Archaeological and paleogeographic evidence on the development of the Neva River (Baltic Basin, Russia)

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Introduction

The history of land development at the mouth of the Neva River is eventful and begins during prehistoric times. The Neva flows through the St. Petersburg (Russia) area and connects Lake Ladoga and the Neva Bay with the Gulf of Finland *(Fig. 1)*. The first Neolithic to Early Metal Age archaeological sites within the present boundaries of St. Petersburg were found in 1908–1930 in the Lakhta and Sestroretsky Razliv regions (Gurina 1961; Sorokin et al. 2009). During the Middle Ages an important route "from the Vikings to the Greeks" passed across the Neva River. Merchant caravans of overseas visitors established landing places along the mouth of the Neva River. Discoveries of silver treasures from Arabic and Western European countries, and commercial treaties in the 13th–14th centuries between Novgorod and cities of the Hanseatic Union give evidence for this.

The marine guard of the Izhora Land, which controlled travel on the waterway and safeguarded against robbery attacks, was encamped at this place. For centuries, the Russian-Swedish Wars were fought on these lands for the free access to the Baltic Sea, for example the Neva battle in AD 1240 at the mouth of the Izhora River, the battle for Landskrona in AD 1300–1301 on the Okhta River, and others. For a long time, the territory of the Neva River mouth had an important strategic and commercial status. Therefore, the study of the Neva River's formation can contribute significantly to the understanding of many historical events and processes.

Details about the formation of the Neva River still remain debatable. The formation of the river is closely related to geological and climatic processes that occurred along the eastern coast of the Baltic Sea and Ladoga Lake after the retreat of an ice sheet. Currently, there are several points of view regarding the time period of the Neva River's formation. The main factor in the river's formation is the change in Lake Ladoga's water level, which resulted from uneven isostatic uplift of the land (De Geer 1893; Ailio 1915). Recent studies (Alexandrovsky et al. 2009; Dolukhanov et al. 2009) have shown that a sharp 10 m decline in the level of Lake Ladoga, which occurred in 1000–400 BC (2.8–2.5 ka. BP), led to the formation of the Neva River and caused a drop in the water level of the whole hydrologic system, including the Volkhov River and Lake Ilmen. The following dates of the culmination of the Ladoga transgression and subsequent Neva River breakthrough were reported by other investigators: 2000 BC (Znamenskaja et al. 1970);

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Fig. 1. Okhta 1, St. Petersburg (RU). The location of the Okhta 1 – Nyenskans monument.

2210–1880 BC (Koshechkin / Ekman 1993); 1530–1250 BC (Malakhovskiy et al. 1993); and around 1350 BC (Saarnisto / Grönlund 1996). There is also the view that the Neva River has existed since the formation of Lake Ladoga (Verzilin et al. 2005).

The Neolithic–Early Metal Age site Okhta 1 was found while workers were carrying out protective archaeological research on the fortresses Landskrona (13th century) and Nyenskans (17th century) in the coastal area at the confluence of the Okhta River with the Neva River *(Fig. 2)* in the centre of St. Petersburg (Gusentsova / Sorokin 2011).

The fortress of Landskrona had been erected in 1300 at the cape between the Neva and Okhta Rivers, when Swedish knights led by Torgils Knutsson had expanded into the Novgorod land (Shaskolsky 1987). According to the chronicles, between the rivers a fortress with earthen-wooden walls and eight towers was built. The plan for the whole territory of Landskrona fortress was developed based on the relief of the cape. The plan included additions from moats to raise them to the level of the highest sites of the cape. Inside the framework, ruined by a fire, cuttings for ceiling logs, the remains of floors at two levels, and other constructive details were excavated.

Soon after the downfall of Landskrona in 1301 the local population set about developing the territory at the Okhta River mouth. According to documents, in 1500 a village of 18 homesteads existed there. It was one of the largest settlements at the mouth of the Neva, and included some small villages (Vremennik 1851). In the end of 16th–beginning of 17th centuries a Russian settlement existed, including a ship landing stage, a Tsar's trade court, a custom-house, and the Church of Michael Archangel (Sorokin 2000; 2001).

In 1611, during the Russian-Swedish war, by order of the Swedish King Carl IX, the fortress of Nyenskans was erected at the mouth of the Okhta River. Initially, it was small

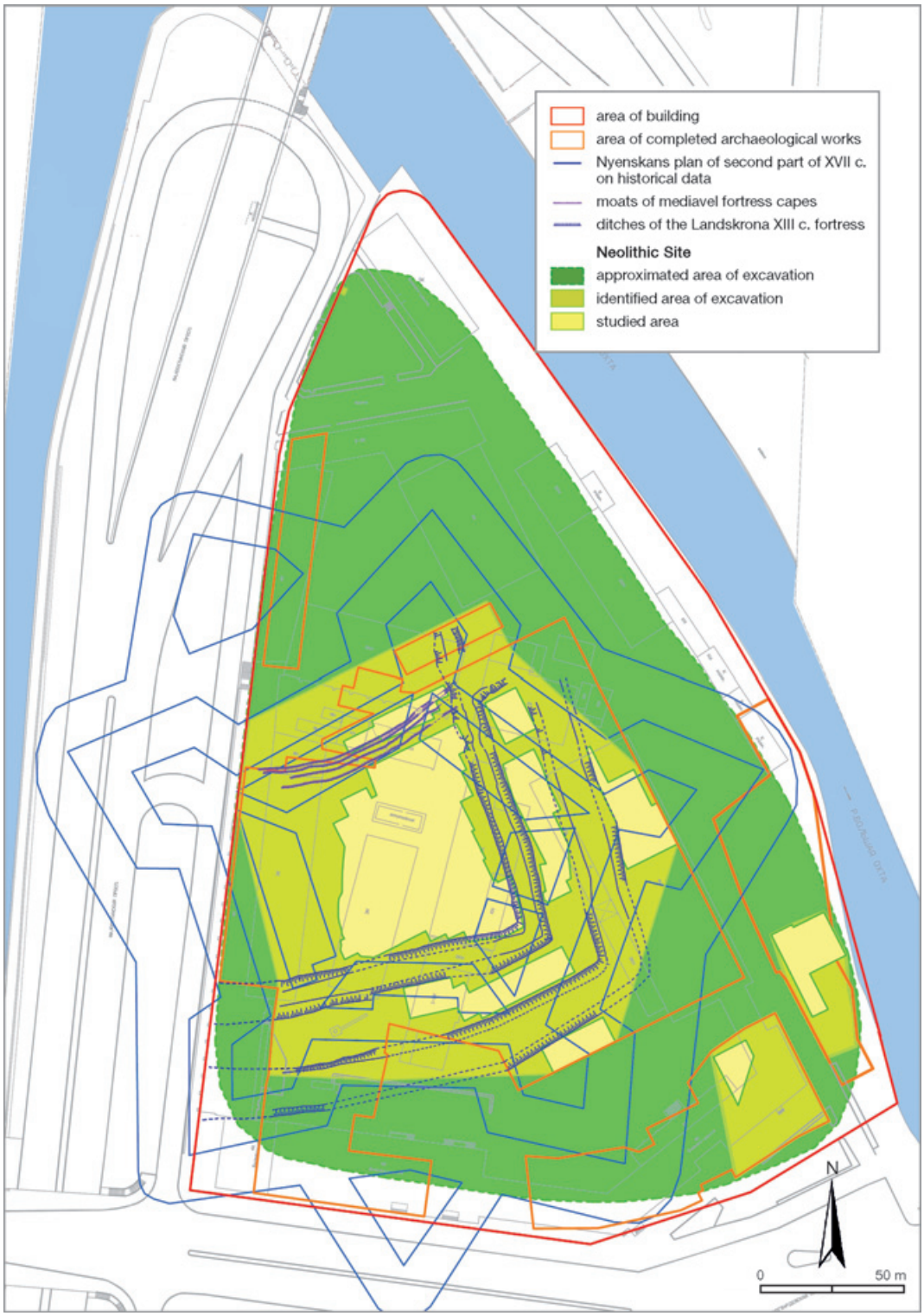

Fig. 2. Okhta 1, St. Petersburg (RU). The area of extend the Okhta 1 – Nyenskans monument.

in size, housing 600 persons of the garrison. During the 17th century, Nyenskans was repeatedly reconstructed and fortified. In 1660, on the promontory between the Neva and Okhta there was an earthen-walled castle with five bastions, situated in the form of a star, and two gate ravelins (Bonsdorff 1891; Hipping 1909; Lappo-Danilevsky 1913). The main gate led to the Okhta, with a bridge across the latter connecting the fortress with the centre of the town. To the south of the castle, between two rivers, there was a bulwark with three bastions, defending the approaches to the fortress.

Nyenskans was assaulted by Russian troops in 1703 and subsequently partly destroyed. The Okhtinsky shipyard operated at the location in the 19th century, and in the 20th century, on its basis the factory "Petrozavod" was constructed, which produced small and mid-sized ships and related equipment (Sorokin 2001).

Materials and Methods

The study of archaeological finds from excavations of the Okhta 1 site, located in the centre of St. Petersburg in the area of the Neva River and Okhta River confluence, has played a significant role in understanding the development of archaeological cultures and paleoenvironmental events in this territory. The cultural remains of the ancient monument were excavated in a square with an area larger than 10,000 m^2 *(Figs. 1, 2)*. Excavations in the central and southern parts of the study area encompassed a square of about 6700 m^2 (excavations in 2008–2009). The cultural layers of the prehistoric settlements are situated under alluvial sandy sediments 1–1.5 m thick, which lie under the buried soil of the Middle Ages. So far, this is the only monument of the Neolithic–Early Metal Age in St. Petersburg.

The collection of archaeological finds totals about 1200 objects, including earthen ware, stone tools, wooden carvings, and amber jewellery. The remains of wood constructions have been discovered for the first time in the St. Petersburg region. These artefacts are mostly wooden piles, strips, and rails. Due to the number of archaeological finds and the preservation of organic finds, the Okhta 1 monument is a unique and rare object of cultural heritage in the territory of the Baltic and Northern Europe. In 2009–2010, the authors conducted detailed investigations of lithological and cultural deposits at Okhta 1, which included archaeological analysis, lithological and grain-size analyses, mineralogical-geochemical methods, pollen and diatom analyses, radiocarbon dating, and dendrochronology. The results of these investigations provided us with a notable data base for reconstructing the paleogeographical conditions, the processes of cultural layer formation, and the development of cultural-historical stages in the region; these results have been published elsewhere (Sorokin et al. 2009; Kulkova et al. 2010a; Gusentsova / Sorokin 2011, Kulkova et al. 2014). Further results are presented in the contribution by Sergeev et al. in this volume. In this article the Neva River formation and the prehistoric site distribution will be considered in view of these new analytic data.

Holocene palaeogeography and settlements of the Karelian Isthmus

The development of prehistoric people in this territory is closely connected with the palaeogeographical situation caused by the retreat of an ice sheet at 10,200–9600 BC[1] (Ge-

[1] All dates in this article are presented as calibrated dates (cal BC or AD).

Fig. 3. Lake Ladoga shores. (a) Lake Ladoga as a part of the Yoldia Sea stage (black line) and Ancylus Lake stage. (b) Lake Ladoga transgressions before the Neva River arose, according to D. Subetto (2007). (c) The main rivers of the modern Ladoga Lake basin.

rasimov / Subetto 2009). The hydrological history of the area has been affected by the Baltic Sea, Lake Ladoga and Lake Saimaa stages. Before the regression of the Baltic Ice Lake the shoreline in the northern part of Lake Ladoga remained c. 70–80 m above the present sea level. During the Yoldia Sea stage the regression of the water level continued rapidly until the Ancylus transgression turned the waters of Lake Ladoga to rise again (Saarnisto 2003). As a result of irregular isostatic uplifts of land in the region of the eastern Baltic coast and Ladoga Lake, there were marked changes in the location of water basin coastlines. The upshift also influenced changes in the locations of prehistoric sites (Hyyppä 1943; Dolukhanov 1979; Saarnisto 2003). The first archaeological evidence of human penetration to this territory was related to the period coinciding with the maximum of the Ancylus transgression *(Fig. 3a)*, which culminated no later than 8200 BC (Gerasimov / Subetto 2009).

The majority of the sites known so far are localised near the shorelines of the Ancylus Lake. The maximums of the Littorina transgression on the Karelian Isthmus according to various estimates are registered in the period 6500–3550 BC (Miettinen 2002; Sandgren et al. 2004; Dolukhanov et al. 2009). After this event the water level in the sea dropped gradually. Around 3000 BC, water from Lake Saimaa penetrated into Lake Ladoga through the Vuoksi River (Saarnisto / Siiriainen 1970) *(Fig. 3b)*. As a result of the transgression, the water level exceeded the runoff threshold of the Heinjoki Strait, and the Baltic Sea was reconnected with Lake Ladoga. The increasing water level in Lake Ladoga after the formation of the Vuoksi River caused the Ladoga Lake transgression (Ailio 1915; Saarnisto / Siiriäinen 1970; Saarnisto 2003; Kvasov 1990). The great rise in the water level of Lake Ladoga was registered at the time interval of 4000–2600 BC during the Vuoksa transgression (Alexandrovsky et al. 2009; Dolukhanov et al. 2009).

