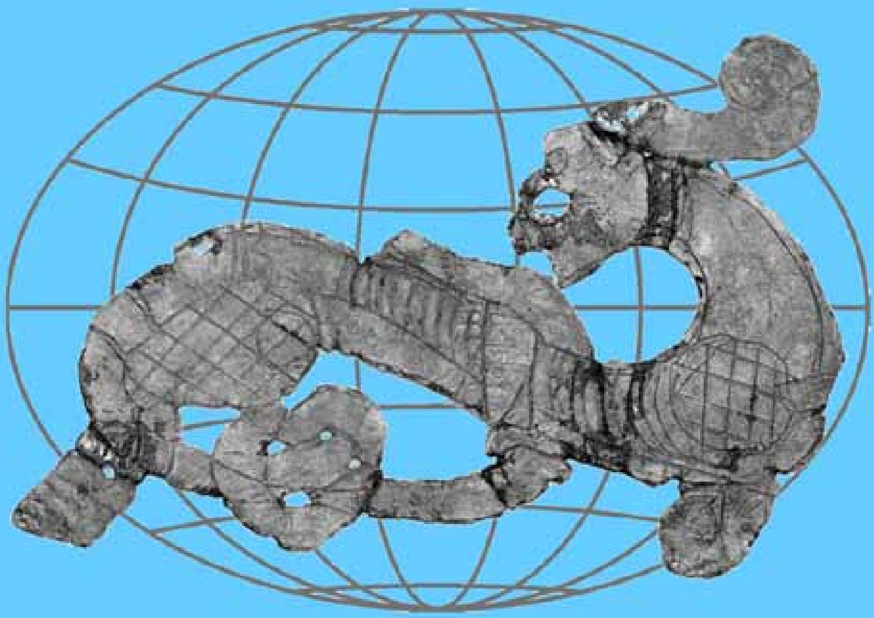
GEOMORPHIC PROCESSES AND GEOARCHAEOLOGY

From Landscape Archaeology to Archaeotourism

International conference
August 20-24, 2012
Moscow-Smolensk, Russia



EXTENDED ABSTRACTS

Administration of the Smolensk Region

Russian Association of Geomorphologists

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University of Moscow:
Faculty of Geography, Faculty of History

Smolensk University for Humanities

Russian Academy of Sciences:
Institute of Geography
Institute of Ethnology and Anthropology

Smolensk State Museum-reserve

State Historical Museum

International Association of Geomorphologists:
Working Group on Geoarchaeology

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CONTENT

FOREWORD

International conference «Geomorphic Processes and Geoarchaeology: From Landscape Archaeology to Archaeotourism» was held in Moscow – Smolensk, Russia, on August 20-24, 2012. It was initiated by Russian Association of Geomorphologists (RuAG) together with Working Group on Geoarchaeology of the International Association of Geomorphologists (IAG) and supported by IAG Working Group on Geomorphosites, International Union for Quaternary Research (INQUA) – Terrestrial Process Commission (Hydrological Change and Climate Focus Area, Hazards and Humans Focus Area), Global Continental Palaeohydrology group (GLOCOPH). Conference was organized and hosted by the Smolensk University for Humanities (SHU) in cooperation with Moscow State Lomonosov University (MSU, Faculty of Geography and Faculty of History), State Historical Museum (SHM), Russian Academy of Sciences (RAS) – Institute of Geography and Institute of Ethnology and Anthropology, State Hermitage Museum.

The aim of the meeting was linking together different kinds of specialists interested in geomorphic and palaeoenvironmental aspects of archaeological studies, risk assessment and protection of archaeological sites and archaeological materials against environmental damaging processes of different nature (geomorphological, hydrological, pedological), and putting archaeological heritage into public domain.

Papers were presented at four oral / poster sessions:

1. Human dimensions of Quaternary palaeoenvironments.
2. Local palaeoenvironments of archaeological sites.
3. Alluvial geoarchaeology, palaeohydrology and paleopedology
4. Preservation of geoarchaeological monuments, geotourism and archaeotourism

In the abstract book all papers are put in alphabetical order in author's original versions.

B

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GEOARCHAELOGY OF PREHISTORIC SITES IN THE TEHRAN AND QAZVIN PLAINS

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Introduction. The arid to semiarid Iranian Plateau is dotted with numerous prehistoric and historic settlements. These settlements occur mainly at the foothills of the Alborz and Zagros mountain ranges, especially on the surface of alluvial fans, where freshwater and appropriate soil are available for cultivation, pottery-making and other activities. There has been little research on earlier Holocene environmental conditions of these areas and the relationships between past humans and their surrounding landscapes. How did earlier inhabitants of the Iranian Plateau interact with the land and other organisms in the course of their making a living, and how, by doing so, did they shape their surrounding landscape? In order to identify the relationship between human societies and their landscapes in the western fringes of Iranian plateau, five prehistoric sites from the Tehran and Qazvin plain were selected for pilot geoarchaeological research: the Late Neolithic (5600-5200 BC) to the Late Chalcolithic (3700-3400 BC) Cheshme Ali and Tepe Pardis in the Tehran plain, and Zagheh, Ghabristan and Sagzabad (together froming the Sagzabad Cluster), occupied in succession from the Transitional Chalcolithic (5370-5070 BC: Zagheh) to the Iron Age (dates?: Sagzabad) in the Qazvin plain (fig. 1).

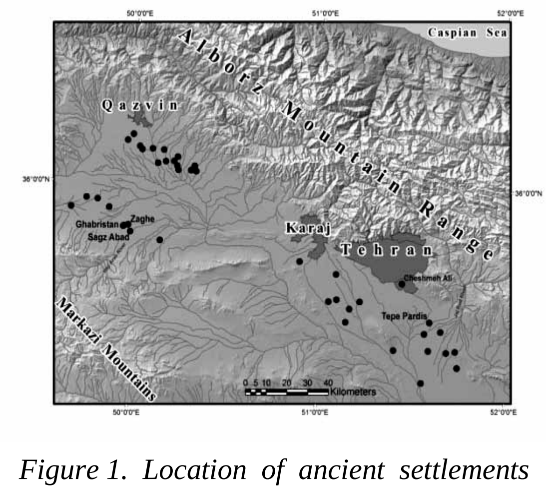


Figure 1. Location of ancient settlements in the Tehran and Qazvin plains

The Tehran and Qazvin plains are adjacent to the southern slopes of the Albors mountain range, in the northern part of the Iranian Plateau. The Jajroud river (catchment ca 1858 km^2) and many smaller seasonal streams in the Tehran Plain, and the Haji Arab (catchment ca 970 km^2) and Khar Roud rivers and their tributaries in the Qazvin Plain, provided water supply to the prehistoric settlements. Migration of these drainage channels, with its resultant erosion and deposition has had an effect on settlement location and preservation at both plains [4].

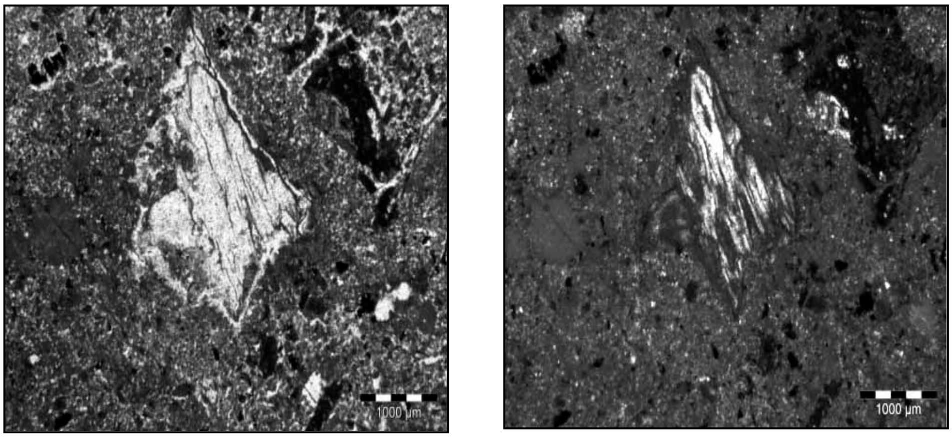
Methodology. The current investigation involved sampling, preparation, description and interpretation of sediment thin sections and other analyses of the composition and structure of archaeological sediments at the sampled sites. Blocks of undisturbed sediment were air-dried and impregnated with polyester resin under desiccation vacuum. Thin sections (30 µm thicknesses) were prepared from these impregnated blocks. These sections were examined under a polarising microscope at magnifications from x 10 to x 400, using plain polarised (PPL), cross polarised (XPL) and oblique incident light (OIL). Disaggregated suspended sediments were subjected to standard procedures of grain size analysis in a Culter lazer particle analyser (Goldberg and Macphail) [3]. Calculation of statistical parameters (mean, standard deviation, coefficient of variation, skewness and kurtosis) and compilation of tables and diagrams were made by using the particle analyser software (LS 230) and GRADISTAT version 4.5.

Results and discussion.

1. Thin section micromorphology.

Charcoal, rubified particles and other human inputs in these sediments occur at various frequencies. Some of the rubified particles contain straw-mouldic pores, suggesting that these were probably derived from straw-tempered masonry elements (e.g. mud bricks or plasters). Hypocoatings and anorthic nodules in some layers suggest cycles of wetting and drying, involving (seasonal ?) water saturation. Calcite rims and hypocoatings suggest conditions of evaporation deficit, consistent with the arid/semiarid regional climate. In some sections, nemorphic gypsum is associated with calcitic ash. This association may have been genetic: experimental work has shown that gypsum nodules can form from rapid (days to weeks in the laboratory; possibly one winter season in nature) recrystallization of *Tamarix aphylla* ash in the presence of water [6]. Such recrystallization perhaps reflects harsher environmental conditions*Tamarix* sp. has been identified as the main fuel at other prehistoric settlements in Iran [5, 7].

A



B

Figure 2. Angular bone fragment in PPL (A) and XPL (B)

2. Granulometry.

Many parts of the Sagzabad Clustercontain sediments with unimodal distribution of grain size, probably resulting from low-energy sheet floods in interchannel areas. Such relatively lower-energy settings are conducive to the preservation of tells. Coarse material (very fine skewed; leptokurtic kurtosis) is dominant only in the pre-settlement layer (GH1). Many layers populations of grain with different hydraulic behaviour, analogous to those present in zones of environmental mixing in alluvial depositional environments [1, 2], suggesting deposition from variable inputs, including anthropogenic. Sediments with trimodal grain size distribution and a notable contribution of the coarse (> 2 mm) fraction are correlated with high human inputs (charcoal, pottery and mud brick fragments, other inclusions) identified through other lines of evidence (e.g. material culture, micromorphology). At all sites, many fine-grained samples (fine sand and mud) are have resulted from degradation of mud brick. As elsewhere in the Near East (e.g. south-west of Baghdad: [8]), the ultimate provenance of building materials was alluvial sediment from around the sites – mainly fine grained overbank deposits [4].

Conclusion. Interdisciplinary approaches in archaeological research can make a major contribution to the determination of human-environmental interactions and the subsistence practices of prehistoric peoples. Evidently, prehistoric inhabitants of the Tehran and Qazvin plains established their settlements at settings that ensured access to freshwater and soils and sediments appropriate for cultivation, pottery making and other activities. Settlement distribution was also affected by the distribution and migration of channels across alluvial fans (which locally resulted in settlement erosion) and by associated sedimentation. Planned the location of their settlements at some sites, anthropogenic input reflects a farming economy based on cereal agriculture and livestock. At the Ghabrestan tell, *Tamarix* sp. woody charcoal may reflect high-temperature burning in the course of industrial activities (probably pottery making). A climate of relatively dry winters may ne indicated by gypsum nodules within the latter. suggest that these took place in a harsh, relatively climate Detailed future work, integrating sedimentary, botanical and chronological evidence from the pre-settleement, settlement and postabandonment stratigrpahies of these sites have the potential to reveal more information about the site formation processes, subsistence practices and the socio-economic and cultural situation of the prehistoric inhabitants of the Tehran and Qazvin plains.

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SUBATLANTIC HILLSLOPE DEPOSITS AND LANDFORM EVOLUTION AS THE EFFECT OF ECONOMIC ACTIVITIES OF MAN IN THE TROUGH OCCUPIED BY LAKE JASIEŃ (NORTH POLAND)

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The intensity of the Neoholocene denudation processes with the resulting landform evolution and occurrence of correlative hillslope deposits were strongly related to the economic activity of man.

In the trough occupied by lake Jasień (North Poland) these events are evidenced by the surveyed buried gully in the late Vistulian valley bottom (valley A), sequence of deposits filling this gully and the youngest gully, which can be seen in the present day landform morphometry.

The original valley bottom was formed predominantly in the late Vistulian. The course of the denudation processes in the North Poland was investigated by Gołębiewski R. (1981), Borówka R.K. (1992) and Majewski M. (2008) and based on their findings we can assume that Eoholocene and Mezoholocene witnessed no significant hillslope processes bringing significant evolution of the then existing valley bottom surface.

The first stage of Subatlantic transformation of the analysed valley occurred earlier than 2135 ± 115 BP where the gully was formed in the valley bottom. This is indicated by the age of roof of the peat and silt layers filling part of the buried valley bottom. Apparently loss of forest cover in the north section of the valley A was the primary, yet indirect factor responsible for formation of the ca. 2.5 m deep gully in valley bottom. This loss of forest cover could be attributed to the economic activity of man in the La Tène period or between late La Tène and early Hallstatt periods. This corresponds to the timing of the numerous finds in the area adjoining the upper part of valley registered in the archaeological survey of Poland (AZP).

Sheet flowing and washing occurred in the catchment area, most probably devoid of trees at that time, and upon reaching the valley bottom these processes have developed into gully erosion. This cause-and-effect for valley landforms was described for example by Dotterweich M. et al. (2003) and Schmitt A. et al. (2005). These two researchers jointly point to heavy rainfalls as a significant factor shaping these processes besides the loss of forest cover as a result of turning the area of valley catchments to farmland. In this context it is worthwhile noting that in early Subatlantic the climate became significantly wetter and colder [5, 6]. Moreover, these climatic conditions could have increased the level of water in a small pond located in the upper part of the valley, in this way increasing the bottom flow, thus intensifying erosion processes.

Gullying and widening of the newly formed valley bottom was followed by deposition of peat and silt – an evidence of continuously high level of groundwater table in this part of the valley.

Yet another process transforming the valley bottom was filling of the gully with the material moving down the slopes. Thus the gully was filled up to the former level of the Vistulian / Holocene. Without knowing the age of the roof of the peat and silt deposit timing of this process cannot be determined with absolute certainty. In the author's opinion it could have happened during the long settlement cycle when Neoholocene evolution of the valley is placed, and more precisely from the La Tène (pre-Roman) period and up to Roman period.

The last stage of the valley shaping processes resulted in formation of a distinct gully in the valley bottom, part of the present day morphology. It is believed to have formed in the subsequent settlement phase in this area associated with Middle Ages. Population inflow entailed clearing of forests to increase the arable land area. With a relatively long time span of Middle Ages and lack of any other relevant data it is impossible to more precisely define the time of subsequent reshaping of the valley bottom and relate this event to the climatic conditions. Clearing of trees which occurred at that time entailed the next increase in sheet washing and development of erosion processes. The gully has survived to the present time owing to forestation of the adjoining land after World War II which has had a preserving effect on the landscape.

A clear record of the effect of man's activity on the formation of hillslope deposits and evolution of landforms was found in the depression Z-1 located in the same area.

The analysis of geological structure of this landform has shown that after 315 ± 70 years BP deposition has rapidly intensified producing diamicton modified by agricultural activity. This was most probably related to land use change, namely transformation of forest to farmland, the most recent evidence of which is the topographic map from the second half of 19th century. This distinct deposition process lasted until ca. 1940 producing 115 cm thick deposits, raising the level of the bottom of the depression. At that time trees were planted in the analysed area and on the adjoining land. As a result the depression and the associated catchment area have become a forested area with hardly any or none hillslope processes. This conclusion is supported by the geological structure analysis of depression Z-4 located near depression Z-1. In the bottom of depression Z-4 hillslope deposits of the Neoholocene period were not found, even though this landform features much more dynamic relief as compared to the depression Z-1. This lack of hillslope layers could be attributed to the presence of forest cover at that time which effectively minimised the effects of water flowing down the slope. That a continuous forest cover existed there for a major part of Holocene is evidenced by the presence of brown podzolic soil in the depression, which is entirely a Holocene material. Forest grew there also in historical times (19th and 20th centuries) as it can be seen on the record maps.

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PALAEOECOLOGY OF MIDDLE – LATE PALAEOLITHIC KABAZI II SITE (WESTERN CRIMEA) BY THE DATA OF SMALL MAMMALS

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Unique multilayered open Middle – Late Palaeolithic site Kabazi II is situated on the third ridge of the Crimean Mountains. Dr. Victor Chabai investigated the archeology of the site and organized the complex study of the deposits of this monument, which includes six archeological Units with many levels [1, 2, 3]. Humans occupied the site during the long period (from Mikulino = Eemian Interglacial till the second part of Valdai Glaciation). This duration was established by archaeological materials and by the results of a number of dating methods (radiocarbon, U-series and ESR). The duration of human occupation was longed about 90 000 yr. (5-2 MIS) and covered the epochs with different climatic conditions.

Material. Rich materials of small mammal remains were collected during 2000-2001 yrs. Small mammal remains were recovered from VI, V, IV, and III archaeological Units with a help of screening and washing of the deposits of these strata. All the archaeological Units include the number of levels. The saturation of the bones in the deposits is rather high. About two thousand of bones have been collected. The 911 bones were identified on the special level. According complex archeological, palynological and geochronological data, all small mammal materials from Units VI-IV correspond to the different stages of Mikulino Interglacial. The materials from Unit III it seems correspond to one of early interstadials of Valdai glaciations [3, 5].

Results. The analysis of rich bone materials of small mammals from Units VI, V, IV, and III of Kabazi II site indicates the following main features of environments during their deposition. The open steppe-like landscapes prevailed during formation these archaeological units. The majority of small mammals identified from the site are the typical habitants of open environments. Some changing in nature could be fixated by the small mammal materials of Kabazi II. The mammal remains, found in Units VI and V, shows on more moderate and humid climate, than in later layers (fig. 1). Some forested or bushed areas were presented near the site during these temporal intervals, what was indicated by the finds of forest species. Later, during the deposition of Units IV-III, only steppe, semi-desert, meadow steppe, and few hydrogenous mammals inhabited the environments near the site.

Now in Crimea habituated 15 species of rodents, 6 insectivores and one lagomorphes [4]. Some of rodents (*Rattus rattus*, *R. norvegicus*, *Ondatra*) appeared in Crimea only in the Holocene. Red squirrel *Sciurus vulgaris* was acclimatized in the Crimea in 1940 yrs (table 1).

The number of small mammals, which remains were found in Kabazi II layers, includes 13 rodents, 1 lagomorphes and one insectivore. The large list of rodents found in Kabazi II permit to be sure that it includes most of the Rodentia inhabited this region during Mikulino Interglacial and the first part of Valdai Glaciation.

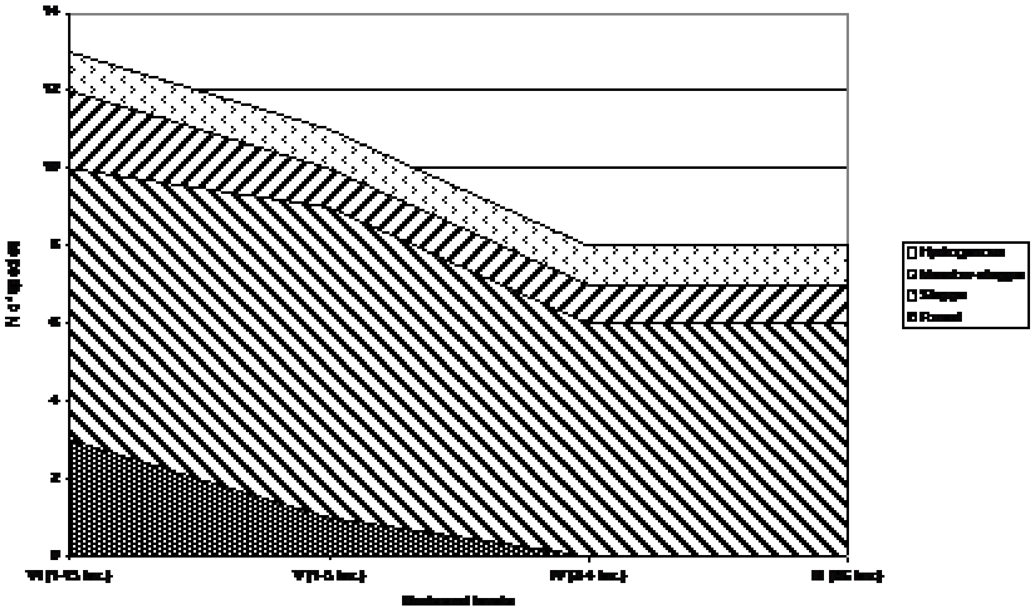

Figure 1. Ecological groups of small mammals in Kabazi II site

The diversity of small mammals from Kabazi II is comparable with the modern one, but the species composition is changed strongly (table 1).

Some of identified species now are disappeared from this region: Yellow steppe lemming decreased its range drastically and now inhabits only some regions of Mongolia and China, and Zaisan Depression. Narrow-skulled vole, which was very common during the Pleistocene on the Russian Plain and in the Crimea, now inhabits Kazakhstan steppes and also tundra zone. Bobac marmot also disappeared from the Crimea and now distributes the easternmost steppe territories. These animals survived in the Crimea and also on the Russian Plain during Valdai Glaciation, because the decreasing of the temperature during glaciation was not restricted conditions for them. The different types of open landscapes, with grass cover, were the main condition for their survival. Modern Russian mole rat range doesn't include the Crimea. So we could conclude that Russian mole rat (which prefers the regions with the rich soils and rich grass cover) was common during the Mikulino Interglacial and disappeared from the Crimea during the first part of Valdai glaciation, which was characterized by more arid conditions.

According the dates of U-series and ESR, LU methods Units VI, V, and IV of Kabazi II formatted before the first large-scale Late Pleistocene glaciation of the Eurasian Arctic [3]. This first stage of Valdai = Weichselian glaciation was dated at 90,000 years ago (OIS-5b).

Table 1.

Kabazi II small mammals and modern Crimean small mammal species composition.

Taxa	Kabazi II, Units				Small mammals, habituated in the Crimea recently
	VI	V	IV	III	
Insectivora:					
Erinaceus europeaus L. – European hedgehog					+
Crocidura leucodon Herm. – white-toothed shrew	+	+			+
Crocidura suaveolens Pall – lesser white-toothed shrew					+
Sorex minutus L. – pigmy shrew					+
Sorex araneus L. – Eurasian common shrew					+
Neomys fodiens Pennant – Eurasian water shrew					+
Lagomorpha:					
Lepus europeus Pallas – European hare		+	+		+
Rodentia:					
Sciurus vulgaris L. – *red squirrel*					+
Marmota bobac – bobac marmot		+			
Spermophilus *pygmaeus* Pallas – little suslik	+	+	+		
Allactaga major *Kerr – Great jerboa*			+		
Spalax microphtalmus Güldenstaedt – Russian mole rat	+	+			
Ellobius talpinus – northern mole-vole Pallas	+	+	+	+	+
Dryomys nitedula Pallas – tree dormice	+				
Sicista subtilis					+
Apodemus (Sylvimus) flavicollis Melch. – yellow-necked mouse	+	+			+
Rattus norvegicus Berc. – common rat					+
Rattus rattus L. – roof rat					+
Mus musculus L. – house mouse					+
Cricetus cricetus L. – common hamster					+
Cricetulus (Cricetulus) migratorius Pallas – grey hamster	+	+			+
Eolagurus luteus Eversmann – yellow steppe lemming	+	+	+	+	
Lagurus lagurus Pallas – steppe lemming	+		+		+
Arvicola terrestris L. – water vole	+	+	+	+	+
Microtus (Stenocranius) gregalis Pallas – narrow-skull vole	+				
Microtus (Sumerionys) socialis Pallas – social vole					+
Microtus (Microtus) obscurus Eversmann (= *M. arvalis obscurus*) – obscures» vole	+	+	+	+	+

If Unit III dates between 117–81 ka are reliable, that means that the Unit III corresponds possibly to OIS stages -5a–5d (to the early phase of last glaciation). This long interval characterized by the noticeable climatic changes with several interstadials. The most pronounced cold period falls on OIS 5b. In this period the sea-level of World Ocean was lower on ~ 50 m. So, the connection between the Crimea and the Russian Plain in this time was significantly stronger than in modern time.

Units VI-IV are related to Mikulino = Eem Interglacial [1]. The Crimean Peninsula in this interval was separated from Eastern Europe even stronger than recently, because the sea-level of Karangat basin of Black Sea was higher than in modern time on 5-7 m. However, the species composition of small mammals of Units VI – IV didn't differ significantly from ones of other Crimean Middle Paleolithic sites correlated with more late intervals. The core of small mammal faunas of all these sites (Kabazi V, Starosele, Buran-Kaya III, Chokurcha I, Karabi-Tamchin) includes mostly the open landscape mammals [5]. Boreal and cold-adapted animals were not found as well as in Mikulino layers of Kabazi II (what is understandable), so in later layers of mentioned-above sites. This fact could be explained by the south position of the Crimea. Some forest mammal remains were recovered from Unit VI and V. The numerous local environs of these low mountains, connected with the different mountain belts, slope exposures, depressions, and so on, gave the possibility for existence of mammals of different ecological groups.

The climatic changes, influenced by the Scandinavian ice-sheet were smoothed in this region and permitted to ancient humans to found here the comfortable and rather stable conditions. Forested and bushed areas were distributed in the Crimea, but they were alternative with the open landscapes, which were very common here as well as during different phases of Mikulino Interglacial, so later, during Valdai time.

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HISTORY OF THE SEIM RIVER VALLEY, CENTRAL RUSSIA, IN THE CONTEXT OF THE AVDEEVO UPPER PALEOLITHIC SITE FORMATION AND PRESERVATION

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In the central Russian Plain, typical for river valleys is a 8-12- m terrace called «first terrace». It is believed to have been formed about Last Glacial Maximum (LGM) when rivers had low discharges but were overloaded with sediments. Rivers are thought to have incised at the Pleistocene/Holocene border, which gave start to formation of floodplains and their occupation by ancient humans. In spite of wide acceptance of this traditional view, several archaeological sites exist that strongly contradict it. One of them is the Avdeevo Upper Paleolithic site on River Seim, 51º 41.3' N, 35º 48.5' E. It is located at the confluence of the Seim and Rogozna rivers on a gentle hill rising only 0.5-1.0 m above surrounding floodplain [1, 2]. Cultural layer with evidences of stationary human occupation is found at the depths of 1-1.5 m, i.e. 5.5-6 m above the present-day water level of river Seim (about the height of modern highest floods). Series of radiocarbon dates of cultural layer (mostly on bone charcoal) group in several periods of human occupation which in total cover the interval between 17-23 ^{14}C ka BP [2], or 20-28 ka BP cal. During this period river floods must have been lower than 5-6 m above the modern river, which may indicate deep river incision before and at the time of LGM. This study is aimed at establishing chronology of the Seim River terraces and its incision/infilling cycles to assess the conditions of the Avdeevo site occupation and its survival in a changeable riverine landscape.

The Seim river valley is situated in extraglacial part of central Russian Plane between the cities of Kursk and Kurchatov. A set of low terraces of the Seim river valley (fig. 1) was studied between the Malutino village on the left riverbank and the Avdeevo village on the right bank.

The following set of methods was used to reconstruct the Seim river valley development: DGPS topographic profiling (Leica Smart Station), examination of terrace sediments in exposures and cores, subsurface exploration (ground penetration radar (GPR) Zond 12e), laboratory study of sedimentary sections (granulometric, spore-pollen), sediment absolute dating (radiocarbon – ^{14}C, optically stimulated luminescence – OSL). Archaeological data have also been taken into account.

Several terrace levels were detected based on the results of GPS-survey (fig. 2): Holocene floodplain (h=2-4 m); terrace T0 with heights 5-8,5 m (levels T0a 5-6 m, T0b 6-7 m, T0c 7-8 m); terrace T1 with heights 12-16 m (levels T1a 12-13 m, T1b 13-14 m, T1c 15-16 m).

Terrace T1 (h=12-16 m) correlates with the so-called «first terrace» in river valleys of Russian Plane. The lower level of this terrace (T1a) was studied in a sand pit (section ML-1). According to OSL dating, alluvium of terrace T1a was accumulated about 45-55 ka ago. It lies on an older alluvial basement dated to *ca* 70-80 ka. The upper 3.7 m of the section is represented by two units of thin-bedded aeolian sands divided by a 0.8- m thick layer of deluvial loam. The upper aeolian unit was dated at *ca* 20-23 ka [3].

Terrace T0 (h=5-8,5 m) can be correlated with the so-called «intermediate terrace» that was distinguished by some scientists in other river valleys of Russian Plane (the Volga River valley – A.I. Moskvitin, the Oka River basin – A.A. Aseev, N.I. Kriger). This terrace rises only 1-2 m above the modern inundation level. According to GPR data, the upper level of this terrace (T0c) is composed predominantly by sands. Two lower levels (T0b and T0a) have different composition which was studied at river bank exposures (sections ML-2 and ML-3 respectively).

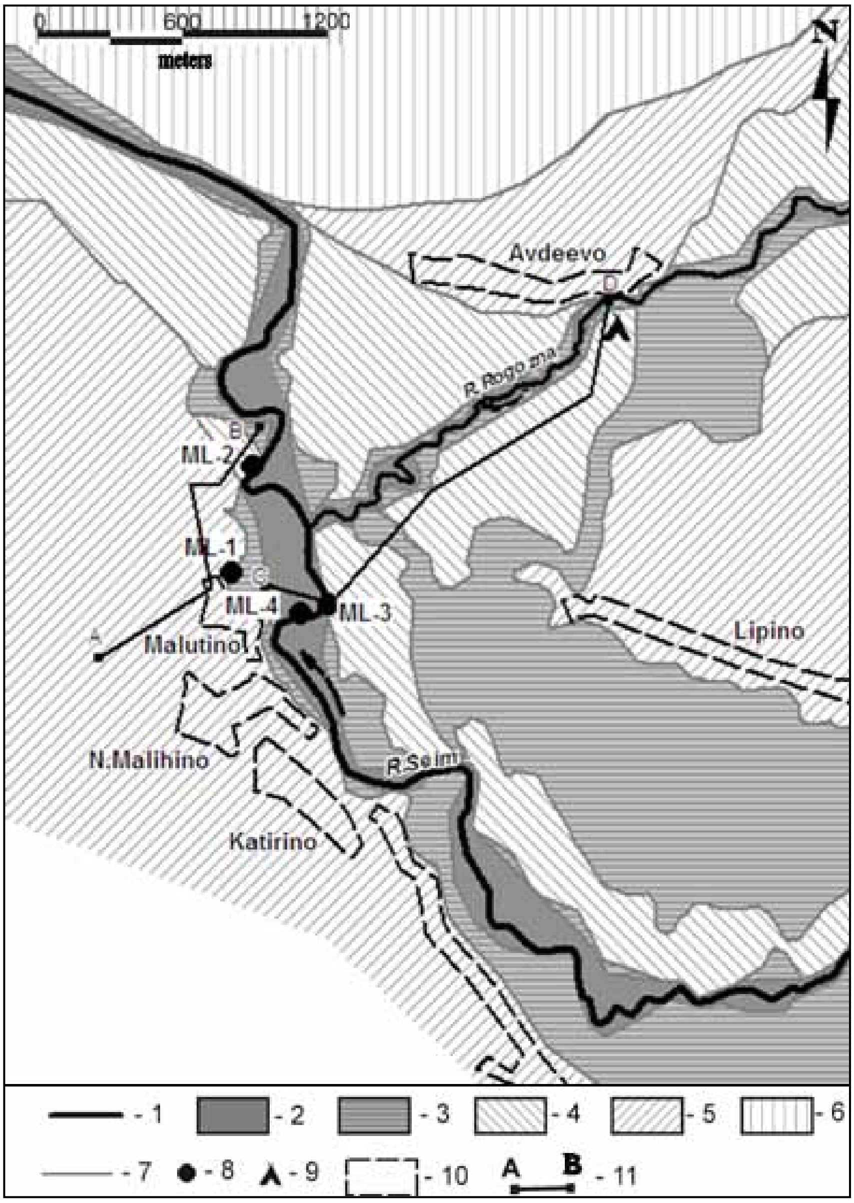

Figure 1. Geomorphological scheme of the Seim river valley between Malutino and Avdeevo. Legend: 1 – channel; alluvial complexes: 2 – Late Holocene (floodplain h = 2-3 m), 3 - Early-Mid Holocene (floodplain h=3-5 m), 4 – Late Valdai ("intermediate terrace", h = 5-6 m) , 5 – Early-Mid Valday (terraces h = 8-16 m), 6 – valley slope; 7 – boundaries; 8 – exposures of terraces , 9 – Avdeevo upper Paleolithic site;10 – settlements; 11 – the line of topographic profile across the Seim river valley

Section ML-2 represents terrace T0b (h=6-7 m) and demonstrates two phases of alluvial accumulation. The older alluvial unit is represented by alternating sands and loams OSL dated to the Mid-Valdai (Mid-Weichselian) epoch ca 30-35 ka BP. At that time the river water level was 2 or 3 m lower than at present. After the first phase of alluvial accumulation there was a long break in sediment deposition during which surface sands of this terrace were probably reworked by aeolian processes. The second phase of alluvial accumulation took place in the beginning of Holocene. The sediments of this phase are represented by massive loams dated at 8700 ± 25 ^{14}C ka (9.5-9.7 ka cal). Two

OSL dates have given different results, of which the date 9.9 ± 0.8 ka correlates well with the ^{14}C date. These loams cover the terrace surface and continue down the terrace edge below the low water level of the modern river [4]. This means that the river was incised by > 1 m in the beginning of Holocene relative to the present.

In the right part of valley bottom a terrace level similar to terrace T0b is found where the Avdeevo Upper Paleolithic site is located. The site is situated on a gentle hill with the top at 7 m above the Seim River and 3 m above the Rogozna River low water level, only a little above the present level of inundation. Core section in the vicinity of the archaeological site opened two principal units. The upper unit (0-120 cm) consists of organic-rich loams, which according pollen data accumulated since the Boreal period of the Holocene. Sharp kind of contact with the lower unit evidence existence of sedimentation break. The lower unit (opened down to 200 cm) consisted of two 250-35- cm layers of brown loamy sands divided by a 20- cm layer of massive loam. Pollen content in the middle loam layer is very low, while in both layers of loamy sands it is high enough to identify steppe or forested steppe communities with participation of broad-leaf trees (in the upper sand layer) evidencing conditions similar to modern climate.

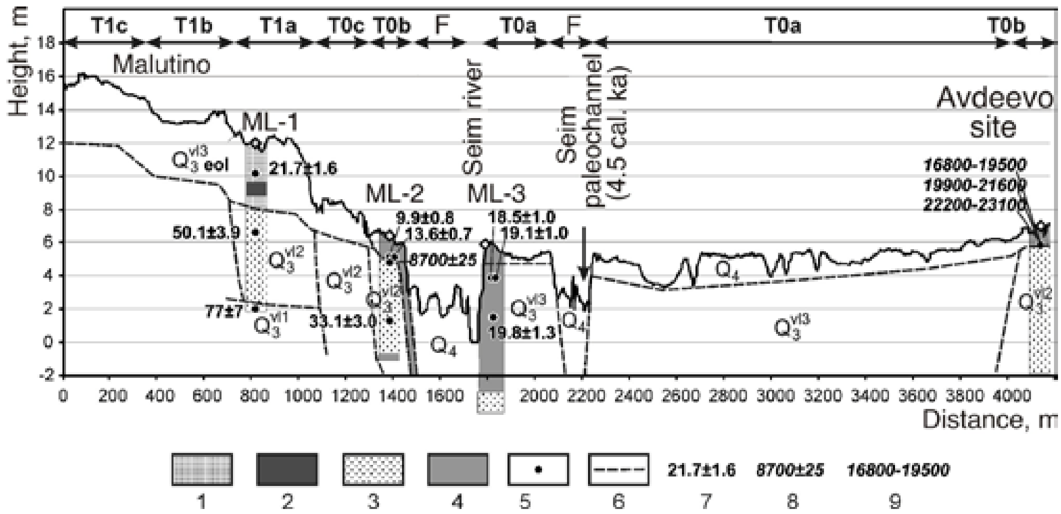

Figure 2. Topographic profile across the Seim river valley and lithological sections of terraces. Symbols: 1 – aeolian sands, 2 – deluvial loam, 3 – alluvial sands, 4 – alluvial clay and loam, 5 – the main stratigraphic boundaries, 6 – location of sampling, 7 – OSL date (cal. ka) 8 – 14 C date (uncalibrated ^{14}C ka), 9 – three periods of Avdeevo site settlement (uncalibrated ^{14}C years), according to [2]

Terrace level T0a (h=5-6 m) is widespread at the right bank of the Seim River between its modern channel and the Avdeevo site (fig. 1). Composition of this terrace was studied at river bank exposure (section ML-3). The whole section consists of loams with indistinct stratification interpreted as overbank alluvium. Content of fine sand increases at depths 0-0.4 and 3.3-4.6 m. OSL dating gave ages immediately following LGM: between 17.5-20 ka at depth of 2.0 m and between 18.5-21 ka at depth of 4.4 m. Sandy channel alluvium was reached by hand coring at depth of 3 m below the current low water level (9 m below the surface of the terrace). Therefore straight after LGM the river channel was still incised 3-4 m deeper relative to the modern river.

In the Holocene, this terrace surface stayed mostly above inundation levels except for few period of extremely high floods – probably, the end of BO and the turn of SB and SA. The latter period of flooding is indicated by composition of the top of terrace alluvium. The upper part of terrace sediments is included into the Holocene chernozem soil. Within this soil, fragments of pottery dated to Early Iron Age were found at depths of 11 and 23-24 cm. Along with higher sand content, it makes an evidence of increased flood levels and resumption of sedimentation between 2-3 ka BP.

The produced geomorphic reconstruction reveals the phase of river incision in the end of the Late Pleistocene. Incision began in the end of the Mid-Valdai (Mid-Vistulian, MIS-2) epoch between 50 ka BP (Terrace T1a) and 35 ka BP (Terrace T0b) and was completed by the beginning of the Late Valdai (Late Vistulisn, MIS-2) epoch. During 28-20 ka BP (cal) the river channel stayed 3-4 m below the modern river. This made it possible for humans to occupy low topographic positions which are subject to flooding at present. Another factor favorable for valley bottom occupation by humans was probably low height of river floods during LGM. It may be deduced from cryoarid conditions of this time indicated by intensive aeolian reworking of terrace sands attributed to this time. Immediately after LGM river floods became higher, which is evident from alluvial composition of terrace T0a. Probably, periodical inundation could be a reason of final abandonement of the Avdeevo site. In the beginning of the Holocene the river was still incised, though floods during some intervals (ex., beginning of the Boreal period) reached levels higher than at present.

Holocene river migrations had much importance for preservation of the Avdeevo site. Now the site is isolated from higher terraces at the valley side by the Rogozna River channel (fig. 1). It is crossed by a paleochannel (fig. 1, 2), which upstream was dated at 4060 ± 120 and 4100 ± 190 ^{14}C BP [5]. So this paleochannel was left about 4.5 cal. ka ago as a result of one or a series of extreme floods. At the same time the Rogozna river was running in the left part of it's valley bottom, east from the Avdeevo site. Then, probably at the turn between SB and SA, when extremely high floods were usual in the Seim River [3], Rogozna jumped to it's current position north and west from the Avdeevo site (fig. 1). Such mechanism of river migration was favorable for preservation of archaeological site because in case of lateral river shift due to bank erosion the site would have been destroyed.

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OBJECTS OF ARCHAEOLOGICAL TOURISM AS CONSTITUENT PARTS OF THE REGIONAL TOURIST-RECREATIONAL SYSTEM

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In contemporary world efficiency of tourism can be ensured only via creation of a unified tourist-recreational system on the national as well as on the regional levels. Development of tourist-recreational systems is caused either by any qualitative changes of the already existing objects or by a quantitative increase of new elements of the system. In the latter case new elements are regarded as those objects of archaeological tourism that need to be correctly and thoughtfully «included» in the system in order to obtain the maximum effect. First of all, we should thoroughly understand the notion of the territorial tourist-recreational system.

The territorial tourist-recreational system (TTRS) is a combination of all interconnected and interrelated tourist-recreational objects on a particular territory. Taking into consideration the hierarchical interdependency, we can distinguish formation of territorial tourist-recreational systems on the level of the world, nation and region.

TTRS presents a schematic and simplified model of the overall tourist-recreational activity. One of the benefits of such a representation is its focus on analyzing internal interconnection and correlation, on studying characteristic features of interrelations among different system elements and on exploring the essence of this phenomenon. Although TTRS seems rather simple, it, nevertheless, allows to conduct quite a detailed analysis of territorial peculiarities of both recreation and tourism, structure of all elements and internal interdependency. All kinds of relations among the system elements (technological, transport etc.) are clearly represented on a particular territory by definite quantitative indices (financial flows, number of tourist arrivals etc.).

TTRSs have certain characteristic system properties. The most important ones are emergentness, i. e. ability of the system to possess the qualities that its separate elements don't have, openness, manageability, poly-systematic character, self-organization, stability, dynamism (mobility) etc. Apart from the above mentioned features, territorial tourist-recreational systems possess a number of specific properties determined by the nature of tourist-recreational activity such as anthropocentric character, topological connection with a certain territory, efficiency etc. Specific properties are to a large extent determined by the nature of the system elements, which are in fact tourist-recreational objects.

Elementary structure and composition of TTRSs is one of the key problems of the system formation. True nature of the TTRS on any hierarchical level is perceived only through understanding its elements and their interrelations. The classic approach to studying composition of TTRSs implies combining similar elements in order to form certain sub-systems. The set of elements and completeness of elementary composition depend on numerous determining factors and, primarily, on the character of a tourist-recreational activity, on the stage of exploration of the tourist-recreational space and on the phase of formation of TTRSs. Bearing in mind such a high level of ambiguity in theoretical comprehension of this issue, we are compelled to choose the classic approach as the most efficient. It allows to unite diverse objects in the frames of a heterogeneous system into several sub-systems (infrastructural, organizing and administrative, natural and recreational, historical and cultural, recreational (the main functional system), economic (accommodation, meals), human resources (the staff), consumers' (tourists) etc. All sub-systems are bound together by direct and indirect ties and that, in turn, ensures the integrity of territorial tourist-recreational systems.

All the above mentioned sub-systems have a general character. Due to this quality they can be filled with any current real content depending on the level of the hierarchy and on the functional character of the TTRS.

The dynamic properties of the TTRS provide it with an opportunity to develop and grow under the influence of various conditions and factors. In the frames of the geo-systematic approach we regard conditions as external causes, i. e. causes that operate outside of the tourist-recreational system, but still make a certain impact on it (climatic, orographic, as well as demographic, social, political etc). Factors are internal causes, operating within the frames of a tourist-recreational system and making a significant impact on it. TTRSs are subjected to the influence of a large number of factors such as location, population's tourist-recreational needs, social and psychological needs, public health, infrastructure, tourist attractiveness, organizing, administrative, economic, ecological and other factors. These are the factors that enable people to exercise influence on the development and transformation of territorial systems.

Introduction of any new object of tourist attraction is a significant factor of development of tourist-recreational systems. However, certain measures need to be taken in order not just to add the object to the system, but to include it as a constituent part into the whole system and to make it produce a positive effect on it.

There is an unalterable condition which should always be applied to all objects of archaeological tourism – readiness to embrace new elements. In order not to hinder scientific researches some notions need to be determined beforehand, namely, what part of the new object will be available for tourists and to what extent.

It is important to take into consideration all specific features of objects of archaeological tourism, because they significantly differ from traditional objects of tourist attraction (monuments, palaces, museums etc). Objects of archaeological tourism are not so «spectacular» for ordinary tourists, as a rule. Very often only the forms of the landscape (barrows, hills, pits etc.) indicate events of the previous epochs. One needs to have profound historical knowledge and a vivid imagination to reconstruct episodes of the past. For that very reason, the problem of setting up museums on such places should be solved first of all. We believe that ideally there should be a combination of a genuine archaeological object and an appropriate museum with thoughtfully selected exhibits complemented by a wide range of interactive activities for tourists (encounter with traditional craft, scenes from routine life of the past) and by reconstruction of historical events (battle scenes where soldiers wear the typical uniforms of a particular historical period etc.).

Inclusion of new objects should be effected through all sub-systems constituting the territorial tourist-recreational system. In regional territorial tourist-recreational systems it can be done via the following sub-systems: the organizing and administrative sub-system (regional authorities, tourist firms, professional unions etc.) effects the following functions: issue a passport for an object, make up sightseeing tours, creating a tourist product as well as its inclusion in the tourist routes and its promotion on the tourist market.

The natural and recreational sub-system and the historic and cultural system both act as one integrated system in the context of archaeological objects. It ensures scientific credibility and reliability of all data and sets up a museum on the basis of the object. The recreational sub-system reflects peculiarities of the recreational activity at a particular object. The infrastructural subsystem provides for transport availability of the object, building of parking lots and walking tracks and providing them with all the necessary facilities. The goal of the material sub-system is to meet the main tourists' needs such as catering, sleep, personal hygiene etc. For that purpose places of catering and accommodation are to be built near objects of archaeotourism. The sub-system of human resources is to ensure training of high-skilled guides, who are able to conduct tours on unique objects professionally.

