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**GEOGRAPHICAL FACTORS IN THE SPREAD OF PERMANENT SETTLEMENT IN PARTS OF FINLAND AND SWEDEN FROM THE END OF THE IRON AGE TO THE BEGINNING OF MODERN TIMES**

*Abstract*

The article discusses the role of ploughed soils in the spread of permanent settlement in Finland and in certain parts of Sweden. The author proceeds from the view that the extent of areas settled by agrarian communities was decisively conditioned by the way these communities were able to utilize the soils of the plough layer.

In many cases the ineffectiveness of implements prevented the spread of settlement into areas where the soil was fertile but difficult to work. These areas could not be settled before the introduction of more effective types of ards and ploughs. In Finland, the boundary of the Häme and Savo-Karelian cultural spheres may be explained by their different technologies for utilizing various types of soils. In Sweden, the old boundary of Swedish and Finnish culture in Västerbotten also appears to correspond to the distribution of different soil types in the plough layer.

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*Introduction*

Studies on the history of permanent post-Iron Age agrarian settlement in the Finnish inland have not focused to any great degree on environmental factors. This is equally true of archaeology, geography and history. The so-called supra-aquatic areas are an exception. These upland parts of Finland were not submerged after the Ice Age, and the nutrients of their soils were not leached to any degree. The settlement history of the supra-aquatic regions has been discussed by several researchers in studies on the expansion of settlement in Savo around the beginning of modern times.<sup>1</sup>

Finnish historians have presented general considerations concerning the role of soils and climate in farming and agrarian settlement. These observations have mainly referred to a few botanical studies on the relationship between soils and abundant flora and settlement.<sup>2</sup> These considerations have not, however, been taken into account in any appreciable way in outlining the regional aspects of the strata and directions of

settlement. An exception is a study by Eino Juttikala from 1933, where the fertility of soils is seen as a significant factor in the spread of permanent settlement in various parts of Finland at the end of prehistoric times and in the Middle Ages.<sup>3</sup>

On the other hand, the role of the environment has been considered in some works on local history dealing with the geographical locations of settlements in the Iron Age, Middle Ages and early modern times. In this context studies by Seppo Suvanto, Oiva Keskitalo, Jorma Keränen and Erkki Kanervo merit mention. Suvanto has also discussed these problems on a broader regional level.<sup>4</sup>

Reijo Solantie has underlined the importance of climatic factors in determining the spread of agrarian settlement. According to him, other environmental factors had, at the most, a marginal role in this process.<sup>5</sup>

The favourability or unfavourability of the environment for settlement are not unchanging factors; they depend to a great degree on the economic structure of the population and the level of

available technology. The success of grain cultivation is in a decisive way conditioned by the farming technology used at the time. This technological complex necessarily includes animal husbandry, which is in a set relation to grain cultivation.<sup>6</sup> An important factor in cultivating grain is whether the agricultural technology mainly exploits mineral nutrients bound up in the vegetation and in the humus layer (as in slash- and-burn farming) or is directed towards the use of the mineral soil of the plough layer (arable cultivation).<sup>7</sup> In the latter, the degree to which the soil can be utilized depends on the effectivity of agricultural implements used to work the soil. Fertile soils can remain unused for centuries if they cannot be tilled, or if working them is felt to be uneconomical in comparison with other soils. In such a situation, settlement will be restricted to areas, where the soil may be less fertile but more easily ploughed. There are Finnish examples of this from as recently as the 19th century.<sup>8</sup> Generally speaking, individual farmers and even whole communities primarily tended to concentrate on locations and areas that were optimal from the point of view of available farming technology, taking into account necessary labour input and crop yield.

Use of natural resources by a farming community and the intensity of these practices do not depend on environmental factors or available technology alone. Demographic factors play a central role in the utilization of resources.<sup>9</sup>

This paper will discuss the significance of environmental conditions for the spread of permanent agrarian settlement in the inland regions of present-day Finland and in parts of Sweden, where conditions are similar to Finland. The period reviewed extends from the end of the Iron Age to c. 1500 around the beginning of modern times. — As this paper concentrates on the regional locations of settlement and not on any overall perspective of resource utilization by agrarian communities, the discussion will mainly exclude demographic factors.

#### *Iron Age settlement in southern Finland*

Prehistoric cemeteries show a concentration of Late Iron Age permanent settlement in a few relatively limited areas of Southern and Western Finland: 1) along the southwest coast in a zone extending at the most c. 20 km into the inland from Pohja in the east to Laitila in the west; 2) along the Kokemäenjoki River between Har-

jalvalta and present-day Tampere with a branch towards Lake Kyrösjärvi in the north; 3) in the southeast parts of Upper Satakunta and Southern Häme in an area extending from Tampere in the west to Janakkala and Lammi in the south and east, where settlements were located mainly along bodies of water flowing from the southeast to the northwest. Between the first two regions were also a few smaller centres of settlement. Iron Age settlement in Southern Finland forms a horseshoe-shaped pattern enclosing a large uninhabited region comprising the inland parts of Finland-Propere, a plateau crossed by the Loimijoki River and its tributaries, and the southwest parts of Häme.<sup>10</sup>

Scattered centres of late prehistoric settlement were located outside the above areas around Lakes Päijänne and Vesijärvi, and in the region of Mikkeli further to the east.<sup>11</sup>

In Finland-Propere, Iron Age settlements concentrated in areas where the fine-grained deposits in the plough layer are dominated by light postglacial Litorina clays, which could be worked with relative ease with primitive implements (cf. Fig. 1). The inland regions of Finland-Propere are at elevation above the highest Litorina shorelines. These parts were not settled permanently before the Middle Ages, and their fine-grained soils contain almost solely heavy glacial clays. Similar clays are characteristic of the Loimijoki River plateau in southeastern Satakunta, which was not settled before the Middle Ages. The late occupation of these areas is clearly linked to a situation, where the heavy glacial clays were difficult to work with primitive implements. It was only when more effective farming technology spread in the late Middle Ages into the area of arable farming in South Finland that settlers could make their way into these parts.<sup>12</sup>

Beds of clay are characteristic features of extensive areas of southern and southwestern Häme. Here, the fine-grained deposits in the plough layer are heavy glacial varved clay. In south-western Häme the area of heavy clays is an extension of the clayey soils of Finland-Propere and the Loimijoki River plateau. A similar area of heavy clays is located further to the east on both sides of the present boundary of the provinces of Häme and Uusimaa. This area extends to the east of the Kymijoki River. In its western parts the area of clays continues to the north of the Salpausselkä Ridges, but east of Lahti the ridges mark the northern boundary of the heavy clayey soils. At present, the clayey soils of Southern Häme and Uusimaa are among the most fertile

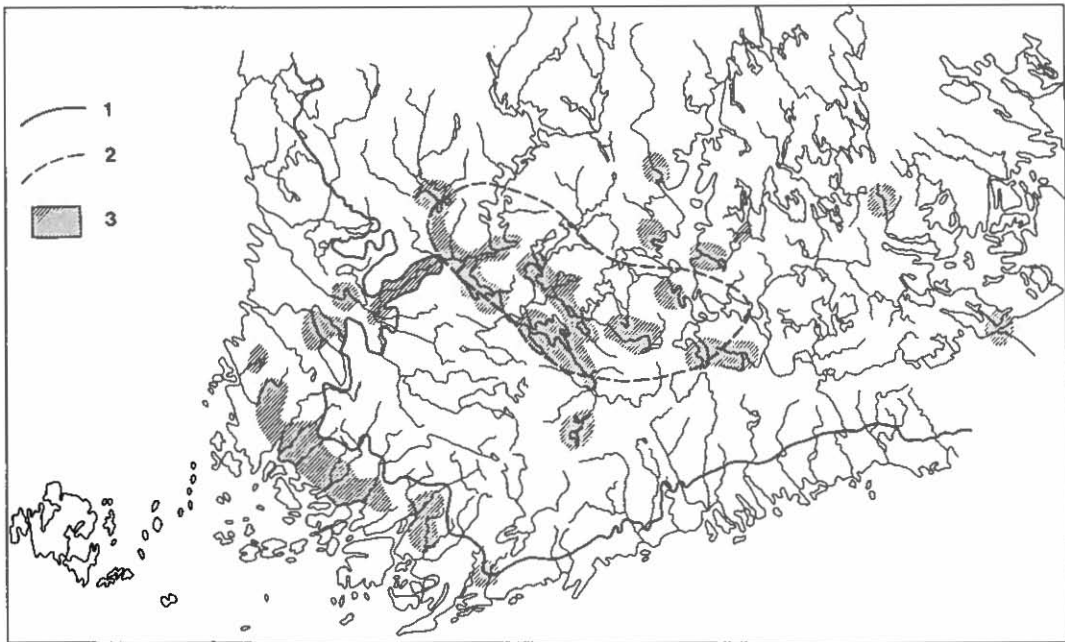


Fig. 1. Permanent settlement in Southern Finland at the end of prehistoric times

- 1 = Highest Litorina shoreline
- 2 = Centre of broadleaved forest in Southern Häme
- 3 = Areas inhabited at the end of prehistoric times

Sources: *Suomen kartasto* 1960, map 4; *Lehtojensuojelutyöryhmän mietintö*, p. 22; literature cited in footnotes 10 and 11.

farming areas of Finland, but their utilization requires effective, modern farming technology. They would have been very difficult to plough with primitive implements.<sup>13</sup>

Around Lakes Rautavesi and Kulovesi near the Kokemäenjoki River and in Southern Häme along Lake Vanaja the soils are dominated by fine-grained deposits, clearly differing from the heavy clays to the south. In the 1920s and '30s, Bernhard Aarnio, an expert on agricultural geology, termed these sediments coarse silty clays, but at present they are classed as coarse and fine silty clays. Typical Southern Häme fine silty clay contains 49 % clay fractions (<0.002 mm), 39 % fine silt (0.002–0.02 mm) and 11 % coarse silt (0.02–0.2 mm). In typical coarse silty clay, clay fractions amount to 39 % with 33 % fine silt, 22 % coarse silt and 6 % sand.<sup>14</sup> Towards the north, the proportion of clay in fine-grained deposits decreases, while fine silt becomes more prominent. General soil maps (scale 1:100,000) show this geographical division as a line running from Kuoranta in Teisko via Orivesi to the region of the church of Kuhmoinen. South of this line, fine-grained deposits are given as clays (at

least 30 % of grain diameter < 0.002 mm), while to the north of the line they are described as fine silt (grain diameter 0.002–0.06 mm).