During the Boreal period (8200–7000 BC) the arboreal vegetation was increasing with the dominance of pine (*Pinus*). During the Atlantic period (7000–3750 BC), the mild climate brought along deciduous trees, such as elm (*Ulmus*), oak (*Quernus*), linden (*Tilia*), and hazel (*Corylus*). At the end of the Atlantic period, spruce (*Picea*) arrived in the area in ca. 4350 cal BC. During the last climatic period of the Stone Age, the Sub-Boreal period 3750–600 cal BC, deciduous trees declined and spruce became more abundant at first, but later declined gain. During this period the climate was cooling off (Davydova et al. 1996; Simola 2003).

Neolithic sites

The water level during the Littorina stage is marked by the positions of some archaeological sites, and stratigraphic analyses of these sites allow us to gather evidence about the further development of Lake Ladoga (Gerasimov / Subetto 2009).

The archaeological monuments Veshevo 1 and 2 *(Fig. 4.6, Tab. 1)* are located near the Heinjoki Strait runoff threshold at the Karelia Isthmus. These sites were occupied during the Early Neolithic as is evidenced by finds of Sperrings type ceramics (Europaeus-Äyräpää 1930) in both settlements. The radiocarbon dates from charcoal are 4800–4400 BC (5770 ± 130 BP [Le-6511]) for Veshevo 1 and 4727–4595 BC (5815 ± 50 BP) for Veshevo 2. The distribution of Neolithic ceramics of Sperrings type after 5000 BC, according to D. V. Gerasimov and D. A. Subetto (2009), corresponds to the period following the maximum Littorina transgression.

The Early Neolithic archaeological sites of the Ladoga Lake area are located on the same terraces as the Late Mesolithic sites. The penetration of Saimaa Lake water into Ladoga Lake around 3000 BC is marked by the stratigraphy of the archaeological sites Kurkieki 33, 35; Silino; Veshevo 1, 2; and Komsomolskoe 3 *(Fig. 4, Tab. 1)*. The cultural layers of the Late Mesolithic and Early Neolithic are covered by lake sediments. After the Saimaa breakthrough the Typical Comb Ware ceramics, which are markers of the further Neolithic development, are spread throughout the Lake Ladoga area (Gerasimov / Subetto 2009).

In the southern part of the Ladoga Lake area, the archaeological site Ust'-Ribezhna 1 can be considered part of the Neolithic–Early Metal period (Gurina 1961). The Neolithic cultural layer was covered by a thick layer of lake sediments (1.5 m) that were formed during the Ladoga Lake transgression (Kulkova et al. 2009). The data obtained allow us to consider some periods of site occupation beginning at 6000 BC and ending in the middle of 3000 BC. The Early Neolithic period is represented by Sperrings culture. Radiocarbon dates of charcoal at 4990–4710 BC (5965 ± 55 BP [Ua-34615]) can be attributed

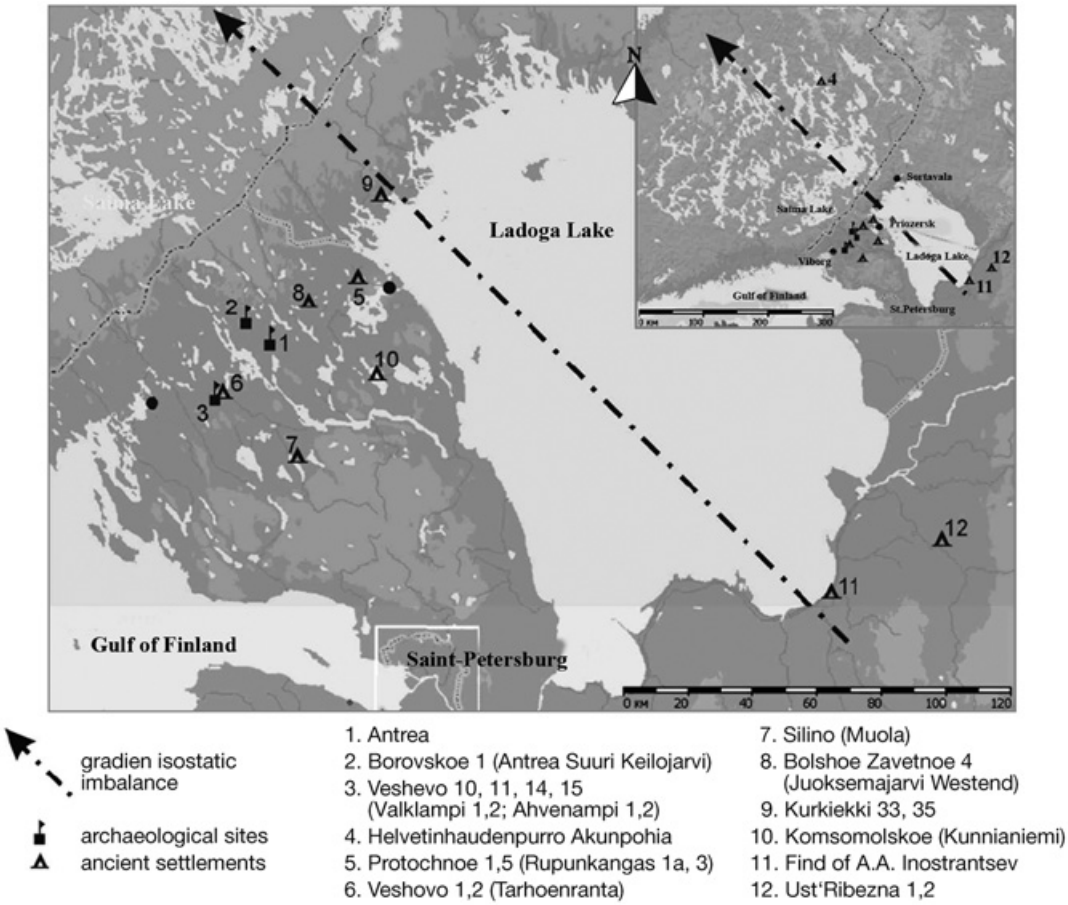

Fig. 4. Archaeological sites from the Mesolithic to Early Metal Age periods on the Karelian Isthmus.

to this period. The radiocarbon date of charred food crust from a Typical Comb Ware ceramic is 4700–3950 BC (5505 ± 140 BP [Ua-34614]). In this collection ceramics with rhombus pits decoration were found as well as ceramics tempered with asbestos. These ceramics have analogies with ceramics from the Voiknavolok XXVII site in Karelia, which has dates of 3130–2550 BC (Kulkova et al. 2009).

Early Metal Age sites

After the Ladoga Lake transgression the breakthrough of water in the southern part of the Karelian Isthmus according to Saarnisto (2003) occurred c.1350 BC and the Neva River was formed. At the location of the ancient Ladoga Gulf, Vuoksi Lake and Sukhodolskoe Lake (Suvanto) were developed (Saarnisto / Siiriainen 1970). One fact testifies to the enormity of this event. For a short period (a few years or decades) the water level in Ladoga Lake dropped by 10 m and the surface area of the lake was significantly reduced, especially at the southern and eastern parts (Dolukhanov et al. 2009). After the Neva breakthrough and sharp drop in the level of Ladoga Lake, a transformation of the ancient settlement system occurred.

Site	Period of occupation (cal BC)	Epoch	Publication
Antrea	9310 ± 140	Early Mesolithic	Gerasimov 2012
Borovskoe 1 (Antrea Suuri Kelpojarvi)	8675–8357	Early Mesolithic	Gerasimov 2012
Protochnoe 1 (Rupunkangas 1a)	8000–7650 5570–5480	Mesolithic– Neolithic	Gerasimov 2012
Protochnoe 5 (Rupunkangas 3)	7880–7610	Mesolithic	Gerasimov 2012
Veshevo 10 (Heinjoki Valklampi 1) Veshevo 11 (Heinjoki Valklampi 2)	7960–7700 7900–7660	Mesolithic	Gerasimov 2012
Veshevo 1,2	6010–5720 4800–4400 850–170	Mesolithic Neolithic Early Metal Age	Gerasimov 2012
Bolshoe Zavetnoe (Joksemajarvi W)	7050–6400 3370–3100 2880–2580 2290–2020 1750–1600 930–520	Mesolithic Neolithic Early Metal Age	Gerasimov 2012
Silino (Muola)	 4800–4440 4000–3590 3340–2910	Mesolithic Neolithic Early Metal Age	Gerasimov 2012
Kurkiekki 35, 33	6840–6640 3700 300–150	Mesolithic Neolithic Iron Age	Gerasimov 2012
Komsomolskoe (Kunnianiemi)	6090–6005 4530–4370 3760–3650 3340–3000 2580–2435	Mesolithic Neolithic Early Metal Age	Gerasimov 2012
Ust'-Ribezhna 1	4990–4710 4700–3950	Early Neolithic– Middle Neolithic	Kulkova et al. 2009
Ust'-Ribezhna 2	2nd mill. BC	Bronze Age	Yushkova 2011

Tab. 1. List of the main archaeological sites of the Karelian Isthmus and the southern part of the Ladoga Lake region.

The archaeological sites of Early Iron Age–Early Middle Ages are located in the northern Ladoga Lake area on terraces then at 10 m above the Baltic Sea level (Gerasimov / Subetto 2009). While for the Neolithic a considerable number of sites could be recorded, in the Early Metal Age (1800–300 BC) this region obviously was less densely populated (Meinander 1954; Gurina 1961; Carpelan 1979; Huurre 2000; Ibid. 2003; Lavento 2001). The most important region of ancient human occupation in the Neolithic period was the land at the lower part of the Vuoksi River and the northern part of the Ladoga Lake area (Saksa 2006b). Ancient fishermen and hunters were attracted to these regions due to the favourable hydrographical situation, different gulfs and rivers with fish, and the islands and coastal areas that were comfortable for living (Gurina 1961; Huurre 2000; Ibid. 2003; Gerasimov et al. 2003).

The decrease in numbers of sites in the Early Metal Age could be related to the paleogeographical situation in the investigated region. According to A. Saksa (2006a), most Bronze Age settlements were located far from bodies of water after the regression of Ladoga Lake. Gulfs, rivers, and lakes rich in fish became features of the land after the Ladoga transgression. This is one of the possible causes of settlement reduction, migration of prehistoric people, and partitioning into small groups. It is possible that Bronze Age sites were covered by layers of sediments from the Ladoga Lake transgressions during water-level fluctuations.

One of the archaeological sites where Bronze Age artefacts were found is Ust'-Ribezhna 2 *(Fig. 4.12)*. Here, fragments of Net Ware ceramics of 1800 BC were excavated (Gurina 1961). This site is located at a height of 15–16 m above the Baltic Sea. The site location far from the coastal zone of Lake Ladoga is extraordinary for this period. During its occupation the settlement was situated on the coast of the Ladoga Lake Gulf in a period of transgression. The site was abandoned after the regression of Ladoga Lake in this area during the formation of the River Neva (Kulkova et al. 2010b). The appearance of sites of this culture in the region under consideration, in Karelia, and in Finland, occurred during the second millennium BC. In this period such outstanding settlements as Ust'-Ribezhna 2 and 3, Ristina Kitulansou, Kelka 3, Suomusalmi Kalmosjarka, and Ohotoma 3 existed (Yushkova 2011). Evidence of bronze production was found at many settlements (Yushkova 2011). The material culture of Net Ware ceramics was replaced by the Volkhov type culture, which was formed on the basis of the Net Ware ceramics culture. The Volkhov type sites existed from the 9th to the 6th centuries BC.

In any case, in inner and eastern Finland, on the Karelian Isthmus and in Karelia near Ladoga Lake, for two thousand years there was no such cultural development as in the Neolithic period (Saksa 1998; Uino 1997; Lavento 2001).

Iron Age sites

The next period is related to the appearance of Iron Age sites in this area. The investigations of A. Saksa (2006a) suggested the development of an Iron Age culture in Karelia near Ladoga Lake beginning in the middle of the 1st century BC. This cultural development could be related to the more global processes of European history, which contributed to the settlement of separate districts in the Baltic Sea region. There is evidence of migrations of foreign cultural groups to this area. The mineral sources of this region were attractive to people from more developed regions of western Finland, Estonia, and from the upper land of the Volga River. The iron wares discovered are evidence of this process (Saksa 1992; 1994; 1998). The first evidence of cereal crop cultivation relates to the Late Roman Iron Age, around AD 200–400 (Kilpola Island) (Taavitsainen et al. 1994; Saarnisto / Grönlund 1996; Saarnisto 2003; Lahtinen / Rowley-Conwy 2013, 1–25). In the samples from the Kurkieki (Kuuppala) and Sortavala (Riekkala Island) regions, cereal pollen was dated to AD 400 and 600 (Simola 2003; Alenius et al. 2004).

Changes in geographical, historical, and socioeconomic processes resulted in the development of historical events in this region at end of the 12th to the beginning of the 14th centuries. During this period commercial-economic relationships flourished. This territory became one of the key centres of Northern Europe.

