6 Emergence history of the Karelian Isthmus

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Abstract

The Late Weichselian and Holocene emergence history of the Karelian Isthmus and Ladoga Karelia is reasonably well known and the palaeohydrological framework can be worked out, including the chronology of events, which is now entirely based on calibrated radiocarbon dates. Some precisely dated events and morphologically well-developed shorelines form the basis also for archaeological investigations and interpretations. These include the upper limit of the Ancylus transgression, dated at 8100 calendar years BC, the upper limit of the Litorina transgression from 5500 BC in Säkkijärvi to slightly over 5000 BC in Terijoki, and further the drainage of Lake Saimaa to Lake Ladoga at 3700 BC and the upper limit of the Ladoga transgression at 1350 BC, as well as the history and elevations of the ancient Lake Vuoksenlaakso, which terminated as late as in the 19th century.

6.1 Introduction

The Karelian Isthmus and Ladoga Karelia were almost completely submerged by the waters of the Baltic basin after the retreat of the Scandinavian Ice Sheet, which was completed approximately 11 500 years ago as the ice margin started to retreat from the Salpausselkä II end moraine. The distribution of land and water changed significantly during the first two millennia following the deglaciation: in Ladoga Karelia, the highest late glacial (Late Weichselian) raised shorelines and delta levels of the Salpausselkä I end moraine are more than 100 metres above the current sea level (asl), whereas in the Karelian Isthmus, the corresponding shorelines are 50 to 70 metres above sea level, and in the easternmost part of the Gulf of Finland they lie just above the current sea level. The differences in the elevations are due to differences in glacial-isostatic land uplift.

The Late Weichselian/Late glacial and Holocene/Post-glacial history of the Baltic basin includes two freshwater lake stages when the Baltic was dammed above the sea level: the Baltic Ice Lake (9500–11 000 BC) and the Ancylus Lake (7500–8700 BC), as well as two brackish water stages when the Baltic basin was connected with the ocean: the Yoldia Sea (8700–9500 BC) and the Litorina Sea (from 7500 BC to the modern Baltic Sea) (for general references, see Björck 1995; Saarnisto 2003). These stages of the Baltic Sea have influenced the Karelian landscape and the living environment of prehistoric man in many ways. The changes in the landscape were significant and fast during the Baltic Ice Lake and Yoldia Sea stages, but since

