LANDSCAPE SUSTAINABILITY AND EARLY FIELD SYSTEMS IN WESTERN ESTONIA

A CASE STUDY ON THE HILL OF SALUMÄGI AT SALEVERE

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Abstract

The thesis assesses levels of sustainability in later prehistoric agricultural landscapes by studying changes in the characteristics of field systems at regional and local scales. The research tackles questions of how agricultural landscapes were organised into field systems, how environmental and social factors affected the character and organisation of field systems, and how the management of field systems changed through time. The project has one primary research question: How did the locations and organisation of field systems impact on landscape sustainability during later prehistory?

The research is organised into regional and local case studies. The regional study examines the distribution of field systems in western Estonia, and reconstructs the environmental and social factors behind the differences in field system location and form. A local case study on the hill of Salumägi at Salevere village investigates specific factors that influenced landscape sustainability in a single location.

The focus on sustainability sets the research apart from earlier studies of field systems in Estonia. The research presents field systems as multifunctional entities that organised landscapes according to interdependent social and environmental processes. It argues that the more functions the field systems had, both in agricultural and social terms, and the more varied and flexible the land use practices were, the more capacity existed for resilience and landscape sustainability.

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1 Introduction

1.1 Background

Prehistoric field systems have been identified and investigated in numerous countries and regions in Europe. The United Kingdom, Netherlands, northern Germany, Sweden, Denmark and Norway are countries where most of the research on ancient field systems has concentrated. Ancient fields similar to those recognised in Estonia are known from the neighbouring countries of Sweden and Lithuania. There has been less fieldwork in Finland and Latvia, where the fields seem to be different in form and chronology. The continuous investigation of field systems started in the 1920s and 1930s in England, Netherlands and Denmark (see Johnston 2013:307 for a summary). In Estonia the continuous study of field systems started in the 1970s.

Ancient field systems in Estonia are mainly distributed in the coastal areas of northern and western Estonia and the western archipelago, with small numbers known inland, to the east. Currently there are 85 field systems under heritage protection (Register of Cultural Monuments) in Estonia although the number of known sites is larger. Of the 85 sites under heritage protection, 14 are located in mainland western Estonia. In addition to that, there are 13 known field systems in West Estonia that are not under heritage protection. A further 58 field systems were located and mapped as part of this PhD project, which brings the current total number of the field systems in western Estonia to 85.

Although field systems in Estonia are dated from the Late Bronze Age (1100–500 BC) until at least the 19th century, the current study focuses primarily on the analysis of later prehistoric (from the Bronze Age until the end of the Iron Age ca. AD 1200) field systems in Estonia. However, the dating of field systems is complicated because in many cases there are overlapping fields within the same complex (both horizontally and vertically) and the exact beginning of the fields along with all the possible consecutive phases within the complex is impossible to determine without extensive excavations. Also, the separation of prehistoric and later fields within the same complexes is often impossible and potentially even needless because it can be argued that despite the dating they are all equal parts of the layers of landscape.

1.2 Key concepts

The key concepts which will be addressed throughout the thesis are:

- Field systems

The narrow definition of field system is “a group or complex of fields which appear to form a coherent whole” (Historic England 2014). In the current thesis field systems are taken as the above ground remnants of past agricultural practices, including terraces, boundaries and stone clearance structures (cairns and banks). This definition excludes fields that are only preserved as plough marks or sediments surviving as sub-surface features.

- Landscape

Landscape is a wider concept and a single definition is hard to bring out. In the Council of Europe Landscape Convention, landscape is defined as “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors” (ELC 2000:2).

Different was to explain the concept of landscape and what it means are discussed in chapter 3 but here it is important to emphasize the concept of landscape as palimpsest. The idea has been in use in landscape archaeology since at least from the second half of the 20th century, for example in the works of the pioneer of aerial archaeology O. G. S. Crawford (1953). He used the metaphor of palimpsest – a manuscript or piece of writing used one or more times after earlier writing has been erased – for landscapes where the surface of earth was compared to the manuscript and archaeological features symbolise the text. However, the earlier “texts” or archaeological remains are not completely erased but rather overwritten in a way that they still can be traceable under the younger layers.

With the emergence of post-processual approaches to the landscape, the concept of landscape became foremost a theoretical construct (e.g. Johnston 1998; Tilley 1994; Wylie 2009). Therefore, landscape palimpsest became a tool of understanding the material remains of past human activities in the landscape and as such it means that the palimpsest is created by an archaeologist in the process of interpretation of the archaeological material and not something that could be objectively discovered (Johnson and Ouimet 2018).

- Sustainability

Sustainability is also a wider concept and its definition has been a subject of many debates. The concept will sustainability will be discussed in chapter 3. According to the most common definition sustainability or sustainable development is something that “meets the needs of the present without compromising the ability of future generations to meet their needs” (Brundtland 1987, cited in Dresner 2008:1).

The term *landscape sustainability* is used in the current thesis which is understood as a way that human activities have influenced the preservation of past landscape elements. Landscape sustainability can be either the cause of intentional or unintentional practices. In a way, the concept of landscape as a palimpsest incorporates also that of landscape sustainability.

1.3 The objectives of the current study

The PhD project targets field systems in mainland western Estonia. The western Estonian archipelago is not included in the study. Since the research of field systems has mostly concentrated on the northern part of the country, only seven sites in western Estonia had been excavated prior to the current study. At the same time, general conclusions about field systems that are mainly based on north Estonian material have been applied uncritically to all fields, including the ones in West Estonia. The question of whether the field systems in West Estonia have different characteristics compared to those of North Estonia was one motivation for undertaking the current thesis. The study was also influenced by a dissatisfaction with mainstream interpretations of field systems that emphasise the role of territorial strategies, population pressure and exploitation of natural resources behind the establishment and evolution of fields. There is a contradiction in terms of how the sustainability of field systems has been presented. On one hand agriculture is interpreted as a practice that was environmentally conditioned and exploitative, on the other hand, studies stress the longevity of agricultural settlement and field systems. What enabled field systems to be sustainable landscape structures in the long term, while the environments, societies and agricultural strategies were dynamic?

A theoretical framework of landscape sustainability has been applied to the study of field systems in the thesis. This is because of my conviction that the term “sustainability” has the most potential to combine different aspects that are important in the study and understanding of the processes behind the inception and maintenance of field systems – the wise (and sustainable) use of landscape resources, the flexibility of land use practices and the temporal dimension.

The research is guided by a primary research question: How did the location and organisation of field systems impact on landscape sustainability during later prehistory? Answers to this question are sought at two levels of study: regional and local.

The regional study of mainland western Estonia identifies the main characteristics of the distribution of field systems, looks for the similarities and differences in the distribution of different types of field systems and the factors behind it. The aim of the regional study is to investigate the chronology of the field systems in western Estonia and to see how the typology and chronology fit within the existing knowledge of field systems in Estonia. The regional analysis also emphasises the relationship of field system with environmental conditions and local settlement history.

A local case study on the hill of Salumägi at Salevere village in the southern part of the study region tackles the social and environmental factors that influenced the character and organisation of field systems. Based on the correlations between the specific characteristics of field systems and other factors, the landscape sustainability related to field systems will be assessed and analysed.

1.4 Structure of the thesis

The thesis consists of seven chapters. After the introduction, in the second chapter, a review of previous research on field systems in Estonia is presented within European context. The third chapter introduces the theoretical framework of the study and the chosen study methods. The aim of the fourth chapter is to provide an overview of the environment and settlement history of the study region in western Estonia and presents a regional analysis of the distribution of field systems in the study region. The fifth and sixth chapters deal with the local case study. The fifth chapter is a thorough analysis of the archaeological features and field systems on the hill of Salumägi. The sixth chapter discusses the results of the excavations that were carried out under the direction of the author. The final chapter of the thesis summarises the main results of the PhD study and addresses the answers to the research questions.

2 A review of previous research on field systems

2.1 Introduction

The history of archaeological research in Estonia divides into several phases: (1) The beginning of archaeological research from the late 18th century until 1918 when Estonia was part of the Russian Empire with a strong, historically developed Baltic German community that formed the social upper class in society; (2) the first decades of professional archaeology in the independent state of Estonia from the 1920s until the beginning of the 1940s; (3) the Soviet period from the 1940s until 1991; (4) from the 1990s until today (Lang and Laneman 2006a). These divisions associate the development of archaeological research with general political and ideological trends in society that affected the methodological and theoretical aspects of archaeological research. However, these periods do not always reflect the internal development of archaeology and associated subjects directly as the study of some monument types or certain topics has reached beyond the formally distinguished research phases.

The study of field systems aligns with these general phases of Estonian archaeology but not neatly so. Three different periods in the study of field systems in Estonia can be distinguished. The first period, limited to the 1920s, was a time when only occasional field systems were recorded and excavated but there was not a formal study of field systems. More systematic research on field systems started in the 1970s when it was mainly limited to rescue excavations. The third phase started in the beginning of the 1990s when the study of field systems became more analytical and interdisciplinary, the amount of problem-based excavations grew, and the main typology and chronology of field systems was established. The results were also combined into general overviews of prehistory. Among the third phase, the investigations since the 2000s can be seen as a separate sub-stage when the amount of extensive excavations and studies of field systems has diminished while more effort has been put into heritage protection and preservation of field systems.

The chapter is divided chronologically and follows a historiographical route to facilitate the understanding of how the study of field systems has developed in Estonia. In the three following sections, the main phases of the study of field systems will be brought forward and discussed. Each period is closely connected with social and ideological trends, and with methodological and theoretical developments in archaeology that are also reviewed to give a general background. Main aspects related to the focus and research questions of the current thesis (sustainability) will be brought forward and discussed in section 2.5, including the current typology of field systems in Estonia. In order to connect the Estonian research of field systems with wider context, each section ends with a short overview of the main trends and developments in the study of European field systems (mostly in the United Kingdom, Netherlands and Scandinavian countries). Later prehistoric field systems have been registered and investigated in numerous other countries and regions in Europe but most of the research of field systems has concentrated in the United Kingdom, Netherlands and the Scandinavian countries.

2.2 Archaeological research in the 1920s and 1930s

2.2.1 Archaeological research and the first recognition of field systems in Estonia

In 1918 Estonia became an independent state and in 1920 the Chair of Estonian and Nordic Archaeology was opened at the University of Tartu (Lang 2006a:21). Archaeological research before the 1920s proceeded within a Baltic German ideology that underlined the Germanic primacy over local developments and peoples. The new research framework was influenced by the national self-determination of the new independent state in which the early history of the Estonians played an important role. Previously archaeology was an antiquarian hobby for the collectors of the late 18th and the 19th centuries (Lang 2006a:15). It had a more scientific component since the late 19th century but was performed by natural scientists (Grewingk 1865; 1871; Hausmann 1896; 1910) or was used as a counterbalance to the ideology of the Baltic Germans by national Romanticist intellectuals during the so-called first national awakening in Estonian society in the late 19th century (Lang 2006a:19). From the 1920s, the institutionalisation of archaeology paved the way for a new generation of professional archaeologists. From now on the archaeological material was interpreted from a local perspective, unlike Baltic German treatments in which socio-cultural developments were connected with people of Germanic origin (Lang 2006a:23).

The first professor of archaeology at the new Chair of Archaeology was Aarne Michaël Tallgren who was invited to this position from Finland (Lang 2006a:21). One of his far-reaching contributions to the development of archaeology in Estonia was organizing the second Estonia-wide inventory and registration of archaeological monuments (Lang 2006a:21; 2006c:293). The first Estonia-wide inventory and registration of archaeological sites had been initiated by an Estonian schoolteacher Jaan Jung in the second half of the 19th century (Jung 1898; 1899; 1910). Tallgren and his students who carried out the fieldwork critically re-examined the sites previously registered by Jung and removed those from the lists that were not regarded as antiquities or had been destroyed or vanished. The resulting database which included mainly the sites with visible structures (stone graves, hillforts, groves and cultic stones) has subsequently been updated and remains in use by archaeologists today[1] (Lang 2006a:22). From the 1930s, Harri Moora, one of Tallgren`s first students, became the professor of archaeology in the University of Tartu and remained the leading archaeologist for many decades. Both Tallgren and Moora contributed to the general treatment and understanding of Estonia`s archaeology (i.e. Tallgren 1922; 1925; Moora 1929; 1932; 1938). Both archaeologists dealt with settlement processes and compiled distribution maps of monuments. Moora also looked more specifically to economy, including agriculture (Moora 1937). The general framework for archaeological research, as it was elsewhere in Europe, was culture-historical. It distinguished several archaeological cultures that were connected directly with prehistoric peoples; cultural changes were explained as a result of the population migration (Tallgren 1922:70–71).

Field clearance cairns were registered in a number of places in West and North Estonia during work on the inventory in the 1920s (Leinbock 1924:43; Moora 1924:66, 69). The only archaeological investigations of the cairns took place in 1928 in Hanikatsi islet near the island of Hiiumaa where a group of about 20 clearance cairns had been recorded a couple of years earlier (Vaas 1923:26). Two cairns had been excavated in 1918 by German soldiers but allegedly the cairns were empty of any kinds of finds (Laid 1928). In 1928, one cairn was excavated by an archaeologist, Eerik Laid, and this also did not reveal any archaeological finds, bones or charcoal. Hence, the dating of the complex of cairns in Hanikatsi remained unclear but Laid (1928) suggested that the cairns were associated with former slash-and-burn agricultural practices.

Although it was considered that the cairns in Hanikatsi and elsewhere were signs of past agriculture, the notion of *past* was not developed any further. The cairns were not seen to be temporally connected with the prehistoric stone graves that were often found in their close vicinity but were thought to be signs of agriculture from the more recent past. This idea was

[1] The information is included in the Database of Archaeology and Local Lore, collected and administrated by the Department of Archaeology of the University of Tartu and Estonian National Heritage Board.

also supported by the fact that in some places the local people remembered the clearance of stones from the fields to the cairns (Moora 1924:70). Because there was no knowledge of how to date the cairns (dating was based on typological considerations), it remained unclear if some of them could be of prehistoric origin. It was only in 1996 when the cairns at Hanikatsi were revisited and charcoal pieces found from one cairn were radiocarbon dated to the 11^{th}–12^{th} centuries AD (Lang 1996a).

The piecemeal investigation of agricultural remains meant that there remains no overall appreciation of the importance of these monuments. Field systems and clearance cairns were being studied elsewhere in Western Europe by this time, though in an equally piecemeal fashion (e.g. Johnston 2001:20–26; 2012:308). Even if the Estonian archaeologists were aware of this wider scholarly work, the connection between random heaps of stones – that could have equally been from historical periods – and honeycomb-like structures of Celtic fields was probably hard to draw.

The main emphasis of archaeological studies in the 1920s and 1930s was towards monumental graves and hill-forts that were interpreted by local archaeologists from a national-romanticist perspective (Lang 2006a:26). This was an explicit counter to earlier inferior attitudes towards the prehistory of Estonians. The new perspective underlined an egalitarian prehistoric society and reflected the social circumstances and trends in Estonian society at this time – a young and growing state was building its own ideology and history by projecting national solidarity and unity back into prehistoric society (Ligi 1995:262).

The fact that nothing was found from the discovered field cairns made them unattractive to archaeologists and therefore there was no scientific interest in their investigation. Prehistoric fields or field systems were also not mentioned in the general treatments of Estonian prehistory of that time or in connection with the studies of agricultural settlement.

2.2.2 The beginning of study of field systems in Europe

In many European countries field systems were recognised in the 16^{th}-17^{th} centuries when, for example long field boundaries in Dartmoor, south-west England and field plots in Drenthe, Netherlands were described by early antiquarians but their prehistoric origin and importance was not acknowledged (Johnston 2013:307). The excavation and survey of field boundaries started in England in the 19^{th} century and to some extent their prehistoric date and connection with other monuments was recognised (Johnston 2001:21–22). The systematic and continuous study of field systems started in the 1920s and 1930s. In England, Eliot and Cecil Curwen carried out surveys of earthwork field boundaries and, independently, O. G. S. Crawford started the aerial survey and interpretation of field systems (Johnston 2013:308; McOmish 2011:2). Both Curwens (Curwen and Curwen 1923) and Crawford (1923) called the rectangular field systems ´Celtic fields` which remained a mainstream term for decades.

In the Netherlands, first excavations of Celtic fields were undertaken in 1848 by L. J. F. Janssen but the interpretation of the excavated structures as field systems remained unclear. Between 1917 and 1944, archaeologist A. E. Van Giffen (1928) excavated several rectangular fields (´so-called heathen military camps`), although it was only later, in 1939, that he acknowledged that the excavated structures are the same kind of Celtic fields that had been discovered in England and also in Denmark (Hatt 1931) (Arnoldussen 2018:305).

The study of field systems in the 1920s and 1930s was included in the culture-historical framework which equated social evolution with ethnic and national pasts: ´Celtic fields` were unambiguously linked with the ethnic group of Celts, associated with a distinct cultural package with specific types of material culture and agriculture (Wickstead 2008a:31).

2.3 Archaeological research from 1944 until the beginning of the 1990s

2.3.1 General trends of archaeological research in Estonia

In 1944, after the Second World War, Estonia was occupied by the Soviet Union. Archaeological research during the 1940s and 1950s was characterised by the degenerating influence of a general stagnation in society and Soviet ideological pressure. The Chair of Archaeology in Tartu was closed and the newly formed Department of Archaeology of the Institute of History in Tallinn became the centre of archaeological research (Jaanits *et al.* 1982:16; Lang 2006a:28–29). State-organised censorship started controlling all scientific research and publications, ensuring that they were written in an ideologically correct manner (Lang 2006a:32). The correct and obligatory ideological framework for all the scientific work had to be historical materialism (Jaanits *et al.* 1982:16), that is the doctrine of Karl Marx and Friedrich Engels, according to which the development of society went through so-called socio-economic stages (Lang 2006a:29–30). All the previous archaeological work that was considered bourgeois-nationalistic, and ideologically wrong, was re-evaluated and re-written according to the Soviet ideology (Lang 2006a:29).

On the one hand, the ideological pushing of archaeological material into pre-determined theoretical frames was coercive and arbitrary. On the other hand, as pointed out by Lang (2006a:30–31), the application of Marxist theory brought more attention to social and economic aspects of prehistoric society. However, archaeological research in general still followed the culture-historical framework: the distribution of sites was equated with human settlement, and attention was given to typologies and chronologies of artefacts and detailed descriptions of the geological background (Lang 2006a:30).

The 1960s-80s brought a certain stabilisation in society and adaptation to the new ideological climate. Systematic and planned excavations for collecting new archaeological data were more widespread (Jaanits *et al.* 1982:16), and it was a lively and active period in the archaeological research – despite the fact that archaeology was not taught as an academic discipline at the University of Tartu (Lang 2006a:34).[2]

In the beginning of the 1970s the third inventory and registration of archaeological monuments was carried out, this time by professional archaeologists (Jaanits *et al.* 1982:20; Lang 2006a:35; Tvauri 2006:259). The main aim of the project was to record and take under state heritage protection as many archaeological sites as possible because the extensive building, quarrying and land improvement works of that time were destroying many known and unknown sites and monuments (Tvauri 2006:259). The inventory led to the discovery of many new sites (Jaanits et al. 1982:20; Lang 2006a:35; Tvauri 2006:259) as did the growth in the number of rescue excavations (Lang 2006a:36; Tvauri 2006:260).

2.3.2 The beginning of the systematic study of field systems in Estonia

The systematic recognition and study of ancient field systems started in the 1970s, in the framework of this intensified archaeological research and rescue excavation. Vello Lõugas carried out most of the investigations and inspections of ancient fields and he analysed the

[2] Nevertheless, it was possible to study archaeology in the framework of special courses under the teaching and supervision of professional archaeologists and therefore there still was a steady increase in the number of archaeologists (Lang 2006a:34).

material in a number of articles in the 1970s and 1980s (e.g. Lõugas 1972; 1975; 1980; 1982). He was the pioneer of the studies of field systems in Estonia who laid the foundation for the theoretical and methodological approaches that influenced studies in the following decades. Of the other archaeologists who contributed to the investigation of field systems at that time, Mati Mandel was important because of the field complexes he excavated in West Estonia (e.g. Mandel 1982a).

The sustained research and recording of field systems in Estonia started with the discovery and investigation of an extensive clearance cairnfield at Kõmsi, in the southern part of West Estonia in 1969–1970. The investigations were led by Vello Lõugas, who during the investigations also inspected the surrounding area south from Matsalu Bay and found more places with clearance cairns (Lõugas 1972:170–171). Later he expanded the research area and recorded and investigated field systems in the northern part of West Estonia, Saaremaa and North Estonia.

The number of field systems discovered in the 1970s and 1980s is not precisely known because not all results were published or reached the national register of monuments. By 1989, 47 locations with ancient fields were mentioned in a book summarising the sites and monuments in Estonia (Lõugas and Selirand 1989). Almost all the field systems were located in northern and western Estonia, the island of Saaremaa being the densest area of their distribution.

Archaeological excavations of field systems were not numerous in the late 1970s and 1980s. In the southern part of West Estonia, south form Matsalu Bay, the largest excavations were at the Kõmsi clearance cairnfield (Fig. 4.12 nos. 10 and 61, Appendix A) in 1969–1970 (Lõugas 1972), 1979 and 1981 (Mandel 1982a). In the same region, a couple of field cairns were excavated in 1981 at Ridase (Fig. 4.12 no. 21, Appendix A) (Mandel 1982b). In the northern part of West Estonia, cairns were excavated in Ellamaa (Fig. 4.11 no. 2, Appendix A) in 1980 (Mandel 1981) and Uugla (Fig. 4.11 no. 25) in 1977 (Mandel 1980). There were no excavations of fields in the islands of Hiiumaa and Saaremaa at that time.

In North Estonia, most of the fields were investigated east of Tallinn during rescue works in advance of building projects and quarrying. Near the modern-day Tallinn district of Lasnamäe there were excavations at Iru-Nehatu in 1974 and 1989 (Lõugas 1976) and Väo in 1980 (Lõugas 1981). Some fieldwork was carried out further to the east in the coastal northern Estonia at Tõugu by Tanel Moora (Lang 2000a:40) and Toolse Sarapiku (Lõugas & Reintam 1988).

The excavated field systems only consisted of clearance cairns. The cairns were generally quite small, 1.5–4m in diameter and low, typically 20–30cm in height. The size of the field complexes varied. The field system at Kõmsi was the largest, covering an area of 56ha, with 357 cairns (for more detailed overview of the excavations see also 4.5.5). No regularity in the cairns' locations was detected although some of the cairns clustered in small groups (Lõugas 1972). In most other cases the size of the area that the field systems covered was not documented. Thirty-two clearance cairns were excavated at Iru-Nehatu, where the field system was located near the group of stone-cist graves[3] (Lõugas 1981:390; Lõugas 1976:51). Ten cairns were surveyed and excavated at Ellamaa (Mandel 1981:10). At Ridase, 16 cairns were surveyed with the uncertainty of whether they are graves or clearance cairns. Five of them were excavated and by the absence of human remains it was concluded that they represented part of a former field system (Mandel 1982b) (for more detailed overview of the excavations see also 4.5.5).

After a decade of studying only clearance cairns, in 1982 a field system was discovered at Rebala, east of Tallinn, which consisted of rectangular field plots that were surrounded by low, 3–4m wide banks of stone (Fig. 2.1). The studies, in conjunction with the excavation of stone-cist graves that lay inside the field system, were carried out in 1982–1983 (Lõugas 1983; Lõugas 1992:73; Lõugas and Selirand 1989:152). The archaeological complex at Rebala (fields and the stone-cist graves) covered an area of 6.5ha (Lang 2007b:103). Where the irregular and rectangular field plots were better preserved and visible, it was possible to define the extent of individual plots: they ranged in size between 12.5x15m and 16x24m (Lõugas and Selirand 1989:152; Lõugas 1992:73).

[3] See 4.4.3 for the definition.

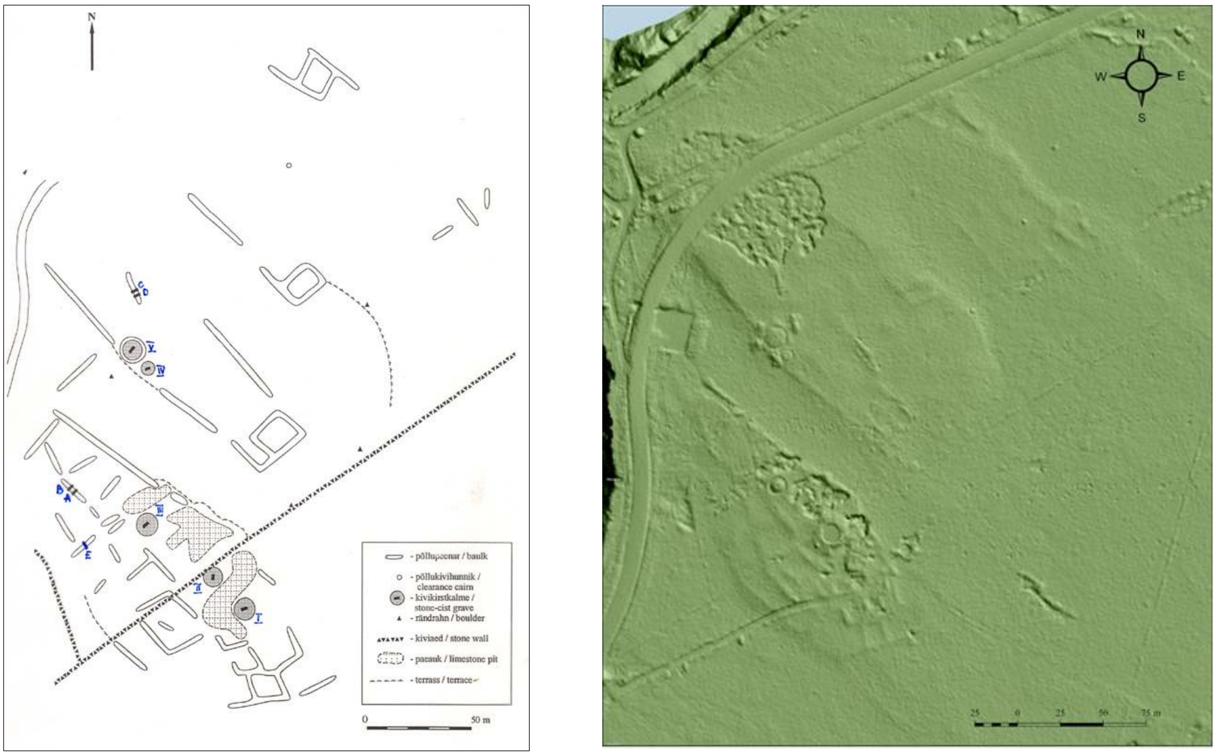


Figure 2.1. Field systems at Rebala. Left: mapped area of the preserved field systems and stone graves (Lang 2007b). Right: The same area on hillshaded relief image (Estonian Land Board 2021).

During the Soviet period, interpretations of the spread of ancient settlement and agricultural land (where fields were located) were still made largely on the basis of monument distributions. In this sense, thinking had not moved on substantially form earlier research periods. The investigation of the field systems since the 1970s did not change concepts about agricultural developments but they were taken as supportive evidence for the conclusions that were reached by other means. The information obtained from the study of field systems was only cursorily mentioned in the general treatments of that time (Jaanits et al. 1982:197; Lõugas 1992:66–75).

2.3.3 Study of field systems in Europe

In the 1950s to 1970s (in the UK) and up to the beginning of the 1990s in some other countries (e.g. Sweden), the study of early field systems was connected with the emergence of landscape and settlement archaeology and the emphasis was on the economical, morphological and chronological aspects of field systems and the role of environment (Johnston 2013:308).

The knowledge about the distribution of field systems grew. A. Brongers (1976) undertook extensive aerial mapping of field systems from Sweden and Gotland, through Denmark and northern Germany, Belgium and the Netherlands (Bradley 1978:265). M. Müller-Wille (1965) mapped most of the known field systems in the eastern part of the Netherlands (Klamm 1993) and extensive landscape surveys were undertaken across England, Wales and Scotland (Bowen 1961). Field systems were also discovered and mapped elsewhere in Germany, France (Bradley 1978:265), Denmark (Nielsen 1971) and Sweden (e.g. Lindquist 1974).

A number of detailed studies of field systems were undertaken in Europe, concentrated on the study of Celtic fields. For example:

- In Netherlands, A. Brongers` (1976) excavations of field systems at Vaassen, where both banks and fields were excavated, including parts of an Iron Age house (Arnoldussen 2018:308). The connection and interrelation between fields and habitation areas inside the field systems was also possible to study at Hijken (O. H. Harsema 1991) and at Peelo-Kleuvenveld (Kooi and De Langen 1987).
- In Denmark V. Nielsen conducted systematic landscape studies on Danish field systems but only few were excavated (Nielsen 1984). Large excavations took place at Store Vildemose, Jutland (Lindquist 1974; Nielsen 1971). The field systems had been preserved under the peat layer and the excavated features included plough marks and strips of unploughed land as boundaries pre-dating earthworks (Bradley 1978:268; Klamm 1993).
- In Sweden Celtic fields had been only discovered in Gotland (Lindquist 1974). In the study of fields, Lindquist (1974:27–29) defined the basic size units of the field plots (195m^2)[4] which was seen as an evidence suggesting general centralised control over agriculture (Bradley 1978:270).

Elsewhere in Sweden, for example in Östergötland, the field systems consisted of long boundaries without divisions into smaller plots (Klamm 1993). These systems were studied, for example, by S. Welinder (1975) who emphasised the role of population growth and pressure in the development of fixed field systems (Bradley 1978:274). M. Widgren has contributed to the study of Swedish field systems from landscape archaeological and geographical point of view

[4] Lindquist (1974) considered this as a basic area module that would be used for planning the fields and in estimating labour and seed requirements. At the same time it has been suggested that the size of an individual plot is determined by the area which can be ploughed in one day. The preferred size of the Gotland fields, according to Lindquist would be 600m^2. However, the mean area of a single field is 2,500m2 and in Europe 1,600m^2. The differences could be related to different factors, e.g. the texture of the subsoil and the plough types that were used (Bradley 1978:270).

but his early work emphasised the role of social structure and field systems as manifestations of property rights (Widgren 1979, 1983, 1989).

In England large-scale landscape projects were undertaken, for example in the Marlborough Downs (Fowler 2000; Fowler and Evans 1967) where excavations were combined with landscape survey, aerial photography and environmental analysis. The results of the studies of field systems was an important part of general overviews of prehistoric agriculture (Barker 1985; Bradley 1978; Fowler 1981) (Johnston 2001:27).

Landscape archaeological survey concentrated mostly on the typology of field systems (Bowen 1961, Bradley 1978) which often had a deterministic view – the more regular and enclosed fields were thought to be later. The relative chronology was based on the observation of the relationships between different landscape elements (Johnston 2001:31).

Especially in England, the shift towards social (socio-political and socio-economic) role of field systems started. It was especially apparent in A. Fleming´s work on Dartmoor (Fleming 1978; 1984) – he initially believed the long boundaries were the evidence of socio-economic model building, but later his interpretations focused on socio-political processes. In his opinion the boundaries were built for the management of land from economic perspective but he believed that the building of such large structures and organising landscape in large level was related to ideology and power relationships in society (Johnston 2001:32–33).

2.4 The studies of field systems and agricultural landscape from the 1990s

2.4.1 General trends of archaeological research in Estonia

Estonia regained and declared its independence from the Soviet Union in 1991. As Konsa (2006:50) has pointed out, the first years of the re-establishment of the independent state can be seen as a critical period of radical reforms, following the stagnation of the 1980s that culminated with the collapse of the Soviet Union. The state and government had to be restructured according to democratic principles, and this included academic and scientific institutions. The main period of institutional rearrangement occurred during 1995–2004 and was complemented with the emergence of a new generation of archaeologists, and 2005 brought the completion of academic reform in archaeology. The broader Westernization of research politics has continued subsequently.

A lack of funding in the early 1990s meant that the number of archaeological investigations diminished, especially in rural areas but the situation changed in the late 1990s due to increasing research support granted by the Estonian Science Foundation (Mäesalu and Valk 2006:150). Since the 2000s, there has been a growth in scientific projects with funding from European Union sources.

The main tendency in archaeological research (as in other fields), especially in the beginning of the period in question, was a move away from a descriptive phase to a more analytical analysis and understanding of underlying phenomena. The end of political isolation brought access to Western publications and broadened the theoretical basis for interpretations. As the borders were now open and the connections with the neighbouring countries could be developed, international collaborations grew. Publications and interpretations of archaeological material were no longer controlled by the state and a lot of the ideas were re-evaluated, especially the concepts of society and social organisation that had been affected by the Soviet ideology. Until the mid-2000s the primary research themes were social organisation, power and ideology. As a counterbalance, the study of religion, culture and cultural landscape emerged, often in collaboration with ecologists and geographers (Konsa 2006:49; see also Ligi 1995, Lang 1996b). This marked an increased tendency for collaboration between different fields of science, with archaeology emerging not as a narrative humanities discipline but an interdisciplinary field of study. The collaboration between archaeologists and natural scientists is growing, including the collaboration with genetics.

The number of publications has grown since the end of the 1990s, introducing new chronologies and general treatments. The first "new" chronology of prehistory was published in 2001 (Lang and Kriiska 2001). It took into account previous studies, the chronologies of neighbouring countries and included the new research data from the 1990s. The chronology has been refined since then but its main structure has stayed the same (e.g. Kriiska and Tvauri 2002). The current chronology of archaeological and historical periods is presented below in Table 2.1. The archaeological periodisation is based on the published chronology by Lang and Kriiska (2001) and complimented with more recent additions to it (Lang 2007b; Tvauri 2012; Mäesalu and

Valk 2006). For the historical periods, overviews summarising the recent works on distinguishing historical periods were used (e.g. Russow et al. 2006; Russow 2006).

<table>
<tr><th></th><th>Main division</th><th colspan="3">Sub-divisions</th></tr>
<tr><td rowspan="15">A R C H A E O L O G I C A L P E R I O D S</td><td rowspan="5">Stone Age
9000–1800 BC</td><td rowspan="2">Mesolithic
9000–4900 BC</td><td colspan="2">Early 9000–6500 BC</td></tr>
<tr><td colspan="2">Late 6500–4900 BC</td></tr>
<tr><td rowspan="3">Neolithic
4900–1800 BC</td><td colspan="2">Early 4900–4200/4100 BC</td></tr>
<tr><td colspan="2">Middle 4200/4100–3200/3000 BC</td></tr>
<tr><td colspan="2">Late 3200/3000–1800</td></tr>
<tr><td rowspan="2">Bronze Age
1800–500 BC</td><td colspan="3">Early Bronze Age 1800–1100 BC</td></tr>
<tr><td colspan="3">Late Bronze Age 1100–500 BC</td></tr>
<tr><td rowspan="8">Iron Age
500 BC– AD 1200</td><td rowspan="4">Early Iron Age
500 BC–AD 450</td><td rowspan="2">Pre-Roman Iron Age
500 BC–AD 50</td><td>Early 500–250 BC</td></tr>
<tr><td>Late 250 BC–AD 50</td></tr>
<tr><td rowspan="2">Roman Iron Age
AD 50–450</td><td>Early AD 50–200</td></tr>
<tr><td>Late AD 200–450</td></tr>
<tr><td rowspan="2">Middle Iron Age
AD 450–800</td><td colspan="2">Migration Period AD 450–600</td></tr>
<tr><td colspan="2">Pre-Viking Age AD 600–800</td></tr>
<tr><td rowspan="2">Late Iron Age
AD 800–1200/ca. 1225</td><td colspan="2">Viking Age AD 800–1050</td></tr>
<tr><td colspan="2">Latest Iron Age AD 1050–1200/ca. 1225</td></tr>
<tr><td rowspan="3">H I S T O R I</td><td colspan="4">Middle Ages
AD 1200/ca. 1225–1561[5]</td></tr>
<tr><td rowspan="2">Post-medieval period
Mid-16th century–end of the 18th century</td><td colspan="3">Swedish rule[6] (part of the Kingdom of Sweden) 1578–1710</td></tr>
<tr><td colspan="3">Russian rule (part of tsarist Russia) 1710–1917</td></tr>
</table>

[5] The end of the Middle Ages is marked with the beginning of the Livonian war (1558–1583), in the course of which in 1561, the last medieval state formations ceased to exist (Russow 2006:193).

[6] Regional differences existed as parts of the country were periodically also ruled by Denmark and Poland (Russow 2006:193).

C A L P E R I O D S	Early modern period (19th century)	
	Present period (20th century onwards)	
		Independent Republic of Estonia 1918–1940
		Soviet occupation 1940–1941/1944–1991
		Republic of Estonia 1991–

Table 2.1. Archaeological and historical periods identified in Estonia. Adapted from: Lang 2007b; Lang and Kriiska 2001; Mäesalu and Valk 2006; Russow 2006; Russow et al. 2006; Tvauri 2012.

Alongside these academic changes, the number of archaeological monuments under state protection has seen a growth in numbers. At the moment there are over 6700 archaeological sites listed in the national register of monuments. As the regulations of protected monuments have improved (complemented by the fact that the financing has diminished), most archaeological excavations nowadays are rescue, development-led, projects.

2.4.2 Study of field systems in Estonia

The studies of field systems continued within this new framework. The most thorough and far-reaching investigations of field systems in the late 1990s and the beginning of 2000s were parts of larger scientific settlement archaeological projects[7]. While previously the field system research concentrated on single locations and monument types, now it became the study of settlement dynamics in a long-term perspective, through several prehistoric periods (Lang 2006a:98). The leading proponent of this approach has been a student of V. Lõugas, Valter Lang, whose ideas and interpretations on field systems, based on his investigations, are immensely influential in Estonian archaeology (e.g. Lang 1995:116–181; Lang 1996b; Lang 2000a). Lang’s work had two main implications. By studying changes in field systems in a

[7] The intensification of studies on field systems in the 1990s was strongly influenced by the Council of Europe`s interdisciplinary PACT project (European Study Group on Physical, Chemical, Biological and Mathematical Techniques Applied to Archaeology) where Estonian archaeologists and natural scientists participated. The first large-scale scientific investigations of field systems were carried out in realm of the project (e.g Lang 1996c; Veski and Lang 1996a; 1996b; Lang 1999b). The positive influence of the project through established collaboration continued in the early 2000s.

specific region, he recognised that the forms of fields could change with time. Inevitably, this led Lang to focus on the typology and chronology of field systems, which were not emphasised systematically by earlier researchers. On the other hand Lang developed the perspective, which Lõugas had started, of seeing field systems as part of a whole landscape. The interpretations were strongly influenced by theoretical ideas about cultural landscapes, following the trends that were prevailing in Swedish archaeology (e.g. Berglund 1991). At the same time the new research had roots in Germanic traditions of settlement archaeology, which were more processual in character. The cultural landscape influences meant that more emphasis, in general, was put on the social and symbolic dimensions of field systems. In its turn, the influences of settlement archaeology, introduced socio-political and economic agendas. When it comes to interpreting field systems, the latter was more prevalent in Lang's work.

One of the largest studies in the late 1990s and early 2000s was the settlement archaeological study of the lower River Pirita, east of Tallinn. It included the study of previously excavated field systems at Iru, Nehatu and Rebala but also included new excavations. The largest investigations were near Loo municipality where extensive field systems at Saha-Loo (Liivamäe) and Proosa were investigated. The investigations have been published in numerous articles (Lang 1994a-c; 1995) and in a comprehensive monograph by V. Lang (1996b). The second large study combined investigations of field systems and related settlement patterns in the north-eastern part of Estonia where field boundaries and clearance cairns were excavated at Vatku, Tõugu, Ilumäe, Muike and Palmse villages and strip fields at Võhma Tandemäe and Uusküla in 1993–1999 (Lang 1999a; 2000a; 2003).

In addition to the research projects, pressure from the building and quarrying industries led to large-scale investigations at Ilmandu and Muraste villages, west of Tallinn in 2002–2003 (Lang et al 2004:72–83) and later in the 2000s at Saha-Loo and Proosa (Kaldre et al 2010; Lang et al 2005; Lang and Laneman 2006). Quarrying required investigations at Kaseküla in Western Estonia in 1999 by V. Lang (Lang 2000b).

Scientific studies of field systems have also been carried out by Felicia Markus at Einbi village in a Swedish settlement area on the Noarootsi peninsula in 1999–2001 (Markus 2002; 2004). Mati Mandel has continued the occasional excavations of single field cairns in West Estonia (e.g Mandel 2017), although his main research interest has been on prehistoric graves. In northern Estonia a number of field systems, mainly clearance cairns have been excavated by

Gurly Vedru at Muuksi (Vedru 1996:435–436; Vedru 1999:60) and Soorinna (Vedru 1996:435) villages in the surroundings of Lake Kahala and at Kaberla (Vedru 2003a:101; 2003b:327) and Vatku (Vedru 2007). Small scale excavations of field systems have been taken place at Kabala in 1994 (Lang 2007b:98) and Jalase (Heinsalu et al. 1994; Tamla 1994) in Rapla County, and Kutsala in north-eastern Estonia (Reintam and Lang 1999). Mapping and small-scale excavations took place at Rebala, among the excavations of stone-cist graves, in 2004 by M. Laneman (Lang et al. 2001:34–47). Slash-and-burn field layers with no stone structures have been studied by Pille Tomson in South-Estonia (e.g. Tomson 2019). Field layers, mainly marked by ard-marks were excavated under a hill-fort layer at Jägala in North Estonia by Aivar Kriiska (Kriiska et al. 2009). The period between 1992 and 2003 can be seen as the most intensive time of the investigation of field systems. Later, from the 2000s onwards the study of field systems has diminished as the large settlement projects ended and the number of scholars with a specific interest in field systems is rather small.

New field systems have discovered and registered throughout the period which are not only limited to the coastal Estonia as during the previous research period but also further inland. At the moment there are 91 field systems under heritage protection in Estonia and 22 sites listed as known but not yet under protection. In addition, there are tens of field systems which are not under state protection. Some of the information is published but some examples only known based on excavation reports or personal information. Many of the field systems once known are now destroyed. The number of new field systems increases every year because archaeologists (and general public) can use freely accessible LiDAR-based terrain models in the open map of the Estonian Land Board Service where field systems are well visible.

In general, the most important aspect of the study of field systems after the 1990s and especially in the 2000s is that the results were for the first time incorporated into general conclusions about prehistoric agriculture and society. In the general treatments the integration of the results from field systems and interdisciplinary, mainly palynological studies, has been used to give an overview of the developments of agricultural society throughout prehistory. The research has been mostly concentrated and more thorough results have been published about the earlier field systems from the Bronze and Early Iron Ages (18^{th} century BC–5^{th} century AD).

2.4.3 *Study of field systems in Europe*

In the UK, landscape archaeological trends in the study of field systems continued in the 1990s. Air photography was the main survey method and facilitated the survey and mapping of field systems, for example in Bodmin Moor (Johnson and Rose 1994), on Dartmoor where systematic extensive survey of the entire moor was undertaken (Butler 1997) and it also proved useful in remote areas of uplands (Bowden and Mackay 1999) (Johnston 2001:30). The general theoretical move was towards rethinking the role of boundaries in the landscape. Research of linear ditches on Salisbury Plain (Bradley et al. 1994) concluded that the network of boundaries was not constructed solely for utilitarian reason or were not necessarily response to pressures on resources but they were rather markers of territory and limits of domesticated land. The emphasis and interest in social practices and conditions and human-land relations was maintained in the study of field systems throughout the 1990s (Barnatt 1999; Kitchen 2000) (Johnston 2001:33).

In Sweden, in addition to the study of Celtic fields, Late Bonze Age and Pre-Roman Iron Age clearance cairnfields from the provinces of Västergötland ja Småland were found and studied in the 1990s (Widgren 1990:16,18; Jönsson et al. 1991; Mascher 1993). Irregular field systems similar to Estonian Baltic fields were studied near Kräklingbo and Alskog in Gotland (Johansson 1993). In Västergötland strip fields that were previously thought to be merely of historical origin and represent common field systems, were excavated and dated to the early Iron Age (Widgren 1990).

Discovery and study of field systems also took place in the neighbouring countries of Estonia:

- In Finland, only a few prehistoric field systems with stone boundaries have been found and studied in Åland (Huurre 2003:44; Roeck Hansen 1991), southern Ostrobothnia (Miettinen and Vuorela 1988) and in south-western Finland at Salo, Laitila (Roeck Hansen and Nissinaho 1995). Rectangular field systems dated to the Viking Age have been investigated in Rapola, south-western part of the country (Vikkula et al. 1994). Most of the clearance cairnfields have been dated to the historic periods while Iron Age datings have been obtained from Hattula Retulansaari, south-western Findland (Mikkola 2005:50).
- In Lithuania, field systems have mostly been registered in the north-western part of the country, where several clearance cairnfields have been recorded and rectangular fields

dated to the Middle Iron Age (7^{th}–10^{th} centuries AD) and/or the Middle Ages (14^{th}–15^{th} centuries AD) investigated in Padvariai (Merkevičius & Nemickienė 2003:195–196).

- In Latvia, field systems have been found from north-western part of the country, near Valmiera and Limbaži districts (Vasks et al. 1999:301–302) and near Valgale hill-fort (Ritums 2000:44).

In the last decades, methodological and theoretical scope of the study of field systems has expanded. The number of archaeological excavations on field systems has grown because of big development-led projects over large areas. For example in England, in the course of Heathrow Terminal 5 building project, complex multi-period landscape, including field systems, was investigated (Lewis et al. 2006, 2010). In South Yorkshire at Armthorpe, brickwork field system was excavated that was previously known but excavations revealed larger extent and complexity; similar excavations also took place near Doncaster (Chadwick 2013:18–20; Roberts 2008: 192–193). In Östergötland, Sweden large-scale excavations during large road projects were combined with the removal of the plough soil over the full extent of the field systems which allowed to detailed interpretations of the development of field systems (Petersson 1999; 2008).

At the same time there have been smaller-scale studies of field systems that have contributed to the wider understanding of field systems: in Ireland (Jones 1998), Wales (Johnston 2008), Salisbury Plain (McOmish, Field and Brown 2002), Skomer island (Barker et al. 2012), Scilly isles (Breen 2008), South West England (Fowler 2000; Fyfe et al. 2004), Southern England (Yates 1999; 2007) and Derbyshire (Barnatt et al. 2002), to name a few in the UK.

Large amount of research is targeted on specific questions related to agricultural aspects and palaeoecology of field systems, often in conjunction with pedological, palynological and micromorphological studies (Arnoldussen 2008; Arnoldussen and Linden 2017; Lagerås and Bartholin 2003; Overland and Hjelle 2013; Spek et al. 2003) and dating methods (Arnoldussen 2018; Lagerås and Bartholin 2003; Nielsen et al. 2018).

From theoretical point of view, archaeology in general has been influenced by post-processual theories in the last decades, and archaeology of field systems is no exception. Post-processual landscape archaeology (Brück 1995, Tilley 1994; 2004; 2010; Ingold 1993) has influenced archaeology of field systems to a great degree and phenomenological approaches have been sometimes applied directly to field systems (Bender et al. 2007; Breen 2008). Post-processual ideas also had an effect on the study of boundaries that were now seen to have a wider meaning than just functional: e.g. building of boundaries representing unified communal actions, meaning they had a social meaning for groups of people (Johnston 2005; Chadwick 2008a), boundaries as representatives of tenure (Wickstead 2008b) and commemorative meaning of boundaries in the landscape (Gosden 2013).

A range of subjects is related to agricultural strategies and intensification (Fokkens 1998; Yates 2007), land allotment, tenure and ownership rights (Gerritsen 2003; Johnston 2005; Wickstead 2008b), dynamics of field systems, their reorganisations, extensions and discontinuation (Brück et al. 2003; Nielsen and Dalsgaard 2017), including questions of planned layouts vs. gradual expansion of field systems (Johnston 2005; Chadwick 2008b; 2013).

2.5 Themes in field systems` research: distribution, chronology and function

The sustainability of field systems has never been a targeted research subject in Estonian archaeology. The way researchers have understood it can be deduced from the way they have interpreted field systems in their other works. As the location and organisation are the main means used to investigate the sustainability of agricultural landscape in the present research, the current section reviews how the distribution of fields and their characteristics (types, chronology and function) have been covered and interpreted in previous research. The section covers and combines the two main periods of archaeological research in Estonia: the Soviet Period and the research after the 1990s which is complemented with the wider European research.

2.5.1 Location and distribution of field systems

The distribution of field systems can be compared with environmental factors and in relation to other known sites and monuments. The connection with environmental conditions has been covered more thoroughly in Estonian archaeology and it has been seen as the main determinative factor behind the spread of field systems. The relations between other archaeological sites and fields has remained more hypothetical because of the scarcity of archaeological excavations and dates from field systems.

During the Soviet period it was noticed that the field systems were distributed in the same areas where agricultural settlements were thought to spread from during the last quarter of the 1st millennium BC. The areas of agricultural settlement were mainly distinguished by and equated with the distribution of stone graves. The newly discovered field systems in the same areas as the graves seemed to complement the picture. These areas were mostly situated in coastal northern and western Estonia where the light and thin but at the same time fertile soils (rendzinas) were spread on the calcareous (limestone) bedrock.[8] These soils were considered to have been easier to till with primitive agricultural tools and therefore more suitable for early agriculture compared to the heavier soils in the inland areas and South Estonia (Jaanits *et al.* 1982:170, 197; Lõugas 1980:53; Lõugas 1992:65). It was also assumed that these areas were already then either covered with sparse forests or lacked forest cover altogether, so it was easier to clear the land compared to thick forests that are typical to inlands and Southern Estonia (Lõugas 1980:53).

Another consideration for the flourishing of the early agricultural settlement in northern and western Estonia was the milder maritime climate in coastal areas. Based on modern parallels, it was stressed that on the coast, the temperatures were more even, and growing seasons and periods without snow and night frost lasted longer (Jaanits et al. 1982:170).

As to the location of field systems in relation to archaeological sites other than stone graves, conclusions on that were rather short and speculative because of the shortage of excavations and information about settlement sites and field systems. Lõugas (1992:70) made an attempt to connect the excavated field systems at Kõmsi with the nearby *tarand*-graves[9] but it was only based on similarities between a few pieces of pottery. Based on the distribution of monuments and field systems close to historic villages, it was assumed there was settlement since the beginning of permanent agricultural settlement, and that throughout this time field systems were located immediately around or next to settlements (Lõugas 1992:65–73).

[8] Lõugas (1980:57) mentions that there are exceptions from this rule but doesn`t explain on what basis he has concluded this.
[9] See 4.4.3 for the definition of tarand-graves.

As the amount of recorded field systems grew after the 1990s, more research on the location and distribution of field systems emerged. Based on new archaeological data that was combined with the results of palynological analysis, it was possible to shift the beginning of agricultural settlement much earlier than it was previously thought: the first signs of farming economy in palynological data appear during the Middle Neolithic (ca 4000BC) and show that the processes were the earliest in western Estonia and the islands (Poska et al 1999; Veski 1998) while the final transition took place by the beginning of Late Bronze Age (1100BC) (Lang 2007b:33–36). The earliest radiocarbon samples from the Saha-Loo field system have been dated to the same period (Lang 2007b:98–101; Lang et al. 2005). Most of the new field systems that were discovered were still distributed mainly in the coastal areas of northern and western Estonia, although fields (clearance cairns) were also found further inland. The distribution of the earliest types of field systems (early clearance cairns, Baltic and Celtic fields) was seen to be limited to areas where limestone bedrock was close to the surface and the soil cover was extremely thin, ca. 20–30cm. The typical soils in these areas are rendzina soils which are stony and vulnerable but also rich in humus (Reintam and Lang 1999). Nowadays in Estonia these areas are called alvars or *loo* areas and are characterised by distinctive plant communities which have developed through long-term human impact (e.g. Helm et al. 2007); often they are also being referred to as semi-natural communities (e.g. Pärtel et al. 1999).

The transition to farming at the end of the Neolithic and the beginning of Bronze Age (ca. 1800BC) was seen as being determined by environmental factors: suitable land (thin rendzina soils in the coastal zone) conditioned the location of settlement. At the same time, the reasons behind the establishment of first field systems were connected with social factors. Lang (2007b:113) has proposed a theory that by the Late Bronze Age growing population and the exhaustion of rendzina soils led to a shortage of agricultural land. Land became a subject of private ownership and permanent structures like stone graves and field systems were established to signal that land was the property of a certain family. These territorial strategies were not necessary in inland regions where there was plenty of land and therefore there was no need to establish such monuments, which would also explain the lack of field systems in these regions. According to Lang (1995:164; 1996:468, 495) around the beginning of the Roman Iron Age (50AD) the land exhaustion in some places in northern Estonia conditioned just the expansion of arable land (field systems) while in other locations where the shortage of land was extreme, people had to move further inland to areas with heavier soils. Referring to Randsborg (1991:23, fig. 13), Lang (1996b:495) also points out the possibility that the abandonment of fields could have been related to warming climate around the 3rd century BC which brought along increase in rainfall which was detrimental for the delicate rendzina soils. The last shift of the agricultural settlement has been seen connected with the emergence of villages at the same places where they mostly are today, as opposed to the earlier single-farm based settlement. Based on the investigation of strip fields, which have been considered as signs of communal land division, Lang (1996b:496; 2000) has dated the shift in a period between the 7th and 10th centuries AD. Based on the excavation results from settlement sites Tvauri (2012:315) argues that the link with specific historic villages can be only dated to the 11th century.

As to connecting the fields with other monuments, the most thorough attempt to see field systems, settlement sites and graves as a whole, has been made in a monograph by Lang (1996b) where he tried to distinguish different internally linked settlement units or areas inside a wider region in North Estonia. In areas where field systems had been investigated in addition to other sites it was possible to see temporal links between them. However, the more specific questions of where did people live who used the fields and where did they bury their dead, for example, remained unanswered, mainly because of small number of archaeological excavations and therefore the lack of solid proof in archaeological material. Just like during the previous research period, the distribution of many field systems in the same areas with and often in immediate vicinity of stone graves and cup-marked stones was noticed by Lang (e.g. Lang 2007b:115). However, in places where both the field systems and graves were excavated (for example at Rebala and Ilmandu), the results showed that the graves were earlier than the field systems, in some cases (Uusküla, Tõugu) even by ca. 1000 years (Lang 2007b:115), hence, their distribution could not be equated, although it was still in some cases (Kabala) brought out as hypothetical option that they could be contemporary (Lang 2007b:115).

Ideally, we would wish to understand the relationships between the field systems and the populations that lived in and used the fields. Settlement sites close to the fields should be investigated but in most cases it has not been done. In most cases the search for settlement sites that could be connected with specific field systems have been unsuccessful (e.g. Lang 1995:156–157). Detecting settlement layers is difficult in Estonia because earlier settlement sites have not left any visible traces in the landscape and therefore their detection is usually random. On the other hand, the later settlement sites are in most cases located in the same areas as the modern villages which also makes their detection and investigation difficult.

In addition to the difficulties in the study of settlement sites, it can also be said that because the research of fields systems has been concentrated on wider and more general aspects of settlement and society, the specific connections between field systems and other sites has been secondary. The latter would also require more detailed and targeted investigations in a specific smaller location along with extensive dating series. Such work has been done for example in Hamneda, southern Sweden (Lagerås and Bartholin 2003) where it was possible to detect short-term phases and local-level land use strategies.

2.5.2 Structure and age of field systems

During the 1970s and 1980s the main differences in the organisation and structure of field systems were not emphasised. The only distinction that was made was between clearance cairnfields and fields where rectangular plots were bordered with banks.

Most of the investigated field remains of that time were dated to a rather narrow period from the end of the 1st millennium BC until the first centuries AD. However, it was admitted that this dating does not necessarily reflect the actual period of their use and some of the fields might belong to either earlier or later periods (Lõugas 1992:73). In a couple of cases (i.e. Ellamaa and in some parts of Kõmsi field system) it was considered very probable that the investigated clearance cairnfields belonged to either Late Iron Age (12th–13th centuries) or even to historical period (Mandel 1981; Lõugas and Selirand 1989:118; Lõugas 1992:70). However, the considerations about the age of field systems remained largely speculative as the dating relied mostly on the occasional finds from the clearance cairns or field banks. Radiocarbon dating of charcoal found between the stones of the field remains was used only in a few cases (Lõugas and Selirand 1989:152). Some conclusions about the age of field systems were also made by analysing their location in connection with other nearby monuments, in most cases graves.

After the beginning of 1990s and more intensive studies of different types of field systems, a general typology and chronology of field systems was established by V. Lang (e.g. Lang 1996b). From now on, the dating of field systems relied on radiocarbon dating of charcoal from the field banks and cairns that was associated with the first clearance of land with fire (Lang 1995a:149; Lang 2007b:97). The typology and chronology established by the end of 1990s has continued in use with recent general treatments. In general, three main types of field systems are identified in Estonia: clearance cairnfields, fields with rectangular plots and strip fields.

Clearance cairnfields were field systems that consist mostly of cairns, although there might be shorter segments of banks or elongated cairns among them as well. Clearance cairnfields have been excavated at Iru (Lõugas 1976) and near villages Ilmandu and Muraste (Fig. 2.2) in northern Estonia (Lang et al. 2004) and at Kaseküla (Lang 2000b) and Kõmsi (Lõugas 1972; Mandel 1982a) in western Estonia. Field plots were not marked in the landscape with long-lasting boundaries. It is possible there were wooden fences around the plots (Lang 2007a:293; Lang 2007b:96) as these would be hard to detect. Rows of post-holes have been recorded on top of field banks in Denmark and Netherlands and have been interpreted as signs of former fences (Klamm 1993:67) and around fields at Saltvik Borgboda in Finland (Huurre 2003:44). Holes between stones of field banks were hesitantly interpreted as post-holes at Saha-Loo (Lang et al. 2005b:6) but the evidence remains unproven.

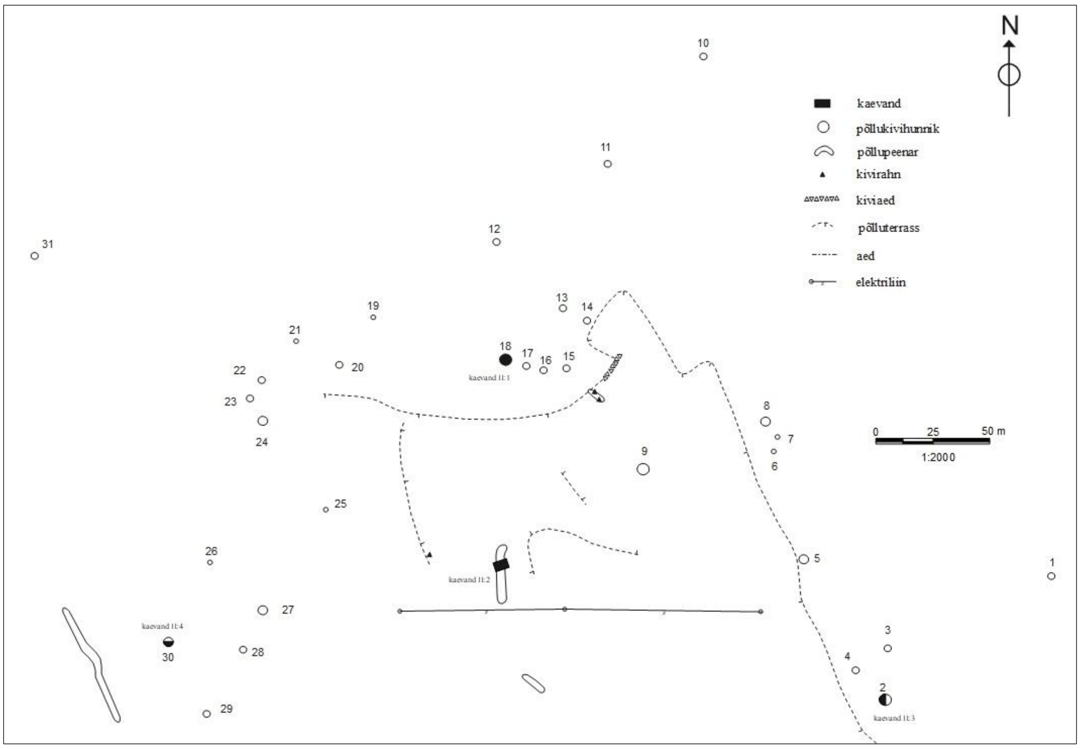


Figure 2.2. Cairnfield at Ilmandu (Lang et al. 2004).

The other explanation to why the banks did not form or develop has been that the position of the plot was changed regularly and there was not enough time for the boundaries to develop

(Lang 2007a:293; Lang 2007b:96). However, these explanations carry a deterministic undertone, as if the ultimate goal would always be the bounding of the field plot. I am not trying to undermine the necessity for barriers around cultivated land but the above demonstrated explanations would exclude the possibility that the land might have had either different agricultural functions where the bounding of the plot was not of ultimate importance, or that the cairns were not always necessarily assembled at the edges of the field plots.

Early field systems with rectangular plots have been referred to as either Baltic (similar fields have called Pre-Celtic fields in Denmark, according to Nielsen 1984) or Celtic fields in Estonian archaeological literature. The so-called Baltic fields had irregular plots that have so far been investigated only at Saha-Loo, near Tallinn (Fig. 2.3). The size of the field plots (Fig. 2.4) was 143–920m^2, the average being 361m^2 (Lang 1995:144; Lang 2007a:297; Lang 2007b:100). The field system at Saha-Loo was established during the Middle Bronze Age, as indicated by the earliest radiocarbon dating from the 14th–11th century BC. The rest of the dates fall roughly into a long period from the 10th century until the 3rd century BC (Lang 2007a:299; Lang 2007b:101). It is assumed that some other similar irregular field systems in northern (e.g. Lilli and Saue in North Estonia), north-eastern (Ojaküla) and possibly in western Estonia might also date to approximately the same period (Lang 2007b:101).

Figure 2.3. Field systems at Saha-Loo. Left: original mapping of the whole area from 1994 (Lang 1994b); right: LiDAR relief model showing more detail (LiDAR data: Estonian Land Board 2020).

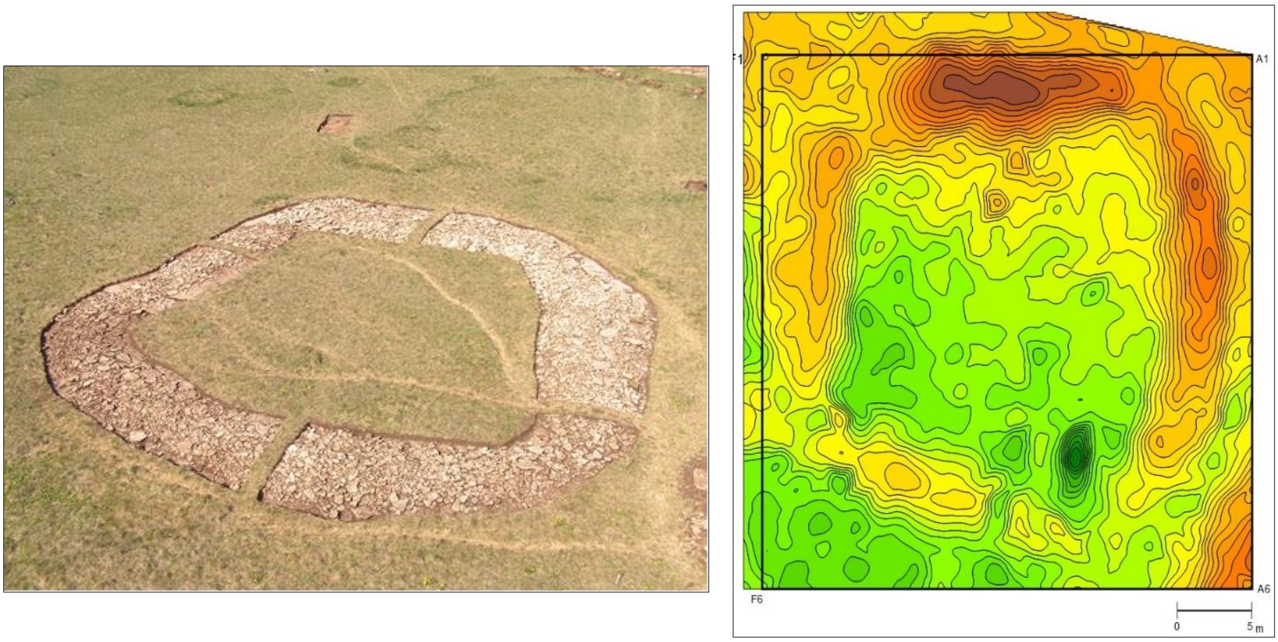


Figure 2.4. Banks of a field plot (no. LVII) were fully opened and excavated at Saha-Loo (left) with detailed mapping of the plot (right) (Drawings after Lang 2005).

The early field systems with more regular layout (Celtic fields) have been investigated at Proosa (Fig. 2.5) and Rebala (Fig. 2.1) in North Estonia. The size of the field plots was similar to the Baltic fields. At Proosa, the size of the plots was 195–696m^2, the average being 390m^2 (Lang 1995:150; Lang 2007a:302; Lang 2007b:103) and at Rebala[10] the maximum size was 400m^2 (Lang 1996b:486). The former complex was dated from the 6^{th}–5^{th} century BC until the 1^{st} century AD (Lang 2007a:302; Lang 2007b:103) and the fields at Rebala to the 1^{st} century BC–1^{st} century AD – to the late Pre-Roman Iron Age (Lõugas and Selirand 1989:152; Lang 2007a:303; Lang 2007b:104).

[10] 6–7 field plots were recorded at Rebala with the measurements being ca. 15–25 x 12–16m (Lang 1996b:486).

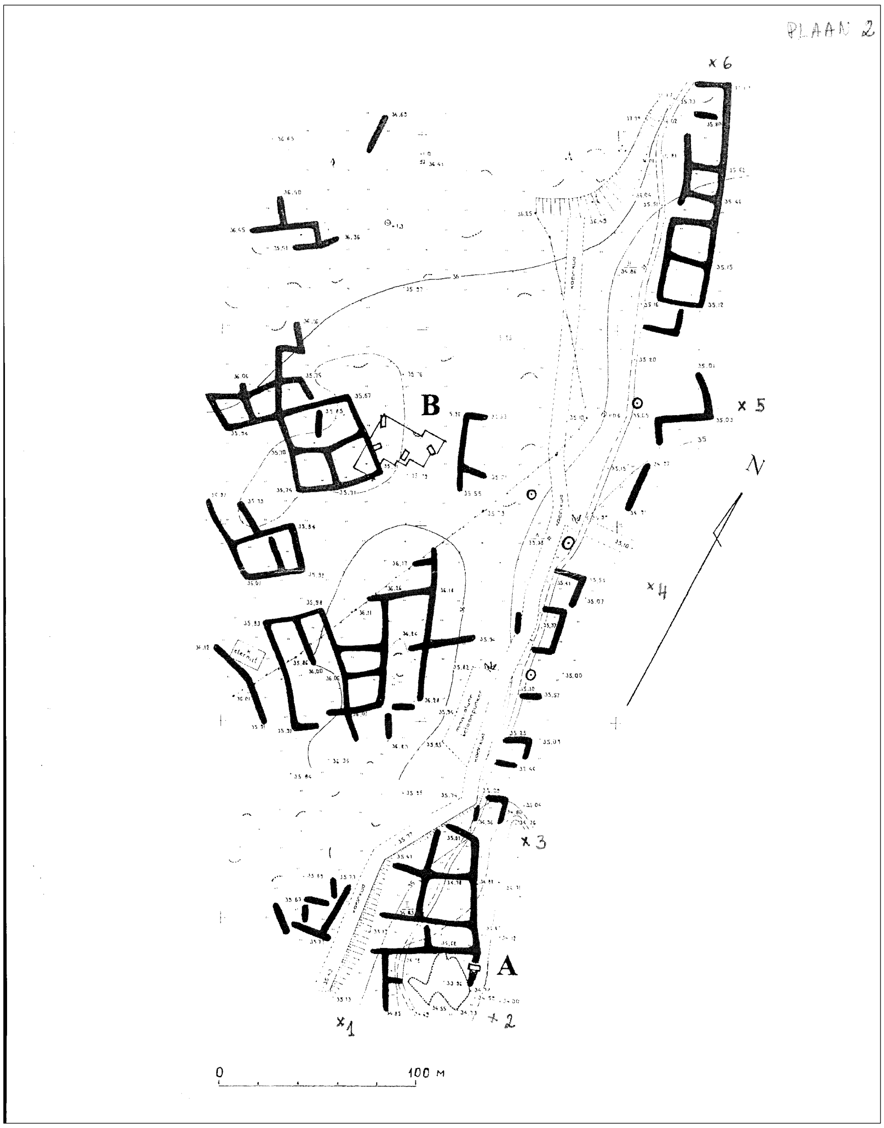


Figure 2.5. Celtic fields at Proosa (Lang 1994c).

For the formation of Baltic and Celtic fields an “ideal” model (Fig. 2.6) was proposed by Lang (1995:146–147). According to Lang’s model, after the clearing of land with fire, stones were cleared into heaps which were randomly placed on the fields. Over the years the heaps became larger and elongated as more and more stones were cleared. During the following stone clearance and cross-ploughing technique that was used, rectangular plots formed between the cairns. The model shows that the whole system was not planned and therefore has an irregular layout. At the same time Celtic fields with regular layout were planned and potentially marked in the landscape from the beginning. In the case of fields where the cairns were positioned in straight rows and combined with short fragments of banks have been seen as indicators of “undeveloped” systems, reflecting a short-term cultivation of an area which resulted in a system that was incomplete (Lang 1995:147; 1996b:485).

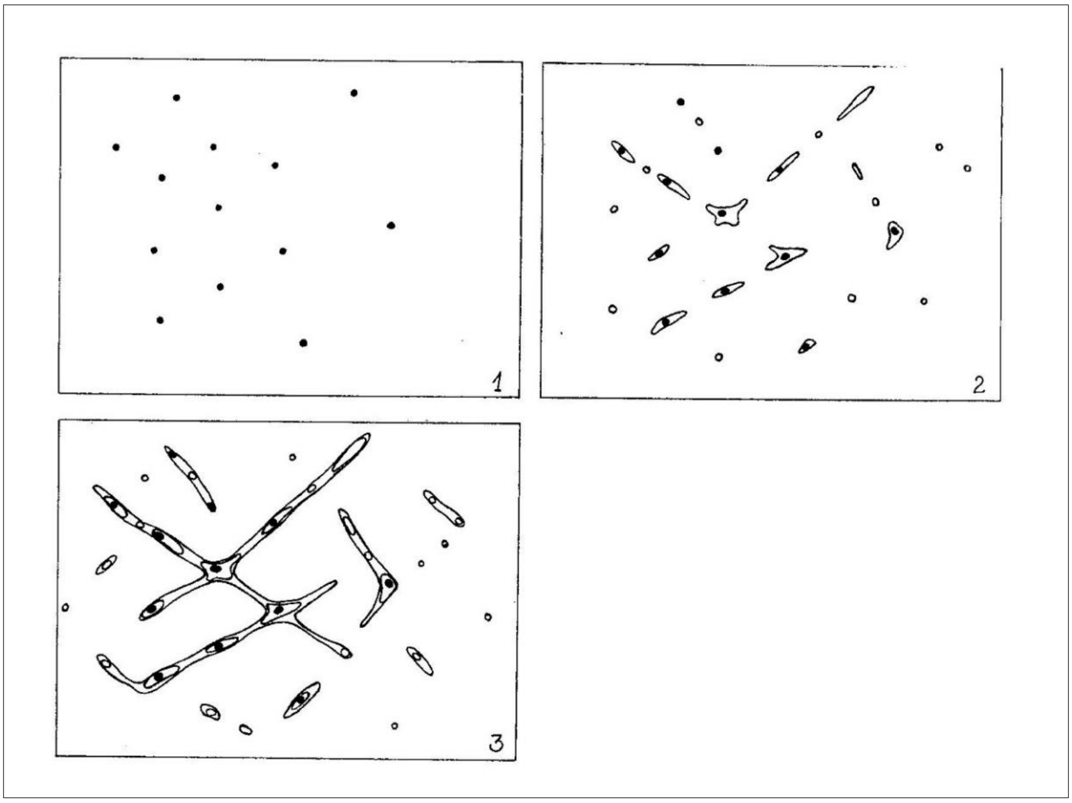


Figure 2.6. Simplified scheme for the formation of Baltic field systems. 1 – clearing of stones into cairns; 2 – development of elongated cairns and short banks; 3 – development of plots (Lang 1995:146, fig. 4.).

The reason why the plots took a rectangular shape was explained by Lang (2007b:100) as the consequence of ploughing with a primitive crook ard which did not turn the soil around, so that the land had to be ploughed crosswise at least twice. In that way rectangular plots evolved over a long period of continuous ploughing (Lang 2007a:312).

Later quadrangular fields (called block-shaped fields in Estonian archaeological literature), either with irregular or regular layout, are similar to the earlier Baltic and Celtic fields, except for their size (Lang 1996b:487–488; Lang 2007b:102). At Ilmandu in Northern Estonia, a field complex (Ilmandu I) was investigated where rectangular plots of different sizes and probably of different ages were recorded (Fig. 2.7). Some of the larger plots, with the size up to 1434m^2 were excavated and dated to the 17th–18th centuries. Smaller rectangular plots adjacent to them, with the size of ca. 629m^2, were not excavated but it was assumed that they represent a younger system (Lang 199ba:489; Lang 2007a:305). A large multi-temporal quadrangular field system with various sizes of plots is mapped (but not excavated) at Mustjala Võhma (Fig. 2.8) on Saaremaa island, which, based on landscape stratigraphy might reach back to the Bronze Age (Lang 2007a:305) or according to the general chronology of the development of field systems (e.g. Lang 1996b:498–499) at least to the Middle Iron Age; however, the fields were also in use in the 19th century[11] (Troska 1987, fig. 5). The historic rectangular field systems were distributed everywhere in Estonia even up to the end of the 18th century and the beginning of the 19th century, some of which had a regular layout and some were irregular (Troska 1987:33). Although there has not been much archaeological investigation of the possible prehistoric quadrangular field systems that are larger than the earlier ones and could originate from the later periods of prehistory, it has been suggested by indirect[12] evidence that a lot of them could date from the Middle Iron Age (Lang 2007a:204–306).

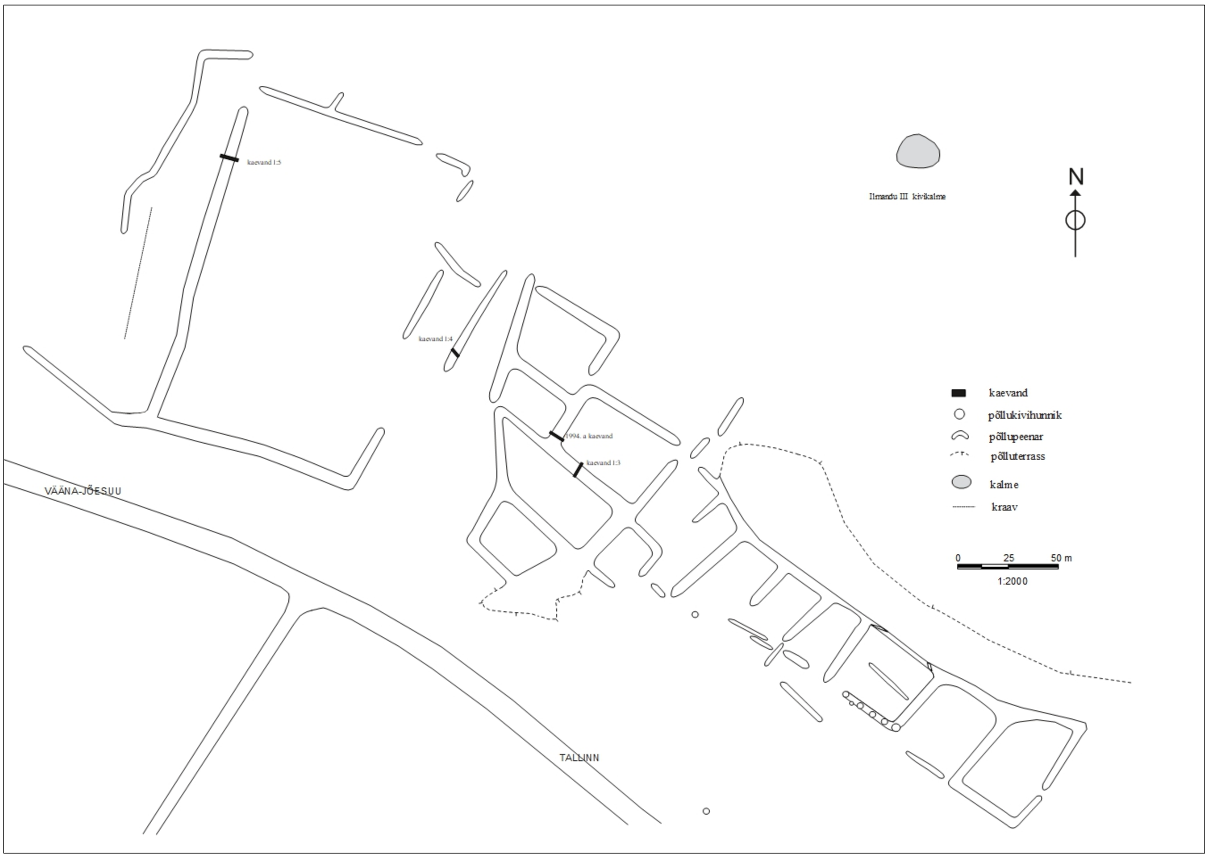


Figure 2.7. Late quadrangular field system at Ilmandu (Lang et al. 2004).

[11] A lot of these kinds of fields have been depicted on the maps from the 17th–19th centuries (i.e. Troska 1987, fig. 2, 3 and 5) but they might originate from the earlier periods.
[12] The so-far investigated field systems of this type have either not been preserved in a way that the rectangular plots are visible, or the radiocarbon dates have been obtained from adjacent clearance cairns instead of the banks.

Figure 2.8. Field systems at Võhma, Saaremaa (Estonian Land Board 2021)

Strip fields consist of long and straight parallel wedges of land of various size which can sometimes be divided into smaller plots of land or crosswise strips (e.g. Troska 1987:36, 42, 46). It was thought that they did not evolve before the 15th–16th centuries (Tarvel 1992:185) but the archaeological excavations have proved that the earliest ones actually date from ca 7th–8th centuries (Lang 1996b:490), the Middle Iron Age. These earlier dates have been obtained from the excavations of field systems at Võhma Tandemäe and Tõugu in northeastern Estonia. There are also strip fields that are dated to the later phases of Iron Age. For example, at Uusküla, North-Eastern Estonia, the field was divided into strips with long banks (from 250m up to 640m in length), the width between which was 70–90m. The strips were separated into narrower plots by smaller banks, lynchets and ditches. According to the radiocarbon dates, the field system was established at least in the 10th–12th centuries AD but the cultivation continued on the same fields until the 20th century (Lang 2007a:307: Lang 2000a:238–241). About 30km eastwards, at Kutsala (Fig. 2.9), a strip field system has been mapped where ca. 400m long strips border ca. 25–35m wide prolonged plots which were occasionally divided into smaller crosswise units (at least one of which measured ca. 2500m^2. In addition to that, some quadrangular fields were located in one corner of the field system where the plots that were more completely bordered to allow definite measurements, had the size between 26 x 74m (1924m^2) and 45 x 100m (4500m^2). The described fields were partly overlain with a later historical strip field system where the strips were more than 600m long and the distance between the long banks was ca. 70m. A small-scale trial excavation in 1996 did not reveal reliable dates of the earliest field systems[13]. A fragment of a strip field was also recorded at Ilmandu, next to the quadrangular plots mentioned earlier. The width of the plots between the banks and ditches was from 11m to 16m and the radiocarbon date beneath one of the banks indicates the use of these fields in the 11th–12th centuries (Lang et al. 2003).

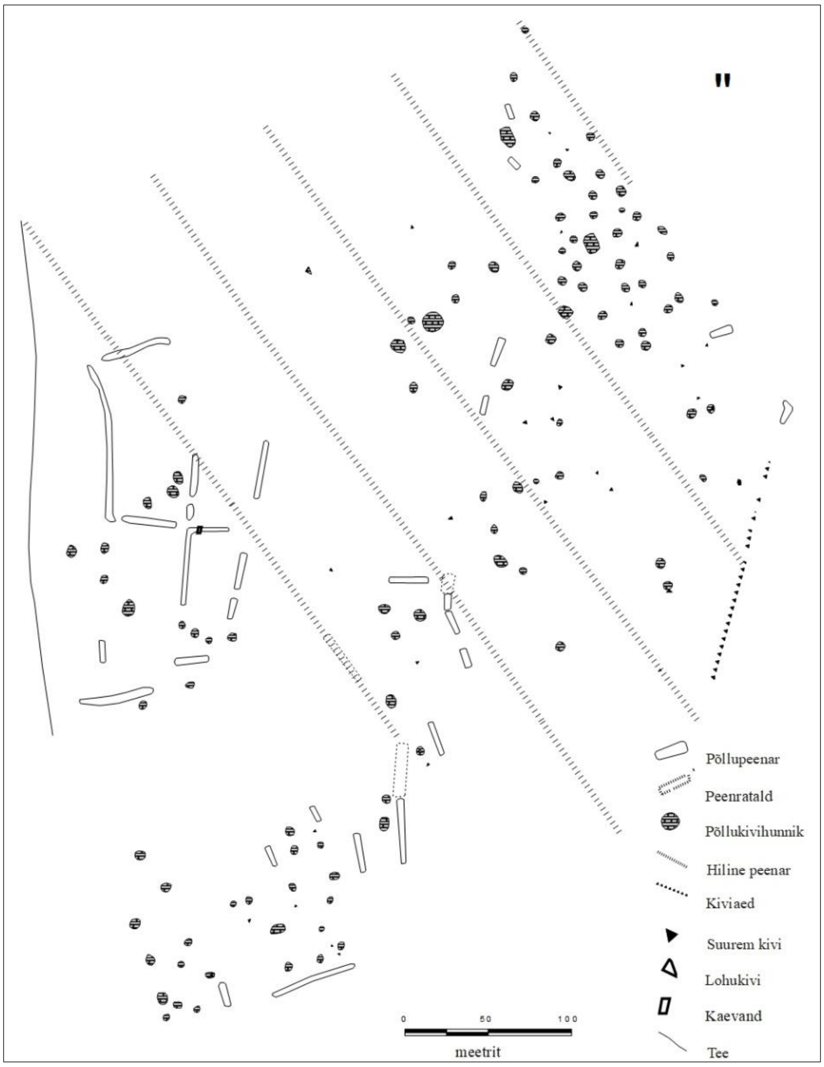


Figure 2.9. Strip Fields overlying an earlier field system with rectangular plots at Kutsala.

[13] One radiocarbon date that was obtained from the charcoal under one long bank was dated to 2140±60 but the find context is somewhat unclear and cannot be used for solid conclusion about the dating of the field system (Lang 1996:490).

In addition to the main typology of field systems, a separate land-use system is known from historical sources – the so-called forest or brushwood fields (*võsapõllud*). It was in use as an alternative system to permanent fields at least until the beginning of the 20th century. These were slash-and-burn fields further away from the villages and village fields, usually in forested marginal areas. In cases when the lands were stony and stone clearance was needed, the stones were usually cleared to heaps and no borders were constructed (Lang 2007a:309–310). Forest fields with clearance cairns have been only studied in 1993 at Jalase (Rapla County) where 66 cairns were mapped in an area of 200 x 150 (Fig. 2.10) and the excavations proved that the fields were in use during the 14th–16th centuries (Heinsalu et al. 1994). Since in many cases the known clearance cairn fields are situated in forested areas, it is possible that some of these systems represent forest fields of medieval or historical date. At the same time, some of the prehistoric cairnfields might be related to similar alternative farming system that was in use alongside the permanent fields.

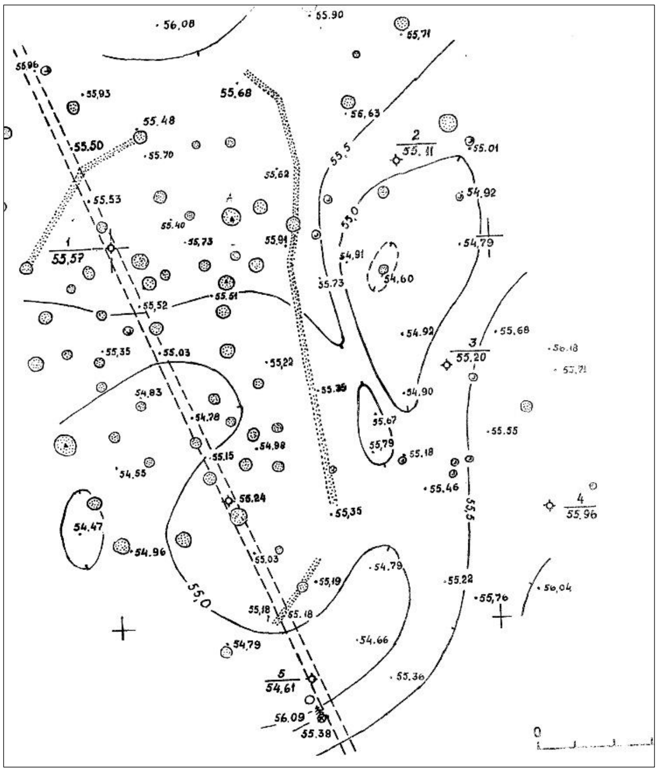


Figure 2.10. Forest fields at Jalase (Heinsalu et al. 1994).

2.5.3 Function of field systems

In the 1970s and 1980s, questions about the function of field systems were not addressed prior to the discovery of the Celtic fields at Rebala. The fact that the stones from the fields had always been cleared was also taken by default and there were no questions about what triggered the need to start clearing the fields of stones. Even after the investigations at Rebala, the analysis of the functional meaning of the fields systems – what processes might have been behind their establishment, what was their purpose in agriculture and did they have any social roles – remained quite modest.

Stone clearance was seen as the main impetus for the establishment of field systems in northern and western Estonia where the rendzina-soils were very stony. Clearance cairns were thought to represent the places where stones from the fields were thrown and their size and density was seen to depend on the abundance of stones and throwing range (Lõugas 1980:60). The necessity for the need to clear the land from stones in prehistory was not doubted. The stoniness of the soils in North and West Estonia and the islands was a well-established fact and stone clearance in these regions was historically regarded as the oldest, most important and labour-intensive method of land improvement (Tarvel 1992:153; Ligi 1963). Therefore, the emergence of field system was explained as being mostly influenced by the need for stone clearance.

Field systems were primarily associated with cereal growing and the dominant agricultural system in northern and western Estonia from the Early Iron Age onwards was believed to be fallow cultivation – after some years of use, fields were left fallow while the soil structure recovered. It was believed that fallow land was used as pasture, which manured the land and helped to restore the soil fertility. Therefore, fallow agriculture was seen to evolve more quickly in areas where there were favourable conditions for cattle breeding, which were mostly in western and northern Estonia (Jaanits *et al.* 1982:198). The role of cattle-breeding was seen as an even more important part of agriculture from the Middle Iron Age (5^{th} century AD) onwards (Jaanits *et al.* 1982:301). During the Late Iron Age (9^{th}–13^{th} century AD), permanent fields and regular manuring along with the development of historically recorded three-field-rotation was seen as becoming dominant all over Estonia (Jaanits *et al.* 1982:389).

The only agricultural change that could be associated with the emergence of field systems was the transition to fallow agriculture. The changes in agriculture after the 5^{th} century were based on general interpretations of field systems and not connected with physical field systems as none of them were dated to that period. There also was not any consideration of the social factors behind these processes. One of the reasons why there was so little attention to these aspects was the small number of investigations of field systems and insufficient ability to interpret the available archaeological evidence about prehistoric agriculture in conjunction with the results from the studies of field systems. Therefore, it can be said that the studies of field systems in the 1970s and 1980s remained in a preliminary stage. However, the foundation was for to the analysis of general patterns in prehistoric agricultural settlement that also had a major influence on subsequent scholarship.

After the 1990s the function of field systems was approached from two levels. Firstly, the establishment of field systems was associated with social functions related to territorial control and land ownership. Secondly, the assumptions about the agricultural functions attributed to field systems during the 1970s and 1980s were elaborated.

Different agricultural functions have been associated with field systems. The question of what was grown on the fields has often remained an unanswered question in Estonian archaeology. The direct finds of cereal grains from banks and cairns have been occasional[14]. Palynological analysis from lakes and mires near the field systems give indirect evidence about what crops were grown (e.g. Veski and Lang 1996a; 1996b; Veski 1998) in prehistory but direct pollen samples from field banks and cairns have not been used in conjunction with archaeological excavations. Charred cereal finds from the settlement layers and their imprints on pottery (e.g. Indreko 1936; Schmiedehelm 1939; Vassar 1939; Schmiedehelm 1959; Valk 1994:388; Konsa et al. 2002:76) is another type of evidence about the plants that were grown. In general, it has been ascertained through cereal finds and palynological studies that barley (*Hordeum*) was the most common cultivated crop in Estonia throughout prehistory, along with wheat (*Triticum*) and to a lesser amount oat (*Avena Sativa*) (Poska et al. 2004; Lang 2007b:33). The cultivation of rye (*Secale Cereale*) that later became a common crop started in ca. 6th century AD (Poska et al. 2004:47; Poska and Saarse 1999; 2002a; 2002b; Veski 1998).

Pieces of charcoal from the field banks and cairns have been associated with the first clearance of land with fire (Lang 1995a:149; Lang 2007b:97). Although slash-and-burn agriculture is known to spread in Estonia up until historic times, especially in South Estonia (Öpik 1992:

[14] Cereal grains were found from excavations at Kaseküla (Lang 2000b:76) but there is no information about other instances.

328–329), it has been doubted that it could be used as a permanent strategy for fields in the coastal areas where the trees probably did not recover on thin soils (Lang 1996b:491). However, charcoal is usually found all through the banks and cairns and is often dated to different periods which suggests that fire continued to be used to some extent after the initial land preparation. Based on ethnographic parallels (Öpik 1992:330–331) and results from Sweden (Arnberg 2005:12) it is possible that the trees and bushes might have been gathered and burnt elsewhere near the fields and it was the ash that was brought into the fields as a fertiliser. However, the option is opposed by the view by Ligi (1963) who states that ash as a fertiliser would not be beneficial on calcareous soils.

The main agricultural system proposed for the earlier types of field systems (early clearance cairnfields, Baltic and Celtic fields) continued to be fallow agriculture (Lang 2007b:114). According to Lang (1996b:490–499; 2007b:114) the land use was unambiguously extensive at least up until the shift to the use of historical village fields and was characterised by long fallow periods during which the fields were used for animal herding, which contributed manure while letting the land rest. In his later studies Lang (2007a:314) associated the later quadrangular fields and strip fields with the emergence of the village communities and communal land distribution based on strips or plots of land which means that the shift to less extensive forms of agriculture probably happened already during the Middle Iron Age. The studies of these later systems have not been as thorough as the earlier types of fields but supposedly they represent permanent fields with two- or three field rotation similar to the historically known fields (Lang 2007a:309).

The most obvious agricultural function of field systems in general and field banks specifically are related to the bounding and limiting of areas of agricultural land. Lang (1996:493; 2007a:312; 2007b:114) sees the development of banks in case of early fields, i.e. before the more carefully planned Celtic fields, as a random consequence of ploughing and stone clearance but according to him farmers must have soon seen the other benefits and functions of the banks: as boundaries between arable fields and pasture or between different types of crops, as a way to keep animals away from the crop but also as walkways between plots while the crop was growing, protection against erosion and deflation. He also emphasised that the formed plots could have been used for measuring for example the amount of time a certain job on a plot required or the size of yield a plot provided. One of Lang`s hypotheses is that the measurability gave the ruling class an opportunity to start imposing taxes on land (Lang 2007a:313;

2007b:114–115). Hence, the planning and deliberate size of Celtic fields must have been something that was brought into effect by an elite class to tax the land.

Clearance cairns could have equally have marked the plots of land but additional functions have been attributed to them as well. For example M. Petersson (1999:68) has suggested, based on Swedish field systems that clearance cairns could have been used as places where people cooked their food while working in the field (which would explain partly the existence of charcoal, at least in some cases). Jarva (1987:102,107) has written how clearance cairns help to accumulate the heat and keep the soil temperature on the fields. The same idea has been presented by Lagerås (1996) who analysed fireplaces near clearance cairns.

A specific function that can be attributed to field systems is their use as pasture. In Estonia, it has been usually seen as a secondary role of the fields. Firstly, within a fallow system the fields were periodically used for keeping the animals. Secondly, in some places (e.g. Saha-Loo) long and narrow parallel banks have recorded that have been interpreted as cattle paths. At Saha-Loo the width of the path was 3.2m (Lang 1996b:257) and the excavation revealed a later dating (ca 2000BP) to the earlier (Baltic) fields at the same location (Lang 1995:149–150; Lang 1996b:258; Lang 2007a:300; Lang 2007b:101). The option that cattle breeding might have been the primary function behind some of the field systems has not been considered, even though the bigger role of animal husbandry in West Estonia, for instance, had already been emphasised in earlier archaeological treatments (Jaanits *et al.* 1982:301) and historical sources from the 13^{th}–16^{th} centuries (Ligi 1992:154–156).

Direct evidence about what social and agricultural roles the field systems might have had are difficult to find and a lot of the ideas can be considered hypothetical. The fact that many researchers have pointed out that stone clearance was not absolutely necessary for primitive agriculture (e.g. Szabó 1980:6–8) paves the way to a discussion about why field systems were established in the first place. When approaching field systems from a wider perspective and seeing them as arenas for various agriculture-related activities where different functions could have been combined, the above investigation results, ideas and hypothesis become even more relevant.

2.6 Conclusion

In this chapter I have given an overview of previous studies of field systems in Estonia and beyond. I started with a chronological review of how the investigation of field systems has developed in Estonia and connected it with a general background of Estonian archaeological research. Three separate periods in the study of field systems can be distinguished in Estonia. The first stage in the 1920s was marked by the first recognition of field systems while during the second period in the 1970s and 1980s (the Soviet Period) the excavation of field systems started and first treatments on the subject were published. The period when most of the research of field systems has been taking place started in the 1990s. Since then the results of numerous investigations have been published and integrated into general overviews of prehistory. Overview of the research of the field systems elsewhere in Europe was given after each stage.

Although the number of excavations has been seemingly sufficient in the recent decades, most of them have been small investigations of only a few cairns or banks. The large-scale research projects have contributed a lot to the development of general treatments. However, investigations targeted at more specific questions would contribute to understanding differences, rather than just similarities in land-use practices across different time periods and locations. The research situation has also been affected by the fact that only a few archaeologists have specialised in the study of field systems.

After the historiographical overview of the main investigations and general results, I moved on to addressing the subjects related to my own research questions more specifically. The subjects in question – the distribution of field systems in the landscape and their types, chronology and the functions attributed to them – form the background to the wider concept of sustainability:

In the section where I reviewed how the location and distribution of field systems has been presented and interpreted in previous research, I reached the conclusion that during the research period in the 1970s–1980s the distribution of fields was mainly seen as being conditioned by natural factors. This environmentally deterministic view was opposed during the recent research phase when social and territorial considerations were put forward when explaining the establishment of fields marked in the landscape. The approach was still strongly affected by treating the environment as a determinative factor. The connections between fields and other archaeological sites remained modest throughout both of the periods.

After that I introduced the typological chronology of prehistoric field systems in Estonia. The section is important as background for my thesis as the previous research of field systems, especially the work of V. Lang has strongly affected my development as a field system researcher. I think that the previous research has not been sufficient to explain the wider importance and dynamics of field systems but the established chronology and typology along with the general view of main developments throughout prehistory forms a solid basis for the future studies. Even typology on its own can be used as a static tool, if we do not assume it explains the way fields were used or connected with other activities.

In the final section I talked about the ways that the different functions of field systems have been addressed. Most of the function-related questions have not been a subject of thorough treatments in the past. It can be said that from an agricultural point of view, fields have been treated by the previous researchers as just places where crops were grown and that were ideally bounded with banks. Clearance cairnfields which did not have visible boundaries were occasionally not even considered as “proper” fields. Even when the possible various functions of field systems were acknowledged or noticed, they were only mentioned and not analysed. In that way, field systems were seen as static entities and not active components of the past landscape.

In conclusion, it can be said that the study of Estonian field systems throughout the research periods, has been a couple of decades behind from the main developments in Europe, especially the UK. The conclusions about the typology, chronology and related general aspects of prehistoric agriculture that were reached elsewhere by the 1970s, were only established by the end of 1990s in Estonia. This is explainable by the general developments in the society, mainly the 50 years of Soviet time when Estonian archaeology operated in a relative vacuum from the European research environment. The time lag is already visible in the 1920s and 1930s when important discoveries were made in the UK and Netherlands thanks to aerial photography but fields systems in Estonia were barely acknowledged as possibly prehistoric monuments with any kind of scientific value. It is understandable because Estonia was a young state that had been under foreign rulers for centuries and the main research directions and methodology was in development stages. Archaeological research in recent decades has changed enormously. It can be said that Estonian archaeology is now part of wider European network. However, publications often do not reach the wider European audience and, for example, in the treatments of field systems Estonian material is seldom referred to. Main work on field systems in Estonia in the recent decades has been done by only one archaeologist – V. Lang – whose conclusions about field systems form the basis for the established interpretations. It can be said that the state of the research of Estonian field systems nowadays is poor. On one hand, it is affected by the limited funding opportunities for archaeological research projects, but it is mainly the lack of young researchers interested in field systems that has led to the situation that today there is barely no research on field systems in Estonia and the excavations of field systems are limited to small-scale development-led rescue investigations.

3 Theory and Methodology

3.1 Introduction

Research questions and approaches often evolve during research. Researchers have the urge to find out everything and fully understand all dimensions of their subject. This cannot be feasible within the limitations of a PhD. When I started the survey and excavations of field systems at Salevere in 2008, I had tens of questions in mind. The questions that prevailed were rooted in landscape archaeology: what was there to see and what was lost; was the hill special in any way and if it was, in what way; how were the field systems and other monuments on the hill related to each other both spatially and temporally, and how was it connected with the wider spatial background; what needs of past peoples did the hill fulfil and can it be seen as an arena for the full range of human activities at any point in time. I was interested in how this piece of land, the local landscape, was maintained and used over the centuries and what caused change and continuum. I have decided that the most suitable framework to encompass these questions is 'sustainability'.

In this chapter I will explain how my research questions relate to the study area at Salevere and why it turned out to be the most suitable place for a detailed case study. I will also discuss my chosen scale of research, which is more local than regional. I will demonstrate how my research questions address the gaps that previous research has left in the study of field systems in Estonia. After this, I will give a short overview of the theoretical approaches that form the background to my research questions, including the concept of sustainability and how it can successfully contribute to the landscape archaeological study of field systems. I will then explain my research methods and show how they are inherently related to and intermixed with both, the research questions and theoretical background.

I have chosen to combine the theory and methodology of my research in the same chapter because of my strong conviction that they are integral and should be presented in relation or dialogue with each other. Theory, which is what I want to know, determines the methodology. The methodology comprises the methods I use to answer the research questions. And inversely, the research methods set limits to the questions that can be answered. The methodology for the current study proceeds from the research questions, which in its turn are directly related to the scale and the chosen theoretical framework for the study. One can ask different questions on the basis of the same archaeological material and that would lead to a different methodology and different approach altogether. It all comes down to **what** we want to know (our ontology) and **how** we interpret things (our epistemology). As I will demonstrate later in this chapter, the same kind of material – field systems – and the same framework – sustainability – can lead to different questions and methodology altogether.

The beauty of archaeology lies in the variety and diversity of approaches and possible interpretations. This does not mean that "anything goes", and all explanation is equally valid. Rather, that diversity in interpretations relates directly to the diversity of social and cultural life: the reasons why and how people made certain choices and how they contextualised it all and made sense of the world around them. Of course, archaeologists' responsibilities as scientists should include an objective, respectful and reflective approach, which fairly represents the realities of the ways things were in the past. However, the nature of archaeological studies and the fact that the main objects of the study – past humans – are not alive anymore and they cannot answer the questions we would like to ask, leads to inevitable gaps in knowledge about the past. We can only do the best we can as archaeologists and accept that our interpretations are partial. After all, in the first place we are humans as well, with our ideas, emotions and social and cultural backgrounds, which shape the way we see and make sense of the world. It is inevitable that who we are has an effect on how we interpret past humans and phenomena.

3.2 Research questions and approach

The aim of this doctoral research is to assess the level of sustainability of past agricultural landscapes by studying the characteristics and changes in the structure and location of past field systems.

In general, the research proceeds from the questions of how the agricultural landscape was organised in the past, how environmental and social factors affected it, and how the organisation and management of field systems changed through time.

The primary research question is: **How did the locations and organisation of field systems impact on landscape sustainability during later prehistory?**

The project's more specific questions are:

1. What are the main characteristics of the distribution of field systems in western Estonia (in terms of environmental conditions and the general settlement pattern)?
2. How was agricultural land organised through differences in the types of field systems in western Estonia?
3. Is there a correlation between the form and location of field systems and what factors (both human/social and environmental) influenced the character and organisation of field systems?
4. Based on diachronic reconstructions of the agricultural and social functions of field systems, how did the inception and maintenance of field systems influence landscape sustainability?

The project's emphasis is on understanding the location and organisation of field systems, from which I infer the agricultural and social structures that created and were reproduced by field systems. Giving the field systems chronologies and understanding how their organisation changed with time – a diachronic perspective – provides the basis for interpreting. Chronologies are especially challenging when researching field systems, and necessarily I limit my primary analysis of chronology in a case study – Salevere.

My research questions derive from my research interests and the unanswered questions of the previous studies of field systems in Estonia, presented in chapter 2. During the first proper phase of archaeological research of field systems in Estonia (from the end of 1960s until the 1990s), the excavations were sporadic and mostly not research-based. The results were nevertheless incorporated into wider generalisations of prehistoric societies and agriculture. From the 1990s, field systems became a focus of directed research and a tool for generalisations on a wider regional and social level. The work was based on case studies which were not numerous and in some occasions the full reliability of data can be questioned (e.g. the number of scientifically dated samples used when establishing chronologies). The sizes of study regions varied and in many studies the field systems played a peripheral role in what were primarily excavations of other monuments.

The 1990s brought important developments in field system research, especially the work of V. Lang. Yet field systems remained objects to talk about "more important" things, like society (not even agriculture), ownership rights and so forth. The research was processual by inspiration and the set of questions asked, and researchers involved, was quite limited. Population pressure and environmental conditions were thought to be the main factors influencing the beginning of field systems and their decline (through land exhaustion). By the end of 1990s, especially thanks to the work of V. Lang, typology and general chronology of Estonian field systems and general ideas about their development, use and wider social and economic meaning was established which remains unchallenged and in use in Estonian archaeology up to today.

The interpretation of field systems was limited and questions of how the organisation of the field systems was related to their function and sustainability was not addressed and the field systems were more or less treated as an inevitable consequence of evolving agricultural practices. People were, in Peter Fowler's (1981:29) pithy phrase, 'simply trying to be better farmers'. Fields were not active in the formation of society and the landscape. Furthermore, field systems were seen as *just* field systems or *simply* fields (the term *fossil fields* that has been commonly used in Estonian archaeological literature reflects the attitude rather well). Studies never searched for ways to interpret the fields as arenas for different kinds of practices where the elements comprising the field systems had varied social and economic roles.

Although the term sustainability has not been used in previous studies of field systems in Estonia, the concept of sustainability is implicit in discussions about the longevity of the fields, the reasons for their emergence and decline. There is a contradiction in how researchers see the sustainability of the field systems. On one hand, they stress longevity – the field systems were probably in use for long periods of time (extensive land use strategies, taking new land into use after the soil was exhausted; long fallow periods). On the other hand, the exhaustion of soil is frequently mobilised as a reason for the abandonment of agriculturally organised landscapes. Explanations proceed from an assumption that agricultural strategies were determined by outside factors (like population, climate). Agricultural practices have never been at the centre of study, defining field system evolution. Environmental studies have served to confirm the time spans when certain fields were in use and have defined periods of agricultural intensification and abatement. This has, in its turn, led to an environmentally deterministic view on agriculture among archaeologists.

My research is explicit about its focus on sustainability, and it approaches the study of long-term landscape change through the formation and organisation of the fields themselves. As with earlier studies of field systems in Estonia, the focus of the current study is not so much on agricultural practices but on the physical characteristics of the field systems and their physical settings. Unlike previous studies, I proceed from the organisation and management of these (agricultural) landscapes to the in-depth focus on the organisation of the landscape in a specific place.

To answer the research questions, the following approach will be used:

1. I will start by doing a comparative regional study of field systems in West Estonia where the emphasis is on the investigation of the types of field systems and their distribution in the landscape. First, I will review the evidence for field systems across the region using LiDAR derived relief models. Then, I will compare the evidence against the established typology and chronology of field systems in Estonia, the environmental location and relationship with prehistoric and historic settlement.
2. Regional analysis is followed by a landscape survey and excavations of a palimpsest of field systems in the case study area on the hill of Salumägi at Salevere in southern part of the study region. It comprises:
    a. Detailed landscape survey and mapping of all the features (natural and man-made) on the case study area that was done over the course of 2008–2015 and lead by the author. The results of the survey will be used to investigate the spatial relationship of all the archaeological and natural features on the hill, with the emphasis on the field systems and the relative chronology of landscape use on the hill.
    b. Archaeological excavations that took place during three consecutive summers from 2008 until 2010 under the supervision of the author. The results from the excavations (archaeological material, radiocarbon dates, structure of the excavated features) will be analysed after the landscape survey.
    c. Combining the survey and excavation results to assess how does excavation results complement the survey results and what does it all tell about the use of the field systems and the whole landscape on the hill over time.

3. On the basis of combining regional and case study results, the sustainability of the landscape of field systems and the factors influencing it, will be assessed.

3.3 Limits of the study area

3.3.1 Geographical limits

The regional context of the study area covers the western Estonian mainland (Fig. 3.1.). Administratively the area is mostly divided between the contemporary Lääne (transl. *west* or *western*) and Pärnu counties but their borders are not taken as strict delimiters of the study region. The administrative division of West Estonia has changed several times, and the historical rather than contemporary divisions are preferred in archaeological studies. Environmental science mainly uses physical geographical divisions to organise research. The study region is presented in detail in Chapter 4.

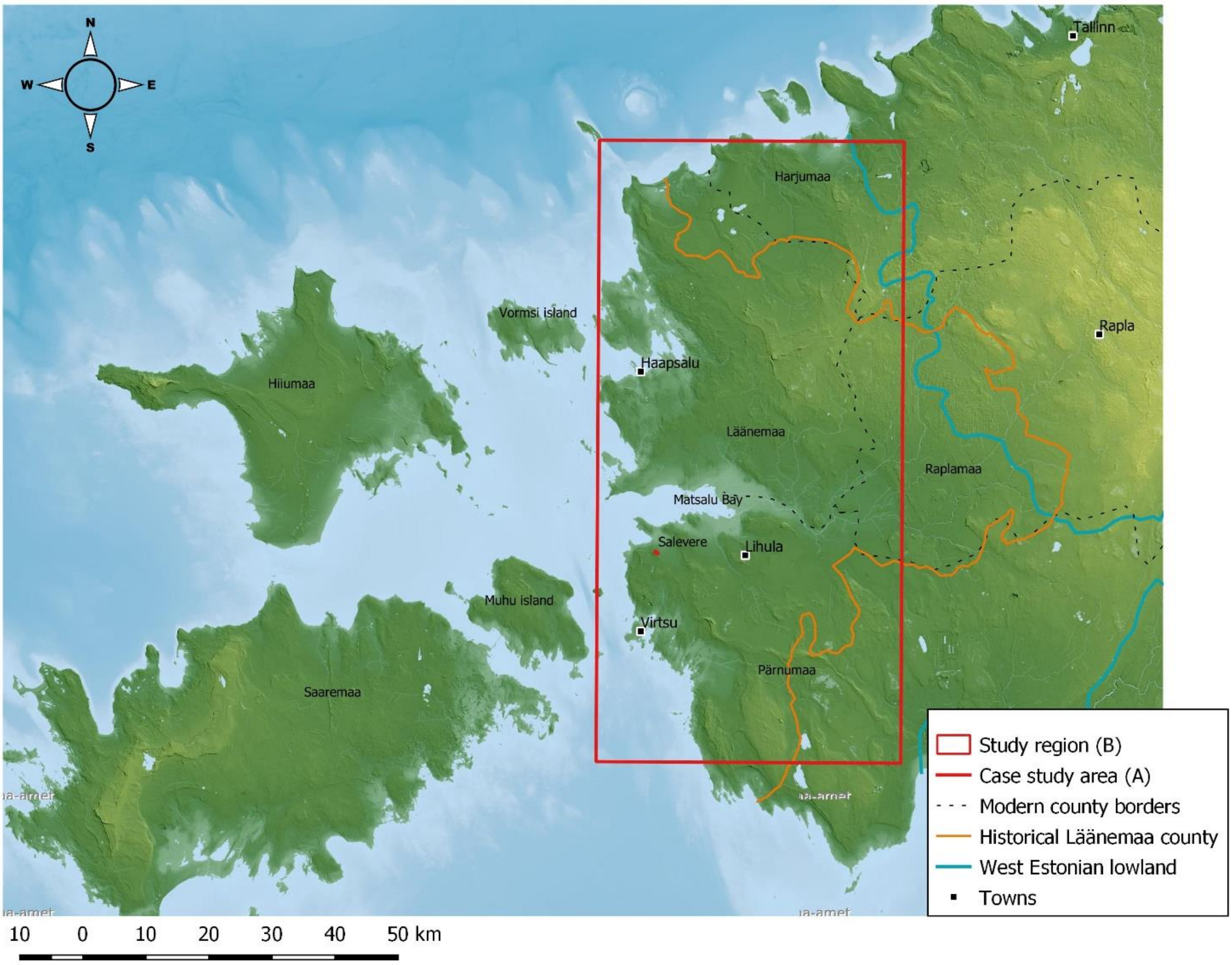


Figure 3.1. The study region of western Estonian mainland. Base map: Estonian Land Board 2019.

Western Estonia was chosen as the study region for several reasons. The focus of the study of field systems in Estonia has so far mainly been on the northern part of the country and therefore there is a need for a more concentrated study in the western Estonia where numerous field systems have been recorded and few investigated. The relative compactness and environmental variability of the study region makes it suitable for studying variability in the distribution, organisation and management of agricultural landscapes. The research does not claim to be a comprehensive study of all the field systems in western Estonia. The largest islands of the western Estonian archipelago – Saaremaa and Hiiumaa – were left out of the study to make the project more feasible within the limits of PhD thesis.

The centre of gravity for the current study is an archaeological case study of the hill of Salumägi at Salevere village in West Estonia (Fig. 5.3). The archaeological remains on the hill, with an area of about 40ha, comprise an enclosure, field banks, clearance cairns, possible building platforms and at least one stone grave. Prehistoric settlement sites and a cemetery are known from nearby. In the surrounding area there are also locations where prehistoric settlements, graves and field remains have been investigated and which can provide useful comparative material for the present study.

The hill of Salumägi at Salevere was chosen as the fieldwork case study because it has evidence for long-term human inhabitation and landscape change on the hill and its close surroundings. The mixture of the enclosure, field banks, clearance cairns and graves[15] provided a good basis for studying the temporal and spatial connections between different landscape features and between different types of field systems. The context of the wider region was also important in the choice of the study area. The southern part of Western Estonia is relatively well studied when it comes to field systems (the largest excavations of field systems in the region took place not far from Salevere, at Kõmsi and Kaseküla) allowing scope for comparisons with the case study.

Another important factor for the choice of the study area (at both regional and local scales) was its geographical location and environmental background. The hill of Salumägi is located on a limestone ridge that is part of the West Estonian klint. Because it is believed that agriculture in West Estonia started in these higher places, because relative sea level left lower areas inundated, it provides the best location to study the longevity of field systems – for how long was high ground enclosed with fields and what were the environmental and human factors that caused changes in the subsequent abandonment of these places? Because modern agriculture mostly uses intensively managed low-lying areas, the hill has not been a subject to large-scale agricultural land improvement which has contributed to the potential persistence of the signs of past human activity. It has been also been facilitated by the fact that the hill is part of the Matsalu Nature reserve which means there are restrictions to construction and other landscape transforming activities that otherwise might be a danger to archaeological and natural heritage.

3.3.2 Temporal limits

Temporal extent is an inevitable part of every archaeological study. Usually the spatial boundaries are easier to set than the temporal. Referring to a more modern example, John

[15] At least one was known at the time of investigation.

Gerring (2007:95) states: “We know, more or less, where a country begins and ends, even though we may have difficulty explaining *when* a country begins and ends.” Because of the nature of the landscape, it is hard to decide what time frame to include or leave out of the study, especially when the objects and features under study do not necessarily occur in a vertical stratigraphy but can be intermingled.

The difficulties with temporal scale relate to the main theoretical concept of the research – sustainability. By definition sustainability is related to the temporal depth of the phenomena which are under investigation. One model of sustainability is the forward-looking approach – to sustain for future generations. In that sense, when talking about the sustainability of the landscape, it is important to look **past in time**, i.e. did past generations leave a sustained landscape behind and **future in time**, to see if the actions of the time period in question were sustainable to the future generations or not.

Having that in mind, it is obvious why it is difficult to determine the exact temporal limits of current study. On the one hand, it is often difficult to determine the age of structures when multiple chronological layers are indistinguishable alongside and on top of one another. Critically, features in landscapes can persist or recur in importance across generations of human history. The inherited landscape may be as important as the contemporary. The use and re-use of landscape elements is a contributing sign of sustainability, therefore it is an important characteristic to acknowledge and understand. For example, for the case study at Salevere, it was impossible to leave certain features out of the analysis because they are too “early” or too “modern”. Also, the age of the features is not self-evident from observational survey alone. A feature might have been constructed and then used in different times and exhibiting multiple temporalities.

In general, the temporal limits for the project are determined by the age of field systems in the study region and the case study area. The limits must be defined broadly because most field systems are not closely dated. The earliest field systems in Estonia are dated to the beginning of Bronze Age (1800 BC) and lasted until the 19^{th}-20^{th} centuries AD. For the Salevere case study, the radiocarbon dates largely determined the temporal span for the research. The focus on sustainability requires a wider, later prehistoric, context: from the beginning of the Bronze Age until the end of the Iron Age (ca. AD 1200). Many of the field systems examined at the regional scale post-date the Iron Age, but the organisation of agriculture from the Middle Ages onwards was different from the prehistory. Thorough study of the later periods at Salevere would have to include a lot of written sources, which would have extended beyond the feasibility of the present thesis, therefore the treatment of historical periods is limited and done from a basic level.

3.4 Theoretical framework

3.4.1 General theoretical starting points

The theoretical background of the current thesis falls within the general framework of post-processual archaeology. The previous, largely processual theoretical standpoints in the research of Estonian field systems were suitable for making conclusions about the typology, chronology and general spread of agricultural economy and settlement but it is not sufficient to assess how the various social and environmental factors influenced the character, organisation and management of field systems and their temporal stability and change which are the questions current thesis is dealing with.

It has to be stated that 'post-processual archaeology' is not a single concept but it includes a set of trends, for example neo-Marxian anthropology, structuralism, influences of cultural theory, feminism, hermeneutics, phenomenology, and many others (Shanks 2008:133). According to M. Shanks, one option of defining the essence of the post-processual is to see it as a certain attitude central to cultural creativity and characterised by 1) constant questioning and critical scepticism; 2) seeing past and present as something that are inherently connected; and 3) the need to understand cultural difference (Shanks 2008:142).

For the study of field systems and current thesis, important concepts that are related to post-processual archaeology are:

- Social theory, social structure and social practice
  These concepts are related to questions about *human agency* and the role that people have in creating and shaping social structures. Seeing people as knowledgeable social agents or subjects in social processes helps to explain the contradiction of how social structures can exist in the actions and thoughts of individuals, and at the same time

clearly extend beyond them. It also helps to understand that people are both determined by social structures, yet also act in ways that work to reproduce and change those structures (Shanks 2008:135).

- Communication and cognition

  It is said that the need to account for cognition and communication has been the rationale behind a great deal of post-processual archaeology. The interest is not just in what people did but what it meant – from the meaning of pottery design to what mortuary practices are saying. However, it is difficult to assign a single specific meaning to things and it has become clear that there are indeed multiple rather than single meanings and therefore there can also be multiple interpretations (Hodder 1982; Hodder et al. 1995; Shanks 2008:136–138).

- Scale of interpretations

  Processual archaeology was mainly interested in producing cross-cultural generalisations or metanarratives under which specific archaeological patterns could be accommodated. The subjects included, for example, the origins of agriculture, the development of civilization, state and social complexity. While all these subjects are important and certainly not fully exhausted, post-processual archaeology has brought forward the role and importance of smaller scale and more local contexts and specific archaeological histories (Shanks 2008:137).

- Discourse and the role of archaeologist

  Archaeological interpretation itself is carried out by knowledgeable agents – archaeologists. The concept of discourse refers to this notion of archaeology as a mode of cultural production. It has enormous implications, most notably that archaeologists don't so much discover the past as produce accounts of it; their attention is drawn as much to contemporary values and attitudes as to the past itself (Shanks 2008:137).

Another set of theoretical framework for the current thesis is related to theoretical landscape archaeology. This too has been affected by the post-processual theories. In its "extreme" version the influences of post-processual theories are reflected in landscape phenomenology, a set of theory with accompanying methodology, established by Christopher Tilley (Tilley 1994). Tilley presented landscape as a cultural set of experiences and meanings and the methodology for studying and understanding past landscapes relied largely on re-experiencing the sensory perceptions in attempt to understand how past inhabitants interacted with their surroundings.

There has been a great deal of criticism towards the directions that landscape archaeology took after Tilley`s theoretical implications (Bradley 1998; Brück 1995; Johnson 2007). Most fundamental was the critique from Fleming (2006) and Barrett and Ko (2009) who even regarded landscape phenomenology as the "crisis of British landscape archaeology" (Barrett and Ko 2009). The "soft" treatments of field systems and agricultural landscapes have been also critiqued in the same sense and it has been said that these kinds of studies are too much concentrated on metaphysical landscape at the expense of the functionalist approach (Kooijmans 2000:324; Chadwick 2008a).

In conclusion, despite of the critique on some aspects of the post-processual archaeology, its general positive implication has been the wider and more integrated understanding of people as social subjects and not just anonymous bystanders in social systems and other social totalities. They are seen as individual agents who "work their way through society and history seeking goals, constantly sending out signals and signs, constantly interpreting the cultural signification around them (Shanks 2008:136)".

Basic idea behind post-processual archaeology is to develop more adequate archaeological accounts of past societies that, for example, embody a more dynamic notion of social structure, recognizing the creativity of human agency, or avoiding the generalizing determinism that was seen to be associated with the society types of culture evolution (Shanks 2008: 139). It emphasises the "active role of individuals in constructing and interpreting the world around them and in continually reshaping culture and society (Knapp and Ashmore 1999:7)".

View to landscapes of field systems inside this theoretical framework can be seen as something that are given meaning through local social practices and experience (conceptualised landscapes). It does not have to exclude the fully agricultural function of field systems – these two can be combined. As has been said by Hodder (1986), "separation of function and meaning tends to support a wider set of dichotomies between materials, adaptation and objective science on the one hand, and symbolism, history and interpretive approaches on the other." Landscape sustainability as a concept can be used to bind these aspects together.

3.4.2 Sustainability

Sustainability and sustainable development are usually issues that are debated in a present context. They are related to political and governmental decision-making, which set laws and guidelines to achieve and maintain the state of sustainability. Sustainability includes both theoretical considerations of what it is and why is it important, and at the same time it can be a set of methods, providing guidelines of how to measure the level of sustainability and how to achieve it. According to the most common definition sustainability or sustainable development is something that "meets the needs of the present without compromising the ability of future generations to meet their needs" (Brundtland 1987, cited in Dresner 2008:1).

The concept of sustainability has emerged in the last thirty or forty years in response to contemporary environmental concerns. In its most widespread meaning it is used as an equivalent to something that is environmentally friendly (Dresner 2008:1). When used in more specific way, different authors have noted the difficulties of defining sustainability (O`Riorden 1985) and there is no single straightforward definition of what sustainability is but there are conceptual differences in what is emphasized in a given definition. Sustainability has been applied to explaining social, economic and environmental processes and the explanation of the term depends on how it is used and what is emphasized. Whatever its variations, sustainability assumes that society and environment are intrinsically connected, and that certain forms of human-environment interaction are more stable (and sustainable) in the long-term than others. Based on what Allen et al. (1991) say, sustainability can be seen as an ideal state of human-environmental relationships.

It has been pointed out by Dresner (2008:2, 82, 121) that the main differences in how the terms sustainability or sustainable development are used are between those who underline economic growth and taking nature as a resource and those emphasizing the protection of environment or "natural capital". It has been also said that sustainability can mean different things for different groups of people, which is dependent on the spatial and temporal contexts (Mansfield 2009:43). When explaining sustainability of past societies, we have to keep in mind that what was considered sustainable in the past, might have been very different from today`s understandings (Dresner 2008:4–5).

Although largely a modern concept, sustainability can be applied to all human interactions with and modifications of the environment. Sustainability has, for instance, been used as a framework to explain the collapse of past (agricultural) societies, for example the collapse of Maya civilisation (Scarborough 2007:51–59). Sustainable agriculture in its broader sense is not the subject of this thesis *per se*. Rather, I use sustainability as the response to a key gap in previous knowledge about field systems in Estonia: how do we interpret periods of landscape stability and change through the study of field systems? Sustainability offers a different lens though which to see field systems and the reasons behind their construction, use and abandonment.

3.4.3 How to assess sustainability or unsustainability of field systems?

When it comes to the sustainability of field systems, it is broadly speaking a question of sustainable agriculture. However, agriculture itself is not the main research interest of the current thesis and because of that, I am making a clear distinction between sustainable agriculture *versus* sustainable organisation of agricultural landscapes, although I accept the two are connected. While the study of sustainability of agriculture would require methods suitable for studying soil quality, environmental changes, climatic conditions, crops regimes and so forth, the study of landscape sustainability can be assessed by different methods. Evidence for agricultural practices and environmental change remain important, though alongside the results of landscape survey and excavations, which are the main basis for the study of landscape sustainability.

By agricultural landscape (rather than agricultural land) I mean the whole scene within which the field systems were established, organised and managed. This was the place of the fields in the broadest sense: ancient and contemporary landscape elements (both natural and human), the boundaries and cairns, the settlement areas and graves. I am interested in the organisation and sustainability of the whole system. This perspective requires the study of the physical location of the field systems, the way the landscape was enclosed and divided, the role of banks and cairns in the system, the organisation and the possible longevity of occupation in the landscape.

An important part of sustainability is the temporality of the phenomena in question. Sustainability addresses long-term processes of human-environment interaction. When continuity breaks down, then relations could be described as unsustainable. Yet discontinuity may mean disruption rather than collapse. The chronologies from Estonian field systems often show that even when there were periods, even centuries, of inactivity, after a while the same area was used again for agriculture. Therefore, sustainability needs to be determined relationally and with some regard to temporal resolution. Distinctions might be made between short and long-term landscape sustainability. Disruptions might have enabled long-term sustainability (for example, through the recovery of soil quality). Our measures of sustainability come from the privilege of looking back over hundreds and thousands of years. The people who made, lived in and abandoned their saw their relations with places and the living world in a different way.

Sustainability, whether we talk about agriculture or field systems, is always concerned with human-environment interactions. The organisation of landscape and use of field systems was a process of organising and managing natural resources – the whole landscape (and not just land) as a natural resource. At the same time, economic considerations and social rules affected the landscape organisation. In previous studies the development of social power and organisation of the society in general were seen as the main factor behind the field systems. I am not trying to undermine the role of the general trends in society but I am more interested in understanding how the landscape was organised at a micro-scale, in a given environment.

3.5 Methodology – how to study sustainability

This section introduces the ways landscape sustainability can be studied and explain the methodology I chose to apply in this project. The methodology of studying sustainability of agricultural landscapes can be approached from two angles. The first one puts the *agriculture* to the front and aims to find out the strategies which either contributed or counteracted the sustainability of agricultural systems. The second approach, which I pursue, proceeds from the wider *landscape* concept and the way landscape organisation can be the main factor behind sustainability.

3.5.1 Basis for the study of sustainability of field systems

Archaeological studies of agricultural sustainability usually research crops, soil fertility, yields and productivity, demographic change, and measures of the economic outputs from agriculture. These studies investigate the chemical and physical analysis of soils, analysis of macroscopic plant remains and microfossils, often using direct case-study based sampling of smaller locations, sometimes even a single excavated feature (Mills et al. 1994).

The study of sustainable landscape organisation proceeds at a different epistemological level. It is concerned with structures and relationships in the landscape. The most widespread ways of studying landscapes and how they were organised are the different remote sensing and ground-based survey methods. They are often non-invasive making them *sustainable* in their assessments of the archaeological resource. The main remote sensing techniques[16] are traditional aerial archaeology (reconnaissance), multispectral imaging, satellite imagery, Airborne Laser Scanning (LiDAR) and magnetometric survey (gradiometery and resistivity). In the study of past agrarian landscapes, such methods are able to assist with the description of patterns of land allotment and exploring the spatial relationship between different features over broad areas and are thus valuable tools for interpretative analysis.

The studies most likely to show information about the variety of landscape elements and make conclusions about their sustainability, are the ones that use a combination of these methods. The importance of that is the fact that different methods are likely to complement each other, because some features that are not visible in aerial imagery, might show up in LiDAR or in geophysics. It also comes from the fact that different features are preserved differently – while ditches can show only as crop-marks, the remains of walls and mounds are raised features that can be observed on the ground, appear on LiDAR and aerial photographs. The importance of combining different methods has been shown as a useful approach in many cases, for example the study in Heslerton, the Vale of Pickering, North Yorkshire by Powlesland et al. (2006).

However, remote sensing methods have a crucial limitation when it comes to defining landscape sustainability. Because sustainability deals with long-term processes with temporal depth, understanding the duration (age) of structures in the landscape is important. Basic stratigraphy and phasing is possible with remote sensing methods, but duration can never be fully inferred from the data. For that excavations are needed.

The current PhD project uses two levels of study for answering the research questions aimed to study the landscape sustainability related to field systems: regional and local.

[16] I am using the term *remote sensing* in a broader sense as to mean anything that is used for getting information of a site or landscape without physically disturbing it. For more detailed discussion about the definition, see for example Johnson 2006, 1—15.

The regional study is a basic, literature based overview of the environmental and settlement history of the region. Additionally, it includes basic mapping of the field systems in the study region. The local study combines the results of archaeological mapping and excavations carried out, under the direction of the author, on the hill of Salumägi at Salevere in 2008–2010 and 2013–2015. This forms the main archaeological basis for this PhD study.

3.5.2 Regional study methods

The regional study was limited to an area of ca. 4425 km^2 in the mainland of western Estonia which is part of a landscape region West Estonian lowland, characterised by generally flat and low-lying topography where higher outcrops occur. The regional analysis comprised three elements: (1) environmental change; (2) human history; and (3) the distribution and form of field systems.

The first two themes serve as a background for an analysis of the locations of field systems. The field systems in West Estonia were derived from listing all the known field systems in the area, the ones that are listed as archaeological monuments in the National Register of Cultural Monuments (https://register.muinas.ee/public.php) and field systems that were known through previous published and unpublished studies but have not yet been listed as monuments. This resulted in 28 confirmed field systems. Additionally, a regional study for detecting new field systems was undertaken. The regional study method was based on the analysis of LiDAR-derived grayscale and coloured hillshaded relief models through the public Web Map Service by the Estonian Land Board. The whole study region was thoroughly examined and the detected field systems were mapped. Altogether 58 previously unknown field systems were discovered, 43 of them from the southern part of the study region and 15 from the northern part. Additional landscape survey for confirming the detected features and field systems was not carried out, therefore the field systems are marked as *unfonfirmed* throughout the thesis.

The relief models with all the 86 field systems were combined in GIS-programme with the most recent and historical ortophotos, historical maps, environmental data and information about the locations of other archaeological sites. Ortophotos, historical maps and some environmental data (for example soil maps) were also available through the Web Map Service. Layers with the information about the protected monuments and archaeological sites that are known but not yet listed as monuments, were provided by the National Board of Heritage. A lot of information (including locational information) about the not protected sites was available through Database of Archaeology and Local Lore, collected and administrated by the Department of Archaeology of the University of Tartu and stored and managed in the online server of Estonian National Heritage Board (about the development of the database, see also 2.2.1). For the age of the historical villages a map layer with the village`s first mentioning in the written sources was used (information was compiled by the National Board of Heritage on the basis of the Dictionary of Estonian Place names).

The aim of the regional study was to analyse what are the main characteristics of the distribution of field systems in West Estonia in relation to environmental conditions and the general settlement pattern and how was agricultural land organised through differences in the types of field systems in western Estonia.

In the course of the analysis, field systems were not mapped in detail, their locations were marked as polygons on the maps and the analysis of the possible typology (according to the established typology of Estonian field systems that was introduced in 2.5.2) and the specific features of the field systems was carried out on the basis of the hillshaded images. The connectedness between the field systems and past human settlement was analysed on the basis of the available archaeological data and historical maps. The relationship and distance between settlement sites and fields is, on one hand an indicator of the age of the fields but on the other hand it also gives hints about the function of the fields (e.g. fields further away from the settlements can be seen as analogues with medieval forest fields) and social relationships in communities. In addition to the settlement sites, the distribution of other archaeological monuments in the close vicinity of the field systems and inside the systems is equally important for determining the age and social functions of the field systems. The structure and the composition of the field systems will also be examined to see if, in addition to cairns, banks and stone fences (that are the most obvious field-related structures in Estonia) there are previously unknown possible graves, enclosures and other potentially man-made positive landforms among the fields.

The importance of the regional study is to see the basic location types of field systems and see any correlation between the organisation of landscape, preferably related to a time period, and natural conditions. The archaeological and environmental data in combination with the field systems shows the organisation and management of and perceptions towards the landscapes of field systems through time and is a valuable addition to studying landscape sustainability.

3.5.3 Case study methods

The case study area is situated in the southern part of the western Estonia, on the hill of Salumägi at Salevere village. It is an outcrop of the limestone bedrock that is one of the highest places in the area.

The case study has two levels of investigation: (1) landscape survey and mapping, and (2) excavation and the analysis of excavated material. Landscape survey integrated three methods: ground survey using a total station, analysis of LiDAR data, further manual survey and ground observation. The excavations examined field banks, clearance cairns and the enclosure wall. The analysis of archaeological material included animal bones, charcoal, and ceramics, and a programme of scientific dating.

The aim of the case study was to see the possible correlations between the form and location of the field systems and explain the factors that influenced their character and organisation. Case study also targeted the question of how landscape sustainability was influenced by the inception and maintenance of field systems.

Mapping of the area was done in four phases over the course of 2008–2015. The initial mapping with total station was carried out in 2008, prior to the excavations. Because of the poor visibility in more densely forested areas, only the enclosure and the field system features in close proximity to the enclosure were mapped. The landscape survey was continued in 2013 with a mapping-grade GPS (precision 3–4m). In 2014, after the initial maps were produced on the basis of the mapping and GPS data, an analytical study of the mapped features was carried out. The aim of the analytical survey was to describe the features, measure their heights (from the surrounding ground) and widths, characterise the areas around the banks and cairns, to see the connections between different features, to make notes about possible functions of the land and to evaluate the mapping and its accuracy. The final phase of the survey was complete in 2015 after the previous mappings had been combined with LiDAR data and it included verification of the newly mapped features.

For the analysis of LiDAR data, raw files in LAS format were ordered from the Estonian Land Board Service. The data from two flights was combined, resulting in ca. 800 000 ground points. Digital Elevation Models (DEM) were produced from the data and for the better visualisation, hill-shaded images were created. The resulting models, combined with the maps of roads and buildings were used for the analysis and mapping of the archaeological objects on the hill.

The DEMs provided a useful tool for the analysis of the archaeological objects because they showed features that had not been noticed previously. However, sometimes the interpolation of the data in ArcGIS created false features, such as objects that looked like cairns or banks but where not present on the ground. There were also minor differences in the locations and sizes of the objects between the LiDAR mapping and the landscape survey. The specific methods that were used to process and analyse the LiDAR data will be explained in detail in 5.4. Here some problems related to the interpretation of Lidar data are discussed.

The methodology for excavating field systems in Estonia has mainly concentrated on the recovery and dating of charcoal amongst the stones in cairns and banks. The charcoal preserved under the lowermost stones of the field remains are thought to indicate clearance of vegetation with fire prior to farming (Lang 1996b: 483–484). Therefore dating the charcoal from between the lowermost stones should show the earliest date of the fields. Sometimes the field banks and cairns yield material that can give alternative information about the age of the fields, for example potsherds or other artefacts. Animal bones are often found associated with the field remains and have been dated in rare cases. There are several problems with dating fields in this way. It is difficult to determine a reliable context for small quantities of charcoal. The charcoal might originate from multiple sources, whether anthropogenic or non-anthropogenic.

The archaeological excavations on the hill of Salumägi took place during three consecutive summers from 2008 until 2010. Altogether seven trenches were excavated to study the banks, cairns and the enclosure.

3.6 Conclusions

When talking about landscape sustainability, I applied the following approach in my study. One of the most essential components of landscape sustainability can be seen in the "wise" use of landscape resources (or landscape as a resource, combining different environmental and social aspects) over a period of time. The second important component would be the functional flexibility (or multifunctionality): the ability to change land use strategies according to changing circumstances (for instance in case the crop yield dropped because of changes in soil quality or when climatic conditions changed or when changes were caused by economic and political factors).

In the current thesis the answer to whether the practices behind the field systems used the landscape resources wisely or not will be sought by the study of different landscape elements and how they were combined into and used within field systems. The functions of the field systems and their possible multifunctionality can be hard to determine with landscape archaeological methods but it was addressed with the study of pattern or form of field systems which were seen as possible reflections of the functional use of the fields. The third aspect of landscape sustainability – chronology of the land use – was studied combining the landscape survey methods (identifying, based on landscape stratigraphy, how the different parts on the hill might have been in use concurrently or not) with archaeological excavations (dating the archaeological features).

4 Western Estonia – landscape history and field systems

4.1 Introduction

The environmental conditions and settlement history have always been interrelated and affected one another. For example, the environmental conditions determined when the land was suitable for habitation after the Ice Age and the natural resources determined the subsistence of first habitants. Location near the sea or larger navigable rivers influenced the potential for oversees contacts and trade, in comparison with inland areas, which affected the cultural and social developments. Different climatic and soil conditions have had direct effects on the formation and development of agriculture, including influencing choices and the development of tools, crops, level of stock-breeding and most probably also the nature of field systems. Geographical and natural conditions have also been seen as an important factor in the formation and development of parishes and counties because the borders of administrative divisions followed the areas that were not well suited for settlement (Lang 2002:167–168; Pae 2006:15, 32). At the same time human activities have always modified natural landscapes, especially after the transition to agriculture. A good example of how long-term agricultural activities have contributed to the formation of species and a specific landscape type is the development of alvar grasslands (alvars). Alvars are semi-natural dry calcareous grassland communities, characterised by high species richness. They are found in areas[17] where the humus horizon is lying directly on the limestone bedrock and the soil cover is shallow (less than 20cm). It has been established that the development of alvars and their high species richness is the result of continuous traditional agricultural management, especially grazing and mowing (Helm et al. 2007; Pärtel et al. 1999; Pärtel et al. 2007).

The purpose of this chapter is to examine connections between the history, environment and spread and characteristics of field systems and show how the environmental conditions and general settlement pattern might have affected the location and form of field systems. The question of how the field systems in western Estonia correlate with the existing knowledge about landscape history and the possibilities that the regional study of field systems can offer to widen the understanding of prehistoric settlement and landscape will be emphasised. The

[17] The distribution of alvars is limited. They occur in Sweden (on the Swedish mainland and islands of Öland and Gotland), Estonia (on the coastal areas and the islands of West Estonia), north western Russia; similar communities on limestone bedrock also occur in few other places in Europe and Canada (Helm et al. 2007:33).

chapter also serves as an essential background for the interpretation of the case study data and will help to show the case study results within a wider environment- and settlement-related context.

The chapter gives an overview of the landscape history and the distribution of field systems in mainland western Estonia. Firstly, a general overview of the study area and its limits in western Estonia is given, after which the development of environmental conditions and known data about human history is presented. In the final part of the chapter, a brief analysis of the registered field systems in the study region is given and the results of previous archaeological investigations of field systems in the region are presented.

4.2 **Location and limits of the study area**

Estonia is situated in the north-east of Europe (geographic coordinates: 59°00´N 26°00´E), on the east coast of the Baltic Sea which surrounds the country from the north, west and south-west (Fig. 4.1-A). Estonia has land borders with Latvia from the south and Russia from the east. Its neighbours across the sea are Finland in the north and Sweden in the west (Varep and Saar 1995:9). Estonia covers an area of 45,215km² of which 9.2% is taken up by islands and 4.8% is under inland bodies of water (Varep and Saar 1995:14). The length of the Estonian coastline is 3,794km; of this 1,242km are on the mainland and 2,552km are divided among the approximately 1,500 islands (Varep and Saar 1995:13).

Estonia is generally a flat country, where uplands and plateau-like areas alternate with lowlands, depressions and wide valleys. The average height above sea level is approximately 50m and the maximum elevation of the country is 318m above sea level (Raukas 1997b; Raukas and Rõuk 1995). 48.9% of Estonian`s area is covered with forests (Hermet 2013:36). Mires, paludified forests and other peat-forming areas constitute 22.5% of the territory of Estonia (Hermet 2013:152). Agricultural land comprises about 9,400km^2 (Hermet 2013:23).

The development of environmental conditions, landscapes and landforms of Estonia have been mostly affected by the last Ice Age and the subsequent ice retreat and the country`s position in the coastal area of the Baltic Sea. The history of Estonia has been influenced for example by its peripheral location in relation to central Europe, geographical position near Scandinavia and Russia but also by its strategic location on the medieval trade routes.

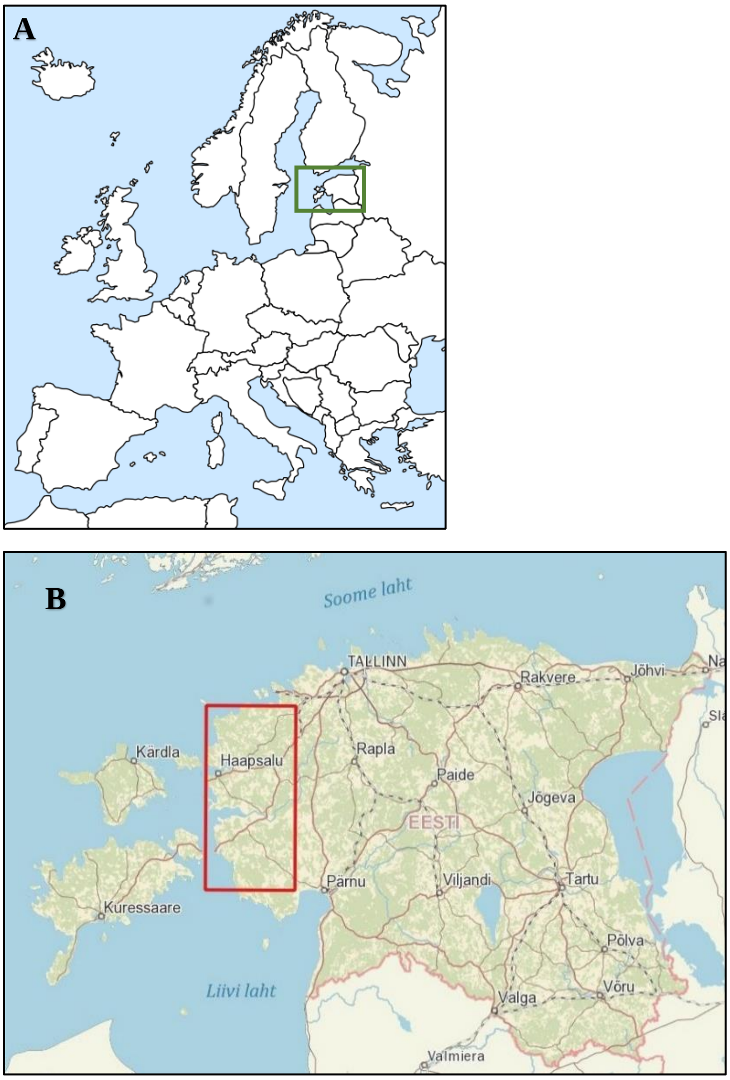


Figure 4.1. A. Location of Estonia in Europe, marked with a green rectangle. Adopted from: Wiki Travel © 2018. B. The study region, marked with a red rectangle. Base map: Estonian Land Board 2019.

The study region (Figs. 4.1-B, 4.2) lies on the western coast of mainland Estonia. The choice of the study area was mainly in accordance with the distribution of field systems in West Estonia which had not been studied thoroughly compared to larger scale investigations in North Estonia. However, the fact that the study area forms both environmentally as well as historically and culturally distinct area, will be taken into account to give background to the study of western Estonian field systems and also in trying to explain their distribution and main characteristics.

