EVOLUTION OF THE WATERWAYS AND EARLY HUMAN MIGRATIONS IN THE NORTH-EASTERN BALTIC AREA

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Abstract: The earliest evidence of human settlement in north-eastern Baltic Area is attested at Antrea-Korpilahti (9200-8250 cal BC) where Mesolithic artifacts were found in the deposits of a channel linking the Ancylus Lake and the Ladoga Lake. At the initial stage of the Littorina Sea, the Ladoga Lake became isolated and was drained into the Baltic Sea through the Palaeo-Vuoksa river system and the Veshchevo (Hejnijoki) Strait. The sites with the earliest evidence of pottery making (5560-5250 cal BC) coincided with the Littorina II stage. The connection of the Saimaa Lake basin with the Gulf of Bothnia was interrupted at 3000 cal BC, when the lake system started to drain into the Ladoga Lake via the Vuoksa (Vuoksi) River. Influx of fresh water caused a rise of the level of the Ladoga Lake. The peak of the ensuing 'Ladoga transgression', was attained between 2210 and 1110 cal BC. At the peak of its transgression the Ladoga Lake formed a new outflow to the Baltic Sea via the Neva River. The current archaeological project is focused on early human migrations, land use and subsistence in relation to environmental changes with a special emphasis on the emergence and configuration of waterways.

1. INTRODUCTION

The north-eastern Baltic area, which includes the Baltic-Ladoga Isthmus, is rich in archaeological sites of prehistoric and early historic age (**Fig. 1**). These sites have been investigated by Russian and Finnish scholars for over a century. Their studies included the monitoring of environmental changes during the final stages of the Ice Age and the Holocene. This article gives an overview of the present knowledge pertinent to the evolution of waterways and their impact on early human migrations.

2. RESULTS

The prehistoric human settlement is strongly connected to the evolution of the waterways in the north-eastern Baltic area. They waterways were controlled by three main factors: 1) postglacial isostatic rebound, 2) global eustatic rise of the sea-level and 3) climatic change.

According to Kvasov (1975), the history of the Baltic Sea started in the Late Glacial period (ca. 13,000 – 12,000 ^{14}C BP), with the formation of several local ice-dammed basins ('Luga', 'Pskov' and 'Vôrtsjarv'). Their shore-lines are found at the altitude of 38-40 m above the present sea-level (a.s.l.). At a later stage (ca. 12,000 – 11,000 ^{14}C BP) these lakes merged and formed the 'Ramsay Sea'. During the Alleröd period (11,000-10,000 ^{14}C BP) the level of the Ramsay Sea dropped and formed the 'Baltic Ice Lake' (BIL). During that period the Neva Plain was at 10-15 m a.s.l., i.e. well above the BIL level. Several peat-bogs that started forming on that plain in the Alleröd grew without interruption throughout the Holocene (Subetto *et al*., 2002).

At the Lakhta peat bog in the northern St. Petersburg suburb (**Fig. 1**, site 1), BIL deposits were found at a depth of 25-18 m below sea level (b.s.l.) (Djinordze and Kleimenova, 1965a). Such deposits were also found at Pesochnaya (10 km to the north) at an elevation of 2.5 to 10.4 m a.s.l. (Djinordze and Kleimenova, 1965b). Hence, the water level of BIL must have considerably fluctuated during the Alleröd and Younger Dryas periods (Dolukhanov, 1979).

There is evidence (Dolukhanov, 1979; Subetto, 2003) that the BIL encompassed the Ladoga Lake and covered