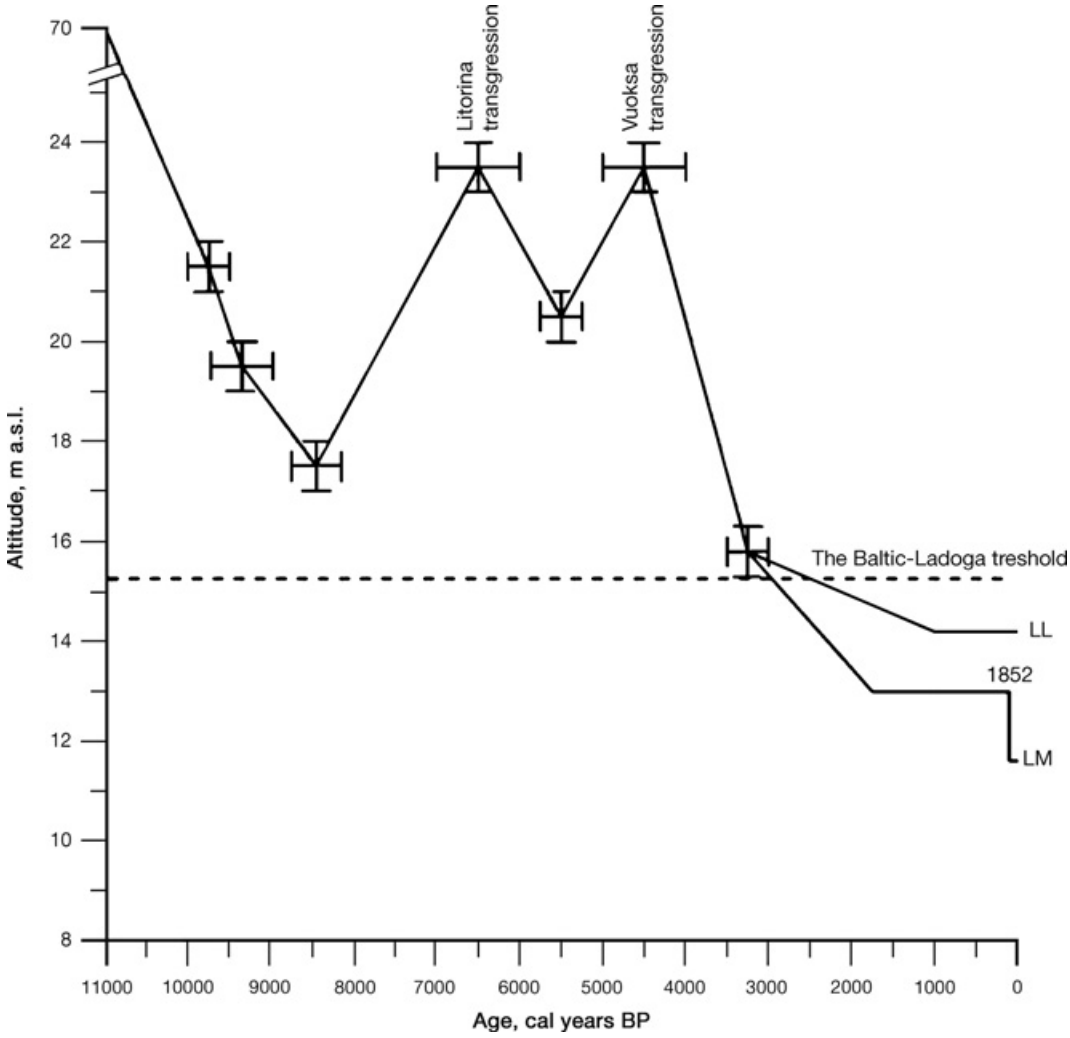

Fig. 5. Fluctuations of the Ladoga Lake on the Karelian Isthmus.

The sedimentological record and palaeoenvironment of Okhta 1

The first archaeological excavations at the mouth of the Okhta River were conducted by the St. Petersburg Archaeological Expedition in 1992–1993 *(Fig. 2)*. Here, a cultural layer from the 17th century and a cemetery from the 16th century were found. During the archaeological conservation excavations of 2007–2009 on the cape at the Okhta River mouth, the foundations of the fortresses appeared to have been almost completely razed and levelled during the period of existence of the Okhtinsky Shipyard and "Petrozavod" factory in the 19th and 20th centuries, respectively (Sorokin 2001; Hipping 1909). The filled-up fortress moats of the fortification constructions in this area have remained in better condition. Four stages of fortification were discovered there. Stages 4–3 are connected with the construction of Nyenskans during the first and second halves of the 17th century; Landskrona was the second stage, constructed at the end of the 13th century; the first stage was an earth hill fort, probably from the Novgorodian period, around the 13th century.

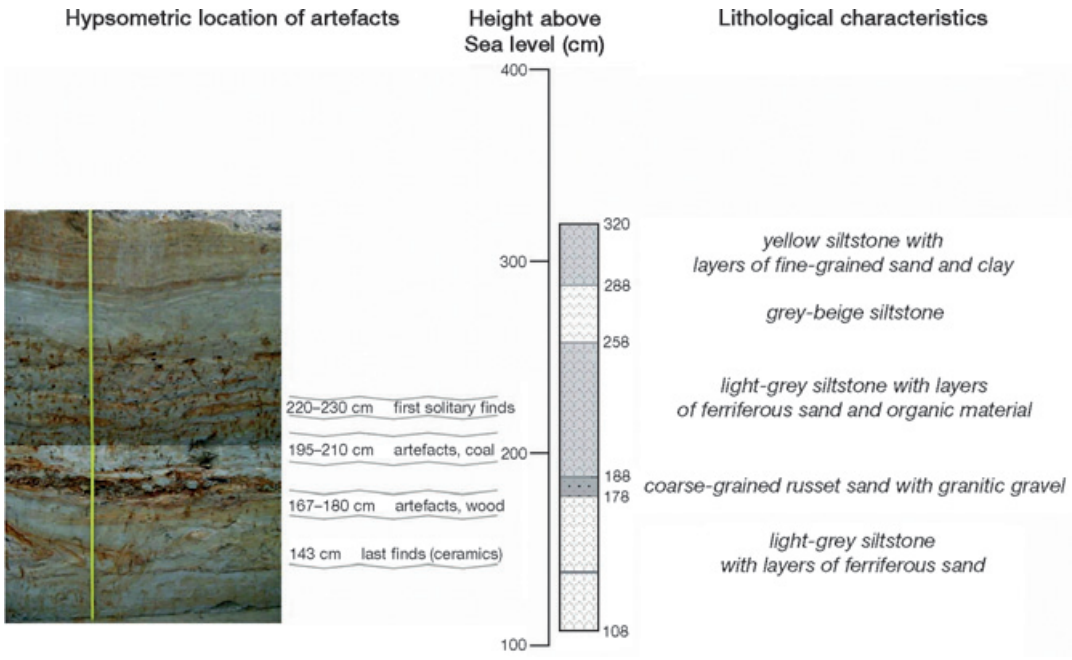

Fig. 6. Okhta 1, St. Petersburg (RU). Stratigraphy of Neolithic–Early Metal Age cultural layers with lithological characteristics.

The cultural layers of Neolithic–Early Metal Age periods were covered by 1–1.5 m of silt-sand deposits and buried soil containing artefacts from Medieval time.

The results of earlier investigations (Kulkova et al. 2010a; Kulkova et al. 2014) enabled the reconstruction of the environmental conditions of the cultural layer sedimentation. The cultural layers of the Neolithic–Early Metal Age belong to horizons of aleurite with thin sand layers, which were formed in the shallow littoral marine basin during the development of the river mouth *(Fig. 6)*. Variations in the water level of the basin were registered. The cultural layers were formed under subaerial conditions (beach) and they are separated by sediments deposited during transgressive stages (cf. Sergeev et al. in this issue). This is confirmed by the distribution of the archaeological finds. The accumulation of deposits, and connected with them, the remains of material culture occurred in general *in situ* as a result of the sedimentation processes. It may be noted that there is insignificant rewashing of sediment layers on the square of their distribution as a result of the rise of the water level.

The stratigraphy of layers and archaeological complexes of different periods is supported by a series of radiocarbon dates (more than 200) from different labs on different types of materials – wood, charcoal, food crust from ceramics, and other organic materials (Kulkova et al. 2010a; Gusentsova / Sorokin 2011) *(tab. 2)*. The investigations allowed us to establish that in the time of the maximum Littorina transgression at 6459–5666 BC the territory of the Okhta River mouth was an open, shallow desalinated Littorina Sea gulf, which had a free connection with the sea (Kulkova et al 2010a; Kulkova et al. 2014). During the decrease of the Littorina water level, a partial isolation of the Okhta Bay occurred and its coastal zone became waterlogged. Our data show a good correlation with the developmental stages of the Littorina Sea as has been discussed by several authors (Dolukhanov et al. 2010; Miettinen et al. 2007; Sandgren et al. 2004).

Lab ID	^{14}C Date BP	Calib. date BC (2σ)	Material	Archaeological context
Hela-2107	9321±61	8744–8420	plant rests	excavation section 7/2, 188 m
SPb_72	7460±90	6462–6104	humic acid	excavation section 16-1
SPb_84	7449±90	6459–6096	humic acid	excavation section 16-1, pit, 80 m
SPb_68	7288±85	6380–5990	seaweed	excavation section 16-1, pit, 80 m
SPb_66	7250±100	6365–5922	humic acid	excavation section 16-1, pit
SPb_83	6959±100	6012–5666	humic acid	excavation section 16-1, pit
SPb_275	5100±150	4261–3634	food crust	excavation section 7/2/4, square Б'13, 140 m, № 5453
Le-8680	5090±150	4260–3632	charcoal	excavation section 7/2, square Ц'15, 184 m
SPb_75	5100±100	4224–3655	bark	excavation section 16-1, pit,105 m
SPb_278	5050±120	4164–3633	food crust	excavation section 7/2/4, square П'14, 157 m, № 5450
SPb_76	5050±60	3963–3708	wood	excavation section 16
SPb_38	5030±100	4036–3640	food crust	excavation section 7/2, № 1288, 187 m
SPb_73	5000±60	3946–3660	wood	excavation section 16, 70 m
SPb_112	4980±150	4065–3375	food crust	excavation section 7/2, square Д'3, 80 m, pit №4 111
Le-8677	4970±140	4047–3376	charcoal	excavation section 7/2, square Ф'17, 211 m
Le-8683	4900±120	3959–3376	charcoal	excavation section 7/2, square Н'17, 203 m
SPb_276	4680±110	3659–3095	food crust	excavation section 7/2, square А'8, 124 m, № 5387
SPb_283	4639±150	3663–2926	food crust	excavation section 7/2, square С'11, 134 m, № 5568
SPb_281	4540±100	3518–2925	food crust	excavation section 7/2, square Г'12, 157 m, № 5308
SPb_186	4537±50	3488–3089	wood	pile 15/5 № 2, 46–60 inner tree-rings
SPb_185	4482±50	3359–3013	wood	pile 15/5 № 2, 31–45 tree-rings
SPb_184	4417±50	3330–2912	wood	pile 15/5 № 2, 16–30 tree-rings
SPb_183	4433±50	3334–2919	wood	pile 15/5 № 2, 0–15 outer tree-rings
SPb_198	4503±50	3361–3026	wood	pile 6/1 № 56, 46–57 inner tree-rings
SPb_197	4443±50	3335–2925	wood	pile 6/1 № 56, 31–45 tree-rings
SPb_196	4447±50	3338–2926	wood	pile 6/1 № 56, 16–30 tree-rings
SPb_195	4454±50	3340–2931	wood	pile 6/1 № 56, 0–15 outer tree-rings
SPb_202	4543±50	3492–3089	wood	pile 6/1 № 112, 46–55 inner tree-rings
SPb_201	4531±50	3369–3030	wood	pile 6/1 № 112, 31–45 tree-rings
SPb_200	4547±50	3494–3089	wood	pile 6/1 № 112, 16–30 tree-rings
SPb_199	4548±50	3494–3089	wood	pile 6/1 № 112, 0–15 outer tree-rings
SPb_274	4510±120	3519–2905	food crust	excavation section 7/2, square Д'9, 168 m, № 4611
SPb_118	4480±100	3495–2903	food crust	excavation section 5/1, 240–232 m
Hela-2013	4472±38	3342–3023	charcoal	excavation section 7/2, 251 m
SPb_280	4450±100	3369–2894	food crust	excavation section 7/2, square Ж'16, 139–130 m, № 5844

Tab. 2.