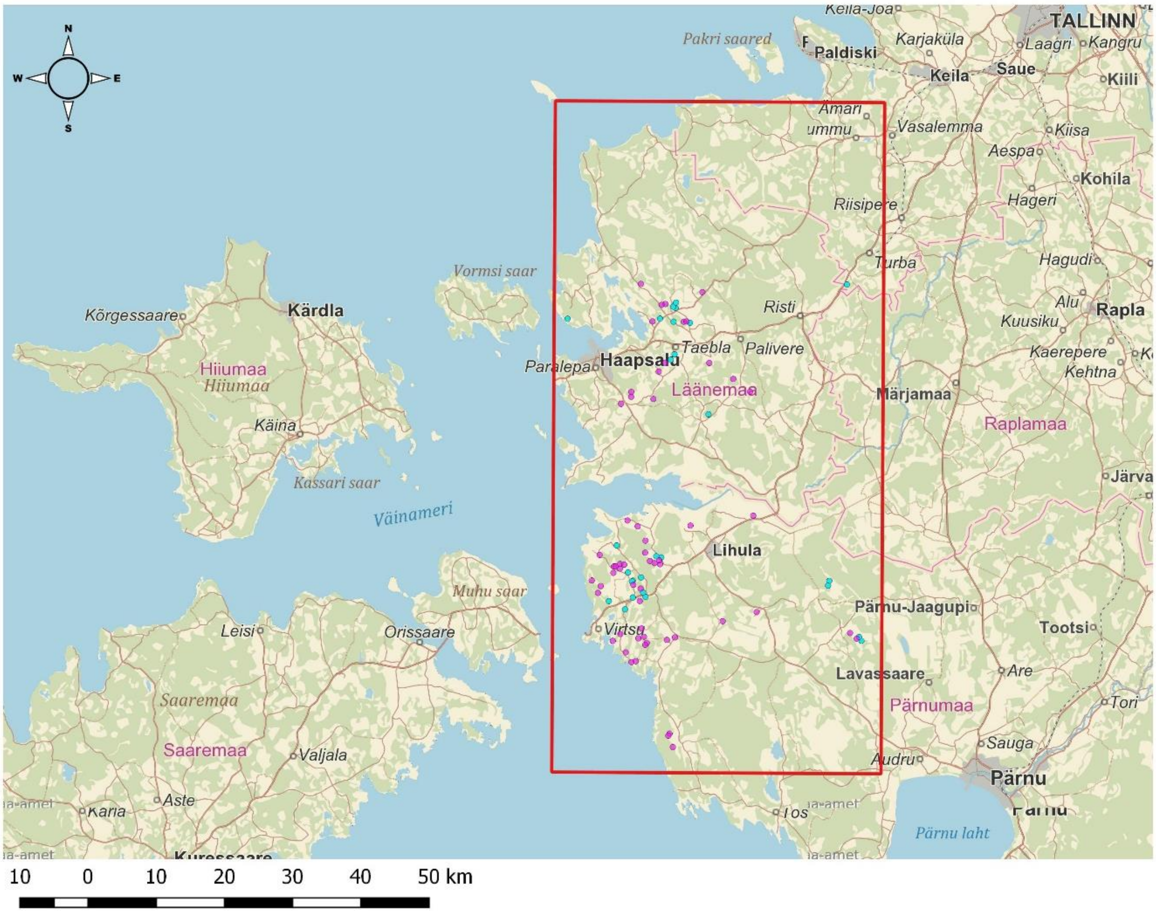


Figure 4.2. Study area (marked with a red rectangle) on the western coast of Estonia. The field systems are marked with blue (confirmed field systems) and pink (unconfirmed field systems) dots. Base map: Estonian Land Board 2021.

There are marked differences in the nature and environment of different parts of Estonia which have given way to several regional environmental classifications. Based on the works about landscape types by Arold (1991; 1993; 2001), and Mander and Oja (1993), a map of Estonian landscape regions has been composed by Peil et al. 2004 (Fig. 4.3). The main differentiation here has been made between Lower and Upper Estonia, the former of which comprises the coastal areas in northern and western Estonia and the inland depressions, and the latter includes the higher upland areas of mainly south-eastern and central Estonia. According to the environmental classification, the current study region lies in Lower Estonia, within the West-Estonian lowland (Fig. 4.3, V-2) which is bordered by the Baltic Sea from to the north and west, with the Harju or the North Estonian plateau from the north-east and with the Gulf of Riga and the Pärnu Lowland from the south. In the east the border overlaps with that of the landscape region of Kõrvemaa and in the south-east with Soomaa. The area of the lowland is approximately 4,200km^2 (9.3% of the Estonian territory) and the length of the coastline is 278km (without the islands) or 366km (including the islands) (Kokovkin 1998b:9).

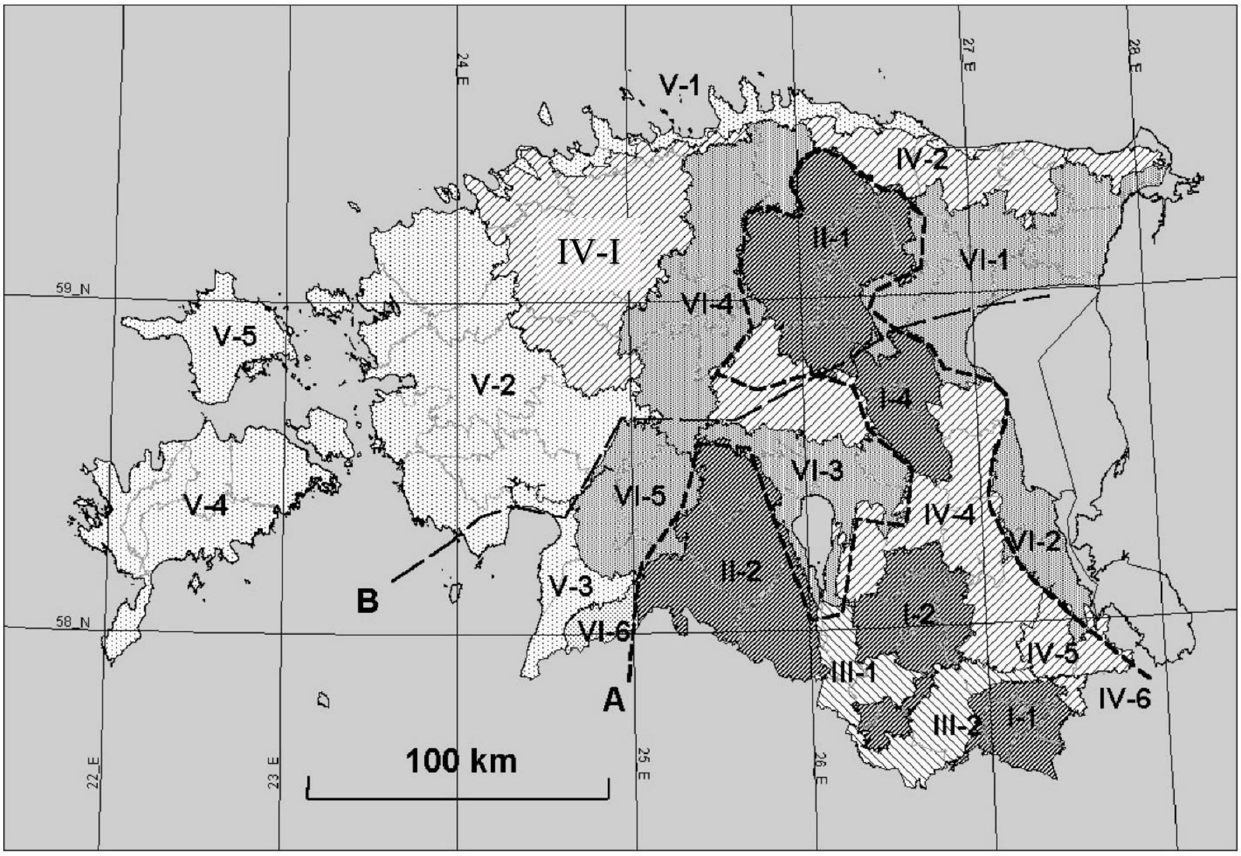


Figure 4.3. Typological landscape regions of Estonia (Peil et al. 2004:5, Fig. 2.).

I Accumulation uplands: I-1 Haanja, I-2 Otepää, I-3 Karula, I-4 Vooremaa; II Abrasional uplands: II-1 Pandivere, II-2 Sakala, III Depressions: III-1 Valga, III-2 Võru-Hargla; IV Plateaus: IV-1 Harju, IV-2 Viru, IV-3 Central Estonian, IV-4 Ugandi, IV-5 Palumaa, IV-6 Irboska; V Marine coastal lowlands: V-1 Gulf of Finland, V-2 West-Estonian, V-3 Gulf of Riga, V-4 Saaremaa, V-5 Hiiumaa; VI Inland swampy lowlands: VI-1 Alutaguse, VI-2 Peipsi, VI-3 Võrtsjärve, VI-4 Kõrvemaa, VI-5 Soomaa, VI-6 Metsepole.

The study area is a coastal plain formed after the last Ice Age by the accumulation of sea and lake sediments (Kokovkin 1998b:9–10). The generally flat landscape is articulated with limestone hills and outcrops (Kirbla, Lihula, Salevere, Mõisaküla) that in the middle part of the region form the Western Estonian klint (Arold 2005:295, 298). The landscape is also diversified by Holocene coastal ridges (Kokovkin 1998b:10). There are two bigger bays that structure the coastline: Haapsalu Bay alongside which the capital and the only town of the Lääne County – Haapsalu – is situated, and Matsalu Bay where the largest coastal reeds of Estonia are found and provide the habitat for the Estonia's largest bird colonies (Arold 2005:295). Matsalu Bay is a drainage basin for the fourth longest river of Estonia (Kasari) that forms a river basin with the size of 3210km^2 (Kokovkin 1998a:55; Arold 2005:304). Aside from the Kasari, there are few rivers in West Estonia and only a few lakes, but numerous swamps and mires that encompass 26.8% of the Western Estonian lowland (Arold 2005:305).

Western Estonia is considered as one of the most environmentally diverse regions of Estonia (Arold 2005:295). There are several protected areas, the most important ones being Matsalu National Park intended for the protection of birds (Kastepõld 1998:183–184), and Puhtu-Laelatu Reserve for the conservation of semi-natural meadows and alvars[18] and the species characteristic to these areas (Vissak 1998:185–186).

Based on current administrative divisions, the study area is divided between the modern Lääne (in translation *western*) County in the north and the northern part of Pärnu County in the south (see Fig. 4.4). A small north-eastern part of the chosen study region also falls under the county of Harju. Western Estonian administrative divisions have changed over the centuries in accordance with the political powers that have ruled Estonia. Conjoining the results of historical and archaeological studies on the administration in Estonia at the end of the prehistory, before the German-Danish crusaders' conquest and Christianisation in the wars of the first half of the 13th century, Lang (2002:125–168) has concluded that the main administration divisions consisted of at least three levels: village, (historical) parish (Estonian *kihelkond*) and historical district or province (Estonian *maakond*). In addition to that, an economical taxation unit called *vakus* comprising of several farms and villages and the so-called fort district that was mainly a political unit have been distinguished (Lang 2002:167).

Lang (2002:167–168) proposes an idea that the districts that comprised of several historical parishes were not political or administrative units at the end of prehistory. Rather, he points out that they were culturally similar geographical areas that were separated by natural borders that were not favourable for settlement, i.e. dense forests, bogs and rivers. He sees the geographical isolation as the main reason behind the well-known cultural differences between counties (that derive from the earlier provinces) that lasted throughout the historical time and are visible in the ethnographic material, dialectical differences, folklore and also archaeological material (Lang 2002: 167–168)[19]. The districts were probably rather autonomous (Markus 2004:137)

[18] Semi-natural dry calcareous grassland communities; for more detailed definition, see 4.1.
[19] The cultural variations between different regions in Estonia have also been associated with larger scale

and were not organised into states. However, there probably was cooperation between the districts (Lang 2002:168), at least during military operations, as has been concluded from the written sources of the 13th century (Tarvel 1992:120). The exact number of districts at the end of prehistory is not exactly known as the information on written sources is somewhat contradictory. Usually seven or eight larger and four to six smaller districts have been distinguished. The parishes were also thought to have been initially just geographical settlement areas while by the end of prehistory they became territorial-administrative units (Lang 2002:167). After Christianisation in the 13th century, parishes also became ecclesiastical units which lasted, although with many changes, until 1925 when a law was passed that abolished them as a territorial as well as congregational units (Vihuri 2008:217).

The historical sources from the 13th century indicate that at the end of prehistory western Estonia formed the district or province of Läänemaa, which, according to Blumfeldt (1938:3) was called *Maritima* in the Latin chronicles from the 13th of century, meaning "the land by the sea" or *Rotalia* (probably named after Ridala parish in West Estonia). Later in the Middle Ages the whole area was called *Wiek* or *Wikum* in German and Nordic sources which means a "shallow bay" (Swedish *Vik*) (Blumfeldt 1938:3). The province was bigger than the modern Lääne County and included the northern part of the current Pärnu County in the south and parts of the Harju County in the north. It has been assumed that there were seven prehistoric parishes in Läänemaa (Blumfeldt 1938:3; Mandel 2004a:189), although there are dissenting opinions about their exact borders, extents and names (e.g. Tarvel 1997). According to Mandel (2003:170), at least Hanila, Karuse and Lihula parishes have been identified as reaching back to prehistory, as well as Soontagana parish on the lands of later Mihkli parish (Tarvel 1997:11). It is believed that the prehistoric parishes that were bigger in size, overlapped with and encompassed the ecclesiastical parishes that were established after the Christianisation (e.g. Mandel 2003:170). The following historical parishes were situated on the mainland[20] of western Estonia: Hanila, Kirbla, Karuse, Kullamaa, Lihula, Lääne-Nigula, Martna, Märjamaa, Noarootsi, Ridala, Varbla, Vigala and northern part of Mihkli parish (Fig. 4.4). As to the fort districts that are considered as the possible parish centres in the Latest Iron Age (11th–13th centuries AD), Mandel (2004a:189–203) has pointed out five of them in the study area: Lihula,

environmental variations. Ethnologist Ants Viires (1998:656–660) points out the border between the Lower and Upper Estonia that divides Estonia into two culturally distinct regions.

[20] The historical Läänemaa district also included the islands of Hiiumaa and Vormsi which will not be covered in the current work.

Vatla and Soontagana in the southern part of western Estonia, and Ridala and Kullamaa in the northern part (Fig. 4.4), however, most of the supposedly existing villages of that time remained outside of the fort districts. During the Middle Ages churches became the centres of the parishes.

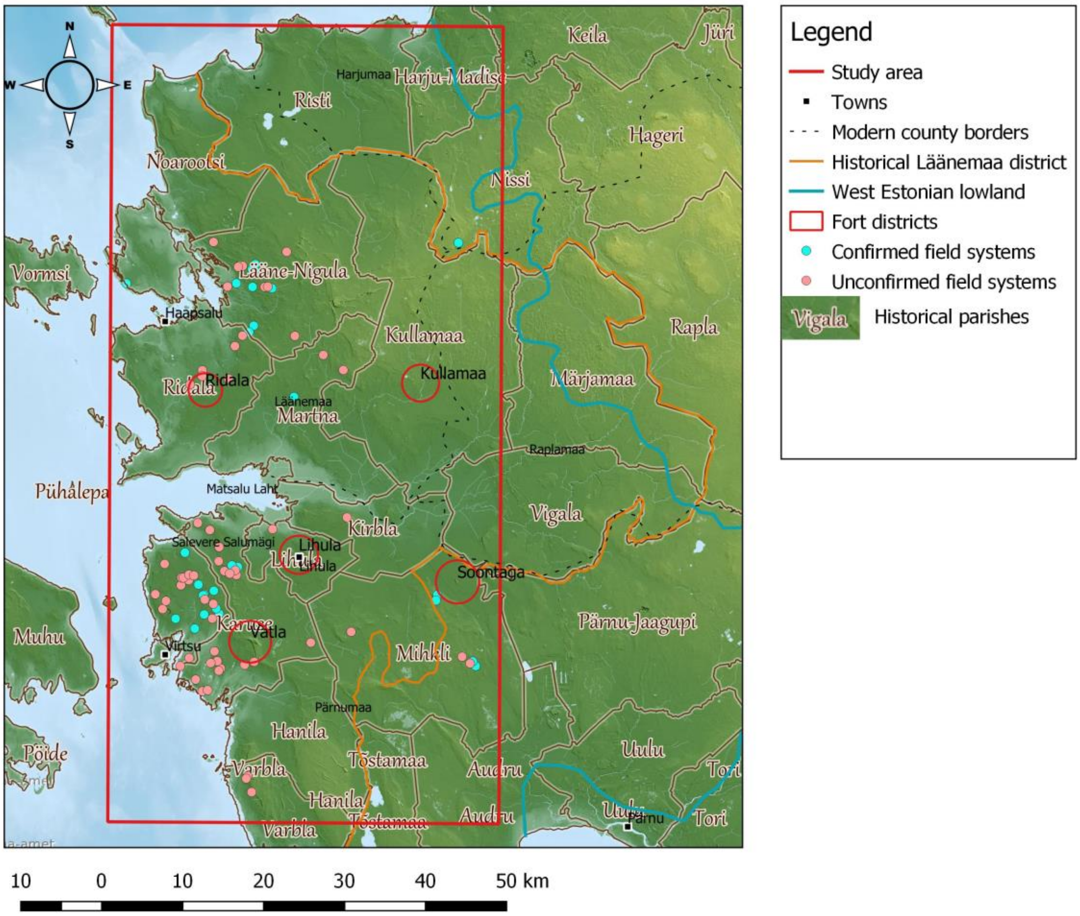


Figure 4.4. Study area with current and historical administrative units, including historical parishes and fort districts. Base map: Estonian Land Board 2021.

Later administrative alterations in the study area were mainly connected with the political changes in Estonian territory which will be dealt more thoroughly in section 4.4. What is important to point out here is that despite the later administrative changes, the parish division remained consistent. The historical districts and parishes are also important from historical and ethnographic perspectives as they formed the basis for the modern administrative divisions and also because they carry the meaning of historic and traditional solidarity and unity that later saw many alterations by the foreign rulers of Estonia. The parishes are still sometimes used by people as unofficial territorial and social units and have remained in use in cultural studies (ethnography, language, folklore, archaeology).

Until 2017 Lääne County covered approximately the same area as the historically known district. After the merging of smaller municipalities during the administrative reform in 2017, only the northern part of the area remained as part of the Lääne County, while the southern part of the historical Läänemaa was joined with the Pärnu County.

The study area, based on the historical division, encompasses the historical Läänemaa district but also the northwestern part of the historical Pärnu County (Audru, Jaagupi, Mihkli, Tõstamaa and part of Pärnu Parishes) and part of Nissi parish in Harju County.

The borders of the historic Läänemaa coincide well with the area of West-Estonian lowland described above and presented in figure 4.3. Therefore the study region is best characterised as the combination of both types of divisions: the landscape region of West-Estonian lowland puts the study area in a widely recognised geographical framework with a specific set of environmental conditions (a flat coastal plain which has been affected by constant land uplift and sea level changes, with characteristic limestone outcrops and hills, and maritime climate) while the historic division (a region which has been distinguished as a separate administrative unit at least from the Middle Ages) has the potential to indicate a distinctive western Estonian cultural context. However, the study area is not fully determined neither by its natural nor historic or modern administrative division and borders but these divisions are taken mainly as guidelines for defining a more compact study region with similar historic and environmental background, whereas the definitive study region is defined by the distribution of previously known field systems and fields that were discovered in the course of the current study.

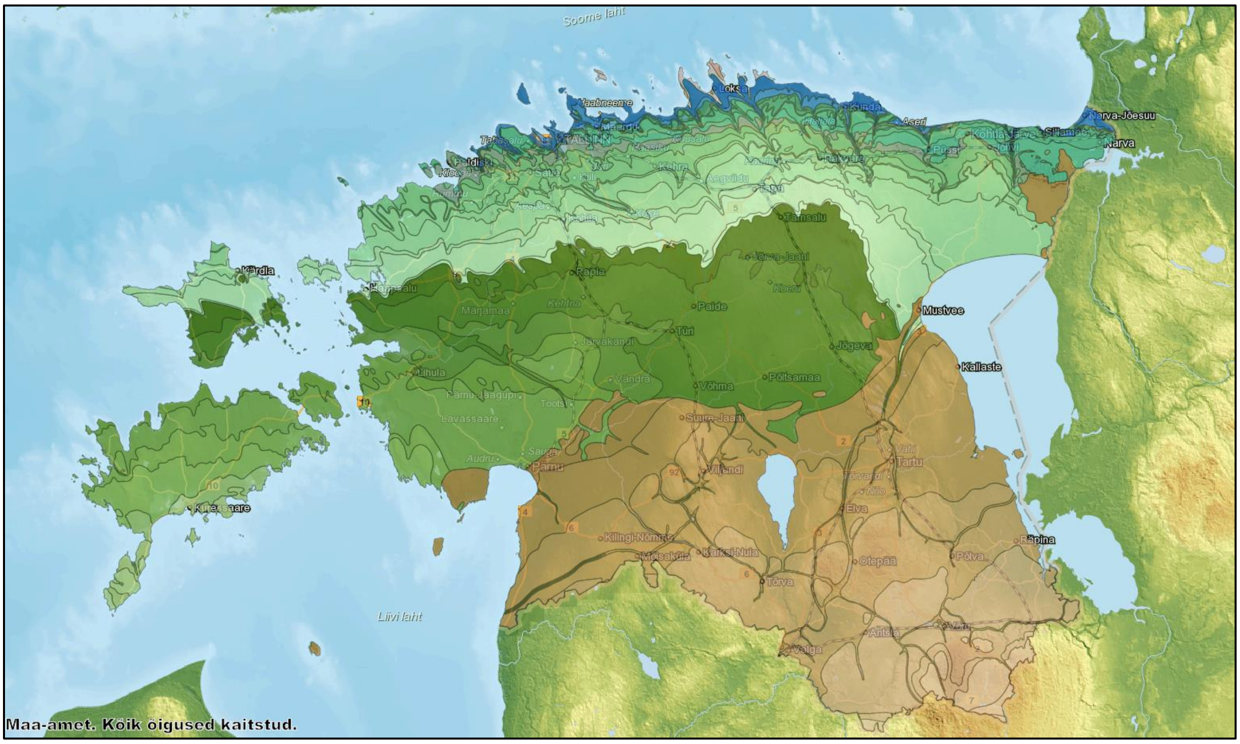
4.3 **Environmental history**

The Estonian environment is characterised by a maritime climate, four distinct seasons, an abundance of lakes, rivers, springs and mires, mixed forests and widespread human influence on the formation of the landscape (Varep and Saar 1995:11). Geologically, Estonia is situated in the north-western part of the East-European platform and for the most part within the boundaries of the southern slope of the Fennoscandian Shield. Climatically, Estonia belongs to the mixed-forest subregion of the Atlantic continental region of the temperate zone (Raukas

1997b; Raukas and Rõuk 1995). Estonian climate is transitional between maritime and continental and characterized by warm summers and moderately mild winters (Jõgi and Tarand 1995:188). The climate is influenced by the Atlantic Ocean from one side and the Eurasian continent from the other (Paal 1999:9) and the location in the extreme north-western part of the Eurasian land mass means that the region is actively influenced by cyclones (Jõgi and Tarand 1995:188–189). Since annual precipitation exceeds evaporation approximately twofold, the climate is excessively damp (Jõgi and Tarand 1995:213–215).

4.3.1 Topography and landforms

The Estonian topography as we see it today derives from a bedrock geology formed billions of years ago. The bedrock has shaped the Quaternary deposits and landforms, and is responsible for the litho- and morphogenesis during the Quaternary as a whole (Tavast 1997). The rocks of the Palaeozoic sedimentary cover are the main source for till and other sediments evolved during ice ages (Arold 2005:398). In Estonia the geological section consists of two principal elements: the Precambrian crystalline basement which is covered by the sedimentary cover of Precambrian Vendian and Palaeozoic (Cambrian, Ordovician, Silurian and Devonian) sedimentary rocks (Puura et al. 1997; Viiding 1995). The Cambrian rocks outcrop only along the Baltic Klint in the coastal area of North-Estonia but mostly they are overlain by younger rocks (Mens and Pirrus 1997). Ordovician, Silurian and Devonian sediments are present in different parts of Estonia and divide the country by differences in geological setting (Fig. 4.5).



Cambrian rocks - sandstone, siltstone, clay.	Ordovician rocks - mainly limestone, marl, also dolomite.	Silurian rocks - mainly limestone, dolomite, also marl.	Devonian rocks - mainly sandstone, siltstone, also dolomite, limestone.

Figure 4.5. Map of Estonian bedrock, scale 1:400,000. Base map: Estonian Land Board 2019.

Most of the study area in West Estonia is represented by Silurian sediments and the northern part of West Estonia has Ordovician sediments. The Ordovician System is represented mostly by limestones, dolostones and marls. These sediments are also found on the northern part of the island Hiiumaa and island Vormsi and in northern and central Estonia, The most impressive outcrops occur in association with the Baltic Klint and along the northern coast of Estonia (Viiding 1995:51–54 and Table 5, 52). The Silurian System consists of limestones, dolostones and marls (Viiding 1995:54 and Table 6, 55). The main outcrops of Silurian rocks are connected with the West-Estonian (Silurian) Klint running from the mainland of southwestern Estonia through the Island of Muhu to the northern coast of the Island of Saaremaa. The West-Estonian Klint, unlike the North-Estonian Klint, does not form a continuous escarpment but consists of isolated small hills and cliffs (Miidel 1997). According to Arold (2005:16) the Silurian system is significant for the bioherms – rocks that have formed from fossilised corals and algae – that are found in the so-called Jaagarahu deposits that forms a basis for the islands of Muhu and

Vilsandi and outcrops in several places around the coast (e.g. the hills of Salevere, Mihkli, Kirbla and Lihula), occasionally forming steep cliff ridges.

After the beginning of Pleistocene, the bedrock surface that so far was controlled by erosional processes was significantly affected by glaciers (Tavast 1997; Raukas 1995a:62–65). During glaciations bedrock topography determined the dynamics of glacier movement, distribution of erosions and accumulation areas, character and composition of glacial deposits (Raukas 1995a:62–65, 550). Glaciers eroded and fractured the upper part of the bedrock and this has determined the composition of the agglomerate landforms by the till and the characteristics of the soil cover by parent rock (Arold 2005:20).

During different glaciations Estonia was affected by ice streams which caused areas of accumulation and erosion (Raukas and Kajak 1997). Glacial erosions prevailed on higher bedrock of North and West Estonia, and these areas are characterised by a thin Quaternary cover. South Estonia is predominantly an area of glacial accumulation and the Quaternary cover is considerably thicker (e.g Raukas and Rõuk 1995:123–130).

Estonia was finally cleared of the continental ice about 11,000 years ago, but before that the glaciers temporarily reinvaded the West-Estonian Archipelago and north-western Estonia (Karukäpp and Raukas 1997). In all stages of deglaciation, considerable areas in front of glacier margins were covered with glacial lakes of different ages (Raukas and Rõuk 1995:140–159).

During the Holocene, the bedrock was mostly affected by the combination the Baltic Sea and several terrestrial geological agents (Tavast 1997; Raukas 1995a:62–65). The Baltic Sea has also played a great role in the development of climatic conditions, flora, fauna, and soils of Estonia. The evolution of the Baltic Sea in the last 12,000 years is characterised by alternating transgressions and regressions (Raukas 1997a). The development of the Baltic Sea can be divided into several stages and phases which have left behind clear traces in the form of prominent coastal deposits and relief forms (Raukas 1997a; Kessel and Punning 1995:219–227).

The area of Fennoscandian continental glaciation was repeatedly subjected to crustal downsinks and uplifts caused by ice sheets loading and unloading. In the late Pleistocene, the areas that were previously covered with glaciers were subjected to neotectonic rise or rebound. The Late-glacial and Holocene crustal movements have been studied in more detail and the following conclusions have been reached: (1) in the Late-glacial and Holocene, Estonia experienced crustal uplift and tilting; (2) the amount and rate of the uplift decreased from the northwest to the southeast; (3) the rate of the uplift has been decreasing from the Late-glacial to the present time but the decrease has been uneven in different time periods and regions. Crustal movements have continued up to the present: the north-western part of Estonia is rising at a rate up to 3mm per year, whereas south-eastern Estonia is sinking at a rate of up to 0.8mm per year (Miidel and Vaher 1997).

Land uplift and sea level changes have influenced West-Estonian coastal areas considerably. They have affected sediments and soil formation and the formation of isolated lakes or mires. Due to the uplift, new land has been constantly emerging throughout the Holocene. The older shoreline formations are located in various absolute heights, sometimes tens of kilometres further from the modern coastline (Miidel and Vaher 1997). These old shorelines have been reconstructed and used in the study of the stages of Baltic Sea (e.g. Raukas 1997a), and the knowledge about shoreline displacement has been used to detect and date Stone Age settlements (e.g. Jussila and Kriiska 2004, Muru et al. 2017, Muru et al. 2018, Rosentau et al 2013).

4.3.2 Quaternary cover and soils

Estonia belongs to the zone of glacial erosion or moderate accumulation and, therefore, the Quaternary cover is rather thin. In western Estonia, on the outcrops of the Silurian carbonate rocks it is usually less than 5 metres. Occasionally, on the so-called alvars, it is lacking completely. The Quaternary cover is at its thickest in the heights and buried valleys of South Estonia (Raukas 1995b:550).

The Quaternary cover (covering palaeozoic sedimentary rocks: limestone and sandstone layers) is composed of formations of variable composition and genesis (see Fig. 4.6). An important factor in the formation of Quaternary lithogenesis was glaciation which has left behind glacial and aqueoglacial deposits. The other types of deposits, such as marine, alluvial and aeolian, are the products of reworked glacial and aqueoglacial sediments. The Pleistocene deposits are dominant by tills (glacial sediments) that cover ca 48% of the area. The different varieties of till identified in Estonia are basal, ablational, frontal and basin till. Glaciolacustrine and glaciofluvial deposits are also widespread, while marine, fluvial, lacustrine, organogenous and some other types of sediments constitute less than 5% of the total amount of the Pleistocene deposits. Bogs occupy 21.2% of Estonian territory (Raukas 1995c:552–553).

Holocene deposits, which accumulated during the last 10,000 years, are represented mainly by marine deposits in Lower Estonia. After the retreat of the glaciers, this area was inundated by the waters of ice lakes or of the Baltic Sea. Later, other geological processes (alluvial, aeolian etc) were added. In Upper Estonia alluvial, aeolian, deluvial and other continental processes began immediately after the retreat of the glacier (Raukas 1995b:70, 553). The Holocene deposits developed on the basis of abrasion and redeposition of mostly Pleistocene sediments, on a smaller scale also of bedrock sediments, therefore their composition is similar to the source material (Raukas 1995b:70).

The Quaternary deposits are the main parent material for soil formation (Reintam 1997). In addition to the parent material, water regime is an important factor in the development of soils (Kokk 1995:430). The soil cover of Estonia is characterized by high diversity due to the varied composition of parent materials and diverse water conditions, a large share of peatland and peaty soils, abundance of calcareous soils (especially in the North and West Estonia), and the high rock content of soils. Basement rocks are the parent material in only 3% of the Estonian territory. Among those, calcareous stones prevail, especially in North Estonia and the islands. In the rest of Estonia, the parent material consists of quaternary sediments, mostly till (Reintam 2012:59), and 75% of soil parent material is calcareous (Reintam 1997).

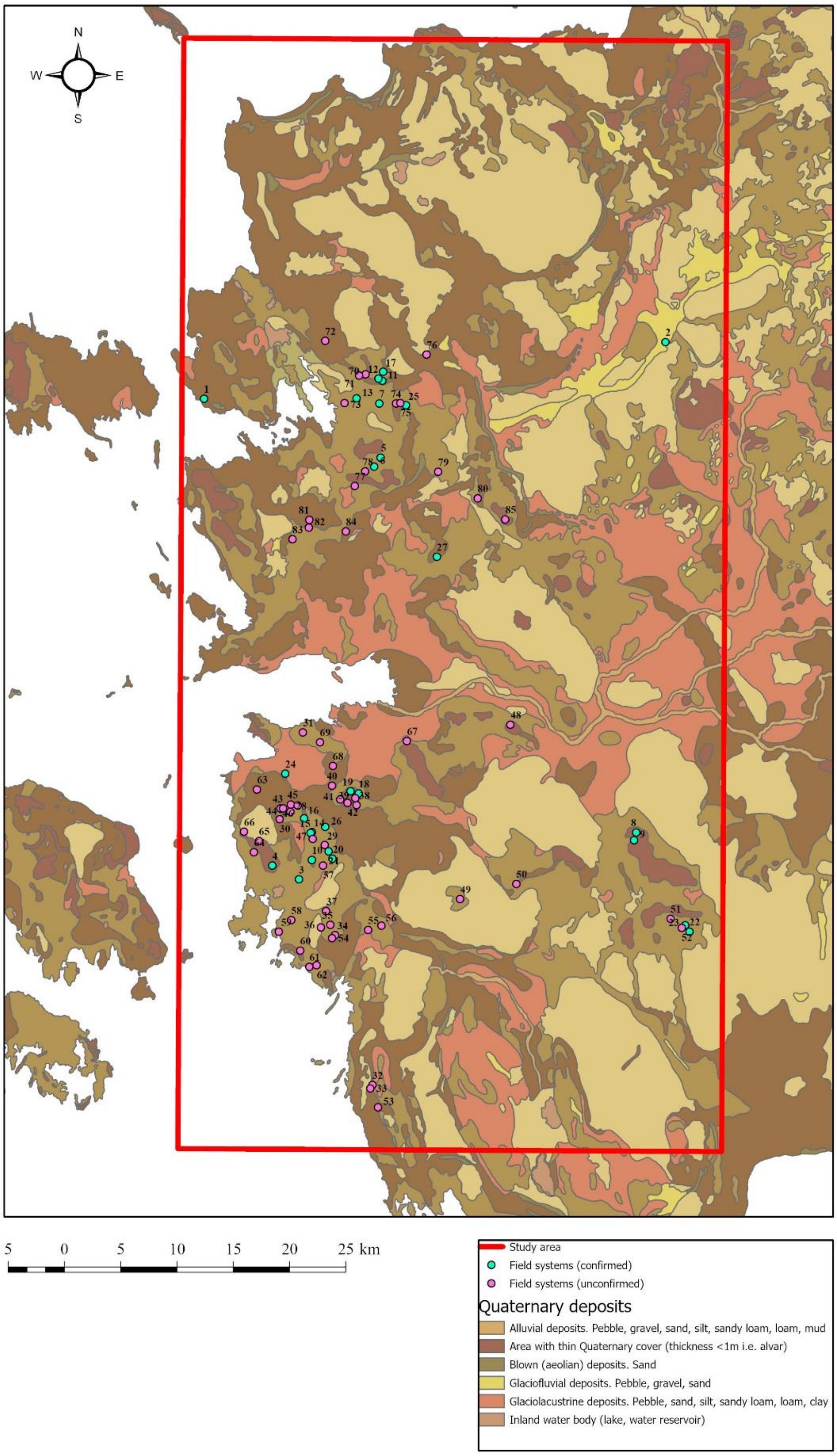


Figure 4.6. Quaternary deposits in the study area. Base map: OÜ Eesti Geoloogiakeskus 2006, systemised by Estonian Land Board 2019.

The soil types in Estonia differ from one another in their distribution, structure and properties. Automorphic soils (Leptosols, Cambisols, Luvisols, Planosols, Podzoluvisols, Podzols and Arenosols) with their gleyic subtypes and eroded kinds cover 42%; different Gleysols make up 32.5%; and Histosols (mires and bogs) 23.2% of Estonia's territory. Fluvisols (alluvial and saline litoral soils) form 2.1% and technogenic formations on reclaimed land (recultivated mining territories) 0.2%. By texture, sandy soils make up 26.7%, peaty soils – 23.7%; loamy sands, loams and clays occupy 17, 27.8 and 4.8% respectively (Reintam 1997).

The soils of West Estonia are categorised into five types: Rendzinas, Brown soils, Gleysols, peat and alluvial soils. The soils in the study area are represented in figures 4.7 (northern part of the study area) and 4.8 (southern part of the study area). I will summarise each of these soil types.

Rendzic Leptosols (Rendzinas) are formed on limestones and dolomitised limestones, on strongly calcareous stony till and on coarse glaciofluvial materials (Reintam 1997). Their distribution is typical to areas where limestone bedrock lies close to the land surface (Kokk 1995:434; Reintam 1997). These soils are high in humus, but stony and sensitive to drought. The most common natural vegetation types on such soils are alvar forests and alvar meadows (Kokk 1995:434). So-called ryhk and pebble rendzinas (rendzic leptosols and calcaric regosols) on calcareous sceletal till can also be found mostly in North and West Estonia, although in areas of thicker quaternary cover. They are rich in humus and nutrients and have a high content of sharp-edged pieces of weathered limestone (ryhk). Nowadays these soils are rarely cultivated. In places they are covered with species-rich wooded meadows and fresh boreo-nemoral forests (Kokk 1995:435).

Brown typical and lessive soils (Cambisols and Luvisols) that are the most productive agricultural soils in Estonia and occur mainly on the till plains of Central Estonia (Kokk 1995:435). They are formed on calcareous tills (Reintam 1997). Their combinations with Rendzinas and Gleysols also occur in the northern and western part of Estonia (Kõlli 2012:353–354).

Gleyic subtypes of any automorphic soil type are typically characterized by some raw humus in A–horizon, stagnic properties in topsoil and gleyic properties in subsoil. Gleysols represent a large association of waterlogged soils with highly variable composition and properties. The common feature of Gleysols is a bluish-grey or greenish-grey gley horizon formed in the conditions of either high ground water level or prolonged surface and perched water. Their surface horizon consists of only partly transformed organic matter — raw humus. Some sandy Gleysols may have undergone podzolisation. Gleysols, formed in a calcareous environment, support paludified deciduous forests. In West Estonia, cultivated grasslands and fields can often be found on Gleysols (Kokk 1995:437).

Gleysols have been the prevailing soil formation since the permafrost tundra stage and they include different hydromorphic types. Rendzic Gleysols, Cambi-Calcaric and Luvi-Calcaric Gleysols develop on calcareous till, but most of Eutric and Dystric Gleysols on graded deposits of the Baltic Sea transgressions. The properties of Gleysols highly depend on the water nutrition as well as on the chemism of water and parent material (Reintam 1997). All Gleysols together predominate in the soil cover of Estonia (Kokk 1995:437).

Histosols (peatland soils; mires and bogs) have a peat (*histic*) horizon with a depth of more than 30cm. They have developed from Gleysols within the Holocene, but also as a result of the eutrophication of waterbodies. Eutric Histosols (lowland mires) are characterized by a ground-water or flooding regime, Dystric Histosols (transitional mires and raised bogs) – by atmospheric nutrition (Reintam 1997). These peatland soils occupy about one-fourth of the territory of Estonia (Kokk 1995:438). Their large expanses occur mainly in the West-Estonian and Peipsi depressions (Kõlli 2012:373–377).

Fluvisols (alluvial soils) are the current formation of seasonal inundation and accumulation of alluvial and lacustrine suspensions (Reintam 1997). They form in the bank and shore zones of inland water bodies in conditions of periodic floods. Relatively few of them have been preserved in Estonia, as the frequency and scope of floods have considerably decreased due to dredging and damming of rivers and drainage. On low sea coasts, in the influence zone of saline seawater, slightly saline littoral soils (Salic Fluvisols) occur. These are, as a rule, young soils still in their developing stage (Kokk 1995:438).

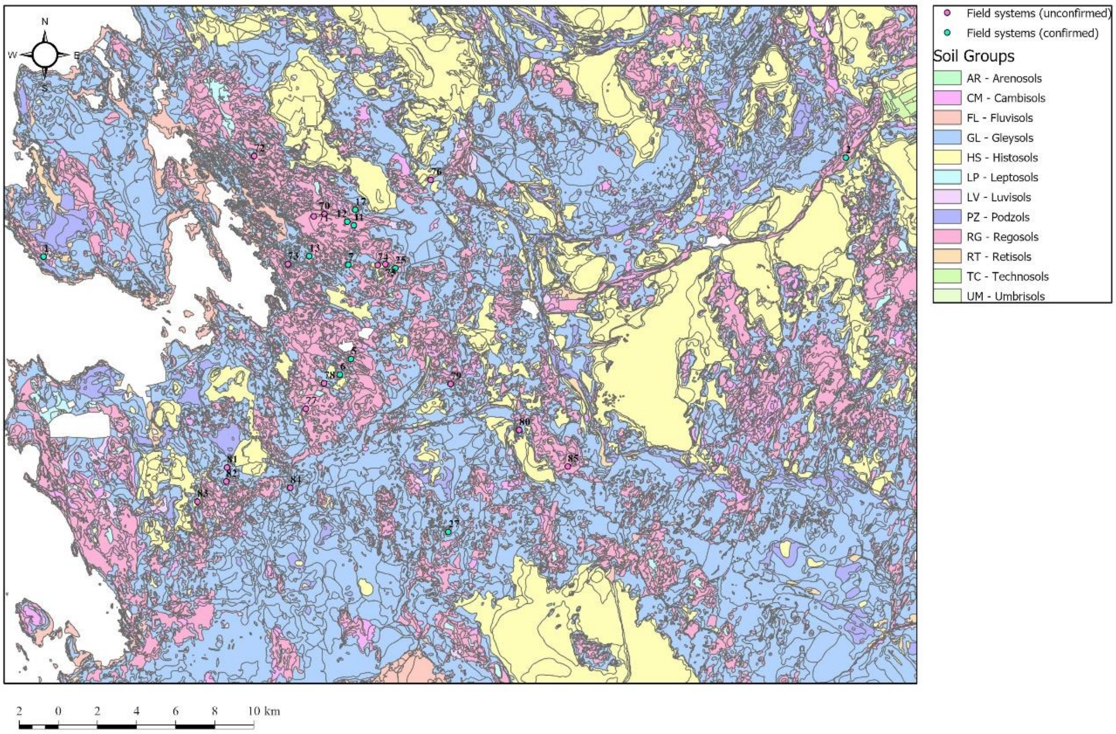


Figure 4.7. Soils in the northern part of the study area. Source: EstSoil-EH v1.2c: EstSoil-EH: A high-resolution eco-hydrological modelling parameters dataset for Estonia. Kmoch et al. 2020.

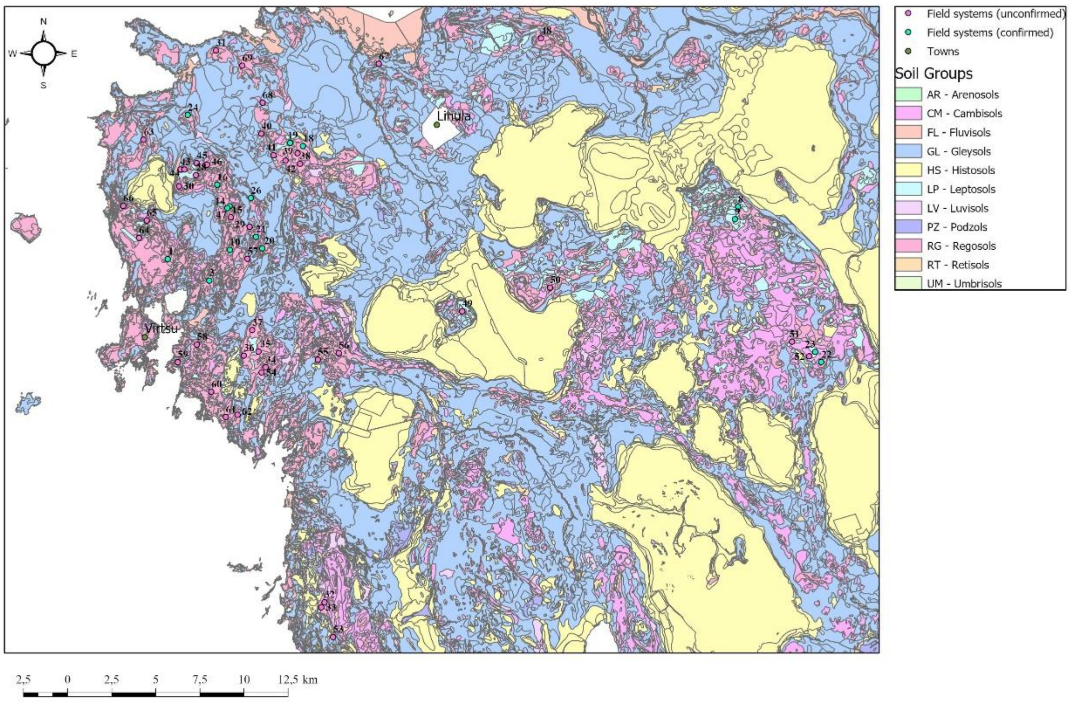


Figure 4.8. Soils in the northern part of the study area. Source: EstSoil-EH v1.2c: EstSoil-EH: A high-resolution eco-hydrological modelling parameters dataset for Estonia. Kmoch et al. 2020.

4.3.3 Climate and vegetation

Periglacial conditions came to dominate after the retreat of the ice sheet from Estonia. At the beginning of the Holocene (from 10,000 BP) a relatively quick warming of the climate took place and at the beginning of the Boreal chronozone (about 9,000 BP), the mean annual temperature could be compared with that at present. During the climatic optimum about 5,500–6,500 years ago, the mean annual temperatures exceeded present values by 1–2°C. This was followed by a decrease in the temperature and an increase in humidity. A short-term warming about 4,000 years ago was again replaced by cooling. More reliable data are available for the last thousand years, and these distinguish a warm interval about 1,000 years ago (Punning 1995:181). For the last century, it has been shown that a gradient of 0.8–0.9°C per hundred years is a natural trend of air temperature rise in the region (Jõgi and Tarand 1995:211).

Estonia's local climate is mostly affected by the Baltic Sea, which causes the main differences between the climate of the Western and Eastern parts of the country. In West Estonia, the climate is more maritime. The annual average temperature in Estonia is between 4.3°C and 6.5°C, being lower on the uplands and higher on the western coast of the islands. In winter the Baltic Sea exerts a strong tempering influence and the difference between the temperatures on the coast and inland is greater than in other seasons (Jõgi and Tarand 1995:188–195). The average air temperature in January is -6°C to -7°C in Central and East Estonia and -2°C to -4°C in the West-Estonian Archipelago. The coldest month is February. Typically, the winter (January-February) is 4–5 degrees warmer in western Estonia and the islands and colder in eastern Estonia whereas in spring and summer it is slightly colder on western coast compared with the inland (Hermet 2013:86; Paal 1999:9).

Another factor affecting climatic differences is altitude – the higher the ground, the more precipitation and the longer the snow cover lasts (Paal 1999:9). The Estonian climate is humid and precipitation exceeds the evaporation. The average annual humidity is 80–83% and the precipitation ranges between 550 and 800mm, being lower in the coast and islands and higher in the inland and upland areas (Paal 1999:10; Jõgi and Tarand 1995:188–195).

It is particularly dry on the coast in spring and in the first half of summer. The western coast receives a comparatively large amount of precipitation in autumn and early winter. The snow cover in Estonia is characterised by large spatial and temporal variations. The average duration of snow cover during winter is 75–135 days. Snow cover remains for the shortest time on the small islands near the western coast of Saaremaa Island and the longest on the Haanja and Pandivere Uplands (Jõgi and Tarand 1995:188–194).

Jõgi and Tarand (1995:195–207) have pointed out microclimatic differences in different physiographic regions of Estonia. When compared with the general climate, the differences in microclimate are remarkable and they can exceed those between North and South Estonia even within one arable field. Microclimate is at its most variable in hilly landscapes, and more uniform on the plains (Jõgi and Tarand 1995:204). Human activity (draining, irrigation etc.) has an impact on the formation of microclimates (Jõgi and Tarand 1995:204–207).

The length of the vegetation period (when the average temperature is above 5°C) is 179–185 days (Paal 1999:10). On clear nights, night frosts can occur in enclosed depressions throughout the summer. The relative air humidity is high because of dominating marine air massed. Annual evaporation is from 450mm (island of Saaremaa) to 470mm (South Estonia). Climatic conditions favour the growth of forest. The amount of heat and precipitation enable satisfactory yields of perennial hay crops, forage root crops, grains, flax, legumes and cultivated berries (Arold 2005:399).

Estonia is located in the mixed forest subzone of the temperate forest zone of the Northern hemisphere. Mixed forests are characteristic to loamy, sandy loamy and clayey areas, as well as to minerotrophic swamps. In the tree layer, there are spruces, birches and pines, and to a lesser extent aspens, lindens and oak trees. In practice, about 25 forest site types are distinguished. Because of extensive sandy areas and cultivated forests, pine forests occupy the largest part of the country (34%). Birch forests stand on the second place. In 2002, the area of forestland was 49.7% while arable land occupied 28% of the territory (Arold 2005:399).

There are more than 2,500 species of algae, about 680 species of lichens and 450 species of mosses, 44 species of ferns and four species of gymnosperms (local species: spruce, pine, juniper and yew tree) in Estonian flora. The number of local flowering species counts to 1,540. The most species-rich families are Asteraceae (136 species), Poaceae (119) and Cyperaceae (103, mostly Carex species) (Arold 2005:399). There are differences in vegetation on the Silurian calcareous bedrock and the Devonian sandstones which were first noticed by Fr. Schmidt in the middle of the last century (Veski 1998:7). The floristic border runs from south-western Estonia to north-east approximately along the highest post-glacial shoreline (Lippmaa

1935, cited in Veski 1998:7). The vegetation to the west of this border has more variety of species because of more maritime climate and calcareous bedrock (Veski 1998:7).

Most of the information about the development of Estonian vegetation through time has been gained from palynology, the analysis of pollen or species of organisms (e.g. algae) in the deposits, combined with dendrochronology, biostratigraphy and plant macrofossils from archaeological deposits (Kukk et al. 2000:90). The main results are summarised in an article by Kukk et al. (2000) that gives a comprehensive overview of the development of vegetation (and animals) after the last Ice Age, along with the changes in climate, stages of the Baltic Sea and corresponding information about the main archaeological periods.[21]

The development of the diversity of species in Estonia started with the end of the last Ice Age (Kukk et al. 2000:91). The ice began retreating from Estonia ca 13,500 years ago and was gone by ca 11,000 years ago. The first species to colonise the land left by the retreating ice were periglacial tundra plants (and animals) (Kukk et al. 2000:92). Since then the diversity of taxons has seen three major increases during the Holocene:

1. 10,000 BP–8,500 BP The colonisation period of Older Dryas and Allerod (Preboreal and Boreal chronozones) when periglacial tundra vegetation and animals immigrated into the ice-freed area. During the first half of the period (until 9,000 BP) birches and pines (Betula and Pinus) dominated in the forests and different grasses and ferns in the lower levels of vegetation (Kukk et al. 2000:93). In West Estonia and islands the development was different than inlands – because of the quick land uplift of that time, large areas were freed of waters. The resulting landscapes were sandy and without vegetation until pine (with sea-buckthorne) started prevailing (Veski 1998).

   The percentage of pine increased after 9,000 BP but after 8,500 BP the rapid escalation in alder (Alnus) is traceable (Kukk et al. 2000:93).

2. 8,000–4,000 BP. The beginning of the climatic optimum when taxon variety increased. In the beginning of Atlantic chronozone (after 8,000 BP) climate became warmer and more maritime. In ca 8000 BP the development of saltwater Litorina Sea started when

[21] See also Kukk et al. 2000:91, Fig. 1.

the Danish channel opened. During 8,000–6,500 BP the pollen of hazelnut, alder and elm increased (Veski 1998) while pine is still common in the transgression areas of West and North-West Estonia (Kukk et al. 2000:94). In many places, the formation of bogs started (Laasimer 1965, cited in Kukk et al. 2000:94).

With the beginning of the Mesolithic, human impacts started affecting the development of vegetation and landscape in general. The pollen diagrams near known Mesolithic settlement sites show the expansion of meadows and indicators of herding in forests in ca 7,500–6,500 BP. Charcoal particles also increase (Kukk et al. 2000:94).

The later part of Atlantic chronozone (6,500–5,000 BP) was the time of climatic optimum when broad-leaved forests prevailed in most of Estonia while the pine and birch pollen is minimal (Kukk et al. 2000:94). The abundance of herb pollen increased which has been interpreted as a sign of open pastures in forests for cattle breeding (Veski and Lang 1996b). At the same time there are signs of increased soil erosion in lakes (Veski 1998) and of rapid increase in charcoal particles (Saarse and Königsson 1992).

The later part of the Subboreal chronozone (5,000–4,000 BP) began with a decline of elm (a phenomenon that has been noticed elsewhere around the Baltic Sea as well – called *landnam* by Iversen 1949). It has been proposed that many factors played a role: fall in temperature, worsening ecological factors and human impact. The human impact is connected with the immigration of the first farmers who started cultivating fertile soils. With the decline of elm, there was an increase in the spread of hazel, oak and spruce (Kukk et al. 2000:94). In general, the climate was more continental and forests more sparse (Kukk et al. 2000:95).

3. Around 4,000 BP agricultural practices of cattle breeding and cultivation became more widespread, which contributed to the increase in the number of taxa, especially synanthropogenic (Kukk et al. 2000:95).

During the late Subboreal chronozone (4,000–2,500 BP) cereal pollen starts occurring continuously in some pollen diagrams (e.g. Maardu lake next to the Saha-Loo field systems in North Estonia). In general, broad-leaved trees disappear slowly while birch and pine increases. There is also a large number of oak and spruce pollen. The increase of oak shows the development of landscape with sparse tree cover and the spread of wooded meadows. The general openness of landscape increases which is also seen as a sign of continuous land cultivation. In the few locations where pollen analysis has been undertaken near excavated field systems, there are correlations between the radiocarbon dates from beneath the field banks and cairns and the dates from cores with cereal pollen and other indicators of farming (Kukk et al. 2000:95; Lang 1994a; Lang 1996b; Veski and Lang 1996b).

Rye pollen (*Secale cereale*) occurs in pollen diagrams for the first time around the end of Bronze Age (ca 500 BC). It is thought that it first started as a weed that grew with wheat and barley and only later as an independent crop (Kukk et al. 2000:95).

The older part of the Subatlantic chronozone (2,500–2,000 BP) is characterised by the spread of birch, spruce and alder. In the middle part of the Subatlantic chronozone, ca 1900–900 BP the climate became more maritime and pollen indicators show further clearance of woodland (Kukk et al. 2000:95). During the last 1,000 years, the landscape became similar to the present (Kukk et al. 2000:96).

4.4 Settlement history

The main environmental factors that have affected the settlement history in western Estonia are the retreating shoreline and the distribution of available soils for agriculture. The most important archaeological changes in prehistoric settlement pattern have been connected with these environmental preconditions and are, respectively, the colonisation of West Estonia and the beginning and spread of agriculture.

4.4.1 Introduction

The most recent overviews of the prehistory of Estonia have been published in the publication series Estonian Archaeology (Eesti Arheoloogia), issued since 2006 by the Chair of Archaeology of the Institute of History and Archaeology of the University of Tartu: The Bronze and Early Iron Ages in Estonia by Valter Lang (2007b) and The Migration Period, Pre-Viking Age, and Viking Age in Estonia by Andres Tvauri (2012). There are gaps in up to date synthesis for the Stone Age and for the later Iron Age which are covered by published materials that concentrate on different subjects, regions, periods and monuments somewhat unevenly. The archaeological and historical periods identified in Estonia were presented in chapter 2 (Table 2.1.).

4.4.2 Stone Age and Early Bronze Age

According to Kriiska (2002:43–44), the oldest archaeological traces of the settlement in the coastal region of western Estonia have been dated to ca. 7000 BC (the early Mesolithic period) and are connected with the seasonal settlements of seal hunters. The final colonisation and the beginning of permanent settlement developed by the end of the Mesolithic period (ca. 4900 BC) and has been associated with population growth and intensification of maritime hunting economy (Kriiska 2002:43–45).

In addition to studies of archaeological material, palynological studies are an important source for understanding human land use and settlement practices during prehistory, especially the Stone and Bronze Ages. Palynologists have payed particular attention to understanding phenomena connected with cultivation and human impact on the environment in the pollen diagrams. The main emphasis in most of the studies is on finding and interpreting the first signs of agriculture (e.g. Poska and Königsson 1996; Poska and Veski 1999) but often a longer time period, including the Bronze and Iron Ages, is covered by the analysis (e.g. Poska et al. 1999, Poska et al. 2004). In several cases, palynological work has taken place in regions where archaeological sites are known, thus creating opportunities to correlate the data. Many palynological investigations have been completed in western coast and the islands (e.g. bogs of Velise and Mustjärve and Lake Tõhela in the continental part, and from Kõivasoo on Hiiumaa Island (Veski 1998; Poska et al. 2004:45), however, there are places that are not so well covered with pollen analytical studies, for example the southern West Estonia where the case study area of the current thesis is located.

General trends in the development of agriculture in prehistory have been established for West Estonia. The earliest Cerealia pollen (Avena- and Hordeum-type) obtained from West Estonia dates to the Middle Neolithic, 4000–3500 BC. The information, correlated with archaeological data, has been used to reach to the conclusion that the early signs of farming show that it remained an insignificant activity next to foraging and did not affect settlement and material culture (Kriiska 2000b:73; 2003b:15; Kriiska 2006:72).

After the first signs of cereal cultivation a period of decline can be seen in West Estonia. The earliest traces of the adoption of cereal farming, defined as the start of a continuous Cerealia pollen curve, are dated to the beginning of the Bronze Age in coastal Estonia (Poska et al. 2004:47). A settlement shift on the coast and islands, probably conditioned by the agricultural needs, has been seen to have taken place during the Late Neolithic (3200/3000–1800 BC) (Kriiska & Tvauri 2002:78 f.; Kriiska 2006:72) or Early Bronze Age (1800–1100 BC) with the abandoning of earlier settlement areas near the larger water bodies and immediate shoreline. The new settlement occurred slightly further in inland and single farms became the main settlement units, as compared with larger open settlements in earlier periods (Kriiska & Tvauri 2002:78 f.; Kriiska 2006:72). The new habitation areas in western and also northern Estonia were usually located in the cliff zone where rendzina soils suitable for primitive cultivation prevailed (Lang 2007b:33–34).

It has been suggested that in West Estonia land suitable for cultivation and therefore early agricultural settlement was limited because low-lying areas, exposed by the retreating sea level, were too wet and higher ground was rare (Lang 2007b:90). Based on the distribution of finds and archaeological sites, the only denser habitation area that has been identified correlates with the surroundings of the Kasari River where a considerable number of Late Stone and Early Bronze Ages stone axes, adzes, and bronze items have been found (Mandel 1975; Mandel 2003:165–167). It has been assumed by Lang (2007b:90) that the finds indicate that people were mostly occupied with foraging economy, although early farming cannot be excluded.

4.4.3 Late Bronze Age and Early Iron Age

In West Estonia, indicators of agricultural land use remained quite stable throughout the Bronze Age (Lang 2007b:33; Veski 1998:107). A rise in human impact to the landscape occurred around 800–600 BC (Saarse and Königsson 1992; Veski 1998:107) in western Estonia, as well as various other parts of Estonia. There are, however, differences between the regional summary curves and the curves of individual sites. In general, even if the changes are gradual in the regional curve, the individual sites show significant fluctuations (Sillasoo et al. 2009:319). The expansion of human indicators in pollen analysis has been described as the emergence of “real” farming (where agriculture is the main basis for subsistence). Agrarian expansion and corresponding deforestation of the landscape is recorded in pollen diagrams in the form of an increase in anthropogenic indicators. In contrast to earlier forest clearances, after which a regeneration of the forest normally occurred, Bronze Age clearance often resulted in a permanent change in the ecosystem (Poska et al. 1999:311).

The main settlement unit throughout the period in question was a single household or a farm which are represented by small open settlement sites with thin occupation layers. The location of most settlement sites in areas where soils suitable for cultivation was present and away from large water bodies has seen as a sign that these were largely agricultural settlements (Lang 2007b:94). Only a few open settlement sites from the Bronze and Pre-Roman Iron Ages have been found in western Estonia and they are not accurately dated due to a paucity of material culture. Settlement sites at Vatla, Kullamaa, Kõmsi and Kaseküla have revealed archaeological material dated to the period in question (Lang 2007b:90–91).

In the southern part of western Estonia a ring fort with a low circular stone rampart has been registered at Massu and early promontory hill forts at Lihunetsi and the hill of Salumägi at Salevere. Based on analogies elsewhere in Estonia and parallels with similar sites on the islands of Gotland and Öland in Sweden, it has been suggested both by Lang (2007b:91) and Mandel (2003:167) that the establishment of the sites can be roughly dated to the 1st millennium BC. Since the excavation of similar sites to Massu, Lihunetsi and Salevere have shown a lack of occupation layer, suggesting that they were not permanently inhabited, the prevailing hypothesis is that the forts functioned as communal religious and ceremonial sites (Lang 2007b:80). Similar interpretations have proposed for the ring forts in Gotland (e.g. Cassel 1998:145 ff., cited in Lang 2007b:80). Although defensive functions of the ring forts are not completely excluded (Lang 2007b:83), the idea proposed by E. Tõnisson, that the sites might have been used for keeping cattle (Tõnisson 1992:81), has not been widely accepted.

The location of graves or grave groups is also considered as an indicator of nearby settlement sites. Stone-cist graves (Fig. 4.9) are the most prominent monuments from the Late Bronze Age and Early Pre-Roman Iron Age. Two areas in mainland western Estonia have been pointed out on the basis of their distribution: in the southern part of western Estonia around the villages of Poanse, Kaseküla, Kõmsi and Vatla, and in the northern part of the study region near the villages of Auaste, Tagavere and Taebla (Mandel 1975; Mandel 2003:165). A further indicator of settlement during that time has been suggested by the distribution of cup-marked stones which are usually found in the same areas as stone graves, although with some exceptions (Lang 2007b:90). The densest areas where cup-marked stones have been found are around Kõmsi and Vatla in the south and Uugla and Taebla in the north which correlates with the distinguished settlement areas based on stone-cist graves (Mandel 1975; Mandel 2003:165–167).

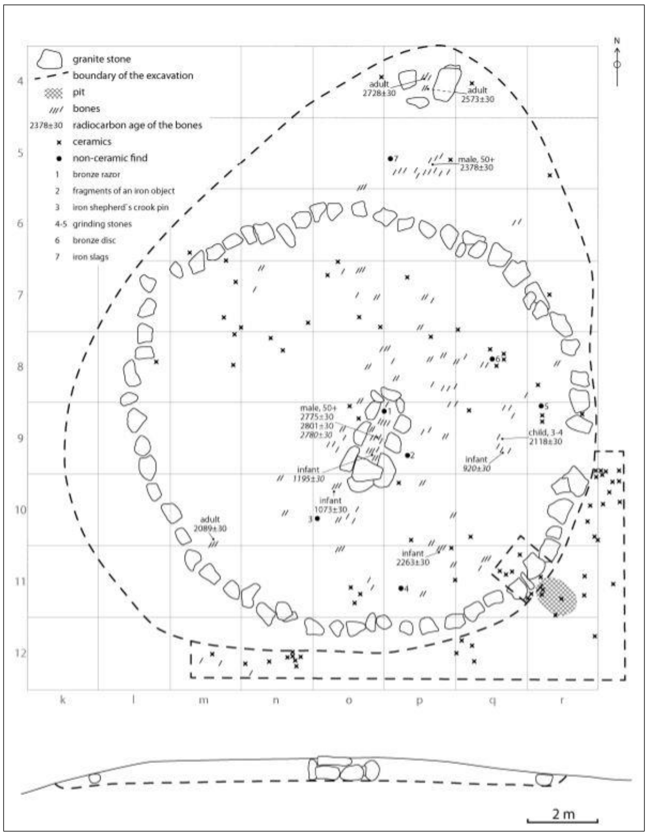


Figure 4.9. Stone-cist grave at Kaseküla.
Drawing: Laneman 2012:95, Fig. 3.

Stone-cist graves were replaced by so-called early *tarand*-graves[22] (Fig. 4.10) during the Pre-Roman Iron Age (500 BC–50 AD). The graves have been found in the western part of the mainland, either in the same regions where earlier stone-cist graves were located: for example, at Kõmsi, Poanse, and Taebla (Lõugas 1972a; Mandel 1978; 1982a); or between two earlier

[22] *Tarand* is an Estonian word for enclosure. More specifically, "*tarands* are quadrangular stone enclosures for burials built on the ground, with the straight flat sides of the walls facing outwards" (Lang 2007b:170). Two main types of *tarand*-graves are distinguished in Estonia: 1) smaller (ca. 7–17m wide and up to 35m long) early *tarand*-graves with irregularly placed tarands, dated to the Pre-Roman Iron Age and 2) larger (up to 100m long and 20-30m wide, rising 1–1.5m above the ground) typical *tarand*-graves (sometimes referred to simply as *tarand*-graves) with regular layout, dated to the Roman Iron Age; it has been suggested that typical *tarand*-graves probably designed from the beginning for collective burials, in most cases there are cremation burials with scattered bones where single burials are not traceable (Lang 2007b).

settlement centres (e.g. Keskvere, Parila) or farther inland (e.g. Rõuma and Leila) (Lang 2007b:91, 93; Mandel 2003, fig.20). Both stone-cist graves and early *tarand*-graves were built for a main individual burial but later other burials were added. The primary burial was usually inhumation, although burnt bones occur in the graves as well. They were collective burial places of a single settlement unit (household). Demographic calculations have shown that not all the members of the community were buried in stone graves but in a way that has left no visible traces in the landscape therefore they are considered as burial places for the most important members of the community (Lang 2007b:161–191; Lang and Ligi 1991).

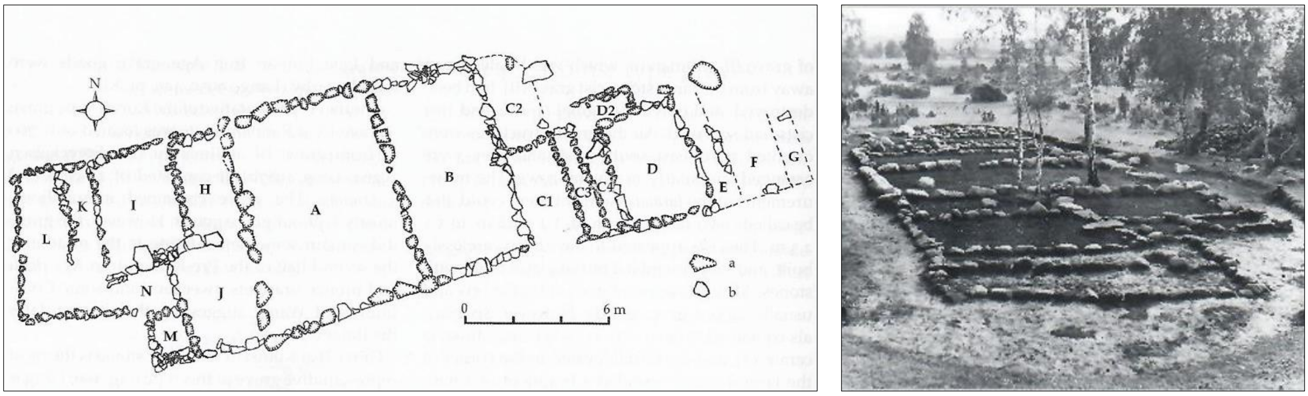


Figure 4.10. Early tarand-grave II at Kõmsi.
Drawing on the left: Lang 2007b:174, Fig. 106; Photo on the right: Jaanits et al. 1982:211, Fig. 140.

There are no monuments in western Estonia that date directly to the Roman Iron Age (AD 50–450). While elsewhere in Estonia the most prominent and widespread monuments are typical *tarand*-graves (Fig. 4.11; note the difference with the early *tarand*-graves, see footnote no. 6), they are completely lacking in West Estonia. Furthermore, no settlement sites, field systems or other sites and monuments have been found that can be clearly dated to the Roman Iron Age (Lang 2007b:91) and there are altogether only a few finds from the period in question. While some archaeologists in the first half of the 20th century believed that the lack of finds equals with discontinuance of the settlement, relocation or even migration (e.g. Moora 1932:35; Vassar 1938a), ideas have changed during the last decades. Mandel (2003:167) points out that the lack of finds might refer to the research situation, i.e. that the sites are yet to be discovered and suggests that targeted research on settlement sites might reveal some material from the 1st–5th centuries AD.

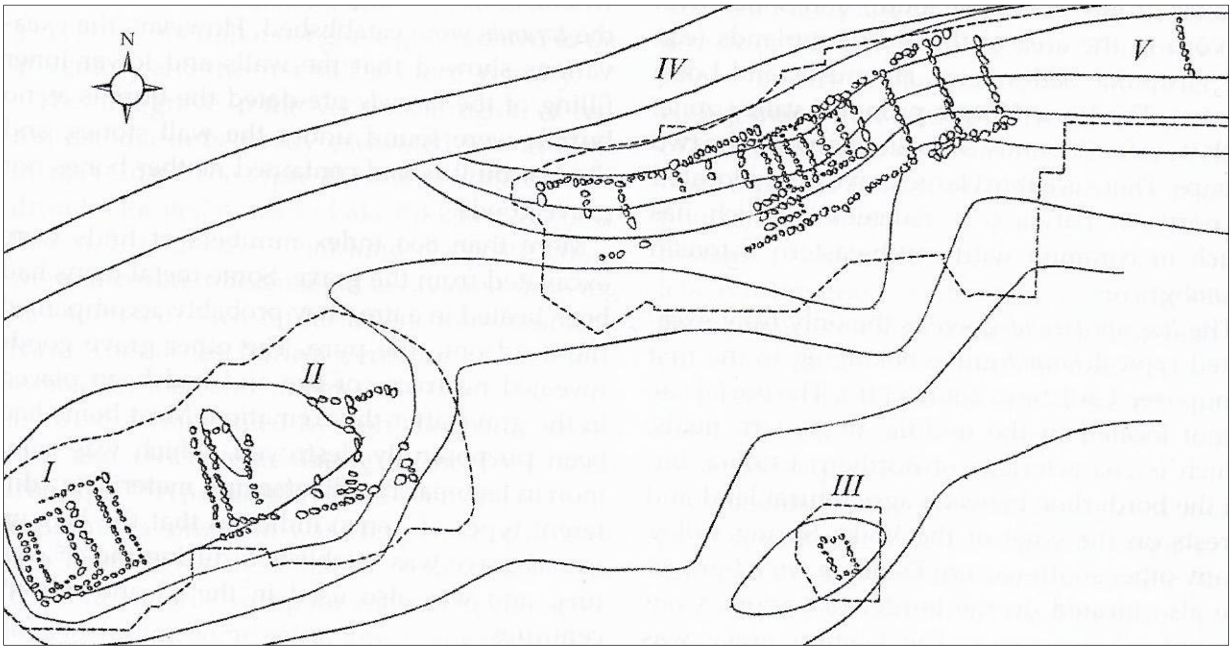


Figure 4.11. Typical tarand-grave at Virunuka, South Estonia.
Drawing: Lang 2007b:200, Fig. 121

Lang (2007b:93) does not exclude partial migration or relocation of some groups of people which, according to him would have been due to the exhaustion of cultivated soils. This in turn would have eased the rivalry for the land which in turn would have meant that people did not have to manifest territorialisation in the landscape, hence there was no need to build monumental graves (Lang 2007b:93). There are no clear indicators of a gap in agricultural activities during the Roman Iron Age in pollen diagrams but interestingly, in some pollen diagrams (e.g. Kaali in Saaremaa, Mustjärve in the northern part of West Estonia) the cultivation indicators were replaced by possible signs of cattle rearing, suggested by the increase in grazed forest indicators in the core (Saarse and Königsson 1992; Veski 1998:57).

Unlike in central and southern Estonia, there are no hilltop fortified settlements in mainland western Estonia from that period, that, along with the presence of ring forts and promontories and lack of monumental typical *tarand*-graves has been interpreted as a sign that the society in western Estonia was less hierarchical than elsewhere in Estonia (Lang 2007b:91–93).

4.4.4 The Middle and Late Iron Ages

The research into the Middle and Late Iron ages in western Estonia has mainly concentrated on the excavation of graves (M. Mandel), which, unlike during the Roman Iron Age, have been found all over the region (except for its north-western corner). Based on the abundance of grave goods, it has been possible to see strong contacts with Scandinavia, especially eastern Sweden and Gotland (Tvauri 2012:321, 323). Little is known about the settlements during the 5th–9th centuries. Pottery and other finds referring to settlement layers have been collected from several locations, none of which has been excavated (Mandel 1993:35; 2003:169). Tvauri (2012:323) has brought out that while elsewhere in Estonia fort-and-settlement complexes (hillforts with a contemporaneous settlement site) evolved from the 7th century and lasted as important power centres until ca. the 11th century, they were absent in West Estonia and the islands. Hill-forts from the aforementioned time span have been found from Ridala, Vatla, Leediküla and Palivere (Mandel 2003:169) among others but it is not clear if they represent the same kind of system as in other parts of Estonia. The research of the hill-forts of the Latest Iron Age (11th–13th centuries) in western Estonia has been equally scarce. Mandel has pointed out five hill-forts of that time (Vatla, Lihula, Kullamaa, Ridala, Soontagana) which he considers as the main power centres of fort districts at the end of the Iron Age (Mandel 2004a:189–199) (Fig. 4.4).

Lang (2007a:314) has suggested that villages similar to the historical ones, one of the characteristics of which was the existence of communal land that was distributed between single farms, emerged during the 7th–8th centuries. The conclusion was based on the excavation of strip fields and late quadrangular fields on the northern Estonia (see 2.5.2). The idea cannot be straightforwardly applied to western Estonia, firstly because of the lack of excavations on settlement sites and secondly, because so far no such fields have been registered or excavated in the region. However, the regional analysis of field systems of the current study has indicated some possible locations where large quadrangular fields might indicate the same kind of system.

According to Mandel (1993:42–43), most of the settlement sites from the Latest Iron Age (11th–13th century) have been found in the exact locations of the historical villages, most of which have lasted until today. Altogether 130 village sites, dated to the end of Iron Age have been registered in mainland West Estonia (Mandel 2003:170), four of which (Linnuse, Kirbla, Kaseküla and Koela Varetemägi) have been a subject of small-scale excavations (Mandel 1993:43). There is little doubt that that the settlement layers are that of villages and not of single farms (Mandel 1993:43) and that by the end of prehistory, most of the arable land in West Estonia had been taken into agricultural use (Mandel 2003:170).

4.4.5 *The Middle Ages*

The beginning of the Middle Ages (and "historical time") in Estonia is dated only to the early 13th century (AD 1225 or 1227) and is marked by the German-Danish crusaders' conquest and violent Christianization of local people in the wars of 1208–1227 (Russow et al. 2006:159). The battles with the locals are by tradition referred to as "the ancient struggle for freedom" but nowadays the concept of the Baltic crusades and Europeanization have also emerged (e.g. Mäesalu and Valk 2006:152), trying to put the events into a wider European background.

Changes in settlement and agriculture were probably not immediate at the beginning of the Middle Ages. Agriculture continued to be the main source of living for the most of the people. Old fields and agricultural practices probably continued to be used and Late Iron Age traditions of village life probably persisted. But the land tenure changed and society was split into an upper class of conquerors and a lower class of local people, which was most marked in the countryside and among peasantry (Russow et al. 2006:161). Local peasantry lost their independence during the 14th–15th centuries and were made into serfs. New types of tools and in agriculture three field rotation were adopted at this time. A big expansion of agricultural indicators in pollen diagrams can also be seen after AD 1200 (Veski 1998:107).

Even though the changes were not immediate, they were profound: ancient hillforts were abandoned, churches and castles were constructed and new social, political and religious structures typical to medieval Europe were established (Russow et al. 2006:159–160). The new political entity that was formed, comprising of present territories of Estonia and Latvia, was called Livonia which was a confederation of small feudal states (Russow et al. 2006:159). The central power in Livonia was the Livonian branch of the Teutonic Order (Livonian Order) which also ruled some territories in western Estonia – in the mainland the town of Lihula[23] and its surroundings and some other smaller areas and parts of the islands (Blumfeldt 1938:9–14; Russow et al. 2006:159). Most of the western Estonia and the islands belonged to the bishopric of Oesel-Wik (Markus 2004:141; Russow et al. 2006:159), the territory of which in the mainland coincided with that of the historic Läänemaa. The centre of the bishopric was established in Haapsalu[24].

[23] Lihula was an administrative centre with a castle and a monastery but it did not have medieval town rights (Russow et al. 2006:161).

[24] Haapsalu got its town charter in 1279 (Russow et al. 2006:160).

After the conquest, churches and ecclesiastical parishes were established in the countryside (Russow et al. 2006:161). Some of the crusaders were given fiefdoms from the new rulers of the country and they – the so-called Baltic German nobility – started creating their own estates in the countryside and gradually became permanent landowners of large estates or manors (Markus 2004:142–143). The land belonged to them along with the local peasants who had to work for them in the fields and pay the so-called tenth (Lukas 1995:67).

The era ends with Livonian War (1558–1583) after which the earlier state system and towns were left destroyed and later replaced by new political systems (Russow et al. 2006:159–160).

4.4.6 Main developments after the Middle Ages

The middle of the 16th century is considered as the borderline between the Middle Ages and the post-medieval period in Estonia. In the course of the Livonian War the medieval state formation with independent ecclesiastic states ceased to exist and in the following centuries Estonia was ruled by Denmark, Poland, Sweden and Russia. Until the beginning of 18th century most of Läänemaa was part of Swedish province of Eestimaa (Russow 2006:193). Despite of the new rulers, the situation of the local peasants remained more or less the same (Laur and Lukas 1995:111–116) – the serfhood continued. The Livonian War with accompanying plague and famine had been devastating for both the towns and the rural people. The biggest famine, followed by crop failure took place at the end of the 17th century. It has been estimated that about 20% of the population died (Lukas 1995:115–116). After the Great Northern war (1700–1721) Sweden lost its Livonian territories to the Tsardom of Russia who ruled Estonia and Latvia until 1917 (the beginning of the World War I). The serfdom was abolished in 1816 in the province of Eestimaa and in 1819 in the province of Liivimaa. Despite the fact that the peasants were officially free, they had to rent their lands from the landlords in exchange of labour which substituted the serfdom with statute labour and in reality did not change the situation. It was only with the new peasant laws in 1849 and 1856 that replaced the statue labour with wage labour and made it realistic for the peasants to pay the rent in money and even redeem their farms (Laur and Tannberg 1995:147–154). In the beginning of the 20th century about 4/5 of the farm lands were redeemed but manors as large holdings continued playing a large part in the rural economy. For a long time the economy was mostly based on the grain farming but since the beginning of the 20th century, its leading role was replaced by dairy husbandry (Pajur 1995a:18–19).

According to E. Blumfeldt (1938:48) cattle breeding in western Estonia was favoured by the abundance of natural grasslands and meadows. However, in an overview of the agriculture of historical Läänemaa in the 1920s and 1930s, J. Viidang (1937:8) brings out that the relatively high amount of grasslands and meadows does not equal with high level of cattle breeding since a lot of the grassland is often flooded which is an obstacle for cattle feeding. The coastal grasslands near the sea are usually common properties to allow the access to the sea. Because of the large amount of excessively moist lands, the arable land is not numerous. The arable farming is quite extensive with a large proportion of land in fallow (Viidang 1937:8–10).

During the World War I Estonia became an independent republic (in 1918). A radical land reform was initiated in 1919 during which the landed properties of the manors were nationalized. Most of the forest was kept as the state holdings while the arable, meadows and grasslands were divided and given to new farmers or small holders. The main branch of agriculture was still dairy husbandry (Pajur 1995b:59–60).

Estonia was occupied by the Soviet Union in 1940/1944. The Soviet rulers initiated a land reform during which the land was nationalized and collectivized during which large collective farms (kolkhozes) and state farms (sovkhozes) were formed. The lands were partly expropriated but partly it was presented as a free choice of people to join the collective farms. In reality the "free choice" meant terror – people who did not join were deported to Siberia (Tannberg 1995: 118–121). Agriculture during the Soviet period was overly extensive. The small-scale agricultural fields were replaced by large mono-cultural and strongly ameliorated and fertilised fields. The purpose of this extensive agriculture was to produce as much as possible for the minimal cost and local conditions and environmental balance were often neglected (Tannberg 1995:126).

Estonian independence was restored in 1991. The first decades of the independence saw challenges with the new land reforms and the re-establishment of the private ownership of the land and restructuring the economic base. Nowadays the agriculture is influenced by the regulations and subsidiaries of European Union. Small-scale tourism sector has evolved in many areas in western Estonia, making use of the naturally outstanding locations and the proximity of the seashore.

4.5 Previous investigations of field systems in western Estonia

4.5.1 Einbi

In the northern part of the study region, thorough investigations were carried out by a Swedish archaeologist Felicia Markus at Noarootsi peninsula which also included excavating field systems. Noarootsi peninsula is historically the settlement area of Estonian Swedes and one of the aims of the study was to find out how far back in time can the colonies associated with Swedish populations be traced. Excavations on field systems were carried out in 1999–2003 in the village of Einbi (Enby) which, indicated by the written sources, was a Swedish village at least from the 1550s (Markus 2004:166). A number of stone walls were investigated in the village and further away from its centre, situated in the forest (Markus 2004:172) and long trenches were excavated through field areas to study the cultivation layers (Markus 2004:176–181). In addition, phosphate mapping and soil sampling were carried out in the area of the field systems (Markus 2004:184–188). The primary aim of the excavations was to date the field systems and land use and for that altogether 29 radiocarbon samples were dated, showing long-term landscape use from the early Iron Age ca 800BC until the 17th century (Markus 2004:182–183, Table 3) even though the dates were not continuous and practices behind the dates were likely not uniform. The early period lasted approximately until the 9th century AD. The next period fell within the period from the 10th until the 13th centuries while the third period was indicated by overlapping dates from the 14th to the 17th centuries. The contemporary dates where used to show the continuum of land use practices until the modern period[25].

4.5.2 Ellamaa

Apart from the investigations at Noarootsi peninsula, 10 field cairns were excavated by M. Mandel in 1981 at Ellamaa before the area was turned into a limestone quarry. Radiocarbon dates were not made from the few samples that were collected. It only remained as a speculation the cairns could date to the 12th–13th century or the Middle Ages (Mandel 1981). A single cairn was excavated along with a stone grave at Uugla in 1977 which was dated to the 11th-12th centuries based on pot-sherds and animal bones (Mandel 1980).

[25] Most Estonian archaeologists tend to undervalue the modern dates from charcoal samples and in general it is thought that they do not contain any important information.

In the southern part of the study region, not far from the case study area on the hill of Salumägi, two prehistoric habitation areas can be pointed out where sites of different type and period have been found and more extensive archaeological investigations have been made.

4.5.3 Kaseküla I

The oldest traces of human settlement in the area have been found at Kaseküla, 7km to the south-west of Salevere, where a settlement site dated to Late Neolithic was unearthed under a stone-cist grave of the Late Bronze Age (Kriiska et al. 1998). At least seven probable stone-cist graves, a few *tarand*-graves and an extensive low stone grave-field with cremation burials from the 11th–12th century were partially investigated (National Registry of Cultural Monuments; Laneman 2012:92–93). At the heart of the present-day village lies a settlement site dated at least to the Pre-Roman Iron Age (Lang 2007b:91), possibly even to the Late Bronze Age. It has also yielded finds from later periods, which has encouraged opinions that the site may have been continuously inhabited until today (Lõugas 1975; Mandel 2011). Approximately 200m west of the grave group, about ten hectares of prehistoric fields were once situated – clearance cairns and a single bank – that have since been destroyed by dolomite extraction. The investigations of the fields in 1999 allowed the field complex to be dated to the 8th–12th centuries AD (Lang 2000).

4.5.4 Kõmsi I-II

About 7km south of Salevere and 2km east of Kaseküla, at Kõmsi village, settlement sites, stone graves, an iron-smelting site and field remains have been recorded and excavated. Two early *tarand*-graves with notably rich grave goods have been excavated here (Lõugas 1972). One of them was established at the beginning of the Pre-Roman Iron Age and used until the turn of the era, the other one dated to the Late Pre-Roman Iron Age (Lang 2007b:174–177). A third stone grave contained cremation burials from the 11th–13th centuries – the Late Iron Age. Two settlement sites have been identified in the vicinity of the graves. One of them probably dates to the Pre-Roman Iron Age or may even have been established in the Bronze Age (Lang 2007b:90). Another settlement site is probably of Late Iron Age origin. An iron-smelting site roughly dated broadly to the 2nd millennium AD has been identified near the second settlement layer. An extensive clearance cairnfield, covering an area of 700 x 800m is located north of the graves. Around 400 clearance cairns have been identified here, of which 78 were excavated during 1969–1970 (Lõugas 1972; 1992:69; Mandel 1982). The complex is dated on the basis of the few finds (potsherds, animal bones, a fragment of a metal artefact) to the Early Iron Age, although it is assumed that there was probably cultivation during later prehistoric periods as well (Lang 2007b:97).

4.5.5 Ridase II

As to the other investigations, two cairns were excavated by M. Mandel in 1981 in Ridase, about 10km south-east of Salevere (Mandel 1982b). They were part of a complex of cairns, consisting of seven cairns. Based on their large size, most of them were thought to be stone graves, similar to the known graves from the same village, located 500m eastwards. Among the large cairns, there were also two smaller ones that were identified as field cairns. However, after the excavation of two of the larger cairns, it turned out that there were no bones present that would indicate that the features were graves. The finds consisted of pottery, a couple of metal items (a ring and a fragment of a bronze wire) and three animal bone fragments. Possible pieces of charcoals were not documented. Based on the results, it was concluded that at least one of the excavated cairns was also a field cairn (Mandel 1982b). Despite of a clear indication that the cairns are graves, three of them were still listed as such. Even though it might apply for some of the cairns, it became clear in the course of the regional analysis that the cairns are part of a field system, consisting of cairns and short banks. The field system is visible in an area of ca 12ha. The complex of seven cairns described above marks its western border and it extends eastwards almost until the group of known graves.

4.6 **Distribution and analysis of field systems in the study area**

4.6.1 Introduction and methodology

One of the aims of the regional study was to detect and map a representative amount of field systems in the study region to identify general patterns of the distribution, typology and possible chronology of the field systems. The aim of the regional analysis of the field systems was also to provide background and context to the case study and further discussion about the landscape sustainability.

The regional analysis started with mapping the known field systems in the study area. This included 14 field systems listed as archaeological monuments in the National Register of Cultural Monuments (https://register.muinas.ee/public.php) and 14 field systems that were known through previous studies but have not been listed as monuments. The resulting 28 field systems were marked as *confirmed* field systems – their location had been confirmed by previous archaeological studies. This also includes sites that have been excavated in the past but are not preserved today (Kaseküla I (no. 4), Ellamaa (no. 2) and Uugla I (no. 25)).

Additionally, 58 previously unknown field systems were discovered in the course of the regional analysis of the current thesis. For the detection of field systems, digital elevation models (coloured and grayscale hillshadings with the pixel size of 25cm) that were available through public Web Map Service (WMS) of Estonian Land Board were systematically examined and marked in GIS-programme (QGIS Desktop 3.0.3, 3.16.7 and ArcGIS Pro were used). The field systems were detected and marked on the map as polygons, covering the areas where visible field structures (cairns, banks and stone fences) could be seen. The locations were verified with looking at the orthophotos to minimise the potential that some of the presumable cairns were actually bushes and shrubs or heaps of branches left in the course of woodcutting. Estonian base maps were also examined because they contain information about the preserved historical stone fences that look similar to the field banks in the elevation models. The stone fences were only eliminated from the detected field systems in cases they were the only visible feature. Sometimes the stone fences were in the same locations with buried archaeological features (banks and cairns) and might show the long-term use and changes in the functions of the field systems. The detected field systems were not surveyed in the landscape, therefore they were marked as *unconfirmed* field systems.

The analysis resulted in 86 field systems (Fig. 4.2, Appendix A) that were divided between the northern (Fig. 4.12) and southern part (Fig. 4.13) of the study area. The border between the southern and northern part of the study area is marked by the Kasari River. 26 field systems were located in the northern part of the study area, 11 of which were confirmed and 15 were detected in the course of the current regional analysis. 2 of the confirmed field systems (Ellamaa and Uugla I) are not preserved until today but both are excavated. 60 field systems were located in the southern part of the study area, 17 of them were confirmed and 43 were found during the current analysis. Kaseküla I (no. 4) is not survived until today.

Detailed mapping of the features was not carried out, instead the field systems were marked as polygon features marking the maximum area they covered. Simplified distribution maps where the field systems are marked with a dot symbol are presented as illustrations in the current chapter. The 3 field systems that are not preserved, were included in the analysis.

The distribution maps of the field systems were combined with the data about the settlement history and environment of the region. Map layers with listed archaeological monuments and sites that are known to archaeologists through published sources but are not yet listed as monuments were provided by the National Heritage Board (the layer with protected sites is also available through Estonian Land Board). Additional information about sites that are not protected was used through Database of Archaeology and Local Lore, collected and administrated by the Department of Archaeology of the University of Tartu and stored and managed in the online server of Estonian National Heritage Board. For the age of the historical villages a map layer with the village`s first mentioning in the written sources was used (information was compiled by the National Board of Heritage on the basis of the Dictionary of Estonian Place names). Historical maps from the second half of the 19th century were also used through WMS because they depict the landscape before the large land reorganisation projects of the 20th century. The environmental data – soil maps, height data - was also available through the Web Map Service. Because the soil information in the maps of Estonian Land Board is in Estonian local system, soil maps with European soil names and references was used in parallel (Kmoch et al. 2020).

The references in the following analysis are to appendix A – a catalogue of fields systems – that includes tables A.1 (northern part) and A.2 (southern part) with all the 86 field systems and information used in the analysis.

4.6.2 Typology of the field systems

The detected field systems were tested against the established typology of Estonian field systems that was brought out in more detail in 2.5.2. According to this, the main types of field systems are clearance cairnfields, the early quadrangular field systems (Baltic and Celtic fields) from the Late Bronze Age and early Iron Age (from 1100 BC until AD 450), later quadrangular fields from the Middle and Late Iron Ages (from AD 450 until the beginning of the 13th century) that were also in use until the 19th century, strip fields dated as early as the Middle Iron Age but that were typically common field systems during the historical period, and the so-called forest fields that by type also consisted mostly of clearance cairns.

Attributing a type to the mapped field systems according to the above typology turned out to be more problematic than was assumed. Firstly, it was related to the methodological issues that were pointed out earlier – the question about detecting the linear structures with the given lighting angle of the hillshades, forested areas, the effect of forest cutting, and lack of confirmative field survey. Secondly, the neat typology is not necessarily always present and preserved in the landscape because of the re-use of the same areas and overlapping of older and younger structures. Thirdly, the typology is mainly based on the northern Estonian field systems and might not fully adapt to western Estonian context.

Therefore, the following field types were distinguished in the study region that are based the established typology but allow more general approach (Appendix A, tables A.1 and A.2). In many cases, several different field systems were detected among the same field system:

1. Clearance cairnfields
2. Clearance cairnfields with boundaries around them
3. Forest fields
4. Strip fields
5. Late strip fields
6. Quadrangular fields
7. Late quadrangular fields

Clearance cairnfields were either simply cairnfields without any additional structures or features or were detected among quadrangular or strip fields. In the latter case the cairnfields represented either over- or underlapping system. In cases where there were single cairns that seemed to be part of the main system and contemporaneous with them, they were not distinguished as a separate type. Simple cairnfields that were located in historically forested locations, were also equally marked as potential forest fields. It is possible that some of the over- or underlapping cairnfields were also forest fields but since it cannot be proved without further study and excavations, it was not marked.

Clearance cairnfields were the most numerous field systems in the study area – altogether 70 field systems were labelled as such. 22 of them were situated in the northern part and 48 in the southern part of the study area. However, in more than half of the cases clearance cairnfields were parts of other field systems as well and the number of ´simple` clearance cairns was 28 (16 in the northern part and 12 in the southern part). 21 of them were equally marked as potential forest fields and for the rest of the 7 this was not considered as a reliable option. A relatively higher rate of potential forest fields was recorded in the northern part of the study region – 13.

Among the clearance cairnfields, a separate type was distinguished where the cairnfield was bordered with continuous boundaries around the areas of cairns. 11 bordered clearance cairnfields were distinguished: Ridase I (no. 20), Kokuta Veski (no. 28), Kõmsi Kopli (no. 29), Massu Lepiku (no. 43), Kõmsi Sepa (no. 47), Esivere III (no. 66) and Laulepa (no. 68) in the southern part and Mõisaküla (no. 70), Vilkla (no. 81), Lõbe (no. 82) and Kolila (no 83) in the northern part.

Strip fields were only distinguished in 5 cases – Linnamäe II (no. 12) in the northern part of the study area, and Petaaluse (no. 18), Poanse I (no. 19), Ridase II (no. 21) and Kaseküla II (no. 59) in the southern part of the study area. Only for Linnamäe II it was considered possible that the fragmented system might be of prehistoric origin. For the other cases it was obvious that the strip fields are historical because they were marked on the Basic Map as rows of stone fences, therefore they were marked as late strip fields. It cannot be excluded that some of these fields can originate from prehistoric periods. In all five cases there was an under-or overlapping clearance cairnfield visible at the same complex. It has to be noted that the number of historical strip fields in western Estonia is not limited to just five cases; in locations were this was the only field system without any signs of possible prehistoric origin visible in the landscape, they were omitted from the current analysis.

55 quadrangular field systems (both late and presumably prehistoric) were mapped in the study area – 46 in the southern part and only 9 in the northern part. They were in most cases distinguished parallel with clearance cairn fields, only in 12 cases in the southern part and 2 cases in the northern part of the study region there were no under- or overlying cairnfields in the same complex. Quadrangular fields were of different size, shape and regularity. The ones that were marked as later quadrangular fields, it was mainly because of their size that exceeded more than 2,000m^2 and usually up to 5,000m^2. As with the later strip fields, there still might be underlying evidence that these fields were established in prehistory but without further study it remains hypothetical. In case of most fields systems that were labelled as ´late`, there were other, possibly older structures – clearance cairnfields, areas with smaller field plots - as well.

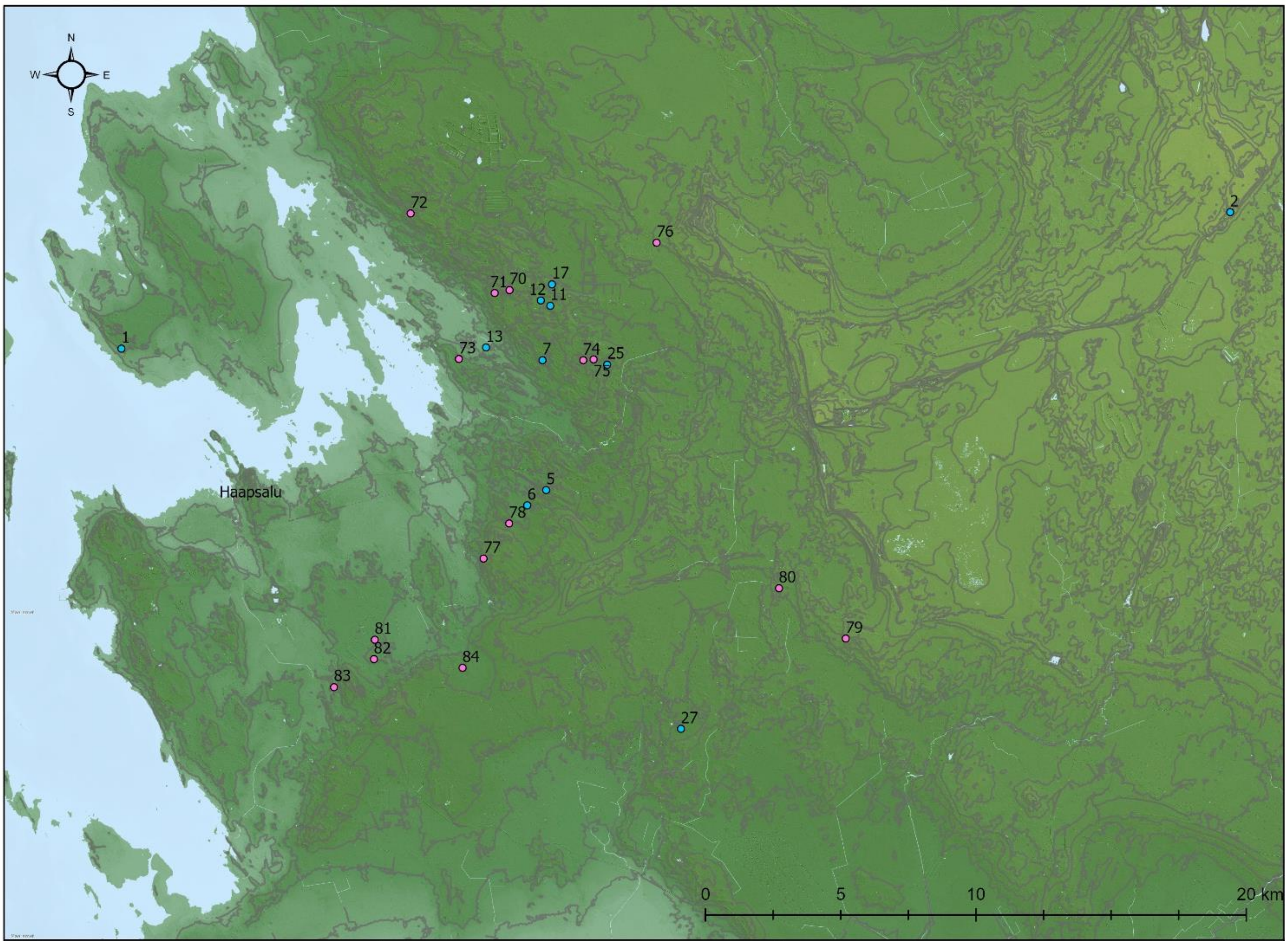
Only at Ingküla[26] (no. 72) and Uusküla[27] (no. 79) there was no other evidence in the landscape for an older field layer.

4.6.3 Distribution of field systems in relation to settlement

Most of the field systems (16) in the northern part of the study area (Fig. 4.12) were located in the former Lääne-Nigula parish. Five field systems were located in Ridala parish and three in Martna parish. Einbi field systems were situated in Noarootsi parish and peninsula. No field systems have been found in the northern part of the study area (northern part of Noarootsi parish and Risti parish) and Kullamaa parish in the western part of the study area. Only one field system is known from the western part of the study region (Ellamaa, no. 2).

[26] There were no archaeological sites or monuments near the Ingküla field system. The village was establihed in 1540.

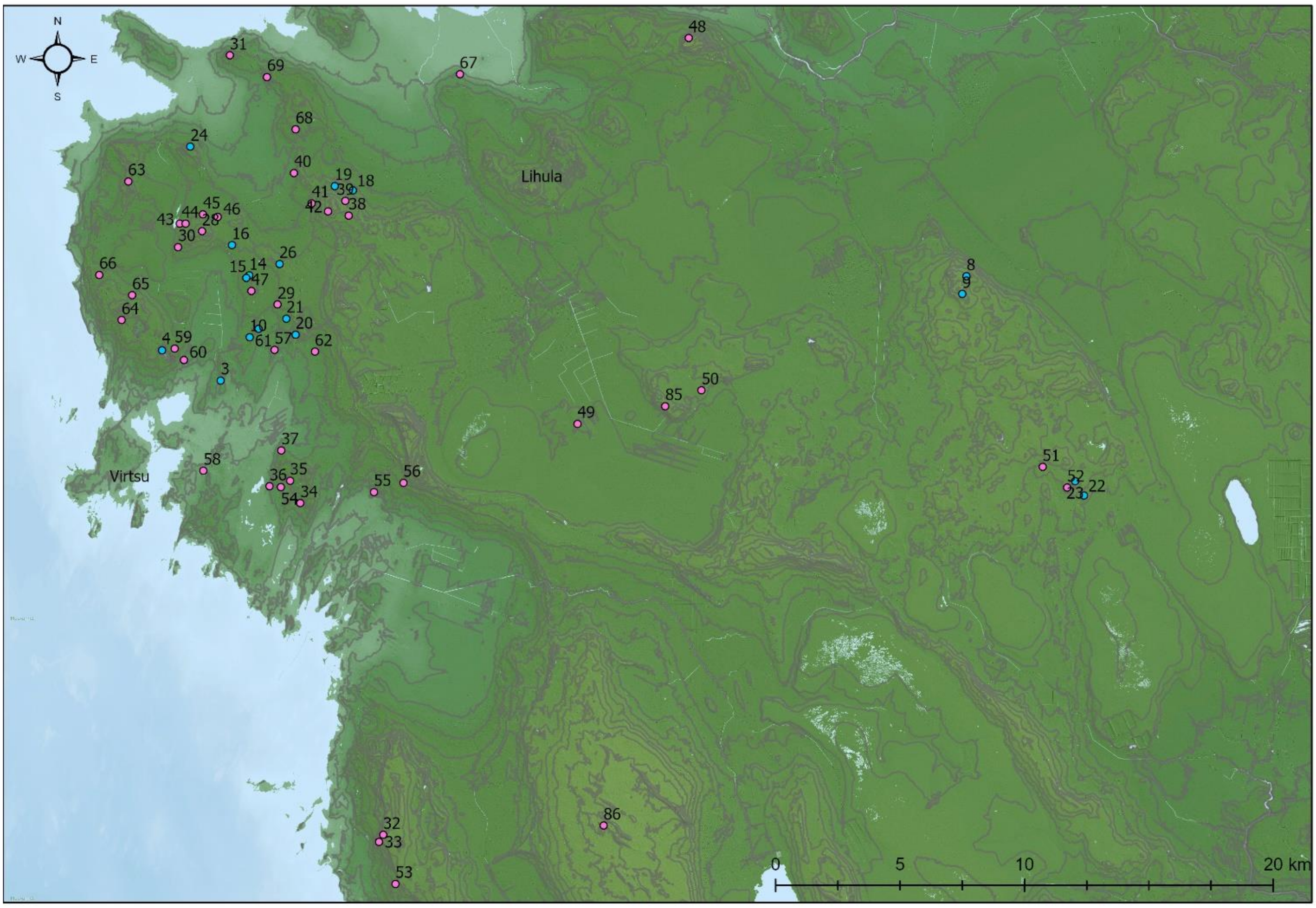
[27] Uusküla field system was close to a historical village that was established in 1726. There is an archaeological cemetery and a settlement site 1km from the field system.



Number	Name	Number	Name	Number	Name
1	Einbi	25	Uugla I	77	Rummu
2	Ellamaa	27	Kuluse	78	Tammiku
5	Kirimäe I	70	Mõisaküla	79	Uusküla
6	Kirimäe II	71	Oru II	80	Väike-Lähtru
7	Koela I	72	Ingküla	81	Vilkla
11	Linnamäe I	73	Saunja	82	Lõbe
12	Linnamäe II	74	Koela II	83	Kolila
13	Räägu	75	Uugla II	84	Uneste-Litu
17	Oru I	76	Jalukse		

Figure 4.12. Field systems in the northern part of the study area (Base map: Estonian Land Board 2021).

Most of the field systems in the southern part of the study region (Fig. 4.13) were concentrated in the former Hanila parish which has been considered as one of the densest habitation areas in the Pre-Roman Iron Age (Jaanits et al. 1982:198; Mandel 2003:170) but an equally large number of fields were located in the historical Karuse parish. Three unconfirmed field systems (Mäliküla I and II, Varbla Kubja) were located further to the south in the historical Varbla parish and seven field systems (Kurese I and II, Salavere I–III, Pikavere and Oidrema Kuusiku) in the former Mihkli parish.



Number	Name	Number	Name	Number	Name	Number	Name	Number	Name	Number	Name	Number	Name	Number	Name
3	Hanila I	18	Petaaluse	28	Kokuta Veski	36	Nehatu III	44	Massu Metsatuka	52	Salavere III	60	Hanila II	68	Laulepa
4	Kaseküla I	19	Poanse I	29	Kõmsi Kopli	37	Nehatu IV	45	Massu Metsakonna	53	Varbla Kubja	61	Kõmsi II	69	Metsküla-Võigaste
8	Kurese I	20	Ridase I	30	Massu/Kokuta	38	Järise	46	Massu Kangru	54	Nehatu V	62	Ridase III	85	Oidrema
9	Kurese II	21	Ridase II	31	Metsküla Laiakivi	39	Poanse II	47	Kõmsi Sepa	55	Äila	63	Mõisaküla	86	Koeri
10	Kõmsi I	22	Salavere I	32	Mäliküla I	40	Poanse III	48	Kirbla	56	Nurmsi	64	Esivere I		
14	Massu Silde	23	Salavere II	33	Mäliküla II	41	Poanse IV	49	Tuhu	57	Kause	65	Esivere II		
15	Massu Urva	24	Salevere Salumägi	34	Nehatu I	42	Poanse/Järise	50	Oidrema Kuusiku	58	Rame	66	Esivere III		
16	Massu Paemurru	26	Voose	35	Nehatu II	43	Massu Lepiku	51	Pikavere	59	Kaseküla II	67	Kirikuküla		

Figure 4.13. Field systems in the southern part of the study area (Base map: Estonian Land Board 2021).

The spatial and temporal connection between field systems and settlement sites has not been thoroughly addressed in Estonian archaeology. It has been assumed by V. Lõugas that since the beginning of permanent agricultural settlement (i.e. since late Bronze Age) the fields were probably located immediately around or next to the settlements (Lõugas 1992:65–70) but the idea was not elaborated in any way. V. Lang has stated that in case of the Early Bronze Age and Late Iron Age when the settlement sites were small, representing single household, they have probably been destroyed in the course of the settlement shift that took place since the Middle Iron Ages and that the fields at that time expanded to the areas of former household remains that were disrupted and turned into fields. Occasionally (for example at Vatku in North

Estonia) earlier archaeological material (pottery) has been found under the field structures that has been interpreted as a possible sign of former households (Lang 2000a:186–187).

In the historical times, the village fields were immediately around the villages, as known from the historical maps. Forest fields were further away from the permanent fields and villages but their distance must have been mainly dependent on the specific natural conditions of the certain area – where were the suitable forests or remote lands located – and there is no set distance for their distance from villages.

Settlement sites among the field systems have not been detected in Estonia, partly because prehistoric settlement sites and house remains are not visible in the physical landscape (see 5.5.7 for the reasons behind it) but also because of the aforementioned issue of survival. A further reason is that in most cases the excavations of field systems have been limited to a couple of trenches through field banks and cairns and wider areas have not been opened that could have yielded material from possible earlier habitation phases. Usually there are settlement sites near the known field systems but there are not enough archaeological evidence from both the field systems and settlement sites to allow good comparison and chronological connections.

For the analysis of relations of settlement sites and field systems in the study area, a reliable distance between fields and settlement was necessary to set. The fields and settlement at Kaseküla was taken as a main reference. At Kaseküla I (no. 4), field systems have been excavated and dated to the 8^{th}–12^{th} centuries (Late Iron Age). The settlement site in the present-day village centre has been dated at least to the Pre-Roman Iron Age (Lang 2007b:91), possibly even to the Late Bronze Age. It has also yielded finds from later periods, which has encouraged opinions that the site may have been continuously inhabited until today (Lõugas 1975; Mandel 2011). The distance between the excavated field systems and the settlement site was 700m–1km which was taken as a reference for the whole study region. The area between the field systems and the settlement was used as strip fields during the historical times, visible in the landscape until today as long strips of land that are bordered with stone fences. There are also numerous stone graves (including a group of stone-cist graves) inside the historical fields and clearance cairns (marked as Kaseküla II (no. 59) in the current study) that might represent an earlier field layer. Field systems (Hanila II, no. 60) with cairns and rectangular plots were also discovered ca. 700m south from the Kaseküla settlement site.

In addition to settlement sites, the relation between field systems and other monuments was also considered. In most cases where there were graves or sacred sites near the field systems, there was also a spatial connection with a settlement site. Occasionally, there was no settlement site within 1km from the field systems but there were other monuments that show the habitation of the area. However, the distance between the fields and graves or cult sites has to be taken with caution because they could have been further away from the villages, especially the sacred sites of the late prehistory (Jonuks 2009).

There were 44 field systems where a known settlement site was within 1km. Most of them (37) were in the southern part and 7 in the northern part and 37 in the southern part. Of the 44 fields systems, 5 did not have other archaeological sites within 1km.

There were 26 field systems that did not have spatial connection with any monuments (11 in the northern part and 15 in the southern part). However, in 4 cases there was a connection with villages that were established between the 13th and 15th centuries and in16 cases with villages from the 16th–17th centuries. Hence, there were 6 field systems with no connection to settlement earlier than the 17th century. Most of them (5) were in the northern part. Three of these sites were connected with settlements from the end of 19th century (Koela I (no. 7), Kirikuküla (no. 67) and Tammiku (no 78)). Field systems Kirimäe II (no. 6), Räägu (no. 13) and Saunja (no. 73) were in remote areas and not connected to settlement.

54 field systems had additional features or sites inside the field system complexes. In most cases it was stone fences but for 21 field systems the features represented prehistoric sites: 11 had stone graves inside them, 4 had sacred sites (including sacred and cup-marked stones) and 9 entailed a small circular or rectangular (Kurese II, no. 9) enclosures. Three of them were situated in the northern part and 18 in the southern part.

4.6.4 Distribution of field systems in relation to environmental location

The distribution of field systems in relation to environmental variables was done in a basic level. General observations were made about the geological setting, modern topography and distance from the sea. Notes about the height from the sea level were made based on the automatic filtration of the layer of contour lines (Appendix A3) but further analysis of the data remained out of the scope of the current thesis. More detailed mapping of the prevalent soils in the areas of field systems was made. It has been stated that early field systems (from Bronze Age and Early Iron Age) mainly spread on rendzina-soils on limestone bedrock, in North and West Estonia. These soils fall under the category of Regosols (R) and Leptosols (LP) according to World Reference Base (WRB) soil classification and according to Estonian soil classification are Calcaric Regosols (K), Calcaric Gleyic Regosols (Kg), Suprarendzic Lithic Leptosols (Kh'), Somerirendzic Leptosols (Kh"), Somerirendzic Leptosols (Kh"g) and Calcaric Skeletic Regosols (Kr). The distribution of field systems on these soils could be a marker of their early prehistoric use.

Most of the field systems (67) were located in forests or former woodland where woodcutting had been taken place recently. 16 field systems were located in an open landscape where primary land use was meadow or slightly wooded meadow. Most of them (13) were in the southern part of the study region. In many cases it was observable that the field systems were situated right next to marshes and bogs. There seemed to be no connection with the rivers, that are not numerous in western Estonia.

Most of the field systems were located on relatively higher ground from the surrounding landscape. It is also well visible on the relief maps with contour lines (Figs. 4.12 and 4.13). 19 of them were situated on limestone outcrops or hills, all in the southern part of the study area. The actual height from the sea level actually changed across the study area from as low as 2.5–5m in locations that were close to the modern coastland (e.g. Einbi (no. 1), Kaseküla (no. 4), Hanila II (no. 60)) to up to 30–50m in the inland areas (Ellamaa (no. 2), Koeri (no. 86), Kurese I and II (nos. 8 and 9) and Mäliküla I (no. 32) (Appendix A3). Contour lines have sometimes been used as simplified indicators of the relative age of the landscape features (e.g. Mandel 2000; Mägi 2004) which can be useful as a basic reference but because of local environmental conditions and variations, the proper application of shoreline chronology should entail a thorough investigation of soils, sediments and geology which has been done in many cases along with the studies of Stone Age settlement (Habicht et al. 2017; Jussila and Kriiska 2004; Muru et al. 2018; Muru et al. 2017; Rosentau et al. 2013).

In addition to the height, the distance from the modern coastline was assessed. Most of the field systems in the northern part of the study area were located within the distance of ca. 10km from the current coastline. Three field systems in Martna parish (Väike-Lähtru (no. 80), Uusküla (no. 85) and Kuluse (no. 27)) had the distance of approximately 20km away from the sea. The fields at Ellamaa were further (30km) inlands. In the southern part, most of the field systems (46) were located within approximately 8km from the modern coastline. For the rest of the field systems, the maximum distance from the coast was 30km.

Most of the field systems were located on the Silurian bedrock which is generally characterised by thin calcareous soils. Only the northernmost field systems were situated on Ordovician bedrock (the division between Silurian and Ordovician bedrock is represented in Fig. 4.5), which is generally associated with thicker and denser soils.

Regosols were the main soil type for 73 field systems. Sometimes they occurred in combination with leptosols and on some occasion with cambisols. All the field systems on the higher ground were on regosols. 4 field systems (Kurese I–II (nos. 8–9) and Salavere I–III (nos. 23 and 52) were situated on leptosols without the significant presence of regosols or any other soil types.

Gleysols were the main soils for 13 field systems, although some of them in the southern part (Ridase I and III (nos. 20 and 62) and Kirikuküla (no. 67)) had a presence of regosols as well. Most of them included clearance cairnfield component, Ridase I (no. 20) and Ridase III (no. 62) also had posiibly prehistoric quadrangular fields and at Ridase I, Lõbe (no. 82) and Kolila (no. 83) incorporated possible enclosed clearance cairnfields. The fields on gleysols that did not have the regosol component were all located in the northern part of the study area and were covered with forests. Three of them (Koela II (no. 74), Väike-Lähtru (no. 80) and Kolila (no. 83)) showed a high presence of histosols which means that they are situated on excessively moist ground. They all represented clearance cairnfields (with the possibility of forest fields) and Kolila was potentially bordered with a boundary as fragments of it were visible. Field survey in the future must be carried out to confirm their characteristics.

4 field systems in the southern part of the study area (Mäliküla I–II (nos. 32–33), Pikavere (no. 51) and Koeri (no. 86) were situated on Cambisols. All of them, except Pikavere, were also on a higher ground. All of them had the under- or overlying clearance cairnfield component, although the small amount of cairns that were present could be contemporary with the main system of late quadrangular fields.

4.6.5 Chronology of the field systems

Basic assumptions about the relative chronology can be made on the basis of the typology of the field systems and their distribution in connection with the settlement pattern and environmental conditions.

Based on the typology, clearance cairnfields could be dated to either prehistoric or historic periods. Further detailed stratigraphic analysis on locations where they occur with other and clearly younger field systems can show their relatively older age compared to the more recent field systems. Among the quadrangular fields, it was impossible to distinguish between field systems that could originate from the early phases of prehistory and from Middle and Late Iron Age because the quadrangular fields did not fall into the established typology of Baltic, Celtic and later quadrangular fields. Late quadrangular fields were distinguished mainly by their size. Most of the strip fields in the study area belonged to later historical phases. Only at Linnamäe (no. 12) in the norther part of the study area, it is possible that the fragments of long field banks represent prehistoric strip fields.

The distribution of field systems in connection with the prehistoric settlement sites shows that most of the fields have a spatial connection with settlement sites or other monuments which means that a large amount of them most likely originate from the prehistory. The presence of Bronze Age and Early Iron Age field systems similar to northern Estonia was not verified based on the relation with other sites but a more thorough analysis of archaeological material could shed some light on the question of the oldest field systems in the study region.

The distribution of field systems in relation to natural environment can, on one hand be beneficial to potentially exclude some field systems from being either prehistoric or field systems at all, for example in cases where they are located on soils that are not suitable for agriculture. However, the soil data might be to some level inaccurate and also, the natural conditions might have changed in the course of time. The location of majority of the field systems on regosols that has been the most suitable soil type for early agriculture can be a further proof that a large portion of field systems in the study area can originate from prehistory.

In general, the analysis of field systems showed that some of the field systems that were mapped as potentially prehistoric do not have typological of distributional proof of that. Therefore, even a basic analysis can be very beneficial in specifying the chronology of field systems. The landscape survey with remote methods cannot provide very definitive absolute dates but it has proved its usefulness for determining general patterns and regularities inside the study region.

4.7 **Conclusions**

The main purpose of this chapter was to point out how the environmental conditions and settlement pattern affected the location and form of field systems. In the first section I explained the limits of my study area. Although different ways to categorise the area – both from environmental and historical perspective – exist, the divisions were taken as guidelines while the actual extent of the study region was more or less defined by the distribution of fields. After that a thorough overview of the main environmental aspects of the study region was provided. This serves mainly as a background for both the regional and case-study based analysis of field systems. After that I reviewed the settlement history of mainland Western Estonia with the emphasis on the prehistoric periods (mainly Bronze and Iron Ages). The historical overview was followed by a short overview of the previous archaeological excavations in the study region. The information was analysed and will be used as a data against which to test some of the questions related to the case study analysis.
A basic analysis of the typology, distribution and relative chronology of field systems was presented, pointing out the main characteristics of the field systems in the study region and differences inside the area.

The possibilities to study the distribution of field systems is inevitably related to the survival of fields in the landscape. The survival of field systems is strongly reliant on later land use practices. Even the Bronze Age and Early Iron Age field systems might have been destroyed in the later phases of prehistory, not to mention the historical land use. The places where the oldest field systems are found in Estonia are the ones where there has been no later activity, especially alvar areas where soil cover is thin and was probably not preferable for later cultivation because better soils were available elsewhere, or because the later agricultural land use was less destructive (e.g cattle rearing). V. Lang has also proposed that in some places long-lasting field boundaries and cairnfields were not established at all, for example where cattle rearing was the main subsistence. This, however has been seen less likely than the destruction of field systems during later land use activities (Lang 2000a:215).

The relative area where field systems were spread, was larger in the southern part of the study region (the northern part of the study area did not reveal any field systems) and the field systems in general were better pronounced in the landscape than in the northern part. At the same time the density of the prehistoric habitation and amount of monuments in the close vicinity of field systems is also higher in the southern part and in many places the historical villages were right next to the preserved field systems. The distribution of field systems in the southern part of the study area opposes to the logic that later land use was often the reason why field systems have not preserved or they might be fragmentary.

In addition to survival, the detection of new field systems and the study of their characteristics and distribution is also dependent on the applied methodology. One of the reason for the larger amount of well-pronounced field systems in the southern part can also be that because of settlement history and environmental conditions the landscape was more open and the field systems were easier to detect with chosen methodology. The primary method of detecting new field systems and investigate the already known ones was the use of LiDAR data. In Estonia the availability of LiDAR data has grown immensely over the last years and LiDAR-based hillshades are one layer of public map and freely available to everyone. Estonian Land Board is performing flights on a yearly basis to improve the coverage and data quality. The raw data and pre-prepared hillshades are freely available to download and use. Pre-prepared hillsades are also available as a web map layer which was used in the current thesis for the regional level survey. Using the pre-prepared hillshades was not the perfect method (as opposed to analyzing raw LiDAR data) because the lighting angle in these relief models was fixed from only one angle which meant that linear structures that were perpendicular to that angle were not visible. LiDAR can also be problematic when it comes to forested areas. Although vegetation is automatically removed during the preparation of the hillshades and there are enough laser points to create the model under the canopy of the trees, the point density is still less than in open areas. This might have been one of the reasons why in the northern part of the study area which was generally more forested, mainly clearance cairnfields prevailed in the forests. Forested areas, especially the ones where woodcutting has taken place, can also cause false features – piles of twigs or stumps left from woodcutting in the forest areas can look like clearance cairns. During the landscape analysis LiDAR data was always looked in parallel with ortophotos and in some cases, areas that looked like cairnfields but had been subject of recent forest cutting were omitted. Many of these obstacles could be resolved by additional fieldwork and landscape survey which was not feasible in the time frames of the current thesis.

The regional analysis included the basic comparison of the location of field systems with known archaeological monuments, with an emphasis to settlement sites in order to see connection with them and evaluate what kind of social communities used the fields? Ideally this could also contribute to relative chronology of the field systems. However, there were problems related to that because of the lack of archaeological data and excavations which means that most of the settlements are not accurately dated. For settlements that fall within the borders of historically known villages (which are usually inhabited until today), it has been assumed that they could originate from the Middle Iron Age onwards. The settlements that are further away from historical villages could be earlier.

The environmental analysis contributed to the relative chronology of the field systems and pointed out areas that had more potential for prehistoric agriculture – higher places in the landscape with easily tillable soils. This correlated with the distribution of field systems but further analysis could help to find even more field systems and other sites that were left unnoticed during the current

As to the typology of the field systems, an effort was made to fit the field systems in the study region into the established Estonian typology of field systems. However, this was not straightforward because of methodological issues pointed out above: the questions about survival, the overlapping of field systems of different periods and also because inevitably typologies are ideal models and the reality might be different.

Typology is the first starting point when talking about the relative chronology of field systems. Because the detected fields did not fit well into the types that have been established in Estonian archaeology, it was difficult to make chronological assumptions based on that. The distribution in connection to other archaeological monuments and sites gave a better indication. However, the location in the vicinity of the prehistoric monuments that have not been precisely dated (e.g. many of the settlement sites), can also only lead to a conclusion that some of the fields – the ones close to the monuments were supposedly also prehistoric but more exact dating is usually not possible to make. In places where there were earlier graves inside the field systems which are dated rather well, the conclusion can be made that the fields were prehistoric but later than the Early Iron Age.

It is possible that the western Estonian field systems do not fit well into the existing typology, chronology, general evolution and development of field systems that has been established based on North Estonian material. For example, a new type of field systems was detected where clearance cairnfields were bordered and enclosed with long boundaries. Their primary function could have been stock enclosures for cattle breeding but clearance cairns inside the enclosed areas can be markers that they were at one point also used for cultivation or as a meadow.

The high occurrence of overlapping field systems and structures in the study area suggest a long term – and sustainable - agricultural use of the same areas. Based on the relatively small size of the potentially prehistoric field systems the fields were probably used by small groups of people, single households or small farmsteads. In several areas in the southern part of the study region there were groups of fields in the close vicinity of each other that showed similarities in form but were separately distributed, so that they could be distinguished as different field systems – for example field systems at Nehatu, Massu, Ridase, Poanse-Järise, Kõmsi and Esivere. This might show that these areas were inhabited by larger communities and that land was divided between the groups; (partly) common land use cannot be excluded either.

5 Case study survey

5.1 Introduction and location

Salevere village (5.6 km^2) is situated in the southern part of West Estonia, in the landscape region called the West Estonian lowland (Peil et al. 2004), in the area between Matsalu Bay and the Virtsu Peninsula (Fig. 5.1). The village is situated in the southern part of the study region. Until 2017 it was one of the 29 villages that belonged to Hanila rural municipality in Läänemaa County. After the merging of smaller municipalities during the administrative reform in 2017 the village is now part of Lääneranna municipality and belongs to Pärnumaa County. According to the historical division, Salevere village was part of Hanila parish in historical Läänemaa province.

Figure 5.1. Location of Salevere village (marked with a red circle) on a modern ortophoto. Base map: Estonian Land Board 2021.

The hill of Salumägi (L-EST97: x 6504851 y 476422; 58° 41′ N, 23° 35′ E) lies in the northern part of Salevere village (Fig. 5.2). With a height of 23m above sea level, it is one of the highest points in an otherwise low-lying landscape, typically no more than 10m above sea level (Arold 2005:301). The northern, north-eastern and south-eastern sides of the hill are defined by a steep cliff, and on the eastern side the hill blends smoothly into the surrounding landscape. From the western and southwestern sides, the hill is bordered by the Kõmsi–Mõisaküla–Salevere Road; on the eastern side by the Ridase–Saastna Road, with a 150–250m wide strip of forest between the hill and the road. In the area north of the hill, sea-ward, there are modern arable fields.

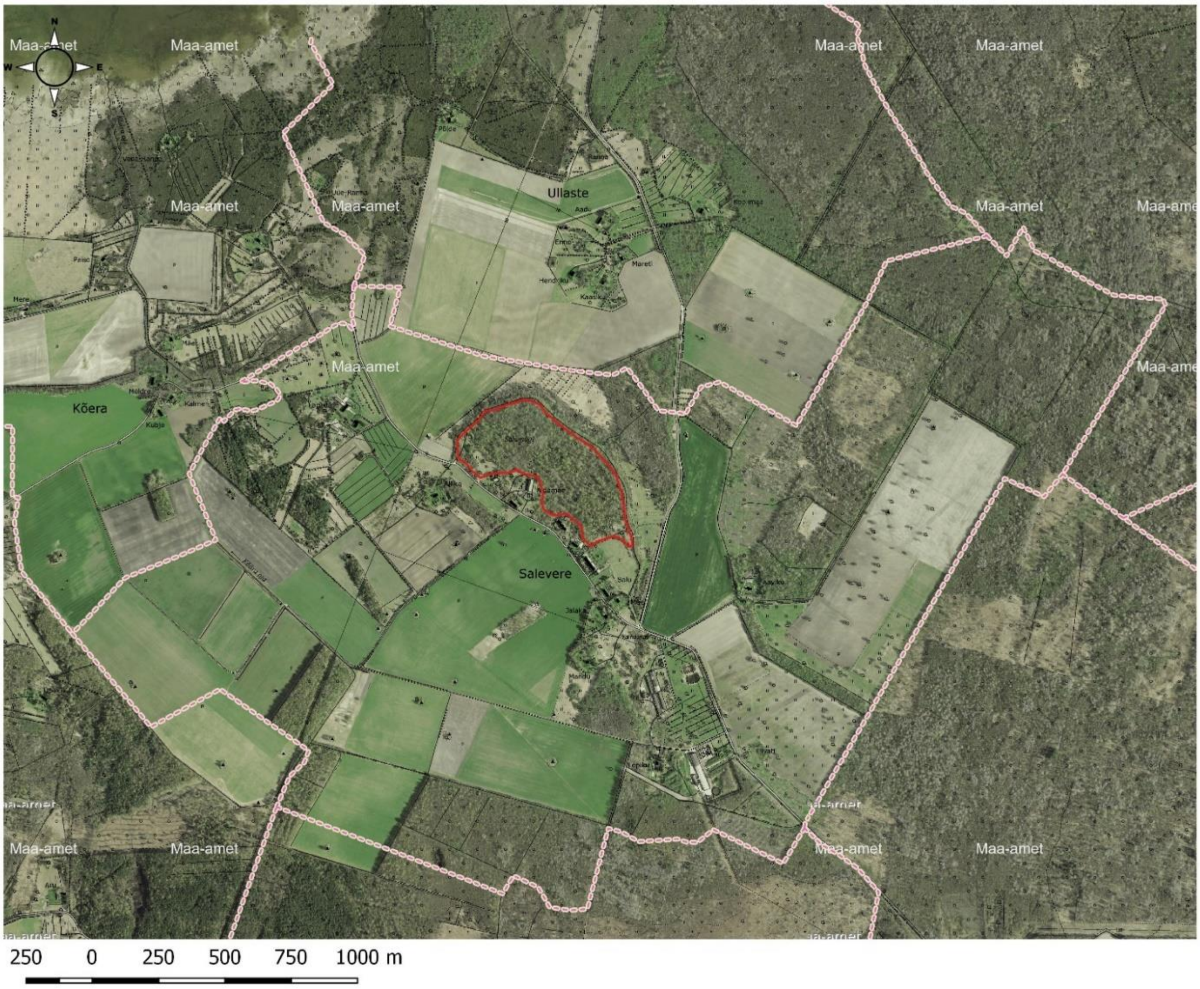


Figure 5.2. Location of the hill of Salumägi at Salevere village on a modern orthophoto and Estonian Basic Map (1:10,000). Mapped area is marked with red polygon. Base map: Estonian Land Board 2021.

The total extent of the hill is 40ha from which 17.5ha on the northern part was the subject of detailed archaeological mapping during the project (Fig. 5.3). The southern and south-western parts of the hill are built with modern inhabited houses and recently abandoned buildings. If there were archaeological features in that part of the hill, they have been destroyed in the course of later building and agricultural activities.

Figure 5.3. Case study area on the hill of Salumägi on a modern ortophoto combined with Estonian Basic Map (1:10,000). Other archaeological sites near the hill: settlement sites (9906, 13097), stone grave (9908), cemetery (9907). Base map: Estonian Land Board 2021.

The chapter describes and analyses the results of the landscape survey on the hill of Salumägi which started in 2008 and was finished in 2013–2015. The primary research aim of the thesis is to see how the locations and organisation of field systems are connected with landscape sustainability. While the regional analysis gave basic knowledge about the general trends of the distribution of field systems in western Estonia and pointed out its main characteristics related to environmental conditions and the known settlement pattern, the case study will address the characteristics of the organisation of field systems in a specific location. The wider aim of the detailed targeted approach in the current survey chapter is to study how the agricultural land was organised and what was the correlation between field systems and other factors (environmental and social). The archaeological features and types of field systems are taken as a main reflection of the possible correlations. Therefore the detailed study of the different features that comprise the field systems is of utmost importance in the current chapter.

As pointed out in chapter 3, the essential aspects to consider when assessing possible landscape sustainability and that can potentially be answered with case study methods are as follows: the "wise" use of landscape resources (or landscape as a resource, combining different environmental and social aspects) over a period of time; the functional flexibility (or multifunctionality) of land use practices; and the time frame that defines landscape sustainability. The archaeological survey of the landscape features and field systems helps to determine how the different landscape elements were combined into and used within field systems. The "wise" use of landscape as a resource would entail combining both the natural prerequisites and environmental components as well as the remnants of past human land use within field systems to make the system sustainable. The function of the field systems can be hard to determine with landscape archaeological methods, however, an effort has been made to analyse how the pattern or form of field systems can reflect its function (i.e. how the field systems were used agriculturally). As to the third aspect – the time frame of landscape sustainability – an emphasis was made, based on the patterns of the field systems on the hill, to see chronological sequence of the land use and see if the different parts on the hill might have been in use concurrently or did they suggest there were different chronological layers. The chronology of the field systems will be dealt with more detail after the excavation results in chapter 6 are presented.

This chapter begins by putting the survey area into a wider environmental and historical context. It describes the development and conditions of the natural setting and the history of human settlement both on the hill and in its immediate surroundings. The history of human settlement is based on the state of knowledge prior to the current study. The chapter continues with the results of the landscape survey, preceded by an overview of the study methods. The original data is presented in two levels. At first, an overview of the different types of archaeological features and their characteristics on the hill is provided, along with a quantitative summary. At the second level, the objects are treated in more integrated way, by identifying separate areas and groups of field systems in the landscape. The mapped area was divided into eight different areas and description and analysis is organised by area.

In the final part of the chapter, an overview of the results of the landscape survey is provided. This aims to reconstruct the longevity of the occupation and land organisation of the field systems on the hill, which I interpret as landscape sustainability. These interpretations set the agenda for the analysis in chapter 6, where the details of the archaeological excavations on the hill are discussed.

5.2 Environment

5.2.1 Formation and geology of the hill

The hill of Salumägi was formed about 400 million years ago in the Silurian period (Viiding 1995:54; Arold 2005:301). It is an outcrop of biohermal limestone of the Jaagarahu Stage that was formed by an accumulation of organic marine material, including corals and molluscs (Viiding 1995:54; Arold 2005:301). During Quaternary glaciations the hill resisted the erosion of the ice streams and the plateau of the hill is relatively flat. The erratic boulders and boulder fields on top of the hill as well as higher elevations on the surface of the hill, are the signs of glacial actions. Most of the hill is characterised by thin quaternary cover, with the thickness of less than 1m. Only on the eastern part of the hill, the quaternary deposits are thicker and contain pebble, sand, silt, loam and clay (Fig. 5.4).

After Estonia was freed of continental ice about 11,000 years ago (Karukäpp and Raukas 1997), the land in front of the glacier margins was flooded by the waters of glacial lakes, the predecessors of the present-day Baltic Sea (Raukas and Rõuk 1995:555). The evolution of the Baltic Sea had periods of transgressions and regressions (Raukas 1997a) which are divided into several stages and phases (Raukas 1997b; Kessel and Punning 1995, 558). It was during the Litorina Sea phase about 5,000–6,000 years ago (Raukas 1997a), when the steep escarpment of the hill of Salumägi was formed. The western and northern seaward slopes of the hill were abraded by the water. The cliff is now up to 15m high (Arold 2005:301).

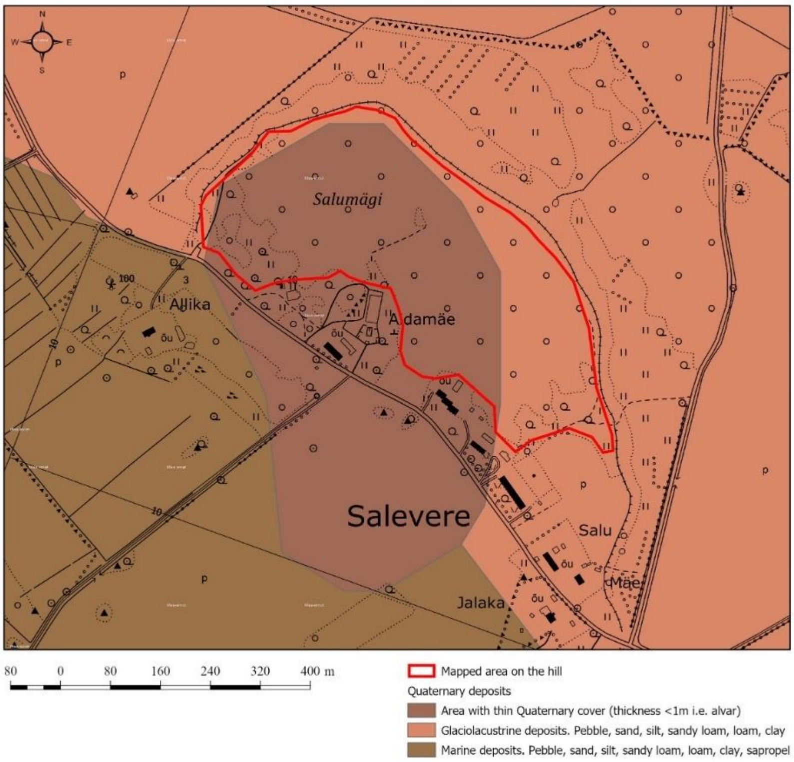


Figure 5.4. Quaternary deposits on the hill and its surroundings. Base map: OÜ Eesti Geoloogiakeskus 2006, systemised by Estonian Land Board 2019.

In the 5000 years since the sea lapped the hillside of Salumägi, the coastline has retreated and today it is about 5km north-west of the hill. The reason for that is the post-glacial isostatic rebound that affects coastal West Estonia and the islands (Arold 2005:415). Due to the uplift, new land has been constantly emerging during the Holocene period.

5.2.2 Soils and vegetation

The Holocene formation processes on the hill's biohermal limestone resulted in the development of soils that were rich in mineral (calciferous) matter. Regosols prevail on the hill and Gleysols in the lower areas around the hill (Fig. 5.5). According to more specific soil classification, the soils on the hill are Calcaric Skeletic Regosols (Fig. 5.6) or Rendzic leptosols (Estonian Soil Map). The soil cover is thin and is formed on limestone bedrock that lies close to the land surface (Kokk 1995:434; Reintam 1997). The thickness of the humus horizon on the hill is, on average, 15–20cm (Estonian Soil Map). There are variations to the thickness of the humus layer at different parts of the hill, as demonstrated during the archaeological excavations. In some places the solid limestone bedrock lies directly beneath the humus layer while in other locations the natural subsoil consisted of a layer of boulder till and the limestone was not reached during the excavations. The soils are high in humus, but stony and sensitive to drought (Kokk 1995:434).

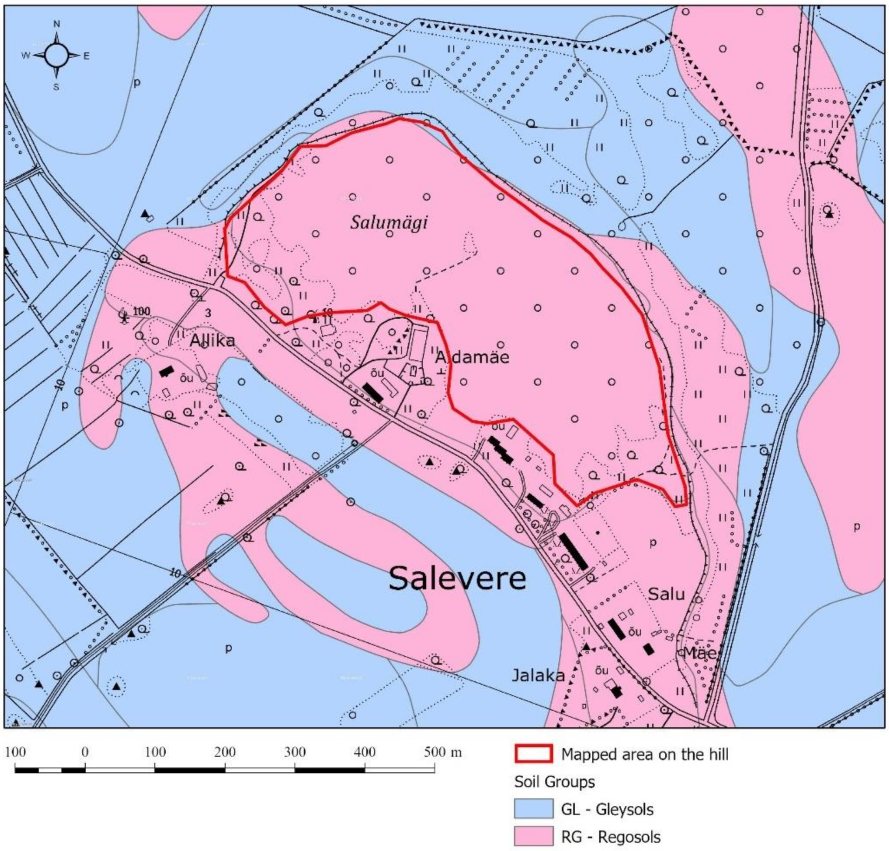


Figure 5.5. Soil types on the hill and its surroundings. Source: EstSoil-EH v1.2c: EstSoil-EH: A high-resolution eco-hydrological modelling parameters dataset for Estonia. Kmoch et al. 2020.

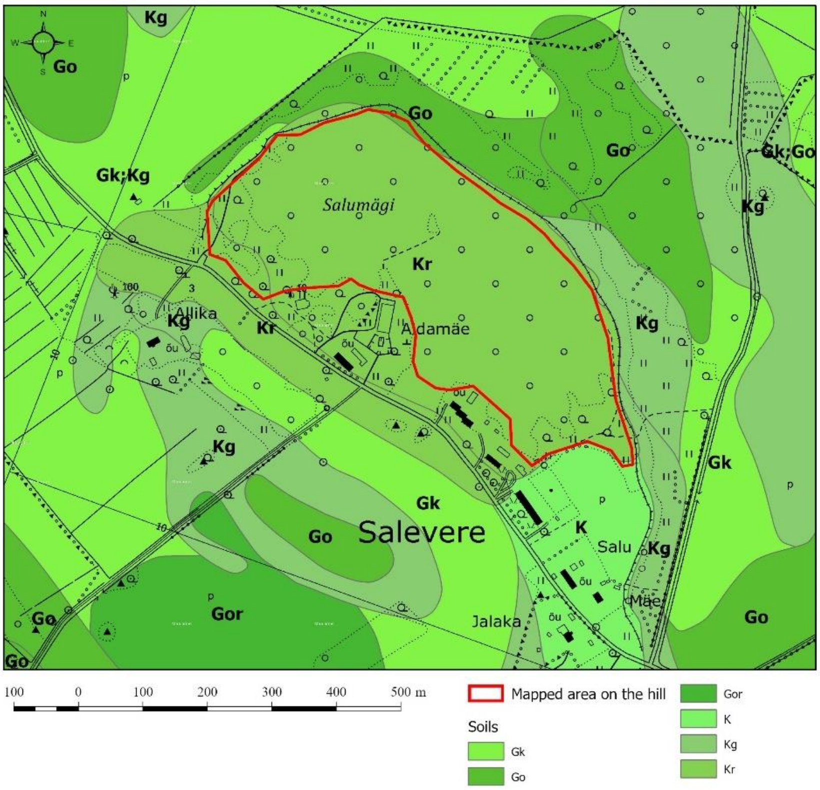


Figure 5.6. Soils on the hill and its surroundings on the Estonian Soil Map. Base map: Estonian Land Board 2021.

Gk – Calcaric Gleysols; Go - Endocalcaric Mollic Gleysols; Gor - Endocalcaric Mollic Gleysols (endoskeletic); K - Calcaric Regosols; Kg - Calcaric Gleyic Regosols; Kr - Calcaric Skeletic Regosols.

There has been no direct analyses of the vegetational history of Salevere. The general trends in the regional history of climate and vegetation were presented in chapter 4. Nowadays most of the hill of Salumägi is covered by the alvar (loo) forest that predominantly consists of oaks and hazels (Fig. 5.7). Only in the south-western and south-eastern parts of the hill, which have been impacted by modern agriculture and have been maintained recently, is the landscape more exposed and the vegetation dominated by junipers and other bushes (Fig. 5.8). Nemoral forest with broad-leaved trees like ash, linden, elm and maple (Fig. 5.9) covers the cliff, the area immediately adjacent to it and extending on the north-eastern side of the hill where a spring flows out of the cliff (Arold 2005:301).

Figure 5.7. Forest with oaks and hazels in the middle part of the hill (2021).

Figure 5.8. Open landscape in the western part of the hill (2021).

Figure 5.9. Nemoral forest covering the cliff (2021).

The development of soils and vegetation have been different for the areas surrounding the hill, especially for the land between the cliff and the sea where it was mostly affected by the retreating sea. The landscape surrounding the hill is mostly a flat plain, with elevations between 7.5–10m above sea level and where agricultural land use dominates (Fig. 5.10). The typical soils are Gleysols characterised by dampness and the existence of a greyish gley horizon formed in conditions of high ground water (Kokk 1995:437) (Figs. 5.5 and 5.6). There are arable fields on the northern, western and south-western side of the hill, whereas grasslands prevail eastwards, except for the nemoral forest on the north-eastern side of the hill, mentioned above.

Figure 5.10. Landscape north-west to the hill, view to north-east (2021).

