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CHRONOLOGY AND PALAEOCLIMATE OF PREHISTORIC SITES IN WESTERN DVINA-LOVAT' AREA OF NORTH-WESTERN RUSSIA

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Abstract: **Combining the evidence of radiocarbon dating, pollen analysis and geochemistry we suggest a chronological division of prehistoric sites in the upper stretches of the Western Dvina and Lovat Rivers in North-Western Russia and discuss the changes in vegetation, climate and history of lakes in that area during the Holocene.**

1. GEOGRAPHICAL BACKGROUND

The investigated area is located in the catchments of the upper stretches of the Western Dvina (Zapadnaya Dvina) and Lovat Rivers, in the southern part of the Pskov and north-western part of the Smolensk Districts of the Russian Federation (**Fig. 1**). The area includes "proximal" morainic hills corresponding to the maximum stage of the Last Ice Age (Würm, Devensian and Valdai). According to Kvasov (1979), starting with this stage, a huge ice-dammed lake was formed directly in the front of the ice edge. Following the recession of the ice-sheet, the level of the lake gradually lowered, opening new thresholds. Consecutive levels of this basin are distinctly visible in a system of terraces and distinguishable in sediments. The present-day lakes occurring in that area (Usvyaty, Zhizhitsa and others) are viewed as the relics of the Late Glacial ice-dammed lake.

Following the drainage of the Baltic Ice Lake at *ca* 10,000 years BP the water level in the hydrological network dropped, which resulted in large-scale erosion of previously accumulated deposits. Lowering and a partial paludination of lakes during the Preboreal (10-9 ka BP) was identified in the Peribaltic area (Kabailiene *et al.*, 1992) and Byelorussia (Yakushko *et al.*, 1992). During the Boreal (9-8 ka BP) the lake-level rose and intense accumulation of organic matter took place in many lakes of central and North-Western Russia as well as in the Peribaltic area and Byelorussia (Davydova, 1992). Starting with the Atlantic period (8-5 ka BP), in conditions of general temperature increase (by 1.5 °C annually) and rainfall (by 80-100 mm annually), one notes a substantial rise in the lake-level throughout Northern and North-Eastern Europe. In the area studied several stratigraphically acknowledgeable fluctuations in the lake-level occurred during the Atlantic and the subsequent Subboreal periods. These fluctuations which were fairly synchronous throughout the area provided an independent time-control for the investigated sites (as a succession of regressions/transgressions).

Fig. 1. *Location of the investigated area.*

Systematic archaeological and environmental investigations in that area have been carried out since the discovery of the first Neolithic sites by A.M. Miklyayev in 1962. Field studies have resulted in the discovery and excavations of numerous archaeological sites (Usvyaty, Serteya and others), ranging in the age from the Late Palaeolithic to early Middle Ages (Dolukhanov and Miklyaev, 1986; Miklyaev, 1994; Mazurkevich, 1988). The sites have been stratigraphically excavated with the use of multidisciplinary methods, which will be discussed below.

3. RADIOCARBON DATING

To this date more that 80 radiocarbon measurements have been obtained for samples of wood from archaeological structures, as well as for organic samples from lacustrine deposits. These measurements were carried out mainly at the Labs of the St. Petersburg Institute for History of Material Culture (LE) and the University of Tartu, Estonia (TA).

4. POLLEN ANALYSIS

Archaeological deposits and lacustrine sediments were intensely cored and the samples studied with the use of pollen analysis. One should especially mention the cores in the area of Usvyaty IV sites studied by E.A. Spiridonova (Malakhovsky, 1969) and M.A. Guman (Miklyayev *et al.*, 1984). The cores in the Rudnya area were studied by N.A. Gey (Dolukhanov *et al.*, 1989) and L.B. Savel'eva (Kul'kova and Savel'eva, 2000).

5. GEOCHEMISTRY

Biological, chemical and physical processes in the lakes reflect the changes in the hydrological regime (e.g. lake depth) and temperature, all this being directly affected by climate variations. These signals are recorded in the geochemical composition of lake sediments (Hostetler, 1995; Stumm and Schnoor, 1995).

