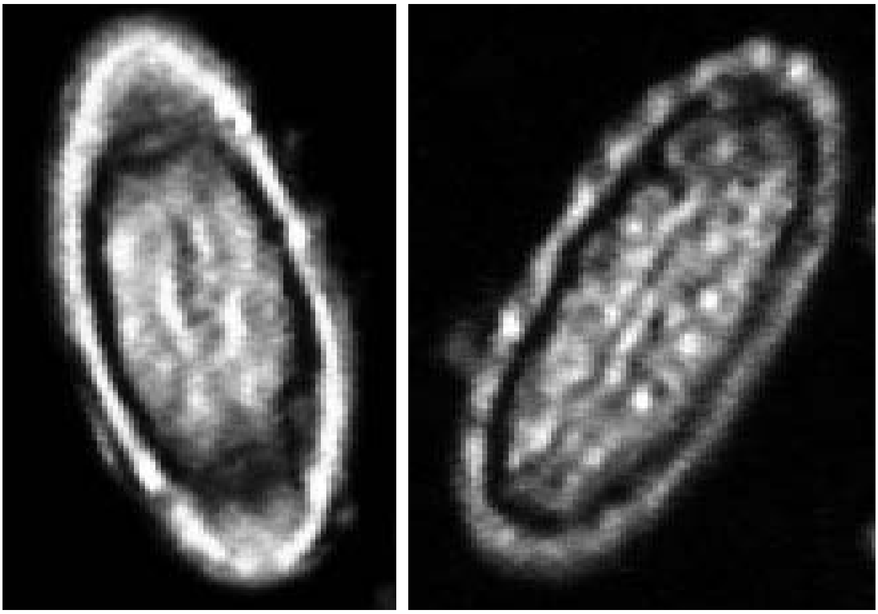

Fig. 4, 5. “Fusiform” nannoliths (genus *Micrascidites* or *Triquetrorhabdulus*) (samlple 55, Taman section)

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THE QUATERNARY STRATIGRAPHY OF IRAN

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The Quaternary deposits cover a half of the Iranian territory. In order of importance they are represented by sediments of alluvial, evaporite, eolian, sandy marine, effusive, landslide debris, and glacial drift types.

The late Walachian minor events and Pasadenian main strong pulsation caused the uplift of mountains and subsidence of river valleys.

The Quaternary alluvial deposits are composed of thick stratified bodies of conglomerate, coarse gravels, boulders, pebbles, sand, silt, and marls. Intervals of different stages were distinct in changes in sedimentation.

The four main dissimilar areas of the Iranian platform show relatively Quaternary deposits. This indicates a uniform action of the modern depositional factors influence in all parts of Iran.

In the central part of Iran, the Quaternary and recent formations are mainly represented by extensive gravel sheets, deposits of salt-water, brackish-water and fresh water lakes (lacustrine deposits, Lut and Kawir deposits, Recent salts), and by aeolian sand. Loess deposits occur in the western foothills of the Alborz and in the western spurs of the Kopet-Dagh.

In the north part of Alborz mountains, Mazandran-Gorgan plain has been formed by marine deposits.

Table 1

Quaternary chronostratigraphy of Iran

Chrono stratigraphy		LITHOSTRATIGRAPHY				Tectono-strati-graphy
		Caspian Region	Piedmont areas			
QUATERNARY	Holocene	Recent Caspian deposits	Holocene alluvium	Holocene stage	Minab alluvium	Pasadenian main Pulsation Vigorous
	Upper	Baku Formation	Tehran alluvial F.	Young alluvial deposits	Sadich alluvium	
			Kahrizak Formation	Old alluvial deposits		
	Lower	Apsheron Formation	Hezardareh Formation	Bakhtyari Conglomerate (Upper half)	Minab Conglomerate (Upper half)	Late Walachian minor events

DEVELOPMENT OF PALEOPEDOGENESIS IN EARLY PLEISTOCENE IN TERRITORY OF THE CISCAUCASIA (TEMIZHBEKSKY SECTION, MIDDLE COURSE OF THE KUBAN RIVER)

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The obtained materials allow revealing stages of the paleopedogenesis development in the Ciscaucasia in the late Pliocene – Pleistocene. Horizons of paleosols are investigated in the context of the Temizhbeksky section, which has thickness of about 48.5 meters. This section is situated on the right bank of the Kuban River (45°26'14"N 40°52'17"E), at the eastern part of the homonymous settlement. The riverside hill cross-sectioned by the river has a local name Sopatyi Kurgan. The section contains 10 horizons of the paleopedogenesis, of which 6 horizons are pedocomplexes (TM-2, TM-4, TM-5, TM-7, TM-8, TM-9), and 4 horizons are represented by individual paleosols (TM-1, TM-3, TM-6, TM-10). The Matuyama / Brunhes boundary is defined in a loess layer, slightly below the TM-3 paleosol. Bones of small mammals *Eolagurus* cf. *luteus* and *Ochotona* sp. were collected in a burrow infillings beneath the TM-2 pedocomplex. This makes it possible to determine the age of the TM-2 pedocomplex in the range of late Middle Pleistocene to the Late Pleistocene. Remains of *Clethrionomys* cf. *kretzoii* (Kowalski), *Mimomys reidi*, and *Mimomys* sp. (large form) were found eight meters above the base of the section, in greenish sandy loams. This record determines the age of the section's base as the earliest Pleistocene (Gelasian) (ca. 2.3-1.8 Ma). Two individual paleosols (TM-1 and TM-3) and one pedocomplex (TM-2) lie above the M/B inversion and belong to Middle and Upper Pleistocene. The TM-1 paleosol correlates with the Bryansk paleosol horizons, and the TM-2 pedocomplex – with the Mezin pedocomplex (Paleoclimates and paleoenvironments... 2009). Five pedocomplexes (TM-4 to TM-9) and two individual paleosols (TM-6, TM-10) lie below the Matuyama/Brunhes boundary and represent seven stages of the pedogenesis in Early Pleistocene (Gelasian-'Calabrian').

The soil-sedimentary record of the section reflects the change of sedimentation environments and paleoclimate during the earliest Pleistocene (Gelasian), the whole of the Early Pleistocene ('Calabrian'), and a part of the Late Pleistocene. At that the climatic trend is superimposed on the directional change of the sedimentation environments. The Temizhbeksky section is to be divided into three intervals. The first interval contains the TM-1, TM-3 paleosols and the TM-2 pedocomplex. This is a loess-paleosol series of the section. The second interval contains the TM-4 to TM-8 pedocomplexes. It is characterized by low rates of the red subaerial-subaqueous sedimentation and available prolonged subaerial breaks. The paleoclimatic conditions changed from warm semihumid or semiarid to warm humid ones in each pedocomplex. The third interval in the base of the section contains the TM-10 paleosol and the TM-9 pedocomplex. These paleosols recorded the carbonate-gley pedogenesis under conditions of high rates of the subaqueous sedimentation in the semiarid climate.

The magnetic susceptibility distribution in the section is characterized by a gradual decrease down to the section. The maximum values of $87x10^{-5}$ SI units are in the upper horizon of the TM-3 profile, the minimum values in the TM-2 profile make up to $17x10^{-5}$ SI units. For the enclosing loesses and loess-like loams the typical values make $27x10^{-5}$ to $32x10^{-5}$.

The TM-4 pedocomplex consists of two paleosols. The upper paleosoil is to be diagnosed as cambisols calcaric, and the lower one, as luvisols (WRB, 2006). The TM-5, TM-7, TM-8 pedocomplexes have a tripartite structure. The TM-8 pedocomplex structure is the most typical. The lower paleosol is to be diagnosed as calcisols and contains the maximum amount of carbonate formations. The middle paleosol is diagnosed as luvisols, and the completely gleyed uppermost paleosol can be diagnosed as gleysols. Each cycle of the pedogenesis is to be divided into three phases. The early phase reflects the most arid conditions. The second, longer phase evidences conditions of semihumid paleolandscapes. The third phase of the paleopedogenesis indicates hydromorphic conditions with periodic excessive flooding of the paleosol.

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QUATERNARY CLIMATIC CHANGES, STRATIGRAPHY, AND SEDIMENTOLOGY OF THE DON RIVER BASIN

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1. The analysis of Pleistocene deposits of the Don River Basin allows the comparison of the sequence of stratigraphical horizons with the marine isotope stages. The oxygen isotope curve of the Pleistocene is divided into two segments. The lower segment includes the section from the basal Pleistocene (1.8 Ma) to the roof of the Jaramillo episode (1.0 Ma) and is formed by complexes of short-term homogeneous and poorly differentiated stages. The lower segment covers the Lower Eopleistocene and the first half of the Upper Eopleistocene. The upper segment consists of long stages, which differ considerably from neighboring stages. It embraces the upper half of the Late Eopleistocene and entire Neopleistocene.

2. The earliest Pleistocene of the Upper Don River has not been recognized. In Russia, it is only known in Western Siberia, where, in the Karagash Formation in the upper half of the Olduvai episode, there is a small mammal fauna of the MN17 Neogene zone. In a later negatively magnetized cryomere, a Quaternary rodent fauna of the MQ18 zone has been recorded (Zykin et al., 2007). A similar structure of the basal Pleistocene was revealed in the Netherlands, England, and Italy. Most of the Lower Pleistocene (Eopleistocene) is characterized by alternating cold and warm periods, which are typical for the Quaternary. In northwestern Europe, these climatoliths are called the Eburonian, Waalian, Menapian, Bavelian, Linge–Dorst, and Interglacial I of the Cromerian. On the Upper Don, similar rhythms are recorded.

3. The earliest cryomere of the Pleistocene of the Don Region corresponds to the negatively magnetized Khokholskii Horizon, the stratotype of which is located in Strelitskii quarry near the city of Voronezh. It contains the Early Odessa Fauna of small mammals with *Allophaiomys pliocaenicus, Prolagurus praepannonicus, Lemmus,* etc. (MQ18 zone) and a mollusk assemblage with elements of a loesses community. The alluvial horizon of the formation is overlain by subaerial formations, which include three horizons of fossil soils, and the Don moraine. the Khokholskii Horizon apparently corresponds to 54–50 stages of the oxygen curve within the Eburonian climatolith.

4. The next climatolith is formed by the Rybnovsky thermomere, which composes the lower part of the Uspenka climatic rhythm and is recorded in a number of outcrops. Its deposits are magnetized negatively and include a Late Odessa fauna of small mammals, with *Allophaiomys pliocaenicus, Prolagurus praepannonicus*, and a thermophilic mollusk assemblage. In the Tancirei outcrop, a positive episode (Kobb Mountain) is recorded. The Rybnovsky thermomere, probably corresponds to the Waalian of Western Europe and is correlated with episodes 49–37 of MIS.

5. The Novovoronezh cryomere overlies the Rybnovsky thermomere and forms the upper half of the Uspenka climatic rhythm. It is recognized in many

sections, magnetized negatively, and contains the earliest Tamanian Fauna of small mammals, including *Allophaiomys pliocaenicus, Prolagurus praepannonicus, P. pannonicus* (Nogaiskii assemblage MQ19). Palynological spectra and fossil seeds indicate a dry and cold climate. In the Korotoyak outcrop, in a continuous section, the boundary between the Lower and Upper Eopleistocene (MQ18 and MQ19 zones) is recognized. This section is used as “the point of the global stratotype of the boundary” between the Lower and Upper Eopleistocene. The Novovoronezh cryomere corresponds to the Menapian of Western Europe and stage 36 of MIS.

6. The Ostrogozhsk thermomere is described from a section at the village of Korotoyak. The horizon lines the valley of erosion in the Uspenka Formation. The Ostrogozhsk beds are magnetized positively (Jaramillo episode) and include *Allophaiomys pliocaenicus*, *Prolagurus pannonicus,* etc. (Kairy Assemblage MQ19) and a forest–steppe mollusk fauna, which includes extinct species and Levantian elements. The Ostrogozhsk Horizon is correlated with the Bavelian of Western Europe. Beds of Korotoyak-3c are the only point in Eastern Europe that precisely corresponds to the Jaramillo episode, as A.K. Markova indicated.

7. The Port-Katon cryomere is revealed in the Korotoyak outcrop overlying the Ostrogozhsk proluvium. It is represented by a negatively magnetized loess with cold-resistant mollusks. This cryomere forms the upper part of the Krivoborskii complex of the Oka–Don Plain (so-called Ranovskaya strata). It contains periglacial plants (borehole 881 at the village of Dashino, borehole 226 at the village of Aleksandrovskie Vyselki, etc.). According to P.I. Dorofeev, these floras come from the terminal “Pliocene.” These strata apparently correlate with loesses of the Korotoyak-4 section. In a section at the village of Moiseevo, a unit of positively magnetized alluvium with small mammals of the Morozovo subassemblage of MQ19 is recognized, which has yielded *Allophaiomys pliocaenicus, Prolagurus pannonicus, Terricola hintoni*, etc. This unit possibly corresponds to the Kamikatsura paleomagnetic episode. The sections including periglacial biotic elements correspond to the upper Bavelian of Western Europe, i.e., the Linge–Dorst glaciations.

8. All horizons of the Neopleistocene (Middle–Upper Pleistocene), as the Petropavlovka thermomere underlying it, clearly correspond to marine isotope stages, as complete global records of the climate on continents. The glacial cryomeres recorded in the central part of the Russian Plain correspond to isotope stages 18.1, 16, 12, 6, 2 (Setun’, Don, Oka, Dneprovian–Moscovian, Valdai moraine). The deposit structure and Neopleistocene stratigraphy of the Upper Don have been described by Yu.I. Iosifova et al. (2006). It is shown that the development of Tiraspol faunas of small mammals of the first half of the Middle Pleistocene is divided into two large stages. The first is characterized by communities with the vole *Mimomys pusillus*, which are connected with the Petropavlovka–Veretie horizons. The second (later) stage is characterized by the prevalence of *Mimomys intermedius*. Communities of this type are characteristic of the Moiseevo and Muchkap horizons. The small mammal fauna from the Muchkap Horizon is identical to the fauna from the Cromerian stratotype (Forest Beds of England), which are correlated with MIS15. Consequently, the Don moraine underlying beds with the Muchkap Fauna should be assigned to stage 16 of MIS. The Ilinka Superhorizon corresponds to MIS17–18.2. Cold stage 18.3 corresponds to the

Pokrovka Horizon, and warm stage 19 of MIS corresponds to the Petropavlovka Horizon. Palynological diagrams of the Muchkap Horizon (Demshinsk, Odintsovo, Roslavl sections), with the Glazovskii and Konakhovskii optima, are very similar to that of stage 15 of MIS. The overlying cryomere up to 3 m thick contains pollen of birch and pine and lacks completely broad-leaved taxa. It probably corresponds to MIS14 (see *table*).

9. A stratigraphically important event is the replacement of faunas with *Mimomys intermedius* by faunas with *Arvicola*. According to our data, this occurred in the Russian Plain in the pre-Oka Time, that is, the terminal Cromerian MIS 13. This is supported by the data on the Mastyuzhenka section, in which the beds with the earliest *Arvicola mosbachensis* are overlain by lacustrine deposits with well-pronounced cryoturbations. These strata are overlain by typical complex 3-m-thick soil of the Likhvin Interglacial.

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SOME RESULTS ON EARLY PALEOLITHIC SITES AND PALEONTOLOGICAL LOCATLITIES IN THE NORTH-EASTERN SEA OF AZOV REGION

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Lately a series of traces of an ancient people being in Georgia, Daghestan and on Taman Peninsula has been found (Amirkhanov, 2007; Derevianko, 2007; Schelinskiy, Kulakov, 2007; Nioradze, 2008). Artifacts from these regions point to the “eastern” way of ancient people migration to the territory of Russian Plain from the African continent. In this accordance, the Sea of Azov and Lower Don regions have a particular historical importance. This area acted as a transit territory during the settlement process of the southern Eastern Europe.

Traces of cultural activity of an early Paleolithic people in the North-Eastern Sea of Azov Region have been known for a long time. In last century some Achelian artifacts were found beyond the stratigraphic context (“handaxes” from Amvrosievka, Makeevka, Beglitsa and Semikarakory, Acheulian-like fragments from Bessergenovka near Taganrog) (Praslov, 2001). Sites with clearer stratigraphic situation were revealed also. These are Gerasimovka (~0.7–0.5 Ma), Khryashchi and Mihailovskoye (~0.5–0.3 Ma) (Matiukhin, 2005). Although their geological age is still under discussion. The results of the latest discoveries have raised a question about the review of the lower chronological border of fossil people migration on this territory, making it older. All known in the last century archeological Acheulian samples were dated by specialists not older than Taman chronological horizon (late Early Pleistocene).

In that case early Lower Pleistocene Khapry alluvial deposits are interesting. On the base of representative paleontological material from Khapry layers widespreading in the Sea of Azov and Lower Don regions Middle Villafranchian Khapry Faunistic Complex was marked out by V.I. Gromov (1948). Recently the Khapry artifact was put into the scientific use (Sablin, Girya, 2009). It is a fragment of hind metapodium of ancient camel *Paracamelus alutensis* with traces of ancient people processing which was collected by N.K. Verestchagin in 1954 in Liventsovka sand pit. In this context the importance of Gromov`s “eolith-like” flint finds of 1934 from gravel-sands pits with Khapry fauna near Matveev Kurgan should be seen in a new way. According to archeologist P.P. Ephimenko opinion 85 % of these flints were handmade (Khohlovkina, 1940).

Unfortunately, the most part of sand pits and outcrops uncovering Khapry deposits are lacking nowadays. In 2008-2010 researchers of the archeological and paleontological laboratory of the Historic department of Taganrog state pedagogical institute made the monitoring of several sites and locations. Sand-pits in Matveev Kurgan region near villages Alexandrovka, Alekseevka, Kulbakovo, Nadezhda were also examined. In the latter point in a sand-pit thickness and at its bottom Acheulian-like chalk flint possibiliths were gathered. Few of them are flakes and few ones are looks like handax-like tools. Two of them were found in situ in the wall of the sand pit. According to opinion of the archeologists who have examined finds – specialists on early Paleolith N.I. Romazhenko and V.Y. Schelinsky (pers. com., 2009) some of these fids have traces of artificial processing.

It is possible to expect the discovery of new archaeological and paleontological finds in the nearest perspective in the North-Eastern Sea of Azov Region which confirm the point of view about Middle Villafranchian age of occurrence of the fossil people in the south of Russian Plain.

THE ZIDINI (CROMERIAN) COMPLEX LAKE SEDIMENT SEQUENCE, SOUTH-EASTERN LATVIA

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Up to 60 m long sequence of lake sediments, covered by three different till layers has been found in the buried valley at the Zidini site, which according the earlier investigations are most complete the lower Middle Pleistocene sequence to have been found in Latvia at present. These Pleistocene sediments have been investigated by a number of scientists during the last decades of the 20th century. Although, different opinion of their stratigraphical position still exists, because of the complicated structure of sediments and location in the buried valley. The age of lake sediments and covering deposits is ranging from the Late Neogene up to the Upper Pleistocene. All drilled boreholes at Zidini site contained interglacial deposits (gyttja, silt) which were analyzed for microfossils and geochemistry. The part of these results is still unpublished and not accessible to the international scientific public. The aim of presentation is to review materials of earlier studies, add new data and draw conclusions of stratigraphical position of lake sediment sequence at the Zidini site.

The pollen diagrams from Zidini area illustrate a typical temperate stage cycle of vegetation change. The climate oscillated between cold and warm temperature conditions several times without evidence characterizing glacial conditions. However intervals containing pollen of periglacial flora suggest forest retreat from the surrounding areas.

The climatic optima are characterized by a high content of thermophytes. The first climatic optimum is characterized by considerable amount of *Ulmus*, *Tilia* and *Quercus*. The pollen spectra obtained from the gyttja accumulated directly before the second climatic optimum provides evidence of spruce forest distribution with presence of *Picea* sect. *Omorica*, *Pinus* sect. *Strobus* and *Abies*. This evidence is also confirmed by finds of *Picea* sect. *Picea* and *Picea* sect. *Omorica* plant macroremains, mainly needles. The start of the second climatic optimum is marked by oak forest expansion.

Pollen spectra from the third climatic optimum indicate that temperatures were not such high as in previous two. The curves of *Picea*, *Alnus* and *Corylus* pollen rise again, together with that of *Quercetum mixtum* providing evidence that the climate had become warmer.

Studies of diatom flora by Chursevitch in 1984 from Zidini sediment complex show the presence of extinct Pliocene diatom species e.g. *Cyclostephanos costatus*, *Stephanodiscus tennis* f. *minor*, *S. niagarae* var. *magnifica* f. *minor* as dominant taxa, and *Cyclotella comta* var. *pliocaenica* as accompanying species, none of which have so far been found in the Holsteinian or the Eemian freshwater diatom flora.

The lower intervals of Zidini sediment sequence include considerable number of redeposited the Mesozoic and Devonian sporomorphs – e.g. *Podocarpus*, *Cedrus*, *Gleichenia*, Schizaea, Cyathea, Hymenozonotriletes, Leiotriletes and Retusotriletes.

The records of palinological, plant macroremain and diatom data show comparatively good correlation with the Turgeliai Interglacial (in Lithuania) which have been correlated with Cromerian in England and with the Belovezhue Interglacial of the East European Plain, as well with Augustovian in Poland.

EVIDENCE FROM DENTAL ANTHROPOLOGY TO THE HISTORY OF EURASIAN POPULATIONS

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This study shoots out from two inspiring sources: progress in genetic reconstructions of our species history and experience in accumulating and analysis rich dental data on living and fossil human populations. The new approach is in combining both advantages to provide new knowledge on Eurasian ancestry. Principles of anthropophenetics determine the basic approach to the research and allow using methods of populational genetics. Yielding to genes in marking precision, phenes win in extent of genome covering. Dental traits provide the best possibility to examine directly time records in populations.

The universal system of analysis, visualization and mapping of dental data *Eurasia* has been developed. It provides the following potentialities: basic data operations; a multi-dimensional analysis of datasets using PCA; plotting populations in the space of principal components; computing Mahalanobis distances and clusterization data based on them; plotting dendrograms; mapping dental markers and principal components; plotting phenetic and morphological profiles as well as epochal variability curves.

All dental data on Eurasian populations available have been input to DB (803 populations, 25 dental traits, no less than 120 dental phenes, and 12 historical periods from Paleolithic to the present).

The longitudinal variability of phene pool in Eurasian populations seems to be the most important regularity revealed by mapping and PCA (fig. 1). Several scenarios of different time series could determine this pattern. One of the most ancient events could be a west spread of a perspective eastern group bearing a combination of the first lower molar gracilization and eastern traits. Subsequent migrants' developing postglacial continental territories determined a peculiar latitudinal variability. This combination is traced since Paleolithic forbearers up to a vast number of living European populations. It suggests the time-space continuity and provides favor evidence to monocentric human ancestry model. Diminishing eastern traits frequencies at different grades in different groups of west continental populations is a discovered phenomenon. Evolutionary factors, including genetic drift, selection and gene flows, may have altered the patterns of phenetic frequency and distribution in existing populations. We are not our ancestors, but there is strong dental evidence for continuity between prehistoric and modern Eurasians.

Several later events stipulating for longitudinal trend in Eurasian phene pool variability were migration flows as a consequence of the Neolithic populational explosion in ancient civilizations centres, first of all in the Near East center.

Some contribution to forming longitudinal variability was made by the latest migrations of different groups along the steppe belt of the continent. These flows resulted dramatically dental pool in Asian groups but evoked only oscillatory migratory waves in the European population settled along the steppe corridor comprising a complicated system in populational interaction.

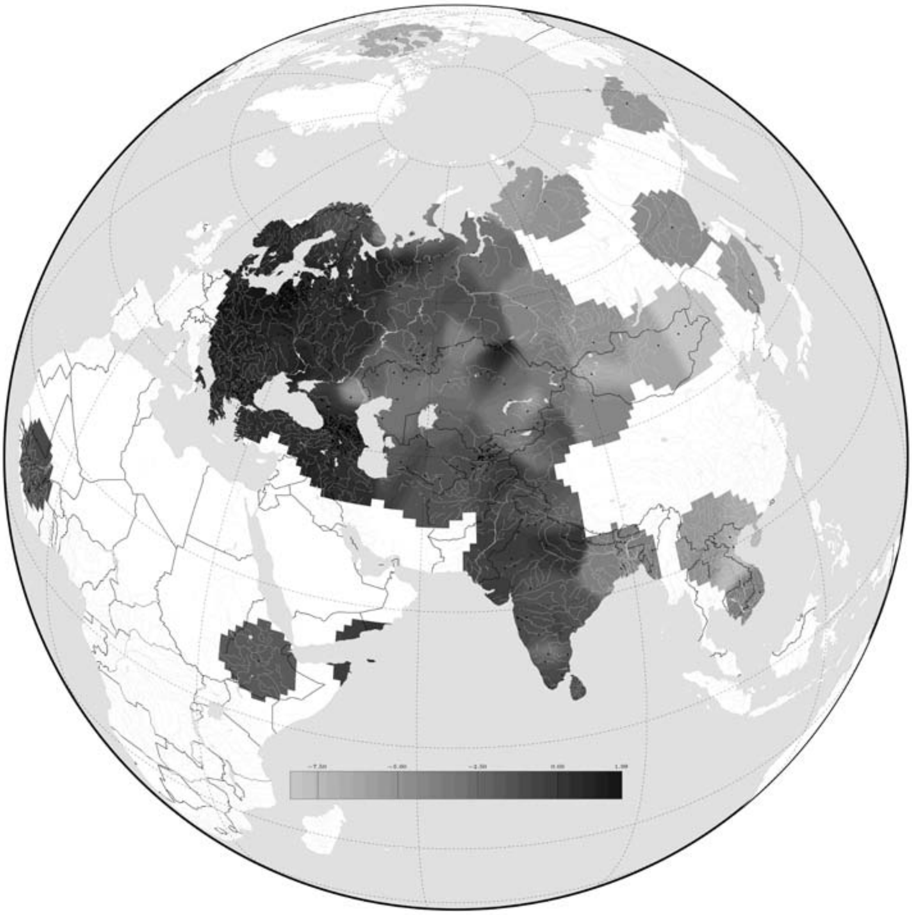

Fig. 1. The 1st principal component meanings in living Eurasian populations map

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LAND SUBSIDENCE PROBLEM IN THE QUATERNARY STRATA OF TEHRAN REGION-IRAN

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The Quaternary deposits cover half of the Iranian territory and in order to importance consist of alluvial, evaporate, eolian, beach sand, effusive, landslide-debris, and glacial drift sediments. The late Walachian minor events and Pasadenian strong main pulsation caused uplifting of mountains and subsidence of river valleys. The Quaternary alluvial deposits are composed of thick stratified deposits formed by conglomerate, coarse gravels, boulders, pebbles, sand, silt, and marls. Intervals of different stages have been distinct by changing in sedimentation. Subsidence is a global problem and particularly in the Tehran, in town of Shahrair, with approximate area of 450 square kilometers. Monitoring and measurements in southern regions of the western Tehran province, especially in the region "Sahryar", showed the land subsidence with the rate of 1.8 meter in the last 20 years. Investigations show that the land subsidence is caused by human activities, mainly from the use of deep underground, with the occurrence, use, and overuse of groundwater.

THE QUATERNARY STRATIGRAPHY AND SEDIMENTOLOGY OF TEHRAN, IRAN

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Tehran is located on relatively recent alluvial deposits extending toward the south from the foothills of Alborz Mountains range. These deposits are the result of river activity and seasonal inundations. The Greater Tehran Area, the capital of Iran is located at the foot slope area of the Alborz range which form a part of the Alps-Himalayan Orogenic belt with high earthquake potential. Urban development has been rapidly progressing in Tehran. The Quaternary deposits have been covered half past of Iranian territory and in order to important consist of alluvial, evaporate, eolian, beach sand, effusive activities, landslide-debris and glacial drift deposits. The late Walachian minor events and Pasadenian main strong pulsation caused uplifting of mountains and subsidence of valleys. The Quaternary sediments of Tehran region were studied during the recent 15 years. On the basis of the stratigraphical and sedimentological development of the Quaternary deposits, that is comprised of four groups: Hezardareh Formation, Kahrizak Formation, Tehran alluvial Formation and Holocene alluvium (Recent alluvium).

The Quaternary alluvial deposits are composed of thick stratified deposits formed by conglomerate, coarse gravels, boulders, pebbles, sand, silt and marls. Intervals of different stages have been distinct by changing in sedimentation.

NEW DATA ON WOOLLY RHINOCEROS (*COELODONTA ANTIQUITATIS* Blum) HORNS

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1) Study of the woolly rhinoceros horn has a long history. The first scientific description was made by the outstanding scientist P. Pallas (1769). The work of his followers discovered the structure of keratin formation, interpreted in the form of nasal horns, its function and growth, the difference in the formation of the anterior and posterior horns, found the origin of cross-banding, unlike the modern rhinoceros horns, as well as similarities and differences with other derivatives of the skin (Eichwald, 1835; Brandt, 1849; Schrenck, 1880; Garutt V. et al, 1970; Fortelius, 1983; Garutt N., 1995, 1998, 2001; Chernova et al, 1998).

2) The number of woolly rhinoceros horns in public and private collections in the world amounts to several tens; the most representative of them is the collection of the Ice Age Museum, Moscow. The study of samples from this collection allowed us to obtain new information on the structure of the horn. The main objects of study were nasal horns nos. F-23 and F-2528.

3) The macrostructure of the *Coelodonta* horn. The horn has an uneven foot "surface" reflecting the curvature of nasal bones of the skull. Accordingly, the place breaking the horns of the natural boundaries of bands also have a curved surface, which has a convex relief on the distal part of the horns (formed early in ontogeny), and concave – on the proximal portion (formed later). Revealed the heterogeneity of the horns of density: the denser the middle part of the sagittal focus. Because of the destruction of the less dense layers of lateral filaments it is visible in the posterior *Coelodonta* horn no. F-2528, where its thickness is about 2 cm (fig. 1-A).

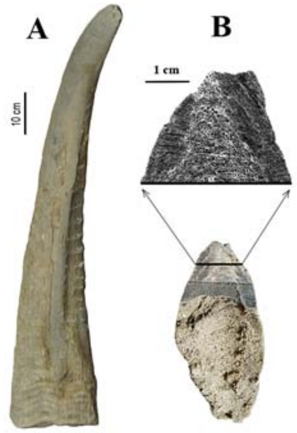

Fig. 1. Woolly rhinoceros nasal horns from the Ice Age Museum. A. Specimen no. F-2528, rear view. B. Specimen no. F-23, bottom view, the enlarged inset is visible to the heterogeneity of the structure of filaments in the center and the periphery of the cross section of the horn

4) The microstructure of the *Coelodonta* horn no. F-23 was studied using a scanning electron microscope JSM 840A (Japan). Diameters of filaments considerably vary in cross (horizontal) section. They are smaller (200–300 mk) in the peripheral part, and larger (500–600 mk), in the central zone (fig. 1-B). The shape of filaments varies from cylindrical to slightly flattened, rounded rectangular-pentagonal. The distance between filaments in the middle and on the periphery part of the horn is about of 100–200 mk but the smaller filaments are spaced closer.

Filaments are oriented along the long axis of the horns, with slightly convoluted and intertwined form, and their thickness is minimal on the periphery of the horns and a maximum in its central region. Matrix septa separating the filaments have a lamellar structure and thicker in the central part of the horn as compared with the periphery.

5) Revealed features in the structure of the Woolly Rhinoceros horns at the macro and micro levels, as previously known, provide strong connecting elements (bands of regular growth, filaments) between them, strength and elasticity of the organ to withstand high mechanical loads, in fact, resulting from adaptation of this animal to specific glacial conditions.

THE USE OF DIGITAL ELEVATION MODEL FOR STUDY OF THE PALEOGEOGRAPHY OF THE AZOV SEA REGION

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Geoinformation technologies become now an integral part of of research in geology and geomorphology. Digital elevation models (DEM) are one of their important components.

Under digital model of relief there is understood a certain form of presentation of initial data and method of their structural description allowing to "calculate" (restore) the object by interpolation, approximation or extrapolation. As a whole, DEM can be presented as a regular grid consisting of cells of given dimension having spatial coordinates (latitude, longitude, height).

In this work we will examine in detail the data of Shuttle Radar Topographic Mission (SRTM) and their application for purposes of geomorphologic analysis on the example of the South-East shore of the Taganrog Bay.

In the course of solving put forward task, on the base of SRTM we have created a digital model of relief for coastal zone of the Taganrog bay and adjacent territory (fig. 1). When analyzing DEM at South-East shore of the Taganrog bay, there were revealed ellipse-like negative topographic forms. Their maximal concentration is observed at the Yeya peninsula. At advancement to the North-East, their density decreases, so as area of distribution. The most large of these forms of relief are marked at the topographic maps of the scale 1:100 000 as "creek valleys" (Kugey creek valley, Chervonnaya creek valley, Krikunov creek valley, etc), and in cases when in them remained closed water basins without exit or marshy areas, estuaries (liman Bolshoi, liman Donchanski, liman Drozdovski, etc.). Besides that, many of distinguished by us at DEM negative topographic forms at the topographic maps of scale 1:100 000 are not shown at all.

The question about origin of present relief forms remains open. There are three hypotheses of an origin of given forms of a relief: suffusion, thermokarst and estuary. The first hypothesis is examined by us as most improbable, because the typical sizes of suffusion depression as a rule are much less than observable here. For a choice of one of the stayed two hypotheses we carried out the comparative analysis of the negative topographic forms revealed at the Yeya peninsula and frost thaw lake basins at the Gyda Peninsula (located in the permafrost zone).

For this purpose the surface element of size 30×30 km was chosen within the bounds of each of studied areas. By the remote sensing data of system Landsat 7 ETM + for Gyda peninsula there were recognized and digitized frost thaw lake basins at the coastal zone of Gydanskaya guba bay. The same operation was done for Yeya Peninsula (digitizing of negative topographic forms on the DEM and satellite image). For each peninsula the areas of researched objects were designed (tab. 1).

From the table it is visible, that frost thaw lakes have smaller absolute sizes and large variability of sizes, rather than negative topographic forms in limits of Yeya Peninsula. Besides in the Azov sea region more elongated forms of depressions of elliptic pattern are observed.

We suppose that the revealed forms of a relief are paleoestuaries, formed in coastal part of the sea since the moment of maximal development of the New-Black

Sea transgression. Later on, the new and new systems of estuaries formed near retreating shoreline of shrinking sea right up to the Meotic phase. With approach of the Nimphean phase the sea level rose again and advanced into the land shoreline "cut off" a part of estuaries (what can be seen between the town of Yeysk and st. Dolzhanskaya).

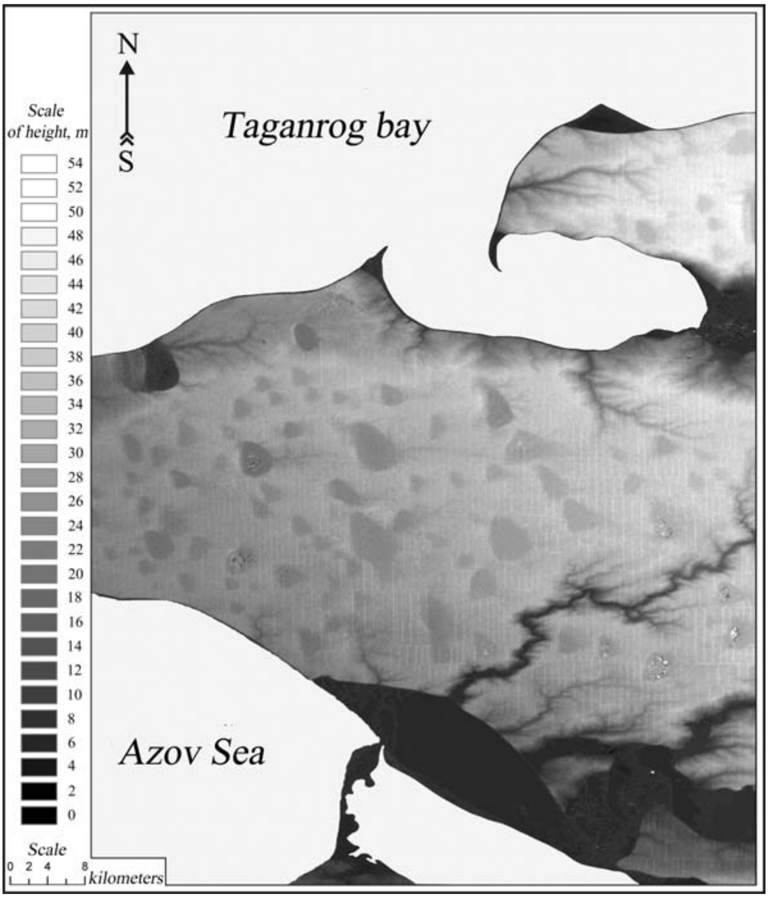

Fig. 1. Fragment of DEM of a coastal zone Taganrog Bay and adjacent territory

Table 1

Results of comparison of the areas frost thaw lake basins of Gyda peninsula and negative forms of a relief of Yeya peninsula (for a platform of 90 km^2)

Area	Max, km^2	Min, km^2	Mean, km^2	SD	CV
Yeya peninsula	15,9	0,4	2,63	3,26	124
Gyda peninsula	3,29	0,01	0,2	0,39	195

As it was mentioned above, the area of the paleolimans spreading by its greater part occupies the Yeya peninsula. This is a single area of the Cis-Azovian, in limits of which on composed by D.G. Panov layout of velocities of the Holocene movements of shores and bottom of the Azov sea there are observed positive velocities (from1 to 0 mm/year).

Besides that, planar position of the Eastern border of the paleoestuary distribution coincides with position of the border of an accumulative plain of the district of newest and Holocene lowerings and stratum-accumulative plain experiencing recent inversion uplift, adduced at the structural-geomorphological layout of Cis-Black sea Region in the work of N.S. Blagovolin and D.A. Lilienberg. Mentioned by them inversion uplift is in good accordance with distinguished by V.I. Makarov with co-authors Yeya uplift, manifesting itself in Quarternary structural plan of described area.

From aforesaid it follows, that suggested explanation of the nature of negative elements of relief, distinguished by analysis of DEM and interpreted by us as paleoestuaries is quite substantiated. In favour of this hypothesis testify substantial linear dimensions (first kilometers), what does not allow to suppose suffusion nature of distinguished objects, and also stability of their shape and orientation in the limits of area of spreading. The adduced example of using modern technologies of acquisition and processing of geomorphologic data obtained in result of remote sensing of the Earth (which are data of SRTM) testifies that use of new technologies allows to reveal earlier unknown natural laws of evolution of the Azov sea and landscapes of Arid zones at the nearest to us intervals of geological history.

BIOSTRATIGRAPHY OF ARVICOLINE ASSEMBLAGES FROM THE ZUURLAND (THE NETHERLANDS) DRILLING PROJECT

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The well-known Zuurland drilling project (Brielle, the Netherlands) produced a uniquely complete stratified record of terrestrial biota during the last 2.5 Ma. The rich information on various groups of organisms gives a unique opportunity to cross-check the results derived from different biostratigraphic approaches elsewhere in middle latitudes of Europe and Northern Asia.

The biostratigraphic framework of the Zuurland sequence is formed by more than ten levels of arvicoline assemblages exposed by multiple parallel boreholes drilled by Mr. Leen Hordijk, Brielle. Some other important results are derived from the analysis of other small mammal groups too. Based on the evolutionary level of arvicolids, five major biostratigraphic units can be recognized in the Zuurland sequence (Units 1 to 5) ranging from the earliest Pleistocene (Gelasian) to the Holocene.

Unit 1 faunas with *Microtus oeconomus*, *Microtus* gr. *arvalis*, and *Arvicola terrestris* occur in the uppermost levels of the sequence (ca. 14-26 m). The advanced evolutionary features of *Arvicola* indicate a latest Pleistocene to Holocene age of Unit 1, and a correlation with the Toringian biochron.

Unit 2 (27–37 m) faunas include a mixed association combining Late Pleistocene and early Middle Pleistocene, and even Early Pleistocene elements: *Arvicola* sp., *Microtus ex*-gr. *arvalis*, *Dicrostonyx* sp., *Lemmus* sp., *Mimomys savini*, *Clethrionomys* cf. *acrorhiza*, *Microtus gregaloides*, *Mimomys* gr. *reidi-pusillus*, *Allophaiomys* sp.

Unit 3 (39–54 m) faunas include *Mimomys savini, Mimomys* ex-gr. *reidi-pusillus, Allophaiomys deucalion, Ungaromys dehmi, Lemmus kowalskii, Clethrionomys kretzoii, Craseomys* aff. *major,* and *Mimomys pliocaenicus.* This faunal composition suggests an Early Pleistocene/early Biharian age. Some forms (*Ungaromys, M. pliocaenicus*) may represent an earliest Pleistocene (Gelasian) taphonomic admixture.

Unit 4 (61–65 m). This richest assemblage of the Zuurland sequence includes *Lemmus kowalskii, Clethrionomys kretzoii, Ungaromys dehmi, Borsodia newtoni, Mimomys pliocaenicus, Mimomys tigliensis, Mimomys pitymyoides, Mimomys hordijki, Mimomys reidi.* The fauna from Unit 4 has an Early Pleistocene (Gelasian) age; a conclusion that is based on the features of several species characteristic of European late Villanyian (MN17) faunas.

Unit 5 (91–101 m) is the lowermost part of the section. The fauna of this unit includes typical Early Pleistocene (Gelasian), Late Villanyian forms such as *Clethrionomys kretzoii, Mimomys tigliensis, Mimomys reidi, Mimomys* cf. *praepliocaenicus.*

The Zuurland sequence is particularly important for the detailed evidence of Late Villanyian arvicoline faunas of the northwestern Europe and their transformation into early Biharian faunas.

ABOUT LOCATION OF POSSIBLE LAST GLACIATION EUROPEAN TREES REFUGIA

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The question about presence or absence trees in the vegetation cover during Last Glaciation has long interested experts in different areas, studying Late Pleistocene. This question is closely linked to the question whether the climate in the peri- and extraglacial areas was so inclement that disappeared all woody vegetation.

Long time most European palynologists' opinion was that vegetation had the character of the tundra, park tundra or steppe-tundra.

A review by K. Willis (2004) of charcoal macrofossils from 40 localities in central and Eastern Europe has revealed evidence for the presence of at least 20 different tree types growing in this landscape during the period of maximum ice-sheet extent. Identified tree types are predominantly needle-leaved, including *Picea, Pinus, Larix, Juniperus*, although broad-leaved types including *Salix, Betula, Fagus, Ulmus, Quercus, Corylus, Sorbus, Carpinus, Rhamnus* and *Populus* have been found at some European localities. She also analyzed data on genetic evidence of extant European tree populations and came to the conclusion that many boreal tree types do not have a genetic distribution pattern that conforms to a model predicting full-glacial isolation in southern European refugia. The evidence presented in your paper fully supports the model interpretations that even during the last full-glacial interval the central and eastern European landscape was partly covered by taiga/mountain woodland, which in some regions also contained isolated pockets of temperate trees. Publications of the European and Russian specialists as early and later (Smirnova et al., 2001, 2004; Turubanova, 2002; Jankovská et al., 2006; Sommer & Nadachowski, 2006; Jankovská & Pokorny, 2008; Binney et al., 2009 and other) confirmed this conclusion.