This algorithm is based on the logic of the geo-systematic analyses of tourist-recreational activity. It might be implemented as a pilot project in the tourist-recreational system of the Smolensk region, where there are two unique objects of archaeotourism – the Gnezdovsky barrows and the Serteisky complex. These days only the first measures to include them in the regional TTRC are being taken. There is still much purposeful and laborious work to be done in order to increase efficiency of the system and to promote itsobjects.

POTTERY OF THE UPPER DVINA REGION OF THE END OF VIII – VI MIL BC AND RAW SOURCES FOR CERAMICS MAKING

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The most part of early neolithic sites of serteyskaya culture is concentrated in the area of paleolakes on the territory of Serteysky and Nivnikovsky lake basins (fig. 1) (Velizhsky area, Smolensk Region). The cultural layers containing the analyzed material are located on boards of ancient lake basins, on kame and terraces formed by paleolakes during early and middle Holocene and in the basis of lacustrine-boggy deposits of Holocene time.

We carried out the x-ray-spectral fluorescent analysis, the petrographic analysis and studying of technology of pottery making, morphology and decor of ancient pottery (207 fragments from 206 vessels) from 21 sites located in Serteysky, Usvyatsky and Sennitsky archaeological microregions. Characteristic of deposits from ten wells and prospecting pits made in the Serteysky archaeological microregion were also took into account.

The analysis of geochemical composition of ceramic fragments and deposits showed that local deposits formed within lake basins served as sources of raw materials. Two groups were distinguished according to the content of oxide of manganese: group with the high content of MnO (0,2-0,5 %) and the low content (0,2-0,02 %). The high content of MnO is characteristic for deposits of glacial genesis, i.e. the fluvio-glacial kame and morainic deposits developed on the boards of lake basins and terraces (from 0,13 to 0,5 %). The lake deposits of Holocene age located in coastal parts of basins are characterized by low values (0,02–0,1 %). Montmorillonite / hydromicaceous clay could have been taken from coastal deposits of the Serteysky lake basinand from kame buttes formed by montmorillonite clay deposits where rewashing of morainic and lake deposits occurred.

Six groups of types of sources of raw materials were distinguished differed due to chemical composition of components:

I group – the ceramics made of coastal deposits of the Serteysky lake basin: the clayey sandy deposits containing clay of kaolinite/ hydromicaceous composition.

II group – the ceramics made of coastal deposits of the Nivnikovsky lake basin: the clayey sandy deposits containing clay of kaolinite/ hydromicaceous composition.

III group – the ceramics made of deposits of kame buttes of the Serteysky lake basin: the outwash clayey deposits containing clay of kaolinite/ hydromicaceous and motmorillonite composition.

IV group – the ceramics made of raw materials found on the terraces of the Nivnikovsky lake basin: outwash clayey aleurite containing clay of kaolinite / hydromicaceous and motmorillonite composition.

V group – the ceramics made of fluvioglacial deposits located on boards of the Nivnikovsky lake basin.

VI group – the ceramics made of morainic loam soil formed on boards of the Serteysky lake basin: clay deposits of montmorillonite structure.

As a result of the carried-out analysis it was defined that sources of local clay and aleurite raw materials situated usually near the settlements were used for pottery making. Use of these sources of raw materials is closely connected with their accessibility. Water level fluctuations in lakes can be traced in the course of early Neolithic settlements existence in this region [1]. It may be supposed that during some periods these fluctuations might lead to the difficulties of use of habitual raw materials from coastal zones that is why other sources found on terraces, kame buttes and lake borders might have been used. These new types of material could have been adapted by adding of some nonplastic material. On the other hand, the choice of raw material resources could have been dictated by pottery making traditions and might reflect emergence of new traditions. It is interesting to notice that two vessels of the ceramic phase «a-1» found in Nivnikovsky lake basin were made from clay from Serteysky lake basin. It raises the question about transfer of some pots for some reasons. This process might have occurred on small distances (up to 7 km) and bigger one. The latter can be proved by two other vessels which were made from non-local clay and which were brought to Serteysky microregion from other regions.

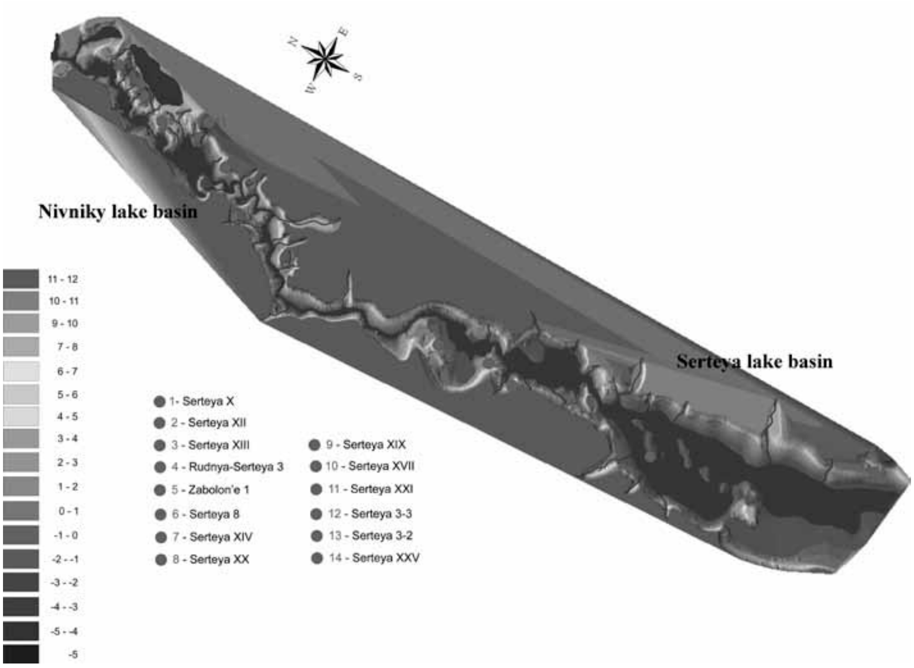

Figure 1. Distribution of early Neolithic sites in Serteysky archaeological microreion

Along with definition of sources of raw materials we have distinguished several recipes of clay paste from which three techniques might be regarded as «basic” traditions. The simplest recipe is represented by technique «A»: aleurite loam soils with the high content of clastic material (strongly sandy loam soils) were used as raw materials without adding of any nonplastic material. This technology was used mostly to make vessels of the II type which have analogies in Middle Volga Elshanian culture and also vessels of the ceramic phases «a», «b» and «b-1» which can be compared with the pottery decorated in pin-pointed action. The high content of clastic material is typical for this type of paste. This tendency is supposed to remain long time. Ancient craftsmen chose different types of clay in most cases with a high content of clastic material and even added nonplastic material (vessels of the phases «b» and «b-1»).

Techniques «B-B1, C-C1, C-2, D» were used, probably, to adapt local loam soils to habitual aleurite raw materials (technique «A») in which percentage of clastic material was from 50 % and above.

The technique «D» is the second tradition which was used to make vessels of the phase «a-1» which is supposed to be similar with pottery from low layers of the site Rakushechny Yar. For this technique use of clayey lake deposits of kaolinite composition with a high content of a clastic material (to 60 %) is characteristic. Adding of chamotte in this technique is a new feature of early Neolithic paste recipe.

Further changes in raw materials and paste recipes choice namely use of fat hydromicaceous, kaolinite and montmorillonite deposits with the mixed recipe: sand + chamotte (techniques «C, C2») were used mostly for vessels of the phase «b-1» and types V, VII which have analogies in materials of Desninskaya culture, early stage of Bug-Dnestr and Middle Don culture.

These techniques are supposed to exist in this region in the end of VIII-VII mil cal BC. Ceramics of the phase «a» found in the horizon A-2 of the site Sertey X can be dated to 7300 ± 180 (Le-5260), 7300 ± 400 (Le-5261) BP, on the site Rudnya Serteyskaya –

7870 ± 100 (Ua-37100) BP due to organic crust. Also the existence of some other types of pottery of the phases «b» and «b-1» found in the same cultural layers can be ascribed to the period of 7300-7000 BP. Pottery of the phase «a-1» found on the site Serteya XIV in low layers was dated to 8380 ± 55 BP (Ua-37099) due to organic crust.

The third tradition – technique «E» – was used to make vessels of the phase «c-1». It is an absolutely new technique which represents another technological tradition. Plastic clay of montmorillonite composition that is widespread on boards of lake basins was used. Vegetation was added which created high porosity of these vessels. This type of pottery can be dated to the end of VI mil cal BC.

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DYNAMICS OF LANDSCAPE DEVELOPING IN EARLY-MIDDLE NEOLITHIC IN DNEPR-DVINA REGION

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Investigation of stone age sites distribution allowed A.M.Miklyaev and P.M.Dolukhanov distinguish «archaeological microregions» – lake basins including archaeological sites which gained the names of the Serteya, Usvyaty, Sennica and Zhizhitsa microregions (fig. 1). Sites of early and middle Neolithic occupy different topographical positions and are situated in different types of landscapes.

All the archaeological sites used for our analysis were investigated in the field. Their coordinates were registered with GPS, and excavations were made, as well as geological test pits. The information obtained from fieldwork was entered in the «MonArh» database. Vector layers of relief, river systems and woodlands were used as a topographical base using 1 : 200000 and 1 : 5,000 scale lists N - 34. Employment of GIS-tools allowed us to analyze the degree of sites illumination all year round, relief characteristics, zones of potential economic activity, distribution of different types of sites.

The Serteya microregion consists of a chain of small residual ice-dam lakes (dating from the late Valdai / Würm glacial) connected by rivers. All sites are located on the shores of confluences and lakes remote from the main waterway, the Western Dvina. The relatively modest occupation of the banks of the big rivers could be explained by insecurity of the main waterways in the past.

In the course of investigation of early Neolithic sites distribution we have managed to distinguish several features which allow us to define several types of sites. Among them – specialized sites situated in specific parts of landscape – winter and summer camps, hunting sites situated along an animal migratory track, fishing spots, and possible observation posts which together formed the settlement system of the Early Neolithic from the 6th to the beginning of the 4th millennium BC. This varied settlement system took into account the seasonal convenience of different places in order to use all the rich resources of the Holocene optimum, and took maximum control of the area that was used for the observation of the natural resources, or for guarding the territory.

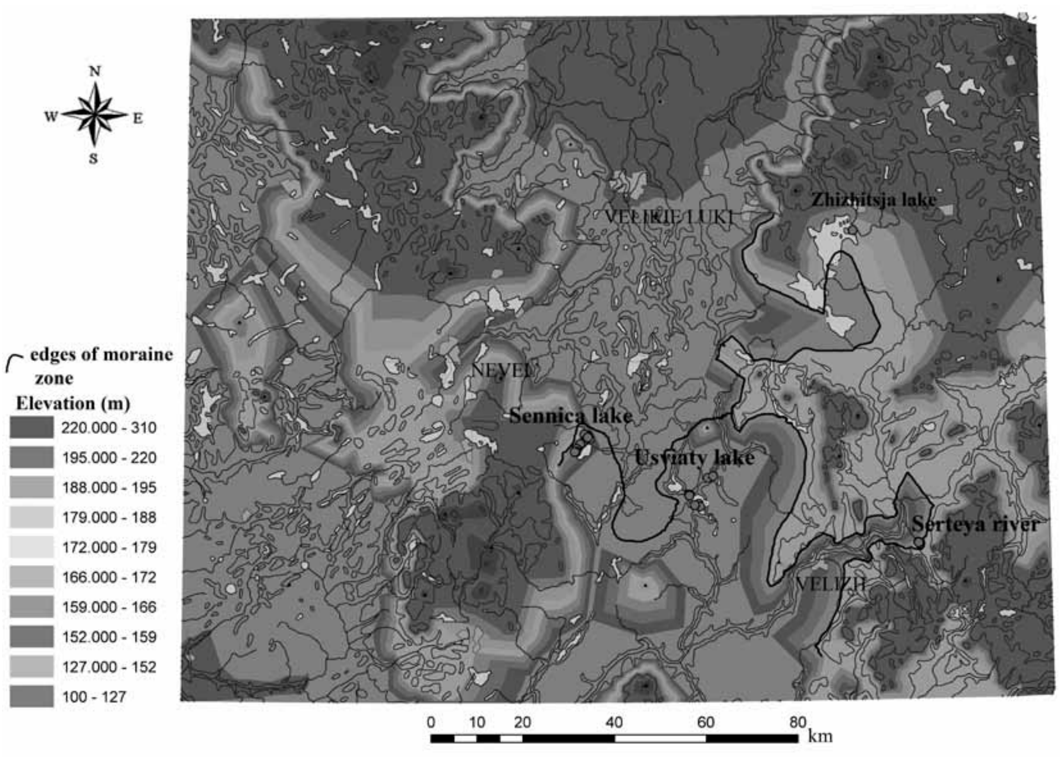

Figure 1. A 3D reconstruction of the relief with the edges of morainic zone and archaeological microregions

Settlement systems in the Early and Middle Neolithic differed greatly as a result of climatic change and changes in the economic and «cultural» strategies adopted by the ancient inhabitants. In comparison to the rather mobile population of the Early Neolithic, whose economic system depended on seasonal changes, the situation in the Middle Neolithic is very different. The zones of economic activity were extended, the sites became inhabited all year round, and the places and types of sites changed. The fluctuations in climatic conditions and the degradation of broad-leaved forests, the fall of lake water levels, the development of mires and the reduction of lake productivity in the Subboreal could have led to a reduction of natural food resources in this territory and more difficult access to water resources. These circumstances resulted in a change of economic strategy – the settlements were now installed on the intersection of different types of landscapes, they were inhabited all year long and the population became more settled, hunting camps had almost disappeared. Analysis of structure of pile dwellings helped us to presume a gradual growth of population which coincided with changes in economic strategy at the transition of the Early to Middle Neolithic: foraging economy was replaced by a more complex system, in which hunting and food-gathering still dominated while productive economy had a prestigious character and was not determined by economic necessity.

Thus we can suppose a hypothesis of multifaceted settlement model of the Early and Middle Neolithic. Our investigations allowed us to reconstruct economic system including settlement models of ancient inhabitants of the Early and Middle Neolithic that differ substantially from the ethnographical models usually used for interpreting the Stone Age. Analysis of the «archaeological microregions» along with mapping of known stone age finds on the territory of Smolensk region allowed us to suppose existence of other «microregions», describe dynamics of settlement of these territories and trace areas where bearers of other cultural traditions could have come.

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THE GEOARCHAEOLOGICAL APPROACHES IN STUDY OF MARITIME ARCHAEOLOGY IN VIETNAM

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Vietnam is an oceanic country. It locates in the Southeast Asia and in the international marine trade line from North Asia to South Asia (fig. 1). The ancient inhabitants who resided at Vietnam had known the ocean for many thousand years ago. In addition, BienDong was a family living environment of the Vietnamese. The Vietnamese ancient marine inhabitants concentrated on the groups and settled in the maritime limestone cave or costal sand dunes. They exploited the oceanic benefit to serve not only eating routine but also exchange with other inhabitants who located in the high mountainous areas. Furthermore, ocean has become a part, which cannot lack for culture and sprit life of maritime inhabitants. They established the oceanic characteristics in traditional culture of Vietnam. The paper from geoarchaeological approaches to contribute to achieve clearly the oceanic cultural characteristics in Vietnamese traditional culture within four parts:

- The first ancient inhabitant living in the sea;
- Economic–culture exchanging between forest and maritime;
- The oceanic fluctuations and immigration trips on the sea;
- Bien Dong in today living.

Figure 1. Vietnam locates in the Southeast Asia

NATURAL DISASTER AS A FACTOR POSSIBLE DESTABILIZATION OF ANCIENT SETTLEMENTS ECONOMY IN NORTH-EAST COAST OF THE BLACK SEA AHD TAMAN PENINSULA

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The purpose of the present article is to compile data about the dominant natural processes and phenomena in the Azov-Black Sea region and accurately assess their hazards to the economy of ancient cities and rural districts.

Greek cities in this region occurred no later than the VI century BC. The bases of their economy were maritime trade, transportation, livestock, fisheries, handicrafts, agriculture, etc. It is recognized that in ancient times the Taman peninsula was an island south-western part of delta of the Kuban (Hypanis). One of the anastomosing branches of the Kuban – Antikites probably flowed within the contemporary Ahtanizovskij liman and flowed into the Gulf of Taman of the Black Sea (Pontus Euxine). This archipelago, due to the accumulation of sediment in the ancient anastomosing branches of the Kuban originated modern Taman Peninsula.

It is considered that the archipelago at the place of the modern Taman Peninsula consisted of three main islands: Kimmeridy, Phanagoria and Sindica. Within the modern delta of the Kuban was the strait connecting the Pontus and Meotida. The climate of the region in ancient times was a rather more harsh and cool, than at present. It is believed that the air temperature in the Northern Black Sea Region VII-VI centuries BC was at 1,5-2° lower than at present. Ancient settlements in the region appeared in the period of Fanagoriyskaja regression, when sea level was at least 5-6 m below the present.

It can be argued, based on the principle of actualism, that the dangerous natural processes and their paragenesis, which we observe in the region today, were developed in ancient times. However, the natural risk from dangerous natural processes for buildings and facilities of the Greek colonies was higher than at present.

In accordance with a map of «Natural risk of sea coasts», the north-east coast of the Black Sea and the Taman Peninsula is currently characterized by a high natural risk of development of territory [1]. Landslides are extremely (catastrophic) hazardous processes. Extremely hazardous and hazardous are the earthquakes, mud volcanoes, flooding and hurricanes. The most dangerous processes of considered epoch are earthquakes and their secondary effects because of low seismic vulnerability of buildings of ancient cities, despite the skills of antiseismic construction (bond from the plinthiform brick, etc.).

According to [2,3] in the Eastern Black Sea region over the past 3,000 years there have been three strong earthquakes: in 800 , 63 BC and in 275 AD. The earthquake of the 63 BC (Panticapaeum) has the following characteristics: M = 6,4 (± 0,7), Io = 8 (± 1), h = 10-40 km. The greatest destruction (shocks of force 8) occurred in Panticapaeum (Kerch), Phanagorja (Taman), Porfmja, Nymphja. The earthquake was felt in the Gorgippja (Anapa). Archaeological excavations in the Kerch have found destroyed terraces which surround the city, the grand destruction of buildings, broken tombs. This earthquake affected the plowed field [4]. Rock falls and landslides, marine shallow gas [5], tsunami (seismogenic and landslide) occurred from the seismic shocks.

Soil liquefaction should be refer to the hazardous secondary effects of earthquakes occurred. On the Taman Peninsula in the upper part of the section according to our research commonly occur dynamically sensitive water-saturated sandy-clayey soils.

These soils could be responsible for a significant and sometimes catastrophic deformation of the rock mass under seismic actions. Earthquake in 800 BC by calculations of Soloviev O. N. and Kuzin I.P. [3], caused tsunami height of 3-6 m near Anapa. The seismic event of 63 BC resulted tsunami height of 3 m (for comparison – the approximate height of storm waves Temryuk Bay currently is 2-5 m). According to Nikonov A.A. the last earthquake caused a slump area of the Azov Sea coast in the north-west of the Kerch Strait. Occurred landslides were the cause of death of the ancient cities of Pierre and Antissa on the Bosporus. Similar seismogenic landslides (seismic dislocations) are widespread on the peninsula Abrau in the band from Anapa to Novorossiysk. One of these landslides is described by us near of urban settlement Sukko. The cirque rock landslide has length 160 m, width up to 700 m. Destruction of massif in the described area associated with a particular type of rock creep under the influence of long seismic vibrations was called «Pontian phenomenon» by Solonenko V.P.

Seismic events cause activation of mud volcanoes. There are documented cases of erupting volcanoes during the earthquakes at the epicentral distance of 100-150 km from the volcano. Eruption, emitting a large amount of mud volcanic breccia, accompanied by explosions, strong emission of gas jets (with or without ignition) and the formation of cracks [6] is especially dangerous. Mud volcanism has been described as a phenomenon in Euxine Pontus coastal area in ancient times. The area of mud volcanoes in the Taman was considered as an entrance to Hades, and the way in it began with mud volcanoes. In 63 BC there has been a partial flooding of the mud of ancient cities, in particular Phanagorja [7].

Processes of clay diapirism in some cases causing a rapid rise in coastal areas are closely related with mud-volcanoes processes. In particular, we have examined the site of the Azov Sea coast near Cape Kamennyj where in 2011 year there was a rapid uplift of the seabed at a speed greater than 2 m / month. Raising occurred in the area length about 600 m and an amplitude of up to 5 m. Such phenomena certainly occurred in the past and could significantly affect the economy of ancient coastal settlements, to cause the destruction of port facilities.

Significant impact on the economic life of the Taman Peninsula had a tectonic processes, changes in sea level, as well as lithodynamic processes in the delta of the Kuban (sediment accumulation).

Sea-level rise (Nimfeyskaja transgression in the 0-1 century AD) increased abrasion, landslides, underflooding and coastal flooding, mud volcanic activity, etc. According to various authors the highest level of Nimfeyskja transgression did not exceed 1-2 m as compared with modern level.

Nimfeyskaja transgression began after Fanagoriyskja regression when the sea level was 5-6 m below today's heights. Subsequent transgression resulted in marine erosion and the partial flooding of coastal settlements. Currently, the highest rate of abrasion (2 m / year) is observed on the eastern coast of the Azov Sea. Erosion increases sharply during the storms. Thus, cliff Golubitskja terrace on area long 1 km withdrew up to 20 m during hurricane of the 1969 year.

It is possible that a sharp rise of sea level created a dangerous landslide situation, and areas of the city located near the cliffs began to crumble. Area of marine abrasion has high probability of rock fall associated with the destruction of port facilities.

Ingression of large masses of Black Sea waters in the Kerch Strait in the initial phase Nimfeyskja transgression likely resulted in the activation of mud volcanoes.

There were fundamental changes in hydrology and sediment dynamics of the river outlet of the Kuban due accumulation of the flow of solid matter of the river, coastal abrasion material, products of the eruption of mud volcanoes. One of the main branches of the Kuban began to fall into the Sea of Azov. This rotation of the Kuban to the north is associated with tectonic movements. Deposit accumulation within the delta of the Kuban watercourses has gradually formed the peninsula. This is a natural event that has occurred, apparently, in the V century AD had a pernicious effect on commercial shipping and the economy of the cities located within the archipelago.

Thus, hazardous natural processes determined not only changes in landscapes of the past, but also could adversely affect the economic activities of ancient settlements.

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LANDSCAPE-DEPENDENT FUNCTIONAL ZONING OF THE EARLY MEDIEVAL GNEZDOVO SETTLEMENT ON THE UPPER DNIEPER RIVER FLOODPLAIN

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1. Gnezdovo archaeological complex (late IX – early XI centuries) is situated at the Western Russian border at about 13 km from one of most ancient Russian town Smolensk. It is known as one of the largest archaeological sites of the period of State formation in the Eastern Europe (corresponding to the Viking Age in Northern Europe) and a key-point on the famous route «from the Varangians to the Greeks». As early as at the beginning of 20th century two hill-forts bordered by extensive nonfortified settlements were fixed in association with about 4000 mounds. The monument scale and materials obtained after its study allow to compare it in terms of several criteria with such northern European proto-urban center as Birka and Hedeby.

The history of Gnezdovo studies commenced above 130 years ago. About 1000 mounds and about 7000 m^2 of settlement occupation deposit were studied. This allowed to conclude that Gnezdovo site could be attributed as ancient Smolensk, the latter being cited in early written sources. Gnezdovo was a civic centre and the largest center of handicraft and international trade. The population of Gnezdovo is characterized as polyethnic, with sufficient part of the Scandinavian incomers.

2. The whole archaelogical complex occupies different morphological elements of the Dnieper River valley. Our attention will be focused only on the part of the Gnezdovo archaeological site which lies on the floodplain area. The occupation deposits within the Dnieper floodplain was discovered only in 1996-1997. Nowadays this territory is completely unfit for stationary living and partly waterlogged. Excavations on the floodplain which started in 1999 had radically altered the existing concept of the site topography and the cultural layers informative value. It has been carried out an unexpected depth of Gnezdovo time layers covered by the Dnieper-river overbank alluvium deposited during springfloods. Alluvial layer overlaid occupation deposits and preserved them from mechanical disturbance.

3. Settlement development on the floodplain was dependend on local landscape much stronger than it did in other geomorphic positions. It was limited by the Dnieper river and its Svinets tributary and proximity to the river played important role in its functioning. Local landscapes have been altered greatly during the last millennium, so only the tight cooperation of archaeologists, geomorphologists and experts in paleopedology could be fruitful, especially in the problem of paleolandscape reconstruction as well as in field work methods (the hand-coring as the instrument of the occupation deposit depth determination and its preliminary characteristic).

4. There are two morphologically different parts of the floodplain: old floodplain with rather smooth topography but total relief of > 3 m, and young floodplain with rough ridge-and-hollow surface. Old floodplain was formed during a period of extremely high floods between 2.3-2.7 ka BP when older floodplain was strongly reworked by river erosion. Few Early-Mid-Holocene remnants which survived during this reworking are also included into the old floodplain area. Formation of this part of the floodplain had finished by 2.2-2.0 ka BP. The first Millennium A.D. was characterized by low flood activity rare or maybe no inund ation of the floodplain. This is obvious in particular from buried Albeluvisols (zonal soils which cannot be formed in conditions of regular seasonal inundation) related to that time and their remnants which are discovered under the floodplain habitation deposits. The second evidence of low intensity of seasonal inundation is a replacement of silts and clays with peaty gyttja in cores of sediments from oxbow lakes and an extinction of water plants from pollen spectra of these sediments. These changes testifies on paludification of oxbow-lakes due to restricted water supply and absence of seasonal floods in particular.

In the 9^th^ c. AD, i.e. already in the second half of the low-flood period, the Gnezdovo settlement was founded and spread over the floodplain. The old floodplain area was covered by a 20 × 20- m net of 2-3 m deep hand cores, which permitted mapping of the habitation deposit. It was found that economic and dwelling activities were located on topmost not inundated areas of floodplain and blended well with local topography. The settlement existed till the 11^th^ c. AD, and floodplain inundation resumed only about 13^th^ c. AD. Therefore, changing hydrological regime was not a factor of either foundation or decline of the settlement.

The key question of the Gnezdovo landscape history is the position of the Dnieper River at the time of the settlement development. To find it a trench was excavated across the border of the old (occupied in Gnezdovo times) and young (post-settlement) floodplain segments. Characteristic slipping-down sedimentary textures were found that were most probably formed due to bank cutting by river channel. They were dated between 1.0-1.3 ka BP, which evidence that at Gnezdovo times the right river bank was located directly at the border between the two floodplain generations and right at the southern limit of the cultural layer expansion over the floodplain. The reconstruction of the Dnieper channel site at the IX-XI centuries obtained as a result of multi-disciplinary studies were completely confirmed during the archaeological excavation at the area of hypothetic beach zone of the ancient Dnieper channel. The southern edge of the settlement was spread to the river bank. No bank erosion during and after the settlement development was found, which means that no loss of the settlement area due to erosion has occurred. In the last millennium the river channel shifted southward eroding its left terrace bank and constructing the ridge-and-hollow young floodplain at its right bank.

5. The ancient landscape reconstruction allowed to make the archaeological field work more purposeful. During the fieldwork (1999-2011) four different function area were identified.

- «Manufacturing» area is situated near the Kamyshi lake and is characterized as a jewelry and forgery center having also some dwelling houses and household buildings. The location of manufacturing workshops connected with high-temperature processes is related to nearby water basins. The alternating record of those is dated back in the range of the second quarter of the 10^{th} century up to the border of the 10^{th}-11^{th} centuries.
- «Harbour» area at the north-east bank of the Bezdonka lake, wich probably was used as the inner harbor. The wooden planking supposedly could have been used as «hards» in the warf of the ancient Gnezdovo. The occupation deposits of this area as a whole could be dated back to the 10^{th} century.
- «Riverbank» area is located at the southern boundary of habitation deposites near the Dnepr ancient river channel bank within the «beach». The traces of different kind of river boat service (tar extraction and black-smith handicraft fire-places) were revealed. This area was probably used only seasonally as the numerous alluvial thin interlayers within the occupation deposit indicate the regular flooding of this territory. The studied features could be dated back in the range of the second quarter of the 10 century up to the border of the 10^{th}-11^{th} centuries.
- «Periphery» (near-terrace) area is located at the boundary of the flood-plain and the terrace. The evident traces of activity aimed at the development of low suitable for living territory were revealed, such as upfilled boggy mould and brushwood road construction. The remnants of dwelling houses were fixed within the area which was dated back to the beginning of the 11^{th} century representing the final stage of the settlement existence.

The stationary archaeological excavations revealed the evident landscape dependence in the development of the area by the population of the ancient Gnezdovo. Probably the whole settlement structure at the Dnepr floodplain was directed toward the river and connected in some way with the transeuropean river trade way.

GEOMORPHIC PROCESSES AND GEOARCHAEOLOGY: THE INDIAN EXPERIENCE

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Lord Curzon visualized that it was in the exploration and study of purely Indian remains, in the probing of the «archaic mounds», in the excavation of old Indian cities and in he copying and reading of ancient inscriptions that a good deal of the work of the archaeologists will in future live. Truly enough, it was the excavation of the mounds near Mohen-jo-Daro and Harappa that put the Indian Civilization as much older than the others by at least three thousand years. The geomorphic processes by rivers resulted in these mounds just as the marine processes resulted in mounds in Lothal and other places in India. The Buddhist Stupas are always in the shape of mounds and their excavations subsequently led to the formation of the Archaeological Survey of India. The Ajanta-Ellora caves in the Deccan traps and caves on the west coast of India and at several other places were the result of geomorphic processes that operated then. There are also natural arches like the one at Tirumala in Andhra Pradesh, clearly the result of geomorphic processes. Most of these places have become places of interest for tourists.

GEOARCHAEOLOGICAL IMPLICATION OF THE LATE HOLOCENE COASTAL EVOLUTION: WESTERN PART OF THE KERCH STRAIT

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Reconstruction of the coastal evolution of the Kerch Strait in the Late Holocene is of great importance for understanding of the structure of the ancient settlement, the bounds of terrain suitable for the defense and farming, localization of harbors, etc. Despite the fact that the study of the sea level change of Black sea in Holocene have a long history the questions about the regional peculiarity of the Black sea transgression rest open. The main regional peculiarity of the Holocene transgression of the Black sea is closely related to the proposed several fluctuations of sea-level although there are disagree on their amplitude, age, and even on their existence. The phanagorian regression of I millennium BC attracted the most attention which is regarded as consequence of global climate cooling («neoglacial»). The drop of the relative sea level up to 3-5 m have explained the submergence of the low part of the ancient Greek cities on the Black sea littoral (Dioskouria, Phanagoria, Olbia and others).

The relative sea level change of the Black sea was accompanied not only by passive flooding (or drying) of a coastal area, but also by change of coastal configuration, advancing and retreating of shoreline, submergence and burial / erosion of cultural layers that, as a whole, render the direct research under such circumstance very difficult and require the apply of various indirect approach such a geological and geophysical technique. The coastal section of the Crimean shore of Kerch Strait between the Tobechik liman and Kamysh-Burun bay that encompass the choras of classic cities Nymphaeum and Tyritaka is an example of coastal areas, where the similar reconstruction is of great importance changes had enough drastic character and have been considered as a part of the historical and archaeological study of this region (fig.1). Despite the large content of geological information for the Kerch Strait and adjacent coastal areas [1], their evolution in the late Holocene remains poorly described in literature, which leaves plenty of room for historical and geographical interpretation [2]. During the joint geoarchaeological researches which is carried out by the Centre archaeological research «Demetra» within the framework of the program «Chora of classic city Tyritaca», the new data have been received concerning the evolution of coastal area of this region since the Bronze Age, that allowed to precise the landscape dynamic of paleo-Kamysh-Burun bay and evaluate the possible location of the port area of classic Nimphaeum [3].

Figure 1. The location of the study area

In order to reconstruct the palaeoenvironment and interpret the landscape evolution of the coastal area of the Kamish-Burun bay, detailed geomorphologic mapping and coring up to depth 10-12 m have been made. The subsequent study of the coastal marine sediment comprised the biostratigraphical, sedimentological and geochronological techniques. Fifteen samples of shell were dated using the conventional radiocarbon method, thus providing temporal control of the sedimentary units. Geomorphologic mapping of subaerial and subaqueous coastal parts of the area was carried out using large scale topographic maps and air photography. Additionally the results of underwater geophysical and archaeological survey of the nearshore zone have been used.

The studied coastal section of Crimean shore of Kerch Strait comprise the three types of the shorelines: the high cliffed coast on southern part, the sandy terrace on the southern outskirt of Nymphaeum and the beach-ridge plain in the inner part of the Kamych-Burun bay that is surrounded by cliffed slope of inner upland. On the former promontory in the bay head the antique city Tyritaka is located. The extended section of open cliffed coast is subjected by steady coastal erosion with the mean rate up to 0.4-

0.8 m / years. The total loss of land for the last 1.5 thousand years is estimated about 400-500 m.

Using archival cartographic and geological materials and geological studies conducted by the authors in 2004-2011 showed that the modern topography of the coastal land of Kamysh-Burun Bay is a series of ancient generations of Kamysh-Burun spit, formed during the follow-up paleo- bay on the spot of estuarine zone of Churubash estuary. The average width of the zone of accumulation and, as a consequence, forwarding of Kamysh-Burun Bay coastline is 2-2.5 km. According to preliminary data this zone of the coastal marine accumulation is a fairly uniform thick layer of shell sand with the capacity of 3.5-4.5 m. Modern Kamysh-Burun Spit represents the newest generation of beach ridges.

The data of coring have shown that the beach-ridges plain is consist of coarse shelly sands which have been redeposited during erosion of more old sandy body that have been located more seaward from the present shoreline and was related with mid-Holocene highstand. The thickness of superficial coarse layer is about 3.5-4.5 m. The mean width of the beach-ridge plain reach the 2.0-2.5 km that define the scale of advancing of shoreline during the last 1.5 thousand years.

Below the subsurface cover of coarse sands the extensive strata of fine well-sorted sand with shells spreads in the inner part of the former semi-enclosed shallow embayment that reach the eastern flank of cliffed shore that bound the coastal lowland. The set of radiocarbon dates of shells from fine sands have shown that the shallow embayment in the inner part of coastal lowland existed between the end of the II millennium BC up to end of the I millennium AD. The belt of silty clay in the outer part of the former embayment confirm the semi-enclosed type of the waterbody and existence the sandy barrier that located easterly from present Kamysh-Burun spit and have been related with mid-Holocene highstand of sea level. This barrier have been destroyed during the acceleration of sea level rise during the last 1,5-1,0 thousands years. The eroded sands have been removed in the inner part of the paleo bay and redeposited during formation of the different generation of the beach ridges that infilled the inner part of embayment.

In general, the underwater archaeological survey indicate that the sea level during the Phanagory regression for the maritime part of Nymphaion in the 4th century BC could correspond to the depth of 5.0-5.5 m below the present. Consequently, during the last 2.5 ky more than 400 m of ancient coastal strip has got under water, which is about 3 square kilometers of Nymphaion polis. This means that the majority of the most ancient rural settlements, burial structures, as well as all port buildings of Nymphaion have been flooded [1]. A similar situation can be observed for the coastal area of rural district of Bosporus cities of Tyritaka, Panticapaeum and Myrmekion.

The results of the geological work in the vicinity of Tyritaka have shown that the fragments of local pottery of Hellenistic time have been met at depth 4,5-5,5 m below present sea level that didn’t contradict to the underwater archeological data and could be used for sea level reconstruction [4]. The geomorphological data have permitted to reconstruct the boundary of embayment which existed in Kamysh-Burun bay in classic time. In the bayhead the paleoshoreline was adjacent to southern border of Tyritaka. In the southern part of embayment she bordered the northern flank of the rocky upland on which the antique Nymphaeum have located. This creates the geological base for assumption about possibility of location of sheltered harbor of Nimphaeum which have been proposed early on the open shoreline easterly from present coastline.

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GEOARCHAEOLOGICAL INVESTIGATIONS OF HARAPPAN SETTLEMENTS IN NORTHWESTERN INDIA WITH SPECIAL REFERENCE TO SOIL MICROMORPHOLOGY OF OCCUPATION DEPOSITS FROM ALAMGIRPUR AND MASUDPUR

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Figure 1. The location of the study area in study area in India

This paper presents preliminary results of the geoarchaeological investigations of soil and sediment sequences associated with a series of Harappan archaeological sites in northwest India dated to between c. 2000 and 300 BC: Masudpur I (Sampolia Khera), Masudpur VII (Bhimwada Jhoda) and Rakhigarhi in Haryana. This period is particularly significant because it was a time when the urban Indus Civilisation declined and its major cities were abandoned, and it was not until c. 300 BC that large urban centres emerged in the Ganges region. Geographically, the research focuses on the plains of Haryana and northern Uttar Pradesh – the modern states forming the Indo-Gangetic catchment area, which have a rich archive of high quality geographical and archaeological data (fig 1, 2). This study provides new insight into associated landscapes as well as site formation processes. It thereby helps to understand human

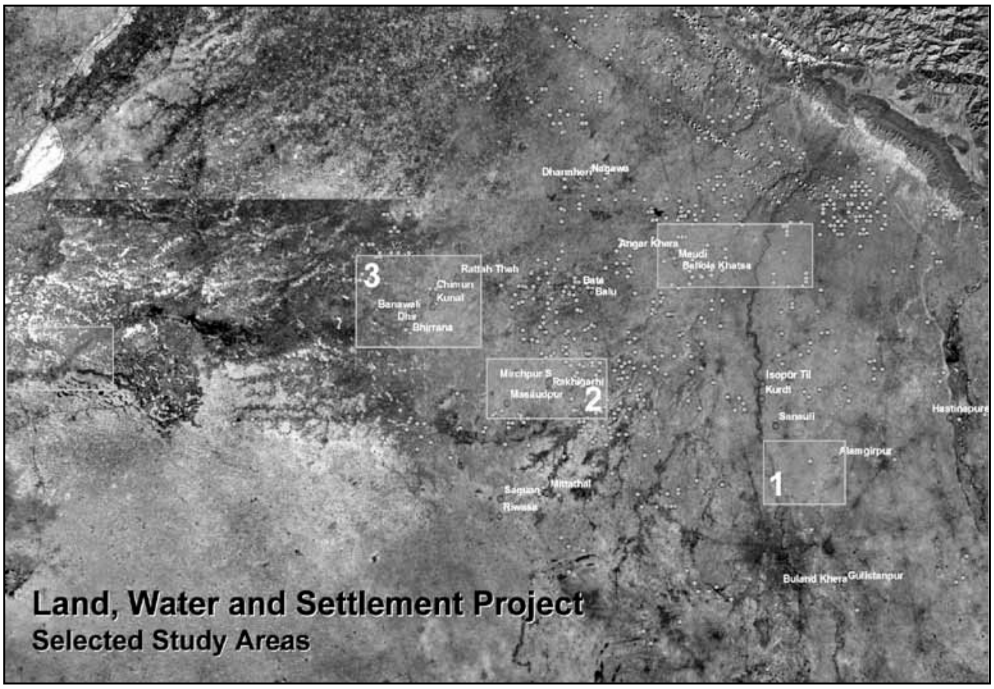

Figure 2. Distribution of Indus sites in Haryana and western UP, with location of study areas, Alamgirpur (Area 1) and Masudpur (Area 2) shown

impacts on this landscape, human responses to environmental change, and the process of cultural change. Main approach towards this study involves studying the archaeological site formation by using soil micro-morphology, reconstructing stratigraphic columns from the excavated sites and distinguishing between natural sedimentary and anthropic processes in the formation of archaeological levels.

This work is one components of the much larger UKIERI funded project of «Land, water and settlement: Environmental constraints and human responses in northwest India between 2000 and 300 BC» [1, 2, 3, 6, 4, 5, 7]. Initial analysis of thin sections from these sites have revealed evidence of a lengthy period of accumulation history (c. 600 years), which is marked by the presence of several compacted floors, settlement-derived debris, and periods of abandonment. It is also apparent that many sites were established on former floodplains which are no longer affected by seasonal inundation and alluvial deposition.

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INTEGRATING GEOGRAPHICAL AND ARCHAEOLOGICAL DATA IN THE ROMANIAN CHALCOLITHIC. CASE STUDY: CUCUTENI SETTLEMENTS FROM *VALEA OII* (SHEEP VALLEY – BAHLUI) WATERSHED

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To integrate geographical and archaeological data to study the interaction between environment and human consists in an interdisciplinary research method – a geoarchaeological approach. This is a very important approach that shows the results offered by modern techniques (GIS) and the classic research methods [3].

The link between archaeology and environment was made since 1970’s, 1980’s. The forerunners who lead to development and implementation of new research methods: geological element [1], climatic element [2], hydrological element [4], geomorphological element [5], paleogeomorphological reconstruction [7].

The relation human-landscape could be considered as one of the most closely related and interdependent one to each other, because human or human communities took into account, with or without their willing, the environmental features (*geological settings* – underground resources as raw material to built their houses, manufacture of weapons for hunting, places to exploit salt resources, etc.; *geomorphological settings* – location of the settlements on the structural plateaus in defensive purpose, in contact areas to make easy the mobility between certain communities, etc.; *hydrological settings* – proximity to water resources like springs, water courses, defending against hydrological risk phenomena such as floods, etc.; *pedological settings* – soil fertility, mineral resources, the existence of clay resources to manufacture the vessels, in this case is well known Cucuteni pottery, etc.; *vegetation and fauna settings* – the existence of an abundant forestry fund to built their houses, to heat them during the cold season, food preparing, but also to burn the vessels, etc.).

The Cucuteni culture (app. 4200-3700 BC, ^{14}C uncalibrated data) had a significant role in the genesis of the most representative european Chalcolithic civilization – Cucuteni Trypillia. Throughout the three evolution stages, Precucuteni (Trypillia A) communities have been spread out over a large territory between Transylvania, interfluve Bug-Dniepr, upper courses of Prut and Dniestr rivers and nort-western Black Sea. Thus it has been heralded the main core of future spreading area of the Cucuteni-Ariud-Trypillia cultural complex [8].

It could be considered one of the most spectaculous and appealing period from south-eastern Europe; in Romania those who contributed to the discovery and research of this period are: Th. Burada, N. Beldiceanu, F. László, H. Schmidt, M. Petrescu-Dîmbovia [6].

Oii Valley watershed (Bahlui) is located in North-Eastern part of Romania and it’s mainly in the area of Moldavian Plain, except a small part from the upper part of basin and the spring of the valley who are located in Suceava Plateau (fig. 1).

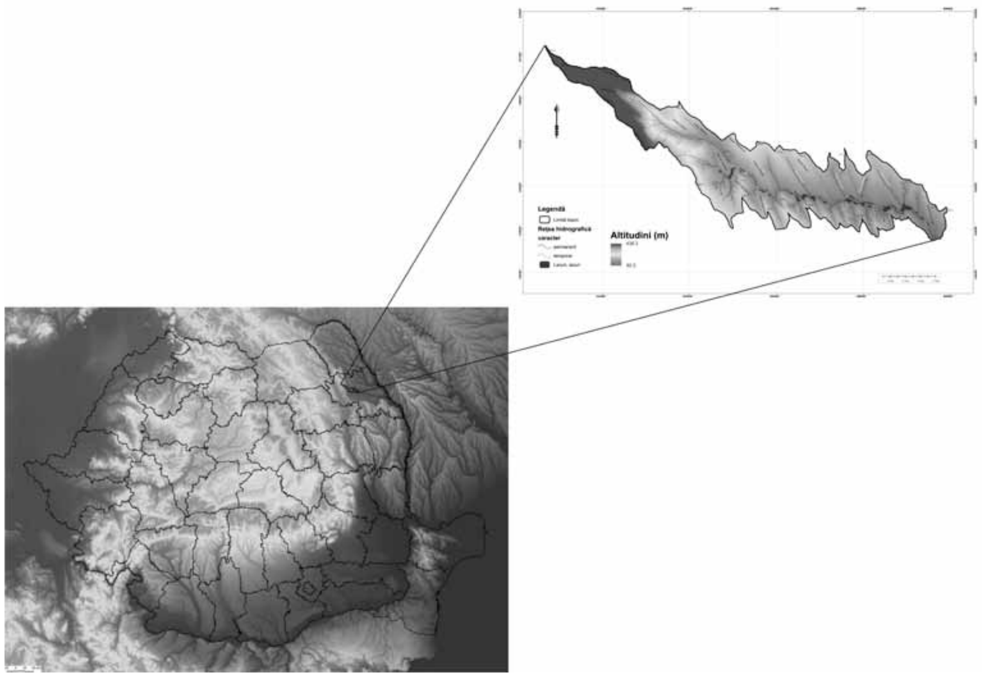

Figure 1.Valea Oii (Sheep Valley) watershed location in Romania

The geologic cover which is visible in the upper part of the basin is made of Sarmatian (Basarabian) deposits. The sandstone-limestone layers are getting thicker and fade away to south. The general pitch of strata on NNW-SSE direction, lend the relief a characteristic morphology: extended structural surfaces, subsequent and consequent valleys, fronts of cuestas (especially on the right side of the basin where the most of the settlements are concentrated).

The research achieved over a period of approximately 2 years by geographers and archaeologists from 2 different universities and one research center, specialized in topography, cartography, archaeological mapping, GIS, respectively Neolithic and Chalcolithic periods, conducted in realizing a map with all archaeological settlements from Oii Valley watershed; fieldwork was combined with the consulting of archaeological repertoires (fig. 2).

Analyzing this figure we can observe some patterns: the majority of settlements are located in the upper part of the basin at the contact between plain and plateau – where limestone resources are concentrated, as well as clays exploitations and a high degree of afforestation (16 settlements), settlements located on the structural plateaus or fronts of cuestas (with and average heights between 150-200 meters), places with a high visibility, like those from the right side of the basin (9 settlements), settlements located on alluvial deposits that contain soils with a high fertility (7 settlements), settlements located right near the water course (10 settlements).