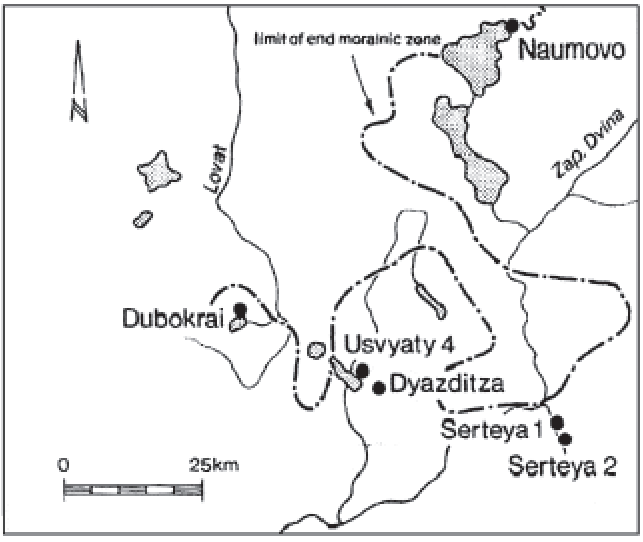

Fig. 2. *Geographical location of the sites.*

Acidity and alkalinity of lake sediments reflect the changes in the vegetation cover in the surrounding area. The expanding vegetation (forests, intensive crop production) produces acidity; chemical weathering neutralizes inputs of acids.

The content of organic matter in lake sediments provides an additional information on lacustrine palaeoenvironment: the history of climate change and the effects of humans on local and regional ecosystems. Detritus of plants living in waters and the surrounding land is the primary source of organic matter in lakes. In addition, winds commonly transport materials such as pollen from the sources located outside local watershed. Progressive eutrophication, changes in the vegetation on the watershed and human induced pollution, all these can be inferred from the elemental, isotopic and molecular composition of sedimentary organic matter. This also includes the carbon/nitrogen (C/N) ratios that reflect the original proportions of algal and land-derived material. Carbon isotopic compositions indicate the history of lake productivity and carbon recycling (Meyers and Ishiwatari, 1995).

During the course of the present study, the geochemical analysis was applied for the samples from two palaeolakes drained by the Serteya river, the tributary of the Western Dvina River, in the vicinity of Rudnya village in the Smolensk Oblast (**Fig. 2**).

The coring of lacustrine sediments combined with the excavations of Neolithic and Bronze Age sites revealed a complicated stratigraphy, which included both mineral (sand of varying granulometric composition and silt) and organic-rich deposits (gyttja and peat) reaching at some points the thickness of 8 m. Eight varieties are distinguishable:

1. Calcareous gyttja with numerous broken shells;
2. Olive-colored gyttja particularly rich in organic matter;
3. Woody gyttja with great amount of plants and timber;
4. Detritus gyttja, rich in plant remains, mostly reed, sedge and scirpus;
5. Clayey gyttja, rich in mineral particles;
6. Light-brown gyttja rich in plant remains;
7. Dark brown gyttja rich in decomposed plant remains;
8. Peat.

Mineral and chemical composition of the samples was established by means of infra-red spectrometry and spectral emission analysis separately for mineral and organic sediments. The obtained data were statistically processed with the use of the factor analysis. The projection on the space of principle components has identified three main factors which defined the mineralogical and chemical composition of the analysed samples:

1. Fluctuations in lake level;
2. Acidity/alkalinity;
3. Thermal changes.

One notes considerable fluctuations in the input of Factor 3 (thermal changes) for mineral (**Fig. 3**) and organic (**Fig. 4**) sediments.

Using the same technique the contributions of the Factor 1 (fluctuations of the lake level) were calculated separately for mineral (**Fig. 4**) and organic (**Fig. 5**) sediments.