5.3 History of human activity at Salevere village

The archaeological remains on the hill of Salumägi comprise an enclosure, field systems and a stone grave. Prehistoric settlement sites and a cemetery are known in close proximity to the hill (see Fig. 5.3). The settings for the human habitation at Salevere were created by the retreating ice and water. The higher places in the landscape had most potential for the earliest settlements and that is where the oldest archaeological signs of human habitation in West Estonia are found.

The earliest known monuments from Salevere, prior to the investigations covered in the current thesis, are from the Early Iron Age (500–250 BC). In the 1970s, archaeologist V. Lõugas discovered a grave (reg. 9908) on the south-eastern slope of the hill, 90m from the southernmost preserved field systems (Fig. 5.11). Small-scale trial excavations were carried out and unburnt human bones and pottery were found. Lõugas assumed the burial was an early *tarand*-grave and dated it to the first half of the first millennium AD, probably from the 1st to the 2nd centuries AD. According to more recent studies early *tarand*-graves date from the Pre-Roman Iron Age (from 500 BC) (Muinsuskaitseamet 2019). Lõugas also noticed numerous cairns on the southern part of the hill closest to the grave, most of which he thought to be from field clearance, although the possibility was not excluded that some cairns might have been stone graves (Lõugas and Selirand 1989:120). If they are stone-cist graves, the hill might have been inhabited earlier in the Bronze Age, based on the general dating of stone graves. The area between the registered grave and field systems is nowadays a meadow that in the recent past was also used as a field. At least one, similar stone grave (reg. 9909) is recorded 800m north-west of the hill, on a higher ridge – a former palaeoshoreline. The area between the hill and the ridge (Fig. 5.10) was subjected to land improvement during the Soviet Period and visible archaeological monuments have not been preserved.

Figure 5.11. Stone grave (reg. 9908) in the landscape (2021).

In 2001 a crescent-shaped wall that borders the promontory of the hill of Salumägi and field banks around it was discovered in the thick scrub covering the hill (Karnau 2001; Mandel 2002; Mandel 2004). The enclosure was categorised as a hillfort based on previous research and parallels with similar sites in Estonia. Comparable monuments have been discovered in Lihunetsi in western Estonia, Jägala and Muuksi in northern Estonia and Võnnumägi in Rapla County (Lang 2007b:81–82). The excavation of these sites usually shows no clear habitation layer. The occasional finds and some radiocarbon dates suggest an Early Iron Age date for the establishment and use of the enclosures. These same dates have been suggested for Salevere (Lang 2007b:81–82). The same year when the enclosure was discovered, field banks were noticed near it (Karnau 2001; Mandel 2002; Mandel 2004). The field systems were believed to originate from different time periods.

During landscape monitoring in 1991, a prehistoric settlement layer (reg. 9906) was identified directly west of the hill, on arable either side of the road. The thickness of the occupation layer containing burned stones, potsherds and animal bones was 40–60cm and based on the area the finds covered it was estimated that the size of the settlement site was 180m x 100m. The few potsherds that were found allowed only to conclude that the settlement layer originates probably from the Middle or Late Iron Age but more specific dating is missing. Another occupation layer, presumably of late prehistoric origin, was also noticed in the centre of Salevere village, on the south-eastern slope of the hill (Mandel 2008:254; Muinsuskaitseamet 2019).

As to later archaeological monuments, there is a so-called village cemetery near the hill that was discovered at the beginning of the 20th century, in which bones, rings, bracelets, coins, knives and timber banks of coffins were found (Jung 1910:193). The area yielded more information in 1971 when more human bones were found in the same location. The results of trial excavations the same year confirmed that it was a village cemetery, a type of burial places which typically are dated to the 15th–18th centuries AD (Lõugas and Selirand 1989:119–120). The hill of Salumägi has also been mentioned in archaeological literature as a "sacred place with unknown date" due to a spring on the northern side of the hill (Fig. 5.12) that was believed to have healing properties (Moora 1942:15; Tavast 1931:25). The spring and the whole hill are listed as sacred natural historical sites (Artes Terrae 2019) based on recorded information in folklore that describe the hill as a place where people went for the healing properties of the spring, where events and gatherings were held and where other outstanding natural elements (boulders, caves) were connected with stories in local lore.

Figure 5.12. Spring on the north-eastern side of the hill (2008)

The first mentioning of the village Salevere in written sources is debatable. A village called *Saltovere* mentioned in a document from 1319 has been associated with either the Salevere village in Hanila parish or a village with the same name in Mihkli parish which is also situated in historical Lääne County (nowadays Pärnu County) but further to the South-East (Kallasmaa 2012:60–65). Salevere village in Hanila parish definitely occurs in written sources from 1539 (Perto Sallover), 1591 (Saleuere By) and 1686 (Saloferby) (Dictionary of Estonian Place names; Kallasmaa 2012:61). On a map from 1798 Salevere (Sallefer) is marked as a pastoral manor that belonged to a larger Saastna manor (Mellin 1798). However, Salevere village is not marked on the map and also not on the maps of the 19th century, the nearest village on the map is Ullaste (Ullast) north-east of the hill (Schmidt 1844; 1884) (Fig. 5.13). Some outbuildings of the manor complex (e.g. distillery) are still preserved but the main building on the southern part of the hill is perished. The village was resettled in the 1920s (Dictionary of Estonian Place names).

Figure 5.13. The hill of Salumägi (1) and the location of the manor (2) on a historical map from 1884 (Estonian Land Board 2021).

Recent land organisation represents the largest single transformation of the rural landscape, and presumably also had a significant impact on the survival of prehistoric features. The 18th–19th centuries brought large-scale land enclosure and the abolishment of some villages, of which a few had origins in prehistory. A further large and brutal reorganisation of land took place during the Soviet period, after the 1940s. All the land was nationalised and a large-scale collectivisation was started with the establishment of kolkhozes or collective farms[28]. The traditional village community was destroyed everywhere in Estonia and many people were deported to Siberia. Since the 1940s the fields around the hill underwent extensive land ameliorations in the course of which the area was intensively drained, mechanically levelled and cleared of stones. If there were any archaeological sites, such as stone graves or field remains, they have all been pushed together into the large stone heaps that are characteristic of

[28] The names and areas of the kolkhozes changed during the Soviet period. The first small kolkhoz where Salevere was affiliated was called *Kungla* which was later joined with larger kolkhozes in the region (Vainu 2015:6–7).

the Soviet agricultural landscape (Arold 2005:305; Markus 2004:147–148). The extent of land improvements are visible in comparison of topographic maps from 1938 and 1942 (Fig. 5.14.) – while in 1938 the areas north and north-west to the hill were meadows and grasslands, in 1942 they were extensively drained and turned into arable fields.

Figure 5.14. The surroundings of the hill on the map from 1938 (left) and 1942 (right). Estonian Land Board 2021.

In the beginning of the 20th century local people used the hill as a pasture (Tavast 1931:25). The remains of a modern wire fence show that animals were kept on the hill until recently. According to local oral history, there were small plots on the hill in the recent past (probably 1970s and/or 1980s) that were used for potato farming. After the Soviet regime collapsed in 1991 the village struggled because of the changed economic and ownership patterns. The last kolkhoz ceased and the lands were returned to private ownership. Today the population of Salevere is estimated to be 28. The hill is part of the Matsalu nature reserve, which was established in 1957, and a designated tourist destination. There is a hiking trail along the edge of the hill which also incorporates the enclosure bank and the spring on the northern side of the cliff. On the north-western part of the hill there is a small recreation ground that is used for small-scale events, for example during Midsummer Day.

5.4 Study methods

As mentioned in the introduction, the archaeological features and types of field systems that were the target of the case study survey, are taken as main reflections of the correlations between field systems (and the elements they comprised) and other factors that influenced landscape sustainability. Following from that, the aim of the survey and mapping was to record and describe the archaeological features as accurately as possible in order to provide a solid basis for the analysis of landscape sustainability.

Mapping of the area was completed in four phases during 2008–2015. The initial mapping was carried out in 2008, prior to the excavations. The mapping was completed using a Trimble 3600 GDM Total Station. The woodland on the hill made GPS survey impossible and the manual survey with tapes impractically slow. The mapping was bound with absolute geographical coordinates (the geodetic points were transferred to the hill, which caused a small loss in precision because the known points were located as far as 1,4km away). The enclosure, field banks and some clearance cairns around it in the area where visibility was sufficient were mapped (Fig. 5.15). The landscape survey was continued in 2013. Hand-held GPS (Garmin) was used in areas where the vegetation was too dense for line-of-sight survey. The average error range shown in the device was ± 3–4m.

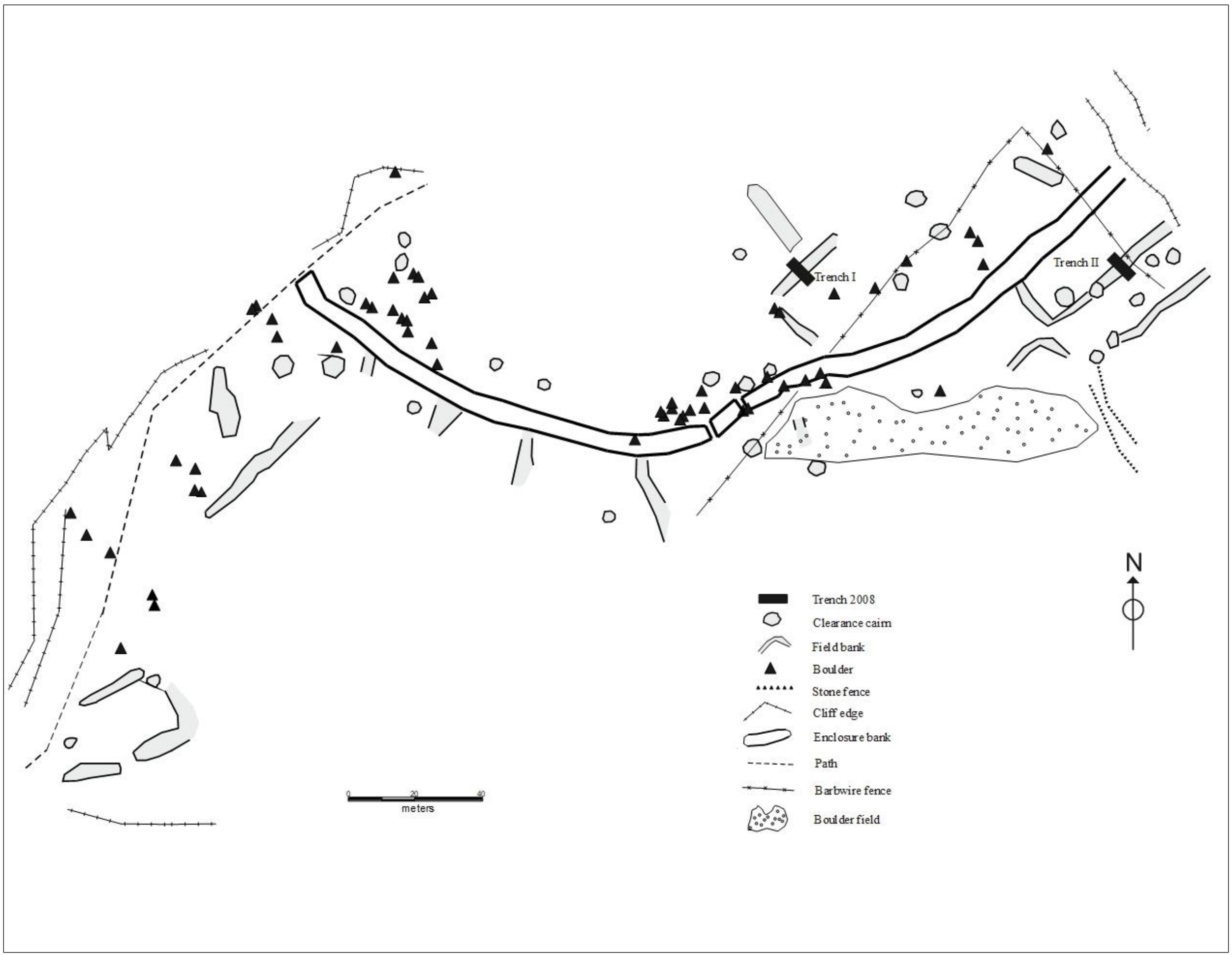


Figure 5.15. The initial mapping of the hill in 2008.

In 2014, an analytical study of the mapped features was carried out using the initial mapping and GPS data. The mapping was mainly done in the area south of the enclosure while the inner part of it remained largely unmapped. The final mapping/survey was carried out in 2015 after the previous mappings had been combined with LiDAR data and included verification of the information that was visible from the LiDAR data and analytical mapping and survey of the northern (enclosed) part of the hill.

The survey recorded the locations and dimensions (heights and widths) of the archaeological features on the hill, and on rare occasions only relative estimations of size were recorded. Sometimes objects that were visible during the first surveys were not relocated during following visits. In these instances, LiDAR data proved useful and helped to determine the sometimes hardly visible features.

For the calculations of average heights, only the cairns with the measured height data were taken into account. For the size, the average size was calculated using the width and length of the cairns, combined as a diameter. Of 262 cairns, 44 lacked the height and diameter measurements and were drawn on the map using the general average. 24 cairns lacked height data but an estimated size was marked down during the survey. On the basis of minimum and maximum sizes of other cairns, the diameter of the bigger ones was estimated to be ca. 7m and the smaller ones 3m. An average height of 0.4m was attributed to them in ArcGIS. The reason why the estimated data was added was because most of the cairns with no or estimated data were in area VII. By leaving them out of the calculations, the fact that a lot of large cairns of ca. 7m in diameter were situated there, wouldn`t have been reflected. Some of these cairns might be stone graves.

The 25 cairns that were detected from Lidar mapping but were not confirmed and measured on the landscape were marked on the map using average sizes. With these possible cairns the amount of cairns on the hill was 287. However, these were not used in the main analysis because they were not confirmed in the landscape.

Field survey was complemented with Lidar data. For the analysis, data in LAS format was used from Estonian Land Board Service that performs (regular) flights for mapping purposes for the Estonian base map. The data from two flights (one in spring 2008 and the other one in spring 2012) was combined for better coverage, resulting in ca. 800,000 ground points. The approximate point density for the ground points was ca. 0.21points/m^2 (Estonian Land Board). Approximately half of them were ground points, others include vegetation, buildings, water bodies and so forth. As the data was processed and classified by the returns, I was able to filter the ground that was of interest. According to that, the classes that I used were 8 (selected terrain points with scheduled distance >20cm or height range +/-0.3cm) and 2 (terrain other than in class 8). It is stated that on one sheet (covering 1 km^2) there are maximum of 1.4 million points (on the average ca 0.5 million points) but by using only the ground points, the amount of points was reduced in half.

The data was processed in ArcGIS (10.1). Firstly, a LAS dataset from LAS files was created. Then a raster was created from the LAS dataset (sampling value 1) and combined with hillshade image. The visibility of the latter was improved by changing the azimuth to 360°, height factor to 3[29] and adding the colour gradient. The resulting hillshaded image – which, according to Crutchley (2013) is basically a visualisation tool to present raster images as 3D map – showed a real-looking landscape with shadows being left from features that were higher than the ground (Fig. 5.16).

All the recorded fieldwork (landscape survey) data, total station points, hand-held GPS points, survey drawings were digitised and imported to ArcGIS 10.1. and referenced to Estonian coordinate system L-EST97, EPSG:3301 (Estonian Land Board 2019). The fieldwork notes were added to the plan and general measurements were used to calculate the sizes of the archaeological features on the hill. The resulting models, combined with the maps of roads and buildings, soil etc. have been used as a base for most of the maps used in this chapter. The main mapping of the whole area is shown on Fig. 5.17.

[29] Different azimuths and height factors were tried but these provided the best results.

Figure 5.16. The hillshaded image used for the landscape survey.

Six main types of archaeological features or types of monuments were distinguished on the hill (Fig. 5.17): the enclosure, field boundaries (mainly banks, but also stone fences or dry stone walls, see 5.5.3. and natural terraces that were used as boundaries), cairns (clearance cairns and probable burial cairns), possible quadrangular graves, platforms and pits. Altogether ca. 400 archaeological features were recorded in the area of 17.5ha. In addition, modern buildings and roads, natural features (boulder fields, boulders and the spring) and excavation trenches were depicted on the map. Hachured plans were drawn on the basis of the landscape survey but it was decided to use simplified maps for the analysis of the landscape survey data. On the detailed maps of the current chapter the features are depicted with simple solid or dotted lines (the latter when the edge of the feature was scattered and dispersed). Different colour codes were used to show the heights of the banks and cairns. The differences between cleared and stony plots were marked on the maps where this was confirmed by field observation.

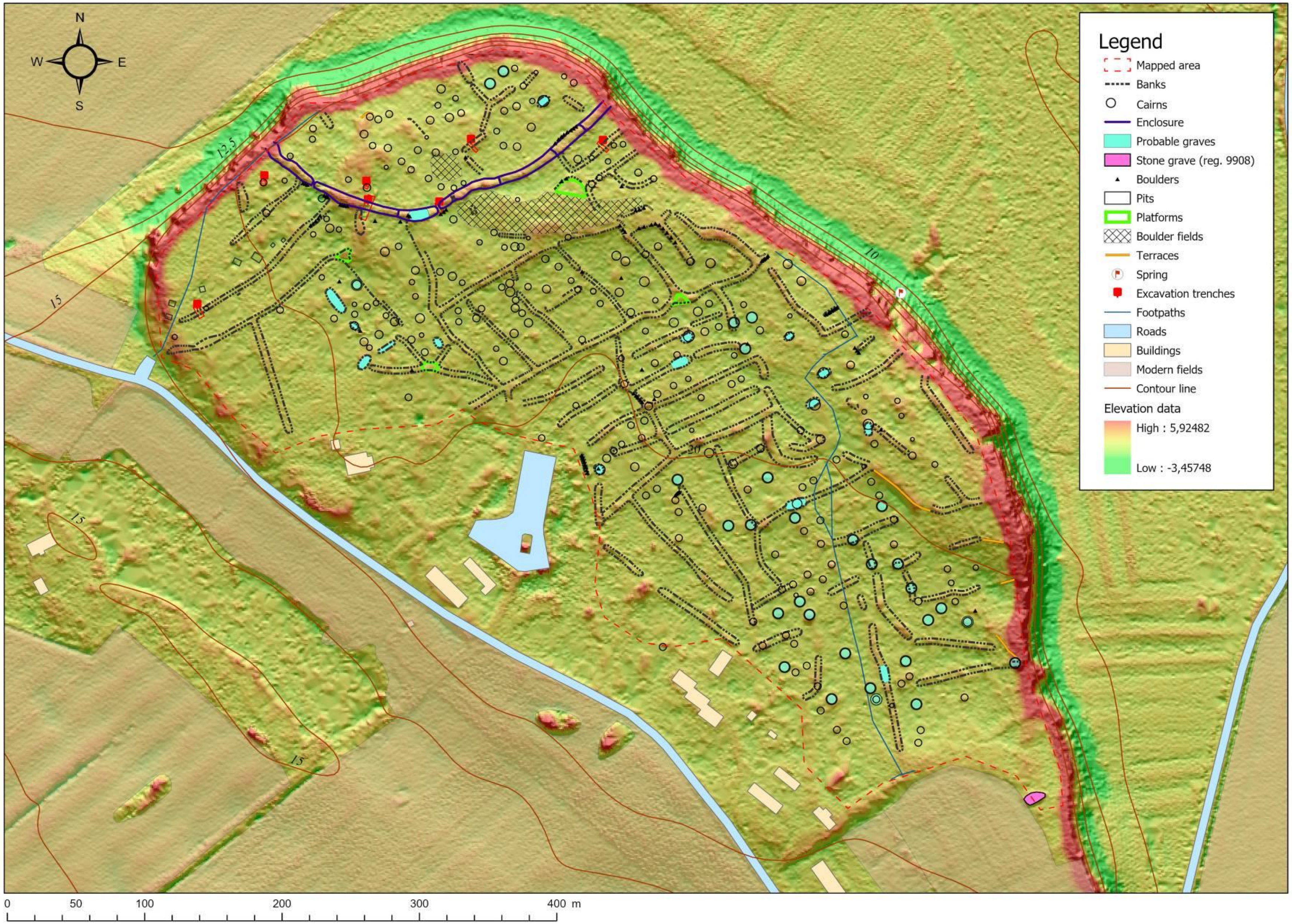


Figure 5.17. Main mapping of the archaeological features on the hill of Salumägi.

Eight different areas/zones were distinguished in the mapped data (see Fig. 5.16). The enclosure was identified as area I and the rest of the areas were distinguished according to variations in the distributions of features and the morphology of field systems. The primary goals of defining separate areas was to organise the analysis, see how different parts of the hill were used and if any temporal changes in the nature of field systems can be detected. The eight areas, including the enclosure, offer one characterisation of the landscape. However, the analysis showed that features often overlapped between areas and the field systems did not perfectly match with the initially distinguished areas. Therefore, the areas serve a heuristic purpose in the research, and should not be taken to as claims for past realities of prehistoric landscape organisation. Above all else, the designation of areas facilitates the description and analysis of the landscape organisation.

The characterisation of areas was easier in cases where the (primary) field system was well preserved and formed a clearly definable unit with distinct axes (V and VI) or where the areas were clearly separated and bounded by other landmarks (II). Areas III, IV, VII and VIII were more difficult to determine because of fragmentariness and variation inside the areas. Subdivisions into smaller regions, sometimes overlapping, were specified and analysed for all the areas. At least six field systems with different characteristics were distinguished on the hill.

5.5 Archaeological features on the hill of Salumägi

The following types of archaeological features were distinguished on the hill: enclosure, field boundaries, clearance cairns, graves, platforms and pits. The field plots and the systems they comprise were defined differently because they are defined by boundaries[30]. The plots are analysed in section 5.6.

The field boundaries were marked by banks and stone fences. A separate section is dedicated to natural features that were in most cases modified and enhanced to be used as field banks or boundaries around areas. No ditches were found during survey that could have served as field boundaries. The most prominent feature on the hill—the enclosure bank—was a boundary but

[30] The definition of boundary, according to the FISH Thesauri (Historic England 2014) is “the limit line of a field”.

it was clearly wider and higher than the rest of the banks on the hill, which were interpreted as parts of field systems.

Cairns were the most numerous single archaeological features in the mapped area. Based on their locations inside the field systems and their physical characteristics, most were probably field clearance cairns. Nevertheless, other possibilities cannot be totally excluded either, as the heaps might also be stone graves, some of which (for example stone-cist graves) look quite similar to the field cairns in the modern landscape. In addition to the circular graves, possible quadrangular graves were recorded, sometimes inside the field banks.

Platforms were recorded in a couple of locations. Their location compared to the field plots and their almost levelled surfaces suggested that their function was different from field boundaries and terraces. These platforms might have served as the bases for buildings or they could have been areas at the edges of the fields where stones and rubbish were dumped.

In the western part of the hill, there were several pits and heaps and banks of soil or stones adjacent to them. They did not seem to be connected with any of the banks, cairns or other features mentioned above and are believed to be recent.

5.5.1 Enclosure

In Estonian archaeological literature, the enclosure on the hill of Salevere has often been referred to as a hillfort (Karnau 2001, Mandel 2002; 2004; 2003; 2008) or, more specifically, an early promontory hillfort which forms “a separate group of sites enclosed with ramparts” and are usually dated to the Early Iron Age (Lang 2007b:81; see also Tõnisson 2008:47[31]). The term “enclosure”, a synonym for “enclosed settlement”, is a broader term indicating any site that was enclosed (Lang 2007b:55–56). In my thesis I have chosen the term “enclosure” to avoid any interpretative assumptions, whether functional or temporal. In chapters 5 and 6 the term applies mainly to the bank surrounding the enclosed area and, in virtue of that, the terms “enclosure bank” or “enclosure wall” are used concurrently.

[31] Early promontory hillfort or early promontory forts enclosed by semi-circular ramparts (Tõnisson 2008:47).

The enclosure consists of two parts: the bank that *encloses* the area inside it and the *enclosed* area itself, which were distinguished as two separate, though related, areas during the landscape survey. The main emphasis in this chapter is to study the different parts and separate elements of the enclosure bank and to give a basis for the further analysis of the possible reasons behind the variations, how, why and when the various parts were conjoined and how the enclosure relates to the field systems and natural features.

The enclosure (Fig. 5.18) is situated on the northern part of the hill of Salumägi, where the slope forms a 15m high limestone cliff. The steep slope bounds the enclosed area from the north, while the enclosure bank provides a boundary on the southern, south-western and south-eastern sides. The enclosed area is 1.7ha in size.

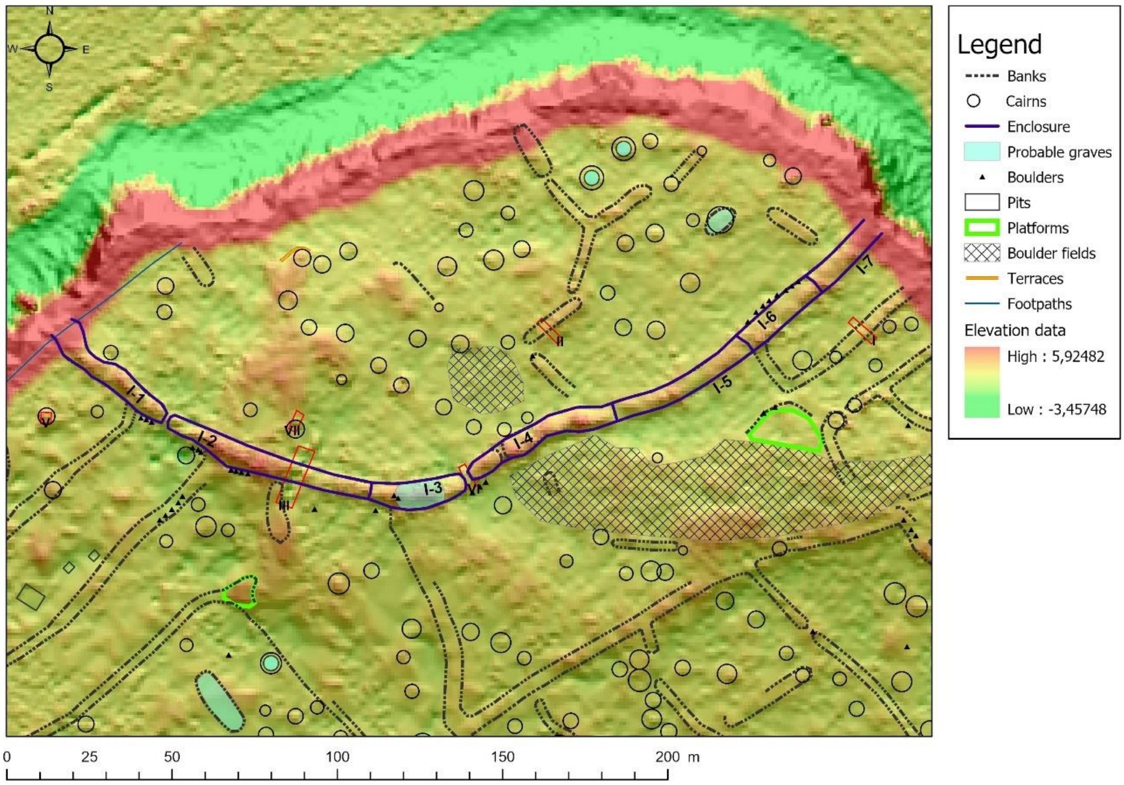


Figure 5.18. The enclosure on the northern part of the hill.

At the time of the discovery of the enclosure in 2001, the bank was overgrown and therefore barely visible. Nowadays it is regularly maintained and cleaned from smaller trees, bushes and higher plants, so that the appearance of the bank is traceable (Fig. 5.19). At the time of the investigation, the enclosure was covered with low grass and occasional old and tall trees but it was apparent that the bank was built of stones because of the thin soil cover. Medium-sized stones were partly observable through the grass and soil and larger stones and boulders were visible on top of the bank and on its sides. In many places, boulders with a diameter of approximately 1m marked the edges of the enclosure bank, especially in the south-eastern part where it was partly adjoined by a boulder field.

Figure 5.19. Photo (taken from W) of the middle part of the enclosure (2014).

The length of the enclosure bank is 286m and it covers an area of 1,840m^2 (0.18ha). The height of the enclosure varied from as low as 0.15m up to 1.1m and the differences in width were between 3m and 8.7m. The calculated average height of the enclosure was 0.55m and the width 6.3m. In general, the enclosure was higher in the southern and western parts and lower in the eastern part. On the westernmost part the bank has been destroyed by a road giving vehicle access to the hill, probably during the Soviet period. In the easternmost part the bank lowers remarkably and disappears before reaching to the edge of the cliff. It is possible that this is also the result of deliberate destruction.

Seven main sections were distinguished within the enclosure, which differed from each other by stoniness, presence or lack of boulders, height and width, existence of gates or gaps and distinctive changes in direction. There were also smaller differences inside the sections but the intention was not to split it up into too many sections but recognise differences while retaining the integrity of the bank. For example, the presence of a gap was not always taken as an indicator of a new section if it was not supported by other criteria and the general appearance of the enclosure remained the same. The sections are described and analysed from West to East (Figs. 5.20 and 5.28).

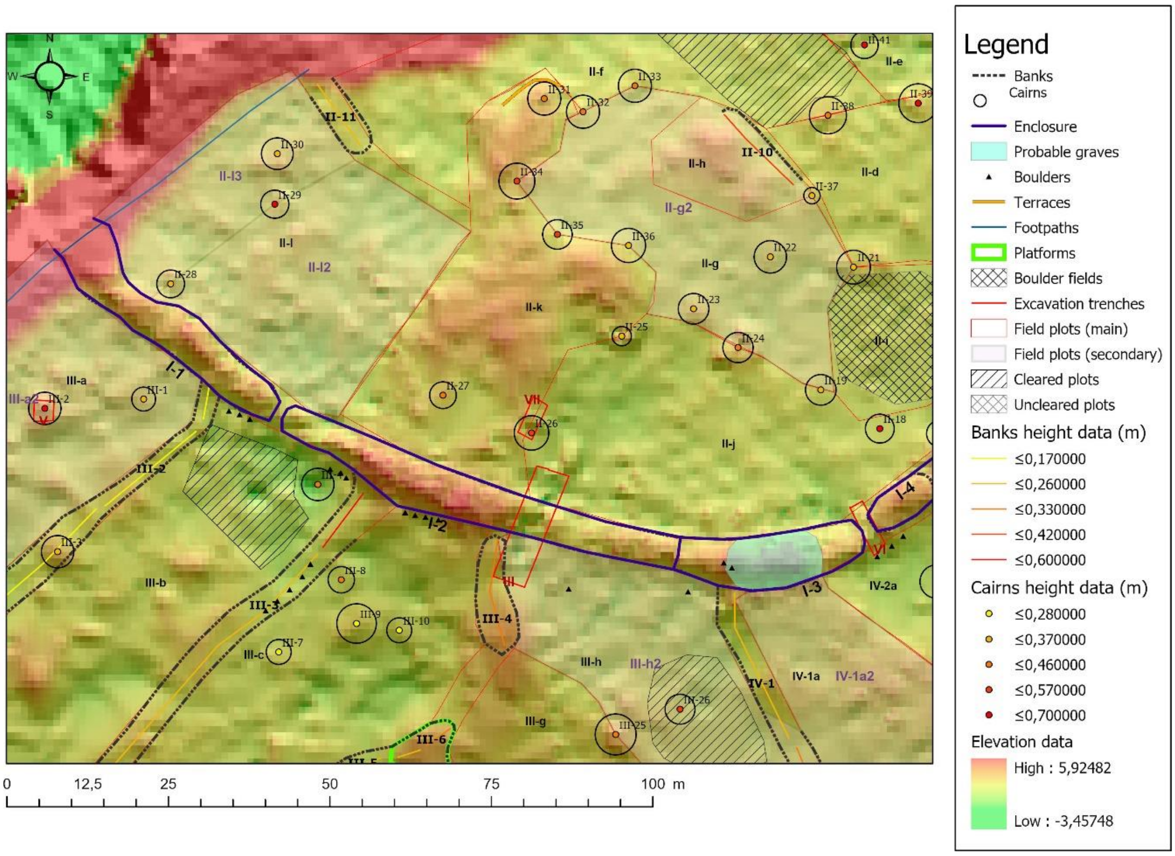


Figure 5.20. Sections I-1, I-2 and I-3 of the enclosure.

Section I-1

The beginning of the section was marked by a sharp cut-off caused by a road to the hill (Fig. 5.21). The enclosure had initially probably continued to the cliff edge. From the eastern side the section was delimited by a 1.5m gap from section I-2. The length of the section was 40.9m and its average height was 0.5m. However, in places it reached higher and in general it was one of the highest parts of the enclosure.

Figure 5.21. The western edge of the enclosure bank that has been cut off with the road (left) and the profile created by the road cut (right) (2021).

In the westernmost part, just eastwards from the path, the enclosure was wide and high—8.6m and 0.8m respectively. This wide and high feature looked almost like a large elongated cairn (Fig. 5.22). East, before reaching the bank III-2, it was narrower, ca 6.5m wide and 0.5m height. After the bank and before the gap, the height remained about the same but the bank was narrower, ca. 5.25m.

Figure 5.22. Higher place on the western part of section I-1, view from NW (2021).

The profile created by the road cut (Fig. 5.21, right) was cleared and described when the enclosure was first discovered in 2001. The inner part of the enclosure was made of limestone slabs with a soil layer underneath (Mandel 2008:254). Limestone was not visible on the top of the enclosure which was covered with grass and sod, but there were some large granite stone boulders of 0.5–1m in diameter, including before the gap where ca. three boulders were situated in a row on the outer side of the enclosure.

Section I-2

A 1.5m wide gap marked the distinction between sections I-1 and I-2. Large boulders were placed in a row on the outside of the enclosure on both sides of the gap (Fig. 5.23). The second section of the enclosure was on a higher ridge that reached inside area II. The direction of the section was unvaried and the outer edge of the enclosure was marked in many places with large boulders that were placed in rows. The section lowered towards its eastern end after excavation trench III until the ground started rising again to form a distinctive high feature marked as section I-3. The length of the second section was 65.2m.

Figure 5.23. The gap between sections I-1 and I-2 (marked with dashed red polygon) and the stones on the outer side of the enclosure bank (marked with red arrows), view from NW (2021).

The beginning of the section right next to the gap rose gradually ca. 7m eastwards. The width of that area was about 0.3m and the heights started from only 0.15m but the wall got wider and higher when it reached bank III-3. Large boulders were placed in a row on the outside of the enclosure, as on the other side of the gap in section I-1. A distinctive high point of the enclosure was situated in the middle of the section, between banks III-3 and III-4 (Fig. 5.24). The western enclosure bank towards bank III-3 was 6.3m wide and up to 1m high. The outer edge of the enclosure was well defined and marked with a row of boulders while the inner side was more diffuse. The eastern part towards bank III-4 was of similar width—6.4m— but not as high as on the other side, remaining around 0.7m. Both sides of the enclosure, the outer and inner, were blended into the surrounding ground. The higher part coincided with the natural ridge in area II that reached further southwards. After bank III-4 the eastern part of the section narrowed to

4.9m and its height was 0.38m. There were occasional boulders visible, some of which were at the outer edge of the enclosure but it did not form a clearly defined edge like it had done in some parts of the enclosure before. This last part of the second section was the transition between one area of higher ground in the middle and the next elevated section, I-3.

Figure 5.24. A distinctive high point of the enclosure between banks III-3 and III-4, view from NW (2021).

Excavation trench III was located at the eastern side of the localised high point. The enclosure in that area was built of limestone slabs on the outer edge, while the inner edge was less clearly defined. The upper parts of the bank were covered with smaller stones that were either fallen from a once higher enclosure or thrown on it later. The results of the excavation support the observations of the enclosure in sections I-1 and I-2 where the outer side of it was well defined in many places while the inner side was gently sloping into the surrounding ground. The results of the excavations are presented in the next chapter.

Section I-3

The most characteristic feature of the third section was a high and wide, elongated cairn-like feature (Fig. 5.25). There was no clear break between sections I-2 and I-3 except for a slight lowering of the local topography. The section continued for 29m eastwards until a gap in the enclosure and the beginning of the next section.

Figure 5.25. Cairn-like feature in section I-3, view from NE (2014).

At the beginning of section I-3 the ground started rising towards the east and a higher section of enclosure bank was noted at the junction with bank IV-1. The high section was 13.6m long, 8.7m wide and 0.89m high. In some places, larger stones and boulders of ca. 1.1–1.5m in diameter were visible on top of it. The size and shape of the feature resembled those of the early *tarand*-graves although its edges were not sharply or clearly marked. The possibility of a former grave inside the enclosure wall is further discussed with the other grave-like features on the hill (see 5.5.6., grave 1). It has to be noted that the assumption was not investigated further and remains hypothetical.

After the possible grave the enclosure narrowed and lowered again, being 6.1m wide and 0.35m high. However, the inner and outer edges of the enclosure were more clearly defined towards the ends of the section.

Section I-4

The 47m long section (Fig. 5.28) was on average 6m wide and 0.73–0.76m high and was characterised by a change of direction in the enclosure (Fig. 5.26). The section was adjacent to boulder fields on both sides. The boulder field in the southern part was ca. 5m from the enclosure and a smaller boulder field in the northern part was ca. 8m away.

Figure 5.26. Section I-4, view from NE. The direction of the enclosure is marked with a dashed line. Cleared areas between the enclosure bank and boulder fields are marked with red arrows (2014).

There were two gaps in section I-4. The first one was 2m wide and marked the separation between I-3 and I-4. The second gap was situated 11m east of the first one and was 1.5m wide. The general character (height and width) of the enclosure remained the same between the two sections and it was decided not to delimit it as a separate segment.

During the excavations, a 0.5–0.7m wide trench (VI) was made through the first gap (Fig. 5.27). It revealed part of the enclosure consisting mostly of granite stones and looking quite different from the structure of the enclosure that was investigated with trench III in section I-2.

Figure 5.27. The location of trench VI through the first gap in the enclosure, view from NW (2021).

After the second gap, the enclosure wall turned north-eastwards, opposite to the general alignment of the enclosure. It was at the place where the boulder field on the southern side almost reached into the enclosure. However, the area between the boulder field and the enclosure was cleared of stones, leaving levelled and smooth ground (Fig. 5.26). It is possible that the stones of the boulder field were used for building the enclosure. The area between the northern boulder field (II-h) and the enclosure was cleared as well, although it was not as level. Two clearance cairns (II-16 and II-17) were situated in this area.

The outer edge of the enclosure bank was clear and steep where it was adjacent to the boulder field, although there were no large boulders as one would expect based on the closeness of the boulder field. The only boulders on the outer side of the enclosure were by the first gap, some of them lying in front of the gap.

Towards the end of the section, where the boulder field on the southern side ended, the bank curved back south-eastwards, towards plot IV-d. The end of the section is marked by a slight break in the enclosure where the ground is lower, forming almost a gap.

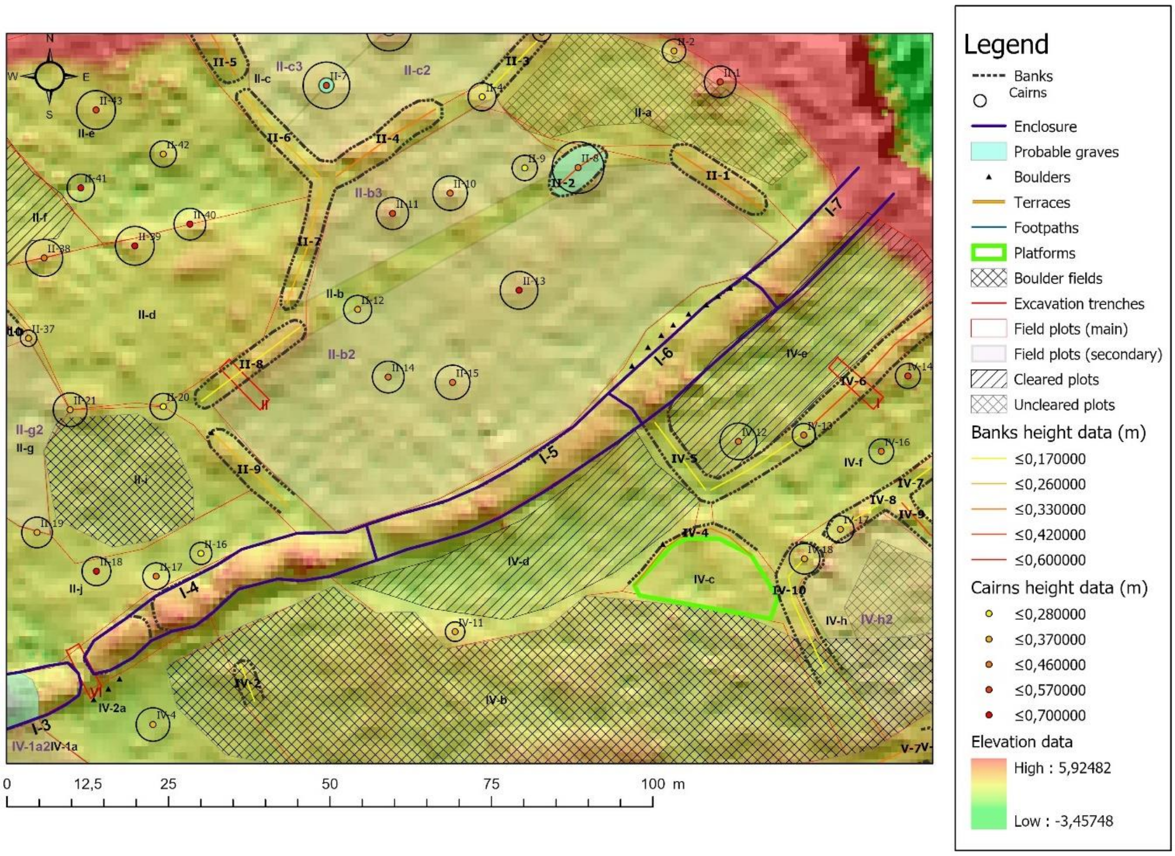


Figure 5.28. Sections I-4 – I-7 of the enclosure.

Sections 5, 6, and 7 (Fig. 5.28) were generally quite similar but there were sufficient differences to distinguish them. There were no sharp changes in the direction of the enclosure, nor in the height and width of the bank. The differences were in how the edges of the enclosure were defined and the overall look and unity of the enclosure.

Section I-5

The section was distinguished by the lower ground that marked the end of section I-4 up to the junction between the enclosure and bank IV-5. I-5 was 45.3m long, quite unvaried through its length but rather scattered and dispersed. Compared to the other sections, the enclosure was generally lower, approximately 0.38m. Its width was 5.6m. The edge of the enclosure was not well defined on either side, such that it was difficult to measure it. The approximate width of the enclosure was 6m. The ground on both sides of the section was cleared and level (Fig. 2.29), especially southwards, on plot IV-d between the enclosure and the boulder field.

Figure 5.29. Section I-5, view from E (2014).

Section I-6

The section extended 26.2m eastwards from where bank IV-5 crossed into the enclosure. It was distinguished as a separate part of the enclosure because its whole northern edge was marked with boulders. The area of field plot II-b northwards of it had a cleared and even surface. The width of the enclosure in this section was 7.3m and the height rather low, 0.35m (Fig. 5.30). Sections I-6 and I-7 bordered field plot IV-e on its northern side.

Figure 5.30. Section I-6 of the enclosure, view from SW (2021).

Section I-7

The enclosure in the last defined section had a length of 23.3m and was wide and scattered. Quite a clear edge was visible on the outer side of the enclosure but in the northern part it disappeared completely, making it distinct from section I-6. Towards the eastern end the bank was slightly higher (0.42m) but was still scattered. The width of the enclosure in section I-7 was ca. 6.6m. At the end of the section the enclosure faded into the surrounding ground (Fig. 5.15) as it reached the path that runs close to the edge of the hill.

Figure 5.31. Photo of section I-7 of the enclosure, view from SW (2008).

5.5.2 Field banks

Banks are generally understood as “linear or curvilinear constructions of earth, turf and stone, often, but not always accompanied by a ditch” (Historic England 2014). In Estonian archaeological terminology there has been some confusion around the use of the term. The term that is used for banks surrounding field plots is in most cases a “baulk”, as a “narrow strip of unploughed land between two fields” (Eesti Keele Instituut). This is unhelpful as in most cases the field banks in Estonia are linear heaps of stones. Therefore I will be use the term “bank” in this study.

Altogether 114 intact banks were recorded on the hill, incorporating 159 bank segments (including stone fences (walls), see 5.5.3.). The separate segments were used to record the characteristics of different parts of banks and for the calculation of width and height of the banks. The numbering of the banks are sequential by area (e.g. VI-7), where the Roman number marks the area where the bank was situated (see 5.6).

The majority of the banks consisted of stones which in most cases were not visible through the thin soil and grass that was covering them (Fig. 5.32). There were probably banks that were mostly made of soil as was the case with bank III-3 which was investigated with a trench IV (see chapter 6.3.4)

Figure 5.32. Bank (III-1) in area III, view from NW (2021).

The longest banks provided the axes for the more coherent parts of the field systems. At the same time, their construction was not uniform – there were differences in their width and height – and therefore the visibly different parts of the longer banks were marked as separate segments. The long banks were also often cut by perpendicular banks and the different sections formed by these partitions were also distinguished as smaller segments. In cases where shorter banks were not connected with other banks, they were marked as separate banks and segments. Some of the small banks looked like oval cairns and were recorded and mapped as banks and cairns simultaneously (see 5.5.5.)[32]. Some banks could have incorporated previous graves later transformed into field banks and therefore they were recorded as banks and possible or tentative graves (see 5.5.6.).

[32] The simultaneous recording was only applied when there was a clearly distinguishable cairn inside the bank. Otherwise the banks were recorded just as small and short banks. E.g. banks III-11 and III-17.

The calculations of height and width of the banks were made using data from the smaller segments. The reason for this was not only that the segments had varied measurements, but it was also kept in mind that even though the long banks could be seen as whole units, it does not mean that they were necessarily constructed simultaneously. Breaking the banks into smaller sections had more potential to represent variation across the survey area.

From the 159 banks, eight are missing height and width data and additional three the height data. In that case, average width 4.2m and height 0.3m were attributed for displaying the objects in ArcGIS (see the calculations below). The average width of the banks was 4.2m and was calculated on the basis of 151 bank segments with data. The minimum recorded width was 1.7m (V-4:58) and maximum 7.7m (VII-3:128).

The average height of the banks was 0.27m which was calculated on the basis of 148 banks with data. The minimum height was 0.06m (IV-6:46; also banks IV-5:45 and III-2:13 were low – 0.08m) and maximum 0.6m (VIII-8:116). The height of the banks in general was close to the average. In area IV they were generally lower than elsewhere and in area VIII they were higher. The narrowest banks, 8cm below the average of 4.2m, were recorded in area IV. In all the other areas the width of the banks was closer to the average. The banks were the widest in areas VI and VII.

Table 5.1. Average width and height of banks per areas.

	average	II	III	IV	V	VI	VII	VIII
Width (m)	4.19	4.2	4.2	3.4	4	4.5	4.4	4.3
Height (m)	0.27	0.27	0.25	0.21	0.29	0.27	0.28	0.33

The length and orientation of the bank segments are not analysed in detail, although these were taken account of as factors in the designation of areas (5.6). In general the long continuous banks in areas III, V and VI were mostly northeast-southwest oriented. In areas III and VI they were about 140–150m long and in area V 170–240m long. The long banks in area VII seemed to follow a northwest-southeast axis and were slightly shorter, between 100–110m. In areas II and IV the banks were much shorter, between 35–45m. The axis of the field systems was harder to determine here but the general orientation seemed to follow a northeast-southwest direction as in adjacent areas III and V.

In a few cases, banks were noticeably higher and more sharply defined on one side compared with the other. Among these examples were ones that were situated on flat ground: bank III-7, and northern parts of IV-1 and V-10. These height differences might have been caused by differential ploughing either side of the boundaries. Other examples that were situated at the edges of higher ground or boulder fields are interpreted as the use of natural features as field boundaries (see 5.5.4.).

5.5.3 Stone fences

Stone fences are similar to field banks. Both consist of stones and they were constructed on the edges of areas of agricultural land. While the banks were usually low and wide and covered with turf and grass, the rows of stones that formed stone fences were clearly visible and were more regularly laid.

Dry stone walls, or stone fences, were recorded in three places on the hill. The first (VI-17) was situated in the south-western edge of the mapped area. South-west from it the landscape was disturbed by modern agricultural buildings. The second one (VIII-3) was recorded in the eastern part of the hill, near the spring (Fig. 5.33). The walls were relatively short, 13m and 9.5m respectively, approximately 2m wide and more or less the same height as the rest of the banks, about 0.3m. The stones were laid in one or two courses. A third segment of stone fence was observed in part of bank VI-3 (section 106), representing a 9m long section inside the bank that consisted of a couple of rows of stones with an overall width of 2.4m and height of 0.2m. The rest of the bank was wider and earth-covered. Stones positioned in rows inside the banks were also recorded elsewhere (between bank VII-6 and cairn VII-18; between bank VIII-5 and cairn VIII-9; inside banks III-3, V-3–6 and V-16) but they did not form compact rows of stones with sufficient length to be considered as stone fences.

Figure 5.33. Segment of a stone fence (VIII-3) in area VIII, taken from NE (2021).

Commonly historic stone fences (Fig. 5.34) are depicted on Estonian topographic maps when they are preserved in the modern landscape (Fig. 5.35). This was not the case for the three wall fragments, maybe because they were not noticed at the time of the surveys. The only stone fence that has been marked on the latest base map of 1:10,000, is situated not far from stone fence VI-17, next to a deserted barn building (Fig. 5.35. A). Another stone fence was marked on a 1:10,000 topographic map from 1959 (Fig. 5.35. B). Neither were detected during the current investigation, which shows that there have been more stone fences on the hill in the past than are preserved today. The stone fences did not form a larger system overlying the ancient field banks, their orientation followed the general pattern of the earlier field systems.

Figure 5.34. Examples of different historical stone fences (www.muinsuskaitseamet.ee).

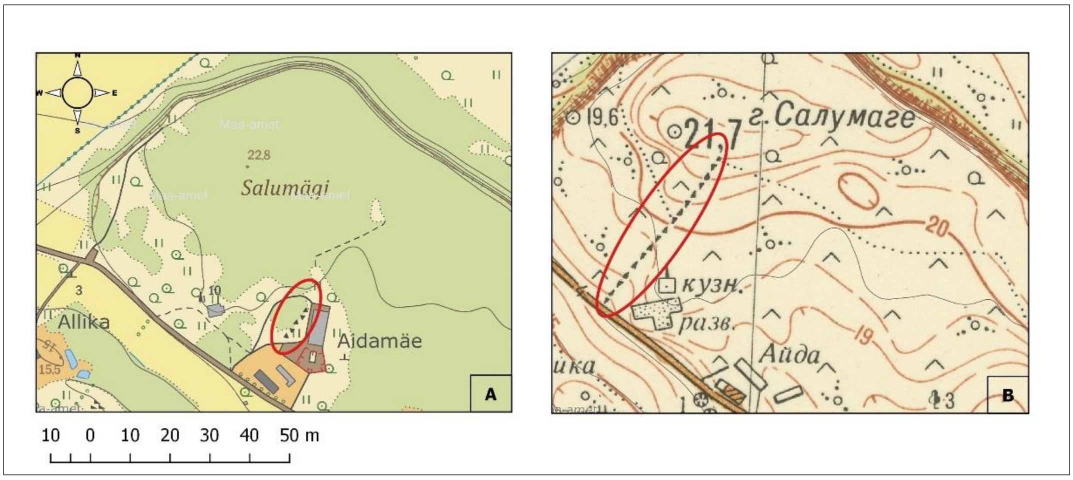


Figure 5.35. Stone fences on the hill on latest (A) and 1959 (B) topographic maps. Base maps: Estonian Land Board.

Historical studies of stone fences have established that the building of stone fences began in the stonier areas of northern Estonia and the islands of West Estonia at least in the 17th century (Troska & Viires 1998:294). They formed larger systems around village lands and are preserved in numerous places today. The differences in ages of the stone fences and field banks can be seen as one of the reasons for their different appearance, if we are to assume that all the field banks on the hill originate from before the 17th century. However, other explanations can be considered as well, mainly their later use and preservation. There has not been much archaeological investigation of stone fences in Estonia but in the northern part of West Estonia, at Einbi village, the evidence suggests that the systems there might have been established by the 10th-13th centuries AD or even earlier, in the 6th–7th centuries (Markus 2002:124; Markus 2004:182–183, Table 3.).

5.5.4 Natural features used as boundaries

The natural topography of the hill cannot be separated from the field systems: they are intrinsic to the same landscape. The main natural features that influenced the organisation of field systems and could have served as boundaries or included inside the field systems were the hill itself, boulder fields and raised areas.

The most obvious natural boundary that partly bounds the area covered with field systems is the steep edge of the hill (Fig. 5.36). It might have been secured with an additional bank or fence on top, especially where the individual plots seemed to be close to it. A built boundary would have been of more importance in areas that were used for herding to stop animals from falling off the cliff. No signs of these supplementary boundaries were seen during the survey. If there were wooden fences, they are not preserved and if there were banks it is possible that they have fallen down the edge through the erosion of the cliff. However, in some places where cairns were close to the edge, they might be marking the boundary of a given plot (for example cairns II-1 and II-2 on plot II-a).

Figure 5.36. The steep cliff of the hill on the northern side of the hill (2008).

Natural heights were used as field boundaries but the strategies of doing it differed slightly between the raised areas on different parts of the hill. The highest and most prominent raised area with a size of ca. 2,500m^2 (including the higher part in the enclosure), was situated in the north-western part of the hill (Fig. 5.37). North from the enclosure, in area II, there were no banks or cairns on top of it and its northern edges were pronounced and steep. Stones were used in the north-eastern part of the hillock, forming a 16m-long bank (II-10) that only sloped on one side while the other side merged with the high ground. A 10-m section of the hillock's edge was also enhanced, although no stones were visible through the turf. There were also clearance cairns on the slope suggesting similar field clearance strategy. The surface of the raised area was uneven, giving the impression that it had not been ploughed which does not exclude its use inside the field systems, for instance for herding or as a meadow. The same raised area reached into area III beyond the enclosure bank. Here the natural height was used differently than in area II: the southernmost part of the raised area coincided with banks III-4 and III-6 and formed a level platform with a levelled top. The feature is analysed in more detail in 5.5.7.

Figure 5.37. Part of the raised area in the north-western part of the hill (2021).

A large raised area, defined as area VIII with the size of 1.82ha was located on the eastern side of the hill. The ground sloped more or less from north-east to south-west, having a clearly accentuated edge in the south-western part that also formed a border between areas VII and VIII and between plots on both sides of the edge. Banks VIII-13 and VIII-14 ran along the steep slope of the raised area while in other parts the banks were missing and the edge of the hillock itself formed a boundary between plots. A slightly different use of the topography was visible on the south-eastern part of the same raised area where the ground sloped more gently and the edge of the hillock was not accentuated. Here, there were four stone banks that were running parallel to the slope while between the banks there were field plots with slightly levelled surfaces suggesting the use of the slope similar to terraces. Banks running along the natural slope were also situated on top of the raised area. It was not possible to see if the plots between the banks formed the same kind of terrace-like features because of the dense vegetation. In general the raised area had a levelled surface, which might have been partly the outcome of ploughing.

Slightly different strategies were used where the boulder fields represented a natural edge for arable land. Between areas IV and V, ground sloped southwards towards area V. The boulder field in area IV (Fig. 3.38) was situated on the higher part of the slope, while fields were located on the lower ground south-east of it. The northern edge of the field system in area V was marked by the slope and it was enhanced by banks V-4, V-5 and V-7 (Fig. 5.39). The stones were thrown and probably also soil was ploughed against the slope, defining the border of the fields and delimiting it from the boulder field. A similar strategy was used in the north-eastern part of the same area where bank V-1 separated a stony plot IV-h on the higher ground and a cultivated plot V-a on the lower ground. In both cases the terrace was formed by cultivating the field on only one side of the natural stony terrace, resulting in the other side of the bank merging with the higher ground without a clear edge. Bank IV-4 had the same kind of position on the side of the boulder field but since it was partly bordering a platform-like feature, it will be analysed in 5.5.7. Bank IV-3 was made on the south-western edge of the boulder field, accentuating the border between the boulder field and plot IV-2a.

Figure 5.38. Boulder field in area IV (2008).

Figure 5.39. Natural slope between areas IV (right) and V (left), enhanced with bank V-7 (2021).

5.5.5 Clearance cairns

While the term *cairn* can refer to monuments of different types and functions, *clearance cairns* are defined as "heaps of stones collected from the field" (Eesti Keele Instituut) that are "irregularly constructed and generally unstructured" (FISH Thesauri. Historic England 2014). In Estonia they are mostly circular or slightly oval heaps with an average diameter between 3–5m and height 20–30cm (Lõugas & Selirand 1977:80; Lang 1995:140).

262 cairns were recorded in the mapped area, including 43 that were clearly distinguishable inside the banks. Twenty-five cairns were noticed from the Lidar mapping[33], two of which were additionally located within banks. The number of cairns when the probable ones detected from LiDAR data are included is 287. However, their existence was not confirmed in the landscape and therefore they are not incorporated into the study.

On the ArcGIS map, the cairns were drawn automatically using their average size calculated from one (in case when the cairn was round and only one measurement was taken) or two

[33] Most of them (15) were located in area VII.

measurements (when the cairns were oblong and the width and length were different). In case of cairns with estimated (24 cairns) or missing (44 cairns) data, measurements close to minimum and maximum values[34] or mean average were used (see study methods 5.4.). Since individual cairns were not drawn separately, the different shapes and irregularities of the cairns are not depicted on the map, except for the ones that were mapped as banks as well.

The average diameter of the cairns, calculated in the aforementioned way, was 5.2m. It was based on the measurements of 218 cairns with recorded data, either directly measured or estimated. The average diameter can be seen as an equalised variable which made it easier to evaluate the general size of the cairns. The minimum size of the cairns was 2.2m and the maximum 10–10.2m.

The average height of the cairns was 0.39m from the surrounding ground which was calculated on the basis of recorded data for 193 cairns. The lowest cairns were only 0.2m high (cairns III-9, III-10, III-11, VII-56, VIII-2 and VIII-17) and the highest ones reached up to 0.7m (V-11 inside the bank V-7, on a natural terrace separating areas IV and V; and VII-69).

Table 5.2. Average width, height and length of cairns per areas.

	average	II	III	IV	V	VI	VII	VIII
Size (m)	5.2	4.8	4.7	4.4	5.2	5.2	6.1	5.18
Height (m)	0.39	0.42	0.37	0.34	0.4	0.42	0.38	0.4

As can be seen from Table 5.2, the biggest cairns by their size were located in area VII where the cairns were 0.9m wider from the average, while the elevation was close to mean. The highest cairns were located in area II where a lot of them reached up to ca. 0.5–0.6m from the surrounding ground. The smallest cairns both by their size and height were in area IV. This coincides with the size of banks in area IV that had the lowest measurements compared to banks in other areas. The cairns in area III were also relatively small with the size being smaller than the average.

[34] For the cairns that had estimated values for their size, an approximation of *at least* 7m was attributed. It was done because otherwise the missing measurements wouldn`t have showed the relatively large size of cairns in area VII. However, it is possible that some of the larger cairns were either smaller or could have been close to 10m in diameter.

In cases where the construction material of the cairns was visible through the turf cover, it was mostly limestone but sometimes granite stones were visible as well (Fig. 3.40). Large boulders were visible inside some of the cairns[35], either in the middle of them or at their sides. This indicates that the location of the cairn was conditioned by the natural obstacle, a boulder. It was easier to throw the stones cleared from the fields in a place where there already was a large stone in the landscape. This is another example of how the natural prerequisites—or obstacles—conditioned the strategies of land use. It remains possible that some of the boulders were dragged into a suitable location.

Figure 5.40. Cairn VII-77 with visible stones on top (2021).

Some of the cairns (for example cairns II-22, II-23 and III-34) had central hollows. The stone may have been robbed from the cairns to use as building material somewhere else. It is also possible that the cairns were thought to be graves and the disturbance is related to searches for grave goods. Because in most cases the turf cover of the hollows was disturbed and the upper stones of the cairn visible, it is likely that stone robbing happened in a recent past. In other cases, there was a depression in the middle of the cairn but it was covered with sod (e.g. cairns

[35] The following cairns with boulders were recorded: II-9, II-10, II-14, II-16, II-17, II-18; III-5, III-23, III-24, III-26, III-32; IV-10, IV-12, IV-15, IV-17; V-2, V-9, V-19, V-31; VI-2, VI-9, VI-22, VI-24, VI-25, VI-29, VIII-3, VIII-4; VII-66.

V-25 and V-27). This might be a sign that these were burial cairns and the hollow was left by a collapsed cist (see 5.5.6.).

Most of the cairns in the landscape were gradually rising from the surrounding ground. However, some of them had clearly defined edges that looked like they were constructed in a regular manner (Fig. 3.41). A couple of these cairns were recorded in area II (10, 13 and 38), one in area VI (VI-10) and one with large boulders around its edge (III-24) was noticed in area III. The cairns, except for III-24, were situated in open and cleared fields and it is possible that the edges were pronounced through regular ploughing around them. Another possibility is that the cairns had formal edges and were burial cairns (see 5.5.6).

Figure 5.41. Cairn II-13 with clearly defined edge - stones are visible in the front right corner (2021).

The cairns were mostly round although there were oval ones as well. Some of the oval cairns formed an elongated and almost linear mound, similar to a small segment of a bank. In these cases they were recorded as banks and cairns simultaneously and drawn on the map accordingly. These features were only recorded when a clear cairn was visible inside the bank, otherwise only a bank was distinguished. Altogether eight objects like that were recorded on the hill. Their length was between 8–10m and width form 3.6m up to 6.7m.

Most of the elongated cairns were located in the eastern part of the hill, in area VIII. Here the field system lacked the regularity that was seen in area VI, for example, and the banks were often not continuous but had breaks in them. The following cairns were recorded here: cairn VIII-7 (bank VIII-4), cairn VIII-10 (bank VIII-6), cairn VIII-11 (bank VIII-8) and cairn VIII-20 (bank VIII-10). One of those cairns was located in the western part of area VI (cairn VI-9 (bank VI-16)) and one in area VII (cairn VII-79 (bank VII-14)). In the eastern irregular part of area III there were several short segments of banks but only one of them had a clearly distinguishable cairn inside it—cairn III-14 (bank III-8). Another long cairn was situated in the eastern part of area II, marked as cairn II-8 (bank II-2).

The elongated cairns might have been created in stonier field plots where more stones were cleared from the soil. It might indicate a longer period of field clearance. The contrary interpretation is that the oval cairns were unfinished banks, and a sign of shorter term clearance and cultivation. Some of them had similarities with stone graves and were mapped accordingly (for the analysis of possible graves among the cairns see 5.5.6.).

The cairns appear scattered around the fields but closer observation and analysis revealed patterns in their location:

- Inside banks: the cairns are at the end points of the banks[36], in the middle of the banks[37] or at junctions of two or more banks[38]. Most of the cairns were located in area VII.
- In rows parallel with banks: on the western sides of banks IV-1, V-12, V-8 and V-9 and on plots V-d, VI-f, VI-g, VI-h, VIII-b (VIII-b2) and VII-h.
- In rows that formed borders along the sides of a field plot where there were no banks: plots II-g, II-h, II-i, VII-j.
- Connecting banks and used as borders or for marking the bank, especially in area VII, but also VIII: cairns VIII-17 and VIII-18 connecting banks VIII-11 and VIII-12, cairns VII-31, VII-36, VII-37 and VII-40 that might form a border inside plot VII-h, and cairns VII-26–VII-28 connecting banks VII-14 and VII-15.
- At the edges of natural ridges—see 5.5.4.

[36] II-3, II-4, IV-20, IV-17, IV-18, V-17, VI-7, VI-18, VII-9, VII-10, VII-39, VII-31, VII-58, VII-60, VII-73.
[37] III-3, III-5, IV-13, V-11, V-4, V-2, VII-4, VII-30, VII-57, VII-64, VII-42, VII-43, VII-49, VII-78, VII-79 and two that were detected from LiDAR mapping.
[38] VI-11, VI-12 and VI-13 inside bank VI-3, in the conjunction points of converging banks; VII-3 in the conjunction point of VII-2 and VII-4.

- Randomly on field plots bordered with banks
- Randomly in areas or fields where there were no banks, especially in area II.
- Clusters of cairns at the edge of the field (e.g. cairns III-7–III-10 in the north-eastern corner of plot III-c) or in the middle of the field.

The different locations of the cairns show their varied use in the fields. Cairns were used as boundaries when they were located either in rows or as clusters in the middle or edges of the fields. In addition of acting like boundaries, the cairns could have had a different role inside the field plot. For example, it has been suggested that cairns helped to accumulate and store heat in the field when temperatures dropped below zero (Jarva 1987:102, 107) and therefore prevented the crop from freezing. The occurrence of cairns inside the banks might indicate that the location of banks were initially marked on the landscape by cairns or that older cairns were used in the making of banks and incorporated into the field system. The cairns at the junctions of banks could have had the same purpose. It is also possible that the cairns represent—at least partly—a system of land allotment and use under- or overlying the banks (or including some of the banks) but this is hard to detect without large-scale extensive excavations.

To conclude the overview of the cairns, clearance cairns have been seen as unavoidable by-products of the clearance of land from unnecessary stones, and their location and construction as a random process that was mainly conditioned by the throwing radius and amount of stones in the soil. While I partly agree with that, the analysis of the location of cairns and their different types suggests that there might have been more varied factors behind their place in the agricultural landscape as part of field systems.

5.5.6 Probable graves

Some of the larger cairns in the south-eastern part of the hill (area VII) were first interpreted as burial cairns in the 1970s (Lõugas 1972:171). During the landscape survey in 2013–2015, in addition to the cairns in area VII, probable graves were also noticed among the cairns, elongated cairns and higher sections of banks elsewhere on the hill (Fig. 5.42). Making the distinction between clearance cairns or banks and possible graves is difficult in most cases. Firstly, it is impossible without excavation to be fully sure if the recorded objects contain burials or not. Secondly, above-ground graves were built all through prehistory and there were larger and smaller graves with different shapes, which makes it challenging to distinguish them, especially when they are inter-mixed with other types of monuments.[39]

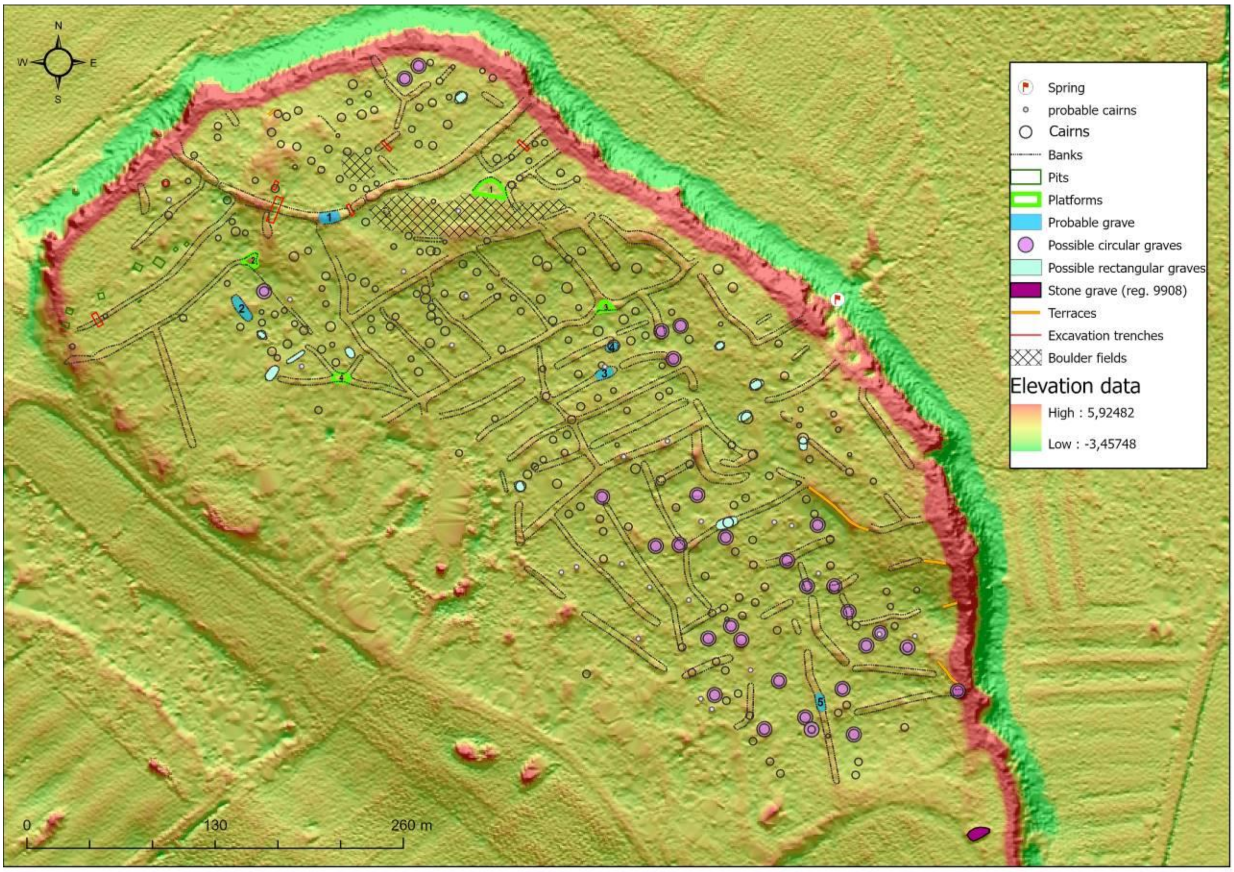


Figure 5.42. Probable and possible graves on the hill.

The above-ground prehistoric graves were either circular or quadrangular in plan, and larger and higher than clearance cairns or field banks. The most typical types of graves that have been often found near field systems are circular stone-cist graves dated to 1,100–200BC (Lang 2007b:161) and rectangular early *tarand*-graves[40], that developed during the Late Bronze Age and the beginning of the Pre-Roman Iron Age, as early as ca. 8th century BC and in use until the 1st century AD (Lang 2007b:189–190).[41] In addition, clearance cairns, including elongated cairns have similarities with cairn-graves, the earliest ones of which have been dated to the Early Pre-Roman Iron Age and were built up to the Middle Iron Age and even up to the end of

[39] The village cemeteries that were used from the 13th century up to the 18th century were slightly different from the typical prehistoric stone graves and were not detected on the hill.
[40] As explained in chapter 4.4.3, *tarand* is an Estonian word for enclosure (Lang 2007b:170).
[41] Typical *tarand*-graves that became the prominent grave type in Roman Iron Age all over Estonia were up to 100m long and 20-30m wide, rising 1–1.5m above the ground (Lang 2007b:192): however, they have not been found in mainland western Estonia (Lang 2007b:202).

prehistory (Lang 2000c:15). There are examples in Estonia where a clearance cairn turned out to be a stone grave during the excavations (Lang 2000c:3–20; Lang 2000a:161–166).

The parameters for distinguishing possible graves are difficult to establish. The first morphological attribute that can help to make the distinction is their size[42]. The size of early *tarand*-graves was varied as it depended on the number of *tarands* in each grave. For example, the early *tarand*-grave on the south-eastern part of the hill of Salumägi measured 17m x 8–8.6m and its height from the surrounding ground was 0.6m (Lõugas 1972:171; Muinsuskaitseamet 2019). The early *tarand*-grave at Kõmsi (Kõmsi II, Fig. 4.10), located not far from Salevere, was 35m long, 15–16m wide and 0.4–0.75m higher from the surrounding ground (Lang 2007b:173; Lõugas 1972:166). Graves of this type, consisting of one *tarand*, were even smaller, usually with their lengths not exceeding 8m. Kõmsi I grave had the measurements of 8m x 6.5m x at least 0.4m (Lang 2007b:177; Lõugas 1972:166). One has to keep in mind though, that a lot of these measurements were taken during excavations and nowadays they appear larger and higher in the landscape under turf cover.

The size of the circular graves also varies. The stone-cist graves in the landscape usually have a diameter of 10–15m and height up to 1.5m (Lang 2006:79, footnote; Lang 2007b:148). The size can be dependent on the height of circular walls around the cist, which are usually one or two courses (Lang 2007b:150). In the nearest location to Salevere where stone-cist graves have been found and investigated, at Kaseküla (see also Fig. 4.9), at least 11 stone-cist graves were recorded with diameters between 8–14m and height between 0.3–1m. (Laneman 2012; Mandel 1975, 2003; Muinsuskaitseamet 2019). The size variation in cairn-graves from different periods can range from as small as 5m up to a maximum of 20m (Lang 2007b:166; Tvauri 2012:256, 258). A type of cremation burial, dated to the later phases of Iron Age, that are surrounded with a stone circle around 2–4m in diameter, look like stone heaps the typical size of clearance cairns. However, so far their research has been only carried out in a couple of locations on Saaremaa island (Tvauri 2012:261–264).

Shape is a further attribute for distinguishing graves, especially early *tarand*-graves. The circular graves were sometimes slightly oblong but it did not affect their general form as the length to width ratio seems to be less than 1:2 while for the early *tarand*-graves with multiple

[42] Also V. Lang has tried to distinguish graves in the landscape based on the typical size of the already excavated monuments (Lang 2000a:189).

tarands it was at least 1:2 or more. However, there were variations in their sizes and a precise ratio is hard to define. As to the early single-*tarand* graves, they had a rather square structure and as such they often appear circular and cairn-like in the landscape, making them easy to confuse with stone-cist graves (Lõugas 1972:166). Sometimes the outlines of the outer walls of some grave types can be detected under the sod covering the graves, and boulders marking either the outer walls or inner structure of the graves can protrude from the surface. For the stone-cist graves it has been noticed that there might be a depression in the middle of the cairn, marking a collapsed cist (i.e. at Kaseküla, see Mandel 1975, 2003; Muinsuskaitseamet 2019).

The orientation of the early *tarand*-graves does not follow a single established direction. Usually they are oriented roughly from either North to South or from East to West. It seems that it was mostly conditioned by the preconditions of the landscape, for example when the graves were on a higher narrow ridge, they were positioned along its axis. The grave on the south-eastern part of the hill (Fig. 5.11) was East–West oriented.

As to the location and positioning of the graves in the landscape, circular types of graves often appear in groups or clusters. The stone-cist graves are usually found in groups of 5–6 graves, although much larger complexes with up to 36 and even 85 graves have been found, the distance between the graves in the group being usually about 10–20m (Lang 2007b:148). At Kaseküla, 7 stone-cist graves were located in a straight row with an approximately 6m distance between them (Mandel 1975, 2003; Muinsuskaitseamet 2019). The graves surrounded by stone circles from Saaremaa, mentioned above, have not been studied enough to distinguish it as a certain grave type. Excavated cairn-graves (Lang 2007b:166) have been excavated in isolation and surveyed in groups (Lang 2007b:166–168; Tvauri 2012:256–258) that could represent either different types of graves or clearance cairns. As to *tarand*-graves, there can be several either similar or different types close to each other, but they do not form clear groups in the landscape.

The aforementioned Late Bronze Age and Early Iron Age stone graves in West Estonia occur mostly in coastal areas (Lang 2007b:170), often on the higher ridges in the landscape that represent former shoreline formations (Lõugas 1972:170; Lõugas 1975:85). The other above-ground grave types from the later phases of prehistory have been found further inland.

As can be seen from the overview, the characteristics of different types of graves are varied and therefore they cannot be reliably interpreted on the basis of observational survey alone. All the above mentioned factors—size, shape, positioning and orientation—were kept in mind when trying to identify possible graves on the hill[43]. In addition, their general appearance and stratigraphic relationship with fields was taken into consideration.

Probable quadrangular graves on the hill could be among the elongated clearance cairns or short segments of banks and some of the raised sections of banks. Five features were categorised as likely graves, presumably early *tarand*-graves[44] because they had more than one or two parameters characteristic to these types of graves.

> **Grave 1** was a higher place inside the enclosure, in section I-3 (Fig. 5.25). It was east-west oriented, its length along the bank was 13.6m and width 8.7m. Its height from the surrounding ground was 0.89m. There were some boulders visible on the top but grave walls were not noticed. The edge might have had smoothed when incorporating it into the enclosure and later when clearing the stones from the fields.
>
> **Grave 2** was identified in the irregular eastern part of area 3. It was also numbered as bank III-9. It was oriented from north-west to south-east and it measured 20m x 7m. Its height from the surrounding ground was 0.57m. It appeared conspicuous compared with its surroundings and had boulders visible on top of it (Fig. 5.43).

[43] The cairns noticed from the LiDAR mapping were not involved in the analysis.
[44] Although the possibility of cairn-graves cannot be fully excluded.

Figure 5.43. Probable grave 2 in area III (2021).

Grave 3 (Fig. 5.44) was located inside the regular field system in area VI, at the eastern side of bank VI-9. The grave was a recognisably high and distinct place inside the bank, measuring 12 x 7.3m. There were boulders 50–90cm in diameter inside the grave, positioned in a row that were probably the signs of the *tarand* walls. The grave was oriented from north-east to south-west, with a slight angle towards east-west axis.

Figure 5.44. Probable grave 3 in area VI (2021).

Grave 4 (Fig. 5.45) was situated ca 10m north-east of the grave 3 and measured 9.2 x 6.7 x 0.45m. It was similarly oriented and was equally recorded as a short bank (VI-5) and cairn VI-21. It was situated on the south eastern side of the bank VI-4 but not inside it. It was distinguished as a grave because it had a couple of large boulders on the sides of it that could mark the grave walls. The inner area of the feature was flat and levelled.

Figure 5.45. Probable grave 4 in area VI (2021).

Grave 5 was recorded in area VII, 80m from the edge of the mapped area, inside a long bank (VII-24) (Fig. 5.46). It was almost North-South oriented and measured 6 x 13 x 0.45m. It was a clearly higher and wider part of the bank. It had some large boulders in it but no signs of straight grave walls were noticed.

Figure 5.46. Probable grave 5 in area VII (2021).

In addition, 11 possible oblong or quadrangular graves were recorded that had fewer criteria to be considered as graves as the former ones.

In area III there were four other short oblong banks in addition to graves 1 and 2 that could be graves. Bank III-8 (also recorded as cairn III-14) was 10m south-east of the first grave, followed the same direction and had measurements of 7.9 x 3.6 x 0.4m. Banks III-11 and III-12 were oriented from north-east to south west and measured 11.5 x 6.5 x 0.25m and 14.5 x 3.2 x 0.35m respectively. The former had a sharp edge on its south-western side while elsewhere it was more dispersed. The clear edge could have been a sign of a grave wall, in which case it is a probable grave but it is also possible that the sharp edge was formed by ploughing the field plot (III-f) next to it. Further south-east a small bank (III-17) was oriented along the same axis as grave 2 and measured 8.4 x 5.4 x 0.35m. They were all lower than the surrounding ground and less pronounced in the landscape than the probable graves 1 and 2.

On the south-western part of the area VI there was an elongated bank (VI-16) or cairn (VI-9) that measured 7.6 x 6.3 x 0.33m, oriented from north-west to south-east that by its size could have been a grave. It was lower than graves 3 and 4 in the same area and there were no stones visible on top of it.

An oblong feature of similar size, measuring 7m x 14m, was recorded inside bank VII-14. It was a higher and wider place that was also marked as cairn VII-79. It looks grave-like on the LiDAR elevation model but it wasn't recognised as a grave during the landscape survey. Its size and orientation would match with graves 3 and 4.

A couple of other quadrangular or oblong features were noticed but not marked as graves because there were not enough matching criteria. Four small elongated cairns or short segments of banks were situated in area VIII: bank VIII-4 (cairn VIII-7), bank VIII-6 (cairn VIII-10), bank VIII-8 (cairn VIII-11), and bank VIII-10 (cairn VIII-20). Most were oriented from north-east to south-west, except for bank VIII-10 that followed an almost north-south axis. The first two of were approximately 7–8m long and 4.5–5.5m wide and their height from the ground was 0.3–0.35m. Banks VIII-8 and VIII-10 were slightly larger and higher, measuring 10m x 5.9m x 0.6m and 9.5m x 5.2m x 0.58m respectively. Based on their heights, the latter two could be graves.

It is also possible that bank II-2 in the eastern part of area II, equally recorded as cairn II-8, could be a probable grave. It measured 10.2m x 5.7m x 0.4m and did not align with the direction and location of field banks.

In addition to the oblong graves, 30 possible circular graves were recorded on the hill (Fig. 5.47). The main criterion for the distinguishing of possible grave cairns was their diameter compared to the other cairns on the hill. The height from the surrounding ground was not taken as a factor because most of the possible grave cairns (20) were missing height data. It is acknowledged that identifying circular graves has limitations because of the wide variety in the sizes of the grave cairns. The larger sizes of certain cairns could have been affected by different factors, as pointed out in section 5.5.5. and therefore does not necessarily mean that they were burial places. Nevertheless, as the general average size of the cairns on the hill was 5.1m, it was decided to mark the cairns that had diameters of 7m or more, as possible circular graves. Two cairns (VII-53 and VII-69) that were smaller than 7m were incorporated in the list because of their height from the surrounding ground (up to 0.7m). One cairn measuring ca 6 x 7m (III-24) was added because it had large granite boulders of ca. 90 x 40cm in size positioned at its edge. Some possible burial cairns were not added to the list because the characteristics referring to it should be further checked in the landscape. For example some cairns with clearly defined edges but no visible stones inside them (II-10, II-13, II-38 and VI-10) and cairns that had stones removed from the top or had a depression in the middle (II-22, II-23, III-34, V-2, V-25, V-27, VI-15) that might mark a collapsed cist in the middle of the cairn.

Figure 5.47. A possible circular grave in area VI (cairn VI-28) (2021).

Altogether 41 possible circular and quadrangular graves were detected on the hill (see fig. 5.42), and five which were more likely to be graves than the others. Most of the 46 graves were distributed either in the eastern part of area II, south-eastern part of area III, north-eastern part of area VI, area VII and VIII. There were no probable graves recorded in areas IV and V. In the latter area there were only a couple of cairns with depressions that were not added to the list of possible cairns.

Most of the circular graves were located in area VII, some of which are probably among the graves that were noticed in the 1970s, during the discovery of the early *tarand*-grave on the hill. A couple of them could be situated in the eastern parts of areas II, III and VI which matches with the location of the possible quadrangular graves. Based on their physical characteristics, the circular graves can be either stone-cist graves, early single-*tarand* graves or cairn graves.

The elongated cairns most likely represent quadrangular early *tarand*-graves, although it cannot be excluded that they were cairn-graves or oblong stone-cist graves. Most of them were located in the south-eastern part of area III and on higher ground in area VIII where they might form groups of graves of similar type. Most of the probable graves (1, 2, 3 and seven of the less certain ones) were oriented roughly from East to West (slightly towards north-east south-west), similar to the registered grave on the hill. The rest followed a roughly North-South alignment (5 was North-South oriented and 2 along with three less certain ones slightly towards north-west south-east).

A relationship between the graves and field systems was detectable. The elongated graves followed the alignment of the banks and four were located inside banks. Most of the possible circular grave cairns were located among other (clearance) cairns on the field plots but six were also inside the banks.

As a conclusion, the identification of graves among the field systems was based on the comparison of their physical characteristics with known graves in the region. The categorisations were not tested with excavations and remain hypothetical. However, one can say that the same applies to a lot of unexcavated graves in the region and there is no reason to doubt the existence of graves on the hill. The quadrangular graves that were located inside the field banks and the enclosure predated the latter and were incorporated into the enclosure bank and the field systems. The same applies to the circular graves inside the banks. Based on parallels with other investigated sites (e.g. Rebala, see Lang 2007b:104), the circular graves outside the field banks were also more likely to be older than the banks but their relative contemporaneity with the banks and especially the field cairns cannot be excluded. These options will be discussed in more detail alongside the results of the excavations and the general chronology of the hill.

5.5.7 *Platforms*

Platforms (Fig. 5.48) were deliberately elevated and levelled areas that could have either accommodated a building or were in use in some other way. Since none of these objects were excavated, it was impossible to determine their function. In some European regions, small platforms are recognised as stances for buildings (Historic England 2014), but evidence for this is so-far unknown in Estonia. The reason why they were distinguished as separate features was that they were smaller than and more regular than natural terraces (see 5.5.4.).

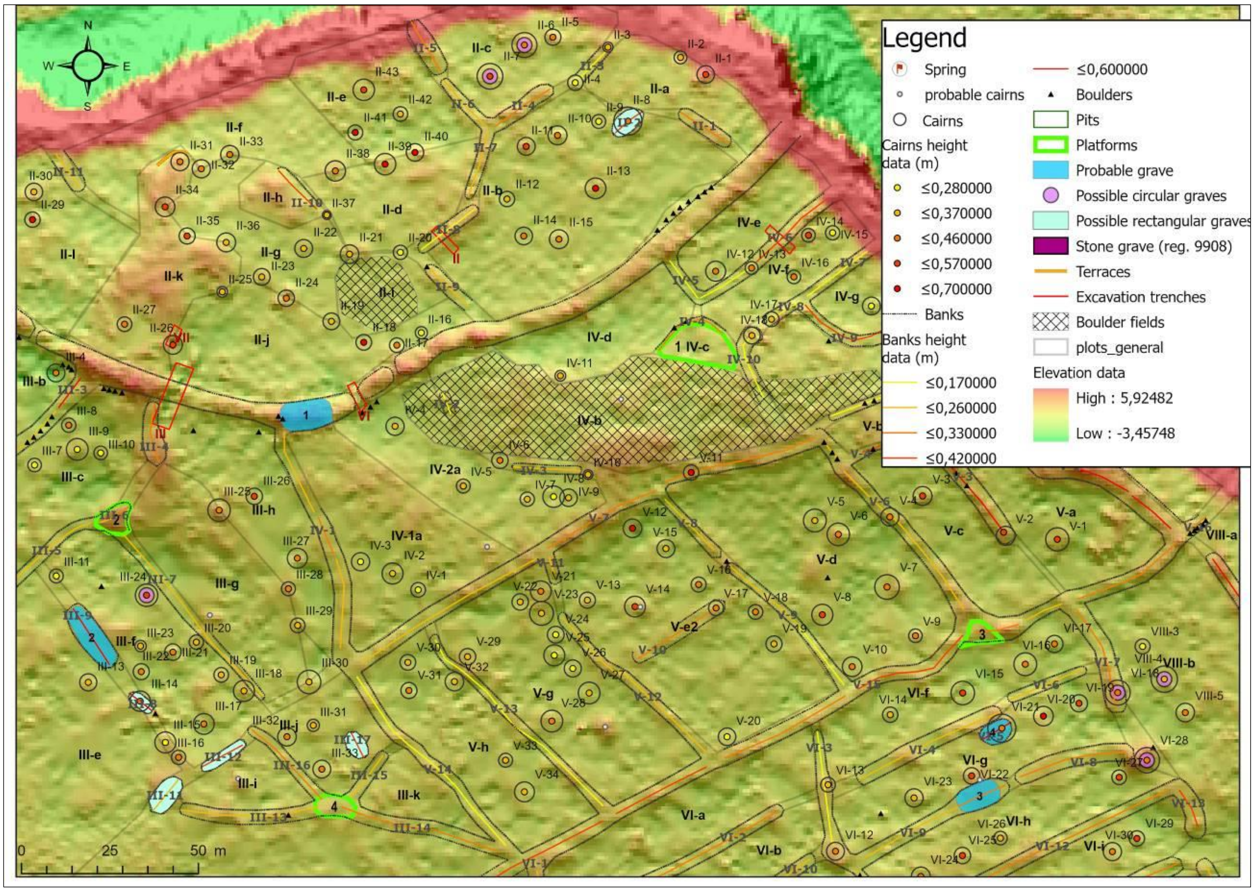


Figure 5.48. Platforms 1-4, marked with green polygons.

Platforms that were characterised by raised levelled surfaces were recorded in two locations:

1. The first platform was located in the middle of area IV, between the enclosure, the boulder field and field plots in the north-eastern part of the area. It was also marked as plot IV-c and was bordered with the boulder field on its south-western side, bank IV-4 on its northern and western sides and bank IV-10 eastwards. The bank (IV-4) was slightly higher than the middle part of the platform. The width of the bank was approximately 2.7m and there were large boulders with 70–100cm in diameter inside it.

The maximum height of the platform, measured from the surrounding cleared plot IV-d was 30cm. The platform measured 13m (from north to south) and 23m (from east to west). The inner part of the platform, excluding the bank, had an area of ca. 180m^2.

Figure 5.49. Platform 1 in area IV, view from NE (2021)

2. The second platform (Fig. 5.50) was situated on a natural raised area in area III, in the junction of banks III-5 and III-7. The northern part of the feature protruded ca 3m towards the north-east and was also named as bank III-6. The width of the bank was 2.5m. The size of the irregularly shaped level area measured approximately 8 x 10m and had an area of ca. 62m^2. The northern edge of the platform was steep and ca. 0.3m higher from the surrounding ground to the north. The southern edge of the platform was a gentle slope that lowered gradually towards plot III-g.

Figure 5.50. Platform 2 from S (field plot III-f) (2021).

In addition, a couple of platform-like features were identified in the corners of field plots, at the junctions of banks:

3. A higher and level area of ca 44m^2 was located between areas V and VI, where bank V-6 joined bank V-15 (Fig. 5.51). As such, it was formed in a place where three banks (V-6, V-15:77 and V-15:159) connected and represented a slightly triangularly shaped elevated and level area. The field plots surrounding the platform (V-c, V-d and VI-f) were all relatively clear of stones and even.

Figure 5.51. Platform 3 between areas V and VI, view from SW (2021).

4. A similar feature, although not as pronounced, was observed at the junction of banks III-13 and III-16. The platform was a higher, level, area between the banks ca. 6m x 10m. Although it was elevated, it was not as level and even as the previously mentioned triangular platform.

The naturally raised area in western part of area II could also have possible platforms on it, especially on its north-eastern part (plot II-h) or northern side (northern part of plot II-k) where the edges of the raised area were rather pronounced and steep. Since the surface was less flat and even than in case of platforms 1–4, these areas were not mapped as platforms.

Platforms 1 and 2 were first recognised as potential building platforms, mainly by their appearance and dissimilarities with other banks and field plots. The idea that higher ridges on the hill could have been used as building foundations was also proposed by M. Mandel after he discovered the enclosure in 2001 (Karnau 2001). However, the hypothesis has to be approached with caution. Firstly, there is a lack of comparative material because the investigations of prehistoric building remains in Estonia have not identified platforms. Secondly, prehistoric settlement sites are usually flat areas in the landscape (except for the hilltop settlements and fortified settlements), distinguished by a dark cultural layer that contains archaeological material (mostly bones and pottery) and burnt stones from hearths; the sites from the later phases of Iron Age also include the charred remains of logs and pieces of clay jointing (Lang 2007b:22–23; Lavi 1997:90). Dwellings have been usually recorded during the excavation of settlement sites in the form of hearths, foundation stones, wood from timber walls and sometimes stone or clay floors (Lang 2007b:57–76; Tvauri 2012:65). No building remains from the Early Bronze Age have been found in Estonia (Lang 2007b:22–23). The Late Bronze Age and Early Iron Age house remains all come from excavated fortified settlements. The rectangular buildings of that time were usually up to 10m in length and 3–7m wide with corner-jointed constructions, postholes along the centre line, indicating a gable roof, and floors of either dirt or paved with limestone slabs. (Lang 2007b:57–76)

In addition to dwelling houses, possible existence of prehistoric cult buildings has been suggested. At Tõnija on Saaremaa Island a possible Roman Iron Age cult site has been investigated that consisted of a stone platform with a preserved area of 4 x 7m and, concluded by the thin charcoal layer all over the platform, a horizontal timber construction on top of the stone base (Mägi 2005:102). Another possible cult house was investigated on Saaremaa at Lepna village that dated from the Migration Period. It was partly a wooden and partly a stone construction with dry limestone foundation on three sides, measuring 8.8 x 5.3m. It was assumed that it had a timber frame where a roof, possibly covered with limestone slabs, rested (Mägi 2005:103–105). It has also been suggested by the same author that by the 5th–7th centuries AD (Migration Period), mortuary houses with corner-joined horizontal timber structures resting on stone foundations might have been built on top of the large classical *tarand*-graves (Mägi 2005: 107–109).

There is little information about buildings of the Middle Iron Age and Viking Age. The available data shows that the main building type was a log cabin, most probably made of horizontal timbers, suggested by the rarity of post-holes at excavated settlement sites (which would be signs of vertical constructions). It is assumed that the beams were placed directly on the ground, although sometimes there was a row of stones between the logs and the ground (Tvauri 2012:66–67). The typical size of the houses was 4–5 x 5–6m. Just like the earlier houses, they mostly had dirt floors, although sometimes, especially in northern and western Estonia, the floors were made of limestone (Tvauri 2012:66–67). The type of house can be referred to as the so-called *smoke cottage* which was a chimneyless dwelling and a typical Estonian farm building from the 8th–15th centuries (Lavi 2005:132) until at least the 19th century

(Troska and Viires 1998:279). The examples from the later periods were usually larger, measuring ca. 4–6 x 6–8m (Troska and Viires 1998:114)

The first archaeological remains of the traditional barn-dwelling (Estonian *rehielamu*), also translated as *threshing-room dwelling house* (L`Heureux 2010), which was unique to Estonia and to some extent in North Latvia, are dated to the 14th–15th centuries (Lavi 1997:117). It was a long multi-purpose farmhouse that combined three main parts: the heated kiln-room as the main living area and place for drying the grain in the middle of the building; the unheated threshing-room on one side of it that was also used for keeping animals in the winter, storing tools and vehicles and was used as a working room; and unheated living chamber(s) on the other side that was a living area only in summer but was mainly used as storage room. The barn-dwelling was the main type of rural house up until the 19th–20th centuries. (Troska and Viires 1998:274–278) The size of the houses varied. The archaeologically investigated houses in the settlement sites had the length of the walls of the main middle room around 5–6m, making the area of it ca. 25–36m^2 (Lavi 1997:116). In the ethnographically studied barn-dwellings, the size of the kiln-room was typically around 30–40m^2 while the full length of the houses reached 15–20m (Troska and Viires 1998:274–282). The construction of these houses was similar to the simpler log houses although they usually had large boulders under the corners between the lowermost logs and the ground, and the corners of the building secured with cross-beam connection (Troska and Viires 1998:269–270). There were various outbuildings in addition to the dwellings, like granaries, barns, smithies, saunas, summer kitchens etc. which tended to be smaller and with lighter constructions (Troska and Viires 1998:283–291).

When looking at the possible building platforms on the hill of Salumägi, we can see that none of them were rectangular, like one would expect from a building. The location of the first platform next to the small fields and on the border of the uncultivated boulder-field makes it tempting to see it as a location for a building that was related to the fields in area IV. It is possible that there was some kind of building structure on top of the raised area but its function would be hard to guess. It could be a raised field that was made by filling the surface on top of the boulders in the corner of the boulder fields to increase the cultivatable land. It is also possible that its shape was misjudged because it merged with the boulder field and it was initially a quadrangular feature. It would still be too large compared to the known house types from the archaeological material but it shows similarities in size with some of the fields in the same area and also with some stone graves in Estonia.

Platforms 2–4 were located at the junctions of banks. However, while 3 and 4 can be quite confidently related to cultivation, 2 had a more even and flat surface and its edges were more pronounced. It was also different from the high raised area in area II where the surface was bumpy and uneven. It remains unknown and doubtful if the platform could have accommodated a building, despite its different character compared to the other junctions of the banks. The location does not match any of the typical locations of buildings because none have been recorded on a small ridge. Hence, at the moment it seems more logical to assume that it represents a more or less similar object to platforms 3 and 4. The reason for its visual conspicuousness might be related to its higher positioning in the landscape while the edges might have been enhanced during ploughing around it.

The possible explanations for the raised levelled surfaces in the junctions of banks are as follows: (1) organic waste from the fields was thrown in these areas and later these composted places were also cultivated which resulted in a flat and even surface; or (2) that the platforms are remnants of earlier landscape elements, for example buildings or graves; or (3) that the raised junctions were formed when plots and banks were later added to the system. The last option does not explain the levelness of the areas but it can be useful for interpreting the stratigraphy of the formation of the field systems.

The results of the landscape survey show that unless the recorded platforms represented a different dwelling type from the previously known ones, or even a cult-related building similar to the one investigated on Saaremaa, they were probably not house platforms. Nevertheless, it does not mean that they could not have been built or used for holding a less permanent type of structure.

5.5.8 Pits

Eight pits were recorded on the south-western part of the hill (Fig. 5.52), among the long field plots in area III, on both sides of bank III-3. Seven of them were situated on plot III-b and a smaller one on plot III-c.

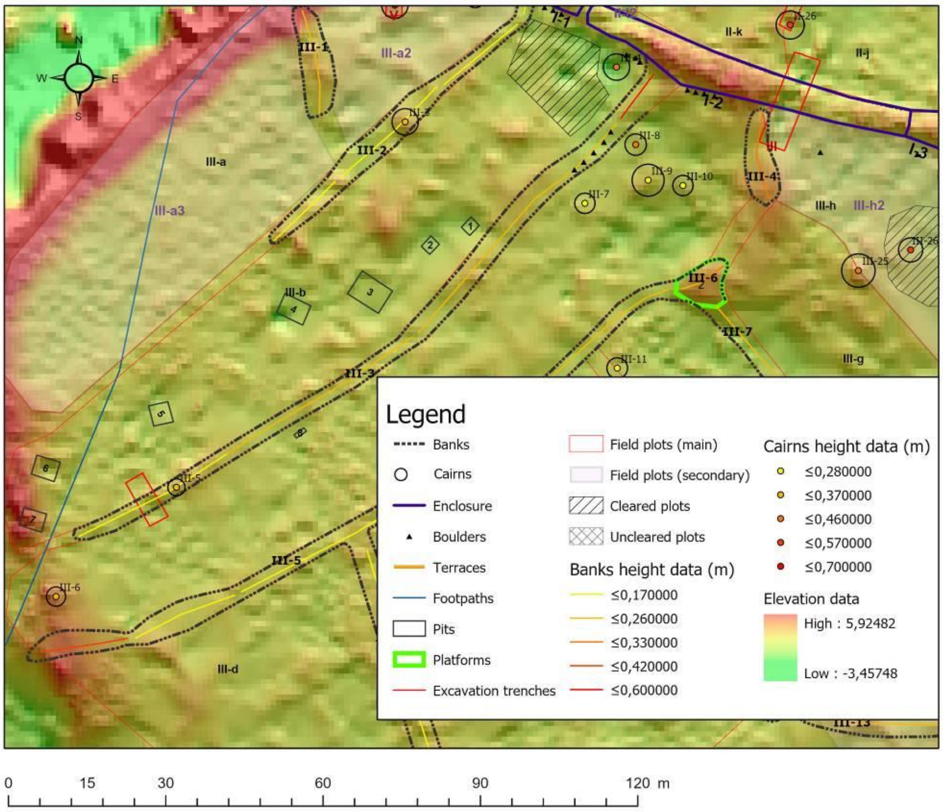


Figure 5.52. Pits on the south-western part of the hill.

Pits 1–7 were located alongside bank III-3. The distance between pits 1–4 was between 5-10m, 5 was located ca. 27m towards south-west from 4 and pits 6–7 further 20m towards the edge of the hill from pit 5, on the other side of the path to the hill. The latter two were ca. 6m apart from each other. Some of the pits (2, 3 and 4) were rectangular (Fig. 5.53), while the others almost square. The side lengths of the pits varied from 2.2m up to almost 7m. The smallest pit of that group was 2, measuring 2.2m x 2.6m and the largest one 3, measuring 5.1m x 6.9m. The depth of the pits in relation to the surrounding flat ground was ca. 30–50cm. Some of the pits were surrounded by a wide, seemingly earthen bank that could reach up to 40cm and that had gaps in each of the four corners of the pit. In most of the pits, limestone was visible on the vertical walls of the pit.

Figure 5.53. Pit 4, view from NW (2021).

Pit 8 on plot III-c was smaller than the rest of the pits, measuring 2.3m x 0.7m. It was ca. 20cm deep and no stones were visible inside the hole. There was no bank around it and the soil was thrown towards the field bank III-3 next to the pit.

It was assumed that the pits were quite recent or at least not prehistoric. Pit 8 was clearly younger than the field bank where the soil that was dug out was placed. Pits 1–7 were also thought to be relatively recent, mainly because the stones on the bottom and on the sides of the pits were visible and therefore it was possible to conclude that soil accumulation was not taken place. No connection with the field banks could be detected. The nature of the pits remained somewhat questionable. According to Mati Mandel, an archaeologist and historian who is an expert in both Western Estonian archaeology and recent history, a local man had told him that the pits can be associated with the activities of Soviet Russian military forces in the 1940s who used to keep their army vehicles on the hill and piled soil around them (M. Mandel, pers. comm.). A lot of Soviet troops were positioned in West Estonia at that time and therefore it is also possible that the pits were made as training trenches.

However, the pits could also represent small quarrying holes for limestone that was needed either as a building material or a source of lime, for example for the needs of the pastoral manor on the hill. The production of lime as a construction material started in Estonia during the 13th century and it was widespread until the 20th century in areas where limestone was available, West Estonia among them. The archaeological investigations of lime kilns indicate a larger size than was recorded for the pits on Salumägi. In addition to that, the banks around the kilns are usually semi-circular and without the gaps in the corners (Tvauri and Saimre 2008: 136–137). Because the pits at Salevere were not investigated any further, their connectedness with lime production remains hypothetical.

5.6 Field systems and plots

In this section I will analyse the field systems on the hill of Salumägi. A lot of emphasis is put on the physical character of fields, on the basis of the observations made during the landscape survey. The size and general characteristics of plots are taken as one of the key points for the analysis of the possible age and function of the field systems on the hill. In addition to the size, their location in the landscape and connectedness with other archaeological features is also crucial for the analysis.

In Estonian archaeological research the size of the field plots was dependent on the age of the fields (see chapter 2) and it has been established that the earlier (Bronze Age and Early Iron Age) plots were smaller than the later prehistoric plots, and the historical fields (Lang 2007b:102). Following from chapter 2, the results from the excavations of field systems show that the size of the single plots of the oldest rectangular field systems (Baltic and Celtic fields) was around 360–400m^2. There was a slight difference between the irregular Baltic fields that were established during the Middle Bronze Age where the plot size was smaller, and the Celtic fields which are mostly dated to the Pre-Roman Iron Age and had slightly larger plots. The quadrangular fields associated with later phases of prehistory are thought to be twice as large as the early field systems. Excavated rectangular fields of historic periods range in sizes from ca 1,400m^2 up to 4,500m^2. For the strip fields, the earliest of which have been dated to the Middle Iron Age, the width and length of the field plots has been taken as a better indicator of their size than area. However, the excavated prehistoric field strips show a large range in the width of the strips, from 11–16m at Ilmandu up to 70–90m at Uusküla. The question of the location and size of the plots in areas where the field system mostly consists of clearance cairns (cairnfields), elongated cairns and fragments of banks has not been approached systematically in Estonian archaeology. Therefore it is impossible to point out any conclusions about the size of the possible plots based on the previous literature. The analysis of the differences in sizes of the plots and strips in different periods, based on previous investigation of field systems in Estonia, shows that there are actually not enough basis for pointing out any clear correlations between size and age of fields. For thorough conclusions, more excavations and dating is required.

The distinguishing of field systems and plots on the hill of Salumägi was somewhat problematic. Just like the identification of field systems is reliant on detecting the fields, the distinction of plots in its turn is reliant on the establishing what bordered, separated or determined plots of land that were in agricultural use. The easily detectable fields on the hill of Salumägi were the ones that were clearly bounded by banks. However, it was acknowledged that the plots did not necessarily have to be enclosed only by banks. Cairns, natural objects (e.g. natural terraces and the edge of the cliff) and fences that have not been preserved were also used to enclose fields. Such fields were more difficult to distinguish and their inclusion into field systems can be debatable.

It can also be speculated that it was the whole field complex that was enclosed or defined by an outer border and that the inner separation of fields was not always necessary or the main goal. For example, if one of the main reasons for bordering the fields was keeping the animals away from the crop, the boundaries around all the fields under cultivation would have been more important. The lack of fields surrounded by banks in area II can be related to the enclosure providing the outer boundary of the area, so that the inner division into separate plots was achieved by less permanent boundaries.

The field systems were most consistent and regular in the middle part of the hill (areas V and VI). The main axis of the system was defined by long continuous banks and here the inner division into smaller plots was also more regular and the banks more intact compared to other areas. Long continuous banks were also present in areas III and the south-western part of area VII but the appearance of the field system was less regular than in the aforementioned areas. The banks on the rest of the hill were more fragmentary and plots and the whole fields systems were harder to define. Here the role of natural features for separating or defining plots and influencing the layout of the field systems was mostly observable.

The remains of field systems were visible in all eight areas, but their regularity, presence of clearly defined fields and the size of the plots varied. It has to be noted that the detected field systems did not always match with the areas that were distinguished prior to the analysis. The breakdown of the whole hill into areas was put in place during the landscape survey and before the analysis of the pattern of the field systems. It was decided not to change the initial division during the analysis phase, but instead point out the locations of the more developed field systems separately. However, because in the previous analysis of the objects the separation into the areas was used, the field systems in the following section are also distinguished based on the general division of areas for the consistency.

5.6.1 General characteristics of plots

Two overlapping methods were used for distinguishing field plots that are integral parts of the field systems. In method A, the whole area was divided into chunks of land that were bordered or separated in one way or the other, although they were not necessarily agricultural land clearly bounded with banks but potential plots with various functions. For example, the boulder fields were distinguished as separate plots according to this categorisation. They were not necessarily cultivated fields but they could have been in use for other agricultural purposes, such as pastures or hayfields. The same applies to the raised area in area II and platform 1 in area IV (platforms 2–4 were located within banks and were not separated as plots). In method B, alternative ways of defining plots were applied. For areas II, IV and V where plots with questionable role as agricultural land (e.g. boulder fields, ridges) were located, the second category were part of formal field systems while the first category were part of the general (only possibly agricultural) use of the hill, however, alternative ways of defining agricultural land were also distinguished. For other areas (III, VI, VII and VIII) method B stands for an alternative way to distinguish plots, the boundaries of which were in many cases not clearly marked with banks. I would suggest that the informally bounded areas were also part of the wider field systems although it was more difficult to detect their edges, sizes and roles. Table 5.3 below presents the average sizes of plots only according to the more general method A to avoid unnecessary complexity. The alternative average sizes are noted within the overviews of each area.

The primary characterisation of plots ignored the possibility that some cairns could have been assembled at the edges of the fields, bounding the plots. Exceptions were made in cases where it was more obvious and supported by other evidence as well. This was done to avoid the over-interpretation of the cairns as possible boundaries and to keep the division into plots simpler. However, the possibility that there were actually smaller plots inside the main division, marked by cairns, was kept in mind and the possible smaller plots are listed in the tables under each area.

On the basis of the method A, 70 plots were defined with the average size being 1877.8m^2. The smallest plot was 180.4m^2 (IV-c) but its function as a field is disputable because it was a higher platform and it could have had a different use than cultivated land (see 5.5.7.). The other small fields with an area less than 300m^2 were also either stony areas on the higher natural ground (V-b) or parts of natural ridges (II-h) where their function as fields was hypothetical. The smallest field bordered with banks was III-k which had the area of 415.1m^2. The maximum size of the plot was 5,277.5m^2 (VII-j). In general, the largest plots were in areas III, VII and VIII with the approximate sizes between 2,500 and 2,700m^2. In the other areas the size varied between ca 1,200–1,500m^2.

Table 5.3. The average size of the field plots per areas.

	average	II	III	IV	V	VI	VII	VIII
Size (m^2)	1,877.8	1,371.5	2,506.4	1,406.5	1,486.6	1,195.7	2,697.8	2,539.9

It has to be noted that plots were not necessarily field plots but all the areas that were separated with archaeological or natural features and formed a separate unity. It was sometimes difficult to determine which ones were of agricultural use but they were still considered as parts of field systems. Detailed descriptions of field plots are presented in Appendix B.

5.6.2 Area II

Area II (Fig. 5.54–5.56) with the size of 1.71ha comprised the enclosed area in the northern part of the hill. It was bordered by the escarpment from the North and the enclosure bank from the South. Most of the area was covered with forest. The western part of it was quite high, incorporating a raised area while the eastern part was low and flat.

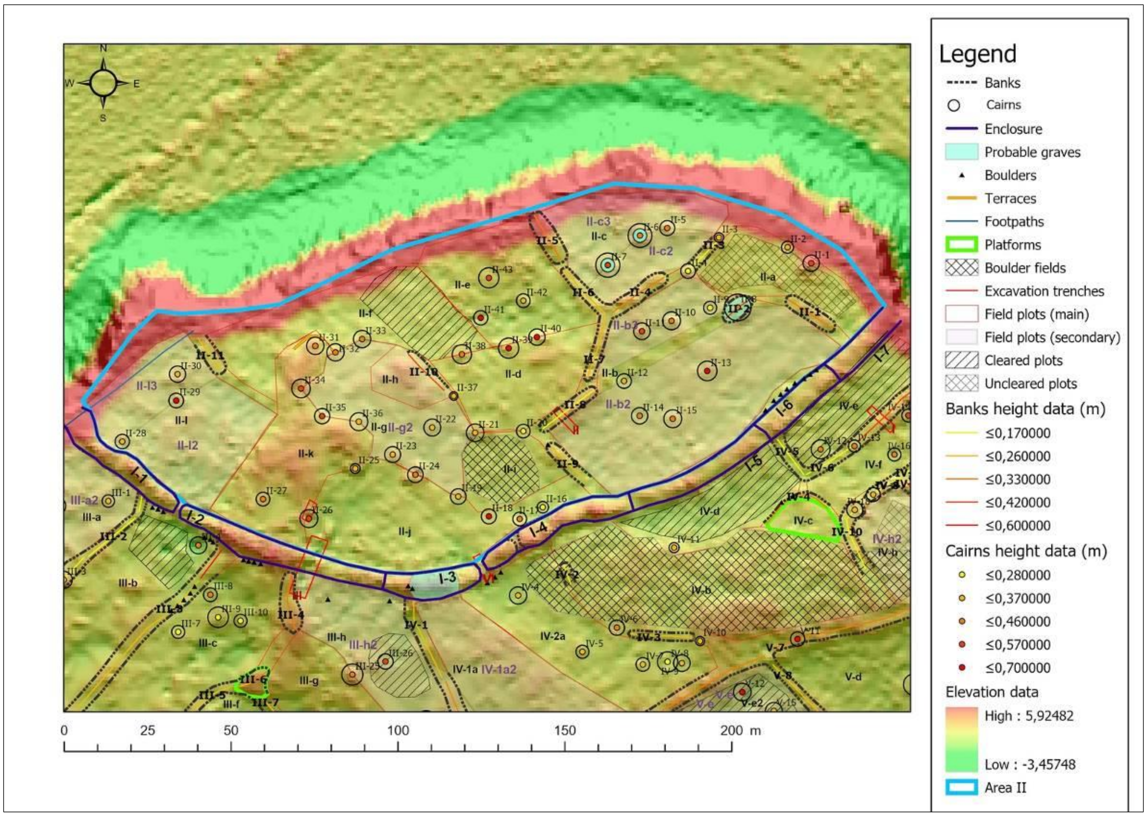


Figure 5.54. Archaeological features in area II.

Altogether 54 archaeological features were identified in the area:

a. Banks

11 numbers of banks were distinguished (II-1–II-11) with the width ranging from 3m (II-3) to 5.8m (II-5), the average being 4.18m. Their height varied from 0.14m (II-8) to 0.4m (II-2 and II-10), the average being 0.27m.

Figure 5.55. Bank II-11, view from NE (2021).

b. Cairns

There were 43 cairns (II-1–II-43) with the diameter from 2.5m (II-37) to 7.95m (II-8 which was recorded as bank and cairn simultaneously), the average being 4.8m. The height ranged from 0.22m (II-9) to 0.66m (II-18) with the average being 0.42m.

Three possible graves were recorded in the eastern part of area II (see 5.5.6.): a large oblong cairn (II-8) or a small bank (II-2) which was irregularly shaped and had small stones visible on the top through the sod; and cairns II-6 and II-7 that were distinguished as probable graves by their size. However, it is possible that they marked a field boundary inside plot II-c, dividing it into plots II-s2 and II-c3. The latter would be supported by the fact that two cairns (II-3 and II-4) on the south-eastern side of plot II-c were connected with a stony bank between them (II-3) that matched with the direction of the presumable border that would have formed by connecting cairns II-6 and II-7; possibly II-5 as well.

Figure 5.56. Cairn II-13 on plot II-b. Typical view of area II with trees and bushes (2021).

Two trenches were made in area II: trench II through bank II-8 and trench VII to investigate a part of cairn II-26.

It was difficult to distinguish separate plots in the area because they were not clearly marked with banks. The recognition of plots (Appendix B1) was made on the basis of the location of banks, ridges and boulder fields and to some extent the nature of the plots (if they were cleared of stones or not and other characteristics) and location of cairns. The plots in area II were irregularly shaped, except for plots II-b2, II-e and II-l that were more or less quadrangular.

The average calculated size of the 12 different plots of land (II-a–II-l) according to method A was 1,258m^2. The smallest plot was the small part of the ridge in the middle of the area (287.1m^2) and the biggest one plot II-b in the eastern part of the area (3,060.3m^2). If we exclude the ridge and the boulder field it leaves us with 9 plots (marked with grey background in the table) with the average size of 1,435.7m^2 (the smallest one in that case being plot II-d with 958.4m^2). When taking the secondary distinction into account, where the cairns would separate the smaller plots and the small ridge (II-h) would be part of plot II-g, the amount of plots would be 14 or 12, depending whether the ridge and the boulder field are included or not. In that case the average size of the plots would be 1,061.2m^2 or 1,080.7m^2, accordingly, with the smallest plot II-b3 measuring 522m^2 and the largest one II-b4 having the area of 2,305.3m^2.

The western part of the field system in area II looks like a clearance cairn field where the cairns were positioned either at the edges of the fields or at the sides of the areas that were not used as a field (the higher ridge, or in the middle of the plots, sometimes in clusters). The fields seemed to be enclosed and defined with cairns, short segments of banks and the natural borders: the ridge, the boulder field and the steep edge of the cliff. The shape of the fields was quite irregular which could also have been conditioned by the location of the natural features.

Most of the banks were located in the eastern part of the area but they did not form a clear and regular field system. However, the plots were quite well bordered with banks, the enclosure bank and the edge of the cliff.

The natural escarpment formed an outer border to the fields adjacent to it and to the whole area in general. There could have been additional fences at the edge of the hill but there were no clear remains confirming that. The enclosure bank bordered the area and some of the fields from the other side. The lack of clearly bounded plots might be an indication that it was more important to enclose the whole area instead of separating individual plots. It is possible that the area was mainly used as a pasture in which case the partition of the land into fields was less important than keeping the animals inside the area. The existence of plots on the other hand shows that it was also used as a cultivated land at times. This is not to say that bordering a pasture and fields was necessarily the primary aim for the building of the enclosure but it could have been used as such later. It is also possible that the banks and some of the cairns represent a different temporal layer.

5.6.3 Area III

Area III (3.39ha) was distinguished in the western corner of the hill (Fig. 5.57). It was bordered with the enclosure on the northern side, the escarpment and the smoother edge of the hill from the western and southern sides and areas IV and V from the eastern side. South-east from the area there were modern buildings and landscape affected by the building of them, therefore no field systems were visible there. The area was partly an open landscape (Fig. 5.60) which made the mapping of the features easy while other areas were overgrown and almost impenetrable. A variety of different features were recorded here, including banks, cairns, pits, platforms and probable graves. The area consisted of two different parts: a western part with long banks and elongated rectangular fields, and an eastern part with smaller fields, among which some where similar to the plots in area V. Separate areas were not distinguished because the fuller picture of the field systems became apparent in the course of analysis, when the areas were already set.

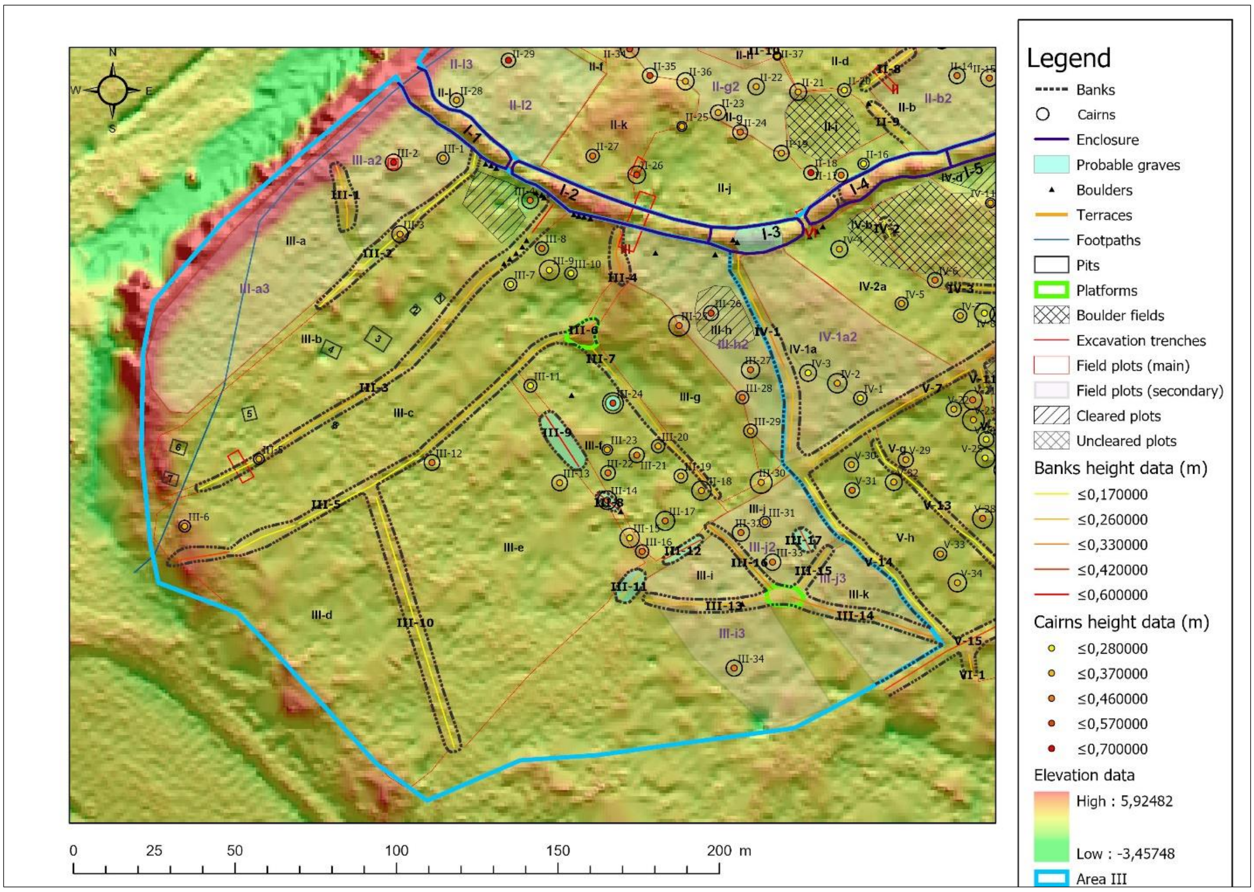


Figure 5.57. Archaeological features in area III.

Altogether 72 archaeological features were identified in the area:

a. Banks

17 whole banks were counted in the area (III-1–III-17) with the average width of 4.09m and the height of 0.25m. Five of the banks were short segments or oblong cairns that could have been graves and one was distinguished as a platform. The narrowest bank was the 2.1m wide north-western part of bank III-7 and the widest one was a short bank (III-9) or a probable grave 2 with the width of 7m. The widest bank that was not a possible grave was bank no III-3 that was ca 6m wide in the junction with the enclosure. The height of the banks varied from 0.08m (III-2) to 0.57 (bank III-9 or probable grave

2) or 0.48 when considering only banks that were not recorded as possible graves concurrently.

Figure 5.58. Western part of area III with bank III-1 (view from NW) (2021).

b. Cairns

34 cairns were recorded in area III (III-1–III-34) with the size ranging from
3.2m (III-23) to 6.65m (III-30), the average being 4.74m. The average height was 0.37m, ranging from 0.2m (III-9, III-10, III-11) to 0.6 (III-2).

Most of the cairns were located in the eastern part of the area, around the possible graves and plot III-h. There were quite a lot of cairns that had large boulders (around 1m in diameter) inside or at the edges III-26, III-23, III-32, III-4 and III-24. Cairn III-34 which was closest to the area damaged by the modern buildings had a hole in the middle, suggesting that stones were taken from it, assumingly for building purposes.

Figure 5.59. Eastern part of area III with cairn III-33 (2021).

c. Probable graves (see 5.5.6.)

It is likely that bank III-9 was an oblong grave (2), possibly a *tarand*-grave that was later used as a field border between plots III-e and III-f. Banks III-11, III-12, III-14 and III-17 were also marked as probable graves but it was considered a more doubtful option than in case of bank III-9. It is also possible that cairn III-24 was a circular grave, deciding from its size and the presence of large stones.

d. Platforms

Two possible platforms were located in the eastern part of the area: platform 2, also marked as bank III-6 and platform 4 in the junction of banks III-33–III-36. The platforms were analysed in chapter 5.5.7.

e. Pits

All the recorded pits (analysed in chapter 5.5.8.) were located in the western part of area III, 1–7 on plot III-b and 8 on plot III-c. The pits were likely to be later than the fields and not connected with them.

Figure 5.60. Open landscape in the south-western part of area III (2008).

Three archaeological features in the area were excavated: a corner of bank III-4 was excavated with trench no III; cairn III-2 in the northern part of the area was fully excavated (trench V); and trench IV was made through a long bank III-3 in the western part of the area. The identification of plots (Appendix B2) was easier in area III than in area II because they were mostly bordered with banks. A couple of alternative options were considered when distinguishing the plots which in some cases probably represent different temporal layers. The fields had a more regular layout than the ones in area III but it lacked the consistency of field systems in area V and VI.

Eleven plots were recorded in the area with an average size of 2,288m^2. If we consider the alternative distinguishing (method B) of the fields, the number of the plots would remain the same and so would the average size—2,329m^2. The largest field in the area was field III-e with the size of 4,756m^2 and the smallest ones, according to the main distinction, the plots in the south-east corner of the area (415–697m^2). The general picture would not change much according to the secondary distribution of the plots, except that the fields in the eastern part of the area would be more similarly sized (on average 1,381m^2).

At least two different field systems were distinguished inside the area:

1. The three long field strips in the north-western part of the area. The fields radiated from the enclosure and were oriented from north-east to south-west. Their size was similar, ranging from 3,477 m^2 to 3,790m^2.

2. In the eastern part of the area, the orientation of the fields was the opposite, from north-west to south-east. It seemed that the long banks of the strip fields determined the axis of the fields III-d–III-h, suggesting that the latter would be later than the former. The fields on the south-eastern part of the area were smaller but their general layout still seemed to match with the general orientation of the fields in that part of the area, especially when considering that they might have been partly conjoined or extended further to the south-east. It is possible though that they were not built as part of the same system or even at the same time. The size of the most distinct plots III-f, III-g and III-h was between 1,478–1,637m^2 which is similar to the plots in the adjacent areas (area V and western part of area IV) and it seems that they formed a connected field system. The option will be further discussed among the field systems in area V, see further down 5.6.2.5. Plots III-d and III-e, although larger, matched with the general orientation of the fields in the eastern part of the area and might have been part of the same system.

In addition to that, there seems to be a third, underlying temporal layer, represented by the possible graves in the south-eastern part of the area. In case the graves were built and used prior to the fields, we can see how they were later incorporated into the field system and used as borders defining the plots.

5.6.4 Area IV

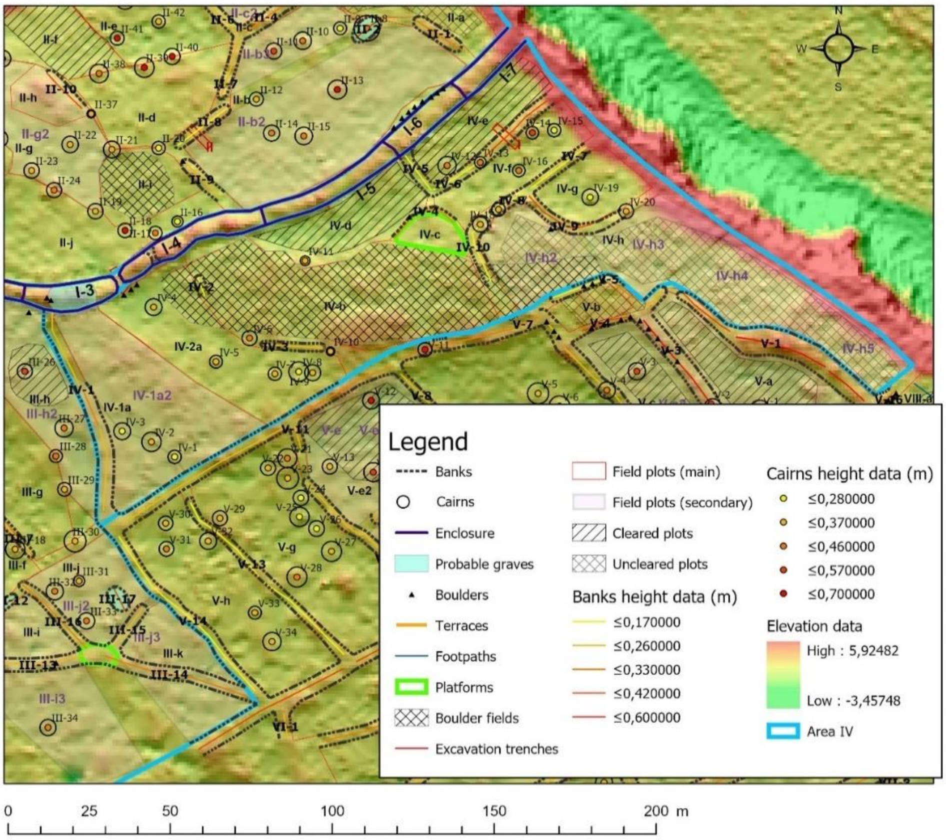


Figure 5.61. Archaeological features in area IV.

Area IV, 1.3ha, was situated in the north-eastern part of the hill (Fig. 5.61). It was bordered with the enclosure from the north, the cliff from the east and areas III and V from the west and south. The border with area III comprised a long bank (IV-1), oriented from North to South but during the analysis it turned out that the fields east of the bank might connect with the ones in area III. Another long bank (V-7) that was east-west oriented separated areas IV and V. The border between the last two was missing on the south-eastern corner of area IV. Therefore the area was marked as extending further to south-east, until reaching bank no V-16 and area VI, especially because the strip of land between the regular fields and the escarpment (IV-h) did not initially seem to be part of the former. A large part of the area (ca. 2,500m^2) IV was covered with a boulder field (Fig. 5.38) while the banks and small fields were situated in the north-eastern part of the area. The area was covered with forest (Fig. 5.62). The ground was generally lower in the eastern part and raised higher towards west.

31 archaeological features were identified in area IV:

a. Banks

Ten banks were recorded in the area (IV-1–IV-10) with the width ranging from 2.3m (IV-3) to 5m (IV-1), the average being 3.4m. The height differed from 0.06m (south-western part of bank IV-6) to 0.4m (north-eastern part of bank IV-6) with the average of 0.2m. Banks in area IV were the narrowest and lowest of all the areas but at the same time they were well-defined and not fragmentary, especially in the eastern part of the area, where the majority of them were located. Some banks had large boulders inside, especially the ones adjacent to the boulder field. Trench II was excavated in the central part of bank IV-6.

b. Cairns

Twenty cairns were recorded in the area (IV-1–IV-20). Their diameter varied from 2.68m (IV-10) to 6.05m (IV-8), the average being 4.44m. The height of the cairns was from 0.24m (IV-19) to 0.49 (IV-14) with the average of 0.34m.

Four cairns in the north-eastern part of the area were recorded inside the banks, in most cases in the beginning or end of it.

c. Platform

The platform (1), also marked as plot IV-c, ca. 180m^2, was described and analysed in more detail in the previous section (5.5.7.). It cannot be excluded that it was in use to accommodate some sort of building. However, it could have equally have been a slightly raised field plot. It could have extended further into the boulder field, in which case it would have been larger and closer to the size of other plots in the area, e.g. IV-g. It might also just represent a part of the boulder field that was used in some way during the agricultural use of the hill.

Figure 5.62. Landscape in the northern part of area IV (plot IV-e) (2008).

At least nine plots (Appendix B3) were recorded in area IV, including the boulder field and platform. There were alternative ways how to distinguish plots in case of fields IV-1a and IV-h which would make the maximum number of plots 12. Although area IV was distinguished on both sides of the boulder fields, the eastern and western parts of it were different. The most obvious difference was the size of the plots: in the north-eastern part they were remarkably smaller than the plots IV-1a and IV-2a[45] in the western part of the area, even if it was divided in two plots.

The average size of the plots was 1,275.4m^2 or 921.7m^2 when following the secondary partition (method B). When excluding the boulder field and the platform, i.e. the biggest and smallest plots, the agricultural function of which is disputable, the average size would be 1,261.2m^2 or 841m^2. The plots on the eastern part of the area had the size between 504.8m^2 and 877m^2, when excluding the platform, boulder field and plot IV-h which was difficult to distinguish. The fields on the western part of the area measured ca. 1,512–1,778m^2 or 1,402–1,512m^2 if considering the option of the border being where the cairns were.

[45] The plot IV-a was finally decided to divide into two plots in the primary division (method A); to avoid changing all the labelling, I marked them as IV-1a and IV-2a.

The fields in the north-eastern part of the area formed a uniform group and were most likely in use at the same time. The orientation of the field system followed the axis of the enclosure. The plots that were cleared of stones and where the ground was even (IV-d and IV-e) were likely to have been used as cultivated fields. The stonier areas (IV-h and maybe even the boulder field) might have been used as a pasture or a hayfield. The role of the platform 1 (plot IV-c) remains unclear. The location between cultivated land, potential pasture and hayfields may suggest a reasonable location for some sort of building, either for habitation or for storage and the location can be seen as a settlement area. A possible gate was recorded east of the platform, between plots IV-h and IV-f (Fig. 5.61 and 5.63) which could have served as an access route between fields that were close to the building(s) and the ones further south-east of it.

Figure 5.63. Possible gate between plots IV-h and IV-f, view from NE (2021).

The large stony plot IV-h could have been part of both areas, IV and V, providing access to the fields and to the spring. There were some suggestions of the large plot being divided into smaller fields, i.e. the orientation and direction of bank V-2 or a higher area of land between plots IV-h4 and IV-h5 that was only visible from the LiDAR mapping and was not detected in the landscape.

The two plots (IV-2a and IV-1a/IV-1a1) in the western part of area IV were not connected with the field system in the eastern part. Their size and orientation suggested that they were part of a larger field system that included the fields in area V and the eastern part of area III. The option will be discussed further down in 5.6.5.

5.6.5 Area V

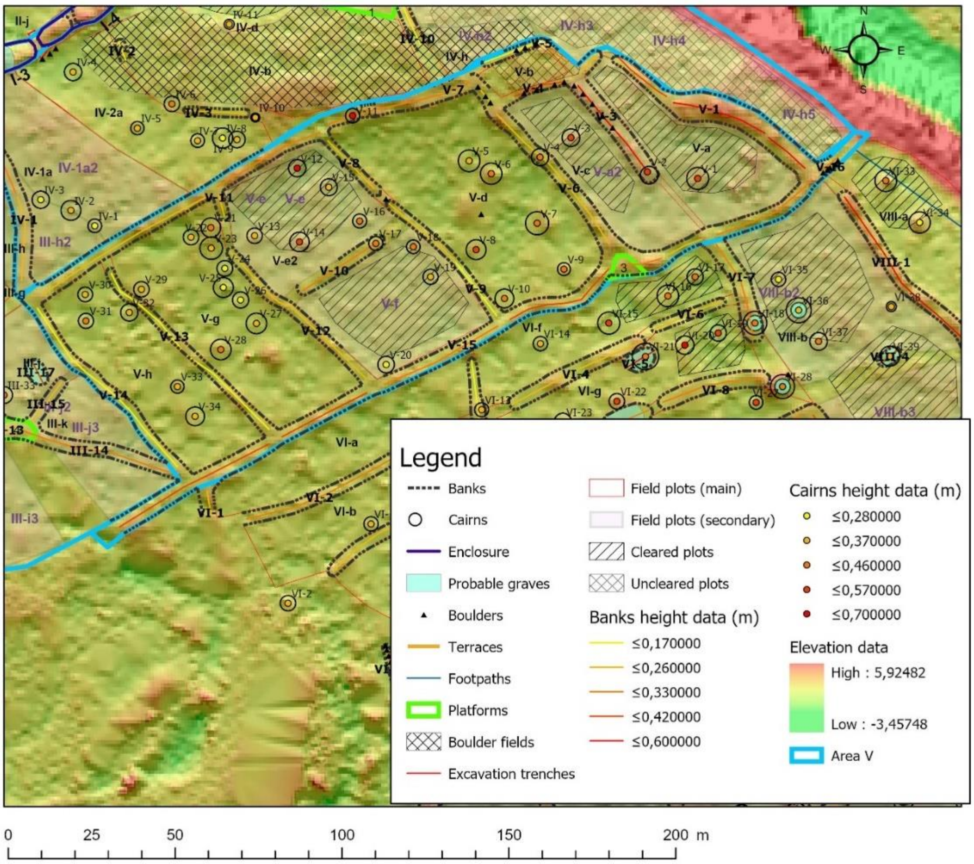


Figure 5.64. Archaeological features in area V.

Area V with the area of 1,6ha was distinguished in the middle part of the hill (Fig. 5.64). It was bordered with area IV and the boulder field from north-west, areas VI and VII from south-east and south, area III from south-west and west, and the stony plot IV-h that was included into area IV from north-east. The north-western and south-eastern borders of the area were marked with long continuous banks. The area between the banks was divided into smaller quadrangular plots of land, mostly quite equal in size and regularly laid. The landscape in the area lowered southwards, compared to area IV and the banks between these two areas (V-5 and V-7) were located on the natural slope, especially on the eastern part of the boundary. The same applies to bank V-1 on the eastern border of the area. The area was quite stony and the occurrence of visible stones on the ground and inside the banks was quite high.

50 archaeological features were recorded in the area:

a. Banks

   16 numbers of banks were identified (V-1–V-16) with the width from 1.7m (V-4) to 7–7.3m (V-1 between area V and plot IV-h), the average being 3.89m. The height of the banks was between 0.12m (V-5 on the sloping border between areas IV and V) and 0.5m (V-3), the average being 0.29m. The size of the banks that divided the area into regularly laid plots was from 2.4m to 3.4m in width and 0.15–0.2m in height. The banks around the whole field system were wider and higher compared to that.

b. Cairns

   34 cairns were recorded in area V (V-1–V-34). Their size varied from 3.85m (V-9) to 6.95m (V-7), the average being 5.22m. Their height ranged from 0.23m (V-26) to 0.7m (V-11) with the average of 0.4m.

   The cairns were generally situated inside the plots, with a few exceptions (V-2, V-4 and V-17) when they were inside and at the end of banks.

c. Platform

   The high and wide area in the junction of banks V-15 and V-16 was marked as a possible platform that had an even surface measuring ca. 44m^2, As stated in chapter 5.5.7., it was likely not a building platform. Most probably it formed during the building of the banks and cultivation of the fields but it cannot be excluded that the area was in use as well, maybe as an agricultural land which was suggested by its level surface.

The number of plots in area V was between 6 and 8, depending on how they were distinguished (Appendix B4). Most of them, except for the small plot V-b (Fig. 5.65), were oriented from north-west to south-east.

Figure 5.65. Stony field plot V-b (2021).

If we take into account the primary distinguishing (method A) of the plots, the average size of the fields was 1,718.8m^2. Excluding the small stony plot V-b, the average would be 1,968.8m^2. The size of the regular field plots was either between 2,609–3,003m^2 for the larger plots or 1,109–2,111m^2 for the smaller ones. For the latter, the size was within the same range irrespective of whether they were narrow plots oriented from north-west to south-east (e.g. V-a, V-c, V-g and V-h) or almost square (e.g. V-e and V-f).

The long banks V-7 (Fig. 5.66) and V-15 were considered as continuous entities that bordered the field system from north-west and south-east and determined the axis for all the fields. The field system was regular and the size of the plots was generally consistent. The level of stone clearance varied between the plots. Some of them (V-a, V-c, V-e and V-f) had an even surface and were cleared of stones while the others had more stones on them, although it seemed that some level of stone clearance had still taken place. The small plot V-b had large boulders in it and might have been connected to either the boulder field or plot IV-h east of it. The plot was not part of the main field system in area V.

Figure 5.66. Long bank V-7 between areas IV and V (2021).

The long banks between which the field system was laid out were not uniform through all their length and there were differences in their widths and length. It is not completely clear whether they were built at once or not. They could have been marked before the land was divided into smaller plots and that would explain why they were generally higher and wider than the shorter banks. However, it is possible that the field system started off with one or two large plots and was extended afterwards. For example, two plots (V-e2 and V-d) in the middle of area V were larger than the ones adjacent to them and could have been earlier from the latter. We can see how the larger plots were later divided into smaller ones in field V-e2 and possibly also V-a2.

The hypothesis of larger plots being the earliest ones can also be related with the location and possible development of a platform-like feature (3) in the junction of banks V-15 and V-6. The stratigraphy of the feature indicates that the western part of the bank V-15 was connected with bank V-6 before the eastern part of bank V-15 was built to join them together. The accumulation of stones and soil resulted in the forming of a platform-like area.

There were gaps between the plots, probably used as gates to access from one plot to another. In some cases they were located in the corner of the field (plots V-g and V-h) but sometimes in the middle of the banks like between banks V-11 and V-12 and banks V-8 and V-9. In the latter case, the gate was even marked with a large boulder on the north-western end of bank V-9.

The general access to the fields seemed to be from its north-eastern side, towards the north-eastern part of area IV. It is possible the two areas were connected and may even be contemporary, despite the different sizes of the fields.

As was mentioned earlier, the orientation and size of the fields in the eastern part of area III and the western part of area IV was similar to the field system in area V. In that case we can see a field system comprising a maximum of 15 field plots and covering an area of ca. 3,6ha. It is possible that the part of plot IV-h that was adjacent to area V and plot V-a was also part of the field system in which case the field system could have extended as far as the edge of the hill. Also, at least one of the plots in the north-eastern corner of area VI was of similar size and orientation as the rest of the fields of the system. The alternative way to interpret field systems in area V is showed in Fig. 5.67.

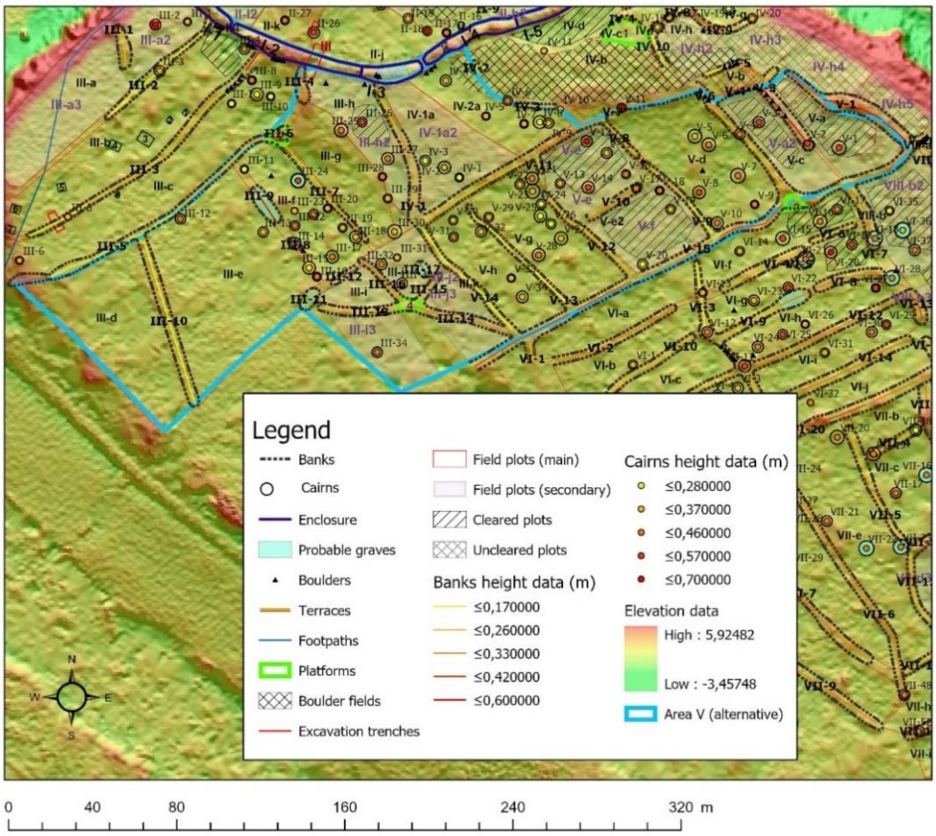


Figure 5.67. Alternative way to interpret field system in area V.