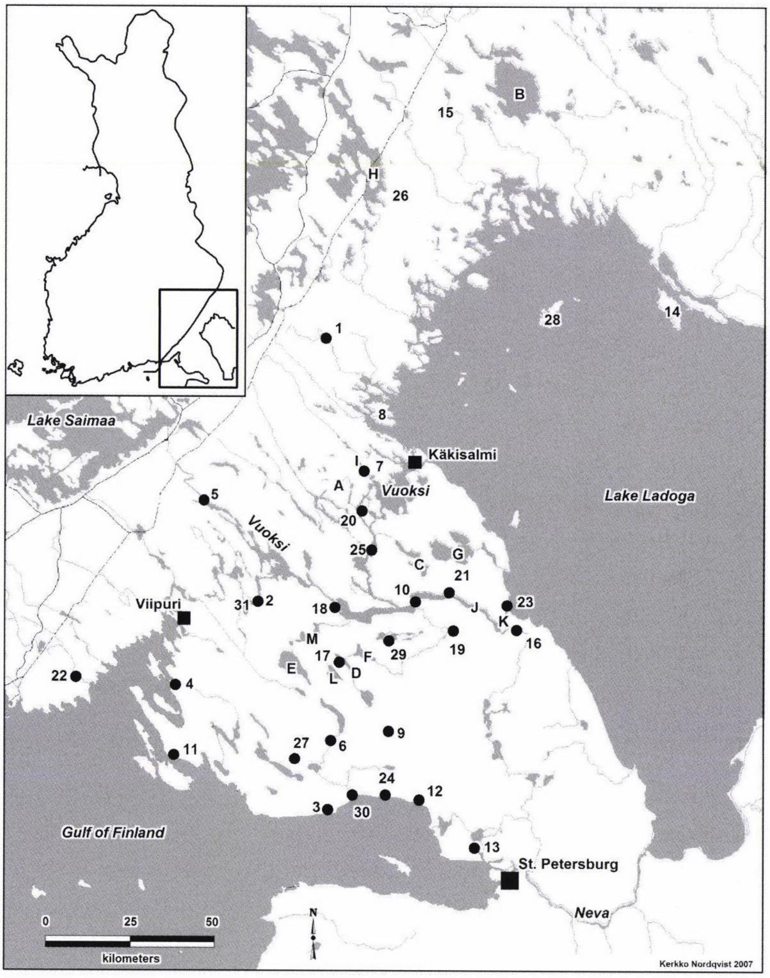

Figure 6.1 Index map of the Karelian Isthmus with the names of the most important localities mentioned in the text. Lakes and rivers: A – Juoksemajärvi; B – Jänisjärvi; C – Kiimajärvi; D – Kirkkojärvi; E – Muolaanjärvi; F – Punnusjärvi; G – Pyhäjärvi; H – Pyhäjärvi; I – Riukjärvi; J – Suvanto; K – Taipaleenjoki; L – Yksjärvi; M – Äyräpäänjärvi. Population centres, islands and other locations: 1 – Elisenvaara; 2 – Heinjoki; 3 – Ino; 4 – Johannes; 5 – Jääski; 6 – Kanneljärvi; 7 – Kaukola; 8 – Kilpolansaari; 9 – Kivennapa; 10 – Kiviniemi; 11 – Koivisto; 12 – Kuokkala; 13 – Lahta; 14 – Mantsinsaari; 15 – Matkaselkä; 16 – Metsäpirtti; 17 – Muolaa; 18 – Pölläkkälä; 19 – Rautu; 20 – Räisälä; 21 – Sakkola; 22 – Säkkijärvi; 23 – Taipale; 24 – Terijoki; 25 – Tiuri; 26 – Tuhkakangas; 27 – Uusikirkko; 28 – Valamo; 29 – Valkjärvi; 30 – Vammelsuu; 31 – Vetokallio. (Map: K. Nordqvist)

the termination of the Ancylus Lake stage until modern times, these changes have been slow, hardly observable during the lifespan of a human being. The most dramatic changes from the human point of view have taken place in the palaeohydrology of the Lake Ladoga basin (Fi. Laatokka, Ru. Ladožskoe ozero) and lakes in the River Vuoksi (Ru. reka Vuoksa) valley (Fi. Vuoksenlaakso). The history of Lake Ladoga is partly connected with the history of the Baltic basin in the eastern Gulf of Finland area, but for most of the Holocene it was an independent lake, whose shoreline displacement was controlled by differential land uplift, changes in its drainage area, and most dramatically the origin of its present outlet channel, the River Neva (Ru. reka Neva), and the subsequent rapid fall of the water level during the Early Metal Period in Karelia.

Prehistoric man has witnessed these changes in water level in Karelia since more than 10 000 years ago. The water level marks the lowest possible limit for dwellings, and therefore the shoreline displacement history is of crucial importance for archaeological reconstructions in an area like Karelia, where changes in water level have been great and highly variable in different areas. The history of the Karelian water bodies and prehistoric man on their shores have been investigated for more than a hundred years (e.g. Inostrancev

1882; Ailio 1915), and the course of water level changes is known in reasonable detail. The present summary article on the emergence history of the Karelian Isthmus is largely based on an article by the author entitled 'Geology of Karelia – Origin of Karelian landscapes', in Finnish (Saarnisto 2003), which contains a comprehensive list of references. Additional references especially to the relevant Russian literature can be found in Saarnisto & Siiriäinen 1970; Saarnisto *et al.* (1995 & 1999); Saarnisto & Grönlund (1996) and Miettinen (2002).

All dates in this article are in calendar years. The age of the boundary between Late Weichselian and Holocene is 11 500 years, i.e. 9500 BC.

6.2 Research history

Raised shorelines along the coast of the Gulf of Finland in the Karelian Isthmus and around the Lake Ladoga basin indicate higher water level than presently, as correctly described already in the early 19th century by Soboleffski (1839) and somewhat later by J. H. Holmberg (1855–1856). The magnificent shore cliffs, for example, in Island of Mantsinsaari (Ru. ostrov Mantsinsaari) in the eastern part of the Ladoga, were first interpreted as representing the highest limit of the Litorina Sea transgression of the Baltic basin (Berghell 1896; Ailio 1898). In his comprehensive monograph on the history of Lake Ladoga, Julius Ailio (1915), however, came to the conclusion that the shore cliffs and shore bars that extend for hundreds of kilometres around the southern Ladoga basin show the highest limit of the transgression of the lake itself, because salt water diatoms were not encountered in sediments deposited during the transgression, and the archaeological discoveries which were flooded by the Ladoga transgression are younger than the highest Litorina transgression. This conclusion has gained support also in later studies by e.g. Markov & Poretsky (1935); Hyyppä (1937; 1942); Znamenskaja & Ananova (1967). Abramova *et al.* (1967) have shown, on the basis of diatom analysis from the bottom sediments of Lake Ladoga, that the lake became isolated from the Baltic basin already at the beginning of the Holocene.