It can be observed that the left side of the basin, which is geomorphologically speaking a reverse of cuesta, almost no archaeological settlement, although with soils that are very good for agriculture, can conclude that they were very preoccupied rather with the defensive purpose than the agricultural one.

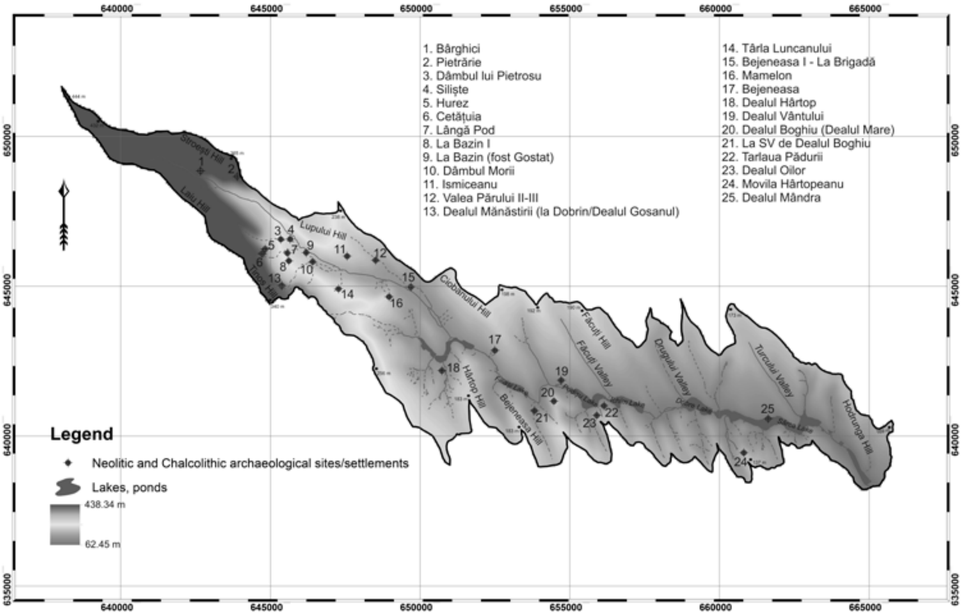

Figure 2. Neolothic and Chalcolithic archaeological settlements from Valea Oii watershed

If we take for example the case of *Bejeneasa I – La Brigadă* as well as *Mândra Hill* archaeological settlement (no. 15, respectively no. 25 from fig. 2), along with field observations, it can be observed that are located right near the main water course, being affected by warping and alluvial processes. *Mândra Hill* it's also affected by the water from Sârca Lake; we didn't find another explanation for this location, than the existence of 3 springs with a considerable flow. In this case the proximity to the water resources was the main reason to place the settlement.

Nowadays, the majority of the archaeological settlements are affected by hydro-geomorphological processes: gullying (eg. no. 6, no. 13), landslides (eg. no. 20, no. 21, no. 22), or processes of aggradation (eg. no. 25); this lead us to the conclusion that fast measures to preserve archaeological settlements must be taken.

In the chronological framework of the Cucuteni culture, different kinds of viewshed are computed in order to strengthen the control of Valea Oii. On another hand, spatial patterning and cost distance analysis allow us to describe territorial models which explain the original organisation of this territory (fig. 3).

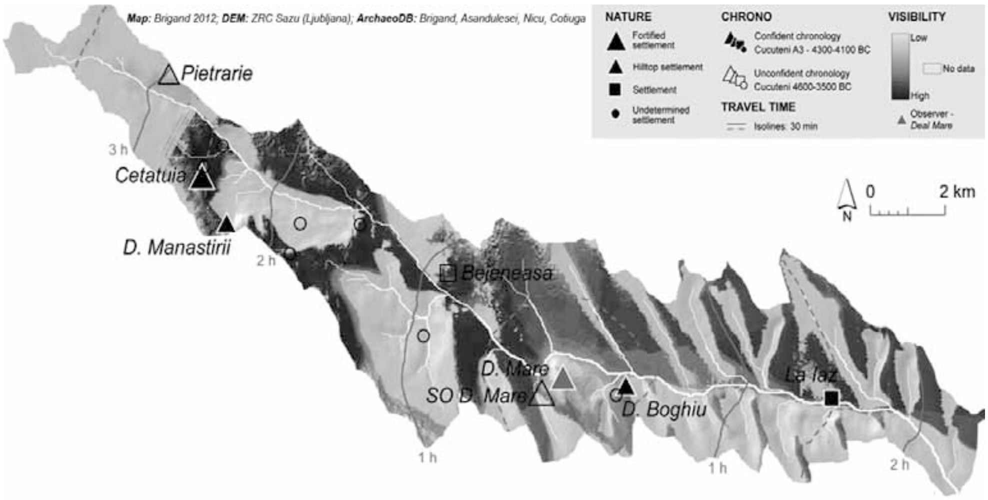

Figure 3. Viewshed and cost distance analysis from Filia-i-Dealul Mare (Valea Oii Watershed)

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DUNINO LANDSCAPE-ARCHEOLOGICAL COMPLEX

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Among the cultural landscapes of Russia the historical-landscape complexes integrating archeological monuments and their natural environment are of particular importance. Within Central Russia a most significant category of such monuments are sites of ancient settlements of the Iron Age, having age of 1.5-2.5 thousand years.

The unique well-preserved Porechyevsky complex of archeological monuments of the Iron Age and the Old Russian time (X-XIII centuries) is located 17 km to the west of Moscow on the forested bank of the Moskva River, between the Porechye country estate (nowadays the Porechye sanatorium of the Russian Academy of Science) and the Dunino village with the memorial estate of M.M. Prishvin. The site of the ancient settlement Dunino has an impressive well-developed system of fortifications with three walls and ditches. In its vicinity there are 5 sites of unfortified ancient settlements of the Early Iron Age and several plots on the valley outwash with the signs of ancient cultivation and cattle breeding that make them very promising for archeological surveys. Besides three sites of unfortified ancient settlements of the Old Russian period and three areas with totally 122 barrows were found.

Landscape features of the «Dunino landscape-archeological complex» stem from its location within a section of the Moskva River valley on its high right bank and the adjacent part of the interfluve plain. Therefore in spite of its rather small territory there are landscape complexes which differ both in their size and properties. Within the small territory there are practically all principal genetic types of landscape complexes of the Moscow suburbs: from moraine and lacustrine-fluvioglacial to valley and valley outwash ones. Many of them are environment-forming, resource-protection and, even, reference territories.

The western part of the complex (to the 3-rd site of unfortified ancient settlement) is a system of river terraces adjoining the high valley outwash. To the east of the path going from the central building of Porechye sanatorium to the river, the landscape structure changes sharply. The steep bank of the Moskva River is much more complicated due to landslide processes there. Thus the valley becomes bowl-shaped with landslide remnants alternating with landslide troughs and gullies. It is in the valley sheltered by the steep slopes that the most part of archeological monuments of the Early Iron Age is located, including the site of the ancient settlement Dunino itself. To the east the valley lenses out at the foothills of the «Witch Mountain». The main bank (high valley outwash) recedes from the channel of the Moskva River there and the character of landscape changes sharply again. The unique natural diversity of the Dunino landslide valley had attracted the settlers during the Early Iron Age because it met the requirements of the cultural-economic type of the Diakov culture population.

In total more than 150 natural complexes (urotshistshes and sub-urotshistshes) of 24 groups have been identified within the area of the complex and its closest vicinity. The following predominant urotshistshes form the base of the landscape structure of the territory. At present the geological structure, water regime and other features of many landscape complexes make them less resistant to environmental and anthropogenic disturbances, thus supporting their instable equilibrium. Many of landscape complexes, for example, remnants of high moraine-fluvioglacial plain and kame hills, are peculiar in their natural features and rather unusual for valley outwash complexes of the Moscow region. The combination of hollow-like depressions and kames located on a remnant in the valley outwash complex is a rare formation indeed and this nature monument requires thorough investigation and conservation.

Reconstruction of nature management in the Iron Age. The ecotone location on the border of interfluve and valley natural territorial complexes, high diversity and contrasts of natural conditions have, in their turn, predetermined the high natural resource potential, and, hence, the prospects for economic development. In the past these landscape complexes were among the most favorable for agricultural development. Apparently, this is one of the most ancient areas of economic development of the territory. The present-day landscape structure of these complexes has a lot of anthropogenic-natural and even anthropogenic («man-made») complexes, such as the site of the ancient settlement Dunino.

Landscape features of the territory contributed to its specific economic development. The long-lasting adaptive economy has formed the territorial structure of land use which balanced the natural features of the territory and the economic needs of the Early Iron Age population.

The analysis of actual natural territorial complexes and their edaphic properties (microclimate, soil fertility, ground moistening etc.) made it possible to reconstruct the primary landscape structure and resource base of the area. This allows suggesting the possible economic use of particular landscape complexes in the Iron Age. The suggested land use has been verified during soil-archeological studies which proved the presence of soil horizons reflecting ancient economic activities of the population.

The archeological excavations of some monuments of the Iron Age in the Moskva River basin in the XX century have proved that the inhabitants of fortified ancient settlements have a developed and complex economy, which combined cultivation, cattle breeding, fishery and hunting. The latter included «creation» and preservation of certain areas to hunt beavers, catch fish etc. The ancient settlements were the elements of well-developed settlement-economic system. The landscape has been already essentially transformed and cultivated; and its organization was rather complex. Forests have been essentially «pressed» by the fields; many crafts, for example, iron making, extraction of clay and sand for manufacturing ceramics and construction of houses have been taken out of the sites of fortified ancient settlements. These were the central fortification points, surrounded with other settlements and areas where different kinds of economic activities were regularly carried out (including seasonal field camps, milking places and so forth).

The high level of economy organization was achieved, among other, by the purposeful use of landscape, especially geomorphologic, features of the valleys of the Moskva River and its small tributaries. The economic activities of the population of the Iron Age were performed within the plots having natural boundaries and natural limits. Thus, it became easier to control free (or semi-free) grazing cattle, fields and others lands. Houses were constructed not only on flat surfaces. The investigations in Dunino have shown that there are considerably thick cultural layers on the landslide terraces. The explanation is that these "inconvenient" from the modern point of view elements of relief formed a basis for the construction of houses and other buildings.

The economic structures were mainly created within the following two types of landscape complexes: 1) valleys of meandering small rivers incised into the high bank of the 3-rd river terrace and the valley slope (typical example is the town of Setun on the Setun River, Busharino on the Setun River, etc.); 2) banks of the Moskva River within its meanders, where the edges of high bank «close» valley segments about 1 km long, forming a natural «theatre», in which the stage lies on the low floodplain, looked through from the elevated site of fortified ancient settlement, while the «boxes» and «bottom rows of the stalls» are situated on the natural landslides, where houses and other buildings were constructed and economic activities took place.

The examples of such monuments upstream the Moskva River are the sites of fortified ancient settlement Dyakovo, Dunino, Mamonovo, Kuntsevo, Spas-Tushino, Golievo, Znamenskoye, Troitskoye, etc. The structure of such core area or landscape-archeological complex includes the «external contour», i.e. the site of fortified ancient settlement with walls and ditches, fenced fields on the near-edge part of the bank limited by erosion forms (tops of small gullies); and the main economic zone, i.e. surfaces of low terraces and landslides the rear parts of which adjoined the slopes of high bank. The bottom level was formed by the floodplain grazing areas, as well as the locks and fishing traps in the river.

The site of the ancient settlement Dunino is the only place in the Moscow oblast where all the above-mentioned elements are archeologically revealed and could be visually distinguished because the history of the area has contributed much to their preservation.

In the Iron Age a typical feature of the settlement system in the Moskva River basin was that specific «settlement-economic complexes» rather than fortified ancient settlements (as it was thought earlier) were on the top of settlement hierarchy. Numerous places where the cultural layer with ceramics, and sometimes even the remains of dwellings, was accumulated are located too close to each other to be «independent» cells of the settlement system (as, for example, the medieval settlements). They are situated mainly on the surface of landslides or within the remnants of river terraces.

As a place for the main fortified settlement a steep-sloped remnant of high valley outwash with the sloping surface was chosen by first settlers of the Iron Age. In our opinion the remnant was probably formed by erosion and landslide processes which had transformed the former valley outwash surface. As a result several remnants and morphometrically close to them inter-network watershed «crests» had been formed within the section of the Moskva River valley. Those habitats have the most suitable soils for cultivation of those times with sufficient fertility, good water-air properties and early terms of readiness for spring field work (these are among the «warmest» and «early-ready» soils of the flat interfluves of the area). Therefore it is possible to get the guaranteed yields of the majority of agricultural crops practically under any weather conditions there.

It was not by chance that the remnant was chosen for the fortified ancient settlement. Its area is optimum for the settlement; it has steep, almost vertical slopes 20-30 m high. It is separated from the outwash surface by a narrow crosspiece dozens meters wide. All this has considerably facilitated ground works during the construction of walls and ditches. The territory of the ancient settlement is protected by a system of 3 defensive walls and 3 ditches and also an escarp on the slope. The first and second walls (from the top) finish at the edge of the bank and the third goes down the slope. Steep slopes of the walls and ditches suggest that the monument was not exposed to active economic use after its desolation and, probably, has been well preserved.

There are 16 interesting archeological finds which are typical for the Moscow region fortified settlements of the Iron Age in the collection from the site of the ancient settlement Dunino. For example, a bone arrow with narrow feather rhombic in section. Summarizing data on the chronology, based on the analysis of things and ceramic, it is possible to suggest that the place of the ancient settlement Dunino had been first settled about the VIII-VII centuries B.C. The site of the ancient settlement was actively used in the Early Diakov time and in the beginning of the Late Diakov stage, i.e. in the V to I centuries B.C. It was during that period that the complex fortification system with three lines of defense was probably built. The finds dating the first half of the I millennium A.D. are practically absent in the collection. Possible reasons are both the incompleteness of sampling (mainly within the northeast edge of the area) and the cessation of life in the settlement at that time.

Temporary unfortified settlements of those times could be located within other habitats with similar properties (convex surfaces of landslides, sloping surfaces of remnants of the low valley outwash and low river terraces). They were also used as permanent arable plots, short-term fallows or for cattle-keeping in «shelters».

Permanent arable lands were also within the natural territorial complexes located near the settlements and having well-drained soils with relatively high natural fertility (sod-podsolic, with a slight degree of podzolisation, and sod soils of light texture – light dusty loams or sandy loams on near-lying sands). Such conditions are characteristic of the suburotshistshes of gently-sloping and sloping (up to 6°-10° steep, otherwise cultivation becomes impossible) near-network slopes of high and low valley outwash, as well as of moraine-kame hills. Despite middle and even late terms of snow melting under prevailing «cold» northern and northwest expositions of slopes, the combination of runoff and deep infiltration favored quick drying of soils of these habitats.

Suburotshistshes of the «crest» of the main surface of the remnant of moraine-fluvioglacial watershed plain and the gently sloping surfaces of high and low valley outwash were used for short-term and medium-term fallows with «turn» in 10-20 years. They were cultivated during 3-4 years, and sometimes even longer, then small-leaved forests which replaced arable lands were used as fallows and pastures, mainly for cattle grazing. Under such type of cultivation the soil had enough time “to rest” and the most important criteria in selecting plots for arable lands were short distance from the settlement and rather good water-air regime of soils while the fertility of substratum did not play the main role during that period of time.

This was even more important for the selection of sites for slash-and-burn cultivation with a long-term fallow, i.e. with a 50-60 years turnover. The main criterion was getting sufficient amount of ash and the absence of constant water-logging of soils (water-logged soils are less suitable for permanent cultivation, particularly for summer crops, first of all, because of the short vegetation period and relative low-fertile substratum). Such lands could be located within several well-drained plots of flat and gently sloping basic surfaces of the remnant of moraine-fluvioglacial watershed plain and high and low valley outwash.

During that historical period of time natural territorial complexes of the high floodplain were most likely used for haymaking and cattle grazing. Cultivation of the floodplain was hampered by long spring flooding or water-logging, and in its rear part also by additional inflow and stagnation of snow melt water from overlying slopes.

Sloping shorelines and deluvium-proluvium aprons, as well as similar areas of the first river terrace, covered with alder thickets, elm-tree and oak groves and bird cherry stands were probably used for permanent grazing or keeping livestock, in particular pigs. Unloading of confined strongly mineralized ground water, input of fine particles and nutrients by the surface runoff from slopes and by watercourses of small erosion forms have supported the megatrophic and large plants in the ground cover of those natural territorial complexes, thus producing plentiful forage for pigs.

Natural territorial complexes of steep slopes of the valley and small erosion forms have been probably occupied by forest lands. The sections of less steep slopes (no more than 20°) were probably used as cattle tracks or for the limited grazing of small cattle, especially in the spring during the early vegetation of grasses. To a greater extent these natural territorial complexes were used for the limited forestry and, probably, apiculture. Steep slopes of the valleys oriented to the north were evidently covered by forests with significant share of lime-tree.

Thus, the natural features and long history of man-nature interaction, as well as the centuries-old forms and territorial structure of economy, are among the factors of integrity of the monuments of spiritual and material culture with their natural environment. Archeological monuments and their natural environment form landscape-historical complexes, thus making the area unique and extremely valuable for the whole territory of Moscow suburbs. However making it officially an «area of special protection» would require a lot of actions: legislative, organizational, economic, including education and ecological instruction.

LAND BRIDGE PROBLEM FOR THE EARLY MEDIEVAL ISLAND FORTRESS OF POR-BAJIN, THE TERE-KHOL LAKE, SOUTHERN SIBERIA

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Fortress Por-Bajin is a 220 × 160-m rectangular architectural complex located on a 6-ha island in the Tere-Khol Lake, south-eastern Sayan-Tuvan Upland, 50.615° N, 97.385° E, 1300 m a.m.s.l. (fig. 1). The lake occupies the south-western edge of the Terekhol Basin, a tectonic depression in the south-western corner of the Baikal rift zone. The fortress is known since early XVIII c., but was first visited by professional scholar only in 1891 [1]. The next archaeologist to study Por-Bajin in late 1950th – early 1960th

was S. Vainstein who referred its construction to the 3rd Uigur Khaganate and dated it using indirect sources to 750 AD [2]. Both researchers stressed the specific island location of the monument and proposed hypothesis of its initial construction on land. This proposal was based on logical implications and on local folklore that contains repeated indications of the young age of Lake Tere-Khol. No direct geomorphological data had existed in favor or against of this opinion till last years, though the question whether the fortress had a connection with land at the time of its construction is important for interpretation of the monument, especially because of negligible signs of its occupation found during excavations in 2007-2008 [3, 4]. Excavations were a core part of the rescue project organized in view of potential risk for the monument imposed by destruction of island banks and fast approaching of the coast line to the fortress walls.

Figure 1. Por-Bajin Fortress (ca 750 AD) in the Tere-Khol Lake

Along with archaeologists a group of scientists was working at the fortress. One of the aims of scientific research was reconstruction of the history of the Tere-Khol Lake and the Island of Por-Bajin. The three study objects may make different successions in their formation: the lake may either older or younger than the fortress, the island may be either older or younger than the lake, and in any case the island (or the initial hill) is older than the fortress. Initial scenarios taken into consideration were as follows:

(1) «young lake – old island»: fortress was built on a hill which was later isolated by transgression of the lake – scenario [1, 2];

(2) «old lake – young island»: the island appeared in an existing lake;

(3) «old lake – old island»: the island was a hill in a dry land that was later inundated by the lake and only after that the fortress was built.

Preliminary bathymetrical survey revealed that in spite of its rather large area (33 km²) the lake is very shallow: average depth is 0.5 m, maximum depth – 1.2 m with single hollows down to 1.9 m. The lake has mostly underground water supply and is drained by a Saldam River – left tributary of one of the sources of the Yenisei River. Water levels are therefore limited in their seasonal and long-term variations. Under the lake there is a talik (melted ground), but severe winters (mean January temperature -29^{o} C) promote the lake freeze through in most shallow places. Lake banks and surrounding plain are permanently frozen down to 150-170 m [5]. This permafrost is probably of Pleistocene age. On lake islands permafrost is much thinner – 15-20 m only [5], which may imply the Holocene age of permafrost accreted on previously melted ground (under-lake talik) and therefore a post-lake formation of islands.

To estimate absolute age of the lake and Island Por-Bajin we made two coring profiles between the island and lake banks (west and south from the island), a number of pits on lake banks and surrounding plain and several cores into permafrost in Island Por-Bajin. Sediment chronology is established by about 70 ^{14}C dates. At four sections incremental sampling was made and a set of laboratory analyses processed (grain size distribution, loss on ignition, bulk chemical compositioin, composition of biological remains), which provided assessment of lacustrine environment changes through time. Study of sedimentary record gave the following results.

1. *Surrounding alluvial plain.* A set of pits opened loams and sandy loams interpreted as overbank alluvium of deltaic alluvial fans. Coarse-grained channel alluvium lies at depth of 1.5-2 m. Overbank loams contain one or two buried soils dated to 10.5-12.0 ka BP (cal). By *ca* 10.5 ka BP (cal) overbank sedimentation had finalized because of channel incision into the fans. This incision was initiated by thermokarstic subsidence of river lower courses occurred shortly after the formation of the lake (see below).

2. *Lake sediments.* In sedimentary cores taken from the deepest (1.0-1.2 m) part of the lake west from the Por-Bajin Island overbank alluvial loams change into highly calcareous lacustrine silts and gyttja *ca* 11 ka BP. This date is taken as the age of the Tere-Khol Lake. After the lake formation no sedimentation breaks has been found in this part of the lake. Total thickness of chemo-biogenic highly carbonate lacustrine silts accumulated during 11,000 years varies between 2.5-3.5 m. Sediments synchronous to the Por-Bajin Fortress construction lie at depth of 35-40 cm. Oldest dates on lacustrine silts south from the island are about 8.5 ka BP (cal). In spite of younger age, their total thickness is almost the same as west form the island due to higher sedimentation rates promoted by shorter distance to modern river outlet. As the base of lacustrine sediments lie a little below the dated layers, lake occupation of this area is dated to an earlier time – 9.5 ka BP (cal), which is obtained from a core in the Por-Bajin Island.

3. *Composition of the Por-Bajin Island.* The island banks 1-1.5 m high are composed totally from lacustrine carbonate silts that contain some distinguishable layers identified in the cores in the bottom of the lake. A core in the south-central part of the island revealed two lacustrine units divided and underlain by alluvial sediments. Permanently frozen sediments below the active layer (1.8 m) are characterized by high total ice content, presence of numerous ice lenses up to 20 cm thick, which cause considerable rise of initial sediment thickness. At depth 6.95 m roof of gravelly coarse sands was found that was interpreted as active channel facies of alluvial fans same as lying under overbank loams outside the lake. It was dated 12.2 (12.0-12.5) ka BP (cal). This date is accepted as the end moment of active formation of alluvial fans. It was succeeded by accumulation of overbank alluvium – sandy loams at depths 6.95-5.80 m.

Lacustrine silts in the interval 5.80-5.20 m evidence the impulse of lake sedimentation dated to 11.0-10.5 ka BP (cal). It was followed by another phase of alluvial sedimentation (1.9-m thick sandy loams). The final establishment of lacustrine regime is marked by change to carbonate lacustrine silts at depth 3.30 m dated to 9.5 ka BP (cal).

To estimate the age of the island the interruption of lacustrine sedimentation (the top of lake sediments at the land surface) should be dated. Radiocarbon dating of mollusk shells from a bank exposure gave dates 2-4 ka older than expected from stratigraphy and extrapolation of sedimentation rates. It is explained by contamination of lake carbonates by old carbon from Paleozoic marbles that compose a big portion of the lake catchment. Sediment composition excluded also luminescent dating techniques. Therefore to date the topmost lacustrine silts in the island geological correlation to a well dated lake core was undertaken. The lake core was divided into 7 sedimentation units based on composition of biological remains (mainly algae) and bulk chemical composition. The lower unit corresponds to underlying alluvial sediments. Sequence of lacustrine sedimentation units reflects succession of phases in lake development with different hydrological regime (more or less active renovation of water because of changing proportion between outflow and evaporation in water balance). Borders between units were radiocarbon-dated. Distinguishable changes of biological and chemical composition of units were used as a correlation tool. The top of lacustrine sediments in Por-Bajin Island were correlated to the second half of Unit V, which give the age estimation between 4-5 ka BP (cal).

Given the above data, history of the Tere-Khol Lake and Por-Bajin Island has been reconstructed as follows. The lake appearance was pre-conditioned in the Late Glacial by active development of alluvial fans of big and small rivers that drained surrounding mountains. The fans protruded into the bottom of the Terekhol Basin and isolated its south-western corner. Shortly after the start of the Holocene *ca* 11,000 years BP the initial lake reservoir appeared probably during an interval of relatively high river runoff. During this initial phase the lake occupied a vast area that included also the location of the modern Por-Bajin Island that did not exist at that time. About 10,500 years BP the lake shrank considerably and the future Por-Bajin Island area changed to lowland terrain subject to overbank alluvial sedimentation. Probable reason for the lake shrinkage was thermokarstic (permafrost melting) subsidence. Lowering of the lake level favored incision of tributary small rivers that in turn resulted in cessation of overbank alluvial sedimentation in surrounding plain.

The next phase of lake development was its final transgression and spread about its modern dimensions that is dated to *ca* 9,500 years BP. Since that moment the area of the Por-Bajin Island had been a part of lake bottom for about 5,000 years. Between 4,000-5,000 years BP the lake bottom rose locally by 5-7 m to make the island. Mechanism of this rise was frost heaving favored by the lake winter freeze through during one of dry phases when water depth was even shallower than usually. In the emerged part of the lake bottom permafrost continued to accrete in subsequent years and led to formation of palsa – frost heave hill. The mechanism was as follows. Freezing of water-saturated sediments and attraction of additional water to the frost caused formation of ice lenses that considerably increased the total volume of sediments and finally had led to formation of a flat hill with the top 4-5 m above the lake and gentle sides sloping down to the lake bottom. This palsa island had existed in the lake for several thousand years before in the mid-VIII century it was chosen as a location for the fortress of Por-Bajin.

The above results and their paleogeomorphic interpretation allow arriving at the following conclusions:

1. The Tere-Khol Lake has natural origin and Early Holocene age (11,000 years).

2. The Por-Bajin Island is younger than the lake (4,000-5,000 years) and has cryogenic origin.

3. No land bridge existed between the island and lake banks at any moment during and after the fortress foundation (1250 years ago). The founders of Por-Bajin are likely to intentionally choose island location for the fortress to isolate it from surroundings. Hopefully this inference would help to better understand functions of this construction.

The last conclusion imposes a problem of delivery of construction materials for walls and buildings which was risen by previous researches [1, 2]. Total volume and mass of artificial constructions are estimated at *ca* 70,000 m^3 and 90,000 tons respectively. The question has been solved by detection of local sources of construction materials. Bulk chemical composition shows that outer and interior walls were made of the same lacustrine silts that compose the island. Two vast pits were found at southern and north-eastern banks of the island that probably served for extraction of silts. Mining depth was shallow – 1.5-2 m – because of its limitation within the active layer above permafrost. After the pits were dug permafrost melting caused surface subsidence. Pits were inundated by the lake and now make inlets in the island coastline.

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SOIL AND CLIMATE CHANGES IN THE STEPPE ZONE OF RUSSIAN PLAINE DURING THE LATE HOLOCENE RECORDED IN PALEOSOILS OF THE ARCHAEOLOGICAL MONUMENTS

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Paleopedological study became an important part of the complex investigations of archaeological monuments. The comparative analysis of recent and buried soils provides an important data for the reconstruction of the soil evolution and the paleogeographic environments.

The objective of this study was to examine changes in the soil formation and paleoecological conditions on the territory of Russian Plain during the second half of the Holocene based on the paleopedological investigation of archaeological monuments of different ages (the Bronze, Early Iron and Middle Ages).

Investigations were carried out in Rostov region. It is arid steppe zone with ordinary and southern chernozems. The object under study was the chronosequence, comprising paleosoils buried 4000, 2400, 2000, 1900, 1200 years ago under archaeological monuments and modern soils. All these soils were formed on the clayey carbonate loess loams and on the plain areas. Dating of the monuments and, consequently, time of soil burial was established in accordance with the archaeological method up to 50-100 years for the Early Iron and the Middle Ages and up to 200-300 years for the Bronze Age.

Morphological properties, stratigraphy and structure of soil profiles, content, compositions, stores, forms and level of accumulations of water soluble salts, gypsum, carbonate, exchangeable cations, humus content and composition (group and fraction), size-particle-distribution were estimated using normal pedological methods.

Considerable changes in soils at some Holocene chrono-cuts were observed. These changes were characterized by cyclicity with different temporal intensity and amplitude of soil parameter changes caused to shift of subtype soil taxon for some periods. Among all soil-forming processes that acted on soils of this chronosequence the leaching of salts (easily soluble, gypsum, carbonates) as well as the development of solonetzicity processes were the most dynamic effects and were closely connected with climatic conditions.

Changes of salt profile within 2m depth had a regular character during last 4000 years, periods of salinization (4000, 2000, 1200 years ago) alternating with periods of desalinization (2400, 1900). Similar regularities were also found for gypsum profile. Well-marked dynamics with repeated transition of solonetzicity from the active to the residual condition and vice versa were observed for the last 4000 years. A high content of exchangeable Na was recorded in soil-exchange complexes (9-13 %) in soils buried 4000, 2000, 1200 years ago, while the amount of absorbed Na in other chronocuts (2400, 1900, modern) was small (1-2 %).

For time intervals considered, some dynamics in the content and profile distribution of $CaCO_3$, the thickness of the accumulation horizon, and the quantity and size of carbonate neoformations was observed. The general tendency was as follows: decrease in the carbonate horizon thickness, raising of its upper boundary, increase in the quantity of soft, white sports with a decrease in size in the periods of climatic aridization (4000, 2000, 1200 years ago). All soils of the chronosequence were characterized by a low content of humus with a predominance of mainly humic acids. Some periods, however (2400, 1900 years ago) were more favorable for humification.

It has been established that the Bronze Ages (4.0-3.7 ky) and the Middle Ages (VIII-XII centuries AD) were characterized by climatic aridization, causing soil salinity. The Early Iron Age was a period of alternation of micro-arids and micro-pluvials episodes. About 2400 years ago the climate was cooler and marked by higher humidity, the evidence of which is absence of readily soluble salt and gypsum accumulations, lack of actual solonetzic features and lowered humus acid component. About 2000 years ago, however, this was interrupted by a shot micro-arid period.

Based on regressive dependency between a number of climatically-sensitive soil indices and the amount of atmospheric precipitation, the range of variation in climatic humidity in the territory under investigation over the last 4000 years may be estimated. These variations were within 380-500 mm.

Various temporal lengths in the soil-forming cyclicity were revealed. The 2000 years- rhythm is the best distinguished. The climate optimum of this rhythm was observed in the middle of the 3rd millennium BC, in the middle of the 1st millennium BC and in the middle of the 2nd millennium AD.

MICROBIOLOGICAL SOIL ANALYSIS AS TOOL TO DETECT FUNCTIONAL AREAS IN HABITATION SITES

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Soil studies in archaeology usually focus on differences in soil chemistry or micro-morphology. Soils, however, are likewise colonized with a high diversity of different microorganisms like bacteria and fungi. The microbial communities of soils are changed in sites inhabited by humans due to the anthropogenic addition of nutrition e.g., urine, faeces, hairs, bones or other organics during the period the settlements is active. Microorganisms live of the added nutrients and energy sources because of their specific metabolic potential which are based on enzymes. Examples for such a metabolic process are ureases which convert urea into ammonium molecules, or keratinases which degrade keratin, the protein constituents of hairs, skin or hooves. The microorganisms can take in poor living conditions adaptation forms and survive in soils for long periods of time.

In a cooperative multidisciplinary project of the Academy of Sciences Yekaterinburg and the Goethe – University Frankfurt a. M. microbiological soil analyzes are carried out on the steppe Bronze Age settlements in the southern Trans-Urals. Previously, the potential of such studies was tested in a multidisciplinary project of the German Archaeological Institute (S. Reinhold), the Archaeological Institute RAS (D. Korobov) and the local heritage organization «Nasledie» (A. Belsinkij) at Late Bronze Age settlements sites in the high mountain zone of the North Caucasus [6].

First microbiological soil analysis to detect functional areas in these sites was tested by analysis of micro-fungi related to the keratin degradation used to detect areas of increased keratin impact [4, 5]. Such can be found e.g. in places where animals were stabled or in areas inhabited by humans. Sterile hair was added to the soil samples and incubated over a certain period of time [7]. The resulting colonies of keratinophile fungi were than evaluated by quantities and length. This gave first ideas about the use of rooms and courtyards at the investigated sites.

A second method was than developed to localize such areas more precisely using microbiological indications for faeces and urine. The urease enzyme segregate urea into carbon dioxide and ammonia. It is important in the nitrogen cycle of soils and enriched in areas where excrements are or had been present. From selected soil sondages the activity of urease was detected using the classical method of Kandeler / Gerber. An express-method was first developed by A. Borisov [2] using special buffer solutions to produce a colour reaction, which can be used as indicators of urease activity. This express-method allows handling large quantities of soil samples. Thus more than 1500 samples from test areas in archaeological sites of Caucasus and nearly 400 samples from the investigation settlement of Trans-Ural were processed.

In addition, the whole microbial biomass and the fungal biomass in both investigation regions were determined [1, 3]. The methods were partly at first time applied systematically at archaeological sites. They were employed on areas previously measured by magnetometry and later partly excavated. The difference of all tested parameters between the cultural layer of the settlements and background soils is shown. The impact factors of the methods were proofed also by vertical sampling. Such analyses allowed to evaluate the change of microbiological parameters at various levels of the archaeological structures. The microbiological aspect in soil analysis thus proofed to be highly informative.

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KROTOVINAS AND STRATIGRAPHIC AMBIGUITIES IN THE UPPER PALAEOLITHIC SITES KOSTIЁNKI AND BORSHCHEVO (MIDDLE RUSSIAN PLAIN)

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The Upper Palaeolithic sites Kostiënki and Borshevo (fig. 1) are worldwide known and have been investigated since the end of the 19th century [1, 2]. The importance of geoscientific research in archaeological contexts increased within the last decades, mainly for reasons of palaeoenvironmental reconstruction in the area of the excavated sites [3, 4], including research on sedimentation processes and soil development [5], in the present case during the period from 40.000 BP until today. Beside unique archaeological findings such as mammoth bone- dwelling constructions or Venus figurines the localities yield a high variety of colluvial deposits, volcanic ashes, and paleosols beneath the Holocene Chernosem.

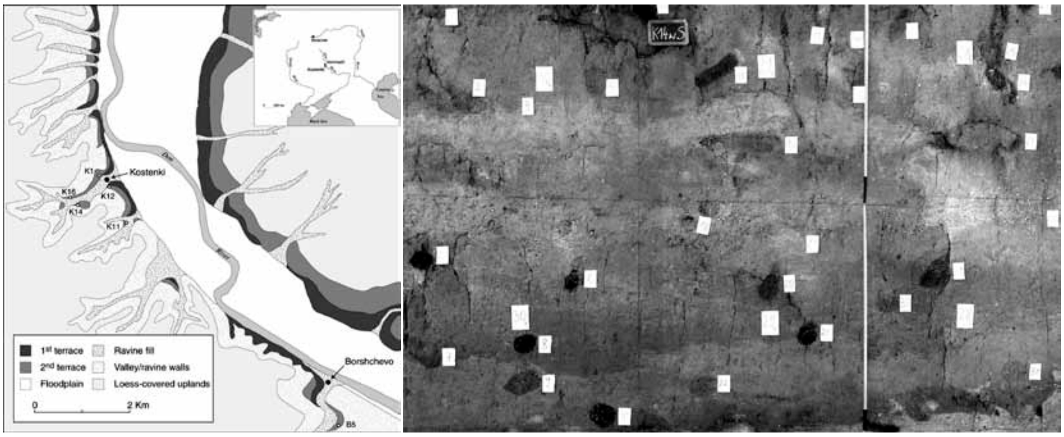

Figure 1. Location of Kostiënki and Borshevo (from Anikovich et al., 2007) and distribution of krotovinas in K14 in 2011 (black krotovina are filled with pedosediment of the Holocene Tschernosem; brown, greyish and whitish fillings are of different origin and composition)

While stratigraphy and cultural chronology – despite some gaps – are known in general, questions of stratigraphical ambiguities, i.e. missing paleosols or colluvial deposits, remained unanswered. When comparing different sections and excavations, one important problem is the irregular occurrence of the Gmelin soil (about 25.000-21.000 BP) or the number of humic beds of the Bryansk soil (about 32.000-27.000 BP) [5]. In contrast, a common and omni-present feature in all sections is the high amount of krotovinas (fig. 1) of e.g. *Lagurus lagurus* and *Cricetus cricetus*: paleontological data suggest that e.g *C. cricetus* underwent repeated range shifts during the Quaternary, whereas especially in warm Early Holocene periods their number decreased [6].

Research on krotovinas showed different sizes, shapes, fillings and weathering status, leading to a newly developed typology (table 1).

Table 1. Typology of Krotovina (D. Pietsch).

Feature	Class
Colour	black (bl), grey (gr), grey-brown (gr-br), brown (br), white (w), mottled (mo)
Boundary	sharp (s), diffuse (di), wavy (wa), drops (dr), platy (pl), crust (cr)
Form – lay	round (r), diagonal (dg) - vertical (ve), horizontal (ho)
Filling	single (si), double (df1, df2 with specification such as single filling combined with platy humus-rich lower boundary (si-lh)

Nevertheless, aside from typology much more important seems to be, whether some of the krotovinas are filled with material from eroded paleosols that cannot be found anymore in the sections under investigation. RFA results, first ^{14}C datings of krotovinas, C_{org}, pedogenic Fe and $CaCO_3$ contents, and soil thin sections of krotovinas and surrounding material will proof two main hypotheses:

(1) Krotovina fillings of shallowly burrowing small mammals can represent eroded surface soils of the Late Pleistocene.

(2) Rims of krotovinas and surrounding material are important pedogenetic transition zones of the loess covered steppe regions.

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GEOSPATIAL METHODS FOR GEOARCHAEOLOGICAL AND PALEOHYDROLOGICAL INVESTIGATIONS. PALEOGEO TEAM EXPERIENCE

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The Paleogeo is a team of the Ponto-Caspian Quaternary paleogeography researchers. The team consists of scientists representing from the Institute of Geography and Institute of Geology RAS and commercial organizations. On the base of geoarchaeological data researches of the influence of the paleogeographic events on the ancient human life in the Ponto-Caspian basin are performed.

Geospatial analyzes is one of the numerous methods which are used. The method is used for field excavation, paleobasins reconstruction, territory visualization, cartography, etc. The basic geospatial resources are: georeferenced images, digital elevation model, e-maps, geotagging data, object coordinates, webmap resources. All geotagging objects (sections, photos, field trip, etc) are exported to kml / kmz format. It’s an easy file format for visualization on the web-maps.

Besides classic methods of using the geospatial tools some technologies special for geoarcheology were developed.

GIS morphometric. There was developed a GIS morphometric method for basins reconstruction [1]. The main aim of the method is definition of quantitative parameters of ancient Caspian Sea. Digital elevation model, bathymetric data, topographic maps were used. The quantitative parameters of Khvalynean basins (Late Pleistocene) were reconstructed [2]. There are 9 stage of basin evolution: Atelian (-120 m abs); Early Khvalynean (+ 50, + 35 m abs); Middle Khvalynean (+ 22,+ 16,+ 5 m abs), Late Khvalynean (0, -5, -12 m abs) (fig. 1). There were specified a geospatial locations of ancient coastlines.

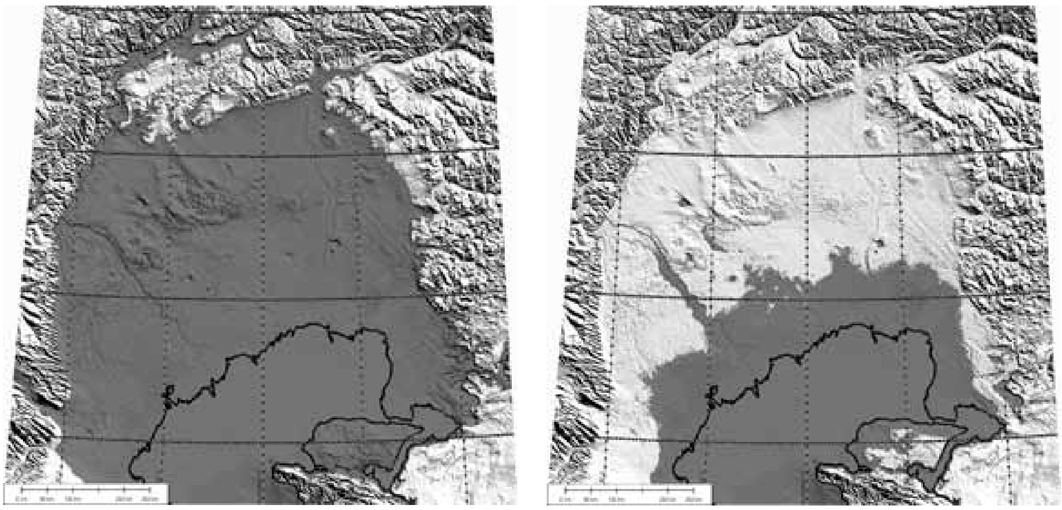

Figure 1. Maximal stage of Early Khvalynean basin (+50 m. abs) and minimal stage of Late Khvalynean (-12 m. abs)

Geomorphologic investigations. Detailed investigations of mezo and microrelief, spatial cover of deposits for oldowan sites Ainikab-1, Mukhkay-1 (Dagestan Republic, Russia) [3] (fig. 2), Bairaki (Moldova) [4], and Late Paleolithic Divnogorie site (Voronezh region, Russia) were realized.

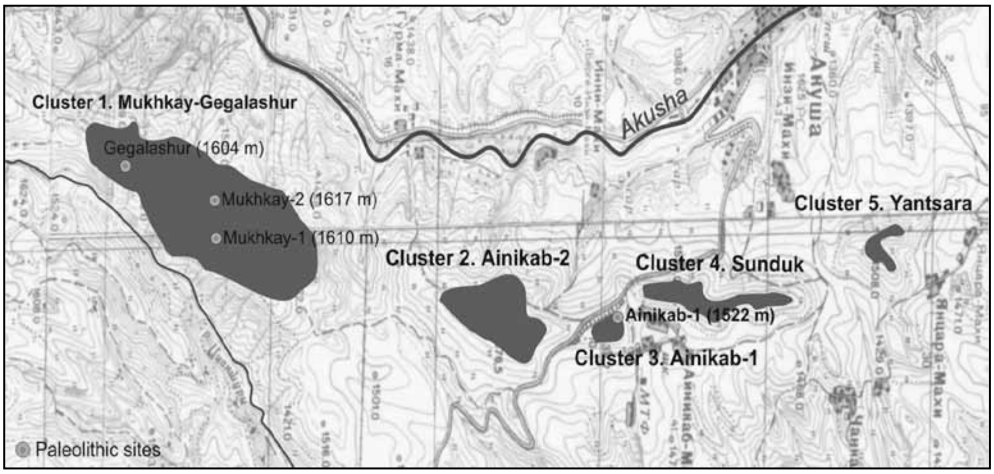

Figure 2. Spatial cover of akusha deposit. There were used GPS survey and georeferenced topomaps

Towards to high resolution spatial reconstruction. The main goals of our geospatial reconstructions are to rise of detalization level and to create a conjoint GIS platform. Today high resolution image are available as well as photogrammetric and GIS software. Integration of Google Earth API technology to paleogeo.org website allows all our visitors open wonderful world of paleogeography.

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PERMAFROST AS AN ARCHAEOLOGICAL ENVIRONMENT

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Permafrost is a global phenomenon, most spread in Asia and in the northern part of North America. In Russia, it covers about 60 % of the territory. Typically these are a remote and/or low populated area which partly causes low frequency of archaeological research.

As a natural conservation agent, the permafrost plays an important role for archiving environmental proxy records including osteological remains and biological materials both of animal and human origin, and archaeological finds particularly made of nondurable (organic) materials such as wood, bone (antler, ivory), or fibrous substances of plant or animal origin.

Generally, permafrost is defined as any earth material that remains below 0° C for at least two years (on the contrary to diurnal or seasonally frozen ground). Deposits of different genesis (e.g., alluvial, colluvial, aeolian or even bedrock) may constitute permafrost formations. Accordingly freezing can be epigenetic (after the deposition), or syngenetic (if contemporary to sedimentation). But in many cases the permafrost is of polygenetic nature.

Ice content is the most important characteristic of the permafrost. It can contain a high percentage of ice or may have practically no ice at all. Ice-rich permafrost contains 20 % to 60 % of ground ice. Epi- or syngenetic ice-wedges are another large constituent of the ice-rich permafrost. Specific form of perennially frozen deposits is known in arctic and sub arctic Siberia namely Ice Complex deposits.

Insulation, atmospheric heat, and water are the worst enemies of the permafrost. This changes landscapes quickly and dramatically effects preservation of archaeological sites in permafrost areas, particularly the sites of Pleistocene age, and may lead to the total destruction of them. Therefore the only survey strategy for these areas will be to monitor zone of potential interest with expectation to locate archaeological material as soon as it becomes exposed. Logic of spatial distribution for archaeological sites in the permafrost areas is basically the same as elsewhere, and then regional waterways should first serve as a survey network. The only survey strategy for these areas will be to monitor zone of potential interest with expectation to locate archaeological material as soon as it becomes exposed.