Coarse silty clays but also fine silty ones are more easy to plough than heavy clays. They, however, contain considerably less nutrients than the latter. Fine silty clay also has the disadvantage of drying into hard clods, and the dry surface crust tears at the roots of vegetation. In modern-day agriculture it is regarded as the poorest type of soil for cultivation. On the other hand, fine silty soil contains more nutrients than coarse silt, and retains them to a better degree. Along the Lake Vanaja water route silty clays appear to be more suitable for natural vegetation than other soils, as stands of broadleaved forest are concentrated on the former, especially on the shores of bodies of water.<sup>15</sup>

Generally speaking, Iron Age settlement between Lakes Rautavesi and Pyhäjärvi and around the Lake Vanaja water route concentrated in areas mostly characterized by fine and coarse silty clays. This is also the case in areas west and southwest of Lake Vanaja, where heavy clays mostly dominate (see Fig. 1). Agrogeological

maps (scale 1:20,000) show that silty clays also occur south of Lake Vanaja as far as Lakes Lehijärvi and Kernaalanjärvi. Coarse silt also occurs in the plough layer near ridges.<sup>16</sup>

Archaeological studies do not usually discuss soil types near Iron Age cemeteries, especially in the plough layer, and we have to rely on the observations of historians.<sup>17</sup> In a number of local-historical works on the inland regions of Finland, the archaeologist Oiva Keskitalo and the historian Seppo Suvanto have pointed to the role of local soils in the choice of Late Iron Age settlements. Suvanto observes that in the locality of Akaa the Iron Age population cultivated the clayey soils along the local rivers, and the Iron Age sites in Pälkäne are in areas of easily tilled mull and fine silty soil. In his studies on Hauho, Luopioinen, Tuulos, and Kuhmoinen further to the east on the west shore of Lake Päijänne, Suvanto points out connections between Iron Age settlements and clayey soils. Oiva Keskitalo stresses the same factor in the early settlement of Jämsä. In his history of the Province of Satakunta, Suvanto makes the general observation that the oldest fields were cleared in areas of mull and coarse silty soil, and that these light soils could easily be worked with a primitive type of plough.<sup>18</sup>

It appears that the Late Iron Age agrarian population of the Finnish inland settled near clayey and also fine silty soils. Agrogeologically, the surface layers of these areas are usually described as coarse silty clays but also as fine silt.

In Southern Häme and in the eastern parts of Satakunta coarse and fine silty soils are concentrated along Lake Vanajavesi and its various tributaries. Because of the relatively large bodies of water in these parts, the local climate is clearly better suited to agriculture than further afield. In this area, the duration of the thermic growing season (+ 5 <> + 5 degrees C) is a minimum of 165 days per annum. Also the effective temperature sum during the growing season is exceptionally high, amounting to a minimum of 1200 degrees C.<sup>19</sup> Reijo Solantie has stressed the decisive role of climate for early settlement.<sup>20</sup> The areas around Lake Vanajavesi and the bodies of water flowing into it from the northeast are exceptionally favourable to vegetation in view of their soils and climate. Because of these conditions, the large number and extent of demanding broadleaved species are typical of a wide zone extending from north of the town of Nokia in the west to the towns of Lahti and Heinola in the east (cf. Fig. 1).<sup>21</sup> This area is known as the centre of broadleaved forest in

Southern Häme, and it appears to follow the boundary of heavy clays and coarse and fine silty soils. In the north, this boundary broadly coincides with the boundary of clay and fine silty soil.

The Iron Age settlement of Eastern Satakunta and Häme is almost completely limited to the above area of broadleaved forest. In Häme, the only centres of Iron Age settlement outside the area are Jämsä, Kuhmoinen, Sysmä, Hartola and Nastola in the east, and Janakkala and Loppi in the west. Urjala, which became deserted in the Crusade Period is also outside the above area.<sup>22</sup> Botanists of the early 20th century pointed to this connection between Iron Age settlement and the predominance of broadleaved species.<sup>23</sup>

Iron Age settlement in the easternmost parts of Satakunta and in Southern Häme is clearly concentrated in an area providing exceptionally favourable soils and climate for vegetation. Decisive factors for the success of farming and animal husbandry may have been the soils of the plough layer, climate or local vegetation.

Grain cultivation and the related practice of animal husbandry were the main elements of the Iron Age economy in the inland regions of Finland.<sup>24</sup> In the earliest stages, grain cultivation was possible only by slash-and-burn methods. Pollen analyses show that this stage continued in Häme until the middle of the first millennium A.D., but in the second half of the first millennium arable farming methods were adopted.<sup>25</sup> This, however, did not spell the end of slash-and-burn farming, which was still part of the agrarian economy in Häme as late as modern times.<sup>26</sup> Both forms of grain cultivation were in use in late prehistoric times, and the clearing of new fields required the use of fire.

Slash-and-burn, or swidden cultivation primarily utilizes the nutrients of the humus layer and trees originally growing at the site, whereas arable farming relies more on the nutrients of the mineral layer.<sup>27</sup> Because of this, the composition of available flora conditioned opportunities for swidden cultivation. The choice of the site depended on its growth of forest and the burn-clearing techniques used. A normal swidden would be cleared in a stand of leaved forest or mixed forest dominated by deciduous trees. Stands of broadleaved trees were the best sites, and this common swidden method is known in Finnish also as "lehtokaski" ("broadleaved-forest swidden"). The "huuhta" method of slash-and-burn cultivation, where the crops are sown directly into the ashes, was better suited to stands of large conifers or conifer-dominated

mixed forest.<sup>28</sup> The success of slash-and-burn cultivation does not primarily depend on the composition of the surface soil layers but on the effect of original vegetation that in turn is dependent on the composition of the soil.

Arable farming utilizes the nutrients of the mineral soil, although the practice requires manure over longer periods of land-use. Even here, the original vegetation plays a role, as it determines the composition of the humus layer. In this method, the degree to which the soil can be worked is a more important factor, whereas in slash-and-burn cultivation the seed grain is ploughed under the burnt surface layer, or in some cases it does not even have to be covered over.<sup>29</sup> The Swedish archaeologist Stig Welinder, however, feels that slash-and-burn cultivation definitely required the use of a digging stick or a primitive wooden plough.<sup>30</sup> In arable farming the degree to which the soil can be worked is a much more critical factor than in swidden cultivation, and depends on the effectivity of the available implements.

In Satakunta and Häme in the Iron Age and medieval times, the above common type of swidden appears to have been the slash-and-burn method that was utilized. It has also been suggested that the Iron Age population of Satakunta practised large-scale burn-clearing of coniferous forests.<sup>31</sup> On the other hand, the locations of sites and settlements in both eastern Satakunta and Häme indicates the common type of swidden rather than the "huhuhta" method of cultivation. Settlement in these regions concentrated in areas supporting broadleaved forest.

As pointed out above, Iron Age settlements in eastern Satakunta and Häme were located in climatically favourable locations, but not all such sites were utilized. Accordingly, the northwest parts of Häme (Tammela and Urjala, and the areas between them) and the adjacent region of Satakunta (Punkalaidun, Loimaa and the localities between them) do not appear to have been permanently settled at the end of prehistoric times, although their climate could well have permitted it.

In view of the above, it appears that local climate was not the decisive factor for grain cultivation in the Iron Age. The above information suggests that, as long as slash-and-burn cultivation was the sole method, local vegetation dictated the choice of plots and sites. In the common method of slash-and-burn cultivation, broadleaved and other deciduous forests were the best locations. These were on coarse and fine silty clays and fine silt on lake shores and along

the rivers. These soils were also the most advantageous ones for the early forms of arable cultivation.

The fact that arable farming depended more directly on the nature of the soil than swidden cultivation may explain the development of Iron Age settlement in the Urjala region of southwest Häme. From the fifth century A.D. several cemeteries were established around the numerous lakes of the locality, but they went out of use by the Viking period, and only a few stray finds suggest any later permanent settlement.<sup>32</sup> The Urjala region appears to have provided a livelihood for a slash-and-burn farming population, but was less suited to arable farming. The fine-grained sediments in the area are classed as heavy clays. The only available soil map of the area is to a scale of 1:100,000 (No. 2114); there are no larger-scale agrogeological maps or soil maps based on basic survey material that might indicate the specific nature of the soils in this area. Although light clays are obviously present in the surface layers, they are nevertheless heavier and harder to work than the clays in the areas to the north.<sup>33</sup>

In Urjala the shift to arable farming may have caused the population to relocate to areas where this was feasible. On the other hand, it can be claimed that extensive slash-and-burn cultivation requires less labour to produce the same crop as arable cultivation. The situation, however, appears to have been the opposite, for growing a crop in an already cleared field requires, in fact, less work than producing the same amount of grain by slash-and-burn methods.<sup>34</sup> When knowledge of arable farming spread, this would have caused at least a partial adoption of the new method, environmental factors permitting. A process of this kind provides a plausible explanation for the decline or disappearance of Iron Age settlement in Urjala.

#### *Iron Age and medieval settlement in the regions to the east of Lake Päijänne.*<sup>35</sup>

By the end of prehistoric times, a few clearly defined centres of settlement had emerged in the areas to the east of Lakes Päijänne and Vesijärvi. Near these lakes, such settlements existed in Hollola, Sysmä, and the adjoining area of Hartola. To the east of Hollola was Nastola, forming a separate centre of settlement. The only significant location of settlement further to the east was in the present-day region of

Mikkeli. Individual graves or small cemeteries of the Late Iron Age have also been found in Iitti, Pertunmaa and Mäntyharju.<sup>36</sup>

Cemetery finds clearly indicate that the settlements in Hollola, Sysmä and Nastola belonged to the prehistoric cultural sphere of Häme, although eastern, mainly Karelian, elements increased around the end of prehistoric times. The oldest stratum of settlement in the Mikkeli region, dating back to the Viking period, is clearly of a Häme-based character. Significant changes set in, however, in the 12th century when the influence of Karelian culture overshadowed western features. Accordingly, the late prehistoric settlement of the Mikkeli region can be described as Karelian.<sup>37</sup>

By the end of prehistoric times, the boundary of the Häme and Savo-Karelian spheres of interest appears to have become established in the regions between the settlements on the shore of Lake Päijänne in the west and the Mikkeli region in the east. The earliest documentary evidence of a boundary between the historical provinces of Häme and Savo is from 1415. The fixed points of this border or boundary included Nauhasaari in Mäntyharju, Muuratmäki on the present border of Toivakka and Kangasniemi and Suonenjoki. Alterations have been made to this boundary in later demarcations, but the original course of the border remained almost unchanged until the 20th century.<sup>38</sup>

The boundary of the spheres of interest of Häme and Savo left Lake Puulavesi on the Savo side, while Lake Suonne belonged to Häme. In the Late Middle Ages, the hunting and fishing ground possessions in the wilderness tracts of the Häme and Savo Finns were intermingled in the border zone.<sup>39</sup>

As pointed out above, Iron Age centres of settlement around Lake Vesijärvi and on the east shore of Lake Päijänne concentrated in locations with a predominance of light clays and/or fine silt. These soils occur mostly in the shore region of Lake Päijänne, but become rarer towards the east. It is only in the region of Mikkeli that more extensive areas of clays and fine silt reappear. This region was aptly named Savilahti ("Clay or Clayey Bay"), from which the whole province of Savo derived its name. To the east of Lake Vesijärvi, south of Lake Päijänne, is a region of heavy clays, but agrarian settlement appears to have avoided these parts for a long time. Sources from the early 20th century mention that the farmers were used to working light clayey soils and avoid heavy clays which were difficult to plough.<sup>40</sup>

Table 1. Soils in the Province of Mikkeli 1920

Type	Hectares	%
Sand and moraine	1,200,700	72.3
Clay and fine silt	41,900	2.5
Fen	302,400	18.2
Sphagnum bog	112,900	6.8
Bedrock	3,300	0.2

Source: 'Mikkelin lääni'. *Suomen maatilat* IV, Porvoo 1932, p. V.

The exceptionally small proportion of clayey and fine silty soils in the southern parts of Savo is clearly indicated by Table 1, presenting different soil types in the Province of Mikkeli in 1920. We must point out that, at the time, the province included the Sysmä-Hartola-Luhanka region on the shore of Lake Päijänne, which had historically been part of Häme and where the above soils were again relatively common.