Before the opening of its present outlet, the River Neva, Lake Ladoga drained towards the Gulf of Finland/Viipurinlahti Bay (Ru. zaliv Vyborgskij) via the Vetokallio threshold in Heinjoki (Ru. Veščevo) (Fig. 6.1). This was obviously first recognized by Gerard de Geer (1893), who visited the area with Hugo Berghell in 1893. The Heinjoki threshold has experienced a more rapid uplift than most of the area of the Ladoga basin, which resulted in rising water levels, the Ladoga transgression, and finally the opening of the River Neva in the south-western corner of the lake. During the Ladoga transgression, the shoreline transgressed several kilometres inland in the southern part of the lake, and littoral deposits covered prehistoric dwelling places and peat bogs, which were discovered in connection with the construction of the New Ladoga Canal along the south coast in 1872–1882 and described in a comprehensive volume by A. A. Inostrancev (1882). Ailio (1915) observed that the transgression was felt also in the area of the Vetokallio threshold. Hyyppä (1942) concluded that the increased water volume of Lake Ladoga explains the rising water level also in the northern lake area and that this was due to climate change, an explanation utilized also by Znamenskaja & Ananova (1967), who investigated in Metsäpirtti (Ru. Zaporožskoe) a peat sequence covered by clay, which was deposited by the Ladoga transgression. The accelerated Ladoga transgression and the opening of the new outlet River Vuoksi for the large Saimaa lake complex in Finland are closely connected both chronologically and archaeologically, and therefore Saarnisto (1970) concluded that the increased water volume from Saimaa adequately explains this rapid transgression, which was felt throughout the Ladoga basin also in the Vetokallio land uplift isobase and along the north coast where uplift is more rapid. The origin of Vuoksi and the Ladoga transgression are also connected via the drainage delta of Vuoksi at Jääski (Ru. Lesogorskij), whose elevation is close to the upper limit of the Ladoga transgression (Hellaakoski 1938). The origin of Vuoksi took place during the Neolithic Combed Ware Style 2, when also the Ladoga transgression reached its highest level (Saarnisto & Siiriäinen 1970; cf. also Äyräpää 1934).

A new era in the study of the emergence history of Karelia commenced when the radiocarbon method was introduced in the 1970s. It was first applied to peat and other organic material buried in littoral or fluvial deposits during the transgressions in the Baltic and Ladoga basins. Saarnisto & Grönlund (1996) emphasized, however, that it is very difficult to correlate such buried organic sediments with the moment of transgression maximum, as most buried sediments are clearly older than the peak of the flooding. The water level changes, both transgressions and regressions, are precisely recorded in the bottom sediments of small lake basins, which have been a part of the large water body of the Baltic and Ladoga basins. Especially the lowering of the water level in connection with the formation of the River Neva should be clearly seen in the lake sediments in the form of an abrupt change from high-energy silty sediments, which were deposited when the lake was a part of the ancient large Lake Ladoga, to a low-energy organic gyttja deposited in the small isolated lake basins. This principle was successfully tested on the Island of Kilpolansaari (Ru. ostrov Kil'pola) in north-western Lake Ladoga, where several small lake basins emerged in connection with the origin of the Neva (Saarnisto & Grönlund 1996). The changes in water level are also reflected in changes in the composition of the diatom flora, especially when a basin is emerging from or flooded by the brackish waters of the Gulf of Finland. Appropriate references are given below in connection with the description of the shoreline history of the Gulf of Finland and Lake Ladoga.

6.3 Deglaciation and the Baltic Ice Lake

When the Ladoga basin became deglaciated, the Baltic Ice Lake was dammed in the Baltic basin in front of the retreating ice margin. The Baltic Ice Lake covered the Ladoga area, the Gulf of Finland, and most of the Karelian Isthmus. Only the central part of the southern Karelian Isthmus was emergent, including Valkjärvi (Ru. Mičurinskoe), parts of Rautu (Ru. Sosnovo), Kivennapa (Ru. Pervomajskoe) and eastern Kanneljärvi (Ru. Pobeda). The gravel plains, i.e., deltas of the Younger Dryas age Salpausselkä end moraines, which were deposited at the ice margin, show the elevation of the water level in the Baltic Ice Lake. Salpausselkä I follows the southern margin of the Saimaa lake complex and extends to Ladoga Karelia between Elisenvaara (Ru. Èlisenvaara) and Matkaselkä (Ru. Matkasel'ka), where the marginal delta of Tuhkakangas (Ru. ur. Tuhkangas) on the eastern shore of Pyhäjärvi (Ru. ozero Pjuhjajarvi) at 100 metres asl marks the highest Baltic Ice Lake level, dated approximately to 10 000 BC.

The Baltic Ice Lake terminated when the water level sank rapidly, perhaps within a couple of years, by c. 30 metres to the level of the ocean when the ice margin retreated from the area of Mount Billingen in Central Sweden.