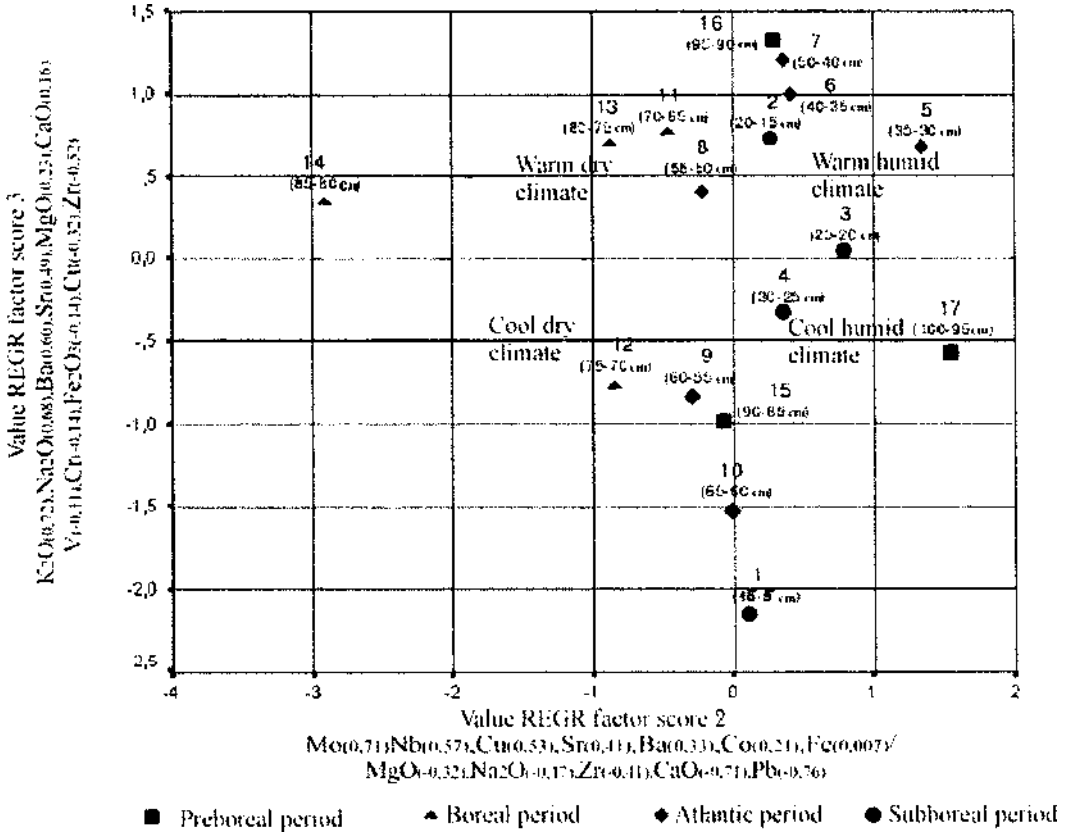

Fig. 3. *Thermal sedimentary environment of mineral deposits (Serteya XIV hole).*