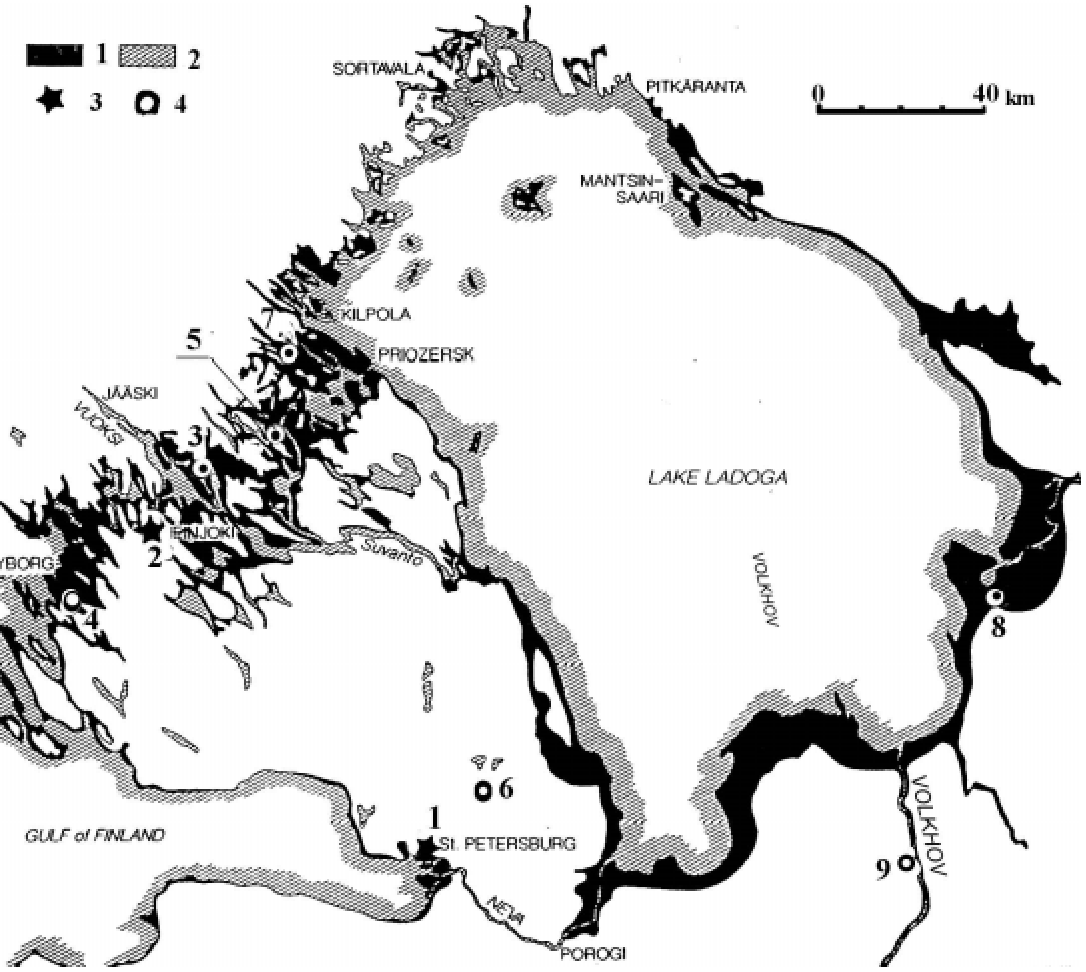

Fig. 1. *Map showing Prehistoric sites and waterways on the Karelian Isthmus (after Saarnisto and Grönlund, 1996).*
Key: 1 – area covered by Yoldia Sea, Ancylus Lake, Littorina Sea and Ladoga Sea transgressions; 2 – present-day waterways; 3 – palaeoenvironmental sites; 4 – archaeological sites.
Sites: 1. Lakhta, 2. Veshchevo (Hejnijoki), 3. Antrea Korpilahti, 4. Häyrynmäki (Vyborg), 5. Bol'shoye Zavetnoye 4, 6. Hepo-yarvi , 7. Riukjärvi, 8. Ust-Rybezhna, 9. Staraja Ladoga.

an entire area of the Karelian Isthmus and the Neva Valley below the altitude of 10-15 m a.s.l. (**Fig. 2**). Several scholars (Markov, 1931; Sauramo, 1958; Hyvarinen and Eronen, 1979) suggested that a strait connected the BIL with the White Sea. Nonetheless, the diatom assemblages in the BIL deposits of the northern Ladoga area contain cold-resistant planktonic diatoms, and do not signal the penetration of brackish-water species (Abramova *et al.,* 1967).

The Baltic Sea became connected with the ocean through a strait that emerged in Central Sweden at 8200 cal BC (Bjork, 1995). The ensuing abrupt drop of the sea level and inflow of oceanic water formed the Yoldia Sea. According to Hyyppä (1963), during the maximum rise of the Yoldia Sea level, the shore-line at 18 m a.s.l was formed in the Vyborg area. Sediments with typical Yoldia diatom assemblages were identified in the mire near Vyborg at the depth ranging from 3.2 m b.s.l. to 8 m a.s.l. Yoldia deposits are found at Lakhta at a depth between 10 and 6.5 m b.s.l. and in St. Petersburg, at 18 -10 m b.s.l. (Djinordze and Kleimenova, 1965a). In the Ladoga Lake bottom deposits (Subetto, 2003) the emergence of the Yoldia Lake is acknowledgeable by a change in sedimentation from varved to 'homogenous' clay. The Ladoga Lake was connected with the Yoldia Sea through a strait in the northern part of the Karelian Isthmus.