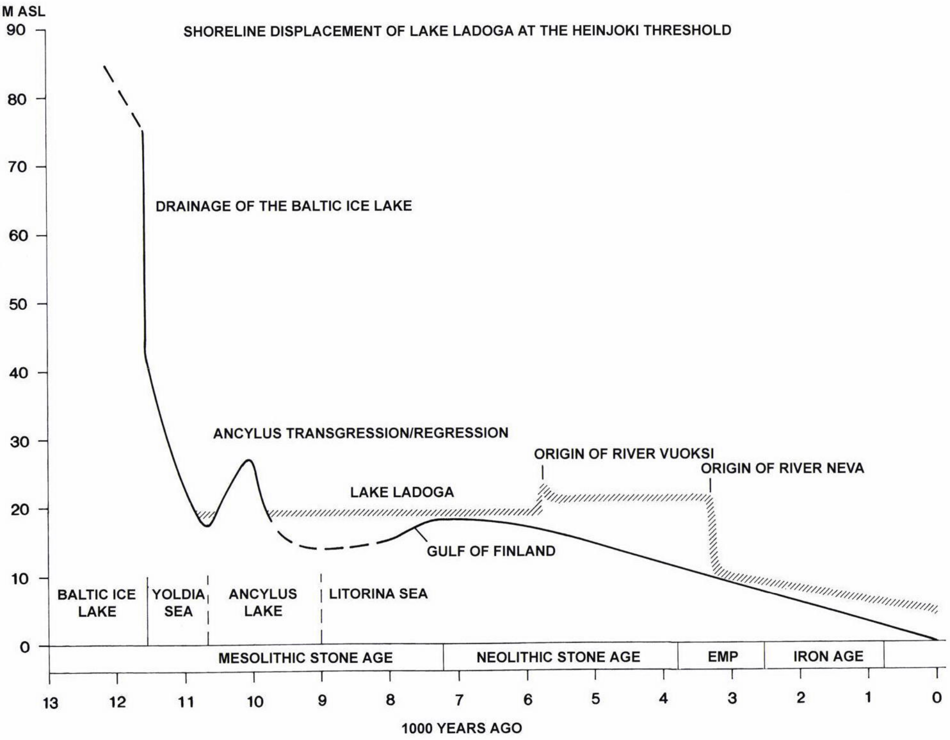

Figure 6.2 Shoreline displacement curves showing water level changes in the Ladoga basin at the Heinjoki threshold (Viipuri) isobase and in the Gulf of Finland at the same isobase. The prehistoric periods and chronology are also shown (Mesolithic & Neolithic Stone Age; EMP = Early Metal Period; Iron Age). (Modified from Saarnisto & Grönlund 1996 and Saarnisto 2003).

At the same time, dated at 9500 BC, the ice margin in Finland retreated from Salpausselkä II, which is a continuous ice marginal formation c. 20 kilometres north - north-west of Salpausselkä I. The dating is based on varved clays in the Lake Onega (Fi. Ääninen, Ru. Onežskoe ozero) and Ladoga basins together with radiocarbon analysis and palaeomagnetic data (Saarnisto & Saarinen 2001). It marks the end of the Late Weichselian period and the beginning of the Holocene and is thus broadly dated to 9500 BC. The current elevation of the last stage of the Baltic Ice Lake north of Lake Ladoga is approximately 90 m asl, whereas further south in the Karelian Isthmus in the Uusikirkko (Ru. Poljany) - Taipale (Ru. Solov'evo) area the elevation is 50 m asl due to the difference in land uplift. The Baltic Ice Lake penetrated to Lake Jänisjärvi (Ru. Janis'jarvi), but Lake Onega remained above it, as it remained above all later stages of the Baltic basin. The River Svir (Fi. Syväri), the present outlet of Lake Onega towards Lake Ladoga, originated c. 8500 BC (Saarnisto *et al.* 1995).

6.4 Yoldia Sea and Ancylus Lake

Large land areas emerged in Karelia in connection with the drainage of the Baltic Ice Lake. At the eastern end of the Gulf of Finland and in the southern Ladoga area, the water level sank at least 10 metres beneath the current sea level. In the northern coastal area of Lake Ladoga,

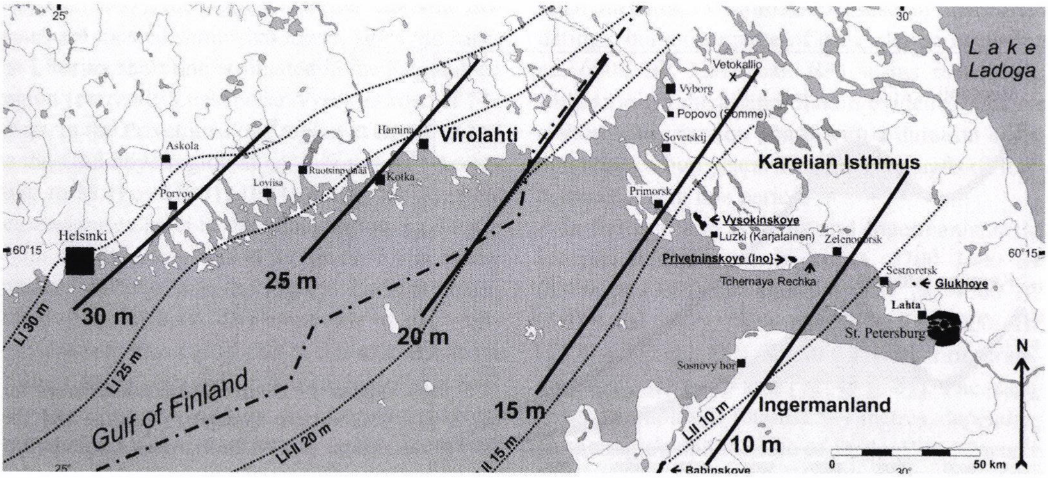

Figure 6.3 The highest Litorina Sea isobases in the eastern part of the Gulf of Finland according to Miettinen (2002). The dashed lines show the highest Litorina Sea isobases according to Hyyppä (1937). The maximum level of the Litorina Sea in Virolahti is nearly 7500 years old and in the Karelian Isthmus slightly more than 7000 years old. (Reprinted from Miettinen 2002 with the permission of the Finnish Academy of Science and Letters).

the highest shores of the Yoldia Sea are 50 to 60 metres asl, but no continuous distinct shorelines were formed during the Yoldia Sea stage because of the rapid fall of the water level as a result of rapid land uplift, several metres per century, which clearly overruled the rapidly eustatically rising ocean level.