Around the end of the Middle Age and the beginning of modern times, means of livelihood in Häme and among the Savo-Karelians differed in many crucial respects. As pointed out above, the agrarian population of Häme practised arable farming and burn-cleared swiddens in deciduous forest. The Savo-Karelians, on the other hand, used the huuhta method, permitting the clearing of plots in stands of coniferous forest, usually dominated by spruce. A main question from the point of view of settlement history is how long this method was practised.<sup>41</sup>

In his study of the region of Sortavala on Lake Ladoga, Erkki Kanervo has pointed out that sites of Iron Age settlement were located in the shore zone, characterized by light postglacial clays.<sup>42</sup>

This suggests that the common type of swidden and also arable fields may have played a major role in the Karelian economy. The concentration of settlement along the shore may have been dictated by the importance of fishing, which is generally regarded as a main factor in the choice of settlements and sites in early times.<sup>43</sup> The fact that the settlers chose the light clayey soils of the Ladoga shore indicates, however, that slash-and-burn methods suited to timber forests did not affect the spread of settlement in these parts.

According to present studies, the huuhta method of swidden cultivation spread as an innovation from Novgorod to the Lake Ladoga regions of Karelia, where the common type of

swidden also survived. According to Kustaa Vilkuna, the huuhta method was adopted in the region of Lake Ladoga in the 11th and 12th centuries, and from there it spread to Savo along with colonization. On the other hand, Arvo M. Soininen maintains that the above technique spread to Savo only at a relatively later stage.<sup>44</sup> Recent paleoecological studies by H. Simola, E. Grönlund and P. Huttunen, however, assert that the supra-aquatic uplands and hill slopes of Savo were burn-cleared for cultivation as early as the period following the middle of the first millennium. This would indicate that these researchers feel that already then the huuhta method was in use.<sup>45</sup> On the basis of 16th and early-17th century sources, Kauko Pirinen presents the conclusion that in the Middle Ages and in the 16th century the difference between the huuhta method and the common swidden was not as clear as in later times.<sup>46</sup> In spite of this, the extensive burn-clearing of coniferous forest for grain cultivation was a distinctive feature of the Savo-Karelian culture until the 19th century.

Ten palynological samples from southern Savo have been analysed from the perspective of cultivation and settlement history. The earliest, random, signs of grain cultivation are from the 6th century A.D. Five samples indicate grain cultivation prior to the 12th century. Three of these samples indicate solely barley in the above period, whereas two contain evidence of rye. Indications of rye cultivation do not become common before the 12th and 13th centuries.<sup>47</sup>

Rye is wind-pollinated and produces a large amount of pollen, up to 500 times that of barley. Accordingly, even a minor degree of rye cultivation should be observed in pollen analyses.<sup>48</sup> Barley is self-pollinating and produces only small amounts of pollen, with a correspondingly low degree of visibility in pollen diagrams. Because of this, the small proportion of rye in the pollen diagrams for Savo indicates that early grain cultivation in southern Savo depended on common-type swiddens cleared in the forests along the shores of lakes, and not in coniferous forests. Rye is the predominant, or possibly sole, species of grain grown by the huuhta method.

Available evidence indicates a minor degree of rye cultivation in Scandinavia throughout the Iron Age.<sup>49</sup> To the east, in the Baltics and among the Slavs of Russia, rye appears to have been a late arrival. The earliest evidence of rye cultivation in the Baltic region is from the second half of the first millennium A.D. In certain regions of the Baltics winter rye was the main crop along with barley in the 8th and 9th cen-

turies.<sup>50</sup> Among the Slavs winter rye did not become a common crop before the 9th and 10th centuries or even later. It became the main crop in the Novgorod region in the 13th century, where millet had dominated up to the preceding century. There are, however, indications of rye cultivation in the Russian forest zone from as early as the 3rd and 4th centuries, and it may even be older in these parts. It has also been pointed out that, before moving into present-day Russia, the Slavs were familiar with rye, and it is hardly probable that they would have forgotten this crop in the process.<sup>51</sup> The above views mainly appear to be based on finds of grains, and not palynological studies.

In the light of the above, the signs of rye cultivation from the 580s and the 8th century from Sulkava and Pieksämäki can hardly be regarded as evidence of the early use of the huuhta method of cultivation in the first millennium. The observed indications may derive from rye growing as weeds among barley, or from the crops grown in common-type swiddens by the Häme Finns. Two pollen diagrams from Sysmä indicate uninterrupted rye cultivation from c. 600 and 700 A.D.

Although only a few pollen analyses are yet available for Savo, they nevertheless seem to indicate that the huuhta method and rye came to Savo around the turn of the 12th century. H. Simola, E. Grönlund and Pirjo Uimonen-Simola, who carried out the palynological analyses of the samples from Savo, point out that in the 12th–16th centuries slash-and-burn cultivation became established in places in southern Savo and spread into new areas, and that evidence of this method can be found in the sediments of lakes even in the most outlying regions.<sup>52</sup>

Taking into account the established relations of settlement in Savo and Karelia since the 12th century and throughout the Middle Ages, it is not probable that the huuhta method spread into Savo as late as the end of the Middle Ages.

In slash-and-burn cultivation the fertility of the soil and the degree to which it can be worked do not place the same limitations as in arable farming. The common type of swidden can be cleared in deciduous or leaved-species dominated forest, but not in stands of conifers. The huuhta method, on the other hand, permitted the clearing of the latter, even with large trees. It allowed the burn-clearance of moraine soils, which were dominated by conifers before the environmental changes brought about by slash-and-burn cultivation. The moraine soils were rich in nutrients and were dominated by spruce.

Documentary sources on the slash-and-burn culture of Savo become more numerous from the beginning of modern times, when moraines as well as silty and clayey soils were utilized. It has been claimed that the settlers of Savo preferred moraines for their swiddens, but, as demonstrated by Kauko Pirinen, this is not exactly true.<sup>53</sup> In any case, the supra-aquatic slopes of the fells and uplands were especially fertile and protected from night frosts, and as such were ideal sites for huuhta swiddens. It is thus clear that the eastern huuhta method allowed the utilization of the moraines which dominate especially in southern Savo.

The exceptionally small proportion of silty and clayey soils in the regions to the east of the Lake Päijänne shore zone appears to have become an obstacle to an eastward spread of settlement from Häme; the only significant centre of settlement in the east was the Mikkeli region in the Viking period. This centre did not expand to any great degree over the next two centuries. This may be explained by a lack of population pressure in eastern Häme that would have led to eastward migration. The above information also suggests that the lack or scarcity of soils east of the shore zone of Lake Päijänne, that would have been suitable to the cultivation techniques of the Häme Finns, prevented eastward expansion. This explanation is supported by the fact that the settlements of the Häme Finns are clearly limited to regions where coarse and fine silt predominate in the plough layer. In southern Savo these soils are present almost uniquely in the areas to the west of the bodies of water leading south from Mikkeli. Of the extensive prehistoric cemeteries in the Mikkeli region, Kyyhkylä, Tuukkala and Visulahti are in environments specifically characterized by these soils, whereas the cemetery of Moisio also in this area is among coarser-grained sediments.<sup>54</sup> It seems obvious that, with the exception of the Mikkeli region, present-day southern Savo was a marginal zone less appealing to the farming techniques of the Häme Finns.

In southern Savo, influence from Häme was overshadowed by an expansion of settlement from Karelia in the east, which is indicated by a predominance of Karelian materials in the archaeological record of the Mikkeli region in the 12th century. This expansion of settlement appears to have been based on the huuhta method of slash-and-burn cultivation, which made it possible to utilize coniferous forests growing on moraines.

The above arguments suggest that the differ-

ent grain growing techniques of the Häme Finns and the Karelians played a role in the formation of the boundary of their respective territories. This boundary also became the border of the eastern and western cultural spheres. Expansion from the east extended further into the west, to Sysmä and Asikkala, and even as far as Jämsä. In these regions, however, the Häme Finns had already become established, and new settlers from the east did not replace the earlier population or its culture.

Broadleaved forest is exceptionally prominent in the areas to the north of Kuopio in Savo, e.g. Siilinjärvi, Nilsjä, northern Kuopio and eastern Maaninka. This centre of broadleaved forest is closely linked to clayey and fine silty soils mostly along bodies of water to the north of Kuopio. Vegetation in this area is exceptionally luxuriant, even to the north of the centre of broadleaved forest. In comparison with neighbouring regions, this area may be described as relatively advantageous for arable cultivation. A number of Late Iron Age archaeological finds suggest that this distant region attracted settlers from the West-Finnish area of arable farming around the end of prehistoric times. This did not, however, lead to any long-term permanent settlement in northern Savo at the time.<sup>55</sup>

#### *The development of medieval settlement in Häme and in the eastern and southeastern parts of Satakunta*

In Finland, the consolidation of permanent settlement in the Middle Ages followed two courses: so-called interior colonization, where new farms and villages were established in areas already settled in the Iron Age; and exterior colonization, which meant the spread of settlement into previously uninhabited areas. The extent and nature of settlement at the end of the Middle Ages is revealed in considerable detail by tax records, which began to be compiled by crown officials from c. 1540 onwards. These records list the villages and farms; they were drawn up because taxation in the Middle Ages and well into modern times was mainly based on farmed holdings. As the extent of settlement at the end of prehistoric times is shown by the spatial distribution of cemeteries, the expansion of Medieval settlement can be outlined by comparing the distribution of the cemeteries with that of villages existing around the beginning of modern times.



By the advent of modern times, permanent settlement had spread into the parts of southern and southwestern Häme and southeast Satakunta that had still been uninhabited at the end of the Iron Age. The history of medieval taxation indicates that settlers could have begun to move into these areas around 1200 at the earliest. Writing of Medieval settlement in the "clay district" of Loimijoki and in Punkalaidun, Seppo Suvanto has stressed the fact that only farming implements introduced in the Middle Ages made it possible to work these areas of heavy clays and to settle in them.<sup>56</sup>

In the latter part of the Iron Age and in early medieval times the main plough type used in Finland was a curved bow ard, which had an iron share. Finnish archaeological finds from the 9th–11th centuries include a few curved-ard shares of iron, most probably dating to the 11th century.<sup>57</sup> The spread of the iron share in this plough type is regarded as the factor which made it possible for settlement to spread from the coastal zone of Finland-*Proper* towards the inland, where heavy clays are the main fine-grained deposits.<sup>58</sup> With reference to southeastern Satakunta, Seppo Suvanto has pointed to spread of the forked plough and the high ard in medieval times, which made it possible to settle the areas of heavy clays.

The high ard appears to have spread from Sweden to Finland in the second half of the 15th century.<sup>59</sup> As an innovation it came too late to be utilized in colonizing the clayey-soil region of Häme and Satakunta. It was an effective implement, and its distribution aided in the settlement of uninhabited areas at the very end of the Middle Ages. On the other hand, the forked plough was adopted in Häme and Satakunta at a time that corresponded quite closely with the settlement of the above areas.