The fresh-water Ancylus Lake emerged at the end of the Pre-Boreal period, when the tectonic uplift in Central Sweden interrupted the connection between the Baltic Sea and the Ocean. Hyyppä (1963) viewed the terraces at the altitude of 15 - 26 m a.s.l. in Vyborg area as formed by the Ancylus Lake. At Lakhta the Ancylus deposits were found at a depth ranging from 0 to 12 m b.s.l. (Djinordze and Kleimenova, 1965a). Judging from the altitude of radiocarbon-dated terraces in various parts of the Baltic Sea, the Ancylus Lake reached its highest level at 8000–7500 cal BC; that was followed by a regression lasting until 7000 – 6500 cal BC (Kessel and Chepalyga, 2002).

The Ancylus Lake was connected with the Ladoga Lake via a strait in the northern part of the Karelian Isthmus. Its deposits were recovered by a core in the Bol'shoi-Osinovsky peat bog near Veshchevo (Hejnijoki) (**Fig. 1**, site 2). A ra-

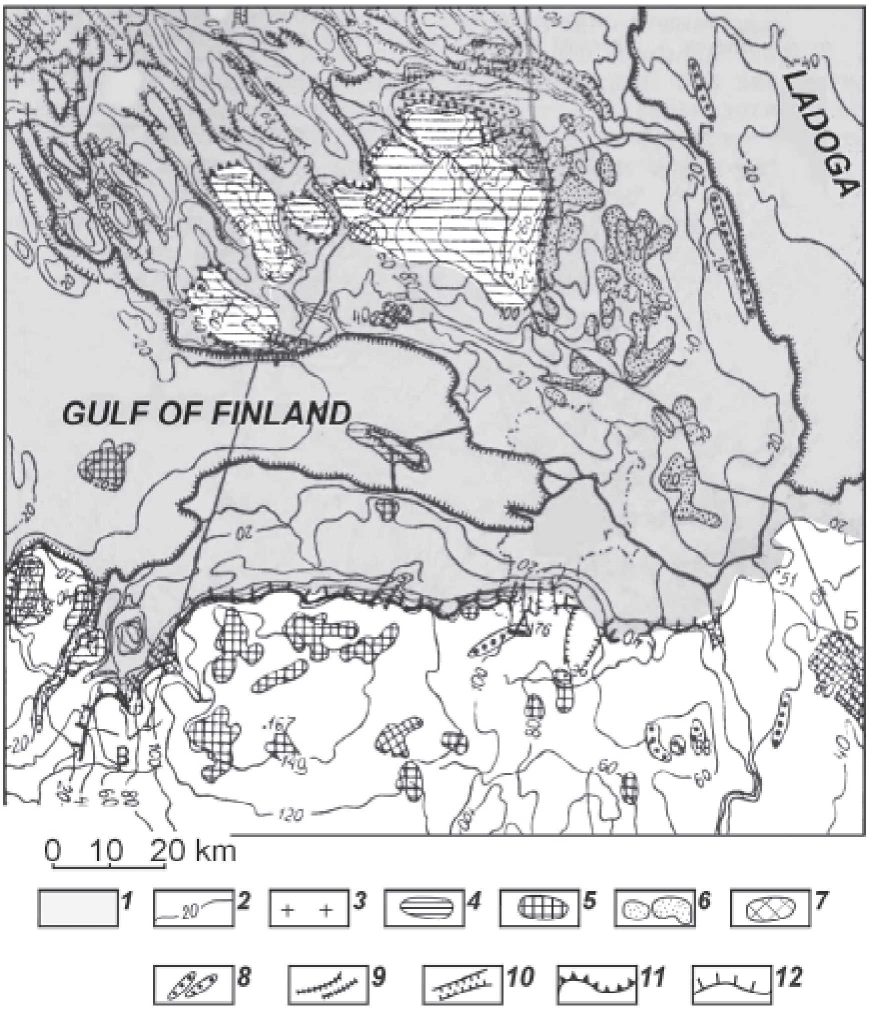

Fig. 2. Main relief features of the Karelian Isthmus (after Malakhovsky and Drozhkina, 1996).
Key: 1 – Area taken up by the Baltic Ice Lake (BIL); 2 – contours a.s.l.; 3 – granite outcrops; 4 – glacial accumulation plain; 5 – morainic uphill; 6 – kame plateau; 7 – kames; 8 – eskers; 9 – morainic ridges; 10 – glacial discharge rills; 11 – glacial lobes contact zone; 12 – The 'Glint' scrap.