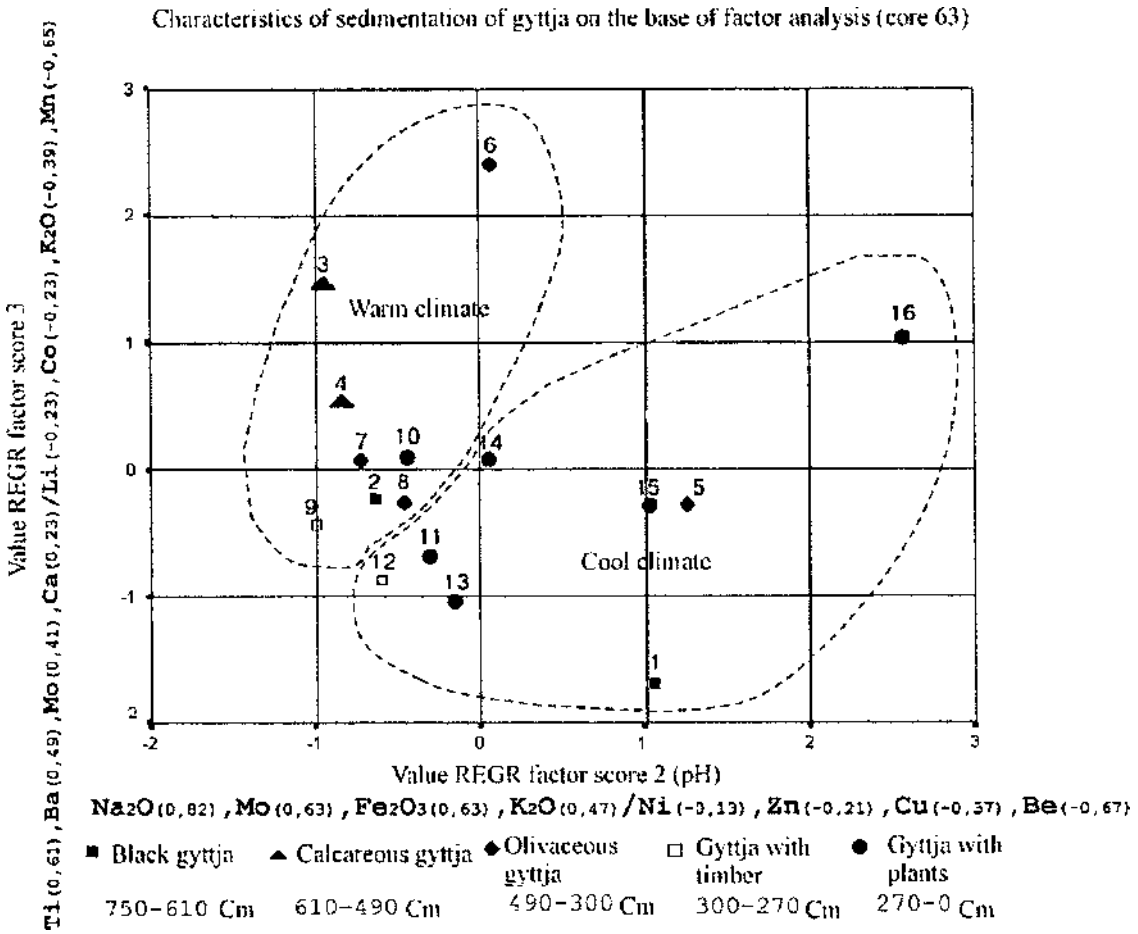

Fig. 4. *Thermal sedimentary environment of organic deposits.*

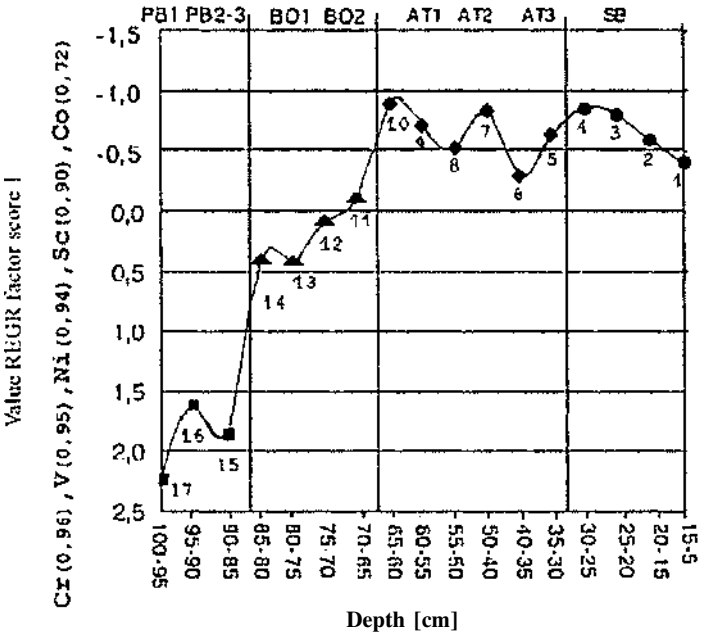

Fig. 5. *Fluctuations of lake levels based on the factor analysis of mineral deposits.*