In the study sections, located in the peri-and extraglacial areas of Central and Eastern Europe, the author came to the same conclusion (Komar et al., 2008, 2009; and other) about the existence of woody groups during the whole Last glaciation interval. In her view, that the Carpathian region is one of the major refugium of trees for the territory of Central Europe. Almost all the territory of Ukraine except the extreme northern parts, western and extreme eastern regions, was a kind of refugium of trees throughout the last glaciation too. Alpine structures (the Carpathians and the Crimea), the Donets Basin and the valleys of major rivers were an excellent "asylums" of woody, even for the broad-leaved and moderately thermophilic taxa.

LATE MAGDALENIAN AND ŚWIDRY CULTURE ARCHEOLOGICAL OBJECTS FROM POLAND IN THE LIGHT OF PALYNOLOGICAL INVESTIGATION

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The research was carried out in the Late Magdalenian site near Wilczyce village in the eastern part of the Sandomierz Upland, and in the Late Palaeolithic site, with the Świdry Culture materials, near Mucharz village in the eastern margin of the Small Beskid Mts, flysch Outer Carpathians (Komar et al. 2008, Valde-Nowak, Łanczont 2008). Both sites are situated in the Vistula River basin (mountain and upland sections), in the immediate vicinity of river valleys, i.e. Opatówka and Skawa River, respectively. They are located on high riverbanks, in exposed places that were good observation points.

The Magdalenian site was TL dated at about 15 ka BP that corresponds well with the results of radiocarbon dating. The characteristic features of periglacial florae are observed in their composition, i.e. coexistence of xerophytes, microtherms, mesophytes, plants of eroded and initial soils. The site was surrounded by a mosaic of different vegetation typical of quite cold climate habitats: wet tundra communities, dry steppe with xerophytes, and patches of coniferous trees. The obtained palynological data, together with these in the literature on the Weichselian full-glacial vegetation of Central Europe, point to the importance of favorable sites as forest refugia, where elements of forest biota survived even the Last Glacial Maximum (Willis et al., 2000; Jankovska et al., 2002; Willis, van Andel, 2004; Jankovska, Pokorny, 2008; and other).

The TL dates obtained for the site with the Świdry Culture materials ranged from 10.3 to 11.02 ka BP (Dryas III). Tundra communities with *Selaginella selaginoides* occurred in park-type landscape but the vegetation succession changed after settlement retreat. Coniferous forests with an admixture of birch, next hazel (macroremnants) and alder developed.

RELICT MAMMAL SPECIES OF THE MIDDLE PLEISTOCENE IN LATE PLEISTOCENE FAUNA OF THE WESTERN SIBERIA SOUTH

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Siberian elasmotherium (*Elasmotherium sibiricum* Fisher von Waldheim, 1808), a horse from stenonid group of the subgenus *Sussemionus* (*Equus* (*Sussemionus*) *ovodovi* Eisenmann, Vasiliev, 2009) and soergelia (*Soergelia* sp.) are the typical species of Early and Middle Pleistocene of the Northern Eurasia (Vangengeim, 1977; Eisenmann, Vasiliev, 2009). However, recently remains of these species are found in the Late Pleistocene fauna complexes in the south of Western Siberia.

Elasmotherium (*Elasmotherium sibiricum*) remains were found in two sites containing the Late Pleistocene fauna complexes. In Smelovskaya cave II (52° 27’ N, 59° 30’ E) its M/3 was found together with bones: *Lepus tanaiticus*, *Marmota bobak*, *Canis lupus*, *Vulpes vulpes*, *V. corsac*, *Ursus arctos*, *Crocuta crocuta*, *Panthera spelaea*, *Mammuthus primigenius*, *Equus* (*Equus*) *ferus*, *Coelodonta antiquitatis*, *Cervus elaphus*, *Bison priscus*, *Saiga tatarica*. By this tooth and tooth of cave hyena C-14 dates >50 000 BP were determined. In the site Batpak (50°30’ N, 72°30’ E) together with elasmotherium remains were found remains of *C. lupus*, *M. primigenius*, *E.* (*E.*) *ferus*, *E. hyndruntinus*, *E. hemionus*, *C. antiquitatis*, *Camelus* sp., *C. elaphus*, *B. priscus*, *S. tatarica*.

Horse remains of the subgenus *Sussemionus* (*E.* (*Sussemionus*) *ovodovi*) related to stenonid horse group were found in many sites of the southeast of the Western Siberia, Altai, Khakassiya (Eisenmann, Vasiliev, 2009). Based on its bones, four C-14 dates ranging from 42 480 ± 1500 BP, CURL-10275 to 49 900 ± 3400 BP, UCIAMS-57009 (Orlando et al., 2009) were obtained. The latest find of this horse bones come from the cave “Kaminnaya” in the Altai Mountains. Here they are found in the layer, for which radiocarbon dates were obtained: 10 870 ± 150 BP, SOAN-3702 and 10 310 ± 330 BP, SOAN-3402 (Vasiliev et al., 2006). Thus, in Altai, this horse survived up to the Pleistocene-Holocene boundary.

Remains of soergelia (*Soergelia* sp.) were found in the alluvial site of Taradanovo (53° 30’ N, 82° 30’ E) together with remains of *L. lepus* sp., *Castor fiber*, *C. lupus*, *V. vulpes*, *U. arctos*, *U. savini*, *Gulo gulo*, *C. crocuta*, *P. spelaea*, *M. primigenius*, *E.* (*E.*) *ferus*, *E.* (*Sussemionus*) *ovodovi*, *C. antiquitatis*, *C. elaphus*, *Megaloceros giganteus*, *Alces alces*, *Rangifer tarandus*, *B. priscus*, *S. tatarica* (Vasiliev, Martynovich, 2007). *Soergelia* bones (30 NISP) have the same degree of fossilization as the rest of bones and have no traces of redeposition. Bones from this site yielded five C-14 dates in the range from 25 715 ± 235 BP, SOAN-5574 to 35 052 575 BP, SOAN-5573, nine dates ⩾ 40 000 BP, and four dates > 42 000 BP (Vasiliev, Orlova, 2006). In this site more than 4200 bones were found, but among of them there are no bones of species characteristic for Early and Middle Pleistocene. This allows us to assign all the fauna to the Late Pleistocene.

The above data show that *Elasmotherium* and *Soergelia* remains were part of the faunas which were composed of characteristic species of the Late Pleistocene. These faunas do not have species what are characteristic ones of Early and

Middle Pleistocene. All this allows to suggest that *Elasmotherium*, *Soergelia* and stenonid lived in the south of the Western Siberia in the first half of the Late Pleistocene.

All three forms are species of the steppe landscape. In the south of Western Siberia steppe landscapes persisted during the Pleistocene (Volkova et al., 2003). Therefore, the cause of preserving this relict species of Middle Pleistocene is the existence of steppe landscapes there. The extinction of these species was due to falling of temperature in the beginning and sharp climate variation at the end of the Late Pleistocene.

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MAMMAL FAUNAS DURING THE LATE PLEISTOCENE AND HOLOCENE IN THE SOUTHERN URALS

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Analysis of changes small and large mammal faunas of the Southern Urals in the end of the Late Pleistocene and Holocene has been done. We used material dated by the C-14 method: 16 local small mammal faunas, 17 local large mammal faunas and 17 individual bones of various species from localities in the northern and southern parts of the Southern Trans-Urals and in the mountainous part of Southern Urals (Smirnov et al 1990; Kuzmina, 2000, Kuzmin et al, 2001, Kuzmin, 2003; Kuzmina, 2009; Danukalova et all, in press). The paper covered the time interval from 35 thousand years ago to 0.2 thousand years ago.

A factor analysis by method of principal components of small mammal faunas was carried out. It was showed that the nature of changes in the fauna in the mountainous part of the Southern Urals differed from those in the Southern Urals. At the same time in the northern and southern parts of the Southern Trans-Urals changes in the fauna occurred in a similar manner. In general, changes in the small mammal fauna during the Late Pleistocene and Holocene were small scale. Several stages were distinguished in history of fauna development.

In the mountainous part of the Southern Urals four stages were described. The first stage (LGM – DR I): *Microtus gregalis* and *Lagurus lagurus* were dominated in the fauna; in the fauna composition included *Dicrostonyx* sp., whose number was rather high in the early stages and decreases significantly at the end. The second phase (BO – PB): *Lagurus lagurus* was dominated, *Microtus gregalis* and *Ochotona pusilla* were numerous species; *Dicrostonyx* sp disappeared from the fauna composition. *Ellobius talpinus* and *Apodemus* appeared in the fauna; number of *Clethrionomys* and *Ochotona pusilla* increased.

The next stage (the third) in AT-1. This stage is characterized by two dominants – *Lagurus lagurus* and *Ochotona pusilla*, and numerous *Clethrionomys*. In the fauna *Cricetus cricetus* appeared. And finally, the last stage (fourth) was in SA-1 – SA-2 when in mountain part of the Southern Urals a forest vegetation was spreading and in the fauna *Clethrionomys* was dominated and the number species open spaces has decreased.

In the Southern Trans-Urals 5 stages were identified. Predominance of steppe and semi-desert species in the fauna was typical for the first stage (LGM): *Lagurus lagurus* was dominated; *Eolagurus luteus* and *Microtus gregalis* were numerous. The second stage (LGT): *Lagurus lagurus* and *Eolagurus luteus* were dominated, *Microtus gregalis* was numerous; *Cricetulus migratorius* and *Microtus oeconomus* appear in the fauna. The third stage (BO): *Microtus gregalis* and *Lagurus lagurus* were dominated in the fauna. Number of meadow and near-water species (*Microtus arvalis, Cricetus cricetus* and *Arvicola terrestris*) were growing and there are forest species (*Sicista* and *Apodemus*).

Fourth stage (SA-1): *Microtus gregalis* was dominated; *Lagurus lagurus* was numerous. Fifth stage (SA-3): as before *M. gregalis* was dominated, and *L. lagurus, Microtus arvalis* were numerous.

In the mountainous part for the end of Late Pleistocene to late Holocene in the fauna dominated by species open landscapes and there is large proportion of forest species. The general direction of changes proceeded in side of increasing forest species proportion. In the Late Holocene composition and structure of small mammal fauna had characteristic of the forest zone. In the Southern Trans-Urals small mammal fauna was consisted of species of an open landscape during the described period. Change in the fauna was proceeding in the side of increasing the proportion of species associated with mesophytic vegetation. The general direction of change in the composition and structure of small mammal fauna in the Southern Urals and Southern Trans-Urals had a direction associated with increasing humidity of climate in the Holocene.

It can be traced only change in the composition of large mammal fauna. In the mountainous part of the Southern Urals and in the Southern Urals changes fauna occurred synchronously and unidirectionally. There were three the most notable changes in large mammal fauna (Kosintsev, Gasilin, 2008). The first change occurred during the transition from MIS-3 to LGM when *Crocuta crocuta, Ursus spelaeus* and *Ovis ammon* were disappearing from the fauna composition. The second change occurred in the transition from LGT to early Holocene. During this period Pleistocene species disappeared (*Panthera spelaea, Mammuthus primigenius, Coelodonta antiquitatis, Bison priscus*) and area of Alopex lagopus fell to the north. *Meles meles, Lutra lutra, Lynx lynx, Sus scrofa, Capreolus pygargus, Bos primigenius* appeared in the fauna. Last change of fauna was at the beginning of the Late Holocene when the *Meles leucurus replaced Meles meles, Mustela putorius* appeared and *Martes foina* and *B. primigenius* disappeared from fauna composition.

In general change of large mammal fauna was more significantly than change of small mammal fauna. Changes in large mammal fauna was result of two processes: of extinction and area change; change in small mammal fauna was result only area changes.

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THE RECONSTRUCTION OF HYDROLOGICAL REGIME AND THE LEVEL OF THE AZOV SEA IN THE QUATERNARY TIME BY USING DIATOM ANALYSIS

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Diatoms, being one of the most informative paleontological objects, are successfully addressed to throughout the researches of biostratigraphy and paleoceanology. Being widely-spread and long-kept fossilized, diatom microorganisms enable to reconstruct global and regional oceanological and climatic events of the past, the replacement of oceanic circulation and sediments' deposition modes, changes in productivity of surface waters.

Stratigraphy of Quaternary Azov deposits is mainly based on the work materials on fossilized shellfish (Nevesskaya, Nevesskiy, 1960; Nevesskaya, 1963; Barg, Yatsenko, 2001), and partially, spore-and-pollen analysis (Vronskiy, 1976; Isagulova, 1978). No data about distribution of diatoms in Late Azov Quaternary deposits (New Azov Layers), besides mentioning about the discoveries of a few mass species, were found. (Vronskiy, 1974).

Consequently, general regularities of diatoms' allocation in New Azov Layers were explored in the following researches (Kovaleva, Polshin, 2006; Kovaleva, 2007, 2008; Matishov at al., 2009). It was discovered, that irrespective of the area of column sampling, two species – *Actinocyclus octonarius* and *Actinoptychus senarius* (fig. 1) represent the mass species in lower layers of sediments.

Actinocyclus octonarius – mesohalobic species, occurring at the shallow waters' plankton of estuaries of mesothermal seas. *Actinoptychus senarius* inhabits sublittoral zones and is sporadically found in plankton. Both species are registered isolated at recent Sea of Azov. Taking into consideration bionomics of these species, they serve as markers of shallow waters. In addition, *Actinocyclus octonarius* is specific for plant-filled basins with low hydrodynamic activity.

Hydrological and climatic conditions, having been changing periodically during Late Azov period (New Azov Layers), reflected in rhythmic alternation of deposits. Silt deposits layers are interrupted by shell detritus layers. Having explored 165 cm the column sampling of bottom sediments with high discrecity (sampling each 1–3 cm), scientists have emitted 6 zones, characterizing change of hydrological regime conditions during last 3110 ± 170 years. It was discovered that specific diatoms are found in specific lithologic deposits. Thus, for instance, mollusk shells are followed by high numbers of *Actinocyclus octonarius*. And, on the contrary, increase of *Chaetoceros* spores has been discovered only in the layers, free of shell detritus interruption.

For zone 1 (separated in terms of diatoms) high content of *Actinocyclus octonarius* shell detritus is typical (fig. 1). The results of the spore-and-pollen analysis evidence, that only this layer contains large number of macrophytes' spores (pondweed, etc.). Thus, sediments have been acumulating in a shallow-water gulf or bay, abundantly overgrown with macrophytes.

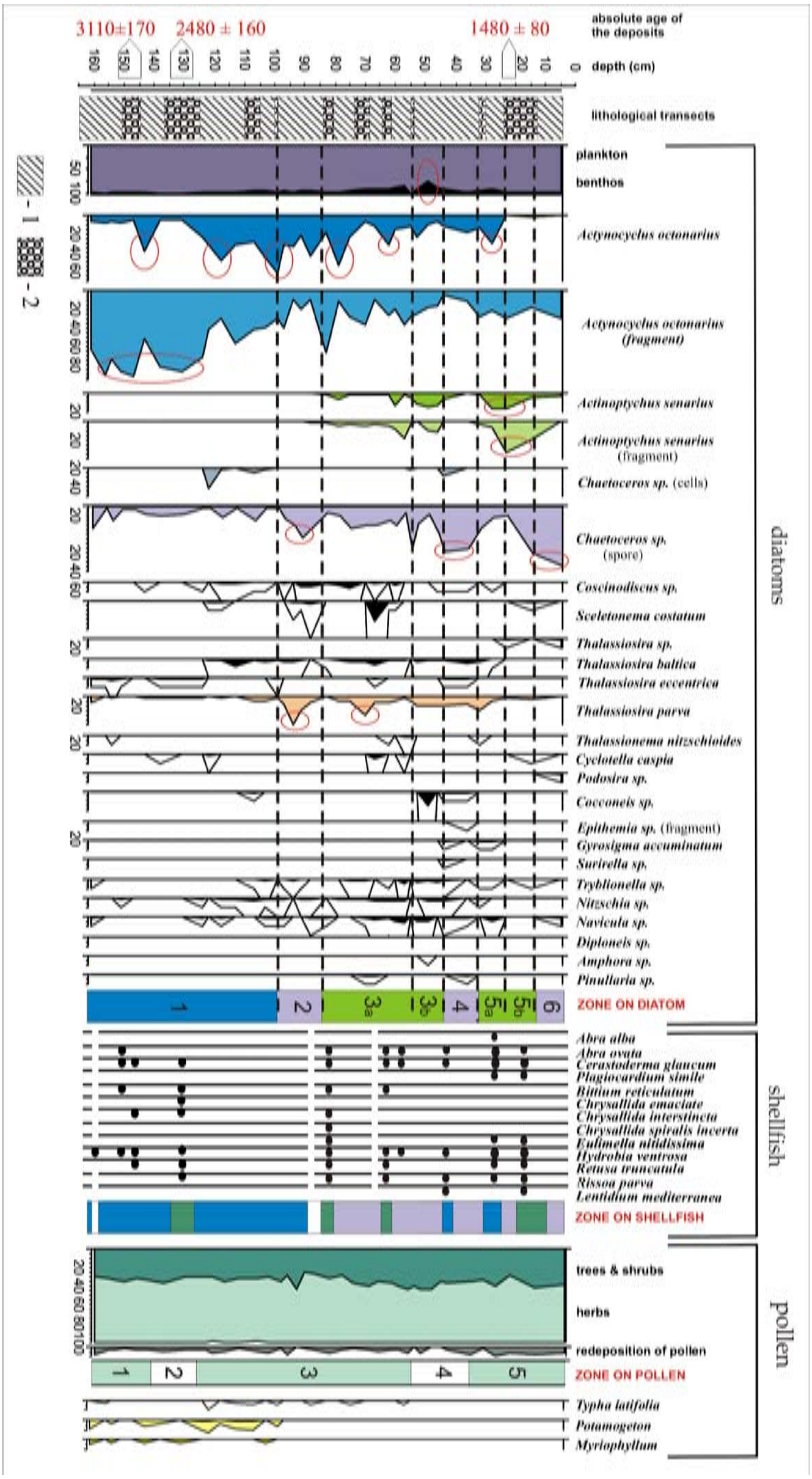

Fig. 1. Diagram of distribution of pollen, diatoms and mollusks in the sediment cores K-86 (South-eastern part of Azov Sea)/
Keys: 1 – argillaceous silt, 2 – silt shell detritus

Zone 2 presents large numbers of *Thalassiosira parva* and *Chaetoceros* spores. It should be noted that changes of cells and spores numbers of *Chaetoceros* genus in diatoms aggregations – serve as reliable indicator of waters' mixing in the zone, where hydrological fronts combine and the sea level increases (Sancetta, 1981, 1982; Makarova, Semina, 1982; Makarova, 1987; Koç Karpuz, Schrader, 1990; Stabell, Koc, 1996; Crosta et al., 1997; Polyakova, 1997; Booth et al., 2002). Thus, during the time, layers, corresponding with the zone 2, have been cumulating – the sea level increased, which evidences large contents of plankton frustules of *Thalassiosira parva* and *Chaetoceros* spores. Probably, salinity of the basin has also increased at that time period.

Zones 3 and 5 are marked out due to occurrence of *Actinoptychus senarius* in the deposits. These zones have smaller subdivisions (3_a, 3_b, 5_a, 5_b), as since diatoms distribution scheme authenticates that ecological conditions have differed at lower and upper parts of the zones. Thus, the increase of benthic diatoms' numbers is typical for the zone 3_b (fig. 1).

In the lower part of the zone 5 the dominant species (*Actinoptychus senarius* and *Actinocyclus octonarius)* occur together (fig. 1, zone 5_a), and in the upper part of the same zone – the second specie has vanished (fig. 1, zone 5_b). For the zones 4 and 6 (as for the zone 2) the increase of *Chaetoceros* spores content is typical, which specifies the change in the hydrological regime of the basin towards the sea level increase and reinforcement of its hydrodynamics.

Therefore, high sampling frequency (1-3 cm) and exploitation of marker diatoms allowed reconstruction of the changes of hydrological regime during Late Azov period. Diatoms distribution zones do not coincide with the same, marked out by pollen (fig. 1), as long as the latter reflecting changes, having occurred at the seashore.

Consequently, during the study on diatoms of New Azov Layers 6 zones are separated, specifying the changes of hydrological regime of the basin during last 3110±170 years. It is revealed, that the diatom zones, correlate with lithologic content of the deposits, malacology and spore-and-pollen analysis.

MORPHOGENESIS OF *ALLOPHAIOMYS* TEETH – THE BASIS OF EUROPEAN EARLY PLEISTOCENE BIOSTRATIGRAPHY

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Morphogenesis of *Allophaiomys* teeth showed up in the change of morphostructure of molars occlusal surface. These changes in relative indexes (coefficients) are presented in table 1.

We are set the following.

1. The Plio-Pleistocene biostratigraphic boundary on small mammals (appearance of *Allophaiomys*) is fixed higher of Olduvai event (1.778 Ma).

2. Taxa *Lagurodon* and *Prolagurus* appear in Pleistocene deposits below of Gilsa subzone (before 1.575 Ma).

3. The mean values of coefficients for species of the *Allophaiomys* phyletic line such: *A. deucalion* – A/L⩽42.0; B/W>26.0; SDQ⩾100.0 and *A. pliocaenicus* – A/L>42.0; B/W<26.0; SDQ<100.0.

Biochronologic dismemberment of Eopleistocene deposits we conduct in two directions – appearance of new taxon and complication of morphostructure of teeth occlusal surface. The names of biochronologic subdivisions (faunistic complex, association, phase), which are used in the article, are accepted for Ukrainian territory.

Tiligul association – characterized by appearance of *Allophaiomys deucalion* and absence of roothless voles *Prolagurus* and *Lagurodon*. Coefficients for *Allophaiomys* the following: A/L<41.0; B/W>31.0; SDQ>110.0.

Verkhnezhevakhian association – characterized by appearance of *Prolagurus ternopolitanus* and *Lagurodon arankae*. An association is subdivided into two phases. For first from them the values of coefficients for *A. deucalion* such – A/L=41–42.0; B/W=29–31.0; SDQ=100–110.0. For Chortkov phase indexes such: A/L=42–43.0; B/W=25–29.0; SDQ=100–103.0. Associations above mentioned behave to the Odessa Faunistic Complex of small mammals.

Tarkhankut association – appearance of species *Allophaiomys pliocaenicus* and *Eolagurus argyropuloi* is marked. For index species *A. pliocaenicus* coefficients have such values: A/L=42–43.0; B/W=25–29.0; SDQ=90–100.0. Age of this association is approximately 1.3 Ma.

Nogaisk association is characterized by appearance of *Prolagurus pannonicus* (approximately age 1.2 Ma). This association is presented by three phases of development. For the first phase (Nogaiskian) there are indexes of evolutional level of progressiveness of vole *A. pliocaenicus* A/L=42–44; B/W=25–29; SDQ=90–100. The second phase (Kairian) consists of the three stages of development. The first stage is presented by such values of coefficients A/L=44–46.0; B/W=20–26.0; SDQ=80–90.0. On the second stage they are presented by values A/L>46.0; B/W=20–25.0; SDQ=80–90.0; For the third stage values are characteristic for *A. pliocaenicus* – A/L>46.0; B/W=20–25.0 SDQ<80.0. Kairian phase is correlated with the Jaramillo subzone. Roksolanian phase of Nogaisk association of small mammals younger than Jaramillo episode. For *Allophaiomys* of this phase the next values of coefficients are characteristic: A/L>46.0; B/W<20.0; SDQ<80.0.

Microtus hintoni and *Clethrionomys glareolus* first marked in **Verkhnecherevichnian association**. For *A. pliocaenicus* coefficients have next values of A/L>46.0; B/W<20.0; SDQ<80.0. The Tarkhankut, Nogaisk and Verkhnecherevichnian associations of small mammals belong to Tamanian faunistic complex.

Luzanovka association is characterized by appearance of *Microtus hintoni-gregaloides* and *Microtus protoeconomus*. This association is characteristic for the Tiraspol complex. However, the bone-bearing level belong to Late Eopleistocene deposits. Morphometric indexes did not change for the cheek teeth of *Allophaiomys*.

Table 1

The morphometric coefficients of the first lower molars of European *Allophaiomys*

	Allophaiomys			**Remarks**
	A/L	**B/W**	**SDQ**	
Neuleiningen	41.52	-	131.9	presence *A. deucalion*, Lippi et al., 1998
Villany 5	39.9	36.8	-	*A. deucalion*, Rekovets, 1994
Zuurland-5	40.0	32.0	126.5	*A. deucalion*, Kolfschoten T., 1998
Kamyk	39.9	99.2	-	*A. deucalion*, Garapich et al., 1996
Mokra	39.8	-	-	*A. deucalion*, Rekovets, 1994
Temnata Dupka	38.7	29.3	-	*A. deucalion*, Rekovets, 1994
Hamamayady	40.0	36.0	98.0	*A. deucalion*, Ünay, 1998
Kolinany-3	40.78	33.98	116.0	*A. deucalion*, Lippi et al., 1998
Tylygul	42.0	33.2	108.9	*A. deucalion*, Rekovets, 1994
Tyzdar I	40.2	30.7	116.7	*A. deucalion*, Tesakov, 2004
Kkyzhanovka I	40.9	29.1	113.0	*A. deucalion*, Rekovets, 1994; Tesakov, 2004
Zuurland-1	41.8	31.0	111.9	*A. deucalion*, Kolfschoten T., 1998
D. Altenburg-10	40.85	-	-	*A. deucalion*, Rekovets, 1994
Monte La Mesa	41.68	23.58	108.2	*A. pliocaenicus*, Masini et al., 1998; Lippi et al., 1998
Melekino	41.7	29.0	106.4	*A. deucalion*, Krokhmal', 2009a; Markova et al..1998
Betfia IX/C	41.8	26.2	105.0	*A. pliocaenicus*, Hir et al, 1998
Zabia cave	41.5	102.0	-	*A. deucalion*, Garapich et al., 1996
Chlum-6	40.66	32.35	102.3	*A. nivaloides*, Masini et al., 1998; Lippi et al., 1998
Pirro Nord (PN34)	41.92	31.06	101.8	*A. ruffoi*, Masini et al., 1998; Lippi et al., 1998
Zhevahova gora	42.0	32.9	100.0	*A. deucalion*, Rekovets, 1994
Chortkov	41.3	25.5	100.0	*A. deucalion*, Rekovets, 1994
Pietrafitta	42.34	27.46	102.8	*A. ruffoi*, Masini et al., 1998; Lippi et al., 1998
Betfia IX/B	42.6	22.8	100.3	*A.pliocaenicus*, Hir et al, 1998
Cava Sud	42.78	26.35	100.7	*A. ruffoi*, Masini et al., 1998; Lippi et al., 1998
Tarhankut	42.9	25.8	90.9	*A. pliocaenicus*, Rekovets, 1994
Nogajsk	42.2	20.04	97.4	– // –
Venta Micena	42.2	27.0	-	– // –
Meiningen	42.5	-	-	– // –
Cueva Victoria	43.0	16.0	-	*A. chalinei*, Agusti.1991
Dell' Erba (DE6-2)	43.0	27.29	99.89	*A. ruffoi*, Masini et al..1998; Lippi et al., 1998
Kürttepe	43.4	14.0	99.6	*A. ruffoi*, n=1 (?), Ünay, 1998
Betfia 2	43.7	25.3	-	*A. pliocaenicus*, Rekovets, 1994
Atapuerca TD4	44.1	33.4	-	*A. chalinei*, Cuenca-Bescos et al., 1995
Kadzielnia	44.6	-	-	*A. pliocaenicus*, Rekovets, 1994
Ahtanizovskaja	44.6	25.7	89.5	*A. pliocaenicus*, Tesakov, 2004

Table 1

	Allophaiomys			**Remarks**
	A/L	**B/W**	**SDQ**	
Nesmejanovka	44.5	21.4	89.3	*A. pliocaenicus*, Tesakov, 2004
Korotojak c3	44.7	20.34	-	*A. pliocaenicus*, Iosifova et al., 1992
Colle Curti	45.05	29.3	89.8	*A. pliocaenicus*, Masini et al., 1998; Ficcarelli et al., 1990
Kairy	45.1	26.7	90.5	*A. pliocaenicus*, Rekovets, 1994
Atapuerca 4BW	45.23	-	-	*A. chalinei*, Cuenca-Bescos et al., 1995
D. Altenburg-4b	45.5	20.08	-	*A. praehintoni*, Nadachowski et al., 1998
Holstein	45.9	-	-	*A. pliocaenicus*, Rekovets, 1994
Bagur-2	46.1	22.8	-	– // –
Mas Rambault	46.1	23.9	-	– // –
Zaleziaki	46.7	-	-	– // –
Limany II	46.75	24.8	87.4	*A. pliocaenicus*, Krokhmal', 2009б
Limany I	46.7	24.2	89.8	– // –
Monte Peglia A	46.54	23.9	73.48	*A. nutiensis*, Lippi et al., 1998
Monte Peglia B	45.99	21.5	77.83	*A. burgondiae*, Lippi et al., 1998
Les Valerots	47.27	21.12	-	*A. nutiensis*, Nadachowski et al., 1998
Chlum-6	46.1	13.11	70.88	*A. pliocaenicus*, Masini et al., 1998; Lippi et al., 1998
Les Valerots	46.69	17.39	-	*A. burgondiae*, Nadachowski et al., 1998
Dursunlu	45.3	14.0	76.9	*A. nutiensis*, Ünay, 1998
Ushkalka	45.3	19.9	57.0	*A. pliocaenicus*, Markova, 1982; Markova et al.,1998
Roksolany	47.0	19.6	72.2	*A. pliocaenicus*, Krokhmal' et al., 2006
Port-Katon	44.6	19.56	79.3	*A. pliocaenicus*, Markova et al., 1998
Cherevichnoje I	47.1	16.4	76.2	pioneering *Microtus hintoni*, Rekovets, 1994
Untermassfeld	48.78	-	70.63	*Microtus thenii*, Lippi et al., 1998
Luzanovka	43.4	25.3	-	+*M. hintoni-gregaloides, M. protoeconomus*, Rekovets, 1994
Karaj-Dubina	43.6	17.4	55.0	– // –
Tihonovka 2	44.4	18.9	-	+ *M. arvalinus, M. arvalidens*, Rekovets, 1994

LAKES SEDIMENTS OF THE CRIMEAN PENINSULA AND THEIR USE IN RECONSTRUCTIONS OF THE BLACK SEA LEVEL CHANGES

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Saline lakes of the Crimea located near the present shore of the Black Sea are object of geological studies for more than 100 years. They represent lagoons isolated from the Sea during the Holocene. Two lake sediment sequences have been recovered from the western part of Crimean Peninsula (Lake Saki (45°06.8' N; 33°33.2' E), water depth ca. 0.8 m, sediments thickness 4.2 m) and Lake Dzharylgach (45°34.7' N; 32°51.7' E), water depth ca. 0.8 m, sediments thickness 4.15 m) during the field campaigns 2005 and 2009. Some results of our studies are presented here and compared with results of the previous investigations. The detailed examination of the cores, which includes varve counting, lithostratigraphy, geochemistry, pollen, diatom and ostracod analyses, is presently carried out.

The sediments of Lake Dzharylgach consist of grey, dark grey and greenish grey clay that were found in the bottom of the core. The grey, yellow grey and greenish grey silt weakly laminated overlay them. The homogeneous dark grey silt was observed in the upper part of the section. Three main zones are distinguished based on the results of the ostracod analysis. Zone 1 corresponds to the marine conditions; the sediments of the zone 2 were formed in the transitional conditions; while zone 3 represents an isolated saline basin with the salinity increasing up-core. The ^{14}C dates of the shells found in the sediments corresponding to the beginning of the isolation give the age of 3590–3350 yr BC. From this time onward the connection with the sea decreased and terminated finally in c. 600 yrs. Since that time the conditions of ultra saline basin prevailed at the site. The mean sedimentation rate is c. 0.6 mm/yr.

The sediments taken from different parts of Lake Saki are subdivided into two main units. Unit 1 (the thickness is 30 cm) is grey dense clay with gravel grains, in-situ shells and sand. These sediments were formed in the marine conditions and during the isolation period. Unit 2 (the thickness is 390 cm) is distinctly laminated silt consisting basically of black and white laminae. Their thickness varies from 0.2 to 30 mm. No clear rhythms were distinguished. The finest laminae are observed in the upper meter of the core. About 1150–1420 couplets of laminae were counted in the wet sediments and after drying. This does not agree with the AMS dating of the shells from the clay/silt boundary that provided the age of 3340–3610 yr BC suggesting the mean sedimentation rate is 0.74 mm/yr.

The first studies of the sedimentation rate in Lake Saki were published in the 1930s. Shostakovich (1935) described distinctly laminated sediments 8.5 meter thick with 4188 couplets, which enabled him to date the beginning of the isolated lake stage as 3510 yr BC. However, he did not describe the underlying sediments that make a comparison of our data problematic. Dzens-Litovsky (1936) described black laminated silt up to 2.5 m thick overlying the "salt" layer with a thickness up to 4.0 m. He found 2000 couplets of laminae in the silt unit and estimated the sedimentation rate as 0.8-2.5 mm/yr.

Generally, the thickness of the laminated sediments usually varies from 2 to 4 m. We could reach the underlying clay only in one core hole out of 13. This spatial variation in thickness of the silt layer increases the error of the counting method.

The isolation of the study lakes from the Black Sea was not simultaneous as we can conclude from the AMS dating results. Specific of Lake Dzharylgach is the absence of the distinct transition between marine and lake sediments. Its isolation from the sea can only be established based on the ostracod analysis while in Lake Saki the start of sedimentation of the laminated silt marks its isolation clearly. The non-synchronous isolation of the lakes located at the same altitude and relatively close to each other (the distance between the lakes is ca.70 km) as well as the difference in the composition of their sediments put forward local geological factors in explaining the differences in the regional palaeogeographical scheme. Among these local factors one should note different hydrodynamic conditions in different parts of the shore that could increase/decrease the age of the lakes' sills formation.

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STRATIGRAPHIC EVIDENCE FOR AN AKTSCHAGYLIAN TO QUATERNARY DEFORMATION DEVELOPED AT A RIGHT ANGLE TO THE MAIN SOUTHERN URALS CHAIN

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According to the recent modifications made to the Quaternary/Pliocene boundary (which is now dated at 2.6 Ma) the Gelasium interval (which was previously part of the Late Pliocene) is now part of the Quaternary. In the area of the modern Caspian basin this interval is equivalent to the Upper subdivision of the Aktschagylian regiostage. It corresponds with a period when the Aktschagylian basin represented the maximum transgression of this sea. At that time marine waters covered the Northern Caspian lowlands and slowly moved to the north through the Volga, Kama and Belaya river valleys and covered all the adjacent low areas. Nowadays, the Aktschagylian deposits of the Fore-Urals are ranging in altitudes between 140 and 160 meters close to the modern Belaya River valley. It is suspected that some tectonic uplift started during the Alpine orogeny (mainly at the end of the Paleogene) and it is assumed that this uplift accelerated at the end of the Pliocene (which now belongs to the Quaternary) (Puchkov, Danukalova, 2004, 2006, 2008). There have been many speculations on this topic but only few evidences support this idea. This is the reason why we wish to bring new data to reinforce this interpretation.

The altitudes of the lowest part of the Upper Cretaceous-Eocene and Aktschagylian stratigraphic ensembles known in the Paleo-Belaya basin and in the Paleo-Urals have been computed and represented at the same time for comparison (fig. 1). These two surfaces evidence an East-West elongated dome which follows the N53° latitude on the western slope of the Southern Urals. This ridge (the Small Nakas Ridge) is superimposed at depth with the remnants of the Sernovodsk-Abdulino Aulacogen and with the Belaya tear fault, which support the existence of a recent rejuvenation of these deep basement disruptions. We know that the initial base of the Aktschagylian marine ingression was originally dipping towards the Caspian Sea but the actual data show that the modern surface has lost its initial inclination over a vast area. This modification results from the post-Aktschagylian deformation. The 3D reconstruction shows that the two surfaces display the same type of uplift at around 56.50 E × 52.50 N.

The difference in altitude observed at the base of the two curves must be attributed to the location of the sampled sites since the Aktschagylian stratigraphic ensemble was sampled in the valleys and the Cretaceous-Eocene formation in the neighbouring hills. However, when the two profiles are superimposed we observe that the "cretaceous" curve is a little bit higher (fig. 2). This result suggests that the uplift started after the Eocene and continued until nowadays. In order to calculate the local amount of uplift after the Aktschagylian we have considered the difference between the maximum uplift of the surface and a regional trend corresponding with the almost horizontal surface of the former deposits. In these conditions the deformation affecting the Aktschagylian-

Quaternary ensemble reaches 175 meters. Since the measured Eocene-Cretaceous uplift incorporates also the Pliocene-Quaternary uplift, we assume that before Pliocene the uplift was only of 23 meters in altitude. This result gives an idea of the irregularity of the topography that the Aktschagylian transgression had to face. This also suggests that the Pliocene-Quaternary amount of uplift was 6 times larger than the previous one. Post-Akchagylian velocity uplift can be calculated. Since we know that the age of the beginning of the deformation started in the Late Oligocene but was especially active during post Akschagylian time (1.8 Ma) (former Pliocene / Quaternary boundary) we can speculate that the most recent uplift of the Small Nakas Ridge developed at a velocity of 0.095 mm/year. Comparison with the uplift of the main Urals chain during the same period of time clearly shows that the uplift of this mountain range (4.5 mm/year) is much larger than that of the Nakas Ridge.

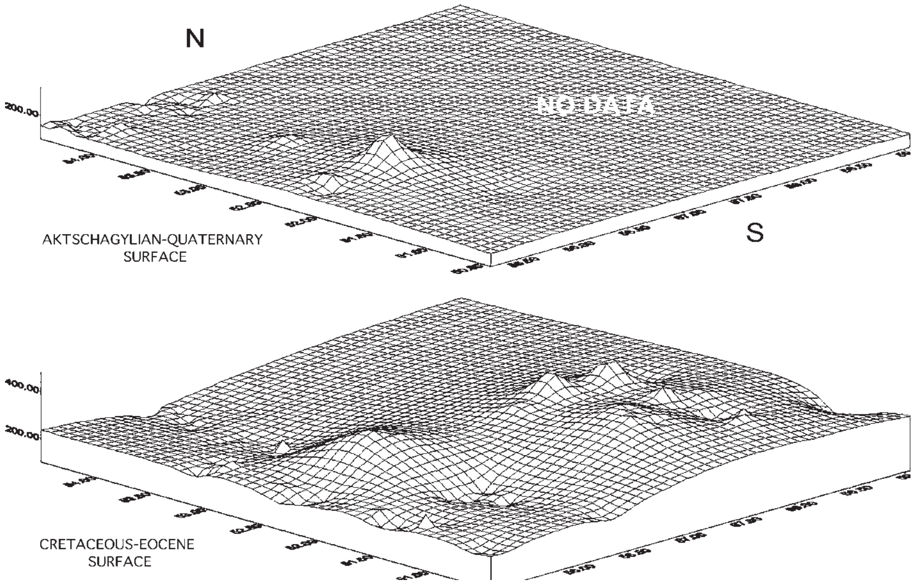

Fig. 1. Comparison of the Upper Cretaceous-Eocene and Quaternary-Aktschagylian 3D surfaces

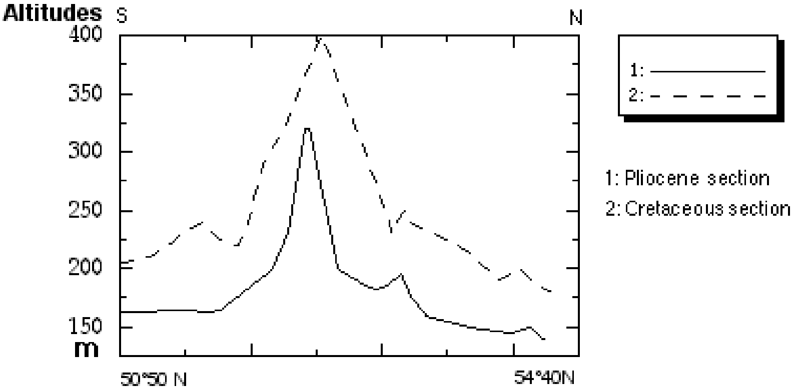

Fig. 2. Difference in altitude between the two surfaces at 56.50 E × 52.50 N

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THE RECONSTRUCTION OF HILLY PALEOLANDSCAPES AND UPPERPALEOLITHIC SUBSISTENCE PRACTICES AND SETTLEMENT SYSTEM ON THE SOUTH OF THE RUSSIAN PLANE

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1. Hilly landscapes are the most favorable territories for inhabitancy of the Upper Paleolithic people. There are many possibilities for choice of the convenient places for base-camps and temporary camps, which had water, fuel, hunting and vegetation resources, had good field of vision around areas, etc.

2. Reconstructions of subsistence practice include the next territories: a) the living sites, b) places of regular daily visits, c) frequent one-day trips for hunting and gathering, d) distant hunting expeditions with using short-lived camps.

Each type of the paleoreconstructions provides for embrace the corresponding square territories and producing them in scales, which permit to reflect the structures of the relief and their landscapes. Besides, every time the goals and tasks of the human employment of the territory were different, so this fact must be reflected in the legends of the maps and schemes of these reconstructions.

Usually, the territory of the living site reconstructed in scales about 1:10–1:100. The territory of regular daily visits, as a rule, covers first hundreds meters around the site. Paleoreconstruction produces in scale about 1:1000, 1:2000. The territory of frequent one-day trips for hunting and gathering, as a rule don't exceed radius of first ten kilometers around the site and have been reconstructed in scale about 1: 25000–1:100 000.

The territories of distant hunting expeditions with using short-lived camps can be spread in regions which were been situated far from base-camp on distance about several tens or first hundred kilometers. The goals of these expeditions may be various: getting stone raw – material, exchange, etc. Paleoreconstructions in this case produce in two scales: 1) observation scale about 1:100 000 – 1:500 000 envisages the discovery of the main directions of expeditions, 2) more detail scale reflects the situation in the area each of temporary camp and in whole coincides with analysis of territories of frequent one-day trips.

3. Te reconstructions of subsistence practice must be accompanied by series of the additional reconstructions with different scales and goals. The most typical from them are reconstruction: of vegetation cover, animal world, methods of hunting and gathering, character of the domestic and manufacturing activities, density of the population in the region and possibilities of the functional differentiation of this population (mainly hunters or mainly fishermen, etc.).

4. The region of the Kamennaya Balka sites may be viewed as typical for the Upper Neo-Pleistocene of the whole northern part of the Azov Sea Area on the following parameters:

- the availability of dated and correlative analogues of all the subdivisions of the general scale of the Eastern Europe Upper Neo-Pleistocene;
- the presence of fauna dated exposure of the Karangatian Sea (to be more precise estuary-sea) terrace practically unique in the northern part of the Azov Sea Area;
- palynological dating of all the analogues of the subdivision of the Upper-Neo-Pleistocene (Wurm) glaciation;
- archeological and absolute dating of the Late Valdaj deposits.

The combination of various and complete paleoecological and archeological data is the basement for constructing of the models of subsistence practices in any period of the inhabitance on the sites.

5. The study of the spreading of the sites of the Kamennaya Balka archeological culture permits to suggest the following model of the region settlement: basic-site located on the quite high board of the ravine (the height under bed-river paleo-Don were 60–70 m at 22 000 BP, 50–60 m – 15 000 BP, 40–50 m – 12–1300 BP) with several small "satellites" not far from it – hunting and gathering camps situated on the surrounded territory. Today there have been stated rather a big number of sites with poor and destroyed cultural layers.

Analysis of the distribution and composition of faunal remains from the base-sites of the Kamennaya Balka culture show that the butchering of the prey did not take place at the sites. According by the well- known ethnoarcheological data we may suppose existence of the special hunting "kill-sites" and "butchering places".