diocarbon date of gyttja samples from these deposits yielded an age of 8560-8270 cal BC (Malakhovsky *et al.,* 1993).

The earliest evidence of human penetration into the Ladoga-Baltic area came from this period. In 1914, remains of a willow bark net, objects of antler, bone and stone of early Mesolithic type were found in the sandy silt at the Antrea-Korpilahti site (**Fig. 1**, site 3) (Pälsi, 1920). The bark net yielded a calibrated ^{14}C age of 9200-8250 cal BC (Matiskainen, 1989)[1]. During the current project, the organic-rich gyttja overlying the sandy silt was radiocarbon dated to 5650-5050 cal BC. Arguably, the Mesolithic artefacts were initially deposited either on the bottom of a shallow lagoon, or in a shallow channel through which the Ladoga discharged into the Ancylus Lake.

The combined effect of a new hydraulic connection with the ocean via the Danish Straits and the global eustatic sea-level rise led to the Littorina Sea transgressions in the Baltic basin. Hyyppä (1937 and 1963), based on morphologic and diatom evidence, distinguished six metachronous Littorina shore-lines in southern Finland. This concept was later questioned by Hyvarinen and Eronen (1979). Recent studies in the south-eastern coastal area of the Gulf of Finland identified only one major Littorina Sea transgression reaching its peak at 5650 – 5250 cal BC (Sandgren *et al.*, 2004).

However, the multitude of Littorina transgressions is apparent in the area of Vyborg, where the maximum altitude of the Littorina transgression is linked to the L IIa shore-line at 19.5-20.0 m a.s.l. A group of Stone-Age sites at Häyrinmäki esker near Vyborg (**Fig. 1**, site 4), lies at the altitudes ranging from 20 to 17 m a.s.l. (Hyyppä, 1937; Siiriäinen, 1970). In the deposits of Häyrynsuo bog, the diatom assemblage confirms two Littorina transgressions separated by a regression with dominating fresh-water diatom species. A sample of sphagnum peat subsequent to the later transgression yielded the age: 3650-2900 cal BC (Dolukhanov, 1995).

At the initial stage of the Littorina Sea period, the Ladoga Lake became isolated and its level remained above that of the Baltic Sea. During that period the Ladoga Lake was drained into the Baltic Sea through the Palaeo-Vuoksa River and the Veshchevo (Hejnijoki) strait, whose threshold lies at 15.4 m a.s.l. (Hyyppä, 1937; Davydova *et al.,* 1996; Saarnisto and Grönlund, 1996).

The Ancylus Lake and the initial Littorina Sea periods coincided with the occurrence of Mesolithic and early Neolithic sites on the Ladoga-Baltic Isthmus. A cluster of these sites lies on the slopes of a large esker, facing the south-western shore of the Bol'shoe Zavetnoe Lake (Juoksemajärvi); **Fig. 1**, site 5; (Timofeev *et al.,* 2003;

[1] *All radiocarbon dates used in this text were calibrated with the use of OxCal Programme v3.5 with the probability of 95.4‰.*

Gerasimov *et al.,* 2003; Lavento *et al.,* 2002). The earlier Mesolithic site 'Point 4' is located on a terraced level at 24-25.5 m a.s.l. This site was later partly destroyed by an early Neolithic dwelling. Charcoal from the Mesolithic layer yielded an age of 7050-6200 cal BC.

The early Neolithic site ('Point 4a') at 23.5 m a.s.l. contains fragments of a complete vessel of the Sperrings type (Style I: 1). At that time, the level of the Ladoga Lake (of which the Bol'shoe Zavetnoe Lake-Juoksemajärvi was a bay) was at 20-21 m a.s.l., which is in agreement with earlier findings (Lavento *et al.,* 2002). The sites with that type of pottery are related by Hyyppä (1937) with the Littorina-II terrace. Siiriäinen (1970; 1982) links the Style I: 1 sites with the maximum transgression of the Pajänne Lake at ca. 5200 cal BC. In a later publication Siiriäinen (1982) suggests an age of 6300-6200 cal BP (or 5300-5000 BC). The Sperrings-type assemblage at the site of Hepoyarvi (**Fig. 1**, site 6) yields an age of 5560-5250 cal BC (Vereshchagina, 2003; Gerasimov *et al.,* 2003).