Not every archaeological site located within the permafrost region is frozen. This depends on local environmental settings, history of sedimentation, and type of the matrix sediment, that generally determine the thickness of active layer. Thus, many of Holocene and Terminal Pleistocene sites of Siberia and Alaska are not frozen while maritime sites of the same areas are mostly frozen although their materials were deposited within past 2000 years [2]. Even younger sites studied far south of the Arctic – for instance, burial mounds in Mountain Altai area, Russia are frozen. However, these sites as well as burial mounds in Kazakhstan are probably the evidence for use of artificially induced frost conditions resulted from human created structures, made with a purpose to prevent the putrefaction of their deads [3].

It should be expected that many of Early Holocene and Pleistocene sites, particularly in Siberia, still remain fully frozen. Not many of them are so far known, but in all cases (Zhokhov site, Yana RHS, and Berelekh) they are hosted by ice-rich deposits [1]. Then, experience of excavating of such sites is limited to these three cases.

Excavation strategies which can be potentially used are determined mostly by (1) ice-richness of matrix and overlain deposits that is related to their genesis and age and (2) thickness of the overlain sediments and that of seasonally thaw layer. Excavations are also affected by the exposition of the area and it's topography including general inclination of the surface, and presence of negative land forms.

After frozen matrix deposit is exposed, the excavation strategy consists of three steps: (1) thawing; (2) drying (by evaporation and drainage); (3) regular excavation of relatively dry cultural deposits. Steps (1) and (2) require permanent control. Use of forced thawing for archaeological purposes is possible in a form any controlled heat technology except for the open fire. However, fast thawing creates too much water and makes the sediment super water saturated; it looses a volume proportionally to the ice content and becomes capable to flow. Because of that, forced thawing can be used only if the excavation can be drained of dried out quickly, before slump of thawed area. Most likely this can be done if the host sediment is not deep frozen and has low ice content.

Ice-rich deposits are best to be excavated under natural conditions of summer insulation and evaporation forced by atmospheric heat and breeze. Certainly, an excavation of frozen sites involves routine archaeological principals. Sewing of the excavated matter is important for the Stone Age archaeology, but for frozen sites it has to be substituted by water screening with low pressure pump.

Obviously, excavations organized from the day light surface (if there is no erosional land form from which margin the excavation can be started) are the hardest case because of the drainage problem. In that case, a sort of caisson (or bore hole) to collect the water could be recommended, and water can be pumped out then. In any case, initial activity on the excavation will be slow depending mostly on the speed of drying of thawed sediments. After a part of the area becomes excavated, work goes faster because there is some space to manage the drainage and drying of the excavation. In some cases walls of the excavation require additional support in a form of falsework.

The open area has to be relatively extensive, which allows having one third of it for thawing, another one for drying, and the last one under excavation itself. Multiple repeating these operations and taking turns of activities in different parts of the excavation allows excavating cultural deposits down to the bottom. Depending on weather conditions, this allows to excavate 5-10 cm of the total thickness per a day. Similar strategy was successfully used in Zhokhov island site, which resulted in excavating of about 500 m^2, with a total thickness of cultural deposits up to 3 m [1]. Importantly in the most of the site area there is almost no overlying sediments.

Different scenario for excavations of the frozen sites is applicable for excavations of the sites with a thick cover of overlain deposits, with a thickness much greater than that of the active layer. Some kind of the erosional land form is necessary to start this kind of the excavations. Thus, in Yana RHS the excavation was started from the frozen river bank exposure [1, 2]. Here the overlain deposits have a thickness of about 7-8 m. Most of it is frozen, except for the active layer which is less than 1 m thick. These sediments are ice rich, with a volume content of 40 % – 50 %, and have syngenetic ice wedges in a form of polygonal grid. Several generations of them present in the profile (Karginian, Sartan, and Holocene).

In any case it is possible to observe and clean up the cultural layer in the profile, and even obtain some cultural material from *in situ* conditions. However, real excavations are possible only if the polygon(s) are separate from the frozen front of the exposure. This happens after thawing and water erosion of the ice wedges is completed to the depth of the cultural layer position. This can be forced if they are well exposed to the air and insulation, while the bottom of exposed side of the frozen polygon has to be below the cultural layer.

As soon as the top of the polygon becomes thawed, the thawed part has to be shoveled out together with material of the active layer until the frozen surface becomes exposed to the day light. Then the operation has to be repeated again for gradual reduction of overlying deposits by notching excavation, so the remnant of the polygon has a ziggurat shape. This prevents thawed deposits from slumping down. The base part of the polygon has to be supported by wooden falsework. Material that was shoveled out is being moved further out by pumped water through natural erosional channels created by running water in the ice wedges.

This allows preparing for excavations 1-2 m wide zone alone the front of the polygon. Size of this area varies and can be from 5 to 10 m^2. After it is excavated, the next portion becomes available for that. Then, this kind of excavation requires a large investment of labor. However, more than 2000 m^2 is excavated in Yana RHS. And, obviously, planning of such excavations has to be done as a long-term project.

Radiocarbon dating of frozen sites in permafrost areas is tricky. Thus wood, particularly small pieces, is a floatable material and then can be easily transported from elsewhere including the sediments which are much older than the site. The latter may happen during the sedimentation, or could be a result of past human activity (e.g., people would move old wood to the site as a fire wood or as a raw material). Except that, a wrong date for overlying deposits can be received due to the permafrost activity such as lifting up datable material in the polygon margins from below as a result of development/growing of the ice-wedges. Archaeological material can be also moved up by the same process and then became included into sediments which are not contemporary to it. Also, some of the organics can be moved from above because of partial thawing of the deposits in the past. This specific «lift-up» mechanism is an important for understanding of archaeological and/or radiocarbon dating results [4].

Possible errors can be avoided if dating of cultural remains is controlled by dates from below the cultural layer and from above as well. Bone collagen from the bones clearly related to past human activity is the best material for dating. Importantly, some of the bones may be not contemporary to the occupation event. Typically these are mammoth remains collected by humans as a raw material in the past. Dating of them gives a difference of 2000 + years if compared to the age of habitation. Then serial dating is absolutely necessary. For overlain and underlain deposits the best datable material would be plant remains (e.g., roots of herbaceous plants) buried in a life position. In some cases radiocarbon date run on bulk sample may be more reliable than the AMS dates. Dating of the host sediment gives dates approximately 2000 radiocarbon years older than the date on plant remains [2]. All radiocarbon samples must be kept under conditions that prevent any bacterial decay which is a powerful contamination factor.

Here we tried to describe briefly the permafrost as a specific working environment for the field archaeology and show potential difficulties of survey, excavation, and radiocarbon dating of the sediments and cultural remains. It is well known that archaeologists normally deal with the traces of the permafrost that existed in the past such as cryoturbation, ice-wedge casts, cryogenic cracks etc. Observations made in 'live' permafrost conditions help better understanding of the processes that took place in the past during the formation of the frozen sediments and, which is even more important, understanding the effect caused by its thawing.

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CHARACTERISTICS OF THE GEOTOURISM DEVELOPMENT IN THE SMOLENSK REGION

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Nowadays geotourism is gaining more and more popularity and is developing very fast. As a kind of tourism geotourism is comparatively young. It can be called a modern one.

Geotourism is a journey with scientific, educational, entertaining, and other goals which is connected with geological and geographical natural objects [1].

Although this kind of tourism is rather well-known and wide-spread among professionals, only few tourists use it. Various problems of the geotourism development are discussed at geological conferences and congresses on the international, national and regional levels.

Geotourism is often regarded as a step towards ecotourism. This perception is quite understandable because one of the objectives of geotourism is not to do any harm to the environment and to enjoy the genuine beauty of various places. Respect for the local population plays an important role among the postulates of geotourism.

If tourists visit a particular place because of its uniqueness, it encourages and motivates local authorities to preserve this site. Proponents of geotourism claim that this kind of tourism will offer new opportunities in creating workplaces for the local population and in increasing profits of local entrepreneurs.

Some foreign countries such as the USA, Canada, France, Italy, Spain, Norway, South-African Republic, Australia and other destinations are particularly good at arranging geotourist routes. There are only few regions in Russia which attempt to develop geotourism on commercial basis. The most promising are considered to be the regions that possess substantial natural resources such as a unique geological formation, mineral deposits, diversity of the landscape as well as various processes which used to take place in the past or are happening these days. The territory of the Gorny Altai, the Krasnoyarsk region as well as the Urals, lake Baikal etc. are bright examples of efficient development of geotourism.

Among all Russian regions the Smolensk region has a considerable potential for developing tourism thanks to its significant history. The synergetic combination of the rich cultural and historical heritage with natural beauty and beneficial geographic location on the eastern border offers opportunities to attract both Russian and foreign tourists. The Smolensk region is distinguished by a large number of monuments such as churches of the XII century, the Fortress Wall, monuments to the Patriotic War with Napoleon in 1812, the Assumption Cathedral, manorial estates of the XIX century and other sights.

The region is annually visited by more than 200 thousand tourists, 32 thousands of which are foreigners. The majority of foreign tourists are from Poland, Germany and the USA. According to the forecasts, the flow of tourists will increase by 1.5 in 2013, because of the celebration of the 1150-year anniversary of the first reference to our city in the chronicle [3].

On the whole, traditionally there have been developing the following kinds of tourism: cultural and educational, health-improving and sanatorium as well as tourism for children. Recently there has sprung up a tendency to develop some new kinds of tourism such as religious, agricultural, hunting, fishing, event-based, ecological and geotourism.

Apart from the traditional (cultural and educational), in some promising areas there have been developed other kinds of tourism, e. g. business tourism in Smolensk, sport tourism in the Krasninsky and Dorogobuzhsky administrative entities, event-based tourism in regional centers, fishing tourism in the Gagarinsky and Dukhovschinsky administrative entities, agricultural and geotourism in the Demidovsky and Vyazemsky administrative entities, hunting tourism in the Pochinkovsky, Roslavlsky and Vyazemsky entities.

All changes which are taking place on the Russian and international tourist markets have caused an increased demand for rest and health-improvement as well as for ecological, and fishing tours and for pilgrimage. There can be distinguished six tourist zones for further exploration in the Smolensk region:

- Smolenskaya (Smolensk, the Smolensky, Kardymovsky and Krasninsky administrative entities);
- Central (the Dorogobuzhsky and Yarzevsky administrative entities);
- Northern-Western (the Velizhsky, Demidovsky, Dukhovschinsky and Rudnyansky administrative entities);
- Northern-Eastern (the Sychevsky and Novoduginsky administrative entities);
- Eastern (the Vyazemsky, Gagarinsky, Urgansky and Temkinsky administrative entities);

· Southern (Desnogorsk, The Pochinkovsky, Elninsky, Roslavlsky and Shumyachsky administrative entities).

Tourist resources of these administrative entities are developing unevenly and have a number of drawbacks. All the above mentioned tourist zones suffer from inadequate development of the tourist infrastructure.

The Smolenskaya tourist zone is characterized by a large number of accommodation and public catering facilities, entertainment establishments, natural and historical tourist attractions, sanatoriums and children’s health camps. The priority in development of this zone is given to tourist resources, namely, the Gnezdovsky archaeological complex, historical and archaeological complex «Teremok» (it means «tower-chamber») in the Smolensk administrative entity, «Solovyeva pereprava» (it means «Solovyeva river-crossing») in the Kardymovsky administrative entity, battle places in the Patriotic war against Napoleon of 1812 in the Krasninsky administrative entity.

In the Central zone the Holy Trinity Boldino Monastery of St. Gerasim in the Dorogobuzh administrative entity and the museum of the Yartzevsky cotton factory in Yartzevo will be primarily developed.

There are plans of development of Serteysky archaeological complex in the Velizhsky administrative entity and tourist complexes in the national park «the Smolensk Lakeland» in the Demidovsky and Dukhovschinsky administrative entities [4].

In the Northern-Eastern zone the priority is given to manorial estates such as Lipetzy (Khomyakov’s estate), Alexandrino (Lobanovy-Rostovsky’s estate) in the Novoduginsky administrative entity, Dugino (Panin’s estate) in the Sychevsky administrative entity. There are plans to develop tourist routes to the river head the Dnieper river in the Sychevsky administrative entity and that can contribute to the overall geotourism development in the region.

In the Eastern tourist zone utilization of the natural and recreational potential is suggested in the following parts: the Yauzovskoye and Vazuzskoye reservoirs in the Gagarinsky administrative entity, the Ugra river basin in the Temkinsky and Ugransky administrative entities. Researches carried out in these zones in 2010 proved that they are very popular among fishers and hunters as well as tourists who are fond of water and walking tours. Consequently, this zone is quite promising for the development of geotourism.

In the Southern zone the key points in development of tourist recources are the following: the monument to Saint Murcury of Smolensk in Dolgomostye in the Pochinkovsky administrative entity, the Cathedral of Transfiguration in Roslavl and the museum of Pervomaysky glass factory in the Shumyachsky administrative entity.

There is a great potential in developing ecological and geotourism in the Smolensk region. It is worth mentioning that such kinds of tourism can not only improve and increase tourist attraction of the region, but also attract tourists who appreciate healthy and educational rest. For Smolensk it gives an excellent opportunity to diversify the range of services for tourists, offering them something more modern than all the historical and cultural monuments that our region abounds in.

The Smolensk region is located in the middle part of the Russian plain and its landscape is typical for the central part of Russia. An important characteristic of the regional landscape is the main watershed of the Russian plain from which its largest rivers such as the Volga, The Dnieper and the Western Dviena flow [2]. Naturally, the prevailing plain landscape creates appropriate conditions for setting up individual sites of geotourist attraction.

One of the geotourist attraction sites can be the Dnieper river head. Tourists can see with their own eyes the birthplace of this great Russian river. The Dnieper starts from the southern part of the Valdai Highlands near the Dudkino village in the Sychevsky administrative entity of the Smolensk region in the vicinity of Gavrilovskoye lake and it falls into the Dnieper estuary of the Black sea. When we speak about the Dnieper such names as Berezina, Sozh, Pripyat, Desna, Vorskla, Samara, Konka, But and many other spring to our mind. In the lower reaches the priority of the Dnieper riverbed is beyond any doubt, whereas in the upper reaches the question about equal roles of the main riverbed and its tributaries naturally arises even if you are not a specialist. There is an ancient legend about the Dnieper and the Desna. Allegedly, they were a brother and a sister in the past. They decided to travel to the sea in the morning and fell asleep to have a rest before a long journey. The Desna overslept the dawn, while the Dnieper decided not to wait for her and went ahead. No matter how hard she tried, the Desna failed to catch up with her brother and, eventually, she turned into his tributary [5].

The Dnieper crosses various landscapes and there are great many interesting natural sites and historically significant places. Nowadays a route «To the origins of the Dnieper» is being developed in the Sychevsky administrative entity.

Among other geo-objects of the Smolensk region there are specific ranges, stony remnants, ribs which were left by the glacier etc. (table 1) [2].

Table 1. The main geo-objects of the Smolensk region.

Type	Sub-type	Examples
Geological	Mineralogical	Covered peat (the village Mikulina in the Rudnyansky administrative entity and the village Nemykari in the Smolensk administrative entity)
Geomorphological	Glaciological-glaciogenic	Ribs in the zone of the Valdai glaciations in the Smolensk administrative entity
	Erosive	Gullies of the valley of minor watercourse in Smolensk
	Water-accumulative	Ranges left by the glacier in the Demidovsky administrative entity
	Residual	Sand-gravel remnant «Talashkinskaya tower» in the Smolensk administrative entity
	Eolian	Eolian soil along the river Western Dvina
	Exarational	Valleys of the glacial plucking of lake Rytoe and lake Dgo in the Demidovsky administrative entity
Hydro-geological		Mineral water spas in the village Przhevalskoye in the Demidovsky administrative entity
Landscapes		Specific landscapes of the Valdai glacier in the Demidovsky administrative entity; peculiar Roslavlskaya-Aselskaya range in the Roslavlsky administrative entity

A special place in the structure of tourism in the Smolensk region for the next 5 years will be taken by even-based, agricultural, hunting, fishing, ecological and geotourism and pilgrimage. They will be actively developing apart from the traditional cultural and educational types of tourism. However, there is an urgent need for the promotion of the tourist product.

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HUMAN IMPACT ON LANDSCAPE DYNAMICS IN THE STEPPE ENVIRONS OF THE DON DELTA (SOUTHERN RUSSIA)

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It is generally accepted that environmental changes, primarily related to oscillations of climate aridity, are a driving factor for prehistoric living in the steppe. However, the effect of human activities on the landscape has not yet been sufficiently examined. On the Sambek, a small steppe river in the Don Delta's ecological sensitive hinterland, we investigate the human footprint on the development of a typical steppe landscape north of the Azov Sea (fig. 1). Prehistoric settlement sites and burial grounds provide evidence for land use within the Sambek catchment since the Palaeolithic. Erosional channels (up to 10 m depth), intensive slope wash and landslides are possibly related to human activity. To identify the human impact sediment cores were retrieved from the floodplain, the alluvial fans and inside settlement sites. The sediments are processed concerning their geochronological, geochemical and physical characteristics. Geomorphological mapping and archaeological data support the analyses.

The stratigraphy of two alluvial fans at the mouthes of a deep gully and a dry valley shows alternating layers of fine grained and stony colluvium up to 3 m below the surface. The sediments' characteristics and dating imply several erosional events since the beginning of the fan development before 6000 BP (Eneolithic, 4500-3400 BC). Strong erosion is detected for the last 2200 years, corresponding to the main settlement phases: the Sarmatian period (200 BC – 400 AD), the Middle Ages (700-1400 AD) and the Russian Colonization (1790-1950). However, the cultural periods of the Bronze Age (3400-1000 BC) are hardly represented in the sediment's stratigraphy and chronology.

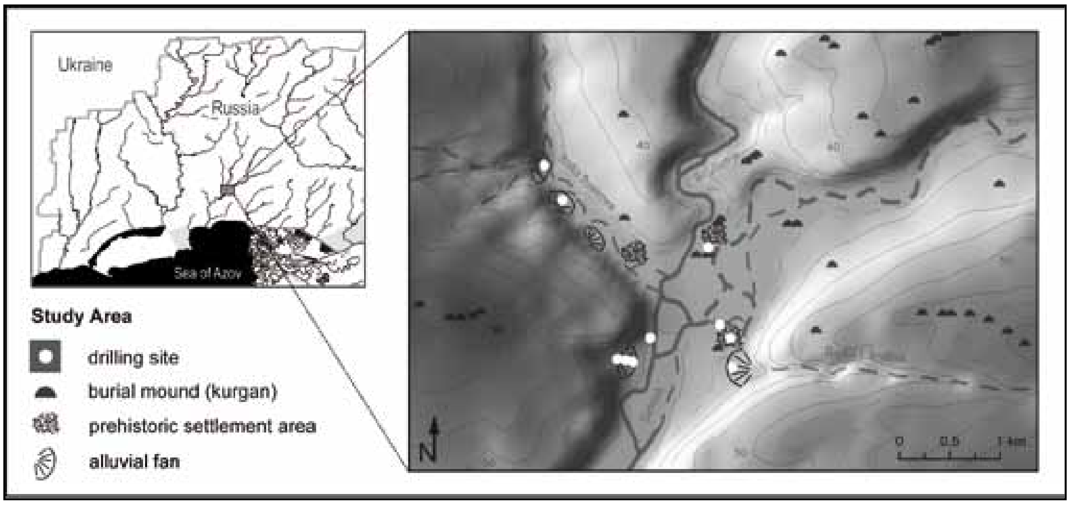

Figure 1. Overview of the Sambek study area (DEM based on the topographic map 1 : 50000)

THE IMPACT OF LANDSCAPE TRANSFORMATION ON THE SIGNIFICANCE OF POLITICAL CENTRES AT THE LOWER ELBE RIVER IN THE 10TH C. AD

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In the 9th c. AD main parts of the lower Elbe river coincided with the north-eastern frontier of the Carolingian Empire fig. 1). But shortly after the death of Charlemagne in 814 some of the frontier trade posts and Carolingian strongholds were abandoned. It was not later than the middle of the 9th c. that Slavonic population crossed the river and started to build settlements and strongholds on its left bank [1].

The Höhbeck-region is special because of its topographical significance for the passage of the river. The Höhbeck, a glacial island-like elevation in the middle of the vast river valley, gave this region at the same time a strategic importance. This is reflected in an unusually high density of strongholds and hillforts in this area (fig. 2).

While a Carolingian hillfort on top of the Höhbeck has remained abandoned since the middle of the 9th c., in Meetschow a Slavic stronghold was built at exactly the same place, where the Carolingian border trade post Schezla had been before [3]. Although the political situation changed, the topographical and strategic importance of its position obviously remained unaffected. All together there were three Slavonic strongholds around the Höhbeck in the beginning of the 10th c. AD (fig. 2). Meetschow seems to be the most important of them, probably because of its position. When the Saxons defeated the Slavs in the well known battle of 929 AD all three strongholds suffered. But while two of them – Elbholz and Lenzen-Neuehaus – were finally destroyed, as archaeological evidence shows, the Meetschow stronghold was used further by the new sovereigns. In the middle of the 10th c. AD a new stronghold in Lenzen was built on the right bank of the Elbe river. At the same time there were building activities in Meetschow, too. Both strongholds can be interpreted as bridgeheads for the passage of the river at that time.

Important finds, like spurs or a golden book clasp, indicate the importance of Meetschow in the 10th c., which was at that time at least a local centre with some good expectations for future development.

It can be assumed that the main reason for the increasing significance of Meetschow in the 9th and 10th centuries was its topographical controlling position on the intersection of a water route and a land route.

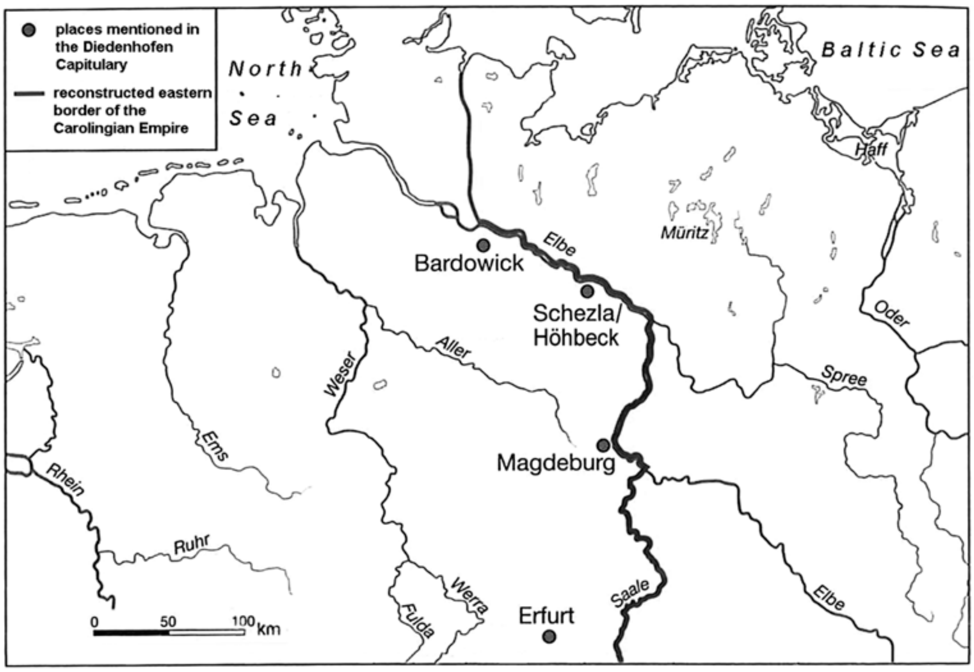

Figure 1. The probable course of the eastern border of Charlemagne's Empire with some places which are mentioned in the Diedenhofen Capitulary of 805 (modified after [2], p. 252, fig. 76)

But then the situation changed. There is strong evidence for a heavy natural event in the second half of the 10th c. AD, or may be a series of closely spaced natural events. All around the Höhbeck we found evidence for destructions by flooding, which we are able to date into the 10th c. East of the Höhbeck the ditch of the by then already destroyed stronghold in the Elbholz was completely filled up with sedimentary sandy deposits. They could be dated by OSL (optically stimulated luminescence) into the 10th c. AD [1]. The excavations in Lenzen on the right river bank revealed evidence of struggling with floodings between the first construction of a stronghold around 945 AD and the next, completely rebuilt stronghold of the early 980s [4]. Corresponding evidence could be recovered in the surroundings of Meetschow on the westside of the Höhbeck. We succeeded to date the running of a dead river branch to the early 10th c. AD. Meetschow as well as two contemporaneous Slavonic settlements were situated on the shore of this river. We tend to consider this river branch as one of the main arms of the 9th/10th c. Elbe, running south of the Höhbeck at that time. The front of the Meetschow stronghold, which was built in the 940s (dendrochronologically dated), was completely destroyed by a heavy natural event, probably a flooding. There is no evidence of repair in the further course of the 10th c. In Meetschow, as well as in the mentioned river segment, there are thick sedimentary deposits, which we unfortunately are not able to date exactly. We can only assume the middle of the 10th c. as a *terminus post quem* for their deposition [5]. Summing up the different evidences we can conclude, that sometime between 950 and 980 AD one or several heavy flooding events caused great impact on the topographical situation around the Höhbeck. In all probability it was just at that time that the main arm of the Elbe turned to run north of the Höhbeck, where it is still running today.

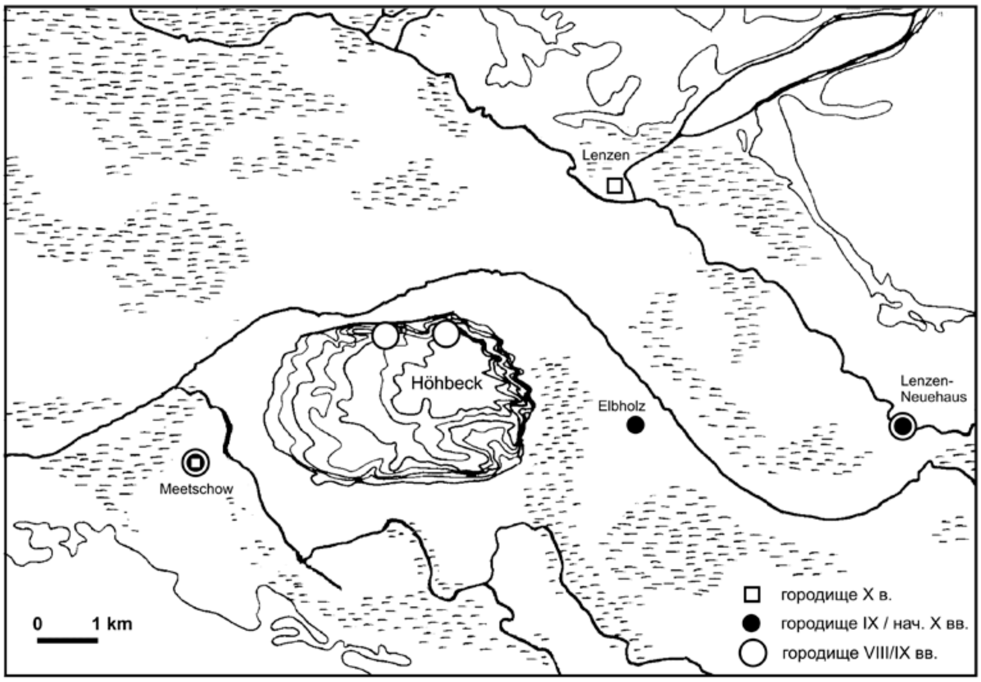

Figure 2. The «Höhbeck» in the Elbe-valley and the early medieval fortifications. Charlemagne's castellum hohbuoki on top of the Höhbeck

In consequence of the changed river course the way of its passage was most likely modified too. It is striking that the further development in Meetschow was declining until the final abandonment of the place sometime in the 12th / 13th c. In the beginning of the 11th c. the old stronghold was rebuilt and than used as a motte for a local lower noble of minor importance. However, trade and craft in the nearby rural settlements prospered during the 11th c. In contrast the stronghold in Lenzen on the other bank of the river was rebuilt in the very beginning of the 980s and then continued to develop. Lenzen became the main center of prosperity and town-development in this region. It is typical and characteristic for the 11th c. that there can be observed a focus on only a few local central sites which were developing into regional centres, often adopting the function of older sites [6]. We can notice a corresponding situation at the Höhbeck, where Lenzen took over the functions of Meetschow and developed into the administrative and political centre of the region. Of course we will never know the exact reasons for this development, but obviously the topographical position of Lenzen was better suited to the new requirements of political centres in the 11th c. than this of the Meetschow site. The drastic transformation of river course and landscape during the 10th c. at the Höhbeck at least promoted this political process, if it was not actually the main cause for it.

It is a matter of particular interest that there can be observed very similar processes all over Europe during the 10th and 11th c. AD. It is a main challenge for today's geoarchaeological research to evaluate the impact of natural events and landscape transformations on the well known geopolitical changes around the turn from the 1st to the 2nd millenium AD.

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STRATIGRAPHY AND PALAEOENVIRONMENTAL IMPLICATIONS OF LATE HOLOCENE ALLUVIAL FANS AT ANCIENT ATARNEUS IN THE ENVIRONS OF PERGAMON (WESTERN TURKEY)

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The ancient city of Atarneus is subject to geoarchaeological research focussing on late Holocence man-environment interactions in the environs of ancient Pergamon (western Turkey). Atarneus, situated on a volcanic butte on the edge of the Bakırçay floodplain, was one of the most important poleis in this region in the second half of the first millenium BCE. It's influence declined when Pergamon extended its power around the beginning of the common era. Intensive studies have been carried out to investigate the rise and fall of Atarneus. However, these studies have concentrated on socio-cultural aspects and little attention has been given to environmental changes. Geomorphological, sedimentological (magnetic susceptibility, element analysis) and geochronological (radiocarbon dating) investigations were conducted on alluvial fans at the break in slope of Atarneus' settlement hill.

Several alluvial fans connected to channels on the settlement hill were identified. Generalized, the fans directly originating in the settled area consist from bottom to top of well-rounded fluvial sediments, coarse colluvials and a reworked occupation layer. Radio carbon dates show that before the rise of Atarneus floodplain conditions prevailed and the fluvial sediments were deposited. During the following period human influence slowly increased. This led to soil erosion-derived colluviation in the fans. Finally, in the heydeys of Atarneus and later, an occupation layer formed and was repeatedly eroded and transported into the fans. Concluding, the stratigraphy of Atarneus' alluvials fans reflects the polis' history and gives evidence of landscape degradation and the development and rework of an occupation layer.

ANTHROPOGENIC INCLUSION AS AN INDICATOR OF SOIL ANTHROPOGENESIS OF HISTORIC SITES LANDSCAPE ARCHITECTURE

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The relevance of historical significance objects in the natural science learning is increased. The historical manor park complexes are a special interest in Russia. It reflects the socio-economic structure and the philosophical and aesthetic ideas of time. Park complexes of Russian estates are historical and architectural monuments on the one hand and they include the surrounding landscape, forming a special ecological space on the other hand [1].

Manor park complexes are man-made landscapes, which are formed as a result of the transformation of the natural landscape. According to the concept of organization of the object the relief has been changed, then were formed new plant associations and in accordance to them artificial soil with desired properties.

Such kind of soils is primarily formed by lawns, paths and planting. Profile of soil-like bodies is represented by a diverse set of artificial horizons.

The content of anthropogenic substances in horizons of these soils is an important diagnostic feature in the classification of urban soils [2, 3].

Artificial horizons of constructed soils are created from materials of various component compositions depending on the purpose of forming planning element. Such materials in its structure have already contained a certain set of inclusions. However, in the process of mining, crushing, conveying, blending and storage of raw materials may further be subjected to accidental contamination by inclusions of various natures. In all cases, these unnatural soil materials get into the soil by accident or by special human activity. Therefore the anthropogenic influence can be found both in the presence of specially introduced materials and accidentally caught by the presence of inclusions. The presence of such soils of a set of inclusions may indicate the probable method of their preparation. And it is a part of the coarse fraction mineral complex.

It is not always preserved historical documents that tell about the structure of the park area and a vertical layout, which aims to change the existing parameters of the relief under the concept of the architect-planner. Conversions can be significantly different both in terms of component composition of the materials used, and in terms of depth conversion of the soil profile.

In some archives there are no data on how soil cultivation under tree planting and lawns, as well as information about the technologies to create tracks. However, this information is important both in terms of image reconstruction of manor life, and for the creation of the modern project of functional zoning of park areas and recreational load optimization.

The aim of this study is to estimate the anthropogenic impact on the topography and soils within the historical park of the Arkhangelskoe estate, Moscow region. Arkhangelskoe estate museum is a historic object of landscape architecture of the 18th century. To characterize the mineral foundation and determine the extent and depth of the transformation of soil designed objects was studied the composition of the inclusions of anthropogenically-altered soils and Arkhangelskoe man-made soils of park.

The objects of study are post agricultural sod-podzolic soils of the landscape, konstruktozems and post agricultural alluvial soils of a regular part of the park.

Selecting of inclusions were analyzed on the basis of a method from the practice of soil forensic research (the study of inclusions in the washed schlich under an optical microscope in 3 size fractions: > 0.5 mm, 0.5-0.25 mm and < 0.25 mm) [4].

Soil contamination was evaluated on the upper horizon (similar to the definition of particle size distribution), and its debris was determined in the fraction containing the greatest number and variety of inclusions.

In the study objects were identified 12 species of man-made inclusions that originally belong to three types: anthropomorphic – magnetic spherules, the residual oil on the grains of minerals, the particles of ceramics, fuel slag, rust, particles of mortar, specs, particle coatings; biomorphs – charcoal; litomorfy – fragments of limestone, granite inclusions, coal.

The presence of inclusions in different depths of soil horizons is a sign indicator of anthropogenic influence. It characterizes the thickness of the layer affected by anthropogenic transformation. For sod-podzolic soil, this capacity is 34 cm, for konstruktozem (on the lawn) – 46 cm, for konstruktozem (on the track) – the whole soil profile penetrated – 120 cm.

It is founded konstruktozems, post agricultural sod-podzolic and alluvial soils differ both in quality and quantitative composition of the inclusions.

Analysis of the distribution of inclusions on fractions showed that young constructed soils contain a wider range of inclusions in the coarse fractions, whereas the mature transformed soil are concentrated inclusions in the finer fractions.

Distribution of different types of inclusions in the horizons of various geneses has certain regularities.

The soils of Arkhangelskoe estate museum differ in the degree of contamination: post agricultural sod-podzolic soils are very poorly littered, alluvial soil post agricultural is slightly littered, konstruktozems are medium littered.

Young construct soils contain a wide range of inclusions in the coarse fractions, whereas the transformed soils of more mature age inclusions concentrate inclusions in finer fractions.

Organic-mineral horizons of agrosod-podzolic soils and konstruktozems are close on a set of inclusions. It indicates that in the process of cultivation was used a similar composition of the material.

Man-made horizons vary considerably in composition and number of inclusions. The maximum diversity of inclusions is characterized organic-mineral horizon of post agricultural alluvial soil.

On the basis of the received data on inclusions in anthropogenic soils it is possible to reveal some historical aspects connected with formation of park soils. Post agricultural sod-podzolic soils were apparently formed by adding the fertile layer on the surface of cultivated soils without subsequent mixing of the topsoil horizon. The composition of fertile layer is close to modern organic-mineral mixtures. Considerable depth (to 120 cm) of soil conversion was revealed on the terraces of the regular part of the park.

As a result of the analysis of distribution of inclusions on fractions in various types of the horizons it was established that for the studied groups of the horizons the most informative fractions are revealed.

Studies show that the most informative in terms of identifying the maximum content and qualitative composition of the inclusions for post agricultural horizons agrosod-podzolic soils are fractions 0.5-0.25 mm and < 0.25 mm for bulk horizon of konstruktozem RAT – 0.5-0.25, for eluvial horizon – < 0.25 mm and for the cultivated horizon of alluvial soil and man-made – > 0.5 mm.

Selecting the most informative fractions allows making practical proposals for simplifying the complex inclusions studies: for man-made and alluvial soils it is advisable to study the selection and the fraction > 0.5 mm, and for agrosod-podzolic < 0.25 mm.

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THE MINERAL RESERVES OF THE KRASKINO HILLFORT (PRIMORYE, RUSSIA)

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The Kraskino hillfort is located on the south-west of the Primorye territory in the flood plain of the Tsukanovka River, which meets the see in the Expeditsiya bay (the western part of Posyet gulf). Coastal zone of the Expeditsiya bay’s north bank belongs to low-lying plain about to 10 km width, which is run up to the Chorniye Gory ridge. Drainage system belongs to the Tesnaya, Kamyshovaya and Gladkaya rivers. The Kraskino hillford is situated in the central part of the Kraskino depression, an isolated tectonic structure. It was formed in the early Paleogene. Kraskino depression has nearly oval shape with the Expeditsiya bay in the center. Its base consists of granites, sedimentary and metamorphic rocks of the later Paleozoic. Upper layer consists of sedimentary and volcanic rocks of the Cainozoic age. Hat of the geological cross-section consists of Quaternary deposits up to 100 m in width: lams, detritus, gravel, coal, aleurite, loam – alluvial and marine sedimentaries. The highest layer of Kraskino cross-section is a «culture layer». Soft sediments of the Kraskino hillfort's culture layer are alluvial sandy and argillo-arenaceous deposits.

Archeological excavations allowed to locate remains of cult, residential and support buildings, fencings and fortifications. They are represented by fragments of various compositions of rocks. The research of Kraskino hillfort's rocks was done. The main purpose of geological research is to find out the sources of rocks used for housebuilding and other activities. Researching method is benchmarking rock fragments from hillfort and rocks from Kraskino hillfort's surroundings. The research was performed in macro- and microscoping (petrological slides' analysis). Benchmarking allowed to locate possible sources of mineral raw materials and ways of carrying. Kraskino hillfort's building materials are mainly represented by 14 groups of rocks: 1 – rare-porphyritic plagiophyre andesites; 2 – short- and medium-grained gabbro (gabbro-diorites?); 3 – porphyritic pyroxene basaltic andesites (andesites?); 4 – large-porphyritic dacite andesites; 5 – porphyritic volcanic acid and mid-acid rocks; 6 – aphyric and rare-porphyritic volcanic acid and mid-acid rocks; 7 – porphyritic leucocratic granites; 8 – fused tuffs (including pumice tuffs); 9 – mid-grained granodiorites; 10 – psephitic crystal-lithoclastic tuffs; 11 – volcanic glass; 12 – mid-grained biotite-amphibolic granites; 13 – microgranites, aplites and quartz veins; 14 – lithified sedimentary rocks.

Geological research (visual and petrographic analysis of hillfort and surroundings' rocks, analysis of geological maps and traverse) allows to make following conclusions:

1. Specialities of Kraskino hillfort's geological structure (soft Quaternary deposits) allow to confirm that all the rock fragments located into the hillfort aren't. They were have being brought here as a result of antropogenic activities;

2. Kraskino hillfort's rock fragments can be divided to the 2 groups by its abrasion degree: 1 – variously abrased alluvium, round stones and chunks; 2 – variously sized and shaped sharp edged. 1st group materials were carried from locations with possibility of natural processing of rocks: river-beds and its surroundings, seashore beaches. 2nd group materials were selected from natural open-cut mines (bed-rock barings, bank stream gravel). Ways of carrying building materials are mainly water: rivers, ingressive guts, the Expeditsiya bay.

3. Magmatic (intrusive, volcanic and sub-volcanic) units prevailing among the Kraskino hillfort's rocks. Sedimentary and methamorphic rocks are affluent. The widest represented are volcanic and sub-volcanic units and allied to them comagmatic and shallow intrusive stones. They are represented by porphyritic andesites (group 1), large-porphyritic andesites (group 9) and short- and medium-grained gabbro (group 2). These rocks make base of wall, footing of temple and other constructions. Points of origin of the rocks take place nearby the hillfort (Novgorodskiy peninsula, tuffet near Kraskino

village). Sharp edged chunks were most likely extracted from natural open-cut located on the tuffet's cleve (left bank of Tsukanovka river). Large-porphyritic andesites usually represented by middle-abrased round stones. They were most likely taken from Tsukanovka river's channel deposits. These materials have been floated to Krackino hillfort by Tsukanovka river. Porphyritic (group 3, 5) and aphyric (group 6) volcanics of average, mid-acid and acid composition, their comagmates (group 7) and tuffs (group 10) almost completely form the southern part of Novgorodskiy peninsula. The rock fragments (variously abrased round stones and chunk) had been carried to the hillfort most likely through Expeditsiya bay. Volcanic glass ratchel (group 11) are very rarely occur. Pumice and lithoclastic tuffs (group 8) are wide represented among rock fragments in hillfort. They are situated in the interfluve of Tsukanovka and Kamyshovaya rivers and also on the north-western bank of Expeditsiya bay. These rocks form natural open-cuts on the banks of ingressive bay. They can be slightly easily divided into blocks. Fragments of the blocks were carried to the hillfort most likely over the ingressive bay, and then through sea. Mid-grained granites (group 12), microgranites, aplites and quartz fragments (group 13) were rarely used for building. They are represented by lightly rolled rocks and small fragments. These rocks make foundation of the Kraskino basin, their yields are known to be in the middle and upper river of Tsukanovka. Round rocks and large cobble of that composition were most likely took from the bed of river and carried to the hillfort by river. Sedimental lithified rocks (group 14) were rarely used for building in to the hillfort. These rocks are known to occur in the north-eastern part of Expeditsiya bay and central part of Novgorodskiy peninsula. They had been most likely carried by marine way from the Novgorodskiy peninsula with the other materials.

It's necessary to mark good territorial combination of natural resources in the Kraskino hillfort location: rich raw minerals potential and high density of natural water stourages and channels necessary for transporting big amounts of mineral raw materials. This allowed dwellers of middle-aged hillfort to use mineral resources of the surrounding territory for building and other purposes.

LATE PLEISTOCENE PALEOSOLS AND ENVIRONMENTAL SETTING OF FIRST MODERN HUMANS IN EUROPE

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The global spread of the anatomically modern humans from its African homeland which took place during the Last Glaciation is in the focus of intensive interdisciplinary study including a wide range of disciplines (archaeology, genetics, Quaternary geology and paleoecology etc). Paleosols could provide a valuable proxy for the ecological conditions of human migrations and settlement (a) producing records of local bioclimatic conditions with highest spatial resolution, (b) providing information about geomorphological setting (landsurface stability), (c) having close spatial relation to the archaeological sites and materials.

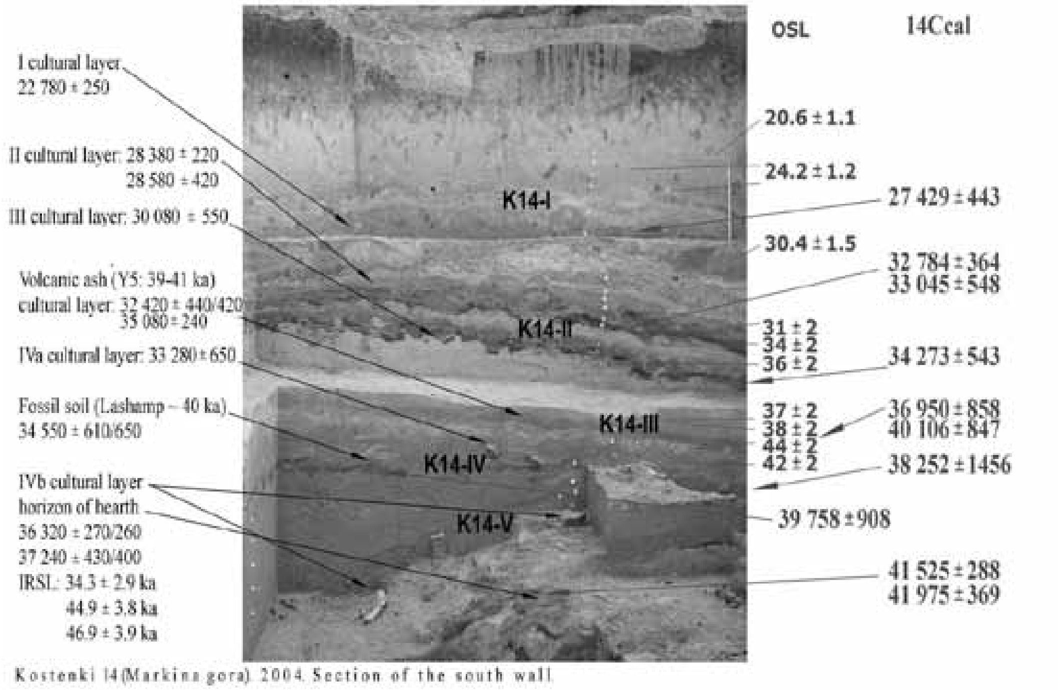
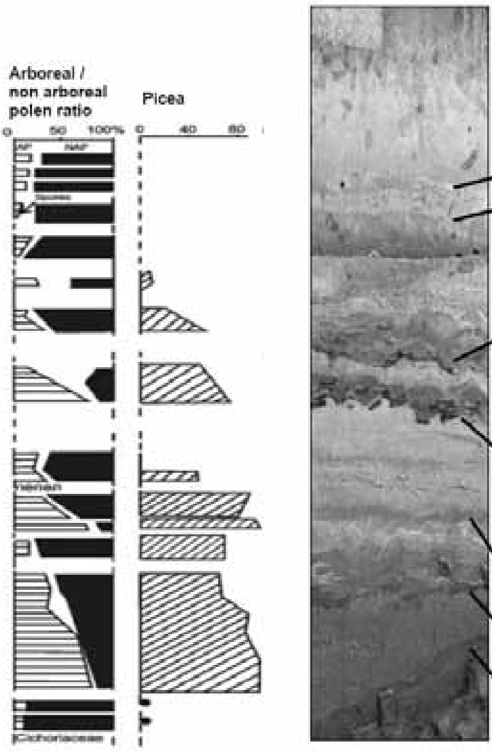


Figure 1. Stratigraphy and chronology of Kostenki-14 section



Paleosol, horizon	Pedogenic microstructure	Pedogenic carbonates	Fe-Mn pedofeatures
K14/Ia	++	++	±
K14/Ib	++	++	±
K14/IIb Bg	++	+	++
Ah	+++	+++	-
Bk	++	+++	-
K14/IIa Bg	+	+	++
Ah	+++	++	+
Bk	++	+++	-
K14/III	++	++	+
K14/IV	+	+	++
K14/V	±	+	+++

Figure 2. Distribution of micromorphological features (right) and some palynologacal characreristics (left; after [2]) in Kostenki 14

The group of Upper Paleolithic sites at Kostenki, located in the Central Russia, some 40 km south of Voronezh is known as one of the earliest localities with the evidences of modern humans occupation in the Eastern European Plain [1]. In the profile Kostenki-14 nine cultural layers in the chronological frameworks of 22-42 nonCal. ka were identified within a colluvial sequence of the slope at the second terrace of a minor valley – right tributary of river Don. Thick Holocene Chernozem is underlain by the Late Pleistocene slope deposits intercalated with 5 paleosol units labeled K14-I to K14-V (fig. 1).