6. Geomorphological analysis of a vaster territory permitted to outline the region of possible regular visits which was determined by the size of an average daily hunting and gathering outing and- included part of the alluvial flood plane of the paleo-Don and hollow hilly right-bank upland adjoining it from the north. The mentioned upland unites old (Pliocene) water-sheds limited the basin of the Kamennaya Balka, and the wide bed situated between these water-shelds, a narrow Pleistocene insertion of the middle and upper course of the modern ravine being deepened into this bad. This territory had the form similar to triangular; the eastern rib this speculative triangle was submeridional 10–15 km long, the north-western was diagonal extending for 15–20 km and the southern was determinate by the location of the deep branches in the flood plain of the paleo-Don. We may suppose that the total area of this territory hardly exceeded 150–200 sq/km. (fig.1).

7. Apart from such regularly visited territory the inhabitants of the Kamennaya Balka used resources from more distant regions- flinty raw materials were delivered from the valley of the Mius River situated to the west at distance of 120–150 km. Territories of economic activities of inhabitants of the Kamennaya Balka were large enough but used with various frequency

8. The epochs of the settlement of the sites were relatively warmer, forest landscapes prevailing or presented in significant quantities; it determined the character of economic activity of the sites inhabitants. In the composition of the hunting prey were found both – the steppe and the forest species. New trasological experiments show that the high percent of tools had been used for working by wood. Obviously

that wood had been used for various economic and domestic activities and also for constructing of dwelling, wind-barriers and etc.

9. The archaeological researches of the cultural layers permit us to say about complexity of the base-site planning including the manufacturing zones and living places with easy ground- dwellings. The quantity of living places which had existed simultaneously gives us the opportunity to estimate the size of inhabitants on the site in the appointed period its being. At the site Kamennaya Balka II (the main cultural layer) we can with confidence to say about 5 simultaneous living places, so, it's mean that there were about 50 residents. According the richness of cultural layer, compose of planning, quantity of faunal remains (the results of dental cement analysis show that hunting took place during whole year) and the availability of stabs-anvils that could serve as a grater proves the use of vegetable food resources we may say about rather settled and stable inhabitance people in this area.

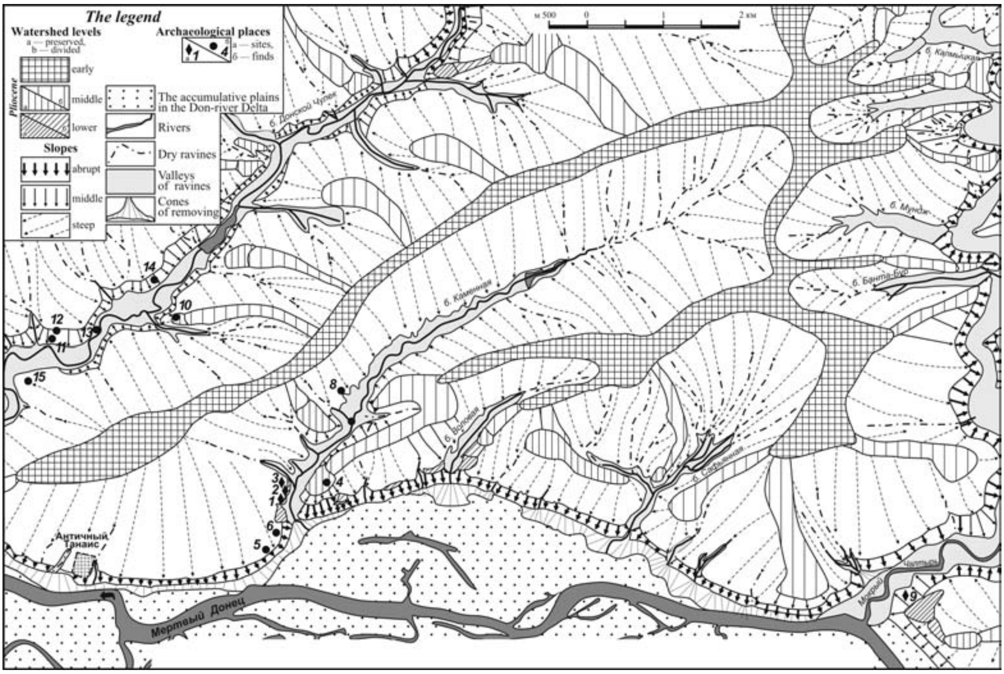

Fig. 1. The Geomorphological map of the area of spreading of the sites of the kamennobalkovskaya culture

The time of existence of the Kamennaya Balka culture was very long – from 21-22 000 to 12-13 000 BP, which testify to the stable cultural adaptations these people to natural life of this area.

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THE FIRST LOCALITY OF FOSSIL RODENTS IN THE MANYCH BASIN (ROSTOV PROVINCE)

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The Manych basin stretches from the south of Yergeny and Stavropol Upland to the Don River basin (600 km duration). Chauda-Bakinian, Early Euksnian, Chazarian and Khvalynian deposits were distinguished in the Manych valley.

Till now the mammal and mollusk remains of this basin were very poor investigated. The first discovery of small mammal locality has been done by A.L. Tchepalyga in 2005 on the north coast of Manych valley near v. San-Manych (Rostov Region). The screening and washing of the bones were carried out during 2007–2009 yrs. More than 1500 remains of rodent bones were discovered in this layer.

Rodent remains were found in gravel and sand layer overlaid by clay and sandy clay deposits and covered the loam of “Gudino” layer.

Seven species of rodents were distinguished in San-Manych locality (tab. 1).

Table 1

Species of rodents from San-Manych locality

Species	
Spermophilus pigmaeus Pallas	pygmy souslik
Pygeretmus (Alactagulus) pumilio Kerr	lesser five-toed jerboa
Ellobius talpinus Pallas	northern mole-vole
Arvicola terrestris Linnaeus	water vole
Eolagurus luteus Eversmann	yellow steppe lemming
Lagurus lagurus Pallas	steppe lemming
Microtus (Stenocranius) gregalis Pallas	narrow skull vole

Lesser five-toes jerboa, northern mole-vole, yellow steppe lemming and steppe lemming are the dominant species. The species composition of fossil fauna sharply distinguishes from the modern rodent fauna of this region. Recently here habituated such species as grey rat and ondatra (which appeared in Holocene), *Spermophilus pigmaeus, Allactaga major, Pygeretmus pumilio*, *Stilodipus telum*, *Sicista subtilus* Pall, *Mus musculus*, *Apodemus sylvaticus*, *Cricetulus migratorius*, *Arvicola terrestris*, *Microtus arvalis*, *M. socialis*, *Ellobius talpinus*, *Spalax microphtalmus* (Minoransky et al., 2006).

By the other way in modern fauna of this region are absent yellow steppe lemming, steppe lemming, narrow-skulled vole, which were found in fossil fauna.

Such sharp difference in species composition of San-Manych fauna from modern Rodentia of Manych valley indicates the significantly different climatic and environmental conditions on the coasts of Lake Manych-Gudilo during deposition of layer with bones from recent ones. All species which have been determinated from San-Manych locality now habituated in different kinds of arid steppes and semi-deserts (sandy, loam-sandy and loess).

Summary. Rodent fauna from San-Manych locality includes only the species of open arid landscapes. Forest and cold-adapted animals were not distinguished from this locality. The water vole was presented by the single bone, what indicates that the climatic conditions were rather cool. The occurrence of significantly rich collection of narrow-skulled vole remains permits to speak about the cool climatic event. The low species diversity of San-Manych fauna (taking into account that the rich collection of the small mammal bones have been analysed) also indicates the cooling of the climate during the deposition of the layer. Thus, judging by the species composition and species diversity of San-Manych rodent fauna, we could conclude that during the deposition of the bones the arid and rather cool climatic condition existed in the Manych-Gudilo Lake region. By the opinion of A.L. Tchepalyga the deposition of the layer corresponds to Early Khvalynian transgression (16–12 kyr BP). This transgression was distributed after the LGM. In this time the Caspian water penetrated to the Manych valley and Manych-Kerch Strait was originated (Tchepalyga, 2002).

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THE SPECIFIC FEATURES OF SEDIMENTATION ON THE SHELF OF THE SOUTHERN SEAS (THE SEA OF AZOV BEING EXEMPLIFIED)

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The study of relief formation and sedimentogenesis processes of the seas of the South of Russia is the most important theoretical and applied task of geomorphology and marine geology. Many issues of sedimentation on the shelf of inland seas, genesis, and development of relief forms, and paleogeography remain to be unsolved. To give answers to the nowadays questions the seas' studying faces is possible basing on the results of complex marine and terrestrial researches. But classical methods, applied to geomorphology and marine geology, should be supplemented and correlated with the results of biostratigraphic research. Since the mid 1990s, such researches have been carried out by SSC RAS. Vast actual material on the Sea of Azov, the Russian part of the Black Sea, and the water area of the Northern Caspian Sea has been accumulated and generalized for the period.

Pre-Holocene history of geological development of these seas, in many aspects, is similar and rather often intersects. Their common long-term development within the limits of one marine basin, alternation of transgress-regressive phases contributed to numerous biological invasions and frequent changes of hydrological and hydro-chemical conditions. During Holocene, separation of marine basins within the framework of current boundaries took place and limited connection with the World Ocean predetermined its own history of development for each water basin.

Underwater landscape studies, including such works as continuous echolocation and seismic profiling, and ground surveys, resulted in obtaining new data on the bottom relief composition, sedimentation conditions and velocity in the Late Holocene. The major part of research was concentrated in the Sea of Azov water area, where the cores of bottom sediments (up to 2 meters) and ground samples from the surface horizon were taken. The preserved shell material and carried out palynologic and diatoms analyses indicate that the sediments are of the Late Holocene age (the New Azov Layers). The results of seismic-acoustic survey and absolute age determinations of bottom sediments, sampled in different areas of the sea from ground cores, confirm biostratigraphic research data (Matishov, 2007; Matishov et al., 2007, 2009).

New ideas of bottom relief composition and genesis, paleogeographic situations of sedimentation and climate changes in the Late Holocene, as well as distribution of recent bottom sediments and related zoo-benthos biocenoses in the Sea of Azov, became the results of analysis and generalization of collected research material (Matishov, 2006, 2007; Matishov et al., 2008, 2009).

The current relief of the Sea of Azov formed during the Holocene as the result of complicated interrelation of endogenous and exogenous processes. In that time the linear accumulative forms of relief (spits), numerous underwater sand-shell ridges caused by wind drifts, and erosive flat hollows of the bottom were formed. Among flat forms of relief, occupying the larger part of water area, abrasive and abrasive-accumulative terraces (located at the depth of 4-9 m.) and accumulative plains linked to the maximum bathymetric points of the sea bottom are specified (Matishov, 2006, 2007). The accumulative plains' morphology is complicated by the system of ancient valleys of paleorivers, with the biggest one being the valley of Paleo-Don (Shnyukov et al., 1974; Matishov, 2006). The outlines of paleorivers' valleys in the bottom relief are smoothed by the covering thickness of marine sediments formed in the Early-Azov and the New-Azov stages of the sea development.

Differentiated character of tectonic movements within the borders of marine basin determined the conditions and rates of sedimentation, as well as morphology and development of relief (Khrustalyev, Shcherbakov, 1974). Frequent changes of the sea level, which took place during the New-Azov stage of the sea development, predetermined the rhythmic character of sedimentary mass composition. The terrigenous sediments, which are, basically, clay and aleurite-clay silts, prevail in the central part of the sea in the studied transects. The larger types of sediments (fine-aleurite silts and fine-grained sands) are registered in the ground cores sampled along the periphery of marine basin, not far away from the coast and situated locally. Carbonaceous sediments are shells and products of its destruction (organic-detritus sand). The presence of heavily carbonaceous (shell) silts and silted shells over the total bottom area of horizons is typical of the sediment mass transect. The mass and quantity of interlayers enriched with shell material generally increase in the cores sampled closer to the coast with the sea depth decreasing. Obviously, it relates to the increase of biomass of bottom organisms from the areas with the distribution of clay silts to the areas covered by more coarse-grained sediments and general cross transport of bottom-bed loads, directed from the centre of the sea to its coastal area.

According to species composition of zoobenthos sampled from different horizons of ground cores, we can say that the composition of bottom sediments in the Sea of Azov, as well as salinity, in the Late Holocene was one of the main limiting factors influencing the distribution of bottom biocenoses (Matishov et al., 2008). In the total sedimentation balance, the role of terrigenous material formed in the result of coast and bottom abrasion with the general lift of the eustatic sea level increased. Because of the lithological composition of rocks experiencing destruction, mainly fine aleurite-clay material entered the water area, which distributed over the bottom under the influence of rough waves and currents. The major part of that clastic material deposited in the central part of the sea within the borders of a broad accumulative plain. The average velocity of sedimentation in the New-Azov period was 2 mm/year, reaching the maximum of 10 mm/year during the Nymphean transgression. Sedimentation rates in the part of accumulative plain close to the Temryuk Bay were 0.2-6 mm/year. The abrasion of the coasts and the outflow volume of the Kuban River loads, apparently, conditioned such a regime. In some cases, depending on geomorphologic situation and closeness to the coastal bluffs, the speed of accumulation reached 4-6 mm/year (Matishov et al., 2009).

Spore-pollen analysis of ground cores of the Sea of Azov bottom sediments showed the increase of pollen quantity of wooden plants in the lower horizons of the cores, indicating that during the accumulation period of the sediments (~1300–1800 years ago) the climate on the sea coast was less arid if compared to the current one. Arborescent pollen is mainly of pine and birch, the decrease of the role of the broad-leaved trees' pollen has been registered. The presence of xerophyte and halophyte types of pollen of Chenopodiaceae is the evidence of climate aridification during the formation of the upper part of the New-Azov sediments (Matishov et al., 2007).

The results of diatomaceous analysis of the bottom sediments indicated that only upper (up to 20–35 cm) layers of sediments are characterized by great species diversity (more than 70 species) and contain shells of diatomaceous algae dominating in the recent plankton of the Sea of Azov (Matishov et al., 2007). Species composition of the mass species differs according to the area of the core sampling. Regardless of the area of the sea, the species composition of diatomaceous in the lower layers of sediments has become very poor. Taking into account the ecology of the registered species, one may assume that during accumulation of the indicated sediments' layers (~1500–1900 years ago) the water body was shallower when compared to the nowadays Sea of Azov (Matishov et al., 2009). Thus, by the methods of absolute geochronology and litho-biostratigraphy, it has been determined that 2-meter sediment cover and the recent bottom relief of the Sea of Azov were formed during the New-Azov period of the water body formation, i.e. during the last 2000 years, together with the recurrent stage of transgression under the conditions of intense denudation-accumulative regime. Tectonic regime of the adjacent areas and periodic alternations of climatic conditions, which, according to the results of biostratigraphic research, were of regular and frequent nature, influenced the relief formation processes that time significantly.

WEST EUROPEAN ARVICOLID EVIDENCE OF INTERCONTINENTAL CONNECTIONS DURING THE EARLY PLEISTOCENE

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In the Early Pleistocene from ca 2.6 Ma to 1.8 Ma, covering the period approximately corresponding to the Gelasian, a series of marine deposits was laid down in the North Sea Basin. In the UK, the highstand marine sands and gravels exposed onshore and in coastal section are known as the Norwich and Wroxham Crag Formations. In the Netherlands, the fine sandy and clay marine deposits from the same period are at depth due to subsidence of that part of the basin and are known as the Maassluis Formation. At the time of their deposition, the North Sea Basin opened to the Atlantic via Scotland and was closed at the southern end by the Weald-Artois anticline.

These deposits yield arvicolid remains which document the main developments of the fauna, very similar to that observed in Central Europe (Austria, Hungary, and Germany) and South Eastern Europe (Ukraine, European Russia). All cases of supposed regional differences investigated up to now are due to different local taxonomic usages, not to real faunal differences. These indicate that the whole of the regions mentioned can be considered to constitute a single West Eurasian faunal unit with potential (recurring) migration of species across the entire area. The extinct rooted lagurid genus *Borsodia* is an example of a clade with a range extending from Asia to the UK. *Borsodia* is lacking in forest faunas (e.g.Tegelen, the Netherlands), but present in other localities in the Netherlands, and the UK, over a range of periods documenting recurring immigration during climatic conditions favouring steppe faunas. In the UK the earliest occurrence of the clade is found in the Earliest Pleistocene Norwich crags (e.g. Sizewell), where it is represented by the species *B. petenyii*. This is similar or identical to the species *B. praehungarica* from South East Europe. Later it occurs as *B. newtoni (=B. hungarica)* at least two horizons. These changes can also be followed in faunas from Hungary, Austria, and Germany.

The arvicolid faunas of the North Sea Basin area provide further species of interest for interregional correlation and hypotheses of intercontinental connection. The clade *Mimomys tigliensis / Mimomys tornensis* appears (without predecessors) at about the level of the Wroxham crag faunas in the UK (e.g. Sidestrand), and at the level of the upper Maassluis Formation in the Netherlands (e.g. Zuurland borehole 95m). In the succession of faunas from the loess sections at Stranzendorf, Austria, it occurs first at Stranzendorf K, and in South Eastern Europe it is recorded first at the locality Liventsovka 5. This FAD is considered in general a potentially useful biostratigraphic datum, although the individual FADs are subject to sampling errors. Synchroneity across the entire area is proposed as a basic model, because the continuous climatic changes demonstrated at that Gelasian of the marine record seem to be sufficient to displace populations across the entire faunal province in a (geologically) relatively short period of time. The origin of the clade (=subgenus *Tscharinomys*) appears to be from Central Asia.

Further evidence of faunal connection is provided by what appears to be a new species of *Mimomys* from the UK Norwich crag. This species has primitive thick enamel, no islet on the m1 or M3, a prominent *Mimomys* ridge. These characteristics are unknown from *Mimomys* from Europe, with the exception of *Mimomys hordijki* recorded so far only from the Zuurland boreholes (depth 60-65m) in the Netherlands. However the UK species differs in having a relatively wide m1 (the M3 of *M. hordijki* is not described yet). The possibility of it being a precursor of *M. hordijki* is not ruled out and this is allowed by current correlations of the source sediments. As recognised already by its authors, *M. hordijki* has an astonishing resemblance to North American species such as *M. dakotensis*, suggesting intercontinental links. Similarly the new material from the UK may be related to North American species. At present no geographically intervening material resembling these forms has been published. A migration route across the (far) North of the Eurasian region therefore has to be considered, the intervening records having been largely destroyed by subsequent glacials.

DISCOVERY OF THE HERD OF LATE PLEISTOCENE MAMMOTHS IN BELARUS

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In 2008 the burial place of the rests of mammoths (*Mammuthus primigenius* (Blumenbach)) was revealed on the territory of Minsk. The new site is unique for yielding remains of 19 individuals of mammoths. Morphological structure of teeth shows that buried animals were of at different individual age. Ten percents of the rests belong to calves in the age of 2–5 years, 16 % of all individuals in the age of 6–9 years, 32 % of animals were in the age of 10–20 years, and 16 % from all animals were in the age of 20–35 years. Old animals, ranging in age from 35 to 50 years, account for up 26 % from the general number of all individuals.

The samples of ribs of mammoths were ^{14}C dated as 20167 – 72±330 yr BP (IGS-1370) which corresponds to the calendar age of 23400–21200 yr. According to the absolute date, these mammoths lived on the territory of present day Minsk during the advancing of the Poozerskiy glacier. The fossil material includes 10 tusks, and 31 premolars and molars. All material is stored in the Zoological Museum of the Biological faculty of the Belorussian State University. All measurements of morphological parameters are executed by the standard technique and shown in tables 1 and 2.

Table 1

Measurements of teeth of mammoths from the "Mashinostroiteley" site in Minsk

Measurements (mm), indexes (%)	Change of a teeth				
	P^{3*}/P_{3**}	P^4/P_4	M^1/M_1	M^2/M_2	M^3/M_3
Length of crown	45 42	105–117 -	145–150 140	- 170–200	220–260 205
Width of crown	31 28	57-62 -	68-76 62	81-82 71-77	81-102 74-77
Height of crown	- 22	41-92 -	120–132 94-111	115–120 116–130	132-160 -
Number of plates	6? 7	11-13 -	17 14-15	17-18 16–19	20–22 19-20
Frequency of plates within 10 cm	- -	5-6 *** -	10–12 9–10	11-12 9–10	10–12 8–10
Thickness of enamel	1.0 1.3	1.2-1.5 -	1.2-1.6 1.4-1.7	1.6–1.7 1.5–1.7	1.6-2.2 1.8-2.0
Index of hypsodont (3:1)	- 52	39-77 -	83-88 67-74	- 65-68	60-61 -
Index of width (2:1)	69 67	53-54 -	47-51 44	- 38-42	37-39 36-37
Index of width to height (2:3)	- 127	67-139 -	57-58 56-66	68-70 59-61	61-64 -

* – a teeth of the upper jaw; ** – a teeth of the lower jaw; *** – frequency within 5 cm

These measurements enable to establish changes of parameters of teeth in ontogenesis of mammoths. On the territory of Belarus it has been done for the first time, since no burial places of the rests of *Mammuthus primigenius* had been found before. The size of each subsequent change of teeth increases with the age of animals. The increase occurs not only in absolute sizes, but also in other separate parameters of teeth. E.g. with the age the chewing surface of a teeth becomes more narrow. The width of a tooth of baby-mammoths reaches 70 % from its length; young animals have this parameter decreased to 50 %, and old individuals, up to 40 %. The height of a tooth relatively to its length grows before the first molar starts functioning from 60 % at cubs up to 90 % at young mammoths and again decreases at old individuals to 60 %. Thus, the hypsodont parameter of teeth in ontogenesis varies. Approximately until the age of 15 years mammoths may have compensated teeth obliterating off due to increase of the hypsodont parameter. After that term duration of functioning of the second and third molars occurred due to increase in quantity of plates at a chewing surface and due to increase in length of corona dents. The number of plates on a chewing surface of teeth progressively grew with 6–7 at young animals up to 20–22 plates at adult animals. Thus frequency of plates within 10 cm of length almost did not vary during the functioning of molars. It remained within the limits of 10–12 plates on the top teeth, and within the limits of 8–10 – on bottom, other words the chewing surface at the top molars had a little stronger surface for fraying through food, than at the bottom teeth. The important attribute during crushing food and for the duration of functioning of teeth was the thickness of enamel. At mammoths of the time of Poozerskiy glacier the thickness of enamel gradually increased about 1.0–1.3 mm at P^3 and P_3 till 2.0–2.2 – at last molars.

Comparison of teeth parameters of studied mammoths with those of Yurovichi location which absolute age is equal on ^{14}C 26470±420, LU-125, shows that more ancient mammoths from Yurovichi were a little bit larger. So, the length of M_2 of the mammoth from Yurovichi was equaled 305-310 mm, and quantity of the teeth plates, – 23 while at investigated animals similar parameters for the second bottom molar were equaled according to 170–200 mm and 16–19 plates. The similar tendency is observed for the teeth of the baby-mammoth. The P_3 of the baby-mammoth from Yurovichi reached 70.5 mm at length, 42 mm at width and had 8 plates on a chewing surface. Baby-mammoths in Minsk had the corresponding sizes of a similar tooth – 42 mm, 28 mm and 7 plates in structure of a tooth. Besides Yurovichi mammoths had rather low frequency of plates on a chewing surface – 7.5 for M_2 while at studied animals this parameter was equal 9–10. Thickness of the teeth enamel is practically identical in animals of both populations. Teeth hypsodonty changes also coincide. Reduction of width of a chewing surface in ontogenesis is identical also. Noted parameters in morphology of teeth of mammoths were characteristic for mammoths of late type. Early mammoths which age was within the limits of 200–130 thousand years ago had other parameters of teeth. So, for M_3 of the early type *Mammuthus primigenius*, the length of a tooth is 240–260 mm, width – 75–104 mm, the hypsodont parameter of crown dents – 42–51 %, frequency of plates – 6–8, and thickness of enamel on teeth – 2.0–2.9 mm.

The noted features permit to infer a gradual, slow evolutionary processes towards smaller size in mammoths. Their teeth became more hypsodont and narrow. In structure of their teeth, the density of plates increased because of the mainly hard grassy vegetation food. Enamel thus becomes noticeably thinner.

Tusks available in the collection, which functionally played a role of the upper incisors (I3), also belonged to animals of different age. Their morphometric characteristics are given in table 2.

Table 2

Measurements of tusks (I^3) of Mammuthus primigenius (Blumenbach) from the "Mashinostroiteley" site in Minsk

Measurements (sm), indexes (%)	"Mashinostroiteley"			Yurovichi		
	young	adults	olds	young	adults	olds
Length of tusk along its curvature	40–44	56–61	170–175	50	107–117	203
Length of tusk, straight	36–39	52–54	100	43	84–87	126
Circumference of tusk at the alveolar part	12–18	17–18	38–39	-	34	40
Circumference of tusk in middle part	11–14	14–15	31–32	19	29	35
Index of curvature of tusk (2:1)	89–90	88–93	57–59	86	72–81	62

HOLOCENE PALEOGEOGRAPHICAL CHANGES IN THE LAPTEV SEA AS EVIDENCED BY SEDIMENTARY AND POLLEN RECORDS

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On the basis of pollen assemblages and sedimentary parameters (TOC content, $\delta^{13}C_{org}$, sedimentation rates) controlled by radiocarbon age model in sediment core from the Khatanga-Anabar river channel in the western Laptev Sea shelf, several phases of change associated with the last postglacial global sea-level rise can be recognized for the Holocene. Caused by a transgressing sea after the last glaciation, this core reveal progressive decreases in sedimentation rates.

Using the sedimentary and pollen records several phases of change are recognized. An early period lasted until ~10 ka BP characterized by an increased deposition of plant debris due to shelf erosion and fluvial runoff; pollen spectra of this deposits are characterized by the increasing of herb pollen with appearance of xerophytes pollen, included xeric *Artemisia*, arcto-steppe species of Caryophyllaceae and sharp decreasing of spores. Shrub tundra with *Betula* sect. *Nanae*, *Alnus fruticosus, Salix* dominated and climate was warmer than today. The presence of wood remains in this deposits (Bauch et al., 1999) shows that at this time at coastal parts of Siberia the distribution of tree and shrub vegetation begin.

A transitional phase with consistently increasing marine conditions until 6 ka BP, which was marked at its beginning near 10 ka BP by the first occurrence of marine bivalves, high TOC content and an increase in $^{13}C_{org;}$ according to pollen record in the interval 10.3-9.6 ka BP, climate became more humid and warm; extensive development of shrub vegetation with dwarf birch and sedge associations. Abundance of *Alnus fruticosus* pollen indicate warming.

A time of extremely slow deposition of sediments, commencing at ~6 ka BP and interpreted as Holocene sea-level highstand, which caused a southward retreat of the depositional centers within the now submerged river channels on the shelf; in the interval 8.5 –6.1 ka BP temperature fall and small reduced humidity of the climate was marked; tussock tundra with sedge and mosses prevailed on the adjacent land.

A final phase with the establishment of modern conditions after ~ 2 ka BP; since 1.7 ka BP until today – both the climate and vegetation are close to the present, cold and dry. The arctic tundra with mosses and severe climatic conditions (T January -36°C, T July +4°C; precipitation < 250 mm/year) were reconstructed.

INFLUENCE OF THE BRONZE AGE BURIALS ON PROPERTIES OF SOILS OF THE LOWER DON REGION

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A comparative study of soils of archaeological monuments of the Bronze age, located in various typomorphic landscapes of the Lower Don region has been carried out.

The morphological, physical and chemical properties in a system of burial mound thickness embankment – buried soil – modern soil were characterized. The macromorphological description of the soil pits was complemented with mesomorphological studies of soil samples under an MBS-10 binocular with magnification from 5 to 32 times, which makes it possible to determine the type, shape, and sizes of neoformations and inclusions. Some of them were also studied under a "Carl Zeiss" EVO series model 40 XVP scanning electron microscope at magnifications from 1000 to 10000. We have studied burial mound "Dyunny" (early Bronze age), located in the floodplain of the Don-Aksay and burial mound "Temernitsky-I" (average Bronze age), located on a watershed within the northern border city of Rostov-on-Don. At the same time modern background soils were studied.

The description of soil morphology of the paleosoil of burial mound "Temernitsky-I" showed the humus horizon limited depth, linguiform, zoodisturbance, coprolites, prismatical structure of soil horizons and a range of carbonate neoformations. These features point out at Subboreal arid steppe soils (4700–3000 years ago). The specific character of intrapedal mass horizons examinated by electron microscopic. The intrapedal material is characterized by significant looseness of packing and the disordered orientation of the particles for the horizons of modern soils and burial mound thickness embankment. The consolidated intrapedal mass of clay and silt particles and debris pedogenic carbonates is formed in the paleosoils horizons. The increase calcareous pseudomycelium forms carbonates are diagnosed at the meso- and submicromorphological levels. The development of new nodules composed of fine-grained calcite is seen on the surface of aggregates in the paleohorizons. Concentrations and single grains of lublinite are seen in the interaggregate pores. Carbonates catch up in the colloidal solution and precipitate in the form of mass collomorphic needle calcite – lublinite in a growing climatic aridification. Small aggregates of crystals of gypsum "roses" are detected in intrapedal mass. Paleochernozem carbonate nonsaline and various degrees of salinity, heavy-loamy and clay particle-size distribution dominated in the Bronze Age on the drained lofty spaces. Those soils in the Rostov region are represented by modern ordinary and southern chernozems of the East European facies.

During the Atlantic period at the area of the Don-Aksay floodplain in the Early Bronze Age (~5000 years ago) warm paleoclimatic phase was predominant that can be proved by the following features. Paleosoils is marked by a clear differentiation and

limited depth of humus horizon, though the content of humus in [A] buried horizons only 2 times less than in modern soils. Supposing the burial stops supply of fresh organic matter of plant residues but mineralization of humic substances still continues as temperature and soil moisture contribute to the activity of microorganisms, it is likely that the humus-accumulative horizon of the ancient soil exceeded the depth of the modern analogues. The buried soil was diagnosed as alluvial sod (meadow) saturated layered soil. The distribution of humus and mobile phosphates in the profiles of the paleosoils is uneven, which is caused by the presence of material of burial mound thickness embankment and the buried horizons in the soil profiles. The horizons are characterized by visible signs of gley, which morphologically leads to the development of iron-manganic nodules in the pores; brown-yellow iron and iron-humus films cover the particles of primary minerals. Manganic-humus and manganic concentrations with a size of larger than 1 cm appear on ped faces in the loci with sharp changes in the redox conditions. Thin iron films also cover the surfaces of calcareous nodules in the humus horizons. The buried soil horizons are characterized by the pronounced zoogenic structure, the clayey-humus plasma, the considerable amount of plant remains, and the presence of small well-shaped aggregates. Abundant hyphas of fungi are marked at the micro level. Throughout the profile paleosoils corresponds to the strongly alkaline pH (> 9.0), due to down migration of water-soluble substances from the burial mound thickness embankment. The diversity of the carbonate concentrations is indicative of frequent changes in the soil conditions specifying the character of the migration and precipitation of carbonates, which may be explained by the diagenetic singularities and/or by the specificity of ancient soil formation in the region. Concentrations of micrograined and fine-grained calcite are seen in the interaggregate pores and on the surface of aggregates in the paleohorizons. At the mid-depths paleosoils character of recrystallization of carbonates have been registered, manifested at the macro level in the form of a solid calcareous impregnation. There are many corroded crystals of group sodium sulphate (thenardite / mirabilite), which can be confirmed by morphological characteristics corresponding to these salt neoformations. Profile of paleosoils is characterized by weak degree of salinity (0,158–0,184 %). Features of plasma mobility in the form of sinters clay can be seen in the buried illuvial horizon [B], which reflects conditions of cyclic wetting. Organic matter is represented in the composition of plasma and iron-humus clots. A large number of inclusions as a free opal phytolites, and not entirely freed from plant tissues were found out. Their occurrence according to the location of fibers of plant residues and the valves diatoms are indicative of very wet conditions of horizon formation. That may have been alluvial-boggy conditions.

As a result of burial soils undergo changes (diagenesis), caused by new cycle of soil formation. Pedogenesis in a system of burial mound thickness embankment – buried soil is determined by a complex combination of factors: the concentration of soil solutions, the partial pressure of CO_2, soil air, moistness and evaporation within the soil mass, the drying up of the soil profile. These factors are determined by hydrothermal conditions created after the cessation of receipt of plant residues, biological activity of the initial soil and down migration of water-soluble substances from the burial mound thickness embankment.

On the basis of these studies it is shown that in a system of burial mound thickness embankment – buried soil – modern soil, there are differences, which are defined by the profile structure, contents of humus and mobile phosphates, pH levels, the depth of genetic horizons, the nature and distribution of neoformations.

VEGETATION DYNAMICS OF THE AZOV SEA REGION IN THE LATE HOLOCENE

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Holocene paleogeographical reconstructions are a key topic of modern paleoenvironmental studies mainly because of their ability to better understand and explain the modern environmental processes and their anticipated changes.

Within the frameworks of the study two cores of marine deposits in the south-eastern and north-eastern parts of the Azov Sea have been samples and investigated. Obtained high resolution pollen and radiocarbon data show that steppe vegetation was widespread in the Sea of Azov Region during the last 3000 cal. years and it was a very similar to the modern one (fig. 1). Applied sampling interval in 2–3 cm allowed us to reconstruct short-term fluctuations in vegetation cover.

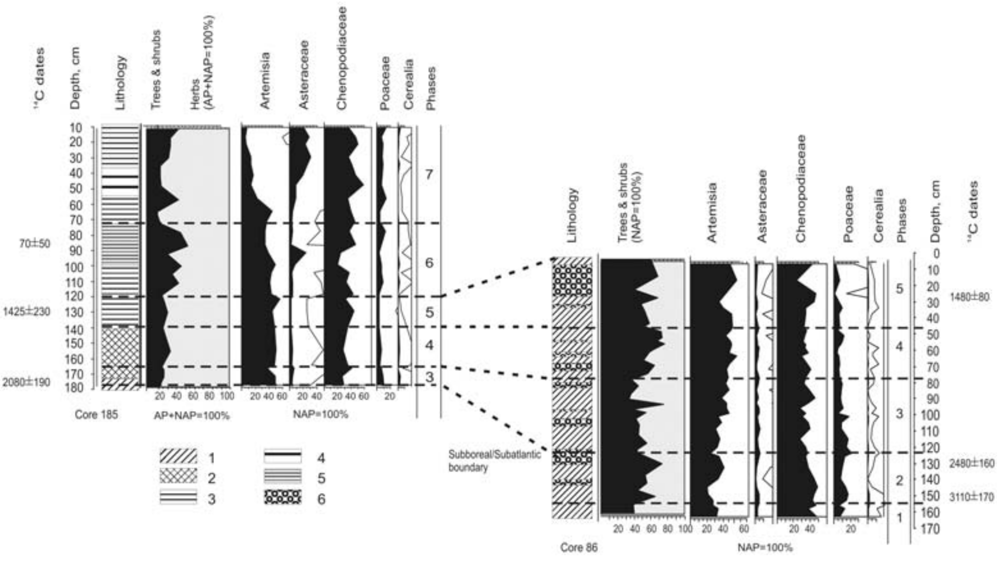

Fig. 1. Correlation of the Late Holocene deposits of the Azov sea (cores 86 and 185): 1 – clayey mud, 2 – calcareous loam, 3 – aleurite-clayey mud, 4 – fine dirty sand, 5 – argillo-arenaceous fine aleurite silt, 6 – shelly ground

Herbaceous pollen (up to 80 % in some intervals) mainly by Chenopodiaceae и *Artemisia* is dominated in pollen assemblages of investigated marine sediments. The participation of Poaceae pollen is relatively high, pollen of Apiaceae, Fabaceae, Rosaceae, Lamiaceae are constantly occurred. Pollen of the typical steppe plants (*Ephedra*, Plumbaginaceae, Dipsacaceae) are also permanent components of the spectra. These plants are very typical both in vegetation cover of the coastal area and pollen assemblages in surface sample and deposits of the sea basin.

Correlation of pollen data of two cores enables us to reconstruct seven phases of vegetation development in the Late Holocene.

Phases 1, 3, 5, 7 are characterized by very high non arboreal pollen content, and, they are probably characterized by very warm and arid conditions.

Phases 2 (2300–3000 cal yr. BP), 4 (1700–2000 cal yr. BP) and 6 (150–600 cal yr. BP) are marked by increased tree pollen value (up to 60 %), mainly due to the birch and alder. Curves of *Quercus, Tilia, Corylus* and *Carpinus* pollen formed noticeable peaks. These changes in pollen assemblages in these periods could be caused by increased forest areas in the valleys of big rivers flowing into the Azov Sea and traced more humid climatic conditions. Humidification of the area as the result of changes in precipitation and evaporation ratio in the Sea of Azov Region was favorable for the moving of forest/steppe boundary to the south. The earliest humid phase is attributed to the late Subboreal cooling that has been identified in the center in northern parts of the East European plain (Khotinski, 1977). The latest phase is obviously corresponded with the Little Ice Age, well pronounced in the natural and historical archives in the Northern Eurasia (Grove, 1988). Thus, the late Holocene trend to aridification in the Sea of Azov Region (Vronski, 1984; Isagulova, 1978) was interrupted by at least three more humid periods with duration of several centuries.

Vegetation development of the Azov Sea Region in the late Holocene was also strongly influenced by human impact, especially during the last 100 years. Pollen of cereals and other anthropogenic indicators (Brassicaceae, Cichoriaceae, *Centaurea, Rumex*, *Polygonum aviculare)* was recorded during the whole period under consideration, but their content increased notably in the last century. *Pinus* pollen is abundant in assemblages of the last 70 years from sediments in the northern part of the sea that can be connected with pine plantation to fix sand soil in the middle part of the Don River basin. A conspicuous increase of Asteraceae pollen value in assemblages of the last hundred years could be connected with plant communities on disturbed areas and/or cultivation of *Helianthus annuus.*

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CAVE BEARS WITH PATHOLOGICAL BONE CHANGES FROM THE NERUBAJSKOE (ODESSA REGION, UKRAINE)

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Late Miocene Lower Pontian limestone outcrops in the vicinity of Nerubayskoe village in as small karst plateau on the water divide of the two gullies. Limestones show a variety of karst phenomena. Karst cavities contain fluvial infillings occasionally rich in bone remains of Pleistocene mammals.

First discoveries of cave bears near Nerubajskoe village were reported by A. Nordmann (1846–1847). This researcher conducted first excavations and collected numerous remains mostly belonging to a large cave bear. Based on this material, he described a new subspecies, *Ursus spelaeus odessanus* (Nordmann, 1858).

In 2003, a new karst cavity with remains of Pleistocene mammals was discovered on the right bank of the Khadzhibei Estuary near Nerubajskoe village. The excavations, with the active participation of the first author, were conducted by the joint Ukrainian-Austrian expedition and started in the same year. The total material unearthed included 450 mammal remains with 95 % belonging to the cave bear, and the remaining bones (5%) representing *Canis cf. lupus*, *Crocuta crocuta* ssp., *Bison* sp., *Equus* sp., *Spalax* sp., and *Lepus* sp. There are two calibrated ^{14}C dates: >52 450 BP (VERA-2761) for the bones of cave bear with plesiomorphic dental features, and 16 700 (VERA-2762) for a fragment of a mammalian rib. Two sedimentation infilling cycles were thus concluded for the Nerubajskoe cave (Nagel at al., 2005).

From the year 2004 the excavations were continued by the Paleontological Museum of the Odessa University. More than 500 mammal bones, mostly belonging to a cave bear, have been collected. The excavations yielded almost intact skulls of cave bears, remains of *Rangifer tarandus, Saiga tatarica,* and birds (Orlov et al., 2005).

The analysis of the material showed that the cave bear from this location belongs to a group of *Ursus ingressus* Rabeder with plesiomorphic morphological traits (Nagel at al., 2005). Some postcranial bones of the cave bear show traces of various pathological changes and diseases.

Special attention deserves defects in the cervical vertebrae. They have a shape of massive inflows of bone substance and resemble beading wax on the candle. These nodules, occurring on the ventral surface of the vertebral body, stretch in the caudal direction. They extend beyond the borders of the articular surface and have a smooth surface. Such features are characteristic of a rare disease, flowing hyperostosis (melorheostosis), related to cases of congenital tissue dysplasia (Rusakov, 1959).

Study of bones phalanges revealed defects looking like circular patterns with sharp edges on the distal epiphysis. The cross-section shows that cancellous bone at the border of the defect is compacted. This gave us a reason to assume the development of chronic inflammatory process characteristic of uric acid diathesis (lithic diathesis) (Abrikosov, 1950; Strukov, Serov, 1985).

The inner surface of the mandibular canine shows a groove-like defect with a smooth surface. It runs on the inner surface from the apex to root and has smooth edges. In our opinion, this defect could occur due to prolonged exposure of the tooth to tangent impacts of a hard blunt object, presumably of occluding upper canine. The affected zone originated by the deviation of the lower canine outwards because of a loosening of the outer edge of its alveolus. The defect was probably caused by a decreased density of the lower canine periodontal tissue as a result of osteoporosis in alveolar region of the mandible (Rusakov, 1959).

In conclusion, it should be noted that cave bears from this locality commonly show evidence of impaired nucleoprotein metabolism mainly manifested as joint uric acid diathesis.

Characteristic defects of canines indicate the mandibular osteoporosis. Particularly noteworthy are rare congenital anomaly of the skeleton, characterized by a dramatic thickening and deformation of the body of cervical vertebrae known as flowing hyperostosis.

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CALCAREOUS NANNOPLANKTON FROM THE HOLOCENE OF THE EASTERN COAST OF SOUTH AFRICA

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One core used in this study is located directly offshore of the Mgeni River mouth, KwaZulu-Natal Bight (312850E, 6700091N, WGS 84, UTM zone 36S). The core was retrieved via vibrocoring method at 20 m depth. Total core length was 6 m, but shortened by 1 m to 5 m length due to compression during barrel penetration. Fifty samples were collected for nannoplankton identification.

Smear slides were prepared from each sample using standard techniques, and were studied under a cross-polarized light microscope at 1250× magnification. Identified assemblage of calcareous nannofossils consists of 20 species, 15 of which are relatively abundant. This assemblage demonstrated that the samples fall into the Emiliania huxleyi Acme Zone according to the Pleistocene zonation by Gartner (1977), indicating that they are not older than 50 Kyr (Lourens et al., 2004).

For palaeoclimatic reconstructions by nannofossils more than 200 coccoliths of the upper-photic species were counted and counting of the lower-photic species were done at the same time. The calcareous nannofossils are generally quite rare, which is explained by the close proximity to the shore and by the influx of fresh water from the Mgeni River.

Abundances of *Discosphaera tubifera*, *Coccolithus pelagicus*, *Pontosphaera* spp., *Calciosolenia brasiliensis*, *Rhabdosphaera clavigera* var. *clavigera* were less than 1 % in all samples, and were judged statistically insignificant for the purpose of this study. They are listed together as the "miscellaneous species". Small placoliths with a bridge structure were treated as small *Gephyrocapsa*, whereas small placoliths without a bridge were treated as small *Reticulofenestra*. At first, coccoliths of *Gephyrocapsa* were divided into *G. caribbeanica* and other forms, the latter being subdivided into three groups based on coccolith size, i.e. large (>5 μm), medium (2.5–5 μm), and small (<2.5 μm).

The angle between the long axis and the bridge of *Gephyrocapsa* coccoliths was related to temperature by Bollmann (1997). The medium and large *Gephyrocapsa* were classified into three types based on the bridge angle: high- (60–90°), intermediate- (30–60°), and low- (0–30°) angle types, which correspond to the warm, intermediate and cold temperatures, respectively.