Lab ID	^{14}C Date BP	Calib. date BC (2σ)	Material	Archaeological context
SPb_277	4440±100	3368–2890	food crust	excavation section 7/2, square Е'12, 174 m, № 4678
SPb_282	4423±100	3363–2888	food crust	excavation section 7/2, square Я'8, 154 m, № 5382-2
SPb_191	4232±50	2920–2634	wood	pile 7/2/3 № 28, 0–15 inner tree-rings
SPb_190	4433±50	3334–2919	wood	pile 7/2/3 № 28,16–30 outer tree-rings
SPb_39	4390±100	3363–2870	food crust	excavation section 7/2, №1074, square Р'7', 192 m
Le-8679	4350±140	3369–2580	charcoal	excavation section 7/2, square П'7, 231 m
SPb_208	4300±50	3087–2759	wood	pile 15/5 № 1, 51–60 inner tree-rings
SPb_207	4290±50	3083–2703	wood	pile 15/5 № 1, 41–50 tree-rings
SPb_206	4278±50	3025–2696	wood	pile 15/5 № 1, 31–40 tree-rings
SPb_205	4257±50	3011–2676	wood	pile 15/5 № 1, 21–30 tree-rings
SPb_204	4241±50	2928–2633	wood	pile 15/5 № 1, 11–20 tree-rings
SPb_203	4210±50	2908–2630	wood	pile 15/5 № 1, 0–10 outer tree-rings
SPb_115	4306±70	3264–2672	wood	excavation section 15/1, square Ч'14, 75 m, fireplace
SPb_117	4308±100	3333–2625	wood	excavation section 15/1, square Ц'14, 89 m
SPb_125	4270±150	3345–2550	charcoal	burial
SPb_116	4270±100	3321–2574	wood	excavation section 15/1, square Ч'14, н.о. 75 m, fireplace
SPb_159	4250±100	3104–2565	wood	excavation section 15/1, square И'15', 124–139 m
SPb_194	4178±50	2893–2619	wood	pile 15/2 № 6, 31–45 inner tree-rings
SPb_193	4196±50	2900–2629	wood	pile 15/2 № 6, 16–30 tree-rings
SPb_192	4178±50	2893–2619	wood	pile 15/2 № 6, 0–15 outer tree-rings
SPb_279	4270±100	3321–2574	food crust	excavation section 7/2
Le-8681	4160±90	2912–2487	charcoal	excavation section 7/2, square Н'17, 253 m
SPb_52	4090±150	3020–2202	food crust	excavation section 7/1, 207 m, № 1003
SPb_55	4080±200	2895–2347	food crust	excavation section 8/2, square П'46', 278 m, № 190
SPb_41	4050±100	2883–2338	food crust	excavation section 7/2, square Р'4', 209 m
SPb_22	4060±130	2908–2275	charcoal	excavation section 7/2, square О'1', 207 m
SPb_57	4000±150	2900–2132	food crust	excavation section 7/2, № 1020, square О'3', 203 m
SPb_23	4000±100	2872–2280	charcoal	excavation section 7/2, square П'1', 233 m
SPb_124	4000±150	2901–2133	charcoal	excavation section 15/1, square Б/6', 250 m
SPb_36	3950±100	2858–2141	food crust	excavation section 7/2, № 1015, square О'5', 216 m
SPb_56	3915±100	2675–2127	food crust	excavation section 8/2, square П'42', 269 m, № 149
SPb_27	3870±100	2580–2031	food crust	excavation section 7/2, № 1218, square Р'11', 218 m

Lab ID	^{14}C Date BP	Calib. date BC (2σ)	Material	Archaeological context
SPb_37	3860±60	2475–2189	charcoal	excavation section 7 / 2, 218 m
SPb_42	3770±100	2471–1934	charcoal	excavation section 7 / 2, square Н'4', 213 m
SPb_58	3700±100	2408–1876	food crust	excavation section 7 / 2
SPb_54	3660±200	2575–1524	food crust	excavation section 8 / 2, square П'42', 303 m, № 114
SPb_40	3650±150	2466–1665	food crust	excavation section 8 / 2, square И'41', 293 m, № 134
SPb_44	3370±100	1901–1439	charcoal	excavation section 7 / 2, square Г'5', 249 m
SPb_34	3280±150	1949–1194	charcoal	excavation section 7 / 2, 220 m
SPb_47	3150±100	1639–1128	charcoal	excavation section 7 / 1, square Д'13', 260 m
SPb_46	2370±100	776–346	charcoal	excavation section 7 / 1, square Ж'19', 325 m
SPb_248	2850±70	1260– 830	charcoal	section 6, hearth 2
SPb_45	2300±100	601–111	charcoal	excavation section 7 / 1, square Б'15', 340 m
IGAN 3858	2040±80	230 BC–130 AD	humic acids	excavation section 6, bottom soil layer
IGAN 3857	1780±80	60–430 AD	humic acids	excavation section 6, upper soil layer
SPb-247	1922±100	BC 200–350 AD	charcoal	excavation section 6, hearth 1

Tab. 2. Okhta 1, St. Petersburg (RU). ^{14}C dates (s. Kulkova et al. [2012]).

The first cultural-chronological complex at Okhta 1 belongs to the Neolithic period, confirmed by radiocarbon dates ranging from 4261 to 3633 BC (SPb_275 and SPb_278 *[tab. 2]*). This was the period when the land became dry after the Littorina transgression. The sand beach of the shallow bay was formed. Prehistoric people of the Middle Neolithic with Pit and Pit-Combed Ware ceramics used this territory first as an area for fishing and hunting because numerous tools for fishing were found associated with these pottery types. During this time a coniferous forest with some broad-leaved trees (lime, elm, oak, beech, and maple) developed. A warm and humid climate prevailed in this area. At the same time, hazel and alder trees were spreading. Hazelnuts were found in the cultural layer of this period (Kulkova et al. 2014).

In the next period, around 3500 BC, the sedimentation conditions changed; the water level in the bay decreased and a system of shallow streams formed. This time is characterised by climatic deterioration. Traces of streams were detected in strips of middle-coarse grained sand and hollows in the aleurite layer.

In the following centuries (3400–3000 BC) landscape-climatic conditions continued to change, and human groups occupied this territory more extensively. There was a coast of a shallow basin that sometimes turned into a swamp. Birch woods were spreading. The climate was warm and humid.

After 2700–2200 BC, sedimentation occurred under the conditions of high wave activity (Kulkova et al. 2010a; Kulkova et al. 2014). The next stage of sedimentation (around 1639–1128 BC) is characterised by an unstable hydrological regime. In general, we can note unfavourable conditions for preservation of pollen. Diatom analysis data indicate that again sedimentation occurred in the littoral zone. The climate can be described as moderate. Anthropogenic activity was low. It can be assumed that this type of sediment was formed during the development of the delta of the river, which flows into the shallow bay.

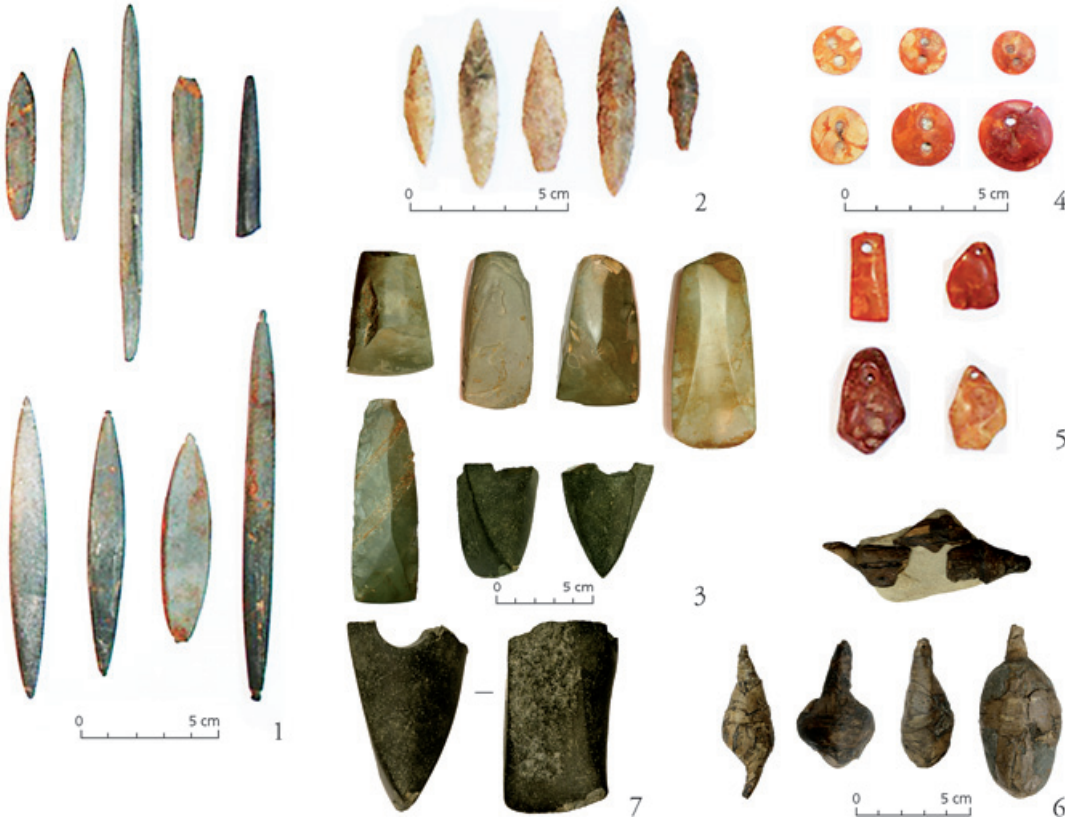

Fig. 7. Okhta 1, St. Petersburg (RU). Finds from the Neolithic–Early Metal Age: 1–3 stone tools; 4–5 amber jewellery; 6 bark plummets. Finds from the Bronze Age: 7 stone axe with drilled hole.

The maximum of the Ladoga Lake transgression in accordance with these investigations can be dated to around 2200 BC. The end of the transgression and respectively the end of the Neva breakthrough relates to around 1000–400 BC. The time of the river formation was around 1639–1128 BC, which corresponds to the results of D. Malakhovskiy (Malakhovskiy et al. 1993) of around 1530–1250 BC. M. Saarnisto (Saarnisto / Grönlund 1996) pointed out that the formation of the Neva River around 1350 BC led to the supply of large amounts of sand and silt deposits to the Gulf of Finland, and for 300 years there was a growth of the delta and the formation of its surface. It should be noted that as a result of the intensive water flow during the Neva River breakthrough, the sand foreland, which was formed in the shallow water marine gulf, was eroded and sedimented as a thick sand-aleurite layer.

The archaeological record and material culture of Okhta 1

Early, Middle and Late Neolithic cultural remains

The archaeological finds from the lower cultural layer include shale sinkers, flint and shale arrows, and an abrasive stone (Kulkova et al. 2010a) *(Fig. 7)*.

Ceramics from the Neolithic period are represented by several cultural-chronological groups *(Fig. 8)*. The ceramics of group 1 are from the Early Neolithic at about 5000 BC.

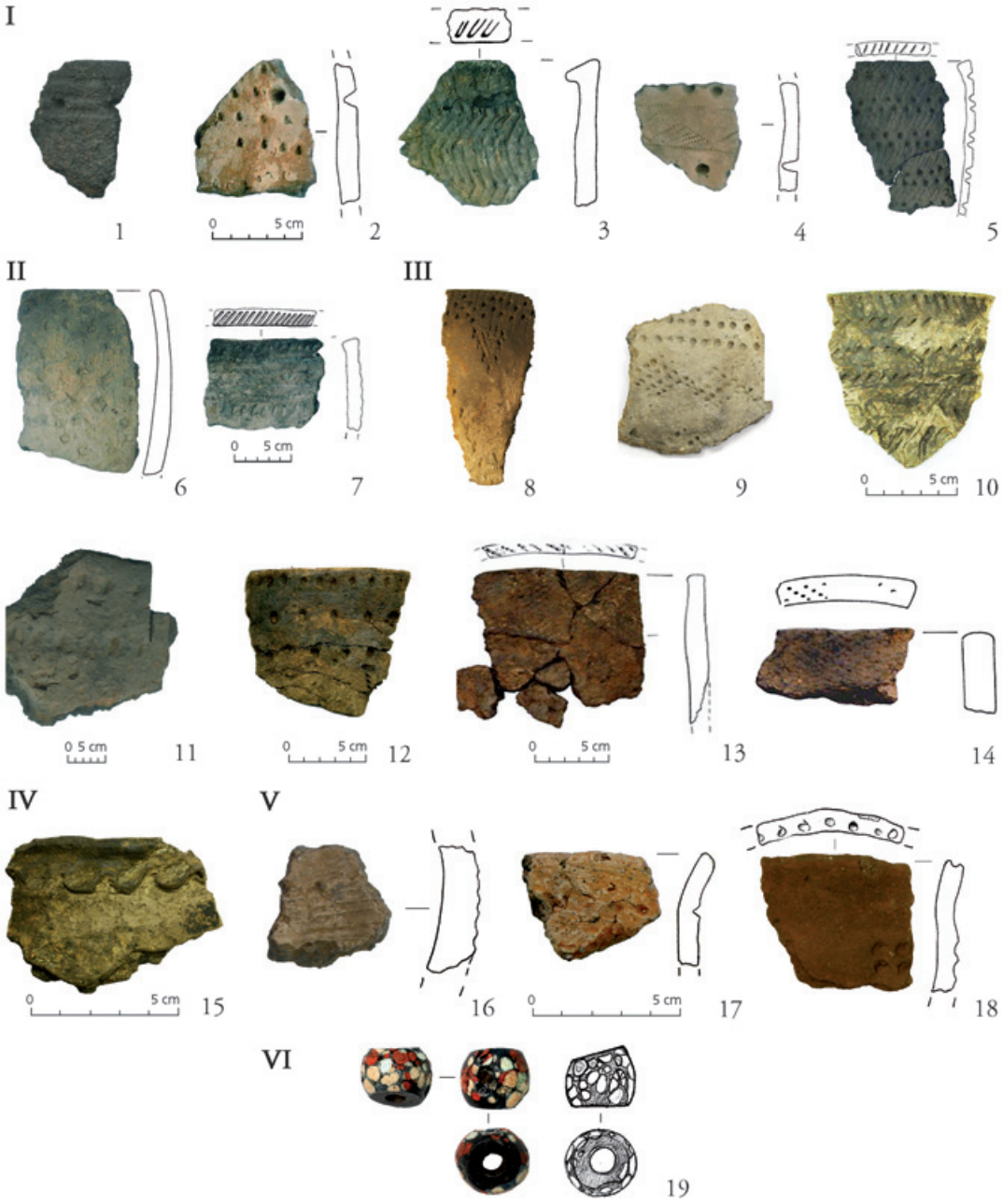

Fig. 8. Okhta 1, St. Petersburg (RU). Ceramic finds. I Early–Middle Neolithic: 1 Sperrings type; 2 ceramics tempered by feather and sand (4261–3632 BC [SPb_275]); 3, 5 ceramics tempered by feather and crushed rocks; 4 Typical Combed Ware ceramics tempered by crushed rocks. II Late Neolithic (3663–2905 BC [SPb_283], 3520–2905 BC [SPb_274]): 6–7 ceramics tempered by feather and sand. III Early Metal Age: 8–11 ceramics tempered by asbestos; 12 ceramics tempered by feather and down (3368–2890 BC [SPb_277]; 13–14 Net Ware ceramics. IV Bronze Age: 15 Cord Ware ceramics. V Early Iron Age: 16–17 Stroked Pottery ceramics; 18 Late Djakovo culture ceramics. VI Early Middle Ages: 19 glass bead of Roman time.