6. HISTORY OF SEDIMENTATION AND SETTLEMENT

Basing on these studies it became possible to follow up the sequence of sedimentation and human settlement that included several stages:

1. Late Glacial Times (>12,000-10,000 BP). This age is attested for silt dominated sediments in the basal sections of the core at the site of Usvyaty 4 and in several cores at Rudnya. The pollen spectra considered as the Alleröd/Younger Dryas transition show the occurrence of spruce and birch forests in an open, herb dominated landscape with high participation of *Chenopodiaceae, Artemisia, Poaceae, Cyperaceae, Helianthemum, Dryas* sp., and aquatic plants. These deposits may originate from the surface erosion and the subsequent inwash of coastal forms of numerous interconnected post-glacial lakes which existed in that area. The coastal forms were subjected to wind erosion, resulting in formation of wind blown dunes. This period corresponded to the initial human settlement of the area, with several sites consisting of large concentrations of flint tools found on the elevated terraces and dunes (Ivantsov Bor, Lukashenki 1-3, Serteya and others). Lithic assemblages include the tanged points of Ahrensburg, Lyngby and Svidry types, suggesting repeated yet ephemeral settlements of hunting groups.

2. Pre-Boreal-Boreal-Early Atlantic (10,000-7000 BP). This period corresponded to the initial stage in the Holocene development of the lake basin with a low level and gradually increasing rates in the accumulation of organic-rich deposits: calcareous and olive-colored gyttja with decreased content of mineral matter. A rise of the lake-level is acknowledged at the end of the Boreal – beginning of the Atlantic period. The pollen show gradual spread of pine dominated forest with hazel in underwood, and an increasing admixture of broad-leaf species starting with the beginning of the Atlantic. No authentic Mesolithic sites attributable to this period have ever been found in the area. There are unconfirmed reports about the finds of Kunda-like implements in deep layers of a peat bog near the Lake of Zhizhitsa.

3. Middle Atlantic (7000-6500 BP). The period of low level during which the calcareous gyttja with shells was deposited on top of the silt at the site of Rudnya Serteyskaya. These deposits for which no radiocarbon dates are available include the materials of the oldest pottery-bearing tradition in that area referred by Miklyaev to the Serteyan. The conic pottery vessels ornamented with rows of triangular impressions were made of clay tampered with coarse sand and organic matter. The stone industry consisted of fragmented implements made on blades and flakes. The pollen spectra reflect a relatively cool episode within the Atlantic climatic optimum, with the total amount of broad-leaved species (oak, elm and lime) being less than 7 %; among the macrofossils were identified: alder, birch, willow and horsetail.

4. Late-Atlantic-1 (6500-6000 BP). After a short-lived rise, a new regression followed with the accumulation of olive-colored gyttja. A new settlement arose the material culture of which is considered as Rudnyaian. The pottery shows a continuity in relation to the Serteyan with the appearance of new elements: the pointed "thorn-bottomed" vessels with S-like profiles, made of clay tempered with crushed shells, organic matter and a small admixture of sand. The stone inventory was dominated by scrapers manufactured from flakes, and includes the arrowheads and the fragments of axes and adzes. The rich bone and antler industry has analogies in the early Neolithic of eastern Peribaltic. A large series of radiocarbon dates falls within a time-span of 6200-6000 BP.

5. Late-Atlantic-2 (6000-5700 BP). Following the rise of the lake-level, the previous settlement was abandoned and covered with yellow medium-grained sand. A new site was found in the level of olive-coloured gyttya. This level includes the pottery of the previous type combined with new varieties which have analogies in the Narvian (eastern Peribaltic) as well as in the Upper Volga and Upper Dniper cultures. Remains of a wishweir lie directly above this level; they were radiocarbon dated to 5780±50 (LE-2577) and 5770±50 (LE-2570) BP. The pollen spectra show the highest content in thermophylous broad-leaved species reaching 34 % and suggesting a significant rise in temperature. The level includes numerous seeds and macrofossil remains of aquatic plants, including *Nymphaea* sp. and *Ceratiophyllum* sp.