According to Kustaa Vilkuna, the forked plough was originally developed for ploughing swiddens, and in later times it developed into variants with a clod board that were suited to arable farming.<sup>60</sup> Recent Soviet studies suggest that the forked plough was originally developed by the eastern Slavs of the forest zone at a stage when arable farming was replacing slash-and-burn methods. This corresponds to recent Finnish ethnographic studies, according to which the *huuhta* swiddens were not ploughed, and the sown grain was not even mulled.<sup>61</sup> Kustaa Vilkuna maintained that the forked plough was an implement for the *huuhta* swiddens, having spread to Finland from the east along with this technique.<sup>62</sup>

According to Vilkuna, the forked plough for arable farming was adopted in Häme from the region of Estonia most probably in the 11th and 12th centuries. Ilmar Talve, on the other hand, claims that this plough type did not spread to the regions north of the Gulf of Finland before the 13th and 14th centuries, by which time the province of Uusimaa had already been settled by Swedes.<sup>63</sup> Talve's views concerning the chronology of the forked plough are in better agreement with recent Soviet results than Vilkuna's views. According to Soviet scholars, the forked plough came about only during the last centuries of the first millennium A.D., and it became common in the Baltics only in the 12th–14th centuries.<sup>64</sup> It does not seem likely that it could have been in use in southern and southwestern Häme already in the 12th century.

The forked plough was a highly effective implement, which could be used to plough fallow fields in areas of heavy clays. Its suitability for these purposes is demonstrated by the fact that it remained in use in southern and southwestern Häme until the 19th century. Alongside this type, the high ard, which spread to western Finland in the 15th century, was used, especially in flat fields. The effectiveness of the forked plough in comparison with the earlier curved bow ard is shown by the fact that in Lithuania the curved bow ard was used only on light soils, or for additional ploughing in fields initially worked with the forked plough.<sup>65</sup>

In the light of the above, it appears that the spread of the forked plough into Häme and eastern Satakunta made it possible to settle southeastern Satakunta and southwest Häme. Given this background, the above interpretation of the conditions for settling the interior regions of Finland-*Proper* present a number of problems. Did the curved bow ard with an iron share permit a course of development in Finland-*Proper* that elsewhere required a completely new type, the forked plough? According to present information, the forked plough spread only into the northeast parts of Finland-*Proper* (Kiikala, Kisko, Koski, Kuusjoki, Pertteli and Suomusjärvi).<sup>66</sup>

During the Middle Ages, settlement in eastern Satakunta and Häme spread to the north. By the end of the Middle Ages settlement along the Ikaalinen water route had spread as far as Parkano; the northernmost farm was most probably on the shore of Lake Linnajärvi, and there were several farms around Lake Parkanonjärvi. On the west shore of Lake Näsijärvi the northernmost settlements in 1540 were at Kahanpää

north of Pengonpohja and on the east shore at Rikala. In the area between Lakes Näsijärvi and Päijänne the northernmost inhabited sites were Sahrajärvi in Juupajoki and a concentration of several farms around Lake Kuorevesi. On Lake Päijänne, Jyväskylä, near the northern end of the lake, was the northernmost village in medieval times.<sup>67</sup>

During the Middle Ages the northward spread of settlement in eastern Satakunta and Häme did not extend beyond the areas south of the so-called Central-Finnish ice-margin formation. This geological formation extends from Hämeen kangas in the west in a line running roughly from Kyröskoski to the vicinity of Pengonpohja on Lake Näsijärvi, from where it turns northeast leaving Jyväskylä on its south side (cf. Fig. 2). It came about when the retreating ice-sheet remained in this position for a longer time. There are relatively high outcrops of bedrock in many places both to the south and the north of the formation.<sup>68</sup>

In the environs of Lake Kyrösjärvi Iron Age settlement had extended to the north of the Central-Finnish ice-margin formation. Of the above-mentioned villages to the east, only Kuorevesi is to the north of the formation (cf. Fig. 2).

The Central-Finnish ice-margin formation may not in itself have prevented permanent medieval settlement – with a couple of exceptions – from spreading northward, although it nevertheless forms a kind of barrier. The areas to the north were intensively utilized by wilderness hunters since the Iron Age, and the private ownership of hunting and fishing grounds in the wilderness tracts by the farmers of Häme and Satakunta clearly predates historically documented times. On the other hand, a number of other environmental factors appear to have prevented permanent settlement from expanding beyond the ice-margin formation in the Middle Ages.

Towards the north, the fine-grained deposits of the surface layer were less suited to grain cultivation, as indicated by the decreasing proportion of clay. The environs of Lake Näsijärvi can be cited as an example: around Pengonpohja-Lempiäniemi the proportion of clay in fine silty soil is 35–38 %, while in the area of Murole-Parkkuu near Lake Vankavesi it is only 21–27 %. The latter area is immediately to the north of the Central-Finnish ice-margin formation.<sup>69</sup> Towards the east the proportion of clay decreases even more sharply than in the west; in soil maps (scale 1:100,000) the fine-grained deposits around Lake Päijänne to the

north of Kuhmoinen are mainly classed as silt (grain diameter 0.06–0.002 mm). The proportion of soils classed as clay clearly decreases towards the north.

Not only the clays of the surface layer become rarer and thinner towards the north; north of the medieval settlements of eastern Satakunta and Häme the proportion of soils classed as coarse and fine silt clearly decreases, although silty soil occurs in limited areas.<sup>70</sup>

Decreasing soil fertility and unfavourable conditions for vegetation is also shown by the fact that the proportion of demanding broadleaved species decreases to the extent that the northern boundary of the centre of broadleaved forest largely coincides with the Central-Finnish ice-margin formation (cf. Fig. 1).

Climatic factors, on the other hand, were not direct obstacles to the northward spread of agrarian settlement. Because of the large lakes, the effective temperature sum during the growing season is high (1200 degrees C) in the environs of the Lake Näsijärvi water route as north as Vaskivesi and Mänttä. The situation was similar along the bodies of water flowing into Lake Päijänne.<sup>71</sup>

The above information suggests that the areas north of the Central-Finnish ice-margin formation were marginal from the perspective of the cultivation techniques of eastern Satakunta and Häme, which were based on arable farming and the common type of swidden. These areas did not attract settlers to venture further north.

The slow northward spread of settlement in the Middle Ages in eastern Satakunta and Häme is not necessarily the result of environmental factors alone. Social institutions may also have played a role in the process. During the Iron Age and long into the Middle Ages furs from the wilderness regions were a major item of long-distance trade for the inhabitants of the inland regions. By the beginning of modern times, however, fishery products had become the most important bounty of the wilderness regions.<sup>72</sup> In this context, it is possible that the communities engaged in the wilderness economy more or less deliberately tried to prevent an influx of settlers, even when families or kin groups tried to occupy wilderness tracts in their ownership. In his study of the Iron Age in Satakunta, Helmer Salmo suggests that this was a factor preventing the spread of settlement, and Veijo Saloheimo, writing of Northern Karelia, points out the possibility that these considerations may have prevented the colonization of traditionally utilized wilderness areas in the 16th and 17th

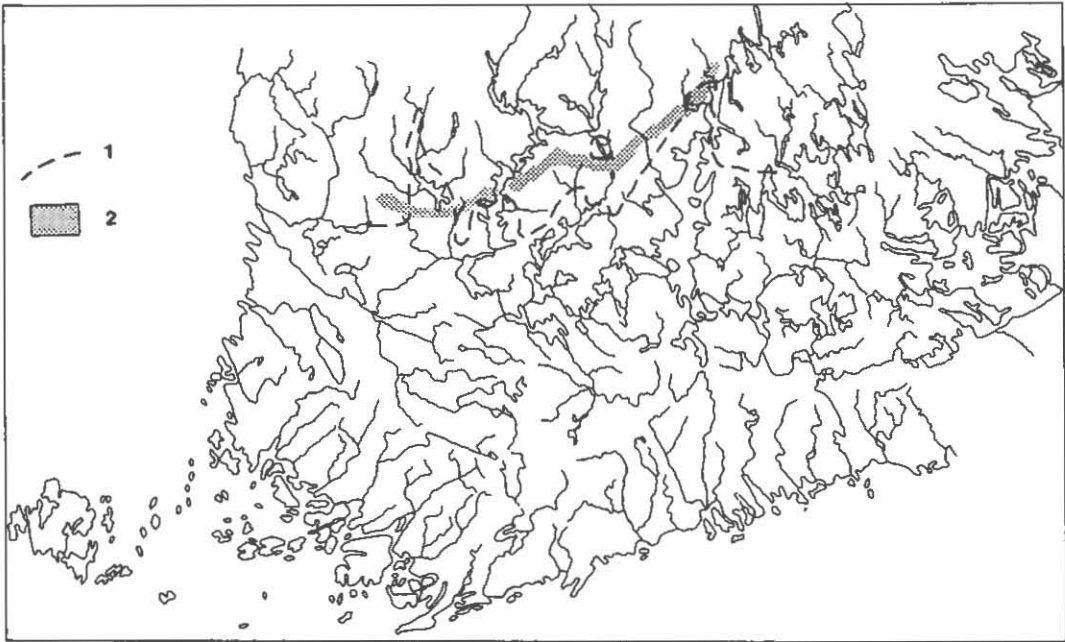


Fig. 2. The northern boundary of settlement in eastern Satakunta and Häme at the end of the Middle Ages  
 1 = General northern boundary of inhabited areas around the end of the 1540s  
 2 = Central-Finnish ice-margin formation

Sources: Literature cited in footnotes 67 and 68.

centuries. Jussi-Pekka Taavitsainen has suggested that the symbiotic relationship of the Häme Finns and the Lapps in the utilization of wilderness resources led to a situation where the Häme Finns did not extend their settlements into the wilderness zone. The equilibrium was not disturbed until the expansion of settlers from Savo.<sup>73</sup>

*The colonization of the wilderness regions of Satakunta and Häme in the second half of the 16th century*

During a period of over 50 years from the second quarter of the 16th century, settlers from Savo spread into the inland regions without permanent agrarian settlement as far as the northern parts of the present region of Kainuu.<sup>74</sup> As part of this process, also the wilderness regions of Upper Satakunta and Häme came to be settled, albeit sparsely, over the course of a few decades. The settlers occupied a zone running c. 150 km from north to south and approximately a

hundred kilometres from east to west. The expansion of the Savo Finns differed completely from the activities of their counterparts in Häme and Satakunta. This is especially evident in the dynamics of the former settlement movement. In roughly four hundred years from the end of the Iron Age to the beginning of modern times, permanent settlement in the eastern parts of Satakunta and Häme had expanded only 25–50 km north of the Iron Age centres, halting – with only a few exceptions – in the areas south of the Central-Finnish ice-margin formation. Colonization of new areas by the Satakunta and Häme Finns continued at a slow pace throughout the 16th century.<sup>75</sup>

From at least the Middle Ages onwards the wilderness regions of Satakunta and Häme were owned by farmers and were in some cases allodially owned. These regions opened up to the settlers from Savo through administrative measures instigated by the crown, which obviated the traditional rights of ownership. The original owners of the wilderness tracts were, however, given priority in establishing farms, and the farmers of Satakunta and Häme had bet-

ter opportunities for acquiring new holdings than the newcomers from Savo. Despite this, the proportion of settlers from Satakunta and Häme remained considerably small, as convincingly demonstrated in many studies on local history. Members of the old owner families did establish a large number of new farms and holdings in their formerly owned tracts, but these properties were usually abandoned after only a few years.<sup>76</sup>

The reasons and specific conditions of the colonization movement of the Savo Finns have been studied by a number of scholars, notably Arvo M. Soininen, Jorma Keränen and Kauko Pirinen. The main reason for the spread of settlers into the northern regions of Savo and into neighbouring provinces was the formation of a relative population surplus in the old centres of settlement in Savo. The huuhta method led to a rapid colonization of extensive areas, as it permitted grain cultivation in the moraine-based coniferous forests of the Finnish inland. Researchers have not, however, focused on the reasons why the Satakunta and Häme Finns were unwilling to resettle in the wilderness regions.<sup>77</sup>

Writing of Häme, Soininen points out that the 16th century did not lead to any major changes in the economic structure that would have forced or attracted the population to resettle in the wilderness regions. Soininen also refers to the fact that the farmers of Häme were not familiar with the huuhta method of cultivation, and their techniques of forest clearance were thus considerably less effective than those of the Savo Finns.<sup>78</sup>

Utilization of wilderness resources by the population of Häme and Satakunta, at least at the end of the Middle Ages and the beginning of modern times, appears to have been well organized; dwellings and stores were built in the wilderness locations, and hunting equipment and boats were stored there.<sup>79</sup> Mid-16th century documentary sources on Northern Ostrobothnia, which belonged to the West-Finnish arable farming area, refer to outlying swiddens often at great distances from the home villages.<sup>80</sup> This raises the question why the Finns of Satakunta and Häme did not clear swiddens in their wilderness tracts. There is at any rate no direct evidence of such activity.