They are individual fragments of Sperrings type ceramics. The ceramic sherds have thick walls tempered with crushed rocks. The wares are ornamented by stamps from fish spinal bones and "rope". Another type is tempered with organic materials and sand. The ornamentation consists of pits / pinholes. The walls of these wares have large holes that have resulted from drilling. A radiocarbon date of charred food crust on this ceramic is 4261–3632 BC (SPb_275).

The ceramics of group 2 are from the Middle Neolithic to the end of the 5th century BC–middle of the 4th century BC. The Typical Comb Ware ceramics belong to the Middle Neolithic. The ceramic fragments were made from clay with admixture of different crushed stones, feathers, and sand. The diameter of the pottery is 20–42–60 cm (mouth–belly–bottom), the wall thickness is 8–10–12 mm. The vessels have slightly convex or flat walls with a conical bottom. The ceramics are decorated by pit and pit-combed ornamentation. The dates from ceramic food crust are 4164–3633 BC (SPb_278). The Typical Comb Ware ceramics (4036–3640 BC [SPb_38]) have analogues with late complexes of Narva settlements, the Neolithic sites of Akali, Kullamyagi in Estonia (Gurina 1967; Jaanits 1959), and with the ceramics of styles Ka 2:1 and Ka 2:2 from archaeological sites in Finland and southern Karelia (Europaeus-Äyräpää 1930; Pesonen 2004).

The Late Neolithic ceramics of group 3 from Okhta 1 are represented by the following types: ceramics tempered by feather and sand with ornamentation of comb, pits, and imprints of plants (3600–3500 BC); ceramics tempered by feather and down with pit ornamentation. This style of ceramics is similar to ceramics of the type at Uskela, Ka 3 in Finland (Pesonen 2004) and the ceramics with mineral admixtures ornamented by large round and rhombic pits are similar to the ceramics of eastern Karelia (Zhulnikov 1999; Vitenkova 2002).

The remains of wooden constructions from pits comprise rails, strips, and piles. The pile constructions were located along the edge of the lagoon coastal zone *(Fig. 9)*. Some of the wooden fishing constructions excavated in the cultural layer in the western part of the cape and on the shore of the Okhta River date to 3946–3660 BC (SPb_73) and 3963–3708 (SPb_76). Inside the pits and channels there are dozens of piles with numerous sinkers made with birch bark. The pits have oval or circular form and a width of 3 to 18 m^2; their depth is c. 1.5 m. The pits are connected with channels with the width of 1.5 m. These pits probably were used for fishing purposes. The largest amount of early objects was discovered in the northwestern part of the cape, dating to c. 3600 BC. Since some of these pits contain artefacts from the Early Metal Age (see below), they probably were used over and over again in different periods.

Late Neolithic–Early Metal Age cultural remains

The maximum of anthropogenic activity refers to the period from 3300 to 2700 BC, when the settlements and burials of the transition period Late Neolithic–Early Metal Age appear. Artefacts and constructions for fishing and hunting, the remains of houses with big areas of organic material and artefacts near them, and places of stone tool pretreatment were found in this cultural layer *(Fig. 10)*.

In one pit a fragment of a long rope twisted from willow twigs, bark boxes of different forms, and fragments of Middle Neolithic pit-combed ceramics were found. Moreover, in this pit a wooden construction of the Early Metal Age with piles and rails with dates of 3359–3013 BC (SPb_185) and 3334–2919 BC (SPb_190) was excavated.

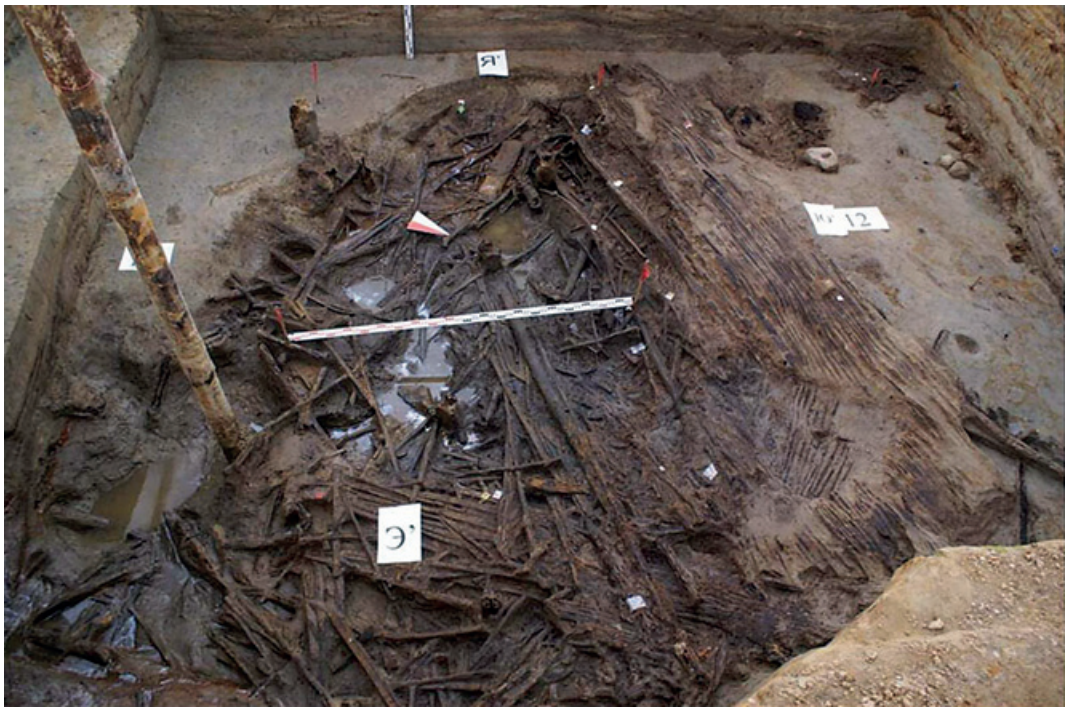

Fig. 9. Okhta 1, St. Petersburg (RU). Remains of wooden constructions in a pit.

Two burials were discovered. While no skeletons were preserved, the grave assemblages include bone remains and amber adornments. The results of geochemical analysis of the cultural layer from one burial show an anomaly of anthropogenic elements (P_2O_5, $CaO_{biog} = CaO / [CaO+Na_2O]$) (Núñez 1975) in the zone of the burial compared to background concentrations *(Fig. 11)*, i. e. revealing the main components of bones and tooth (Nesterov et al. 2011). The charcoal date from one of the burials is 3345–2550 BC (SPb_125).

Radiocarbon dates of charcoal, food crust from ceramics, and organic remains from constructions on the shore, which were interpreted as houses, belong to 3321–2574 BC (SPb_279) and they coincide with the dates of the pile constructions 3104–2565 BC (SPb_159).

The main system of pile constructions *(Fig. 12)* located in the central and southwestern parts of the cape (section 7 / 2) is dated to 3390–3000 BC on the basis of radiocarbon and dendrochronological analyses *(Tab. 2)* (Kulkova et al. 2012). The latest dates of 3100–2700 BC were obtained for piles from a channel crossing the cape (section 1 / 15, *Tab. 2*). A total of 400 piles were found. The piles were 0.5–5 m long and 7–16 cm in diameter. The piles were made from coniferous and broad-leaved trees, namely: pine, spruce, alder, willow, birch, juniper, and rowan. According to the analysis of working traces, the wooden piles were prepared using stone tools.

Fig. 10. Okhta 1, St. Petersburg (RU). Distribution of archaeological finds marking the coastal zone of the Gulf of Finland (cf. *Fig. 2*).

Early Metal Age objects

The ceramics of the Early Metal period include three types: pottery tempered by asbestos, pottery tempered by organic material, and pottery tempered by grog. The porous ceramics tempered by organic material, namely feathers and down, were made of thin smectite clay.

The vessels with asbestos are large, with diameters of 30–60 cm. The ornamentation on the pottery consists of superficial pit impressions. The corolla vessel is concaved inward and is decorated with shallow incisions. The ^{14}C dates of food crust from the vessel surfaces are at 3363–2870 BC (SPb_39). The ceramics of this type are similar to pottery from eastern Baltic, eastern Karelia, and Karelian Isthmus sites (Jaanits 1959; Zhulnikov 1999; Gerasimov et al. 2003). The ceramics tempered by organic and mineral materials, with an added chamotte or grog, have been found together in the layers with organic tempered wares.

The ceramic group from the upper part of the cultural layer had radiocarbon dates from 3020 to 1524 BC (3020–2202 BC [SPb_52] and 2575–1524 BC [SPb_54]). The ceramics were made of clay tempered by organics or asbestos. Some of the sherds from this cultural layer have thick walls ornamented by a net, which was decorated by a vast comb stamp on the textile. The ceramics were tempered by grog. The age of this ceramic type according to A. Kriiska (Kriiska et al. 2005) is 2900–2600 BC. This type of pottery was found in the ancient channel in the northwestern area of excavation.

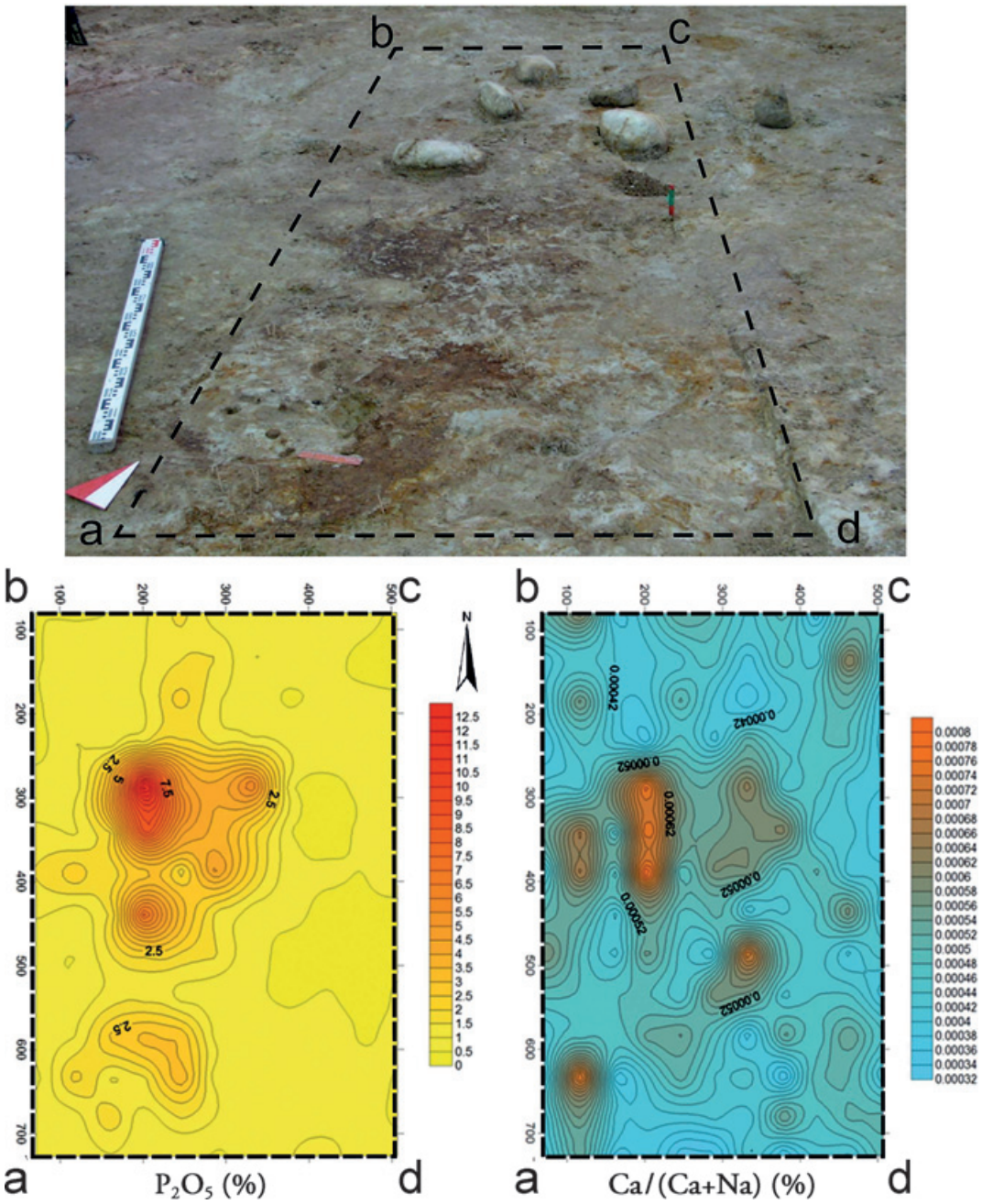

Fig. 11. Okhta 1, St. Petersburg (RU). Geochemical maps of anthropogenic element proxies marking the contours of a burial area.