The most dominant species is *Emiliania huxleyi* (32.3–62 %). This species is a cosmopolitan and highly eurytopic, and do not convey much palaeoenviromental information.

The second abundant and ecologically important species is *Florisphaera profunda* (7–28 %). This species normally dwells in the lower photic zone and plays a key role as an indicator of past productivity and upwelling (Winter, Jordan & Roth, 1994). According to Okada (1983, 1989) the relative abundance of *F. profunda* is just a few percent in shelf sediments but may reach 70 % on continental slopes and in deep basins. Relatively low abundance of *F. profunda* is not unexpected due to shallow water and the proximity of the Mgeni River.

The abundances of small (<2.5 μm) placolith-bearing species (*Reticulofenestra* spp. and *Gephyrocapsa* spp.) increase in eutrophic regions. The ratio of small placoliths and lower-photic species was calculated and used as a proxy of the nutrient condition in the water column, i.e. increased ratio indicates a shallower nutricline (Takahashi, Okada, 2000). This ratio fluctuates from 0 to 40.5 % (average 19.6 %) in our material. A possible explanation of the sharp changes of the ratio is in the presence of the local coastal upwelling that supplies nutrients to the photic zone and maybe also in the influence of the river influx that mixes the water mass.

The intermediate- (25.8–86.9 %) and high-angle (3.6–64.5 %) types of *Gephyrocapsa* are more abundant in the assemblage, with the low-angle type being less significant (1.8–32.9 %); this is indicative of a rather warm conditions with fluctuations.

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CLIMATE CHANGES AND LARGE MAMMAL DISPERSAL DURING THE QUATERNARY: A MEDITERRANEAN PERSPECTIVE

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During the Quaternary, Earth's climate underwent a significant evolution: climatic oscillations were a recurring phenomenon, and took place on different temporal and geographic scales, from gradual, long term trends of warming and cooling (mainly driven by tectonic processes, on time scales of hundreds of thousands to millions of years), to rhythmic or periodic cycles (triggered by orbital processes with roughly hundred-thousand year cycles), to rare, rapid aberrant shifts and extreme climate transitions lasting thousand years (Zaachos et al., 2001). The multifaceted and intriguing evolutionary history of mammals, which led to the present day's biodiversity and biogeographical settings, mingles with those of palaeogeographic, climatic and environmental changes.

A number of sequences of ecological and dispersal events have been seen as developing on a backdrop of climatic oscillations, both warming and cooling phases, although cooling episodes seem to have had the most significance at the middle latitudes. The Quaternary period is especially appropriate to investigate as to the actual impact that rhythmic/periodic cycles – as well as the increased potential for isolation of populations due to environmental fragmentation and multiple rearrangement of climatic zones – had on evolution, dispersal and extinction of late Cenozoic large mammals, which are generally believed to have less environmental sensitivity than other organisms (e.g. Dysesius, Jansson, 2000; Barnosky, 2005; van Dam et al., 2006).

The Mediterranean basin, with its complex physiography, climatic heterogeneity, presence of important geographical and ecological barriers experienced, throughout the Quaternary, a long and complex history of species turnover, invasions, and competitive exclusion, as well as the origination of endemic species and prolonged survivals of some taxa in refugium areas. Turnover pulses as well as first/last appearances scattered bioevents (local evolution, dispersal, extinction) – which was regionally sometimes synchronous but often diachronous – led to a progressive reconstruction of mammalian faunal complexes that lasted into the so-called megafaunal extinctions.

From a paleobiogeographical point of view, the late Cenozoic Western Mediterranean palaeocenochrons originated from a mosaic of species of varying geographical origin and provenance. Over time, the range of several taxa reached the North Mediterranean region. A number of dispersal "routes" ended up in the Italian and Iberian peninsulas, whereas faunal interchanges with central and southeastern Europe mainly concerned French and Balkan-Greek territories, respectively (Kostopoulos et al., 2007). Most were among taxa which dispersed towards the North Mediterranean from the East, originating in Asia. Some were of African origin and few dispersed from South Asia. The dispersal towards and across the North Mediterranean of taxa – either originating in Asia or entering Asia from North America – involved, at different times, mainly ungulates (among others, *Equus, Stephanorhinus, Coelodonta, Sus,* Megacerini, Cervini, *Bison,* Antilopini, Caprini including "Ovibovini"), with few carnivores (as *Lycaon (Xenocyon) falconeri*). Among taxa of large mammals that dispersed from Africa during the Late Pliocene and the Quaternary, some spread to Asia but not to Western Europe (among others, *Elephas, Giraffa, Hippotragus, Oryx, Damalops* and *Kolpochoerus,* although the latter may be confined to the Levant) or vice versa (among others, *Parahyaena, Panthera pardus, Panthera "leo"*), while some others appeared almost at the same time in Europe and Asia (e.g., *Theropithecus* cf. *Theropithecus oswaldi, Pachycrocuta brevirostris,* archaic *Mammuthus*). A few others appeared in Asia earlier than in Europe (e.g. *Potamochoerus,?Palaeoloxodon*) or, perhaps, vice versa (? *Canis* ex gr. *C. etruscus)* (see for instance Martinez-Navarro 2004; Martinez-Navarro et al., 2007; Hughens et al., 2008; Lacombat et al., 2008; O'Regan et al., 2009; and references in those papers). The main bioevents in the dispersal of "African" and Asian taxa, were mostly triggered by major global climatic changes (noticeably cold-shift oscillations around 2.6 and 1.0 Ma), to which large mammals more frequently reacted not by evolving and producing new species, but by varying their range, in keeping with the vegetation cover and latitudinal displacement of biomes. Over time, the appearance of such newcomers in the North Mediterranean modified the structure of the preexisting mammalian faunas, altering the internal equilibrium of palaeocommunities, perhaps removing keystone species and giving rise to new inter-guild and intra-guild dynamics. Diachroneity in local turnover across the North Mediterranean would probably have relied on differences in local dynamic patterns of competition/coevolution even if the different manifestations of global climate changes in different geographic settings would have contributed to the scale of local bioevents.

Available evidence suggests that during the last 3 Ma (excluding the manifold phenomenon of Late Pleistocene megafaunal extinctions), only the main global climate changes (particular changes in periodicity) triggered significant faunal dispersals and taxonomical turnovers. Some other progressive faunal changes developed during periods exceeding Milankovitch's cycles as the cumulative result of the responses of individual species to climate change, contraction and expansion of species range, and reassessment of biotic interactions.

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THE EARLY TO MIDDLE PLEISTOCENE ITALIAN BOVIDAE: BIOCHRONOLOGY AND PALAEOECOLOGY

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During the Quaternary, in Italy, as in Eurasia, bovids are common elements in local faunal assemblages (LFAs). Their dispersion and commonness varies over time and across the peninsula due to a multiple set of factors, including physiography and multifaceted environmental conditions across the peninsula, discontinuity in the fossil record, ecological and taphonomical biases, etc.

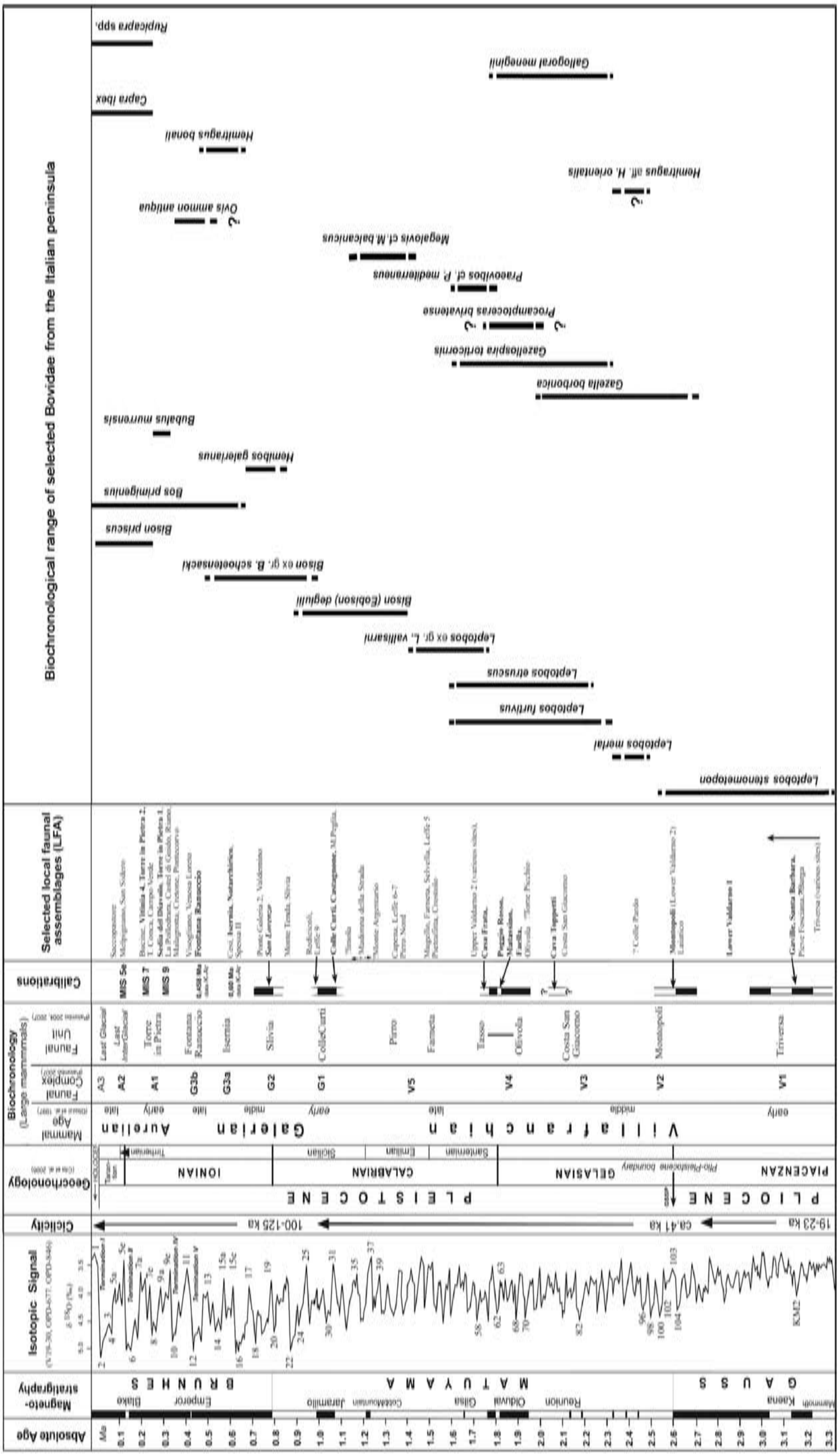
The richness of the Italian Bovidae is less than in most regions of the North Mediterranean. A few European genera of different tribes, such as *Saiga, Ammotragus, Caprovis, Soergelia* and *Ovibos*, are missing (Palombo, 2009) as well as some species which seem to be either endemic in the North Eastern Mediterranean (*Euthyceros thessalicus*, *Antilope* (= *Parastrepsiceros*) *koufosi*) or even present in the Black Sea area (*Pontoceros ambiguus*) (Kostopoulos, 2006; Crégut-Bonnoure, 2007). Conversely, few species either endemic (e.g. *Hemitragus galerianus*) or rarely reported in Europe (e.g. *Bubalus murrensis*) are recorded from the Italian peninsula.

Throughout the Early and the early Middle Pleistocene, the diversity and ecological role of Italian bovids have been changing in LFAs as well as in faunal units (FUs). During the Gelasian and the Early Calabrian (from Montopoli to Tasso FU), species of the genus *Leptobos*, sometimes found in association with small bovids mainly Antilopini and Caprini, are definitely the most frequent (Gentili, Masini, 2005) (tab. 1). This time span shows the highest bovid diversity which peaks at the time of the Olivola FU. Almost all ecological categories are represented, though the percentage of large bovids increases throughout the early late Villafranchian (fig. 1). During the following Early Pleistocene (Farneta, Pirro and Collecurti FUs), diversity dramatically decreased. A number of middle and early late Villafranchian taxa disappeared, while representatives of the genus *Bison* replaced *Leptobos,* and among middle sized bovids only *Megalovis* is thus far recorded in the Pirro Nord LFA (tab. 1; fig. 1). During the Middle Pleistocene, diversity of bovids progressively increased due to the appearance of both large and very large Bovini (*Hemibos galerianus*, *Bos primigenius* and then *Bubalus murrensis*) and Caprini as well. Among the latter, *Hemitragus bonali* and *Ovis ammon antiqua* are reported from a few early Middle Pleistocene sites, whereas *Capra ibex* and *Rupicapra,* which appeared at the end of the Middle Pleistocene, are more frequent throughout the Late Pleistocene.

Several methods are applied here in the attempt to analyze the reasons behind the presence/absence of different Bovidae in the Italian LFAs during the Early to Middle Pleistocene. The fluctuation in time of ecological groups – defined on the basis of their body mass, locomotory adaptation, feeding behavior, and preferred habitat – have finally been discussed in relation to the changing structure of Italian large mammal palaeocommunities.

Table 1

Integrated chronological scheme for the Late Pliocene to Late Pleistocene Bovidae record of the Italian peninsula



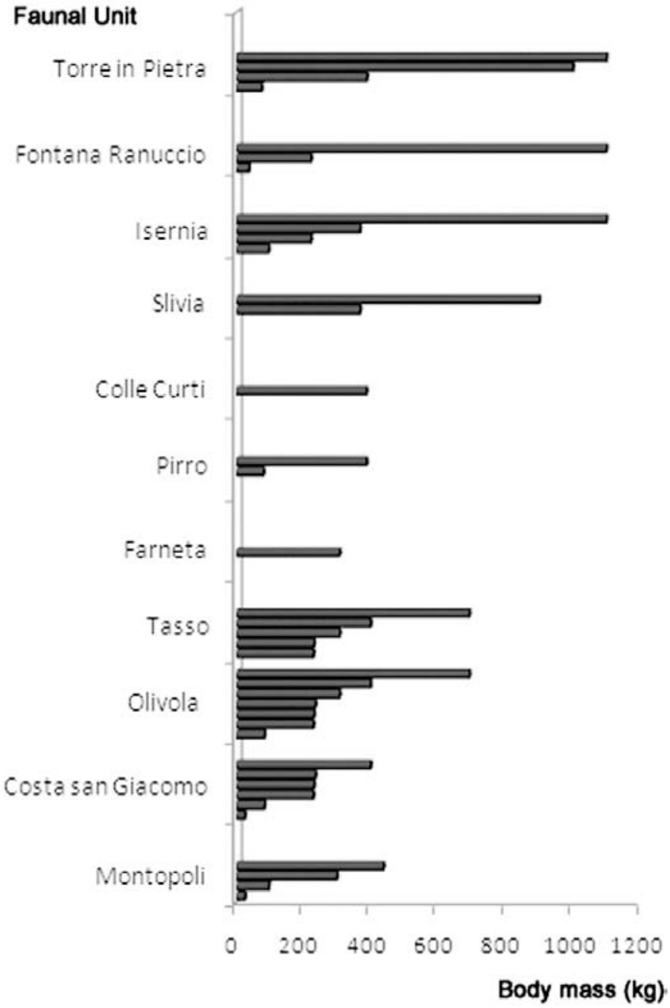


Fig. 1. Body mass distribution of selected species of Bovidae in Italian faunal complexes (FUs) from the Early to Middle Pleistocene

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NEW DATA ABOUT THE SKULL OF THE *ELASMOTHERIUM SIBIRICUM*

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The *Elasmotherium* is a giant rhinoceros, which lived in the Late Pliocene – Middle Pleistocene of the Eurasia. This animal occupied an important position in the Pliocene – Pleistocene ecosystems along with the elephants. There were found a lot of skeletal remains of *Elasmotherium* in Eastern Eurasia, mostly as isolated teeth, fragments of skulls and mandibles, bones of postcranial skeleton. The information about these remains is rather scant, as a rule. In this connection, we studied four complete and 11 partial skulls of *Elasmotherium* stored in the collection of the Zoological Institute of the Russian Academy of Sciences, Paleontological Institute of the Russian Academy of Sciences, Central Museum of Geological Exploration, Saint-Petersburg State Mining Institute, Vernadsky State Geological Museum, Stukenberg Museum of Geology and Mineralogy of Kazan State University. All the specimens come from the localities of the Volga region. The skull from Luchka (ZIN 10792), which was designated as lectotype *Elasmotherium sibiricum* Fischer, 1809 has been also investigated. The skulls were compared with specimens from Tokmak (Late Pliocene), Liventsovka (Late Pliocene) and Zelenokumsk.

The investigation has shown that the skulls are similar to each other by general features. At the same time there are some various signs. One part of the skulls has got not a big occipital crest and not a big width in mastoid, and also a weak roughness of a frontal bone, triangular nuchal fossa and mastoids, which not protrude beyond the level of the orbits. The other part of skulls has a wide occipital crest, a big width in mastoid, strongly developed roughness of a frontal bone, oval nuchal fossa and mastoid protrudes beyond the level of the orbits. Comparison of the sizes of skulls *Elasmotherium* from the Volga region has shown that on the general sizes they are similar to *E. chaprovicum* from Liventsovka and with *Elasmotherium* from Tokmaka, which at first has been determined as *E. caucasicum*, and they were redefined, as *E. peii*.

All the studied sculls of the Volga region correspond to the lectotype of *Elasmotherium sibiricum* in general morphological and morphometric features. Morphological and morphometric differences that were revealed most probably reflect the sexual dimorphism, rather than individual, geographical, or geological distinctions. This is clearly expressed in some fossil and modern forms of Rhinocerotidae Gray, 1821. Firstly, it is evidenced by the fact that all studied skulls belonged to adults and sexually mature animals, as all sutures on the skulls are obliterated and septum are completely ossified. Secondly, it is indicated by the fact that same localities produced skulls with different features. For example, among four *Elasmotherium* skulls from Luchka, two (ZIN 10792, SNM 8470) do not have a strong occipital crest and triangular nuchal fossa, whereas the other two (ZIN 10794, 10795) show a very wide occipital crest and oval nuchal fossa. Thirdly, similarity of the skull sizes of *E. sibiricum* from the Volga region with that of Late Pliocene Liventsovka and Tokmak forms indicate a very weak cranial variability in *Elasmotherium* through the studied geological period.

Thus, our study shows the possibility to attribute skulls of *E. sibiricum* to sexes. To Females of *E. sibiricum* are represented by individuals with a moderate occipital crest and not a big width in mastoid, with a weak roughness of a frontal bone, triangular nuchal fossa and mastoids, which not protrude beyond the level of the orbits. Skulls with wide occipital crest, big width in mastoid, strongly developed roughness of a frontal bone, oval nuchal fossa and mastoid, which protrudes beyond the level of the orbits, should be referred to males.

NEW DATA ON PLIOCENE VOLE FAUNA FROM ZVERINOGOLOVSKOYE LOCALITY (SOUTHERN TRANS-URALS REGION)

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Zverinogolovskoye is the only locality known in the Southern Trans-Urals region providing information on the history of the micromammal fauna of the region in Pliocene. The locality is situated in the basin of Tobol River near Zverinogolovskoye settlement (Kurgan Region, Zverinigolovsky district). The field campaigns in 1970-72 (collected by A.G. Maleeva), 1991, 1994, 1995 (collected by N.V. Pogodina) have produced a collection of small vertebrates (Stefanovskii, Pogodina, 2005). New remains of micromammals from bed sands (exposure 109) were found during the field campaign in 2009 (fig. 1). Small bone fragments, isolated arvicoline and lagomorph teeth are revealed. This paper focuses on the arvicoline molars. 63 molars were studied.

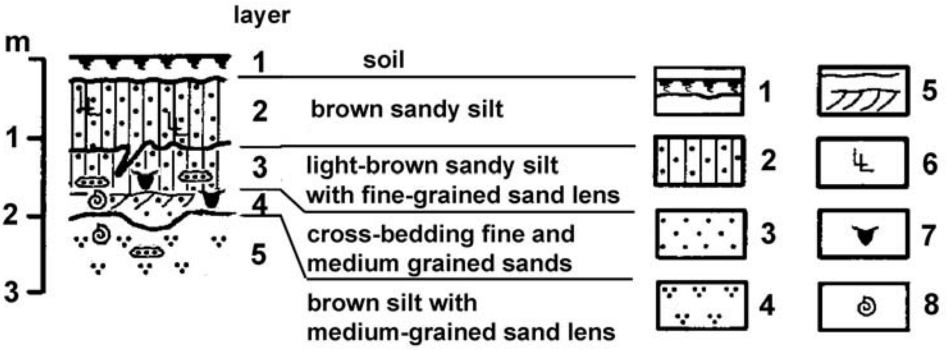

Fig. 1. Section Zverinogolovskoye (exposure 109).
Caption: 1 – soil, 2 – sandy silt, 3 – sand, 4 – silt, 5 – cross-bedding, 6 – calcareous concretions, 7 – remains of mammals, 8 – shells of mollusks

The large number of molars were identified as belonging to four species.

1. *Mimomys hintoni* Feifar, 1961: a medium-size molars with relatively wide occlusal surface. Cement accumulations are moderate. Dentine tracts are not high. Enamel islet is not yet formed in young molars being present as an islet fold. The islet fold reduces when the crown height is about 3,2 mm (rhizodont stage), islet is slightly oval and long persistent.

2. *M. cf. reidi* Hinton, 1910*:* Cement accumulations are more abundant. The young animals have enamel islet, it is round and quickly disappeared wish wear.

3. *Promimomys baschkirica* (Suchov, 1970) – a medium-size molars with relatively narrow occlusal surface. Cement accumulations are sparse. The dentine tracts are high. Enamel islet is small and round. The islet fold reduces when the crown height is about 3,8 mm (merhorhiz stage).

4. *Borsodia novoasovica* Topachevsky et Scorik, 1977 – a medium-size molars without cement. *Mimomys* ridge is well developed.

Also species *Pliomys* sp., *M. hajnackensis* Feifar, 1961, *M. polonicus* Kowalski, 1960, *Promimomys gracilis* Kretzoi, 1959 were recognized. So the fauna of Zverinogolovskoye locality comprises the usual species, occurring in the Western Europe, Russian Plain, and West Siberia.

The variability of the height of dentine tracts was studied. The analysis of heights of dentine tracts of the posterior prism of first lower molar (m1) is of the greatest interest (fig. 2).

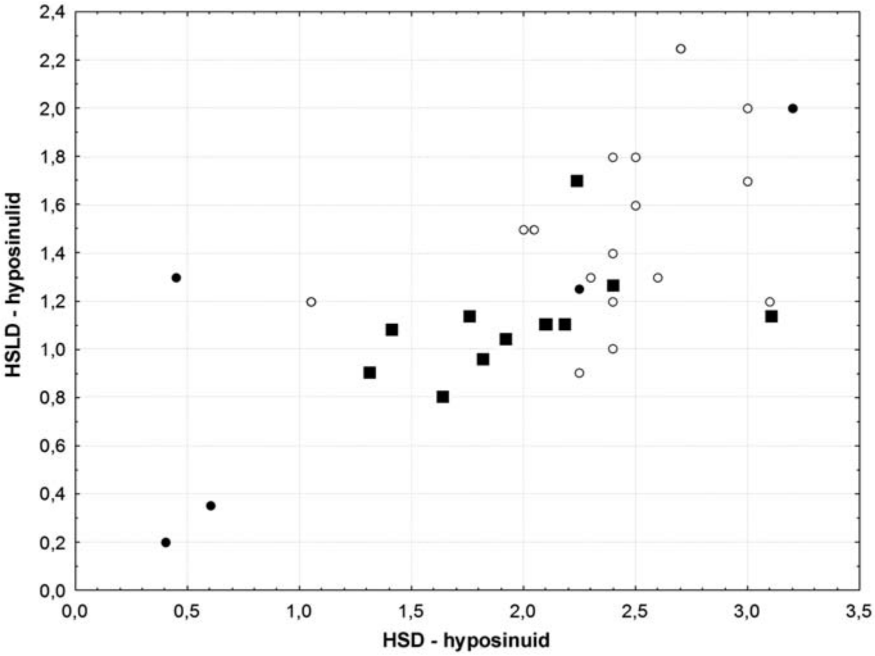

Fig. 2. Heights of dentine tracts of the posterior prism of m1 from the locality Zverinogolovskoye.
Ages: • – 1970–72, 1991; ◦ – 1994–95; ▪ – 2009.
HSD – labial dentine tract; HSLD – lingual dentine tract

The molars with medium dentine tracts are dominated in the collection of 2009. The considerable part of undamaged material belonged to species *M. hintoni* and *M.* cf. *reidi*. The molars with medium (*M. hintoni, B. novoasovica)* and high (*P. baschkirica*) dentine tracts presents in the collections of 1994–95. The collections of 1970–72, 1991 are the most heterogeneous. The molars of species *Pliomys* sp., *M. hajnackensis, P. gracilis* with the lowest dentine tracts were found in these years. This study shows that the collections of the fossils from Zverinogolovskoye locality contain molars of the different evolutionary levels. The collections of 1994–95 and 2009 are relatively homogeneous.

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HISTORY OF *SPERMOPHILUS* SPECIES, AS IT HAS BEEN READ THROUGH THE TEETH

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The history of speciation and spreading of the ground squirrels of the South Black Sea area, as it is presented here, is based mostly on the occlusive surface studying. The main purpose of the investigation was improving the *Spermophilus* isolated cheek teeth diagnostic methods (species *S. pygmaeus, S. citellus, S. odessanus*[1], *S. suslicus* and *S. xanthoprymnus*); it means the possibility of successful determination of fossil material. The set of studied characters is shown on fig. 1. The characters presence/absence seems to be linked with such important features as proportions of tooth, distance between main crests, structural density. The studied discrete features form specific complexes with clear diagnostic significance (citellus-, pygmaeus, odessanus-tend complexes, and plesiomorphic one). Besides, the present study allows us to propose for mentioned species the scheme of their phylogeny and the sequence of their appearance in the Northern Black Sea region. The received conclusions are based mainly on the recent material studying; some fossil material was used for proving obtained diagnostic models.

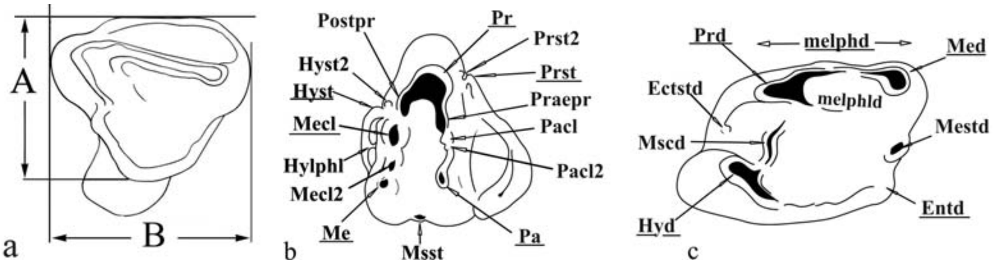

Fig. 1. Dimensional and discrete characters of the *Spermophilus* cheek teeth using in the paper.

a) A – length M^3 (*S. citellus*), B – width M^3. Upper teeth **b**) and lower teeth (**c**) discrete characters: pr(d) –protocone (-id), pa – paracone, me(d) – metacone(-id), mecl – metaconule, mecl2 – double metaconule, pacl – paraconule, pacl2 – double paraconule, prst – protostile, hyst – hypostile, past2 – double protostile, hyst2 – double hypostile, msst – mesostile, hylphl – hypolophule, mestd – metastilid, ectstd – ectostilid, melphd –metalophid, melphld – metalophulid, entd – entoconid. Some continually present structures (mentioned in the text, but non-analyzed) are shown also. They are underlined

Analysis of the discrete characters occurrence frequencies, as well as the discriminant analysis has shown that *S. citellus* is the most separated species among the studied species inhabiting Ukraine. Zagorodniuk (2002), basing on the species karyotyps, suggested that *S. citellus* linked *S. xanthoprymnus* and other studied species. At the first sight, it seems to be true. The morphological difference between *S. citellus* and *S. pygmaeus* & *S. odessanus*

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[1] The author shares existing opinion about specific status of 34-chromosome and 36-chromosome spotted ground squirrels (Liapunova, 2007) and use for the latter the name *odessanus*, after Zagorodniuk, 2002).

& *S. suslicus* is based on the archaism of *S. citellus* dentition. Bunodont upper cheek teeth with wide cingulums are characteristic for *S. citellus*, hence high frequency of mesostile observes, hypolophule sometimes presents. But the absence of some conules (paraconule, paraconule2 and metaconule2, protostile2 and hypostile2) is characteristic for *S. citellus* too. Paracone and metacone of *S. citellus* are distinctly separated cusps whereas the main crests of upper teeth are relatively weak (paralophe, as a rule, has a notch in the middle, instead of any additional cusps). This last circumstance allows us to reject the assumption about *S. citellus* ancestrity for any of other species under study. *S. citellus* simply does not have the morphological elements, which create dentition specificity in these species, and, at the same time, *S. citellus* dentition is "archaic".

The only possible connecting link between *S. xanthoprymnus* and *S. odessanus* & *S. suslicus* is *S. pygmaeus*. This species is bunodont also, but has additional cusps of the upper main crests (odessanus-complex of features). It would be necessary base for developing of the high main crests, characteristic for "the spotted species". Cusps transforming into the crests is "advanced" tend, which adopted for all respectable herbivores. In the *Spermophilus* case it has led to increasing of strict grass-feeding specialization observed in "the spotted species". Protostile2 and hypostile2 also make closer *S. pygmaeus* and both "the spotted sousliks".

Continual features of P^4-M^2 (ratio of metolophe and protocone height, see fig. 2) and dimensional and non-dimensional characters of M^3 demonstrate, on the contrary, the distinct differentiation of *S. pygmaeus* and group "*S. citellus*, *S. odessanus*, *S. suslicus*".

Variability of the low cheek teeth doesn't show such duality: both continual characters (reduction of P_4 hypoconid), and discrete ones indicate *S. pygmaeus* to be the mostly separated. The discrete characters of the lower cheek teeth of the small ground squirrels form pygmaeus-complex (relatively high frequency of mesostilid, mesoconid and ectostilid). These features discriminate between *S. pygmaeus* and "the spotted" species, and reflect plesiomorphism of *S. pygmaeus* teeth.

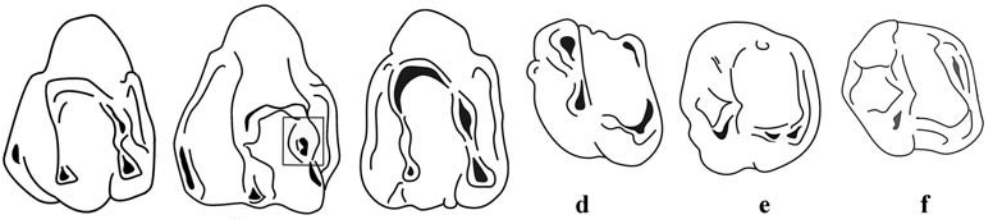
Thus, "spotted" ground squirrels inherit odessanus-complex, but in transfigurated advanced form. Besides, they, in unequal degree, lose pygmaeus-complex because of shortenings of the molars. *S. suslicus* looks more primitive than *S. odessanus* from this side, though *S. odessanus* is relatively more ancient (after Povodyrenko, Recovets, 2003, it is present in the Holsteinian faunas of the Bug area). All these facts allow to suggest the descendance of both "spotted species" from *S. pygmaeus* stem, and *S. odessanus* derived far earlier then *S. suslicus*. Otherwise both events would be simultaneous but *S. suslicus* would need less prominent grass-feeding adaptations.

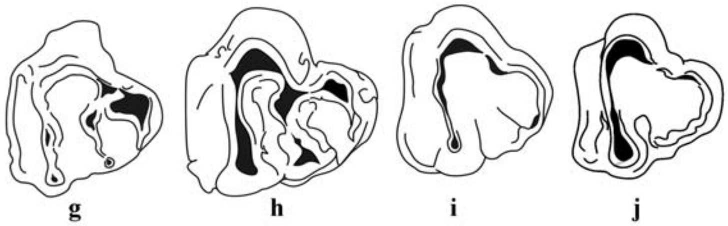
The first version looks justified better. There were no attempts to distinguish fossils of *S. odessanus* and *S. suslicus*, but generally speaking, living space for *S. suslicus* had emerged by the Holocene only. The recent geographic range of this species during the Late Pleistocene was occupied by *S. severskensis*, which was completely unlike *S. suslicus* and was hardly allied. The areas to the south were occupied by *S. pygmaeus* and allied to him *S. musicoides* since the second half of the Cromerian (Tiraspol fauna Tichonovka2). Western, left-bank Dnieper areas were inhabited by *S. odessanus* since early Holsteinian, after Povodyrenko, Recovets (2003).

Noticeable the resemblance in M^3 pattern exists between *S. suslicus* and other Holocene invader of Ukraine area (after Gromov et al., 1965) – *S. citellus*. The both species never need adapt themselves to severe conditions of tundra-steppe.

S. xanthoprymnus is the owner of all three specific complexes of occlusive characters: *citellus*-, *odessanus*- and *pygmaeus*-complexes, in other words, it is plesiomorphic.

This species is a fit contender to be an ancestor of the other species under study (fig. 3). The phylogeny proposed on fig. 3 is tentative, because data concerning extinct species are not considered here.





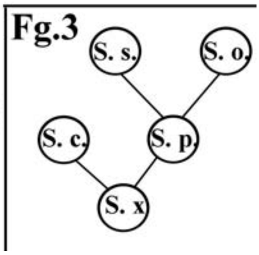

Fg.3

Fig. 2. a-c – protocone and upper main crests in *S. odessanus* (P^4), *S. pygmaeus* (P^4) and *S. citellus* (M^1); d-f – P_4 hypoconid: unreduced one in *S. citellus* and reduced in *S. pygmaeus* (e, f). Typical structure of M^3 in *S. odessanus* (g), *S. pygmaeus* (h), *S. citellus* (i) and *S. suslicus* (j). All teeth are left

THE FAUNISTIC ASSOCIACION AND EVOLUTION OF BIOCOENOSIS OF THE PERIGLACIAL ZONE OF EURASIA IN THE LATE PLEISTOCENE

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Most recently periglaciation occurred during the Würm (Valdai, Weichselian), within which a variety of cool, warm, moist and arid phases (interstages, interphases, cryostages, palinozones etc.) can be identified. Climatic variability complicated the formation of biocoenoses in the hyperzone and their stability. At this time in the periglacial zone, tundra-steppe conditions produced a specific community of fauna and flora. Among trees dominating the remaining arboreal pollen were a coenosis of dwarf birch *Betula nana* (a representative of forest-tundra and northern taiga) and pine *Pinus*. These co-occurred with *Ephedra* and *Sphagnum*. In the coldest phases vegetation comprised a birch forest-steppe but was dominated by grasses of tundra environment. The flora was similar to that of modern Western Taimyr (Paleogeography of Europe, 1982).

In some parts of Western Europe at this time Arctic alpine plants such as *Selaginella selaginoides*, *Salix* ex. gr. *polaris*, *Polygonum viviparum*, *Potentilla* cf. *nivea* have been recorded. Open cold steppe with some trees and cereals was present at higher altitude (placores) while small shrubs and abundant grasses were only found in river meadows. Large herbivores such as mammoth, deer, and horse were recorded there feeding mainly on meadow cereals (Poacea), sedges *Carex*, willow *Salix*, birch *Betula* and alder *Alnus*.

In our opinion the mixed (periglacial) faunas of Eurasia are natural historical formations occurring in certain specific (tundra-steppe) ecosystems of the hyperzone.

Species were associated to certain coenoses within this zone. Open steppe fauna (*Ochotona spelaeus*, *Allactaga jaculus*, *Spermophilus severskensis*, *S. superciliosus*, *Lagurus lagurus*, *Eolagurus luteus*, *Equus latipes*) was ecologically associated with open parts of watersheds and uplands (arid steppe). Tundra species (*Dicrostonyx gulielmi*, *Microtus gregalis*, *Lemmus sibiricus*, *Alopex lagopus*, and perhaps *Mammuthus primigenius*) were probably present in low-lying areas of the cold steppe. In the typical hyperzone lemming fauna of Eastern Europe the arvaloid field voles (groups similar to *Microtus arvalis*), as well as representatives of. Muridae, forest voles (*Clethrionomys*), dormouse (Gliridae) and also some other species, were absent. These fauna were present in Western European and partly Asia biocoenoces of the hyperzone.

Some species of mammals of the hyperzone were of large size (*Microtus gregalis*, *M. oeconomus*, *Lagurus lagurus*, *Eolagurus luteus*), which suggests they occupied a low-temperature tundra environment. Taxa had also more complicated occlusal tooth morphologies than the modern species (Arvicolidae, Sciuridae) which indicate that they were inhabitants of arid steppe. Other species had either higher tooth crowns (*Lepus*, *Equus*) or broader distal parts of extremities (*Allactaga*, *Equus*).

The periglacial zone was not faunally homogeneous. For example, around latitude 50-55° north (typical hyper zone) ecosystems of shrub tundra-steppe with parts of forest-tundra dominated. They were populated by the genera *Dicrostonyx*, *Lemmus*, *Ovibos*, *Gulo*, *Mammuthus*, *Rangifer*, *Alopex*, *Lagopus*, *M.* (*Stenocranius*). At the same time the species of the open steppe (*Ochotona*, *Spermophilus*, *Marmota*, *Allactaga*, *Lagurus*, *Eolagurus*, *Equus*, *Bison*) were more prevalent in the south.

Eastwards (up to Transbaikalia) *Mammuthus* and *Rangifer* were rare and *Ovibos*, *Alopex*, and *Dicrostonyx* were absent. The species *Poephagus baikalensis*, *Spiroceros kiakhtensis*, *Procapra gutturosa*, *Microtus brandti*, *Lepus tolai*, characteristic of eastern regions, were present. Westwards, steppe species become more rare, especially those of the following genera *Ochotona*, *Allactaga*, *Lagurini*, while variety of ecologically more plastic groups, such as *Apodemus*, *Arvicola*, *Microtus*, *Cervus*, and *Capreolus*, has increased.

The ecological structure of the hyperzone should be viewed as a set of narrow specialized (tundra, steppe and inter zonal) and co-adaptive niches. Homeostasis of the populations and the evolution of coenosis were supported at the expense of the action of elementary mechanisms of microevolution (mutation, isolation, selections). Population waves, especially of such groups as *Dicrostonyx*, *Lagurus*, *Microtus* (*Stenocranius*), took place, which is proved by their mass quantity. A special adaptive ecologically stable system might be formed this way, in this adaptive zone the adaptability ecologically different group remained entirely constant. The taxonomic and ecological combination which occurred here (mainly in migrations of species) was a program mechanism of the biosystem development in time. Any changes in such a system etc. were a kind of "mutation" in biocoenosis (often by saltation changes), the main dynamic force of the evolution of the integrated system.

At the taxonomic level this appeared as comparatively raid development of new species or subspecies. For example, *Spermophilus severskensis*, *S. superciliosus*, *Distrostonyx gulielmi*, *Lepus tanaiticus*, *Ochotona spelaeus*, *Equus latip*es, or at the subspecific level taxa such as *Microtus gregalis kriogenicus, M. gregalis erogovi*, *M. oeconomus major*, *Eolagurus luteus antecedens, Lagurus lagurus major*, *Cricetulus migratorius parvus* or *Alactaga jaculus severskensis*. Selection pressures moved and periodically become stabilizing. The latter process is characteristic of *Arvicola*, *Lemmus*, Carnivora.

In terms of the formation of phytocoenosis, xerophilic plants were the main components; for example, wormwood, cereals, ephedra, chicory, birch. These groups populated placores and were relatively stable. Mammal species that occupied this phytocoenosis were mainly of the steppe ecosystem (*Lagurus*, *Spermophilus*, *Ochotona*). The main evolution of ecosystems of the hyperzone took place in interzone at the expense of xerophobic plants (ferns, lycopodium, selaginella, alder-tree). This coenosis was not greatly influenced by stabilizing selection and was the most dynamic during the climate changes. Its evolutionary potential was secured by the absence of narrow specialization.

From the point of view of the macroevolution, xerophobic groups are phylogenetically young taxa, with high speeds of evolutionary transformations. The xerophobic ecosystems were in reserve during the formation of mesophyll or steppe ecosystems during a warmer climate in interphases and interstadials and at the final stage of Würm and in the Holocene. The mammal fauna, and in particular micromammals inhabiting moist ecosystems, displayed comparatively rapid evolution (*Dicrostonyx gulielmi*, *Microtus* and Lagurini). Their taxonomic diversity grew also mainly at the expense of the recognition of subspecies.

In such case periglacial coenosis is one of the most suitable models of the evolution of biosystems: their formation, stable existence and distraction. At certain stages of such dynamics the evolution of the system had a non-coherent (uncoordinated) character, which became apparent through the crisis of populations-increase of quantity (population waves and quantum evolution). It is characteristic of many population of Arvicolidae, *Lepus*, *Spermophilus* and phytocoenosis.

VEGETATION AND CLIMATE DYNAMICS THROUGH LATE GLACIAL TO MIDDLE HOLOCENE DERIVED FROM PECHORA SEA POLLEN RECORDS

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The study is aimed at the reconstruction of the major paleogeographic events in the Pechora Sea Region through the Late Weichselian-to-Middle Holocene based on the data from pollen analysis. Both terrestrial (spores and pollen) and aquatic (dynoflagellate cysts, chlorococcal algae) palynomorphs were studied in piston core 24 and borehole 109 recovered from the submarine continental valley eastward from Kolguev Island (fig. 1). The age model of the sections investigated is based on litho-, seismostratigraphic and pollen data supported by correlation with AMS^{14}C age-controlled adjacent borehole 104 (Polyak et al., 2000) as well as diatom and microfaunal data from our studied sections (Kostin et al., 1988).

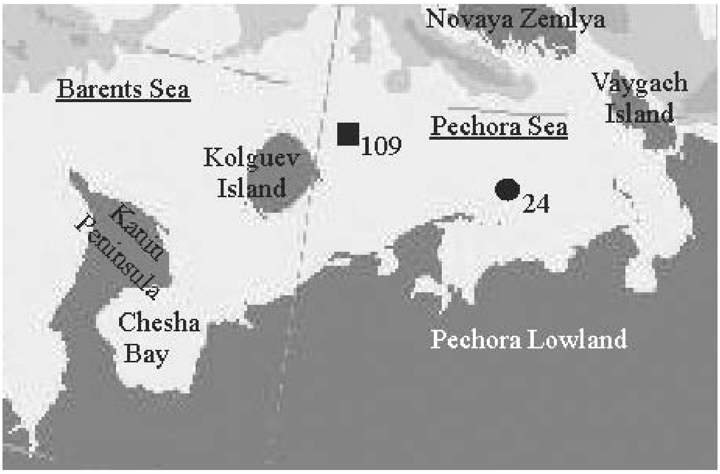

Fig. 1. Overview map of the Pechora Sea Region with location of the investigated sections: piston core 24 – length – 1,2 m; water depth – 17 m; borehole 109 – length – 41,6 m; water depth – 21 m

Borehole 109 displays 7-m-thick Late Weichselian glacial diamicton at the base of the Quaternary sequence, which unconformably overlies laminated Lower Cretaceous bedrock at the core depth of 11.6 m. It is characterized by only sporadic occurrence of single grains of pollen and spores of Quaternary age (mainly *Betula* sect. *Nanae* and *Sphagnum* sp.) in contrast to large amount of reworked pollen of Mesozoic conifers (*Protohaploxypinus* sp., *Piceapollenites variabiliformis* Bolch., *Paleoconiferus asaccatus* Bolch., *Protoabietipites* Maljavkina, *Picea gigantissima* Bolch.) and various spores of mainly formal genus. No traces of any aquatic palynomorphs were recovered in that part of the section.