Studies concerning the wilderness utilization economy appear to take for granted that grain was transported for consumption to the outlying areas, and this practise is referred to in written sources from the early 16th century.<sup>81</sup> It is, however, possible that the necessary grain could have been grown in swiddens cleared in the wil-

derness. This might at least partly explain palynological evidence of short-term cultivation in locations far from settled areas. Short-term slash-and-burn cultivation has been observed in Southern Ostrobothnia from a period when the region was not permanently inhabited.<sup>82</sup> There is similar evidence from the western parts of Uusimaa from the end of the Iron Age.<sup>83</sup> Assuming that the grain grown in outlying swiddens far from centres of settlement was meant to be consumed on the site and not to be transported to permanently inhabited villages, outlying swiddens are a plausible alternative.

In his studies of the northern wilderness regions of Häme, Taavitsainen has demonstrated that Iron Age burials and stray finds are clearly concentrated in places where silt and possibly clay occur in the soil.<sup>84</sup> On the shores of lakes and rivers this type of soil is suited to forest dominated by deciduous trees, which could be utilized by the common method of slash-and-burn cultivation. Accordingly, the concentration of Iron Age finds on silty and clayey soils supports the suggestion that a minor degree of slash-and-burn cultivation was part of the wilderness-resource economy in Häme and Satakunta since the Iron Age.

As argued above, medieval settlement in Satakunta and Häme extended only as far as the southern perimeter of the Central-Finnish ice-margin formation, because further to the north, soils suitable for field clearance or common-type swidden cultivation are clearly rarer than in the areas to the south of the formation. To the north, the soils suitable for fields are clearly less fertile than in the southern area. Although the Satakunta and Häme Finns may have practised slash-and-burn grain cultivation in their wilderness tracts for immediate consumption, this practice did not permit them to compete effectively with the settlers from Savo. We may thus concur with Soininen, who states that the Savo Finns were better prepared to establish new farms in the wilderness regions than their counterparts from Satakunta and Häme.

#### *The Lake Mälaren region, the Norrland coast in Sweden, and Northern Ostrobothnia*

Swedish studies on settlement history have attempted to apply an overall perspective on population growth, farming technology and the use of resources. These studies have mainly involved the joint efforts of archaeologists and cultural geographers.<sup>85</sup> There has been less interest,

however, in land use from the perspective of soil types and agricultural technology. Most studies have only pointed to the different conditions for cultivation in the supra-aquatic areas located above the highest shorelines, as compared with the sub-aquatic areas below these elevations.<sup>86</sup> Swedish scholars have not discussed to any major degree the way in which the various soil types, and the degree to which they can be utilized with different implements, affected the spread of settlement. The only exception is the Finnish immigrant population from Savo, and their methods of land use in the 16th and 17th centuries. The following section reviews the relationship of soils and settlement history in the Lake Mälaren region, the coastal zone of Norrland and in Northern Ostrobothnia.

Iron Age settlement in Middle Sweden concentrated mainly around Lake Mälaren, which was still a large inlet of the Baltic at the beginning of historically documented times. The glacial and post-glacial geological history of this region corresponds to the phases of the South-west Finnish seaboard and the northern coastal region of Uusimaa. It has been observed in the latter regions that the degree to which the soils of the plough layer could be worked and tilled clearly affected the spread of permanent settlement.<sup>87</sup> Because of similar conditions, we may assume a similar course of development in the Lake Mälaren region.

The relationship of the ecological environment and the history of settlement in the Lake Mälaren region has been studied by Stig Welinder, especially from the perspective of natural resources and their utilization. The area studied by Welinder comprised a zone extending north from the vicinity of Västerås north of Lake Mälaren in the province of Västmanland.<sup>88</sup>

Welinder observed that settlement in the Early Iron Age and even in the first stages of the Late Iron Age was limited to the shore zone at elevations below 35–40 metres above present sea-level. The soils of this zone are characterized by clays. In the Late Iron Age (mainly from the 8th century onwards) settlement extended to areas above the 35–40 metre a.s.l. zone, which were forests growing on clayey soil.<sup>89</sup>

According to Welinder, the northern perimeter of Early Iron Age settlement was based on the political power of local leaders or other social factors; he also observes that this perimeter was fortified. Environmental factors would thus not have affected the formation of the settled area. Late Iron Age colonization extended beyond the perimeter into the forest

zone. Welinder maintains that this latter development was based on the initiative of the leading sectors of the political hierarchy.<sup>90</sup>

Welinder's interpretation of the dynamics of Iron Age settlement in the Lake Mälaren region presents a number of problems. According to him, interior colonization during the Early Iron Age saturated the shore zone, which had been the focus of settlement. This would have led to a crisis of the agrarian society, evident in decreasing produce, possible revolts, military action and emigration. Following this crisis, the agrarian society entered into a new stage of expansion, and became reorganized into the structure which still existed in the Middle Ages. Welinder dates this stage to a period of innovation from A.D. 500 to 1000, when iron agricultural implements became common, and crop rotation and the open field system were introduced.<sup>91</sup>

In outlining a general model for the history of settlement in the Lake Mälaren region, Welinder presents as ecological factors soil deterioration and soil distribution, but does not discuss them in any further detail.<sup>92</sup> According to him, innovations in agricultural technology in the second half of the first millennium were related to processes of change in agrarian society, but he does not see them as being linked in any direct way to the spread of settlers into new areas. This is also suggested by his view that colonization beyond the Early Iron Age perimeter of settlement was based on the initiative of the political leadership.

In the topographic description of his research area, Welinder points out that in the vicinity of Lake Mälaren glacial clays below the 35-metre a.s.l. contour are covered by postglacial clays.<sup>93</sup> According to the Swedish classification, these are described as 'heavy intermediate clay' (clay content 40–50 %). The clays of the plough layer at higher elevations are heterogeneous, with heavy or intermediate clays in lowland locations and a larger proportion of coarser material at higher elevations on slopes. In the Lake Mälaren region, cultivation has traditionally concentrated in the low-lying shore zone, dominated by post-glacial clays, often termed "field clay" especially in connection with Litorina clays.<sup>94</sup>

To what degree the Litorina clays of the shore zone around Lake Mälaren were more easily worked than the clays at higher elevations is a question that is not addressed in the Swedish studies. It must be pointed out that the degree to which the land can be tilled is only one of the factors in assessing the potential of soils. Fertility is, of course, a main consideration.

In the light of the above, certain aspects of the

history of settlement in the Lake Mälaren region resemble to a great degree the situation in Finland-Proprietary. Settlement began to spread from areas of Litorina clays to other clay areas a few centuries after the introduction of the iron ploughshare. In both areas, the primitive curved bow ard remained in use throughout the Iron Age and up to the Early Middle Ages. In Finland-Proprietary this phenomenon occurred only a few centuries later than in the above regions of Sweden.

In the Viking period and the Early Middle Ages Sweden experienced marked population growth, which in turn explains the rapid expansion of settled areas in the various provinces of Sweden.<sup>95</sup> It is obvious in this connection that developments in agricultural technology in the second half of the first millennium A.D. permitted the settlement of areas previously regarded as unfit for cultivation.

Studies on prehistoric settlement in the coastal regions of Norrland have consistently underlined that Iron Age settlements remained at elevations below the highest ancient shorelines.<sup>96</sup> Scholars have not, however, investigated whether these settlements were below some other, lower, elevation as well, although in many places a wide zone remained between the supra-aquatic areas and the highest elevations of Iron Age settlement. These areas were not settled before the Middle Ages.<sup>97</sup>

On the regional level, the topographic locations of Iron Age settlement in Norrland show that, along the coast, sites were at elevations clearly below the highest Litorina shorelines. The only definite exceptions are two minor settlements in the valley of the Voxna River, and settlements in the valley of the Dalaälven River in Dalecarlia.<sup>98</sup>

The situation can clearly be seen in the coastal zone of Gästrikland and Hälsingland (see Fig. 3), where the highest Litorina shoreline is at an elevation of over 110 metres in the northern parts and slightly below 80 metres in the south. With very few exceptions, Iron Age burial finds are limited to the areas below 100 metres a.s.l., and all major centres of settlement are below 66 metres a.s.l. Klas-Göran Selinge's studies on the Medelpad region indicate a similar situation, the only exception being Iron Age settlement on the border of Jämtland, which was, however, part of the centre of settlement in Jämtland located in an area of Baltic Ice Lake sediments. The materials presented by Selinge clearly demonstrate that settlement did not go beyond the highest Litorina shorelines before the Middle Ages. In-

terior colonization in the Middle Ages created new villages also in the former Iron Age settlement area of Medelpad.<sup>99</sup>

In the valleys of the Tornionjoki and Kemijoki Rivers, flowing into the Gulf of Bothnia, medieval settlement clearly remained below the highest Litorina shoreline; the northernmost medieval villages being Pello and Rovaniemi.<sup>100</sup>

The soils of Norrland display certain regularities; grain diameter in the plough layer generally increases towards the inland and to the north. This is indicated by the main soils of modern-day cultivated areas. Clayey soil, classed as fine silty clay, ends around the latitude of Örnsköldsvik with coarser-grained soils predominating to the north.<sup>101</sup> Örnsköldsvik was the northernmost major centre of Iron Age settlement in Norrland, and further to the north Iron Age finds become considerably sparser than in the areas to the south.<sup>102</sup>

Space does not permit any detailed analysis of the reasons behind the observed features of settlement history in Norrland. Viking Period and medieval population growth played a central role in the spread of settlement into new areas. The spread of settlement into such agriculturally marginal areas was apparently the result of more effective ploughing methods permitted by the use of iron shares in primitive ards.