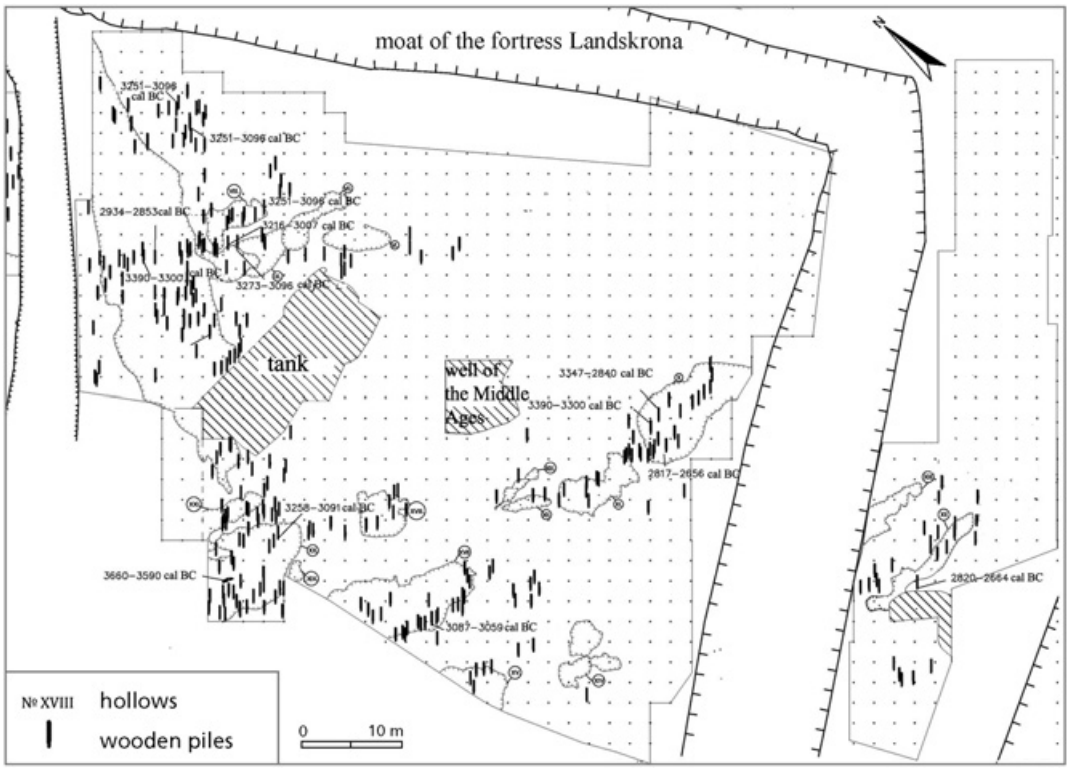

Fig. 12. Okhta 1, St. Petersburg (RU). Plan of the system of wood pile constructions on the ancient surface of the coastal zone.

The distribution of artefacts and wood piles, the features of cape topography, and data from the paleogeographical reconstructions indicate that in this period the territory under review was a shallow water lagoon with many streams and rivers flowing into it.

Bronze Age artefacts

In the upper part of the cultural layer, a fragment of corolla from a vessel ornamented by cord and a fragment of the blade from a drilling axe were found *(Figs 7, 8)*. These findings probably belong to the Bronze Age, i. e. to the end of the 3rd or beginning of the 2nd millennium BC. The artefacts can be attributed to the Baltic culture of the Cord Ware ceramics.

In section 11, three hearths with stones were found (Sorokin et al. 2011). The stones are very heavily cracked. Layers of charcoal and sherds of Cord Ware ceramics were found at the bottom of the hearths. The radiocarbon date of a sample from the upper layer of the buried soil from section 6 is 1780 ± 80 BP (AD 60–430) (IGAN 3857). The radiocarbon date of buried soil from the bottom layer is 2040 ± 80 BP (230 BC–AD 130) (IGAN 3858). These dates are corresponding to the radiocarbon date of charcoal from hearth 1, which is 1922 ± 100 BP (BC 200–AD 350) (SPb-247). Another date of charcoal from hearth 2 is early at 2850 ± 70 BP (1260–830 BC) (SPb-248). The formation of sediments during the development of the river delta, when the river flowed into the shallow sea bay, occurred from 1639 to 1128 BC. After that event and into the beginning of the 1st millennium AD a stable hydrological regime and the formation of soils are recorded.

Iron Age artefacts

In section 15 at the centre of the cape, fragments of moulded ceramics relating to the Early Iron Age were excavated. One sherd presents a slightly shaped corolla decorated by small conical pits at the neck of the vessel. This ceramic fragment is of a dense, dark-gray colour with added coarse sand in the clay. The surface is covered in white clay. Another vessel fragment is ornamented by crushed stones. There are well-defined strokes on the wall surfaces. Moreover, some fragments of a thin-walled, cup-like vessel tempered by crushed rocks but without strokes have been found. One ceramic sherd found at Okhta 1 is a shaped corolla with pitted ornamentation on the shoulder and edge of the corolla.

Some of these sherds can be connected to the Stroked Pottery Culture. The Stroked Pottery Culture (Sorokin et al. 2011) spread across a vast territory from the basin of the Neman River and the Zapadnaya Dvina River to Estonia, Novgorod, and Leningrad districts, starting around 1000 BC and lasting to the first half of 1st millennium AD. As A. V. Vasks (1991) notes, the eastern border of the distribution of the Stoked Pottery Culture has not been determined because the monuments at the eastern zone from Chudskoe Lake are too poorly studied. Stroked Pottery ceramics have been revealed in various settlements of the Leningrad and Novgorod districts, namely Gorodok, Bor, and Kobilia Golova.

A single sherd can be attributed to the Late Djakovskaya Culture of the first half of the 1st century AD ceramic tradition. The main territory of distribution of this culture is the basin of the Upper Volga and Valdai (Burov 2003; Islanova 2002). Ceramics of this type are known at western Priilmenie on the Mshaga, Vasilievskoe, and Gorshkovo sites (Yushkova 2011). This ceramic find from the Okhta 1 site shows that the material culture of this archaeological group was spread in the northwest as well. In the Upper Podniprovie, Podvinie, in the Upper flow of the Lovat' River, vessels of this style were connected with the middle layer Tushemli of the 1st–3rd centuries AD (Korotkevich 2004). It is important to note that the distribution of this new ceramic tradition between cultures of the forest zone in the Early Iron Age is attributed to the appearance of occupants from southern areas (Krenke 1987; Furasiev 2000). As Sorokin et al. (2009) note, these artefacts are very significant for determining the colonisation process during the Iron Age.

Roman era artefacts

Among the finds of the Roman era, a bead made of clear blue glass with spots of white cloudy glass was reported. The bead was excavated in the buried soil redeposited during the Landskrona construction. This bead dates to the 5th–6th or the 6th–7th centuries AD (Mastikova / Plokhov 2010).

Medieval constructions

The next period of development in this territory relates to the building of Middle Ages fortifications. The surface of the Medieval topography of the Okhta cape has formed naturally at the time of fortification of the building and slopes to the north, northwest, and northeast from a level of 3.00 m to 1.7–1.9 in the coastal zone of excavation sections 11, 15, and 16. The thick sand-silt layer, deposited as a result of the formation of the river mouth and covered by soil horizon, was the same surface on which the earthen fortifications of the Middle Ages were constructed. This thick sand-silt layer has covered and preserved the lower-lying cultural layers of the Stone Ages. The remains of a moat construc-

Fig. 13. Okhta 1, St. Petersburg (RU). Remains of the moat constructions of Landskrona time (13th century).

tion showed that the moat had been dug into the surrounding older layers, and had crossed the cape in a latitudinal direction to a width of about 80 m *(Fig. 13)*.

The moat had a V-shaped cut; however, during the excavation it was not possible to determine the bottom exactly, because the moat had been filled in by sandy soil. Its width was about 3–4 m at the top part, and its depth reached 1.6–1.8 m. These constructions had been filled up during the building of the earthen-wooden fortification of Landskrona, and thus these sandy soils covered the natural stratigraphy of the place. In addition, at the eastern side they are cut by the moat of Landskrona. No absolute dates could be generated here. However, considering their stratigraphical position under the buildings of Landskrona from 1300, it is possible to connect the occurrence of these cultural remains with an earlier time, having belonged to the Novgorod or Izhora era dependent from it.

Landskrona was rectangular, which is characteristic of regular fortresses. The fortress was surrounded by two lines of moats, close to the bank of the Neva. It is possible to assume that at the western and northern parts there was a similar strengthening. The studied area of the stronghold shows that the inner platform of the fortress was not less than 140 × 140 m, and its square was 19,600 sq. m. The total area occupied by the fortress was about 25,000 sq. m; thus, Landskrona was a quite large fortress.

The surface of the part of the cape where Landskrona was located was very uneven and covered with mixed forest. Differences in land elevations reached 2–3 m. In the centre of this area in a hollow was a stream running into the Neva. Therefore, a large-scale land-management plan was undertaken at the fortress construction. Trees were cut down and small vegetation was burnt. The stream channels as well as the other lower parts of the territory were filled by fascines from tree branches: pines, fur-trees, birches, oaks, and alders, to make a drainage system. Moreover, a cemetery of the end of 16th–beginning of

17th centuries and artefacts belonging to the settlement Nevskoe Ust', of an urban type, have been excavated at the Okhta cape.

Discussion – disentangling large environmental changes and human colonisation on the prehistoric to Medieval dwelling sites at Okhta 1

The territory of the Neva River mouth is home to a unique combination of landscape-geographical conditions that emerged as a result of the development of the coastal zone of the Baltic Sea after the retreat of the Würm ice sheet. Immediately after the Littorina Sea regression in 4200 BC, the coastal zone of the shallow water Gulf separated from the sea by a sand spit was occupied by people of the Neolithic period. They used this coastal area as place for fishing and hunting. The periodic variations in the water level of the basin, in connection with the isostatic uplift of land in this period, continuously changed the topography of this region. Around 3500 BC the water level in the bay decreased and a system of shallow streams formed. This period is characterised by climatic deterioration. The formation of a coastal zone on the shore of a shallow, occasionally waterlogged basin occurred around 3400–3000 BC. During this period, Late Neolithic settlements with houses and pile constructions as well as burials appeared in this area and continued to the Early Metal Age. The pile constructions can be interpreted as the remains of fishing devices as well as of pile dwellings. Dates derived from the wood range from 3300 to 2700 BC.

Changes in the hydrological conditions were registered after 2700–2200 BC, and sedimentation occurred under the conditions of high wave activity. While human activity decreased, finds from the Bronze Age (end of 3rd to beginning of 2nd millennium BC) are presented by rare sherds of Cord Ware ceramics. Ceramics with a turned-out rim and a moulded ring pattern around the circumference were found in the upper level (1A) of the Shvjantoy settlement (Rimantienė 2005). The area of distribution of this culture was determined to be the northeastern part of the Narva River. At the present time, its distribution can be expanded to the Neva River. To the east, the finds of this style extend to the Lovat' basin and the upper part of the Dnieper River. This culture spans the period 3–2 ka. BC. In the territory of Estonia it existed until 1500–1300 BC (Jaanits 1959).

For the next period, conditions of an unstable hydrological environment with high wave activity became evident. Artefacts have not been found in this layer of deposits. The deposits were rewashed intensively; they formed during the river delta development when the river flowed into a shallow sea bay. The sediment formation occurred during 1639–1128 BC, according to finds of charcoal from these layers. These data correlate well with data obtained earlier regarding the formation of the Neva River (Znamenskaja et al. 1975; Kvasov et al., 1990; Koshechkin / Ekman 1993; Malakhovskiy et al., 1993; Saarnisto / Grönlund 1996; Alexandrovsky et al. 2009). Our data show that the end of the river delta formation can be correlated with the appearance of the next stage of human occupation, which occurred at 800 BC. This was the beginning of the Early Iron Age. Artefacts from the Iron Age were found at the highest points of the cape. The rare artefacts such as sherds from the Stroked Pottery Culture (Sorokin et al. 2011) and a single sherd from the Late Djakovskaya Culture (1st century AD) show that during the Early Iron Age period, the cape was not constantly occupied by humans.

The development of soil cover at AD 60–430 is evidence of the stabilisation of the hydrological regime. The findings from Roman times, e. g. a glass bead, belong to this period.

The formation of a thick layer of sand-aleurite deposits during the Neva River breakthrough facilitated the preservation of Stone Age remains. At the same time, these deposits formed a high sand cape, which was used in the Middle Ages for building the fortresses of Landskrona and Nyenskans.

The excavation of Okhta 1 gave new important evidence for the mechanism of Neva River formation. This place located in the lower part of the Neva River was one of the most popular districts for human settlement during the Neolithic to present. The Neva River formation time was established around 1639–1128 BC after the Ladoga Lake transgression. This place was intensively occupied by people before and after this event. The cape that was formed after the Neva River formation was conveniently located at the intersection of the most important routes the waterway, which flowed to the Neva River, and the terrestrial way, which connected Novgorod City and Izhora Land with Karelia and Finland. The elevated cape was safe from flooding. Therefore, the cape provided a convenient and protected harbour for docking ships in Medieval time. These favourable conditions led to the area being chosen by Swedish troops in AD 1300, and long after, a colony centre developed at this location, eventually becoming the foundation of the city of St. Petersburg.