Up the section, the 5-m-thick dark gray mud intercalates with silts being the analog of the 0,85-m-thick basal layer of the core section 24, which additionally contained abundant pebble and gravel clusters. This litostratigraphic unit corresponds to the topmost part of the second seismostratigraphic unit of the Pechora

Sea (Gritzenko, Krapivner, 1989). L. Polyak et al. (2000) consider the grayish mud in the western Pechora Sea to be analogous to the Last Glacial Maximum glaciomarine till of the Barents Sea. Pollen diagram 109 shows 2 pollen zones in that part of the section. The first one is dominated by non-arboreal pollen and well-floating spores *Polypodiaceae* and *Sphagnales*. Pollen data give evidence for the extremely unfavourable environmental conditions as only xerophilous open steppe-like communities with wormwood, cereals and different composite predominated on watersheds, whereas tundra-like communities with dwarf birch, arctic willows, dryads and sedges were common within the slightly more humid lowland coastal refuges. High portion of herbs in palynospectra and extremely low diversity of the aquatic palynomorphs represented by scarce freshwater chlorococcalean algae *Pediastrum kawraiskii* Schmidle 1897 and *P. duplex* Meyen 1829 indicate shallow-water prodeltaic conditions due to the sea-level fall and close location of the former coastline. Another one argument is the absence of marine dynoflagellate cysts in dark gray mud and extremely low concentration of diatom valves (Kostin et al., 1988). Palynospectra of this pollen zone closely resemble those recorded in adjacent areas: Taimyr Lowland (Andreev et al., 2002), Novaya Zemlya (Serebryannyi et al., 1998) and Kolguev shelf (Baranovskaya et al., 1976; Veinbergs et al., 1995; Polyak et al., 2000; Tarasov et al., 2005).

The second palynozone reflects the slight climate amelioration when discontinuous tundra-steppe treeless associations were gradually replaced by dwarf ernik tundra.

Later, in the course of the Holocene transgression, Pechora Sea shelf underwent intensive abrasion by the advancing sea. The Holocene boundary occurs at the core depth of 0,85 m in piston core 24, where the transgressive sandy siltstones dating back to about 10-8 e contact zone (Rudenko, Polyakova, 2005). Palynological data reveal a river-affected shallow environment as evidenced by considerable surge in fresh water chlorococcalean algae concentration. Pollen diagram shows a dramatic decrease in the pollen of herbaceous periglacial plants 9. Increasing concentration of long-distantly-blown *Pinus* sp. pollen suggests either a beginning of northward forest progradation within the Pechora Lowland or a far inland coastline retreat due to sea-flooding. This is well-compared with the previously reconstructed early Atlantic removal (up to 300-400 km) of northern limits of taiga zone in the Pechora Plain and Severnaya Dvina regions (Khotinsky, 1977). The *Picea* sp. curve rises up to 20 % at the core depth of 0.75 m. The increased concentration of the deciduous plants pollen (up to 5 % in total) at the core 24 depth of 0.65 m indicates the influx of the Atlantic waters importing this «exotic» pollen to such high-latitude arctic area from the southern Scandinavian forests. The further climate humidification during the Holocene optimum resulted in expansion of boggy ecotopes which slightly reduced but did not eliminate the dwarf birch boscages. Palynospectra are dominated by conifers with darkneedled taiga components.

MIGRATION OF PONTO-CASPIAN *DREISSENA POLYMORPHA* (PALLAS) INTO UPPER DNIEPER BASIN IN PLEISTOCENE AND HOLOCENE

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Primary area of the zebra mussel *Dreissena polymorpha* (Pallas) covered territory of northern coast of the Caspian and Black seas. In Pleistocene the species appeared in river-basin of the Upper Dnieper only during Eemian Interglacial and Early Vistulian Interstadials. that, by the way, has stratigraphical value. Pessimum of Last Glaciation the species has gone through in refuges. The next migration of the species upwards the Dnieper has occurred in Holocene. It is considered, that in Early Holocene the species area has reached Polesye (Zebra mussel... 1994). The species occupied all river-basin of the Upper Dnieper in the Middle Holocene. During the Late Holocene the species has overcome the Main watershed of Europe and was settled in lakes and rivers of the Baltic reservoir. Now the species area covers almost all Europe except for its extreme northern and southwest regions. The zebra mussel has got as well through ocean, into the North America. It is obvious, that so prompt migration in Holocene could not be carried out without, most likely, not realized, help of the man.

The schematic map shows the distribution of zebra mussel in Belarus and the neighboring regions during the Eemian Interglacial (fig. 1). Distribution of Eemian sites with fresh-water fauna, with and without zebra mussel, indicates that the northern border of the species range corresponded to the watershed line between drainage basin of the Black (Pont) and the Baltic (Eem) seas. The Eemian watershed arrangement slightly differed from the modern main drainage divide between Black and Baltic seas.

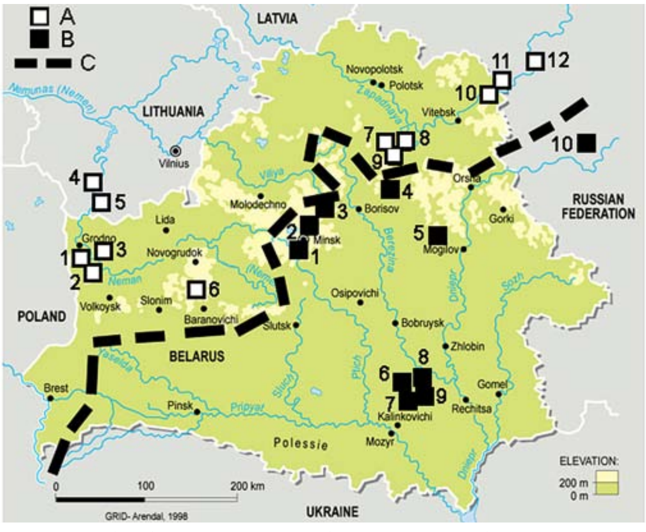

Fig. 1. A card-scheme of sites of the Eemian fresh-water mollusks.
A (without zebra mussel): 1 – Rumlovka, 2 – Zhukevichi, 3 – Komotovo, 4 – Netesos,
5 – Ionionys, 6 – Timoshkovichi, 7–9 – Tchashniki, 10–11 – Cherny Bereg, 12 – Konevich;
B (with zebra mussel): 1 – Petrovshchina, 2 – Uruchje, 3 – Kuzevichi, 4 – Chernoosovo,
5 – Belynovichi, 6 – Dubrova, 7 – Boroviki, 8-9 – Svetlogorsk, 1
0 – Toporovo; C: a watershed line

A malacological diagram of site Petrovshchina in Minsk reflects features of development *D. polymorpha* in the Eemian Interglacial (fig. 2). The species was the absolute dominant in the Eemian optimum, occasionally amounting (borehole 88, Svetlogorsk) to 90 % of total specimens in the fauna. The role of zebra mussel decreased in Early and Late Eemian Interglacial malacofaunas because of climatic conditions. The species has gone through a first stadial snaps of Vistulian on the Low Dnieper. Zebra mussel again appeared, at least, in two Interstadial warming of Early Vistulian (site Boroviki near Svetlogorsk). The density and a biomass of zebra mussel in malacocenosis of Early Vistulian Interstadials was considerably reduced in comparison with similar indicators of Eemian Interglacial.

The zebra mussel is fixed in alluvial deposits of river Svisloch in Minsk in first time 9580±180 (IGSB-1168) years ago (Sanko, Ivanov, 2007).

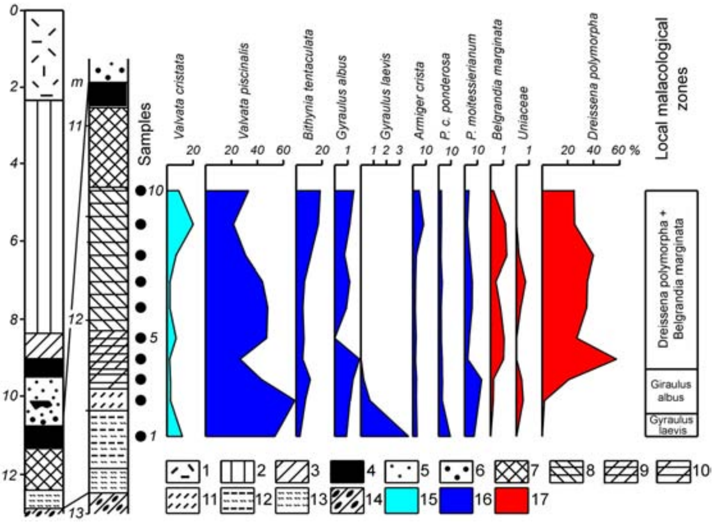

Fig. 2. The malakological diagram from Eemian sediments of site Petrovshchina
1 – deposits of embankment, 2 – loess, 3 – loam, 4 – peat, 5 – sand, 6 – sand with gravel, 7–12 – gittya, 13 – sandy loam, 14 – till, 15 – species of currently water, 16 – lake species, 17 – river molluscs

Migration *D. polymorpha* (Pallas) far beyond the primary area, certainly, it is necessary to connect with settling of river-basin of the Upper Dnieper by man in mesolit and a neolith. Whether moving is zebra mussel in a Mousterian epoch reflexion of migration of the Neanderthal man? The answer to this question, more likely, is positive, than negative. Though Mousterian sites in this territory are not known yet, however isolated finds of Mousterian tools, numerous inclusions of pieces of coal in Eemian lake and marsh sedimants, traces of hunting for a wood elephant in an Eemian bog in Uruchje (Minsk) testify that the Mousterian man came on this territory.

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MAMMOTH FAUNA OF BAIKAL SIBERIA: RESULTS OF CONTEMPORARY ARCHAEOLOGICAL STUDIES

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Vast areas of Northern Eurasia were populated by a great diversity of mammals in the Paleolithic Age. V.I. Gromov (1948) distinguished the Upper Paleolithic faunal complex, the main species of which were *Mammuthus* and *Coelodonta*. The differences in the species composition of fauna in certain areas of North Asia were associated with different climatic conditions.

In the Baikal region, the bone remains of mammoth fauna have been collected at numerous sites since the beginning of the nineteenth century. The species composition of megafauna from some of the archaeological sites was determined by N.D. Ovodov (1975, 1987), A.K. Kasparov (Kasparov, 1986; Kirillov, Kasparov, 1990), M. Germonpre (Germonpre, Lbova, 1996), N.P. Kalmykov (2001), Klement'ev (2007), and Sato (2008). The research results for the megafauna of these archaeological sites were summarized by N.M. Ermolova (1978). Small mammals enriched the taxonomic diversity of mammoth fauna considerably (Khenzykhenova, 2008). In two subregions of the Baikal region, periglacial Siberian (Fore-Baikal area) and non-glacial arid Central Asian (Transbaikalian area), the differences were distinguished in the species composition of the mammal association and paleoenvironment.

Thus, in Zabaikalie, the fauna of the Kargin Interstadial (MIS 3): Varvarina Gora, Sukhotino, Tolbaga, Kamenka, Podzvonkaya, Zangisan was represented by *Lepus timidus*, *L. tolai, Ochotona daurica, Spermophilus undulatus, Cricetulus barabensis, Marmota sibirica, Lasiopodomys brandti, Microtus gregalis, M. fortis, Canis lupus*, *Vulpes vulpes, V. corsac*, *Ursus arctos*, *Lynx lynx*, *Panthera leo*, *Crocuta crocuta spelea*, *Mammuthus primigenius, Equus caballus*, *E. hemionus*, *Coelodonta antiquitatis*, *Camelus* sp., *Megaloceros giganteus*, *Capreolus pygargus*, *Cervus elaphus*, *Alces alces*, *Rangifer tarandus*, *Procapra gutturosa*, *Spirocerus kiakhtensis*, *Saiga* cf. *tatarica*, *Capra sibirica*, *Ovis ammon*, *Bison priscus*, and *Poephagus baikalensis*. The fauna of the Sartanian glacial sites (MIS 2): Kunalei, Studenoe-2, Sannyi Mys, Cheremushki, Ust'-Kyakhta-17, Melnichnoe-2 included the following species: *O. daurica, M. sibirica, S. undulatus, Myopus schisticolor, Alticola* sp., *L. brandti, M. gregalis, M. fortis, Ellobius* cf. *tancrei, M. primigenius, C. antiquitatis, E. caballus, B. priscus, R. tarandus, C. elaphus, S. kiakhtensis, Saiga* sp. A rich species composition indicated the prevalence of dry steppes during the Sartanian glacial period and a high landscape pattern structure with domination of the steppes in the intermountain areas and forest-steppe territories on the mountain slopes and along the river valleys during the Kargin interglacial period.

In Predbaikalie, the fauna of the Sartanian sites (MIS 2) – Shishkino, Makarovo, Igetei geoarchaeological complex, Bol'shoi Yakor', Mal'ta, Buret', Krasnyi Yar, Lisikha, Fedyaevo, Vercholenskaya Gora and others – were represented by *L. timidus, O. pusilla, O. hyperborea, S. undulatus, S.* cf. *parryi, Marmota* sp., *Clethrionomys rutilus,* *Dicrostonyx guilielmi, Lemmus sibiricus, M. schisticolor, Lagurus lagurus, M. gregalis, M.* cf. *hyperboreus, M.* cf. *middendorfii, M. primigenius, C. antiquitatis, E. caballus, B. priscus, Ovis nivicola, M. giganteus, R. tarandus, C. elaphus, A. alces, U. arctos, C. lupus, Cuon* cf. *alpinus, Panthera leo, V. vulpes, Alopex lagopus, Gulo gulo.*

Modern joint archaeological studies by a Japanese-Russian team helped determine the first representative mammal fauna of the Kargin age (MIS 3) in Predbaikalie, at the Bol'shoi Naryn site in the southern part of the Bratsk reservoir, and at the Gerasimov's site in Irkutsk. This fauna included the following mammals: *Sorex* sp., *Chiroptera* gen. indet., *Lepus* sp., *O. hyperborea*, *O.* cf. *pusilla*, *Ochotona* sp., *Eutamias sibiricus*, *Marmota* sp., *Spermophilus undulatus* Pall., *Cricetulus barabensis* Pall., *C. rutilus* Pall., *C. rufocanus, L. amurensis, M. schisticolor, D.* cf. *guilielmi, Dicrostonyx* sp., *Alticola* sp., *L. lagurus*, *M. gregalis, M.* cf. *middendorffii, M.* ex gr. *middendorffii-hyperboreus, M.* cf. *hyperboreus, M. oeconomus, Microtus* sp., *Alopex lagopus* L., *Martes zibellina* L., *Mammuthus* sp., *Equus* sp., *Cervus* sp., *Rangifer tarandus* L., *Bos* sp., and *Bison priscus.*

Thus, the species composition of the Predbaikalie mammal fauna indicated the existence of tundra-steppe landscapes in the first two-thirds of the Sartanian glacial period and tundra-forest-steppes in the final stage of the Sartanian glacial and during the Kargin interstadial period.

We think that further joint studies must answer the question as to why the share of the tundra species was considerable during the Kargin glacial period and what the degree of difference was between the natural environments of the Kargin interstadial and Sartanian glacial periods in Predbaikalie.

GEOARCHAEOLOGICAL INVESTIGATIONS ON THE LANDSCAPE HISTORY OF THE PREAZOVIAN PLAIN (SOUTHERN RUSSIA) DURING THE LATE HOLOCENE

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The research is embedded within a multidisciplinary project at the Berlin Cluster of Excellence TOPOI and focuses on the natural and cultural landscape development of the Preazovian Plain in the southern Pontic steppe (between the Donets Ridge and the Taganrog Bay). The region is extraordinarily rich in prehistoric settlement sites. Especially in the Bronze Age settlement patterns are dynamic: while in the Late Bronze Age (ca. 2100–1200 BC) hundreds of settlements were spread all over the steppe, in the Middle (3rd mill BC) and Final Bronze Age (ca. 1200–900 BC) only few settlements existed and these were restricted to the coastline of the Azov Sea and the Don delta. We analyse terrestrial archives in order to investigate the dynamic relation between humans and landscape during the Late Holocene to answer the questions: how did landscape develop and to what extant human activities have influenced the natural landscape?

The Preazovian Plain is characterised by a level topography up to 160 m above sea level. A system of rivers and periglacial dry valleys (locally known as 'balka(s)') divides the plain into low-lying plateaus. Due to postglacial erosive processes the steep valley-side slopes are dissected by gullies ('ovrag') and the balkas are incised by younger valleys. For our palaeogeographical analyses we concentrate on the Sambek river valley (fig. 1), 15 km west of the Don delta, which is regarded as representative for the Preazovian plain. Several Bronze Age settlements and burial grounds provide evidence for landuse within the Sambek river valley and its catchment over several millennia. A number of drilling cores (altogether 45 m of sediments) were taken on the floodplain, the alluvial fans and inside settlement areas to investigate the landscape development. The cores are processed concerning their geochemical and physical characteristics (e.g. grain size, organic and inorganic carbon contents, phosphate concentration, and magnetic susceptibility). The sediment analyses are supplemented by detailed geomorphological mapping in the area around the drilling locations.

The Sambek valley and its tributaries show the typical asymmetric cross section as characteristic for the region. The steep slopes are dissected by branched gullies down to 10 m depth. Geomorphological processes next to gully erosion are slope wash, landslides and fluvial activity. The stratigraphy of the 6 m floodplain core SAM1 documents the landscape history of the last 4000 years. We identified several phases of fluvial sedimentation interrupted by layers of eroded slope material. According to preliminary results and first ^{14}C-dates the slope erosion probably corresponds to the main settlement phases which are also phases of intensive land use: Late Bronze Age (2140–1920 BC), Middle Ages (890–1160 AD, 1280–1410 AD) and Russian Colonization (1790–1950).

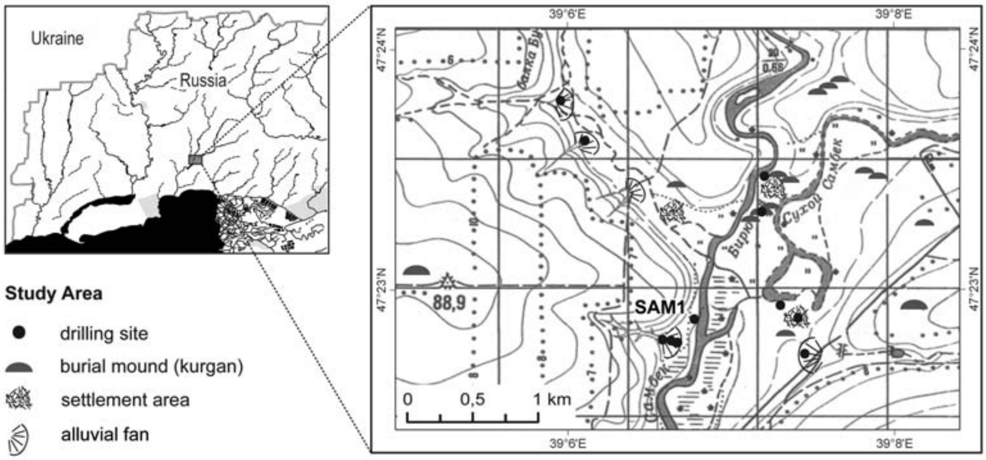

Fig. 1. The study area of the Sambek river valley

Through the analyses of macro- and microfossils such as pollen, spores and ostracodes we hope to receive additional information about the dynamics of the landscape history of the valley and especially about human-environmental interactions.

EARLY WEICHSELIAN PALAEOGEOGRAPHY AND PALAEO-ECOLOGY OF THE NORTH-WESTERN NETHERLANDS AND CORRELATION TO GLOBAL EVENTS

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The shallow subsurface of the North-Western Netherlands is characterised by up to 10 m thick sequences of Early to Middle Weichselian, fine-grained, organic-rich deposits. These sequences are part of the complex infill of a wide palaeovalley that was created during the retreat of the Saalian ice sheet (Late MIS 6), submerged during the Eemian marine highstand (MIS 5e) and in use by the river Rhine until the Middle Weichselian (MIS 5d-3). This study aims to characterise and map the sedimentary facies in the upper part of the valley fill and reconstruct the palaeo-ecological and palaeogeographical development in and around the valley from the Eemian marine highstand onward.

On top of up to 30 m thick shell-rich sandy and clayey Eemian tidal deposits, sandy fluvial Rhine sediments are found. At several locations, these deposits grade into loam, clay and sometimes peat, representing overbank deposits of a low-grade meandering river system (fig. 1). After disappearance of the Rhine, the remainder of the valley was filled by fluvioperiglacial and aeolian deposits. A detailed palynological analysis was completed on core Oudkarspel (fig. 2). Local Pollen Assemblage Zone (LPAZ) A coincides with shell-rich marine sand and contains peaks of *Corylus* and *Quercus*. This zone is interpreted as Eemian stage E4a (MIS 5e). LPAZ B is characterized by high percentages of *Picea omorikoides*. According to Zagwijn (1961), the appearance of *Picea omorikoides* is coincident with the onset of the Brörup Interstadial (EW IV; MIS 5c), a period of intermediate sea level (-30 m) and relatively high Mean Air Temperature (MAT ~4°C below present). This zone coincides with enriched carbon isotope values. LPAZ C shows an increase in heathland and a decrease in trees. LPAZ D is thought to represent the onset of the cool Early Pleniglacial (MIS 4; MAT ~8°C below present). A low sea level (-70 m) at this time may have favoured fluvial incision, resulting in dryer surface conditions, a more open landscape and increased aeolian activity, which is consistent with a sandy lithology.

Fig. 1. Photos of core Oudkarspel, showing the sediments between 11.25 (left) and 32.40 (right) m below surface level

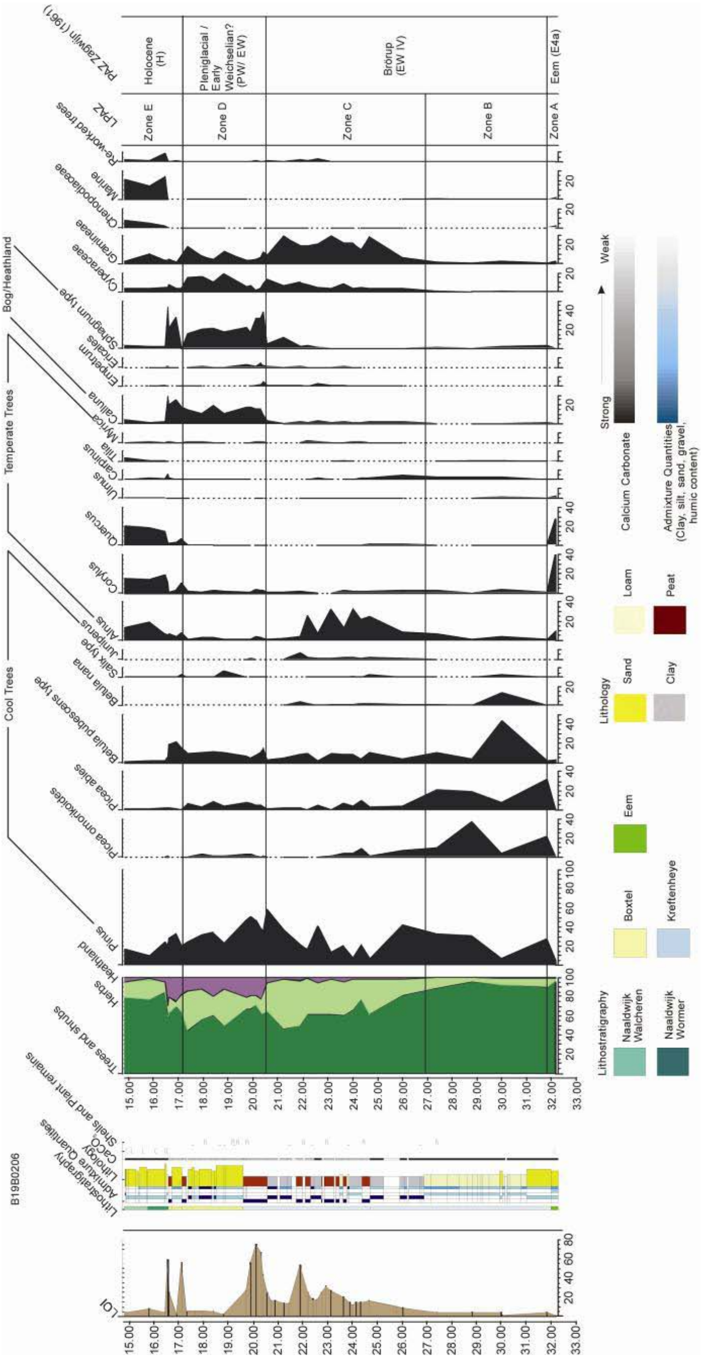

Fig. 2. Lithology and pollen diagram of core Oudkarspel, illustrating the palaeo-ecological changes from the Eemian to the Holocene

The combined interpretation of undisturbed core material, digitally archived core descriptions and palaeo-ecological data allows us to reconstruct the history of infilling of the valley system under changing climatic and environmental conditions and sheds new light on the fluvial character and timing of this main branch of the river Rhine. The resulting geological framework will be used in applied geological modelling.

GEOLOGICAL AGE AND MORPHOLOGY OF *ARCHIDISKODON MERIDIONALIS* FROM STAVROPOL REGION (RUSSIA)

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The skeleton of an elephant was found on August 27, 2007, during open mining between villages Ravninniy and Rodionov. Finds of complete skeletons of fossil elephants are very rare; this is why the second complete skeleton of *Archidiskodon* in the Stavropol Region is of the utmost importance for the paleontological study of Proboscidea. The site has coordinates 45015’44”N and 41027’18”E. The excavation was conducted by the Stavropol State Memorial Museum, by the team lead by A.K. Shvyreva, in September-October, 2007 The following study indicated a find of an almost complete elephant skeleton of the genus *Archidiskodon* (Pohlig, 1885) (collection BX-2120). The material includes fragmentary tusks, upper and lower teeth, skull fragments and mandible. In addition, the excavation yielded 54 postcranial bones, including eleven long bones of extremities and their belts, five cervical vertebras, 14 vertebra bodies, sacrum, 21 ribs (seven left and 14 right), and six distal bones of posterior appendages.

The clay and sand pit is situated at the left bank of the Tverdova Balka, the left bank tributary of the Egorlyk River. The pit exposes deposits with the observed thickness of 7–8 m. The section described downwards (fig. 1) includes the modern soil (0.5 m), not layered yellow-brown carbonate loam (0.7–1.0 m), yellow-brown horizontally layered carbonate loam with frequent flat pebbles up to 1 cm in diameter (2.3–2.5 m), red-brown carbonate lumpy clay with inclusions of large pebbles (up to 2.5–3.0 cm) and gypsum roses (2.5–2.7 m), and the clay-gravel bed with coarse-grained sandy matrix and with mainly large pebble well rounded pebbles at the bottom and poorly rounded at the upper part (>0.8–0.9 m). The burial place of the skeleton is located in the valley with the wide terraces, formed by flood-plain deposits and channel alluvium. It is characterized by poorly sorted, not thick sediments. The flood-plain deposits postsedimentary changed into loams and sometimes clay. Lithological features (lumpy structure, their mixed-colour with prevalence of yellow-brownish tones, presence of gypsum roses) point to a mainly subaerial origin of deposits of the bed 4. The occurrence of red-colored clays and “gypsum roses” indicate dry and relatively hot climate during the formation of the deposits.

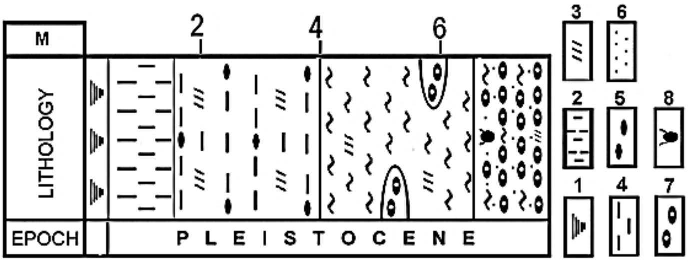

Fig. 1. A geological cut in career of Tverdova Balka (Stavropol Region, Russia): 1 – modern soil, 2 – loam not layered, 3 – carbonation, 4 – loam layered, 5 – a flat pebble, 6 – coarse-grained sand, 7 – a pebble, 8 – bones of the elephant

The skeleton occurred at the depth of about 7 m in a sandy-silty lens with small pebbles covered by a layer of large agglutinated pebble and coarse-grained sand (Shvyreva, 2007) (fig. 2). The preserved skeletal bones of an elephant covered an area of about 35 m^2. The skull was strongly damaged by pitting operations, occurred with the chewing surface of teeth downwards. The mandible, also damaged by quarrying, occurred in situ, ahead from the premaxillaria. Most skeletal bones, including bones of extremities, vertebrae and some ribs, preserved anatomic arrangement in situ. This point to insignificant transportation of the animal's remains from a death place, and a gradual burial process. Most appendicular bones lack distal parts probably destroyed during the burial.

Fig. 2. An arrangement of bones of the skeleton of the elephant in situ. Length of a scale ruler is of 1 m

The structure of the terrace of the Egorlyk River and the geological structure of the entire area indicate that this site is close in age to the burial of the skeleton of *A. meridionalis* (Nesti) near Georgievsk and corresponds to the beginning of the early Pleistocene (late Villafranchian, lower Apsheronian) (Garutt, Safronov, 1965; Lebedeva, 1978). Finds of almost complete skeletons and other elephant remains in the North Caucasus (Stavropol and Rostov Regions, Russia) indicate that *Archidiskodon* elephants continuously inhabited this area in Pliocene and early Pleistocene.

Elephants of the genus *Archidiskodon* are characteristic in relatively low crowns of M3/m3. The height of unworn plate in m3 is 149.0 mm. The morphology of the functioning m3 in *Archidiskodon* from the Tverdova Balka closely corresponds to morphology of the species *Archidiskodon m. meridionalis*. The thickness of enamel is 3.7–4.2 mm; frequency of plates – 4.5; full number of plates – /14?; length/width of a plate – 9–10.5/82.0–87.0 mm; the interval between plates – 3.0–4.0 mm. *Archidiskodon m. meridionalis* from Georgievsk show the following measurements (Garutt, Safronov, 1965): thickness of enamel – 3.2–4.0 mm; frequency of plates – 3.2–4.0; full number of plates – /12–14?; length/width of a plate – 19.0/-mm; the interval between plates – 3.0–3.5 mm.

The sizes of long bones of postcranial skeleton *Archidiskodon m. meridionalis* from Rodionov, Tverdova Balka (Maschenko et al., submitted) and Georgievsk (Garutt, Safronov, 1965) appear very close. Rodionov (beam Tverdova)/Georgievsk (mm): humerus – length – 1260,0/1225,0, width of distal epiphyses- 353,0/334,0; femur – length – 1440,0/1430,0, width of distal epiphyses – 288,0/288,0; ulna – length – 1075,0/1100,0, width of distal epiphyses – 225,0/215,0; tibia – length – 800,8/820,0, width of proximal epiphyses – 283.0/-. The height of the body of the elephant from Rodionov (gorgeTverdova) in withers could be about 400–410 cm, and weight of 10–12 tons (Maschenko et al., submitted). The comparable body size is typical for males of *Archidiskodon m. meridionalis*.

The individual age, defined for modern African elephants, by the degree of teeth obliteration (strongly obliterated M2/m2, starting wear of M3/m3) is about 40 years. The degree of epiphyses connection on long bones and vertebras fits the corresponding individual age of *Archidiskodon meridionalis* males with proximal epiphyseses completely grown with the obliteration of epiphysal suture, and distal epiphyseses on ulna and tibia showing an incompletely closed epiphysis suture. This morphology of epiphyses is combined with varibla degree of epiphyses fusion in bodies of chest and cervical vertebrae (Maschenko et al., submitted).

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MIS3 PALEOSOLS IN MEXICO AND NORTERN CENTRAL RUSSIA: PALEOENVIRONMENTAL IMPLICATIONS FROM TWO GEOGRAPHICAL EXTREMES OF INTERSTADIAL PEDOGENESIS

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The reconstruction of paleoenvironments of MIS3 – an extensive phase of milder climatic conditions within the last glacial period – is still a matter of intensive discussions. Paleosols being a reliable terrestrial paleoecological proxy could contribute a lot to understanding of environmental changes. The diversity and distribution of the paleosol bodies within the ancient pedosphere could be key to understanding the variety and paleogeography of MIS3 ecosystems. The paleosols corresponding to the interstadials within MIS3 (e.g. Bryansk soil in Russia, Lohner soil in Germany) are studied principally in the actual temperate areas; much less is known about paleopedogenesis to the north and to the south of these areas. We present the results from the paleosols developed in the “geographical extremes” of the MIS3 paleopedosphere: in the actual boreal areas (taiga forests) of northern central Russia and in the tropical mountainous volcanic region of Central Mexico.

Among tephra-paleosol sequences in the Transmexican Volcanic Belt, presenting a rare example of well preserved Quaternary paleosols in the tropics, two localities demonstrate well preserved profiles corresponding to MIS3: Nevado de Toluca (Sedov et al., 2001, 2003; Solleiro et al., 2004) and Tlaxcala (Sedov et al., 2009). Sequence includes 7 pedostratigraphic units (named PT1-PT7) interlayer with ash and pumice. The formation period of PT2-PT4 corresponds to the second half of MIS3, taking into account that the radiocarbon dates, available for these pedocomplexes, presume their formation in the time interval 42,000–27,000 C14 yr. BP. These units are presented by Andosols with thick dark Ah horizon, high accumulation of humus, amorphous Al and Si compounds, and pedogenic Fe oxides. The underlying pedocomplexes PT5-PT7 are presented by Luvisols with well developed diagnostic argic (Bt) horizons, characterised by extensive clay accumulation and numerous illuvial clay coatings. At present no instrumental dates are available, however, judging from the rates of formation of argic horizons, we assume that these pedocomplexes cover an interval of n x 10,000 yr before PT4. That means that the time of pedogenesis of PT5-PT7 corresponds to the early-middle MIS3. Comparing paleosols with modern analogues lead to primary interpretation, that Andosols of PT2-PT4 have combination of features typical for volcanic soils of humid forest ecosystems. Older Luvisols PT5-PT7 also is indicative of humid forest pedogenesis, presenting its more advanced stage. Differences between these two groups of paleosols are related to variations in duration of pedogenesis and not to changes of bioclimatic factors.

Further studies of clay mineralogy, C12/C13 ratio in humus and phytolith assemblages in Andosols PT2-PT4 showed that these properties do not agree completely with the hypothesis of humid pedogenesis. Halloysite and metahalloysite are abundant in clay fraction of studied soils, whereas in Andosols of true humid environment allophanes should be dominant. The $d^{13}C$ values are in the range -17... -20 ‰, that is higher than in the humus of present day forest soils and is intermediate between the values typical for C3 (typical for more humid conditions) and C4 plants (typical for drier conditions). In agreement with carbon isotope ratios, phytolith assemblages include both forms, typical for C3 and C4 grasses. All these results, indicating alternation of moist and dry periods during the formation of paleosols PT2-PT4, allowed to correct the primary interpretation, in agreement with lacustrine records. Thus two blocks of soil memory can be discriminated in the studied Late Pleistocene paleosols: 1) reflecting only periods of humid pedogenesis and 2) conserving information both about humid and dry pedogenesis in the mixed form.

In Tlaxcala sequence the paleosol TX2 has radiocarbon dates ranging from 27,000 to 38,000 C14 yr. BP that allows to attribute its pedogenesis to the late MIS3. TX2 is a Stagnic Luvisol and is the most developed paleosol in the Late Quaternary "Grey Unit" of Tlaxcala sequence. It also combines the features of "humid" pedogenetic processes – clay illuviation and gleyzation with strongly developed vertic properties, indicative of seasonal climate with a marked dry period. In general the development status of MIS3 paleosols studied in Central Mexico is similar or higher than that of the Holocene soils. They demonstrate the advance of the pedogenetic processes considered to be "slow" (characteristic time > 10,000 yr.): clay illuviation, weathering and accumulation of secondary components – clay and iron oxides.

The paleosols studied in the northern central Russia are developed within nearest periglacial zone of East European Plain (56.7°–58.5° N, the Upper Volga River basin). These paleosols are strongly formed: 1) on Moscowian (Riss II) moraine or moraine-like deposits and 2) on ancient (Riss II) lake clayey sediments. The buried profiles are represented by system of horizons Agb-Gb, Hb-Gb(Ghb); pedocomplex consisted of: 1) the paleohumus and paleogley (2Atgb-2Gtb-3Atgb) and 2) paleohumus (3Atgb-3AtGb) horizons. These pedostratigraphical units were classified as the Umbric Gley and Histosols. The ^{14}C age of the paleosol humus and peat horizons varied between 46,700–24,350 yr BP thus corresponding to the second half of MIS3. The studied paleosols reflect part of ancient soil cover developed in the forest-tundra and tundra-steppe landscapes which existed within investigated area during the Bryansk Interstadial (25000–31000 yr BP). Our data showed the northernmost occurrence of the MIS3 fossil soil in Europe. It was possible to identify the Late Quaternary pedogenic processes under severe extra-continental climate, including gleyzation, aggregation, cracking and humus formation. The paleosols developed during MIS3 within southern part of East European Plain are different from our investigated area. The former are represented by Cryogenic Gley soils and Umbric Gley soils (having Bca horizons) formed loess deposits. The upper strata with a thickness of 0.7–2.5 and 3.5–4.1 m which cover the deposits containing the Bryansk Soils and other MIS3 paleosols, are represented by mantle loams and rarely clayey late Pleistocene deposits. They mark a presence of wide extraglacial lakes existed here during maximum advancement of the Valday (Würm) glaciations (MIS2). On these both upper layers the Holocene Albeluvisols are formed. Good preservation of individual pedogenic processes marked above is shown to be a soil memory under the overlapping press of Holocene pedogenesis. It was shown that the clay coating in the Middle Valday paleosols and pedocomplex is a part of the Holocene soil formation.

We conclude that during the Late Quaternary the predominant individual pedogenic processes (IPP) are to be described by the following characteristic time (CT) (Targulian, 2005): 1) fast IPP, CT – $n \cdot 10^1–10^2$ years: gleyzation, aggregation and cracking; 2) medium-rate IPP, CT – n·10^2–10^{3-4} years: humus and peat formation. In the Holocene, the medium-rate IPP dominated, such as, lessivage and partluvation, podzolization, blocky and prismatic structuring and humus formation. Some of these processes overlapped with the Middle Valday pedogenesis, of which morphological features have been recorded in paleosol horizons. Despite the predominance of fast IPP during the formation of Bryansk paleopedocomplex, the result of these processes has been relatively stable and preserved in soil memory as a reflection of the Holocene pedogenesis. However in general MIS3 paleosols of northern central Russia are much less developed, that the Holocene soils. We observe a contrasting difference in the relative development of the MIS3 and Holocene paleosols as well as the rates of the processes involved in MIS3 pedogenesis in tropics (Mexico) and boreal regions (Russia). It is possible that this difference is at least partly related to the different impact of contrasting short (millennial) scale paleoclimate cyclicity (Heinrich events) within MIS3. The cold phases were influenced stronger the soil formation at the northern extreme, interrupting it and permitting only the effects of rapid processes whereas in tropics these climate oscillations had minor effects; they not interrupt soil formation and advance of slow pedogenetic processes.

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THE LATE CENOZOIC HYAENIDAE (MAMMALIA, CARNIVORA) OF SOUTH-EAST MIDDLE ASIA AND THEIR STRATIGRAPHICALLY DISTRIBUTION

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The Hyaenidae of the superfamily Feloidea is one of the most widespread and in systematically complex groups of Carnivora in the Late Cenozoic fauna of South East Middle Asia. The numerous discoveries of their remains in continental deposits of the Afghan-Tajik Depression (Pre-Darvas and Pre-Hyssar depressions), the North-West Tien-Shan (Ferghana depression) and Hyssar-Alay (Penjikent and Magyan Basins) support this concept. These discoveries indicate the occurrence of 5 genera and 8 species of hyaenids from 2 Families: Viverridae (Subfamily Ictitheriinae Trouessart, 1897) and Hyaenidae (subfamily Hyaeninae Mivart, 1882) of order Carnivora (fig. 1).

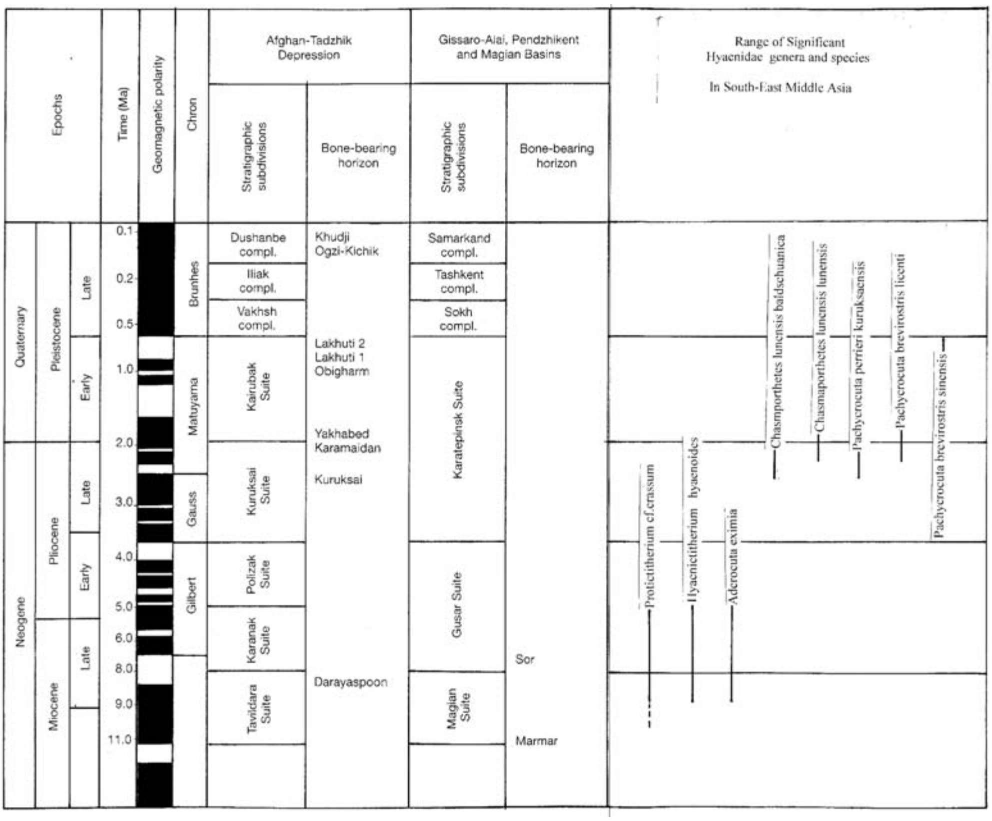

Fig. 1. Stratigraphic scheme, showing the placement of the fossil localities discussed in this aricle

The most ancient forms of the Ictitheriinae and Hyaeninae have been obtained from Late Miocene-Early Pliocene deposits, where they are represented by the following genera: *Protictitherium* Kretzoi, *Hyaenictitherium* Kretzoi and *Adcrocuta* Kretzoi. These genera are typical of the Miocene of Eurasia and Northern Africa

Hipparion faunas. The upper age limit of the stratigraphic distribution these genera beginning from late Miocene (Vallesian MN 9–10) has been determined up to recently as early Turolian (MN 11–13) and early Pliocene (Ruscinian MN 14–15). The remains of these carnivores the first have been found in the Sor locality of the Magyan Basin of northwestern Tajikistan co-occurring with *Hipparion mediterraneum, Chilotherium schlosseri, Microstonics* cf. *major*, *Chalicotherium* sp., *Samotherium* sp., *Protoryx tadjikistanica*, *Sogdohyrax magianense* etc. (Forsten, Sharapov, 2000; Sharapov, 2008).