6. Subboreal-1 (5700-5500 BP). This stage started with an abrupt fall of the lake levels during which the lake at Rudnya-Serteya turned into mire with accumulation of detritus gyttja, rich in plant remains, mostly reed, sedge and scirpus, dark brown gyttja rich in decomposed plant remains and peat. Simultaneously the pile dwellings started emerging on lower levels of several lakes. The initial stage of pile dwellings is particularly well represented at the site of Usvyaty 4, in the levels dated: 5570±40, 5530±40, 5490±65, 5480±60 BP etc.

7. Subboreal-2 (5500-4200 BP). During the subsequent rise of the lake level, the settlement was repeatedly relocated onto higher levels and nearer to the shore and eventually destroyed by the fire at about 4200 BP; its remains were sealed with sand. Judging from the pollen evidence, at that time, mixed coniferous forests were restricted to morainic hills, with pine forests on sandy plains and rich aquatic flora in the immediate vicinity of the sites. The deposits contain 40 species of animals and fishes including large mammals: elk, brown bear and boar being the most common, and also fur animals: marten, otter and squirrel. Judging by the age groups, the elk was huntered throughout the year. Pike and perch were the most common among the fish. At least 30 edible plants were identified in the deposits of pile-dwellings; hazel-nut and water chestnut (*Trapa natans*) were allegedly the main source of plant protein. Rich cultural assemblage found in these levels is referred to as Usvyatian. A short-lived regression marked the end of this stage.

8. Subboreal-3 (4200-3600 BP). During the subsequent fluctuations in the lake levels the settlements shifted to higher levels. Radiocarbon dates for this stage: 4000-3700 (lake-level rise) and 3700-3600 (lake-level fall) BP. These settlements are considered as belonging to different cultural traditions: Zhizhitsian and North-Byelorussian, the latter being viewed as a local variant of the Corded Ware. The deposits of this stage contain limited amount of bones of domesticates (sheep, goat, cattle, pig), yet their overall rate is less that 14 %. Following the catastrophic transgression the tradition of lake dwellings ceased and was never resumed again. Early Iron Age sites (starting with Uzmenian culture) emerged on higher levels at greater distance from the lakes.

7. DISCUSSION

The landscapes in the basins of the upper Western Dvina and Loval were first penetrated by groups of hunter-gatherers during the Late Glacial times (12-10 ka BP) and remained an arena of intensive settlement ever since. The attractiveness of this area apparently stemmed from the richness and productiveness of local lacustrine eco-systems. Judging by the variety of culturally identifiable stone tools (tanged points) found at the earlier sites, initially the human groups came here both from the west and from the south, moving along the waterways and following the seasonal migratory routes of large herd animals (the reindeer, in the first place).

The new stage of human settlement started during the Atlantic climatic period when the rise in temperature and humidity considerably enriched and diversified the productivity of the lacustrine eco-system. New evidence clearly shows that the beginning of pottery making on East European Plain nearly coincided with the onset of the climatic optimum, *ca* 8000 BP. An increased sedentariness and an apparent population growth in that area followed an intensification of hunter-gathering, without any apparent evidence of either agriculture or stock-breeding. Pottery-making in the Western Dvina-Loval area identifiable at Serteyan stage started at *ca* 7000 BP. Similar age is now attested for early pottery-bearing sites in Central, North-Western Russia and in eastern Peribaltic. The initial im-

