

**Aivar Kriiska, Lembi Lõugas, Mari Lõhmus,
Kristiina Mannermaa and Kristiina Johanson**

NEW AMS DATES FROM ESTONIAN STONE AGE BURIAL SITES

The article discusses radiocarbon dates of 17 skeletons excavated from ten Stone Age burial sites in Estonia. The skeletons, dated by the AMS method in the frames of different research projects in recent years, are presented by burial sites together with detailed descriptions of the graves. The graves are compared with one another and main temporal differences and similarities are introduced. If the obtained results are different from the interpretations valid so far, the credibility of the dates is contemplated on.

On the basis of the obtained radiocarbon dates the Estonian Stone Age inhumation graves can be divided into four groups: the Early Neolithic (Veibri II, Tamula VII and Kivisaare IV), the end of the Early Neolithic–the beginning of the Middle Neolithic (Tamula VIII and X), the Middle Neolithic (Tamula I, III, XIX and Kudruküla) and the Late Neolithic (Ardu II, Sope II, Tika, Kunila II, Karlova and Naakamäe). The dates enable following changes in the burial customs during the Neolithic more exactly than before. In addition to the burials within settlement sites also separate burial sites have been established all through the Neolithic. Single burials dominate at that time and the deceased have been buried both in straight supine and flexed positions; however, the composition and number of grave goods vary.

On käsitletud kümnest Eesti kiviaja matmispaigast väljakaevatud 17 luustiku radiosüsiniku-dateeringuid. Viimastel aastatel erinevate uurimisprojektide raames kiirendi-mass-spektrometriga (AMS) dateeritud luustikud on esitatud muististe kaupa koos haudade detailse kirjeldusega. Haudu on omavahel võrreldud ja välja toodud olulisemad ajalised erinevused ja sarnasused. Juhul kui saadud tulemused erinevad senistest tõlgendustest, on vaetud vanusemäärangute usaldusväärsuse üle.

Saadud radiosüsinikudateeringute põhjal võib Eesti kiviaegsed maahaudkalmed jagada ajaliselt neljaks rühmaks: varaneoliitikum (Veibri II, Tamula VII ja Kivisaare IV), varaneoliitikumi lõpp/keskneoliitikumi algus (Tamula VIII ja X), keskneoliitikum (Tamula I, III, XIX ja Kudruküla) ning hilisneoliitikum (Ardu II, Sope II, Tika, Kunila II, Karlova ja Naakamäe). Saadud dateeringud võimaldavad neoliitikumi jooksul matmiskombestikus toimunud muutusi senisest palju täpsemalt jälgida. Läbi neoliitikumi on lisaks elupaikadesse tehtud matustele rajatud ka eraldi paiknevaid kalmistuid. Valdavad on üksikmatused ja kogu perioodi jooksul on surnuid maetud nii selili-siruli- kui ka kägarasendis, varieerub aga hauapanuste kooslus ning hulk.

Aivar Kriiska, Chair of Archaeology, Institute of History and Archaeology, University of Tartu, 3 Lossi St., 51003 Tartu, Estonia; aivar.kriiska@ut.ee

Lembi Lõugas, Department of Archaeobiology and Prehistoric Technology, Institute of History, Tallinn University, 10 Rütli St., 10130 Tallinn, Estonia; lembi@ai.ee

Mari Lõhmus, Chair of Archaeology, Institute of History and Archaeology, University of Tartu, 3 Lossi St., 51003 Tartu, Estonia; pints@ut.ee

Kristiina Mannermaa, Department of Archaeology, Institute for Cultural Research, University of Helsinki, Unioninkatu 38 F, Helsinki, Finland; kristiina.mannermaa@helsinki.fi

Kristiina Johanson, Chair of Archaeology, Institute of History and Archaeology, University of Tartu, 3 Lossi St., 51003 Tartu, Estonia; kristiina.johanson@ut.ee

Introduction

Investigation of Stone Age burial sites in Estonia was started in the final decades of the 19th century when burials of that time were found from several places during digging of gravel. The first Stone Age burial was discovered in 1876 in the village of Külasema on Muhu Island, west Estonia (Tiitsmaa 1922; Indreko 1935, 206). Information on Stone Age burial sites derives mainly from the first half of the 20th century.¹ The last Stone Age burial site until now was detected from the village of Veibri near Tartu, south-eastern Estonia, in 2003. Despite the fact that the research traditions of Stone Age burials are a century and a half long, interpretation of results has been hindered by lack of exact dates and their resting on the relative chronology based on findings and burial position, which in addition to other problems leaves the graves without grave goods almost totally beyond analysis.

The first radiocarbon date from a Stone Age grave in Estonia was obtained from the Tamula I settlement and burial site in south-eastern Estonia (Jaanits et al. 1982, 82; Jaanits 1984, 192). In addition to three samples from the cultural layer of the settlement site², the twigs found under a skeleton in one grave (Jaanits et al. 1982, 82)³ were dated (Table 1). The first AMS dates in Estonia were taken from human bones collected from the settlement site of Kudruküla, north-eastern Estonia (Table 1; Lõugas et al. 1996, 408, 405, table II). In the case of Kudruküla, no complete skeletons have been found, the bones derive from either destroyed inhumation burials or partial burials. A skeleton found from the settlement site of Naakamäe, Saaremaa Island, and another from Tamula burial X

¹ In 1935 Richard Indreko published data on 19 graves and altogether 59 burials (Indreko 1935, 202).

² 3600 ± 180 BP, (Ta-10), 4050 ± 180 BP (Ta-28), 4300 ± 70 BP (Ta-?) (Jaanits 1984, 192; Ots 2006, 42, fig. 7). These are the first dates in the Baltic countries by the radiocarbon laboratory whose activity began in 1957 at the Institute of Zoology and Botany, Academy of Sciences of the Estonian SSR (Ильвес et al. 1974, 177; Liiva et al. 1975, 7).

³ Unfortunately it is not clear which burial we are exactly dealing with. Altogether eight burials – VIII, IX, X, XI, XV, XIX, XX, XXII – in the Tamula I settlement and burial site had a ‘bed’ of branches.

Table 1. Radiocarbon dates from Estonian Stone Age burial sites**Tabel 1.** Eesti kiviaja matmispaikade radiosüsinikudateeringud

Site and number of the grave ^a	Area	¹⁴ C-year (BP)	Calibrated date 1 sigma (cal BC) ^b	Calibrated date 2 sigma (cal BC)	$\delta^{13}\text{C}^c$	Lab. no.	Sample material
Veibri, burial II	SE Estonia	6090 ± 45	5200–4930	5210–4850	–24.0	Hela-1331	Human, <i>radius dext. corpus</i>
Kivisaare, burial IV	Central Estonia	5450 ± 40	4345–4260	4360–4230	–	Poz-10840	Human, <i>cranium</i>
Tamula I, burial I	SE Estonia	4680 ± 40	3520–3370	3630–3360	–	Poz-15645	Human, <i>femur</i>
Tamula I, burial III ^d	SE Estonia	4940 ± 40	3770–3650	3800–3640	–	Poz-10826	Human, <i>costa</i>
Tamula I, burial VII	SE Estonia	5760 ± 45	4620–4540	4720–4490	–27.1	Hela-1335	Human, <i>mandibula</i>
Tamula I, burial VIII	SE Estonia	5370 ± 45	4330–4070	4340–4050	–25.8	Hela-1336	Human, <i>femur sinister</i>
Tamula I, burial X	SE Estonia	5310 ± 85	4250–4000	4330–3970	–23.9	Ua-4828	Human, <i>concha nasalis</i>
Tamula I, burial XIX	SE Estonia	4925 ± 40	3760–3650	3790–3640	–25.0	Hela-1337	Human, <i>femur</i>
Tamula I, definite burial unknown	SE Estonia	4080 ± 100	2860–2490	2900–2300	–	Ta-219	Wood from bottom of grave
Sope, burial II	NE Estonia	4090 ± 35	2850–2570	2870–2490	–	Poz-10827	Human, female, <i>metatarsus I dext.</i>
Ardu, burial II	Northern Estonia	4110 ± 40	2860–2580	2880–2500	–	Poz-10824	Human, male, <i>ulna sin. corpus</i>
Tika	Saaremaa Island	4035 ± 35	2620–2480	2840–2470	–	Poz-10803	Human, <i>mandibula</i>
Kunila, burial II	Central Estonia	3960 ± 40	2570–2350	2580–2340	–	Poz-10825	Human, <i>mandibula</i>
Karlova	SE Estonia	3805 ± 35	2300–2150	2460–2130	–	Poz-15499	Human, <i>mandibula</i>
Kudruküla I	NE Estonia	4770 ± 60	3640–3380	3660–3370	–21.7	CAMS-6265	Human, <i>mandibula</i>
Kudruküla II	NE Estonia	4860 ± 60	3710–3530	3780–3510	–20.4	CAMS-6266	Human, <i>mandibula</i>
Naakamäe	Saaremaa Island	4125 ± 85	2780–2580	2890–2480	–16.0	Ua-4822	Human, <i>femur</i>

^a The numeration proposed by Lembit Jaanits in 1965 is used.^b All the calibrations by: Atmospheric data from Reimer et al. (2004); OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron].^c Presented only if submitted by the laboratory that completed the dating.^d Too little collagen in the sample, which may have affected the date.

were dated in the frames of the same project (Table 1; Lõugas et al. 1996, 412, table 3). Samples were taken from a male skeleton (I) from Kõljala, Saaremaa Island, and Tamula burial XI⁴, but unfortunately the samples did not contain enough collagen for dating (Lõugas et al. 1996, 408).

The need for absolute dates from Stone Age graves has been obvious for a long time now (e.g. Lang & Kriiska 2001; Kriiska et al. 2005) and within several research projects⁵ samples of human bones from several burial sites have lately been dated with the AMS method. By now altogether 17 graves from ten burial sites have been dated (Table 1; Fig. 1).

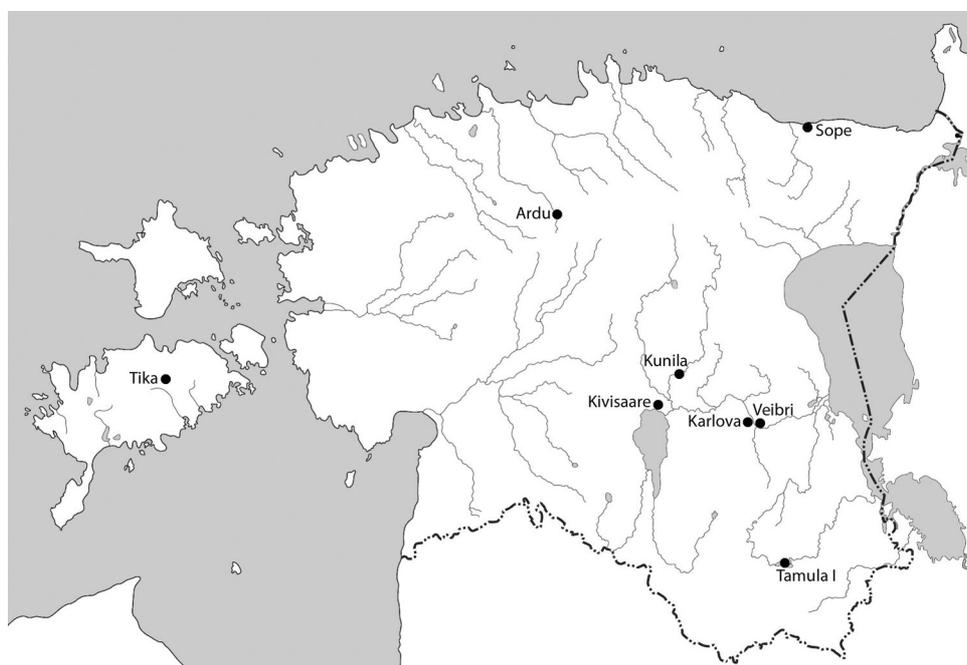


Fig. 1. Estonian Stone Age burial sites dated by the radiocarbon method in the 2000s.

Joon 1. 2000. aastatel radiosüsinikumeetodil dateeritud Eesti kiviaegsed matmispaigad.

⁴ It is not clear in Lõugas et al. (1996) whether Tamula X or XI was dated earlier and skeleton XI has been erroneously considered to have been dated instead of skeleton X (Ots 2006, 42, joon 7). In order to clarify the situation, boxes of both skeletons in the Institute of History, Tallinn University, were inspected. Since the dated bone was *concha nasalis*, and the box of the skeleton no. X contained bones of the skull's inner part (such bones were absent in XI), then probably no. X was actually dated in 1996.

⁵ AMS dating has been financed by the Estonian National Heritage Board and different research projects led by Aivar Kriiska, Lembi Lõugas and Kristiina Mannerman.

Burial sites dated in the 2000s

Veibri burial site

Location

The burial site is situated in south-eastern Estonia (Fig. 1) on a flood plain on the northern shore of the Suur-Emajõgi River (absolute elevation up to 32 m a.s.l.) in the village of Veibri on the border of Tartu town approximately 130 m west of a Corded Ware Culture settlement site (reg. no. 27195). It is a relatively plane area, which is nevertheless distinguished from the surroundings by a low hill of sand and gravel.

Research history

In spring 1997 Andres Tvauri and Andres Vindi, archaeologists from the University of Tartu, discovered a Corded Ware Culture and medieval settlement site in Veibri village. In the autumn of the same year, preliminary research was conducted on the spot under the leadership of Aivar Kriiska. It was ascertained that the cultural layer had been extensively mixed in the course of later agricultural activity (Kriiska 1997)⁶. In autumn 2003 the settlement site of Veibri attracted the interest of archaeologists again because of the intensified construction activity in the area. The same autumn the then inspector of the National Heritage Board in Tartumaa, Kalle Lange, found human bones in the neighbourhood of this settlement site. The bones were exposed on the ground as the turf layer and part of the soil under it had been removed with a bulldozer. As the site is not a typical burial site of historical times by its location, a probability existed that the destroyed grave is older; it was even supposed that the bones were connected with the Corded Ware Culture.