The Yoldia Sea penetrated to the Lake Ladoga basin via the Viipurinlahti Bay over the Heinjoki threshold. At the beginning of the Yoldia Sea stage, the Heinjoki threshold, now at 15 m asl, remained under water at a depth of c. 25 metres, and the connection between the Viipurinlahti Bay and Lake Ladoga was several kilometres wide. Brackish water diatoms in the bottom clays of the Lintusuo bog (Ru. Nižne-Osinovskoe) situated at the Heinjoki threshold area indicate that the connection, which opened around 9000 BC, remained open for several hundred years, perhaps until the end of the Yoldia Sea stage in 8700 BC, despite the fast land uplift (Saarnisto *et al.* 1999).

The Heinjoki thresholds at Vetokallio and nearby (Ailio 1915) have had a crucial role in the palaeohydrology of Lake Ladoga and the valley of the River Vuoksi from the time of the Yoldia Sea until historical times, for nearly 11 000 years. The level of the Yoldia Sea at Heinjoki was at its lowest at its termination and transition to the Ancylus Sea stage 10 700 years ago, and Lake Ladoga may also have remained above the sea level until the onset of the transgression of the Ancylus Lake (Fig. 6.2). Vetokallio thus acted for the first time as an outlet threshold of Lake Ladoga (Saarnisto & Grönlund 1996; Saarnisto 2003).

The transgression of the Ancylus Lake was felt throughout the Gulf of Finland and Lake Ladoga. It covered coastal peatlands with silt and sand, for example, at Pölläkkälä (Äyräpää) (Ru. Baryševo), along the River Taipaleenjoki (Ru. reka Burnaja), on the Island of Mantsinsaari, and at Lahta near St. Petersburg (e.g. Dolukhanov 1979; Hyyppä 1942). The water level at Heinjoki rose nearly 10 metres and a shore cliff north of Vetokallio was eroded into an esker at 27 metres asl, which should represent the upper limit of the Ancylus transgression here. The transgression limit is shown by magnificent coastal cliffs on the southern Karelian Isthmus and shore bars e.g. at the Island of Mantsinsaari. The upper limit of the Ancylus transgression is at 30 m asl along the northern Lake Ladoga coast and at c. 20 m at Käkisalmi (Ru. Priozersk) and Metsäpirtti, but in the southern Ladoga area, the transgression limit stays below the present lake level at 5 m. Along the coast of the Gulf of Finland at Viipuri (Ru. Vyborg), the highest Ancylus shore is at 30 m, at Koivisto (Ru. Primorsk) 25 m, at Uusikirkko 15 m and at Terijoki (Ru. Zelenogorsk) 10 m asl.

The Ancylus transgression terminated 8100 BC when the outlet threshold of the Ancylus Lake changed from Central Sweden to the Danish Straits and a rapid fall of the water level commenced. This is thus the age of the Ancylus limit. A couple of centuries later, around 7800 BC, the Vetokallio threshold emerged and the Lake Ladoga basin became isolated from the Baltic basin. The upper limit of the Ancylus transgression is a well-dated event, and as it is also manifested by raised coastal cliffs and shore bars, it has an important role in the emergence history of Karelia and in reconstructions of the palaeoenvironment of the oldest Mesolithic archaeological sites. In fact, the upper Ancylus limit is the only well-dated and morphologically distinct shore level following the Baltic Ice Lake after 9500 BC and before the formation of the uppermost Litorina Sea shores in 5000–5500 BC, close to the transition from the Mesolithic to Neolithic Stone Age c. 5000 BC.

6.5 Litorina Sea

At the beginning of the Litorina Sea stage, the ocean level was still rising rapidly, as the last remnants of the continental ice sheets melted in North America. Salt water penetrated via the Danish Straits to the southern Baltic basin 7500 BC, and this was felt in the southern coastal areas of Finland some 500 years later. The glacial-isostatic land uplift was already slowing down, and the Litorina Sea flooded the coastal areas east of Helsinki, including the Karelian Isthmus where land uplift was slow. The eustatic rise of the ocean/Litorina Sea terminated c. 4000 BC, and since then the sea level has remained stable within the limits of one to two metres. The land uplift has continued, however, and therefore the shorelines of the Litorina Sea are now above the sea. The upper Litorina limit has been precisely determined also in the Karelian Isthmus on the basis of brackish water lagoonal diatoms found in bottom deposits of lakes and mires that have formerly been below the Litorina Sea limit (e.g. Hyyppä 1937; Miettinen 2002).