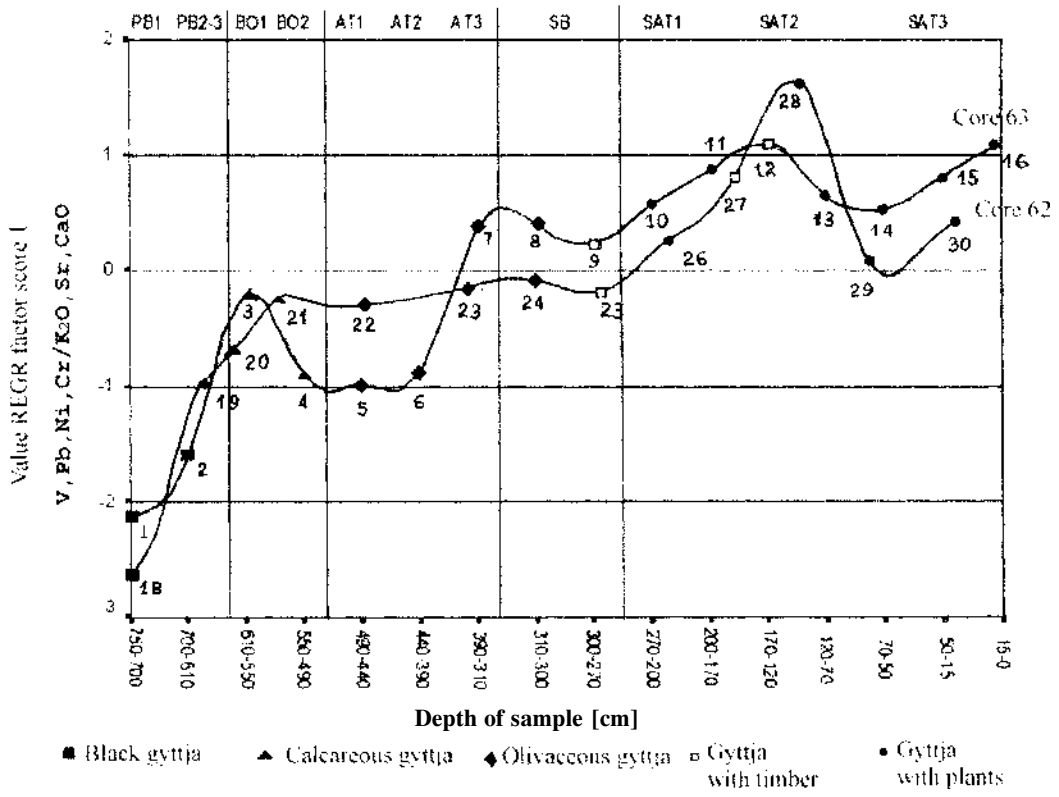

Fig. 6. *Fluctuations of lake levels based on the factor analysis of organic deposits.*

pulse of pottery-making may have come from the south, where, judging from the available evidence, the pottery-making tradition was older by at least 1000 years (Rakushechnyi Yar on the Lower Don River, Elshan on the Lower Volga River).

The highest degree of adaptation to lacustrine environment was reached in the Late Atlantic with the construction of pile dwellings in the coastal areas of the lakes. Remarkably a similar tradition was developed at the same time in the Alpine area (Schichtherle and Wahlster, 1986). One notes similarities in the microenvironment and the subsistence. In both areas the fishing and food gathering constituted significant strategies of food-quest (the agriculture was well developed in the alpine zone). The resemblance was particularly phenomenal in the technique of house-building which included pointed posts deepened into the lacustrine silt, forming the foundation of platforms on which various structures were erected. In both areas the settlements were occupied all year round; the living structures were often refurbished, rebuilt, moved to a higher elevation following the rise of lake-level; on several occasions major fires could be recognized.