In summer 2006 rescue excavations were carried out on the endangered grave site under the leadership of Kristiina Johanson, Tõnno Jonuks and Mari Lõhmus. In the course of the excavations a quadruple burial (Fig. 2) with three children and an adult⁷ was opened. Two children, respectively skeleton I belonging to an 11-year-old child and skeleton IV of a 4-year-old child, were orientated towards south-east and the adult (skeleton II) and the child next to her (skeleton III; 5 years old) had been placed in the grave in the opposite direction with the first two, i.e. orientated to north-west. All the inhumed individuals lay in an extended supine position. The deceased, who had apparently been placed into the grave together, lacked grave goods. A probably Narva-type pottery sherd was found close to skeleton III (TÜ 1424: 98); however, its connection with the discussed grave is problematic as the sherd was not found in the immediate vicinity of the buried. No grave depression could be distinguished from the surrounding soil: the dead

⁶ Finds in the *Kabinet* of Archaeology, Institute of History and Archaeology of the University of Tartu (TÜ 568).

⁷ Preliminary anthropological identifications were made by Raili Allmäe.

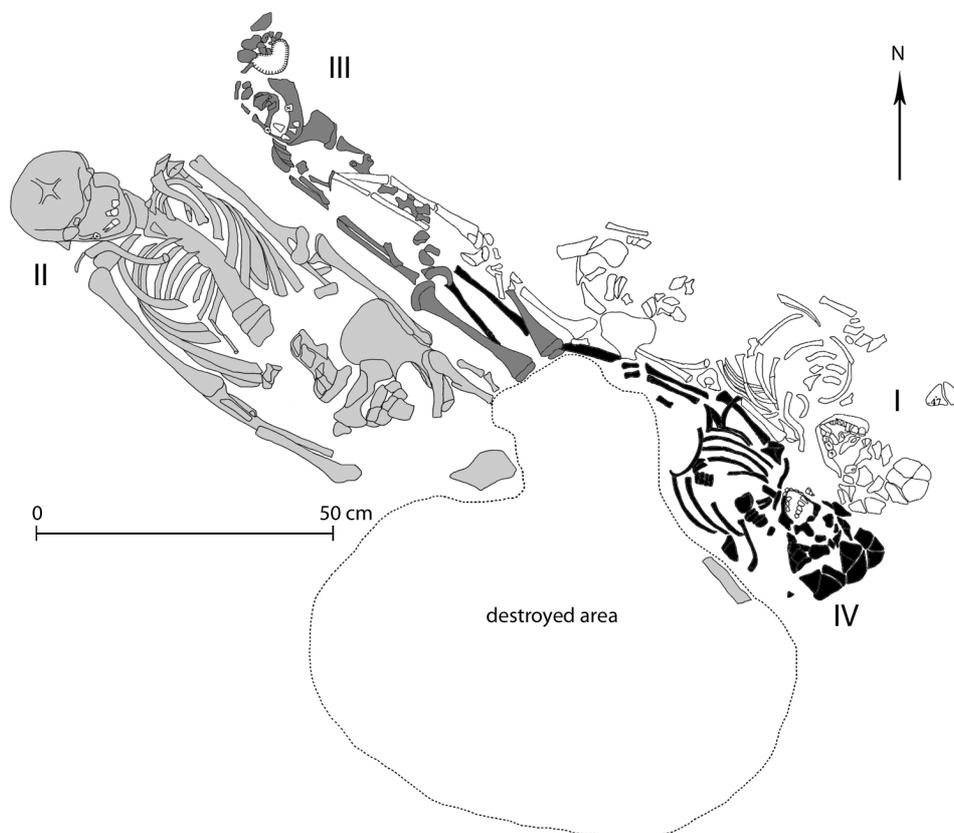


Fig. 2. Veibri quadruple burial.

Joon 2. Veibri nelikmatust.

had been inhumed into yellowish-grey gravelly moraine. The middle part of the grave was somewhat deeper than its edges. The fact that we are not dealing with a solitary grave is referred to by a tubular bone exposed in the north-western end of the excavation and human *metacarp*i gathered from a test-pit 20 m north-west of the opened burials.

Dated burial

An AMS sample from the quadruple burial was taken from the bone of the adult individual (skeleton II) as her bones were bigger and thus the possibility that the sample might not contain enough collagen was smaller than in the case of the children's bones. The dated bone belongs to an adult, who lay in the grave depression in a north-west–south-east directed position. The deceased had been placed into the grave in an extended supine posture and her arms were pressed

tightly against her body with hands put under her pelvis (Fig. 2). The upper part of the skeleton was well preserved until the pelvis, only the higher part of the skull, destroyed by the bulldozer, was missing. The legs of the dead had been removed by a later dig; only the proximal end of the *femur* was preserved. As mentioned above, no grave goods were accompanying the deceased. The sample for AMS analysis was taken from the corpus (diaphyse) of the right *radius*.

Date: 6090 ± 45 BP (Hela-1331) (Table 1).

Kivisaare settlement and burial site

Location

The Mesolithic and Neolithic settlement and burial site (reg. no. 13221) of Kivisaare is situated in Meleski village, central Estonia (Fig. 1), in the central and south-eastern part of a small south-east–north-west directed drumlin. The small drumlin surrounded by a fen (absolute elevation up to 38 m a.s.l.) is located approximately 6 km from Lake Võrtsjärv and 1.5 km from the Põltsamaa River.

Research history

The first graves in Kivisaare were discovered in 1882 during digging for gravel on a small hill in the central part of the drumlin. According to the local farmer Jaan Pekk, five skeletons were discovered and destroyed then (Bolz 1914, 27). In the course of road building in 1903 another human skeleton was found and with farming in 1908–1910 seven more skeletons were unearthed there and registered by J. Pekk and Martin Bolz (Bolz 1914, 27). Thereafter archaeological excavations have repeatedly been conducted at Kivisaare: in 1910 six graves were opened by Richard Hausmann (Ottow 1911, 154 f.), in 1913 Max Ebert and in 1921 Aarne Michaël Tallgren both unearthed one burial (Tallgren 1921, 1). Extensive excavations were made in 1931 by R. Indreko and in 1962 and 1964–1965 by Lembit Jaanits. Indreko (1931a) unearthed two and Jaanits (1965) four skeletons. In 2002–2004 archaeological excavations took place under the direction of Aivar Kriiska. In the course of these bones of approximately ten individuals were collected, including two re-burials from probably the 20th century, but no in situ grave could be detected (Kriiska et al. 2003, 34; 2004, 35 ff; Kriiska & Lõhmus 2005, 33 ff.).

Altogether more than 20 relatively fully preserved skeletons and loose bones from more than 10 individuals have been found from the drumlin.⁸ Age and sex have been determined for the human bones found in the excavations of 2002. According to the determinations, men, women and children have been buried on the cemetery, the oldest of the deceased being over 35 and the youngest 2–3 years old. Unfortunately, it has not been possible to date the inhumations more exactly; therefore, different prehistoric periods have been suggested for the time of the

⁸ Anthropological identifications were made by R. Allmäe.

burials. Bolz (1914, 15), who started the research, dated the cemetery to the Neolithic⁹, Tallgren (1922, 49) to a time period that corresponds to the Late Mesolithic by the currently valid periodization, Indreko (1935, 10) to the Neolithic and the Bronze Age, and before the beginning of the new excavations one of the authors of the present article dated it more widely – to the Mesolithic and Neolithic (Kriiska & Tvaari 2002, 35).

On the territory and in the surroundings of the cemetery there has been a settlement site in the Mesolithic and the Neolithic (Narva, Comb Ware and Corded Ware cultures) (Kriiska et al. 2003; 2004; Kriiska & Lõhmus 2005).

Dated burial

During the excavations of 1965 a child's grave was found in the south-eastern part of the drumlin: skeleton 4 according to the numeration of Jaanits (1965, 9). The child had been placed into a relatively shallow oval grave (Figs 3 and 4; Jaanits 1965, 9), the central part of which was deeper than the head (the skull was unearthed 12–15 cm from ground level). The outlines of the grave depression of a maximum size of 1.6 × 0.6 m (Fig. 3) were exposed 16–17 cm from ground level.



Fig. 3. Kivisaare burial IV.

Joon 3. Kivisaare IV matus.

⁹ It should be considered that the periodization used then was: (1) Palaeolithic and (2) Neolithic. No absolute dates were offered by Bolz.

The child had been placed into the grave in a south-south-west–north-north-east directed position with its head orientated towards south-south-west. The skeleton was poorly preserved (Fig. 4): bones were shattered; nevertheless, it has been a whole burial (Jaanits 1965, 9). Similarly to several other graves from the Kivisaare drumlin, the discussed child's burial also lacked grave goods. The sample for AMS analysis was taken from a skull fragment.

Date: 5450 ± 40 BP (Poz-10840) (Table 1).

Tamula I settlement and burial site

Location

The Neolithic settlement and burial site (reg. no. 13804) is situated in south-eastern Estonia (Fig. 1), near the town of Võru, on Cape Roosisaar (absolute elevation up to 71 m a.s.l.) on the shore of Lake Tamula. The Võhandu River and a stream connecting lakes Tamula and Vagula flow out from the northern corner of Lake Võhandu near this cape (Indreko 1945, 26; Jaanits et al. 1982, 78; Jaanits 1984, 183). In some stages of the Stone Age the cape may have been an island (Mäemets 1977, 210). The site was inhabited already in the Mesolithic (Tamula II settlement site) (Ots 2002, 1). Due to the rise of the water level the Neolithic cultural layer has become covered with peat, which has abundantly preserved bone, antler and even wood.

Research history

The site was accidentally discovered in 1938 by Ida Kepnik, who had lost her ring in the lake and found bone fragments while looking for it (Indreko 1938). In different times altogether 25 burials have been excavated from the cultural layer of the Tamula I settlement site. Due to its location in peat (Jaanits 1988, 218) bone material has preserved relatively well there enabling characterization of a total of 11 whole burials. The first archaeological excavations on the site took place in 1942–1943 under the leadership of Indreko. In the first excavation year

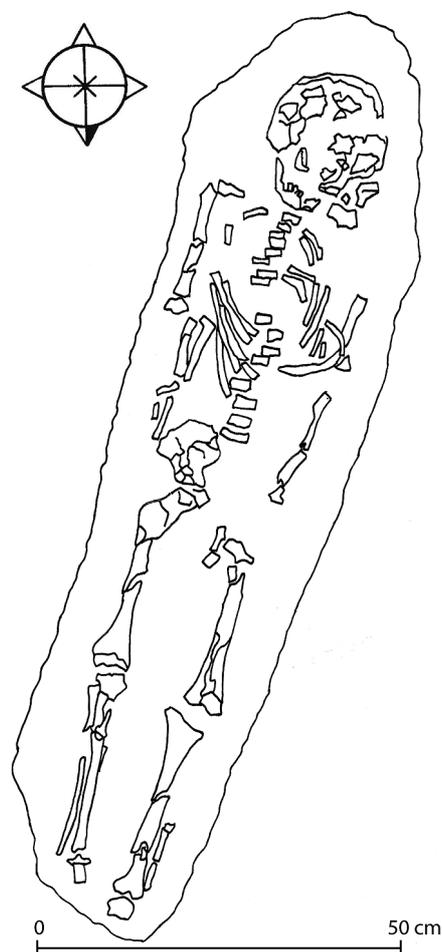


Fig. 4. Kivisaare burial IV.

Joona 4. Kivisaare IV matus.

the remains of three individuals (I–III) were found; these were located in the lower part of the cultural layer 48–56 cm from ground level (Indreko 1942, 2). During the excavations of 1946, which were conducted by Harri Moora, the graves of four individuals (IV–VII) were opened (Moora 1946). Next excavations on the Tamula I settlement and burial site took place in 1955–1956, 1961 and 1968 under the direction of Lembit Jaanits. In the first two excavation years the remains of 14 more humans (VIII–XXI) were discovered in the lower and middle parts of the cultural layer (Jaanits 1957, 80). The last excavations in Tamula until now were carried out by Jaanits in 1988–1989; however, the last four burials (XXII–XXV), of these a whole burial and three skulls, were unearthed already during the excavations of 1961.

Until now the majority of the researchers have considered the graves from Tamula I contemporary with the Comb Ware and Corded Ware Culture settlement sites. This interpretation is supported by finds and the position of graves in the cultural layer. For example, in the excavation plot of 1942 the burials as well as find material concentrated into its western part. According to this, it was supposed that skeletons I–III had been placed inside dwelling houses (Indreko 1942, 2). Later the same interpretation was presented by Jaanits (1957, 94, 96). On the basis of burial position, lack of amber, and stratigraphy the flexed burials (I, II, III, XIII, XIX, XXI, XXII) from the Tamula I settlement and burial site have been considered to belong to the final stage of the existence of the settlement and be connected with the Corded Ware Culture or at least its influence on the people of the Late Comb Ware Culture (Jaanits 1957, 97; Jaanits et al. 1982, 82; Kriiska & Tvauri 2002, 80). The burials in an extended supine position have been associated with the Comb Ware Culture (Jaanits 1957, 97). In the light of new dates these standpoints have been revised (Lõugas et al. 2007, 23).

Dated burials

Skeleton I

Skeleton I (Fig. 5) was found in 1942 from the south-eastern part of the settlement site, near skeletons II and III. It belonged to a 25–35-year-old female lying on her right side in a flexed position (Ots 2006, table 11). Because of decay and sinking of soft layers the position of her hands could not be documented. Only her left *humerus* on the side of the skeleton can be seen on the excavation plan (Fig. 5); the left *ulna* had probably lain on the body of the deceased. The woman had been orientated from north-west to south-east, her head was directed to north-west. The borders of the grave depression remained vague, the arched north-western end of the grave depression can probably be noticed only on one glass negative (Fig. 6). The skeleton had lain relatively deep (48–58 cm from ground level); the depth of the frontal bone was 58 cm and that of the *occiput* 73 cm from ground level.