During that time an intensive growth of peat occurred in the southern Ladoga Lake area. The site Ust'-Rybezhna I (**Fig. 1**, site 8), found in the layer of peat, yielded a calibrated an age of 5650-5050 cal BC.

Saarnisto (1970) found evidence that the connection of the Saimaa Lake basin with the Gulf of Bothnia was interrupted at ca. 3000 cal BC when the lake system also started to drain into the Ladoga Lake via the Vuoksa (Vuoksi) River. The resulting influx of fresh water led to the rapid rise of the Ladoga Lake level (**Fig. 1**). During this transgression Ust'-Rybezhna and many other sites in the low laying areas were buried beneath the lake deposits.

Controversial hypotheses place the peak of the 'Ladoga transgression' into the time-span either between 2210-1880 cal BC (Koshechkin and Ekman, 1993) or 1530-1250 cal BC (Malakhovsky *et al.*, 1993). Saarnisto and Grönlund (1996) on the basis of the dates obtained for peat samples from the bogs on Kilpolansaari Island in the north-western Ladoga lake, suggest that the transgression had reached its maximum before 1690-1110 cal BC. At the height of its transgression the Ladoga Lake formed a new outflow to the Baltic Sea in the south-east via the Neva River

3. DISCUSSION

The location of the earliest attested prehistoric site Antrea-Korpilahti at the Ladoga-Baltic Straits suggests that the settlement of the eastern Fennoscandia proceeded from the south along the waterways from the interior of the East European Plain. After the disappearance of the ice-cover, sparse groups of 'Epi-Palaeolithic' and, later, Mesolithic hunter-gatherers expanded to northern Eurasia. The continuity of their conspicuous stone and bone artifacts implies that these industries developed locally from direct descendants of the Paleolithic population. When the ice-cover receded, groups of hunters migrated to the north, moving along the shores of numerous lakes and 'tunnel' valleys.

The Mesolithic groups had complex social organisations allegedly of a 'band type'. They consisted of a small number of nuclear families who were loosely organised for improved subsistence and security. In several areas, large 'communal' Mesolithic cemeteries were found. The largest one was discovered on the Reindeer Island of the Onega Lake in Russian Karelia. It contains at least 174 burials (Gurina, 1956).

The general increase in biomass and available wildlife resources during the climatic optimum resulted in diversification and intensification of the food-procurement strategies. As a result the population density and sedentariness increased, as reflected by an intensive pottery-making that started at 5560-5250 cal BC.

Throughout the Stone and Early Iron Ages, the general settlement pattern remains basically unchanged. Waterways played a pivotal role in the movement and location of social groups whose subsistence was based on effective fishing, hunting and food-gathering. This became particularly apparent in the case of Mesolithic and Neolithic sites on the Rjukrarvi Lake (**Fig. 1**, site 7) (Gerasimov *et al.*, 2003), linked to the Ladoga-Baltic strait. The sites in that area were found either on the promontories or on small islets. This location enabled the inhabitants to use various wild-life resources throughout the year and provided them with an opportunity to maintain contact with other communities. The larger sites (supposedly 'winter' base-camps) were located on the elevated landforms, while the smaller ones ('seasonal') camps were found close to the lakes.

The emergence of the Neva River completely reconfigured the network waterways in the entire North-eastern Baltic area. The Neva forms a starting point of an extended waterway, leading from the Baltic Sea into Russia's interior. This waterway includes the Ladoga Lake, the Volkhov River and the Ilmen Lake. Through it passed trade routes and human groups which included the Finnic, Slavic and Scandinavian elements. Along this waterway fortified settlements arose, as exemplified by Staroja Ladoga on the Volkhov River (**Fig. 1**, site 9).

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REFERENCES

Abramova S.A., Davydova N.N. and Kvasov D.D., 1967: O vostochnyh predelah rasprostranenija preboreal'nogo ioldievogo morja (On the eastern limits in the extension of the Pre-Boreal Yoldia Sea). *Baltica* 3: 11-22 (in Russian).