Acknowledgements

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References

Ailio 1915
J. Ailio, Die geographische Entwicklung des Ladogasees in postglazialer Zeit und ihre Beziehung zur steinzeitlichen Besiedelung. Fennia 38 (Helsingfors 1915).

Alenius et al. 2004
T. Alenius / E. Grönlund / H. Simola / A. Saksa, Land-use history of Riekkalansaari Island in the northern archipelago of Lake Ladoga, Karelian Republic, Russia. Vegetation History and Archaeobotany 13, 2004, 23–31.

Alexandrovsky et al. 2009
A. L. Alexandrovsky / Kh. A. Arslanov / N. N. Davidova / P. M. Dolukhanov / G. I. Zaitseva / A. N. Kirpichnikov / D. D. Kuznetsov / M. Lavento / A. V. Ludikova / E. N. Nosov / L. A. Savelieva / T. V. Sapelko / D. A. Subetto, Novie dannii otnositelno transgressii Ladogskogo ozera, obrazovanija reki Nevi i zemledelcheskogo osvoenija Severo-zapada Rossii [New data about the Ladoga Lake transgression, the Neva river formation and domestication in North-Western Russia]. Reports of the Academy of Science 424 (5), 2009, 682–687 [in Russ.].

Bonsdorff 1891
C. Bonsdorff, Nyen och Nyenskans (Helsingfors 1891).

Burov 2003
V. A. Burov, Gorodishe Varvarina Gora. Poselenie I–V i XI–XIV cc. na Yuge Novgorodskoy zemli [The settlement Varvarina Gora. The settlement I–V and XI–XIV on the south of Novgorod land] (Moscow 2003) [in Russ.].

Carpelan 1979
Chr. Carpelan, Om asbestkeramikens historia i Fennoskandien. Finskt Museum, 1978 (Helsinki 1979).

Davidova 1992
N. N. Davidova (Ed.), Istoriya ozer Vostochno-Evropeyskoi ravnini [History of Lakes of Eastern-European Plane] (St. Petersburg 1992) [in Russ.].

De Geer 1893
G. De Geer, Öfversigt öfver sina kvartärgeologiska iakttagelser under en nyligen avslutad resa till Finland och Ryssland. Geologiska Förenigens i Stockolm, Förhandlingar 15, 1893, 537–538.

Dolukhanov 1979
P. M. Dolukhanov, The Quaternary history of the Baltic. Leningrad and Soviet Carelia. The Quaternary history of the Baltic / Acta Universittis Upsaliensis, Symposia Universitatis Upsaliensis Annum Quingentesimum Celebrantis 1, Upsala 1979, 115–125.

Dolukhanov et al. 2009
P. M. Dolukhanov / D. A. Subetto / Kh. A. Arslanov / N. N. Davydova / G. I. Zaitseva / E. N. Djinoridze / D. D. Kuznetsov / A. V. Ludikova / T. V. Sapelko / L. A. Savelieva, The Baltic Sea and Ladoga Lake transgressions and early human migrations in North-western Russia. Quaternary International 203, 2009, 33–51.

Dolukhanov et al. 2010
P. M. Dolukhanov / D. A. Subetto / Kh. A. Arslanov / N. N. Davydova / G. I. Zaitseva / D. D. Kuznetsov / A. V. Ludikova / T. V. Sapelko / L. A. Savelieva, Holocene oscillations of the Baltic Sea and Ladoga levels and early human movements. Quaternary International 220, 2010, 102–111.

Europaeus-Äyräpää 1930
A. Europaeus-Äyräpää, Die relative Chronologie der steinzeitlichen Keramik in Finnland I–II. Acta Archaeologica I. Fasc. 2 & 3 (København 1930).

Furasiev 2000
A. G. Furasiev, Srednetushemlinskie pamjatniki Podvinja (istoki keramicheskoi tradizii) [The middle Tushemlin monuments of Podvinie (the sources of ceramic traditions)]. Stratum plus 4, 2000, 201–208 [in Russ.].

Gerasimov et al. 2003
D. V. Gerasimov / S. N. Lisitsin / V. I. Timofeev, Materiali k arheologicheskoi karte Karelskogo peresheika (Leningradskaya oblast') [Materials to archaeological map of Kerelian Ithmus (Leningradskaya district)]. The Monuments of Stone Age and Period of Early Metal, IHMC RSA (St. Petersburg 2003) 3–63 [in Russ.].

Gerasimov / Subetto 2009
D. V. Gerasimov / D. A. Subetto, Istoriya Ladogskogo ozera v svete arheologicheskih dannih [The history of Ladoga Lake in light of archaeological data]. Izvestiya Rossiiskogo Gosudarstvennogo Universiteta im. A. I. Herzena 106, 2009, 37–49 [In Russ.].

Gerasimov 2012
D. V. Gerasimov, Dinamica kamennikh industrii mezolita-neolita Karelskogo peresheyka [Dynamic of stone industry of Mesolithic-Neolithic on the Karelian Isthmus]. Dissertaziya na soiskanie stepeni kandidata istoricheskih nauk. PhD thesis (St. Petersburg 2012) [in Russ.].

Gurina 1961
N. N. Gurina, Drevnjaja istorija Severo-Zapada Evropeiskoy chasti SSSR [The ancient history of the North-West of the European part of the USSR] (Leningrad 1961) [in Russ.].

Gurina 1967
N. N. Gurina, Iz istorii drevnikh plemen zapadnykh oblastei SSSR (pomaterialam narvskoi ekspeditsii) [From the History of Ancient Tribes of the Western Districts of the USSR (on the Materials of Expeditions)] (Leningrad 1967) [in Russ.].

Gusentsova / Sorokin 2011
T. M. Gusentsova / P. E. Sorokin, Okhta 1 – pervii pamjatnik epoh neolita i rannego metalla v zentralnoy chasti Sankt-Peterburga [Okhta 1 – the first monument of Neolithic–Early Metal Age epochs in the centre of Sankt-Petersburg]. Russian Archaeological Annual 1, 2011, 421–451 [in Russ.].

Hipping 1909
A. I. Hipping, Neva i Nienschanz [Neva River and Nyenskans] 1, 2 (St. Petersburg 1909) [in Russ.].

Huurre 2000
M. Huurre, 9000 vuotta Suomen esihistoriaa (Keuruu 2000).

Huurre 2003
M. Huurre, Viipurin läänin kivikausi. Karjalan synty. Viipurin läänin historia I (Juväskylä 2003) 151–244.

Hyyppä 1943
E. Hyyppä, Beiträge zur Kenntnis der Ladoga- und Ancylustransgression. Bulletin de la commission geologique de Finlande 128, 1942 (1943), 122–127.

Islanova 2002
I. V. Islanova, O lokalnih gruppah djakovskih pamjatnikov [About local groups of Djakovskih monuments]. TAS 5, 2002, 451–460 [in Russ.]

Jaanits 1959
L. Yu. Jaanits, Poselenia epohi neolita i rannego metalla v priustie r.Emaiigi (Estonskaya SSR) [The Sites of Neolithic and Early Metal Age in the Estuary of Emaiiga River (Estonian SSR)] (Tallin 1959) [in Russ.].

Koshechkin / Ekman 1993
B. I. Koshechkin / I. M. Ekman, Golozenovie transgresii Ladogskogo ozera [Transgression of Ladoga Lake in the holocene]. In: The Evolution of Environment and Modern Condition of Ladoga Lake Geosystem (St. Petersburg 1993) 49–60 [in Russ.].

Korotkevish 2004
B. S. Korotkevich, Rannii zheleznii vek v verhovijah Zapadnoy Dvini i Lovati. (Avtoreferat dissertacii kandidata istoricheskih nauk). [The Early Iron Age in the Upper Part of Western Dvina and Lavat']. PhD thesis (St. Petersburg 2004) [in Russ.].

Krenke 1987
N. A. Krenke, Kultura naselenija basseina Moskvi reki v zheleznom veke i rannem srednevekovie. (Avtoreferat dissertacii kandidata istoricheskih nauk). [The Culture of the Population of the Moscow River basin at the Iron Age and Early Middle Ages]. PhD thesis (Moscow 1987) [in Russ.].

Kriiska et al. 2005
A. Kriiska / M. Lavento / J. Peets, New AMS dates of the Neolithic and Bronze age ceramics in Estonia: preliminary results and interpretations. Estonian Journal of Archeology 9, 2005, 3–31.

Kulkova et al. 2009
M. A. Kulkova / N. A. Kozin / A. I. Murashkin / D. V. Gerasimov / M. A. Yushkova, Geoecologicheskie osobennosti neoliticheskoi stojanki Ust'-Ribezhna 1) [Geoecological features of the Neolithic site Ust'-Ribezhna 1]. Geology Geologija, Geoecologija, Evoluzionnaja Geographija 9 (St. Petersburg 2009) 120–126 [in Russ.].

Kulkova et al. 2010a
M. A. Kulkova / T. V. Sapelko / A. V. Ludikova / D. A. Kuznetsov / D. A. Subetto / E. M. Nesterov / T. M. Gusentsova / P. E. Sorokin, Paleogepgrafiya i arheologia stojanok neolita–rannego metalla v ustie reki Ohti (Sank-Peterburg) [Paleogeography and archaeology of Neolithic–Metal Age sites at the mouth of Okhta River (St. Petersburg)]. Izvestija Rossiiskogo Geograficheskogo Obshestva 142 (6), 2010, 1–31 [in Russ.].

Kulkova et al. 2010b
M. A. Kulkova / M. A. Yushkova / D. A. Subetto, Mineralogo-geohimicheskii sostav chetvertichnih otlozhenii regiona Priladozhia, Priilmenia kak istochnikov sirja dlja izgotovlenija keramiki epohi bronzi–rannego zheleznogo veka [The mineralogical-geochemical composition of Quaternary deposits of Priladogie, Preilmenie as mineral sources for pottery making in Bronze–Early Iron Age epochs]. Nauka i Obrazovanie 4, 2010, 70–75 [In Russ.].

Kulkova et al. 2012
M. A. Kulkova / T. M. Gusentsova / E. M. Nesterov / P. E. Sorokin / T. V. Sapelko, Chronology of Neolithic–Early Metal Age sites at the mouth of Okhta River (St. Petersburg). Radiocarbon 54 (3–4), 2012, 1049–1063.

Kulkova et al. 2014
M. A. Kulkova / T. M. Gusentsova / T. V. Sapelko / E. M. Nesterov / P. E. Sorokin / A. V. Ludikova / D. V. Ryabchuk / M. A. Markova, Geoarchaeological investigations on the development of the Neva River delta (Gulf of Finland) during the holocene. Marine System 129, 2014, 19–34.

Kvasov 1990
D. D. Kvasov (ed.), Istorija Ladogskogo, Onegskogo, Pskovsko-Chudskogo ozer, Baikala I Khanki (Seria: Istorija ozer) [The history of Ladoga Lake, Onega Lake, Pskovsko-Chudskoe Lake, Baikal Lake and Khanka

(Series: The history of lakes of USSR)] (Nauka 1990) [in Russ.].

Lappo-Danilevsky 1913
A. S. Lappo-Danilevsky, Karty i plany Nevy i Nienschanza, sobrannye A. I. Gippingom i A. A. Kunikom [The maps and planes of Neva River and Nyenskans, the collection of A. I. Hipping and A. A. Kunik] (St. Petersburg 1913) [in Russ.].

Lahtinen / Rolwey-Conwy 2013
M. Lahtinen / P. Rolwey-Conwy, Early farming in Finland: Was there cultivation before the Iron Age (500 BC)? European Journal of Archaeology 16, 2013, 660–684.

Lavento 2001
M. Lavento, Textile Ceramics in Finland and on the Karelian Istmus. SMYA 109 (Helsinki 2001).

Malakhovskiy et al. 1993
D. B. Malakhovskiy / Kh. A. Arslanov / N. A. Gey / R. N. Djinoridze, Novie dannie po istorii vozniknovenija Nevi [New data on the history of the Neva formation. The evolution of environment and modern condition of Ladoga Lake geosystem] (St. Petersburg 1993) 74–84 [in Russ.].

Mastikova / Plokhov 2010
A. V. Mastikova / A. V. Plokhov, Datirovka i proishozhdenie stekljannih bus iz mogilnika u oz. Sezgee [The date and origin of glass beads from burial near Sezgee Lake]. In: Dialog kultur i narodov srednevekovoi Evropi (St. Petersburg 2010) 337–357 [in Russ.].

Meinander 1954
C. F. Meinander, Die Bronzezeit Finlands. SMYA 53 (Helsinki 1954).

Miettinen 2002
A. Miettinen, Relative sea-level changes in the eastern part of the Gulf of Finland during the last 8000 years. Ann. Acad. Sci. Fenn Geologica-Geographica 2002,162.

Miettinen et al. 2007
A. Miettinen / L. Savelieva / D. Subetto / R. Dzhinoridze / Kh. Arslanov / H. Hyvärinen, Palaeoenvironment of the Karelian Isthmus, the easternmost part of the Gulf of Finland, during the Littorina Sea stage of the Baltic Sea history. Boreas 36, 2007, 441–458.