Although no clear border of the grave depression could be determined and the skeleton was located in the middle of the settlement finds, Indreko associated several finds – grave goods – with this burial. Among others pottery sherds were

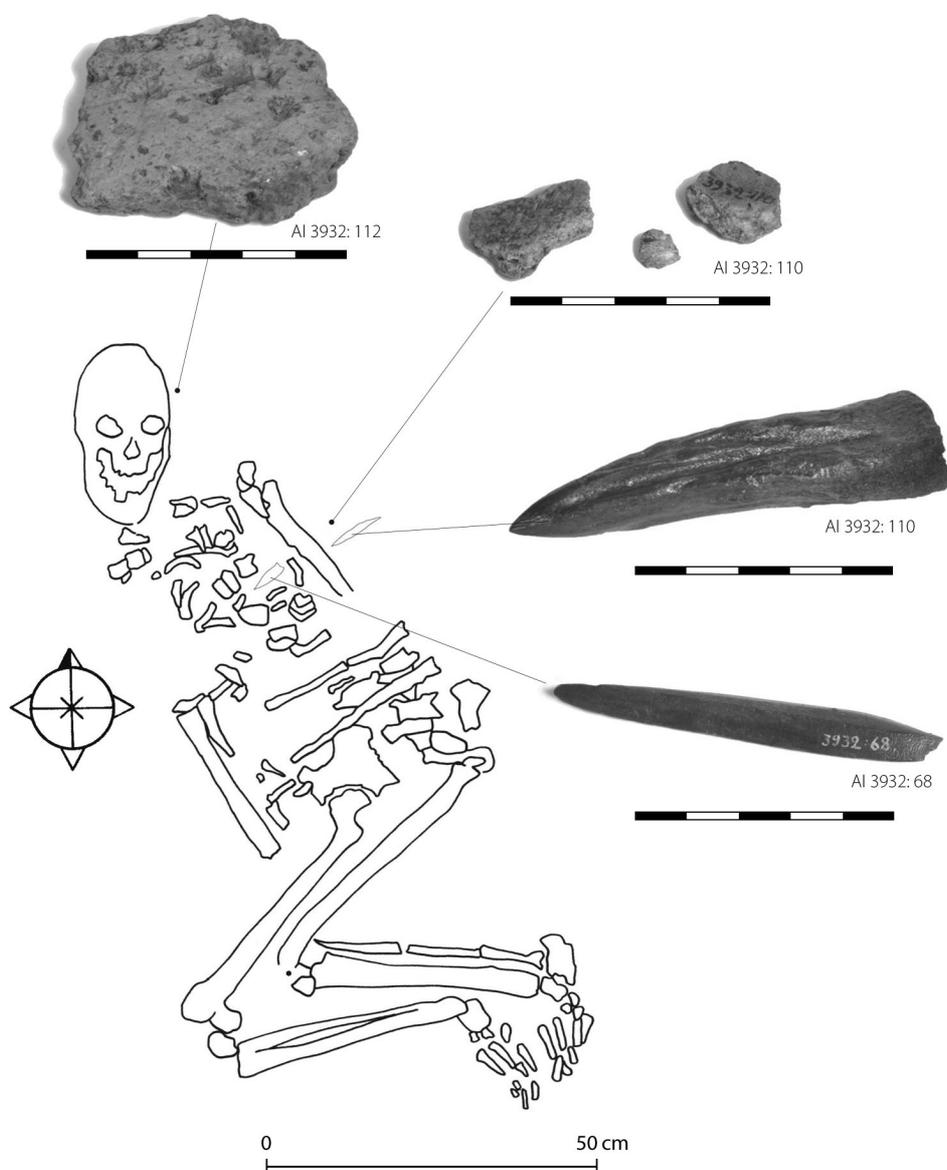


Fig. 5. Tamula burial I.

Joon 5. Tamula I matus.

collected above the kneecap of the skeleton, from the left side of the skull and next to her left *humerus* (Indreko 1942, 3). In addition to the ceramic vessel(?) bone arrowheads (arrows?) were found by both the left and the right hand; a bone point and a fragment of a bone artefact (Fig. 5) were also located by the deceased; it is possible that fragments of animal bones as well as nutshells and pieces of



Fig. 6. Tamula burial I.

Joon 6. Tamula I matus.

acorns can be associated with the discussed burial. The sample for AMS analysis was taken from the *femur*.

Date: 4680 ± 40 BC (Poz-15645) (Table 1).

Skeleton III

Skeleton III (Fig. 7), also found in 1942, was located approximately 1 m south-east of another skeleton and had been placed parallel to it. The deceased, placed in the grave in the north-eastern–south-western position, was a 25–35 years old



Fig. 7. Tamula burial III.

Joon 7. Tamula III matus.

male (Loze 2006, 316; Ots 2006, table 11). Similarly to the other skeleton the dead had been placed into the grave in a flexed position: his legs were flexed to right whereas his vertebral column lay straight (supine) and his hands were placed crosswise over his stomach. The skeleton lay at a depth of 48–56 cm from ground level. Similarly to several other burials, his head lay somewhat higher than the rest of the body. With a slight uncertainty Indreko considered the finds gathered in the vicinity of the skeleton to be grave goods: tooth pendants, a fragment of a spear and pottery sherds were found at a depth of 50–60 cm from ground level (Indreko 1942, 4). The sample for the AMS analysis was taken from a rib.

Date: 4940 ± 40 BP (Poz-10826) (Table 1).

Skeleton VII

Skeleton VII in the middle of the burial site, which belonged to a 8 ± 2 -year-old child (determined by Allmäe; see Ots 2006, table 11) and was accompanied by rich grave goods, was relatively well preserved (Fig. 8). The north–south directed skeleton lay in a 50-cm deep grave in an extended supine position, both hands on its side. The skull was prone to left and shattered, probably under the weight of

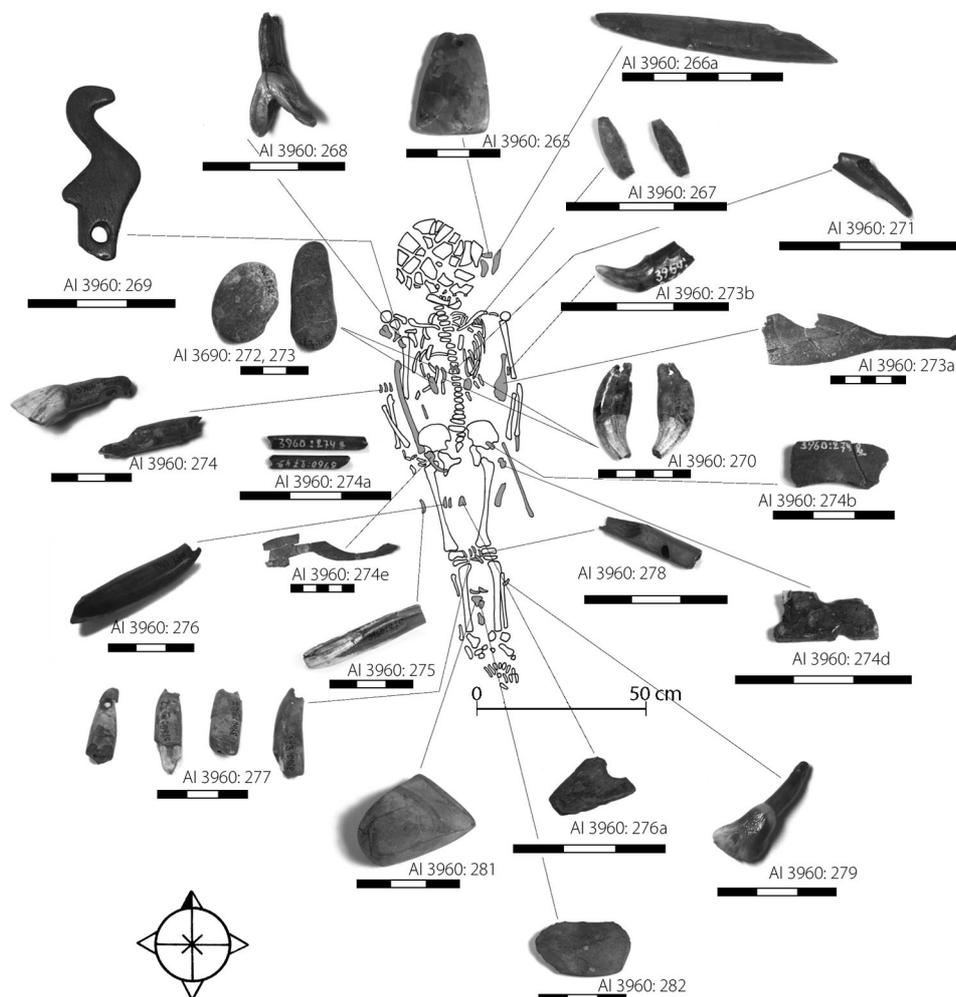


Fig. 8. Tamula burial VII.

Joon 8. Tamula VII matus.

a boulder placed on it. A row of small notches was discovered on the child's forearm (Moora 1946), which must have been made before the inhumation of the deceased. This is indicated by the intact cultural layer on top of the grave as well as by the undisturbed skeleton itself (Jaanits 1947, 10).

Differently from several other burials, this deceased was accompanied by rich grave goods (Fig. 8). Two amber pendants were found beside the left temple bone and during later cleaning a fragment of a bone knife was found next to these; two amber pieces were exposed above the left collarbone. Two pebbles were found

on the chest and a fragment of a whistle-like tubular bird bone between the knees. Between the legs of the deceased there was an adze with the so-called fingernail-shaped blade¹⁰ with a piece of a stone wedge placed on top of it. Tooth pendants with drilled holes belonging to several different animal species were discovered on different parts of the skeleton, for example, bear fangs¹¹ were found at the lower part of the rib cage. A bone pendant and worked bone fragments were found by the left elbow, etc. Fragments of common crane (*Grus grus*) wings had been placed into both hands of the child. Two bone bird figurines were unearthed by the skeleton. The sample for AMS analysis was taken from the lower *mandibula*.

Date: 5760 ± 45 BP (Hela-1335) (Table 1).

Skeleton VIII

Skeleton VIII, which was discovered during the excavations in 1955, belonged to a 18–25-year-old female (Fig. 9; Ots 2006, table 11). The deceased was located two metres north of skeleton I (Indreko 1942) at a depth of 60–65 cm from the present ground level. She had been laid on a ‘bed’ of branches and a wooden pole¹² had been put under her head ‘like a pillow’ (Jaanits 1961, 60). The south-east–north-west directed deceased was placed in the grave in a supine position, legs extended and hands straight on the side (Jaanits 1957, 80). The deceased was also accompanied by abundant grave goods (Fig. 9). The vicinity of the skull was an especially rich area with three bone arrowheads, a slate adze with the fingernail-shaped blade, a flint scraper, a bone awl and a polished bone stick found. Also the lower mandible of a pine marten (*Martes martes*), tongue bone of an European elk (*Alces alces*) and animal teeth were discovered in the vicinity. As the bones lacked traces of working they probably did not belong to the clothing of the deceased but were grave goods (Jaanits 1961, 60). In addition to these, pendants of dog (*Canis familiaris*), marten and elk teeth as well as cylindrical beads of bird bones were found near different parts of the skeleton. These had probably been attached to the clothes of the buried (Jaanits 1957, 81 f.; 1961, 60). Three anthropomorphic bone plate figurines and a fragment of a two-headed snake figure¹³ were discovered between her *tibiae*. The sample for AMS analysis was taken from the corpus of the left *femur*.

Date: 5370 ± 45 BP (Hela-1336) (Table 1).

¹⁰ For adzes with fingernail-shaped blade see more in Jaanits et al. 1982, 79 and Edgren 1984, 43.

¹¹ In the earlier literature (Moora 1946; Jaanits 1947; Янитс 1952) these were considered wolf fangs, but according to the identification by L. Lõugas we are dealing with bear fangs.

¹² Length 70 cm and thickness 6–7 cm (Jaanits 1957, 80).

¹³ The snake figure was considered the leg part of a human figure by Jaanits (1961, 62), at the same time the skilfully crafted ‘head parts’ are very similar to the head of a snake found from Tamula burial XIV.