Paleosols are thin and formed by rapid pedogenetic processes (humus accumulation; development of structure due to cryogenic and biogenic aggregation; cryogenic redistribution of skeletal material; precipitation of secondary calcite; gleyzation) both due to rather short formation intervals and severe climatic conditions during the Last Glaciation. Lower paleosols have more abundant redoximorphic features which require excessive moisture whereas upper ones have more abundant neoformed carbonates indicative of drier environment. These tendencies fit well to the decrease of tree pollen and increase of grasses towards the upper part of the profile. Thus the distribution of pedogenetic features in different units provide a local paleoecological proxy correlative with the paleobotanical record.

The paleosols of the unit K14-II formed between ~ 28 and ~ 32 ka BP demonstrates stronger profile development and abundance of organic materials, biogenic aggregates as well as diversity of calcitic pedofeatures. Advanced decomposition of plant residues and accumulation of colloidal humus, together with the signs of intensive bioturbation and strong maximum of magnetic susceptibility cast doubt on the earlier hypothesis of hydromorphic origin of this paleosol. Instead we suppose pedogenesis in a drained soil environment, under cool meadow-steppe ecosystem, having modern analogues in the cryo-arid soils of Eastern Siberia (for details see [3]).

A B

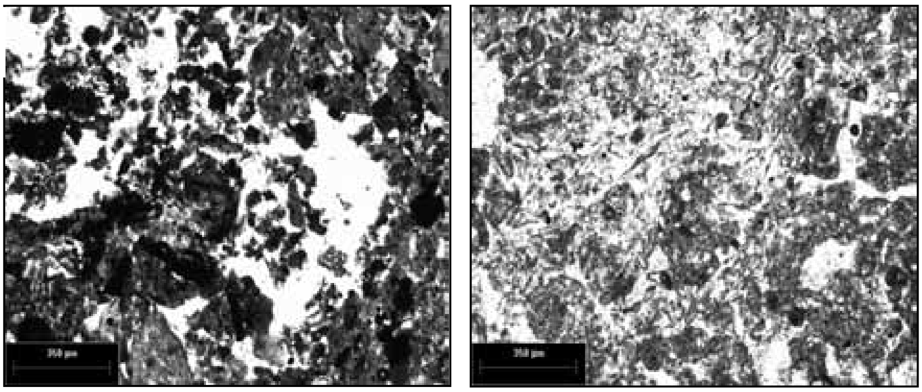


Figure 3. Micromorphology of paleosols. A: zoogenic structure in Ah horizon of PK14-IIb paleosol; B: ash inclusions (upper left) in PK14-III paleosol. Plain Polarized Light

The K14-III paleosol unit is associated with the layer of volcanic ash (probably Campanian Ignimbrite, deposited ~ 40 ka BP. The microscopic observation demonstrated that the soil is developed in the local sediments whereas pyroclastic material is very poorly integrated in the matrix and not transformed by pedogenesis; implying that the ash was deposited at the final stage of the paleosol development.

In K14 as well as in the other sites of Kostenki group the most rich archaeological levels coinside with paleosols. It means that on the local scale the occupation by modern humans coincided with the intervals of higher landsurface stability, marked by paleopedogenesis.

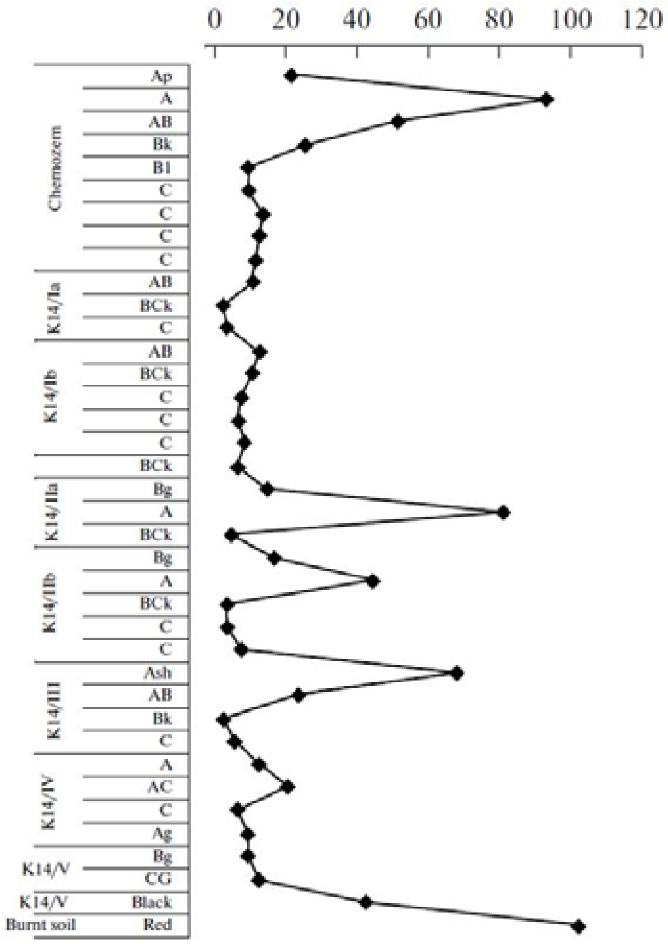


Figure 4. Magnetic susceptibility distribution in Kostenki 14

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SPATIAL MODELING OF SEISMIC-INDUCED DEFORMATIONS OF THE POR-BAJIN FORTRESS (VIII C. AD), SOUTHERN SIBERIA

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Por-Bajin Fortress is a dilapidated archaeological 220*160-m rectangular monument made of lacustrine clay and located on a small 6-ha island in the Terekhol Lake. There is permafrost in the island some 15-20 m thick. Present-day topography of the island and walls of the fortress are significantly deformed (up to 5-6 m in amplitude). Deformations were triggered by several strong earthquakes in the last millennium whose impact was detected by geological and geomorphic markers. This research is aimed at quantitative estimation of deformation amplitudes and reconstruction of ancient topography of the island which existed at the time of the fortress construction (about AD 750). We used spatial modeling in GIS to separate present-day surface and estimate post-construction vertical displacements. Methods were based on deformations of the fortress walls and topography of buried pre-construction soil studied in the field.

To model seismic-induced deformations we used terrestrial laser scanning DEM with a 30-cm resolution for the whole island, results of field coring, geodesy survey and assumption that wall crests initially were at the same horizontal level. This statement based on a technique of the fortress construction (ancient Chinese KhanTo technology) which implies impaction and leveling of subsequent layers of wet clay.

Present variations of walls tops were found to result from several sources: (1) areal subsidence of the island surface extending over large portions of the island; (2) local subsidence located under heavy outer walls only; both local and area are caused by seismic shocks; (3) gravitational collapses of wall top either induced by seismic shocks or resulted from other reasons. Corrections for top collapses were determined from volumes of collapsed masses in 6 trenches. Local subsidence were estimated in trenches and interpolated in a digital model (fig. 2). The range of value of local subsidence – up to 2 meters. Maximum of deformations under south and east walls. Areal subsidence of the island surface estimated as deviations from the horizontal level along wall crests of the fortress on DSM-profiles minus local deformations (fig. 1). Values of areal subsidence were determined along all outer and inner walls and interpolated into regular grid to make a digital model of the island deformations. The range of value of areal subsidence – up to 7 meters. Maximum of deformations is in the NW corner and east part of the fortress area.

Surface of the island is buried under the fortress construction and its derivatives. Data from over 100 cores was used to make DEM of the soil surface as a present-day natural topography surface (fig. 3). To reconstruct initial (paleotopography) topography of the island before fortress was built DEM of the present-day natural topography was summed with the deformation models. The final result that initial topography of the island was low-relief, more flat than nowadays and more appropriate to fortress construction (fig. 4).

The results obtained contribute to the RFBR Project 09-05-00351.

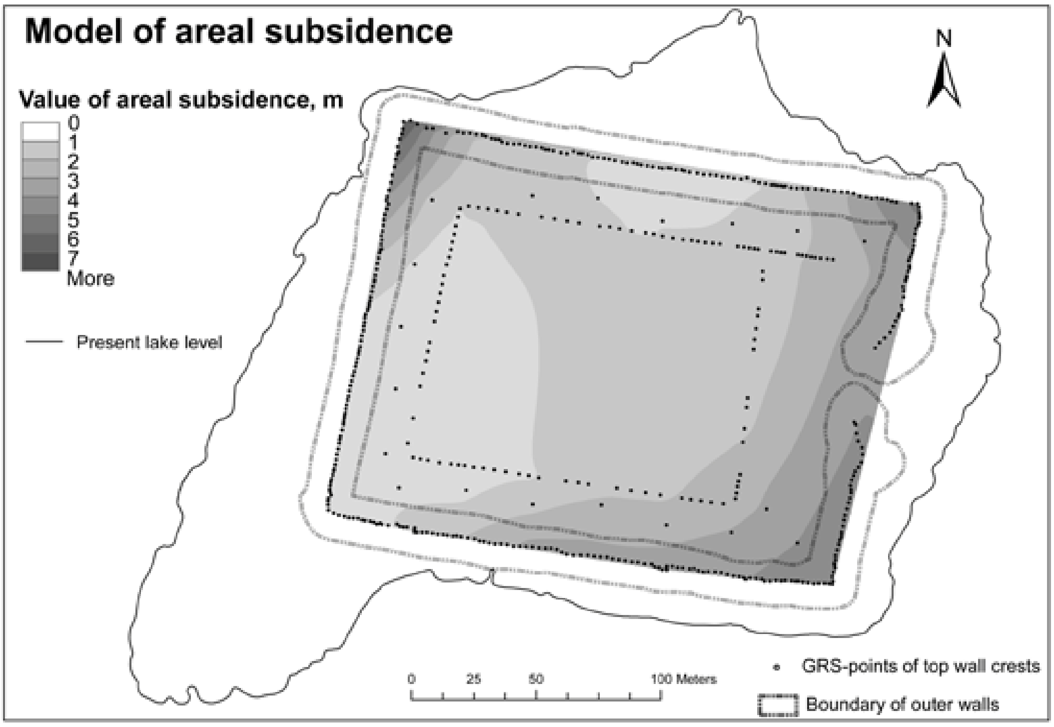

Figure 1. Model of areal subsidence

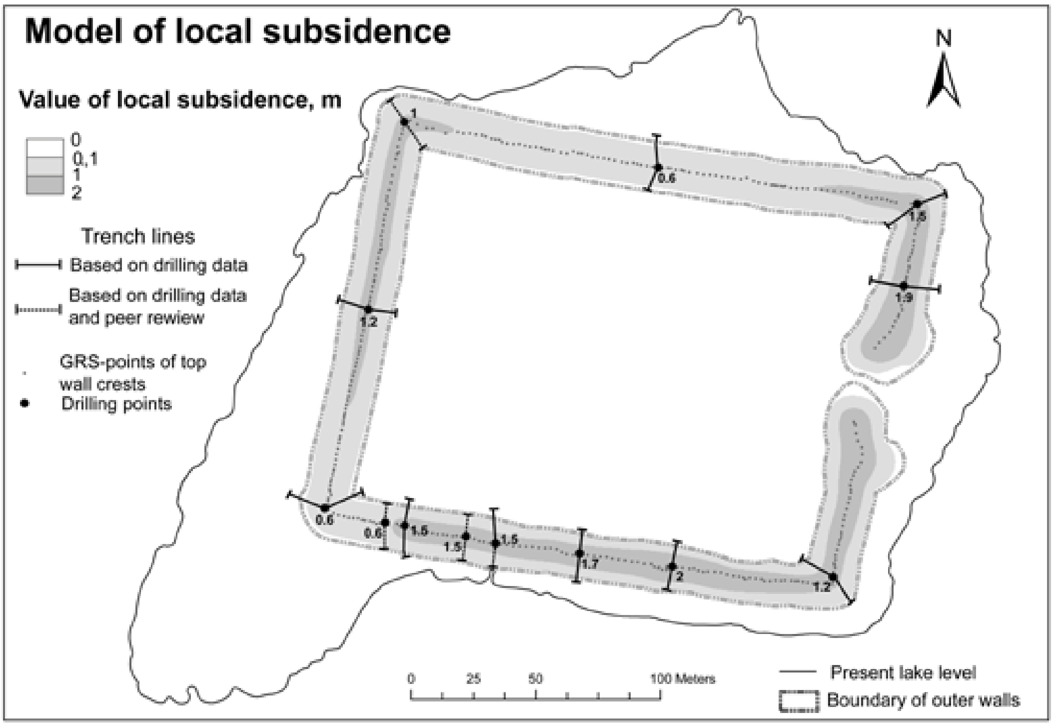

Figure 2. Model of local subsidence

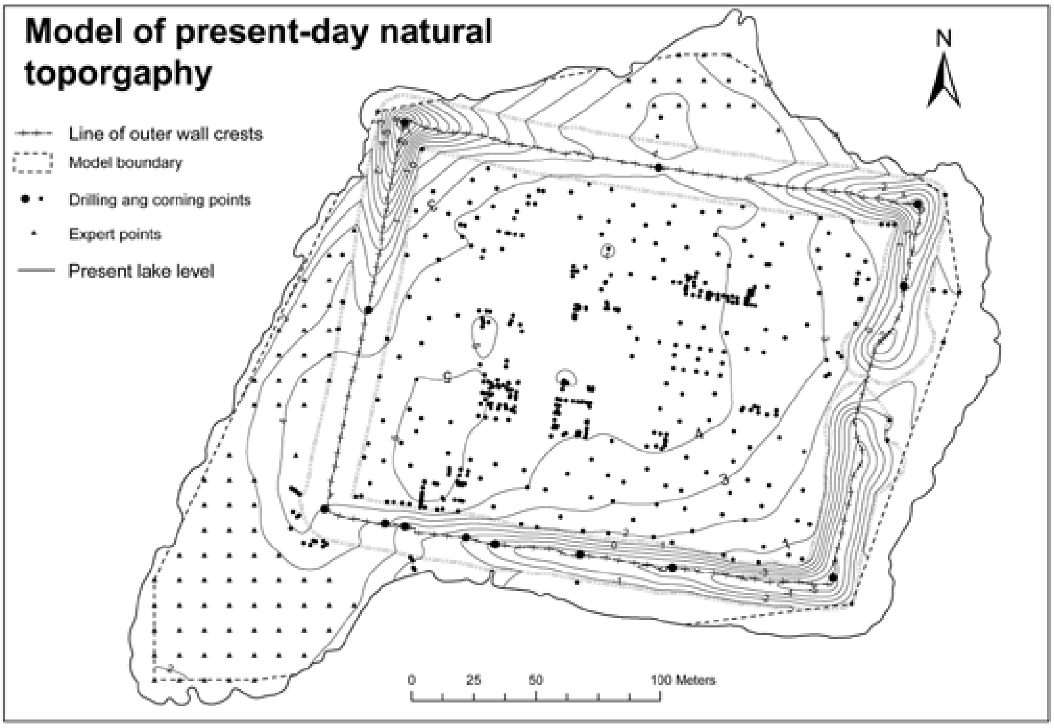

Figure 3. Model of present-day natural topography

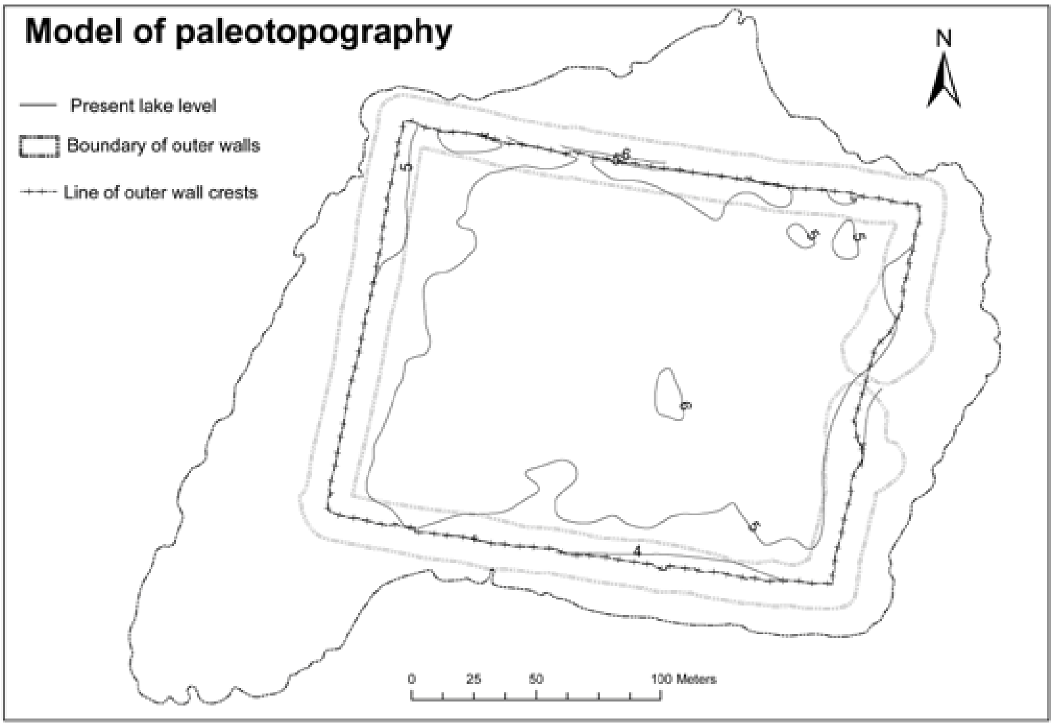

Figure 4. Model of paleotopography

VIKING HERITAGE SITES IN RUSSIA AS TOURISTIC OBJECTS: SOME RESULTS OF FIELD RESEARCH 2011

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Looking into the question of mediation of the Viking history, or in other words – Viking – Russian contacts and exchange in the Viking Age, there are rather pronounced differences between the different sites of Viking history, and between museums visited. Some of the sites have a well developed mediation at a local or regional museum, often connected to a home page. In Staraya Ladoga, as well as in Izborsk and Novgorod, there are a well illustrated display of the Viking Age history at the museums, and connected to that an illustrative home page.

Many of these sites are directly connected and referred to the early history of Scandinavian – Russian contacts, mentioned in the Primary Chronicle, and give a good view of the Viking history in the region. They all, more or less, refer to the history of Rurik and his brothers as symbols for the early history of the towns, even if it sometimes is not explained who Rurik and his brothers were.

Other sites of Viking history are less well promoted in museums, as in Rostov (In particular about the Sarsky hill fort) and Belozersk local museum (about the earliest phase of settlement around White Lake). For instance, the extensive excavations carried out at Timerevo (more than 400 burial mound excavated, and huge areas of settlement) and at Petrovskoe in the surroundings of Jaroslavl, is to a very limited degree on display in the museum in Jaroslavl.

The museum, situated in the Kremlin, where they mainly display the history of present day Jaroslavl back to medieval time, and have very limited information about the Viking connections found in the different archaeological investigated sites in the vicinity of the town.

In Rostov, as well as in Belozersk, Pskov and Karelia, there is some information about the sites with Viking material, but they only represent a small part of the exhibitions, and have very few objects, etc from the sites in question, and give a rather limited overview of these sites.

The investigations into the question of Russian Viking routes, there are some clear positive sides of it, as well as some obvious problems in making the Viking theme into a tourist product. The two most basic strengths are first of all the rich heritage seen in the artefacts as well as in the many monuments and sites in the landscape. It should also be noted the many written sources of this Eastern Viking Route, in the Icelandic Sagas, on runic stones in Middle Sweden, as well as the Primary Chronicle. Many years of intensive archaeological excavations and research has given a clear picture of the importance and extensive contacts that existed between Scandinavia and Russia in the Viking Age.

It is also clear, that these contacts were not just casual, but could also be seen as a kind of immigration, far wider than just the main trading routes and towns. As evidenced by thousands of objects found, spread over a huge area from Kiev in the south to Lake Ladoga in the north.

The other main strengths are the many museums and exhibitions that display the Scandinavian – Russian contact in North-West Russia, even if some are at a rather rudimentary lever. But it is a basic resource on which to build a much more elaborate information on, and they exist more or less in all the places of importance. Reports and books in archaeology are a complementary source, even if many places the information is only to a limited part published and that is mainly in the Russian language.

Another resource is the knowledge as well as interest among the responsible people in charge of many of the sites. In discussions with representatives of the museums and exhibitions, there is a keen interest in developing the sites as well as the basic information further, and at some places, like Novgorod / Gorodische and Gnezdovo, there are advanced plans for developing the sites much further into important tourist destinations along with the sites in the landscape, which is very encouraging.

Among the towns and sites connected to the history that are mentioned in the Primary Chronicle, connected to the coming of Rurik and his brothers, there is a clear image of the importance of this information, and in many places they use this history as a symbol of the town, as for example in Novgorod / Gorodische, Belozersk, Staraya Ladoga and Izborsk.

This connection of many places to the history of Rurik is a common base to build a network, as a foundation for Viking Route Russia. As mentioned earlier, in Belozersk, they are currently advertising the year 1149, meaning that 2012 will be the 1150 anniversary celebration of Belozersk, being the place for Rurik’s brother Sineus, and the «beginning» of the Russian State.

In this connection, it is rather interesting that President Medvedev, and the Russian government, has decided to celebrate the year 2012 as the beginning of Russia, giving an interesting opportunity for marketing the Scandinavian – Russian common history in the Viking Age.

Looking into the weaknesses of the idea of Russian Viking Routes today, they are mainly two important ones, very much connected to each other. The basic problem is the, in general low knowledge of and, perhaps, interest in the Viking age history. Besides people directly involved in museums and exhibitions or archaeological excavations, the public have, what it appears to be, very little knowledge about that history.

And this also, on a general level, goes for the tourism industry. As far as we have experience, there is very little tourist information about the Scandinavian-Russian early history, and very few of the sites are included directly in a general tourist product, like for instance the impressive exhibition in Kirillov.

There are of course some exceptions, mainly in Novgorod / Gorodische, and to a certain degree also at Izborsk, where the public probably are more aware of the Scandinavian-Russian history. It also looks that administration of sites from municipalities or regions, are, with a few exceptions, very little devoted to protect and manage these sites in the landscape, which leads into the second main problem - the maintenance of sites and monuments.

Most of the sites are in a rather bad state of repair and there seems in general to be no plans for development or maintenance, with some exceptions like Gorodische and Gnezdovo. It is also obvious, that without an emphasis on the importance of this early history of Russia, both among authorities as well as from common people, there will be no tourist product.

Suggestions for development. From the discussion above, it is obvious that the main and basic problem of developing the Viking Route Russia into an important theme, both for the general public and for tourism, is partly the ignorance among the public, the tourism industry and the authorities about their Viking history. This ignorance is directly connected to the rudimentary maintenance of sites and monuments in the landscape and it is probably rather difficult to spend money on maintaining of a site to which people have little connection, be it the public or the authorities. But, there is also a limited knowledge from the outside of the fascinating history of Scandinavian–Russian contact in the Viking Age, and the huge number of places as well as material found in this connection.

To achieve the goal to develop the Viking Route as an important part of historical tourism in Russia, there is obviously a rather long way to go, at least if one wants to make it into a broad theme, connecting many places in northern Russia. Some places are well on their way, like Novgorod / Gorodische and Izborsk, but for other places, there is much work to be done.

The logical first step is to create an information and educational package about the history, in as many ways as possible, and it is a golden opportunity in 2012, being a celebration year about the year 862, the year of Rurik and his brothers. Below, there are suggestions for the short and long term to turn the Viking Age history into an important part of northwest Russian tourism industry, with a connection to Viking History tourism in Western Europe.

Is this all possible or not – it is still a question. In the existing system of three-level budget with very few money in local municipalities the organizing of such a network looks very problematic. The other problem is less interest of local stockholders to immediate Viking heritage: the more interesting for them is «History of Old Rus» while even it is the same the name «Viking» could play very negative role while promoting the heritage in provincial Russia. Sometimes one could hear very serious dialogues among the stockholders (not historians of course) about the probable nationality of Rurik etc. In any case the only way to promote something, to elaborate the heritage of «Plotting Rus» or «Viking Heritage» – is private initiative. During our expedition only in Beloozero-Kirillov region we had met with the existing and working model of such private initiative. The traditional state maintenance, with very strong Soviet heritage, practically everywhere lose the initiative while following different instructions and report indicators (such as number of excursions per year etc.).

GEOTOPS OF IRAN PLAYAS: A GEOARCHAEOLOGY EVIDENCE

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Playas are important geomorphic features of the world's arid regions and are considered to be very sensitive to hydrologic and climatic changes. Those classified as a geomorphologic unit of desert areas. Playas vary in size from very small depressions of a few tens of m^2 to massive tectonic basins, which may extend up to 10, 000 km^2. Given the range of origins and scales, these playas display wide range of variability in morphology, hydrology and sedimentology. During the last few decades, playas have received enormous attention due to their significance as indicators of climate change and palaeo-hydrological reconstruction. While the landscape and drainage in playa catchments provide a qualitative assessment of climatic and hydrological regime in the past, playa sediments preserve a wealth of palaeo-environmental information. The geomorphologic types of playa such as Kavir, salt lake and morphologic facies, have been caused the playa as a unique entity for geoarchaeology studies. Iran having more than 60 % desert environments has vast expanse areas of playa units. Central Iran with a wide section of the Lut desert can be a good sample of playa landforms which are an evidence for geoarchaeology and also with high potential for geo-tourism activities. The Yazd region, located center of Iran, constitutes one of the most significant environmental and cultural reserves on Iran, strewn with unique and significant natural geological monuments that are called Geotopes. The Geotopes are the meeting places of elements recording the geological history of each region. Those are the irrefutable witnesses of an everlasting evolution of life on earth, such as volcanoes, caves, gorges, fossilized areas, large geological rifts, ancient mines, geological formation or landscapes chiseled by natural forces throughout the geological ages. Such sites have a special scientific and aesthetic value and could become areas with significant tourist interest. Recent efforts to record, upgrade and exploit a number of geological sites in yazd have produced significant results; the erratic rocks on the Fakhr-Abad, the cirques of Tezergan on Tezergan, the glacial gorge in Deh-Bala, the underground natural dam on Mehriz and sand dam in ashkezar and the granite rocks and the marble mine, the gorge in Taftb, the Kavir and glassi desert in Abar Kooh and Darangier to mention are cased Yazd to be as a natural history museum. Desert of Yazd with extended area of Playa unit as a typical geomorphologic unit involve specific Geotops which reminiscent quaternary climate change and glacier conditions of desert at Pleistocene age. The Playa of desert, there are a number of witnesses in this area that shows this place have had a wetter climatic period in past. This article with new approach to the geomorphologic landforms has been introduced the Geotops and considered those as an evidence for geologic history and geomorphology evolutions and also as a geo-tourism features.

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ISLANDS KROSSØYA AND RUSSØYA GEOLOGICAL AND ARCHAEOLOGICAL MONUMENTS OF SPITSBERGEN

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Interest to Murchison-fiord is caused by variety of the reasons. One of the main things of them is that that in a gulf the most northern monuments of Russian pomors settled down. Already this fact carries them to the category of the unique. The same concerns and quarternary adjournment. It is connected with inaccessibility of islands Krossøya and Russøya, difficult ice conditions in comparison with other areas of archipelago.

In the summer by 2005 geologists PMGE have been studied Quaternary deposits and a geomorphological structure of island Krøossoya. Here the section Quaternary sediments in coastal cliff at southern coast of island has been made (fig. 1). Section is binomial. The bottom part consists of thickness till, presented red-brown silt with inclusion of boulders, gravel and pebbles. The cluster material is non-sorted and also is non-directional. In deposits small indefinable fragments of shells are found out. Contact to overlying deposits to numerous pockets of filling. These sediments are interpreted by us as marine-glacial, concerning the top link of a Neopleistocene. The top part of a cut is combined by sea-shore series of sand, gravel and pebble in which roof the pack beach gravel lies down. Thickness of sea deposits varies from 3 to 6,2 m. From this horizon, from height of 4.3 m above sea level, shells *Mya truncata* (Linne) are described. The radio carbon age of this sample has made 9 080 ± 100 years, and calendar 10 250 ± 140 years [1]. This dating fixes the beginning sea Holocene sediment sedimentation.

In the geomorphological plan the island Krøossoya represents terraced plain with the maximum absolute mark of 22 m (the cross location). Following sea levels are most accurately traced: 1-2 m, 5-6 m, 10-12 m, 18 m and 20-22 m.

Dating from Quaternary sediments of this island concerns the sample selected in 0.7 km to the west of the made section on coast. As a material for dating the fragment of an edge of a whale which was on a platform of a sea terrace of level of 6 m in the field of a rear seam served. The radio carbon age of this sample has made 6 540 ± 90 years, calendar – 7 440 ± 90 years [1]. Thus, received ^{14}C datings, along with earlier published, and also studying Quaternary sediments bring the new information on formation and age of coastal lines, formation stories Quaternary deposits in Neopleistocene-Holocene and character of the newest tectonic movements in one of the most remote areas of Spitsbergen – Nordaustlandet.

Pomorsky monuments on islands in Murchisonfjorden, located at west cost of North East land, are the most northern (80° N) archaeological complexes (fig. 1). On available sources it is Northern Russian island (Nordre Russøya), island Krøssoya and the Big Russian island (Søre Russøya). However, on the card of 1898 made by the researcher of these islands by Swedish geologist Wilhelm Karlhejm-Gjullensheld, the island Krøossoya appears as island Itteren (Ytteren).

On a raised place of a southern part of island Krøssoya Swedes have found out and have photographed an eight-final Russian orthodox cross in height of 5.5-6.0 meters at which the lowermost crossbeam hasn't remained, but for it there was a slanting groove. The basic vertical part of a cross has been made of «the tree trunk beaten to coast» in diameter about 40 cm which basis was the fixed solid stone laying. The round tree trunk towered over krepid approximately on 60-70 cm, and then passed in accurate затесанный a vertical bar to which cross-section boards fastened. On them the reduced inscription in the Church Slavonic language, literally translated as «JESUS the NAZARENE the TSAR JUDAIC» and «JESUS the CHRIST the SON DIVINE» was read. On island as marked Karlhejm-Gjullensheld, «any rests of dwellings were absent». In the bottom part of a vertical rack much later inscriptions and the abbreviations made Latin letters and belonging, to possibly, Norwegian field men or tourists are fixed. The Swedish researcher about them writes nothing, hence, they could appear not earlier than the beginning of XX century. The cross of second half XVIII-first third XIX centuries is dated.

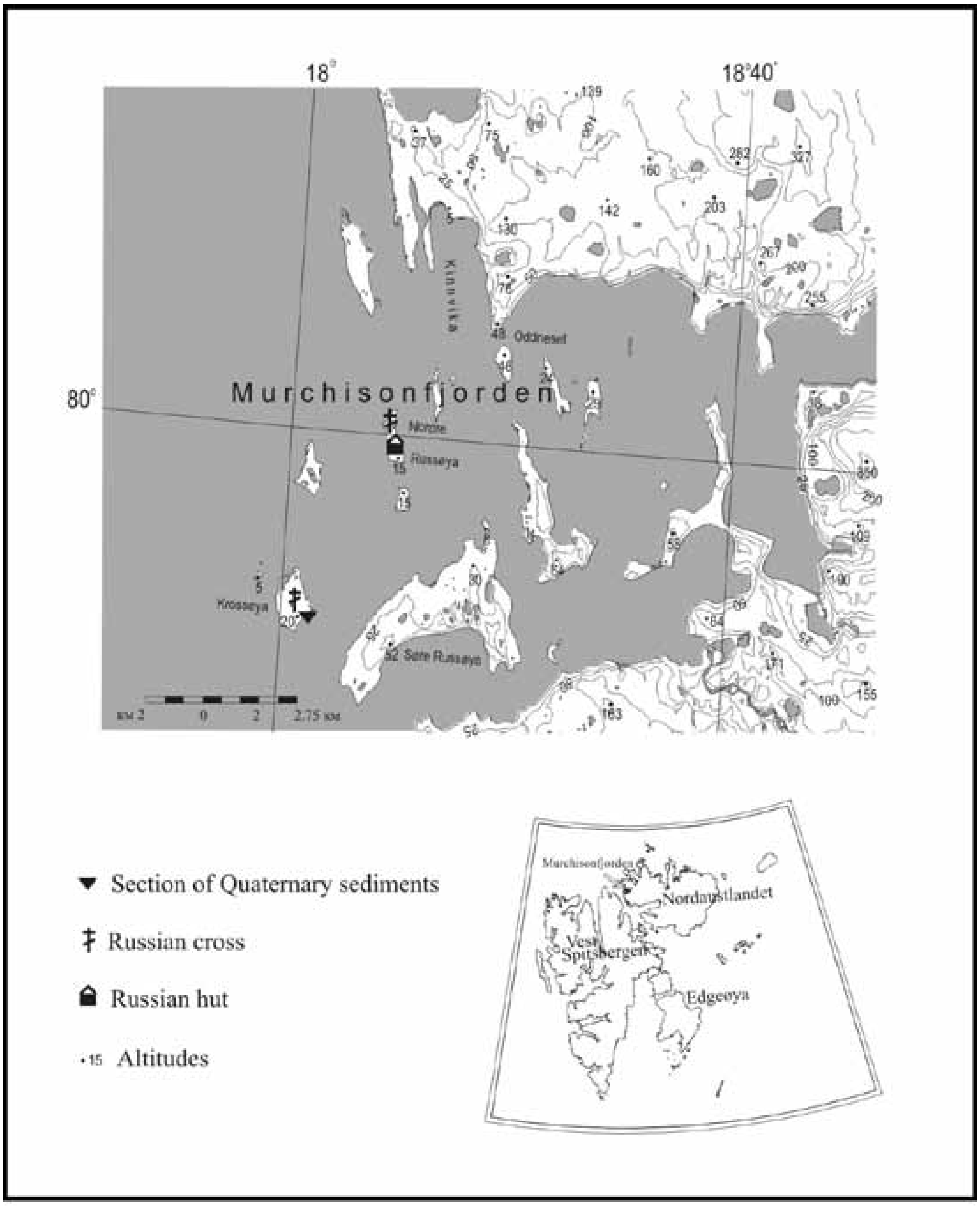

Figure 1. Spitsbergen archipelago, showing the study area

The first information on this cross was given in the notes N.A.E.Nordenskold, by the visited island in 1861 as a part of expedition of Otto Torrelja. After Karlhejm-Gjullenshold the Canadian scientist Veston Blake in 1957 and has visited Murchisonfjord as a part of Swedish гляциологической expeditions 1958 and has photographed a cross [2]. In 2000 Swede U.Urokberg has visited Northern Russian island on which has made Russian monitoring settlement, dug out in 1898 Last picture of a cross on Krossojja has been made by one of authors in 2005. And if it to compare to V.Karlhejm-Gjullenshelda's 1898 [3] photo it is necessary to notice that the massive laying in the basis of a cross hasn't undergone essential changes and furthermore destructions, and the cross through 100 with superfluous has appeared years quite in a good condition unless inscriptions became less distinct.

The cross on Krøossoya, most likely, could carry out some functions. First of all it was worshiping cross and at the same time - navigating, but it also could serve and as land-surveying sign, i.e. to be as an application column on the given trade territory. Besides it is not excluded that under a stone bookmark in the basis of a cross which didn't understand, there can be a burial or burials. On Spitsbergen secondary burial places in the basis of the big crosses, as a rule, in the form of separate skulls, not a rarity. As an example it is possible to result burial places of 10 skulls in the cross basis on settlement Skoltneset; finds of several skulls are found out in bottom of crosses on anchor parking «Sofia» in Wood-fiord (Lifdebay) and in Bettibukte in Storfjorden.

After V.Karlhejm-Gjullensheld's island Krøossoya the Big Russian where has put the camp on a place standing there has gone on island there is no time the large Russian settlement consisting of set of log huts and the big cross which, by the time of arrival on island of Swedes, field men – possibly have disassembled, Norwegian. According to skipper Pedersen «Russians lived here within 36 years, and earlier Russians vessels could come directly into a lagoon, but in 1898 the Swedish boat at small water often took the ground» [3].

Having left the Big Russian island, Swedes have gone on Northern Russian, on pomors settlement which scale enough excavation has made. In 200 meters from a two-private log hut there was a high 5-meter cross. Inscriptions on it weren't (probably, hasn't remained), but in the bottom part of the basic vertical rack there was scratched figure 1798, possibly, not connected with founders of the cross, i.e. pomors, but indirectly specifying that (and settlement) will erect a cross here before this date. Another, destroyed, the cross stood on a high rock near to a log hut. Its vertical rack on height from 3 to 4 meters has been scratched by the bear claws. Cross-section boards of a cross haven't remained. During excavation of Karlhejm-Gjullensheld tried to define design features of Russian dwelling, having made many interesting supervision. In limits pomor houses and out of it rather rich collection of individual finds has been revealed, a mass ceramic material, subjects of spiritual culture, etc. It is possible to tell without exaggeration that in Murchison-fiord he spent to saving excavation and thus marked vandalism traces on a monument. Northern Russian island which has visited in 2000 Swede Urban Uorberg who has photographed a cross and the rests of wooden construction, also has paid attention to traces of barbarous destructions of the settlement [4].

The settlement in Murchisonfjorden didn't represent large for long-term dwelling становища, as for example, Trjughamna, Habenihtbukta, Russekejla, etc., widely extended across Spitsbergen in XVIII century But it was quite sound seasonal settlement on which from continent field men went in June, and came back in August. About one of these islands (Krossøya, Russøya and Northern Russian), most likely, went speech at polls pomor. Industrialists informed that «most northern to the north the point which they reached, is the small islet lying in the northeast where they are forwarded sometimes from Lovely harbor on small boats», and some from pomors visited also nearby the located North East land [5].

If islands in the Murchisonfjorden, formed in Quaternary the period, are one of most far away on archipelago the archaeological complexes located on them should be considered as the most northern pomor (and not only pomor) monuments in Arctic regions. Geological and archaeological researches, certainly, supplement each other, therefore their further continuation is represented perspective enough in business of more detailed studying of monuments of Murchisonfjorden.

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TYPES OF ARCHAEOLOGICAL MONUMENTS OF THE SAMARQAND SOGHD

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Typological classifications of archaeological monuments offered in the article are based on the materials received during the archaeological exploration of the town site Durmen (ancient Istiskat) and surveys conducted from this stationary base by the Central Asian Archaeological Expedition of the State Museum of Oriental Art in 1986-1991 in the Pastdargom region of the Samarqand Province of the Republic of Uzbekistan. We also took into consideration the data on the distance analysis received during the recent years on a much broader territory. The classification offered here is not meant to be all-embracing and is based exclusively on morphological properties of the sites. Yet the morphology of surviving ruins allows one to identify the following categories of monuments: А – dwelling complexes; Б – military architecture; В – religious buildings; Г –burial structures; Д – irrigation constructions; Е – agricultural lands; Ж – mines. Each category consists of subdivisions containing typologically related objects. Such subdivision permits categorization based on secondary properties, on properties of the third grade and further down on lower grade properties. While the properties used to distinguish the type of a monument are purely formal, the name assigned to each type reflects the function of the monument. Altogether we distinguish twenty two types of archaeological monuments. In process of work on the principles and the main properties used in this typological classification of archaeological monuments, authors had to pose and address various questions, the social organization of the Soghd in historical prospective being one of them.

OUTLOOKS OF THE DEVELOPMENT OF THE HISTORICAL AND ARCHAEOLOGICAL COMPLEX IN SMOLENSK ON THE TERRITORY OF THE SVIRSKAYA SLOBODA

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Being one of the most ancient cities in Russia, Smolensk abounds in archaeological and historical sights. A lot of mysteries of its origin and development have not been unveiled completely so far and there are significant difficulties in uncovering the truth. To a large extent it is caused by the following facts: Smolensk has been destroyed many times during the wars and rebuilt with significant changes not only in its appearance, but also in the depth of the soil that could have told us much about the past. For the last two decades there have sprung up new difficulties in conducting a research to reveal the unknown «pages» of the past which are caused by a tendency to carry out construction in any vacant territory in the city and in some places where there used to be the ancient town.

There are only few places of the ancient construction left on the territory of the city where there haven't been any substantial remakes and where there can still be held some archaeological research. There is one of such places in the vicinity of the Michael Archangel Church (the Svirskaya Church) that was erected between 1180 and 1197 by David Rostislavovitch on the Svirsky Hill. This church at the country palace of the duke was considered to be the best among all churches existing in the town at that time. It impressed all contemporaries by its size, stateliness, symmetry and grandeur. This church is unique not only for Smolensk, but also for the Russian architecture on the whole, because a lot of new tendencies are inspired by it. The church was distinguished by its luxurious decoration, i.e. colourful paintings, precious articles of worship and holy vessels, floors with shimmering multi-coloured glaze.

The palace was situated not far from the church and the Prince visited it every day, at least some historians claim it. However, the exact location of the palace is unknown. Some sources indicate that it was situated to the south of the church. Nowadays these is a vacant territory about 1 hectare to the south of the church next to the cemetery. It is not under cultivation at the moment, there are only scattered trees there. The land belongs to the lyceum which was built in the 60^{s} of the last century. Unfortunately, there is no guarantee that this vacant lot wouldn't be allocated for the construction of cottages or any other buildings, because it is not included in the list of places that have some historical value.

There was a private house on this territory where there lived three families from the end of the Great Patriotic War till the mid-80^{s}. The major part of the territory was used for vegetable gardens and for orchards.

We can infer with a large amount of certainty that it is the territory where either the country residence of the Prince or the main part of buildings for his servants and his armed force was situated. The existence of a huge cultural layer in the soil of the considerable part of the territory, which is not characteristic of any neighbouring regions, is good evidence of this fact. The soil here has not only a significantly strong humic horizon, but also a rare clot and dust structure, peculiar to the places of centuries-old reclamation.

The annexe built at the southern side of the church in order to show the main entrance, which existed for a long time till the beginning of the restoration which was held in the 70^s, can be treated as another evidence that the Prince's residence was located to the south of the church. It was demolished as well as another larger annexe on the pretext that they were both built later than the church itself.

The territory to the south of the church has been subjected to the anthropogenic influence for all the centuries since the construction of the church. However, there are no data on what has ever been built there. There is no doubt that there have been numerous changes in the state of this land. The last significant change took place during the Great Patriotic War. There were anti-aircraft guns there, apart from that some shelters and dugouts were built on its territory.

Some traces of foreigners' stay were found there. There is some evidence of their stay such as a sabre of some foreign origin found in the last century in the 50^s. Big forged nails, pieces of broken crockery made of clay, which were not typical for the plates and vessels of that time, are also attributed to the past times.

These days this lot is somehow preserved. As the soil is not being cultivated at the moment, there are favourable conditions for conducting excavations. Even in case no diggings are carried out or nothing significant is found as a result of excavations, the soil of this territory should be applied as an original testing ground for exploration of all changes that have happen to it in the process of long usage.

There is an old open pit, which is mainly lined with cottages, to the south-east of the church less than 300 meters away. It is possible that the loamy soil extracted from this open pit was used for production of bricks to build the church. This hypothesis can be proved by the fact that no substantial buildings have been built in this western part of the city for the last few centuries. Another old open pit, where there are also many cottages, is situated several hundred meters to the south of the first open pit. Only specialists conducting special research can define whether the soil extracted from these open pits was used for building the Svirskaya church or any other churches. Nothing is mentioned in the chronicle about who built the church, where the raw materials for producing bricks were extracted from or where other construction materials were brought from.

The cemetery which is located near the church is one of the oldest in the city. Burial places in its southern part, where primarily noble people were buried in the ancient times, could tell us much about the history. It can be proved by original creative monuments that existed here till the 60^s of the last century (e.g. a peculiar monument in the south-eastern part of the cemetery made of granite in the form of an oak tree) and burial vaults. Some coffin chambers, where people of different generations were buried, are characterized by rich decorations and by various articles made of silver and gold. Unfortunately, they were plundered during the first post-war years after the prohibition to bury people in this cemetery.

Nowadays there are neither any monuments, no any tombs of different burial periods. Almost all the territory of the cemetery near the church, especially to the south and to the east, is flattened. From the south-eastern part there is a road built on the place where there used to be tombs. A lot of cars move on this road on significant religious holidays. There is also a building owned by the church erected in the western part of the cemetery and a road made on the old tombs leads to this building. Names of people who were buried in the old southern and eastern parts of the cemetery might have been in some way connected with the history of our city.

It was not a coincidence that the Prince's palace and all the accompanying buildings were constructed in the vicinity of Smyadyn'. This place was chosen with the purpose of having a better control over the situation on the quay where great many ships came to on the Dnieper.

There is no doubt that the whole territory to the north and to the east of the church as well as the territory along the Dnieper to the west to the Cathedral Hill (along the modern Bolshaya Krasnoflotskaya street) was lined with buildings. These places haven't been duly explored so far. There are only scarce data about the population of this territory and about the role it played in the development of the city.