The areas of the fields varied and so did their widths and some of them seemed to have been divided into smaller plots at some point after their construction. The larger undivided plots were generally ca. 40m wide while the narrower ones were mostly ca. 20m wide. The length of the plots was rather uniform, ranging from 65m to 75m.

The field system was framed by two parallel banks, between which the smaller fields were laid. In addition to the fields between and defined by the long banks in area V, the enclosure and bank V-7 formed the frame for fields IV-2a, IV-1a/IV-1a2 and III-h/III-h. These plots were more irregular than the ones in area V. The plots III-d, III-e and III-f proceeded from the long bank III-5. The opposite main bank was mostly missing because of the disturbed landscape in the southern part of area III but parts of a bank that would match with the direction of bank V-7 and be parallel with bank III-5 were visible on the south-eastern edge of plot III-f. These segments of banks (III-11 and III-12) were marked as possible graves. Plots III-d and III-e, especially the latter, were larger than the rest of the fields and it is not sure if they were part of this field system. Their orientation seems to suggest that they were indeed and that they could have been divided into smaller plots with borders that were not preserved; or they were not divided yet. Plot III-g, adjacent to III-f was not enclosed with banks but its position between two fields showed that it was part of the same system. Its north-western border was missing between platform 2 and bank III-4. It is possible that it was deliberately constructed like that to form a gate or an access to the fields. There were three small plots in the south-eastern corner of area III that from the first look seemed to have been small and irregular and not similar to the plots of the field system. However, banks III-13 and III-14 and platform 4 between them could have been a result of a temporally different land use activity and the small plots could have formed similar plots to the rest of the system. Plot III-j3 could have reached until bank V-15 and plot III-i3 could have reached further towards the south-eastl, while bank V-15 could have reached further south-west to form a border for it as well. Plot III-j3 was divided into two almost square plots with bank III-15 which was similar to the inner partition of plot V-e2 eastwards of it. In some cases there were no clear boundaries between the plots, e.g. the border between plots III-g and III-h was marked with cairns and the division between plots IV-1a and IV-2a was only apparent from the differences in the general characteristics of the plots, i.e. one plot being on a higher ground than the other.

5.6.6 *Area VI*

Area VI is in the middle of the hill, south-east of the main part of the field system in area V (Fig. 5.68). The size of the area was 1.77ha and it consisted of regular rectangular fields that were northeast-southwest oriented. The area was bordered with the long bank V-15 from north-west, banks VI-19 and VI-20 that separated it from area VII from south-east while the north-eastern border was marked with less intact banks VI-7, VI-13 and VI-21 separating it from area VIII. The south-western boundary was largely destroyed by the construction of modern buildings westwards of the area. The orientation of the fields was uniform and the whole system looked homogeneous and different from the fields in its surrounding areas.

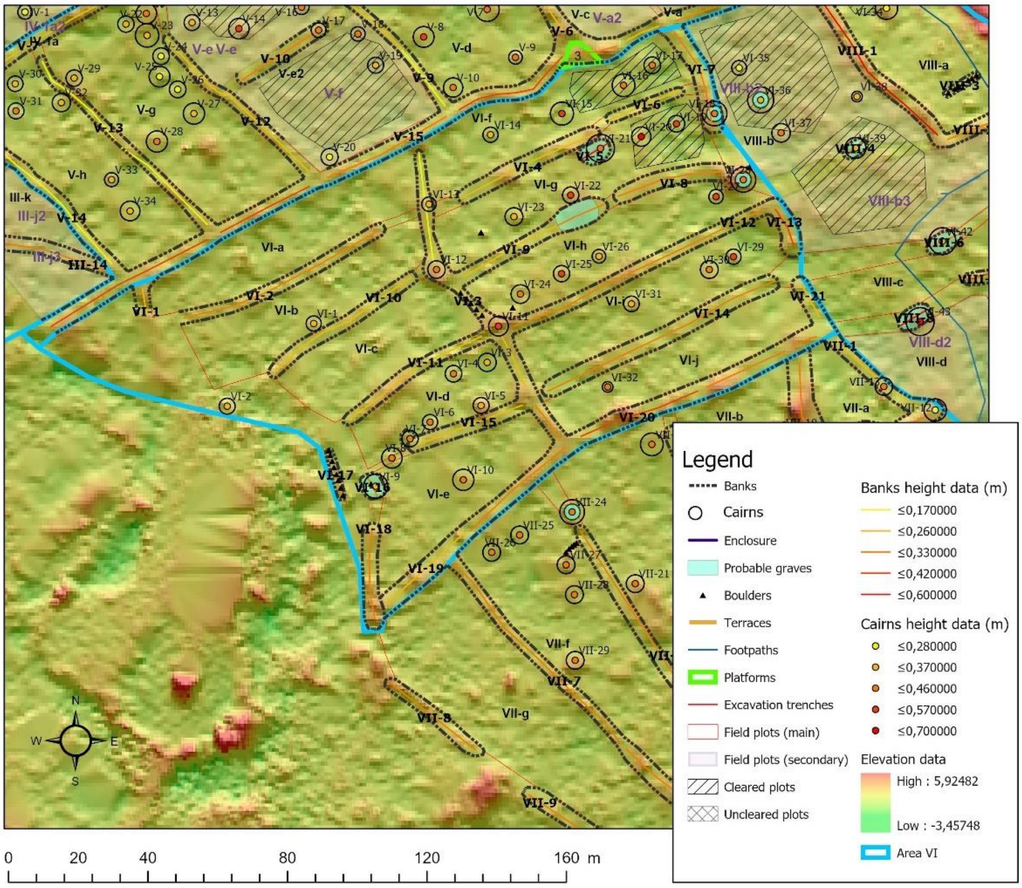


Figure 5.68. Archaeological features in area VI.

Altogether 55 (or possibly 58) archaeological features were identified in the area.

a. Banks

There were 21 numbers of banks in the area (VI-1–VI-21), including two stone fences or segments of it (VI-17 and VI-3;106). A segment of one of the stone fences (VI-3;106) was the narrowest recorded linear feature (2.4m) whereas the width of the rest of the banks (excluding the probable or possible graves that were 6.3–7.3m wide) ranged from 2.9m (VI-6) to 5.8m (VI-19) with the average of 4.53m (or 4.23 if the graves are excluded). The recorded height ranged from 0.15m (VI-3; 105) to 0.37m (VI-13) or 0.45m if we include grave no 4, with the average of 0.27m (or 0.26m if the graves are excluded).

Three banks were mapped without the height data, including two which also had no width recorded. In that case the average values for all the banks (4.2m for width and 0.3m for height) were used. Since one of the features was a stone fence, it was estimated to be narrower, ca 2.1m.

b. Cairns

There were 32 cairns in the area (VI-1–VI-32) with the average diameter being 5.16m. Some of the largest cairns (VI-9, VI-18, VI-21 and VI-28) with the size between ca 7–8m were also recorded as probable or possible graves. The cairns in general were rather large, ranging between 4–5m (only one cairn–VI-32–was smaller and had a diameter of ca 3m). Their height varied from 0.3m (VI-23, VI-26) to 0.6m (VI-20) with the average of 0.42m.

Most of the cairns were situated on the plots while the amount of them on a specific plot varied. There were cairns inside the long bank no VI-3 which formed the middle axis of the field system; the cairns were situated in the junctions of converging banks, suggesting that the main axis could have been marked beforehand. Two cairns were noted from the LiDAR mapping inside bank VI-20 that marked the south-eastern border of the area but they were not recorded and therefore confirmed during the landscape survey. Two large cairns were also recorded on the north-eastern border of the area that, by their size could represent former stone graves.

c. Probable graves (see 5.5.6. for more details)

Two probable *tarand*-graves were recognised: grave 3 was a higher and wider place in the north-eastern part of bank VI-9 and grave 4 was a similar, although slightly smaller feature on the south-eastern side of bank VI-4. Grave 3 was later used as part of a field bank while grave 4 was, for some reason left next to the bank. It is possible that the former was just a higher place in the bank and that the latter represented just a large clearance cairn. However, the visual appearance of the features suggests that they were graves. It is possible that there was another similar grave in the south-western part of the area, recorded as cairn VI-9 and bank VI-16. In addition to that, two cairns (VI-18 and VI-28) in the north-eastern part of the area were marked as possible circular graves.

The distinguishing of the field plots in area VI was effortless as the plots formed a coherent whole (see Appendix B5).

Ten plots were recognized in the area with the average size of 1,195.7m^2. The narrow rectangular plots were oriented similarly from north-east to south-west (Fig. 5.69). The plots formed two groups, separated by bank VI-3. The north-eastern part of the field system (plots VI-f–VI-j) was well preserved, with plots being bordered from each sides, with gaps being left in their corners or in some cases in the middle of banks, probably for access from one plot to another. The plots on the south-western part of the field system (VI-a–VI-e) were partly destroyed by modern building activity, especially VI-c, VI-d and VI-e. A fragment of a bank (VI-1) on the western side of plot VI-a and possibly also bank VI-18 bordering plot VI-e seem to be representing the initial location of the south-western border of the plots VI-a–VI-e. It seems that the initial size of the plots everywhere in area VI was equally ca 1,000–1,400m^2. The width of the plots remained between 14–19m and the length of the intact plots between 79–84m, showing a large uniformity in their size. All the plots were also of similarly flat and relatively cleared of stones. It also cannot be excluded that the field system once reached further south-west, towards the road.

Figure 5.69. Plot VI-a, view from NW (2021).

The position and nature of the banks suggests that the field system was planned from the beginning. The layout of the plots probably started with the long banks north-east to south-west oriented banks that were better marked and pronounced. It also seems that the bank separating it from area V was there prior to the establishing of the field system in area VI and it could have determined the orientation of field system in area VI. The division of plots with north-west to south-east oriented banks was less pronounced – the banks separating the eastern and western groups of fields and the whole field system from area VIII were curved and not as straight as the converging banks. There were a lot of high cairns inside the banks, suggesting they might have been initially marked with cairns and later, during the tilling and stone clearance joined into banks. In many cases the cairns were located at the end points of banks, marking gaps from where it was possible to enter the fields (Fig. 5.70). We can assume that in that case the location of the cairns was also planned. However, it is also possible that some of the cairns were in place prior to the establishing of the field system. In that case the presence and location of the cairns would have influenced the layout of the fields and the whole field system.

Figure 5.70. Gap between large cairns VI-18 and VI-28 (2021).

5.6.7 Area VII

The southern and south-eastern parts of the hill was distinguished as area VII, 5.7ha (Fig. 5.71). From the north-western side it was bordered by area VI with the intact banks VI-19 and VI-20 forming a clear border between the two. Area VIII on higher ground bordered it from the north-east, with the border marked with a steep terrace and banks VII-4, VIII-13 and VIII-14. The eastern side of the area was marked with the edge of the hill and modern buildings and fields were situated south-west and south of the area. The mapped area was covered with forest and bushes, especially its western part which made the mapping challenging and was one of the reasons why a lot of the features remained unmeasured. The field system was not uniform, there were groups of fields with different orientation, size and shape. It is possible that there were at least two overlapping field systems that were in use at different times that partly matches with fields in area VIII.

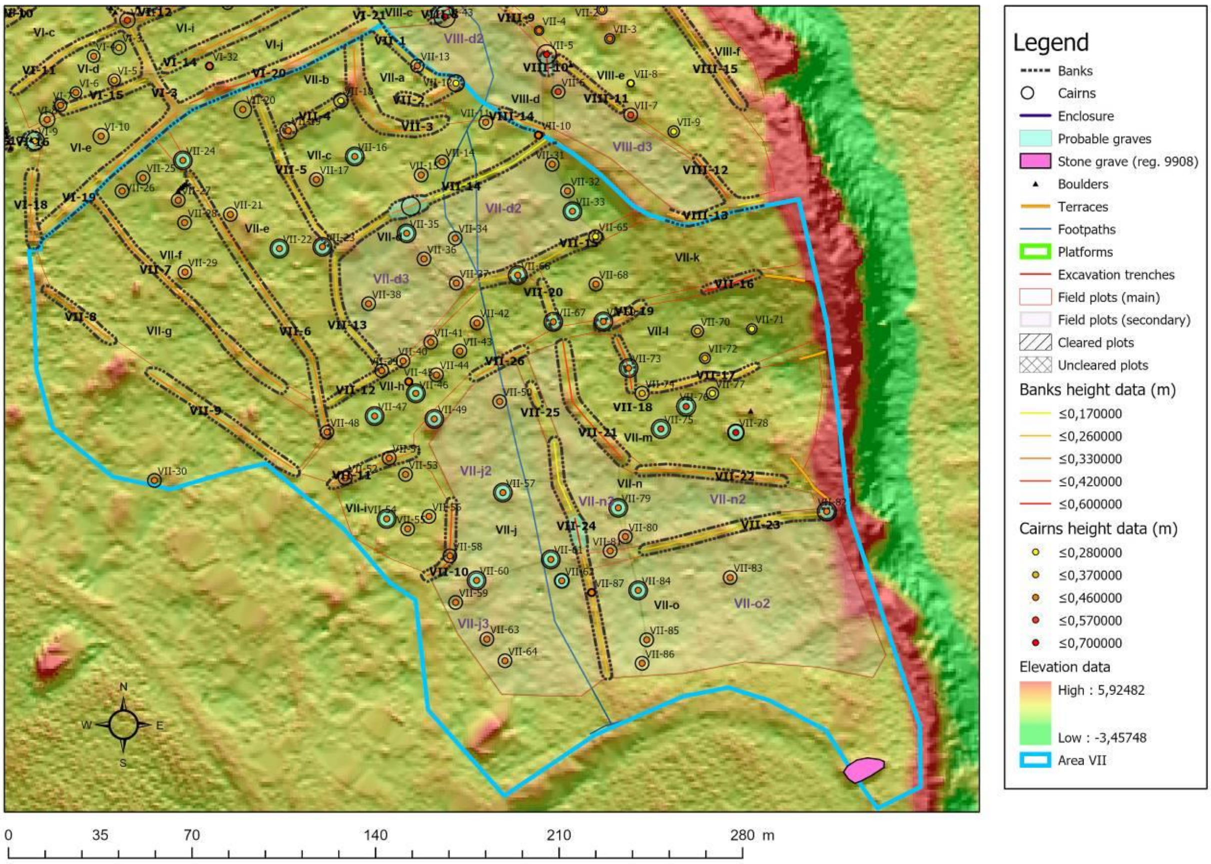


Figure 5.71. Archaeological features in area VII.

At least 106 archaeological features were recorded in the area:

a. Banks

A total of 26 banks were recorded (VII-1–VII-26). The width of the banks ranged from 2.9m (VII-17) to 7.7m (VII-13:128) with the average of 4.41m (or 4.36m without the grave no 5 that was part of the bank VII-24). The height of the banks varied from as low as 0.15m (VII-14:144 and VII-24:157) to 0.52m (VII-16) with the average of 0.28m (or 0.27m without the grave). Three banks were mapped without the height data, including two which also had no width recorded; in that case the average values for all the banks (4.2m for width and 0.3m for height) were used.

The nature of the banks was varied, there were both long and wide ones and shorter narrower banks, the latter of which were mostly following the natural terraces and situated in the eastern part of the area.

b. Cairns

There were 79 cairns recorded in the area (VII-1–VII-79). Their diameter varied from 3.90m (VII-62) to 7.2m (VII-67, VII-73), the average being 6.12m (Fig. 5.72). The height of the measured cairns ranged from 0.2m (VII-56) to 0.7m (VII-69), with the average of 0.38m. However, the statistical data does not represent the actual height and size of the cairns well because for 40 cairns the measurements were not taken during the fieldwork and hence were also not used in the calculations. In this case the average values (size 5.1m and height 0.4m) were attributed for the drawing of the features. This has resulted the cairns looking quite similar in size on the drawing. In addition to that, 18 of the cairns that were also considered as possible circular graves had an estimated size that was approximately 7m which was used in the calculations but the height was equally dismissed. When excluding the estimated size of the possible circular graves as well, the average calculated size of the cairns would be 5.62m.

Figure 5.72. A small but high cairn VII-62 (2021).

c. Probable graves

A probable stone grave (5) was recorded in the southern part of area VIII, inside bank VII-24:156. In addition to that, another possible grave was noticed in the middle of the area, inside bank VII-14 but it was considered more likely that it actually was just a higher place inside the bank, possibly an initial cairn (also marked as cairn VII-79).

A high number (24) of large circular cairns was recorded in area VIII that could represent stone graves, as was noticed already in the 1970s. The recorded and trial excavated *tarand*-grave was situated ca 40m southwards from area VII.

It was possible to distinguish 15 plots with the average size of 2,697.8m^2. The fields were not uniform and they had different characteristics in north-eastern (Appendix B6), north-western (Appendix B7) and southern (Appendix B8) parts of area VII. For the better analysis of the fields the different parts are treated separately.

In the north-eastern part it was difficult to connect the four fields (VII-a, VII-b, VII-c and VII-d) with other parts of area VII (and also adjacent area VIII), although the shape and orientation of plot VII-d could be comparable with plots VII-h and VII-k south of it. There could be temporal or functional differences with the adjacent fields and field systems which are hard to determine.

The three plots in the north-western part of the area (VII-e, VII-f and VII-g) formed the most regular part of area VII (Fig. 5.73). They were oriented similarly from north-west to south-east and the size of them was comparable. It is possible that similar plots once continued further towards south-west where modern houses are situated now.

Figure 5.73. Plot VII-f, view from NW (2021).

Nine possible plots (VII-h – VII-o) were distinguished in the southern part of the area (Fig. 5.74). A uniform field system like in the north-western part of area VII could not be detected here. Signs of different chronological layers were visible – the cairns, the east-west oriented short banks and long banks that were oriented roughly form north to south and could have served as a cattle path. However, the fields might still have been in use at the same time. The large amount of possible circular graves might refer to a previous non-agricultural land use of the area and it is possible that mixed elements from different time periods have an effect on seeing regularities within the area.

Figure 5.74. Plot VII-o, view from SE (2021).

Altogether 15 plots with the average size of 2,698m^2 were distinguished in area VII. Considering the division of plots according to method B, the average size of the plots would be 2,352m^2. The field system in the area was not uniform and it seemed to consist of different layers. Only the north-western part of the area formed a regular field system with three plots with the area between ca. 2,450–3,100m^2. The size of the plots showed large similarities – the width of all the plots was 30m and the length between 115–129m.

The plots in the north-eastern part of area VII were irregularly shaped and there were different possible ways how to identify them. It seemed that the gaps within banks bordering plots VII-a and VII-c might have left deliberately to provide access to area VIII on a higher ground. Plot VII-a was bordered with banks that had a curved position, partly reaching into the plot and its role within the field system remained unclear.

The southern part of area VII was scattered and irregular with abundance of cairns, short segments of banks and two long, almost parallel banks running roughly from north to south. The area might have been connected or in use at the same time with fields in area VIII, although a clearly visible access between the two areas was not visible. There is a possibility that the area once extended further southwards where a modern field with flattened surface is situated. A settlement layer has been identified ca. 200m south-east of the fields in area VII which might have been connected with the irregular fields in the southern part; the possible cattle path might indicate that the primary land use was pasture. The historical pastoral manor was also situated around the same place with the aforementioned settlement layer and without excavations it cannot be excluded that the fields are not contemporary with the manor.

5.6.8 Area VIII

Area VIII (1.82ha) was distinguished on the higher eastern part of the area towards the edge of the hill, south from area IV and eastwards from areas VI and VII (Fig. 5.75). The western border of the area formed a natural sloping edge which was steeper between areas VIII and VII (Fig.5.76) and less pronounced between areas VIII and VI. The access to the spring on the eastern part of the cliff was also located in area VIII. The fields were irregular and had a scattered appearance, so that it is doubtful that it can be considered as a separate coherent field system. It is more likely that the area was connected with other fields in areas alongside of it, possible with areas VI or VII. However, since the connection was not obvious and the area was located on a distinctively higher ground, it was identified as an individual area.

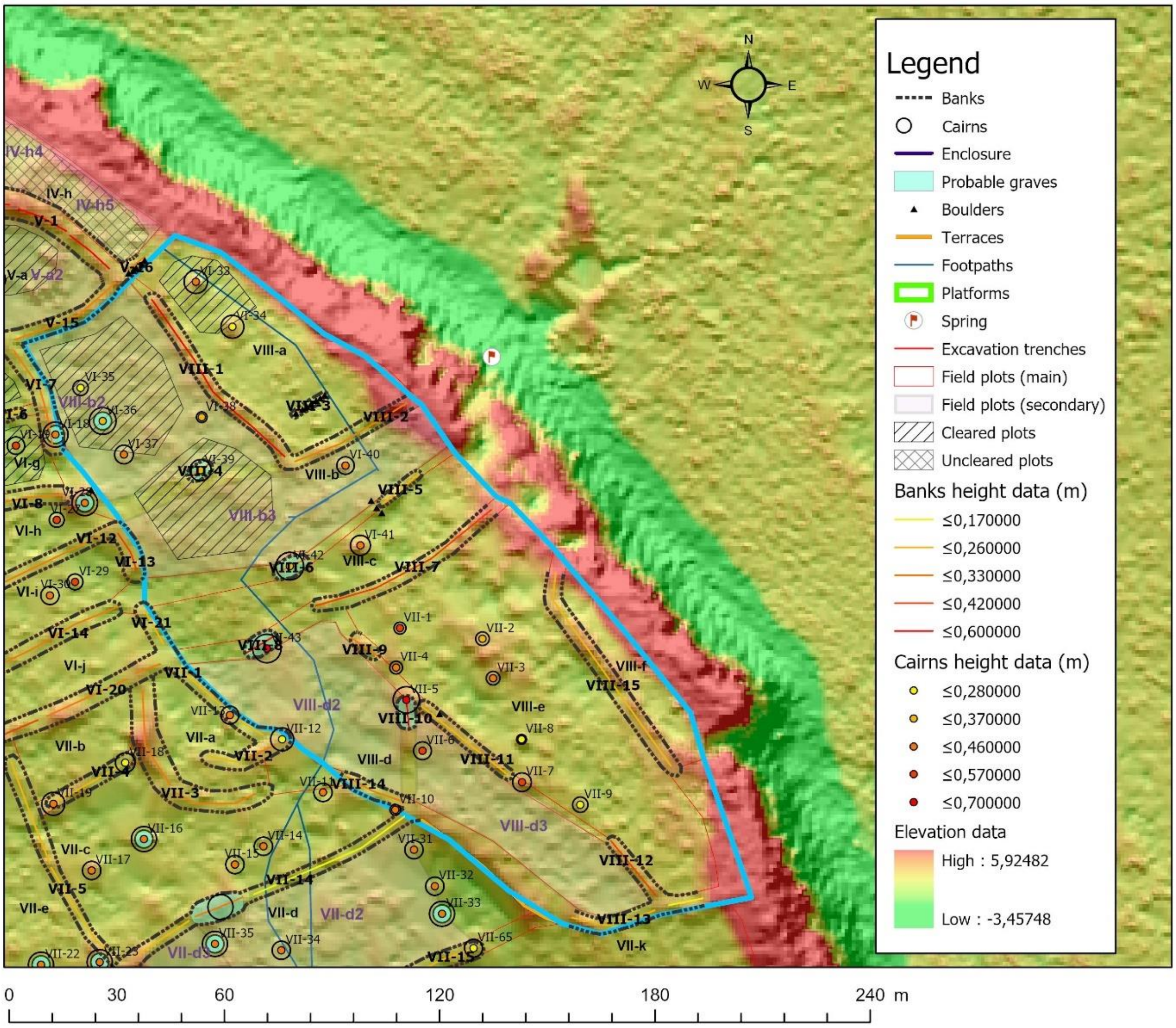


Figure 5.75. Archaeological features in area VIII.

Altogether 35 (or possibly 40) archaeological features were identified in the area:

a. Banks

There were 15 banks in the area (VIII-1–VIII-15), including a stone fence (VIII-3) and excluding the terrace edge that was part of the border between areas VIII and VII (Fig. 5.76). Among the banks there were four oval features or short segments of banks which had a length varying from ca 7–10m that were mapped as banks and cairns at the same time (VIII-4, VIII-6, VIII-8 and VIII-10). They were generally wider than the rest of the banks (between 5.2–5.9m, except for VIII-4 that had the average width of banks in area VIII (4.3m), and some of them (VIII-8 and VIII-10) reached 0.6m above the surrounding ground which is higher from the rest of the banks. They might have been just larger oval cairns but it cannot be excluded that they were connected or supposed to be connected with longer adjacent banks VIII-5 and VIII-7 that followed the same direction. It was also kept in mind that these features might be stone graves, based on their similarities in size with other probable or possible graves on the hill.

Figure 5.76. The terrace edge separating areas VII and VIII, view from SW (2021).

The width of the banks ranged from 2.8m (VIII-5) to 4.6m (VIII-15) or 5.9m (VIII-8) if we include the oval features. The average width of all the banks was 4.3m, or 3.9m if we exclude the oval features. The height ranged from only 0.1m (VIII-13;122) to 0.5m (VIII-1) or up to 0.6 if we include the oval features. The average height of all the banks was 0.33m, or 0.26m without the oval features. Two of the banks were not measured during the fieldwork, including a stone fence. In that case, the average width of 4.2m (2.1m for the stone fence) and height of 0.3m was used.

b. Cairns

There were 20 cairns in the area (VIII-1–VIII-20) with the calculated size from 2.75m (VIII-16) to 6.5m (VIII-1), or even up to 7.95m (VIII-11) when including the above mentioned oval features (Fig. 5.77). The average diameter including the above mentioned features was 5.2m or 4.5m when excluding them. The height of the cairns varied from 0.2m (VIII-2 and VIII-17) to 0.51m (VIII-19), while some of the oval features reached up to 0.6m. The average height of the cairns was 0.38m–0.4m, depending on whether the oval features were excluded or not.

Figure 5.77. Cairn VIII-5 on plot VIII-b (2021).

c. Possible graves

As mentioned above, four oval features were recorded that could represent stone graves. Three of them (VIII-4, VIII-6 and VIII-8) were northeast-southwest oriented and one (VIII-10) approximately north-south oriented. There was also a possible circular grave on plot VIII-b, close to the ones that were on the eastern border of area VI. Although it is possible that the oval features were graves, it is more likely they were short segments of banks.

Defining the plots in area VIII was complicated because mostly they were not rectangular fields with clearly defined borders. However, six, or possibly eight areas of land were distinguished that were seen as parts of agricultural land division (Appendix B9).

Six plots with the average size of 2,539,9m^2 were identified in the area. If we assume that plots VIII-b and VIII-d were divided into smaller ones, then we would have 8 plots with the average size 1,860.47m^2. There were large differences in sizes of the plots, the smallest one (VIII-f) measuring only 5,68.3m^2 and the biggest one (VIII-e) 4,195.8m^2.

Fields in area VIII were located on a naturally higher ground which lowered towards south-west. Banks and terraces were located on the side/edge of the natural ridge, showing how the natural landscape was used and changed in the course of land use strategies. The naturally higher ground with good visibility would have also been a potentially favourable place for the location of graves. 5 potential graves were recorded in the area but it remains highly hypothetical whether they actually were burial places or not.

Although area VIII was distinguished as a separate area, the plots show similarities with the ones in adjacent areas. The plots on the north-western part of the area could equally be connected with fields in area V, especially VIII-a but also VII-b (and especially VII-b2). The south-eastern plots VIII-e and VIII-d match with the size and orientation of fields in the western part of area VII (VII-e, VII-f and VII-g) which might show that they were part of the same field system. In the middle part of area VIII the distinguishing of the plots was difficult as the borders between the possible fields were not clearly marked. However, if we assume that areas defined as plots VIII-c and VIII-b (especially VIII-b3) were once more intact or that their marking in the landscape was not fully finished, they would match the approximate size and orientation of field system in area VI.

It can also be assumed that the plots with irregular structure and no clear borders, i.e. VIII-b that could have been even connected to VIII-d had a different function inside the field system, for example related to the access to the spring from plots VIII-b and VIII-c. The aforementioned area could have also possibly served as an area connected to the north-eastern part of area VII south-west of it which had similarly irregular layout. If we look at areas VII and VIII together, the only logical access road between those areas would have been, based on the current landscape situation, from plot VIII-d to plot VII-c where there was a gap of ca 17m between bank VIII-14 and cairn VII-3 in the junction of banks VII-1 andVII-2. The possible access was also where the terrace was not as steep and high as elsewhere and the natural ground was generally lower. The possible access would have also been connected with irregular plots VII-c and VII-a that were otherwise difficult to associate with other fields in area VII. It is possible that the option would also give some kind of explanation to the gate-like borders of plot VII-a.

5.7 Discussion and conclusions

The aim of the chapter was to study how the landscape on the hill of Salumägi was organised and what was the correlation between field systems and other factors (environmental and social). The archaeological features and types of field systems were taken as main reflections of the possible correlations and were the main target of study in the current chapter. The emphasis was on detecting how the different landscape elements were combined into and used within field systems, how the pattern or form of field systems reflected their function and the chronological sequence of the land use on the hill, and the relationship between land use patterns in different parts or the hill. Based on the results it was assessed how the locations and organisation of field systems were connected with landscape sustainability

At first an overview of environmental conditions and settlement history of the case study location were presented and the study methods explained. The chapter was divided into two large subjects: the analysis of the archaeological features on the hill and the study of field plots and the characteristics of field systems on the hill.

5.7.1 Archaeological features on the hill

The analysis of the archaeological features started with distinguishing the following features: the enclosure, field banks and stone fences (walls), clearance cairns, graves, platforms and pits. In addition, it was discussed how the natural features – the hill itself, raised areas on the hill and boulder fields – were used as part of land organisation.

The enclosure bank was not uniform and seven different segments were detected inside it, each having different characteristics, suggesting that it was not built at once but over a period of time. The different segments differed in terms of size, presence of stones and gaps and direction. It was confirmed that landscape elements pre-dating the bank, both natural and man-made, affected the building and appearance of the enclosure. It was visible from the way how the enclosure was separated from the boulder fields and how a possible stone grave was included into the enclosure. The primary hypothesis was that the enclosure pre-dated the field systems on the hill. It was visible from the way the banks started and radiated from the enclosure, although it remained unclear why some of the banks did not join up with the enclosure and there was a gap between the two. However, the enclosure was also included into the field system and served as a field bank or was used as a cattle enclosure. The gaps inside the enclosure bank might be related to the agricultural phase, although entrance had to be there during the first phase of its use as well.

The field banks showed a variety of types: there were long and well-established banks defining regular field systems and short segments that – sometimes in combination with cairns – also bordered plots. The reason behind the short banks might be related to the shorter time span of agricultural activities in areas where they prevailed (areas II, VII and VIII) but they can also reflect on different functions of the field systems, compared to that of the regularly laid fields.

For example they might have been primarily in use as pastures or hay-fields for which the clearly delimited field plots were not essential. It is also possible that they represent an underlying system that was destroyed during the later phases of clearance. One must also keep in mind that in addition to the boundaries made of stone, wooden fences around fields might have existed as well that are not preserved. The banks varied also from their width and height and there were banks inside of which cairns or possible graves were detected. The presence of cairns might be a sign of marking the location of the bank beforehand but the option that it is a sign of using the older landscape elements is equally possible – it was probably easier to make a bank to a place where there already were obstacles in the form of cairns or old graves.

The cairns were scattered all over the hill, except the boulder field in area IV and the stony area north-west of area VIII (marked as plot IV-h) which had only occasional cairns inside them. The analysis of cairns that are usually in archaeological literature interpreted merely as places where stones were collected from the fields without any other meaning than their location within a throwing radius attached to them showed a vast variety of different characteristics: the size of the cairns varied from 2–10m in diameter, there were elongated cairns, some were marked with larger stones in the middle while others had central hollow, some had defined edges suggesting they were deliberately built, not just thrown together. The morphological differences might be signs of different practices and functions attached to them. The larger cairns might show long term land use or they can be burial cairns. The distribution and positioning of the cairns shows that they were used as marking field boundaries in cases where they were located either in rows or as clusters at the edges of field plots. The distribution of the cairns might also indicate an earlier layer of land use on the hill.

In addition to banks and cairns, natural features were used as boundaries and were therefore included in the field systems in a wider sense of meaning. The natural landscape elements – the hill itself, raised areas on the hill and boulder fields – had been used in different manners, either as places at the edges of which stones were gathered, forming boundaries, or as places on top of which fields were made. Signs of terracing the slopes of the raised areas were also detected in areas VII and VIII.

Platforms were identified in at least four locations on the hill. They could have been possible building platforms, either for permanent, temporary, cult-related or storage buildings or places that had a more active role in the farming practices. For example, platform in area IV could have been a raised field that was made by filling the surface on top of the boulders in the corner of the boulder fields to increase the cultivatable land. Platforms that were located at the junctions of banks might have formed during the agricultural practices although they can also be remnants of earlier landscape elements.

Pits and segments of stone fences or walls were also recorded that were probably related to historical activities – stone walls used as fences around agricultural land similarly to the field banks; and pits related either to quarrying or military activities during the first half of the 20th century.

5.7.2 Contextual analysis of the field systems

Analysis of plots and field systems showed that there were differences in regularity of field systems in different parts of the hill. The whole area was divided into chunks of land – plots – that were defined either by boundaries or separated from each other in some other way. The plots were not necessarily cultivated fields but potential delimited plots of land with various functions that were included in the field systems. The field systems were most consistent and regular in the middle part of the hill (areas V and VI) where the main axes of the systems were defined by long continuous banks and the inner division into smaller plots was regularly organised. Long continuous or smaller intact banks bounding regular plots were also present in the western part of area III, eastern part of area IV and the north-western part of area VII but the appearance of the field system was less regular than in areas V and VI. The banks on the rest of the hill were more fragmentary and plots and the whole fields systems were harder to define. Here the role of natural features for separating or defining plots and influencing the layout of the field systems was mostly observable.

The landscape stratigraphy suggested different ways how the field systems and their chronology could be interpreted. The simplified chronological model for the landscape use is as follows:

- Pre-fields: the hill as a landmark, enclosure, graves and possibly also some of the platforms. These were landscape components pre-dating the agricultural phases represented by field systems. It might form a layer of ritual landscape. The hill as a landmark was given a meaning by building the enclosure and using it as a burial place for the dead. The hill as a burial place might be the first phase of land use, pre-dating the enclosure in case the hypothesis of the grave inside the enclosure is true. The enclosure and graves, at least some of them might have been in use at the same time. Platforms might have been related to the ritual use of the landscape in case they represent foundations of cult related buildings.

- Cairnfields might represent the first field system, although some of the cairns might belong to the pre-field period as graves, although it is possible that fields were located on the hill at the same time when the graves and enclosure were built. The way how cairns show as the oldest field layer is mostly by their location inside the banks.

- Regular fields. The establishment, organisation and maintenance of the regular field systems is related to questions of integrity and temporality of field systems. If all the field systems on the hill are taken as a coherent whole, then we can assume that the establishment of field systems first started in one location – core area – after which it gradually expanded.

The most obvious core area was the pronounced field system in area V where the east-west oriented banks formed the axis of the field system. Northern border was the boulder field which might have been the main natural feature conditioning the location of the field system. The long bank in the southern part of the area formed the southern border for the field system. Rather equally sized plots were constructed between the northern and southern borders. The field system might have extended further to the north, north-west and south-east although the plots are either not preserved in a clearly visible way or they represent the beginning of the expansion of the field system form the core and was not fully developed. Further expansion of the field system in area V can be seen toward south where regular plots in area VI were attached to the southern border of the core area. The long curvy bank (VI-3) served as the axis to these field systems while narrow, equally sized strips were built east- and westwards form it. Field system in area VI had a different orientation compared to that of area V, suggesting that there was a time span between the establishments of the fields. The north-western part of area VII with long north-south oriented banks seems to be next expansion in timeline. Again, the different orientation compared to field system in area VI suggests a different time of its construction. The fields further towards south-east in area VII have more fragmentary nature. It is possible that this is due to the shorter use of the landscape. A possible underlying or overlapping system can be seen in the south-eastern part of area VII: the short segments of east-west oriented banks were overlapped by two longer and parallel, north-south oriented banks. The latter might be considered as part of a cattle path. It is possible that area VIII on a higher ground represented an area that was primarily a pasture – as it was lacking a regular field system. In that case it is possible that the cattle path connects area VIII with lands further south-east on the hill where nowadays lies a flat modern field where field system is not preserved. The abundance of cairns in area VII might suggest an older underlying system of a cairnfield or refers to the use of the area mainly as a pasture.

Another possible core area might be the enclosure that formed the axis around which the field were later assembled. However, the amount of banks that radiate from it is rather small: only the long banks in the western part of area III, eastern part of area IV and eastern part of area II can be related with the enclosure as a field bank, in addition to the fact that the enclosure formed a boundary around fields in area II.

The temporal connections between the two possible core areas are unclear. The second core area might also be part of the expansion of the field system in area V, representing fields that were not in use for such a long time that it would have resulted in clearly developed field system or had a different function to the fields in core area – hayfields or pastures. In that way the enclosure bank can represent an enclosed area where cattle was kept.

It is also possible that there were several core areas, either separately or at one time and that all or most of the distinguished areas (II–VIII) served as core areas. Being a core area could have meant that each group of field had its own function during a certain period of time or that each group of field was used by different communities. The fact that two settlement sites have been detected in the area surrounding the hill – one in north-west of the hill and the other in south-east of the hill – might suggest that at least two different communities used the hill. Settlement sites could have also been on top of the hill, as suggested by the platforms, which means that the amount of communities involved could have been more than two. However, we do not know if the settlement sites were in use at the same time nor do we have sufficient absolute chronology of the field systems, therefore the simultaneous use of the field systems remains hypothetical.

Despite of the number of possible communities – households, single farmsteads or villages – that used the hill for ritual, burial and agricultural purposes at a certain time period, the amount of diverse built structures on the hill, and the different landscape use patterns suggest that the landscape use practices probably had equally components of individual and communal landscape management.

The division of land into long strips in the north-western part of area III and western part of area VII, and into regular quadrangular plots in areas V and VI could be signs of communal land division. Fields with rather equally divided strips and quadrangular plots with different forms, shapes and level of regularity were a common land use for in the historical periods in village communities (Troska 1987). Excavation results have showed that similar communal land use strategies started already in the Middle Iron Age in Estonia (Lang 2007a:307: Lang 2000a:238–241) but parallels have been also found in Sweden (Widgren 1990).

In addition to the chronological stratigraphy, the differences in forms of the field systems might also be signs of multiple agricultural and social functions of the hill. The agricultural functions entailed and combined cultivation and cattle-breeding. The relative importance of the latter in agricultural strategies has been brought out in historical context but long-term cattle-raising practices contributed to the development of alvars and semi-natural communities which are numerous in western Estonia. Cattle-breeding also included land that was needed for hay cultivation. While the possibilities of crop growing were limited in areas where lands were low-lying and wet, which also could have been an obstacle for using these areas as meadows and pastures, the hill served as a perfect place for all these activities. All the different agricultural functions might have changed over time but the hill might have served all the different functions at one time as well. The hill has been used for agricultural purposes during historical time when it was part of the pastoral manor, in the beginning of the 20th century and up to recent times when potatoes were grown on small plots and as indicated by the remains of modern barbwire fences, also animals were kept on the hill. The hill probably also had other practical functions related to possible limestone mining and lime burning as indicated by the pits on the south-western part of the hill.

The long-term and multifunctional use of the hill is also related to the question of how have the different communities and people valued the hill as a whole. In addition to serving a purely functional need, there are also clear markers that the hill has also been – and is up until today –

a significant place for non-practical reasons, although the functional and non-functional or practical and impractical aspects probably were closely related in the past. The spiritual or ritual importance of the hill is connected with the enclosure and the use of hill as a burial place. Both had a strong communal aspect – the building of the enclosure required a considerable work effort and building a grave was not a one-man-job either. The use of the enclosure for different events and burial practices brought people together and as such, the hill was a communal meeting place for people. While on one hand the agricultural activities on the hill were hard work in order to produce food and survive, the activities also made people to gather on a regular basis and made them engage and communicate. The sacred spring is also part of the impractical value of hill but at the same time sacred places were used to ´gain` something – good health, good eye-sight, happiness etc. –, i.e. in a practical manner which also shows the intertwining of tangible and immaterial worlds. The hill is a popular gathering place up until today, for example on Midsummer Day which is traditionally celebrated all over Estonia.

In addition to the different landscape elements on the hill, the hill itself carries a meaning. It is an outstanding landscape element in a low-lying and flat landscape that has stood there for millennia as a constant structure while the lands around it have changed. The stony landscape elements, both man-made and natural, were part of it and as has turned out, have remained equally constant and permanent.

Finally, the following aspects related to landscape sustainability on the hill of Salumägi can be pointed out based on the survey results: If we take into consideration the ways the different landscape features, both natural and man-made, were used as parts of field systems, the general landscape use can be seen as sustainable. The natural features were incorporated into field systems. The old landscape elements were used in defining the field systems. At the same time we can also see how the landscape could have used in an opposite manner. For example, if the option was true, that the landscape layer pre-dating the fields was based on religious or sacred practices, then it is possible that the fields were constructed deliberately on top of it. It could have been an ideological act of destroying the old layer in which case we can assume that the beginning of the agricultural use on the hill is connected with general political and ideological changes in the society. Another option is that the old sacred place was used for the location of the fields to give the place a positive meaning. The first option cannot be considered as sustainable use of landscape while the other can so.

6 Case study: the results of the excavations on the hill of Salumägi at Salevere

6.1 Introduction

The archaeological excavations on the hill of Salumägi at Salevere were carried out, under the direction of the author, in 2008–2010[46]. During these years, seven trenches with the total area of c. $100m^2$ were cut through the field banks, cairns and the enclosure bank.

This chapter presents a detailed overview of the structure of the excavated archaeological features and the material obtained from the trenches. The aim of the excavations chapter is to compliment the case study with more detail regarding the signs of sustainable use and management and organisation of the landscape on the hill of Salumägi. The previous chapter mainly addressed the specific location of the hill and especially the organisation and type of the field systems in connection with various landscape elements and brought forward ideas behind differences in form, suggesting different functions, stratigraphic chronology and differences in the time span when the different parts of the hill were used. In the current chapter I will try to explore in detail how the features were built (i.e. their structure) and what supporting evidence does archaeological material provide about the age and function of the field systems.

Firstly, an overview of the excavation methods will be given, followed by the overview of the excavated trenches and a general summary of the results of the analysis of archaeological material. After that a chronological analysis of the human use of the hill throughout the time is given, based on the results of the excavation.

6.2 Study methods

The archaeological excavations started in 2008, before the survey and mapping of the hill was completed. Prior to the excavations, only the south-western part of the hill and the features in the immediate surrounding of the enclosure had been mapped. It was decided to locate the trenches in the mapped area to be as sure as possible about the locational context of the

[46] Estonian National Heritage Board permit numbers 4096, 5333 and 6459.

archaeological features that were excavated. The excavations took place in three consecutive summers in 2008–2010 during which seven trenches were excavated (Table 6.1, Fig. 6.2). Three of the trenches were made through field banks, two to investigate cairns and two through the enclosure bank.

The excavations also served as a training base for MA students at the University of Tartu, under the course Management of Archaeological Field-Work. Each trench, except for the main trench III was led by a MA student, under the supervision of the author. The students had to follow the set guidelines of the excavation, recording and description methods and they were also required to produce the initial excavation report along with the drawings and figures. Because at the same time they were given rather large amount of freedom to practice individual leading of excavations, it turned out afterwards that the individual styles of the students had an impact on the level of detail in the description of the features and contexts and also on the way some of the finds were recorded. This made the overall summarising, interpretation and unifying of the material somewhat challenging.

The character of the archaeological features was similar in most of the trenches – the field banks, enclosure and cairns all consisted of stones. Only one of the excavated banks was largely formed by the accumulation of sediment in addition to the stones. Most of the stones used for cairns, banks and the enclosure were limestone which occurs naturally in the soil. The trenches were excavated perpendicular to the axes of field banks and the enclosure. Cairns were opened either to their full extent (Trench V) or partly (Trench VII). The location and sometimes the extent of the trenches was affected by the fact that the hill is part of a national park and therefore there were limitations to the amount of trees and other vegetation that could be removed to enable the excavations.

To facilitate the recording and understanding of the features, arbitrary horizontal stone layers were distinguished, as it has been common in excavating field systems in Estonian archaeological tradition. Each layer consisted of a more or less intact layer of stones and soil above and between them. The natural bedrock was marked as the last layer.

Ideally, the layers that form a compact unit of stones should be clearly separated with a layer of soil. In that case we could assume that the varying stone and soil layers form separate contexts and can be separately dated. However, it is usually not that simple when it comes to field cairns and banks where stones are – at least to an extent – piled up rather randomly instead of being placed in an orderly manner. The same issue was faced at Salevere. The distinguishing of intact stone layers was problematic because there were differences in the occurrence and thickness of the soil between the stones and hence the compactness of stone layers. In general, the stones and soil in one trench were mixed which above all implicates that all the distinguished layers as a whole show the overall thickness of the stone heap (i.e. how much stones were collected from the field) in the specific trench. The overall thickness of the stone layers might partly be connected with the length of time the field was used but other factors must be considered as well, for example the natural occurrence of stones in the soil, the specific agricultural use of the field in combination with the necessity to clear the stones in the first place.

The recorded cross-sections of the trenches through banks and cairns helped to trace the stratigraphy to some extent. In some cases the different colours of soil layers were visible that were hard to notice when excavating horizontally. However, the possible alternation of stone and soil layers was also difficult to see. Even more, it was often different in the middle or on top of the feature and its sides or altogether in different parts of the feature. The stratigraphy of the enclosure was somewhat different and here the different building phases and contexts were better traceable from the horizontal layers than from the thin cultural layer in cross-sections.

The presence of a distinct soil layer could be seen as a sign of a phase of the accumulation of soil and other organic material before the next stone layer was formed. As such, each stone layer can be seen as a separate possible context or event. The length of time for the formation of soil layers between stones could have been very different, ranging from one season to several years and in this case we can talk about multi-temporal features. However, the absence of clearly visible intact soil layer does not necessarily mean that the formation of these kind of stone layers took place at once because of the different variables affecting soil formation and accumulation processes (e.g. the soil and organic material could have moved downwards, into the gaps between stones etc.). Even the presence of a clear soil layer between the stones does not mean that there was a considerable time length when it was formed but instead it could have been thrown in the bank or field cairn together with the stones. For these considerations it was decided to record all the visible stone layers, irrespective of the presence of a clearly distinguishable soil layer to avoid destroying potential information.

Therefore it must be emphasised that although the different layers might represent separate contexts, they were, above all arbitrary measures for the recording of the features. The thickness of the stone cover that was thrown into the field banks and cairns at once was probably very varied and it is extremely difficult to see whether the features formed one context all the way through or there were several phases and events related to it. Even within the distinguished layers there were areas of less stones or holes and larger stones that reached through several layers. These stones were left in place after clearing out the stones of the already recorded layer as their removal would have disturbed the next layer. Not removing the larger stones after finishing a certain stone layer served another purpose – they were left in place to track the possible structures and contexts in the trench. In some cases (e.g. trenches II and III), when separate contexts or structures were present, they were excavated and recorded at once, disregarding the arbitrary horizontal layers.

The turf cover was removed by hand, with spades. Each stone layer was cleared out with shovels and brushes and recorded by describing and measuring the general nature and details of possible structures. Photographs were taken of each layer and in trench III the composite plan of each layer was drawn on the scale of 1:25. Also the height of the layer was measured, either in relation to the surrounding ground level or absolute height from the sea level when total station was used. After the recording of a layer, most of the visible stones were removed and the stones forming the next layer were cleared out.

Excavation was carried out until the natural ground was reached. For the most part it was the limestone bedrock but in a couple of cases (Trenches I, II and IV) the excavations finished up until the yellowish boulder clay or till that covered the bedrock. Finally, profile drawings (vertical sections) of the trenches were drawn. It was only in the case of a clearance cairn in trench V where a good profile of the feature was not recorded because the cairn was excavated more or less in its full size. It would have been more justified to excavate the feature in two halves to get a proper profile view of the cairn. After the excavations were finished, most of the trenches were refilled with stones and soil and the turfs were put back on the surface. However, trench III and VI were left open, with the consensus with the National Park management, to let the visitors see the nature of the bedrock. Only its profile sections were secured with stones to avoid them to collapse (Fig. 6.1).

Figure 6.1. The natural bedrock and secured profiles of Trench III after the excavations in 2012. View from NE.

The archaeological finds consisted of pottery, animal bone fragments, wood charcoal and occasional fragments of metal artefacts. The location of finds in trenches III, VI and VII was recorded with a total station Trimble 3600 GDM (using the absolute coordinates and height above mean sea level) and in trenches I, II, IV and V by rectangular measurements of coordinates with measuring tape from x and y axis that were later connected and re-calculated with the absolute coordinates. The height of the finds and the layers was measured with total station when it was used or with a surveyor`s level, choosing a point for zero measurements near the trench, usually a distinctive stone. The absolute coordinates of these initial zero-points were also measured afterwards with the total station and re-calculated to absolute heights above the sea level. The soil that was cleared out between the stones was dry-sieved and the locations of the finds from sieving are recorded with less precision, 0.5–1m precision range both horizontally and vertically.

The aim of the precise recording of finds was to record the finds and structures as precisely and *in situ* as possible. In most instances single finds were recorded but when there were more than one animal bone fragment or several pieces of pottery within ca. 5 cm radius, they were recorded under one main number as an assemblage. Because the individual pottery fragment were not counted or weighed during the pottery analysis and only the charcoal fragments that were analysed (appendix C), the exact number of these finds is not known. A detailed and precise amount of animal bone fragments is known because it was part of the animal bone analysis (appendix D). To overcome the inaccuracy and assess the quantity of different finds material in the trenches, the average recorded assemblage amount of charcoal and pottery per m^2 was calculated and used in comparing the amount of material from different trenches. While not a perfect method, it allowed to bring out basic patterns in the distribution of archaeological material on the hill (see also section 6.4 and Table 6.2).

The archaeological drawings were digitised after the excavations in AutoCAD. The distribution plans of the archaeological finds were made in ArcGIS. The analysis and determining of the species of the animal bones was conducted by Eve Rannamäe (mammals) and Freydis Ehrlich (birds) from the University of Tartu (appendix D). Wood charcoal was analysed by Ellen Simmons from the University of Sheffield (appendix C). The metal artefacts were conserved by Andres Vindi from the University of Tartu. Pottery was assessed and notes about typology and possible age were made with the help of Prof. Valter Lang from the University of Tartu. All the finds are kept at the University of Tartu.

22 samples of charcoal or animal bone were radiocarbon dated (AMS). Two samples from trenches I and II were dated in 2009 in the Dating Laboratory of the University of Helsinki. In 2011 four samples from trenches III, V and VII were dated in Beta Analytic Inc. Radiocarbon Dating Lab. In 2012 eight samples from trenches II–VI were dated in Poznań Radiocarbon Laboratory. In 2013 further three samples from trenches II and III were radiocarbon dated in Poznań and four additional samples from trench III were dated in Beta Analytic Inc. All the datings were financed by Institute of History and Archaeology at the University of Tartu.

The location of the samples for radiocarbon dating was chosen to represent the possible context and different layers of the excavated features. At least one of the samples was chosen from the bottom layer of the archaeological feature, between the lowermost stones and in the connection point of the stones and the natural bedrock or soil under it to show the age when the bank or cairn was initially erected. Most of the trenches were dated based on at least two samples but for trenches I, VI and VII only one charcoal sample from the bottom layer (under or between the lowermost stones) was dated. The largest number of samples were dated from trench III. Here, samples from both sides of the topmost stone layers covering the enclosure bank were dated, as well as from the middle part of the enclosure and the charred timber that was part of the inner structure of the enclosure. Four samples from the field bank in trench III were dated and one sample from the area between the bank and the enclosure.

The resulting 22 radiocarbon dates can be considered as a representative number to make conclusions about the age of the enclosure and different agricultural phases on the hill. However, there are deficiencies in the dataset that affect the interpretation of the dates. Firstly, as mentioned earlier, the dates concentrate only in the areas that were mapped prior to the excavations, mostly around the enclosure. Therefore the absolute chronology of all the field systems on the hill still remains unanswered. Secondly, the wood charcoal was not analysed prior to choosing the samples for radiocarbon dating, therefore for most of the samples the species and parts of trees from where the charcoal originates, is not known. It was only possible to determine one sample (Salevere II:19) that was returned after the radiocarbon dating whereas for the other samples it remains unknown. Thirdly, the samples were recorded during the excavations from horizontal arbitrary layers and it was difficult to connect the samples with more specific vertical contexts afterwards; for the samples where the specific context within the stone layer was not clear during the excavations, it would have been more useful to the samples from the cross sections of the excavated features.

Despite the shortages in the excavation methods, the archaeological material as a whole, including the radiocarbon dates gave answers to the initial purpose of the excavations – it was sufficient to date the enclosure bank and show the different agricultural phases on the hill. In addition, it also showed signs of the use of the hill prior to its agricultural use. The number of radiocarbon dates is high, considering the Estonian context of excavating field systems where usually the number of radiocarbon dates is much fewer. It also has to be noted that the analysis of wood charcoal (before or after choosing the samples for dating) is not a common practice.

6.3 Excavation results

In this section an overview of the location and main characteristics of the archaeological features that were investigated with the excavation trenches will be given. Not all the areas (I-VIII) that were distinguished on the hill were studied with excavation methods. In addition to the enclosure, the trenches were made in area II where a field bank and a clearance cairn were excavated, in area III where two field banks and a cairn were investigated, and area IV where a field bank was excavated. The location of the trenches is presented in Fig. 6.2.

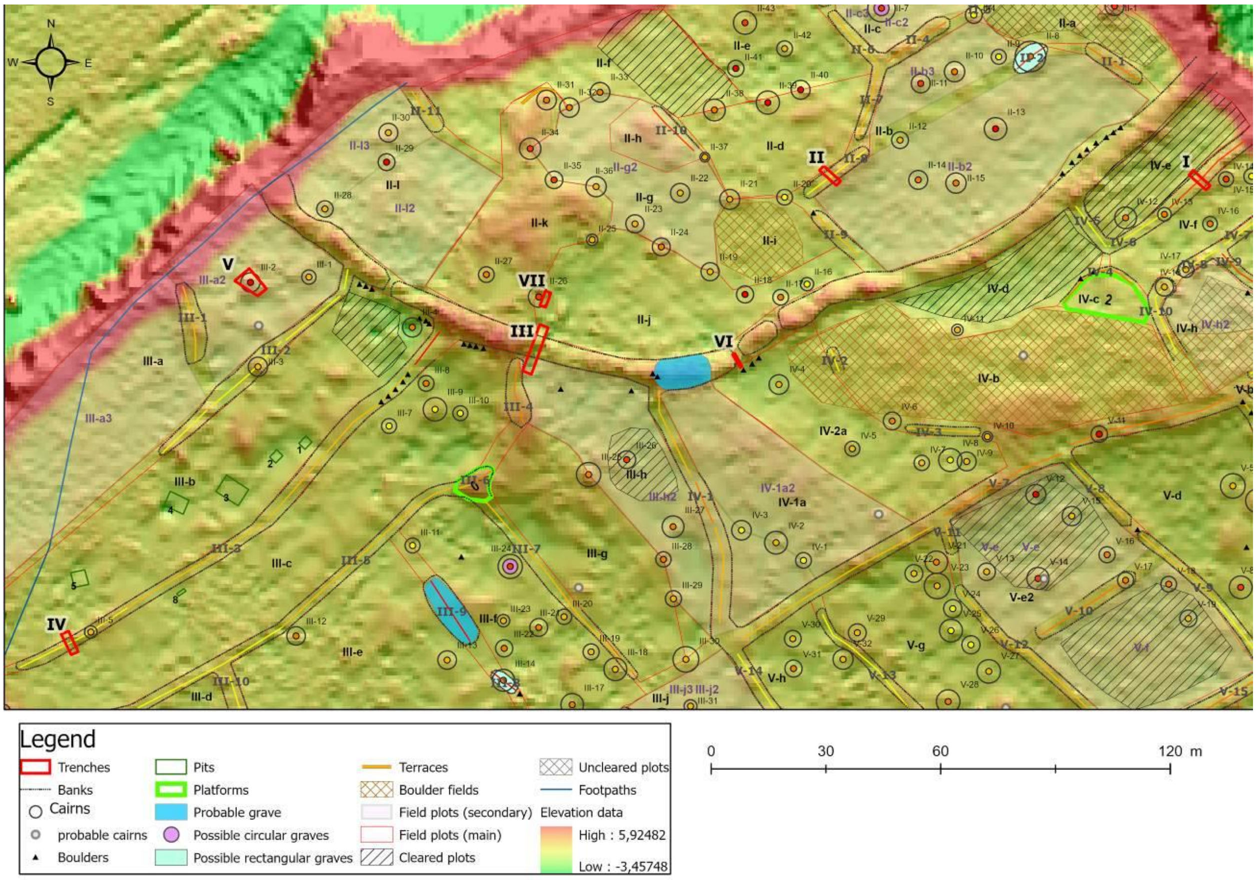


Figure 6.2. Trenches I-VII on the hill.

Most of the trenches were located to investigate just one object while trench III encompassed two, the enclosure and an edge of a field bank close to it. Two trenches (III and VI) were made through the enclosure bank. Field banks were excavated in four places – trenches I, II, IV and part of trench III. Trenches I – III were situated in the close vicinity of the enclosure and trench IV ca 130m south-west from it, in area III. Two clearance cairns were excavated on the hill – a cairn (trench VII) close to the enclosure bank inside the enclosed area (II) and a large cairn (trench V) outside the enclosed area (III).

The summarised overview of the excavated archaeological features and excavation results is presented in Table 6.1.

Table 6.1. Overview of the excavated trenches.

Trench no.	Year of excavation	Location	Size	Archaeological material	Radiocarbon date (BP)	
I	2008	**Area IV**, field bank IV-6.	$9m^2$	Pottery, animal bones, charcoal	**Salevere I:20** (charcoal)	1315±35
II	2008	**Area II**, bank II-8.	$8.4m^2$	Pottery, animal bones, charcoal	**Salevere II:19** (charcoal (ash))	3130±40
					Salevere II:5 (charcoal)	620±30
					Salevere II:26 (animal bone-goat/sheep)	1205±30
III	2009–2010	Enclosure bank (**segment I-2**) and field bank III-4 **in area III**, between plots III-d and III-h	$32.5m^2$	Pottery, animal bones, charcoal	**Salevere III:49** (animal bone-bovine; enclosure)	260±30
					Salevere III:155a (animal bone-horse; field bank)	1215±30
					Salevere III:155b (animal bone-pig; field bank)	400±30
					Salevere III:117 (charcoal; field bank)	1650±40
					Salevere III:559 (charcoal; enclosure)	2160±40
					Salevere III:174 (charcoal, enclosure)	125±30
					Salevere III:238 (charcoal, enclosure)	285±30
					Salevere III:86 (charcoal, field bank)	820±30

					Salevere III:458 (bone collagen (pike), enclosure)	3940±30
					Salevere III:464a (bone collagen (pig), enclosure)	1070±30
					Salevere III:503 (plant material, enclosure)	2120±30
					Salevere III:562 (charred material, enclosure)	2130±30
IV	2009	**Area III** (western part), bank III-3 between plots III-c and III-d	12m^2	Pieces of metal artefacts (2), animal bones, charcoal	**Salevere IV:25** (charcoal)	260±30
					Salevere IV:13 (charcoal)	225±30
V	2009	**Area III** (north-western part), cairn III-2 on plot III-a	27.5m^2	Animal bones, charcoal, pottery, two pieces of metal artefacts (1 nail)	**Salevere V:81** (charcoal)	800±40
					Salevere V:49 (charcoal)	755±30
VI	2009	Enclosure bank (**gap between sections I-3 and I-4**)	2.3m^2	Animal bones, charcoal	**Salevere VI:23** (charcoal)	1250±30
VII	2010	**Area II**, cairn II-26 in the enclosed area, between plots II-i and II-j (ridge)	6 m^2	Animal bones, charcoal, pottery	**Salevere VII:220** (charcoal)	890±40

6.3.1 Enclosure bank

Two trenches were made through the enclosure bank: trenches III and VI. Trench III was the main excavation plot to study the structure and age of the enclosure. The location was chosen for the following reasons: firstly, the enclosure was quite high and well pronounced there, with the average height between 0.7–1m from the ground and width of ca. 6.4m; secondly, because there was a field bank attached or close to its outer side which would allow to study the connection between the two features; and thirdly because the area was cleared of larger trees and vegetation and was therefore easily accessible. The aim of trench VI was to investigate a narrow gap through the enclosure plot to see if it was related to the enclosure or field systems.

Trench III provided a cross section through the enclosure to study its structure, search for possible features within the enclosure, get material for reliable dating of the feature, and investigate the relationship between the enclosure and field systems. It was located on the western half of the enclosure, 65.2m along section I-2 (Fig. 6.2). The location of the trench seemed to represent a "typical" part of the enclosure where it was not too high or there were no gaps in it (Fig. 6.3). The trench measured 2.5 x 13 m (32.5 m^2) and its longer side was oriented from the north-east to the south-west. In the south-eastern part the trench encompassed part of a field bank no. III-4 (see 6.3.2).

Figure 6.3. Location of trench III in 2021, view from E.

After the removal of the turf cover and soil immediately beneath it, a layer of stones covering the enclosure was revealed. The stones were irregularly placed, mostly limestones of generally 10cm in diameter. The higher part of the enclosure, including the sloping edges was 7–8m wide.

The core area of the enclosure where the top layer was at even height level measured ca 3.6–4m (Fig. 6.4).

Figure 6.4. The upper stone layer in trench III, view from SW.

The structure of the enclosure bank became visible after the first layers of smaller stones and soil between them were removed (Fig. 6.5). The outer edge of the enclosure was marked with horizontally positioned limestone slabs while the inner edge was less pronounced and intact. The width of the enclosure bank was ca. 4m. Inside the wall, larger pieces of charred timber became visible that were probably part of the wooden structure inside the wall. After clearing out the layer of burned timber, it became evident that the area with timber was ca 1.6m wide and the timbers were surrounded by almost vertical upright limestones as if they had been initially erected and secured with the stones. The stones and the soil showed heavy signs of burning. The area between the timbers and the outer and inner walls of the enclosure was filled with medium-sized stones, gravel and light yellowish soil. The timber structure had been built on a layer of smaller stones, pebbles and soil, under which the natural bedrock was reached.

Figure 6.5. The structure of the enclosure bank after the removal on smaller stones and soil from the top layers. View from SE.

The yellow tags mark the locations of the charred timber.

The exact nature of the timber structure remained unclear. The size and the direction of the charred timbers was difficult to distinguish and even the separation of different timbers was a challenge because of the poor preservation of the material. The timbers were preserved only partially and in some cases only patches of charcoal or very dark soil was visible. The size of the more intact wooden remains was 20-40cm in length and ca 10cm in thickness (Fig.6.6). In cases where their orientation was observable it seemed that the majority were oriented more or less along the longer size of the trench and a lesser amount were in the perpendicular position to them. However, in most cases, their orientation remained unclear.

Three radiocarbon dates of the wood (Table 6.3, Salevere III:559; III:562; III:503) produced the following results: 2160±40 BP, or 347–174 cal BC (2σ); 2130±30 BP, or 200–116 cal BC (2σ); 2120±30 BP, or 193–111 cal BC (2σ). It dates the enclosure to the 4th century BC–2nd century BC (Pre-Roman Iron Age). There were no structures that could be related to the enclosure on the inner side of the trench.

Figure 6.6. Charred timber inside the enclosure bank, view from SE.

Between the stones and soil of the upper layers there had been numerous fragments of animal bones and pottery while inside the enclosure structure, only occasional animal bones occurred and there was no pottery (Fig. 6.7). One of the animal bones (a mandible of a pike) under the timber layer was dated to the 3940±30 BP, or 2566–2305 cal BC (2σ) (Table 6.3, III:458). It is remarkably older than the timber structure and the date indicates the earliest layer of human activity on the hill. The problems with the date and details of the earliest chronological phase on the hill will be dealt with in 6.5.

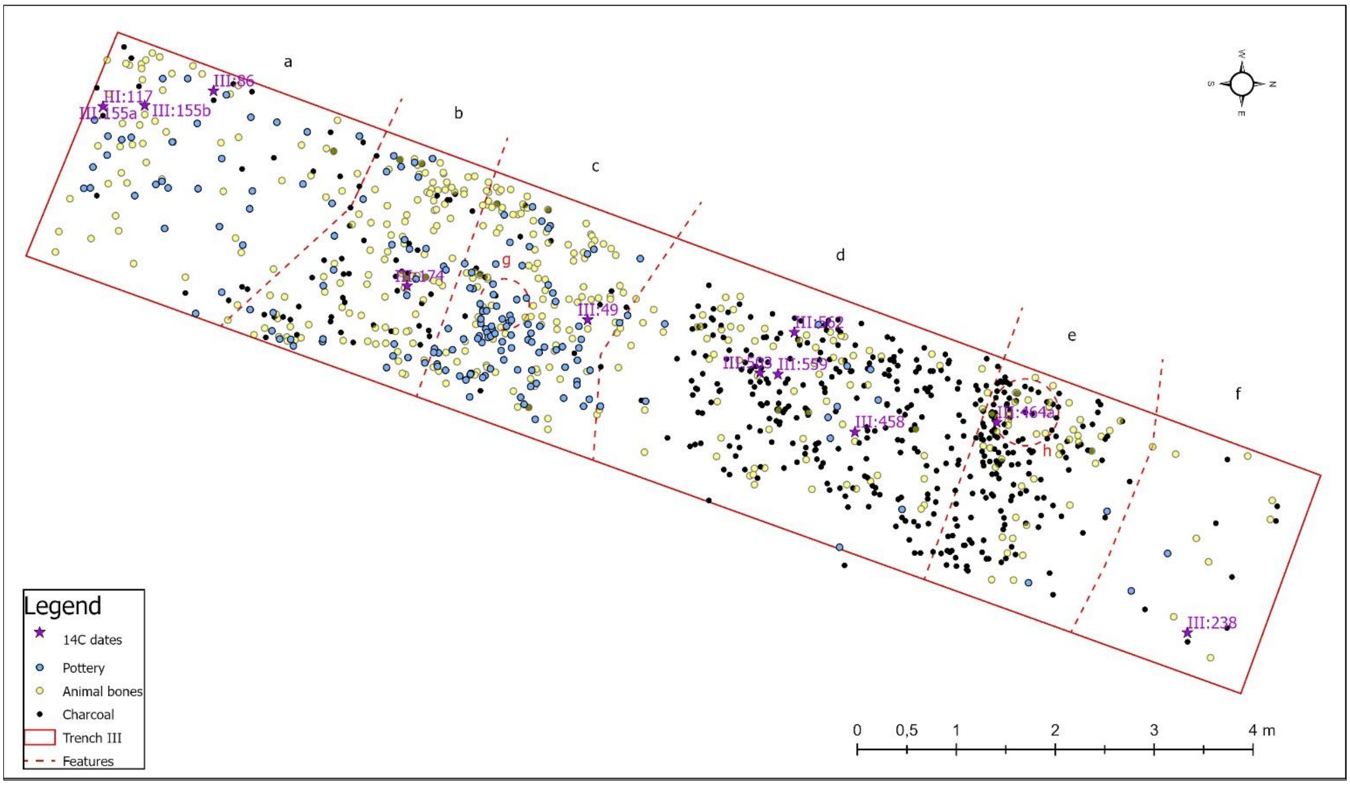


Figure 6.7. Distribution of finds and 14C dates in trench III.

Detected features: a) field bank; b) area between the field bank and the stones covering the outer edge of the enclosure bank; c) stone cover on the outer side of the enclosure; d) the core area of the enclosure bank; e) stone cover on the inner side of the enclosure; f) field plot II-j; g) cluster of pot-sherds; h) fireplace.

Some of the stones of the upper stone layers covering the enclosure might be part of the collapsed wall. However, based on the radiocarbon dates and the distribution of finds it turned out that the upper stone layers covering the enclosure bank were connected with the use of the enclosure as a field bank during the cultivation phases on the hill and will be summarised in 6.3.2.

Trench VI was made ca 50m eastwards from trench III, between sections I-3 and I-4. The reason why the trench was made here was that the narrow gap (the measured width prior to excavations was 2m) between two sections of the enclosure gave ground to the assumption that there might have been a gate or an entrance between the enclosed and unenclosed areas, i.e a gateway (Fig. 6.7). The width of the gap prior to the excavations was 2m. A second similar gap, although slightly narrower (ca 1.5m) was located 11m north-east of it. Plot II-i was located north-east from the trench, inside the enclosed area and to the south there was plot IV-a outside the enclosed area. The trench was in the vicinity of the boulder field (IV-b) that reached south-east and east of the trench (Fig. 6.2). The boulder field was situated ca. 10m from the trench. On the north-eastern side of the trench, there were ca 3 boulders visible while the south-western part of the trench was considerably lower. The boulders were visible before the excavations and they reached further down, almost until the excavated bottom level of the trench. The size of the trench was 2.3m^2 and it was of irregular shape, measuring 4 x 0.72 x 0.45m and oriented towards NW-SE axis.

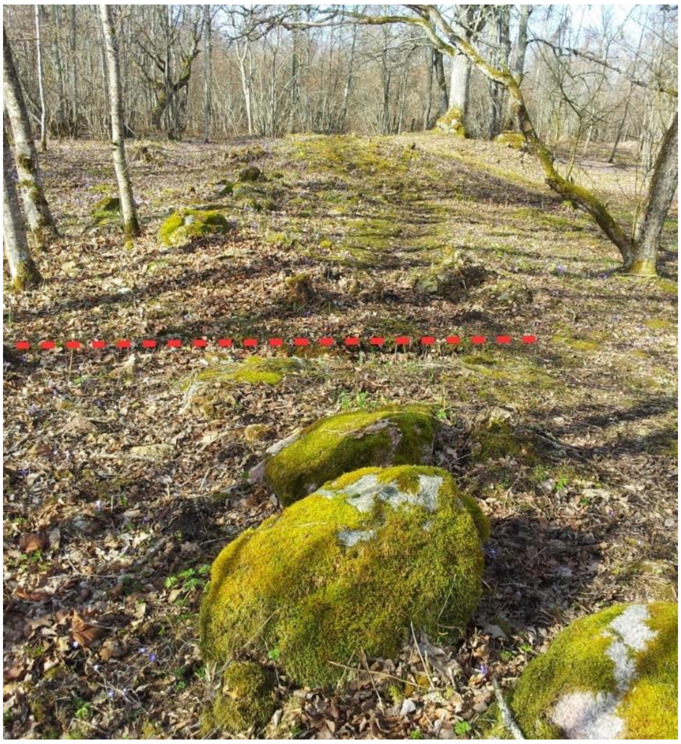


Figure 6.8. Location of trench VI (marked with red dashed line) in 2014, view from NE.

The finds consisted of only seven fragments of animal bones and there was no pottery. Charcoal was mostly revealed from the soil between the stones of what seemed to be the core part of the enclosure. A piece of charcoal under the stone layers (Fig. 6.9) was radiocarbon dated to 1250±30 BP, or cal AD 694–774 (2σ) (Table 6.3, VI:23).

The date coincides with the agricultural phases on the hill. The size of the trench was small and the natural bedrock was not reached. It is not clear if the gap was made already during the enclosure phase or it was dug into the wall when the area was used as a field to provide better access. However, considering from the irregular stone layer inside the trench, it seems that the gap was at one point filled with stones cleared from the fields. For better understanding if the gap was there since the enclosure, a wider area should have opened.

Figure 6.9. The bottom layer excavated in trench VI, view from NW.

The location of the 14C sample is marked with a purple star.

In summary, the excavations of the main trench (III) through the enclosure showed the inner structure of the enclosure bank – it consisted of a sharp edge on the outer side with signs of wooden structure on the inside. The inner edge of the enclosure bank was not clearly visible. The enclosure bank was later used as a field bank as was shown from the upper layers that consisted of stones cleared from the fields. The exact nature of the gap in trench VI remained somewhat unclear but the radiocarbon date shows the use of the area during the agricultural use of the hill.

6.3.2 *Field banks*

Field banks were excavated in four locations in areas II, III and IV. Trenches I and II were made to either sides of the enclosure bank: the enclosed area (trench I) and the area outside it (trench II). The third trench (III) was made mainly to investigate the enclosure bank but it also included a small section of a crosswise field bank. Trench V was made further to the south-west of the enclosure. Additionally, the enclosure bank was used as a field bank as was shown in trenches III and VI.

Trench I was made crosswise through a field bank IV-6 in the north-eastern part of the hill (area IV) outside the enclosed area (Fig. 6.2). The 45m long and 2–4.5m wide bank was orientated from north-east to south-west and it ran parallel to the enclosure that was located 17m south-east of it. Platform 1 in area IV was located ca. 25m south-west of the trench. The south-western part of the bank was rather low, with the average height of only 0.6m while the north-eastern part was higher, ca 0.4m. The trench was made in the higher part of the bank. The bank separated field plots IV-e and IV-f. The plot IV-e (695m^2) between the bank and the enclosure was very even and cleared of stones while the surface of plot IV-f (672m^2) south-east of the bank was more uneven. The bank ran towards the edge of the cliff and the location of the trench was ca 32m from it. The trench measured 1.5 x 6m. It was located in a densely forested area and there were trees and bushes growing on the trench prior to excavations (Fig. 6.10).

Figure 6.10. Location of Trench I in 2021, view from NW. The axis of the bank is marked with a dashed line.

The bank consisted predominantly of stones and was rather high, reaching 40–60cm from the bedrock while the extent of the stone cover was 400–436cm (Fig. 6.11, upper image). Altogether 18 numbers of pot-sherds, 14 fragments of animal bones and 21 numbers of charcoal were found, predominantly between and under the stones of the bank. A sample of charcoal (Salevere I-20) from the soil underneath the south-eastern side of the bank (Fig. 6.11, lower image) was radiocarbon dated to the 1315±35 BP, or cal. AD 661–690 (2σ) (Table 6.3, I:20).

Figure 6.11. The upper stone cover of the bank in trench I (upper image) and the layer of stones and soil on top of the natural bedrock (lower image), view from SW.

The location of the 14C sample is marked with a purple star.

Trench II was made through a field bank II-8 in the middle part of the enclosed area (II) (Fig. 6.2). The bank was located between plots II-b (3060m^2) in its south-eastern side and II-d (2192m^2) or II-d2 (909m^2) in its north-western side. The bank was oriented from south-west to north-east and had the length of 19m. The average width of the bank was 3.55m and height 0.14m, although it appeared higher in the landscape. The field system in area II was rather scattered and did not always form distinct rectangular plots that were bordered with banks from each side. The bank that was chosen for the location of the trench was one of the clearly visible ones and the field plot II-b was also clearly distinguishable and bordered with banks and the enclosure from most of its sides. The bank ran more or less parallel with the enclosure and in the location of the trench was located 33m north-west of it. The trench measured 1.4 x 6m and it was located in a forested area (Fig. 6.12).

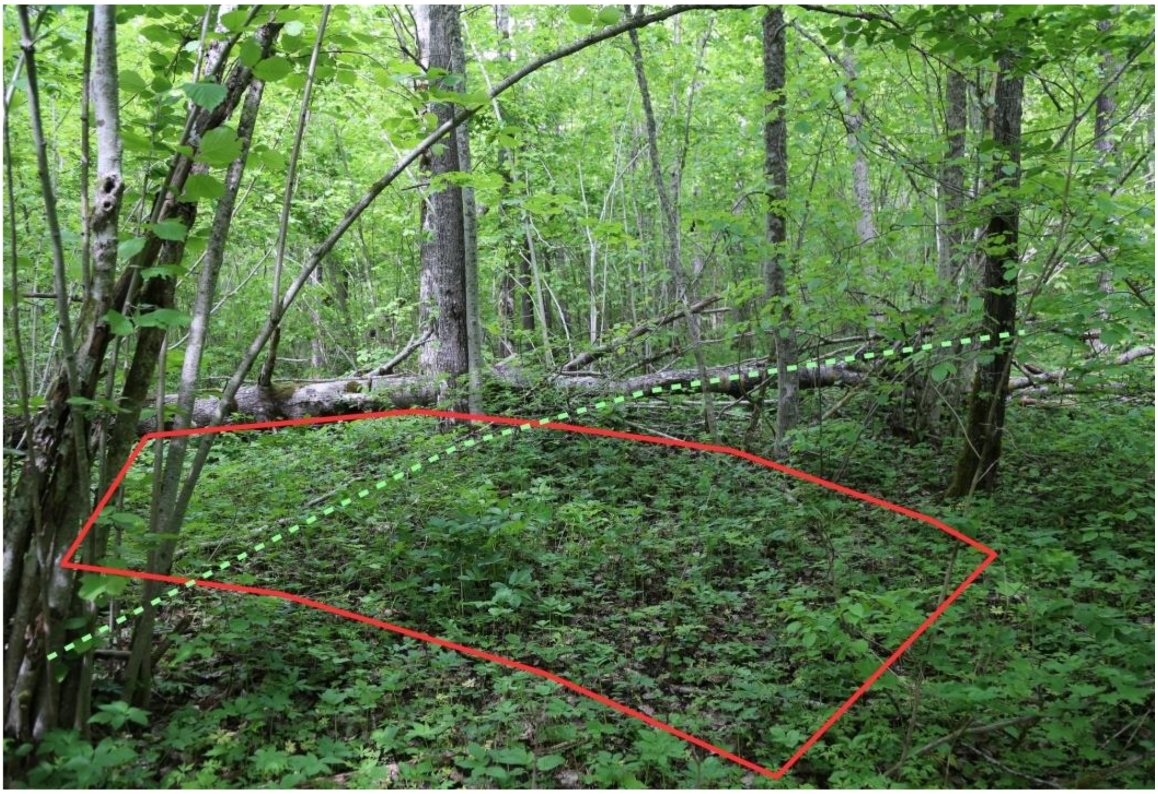


Figure 6.12. Location of Trench II /marked with red polygon) in 2021, view from SW. The axis of the bank is marked with a dashed line.

The bank consisted mostly of limestone slabs with a diameter of 20cm but there were also bigger granite and limestones, with the diameter of 30–40cm. The uppermost stone-layer was covered with 10cm of soil. The width of the bank measured during the excavations was 300–380 cm and the thickness of the stone cover 40cm (Fig. 6.13).

Figure 6.13. The upper stone layer of field bank in trench II, view from SW.

Under the stones, in the centre of the bank, there was 30cm wide layer of sparsely situated but strongly burnt stones. The soil between them was orange and there were small pieces of charcoal in it (Fig. 6.14). A sample of a fragment of ash charcoal for radiocarbon dating was taken from here, dated to the 3130±40 BP, or cal. 1432–1398 cal. BC (2σ) (Table 6.3, II:19). The remarkably old date will be discussed in more detail in 6.5.

Figure 6.14. Location of the sample II:19, view from SW.

In the north-western part of the excavation plot, there was a pit filled with dark soil that extended partly under the bank (Fig. 6.15). The topmost part of it was measured by 1m to up to 0,7m and its bottom was ca 20cm below the natural ground surface. The soil contained occasional limestone slabs, pottery (including a fine ware sherd decorated with horizontal lines) and animal bones. Some of the stones were burned, but similar to the other parts of the trench, there were only a few charcoal pieces in the dark soil. There were some small, 5–7cm stones at the edge of this area and bigger ones (up to 20cm in diameter) on its south-eastern side which seemed to have been placed there deliberately. A charcoal sample (Table 6.3, II:5) that was taken slightly higher from these larger stones was dated to the 620±30 BP, or cal. AD 1299–1394 (2σ). Although it remained unclear, why this hole was dug, it seems that it was contemporary to the bank, since the finds from it and from other parts of the bank were similar.

Figure 6.15. Pit with dark soil (A) and the location of Bronze Age date (B) under the bank, view from NW.

In between the stones of the bank, altogether 59 potsherds and 40 fragments of animal bones were found. The majority of the finds came from the bottom layers of the bank and they were distributed all over the area of the bank quite evenly (except for the darker area described before that contained more finds). A sample of an animal bone (goat/sheep) from the soil under the bank was radiocarbon dated to the 1205±30BP, or cal. AD 772–876 (2σ).

Trench III that was made through the enclosure was extended south-eastwards to encompass part of a field bank (no. III-4) to study the relationship between the bank and the enclosure. The bank and the part of the trench it opened was located in the northern part of the hill in area III (Fig. 6.2). Trench III measured 2.5 x 13m (32.5 m^2) and the bank covered an area of 6.4m^2. The bank was located in the south-western corner of the trench and was oriented from north-west to south-east. Before the excavations it was believed that the bank radiates from the enclosure crosswise, like it seemed to be the case with banks III-2 and III-3. However it turned out that in the trench area the bank was not attached to the enclosure but there was a shallow gap of at least 1–2m between the two features. After the landscape survey in 2013 and 2014 it became evident that the reason for it most probably was that the bank was not perpendicular to the enclosure but ran from it in a 45° angle, like banks IV-1 and IV-5 eastwards of it (Fig. 6.16). Hence, the trench opened a part of the north-eastern side of the bank and the possible connection point of the bank and the enclosure (which remained unprovable through the excavations) would have been further to the west.

The bank was short, reaching 18m towards a higher ridge (platform no. 2) between plots III-d (3631m^2) and III-h (3815m^2) or III-h3 (3008m^2) where it ended. The width of the bank was 5.7m and height 0.3m from the surrounding ground. It appeared higher which is explainable with its location partly on the ridge.

Figure 6.16. The north-eastern part of bank III-4 was excavated with trench III. The edges of the trench are marked with red solid lines, the axis of the remaining bank with red dashed line. View from N (2021).

The bank consisted of limestone slabs and granite stones (Fig. 6.17), the latter of which were more dominant in the bottom layer of the bank. There was a thin layer of dark soil present under the stones of the bank on top of the bedrock. The bedrock was higher under the bank than at the side of it and between the bank and the enclosure. Two charcoal samples were taken for dating from the dark soil, both from the core part of the bank (Fig. 6.7). One (Table 6.3, Salevere

III:86) was dated to the 820±30BP, or cal. AD 1214–1254 (2σ) and the other one (Table 6.3, Salevere III:117) to the 1650±40BP, or cal. AD 387–418 (2σ).

Figure 6.17. Field bank in trench III, view from NE.

In addition to the two charcoal samples, two animal bones were radiocarbon dated (Fig. 6.7). Both of them were found from the same location but yielded a different result. A metatarsal bone of a horse (Table 6.3, Salevere III:155a) was dated to the 1215±30BP, or cal. AD 769–873 (2σ) and a femur of a pig (Table 6.3, Salevere III:155b) to the 400±30BP, or cal. AD 1447–1476 (2σ).

The number of finds – both pottery and animal bones – and the amount of charcoal was high everywhere in the field bank (Fig. 6.7). There were some differences between the core part of the bank and its sides but there were no areas that lacked finds. Altogether 91 numbers of bones, 68 numbers of pottery and 53 numbers of charcoal were recorded.

The upper stone layers of the enclosure bank in trench III and the area between the field bank and the enclosure had similar appearance and distribution of animal bones and pottery than the field bank (Fig. 6.7) while the inner structure of the enclosure wall did not contain these finds. Therefore it seems likely that the enclosure bank was used as a field bank during the different stages of the agricultural use of the hill. Two radiocarbon dates from the stone layers covering the outer edge of the enclosure bank date to the 17th century. A bone sample (Table 6.3, III:49) of a molar tooth of a cattle was radiocarbon dated to the 260±30BP, or 1642–1655 cal. AD (2σ). The bone was found from the second stone layer, right next to the higher edge of the enclosure (Figs. 6.7 and 6.18 (A)). A charcoal sample (Table 6.3, III:174) from the area between the core area of the field bank and the enclosure (Figs. 6.7 and 6.18 (B)) was radiocarbon dated to the 125±30BP, or 1687–1929 cal AD (2σ).

Figure 6.18. Location of samples III:49 (A) and III:174 (B), view from the highest part of the enclosure to SW.

From the north-eastern side of the trench that remained outside of the compact stone layer covering the enclosure bank, a charcoal sample (Table 6.3, III:238) was radiocarbon dated to the 285±30BP, or 1527–1650 cal AD (2σ) (Fig. 6.7). A prehistoric date (1070±30BP, or 970–

1014 cal AD (2σ)) was obtained from a sample of a pig bone (Table 6.3, III:464a) that was found from the stone layer covering the inner part of the enclosure bank. A potential fireplace was excavated on the same location, containing numerous amounts of charcoal and burnt stones (Fig. 6.19).

Figure 6.19. Location of the possible fireplace and sample III:464a, view from NE.

As was pointed out earlier in 6.3.1, the radiocarbon date (1250±30 BP, or cal AD 694–774 (2σ) (Table 6.3, VI:23)) from trench VI where the possible gap in the enclosure was excavated, is also probably connected with the agricultural use of the enclosure bank.

Trench IV was made in area III through the south-western part of the 144m long bank no. III-3 (Fig. 6.2). The bank radiated south-west from the enclosure and reached until the western edge of the hill. The height and width of the bank in its northern part, close to the enclosure reached 0.5m and 6m respectively while the average measurements in its southern part were

0.2m for the height and ca 3m for the width. The trench was located 127m from the enclosure and 14m from the south-western edge of the hill, quite far from the other excavated trenches. It was situated between two large field plots III-d (3631m^2) in south-east and III-c (3484m^2) north-west. The location of the trench was chosen partly due to its accessibility – the area around the bank was cleared and there were no trees and bushes growing on the trench area (Fig. 6.20). This made the bank look quite well defined and high compared to the surrounding ground.

Figure 6.20. Location of trench IV prior to excavations in 2009, view from NW.

The size of the trench was 2 x 6m (12m^2) and its longer axis was oriented from north-west to south-east. The bank was narrow, with the approximate width of 2m. It consisted of a 1.2m wide section of stones in the middle axis of it while the rest of the bank was formed of accumulated soil (Fig. 6.21). The soil in the surrounding field plots that were also opened with the trench also had a high level of stones in it. The natural ground consisted of yellow gravel and coarse sand which was mixed with big limestone slabs attached to the moraine and not a solid limestone bedrock like in most of the trenches. The maximum height of the bank was 30cm.

Figure 6.21. The field bank in trench IV, view from N.

26 samples of charcoal were collected between the stones and in the soil of the field bank. Two of the samples from the bottom layers were radiocarbon dated. One of them (Table 6.3, Salevere IV:25) was dated to the 260±30BP, or cal. AD 1642–1655 (2σ). Sample IV:13 (Table 6.3) was dated to the 225±30BP, or cal. AD 1656–1797 (2σ). In addition to charcoal, only three animal bones and two fragments of metal artefacts were found.

In summary, the results of the excavation of field banks showed that the banks that were close to the enclosure (trenches I–III) were of similar nature – they consisted of a thick and compact stone layer and contained a relatively large amount of pottery sherds and animal bone fragments. Trench IV further to the south-west from the enclosure consisted mainly of accumulated soil with only a narrow stone structure in the middle and contained only a small amount of animal bones and no pottery. It suggests that the time of use and agricultural strategies must have been different in areas close to the enclosure and further away from it.

Furthermore, the enclosure was used as a field bank during different periods of agriculture which will be discussed in more detail in 6.5.

6.3.3 Cairns

Two cairns were excavated on the hill. A cairn outside the enclosed area (trench V) was excavated in almost its full extent while only one side of the other cairn inside the enclosed area was investigated (trench VII).

Trench V was made to investigate clearance cairn III-2 in the north-western part of the hill in area III (Fig. 6.2). The cairn was located about 40m south-east from the cliff and ca 18m south-west from the enclosure. It was situated in the middle of a small plot (III-a) with an area of 1211m^2. The north-western part of the plot seemed to be well cleared of stones but it might have been mostly because of the fact that this area was cleared of vegetation and it was used by the visitors of the hill through the path that was located there. The south-eastern part of the plot, towards bank III-2 was almost impenetrable because of dense vegetation.

The cairn was relatively big, compared to the majority of the cairns on the hill (Fig. 6.22). Prior to excavations, the cairn was almost round and had a diameter of 5–6m and it was 70cm higher from the surrounding ground. The vertical extent of the cairn from the bedrock to the top was ca. 1m. There were no visible stones on the surface of the cairn as it was covered with turf and smaller trees and bushes, most of which were removed before the excavations. Because of the trees and difficult vegetation, the trench was not made as a rectangular plot but it had an irregular trapezoid-like shape with the sides measuring 7m, 3m, 7.3m and 5m, from the north-east to the north-west respectively. The area opened with the trench had a surface area of 27.5m^2. The south-eastern and north-western sides of the cairn were fully excavated. Here the trench also encompassed parts of the field plot where it was situated. The north-eastern and south-western sides of the trench did not reach the edges of the cairn which proved too difficult because of the vegetation. Because of that, two sections of the cairn were visible after the excavations

Figure 6.22. Trench V prior to excavations in 2009, after the removal of bushes. View from NW corner.

127 numbers of charcoal were recorded in the trench, the majority of it (91%) originating from the lower stone layers and the soil between the stones and the bedrock. Two charcoal samples were dated which gave similar results that indicated that the cairn originated from the end of the prehistory. Sample V:49 (Table 6.3) in the south-western side of the cairn (Fig. 6.23) was dated to the 755±30BP, or cal. AD 1261–1277 (2σ) and sample V:81 (Table 6.3) from the soil on top of the bedrock to the 800±40BP, or cal. AD 1221–1259 (2σ) (Fig. 6.23).

Figure 6.23. Left: location of sample V:49, view from SE. Right: location of sample V:81, view from NW. Also visible is the higher bedrock reef on which the cairn was erected.

Other finds in the trench were sparse. A nail from the top stone layer is probably of modern origin and a fragment of a metal artefact from the fifth layer remained unidentifiable. Only three pot-sherds and 19 fragments of animal bones were found. After the excavations it became clear that in addition to the thick stone cover the other reason why the cairn appeared so big was the fact that it was situated on a bedrock reef.

Trench VII covered the south-eastern part of cairn II-26 in the northern part of the hill, on the western half of the enclosed area II (Fig. 6.2). The cairn was very close to the enclosure – ca 8m north of it. It was situated between plots II-i (1579m^2) and II-j (1434m^2). Plot II-j west of the cairn was on a higher ridge while plot II-i eastwards was on a considerably lower ground that appeared to be flat and well cleared of stones. The cairn was situated on the south-eastern side of the ridge.

The diameter of the cairn, measured before the excavations was 5–5.7m and its height, measured from the south-eastern side was 0.5m. The excavations confirmed that the maximum thickness of the stone cover was 0.6m from the natural bedrock. The trench with the size of 4 x 1.5m (6m^2) was made on the south-eastern part of the cairn and the excavated area covered approximately ¼ of it. The longer side of the trench was oriented from north-east to south-west.

There were trees and bushes growing on the area of the trench which were removed prior to the excavations (Fig. 6.24).

Figure 6.24. Trench VII prior to excavations in 2010, after the removal of bushes. View from NE.

The cairn consisted mainly of limestones and there were only some granite stones present in the top stone cover. Under the last layer of larger stones a soil layer, mixed with pebbles continued until the solid limestone bedrock was cleared out. Although charcoal was abundant everywhere in the area of the cairn, the bottom part of that last soil layer contained even more of it. A sample of charcoal from that layer (Table 6.3, VII:220), from the middle of the cairn but towards the south-eastern edge of it, was dated to the 890±40BP, or cal. AD 1053–1186 (2σ) (Fig. 6.25).

Figure 6.25. Location of sample VII:220 in the trench, view from SE.

Only two pieces of pottery were found from the north-western part of the trench, the rest of the finds consisted of 58 fragments of animal bones and 266 numbers of charcoal. Bones and charcoal were abundant more or less everywhere in the trench, especially in the middle of it. The number of finds increased after the third layer and most of them came from the last soil layers on top of the bedrock.

The results showed that both of the cairns were relatively similar – they were both high and well pronounced, especially cairn III-2 (trench V) and both of them were piled on a higher natural ground. Both of the cairns had only a small amount of pottery present which was surprising, considering that the field banks close to the enclosure bank consisted relatively large amounts of it. The amount of animal bones was also low in cairn III-2 (trench V) whereas in cairn II-26 (trench VII) the amount of animal bones per m^2 was one of the highest among the trenches. The amount of charcoal in cairn III-2 was moderate while cairn II-26 had the highest number of wood charcoal fragments per m^2.

6.4 Analysis of archaeological material

6.4.1 Introduction

Finds assemblages are usually quite modest in field remains excavated in Estonia. At Salevere the situation was the converse and the finds consisted of pottery, animal bones, charcoal fragments and occasional fragments of metal artefacts. As it was brought out in section 6.2., the exact number of pieces or fragments of pottery and wood charcoal was not always recorded[47]. Therefore, to facilitate the estimation of the quantity of finds in a trench and to compare the patterns of the distribution of archaeological finds, an average recorded assemblage amount of charcoal and pottery and the number of animal bone fragments per m^2 was calculated (Table 6.2). On the basis of the estimated mean calculations the following conclusions can be made. Trenches I–III yielded numerous potsherds, while only small amount of pottery was present in trenches V and VII and it was lacking in trenches IV and VI. Fragments of animal bones were found from all the trenches but in trenches II, III and VII the quantities were the largest. Other archaeological finds were marginally represented with a few fragments of metal artefacts in trenches III and IV (not included in table 6.2). Additionally, charcoal fragments were collected from all excavation trenches which were especially numerous in trenches III and VII. Although the average number of charcoal assemblages in trench VII shows to be the highest, it can be estimated that the overall amount of charcoal was larger in trench III. Here there were many large assemblages recorded as one sample, for example the charred logs in the middle of the enclosure bank.

Table 6.2. The amount of pottery, animal bones and charcoal in trenches I-VII.

Trench no.	Size (m^2)	Pottery		Animal bones		Charcoal	
		no. of samples	samples per m^2	no. of fragments	samples per m^2	no. of samples	samples per m^2
I	9	34	3.8	14	1.6	43	4.8
II	8.4	60	**7.1**	40	4.8	26	3.1
III	32.5	219	**6.7**	649	**20**	564	**17.4**
IV	12	-	-	3	0.3	26	2.2
V	27.5	3	0.1	19	0.7	127	4.6

[47] The exact number of animal bone fragments is known because it was later counted during the bone analysis (appendix D).

VI	2.3	-	-	8	3.5	32	13.9
VII	6	2	0.3	58	**9.7**	267	**44.5**

22 charcoal and animal bone fragments were radiocarbon dated. The results of the radiocarbon dating are summarised below in Table 6.3. The analysis of animal bones was done before the dating of the samples (appendix D) but the analysis of wood charcoal (appendix C) was performed only after the samples were radiocarbon dated which can be seen as one of the shortages of the project. The pottery analysis was performed on a basic level, mostly to bring forth the main characteristics, types and possible dates of the pottery. Other archaeological finds were rare and they do not allow for thorough conclusions.

A general summary of the results of the analysis of the archaeological material will be given below. More detailed chronological discussion about the phases of human activity on the hill will follow in 6.5.

6.4.2 Charcoal and 14C

The research project has produced 22 radiocarbon dates from the hill of Salumägi (Table 6.3). Charcoal samples were dated in most of the cases but for six samples the dated material was animal bone (five from trench III and one from trench II). The radiocarbon dates BP were calibrated using IntCal20 calibration curve (Bronk Ramsey 2009; 2021).

Table 6.3. The results of the 14C analysis.

Lab no.	Sample no.	Radiocarbon date BP	Sample material	Context	Calibrated age (95%)
Beta - 368208	Salevere III:458	3940±30	bone collagen (pike)	enclosure	2566-2305 cal BC*
Hela-1862	Salevere II:19	3130±40	Charcoal (ash, ring curvature=1)	field bank	1432-1398 cal BC
Beta - 293540	Salevere III:559	2160±40	charcoal	enclosure	347-174 cal BC
Beta - 368211	Salevere III:562	2130±30	charred material	enclosure	200-116 cal BC

Beta - 368210	Salevere III:503	2120±30	plant material	enclosure	193-111 cal BC
Beta - 293539	Salevere III:117	1650±40	charcoal	field bank	387-418 AD
Hela-1861	Salevere I:20	1315±35	charcoal	field bank	661-690 AD
Poz-46725	Salevere VI:23	1250±30	charcoal	enclosure	694-774 AD
Poz-52980	Salevere III:155a	1215±30	animal bone (horse)	field bank	769-873 AD
Poz-52978	Salevere II:26	1205±30	animal bone (goat/sheep)	field bank	772-876 AD
Beta - 368209	Salevere III:464a	1070±30	bone collagen (pig)	enclosure	970-1014 AD
Beta - 293541	Salevere VII:220	890±40	charcoal	clearance cairn	1053-1186 AD
Poz-46729	Salevere III:86	820±30	charcoal	field bank	1214-1254 AD
Beta - 293538	Salevere V:81	800±40	charcoal	clearance cairn	1221-1259 AD
Poz-46724	Salevere V:49	755±30	charcoal	clearance cairn	1261-1277 AD
Poz-46720	Salevere II:5	620±30	charcoal	field bank	1299-1394 AD
Poz-52981	Salevere III:155b	400±30	animal bone (pig)	field bank	1447-1476 AD
Poz-46728	Salevere III:238	285±30	charcoal	enclosure, inner side	1527-1650 AD
Poz-52979	Salevere III:49	260±30	animal bone (bovine)	between the stones of the connection point of a field bank and the enclosure	1642-1655 AD
Poz-46721	Salevere IV:25	260±30	charcoal	field bank	1642-1655 AD
Poz-46723	Salevere IV:13	225±30	charcoal	field bank	1656-1797 AD

Poz-46727	Salevere III:174	125±30	charcoal	enclosure, outer side	1687-1929 AD

While the results of radiocarbon dating help to date specific features and excavated contexts, as was presented in 6.3, the assemblage as a whole allows to see the larger patterns and regularities of the dataset as a whole and determine the phases and locations of human activity on the hill. Based on the radiocarbon dates, the following phases were distinguished:

1. 2nd millennium (Early Bronze Age) in trenches II and III. The oldest calibrated date from trench III refers to Late Neolithic but the result might be affected by reservoir effect that will be discussed in detail below;
2. 4th century BC–2nd century BC (Pre-Roman Iron Age) – the enclosure;
3. 4.–5th century (Late Roman Iron Age) – possibly the earliest agricultural phase, indicated by a single date from the field bank in trench III;
4. Second half of the 7th century until second half of the 9th century (second half of the Middle Iron Age and the beginning of Viking Age) – in areas around the enclosure bank (trenches I, II, III and VI);
5. Agricultural activities from the second half of the 10th century until the second half of the 15th century. The radiocarbon dates form more or less continuous line. Different sub-periods can be distinguished but the gaps are rather short:
    a. 10th century (970) until the end of prehistory (Late Iron Age) – in areas around the enclosure (trenches III, VII, V);
    b. The gap between the Late Iron Age phase and the indication of farming in the 14th century from trench II (Salevere II:5) is small and it seems that the Late Iron Age phase continued up until the end of the 14th century (beginning of the Middle Ages);
    c. Agricultural activities in the 15th century are represented with one date from the field bank in trench III (III:155b). It might form the same phase that started in the Late Iron Age because the gaps in radiocarbon dates are short;
6. Post-medieval agricultural phase. It might have started already in the first half of the 16th century, as indicated by sample III:238 but the majority of the dates fall into the 17th century (possibly extending to the 18th century and up until the beginning of the 20th century) – trenches III and IV.

The possible Late Neolithic date from under the enclosure bank (Salevere III:458) is a sign of the pre-enclosure phase on the hill. However, the date must be taken with caution and it is actually presumably younger than the calibration result indicates. The dated sample was a fragment of a pike mandible. Pike is a species that inhabits freshwater reservoirs and brackish waters like the coastal areas of the Baltic Sea (Verliin et al. 2014). The concentration of radiocarbon (14C) differs between aquatic environments and atmosphere because of large carbon reservoirs of the oceans due to inclusion of old carbon which is incorporated into organisms living in these environments. This creates a reservoir effect in aquatic resources and the calibrated radiocarbon dates can be several centuries or in case of freshwater organisms even thousands of years older (Heaton et al. 2020; Kriiska et al. 2017; Stuiver and Braziunas 1993). Therefore the real calibrated age of the pike bone might be younger from Late Neolithic. The marine samples need a specific calibration curve and cannot be calibrated against the atmospheric-based curve (IntCal20) (Heaton et al. 2020). The utilisation of marine calibration, however, requires a comparison with terrestrial material because the reservoir effect varies in spatial and temporal terms, depending also on local ecology and between species (Keaveney & Reimer 2012; Philippsen & Heinemeier 2013). For example, in Estonia dates of the land mammals proved to be on average 400–1000 years younger than the AMS dates of the samples of aquatic origin at Kääpa and Riigiküla II Mesolithic sites when comparing the different samples (Kriiska et al. 2017:76–77).

The specific corrections of the sample of pike mandible were not performed during the project, due to the lack of comparative material from the same context. Therefore it must be kept in mind that the calibrated date that shows Late Neolithic human use of the hill might actually be centuries younger. It is possible that it falls in the same period than the next oldest date (Salevere II:19) and in combination these dates show the Early Bronze Age phase on the hill.

The enclosure bank was rather reliably dated to the Pre-Roman Iron Age, based on three radiocarbon dates of charred timber inside the enclosure bank. The details of the possible timber structure remained unclear during the excavations. As was pointed out earlier, the wood charcoal was analysed only after the samples were radiocarbon dated and therefore the specifications of the dated timber samples are not known. However, based on the results of the analysis of other charred timber fragments from the similar contexts, it can be said that most of the charcoal fragments from inside the enclosure bank belonged to hazel and oak. Most of the charcoal had weakly curved growth rings indicating larger branches or trunk wood. At the same time, as the proportion of oak fragments with tyloses, indicating the presence of heartwood and therefore mature trunk was relatively low compared to other trenches, it was suggested that less mature oak from more open woodland was used at that time (appendix C).

Agricultural activities on the hill started probably already during the Late Roman Iron Age but it is only confirmed by one calibrated date. An expansion can be seen from the second half of the Middle Iron Age until the beginning of Viking Age. The radiocarbon dates from the agricultural phases from the second half of the 10th century until the second half of the 15th century form rather continuous line and different sub-periods were difficult to distinguish. A separate phase is dated to the 17^{th} century that possibly continued during the 18^{th} century. The agricultural land use in the beginning of the 20^{th} century is represented with a calibrated date from the upper stone layer covering the enclosure bank that has a wide extent of 200 years (from the 17^{th} century). The error range of the sample might indicate a contamination but the agricultural activities of that time are also known from the written sources.

The charcoal samples from field banks and cairns were not determined before they were sent for radiocarbon dating. Only in one case (Salevere II:19) it was possible to indicate the species after the dating because the sample was returned and provided enough material for the wood analysis. It showed that the Early Bronze Age date from trench II was obtained from a charcoal fragment of an ash with low ring curvature, indicating that the fragment was from a large branch or a trunk (appendix C).

Although the dated charcoal species were not determined, charcoal from all the trenches was analysed afterwards. A relatively diverse assemblage of fourteen different taxa were represented in the charcoal assemblage from the site as a whole (appendic C, Table 1). The most numerous taxa was ash that was present in all the trenches. Oak was present in all but trench IV and maple in all but trenches IV and VII. Additionally, the number of hazel, probable gooseberry or current, elm, poplar or aspen/willow and alder was high, indicating a presence of deciduous woodland or woodland clearings, along with areas of damp soil. Pine and Norway spruce were present sporadically.

There was a high proportion of charcoal fragments with closely spaced growth rings indicating slow grown timber in the upper layers of the enclosure bank that were related to the use of the enclosure as a field bank in trench III, trench VI through the enclosure and the cairn closest to the enclosure (VII). At the same time the analysis showed that indicators of heartwood and therefore mature timber but also signs of the use or dead or rotting wood were high in these locations (except trench VI). A high proportion of the charcoal fragments from all trenches exhibited weakly curved growth rings indicating the general use of a high proportion of larger branches or trunk wood. The use of smaller branches or twigs is also however indicated by a relatively high proportion of charcoal fragments with strongly curved growth rings in Trench II and Trench V (appendix C).

6.4.3 Animal bones

Contrarily to the wood charcoal the animal bones were determined before dating the samples. The analysis was done by Eve Rannamäe and Freydis Ehrlich from the University of Tartu (appendix D). In most cases bones of domestic animals (horse, pig, bovine, goat/sheep) were chosen for radiocarbon dating. These were also the most numerous species that could be determined to specific taxon level (appendix D, Fig. 2). In one case a fishbone (pike) was radiocarbon dated that can provide debatable results because of reservoir effect, discussed earlier. The choice to date a fish bone sample was made because there was a need for an alternative date from under the enclosure bank other than the charcoal from the timber structure. The other animal bones from the same context that were reliably determined belonged to either small rodents or birds, both of which cannot be confidentially related to human activities. The fragment of the pike bone was the only one that could be definitely associated with human activities. Altogether 17 fragments of fish bones were found from excavated features, all of them from the stone layers covering the enclosure bank or underneath the timber layer in trench III (not from the field bank). In addition to pike, there were also bones of perch and bream. All the species are common in brackish waters like the coastal areas of the Baltic Sea (Verliin et al. 2014) and were most likely part of the diet of people who lived in the area. Additionally, three fragments of seal bones were found from trench III (similar context to fish bones) that all showed signs of being in fire and one fragment had cut-marks which shows that seals were hunted and eaten as well.

785 intact or fragmented pieces of bones were counted from the seven trenches, most of them from trench III. Most of the bone material was extremely fragmented (96% or 755 finds) while intact or almost intact bones were only 4% (30 finds). More than half (64%) of the bone material

was burnt. The big amount of fragmentary and burnt bones was the main reason why most of the precise taxons of bones were not determined. In most cases it was only possible to say if the bone belonged to a small, middle-sized or a big mammal (appendix D).

6.4.4 Pottery

Pottery was found from trenches I, II, III, V and VII while there was no pottery present in trench IV in the western part of the hill and the narrow trench VI through the enclosure wall. Both of the excavated clearance cairns (trenches V and VII) had only a couple of pieces of highly damaged and crumbled pottery. The amount of pottery in trenches I and II was quite numerous but it was noticeable that trench II inside the enclosed area had about twice the amount of pottery than trench I which was outside of the enclosed area.

Trench III, being the largest one of all the trenches, had the most numerous amount of pottery. It was equally found in the enclosure bank and the field bank but the outer side of the enclosure bank had much more pottery than the inner side (i.e. towards the enclosed area).

Most of the potsherds were difficult to date because the kind of coarse ware that was mostly found is common to all periods of prehistory in Estonia (Fig. 6.26, left). Nonetheless, some decorated pieces have clear parallels with the pottery characteristic of the Middle Iron Age. It is probably not a coincidence that the trenches yielding more potsherds were the ones where radiocarbon dates indicate the same period of use.


Figure 6.26. Types of pottery from the excavation trenches: coarse ware (left) and fine ware (right).

In addition to coarse ware, there were also pieces of fine ware pottery present in the material (Fig. 6.26, right). Since the pieces were very fragmentary, it was in many cases difficult to determine the type but in general most of the pottery represented coarse ware. Only trench II revealed relatively higher amount of fine ware. Interestingly, a lot of the sherds in trench II seemed to be originating from the same pot (V. Lang, pers. comm.) while in other trenches the material was more mixed. In general, the burning level and colour differences were uneven and there were a few ornamented pieces. By typology, most of the pottery seemed to originate from the second half of the 1st Millennium AD (from the 7th-8th century until the end of the Estonian Viking Age 1050 AD) (V. Lang, pers. comm.)

In most cases it seemed that the sherds were mixed, maybe in the soil before making the banks and there were no signs of the sherds originating from one pot that was broken *in situ*. An exception to that was a cluster of pot-sherds that was found under the stones covering the outer edge of the enclosure bank in trench III: the pot-sherds originated (mostly) from one pot that has been partly reconstructed (Figs. 6.27 and 6.28). However, the pot was quite damaged, it wasn`t intact and the sherds of it were found further away from the main cluster as well which made the reconstruction more difficult. The bottom parts of the pot were situated lower so it can be assumed that it was placed or left there. On the basis of visual assessment it was said that the pot is of Viking Age origin and represents a coarse ware (Iru and Rõuge) (V. Lang, pers. comm.).

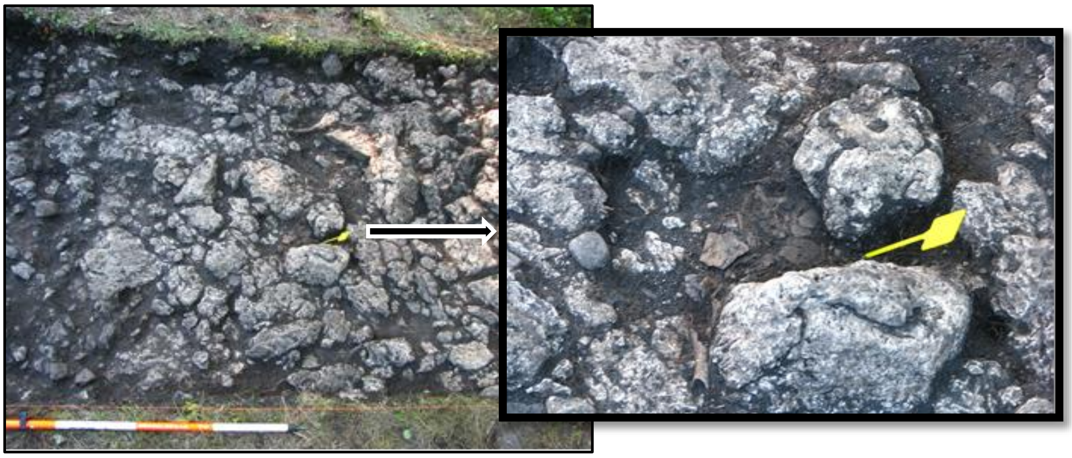


Figure 6.27. The location of the pot in trench III.

Figure 6.28. Partly reconstructed pot from trench III.

The basic analysis of the pottery that was found during the excavations supplemented the results of calibrated radiocarbon dates. Field banks in trenches I, II and III revealed an unusually high number of pot-sherds which are usually rare and limited when excavating field systems. The same trenches had layers that were radiocarbon dated to the 7th–9th centuries (the second agricultural phase). The fact that the upper stone layers covering the enclosure bank contained equally numerous fragments of pottery (while it was missing inside the enclosure bank) serves as a further proof that the enclosure was used as a field bank at that time.

6.4.5 Other archaeological finds

Other archaeological finds consisted of a couple of fragments of metal artefacts: a small stud from trench III could not be identified any further and a knife blade from trench V (Fig. 6.28) was of a very common type that were used in the later phases of prehistory as well as during historical times. The finds do not allow thorough conclusions about the age, agricultural practices and use of the hill.

Figure 6.29. A knife blade from trench V.

6.4.6 Conclusions about the archaeological material

Despite of some shortages in the methodology of the excavations, sampling and analysis of the archaeological material (e.g. the dating of charcoal prior to determining the species; the problem with reservoir effect on fish bones; the fact that for some of the trenches there is only one radiocarbon date), the dataset as a whole is crucial to determining and dating the phases of human activity on the hill. Additionally, the distribution and analysis of the archaeological material gives information about the possible agricultural practices through time.

Charcoal fragments are frequently found when excavating field systems in Estonia and in many cases it is the only archaeological material that is found. The mainstream idea is that the charcoal originates mostly from slash-and-burn practices and that the charcoal from the lowermost layer under the stones of the field banks or cairns is a sign of initial clearance of land with fire (Lang 1995a:149; Lang 2007b:97; see also 2.5.2). However, charcoal fragments along with pottery and animal bones in the soil and inside the excavated features can equally be part of household waste that was brought on the fields. It has been established in the studies of prehistoric field systems in Europe that the spreading of household waste on the fields has been part of the manuring strategy since the Bronze Age (Bakels 1996; Nielsen and Kristiansen 2014:397) and through Medieval Period (Jones 2005).

In case the archaeological material is part of household waste, then it raises the question of where was it brought to the hill, i.e. where did the people live who had their fields on the hill. The two settlement sites at Salevere are both within a reasonable distance from the trenches that contained the household waste. However, it is also possible that the finds are related to potential settlement layer on the hill, for example in area IV near platform no. 1 or platform no. 2 in area III.

The fact that radiocarbon dating of charcoal and bone fragments gave similar results that also have parallels with the typological dating of the pottery indicates that all these components were, at least to some degree, part of the same household waste that was brought on the fields. In addition to bringing household waste on the fields that contained pottery and animal bones, other manuring strategies were used as well. For example, no pottery or animal bones were present in the field bank in the south-western part of area III (trench IV) and clearance cairn in area III (trench V) but fragments of charcoal occurred in the soil. Trench IV was dated to the 17th century and trench V to the 13th century. It is possible that the fields near these trenches were manured mainly with animal dung or other organic waste or were used as pastures and manured when the cattle was kept on the fields. Alternatively, they might have served as hayfields. However, these different ways to improve soil fertility or the alternative agricultural functions were not related to a specific period because these two examples are from different agricultural phases on the hill. It does not exclude the option that charcoal fragments can also reflect the slash-and-burn practices.

Therefore, the archaeological material shows that the strategies to improve soil fertility were diverse and multiple and not necessarily determined with a specific time period – similar practices that were used in the 13th century were also in use during the Modern Period. At the same time, radiocarbon dating helps to date specific contexts and features within excavation trenches but the strength of the whole dataset is to outline the main phases of human activity on the hill.

6.5 Discussion: chronology and use of the hill

The radiocarbon dating shows ca. 4000 years of human activity on the hill of Salumägi. The first signs date from ca. 2000 cal. BC up until the 20th century. The human use of the hill has not been continuous – there are periods of gaps where there are no clear indicators of human activity. Nevertheless, for various reasons people have kept coming back. The excavation results suggest that the most active area was the enclosure bank and its immediate surroundings that revealed dates from different phases. Although the enclosure bank definitely was an impressive landmark on the hill, it has to keep in mind that the excavations did not reach further south-east from area IV and areas V–VIII were not excavated archaeologically. Despite of that, the results of the excavations have specified the landscape chronology that was brought out in the previous chapter and was based on landscape survey.

6.5.1 The hill before the enclosure

Two radiocarbon dating results stand out from the samples: fish bone from under the enclosure wall that was dated to the Late Neolithic but is probably younger because of reservoir effect and a charcoal sample of an ash dated to the Early Bronze Age from the layer of burnt soil under the field bank (trench II) in area enclosed with the enclosure bank (area II). Because of the possible reservoir effect, both of the dates probably belong to approximately the same period in the 2nd millennium BC.

The dates indicate human activity on the hill before the enclosure and the field systems. Although it is not known if there was a permanent settlement site on the hill or it was used as a seasonal or occasional place for staying or even if it had a ritual meaning, the phase also pre-dates the possible use of the hill as a burial place, as was brought out as an option in chapter 5. The possible use of the hill as a burial place was not confirmed by the excavations but it is still possible that some of the large cairns on the hill are stone-cist graves, dated to the Late Bronze Age and Early Pre-Roman Iron Age.

6.5.2 Enclosure

The next group of dates fall within Pre-Roman Iron Age and date the enclosure bank to the 4th century BC–2nd century BC. This coincides broadly with the initial assumptions about the age of the enclosure that were based on parallels elsewhere in Estonia (Lang 2007:81; Mandel 2003:167; Tõnisson 2008; see also chapter 5.5.1). It cannot be excluded that at the same time when the enclosure was built, the hill was used as a burial place because the general dating of stone-cist graves overlaps with the radiocarbon dates from the enclosure. The same applies to the general dating of early *tarand*-graves (dated to the Pre-Roman Iron Age, 500 BC–AD 50), one of which is situated in the south-eastern part of the hill and also other possible *tarand*-graves were detected during the landscape survey.

The structure of the enclosure consisted of large horizontal limestone slabs that were laid regularly and formed a dry stone walling. The courses of these large stones were better defined on the outer edge of the bank, where at least five were clearly recognisable. On the inner side of the enclosure, the walling was more damaged and the stones broken and collapsed. The width of the wall between the dry-stone revetments was 3.6–4m. The filling of the wall consisted of smaller stones and coarse, sandy soil that showed signs of heavy burning. The remains of a charred wooden construction were also found. The inner area of the enclosure was also opened with the trench but there were no signs of occupation layer that could be contemporary to the enclosure. The soil cover on top of the natural bedrock was thin and if there had been remains related to the enclosure, they were probably destroyed in the course of later agricultural activities.

The hypothesis that early ring forts and promontories are mainly sites that functioned as communal religious and ceremonial sites (Cassel 1998:145; Lang 2007b:80) seems believable in case of Salevere as well. It is important to point out that the building of the enclosure to the same place on the hill where there had been human activity about 1000 years earlier shows the importance of the near-cliff areas as landmarks. In case the pre-enclosure phase included stone graves on the hill, they were also visible landmarks on the hill that might have conditioned the location of the enclosure. The building of the enclosure itself must have required a considerable communal effort and was probably built over long period of time.

6.5.3 The beginning of agricultural activities

The landscape survey (chapter 5) suggested that the cairnfields might represent the first field system on the hill after the enclosure was probably not in use any more. Although it is still a reliable possibility, the excavations did not confirm it. The two clearance cairns that were excavated were dated to the 11th–12th century (Latest Iron Age) (Trench VII) and to the 13th century (Trench V).

Instead, the earliest date from fields was obtained from the bottom layer of the field bank in trench III and was dated to the 4.–5th century (Late Roman Iron Age. It was a single date and there were no other parallels to that on the hill. The date is important because of the wider regional context. As was brought out in chapter 4.4.3, the monuments and sites from Roman Iron Age are not well presented in the archaeological material of West Estonia and partial migration or relocation of people from previous agricultural settlement areas has been suggested (Lang 2007b:93). Pollen diagrams do not indicate the gap that is visible in archaeological material but in some pollen diagrams possible signs of cattle rearing rise (Saarse and Königsson 1992; Veski 1998:57). The age of the sample from the field bank at Salevere can be seen as a proof that there is no gap in human activity at that time in West Estonia and that it was the time when agricultural activities started on the hill. It also shows that the agricultural use of the hill started about five centuries after the building of the enclosure.

6.5.4 Field systems in the Middle and Late Iron Age

The first intensive agricultural phase is dated to the second half of the 7th century until second half of the 9th century (Middle Iron Age and the beginning of Viking Age), based on four radiocarbon dates from field banks close to the enclosure (trenches I, II, III and VI). The trenches contained high amounts of archaeological material – charcoal fragments, pottery (was not present in narrow trench VI through the enclosure) and animal bones. This can be seen as a sign of manuring the fields with household waste, either from the settlement site(s) next to the hill or there was a settlement site on the hill (possibly indicated by the platforms in areas III and IV).

It has been established in Estonian archaeology that villages emerged during the 7th–8th century, one of the characteristics of which was the existence of communal land that was distributed between single farms. If the hill was used by the communities that lived around the hill (i.e. the two settlement sites near the hill) or on the hill, the agricultural practices of improving the soil with manuring and stone clearance can be seen as a communal effort. One cannot say in certainty if the previous history of the hill (the possible use of it as a burial place and the enclosure as a communal ritual or ceremonial site) was known to the people who farmed the fields at that time. However, it seems that the agricultural activities were concentrated around the enclosure that formed the main axis to the field plots that were built.

6.5.5 Field systems in the Late Iron Age and the Middle Ages

The second intensive agricultural phase started in the second half of the 10th century and lasted until the second half of the 15th century. The gap between that and the previous agricultural phase is rather short and based on the radiocarbon dates lasted only a century. It might be that the gap is artificial and related to the available radiocarbon dates while in reality it formed a single phase. Different sub-periods can be distinguished inside the second phase but the gaps between them are rather short and therefore the phase is taken as a whole:

1. 10th century until the end of prehistory (Late Iron Age) in areas around the enclosure. Two dates from that period were obtained from trench III – one from the field bank and other from the upper layers of stones that covered the former enclosure wall. The location of the latter coincided with a probable fireplace that was dug on top of the enclosure (see 6.3.2, Fig. 6.19). Both of the excavated clearance cairns (trench V outside the enclosed area and trench VII close to the enclosure wall inside the enclosed area) were dated to that period.
2. The field bank inside the enclosed area that had been used during the 8th–9th century and under which the Early Bronze Age date originates, was also used during the 14th century (beginning of the Middle Ages).
3. Agricultural activities in the 15th century are represented with one date from the field bank in trench III. The gap between the date from trench II is ca. 50 years and therefore it is included in the current agricultural phase. The same field bank that was perpendicular to the enclosure bank had also revealed dates from all the earlier agricultural activities as well.

The political and social organisation in Estonia changed in the early 13th century with the German-Danish crusaders' conquest, violent Christianization of local people and the establishment of political and religious structures typical to medieval Europe (Russow et al. 2006:159–160) that brought along the emergence of new landowners and the gradual loosing of freedom of the local peasants. However, the changes are not reflected in the archaeological material on the hill of Salevere. Rather, it seems that the agricultural practices that started in the second half of the 10th century, continued more or less until the 15th century. It is possible that the changes in land ownership do not reflect on the archaeological material and also that the excavation results from the wider area (for example the field systems further to the south-east from the enclosure) would reveal a different situation. But it is equally possible that Salevere was a marginal area where the innovations did not reach during that time and the farming on the hill continued from the old basis.

6.5.6 Field systems in Post-Medieval and Historic period

The next agricultural phase is indicated by five radiocarbon dates, the majority of which fall into the 17th century. It is possible that the phase started already in the first half of the 16th century, as indicated by a sample from trench III, and extended possibly to the 18th century and up until the beginning of the 20th century. Two radiocarbon dates from the field bank in the south-western part of the hill (trench IV) were dated to the 17th century. The field bank in trench IV was of different nature than the rest of the field banks on the hill, consisting of a narrow row of stones in the middle of the bank while the rest of it was formed of soil. The rest of the dates show that the former enclosure bank was used as a field bank during that time: samples of charcoal and animal bone from both the inner and outer stone layers covering the enclosure bank were dated to that period.

It is probable that the settlement site south-east to the hill was used at that time. A village cemetery, dated roughly to the 15th–18th centuries AD (Lõugas and Selirand 1989:119–120) was situated close to it. Salevere village is also mentioned in the written sources from the 16th–17th centuries which probably marks the same settlement area that might have been in use already during the late prehistory. The pastoral manor on the southern part of the hill was probably established during the 18th century and it can be suggested that at that time the hill was used mostly as a pasture. The remains of the occasional stone fences can be related to that period. It is also possible that at the same time the hill was known and used as a sacred place.

6.5.7 Use of the hill from the 20th century until today

The use of the hill as an agricultural land continued in the more recent past. The hill was used as a pasture in the beginning of the 20th century, as is known from the written sources (Tavast 1931). The extensive farming of the Soviet period concentrated on the areas around the hill that were irrigated and turned into large fields. Because there was enough land, the hill of Salumägi remained a marginal area to be included into the communal farm re-organisation. According to local oral history, there were small plots on the hill in the 1970s and/or 1980s that were used by local people for personal potato cultivation and presumably also for keeping animals, as can be concluded from the remains of a modern wire fence that is still visible on the hill.

In 1957 the hill was included into the Matsalu nature reserve area that has also helped to preserve the layers of landscape that are the result of ca. 4000 years of human activity. The hill was overgrown with bushes and trees, so that even despite of the fact that archaeological landscape inventories had been numerous in the area, the enclosure wall was only discovered in the beginning of the 21st century. The discovery of the enclosure has enhanced the popularity of the hill as a tourist destination and in a way keeps bringing people together and adding to community values up to this day.

6.6 Conclusion

The aim of the chapter was to study how the archaeological features on the hill of Salumägi were built (structure) and see what supporting evidence archaeological material provides about the age and function of the field systems. The wider aim of the chapter was to identify how the results contribute to the understanding of sustainable landscape use on the hill.

In the first part of the chapter I presented the results of the excavations on the hill during which seven trenches were excavated to study banks, cairns and the enclosure. The trenches were not located evenly around the hill but mainly around the enclosure, therefore the results might not be the best representation of the whole hill. However, the results gave useful additions to the ideas that were put forward in the previous chapter about the chronology and function of the field systems on the hill.

In the second part of the chapter, archaeological material from the trenches was presented and discussed in the third part. The radiocarbon dating results allowed to distinguish six separate phases of human activity on the hill over the course of 4000 years. During the Early Bronze Age phase, the hill itself with the cliff edge was probably the most important landscape element that conditioned the human activities. After the building of the enclosure to the same location of the earlier activity ca. 1000 years later, the enclosure bank became the most dominant landmark. The enclosure and the immediate surrounding of it were later used during all the agricultural phases on the hill. The agricultural use of the hill started in the 4th century AD and lasted until the beginning of the 20th century. The prehistoric and medieval agricultural use showed that different strategies were used to improve soil fertility and the agricultural functions were probably related to both, cultivation of crops and animal herding.

It was possible to see from the results of the excavations that the agricultural activities did not expand from a certain area to specific directions. Rather, the same areas were revisited and reused over time. The most intensively used area was the field bank immediately on the outer side of the enclosure that contained material from all the distinguished phases and the wall itself.

After the beginning of the 20th century, the agricultural activities on the hill continued on the smaller scale. While previously it had been a place of communal farming where the fields were probably divided between different households, now it became a subject of small-scale personal farming and cattle raising. The communal value and use of the hill that started with the large-scale erection of the enclosure wall, was sustained in the course of agricultural practices and also through keeping the place in memory as a sacred site, is preserved nowadays in the form of a nature reserve and a tourist destination.

The case study results show that the ways how the hill of Salumägi was used over time for agricultural and wider communal purposes reflect strongly on long-term landscape sustainability. The hill has retained its meaning as a valued place for a wider community over 4000 years. At the same time it has been used for various agricultural purposes, thus fulfilling subsistence purposes for generations of people. During the agricultural phases the older landscape elements were constantly used and re-used, in the course of which some layers of landscape were probably destroyed. However, the main landscape elements were sustained and their importance grew over time.

7 Discussion and conclusion

This doctoral research studied landscape sustainability and prehistoric field systems in western Estonia. I began by reviewing previous research on field systems in Estonia. The gaps in previous research lie in both the quantitative and the qualitative aspects of the interpretations. Interpretations tend towards general narratives where territorial strategies, population pressure and exploitation of natural resources are accentuated as factors in the formation and transformation of agricultural landscapes. Field systems are not presented as active in the formation of society and the landscape in long-term perspective. There is also a geographical bias in previous research. Fieldwork and interpretative studies have concentrated on northern Estonia. The results are then generalised and applied to other regions where field systems were located – western Estonia and the islands in the western archipelago.

The thesis proposes that landscape sustainability is a concept that can engender a more holistic and contextual approach to the study of field systems. Field systems are not approached as *just* fields but as places where land use practices were influenced by various social and environmental factors and as such they developed into systems to which a set of different functions and meanings can be attributed. Field systems are theorised as a part and the best example of the nature of the landscape as a palimpsest where different temporal layers had an active impact on each other over long periods of time. Their visible signs in the current landscape, left by these active and varied land use practices, formed the starting point for the doctoral research.

The thesis has one primary research question: How did the locations and organisation of field systems impact on landscape sustainability during later prehistory?

More specific research questions were as follows:

1. What are the main characteristics of the distribution of field systems in western Estonia (in terms of environmental conditions and the general settlement pattern)?
2. How was agricultural land organised through differences in the types of field systems in western Estonia?

3. Is there a correlation between the form and location of field systems and what factors (both human/social and environmental) influenced the character and organisation of field systems?
4. Based on diachronic reconstructions of the agricultural and social functions of field systems, how did the inception and maintenance of field systems influence landscape sustainability?

The study progressed at two levels: regional analysis of field systems in western Estonia, and a case study analysis of field systems on the hill of Salumägi at Salevere village in the southern part of West Estonia. The aim of the regional study was to answer questions 1 and 2 about the main characteristics of the distribution of field systems in western Estonia and how the different types of field systems relate to the organisation of agricultural land. The aim of the case study was to see the possible correlations between the form and location of the field systems and explain the factors that influenced their character and organisation (question 3). Question 4, how was landscape sustainability influenced by the inception and maintenance of field systems, was addressed through the combination of the regional and local case studies.

The regional study identified the principal characteristics and differences in the distribution of field systems inside the study region. The primary method of detecting new field systems and map the already known ones was the use of LiDAR data that was combined with orthophotos, base maps that showed potentially modern features, historical maps, environmental data and distribution maps of archaeological monuments and sites. Fifty-eight previously unknown field systems were discovered in the course of the regional analysis. The types of the detected fields did not fit well with the existing typology of Estonian field systems, partly because of the survival and overlapping of field systems of different periods. It also seemed that the general evolution and development of field systems was different from the north Estonian material that has been the main basis for the established typology and chronology of Estonian fields. For example, a new type of field systems was detected where clearance cairnfields were bordered and enclosed with long boundaries, suggesting that their primary function could have been large stock enclosures for cattle breeding.

There were no remarkable differences in the typology of the field systems between the northern and southern parts of the study region. There was a relatively larger amount of potential forest fields in the northern part and the distance between the fields, known settlements and other archaeological monuments was longer than in the southern part. This, however, was partly because the previous research and detection of archaeological sites has been more intense in the southern part, and also because the landscape in the southern part was more open which aided the detection of field systems, other archaeological sites and their spatial relations.

Most of the field systems were located on relatively higher ground compared with the surrounding landscape, within 10km of the modern coastline and on the Silurian bedrock which is generally characterised by thin calcareous soils. Only the northernmost field systems were situated on Ordovician bedrock which is generally associated with thicker and denser soils. The majority of field systems in both study areas were situated on weakly developed mineral soils that lack a significant soil horizon (Regosols), were formed on limestone bedrock and are high in humus, but stony and sensitive to drought (Rendzic Leptosols).

The regional analysis showed that some of the field systems that were mapped as potentially prehistoric did not have typological of distributional evidence for their dating. Landscape survey using remote methods cannot provide very definitive absolute dates, but it proved its usefulness for determining general patterns and regularities inside the study region. An important result of the regional study was to demonstrate that the established typology and chronology of Estonia field systems does not apply well to West Estonia where it seemed that specific regional environmental and historic conditions that were different from those of North Estonia, determined the development of field systems in a different manner.

The high occurrence of overlapping field systems and structures in the study area suggest a long term – and therefore sustainable – agricultural use of the same areas. Based on the relatively small size of the potentially prehistoric field systems the fields were probably used by small groups of people, single households or small farmsteads. In several areas in the southern part of the study region, larger complex or groups of field systems in the close vicinity of each other were mapped that might show that the fields were used by larger communities and that land was divided between the groups and was probably at least to some extent used as common land.

The case study was based on a landscape survey and excavations on the hill of Salumägi at Salevere village. The principal aim of the case study was to detect possible correlations between the form and location of field systems and the factors (both human/social and environmental) that influenced the character and organisation of field systems.

The main targets for the landscape survey were the archaeological features and types of field systems on the hill that were taken as main reflections through which to study the possible correlations in their form and location. The emphasis was on detecting how the different landscape elements were combined into and used within field systems, how the pattern or form of field systems reflected their function and the chronological sequence of the land use on the hill, and the possible similarities and differences of land use patterns in different parts or the hill. Based on the results it was assessed how the locations and organisation of field systems were connected with landscape sustainability.

The field systems formed different entities on the hill (categorised as areas) that had different characteristics and forms. Analysis of plots and field systems showed that there were differences in regularity of field systems in different parts of the hill. The field systems were most consistent and regular in the middle part of the hill (areas V and VI) where the main axes of the systems were defined by long continuous banks and the inner division into smaller plots was regularly organised. Long continuous or smaller intact banks bounding regular plots were also present in the western part of area III, eastern part of area IV and the north-western part of area VII, but the appearance of the field system was less regular than in areas V and VI. The banks on the rest of the hill were more fragmentary and plots and the whole field systems were harder to define. Here the role of natural features for separating or defining plots and influencing the layout of the field systems was mostly observable.

The landscape survey showed that the different areas of field systems were connected with each other by sharing a common axis – usually long and well-pronounced field banks but also natural features were used like the higher ridges or natural terraces and boulder fields – from which the smaller banks radiated. There were numerous cairns all over the hill that partly seemed to form over- or underlapping clearance cairnfields but some of the cairns might be prehistoric graves pre-dating the field systems.

The way the past landscape elements and natural features were used as an integrated whole was taken as an indicator of long-term sustainable landscape use on the hill. The way older landscape elements and natural features had been integrated into field systems was also visible from the use of higher ridges as possible building platforms, terraces used as field banks and boulder fields as areas that might have served as pastures. The sustainable landscape use was most strikingly exemplified by the use of the enclosure bank as a field bank after its primary use as bounding the northern part of the hill for probable ritual or communal purposes (although the use of the enclosure as a stock enclosure cannot be excluded either) had stopped. At the same time the bank itself had probably incorporated landscape elements pre-dating the enclosure (a possible *tarand*-grave).

The excavations on the hill of Salumägi complemented the landscape survey and helped refine the correlations between the form and location of field systems and other landscape elements and the chronology of the human use of the hill. Six phases of human activity on the hill over the course of 4000 years were distinguished based on radiocarbon dating results. The earliest human activity was dated to the Early Bronze Age on the northern part of the hill. Ca. 1000 years later the enclosure was built on the same location. The agricultural use of the hill started in the 4th century AD and lasted until the beginning of the 20th century. The enclosure and the immediate surrounding of it were later used during all the agricultural phases on the hill. Some excavated banks and cairns also revealed dates from multiple phases while others were seemed to be in use only during a single phase. However, this conclusion was reached on the basis of dating the archaeological material (animal bones, pottery and fragments of charcoal) that was present inside the banks and cairns and it does not exclude the possibility that some agricultural activities during different times simply did not leave traces in the archaeological material. One also has to keep in mind that the amount of samples that were dated was limited and there is a certain randomness in dating an archaeological feature (a whole field bank or a cairn) based on one or two samples. However, the project produced 22 radiocarbon dates as a whole which proved as a valuable dataset that allowed to see larger patterns and determine the phases and locations of human activity on the hill. Based on the archaeological material it was possible to conclude that during the prehistoric and medieval agricultural phases different strategies were used to improve soil fertility and the agricultural functions were probably related to both cultivation of crops and animal herding.

The case study demonstrated that the locations of the landscape elements – the probable graves, the enclosure and field systems – were conditioned by the previous use of landscape and the landmarks that had been left during past activities. As such, the landscape use can be considered as sustainable. The incorporation of the older features might have served mostly a practical reason – it was easier to use the former enclosure bank as a field bank than to destroy it, and it was also reasonable to collect stones from the fields to a place that was already high on the field, for example a former circular grave; but probably also places where natural bedrock was higher were used as locations for the cairns as was visible from the excavated cairns on the hill. At the same time, even if the consequential landscape sustainability was unintentional, it does not make it less important in the long term.

The long-term consequence of the sustainable use of landscape has left us with a local landscape that contains elements and signs of human use from a period of ca. 4000 years. Obviously, some of the past landscape elements have been erased from the landscape which is inevitable. However, new layers are added up until today – nowadays the hill is part of a nature reserve and a tourism destination where community events are held. The archaeological features on the hill are not yet listed as monuments because the system on listing archaeological sites as monuments is a complicated and long process in Estonia. Because the hill is part of the Matsalu nature reserve, there is no immediate danger to the preservation of the archaeological features but in the future the hill definitely deserves to be a designated archaeological monument. At the same time we have to keep in mind that while protecting the past elements of the landscape we should not prevent the creation of new layers that in the long term are just as important and valuable markers of diverse ways humans interact with the landscape.

The primary research question of the thesis has been answered. The thesis has demonstrated that the locations of field systems impact on landscape sustainability either when the remains of the past human activities and natural landscape elements were incorporated into field systems intentionally or when it was an unintentional consequence, driven by more practical reasons. The way field systems were organised and managed through time showed flexible and “wise” use of the landscape. The case study results on the hill of Salumägi showed that the same areas were used and re-used as fields over a long period of time while different soil improvement techniques were applied and probably a range of different land-use practices were used.

There were limitations in the used investigation methods – for example the landscape survey should have preceded to the excavations in order to make better choices for the locations of the trenches and the sampling methods could have been more detailed. Despite this, the combined results of the survey and excavations show the importance of a detailed and thorough study with survey and excavation methods. It is not uncommon that people and even fellow archaeologists question the necessity to excavate field systems because they do not provide a considerable amount of finds. In a way, if the primary aim is to date field systems and to get as many samples for dating as possible, the kind of detailed layer-by-layer excavations would not be necessary. At the same time, it would exclude the possibility to gather and interpret the possible finds assemblages. At Salevere the analysis of archaeological material supplemented the chronology but also indicated the soil improvement practices, which justifies the detailed excavations over three years. Ideally, the investigation of field systems should start with detailed mapping and landscape survey, followed by sampling over the whole area of the field systems and excavation trenches in carefully targeted locations.

I will conclude with the observation that the study of field systems is important in understanding how the landscape as a whole was used over the course of time. Field systems are the main monuments that allow a thorough and diverse study of the spatial relations of human-environment interactions and of the ways how the different temporal layers of past human activities have affected the consecutive generations and their practices of landscape use, and thus the sustainable use of agricultural landscape. Field systems allow to study how people perceived their environment but also how they perceived their past and how attitudes changed over time.

The importance of the current thesis is that it complements the study of Estonian field systems with a large dataset of new information from a region where field systems were not previously systematically studied. On a regional level, 58 potential field systems were discovered and the methodology for studying large areas with remote sensing methods was applied for the first time in Estonia. On a local level, a new approach to the study of field systems was introduced that emphasises the wider social meaning of field systems, making them more than just as markers of territoriality and subsistence. The material deserves to be recognised in a wider European level and hopefully this thesis helps to introduce Estonian field systems to a wider audience.