Swedish cartographic material shows that in the north around the northern shore of the Gulf of Bothnia is an area where fine silty clay is the main soil of present-day fields. This area begins around Piteå where the clays are in the vicinity of the coast, but in the north fine silty clays extend further inland in the river valleys. West of the Tornionjoki River fine silty clay is the main soil type of present fields in an area roughly encompassed by the railway line from Luleå via Boden and Karunki to Haaparanta. East of the river, fine-grained sediments classed as clay and silt occur in the area extending as far as the Kemijoki River. These sediments are also present in the river valleys extending far into the inland. Coarse silt appears to be the most common fine-grained deposit of the surface layer.<sup>103</sup>

The soils of the plough layer in the areas around the northern shore of the Gulf of Bothnia clearly dictated the locations of settlements and ethnic conditions in these regions. Several researchers have pointed to a cultural boundary running c. 100 km south of Piteå through the commune of Skellefteå. Finnish culture, dating back to the Middle Ages or even prehistoric times, is characteristic of the areas to the north and east of this boundary.<sup>104</sup>

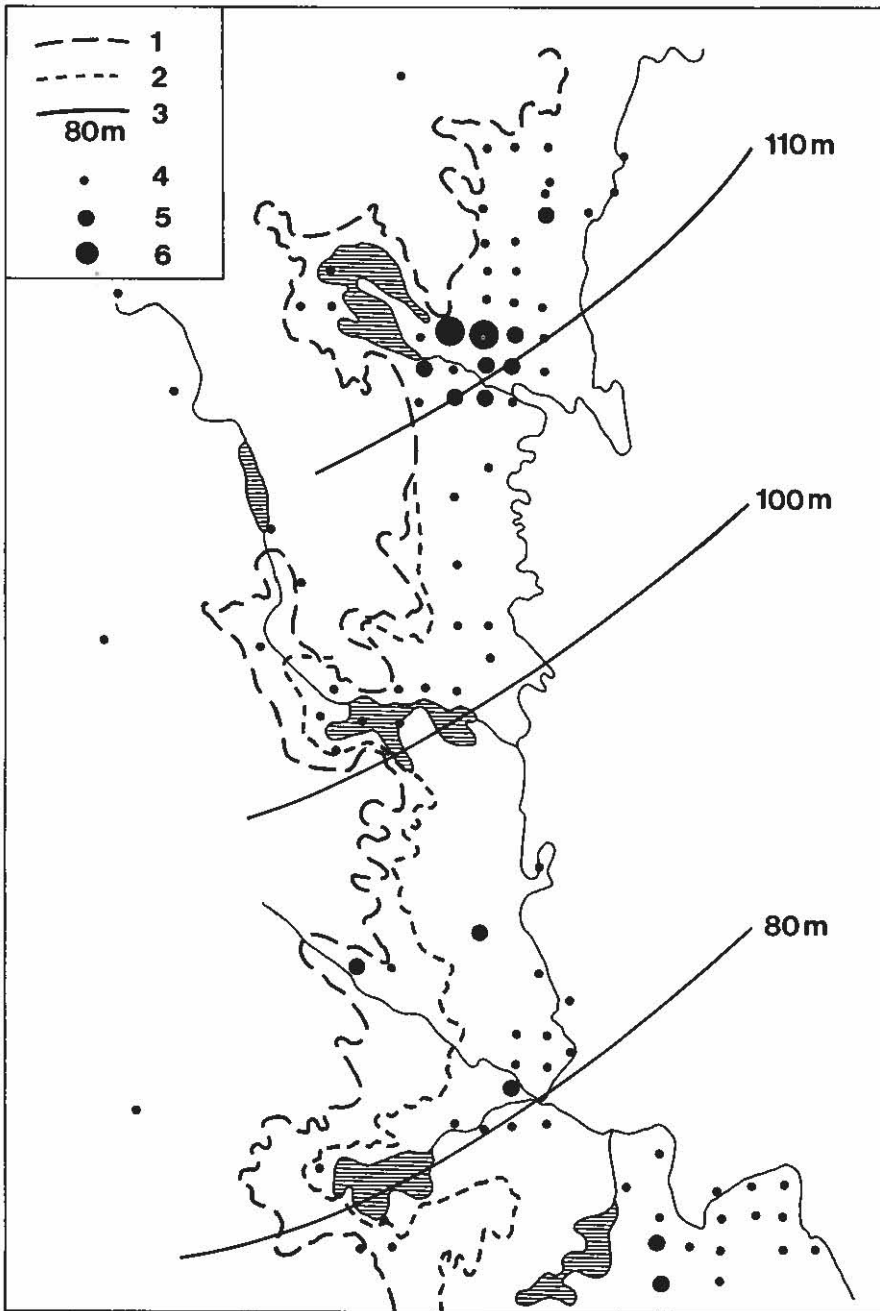


Fig. 3. Iron Age settlement in Gästrikland and Hälsingland

- 1 = General 100-metre a.s.l. contour
- 2 = General 66-metre a.s.l. contour
- 3 = Highest Litorina shoreline isobases
- 4 = 1-4 cemeteries per map sheet
- 5 = 5-14 cemeteries per map sheet
- 6 = 15-29 cemeteries per map sheet

Sources: Map 63 on p. 55 in Åke Hyenstrand, *Forntida samhällsformer och arkeologiska forskningsprogram*, Riksantikvarieämbetet, Dokumentationsbyrå, Arbetshandlingar, Stockholm 1982, with additional data from *Atlas över Sverige*, maps 1 and 20:7.

In attempting to outline the relationship between settlement and the natural environment in the northern areas, we cannot rely solely on observations from Southern Finland. This also applies to the composition of the plough layer and its significance for the local economy and the locations of settlement.

It can be claimed, however, that agrarian settlement existed in these regions at the end of prehistoric times and the beginning of the Middle Ages. Its success depended on grain cultivation in the immediate vicinity of the sites, either in fields or in swiddens.<sup>105</sup> Before the expansion of Karelian settlement into this region – beginning in the 12th century according to present views<sup>106</sup> – slash-and-burn cultivation involved the common type of swidden cleared in deciduous forest or ones dominated by leaved species. As indicated by observations from other parts of Finland, clayey and silty soils were generally suited to deciduous and mixed forest, especially near bodies of water.

Grain was not necessarily the main item of the diet in this northern region at the end of prehistoric times or in the Middle Ages; game and especially fish were clearly of major importance. Despite this, we may claim that grain was nevertheless an essential element of the diet. This is suggested by the fact that in the wilderness hunting culture of Häme and Satakunta grain products were transported over long distances to the wilderness tracts, and – as suggested above – grain was also grown in wilderness swiddens for immediate consumption. We must also point out that the early Finnish settlers of Northern Ostrobothnia and Norrland came from Häme and Satakunta.<sup>107</sup>

Compared with coarser-grained deposits, clayey and silty soils were suited to growing fodder, especially near bodies of water. Because of this, clayey and silty soils, which in this region are concentrated in the area between the Piteå and Kemijoki Rivers, provided suitable sites for the economy of the Finns.

The above considerations suggests that the distribution of soils suited to the farming technology of the Iron Age and medieval population had a decisive effect on the spread of Finnish settlement in this area at the end of prehistoric times and in the Middle Ages. These considerations also apply to Swedish settlers from the west.

To stress the role of locations suitable for grain cultivation and animal husbandry in the distribution of Finnish settlement in the north does not mean that conditions favouring

agriculture would have attracted the Finns to the northern regions. Fur-hunting, the exacting of tribute from the Lapps and possibly other factors led to permanent settlement in Northern Ostrobothnia and Norrland, where it sought out locations best suited to the economy as a whole. In this context, the needs of grain cultivation, even on a small scale, were important factors.

### *Summary*

The foregoing discussion shows that in most of Finland and at least in certain parts of Sweden, the geographic distribution of permanent settlement in the Iron Age, the Middle Ages and even around the beginning of modern times was closely linked to available farming technology, and especially the effectivity of ploughing implements. The introduction of the iron share clearly appears to have created the necessary conditions for the settling and cultivation of areas predominated by heavy glacial clays in certain parts of both Finland and Sweden. In the inland regions of Finland the forked plough adopted from the east and the south played a similar role.

In the Iron Age and the Middle Ages arable farming and the common type of swidden cleared in broadleaved forest were both feasible on similar, clayey and silty, soils. The huuhta technique of slash-and burn farming, used by the Karelians and the Savo Finns, was in turn suited to the moraines of the Finnish inland, where spruce forests dominated. This had a decisive effect on the geographic extent of the West and East Finnish spheres of culture, and the formation of the provinces of Häme and Savo.

In the light of the above, climatic factors appear to have played a secondary role in Iron Age and medieval settlement activity. We must, however, stress the fact that the best climatic conditions for the agrarian economy existed in the vicinity of the large lakes, where the soils of the plough layer and vegetation were especially suited to arable farming. The suitability of soils for cultivation was, however, the central factor in the expansion of settlement.