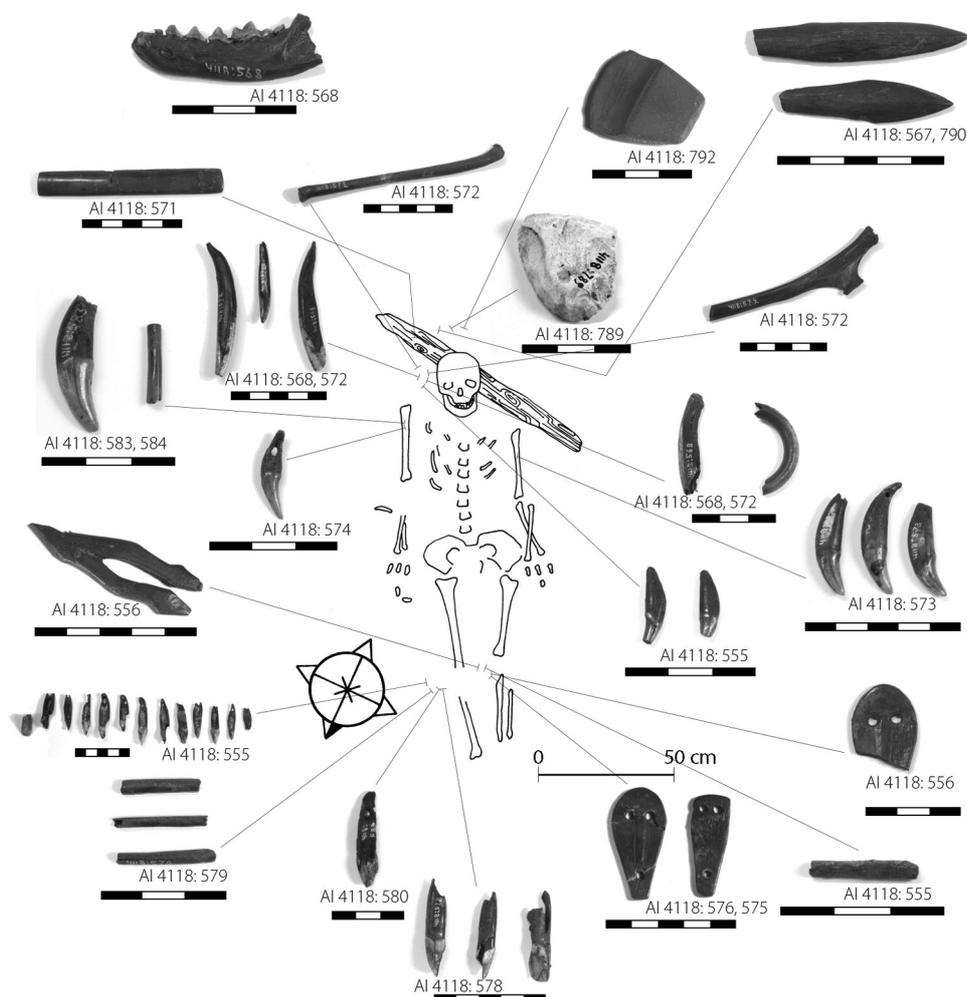


Fig. 9. Tamula burial VIII.
Joon 9. Tamula VIII matus.

Skeleton XIX

The south-west–north-east directed skeleton, which was unearthed in 1956, belonged to a 20–30-year-old male (Ots 2006, table 11). The poorly preserved skeleton was located in the south-western part of the burial site. The deceased had been placed into the grave so that his upper body was in a supine position but the lower part of his vertebral column had been slightly turned to right (Fig. 10). His face was directed to left and the left forearm had been bent towards his body from the elbow. The skeleton was situated in the lower part

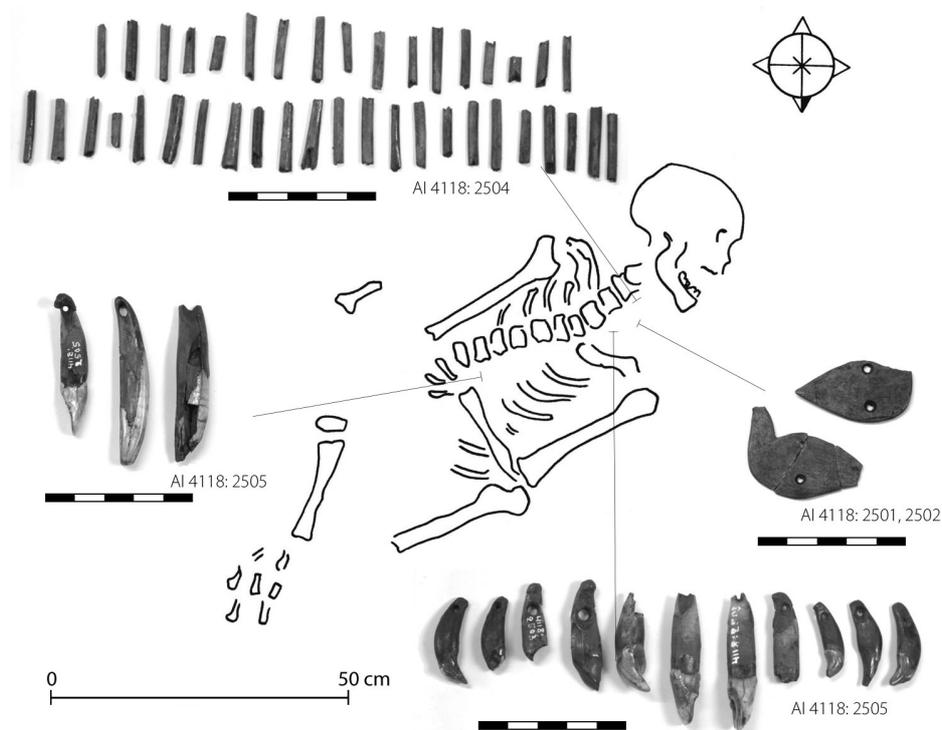


Fig. 10. Tamula burial XIX.

Joon 10. Tamula XIX matus.

of the cultural layer at a depth of 40–47 cm from the present ground level (Jaanits 1957, 88). Two bird figurines of bone plate, tooth pendants and cylindrical beads, which probably formed part of a necklace (Jaanits 1957, 88) were found in the grave. The sample for AMS analysis was taken from the corpus of the *femur*.

Date: 4925 ± 40 BP (Hela-1337) (Table 1).

Sope burial site

Location

The Stone Age cemetery is situated in north-eastern Estonia (Fig. 1), 4 km east of Purtse and 2 km south of Jabara (former Sope and Jäbara) village, on the lands of Metsavälja farmstead, on a small sandy knoll on the bank of the Sope Stream (Jaanits et al. 1982, 102).

Research history

The first finds from the Sope burial site were collected in 1884 or 1889 when a skeleton together with a boat-shaped axe was unearthed at a place of a cellar or during farming; the axe was said to have gone missing in 1922 (Indreko 1933; 1935, 213). In 1904 or 1908 six more skeletons were found while making headland; all these were later reburied in the vicinity (Liiv 1924; Indreko 1933). Archaeological excavations on the cemetery of Sope were carried out in 1926 by Moora. A female burial in a strongly flexed position and with grave goods was exposed on the area of a 9 × 24 m excavation plot (Moora 1926). In 1933–1934 excavations were conducted by Indreko, who found a complete female skeleton in the first year of his fieldwork (Indreko 1933) and documented single finds in the second year (Indreko 1934). As estimated, altogether 10 individuals were buried in Sope. This makes it the largest known Corded Ware Culture burial site in Estonia.

Dated grave

The dated female skeleton (II) lay in the grave depression on her right side, knees flexed, right hand under her head, left hand on her body (Fig. 11). The deceased was orientated from north-west to south-east, her head was turned to north-west. At the foot of the grave there were an almost whole ceramic vessel,



Fig. 11. Sope burial II.

Joon 11. Sope II matus.

a bone awl and a shell of a freshwater pearl mussel (*Margaritifera margaritifera*)¹⁴ (Indreko 1933). A handful of small round stones under her right shoulder had apparently been placed there deliberately. Similarly to grave I it was relatively shallow: the deceased was lying at a depth of 20–27 cm and the bottom of the depression was only 35 cm from the present ground level. The grave depression itself could not be distinguished from the surrounding soil, it was only observed that the burial was surrounded by clean sandy soil without pebbles (Indreko 1933). The sample for AMS analysis was taken from the first metatarsal bone.

Date: 4090 ± 35 BP (Poz-10827) (Table 1).

Ardu burial site

Location

The Ardu cemetery (reg. no. 18540) is situated in northern Estonia, in the village of Ardu, on the lands of Hansumardi¹⁵ farmstead, in the area of the upper reaches of the Pirita River, 100 meters from the river, on a gravel hill rising above the surrounding river plain (Jaanits et al. 1982, 104).

Research history

In 1931 Peeter Metsis found human bones from a gravel hole by his field track; among other things there was a skull on the right side of which a stone adze was discovered (Indreko 1931b). It was a male burial lying at a depth of 80–90 cm on his left side with his head turned towards north. The excavation of the burial was completed in one day (Indreko 1931b). In 1936 another skeleton was discovered there when digging for sand for construction work: ‘*Das skelett wurde wie das die vorige vom Gehilfen des Gehöftbesitzers beim Graben von Bausand entdeckt, wobei die Schaufel auf den Schädel steiss*’ (Indreko 1937, 186). The workmen who had discovered the skeleton immediately gave notice of the find whereafter rescue excavations were carried out there by E. Saadre (Indreko 1937, 186). The skeleton was situated 1–1.5 m south-east of the burial unearthed in 1931, and was also a male.

In spring 2006, in connection with digging a central heating trench, preliminary investigations were completed at the site of the cemetery. No new burials were detected in the course of these investigations (Kriiska 2006).

Dated burial

The deceased (skeleton II) lay in the grave depression in the natural sand layer on his left side with flexed legs (Fig. 12). His head was orientated to north, legs

¹⁴ According to locals, mussel shells have been found with other skeletons as well (Indreko 1933).

¹⁵ In 1936 the farmstead was called by this name.

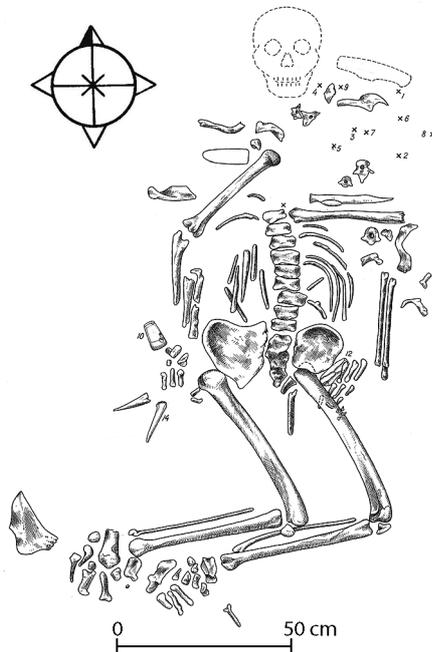


Fig. 12. Ardu burial II.
Joon 12. Ardu II matus.

porphyry was found left of the skull and a whole clay vessel (altogether 10 sherds were found during the excavation) was unearthed at the head. The vessel had shattered due to the weight of the soil and some sherds had been removed during the digging for sand. A bone adze had been placed by the right shoulder, a flint adze near the right wrist and a bone awl and a piece of antler lay by the bones of the right hand. A blade scraper or a knife of white flint was found between the phalanxes of the left hand by the left hip bone and a bone button between thigh bones (Indreko 1937, 186). The sample for AMS analysis was taken from the left *ulna*.

Date: 4110 ± 40 BP (Poz-10824) (Table 1).

Tika burial site

Location

The burial site is situated on the Island of Saaremaa (Fig. 1), in the village of Tika, on a gravel hill slightly higher than the surrounding landscape (Indreko 1939).

to south. The skeleton was predominantly anatomically correct, only the left *humerus* was in a 'wrong' position. Most of the upper part of the vertebral column (cervical *vertebrae* and single thoracic *vertebrae*) was not preserved and the lower *mandibula* was missing (Saadre 1936). The skeleton lay at a depth of 100–125 cm from ground level. At the same height a 50-cm long darker line, which partly continued over the bones of the left leg of the skeleton, was detected in the sand. Indreko supposed that it was a deposition of the decomposition of some organic material: for example a wooden pole may have been placed in the grave (Indreko 1937, 186 f.). According to the determination of the anthropologist Juhan Aul the deceased was a 40–45-year-old 175–178-cm tall strongly built male (Indreko 137, 198).

The deceased was accompanied by abundant grave goods (Fig. 12).

A Karlova-type battle-axe of diabase or

Research history

In 1934 a skeleton with a bone spearhead and Corded Ware sherds was found in the forest of Tika when digging for gravel for road building (Pöld 1938). At Tutku, 4–5 km south of the mentioned place, three more skeletons with pottery sherds by one of these were unearthed during the same road construction works. In 1938 Indreko carried out excavations there but inspection of the sites gave no results and no new skeletons were discovered. Only a single human bone was collected from Tika, which proved the existence of the burial site at the location (Indreko 1939).

Dated burial

The human bones found from Tika in 1934 were dated. According to the information from eyewitnesses, the skeleton had lain in gravel approximately at a depth of 30 cm from the present ground level (Indreko 1939) with its head directed to north (Pöld 1938; Indreko 1939). A ceramic vessel and a spearhead had been placed in the grave to accompany the dead. The sample for AMS analysis was taken from the lower *mandibula* (AI 3663: 2).

Date: 4035 ± 35 BP (Poz-10803) (Table 1).

Kunila burial site

Location

The cemetery is situated in central Estonia (Fig. 1), 4 km south-west of Puurmani on the western side of a small drumlin – on Jaaniansu hill. The Pedja River flows south from the north-east–south-west directed drumlin (Jaanits 1949).

Research history

During digging for gravel in 1938 a stone axe (AI 3723) and human bones were discovered in the Jaaniansu drumlin at Kunila. In 1948 Jaanits conducted archaeological excavations on the site in the course of which three excavation plots were opened (Jaanits 1949; Янитс 1985). The remains of two individuals were found in one of these.

Skeleton I was situated at a depth of 50–60 cm in the ground. According to Jaanits (1949, 3): ‘I got the impression as if the bones of skeleton I had been grouped in three sets the biggest of which mostly included big tubular bones, south-east of this was the skull and in south a smaller set contained some fragments of tubular bones.’ There were grave goods in the grave: a stone adze was obtained north-west of the skull and a battle-axe by the right *ulna* in the biggest bone set. In addition to these the grave contained wild boar and beaver teeth (Lõugas et al. 2007) as well as a point of the fang of a wild boar, a flint blade and wood remains. On the basis of the items Jaanits considered the burial to be a

male one (Jaanits 1949, 5). Besides the described skeleton also human bones in single smaller sets were discovered on the area of the excavation plot; these were documented as skeleton II (Jaanits 1949, 4).

It is possible that we are dealing with a somewhat larger cemetery. In the course of the preliminary work Jaanits gathered information from local people according to whom big bones and even an intact skeleton had been found from the gravel pit before 1938 (Jaanits 1949, 2). However, it is difficult to ascertain whether the bones were human or belonged to animals.