There is also no data about what the river Smyadyn' actually was. As far as we can judge by its length at that time, it was just a comparatively small water stream. On the basis of preliminary research of its mouth, it is possible to claim that it didn't fall into the Dnieper itself, but into the significantly long river bay, that was preserved on the place of the riverbed which used to exist there in the ancient times. This river bay might have been deepened and widened in order to allow more ships to come.

There is no doubt that as a result of conducting a substantial complex research on the territory of the Svirskaya Church a lot of new significant information on the history of the city can be obtained. Provision of the necessary facilities and amenities on the territory of the Svirskaya Church and on the neighbouring part of Smyadyn' can lead to setting up an attractive tourist complex there in the future.

MODELS OF LANDSCAPE USE IN THE UPPER PALAEOLITHIC

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There appear to be two principal reasons for apparent variations in landscape use by Palaeolithic humans: (a) the relationship between material culture and the environment, reflecting foraging strategies and raw material procurement, and: (b) the development of a survey strategy for new site discoveries (based on (a)), which is nearly absent in modern Palaeolithic archeology.

Throughout prehistory and history, human populations have never distributed themselves at regular intervals on the landscape. Settlements were invariably concentrated in specific places and separated by unoccupied areas. The clumped character of population distribution may be considered a particular feature that distinguishes humans (genus *Homo*) from the remainder of the animal kingdom.

During the historic and proto-historic periods, with constant military conflict, the natural defensive properties of the landscape became paramount in the selection of site locations. Two settings for cities were typical: an island, protected by water barrier, and a natural promontory, protected by steep slopes. In contrast, defensive considerations did not play a fundamental role in site location in a prehistoric context, where natural fortification features are unknown. Nevertheless, the regional character of population distribution on the landscape also is evident in prehistory. In Eastern Europe, several concentrations of Upper Palaeolithic sites may be recognized: Kostenki-Borshchevo on the Middle Don River, Chulatovo-Pushkari on the Upper Dnepr River, the Dnestr – Prut area, the Volyn – Transcarpathian area, the area around the Sea of Azov, the Volga-Oka interfluve, and the middle Ural Mountains. The specific appeal of these areas remains unclear, because the areas containing concentrations of sites do not seem to differ from adjoining areas. Three avenues of research may be pursued in quest of an explanation:

1. Relationship with climate zones. The association of the principal cultural entities with large river basins, which on the Russian Plain extend longitudinally and cut across climate zones, is a distinctive feature of the East European Upper Palaeolithic.

Sites of the Initial Upper Palaeolithic (IUP stratum) (42-36 ka) are distributed from Crimea in the south (Buran-Kaya) to the Urals (Zaozerie) and Transcarpathian area (Sokernitsa). Assemblages of the Early Upper Palaeolithic (EUP) (36-29 ka), as everywhere in Europe, exhibit a binary structure comprising the Aurignacian (pan-European distribution) and the local «transitional» Streletskian, and reveal the same pattern of distribution. Aurignacian sites are known from Crimea to Kostenki (Middle Don River) and the Transcarpathian (Beregovo). Streletskian assemblages are found from Lower Dnepr Basin (Vys) and Lower Don (Biriuchaya Balka) to the Middle Ural region (Garchi). A similar pattern is evident in the middle Upper Palaeolithic (MUP) (28-20 ka), a distinctive feature of which is the «mosaic» of Gravettian cultural unities, and also for the late Upper Palaeolithic (LUP) (19-12 ka), with some local variants of the so-called «epi-Gravettian» technocomplex. Only one archaeological culture exhibits a latitudinal distribution. This is the Kostenki-Avdeevo entity – the most expressive archaeological culture of East European Palaeolithic. Almost all the sites are found on the margins of the Central Russian Upland. It remains the only one case of a probable link between the distribution of a cultural unity with a macro-landscape latitudinal zone.

The situation is different during the Final Upper Palaeolithic epoch (FUP) (12-9 ka), when it is apparent that there is a true division of cultural entities: (1) with tanged points, spread from Britain and Netherlands in the West to the Upper Volga in the East, and (2) cultures with trapezes and geometric microliths in the southern areas. The correspondence between the spatial distribution of archaeological cultures and latitudinal zones is further amplified during the Mesolithic and Neolithic, and emerges in the Neolithic in the form of cultures of the circumpolar, forest, and steppe zones.

In general, the East European Upper Palaeolithic appears to lack a correspondence between the spatial distribution of the ancient population and latitudinal climate zones.

2. Relationship with geomorphic setting in macro-landscapes. The presence of multilayered open-air sites with layers of different cultural traditions appears to reflect the universal character of locational criteria in selecting sites. Examples from Kostenki reveal a common set of criteria for the people of the Streletskian, Aurignacian, Gravettian and other cultural traditions that determined the place for settlement over 20 ka under constantly varying environmental conditions.

Two patterns of site selection with respect to geomorphic setting are evident for open-air sites: 1) on terrace promontories, chiefly in deeply incised valleys (a setting that offered protection from wind, proximity to freshwater, and steep slopes convenient for hunting gregarious animals; the best example is found among sites of the Kostenki group); 2) high elevation, associated with natural increases of relief with the dominant position in landscape (a setting that offered a maximum view of the surrounding landscape for observing the movement of gregarious prey animals; the best example for this pattern seems to be the sites of Kamennaya balka' group in steppe region near the Sea of Azov).

Actualistic logic is the main basis for interpreting both patterns: the advantages of one automatically are the disadvantages of the other. While the location of sites in deep valleys restricts the view of the vicinity, the location on a high elevation exposes the settlement to «all winds» and requires added effort for maintaining the supply of freshwater. It should be noted that multilayered sites on higher elevations are rare. The two patterns are mutually exclusive; nowhere are they found together at one locality. Also, they fail to show any relationship with the cultural affiliation of assemblages, with the species hunted, or with functional loading. At Kostenki, the same geomorphic setting was occupied by hunters of mammoth and those of horse. The setting is identical also for long-term structured settlements and for short-term seasonal sites.

3. Relationship with the geomorphology of the micro-landscape. The similar orientation of linear hearth arrangements in the structured habitation areas at two settlements of distinct cultural affiliation, Kostenki 1 (cultural layer I) and Kostenki 4 (cultural layer II), may be used to examine regularities of micro-landscape use. The line of hearths at Kostenki 1 is aligned with the direction of the slope, while at Kostenki 4 it is orthogonal to the slope. Thus, the relationship of the orientation of the line of hearths to the cardinal points was more important for the inhabitants of the site than its relationship to the slope gradient.

The possible relationship of site locations to places where animals might have forded watercourses and/or been attracted to watering places represents another approach to searching for regularities because both remain constants for a long time. Cultural layer IVa at Kostenki 14 provides evidence of a so-called kill site, where a herd of horses was slaughtered as a result of one hunting event. One of the models for hunting gregarious mammal assumes the use of a watering place where large mammals could have been forced to move upslope under conditions of limited maneuverability.

Another argument in favor of using of a watering place near a settlement appears to be the mammoth skeleton in bedded sediments that fill the cavity of an ancient ravine at Kostenki 14. The recurring natural mortality of large mammals trapped in marshy areas around a watering place is a pattern observed in North American paleontological localities (e.g., Hot Springs Mammoth Site, South Dakota USA).

3. Relationship to local resources. Everyday human activity requires available raw materials for tool manufacture, fuel, and plant resources, in addition to the freshwater supply and prey animals. Ideally, all of these resources should be accessible at a reasonable distance.

3.1. Raw materials for tool manufacture. Some concentrations of Palaeolithic sites display a visible connection with sources of raw material (i.e., Upper Dnepr, Dnestr-Prut areas), while in other cases, this is absent. Two patterns of raw material procurement are evident at Kostenki. The first reflects use of high-quality Cretaceous flint from a known source approximately 150 km from Kostenki. The second pattern is characterized by use of a wide spectrum of stone raw material, with emphasis on brown and reddish flint from moraine deposits and a whitish chert, locally available at Kostenki. The first is typical of the Gravettian assemblages, while the second pattern is typical for the Aurignacian, Streletskian, and Gorodtsovian, and, in general, typical for the sites of the most ancient stages of the Upper Palaeolithic (with the exception of Spitsynian, which contains imported raw-material).

3.2. Fuel. The quantity of large hearths, up to 1 m in diameter and up to 50 cm in thickness, filled with bone charcoal at the Gravettian sites provides direct evidence for heavy use of bone fuel. Most probably, bone was the primary fuel under the cold conditions of MIS2, because wood charcoal is extremely rare at the sites of this period. By contrast, wood charcoal is more common in the cultural layers of earlier periods, although this may be related to taphonomic conditions of the more humic sediments of these periods.

In general, fuel resources did not have a significant role in site location decisions. The highly adaptive abilities of Palaeolithic populations, even under periglacial conditions, ensured use of all available organic materials for fuel.

3.3. Plant resources. Although the Palaeolithic economy is traditionally characterized as «hunting and gathering», the problem of gathering remains largely unaddressed because of the lack of material evidence for plant use. Rogachev's hypothesis of «complex gathering», based on the recovery of «pestle – grinders» as tools for preparation of plant foods for long-term storage, recently received support from the identification of traces of starch on the surface of these artifacts. Nevertheless, the role of plant foods in the diet of Palaeolithic peoples is based primarily on actualistic logic and ethnographic analogy. Most likely, vegetal foods did not play a major role in the diet and did not significantly affect site location choices.

4. Conclusions

1. The lack of correspondence between specific cultures of the Upper Palaeolithic and the regional concentrations of sites suggests the absence of a connection between the spatial distribution of archaeological cultures and the environment.

2. The longitudinal distribution of Palaeolithic cultures along large river basins, cutting across latitudinal climate zones, also supports the argument that such a connection is absent.

3. Site locational criteria for settlements by Palaeolithic populations were uniform for all periods and cultural traditions.

4. The two patterns: a) within deeply incised valleys, and b) on high elevations, reflect different site location criteria and local conditions and do not correspond to specific cultural traditions.

5. On the basis of our current state of knowledge, no specific consideration (geomorphic setting, fuel, raw materials, etc.) seems to have been the only factor in the choice of site location.

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HUMAN ADAPTATION TO THE PERIGLACIAL ENVIRONMENT IN THE LATE PALAEOLITHIC

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The earliest sites of the Final Palaeolithic (12,800 – 10,100 BP, Bølling – younger Dryas) in Eastern Europe are located in different landscape zones. They base on the

Epigravettian technological and typological tradition of the previous Late Palaeolithic Age. Criteria for choice of the place for sites in the Final Palaeolithic changed a bit from traditions of the Late Upper Palaeolithic, however we are able to distinguish sites, location of which appears to be typical for the epoch.

This paper deals with the sites in thawed permafrost fissures. The Magdalenian site of Wilczyce in southern Poland [1] was dated on the basis of osteological finds to the 11,890–11,400 BP. Stratigraphically, the cultural remains lied at the depth of 90 cm down from the modern surface, at the depth of 62 cm below the ploughed soil. Almost all of the finds were located in the permafrost fissure filled with maize-yellow loess.

Excavations put in evidence a system of three generations of fissures. Archaeological material in two of them was arranged vertically and obliquely near the walls. The most recent Mesolithic wedge contained bones, chipped flints, ochre, sandstone blades. Stratigraphic analysis of the finds suggests that they came into the ice wedge due to seasonable cycles of thawing when the wedge was still partly filled by the «ice core». It is supposed that the bottom of loess was formed during the occupation of site by ancient peoples and later defrosting subsequently. Most probably, the ice wedge at the site Wilczyce is dated by the maximum of the last glaciation. Series of Magdalenian sites near Krakow lie in similar stratigraphic positions. Cultural remains of them also come from the fillings of the polygonal grid of the ice wedges, with the depth up to 5 m.

Archaeological materials from the multilayer Final-Palaeolithic site Vyshegora I (Smolensk Oblast, Novoduginsky District, near the village of Khvoshchevatoye) also connected with the ancient polygonal micro-relief [2]. This site is located within the Upper-Dnieper glacial depression which is slightly inclined towards the Dnieper River. The bed of Dnieper is carved into depression; the flood-plain is at the level of 5-6 m. According to Yu.A. Lavrushin there is no any other terraces in the valley besides that flood-plain.

Polygons were filled by pale yellow sandy loam; brown loam with flint concretions, limestones and occasionally granite boulders were identified between the polygons.

Sequences of six lithological layers have been distinguished at the site. Grey slightly humic sandy loam of 15-45 cm in thickness (stratum 5), redeposited during flooding, lied under the modern soil (stratum 6). Buried soil of 10-14 cm in thickness with the Göthenburg excurse (stratum 4) lied beneath. This layer consists of dark-grey humic sandy loam; its upper surface is slightly bulged; the soil manifests draining of the polygon. Cultural remains from strata 6-4 comprise numerous artefacts localised mostly along the polygonal fissure, but no features or objects of everyday human activity have been revealed here. Depression of wedge-shaped section, 2 metres wide, was revealed under the buried soil. It was filled by thin pale-yellow sandy loam, below at the bottom by dense brownish loamy soil with manganese compounds. Archaeological remains in pale-yellow sandy loam were concentrated on three accumulations inside the polygonal fissure and on its side. Like in Wilczyce, the archaeological materials were positioned vertically or obliquely, mostly close to the walls of the wedge-like hollow.

Material culture of the final Palaeolithic sites of the Upper Dnieper is rather peculiar. Local carboniferous flint of diverse hues was used for tools manufacture. At the modern times their nodules are abundant on the Dnieper banks. The abundance of raw materials allowed to use them wastefully, therefore debitage dominate among the finds (up to 97 %): pre-cores, debris, primary flakes and massive spalls.

Typological analysis of all stratified assemblages put in evidence the evolution of one technological tradition of material culture during the period of the site occupation.

Natural depressions and shelters were often used by ancient peoples. In addition to the Magdalenian site of Wilczyce, habitation of man in similar conditions has been recorded on the site Verkholenskaya gora near Irkutsk [3] where three fires ordered in line were identified in the filling of the frost fissure.

Analyses of animal bones from Wilczyce suggest for the seasonable character of the use of natural depression.

Evidences for other model of landscape using by final Palaeolithic peoples are presented by reindeer hunters sites of the Danish Bromme culture. According to modern reflections it existed both during the relatively soft climatic conditions of the Allerød and during the cooling younger Dryas – the time of the wide spread of periglacial forest landscapes. According to zooarhaeological analyses, economics of this culture were based on reindeer hunting together with hunting on animals of forest zone: elk, megaceros, beaver, glutton, roe. Sites of the Bromme culture were ranged mostly along the corridors of reindeer migration, near the boundary of the forest zone. It is believed that the migration routes of reindeer hunters were relatively stable and repeated. It is supposed that migration of the population was seasonable following the deer: peoples moved northwards in spring and southwards in autumn. The intensity of migrations was connected with the period of calving of the animals in the open tundra. Settlements of the Bromme culture are divided into 4 groups on the base of functional features and of the character of natural resources using: 1) places of butchering of the hunted bag located on high dry moraine hills without any connection with water-places. Sites of this type are characterized by the predominance of arrowheads (up to 100 %) in lithic assemblage; 2) hunting camp-sites; 3) workshops for flint knapping; 4) basic settlements. Hunting camps and basic sites were located near the water, often near fords where animals were the easiest prey and where sources of raw material were available [4].

Basic settlement of the Podolsk culture (local variety of Bromme technocomplex) was discovered at the source of Volga (northern bank of Lake Volgo, Valdai Plateau, Tver disrict), where the river flows out from the lake and where probably was a crossing route of the reindeer migration. The sites of Podol III / 1 and Podol III / 2 were located on the two banks of an ancient ravine, in a narrow sloping area between Lake Volgo and the adjoining bedrock slope composed of Carboniferous limestones. According to Yu.A. Lavrushin, this surface were made by small proluvial cone ejected from ravine, along to which mud torrents descended periodically and destroyed the main area of the site. Fragments of the cultural layer were preserved at the banks of the ravine. Micro-stratigraphy of the section showed the repeated occupation of this site. Excavations put in evidence a dwelling construction, oval in plan (6 x 2.5 m), with the base a bit sunken deep in the ground and a corridor-like entrance. The dwelling cut the brown iron-rich (Allerød) soil and was sunk into the underlying layer of yellow sand. Round fire-place of 40 x 50 cm in diameter was identified in the centre of dwelling. Radiocarbon date of 9,180 ± 75 (LE-5029) BP (10,079 BP cal on CalPal-07) was obtain on charcoal from the fire. Storage pits, flint knapping area, concentration of calcined bones were identified at the site together with dwelling that indicates full cycle of domestic activities. The site with nearly same archaeological materials of the younger Dryas age was discovered on the left bank of the ravine.

Recurrence occupation of one site is manifested by materials of multilayer sites of Siberia. Dwellings of different periods divided by sterile intercalations are arranged regularly one above another. Such position is explained by theirs seasonal character. During the period of spring floods peoples left the site, but after it, in summer, the population returned to the places and the basic structure of the sites was restored.

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RECORDS OF HUMAN ACTIVITY REFLECTED IN RIVER SEDIMENTS IN THE CARPATHIANS AND THEIR FORELAND

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Records of human activity in valleys of the Carpathians and their foreland date back to the Neolithic and embrace alluvia and deluvia in small valleys, connected with local heavy rains as well as changes in large valleys, reflecting floods marked by modifications of river channels and accelerated deposition of overbank facies. Among these periods are phases determined by climate as well as human activity and phases recording coincidence of both factors.

The oldest sites recording human impact have been identified in the Vistula river valley downstream of Kraków and dated at 6200 BP [1]. Aggradation of the overbank facies in the Late Neolithic is evidenced by coarse grained flood inserts with organic material, dated at 4400-4000 BP in small valleys of the Carpathian margin and development of peat-bogs in depressions [2]. Younger phase of fluvial deposition falls on the period 3300-3100 BP [3, 4].

The Roman Period in southern Poland (1-3rd centuries AD) was a time of enhanced human activity and flood deposition, which is proved by subfossil stumps and tree trunks processed by man in the channel alluvia of the Vistula [5] and the San [6] river valleys, as well as fans of small valleys in the Carpathian margin [2]. In the Migration Period (5-6th centuries) regression of agriculture, reforestation and simultaneous increase in frequency of floods (growth of precipitation) is observed [7, 8]. This phase is recorded by agglomeration of tree trunks in the channel alluvia of the Vistula [5], Wisłoka [9] and the San [6] river valleys. This time is also represented by insert of the alluvia within the Strvyaž terrace in Ukrainian Carpathian foreland [10].

The 8-10th centuries are attributed by the colonisation of river valley bottoms, the earliest in the Morava river valley [11]. Correlation of sequences of fluvial, slope and peat-bog sediments in the Carpathian river valleys indicates that in the 10-12th centuries expansion of human settlements took place in the catchment of the Upper Vistula river. In the Wisłoka river valley migration of meandering channels started about 965 ± 75 BP (940-1240 cal AD) [12]. Similar dates: 925 ± 30 BP (1030-1180 cal AD) and 1080 ± 30 BP (890-1020 cal AD) were obtained from subfossil tree trunks in the Wislok valley [13].

The progressing deforestation in the 10-12th centuries is evidenced by palynological analyses of overbank sediments of the Wisłoka river valley dated at 1040 ± 95 BP [12], as well as peat-bogs and organic sediments overlain by overbank sediments in the Upper Dniester Basin [14]. Record of the Early Medieval floods is reflected in the Dniester river valley, in its Carpathian outlet, by insert of 2-4 m gravel terrace [15].

The tree felling, overbank deposition and displacements of river channel in the Vistula river valley indicate frequent floods in the period 900-1150 AD [12, 7, 3]. In the same time, in the Beskid Śląski Mts. foothill, aggradation of the Upper Vistula alluvial fan began [16]. Simultaneous aggradation in the Lower Strvyaž river valley [10]. Coincided with increase in precipitation and cooling in the first half of 11th century.

Covering of peat-bogs by overbank sediments, dated at 620 ± 110 BP (1160-1490 cal AD) and 650 ± 75 BP (1220-1430 cal AD) in the Upper and Middle Dniester valley [15] indicates increase in frequency and violence of floods in 14-15th centuries, which could have been connected with deforestation and increasing precipitation [17]. It is correlated with dated by dendrochronological method sequence of tree trunks fallen or cut during the floods in the 14th century in Starunia in the Velyky Lukavets river valley in the Ukrainian Carpathians [18]. The phase of floods in the 14-15th centuries is confirmed also by tree trunks dated at 650 ± 40 BP and 660 ± 45 BP (1270-1400 cal. AD) buried in alluvia of the Michydra and Moldova rivers (tributaries of Siret) in Bukovyna region [15, 19]. Similarly, single tree trunks from the 14-15th centuries were found in the Vistula [5, 7] and the San [15] river valleys.

In the 15-16th century agriculture stretched on upland and mountainous areas. Deforested terrain was exposed to soil erosion. Colonisation of the San catchment area in the Bieszczady Mts. in the transition of the 15-16th centuries, was directly reflected by soil erosion and deposition of flood sediments, both in small valleys (460 ± 50 BP) [20], and in the San river valley [20, 21]. The scale of flow oscillation and rate of overbank deposition is evidenced by lower accumulation terraces formed in the last centuries e.g. in the outlet of the Wisłoka river in the Carpathian margin [22] as well as in the Dniester valley in Kružyky site, where at the bottom of the 5-meter terrace oak trunk processed by man, dated at 400 ± 35 BP (1440-1620 cal AD) [15] were found. Progress of economic activity coincided with the beginning of the Little Ice Age.

Increasing number of sites in river valleys indicates sequential occurrence of enhanced flood accumulation connected exclusively with human impact (e.g. Roman Period), phases conditioned exclusively by increase in precipitation in the periods of economical recession (5-6th centuries) as well as phases of coincidence of both these factors (e.g. 11 century and Little Ice Age) [8, 23].

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LATE GLACIAL PALEOSOLS (MIS 2) OF THE GEOARCHEOLOGICAL MONUMENT «DIVNOGOR'E 9»

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Soils of the late glacial period are locally distributed on the territory of the East-European Plain and are more often described around archeological monuments. Stratigraphic position, genesis and evolution of these soils are still not well known.

However the paleosols of MIS 2 are of great importance for the detailed differentiation of the Late Neopleistocene sediments, paleoclimatic and paleoecological reconstructions of the glacial to interglacial reconstruction, quick change of the fauna complexes, initial episodes of the active anthropogenic activity. The late glacial paleosols of the recently discovered unique geoarcheological and paleofaunal locality Divnogor'e 9 reflect short periods of latest pre-Holocene warmings.

The monument Divnogor'e 9 is situated on a chalky Cretaceous plateau in the south of the Middle Russian Plain [1]. This territory is characterized by high variability of the landscapes complexes of southern sub-zone of the Middle Russian forest-steppe. Chalky plateau is located on the right bank of the Don river and is delineated by the floodplains of the Don in the north and Tikhaya Sosna in the west. The slopes of the plateau are dissected by the dense network of the gullies, opening into the rivers floodplains and large gullies (balkas).

Six levels of the concentration of horses bones and skeletons (*Equus ferus)* were discovered in Divnogor'e 9 [1, 2]. A set of radiocarbon dates of bones were obtained for various levels of bedding: 1st level – 11 400 ± 120 yrs BP (LE-8137), 13 150 ± 200 yrs BP (LE-8136); 2nd level – from 12 980 ± 180 yrs BP (LE-8135) to 13 560 ± 200 yrs BP (LE-8131) [1]. The AMS ^{14}C-dates were similar: 1st level – 13 430 ± 130 yrs BP (AA № 90650); 3rd level – 13 870 ± 140 yrs BP (AA № 90652); 4th level – 13 830 ± 150 yrs BP (AA № 90653); 5th level – 13900 ± 140 yrs BP (AA № 90654); 6th level – 14450 ± 160 yrs BP (AA N90655) [2]. Thus, the dates cover the late glacial period including Raunis (14,5-13,4 kyrs. BP), early Drias (13,4-13,1 kyrs B.P.) up to Alleroed interstadial.

Small siliceous artifacts were founds among the bones at level 6. Siliceous flakes and two nucleus were found to be associate with the 4th level. Levels with bones concentrations correspond to the weak light brown loamy layers of the temporally dammed reservoir (lake), divided by chalky blocs and rubble lenses – the sediments representing the falls, rockslides and proluvial mudflows [2]. Good preservation of bones and often their anatomic occurrence testify that horses were buried practically immediately after their death. Bone-bearing layers are recovered by thick deluvial deposits consisting chiefly from large chalky blocks in combination with loamy lamination. Upper batch of the deluvial sediments contains two lenses of charcoal concentration and several layers of the embryonic soil formation.

Late Holocene paleosols occur immediately below the Holocene Rendzina and overly the complex batch of lacustrine-proluvial deposits with bones-bearing layers. Paleosols were studied by macromorphological methods followed by the determination of the texture according to Kachinsky's pyrophosphate method, organic carbon after Turin and Bascomb, oxides of Fe, Al and Mn after Tamm, Mehra and Jackson, and Bascomb, CO_2 of carbonates.

Soil pit 1 / 10 situated directly into the excavation Divnogor'e 9 has 2 weakly developed paleosols. Bfe horizon of the upper brown forest soil of the Alleroed(?) age is non-uniform pale brown heavy loam, contains the chalky fragments of various size and degree of roundness, dense, with ooid microstructure. It also contains secondary carbonates in form of small white concretions 0.3-1 mm in diameter. Chalky fragments have pale brown coatings.

Pale silty-loam containing large chalky fragments differentiates the upper and lower paleosols. The burnt layer declines in this site; brownish-grayey humus material increases in the middle part. The A horizon of the lower soddy paleosol is heavy loamy, pale light gray, with inclusions of the weakly rounded rubble. The lower soil is underlied by the rudaceous layer - first layer of bones concentration.

The texture of paleosols and the intermediate loam is similar with the abundance of the fine silt – up to 40 %, and high content of the coarse silt (loessial fraction). This indicates that all three layers have a similar deluvial genesis. Bfe horizon has higher content of the clay fraction. It does not show any increasing of the organic carbon and has the decreased content of carbonates together with weak increasing of Fe, Al, and Mn oxides. This indicates that such soil forming processes as carbonate leaching, glayization and ferruginization were weakly developed.

The other site Divnogor’e 2 / 10 was situated in 10-15 m from Divnogor’e 9 towards the upper part of the gulley. Soil pit 2 / 10 (1) exhibits the upper part of the paleoslope. It is the most complete section representing the upper deluvial-proluvial interval, which includes three layers with weakly developed paleosols.

The first initial brown forest paleosol was found at a depth 85 cm. Its Bf horizon is 20 cm thick, rustly-pale, silty loam with yellowish hue, non-uniform, granular. Chalky fragments content increases up to 60-70 %. They have thick ferruginous coatings and became more rounded.

The second weakly developed paleosol with AB-BCca profile occurs at a depth 105 cm. AB horizon is 25 cm thick. It is represented by gray-brown slightly humus light loam with subangular-blocky to granular structures. The concentration and size of the chalky fragments increase. The coatinsg on chalky fragments are brown, thick, humus powdered. Carbonate horizon at a depth 130-150 cm is light pale, loamy, with secondary carbonate concretions. Chalky fragments have thick dark-pale coatings and range in size from some mm up to 5-7 cm.

The third weakly developed paleosol with A-C profile occurs at a depth 150 cm. It’s a horizon about 40 cm thick, weakly humic, pale light-gray, silty loamy. The chalky inclusions are more homogenous in size 3-7 cm. The clods 1.0-1.5 cm in size occur consisting of grayey material with fine porosity. The soil is formed on fine clayey loam apparently of lacustrine genesis underlied by pale loam enriched by large chalky fragments 5-15 cm size and horses bone fragments.

The low lacustrine-proluvial part and the upper pedo-deluvial part have clear difference in the texture. Textural composition of lacustrine formation is characterized by low portion of coarse fractions (about 1 % sand and 7 % of coarse silt) with domination of clay (> 33-35 %) and fine silt (47-48 %) fractions. Upper formation differs by strong increasing of sand and coarse silt fractions (up to 3 to 4 time), and decreasing of fine fractions, such as clay and especially fine silt. This formation, in its turn, subdivides into 3 to 5 layers of soils and deluvial material according to the sand and coarse silt concentrations.

All buried soils are marked by the increased humus content. The highest Corg content was found in the lower paleosol – up to 0.61-0.73 %. The intermediate paleosol has 0.61 % of organic carbon. But even Bfe of the upper paleosol has elevated Corg content about 0.51 %, which is much higher than in the recovering sediment. Lacustrine deposits have the minimal Corg content. The content of dissolved humus (after Bascomb) also proves the presence of the ancient humus formation in all three soils. Corg content in pedogenic horizons is 2-4 times increased comparing with lacustrine and proluvial sediments.

Carbonate content is high in all specimens, more that 30 %. This is not surprising as all these studied soils and sediments derivated from the weathering and re-deposition of the Cretaceous chalky material. But A1 soil horizons and lacustine sediments are slightly depleted (30-31 %), while proluvial-deluvial sediments have slightly elevated 33-36 % carbonate concentrations.

All three paleosols and especially the upper one have the elevated concentration of Fe oxides determined by different methods (Tamm, Merha and Jackson, Bascomb). The Alleroed paleosol has the increased content of Al and Mn oxides (after Tamm).

Thus, two main late Valdai intervals of various genesis were found in Divnogor'e 9, indicating two various sedimentation regimes. The lower interval represents proluvial-lacustrine sedimentation of dammed basin, and the upper is pedo-deluvial (slope) interval. The lower interval is characterized by the interchange of cyclic layered clayey, fine and intermediate loamy subhorizontal layers (lacustrine batch) with fine and intermediate loamy layers containing the inclusions of chalky Cretaceous fragments of variable size and roundness (of proluvial genesis). The upper interval is represented by the interchanging of weakly developed paleosols with talus layers and proluvial-deluvial loams. The pit is underlied by well developed soddy calcareous soil (Rendzina) of the Holocene age, which in its turn is recovered by agro-deluvial sediments.

Three levels were identified indicating the late Valdai weakly developed soils with various genesis and degree of preservation. Their age is younger than the age of the bone-bearing layer, but older than Holocene. The upper soil (expected to be of the Alleroed age) is represented by the ferruginous horizon, which is also marked by the small increasing of humus and Fe, Al, Mn oxides. This soil is preliminary correlated with weakly developed brown forest soil. The intermediate soil contains two horizons: weakly developed humus and carbonate horizons identified by the increased humus and carbonates contents respectively. This soil is identified as weakly developed soddy-calcareous soil (Rendzina). The lower soil is the most developed and humus rich, identified as the weakly developed meadow-calcareous soil.

The lower and intermediate soils were formed under the forest-steppe periglacial environment. The upper soil is expected to be formed under forest periglacial environment. It is likely that all three soils reflect the short (n $10^{1\text{-}2}$ years) periods corresponding to one or two warming periods (interphasials). Two lower soils correspond to the first drier stage, while the upper soil reflects the second wetter stage. It may occur that the soils reflect two warming periods. In this case the lower soil indicates the first (Boelling?), and the second humic soil and third brown soil correspond to the second warming period (Alleroed?).

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GEOARCHAEOLOGY AND USE OF SPACE IN THE EARLY BRONZE AGE AT DHASKALIO, CYCLADES GREECE

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Research. This research represents the application of science to a cultural problem. A geoarchaeological approach based in the earth sciences has been applied to an investigation of urban space at the Greek prehistoric site of Dhaskalio.

The project aims to provide an understanding to the use of space by analysis of floors and occupation deposits at the Early Bronze Age site at Dhaskalio, Cyclades, Greece. The relationship between the use of space and socio-cultural practices will be examined and relate to the analysis of consequences of human action as recorded in and structured by sequences of floors and overlying deposits. Geoarchaeological survey of the neighbouring landscape will place Dhaskalio in it's environmental and contextual setting.

Background to the research. The Island of Keros is clearly one of the most remarkable and richest prehistoric sites in the Cycladic Islands. Indeed it is so important that Professor Colin Renfrew recognised it as the type site for the Early Bronze Age Keros-Syros culture. It is most unusual in that it appears to be a ritual site where figurines, marble bowls and painted pottery were brought from other islands and deposited in pits. The figurines are famous for their highly stylised form and have been a focus of interest from 'collectors' who have created a great demand for such objects. Inevitably, the site has been extensively looted from the early 1960's, no doubt with the intention of finding figurines. Consequently there has been enormous destruction of this important site. However, 80 m to the west, lies the small island of Dhaskalio which is clearly related to the site on Keros. Recent excavations have revealed numerous Early Bronze Age rectilinear structures that hold out enormous potential for the analysis of intact floors and deposits accumulating on those surfaces. My research will seek to incorporate this new and important data set to address important questions and developments relating to the Early Bronze Age in the Aegean.

Objectives of the research. To use comparative data as a means of testing the special status of the site or otherwise.

To examine the processes of immigration, settlement and social change in the Cyclades during the Early Bronze Age Period.

To understand the relationship between social change and its environmental context.

To understand the nature of the settlement on Dhaskalio and understand how it relates to the major ritual centre of Keros. Was it a permanent settlement or seasonally occupied. Was Keros a «special» island, in the same sense as later cult centres of the classical period such as Delphi and Olympia?

Methodology. I will use an archaeological science approach and specifically geoarchaeology to address these questions at Dhaskalio. The methodology includes:

The application of soil micromorphology which is the microscopic analysis of intact blocks of cultural sediment. Key research questions will relate to the identification of floor, wall and roofing materials used in the construction of these structures, roofed versus open space, as well as the use in life and will take into account post-depositional changes within these structures.

The application of a wide range of other analytical techniques rooted strongly in the earth sciences, including the geochemical and geomagnetic analyses of archaeological soils and sediments, in order to achieve a holistic understanding of the contexts, site formation processes and mechanisms of use of space and the elucidation of social and environmental change.

The comparison of microstatigraphic data with artifactual and biological data recovered from the same context with the aim of constructing interpretive information.

Preliminary results. The first floor has already been examined showing compound floors of coarse aggregates and fine plaster. Several abandonment and rebuild episodes are clearly observed in the field and in thin section. There are clear distinctions between one-off constructions, multiple compound floors and floors with completely different treatments. Further analysis will give insights into the time depth, use and occupation. The value of this research is that the soil record will be able to contribute in a unique way to problems relating to the structural and social complexity aspects of Early Bronze Age settlements and society in Greece.

RESEARCH AND STUDIES OF CULTURAL LAYERS IN LANDSLIDES (ON THE EXAMPLE OF THE ARCHAEOLOGICAL SITE ON STARAYA RYAZAN)

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In archaeological practice there are still no methods, that make it possible to date and examine the plot of cultural layer, that has been exposed to destructive relief formation process such as a landslide. Therefore, it is considered to be irretrievably lost for archaeological research. Nevertheless, the development of such methods is necessary for clear reconstruction of the ancient settlement pattern, because the majority of archeological sites (and their central areas especially) are situated in dangerous places influenced of modern exogenous relief forming process and have been destroyed by the nature.

The team of Geographers of Ryazan State University named for S. Esenin and archeologists of the Archeology Institute of the Russian Academy of Science under the supervision of Uskov V.A. and Strikalov I.Yu. financially supported by Russian Foundation for Basic Research have developed and applied in the practice of the archaeological researches an original method of search for and study the cultural layer on the landslides, which made it possible to age-date and use the occupation over-placement and archeological artifacts for the archeological object reconstruction.

Staraya Ryazan – a unique ancient town of the Old Russian (Drevnyaya Rus') archeology (XI–XIV AD) – was chosen as a platform for the new method development and monitoring. After the desolation at the end of the XIV AD the settlement territory was not built on and was preserved almost in the same form in which the people of the middle ages saw it. As the town stopped functioning and the territory became agricultural – it triggered off the modern destructive exogenous relief forming processes – landslides which reduced the settlement area by 6.0 % (4,5 ha from 72.0 to 67.5 ha) for less than 700 years. Soil slip moved the cultural layer downhill western and northern settlement area including the fortifications. Influenced by such a move the cultural layer underwent different deformations (rupture, fault, disconformity, etc), all this made the traditional archeological research of the cultural layer impossible.

Based on long-term research and experience in the geological and geomorphological control of destructive exogenous relief forming process, engineering-geological work at historical territory, also aimed at paleorelief restoration and cultural layer mapping, a new algorithm of tracking methods and cultural layer research in landslides process is introduced below:

1) identification and detailed characteristics of the landslide bodies in which the cultural layer seems to survive with the slightly disrupted stratigraphy;

2) compiling list of previous areas of archeological excavations which stratigraphy of the cultural layer seems to be similar or close with one of the investigated landslide bodies;

3) sequencing landslide bodies for the further research;

4) laying of engineering-geological tees on the landslide body transversely to the slope's trend using the spared engineering-geological hand-held drill for the identification of the cultural layer in the landslide body;

5) based on the drilling data, mapping of the cultural layer stratification depth on the landslide.

The method and the drilling data should be verified by using archeological tracing by a trench.

We have already published the detailed analysis of geological, geomorphological and archeological studies of Staraya Ryazan settlement and its results and conclusions.

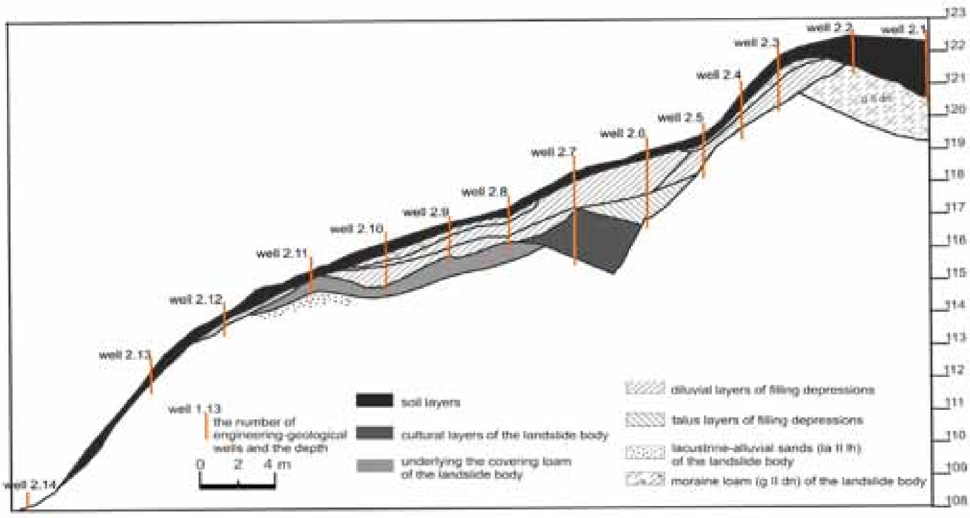

Figure 1. Scheme of the profile 1 according to the data of engineering-geological drilling in the fourth generation landslides of the root border of the Oka river valley

For the purpose of testing the method in 2011 the detailed examination of the landslip body of the forth generation were introduced. The object of investigation is located beneath the area of excavation # 7 (100 meters to the north-west of it). This area lies on the edge of the interfluvial plateau occupied by the town and has a good stratification. Moreover, the archaeological research have shown the presence of the destroyed area on the edge of the plateau.

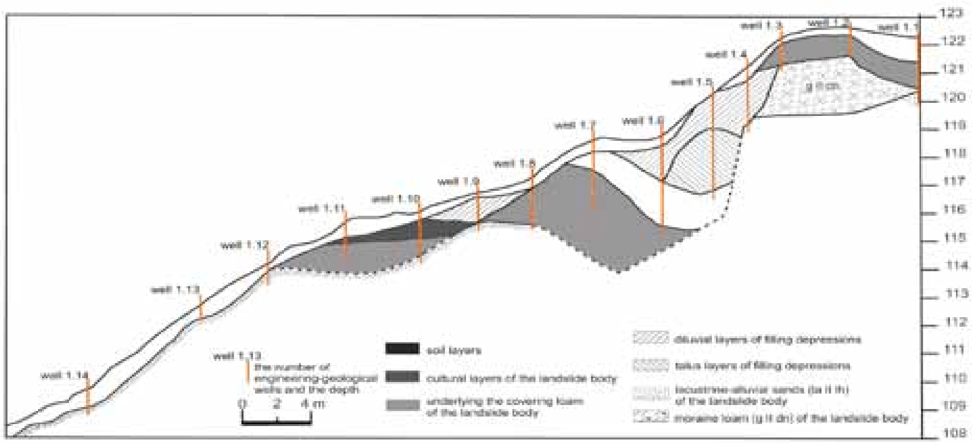

Figure 2. Scheme of the profile 2 according to the data of engineering-geological drilling in the fourth generation landslides of the root border of the Oka river valley

During the spared engineering-geological drilling three lines of well have been laid, one of which was verified by tracing through the traditional archeological trench method. The trench oriented transversely to the linear kerf 1.0 meter wide and 16.0 long, goes across the inner commissure, fixed on the lowering absolute levels. Unfortunately, during the season we couldn't explore the landslide body to its foot along the whole length (in the central, the deepest part 5,0 meter deep from the highest point, further investigation demanded to broaden out the trench). Nevertheless, the results already at this stage allow to make certain conclusions.

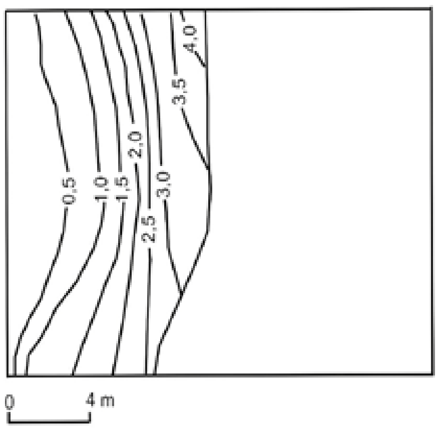

Figure 3. The map of the culture layer, m

As a result of the study three profiles were created through the methods of engineering-geological profiling. Two of them pass along the whole slump length (60.6 meters) (fig. 1, 2) and one – short, lays in the area of uncovered cultural layer blocked with the landslide body (23.3 meter length). Pitch between profiles is 8 meters. Along the profiles the drilling have been made with the pitch of 2-4 meters (dependent on relief peculiarities) in the bedding area of cultural layer and with the pitch of 3-5 meters in the dissemination area of diluvial deposits with the archeological artifacts.

The whole exploring area is 969.6 m^2. We have defined the limits of the expansion, thickness, constituents and the depth of the cultural layer in one of the landslips bodies (on the area of 144 m^2), happened after the stopping of active life at the Staraya Ryazan settlement using the method of spared engineering-geological drilling. A map of the cultural layer depth was created (fig. 3). The degree of cultural layer preservation according to the chosen markers is estimated as high. The verification of the data, gathered by the engineering-geological method, has begun by traditional archaeological tracing with a trench. A 3.7 m deep trench have been excavated along the line of the shortened profile and preserved till 2012.

The analysis of the landslide section by the archeological trench in 2011 showed a good condition of cultural layer preservation in the landslide body, despite a long period of time passed after the destruction. The stratigraphy of the cultural layer is similar to the one at the settlement (at the excavation area # 7) and allows to consider the fragment a part of the settlement, or a continuation of the cultural layer of the site. It opens prospects for clear reconstruction of the settlement pattern before it was destroyed by the landslide.

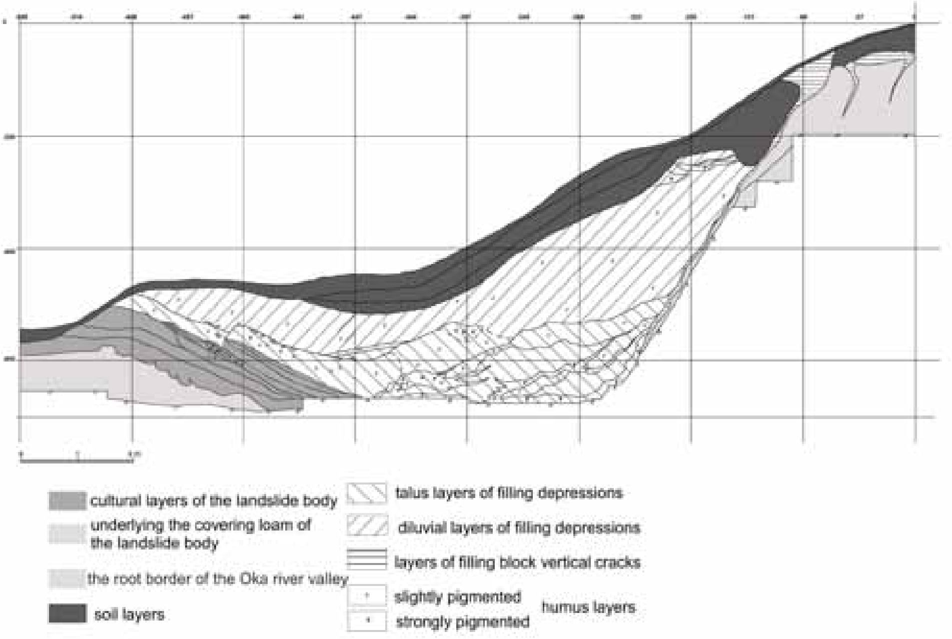

Figure 4. Northern profile of the trench in 2011 on the 4th generation of the root border of the Oka river valley

The research also made it possible to carry out more accurate dating as the landslide itself as well as other natural processes, happening on this territory after the landslide, track its intensity in different time periods. The data of the research have proved the preliminary conclusions about the XIV-XVII centuries, as most probable time of the linear erosion and landslide activation. The results still need to be compared with the existing records of the climate changes at that period.