The upper limit of the Litorina Sea at St. Petersburg is 5–6 m asl, at Kuokkala (Ru. Repino) and Terijoki 10 m, at Ino (Ru. Privetninskoe) 12 m, at Koivisto 15 m, at Johannes (Ru. Sovetskij) 17 m, at Viipuri 18 m, and at Säkkijärvi (Ru. Kondrat'evo) 20 m asl (Fig. 6.3; Miettinen 2002). The highest Litorina shoreline along the coast of the Gulf of Finland is manifested by a high shore cliff extending from Kuokkala to Terijoki and further to Vammelsuu (Ru. Serovo), Uusikirkko, and Johannes. It was formed during the long period of the Litorina transgression, and in Terijoki it also marks the upper boundary of the Ancylus transgression. The cliff forms an important chronological boundary in the emergence history of the southern Karelian Isthmus, as most of the land areas above the cliff became dry land already in connection with the drainage of the Baltic Ice Lake to the Yoldia Sea level 9500 BC, whereas the areas below the cliff to the present coast of the Gulf of Finland emerged only later than 5000 BC, after the peak of the Litorina transgression.

During the Litorina Sea stage, the Viipurinlahti Bay was much larger than today (Figs. 6.4 and 6.5) and its level was close to the threshold

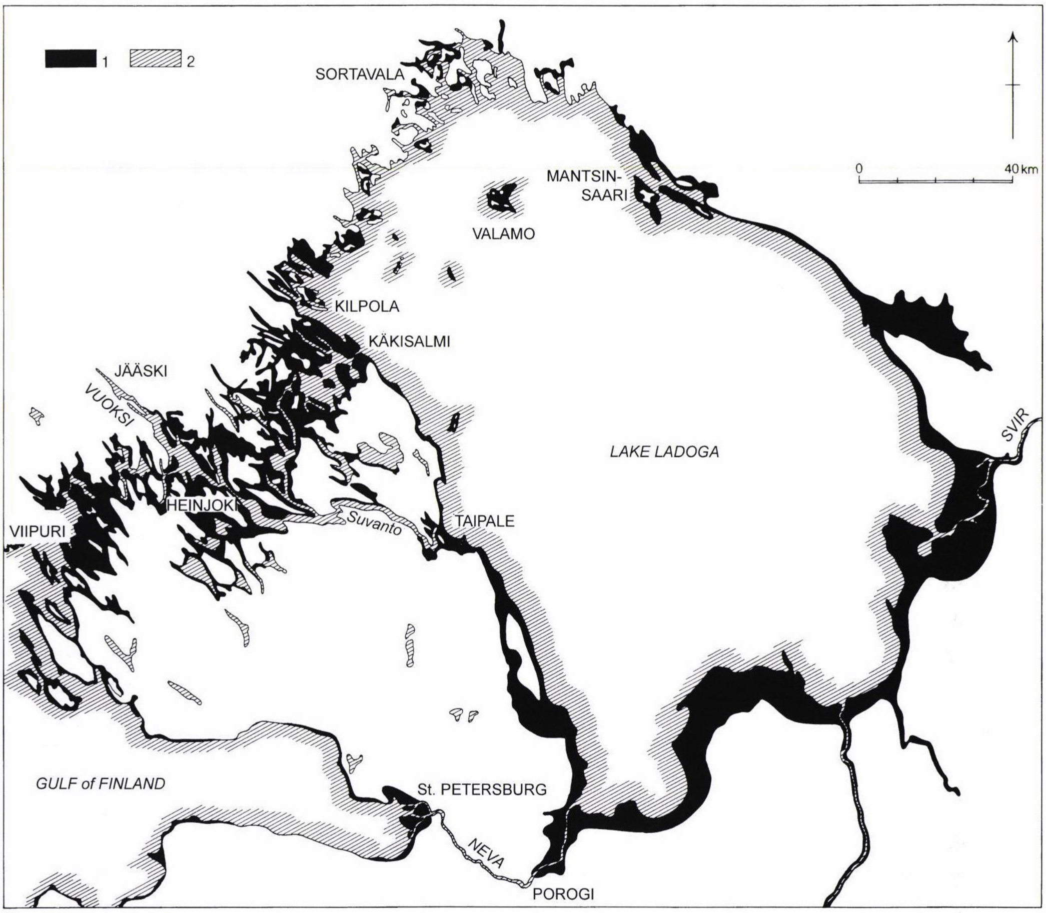

Figure 6.4 Map showing the area covered by the ancient Lake Ladoga (black) before the formation of the River Neva. The areas submerged in the coastal region of the Gulf of Finland are also shown (black). (Redrawn from Ailio 1915).

level of Heinjoki. No positive evidence of the brackish water penetration to the Ladoga basin has been found in the diatom analytical studies in the Ladoga area (e.g. Davydova 1969; Saarnisto & Grönlund 1996), but there was nevertheless an easy access between Lake Ladoga and the Viipurinlahti Bay/Litorina Sea still at the beginning of the Neolithic Stone Age, as had been the case since the deglaciation.