Dated burial

Dated bones derived from burial II found west of burial I. The first bone fragments were exposed already at a depth of 30–40 cm, but the majority of the bones were unearthed at a depth of 50–65 cm from the present ground level. Similarly to the first burial the dated skeleton was only partially preserved with the bones being fragmentary: the vertebral column was found with the cervical vertebrae lying east of the rest, a *mandibula* with teeth and two loose teeth were found at the same place. Single bones, among which the ends of the right and left *radii* were distinguished, were collected south-east of the mentioned bones. These lay 70–80 cm deep in the ground. An adze of white flint and a grinding stone were obtained by the first described bone set. The bones had been massive, which indicates that we are dealing with a male skeleton (Jaanits 1949, 5).

Jaanits (1949, 5) considered the reason for the disturbance to be the burying of the 1st deceased. In his opinion the two inhumations had been buried at different times, with skeleton II buried first. Later destruction during digging for gravel or even a partial burial cannot be excluded either. The sample for AMS analysis was taken from the lower *mandibula*.

Date: 3960 ± 40 BP (Poz-10825) (Table 1).

Karlova burial site

Location

The burial site (reg. no. 12977) is situated in south-eastern Estonia (Fig. 1) in the centre of the town of Tartu, in the park of former Karlova manor (Lõugas & Selirand 1977, 273).

Research history

In 1910 a potter Napp and bricklayer Hans Kurrik discovered a human skeleton during building a new cellar in the park of Karlova manor. The find was inspected by R. Hausmann and others (Hausmann 1911, 60). The burial site has not been excavated archaeologically.

Dated burial

The burial was located between the old cellar walls 30 cm deeper than their footing. The grave had been dug into clayey, sandy and gravelly soil where the deceased had been rested in a north–south directed supine position, head turned to north. The arms of the 18–20-year-old male (Hausmann 1911, 66) were tightly against his sides, his legs were extended and a 12 × 60 × 45 cm limestone slab had been placed on his chest. Two grave goods were discovered: a blackish-green Karlova-type battle-axe of diorite, which lay by his right hand, and a phyllite arrowhead (arrow as a grave good?) on his left hip (Hausmann 1911, 60–61).

The majority of the bones were to some extent defective, thus for example only three ribs had preserved from the body of the buried and his skull had been shattered to pieces. Both arms had *humeri* as well as *ulnae* and *radii*. Out of the lower extremities the right *femur* was intactly preserved, which enabled calculating 170 cm or a little more for the whole height of the deceased. The left side of the skeleton had been damaged more and compared to the right limbs the left ones were in poorer condition (Hausmann 1911, 65).

On the basis of the stone axe the discussed skeleton is connected with the Corded Ware Culture. The sample for AMS analysis was taken from the lower *mandibula*.

Date: 3805 ± 35 BP (Poz-15499) (Table 1).

Discussion

On the basis of the obtained radiocarbon dates the Estonian Stone Age inhumation burials can be divided into four temporal groups. The whole Neolithic¹⁶ is represented, which allows following changes in burial customs in considerably narrower temporal limits than it has been done by the frame dates of archaeological cultures so far.

The earliest are the skeletons of Veibri burial II (5210–4850 cal BC¹⁷), Tamula burial VII (4720–4490 cal BC) and Kivisaare burial IV (4360–4230 cal BC), which according to the presently valid Estonian Stone Age periodization (Lang & Kriiska 2001) belong to the Early Neolithic. In the case of all these skeletons we are dealing with extended supine burials. Veibri (if we leave aside the sherd of Narva-type pottery the context of which is somewhat unclear) is a quadruple burial without grave goods, Kivisaare IV a solitary burial without grave goods and Tamula VII a solitary burial with a rich grave inventory. The last burial is clearly different from the others and its date contradicts with the current interpretations.

¹⁶ The border between the Mesolithic and the Neolithic in Estonia is the introduction of pottery (Lang & Kriiska 2001).

¹⁷ Calibrated date 2 sigma.

Tamula burials VIII (4340–4050 cal BC) and X (4330–3970 cal BC) are discerned as a separate group, being dated to the border of the Early and Middle Neolithic. Comparison of Tamula burials X and VIII reveals several similar elements. Both are single burials in an extended supine position that have been placed on a ‘bed’ of branches. Also their orientation coincides largely (south-south-east–north-north-west and south-east–north-west respectively). Both deceased were accompanied by a rich variety of grave goods, six amber artefacts (three pendants, a disc and two cylindrical beads) being found with skeleton X.

Three skeletons from the Tamula I settlement and burial site, Tamula burial I (3630–3360 cal BC), III (3800–3640 cal BC) and XIX (3790–3640 cal BC), are clearly Middle Neolithic. Previously also human bones from the Kudruküla settlement site (Table 1) in north-eastern Estonia have been dated to this time-span. The Tamula III and XIX male burials are relatively similar. We are actually dealing with burials in opposite directions but the deceased have been placed in the graves in a similar way: both upper bodies have been laid straightly, only their legs have been flexed from knees towards right. The body position of the Tamula I female burial is quite similar as here the deceased woman has been placed in the grave partly flexed as well. Also the grave goods are alike: bone artefacts and supposedly also pottery sherds in graves I and III, animal tooth pendants in graves III and XIX; the inventory of grave XIX is slightly different from the others containing cylindrical beads of bird bone and two bone bird figurines.

According to the new AMS dates, five burials belong to the Late Neolithic. Of these Ardu II (2880–2500 cal BC), Sope II (2870–2490 cal BC) and Tika (2840–2470 cal BC) skeletons are somewhat older than Kunila II (2580–2340 cal BC) and Karlova (2460–2130 cal BC). Largely contemporary with the first three is the Naakamäe burial dated earlier (2890–2480 cal BC) and an unlocalized burial in Tamula where the date has been made from a wood sample (2900–2300 cal BC) (Table 1). The body positions of the deceased in the discussed sub-group differ: Ardu II and Sope II are flexed burials, in Karlova and Naakamäe the skeletons were laid in an extended supine position, the body positions of Tika and Tamula are not known. Also the grave inventory of the observed burials varies. Only a bone awl was obtained in the Naakamäe burial, in Karlova a Karlova-type stone axe and a stone arrowhead had been placed in the grave. As it is not known which of the burials from the Tamula I settlement and burial site we are dealing with, its grave goods can unfortunately not be analysed at this point. A Corded Ware vessel, a bone awl and a freshwater pearl mussel were obtained with the Sope II skeleton. Similarly to the burial from Karlova, a Karlova-type stone axe was found by the Ardu II skeleton. In addition, a ceramic vessel, a flint adze, a bone awl and a bone button were collected with this burial (more specifically on bone artefacts see Lõugas et al. 2007).

Beyond doubt the question concerning the credibility of the dates emerges. The dates are predominantly problematic in the case of the Tamula I settlement and burial site. In the light of new dates the site was used for burying between 4340 and 3360 cal BC, on average between 4200 and 3495 cal BC, according to

the periodization of archaeological cultures during the Typical Comb Ware Culture and at the beginning of the Late Comb Ware Culture. Tamula grave VII (the average date 4600 cal BC) is an exception not fitting in the above frames and it should belong to the Early Neolithic period, after the periodization of archaeological cultures to the era of the Narva Culture. These dates contradict with the until now dominating age determinations of both the settlement and the burial site. As mentioned above, the burial site has earlier been considered contemporary with the settlement site, the Late Neolithic, as it was judged on the basis of the stratigraphy that the deceased had been buried on the territory of the settlement site. At the same time the stratigraphy of the site is far from being unambiguously clear. In his first writings on the Tamula I settlement and burial site Jaanits (1947, 8; 1957, 94) is convinced that the burials are not earlier than the settlement site as single finds reach deeper than the skeletons and none of the grave depressions has been separated from the cultural layer by a sterile layer. However, later Jaanits describes the burials as having been situated 'in the lower part of the cultural layer or directly under it' (Jaanits et al. 1982, 81). In view of the AMS date from the 1990s the simultaneity of the burial and settlement site of Tamula I has started to raise doubts (Lõugas et al. 1996, 414; Lang & Kriiska 2001, 92; Ots 2003).

Dating with the radiocarbon method may yield results that do not correlate with other dates from the same site. The dissonances may be caused either by radiocarbon dating (which in turn may be due to errors in taking the sample, inaccuracy of the dating lab while cleaning the sample, etc.) or incorrect interpretation of the gathered archaeological material. In dating a bone one of the major reasons for errors is that contamination cannot be removed from the material. An important contamination source of bone material is humic acids, which, if left unremoved, could cause the obtained dates to seem older or younger than they actually are. This, however, depends on the environment of the specific find place (Bowman 1995, 27).

In the case of Tamula we should be careful when interpreting the date from skeleton III because the insufficient content of collagen – only 0.04% – may have influenced the result. In fact already samples with collagen content of 0.5–1% are considered problematic (van Klinken 1999, 689).

One mechanism for checking the credibility of dates is the value of a stable carbon isotope ($\delta^{13}\text{C}$) from the same sample. In the samples of the Tamula I settlement and burial site the value of $\delta^{13}\text{C}$ remains between -23.9‰ and -27.2‰ . Generally the standard value is considered to be -21‰ to -22‰ and deviations are regarded as a failure of radiocarbon dating (van Klinken 1999, 689; Eriksson & Zagorska 2003, 164). Considering this we could have doubts about all AMS dates of the human bones from the Tamula I settlement and burial site (see $\delta^{13}\text{C}$ values in Table 1). Although it is theoretically possible that a too low $\delta^{13}\text{C}$ value shows contamination of the sample, practically it is rare that a single parameter that deviates from the standard indicates at a contaminated sample (van Klinken 1999, 692). In the Estonian context the Tamula I settlement and

burial site is hardly an exception in this matter: similar low values of the stable isotope have been gained when dating other Stone¹⁸ and Bronze Age¹⁹ sites (see also Lõugas et al. 1996).

Since every site is unique nothing final can be said about the $\delta^{13}\text{C}$ values of the Tamula I settlement and burial site as indicators of possible contamination of the sample before comparable studies of the cultural layer and the faunal remains of the settlement site have been completed or special ^{13}C analyses made with the discussed value not obtained as a by-product of ^{14}C analyses. Considering the complex development of the Baltic Sea a specific ecology of isotopes must be elaborated in this region (Eriksson 2003, 19) that would enable adjusting for the situation where the $\delta^{13}\text{C}$ values of several sites exceed the standard values valid in western Europe. In the case of problematic burials repetitive analyses are undoubtedly necessary. Also settlement material should be dated at the Tamula I site to enable explaining the interrelationship of the settlement and the burial site.

To sum up, it should be said that while a single sample with a low $\delta^{13}\text{C}$ value from the Tamula I settlement and burial site might refer to the date being irrelevant, then the falling of recurrent samples into the same timespan suggests that the earlier interpretations are false rather than the radiocarbon ones. Considering the currently available material – stratigraphy (see Table 2), find material as well as

Table 2. Location of the dated burials in the cultural layer in Tamula

Tabel 2. Tamula dateeritud haudade asukoht kultuurikihis

Burial	Year of excavation, researcher	Date (BP) ^a	Location in the cultural layer (Jaanits 1957, table I), depth from ground level
Tamula I	1942, Indreko	4680 ± 40	In lower part ^b (48–58 cm)
Tamula III	1942, Indreko	4940 ± 40	In lower part (48–55/56 cm)
Tamula VII	1946, Moora	5760 ± 45	The lowermost border ^c (50 cm)
Tamula VIII	1955, Jaanits	5370 ± 45	The lowermost border (60–65 cm)
Tamula X	1955, Jaanits	5310 ± 85	In lower part (49–55 cm)
Tamula XIX	1956, Jaanits	4925 ± 40	In lower part (40–47 cm)

^a Detailed information in Table 1.

^b *Im unteren Teil* (Jaanits 1957, table I).

^c *An der untersten Grenze* (Jaanits 1957, table I).

¹⁸ The value of $\delta^{13}\text{C}$ on the charred layer on an Early Neolithic pottery sherd from the Kõpu I settlement site was –26.3‰ (Hela-843) (date published: Kriiska et al. 2005).

¹⁹ The radiocarbon date from the Kihnu Mõisaküla settlement site gave –25.8 for the value of $\delta^{13}\text{C}$, the indexes on the charred layer on ceramic vessels from Assaku and Altküla were respectively –27.2‰ (Hela-837) and –25.0‰ (Hela-838) and on the charred layers on pottery sherds from Joaorg at Narva –28.5‰ (Hela-1021) and –28.0‰ (Hela-1020) (dates published in Kriiska & Lõhmus 2004; Kriiska et al. 2005; Kriiska & Lavento 2006).

AMS dates from burials – it is possible that in the case of the Tamula I settlement and burial site we are dealing with (1) a site dated to different periods where the cemetery precedes the settlement site or (2) a site dated to different periods where part of the burials precede the settlement site, whereas the other part are contemporary with it.

Another important aspect regarding the inspection of the relevance of the dates is artefactual material: whether and to what extent the absolute chronology correlates with the relative chronology based on the analysis of the artefactual material.

As a rule Early Neolithic burials have few grave goods (Kõnnu and Joaorg at Narva – e.g. Kriiska & Tvauri 2002, 49) or they are completely lacking. No sure grave goods have been found with the collective burial of Veibri or with Kivisaare skeleton IV. In the case of these burials there is no contradiction with dates. However, the date of Veibri is supported by a Narva-type pottery sherd in the vicinity of the skeletons. Regardless of whether the sherd is a grave good or not, it shows Early Neolithic activity at the site. Narva-type pottery has been found in the immediate vicinity of Kivisaare burial IV as well (Kriiska et al. 2003, 37) with some sherds in the excavations of 2002 gathered from the destroyed grave depressions.