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MAN'S STRUGGLE AGAINST WATER: HISTORICAL LANDSCAPE RECONSTRUCTION OF SCHOKLAND (FLEVOLAND, THE NETHERLANDS); A COMBINED ARCHAEOLOGICAL, GEOLOGICAL AND HISTORICAL GEOGRAPHICAL APPROACH

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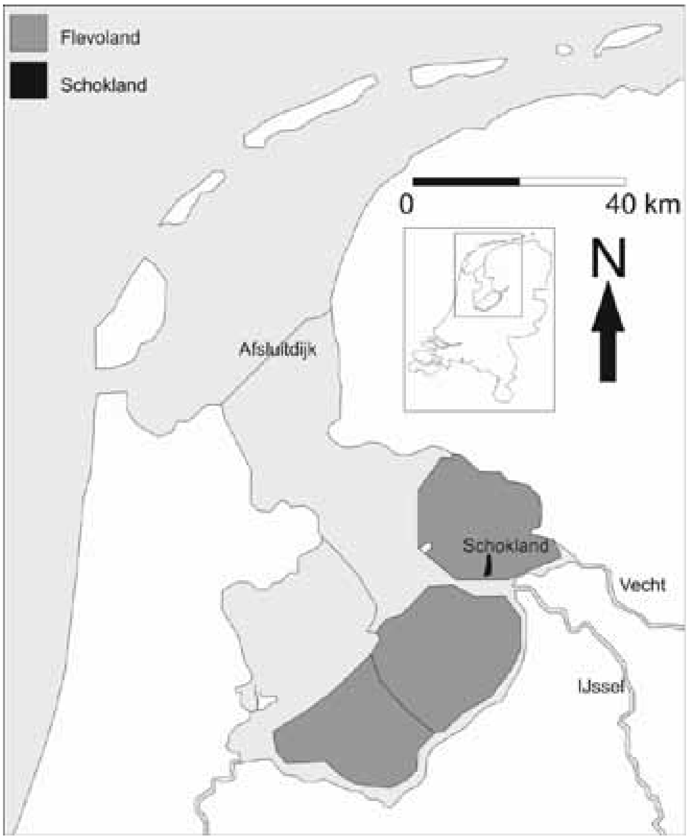
Flevoland (central Netherlands, fig. 1) is an area of long-term discontinuous deposition, which has been reclaimed from the Zuiderzee in the 20th century. Before the reclamation, the Zuiderzee was in a phase of enlargement, threatening civilians on the islands and the shores.During this time-period, a surficial clay cover was deposited at the island Schokland (World Heritage Site; Noordoostpolder, northern part of Flevoland, fig. 1). We have studied the clay sequence in order to determine the most recent geological history of Flevoland (last 1200 years).Knowledge on the recent geological history of the former island is essential to understand the processes that underlie human occupation, land use changesand flooding history.

To gather data on the most recent geological history of the former island, lithostratigraphic mapping was carried out at six evenly distributed profiles oriented east-west across Schokland. A total of 39corings (depth varied from 1.20 to 6.75 meter) were performed at the study area (fig. 2). Samples were taken from the clay for thermogravimetric (TGA), grain size, pollen, foraminifera and magnetic susceptibility analyses. On the basis of the results of these lab analyses, and added with field coring descriptions and literature, a landscape reconstruction of Schokland was made for the period of Medieval to Recent occupation (last 1200 years). This reconstruction provides the environmental context to explain man's struggle against the sea as inferred from the presence of dykes and location of dwelling mounds. Moreover, this research shows that storm events play a major role in the sedimentation pattern. A comparison between geological data and documented storms can be made.



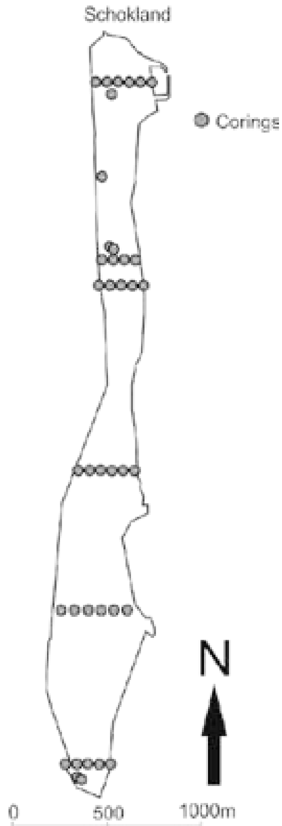


Figure 1. Location of Flevoland and Schokland within Netherlands

Figure 2. Location of the corings at Schokland

The results presented in this paper form part of the ongoing multidisciplinary 'Biography of the New Land' research program.

GEO-ARCHAEOLOGY AND MEDICINE

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Modern methods of medical research applied to pre-historical and proto-historical studies provide new perspectives to geo-archaeological knowledge. Conversely, palaeontology becomes an important source of information for medicine historians. This paper highlights most recent results showing cross fertilizations between the two sciences.

In the field of Physiologic Anatomy *Homo Neanderthalensis*, despite the reduced length of his distal limb segments (a characteristic of bovids), gained a strategic advantage in hunting on sloped and rugged terrains, thanks to his lower crural indices [13, 19].

Recent discoveries on particular features of extant mammal sensory systems, such as evolutionary modifications to the light-regulated circadian system, photoreceptor complements and retinal morphology, allow a better understanding of the evolution of mammalian vision from nocturne to diurnal. Thanks to them, we may now argue that extant mammals – benefitting from the diurnal vision – still retain a scotopic eye design as well as expanded binocular zones, as a consequence of their nocturnal origin [1, 12].

Many eco-geographic variations in body shape have been observed among Pleistocene *Hominids*: first of all, a pelvic breadth with increased ellipticity of birth canal, as a result of the non-rotational birth mechanism, common to both *Australipithecines* and to archaic *Homo* . New studies provide also evidence that the 15,000 years-old Ethiopian Gona specimen (previously classified as *Homo erectus*) is instead closer to *Non-homo* samples, like *Australopithecus africanus* [24].

However, the main contribution to geo-archaeology comes from the Medical Molecular Genetics with a tide of studies on both the *Hominids* evolution as well as the exact placing (either temporal or geographic) of *Neanderthals* and *Denisovians*. Studies on Human Genoma show that during Bronze and Iron Ages a mixture took place between nomad populations coming from Europe and Asia, who settled in the large «Turpan Depression» of Western China [3].

A very close kinship between humans and chimpanzees [10] has been also discovered by Comparative Molecular studies, coupled with Philogenetic ones [16, 20]. Preliminary results from the genoma mapping of *Homo Neanderthalensis*, show to be the nearest relative to *Homo sapiens*, before separation of their lines, because both share most of their genetic material.

An important hypothesis has been proposed by recent studies on Paleo-immunology. They concern origins of acquired immunity in mammalians, considered as a result of insertion in lymphocytes of a primordial *Herpesvirus*-like element encoding a «RAG transposon» (DDE recombinase / RNAse) [6].

Among contributions to Palaeontology provided by Microbiology, the discovery of endemic infections in theropoid dinosaurs (in particular, *Tyrannosaurus rex*) caused by a *Trichomonas gallinae*-like protozoan, must be reported. This chronic parasitosis – a consequence of bite wounds from other tyrannosaurids and often lethal because of starvation – is considered to be the first example of an avian infection transmitted to a non-avian host [33]. Evidences of odontogenic purulent maxillar osteomyelitis in *Ursus spelaeus* were also found in caves in Slovak Republic [27].

Other contributions come from Molecular Palaeo-parasitology, mapping the large spread of parasitic infections among Medieval populations in Asia [21].

Some interesting data are coming from molecular analysis of *M.tuberculosis.* This species, born from a mutation of an ancient (2,5 mill. years-old) environmental *Mycobacterium* arose in Central Africa (35,000 years BC, was subsequently carried to East-Europe, where the first human bone tuberculosis patient (of 9000 years ago) was found [14].

In earth's history, many transmissible diseases appeared to be consequence of paleo-environmental changes. In Neolithic, the raise of sea levels occurred in Europe and Middle East consequently to earth's heating. A lot of geological upsetting – as marshes grown along Mediterranean coasts - consequently arrived, followed by large botanical as well zoological re-arrangements. These ecological changes affected the spread of many transmissible diseases. We believe today that simultaneous disappearance of *Ursus* *spelaeus* and of *Homo sapiens Neanderthalensis* was caused by the same (still unknown) epidemic infection, during the last Glacial Era.

Around 8500 BC, life conditions improved in the «Fertile Half-Moon» of Middle East. Because of the more favourable environment, Hominids changed from «food sweepers» to (still nomads) hunters-harvesters and eventually to farmers (32). Nomads were more often affected by common chronic parasitic and bacterial infections, while settled populations were mainly struck by viral diseases.

But the advent of agriculture allowed a dramatic increase in both resource accumulation and population density, and in promiscuousness too, with consequent spreading of many transmissible diseases.

Harvesting of domestic rubbish around (and into) houses and breeding of domestic animals favoured, in Eurasia, development of animal-transmitted diseases.

Turning to the other side, about relationships between palaeontology and history of medicine, this latter benefits from new informations arising from the epidemiology of some important diseases as: infections, cancer, rheumatic and degenerative [4, 11, 17]. Coming to the Modern Age, it is also impressive to ascertain how advanced were – in some fields – both medicine and surgery: not only at time of Ancient Egypt, China and Roman Empires but also in the previous Era when – for instance – atherosclerosis, malaria, tumours, and sickle cell disease were already well known and feared [2, 7, 8].

In ancient Americas, the presence of both skeketal treponematoses and rheumatoid arthritis has been also proved: the former in 1300 AD [23], the latter in 3000 BC [11].

The effectiveness of the cross fertilization among different sciences – already emphasized in the last years [9] – will be discussed.

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MULTILAYER ARCHAEOLOGICAL SITE IN THE VALLEY OF THE IZHMA RIVER

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Multilayer archaeological sites are well represented in Middle and East Siberia when cultural layers are included into dark layers of alluvial sandy loam which are separated by sterile sandy layers. There are more than 20 cultural layers. Importance of these sites could hardly be overestimated.

They are located in mouth areas of small rivers which flow into rivers of the second level. These are e.g. Bel’kachi 1, at the Aldan river, tributary of the Lena river [1]; Bol’shoi Yakor’ [2] and Ust’-Karenga [3] at the Vitim river, tributary of the Lena river; Gorelyi Les and others at the Belaya river, tributary of the Angara river [4]; Kazachka at the Kan river, tributary of the Enisey river [5]. Usually they are associated with sediments of the river’s high flood plain.

It is obvious that all above-mentioned sites are located in mountain areas. We can suppose that this fact determinates existence of archaeological sites of this type. Nevertheless, multilayer site with similar stratigraphy Vylys Tom 2 was found at the Izhma river, the biggest left tributary of the Pechora river, at the very north-east of European Russia (north of the East European Plain).

Archaeological site Vylys Tom 2 is situated at the right bank of the Izhma river in the mouth area of its tributary – the Vylys Tom river. Cultural remains are located in sediments of the terrace’s nose relic which is 10 m high. This terrace remnant is well visible in flood plain which is 7 m high. The site is discovered in 2003; excavations at small territory were done in 2010 and 2011. Nowadays we distinguish 4 cultural layers.

The first cultural layer is placed in contemporary forest soil. Badly preserved fragments of ceramic pots are found in this layer. Nevertheless, typical peculiarities of their forms and ornament allow to date this layer to the end of Anan’yno culture – beginning of Glyadenovo culture, Early Iron Age, transition from BC to AD.

The second cultural layer is placed in brown loam at 0.3-0.5 m depth from contemporary day surface. Flint artefacts are not numerous. Thermal treatment traces of flint, thin bifaces production, large burins are typical for the Late Neolithic or the Bronze Age.

Several artefacts (depth 1.5 m) were found in alluvial soil strata, placed under loam layer. This can indicate to the existence of one more cultural layer. The 3rd and 4th

cultural layers are placed in thin humus sandy loam layers of alluvial soil strata and they are found at > 2 m depth from contemporary day surface.

Large lenticles of charcoal and huge amount of bones, including long bones of big mammals, are found in the 3rd cultural layer. Unfortunately they are badly preserved what makes impossible to move them from the layer. Elk and beaver are identified according to the teeth finds. Flint material is not numerous. Very big chopping tool and a fragment of abrasive tool are found also.

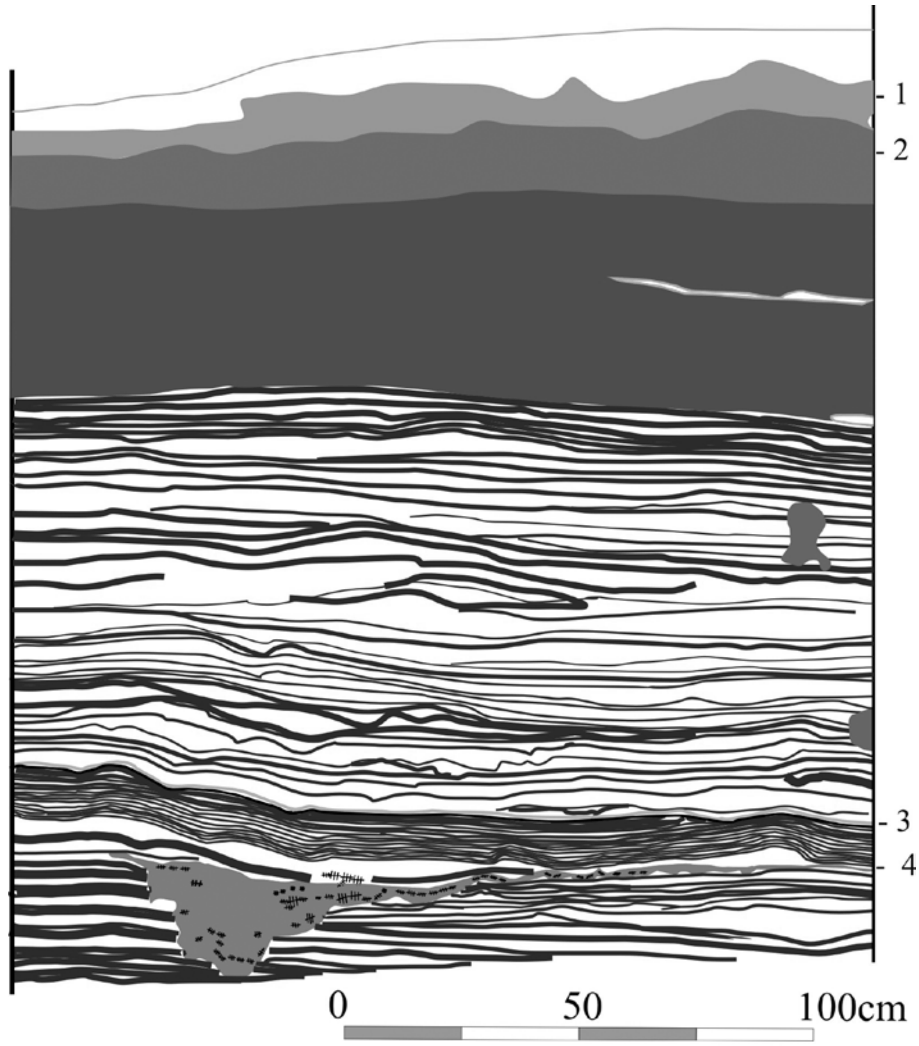

Figure 1. Archaeological Site Vylys Tom 2: section of the deposits. 1 – 4 are cultural layers

A fireplace was found in the 4th cultural layer. It has typical rose calcinations, a coal lens above the calcinations and small fragments of burned bones. A pit which continued in several underlying humus layers was defined near the fireplace. The pit was filled with coal and burned bones' fragments. Flint artefacts were found in it. More than 200 finds were located around the fireplace and inside it. All the cores are in their final stage of knapping, one of them is changed into the scraper. A large hammer-stone is found also. There are chips from large grinded tools. Tools are represented by point-scraper, scrapers, burins, pointed bladelet, retouched bladelets. We distinguish similarity between tools from the 3rd and 4th cultural layers. We date them to the Mesolithic preliminarily. Nevertheless we can't name similar industries of the same period in the region.

Nowadays we are going to receive dates (radiocarbon analysis) from the 3rd and 4th layers as well as results of spore-pollen analysis of the sediments. Sediments in the profile contain pebbles and huge nodules (diameter 10-15 cm) and thin tablets of slate. This fact as well as huge thickness of alluvial soil at valley lowland river could hardly be explained. Usually multilayer sites in Siberia contain cultural layers in each humus stratum. Such strata (up to 10 cm) are thicker than at our site at the Izhma river (1-2 cm). Moreover, in Siberia there are groups of such sites – up to 10 in the mouth-area of the river. Vylys Tom 2 has no neighbor multilayer sites.

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NEW GEOARCHEOLOGICAL STUDIES OF THE MIDDLE PALEOLITHIC SITE KHOTYLEVO I (THE UPPER DESNA RIVER BASIN, RUSSIA)

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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. There is evidence of earlier presence of humans here, practically since the initial occupation of the East European Plain. In this paper we discuss the new data on lithology and environments of sedimentation of Late Pleistocene loess-soil and fluvial series at one of the most famous Middle Paleolithic site in this region known as Khotylevo I occurrence.

The Middle Paleolithic site Khotylevo I is situated on the high right bank of the Desna River, 18 km to the north-west from Bryansk city. The site Khotylevo I was first excavated by one of the main investigator of prehistorical archaeology of western Russian regions F.M. Zavernjaev during 1960-1964. He found only one cultural layer with numerous of debitage there – Levallois flakes, classical Levallois cores, unifacial and bifacial tools. These large collections, including more than 18.000 pieces, were divided him according to F. Bordes system into several complexes: Acheulo-Mousterian complex (there were majority of bifacial forms), Quina complex and Ferrassie complex. The oldest one was dated as Riss-Wurm complex (Acheulo-Mousterian). This point of view was published in monography of F.M. Zavernjaev in 1978 [1]. Over years of study, various views have been formulated with regard to the typology of lithic industries and the stratigraphy. Different researchers of former Soviet Palaeolithic School at different times paid attention to Micoquian components in these collections and put this site in to the Eastern Micoquian.

The Khotylevo I is extended at a distance about 800 m along the riverbed of the Desna river. The right bank has a height of 22–25 m above the water level and gently slopes down in the valley of right tributant of Desna river named Gosoma downstream of the site. The features of relief such as high floodplain areas and the first terrace are clearly visible. The structure of the high bank shows considerable variability between the downstream and the upstream sections of the site. The downstream sections of Khotylevo I cultural horizon are associated with the basal alluvial horizon. Tabular flint pieces (including flinty artifacts), rounded pebbles of crystalline rocks and rare bones remains of the mammoth faunal complex were recovered at a depth of 10.44–10.55 m below the surface.

This culture-bearing horizon overlies bed-rock Cenomanian quartz-glauconite sands. Overlying sediments are divided into alluvial and sub-aerial series. The alluvial unit up to 5-7 m thick comprises riverbed, oxbow lake, and floodplain facies. The upper portion of the profile contains sediments of subaerial origin. These sediments represent the redeposited Mezin pedocomplex overlayed by thick horizon of Late Valdai loess deposits with modern grey forest soil on the top. The material of paleosols was moved by process of solifluction in the periods of active slope erosion, obviously between the end of formation of the Mezin polygenetic complex and the Middle Valdai megainterstadial [2].

Recently we returned to the collections of Khotylevo I and found that cultural remains layers in different geologo-geomorphologocal positions depend on the location of key sections, which situated in upsteram or downstream. We began field works at the upsteams sectons of site in 2010 and found cultural remains in buried soils there. This area, named Khotylevo I-6-2, located in several hundred meters upstream from the place, where the first excavations by F.M. Zavernjaev were situated. It should be noted, that on the thickness of loess and soil sub-aerial deposits increase in the upsterams sections of occurrence. At the some sections of site Khotylevo I-6-2 sub-aerial Valdai deposits covered directly on the sandy Turonian chalk containing numerous of black flint concretions.

During the field season of 2010 we found four horizons with the cultural remains. The materials from the whole horizons have middle palaeolithic morphological and technological features. In all horizons we have different variants of Levallois cores (flat cores) and end cores, the Levallois flakes and simple tools, made on them; only in the Second horizon we have number of biface thinning flakes and chips (fig. 1).

The sediments enclosing fourth cultural horizon (lithological layer № 15) was represent light gray coarse-grained sand interlayered with bands of greenish clay and with numerous chalk and flint concretions. And only Fourth cultural horizon lies on the Cenomanian bedrock sands (lithological layer № 16) in the same positions like in downstream section. This cultural horizon was overlayed by layers of floodplain alluvium up to 90 cm thick (lithological layers № 14-13), represented by gray laminated small-grained sands and loams.

The Third horizon of cultural remains presents only rare chips and two typical Levallois flakes and consists of light brown sandy loam (lithological layer № 13). Another four horizons with the cultural remains lie down in different variants of fossil soils.

The first (from the bottom of section Khotylevo I-6-2 (2010)) laminated buried soil (lithological layer № 12) consists of three thin humus horizons separated by layers of fine-grained rusty sands and has a characteristic of less developed alluvial soil. The cultural remains from the Second cultural horizon, lie in the humus horizons and are also divided into three sub-horizons. From the second sub-horizon (cultural horizon № 2 / 2) we have single ^{14}C data 42270 ± 3300 (GIN-14414) made of the humus acid from soil [3].

The second burial soil, enclosing artifacts of First cultural horizon, represents brown sandy loam with lenses of black humus (lithological layer № 9) underlaying by horizon of greeny marl with pieces of chalk. The properties of reworked soil material indicate that soil profile was disturbed as result of moving of slope material in hydromorphic conditions with cryogenic deformation. The micromorfological structure feature of this soil has some similarities with Bryansk Middle Valdai paleosol [4].

The deposits overlying of paleosols with cultural layers represented by thick series of laminated loess-like carbonated-free silt sediments; some gley horizons and lenses of weathering pieces of chalk have been determined. The uppermost part of sections is modern sod-podsol soil.

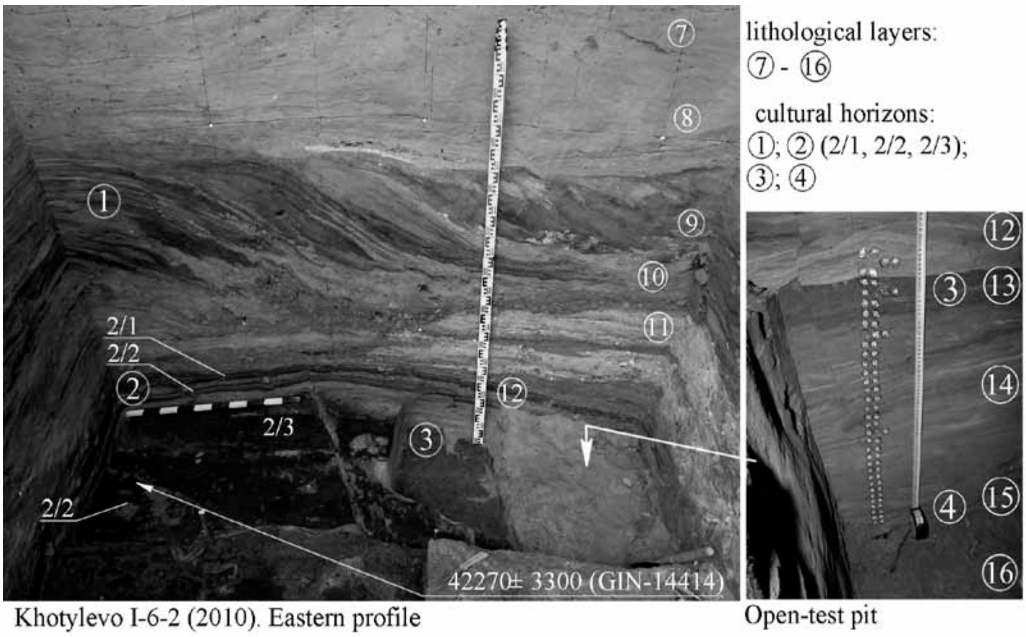

Figure 1. Distribution of buried soils and cultural horizons in Khotylevo I-6-2 (2010) section

The time of occupation of Khotylevo I by Middle Paleolithic men should be correlated with chronological interval of Early / Middle Valdai transition period which characterized by sharp and short-term climatic changes. The Middle Paleolithic men preferred the areas of inner parts of floodplain near backslopes. During the second part of the last glacial epoch 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. Therefore the most part of inhabited areas of Middle Paleolithic was destroyed and these areas have no traces in modern relief of the Desna river valley.

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LATE MID-HOLOCENE CLIMATE VARIABILITY AND FALL OF THE OLD KINGDOM IN EGYPT CA. 2100 BC, A NEW GEOARCHAEOLOGICAL PERSPECTIVE

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Geoarcheological and textual data clearly indicate, that the second half of the Old Kingdom Period (from ca. 4400 BP) witnessed a gradual change of climatic conditions in Egypt. From the end of the Old Kingdom, i.e. 4200 BP, the climate throughout the country had become gradually more and more dry, resulting in droughts and famine [1]. In opinion of many Egyptologists, such environmental events are also reflected in textual data from the First Intermediate Period (ca. 4000 BP) [2]. It can be deduced from several inscriptions dating to the period in respect, that there was a series of catastrophically low floods between 4250 and 3950 BP [3, 4]. Unstable climate conditions strongly affected the Egyptian society. The most distinctive marker of these times is the almost complete breakup of the royal administrative system that caused internal unrest and in consequence the collapse of the country [5].

Geoarcheological research of the Polish archeological mission (headed by Professor Karol Myśliwiec) in western Saqqara (fig. 1) [6] (middle part of so called memphite necropolis) permits to reconstruct local climatic conditions in the terminal phases of the Old Kingdom (ca. 4100 BC). It has been demonstrated that the climate in the area of memphite necropolis at that time was characterized by considerable variability, i.e. dry periods alternated with phases of intensive rainfalls [7]. This extremely humid interval was in all probability the main reason for the decline of the necropolis, located close to the west temenos wall of the Step Pyramid complex and searched by the Polish mission [8]. The rainy weather, which intensified over time, coincided with mass plundering of tombs. The shafts and burial chambers, almost entirely emptied by robbers, were rapidly filled with rubble and mud brought by very intensive flash floods [9, 10]. It is still difficult to distinguish in the longer time perspective the changes in the frequency of rainfall events in Saqqara, recorded in rhythmic deposits noted in many tombs located around the Step Pyramid complex. It is not the mere fact of rainy periods occurring especially at the end of the Old Kingdom (periodic winter rainfalls in Egypt during the mid-Holocene are not surprising) that is noteworthy, but the surprisingly high intensity of the recorded run-off events.

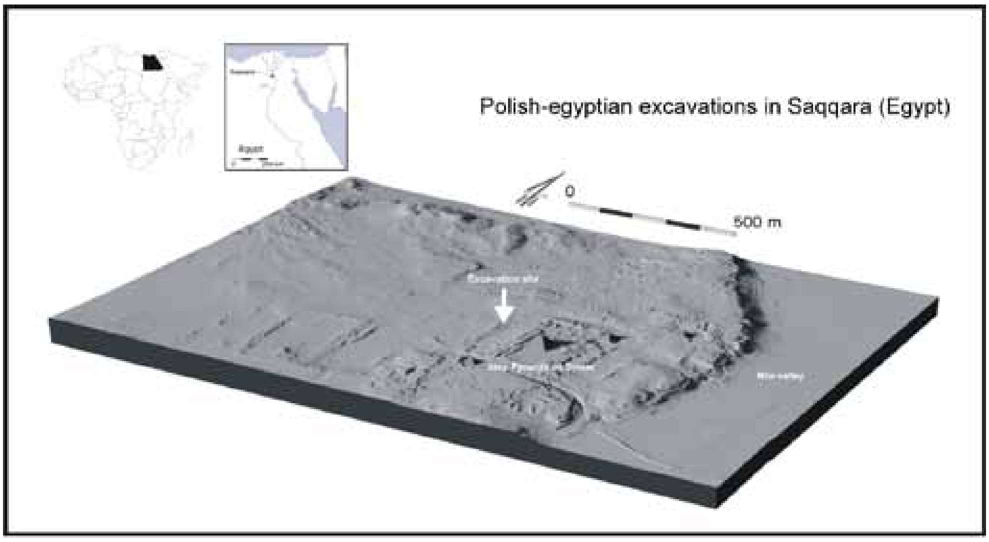

Figure 1. Localization of the polish – egyptian excavations in Saqqara (Egypt)

Layers of drifted sand found immediately on top of discovered structures by the Polish-Egyptian mission point to a gradual drying of the climate. Almost all discovered burial shafts are filled with dense aeolian deposits, which have started to be deposited (according to cermatological material) from the beginning of the First Intermediate Period (since 4000 BP) [8]. This dry phase correlates very well with the Nile filature recorded in ancient text mentioned above. Since that time the regional climate has started to be dry, with the conditions similar to the present weather prevailing in modern Egypt.

The recorded climatic events in Saqqara necropolis seem to be significant for understanding some aspects of the mid-Holocene climate variability. A recent progress in palaeoclimatic investigations enables to present a wider, regional or even global context of past local climatic changes. It seems quite obvious that every-year low floods of the Nile at the end of the Old Kingdom must have been a consequence of decreased summer precipitation in the Ethiopian Plateau [11] and the resulting low discharges in the Blue

Nile drainage basin that is responsible at present for 70 % of the annual runoff in the Lower Nile. A progressive shifting of the climate towards drier conditions has been recognized not only in eastern Africa but also in tropical areas as well as in eastern and central Mediterranean, including Anatolia [12]. In southern Italy there was a distinct forest clearance, starting already about 4500 BP that has been interpreted lately as the effect of aridification [13]. In central Mediterranean drier conditions were distinguished for the interval 4100-3950 cal. yrs BP, preceded and followed by wetter phases [14, 15].

In a global scale, there are distinct links of similar climatic changes between eastern Mediterranean and the Indian Monsoon systems [16]. The aridification resulted in a decline of the Harappa in India and the Akkadian society in Mesopotamia. In the North Atlantic region [17] there was a synchronous cooling (1-2° C), connected with changing water circulation and with deposition of ice-rafted debris (Bond Event 3) [18]. Such world-wide and synchronous occurrence of climate changes around 4100 BP suggests that they could depend on transformation of the global oceanic thermohaline circulation.

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TOPOGRAPHY OF ARCHAEOLOGICAL MONUMENTS AND PREDICTIVE CAPABILITY OF THEIR DETECTING (BY EXAMPLE OF THE TERRITORY OF SURGUT PRIOB'YE TAIGA ZONE IN WEST SIBERIA)

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Topographical characteristics of archaeological monuments come to be important source in the study of interaction between man and nature in past history, both in general and within individual territories. If the natural environment influenced ancient people's choice of place of residence and farming, the traces of this activity should be reflected in the placement of monuments. Systematization of data on the location of archaeological sites can help to reconstruct the overall picture of the ancient settlements.

Besides the scientific significance, mapping of the archaeological monuments and analysis of their topographic association may be important in terms of solving practical problems related to the protection of archaeological heritage. Under the conditions of intensive economic activity, when the industrial development of land is much faster than its archaeological survey, understanding the laws of archeological sites' location can become the basis for prognosis-evaluative mapping.

At the present stage, the lack of traditional methods of archeological sites' identification and protection is obvious, especially in the inaccessibility of the northern territories. In domestic archaeology, examples of such modern techniques as aerial photography, space imagery, earth remote sensing, etc. are rare, especially as they are not used for the protection of archeological sites [1, 2]. In 1980ˢ prognostic «red flag models» were successfully used by foreign countries in the system of archaeological monuments' identification; they were based on the hypothesis of the laws of the location of archaeological sites, depending on environmental and social factors. The probability of finding archeological sites was calculated by a mathematical model that took into account the differences in landscape of areas with and without monuments [3].

Ample opportunities for identifying regularities in the location of archeological monuments and the establishment of prognosis facilities of their identification, the use of mathematical methods and cartography techniques presents historical and cultural potential of Surgut Priob'ye, where more than 3,000 archeological monuments have been revealed. As for geography, this region is located within the taiga zone of the West Siberian Plain. In accordance with the modern administrative-territorial division it occupies the central and eastern part of the Khanty-Mansiysk Autonomous Okrug – Yugra.

Nature and climate changes that occurred during the Holocene have influenced the modern physical and geographical situation of the territory investigated. Repeated changes of climatic periods in the early and middle Holocene led to the establishment of modern zoning of vegetation, hydrological conditions and landscape development processes of bog formation. These natural and geographical features significantly affected the processes of archaeologisation of objects of human activity; as a result of that, visual fixation of archaeological sites' micro relief is possible nowadays.

As a result of intensive oil and gas exploration in the Khanty-Mansiysk Autonomous Okrug – Yugra in 1960 – 1990, the question on harmonization of land allotment for industrial facilities construction and archaeological monuments preservation arose. In this regard, starting from 1995 so-called cameral system of zoning has developed in the Cultural Heritage Protection system of the region; its essence laid in the allocation of areas with high and low probability of detection of objects of cultural heritage [4]. The procedure included:

- analysis of map materials and landscape-topographical situation in terms of favorability of its settlement in ancient times;
- analysis of archival material and literature to determine the cultural heritage sites of the area that have already been identified;
- analysis of the traditional way of life, the location of housing, economic, religious and other objects of the period of the ethnographic present in the surroundings of the expertized areas;
- definition of regularity in the location of objects of cultural heritage, both in the under study area and in adjacent areas with similar landscape and topographical features.

Results of cameral zoning took the form of an act of historical and cultural examination of the original documentation with the application of graphic materials; this act was a basis for project coordination of economic activities or a full-scale survey program development, if the projected object fell into the «promising» or «unpromising» zones. Conclusions about the «promising» or «unpromising» area to identify archaeological sites were built on the basis of several criteria:

- the proximity of the ponds, estuarine sections of rivers, the confluence of streams to larger rivers, lakes flow;
- the presence of areas evolved from a common landscape: belomoshnye forests, dry valleys Urman and well-drained, not flooded areas of the coastal terraces and mane.

In practice, it looked like this. Taking into account these criteria, the borders of «promising» and «unpromising» zones were charted on topographic maps.

«Promising» zone was usually between 300 and 500 m from the modern river bed, and «unpromising» was buffered and did not go beyond 300 m. Thus, the area of 1 km from the bed of the river became a major potentially promising in terms of detection objects of archaeological heritage. In such a way, the area of 1 km from the bed of the large river became potentially promising in terms of detection of objects of archaeological heritage.

Since the design of the procedure occurred during practical activities, it relied heavily on experience and intuition of researchers. Over time, weaknesses of the system became apparent, specifically the main disadvantage was the lack of clear assessing of «promising» or «unpromising» criteria of a certain area [5, 6]. At the present stage there is necessity in improvement of this procedure, creation of objective methodological framework based on complex analysis and mathematical statistics.

Data on the arrangement of the monuments of Surgut Priob'ye allow improving the existing methods of identifying and prediction of the archaeological sites on the unexplored territories. In order to establish the monuments spatial classification has been developed, the basis of which were attributes that reflect the particular location of archaeological sites Surgut Priob'ye. Comprehensive analysis of natural and geographical conditions of the territory and data on the location of archaeological sites of Surgut Priob'ye allowed identifying 15 attributes that best reflect the placement of monuments in the space of five criteria, provisionally titled: hydrography, landscape, vegetation, soil, and distance.

As a result, the established laws allowed determining the maximum width of the promising zone from the perspective of the modern river beds. For the right bank of the River Ob promising area must be at least: on Ob river – 8500 m, on the tributaries of the first order – 1500 m, on the second-order tributaries – 3000 m; on the third-order tributaries – 2600 m on the fourth-order tributaries – 700 m, on the fifth order tributaries – 750 m; the numbers for the left bank of Ob river – 8000 m, on the tributaries of the first order – 3000 m, on the second-order tributaries – 1300 m, on the third-order tributaries – 1500 m, at present, data on the tributaries of the fourth and fifth from the left bank of the river is unknown.

At the same time exception of their detection in such places is impossible. By analogy with the right bank of the river Ob the same criteria can be applied – 700 m from the river beds 4 and 750 m from the bed of the tributaries of fifth order. During the prognostication of monuments identifying along the shores of lake width of the «promising» area shall be not less than 500 m.

Therefore, the laws of the location of archeological sites can serve as a basis for predicting of their detecting at unexplored areas with similar natural and geographical conditions. Creation of maps of resource-evaluative perspective allows using this approach in other areas considering their local circumstances.

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THE ANCIENT SETTLEMENT KAMNO: PALEOLANDSCAPE FEATURES RECONSTRUCTION

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The ancient settlement named «Kamno» is situated 3,5 km to the NW from Pskov city at the riverhead of the Kamenka river, the left tributary of the Velikaya river. It's located at the landing of a cape-like promontory at the watershed of two gullies.

The valley of the Kamenka river and its slopy gullies are of preglacial age. They were made by both water erosion and karst processes in the thickness of local Devonian limestone and dolomite. The direction orientations of both of them inherited the directions of cracking, which are characteristic for the thickness of local bed-rock (N – 310-330º; NE – 30-60º). The surface of the bed-rock is laid over by a thin (only 0,3-0,5 m) layer of the late pleistocenic moraine loam, which contains local carbonate detritus and rare erratic Scandinavian pebbles and boulders. Its thickness at the cuttings of the ancient valley of the Kamenka river reaches 20-30 m.

The vicinity of the ancient settlement Kamno is located on a structural slope of Devonian cuesta. From the point of view of geomorphology it occupies a part of territory of the Izborsko-Pskovskaya abrasion limnoglacial plain, a surface of which has the absolute marks of 45-46 m. The surface of this plain is composed of abrasion moraine loam and in some places by limnoglacial sands. From the NE to the SW the plain is crossed by hills and ridges of Vaulinogosky marginal complex. The other remarkable geomorfological features are drumlin hills, which form the Pskovsky drumlin field [1].

Geological and geomorphological characteristics determine the orolitogenic basis of modern Kamno vicinity. They allow us to reconstruct the paleolandscape features of this territory for the Holocene epoch.

The landscape features of the settlement Kamno began to form during the preboreal and boreal periods of Holocene epoch after the dissapearance of the Chudskoye ice-dam lake [2], when there happened the climate warming.

During the boreal climatic period the average temperature of July and annual temperatures at the latitude of Kamno settlement were only 5-2 C lower than today and annual atmospheric precipitation was only 50 mm more. At this relatively warmer time the preglacial valley of the Kamenka river and its gullies got free from the dead ice fillings. As the result the ancient cuttings got partially filled with sediments which melt out from the dead ice. Thus, towards the end of boreal period of Holocene the preboreal fitolandscapes of tundra-forest-steppe zone were replaced by forest fitolandscapes of taiga zone. In these forests mainly pine and birch with some fir-tree and alder-tree (to10 %), and oak, elm and linden (2-4 %) grew.

However, at that time the local peculiarities of relief, mother rock soil and the extent of wetting began to influence the plants group composition. These peculiarities formed the landscapes of waterless meadows with a sparse growth of trees at the well drained watershed spaces of the Kamenka river valley and its gullies and also the landscapes of forests at their slopes and bottoms which had more wetting [3].

During the early Holocene the Velikaya river had a Pskovsko-Chudskoy segment of its valley. It occupied a large part of the then drained depression of the modern Pskovsko-Chudskoye Lake and the Velikaya river flew into the Small Chudskoye Lake. This lake was a relict of the Chudskoye ice-dam lake. It occupied the deepest northern part of the Pskovsko-Chudskaya depression and its water level almost reached the 20 m absolute mark. This water level was the basis of the Velikaya river erosion. Due to this fact the water- level of the Velikaya river at the place, where the Kamenka river flows into it, was10 m lower than today (30,5 m) and the Kamenka had larger waterfall angles and speed of flowing than now.

However, dissapearance of glacial pressure on the earth crust at the area of the last glaciation provoked the compensatory isostatic raising of this territory It was quicker at the northern part of the Pskovsko-Chudskaya depression than at the southern part. For this reason a warp of depression in the southern direction took place and thus, as the stream of water flowing from the Small Chudskoye lake into the Baltic sea became difficult, the waters began to fill the lacustrine waters of the Pskovsko-Chudskaya depression and thus the transgression of these waters in southern direction started. As a result of this transgression the Pskovsko-Chudskoy segment of the Velikaya river valley stopped its existence. A lake with the water level of 25 m absolute mark was formed and the lower tributaries of the Velikaya river turned into estuary type bays [4]. At the same time a similar lake bay in the Kamenka river valley began to form.

In the middle of subboreal period of the Holocene the climatic conditions grew worse: summer, winter and average annual temperatures became lower and annual precipitation quantity increased. This climatic change brought about an increasing share of fir-tree in forest landscapes (to 50-60 %), and a reduction of the share of pine, birch, alder, aspen and broad-leaved species of trees. At this time swamping processes become more active, and the water level of the Pskovsko-Chudskoye lake continues to rise (approximately to 27 m absolute mark).

The filling of the Pskovsko-Chudskaya depression with lacustrine waters made human settlements on this territory impossible. At the atlanticum period of the Holocene these are the banks of estuaries and rivers that become suitable for the settlement.

This may be confirmed by the discovery of the Middle and Late Neolythic time settlements on the Belaya Struga Lake and on the left bank of the river Obdyox, which after the filling of the Pskovsko-Chudskaya depression with lacustrine waters were situated along the ancient bank line [5]. The Kamenka river basin also becomes perspective for the Neolythic men settlement. For example the cape-like promontories at the riverhead of the estuary of the Kamenka river became especially attractive. Most probably the further search for the Neolythic settlements in the Kamenka river basin will make it possible to confirm this hypothesis.

The improvement of the climatic environment at the atlanticum period, which was the climatic optimum of the Holocene, could have also contributed to the settlement promotion. At this time average temperatures of July and January were 1-2º C higher than at present, and annual quantity of precipitations was 25-50 mm larger as compared to that of today. These factors influenced the fitolandscapes of Kamno settlement vicinity. The share of fir-tree in its forestry phytocenoses increases (more then 5 %) and the share of broad-leaved species of tree (elm, oak, linden, hazel) increases to 10-12 %. In phytocenoses of grassy vegetation the number of preboreal and boreal xerophile species of plants decreases. Due to underground-water level raising and the mouths of the Kamenka river and its gullies flooding swampy landscapes are formed.

At the beginning of the subatlanticum period of Holocene the climatic conditions changed to the furher lowering of a temperatures and the increase of dryness. The average temperatures of July and January at this period become 1-2º C lower than today. The precipitation decreases 25-50 mm as compared to modern number. By this reason the share of fir-tree and broad-leaved trees in a forest associations of a local landscapes changed (to 5 %) quotes and the share of pine and birch raised.

However, in the middle of subatlanticum period of the Holocene raising of temperatures which was named as «a small climatic optimum of the VIII–XII centuries» in paleogeography was observed. The average temperatures of July and January were 0,5-1º C higher then modern and the precipitation quantity was 25-50 mm higher than that at present.

Such improvement of climatic conditions provoked a new migration of fir-tree into local forest formations on the divide of the Velikaya and the Kamenka rivers. At the same time the share of broad-leaved trees (to 8-12 %) and alder (to 15-20 %) increases.

It is to that period of time that the earliest and archaeologically confirmed evidence of settlement of the territory of the ancient settlement Kamno and its vicinity refers. The lowest layer of the ancient settlement Kamno exhibits trustworthy traces of the existence of a large fortified settlement and several smaller settlements of the VIII-IX c. in its vicinity. Leaving the issues connected with the origin of the early population of Kamno outside the limits of our article we can obviously trace its appearance in the riverhead of the Kamenka to migration processes.

The choice of the place of settlement was most obviously determined by favorable nature conditions. Warm and damp climate, lands suitable for arable farming and pasture contributed to the development of agricultural economy at this place. Archaeological data proves this fact. The layers of the VII-IX c. produce numerous finds of cultivated plant seeds (wheat-polba, barley, oats, peas) and more than 20 species of weeds, animal bones, and also agricultural weapons (sickle, ploughshare, scythe, millstone . High construction density traced by archaeological excavations as well as by archaeological geo-physical observation of the whole settlement site also testifies to the conditions favorable for settlement development at this period of time [6].

The observation showed that during the last stage of the settlement existence practically the whole territory of the settlement cape was used by man. Recent investigations give us right to suppose the existence of several non fortified settlements to the South of the ancient settlement Kamno.

Beside arable farming the population of Kamno was occupied with bronze casting and other trades (hunting, fishing etc.) Archaeological finds connected with fishery (fish bones, fishery implements) testify to the fact that fishery played a great role in Kamno economy. The research shows that at the period of ancient settlement existence the Kamenka river was rather high watered. Osteological data speak to the fact that Kamno fish catches reflect the ichtiofauna of the river Velikaya delta. Most probably Kamno's population caught most of fish at the period of spawning when the fish went up the tributaries of the Velikaya river.

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ORE GEOARCHEOLOGY OF URALS

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Ore Geoarchaeology deals with raw material of ancient societies, products of ore redivision and metal-working (slags, bars, metallic items) using geological and other sciences including economic geology (minerageny), mining, mineragraphy, mineralogy and petrography (study of ores, slags and metallic items using optical microscopes), geochemistry (including, isotopic), analytical researches, ore geophysics, and paleometallurgy.

Ore Geoarchaeology is based on the geological and geoarchaeological data obtained by great experts from industrial and scientific organizations and universities.

The main objects are ancient mines of the Urals region (some of them were found by authors): Vorovskaya Yama, Ishkinino, Dergamish, Ivanovka. The geological schemes of mines and ore-bearing areas were complicated, and geological, geochemical and micromagnetic surveys were carried out. Authors took part in excavations of Arkaim, Alandskoye, Sintashta, Kuysak ancient settlements, Bolshe-Karagansky, Alexandrovsky and Kamenny Ambar burial mounds. We got the materials from our colleagues to study slags, copper, bronze and gold items from 30 archaeological monuments of Southern Urals.