NOTES

- <sup>1</sup> Arvo M. Soininen, *Pohjois-Savon asuttaminen keski- ja uuden ajan vaihteessa*, Historiallisia tutkimuksia 58, Helsinki 1961, p. 146, 148; Jorma Keränen, *Kainuun asuttaminen*, Studia Historica Jyväskylänsä 28, Keuruu 1984, p. 201–218; J.G. Granö, 'Asutus', *Suomen maantieteen käsikirja*, Helsinki 1951, p. 310; Kalevi Rikkinen, *Suomen asutusmaantiede*, Keuruu 1977, p. 54–59.
- <sup>2</sup> Yrjö Kaukiainen, 'Suomen asuttaminen', *Suomen taloushistoria I*, Helsinki 1980, p. 44–46; K. Linkola, *Zur Kenntnis der Verteilung der landwirtschaftlichen Siedlung auf die Böden verschiedener Waldtype in Finnland*, Acta forestalia fennica 22:3, Helsingfors 1922; O. J. Lukkala, *Tutkimuksia viljavan maa-alan jakautumisesta etenkin Savossa ja Karjalassa*, Acta forestalia fennica 9:1, Helsinki 1919.
- <sup>3</sup> Eino Jutikkala, 'Asutuksen leviäminen 1600-luvun alkuun mennessä', *Suomen kulttuurihistoria I*, Jyväskylä 1933, p. 54, 60–61.
- <sup>4</sup> Seppo Suvanto, 'Keskiäika', *Satakunnan historia III*, s.l. 1973, p. 198–201, 221–222; Idem, *Kuhmoisten historia*, Lahti 1965, p. 127; Idem, 'Hauhon – Luopioisten – Tuuloksen keskiaika', *Hauhon – Luopioisten – Tuuloksen historia I*, Hämeenlinna 1985, p. 771; Oiva Keskitalo, 'Suur-Jämsän esihistoria', *Suur-Jämsän historia I*, Forssa 1954, p. 82; Erkki Kanervo, 'Sortavalan seudun asutusmaantieteestä', *Laatokan-Karjalan maakuntaliiton vuosikirja 1*, Sortavala 1937, p. 26–31; Keränen, op.cit., p. 128–136, 201–218.
- <sup>5</sup> Reijo Solantie, 'Climatic conditions for the cultivation of rye with reference to the history of settlement in Finland', *Fennoscandia Archaeologica V* (1988).
- <sup>6</sup> Kåre Lunden, 'Some Causes of Change in a Peasant Economy: Interaction between Cultivated Area, Farming, Population, Climate, Taxation and Technology c. 800–1600', *Scandinavian Economic History Review* 1974, p. 122–127, 131–135; Idem, 'Merknader om empiri og modeller i historiegranskninga', *Historisk tidsskrift* (norsk) 1976, p. 394–403; Stig Welinder, *Prehistoric Agriculture in Eastern Middle Sweden*, Acta Archaeologica Lundensia, Series in 8<sup>o</sup> minore No 4, Lund 1975. – Cf. Jørn Sandnes, 'Teori, modeller og empiri i nyere norsk middelalderforskning', *Historisk tidsskrift* (norsk) 1976, p. 17; Janken Myrdal, *Medeltidens åkerbruk. Agrarieknik i Sverige ca 1000 till 1520*. Nordiska museets Handlingar 105, Borås 1985, p. 152–153; Karl-Erik Frandsen, *Vang og taegt. Studier over dyrkningssystemer og agrarstruktur i Danmarks landsbyer 1682–1683*, Esbjerg 1983, p. 255; Keränen, op.cit., p. 137–138.
- <sup>7</sup> Welinder, *Prehistoric Agriculture in Eastern Middle Sweden*, p. 40–41.
- <sup>8</sup> Linkola, op.cit., p. 9.
- <sup>9</sup> Cf. Welinder, *Prehistoric Agriculture in Eastern Middle Sweden*, p. 54–66; Lunden, 'Merknader om empiri og modeller', p. 398–401.
- <sup>10</sup> Ella Kivikoski, *Suomen esihistoria*, Suomen historia I, Porvoo – Helsinki 1961, p. 191–192, 229–234, 290–291; Idem, 'Hämeen rautakausi', *Hämeen historia I*, Hämeenlinna 1955, 54–55; Matti Huurre, *9000 vuotta Suomen esihistoriaa*, Keuruu 1979, p. 125–136.
- <sup>11</sup> Kivikoski, *Suomen esihistoria*, p. 213–214, Huurre, op.cit., p. 169–172.
- <sup>12</sup> Suvanto, *Satakunnan historia III*, p. 198–201, 220–221; Eljas Orrman, 'Om geologiska faktorers inverkan på bebyggelsen i södra Finland mot slutet av järnåldern och under tidig medeltid', *Historisk Tidskrift för Finland* 1987, p. 181–186.
- <sup>13</sup> Orrman, 'Om geologiska faktorers inverkan på bebyggelsen', p. 177–178.
- <sup>14</sup> Bernhard Aarnio, *Mineralogian, geologian ja maaperäopin oppikirja maa- ja metsätaloutta varten*, Helsinki 1939, p. 143; Idem, 'Etelä-Hämeen maaperä', *Talonpoika IV*, Porvoo 1927, p. 15–18; Rauno Erviö, 'Valkeakoski-Leteensuo', *Annales Agriculturae Fennicae*, vol. 4 suppl. 1, Helsinki 1965, p. 14.
- <sup>15</sup> Aarnio, *Mineralogian, geologian ja maaperäopin oppikirja*, p. 153–154; Idem, 'Etelä-Hämeen maaperä', p. 19; *Maaperäkartan käyttöopas 1:20 000, 1:50 000*, ed. by Maija Haavisto, Geologian tutkimuslaitos. Opas 10, Espoo 1983, p. 50; Lukkala, op.cit., p. 191.
- <sup>16</sup> *Maataloudellinen maaperäkarta 1:20 000*, no 2132 01 - 2132 05.
- <sup>17</sup> Unto Salo, 'Hjame i Satakunta', *Finn y Evrope VI-XV veka. Pribaltijsko-finskije narody. Istoriko-arheologičeskie issledovanija*, ed. by A.N. Kirpičnikov & E.A. Rjabinin, Moskva 1990, p. 68.
- <sup>18</sup> Seppo Suvanto, *Akaan historia I*, Vammala 1954, p. 18, 85; Idem, 'Pälkäneen keskiaika', *Pälkäneen historia I*, Vammala 1972, p. 204; Idem, *Kuhmoisten historia*, p. 127; Idem, 'Suur-Jämsän keskiaika', *Suur-Jämsän historia I*, Forssa 1954, p. 131; Idem, 'Hauhon-Luopioisten-Tuuloksen keskiaika', p. 771; Keskitalo, 'Suur-Jämsän esihistoria', p. 82; Idem, 'Nordgränsen för Tavastlands bosättning under vikingatiden i belysning av fynden från Jämsä socken', *Finski Museum* 1956, p. 45.
- <sup>19</sup> *Suomen Kartasto – Atlas of Finland*, folio 131, Climate (1987), fig. 9k, o-p.
- <sup>20</sup> Solantie, 'Climatic conditions for the cultivation of rye', e.g. p. 14–16.
- <sup>21</sup> *Lehtojensuojelutyöryhmän mietintö*, Komiteamietintö 1988:16, Helsinki 1988, map I p. 22.
- <sup>22</sup> Cf. fig. 1 and Kivikoski, 'Hämeen rautakausi', fig. 14 p. 55; Helmer Salmo, 'Satakunnan rautakausi', *Satakunnan historia II*, Vammala 1952, appendix map.
- <sup>23</sup> Lukkala, op.cit., p. 188, 191; Linkola, op.cit., p. 8, 24–25.
- <sup>24</sup> Kaukiainen, op.cit., p. 54–55.
- <sup>25</sup> Irmeli Vuorela, *Sysmän piitjän asutushistorian tulkinta siitepölyanalyysin perusteella*, Lahden museo- ja taidelautakunnan tutkimuksia XV/1979, Lahti 1980, p. 14.
- <sup>26</sup> Kaukiainen, op.cit., p. 66–69; Armas Luukko, 'Elinkeinot', *Hämeen historia II:1*, Hämeenlinna 1957, p. 469–475; Mauno Jokipii, 'Satakunnan talouselämä uuden ajan alusta isoonvihaan', *Satakunnan historia IV*, s.l. 1974, p. 124–143.
- <sup>27</sup> Cf. Welinder, *Prehistoric Agriculture in Eastern Middle Sweden*, p. 40–43.
- <sup>28</sup> Arvo M. Soininen, *Vanha maataloutemme. Maatalous ja maatalousväestö Suomessa perinnäisen maatalouden loppukaudella 1720-luvulta 1870-luvulle*, Historiallisia tutkimuksia 96, Helsinki 1974, p. 59; Kustaa Vilkkunen, 'Svedjebbruk', *Kulturhistoriskt Lexikon för Nordisk Medeltid XVII*, Helsingfors 1972, col. 487–488; Kaukiainen op.cit., p. 69–71.
- <sup>29</sup> J. Juhani Kortessalmi, 'Suomalainen huuhtaviljely. Kansatieteellinen tutkimus', *Scripta historica II*, Oulu 1969, p. 320–325, 39–340; Arvo M. Soininen,

- 'Kaskiviljely', *Suomen taloushistoria I*, Helsinki 1980, p. 207–208.
- <sup>30</sup> Welinder, *Prehistoric Agriculture in Eastern Middle Sweden*, p. 43, 80.
- <sup>31</sup> Unto Salo, 'Tampereen esihistoria', *Tampereen historia I*, Tampere 1988, p. 111–113.
- <sup>32</sup> Kivikoski, 'Hämeen rautakausi', p. 46, 53; Idem, *Suomen esihistoria*, p. 192.
- <sup>33</sup> B. Aarnio places Urjala in the Southwest Finnish region of heavy clays, which includes Tammela and Forssa, where burials indicating temporary occupation have been found. Aarnio, 'Etelä-Hämeen maaperä', p. 15; Kivikoski, 'Hämeen rautakausi', p. 53, 189, 193; Idem, *Suomen esihistoria*, p. 192.
- <sup>34</sup> Welinder, *Prehistoric Agriculture in Eastern Middle Sweden*, p. 58–66; Kaukiainen, op.cit., p. 71–72.
- <sup>35</sup> The main points of the author's interpretation of the factors that led to the formation of a boundary of culture and spheres of interest between the Häme and Savo Finns have been presented in his review of Savon historia I, 'Savolax förhistoria och medeltid', *Historisk Tidskrift för Finland* 1988, footnote 1 p. 639–640.
- <sup>36</sup> Kivikoski, 'Hämeen rautakausi', p. 54; Idem, *Suomen esihistoria*, p. 213–214.
- <sup>37</sup> Kivikoski, *Suomen esihistoria*, p. 269–273; Huurre, op.cit., p. 133–136, 169–171; Pirkko-Liisa Lehtosalo-Hilander, 'Esihistorian vuosituhannet Savon alueella', *Savon historia I*, Kuopio 1988, p. 220–224; J.-P. Taavitsainen, *Ancient Hillforts of Finland. Problems of Analysis, Chronology and Interpretation with Special Reference to the Hillfort of Kuhmoinen*, Suomen Muinaismuistoyhdistyksen Aikakauskirja 94, Helsinki 1990, p. 71–72.
- <sup>38</sup> Kauko Pirinen, 'Savon keskiaika', *Savon historia I*, Kuopio 1988, p. 308–325.
- <sup>39</sup> Ibid.
- <sup>40</sup> Linkola, op.cit., p. 9
- <sup>41</sup> Cf. Kaukiainen, op.cit., p. 66–73, 88–91.
- <sup>42</sup> Kanervo, op.cit., p. 26–31.
- <sup>43</sup> Cf. Kaukiainen, op.cit., p. 62–66; Keränen, op.cit., p. 133, 139–140, 151–152.
- <sup>44</sup> Kustaa Vilkuna, 'Svedjebruk', col. 489–491; Soininen, *Pohjois-Savon asuttaminen*, p. 261–265.
- <sup>45</sup> Heikki Simola, Elisabeth Grönlund & Pertti Huttunen, 'Ovatko Kerimäen uhrikivet rautakautisia', *Piirtoja itäsuomalaiseen menneisyyteen. Veijo Saloheimolle omistettu juhlaakirja*, Joensuu 1984, p. 19–22.
- <sup>46</sup> Kauko Pirinen, 'Rajamaakunta asutusliikkeen aikakautena', *Savon historia II:1*, Pieksämäki 1982, p. 351–362.
- <sup>47</sup> Heikki Simola, Elisabeth Grönlund & Pirjo Uimonen-Simola, *Etelä-Savon asutushistorian paleoekologinen tutkimus*, University of Joensuu. Publications of Karelian Institute No 84, Joensuu 1988, p. 30.
- <sup>48</sup> E.g. Hans Sundström, *Ogräs i odlingshistoriens tjänst*, Bothnica 2, Oulu 1983, p. 28.
- <sup>49</sup> Myrdal, *Medeltidens åkerbruk*, p. 64–68.
- <sup>50</sup> *Istoriko-ëtnografičeskij atlas Pribaltiiki*. Zemledelie, Vil'njus 1985, p. 21.
- <sup>51</sup> *Agrarnaja istorija severo-zapada Rossii. Vtoraja polovina XV-načalo XVI v.*, ed. by A.L. Šapiro, Leningrad 1971, 343–344; Carsten Goehrke, 'Gross-Novgorod und Pskov/Pleskau', *Handbuch der Geschichte Russlands 1:1*, Stuttgart 1981, p. 473; B.A. Timočuk, 'O složenii sistem zemledelija u vostočnyh slavjan', *Priroda i čelovek*, ed. by V.I. Markovin, Moskva 1988, p. 142.
- <sup>52</sup> Simola, Grönlund & Uimonen-Simola, *Etelä-Savon asutushistorian paleoekologinen tutkimus*, p. 28–32.
- <sup>53</sup> Pirinen, *Savon historia II:1*, p. 357.
- <sup>54</sup> *Peruskartta. Maaperäkartta I:20 000*, no. 3142 01 – 3142 12. – The Kyyhkylä region is dominated by coarse silt, fine sand, clay and fine silt, and fine sand. The soil at Tuukkala is coarse silt, clay and fine sand. The largest distinct areas of clay in the region are at Visulahti. Cf. Taavitsainen, *Ancient Hillforts of Finland*, p. 65–67.
- <sup>55</sup> *Lehtojensuojelutyöryhmän mietintö*, map 1 p. 22; *Suomen maaperä – Quarternary Deposits of Finland 1:1 000 000* (1984); Lehtosalo-Hilander, op.cit., p. 163–170.
- <sup>56</sup> Kauko Pirinen, *Kymmenysverotus Suomessa ennen kirkkoreduktiota*, Historiallisia tutkimuksia 55, Helsinki 1962, p. 74–75; Eljas Orrman, 'Den medeltida bebyggelseutvecklingen i Egentliga Finland i ljuset av medeltidens skatteenheter', *Historisk Tidskrift för Finland* 1983, p. 293–295; Suvanto, *Satakunnan historia III*, p. 221.
- <sup>57</sup> Kustaa Vilkuna, 'Die Pfluggeräte Finnlands', *Studia fennica* 16, Helsinki 1971, illustration text p. 40, 161, 165; Orrman, 'Om geologiska faktorers inverkan på bebyggelsen', p. 187.
- <sup>58</sup> Orrman, 'Om geologiska faktorers inverkan på bebyggelsen', p. 187.
- <sup>59</sup> Vilkuna, 'Die Pfluggeräte Finnlands', p. 55–62, 162, 165; Myrdal, *Medeltidens åkerbruk*, p. 85.
- <sup>60</sup> Vilkuna, 'Die Pfluggeräte Finnlands', p. 100–103, 120–122.
- <sup>61</sup> Ju.A. Krasnov, *Drevnie i srednevekoveye pahotnye orudija vostočnoj Evropy*, Moskva 1987, p. 183–196; Kortessalmi, op.cit., p. 320–331, 342–350.
- <sup>62</sup> Vilkuna, 'Die Pfluggeräte Finnlands', p. 97–99, 161–162.
- <sup>63</sup> Vilkuna, 'Die Pfluggeräte Finnlands', p. 97–99, 161–162; Ilmar Talve, *Suomen kansankulttuuri*, Suomalaisen Kirjallisuuden Seuran toimituksia 355, Helsinki 1979, p. 58.
- <sup>64</sup> Krasnov, op.cit., p. 193–194; *Istoriko-ëtnografičeskij atlas Pribaltiiki*. Zemledelie, p. 23–25.
- <sup>65</sup> Vilkuna, 'Die Pfluggeräte Finnlands', p. 84–85; *Istoriko-ëtnografičeskij atlas Pribaltiiki*. Zemledelie, p. 25.
- <sup>66</sup> *Suomen kansankulttuurin kartasto – Atlas of Finnish Folklore Culture*, ed. by Toivo Vuorela, Helsinki 1976, maps 6 and 7 p. 32–35.
- <sup>67</sup> Suvanto, *Satakunnan historia III*, p. 215, 218–220; Mauno Jokipii, 'Parkanon ja Kihniön synty', *Parkanon ja Kihniön kirja*, Jyväskylä 1971, p. 37; Nils Berndtsson, *Laukaan historia I*, Jyväskylä 1965, p. 91–93.
- <sup>68</sup> *Suomen kartasto – Atlas of Finland*, folio 122 (1986), Geomorphology, p. 3–3a, 17; *Maaperäkartan opas*, p. 39.
- <sup>69</sup> Leila Urvas, 'Teisko – Murole', *Annales Agriculturae Fennicae*, vol. 8 suppl. 2, Helsinki 1969, p. 11.
- <sup>70</sup> *Suomen maaperä 1:1 000 000*. – In this map clay and silt are classed together.
- <sup>71</sup> *Suomen kartasto – Atlas of Finland*, folio 131, fig. 9 p.
- <sup>72</sup> Cf. Kaukiainen, op.cit., p. 54–66.
- <sup>73</sup> Salmo, op.cit., p. 141–142; Veijo Saloheimo, *Pohjois-Karjalan asutusmuodot 1600-luvulla*, Joensuu 1971, p. 28, 241–242; Jussi-Pekka Taavitsainen,