Nesterov et al. 2011
E. M. Nesterov / M. A. Kulkova / M. A. Markova / D. A. Nesterov, Geohimicheskaja ozenka antropogennih otlozhenii epoh neolita-eneolita na pamjatnike Okhta 1 (St. Petersburg) [Geochemical assessment of anthropogenic deposits of Neolithic-Eneolithic Epochs on the Okhta 1 monument (St. Petersburg)]. Vestnik MANEB. Nauchno-tehnicheskii zhurnal Mezhdunarodnoi akademii nauk, ekologii, bezopasnosti cheloveka iprirodi Messenger of MANEB 15 (5), 2011, 56–61 [in Russ.].

Núñez 1975
M. Núñez, Phosphorus determination of the graves of Kilteri in Vantaa, southern Finland. Suomen Museo 82, 1975, 18–25.

Pesonen 2004
P. Pesonen, Neolithic pots and ceramics chronology-AMS-dating of Middle and Late Neolithic ceramics in Finland. Museovirastj (Helsinki 2004) 87–97.

Rimantienė 2005
R. Rimantienė, Akmens amžiaus žvejai prie Pajūrio lagūnos. Šventosios ir būtingės tyrinėjimai (Vilnius 2005).

Saarnisto 2003
M. Saarnisto, Karjalan geologia. Karjalan luonnonmaiseman synty. Karjalan synty. Viipurin läänin historia I (Jyväskylä 2003) 2180.

Saarnisto / Siiriainen 1970
M. Saarnisto / A. Siiriainen, Laatokan transgressioraja. Suomen Museo 77 (Helsinki 1970) 10–22.

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

Saksa 1992
A. I. Saksa, Karelia and the West Finnish cultural area in the Late Iron Age. In: Cultural Heritage of the Finno-Ugrians and Slavs (Tallinn 1992) 96–105.

Saksa 1994
A. I. Saksa, Rautakautinen Karjala — Karjalan synty. Kahden Karjalan välillä Kahden

Riikin riitamaalla. Studia Carelica Humanistica 5 (Joensuu 1994) 29–45.

Saksa 1998
A. I. Saksa, Rautakautinen Karjala. Muinais-Karjalan asutuksen synty ja varhaiskehitys. Studia Carelica Humanistica II (Joensuu 1998).

Saksa 2000
A. I. Saksa, Arheologicheskoe nasledie drevney koreli [Archaeological heritage of ancient Karelians]. Kulturnoe nasledie Rossiskogo gosudarstva 2, 2000, 121–129 [in Russ.].

Saksa 2006a
A. I. Saksa, The Karelian Isthmus: Origins of the natural and human environment. Archaeology, Ethnology & Anthropology of Eurasia 2 (26), 2006, 35–44.

Saksa 2006b
A. I. Saksa, Drevnjaja Karelija v epohu zheleznogo veka (k voprosu o proishozhdenii letopisnoy koreli) [Ancient Karelia in the Iron Age (the question of the origin of recorded Karelians)]. In: K 85 letiyu professora A. D. Stoljara (St. Petersburg 2006) 282–307 [in Russ.].

Sandgren et al. 2004
P. Sandgren / D. A. Subetto / B. E. Berglund / N. N. Davidova / L. A. Savelieva, Mid-holocene Littorina Sea transgressions based on stratigraphic studies in coastal lakes of NW Russia. GFF 126, 2004, 363–380.

Shaskolsky 1987
I. P. Shaskolsky, Bor'ba Rusi za sohranenie vyhoda v Baliyskoe more v XIV veke [The fight of Russia for protection of entrance in the Baltic Sea at XIV c.] (Leningrad 1987) [in Russ.].

Simola 2003
H. Simola, Karjalan luonto. Karjalan synty. In: Viipurin läänin historia I (Juväskylä 2003) 81–116.

Sorokin 2000
P. E. Sorokin, Ustye reki Okhty – pervonachalnyj poselencheskiy zentr v nizovye Nevy [The mouth of the Okhta River – the original settler centre at the lower part of Neva River]. In: Slavs, Finno-Ugric, Norse, Volga Bulgars. (St. Petersburg 2000) 194–207 [in Russ.].

Sorokin 2001
P. E. Sorokin, Landskrona, Nevskoe Ustye, Nienschanz: 700 let poseleniyu na Neve [Landskrona, Nevskoe Ustye, Nyenskanz: 700 years of settlement on the Neva] (St. Petersburg 2001) [in Russ.].

Sorokin et al. 2009
P. E. Sorokin / T. M. Gusentsova / V. O. Glukhov / A. A. Ekimova / M. A. Kulkova, Nekotorie rezultati izuchenija poselenija Ohta 1 v Sankt-Peterburge. Epoha neolita–rannego metalla [Some results of investigation of site Okhta 1 in St. Petersburg. Epoch of Neolithic–Early Metal Age]. Archaeological Heritage of St. Petersburg City 3, 2009, 205–221.

Sorokin et al. 2011
P. E. Sorokin / B. S. Korotkevich / V. D. Gukin, Nahodki epohi bronzi–rannego srednevekovija na Okhtinskom misu. (Evropeiskaja Sarmatija) [The finds of Bronze Epoch–Early Middle Ages on Okhta cape]. In: European Sarmaties (St. Petersburg 2011) 368–382.

Subetto 2007
D. A. Subetto, Istoriya formirovaniya Ladozhskogo ozera i ego soedineniya s Baltiyskim morem [The history of Lagoga Lake formation and its joining with the Baltic Sea]. Obzhestvo, sreda, razvitiye 1 (2), 2007, 111–120.

Taavitsainen et al. 1994
J.-P. Taavitsainen / L. Ikonen / A. Saksa, On early agriculture in the archipelago of Lake Ladoga. Fennoscandia archaeologica XL, 1994, 29–40.

Uino 1997
P. Uino, Ancient Karelia. Archaeological Studies. Muinais-Karjala. Arkeologisia tutkimuksia. Suomen muinaismuistoyhdistyksen aikakauskirja 104 (Helsinki 1997).

Vasks 1991
A. V. Vasks, Keramika epohi pozdney bronzi I rannego zheleza Latvii [The Ceramics of Epochs of Late Bronze Age and Early Iron Age of Latvia] (Riga 1991) [in Russ.].

Verzilin et al. 2005
N. N. Verzilin / G. I. Kleimenova / D. V. Sevastianov, Transformazija gidrographiches-

koi seti i limnogljazialnih komplexov Karelskogo peresheika v pozdne–poslelednikovie [Transformation of hydrographical net and limnoglacial complexes of Karelian Isthmus at Late–After Glacial Period]. Bulletin of St. Petersburg State University, Series 7 (2), 2005, 40–50 [in Russ.].

Vitenkova 2002
I. F. Vitenkova, Pamjatniki pozdnego neolita na territorii Karelii [The Late Neolithic Settlements on the Territory of Karelia] (Petrozavodsk 2002) [in Russ.].

Vremennik 1851
Vremennik obschestva i drevnostej Rossijskih. Kn.11. (Perepisnaia Okladnaia kniga po Novugorodu Vot'skoj piatiny 7008 g) [Annals of the Society of Antiquities of Russian Princes. The re-writing of accountant book in Novgorod 7008] (Moscow 1851) [in Russ.].

Yushkova 2011
M. A. Yushkova, Epoha bronzi i rannii zheleznii vek na Severo-Zapade Rossii. (Avtoreferat dissertacii kandidata istoricheskih nauk) [The Epoch of Bronze and Early Iron Ages in North-Western Russia]. PhD thesis (St. Petersburg 2011).

Zhulnikov 1999
A. M. Zhulnikov, Eneolit Karelii [The Eneolithic of Kerelia] (Petrozavodsk 1999).

Znamenskaja et al. 1970
O. M. Znamenskaja / V. B. Sokolova / V. I. Khomutova, Sravnitelnii analis paleogeographicheskogo razvitija jugnih i zapadnih beregov Ladogskogo ozera [Comparative Analysis of the Paleogeographical Development of the Southern and Western Coasts of Ladoga Lake]. History of Lakes (Vilnus 1970) [in Russ.].

Zusammenfassung: Archäologische und paläogeographische Zeugnisse zur Entwicklung der Newa (Ostseebecken, Russland)

Viele Fragen über die Entstehung des Flusses Newa sind noch immer offen. Die Entdeckung des neolithischen bis frühmetallzeitlichen Fundplatzes Okhta 1 an der Mündung der Newa im Zentrum von St. Petersburg (Russland) lieferte neue Daten. Das archäologische Fundspektrum umfasst insgesamt 1200 Objekte, darunter Tonware, Steinwerkzeuge, hölzerne Schnitzereien und Bernsteinschmuck. Erstmals wurden Überreste hölzerner Konstruktionen aufgefunden. Aufgrund der Zahl der Funde und der Erhaltung der Befunde ist Okhta 1 ein einzigartiges und seltenes Denkmal des Kulturerbes im Ostseeraum und Nordeuropa. Kulturschichten wurden unter sandigen Sedimenten von 1 bis 1,5 m Dicke ebenso wie Paläoböden unter den Festungen Landskrona (13. Jahrhundert) und Nyenskans (17. Jahrhundert) ergraben. Nach der Regression des Littorina-Meeres um 4200 v. Chr. wurde die Küstenzone des Flachwassergolfs, vom Meer durch eine Sandnehrung getrennt, von Menschen der neolithischen Epoche besiedelt. Die Formation einer Küstenzone am Rand eines flachen, gelegentlich vernässten Beckens trat um 3400 bis 2200 v. Chr. auf. In dieser Zeit entstanden sowohl Siedlungen mit Häusern als auch Gräber des Spätneolithikums bis zur Frühmetallzeit und Bronzezeit in diesem Gebiet. Die Entstehung der Newa konnte auf die Zeit um 1639–1128 cal. BC festgelegt werden durch die Untersuchung der Geschichte der Besiedlung der Region am Finnischen Meerbusen, die eng verknüpft war mit den hiesigen Landschaftsveränderungen während des Holozäns.

Abstract: Archaeological and paleogeographic evidence on the development of the Neva River (Baltic Basin, Russia)

Many questions remain about the formation of the Neva River. The discovery of the Neolithic to Early Metal Age site Okhta 1 at the mouth of the Neva River (centre of

St. Petersburg, Russia) provided new data. The collection of archaeological finds totals about 1200 objects, including pottery, stone tools, wooden carvings, and amber jewellery. The remains of wooden constructions have been discovered for the first time. Due to the number of archaeological finds and the preservation of the remnants, the Okhta 1 monument is a unique and rare object of cultural heritage in the territory of the Baltic and Northern Europe. Cultural layers were excavated under sandy sediments of 1–1.5 m and buried soil under the fortresses Landskrona (13th century) and Nyenskans (17th century). After the Littorina Sea regression in 4200 BC, the coastal zone of the shallow water gulf, separated from the sea by a sand spit, was occupied by people of the Neolithic period. The formation of a coastal zone on the shore of a shallow, occasionally waterlogged basin occurred around 3400–2200 BC. During this period, settlements with houses and burials of the Late Neolithic–Early Metal Age and Bronze Age appeared in this area. The Neva River formation time of around 1639–1128 BC was established by considering the history of ancient human occupation in this region at the Gulf of Finland, which was closely connected to paleoenvironmental changes that occurred there during the Holocene.

Résumé: Témoins archéologiques et paléogéographiques de l'évolution de la Néva (mer Baltique, Russie)

Bien des questions restent ouvertes au sujet de la formation du fleuve de la Néva. La découverte du site néolithique et de l'ère du métal précoce, Okhta 1, à l'embouchure de la Néva au centre de Saint-Pétersbourg a livré de nouvelles données. L'éventail des trouvailles archéologiques comprend en tout 1200 objets, dont de la poterie, des outils lithiques, des objets en bois sculptés et des bijoux d'ambre. On a découvert pour la première fois des vestiges de constructions en bois. La quantité de trouvailles et la conservation des structures font d'Okhta 1 un monument du patrimoine culturel rare et unique en son genre dans la Baltique et en Europe du Nord. Des couches archéologiques furent fouillées sous 1 – 1,5 m de sédiments sableux, ainsi que des paléosols sous les forteresses de Landskrona (13e siècle) et Nyenskans (17e siècle). Suite à la régression de la mer à Littorines vers 4200 av. J.-C., la zone côtière du golfe peu profond fut séparée de la mer par une flèche littorale sableuse et occupée par des Néolithiques. Une zone côtière le long d'une faible dépression, parfois gorgée d'eau, se forma entre 3400 et 2200 av. J.-C. C'est à cette époque, du Néolithique tardif au début de l'ère du métal et à l'âge du Bronze, que se développèrent ici des habitats comprenant des maisons et accompagnés de sépultures. L'étude de l'histoire du peuplement de cette région du golfe de Finlande, qui était fortement lié à l'évolution du paysage durant l'Holocène, permet de fixer la formation de la Néva entre 1639 et 1128 cal. BC.

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References of figures:
Fig. 1; 2: P. Sorokin. – *Fig. 3:* From Subetto 2007. – *Fig. 4:* From Gerasimov / Subetto 2009. – *Fig. 5:* From Dolukhanov et al. 2009. – *Fig. 6:* From Kulkova et al. 2014. *Fig. 7–9:* Photos T. M. Gusentsova. – *Fig. 10, 12:* T. M. Gusentsova. – *Fig. 11:* From Nesterov et al. 2011. – *Fig. 13:* Photo P. Sorokin. – *Tab. 1; 2:* K. Ruppel, RGK, after tables by the authors.