Artifact compositions were studied in Institute of Mineralogy UB RAS using following methods: optical (Olympus BX-51 and Axiolab, Carl Zeiss microscopes), chemical, atomic-adsorption (Perkin-Elmer 3110); X-ray spectrometry (REMMA 202M electron microscope, microanalizer JEOL-733), RFA (INNOV-□-4). The INNOV analyzer is compact and allows analyzing of items by non-destructing method that is very important for archaeological researches. According to these works the geoarchaeological database with descriptions of ancient mines, concentrating mills and metallurgical kiln relics was made. The tables with results of ore composition, mineral and melt inclusions in slags, metallic items were composed. These data review allows basing metal distribution on ancient society places at the territory.

Cu ores mining and extraction industry. Ancient Cu mines are quarries with 80 m diameter, and vertical and inclined mine workings. Mostly oxidized ores containing malachite, azurite, bornite, tenorite, etc., were exploited. Sulfide ores were rare that is established according to bead compositions in slags and mineral inclusions (covellite). In Southern Transurals there are 3 main types of Cu objects differed with geological setting, ore body structure, mineral and chemical composition and mineral resources.

1. Mines confined to ultrabasites with Cu-, Ni-, Co- and As-containing ores (Vorovskaya Yama, Ishkinino, Dergamish, Ivanovka).

2. Mines confined to rhyolite-basalt complexes of VMS deposits. They are broken by modern mining works. The typical for this type is Bakr-Usyak deposit.

3. Mines confined to granitoide intrusion contacts (tourmaline-malachite Elenovka deposit).

The total estimation of Cu ore resources of the Southern Transurals ancient mines is 70 thousands tons [1]. For approximate estimation of built-up metal the Cu contents in ores (3-5 % for different mines) and metallurgical extraction coefficient (min 50 %) are important [2]. Using these parameters 1400 tons Cu were extracted from ores.

Ancient metallurgical slags and metallic items. Authors studied slag compositions from 16 settlements of Southern Urals. Several groups are divided, differed in composition, mineral and melt inclusions. According to RFA data the main types are Cu-, Cr-, Co-, and Sn-containing slags.

Mineral inclusions in slags are cromites $FeCr_2O_4$ – minerals from Cr-spinel group with admixtures of Mg, Al, Ti, Mn, Zn, V in different ratios. This is refractory mineral, and melting temperature of high cromites is 2180°C [3] and it poorly reacted with slag melt. This mineral feature and chromite composition allow to determine specific raw mineral source for several metallurgical centers.

Melt inclusions are copper and As- and Sn-bronze types. The first one is related with arsenide ores from Co-Cu-VMS deposits occurred in ultrabasites. Sn-bronzes are determined by beads presence in slags. These inclusions have not revealed before in Uralian metal-working products, and their presence testifies that Sn-containing ores were used. These minerals were not found in quantity. According to geological data the sources for this raw material were Sn deposits of Kazakhstan.

Metallic plate-shaped items are 3 types: As-, Sn-bronzes and native Cu. In As-bronzes Pb-inclusions were established.

Au ores mining and jewellery industry. Au-quartz deposits and placers exploration evidences. The evidences of Au extraction from Au-quartz veins at ancient mines of Kyzyl and Sakmara river basins in Baymak ore region were observed. Ancient pits look like quarries and small pits with soot on the walls. Near the pits stone stamps and mortars are found which looked like stone plates with diameter of 30 sm and hollow in the centre. The finds of bronze and stone picks in Au-bearing sands testify about placers exploration. Such finds were established in placers of Miass, Kochkar and Beresovsk ore regions.

Ancient jewelleries were found in Urals archaeological monuments at the territory of Orenburg, Chelyabinsk regions and Bashkortostan Republic. The richest are Philippovka, Perevolochan I, Magnitny and Kichigino burial grounds. The most expressive is gold deers and jewellery collection from Philippovka burial ground in museums of Ufa and Orenburg [4]. All items are made with “Siberian animal style”. Different jewellery pieces and wire balls were found in the Middle-Ages workshop at Ufa II settlement.

Archaeological Au compositions are different. According to Au standard distribution histograms there are several groups with different compositions (per thousand): high-standard (980-860), middle-standard (840-600), and low-standard (550-370). It testifies about different metal sources. Au pieces composition from archaeological monuments of Bashkortostan, Chelyabinsk and Orenburg regions was characterized. According to composition the items with contents of 82-87 % Au prevail, and rarely – 61-67 %. In jeweller's workshop of Ufa II settlement the wire with 97 % Au contents was found. According to Cu contents the items produced using alloyage process were determined. This rate for native Au is less than 3 %. Items with higher (up to 9 %) rates were obtained using artificial addition to Cu melt.

PGE mineral inclusions in ancient Au items. The most important results of our study are PGE minerals finds in items from several archaeological monuments. These finds were established in 3 monument groups: 1) the western group in Transurals

(Philippovka I, Ufa II), 2) the central group contiguous to the Main Urals Fault zone (Perevolochan I, Yakovlevka II), and 3) the eastern one (Kichigino I, Bolshoy Klimovsky, Stepnoy and Ushkatta). The eastern monuments are confined to the East-Urals Fault zone at Ural-Tobol rivers divide. The study of 34 PGE mineral grains was carried out which correspond to 3 composition types with Os, Ru and Ir prevalence, appox. [5]. On Os-Ru-Ir triangular diagram the most of fields are in its central part correspond to Os from Urals placers. Also there are separate figurative points which analogues not to established before at these deposits.

Metal sources. We estimated probable sources of Au and PGE from ancient jewellers. According to inclusion morphology (roundness and heterogeneous composition) they were extracted from placers. The probable metal sources were used Au placers situated in the Main Urals and East-Urals Fault zones. These tectonic structures host Au-bearing ultrabasite bodies with Os mineralization and related placers. The comparison of native Os composition of Urals placers and Au jewelers from all points of this rare mineral finds will be carried out to determine Au extraction places for jewelleries.

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INTERNATIONAL GEOARCHAEOLOGICAL COLLABORATION AT THE BEGINNING OF THE XXI CENTURY (RUSSIA, KAZAKHSTAN, TURKMENISTAN, UKRAINE, BULGARIA)

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The cooperation of archaeology and geological sciences increased at the beginning of the XXI century due to modern analytical equipment in several scientific centers. Our publication is devoted to geoarchaeological researches of Institute of Mineralogy UB RAS experts and their colleagues.

Our researches started from Arkaim settlement study which discovered in 1987 at the Chelyabinsk region southern part. During the Arkaim Reserve organization it was required to compose geological map and ore minerals distribution scheme to determine places of raw materials of our ancestors. Later this monument has been applied to reinforced settlements group of Bronze Age with plottage of 100 × 300 km, which was named «Country of Towns». The aim was raised to study raw mineral base of this territory including materials for fortification buildings. In common with Chelyabinsk State University experts the study of stone industry petrofond was carried out, metallurgical stove structures and the composition of slags and metallic items were studied. During these researches RFA and atomic-adsorption method for artifact analyses were used.

The important event which increased the results of our researches to higher standard was the purchase INNOV RF analyzer by the Institute of Mineralogy in 2008. It allows archaeological items measuring without destruction. The same equipment is in the Institute of Archaeology RAS, Hermitage Museum and Altai University. Owing to this fact the collaboration with archaeologists from the scientific centers of Russia, Kazakhstan, Turkmenistan, Ukraine and Bulgaria was increased from this time (fig. 1). We have an opportunity to determine the composition of bronzes, Au and slags from archaeological monuments and museum collections pieces. The latest achievements are finds of As- and Sn-containing slags at Southern Urals.

Figure 1. Scientific centers of Russia, Kazakhstan, Turkmenistan, Ukraine and Bulgaria

Russia. Especially among Russian institutions we effectively cooperated with the Institute of Archaeology RAS during Au study from Philippovka I burial mound. The results of these researches were published in [1]. At Urals we collaborate with the Institute of History and Archaeology UB RAS (Ekaterinburg) and Institute of Humanities (Orsk). As a result the Kamenny Ambar settlement (Chelyabinsk region) and ancient Ishkinino Cu mine with Cr-containing ores (Orenburg region) were described. Near this pit the miner village with metallurgical industry evidences in the form of slags with chromites which are similar to inclusions in ore.

During the researches in Siberia Au from Khakarinsky dol (Altai Krai) and Arzhan 2 (Tuva) burial grounds were studied in collaboration with archaeologists from Hermitage Museum and Altai University. In Au items from these burial grounds Os inclusions differed from similar minerals of Urals monuments were established. Experts from the Institute of Archaeology and Ethnography SB RAS and Irkutsk University help and discuss our researches. Major articles on geoarchaeological themes were published in «Archaeology, ethnography and anthropology of Eurasia» Journal [2].

Kazakhstan. The project of ancient mines of Western Kazakhstan study was carried out in collaboration with experts from Aktyubinsky Research Mining Oil Institute. The places of Cu ores extraction in Mugodzhary Mountains were studied and the publication about Mugodzhary Mining-Metallurgical Center was prepared. Ore resources extracted from the Western Kazakhstan mines, and smelt metal quantity were estimated [3]. Au compositions from the Kazakhstan Central State Museum collection, including Issyk («Gold soldier») and Chiliktinsky burial grounds, Zhalauly and Pokrovsky buried treasures, were studied. Au study from Taldy-2 burial ground was meaningful and carried out in collaboration with experts from the Institute of Archaeology of Margulan [4]. The review article titled «Ancient gold of Kazakhstan» was prepared.

Turkmenistan. The works were executed in Gonur-Depe administrative and cultural center existed in XXV-XVIII BC. These researches were carried out in collaboration with the Institute of Archaeology and Ethnography RAS and Margiana archaeological expedition. The aim was to analyze the petrofond of stone industry of Margiana center.

Ukraine. The study of artifacts composition from Belsky settlement and Pessochinsky burial ground near Kharkov was carried out in collaboration with archaeologists from Kharkov National University and Kharkov local-history museum. Brass and lead bars produced in the Early Middle-Ages workshops, were established. The information about Au item compositions from Berdyansky, Tolstaya mogila, and Alexandrovsky burial grounds was obtained from experts of the Institute of Geochemistry and Ore Formation UAS (Kiev). Geologists from Donetsk National University gave the data about Au compositions from Nagolny Mountain Ridge deposits.

Bulgaria. The researches were carried out in collaboration with experts from the Institute of Archaeology, Museum of Bulgarian Science Academy, Vrats Museum and Ada-Tepe Gold-Mining Company. Ancient Cu pits in SE Bulgaria were sampled and analyzed. The publications about gold compositions from Au- and Ag of Vilchitryn, Mogilanska mogila, and Rogosen buried treasures were prepared.

Conclusion. According to obtained data the monograph «Geoarchaeology» was published [5], which devoted to geological methods application in archaeological researches. In the monograph, except for «Uralian» objects, information about geological expeditions to Kazakhstan, Southern Siberia and Eastern Europe is used. The methodology of petrographical, mineralogical and mineragraphical study is demonstrated to determine raw material sources where used by ancient metallurgists. The tutorial is intended for students of archaeology and geology. Monograph in Internet is: http://baseserv.ilmeny.ac.ru/files/OFIC/REPOSITORY_F/1947.pdf. In what follows we'll plan to finish the monograph «Gold of Eurasia steppe», which is characterized noble metals in ores and ancient Au items from this unique region.

Authors appreciate their colleagues A.A. Akishev, K. Altynbekov, A.S. Beisenov, I.A. Blinov, E.V. Zaykova, G.B. Zdanovich, D.G. Zdanovich, S.Ya. Zdanovich, B.S. Kakabaeva, V.A. Kotlyarov, T.S. Malyutina, A.N. Sultanova, A.D. Tairov, A.A. Tishkin, V.V. Tkachev, Yu.M. Treisser, S.V. Sirotina, V.V. Ovsyannikova, P.V. Kchvorov, E.I. Churin, M.S. Shemakhanskaya and L.T. Yablonsky to collect and analyze materials.

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THE STRUCTURE AND LANDSCAPE PATTERNS OF THE GNEZDOVO NECROPOLIS

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The Gnezdovo complex of archaeological sites situated some 7-13 km to the west from Smolensk town is one of the major preurban centers of Medieval Rus' covering an area of more then 150 hectares. The complex is settled mostly on the right, with some parts also on the left, bank of the Dnepr River. The Gnezdovo archaeological complex currently consists of 2 hillforts, vast settlement and 6 groups of mounds interrelated by period of existence and homogeneity of material culture. The necropolis of Gnezdovo totally count more then 1600 mound survived from damage and previous excavations (fig. 1).

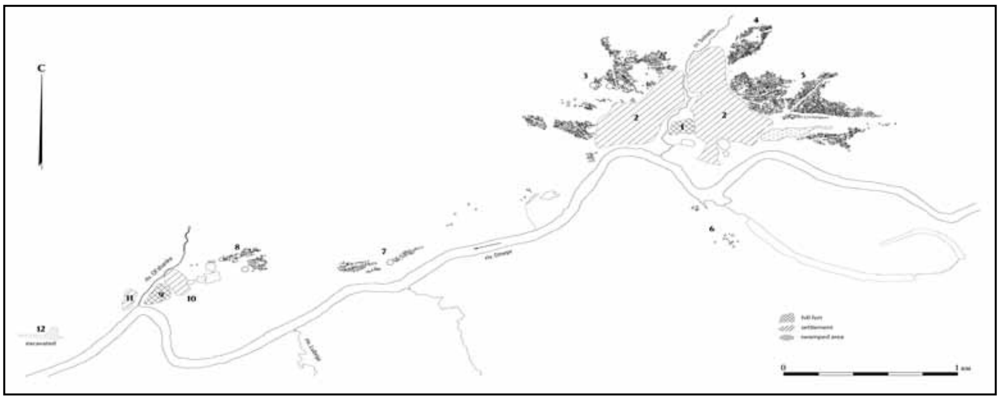

Figure 1. Map of the Gnezdovo archaeological complex: 1 – Tsentralnoe gorodishe (Central hill fort), 2 – Tsentralnoe selishe (Central settlement), 3 – Tsentralnaja gruppa (Central mound group), 4 – Glushenkovskja mound group, 5 – Lesnaja mound group, 6 – Levoberezhnaja mound group, 7 – Dneprovskaja mound group, 8 – Ol'shanskaja mound group, 9 – Ol'shanskoe gorodishe (hill fort), 10 – Ol'shanskoe selishe (settlement), 11 – Zaol'shanskoe selishe (settlement), 12 – Zaol'shanskaja mound group

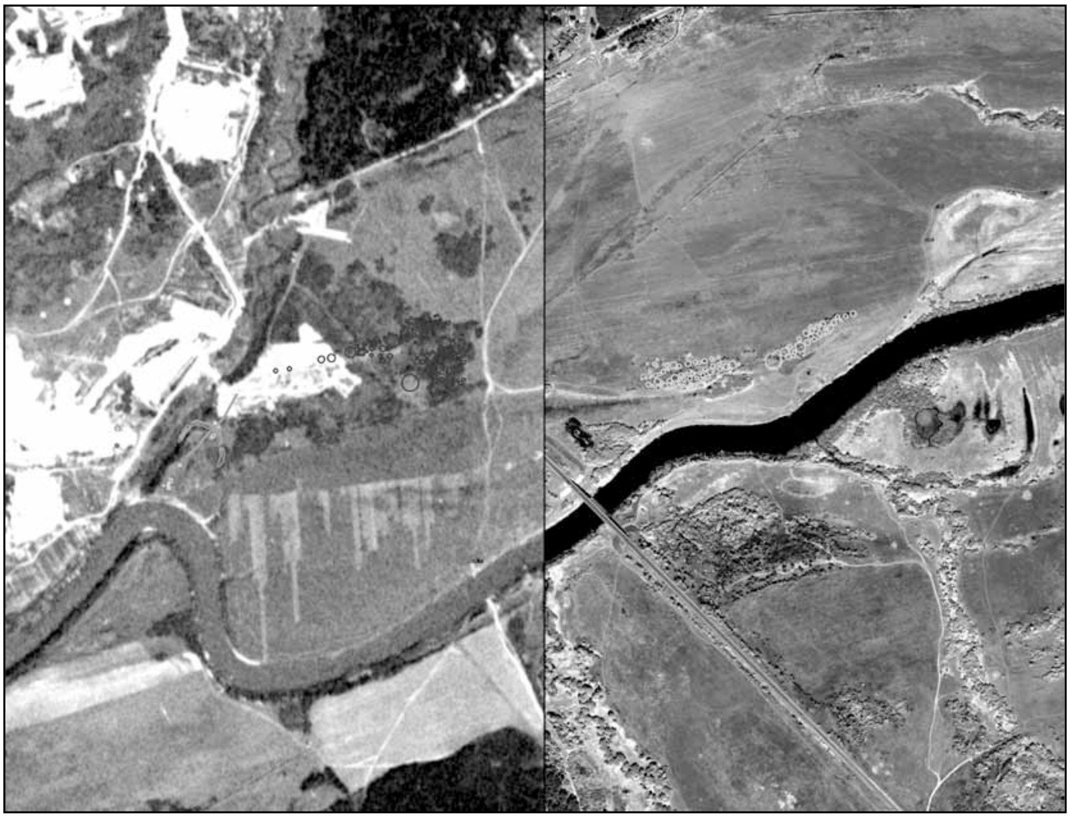

Figure 2. Georeferenced data in a GIS framework: left side – intelligence image from 1970's, right side – contemporary image, color overlay – mound groups

In the past decade the History faculty of the Moscow State University has launched a project which aim was to integrate the total amount of scientific knowledge obtained from 140 years of excavations in a multifunctional computer data system. The data core of the system is operated by GIS engine which enables the spatial potential of archaeological data. The multilayer cartography framework of Gnezdovo GIS includes a broad scope of topographic, cartography and remote sensing data: archive maps of the region dating from 1730's, historical topographic maps of the 19th century, large-scaled topographic map from 1 : 50000 to 1 : 500 produced during 20th century, archaeological plans of the complex beginning from the very end of the 19th century. A scope of remote sensing data covers intelligence photos of WW2 and 1970's as well as current high resolution satellite imagery.

Within GIS cartographic spatial data was georeferenced to a sole global coordinate system giving a versatile view on the Gnezdovo archaeological complex through temporal and anthropological change. Integration of the geodata multiplied its potential through spatial analysis algorithms applied to a variety of issues of landscape and structure specific patterns of the site (fig. 2).

Among those is the structure and interrelation between mound groups of the Gnezdovo archaeological complex. The structure of the Gnezdovo necropolis shows two distinct patterns – dense circular allocation of mounds around the settlement core of the complex and separated linear concentrations following the Dnepr flow as a baseline. Both patterns are relief relevant tending to keep an 8-10 meter minimum height gap from the water level of the Dnepr River (in its current summer flow state). The disposition of mounds avoids river floodplain and any lowlands, e.g. swamped areas. In the height critical peripheral zones of the necropolis the density of mounds seem to arise, which confirms the notion of Gnezdovo inhabitants to isolate their graves from the flood (fig. 3).

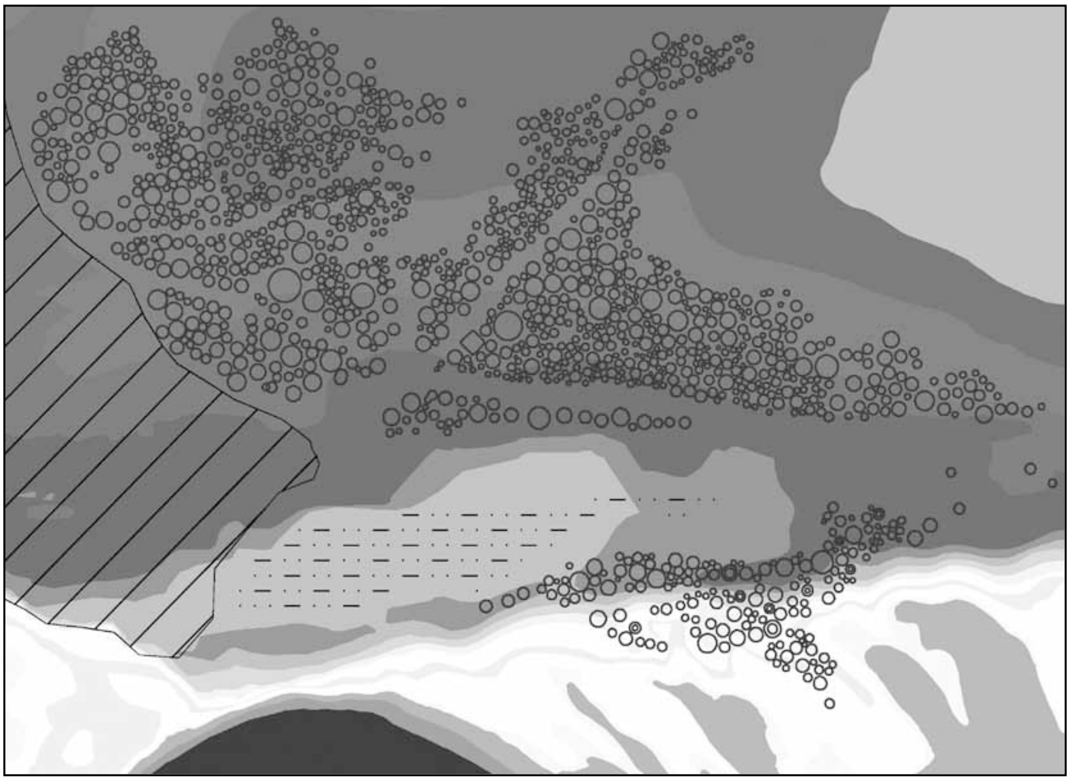

Figure 3. Eastern part of the central Gnezdovo necropolis (pattern 1) overlaid on the elevation banded map

Meanwhile in terms of isolation the circular pattern of the major part of the necropolis forms a distinct landscape barrier cutting off the settlement from the outer land. Its horseshow structure encloses the settlement from the west, north and east, while the Dnepr River provides a natural frontier from the south.

The analysis of the internal allocation of mounds within the mound belt revealed intentional gaps between mounds not related to later damage or anthropological change of the necropolis. These linear gaps most likely to be interpreted as ancient paths and roads concurrent to the Gnezdovo site.

The second allocation pattern of the Gnezdovo mounds demonstrates prominent semantic relation to the Dnepr flow, with a riverbed forming a baseline of the pattern. Mounds are grouped on the top of elevated floodplain ridges, majorly tending to their ends facing the main stream of the river (fig. 4). As opposed to the primary allocation pattern of the Gnezdovo mounds related to the settlement these mounds show no connection with inhabited areas. Such type of mound allocation forms a system of landscape marks emphasizing the role of river in the society of Gnezdovo population.

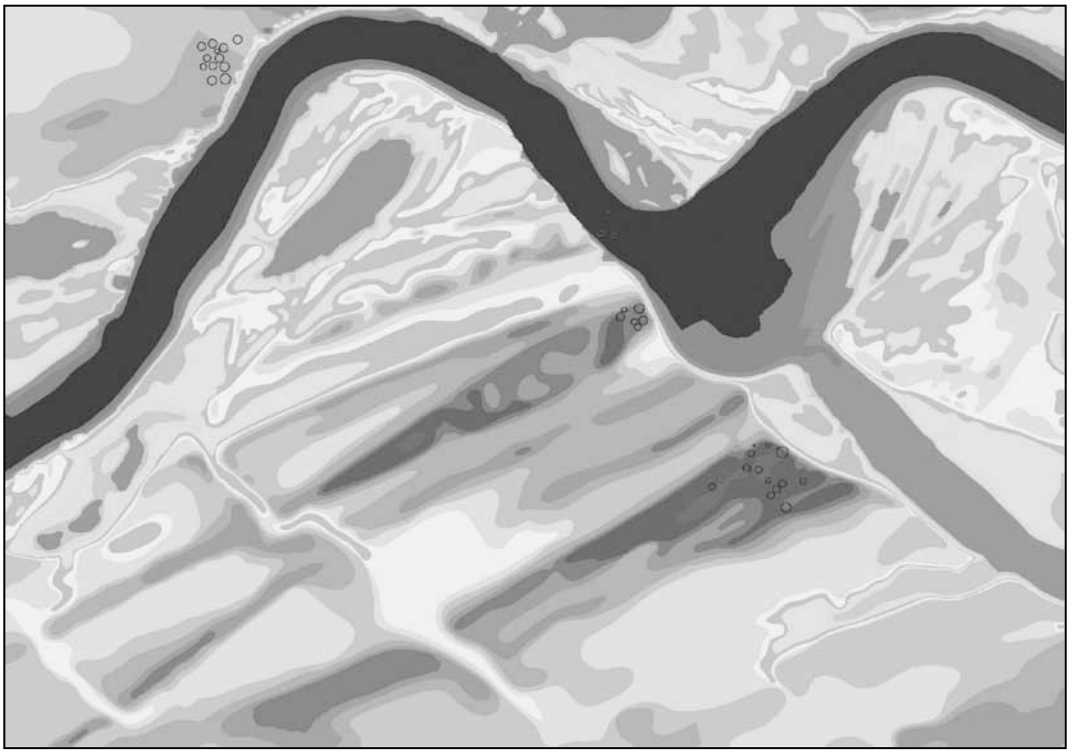

Figure 4. Mounds on the left bank of the Dnepr River demonstrating the second type of landscape allocation

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HORSE BURIALS IN BALTIC REGION: POTENTIALS FOR ARCHAEOTOURISM

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Archaeotourism as a form of cultural tourism becomes increasingly popular in recent years. Aimed to promote the public interest in archaeology and conservation of historical sites, it is often associated with concrete archaeological sites and objects of particular historical importance. Horse burials are among such objects in the continuous area of the Baltic region. They made their appearance in the period of Roman influence (2^{nd}-4^{th} centuries AD) [1-3]. Numerous works on horse burials, connected rituals and horse physical appearance exist for the area of Baltic tribes and adjacent territories (for the literature review see [4]). This makes the coherent grouping of cultic equestrian burials possible, despite the complex history of the region. Reconstructed in timely evolution in relation to the ethnic and social history horse burials constitute important objects of cultural heritage in Baltic region.

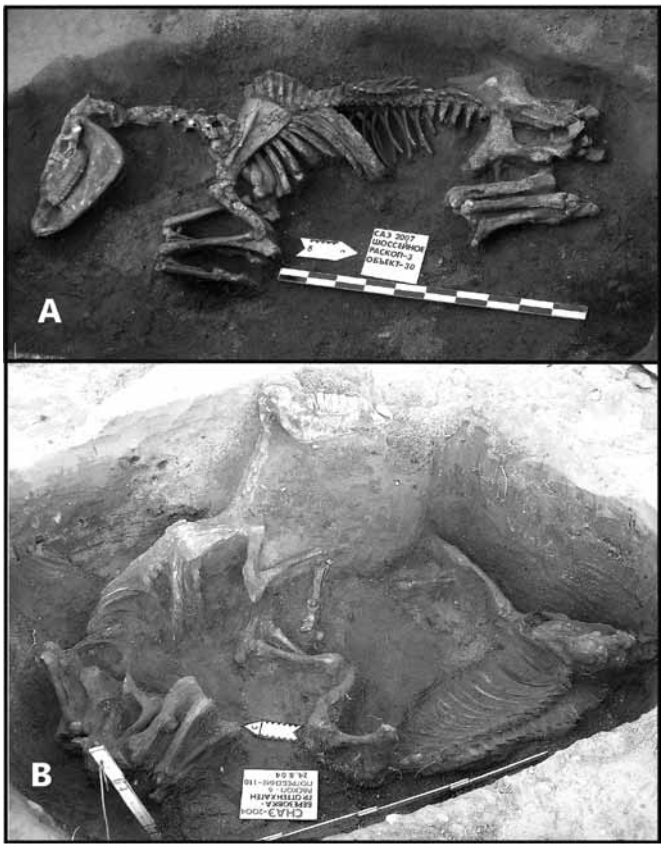

Figure 1. Single and double horse burials. 2nd century AD: A – Schosseinyi (Dorf Warten Kreis Königsberg); B – Berezovka (Groß Ottenhagen). Photos courtesy K. Skvortsov

Whole horse burials are among the most attractive and frequent types of horse burials. Single (fig. 1A), less frequently two (fig. 1B) and rarely three horses are buried in a tight pit to the west from the human inhumation or on the bottom of it [3, 4]. Bridle bits often associated with skeletons as well as the absence of mutilation traces suggest the practice of burying horses alive. The tightness of the pit, when horse (horses) were forced there with legs flexed under the stomach, has made the escape of still living animal impossible. Literature sources can be added as an entertaining supplement to the illustration of this ritual. Vulfstan's stories in King Alfred's edition of Orosius' History of the World (9^{th} century) and even later works (13-14 centuries) such as those by von Dusburg record the habit of Prussians and Lithuanians to 'run the horses off their feet to such an extent, that the animals can hardly keep stand'. Then they could be easily stuffed into the pit. The ritual character of such a burial is displayed by a special position of the horse in the pit. The head of it is frequently positioned in a special niche lower [6] or higher of the croup level [7]. Although there seems to be no actual preferences to the age of buried or sacrificed animals, some of the burial grounds show the prevalence of young horses (3.5 – 4 years old). The preference is only traceable in the sex of animals – most of them are stallions, highly praised as riding animals in European tradition [8]. The entirety of the buried horses indicates the death, which would hardly have been swift, displaying more ceremonial rather practical goal of the tradition [2].

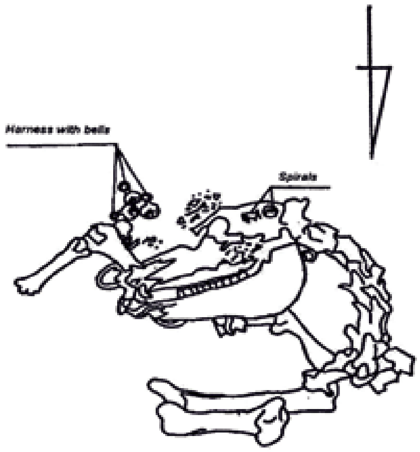

Figure 2. Example of horse burial (head with forelegs). Marvelė burial ground, Lithuania. After [6]

Head of the head with forelegs appear somewhat later than the previous type (around 5th century AD). This type of burial is known for the entire Baltic region [9, 10] and in some burial grounds of Lithuania constitutes 14-15 % of all horse graves [6] (fig. 2). Presence in the burial equine parts, often with the skin, shows sacrificial character of this type of burial. Historical reports could be instructive in understanding of this type of burial. Besides the report of Adam of Bremen of horse sacrifice in Sweden, when heads were cut from the bodies of sacrificial animals and men, a Moorish Arab Ibrahim At-Tartushi presented an interesting account. On his visit of Danish town Hedeby he witnessed the habit of placing sacrificial beasts on the pole as an offering to god. Often the body was eaten, thus only head and legs were places on the pole. Travelers of the Viking period also wrote of a custom in southern Russia where the horse's skin, feet and head were placed on a pole over the grave of a dead man' [11].

Scattered and often burned horse remains are also common and better described for Lithuania [6], old Prussian burial grounds [12] and north of Russia [13]. Horses were definitely chopped into pieces as ritual offering (fig. 3). Was this offering consumed by the participants of the ritual or destined as food for the buried individual or gods is not always clear. This offering was often accompanied by the sacrificial chopping of other animals, such as dogs, goats and chicken. Arabic traveler Ibn Fadlan reported as an eyewitness, that the funeral of noble Rus was accompanied among others by chopping with swords of one dog and two horses. All of them, along with the boat, slave girl and other belongings were burned and secured under the barrow.

Burials with no horse bones, containing only bridle bits and / or sickle, appear late in the region and traditionally linked to the onset of Christianity around the turn of the millennium [14].

A good companion, since the early time of domestication the horse has been treated as ritual and sacrificial animal. Either destined to follow the proprietor to the afterlife as a mediator or part of valuable property, or serving as food during the ceremonial funeral feast, horse deeply entered in antique and medieval culture of tribes in Baltic region. Thus the potentials of horse burials, revealing the significant cultural layer of Baltic tribes, are among the highest in archaeological tourism.

Figure 3. Scattered horse remains from the grave No. 164. Marvelė burial ground, Lithuania. After [6]

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ГЕОМОРФОЛОГИЧЕСКОЕ ПОЛОЖЕНИЕ ГОРОДИЩ РАННЕГО ЖЕЛЕЗНОГО ВЕКА НА ПРАВОБЕРЕЖЬЕ Р. КАМА

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Пристальное внимание к интегративным возможностям научного знания все чаще становится неотъемлемой частью археологии. Наш небольшой опыт совместных археолого-геоморфологических исследований в прикамских районах Удмуртии позволяет обменяться некоторыми наблюдениями и размышлениями. Правобережье Камы, ввиду весьма благоприятных условий для оседлого проживания, осваивалось на территории современной Удмуртии одним из первых. Наибольшую плотность древние поселения имеют в нижнем течении этой водной артерии, на территории Каракулинского района. Хорошо известны поселения бронзового века, но особую известность получили городища начальной поры железного века. Именно освоение нового сырья – железа – способствовало быстрому развитию производящей экономики у местного населения и, как следствие, росту народонаселения. В ананьинское время (VI–III вв. до н.э) на рассматриваемой территории резко увеличивается количество поселений, появляются городища. Из 30 известных сегодня в пределах района городищ, на 22 выявлены культурные слои и находки ананьинской и чегандинской (II в. до н.э. – V в. н. э.) культур. Одним из руководящих факторов размещения поселений, особенно городищ, безусловно, является рельеф. От того, насколько удачным будет выбор площадки для проживания, зависит его долговременность, степень защищенности.

Каракулинское Прикамье находится в восточной части Восточно-Европейской (Русской) равнины, интенсивно расчлененной эрозионной сетью. Главной водной артерией среднего Предуралья и базисом эрозии является р. Кама. С ней связаны многочисленные малые реки и густая овражно-балочная сеть. Камская долина резко асимметрична: правый склон преимущественно коренной, левый – террасированный. Долина Камы разрезает Сарапульскую возвышенность, что обуславливает значительную крутизну склонов, а при низкой залесенности (в настоящее время 8 %) вызывает интенсивное протекание склоновых процессов.

Активному разрушению правобережья долины также способствуют боковая эрозия Камы и абразия Нижнекамского водохранилища.

Благодаря геологическому строению территории, а именно чередованию водопроницаемых (песчаники, трещиноватые известняки и мергели) и водоупорных пород (глины), на правобережье Камы многочисленны выходы подземных вод, в т.ч. высокодебитных восходящих ключей. Довольно полноводные постоянные ручьи также имеют многие глубокие лога.

Давнее земледельческое освоение территории спровоцировало активизацию делювиального смыва в верхней части склонов и овражной эрозии ниже по склону. В результате водораздельные пространства приобрели характер увалов, а средние и нижние части склонов оказались расчленены густой сетью береговых антропогенных оврагов. Увалы с выпуклыми вершинами порою настолько круты, что именуются в народе горами, или «рёлками» [1]. Водораздельные пространства не образуют явной поверхности выравнивания: они не имеют четких бровок и выражены островными, изолированными округлыми вершинами. Водораздел относится к средней денудационной ступени выравнивания, т.н. «нижнему плато» (абсолютные отметки 180-220 м). Эта ступень имеет плиоцен–плейстоценовый возраст (N_2 – Q_1), т.е. сформировалась 1.5 млн. – 460 тыс. л.н. Местами выражена нижняя денудационная ступень с высотами 140-160 м. Эти поверхности выравнивания отделяются друг от друга плавными, но достаточно отчетливыми уступами относительной высотой 30-40 м. Нижняя ступень встречается на склонах вблизи водоразделов, обращенных к долине Камы. Ее поверхность имеет террасовидный характер и постепенно выклинивается к верховьям рек. Она образовалась за счет разрушения более высокой, о чем свидетельствуют останцы последней в пределах нижней поверхности. Однако в отличие от вышележащей глинистой средней ступени в строении и препарировке нижней ступени большую роль сыграли бронирующие известняки и мергели, благодаря которым она имеет более ровную прямую, почти горизонтальную поверхность. Благодаря высокому положению в рельефе именно здесь было основано большинство городищ, которые имели скорее сторожевую функцию, чем постоянное место проживания крупных групп людей.

Овраги к настоящему времени прошли основные стадии развития и находятся в последней стадии – затухания (старости), т.е. представлены логами и логовинами. Они довольно глубоко врезаны в правобережные надпойменные террасы, затухая в коренных склонах. В процессе регрессивной (попятной) эрозии отвершки оврагов достигали прочных коренных пород с повышенной эрозионной устойчивостью (конгломераты, гравелиты, известняки, мергели). В результате направление течения временных водотоков отклонялось вдоль склона, способствуя отчленению террас, некоторой изоляции их от склона. Таким путем формируется площадка, которая обрывается с двух-трех сторон крутыми уступами крутизной 35–40^0 глубиной до 10 м, что весьма удобно для поселения с тактической точки зрения [2].

Речная долина Нижней Камы имеет возраст 5 млн. лет, поэтому она хорошо разработана и включает все основные элементы. Террасовый комплекс состоит из первой, второй и третьей надпойменных террас, которые обособлены более или менее четкими уступами.

Третья надпойменная терраса широко распространена и обособляется четким уступом с плоской поверхностью шириной 100–200 м. Она занимает абсолютные высоты 90–100 м. Возраст ее – шкловско-московский (II sk-ms, 240–120 тыс. л.н.). Эта терраса цокольного типа, т.е. нижние 2 / 3 разреза сложены коренными породами. На контакте с верхней, четвертичной, пачкой часто вскрываются грунтовые воды в виде источников. Здесь находится множество поселений и городищ, что связано с довольно высоким гипсометрическим положением, наличием чистой питьевой воды, а также во многих случаях обособленностью овражно-балочными (логами) формами.

Вторая надпойменная терраса имеет в данном районе ограниченное распространение и развита фрагментарно. Она занимает абсолютные отметки 80–85 м. Первичная морфология террасы значительно изменена, что может быть связано с вскрытием водоносного горизонта на высотах 75–80 м. Постоянные водотоки отчленяют террасу от коренного склона или от третьей террасы и размывают ее. Вторая терраса имеет микулинско-калининский возраст (III mk-k, 120–50 тыс. л.н.). На ее поверхности известны единичные городища и поселения.

Первая надпойменная терраса прослеживается почти на всем протяжении правобережья Каракулинского Прикамья. Она занимает самые низкие отметки на абсолютных высотах около 70 м и выражена широким (до 100 м) плоским участком с очень пологим (1-2^0) наклоном в сторону Камы. Она имеет ленинградско–осташковский возраст (III ln-os), т.е. сформирована 50–10 тыс. л.н. Поселения раннего железного века здесь редки по сравнению с более высокими участками. Это могло быть вызвано как реальной опасностью нападения со стороны реки, так и собственно плохо сохранившейся самой террасой, испытавшей техногенное давление [3].

Таблица 1. Приуроченность городищ Каракулинского Прикамья к геоморфологическим элементам.

Денудационные поверхности	Третья надпойменная терраса	Вторая надпойменная терраса
Чеганда I Юньгинское I Юньгинское II Колесниковское I Боярское Ныргындинское I Ныргындинское II Пермяковское Сухаревское Цигвинцевское Зуевоключевское III	Половинный Лог Ныргындинское III Кухтинское Галановское Зуевоключевское I	Обуховское Ныргындинское IV
61,1 %	27,8 %	11,1 %

Изучение особенностей размещения поселений раннего железного века (неукрепленных селищ и укрепленных поселений – городищ) на правобережье Каракулинского Прикамья показало, что большинство их приурочено к достаточно высоким террасовидным площадкам – денудационным поверхностям (поверхностям выравнивания) и третьим надпойменным террасам (таб. 1). В нашем распоряжении пока недостаточно материалов, характеризующих хозяйственную деятельность населения (соотношение основных производящих отраслей экономики – земледелия и животноводства), которые также могли существенным образом определять выбор конкретных участков рельефа для размещения поселений. Оценка геоморфологической картины расселения в раннем железном веке с наложением на нее данных палинологии, палеоботаники и палеозоологии, бесспорно, поможет в дальнейшем конкретизировать полученные выводы и наполнить их более весомой аргументацией.

Резюмируя высказанные наблюдения, можно заключить, что наличие выровненных естественных площадок (денудационные ступени и надпойменные террасы) вблизи крупной реки и полноводных родников, обуславливали в прошлом (I тысячелетие до н.э. – начало I тысячелетия н.э.) весьма благоприятные геоморфологические и гидрогеологические условия для формирования сети укрепленных поселений в Каракулинском Прикамье.

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СКАЛЫ В МОРФОЛОГИЧЕСКИХ ЛАНДШАФТАХ РОССИИ

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Скалы и скальные группы запоминаемы и находят свое отражение в русских народных говорах, например, Забайкалья и Приамурья [1, 2, 3]: боец, бык, отстой, бом, щека, камень болван, отёк, роклеп (скала под водой), столбы, братья, дивы, зубы, кекуры, кигилляхи, монахи, пальцы, соборы и др. Для скал, украшающих в группах различные формы рельефа, существуют более образные термины – «ламский городок» в верховьях долины Чикоя, «тёщин город», и в них многообразного в мышлении. Они часто имеют и антропоморфное значение («дунькин пуп»). Нередко говорят о каменных (особенно эоловых) городах, в которых скальные ландшафты выработаны преимущественно ветровыми процессами. Это, например, каменный город вокруг восточной части Колыванского озера вблизи Змеиногорска на Алтае [4]. Сюда же включают и т. н «тёщины города», например, в Забайкалье.

Особым морфологическим скальным ландшафтом являются курчавые скалы, выпуклые скалистые поверхности, сглаженные перемещавшимися с Балтики материковыми ледниками. Они составляют характерный облик побережий Белого и Балтийского морей и озёр Карелии. Многие небольшие водопады здесь образованы курчавыми скалами.

В расположенных южнее районах Европейской России скальные ландшафты встречаются на берегах крупнейших речных долин. Это, в первую очередь, правые берега Волги и в особенности Жигулёвские горы с утёсом Стеньки Разина. Но в большинстве долины рек Европейской России равнинные и имеют пологие склоны. А вот на западном склоне Урала ситуация меняется. Здесь долины крупнейших рек (Чусовая, Колва, Кама, Вишера) врезаны в предгорье, и их борта составлены живописными скальными выступами-камнями. Особенно характерна долина на реке Чусовой, на бортах которой выступают камни с запоминающимися названиями, которые часто основаниями погружаются под воду и в прошлом оказывались «бойцами», где разбивались во время паводков барки с товаром уральских заводов. Такие же камни-бойцы распространены в долинах Колвы и Вишеры и на протяженных реках восточного склона Урала, где они врезаны на глубину менее 100 м в плосковершинную поверхность т.н. «Зауральского» пенеплена: долины Ивделя и Исети, Верхней Пышмы являются их примерами. На левом борту р. Исети и у г. Каменска-Уральского располагается скала Каменные Ворота. В Кисловодске многие отдыхающие видели Кольцо-Камень, и такого же рода скальные группы с выветрелыми нишами располагаются в слоях песчаников на склонах Курортного парка. Здесь же известны группы скал – Красные камни и знаменитая скала Лермонтова, описанная как место дуэли Печорина с Грушницким.

На пологих склонах уральских низкогорий располагаются группы торов – скальных выходов кристаллических пород, т.н. «каменные палатки», примером которых являются скалы Семи Братьев у Екатеринбурга, Шарташские каменные палатки в этом городе. В вершинном поясе гор распространены денудационные останцы-болваны, характерным примером которых является гора Маньпупуньер. На Южном Урале живописными скальными группами выступает гребень хребта Таганай, в облике скал которого часто нетрудно увидеть антропоморфные личины.

Каменные палатки и скальные города обычны для низкогорий Алтая – Близнецы около кур. Белокуриха и в районе Змеиногорска. Такие же группы скал-торов составляют заповедник Красноярские Столбы. Они распространены и на западном побережье Байкала, где составляют живописные скальные группы на склонах в окрестностях бухты Песчаной и северо-западнее её, а также на вершинных поверхностях Олхинского плоскогорья по дороге от Иркутска к гор. Слюдянке. На самих берегах Байкала абразионные скалы-уступы с останцами-кекурами и извилистыми мысами распространены реже. Это мыс Шаманка около Слюдянки и мысы Мал. и Бол. Колокольни у бухты Песчаной. В Чивыркуйском заливе устье р. Бол.Чивыркуй прикрыто скалой, в облике которой нетрудно увидеть личину динозавра. В Баргузинской котловине, продолжающей Байкал на северо-восток, находится Инский сад камней, представляющий загадочное образование и т.н. Сувинские Дворцы в виде группы гранитоидных скал-торов.

Многие мысы на Байкале имеют облик скальных выступов: мысы Бурхан и Хобой на острове Ольхон, мыс Хорин-Ирги (Кобылья голова), отделенный от материковой земли узким (1-1,5 м) проливом, мыс Улан-Хада.

В Восточной Сибири, где на берегах долин распространены карбонатные толщи нижнего палеозоя, распространены «каменные столбы» – свидетели наружного карста. В первую очередь, это т.н. Ленские столбы, и такие же скальные ландшафты распространены в долинах Оленёка, Анибара и Алдана, где можно видеть антропоморфные группы скал-сфинксов или человека.

Весьма живописны берега дальневосточных морей. Шантарские острова в Охотском море работавшие там геологи называли «Шантарской Швейцарией», а на побережьях этого моря обычны скальные платформы-бенчи, на которых располагаются высокие скальные выступы-кекуры (у мыса Борисова под Аяном Три брата на Камчатке, Орлов Камень на острове Беринга и др.)

В большинстве примечательные скальные выступы на берегах рек или склонах и вершинах гор имеют облик памятников природы и обретают особую чтимость в её охране. Это замечательные творения, дающие нам познание окружающих просторов и вечность творения природы в различных и столь запоминающихся её качествах. Все это обеспечивает их благотворное влияние, природное наследие и его богатства, на внутренний мир человека.

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FOR NOTES