The locality Sor with its two fossiliferous horizons has erroneously been dated to middle Pliocene (Nesmeyanov, 1982) or early Pliocene (Zhegallo, 1978; Sharapov,1982; Dmitrieva, Nesmeyanov, 1982), but it likely correlates with the late Miocene-Pontian of the eastern Paratethys and Pannonian-Turolian of the Western Europe, as determined on the basis of *Machairodus giganteus soricus*, *Protictitherium* cf. *crassum*, *Hyaenictitherium hyaenoides* (Zdansky, 1924), *Adcrocuta eximia* Roth et Wagner,1855 and *Hipparion mediterraneum* (Forsten, Sharapov, 2000).

In the Late Pliocene (Middle-Late Villafranchian) intensive adaptive radiation has been observed in South-East Middle Asia carnivores fauna. The genera above mentioned had become extinct by this time. Moreover, new hyaenid forms had appeared including genus *Chasmaporthetes* Hay, 1921 and *Pachycrocuta* Kretzoi,1938 (*Pliocrocuta* Kretzoi by Qiu Zhan-Xiang,1987).

The remains of the genus *Chasmaporthetes* (*C. lunensis baldschuanica* and *C. lunensis lunensis*) were discovered in the Kuruksai and Jakkhabed localities of south-eastern part of Afghan-Tajik depression. These sites, and Karamaidan and Lakhuti-2 localities yielded remains of the genus *Pachycrocuta* (*P. perrieri kuruksaensis, P. brevirostris licenti*, and *P. b. sinensis*).

The *Chasmaporthetes* and *Pachycrocuta* genera appeared in the Ruscinian (MN 14, 15) and widely spread in the Villafranchian and Middle Pleistocene of Eurasia, Africa, and North and South America (only *Chasmaporthetes*). In Europe, the remains of these genera originated from the Ruscinian-Early Villafranchian and Early Pleistocene localities of France (Serrat d`en Vacquer, Etouair, Rocca-Neyra, Pardin, St-Vallier, Senese, Sainzelles), Spain (Layna, Villaroya, Puebla de Valverde), Italy (Montopoli, Olivola, Val d`Arno), Germany (Erpfingen, Schernfeld, Erlangen, Sussenborn), Netherlands (Tegelen), and Moldova (Bessarabien). In Asia they originate from Ruscinian–Late Villafranchian and Middle Pleistocene localities of China (Yushe, Shoujang, Nihowan, Minchi, Choukoutian), and Turkey (Gulyazi, Yassioren). In Africa, from Ruscinian-Middle Pleistocene localities of South Africa (Langebaanweg, Sterkfontein, Swartkraans, Kromdraai, Makapan). In North America, from Blancan-Irvingtonian localities of USA (Arisona: Anita, Texas: N.-Cita Canyon, Florida: Santa Fe IB, Inglis IA, Kansas, Idaho; N. Mexica).

There is a great resemblance between Late Pliocene (Middle Villafranchian) Kuruksai carnivora mammal faunal assemblages (including Jakkhabed and Karamaidan faunas) and Europe Middle Villafranchian carnivora mammals faunas (MN 17) from St-Vallier, Pardin, Rocca-Neyra localities in France and Puebla de Valverde locality in Spain. The Lakhuti-2 of faunal assemblages with the *Pachycrocuta brevirostris sinensis* is most close to early Pleistocene fauna (MN 21–22) of Europe and Central Asia. Below given is the stratigraphic scheme, showing the placement of the fossil localities discussed in this article and range of significant Hyanidae genera and species in South-East Middle Asia.

EARLY PALEOLITHIC SITES IN THE AZOV SEA REGION: STRATIGRAPHIC POSITION, STONE ASSOCIATIONS, AND NEW DISCOVERIES

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The Asov Sea region (Azov-Black Sea area, Russia) is one of the major areas for Pleistocene studies in Eastern Europe. This region hosts important localities of small and large mammals, reference sections of Quaternary deposits of various origins, and numerous clearly stratified Paleolithic sites of different age.

Of special interest are the recent discoveries of Early Paleolitic sites in the Taman Peninsula near Za Rodinu settlement (Krasnodar Region, Russia). These finds have been done in Early Pleistocene (Eopleistocene) deposits in the area of the type locality of the Taman faunal unit, Sinyaya Balka. The early Paleolithic sites were called Bogatyri/Sinyaya Balka and Rodniki. The preliminary results of their multidisciplinary study were published in materials of international conferences on Early Paleolithic (Shchelinsky et al., 2008a, 2008b; Dodonov et al., 2008a, 2008b; Bajgusheva, Titov, 2008). The Tamanian type fauna includes *Archidiskodon meridionalis tamanensis* Dubrovo, *Elasmotherium caucasicum* Borissiak, *Mimomys savini* Hinton, *Lagurodon arankae* Kretzoi and other forms. Combined biostratigraphic and structural geological data permit dating of these sites in the range of 1.6–1.1 Ma, and correlation of the enclosing off-shore marine and continental deposits to the mid Apsheronian (Gurian) of the Ponto-Caspian regional scheme (Shchelinski et al, in press).

Associations of stone artifacts in Bogatyri/Sinyaya Balka and Rodniki are quite similar. They are archaic in stone processing techniques and shape of the objects. The initial preparation was associated with sporadic use of nuclei and common use of side fragmentation and disintegration of slabs and plates to obtain blanks for tool manufacture. Though the studied assemblages contain numerous, occasionally processed flakes, most tools were manufactured with the use of platy slabs of the source stone material. The association includes characteristic variable choppers, picks-like tools, high massive sidescrapers, core-like endscrapers, beaked tools, thorned tools, small thick points, notches, and denticulates. This industry belongs to the Tamanian variety of the Oldowan. Specific features of the industry are determined by the local stone non-flint material including platy silicified clastic rocks of Tertiary and Mesozoic age.

The above reviewed sites occur in the eastern limb of the Tizdar brachyanticline exposed in the coastal cliff of the Sea of Azov. The underlying deposits of this structure are characterized by late Kujalnik brackish and fresh-water mollusks and earliest Biharian small mammal faunas Tizdar 1 and Tizdar 2 with *Allophaiomys* *deucalion* paleomagnetically and biostratigraphically dated in the range of 2.1–2.0 Ma (Tesakov, 2004). This part of the sequence is associated with a ca. 40 m thick sandy member. Recently these deposits yielded an association of Early Paleolithic stone tools (the site Kermek) similar in source material and typological features to materials from Bogatyri/Sinyaya Balka and Rodniki. The Kermek site is associated with a bed of sand with rubble and shells of freshwater mollusks in approximately 5 m above the base of the member and the site Tizdar 1, and in ca. 25 m below the site Tizdar 2. The molluskan assemblage of Kermek includes *Margaritifera* sp., *Unio* (*Pseudosturia*) sp., *Potomida sublitoralis* Tschepalyga, *Dreissena polymorpha* Pallas, *Viviparus* sp., *Valvata* sp., *Fagotia* sp. (determinations of T.A. Yanina and A.L. Tchepalyga). Judging by the geological position, this site has an estimated age of 2.0 Ma.

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NEW DATA ON STRATIGRAPHY AND FAUNA OF EMINE-BAIR-KHOSAR CAVE, CRIMEA, UKRAINE

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The Emine-Bair-Khosar Cave (EBH), situated 30 km south from Simferopol, is the most interesting palaeontological site on the Lower Chatyrdag Plateau, of the Crimean Mountains, Ukraine. It is one of the largest cavities at the area with total length of 1.460 m and a depth of -125 m. Its modern entrance is located little below the northern edge of the plateau (990 m a.s.l.). The Chatyrdag massif includes two main denudation levels named the Upper (1350 – 1.450 m a.s.l.) and Lower Plateau (1000 – 1.100 m a.s.l.). The lower plateau has a strongly karstified flat-top relief with several vertical karst pits. The upper part of geological sequence is represented by massive Jurassic limestone, which is quite karstified. Until now more than 150 potholes and caves are known here.

The entrance looks as 18 m deep pit, which functioned as a natural trap during long time. All known passages of EBH are oriented not towards the closest erosional base level, but inside the mountain massif. This peculiar configuration is related to the initial hydrothermal origin of the cave. From morphological point of view, huge phreatic cavities are developed on two main levels: the upper one is composed by large chambers and passages which progressively descend to -50 m, while the lower level, interconnected by pits, is sub-horizontal and developed at the depth of -125 m.

The first development stage is probably connected with hydrothermal activity responsible for the main phreatic-morphological features and huge initial volume of cavities. The time of hydrothermal activity is still discussable and can be interpreted from Early Cretaceous (Late Jurassic) till Early Neogene. A subsequent stage of vadouse evolution can be recognized, followed by a second, cold-phreatic stage, which is well expressed by superposed under-pressure phreatic morphological elements (like washed/corroded stumps of stalactites), especially on the surface of early generations flowstones and other speleothems belonging to the “early vadouse stage”. Finally a fourth, the latest vadouse stage is now developing.

The first speleological and palaeontological investigations of EBH were carried out in the 1960ties. That time some two hundred bones were collected from a small chamber near the main access passage. This material belongs mainly to carnivores (*Canis lupus, Vulpes corsac, Ursus spelaeus, Panthera leo spelaea, Lynx lynx*) and some herbivores (*Equus* sp., *Cervus elaphus*). The next palaeontological studies, undertaken by B. Ridush and M. Vremir in two new sites, started in 1999 and were continued till 2004. The most important bone accumulations (sites Bb and Bc) provided more than 5000 bones. From different stratigraphical units, at least 35 vertebrate species (mainly mammals, but birds and reptiles are also present) were recorded. The most important results come from the Bc site (“Skull chamber”) which preserves partial carcasses and whole skeletons, accumulated very close one to another in several stages. Every stratigraphical unit presents particularities from palaeontological and taphonomical points of view. The vertebrate assemblages, the preservation and spatial distribution of the bone material, the stratigraphic (micromineralogic) and microambiental data suggest a very peculiar taphofacies as well as very complex sediment-entrapment processes.

Regular excavations of the other site (Ba2) started by B. Ridush in 2005 were continued by international and interdisciplinary team in 2008 and 2009. Deposits at this site are formed by soil/loess material, transported into the cave from outdoor throw the entrance pit, and limestone debris. Cave fill contains a lot of palaeontological remains and has visible horizontal stratification providing the possibility of obtaining secular variation record and applying magnetostratigraphic dating. The studied section is currently about 5 m deep. The upper part of sequence, revealed by excavations, is composed by seven layers (A-G). Layer A (0-0.75 m) is darkly-grey, loose, unstructured, wet, light-loamy mechanical composition, containing mainly soil material. Layer B (0.75–1 m) – consisting of eight packs of clayey-debris interlayers, brown colour, size of limestone particles in debris interlayers increases from 1–2 mm in upper part of layer to 1 cm at the foot. Layer C (1–1.3 m) pale-yellow light, homogeneous, clayey, with small contents of debris material. In the section two detritus layers are also fixed – D (1.3-1.5 m) and F (1.8-2 m) – chaotic accumulation of acute-angle limestone debris with diameter up to 5 cm. Layer E (1.5–1.8 cm) by morphological feature is similar with layer C, revealed by clearing 2 and 3. The layer G (2-2.6 m), is formed by greyish-brown wet clays with thin debris interlayers. The underlying sediments section (2.6-5 m) is represented with large rock debris of limestone with clay filler.

A saiga bone found at ca. 2.0 m depth was dated by ^{14}C at 10.490±170 BP (Ki-13063) while *Cervus elaphus* bone at the depth of 1.65 m yielded an AMS ^{14}C date 12.050±60 BP (Poz-28732). It probably means that the upper layers (A, B, and C) are of Holocene age while layers D and E were deposited at the end of the Pleistocene in Late Valdai (end of the MIS 2). Another fragment of the red deer bone from layer G was dated to 33,500±400 BP (Poz-28889) indicating the middle Valdai age of the deposit (MIS 3). Two last bones of *Saiga* and *Cervus* both from deepest part of the excavated profile (4.6 m and 4.7 m) yielded AMS dates 48,500±2,000 BP and >46,000 BP, respectively.

The fauna consists of more than 30 species of large and small mammals as well as birds and lower vertebrates. In general the most frequent in all distinguished layers are *Saiga tatarica borealis, Cervus elaphus* and *Bison priscus*. The other ungulate mammal species are represented by *Equus hidruntinus/hemionus*, *Megaloceros* sp., *Ceolodonta antiquitatis*, *Mammuthus primigenius*. Among carnivores the most frequent is *Vulpes* cf. *corsac* and some species of *Mustela*. Among lagomorphs *Lepus* is represented by two species and one species of *Ochotona*. Small mammals are represented first of all by rodents: *Microtus arvalis*, *Myodes glareolus*, *Arvicola*, *Apodemus* sp., *Allactaga* and *Lagurus lagurus*. Also remains of insectivores (*Sorex*) and bats (Chiroptera) have been found.

On the basis of available radiocarbon dates and faunal composition the EBH assemblage from Ba2 site seems to be first of all of Middle and Late Valdaian age (MIS 3 and MIS 2), although the uppermost part of the section was probably deposited during the Holocene.

The faunal composition of EBH sites supports the opinion the Crimean Peninsula played a major role as the most north-eastern refugium for temperate species during the Late Pleistocene in this part of the European continent.

MAJOR BIOTIC EVENTS RELATED TO THE DISPERSAL AND EVOLUTION OF CANIDAE DURIND THE PLIOCENE AND PLEISTOCENE IN EURASIA

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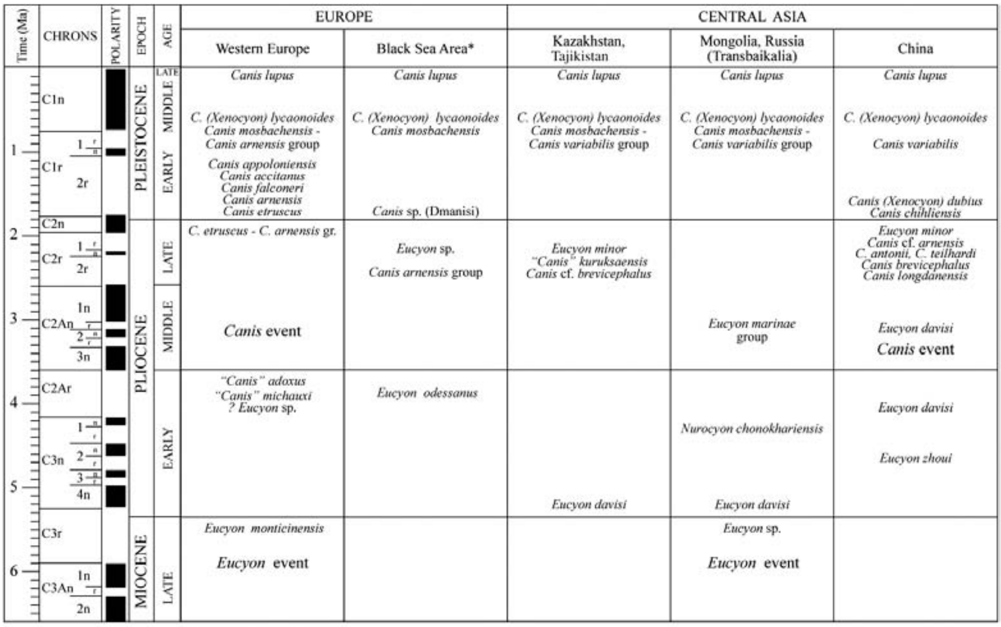
An analysis of the taxonomy and distribution of the Mio-Pliocene and Pleistocene *Eucyon*-like and *Canis*-like canids showed that the major biotic events related to the Canini dispersal and evolution in Eurasia generally coincided with faunal turnovers on the continent during the interval from 5.5 to 0.5 Ma. However, the species diversity of the Canini peaked asynchronously in Europe and Asia (fig. 1).



* Bulgaria, Moldova, Russia, Romania, Turkey, Ukraine

Fig. 1. Dispersal of the Canini across Eurasia during the Late Miocene to Early Pleistocene (Sotnikova, Rook, 2010)

The most significant events in the Eurasian history of the Canini were the "*Eucyon* event" and "*Canis* event" that took place in the terminal Miocene and at the beginning of Middle Pliocene, respectively. They occurred simultaneously in Europe and Asia.

The Late Miocene appearances of *Eucyon monticinensis* in Europe, *E. davisi* in Asia, and *E. intrepidus* in Africa were contemporaneous for the Old World. This expansion of canids is designated here as the "*Eucyon* event" (fig. 1).

The diversification of Canini in Central Asia peaked at the beginning of the Early Pliocene, as evidenced by the appearance of *Nurocyon chonokhariensis* and *Eucyon zhoui* and by the increase in number of the *Eucyon davisi* finds. The Early Pliocene European diversity peaked later, with the arrival of "*Canis*" *michauxi*, "Canis" *adoxus* and abundant *Eucyon odessanus* in the Late Ruscinian (MN15).

The next principal bioevent corresponds to the Middle Pliocene. The Ruscinian/Villafranchian transition was accompanied by the disappearance of diverse small Canini that had evolved in the Early Pliocene of Eurasia. This extinction coincided exactly with the appearance of a new group of *Eucyon*-like canids in Central Asia at the beginning of the Early Villafranchian and with the invasion of wolf-like canids into Eurasia. The wolf-sized species of the *Canis* – group made their first appearance in Eurasia in the Middle Pliocene (the "*Canis* event"). The peak of their diversity occurred in the Late Pliocene in Asia and at the beginning of the Early Pleistocene in Europe.

The histories of Canini in Europe and Asia were most different during the Middle Villafranchian. A group of advanced eucyons represented by *Eucyon minor* and "*Canis*" *kuruksaensis* survived only in Central Asia, where the explosive radiation of the wolf- and coyote-sized canids also took place, as reflected in the appearance of *C. teilhardi*, *C. longdanensis*, *C. brevicephalus*, *C.* cf. *arnensis* and hypercarnivorous *Sinicuon* cf. *dubius*. A high diversity of the *Canis* group in Asia continued to the end of the Pliocene.

Radiations of the wolf- and coyote-sized canids in Europe occurred primarily in the Early Pleistocene. This turnover included the increased abundance of *C. etruscus* and *C. arnensis*, and appearance of *Canis apolloniensis*, *Canis accitanus* and hypercarnivorous *Canis falconeri*.

The diversity of the *Canis* group appreciably decreased by the end of the Early to Middle Pleistocene being limited by the occurrence of small wolves of the *Canis mosbachensis*-*C. variabilis* group and large hypercarnivorous *Canis* (*Xenocyon*) *lycaonoides* in Eurasia.

The true gray wolves made their appearance at the end of the Middle Pleistocene at about 0.5-0.3 Ma.

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LATE–EARLY–MIDDLE PLEISTOCENE RECORDS OF HOMOTHERIUM FABRINI (FELIDAE, MACHAIRODONTINAE) FROM THE ASIAN TERRITORY OF RUSSIA

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The time span of the *Homotherium* occurrence is defined within 3.7 to 0.5 Ma. In the Pliocene and Pleistocene the homotheres inhabited Eurasia, Africa, and North America. The latest homotheres are known as *H. latidens* from the terminal Early to Middle Pleistocene sediments in Europe from England to the Black Sea region (Turner, Antón, 1997; Sotnikova, Titov, 2009), whereas their synchronous analogs in Asia are described as *H. ultimus* in China and *H. teilhardipiveteaui* in Tajikistan (Teilhard de Chardin, 1939; Sharapov, 1989).

In Asian Russia finds of *Homotherium* were recorded in the Kuznetsk Depression (Novosergeevo quarry), near Krasnoyarsk (Kurtak archeological area), in the Adycha River basin, northern Siberia (Kyra-Sullar outcrop), and in the western Transbaikalia in the Zasukhino 2–3 and Kudun localities (Erbaeva et al., 1977; Sotnikova, 1978; Foronova, 1983, 2001).

In the Novosergeevo quarry the lower mandible assigned to *Homotherium* aff. *ultimus* (IGG 3486) was collected nearby the section, in which the Sergeevo Formation deposits corresponding to the upper part of the Matuyama Chron are overlain by the Middle and Late Pleistocene sediments (Foronova, 1998, 2001). The finding of another lower mandible fragment of a small-sized *Homotherium* (IGG 1050) is associated with the Middle Pleistocene deposits of the Berezhekovo section in the Paleolithic Kurtak area (Foronova, 2001). The fragment of humerus of *Homotherium* (PIN 3659–509) encountered on the Adycha River bank at the Kyra-Sullar outcrop, is most likely associated with the Olyor fauna (1.4–0.5 Ma) of northeastern Siberia (Sotnikova, 1978). The material from Transbaikalia is characterized by the most reliable age attribution. Here, the proluvial sequences of the Kudun (Kizhing-Kudun depression) and Zasukhino (Itantsa River basin) localities include postcranial material and crenulated teeth fragments of *Homotherium* together with *Allophaiomys* cf. *pliocaenicus* characterized by the advanced dental characters with differentiated enamel (Erbaeva et al., 1977). In the Transbaikalian stratigraphic scale the Kudun and Zasukhino faunal assemblages are correlated with the uppermost Matuyama Chron and correspond to the uppermost Early Pleistocene (Erbaeva, Alexeeva, 2000).

According to relatively small size of mandible and morphological characters as a moderate development of mental flange and strongly arched incisors and canine series of lower dents, the Siberian homotheres show a clear resemblance with their Pleistocene analogs from China and Tajikistan.

The postcranial material was found in Asia for the first time. It was derived from the Kudun locality in Transbaikalia and is represented by long bones, metacarpal and metatarsal series, as well as carpal and tarsal bones (GIN 971/1442).

The postcranial skeleton of *Homotherium* in Europe is known from the Senèze dated as the Late Pliocene (Ballesio, 1963) and Incarcal, as initial Early Pleistocene (Antón et al., 2005). The detailed skeletal description of American *Homotherium serum* from Freisenhahn Cave (Late Pleistocene) was also published by Rawn-Schatzinger (1992).

According to these authors *Homotherium* had elongated fore and shorter hind limbs and the body with a slightly sloping back resembling that of hyena. Ballesio (1963) and Rawn-Schatzinger (1992) have pointed out the mosaic nature of the morphological characters in *Homotherium* legs, from plantigrade to highly digitigrade and cursorial. The modern analysis suggests that in *Homotherium*, despite all peculiarities of foot bones morphology, the Feline type of legs prevailed (Antón et al., 2005).

Our analysis showed that the Asian homotheres display postcranial features recorded in the European and American forms. The Kudun form was smaller than *Homotherium* from Senèze and had the same size as *Homotherium* from Incarcal. The morphology of the appendicular skeleton in the Asian form demonstrates some proportions and characters reminding of plantigrade or semi-plantigrade stance. Judging from the massive and short calcaneum and astragalus, the *Homotherium* from Kudun was more advanced in the development of plantigrade features than their European analogs.

The finds of *Homotherium* in Siberia are the northernmost in Asia. They indicate that in the Pleistocene the distribution area of these carnivorans covered many Asian regions and reached the northernmost Siberian margins. The revealed Beringian occurrence of *Homotherium* in Eurasia is of extreme importance for the understanding of the Pleistocene faunal exchange between Eurasia and North America.

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THE PALEOENVIRONMENTAL IMPLICATIONS OF THE EASTERN MEDITERRANEAN: A CONSTRUCTION BASED ON RODENTS

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Üçağızlı cave is located on the Eastern Mediterranean coast of the Hatay region (fig. 1). The Üçağızlı cave deposits are represented by reddish clay or silty clay (terra rossa) typical of limestone and karstic terrains in the Mediterranean. Üçağızlı cave includes Late Pleistocene fauna. Taxons of small mammals are abundant. Small mammal assemblages of Üçağızlı cave spanning a period from 41 to 17 KYA are described. The remains are referred to *Chionomys nivalis*, *Microtus guentheri, Apodemus mystacinus, Apodemus flavicollis, Apodemus witherbyi, Mus macedonicus*, *Mesocricetus brandti*, *Glirulus* sp., *Crocidura* sp., *Pipistrellus* cf. *kuhlii* and *Myotis* sp. The rodent assemblages of Üçağızlı contain European, local and Asiatic elements.

Fig. 1. Location map

The rodent fauna contains species characteristic of different subenvironments such as open country, rocky ground and woodland. *A. mystacinus, A. flavicollis, A. witherbyi* are the species of primarily deciduous forests and Mediterranean woods. *A.mystacinus* prefers drier habitats than the others do (Tchernov, 1986) and has been reported from barren, rocky areas of dry, open environments (Mayhew, 1978; Storch, 1988; Montuire et al, 1994). *A. flavicollis* is much less tolerant to dry environments (Tchernov, 1986) and most often recorded in more moist-wooded habitats (Storch, 1975; Nadachowski, 1982; Montuire et al., 1994). *A. witherbyi* (=*hermonensis*) requires woodlands (Filippucci et al., 1996; Siahsarvie and Darvish, 2008). *M. macedonicus* prefers crop areas, open, dry environments (Çolak et al., 2006) *C. nivalis* is known to represent rocky environments (Storch, 1975; Mayhew, 1978; Chaline et al, 1995). *M. guentheri* is a steppe element (Storch, 1975; Mayhew, 1978) and so is *M. brandti* (Tchernov, 1968). The species of *Glirulus* however, are assumed to prefer wooded environments (Meulen, de Bruijn, 1982; Daams, Meulen, 1984; van Dam, 1997). The only living species of the genus, *Glirulus japonicus,* inhabits mountain forests on some Japanese islands (Nowak, 1991).

In order to see the distribution of the environmental indicators and to check whether or not environmental changes have existed between the levels the rodents are grouped according to the environments of preference: *M. guentheri, C. nivalis, M. brandti, A. mystacinus* and *M. macedonicus* as representing open country environment with rocky ground and *A. flavicollis, A. witherbyi* and *Glirulus* as representing woodlands. Fig 2 shows that the relative frequencies of these ecological groups.

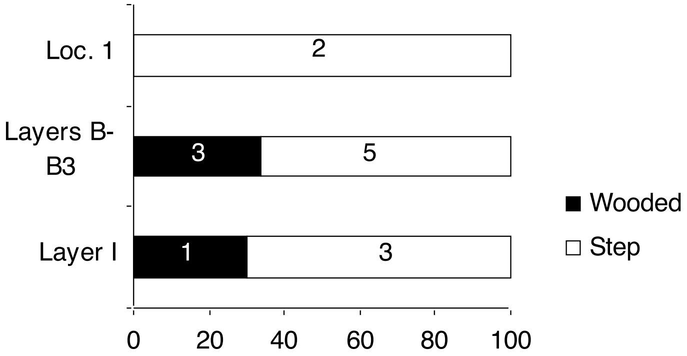

Fig. 2. Relative frequencies of the ecological groups of rodents represented in the various levels of Üçağızlı cave. Numbers refer to the number of rodent species (Üçağızlı based on the total number of M1, M2, m1, m2 of the Rodentia, Chiroptera and Soricomorpha)

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LATE PLEISTOCENE HISTORY OF THE RUSSIAN SHELF OF THE CASPIAN SEA

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We trace the history of the shelf during the end of Pleistocene. During that time the following sequence of palaeogeographical events took place within the Caspian Sea shelf: (1) the end of the Atelian regression; (2) the Khvalynian transgression and (3) its final stage.

(1) The *end of the Atelian regression* (about 30 to 16 thousand years B.P.). The stage correlates with the end of the Middle Valdai interstade (the Dunaev warming) and the beginning and the maximum of the Late Valdai glaciation (the Ostashkov and Vepsovo stages). The Atelian regression lasted for more than 40 thousand years and it was a low-level period of the Caspian Sea. The depth of the sea could be identified by the submerged coastal landforms and deposits. It was thought that during maximum regression the coastline was 20–25 m below the present-day one. But according to recent seismic sounding within the northern part of the Middle Caspian shelf a buried lens of accumulated deposits was located below the Khvalynian sediments which are up to 90 m thick and 2.5 km^2 large. The deposits were dated (Lokhin, Mayev, 1990) to the Atelian period. They were accumulated 70–80 m below the present-day sea level, i.e. at the depth of -100... -120 m. Abrasion escarpments and terrace, as well as two accumulative bodies of beach ridges were found within the erosion surfaces neighboring the buried delta, thus suggesting another (later) phase of the Atelian regression. The most essential changes of the fauna in the shallow and shrunk Caspian Sea coincide with the Atelian regression. Numerous Khazarian didacnas of the "crassa" group (*Didacna nalivkini*) and related species (*D. surachanica*, *D. pravoslavlevi*) became nearly extinct. Main components of the Khvalynian fauna were formed, i.e. mollusks of the "trigonoides" group (*Didacna praetrigonoides*, *D. ebersini*), which generally prefer habitats with lesser salinity. During the drop of the sea level vast shelf areas, particularly of the Northern Caspian, came out of water and the intense incision of river channels took place. The incision of the Volga River was dozens of meters in its mouth and 20 m near the town of Volgograd. The continuing drop of the Caspian Sea level resulted in the intense accumulation of diverse sediments within the shelf area and on the coast, namely loess loam and buried soils, aqueous-terrigenous and shallow-water deposits. The Atelian sediments were accumulated under conditions of cold continental climate. Steppe landscapes were widespread during the Atelian epoch and the ground often underwent permafrost deformations. To the end of the epoch the climate became warmer and the forests gained wider distribution.

(2) The *Early Khvalynian transgression* (16–11 thousand years B.P.) fell within the interstade of the Late Valdai (Late Würm) glaciation, i.e. colder period of the Early and Middle Dryas and the Allerod and Bolling warming phases. The Early Khvalynian transgression was among the largest during the Pleistocene evolution of the Caspian Sea. During the maximum stage of the Khvalynian Sea the absolute height of its level was 50 m. Well-defined ancient coastlines make it possible to conclude that during the Early Khvalynian epoch there were at least three phases

of significant rise, or rather long stagnation, of the retreating sea (Talgin, Buinaksk and Turkmenian), and the periods of rapid sea level drop in between. Deposits of the Khvalynian transgression are the most widespread on the Caspian coast. The sediments are quite diverse, from chocolate clay of the Lower Volga region to shingle beds and shell limestone of the Caucasian coasts. The stratigraphical classification of Khvalynian deposits and the palaeogeographical reconstructions are based on the complexes of Caspian mollusks belonging to the *Didacna* Eichwald genus. Associations of *Didacna parallella*, *D. protracta*, *D. cristata*, *D. subcatillus*, *D. zhukovi*, etc. are characteristic of the Lower Khvalynian deposits. On the shelf the Khvalynian deposits are less diverse and their composition usually corresponds to the steep-coast situation. The Northern Caspian deposits predominantly include fine facies of clay-silt sediments with the interlayers of sand and coarse silt and the shells of Khvalynian mollusks. The clays are usually compact, dark-brown, usually with gypsum and carbonate nodules. Shallow water formations, i.e. sands with the shells of *Didacna protrata* and *D. parallella*, are also present. The Khvalynian Sea was a brackish reservoir. At the beginning of transgression salinity was low in the peripheral parts of the reservoir. In the Northern part it was just 3–5 g/l, i.e. the optimum value for *Dreissena polymorpha* and *Adacna vitrea* which were predominant mollusks there at the time. The salinity increased up to 6–8 g/l along with the sea level rise and amounted to as much as 13 g/l at the peak of the transgression, reaching the optimum value for the index species *Didacna protracta*. With the advent of regressive trend the salinity of the reservoir drop down to 6–8 g/l again. At the peak of transgression when the Khvalynian Sea level exceeded +45 m its waters used to be discharged by the Manych hollow into the Black Sea depression, where the Neoeuxinian reservoir occurred at the time.

(3) *Final stage of the Khvalynian transgression* (11–6 thousand years B.P.) was rich in palaeogeographical events. These are the Enotayevsk regression, Late Khvalynian transgression and Mangyshlak regression. The Enotayevsk regression (11–9 thousand years B.P.) was a short but profound drop of the Caspian Sea level in between the Early and Late Khvalynian transgressions. It was synchronous with the Late Drias cooling and the beginning of the post-glacial epoch. The lowest position of the sea level was 70–80 m below the present-day one (Mayev, 1994). This was proved by the discovery of a buried valley and delta on the Western Caspian shelf. The channel has the form of a hollow and the delta is a flat upland limited by 50 m isobaths. The adjacent surface has a lot of small erosion forms, accumulative banks and terraces. Well profiles of the Northern Caspian shelf demonstrate the deposits of the Enotayevsk regression in the form of sand lenses with shell limestone. At the Northern Caspian coast the signs of the regression were for the first time identified in the town of Enotayevsk reference section as a slightly soil-processed top layer of the Lower Khvalynian deposits. It was the time of significant faunistic changes within the reduced Khvalynian Sea because the species variety in didacnas associations declined considerably.

The Late Khvalynian transgression (9–7 thousand years B.P.) was the last significant positive change of the Khvalyn Lake during the period of its general regression. It dates back to the very beginning of the Holocene. The transgression was synchronous with the advent of post-glacial epoch in the northern part of the Russian Plain and the intense melting of Scandinavian glaciers. The transgression went through several stages; the ancient coastlines could be found at 0–2 m (the akhachkala stage), -10... -12 m (the Sartas stage) and -5... -6 m (the Kushum stage). The Upper Khvalynian deposits consist of clayey silt and low-carbonized grey clay, yellow sands with grey-green mud, with *Didacna praetriginoides*. Within the coastal shallows and large deltas there is a specific facies of the so-called mound deposits which build the unique landscapes of the Baer's mounds of the Volga and Ural deltas. They were formed stage by stage within the shallow sea under strong wind-effected discharge currents of opposite directions. The complex of mollusks of the shallow Late Khvalynian Sea shelf is less diverse as compared with the epoch of peak transgression. The reason is more likely the intensification of hydrodynamic regime within the shallow sea than the decreasing salinity. According to the palaeobotanical data, the trees grew on the western and northern coasts at the beginning of the Late Khvalyiann epoch, and the forb-meadow and steppe cenoses were widespread. To the end of the epoch the climate became arid and hot, thus supporting the expansion of semi-deserts.

The Mangyshlak regression (7–6 thousand years ago) closed the Khvalynian epoch and separated it from the resent (New Caspian) one. It falls on the post-glacial time when the glaciers within the centers of the Late Valdai glaciation totally disappeared. The regression could be identified by numerous evidences, first of all, buried subaerial landforms and deposits. The drop of the sea level at the peak of regression is estimated to be about -90... -100 m (Mayev, 2006). At the time the whole Northern Caspian area came out of water and was dissected by the palaeo-channels of Volga, Terek, Kuma and Sulak rivers. The intense accumulation of various subaerial deposits took place within the dried-off shelf of the Caspian Sea. They were mainly aeolian sands, as well as alluvial silts and floodplain and lacustrine clays. The shallow-water marine sediments were found at the depth of 17-60 m, i.e. coarse sands with admixture of gravel and pebbles and numerous shells of *Didacna barbotdemarnyi*, *D. longipes*, etc. (Artamonov, Mayev, 1979). The palynological data (predominance of sagebrush and *Chenopodiaceae* pollen) and lithological evidence (increased concentrations of chlorite and montmorillonite among clay minerals) suggest the predominance of arid and hot climate over the Caspian area during the Mangychlak time.

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HIGH-RESOLUTION STRATIGRAPHY AND CHRONOLOGY OF LATE PLEISTOCENE PERIGLACIAL ZONE OF THE EAST-EUROPEAN PLAIN

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The stratigraphy of late Pleistocene of the periglacial zone of the East-European plain is based till now upon the investigation of the outcrops and soil pits situated on the interfluves, interfluve's slopes, ancient terraces. The structure of such type of outcrops and soil pits is not detailed – many horizons known for the glacial regions or other territories are absent; soils are often superimposed. Such compressed stratigraphy is obviously not satisfactory for the investigation of middle and upper Paleolithic sites

The most thickness and complexity of late Pleistocene deposits in periglacial zone of the Russian Plain are characteristic to the filling of depressions, formed in the beginning of the new climate-erosional cycle – during the Moscow late-glacial before the Mikulino Interglacial. They are presented by buried gullies (balkas) and little paleovalleys. Such conditions lead to the formation of pedolithogenic cyclitis consisting of the deposits of alluvial, slope, and aeolian genesis separated by paleosols.

Relief-forming processes and accumulation of deposits prevailed during the periods of cooling unfavorable for the vegetation. During the warm periods the rate of pedogenic processes was higher than the rate of sedimentation, and soils of various genesis and various degree of the development were formed. We investigated such objects in Mikchailov, Aleksandrov, Monastirsky, Novoposelkovsky and Lebedinsky open pits across the Middle Russian Plain.

The late Pleistocene deposits are based on the Mikulino paleosoil formed on the Moscow loess (MIS 5e). Mikulino paleosoil can be found in the bottoms and on the slopes of the paleogullies, and represents the forest pedogenesis: sod-podzolic soils on the slopes and light gray soil in the bottoms. Mikulino interglacial soil includes 3-4 pedogenic stages with the initial formation of meadow soils, followed by the formation of forest soils, and 2–3 morpholithogenic stages with the increasing of erosional and accumulative processes in the bottom of the gullies under the endothermic cooling. One of such cooling is marked by the development of deep seasonal frost penetration.

Strong forest fires happened to be because of climatic instability following the transitions to the Valday glaciation. Fires destroyed the vegetation and resulted in the accelerated erosion of Mikulino paleosoil from the slopes. Fluvial processes together with the solifluctions due to the strong cooling increased the existed process of filling of the depressions. This stage correlates with MIS 5d.

Two interstadial forest-steppe soils of temperate belt were formed during the early Valdai warming – Kukuev meadow paleosoil (MIS 5c) and Streletzk chernozem-meadow soil (MIS 5a). Frost and relief-forming processes revived during the stadial separating these stages (MIS 5b). The second interstadial was longer and warmed according paleosol and paleobotanical data. Early Valdai was ended by strong cooling (MIS 4) reflected in the formation of caldron-shaped pseudomorphs in the pedosediment above Streletzk paleosoil.

Two interstadial periglacial forest-steppe soils were formed during middle Valdai (MIS 3): Aleksandrov wet-meadow paleosoil (14-C dates – 49600±700 yrs. B.P.) with plastic cryogenic deformations, and more complex Bryansk paleosoil, transformed by wedge-shaped deformations. Gleyic loessial loam separating these paleosoils indicates the mollification of the severe periglacial environment. The bone fragments of wooly rhinoceros and horse were found in the loessial material (tab. 1). Hydrouzelsk paleosoil (^{14}C-age ~37 kyrs. B.P.) has close stratigraphic location. Bryansk paleosol is now represented by complicated pedolithocomplex including at least 2 pedogenic phases: 33–27 kyrs and 25–24 kyrs. Deluvial slopes towards the second terrace have even more detailed record of the middle Valdai sediments (outcrops Molodova, Korman') or the fillings of burial gullies (Kostenki).

Table 1

Correlation of the author's high-resolution scheme with A.A.Velichko's scheme

A.A. Velichko	S.A. Sycheva			MIS
Soil, loess	Saint Germaine	Sites	14C-dates, yrs.B.P.	
Holocene	Holocene	All objects		1
Altynovo	Loess	-«-		2
	Allered paleosoil	Monastyrsk, Aleksandrov open pits	11200±90, 11140±190	
	Loess	-«-		
Trubchevsk	2–3 embryonic soils	Fatyanovka, Kamennaya Balka etc.	14750±150 17900±200	
Desna	Loess			
Bryansk	Bryansk paleosoil	Monastyrsk open pit	23400+230	3
		Monastyrshina	24400±700	
	Loess	-«-		
	Monastyrsk paleosoil	-«-	29100± 340	
		Hydrouzel	30400±450	
		Aleksandrov open pit	33140±230	
?	Loess	-«-		
	Hydrouzel paleosoil	Hydrouzel	36950±1190	
			37200±500	
	Gleyish loess	Aleksandrov open pit	39710±580	
			40200±420	
	Aleksandrov paleosoil	-«-	49600±700	
Khotylevo	Loess, Sediment	-«-		4
Krutitsa	Streletzk paleosoil	Aleksandrov, Monastyrsk, Novoposelkovsk open pits		5a
	Sediment			5b
	Kukuev paleosoil			5c
Sevsk	Sediment			5d
Salyn	Mikulino paleosoil		3 pedogenic stages	5e

Late Valdai sediments (MIS 2) in periglacial zone of Russian Plain have several levels of embryonic paleosoils often with gleyic features. They were formed during the warm periods of smaller scale than early or middle Valdai interstadials.

Thus the Late Pleistocene of the periglacial zone of the East-European plain appear to be much more complicated period than it is presented in the common scheme of ISC or A.A.Velichko.

High-resolution stratigraphic scheme of the late Pleistocene correlates well with the views of middle and west European scientists. We can correlate Mikulino paleosoil with Eemian interglacial, Kukuev paleosoil with = Brorup+Amersfoort = Saint Germaine 1 (~115–105 ca. B.P.), Streletzk paleosoil with = Odderade = Saint Germaine 2 (~70–80 ca. B.P.), Aleksandrov paleosoil with = Oerel (~50 ca. B.P.), Merskhort; glayish loam, Hydrouzelsk paleosoil – Moershoofd = (44–45 kyrs. B.P.) and Hengelo (38–40 ca. B.P.), Monastyrsk and Bryansk paleosoils = Denenkamp = Grand Bois (33–24 ca. B.P.).

REVIEW OF TURTLE RECORDS FROM THE QUATERNARY SEDIMENTS OF EUROPEAN RUSSIA AND ADJACENT TERRITORIES

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This paper reviews published and new records of turtles from the Pleistocene and Holocene localities of European Russia and adjacent territories.