The highest Litorina limit has various ages in Karelia depending on the speed of land uplift. In Säkkijärvi, land uplift overcame the slowing rise of the sea level already around 5000–5500 BC and the water level began to fall, whereas farther east, the Litorina transgression continued until 5000 BC. At Säkkijärvi, the flooding of the Litorina Sea was nearly 5 metres, in Ino 7 metres, and in St. Petersburg as much as 10 metres (Miettinen 2002). It is obvious that an unknown number of Mesolithic and Early Neolithic dwellings were also flooded.

6.6 Shoreline displacement of Lake Ladoga

The Ladoga basin finally became an independent lake during the rapid regression of the Ancylus Lake c. 7800 BC. The Vetokallio area at Heinjoki developed from an open strait to the outlet threshold of Lake Ladoga. The water level of Lake Ladoga remained at nearly the same level, 20–21 m asl, for thousands of years in the vicinity of Heinjoki in the valley of the Vuoksi River and in the northern Lake Ladoga area where the land uplift was as rapid as at Heinjoki. In the southern Lake Ladoga area, where land uplift was slow, the water level rose nearly twenty metres from the present sea level – from beneath the present Lake Ladoga level at 5 m asl to the highest ancient Lake Ladoga level 16 to 17 metres asl. The upper limit of the Ladoga transgression is documented by shore cliffs and shore bars that are tens of kilometres long. The highest Ancylus Lake shore in the Ladoga basin is nearly the same as the limit of the Ladoga transgression on the Island of Mantsinsaari and on the west coast south of Käkisalmi. Elsewhere, these transgression limits are situated at different elevations as the older Ancylus shoreline has tilted more. In the southern Ladoga basin, the Ancylus limit is below the upper limit of the Ladoga transgression, whereas in the north the Ancylus limit lies higher.

The Ladoga transgression terminated when the lowest threshold at Porogi east of St. Petersburg broke through in 1350 BC during the Karelian Metal Age and the water level sank rapidly by as much as 12 metres (Saarnisto & Grönlund 1996; Saarnisto 2003). This is based on radiocarbon dates from the sediments of the small Vitsalampi Lake on Kilpolansaari Island in north-western Lake Ladoga and confirmed on the Island of Valamo (Ru. ostrov Valaam), where all small lake basins emerged due to the rapid lowering of the water level in connection with the origin of the Neva. This age is nearly the same as in some older Russian studies on peat buried by littoral sediments of the Ladoga transgression, e.g. Lak & Ekman (1975), but it deviates from many of the previously published dates (see Saarnisto & Grönlund 1996 for Russian references).

The Ladoga transgression caused the shoreline to move several kilometres inland in the southern part of the lake. In this connection littoral deposits covered prehistoric dwelling places, some of which were discovered in connection with the construction of the New Ladoga Canal along the south coast in 1872–1882 (see Inostrancev 1882). The Ladoga transgression was accelerated 3700 BC when the waters of the Saimaa lake complex drained to Lake Ladoga near Jääski. The transgression covered Combed Ware dwelling sites on the northern Karelian Isthmus (Saarnisto & Siiriäinen 1970). A recent discovery of such has been made by Takala (2004) on the east shore of Lake Kirkkojärvi (Ru. ozero Pravdinskoe) at Telkkälä (Ru. Silino) in Muolaa (Ru. Pravdino).

The large lakes of the northern Karelian Isthmus were nearly exclusively a part of the ancient Lake Ladoga (Figs. 6.4 and 6.5; Ailio 1915). These include Lakes Pyhäjärvi (Ru. ozero Otradnoe), Kiimajärvi (Ru. ozero Komsomol'skoe), Äyräpäänjärvi (Ru. ozero Bol'šoe Rakovoe), Muolaanjärvi (Ru. ozero Glubokoe), Kirkkojärvi, Yksjärvi (Ru. ozero Višnevskoe), and Punnusjärvi (Ru. ozero Krasnoe). In the north, Lake Ladoga extended to Riukjärvi (Ru. ozero Uzlovoe) in Kaukola (Ru. Sevast'janovo) and Juoksemajärvi (Ru. ozero Bol'šoe Zavetnoe) in Räisälä (Ru. Mel'nikovo). Most of these lakes are also known for their prehistoric dwelling sites, which are located on the shores of the ancient Lake Ladoga. On the northern Karelian Isthmus, the distribution of land and water remained nearly the same for thousands of years, and the lake complex of ancient Lake Ladoga served as a most favorable and safe travel route throughout the Stone Age and Metal Period in Karelia and, in fact, until the 19th century, as will be seen below.