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Appendix A: Field systems in study region

Appendix A1. Field systems in the northern part of the study area

Appendix A2. Field systems in the southern part of the study area

Appendix A3. Height data (above the sea level)

Abbreviations used in tables:

	Field types
CCF	Clearance cairnfields
CCFB	Clearance cairnfields with boundaries around them / enclosed clearance cairnfields
FF	Forest fields
SF	Strip fields
LSF	Late strip fields
QF	Quadrangular fields
LQF	Late quadrangular fields

	Additional features
StF	Stone fence
E	Enclosure
CP	Cattle path
HV	Historical village
SS	Sacred site (or stone)
G	Grave
HF	Hill-fort
S	Settlement

Estonian soil typology		WRB equivalent
Gk	Calcaric Gleysols	GL-ca
Gkr	Calcaric Gleysols (skeletic)	GL-ca-sk
Go	Endocalcaric Mollic Gleysols	GL-mo.can
Go1	Eutric Histic Gleysols	GL-hi.eu
K	Calcaric Regosols	RG-ca
Kg	Calcaric Gleyic Regosols	RG-gl.ca
Kh'	Suprarendzic Lithic Leptosols	LP-li.rzs
Kh''	Somerirendzic Leptosols	LP-sr
Kh''g	Somerirendzic Leptosols (gleyic)	LP-sr-gl
Kl	Endocalcaric Luvisols	LV-can
Ko	Endocalcaric Cambisols	CM-can
Kog	Endocalcaric Endogleyic Cambisols	CM-gln.can
Korg	Endocalcaric Endoskeletic Endogleyic Cambisols	CM-gln.skn.can
Kr	Calcaric Skeletic Regosols	RG-sk.ca
LkI	Dystric Albic Retisols	RT-ab.dy
M'	Sapric Histosols	HS-sa

WRB soil types	
CM	Cambisols
GL	Gleysols
HS	Histosols
LP	Leptosols
LV	Luvisols
RG	Regosols
RT	Retisols

Legends for the Figures:

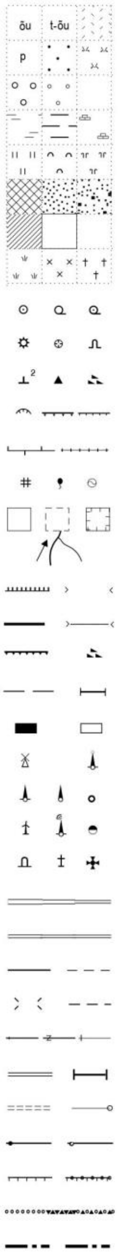
Field areas (colours of the polygons):

Light blue – confirmed field systems

Purple – unconfirmed field systems

Legend of Estonian Basic Map:

Mustvalge Eesti Põhikaardi 1:10 000 LEPPEMÄRGID
LEGEND of Estonian Basic Map 1:10 000 (monochrome)



õu; tootmisala; jäätmaa .... yard; production area; wasteland
põld; puuvilja- või marjaaed; haljasala .... arable land; orchard; green area
mets; noorendik; lage ala .... forest; young forest; open area / water area
madalsoo; raba / raskestiläbitav soo; turbaväli .... swamp/mire; bog / hard-passable swamp; peat field
rohumaa; põõsastik; soovik .... grassland; shrub; marshy grassland
karjäär; liivane ala; klibune ala; .... quarry; sandy area; stony (pebble) area
spordiväljak/spordikompleks; teeala/plats/viadukt .... sporting facility/stadium; road area or square
roostik; prügila; kalmistu .... reedy area; landfill/dumping ground; cemetery
üksik puittaim; harvik; salu .... single tree; scattered trees; grove
tehisküngas; auk; koobas .... artificial mound; hole; cave
rändrahn (kõrgus); kivihunnik; kivikülv .... boulder (height in meters); heap of stones; scattered boulders
tõngermaa; järsak; karjääri serv/nõlv .... rooted up ground; natural escarpment; career edge/slope
kaeve või kaitsekraav; vall .... trench/excavation; embankment/berm
tuletõrje veevõtukoht; allikas; puurkaev .... fire reservoir; spring; driven well
kindel kaldajoon; ebamäärane kaldajoon; kaldakindlustis .... definite coastline, indefinite coastline; sea wall or fortified shore
voolusuund; jõgi, oja või kraav: laiusega 6-8 m, laiusega kuni 6 m .... direction of flow; stream or ditch: 6-8 meters wide, up to 6 meter wide
pais; ülesõit (truup) .... dam; culvert
paadisild; ülekäik (jalgsild, purre) .... pier/jetty; footbridge
juga; kärestik .... waterfall; rapids
metsasiht; sõidutakistus .... a division line between forest compartments; road closed for traffic
elumaja/ühiskondlik hoone; muu hoone .... dwelling or public building; any other building or production facility
tuulik; tuletorn .... windmill; lighthouse
korsten; torn; muu rajatis .... chimney; tower; other construction
elektrituulik; sidemast; mahuti .... wind turbine; communication mast; tank
mälestusmärk; haud; kirik .... monument; grave; church
põhimaantee; tugimaantee; kõrvalmaantee .... main road; basic road; secondary road
kohalik maantee; ramp/tänav .... local road; street
pinnastee; rada .... dirt road; track/path
sild või viadukt; ülevedu .... bridge or viaduct; ferry line
raudtee; elektriraudtee; kitsarööpmeline raudtee .... broad gauge/railway; electric railway; narrow gauge railway line
trammitee; rippraudtee või suusatõstuk .... tramway; cable car or chair lift
tunnel; elektriliin; trafo .... tunnel; electricity transmission line; transformer
torujuhe: maapealne, maa-alune .... pipeline: above ground, underground
müür, tehissein või piirdeaed ilma puittaimedeta ja koos puitttaimedega .... wall, concrete wall or fence without trees and with trees
puittaimede rida; kiviaed; kiviaed puittaimedega .... row of trees; stone fence; stone fence with trees
riigipiir; Eesti Vabariigi ja Vene Föderatsiooni vaheline kontrolljoon .... state border; Estonian-Russian control line

TARTU	linn .... town
AHTME	linnaosa .... town district
VÄNDRA	alev .... borough
Helme	alevik .... village
Roobe	küla .... hamlet/small village
Tamme	maaüksuse nimi (talu) .... farm
Kase pst	tänava nimi .... street name
2 A 11174 K	maantee number ja kate (A - kõvakate, K - kruusakate) .... road number (A-pavement road, K - gravel road)
mv lv vv	maavalitsus; linnavalitsus; vallavalitsus .... county government; municipality
Võrtsjärv	veekogu nimi .... name of the waterbody
Toomemägi	loodusobjekti nimi .... name of the nature object
park kurisu	selgitav tekst nähtuse asukohas .... explanatory remark in a location of the nature object
Koorküla veski	rajatise nimi .... name of the construction/object

Maa-amet 2012

Appendix A1. Field systems in the northern part of the study area in mainland western Estonia (confirmed with previous fieldwork and unconfirmed during the current study)

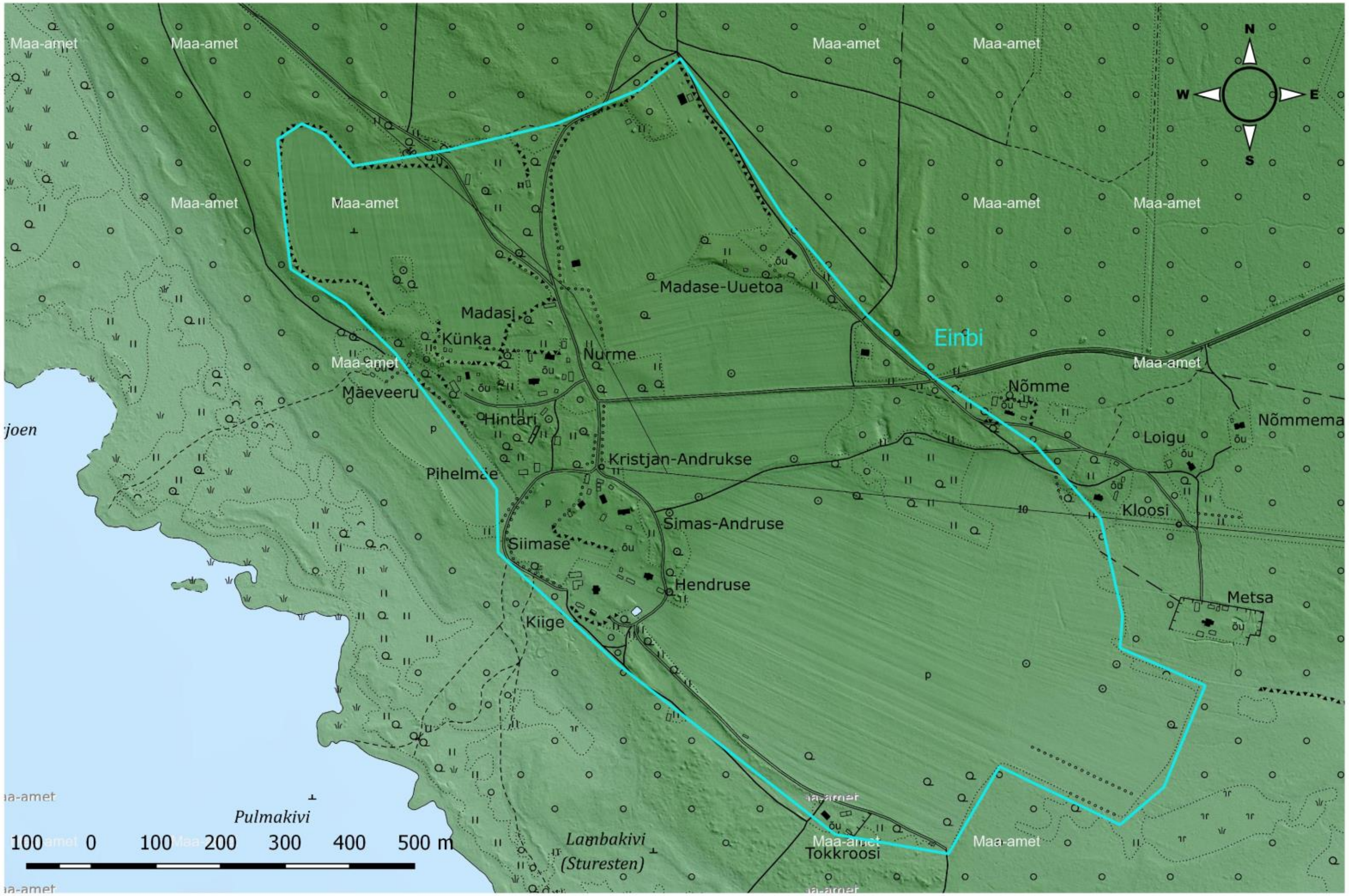
Table A. 1. Field systems in the northern part of the study area.

No	Name	Excavated	Preserved	conf/unconf	Features	Type	Other features	Area	Main soils_wrb	Main soils_Est	Modern land use	Arch sites within 1km	Prehistoric settlement	Historical village
1	Einbi	Y	Y	conf	Stone fences, banks, cairns	QF	StF, HV	N	CM, LV, RG	LkI	Village, meadow	none		1540
2	Ellamaa	Y	N	conf	Cairns	CCF, FF		N	RG	K	Quarry (previously forest)	Cemetery (both 700m)	Yes	1275
5	Kirimäe I	N	Y	conf	Cairns, some banks, stone fences	CCF, FF	StF	N	RG	K	Forest	none		1341
6	Kirimäe II	N	Y	conf	Cairns, some banks	CCF, FF		N	GL, RG	Kg	Forest	none		none
7	Koela I	N	Y	conf	Cairns, some banks	CCF, FF		N	RG	Gk	Forest	none		1977
11	Linnamäe I	N	Y	conf	Cairns, elongated cairns	CCF, FF		N	RG	K	Forest	Sacred stone		1689
12	Linnamäe II	N	Y	conf	Cairns, elongated cairns, banks, single plots?	CCF, SF?		N	RG	K	Forest/clearing	cup-marked stone (400-500m)		1689
13	Räägu	N	Y	conf	Cairns	CCF, FF		N	GL, RG	Kg	Forest/clearing	none		none

17	Oru I	N	Y	conf	Cairns	CCF, FF		N	RG	KI	Forest	cup-marked stone (400-500m)		none
25	Uugla I	Y	N	conf	Cairn(s)	CCF, FF		N	RG	Kr	Meadow	Stone graves	Yes	**1323**
27	Kuluse	N	Y	conf	Cairns, some banks	CCF, FF		N	RG, GL	Kg	Forest	Sacred site, cemetery - 600-700m		1590
70	Mõisaküla	N	Y	unconf	Cairns, banks, enclosure ?	CCFB	E?	N	RG	K	Forest/clearin g	Sacred stone		1534
71	Oru II	N	Y	unconf	Banks, cairns, irregular plots?	CCF, LQF		N	RG	K	Forest	Sacred stone		1689
72	Ingküla	N	Y	unconf	Stone fences, cairns, banks, irregular plots	LQF	StF	N	RG, GL	Go	Forest	none		1540
73	Saunja	N	Y	unconf	Banks, cairns, quite regular plots	CCF, LQF		N	RG, GL	K	Forest/clearin g	none		none
74	Koela II	N	Y	unconf	Cairns	CCF, FF		N	GL	M'	Forest	Sacred stone		1228
75	Uugla II	N	Y	unconf	Cairns	CCF, FF	SS	N	GL	Go	Forest	Sacred stone	Yes	1323
76	Jalukse	N	Y	unconf	Cairns	CCF, FF		N	GL, RG	Go	Forest	none		1601
77	Rummu	N	Y	unconf	Irregular plots, banks, cairns, enclosure	QF	E, CP	N	RG, GL	Kr	Forest	Cemeter y (500m)	Yes	1913

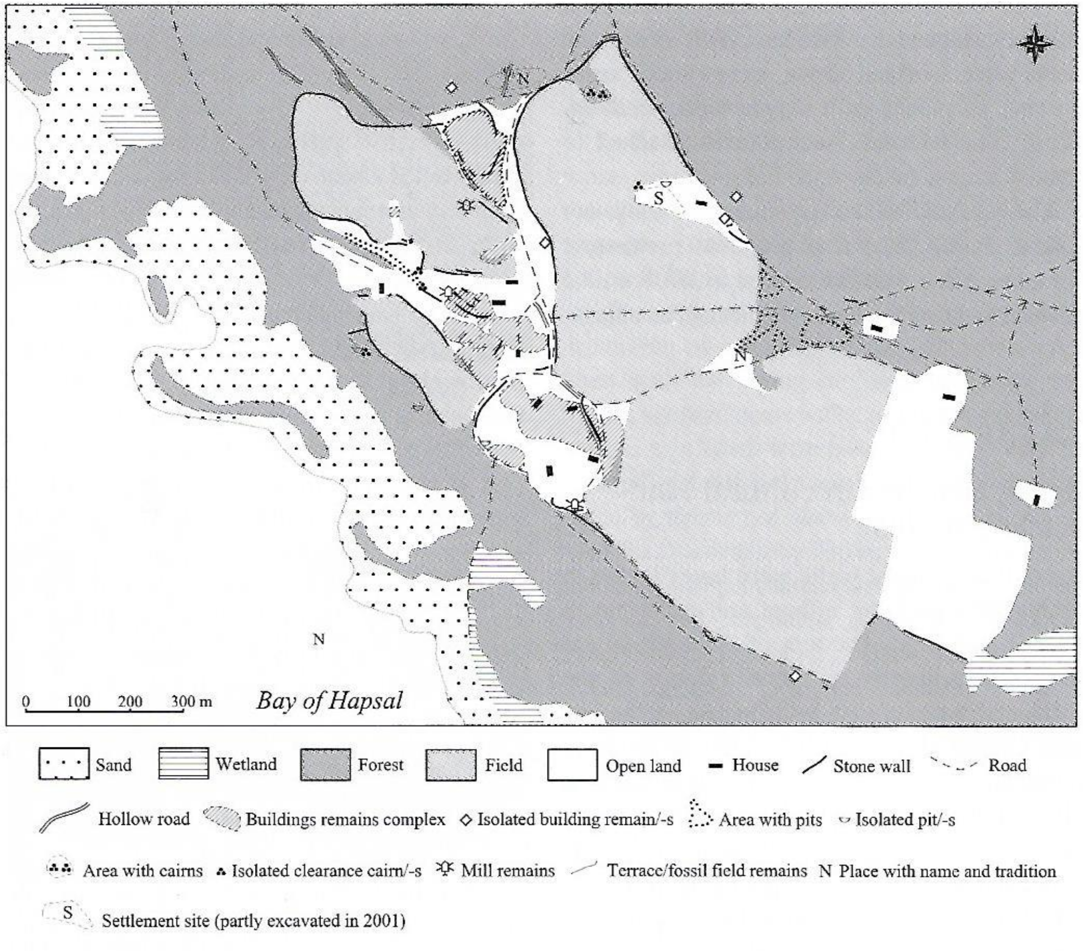
78	Tammiku	N	Y	unconf	Banks, cairns, stone fences nearby, large irregular plots?	CCF, LQF		N	GL, RG	Go1	Forest/clearin g	none		1871
79	Uusküla	N	Y	unconf	Irregular plots, banks, cairns, stone fences nearby	LQF	HV	N	RG, CM	Kg	Village, meadows	Cemeter y (700m)	Yes	1726
80	Väike-Lähtru	N	Y	unconf	Cairns, single long bank	CCF, FF		N	GL, RG, CM	M'	Forest	none		1591
81	Vilkla	N	Y	unconf	Irregular large plots, cairns, some banks	CCFB		N	RG, GL	Kg	Forest	Sacred site (100m)		1591
82	Lõbe	N	Y	unconf	Irregular large plots, cairns, banks	CCF, CCFB? , LQF?		N	GL, RG	Gkr	Forest/clearin g		Yes	1591
83	Kolila	N	Y	unconf	Cairns, some single banks	CCF, CCFB?		N	GL	M'	Forest	13th century church (300m)	Yes	1739
84	Uneste-Litu	N	Y	unconf	Regular plots, banks, cairns	CCF, LQF		N	GL	Gk	Forest	none		1598

1. Einbi

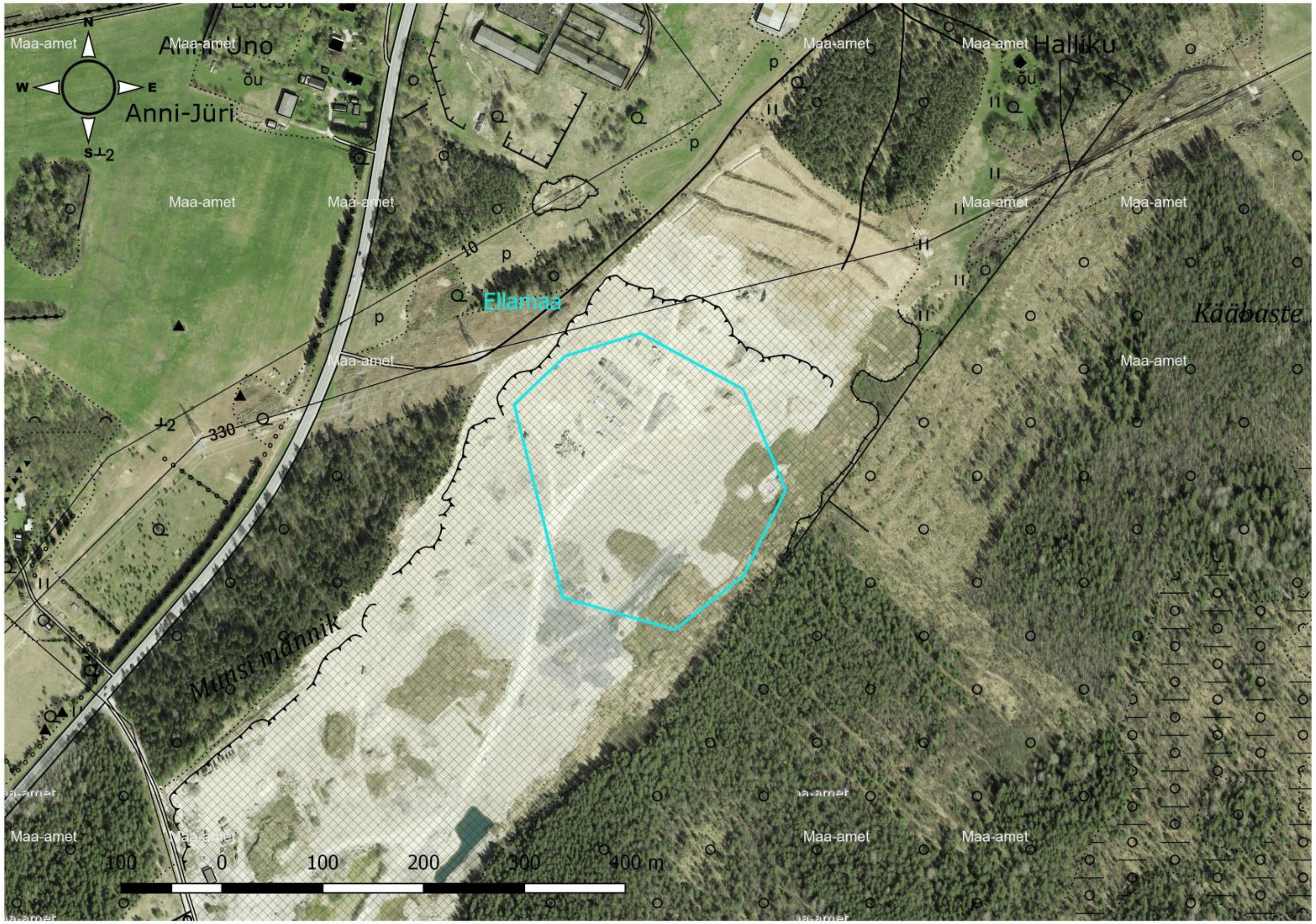

Einbi
Madase-Uuetoa
Madasi
Künka
Nurme
Mäeveeru
Hintari
Pihelmäe
Kristjan-Andrukse
Simas-Andruse
Siimase
Hendruse
Kiige
Nõmme
Nõmmema
Loigu
Kloosi
Metsa
Tokkroosi
Pulmakivi
Lambakivi
(Sturesten)
100 0 100 200 300 400 500 m
N
S
W
E
Maa-amet

1. Einbi

Mapping of central Einbi (Markus 2004, Fig. 40).



2. Ellamaa



Maa-amet
Anni-Uno
õu
Anni-Jüri
Halliku
Ellamaa
Käbaste
Munsi männik
N
S
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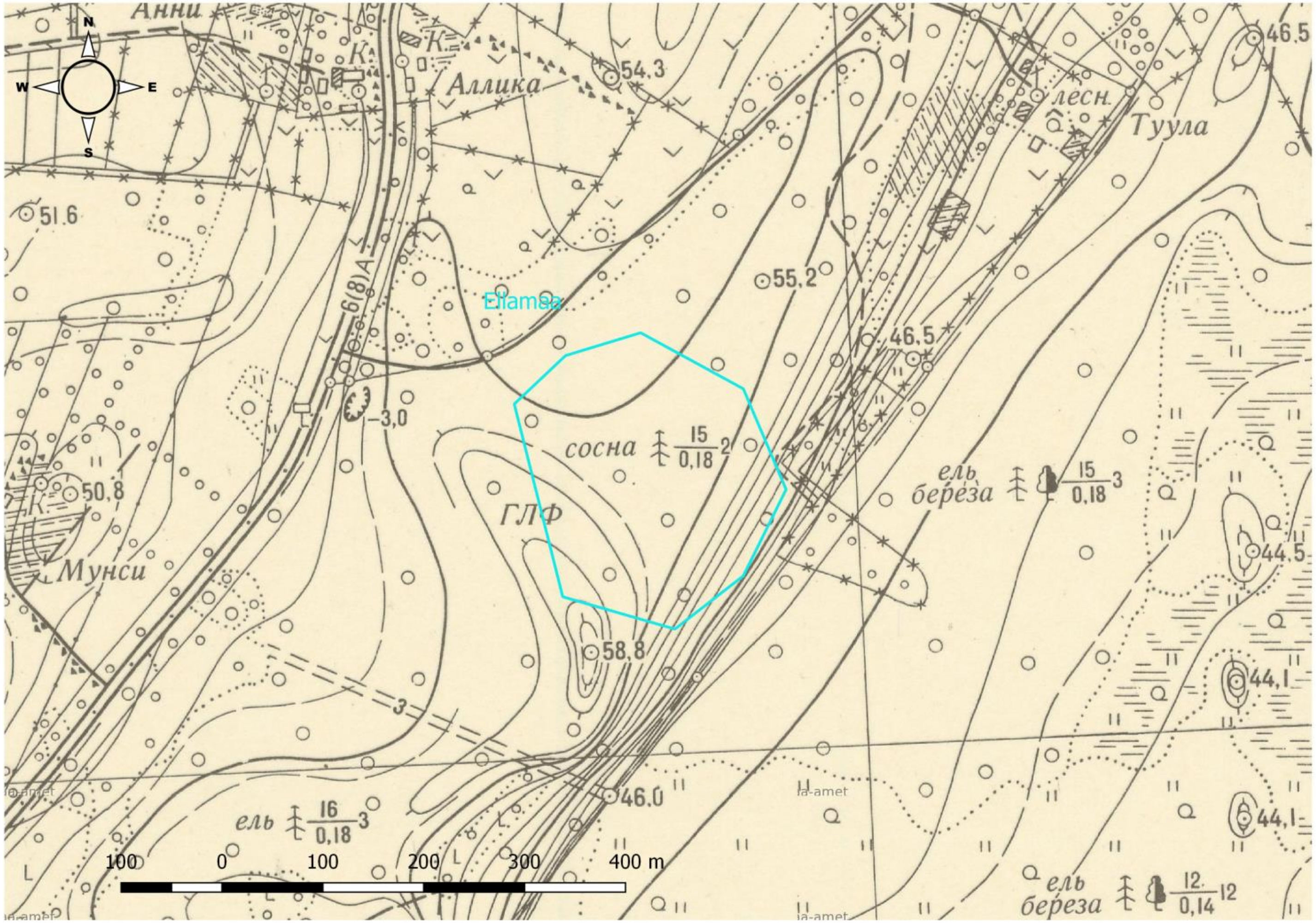
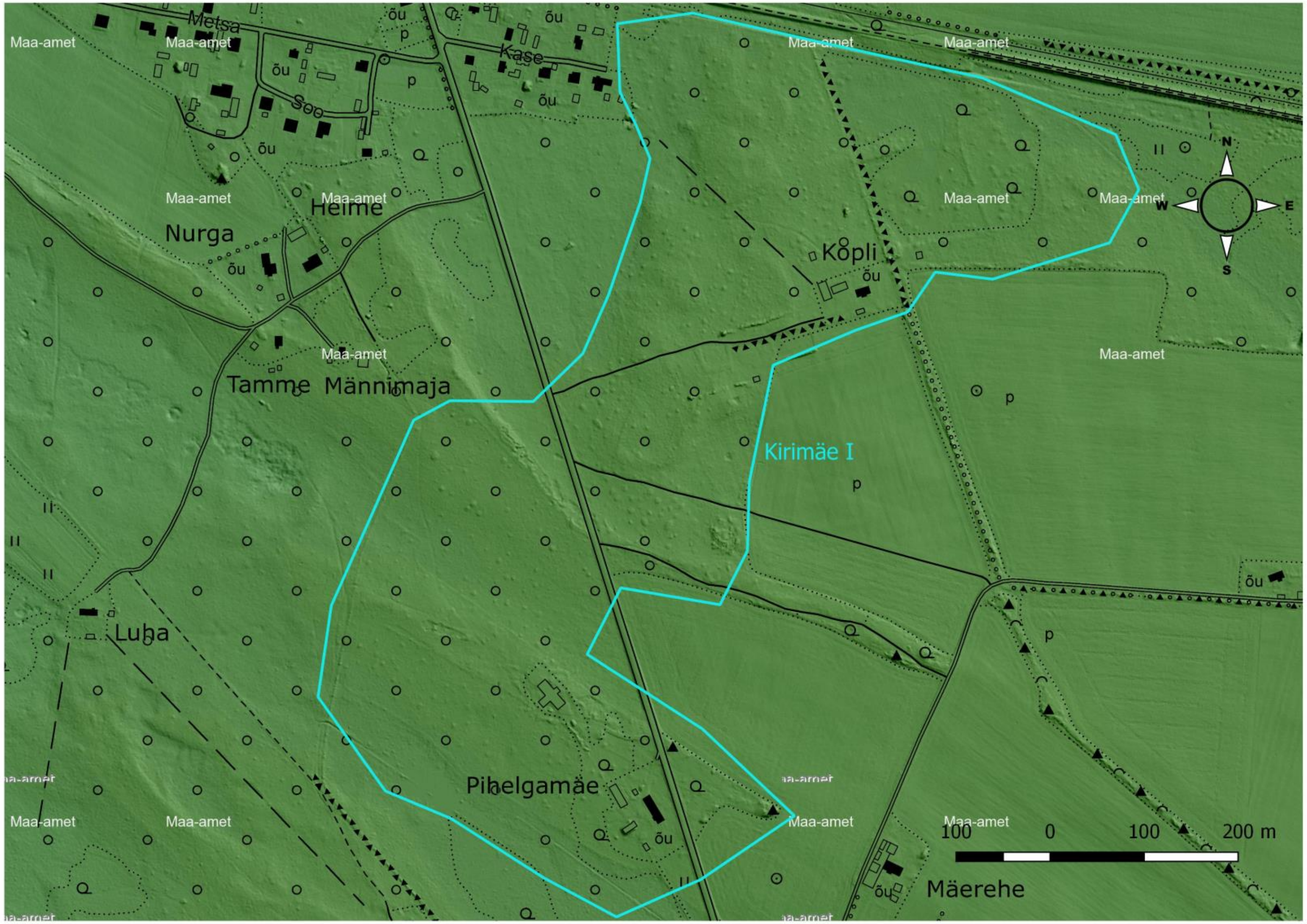
E
10
330
p
100
0
100
200
300
400 m

2. Ellamaa

Topographic map from 1965 (Estonian Land Board 2021).



5. Kirimäe I



Metsa
Kase
Soo
Heime
Nurga
Kopli
Tamme
Männimaja
Kirimäe I
Luha
Pihelgamäe
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Maa-amet
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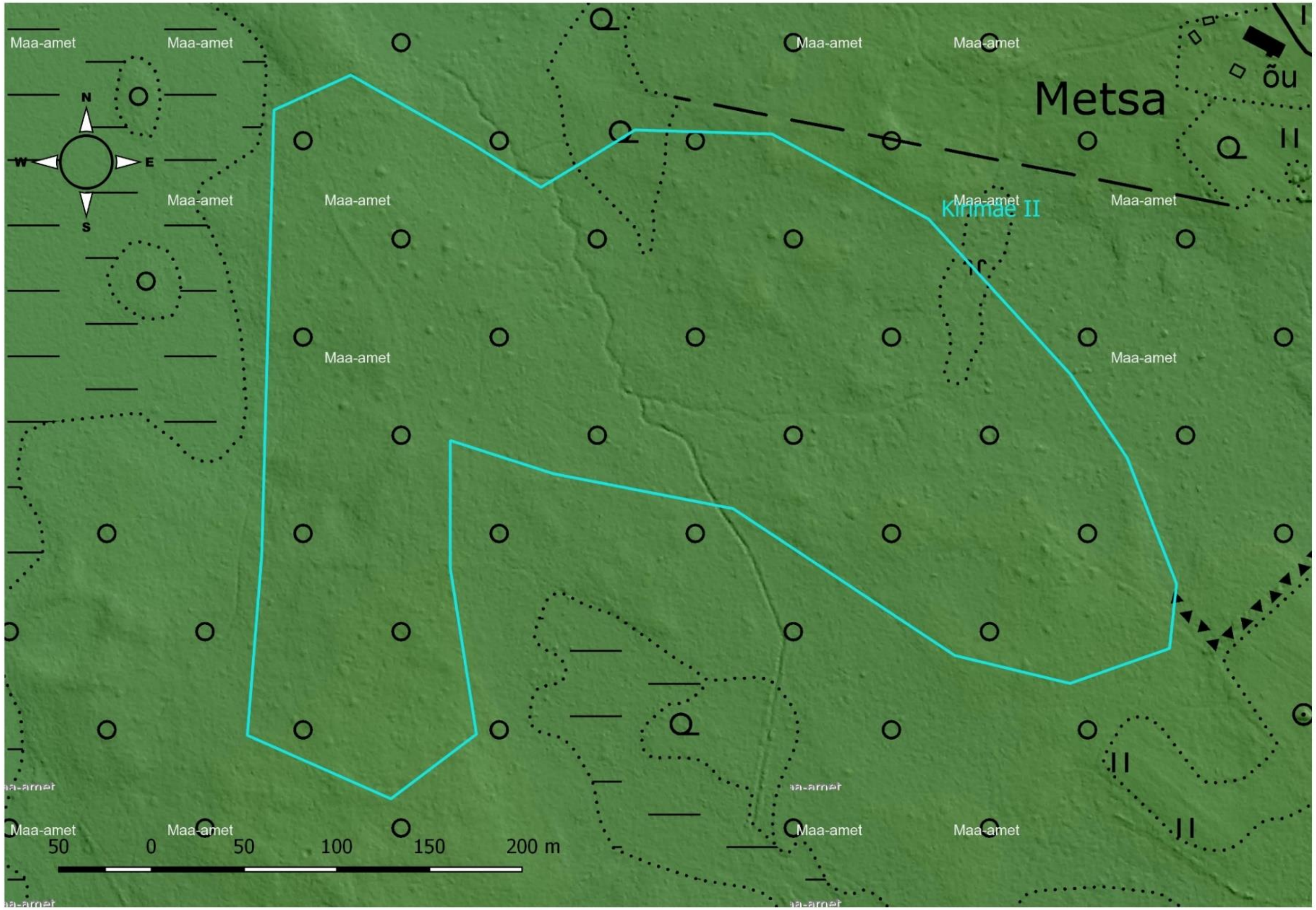
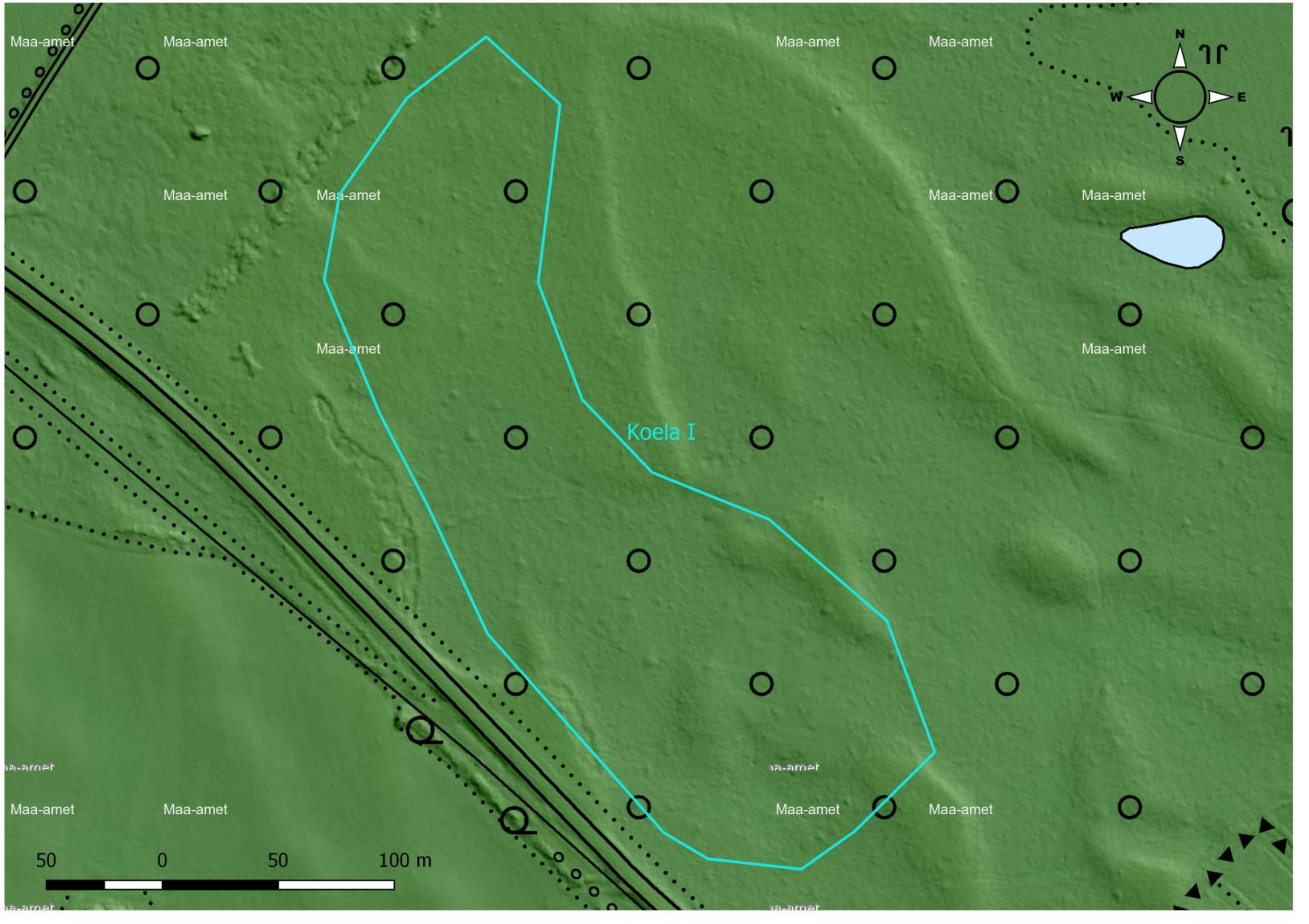
200 m

6. Kirimäe II

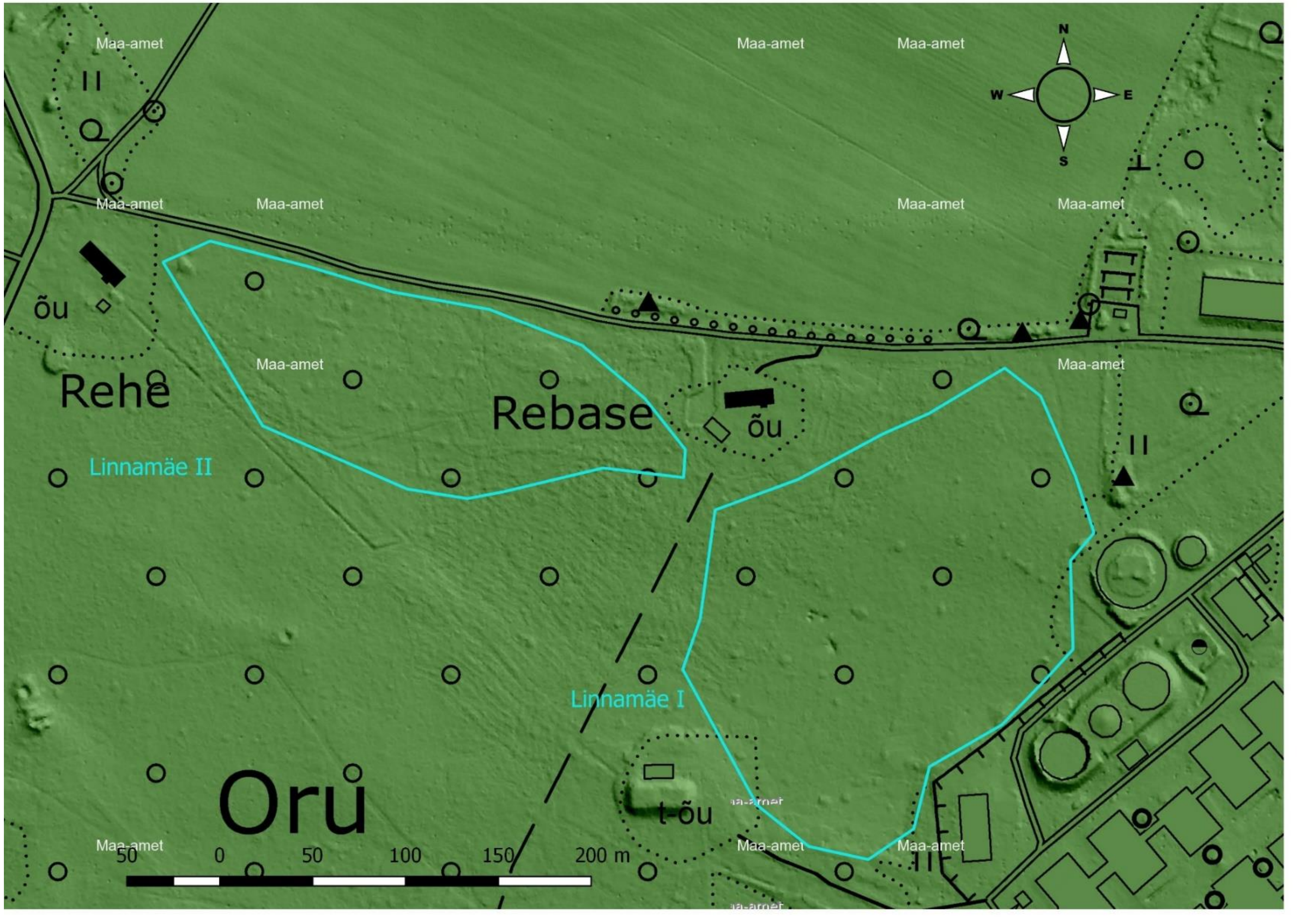


7. Koela I

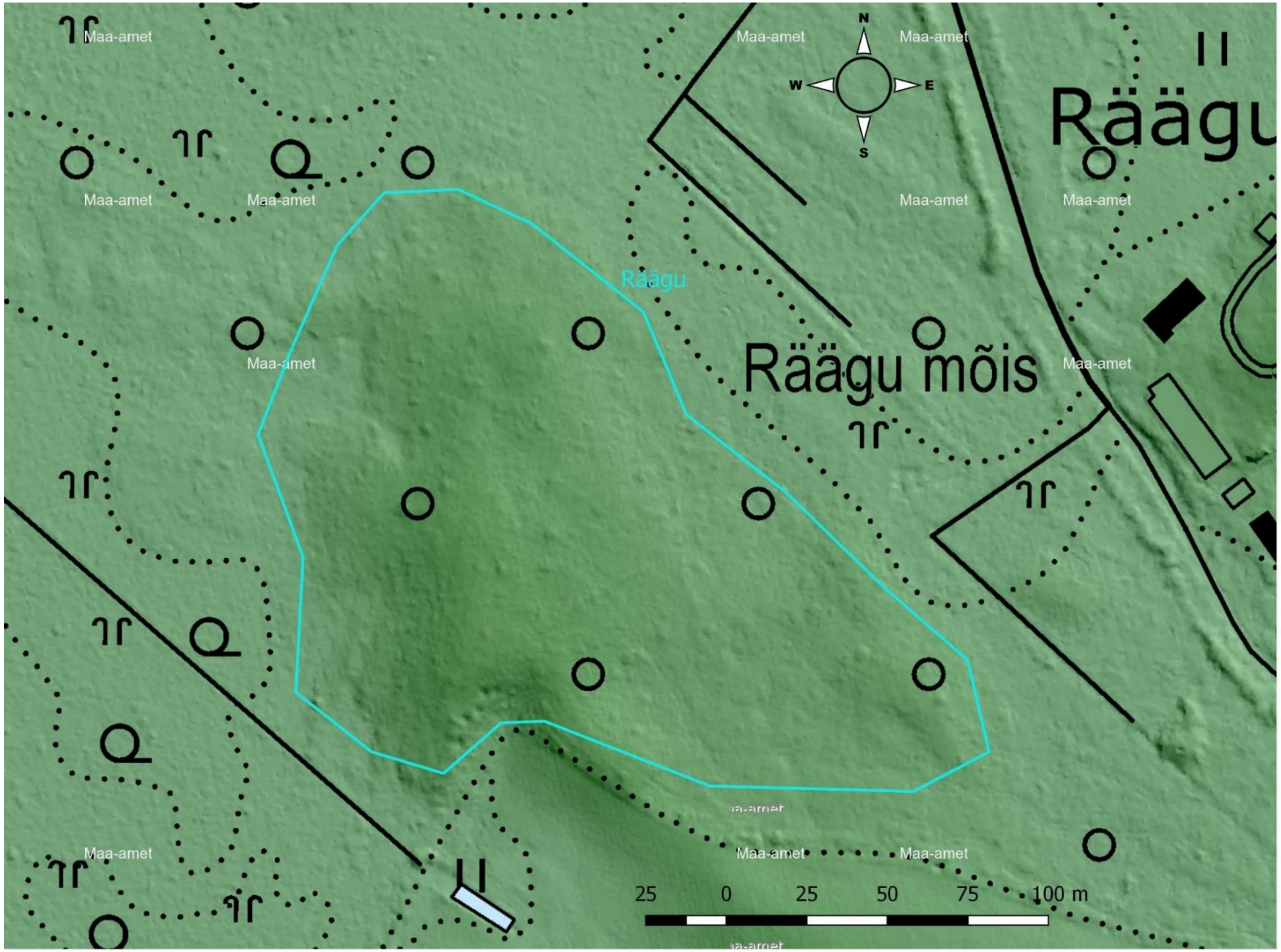


11. Linnamäe I

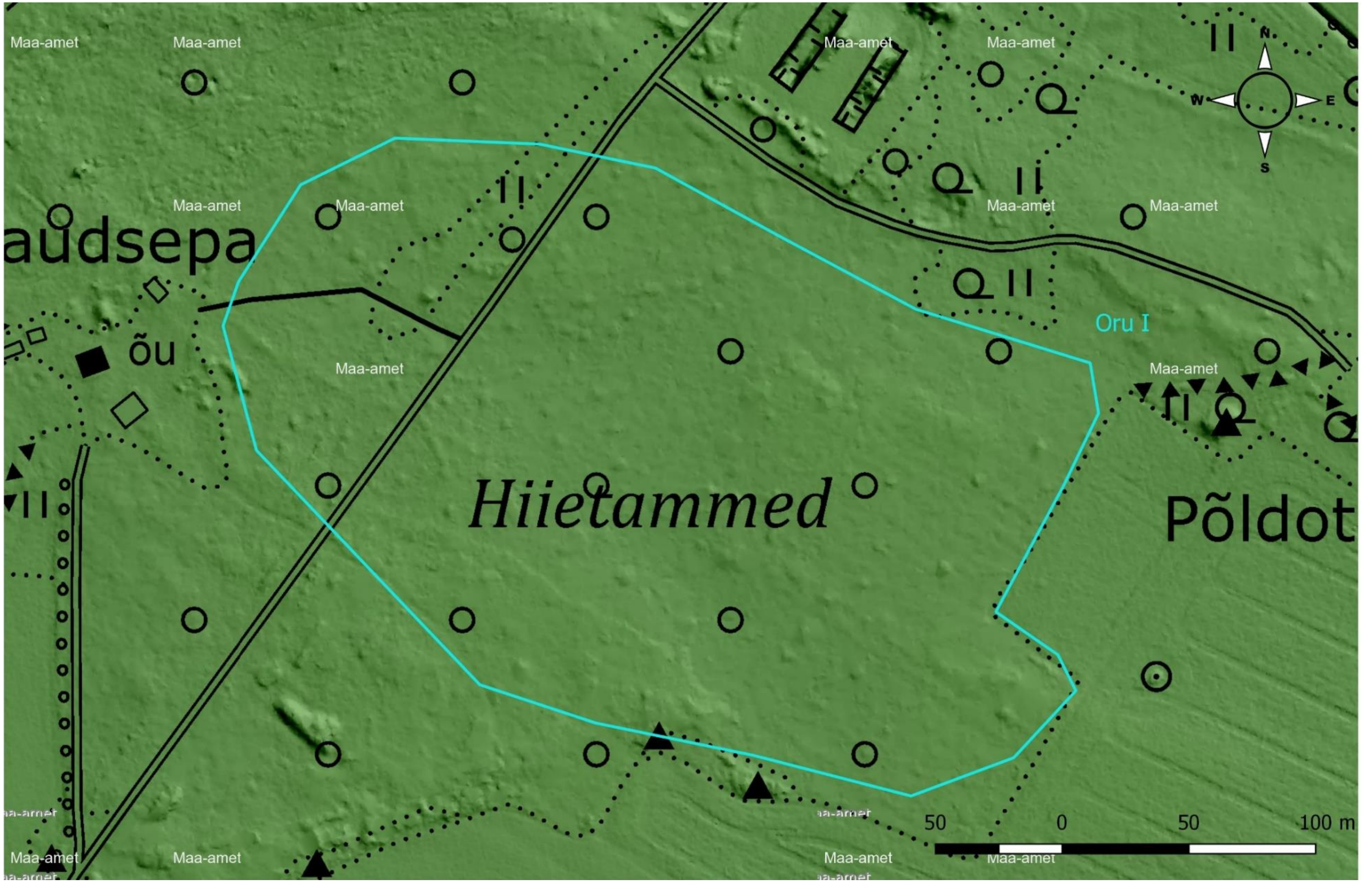
12. Linnamäe II



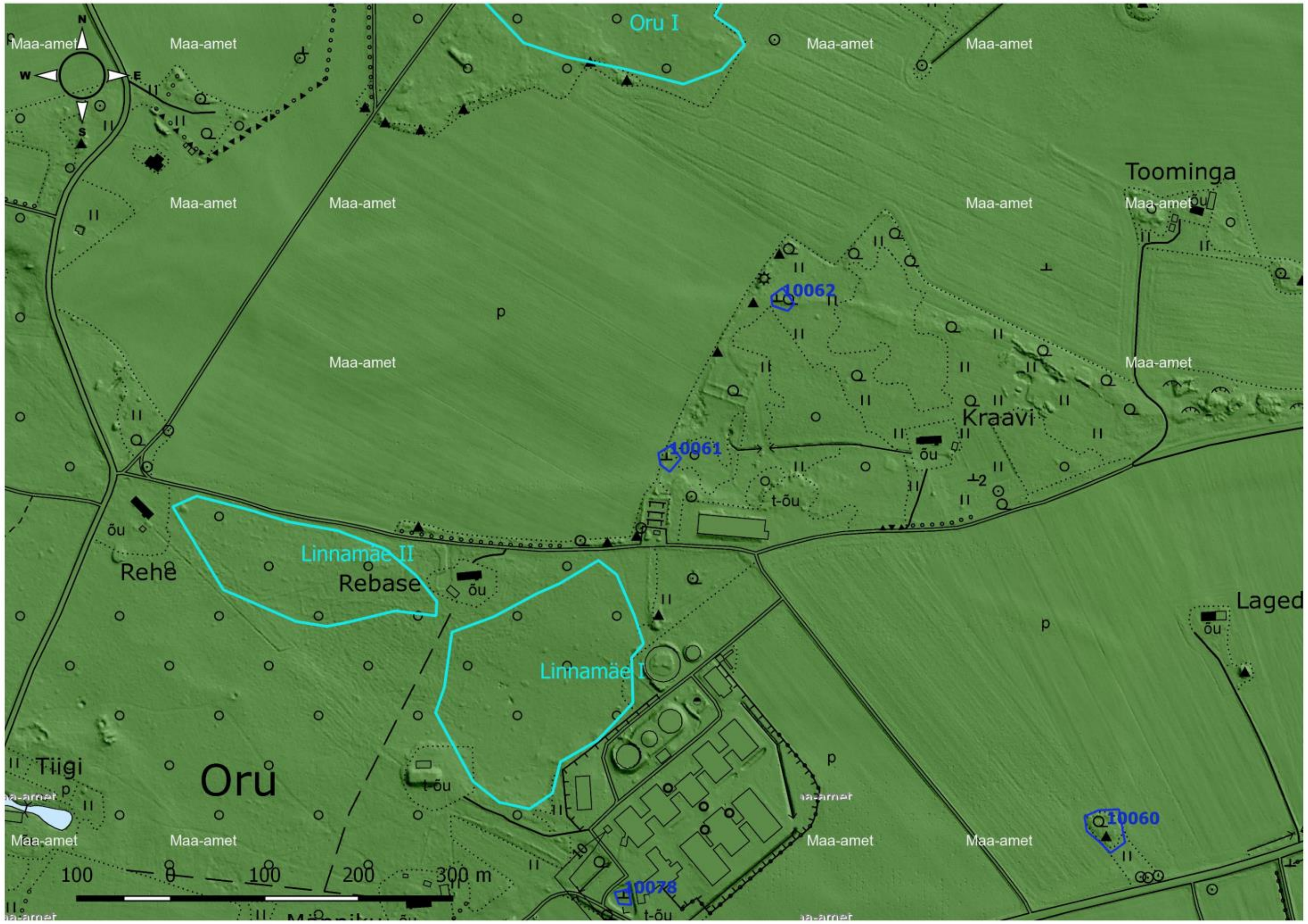
13. Räägu



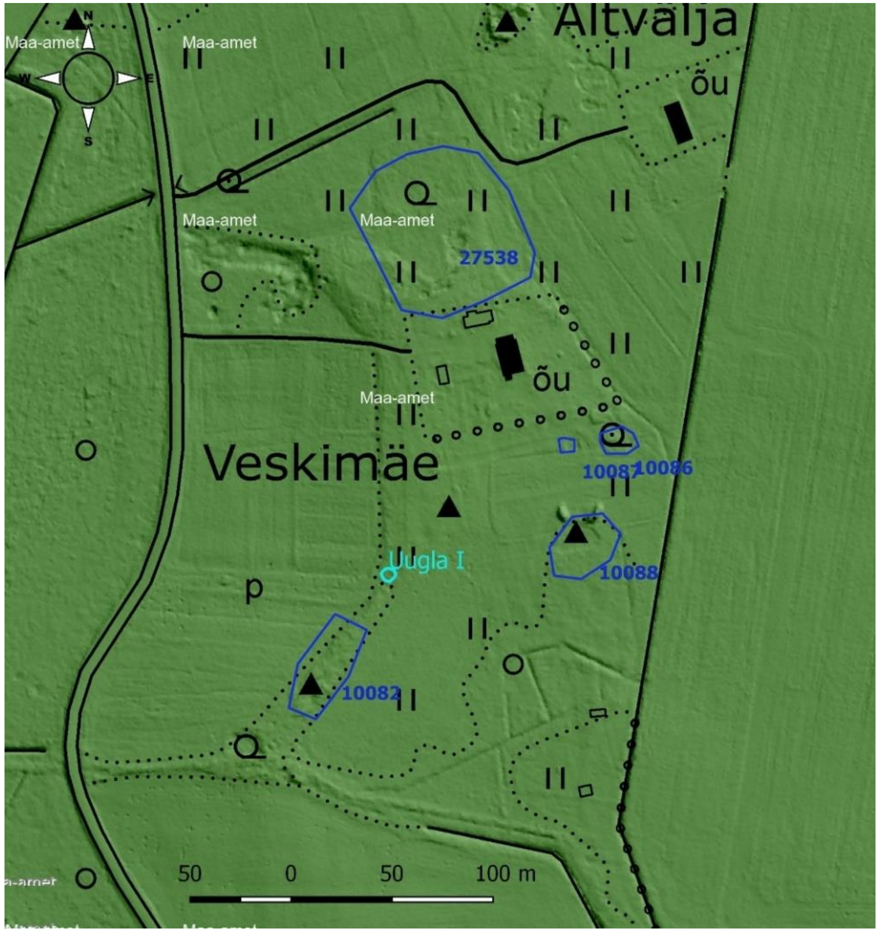
17. Oru I



11. Linnamäe I
12. Linnamäe II
17. Oru I



25. Uugla I



Altvalja
õu
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Veskimäe
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Uugla I
p
10082
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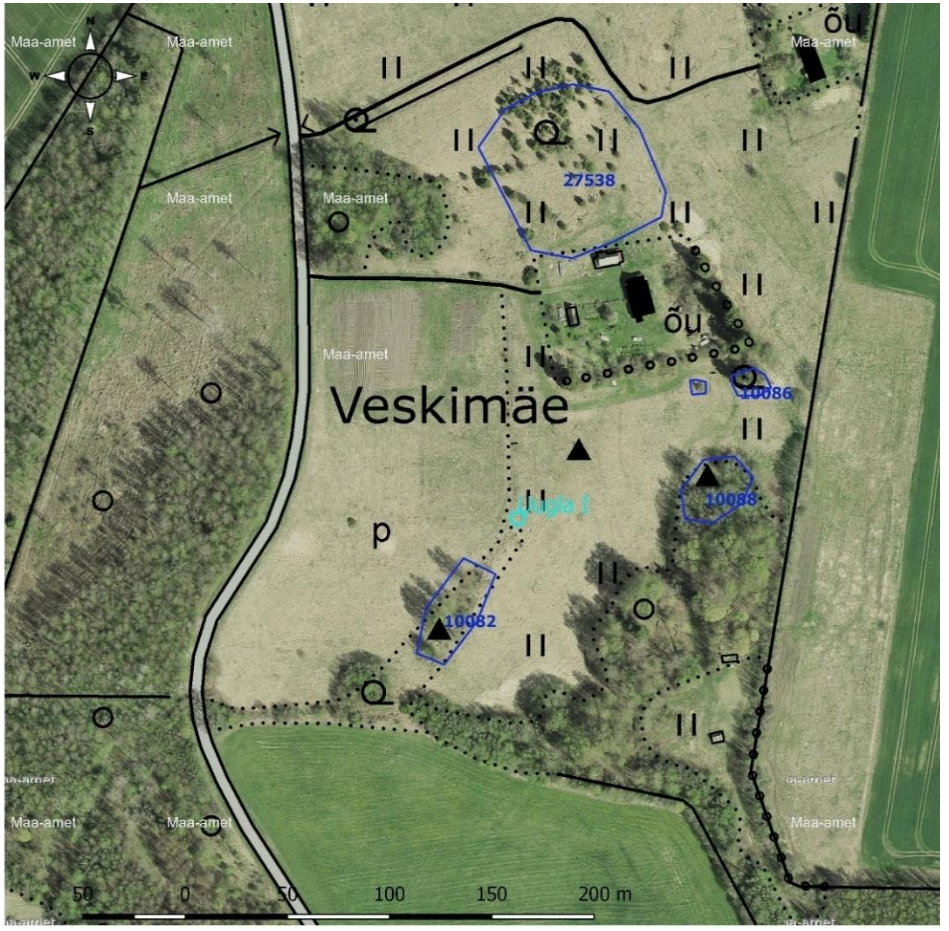

õu
Maa-amet
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Veskimäe
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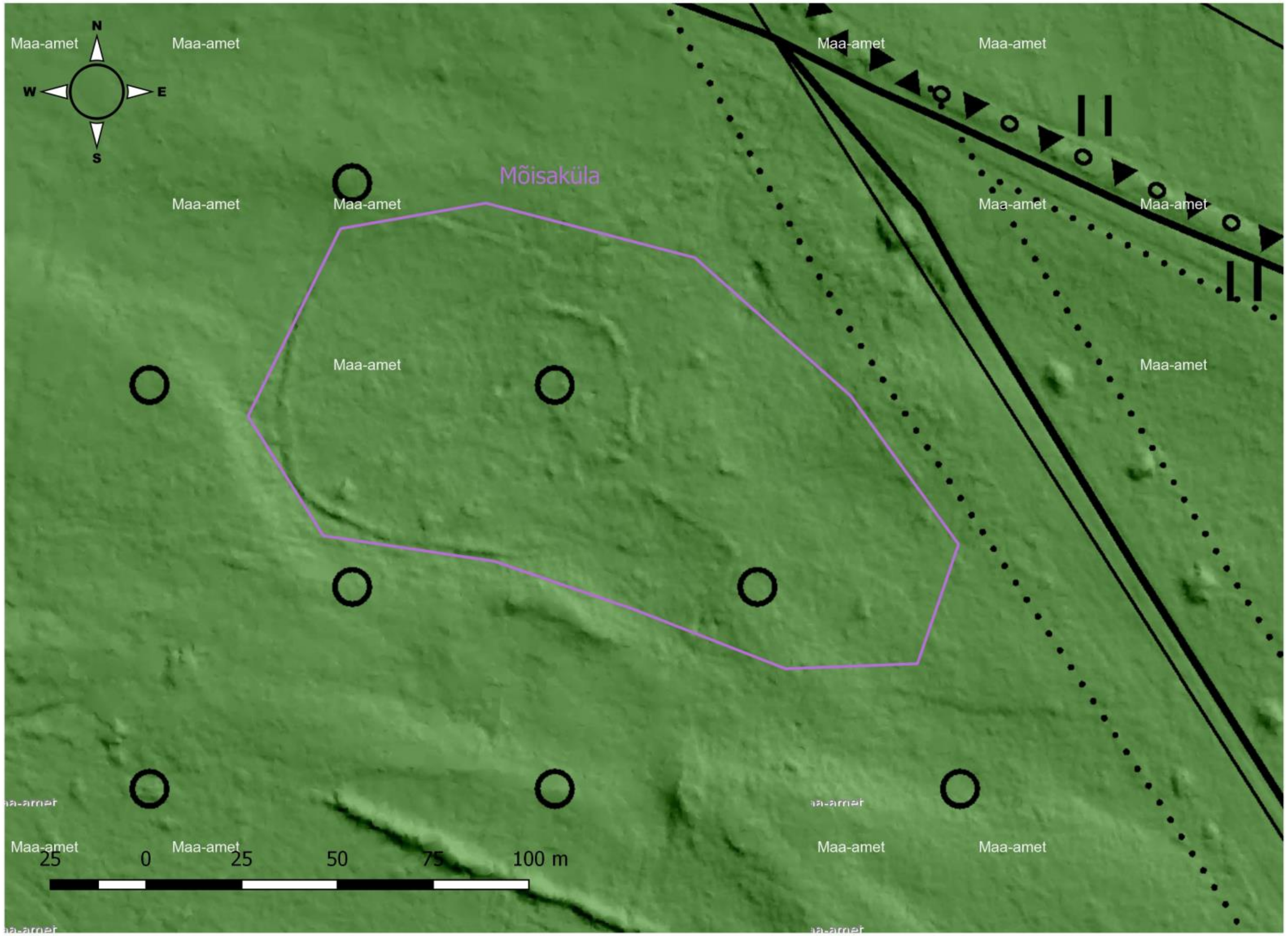
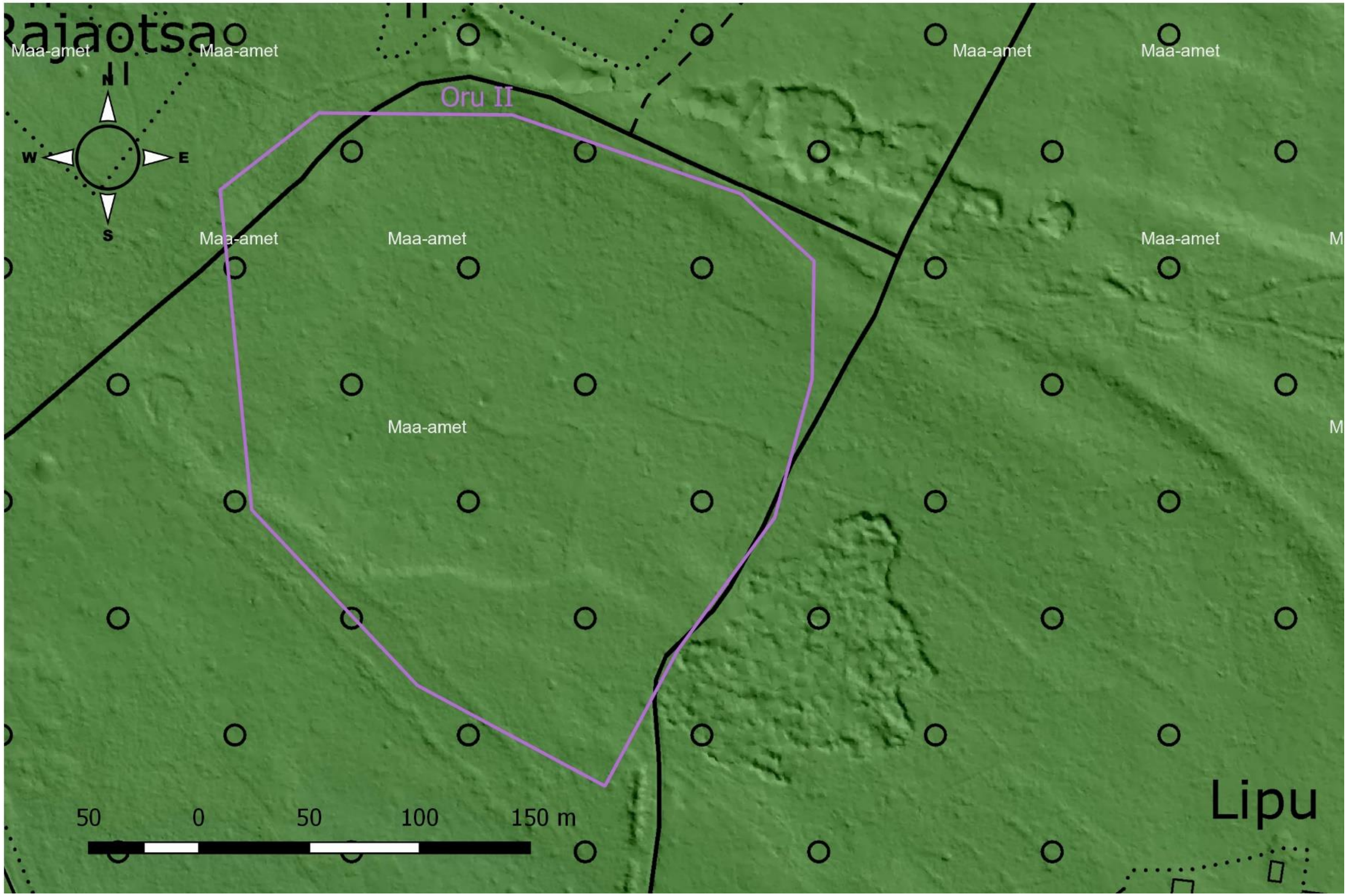
Uugla I
p
10082
50 0 50 100 150 200 m

27. Kuluse

70. Mõisaküla

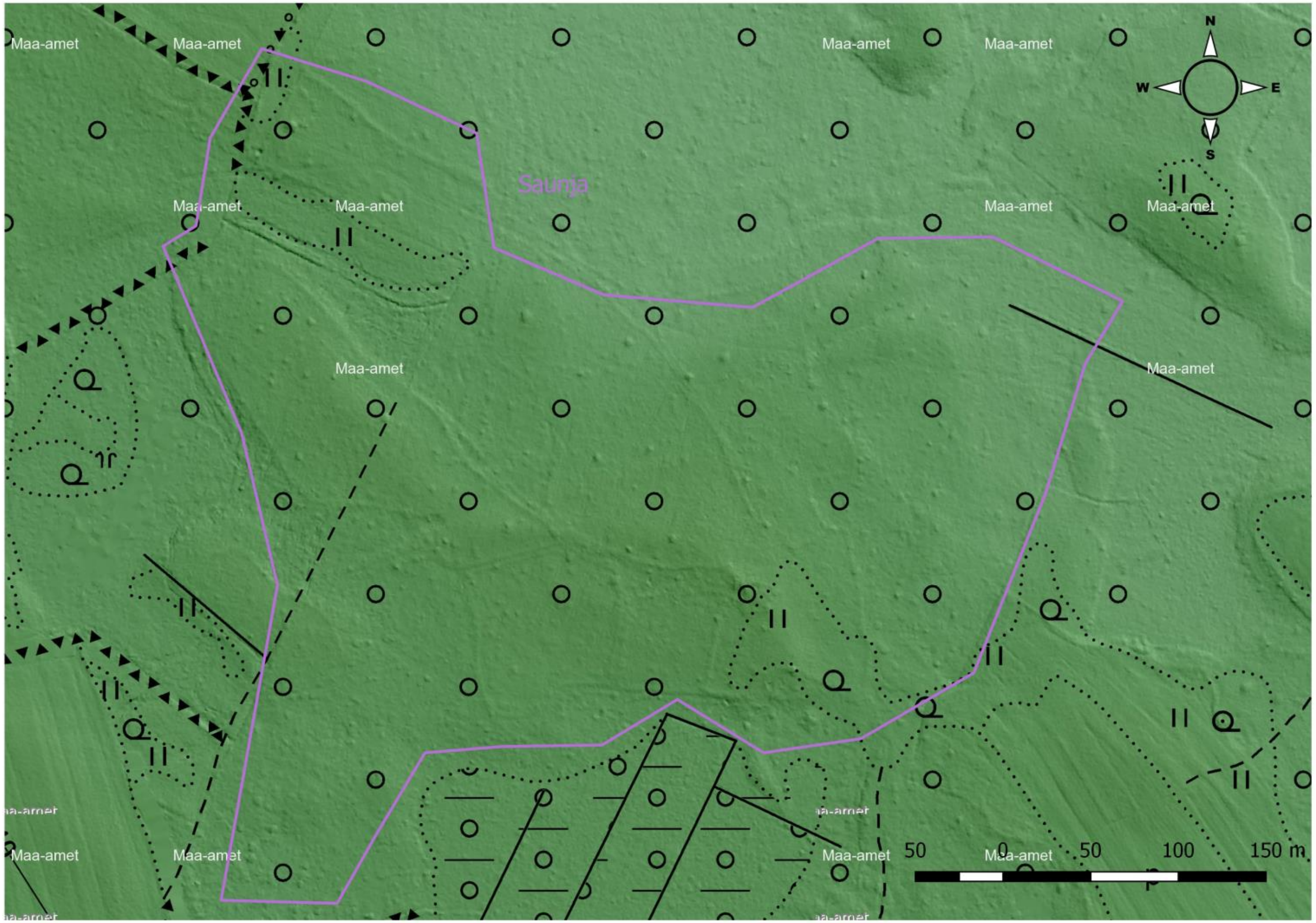


71. Oru II


Rajaotsa
Maa-amet
Maa-amet
Maa-amet
Maa-amet
N
W
E
S
Oru II
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Lipu
50 0 50 100 150 m

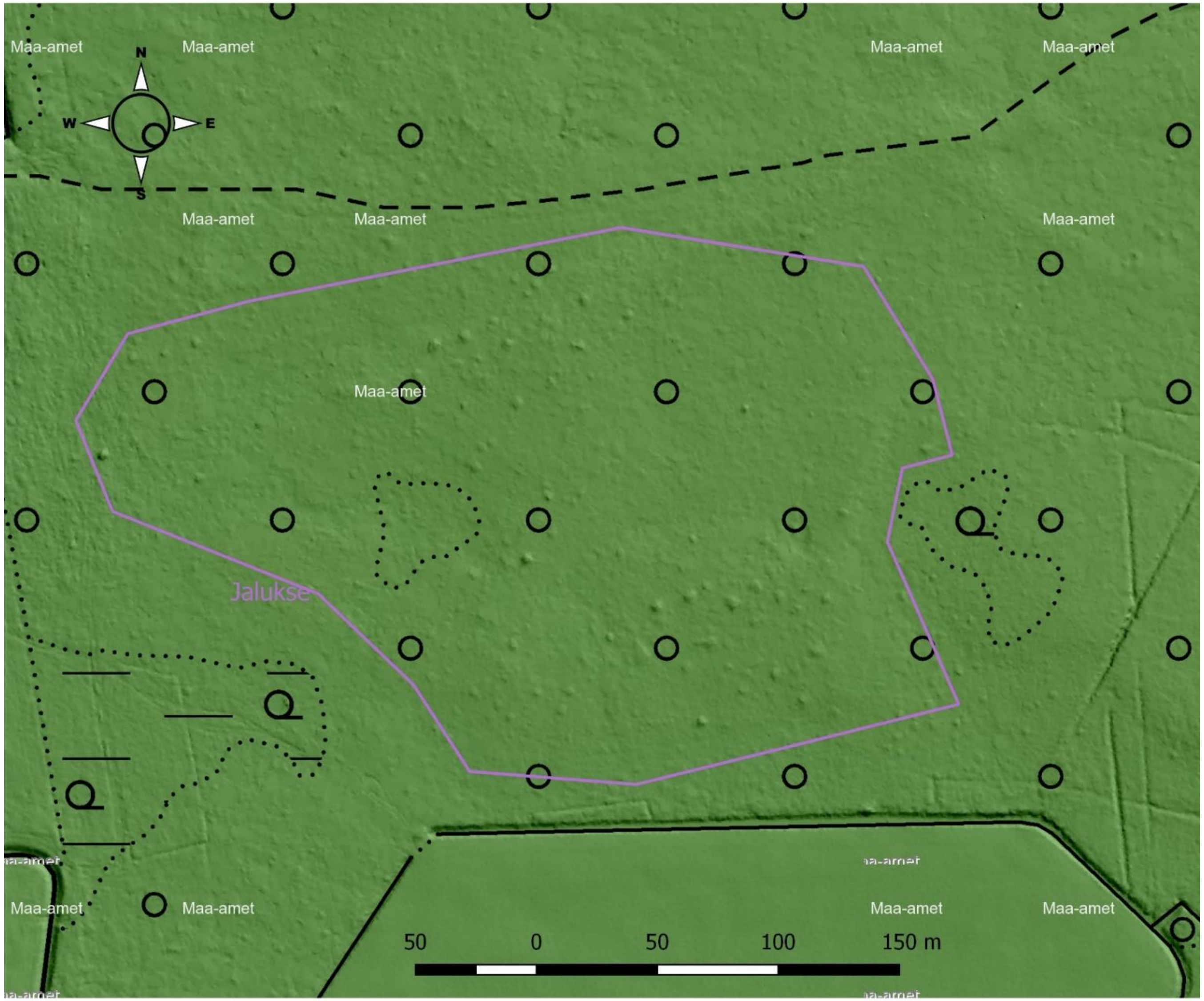
72. Ingküla

73. Saunja



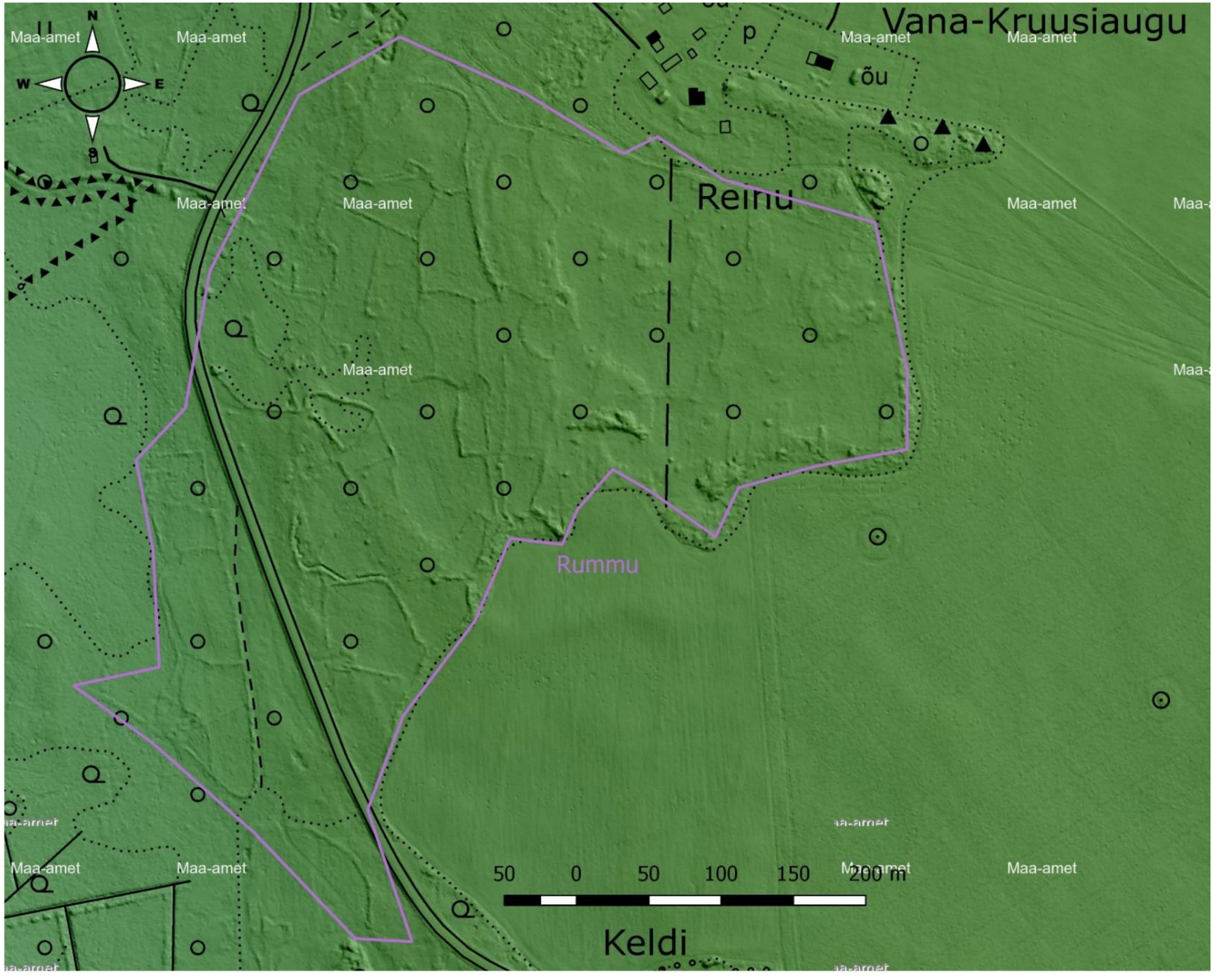
74. Koela II
75. Uugla II

76. Jalukse

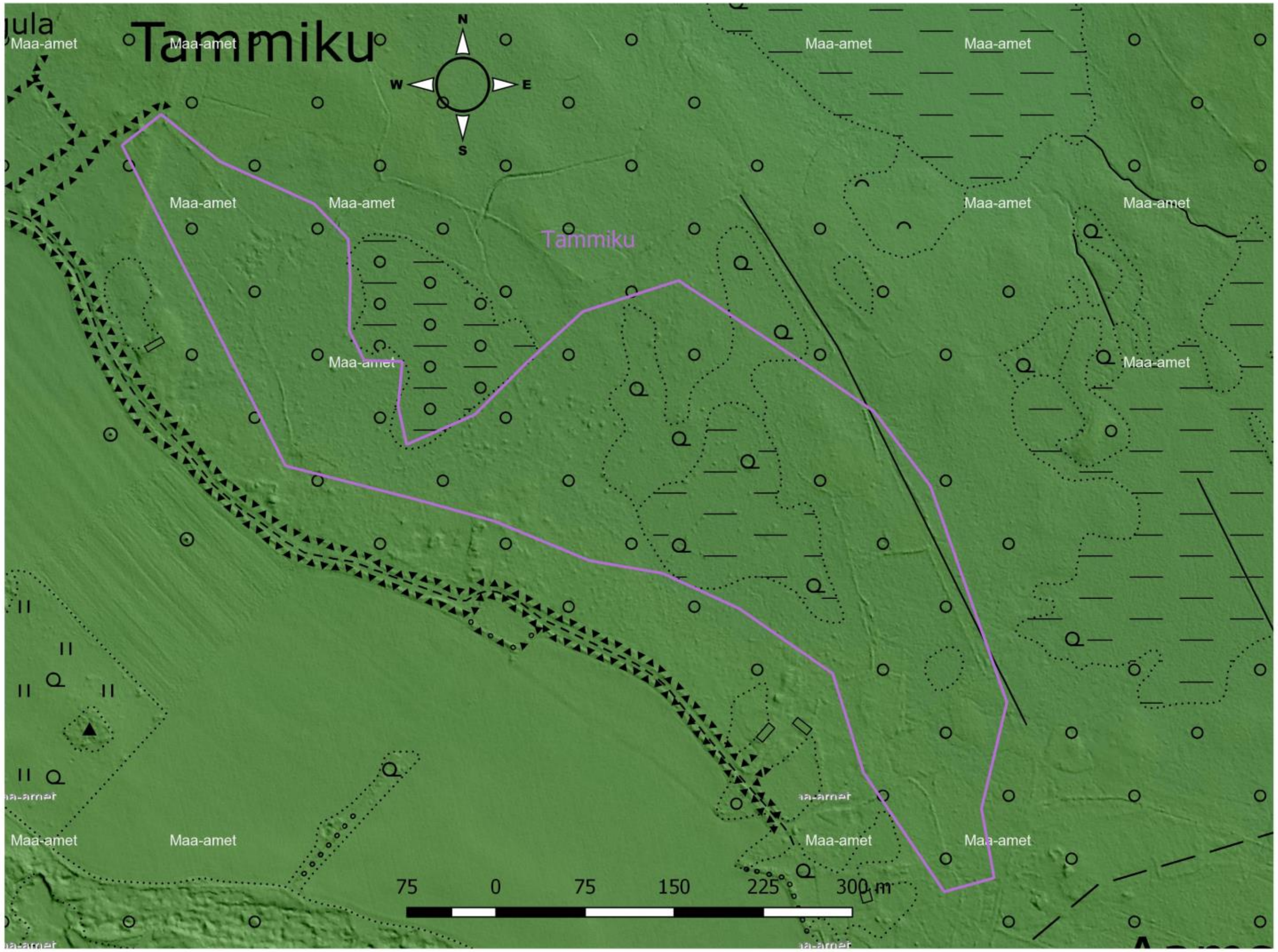


Maa-amet
Maa-amet
Maa-amet
Maa-amet
N
W
E
S
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Jalukse
Maa-amet
Maa-amet
Maa-amet
Maa-amet
50
0
50
100
150 m

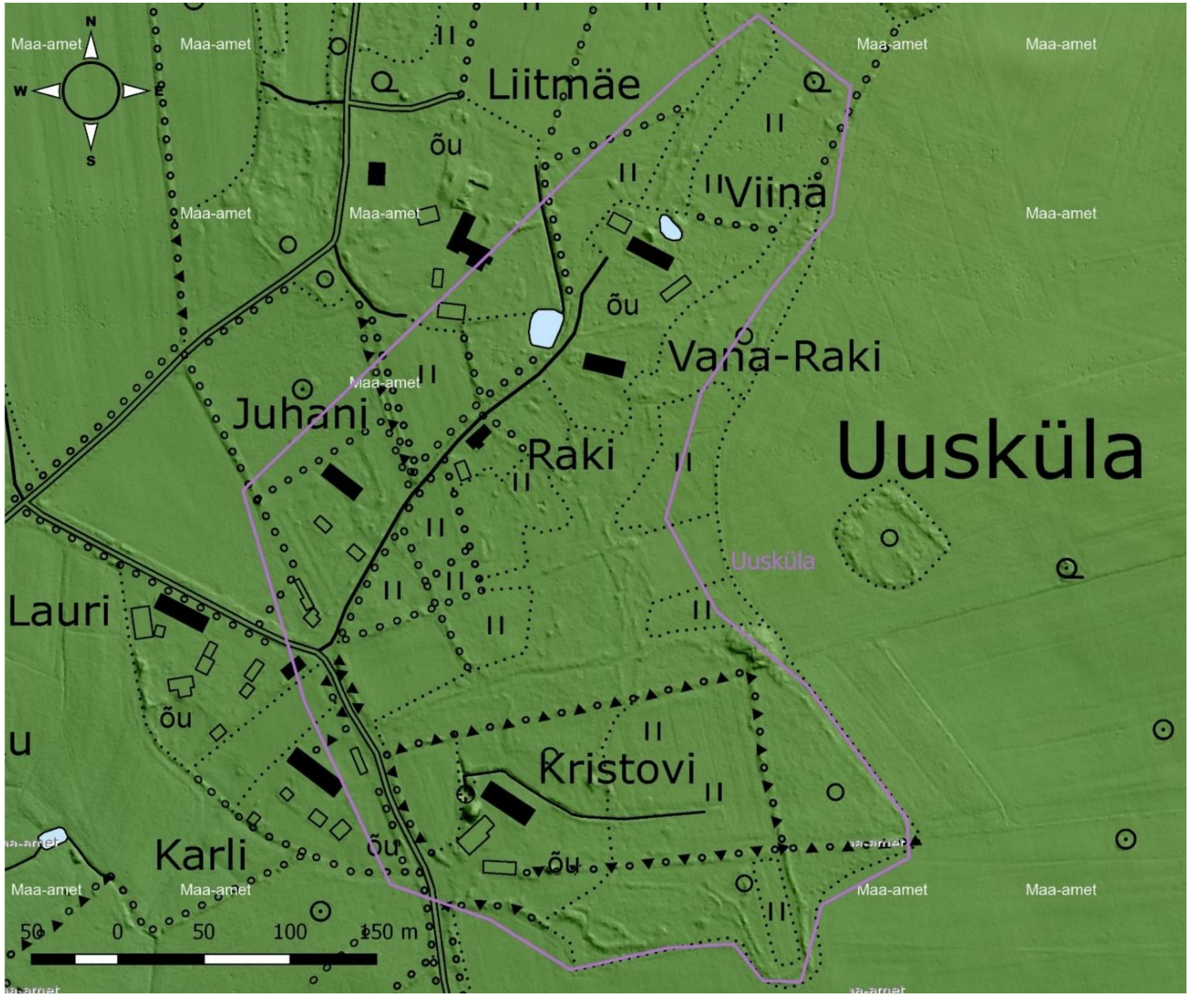
77. Rummu


Vana-Kruusiaugu
Reinu
Rummu
Keldi
õu
p
N
S
W
E
50 0 50 100 150 200 m
Maa-amet

78. Tammiku

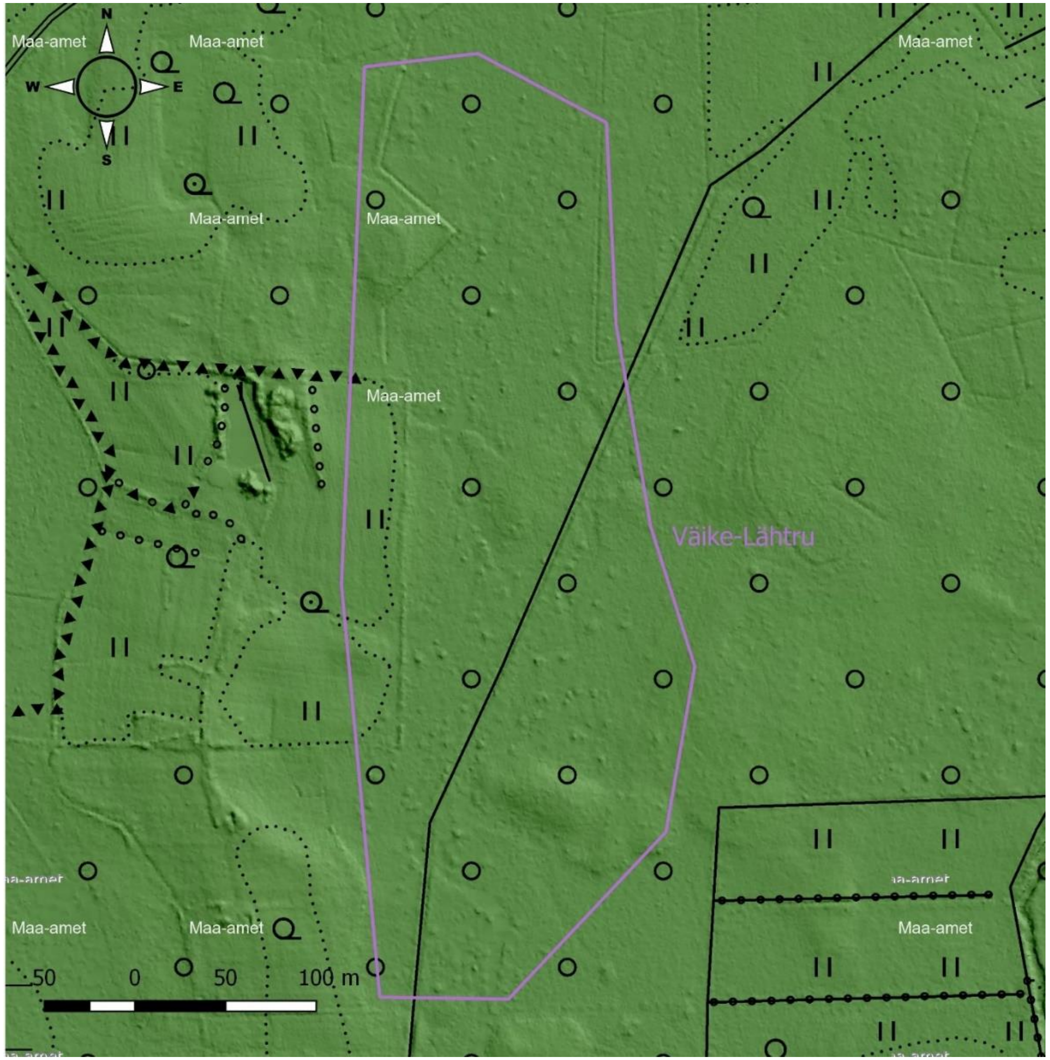


79. Uusküla



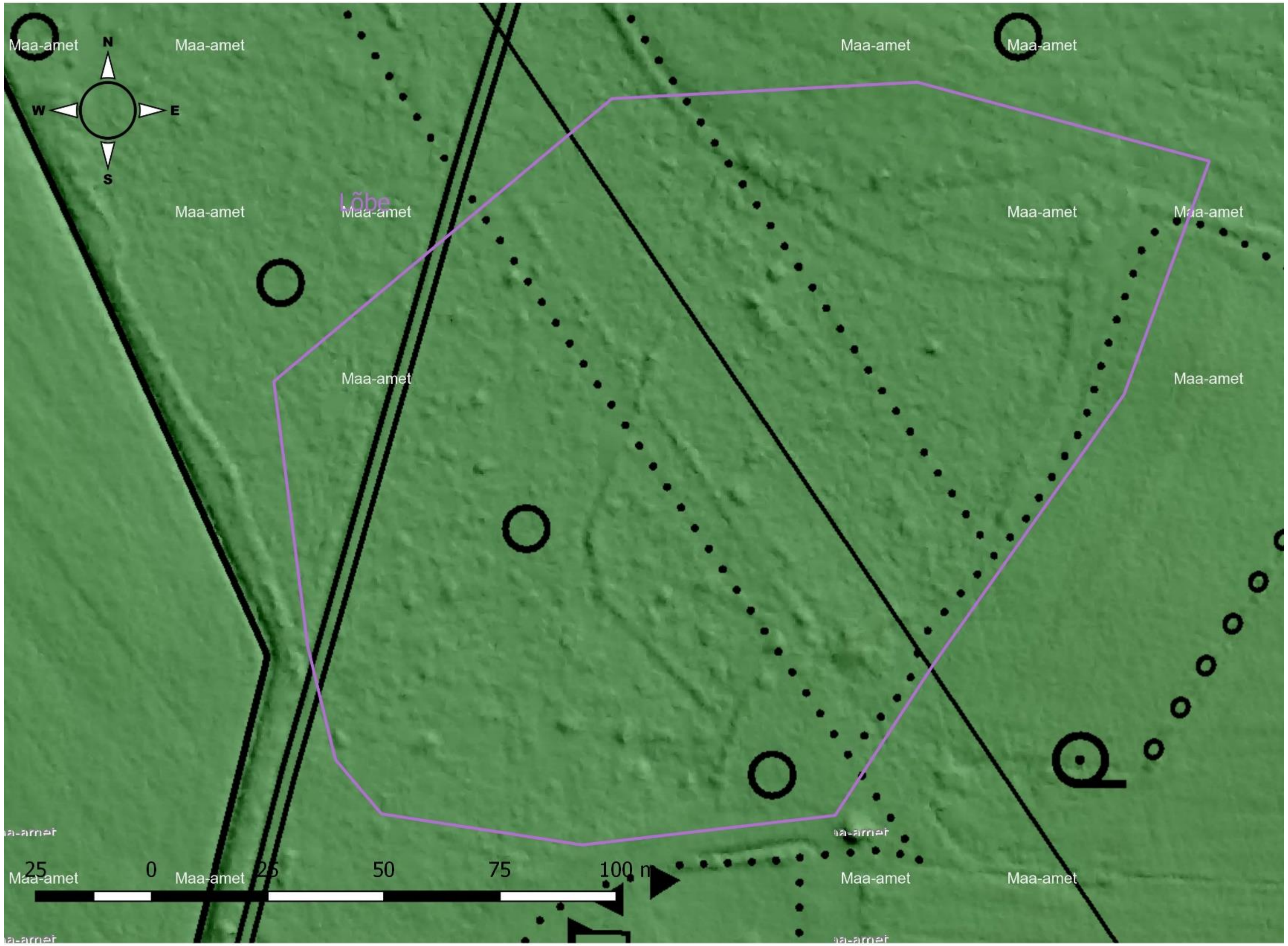
N
W
E
S
Maa-amet
Liitmäe
õu
Viina
Vana-Raki
Juhani
Raki
Uusküla
Lauri
Kristovi
Karli
õu
50 0 50 100 150 m

80. Väike-Lähtru

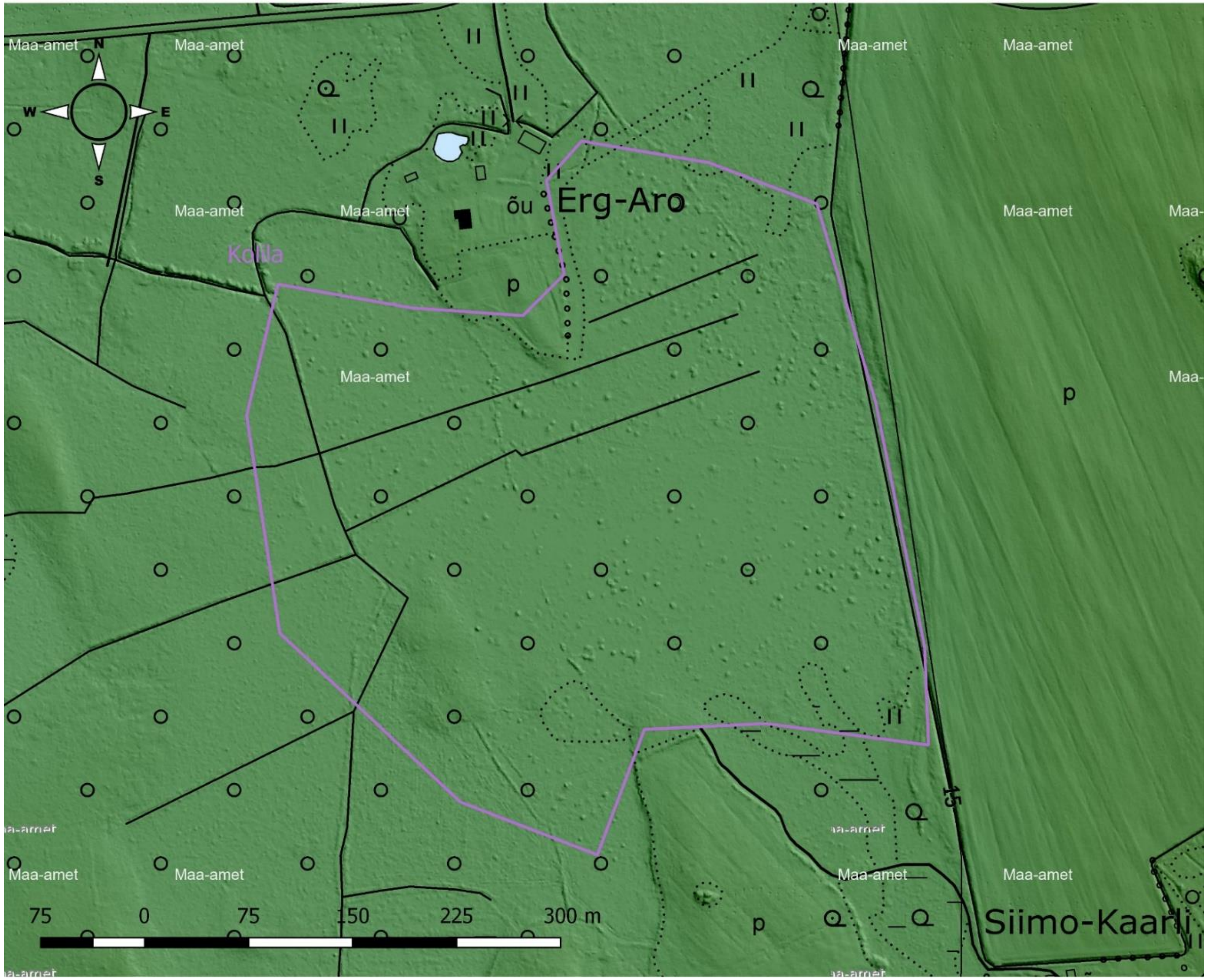


81. Vilkla

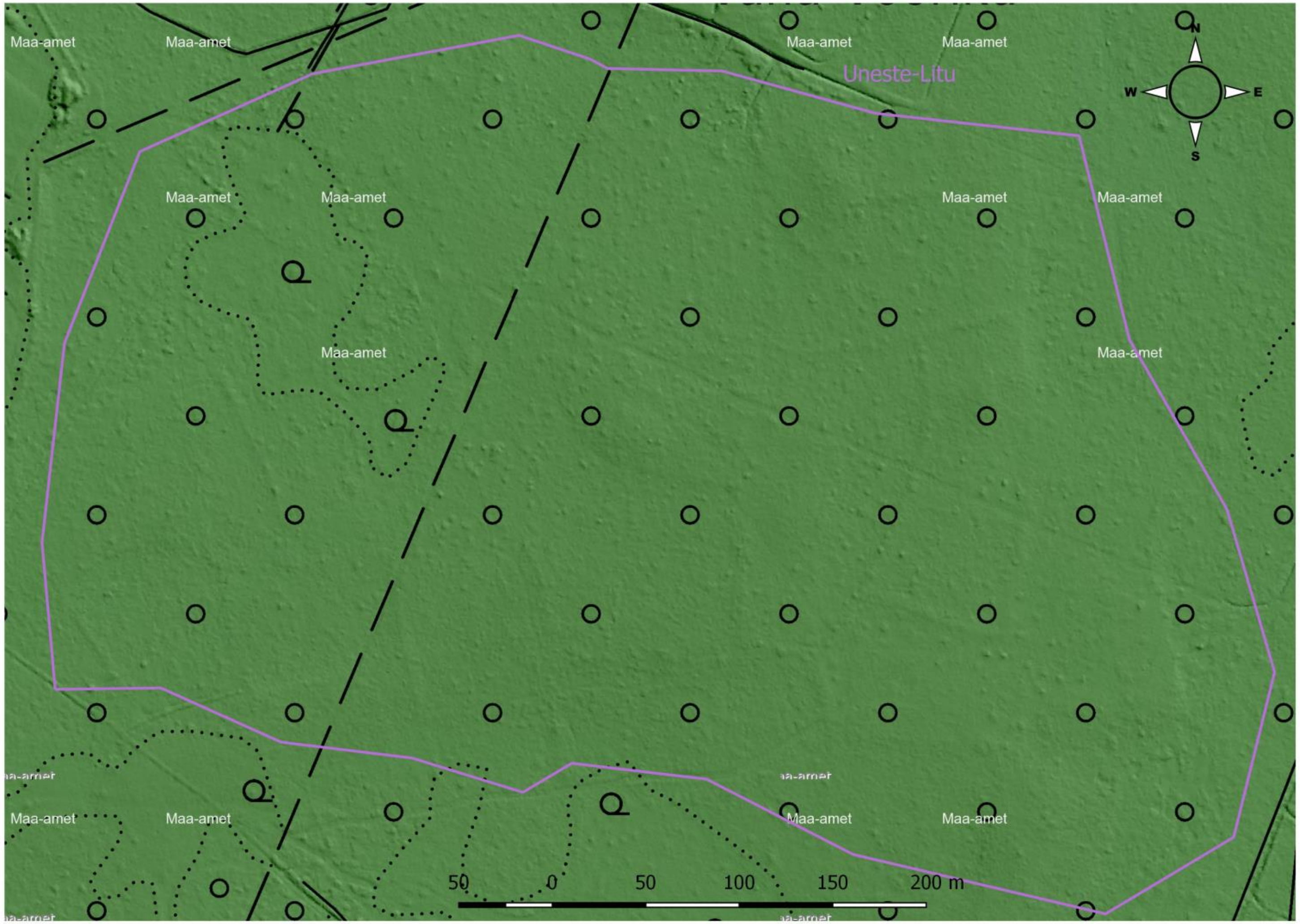
82. Lõbe



83. Kolila



84. Uneste-Litu



Appendix A2. Field systems in the southern part of the study area in mainland western Estonia (confirmed with previous fieldwork and unconfirmed during the current study)

Table A. 2. Field systems in the southern part of the study area.

No	Name	Excavated	Preserved	conf/unconf	Features	Type	Other features	Area	Main soils_wrb	Main soils_Est	Modern land use	Arch sites within 1km	Prehistoric settlement	Historical village
3	Hanila I	N	Y	conf	Cairns?	CCF, FF		S	RG	K	Forest	Sacred stone		1218
4	Kaseküla I	Y	N	conf	Cairns, some banks, stone fences	CCF		S	RG	K	Quarry	Stone graves, Stone Age settlement site		1320
8	Kurese I	N	Y	conf	Cairns, banks, stone fences, irregular plots?	CCF, LQF	StF, G, S	S	LP	Kh'	Meadow	Stone graves, hill-fort	Yes	1534
9	Kurese II	N	Y	conf	Irregular plots, banks, cairns, enclosure	QF	StF, G, E	S	LP	Kh"	Meadow	Stone graves, enclosure	Yes	1534
10	Kõmsi I	Y	Y	conf	Cairns	CCF, FF	G	S	RG	K	Forest, wooded meadow	Tarand-graves, iron smelting site	Yes	1689

14	Massu Silde	N	Y	conf	Cairns, banks, stone fences	CCF	StF	S	RG	K	Forest, wooded meadow	further from the historical village, btw Massu and Kõmsi		1538
15	Massu Urva	N	Y	conf	Irregular plots, banks, cairns	QF		S	RG	K	Forest, village	further from the historical village, btw Massu and Kõmsi		1538
16	Massu Paemurru	N	Y	conf	Cairns	CCF, FF	HF/E	S	RG	K	Forest	Enclosur e, Tarand grave	Yes	1538
18	Petaaluse	N	Y	conf	Cairns, some banks, regular stone fences	CCF, LSF	StF	S	RG	K	Wooded meadow	sacred site (400m), stone graves (700m)	Yes	1530
19	Poanse I	N	Y	conf	Cairns, some banks?, regular stone fences	CCF, LSF	StF, G	S	RG, LP	K	Wooded meadow	Stone graves	Yes	1564
20	Ridase I	N	Y	conf	Cairns, stone fences, some banks?	CCFB, QF, LQF	StF	S	GL, RG	Kg	Forest, wooded meadow	Stone graves, sacred stone	Yes	1564
21	Ridase II	Y	Y	conf	Banks, cairns, stone fences	CCF, QF, LSF	G, StF	S	RG	Kog	Forest, village,	Stone graves	Yes	1564

											wooded meadow			
22	Salavere I	N	Y	conf	Irregular plots, banks, cairns	QF		S	RG, LP	Kh"	Meadow	Stone graves, sacred site	Yes	1534
23	Salavere II	N	Y	conf	Irregular plots, banks, some cairns, some stone fences	QF	StF, S, CP	S	LP	Kh"	Forest, meadow	Settleme nt site, stone graves	Yes	1534
24	Salevere Salumägi	Y	Y	conf	Regular plots, banks, cairns, enclosure, some stone fences	QF, CCF	E, G, StF	S	RG	Kr	Forest, wooded meadow	Stone grave, cemetery	Yes	1539
26	Voose	N	Y	conf	Cairns?	CCF?, FF?	G	S	RG	Kg	Forest, wooded meadow	Stone grave	Yes	1565
28	Kokuta Veski	N	Y	unconf	Irregular plots, banks, cairns, stone fences	CCFB, QF, LQF	StF	S	RG	K	Forest, wooded meadow	Sacred stone, cemetery	Yes	1534
29	Kõmsi Kopli	N	Y	unconf	Banks, cairns, large enclosure?	CCF, CCFB, QF		S	RG, GL	Gk	Forest	Stone graves, settlemen t site not far but btw denser habitatio n areas (Kõmsi, Voose, Ridase)		1689

30	Massu/Kokuta	N	Y	unconf	Irregular plots, banks, cairns, stone fences	QF	StF	S	RG	K	Forest, wooded meadow	Stone graves	Yes	1534
31	Metsküla Laiakivi	N	Y	unconf	Irregular plots, banks, cairns, stone fences	CCF, QF	StF	S	RG	K	Forest, wooded meadow	Sacred site	Yes	1320
32	Mäliküla I	N	Y	unconf	Some regular plots, cairns, some banks	CCF		S	CM	Ko	Forest, meadow	none		1686
33	Mäliküla II	N	Y	unconf	Regular plots, banks, cairns, stone fences	QF, CCF	StF	S	CM	Kog	Forest, meadow, village	none		1686
34	Nehatu I	N	Y	unconf	Irregular plots, cairns, banks, some fences	CCF, QF	StF, SS	S	RG	K	Forest, wooded meadow, village	cemetery , settlemen t site	Yes	1598
35	Nehatu II	N	Y	unconf	Irregular plots, cairns, banks, some stone fences	CCF, QF	StF	S	RG	Kr	Forest, wooded meadow, village	Cemetery , sacred site	Yes	1598
36	Nehatu III	N	Y	unconf	regular plots, cairns, banks, stone fences	CCF, QF, LQF	StF	S	RG	K	Forest, wooded meadow, village	Cemetery (1km)	Yes	1598
37	Nehatu IV	N	Y	unconf	Irregular plots, cairns, banks, stone fences	CCF, QF, LQF	StF	S	RG	K	Forest, wooded meadow	Sacred site	Yes	1598
38	Järise	N	Y	unconf	Iregular plots, cairns, banks, stone fences	CCF, QF	StF	S	RG	K	Wooded meadow	Stone graves, cemeterie s	Yes	1565

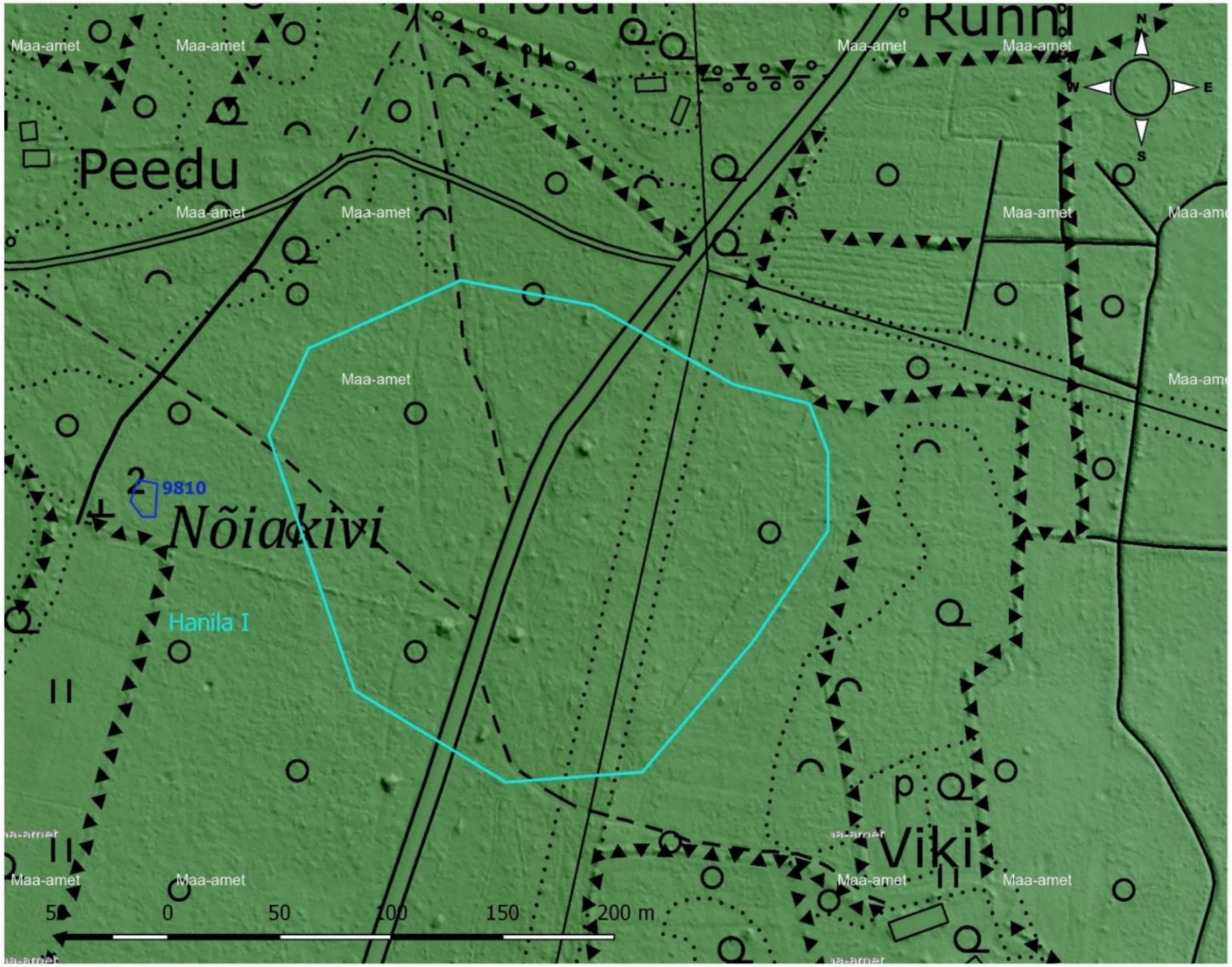
39	Poanse II	N	Y	unconf	Irregular plots, cairns, banks, stone fences, enclosure?	CCF, QF	StF, E	S	RG	K	Wooded meadow	Stone grave	Yes	1564
40	Poanse III	N	Y	unconf	Cairns, banks, some stone fences, ditches (late), enclosure?	CCF, FF	StF, E	S	RG, GL	M'	Forest	Sacred sites, stone graves	Yes	1564
41	Poanse IV	N	Y	unconf	Cairns, short banks, stone fences	CCF, QF, LQF	StF	S	RG, GL, LP	Kh"g	Wooded meadow		Yes	1564
42	Poanse/Järise	N	Y	unconf	Cairns, short banks, stone fences	CCF, QF, LQF	StF	S	RG	K	Wooded meadow		Yes	1564, 1565
43	Massu Lepiku	N	Y	unconf	Cairns, some long banks, stone fences (around)	CCF, CCFB ?, QF	CP	S	RG, LP	Go	Forest	none		1538
44	Massu Metsatuka	N	Y	unconf	Cairns, some long banks, stone fences (around)	CCF, LQF	CP?	S	RG, LP	Kr	Forest	none		1538
45	Massu Metsakonna	N	Y	unconf	Cairns, long banks	QF?	CP?	S	RG, GL, CM	K	Forest, meadow	none		1538
46	Massu Kangru	N	Y	unconf	Cairns, long banks	CCF, LQF		S	RG	Kg	Forest, meadow	none		1538
47	Kõmsi Sepa	N	Y	unconf	Cairns, banks, irregular enclosure?	CCF, CCFB, QF	G	S	RG	Kr	Wooded meadow	Stone graves, cup-marked stone	Yes	1689

48	Kirbla	N	Y	unconf	Cairns	CCF, FF	G	S	RG	Kr	Meadow	Stone graves (inside)	Yes	1519
49	Tuhu	N	Y	unconf	Some irregular plots, cairns, banks, stone fences, enclosure?	CCF, QF	StF, E?	S	LP, RG	Kh'	Forest, wooded meadow	Cemetery	Yes	1726
50	Oidrema Kuusiku	N	Y	unconf	Some irregular plots, banks, cairns, cattle path	CCF, QF		S	RG	Kh"	Forest, meadow, village	Cemetery		1534
51	Pikavere	N	Y	unconf	Cairns, banks?, stone fences?	CCF? LQF		S	CM	Korg	Forest, village	none		1534
52	Salavere III	N	Y	unconf	Irregular plots, banks, some cairns	QF	StF	S	LP, CM	Kh"	Forest		Yes	1534
53	Varbla Kubja	N	Y	unconf	Regular plots, banks, Cairns	CCF, QF		S	RG, HS	Kg	Forest	none		1426
54	Nehatu V	N	Y	unconf	Irregular plots, cairns, banks,some stone fences	CCF, QF	StF	S	RG	K	Forest	Cemetery	Yes	1598
55	Äila	N	Y	unconf	Banks, stone fences, cairns	QF	StF	S	RG, GL	Kg	Village, forest, clearing	none		Vatla manor (16th century)
56	Nurmsi	N	Y	unconf	Regular and irregular plots, banks, cairns, stone fences?	QF, CCF?	G, SS	S	RG, CM	K	Forest, meadow	Stone graves, cup-marked stones	Yes	1320

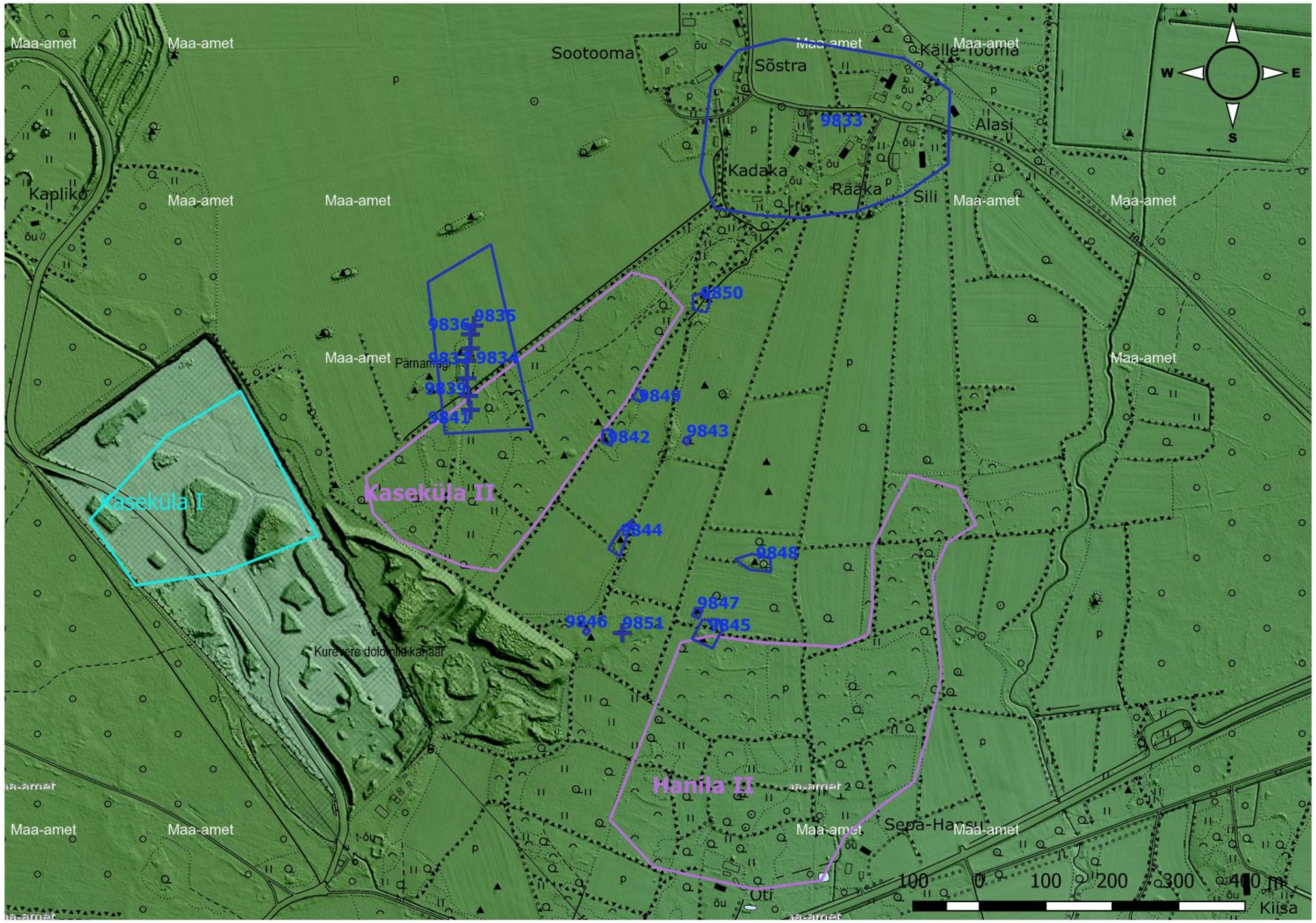
57	Kause	N	Y	unconf	Some irregular plots, stone fences, cairns, banks	CCF, QF, LQF	StF	S	RG, GL, CM	Kog	Forest, clearing, wooded meadow	Stone grave, sacred site	Yes	1585
58	Rame	N	Y	unconf	Regular plots, stone fences, cairns, banks	QF, LQF	StF	S	RG, GL	K	Forest, wooded meadow	Sacred site	Yes	1478
59	Kaseküla II	N	Y	unconf	Irregular plots?, cairns, stone fences, short banks	CCF, LQF, LSF	StF, S, G	S	RG	K	Forest, wooded meadow	Stone graves, Stone Age settlemen t site	Yes	1320
60	Hanila II	N	Y	unconf	Irregular plots, cairns, banks, stone fences	QF, CCF, LQF	StF	S	RG, CM	K	Wooded meadow	Stone graves	Yes	1320
61	Kõmsi II	Y	Y	conf	Cairns	CCF, FF		S	RG	K	Forest, village	stone graves	Yes	1689
62	Ridase III	N	Y	unconf	Regular plots, cairns, banks, stone fences/enclosur e?	CCF, QF	StF	S	GL, CM	Kog	Forest, clearing, meadow	none		1564
63	Mõisaküla Salumägi	N	Y	unconf	Irregular plots, banks, a few cairns	QF		S	RG	Kh'	Forest, meadow		Yes	1512
64	Esivere I	N	Y	unconf	Irregular plots, banks, stone fences, a few cairns	QF	StF	S	RG	Ko	Wooded meadow	none		1478

65	Esivere II	N	Y	unconf	Irregular plots, banks, cairns, stone fences	QF, LQF	StF	S	RG, LP, CM	K	Forest, wooded meadow	Sacred stone	Yes	1478
66	Esivere III	N	Y	unconf	Cairns, banks, stone fences	CCF, CCFB, QF	StF	S	RG, CM	Kr	Forest, clearing, village	none		1478
67	Kirikuküla	N	Y	unconf	Cairns	CCF, FF		S	GL, RG	Kg	Forest	none		1923
68	Laulepa	N	Y	unconf	Cairns, banks/enclosure ?	CCF, CCFB ?	E?	S	RG, GL	Kg	Forest, clearing	none		1686
69	Metsküla-Võigaste	N	Y	unconf	Banks, cairns, stone fences	CCF, QF, LQF	StF, SS	S	RG, GL	K	Forest, wooded meadow	Sacred sites		1320,1686
85	Oidrema	N	Y	unconf	Cairns, small banks, stone fences	CCF, QF?	StF	S	RG	Kr	Forest, wooded meadow, village	Sacred site		1534
86	Koeri	N	Y	unconf	Some regular plots, cairns, banks, stone fences	CCF, QF	StF	S	CM	Kog	Forest/clearing	none		1543

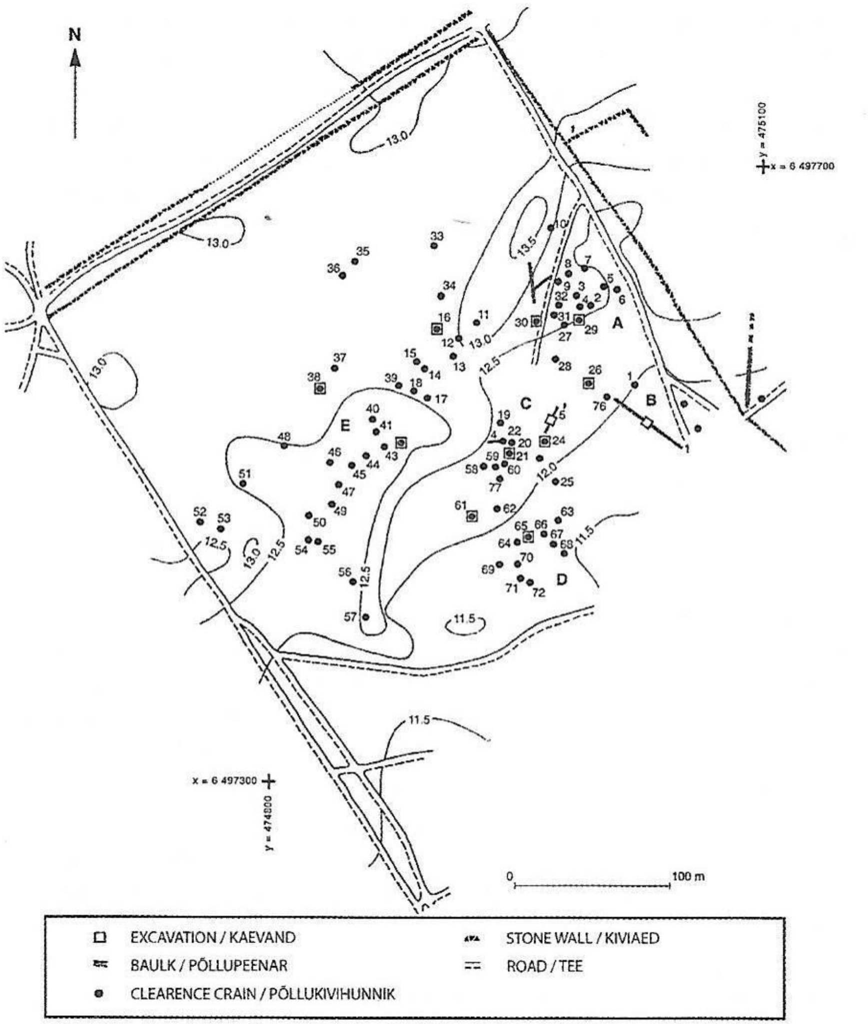
3. Hanila I


Peedu
Runni
Nõiakivi
9810
Hanila I
Viki
Maa-amet
N
S
E
W
50
0
50
100
150
200 m

4. Kaseküla I
59. Kaseküla II
60. Hanila II

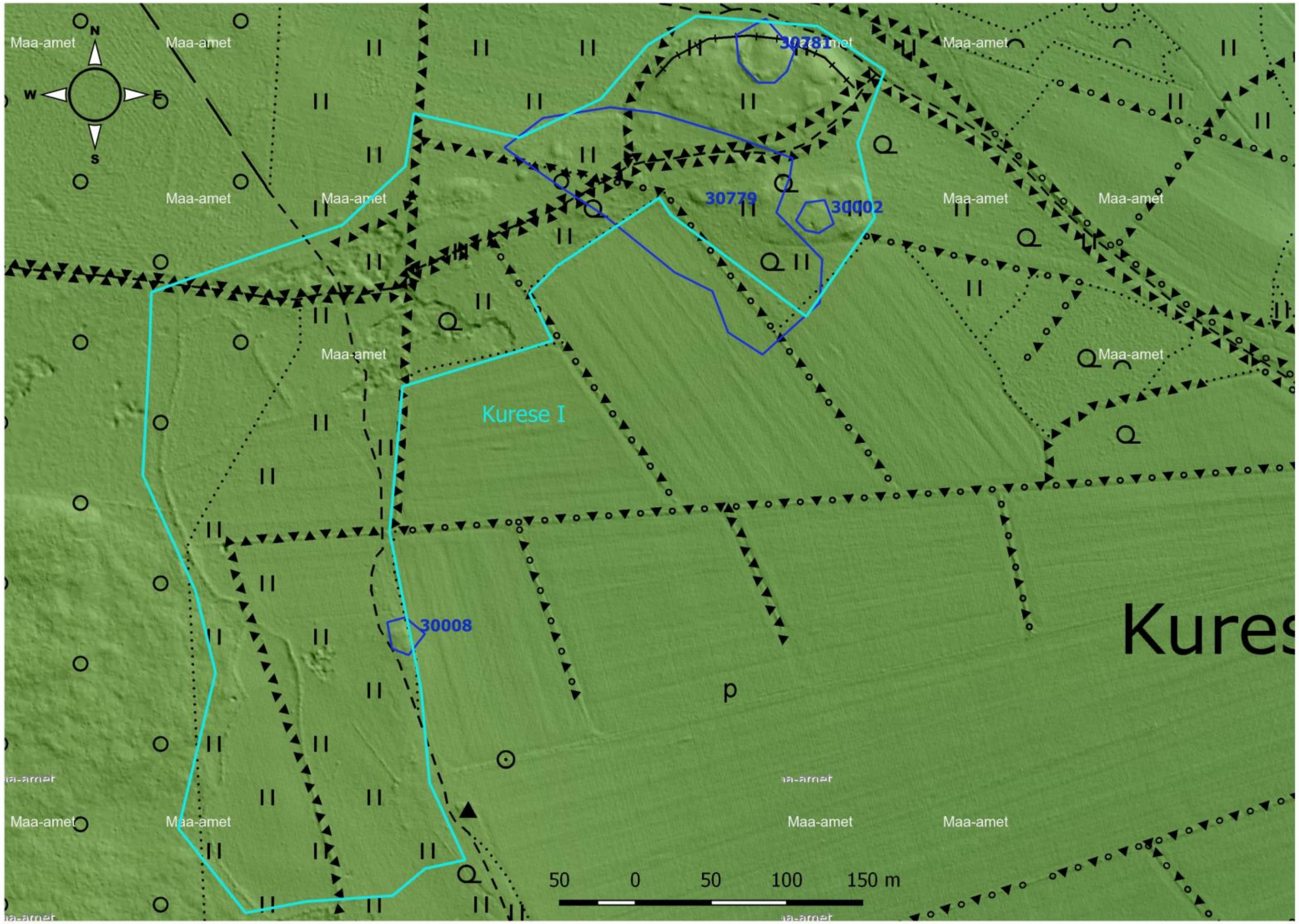


4. Kaseküla I

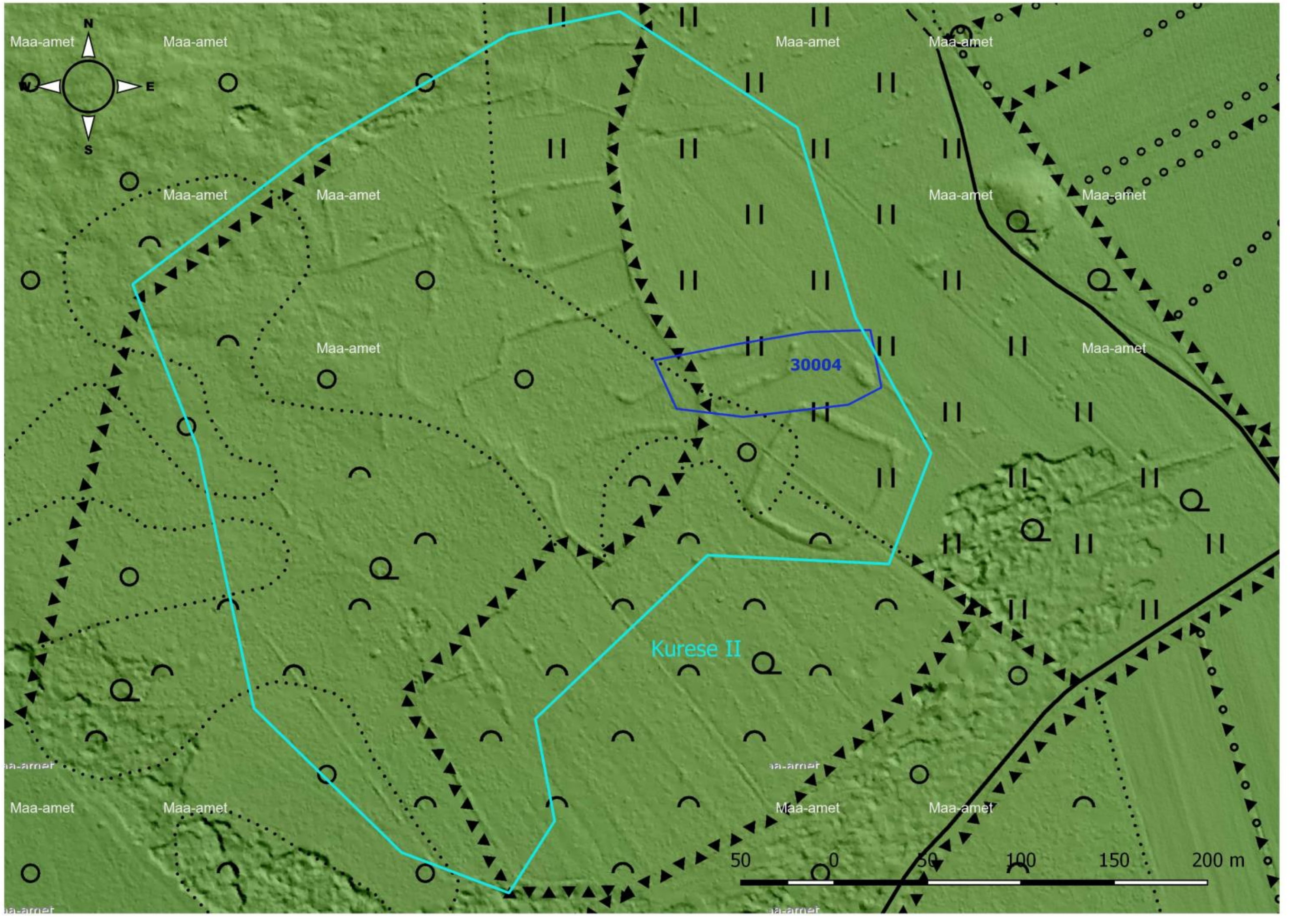


N
EXCAVATION / KAEVAND
BAULK / PÕLLUPEENAR
CLEARENCE CRAIN / PÕLLUKIVIHUNNIK
STONE WALL / KIVIAED
ROAD / TEE
0
100 m
x = 6 497300
y = 474800
y = 475100
x = 6 497700
A
B
C
D
E

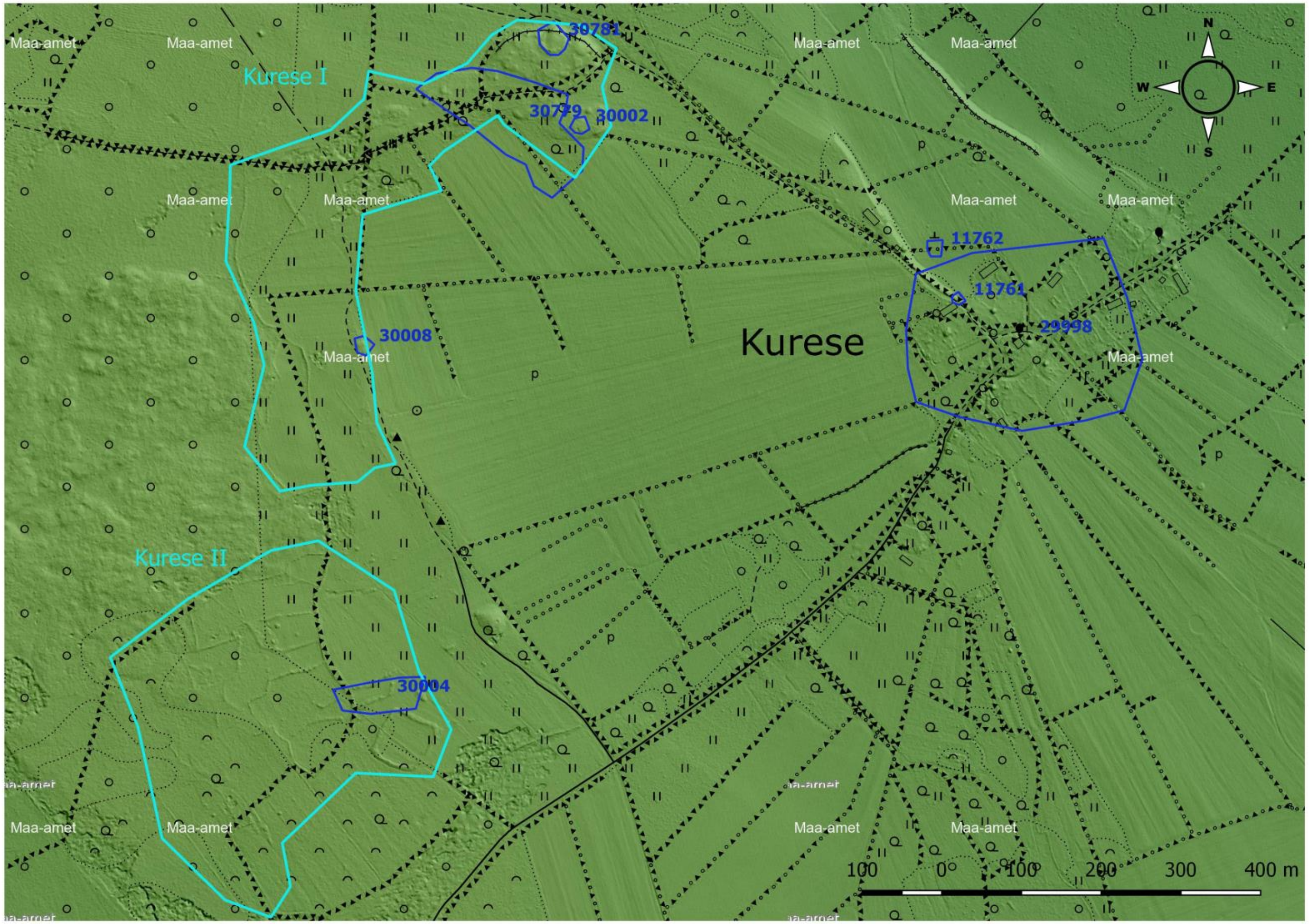
8. Kurese I


Maa-amet
N
W
E
S
30781
30779
30002
30008
Kurese I
Kures
p
50 0 50 100 150 m

9. Kurese II



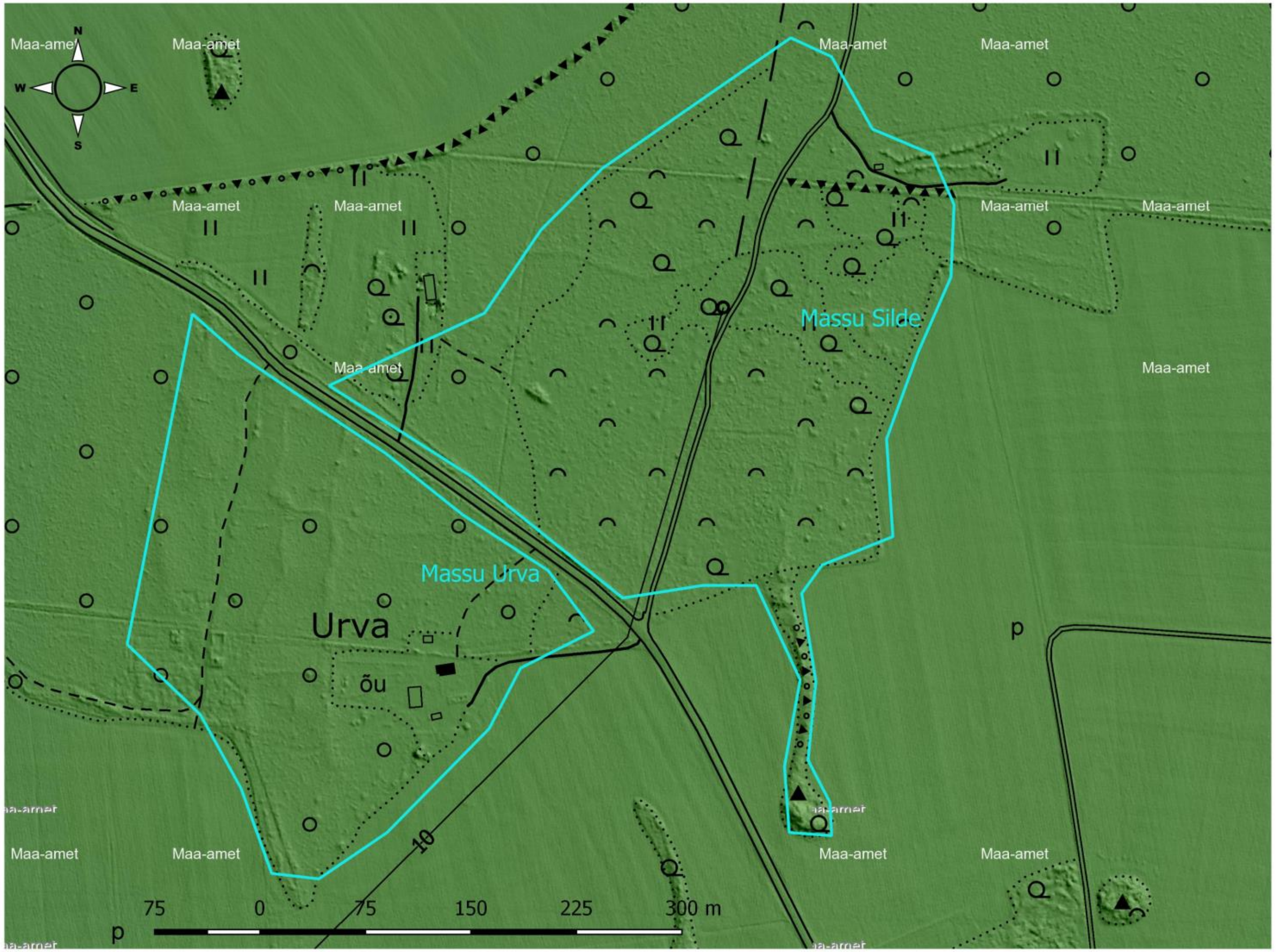
8. Kurese I
9. Kurese II



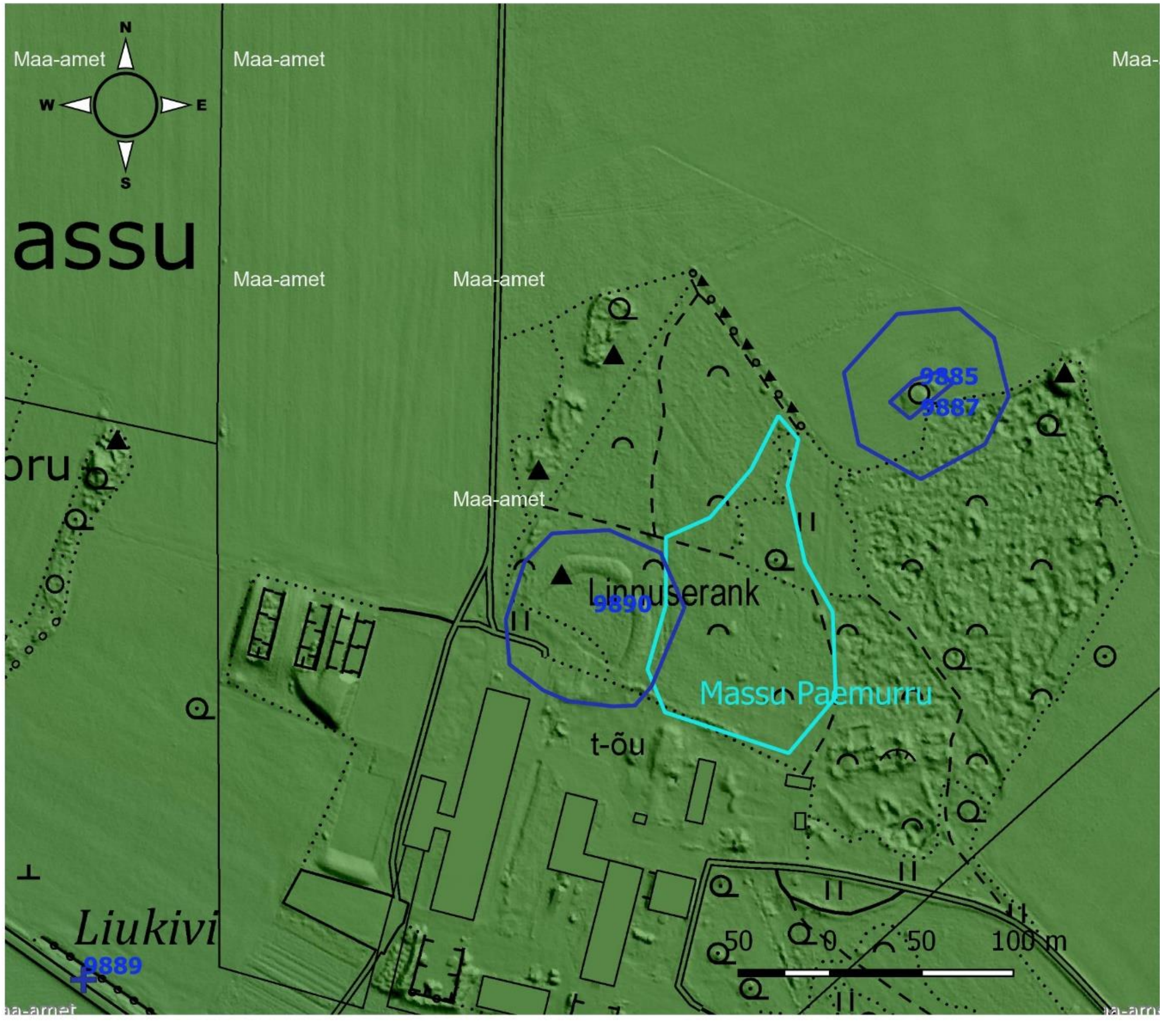
10. Kõmsi I
61. Kõmsi II

14. Massu Silde

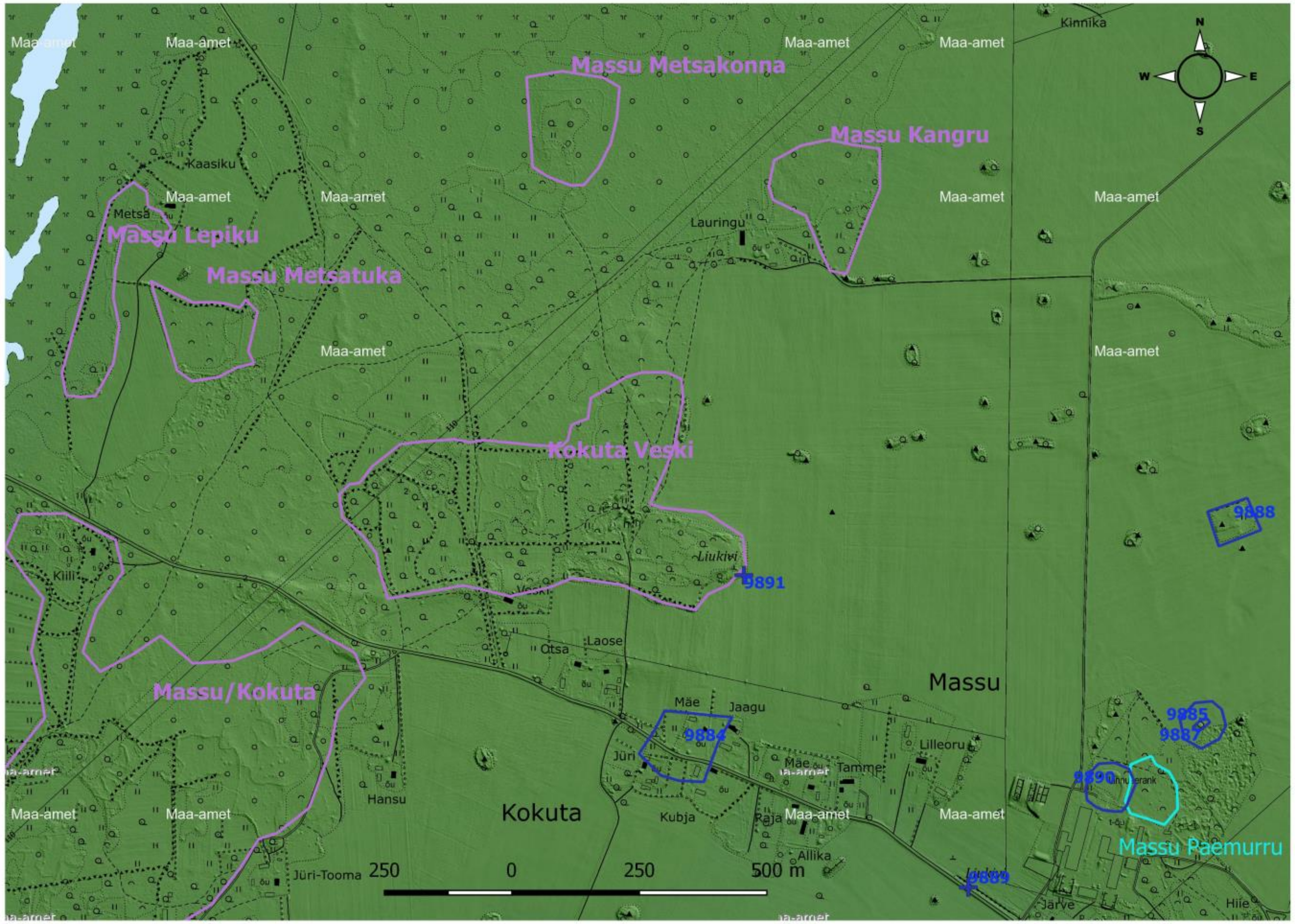
15. Massu Urva



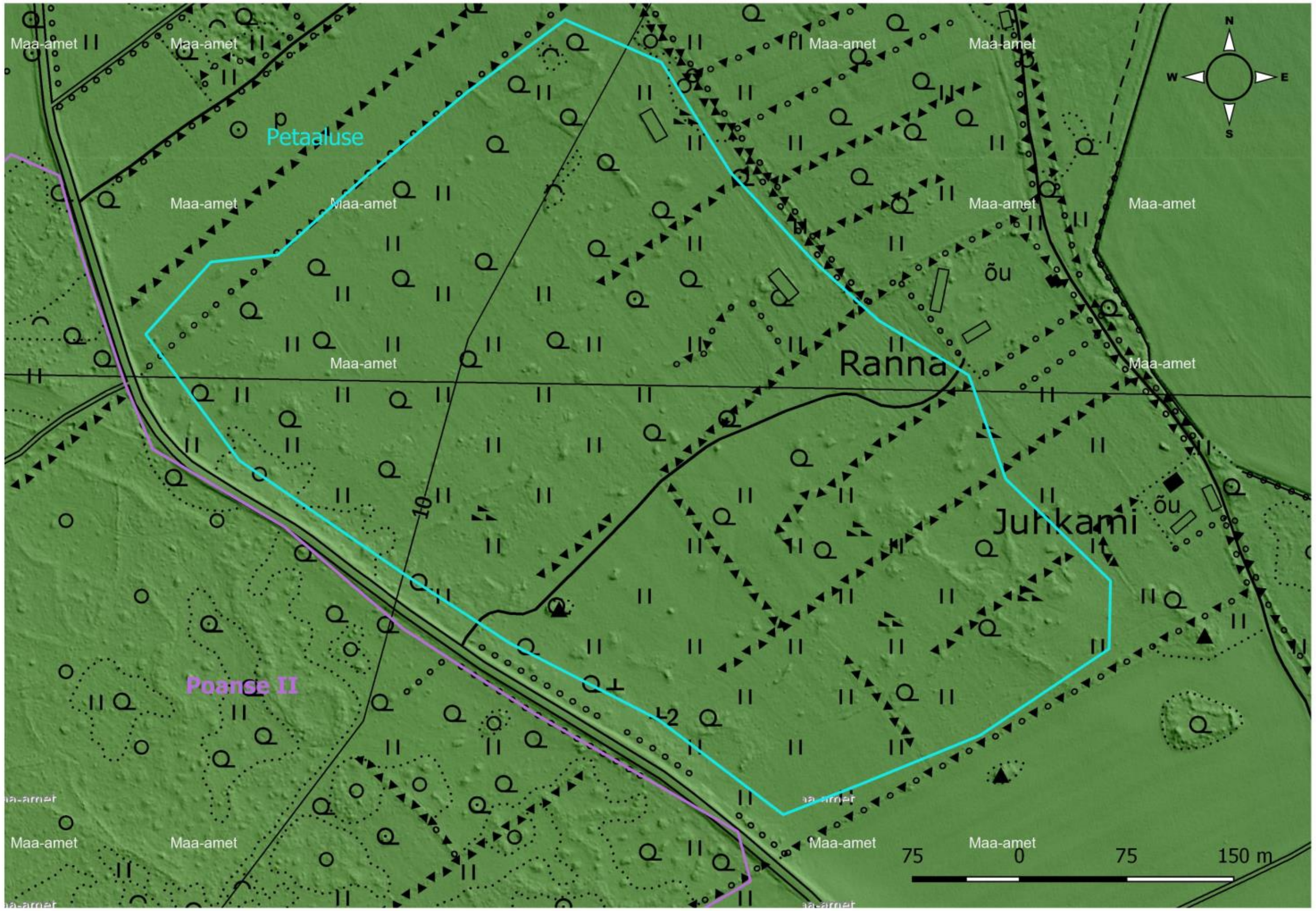
16. Massu Paemurru



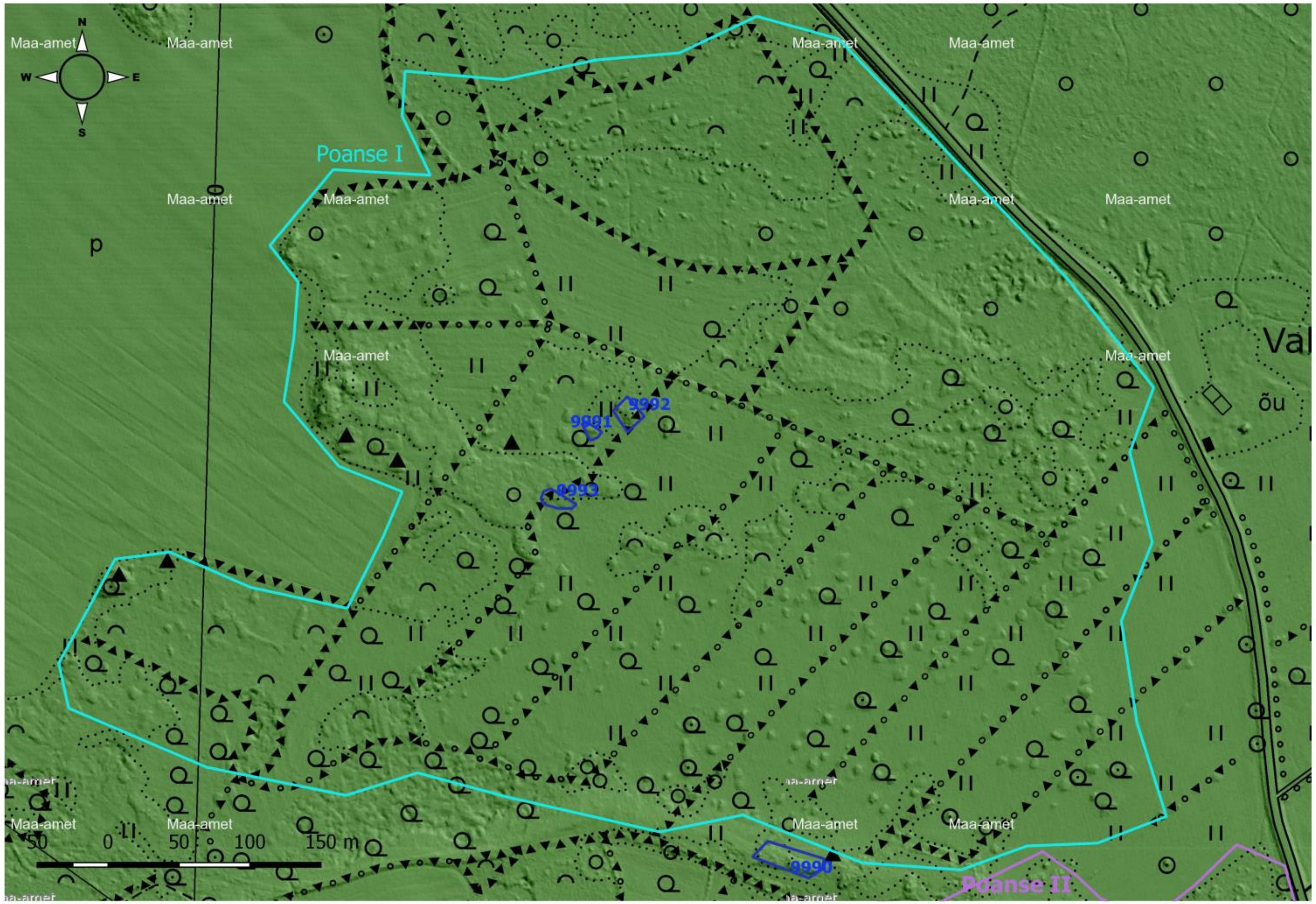
16. Massu Paemurru
28. Kokuta Veski
30. Massu/Kokuta
43–46 (Massu Lepiku, Massu Metsatuka, Massu Metsakonna, Massu Kangru