The European pond turtle (*Emys orbicularis* (Linnaeus, 1758)) was reported from the following localities: **Alazani**, Eastern Georgia, Holocene (Ckhkikvadze, 1977); **Andriivka**, Kiev Province, Ukraine, Holocene (Taraschuk, 1971); **Cherkasskaya**, Voronezh Province, Russia, Holocene (Kuz'mina, Kasparov, 1987); **Chornoliska**, Kirovogradsk Province, Ukraine, Holocene (Pidoplichko, 1956); **Darkveti**, Western Georgia, Holocene (Bendukidze, 1972); **Dniproges**, Zaporozhye Province, Ukraine, Holocene (Pidoplichko, 1956); **Gorods'ke**, Zhytomyr Province, Ukraine, Holocene (Pidoplichko, 1956); **Goryn' River**, Ukraine, Pleistocene-Holocene (Tatarinov, 1973); **Grushivka**, Dnipropetrovsk Province, Ukraine, Holocene (Pidoplichko, 1956); **Kaniv**, Kherson Province, Ukraine, Holocene (Pidoplichko, 1956); **Karataevo**, Rostov Province, Russia, Holocene (Myagkova, 2005); **Khalep'ya**, Kiev Province, Ukraine, Holocene (Pidoplichko, 1956); **Kiev**, Kiev Province, Ukraine, Holocene (Pidoplichko, 1956); **Kopanische 1**, **4**, Voronezh Province, Russia, Holocene (Kuz'mina, Kasparov, 1987); **Kotsakhuri**, Eastern Georgia, Early Pleistocene (Chkhikvadze, 1977); **Kudaro 3**, Georgia, Middle Pleistocene (Baryshnikov, Nessov, 1995); **Kut**, Dnepropetrovsk Province, Ukraine, Holocene (Pidoplichko, 1956); **Kuz'michi 1**, Belarus, Holocene (Krival'tcevich, Bakharev, 2007); **Mashuk**, Northern Caucasus, Russia, Pleistocene (Khosatzky, 1951); **Mikhajlovka**, Kherson Province, Ukraine, Holocene (Pidoplichko, 1956); **Mikol's'ke**, Dnipropetrovsk Province, Ukraine, Holocene (Pidoplichko, 1956); **Nizhnee Krivche**, Ternopol' Province, Ukraine, Late Pleistocene (Tatarinov, 1973); **Ogrin'**, Dnipropetrovsk Province, Ukraine, Holocene (Pidoplichko, 1956); **Ozernoe**, Odessa Province, Ukraine, Early Pleistocene (Ckhkikvadze, 1983); **Perun**, Zaporozhye Province, Ukraine, Holocene (Pidoplichko, 1956); **Petukhivka**, Mikolaiv Province, Ukraine, Holocene (Pidoplichko, 1956); **Privil'ne**, Zaporozhye Province, Ukraine, Holocene (Pidoplichko, 1956); **Sabatinivka**, Kirovohrad Province, Ukraine, Holocene (Pidoplichko, 1956); **Sandraki**, Vinnytsya Province, Ukraine, Holocene (Pidoplichko, 1956); **Shan-Koba**, Southern Crimea, Ukraine, Late Pleistocene (Khosatzky, 1946); **Shiryaevo**, Sumy Province, Ukraine, Holocene (Pidoplichko, 1956); **Sluch' River**, Ukraine, Pleistocene–Holocene (Tatarinov, 1973); **Tamula**, Southern Estonia, Holocene (Paaver, 1958); **Tanais**, Rostov Province, Russia, Holocene (Myagkova, 2000); **Terpinnya**, Zaporozhye Province, Ukraine, Holocene (Pidoplichko, 1956); **Tikhonivka**, Zaporozhye Province, Ukraine, Early Pleistocene (Pidoplichko, 1956); **Usatove**, Odessa Province, Ukraine, Holocene (Pidoplichko, 1956); **Volos'ke**, Dnipropetrovsk Province, Ukraine, Holocene (Pidoplichko, 1956); **Zakatnoe 1**, Rostov Province, Russia, Holocene (Myagkova, 2005); **Zamost'e**, Moscow Province, Russia, Holocene (Klemente Konte, 2001); **Zaporizhzhya**, Zaporozhye Province, Ukraine, Holocene (Taraschuk, 1971); **Zimove**, Volyn' Province, Ukraine, Holocene (Pidoplichko, 1956); **Zlivki**, Rostov Province, Russia, Holocene (Myagkova, 2005); **Zmiivka**, Kherson Province, Holocene (Pidoplichko, 1956).

New material of *E. orbicularis* (stored in the paleoherpetological collection, Zoological Institute of the Russian Academy of Sciences) comes from the following localities: **Aleksandrovskaya**, Rostov Province, Russia, Pleistocene; **Bol'shoj Log**, Rostov Province, Russia, Holocene; **Chaltyr'**, Rostov Province, Russia, Holocene; **Elizavetovka**, Rostov Province, Russia, Holocene; **Kuleshovka**, Rostov Province, Russia, Holocene; **Lipetsk Lake**, Voronezh Province, Russia, Holocene; **Novotroitskoe**, Sumy Province, Ukraine, Holocene; **Port-Katon**, Rostov Province, Russia, Early Pleistocene; **Potemkinskaya**, Zatonsk Channel, Ukraine, Early Pleistocene; **Suvorovskaya**, Volgograd Province, Russia, Late Pleistocene; **Tsimlyansk**, Rostov Province, Russia, Holocene; **Tsymbal**, Taman Peninsula, Russia, Early Pleistocene; **Tuzluki**, Rostov Province, Russia, Holocene. Remains of Emydidae gen. indet. were reported from **Dalis-Mtha**, Eastern Georgia, Early Pleistocene (Chkhikvadze, Petrov, 2001).

The Caspian pond turtle (*Mauremys caspica* (Gmelin, 1774)) was reported from the following localities: **Eldar Steppe**, Eastern Georgia, Early Pleistocene (Chkhikvadze, 1983); **Enikend**, Azerbaijan, Pleistocene (Chkhikvadze, 1983); **Guzgun-Tapa**, Western Azerbaijan, Middle Pleistocene (Chkhikvadze, 1977).

The Greek tortoise (*Testudo graeca* Linnaeus, 1758 sensu lato) was r reported from the following localities: **Aruchlo 1**, Eastern Georgia, Holocene (Bendukidze, 1979); **Azykh**, Azerbaijan, Middle Pleistocene (Aliev, 1969); **Belaya Cave**, Western Georgia, Holocene (Vekua et al., 1979); **Binagady**, Apsheron Peninsula, Eastern Azerbaidjan, Middle Pleistocene (Alekperov, 1978); **Dalis-Mtha**, Eastern Georgia, Early Pleistocene (Chkhikvadze, Petrov, 2001); **Damjily**, Azerbaijan, Pleistocene (Bakradze, Chkhikvadze, 1984); **Darkveti**, Western Georgia, Holocene (Bendukidze, 1972); **Dmanisi**, Eastern Georgia, Pleistocene (Vekua, 1955); **Fat'mai**, Apsheron Peninsula, Azerbaijan, Pleistocene (Alekperov, 1978); **Hyena Cave**, Eastern Georgia, Pleistocene (Vekua et al., 1980); **Kotsakhuri**, Eastern Georgia, Early Pleistocene (Chkhikvadze, 1977); **Imiris Gora**, Eastern Georgia, Holocene (Bendukidze, 1979); **Minchegaur**, Western Azerbaijan, Holocene (Khosatzky, Alekperov, 1957); **Sakazhia**, Western Georgia, Late Pleistocene (Vekua et al., 1979); **Samele Klde**, Western Georgia, Holocene (Bendukidze, 1972); **Talgar**, Azerbaijan, Pleistocene (Bakradze, Chkhikvadze, 1984); **Taman Peninsula**, Krasnodar Province, Russia, Pleistocene (Alekperov, 1978); **Tsopi**, Georgia, Holocene (Bendukidze, 1979); **Tsutskhvati**, Western Georgia, Pleistocene (Vekua, 1972). New material of *T. graeca* s.l. (stored in the paleoherpetological collection, Zoological Institute of the Russian Academy of Sciences) comes from **Zhukovski Quarry**, Stavropol Province, Russia, Early Pleistocene.

In addition, undetermined records of turtles (Testudines indet.) were reported from the following localities: **Chekalino**, Volga Region, Russia, Holocene (Vybornov et al., 2003); **Dolgovskaya**, Lipetsk Province, Russia, Holocene (Sinyuk, 1986); **Dronikha**, Voronezh Province, Russia, Holocene (Sinyuk, 1986); **Duz-Dag**, Azerbaijan, Early Pleistocene (Chkhikvadze, 1977); **Gundorovskoe**, Samara Province, Russia, Holocene (Vasil'ev, Ovchinnikova, 1986, 1990); **Lebyazhinka**, Volga Region, Russia, Holocene (Vybornov et al., 2003); **Palantyukan**, Azerbaijan, Early Pleistocene (Chkhikvadze, 1977); **Rakushechnyj Yar**, Rostov Province, Russia, Holocene (Belanovskaya, 2003); **Vilovatovskaya**, Volga Region, Russia, Holocene (Ovchinnikova, 1995).

Thus, mentioned records demonstrate that *E. orbicularis* reached its distributional maximum in the Holocene and Pleistocene thermal periods. Their current northern distribution limit reaches Smolensk and Tula Provinces of Russia. In the Holocene and Pleistocene, *E. orbicularis* extended to the more northern areas of the considered territory (Moscow Province of Russia and Southern Estonia) and disappeared from these areas during the last 2.000 years. Distribution of records of *T. graeca* closely resembles the recent range apart from localities of Taman Peninsula and Western Georgia. This indicates that *T. graeca* had a more continuous range unlike disjunctive current populations.

NEW SMALL MAMMAL FAUNAS OF LATE PLIOCENE – EARLY PLEISTOCENE FROM NORTHERN CAUCASUS AND LOWER DON AREA

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Northern Caucasus remains a relatively poorly studied region in terms of the fossil record of Late Cenozoic mammalian faunas. In recent years several new fossil assemblages of Late Pliocene have been discovered shedding new light on faunal history of small mammals in this area. These new discoveries are reviewed below in stratigraphic order.

Zhukovskyi Mayak (47°38'26"N 42°29'29"E). The site was discovered in 2007. It is located in the cliff of the Tsymla Reservoir, near the Zhukovskaya village (Rostov Region). The bone bearing cross-bedded fluviatile sands belong to the upper part of the Nagavskaya Formation. The assemblage includes *Desmana* sp. (1), *Beremendia* sp. (1), cf. *Petenyia* sp. 1, *Sorex* cf. *minutus* (1), Leporidae gen. (1), *Allactaga* sp. (2), *Allocricetus* sp. (1), *Mimomys hajnackensis* (61), *Mimomys* sp. (2), *Borsodia novoasovica* (82), *Pliomys ucrainicus* (1), *Micromys* cf. *praeminutus* (2), Muridae gen. (4). The fauna can be dated to Late Pliocene (Piacenzian), Akchagylian, the zone MN16a, and the regional zone MNR5. This fauna is very similar to the fauna of Shirokino (Ukraine).

Terskyi (44°11'39" 43°20'29"). The site, located in Stavropol Region near the town of Georgievsk, was discovered by G.A. Pismenskaya in 2004. It was briefly described (Tesakov, Pismenskaya, 2005). Fossiliferous sands of fluvial origin overly the Akchagylian marine deposits. The scarce available material includes Leporidae gen., *Nannospalax* sp., *Apodemus* sp., *Mimomys praepliocaenicus*, and *Clethrionomys* cf. *primitivus*. The fauna is dated to earliest Pleistocene (Gelasian), late Villanyin, MN17, regional zone MNR3. This level has no faunal matches in the Northern Caucasus.

Sopatyi Kurgan (45°26'6"N 40°52'16"E). The site was discovered in 2007. The bone bearing bed (greenish sandy silts with carbonate and manganese concretions) occurs at the base of thick subaerial sequence in the right bank of the Kuban River at the upper margin of Temizhbekskaya village (Krasnodar Region). The scarce assemblage includes *Clethrionomys* cf. *kretzoii, Mimomys reidi*, and *Mimomys* sp. This association is dated to earliest Pleistocene (Gelasian), late Villanyian, MN17, and regional zone MNR1. The fauna is a probable analog of Psekups small mammal fauna (Tesakov, 2004).

Forstadt 2 (45°1'19"N 41°9'52"E). The sate was found in 2004. The bone bearing horizon is exposed in the old clay pit at the Forstadt village near the town of Armavir (Krasnodar Region). The fauna includes *Ochotona* sp. (2), *Spermophilus* sp. (2), *Spalax* sp. (2), *Allophaiomys* vel *Chionomys* (12), *Lagurodon arankae* (5), Prolagurus cf. *panonicus* (2), Lagurini gen. (22), *Mimomys* ex gr. *pusillus* (2), Muridae gen. (1), *Cricetus* sp. (2), and *Cricetulus* sp. (1). The fauna is dated to Early Pleistocene (Eopleistocene of the Russian scheme), 'Calabrian', early Biharian, and regional zone MQR8.

Iskra (45°21'9"N 36°49'52"E). This site was discovered in 2008. The fossiliferous offshore brackish and fresh water deposits outcrops in a clay pit near Beregovoi settlement (Taman Peninsula, Krasnodar region). The source deposits contain abundant shells of *Dreissena* spp., and *Unio (Pseudosturia)* sp. Small mammal material includes *Allophaiomys pliocaenicus* and Lagurini. This fauna dates to Early Pleistocene ('Calabrian'), early Biharian, and regional zone MQR8.

GORKAYA BALKA: A REFERENCE QUATERNARY SECTION IN THE NORTH CAUCASUS (KRASNODAR REGION, RUSSIA)

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The section Gorkaya Balka (45°9'22.2" N 41°3'28.4" E) is located in the high, right bank of the Kuban River downstream from Severo-Kavkazskii settlement, in 12 km to the north from the town of Armavir. Main features of geological structure of the Kuban River between Armavir and Kropotkin were studied by several authors, most closely by N.A. Lebedeva (1963). The research team of the Geological Institute RAS and other institution studied this section in 2005–2007, and 2009 (Dodonov et al., 2006). The 36 m thick section represents the interlayered sequence of mostly subaerial deposits. Paleomagnetic study by Dr. V. Tubikhin (Geological Institute, Moscow) revealed the normally magnetized upper part (Brunhes) and reversely magnetized lower part of the section (Matuyama). The M/B boundary is situated in 21 m below the section's top. The upper 20 m of the section contain six paleosols (GB1-GB6). The lower 16 m of the section are mostly composed of silty loams with occasional signs of fluvial sedimentation. Two paleosols are present in this part, in two m below M/B datum, and at exposed base of the section.

In 35.5 m below the top of the section, at the base of a member of yellow-brown layered silts and fine-grained sands, bones of elephant have been excavated in 2005. The spirally bent tusk with a maximal diameter of 109 mm can belong to a younger individual of the southern elephant *Archidiskodon* sp. or to a female of *Mammuthus trogontherii*. At the top of the same member, at the depth of 33 m, remains of small mammals have been collected by screen washing bone enriched sediments. The assemblage contains *Mimomys savini* (n=1), *Mimomys pusillus* (2), *Ellobius sp.* (3), *Eolagurus argyropuloi* (7), *Lagurus pannonicus transylvanicus* (96), *Microtus (Stenocranius) hintoni* (22), *Microtus* aff. *arvalidens* (14), *Microtus* spp. (56), *Cricetus* sp. (1), *Allocricetus* sp. (1), *Cricetulus* sp. (1), *Marmota* sp. (2), *Spermophilus* sp. (22), *Spalax* sp. (6). This fauna belongs to the lower part of the regional zone MQR7 (*Prolagurus pannonicus – Stenocranius hintoni*) and corresponds to late Early Pleistocene (Eopleistocene) interval between the Jaramillo Subrchron and the M/B boundary. Small mammal fauna was recovered in 11.5 m below the paleomagnetic inversion. The environmental aspect of the fauna indicates the presence of open, steppe-like biotopes.

The lower part of the section in the depth range from 18 to 36 m was palynologically studied. Samples are relatively poor in pollen and spores. Arboreal pollen (mostly *Pinus* and *Alnus*) does not exceed 30 % of the total spectra composition. Dominant is pollen of Asteraceae, Cichoriaceae, Chenopodiaceae, Primulaceae, Caryophyllaceae, Plumbaginaceae, Apiaceae, Brassicaceae, and Rubiaceae. Subrecent appearance of pollen spectra indicate widespread steppe vegetation. The general composition of spectra below the M/B inversion evidences the presence of wooded (conifer and broad-leaved) and forest-steppe landscapes indicated by pollen of *Pinus* sg. *Dyploxylon*, *P.* sg. *Haploxylon*, *P.* sect. *Strobus*, Betulaceae (*Betula, Corylus, Alnus, Carpinus*). Herbaceous vegetation is represented by *Ephedra*, Asteraceae, Poaceae, Chenopodiaceae, and Brassicaceae. Also present are spores of *Lycopodium clavatum* and *Osmunda*. Plaeosol (GB-6) and loess-like loam above the M/B boundary yielded pollen spectra that show a decrease in diversity of species composition. In particular, these spectra lack *Tsuga, Carya, Zelkova*, and Ericales. In general, late Early Pleistocene (Eoplestocene) and early Middle Pleistocene (Early Neopleistocene) of Gorkaya Balka are characterized by extensive development of forest-steppe landscapes combining meadow-steppe stations and patches of conifer – broad-leaved forests.

The six upper paleosols of the section were studied by a several methods. The first paleosol (GB-1) has grayish-brown color. It is humified and has a poorly differentiated profile. It also does not show signs of cryogenic transformations and low carbonate content. Paleosol GB-1 has a ^{14}C date 18750±1100 BP (IGAN-3725) based on stable fraction of humic acids. GB-1 is interpreted as sod light-colored humic paleosol. It indicates semiarid climatic conditions with relatively fast accumulation of light loess-like sedimentary matrix. The second paleosol (GB-2) level represents a pedocomplex with two superimposed profiles. The upper one is gray, poorly carbonatized profile, whereas the lower one represents a humified soil. The four lower paleosols are characterized by poor differentiation of profiles.

In conclusion, the Gorkaya Balka reference section produces multidisciplinary data on the paleoenvironment of Northern Caucasus in time interval from Early to Late Pleistocene. Variegated subaerial deposits of the high bank of Kuban River in its middle curse represent a detailed record of environmental changes in the Northern Caucasus for the last million years.

DISTRIBUTION OF *ELASMOTHERIUM* IN KAZAKHSTAN

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Elasmotherium is the peculiar group of terrestrial vertebrates of very large sizes, with specific structure of skull and jaw, strongly plicated enamel of hypsodont teeth, reduced or absent roots. Its representatives, as quite formed group of perissodactyls, have appeared in late Pliocene, but reached the highest growth in early and middle Pleistocene of Eastern Europe, Povolzhie, Middle Asia and China. To the present time, on the territory of Kazakhstan are determined 30 localities with remains of *Elasmotherium sibiricum* (Kozhamkulova 1969; 1981; 2000). B.S. Kozhamkulova (1977) has distinguished Kazakhstan – South – Ural zoogeographic province on the basis of these data. Existence interval of genus *Elasmotherium* in Eastern Europe is within 2 m years; they appeared in late Pliocene and disappeared in the period of maximum glaciations. And as truly mentioned A.K. Shvyreva (1988), the geographic centre of Siberian elasmotherium at that time should be considered the Southern Ural and Kazakhstan where it met together with typical representatives of early Pleistocene fauna: *Elephas wusti, Equus (Equus) mosbachensis, Dicerorhinus mercki, Paracamelus (Paracamelus) gigas, Bison (Bison) schoetensacki***.** *Elasmotherium* finds are of significant stratigraphic value, parallel with other animals, for paleontological basis of deposits age. Therefore, we have studied in detail, the collection of elasmotherium teeth from the known localities. As a result, are received the interesting data that in Kazakhstan, genus *Elasmotherium* was presented in by different species during its existence.

The most early representatives of genus *Elasmotherium* in Kazakhstan are found in the deposits of Podpusk – Lebjazhie complex on the Irtysh river (village Lebjazhie). Earlier, the tooth found by Kozhamkulova (1969) was attributed to M2 (N60–13g/1962) of *Elasmotherium sibiricum*. However, the morphometric indices, such as more rhinoceros – like appearance of tooth surface; well differentiated crown and root; weak plication and wavy of tooth enamel and its small sizes (length – 44.4, width – 25.0; enamel thickness – 1.38 mm) are corresponded to indices for P4 and with characteristic diagnosis for *Elasmotherium peii* (Chou Minchen, 1958; Shvyreva, 1988). This species of elasmotherium is marked, for the first time, for early and middle Pleistocene of China, late Villafranchian of Odessa faunistic complex of Eastern Europe (Minchen, 1958; Shvyreva, 1988) and also for early Pleistocene locality Salcia, Moldova (David, Eremeiko, 2003).

In Podpusk – Lebjazhie complex in Pavlodar Priirtyshie, in common with Elasmotherium, are found the remains of *Mimomys pliocaenicus, M. coelodus, Trogontherium minus, Equus* cf. *stenonis, E. livenzovensis, Archidiskodon gromovi, A.* cf. *meridionalis, Paracamelus* cf. *gigas, Eucladoceros* sp., *Antilospira* cf. *gracilis, Gazella* cf. *sinensis* and many others (Vislobokova, 1996). By Vislobokova's (1956) data, on the basis of bone extremities is defined the presence of *Elasmotherium* sp, with reserve, that it is similar to *E. sibiricum* by sizes. We have studied elasmotherium P4, which by its morphometric characters, is the most similar to that of *Elasmotherium peii* Minchen. Shvyreva (1988) is noted, that *Elasmotherium peii* and *Elasmotherium* *sibiricum* are practically similar by sizes Therefore, on the basis of tooth morphological characters, we have defined *Elasmotherium peii,* that was find with *Equus* cf. *stenonis.* This complex is the analogue of middle Villafranchian fauna of Eastern Europe.

The distribution of Koshkurgan complex representatives (analogue of Tiraspol) with remains of Elasmotherium, that were found in Turkestan region within the south – western Karatau ridge, near Koshkurgan settlement is characteristic for early Pleistocene. The type locality for complex is Koshkurgan. Bone remains of complex, in common with stone artifacts ancient Paleolithic epoch were deposited in water – bearing lens of gravel – pebbly sands (Aubekerov, 2000). Earlier, in composition of this complex was defined one species Elasmotherium sibiricum (Kozhamkulova, 1969, 2000; Kochenov, 1989). Detailed study of collection materials by teeth from Koshkurgan locality allowed us to establish the presence of two species of genus *Elasmotherium.* One of them, *Elasmotherium sibiricum*, with characteristic for its teeth pattern and strongly plicated enamel of surface, with opened roots and proper sizes. The second species is also defined by morphometric teeth characters. This elosmotherium is similar to Eopleistocene *E. caucasicum* and early middle Pleistocene *E. peii*, by development of weak enamel plication, presence of closed back valley but differed from them by small sizes, opened roots of tooth. It is differed from *E. sibiricum* by more small sizes; weak enamel plication and presence of closed back valley. Lower teeth are also small and have more simple and thick enamel. Similarity is observed in the presence of opened roots. From *E.* cf. *peii* (Moldova) is differed by significantly smaller tooth sizes and opened root. They are similar in that paracone is stretched forward and teeth have rhombic form. In spite of small sizes, the permanent teeth of Koshkurgan species are hypsodont. Unfortunately, the lack of bony material, is not allowed to attribute it with confidence to any definite species Nevertheless, the existent material is indicated to the presence of small size elasmotherium, relative to known species of this genus. As is generally known, during the period of Singil fauna distribution, *Elasmotherium sibiricum* was differed by more small sizes and more strong plication of teeth enamel, especially lower ones (Shvyreva, 1984). But Koshkurgan elasmotherium is differed from Singil one by more simple plication of teeth. One the basis of these morphometric characters, we assume, that in Koshkurgan fauna is presented the new species of elasmotherium, which is more archaic and was found in section base. We, tentatively, attribute it to *Elasmotherium* sp. (probably new species). In common with elasmotherium are found the remains of: *Archidiskodon trogontherii, Equus (Equus) mosbachensis, E. (Hemionus) hydruntinus, Dicerorhinus kirchbergensis, Paracamelus (Paracamelus) gigas, Bison (Bison) schoetensacki, Praeovibos* sp. and others (Kozhamkulova, 2005). As it was already noted, fauna discovered in Koshkurgan I and II, is heterogeneous by evolutional level and composition (Foronova, 2000), that gives the base to establish within this fauna and, correspondingly, within the deposits, of several layers with fauna of different age. Therefore, we suppose that new species of *Elasmotherium* may stratify the lower layers of section and fauna, with remains of *Elasmotherium sibiricum*, is bedded higher. Earlier, were received EPR – dates by bones from bone – bearing lens; data of Russian Academy of Science gave the following meanings: 500± 23; 487±20; data on EPR of *Paracamelus gigas* teeth enamel gave 800 thou of years (in press). Therefore, in Koshkurgan, may be supposed the presence of bone – bearing horizons of different age, corresponding to the levels of Eopleistocene upper part and the beginning of early Neopleistocene, with new species of archaic *Elasmotherium* sp., *Paracamelus (Paracamelus) gigas*, *Archidiskodon* elaphant the upper limit of which is restricted by first half of lower Neopleistocene; horizon of the end of lower Neopleistocene and middle (at the level 500 thou years) with remains of *Elasmotherium sibiricum, Equus (Equus) mosbachensis, E. (Hemionus) hydruntinus, Dicerorhinus kirchbergensis* and others, the upper limit of which is covered middle Neopleistocene and some elements were widely distributed in upper Neopleistocene. For middle Plestocene is characteristic the distribution of *Elasmotherium sibiricum.*

We have studied the skull, lower jaw of *Elasmotherium sibiricum* Fisch., found in the Akmolinsk region in 75 km of north – east of Astana town, in dry channel of Akzhar river (right tributary of Selekty river), for which is characteristic the development of more strong plication of teeth enamel and molars have opened roots in contrast to more early species. Besides, its sizes are corresponded to those of middle Pleistocene elasmotherium. M2 from locality Kapchagai (=Novoiliisk), lower M_1 from Aktuybinsk region (near Emba station), upper M^3 from East-Kazakhstan region are characterized by morphometric indices, specific for *Elasmotherium sibiricum.*

STUDIES ON THE EARLY STEPPE MAMMOTH FROM NORTH CHINA, COMPARED WITH THOSE FROM RUSSIA

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In East Asia, elephantine fossils were among the most frequently appearing mammalian taxa during Pleistocene. But the current study on the evolutionary systematics of this group is not so convincing; to some extent, it makes people a little confused. The crucial problem is the evolutionary relationships among *Mammuthus* (including *Archidiskodon*), *Palaeoloxodon* and *Elephas*.

In the past decades, the evolutionary phylogeny for the Genus *Palaeoloxodon* was hypothised like this: *Archidiskodon planifrons* (Early Pleistocene)→*Palaeoloxodon tokunagai* (late Early Pleistocene to Middle Pleistocene)→*Palaeoloxodon namadicus* (Middle Pleistocene)→*Palaeoloxodon naumanni* (Late Pleistocene) (Zhou and Zhang, 1974). But the recent situation is completely different, because some researchers have included some of the materials once referred to the primary three species to *Mammuthus meridionalis* and *Mammuthus trogontherii* respectively (Wei et al., 2003, 2006), which arose another serious problem, i.e. the root of the widely-spreaded species *Palaeoloxodon naumanni*. It seems not very appropriate to employ all the fossil materials only to the reconstruction of the phylogenetic system of *Mammuthus* but ignore the evolution of *Palaeoloxodon* at all.

It seems that *Mammuthus* has the closest relationship with *Palaeoloxodon*. The cranial morphology and the dental characters support this proposal.

Nihewan Basin is an ideal place to study the evolution of the Tribe of Elephantini. Up to now, more than 10 fossil localities have been reported and at least 4 species have been recognized, namely *Mammuthus meridionalis*, *Mammuthus trogontherii*, *Palaeoloxodon naumanni* and *Elephas maximus* etc. Both the earliest (Wei et al., 2003) and the latest (Tong, 2010) steppe mammoth of the world were recovered in Nihewan Basin.

In Russia, the early representatives of mammoth lineage were referred to the genus *Archidiskodon* which only comprises one species, *Archidiskodon meridionalis*. But the latter mammoth species are in common with the Chinese counterparts.

LATE PLEISTOCENE – HOLOCENE TRANSFORMATION OF DIATOM ASSEMBLAGES IN THE BLACK SEA NORTH-WESTERN SHELF

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The contemporary semi-marine Black Sea basin was formed under the influence of the post-glacial transgression. At the Last Glacial Maximum the Black Sea was a semi-fresh to brackish Neo-Euxinian sea-lake. The Late Pleistocene-Holocene transformation of diatom assemblages in the North-Western Black Sea Shelf has been traced in original material. Changes in the genera and species structure are related to evolution of palaeoenvironments.

A sediment core MGP-05 C334 (90.4 m) was taken from a depth 14.5 m in the northern part of the Ukrainian Black Sea Shelf near Odessa. To study diatom assemblages, the core C334 was sub-sampled at thirteen intervals: 2.1–2.12 m, 2.38–2.4 m, 5.5–5.6 m, 7.25 m, 9.5 m, 11.0 m, 13.3 m, 13.8–14.0 m, 14.7 m, 15.1 m, 16.1 m 17.5 m, 18.0 m. The material was treated in accordance with standard techniques. Diatom frustules where examined by light and scanning electron microscopy. Quantitative and qualitative diatom analyses of the sediments where carried out. At least 500 diatom frustules where identified in each sub-sample. A total of 36 genera and 85 species were identified in thirteen subsamples taken from 8 levels analysed. On the basis of diatom and sediment composition, the sediment section was subdivided into five units.

Unit 5 is composed of coarse-grained to fine-grained silt formed in the Late Pleistocene-Early Holocene. The shell and organic detritus are in interval in considerable number. The depth level 16.6–19.4 m contains freshwater and brackish-freshwater diatom assemblage. Most abundant are epiphytes and epipelon: *Epithemia turgida* (Ehr.) Kütz., *Epithemia adnata* (Kütz.) Breb., *Epithemia sorex* Kütz., *Cocconeis placentula* Ehr., *Rhopalodia gibba (Ehr.) O.Müll., Rhopalodia gibberula (Ehr.) O.Müll., Navicula oblonga* (Kütz.) Kütz. *Tryblionella gracilis* W. Sm., *Anomoeoneis sphaerophora* (Ehr.) Pfit., *Cymbella* aff. *cymbiformis* Ag., *Cymbella cistula* (Hemp.) Kirch., *Cymbella ehrenbergii* Kütz., *Nitzschia* aff. *amphibia* Grun., *Rhoicosphenia abbreviata* (Ag.) L.-B., *Frustulia* sp., *Pinnularia viridis* (Nitz.) Ehr., and freshwater plankton: *Cyclotella meneghiniana* Kütz., *Synedra ulna* (Nitz.) Ehr. Dominant taxa are borealic and cosmopolitan species of the genera *Epithemia* (*Epithemia turgida* (Ehr.) Kütz., *Epithemia adnata* (Kütz.) Breb., *Epithemia sorex* (Kütz.) (near 50 % of the total number of diatom frustules), and *Cocconeis placentula* Ehr. (near 10 %), *Anomoeoneis sphaerophora* (Ehr.) Pfit. (2–6 %), *Navicula oblonga* (Kütz.) Kütz. (3 %).

The upper part of the lacustrine Unit 5 shows a gradual disappearance of the freshwater species assemblage. Dominant taxa are: *Anomoeoneis sphaerophora* (Ehr.) Pfit. (26 %), *Pinnularia viridis* (Nitz.) Ehr. (24 %), *Epithemia turgida* (Ehr.) Kütz. (10 %), *Epithemia adnata* (Kütz.) Breb. (6 %), *Navicula oblonga* (Kütz.) Kütz. (3 %), and *Amphora ovalis* (Kütz.) Kütz. (3 %). In the other hand, the assemblage of upper part is characterized by the presence of marine-brackish epipelic species: *Campylodiscus clypeus* Ehr. (4 %), *Caloneis westii* (W.Sm.) Hend. (7 %), and *Caloneis permagna* (Bail.) Cl.

Unit 4 is deficient in diatom remains. The level (14.85–15.4 m) is composed of green-grey clay with a smoll amount of the shell and organic detritus. None were found in sediment sample.

Unit 3 is represented by the dark-brown peat with the rare shell detritus formed in the Early Holocene. The depth level 14.65–14.85 m contains poor freshwater and brackish-water diatom assemblage. Epiphytic and epipelic species are present: *Achnanthes brevipes* Ag., *Epithemia turgida* (Ehr.) Kütz., *Epithemia adnata* (Kütz.) Breb., *Navicula oblonga* (Kütz.) Kütz., *Surirella maeotica* Pant.

The lower part of the alternating dark-grey fine-grained sand and silt (14.2–14.65 m) formed in the Early Holocene wasn't sampled.

Unit 2 is composed of the upper part of the Lower Holocene alternating dark-grey fine-grained sand and silt, and the Lower Holocene grey mud (7.5–14.2 m). In the lower part of the interval organic remains and detritus are in considerable number. Most of diatom valves were broken greatly. The assemblage is characterized by the presence of epiphytic and epipelic both marine-brackish (*Campylodiscus echeneis* Ehr., *Campylodiscus daemelianus* Grun., *Campylodiscus clypeus* Ehr., *Achnanthes brevipes* Ag., *Grammatophora marina* (Lyngb.) Kütz., *Surirella maeotica* Pant., *Tryblionella punctata* (W. Sm.), and freshwater (*Anomoeoneis sphaerophora* (Ehr.) Pfit., *Ellerbeckia arenaria (Moore* ex *Ralfs)* Crawf., *Epithemia turgida* (Ehr.) Kütz., *Caloneis latiuscula* (Kütz.) Cl., *Cymatopleura elliptica* (Breb.) W.Sm., *Cymatopleura solea* (Breb.) W.Sm. species. The diatom flora of Unit 2 is mostly bentic with some planctoic marine and freshwoter species: *Actinocyclus octonarius Ehr., Aulacoseira ambigua* (Grun.) Sim., *Chaetoceros* sp. Dominant taxa are boreal and cosmopolitan species.

Unit 1 combines the Lower-Middle Holocene green-grey muds of depth interval 2.1-7.5 m. As a whole, the diatom species composition is similar to the present-day littoral Black Sea flora. The diversity of the taxonomic composition within the interval is low; a species of the genera *Campylodiscus* account for 80 to 90 % of the total number of diatoms. Dominant taxa are marine-brackish epipelon and epiphytes: *Campylodiscus echeneis* Ehr. (35–55 %), *Campylodiscus daemelianus* Grun. (25–50 %), *Campylodiscus clypeus Ehr.* (5–10 %), *Diploneis bombus* Ehr., *Grammatophora marina* (Lyngb.) Kütz., *Tryblionella punctata* W. Sm., *Achnanthes brevipes* Ag.

The assemblage of lowest part of Unit 1 is characterized by the freshwater planktonic species *Aulacoseira ambigua* (Grun.) Sim. and the frashwater epiphyte and epipelon *Ellerbeckia arenaria (Moore* ex *Ralfs)* Crawf., *Cymatopleura elliptica* (Breb.) W.Sm. The disappearance of *Grammatophora marina* (Lyngb.) Kütz. combines with the increase in frashwater epiphytic and epipelicn species (*Cocconeis pediculus Ehr., Anomoeoneis sphaerophora* (Ehr.) Pfit., *Diploneis domblittensis* (Grun.) Cl., *Epithemia turgida* (Ehr.) Kütz., *Epithemia adnata* (Kütz.) Breb.).

Most of the diatoms within Unit 1 are brackish-water benthic and littoral species, but marine-brackish-water plankton are also: *Paralia sulcata* (Ehr.) Cl., *Chaetoceros* sp., *Actinocyclus octonarius* Ehr., *Coscinodiscus radiatus* Ehr., *Coscinodiscus oculus iridis* Ehr. A typical oceanic littoral species, *Terpsinoe americana* (Bail.) Ralfs, was found within the Unit 1. It is the first occurence of *Terpsinoe americana* in the Black Sea Holocene. Other rare species, such as *Achnanthes baldjikii* (Bright.) Grun., *Surirella maeotica* Pant., *Amphora variabilis* Kozyr., were also found in the Black Sea Middle Holocene sediments.

On the basis of diatom composition, the succession of Late Pleistocene-Holocene sediments in core MGP-05 C334 can be subdivided into five units representing alternating episodes of freshwater and marine-brackish conditions. Lacustrine sediments of the Late Pleistocene and the Pleistocene-Holocene boundary contain freshwater fossil diatoms. A Holocene evolution of the Black Sea basin resulted in a rather gradual transformation of diatom assemblages in the North-Western Black Sea Shelf to marine-brackish present-day flora.

MEIZHARTYK – LATE PLIOCENE LOCALITY OF SMALL MAMMALS (NORTH KAZAKHSTAN)

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Locality Meizhartyk is situated in 90 km north-east of Arkalyk town (through Furmanovka settlement, near Ushtobe settlement), Meizhartyk ravine (=Meizhartik) is formed by temporal river, making the left tributary of Tasty river, falling into Selety River (at UTM 5030N, 6635E). Bones of mammals were collected there, for the first time, at the beginning of 70-th by A.J. Gus'kova and Zh. Duisebaev. Material was collected in coarse gravel of the lower part of section and sandy deposits of middle part. They belonged to *Paracamelus praebactrianus*, *Cervus* sp., *Gazella* sp., *Anancus arvernensis* (Geology of the USSR, 1972), by B.S. Kozhamkulova definitions. Later, the detailed description of series and data on new collections were given in the work of P.A. Tleuberdina, B.S. Tsirel'son, A.I. Gus'kova, L.L. Kuznetsova and N.R. Dyagileva (2004). By their data, in 3,65 m series, attributed by them to Beteke suite, were isolated the following layers (from bottom to up wards):

1. Medium-grained sand with lens and clay parting, pebble admixture. In the lower part are met distinct clay lens of underlying crust of weathering and dense argillites . . . . .1,7 m.
2. Almost horizontal interbedding of clays of brown, light-grey and grey colours with fine-grained sand, rare pebble. In this layers were found the bones of Hipparion sp., Paracamelus praebactrianus, *Cervus* sp., *Gazella* sp., *Proochotona* sp. (late form) . . . . .1,0 m.
3. Inequigranular sand with well rounded pebble, lens of pebble at the bottom . . . . .0,3 m.
4. Well rounded pebble with inequigranular sand, lens of sandy loam and clay . . . . .0,2 m.
5. Clay with lens of fine-grained sand, lens of sandy loam and clay . . . . . .0,15 m.
6. Inequigranular sand with well rounded pebble . . . . .0,2 m.
7. Clay of brown colour with sand lens . . . . .0,1 m.
8. Inequigranular sand with inclusion of well rounded pebble. Bedding is almost horizontal, in the lower part of layer weakly marked oblique bedding . . . . .0,7 m.

On the basis of discovered remains, the age of contained rocks was dated by late Pliocene. More late collection of lagomorphs and rodents in Meizhartyk was gathered in 2002 by the author of this article. However, the lithology of layers, from which they were collected is significantly differed from above mentioned description of section. Its thickness in the place of collection is approximately 3,5 m. Here, may be distinguished three main layers from the top to the bottom:

1. Rusty sandstone with manganic-violet spots . . . . 1,0 m.
2. White sandstone . . . . 0,5 m.
3. Brown clayey sandstone with lens of yellow gravel. The remains of small mammals are collected from this layer . . . . 2,0 m.

At present, in the composition of Meizhartyk microtheriocomplex were determined *Hypolagus* sp., *Pliolagomys kujalnikensis*, *Tamias* sp., Castoridae (?*Sinocastor*), Ctenodactylinae gen. et sp. indet., *Prosiphneus* ex gr. *praetingi*, *Orientalomys* sp., *Pliopygerethmus* sp., *Allocricetus* sp., *Borsodia* sp. In the layer, from which were collected the remains of these animals, was presented mastodon pelvic bone.

It must be noted, analyzing the systematic composition of discovered fauna, its large similarity with those from two localities, situated north of Meizhartyk. In first – Simbugino (Kumurly and Karlaman horizons, early Akchagyl, the end of Gilbert epoch), were also described Hypolagus sp., *Tamias* sp., Castoridae (?*Sinocastor*), *Prosiphneus* ex gr. *praetingi* и *Borsodia* (described by V.P. Sukhov (1977) as *Mimomys* (*Ch.*) ex gr. *baschkirica*). In the second – Beteke (Beteke suite, middle Akchagyl) are listed such common forms as *Hypolagus* sp., Pliolagomys kujalnikensis (earlier was described by M.A. Erbajeva (1982) from the locality Tobol, as *Proochotona* cf. *gigas*), *Prosiphneus* sp., *Borsodia* (described by V.S. Zazhigin (1980) as *Kulundomys*). Thus, the age of Meizhartyk locality is considered at present in vast range: early-middle Akchagyl (Late Pliocene).

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BIOGEOGRAPHY AND HUMAN DISPERSAL INTO EUROPE

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Human presence in southern Asia is documented from about 1.8 Ma onwards. On the one hand, the appearance of the large bodied *Homo ergaster* in Africa and immediately afterwards of *H. erectus* in Southern Asia suggests that an evolutionary advance allowed for the dispersal. On the other hand, primitive characteristics of the human remains from Dmanisi and from Flores suggest that the dispersal may have been earlier and that a more primitive species may have been involved.

At present there is an arid belt extending from the Sahara, through the Middle East to Central Asia. The distribution of localities that yielded fossils of animals adapted to open or dry environments, like camels, giraffids, gerbilids and ostriches, suggests a similar distribution of dry or open environments at least since the Middle Miocene. This is confirmed by the distribution of fossils of animals adapted to humid or closed habitats, like deer, tapirs, beavers, moles, and *Anchitherium*. This belt of dry habitats may have fluctuated in its degree of dryness, width, position and thus in its capacity of a barrier or filter that regulates the faunal exchange between Africa and the Indian Subcontinent in the South and Europe and Asia in the North. Proxies for the dryness of parts of this belt were documented for the past 4 Ma, and reflect an overall tendency towards increasing aridity as well as fluctuations with periodicities of the different Milankovich cyclicities (de Menocal, 1995).

The record of mammalian dispersals into and out of Africa was intense before approximately 2.5 Ma, after that date mainly mammals dispersed that were adapted to dry or open environments, and after about 1.8 Ma nearly no dispersals occurred for some time. Apparently, human dispersal out of Africa occurred when this was still possible, while the more advanced Acheulean or Mode 2 culture originated shortly after this date in Africa but did not disperse into Eurasia (Van der Made, 2010).

Human dispersal into Europe is a second and much later event, involving a different species and different causes. It may have occurred around 1.2 Ma. The humid environments and their faunas of mid-latitude Europe and Asia graded into the arid belt and its fauna in the area around the Black Sea (Van der Made & Mateos 2009). Humans were present in the northern part of this arid belt for a long time and may have favoured open but not very dry environments. Their dispersal into Europe may have been checked by closed environments of central Europe until the eccentricity cycle became increasingly important forcing global climate and modifying central European environments. The study of the Pleistocene faunas around the Black Sea is expected to contribute to understanding of human dispersal into Central and Western Europe.

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THE FAUNA FROM AZOKH: NEW FOSSILS AND NEW INTERPRETATIONS

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The cave of Azokh (also known as Azykh), at the lesser Caucasus, has yielded a Middle Pleistocene human mandible. Together with human evidence, including lithic industry, a large record of vertebrate fossils was recovered in the 1960's to 1980's. The sequence is divided into Beds that are numbered from the top to the bottom, Beds I to IX being Beds I to VI fossiliferous. New excavations in levels I to V were undertaken since 2002. Here we present the study of the new large mammal fossils and a revision of part of the older collections.

Bed V has the richest fauna and the subsequent levels contain mostly the same species, while in Bed I domestic animals appear. A distinctive erosive discordance between Bed I and Bed II puts in contact historic and Middle Pleistocene sediments. A faunal change within the section was expected, but this could not be demonstrated; in some genera the material from Beds I and II was too poor to confirm or reject the persistence of a species from the lower Beds.

Carnivores are best represented in Bed V. *Ursus spelaeus* is particularly abundant. In addition there are remains of other than *Ursus* such as *Vulpes vulpes*, *Canis lupus*, *Canis aureus*, *Meles*, *Martes*, *Crocuta*, *Felis*, and *Panthera pardus*. There are large and small equids and rhinoceroces *Stephanorhinus hemitoechus* and *S. kirchbergensis*. The following eventoed ungulates are present: *Sus scrofa*, *Capreolus pygargus*, *Dama* aff. *peleponesiaca*, *Dama* sp., *Megaloceros solilhacus* (or *Megaceroides*), *Cervus elaphus*, *Bison schoetensacki*, *Ovis ammon*, *Capra* and *Saiga*.

There are no typical "cold" elements in any of the faunas, with the possible exception of *Saiga*, which is part of the interglacial fauna in Western Europe, but which has its refugium in central Asia. There are several "warm" elements, such as *Sus*, *Dama* and *Stephanorhinus kirchbergensis*. These suggest that all beds were formed during interglacial conditions, because, though the area south of the Caucasus may have been a refugium, the great altitude would result in a very harsh climate during glacial times.