Bjork S., 1995: A review of the history of the Baltic Sea 13.0-8.0 thousand BP. *Quaternary International* 27: 19-40.

Davydova N.N., Arslanov K.A., Khomutova V.I., Krasnov I.I., Malakhovsky D.B., Saarnisto M., Saksa A.I. and Subetto D.A., 1996: Late- and post-glacial history of lakes of the Karelian Isthmus. *Hydrobiologia* 322: 199-204.

Djinoridze R.N. and Kleimenova G.I., 1965a: Materialy k paleobotanicheskoi harakteristike pozdne- i poslelednikovyh otlozhenii Lahtinskoi kotloviny (Materials on palaeobotanic characteristics of the late- and postglacial deposits of the Lakhta basin). *Problemy paleogeografii.* Leningrad, Leningrad State University Press: 193-213 (in Russian).

Djinoridze R.N and Kleimenova G.I., 1965b: Dannye sporovo-pylcevogo i diatomogo analiza ob otlozheniyah alleredskogo vremeni v Leningradskoi oblasti (Spore-polleen and diatom evidence on the Alleröd age deposits in the Leningrad Oblast). *Baltica* 2: 1-5 (in Russian).

Dolukhanov P M., 1979: Leningrad and Soviet Karelia. In: Gudelis V. and Königsson L.-K., eds, *The Quaternary History of the Baltic.* Acta Universitatis Uppsalensis Symposia I: 115-126.

Dolukhanov P M., 1995: The Holocene environment and prehistoric settlement in the northeastern Baltic area. *Fennoscandia archaeologica* XII: 25-33.

Gerasimov D.V., Lisicyn S.N. and Timofeev V.I., 2003: *Materialy karheologicheskoi karte Karel'skogo peresheika (Leningradskaya oblast'). Pamyatniki kamennogo veka i perioda rannego metalla (Materials for the archaeological map of the Karelian Isthmus, Leningrad Oblast. Stone and Early Metal Ages sites).* St. Petersburg, Institute for History of Material Culture: 68 pp (in Russian).

Gurina N.N., 1956: *Oleneostrovskii mogil'nik* – Materialy iissledovaniya po arheologii SSSR (Materials and Investigations on the Archaeology of the USSR), 47, Leningrad, USSR Academy of Sciences Publishers: 431 pp (in Russian).

Hyvarinen H. and Eronen M., 1979: An outline of the investigations of the natural history of the Baltic Sea. The northern part. In: Gudelis V. and Königsson L.-K., eds, *The Quaternary History of the Baltic,* Acta Universitatis Uppsalensis Symposia I: 7-28.

Hyyppä E., 1937: Post-glacial changes of shore-lines in south Finland. *Bulletin de la Commission Géologique de la Finlande,* 120, 223 pp, 224 pp.

Hyyppä E., 1963: On the Late Quaternary history of the Baltic Sea. *Fennia* 89 (1): 37-48.

Kessel H. and Chepalyga A.L. 2002. Baltiiskoe more (Baltic Sea). In: Velichko A.A., ed. *Dinamika landshaftnyh komponentov i vnutrennih morskih basseinov za poslednie 130000 let (Dynamics of Landscape Components and Inner Marine Basins during the Last 130,000 Years)*. Moscow, Geos: 191-196.

Koshechkin B.I. and Ekman I.M., 1993: Golocenovye transgressii Ladozhskogo ozera (The Holocene transgressions of the Ladoga Lake). In: Davydova N.N. and Koshechkin B.I., eds, *Evoluciya prirodnyh obstanovoki i sovremennoe sostoyanie geosistemy Ladozhskogo ozera (The Evolution of the Environment and Present State of the Ladoga Lake Geosystems).* St. Petersburg, Russian Geographical Society: 49-60 (in Russian).

Kvasov D.D., 1975: *Pozdnechetvertichnaya istoriya krupnyh ozer i vnutrennih morei Vostochnoi Evropy (Late Quaternary History of Large Lakes and Inner Marine Basins of Eastern Europe).* Leningrad, Nauka: 278 pp (In Russian).

Lavento M., Halinen B.I.**, Timofeev V., Gerasimov V. and Saksa A., 2002**: Archaeological field survey of Stone Age and Early Metal Period settlement at Kaukola (Sevastyanovo) and Räisälä (Melnikovo) on the Karelian Isthmus in 1999. *Fennoscandia archaeologica,* XVIII: 3-25.