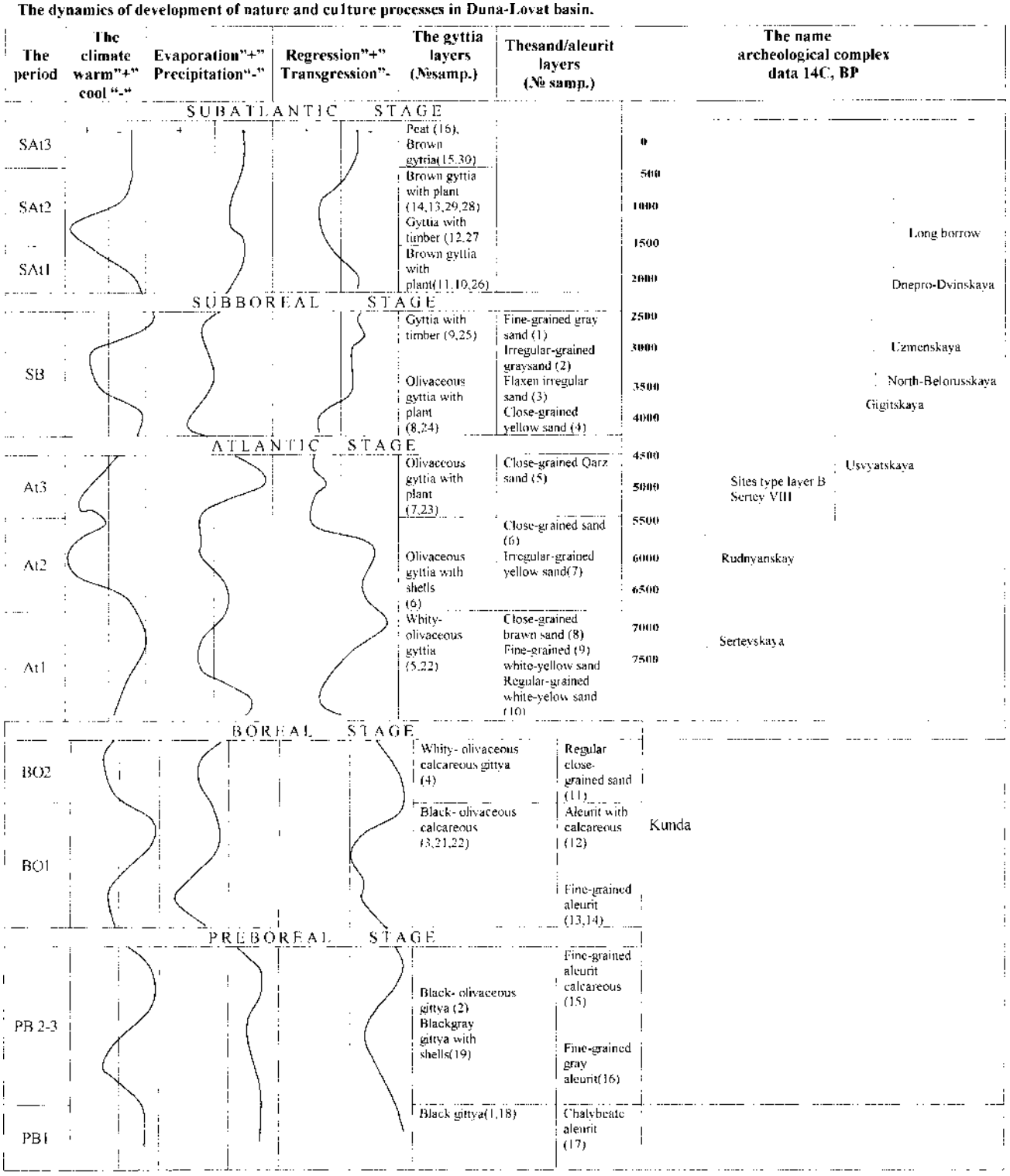

Fig. 7. *Climate change, lake-level fluctuations and sequence of cultural deposits.*

The ornamental patterns on the ceramic vessels show certain similarities with the ornamentation on the Funnel Beakers and Globular Amphorae (Miklyayev, 1995; Mazurkevich, 1998). This may be viewed as an evidence of a direct social and cultural interaction of local groups with the farming communities in the west.

The interaction with the west became yet more conspicuous at the stage of North-Byelorussian culture. Ornamental patterns taken of the entire pottery corpus of the multi-layered site of Naumovo were processed by the technique of multivariate analysis (Dolukhanov and Fonyakov, 1984). The principle component analysis for the lower and middle levels of the site has produced two clearly distinguishable clusters of signals which merged at the forming a new entity at the upper level. One gets an obvious impression of the intrusion of a new cultural tradition which was gradually absorbed by an old one. This may be seen as an indication of an inflow of the surplus population from the Corded Ware areas in the west, which brought in some cultural and technological innovations. In a very short time the newcomers were totally absorbed by local groups adopting the local mode of life and cultural symbols.

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