Tamula grave VII, which was also dated to the Early Neolithic, is extremely rich in grave goods (Fig. 8): amber pendants, pieces of amber, tooth pendants, bone bird figurines, bear fangs, pebbles, fragments of tubular bone, an adze with the fingernail-shaped blade, a fragment of a bone knife, a bone pendant, a fragment of a cylindrical bead, bone plates and their fragments (Lõhmus 2005, table 2). If the age determination is really true a contradiction must be stated with the dates obtained on the basis of the find material.

The unearthed amber pendants (AI 3960: 265, 266) are highly crafted artefacts and similar artefacts have been produced in most of the Middle Neolithic amber working centres (Ots 2006, 29). No information about specific artefacts or the use of amber before the Comb Ware Cultures can be found in Estonia. Until now amber has been considered a typical grave good for the Middle and Late Neolithic burial sites (Ots 2003, 96, 104). Adzes with the fingernail-shaped blade are of the same age and archaeological cultural background as well. In Finland where hundreds of such artefacts are known, they are characteristic of the Typical Comb Ware Culture period, especially of its younger part, and they have been used even during the Late Neolithic (e.g. Edgren 1984, 43). In Estonia they have been associated with the Late Comb Ware Culture period until now but this is based on numerous examples from the Tamula I settlement and burial site (for example Jaanits et al. 1982, 79). Current knowledge and dates suggest that both amber and the adze with the fingernail-shaped blade should be at least 400 years younger than the AMS date.

It should be born in mind that the chronology and periodization, which were supplemented and corrected for the last time at the beginning of the 2000s (Kriiska 2001; Lang & Kriiska 2001) were created mostly on the basis of the

chronologies of the neighbouring countries and only a few local dates. Therefore this chronology is as questionable as the date of Tamula grave VII. The possibility the artefacts characteristic of the Typical Comb Ware Culture (which is the basis for the distinguishing of the Middle Neolithic), including amber, were used already before 4200 BC is referred to by a date obtained from collective burial no. 274 in Zvejnieki – 4460–4330 cal BC (5545 ± 65 PB; Ua-19810 – Eriksson et al. 2003, table 1; Zagorska 2006, 101 f., table IV). Other Zvejnieki graves with amber also have comparatively early dates; nevertheless, they remain within the limits of the Middle Neolithic. With the present information it is not possible to convincingly prove either erroneous nature of the date of Tamula skeleton VII or the beginning of the Typical Comb Ware Culture; however, we cannot ignore the dissonance while seeking new interpretations.

Burials dated to the end of the Early Neolithic–beginning of the Middle Neolithic and to the Middle Neolithic have rich grave goods: there are adornments attached to clothing, consumer goods as well as food remains. Amber artefacts (Tamula grave X) and zoo- and anthropomorphic figurines of bone (Tamula graves VII and XIX) are the most exceptional finds in graves of that time. Predominantly we are dealing with pendants from animal teeth or bird tubular bones (Tamula graves III and XIX), also bone awls (Tamula grave I) and arrowheads (Tamula graves I and III) occur. This material correlates with the existing Stone Age chronology, the archaeological cultural background as well as new dates.

The same can generally be said about the Late Neolithic burials. Ceramic vessels (Sope II, Ardu II, Tika), stone axes (Ardu II, Karlova, Kunila), awls (Sope II, Ardu II), adzes (Ardu II, Kunila), freshwater pearl mussels (Sope II), etc. have been put in graves. The only question is raised in the case of the Karlova burial. The Karlova-type stone axes – artefact type that got its name after this burial – is a typical material in the Estonian Corded Ware Culture. This axe type is considered to have developed in western Estonia with strong influences from the Finnish Corded Ware Culture (Jaanits et al. 1982, 111). On the other hand, the phyllite arrowhead found in the same grave belongs rather to the artefact complexes of the Comb Ware Cultures. The arrowhead of Karlova belongs to the so-called Pyheensilta or Nylev type, which is mostly distributed in Finland, Norway, the Kola Peninsula and as single items also in the Baltic countries. They are dated mainly to the Late Neolithic (Kriiska & Saluäär 2000 and references therein); however, to some extent they have been found already from the settlement sites of the Typical Comb Ware Culture (oral commentary by Petro Pesonen, 5 November 2007).

AMS dating has brought about a real breakthrough in archaeology. Small quantities necessary for the analysis enable the dating of rare materials, including Stone Age human bones. New dates from a burial site very often have not only offered additional information and answers to existing questions, but have raised new problems and led to fresh interpretations. Of the Baltic Sea area examples can be given from Lithuania where together with new dates the perceptions of the anthropological material inherent to specific archaeological cultures have changed

as well. For example, after dating the Turlojiškė burial it was ascertained that it was not a grave from the Nemunas Culture period as it had been interpreted before (Antanaitis-Jacobs & Girininkas 2002, 17). The Donkalis 4 burial, which had been considered to belong to the Late Neolithic, turned out to be considerably older – Late Mesolithic – thus referring to the unclear stratigraphy of the settlement site (Antanaitis-Jacobs & Girininkas 2002, 16 f.). These graves have earlier been considered the determinants of archaeological cultures and thus the basis for the development history of anthropological types in Lithuania. In Finland the ochre burials in cists connected to the Early Neolithic so-called Jäkärälä group proved to belong to the Iron Age (Edgren 1999, 323). AMS dates from the northern Latvian Zvejnieki cemetery have been significantly supplemented and specified and have therewith brought the earlier chronological borders into question. With its 55 dates Zvejnieki is one of the best dated Stone Age burial sites in eastern Europe (Zagorska 2006, 92; Mannermaa et al. 2007).

On the one hand AMS dates from Estonian Stone Age burial sites demonstrate quite a great similarity during the whole Neolithic. Differently from the so far dominating opinion according to which the deceased were buried into settlement sites during the Neolithic period until the Corded Ware Culture, we can now state that among the known material cemeteries located separately from settlements prevail. Single burials (excluding the Veibri quadruple burial) dominate. More variations seem to be in body positions during the Late Neolithic, but both an extended supine and a flexed position were used already since the Early Neolithic (Kõnnu burial site in Saaremaa – Kriiska 2007, 18 and references therein). In the Tamula I burial site where wood has preserved burials dated to the border of the Early and Middle Neolithic (graves VIII and X) are discerned where the bottoms of the graves have been lined with branches. The composition and the amount of grave goods strongly vary during the Neolithic. In Early Neolithic graves there are as a rule few grave goods or these are lacking altogether, at the same time graves dated to the period from the Early to the Middle Neolithic and to the Middle Neolithic are rich in grave goods; Late Neolithic Corded Ware Culture burials have been equipped with different inventory.

Summary

Until now 17 burials from 10 Estonian Stone Age burial sites have been radiocarbon dated. These make up about one fifth of all the known Stone Age burials here. The obtained radiocarbon dates enable much more precise following of the changes in the burial customs in the area that is now Estonia. At the same time the new information raises numerous questions, among which the most important are: (1) Into which temporal context do the observed burials belong on the basis of the dates? (2) Can the dates be considered trustworthy and if so, how trustworthy? (3) How do the dates of the burials relate to the grave inventory and earlier interpretations?

The dates of the skeletons of the Tamula I settlement and burial site are the most problematic. On one hand these contradict with the opinion prevailing until now according to which the cemetery and the settlement site are simultaneous and belong to the Late Neolithic, on the other the skeletons have a disturbingly low value of the stable isotope ($\delta^{13}\text{C}$) and the amount of collagen was very small in one sample. As the timespans where the human bones are dated are often recurrent, then in our opinion there is reason to give up the earlier interpretations and suggest that in the case of the Tamula I settlement and burial site we are dealing with either sites from different periods where the cemetery precedes the settlement site or sites from different periods where part of the burials precede the settlement site, the other part being simultaneous with it. Beyond doubt the material of Tamula needs additional research and at least some repetitive dating of the same skeletons.

On the basis of the obtained radiocarbon dates Estonian Stone Age inhumation graves can be divided into four groups: Early Neolithic (Veibri II, Tamula VII and Kivisaare IV skeletons), the end of the Early Neolithic and the beginning of the Middle Neolithic (Tamula skeletons VIII and X), Middle Neolithic (Tamula skeletons I, III, XIX and human bones from Kudruküla) and Late Neolithic (Ardu II, Sope II, Tika, Kunila II, Karlova and Naakamäe skeletons). Although single burials were connected with the Early Neolithic already before (Kõnnu, Joaorg at Narva), now the tradition of inhumations can, on the basis of absolute dates, be traced back into the Early Neolithic. All through the Neolithic there were separate cemeteries in addition to burials in settlement sites in Estonia. Single burials are dominating and deceased were buried in an extended supine as well as a flexed position during the period. At the same time the association and amount of grave goods vary in temporal as well as in archaeological cultural sense.

Acknowledgements

The study was carried out with support of the Estonian Science Foundation under grants nos 5098 and 6899, and base-funded project of the University of Tartu 'Interdisciplinary archaeology: interactions of culture and the natural environment in the past'. The authors are grateful to the Estonian National Heritage Board, and to Raili Allmäe (MA) and Kristel Külljastinen (MA) for completing the drawings in the article.

References

- Antanaitis-Jacobs, I. & Girininkas, A.** 2002. Periodization and chronology of the Neolithic in Lithuania. – *Archaeologia Baltica*, 5, 9–39.
- Bolz, M.** 1914. Das neolithische Gräberfeld von Kiwisaare in Livland. – *Baltische Studien zur Archäologie und Geschichte. Arbeiten des Baltischen Vorbereitenden Komitees für den XVI.*

- Archäologischen Kongress in Pleskau 1914 herausgegeben von der Gesellschaft für Geschichte und Altertumskunde der Ostseeprovinzen Russlands. Riga, 15–32.
- Bowman, S.** 1995. Radiocarbon Dating. Interpreting the Past. British Museum Press.
- Bronk Ramsey, C.** 2005. OxCal (computer program). Version 3.10. The Manual (available at <http://www.rlaha.ox.ac.uk/oxcal/oxcal.htm>).
- Edgren, T.** 1984. Kivikausi. (Suomen historia, 1.) Weilin & Göös, Espoo, 18–95.
- Edgren, T.** 1999. Alkavan rautakauden kulttuurikuva Länsi-Suomessa. – **Fogelberg, P.** (ed.). Pohjan poluilla. Suomalaisten juuret nykytutkimuksen mukaan. (Bidrag kändedom av Finlands natur och folk, 153.) Suomen Tiedeseura, Helsinki, 311–333.
- Eriksson, G.** 2003. Norm and Difference, Stone Age Dietary Practice in the Baltic Region. Jannes Snabbtryck Kuvertproffset HB, Stockholm.
- Eriksson, G. & Zagorska, I.** 2003. Do dogs eat like humans? Marine stable isotope signals in dog teeth from inland Zvejnieki. – **Eriksson, G.** Norm and Difference, Stone Age Dietary Practice in the Baltic Region. Jannes Snabbtryck Kuvertproffset HB, Stockholm, 160–168.
- Eriksson, G., Lõugas, L. & Zagorska, I.** 2003. Stone Age hunter-fisher-gatherers at Zvejnieki, northern Latvia: Radiocarbon, stable isotope and archaeozoology data. – Before Farming (<http://www.waspjournals.com>), 1: 2, 1–25.
- Hausmann, R.** 1911. Das Steinzeitgrab von Karlowa bei Dorpat. – Sitzungsberichte der Gelehrten Estnischen Gesellschaft 1910. Jurjew-Dorpat, 60–66.
- Indreko, R.** 1931a. Aruanne Kivisaare kaevamistest Kolga-Jaani khk. Võisiku vld. Kivisaare tl. 8.–10. VI 31. (Manuscript in the Institute of History of Tallinn University.)
- Indreko, R.** 1931b. Aruanne kaevamistest Harjumaal Kose kihelkonnas 7. mail 1931. (Manuscript in the Institute of History of Tallinn University.)
- Indreko, R.** 1933. Aruanne kaevamistest Lügause khk. Püssi vld. Sope kl. Metsvälja tl. maal 9.–13. VIII. 1933. (Manuscript in the Institute of History of Tallinn University.)
- Indreko, R.** 1934. Aruanne kaevamistest Lügause khk. Püssi vld. Sope kl. Metsvälja tl. maal 23.–25. V. 1934. (Manuscript in the Institute of History of Tallinn University.)
- Indreko, R.** 1935. Sépultures néolithiques en Estonie. – Õpetatud Eesti Seltsi aastaraamat, 1933. Tartu, 202–223.
- Indreko, R.** 1937. Ein Hockergrab in Ardu, Ksp. Kose. – Õpetatud Eesti Seltsi toimetised, XXX. Tartu, 185–200.
- Indreko, R.** 1938. Aruanne inspeksiooni kohta Võru Tamula järve kiviaja leiukohale 13. augustil 1938. a. (Manuscript in the Institute of History of Tallinn University.)
- Indreko, R.** 1939. Aruanne järelkaevamiste kohta venekirveskultuuri haudade leiukohtadel Tika metsas ja Tutku kl kruusaaugus 24.–27. VIII 1938. (Manuscript in the Institute of History of Tallinn University.)
- Indreko, R.** 1942. Aruanne kaevamiste kohta kiviaja asulal Rõuge khk. Kasaritsa vl. Võru-Tamula järve kaldal Eduard Tärna heinamaal 18. VIII–1. IX 1942. a. (Manuscript in the Institute of History of Tallinn University.)
- Indreko, R.** 1945. Märkmeid Tamula leiu kohta. – SMYA, XLV, 26–43.
- Jaanits, L.** 1947. Tamula-äärse neoliitilise asula leiuainese käsitus. Auhinnatöö. (Manuscript in the Library of the University of Tartu.)
- Jaanits, L.** 1949. Aruanne kaevamistest Kursi khk-s ja vallas Kunila külas Mäe-Jaaniansu e. Keldri talu piirides asuval Jaaniansu mäel 5.–10. juunini 1948. (Manuscript in the Institute of History of Tallinn University.)
- Jaanits, L.** 1957. Neue Gräberfunde auf dem spätneolithischen Wohnplatz Tamula in Estland. – *Studia Neolithica* in honorem Aarne Äyräpää. (SMYA, 58.) Helsinki, 81–100.
- Jaanits, L.** 1961. Jooni kiviaja uskumustest. – **Jansen, E.** (ed.). Religiooni ja ateismi ajaloost. Artiklite kogumik, II. Eesti Riiklik Kirjastus, Tallinn.
- Jaanits, L.** 1965. Aruanne arheoloogilistest kaevamistest Kivisaare kalmistul Viljandi rajoonis end. Kolga-Jaani kihelkonnas 29. VI 1962. a. ja 6.–19. VII 1965. a. (Manuscript in the Institute of History of Tallinn University.)