18. Petaaluse

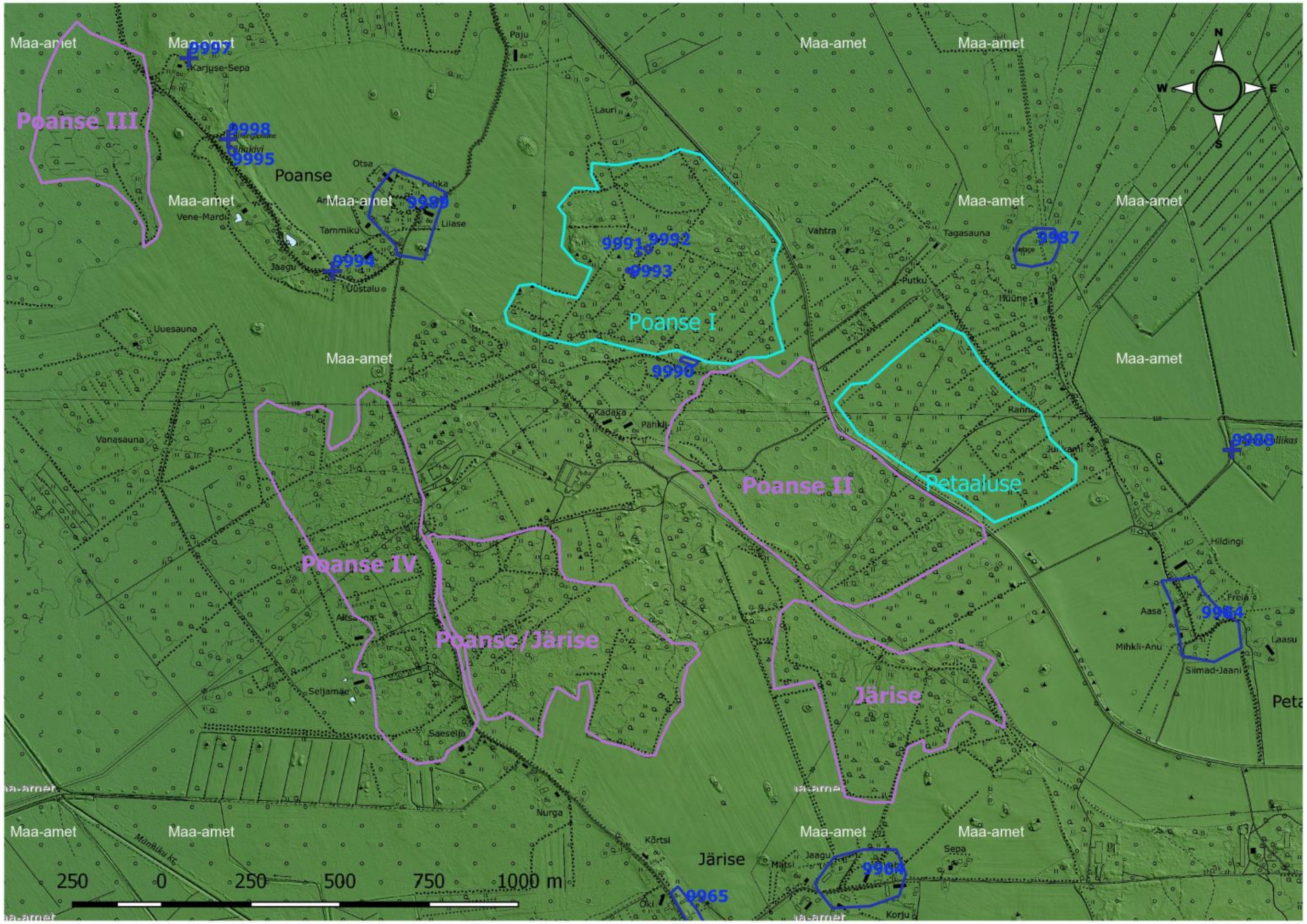


19. Poanse I

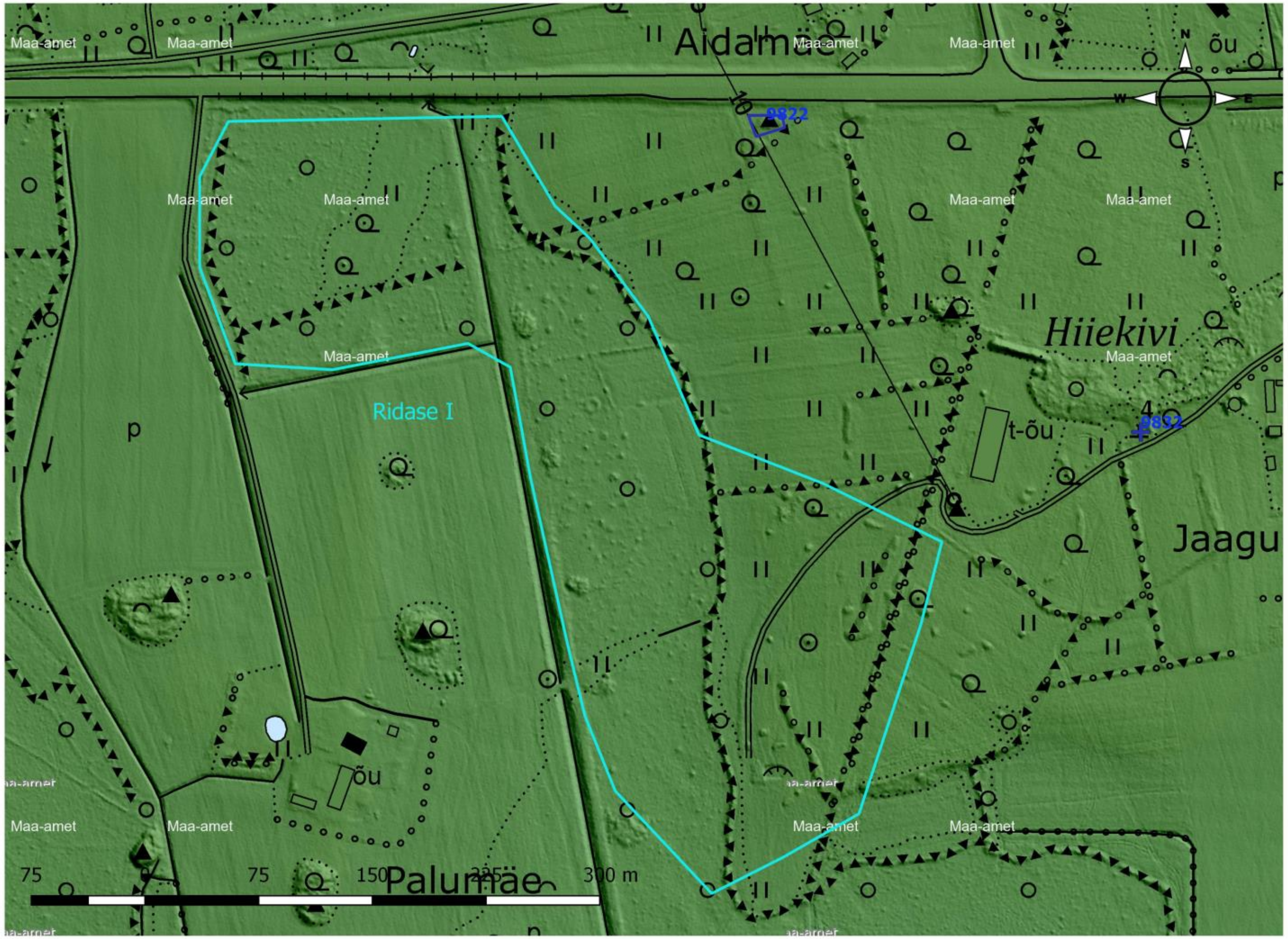


N
W
E
S
Maa-amet
Poanse I
p
Val
õu
9991
9992
9993
9990
Poanse II
50 0 50 100 150 m

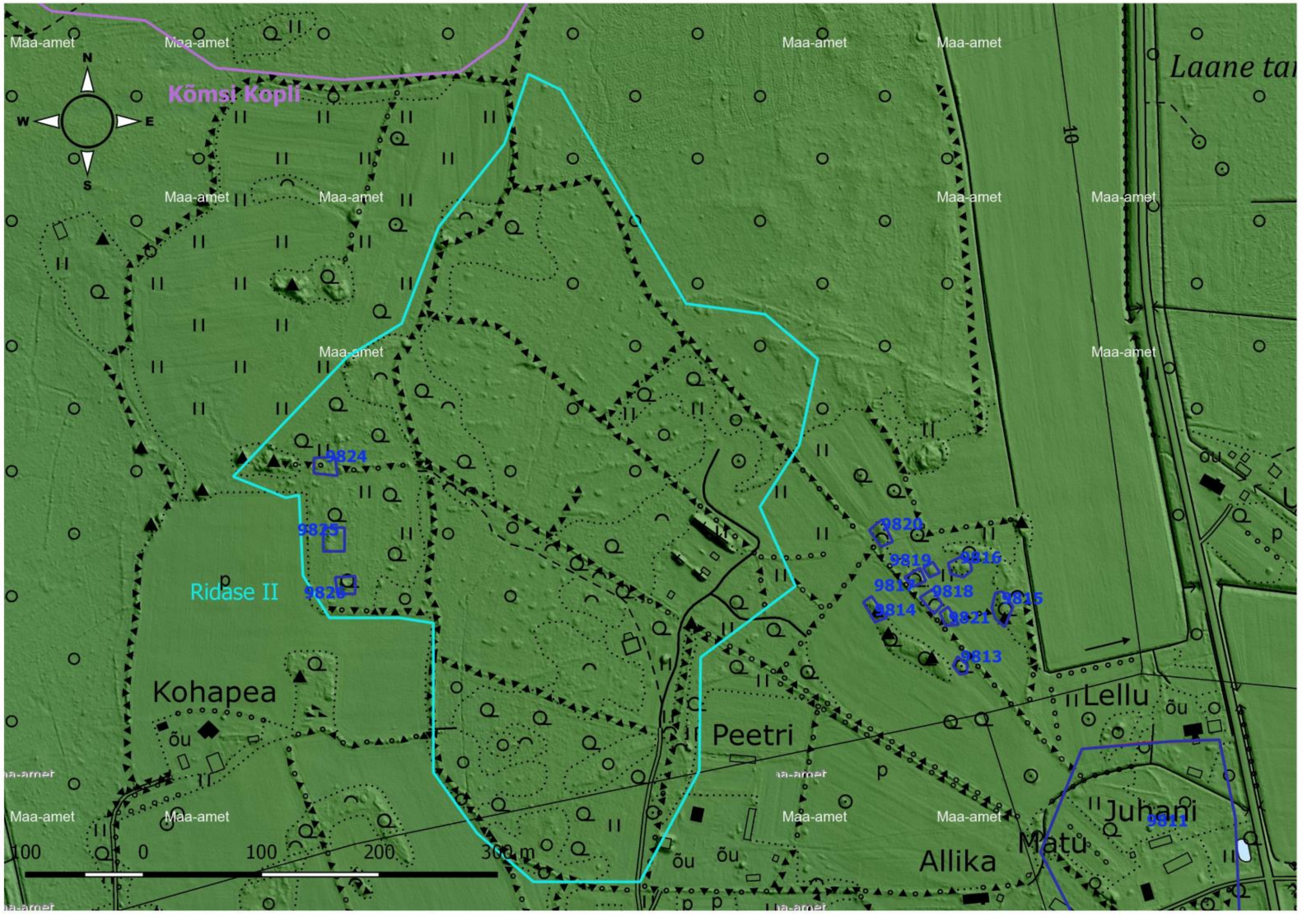
18–19 (Petaaluse and Poanse I)
38–42 (Järise, Poanse II, Poanse III, Poanse IV, Poanse/Järise



20. Ridase I

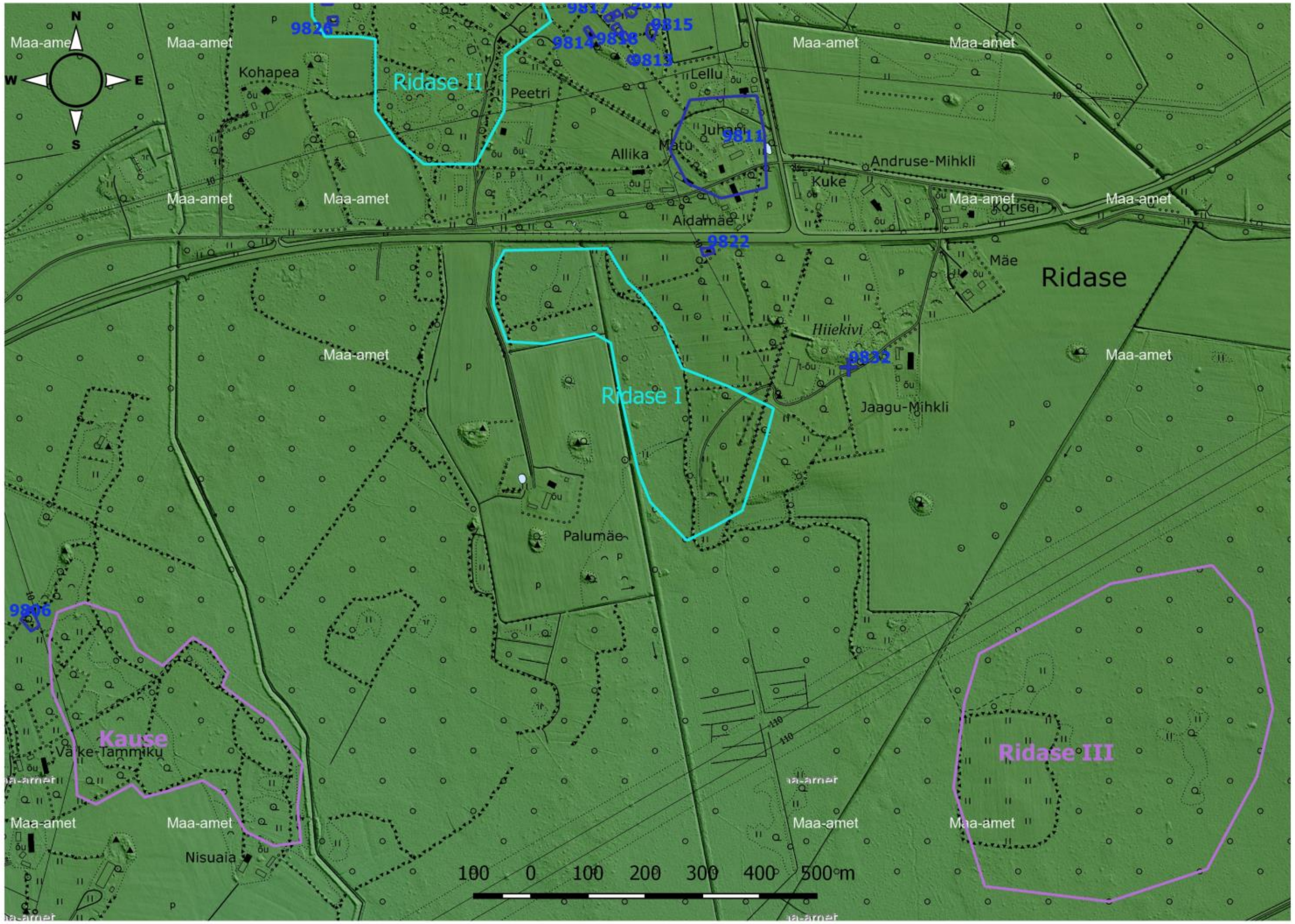

Aidamäe
Ridase I
Hiiekivi
t-õu
Jaagu
õu
Palumäe
p
9822
9832
N
S
W
E
75
75
150
225
300 m
Maa-amet

21. Ridase II

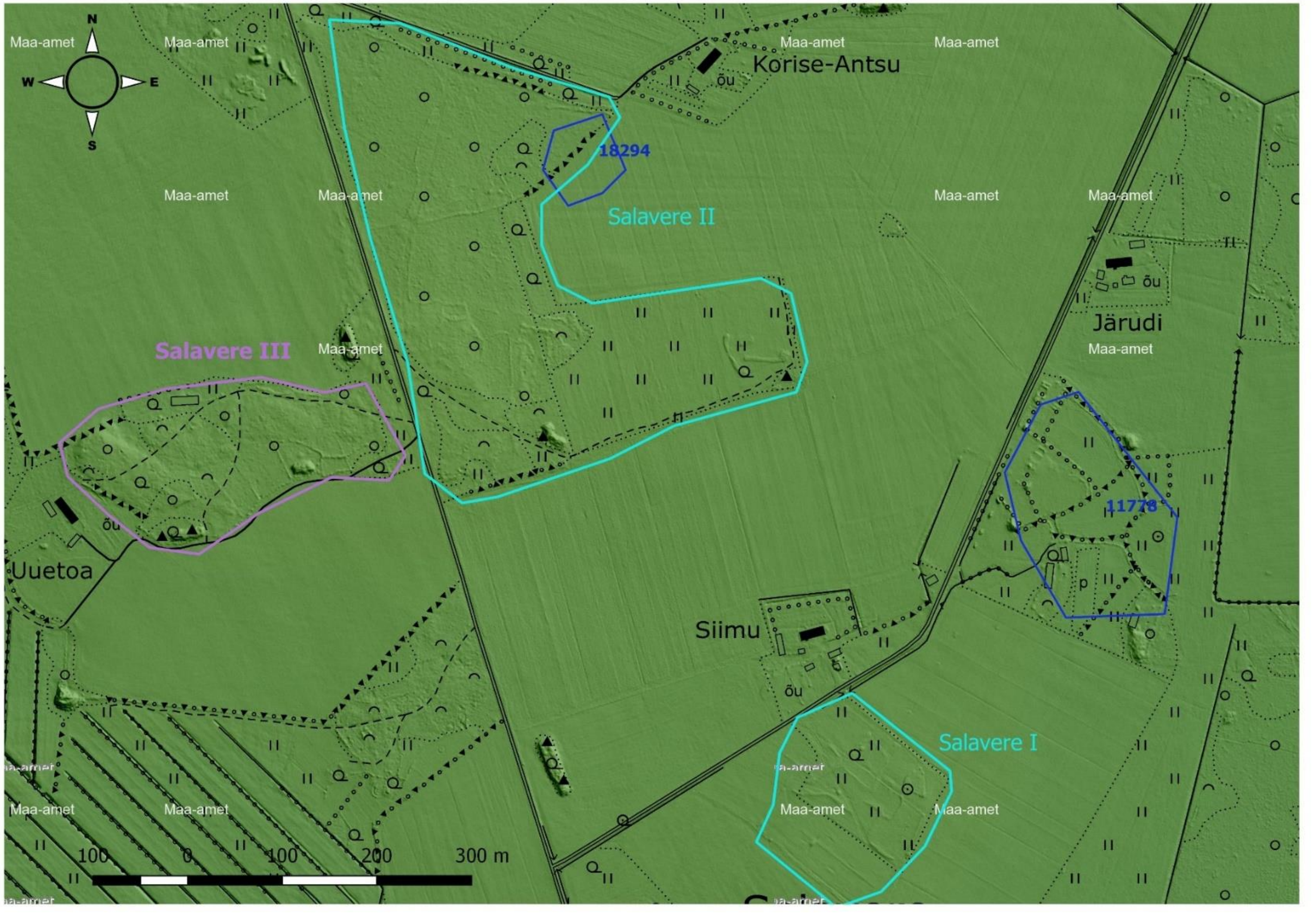


Kõmsi Kopli
Laane ta
Ridase II
Kohapea
Peetri
Lellu
Juhani
Allika
Matu
9824
9825
9826
9820
9819
9816
9817
9818
9815
9814
9821
9813
9811
0
100
200
300 m

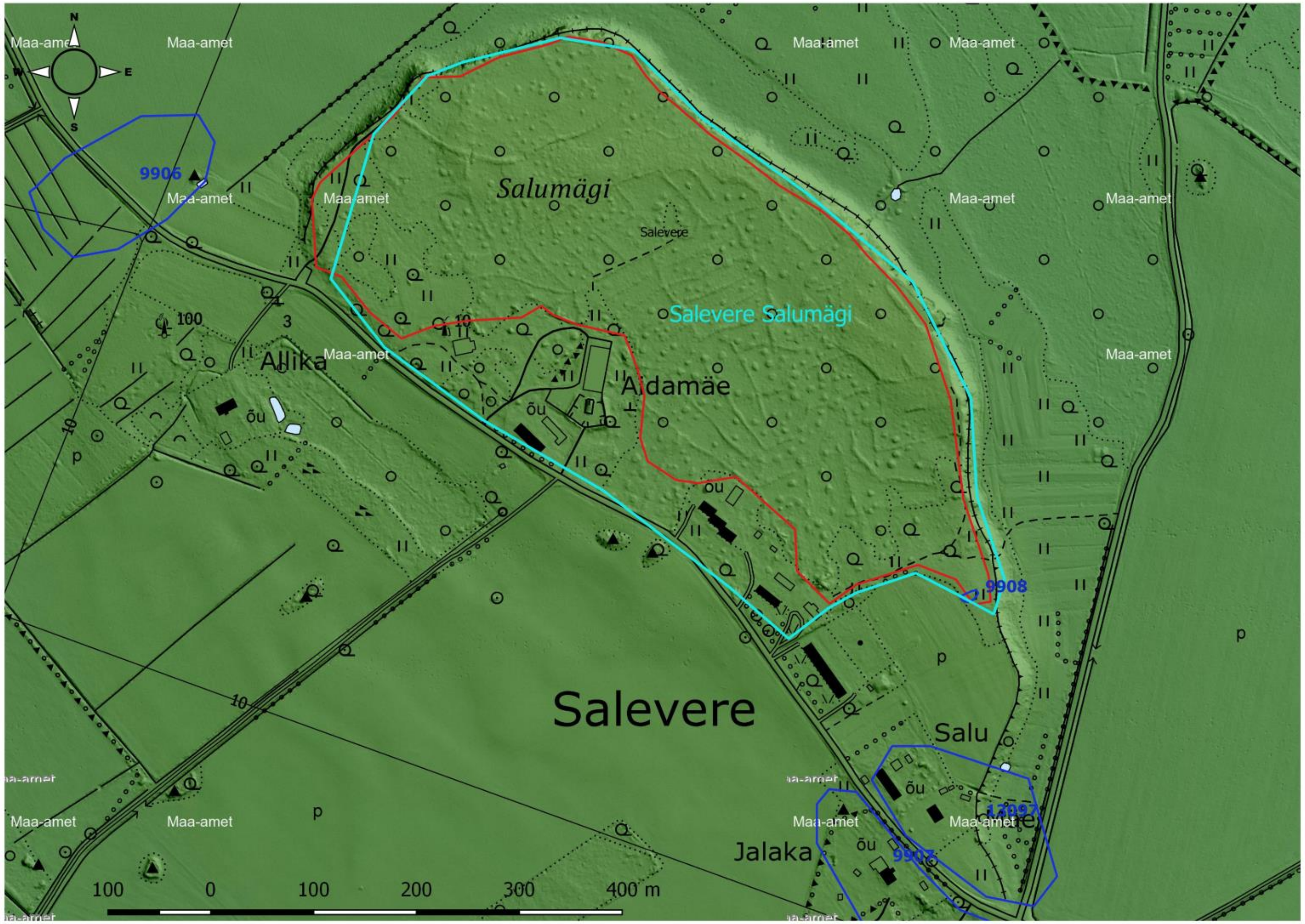
20–21 (Ridase I–II)
62. Ridase III
57. Kause



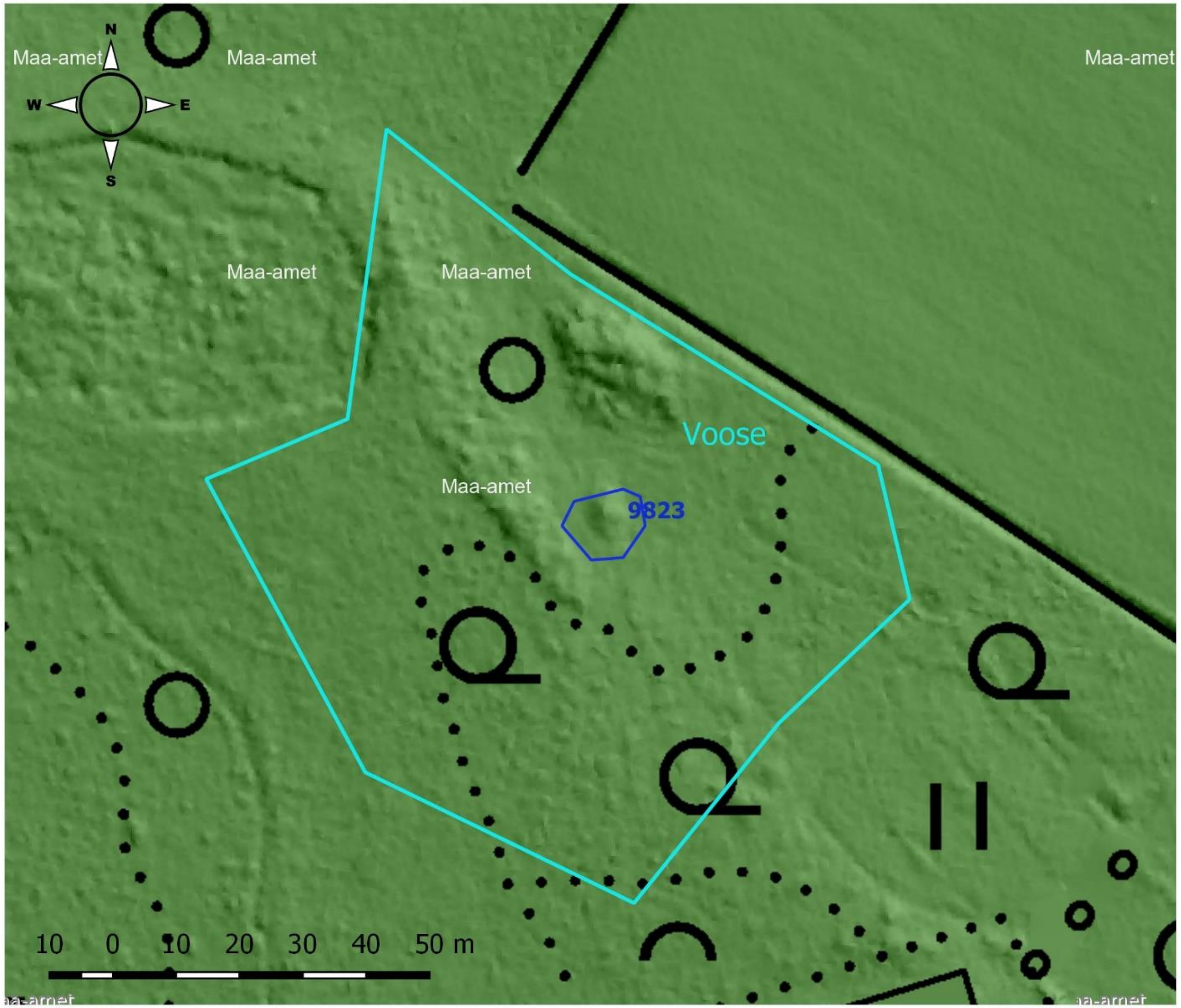
22. Salavere I
23. Salavere II
52. Salavere III



24. Salevere Salumägi

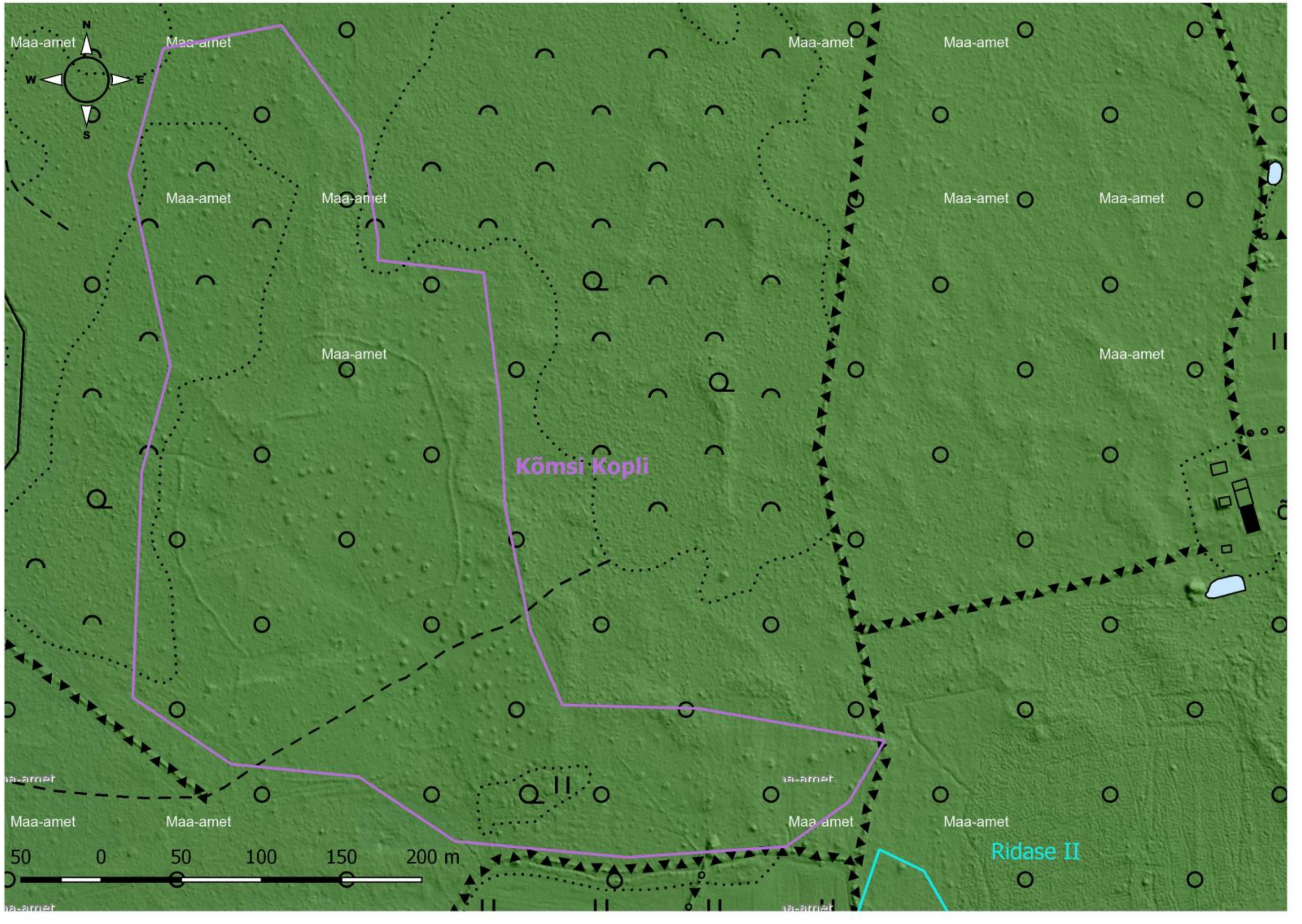


26. Voose


N
W
E
S
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Voose
9823
10 0 10 20 30 40 50 m

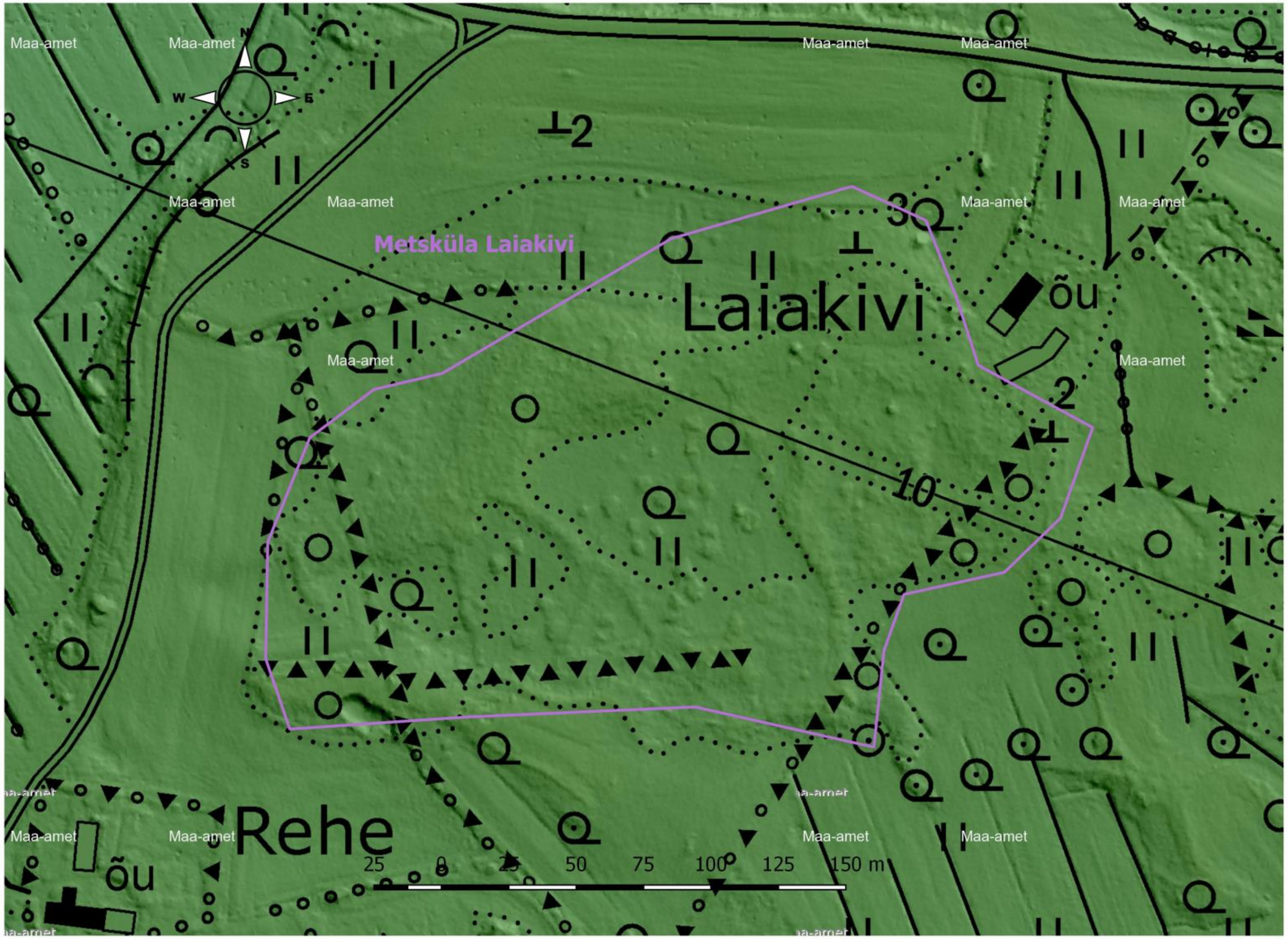
28. Kokuta Veski

29. Kõmsi Kopli



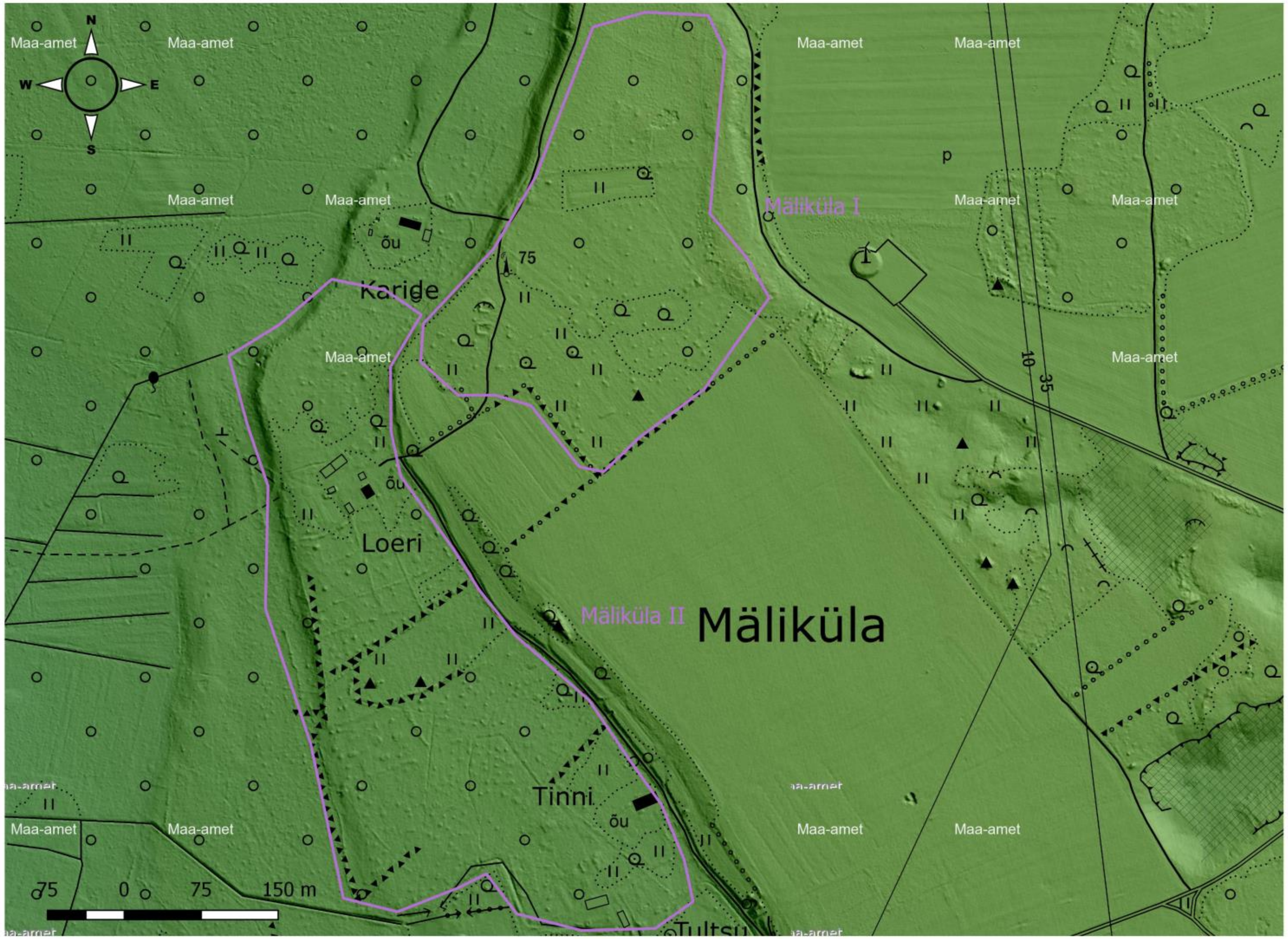
30. Massu-Kokuta

31. Metsküla Laiakivi

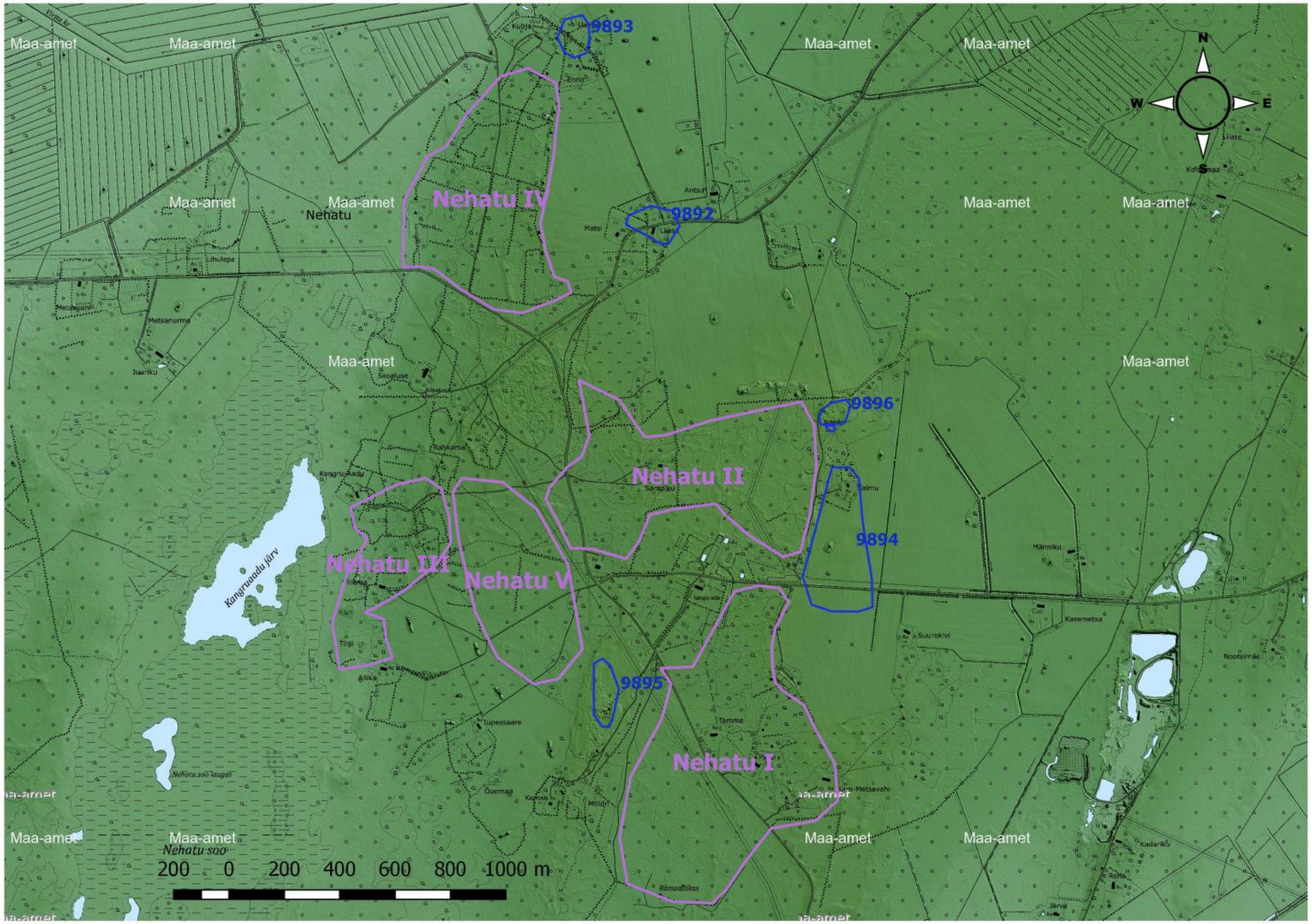


32. Mäliküla I

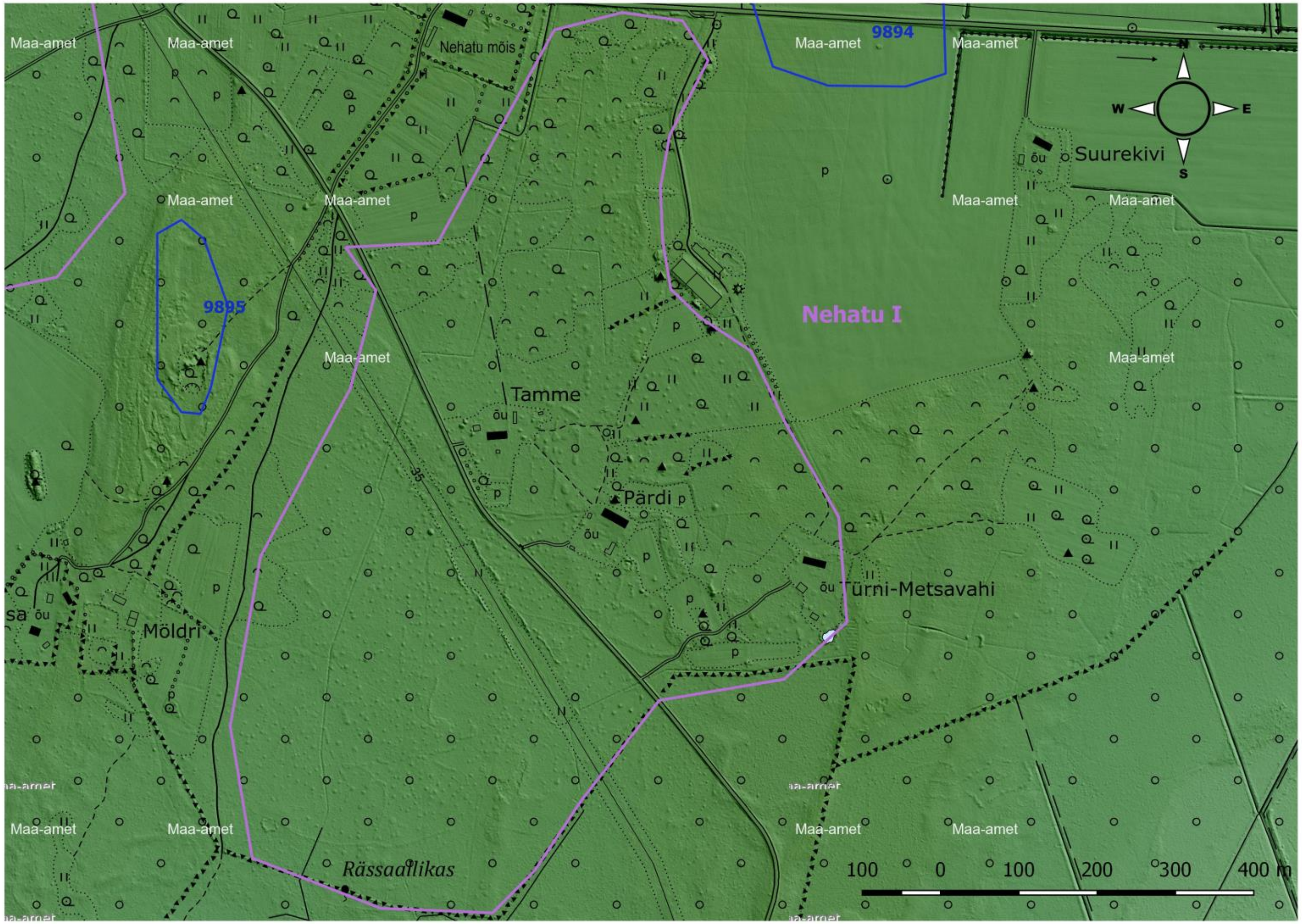
33. Mäliküla II



34–37 (Nehatu I–IV)
54. Nehatu V

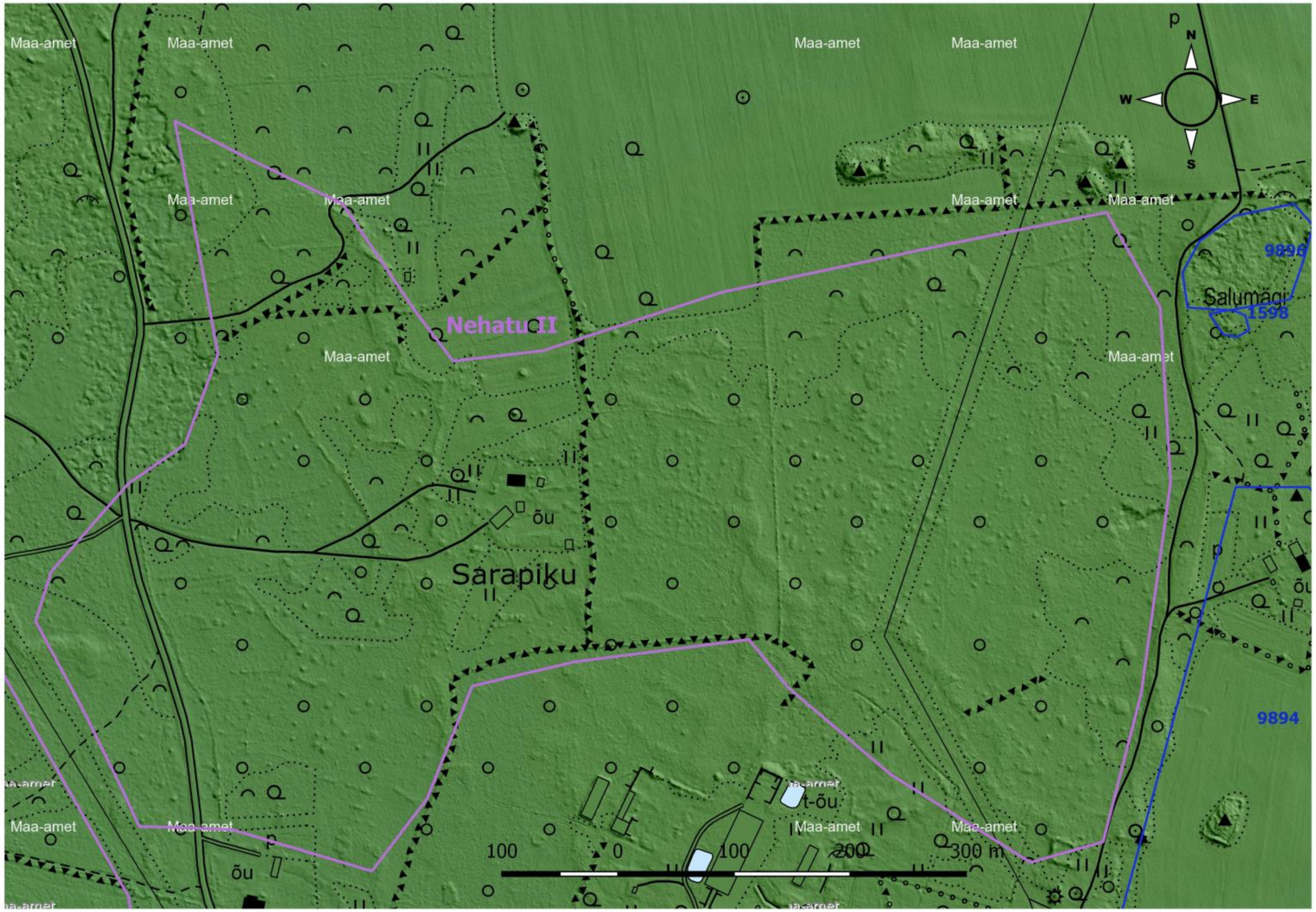


34. Nehatu I

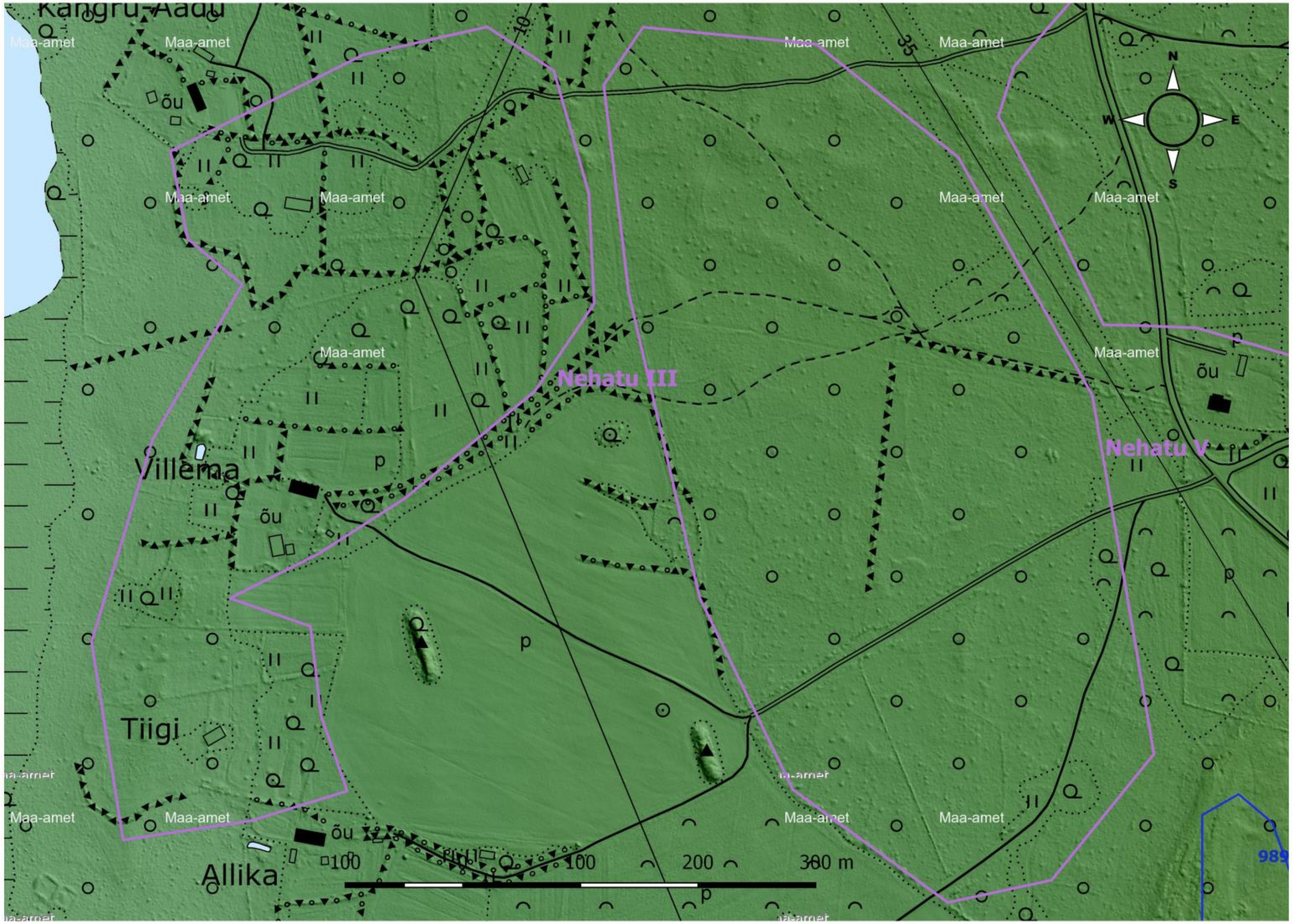


Nehatu mõis
9894
9895
Suurekivi
Nehatu I
Tamme
Pärdi
Türni-Metsavahi
Möldri
Rässaallikas
100 0 100 200 300 400 m

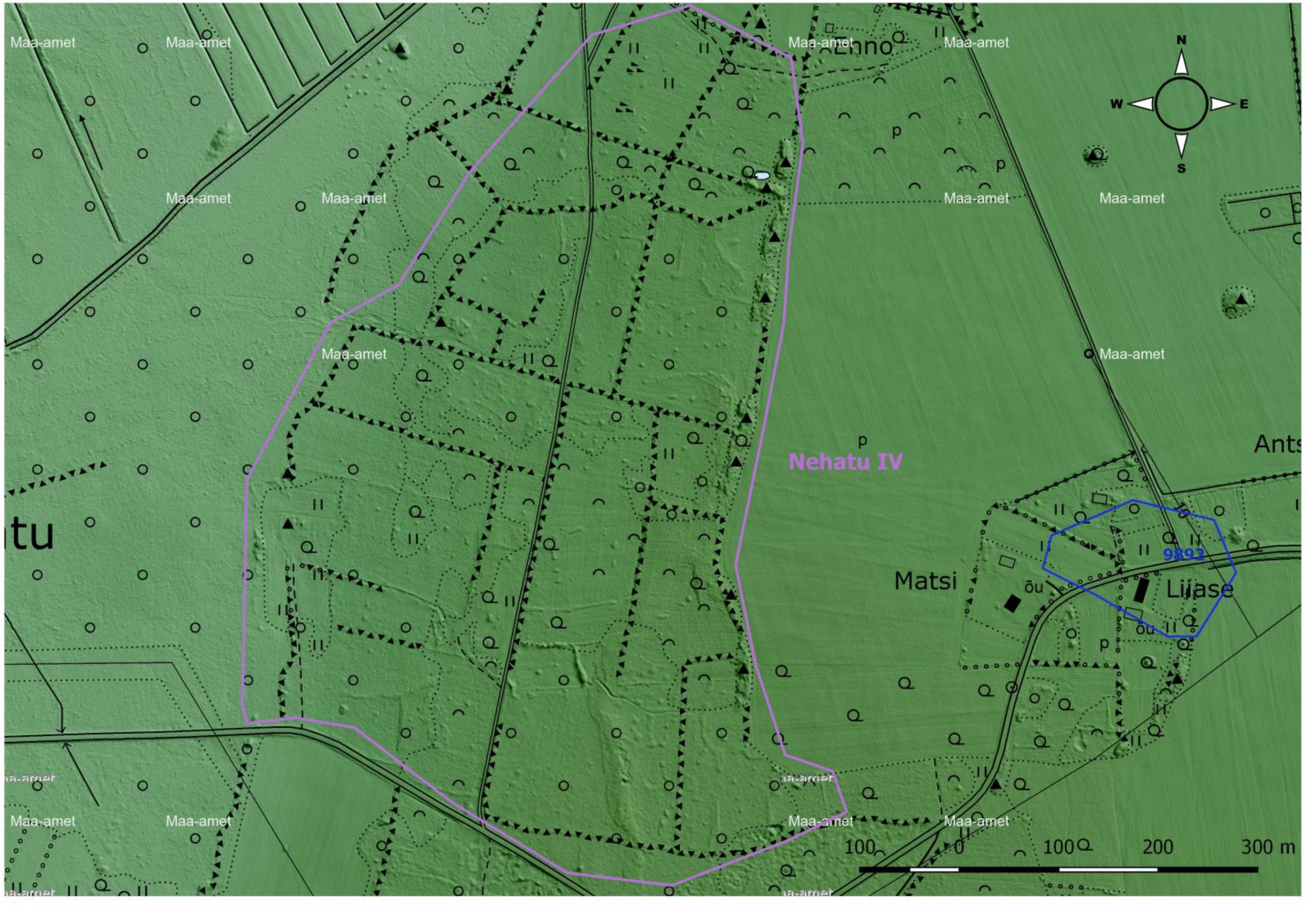
35. Nehatu II


Nehatu II
Sarapiku
Salumägi
9894
1598
õu
N
S
W
E
Maa-amet
100 0 100 200 300 m

36. Nehatu III
54. Nehatu V

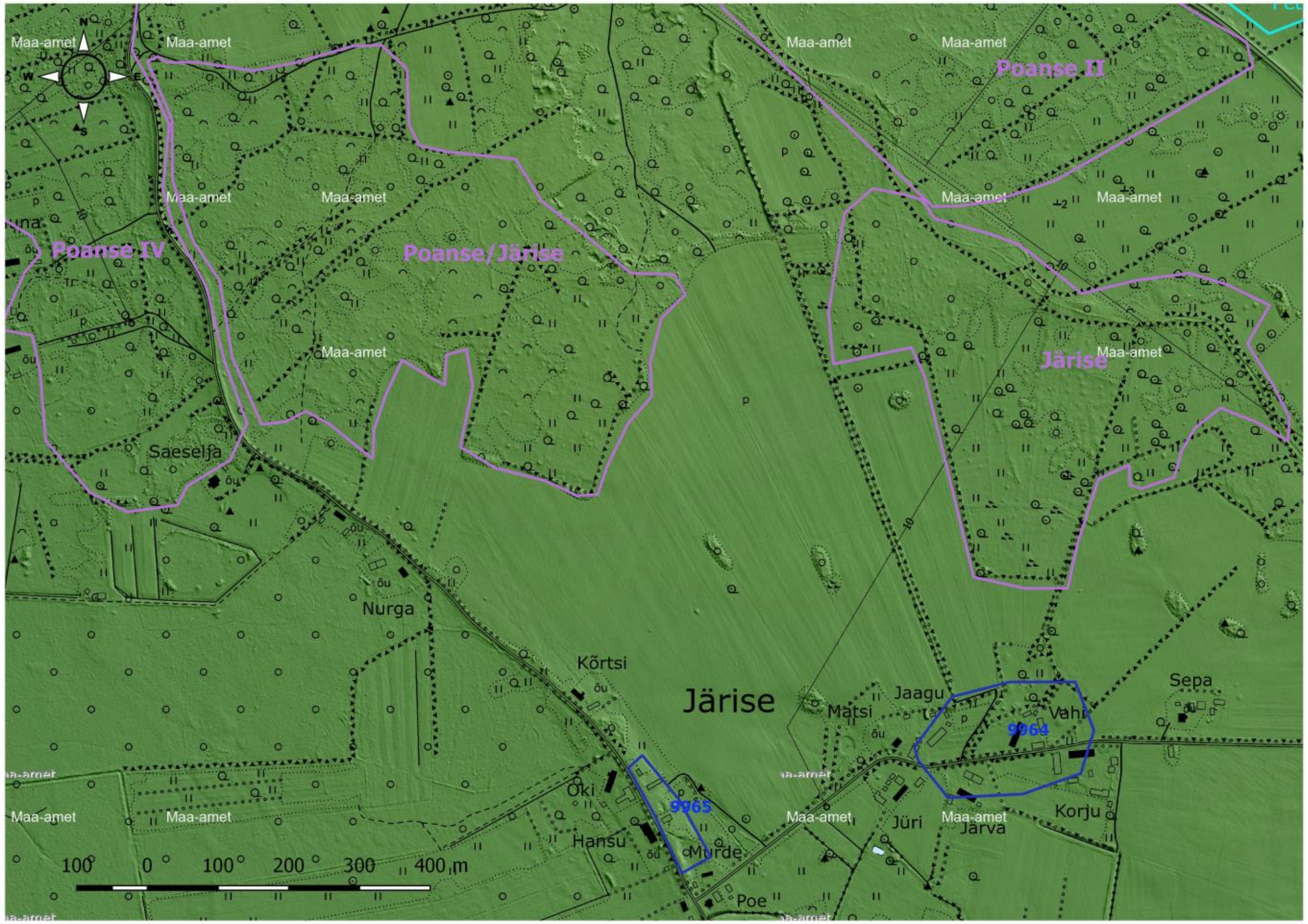


37. Nehatu IV



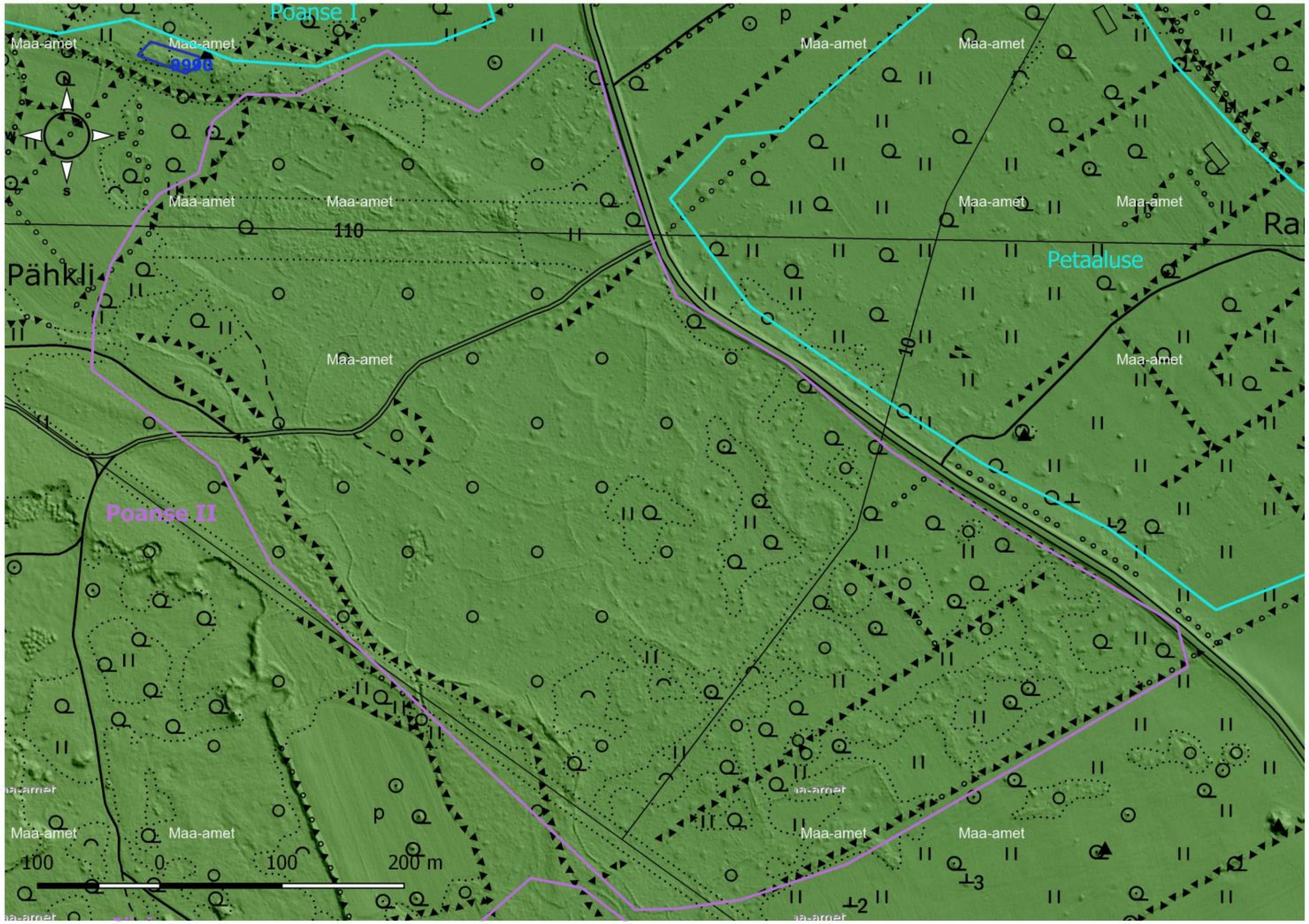
Nehatu IV
Matsi
Liiase
Enno
Ants
tu
9892
N
W
E
S
100
0
100
200
300 m

38. Järise
39. Poanse II
41. Poanse IV
42. Poanse/Järise

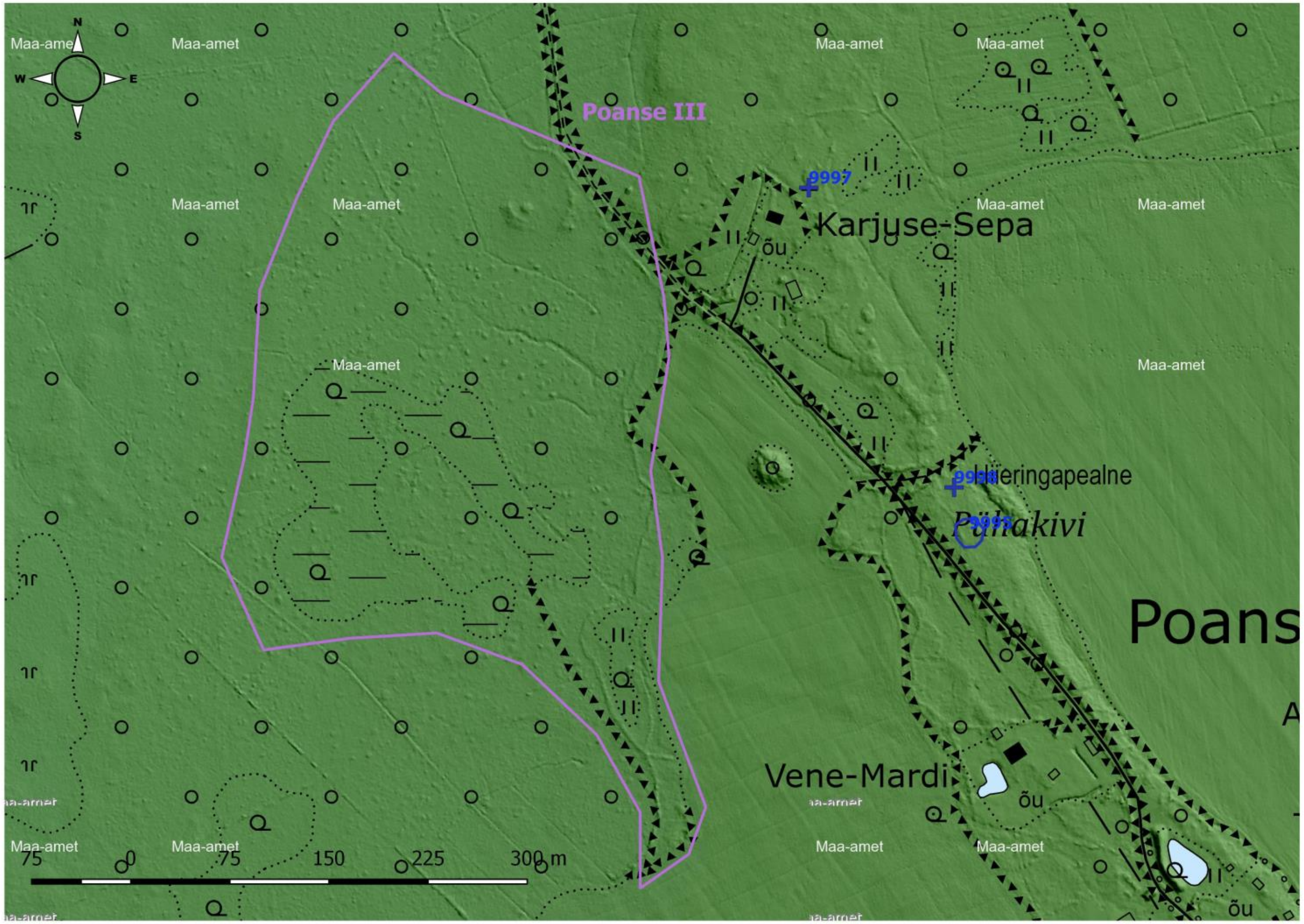


38. Järise

39. Poanse II


Poanse I
Maa-amet
Pähkli
110
Poanse II
Petaaluse
100
0
100
200 m

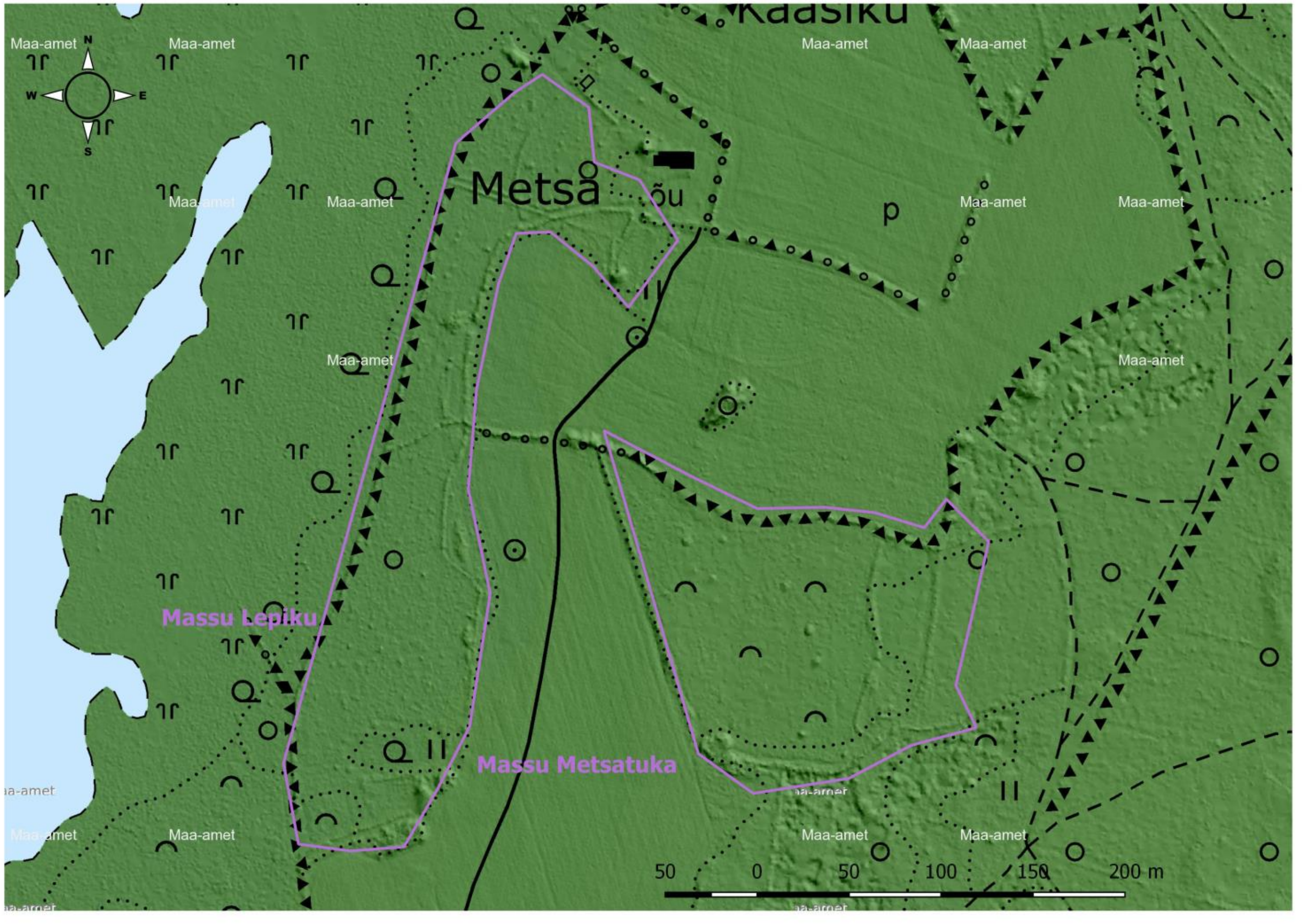
40. Poanse III



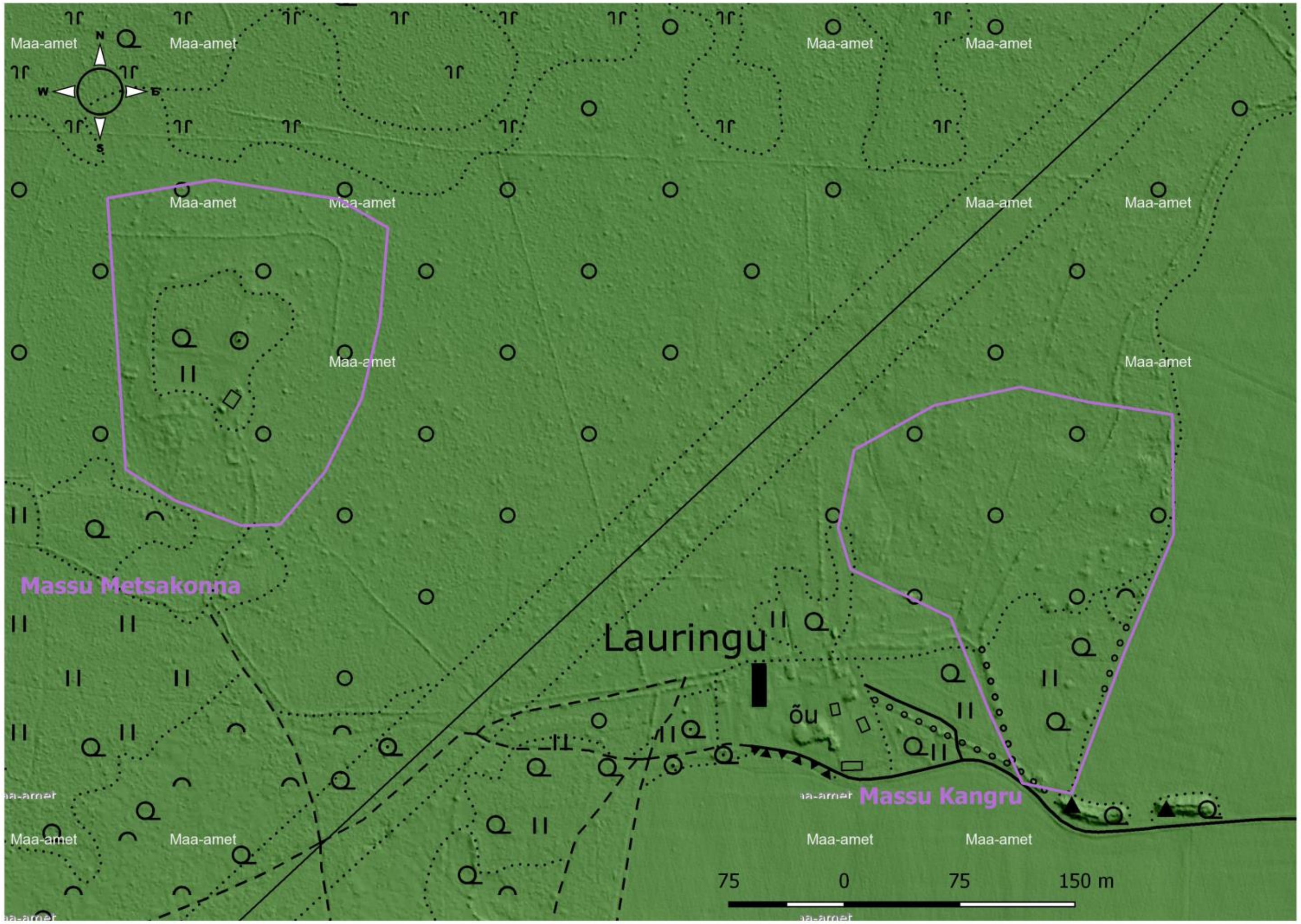
41. Poanse IV
42. Poanse-Järise

43. Massu Lepiku

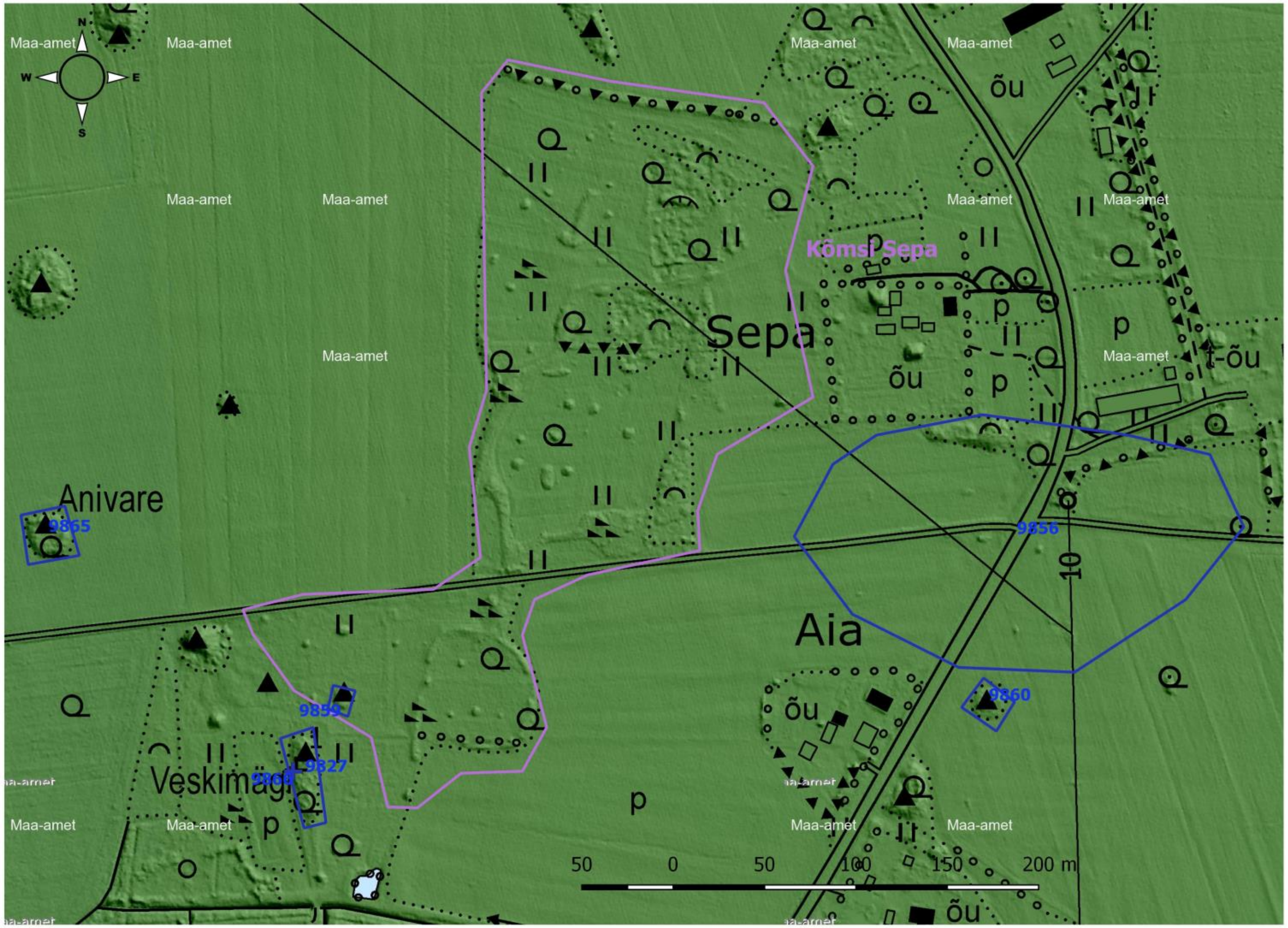
44. Massu Metsatuka



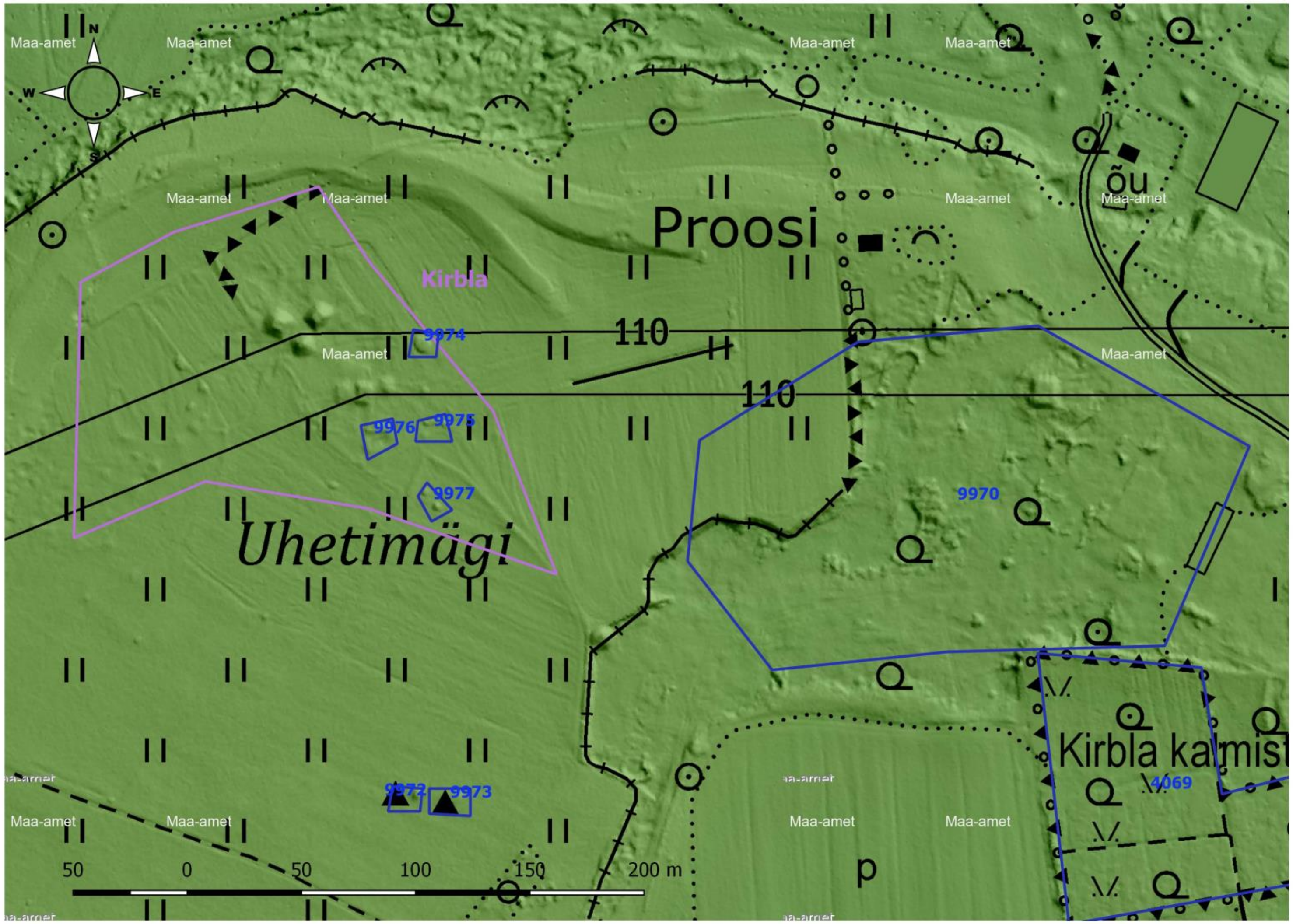
45. Massu Metsakonna
46. Massu Kangru



47. Kõmsi Sepa



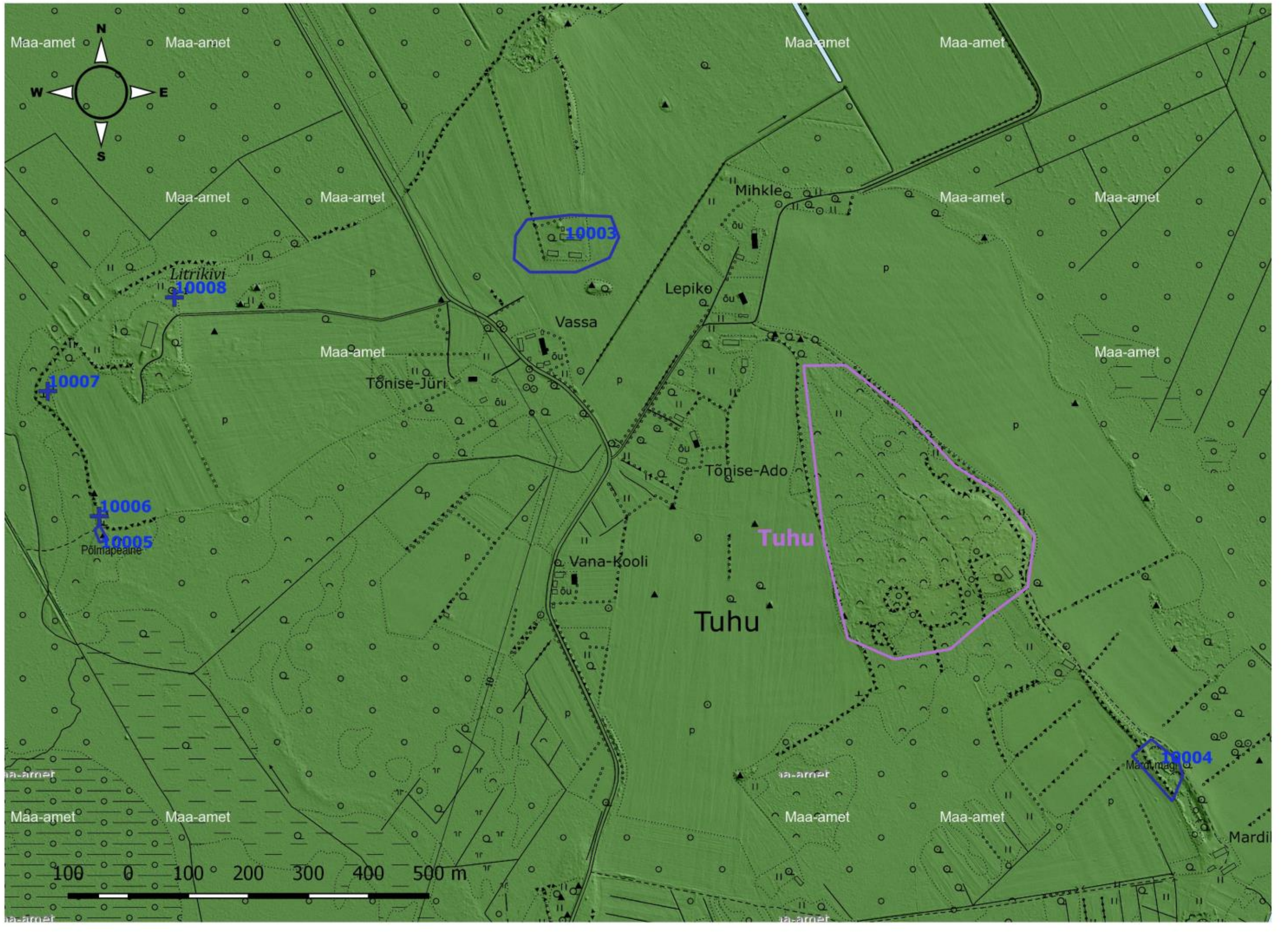
48. Kirbla



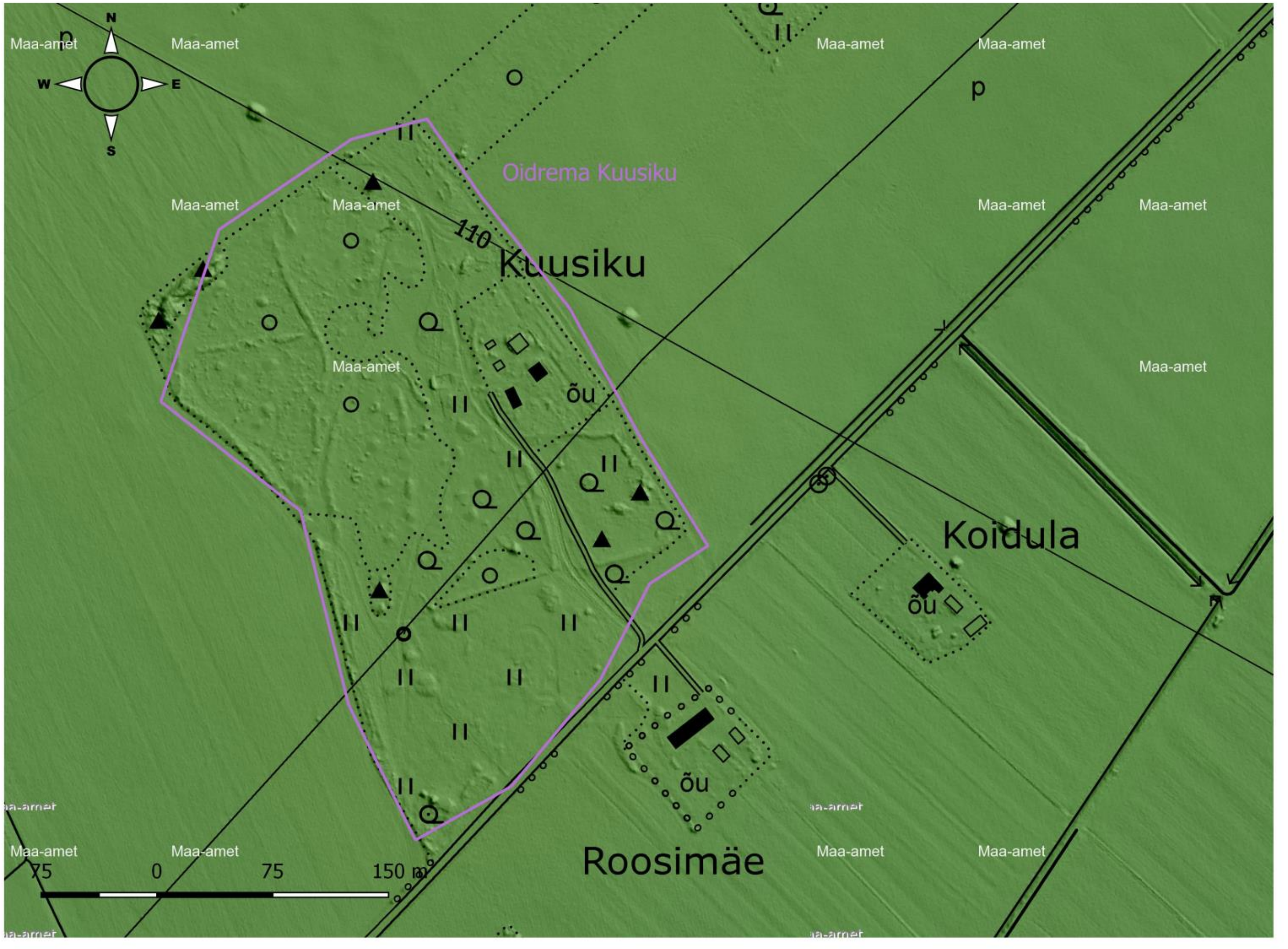
N
W
E
S
Maa-amet
Proosi
Kirbla
õu
9974
110
110
9976
9975
9977
9970
Uhetimägi
Kirbla kalmist
4069
9972
9973
p
50
0
50
100
150
200 m

49. Tuhu

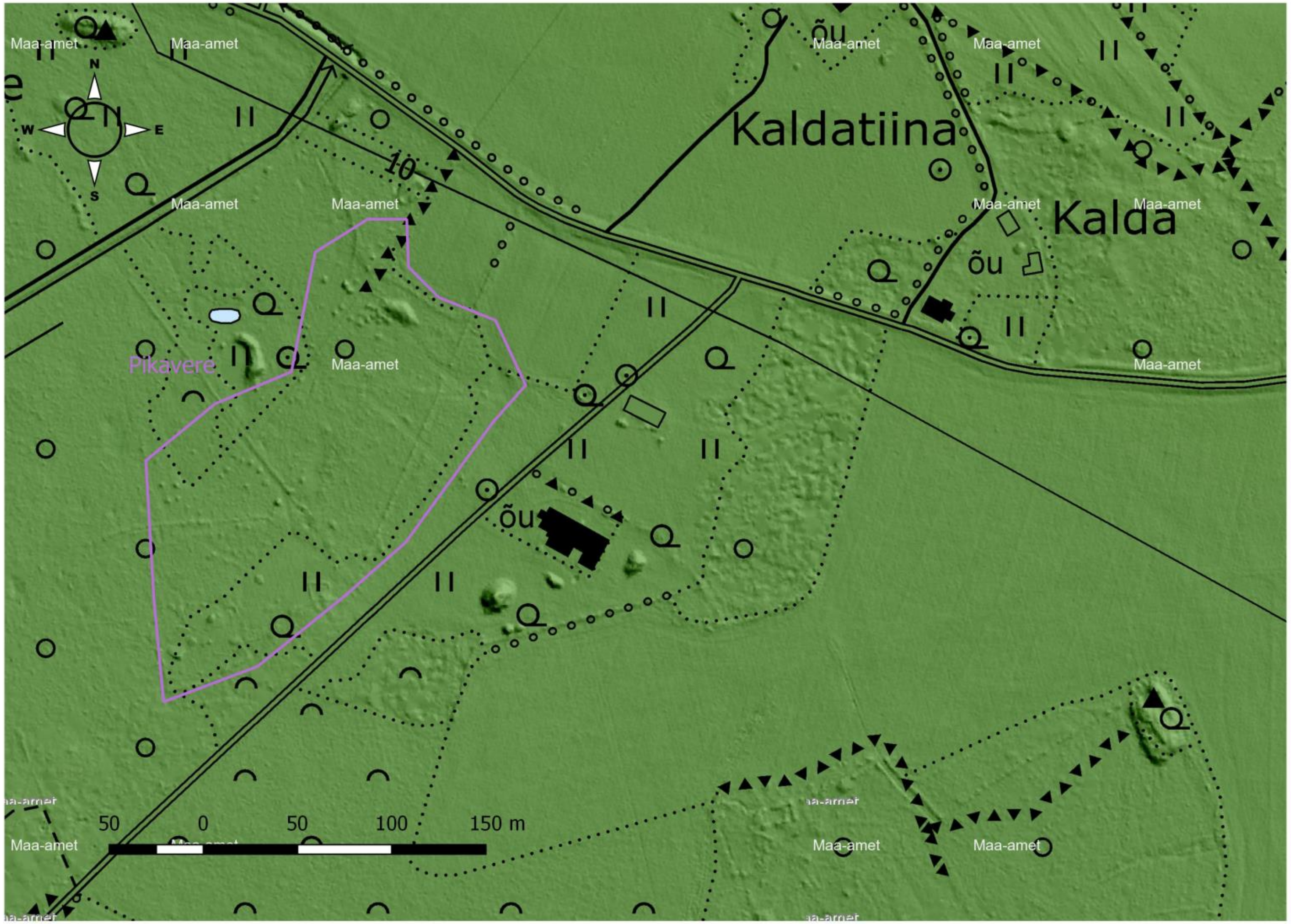
49. Tuhu (larger area)



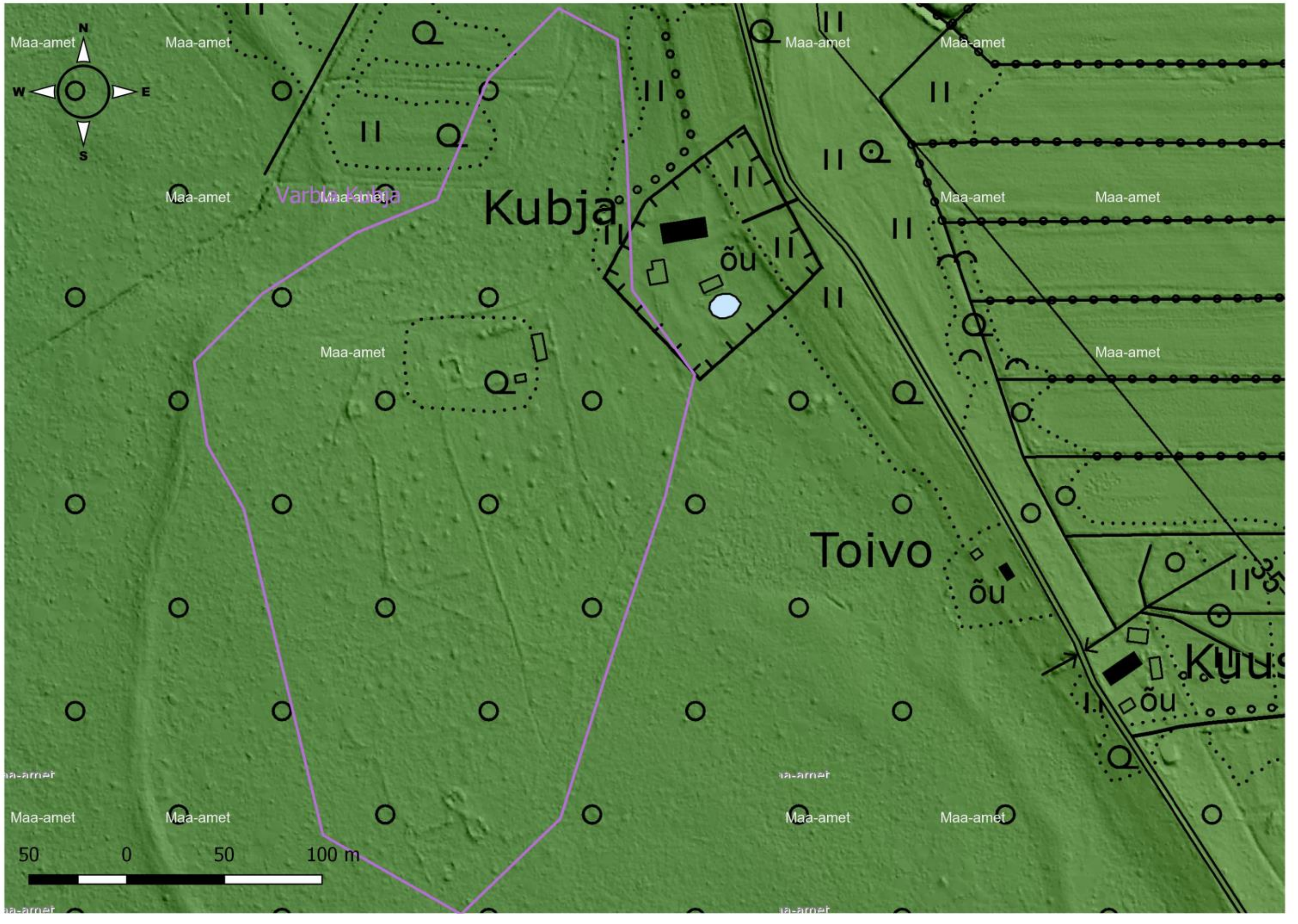
50. Oidrema Kuusiku



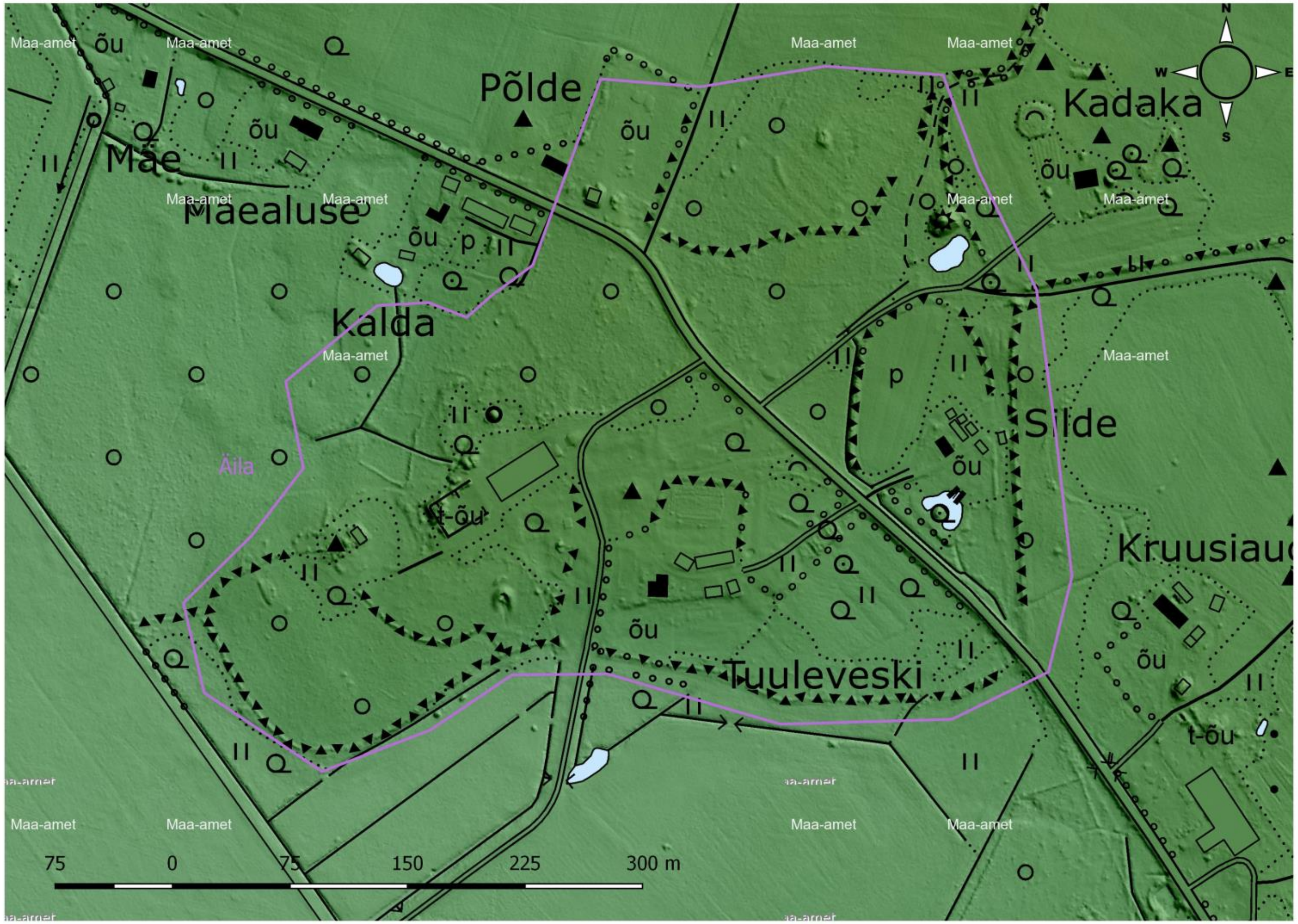
51. Pikavere


Kaldatiina
Kalda
Pikavere
õu
õu
õu
10
N
S
W
E
Maa-amet
50
0
50
100
150 m

53. Varbla Kubja

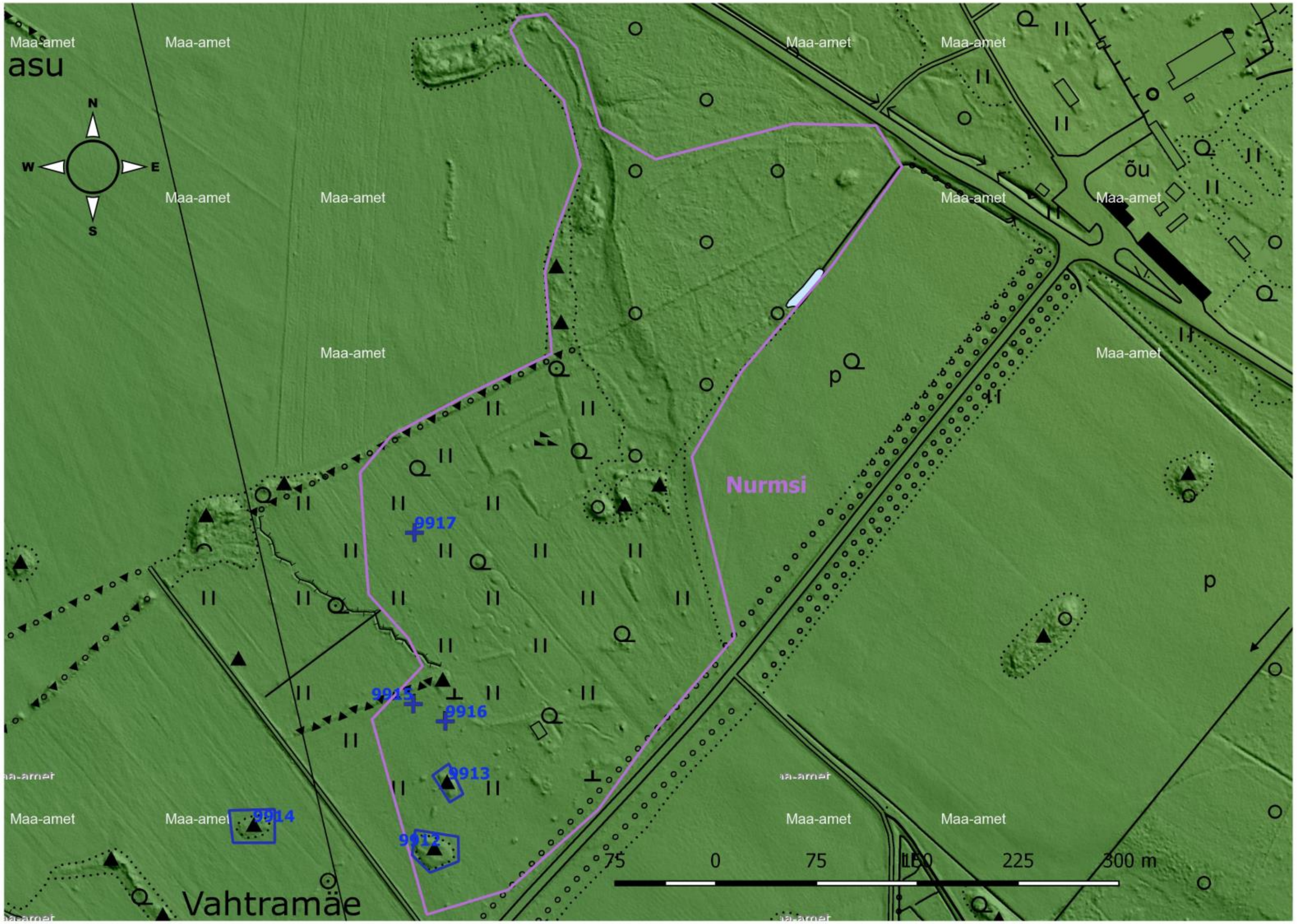


55. Äila



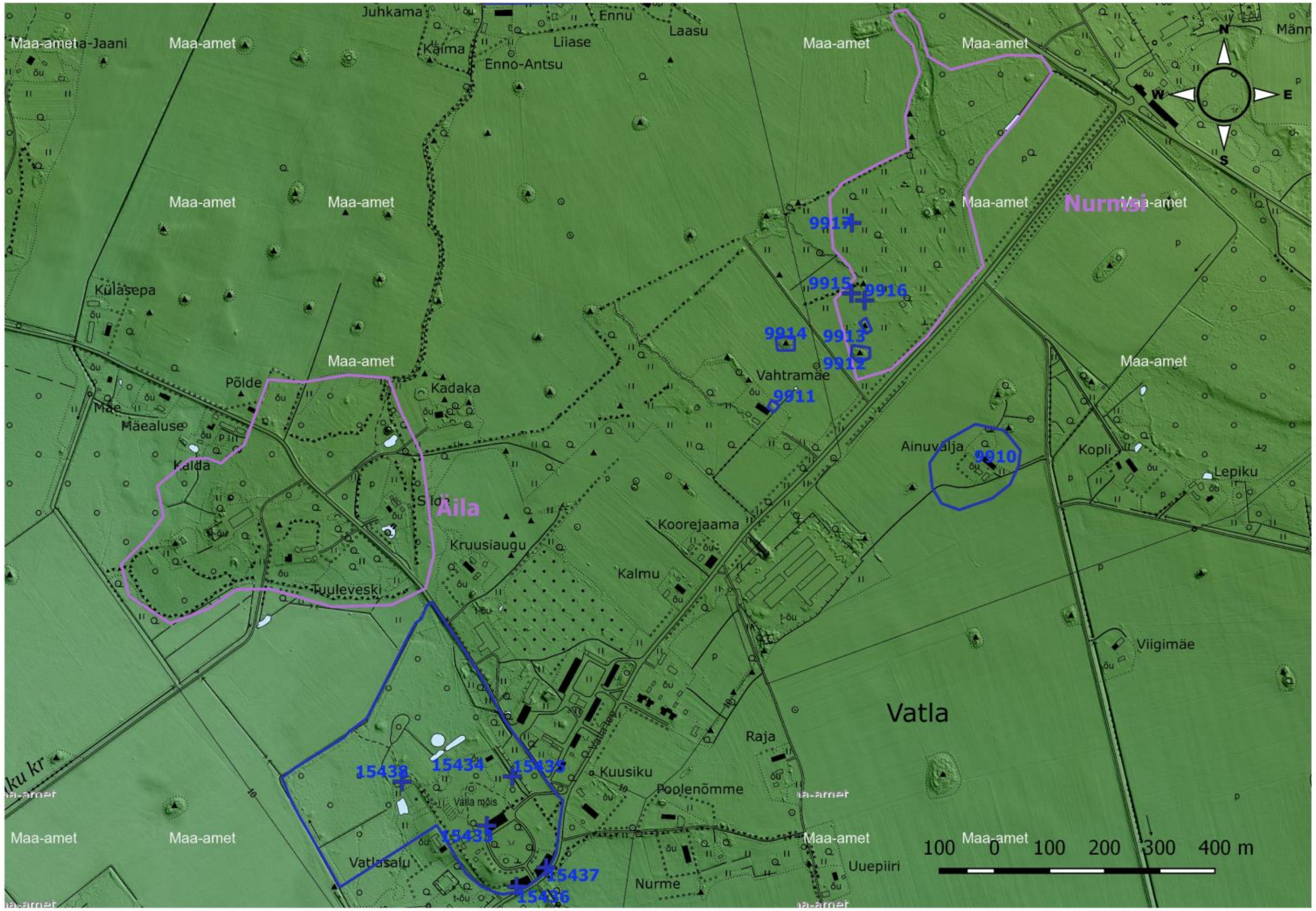
Maa-amet
õu
Põlde
Kadaka
Mäe
Maealuse
Kalda
Äila
t-õu
Silde
Kruusiaud
Tuuleveski
p
N
W
E
S
75
0
75
150
225
300 m

56. Nurmsi

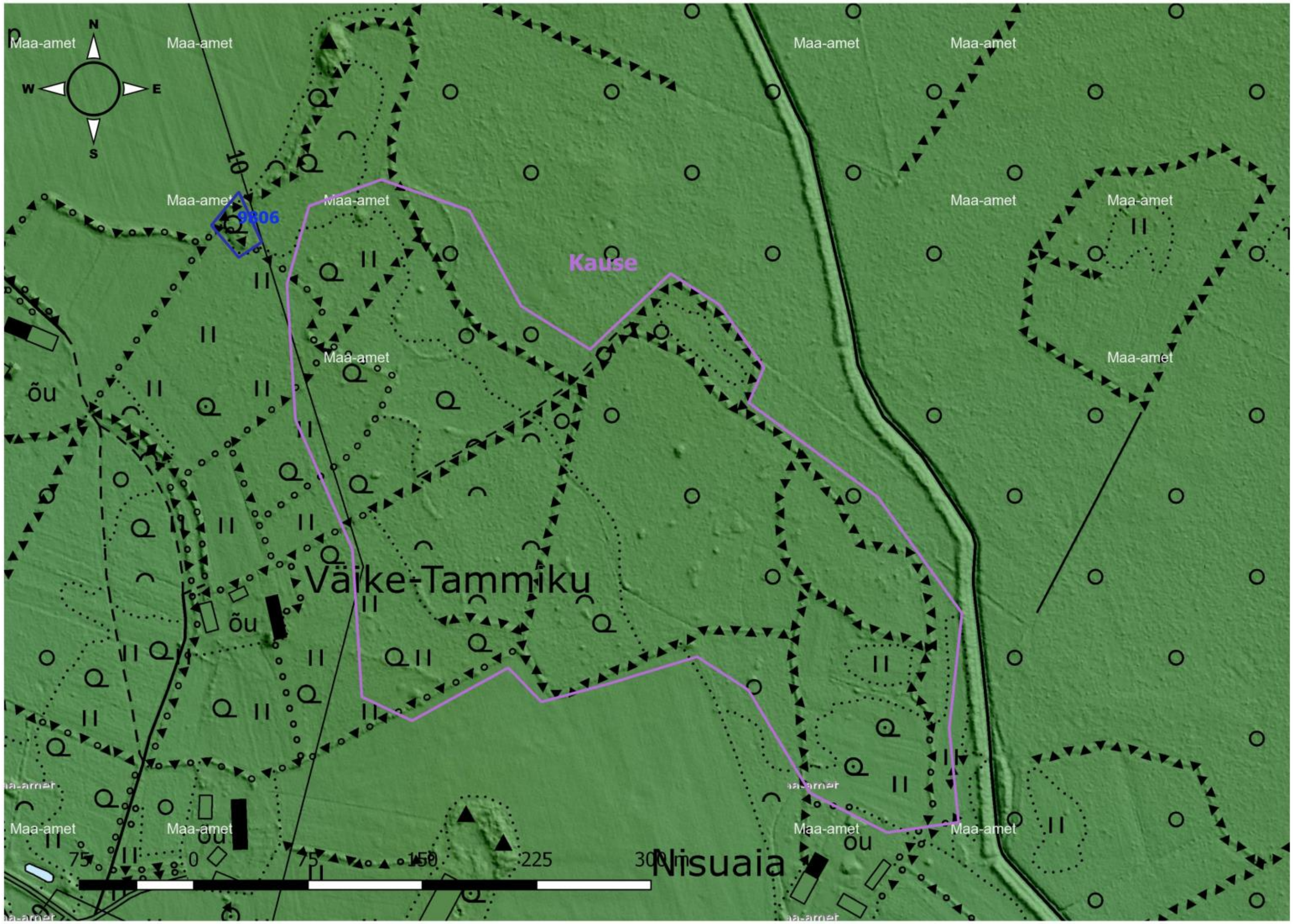


asu
N
W
E
S
Nurmsi
õu
p
9917
9915
9916
9913
9914
9912
Vahtramäe
75
0
75
150
225
300 m

55. Äila
56. Nurmsi

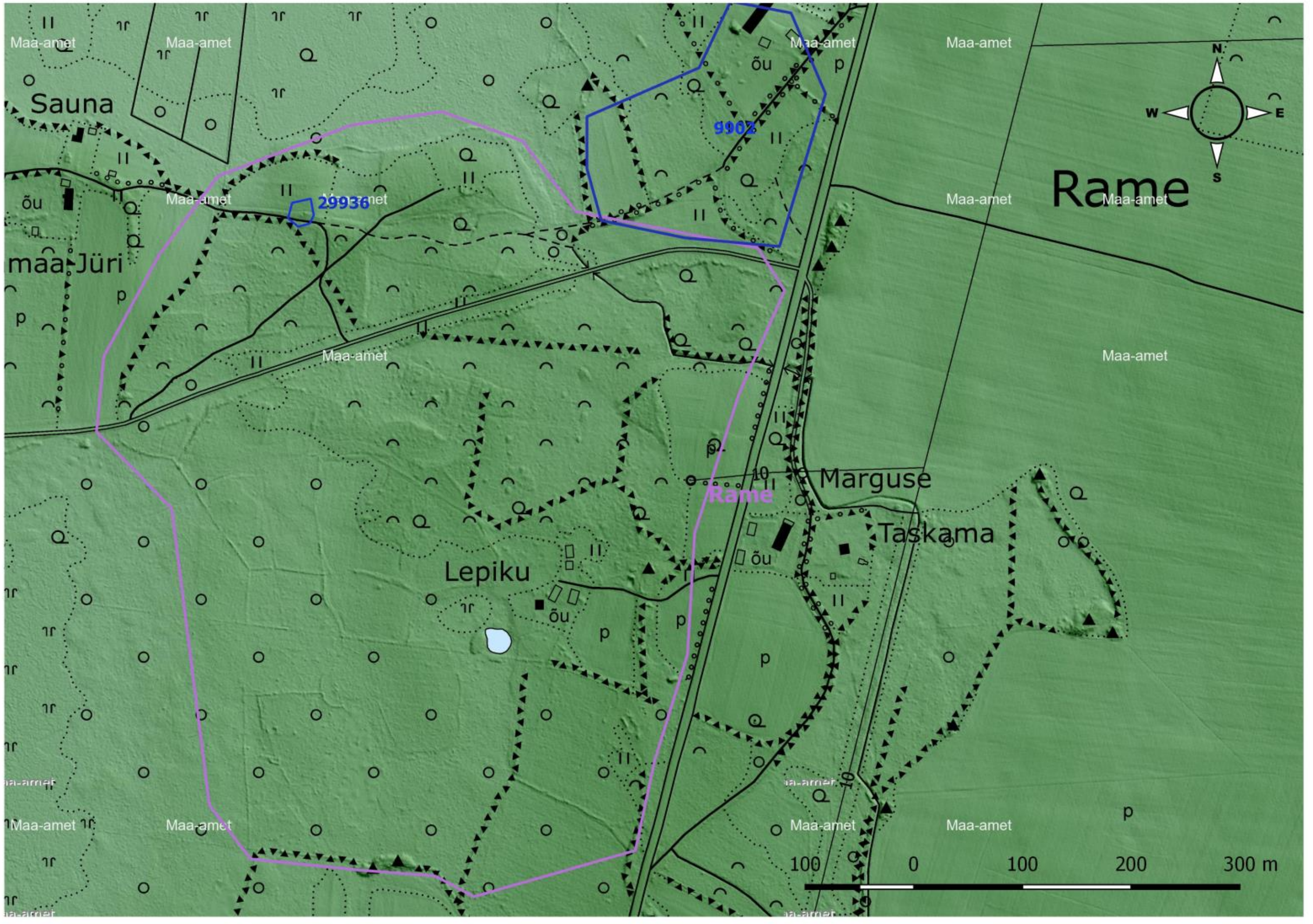


57. Kause

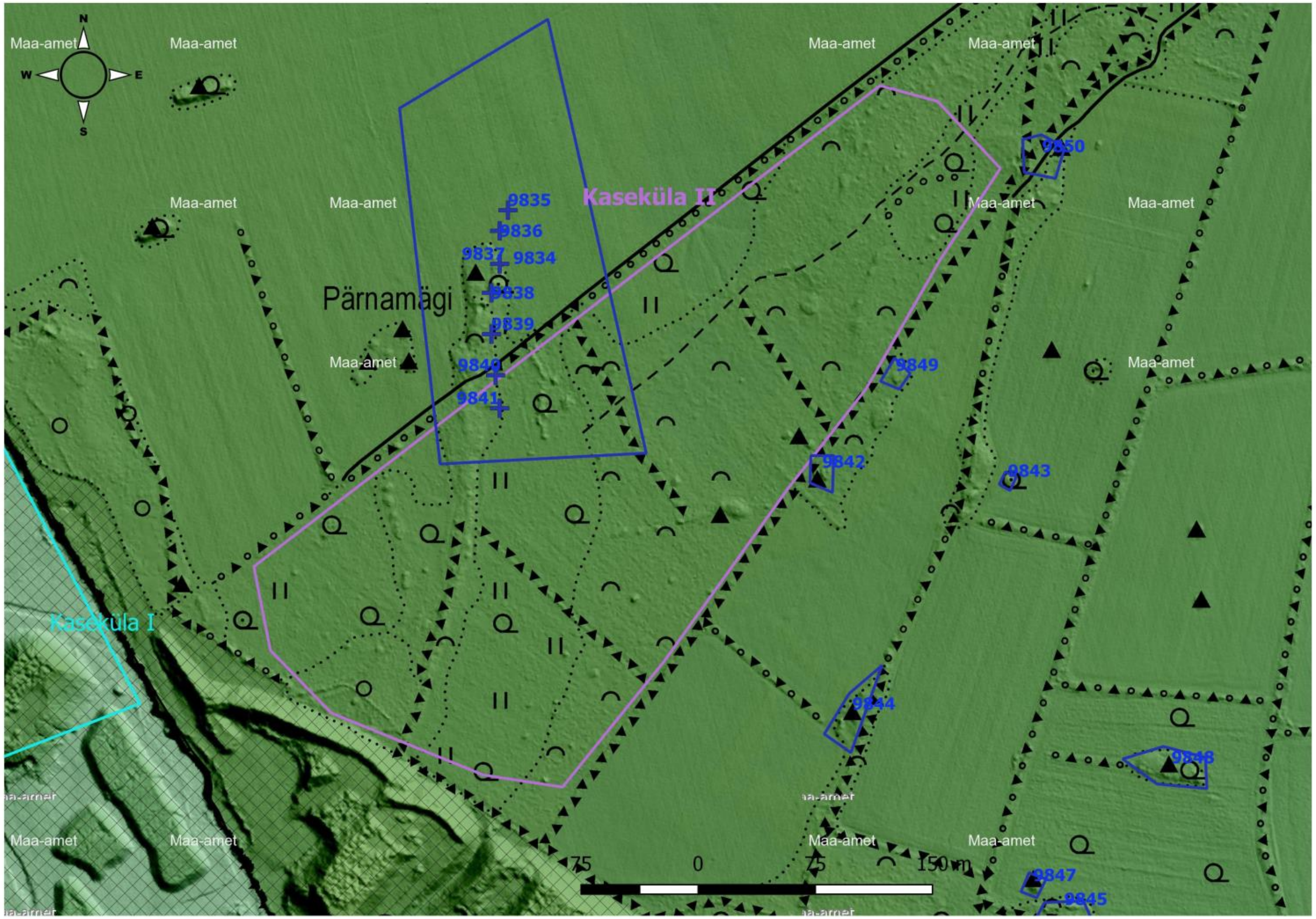


N
W
E
S
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
Maa-amet
9806
Kause
õu
õu
õu
Väike-Tammiku
Nisuaia
75
0
75
150
225
300 m

58. Rame


Sauna
maa Jüri
Rame
Marguse
Taskama
Lepiku
õu
29936
9902
Maa-amet
N
S
W
E
100
0
100
200
300 m

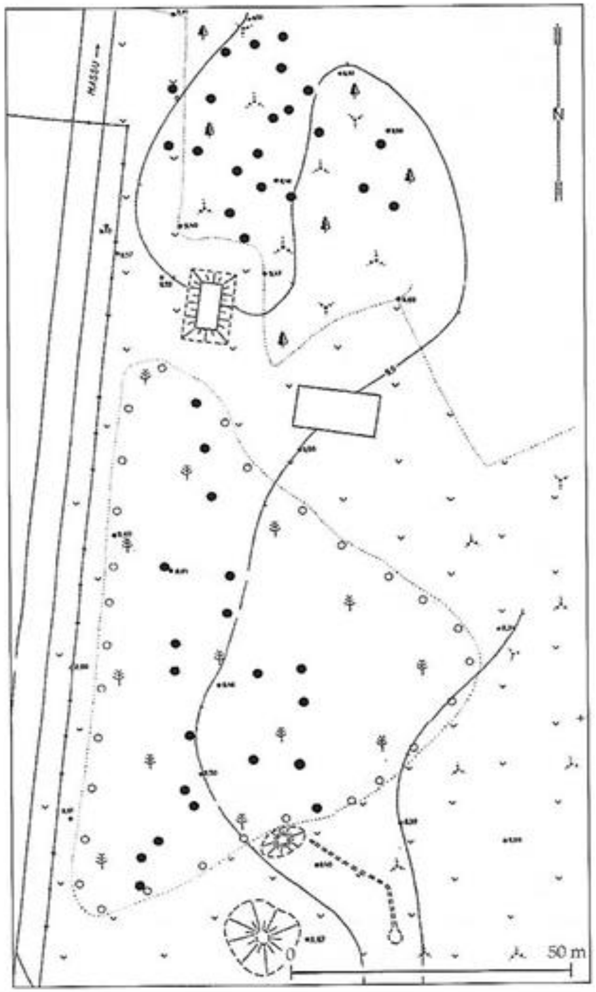
59. Kaseküla II



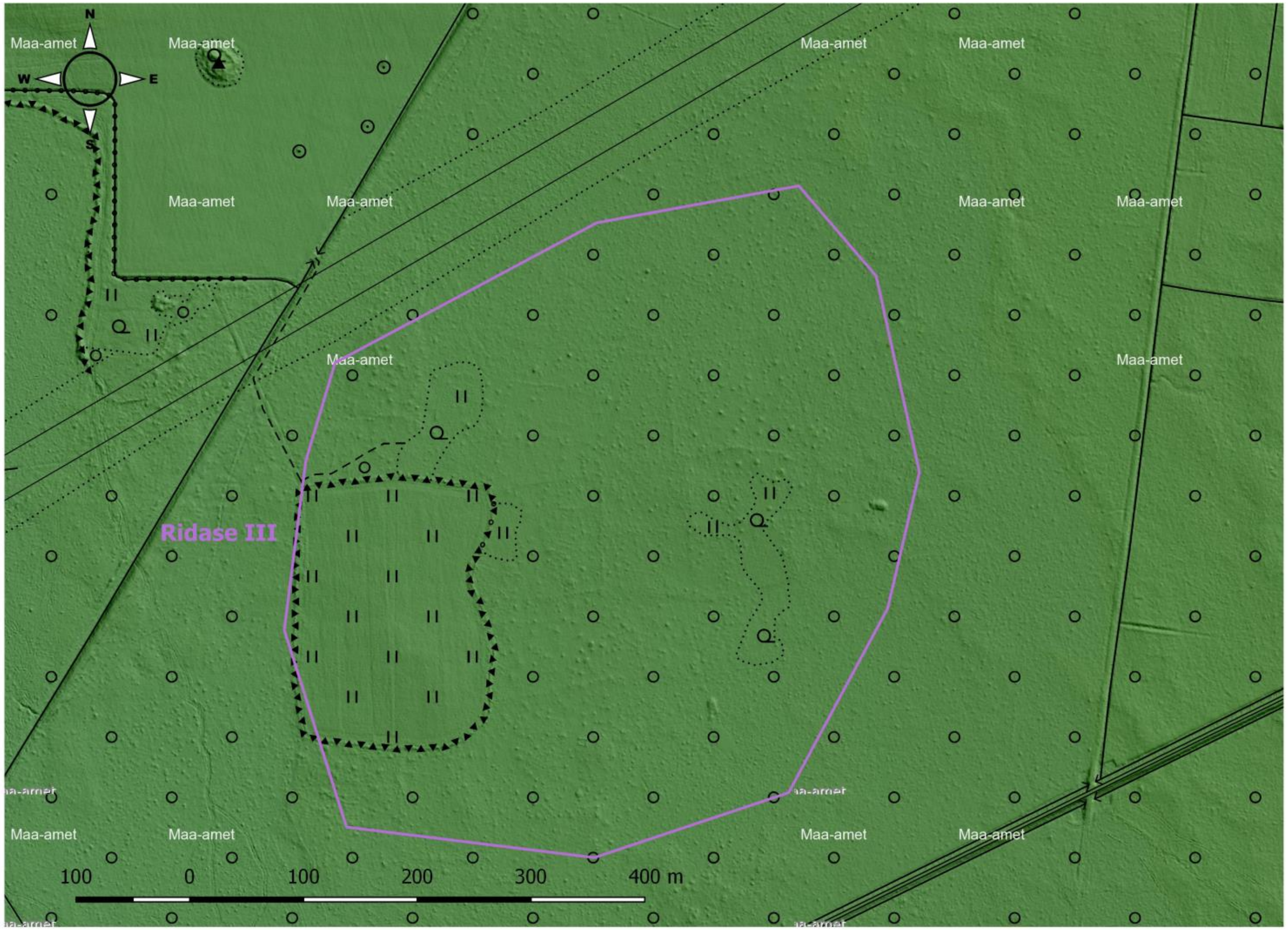
60. Hanila


Maa-amet
Hanila II
9844
9848
9847
9846
9851
9845
Sepa-Hansu
õu
50 0 50 100 150 200 m