Malakhovsky D.B., Arslanov H.A., Gei N.A. and Djinoridze R.N., 1993: Novye dannye po istorii vozniknoveniya Nevy (New evidence on the emergence of the Neva River). In: Davydova N.N. and Koshechkin B.I., eds, *Evoluciya prirodnyh obstanovok i sovremennoe sostoyanie geosistemy Ladozhskogo ozera (The Evolution of the Environment and Present State of the Ladoga Lake Geosystems).* St. Petersburg, Russian Geographical Society: 74-84 (in Russian).

Malakhovsky D.B. and Drozhkina M.V., 1996: Problemy geomorfoloigii Sankt-Peterburgskogo raiona (Problems of Geomorphology of the St. Petersburg area). *Vestnik Sankt-Peterburgskogo Universiteta,* 26 (2): 23-35 (In Russian).

Markov K.K., 1931: *Razvitie rel'efa severo-zapadnoi chasti Leningradskoi oblasti (Evolution of the Relief of the North-Western Part of the Leningrad Oblast).* Leningrad: 256 pp (in Russian).

Matiskainen H., 1989: *Studies in Chronology, Material Culture and Subsistence of the Finnish Mesolithic, 10,000 – 6,000 BP*. Iksos 8. Helsinki, 97 pp.

Pälsi S., 1920: Ein steinzeitlisher Moorfund. *Suomen Muinaismuisto-yhdistyksen aikakauskirja* XXVIII (2): 1-19.

Saarnisto M., 1970: The Late Weichselian and Flandrian history of the Saimaa Lake complex. *Societas Scientiarium. Fennicae, Commentationes Physico-Mathematicae* 37.

Saarnisto M. and Grönlund T., 1996: Shoreline displacement of Lake Ladoga – new data from Kilpolansaari. *Hydrobiologia* 322: 205-215.

Sauramo M., 1958: Die Geschichte der Ostsee. *Annales Academiae Scientiarium* A, III, 51, 522 pp.

Sandgren P., Subetto D.A., Berglund B.E., Davydova N.N. and Savieleva L.A. 2004. Mid-Holocene Littorina transgressions based on stratigraphic studies in coastal lakes on NW Russia. *Geologiska Föreningen Stockholm Förhandlingar (GFF)* 126: 363-380.

Siiriäinen A., 1970: Archaeological background of Ancient Lake Päijänne and geological dating of the Meso-Neolithic bondary in Finland. *Bulletin of the Geological Society of Finland*: 119-127.

Siiriäinen A., 1982: Shore Displacement and Archaeology in Finland. *Annales Academiae Scientiarium Fennicae., Ser. A III. Geologica- Geograpiae* 134: 173-184.

Subetto D.A., Wohlparth B., Davydova N.N., Sapelko T.V., Björkman L., Solovieva N., Watergård S., Possert G. and Khomutova V.I., 2002: Climate and environment on the Karelian Isthmus, 13,000-9000 yrs cal BP. *Boreas* 31: 1-19.

Subetto D.A., 2003: *Ozernyi sedimentogenez severa evropeiskoi chasti Rossii v pozdnem Pleistocene i golocene (Lacustrine Sedimentation in the Northern Part of European Russia during the Late Pleistocene and Holocene).* Dr. habil. Dissertation abstract. St. Petersburg, Institute for Limnology: 25 pp. (in Russian).

Timofeev V.I., Gerasimov D.V., Lisicyn S.N., Halinen P. and Lavento M., 2003: Issledovaniya stoyanok kamenogo veka na ozere Bol'shoe Zavetnoe (Investigations of Stone Age sites on the Bol'shoe Zavetnoe Lake). *Archeologicheskie otkrytiya 2002 goda (Archaeological Discoveries in 2002),* Moscow, Institute of Archaeology: 64-66 (in Russian).

Vereshchagina I.V., 2003: Poselenie Hepo-yarvi v yuzhnoi chasti Karel'skogo persheika (Hepo-yarvi site in the southern part of the Karelian Isthmus). In: Timofeev V.I., ed., *Neolit – eneolit yuga i neolit severa Vostochnoi Evropy (The Neolithic Chalcolithic in the South and the Neolithic in the North of Eastern Europe).* St. Petersburg, Institute for History of Material Culture: 140-151 (in Russian).