- Jaanits, L.** 1984. Die kennzeichnende Züge der Siedlung Tamula. – ISKOS, 4, 183–193.
- Jaanits, L.** 1988. Eesti sooarheoloogias. – **Valk, U.** (ed.). Eesti sood. Valgus, Tallinn, 217–221.
- Jaanits, L., Laul, S., Lõugas, V. & Tõnisson, E.** 1982. Eesti esiajalugu. Eesti Raamat, Tallinn.
- Kriiska, A.** 1997. Aruanne arheoloogilisest inspeksioonist Ihastes (Tartu-Maarja khk.) 22.–27. sept. 1997. (Manuscript in the Institute of History and Archaeology of the University of Tartu.)
- Kriiska, A.** 2001. Stone Age Settlement and Economic Processes in the Estonian Coastal Area and Islands. Academic Dissertation. Helsinki. <http://ethesis.helsinki.fi/julkaisut/kultt/vk/kriiska/>
- Kriiska, A.** 2006. Aruanne arheoloogilistest eeluuringutest Ardu külas hilisneoliitilise kalmistu kaitsevööndis. (Manuscript in the Institute of History and Archaeology of the University of Tartu.)
- Kriiska, A.** 2007. Saaremaa kiviaeg. – **Jänes-Kapp, K., Randma, E. & Soosaar, M.** (eds). Ajalugu, majandus, kultuur. (Saaremaa, 2.) Tallinn, 9–36.
- Kriiska, A. & Lavento, M.** 2006. Narva Joaoru asulakohalt leitud keraamika kõrbekihi AMS-dateeringud. – **Kriiska, A. & Ivask, M.** (eds). Linnas ja linnuses. Uurimusi Narva ajaloost. (Narva Muuseumi Toimetised, 6.) Narva, 126–135.
- Kriiska, A. & Lõhmus, M.** 2004. Archaeological excavations on Mõisaküla settlement site in Kihnu. – AVE, 2003, 132–136.
- Kriiska, A. & Lõhmus, M.** 2005. Archaeological fieldwork on Kivisaare Stone Age burial ground and settlement site. – AVE, 2004, 31–43.
- Kriiska, A. & Saluäär, U.** 2000. Lemmetsa ja Malda neoliitilised asulakohad Audru jõe alamjooksul. – **Vunk, A.** (ed.). Artiklite kogumik, 2. (Pärnumaa ajalugu, 3. vihik.) Pärnu, 8–38.
- Kriiska, A. & Tvaauri, A.** 2002. Eesti muinasaeg. Avita, Tallinn.
- Kriiska, A., Johanson, K., Saluäär, U. & Lõugas, L.** 2003. The results of research of Estonian Stone Age. – AVE, 2002, 25–41.
- Kriiska, A., Allmäe, R., Lõhmus, M. & Johanson, K.** 2004. Archaeological investigation at the settlement and burial site of Kivisaare. – AVE, 2003, 29–44.
- Kriiska, A., Lavento, M. & Peets, J.** 2005. New AMS dates of the Neolithic and Bronze Age ceramics. – EJA, 9: 1, 3–31.
- Lang, V. & Kriiska, A.** 2001. Eesti esiaja periodiseering ja kronoloogia. – EAA, 5: 2, 83–109.
- Liiv, O.** 1924. Lüganuse (kihelkonna kirjeldus). (Manuscript in the Institute of History of Tallinn University.)
- Liiva, A., Ilves, E. & Punning, J.-M.** 1975. Radiosüsiniku alased uurimised geobiokeemia laboratooriumis. Tartu.
- Lõhmus, M.** 2005. Kammkeraamika kultuuride matused Eestis ning nende tõlgendusprobleemid. BA dissertation. (Manuscript in the Institute of History and Archaeology of the University of Tartu.)
- Lõugas, V. & Selirand, J.** 1977. Arheoloogiga Eestimaa teedel. Valgus, Tallinn.
- Lõugas, L., Lidén, K. & Nelson, D. E.** 1996. Resource utilization along the Estonian coast during the Stone Age. – **Hackens, T., Hicks, S., Lang, V., Miller, U. & Saarse, L.** (eds). Coastal Estonia. Recent Advances in Environmental and Cultural History. (PACT, 51.) Rixensart, 399–420.
- Lõugas, L., Kriiska, A. & Maldre, L.** 2007. New dates for the Late Neolithic Corded Ware Culture burials and early animal husbandry in the East Baltic region. – Arheofauna, 16, 21–31.
- Loze, I.** 2006. Crouched burials of the Corded Ware Culture in east Baltic. – Back to the Origin. New Research on the Mesolithic–Neolithic Zvejnieki Cemetery and Environment, Northern Latvia. (Acta Archaeologica Lundensia, Series in 8°, No. 52.) Almqvist & Wiksell International, Stockholm, 311–326.
- Mäemets, A.** 1977. Eesti NSV järved ja nende kaitse. Tallinn.
- Mannermaa, K., Zagorska, I., Jungner, H. & Zarina, G.** 2007. New radiocarbon dates of human and bird bones from Zvejnieki Stone Age burial ground in northern Latvia. – Before Farming, 1, 1–12.
- Moora, H.** 1926. Aruanne kaevamistest Lüganuse khk. Sope kl. Metsvälja tl. maal 23. aug. 1926. a. (Manuscript in the Institute of History of Tallinn University.)
- Moora, H.** 1946. Kaevamisaruanne Rõuge khk. Kasaritsa vallas Tamula järve kaldal paikneval neoliitilisel asulal 10.–19. augustil 1946. (Manuscript in the Institute of History of Tallinn University.)

- Ots, M.** 2002. Aruane inspektsioonist Võrumaale Rõuge ja Põlva kihelkondadesse 11. aprillil 2002. aastal. (Manuscript in the Institute of History of Tallinn University.)
- Ots, M.** 2003. Stone Age amber finds in Estonia. – Amber in Archaeology. Proceedings of the Fourth International Conference on Amber in Talsi, 2001. Riga, 96–107.
- Ots, M.** 2006. Merevaiguleiud Baltimaade kivi- ja pronksiaja muististes. MA dissertation. (Manuscript in the Library of the University of Tartu.)
- Ottow, B.** 1911. Das neolithische Grabfeld von Kiwisaar an der Pahle (Nordlivland). – Sitzungsberichte der Gelehrten Estnischen Gesellschaft, 1910. Jurjew-Dorpat, 148–160.
- Pöld, J.** 1938. Tartu ülikooli arheoloogia kabinetile. (Letter in the Institute of History of Tallinn University.)
- Reimer, P. J., Baillie, M. G. L., Bard, E., Bayliss, A., Beck, J. W.** et al. 2004. IntCal04 terrestrial radiocarbon age calibration, 0–26 cal kyr BP. – Radiocarbon, 46: 3, 1029–1058.
- Saadre, E.** 1936. Aruane Kose khk., Triigi vld., Ardu kl., Hansu-Mardi tl. maal leitud kiviaja luustiku kohta suvel 19. augustil 1936. (Manuscript in the Institute of History of Tallinn University.)
- Tallgren, A. M.** 1921. Aruane uurimisist Kolga-Jaanis kevadel 1921. a. ette võet üliõpilaste ekskursioonil. (Manuscript in the Institute of History of Tallinn University.)
- Tallgren, A. M.** 1922. Zur Archäologie Eestis, 1. Vom anfang der Besiedlung bis etwa 500. n. Chr. (Acta et Commentationes Universitatis Tartuensis (Dorpatensis), III: 6.) Dorpat.
- Tiitsmaa, A.** 1922. Muhu. (Manuscript in the Institute of History of Tallinn University.)
- Van Klinken, G. J.** 1999. Bone collagen quality indicators for palaeodietary and radiocarbon measurements. – Journal of Archaeological Science, 26, 687–695.
- Zagorska, I.** 2006. Radiocarbon chronology of the Zvejnieki burials. – Back to the Origin. New Research on the Mesolithic–Neolithic Zvejnieki Cemetery and Environment, Northen Latvia. (Acta Archaeologica Lundensia, Series in 8°, No. 52.) Almqvist & Wiksell International, Stockholm, 91–113.
- Ильвес Э., Лийва А. & Пуннинг Я.-М.** 1974. Радиоуглеродный метод и его применение в четвертичной геологии и археологии Эстонии. Таллин.
- Янитс Л.** 1952. Позднеолитические могильники в Эстонской ССР. – Академия наук СССР. О докладах и полевых исследованиях Института истории материальной культуры. Таллин, 53–65.
- Янитс Л. Ю.** 1985. Могильник культуры ладьевидных топоров в Кунила. – Изыскания по мезолиту СССР. Ленинград, 84–90.

**Aivar Kriiska, Lembi Lõugas, Mari Lõhmus,
Kristiina Mannermaa ja Kristiina Johanson**

UUED AMS-DATEERINGUD EESTI KIVIAJA MATMISPAIKADEST

Resüme

Kiviaegsete matmispaikade uurimine sai Eestis alguse 19. sajandi lõpu-kümnenditel, suurem osa teavet on kogutud aga 20. sajandi esimesel poolel. Seni viimane kiviaegne matmispaik leiti 2003. aastal Tartu linna lähedalt Veibril. Vaatamata sellele et kiviaegse matmiskombestiku uurimistraditsioon ulatub pooleteise sajandi taha, on seni pärssinud tõlgendamist muuhulgas täpsete dateeringute puudumine.

Kuigi esimene radiosüsinikudateering Eesti kiviaegsest matusest tehti juba 1950. aastate lõpul, mil analüüsiti ühest Tamula I asula- ja matmispaigal (joon 1, tabel 1) avatud hauast leitud puitu, avanes kiviaegsete inimluude kui väga haruldase materjali ajaliseks määramiseks võimalus alles kiirendi-massispektromeetria (AMS) rakendamisega radiosüsiniku dateerimises. Esimesed AMS-dateeringud tehti Eestis 1990. aastatel Kudruküla asulakohalt leitud inimluudest ja Naakamäe asulakohalt ning Tamula I asula- ja matmispaigalt leitud luustikust (haud X). Tänu erinevatele uurimisprojektidele on 2000. aastatel tehtud AMS-dateeringuid veel kaheteistkümnest luustikust.

Kagu-Eestis Suur-Emajõe põhjakaldal **Veibris** paikneval matmispaigal on välja kaevatud (2003) üks nelikhaud (joon 2), kuhu oli maetud selili-siruliasendis kolm last ja täiskasvanu. Kaks last olid orienteeritud peaga kagusse ja täiskasvanu ning tema kõrval lamanud laps asetsesid esimestega diametraalselt vastassuunaliselt. Samaaegselt hauda pandud surnutel puudusid panused, kuid välistada ei saa ühe arvatava Narva-tüüpi savinõu killu kuulumist kompleksi. Luuproov AMS-dateerimiseks võeti täiskasvanud indiviidi (luustik II) parema kodarluu korpuse osast. Dateeringuks saadi 6090 ± 45 ^{14}C -aastat (Hela-1331).

Kesk-Eestis Meleski külas kagu-loode-suunalisel voorel paiknevast **Kivisaare** kiviaja matmispaigast leiti haudu juba 19. sajandi teisel poolel ja seejärel (1903, 1908–1910, 1913, 1921, 1931, 1962, 1964–1965, 2002–2004) on sealt erinevate uurijate poolt välja kaevatud enam kui paarkümmend suhteliselt tervikuna säilinud luustikku ning üksikuid luid rohkem kui kümnelt indiviidilt. Luuproov AMS-dateerimiseks võeti 1965. aasta kaevamistel leitud lõunaedela-põhjakirde-suunalises madalas ovaalses hauas paiknenud selili-siruliasendis panusteta lapseluustiku (joon 3, 4) kolju fragmendist (1960. aastatel uuritud haudade numeratsiooni kohaselt luustik 4). Dateeringuks saadi 5450 ± 40 ^{14}C -aastat (Poz-10840).

Kagu-Eestis Võru linna lähedal Tamula järve kaldal paiknevalt **Tamula I** neoliitiliselt asula- ja matmispaigalt on aja jooksul (1942–1943, 1946, 1955–1956, 1961, 1968, 1988–1989) välja kaevatud 25 rohkem või vähem tervikliikku luustikku. AMS-dateeringud on tehtud neist viiest (matused I, III, VII, VIII, XIX). **I luustik** kuulus naisele, kes oli maetud peaga loode suunas paremale küljele kõverdatud asendis (joon 5, 6) koos mitmete panustega (nooleotsad, luuteravik, luueseme katke jms). Reieluust võetud proovist saadi vanusemäärang 4680 ± 40 ^{14}C -aastat (Poz-15645). **III luustik** (joon 7) kuulus mehele, kes oli kirde-edela-suunalisse hauda asetatud kägardatult, jalad paremale poole konksus (samas paiknes lüüsammas otse), koos panustega (hammasripatsid, ahinguotsa katke ja savinõukillud). Roidest võetud proovist saadi vanusemäärang 4940 ± 40 ^{14}C -aastat (Poz-10826). **VII luustik** kuulus lapsele (joon 8), kes oli maetud põhja-lõuna-suunaliselt selili-siruliasendis koos rikkalike panustega (küüstalb, luust noa katke, hammasripatsid, luuripats, merevaikripatsid, luust loomakujukesed jms), mõlemas käes sookure tiibade fragmendid. Alalõualuust võetud proovist saadi vanusemäärang 5760 ± 45 ^{14}C -aastat (Hela-1335). **VIII luustik** (joon 9) kuulus naisele, kes oli kagu-loode-suunalisse puuokstega vooderdatud hauda asetatud selili-siruli

koos panustega (luust nooleotsad, kiltkivist küüstalb, tulekivist kõõvits, luunaaskel, linnuluust toruhelmed, luuplaadist antropo- ja zoomorfsed figuurid). Vasaku reieluu korpuse osast võetud proovist saadi vanusemäärang 5370 ± 45 ^{14}C -aastat (Hela-1336). **XIX luustik** (joon 10) kuulus mehele, kes oli edela–kirde-suunalisse hauda asetatud nii, et ülakeha jäi selili, kuid lüüsisamba alumine osa oli mõnevõrra paremale keeratud. Kaasa oli pandud panuseid (luuplaadist linnufiguur, hammasripatsid, linnuluust toruhelmed). Reieluu korpuse osast võetud proovist saadi vanusemäärang 4925 ± 40 ^{14}C -aastat (Hela-1337).