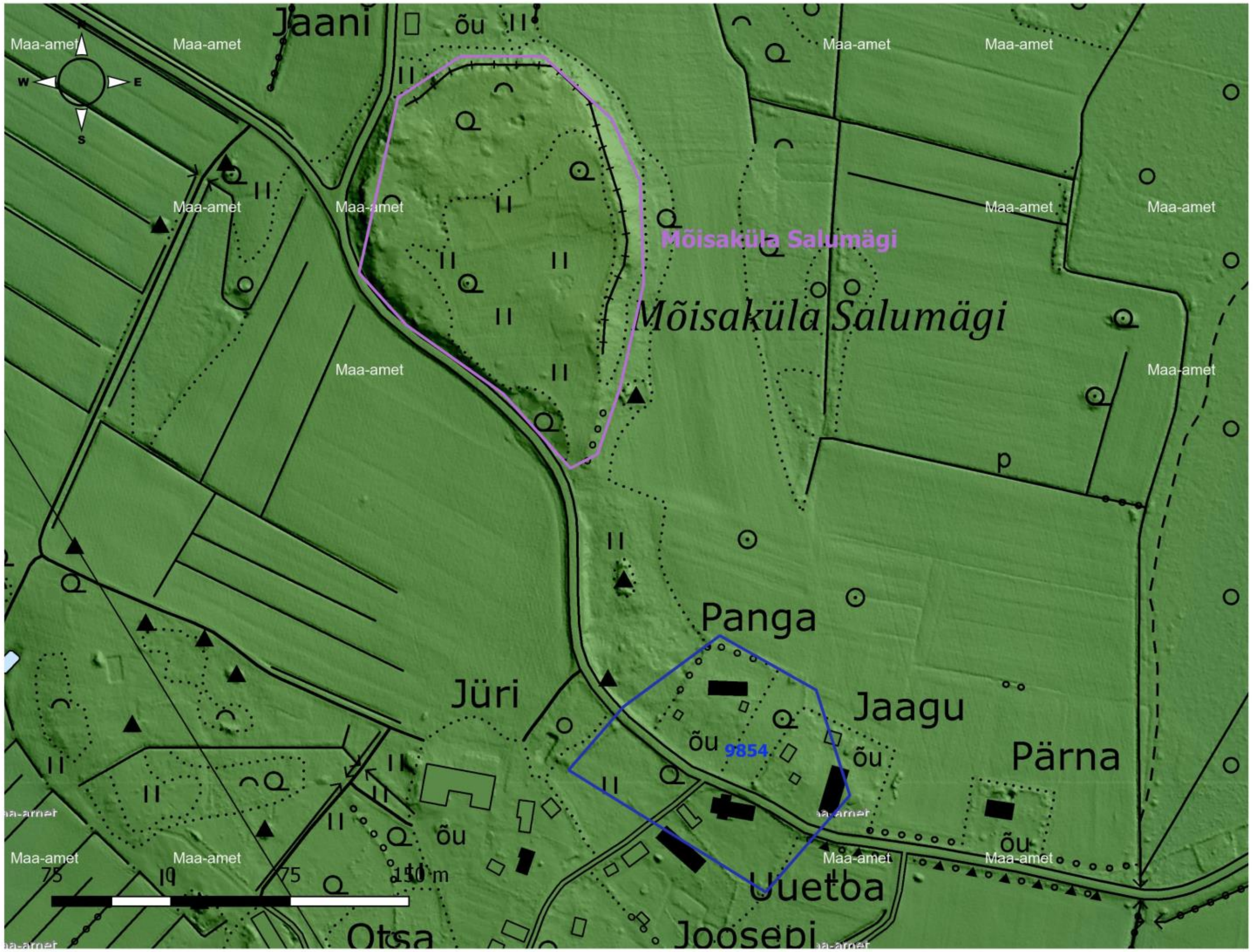
61. Kõmsi II



62. Ridase III

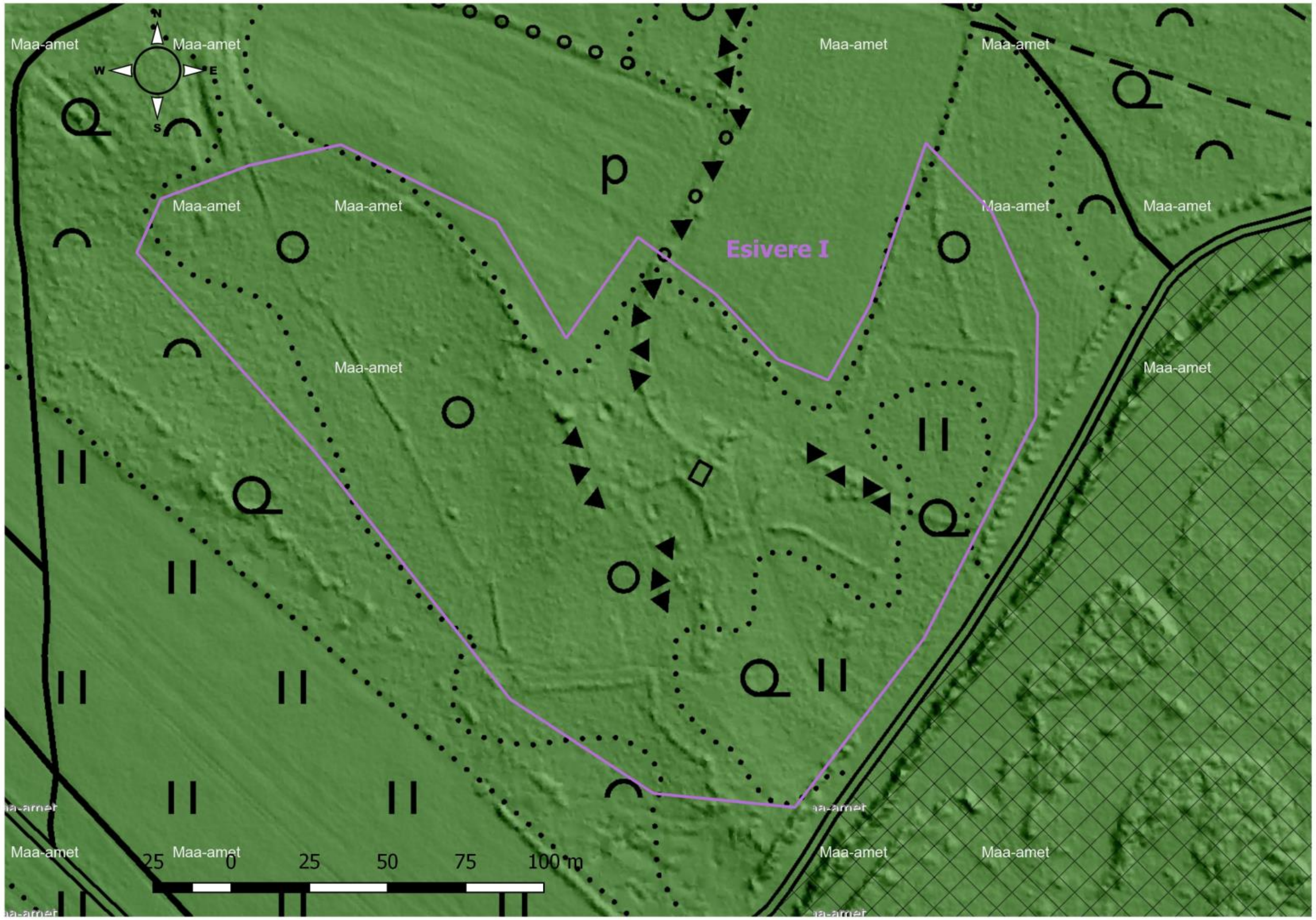


63. Mõisaküla Salumägi

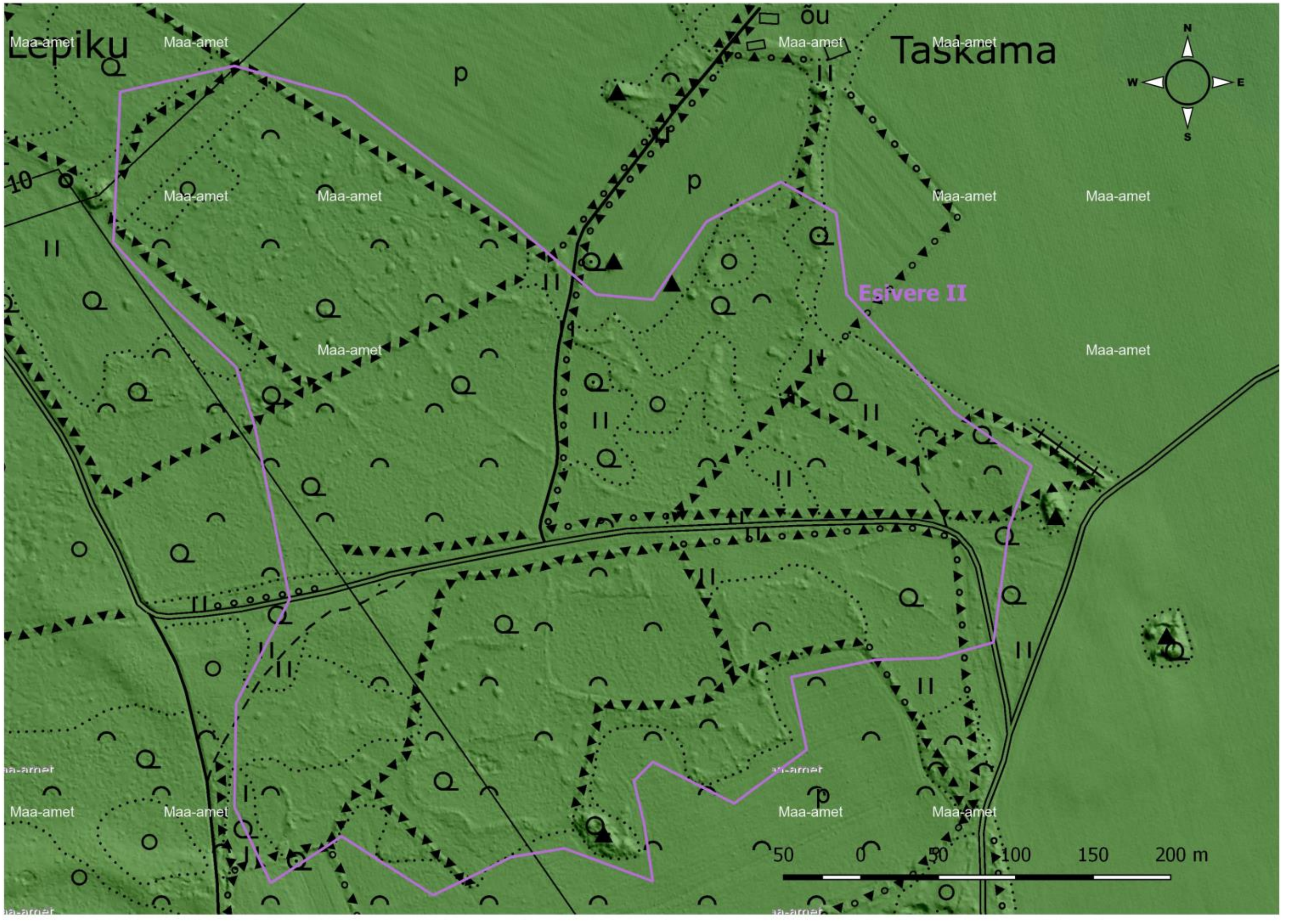


64–66 (Esivere I–III)

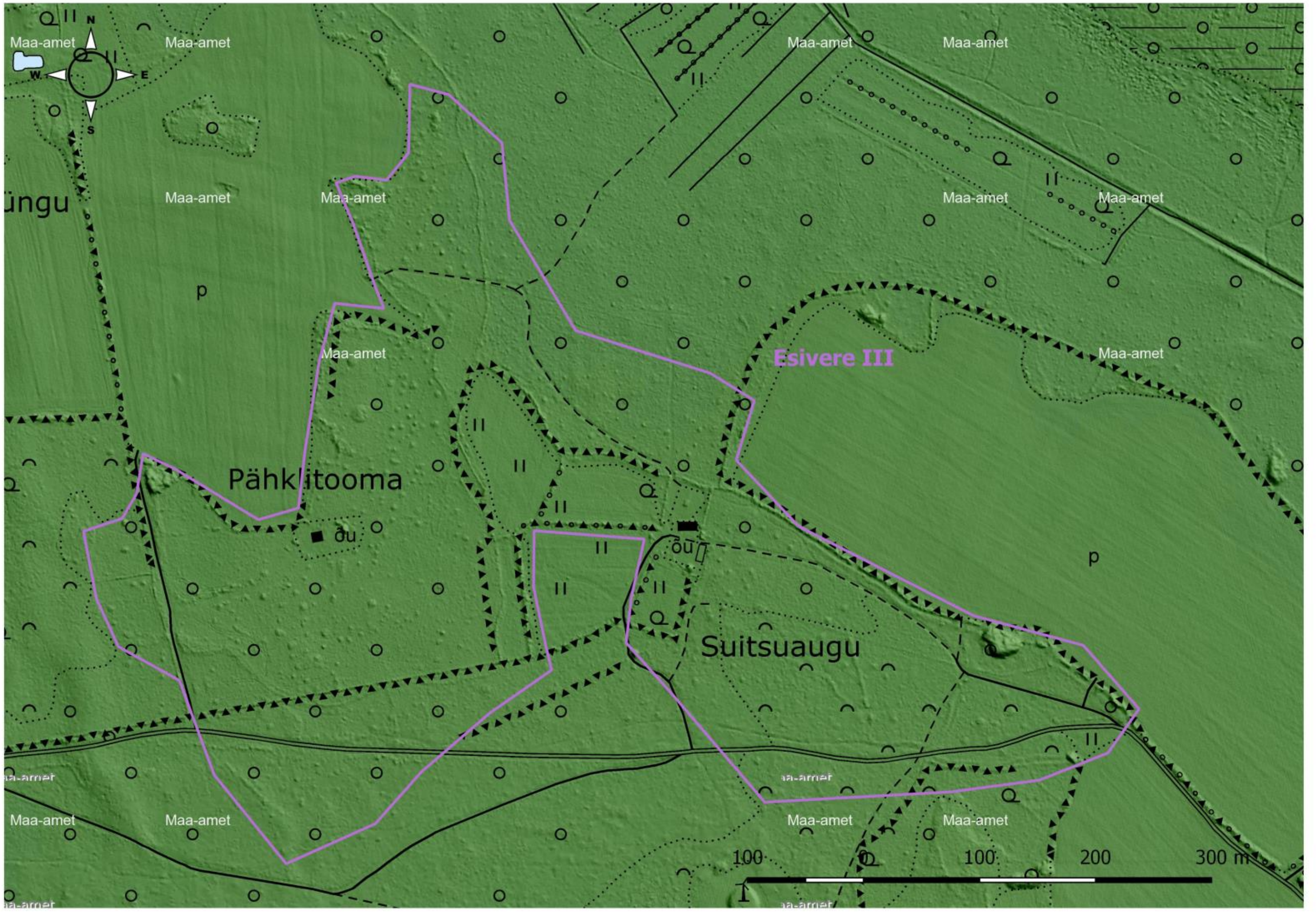
64. Esivere I



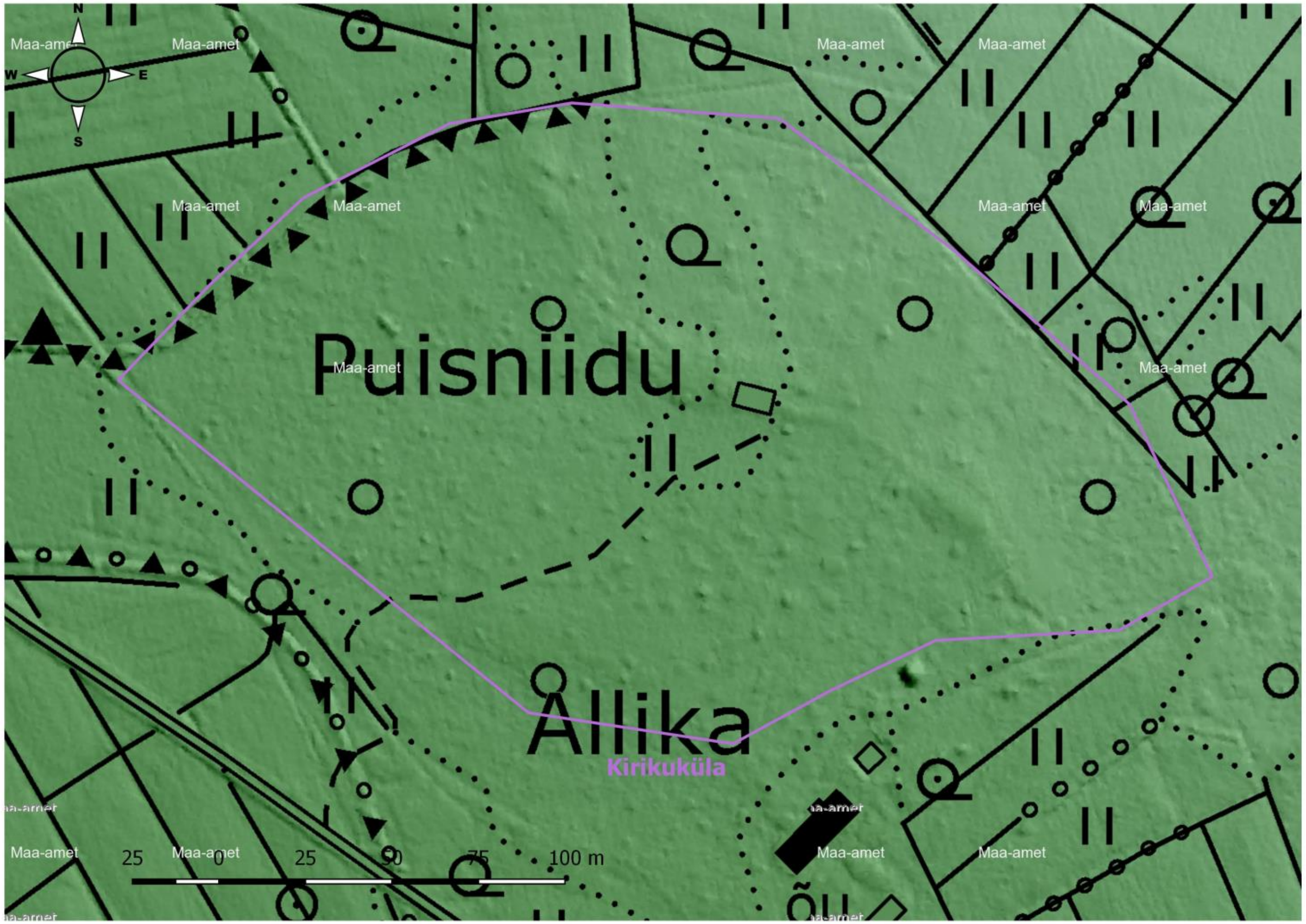
65. Esivere II



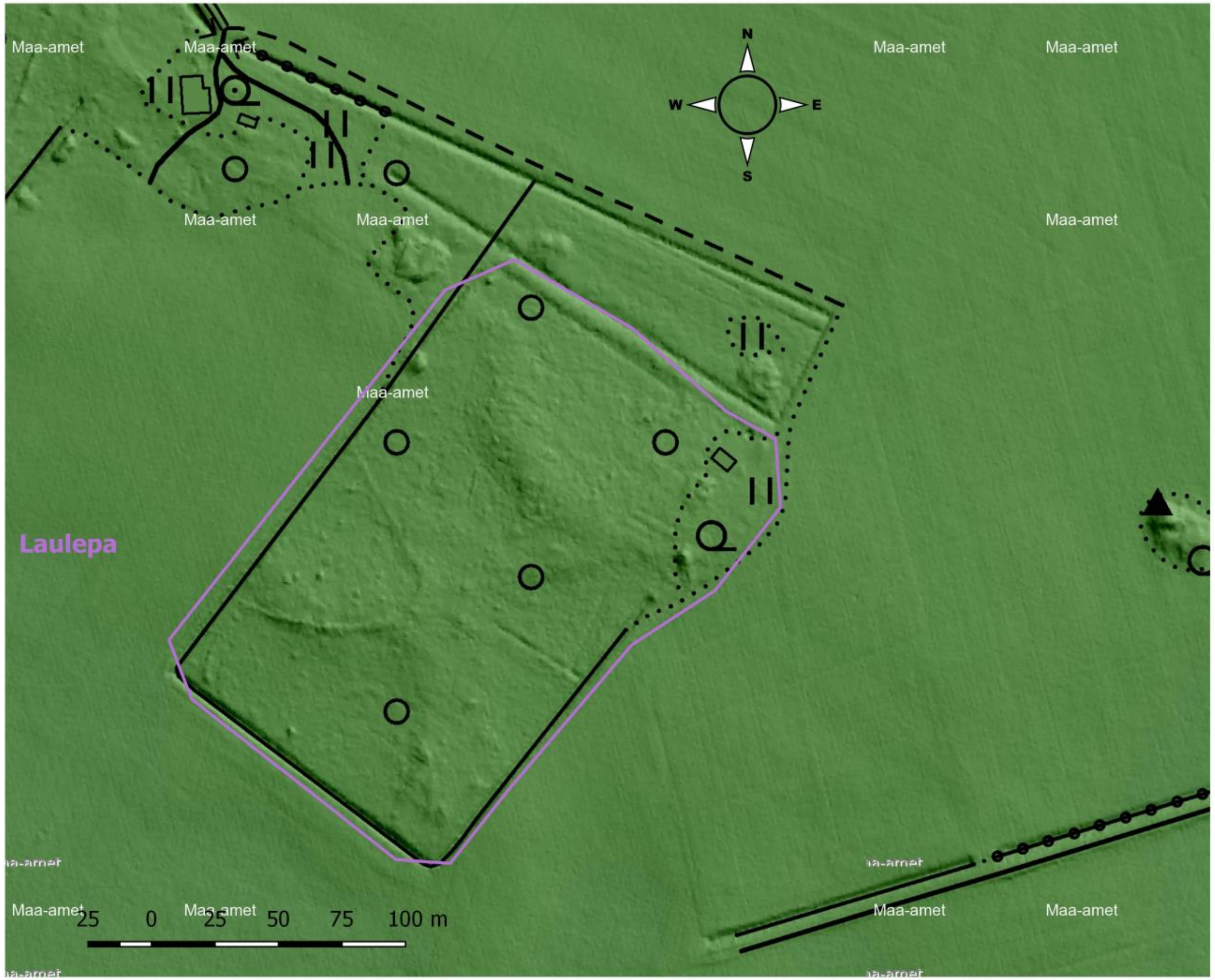
66. Esivere III



67. Kirikuküla

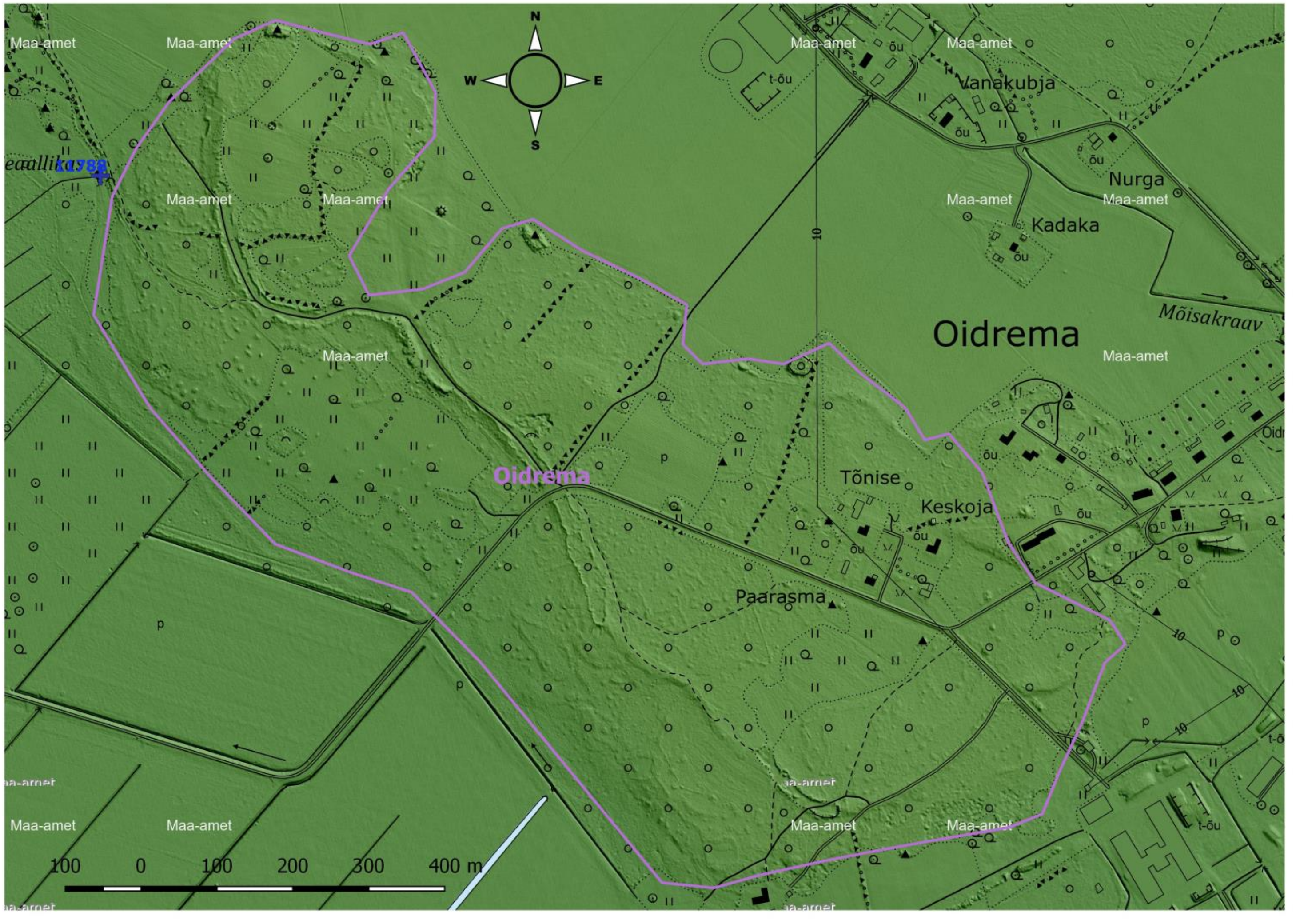


68. Laulepa



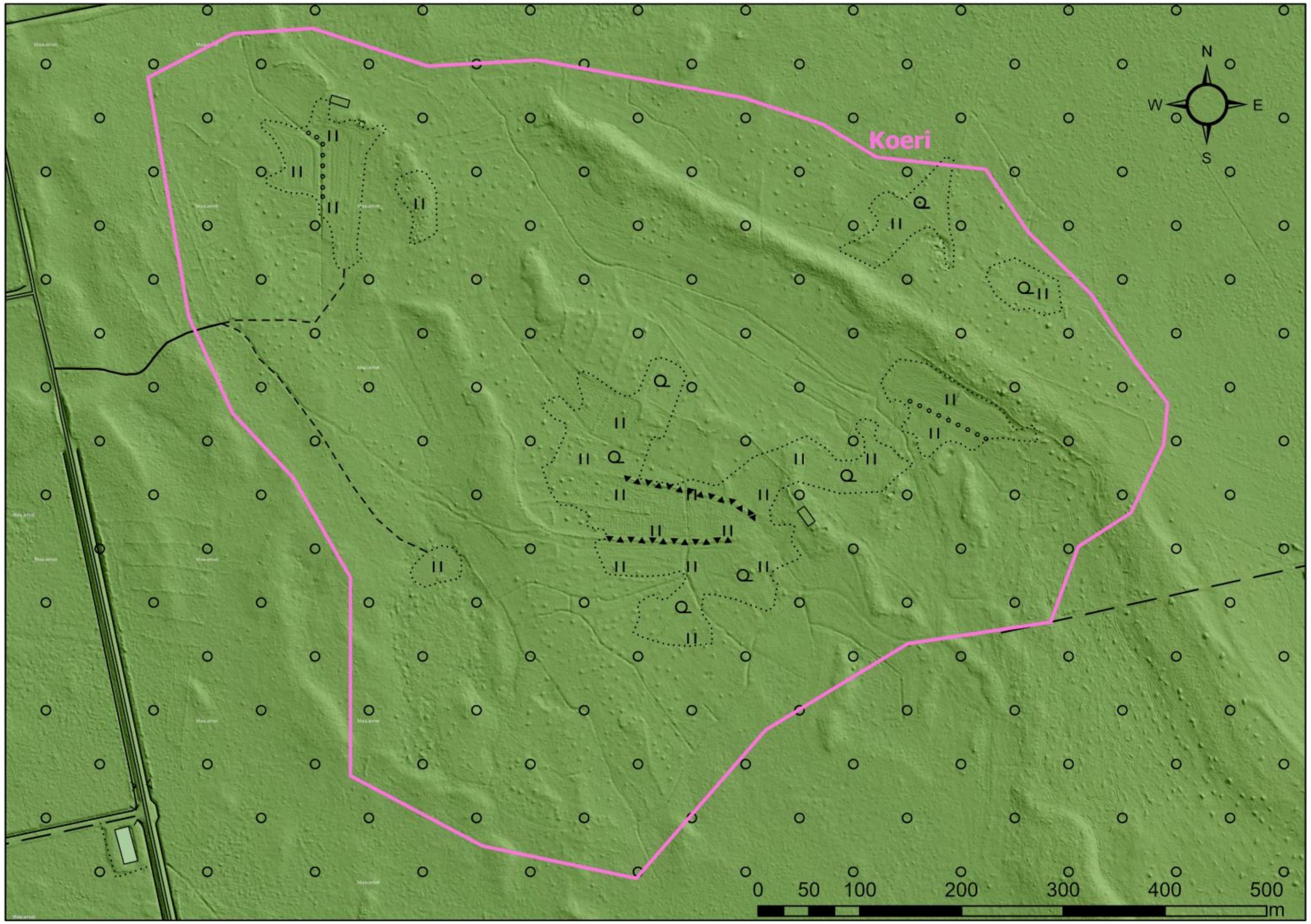
69. Metsküla-Võigaste

85. Oidrema



N
W
E
S
Maa-amet
Vanakubja
Nurga
Kadaka
Mõisakraav
Oidrema
Oidrema
Tõnise
Keskoja
Paarasma
õu
t-õu
100 0 100 200 300 400 m

86. Koeri



Appendix A3. Height data (above the sea level)

id	Name	Area	Height (from sea level
1	Einbi	N	2,5
1	Einbi	N	2,5
1	Einbi	N	2,5
1	Einbi	N	5
1	Einbi	N	5
1	Einbi	N	5
1	Einbi	N	7,5
1	Einbi	N	7,5
1	Einbi	N	7,5
1	Einbi	N	7,5
2	Ellamaa	N	50
4	Kasek la I	S	2,5
4	Kasek la I	S	2,5
4	Kasek la I	S	2,5
4	Kasek la I	S	2,5
4	Kasek la I	S	5
4	Kasek la I	S	5
4	Kasek la I	S	5
4	Kasek la I	S	7,5
4	Kasek la I	S	7,5
4	Kasek la I	S	10
4	Kasek la I	S	10
5	Kirimae I	N	10
5	Kirimae I	N	10
5	Kirimae I	N	12,5
5	Kirimae I	N	12,5
5	Kirimae I	N	12,5
5	Kirimae I	N	12,5
6	Kirimae II	N	10
7	Koela I	N	10
7	Koela I	N	10
8	Kurese I	S	27,5
8	Kurese I	S	30
8	Kurese I	S	32,5
8	Kurese I	S	32,5
9	Kurese II	S	30
9	Kurese II	S	32,5
9	Kurese II	S	32,5
10	Kimsi I	S	10
11	Linnamle I	N	15
12	Linnamle II	N	15
13	Roegu	N	2,5
13	Roegu	N	5
14	Massu Silde	S	12,5

16	Massu Paemurru	S	12,5
17	Oru I	N	17,5
17	Oru I	N	17,5
18	Petaaluse	S	15
19	Poanse I	S	12,5
19	Poanse I	S	12,5
19	Poanse I	S	15
19	Poanse I	S	17,5
20	Ridase I	S	10
20	Ridase I	S	12,5
21	Ridase II	S	12,5
22	Salavere I	S	22,5
23	Salavere II	S	25
23	Salavere II	S	27,5
24	Salevere Salum	S	12,5
24	Salevere Salum	S	15
24	Salevere Salum	S	17,5
24	Salevere Salum	S	20
26	Voose	S	15
27	Kuluse	N	10
27	Kuluse	N	12,5
27	Kuluse	N	12,5
27	Kuluse	N	12,5
27	Kuluse	N	12,5
28	Kokuta Veski	S	15
28	Kokuta Veski	S	17,5
28	Kokuta Veski	S	17,5
29	Kimsi Kopli	S	12,5
29	Kimsi Kopli	S	12,5
29	Kimsi Kopli	S	12,5
30	Massu/Kokuta	S	10
30	Massu/Kokuta	S	12,5
30	Massu/Kokuta	S	15
30	Massu/Kokuta	S	15
30	Massu/Kokuta	S	17,5
31	Metsk la Laiakivi	S	10
32	Malikala I	S	25
32	Malikala I	S	27,5
32	Malikala I	S	30
32	Malikala I	S	30
33	Malikala II	S	15
33	Malikala II	S	17,5
33	Malikala II	S	20
33	Malikala II	S	22,5
34	Nehatu I	S	7,5
34	Nehatu I	S	10
34	Nehatu I	S	10
34	Nehatu I	S	10
34	Nehatu I	S	12,5
35	Nehatu II	S	10
35	Nehatu II	S	10
35	Nehatu II	S	12,5

35	Nehatu II	S	12,5
35	Nehatu II	S	12,5
36	Nehatu III	S	5
36	Nehatu III	S	7,5
37	Nehatu IV	S	5
37	Nehatu IV	S	7,5
37	Nehatu IV	S	10
37	Nehatu IV	S	10
38	Jorise	S	20
38	Jorise	S	20
39	Poanse II	S	17,5
39	Poanse II	S	17,5
39	Poanse II	S	20
40	Poanse III	S	10
41	Poanse IV	S	12,5
41	Poanse IV	S	15
41	Poanse IV	S	17,5
42	Poanse/JVrise	S	20
42	Poanse/JVrise	S	22,5
42	Poanse/JVrise	S	25
43	Massu Lepiku	S	10
44	Massu Metsatuka	S	12,5
46	Massu Kangru	S	12,5
47	Kimsi Sepa	S	12,5
47	Kimsi Sepa	S	12,5
49	Tuhu	S	17,5
49	Tuhu	S	20
50	Oidrema Kuusiku	S	22,5
50	Oidrema Kuusiku	S	22,5
51	Pikavere	S	22,5
52	Salavere III	S	25
53	Varbla Kubja	S	17,5
53	Varbla Kubja	S	20
54	Nehatu V	S	7,5
54	Nehatu V	S	10
55	Nila	S	5
55	Nila	S	7,5
55	Nila	S	10
56	Nurmsi	S	12,5
56	Nurmsi	S	15
56	Nurmsi	S	17,5
56	Nurmsi	S	20
56	Nurmsi	S	22,5
57	Kause	S	7,5
58	Rame	S	2,5
58	Rame	S	5
60	Hanila II	S	5
60	Hanila II	S	5
60	Hanila II	S	7,5
60	Hanila II	S	7,5
62	Ridase III	S	10

63	Msisakela Salum	S	15
63	Msisakela Salum	S	17,5
63	Msisakela Salum	S	20
63	Msisakela Salum	S	22,5
64	Esivere I	S	15
65	Esivere II	S	12,5
65	Esivere II	S	15
66	Esivere III	S	12,5
67	KirikukIla	S	5
68	Laulepa	S	12,5
69	Metsk la-Vaigaste	S	7,5
69	Metsk la-Vaigaste	S	10
69	Metsk la-Vaigaste	S	10
69	Metsk la-Vaigaste	S	12,5
69	Metsk la-Vaigaste	S	12,5
71	Oru II	N	12,5
72	IngkIla	N	10
72	IngkIla	N	10
72	IngkIla	N	10
72	IngkIla	N	10
73	Saunja	N	5
73	Saunja	N	7,5
74	Koela II	N	12,5
75	Uugla II	N	12,5
76	Jalukse	N	22,5
77	Rummu	N	5
77	Rummu	N	7,5
77	Rummu	N	10
77	Rummu	N	12,5
77	Rummu	N	15
77	Rummu	N	15
77	Rummu	N	15
78	Tammiku	N	10
78	Tammiku	N	10
79	Uuskela	N	22,5
79	Uuskela	N	25
79	Uuskela	N	27,5
80	Vuike-L	N	17,5
80	Vuike-L	N	17,5
83	Kolila	N	5
83	Kolila	N	5
84	Uneste-Litu	N	10
85	Oidrema	S	17,5
85	Oidrema	S	20
85	Oidrema	S	22,5
85	Oidrema	S	25

85	Oidrema	S	25
85	Oidrema	S	25
85	Oidrema	S	25
86	Koeri	S	35
86	Koeri	S	35
86	Koeri	S	35
86	Koeri	S	35
86	Koeri	S	35
86	Koeri	S	35
86	Koeri	S	37,5
86	Koeri	S	37,5
86	Koeri	S	40

Appendix B: Fields in areas II – VIII

Table B. 1. Fields in area II.

Number	Size (m^2)	Description
II-a	789.6	A stony plot in the eastern part of the area, bordered with the edge of the cliff and cairns II-1 and II-2 on the side of the edge, banks II-1 and II-3.
II-b II-b2 II-b3	3060.3 2305.3 522	Large field, also in the eastern half of the area. Quite even surface. Bordered with the enclosure on the southern side and banks II-1, II-4, II-7, II-8 and II-9 elsewhere. Almost fully bordered with banks. A cluster of cairns in the middle of it and some in its north-western part. Possible grave, marked as bank II-2 or cairn II-8 on its northern side. It is possible that the latter, that`s direction coincides with bank II-8 formed a border, including cairn II-12. In that case there were two smaller plots II-b2 and II-b3. The border between these two plots could have also been where the northern cluster of cairns were, including the possible grave.
II-c II-c2 II-c3	1190.2 388.7 792.5	A plot in the north-eastern corner of the area. Fully bordered with banks II-3–II-6 and the edge of the hill from the northern side As mentioned above, the three cairns (II-5–II-7) in the middle of the plot divided plot II-c in two halves (II-c2 and II-c3).
II-d	958.3	The plot was defined by banks II-7 and II-8, plot II-e and cairns II-39 and II-40 between them, part of plot no II-f and cairn no II-38, small part of the ridge (II-h) and a terrace edge II-10, part of plot II-g and boulder field (II-i). The distinction between plots II-d and II-e was mainly made because the former was on a higher ground than the latter. The location of the cairns matched with the border between higher and lower grounds. Plot II-f that was also on lower ground and that was cleared of stones, was separated from plot II-d with a cairn (II-38). The cairns II-38–II-40 were located almost in a straight row, matching with the junction of banks II-4, II-6 and II-7. No cairns were situated on the plot itself but 3 more cairns

		were recorded in the locations where the field adjoined with the ridge and the boulder field.
II-e	1200.1	The quadrangular plot was bordered with the cliff edge from the north, banks II-5 and II-6 from the east and cairns II-39 and II-40 from the south. The border with plot II-f to the west was not marked with any banks on cairns. However, there was a clear distinction between the plots because plot II-f was even and cleared of stones whereas plot II-e was lumpy and uneven. Three cairns (II41–II-43) were located in the middle of the plot.
II-f	1434.4	The field was distinguished between plots II-d and II-e to the east, northern part of plot II-g and ridges II-h and II-k. It reached westwards until bank II-11 that separated it from plot II-l. The plot was generally even and cleared of stones, especially in its eastern part. Despite of that there were no cairns recorded on the plot.
II-g II-g2	1025.2 1312.3	The plot was irregularly shaped and was located in the area between the ridges II-h and II-k. Clearance cairns were located on the edge the larger ridge (II-k) and the field, marking the border between them. There were no cairns on the edge of the smaller part of the ridge (II-h) and it might be that the latter was part of the field (II-g2). Plot II-f was located to the north of the plot and there was also a cairn (II-33) between them. From the south the plot bordered with clearance cairns II-23 and II-24 that separated it from plot II-j. Boulder field II-i and plot II-d were situated eastwards from the plot. The field was definitely more uneven than plots II-f and II-j to the north and south of it. In addition to the cairns at the edges of the plot, only one was located in the middle of it.
II-h	287.1	The small ridge that geologically seemed to be part of the larger ridge II-k was marked as a separate plot. There was a bank (II-10), partly merging with the ridge on the north-eastern side of the ridge, facing plots II-e and II-f. There were no cairns on the ridge.
II-i	536.1	The boulder field was also distinguished as a separate plot, although its function in the agricultural system remains unclear. It is likely that it was connected with the large boulder field IV-b

		before the enclosure was built. There was about 7m wide cleared area between the boulder field and the enclosure bank, suggesting that the stones from the boulder field were used in the construction of the bank.
II-j	1630.8	The plot was situated between the larger part of the ridge (II-k), plot II-g, boulder field and the enclosure bank. The area between the boulder field and enclosure was also included into the plot. There were 3 cairns located in the latter part of the plot but other than that there were no cairns. The surface of the plot was even.
II-k	1352	The main part of the ridge was also separated as an individual plot. The surface of it was uneven and there were no cairns on top of it. On the eastern edges of the ridge, towards plots II-g and II-j there were cairns on the side of it while on the western side the cairns were missing. The northern edge of the ridge formed a steep terrace.
II-l II-l2 II-l3	1632.3 991.9 641.9	A quadrangular field that was bordered with bank 11, the enclosure, the cliff edge and the ridge. Three cairns were recorded inside the plot. Two of them (II-28 and II-29) could have represented the border between plots II-l2 and II-l3) but there were no other indicators of the existence of two plots instead of one. The whole area of the plot was uneven.

Table B. 2. Fields in area III.

Number	Size (m^2)	Description
III-a III-a2 III-a3	3789.7 1203.2 2415.2	A large plot, oriented from north-east to south-west. Bank III-1 seemed to separate the plot in two (III-a2 and III-a3) but it was taken as a secondary division because the difference in the nature of the two parts was not big. The north-eastern part seemed to be slightly stonier and bumpier than the south-western part and there were three clearance cairns there. It was seen likely that bank no III-1 was constructed either earlier or later than bank III-2 that separated plots

		III-a and III-b. The size and orientation of the field matched with plots III-b and III-c.
III-b	3477.4	A large plot, oriented from north-east to south-west. Coincides with the part of the enclosure where there was a narrow gap or a gate. The north-eastern part of the plot close to the enclosure was low-lying and cleared of stones. The pits were also located on that plot. Only one cairn was recorded on the plot, close to the enclosure.
III-c	3631.2	A large and narrow plot, oriented from north-east to south-west. There were four cairns in the north-eastern part and the land around them seemed uneven.
III-d	3226.1	Irregularly shaped plot, oriented roughly from north-west to south-east. It was bordered with banks III-5 and III-10 from its northern and eastern sides. There was no clear border on the southern side due to the landscape being disturbed with more recent activities. Its western border was marked by the edge of the hill where there were some stones positioned in a row but no bank. There were no cairns on the plot.
III-e	4755.6	A large quadrangular plot, oriented from north-west to south-east. It was defined by banks III-10 and III-5 from west and north. Its southern border was missing for the similar reasons as with the plot III-d but the positioning of short bank III-1 was used to determine the border of it, even though it is possible that it reached further southwards. The north-eastern border of the plot was marked with banks III-9 and III-14, both of which were probable graves; and cairns III-11, III-15 and III-16. The field was rather cleared of stones. Two cairns were located on the plot, both on the edges of it. It is possible that the plot was divided into two parts but there were no signs of it in the landscape.
III-f	1637.2	A rectangular plot that was oriented similarly to the previous plot. The aforementioned short banks and cairns formed its western border and a similar bank its south-eastern border. Banks III-5 and III-7 and platform 2 bordered the field from northern and eastern

		sides. There were 7 cairns located on the plot, one of which (III-24) could be a stone grave.
III-g	1625.2	A rectangular plot with a similar north-west to south-east orientation as the previously described plots. It was bordered with bank III-7 from its western side, platform 2 and bank III-4 or rather a gap between them from north-west and cairns III-25, III-28 and III-29 from the west. The border with plot III-h to the east was, in addition to the cairns, also marked with the change in the nature of the landscape—plot III-g was on a slightly higher ground and much uneven and not cleared of stones than plot III-h. The south-eastern border of the plot was marked with cairn III-30 and a notional line connecting banks III-12 and V-7.
III-h III-h2	1477.7 2024.5	The distinguished plot was roughly oriented from north-west to south-east like the previously described fields. It was irregularly shaped and bordered with the enclosure from the north, bank IV-1 from the east and bank III-4, cairns III-25, III-28, III-29 and possibly III-30 from the western side. The surface of the plot was well cleared of stones, especially in the middle of the plots, between clearance cairns III-26 and III-27. It seemed that the plot could have reached further to the east, until cairns IV-1–IV-3 (III-h2). In that case bank IV-1, or at least the southern part of it could have represented a temporally different object to the fields. The northern part of the bank, from where the division could have been, was different by being lower and having only one bottom on its western side, as opposed to the southern part of it.
III-i III-i3	443.8 1648	A small triangularly shaped plot between banks III-12, III-13 and III-16. There were no cairns on the plot, except for one that was detected from LiDAR data but was not confirmed in the landscape. If we consider an option that bank III-13, together with bank III-14 and possibly platform 4 in the middle of them, might represent a different temporal layer (see also further down with III-j), the field could have reached further southwards, until at least cairn III-34. In

		that case the size and orientation of it would have been comparable with that of plots III-f–III-h and III-j2. However, the possibility was not proved in any way and remains hypothetical.
III-j III-j2 III-j3	696.8 1175.9 1725.4	A small quadrangular field between banks III-15, III-16, V-14 and the border with fields III-g and III-h which was marked with cairn III-30 triangular plot. Three cairns were located on the plot and an oblong possible grave that was marked as bank III-17. It is possible that it was conjoined with field III-k on its southern side (III-j2), despite of the bank III-15 between them that could have been either from a different time or marking an inner division of the plot. In that case the plot would match with the approximate size and orientation of plots III-f, III-g and III-h (III-h2). It is also possible that the south-western border was further to the south from bank III-14 and it was rectangular, rather than slightly triangular field (III-j3). The option remained hypothetical, similarly to the distinguishing of plot III-i3, and was not used as a valid possibility in calculations of the possible sizes of the fields.
III-k	415.1	A small triangular plot, bordered with banks III-14, III-15 and V-14. There were no cairns on the plot. The distinguished small plots III-i, III-j and III-k were around the platform 4 between a junction of 4 banks.

Table B. 3. Fields in area IV.

Number	Size	Description
IV-1a IV-1a2	1777.6 1401.5	The westernmost plot of the area, was bordered with bank IV-1 and area III from the western side, the enclosure (the possible grave 1 inside the enclosure) from the north-west, bank V-7 from the south-east and plot IV-2a from the east. The plot was on a higher ground, compared to the plot IV-2a. There were no other borders between these two fields but the distinction between the different natures of the plots was taken for the reason to separate them. It is possible that initially there was a border between the plots that has not preserved. As noted in the description of area III, it

		seemed that the easternmost plot of the latter might have reached to area IV, the edge of it being marked with cairns IV-1–IV-3, rather than bank IV-1. In that case the western border of the plot IV-1a would also be where the aforementioned cairns are (IV-1a2). In that case the orientation and size of plots III-h2, IV-1a2 and IV-2a would be similar to each other and the other ones in areas III and V.
IV-2a	1511.6	The plot was situated between plot IV-1a, the boulder field (IV-b), enclosure and bank V-7. Two segments of banks (IV-2 and IV-3) and two cairns (IV-6 and IV-10) were assembled on the edge of the plot and almost inside the boulder field. All the other cairns (5) were also agglomerated towards the boulder field. The part of the enclosure that formed the northern border of the plot had two gaps or gates inside it, suggesting that it might have been used to enter the plot. Trench VI was excavated through one of the gaps.
IV-b	2469.9	The boulder field consisted of mainly granite stones with the average diameter of approximately 1m. One of the banks (IV-2) and a cairn detected from LiDAR data were inside the boulder field. There were no banks or cairns inside the boulder field. There was a narrow strip of land that was cleared of stones between the enclosure and the boulder field, suggesting that the stones from the boulder field were used to build the enclosure. The strip could have also served as an access route to the fields, through the aforementioned gaps. The area covered with boulders extended eastwards into plot IV-h. Since the latter was rather stony, it was difficult to see how far the boulder field actually reached.
IV-c	180.4	Platform 1 on the north-eastern edge of the boulder field. More detailed description is given above and in chapter 5.5.7.
IV-d	877.2	A cleared, even and level field between the boulder field and the enclosure. It was also bordered with the platform and plot IV-e. The plot was oriented roughly from north-east to south-west. There were no cairns, except for one (IV-11) adjacent to the boulder field.
IV-e	694.8	A cleared and even field that bordered with the enclosure from the northern side, the edge of the hill from the east and banks IV-5 and IV-6 from west

		and south. It was oriented from north-east to south-west. There was a high cairn near its south-west corner.
IV-f	671.7	A plot that was cleared of stones but not as even that IV-d and IV-e. It was bordered with plot IV-e from the north, platform from the west, the edge of the hill from the east and plots IV-h and IV-g from the south. The field was northeast-southwest oriented, just like plots IV-d and IV-e. Three cairns were located in the eastern half of the field. There was a ca. 2m wide gap on its south-eastern border, between banks IV-8 and IV-10. The possible gate was also marked with two cairns at both ends of it, inside the banks.
IV-g	504.8	A small plot between plots IV-f and IV-h, bordered with the edge of the hill from east. The area of the field was rather well cleared of stones, similarly to plot IV-f. One cairn was located in the middle of the field and another one at the eastern end of bank IV-9 that did not reach until the edge of the cliff.
IV-h IV-h2 IV-h3 IV-h4 IV-h5	2790.4 725.1 739.5 770.4 513.3	The plot was distinguished in the rest of the area IV, bordering with the edge of the hill eastwards, area V from the west, area VI from south-east and banks IV-9, IV-18 and IV-17. Although different options for dividing the area into smaller plots were noticed, the whole character of the area in question was similar: it was stony and not well cleared of stones, so that the distinction between the boulder field was difficult to make in its western part. However, the stones were generally smaller than and not as numerous as in the boulder field. Four different possible plots (IV-h2–IV-h5) were distinguished inside the field but they were not clearly marked with banks or cairns. The fields according to the secondary division would roughly match with the size of other plots in the eastern part of the area. Although the plot was recorded as being part of the eastern part of area IV, it can be seen that it was also part of the field system in area V, providing access to field V-a. At the same time it reached until plot VI-l that was adjacent to the spring. It could have been in use as an access to the water, maybe even a path for the cattle. The option could be connected with the gate between plots IV-h and IV-f, mentioned above. The width of the plot

		(14–30m) would have been enough to serve as an access route or a path and a field plot with some agricultural function at the same time.

Table B. 4. Fields in area V.

Number	Size	Description
V-a V-a2	1270	Irregularly shaped plot in the north-eastern part of area V. In the north-eastern edge of it there was a gap between banks V-1 and V-2, connecting the plot with field IV-h. Bank V-3 did not reach to the full length of the field but instead connected it with field V-c from south-west, leaving a 20m wide gap between them. It is possible that the field was initially connected with plot V-c and that the bank was made later. The size of the combined plot V-a2 would be similar to plots V-d and V-e2. The field was mostly cleared of stones, except for its south-eastern part next to bank V-15 where it was relatively stonier. One clearance cairn was situated on the plot.
V-b	218.5	A small field that was bordered with banks from all sides. It was situated immediately next to the boulder field, on a higher slope, compared to the other fields in the area. The plot was stony, almost like plot IV-h. The banks around the plot also had large boulders inside and it was not completely sure if it was a plot surrounded by banks at all or just a stony area on the higher natural ground that was not used as a cultivated field. By the nature of the plot, it would have been more justified to include it in area IV.
V-c	1108.8	The plot was bordered with banks from each side, except for the gap between this and plot V-a on its south-eastern side. Similarly to plot V-a, it was mostly cleared of stones, except for its south-eastern side. One clearance cairn was situated on the plot.
V-d	2726.7	A low-lying plot that was quite well cleared of stones. It was fully enclosed with banks with at least one gap between banks V-8 and V-9 to provide access to plot V-e. 6 clearance cairns were scattered around on

		the south-eastern half of the plot and a large boulder measuring 620cm x 910cm and the height of 55cm.
V-e2 V-e V-f	3002.7 1411 1453.4	Plots V-e and V-f were initially distinguished as two separate plots, being divided by a bank. During the analysis it was seen that the two fields were probably connected at first and then divided by the bank afterwards. The size of the joined plot, marked as V-e2 was similar to plots V-d and V-a2. At some point the plot was divided into two square-shaped fields with bank no V-10 in the middle of it which did not reach all the way through the field but had gaps on both sides of it. The plot was even and cleared of stones. 7 clearance cairns were mapped on the plot and additionally one was located on one end of the bank. The field was fully enclosed with banks but gaps were left between banks V-8 and V-9, and V-11 and V-12.
V-g	2110.9	The plot was fully bordered with banks with a gap between banks V-7 and V-13 in its north-western corner. At least 9 cairns were located on the plot, most of which agglomerated near the banks V-11 and V-12, partly even blocking the gap or gate between the banks. The surface of the plot was cleared of stones but it was not as level as plot V-e2.
V-h	1593.7	The plot looked similar to the previous one. It was also enclosed with banks with the only gap being left between banks V-13 and V-7. 5 cairns were scattered around on the plot.

Table B. 5. Fields in area VI.

Number	Size	Description
VI-a	1350.078	Intact. bordered with banks from all sides except for the south-western part where only a fragment of a bank (VI-1) was preserved. No cairns on the plot.
VI-b	1159.726	Close to the true initial size. despite that the south-western border was not preserved; however. the location of it was traceable from the LiDAR image (extended bank VI-1). One cairn.

VI-c	1069.674	South-western border was not traceable. Might be a fragment and could have initially been larger. No cairns.
VI-d	799.0375	Fragmentarily preserved. A stone fence (IV-17) on the south-western side of it but it might be later than the plot and therefore not marking its boundary. 5 cairns (VI-3–VI-7).
VI-e	1219.002	Preserved as a trapezoid-shaped plot. south-western borders are bank VI-18 that has a different orientation from the rest of the banks in the area (i.e. almost north-south). might be pushed together. with soil. during the building of the houses. One cairn in the middle part of the plot.
VI-f	1350.739	Cleared plot. especially its north-eastern part. fully bordered with banks (except for the gaps). 4 cairns in the middle.
VI-g	1408.377	Cleared plot. especially its north-eastern part. Four cairns in the middle and probable grave no 4. Fully bordered with banks.
VI-h	1301.344	Four cairns in the middle. North-eastern border marked with a large cairn (possible circular grave). Because bank VI-8 turned eastwards. slightly irregular. not rectangular.
VI-i	1278.08	Rectangular. fully bordered. three cairns in the middle.
VI-j	1021.2	Rectangular. fully bordered. one cairn in the middle.

Table B. 6. Fields in north-eastern part of area VII.

Number	Size	Description
VII-a	557.11	A small irregularly shaped plot. The curved position of banks VII-2 and VII-3 form a gate- or entrance-like feature on its south-eastern side. The plot was accessible from plots VII-c and possibly from VIII-d. Fully bordered with banks from the other sides. No cairns.

VII-b	552.33	A small. almost rectangular plot. fully bordered with banks except for the gap in its north-western corner. No cairns
VII-c	2572.44	Irregularly shaped plot. Bordered with banks. except in its north-eastern corner where there was a 19-m wide gap between banks VII-3 and VIII-14. Five cairns in the middle of the plot. including a possible circular grave.
VII-d VIII-d2 VIII-d3	4047.04 2025.81 1548.69	Relatively regular and large plot. It might have been separated into two plots if cairns VII-26–VII-28 marked the inner border. In that case there would have been two plots. VII-d2 and VII-d3. Plot VII-d was bordered partly with banks which were missing on its southern side. leaving a gap of ca 34m between this and plot VII-h. Instead of a bank. the north-eastern border of the plot consisted of a natural steep terrace which was not turned into a bank. A row of cairns were located 10—15m westwards of the terrace while between the terrace and the cairns the land was even and cleared of stones. Altogether 8 cairns on the plot. two of which were marked as possible circular graves.

Table B. 7. Fields in north-western part of area VII.

Number	Size	Description
VII-e	3060.82	Almost fully bordered with banks. except for two gaps in the north-eastern and north-western corners. Four cairns. two of which were considered as possible circular graves. The plot measured ca 30 x 120m.
VII-f	2449.88	Almost fully bordered with banks. except for two gaps in the north-eastern and southern corners. Five cairns located in the middle of the plot. The plot measured ca 30 x 115m.
VII-g	3121.61	Bordered with continuous bank from north and north-east while the border was missing in its south-eastern part. The bank on its south-western side had gaps in it and was probably damaged in the course of modern building activity.

		No recorded cairns on the plot. although some possible cairns were detected from LiDAR mapping which remained unspecified in the landscape. The measurements of the plot were ca 30 x 129m.

Table B. 8. Fields in southern part of area VII

Number	Size	Description
VII-h	2411.325	The plot was oriented from north-east to south west. The borders around it were only partly marked with banks and cairns and it could have been connected with VII-d3. VII-j and VII-n3. There were 6 or 7 cairns in the middle of the plot. two of which were considered as possible circular graves. The size (ca 25 x 105m) and orientation of the plot was similar to plot VII-k. The two plots were separated by a short bank VII-20.
VII-i	1246.701	A fragment of a plot which was partly bordered with only two banks (VII-10 and VII-11). The western border of the plot was destroyed with modern activity. The plot was connected with plot VII-j from north-east. although there was a possible cairn in the middle that was only detected from LiDAR mapping. There were four cairns in the middle of the plot. one of which could have been a circular grave.
VII-j	5277.502	A large and rather irregularly shaped plot. although its rectangular shape was well visible. A long bank (VII-24) formed its eastern border and separated it from plots VII-n and VII-o. The southern and south-western borders were missing which can be related to modern destructive activities. 8 cairns were scattered inside the plot. four of which could have been circular graves.
VII-k	2482.589	The plot was situated eastwards from plot VII-h and had a similar size (ca 25 x 97m) and orientation with it. The plot was partly bordered with segments of banks leaving access to adjacent plots. The edge of the hill formed its eastern border. The eastern half of the plot reached to the higher natural ridge that was in majority distinguished as area VIII. There was only one cairn on the plot.

VII-l	2126.923	A rectangular plot. partly bordered with banks and the edge of the hill from its eastern side. The gaps in the borders connected the plot with adjacent plots. The plot was oriented from north-east to south-west that was similar to plot VII-k on its northern side but it was smaller by measurements (ca 35 x 75m). 3 cairns were located in the middle of the plot.
VII-m	3136.949	Irregularly shaped plot. partly bordered with banks that were missing in its northern side. The edge of the hill formed its eastern border. Eastern part of the plot was roughly east-west oriented. while the northern part was almost north-south oriented. There was no inner border between the two separate areas. Four cairns were located on the plot. three of which were marked as possible circular graves. The shape. orientation and approximate size of the plot was comparable with plot VII-n.
VII-n VII-n2 VII-n3	2382.964 1242.74 1793.39	Irregular-shaped plot similar to VII-m that was partly bordered with banks that were missing in its northern and southern sides. although a cairn was situated in the border between this and plot VII-o. The edge of the hill formed the eastern border of the plot. although a steeper terrace was also situated there. Eastern part of the plot was roughly east-west oriented. while the northern part was almost north-south oriented. It was possible to see a hypothetical option how the plot could have been divided into two separate areas if the two cairns (one of which could have been a circular grave) in the middle of the plot were marking the border between the eastern and northern parts of it. In that case. the western and northern parts of the plot would have formed a narrow. north-south oriented plot which could have extended even further to the south. encompassing the western part of plot VII-o as well. In that case. long bank VII-24 would have formed the western border of the narrow plot while its eastern side would have been marked with less intact banks and cairns. The resulting plot VII-n3 could have served as a cattle path and could refer to herding function of the plots in areas VII and possibly VIII.
VII-o	5040.408	A large and regular plot. bordered with banks from its northern and western sides. The eastern border was marked with the edge of the hill and southern

VII-o2	4381.42	border was no longer visible. possibly because the area south of it had been used as a field in modern times. If the western part of the plot was part of the hypothetical narrow cattle-path. the size of the plot (VII-o2) would be smaller

Table B. 9. Fields in area VIII.

Number	Size	Description
VIII-a	1998.452	A fairly regular plot in the north-eastern part of the area. bordered with the cliff from the eastern side and with three banks from rest of the sides. It was oriented from north-west to south-east. Although the orientation was the same. it was clearly different from the adjacent plot IV-h as it was cleared of stones. especially its north-western part where also two cairns were located. There was a part of a stone fence (VIII-3) on its south-eastern side.
VIII-b VIII-b2 VIII-b3	4195.802 2119.612 1646.78	A large irregularly shaped plot. Clearly defined by banks from north-west and partly from north-east while the south-western border matched with the scattered border with area VI. Because of lack of clear banks on its south-eastern corner. it seemed to extend up until the edge of the hill. between plots VIII-a and VIII-c. The southern border between plot VIII-c was not marked and was distinguished conditionally. taking into account the line between a short bank VIII-6 and VI-14 that followed the same direction. It is possible that the area of the field consisted of two plots VIII-b2 and VIII-b3. The former would be conditionally marked with a border between banks VIII-2 and VI-12. possibly including a short segment of bank VIII-4. The size and orientation of such plot would more or less match that of plot VIII-a. The two plots could have even been part of the extended field system V. matching largely with its orientation and size.

		If that was the case. then plot VIII-b3 with the width of 15–25m would be similar to plot VIII-c and at the same time match the size and orientation of the regularly lied plots in the adjacent area VI. The whole large plot was well cleared of stones and there were altogether 5 cairns on the plot.
VIII-c	1422.237	A narrow plot. oriented from north-east to south-west. similarly with the plots in area VI. The estimated width of the plot was 9–17m. However. it was loosely bordered with banks. Bank VI-21 bordering the plot from south-west was the most intact one. while the escarpment formed its north-eastern border. Bank VIII-7 defined partly its south-eastern border with plot VIII-e while only a short segment of a bank VIII-8 separated it from plot VIII-d. while to most part there were no signs of borders. The north-western side of the plot was only marked with a narrow bank no VIII-5 and a short bank no VIII-6 and therefore it is possible that the plot formed the same unit with plot VIII-b and maybe even VIII-d to its south-east. There was one cairn on the plot.
VIII-d VIII-d2 VIII-d3	2872.21 1625.63 1320.37	A large. slightly irregular plot. oriented from north-west to south east like VIII-e adjacent to it. Situated on the edge of a higher ground and the terrace edge. along with banks VII-1 and VIII-14 that formed its south-western boundary. The south-eastern border of the plot was marked with bank VIII-13 that followed the natural terrace. The border between plot no VIII-e was defined by banks VIII-9. VIII-11 and VIII-12. and a couple of cairns. The north-western border with plot VIII-c was loosely marked with a short bank no VIII-8. It is possible that the two fields – and maybe even plot VIII-b further to north-west – were at one point connected as a single agricultural land. Only one cairn was located on the plot. The estimated width of the plot was 19–40m.

		There was a short segment of a bank (VIII-10) that was oriented in a different way than the rest of the banks. It seemed to be reaching towards bank VIII-14 and was possibly dividing the plot in two smaller fields VIII-d2 and VIII-d3
VIII-e	4182.373	Irregular-shaped large plot. Compared to most other plots in the area. it was quite well defined with banks and cairns from all the sides. Some of the cairns (VIII-15. VIII-17 and VIII-18) where situated between shorter banks that divided plots VIII-e and VIII-d and marking the border between the banks. In addition. there were 4 other cairns in the middle of the plot.
VIII-f	568.2773	A narrow strip. about 10m wide and 64m long between bank VIII-15 and the edge of the hill. The surface of it was even and looked as being cleared of stones. There were no cairns or other features on the plot.

Appendix C: Analysis of wood charcoal from the archaeological excavations on the hill of Salumägi

Salevere Salumägi Wood Charcoal Analysis

Ellen Simmons, University of Sheffield

Laboratory methods

A minimum charcoal fragment size of 2mm was chosen for identification, as smaller fragments are difficult to fracture in all three planes and therefore difficult to identify. This may however result in a bias against the representation species such as lime (*Tilia* sp.) which tend to be fragile and fracture easily into small pieces. Where possible equal quantities of >4mm and 2-4mm wood charcoal fragments were examined from each sample with the aim of reducing bias related to differential fragmentation.

For the identification of fragments from the enclosure in trench III (samples I-XXVII), five fragments of wood charcoal greater than 4mm in size and five fragments of wood greater than 2mm in size were examined from 20 sample locations. This enabled 200 wood charcoal fragments to be identified across the enclosure. Due to the small sample size, charcoal fragments were picked for identification using a random grab sampling method rather than using the riffle splitter.

For samples taken from the inner side of the enclosure (Trench IIIa) ten charcoal fragments per sample, totalling 100 pieces, were identified. From each of these samples, five fragments of wood charcoal greater than 4mm in size and five fragments greater than 2mm in size were randomly grab sampled for identification. Fifty charcoal fragments from each of the two samples collected on top of the enclosure (Trench IIIb) were identified, with twenty five fragments of wood charcoal greater than 4mm in size, and twenty five fragments greater than 2mm in size selected from each sample by random grab sampling for examination. From the field bank (Trench IIIc) a total of 100 charcoal fragments were identified from the forty-six samples. Due to the small size of the samples from the field bank, most samples were examined in their entirety.

For the remaining trenches (Trench I, II, IV, V, VII and VII), the aim was to identify 50 charcoal fragments from each sample. A sample size of 50 fragments was chosen with the aim of identifying the main taxa present within as many deposits as possible, within a limited time frame. The identification of only 50 charcoal fragments may however have resulted in some rarer types not being recorded (Stuijts 2006, 28). From the field bank (Trench I) 45 charcoal fragments were identified from eleven samples from layer III, 3 charcoal fragments were identified from two samples from layer V and 2 charcoal fragments were identified from one sample from layer IV, making a total of 50 charcoal fragments from Trench I. From the field bank (Trench II) 30 charcoal fragments were identified from ten samples as only 30 identifiable fragments were present. From the field bank (Trench IV) 25 charcoal fragments were identified from thirteen samples as only 25 identifiable charcoal fragments were present. From clearance cairn (Trench V) 25 charcoal fragments were identified from nine samples from Layer VIIa and 25 charcoal fragments were identified from eleven samples from Layer VIIb, making a total of 50 charcoal fragments from Trench V. From enclosure trench (Trench VI), 25 charcoal fragments were identified from eleven samples as only 25 identifiable charcoal fragments were present. From clearance cairn (Trench VII) 50 charcoal fragments were identified from thirty three samples.

Wood charcoal fragments were fractured manually and the resultant anatomical features observed in transverse, radial and tangential planes, using high power binocular reflected light (episcopic) microscopy (x 50, x 100 and x 400). Identification of each fragment was carried out to as high a taxonomic level as possible by comparison with material in the reference collections at the Department of Archaeology, University of Sheffield, UK and various reference works (e.g. Schweingruber 1990; Hather 2000). Nomenclature follows Polunin and Walters (1985). Identified charcoal fragments were grouped by taxa, weighed and stored in sealable plastic bags.

A record was also made, where possible, of the ring curvature of the wood and details of the ligneous structure, in order for the part of the woody plant which had been burnt and the state of wood before charring, to be determined (Marguerie and Hunot 2007). The ring curvature of the charcoal fragments was designated as weak, intermediate or strong, indicating larger branches or trunk material, intermediate sized branches and smaller branches or twigs, based on the classification in Marguerie and Hunot (2007, 1421). The presence of narrow rings which may indicate slow grown wood was recorded (Marguerie and Hunot 2007, 1422). The presence of tyloses in vessel cavities, which indicate the presence of heartwood and therefore mature trunk wood, was recorded. The presence of fungal hyphae, which indicate the use of dead or rotting wood, was recorded (Marguerie and Hunot 2007, 1419). The presence of radial cracks, which may relate to the dampness of the wood prior to charring as well as to the anatomy of the wood was recorded (Marguerie and Hunot 2007, 1421). The degree of vitrification of the charcoal fragments was recorded as a measure of preservation, with levels of vitrification classified as either low brilliance refractiveness (degree 1), strong brilliance (degree 2) or total fusion (degree 3) (Marguerie and Hunot 2007, 1421) . The presence of mineralisation in the vessel cavities, whereby mineral deposits penetrate into the vessels of the wood charcoal fragments obscuring morphological characteristics, was also recorded as a measure of preservation.

Preservation

The charcoal assemblage overall exhibited good preservation, with the majority of charcoal fragments examined being identifiable, and with very low levels of mineralisation. The proportion of charcoal fragments exhibiting Vitrification, was however relatively high in Trench III, although this did not significantly hamper identification.

Results

The interpretation of wood charcoal assemblages is complicated by the variety of taphonomic influences on composition, including anthropogenic wood collection strategies, combustion factors and depositional and post-depositional processes (Théry-Parisot *et al*. 2010). It is unlikely therefore that the dominance of a particular taxa within a charcoal assemblage directly reflects a dominance of that taxa in the surrounding environment. Wood used as fuel may also have been collected specifically for that purpose or represent offcuts from the use of wood for timber. The number of fragments of each taxa present in the charcoal assemblage from each trench may therefore be somewhat misleading in terms of the dominant taxa present, as for some samples several fragments of the same taxa were present and it is likely that in these cases, these were all fragments of one original charcoal piece. The presence or absence of woody taxa in the charcoal assemblage therefore provides a more reliable measure of wood utilisation than just the number of fragments present. A dominance of one particular taxa in the charcoal assemblage can also indicate the preferential selection of that taxa as fuel so both the presence and the number of fragments present of each taxa, are recorded below in table 1.

		Trench									
Taxon	**Common name**	I	II	III	IIIa	IIIb	IIIc	IV	V	VI	VII
Picea abies	Norway spruce			5							
Pinus sp.	Pine	1									
cf. *Ribes*	Probable gooseberry / current			1	6	10	1			2	
Prunus sp.	Cherry / blackthorn	2		2							1
Ulmus sp.	Elm	1					5		4	3	
Quercus sp.	Oak	11	2	59	90	54	13		8	5	41
Betula sp.	Birch	1						1		2	
Alnus sp.	Alder	10	4						7		
Corylus avellana	Hazel	6		82			24	20	12		2
cf. *Fagus* sp.	Probable beech									3	
Populus / Salix	Poplar or aspen / willow	14	10						6		4
Acer sp.	Maple	3	1	35	2		28		6	1	
Tilia sp.	Lime								1		
Fraxinus excelsior	Ash	1	13	11	2	36	21	3	6	5	2
Corylus avellana / Alnus sp.	Hazel / alder			1							
Prunus sp. / Acer sp.	Cherry or blackthorn / maple			2							
Ulmus sp. / *Quercus* sp.	Elm / oak									1	
Quercus sp./ *Fraxinus excelsior*	Oak / ash						1				
Indeterminate				2			7	1		3	
Total		50	30	200	100	100	100	25	50	25	50

Table 1 – presence and frequency of taxa present in the wood charcoal assemblage by trench

A relatively diverse assemblage of fourteen different taxa are represented in the charcoal assemblage from the site as a whole. The taxa present are listed below. Identification criteria is taken from Schweingruber (1990) and general ecological information is taken from various reference works eg. Polunin and Walters (1985), Aas and Riedmiller (1994), Humphries *et al*, (1993).

- Norway spruce (*Picea abies*) is a common coniferous forest tree of the Northeast Central European region.
- Pine (*Pinus* sp.) which could not be identified to species although the most widespread pine in the coniferous forests of central Europe is Scots pine (*Pinus sylvestris*).
- Probable gooseberry / current (cf. *Ribes*) are fruit bearing shrubs which are commonly associated with woodland or hedgerows.
- Cherry / blackthorn (*Prunus* sp.) could not be identified to species. Potential species are all fruit bearing trees commonly associated with the underwood of open deciduous woodland, woodland margins and hedgerows.
- Elm (*Ulmus* sp.) charcoal cannot be identified to species based on morphological characteristics and a number of species of elm could possibly be represented. Elms are commonly associated with deciduous woodland as well as copses and hedgerows.
- Oak (*Quercus* sp.) charcoal cannot be identified to species using morphological characteristics so either sessile oak (*Quercus petraea*) or penduncluate oak (*Quercus robur*) is represented. Oaks are commonly associated with deciduous woodland as well as copses and hedgerows.
- Birch (*Betula* sp.) cannot be identified to species based on morphological characteristics so either silver birch (*Betula pendula*) or downy birch (*Betula pubescens*) is represented. Birch is a pioneer tree often forming the first woodland cover on recently cleared ground but is also commonly associated with the underwood of open deciduous woodland.
- Alder (*Alnus* sp.) cannot be identified to species using morphological characteristics so either grey alder (*Alnus incana*) or common alder (*Alnus glutinosa*) is represented. Alder is a common tree of bogs, fens, lakes and stream sides although it is not tolerant of prolonged waterlogging.
- Hazel (*Corylus avellana*) is an edible nut bearing tree commonly associated with underwood in open deciduous woodland and with woodland margins.
- Probable beech (cf. *Fagus*) which is a common deciduous forest tree of central Europe.
- Poplar or aspen / willow (*Populus / Salix*) charcoal cannot be differentiated based on morphological characteristics and a number of different species may be represented. Willow tends to favour wet soils, while poplar or aspen is commonly associated with a variety of soils in woodland as well as copses and hedgerows.
- Maple (*Acer* sp.) charcoal is difficult to identify to species based on morphological characteristics and a number of species could be represented. Maple is commonly associated with deciduous woodland as well as woodland margins and copses.
- Lime (*Tilia* sp.) charcoal cannot be identified to species using morphological characteristics so either large leaved lime (*Tilia platyphyllos*) or small leaved lime (*Tilia cordata*) is represented. Lime is a deciduous woodland tree which has a tolerance for poorly drained soils. Lime is generally rare in archaeobotanical assemblages possibly due to its fragility when preserved as charcoal and so may be underrepresented.
- Ash (*Fraxinus excelsior*) is a common tree of open deciduous woodland as well as copses and hedgerows.

The most ubiquitous taxa represented in the charcoal assemblage from the site as a whole is ash (*Fraxinus excelsior*) which is present in every trench. Oak (*Quercus* sp.) is present in all but trench IV and it is possible that this was due to the small sample size of the charcoal assemblage from trench IV. Maple (*Acer* sp.) is present in all but trench IIIb, IV and VII. Also relatively frequently represented are hazel (*Corylus avellana*), probable gooseberry or current (cf. *Ribes* sp.) elm (*Ulmus* sp.), poplar or aspen / willow (*Populus / Salix*) and alder (*Alnus* sp.). This indicates a likely local presence of deciduous woodland, woodland clearings or woodland fringes, along with areas of damp soils or watercourses, throughout the period represented by the sampled contexts. Coniferous woodland is also represented by the sporadic presence of pine (*Pinus* sp.) and Norway spruce (*Picea abies*).

The use of some slow grown timber, such as would be expected where trees were growing in primary or closed woodland, is indicated by a high proportion of charcoal fragments with closely spaced growth rings present in Trench IIIb and IIIa as well as Trench VI and VII. A high frequency of the charcoal fragments examined from trenches IIIb, IIIa, VI and VII were of oak and the proportion of fragments with tyloses, indicating the use of heartwood and therefore mature timber, is also high in trenches IIIb, IIIa and VII, although not trench VI. The proportion of fragments with fungal hyphae, indicating dead or rotting wood, is also high in Trenchs IIIb, IIIa and VII. The use of at least some mature, slow grown oak as fuel during the period of deposition in trenches IIIb, IIIa and VII is therefore indicated. Trench III also contained a high frequency of oak charcoal although the proportion of fragments with tyloses or narrow rings was relatively low for this trench. This may indicate the use of some less mature oak from more open woodland during the period of deposition in Trench III.

A high proportion of the charcoal fragments from all trenches exhibited weakly curved growth rings indicating the general use of a high proportion of larger branches or trunk wood. The use of smaller branches or twigs is also however indicated by a relatively high proportion of charcoal fragments with strongly curved growth rings in Trench II and Trench V.

	Trench									
	I	II	III	IIIa	IIIb	IIIc	IV	V	VI	VII
% strong curved growth rings	19	38	2	7	20	16	0	41	13	8
% intermediate curved growth rings	6	0	8	0	20	6	0	8	13	2
% weakly curved growth rings	75	63	91	93	60	79	100	51	74	30
% narrow rings	16	0	25	89	92	20	4	6	64	54
% radial cracks	12	7	23	1	0	12	0	2	0	0
% tyloses	32	7	10.5	46	49	17	0	14	0	56
% fungal hyphae	56	20	19.5	75	54	42	20	10	32	66
% vitrification present	2	27	17	49	47	18	4	8	28	14
% mineralisation present	0	0	0	0	1	3	0	0	0	0

Table 2 - ring curvature and details of the ligneous structure of wood charcoal fragments by trench

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Charcoal recording tables

SITE CODE / NAME		**Salevere Salumägi**			**SAMPLE NUMBER**			**XV**	
CONTEXT NUMBER		**529**							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
1	**4mm**	*Quercus* sp.	1	1	1	1	1		
2	**4mm**	*Quercus* sp.	1	1	1	1	1		
3	**4mm**	*Quercus* sp.	1	1	1	1			
4	**4mm**	*Quercus* sp.	1	1	1	1	1		
5	**4mm**	*Quercus* sp.	1	1	1	1	1		
6	**2mm**	*Quercus* sp.	1	1	1		1		
7	**2mm**	*Quercus* sp.	1	1	1		1		
8	**2mm**	*Quercus* sp.	1		1		1		
9	**2mm**	*Quercus* sp.	1		1	1	1		
10	**2mm**	*Quercus* sp.	1	1	1	1	1		
Comment:	A lot of fragments are from a big knot of wood.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		**Salevere Salumägi**			**SAMPLE NUMBER**			**XII**	
CONTEXT NUMBER		**460**							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
1	**4mm**	*Quercus* sp.	1						
2	**4mm**	*Quercus* sp.	2			1			
3	**4mm**	*Quercus* sp.	2		1				
4	**4mm**	*Quercus* sp.	2	1				1	
5	**4mm**	*Quercus* sp.	1						
6	**2mm**	*Quercus* sp.	1						
7	**2mm**	*Quercus* sp.	1				1	1	
8	**2mm**	*Quercus* sp.	1	1					
9	**2mm**	*Quercus* sp.	1						
10	**2mm**	*Quercus* sp.	1						
Comment:	#5 has trauma false growth ring.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		**Salevere Salumägi**			**SAMPLE NUMBER**			**X**	
CONTEXT NUMBER		**459**							
Fragment No.	**Size**	**Taxa**	**Ring Curve[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
1	**4mm**	*Corylus avellana*	2						
2	**4mm**	*Quercus* sp.	3						
3	**4mm**	*Quercus* sp.	3	1					
4	**4mm**	*Corylus avellana*							
5	**4mm**	*Quercus* sp.	2	1		1			
6	**4mm**	*Corylus avellana*	2						
7	**2mm**	*Corylus avellana*	2						

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			X	
CONTEXT NUMBER		459							
Fragment No.	**Size**	**Taxa**	**Ring Curve[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
8	**2mm**	*Corylus avellana*	1						
9	**2mm**	*Corylus avellana*	1						
10	**2mm**	*Quercus* sp.	1				1	1	
Comment:	#3 includes pith to 30 growth rings more like this in bag. All 2mm seem to be frags from 4mm pieces.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XI	
CONTEXT NUMBER		526							
Fragment No.	**Size**	**Taxa**	**Ring Curve[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Mineral i-sation[b]**
1	**4mm**	*Corylus avellana*	1		1				
2	**4mm**	*Corylus avellana*	1		1				
3	**4mm**	*Corylus avellana*	1						
4	**4mm**	*Corylus avellana*	1		1				
5	**4mm**	*Corylus avellana*	1						
6	**2mm**	*Corylus avellana*	1						
7	**2mm**	*Corylus avellana*	1						
8	**2mm**	*Corylus avellana*	1					1	
9	**2mm**	*Corylus avellana*	1						
10	**2mm**	*Corylus avellana*	1					1	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			IX	
CONTEXT NUMBER		523							
Fragment No.	**Size**	**Taxa**	**Ring Curve[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
1	**4mm**	*Corylus avellana*	1		1				
2	**4mm**	*Quercus* sp.	1	1		1			
3	**4mm**	*Corylus avellana*	1		1				
4	**4mm**	*Corylus avellana*	1						
5	**4mm**	*Quercus* sp.	1	1		1	1		
6	**2mm**	*Quercus* sp.	1	1					
7	**2mm**	*Corylus avellana* /*Alnus* sp.	1						
8	**2mm**	*Quercus* sp.	1						
9	**2mm**	*Quercus* sp.	1						
10	**2mm**	*Corylus avellana*	1	1					
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			I	
CONTEXT NUMBER		492							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
1	**4mm**	*Acer* sp.	1						
2	**4mm**	*Acer* sp.	1						
3	**4mm**	*Acer* sp.	1						
4	**4mm**	*Corylus avellana*	1						
5	**4mm**	*Corylus avellana*	1						
6	**2mm**	*Acer* sp.	1						
7	**2mm**	*Acer* sp.	1						
8	**2mm**	*Acer* sp.	1						
9	**2mm**	*Acer* sp.	1						
10	**2mm**	*Acer* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			II	
CONTEXT NUMBER		493							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
1	**4mm**	*Acer* sp.	1						
2	**4mm**	*Acer* sp.	1						
3	**4mm**	*Acer* sp.	1						
4	**4mm**	*Acer* sp.	1						
5	**4mm**	*Acer* sp.	1						
6	**2mm**	*Acer* sp.	1						
7	**2mm**	*Quercus* sp.	1						
8	**2mm**	*Acer* sp.	1						
9	**2mm**	*Acer* sp.	1					1	
10	**2mm**	*Acer* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			III	
CONTEXT NUMBER		530							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
1	**4mm**	*Quercus* sp.	1					2	
2	**4mm**	cf. *Prunus* sp.	1					2	
3	**4mm**	*Quercus* sp.	1		1			3	
4	**4mm**	Indet round wood	3					2	
5	**4mm**	*Quercus* sp.	1					3	
6	**2mm**	*Quercus* sp.	1				1		
7	**2mm**	*Quercus* sp.	1					1	

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER			III	
CONTEXT NUMBER	530							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
8	2mm	*Quercus* sp.	1					2	
9	2mm	cf. *Prunus* sp.	1					1	
10	2mm	*Quercus* sp.	1					2	
Comment:	#4 roundwood pith to bark 9 growth rings – Prusus/Maloideae?								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER				IV	
CONTEXT NUMBER	504								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Quercus* sp.	1					1	
2	4mm	*Corylus avellana*	1					2	
3	4mm	*Corylus avellana*	1	1					
4	4mm	*Quercus* sp.	1					1	
5	4mm	cf. *Acer* sp.	1						
6	2mm	*Acer* sp.	1						
7	2mm	*Corylus avellana*	1						
8	2mm	*Corylus avellana*	1						
9	2mm	*Acer* sp./*Prunus* sp.	1						
10	2mm	*Acer* sp./*Prunus* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER				V	
CONTEXT NUMBER	495								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Corylus avellana*	1						
2	4mm	*Corylus avellana*	1						
3	4mm	*Corylus avellana*	1						
4	4mm	*Corylus avellana*	1						
5	4mm	*Corylus avellana*	1						
6	2mm	*Corylus avellana*	1						
7	2mm	*Corylus avellana*	1						

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			V	
CONTEXT NUMBER		495							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
8	**2mm**	*Corylus avellana*	1						
9	**2mm**	*Corylus avellana*	1						
10	**2mm**	cf. *Corylus avellana*	?					3	
Comment:	Some have insect damage								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			VIII	
CONTEXT NUMBER		524							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	**4mm**	*Quercus* sp.	1			1			
2	**4mm**	*Fraxinus excelsior*	1		1				
3	**4mm**	*Acer* sp.	1						
4	**4mm**	*Quercus* sp.	1		1	1			
5	**4mm**	*Acer* sp.	1		1				
6	**2mm**	*Quercus* sp.	1		1		1		
7	**2mm**	*Quercus* sp.	1				1	1	
8	**2mm**	*Quercus* sp.	1	1					
9	**2mm**	*Quercus* sp.	1		1				
10	**2mm**	*Quercus* sp.	1		1				
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XVI	
CONTEXT NUMBER		506							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	**4mm**	*Corylus avellana*	1						
2	**4mm**	*Corylus avellana*	1	1					
3	**4mm**	*Corylus avellana*	1						
4	**4mm**	*Corylus avellana*	1						
5	**4mm**	*Corylus avellana*	1						
6	**2mm**	*Corylus avellana*	1						
7	**2mm**	*Corylus avellana*	1				1		

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER			XVI		
CONTEXT NUMBER	506								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
8	2mm	*Corylus avellana*	1						
9	2mm	*Corylus avellana*	?						
10	2mm	*Corylus avellana*	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER			XVII		
CONTEXT NUMBER	520								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Corylus avellana*	1				1		
2	4mm	*Acer* sp.	2						
3	4mm	*Corylus avellana*	1				1		
4	4mm	*Corylus avellana*	1				1		
5	4mm	*Corylus avellana*	1				1		
6	2mm	*Corylus avellana*	1						
7	2mm	*Corylus avellana*	1						
8	2mm	*Corylus avellana*	1						
9	2mm	*Corylus avellana*	1						
10	2mm	*Corylus avellana*	1						
Comment:	#3, 1, 4, 5 have insect bore holes								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER			XVIII		
CONTEXT NUMBER	522								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	cf. *Ribes*	1						
2	4mm	*Corylus avellana*	1			1	1		
3	4mm	*Corylus avellana*	1						
4	4mm	*Corylus avellana*	1						
5	4mm	*Quercus* sp.	1	1		1	1		

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XVIII	
CONTEXT NUMBER		522							
Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
6	4mm	*Corylus avellana*	1						
7	2mm	*Corylus avellana*	1						
8	2mm	*Corylus avellana*	1						
9	2mm	*Corylus avellana*	1						
10	2mm	*Quercus* sp.	1	1					
Comment:	Extra 4mm because no more 2mm frags. Rocks.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XIX	
CONTEXT NUMBER		488							
Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Acer* sp.	1		1				
2	4mm	*Picea abies*	1		1				
3	4mm	*Acer* sp.	1						
4	4mm	*Acer* sp.	1		1				
5	4mm	*Acer* sp.	1						
6	2mm	*Picea abies*	1		1				
7	2mm	*Picea abies*	1		1				
8	2mm	*Picea abies*	1		1				
9	2mm	Indet.							
10	2mm	*Picea abies*	1		1				
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XXVI	
CONTEXT NUMBER		561							
Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Acer* sp.	1				1		
2	4mm	*Acer* sp.	1	1			1		
3	4mm	*Acer* sp.	1				1		
4	4mm	*Acer* sp.	1		1		1		
5	4mm	*Quercus* sp.	1	1					
6	2mm	*Acer* sp.	1						
7	2mm	*Acer* sp.	1						
8	2mm	*Acer* sp.	1						
9	2mm	*Acer* sp.	1				1		
10	2mm	*Acer* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XXI	
CONTEXT NUMBER		528							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Quercus* sp.	1	1	1			1	
2	4mm	*Quercus* sp.	1	1	1		1	2	
3	4mm	*Quercus* sp.	1	1	1		1	2	
4	4mm	*Quercus* sp.	1	1	1		1	2	
5	4mm	*Quercus* sp.	1	1	1			1	
6	2mm	*Quercus* sp.	1	1	1			2	
7	2mm	*Quercus* sp.	1	1				2	
8	2mm	*Quercus* sp.	1	1				2	
9	2mm	*Quercus* sp.	1	1	1	1		2	
10	2mm	*Quercus* sp.	1	1		1		1	
Comment:	#2 has insect damage								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XXV	
CONTEXT NUMBER		560							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Fraxinus excelsior*	2	1	1		1		
2	4mm	*Corylus avellana*	1						
3	4mm	*Fraxinus excelsior*	1	1	1	1	1		
4	4mm	*Fraxinus excelsior*	2	1		1	1		
5	4mm	*Fraxinus excelsior*	2	1	1				
6	2mm	*Fraxinus excelsior*	1						
7	2mm	*Fraxinus excelsior*	1	1		1			
8	2mm	*Fraxinus excelsior*	1	1					
9	2mm	*Fraxinus excelsior*	1	1					
10	2mm	*Fraxinus excelsior*	1	1	1				
Comment:	#2, 3 have insect damage.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XX	
CONTEXT NUMBER		502							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Corylus avellana*	1				1		
2	4mm	*Corylus avellana*	2				1		
3	4mm	*Corylus avellana*	1						
4	4mm	*Corylus avellana*	2	1					
5	4mm	cf. *Corylus avellana*	2	1	1			2	
6	2mm	*Corylus avellana*	2					2	
7	2mm	*Corylus avellana*	1					2	
8	2mm	cf. *Corylus avellana*	1	1			1	3	
9	2mm	*Corylus avellana*	1	1					
10	2mm	*Corylus avellana*	1				1		
Comment:	#2 and 3 have insect bore holes. #6 some growth rings vitrified.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			XXII	
CONTEXT NUMBER		525							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Corylus avellana*	1	1			1		
2	4mm	*Corylus avellana*	1		1				
3	4mm	*Corylus avellana*	1				1		
4	4mm	*Corylus avellana*	1	1					
5	4mm	*Corylus avellana*	1		1				
6	2mm	*Corylus avellana*	1						
7	2mm	*Corylus avellana*	1	1	1				
8	2mm	*Fraxinus excelsior*	1			1			
9	2mm	*Corylus avellana*	1	1					
10	2mm	*Corylus avellana*	1	1					
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			129	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Acer* sp.	1				1		
2	4mm	*Acer* sp.	1				1		
3	4mm	*Acer* sp.	1		1	1	1		
4	4mm	*Acer* sp.	1						
5	4mm	*Acer* sp.	1						
6	4mm	*Acer* sp.	1			1			
Comment:	No 2mm fragments								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			121	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Acer* sp.	3	1			1	1	
2	4mm	*Acer* sp.	3	1				1	
3	4mm	*Acer* sp.	3	1					
Comment:	#1, 2, 3 round wood								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			32	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Acer* sp.	1						
2	4mm	*Acer* sp.	1						

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			32	
TRENCH		IIIc							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrification [c]**	**Mineralisation [b]**
3	4mm	*Acer* sp.	1						
4	4mm	*Corylus avellana*	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			35	
TRENCH		IIIc							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrification [c]**	**Mineralisation [b]**
1	4mm	*Fraxinus excelsior*	1						
2	4mm	*Fraxinus excelsior*	1						
3	4mm	*Fraxinus excelsior*	1						
4	4mm	*Fraxinus excelsior*	1						
5	4mm	*Fraxinus excelsior*	1		1				
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			118	
TRENCH		IIIc							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrification [c]**	**Mineralisation [b]**
1	4mm	*Acer* sp.	1			1	1		
2	4mm	*Acer* sp.	1			1	1		
Comment:									

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			349	
TRENCH		IIIc							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrification [c]**	**Mineralisation [b]**
1	4mm	*Fraxinus excelsior*	1		1				
2	4mm	cf. *Quercus* sp.	1	1		1			
3	4mm	*Fraxinus excelsior*	1		1			1	
4	4mm	*Fraxinus excelsior*	1						
5	4mm	*Fraxinus excelsior*	1						
6	2mm	*Fraxinus excelsior*	1				1		

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			118	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
7	2mm	*Fraxinus excelsior*	1		1				
8	2mm	*Quercus* sp./ *Fraxinus excelsior*	1				1	2	
9	2mm	*Fraxinus excelsior*	1						
10	2mm	cf. *Quercus* sp.	?						
Comment:									

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			34	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Fraxinus excelsior*	1				1		
2	4mm	*Fraxinus excelsior*	1				1		
3	4mm	*Fraxinus excelsior*	1				1		
Comment:									

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			28	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Corylus avellana*	1				1		
2	4mm	*Corylus avellana*	1				1		
Comment:									

SITE CODE / NAME					SAMPLE NUMBER			69	
CONTEXT NUMBER		IIIc			SAMPLE WEIGHT			g	
Fragment No.	Fragment Size	Species	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Mineralisation[b]
1	4mm	*Quercus* sp.	1	1		1	1		
2	4mm	*Quercus* sp.	1	1		1	1		
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER			98		
TRENCH	IIIc								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Fraxinus excelsior*	1					2	
2	4mm	*Fraxinus excelsior*	1					2	
3	4mm	*Quercus* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER			101		
TRENCH	IIIc								
Fragment No.	Fragment Size	Species	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Corylus avellana*	2				1		
2	4mm	*Corylus avellana*	2				1		
3	4mm	*Corylus avellana*	3				1		
4	4mm	*Corylus avellana*	2				1		
5	4mm	*Corylus avellana*	2				1		
Comment:	#3 round wood								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER			99		
TRENCH	IIIc								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Corylus avellana*	1				1		
2	4mm	*Corylus avellana*	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi			SAMPLE NUMBER			97		
TRENCH	IIIc								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Corylus avellana*	1				1		

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			97	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
2	4mm	*Corylus avellana*	1	1		1			
3	4mm	*Quercus* sp.	1			1	1		
4	4mm	*Quercus* sp.	1			1	1		
Comment:	#1 insect bore hole.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			351	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	cf *Ulmus* sp.	3	1					
2	4mm	cf. *Ulmus* sp.	3	1					
3	4mm	roundwood	3	1					
4	4mm	cf. *Ulmus* sp.							
Comment:	#1 and 2 are round wood. #3has 5 growth rings								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			352	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Acer* sp.	1		1				
2	4mm	*Acer* sp.	1						
3	4mm	*Acer* sp.	1				1		
4	4mm	*Acer* sp.	1				1		
5	4mm	*Acer* sp.	1				1		
6	4mm	*Acer* sp.	1				1		
Comment:									

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			102	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrification[c]	Minerali-sation[b]
1	4mm	*Corylus avellana*	3					1	
2	4mm	*Corylus avellana*	3						
3	4mm	*Corylus avellana*	3						
Comment:	All same piece pith to 8 growth rings.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		**Salevere Salumägi**			**SAMPLE NUMBER**			**85**	
TRENCH		**IIIc**							
Fragment No.	**Fragment Size**	Taxa	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
1	**4mm**	cf. *Quercus* sp.	1				1	2	
2	**4mm**	*Fraxinus excelsior*	1		1				
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		**Salevere Salumägi**			**SAMPLE NUMBER**			**353**	
TRENCH		**IIIc**							
Fragment No.	**Fragment Size**	Taxa	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
1	**4mm**	*Corylus avellana*	1				1		
2	**4mm**	*Corylus avellana*	1						
3	**4mm**	Indet						3	
Comment:	#3 completely fused.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		**Salevere Salumägi**			**SAMPLE NUMBER**			**94**	
TRENCH		**IIIc**							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
1	**4mm**	cf. *Quercus* sp.	?						
2	**4mm**	*Quercus* sp.	1	1			1		1
3	**4mm**	*Quercus* sp.	1	1			1		1
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		**Salevere Salumägi**			**SAMPLE NUMBER**			**49**	
TRENCH		**IIIc**							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
1	**4mm**	*Corylus avellana*	1				1		
2	**4mm**	cf. *Corylus avellana*	3						
3	**4mm**	*Corylus avellana*	1		1		1		
4	**4mm**	Indet.							
Comment:	#2 pith and 2 growth rings								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			124	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Acer* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			125	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Quercus* sp.	1	1		1	1		
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			90	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	cf. *Corylus avellana*	1		1			1	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			88	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	Indet.							
Comment:	Parenchyma								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			104	
TRENCH		IIIc							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Acer* sp.	3	1				2	

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			104	
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
Comment:	roundwood								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			122	
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
1	**4mm**	cf. *Fraxinus excelsior*	1	1				1	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			354	
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
1	**4mm**	*Acer* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			123	
TRENCH	IIIC								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
1	**4mm**	cf. *Ribes*	3						1
Comment:	Roundwood – outrer growth rings decayed/mineralized								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			350	
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
1	**4mm**	Indet Bark	NA						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi		SAMPLE NUMBER				19		
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrifi - cation [c]**	**Minerali -sation [b]**
1	**4mm**	*Corylus avellana*	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi		SAMPLE NUMBER				95		
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrifi - cation [c]**	**Minerali -sation [b]**
1	**4mm**	Indet Knot	?				1		
Comment:	Alnus/Corylus/Betula. Aggregate rays – but a knot.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi		SAMPLE NUMBER				120		
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrifi - cation [c]**	**Minerali -sation [b]**
1	**4mm**	*Corylus avellana*	1			1			
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi		SAMPLE NUMBER				103		
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrifi - cation [c]**	**Minerali -sation [b]**
1	**4mm**	*Acer* sp.	1						
2	**4mm**	*Acer* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi		SAMPLE NUMBER				48		
TRENCH	IIIc								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrifi - cation [c]**	**Minerali -sation [b]**
1	**4mm**	cf. *Acer* sp.	2	1		1	1	2	
Comment:	.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			127	
TRENCH	IIIc								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Quercus* sp.	1	1		1			
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			126	
TRENCH	IIIc								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Acer* sp.	1			1			
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			89	
TRENCH	IIIc								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	cf. *Fraxinus excelsior*	1		1		1		
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			36	
TRENCH	IIIc								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	cf. *Corylus avellana*	1					2	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			22	
TRENCH	IIIc								
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Fraxinus excelsior*	1		1			2	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	**Salevere Salumägi**				**SAMPLE NUMBER**			**25**	
TRENCH	**IIIc**								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrification[c]**	**Mineralisation[b]**
1	**4mm**	cf. *Ulmus* sp.	?	1		1	1	2	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	**Salevere Salumägi**				**SAMPLE NUMBER**			**87**	
TRENCH	**IIIc**								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrification[c]**	**Mineralisation[b]**
1	**4mm**	*Ulmus* sp.	1	1		1	1	2	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	**Salevere Salumägi**				**SAMPLE NUMBER**			**96**	
TRENCH	**IIIc**								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrification[c]**	**Mineralisation[b]**
1	**4mm**	Indet	?		1		1		
Comment:	Knot								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	**Salevere Salumägi**				**SAMPLE NUMBER**			**24**	
TRENCH	**IIIc**								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrification[c]**	**Mineralisation[b]**
1	**4mm**	cf. *Acer* sp.	3	1			1	2	
Comment:	Round wood pith included								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	**Salevere Salumägi**				**SAMPLE NUMBER**			**251**	
TRENCH	**IIIb**								
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrification[c]**	**Mineralisation[b]**
1	**4mm**	*Fraxinus excelsior*	3	1				1	

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			251	
TRENCH		IIIb							
Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
2	4mm	*Fraxinus excelsior*	2	1			1	1	
3	4mm	*Fraxinus excelsior*	3	1		1	1	1	
4	4mm	*Fraxinus excelsior*	2	1			1	1	
5	4mm	*Fraxinus excelsior*	2	1			1	1	
6	4mm	*Fraxinus excelsior*	3	1		1	1	1	
7	4mm	*Fraxinus excelsior*	3	1				1	
8	4mm	*Quercus* sp.	1	1					
9	4mm	*Quercus* sp.	1	1		1	1		
10	4mm	*Quercus* sp.	1	1					
11	4mm	cf. *Ribes*	3				1	1	
12	4mm	*Fraxinus excelsior*	2					1	
13	4mm	*Quercus* sp.	1	1		1			
14	4mm	cf. *Ribes*	3					2	
15	4mm	cf. *Ribes*	3	1				2	
16	4mm	*Fraxinus excelsior*	3	1				1	
17	4mm	*Fraxinus excelsior*	3					2	
18	4mm	*Fraxinus excelsior*	1					2	
19	4mm	*Fraxinus excelsior*	2					1	
20	4mm	*Fraxinus excelsior*	2	1			1	1	
21	4mm	*Fraxinus excelsior*	2	1				1	
22	4mm	*Quercus* sp.	1	1				1	
23	4mm	*Fraxinus excelsior*	2	1				1	
24	4mm	*Fraxinus excelsior*	2	1				1	
25	4mm	*Fraxinus excelsior*	2	1				1	
26	2mm	cf. *Ribes*	3	1				2	
27	2mm	*Fraxinus excelsior*	2	1			1		
28	2mm	*Fraxinus excelsior*	2	1				2	
29	2mm	*Fraxinus excelsior*	2	1				2	
30	2mm	*Quercus* sp.	1	1				2	
31	2mm	cf. *Ribes*	3	1				3	
32	2mm	*Quercus* sp.	2	1				1	
33	2mm	*Quercus* sp.	1	1				1	

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			251	
TRENCH		IIIb							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrification[c]**	**Mineralisation[b]**
34	**2mm**	*Quercus* sp.	1	1		1	1		
35	**2mm**	*Fraxinus excelsior*	3	1				1	
36	**2mm**	*Fraxinus excelsior*	2	1				1	
37	**2mm**	*Quercus* sp.	1	1		1	1	1	
38	**2mm**	*Fraxinus excelsior*	1	1				1	
39	**2mm**	*Quercus* sp.	1	1		1	1		
40	**2mm**	*Fraxinus excelsior*	2	1				1	
41	**2mm**	*Quercus* sp.	1	1		1	1		
42	**2mm**	*Quercus* sp.	1	1		1	1		1
43	**2mm**	*Quercus* sp.	1	1		1	1		
44	**2mm**	*Quercus* sp.	1	1		1	1		
45	**2mm**	*Fraxinus excelsior*	3	1				1	
46	**2mm**	*Fraxinus excelsior*	1	1				1	
47	**2mm**	*Quercus* sp.	1	1		1		3	
48	**2mm**	*Quercus* sp.	1	1		1	1		
49	**2mm**	*Quercus* sp.	1	1		1	1		
50	**2mm**	*Fraxinus excelsior*	1	1				1	
Comment:	#1-3, 6 roundwood c 5GR. 14 roundwood 45 roundwood								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			158	
TRENCH		IIIb							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrification[c]**	**Mineralisation[b]**
1	**4mm**	*Fraxinus excelsior*	3	1		1	1	2	
2	**4mm**	*Fraxinus excelsior*	3	1		1	1	1	
3	**4mm**	cf. *Ribes*	3					1	
4	**4mm**	*Quercus* sp.	1	1		1	1		
5	**4mm**	*Quercus* sp.	1	1		1	1		
6	**4mm**	*Quercus* sp.	1	1		1	1		
7	**4mm**	*Quercus* sp.	1	1		1	1		
8	**4mm**	*Quercus* sp.	1	1		1	1		
9	**4mm**	*Quercus* sp.	1	1		1	1		
10	**4mm**	*Quercus* sp.	1	1		1	1		
11	**4mm**	*Quercus* sp.	1	1		1	1		
12	**4mm**	*Quercus* sp.	1	1		1	1		
13	**4mm**	*Quercus* sp.	1	1		1	1		

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			158	
TRENCH		IIIb							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
14	**4mm**	*Quercus* sp.	1	1		1	1		
15	**4mm**	*Fraxinus excelsior*	1	1				2	
16	**4mm**	cf. *Ribes*	3	1				2	
17	**4mm**	cf. *Ribes*	3	1				2	
18	**4mm**	Fraxinus	3	1				2	
19	**4mm**	*Quercus* sp.	1	1		1	1		
20	**4mm**	*Quercus* sp.	1	1		1	1		
21	**4mm**	*Quercus* sp.	1	1		1	1		
22	**4mm**	*Quercus* sp.	1	1		1	1		
23	**4mm**	*Quercus* sp.	1	1		1	1		
24	**4mm**	*Fraxinus excelsior*	2	1				1	
25	**4mm**	*Quercus* sp.	1	1		1	1		
26	**4mm**	*Quercus* sp.	1	1		1	1		
27	**4mm**	*Quercus* sp.	1	1		1	1		
28	**4mm**	*Quercus* sp.	1	1		1	1		
29	**4mm**	*Quercus* sp.	1	1		1	1		
30	**4mm**	*Fraxinus excelsior*	2	1				1	
31	**4mm**	*Quercus* sp.	1	1		1	1		
32	**4mm**	cf. *Ribes*	2				1		
33	**4mm**	*Quercus* sp.	1	1		1	1		
34	**4mm**	*Quercus* sp.	1	1		1	1		
35	**4mm**	*Quercus* sp.	1	1		1	1		
36	**4mm**	*Quercus* sp.	1	1		1	1		
37	**4mm**	cf. *Ribes*	2	1				1	
38	**4mm**	*Quercus* sp.	1	1		1	1		
39	**2mm**	*Quercus* sp.	1	1		1	1		
40	**2mm**	*Fraxinus excelsior*	1	1					
41	**2mm**	*Quercus* sp.	1	1		1	1		
42	**2mm**	*Quercus* sp.	1	1					
43	**2mm**	*Quercus* sp.	1	1					
44	**2mm**	*Fraxinus excelsior*	3	1					
45	**2mm**	*Quercus* sp.	1	1					
46	**2mm**	*Quercus* sp.	1	1		1	1		
47	**2mm**	*Quercus* sp.	1	1		1	1		
48	**2mm**	*Fraxinus excelsior*	1	1					
49	**2mm**	*Quercus* sp.	1	1		1	1		
50	**2mm**	*Quercus* sp.	1	1		1	1		
Comment:	#18 roundwood 7GR. 31 pith and 3 GR. Only 12 suitable >2mm frags present								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

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SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			221	
TRENCH		IIIa							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Quercus* sp.	1	1		1	1	1	
2	4mm	cf. *Ribes*	3	1	1		1		
3	4mm	*Quercus* sp.	1	1			1		
4	4mm	*Quercus* sp.	1	1			1		
5	4mm	*Quercus* sp.	1	1				2	
6	2mm	*Quercus* sp.	1	1				2	
7	2mm	*Quercus* sp.	1	1				2	
8	2mm	*Quercus* sp.	1	1				1	
9	2mm	*Quercus* sp.	1	1				2	
10	2mm	*Quercus* sp.	1	1				2	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			143	
TRENCH		IIIa							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Quercus* sp.	1	1				1	
2	4mm	*Quercus* sp.	?	1				1	
3	4mm	*Quercus* sp.	1	1		1	1	1	
4	4mm	*Quercus* sp.	1	1		1	1	1	
5	4mm	*Quercus* sp.	1	1			1	1	
6	2mm	*Quercus* sp.	1	1			1	1	
7	2mm	*Quercus* sp.	1	1				2	
8	2mm	*Quercus* sp.	1	1				2	
9	2mm	*Quercus* sp.	1	1				2	
10	2mm	*Quercus* sp.	1	1		1	1	2	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			157	
TRENCH		IIIa							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Acer* sp.	1				1		
2	4mm	*Quercus* sp.	1	1			1		
3	4mm	*Quercus* sp.	1	1		1	1		
4	4mm	*Acer* sp.	1				1		
5	4mm	*Quercus* sp.	1	1			1	2	
6	2mm	*Quercus* sp.	1	1			1		
7	2mm	*Quercus* sp.	1	1				1	
8	2mm	*Quercus* sp.	1	1			1	1	

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			157	
TRENCH		IIIa							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrifi-cation [c]**	**Minerali-sation [b]**
9	2mm	*Quercus* sp.	1	1		1	1		
10	2mm	*Quercus* sp.	1	1			1	1	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			180	
TRENCH		IIIa							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrifi-cation [c]**	**Minerali-sation [b]**
1	4mm	*Quercus* sp.	1	1		1	1	1	
2	4mm	*Quercus* sp.	1	1			1	1	
3	4mm	*Quercus* sp.	1	1			1		
4	4mm	*Fraxinus excelsior*	1					1	
5	4mm	*Quercus* sp.	1	1			1	1	
6	2mm	*Quercus* sp.	1	1				1	
7	2mm	*Quercus* sp.	1	1				1	
8	2mm	*Quercus* sp.	1	1		1	1		
9	2mm	*Quercus* sp.	1	1			1	2	
10	2mm	*Quercus* sp.	1	1			1	1	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			176	
TRENCH		IIIa							
Fragment No.	**Fragment Size**	**Taxa**	**Ring Curvature [a]**	**Narrow rings [b]**	**Radial Cracks [b]**	**Tyloses [b]**	**Fungal Hyphae [b]**	**Vitrifi-cation [c]**	**Minerali-sation [b]**
1	4mm	*Quercus* sp.	1	1		1			
2	4mm	*Quercus* sp.	1	1		1	1		
3	4mm	*Quercus* sp.	1	1		1	1		
4	4mm	*Quercus* sp.	1	1		1	1		
5	4mm	*Quercus* sp.	1	1		1	1		
6	2mm	*Quercus* sp.	1	1		1	1		
7	2mm	*Quercus* sp.	1	1				1	
8	2mm	*Quercus* sp.	1	1			1	1	
9	2mm	*Quercus* sp.	1			1	1		
10	2mm	*Quercus* sp.	1	1		1	1		
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			216	
TRENCH	IIIa								

Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Quercus* sp.	1	1			1		
2	4mm	*Fraxinus excelsior*	3	1				1	
3	4mm	*Quercus* sp.	1	1			1	1	
4	4mm	*Quercus* sp.	1	1		1	1		
5	4mm	*Quercus* sp.	1	1			1		
6	2mm	*Quercus* sp.	1	1			1		
7	2mm	*Quercus* sp.	1	1			1	1	
8	2mm	*Quercus* sp.	1	1				1	
9	2mm	*Quercus* sp.	1	1					
10	2mm	*Quercus* sp.	1	1			1		
Comment:	#2 roundwood								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			209	
TRENCH	IIIa								

Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	4.8 cf. *Ribes*	3	1					
2	4mm	*Quercus* sp.	1				1		
3	4mm	cf. *Ribes*	3	1					
4	4mm	*Quercus* sp.	1	1			1	1	
5	4mm	*Quercus* sp.	1	1			1	1	
6	2mm	cf. *Ribes*	3	1				1	
7	2mm	*Quercus* sp.	1	1			1		
8	2mm	*Quercus* sp.	1	1			1		
9	2mm	cf. *Ribes*	3	1					
10	2mm	cf. *Ribes*	3	1				1	
Comment:	Most >4mm are oak. All ribes are round wood.								

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi				SAMPLE NUMBER			161	
TRENCH	IIIa								

Fragment No.	Fragment Size	Taxa	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
1	4mm	*Quercus* sp.	1	1		1	1		
2	4mm	*Quercus* sp.	1	1		1	1		
3	4mm	*Quercus* sp.	1	1		1	1		
4	4mm	*Quercus* sp.	1	1		1	1		
5	4mm	*Quercus* sp.	1			1	1		
6	2mm	*Quercus* sp.	1	1		1	1		

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			161	
TRENCH		IIIa							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
7	2mm	*Quercus* sp.	1				1	1	
8	2mm	*Quercus* sp.	1	1		1	1	1	
9	2mm	*Quercus* sp.	1			1	1	1	
10	2mm	*Quercus* sp.	1	1		1	1	1	
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			197	
TRENCH		IIIa							
Fragment No.	Fragment Size	Taxa	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Quercus* sp.	1			1	1	1	
2	4mm	*Quercus* sp.	1			1	1	1	
3	4mm	*Quercus* sp.	1			1	1		
4	4mm	*Quercus* sp.	1	1		1	1	1	
5	4mm	*Quercus* sp.	1	1		1	1		
6	2mm	*Quercus* sp.	1	1		1	1		
7	2mm	*Quercus* sp.	1	1		1	1		
8	2mm	*Quercus* sp.	1	1		1	1		
9	2mm	*Quercus* sp.	1	1		1	1		
10	2mm	*Quercus* sp.	1	1		1	1		
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi			SAMPLE NUMBER			169	
TRENCH		IIIa							
Fragment No.	Fragment Size	Species	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
1	4mm	*Quercus* sp.	1	1		1	1		
2	4mm	*Quercus* sp.	1	1		1	1	1	
3	4mm	*Quercus* sp.	1	1		1	1	1	
4	4mm	*Quercus* sp.	1	1		1	1		
5	4mm	*Quercus* sp.	1	1		1	1	1	
6	2mm	*Quercus* sp.	1	1		1	1		
7	2mm	*Quercus* sp.	1	1		1	1		
8	2mm	*Quercus* sp.	1	1		1	1		
9	2mm	*Quercus* sp.	1	1		1	1		
10	2mm	*Quercus* sp.	1	1		1	1		
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi							
TRENCH		Trench I, Layer III							
Charcoal No.	**Fragment Size**	**Species**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
2	4mm	*Ulmus* sp.	?						
4	4mm	*Alnus* sp.	?				1		
7	4mm	*Alnus sp.*	?		1		1		
7	4mm	*Alnus sp.*	?		1		1		
7	2mm	*Alnus sp.*	?		1		1		
8	4mm	cf. *Quercus* sp.	?					2	
9	4mm	*Alnus* sp.	?		1				
9	2mm	*Alnus* sp.	?		1				
9	2mm	cf. *Betula* sp.	?						
10	4mm	*Corylus avellana*	3						
10	4mm	*Corylus avellana*	3						
10	4mm	*Quercus* sp.	1	1			1		
10	4mm	*Quercus* sp.	3				1		
10	4mm	*Alnus* sp.	?						
10	4mm	*Quercus* sp.	?	1			1		
10	4mm	*Quercus* sp.	?	1			1		
10	2mm	*Quercus* sp.	?	1			1		
10	2mm	*Quercus* sp.	?	1			1		
10	2mm	*Quercus* sp.	?	1			1		
10	2mm	*Quercus* sp.	?	1			1		
10	2mm	*Quercus* sp.	?	1			1		
10	2mm	*Alnus* sp.	?						
11	4mm	*Alnus* sp.	2						
11	4mm	*Corylus avellana*	?		1				
11	4mm	*Corylus avellana*	?						
11	2mm	*Corylus avellana*	?						
11	2mm	*Corylus avellana*	?						
13	4mm	*Prunus spinosa*	?						
15	4mm	*Pinus* sp.	1						
15	2mm	*Prunus* sp.	1						
16	4mm	*Populus / Salix*	1			1	1		
16	4mm	*Populus / Salix*	1			1	1		
16	4mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	?			1	1		

SITE CODE / NAME		Salevere Salumägi							
TRENCH		Trench I, Layer III							
Charcoal No.	Fragment Size	Species	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
16	2mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	1			1	1		
16	2mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	?			1	1		
16	2mm	*Populus / Salix*	?			1	1		
17	2mm	*Fraxinus excelsior*	1			1	1		
SAMPLE LOCATION		Trench I Layer V							
42	4mm	*Acer*	1						
42	4mm	*Acer*	1						
37	4mm	*Acer*	1						
SAMPLE LOCATION		Trench I Layer IV							
35	4mm	*Quercus* sp.	1			1			
35	4mm	*Alnus* sp.	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME		Salevere Salumägi							
TRENCH		Trench II							
Charcoal No.	Fragment Size	Species	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
4	4mm	*Populus / Salix*	3						
4	4mm	*Populus / Salix*	3						
4	2mm	*Populus / Salix*	3						
4	2mm	*Populus / Salix*	3						
11	4mm	*Populus / Salix*	3					1	
11	4mm	*Populus / Salix*	3					1	
11	4mm	*Populus / Salix*	3					1	
11	4mm	*Populus / Salix*	3					1	

SITE CODE / NAME		Salevere Salumägi								
TRENCH		**Trench II**								
Charcoal No.	**Fragment Size**	**Species**	**Ring Curvature**[a]	**Narrow rings**[b]	**Radial Cracks**[b]	**Tyloses**[b]	**Fungal Hyphae**[b]	**Vitrifi - cation**[c]	**Minerali -sation**[b]
11	**4mm**	*Populus / Salix*	3					1	
11	**4mm**	*Populus / Salix*	3					1	
11	**4mm**	*Populus / Salix*	3					1	
11	**2mm**	*Quercus* sp.	?						
11	**2mm**	*Populus / Salix*	3					1	
11	**2mm**	*Populus / Salix*	3					1	
11	**2mm**	*Populus / Salix*	3					1	
11	**2mm**	*Fraxinus excelsior*	1						
11	**2mm**	*Populus / Salix*	?					1	
11	**2mm**	*Populus / Salix*	?						
11	**2mm**	*Populus / Salix*	?						
16	**4mm**	*Fraxinus excelsior*	1				1		
16	**4mm**	*Fraxinus excelsior*	1			1	1		
17	**4mm**	*Acer*	1						
18	**2mm**	*Quercus* sp.	?						
19	**4mm**	*Fraxinus excelsior*	1						
19	**2mm**	*Fraxinus excelsior*	?						
21	**2mm**	*Populus / Salix*	?					2	
21	**2mm**	*Alnus* sp.	?						
21	**2mm**	*Alnus* sp.	?				1		
24	**4mm**	*Fraxinus excelsior*	?				1		
25	**4mm**	*Fraxinus excelsior*	1				1		
25	**4mm**	*Fraxinus excelsior*	1				1		
96	**2mm**	*Fraxinus excelsior*	?						
96	**2mm**	*Fraxinus excelsior*	?						
96	**2mm**	*Fraxinus excelsior*	?						
96	**2mm**	*Fraxinus excelsior*	?						
97	**4mm**	*Fraxinus excelsior*	1			1			
97	**2mm**	*Alnus* sp.	1		1				
97	**2mm**	*Alnus* sp.	1		1				

SITE CODE / NAME	Salevere Salumägi								
TRENCH	Trench II								
Charcoal No.	Fragment Size	Species	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi								
TRENCH	Trench IV, Layer III								
Charcoal No.	Fragment Size	Species	Ring Curvature[a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi-cation[c]	Minerali-sation[b]
12	4mm	*Corylus avellana*	1				1		
12	4mm	*Corylus avellana*	1				1		
12	4mm	*Corylus avellana*	1				1		
14	4mm	*Corylus avellana*	1						
15	4mm	*Corylus avellana*	1						
16	4mm	knot							
17	4mm	*Corylus avellana*							
17	4mm	*Corylus avellana*							
17	4mm	*Corylus avellana*							
17	4mm	*Corylus avellana*							
18	4mm	*Corylus avellana*							
18	4mm	*Corylus avellana*							
19	4mm	*Corylus avellana*							
19	4mm	*Corylus avellana*					1		
19	4mm	*Corylus avellana*							
19	4mm	*Corylus avellana*							
20	4mm	*Corylus avellana*						1	
20	4mm	*Corylus avellana*					1		
20	4mm	*Fraxinus excelsior*							
21	4mm	*Betula* sp.	1						
22	4mm	*Corylus avellana*	1						
23	4mm	*Fraxinus excelsior*							
23	4mm	*Fraxinus excelsior*							

SITE CODE / NAME	Salevere Salumägi								
TRENCH	Trench IV, Layer III								
Charcoal No.	**Fragment Size**	**Species**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
24	**4mm**	*Corylus avellana*	1	1					
26	**4mm**	*Corylus avellana*	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi								
TRENCH	Trench V, Layer VIIa								
Charcoal No.	**Fragment Size**	**Species**	**Ring Curvature[a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi-cation[c]**	**Minerali-sation[b]**
82	**4mm**	*Populus / Salix*	3						
82	**4mm**	*Corylus avellana*	?						
83	**2mm**	*Corylus avellana*	?						
85	**4mm**	*Quercus* sp.	3				1		
86	**2mm**	*Fraxinus excelsior*	1						
86	**2mm**	*Corylus avellana*	3					1	
87	**2mm**	*Fraxinus excelsior*	3						
87	**4mm**	*Populus / Salix*	3						
87	**2mm**	*Fraxinus excelsior*	3						
88	**4mm**	*Fraxinus excelsior*	2						
89	**4mm**	*Populus / Salix*	3					1	
89	**2mm**	*Populus / Salix*	3						
89	**2mm**	*Alnus* sp.	3						
89	**2mm**	*Populus / Salix*	1			1			
91	**4mm**	*Ulmus* sp.	1						
91	**4mm**	*Ulmus* sp.	1						
91	**2mm**	*Corylus avellana*	?		1				
91	**2mm**	*Ulmus* sp.	?						
92	**4mm**	*Acer* sp.	1						
92	**4mm**	*Acer* sp.	1						
92	**4mm**	*Alnus* sp.	1						
92	**4mm**	*Acer* sp.	1						
92	**4mm**	*Ulmus* sp.	1						
92	**4mm**	*Tilia* sp.	1						
92	**2mm**	*Acer* sp.	1						
TRENCH	**Trench V, Layer VIIb**								

SITE CODE / NAME	Salevere Salumägi								
TRENCH	**Trench V, Layer VIIa**								
Charcoal No.	**Fragment Size**	**Species**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
100	**4mm**	*Fraxinus excelsior*	2						
100	**2mm**	*Fraxinus excelsior*	?						
101	**4mm**	*Corylus avellana*	3						
101	**4mm**	*Corylus avellana*	?						
101	**4mm**	*Corylus avellana*	3						
102	**4mm**	*Corylus avellana*	2						
103	**4mm**	*Quercus* sp.	3						
104	**4mm**	*Acer* sp.	?						
104	**4mm**	*Corylus avellana*	?				1		
104	**4mm**	*Acer* sp.	1						
104	**4mm**	*Corylus avellana*	?				1		
104	**4mm**	*Corylus avellana*	?				1		
106	**4mm**	*Alnus* sp.	?						
106	**4mm**	*Alnus* sp.	1						
106	**2mm**	*Alnus* sp.	?						
107	**4mm**	*Corylus avellana*	3					1	
108	**4mm**	*Alnus* sp.	?						
108	**2mm**	*Alnus* sp.	3					1	
108	**2mm**	*Quercus* sp.	1	1		1	1		
109	**4mm**	*Quercus* sp.	1			1			
109	**4mm**	*Quercus* sp.	1			1			
109	**2mm**	*Quercus* sp.	1			1			
110	**4mm**	*Quercus* sp.	1	1		1			
110	**2mm**	*Quercus* sp.	1	1		1			
112	**4mm**	*Populus / Salix*	3						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi								
TRENCH	**Trench VI, Layer III**								
Charcoal No.	**Fragment Size**	**Species**	**Ring Curvature [a]**	**Narrow rings[b]**	**Radial Cracks[b]**	**Tyloses[b]**	**Fungal Hyphae[b]**	**Vitrifi - cation[c]**	**Minerali -sation[b]**
21	**4mm**	*Ulmus* sp.	1				1		
21	**4mm**	*Ulmus / Quercus*	1						
22	**4mm**	*Betula* sp.	1	1					
22	**4mm**	*Acer* sp.	1						
24	**4mm**	knot							

SITE CODE / NAME	Salevere Salumägi								
TRENCH	Trench VI, Layer III								
Charcoal No.	Fragment Size	Species	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
24	4mm	*Quercus* sp.	1						
26	4mm	*Betula* sp.	1				1		
26	4mm	cf. *Fagus* sp.	1	1				3	
26	4mm	cf. *Fagus* sp.	1	1				3	
26	4mm	cf. *Fagus* sp.	1	1				3	
27	4mm	*Ulmus* sp.	1	1					
28	4mm	*Quercus* sp.	1	1			1		
28	4mm	*Quercus* sp.	1	1			1		
29	4mm	*Quercus* sp.	1	1			1		
29	4mm	*Quercus* sp.	1	1			1	1	
30	4mm	Indet.	1	1			1	3	
31	4mm	cf. *Ribes*	3	1				2	
31	4mm	cf. *Ribes*	3	1				2	
31	4mm	*Fraxinus excelsior*	2	1					
31	4mm	*Ulmus* sp.	1	1			1		
32	4mm	*Fraxinus excelsior*	3	1					
32	4mm	*Fraxinus excelsior*	2	1					
32	4mm	*Fraxinus excelsior*	2						
32	4mm	*Fraxinus excelsior*	1						
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

SITE CODE / NAME	Salevere Salumägi								
TRENCH	Trench VII, Layer VI								
Charcoal No.	Fragment Size	Species	Ring Curvature [a]	Narrow rings[b]	Radial Cracks[b]	Tyloses[b]	Fungal Hyphae[b]	Vitrifi - cation[c]	Minerali -sation[b]
84	4mm	*Quercus* sp.	1	1		1	1		
85	4mm	*Populus / Salix*	1				1		
86	4mm	*Quercus* sp.	1			1	1		
87	4mm	*Populus / Salix*	3						
88	2mm	*Corylus avellana*	2						
89	2mm	*Prunus* sp.	3					1	
89	2mm	*Quercus* sp.	3	1				2	
90	4mm	*Populus / Salix*	2				1	1	
98	2mm	*Quercus* sp.	3	1					
102	4mm	*Quercus* sp.	1	1			1		
102	4mm	*Quercus* sp.	1	1		1	1		
102	4mm	*Quercus* sp.	1	1		1			
102	4mm	*Quercus* sp.	1	1		1	1		

SITE CODE / NAME		**Salevere Salumägi**							
TRENCH		**Trench VII, Layer VI**							
Charcoal No.	**Fragment Size**	**Species**	**Ring Curvature** [a]	**Narrow rings**[b]	**Radial Cracks**[b]	**Tyloses**[b]	**Fungal Hyphae**[b]	**Vitrifi - cation**[c]	**Minerali -sation**[b]
102	**4mm**	*Quercus* sp.	1	1		1	1		
106	**4mm**	*Quercus* sp.							
106	**2mm**	*Quercus* sp.							
111	**n/a**	*Corylus avellana* nutshell							
112	**4mm**	*Quercus* sp.	1	1		1	1		
113	**2mm**	*Quercus* sp.	1	1		1	1		
115	**4mm**	*Quercus* sp.	3	1			1	1	
115	**2mm**	*Quercus* sp.	?	1					
115	**2mm**	*Quercus* sp.	1				1		
115	**2mm**	*Quercus* sp.	?				1		
121	**4mm**	*Quercus* sp.	?	1				1	
131	**4mm**	*Quercus* sp.	1			1	1		
133	**2mm**	*Quercus* sp.	?				1		
142	**4mm**	*Quercus* sp.	1			1	1		
143	**4mm**	*Quercus* sp.	1			1	1		
152	**2mm**	*Quercus* sp.	1	1		1			
154	**2mm**	*Quercus* sp.	1	1		1	1		
155	**4mm**	*Populus / Salix*	3						
156	**2mm**	*Quercus* sp.	1			1	1		
158	**2mm**	*Quercus* sp.	?			1		1	
158	**4mm**	*Quercus* sp.	?			1	1		
158	**2mm**	*Quercus* sp.	?				1		
159	**2mm**	*Quercus* sp.	1	1		1	1		
159	**4mm**	*Quercus* sp.	1	1		1	1		
160	**4mm**	*Quercus* sp.	1	1		1	1		
160	**4mm**	*Quercus* sp.	1	1		1	1		
164	**4mm**	*Quercus* sp.	1	1		1	1		
165	**4mm**	*Quercus* sp.	1	1		1	1		
165	**4mm**	*Quercus* sp.	1	1		1	1		
165	**4mm**	*Quercus* sp.	1	1		1	1		
165	**4mm**	*Quercus* sp.	1	1		1	1		
165	**4mm**	*Quercus* sp.	1	1		1	1		
166	**4mm**	*Fraxinus excelsior*	1						
167	**4mm**	*Quercus* sp.	3					2	
169	**4mm**	*Quercus* sp.	1	1		1	1		
170	**4mm**	*Fraxinus excelsior*	3						
172	**4mm**	*Quercus* sp.	1	1		1	1		
Comment:									

[a]1 = low curve rings; 2 = intermediate curved rings; 3 = strong curve rings. [b]1 = yes. [c]1 = low brilliance; 2 = strong brilliance; 3 = total fusion

Appendix D: Analysis of animal bones from the archaeological excavations on the hill of Salumägi

Salevere Salumägi (Hanila khk.) 2008–2010 loomaluude analüüs
TÜ 1692–1693, 1781–1783, 1871

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2018

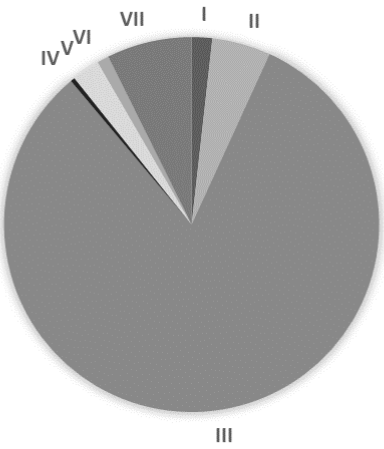
Salevere Salumäelt 2008–2010 välja kaevatud loomaluud on hoiustatud Tartu Ülikooli arheoloogia osakonna zooarheoloogilistes kogudes. Luud on pakendatud kaevandi ja peanumbri kaupa eraldi kilekottidesse, ühte hoiukarpi, ning tähistatud siltidega, millel luuleiu number. Kogu olemasolev luumaterjal sai määratud perioodil 2012–2018 – vastavalt arheoloogi tööplaani erinevatele etappidele.

Luud määrati vastavalt kaevandi ja leiunumbri numeratsiooni järgides. Kõik määrangud on esitatud Tabelis 1, iga luuleid omal real. Kui ühe leiunumbri all oli mitu luuleidu, tähistati need määramise käigus antud alanumbriga (:1, :2, jne). Luude määramisel osutus väike osa leidudest mõneks teiseks leiutüübiks (keraamika, süsi, fossiil vmt). Ka need on selguse mõttes Tabel 1 lõppu lisatud. Samuti on tabeli lõpus kaheksa leiunumbrit, mis olid kirjas esialgses luunimekirjas, kuid määramise ajal vastavaid kotikesi materjali hulgas ei leidunud. Tabel 1 paremaks mõistmiseks on aruandele lisatud taksonite, luude, skeletiosade ja kehasuundade nimetused eesti, ladina ja inglise keeles ning selgitused loomade suuruste hindamise kohta (Tabel 1 – Lisa).

Määramisel kasutati peamiselt Tartu ülikooli arheoloogia osakonna zooloogilist võrdluskogu. Linnuluude määramisel oli abiks Poola Teaduste Akadeemia zooloogiline võrdluskogu Krakowis. Lisaks kasutati luuatlaseid (Ernits, Nahkur 2013; Bocheński, Tomek 2009; Tomek, Bocheński 2009). Määratud luude arvu esitamisel on kasutatud rahvusvahelist lühendit NISP (*number of identified specimens*). Kõik mõõdud on millimeetrites ja võetud üldlevinud standardite järgi (von den Driesch 1976) digitaalse nihikuga. Vanust sai veidi täpsemalt hinnata vaid mõnel korral, vastavalt epifüüside kinnitumise ajale (Chaix, Méniel 2001).

Salevere Salumäe luumaterjal (kokku 791 leidu) jaguneb seitsme kaevandi vahel (Joonis 1), millest enamus pärineb kaevandist III.

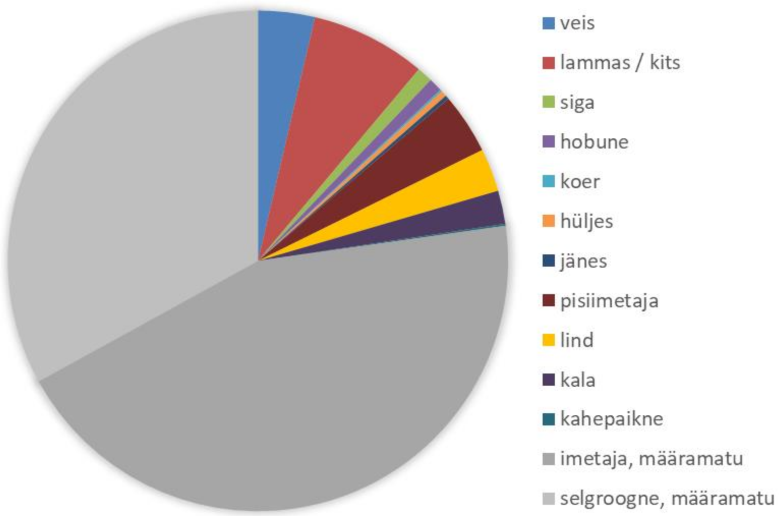
Kaevand	NISP	%
I	14	1.8
II	40	5.1
III	649	82.0
IV	3	0.4
V	19	2.4
VI	8	1.0
VII	58	7.3
Kokku	**791**	**100.0**



Joonis 1. Salevere Salumäelt kogutud loomaluude jaotumus kaevandites.

Kogu luumaterjalist (NISP=791; Joonis 2) oli võimalik täpsema taksonini määrata vaid 23% (NISP=180), samas kui määramata jäi 77% (NISP=611). Määratud luude hulgas on esindatud pea kõik põhilised klassid: imetajad, linnud, kalad ja kahepaiksed.

Takson	NISP	%
veis	29	3.7
lammas/kits	59	7.5
siga	8	1.0
hobune	7	0.9
koer	1	0.1
hüljes	3	0.4
jänes	2	0.3
pisiimetaja	31	3.9
lind	22	2.8
kala	17	2.1
kahepaikne	1	0.1

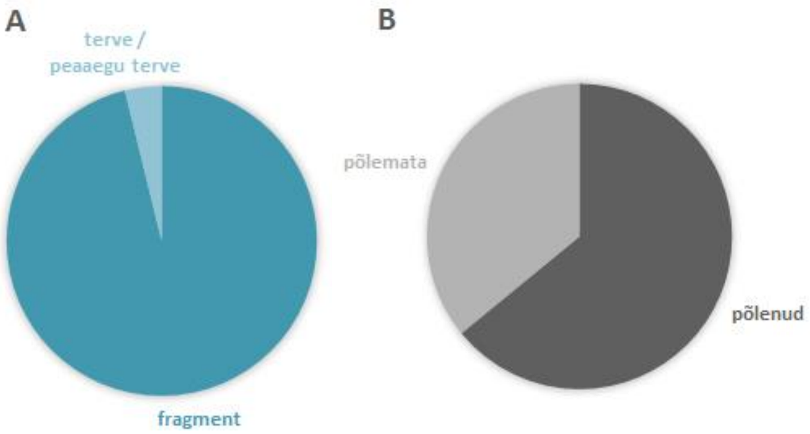


imetaja, määramatu	350	44.2
selgroogne, määramatu	261	33.0
Kokku	**791**	**100.0**

Joonis 2. Salevere Salumäe seitsmest kaevandist kogutud loomaluude taksonoomiline jaotumus koos määramata jäänud materjaliga.

Enamus Salevere luumaterjalist – 96% (NISP=761) on äärmiselt fragmenteerunud, samas kui terved või peaaegu („ca“) terved skeletielemendid moodustavad vaid 4% (NISP=30; Joonis 3A). Viimaste hulgas on ootuspäraselt enamuses väiksemad skeletielemendid: hambad ja pisiimetajate luud, mõned linnuluud, kalade selgroolülid, veise ning lamba/kitse varbalülid ja lamba kannaluu. Enam kui pooled luuleiud on põlenud (Joonis 3B). Lisaks kindlalt põlenud luudele on Tabelis 1 märgitud küsimärgiga 35 leidu, mille puhul ei ole kindel, kas luu on põlenud või ei – analüüsis/määranguandes need leiud põlenud luude hulgas ei kajastu.

A. Fragmenteeritus	**NISP**	**%**
fragment	761	96.2
terve / ca terve	30	3.8
Kokku	**791**	**100.0**
B. Põlemus	**Arv**	**%**
põlenud	508	64.2
põlemata	283	35.8
Kokku	**791**	**100.0**



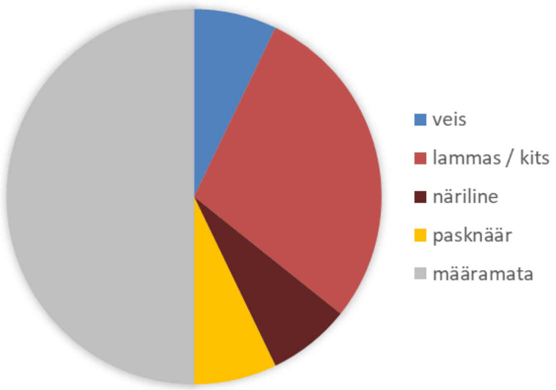
Joonis 3. Salevere Salumäelt kogutud loomaluude fragmenteeritus (A) ja põlemus (B).

Ulatuslik fragmenteeritus ja põlemus on põhjusteks, miks enamus luid jäi täpsema taksonini määramata. Enamus juhtudel oli vaid võimalik öelda, et tegemist on väikese, keskmise või suure imetajaga. Mõnel juhul oli võimalik lisada määrangu lahtrisse ka oletus, mis liiki loomaga tegemist võiks olla. Siiski, vähemal määral oli võimalik kindlaks määrata ka liik või selts, ning hoolimata materjali kehvast säilivusest ja määramata jäänud leidude suurest hulgast on saadud liikide nimekiri üllatavalt mitmekülgne. Järgnevalt on esitatud kõikide kaevandite materjal eraldi.

Kaevand I (TÜ 1692)

Kaevandist I leiti vaid 14 luuleidu (Joonis 4). Neist pooled (NISP=7) jäid **määramata**, sealhulgas üks on põlenud. Määratud luudest neli koljufragmenti kuulub **lambale/kitsele**, kusjuures mõlemad oimuluufragmendid pärinevad ühelt isendilt ja mõlemad ülalõualuufragmendid kuuluvad samuti ühele isendile. Seega ei ole välistatud, et kõik neli koljufragmenti pärinevad ühe täiskasvanud lamba/kitse koljust. **Veis** on esindatud ühe terve varbalüliga, millel on lõikejäljed – varbalülidel lõikejäljed on tavaliselt seostatavad nülgimisega, aga võivad olla seotud ka toiduvalmistamisega. Veiseluu on samuti täiskasvanud looma mõõtmetega. **Pasknääri** ja **närilise** luu on tõenäoliselt materjali sattunud looduslikul teel.

Takson	NISP	%
veis	1	7.1
lammas/kits	4	28.6
näriline	1	7.1
pasknäär	1	7.1
määramata	7	50.0
Kokku	**14**	100.0

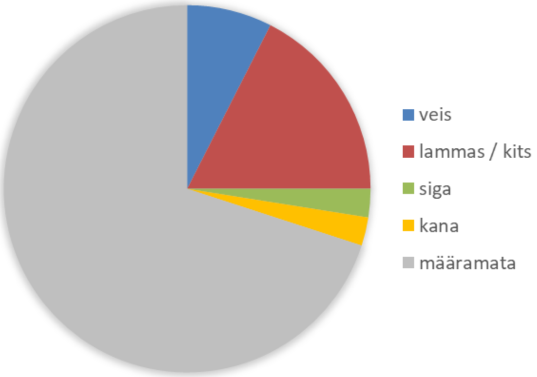


Joonis 4. Salevere Salumägi, kaevand I (TÜ 1692), luuleidude taksonoomiline jaotumus.

Kaevand II (TÜ 1693)

Kaevandist II leiti 40 luuleidu (Joonis 5). Neist 28 jäi täpsemalt **määramata**, viimaste hulgas on 26 põlenud. Ühel määramatu selgroogse (tõenäoliselt) toruluul on töötlemisjäljed. Ühel määramatu imetaja luul (võib-olla lamba/kitse) kodarluul on aga näha närimisjälgi. Kindlaid **lamba-/kitseluid** on seitse, kusjuures enamus fragmente pärineb tagajala luudest ning neli neist on põlenud. Kaks lamba-/kitseluud – TÜ 1693:11 ja TÜ 1693:26 – dateeriti radiosüsinikmeetodiga, neist esimene osutus tänapäevaseks ja teine pärineb viikingiajast. **Veiseluid** on kolm – sarvjätke, roie ja varbalüli, kusjuures nii nagu I kaevandi varbalüli puhul, on ka siinsel varbaluul lõike-, täpsemalt raiejäljed. Lisaks on nii varbalüli kui ka sarvjätke põlenud. **Siga** on esindatud vaid õlavarreluu fragmendiga, mille puhul võib oletada raiejälje olemasolu. Ainuke linnuluu II kaevandist on **kana** põlenud pindluu.

Takson	NISP	%
veis	3	7.5
lammas/kits	7	17.5
siga	1	2.5
kana	1	2.5
määramata	28	70
Kokku	**40**	**100**

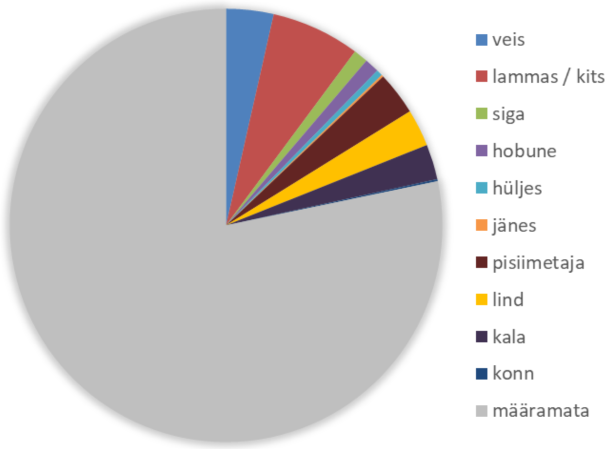


Joonis 5. Salevere Salumägi, kaevand II (TÜ 1693), luuleidude taksonoomiline jaotumus.

Kaevand III (TÜ 1783)

III kaevandist on luuleide kõige rohkem (NISP=649; Joonis 6). **Määramata** jäi neist paraku enamus (NISP=508). Viimaste hulgas on 364 luuleidu põlenud. Mõned luud kannavad hamba- ja lõikejälgi. **Veiseluudest** (NISP=23) 16 on põlenud, kaheksa luud pärinevad koljust (võimalik, et ühest ja samast), lisaks on mõned reieluu- ja roidefragmendid. **Lamba-/kitseluudest** (NISP=43) sai kindlalt lambale omistada vaid ühe kontsluu. Luid esineb igast kerepiirkonnast, 35 fragmenti on põlenud, neljal luul esinevad lõikejäljed. **Sealuud** (NISP=7) pärinevad nii koljust kui jäsemetest, viis neist on põlenud. Dateeritud sea reieluu (TÜ 1783:155:2) pärineb keskajast/varauusajast ning õlavarreluu (TÜ 1783:464:1) viikingiajast. **Hobuseluudest** (NISP=7) viis põlenud fragmenti oli võimalik omavahel kokku liita (määramise hõlbustamiseks liimiti fragmendid kokku) – saadud luu on täiskasvanud hobuse patoloogiline kämblaluu, mis on kokku kasvanud kolmanda randmeluuga ning millel esineb luuvohang. Ülejäänud kaks luufragmenti on samuti täiskasvanud suurusega isendilt: pöia- ja kabjaluu. Pöialuul esinevad paralleelsed lõikejäljed, mis viitavad nülgimisele ja/või kõõluste läbilõikamisele. Seesama pöialuu (TÜ 1783:155:1) dateeriti viikingiaega. Kabjaluu on sarnaselt patoloogilisele kämblaluule põlenud. Kõik kolm **hülgeluud** on põlenud, neist roidel võib oletada lõikejälgi. **Jäneselt** on vaid varbalüli, mis inimtegevuse jälgi ei kanna. **Kalaluid** on 17, nii koljust kui kerest, neli neist põlenud. Kaheksa kalaluud oli võimalik määrata haugile, ahvenale ja latikale. Üks ahvenaluu võib pärineda umbes 25 cm pikkuselt isendilt, latikaluu aga umbes 30–40 cm pikkuselt isendilt. Ühe haugi puhul võib oletada, et tegemist on pigem väiksema isendiga. Haugi alalõualuu (TÜ 1783:458) süsinikdateering andis tulemuseks, et antud isend pärineb neoliitikumist. **Pisiimetajate** (NISP=21) hulgas on nii mutti kui närilisi, luid pärineb nii koljust kui kerest, kusjuures mõnelt isendilt on mitu luud. Üks muti alalõualuu on põlenud. Suurima tõenäosusega võib pisiimetajate ja ka üksiku **konna** luid Saleveres pidada n-ö looduslikuks sisendiks. Samas, inimtegevuse jälgede puudumine antud luudel ei tähenda, et nad ilmtingimata inimtegevusega kuidagi seotud ei olnud. Linnuluudest (NISP=18) mitmed kuuluvad veelindudele nagu **jääkoskel**, **tõmmuvaeras**, **kaur** ja **sinikael-part**. Lisaks on üks **kanalise** ja **kurvitsalise** luu. Neli linnuluud on põlenud.

Takson	**NISP**	**%**
veis	23	3.5
lammas/kits	43	6.6
siga	7	1.1
hobune	7	1.1
hüljes	3	0.5
jänes	1	0.2
pisiimetaja	21	3.2
lind	18	2.8
kala	17	2.6
konn	1	0.2
määramata	508	78.3
Kokku	**649**	**100.0**

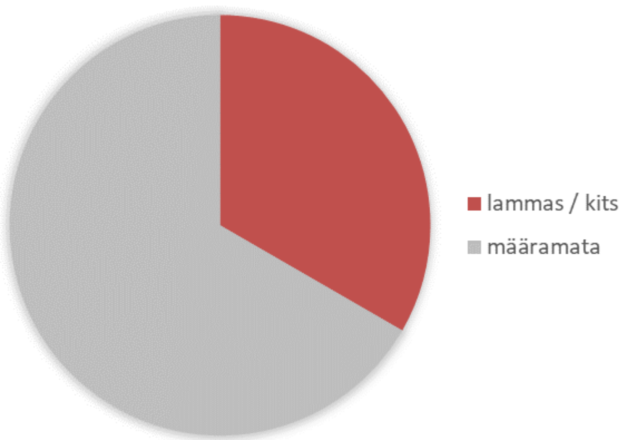


Joonis 6. Salevere Salumägi, kaevand III (TÜ 1783), luuleidude taksonoomiline jaotumus.

Kaevand IV (TÜ 1781)

IV kaevandist leiti vaid kolm loomaluud (Joonis 7). Neist ühe puhul võib kindlalt öelda, et tegemist on lamba/kitse purihambaga, kusjuures määramata jäänud hambafragment võib sellega kokku kuuluda.

Takson	**NISP**	**%**
lammas/kits	1	33.3
määramata	2	66.7
Kokku	**3**	100.0

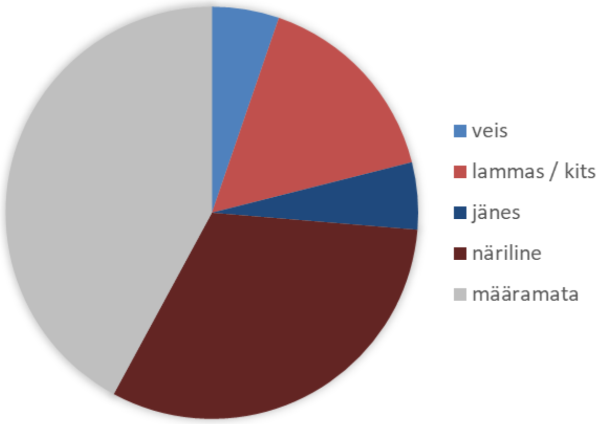


Joonis 7. Salevere Salumägi, kaevand IV (TÜ 1781), luuleidude taksonoomiline jaotumus.