Early *Cervus elaphus* did not have antlers with crowns, but from approximately 400 ka onward, crowns appear in the fossil record and two specimens are present in Bed V. In Western Europe *Cervus elaphus* shows important size changes (which cannot be explained by Bergmans Rule or climate); the species is large bodied until about 600 ka, then it becomes small and between about 240 to 90 ka it is large again. Here *Cervus* is small in all Beds, with the exception of Bed II. In Western and central Europe, *Stephanorhinus hemitoechus* appeared around 450 ka, *Ursus spelaeus* appeared roughly around 300 ka, and the smaller *Canis mosbachensis* (until about 400 ka) is replaced by the larger *Canis lupus lunellensis* (around 300 ka) and a still larger *Canis* *lupus* (from about 200 ka onwards and present in Bed II), while the last appearance of *Megaloceros solilhacus* (present in Bed V) is possibly around 300–400 ka. *Dama peloponesiaca* occurs in Greece along with *Megaloceros solilhacus* and is different from the *Dama* aff. *peloponesiaca* from Azokh VI and V, suggesting an age difference. These comparisons might be erroneous in underestimating long distance diachrony, but are the best we have at present and they suggests that Beds VI to III might be correlated to Stage 9, while Bed II might be as young as Stage 5 and Bed I should be Stage 1.

QUATERNARY STRATIGRAPHICAL FRAMEWORK OF THE ZAKARPATTIA REION OF UKRAINE

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In order to work out in details the Quaternary stratigraphic framework of the Ukrainian Zakarpattia (the eastern part of the Middle Danube Plain), the special study has been carried out in this region during 2006–2009. This study was a part of the international project on correlation of Quaternary units of the Zakarpattia depression (Ukraine) and the East Slovak depression (Slovak Republic). It also was a part of "The Complex work program on methodological support of regional geological research in Ukraine during 2003–2010". The study was fulfilled with support of experts from the National Taras Shevchenko University of Kyiv (N.P. Gerasimenko) and from the Zakarpattia prospecting expedition (J.J. Cherepanya).

The research area includes the Chop-Mukachevsky Depression, the Solotvinsky Depression and the Vygorlat-Gutynsky Ridge (fig. 1) where 78 exposures, 7 boreholes and 43 alluvial terrace profiles have been investigated. The identification of stratigraphical units has been done on the base of the Quaternary Stratigrafical framework of Ukraine (Veklych et al., 1993) including the methodology of the Late Cainozoic paleogeographical research.

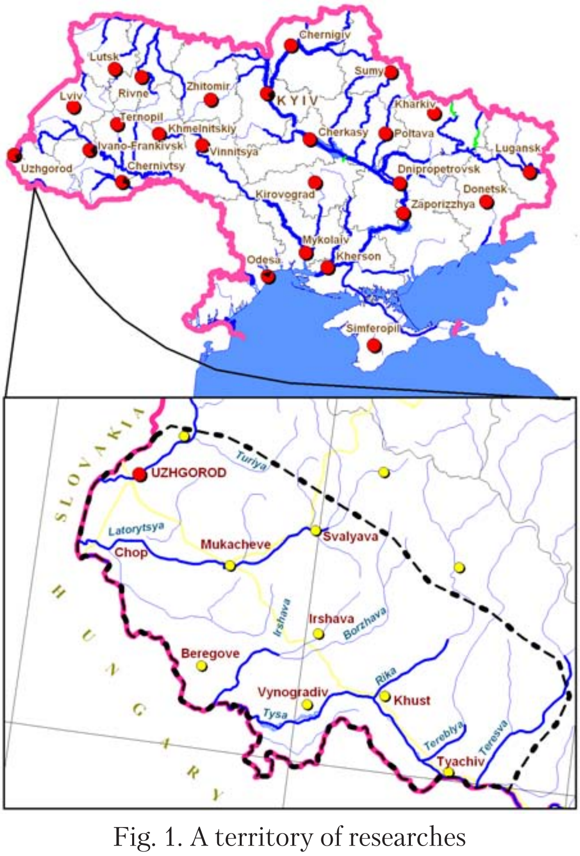

Fig. 1. A territory of researches

The elaborated framework of paleogeographical stages and detailed stratigraphy of the Late (Upper) Cenozoic of the Zakarpattia region (the Holocene, Pleistocene, Pliocene, and Late Miocene) is substantiated by stratigraphical, paleopedological, facial, geomorphological, pollen and archaeological studies. The stratigraphical correlation of the Quaternary units of the Zakarpattia Lowland in Ukraine and Slovak Republic is elaborated together with the Slovak experts J. Pristash and Y. Maglaj.

Characteristics of alluvial, superaquatic and subaerial sediments of all paleogeographical (paleoclimatic) stages are represented in the framework. The framework also includes the qualitative characteristics of neotectonic movements and paleovolcanic episodes for the Vygorlat-Gutynsky Ridge, Chop-Mukachevsky and Solotvinsky Depressions and the adjacent areas of the Carpathians.

The obtained data shows the Pre-Quaternary (even Pre-Pliocene) age of the final volcanic events in the Vygorlat-Gutynsky Ridge and the same age of the formation of the “Kopanska” accumulative terrace. The position of the local stratigraphical divisions – the Minay, Onok and Chop – within the Pliocene and Quaternary stratigrpahical frameworks of Ukraine is established.

It is shown that two types of Quaternary sequences are widely distributed through the area. One includes succession of the loess and palaeosol units of the second half of the Pleistocene (the Lubny, Tiligul, Zavadivka, Dnieper, Kaydaky, Tyasmyn, Pryluky, Uday, Vytachiv, Bug, units and the Dofinivka-Holocene complex). The second type of the Quaternary sequence is characterized by prevalence of palaeosols and loesses of the Kryshanovka, Illichivsk, Shyrokino, Pryazov, Martonosha and Sula units of the Eopleistocene and the Early Pleistocene.

The built up of loess-palaeosol sequence and the relief characteristics of the Zakarpattia area were subjected to a strong change in a tectonic mode and in a eolian morfolithogenesis type during the interval between the Martonosha and the Lubny paleogeographical stages and also, possibly, at the beginning of the Dofinika stage.

THE STRUCTURE OF PLEISTOCENE LOESS-PALEOSOL FORMATION IN SOUTHERN RUSSIAN PLAIN BASED ON DATA FROM EASTERN AZOV SEA REGION

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Several high coastal section along the shore of the Taganrog Gulf expose subaqual sediments (fluviatile deposits of the ancient Don River origin and estuarine deposits of the Azov Sea), overlain by subaerial deposits that primarily belong to the loess-paleosol formation. The underlying subaqual sediments are arranged in three terraces. The early one, the Nogaisk terrace yielded fossil mammals of the Tamanian faunal assemblage (Eopleistocene). The two others, the Platovo and Voznesenskaya terraces produced the fauna of early and late Tiraspolian assemblage, respectively (Lebedeva, 1965; Dodonov et al., 2005; Tesakov et al., 2007), and are referred to the lower Pleistocene. This provided a chronological control for the lower boundary of the subaerial sequence at the preliminary stage of the study (Velichko et al., 1973).

Sections of eastern Azov Sea Region are well correlated based on the magnetic susceptibility (K). A significant regional marker for the LPS is the maximal value of this parameter (up to 981×10^{-3} SI/g) in the Vorona PC. Somewhat less clear are correlations based on K values of the Inzhava and Kamenka soil complexes. The Mezin PC, as compared to the above-mentioned complexes, is distinct in a clear peak (up to 704×10^{-3} SI/g) in all studied sections.

The study of morphotype properties of PC's in comparison with those known for heterochronous soil complexes from central regions of East European periglacial area (Velichko et al., 1984) resulted in identification (downsection) of the Mezin (main phase correlated with the Mikulino interglacial), Kamenka (main phase, Kamenka interglacial), Inzhava (main phase, Likhvin interglacial), and Vorona (main phase, Muchkap interglacial) paleosol complexes.

The interrelation of the Vorona PC and the alluvium points to its formation during the late Tiraspolian chronological stage. This provides a correlation of the Vorona PC in the Azov Region with the Muchkap interglacial (Velichko et al., 2005). Small mammal fauna from this level includes *Eolagurus* sp., *Lagurus* ex gr. *transiens-lagurus*, *Microtus* cf. *arvalidens*, *Spermophilus* sp.

The Vorona paleosol complex has a more complex structure when it occurs on the V (Platovo) terrace, correlated by Lebedeva (Lebedeva, 1965) to the main, i.e. the earlier part of the Tiraspolian interval. The fauna of small mammals from the alluvial sediments underlying the LPS in Semibalki and Platovo corresponds to the early part of the Tiraspolian assemblage (Rekovets, 1994; Tesakov et al., 2007). The Vorona soil profile in sections Semibalki 2 and Shabelskoe includes the horizon A. It is underlain by the horizon B with its upper part represented by red-brown loam with krotovinas. Below, this level is replaced by a lighter loam underlain by another red-colored level, which represents an earlier stage of pedogenesis. This bed has an indistinct lower boundary with abundant thin streaks penetrating into the underlying bed down to the depth of ca. 0.5–0.7 m.

The lithological homogeneity and coloration of this layer, and its role as a source bed for soil formation processes evidence its subaerial origin prior to the loess formation. The basal sandy clay, occurring below the hydromorphic soil, yielded small mammal association including *Lagurus transiens, Microtus gregaloides, Microtus* ex gr. *arvalis*, *Eolagurus* sp., *Ellobius* (*Ellobius*) sp., *Spermophilus* sp., and other forms. This fauna clearly dates the source sediments to the later part of the Tiraspolian assemblage.

A new important component is present in the lower part of subaerial strata composing a still older VI (Nogaisk) terrace. One of the key sections that document the Tamanian age of the terrace estuarine and fluviatile deposits (Lebedeva, 1965; Dodonov et al., 2007; Tesakov et al., 2007) is Port-Katon. The main part of the section exposes the LPS structure similar to that known in the Platovo terrace. For example, the Vorona paleosol complex is also represented here by several soil phases. Its upper main stage, occurring at the depth of 11.50 m, is represented by the dark, brown-gray humus-rich loam (0.5 m) underlain by the brown with a reddish tinge loam (ca. 0.45 m) rich in secondary carbonate concretions and krotovinas. Still lower occurs another reddish-brown bed (ca. 0.4 m) with carbonates and krotovinas that corresponds to an earlier soil formation phase. At the base of the section, below this early phase of the Vorona PC and underlying yellowish pale loams, the contact zone with sandy estuarine-fluviatile loams documents the earliest soil formation level preserved as a carbonate bed (ca. 0.4 m) with abundant large krotovinas (up to 10–15 cm in diameter) filled with brownish loam.

Age estimates of soil beds in the studied LPS were obtained based on the fossil remains of small mammals extracted from krotovina infillings. Despite low concentrations of fossil bone material in krotovinas, these finds, in contrast to redeposited remains from fluviatile deposits, provide precise chronological and paleoenvironmental evidence directly related to the particular soil formation epoch (Agadzhanyan, 1972). Screen washing of krotovina infillings of the earliest level of soil formation, separated from the Vorona paleosol complex by subaerial pale yellowish heavy loam and represented by the horizon Bca-krot yielded the following fauna (tab. 1).

This association includes *Prolagurus* ex gr. *pannonicus-posterius*, Microtini gen., and *Spermophilus* (*Urocitellus*) sp. The evolutionary stage of the steppe lemming *Prolagurus*, transitional from *P. pannonicus* of the Tamanian faunal assemblage to *Lagurus posterius* of the early phase of the Tiraspolian assemblage, is sometimes assigned to a separate species, *Lagurus transylvanicus* Terzea, 1989.

Table 1

Data on faunal remains recovered from paleosols of the studies sections

Layer / Section	**Semibalki-2**	**Semibalki -1**	**Shabelskoye**	**Port-Katon**
Modern soil	-	Steppe lemming *Lagurus* sp. Terrestrial mollusk *Valvata* sp.	-*	-
Mezin PC	-	Souslik *Spermophilus* sp. Steppe lemming *Lagurus lagurus* Lizard Lacertidae gen. **Age**: Late Pleistocene	Insectivora gen. Souslik *Spermophilus* sp. Terrestrial mollusks *Valvata* sp., *Chondrula tridens*	Steppe lemming Lagurini gen. Reptile Reptilia
Kamenka PC	-	-*	Souslik *Spermophilus* sp. Mole rat *Spalax* sp. Steppe lemming *Lagurus* sp. Vole *Microtus* sp. Terrestrial mollusks *Valvata* sp., *Chondrula tridens*	Steppe lemming Lagurini gen. Vole *Microtus* sp. Vole Microtini gen.? Lizard Reptilia: Squamata?
Inzhavino PC	*Spermophilus* sp.	-*	Shrew *Sorex* sp. Common vole *Microtus* ex gr. *arvalis* Vole *Microtus* sp.	-
Vorona PC	-	Souslik *Spermophilus* sp. Steppe lemming *Lagurus* ex gr. *transiens-lagurus* Yellow vole *Eolagurus* sp. Vole *Microtus* cf. *arvalidens* Amphibia Anura Mollusk *Chondrula tridens* **Age**: the end of Late-beginning of Middle Pleistocene, Late Tiraspolian complex	Souslik Spermophilus sp.	
Earlier reduced PC			Ochotona sp., Spermophilus sp., Pygeretmus sp., Spalax sp., Ellobius (Ellobius) sp., Lagurus transiens, Eolagurus sp., Microtus gregaloides, Microtus ex gr. arvalis, Microtus sp., amphibia n and reptilian bones. **Age**: second half of Early Pleistocene, Tiraspolian complex	Souslik *Spermophilus* (*Urocitellus*) sp., Steppe lemming *Prolagurus* ex gr. *pannonicus – posterius*, Vole *Microtus* ex gr. *hintoni*, Lagurini gen. **Age:** transition from Eopleistocene to Early Pleistocene (transition from Taman to Tiraspolian complex)

This form is characterisitic for the so-called Petropavlovka type faunas referred by different researchers either to the Tamanian or Tiraspolian assemblages and associated with the end of the paleomagnetic Matuyama Chron. The same sediments (clayey layered sand and hydromorphic soil) produced remains of the vole *Microtus* ex gr. *hintoni* (primitive morphotype) that clearly indicates the transition between the Tamanian and Tiraspolian assemblages too.

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CORRELATION OF THE GLACIAL AND PERIGLACIAL PLEISTOCENE EVENTS IN EASTERN EUROPE: LINES OF ATTACK

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The Quaternary sediments in the East European Plain reveal a complicated succession of geologic events in the glacial and periglacial areas and their transboundary relationship. Geochronology and paleogeography of this multicomponent complex is based on lithological, paleomagnetic, paleontological, paleopedological, radiological (^{14}C, Th/U, OSL, etc.), and other methods.

The proposed correlational scheme (tab. 1) represents an attempt to estimate from the present knowledge the chronostratigraphic position of certain horizons in the glacial and periglacial realms of the East European Plain and to designate the problems of the new data interpretation.

One of these problems for the early Pleistocene is the stratigraphic position of the interglacial deposits recovered between the Don till base (MIS 16) and the Brunhes/Matuyama boundary (MIS 19). Two interglacials, the Akulovo and Okatovo, which preceded the Don glaciation, have been already recognized. They are well paleobotanically characterized and are correlated in the periglacial zone with the Balashov and Rzhaksa soils, respectively (Velichko et al., 2002). At the top of the latter the Brunhes/Matuyama boundary is recorded. The new records available in recent years suggest the recognition of one more pre-Don interglacial (Krasikovo) on evidence from the studied section nearby the Krasikovo Village in the Upper Volga basin. Though its flora is of mesophilic character, but compared to the Akulovo assemblage, it is poorer in coniferous and broad-leaved species composition. It lacks *Pinus* sec. *Mirabilis* An. and among the moderately thermophilic forms, *Eucommia*. This interglacial is most likely intermediate between the two previously recognized, however, its stratigraphic position in this interval is still assumptive because the sediments bearing such a flora are as yet only known in the Moscow region. The succession discussed bears certain similarities to the corresponding units of the Cromerian complex.

An important common feature of glacial-interglacial cycles traced starting at least with the late Tiraspolian, is the stable occurrence in every cycle of a well-pronounced interstadial at the very beginning of glaciation. This phenomenon is clearly recorded in the loess-soil sections of the periglacial zone (Velichko et al., 2007). As for the interglacials, they are not always characterized by a single optimum. For instance, the problem is the estimation of climatic changes during the Muchkap interglacial, which sediments rich in the Tiraspolian small mammal fauna are correlated with the lower part of the also complicated Vorona pedocomplex in the periglacial zone. The number of optima, two or three, in this interglacial is still under discussion. The Muchkap interglacial as a whole is correlated with Interglacial III of the Holland Cromerian, Ferdynandow (Poland) and Voigtstedt (Germany) interglacials.

Recently, based on the early forms of *Arvicola mosbachensis* encountered in the Middle Don sediments that are separated by a cryoturbation bed from the buried soil correlated with the Inzhavino (Likhvin) paleosol, it was suggested to include the so-called Ikorets interglacial in the Lower Pleistocene scheme (Iosifova et al., 2009). However, owing to the lack of justified paleobotanical evidence and paleopedological studies of the recognized Inzhavino soil its validity remains an open question.

Table 1

Pleistocene units in glacial and periglacial areas in Eastern Europe

West European glacial area			East European glacial area				East European periglacial area		MIS	
									Var. 1	Var. 2
Holocene									1	1
Weichselian glaciation		Late Weichselian	Valdai glaciation			Late Valdai		Altynovo loess	2	2
								Trubchevsk soil		
								Desna loess		
	Middle Weichselian	I/s Denekamp		Middle Valdai	Bryansk megainterval	I/s Dunaevo		mild stage	3	3
						Shenskoye cooling		cool stage		
		Cool and warm stages				Leningrad warming		mild stage		
						Kashin cooling		cool stage		
						Krasnogorsk warming		warm stage		
								temperate stage		
	Early Weichselian	Cool and warm stages		Early Valdai		Early Valdai stages		Khotylevo loess	4	4
		I/s Brorup				I/s Upper Volga (Krutitsa)	Mezin soil complex	I/s Krutitsa soil	5	5
		Cool and warm stages				Early Valdai stages		Sevsk loess		
Eemian Interglacial			Mikulino Interglacial					Salyn interglacial soil	5e	5e
Saale glaciation		Warthe (Saale III) stage	Dnieper glaciation			Moscow stage		Moscow loess	6-8	6
		I/s Treene				I/s Kostroma		I/s Kursk soil		
		Saale II (Drente II) stage				Dnieper stage	Dnieper loess	i/s Romny soil Orchik loess		
		Saale I (Drente I) stage				Interstadial	Kamenka soil complex	I/s Late Kamenka soil		
						Stage		Loess		
Demnits, Wacken Interglacial			Kamenka Interglacial					Early Kamenka interglacial soil	9	7
Fuhne glaciation		Stage II	Glatiation (Pechora?)			Stage		Borisoglebsk loess	10	8
		Interstadial				Interstadial	Inzhavino interglacial soil	I/s Late Inzhavino soil		
		Stage I				Stage		Loess		
Holstein Interglacial			Likhvin Interglacial					Early Inzhavino intrglacial soil	11	9
Elster glaciation		Elster II stage	Oka glaciation				Korostelevo loess		12	10
		Interstadial								
		Elster I stage								
Cromer complex		Interglacial IV Voigstedt	Ikorets Interglacial ?				Vorona soil complex	Late Vorona soil	13	11
		Stage C	?					Loess	14	12
		Interglacial III	Muchcap Interglacial			optimum 2		Early Vorona interglacial soil (optimum 2)	15	13
						cold stage		cold stage		14
						optimum 1		(optimum 1)		15
		Stage B	Don glaciation				Don loess		16	16
		Interglacial II	Okatovo Interglacial				Rzhaksa interglacial soil		17	17
		Stage A	Setun stage				Bobrov loess	Brunhes	18	18
		Interglacial I	Krasikovo Interglacial				Balashov soil complex	Matuyama Balashov interglacial soil	19	19
			?							
			Akulovo Interglacial							
			Likovo glaciation							

The chronology of events in the Middle Pleistocene has been considerably revised as well. For instance, in the interval preceding the Dnieper Glaciation, in addition to the Likhvin (Holsteinian) Interglacial, a younger, Kamenka (Demnitz) Interglacial is distinguished. Its stratigraphic position initially defined in the periglacial zone, is confirmed by the studies of lacustrine deposits in the glacial area, in the Upper Volga basin and Moscow region (Pisareva, 2001).

The chronology of the Dnieper Glaciation turns out to be more complicated. Its first stage corresponding to the proper Dnieper ice sheet included no less than two stadial shifts separated by an interstadial most likely manifested as a weakly developed soil named Romny soil.

The Dnieper glacial deposits are separated from the Moscow till by interstadial sediments corresponding to the Kostroma interstadial in the glacial area and to the Kursk soil-forming interval in the periglacial zone.

During the Moscow stage ice repeatedly expanded and with its retreat the interphasial deposits were accumulated.

The Zaalian glacial epoch in Western Europe corresponding to the Dnieper Glaciation is also noted for complex dynamics.

The challenge of chronostratigraphy of the European Late Pleistocene is still the correlation of climatic changes, their amplitude and age, primarily within the last Valdai Glaciation. In Eastern Europe the first post-Mikulino cooling, presumably 117–110 ka, is clearly recorded by the Smolensk cryogenic horizon (Phase “a”) and by the distribution in northwestern Russia of light birch forests alternating with boggy areas of dwarf birch and alder (Grichuk, 1989, etc.). The subsequent early Valdai (Upper Volga) warming and the corresponding interstadial Krutitsa soil are correlated with the Brörup Interstadial in Western Europe (terminal MIS 5c). At that time the area south of the Baltic Sea depression was covered with coniferous, and the Dnieper and Upper Volga basins, with light coniferous forests with an admixture of spruce. The following cooling (MIS 5b) did not result in a glaciation beyond the Baltic shield but produced only local ice covers in mountain regions of the Kola Peninsula (Yevzerov, 2005). At the end of the early Valdai (MIS 5a) the climate was slightly softened but beginning with 70 ka ago (68–65 ka), i.e. in MIS 4, the Scandinavian glaciers again extended beyond the mountain regions though retaining within Karelia. A separate ice sheet occurred in the Timanskii Peninsula as well.

The time span from 55 to 25 ka ago, recognized as the middle Valdai (Bryansk) megainterval, was characterized by the alternation of warm and cool phases correlated with those of Western Europe (Velichko et al., 2005). On the background of a general softening of continental climate, short-term periods with interglacial-like conditions likely occurred (Velichko, 2009, etc.), when taiga forests were replaced by associations bearing thermophilic forms. The terminal interval of the middle Valdai (31–25 ka ago) is recognized in the glacial area as the Dunaevo warming and in the periglacial realm, as the late phase of the Bryansk pedocomplex. Radiocarbon ages of ~ 30–25 ka were received for its humus bed, whereas the soil as a whole was developed during a considerable part of the Bryansk megainterval.

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LATE PLEISTOCENE STRATIGRAPHY AND STRATIGRAPHIC SETTING OF THE KHOTYLEVO PALEOLITHIC SITES (CENTRAL EAST EUROPEAN PLAIN, DESNA DRAINAGE BASIN)

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The Desna River valley is one of the most interesting places of concentration of Paleolithic sites in the East-European Plain. The occurrence of different Paleolithic sites in vicinity of Khotylevo village near Bryansk city could be considered evidence that this place was exceedingly attractive for ancient hunters and gatherers. In this paper we discuss the data on lithology and environments of sedimentation of Late Pleistocene loess-soil and fluvial series at the group of Khotylevo Paleolithic sites.

There is evidence of earlier presence of humans here, practically since the initial occupation of the East European Plain by Paleolithic tribes; that is suggested by occurrence of Mousterian tools, known as Khotylevo-1 occurrence (Zavernyaev, 1978; Velichko, 1988). The Middle Paleolithic occurrence Khotylevo I is located at the foot of the Desna right bank at 22–25 m above the water level. The artifacts were recovered from the lowermost part of channel facies. Tabular flint pieces (including flinty artifacts), rounded pebbles of crystalline rocks and rare fauna remains were recovered from the depth of 10.44–10.55 m below the surface. This culture-bearing horizon overlies Cenomanian sands. Overlying sediments are alluvial and sub-aerial series. The alluvial unit comprises riverbed, oxbow lake, and floodplain facies. The upper portion of the profile contains sediments of subaerial origin. These sediments represent the redeposited and distorted Mezin pedocomplex composed of brown sandy loam with lenses of black humus and ferriferous fine-grained sand at the lower part of the layer. The process of solifluction-deluvial redeposition of paleosols coincided with periods of slope process activity tentatively dated to the interval between the end of formation of the Mezin polygenetic complex and the Middle Valdai megainterstadial. The uppermost portion of the profile contains Late Valdai loess deposits (Ocherednoi, Voskresenskaya, 2009).

The Late Paleolithic sites Khotylevo-2 and Khotylevo-6 are located 700 m upstream the Desna River on the steep right slope of Desna R. valley. The sites are positioned on a west and east cusps of Kladbishenskaya balka at about 20 m above the water edge. Sediments enclosing the cultural layers Khotylevo-2 and Khotylevo-6 (5.3 and 4.4 m thick respectively) are composed of loess-soil series accumulated during the last Interglacial-Glacial cycle.

The deposits enclosing the Khotylevo-2 cultural layer are represented by thick series of laminated loess-like silts, with some horizons of gleying and of weak soil formation. The cultural layer is confined in thin initial soil, represented by light-brown humified carbonate loam. The cultural layer of Khotylevo-2 has been recorded in four points in central and western parts of the cusp (Gavrilov, 2008). The horizon with artifacts does not bear traces of redeposition, though microstratigraphy is locally somewhat specific. In general, cultural layer includes bone remains of different degree of preservation (mammoth, bison, wolf, reindeer, rodents), as well as flint tools, bone charcoal, ocher. The radiocarbon data of Khotylevo-2 cultural layer, obtained on bones, mammoth tooth and bone charcoal span a time interval from 24960±400 (IG RAS-73) to 21680±160 (GIN 8886) BP (Voskresenskaya, Gavrilov, 2007).

The underlying solid rock is weathered chalk that includes interlayers of flint used by Paleolithic men for tool making. The top surface of chalk is irregular and hummocky. This feature though does not affect the position of the horizon with artifacts. These irregularities are smoothed and depressions filled with humified silt and sand – redeposited remains of Mesin paleosol complex and Bryansk paleosol, so the cultural layer occurs subhorizontally.

The remains of slightly humified clay are probably related to Bryansk paleosol affected by slope processes and subsequent frost cracking. The undisturbed Bryansk paleosol is found on left bank. The upper part of this paleosol contains the cultural layer of late Paleolithic site Khotylevo-6, chronologically older than Khotylevo-2. The properties of reworked soil material here indicate moving of slope material in hydromorphic conditions with cryogenic deformation. The cultural layer is represented by flint tools only.

In Khotylevo-6 and in Khotylevo-2 the cultural layers are overlain with loess-like loam that has much in common at both sites. They are of the post-Bryansk age and form the parent rock for the modern soil profile (gray forest soil). The ortsand lines (that is, Bt horizon of the modern soil) follow cryptic layering of loess. Ortsands accentuate the relic cryogenic formations (ice-wedge pseudomorphs) of Yaroslavl' cryogenic horizon, which sometimes penetrate down to the cultural layer. At the contact between ortsand horizon and "clear" loess archeologists recorded signs of evidence suggests that Paleolithic humans visited this place at the final stage of deposition of loess-like sediments and beginning of permafrost degradation.

In conclusion it should be noted, that lithology and rate of sedimentation, certainly, influenced Paleolithic men in choosing the dwelling place. During the last glacial epoch in the periglacial zone stages of loess accumulation on watersheds and fluvial sediments in valleys more than once alternated with those of mass movement activation on slopes and channel downcutting in the Desna valley. When the Khotylevo-2 site was inhabited, the intensity of slope processes was relatively low, and ephemeral horizon of initial soil (corresponding to the cultural layer of site) could develop. The total area of Khotylevo-2 site is so large, that one can hardly decide whether all the known sites were inhabited simultaneously (Gavrilov, 2008). Major cryogenic deformations of culture level of Khotylevo-6 site, enclosed in the upper part of this Brynsk paleosol suggest active erosion and solifluction just before human settlement on this place. Older surfaces that the Middle Paleolithic man inhabited are not directly pronounced in the modern topography; they are mostly eroded or buried under thick loess-paleosol series of Middle and Late Valday age. The cultural layer of the Middle Paleolithic occurrence Khotylevo 1 has been completely redeposited and occurs at the base of the Early Valday fluvial series.

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THE NORTH SEA DRILLING PROJECT: CENOZOIC CLIMATE AND SEA LEVEL CHANGES ON THE NW EUROPEAN SHELF – A MAJOR CHALLENGE FOR SCIENCE (PROPOSAL OUTLINES)

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Prior work has shown that the Paleogene and Neogene-Quaternary sedimentary record of the North Sea Basin (NSB) reveals detailed information on the climate and sea level history but also that there is a lack of a firm stratigraphical framework for the entire basin. Unravelling the Cenozoic history of climate change, sea-level variations and palaeoenvironmental development of the NSB is a tremendous but feasible task.

The subsurface of onshore and offshore NW Europe is an excellent natural laboratory to study the interaction between past sea-level, climatic and sedimentary processes, and land-sea correlation. The expanded Cenozoic sedimentary shelf successions (up to 3000 m thick in places) permit ultra-detailed analyses and potential new insights into regional and global Cenozoic climate evolution. Throughout the Cenozoic, shallow marine, coastal/estuarine and basin-fluvial depositional environments have alternated in the hinge zone of the basin.

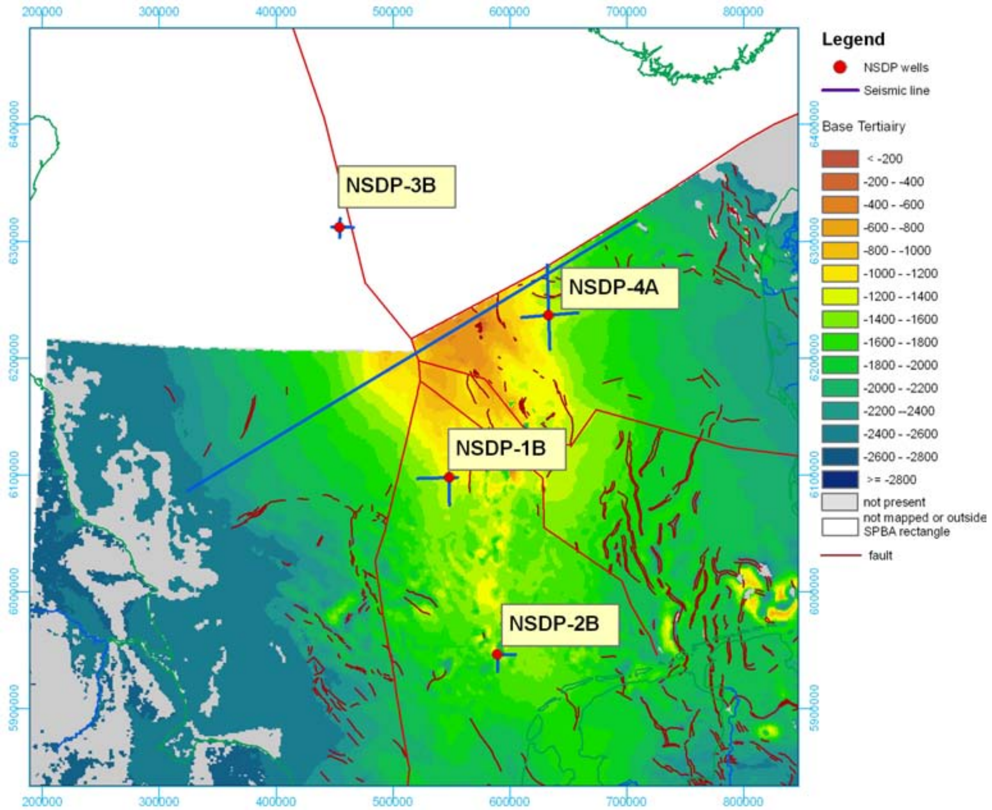

Fig. 1. Proposed sites North Sea Drilling Project. Contour lines show the base of the Tertiary deposits in the southern NSB

In order to establish a firm chronostratigraphic framework for the NSB Cenozoic a consortium of NW-European scientists proposed the Integrated Ocean Drilling Program (IODP) to drill at 4 sites the marginal marine succession of the NSB shelf. Such an effort will finally provide a first ever regional integrated stratigraphic framework with detailed paleomagnetic and biostratigraphic data. It allows for sequence-stratigraphic approaches and differentiation between regional and global scale changes. It is foreseeable that the North Sea Drilling Project (NSDP) will significantly augment existing information by several orders of magnitude

The proposed sites **NSDP-1B, 2B, 3B** and **4A** form an SE-NW transect in the central North Sea Basin and are targeted at (1) full Cenozoic recovery, (2) detailed land-sea correlations of climate record and basin infill through fluvial input, and (3) Quaternary / Neogene developed clinoforms eastward (sites 1B and 4A). Specifically, site 4A offshore south-western Denmark is targeted at retrieving extensive, northern successions of Oligocene to Pliocene clinoforms and deltaic deposits that are relatively condensed in Sites 1B-2B. Based on 3D seismic, the proposed sites 1B and 4A present the regionally most complete successions for the Neogene that are relatively near shore and likely to contain abundant terrestrial material. Site 2B in the central NL sector for the Paleogene, and site 3B offshore UK for the Neogene, record deep water outer neritic to bathyal environments providing a continuous Cenozoic record and correlation to deep oceanic sites.

The selected sites build on earlier investigations and allow for sequence-stratigraphical approaches and differentiation between regional and global changes. The sites provide the possibility to study unique examples of delta-shelf systems and their responses to climate change and tectonic pulses and encompass the fundament for detailed source to sink analyses. The latter also will contribute to improved land-sea correlations.

In the present paper we intent to present the outlines of the project and its main objectives on the background of the Cenozoic palaeogeograpghical development of the NSB.

BIOSTRATIGRAPHY OF THE CASPIAN NEOPLEISTOCENE

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Stratification of marine Pleistocene deposits is based on the vertical succession of fossil molluscan assemblages mainly belonging to the genus *Didacna* Eichwald. N.I. Andrusov was the first to apply this approach at the beginning of this century. His investigations were continued by D.V. Nalivkin, V.V. Bogachev, P.A. Pravoslavlev, L.A. Nevesskaya, P.V. Fedorov, G.I. Popov, B.G. Vekilov, among others. Exact classification of the Caspian deposits was realizes. But the existent geological bodies are determined as different grades, diverse stratigraphical and nomenclature position in the scales of different investigators.

We work out the groups of *Didacna* molluscs with diverse taxonomic composition and grade: fauna, assemblage, subassemblage, association, which correspond to paleogeographical events of diverse grade (transgression, stage of transgression, phase, etc). They form a kind of a «framework» for biostratigraphical subdivision of the Neopleistocene marine deposits in the Caspian Sea Region (tab. 1).

The highest rank in the regional Neopleistocene stratigraphical scale of the area is represented by the Caspian group corresponding to the biozone of the genus *Didacna* Eichwald. This zone covers the whole Neopleistocene (0.780 mln yrs). By *Didacna* groups several horizons, subhorizons and layers are distinguished in the Caspian Neopleistocene (tab. 1). Thus, the Baku, Urundzhik, Lower Khazarian, Upper Khazarian, Khvalynian and New Caspian horizons are distinguished on the base of different *Didacna* faunas (subzones). The assemblages of mollusks (interval-zones) serve as the basis for subdivision of the horizons into the subhorizons. More detailed subdivision of the Caspian Neopleistocene into layers is based on the succession of fossil *Didacna* subassemblages. The index-fossils are defined for horizons and subhorisons. The stratotypical sections are distinguished for all biostratigraphical units.

The mollusks associations reflect the diversity of palaeohydrological and palaeoecological conditions of Caspian paleobasins, they demonstrate facial manifoldness of horizons, subhorizons and layers. The biostratigraphical scale don't include deposits of regressive basins, because there are little paleogeographical evidences of them.

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Table 1

Regional biostratigraphical (ecostratigraphical) scale of the Caspian marine Neopleistocene

Stratigraphic scale		Biozone	Horizon	Groups of Didacna			Subzone (Fauna)	Index-fossils	Subhorizon	Interval-zone (Faunistik assemblage)	Layers	Sub-assemblage	Strato typical sections
				crassa	trigono-ides	catillus							
Holocene		Didacna Eichwald	New Caspian	▨	▨	□	crassa-trigonoides (New Caspian)	***Cerastoderma glaucum*** *D. crassa* *D. baeri* *D. trigonoides*			nk_3	Mytilaster	Turali (Dagestan)
											nk_2	Cerastoderma	
											nk_1	D. crassa – D. trigonoides	
Neopleistocene	Upper		Khvalynian	□	▨	▨	trigonoides-catillus (Khvalynian)	***D. ebersini*** ***D. praetrigonoides*** *D. parallella* *D. protracta*	hv_2	D. praetrigonoides			Enotaevka-Kopanovka-Tsagan-Aman (Lower Volga)
									hv_1	D. parallella- D. protracta			
			Upper Khazarian	■	□	□	crassa (Late Khazarian)	***D. surachanica*** *D. nalivkini*	hz_2^2	D. surachanica- D. nalivkini			Seroglazovka (Lower Volga) Shura-Ozen (Dagestan)
									hz_2^1	D. nalivkini			
	Middle		Lower Khazarian	▨	■	▨	trigonoides (Early Khvalynian)	*D. subpyramidata* *D. paleotrigonoides* *D. shuraosenica*	hz_1^3	D. paleotrigonoides-D. nalivkini			Seroglazovka, Kopanovka (Lower Volga)
									hz_1^2	D. paleotrigonoides- D. subpyramidata – D. shuraosenica			
									hz_1^1	D. subpyramidata			
			Urundzhik	■	□	□	crassa (Urundzhik)	***D. celekenica*** *D. eulachia* *D. kovalevskii* *D. pravoslavlevi*			ur_2	D. kovalevskii	Nephtyanaya Balka (Kura depression)
											ur_1	D. eulachia	
	Lower		Baku	▨	□	▨	crassa-catillus (Baku)	***D. parvula,*** ***D. catillus catillus*** *D. rudis* *D. carditoides*			b_2	D. rudis – D. carditoides	Gora Bakinskogo Yarusa (Apsheron peninsula) Nephtyanaya balka (Kura depression)
											b_1	D. parvula- D. catillus	

■ 1 – dominance, ▨ 2 – many, □ 3 – rare

PLEISTOCENE NATURE EVENTS OF THE CENTRAL AND MIDDLE-EAST EUROPE FOR THE COMPREHENSION OF THEIR DEVELOPMENT IN THE FUTURE (BY PALYNOLOGICAL DATA)

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The Glacial-Pleistocene climate-stratigraphic scheme of Belarus of the author is based on the palynological study of the ancient lacustrine deposits. The study characterizes the rhythmic sequence of the eight interglacials and eight glaciations corresponding to 18 isotopic-oxygen stages of the Pleistocene geochronological scale of the Northern Hemisphere based on the data of the absolute age of the oceanic sedimentations. The analysis of isotopic-oxygen and insolation curves has shown the convergence of the number of Pleistocene events not only within stages, but also inside them. During the interglacials, these variations definitely correspond to the number of alternating climatic optima and interoptimum coolings, and, within glaciations, to the number of the stages and interstages. The stratum position of the Pleistocene interglacials determines an age series of the palynoflora with the contents of the reference exotic elements. In this version Alexandrya (Holstein, Lichvin) interglacial corresponds to the OIS 11, as proposed at the 14th INQUA Congress in Rino, 2003 (Nevada, USA). The correlation of the oxygen isotope oceanic stages and successions of green by the continental deposits in the studied area is shown in the table 1.

Table 1

Correlation of the Pleistocene stratum schemes of Poland, Ukraine and Belarus

Stages and horizonts	**Poland**	**Ukraine**	**Belarus**	
1—igl	**Holocene**	**Holocene**	**Holocene**	one optima
2–4—gl	Visla	Valdai	Poozerje	series stages and interstages
5—igl	**Eem**	**Priluki**	**Murava**	two optimum and warmer
6—gl	Varta	Tyasmin	Shoz	two stages and interstage
7—igl	**Lyubava**	**Кajdaki**	Shklov	three optimum and two cold snap
8—gl	Odra	Dniepr	Dniepr	two main stages and interstage
9—igl	**Zbujno**	**Potyagajlov**	**Smolensk**	two optimum and cold snap
10—gl	Livets	Orel	Yachny	main phase and interstage
11—igl	**Mazovshe**	**Zavadovka 2**	**Alexandria**	two optimum and intermediate cold snap
12—gl	Brock	Zavadovka 1/2	Eselew	one main phase
13—igl	**Mrongovo**	**Zavadovka 1**	**Ishkoldj**	three optimum and two cold snap
14—gl	San-2	Tiligul	Berezina	main phase and interstage
15—igl	**Ferdinanduv**	**Luben**	**Byelovezha**	two optimum and cold snap
16—gl	San-1	Sula	Servech	one main phase
17—igl	**Malopolje**	**Martonosha**	**Кorchevo**	one optima
18—gl	Nida	Priazovje	Narev*	main phase and interstage
19—36	**Podlyasje/ Avgustov**	**Shirokino**	**Brest**	Upper part of Eopleistocene
	Narev*	Ikjichev		

—*Narev glaciations in Belarus and Poland have different ages.

As is known, the oxygen isotope scales from the bottom deposits of the World Ocean and ice cores of Greenland and Antarctic comprise a time interval up to 1 million years. These records show that during warm and humid interglacials these thick ice sequences do not melt completely, thus preserving the evidence of the sequence and climatic dynamics in a complex interaction with levels of solar radiation. Therefore, the modern "global warming" of the Earth's climate has not reached the values of the interglacial temperatures and the objective rhythmicity indicates the future end of the Holocene interglacial and approach of a new glaciation.

On the other hand, the off-the-shelf global temperature curve of the project PALEOMAP-2008 (USA) prospects a trend to the growth of the absolute temperature of the Earth up to 13 °C. It gives new evidence that glacial Pleistocene, as the only last third of late Cenozoic, will likely be followed by a new natural period, a succeeding global scale warming of the Earth's climate. It could be comparable to natural conditions of the main geological periods of the Earth as contrasted to the Quaternary interglacial of our region. It is indicated by a gradual reduction of glaciation scale after the maximum extension of the Late Cenozoic glaciation in the Dniepr glacial epoch (about 180 thousand years ago). Two subsequent glaciations (Shoz/Varta and Poozerje/Visla) had much smaller areas, whereas the alternating interglacials showed higher temperatures. A "global warming" can be largely connected to the natural redistribution of the warmth between the oceans and continents at the expense of the internal dynamics of the climatic system of the Earth. Thus, the researches in the evolutional geography provide reasonable conclusions on environment of the Earth in the geological past, whereas the comparison with the present day conditions enable possible forecast for the future.

The ratio of the change of natural components in the World Ocean–Atmosphere interconnection is the major factor in this evolution. The anthropogenic influences complicate these interactions, and sometimes reaches a threatening level in transformation and destruction of modern landscapes.

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CONTENTS

СОДЕРЖАНИЕ

Научное издание

Quaternary stratigraphy and paleontology of the southern Russia: connections between Europe, Africa and Asia

Abstract volume
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