- 'Luhangan Tuomisaaren kattilalöytö', *Keski-Suomi* 18, Saarijärvi 1986, p. 41.
- <sup>74</sup> Pirinen, *Savon historia* II:1, p. 265–294; Kaukiainen, op. cit., p. 34–37.
- <sup>75</sup> Arvo M. Soininen, 'Erämaiden asuttaminen', *Hämeen historia* II:1, Hämeenlinna 1957, p. 21–22, 32–35, 53–55; Pirinen, *Savon historia* II:1, p. 268–270; 279, 280.
- <sup>76</sup> Cf. Soininen, 'Erämaiden asuttaminen', p. 21, 32–33; Mauno Jokipii, *Vanhan Ruoveden historia*, Jyväskylä 1959, p. 169; Reino Kallio, *Vanhan Saarijärven historia*, Jyväskylä 1972, p. 117.
- <sup>77</sup> Cf. Kaukiainen, op. cit., p. 35–36.
- <sup>78</sup> Soininen, 'Erämaiden asuttaminen', p. 21–2.
- <sup>79</sup> Väinö Voionmaa, *Hämäläinen eräkausi*, Porvoo – Helsinki 1947, p. 286–287; Mauno Jokipii, *Vanhan Ruoveden historia* I, p. 134–135; Idem, 'Metsästyksestä Satakunnassa 1500- ja 1600-luvuilla', *Satakunta* XVIII, Helsinki 1967, p. 62–67; Idem, *Satakunnan historia* IV, p. 365–370.
- <sup>80</sup> Keränen, op. cit., p. 61–62.
- <sup>81</sup> Voionmaa, op. cit., p. 268–276.
- <sup>82</sup> Keränen, op. cit., p. 61–62.
- <sup>83</sup> Kimmo Tolonen, Ari Siirriäinen & Anna-Liisa Hirviluoto, 'Iron Age Cultivation in SW Finland', *Finskt Museum* 1976, p. 59.
- <sup>84</sup> Taavitsainen, *Ancient Hillforts of Finland*, p. 65–67.
- <sup>85</sup> Welinder, *Prehistoric Agriculture in Eastern Middle Sweden*; Idem, *Kulturlandskapet i Mälaronrådet*, University of Lund. Department of Quarternary Geology, Report 5–6, Lund 1974; S.-O. Lindquist, *Det förhistoriska kulturlandskapet i östra Östergötland*, Stockholm 1968.
- <sup>86</sup> Klas-Göran Selinge, *Agrarian Settlements and Hunting Grounds. A Study of the Prehistoric Culture System in a North Swedish River Valley*, Theses and Papers in North-European Archaeology 8, Stockholm 1979, fig. 31–32 p. 228–29; Idem, 'Järnålderns bondekultur i Västernorrland', *Västernorrlands förhistoria*, Motala 1977, p. 180; Kjell Lundholm, 'Pysyvän asutuksen edellytykset', *Tornionlaakson historia* I, Malung 1991, p. 163–164.
- <sup>87</sup> Orrman, 'Om geologiska faktorers inverkan på bebyggelsen', p. 176–184.
- <sup>88</sup> Welinder, *Kulturlandskapet i Mälaronrådet*; Idem, *Prehistoric Agriculture in Eastern Middle Sweden*.
- <sup>89</sup> Welinder, *Kulturlandskapet i Mälaronrådet*, p. 6–7, 119, 253.
- <sup>90</sup> Ibid., p. 253–255.
- <sup>91</sup> Ibid.
- <sup>92</sup> Welinder, *Prehistoric Agriculture in Eastern Middle Sweden*, p. 86–87.
- <sup>93</sup> Welinder, *Kulturlandskapet i Mälaronrådet*, p. 6.
- <sup>94</sup> *Atlas över Sverige – National Atlas of Sweden*, Stockholm 1953–1971, text to maps 63–64; Harry von Eckerman, 'Geologisk historia', *En bok om Mälarlanskapen. Bygd och näringar genom tiderna*, Stockholm 1953, p. 42–43.
- <sup>95</sup> E.g. Kristian Hald, 'Busetnad. Danmark og Sverige', *Kulturhistoriskt Lexikon för Nordisk Medeltid* II, Helsingfors 1957, col. 374–378; Carl Göran Andrae, 'Kolonisation. Sverige', *Kulturhistoriskt Lexikon för Nordisk Medeltid* VIII, Helsingfors 1963, col. 633–637; Åke Hyenstrand, *Fasta fornlämningar och arkeologiska regioner*, Riksantikvarieämbetet och Statens historiska museer, Rapport 1984:7, Stockholm 1984, p. 115–116, 176, 191, 198.
- <sup>96</sup> E.g. Selinge, 'Järnålderns bondekultur i Västernorrland', p. 180; Lundholm, 'Pysyvän asutuksen edellytykset', p. 163–164.
- <sup>97</sup> E.g. Selinge, *Agrarian Settlements and Hunting Grounds*, fig. 13 p. 111.
- <sup>98</sup> Åke Hyenstrand, *Fasta fornlämningar och arkeologiska regioner*, map 102 p. 199; *Atlas över Sverige*, map 1 and 20:7.
- <sup>99</sup> Selinge, *Agrarian Settlements and Hunting Grounds*, fig. 18 and 26–27 p. 216, 224–225; *Atlas över Sverige*, map 1.
- <sup>100</sup> Armas Luukko, 'Pohjois-Pohjanmaan ja Lapin keskiaika sekä 1500-luku', *Pohjois-Pohjanmaan ja Lapin historia* II, Oulu 1954, p. 106; Kyösti Julku, 'Keskiaikainen tuomio Pellon rajoista', *Oulun yliopisto. Historian laitos. Eripainossarja* no 20; *Suomen kartasto – Atlas of Finland* 1960, Helsinki 1961, map 4.
- <sup>101</sup> *Atlas över Sverige*, maps 63–64 and text; G. Lundqvist, 'Jordarterna och deras fördelning inom Norrland och Dalarna', *Ymer* 1942, p. 126–127.
- <sup>102</sup> *Atlas över Sverige*, maps 131–132; Evert Baudou, 'Övre Norrland', *Med arkeologen Sverige runt*, Stockholm 1980, p. 346.
- <sup>103</sup> *Atlas över Sverige*, maps 63–64 and text; *Suomen kartasto* 1960, map 4; *Maataloudellinen maaperäkarta* 1:20 000, no 2541 02–2541 03, 2541 05–2541 12. According to the Swedish classification, light clays (including silty clay) contains 15–30 % clay; the corresponding figure in the Finnish classification is 30 % (minimum). *Atlas över Sverige*, text to maps 63–64; *Maaperäkartan käyttöopas*, p. 47. According to B. Aarnio, the fine-grained deposits in the surface layer in the coastal area between the Tornio and Kemi rivers consisted of light clay. Aarnio, *Minerologian, geologian ja maaperäopin oppikirja*, appendix map.
- <sup>104</sup> Phebe Fjellström, 'Den nordsvenska kulturbarriären – en symbol för det mångkulturella Norrland', *Bebyggelsehistorisk tidskrift* 14 (1987), fig. 1 p. 44.
- <sup>105</sup> Luukko, *Pohjois-Pohjanmaan ja Lapin historia* II, p. 180–193; Lundholm, 'Elinkeinojen kehitys', *Tornionlaakson historia* I, Malung 1990 p. 266–291.
- <sup>106</sup> Jouko Vahtola, 'Kansojen moninaisuus', *Tornionlaakson historia* I, Malung 1991, p. 205.
- <sup>107</sup> Matti Huurre, 'Pohjois-Pohjanmaan ja Lapin esihistoria', *Pohjois-Pohjanmaan ja Lapin historia* I, Kuusamo 1983, p. 414–418, 442; Vahtola, 'Kansojen moninaisuus', p. 197–199.