Kaevand V (TÜ 1782)

Kaevandi V kokku 19st luust kaheksa jäi **määramata** (Joonis 8). **Veis** on esindatud vaid ühe sääreluu fragmendiga. Kolme **lamba/kitse** luuleiu hulgas on nii täiskasvanud kui noorloom. Ainukesel **jäneseluul** esinevad hambajäljed. Kuus **pisiimetaja** luud on materjalis tõenäoliselt juhuslikud.

Takson	NISP	%
veis	1	5.3
lammas/kits	3	15.8
jänes	1	5.3
näriline	6	31.6
määramata	8	42.1
Kokku	**19**	100.0

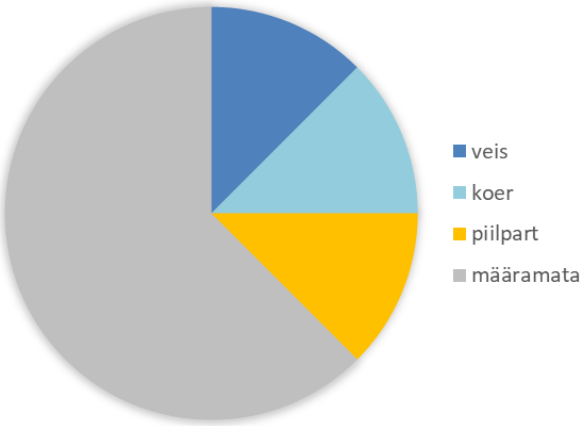


Joonis 8. Salevere Salumägi, kaevand V (TÜ 1782), luuleidude taksonoomiline jaotumus.

Kaevand VI (peanumber puudub)

VI kaevandist on vaid kaheksa luuleidu (Joonis 9). Neist viis fragmenti jäi **määramata**, sealhulgas kaks neist kuuluvad omavahel kokku ja üks on põlenud. Ainuke leitud **veise** hammas on samuti põlenud. **Koer** on esindatud kihvhambaga (hoiustamise ajal oli hammas kaheks murdunud, määramise ajal liimiti need kokku) ja **piilpart** kaarnaluuga.

Takson	NISP	%
veis	1	12.5
koer	1	12.5
piilpart	1	12.5
määramata	5	62.5
Kokku	**8**	100

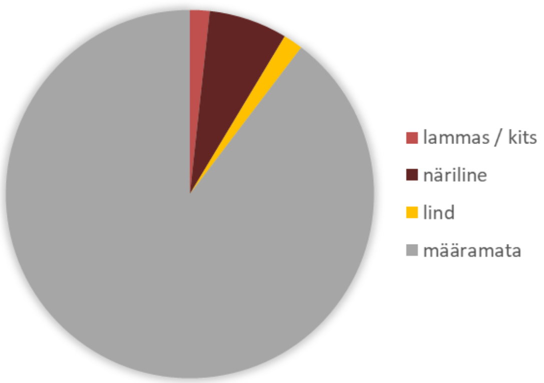


Joonis 9. Salevere Salumägi, kaevand VI (peanumber puudub), luuleidude taksonoomiline jaotumus.

Kaevand VII (TÜ 1871)

Kokku 58 luust, mis kaevandist VII leiti (Joonis 10), lausa 52 jäi **määramata**. Põlenuid on nende hulgas 35. **Lammas/kits** on esindatud vaid ühe sääreluu fragmendiga. Lisaks on materjalis ühe määramatu **noorlinnu** kaarnaluu. Neli **pisiimetaja** luud on tõenäoliselt looduslikku päritolu.

Takson	NISP	%
lammas/kits	1	1.7
näriline	4	6.9
lind	1	1.7
määramata	52	89.7
Kokku	**58**	100.0



Joonis 10. Salevere Salumägi, kaevand VII (TÜ 1871), luuleidude taksonoomiline jaotumus.

Kokkuvõtteks

Salevere Salumäe luumaterjal oli üsna raskesti määratav ja analüüsitav selle fragmenteerituse ja põlemuse tõttu. Antud aruande koostajad ei välista, et määrangutes võib esineda kaheldavusi, kuid vajadusel on ehk võimalik neid tulevikus täpsustada – uuesti üle vaatamisel või molekulaarsete meetoditega.

Salevere Salumäe loomaluud pärinevad väga laiast ajavahemikust – süsinikdateeringute põhjal neoliitikumist tänapäevani. Seetõttu ei ole võimalik teha analüüse loomade esinemise kohta teatud ajaperioodidel. Mitmete liikide puhul (metslinnud ja -imetajad) ei ole võimalik kinnitada nende seost ka inimtegevusega. Iga luuleiu interpreteerimisel või edasisel analüüsil on radiosüsinikdateering kindlasti vajalik (nt lõikejälgedega hobuseluu puhul). Olemasolevad dateeringud pakuvad aga juba huvitavaid juhtumeid ja võimalusi edasisteks uuringuteks (nt viikingiaegne patoloogiline hobuseluu).

Kirjandus

Bochenski Z.B., Tomek T. 2009. *A Key for the identification of domestic bird bones in Europe Preliminary determination.* Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Krakow.

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von den Driesch A. 1976. *Das Vermessen von Tierknochen aus vor- und frühgeschichtlichen Siedlungen.* Institut für Paläoanatomie, Domestikationsforschung und Geschichte der Tiermedizin der Universität München, München

Tabel 1. Salevere Salumägi - loomaluude määrangud

Kaevamisaastad ja peanumbrid: 2008 (TÜ 1692-1693), 2009 (TÜ 1781-1783; lisaks üks peanumbrita kogum), 2010 (TÜ 1871).
Määrajad: Eve Rannamäe (imetajad), Freydis Ehrlich (linnud) - Arheoloogia osakond, Ajaloo ja arheoloogia instituut, Tartu Ülikool.
Määramise aeg: 2012-2018.

Metoodika: Ernits ja Nahkur 2013, Bocheński ja Tomek 2009, Tomek ja Bocheński 2009 (luude atlased); von den Driesch 1976 (mõõtmise standardid; kõik mõõdud millimeetrites); Chaix ja Méniel 2001 (vanusemäärang epifüüside kinnitumise järgi).

Kasutatud võrdluskogu: Tartu Ülikooli Ajaloo ja arheoloogia instituudi zooloogiline võrdluskogu, Poola Teaduste Akadeemia zooloogiline võrdluskogu.

TÜ pe	luu nr.	kuupäev	kae-vand	leiukoha kirjeldus	kiht	0-tik	x (c	y (c	z (c	tahhü-	määrang (takson)	fr.	skeleti piirkond	skeletielemendi osa /	keh	tafonoomia, mõõdud, vanus, märkused	põlenud	Süsinikdateering
16 92	1	07.08.20 08	I	Peenra loodepoolsest	2	A	5 7	4 9	- 1		määramatu selgroogne	fr.	luu				+ (tumehall-	
16 92	2	07.08.20 08	I	Peenrakivide vahelt/alt, peenra keskosa	3	A	5 9	3 0	- 1		määramatu selgroogne	fr.	luu				+? (hall-	
16 92	3	07.08.20 08	I	Peenra loodepoolsest	3	A	2 7	4 4	- 3		kits/lammas	fr.	kolju	oimuluu	p	täiskasvanud looma suurus; tõen.kuulub kokku luuga TÜ 1692: 6		
16 92	4	07.08.20 08	I	Peenrakivide vahelt/alt, peenra keskosa	3	A	2 7	3 1	- 1		pasknäär	c a	õlavarreluu		v	mõõdud: GL=41.2 Bp=11.8 KC=3.8		
16 92	5	08.08.20 08	I	Peenra loodepoolsest	3	A	3	4 7	- 4		kits/lammas	fr.	kolju	ülalõualuu + kolm	p	mõõdud (lk 31): 22=44.0; kuulub		
16 92	6	08.08.20 08	I	Peenra loodepoolsest	3	A	3	4 7	- 3		kits/lammas	fr.	kolju	oimuluu	p	täiskasvanud looma suurus; tõen.kuulub kokku luuga TÜ 1692: 3		
16 92	7	08.08.20 08	I	Peenrakivide vahelt/alt, peenra keskosa	3	A	5 3	3 5	- 3		näriline tõen.	fr.	reieluu	proksimaalne pool	v			
16	8	08.08.20	I	Peenra kagupoolsest	3	A	1	1	-		määramatu selgroogne	fr.	luu					
16	9	08.08.20	I	Peenrakivide vahelt/alt, peenra	3	A	1	3	-		määramatu selgroogne	fr.	luu				+? (pruun-	
16	10	09.08.20	I	Peenra loodeserva kivide vahelt	3	A	7	5	-		imetaja/lind, väike	fr.	luu, toruluu	diafüüs, külg				
16	11	09.08.20	I	Peenra loodepoolsest	4	A	1	4	-		imetaja, väike	fr.	sääreluu tõen.	diafüüs				
16	13	09.08.20	I	Peenra loodepoolsest	4	A	4	4	-		imetaja, keskmine/suur	fr.	luu					
16 92	14	11.08.20 08	I	Peenrakivide vahelt/alt, peenra keskosa	5	A	1 4 0	3 7 0	- 4 6		veis	terve	varbalüli, II			proksimaalne epifüüs kinnitunud → üle 1.5 a.; mõõdud: GL=38.8 Bp=31.0 KD=24.5 Bd=26.9; lõikejälied		
16	15	2008	I	Ilma numbrita, leidude seast							kits/lammas	3	kolju	ülalõualuu + neljas	p	kuulub kokku luuga TÜ 1692:		

16 93	1	06/08/20 08	II	Kaevandi loodeserv, peenrast väljas, sügavus mõõdetud maapinnast	1	S	7 3	5 1 7	0		imetaja, v-o veis	fr.	roie				+ (tumehall)	
16 93	2	07/08/20 08	II	Peenra loodepoolne madalam osa, ruut	2	S	1 0	4 5			imetaja, v-o veis	fr.	luu, toruluu	diafüüs			+ (pruu n	
16 93	3	07/08/20 08	II	Peenra loodepoolne madalam osa	2	S	3 9	4 4			imetaja, v-o keskmine/	fr.	luu, toruluu	diafüüs			+ (must -	

16 93	4	07/08/20 08	II	Kaevandi kagupoolne osa,	2	S	2 0	4 2			siga	fr.	õlavarreluu	distaalne osa	p	distaalne epifüüs tõen. küljest raiutud		
16 93	5	07/08/20 08	II	Kaevandi loodeserv, peenrast väljas, sügavus mõõdetud maapinnast	2	S	2 7	4 8 6	- 1 9		kits/lammas tõen.	fr.	luu, v-o reieluu	diafüüs			+ (hal l-	
16 93	6	07/08/20 08	II	Kaevandi loodeserv, peenrast väljas, sügavus mõõdetud maapinnast	2	S	9 5	5 2 9	- 1 3		imetaja, v-o keskmine	fr.	luu, v-o toruluu	v-o diafüüs			+ (sinakas - hall)	
16 93	7	07/08/20 08	II	Kaevandi kagupoolne osa, peenrast väljas, ruut S1, sõelalt	2	S	3 5	5 0			imetaja, v-o suur	fr.	luu, v-o roie/epifüüs				+ (tumehall)	
16 93	8	07/08/20 08	II	Kaevandi loodeserv, peenrast väljas, sügavus mõõdetud maapinnast	2	S	4 7	5 6 7	- 1 4		kits/lammas	fr.	pöialuu	diafüüs			+ (pruu n-	
16 93	9	08.08.20 08	II	Peenra tuumik, 1.5m laiune ala	3	S	1 2	3 8	-3		imetaja, suur	fr.	luu, toruluu	diafüüs			+ (tumehall	
16 93	1 0	08.08.20 08	II	Peenra kagupoolne osa, tuumikust kagu pool, kividega piiratud ala	3	S	8 8	2 0 8	-7		kits/lammas tõen.	fr.	sääreluu tõen.	diafüüs, proksimaalne osa		hästi "kulunud"		
16 93	1 1	08.08.20 08	II	Peenra tuumik, 1.5m laiune ala, ruut N3, sõelalt	3	S	1 0 5	3 5 0	- 1 0		kits/lammas	fr.	varbalüli, III	liigespinna koht				Dateering (Poznan, 2013): > 0 BP, not to be dated; proovivõtuprotokoll nr 91; kogu luu hävines analüüsi käigus.
16 93	1 2	08.08.20 08	II	Peenra tuumik, 1.5m laiune ala, ruut S3, sõelalt	3	S	3 5	2 5	u -9		kits/lammas tõen.	fr.	sääreluu tõen.	diafüüs			+ (tumehall)	
16 93	1 3	08.08.20 08	II	Peenra kagupoolne osa, tuumikust kagu pool	3	S	3 7	1 4	- 1		veis tõen.	fr.	roie	külg				
16 93	1 4	08.08.20 08	II	Peenra kagupoolne osa, tuumikust kagu pool	3	S	1 0	1 5	- 1		imetaja, v-o kits/lammas	fr.	kolju					
16 93	1 5	08.08.20 08	II	Peenra loodepoolne madalam osa, ruut	3	S	1 0	4 3	-8		imetaja, v-o veis	fr.	luu, toruluu	diafüüs			+ (tumehall)	
16 93	1 6	08.08.20 08	II	Peenra loodepoolne	3	S	8 0	4 4	-7		määramatu selgroogne	fr.	luu	käsnaine			+ (tumehall)	
16 93	1 7	08.08.20 08	II	Kaevandi loodeserv,	3	S	8 6	5 4	- 1		imetaja, suur	fr.	luu, toruluu	diafüüs			+ (hal	
16 93	18 :1	08.08.20 08	II	Kaevandi loodeserv,	3	S	1 2	5 0	- 1		imetaja, suur	fr.	luu, v-o toruluu	v-o diafüüs			+ (hal	
16 93	18 :2	08.08.20 08	II	Kaevandi loodeserv,	3	S	1 2	5 0	- 1		määramatu selgroogne	fr.	luu, v-o toruluu			töötlemisjäljed	+ (hal	
16 93	1 9	08.08.20 08	II	Kaevandi loodeserv, peenrast väljas, ruut W1, sõelalt	3	S	3 5	5 5			imetaja, suur	fr.	luu, toruluu	diafüüs			+ (pruu n	
16 93	2 0	08.08.20 08	II	Kaevandi loodeserv,	3	S	1 0	5 9	- 1		imetaja, v-o kits/lammas	fr.	luu, v-o sääreluu	diafüüs			+ (sinakas	
16 93	2 1	08.08.20 08	II	Peenra tuumik, 1.5m laiune ala, ruut W3, sõelalt	3	S	3 5	3 5	- 1		veis tõen.	fr.	kolju	sarvjätke			+ (hal l	

1693	22	08.08.2008	II	Kaevandi loodeserv, peenrast väljas, ruut W1, sõelalt	3	S	35	55	-1		imetaja, suur	fr.	luu, tõen. toruluu				+ (must	
1693	23:1	08.08.2008	II	Peenra tuumik, 1.5m laiune ala	3	S	90	38	-9		määramatu selgroogne	fr.	luu, lameluu				+ (hall)	
1693	23:2	08.08.2008	II	Peenra tuumik, 1.5m laiune ala	3	S	90	38	-9		imetaja, v-o koer	2 fr	reieluu	distaalne epifüüs			+ (must)	
1693	24	09.08.2008	II	Peenra tuumik, 1.5m laiune ala, sügavus	4	S	12	26	-3		imetaja, suur	fr.	luu, v-o toru-/alalõualuu				+ (hal	
1693	25	09.08.2008	II	Peenra tuumik, 1.5m laiune ala, sissekaeve edelaservas,	4	S	38	407	-34		määramatu selgroogne	fr.	luu, toruluu				+ (must-tumepr	
1693	26	09.08.2008	II	Peenra loodepoolne madalam osa, sügavus mõõdetud maapinnast	4	S	136	441	-25		kits/lammas	fr.	reieluu	diafüüs, distaalne osa	v			Dateering (Poznan, 2013): 1205±30 BP; proovivõtuprotokoll nr 92; kogu luu hävines
1693	27	09.08.2008	II	Kaevandi loodeserv, peenrast väljas	4	S	13	59			imetaja, v-o kits/lammas	fr.	luu, v-o kodarluu	diafüüs, distaalne osa		hambajäljed	+ (tumehall-valge)	
1693	28	09.08.2008	II	Peenra tuumik, 1.5m laiune ala,	4	S	13	30			veis	2 fr	varbalüli, I			raiejälg palmaarsel küljel	+ (pruu	
1693	29:1	09.08.2008	II	Peenra tuumik, 1.5m laiune ala,	4	S	11	40	u -15		määramatu selgroogne	fr.	luu					
1693	29:2	09.08.2008	II	Peenra tuumik, 1.5m laiune ala,	4	S	11	40	u -15		kits/lammas	fr.	sääreluu	diafüüs			+ (beež-valge)	
1693	30	09.08.2008	II	Peenra tuumik, 1.5m laiune ala	4	S	35	24	-1		imetaja, v-o veis/hobune	fr.	lüli, tõen. rinnalüli	ogajätke			+ (pruu	
1693	31	09.08.2008	II	Peenra kagupoolne osa, tuumikust kagu pool, sõelalt	4	S	10	20			määramatu selgroogne	fr.	luu			põlemisest deformeerunud	+ (tumehall-valge)	
1693	32	10.08.2008	II	Peenra loodepoolne madalam osa, sissekaeve edelaservas, sõelalt	5	S	35	450			määramatu selgroogne	fr.	luu				+ (tumepruun)	
1693	33	10.08.2008	II	Peenra loodepoolne madalam osa, sissekaeve edelaservas, ruut W2, sõelalt	5	S	35	450			määramatu selgroogne	fr.	luu				+ (must-tumepruun)	
1693	34	10.08.2008	II	Peenra loodepoolne madalam osa, sissekaeve edelaservas, ruut W2, sõelalt	5	S	35	450			imetaja, keskmine	fr.	reieluu tõen.	diafüüs			+ (beež-hall)	
1693	35	10.08.2008	II	Peenra loodepoolne madalam osa, sissekaeve edelaservas, ruut W2, sõelalt	5	S	35	450			määramatu selgroogne	fr.	luu				+ (beež-hall)	
1693	36	10.08.2008	II	Peenra loodepoolne madalam osa, sügavus mõõdetud maapinnast	5	S	80	461	-38		kana	2 fr.	pindluu	proksimaalne ots	p		+ (tumehall)	

16 93	3 7	08/08/20 08	II	Peenra tuumik, 1.5m laiune ala, ruut N3, sõelalt	4	S	1 0	3 5			imetaja, v-o suur	fr.	luu				+ (hall)	

17 83	1	07.08.20 09	III	Põllupeenar	1					74	veis tõen.	fr.	reieluu	diafüüs, kraniaalne külg			+ (beež-hall)	
17 83	2: 1	07.08.20 09	III	Peenra ja valli	1					77	imetaja, suur	fr.	luu				+ (beež-must)	
17 83	2: 2	07.08.20 09	III	Peenra ja valli	1					77	määramatu selgroogne	fr.	luu				+ (must-	
17 83	3	07.08.20 09	III	Peenra ja valli	1					75	määramatu selgroogne	fr.	roie tõen.	külg			+ (helehal	
17 83	4	07.08.20 09	III	Peenra ja valli	1					76	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	5	07.08.20 09	III	Peenra ja valli	1					78	imetaja, keskmine	fr.	luu, tõen. toruluu	diafüüs, külg			+ (tumehall-	
17 83	6	07.08.20 09	III	Peenra ja valli	1					79	määramatu selgroogne	fr.	luu				+ (tumehall)	
17	7	07.08.20	III	Valli edelapoolne	1					80	imetaja, keskmine	fr.	luu				+ (hall)	
17 83	8	07.08.20 09	III	Peenra ja valli	1					82	imetaja, v-o siga	fr.	luu, v-o puusaluu				+ (tumehall)	
17 83	9	07.08.20 09	III	Valli edelapoolne osa	1					90	kits/lammas	fr.	puusaluu	niudeluu + veidi	p		+ (hal	
17 83	10 :1	07.08.20 09	III	Valli edelapoolne osa	1					97	imetaja, keskmine	fr.	kolju	ajukolju			+ (helehal	
17 83	10 :2	07.08.20 09	III	Valli edelapoolne osa	1					97	määramatu selgroogne	fr.	luu, v-o toru-/alalõualuu				+ (tumehall	
17 83	11	07.08.20 09	III	Valli edelapoolne osa	1					96	määramatu selgroogne	fr.	luu				+ (must-	
17 83	12	07.08.20 09	III	Valli edelapoolne osa	1					99	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (tumehall	
17 83	13	07.08.20 09	III	Valli edelapoolne osa	1					98	hüljes tõen.	fr.	roie	ventraalne ots		kaks lõikejälge? täiskasvanud?	+? (beež-hall)	
17 83	14	10.08.20 09	III	Valli edelapoolne osa	1					11 2	lammas	ter ve	kontsluu		v	mõõdud: GLl=25.7 GLm=25.4 Tm=15.7 Tl=14.2 Bd=16.2	+ (must	
17 83	15	10.08.20 09	III	Valli edelapoolne osa	1					11 3	imetaja, v-o kits/lammas	fr.	luu, v-o õlavarreluu	diafüüs, külg			+ (must	
17 83	16	10.08.20 09	III	Valli edelapoolne osa	1					11 9	imetaja, keskmine/suur	fr.	roie tõen.	külg			+ (tumehall	
17 83	17 :1	10.08.20 09	III	Valli edelapoolne osa	1					11 8	imetaja, suur	fr.	luu, v-o roie	külg			+ (tumehall)	
17 83	17 :2	10.08.20 09	III	Valli edelapoolne osa	1					11 8	kits/lammas	fr.	puusaluu	istmikuluukeha + veidi puusanappa	p		+ (tumepruun)	
17	17	10.08.20	III	Valli edelapoolne	1					11	imetaja, keskmine/suur	fr.	luu, v-o roie	serv		hambajäljed (kiskjaline)		
17 83	18 :1	10.08.20 09	III	Valli edelapoolne osa	1					10 7	imetaja, keskmine	fr.	luu, tõen. toruluu	diafüüs			+ (must	
17 83	18 :2	10.08.20 09	III	Valli edelapoolne osa	1					10 7	imetaja, v-o keskmine	fr.	luu, tõen. toruluu	diafüüs			+ (must	
17 83	18 :3	10.08.20 09	III	Valli edelapoolne osa	1					10 7	imetaja, keskmine	2 fr	kolju	alalõualuu keha			+ (tumepruun)	
17 83	19 :1	11.08.20 09	III	Peenra ja valli	1					13 1	siga tõen.	fr.	pindluu	distaalne ots	v	hambajäljed (kiskjaline)	+ (pruu	
17 83	19 :2	11.08.20 09	III	Peenra ja valli	1					13 1	imetaja	fr.	luu				+ (tumehall)	
17 83	20	11.08.20 09	III	Valli edelapoolne osa	1					13 5	imetaja, v-o kits/lammas	fr.	luu, v-o sääreluu	diafüüs, külg			+ (must-	

17 83	21	12.08.20 09	III	Kaevandi kirdeservas olev	1					18 5	imetaja, suur	fr.	luu					

17 83	22	12.08.20 09	III	Peenra ja valli	1					20 3	imetaja, keskmine/suur	fr.	puusaluu	serv		hambajäljed? (kiskjaline)	+ (hall)	
17	23	12.08.20	III	Põllupeenar	2					20	imetaja, suur	fr.	luu, v-o toruluu			paks kompaktaine		
17	23	12.08.20	III	Põllupeenar	2					20	imetaja, suur	fr.	luu, v-o abaluu					
17 83	24	12.08.20 09	III	Põllupeenar	2					20 5	imetaja, v-o suur	fr.	luu, v-o õlavarreluu	diafüüs			+ (hal	
17 83	25	12.08.20 09	III	Põllupeenar	2					20 6	hobune	fr.	kämblaluu + kolmas randmeluu		v	patoloogia: luuvohang, kämblaluu kokku kasvanud III randmeluuga; sama luu mis TÜ 1783: 45-46, 67,	+ (must-tumepr	
17	26	12.08.20	III	Põllupeenar	2					20	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	27	12.08.20 09	III	Põllupeenar	2					20 8	määramatu selgroogne	fr.	luu				+ (hall-valge)	
17 83	28 :1	12.08.20 09	III	Peenra ja valli	2					21 0	imetaja, suur	2 fr.	luu					
17 83	28 :2	12.08.20 09	III	Peenra ja valli	2					21 0	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	29	12.08.20 09	III	Peenra ja valli	2					20 9	kits/lammas	fr.	sääreluu	diafüüs, külg			+ (hal	
17 83	30	14.08.20 09	III	Kaevandi kirdeservas olev	1					22 0	haug	fr.	kolju	alalõualuu	p			
17 83	31 :1	14.08.20 09	III	Peenra ja valli vahepealse	2					21 5	kits/lammas	fr.	sääreluu	diafüüs, külg			+ (tumepruun)	
17 83	31 :2	14.08.20 09	III	Peenra ja valli	2					21 5	imetaja, v-o siga	fr.	roie	keskosa			+ (helehal	
17	32	14.08.20	III	Põllupeenar	2					21	veis tõen.	fr.	küünarluu tõen.	keskosa				
17	33	14.08.20	III	Põllupeenar	2					21	imetaja, keskmine/suur	fr.	reieluu tõen.	diafüüs, külg			+ (beež)	
17	33	14.08.20	III	Põllupeenar	2					21	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (beež)	
17	34	14.08.20	III	Põllupeenar	2					25	imetaja, suur	fr.	roie				+ (must)	
17 83	34 :2	14.08.20 09	III	Põllupeenar	2					25 5	imetaja, keskmine	fr.	roie				+? (hall-	
17 83	35	14.08.20 09	III	Valli kirdepoolne osa	1					25 6	imetaja, suur	fr.	roie tõen.	külg			+ (tumepruun)	
17 83	36	17.08.20 09	III	Põllupeenar	2					27 0	imetaja, keskmine/suur	fr.	luu				+ (tumehall)	
17	37	17.08.20	III	Põllupeenar	2					29	imetaja, keskmine/suur	2	roie tõen.	külg			+ (beež)	
17	37	17.08.20	III	Põllupeenar	2					29	imetaja, keskmine/suur	fr.	roie tõen.	keskosa			+ (pruun)	
17 83	37 :3	17.08.20 09	III	Põllupeenar	2					29 2	imetaja, kits/lammas/siga	fr.	varbalüli, I/II	distaalne külgmine osa			+ (beež)	
17 83	38	17.08.20 09	III	Põllupeenar	2					29 1	imetaja, keskmine/suur	fr.	luu				+ (tumepruun)	
17 83	39	17.08.20 09	III	Põllupeenar	2					29 0	imetaja, keskmine/suur	fr.	luu			lõikejälg	+ (tumehall)	
17	40	17.08.20	III	Põllupeenar	2					28	veis tõen.	fr.	reieluu tõen.	diafüüs, külg			+ (beež)	
17 83	41 :1	17.08.20 09	III	Põllupeenar	2					28 8	imetaja, v-o kits/lammas	fr.	sääreluu tõen.	diafüüs			+ (hall)	
17 83	41 :2	17.08.20 09	III	Põllupeenar	2					28 8	määramatu selgroogne	fr.	luu				+ (hal	
17	42	17.08.20	III	Põllupeenar	2					28	määramatu selgroogne	fr.	luu, toruluu	diafüüs			+ (hall)	
17	43	17.08.20	III	Põllupeenar	2					28	määramatu selgroogne	fr.	luu, toruluu	diafüüs			+ (hall)	
17	44	17.08.20	III	Põllupeenar	2					28	imetaja, v-o veis	fr.	roie					
17	44	17.08.20	III	Põllupeenar	2					28	imetaja, keskmine	fr.	luu, v-o sääreluu	diafüüs				

17 83	45	17.08.20 09	III	Põllupeenar	2					28 3	hobune	fr.	kämblaluu + kolmas randmeluu		v	patoloogia: luuvohang, kämblaluu kokku kasvanud III randmeluuga; sama luu mis TÜ 1783: 25, 46, 67,	+ (must-tumepr	
17 83	46	17.08.20 09	III	Põllupeenar	2					28 4	hobune	fr.	kämblaluu + kolmas randmeluu		v	patoloogia: luuvohang, kämblaluu kokku kasvanud III randmeluuga; sama luu mis TÜ 1783: 25, 45, 67,	+ (must-tumepr	
17	47	17.08.20	III	Põllupeenar	2					28	määramatu selgroogne	fr.	luu			närimisjäljed		
17	47	17.08.20	III	Põllupeenar	2					28	määramatu selgroogne	fr.	luu, v-o toruluu				+ (hall)	
17 83	48	18.08.20 09	III	Valli edelapoolne osa	2					35 9	veis tõen.	fr.	kolju	hammas, purihammas		v-o sama hammas mis TÜ 1783: 55, 61	+ (tumehall	
17 83	49	18.08.20 09	III	Valli edelapoolne osa	2					36 0	veis	ter ve	kolju	hammas, esimene/teine alumine purihammas	p	mõõdud:L=20.6 B=12.9		Dateering (Poznan, 2013): 260±30 BP; proovivõtuprotokoll nr
17 83	50	18.08.20 09	III	Valli edelapoolne osa	2					35 8	veis tõen.	fr.	roie	külg			+ (tumepruu n)	
17 83	51	18.08.20 09	III	Valli edelapoolne osa	2					36 1	veis tõen.	fr.	roie	külg			+ (tumepruu n)	
17 83	52 :1	18.08.20 09	III	Valli edelapoolne osa	2					35 7	imetaja, v-o kits/lammas	fr.	reieluu	diafüüs, külg			+ (must	
17	52	18.08.20	III	Valli edelapoolne	2					35	jääkoskel	fr.	kaarnaluu	distaalne ots puudu	p			
17	53	18.08.20	III	Põllupeenar	2					36	imetaja, keskmine	fr.	roie				+ (valge)	
17 83	55	18.08.20 09	III	Valli edelapoolne osa	2					36 6	veis	fr.	kolju	hammas, purihammas		v-o sama hammas mis TÜ 1783: 48, 61	+ (hal	
17 83	56	18.08.20 09	III	Vall edelapoolne osa	2					36 5	imetaja, keskmine	fr.	luu, tõen. toruluu	diafüüs, külg			+ (sinakas	
17 83	57	18.08.20 09	III	Vall edelapoolne osa / Peenra ja valli vahepealne	2					38 4	imetaja, v-o veis	fr.	reieluu tõen.	diafüüs, külg			+ (sinakas - hall)	
17 83	59 :1	18.08.20 09	III	Vall edelapoolne osa	2					38 5	imetaja, v-o kits/lammas	fr.	luu, v-o õlavarreluu	diafüüs, külg			+ (must	
17 83	59 :2	18.08.20 09	III	Vall edelapoolne osa	2					38 5	imetaja, keskmine/suur	fr.	luu, tõen. toruluu	diafüüs, külg			+ (sinakas	
17 83	60	18.08.20 09	III	Vall edelapoolne osa	2					38 7	imetaja, keskmine/suur	fr.	luu, v-o kolju	v-o alalõualuu			+ (tumehall)	
17 83	61	18.08.20 09	III	Vall edelapoolne osa	2					38 3	veis tõen.	fr.	kolju	hammas, purihammas		v-o sama hammas mis TÜ 1783: 48, 55	+ (pruun)	
17 83	62	18.08.20 09	III	Vall edelapoolne osa	2					38 1	imetaja, v-o kits/lammas	fr.	luu, v-o õlavarreluu	diafüüs, külg			+ (pruu	
17 83	63	18.08.20 09	III	Vall edelapoolne osa	2					38 2	imetaja, v-o kits/lammas	fr.	luu, v-o sääreluu	v-o diafüüs, külg			+ (must	
17	64	18.08.20	III	Põllupeenar	2					37	imetaja, keskmine	fr.	roie	külg				
17 83	64 :2	18.08.20 09	III	Põllupeenar	2					37 7	imetaja, keskmine/suur	fr.	luu				+ (tumehall)	
17	65	18.08.20	III	Põllupeenar	2					37	lind, keskmine	fr.	luu, toruluu	diafüüs, külg				
17	66	18.08.20	III	Põllupeenar	2					37	määramatu selgroogne	fr.	luu, tõen. toruluu				+ (hall)	
17	66	18.08.20	III	Põllupeenar	2					37	imetaja, keskmine	fr.	luu, toruluu	diafüüs			+ (hall)	
17 83	67	18.08.20 09	III	Põllupeenar	2					37 3	hobune	fr.	kämblaluu + kolmas randmeluu		v	patoloogia: luuvohang, kämblaluu kokku kasvanud III randmeluuga; sama luu mis TÜ 1783: 25, 45-46,	+ (must-tumepr	

17 83	68	18.08.20 09	III	Põllupeenar	2					37 4	määramatu selgroogne	fr.	luu				+ (beež-hall)	
17	69	19.08.20	III	Põllupeenar	2					40	imetaja, keskmine/suur	fr.	luu				+ (valge)	

17 83	70	19.08.20 09	III	Põllupeenar	2					40 5	imetaja, v-o kits/lammas	fr.	luu, v-o alalõualuu	kaudaalne nurk			+ (tumehall-	
17 83	71	19.08.20 09	III	Põllupeenar	2					40 6	imetaja, keskmine/suur	fr.	luu, tõen. toruluu	diafüüs, külg			+ (tumehall)	
17	74	19.08.20	III	Valli edelapoolne	2					39	kits/lammas tõen.	fr.	pöialuu tõen.	diafüüs, külg			+ (pruun)	
17 83	75 :1	19.08.20 09	III	Valli edelapoolne osa	2					40 2	imetaja, suur	fr.	roie	külg			+ (tumepruun)	
17	75	19.08.20	III	Valli edelapoolne	2					40	imetaja, keskmine/suur	fr.	roie	külg			+ (hall)	
17 83	76	19.08.20 09	III	Valli edelapoolne osa	2					39 5	kits/lammas	fr.	kodarluu	diafüüs, lateraalne serv		lõikejälg	+? (pruun)	
17	77	19.08.20	III	Valli edelapoolne	2					39	imetaja, suur	fr.	luu			äralöödud kild?	+ (must)	
17 83	78 :1	19.08.20 09	III	Peenra ja valli	2					41 2	imetaja, suur	fr.	luu, v-o kolju	v-o alalõualuu, külg			+ (must	
17 83	78 :2	19.08.20 09	III	Peenra ja valli	2					41 2	imetaja, suur	fr.	luu				+ (beež-hall)	
17 83	79	19.08.20 09	III	Peenra ja valli	2					41 1	imetaja, keskmine/suur	fr.	luu				+ (valge)	
17 83	80	19.08.20 09	III	Peenra ja valli	2					40 9	imetaja, keskmine/suur	fr.	luu				+ (tumehall)	
17 83	81	19.08.20 09	III	Peenra ja valli	2					40 9	imetaja, keskmine/suur	fr.	luu					
17	82	19.08.20	III	Valli edelapoolne	2					41	imetaja, keskmine/suur	fr.	reieluu tõen.	diafüüs, külg			+ (pruun)	
17 83	83	19.08.20 09	III	Valli edelapoolne osa	2					41 4	imetaja, keskmine/suur	2 fr.	roie	serv			+ (sinakas	
17	84	19.08.20	III	Valli edelapoolne	2					41	imetaja, keskmine/suur	fr.	luu					
17 83	84 :2	19.08.20 09	III	Valli edelapoolne osa	2					41 5	imetaja, keskmine/suur	fr.	luu				+ (tumepruun)	
17 83	85	19.08.20 09	III	Peenra ja valli	2					42 1	veis tõen.	fr.	roie	serv				
17 83	86	19.08.20 09	III	Peenra ja valli	2					42 0	imetaja, keskmine/suur	fr.	roie tõen.	külg			+? (pruun)	
17 83	87	19.08.20 09	III	Valli edelapoolne osa / Peenra ja valli vahepealne	2					42 2	imetaja, keskmine/suur	fr.	luu					
17	88	19.08.20	III	Valli edelapoolne	2					41	imetaja, suur	fr.	luu				+ (beež)	
17 83	89	19.08.20 09	III	Valli edelapoolne osa / Peenra ja valli vahepealne	2					41 8	imetaja, suur	fr.	luu, toru-/alalõualuu	külg			+ (beež)	
17 83	90 :1	19.08.20 09	III	Peenra ja valli	2					41 7	imetaja, suur	fr.	roie tõen.	külg			+ (beež)	
17 83	90 :2	19.08.20 09	III	Peenra ja valli	2					41 7	lind	2 fr.	luu, toruluu				+ (hall)	
17 83	91	20.08.20 09	III	Valli edelapoolne osa	2					43 1	imetaja, keskmine/suur	fr.	luu				+ (must	
17 83	92	20.08.20 09	III	Valli edelapoolne osa	2					42 9	kits/lammas	fr.	abaluu	kaelaosa	v	täiskasvanud looma suurus	+ (must	
17 83	93	20.08.20 09	III	Valli edelapoolne osa	2					43 2	imetaja, v-o kits/lammas	fr.	luu, v-o puusaluu	v-o süleluu			+? (beež-pruun)	
17 83	94	20.08.20 09	III	Valli edelapoolne osa	2					43 4	imetaja, v-o veis	fr.	luu, v-o puusaluu	v-o istmikuluuharu, serv			+? (tumepruun)	
17 83	95 :1	20.08.20 09	III	Valli edelapoolne osa	2					43 6	imetaja, suur	fr.	roie	külg			+ (must	

1783	95:2	20.08.2009	III	Valli edelapoolne osa	2					436	imetaja, keskmine	fr.	roie tõen.	külg			+ (must	
17	95	20.08.20	III	Valli edelapoolne	2					43	ahven	fr.	kolju	liigeseluu	v			

17 83	96	20.08.20 09	III	Peenra ja valli	2					45 1	imetaja, keskmine/suur	fr.	luu, v-o roie	külg			+ (hall)	
17 83	97	20.08.20 09	III	Peenra ja valli	2					44 9	imetaja, keskmine/suur	fr.	luu, v-o kolju				+ (tumepruun)	
17 83	98	20.08.20 09	III	Peenra ja valli	2					44 8	imetaja, keskmine/suur	fr.	roie tõen.	külg			+ (pruun)	
17 83	99	20.08.20 09	III	Peenra ja valli	2					44 7	kits/lammas tõen.	fr.	kodarluu tõen.	diafüüs		täiskasvanud looma suurus	+ (tumehall)	
17 83	10 0:1	20.08.20 09	III	Põllupeenar	2					45 3	imetaja, keskmine/suur	fr.	kolju tõen.				+ (beež-hall)	
17 83	10 0:2	20.08.20 09	III	Põllupeenar	2					45 3	imetaja, keskmine	fr.	luu, v-o reieluu	diafüüs, külg			+ (beež-hall)	
17	10	20.08.20	III	Põllupeenar	2					45	imetaja, suur	fr.	kolju				+ (pruun)	
17 83	10 3:1	20.08.20 09	III	Põllupeenar	2					45 7	imetaja, keskmine/suur	3 fr.	roie	külg			+ (tumehall)	
17	10	20.08.20	III	Põllupeenar	2					45	imetaja, keskmine/suur	fr.	luu					
17 83	10 4	20.08.20 09	III	Peenra ja valli	2					43 9	imetaja, suur	fr.	luu, toruluu	diafüüs, külg			+ (hal	
17	10	20.08.20	III	Valli edelapoolne	2					43	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (pruun)	
17 83	10 6	20.08.20 09	III	Peenra ja valli	2					46 6	imetaja, suur	fr.	luu, toruluu	külg			+ (tumehall)	
17 83	10 7:1	20.08.20 09	III	Peenra ja valli	2					46 3	imetaja, keskmine/suur	fr.	luu				+ (must-	
17 83	10 7:2	20.08.20 09	III	Peenra ja valli	2					46 3	imetaja, keskmine/suur	fr.	luu				+ (beež-hall)	
17 83	10 8	20.08.20 09	III	Peenra ja valli	2					46 5	imetaja, suur	fr.	luu, toruluu	diafüüs, külg				
17 83	10 9	20.08.20 09	III	Peenra ja valli	2					48 1	imetaja, keskmine	fr.	roie	keskosa			+ (tumehall	
17 83	11 0	20.08.20 09	III	Peenra ja valli	2					47 6	imetaja, keskmine/suur	fr.	luu				+ (helehal	
17 83	11 1	20.08.20 09	III	Peenra ja valli	2					47 5	imetaja, suur	fr.	luu				+ (tumehall-	
17 83	11 2	20.08.20 09	III	Peenra ja valli	2					47 7	imetaja, v-o kits/lammas	fr.	luu, v-o pöialuu	diafüüs, külg			+? (beež-pruun)	
17 83	11 3	20.08.20 09	III	Peenra ja valli	2					47 2	imetaja, suur	fr.	luu				+ (beež-hall)	
17 83	11 4	20.08.20 09	III	Peenra ja valli	2					46 8	imetaja, suur	fr.	luu, v-o toru-/alalõualuu				+ (must	
17 83	11 5:1	20.08.20 09	III	Peenra ja valli	2					46 7	imetaja, keskmine/suur	fr.	luu, v-o roie	külg			+ (tumehall)	
17 83	11 5:2	20.08.20 09	III	Peenra ja valli	2					46 7	imetaja, keskmine	fr.	luu, v-o roie	külg			+ (tumehall)	
17 83	11 5:3	20.08.20 09	III	Peenra ja valli	2					46 7	hüljes tõen.	fr.	varbalüli, II	distaalsest osast katki		kaks fr. kokku liimitud	+ (hall)	
17 83	11 5:4	20.08.20 09	III	Peenra ja valli	2					46 7	ahven	fr.	lüli			tõen. ca 25cm pikkune isend	+ (valge)	
17 83	11 6:1	20.08.20 09	III	Peenra ja valli	2					47 1	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	11 6:2	20.08.20 09	III	Peenra ja valli	2					47 1	määramatu selgroogne	fr.	roie tõen.	külg			+ (valge)	
17 83	11 6:3	20.08.20 09	III	Peenra ja valli	2					47 1	määramatu selgroogne	fr.	luu				+ (valge)	

17 83	11 6:4	20.08.20 09	III	Peenra ja valli	2					47 1	määramatu selgroogne	fr.	luu				+ (beež)	

17 83	11 6:5	20.08.20 09	III	Peenra ja valli	2					47 1	määramatu selgroogne	fr.	luu				+ (beež-valge)	
17 83	11 6:6	20.08.20 09	III	Peenra ja valli	2					47 1	lind	fr.	luu				+ (sinakas	
17 83	11 7:1	20.08.20 09	III	Peenra ja valli	2					47 3	imetaja, keskmine	fr.	roie	keskosa			+ (hall)	
17 83	11 7:2	20.08.20 09	III	Peenra ja valli	2					47 3	imetaja, v-o veis	fr.	luu, v-o sääre-/pöialuu	luu ots			+ (beež-hall)	
17 83	11 8:1	21.08.20 09	III	Peenra ja valli vahepealne	2					50 0	kits/lammas	fr.	kolju	alalõualuu, diasteemi + teise eespurihamba	p		+ (beež-hall)	
17 83	11 8:2	21.08.20 09	III	Peenra ja valli	2					50 0	imetaja, keskmine	fr.	luu			läbi lõigatud?	+ (hall)	
17 83	11 8:3	21.08.20 09	III	Peenra ja valli	2					50 0	kits/lammas	fr.	küünarluu	küünarnuki dorsaalne serv	v		+ (beež-hall)	
17 83	11 9:1	21.08.20 09	III	Peenra ja valli	2					49 9	siga	fr.	õlavarreluu	diafüüs, distaalse osa mediaalne	v		+ (sinakas	
17 83	11 9:2	21.08.20 09	III	Peenra ja valli	2					49 9	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (beež-hall)	
17 83	12 0:1	21.08.20 09	III	Põllupeenar	2					49 4	imetaja, veis/kits/lammas	fr.	kolju	lõualuu, külg, hambasombu			+ (valge)	
17 83	12 0:2	21.08.20 09	III	Põllupeenar	2					49 4	määramatu selgroogne	fr.	luu				+ (sinakas	
17 83	12 0:3	21.08.20 09	III	Põllupeenar	2					49 4	määramatu selgroogne	fr.	luu				+ (sinakas	
17 83	12 1	21.08.20 09	III	Peenra ja valli	2					49 7	imetaja, suur	fr.	luu, v-o roie	külg			+ (sinakas	
17 83	12 2:1	21.08.20 09	III	Peenra ja valli	2					49 2	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	12 2:2	21.08.20 09	III	Peenra ja valli	2					49 2	imetaja, keskmine	fr.	luu, v-o õlavarreluu	diafüüs, külg			+ (must	
17 83	12 2:3	21.08.20 09	III	Peenra ja valli	2					49 2	määramatu selgroogne	fr.	luu				+ (hall-valge)	
17 83	12 2:4	21.08.20 09	III	Peenra ja valli	2					49 2	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	12 2:5	21.08.20 09	III	Peenra ja valli	2					49 2	määramatu selgroogne	fr.	luu	v-o epifüüs,			+ (hall-valge)	
17 83	12 2:6	21.08.20 09	III	Peenra ja valli	2					49 2	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	12 2:7	21.08.20 09	III	Peenra ja valli	2					49 2	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	12 2:8	21.08.20 09	III	Peenra ja valli	2					49 2	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	12 2:9	21.08.20 09	III	Peenra ja valli	2					49 2	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	122 :10	21.08.20 09	III	Peenra ja valli	2					49 2	kits/lammas	fr.	kodarluu	diafüüs			+ (valge)	
17	12	21.08.20	III	Valli edelapoolne	2					48	määramatu selgroogne	fr.	luu				+ (beež)	
17 83	12 3:2	21.08.20 09	III	Valli edelapoolne osa	2					48 6	imetaja, keskmine	fr.	roie	külg			+ (beež-hall)	
17 83	12 4	21.08.20 09	III	Peenra ja valli	2					48 9	kits/lammas	ca	kolju	hammas, lõikeham	v	täiskasvanud looma suurus		

1783	125:1	21.08.2009	III	Peenra ja valli	2					490	määramatu selgroogne	fr.	kolju tõen.				+ (beež-hall)	
1783	125:2	21.08.2009	III	Peenra ja valli	2					490	imetaja, keskmine	fr.	reieluu tõen.	diafüüs, külg		kuulub kokku luuga TÜ 1783: 126	+ (must-hall)	

17 83	12 5:3	21.08.20 09	III	Peenra ja valli	2					49 0	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	12 5:4	21.08.20 09	III	Peenra ja valli	2					49 0	kits/lammas tõen.	fr.	küünarluu	keskosa	v		+ (must-	
17 83	12 6:1	21.08.20 09	III	Peenra ja valli	2					48 8	imetaja, keskmine	fr.	reieluu tõen.	diafüüs, külg		kuulub kokku luuga TÜ 1783: 125	+ (tumehall)	
17 83	12 6:2	21.08.20 09	III	Peenra ja valli	2					48 8	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	12 7	21.08.20 09	III	Valli edelapoolne osa	2					51 4	imetaja, väike/keskmine	fr.	luu, v-o toruluu	külg			+ (tumepruun)	
17	12	24.08.20	III	Põllupeenar	2					51	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	12 9	24.08.20 09	III	Peenra ja valli	2					52 2	imetaja, keskmine	fr.	roie	külg			+ (tumehall)	
17 83	13 0	24.08.20 09	III	Peenra ja valli	2					52 7	imetaja, keskmine	5 fr.	kolju				+ (tumehall)	
17 83	13 2	24.08.20 09	III	Peenra ja valli	2					53 0	imetaja, keskmine/suur	fr.	luu, v-o kolju	v-o alalõualuu, külg			+ (hal	
17 83	13 3	24.08.20 09	III	Valli edelapoolne osa	2					53 1	imetaja, suur	fr.	luu				+ (tumehall)	
17	13	24.08.20	III	Valli edelapoolne	2					53	kits/lammas tõen.	fr.	sääreluu tõen.	diafüüs, külg			+ (valge)	
17 83	13 5	24.08.20 09	III	Valli edelapoolne osa	2					53 2	määramatu selgroogne	fr.	luu				+ (must-	
17 83	13 6	25.08.20 09	III	Valli edelapoolne osa	2					53 9	määramatu selgroogne	fr.	kolju tõen.				+ (tumepruun)	
17 83	13 7	25.08.20 09	III	Valli edelapoolne osa	3					54 3	määramatu selgroogne	fr.	luu, v-o lüli				+ (hall-valge)	
17 83	13 8	25.08.20 09	III	Valli edelapoolne osa	3					54 2	imetaja, väike/keskmine	fr.	luu, tõen. toruluu	diafüüs, külg			+? (pruun)	
17 83	13 9	25.08.20 09	III	Valli edelapoolne osa	3					54 0	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (must-	
17 83	14 0	25.08.20 09	III	Valli edelapoolne osa	3					54 1	veis tõen.	fr.	kolju	hammas, purihamba juur			+ (must-	
17 83	14 1	25.08.20 09	III	Valli edelapoolne osa	3					54 5	imetaja, väike/keskmine	fr.	luu				+? (pruun)	
17 83	14 2:1	25.08.20 09	III	Valli edelapoolne osa	3					54 4	veis	fr.	kolju	hammas, purihammas			+ (beež-hall)	
17	14	25.08.20	III	Valli edelapoolne	3					54	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (pruun)	
17	14	25.08.20	III	Valli kirdepoolne osa	2					63	määramatu selgroogne	fr.	luu					
17 83	14 4	25.08.20 09	III	Kaevandi kirdeservas olev	2					62 7	lind	fr.	luu, toruluu	diafüüs, külg				
17 83	14 5	25.08.20 09	III	Kaevandi kirdeservas olev	3					62 5	kits/lammas	fr.	küünarluu	keskosa		v-o luu keskelt pooleks lõigatud		
17	14	25.08.20	III	Põllupeenar	3					63	imetaja, keskmine	fr.	roie	keskosa			+	
17 83	14 7:1	25.08.20 09	III	Põllupeenar	3					63 6	imetaja, suur	fr.	luu, toruluu	diafüüs, külg			+ (must	
17 83	14 7:2	25.08.20 09	III	Põllupeenar	3					63 6	määramatu selgroogne	fr.	luu				+ (must	
17 83	14 9	25.08.20 09	III	Põllupeenar	3					63 5	kits/lammas	fr.	kodarluu	diafüüs, külg			+ (beež-hall)	
17	15	25.08.20	III	Põllupeenar	3					64	imetaja, v-o keskmine	2	luu, v-o roie					
17 83	15 0:2	25.08.20 09	III	Põllupeenar	3					64 7	määramatu selgroogne	fr.	luu				+ (tumehall)	
17	15	25.08.20	III	Põllupeenar	3					64	määramatu selgroogne	fr.	luu					
17	15	25.08.20	III	Põllupeenar	3					64	määramatu selgroogne	fr.	luu				+ (must)	

17	15	25.08.20	III	Põllupeenar	3					64	imetaja, v-o suur	fr.	luu, v-o roie					

17 83	15 3	25.08.20 09	III	Põllupeenar	3					64 5	hobune	fr.	kämblaluu + kolmas randmeluu		v	patoloogia: luuvohang, kämblaluu kokku kasvanud III randmeluuga; sama luu mis TÜ 1783: 25, 45-46, 67, 153	+ (must-tumepr uun)	
17 83	15 5:1	25.08.20 09	III	Põllupeenar	3					64 1	hobune	3 fr .	pöialuu	distaalne osa	p	distaalne epifüüs kinnitunud → üle 15 kuu; mõõdud: Bd=45.1 Td=34.6; tõen.närimisjäljed + paralleelsed lõikejäljed distaalses otsas (viitavad nülgimisele / kõõluste läbilõikamisele)		Dateering (Poznan, 2013): 1215±3 BP; proovivõtuprotokoll nr 94; luu hävines analüüsi käigus
17 83	15 5:2	25.08.20 09	III	Põllupeenar	3					64 1	siga	fr.	reieluu	diafüüs	v			Dateering (Poznan, 2013): 400±30 BP; proovivõtuprotokoll nr
17 83	15 6:1	25.08.20 09	III	Põllupeenar	3					65 0	määramatu selgroogne	fr.	luu				+ (must	
17 83	15 6:2	25.08.20 09	III	Põllupeenar	3					65 0	määramatu selgroogne	fr.	luu				+ (hal	
17 83	15 6:3	25.08.20 09	III	Põllupeenar	3					65 0	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	15 7	26.08.20 09	III	Põllupeenar	3	C	2 0	5 5	- 8		määramatu selgroogne	fr.	roie	külg			+ (tumehall)	
17	15	26.08.20	III	Põllupeenar	3	C	1	8	-		määramatu selgroogne	fr.	luu/sarv					
17 83	15 9	26.08.20 09	III	Põllupeenar	3	C	1 6	2 4	- 2		imetaja, suur	fr.	luu, toru-/alalõualuu	külg			+ (must-hall-tumepruu	
17	16	26.08.20	III	Põllupeenar	3	C	1	2	-		määramatu selgroogne	fr.	roie	külg				
17 83	16 0:2	26.08.20 09	III	Põllupeenar	3	C	1 1	2 1	- 2		määramatu selgroogne	fr.	luu, v-o abaluu				+ (beež-hall)	
17 83	16 0:3	26.08.20 09	III	Põllupeenar	3	C	1 1	2 1	- 2		imetaja, suur	fr.	luu, v-o alalõua-/puusaluu				+ (hall)	
17 83	16 1:1	26.08.20 09	III	Põllupeenar	3	C	1 4	1 9	- 23		määramatu selgroogne	fr.	kolju				+ (tumehall)	
17	16	26.08.20	III	Põllupeenar	3	C	1	1	-		imetaja, v-o veis	fr.	luu, v-o kolju	v-o alalõualuu, külg			+ (hall)	
17 83	16 1:3	26.08.20 09	III	Põllupeenar	3	C	1 4	1 9	- 23		määramatu selgroogne	fr.	luu				+ (hal	
17	16	26.08.20	III	Põllupeenar	3	C	1	1	-		määramatu selgroogne	fr.	luu				+ (hall)	
17 83	16 1:5	26.08.20 09	III	Põllupeenar	3	C	1 4	1 9	- 23		kits/lammas	fr.	sääreluu	diafüüs, külg		v-o lõikejäljed	+ (beež-hall)	
17 83	16 2:1	26.08.20 09	III	Põllupeenar	3	C	1 6	2 4	- 2		määramatu selgroogne	6 fr	luu				+ (hal	
17 83	16 2:2	26.08.20 09	III	Põllupeenar	3	C	1 6	2 4	- 2		määramatu selgroogne	fr.	kolju tõen.	lõualuu, hambasombu koht tõen.			+ (beež-hall)	
17 83	16 2:3	26.08.20 09	III	Põllupeenar	3	C	1 6	2 4	- 2		määramatu selgroogne	fr.	luu, v-o roie	külg			+ (hall-valge)	
17 83	16 3	26.08.20 09	III	Põllupeenar	3	C	2 1	1 2	- 1		imetaja, keskmine	3 fr	luu				+ (hal	
17 83	16 4	26.08.20 09	III	Kaevandi kirdeservas olev	3	C	1 0	10 96	- 27		määramatu selgroogne	fr.	luu			veekahjustused?		
17 83	16 5	26.08.20 09	III	Peenra ja valli	3	C	4 8	1 8	- 2		imetaja, keskmine	fr.	luu, toruluu	külg			+ (hal	
17	16	26.08.20	III	Põllupeenar	3	C	1	2	-		määramatu selgroogne	2	luu				+ (pruun)	

17 83	16 7	26.08.20 09	III	Põllupeenar	3	C	1 8	7 6	- 9		imetaja, suur	fr.	luu, v-o toru- /alalõualuu			hästi paksu kompaktainega	+ (must	

17	16	26.08.20	III	Põllupeenar	3	C	1	6	-8		imetaja, keskmine	fr.	luu, toruluu	külg			+ (beež)	
17 83	16 9	26.08.20 09	III	Põllupeenar	3	C	1 8	9 9	- 1		määramatu selgroogne	fr.	luu				+ (beež-hall)	
17 83	17 0	26.08.20 09	III	Põllupeenar	3	C	1 8	9 0	- 1		määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	17 1	27/08/20 09	III	Kaevandi kirdeservas olev	3	B	2 9	1 1	- 35		imetaja, suur	fr.	luu, v-o kämbla-/pöialuu	diafüüs, külg				
17 83	17 2	27/08/20 09	III	Kaevandi kirdeservas olev	3	B	4 6	1 0	- 37		imetaja, suur	fr.	luu, v-o kolju					
17 83	17 3	27/08/20 09	III	Kaevandi kirdeservas olev	3	B	6 1	2 2	- 3		määramatu selgroogne	fr.	luu				+ (tumepruun)	
17 83	17 4	27/08/20 09	III	Kaevandi kirdeservas olev	3	B	1 3	1 8	- 34		imetaja, suur	fr.	luu				+ (hal	
17 83	17 5	27/08/20 09	III	Kaevandi kirdeservas olev	3	B	1 2	1 7	- 3		määramatu selgroogne	fr.	luu				+ (pruun-sinakas	
17 83	17 6	27/08/20 09	III	Kaevandi kirdeservas olev	3	B	3 8	9 5	- 39		ahven	fr.	kolju	alakaaneluu	p			
17 83	17 7	12/09/20 09	III	Põllupeenar	4	C	8 7	1 4	- 3		kits/lammas	terve	kolju	hammas, ülemine	v	mõõdud: L=16.1 B=10.6		
17 83	17 8	12/09/20 09	III	Põllupeenar	4	C	1 3	1 4	- 2		imetaja, v-o veis	fr.	randme-/kannaluu				+ (beež)	
17 83	17 9	12/09/20 09	III	Peenra ja valli vahepealse	4	C	4 5	1 2	- 3		veis tõen.	fr.	kolju tõen.	alalõualuuharu rostraalne serv tõen.			+ (tumehall-beež)	
17 83	18 0	12/09/20 09	III	Põllupeenar	4	C	7 7	1 2	- 2		imetaja, suur	fr.	kolju tõen.	alalõualuu tõen.			+ (beež-hall)	
17 83	18 1	12/09/20 09	III	Põllupeenar	4	C	1 7	1 4	- 1		imetaja, v-o kits/lammas	fr.	kolju	alalõualuu, külg, hambasompude koht				
17 83	18 2	12/09/20 09	III	Põllupeenar	4	C	1 7	1 5	- 1		määramatu selgroogne	fr.	luu, toruluu	käsnaine			+ (must	
17 83	18 3	12/09/20 09	III	Põllupeenar	4	C	1 4	1 3	- 2		määramatu selgroogne	fr.	luu				+ (beež-hall)	
17	18	12/09/20	III	Põllupeenar	4	C	5	1	-		imetaja, v-o veis/põder	fr.	küünarluu tõen.	keskosa				
17 83	18 5	12/09/20 09	III	Põllupeenar	4	C	1 7	1 9	- 2		imetaja, keskmine	fr.	luu, v-o pöialuu	külg		v-o hambajäljed (kiskjaline, nt koer)	+ (beež-hall)	
17 83	18 6	12/09/20 09	III	Peenra ja valli	4	C	4 7	1 4	- 35		imetaja, v-o kits/lammas	fr.	roie	dorsaalne osa				
17 83	18 7:1	12/09/20 09	III	Põllupeenar	4	C	3 9	3 2	- 2		imetaja, keskmine	fr.	kolju tõen.	lõualuu külg tõen.			+ (tumehall)	
17 83	18 7:2	12/09/20 09	III	Põllupeenar	4	C	3 9	3 2	- 2		määramatu selgroogne	fr.	luu				+ (beež-hall)	
17	18	12/09/20	III	Põllupeenar	4	C	2	2	-		veis tõen.	fr.	roie	serv			+ (beež)	
17 83	18 9	12/09/20 09	III	Peenra ja valli	4	C	2 3	2 9	- 2		imetaja, v-o suur	fr.	luu, v-o roie				+ (hal	
17	19	16/10/20	III	Põllupeenar	5					66	imetaja, keskmine	4	luu, v-o reieluu				+ (hall)	
17 83	19 1	20.07.20 10	III	Valli keskosa	2					99	määramatu selgroogne	2 fr	luu				+ (must-	
17 83	19 2	20.07.20 10	III	Valli keskosa	2					10 0	määramatu selgroogne	fr.	luu				+ (must	
17 83	19 3	20.07.20 10	III	Valli keskosa	2					10 2	määramatu selgroogne	fr.	luu				+ (beež-hall)	
17 83	19 4	20.07.20 10	III	Valli keskosa	2					10 1	siga tõen.	3 fr	puusaluu	niudeluuke ha +	p		+ (must	

17	19	20.07.20	III	Valli keskosa	2					10	imetaja, keskmine	fr.	luu					

17 83	19 6	20.07.20 10	III	Valli keskosa	2					11 1	määramatu selgroogne	fr.	luu				+ (must	
17 83	19 7	20.07.20 10	III	Valli keskosa	2					10 9	määramatu selgroogne	fr.	luu				+ (beež-pruun)	
17	19	20.07.20	III	Valli keskosa	2					11	imetaja, suur	fr.	luu				+ (must)	
17	19	20.07.20	III	Valli keskosa	2					11	määramatu selgroogne	fr.	luu, v-o kolju				+ (must)	
17 83	20 0	20.07.20 10	III	Valli keskosa	2					12 2	imetaja, keskmine	fr.	õlavarreluu	diafüüs, külg			+ (pruu	
17 83	20 1	20.07.20 10	III	Valli keskosa	2					11 5	hobune	fr.	varbalüli, III	proksimaalne ots		täiskasvanud looma suurus	+ (must	
17 83	20 2:1	20.07.20 10	III	Valli keskosa	2					11 6	määramatu selgroogne	fr.	luu, v-o kolju				+ (must	
17 83	20 2:2	20.07.20 10	III	Valli keskosa	2					11 6	määramatu selgroogne	fr.	luu, v-o kolju				+ (must	
17	20	20.07.20	III	Valli keskosa	2					11	määramatu selgroogne	fr.	luu				+ (must)	
17 83	20 4	20.07.20 10	III	Valli keskosa	2					12 1	imetaja, suur	fr.	luu				+ (must	
17 83	20 5	20.07.20 10	III	Valli keskosa	2					12 3	määramatu selgroogne	fr.	kolju	alalõualuu, hambasombu			+ (must	
17 83	20 6	20.07.20 10	III	Valli edelapoolne osa	3					12 4	imetaja, suur	fr.	luu				+ (beež-must)	
17	20	20.07.20	III	Valli edelapoolne	3					12	imetaja, keskmine	fr.	luu, toruluu	külg			+ (hall)	
17	20	20.07.20	III	Valli keskosa	2					11	määramatu selgroogne	fr.	luu				+ (must)	
17 83	20 9	20/07/20 10	III	Valli keskosa	2					11 7	kala	c a	lüli					
17 83	21 0:1	20.07.20 10	III	Valli keskosa	2					12 0	imetaja, suur	fr.	luu				+ (tumehall)	
17 83	21 0:2	20.07.20 10	III	Valli keskosa	2					12 0	määramatu selgroogne	fr.	luu				+ (must	
17 83	21 1	21.07.20 10	III	Valli edelapoolne osa	3					14 9	imetaja, v-o kits/lammas	fr.	luu, v-o sääreluu	diafüüs, külg			+ (beež-hall)	
17	21	21.07.20	III	Valli edelapoolne	3					15	määramatu selgroogne	fr.	luu, v-o kolju				+ (hall)	
17	21	21.07.20	III	Valli edelapoolne	3					15	määramatu selgroogne	fr.	luu				+ (beež)	
17 83	21 3:2	21.07.20 10	III	Valli edelapoolne osa	3					15 1	määramatu selgroogne	fr.	luu				+ (must	
17 83	21 4	21.07.20 10	III	Valli edelapoolne osa	3					17 3	määramatu selgroogne	fr.	luu				+ (tumepruun)	
17	21	21.07.20	III	Valli edelapoolne	3					17	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	21 5:2	21.07.20 10	III	Valli edelapoolne osa	3					17 4	määramatu selgroogne	fr.	hammas	hammas, email			+ (tumehall)	
17	21	21.07.20	III	Valli edelapoolne	3					16	imetaja, v-o keskmine	fr.	luu, v-o roie	külg			+? (beež)	
17 83	21 7	21.07.20 10	III	Valli edelapoolne osa	3					17 2	kits/lammas tõen.	fr.	sääreluu tõen.	diafüüs, külg			+ (hall-valge)	
17	21	21.07.20	III	Valli edelapoolne	3					17	määramatu selgroogne	fr.	roie tõen.	külg			+ (hall)	
17 83	21 8:2	21.07.20 10	III	Valli edelapoolne osa	3					17 0	imetaja, v-o veis	2 fr	luu, v-o kolju	v-o ülalõualuu, hambasombu			+ (tumehall)	
17 83	21 9:1	21.07.20 10	III	Valli edelapoolne osa	3					17 5	veis tõen.	3 fr	kolju tõen.	alalõualuu alaserv tõen.			+? (pruun)	
17 83	21 9:2	21.07.20 10	III	Valli edelapoolne osa	3					17 5	imetaja, keskmine	2 fr	roie	külg			+ (beež-hall)	
17 83	21 9:3	21.07.20 10	III	Valli edelapoolne osa	3					17 5	kits/lammas	2 fr	kodarluu	diafüüs, lateraalne külg	p		+ (must	
17 83	21 9:4	21.07.20 10	III	Valli edelapoolne osa	3					17 5	kits/lammas	fr.	sääreluu	diafüüs, külg			+ (tumepruun)	

17 83	21 9:5	21.07.20 10	III	Valli edelapoolne ase	3					17 5	määramatu selgroogne	fr.	luu				+ (hal	

17 83	21 9:6	21.07.20 10	III	Valli edelapoolne osa	3					17 5	kurvitsaline, vrdl.	c a	kaarnaluu		v	noor		
17	22	21.07.20	III	Valli edelapoolne	3					17	määramatu selgroogne	fr.	luu					
17 83	22 1	21.07.20 10	III	Valli edelapoolne osa / Valli keskosa	3					17 9	määramatu selgroogne	fr.	luu				+ (must)	
17 83	22 2	21.07.20 10	III	Valli edelapoolne osa	3					17 1	määramatu selgroogne	fr.	kolju	ajukolju			+ (beež-hall)	
17 83	22 3	21.07.20 10	III	Valli edelapoolne osa	3					17 6	kits/lammas tõen.	fr.	roie	ventraalne osa		pooleks lõigatud	+ (must-	
17 83	22 4	21.07.20 10	III	Valli edelapoolne osa	3					17 7	imetaja, kits/lammas/siga	fr.	õlavarreluu	diafüüs, külg			+ (tumehall)	
17 83	22 5	21.07.20 10	III	Valli edelapoolne osa	3					16 8	määramatu selgroogne	fr.	luu/sarv	v-o sarv / kompakt			+ (tumehall)	
17 83	22 6	21.07.20 10	III	Valli keskosa	2					18 0	imetaja, v-o siga	fr.	luu, v-o kolju				+ (pruu	
17 83	22 7	21.07.20 10	III	Valli keskosa	2					18 9	imetaja, v-o siga	fr.	luu, v-o kolju	v-o alalõualuu			+? (beež-pruun)	
17	22	21.07.20	III	Valli edelapoolne	3					19	määramatu selgroogne	fr.	luu				+ (beež)	
17	22	21.07.20	III	Valli edelapoolne	3					19	määramatu selgroogne	fr.	luu					
17 83	22 9:2	21.07.20 10	III	Valli edelapoolne osa	3					19 8	määramatu selgroogne	fr.	luu				+ (beež-valge)	
17 83	23 0	21.07.20 10	III	Valli edelapoolne osa	3					19 6	määramatu selgroogne	fr.	luu				+ (hall-valge)	
17 83	23 1	21.07.20 10	III	Valli edelapoolne osa	3					19 7	määramatu selgroogne	2 fr	luu				+ (hall-valge)	
17	23	21.07.20	III	Valli edelapoolne	3					19	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	23 4:1	21.07.20 10	III	Valli edelapoolne osa	3					18 6	imetaja, kits/lammas/siga	fr.	luu, v-o õlavarre-/sääreluu	diafüüs, külg		kaks hambajälge (kiskjaline)	+ (must	
17	23	21.07.20	III	Valli edelapoolne	3					18	imetaja, v-o veis	fr.	luu, v-o kolju	v-o alalõualuu				
17 83	23 5	21.07.20 10	III	Valli keskosa	2					18 8	määramatu selgroogne	fr.	luu				+ (must-	
17 83	23 6	21.07.20 10	III	Valli edelapoolne osa	3					18 7	imetaja, veis/kits/lammas	fr.	kolju	hammas, email			+ (hall-valge)	
17	23	21.07.20	III	Valli kirdepoolne osa	3					21	määramatu selgroogne	fr.	luu					
17	23	21.07.20	III	Valli kirdepoolne osa	3					21	määramatu selgroogne	fr.	luu					
17 83	23 8	21.07.20 10	III	Valli edelapoolne osa	3					20 9	imetaja, keskmine	2 fr	luu, v-o reieluu	diafüüs, külg			+ (pruun-	
17	23	21.07.20	III	Valli edelapoolne	3					20	määramatu selgroogne	fr.	luu				+ (valge)	
17	24	21.07.20	III	Valli edelapoolne	3					20	määramatu selgroogne	fr.	luu, v-o kolju	v-o hammas, email			+ (hall)	
17 83	24 1	21.07.20 10	III	Valli edelapoolne osa	3					20 7	imetaja, keskmine/suur	fr.	luu				+ (tumehall-	
17 83	24 2	21.07.20 10	III	Valli edelapoolne osa	3					20 8	imetaja, v-o veis	fr.	luu, v-o sääreluu	diafüüs, proksimaalse osa lateraalne külg	v		+ (tumehall)	
17 83	24 3	21.07.20 10	III	Valli keskosa	2					22 7	imetaja, keskmine/suur	fr.	luu				+ (must-	
17	24	21.07.20	III	Valli kirdepoolne osa	3					22	imetaja, keskmine/suur	fr.	luu					
17	24	21.07.20	III	Valli edelapoolne	3					21	imetaja, keskmine/suur	fr.	luu				+ (must)	
17	24	21.07.20	III	Valli edelapoolne	3					24	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	24 7	21.07.20 10	III	Valli edelapoolne osa	3					24 5	imetaja, v-o veis	fr.	kolju	hammas			+ (must	
17 83	24 8	21.07.20 10	III	Valli edelapoolne osa	3					24 6	imetaja, keskmine/suur	fr.	kolju	hammas			+ (beež-pruun)	
17 83	24 9	21.07.20 10	III	Valli edelapoolne osa	3					24 7	imetaja, keskmine/suur	fr.	luu				+ (beež-hall)	
17	25	21.07.20	III	Valli edelapoolne	3					24	määramatu selgroogne	fr.	luu				+ (valge)	

17 83	25 1	21.07.20 10	III	Valli edelapoolne osa	3					25 2	kits/lammas	fr.	küünarluu	diafüüs			+ (must	

17 83	25 2	21.07.20 10	III	Valli keskosa	2					26 5	imetaja, v-o veis	fr.	luu, v-o roie	külg			+ (must	
17 83	25 3	21.07.20 10	III	Valli keskosa	2					26 2	määramatu selgroogne	5 fr	luu				+ (must-	
17	25	21.07.20	III	Valli kirdepoolne osa	3					26	imetaja, suur	fr.	luu					
17 83	25 5	21.07.20 10	III	Valli kirdepoolne osa	3					26 3	jänes	ter ve	varbalüli, I			distaalne epifüüs kinnitunud; mõõdud: GL=30.8 Bp=5.9		
17	25	21.07.20	III	Valli edelapoolne	3					25	kits/lammas tõen.	2	sääreluu	diafüüs, külg			+ (beež)	
17 83	25 8:1	21.07.20 10	III	Valli edelapoolne osa	3					24 9	kits/lammas	fr.	abaluu	distaalne ots	v	tõen. hambajälg (kiskjaline)	+ (pruun-	
17	25	21.07.20	III	Valli edelapoolne	3					24	imetaja, suur	fr.	luu				+?	
17 83	25 8:3	21.07.20 10	III	Valli edelapoolne osa	3					24 9	veis tõen.	fr.	roie	külg		täiskasvanud looma suurus	+ (pruu	
17 83	25 8:4	21.07.20 10	III	Valli edelapoolne osa	3					24 9	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	25 9	21.07.20 10	III	Valli edelapoolne osa	3					25 0	imetaja, suur	fr.	luu				+ (tumehall-	
17 83	26 0	21.07.20 10	III	Peenra ja valli	3					29 2	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	26 1	21.07.20 10	III	Peenra ja valli	3					29 3	määramatu selgroogne	fr.	luu				+ (beež-hall)	
17 83	26 3	21.07.20 10	III	Peenra ja valli	3					28 9	määramatu selgroogne	fr.	luu				+ (helehall)	
17 83	26 4	21.07.20 10	III	Valli edelapoolne osa	3					28 7	määramatu selgroogne	fr.	luu, v-o kolju				+ (beež-hall)	
17	26	21.07.20	III	Valli edelapoolne	3					28	määramatu selgroogne	fr.	luu				+ (valge)	
17	26	21.07.20	III	Valli edelapoolne	3					28	imetaja, keskmine/suur	fr.	luu					
17 83	26 6:1	21.07.20 10	III	Valli edelapoolne osa	3					28 3	imetaja, keskmine/suur	fr.	luu				+ (pruu	
17	26	21.07.20	III	Valli edelapoolne	3					28	määramatu selgroogne	fr.	luu					
17 83	26 7	21.07.20 10	III	Valli edelapoolne osa	3					28 2	veis	fr.	kolju	hammas, email			+ (beež-hall)	
17 83	26 8:1	21.07.20 10	III	Valli edelapoolne osa	3					29 5	määramatu selgroogne	fr.	luu				+ (must	
17	26	21.07.20	III	Valli edelapoolne	3					29	imetaja, keskmine	fr.	roie	külg				
17	26	21.07.20	III	Valli edelapoolne	3					29	hüljes	fr.	pöialuu	proksimaalne ots	v		+ (pruun)	
17	27	21.07.20	III	Valli kirdepoolne osa	3					31	imetaja, suur	fr.	luu				+?	
17 83	27 1:1	21.07.20 10	III	Valli edelapoolne osa	3					28 5	määramatu selgroogne	fr.	luu				+ (beež-hall)	
17	27	21/07/20	III	Valli edelapoolne	3					28	määramatu selgroogne	fr.	luu					
17	27	21.07.20	III	Valli edelapoolne	3					29	määramatu selgroogne	fr.	luu				+ (beež)	
17 83	27 3:1	21.07.20 10	III	Valli edelapoolne osa	3					28 6	kits/lammas	fr.	õlavarreluu	distaalse otsa lateraalne	p	täiskasvanud looma suurus; tõen. sama luu mis TÜ 1783: 273: 2, 3	+? (beež)	
17 83	27 3:2	21.07.20 10	III	Valli edelapoolne osa	3					28 6	kits/lammas tõen.	fr.	õlavarreluu tõen.			tõen. sama luu mis TÜ 1783: 273: 1, 3	+ (hal	
17 83	27 3:3	21.07.20 10	III	Valli edelapoolne osa	3					28 6	kits/lammas tõen.	fr.	õlavarreluu tõen.			tõen. sama luu mis TÜ 1783: 273: 1, 2	+ (hal	
17	27	21.07.20	III	Valli edelapoolne	3					28	imetaja, keskmine	2	luu, tõen. toruluu	diafüüs, külg			+ (hall)	
17	27	21.07.20	III	Valli edelapoolne	3					28	imetaja, keskmine	fr.	roie	külg			+ (hall)	
17 83	27 5	21.07.20 10	III	Peenra ja valli	3					29 1	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	27 6:1	21.07.20 10	III	Valli kirdepoolne osa	3					32 0	kits/lammas tõen.	fr.	sääreluu tõen.	diafüüs, külg			+ (must-	
17	27	21.07.20	III	Valli kirdepoolne osa	3					32	veis tõen.	2	roie	dorsaalne osa, külg		tõen. hambajälg (kiskjaline)		

1783	277	21.07.2010	III	Peenra ja valli	3					321	määramatu selgroogne	fr.	luu				+ (valge)	

17	27	22.07.20	III	Valli edelapoolne	3					34	imetaja, keskmine/suur	fr.	luu				+ (beež)	
17	27	22.07.20	III	Valli edelapoolne	3					34	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	28 0:1	22.07.20 10	III	Peenra ja valli	3					35 3	imetaja, v-o kits/lammas	fr.	kolju	ajukolju			+ (hal	
17 83	28 0:2	22.07.20 10	III	Peenra ja valli	3					35 3	määramatu selgroogne	7 fr	luu			väga pisikesed fr-d	+ (hall-valge-pruun)	
17 83	28 1	22.07.20 10	III	Valli edelapoolne osa	3					34 1	siga tõen.	fr.	kolju	hammas, ülemine			+ (tumehall)	
17 83	28 2	22.07.20 10	III	Valli edelapoolne osa	3					34 3	määramatu selgroogne	fr.	luu				+ (pruu	
17	28	22.07.20	III	Valli edelapoolne	3					34	lind	fr.	luu, v-o kaarnaluu					
17	28	22.07.20	III	Valli edelapoolne	3					34	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	28 6	22.07.20 10	III	Peenra ja valli	3					35 2	määramatu selgroogne	fr.	luu				+ (helehall)	
17 83	28 7:1	22.07.20 10	III	Valli edelapoolne osa	3					34 2	imetaja, suur	fr.	luu				+ (must	
17	28	22.07.20	III	Valli edelapoolne	3					34	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	28 8:1	22.07.20 10	III	Peenra ja valli vahepealne	3					34 9	määramatu selgroogne	fr.	kolju tõen.				+ (pruun-sinakas	
17 83	28 8:2	22.07.20 10	III	Peenra ja valli	3					34 9	imetaja, keskmine/suur	fr.	luu, toruluu	diafüüs, külg			+ (valge)	
17 83	28 8:3	22.07.20 10	III	Peenra ja valli	3					34 9	kits/lammas	fr.	sääreluu	diafüüs, proksimaalse osa lateraalne külg	v		+ (beež)	
17 83	28 8:4	22.07.20 10	III	Peenra ja valli	3					34 9	kits/lammas	fr.	õlavarreluu	diafüüs, distaalne-	v	tõen. lõikejälg	+ (hall-valge)	
17 83	28 9	22.07.20 10	III	Valli edelapoolne osa / Peenra ja valli vahepealne	3					35 0	kits/lammas tõen.	fr.	sääreluu tõen.	diafüüs, külg			+ (valge)	
17 83	29 0	22.07.20 10	III	Valli edelapoolne osa / Peenra ja valli vahepealne	3					34 8	kits/lammas tõen.	fr.	sääreluu tõen.	diafüüs, külg			+ (valge)	
17 83	29 1:1	22.07.20 10	III	Peenra ja valli	3					35 4	määramatu selgroogne	fr.	luu					
17 83	29 1:2	22.07.20 10	III	Peenra ja valli	3					35 4	määramatu selgroogne	fr.	luu				+ (sinakas	
17 83	29 1:3	22.07.20 10	III	Peenra ja valli	3					35 4	lind	fr.	luu					
17 83	29 1:4	22.07.20 10	III	Peenra ja valli	3					35 4	määramatu selgroogne	fr.	luu				+? (tumepruun)	
17 83	29 1:5	22.07.20 10	III	Peenra ja valli	3					35 4	imetaja, väike	fr.	luu, toruluu	diafüüs, külg			+ (sinakas	
17 83	29 2	22.07.20 10	III	Peenra ja valli	3					37 1	määramatu selgroogne	4 fr	luu				+ (valge)	
17	29	22.07.20	III	Valli edelapoolne	3					37	imetaja, keskmine/suur	fr.	luu					
17 83	29 4	22.07.20 10	III	Kaevandi kirdervas olev	3					38 7	määramatu selgroogne	fr.	luu				+ (hal	
17	29	22.07.20	III	Valli kirdepoolne osa	3					38	määramatu selgroogne	fr.	luu					
17	29	22.07.20	III	Valli kirdepoolne osa	3						määramatu selgroogne	fr.	luu					
17	29	22.07.20	III	Valli kirdepoolne osa	3					38	määramatu selgroogne	fr.	luu, v-o kolju					
17	29	22.07.20	III	Valli kirdepoolne osa	3					38	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg				
17	29	22.07.20	III	Valli kirdepoolne osa	3					38	imetaja, keskmine/suur	fr.	luu					

17	29	22.07.20	III	Valli kirdepoolne osa	3					38	määramatu selgroogne	fr.	luu					
17	29	22.07.20	III	Valli kirdepoolne osa	3					38	hamsterlane	fr.	kolju	alalõualuu	v			

17	29	22.07.20	III	Valli edelapoolne	3					38	määramatu selgroogne	fr.	luu				+	
17 83	29 8:2	22.07.20 10	III	Valli edelapoolne osa	3					38 8	kits/lammas	fr.	puusaluu	süleluu + puusanapp	p		+ (tumehall	
17 83	29 9:1	22.07.20 10	III	Valli edelapoolne osa / Peenra ja valli vahepealne	3					38 9	imetaja, keskmine/suur	fr.	luu				+ (beež-hall)	
17 83	29 9:2	22.07.20 10	III	Valli edelapoolne osa / Peenra ja valli vahepealne	3					38 9	määramatu selgroogne	fr.	luu				+ (beež-hall)	
17 83	30 0	22.07.20 10	III	Peenra ja valli	3					39 0	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	30 1	22.07.20 10	III	Peenra ja valli	3					39 6	imetaja, keskmine/suur	fr.	luu				+? (beež)	
17 83	30 2:1	22.07.20 10	III	Peenra ja valli	3					40 0	määramatu selgroogne	fr.	luu				+ (beež-hall)	
17 83	30 2:2	22.07.20 10	III	Peenra ja valli	3					40 0	määramatu selgroogne	fr.	luu				+ (pruun)	
17 83	30 3	22.07.20 10	III	Peenra ja valli	3					39 9	veis tõen.	fr.	küünarluu tõen.	diafüüs, külg			+? (beež-hall)	
17 83	30 4	22.07.20 10	III	Peenra ja valli vahepealne	3					39 5	määramatu selgroogne	fr.	luu				+? (tumepruun)	
17 83	30 5	22.07.20 10	III	Peenra ja valli	3					39 4	imetaja, keskmine	fr.	roie	külg			+ (sinakas	
17 83	30 6	22.07.20 10	III	Valli edelapoolne osa	3					39 8	määramatu selgroogne	fr.	luu				+ (beež-valge)	
17 83	30 8	22.07.20 10	III	Peenra ja valli	3					40 1	imetaja, v-o kits/lammas	fr.	kolju	ajukolju				
17	31	22.07.20	III	Valli edelapoolne	3					40	määramatu selgroogne	fr.	luu				+ (valge)	
17	31	22.07.20	III	Valli edelapoolne	3					40	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	31 0:3	22.07.20 10	III	Valli edelapoolne osa	3					40 8	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	31 1:1	22.07.20 10	III	Peenra ja valli	3					41 0	imetaja, keskmine/suur	fr.	luu, õlavarre-/reieluu	proksimaalne epifüüs		läbi lõigatud	+ (sinakas	
17 83	31 1:2	22.07.20 10	III	Peenra ja valli	3					41 0	määramatu selgroogne	fr.	luu, v-o kolju				+ (sinakas-	
17 83	31 1:3	22.07.20 10	III	Peenra ja valli	3					41 0	imetaja, v-o siga	fr.	kolju tõen.	ülalõualuu külg tõen.			+? (beež-hall)	
17 83	31 2	22.07.20 10	III	Peenra ja valli vahepealne	3					40 6	imetaja, v-o veis	fr.	roie tõen.	külg			+? (tumepruun)	
17 83	31 3	22.07.20 10	III	Peenra ja valli vahepealne	3					41 2	imetaja, v-o kits/lammas	fr.	sääreluu	diafüüs	p	noor, v-o isegi loode? (umbkaudsed mõõdud: KD=5.0 GL=ca 35)	+ (sinakas valge)	
17 83	31 4	22.07.20 10	III	Valli edelapoolne osa	3					41 1	imetaja, keskmine/suur	2 fr.	luu				+ (beež-hall)	
17 83	31 5	22.07.20 10	III	Peenra ja valli	3					40 5	imetaja, keskmine	fr.	luu				+ (hall)	
17 83	31 6	22.07.20 10	III	Valli edelapoolne osa	3					40 9	kanaline, vrdl. kodukana	fr.	sääreluu	diafüüs, distaalne külg	p		+ (sinakas	
17 83	31 7	22.07.20 10	III	Peenra ja valli	3					40 7	määramatu selgroogne	fr.	kolju tõen.	ülalõualuu tõen.			+? (beež-hall)	
17 83	31 8	22.07.20 10	III	Peenra ja valli	3					41 3	imetaja, v-o kits/lammas	fr.	kolju	ajukolju			+? (beež-hall)	

17 83	31 9:1	22.07.20 10	III	Peenra ja valli	3					42 2	kits/lammas tõen.	2 fr	sääreluu	diafüüs, külg			+ (hall-valge)	

17 83	31 9:2	22.07.20 10	III	Peenra ja valli	3					42 2	imetaja, keskmine/suur	fr.	luu				+ (tumehall)	
17 83	31 9:3	22.07.20 10	III	Peenra ja valli	3					42 2	imetaja, v-o veis	fr.	luu, v-o proksimaalne seesamluu				+ (pruu n	
17 83	32 0	22.07.20 10	III	Peenra ja valli	3					44 5	siga tõen.	fr.	kolju	hammas, juur			+ (hal	
17 83	32 1	22.07.20 10	III	Peenra ja valli	3					44 6	imetaja, keskmine/suur	fr.	luu, toruluu	diafüüs, külg			+ (valge)	
17 83	32 2	22.07.20 10	III	Valli edelapoolne osa	3					44 3	imetaja, keskmine/suur	fr.	luu				+ (beež-hall)	
17	32	22.07.20	III	Valli edelapoolne	3					44	haug tõen.	fr.	lüli				+ (hall)	
17 83	32 4	22.07.20 10	III	Peenra ja valli	3					44 4	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (hall-valge)	
17 83	32 5:1	22.07.20 10	III	Kaevandi kirdervas olev	3					48 7	määramatu selgroogne	fr.	luu					
17	32	22.07.20	III	Valli kirdepoolne osa	3					48	veis tõen.	fr.	õlavarreluu	õlavarreluu-pea		täiskasvanud looma suurus		
17 83	32 7:1	22.07.20 10	III	Peenra ja valli	3					50 1	imetaja, keskmine/suur	fr.	kolju				+ (valge)	
17 83	32 7:2	22.07.20 10	III	Peenra ja valli	3					50 1	määramatu selgroogne	fr.	luu				+? (tumehall)	
17 83	32 8:1	22.07.20 10	III	Valli kirdepoolne osa	3					50 8	imetaja, suur	fr.	luu				+ (tumepruu n)	
17	32	22.07.20	III	Valli kirdepoolne osa	3					50	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	32 9:1	22.07.20 10	III	Kaevandi kirdervas olev	3					50 7	imetaja, suur	fr.	luu					
17 83	32 9:2	22.07.20 10	III	Kaevandi kirdervas olev	3					50 7	lind, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (sinakas	
17 83	33 1:1	23.07.20 10	III	Peenra ja valli	3					53 5	määramatu selgroogne	fr.	luu					
17 83	33 1:2	23.07.20 10	III	Peenra ja valli	3					53 5	määramatu selgroogne	fr.	luu					
17 83	33 1:3	23.07.20 10	III	Peenra ja valli	3					53 5	määramatu selgroogne	fr.	luu					
17 83	33 2:1	23.07.20 10	III	Peenra ja valli	3					53 4	määramatu selgroogne	fr.	luu				+ (must)	
17 83	33 2:2	23.07.20 10	III	Peenra ja valli	3					53 4	määramatu selgroogne	fr.	luu					
17 83	33 2:3	23.07.20 10	III	Peenra ja valli	3					53 4	määramatu selgroogne	fr.	hammas	hammas, email				
17 83	33 3:1	23.07.20 10	III	Peenra ja valli	3					53 2	määramatu selgroogne	fr.	luu				+ (sinakas	
17 83	33 3:2	23.07.20 10	III	Peenra ja valli	3					53 2	määramatu selgroogne	fr.	luu				+? (pruun)	
17 83	33 4	23.07.20 10	III	Peenra ja valli	3					53 3	imetaja, keskmine	fr.	roie tõen.	külg				
17	33	23.07.20	III	Valli kirdepoolne osa	3					54	imetaja, suur	fr.	luu					
17	33	23.07.20	III	Valli kirdepoolne osa	3					54	imetaja, keskmine/suur	fr.	luu					
17	33	23.07.20	III	Valli kirdepoolne osa	3						määramatu selgroogne	fr.	luu					
17	33	23.07.20	III	Valli kirdepoolne osa	3						määramatu selgroogne	fr.	luu					
17 83	33 6:4	23.07.20 10	III	Valli kirdepoolne osa	3						hamsterlane	ter ve	kolju	hammas, purihammas				
17	33	23.07.20	III	Valli kirdepoolne osa	3					54	imetaja, suur	fr.	luu					

17 83	33 8	23.07.20 10	III	Peenra ja valli	3					53 1	kits/lammas	fr.	roie	dorsaalne ots			+ (hall)	
17	33	23.07.20	III	Valli kirdepoolne osa	3					55	imetaja, keskmine/suur	fr.	luu					

17 83	34 0	23.07.20 10	III	Peenra ja valli						54 8	imetaja, keskmine/suur	fr.	luu/hammas	v-o hammas, email				
17 83	34 1	23.07.20 10	III	Peenra ja valli						55 4	kits/lammas tõen.	fr.	varbalüli, I	distaalne külgmine osa		täiskasvanud looma suurus		
17 83	34 2	23.07.20 10	III	Kaevandi kirdervas olev	4					58 8	määramatu selgroogne	fr.	luu					
17 83	34 3:1	23.07.20 10	III	Kaevandi kirdervas olev	4					59 3	imetaja, v-o kits/lammas	fr.	luu, v-o kämbla-/pöialuu	külg				
17 83	34 3:2	23.07.20 10	III	Kaevandi kirdervas olev	4					59 3	määramatu selgroogne	fr.	luu					
17 83	34 4:1	23.07.20 10	III	Kaevandi kirdervas olev	4					59 4	määramatu selgroogne	fr.	luu					
17 83	34 4:2	23.07.20 10	III	Kaevandi kirdervas olev	4					59 4	määramatu selgroogne	fr.	luu					
17 83	34 5:1	23.07.20 10	III	Kaevandi kirdervas olev	4					59 5	imetaja, keskmine/suur	fr.	luu, v-o roie	külg				
17 83	34 5:2	23.07.20 10	III	Kaevandi kirdervas olev	4					59 5	määramatu selgroogne	fr.	kolju tõen.					
17	34	26.07.20	III	Valli kirdepoolne osa	4					72	kala	fr.	luu					
17	34	26.07.20	III	Valli kirdepoolne osa	4						määramatu selgroogne	fr.	luu				+ (valge)	
17	34	26.07.20	III	Valli kirdepoolne osa	4					73	määramatu selgroogne	fr.	luu					
17	34	26.07.20	III	Valli kirdepoolne osa	4					75	imetaja, keskmine/suur	fr.	luu					
17 83	34 9	26.07.20 10	III	Valli keskosa	3					76 0	imetaja, keskmine/suur	fr.	luu				+ (must	
17 83	35 1:1	26.07.20 10	III	Valli keskosa	3					80 3	kits/lammas	7 fr	sääreluu	distaalne ots	v	distaalne epifüüs kinnitunud → üle 1.5-2 a.; lõikejälg dorsaalsel küljel; sama luu mis TÜ 1783: 356		
17 83	35 1:2	26.07.20 10	III	Valli keskosa	3					80 3	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg		v-o sama luu mis TÜ 1783: 351:1, 356; põlenud on ainult üks ots	+ (must)	
17	35	26.07.20	III	Valli kirdepoolne osa	4					78	määramatu selgroogne	fr.	luu					
17	35	26.07.20	III	Valli kirdepoolne osa	4						määramatu selgroogne	fr.	luu					
17	35	26.07.20	III	Valli kirdepoolne osa	4					79	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	35 5	26.07.20 10	III	Valli keskosa	3					80 5	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg		tõen. kuulub kokku luuga TÜ 1783: 351:2; ainult ots põlenud	+ (must)	
17	35	26.07.20	III	Valli keskosa	3					85	kits/lammas	fr.	sääreluu	diafüüs, külg		sama luu mis TÜ 1783: 351		
17 83	35 7	26.07.20 10	III	Valli keskosa	3					85 7	imetaja, keskmine/suur	fr.	luu				+ (sinakas	
17 83	35 8	26.07.20 10	III	Valli kirdepoolne osa	4					85 9	imetaja, suur	fr.	luu				+ (sinakas	
17	35	26.07.20	III	Valli kirdepoolne osa	4					86	imetaja, suur	fr.	luu				+?	
17 83	36 0	26.07.20 10	III	Valli edelapoolne osa	4					85 5	imetaja, keskmine/suur	fr.	luu				+ (hall-valge)	
17	36	26.07.20	III	Valli edelapoolne	4					85	imetaja, keskmine/suur	fr.	luu, v-o roie					
17 83	36 3	26.07.20 10	III	Valli keskosa	3					85 8	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	36 4	27.07.20 10	III	Valli edelapoolne osa	4					93 1	imetaja, suur	2 fr.	luu				+ (hall-valge)	
17 83	36 5	27.07.20 10	III	Valli edelapoolne osa	4					93 0	imetaja, suur	fr.	luu	käsnaine			+ (hall-valge)	
17 83	36 6	27.07.20 10	III	Valli edelapoolne osa	4					92 9	kits/lammas	fr.	sääreluu	diafüüs, külg		täiskasvanud looma suurus	+ (must	

17 83	36 7	27.07.20 10	III	Valli keskosa	3					92 7	imetaja, keskmine/suur	fr.	kolju	ülalõualuu			+ (must	
17 83	36 8	27.07.20 10	III	Valli keskosa	3					92 8	imetaja, keskmine/suur	3 fr	luu				+ (must	

17 83	36 9	27.07.20 10	III	Valli keskosa	3					93 2	imetaja, v-o kits/lammas	fr.	kolju tõen.	lõualuu tõen., v-o				
17 83	37 0	27.07.20 10	III	Valli kirdepoolne osa	4					93 3	imetaja, keskmine/suur	fr.	luu				+ (beež-hall)	
17 83	37 1	27.07.20 10	III	Valli keskosa	3					94 4	imetaja, keskmine/suur	fr.	luu				+ (sinakas	
17 83	37 2:1	27.07.20 10	III	Valli keskosa	3					94 5	imetaja, keskmine	fr.	lüli	epifüüs, kinnitumata			+ (hall-valge)	
17 83	37 2:2	27.07.20 10	III	Valli keskosa	3					94 5	määramatu selgroogne	fr.	luu				+ (hall-valge)	
17 83	37 3	27.07.20 10	III	Valli keskosa	3					94 6	imetaja, suur	fr.	roie	külg			+ (sinakas	
17	37	27.07.20	III	Valli kirdepoolne osa	4					94	imetaja, keskmine/suur	fr.	luu				+ (valge)	
17	37	27.07.20	III	Valli kirdepoolne osa	4					94	imetaja, keskmine/suur	fr.	luu					
17 83	37 6	27.07.20 10	III	Valli keskosa	3					97 9	imetaja, keskmine/suur	fr.	luu				+ (sinakas-	
17	37	27.07.20	III	Valli keskosa	3					98	kits/lammas tõen.	fr.	õlavarreluu	diafüüs, külg		vaid osaliselt põlenud	+ (must)	
17 83	37 8	27.07.20 10	III	Valli keskosa	3					98 1	imetaja, keskmine/suur	fr.	luu				+ (beež-hall)	
17 83	37 9	27.07.20 10	III	Valli keskosa	3					98 4	imetaja, keskmine/suur	fr.	luu				+ (beež-hall)	
17	38	27.07.20	III	Valli kirdepoolne osa	4					10	imetaja, keskmine/suur	fr.	luu					
17	38	27.07.20	III	Valli kirdepoolne osa	4					10	määramatu selgroogne	fr.	luu					
17	38	27.07.20	III	Valli kirdepoolne osa	4					10	määramatu selgroogne	3	luu					
17	38	27.07.20	III	Valli kirdepoolne osa	4					10	imetaja/lind, pisi	fr.	luu, toruluu					
17	38	27.07.20	III	Valli kirdepoolne osa	4					10	määramatu selgroogne	fr.	luu					
17 83	38 4	27.07.20 10	III	Peenra ja valli	4					10 27	imetaja, keskmine/suur	fr.	luu				+ (hall-valge)	
17 83	38 5:1	28.07.20 10	III	Peenra ja valli	S O-					10 82	imetaja, keskmine	3 fr	luu, toruluu	diafüüs, külg				
17 83	38 5:2	28.07.20 10	III	Peenra ja valli	S O-					10 82	imetaja, keskmine/suur	2 fr	luu				+ (beež)	
17 83	38 6	28.07.20 10	III	Peenra ja valli	S O- pro					10 83	imetaja, suur	fr.	roie tõen.	külg			+ (pruun-sinakas	
17 83	38 7	28.07.20 10	III	Peenra ja valli	S O-					10 84	imetaja, keskmine/suur	fr.	kolju	alalõualuu, külg			+ (sinakas-	
17 83	38 8	28.07.20 10	III	Peenra ja valli	4					10 76	imetaja, keskmine/suur	fr.	roie tõen.	külg			+ (beež)	
17 83	38 9:1	28.07.20 10	III	Valli edelapoolne osa	4					10 75	määramatu selgroogne	fr.	luu				+ (tumehall)	
17	38	28.07.20	III	Valli edelapoolne	4					10	määramatu selgroogne	fr.	luu				+ (hall)	
17	39	28.07.20	III	Valli edelapoolne	4					10	kala	fr.	luu					
17	39	28.07.20	III	Valli edelapoolne	4					10	imetaja, keskmine	fr.	luu, v-o	diafüüs, külg			+ (beež)	
17	39	28.07.20	III	Valli edelapoolne	4					10	määramatu selgroogne	fr.	luu					
17	39	28.07.20	III	Valli edelapoolne	4					10	määramatu selgroogne	fr.	luu					
17	39	28.07.20	III	Valli edelapoolne	4					10	määramatu selgroogne	fr.	luu					
17 83	39 2:4	28.07.20 10	III	Valli edelapoolne osa	4					10 67	kala	fr.	roie				+ (tumehall)	
17	39	28.07.20	III	Valli edelapoolne	4					10	veis tõen.	fr.	roie	dorsaalne osa		täiskasvanud looma suurus	+ (hall)	
17	39	28.07.20	III	Valli edelapoolne	4					10	määramatu selgroogne	fr.	luu				+ (valge)	
17	39	28.07.20	III	Valli edelapoolne	4					10	määramatu selgroogne	fr.	luu					
17 83	39 4	28.07.20 10	III	Valli edelapoolne osa	4					10 64	imetaja, keskmine	fr.	roie tõen.	külg			+ (tumepruun)	

17 83	39 5	28.07.20 10	III	Valli edelapoolne osa	4					10 66	imetaja, keskmine/suur	fr.	luu, v-o kolju				+ (sinakas	

17 83	39 6:1	28.07.20 10	III	Peenra ja valli	N W-					10 74	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	39 6:2	28.07.20 10	III	Peenra ja valli	N W-					10 74	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	39 6:3	28.07.20 10	III	Peenra ja valli	N W-					10 74	määramatu selgroogne	2 fr.	roie	dorsaalne ots			+ (valge)	
17 83	39 8:1	28.07.20 10	III	Valli edelapoolne osa	N W-					10 72	imetaja, keskmine/suur	fr.	luu				+ (beež-hall)	
17 83	39 8:2	28.07.20 10	III	Valli edelapoolne osa	N W-					10 72	määramatu selgroogne	fr.	luu				+ (valge)	
17 83	39 9	28.07.20 10	III	Peenra ja valli	N W-					10 71	imetaja, v-o keskmine	2 fr.	luu, v-o kolju	v-o alalõualuu				
17 83	40 0	28.07.20 10	III	Peenra ja valli	4					11 32	imetaja, v-o veis	fr.	roie tõen.	dorsaalne ots, külg		täiskasvanud looma suurus	+ (tumehall	
17 83	40 1	28.07.20 10	III	Peenra ja valli	4					11 31	imetaja, keskmine/suur	fr.	luu					
17 83	40 2:1	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, keskmine/suur	2 fr.	luu				+ (beež-pruun)	
17 83	40 2:2	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, keskmine/suur	fr.	luu, v-o kolju				+? (beež)	
17 83	40 2:3	28.07.20 10	III	Põllupeenar	N W-					11 36	määramatu selgroogne	fr.	luu					
17 83	40 2:4	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, keskmine/suur	fr.	luu					
17 83	40 2:5	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, keskmine/suur	fr.	luu					
17 83	40 2:6	28.07.20 10	III	Põllupeenar	N W-					11 36	määramatu selgroogne	fr.	kolju				+ (hall)	
17 83	40 2:7	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, keskmine/suur	fr.	luu				+ (hall)	
17 83	40 2:8	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, keskmine/suur	fr.	luu					
17 83	40 2:9	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, keskmine/suur	fr.	roie	külg			+ (tumehall)	
17 83	402 :10	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, kits/lammas/siga	fr.	kolju tõen.	ninaluu tõen.			+ (beež-hall)	
17 83	402 :11	28.07.20 10	III	Põllupeenar	N W-					11 36	imetaja, v-o veis	fr.	lüli tõen., telglüli	telglüli hammas, serv			+ (beež-hall)	
17 83	40 3:1	28.07.20 10	III	Põllupeenar	N W-					11 41	kits/lammas	fr.	kodarluu	diafüüs		täiskasvanud looma suurus	+ (hall)	
17 83	40 3:2	28.07.20 10	III	Põllupeenar	N W-					11 41	imetaja, keskmine/suur	fr.	luu, v-o roie	külg			+ (beež-hall)	
17 83	40 4:1	28.07.20 10	III	Põllupeenar	N W-					11 40	imetaja, v-o keskmine	fr.	luu, v-o kolju	v-o ninaluu			+ (beež-hall)	
17 83	40 4:2	28.07.20 10	III	Põllupeenar	N W-					11 40	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg				
17 83	40 5	28.07.20 10	III	Põllupeenar	N W-					11 39	imetaja, suur	fr.	luu				+ (beež-hall)	
17 83	40 6	28.07.20 10	III	Põllupeenar	N W-					11 38	imetaja, suur	fr.	luu				+ (beež-must)	
17 83	40 7	28.07.20 10	III	Põllupeenar	N W-					11 42	imetaja, suur	fr.	õlavarreluu tõen.	õlavarreluu-pea		täiskasvanud looma suurus	+ (sinakas	
17	40	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine/suur	fr.	luu				+ (must)	
17	40	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine/suur	fr.	luu				+ (must)	
17	40	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine/suur	fr.	luu				+ (must)	

17 83	40 9	29.07.20 10	III	Valli keskosa	4					12 52	veis tõen.	fr.	kolju	ülalõualuu, külg			+ (beež-must)	
17 83	41 0:1	29.07.20 10	III	Valli keskosa	4					12 35	imetaja, kits/lammas/siga	fr.	lüli, rinna-/nimmelüli	epifüüs, kinnitumata			+ (hall-valge)	

17	41	29.07.20	III	Valli keskosa	4					12	imetaja, väike	fr.	luu, toruluu	diafüüs, külg				
17	41	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine/suur	fr.	kolju	hammas, juur			+ (must)	
17 83	41 2	29.07.20 10	III	Valli keskosa	4					12 34	veis tõen.	fr.	roie	serv		täiskasvanud looma suurus	+ (hal	
17	41	29.07.20	III	Valli keskosa	4					12	tõmmuvaeras	fr.	abaluu	kraniaalne ots		noor		
17	41	29.07.20	III	Valli keskosa	4					12	imetaja/lind, pisi	fr.	luu, v-o roie					
17	41	29.07.20	III	Valli keskosa	4					12	kahepaikne, konn tõen.	fr.	luu					
17	41	29.07.20	III	Valli keskosa	4					12	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	41 5:1	29.07.20 10	III	Valli keskosa	4					12 54	mutt	fr.	vaagen			v-o sama isend kes TÜ 1783: 415: 2		
17 83	41 5:2	29.07.20 10	III	Valli keskosa	4					12 54	imetaja, pisi, v-o mutt	ter ve	lüli, nimmelüli			v-o sama isend kes TÜ 1783: 415: 1		
17	41	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine/suur	fr.	kolju	ülalõualuu, külg			+ (hall)	
17	41	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (beež)	
17	41	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine/suur	fr.	kolju	hammas, email			+ (must)	
17	41	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine/suur	fr.	luu					
17	41	29.07.20	III	Valli keskosa	4					12	hamsterlane	ter	kolju	alalõualuu		väiksem hiireliik		
17 83	41 7	29.07.20 10	III	Valli keskosa	4					12 75	imetaja, keskmine/suur	fr.	kolju	hammas, email/tse				
17	41	29.07.20	III	Valli keskosa	4					12	määramatu selgroogne	fr.	luu				+ (must)	
17 83	41 9	29.07.20 10	III	Valli edelapoolne osa	5					12 84	imetaja, keskmine/suur	fr.	luu				+ (tumehall	
17	42	29.07.20	III	Valli keskosa	4					12	määramatu selgroogne	fr.	luu					
17	42	29.07.20	III	Valli keskosa	4					12	imetaja, keskmine/suur	fr.	luu					
17 83	42 2	29.07.20 10	III	Kaevandi kirdervas olev ala ja valli	5					12 87	imetaja, suur	fr.	luu					
17	42	30.07.20	III	Valli keskosa	4					13	imetaja, suur	fr.	luu, v-o reieluu	luu ots		vaid osaliselt põlenud	+ (must)	
17 83	42 4	30.07.20 10	III	Valli keskosa	4					13 03	määramatu selgroogne	2 fr	luu				+ (beež-must)	
17	42	30.07.20	III	Valli kirdepoolne osa	5					13	imetaja, v-o veis	fr.	luu, v-o kolju	v-o alalõualuu			+?	
17	42	30.07.20	III	Valli kirdepoolne osa	5					13	imetaja, keskmine/suur	2	luu					
17	42	30.07.20	III	Valli kirdepoolne osa	5					13	imetaja, suur	fr.	luu					
17	42	30.07.20	III	Valli kirdepoolne osa	5					13	imetaja, keskmine/suur	fr.	luu					
17	42	30.07.20	III	Valli kirdepoolne osa	5					13	määramatu selgroogne	fr.	luu					
17	42	30.07.20	III	Valli kirdepoolne osa	5					13	määramatu selgroogne	fr.	luu					
17	42	30.07.20	III	Valli kirdepoolne osa	5					13	määramatu selgroogne	fr.	luu					
17 83	42 9	30.07.20 10	III	Valli keskosa	4					13 34	kaur, punakurk- või järvekaur	fr.	kaarnaluu	proksimaalne ots	p	noor		
17	43	30.07.20	III	Valli kirdepoolne osa	5					13	imetaja, keskmine/suur	fr.	luu					
17	43	30.07.20	III	Valli kirdepoolne osa	5					13	kala	fr.	luu					
17	43	30.07.20	III	Valli keskosa	4					13	mutt	ter	kolju	alalõualuu	v			
17	43	30.07.20	III	Valli keskosa	4					13	imetaja, keskmine/suur	2	luu					
17 83	43 4:1	02.08.20 10	III	Valli keskosa	4					13 45	imetaja, keskmine/suur	fr.	luu				+ (tumehall)	
17 83	43 4:2	02.08.20 10	III	Valli keskosa	4					13 45	mutt	2 fr	kolju	alalõualuu			+ (tumehall)	
17 83	43 5	02.08.20 10	III	Valli keskosa	4					13 44	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (beež-must)	
17	43	02.08.20	III	Valli keskosa	4					13	määramatu selgroogne	fr.	luu				+ (hall)	
17 83	43 7:1	02.08.20 10	III	Valli keskosa	4					13 42	imetaja, keskmine/suur	fr.	luu				+ (hall-valge)	
17 83	43 7:2	02.08.20 10	III	Valli keskosa	4					13 42	näriline	fr.	kolju	hammas, lõikeham				
17	43	02.08.20	III	Valli keskosa	4					13	hamsterlane	fr.	kolju	alalõualuu	p	isend 1		
17	43	02.08.20	III	Valli keskosa	4					13	hamsterlane	fr.	kolju	alalõualuu	v	isend 2		

17	43	02.08.20	III	Valli keskosa	4					13	hamsterlane	fr.	kolju	ülalõualuu	p	isend 2		

17 83	43 9:4	02.08.20 10	III	Valli keskosa	4					13 52	hamsterlane	ter ve	kolju	hammas, alumine		isend 2		
17	44	02.08.20	III	Valli keskosa	4					13	haug tõen.	fr.	kolju	alalõualuu	p			
17	44	02.08.20	III	Valli keskosa	4					13	hamsterlane	fr.	kolju	alalõualuu	v			
17	44	02.08.20	III	Valli keskosa	4					13	hamsterlane	fr.	kolju	alalõualuu	v			
17	44	02.08.20	III	Valli keskosa	4					13	kala	fr.	luu					
17	44	02.08.20	III	Valli keskosa	4					13	näriline	fr.	küünarluu	proksimaalne ots	p			
17 83	44 1	02.08.20 10	III	Valli kirdepoolne osa	5					13 61	imetaja, keskmine/suur	2 fr	luu				+ (must	
17 83	44 2	02.08.20 10	III	Valli edelapoolne osa	5					13 64	määramatu selgroogne	fr.	luu				+ (must	
17 83	44 3:1	02.08.20 10	III	Valli edelapoolne osa	5					13 65	imetaja, keskmine/suur	fr.	kolju	hammas, email			+ (sinakas	
17	44	02.08.20	III	Valli edelapoolne	5					13	kala tõen.	fr.	luu				+ (must)	
17	44	02.08.20	III	Valli edelapoolne	5					13	määramatu selgroogne	fr.	luu				+ (must)	
17 83	44 3:4	02.08.20 10	III	Valli edelapoolne osa	5					13 65	määramatu selgroogne	fr.	luu				+ (tumehall)	
17 83	44 3:5	02.08.20 10	III	Valli edelapoolne osa	5					13 65	kala	c a	lüli					
17	44	02.08.20	III	Valli kirdepoolne osa	5					13	imetaja, suur	9	luu					
17	44	02.08.20	III	Valli kirdepoolne osa	5					13	imetaja, keskmine/suur	fr.	luu					
17 83	44 5	03.08.20 10	III	Valli kirdepoolne osa	6					14 28	kala	c a	lüli					
17	44	03.08.20	III	Valli kirdepoolne osa	6					14	määramatu selgroogne	fr.	luu					
17	44	03.08.20	III	Valli keskosa	5					14	imetaja, väike	fr.	luu, toruluu	diafüüs, külg				
17 83	44 8	03.08.20 10	III	Valli keskosa	5					14 43	lind	fr.	kolju	ülalõualuu (nokk),				
17 83	44 9	03.08.20 10	III	Valli kirdepoolne osa	6					14 42	imetaja, keskmine/suur	fr.	luu				+ (sinakas	
17 83	45 0	03.08.20 10	III	Valli keskosa	5					14 40	imetaja, keskmine/suur	fr.	luu				+ (beež-must)	
17	45	03.08.20	III	Valli keskosa	5					14	imetaja, keskmine/suur	fr.	kolju					
17	45	03.08.20	III	Valli kirdepoolne osa	6					14	imetaja, keskmine/suur	fr.	luu				+ (beež)	
17	45	03.08.20	III	Valli keskosa	5					14	imetaja, keskmine/suur	fr.	luu					
17	45	04.08.20	III	Valli kirdepoolne osa	6					14	imetaja, suur	fr.	luu					
17	45	04.08.20	III	Valli keskosa	5					14	määramatu selgroogne	fr.	luu				+ (must)	
17 83	45 7	04.08.20 10	III	Valli keskosa	5					14 89	mutt	c a	kolju	alalõualuu	p			
17 83	45 8	05.08.20 10	III	Valli keskosa	6					15 57	haug	fr.	kolju	alalõualuu	p	väiksem isend		Dateering (Beta-368208, 2013): 3940±30 BP; 13C/12C Ratio -11.8 o/oo; 15N/14N= +10.4 o/oo; Conventional Radiocarbon Age 4160 +/- 30 BP; proovivõtuprotokoll nr 96. luu hävines
17	45	06.08.20	III	Valli keskosa	6					16	lind, keskmine	fr.	pindluu	proksimaalne ots				
17 83	46 0	06.08.20 10	III	Kaevandi kirdeservas olev	8						imetaja, keskmine/suur	fr.	luu				+ (tumepruun)	
17	46	07.08.20	III	Valli keskosa	8					16	värvuline	fr.	rinnak					
17	46	07.08.20	III	Valli keskosa	8					16	imetaja/lind, väike	2	luu, toruluu	diafüüs, külg				
17	46	07.08.20	III	Valli keskosa	8					16	määramatu selgroogne	fr.	luu					

17	46	07.08.20	III	Valli keskosa	8					16	näriline	fr.	küünarluu	proksimaalne pool	v			

17 83	46 4:1	07.08.20 10	III	Valli kirdepoolne osa	9					16 63	siga	fr.	õlavarreluu	distaalne-mediaalne osa	v			Dateering (Beta-368209, 2013): 1070±30 BP; 13C/12C Ratio -20.6 o/oo; 15N/14N= +6.3 o/oo; Conventional Radiocarbon Age 1140 +/- 30 BP; proovivõtuprotokoll nr 97, luu hävines
17	46	07.08.20	III	Valli kirdepoolne osa	9					16	latikas	fr.	kolju	keelealalõualuu	v	ca 30-40 cm pikkune isend		
17 83	46 4:3	07.08.20 10	III	Valli kirdepoolne osa	9					16 63	imetaja, väike/keskmine	fr.	lüli	epifüüs, kinnitumata		noor		
17	46	07.08.20	III	Valli kirdepoolne osa	9					16	määramatu selgroogne	2	luu					
17	46	07.08.20	III	Valli keskosa	9					17	sinikael-part	fr.	abaluu	proksimaalne ots	p	mõõdud: Dc=11.4		
17	46	07.08.20	III	Valli keskosa	9					17	määramatu selgroogne	fr.	luu, v-o roie			noor?		
17	46	07.08.20	III	Valli keskosa	9					17	lind	fr.	luu, toruluu	diafüüs, külg				
17	46	07.08.20	III	Valli keskosa	9					17	imetaja, pisi	fr.	puusaluu					
17 83	46 6:1	07.08.20 10	III	Valli keskosa	9					17 02	näriline	ter ve	õlavarreluu		p	proksimaalne epifüüs kinnitumata → noor; rotisuurune liik		
17	46	07.08.20	III	Valli keskosa	9					17	hiirlane tõen.	fr.	kolju	ajukolju				
17 83	46 8:1	07.08.20 10	III	Valli keskosa	pro fiil						imetaja, keskmine	fr.	reieluu tõen.	diafüüs, külg			+ (bež-must)	
17 83	46 8:2	07.08.20 10	III	Valli keskosa	pro fiil						määramatu selgroogne	2 fr	luu				+ (must	
17	46	07.08.20	III	Valli keskosa	9					17	määramatu selgroogne	4	luu, toruluu		p			
17 83	46 9:2	07.08.20 10	III	Valli keskosa	9					17 03	kaur, punakurk- või järvekaur	fr.	kolju	alalõualuu	p			
17 83	47 0	10.08.20 09	III	Valli edelapoolne osa	1					11 5	imetaja, keskmine/suur	fr.	luu				+ (hall-valge)	
17 83	47 1	18.08.20 09	III	Peenar	2					37 1	imetaja, keskmine/suur	fr.	luu				+ (must	
17 83	47 2	18.08.20 09	III	Valli edelapoolne osa	2					38 0	imetaja	fr.	luu				+ (must	
17 83	47 3	10.08.20 09	III	Valli edelapoolne osa	1					10 6	näriline	fr.	kolju	hammas, lõikeham				
17 81	1	04.08.20 09	IV	Peenra tuumikala kividest vahetult kagu pool, ruut C2, sõelalt	1	C	4 5	1 9	- 1		imetaja, keskmine	fr.	luu					
17 81	2	05.08.20 09	IV	Kaevandi loodepoolne serv, ruut B1, sõelalt	3	C	7 7	5 1	- 2		kits/lammas	fr.	kolju	hammas, ülemine purihammas		väga kehvasti säilinud; v-o kuulub kokku luuga TÜ 1781: 3		
17 81	3	05.08.20 09	IV	Kaevandi loodepoolne serv, ruut B1, sõelalt	3	C	7 4	5 6	- 2		imetaja, v-o kits/lammas	fr.	kolju	hammas		v-o kuulub kokku luuga TÜ 1781: 2		
17 82	1	2009	V	Kaevandi põhjanurga	3	A	1	7	-		määramatu selgroogne	fr.	luu					
17 82	2	2009	V	Põllukivihunniku keskosa kivide vahelisest mullast, sõelalt	3	A	4 6 2	2 2 4	- 7 0		imetaja, v-o veis	2 fr	luu, v-o kolju	v-o lõualuu, külg				
17 82	3	2009	V	Kaevandi loodepoolne osa	4	A	1	2	-		hamsterlane	ter ve	kolju	alalõualuu	p			
17 82	4	2009	V	Kaevandi loodepoolne osa	4	A	1	2	-		määramatu selgroogne	2 fr	luu					

17 82	5	2009	V	Põllukivihunniku keskosa	4	A	5 0	3 5	- 2		kits/lammas tõen.	fr.	kolju	kuklaluu, kuklapõnt	p			

17 82	6	2009	V	Kaevandi põhjanurga lähedalt	5	A	1 4	9 2	- 1		veis	fr.	sääreluu	diafüüs, proksimaalse osa lateraalne külg	v	täiskasvanud looma suurus		
17 82	7: 1	2009	V	Kaevandi loodepoolne osa	5	A	2 1	2 7	- 3		hamsterlane	c a	kolju	alalõualuu	p			
17 82	7: 2	2009	V	Kaevandi loodepoolne osa	5	A	2 1	2 7	- 3		hamsterlane	c a	kolju	alalõualuu	p			
17 82	7: 3	2009	V	Kaevandi loodepoolne osa	5	A	2 1	2 7	- 3		näriline tõen.	c a	õlavarreluu		v			
17 82	7: 4	2009	V	Kaevandi loodepoolne osa	5	A	2 1	2 7	- 3		näriline tõen.	c a	reieluu		v			
17 82	7: 5	2009	V	Kaevandi loodepoolne osa	5	A	2 1	2 7	- 3		näriline tõen.	c a	puusaluu		p			
17 82	8: 1	2009	V	Kaevandi loodepoolne osa	5	A	2 7	3 1	- 3		imetaja, v-o kits/lammas	fr.	kolju	hammas, email				
17 82	8: 2	2009	V	Kaevandi loodepoolne osa	5	A	2 7	3 1	- 3		määramatu selgroogne	2 fr	luu					
17 82	8: 3	2009	V	Kaevandi loodepoolne osa	5	A	2 7	3 1	- 3		kits/lammas	ter ve	varbalüli, I			proksimaalne epifüüs kinnitumata → alla 7-10 kuu		
17 82	9	2009	V	Kaevandi loodepoolne osa	5	A	2 7 0	3 5 1	- 4 2		jänes	fr.	küünarluu	proksimaalne ots	p	proksimaalne epifüüs kinnitunud; mõõdud: BPC=8.3 LO=10.7 TPA=10.6 KTO=10.5; hambajäljed proksimaalse epifüüsi		
17 82	10	2009	V	Kaevandi loodepoolne osa	6	A	3 3	2 9	- 3		kits/lammas tõen.	fr.	reieluu	reieluu pea		täiskasvanud looma suurus		
17 82	11	2009	V	Kaevandi loodepoolne osa	6	A	3 0	3 4	- 3		imetaja, suur	fr.	luu					
17 82	12	2009	V	Põllukivihun niku	7	A	4 5	1 5	- 2		imetaja, keskmine/suur	fr.	luu					
17 82	1 3	2009	V	Põllukivihunniku kirdenõlvalt väiksemate kivide vahelt	3	A	4 6	1 5 4	- 3 0		imetaja, keskmine/suur	fr.	luu					
-	1	12.08.20 09	VI	Kaevandi loodepoolne osa, valliga piiratud ala	1					19 8	piilpart	te rv	kaarnaluu		v	mõõdud: GL=31.3 Lm=30.0 Bb=13.4 BF=12.3		
-	2	14.08.20 09	VI	Kaevandi loodepoolne osa, valli tuumikalast	1					22 7	koer tõen.	te rv	kolju	hammas, ülemine kihvhammas	v	kaks fr. kokku liimitud (Rannamäe); mõõdud: L=ca 21.7		
-	3	14.08.20 09	VI	Valli tuumikalast	1					22 8	määramatu selgroogne	fr.	luu					
-	4	14.08.20 09	VI	Kaevandi loodeservast, valliga piiratud ala	1					22 9	imetaja, keskmine/suur	2 fr	luu				+ (must- tumepr	
-	5	15.08.20 09	VI	Valli tuumikalast	2	N	6 1	2 0	- 7		imetaja, suur	fr.	luu, v-o toru- /alalõualuu					
-	6	15.08.20 09	VI	Kaevandi loodepoolsest osast, nõlvalt	3	N	2 9	9 4	- 7		imetaja, keskmine	fr.	roie	keskosa		kuulub kokku luuga nr 7:1 (värske murd)		
-	7: 1	15.08.20 09	VI	Kaevandi loodepoolse osa ja valli tuumikala	3	N	3 4	1 4	- 7		imetaja, keskmine	fr.	roie	keskosa		kuulub kokku luuga nr 6 (värske murd)		
-	7: 2	15.08.20 09	VI	Kaevandi loodepoolse osa ja valli tuumikala	3	N	3 4	1 4	- 7		veis tõen.	fr.	kolju	hammas, purihammas			+ (must)	

18 71	1	21/07/20 10	VII	Kaevandi kirdeserv,	2					15 5	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (hall)	

18 71	2: 1	21.07.20 10	VII	Kaevandi edelaserv,	3					23 7	hamsterlane	te rv	kolju	hammas, purihammas				
18 71	2: 2	21.07.20 10	VII	Kaevandi edelaserv,	3					23 7	määramatu selgroogne	fr.	luu				+ (sinakas	
18 71	3: 1	21.07.20 10	VII	Põllukivihunniku kirdeserv	3					24 3	imetaja, suur	fr.	kolju	hammas				
18 71	3: 2	21.07.20 10	VII	Põllukivihunniku kirdeserv	3					24 3	määramatu selgroogne	fr.	luu					
18 71	4: 1	21.07.20 10	VII	Põllukivihunniku keskelt	3					27 5	hamsterlane	te rv	kolju	hammas, eesmine/tagu mine				
18 71	4: 2	21.07.20 10	VII	Põllukivihunniku keskelt	3					27 5	imetaja, keskmine/suur	fr.	luu				+ (must	
18 71	5	21.07.20 10	VII	Põllukivihunniku keskelt, sõelalt	4					27 8	imetaja, keskmine/suur	fr.	luu				+ (sinakas	
18 71	6	22.07.20 10	VII	Kaevandi kaguserv, sõelalt	4					33 5	imetaja, suur	fr.	luu				+ (tumepruu n)	
18 71	7	22.07.20 10	VII	Põllukivihunniku kirdepoolne osa, kiviklibu vahelt	4					33 7	imetaja, suur	fr.	luu, v-o kolju	v-o alalõualuu, alaserv			+ (hall-valge-pruun)	
18 71	9	22.07.20 10	VII	Põllukivihunniku keskelt, sõelalt	4					34 0	imetaja, keskmine	fr.	luu, randme-/kannaluu				+? (tumepruu n)	
18 71	1 0	22.07.20 10	VII	Põllukivihunniku edelapoolsest	4					37 3	kits/lammas tõen.	fr.	sääreluu tõen.	diafüüs, külg		täiskasvanud looma suurus		
18 71	1 1	22.07.20 10	VII	Põllukivihunniku kirdepoolsest	4					42 3	määramatu selgroogne	fr.	luu				+ (hall-valge)	
18 71	1 2	22.07.20 10	VII	Põllukivihunniku keskelt	4					42 4	imetaja, suur	fr.	luu, v-o puusaluu				+? (bež)	
18 71	13 :1	22.07.20 10	VII	Põllukivihunniku kirdepoolsest	4					42 8	imetaja, suur	fr.	luu				+ (pruu	
18 71	13 :2	22.07.20 10	VII	Põllukivihunniku kirdepoolsest	4					42 8	määramatu selgroogne	fr.	luu				+? (bež)	
18 71	1 4	22.07.20 10	VII	Põllukivihunniku keskelt, sõelalt	4					42 9	määramatu selgroogne	fr.	luu				+ (valge)	
18 71	1 5	22.07.20 10	VII	Põllukivihunniku kirdepoolsest	4					43 0	määramatu selgroogne	fr.	luu				+ (valge)	
18 71	1 6	22.07.20 10	VII	Põllukivihunniku kirdepoolsest	4					43 1	imetaja, suur	fr.	roie tõen.	külg			+? (pruun)	
18 71	1 7	22.07.20 10	VII	Põllukivihunniku kirdepoolsest osast, looduslikult aluspõhjalt	4					43 2	määramatu selgroogne	fr.	luu				+ (hall-valge)	
18 71	1 8	22.07.20 10	VII	Põllukivihunniku kirdepoolsest osast, looduslikult paepõhjalt, sõelalt	4					45 6	määramatu selgroogne	fr.	luu					
18 71	1 9	23.07.20 10	VII	Põllukivihunniku edelaserv	5					50 4	määramatu selgroogne	fr.	luu					
18	2	23.07.20	VII	Kaevandi kaguserv	5					51	lind	fr.	kaarnaluu	rinnakupoolne osa	p	noor		
18 71	2 1	23.07.20 10	VII	Kaevandi edelaserv, looduslikult	5					51 3	määramatu selgroogne	fr.	luu				+ (hall-valge)	
18 71	22 :1	23.07.20 10	VII	Põllukivihun niku	5					51 5	imetaja, keskmine	fr.	luu, v-o kämbla-/pöialuu	diafüüs, külg				

18 71	22 :2	23.07.20 10	VII	Põllukivihun niku	5					51 5	määramatu selgroogne	fr.	luu					

1871	23	23.07.2010	VII	Põllukivihunniku keskelt	5					516	imetaja, suur	fr.	luu				+ (tumehall)	
1871	24	23.07.2010	VII	Põllukivihunniku keskelt	5					555	määramatu selgroogne	fr.	luu				+ (hal	
1871	25	23.07.2010	VII	Põllukivihunniku kaguserv	5					556	määramatu selgroogne	fr.	luu					
1871	26	26.07.2010	VII	Põllukivihunniku kaguserv	6					687	määramatu selgroogne	fr.	luu				+ (pruu	
1871	27	26.07.2010	VII	Kaevandi kaguserv	6					688	määramatu selgroogne	fr.	luu				+? (tumepruun)	
1871	28	26.07.2010	VII	Põllukivihunniku kagupoolne	6					719	määramatu selgroogne	fr.	luu				+ (pruun-	
1871	29	26.07.2010	VII	Kaevandi kaguserv, sõelalt	6					735	määramatu selgroogne	fr.	luu				+ (pruun-	
1871	30	26.07.2010	VII	Põllukivihunniku edelaserv, looduslikult	6					734	määramatu selgroogne	fr.	luu				+ (hall-valge)	
1871	31	26.07.2010	VII	Põllukivihunniku edelaserv,	6					733	määramatu selgroogne	fr.	luu				+ (valge)	
1871	32	26.07.2010	VII	Põllukivihunniku edelaserv, looduslikult	6					767	määramatu selgroogne	2 fr	luu				+ (hall-valge)	
1871	33	26.07.2010	VII	Põllukivihunniku keskelt, looduslikult aluspõhjalt	6					768	määramatu selgroogne	fr.	luu					
1871	34	26.07.2010	VII	Põllukivihunniku keskelt, looduslikult aluspõhjalt	6					769	määramatu selgroogne	3 fr	luu				+ (valge)	
1871	35	26.07.2010	VII	Põllukivihunniku keskelt, looduslikult aluspõhjalt	6					807	määramatu selgroogne	fr.	luu				+ (must	
1871	36	26.07.2010	VII	Põllukivihunniku keskelt, looduslikult aluspõhjalt	6					808	määramatu selgroogne	fr.	luu				+ (valge)	
1871	37	26.07.2010	VII	Põllukivihunniku keskelt, looduslikult aluspõhjalt	6					809	määramatu selgroogne	fr.	luu					
1871	38	26.07.2010	VII	Põllukivihunniku keskelt, looduslikult aluspõhjalt	6					810	määramatu selgroogne	fr.	luu				+ (beež-hall)	
1871	39	26.07.2010	VII	Põllukivihunniku keskelt, looduslikult aluspõhjalt	6					866	määramatu selgroogne	fr.	luu				+ (valge)	
1871	40	26.07.2010	VII	Põllukivihunniku kirdeserv, looduslikult	6					864	määramatu selgroogne	fr.	luu				+ (sinakas-hall	
1871	41	26.07.2010	VII	Põllukivihunniku kagupoolsest osast, looduslikult aluspõhjalt	6					865	imetaja, keskmine/suur	fr.	luu				+ (tumehall)	
1871	42	27.07.2010	VII	Põllukivihunniku keskosa, looduslikult aluspõhjalt	6					896	näriline	terv	reieluu		p			

18 71	4 3	27.07.20 10	VII	Kaevandi kaguserv, profiil	7					95 2	imetaja, keskmine	fr.	luu				+ (tumepruu n)	

18 71	4 4	27.07.20 10	VII	Põllukivihunniku keskelt	7					94 9	imetaja, keskmine	fr.	luu, toruluu	diafüüs, külg			+ (beež-hall)	
18 71	4 5	27.07.20 10	VII	Põllukivihunniku keskelt, looduslikult aluspõhjalt	7					95 1	määramatu selgroogne	fr.	luu					
18 71	46 :1	27.07.20 10	VII	Põllukivihunniku edelapoolne serv, looduslikult aluspõhjalt, sõelalt	7					94 8	määramatu selgroogne	fr.	luu				+ (valge)	
18 71	46 :2	27.07.20 10	VII	Põllukivihunniku edelapoolne serv, looduslikult aluspõhjalt, sõelalt	7					94 8	määramatu selgroogne	fr.	luu				+ (tumehall - valge)	
18 71	4 7	27.07.20 10	VII	Põllukivihunniku keskelt, mulla pealt	7					95 0	määramatu selgroogne	fr.	luu					
18 71	4 8	27.07.20 10	VII	Kaevandi edelaserv, looduslikult	7					10 11	määramatu selgroogne	fr.	luu					
18 71	4 9	27.07.20 10	VII	Põllukivihunniku keskelt, mulla pealt	7					10 12	imetaja, keskmine	fr.	luu				+ (pruu	
18 71	5 0	27.07.20 10	VII	Põllukivihunniku keskelt, mulla pealt	7					10 32	määramatu selgroogne	fr.	luu				+ (valge)	
18 71	5 1	27.07.20 10	VII	Põllukivihunniku keskelt, mulla pealt	7					10 33	määramatu selgroogne	fr.	luu				+ (tumepruun)	
18 71	5 3	27.07.20 10	VII	Põllukivihunniku keskelt, kivide pealt	7					10 54	näriline	2 fr	küünarluu	distaalne ots puudu	v			
18 71	5 4	27.07.20 10	VII	Kaevandi kaguserv, profiil	7					10 89	määramatu selgroogne	fr.	luu				+ (pruun)	

Kaevamistel üles võetud ja nummerdatud fossiilid - ei kajastu osteoloogilises analüüsis

17	32	22.07.20	III	valli NE-poolne varing	2/						fossiil tõen.							
17	43	02.08.20	III	valli SW-poolne varing	4/					13	fossiil tõen.						+?	
17 83	46 7	07.08.20 10	III	valli tuumikala / keskosa	9 vall					17 00	fossiil tõen.							
17	4	2009	IV		3	C	1	1	-		fossiil							
17	5	2009	IV		3	C	1	2	-		fossiil							
17	6	2009	IV		3	C	1	2	-		fossiil tõen.							

Kaevamis- või kameraaltööde jooksul kaotsi läinud leiunumbrid - ei kajastu osteoloogilises analüüsis

17 83	58	18.08.20 09	III	valli SW-poolne varing, sõelalt	2					38 6								
17	13	24.08.20	III	valli SW-poolne varing	2					52								
17	30	22.07.20	III	valli NE-poolne varing	2/					42								
17	35	26.07.20	III	valli NE-poolne varing	3/					79								
17	36	26.07.20	III	valli SW-poolne varing	3/					85								
17	38	27.07.20	III	valli SW-poolne varing	3/					10								
17 83	39 7	28.07.20 10	III	valli SW-poolne varing	N W-					10 73								
17	45	03.08.20	III	vall	5/					14								

Kaevamistel üles võetud luuleidude numbrid, mis määramise ajal osutusid muuks leiutüübiks (on lisatud vastavatesse leiunimekirjadesse)

TÜ p	luu nr.	kuupäev	kae-vand	leiu tüüp	kiht	0-tik	x (c	y (c	z (c	tahhü-
16	12	09.08.20	I	süsi	4		84	20	-	
17	54	18.08.20	III	keraamika	2					36
17	72	19.08.20	III	kivi	2					39

17	73	19.08.20	III	keraamika	2					40
17	77	19.08.20	III	raudese	2					39
17	78	19.08.20	III	savitihend	2					41
17	10	20.08.20	III	keraamika	2					45
17	10	20.08.20	III	süsi	2					45
17	13	25.08.20	III	keraamika	2					53
17	14	25.08.20	III	keraamika	2/					54
17	14	25.08.20	III	süsi	3					63
17	15	25.08.20	III	süsi	3					64
17	16	26.08.20	III	keraamika (2x)	3					
17	20	20.07.20	III	süsi	2					11
17	23	21.07.20	III	süsi	2/					20
17	25	21.07.20	III	süsi	2/					25
17	26	21.07.20	III	süsi	2/					29
17	28	22.07.20	III	keraamika	2/					35
17	29	22.07.20	III	süsi (2x)	2/					38
17	30	22.07.20	III	kivi	2/					39
17	33	22.07.20	III	savitihend	2/					50
17	33	23.07.20	III	keraamika	2/					53
17	35	26.07.20	III	kivi	2/					76
17	37	27.07.20	III	süsi	3/					94
17	44	02.08.20	III	looduslik moodustis	4/					13
17	1	-	V	süsi (2x)	3	A	1	7	2	
17 82	4	-	V	looduslik moodustis (3x)	4	A	1 8	2 7	3 7	
17	5	-	V	kivi	4	A	5	3	2	
18	8	22.07.20	VII	kivi	4					33
18	52	27.07.20	VII	puit	7					10

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Tabel 1 - Lisa. Selgitused ja tõlked

TAKSONID

eestikeelne nimetus	ladinakeelne nimetus	inglisekeelne nimetus	võimalik liik (kui mingi suurema rühmaga tegemist)
ahven	*Perca fluviatilis*	perch	
hamsterlane	*Cricetidae*	cricetid	
haug	*Esox lucius*	pike	
hiirlane	*Muridae*	murid	
hobune	*Equus caballus*	horse	
hüljes	*Phocidae* (hülglased)	seal	hallhüljes (*Halichoerus grypus* ; grey seal) / viigerhüljes (*Pusa hispida* ; ringed seal)
imetaja	*Mammalia*	mammal	
jänes	*Lepus* sp.	hare	valgejänes (*Lepus timidus* ; white hare) / halljänes (*Lepus*
jääkoskel	*Mergus merganser*	common merganser	
kahepaikne	*Amphibia*	amphibian	
kala	*Pisces*	fish	
kana	*Gallus gallus domesticus*	chicken	
kanaline	*Galliformes*	galliform	
kaur	*Gavia* sp.	loon	punakurk-kaur (*Gavia stellata; red- throated loon*) või järvekaur (*Gavia arctica; black-throated*
kits	*Capra hircus*	goat	
koer	*Canis lupus familiaris*	dog	
konn	*Anura* (päriskonnalised)	frog	
kurvitsaline	*Charadriiformes*	charadriiform	metskurvits (*Scolopax rusticola; Eurasian*
lammas	*Ovis aries*	sheep	
latikas	*Abramis brama*	common bream	
lind	*Aves*	bird	
mutt	*Talpa europaea*	European mole	
selgroogne	*vertebrata*	vertebrate	
näriline	*Rodentia*	rodent	
pasknäär	*Garrulus glandarius*	Eurasian jay	
piilpart	*Anas crecca*	Eurasian teal	
põder	*Alces alces*	elk	
siga	*Sus scrofa domesticus*	pig	suuruse järgi on tõenäoliselt tegemist koduseaga
sinikael-part	*Anas platyrhynchos*	mallard	
tõmmuvaeras	*Melanitta fusca*	velvet scoter	
veis	*Bos taurus*	cattle	
värvuline	*Passeriformes*	passeriform	

LUUD ja SKELETIOSAD (Ernits ja Nahkur 2013 järgi)

eestikeelne nimetus	ladinakeelne nimetus	inglisekeelne nimetus
abaluu	*scapula*	scapula
ajukolju	*os cranium*	cranial bone
alakaaneluu	*suboperculare*	subopercular bone
alalõualuu	*mandibula*	mandible
alalõualuuharu	*ramus mandibulae*	ramus of mandible
eespurihammas	*dens premolaris*	premolar
epifüüs	*epiphysis*	epiphysis
hambaemail	*enamelum*	enamel
hambajuur	*radix dentis*	root of tooth
hambalaie	*diastema*	diastema
hambasomp	*alveolus*	alveolus
hambatsement	*cementum*	cementum
hammas	*dens*	tooth
istmikuluuharu	*ramus ossis ischii*	ramus of ischium
istmikuluukeha	*corpus ossis ischii*	body of ischium
kaarnaluu	*coracoideum*	coracoid
kannaluu	*os tarsale*	tarsal
keelealalõualuu	*hyomandibulare*	hyomandibula
kihvhammas	*dens caninus*	canine
kodarluu	*radius*	radius
kolju	*cranium*	skull
kontsluu	*talus*	talus

kuklaluu	*os occipitale*	occipital bone
kuklapõnt	*condylus occipitalis*	occipital condyle
kämblaluu	*os metacarpale*	metacarpus / metacarpal bone
küünarluu	*ulna*	ulna
küünarnukk	*olecranon*	olecranon, elbow
lameluu	*os planum*	flat bone
liigeseluu	*articulare*	articular bone
luu	*os*	bone
lõikehammas	*dens incisivus*	incisor
lüli	*vertebra*	vertebra
nimmelüli	*vertebra lumbalis*	lumbal vertebra
ninaluu	*os nasale*	nasal bone
niudeluu	*os ilium*	ilium
niudeluukeha	*corpus ossis ilii*	body of ilium
ogajätke	*processus spinosus*	spinous process
oimuluu	*os temporale*	temporal bone
pindluu	*fibula*	fibula
proksimaalne seesamluu	*os sesamoideum proximale*	proximal sesamoid bone
purihammas	*dens molaris*	molar tooth
puusaluu	*os coxae*	hip bone
puusanapp	*acetabulum*	acetabulum
pöialuu	*os metatarsale*	metatarsus / metatarsal bone
randmeluu	*os carpale*	carpal
reieluu	*os femoris*	femur
reieluupea	*caput ossis femoris*	head of femur
rinnak	*sternum*	sternum
rinnalüli	*vertebra thoracica*	thoracic vertebra
roie	*costa*	rib
sarv	*cornibus*	antler
sarvjätke	*processus cornualis*	horn core
sääreluu	*tibia*	tibia
süleluu	*os pubis*	pubic bone
telglüli	*axis*	axis
toruluu	*os longum*	long bone / tubular bone
vaagen	*pelvis*	pelvis
varbalüli, I	*phalanx proximalis*	first / proximal phalanx
varbalüli, II	*phalanx media*	second / middle phalanx
varbalüli, III	*phalanx distalis*	third / distal phalanx
õlavarreluu	*humerus*	humerus
õlavarreluu-pea	*caput humeri*	head of humerus
ülalõualuu	*maxilla*	maxilla

SUURUSTE HINNANGUD

imetaja, pisi	muti, hiire suurune
imetaja, väike	jänese, kopra, kassi suurune
imetaja, keskmine	koera, sea, lamba/kitse suurune
imetaja, suur	veise, hobuse, põdra suurune
lind, keskmine	kana, pardi suurune

SUUNAD

Tabelis olev lühend ja vaste	**ladinakeelne nimetus**	**inglisekeelne nimetus**
diafüüs = toruluu keskosa	*diaphysis*	diaphysis
distaalne = kaugmine	*distalis*	distal
dorsaalne = selgmine	*dorsalis*	dorsal
kaudaalne = sabamine	*caudalis*	caudal
kraniaalne = koljumine	*cranialis*	cranial
lateraalne = külgmine	*lateralis*	lateral
mediaalne = keskmine	*medialis*	medial
proksimaalne = lähimine	*proximalis*	proximal
rostraalne = ninatipmine	*rostralis*	rostral
ventraalne = kõhtmine	*ventralis*	ventral