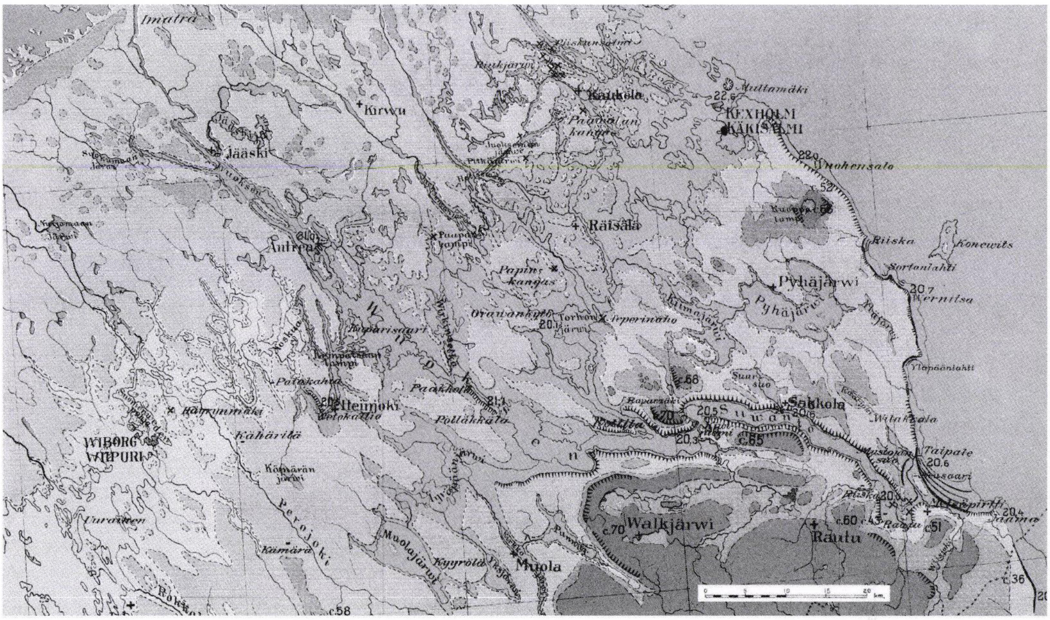

Figure 6.5 Map representing the extent of the ancient Lake Ladoga in the inner parts of Karelian Isthmus. (Reprinted from Ailio 1915).

6.7 The ancient Lake Vuoksenlaakso

As the River Neva originated in 1350 BC, the water level in the main Ladoga basin fell 12 metres, as described above, but on the northern Karelian Isthmus in Vuoksenlaakso, the lowering of the water level was only three metres from 20 m asl to c. 17 m asl and later to 15.5 m asl. This is because the threshold at Tiuri in Räisälä emerged and dammed the waters of the ancient Lake Ladoga well above the main body of the falling Ladoga waters. This ancient Lake Vuoksenlaakso submerged nearly as much area as the ancient Lake Ladoga and extended from Jääski in the north-west to Suvanto (Ru. ozero Suhodol'skoe) in the east and from Muolaa in the south to Tiuri in the north (Saarnisto 2003). The main outlet of the lake was at Tiuri towards Lake Ladoga, and the water level was also just above the Heinjoki threshold, which acted as a boating route between Vuoksenlaakso and the Gulf of Finland until the 17th century (Ruuth 1906). The 15.5 m level is a critical level for archaeological inventories in Vuoksenlaakso, as all areas below it were submerged until the 19th century contrary to other areas in the coastal areas of Lake Ladoga, where a 12 metres vertical emergence took place already 1350 BC in connection with the origin of the Neva. In Vuoksenlaakso, the water level fell slightly from the 15.5. m level first in 1818, when the River Taipaleenjoki originated, and later in 1857 due to man-made deepening of the Kiviniemi threshold (Ru. Losevo) at Sakkola (Ru. Gromovo), which resulted altogether in a fall of 5 metres in the water level in the upper Vuoksenlaakso (Ailio 1915). As a result of the deepening of Kiviniemi, the northern drainage route of the River Vuoksi towards Tiuri and Käkisalmi became nearly dry and the Suvanto-Taipaleenjoki route formed the main drainage of the Vuoksi waters towards Lake Ladoga.

6.8 Concluding remarks

The emergence history of the Karelian Isthmus and Ladoga Karelia is reasonably well known and the palaeohydrological framework can be worked out, including the chronology of events, which is now entirely based on calibrated radiocarbon dates. Some precisely dated events and morphologically well-developed shorelines form the basis also for archaeological investigations and interpretations. These include the upper limit of the Ancylus transgression, dated at 8100 BC, the upper limit of the Litorina transgression from slightly over 5500 BC in Säkkijärvi to 5000 BC in Terijoki, the drainage of Lake Saimaa to Lake Ladoga at 3700 BC, and the upper limit of the Ladoga transgression at 1350 BC, as well as the history and elevations of the ancient Lake Vuoksenlaakso, which terminated as late as in the 19th century AD. It would further be tempting to use the shoreline displacement curves constructed for the eastern Gulf of Finland and Lake Ladoga (Fig. 6.2) also for the dating of coastal dwelling sites especially in Mesolithic times, when the dating of archaeological material is more problematic than later. However, it should be emphasized that the accuracy of the shoreline displacement curves is limited, especially during the Yoldia Sea stage when rapid changes took place, and the dating of the curves is based on indirect evidence. The early parts of the curve should be used only for broad estimations of the emergence history and not for producing misleading, apparently accurate figures of the age of dwelling sites.

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