Kirde-Eestis Purtse lähedal paiknevalt **Sope** matmispaigalt on alates 19. sajandi lõpust erinevatel aegadel leitud enam kui kümne inimese luid, neist kaks on välja kaevatud (1926, 1933) arheoloogide poolt. Proov AMS-dateerimiseks võeti 1933. aasta kaevamistel leitud naise luustikust (matus II). Naine oli maetud loode–kagu-suunalisse hauda paremale küljele, põlved kõverdunud, parem käsi pea all, vasak kehal (joon 11), koos panustega (terve savinõu, luunaaskel, jõekarbi koda, peotäis väikesi ümaraid kivikesi). Paremast esimesest põialuust võetud proovist saadi vanusemäärang 4090 ± 35 ^{14}C -aastat (Poz-10827).

Loode-Eestis **Ardu** külas paiknevalt matmispaigalt on leitud (1931 ja 1936) kaks luustikku. Proov AMS-dateerimiseks võeti 1936. aasta kaevamistel leitud mehe luustikust (matus II). Mees oli maetud põhja–lõuna-suunalisse hauda kõverdunud jalgadega (joon 12) koos rohkete panustega (venekujuline kivikirves, terviklik savinõu, luust talb, tulekivist talb, tulekivist laastkõõvits või nuga, luupöör, luust naaskel ja sarveots). Vasakust küünarluust võetud proovist saadi vanusemäärang 4110 ± 40 ^{14}C -aastat (Poz-10824).

Saaremaalt **Tika** külast on juhuslikult kruusa kaevandamisel leitud (1934) üks luustik koos väheste panustega (luust ahinguots ja nõorkeraamika killud). Alalõualuust võetud proovist saadi vanusemäärang 4035 ± 35 ^{14}C -aastat (Poz-10803).

Kesk-Eestis Puurmani lähedal **Kunilast** on väikeselt voorelt leitud kiviaegseid matuseid juhuslikult ja kaks avatud arheoloogiliste väljakaevamiste (1948) käigus. Proov AMS-dateerimiseks võeti hauast (matus II), kus paiknes vaid osaline või osaliselt säilinud luustik koos mõningate panustega (tulekivist talb ja ihumis-kivi). Alalõualuust võetud proovist saadi vanusemäärang 3960 ± 40 ^{14}C -aastat (Poz-10825).

Kagu-Eestist Tartu **Karlova** linnaosast on leitud kiviaegne põhja–lõuna-suunaline haud, kuhu oli maetud selili-siruliasendis mees koos mõningate panustega (venekujuline kivikirves ja nooleots). Alalõualuust võetud proovist saadi vanusemäärang 3805 ± 35 ^{14}C -aastat (Poz-15499).

Saadud radiosüsinikudateeringute põhjal võib Eesti kiviaegsed maahaudkalmed jagada ajaliselt neljaks rühmaks. Kõige varasemad on Veibri II (5210–4850 eKr²⁰), Tamula VII (4720–4490 eKr) ja Kivisaare IV luustik (4360–4230 eKr), kuuludes Eesti kiviaja praeguse periodiseeringu kohaselt varaneoliitikumi. Kõigi nimetatud haudade puhul on tegemist selili-siruli matustega. Veibri I on (kui jätta kõrvale

²⁰ Kalibreeritud vanus, 2 sigma.

mõneti ebaselge kontekstiga oletatav Narva-tüüpi keraamika kild) panusteta nelikmatus, Kivisaare IV on panusteta üksikmatus ja Tamula VII on rikkaliku hauainventariga üksikmatus. Viimane eristub teistest selgelt ja selle dateering on vastuolus seniste tõlgendustega.

Omaette rühmana eristuvad Tamula VIII (4340–4050 eKr) ja X luustik (4330–3970 eKr), paiknedes varaneoliitikumi ja keskneoliitikumi piiril. Tamula X ja VIII matust kõrvutades torkab silma mitmeid sarnaseid elemente. Tegemist on okstest alusele asetatud selili-siruli üksikmatustega, mille orientatsioon suures osas korreleerub (vastavalt lõunakagu–põhjakirre ja kagu–kirre). Mõlemale surnule on hauda kaasa pandud rohkelt esemeid, kusjuures X luustiku juurest on saadud ka kuus merevaihket.

Kindlalt keskneoliitilised on kolm luustikku Tamula I asula- ja matmispaigast: Tamula I (3630–3360 eKr), III (3800–3640 eKr) ning XIX (3790–3640 eKr). Varem on sama vahemikuga dateeritud inimluud Kirde-Eestist Kudruküla asulast. Tamula III ja XIX mehe matused on küllalt sarnased. Tegemist on küll vastasorientatsiooniliste haudadega, ent see-eest on surnud hauda asetatud ühetaoliselt: mõlema ülakeha on lebanud sirgelt, vaid nende jalad on olnud põlvest paremale poole kõverdatud. Kehaasendi poolest küllalt sarnane on ka Tamula I naisele kuulunud matus, kus surnu on samuti hauda asetatud osaliselt kägardatuna. Ka panused on suhteliselt sarnased: I ja III hauas luuesemed ning oletatavasti ka savinõukillud, III ja XIX hauas loomahammastest ripatsid; teistest pisut erinev on XIX haa inventar, mis sisaldab ka linnuluust toruhelmeid ning kaht luust linnufiguuri.

Hilisneoliitikumi kuulub uute AMS-dateeringute põhjal viis matust: Ardu II (2880–2500 eKr), Sope II (2870–2490 eKr), Tika (2840–2470 eKr), Kunila II (2580–2340 eKr) ja Karlova (2460–2130 eKr). Esimese kolmega laias laastus samaaegne on ka varem dateeritud Naakamäe matus (2890–2480 eKr) ja üks Tamula lokaliseerimata haud puidust tehtud dateeringu järgi (2900–2300 eKr). Vaadeldavas alarühmas on surnute kehaasend varieerunud: Ardu II ja Sope II on kägarmatused, Karlovas ning Naakamäel asetsesid luustikud selili-siruliasendis, Tika ja Tamula maetute kehaasend ei ole teada. Samuti erineb vaadeldavatel matustel panuseline materjal. Naakamäe matuse juurest on saadud vaid luust naaskel, Karlovas oli hauda asetatud Karlova-tüüpi kivikirves ja kivist nooleots. Kuna pole teada, millise Tamula I asula- ja kalmistumatuses täpselt tegemist on, siis ei ole selle panuselist materjali siinkohal võimalik analüüsida. Sope II luustiku juurest saadi aga nõorkeraamiline savinõu, luust naaskel ja jõe pärlkarp. Sarnaselt Karlova matusele oli ka Ardu II luustiku juures Karlova-tüüpi kivikirves, lisaks sellele saadi sealt savinõu, luutalb, tulekivist talb, luust naaskel ja pöör.

Kahtlemata kerkib üles küsimus saadud dateeringute usaldusväärsusest. Probleemsed on need eelkõige Tamula I asula- ja matmispaiga puhul. Uute dateeringute valgusel on sinna maetud peamiselt ajavahemikus 4340 kuni 3360 eKr, keskmistatud näitadena 4200 kuni 3495 eKr, arheoloogilis-kultuurilise periodiseeringu kohaselt tüüpilise kammkeraamika perioodil ja hilise kammkeraamika ajajärgu algul. Erandiks on Tamula VII haud (keskmistatult 4600 eKr), mis nendesse raa-

midesse ei mahu ja peaks kuuluma varaneoliitikumi, Narva kultuuri aega. Need dateeringud on aga vastuolus nii asula kui ka kalmistu senise vanusemääranguga. Matmispaik on dateeritud varem asulaga samaaegseks, hilisneoliitikumi, oletades peamiselt stratigraafia järgi, et matmine on toimunud elupaiga territooriumile.

Dateerimisel radiosüsinikumeetodil esineb juhte, kus saadud vanusemäärangud ei korreleeru teiste samast muistisest saadud dateeringutega. Ebakõlad võivad olla tingitud kas radiosüsinikudateeringust (mis omakorda on võinud tekkida proovi võtmisel tehtud vigadest, dateerimislabori tegematajätmistest proovi puhastamisel vms) või kogutud arheoloogilise materjali ebatäpsest tõlgendamisest. Luude dateerimisel peetakse üheks peamiseks vea tekkepõhjuseks seda, et materjalilt ei suudeta reostust eemaldada. Luumaterjali puhul on üheks oluliseks saasteallikaks huumuses olevad happed, mille eemaldamata jätmise proovist võib tekitada olukorra, kus saadud vanusemäärangud on tegelikkusest vanemad või nooremad. Viimane sõltub aga eelkõige konkreetse leiukoha keskkonnast.

Tamula puhul on kindlasti põhjust olla ettevaatlik III luustikust tehtud dateeringu puhul, kuna proovi tulemust on võinud mõjutada vähene – vaid 0,04% – kollageeni sisaldus.

Üheks dateeringute usaldusväärsust kontrollivaks mehhanismiks on stabiilse isotoobi ($\delta^{13}\text{C}$) väärtus samas proovis. Tamula I asula- ja matmispaiga proovides on see vahemikus $-23,9\%$ kuni $-27,2\%$. Üldjuhul peetakse normväärtuseks $-21/22\%$ ja kõrvalekalded tähendaksid radiosüsinikudateeringu ebaõnnestumist. Selle kohaselt võiks kahelda kõigis Tamula I asula- ja matmispaigalt saadud inimluude dateeringutes. Kuigi teoreetiliselt on tõesti võimalik, et liialt madal $\delta^{13}\text{C}$ väärtus näitab proovi saastatust, juhtub praktiliselt siiski harva, et proovi rikub üksainus normist kõrvale kalduv parameeter. Eesti kontekstis ei ole Tamula I asula- ja matmispaik mingi erand: sarnaseid madalaid stabiilse isotoobi väärtusi on saadud ka teiste kivi- ning pronksiaja muististe dateerimisel. Probleemsete matuste puhul on kahtlemata vajalikud korduvalüüsid.

Tuleb tõdeda, et kui ühe juhusliku madala $\delta^{13}\text{C}$ väärtusega proovi puhul Tamula I asula- ja matmispaigast võib veel kahelda selle dateeringu relevantsuses, siis paljude proovide langemine ühte ja samasse ajavahemikku annab kindluse, pidamaks vääraks pigem varasemat tõlgendust kui saadud radiosüsinikudateeringuid. Arvestades hetkel olemasoleva materjaliga – nii stratigraafia, leiuaines kui ka AMS-dateeringud matustest –, on tõenäoline, et Tamula I asula- ja matmispaiga puhul on tegemist kas: 1) eriaegsete muististega, kus kalmistu eelneb asulakohale, või 2) eriaegsete muististega, kus osa matuseid eelneb asulakohale, teised on aga sellega samaaegsed.

Teiseks oluliseks aspektiks saadud dateeringute relevantsuse kontrollimisel on esemeline materjal: kas ja mil määral korreleeruvad omavahel absoluutne ja esemelise materjali analüüsil baseeruv suhteline kronoloogia?

Varaneoliitilised matused on reeglina väheste panustega (Kõnnu ja Narva Joaoru) või puuduvad need sootuks. Nii Veibri kollektiivmatusest kui ka Kivi- saare IV hauast pole kindlaid panuseid saadud. Nende haudade puhul ei ole või-

malik täheldada dateeringutega mingit vastuolu. Siiski toetab Veibri dateeringut oletatav Narva-tüüpi keraamika kild luustike juurest. Sõltumata sellest, kas see on hauapanus või ei, näitab see seal toimunud varaneoliitilist tegevust. Ka Kivisaare IV haua lähialalt on leitud Narva-tüüpi keraamikat, kusjuures mõned killud paiknesid isegi oletatavates lõhutud haualohkudes.

Äärmiselt rikkalike panustega Tamula VII haud on samuti andnud varaneoliitilise dateeringu. Juhul kui vanusemäärang on tõene, tekib vastuolu hauast leitud esemete põhjal saadavate dateeringutega. Leitud merevaikripatsite puhul on tegemist hästi töödeldud esemetega, mille sarnaseid on valmistatud enamikus keskneoliitilistes töötluskeskustes. Nii konkreetset tüüpi esemete kui ka üldse merevaigu kasutamisest enne kammkeraamika kultuuri ei ole Eestist mingeid andmeid. Seni on merevaiku peetud Eesti matmispaikadele omaseks hauapanuseks kesk- ja hilisneoliitikumis. Sarnase vanuse ja arheoloogilis-kultuurilise taustaga on ka küüсталvad. Soomes, kus selliseid esemeid tuntakse sadu, on need omased tüüpilise kammkeraamika ajajärgule, eriti selle nooremale osale, neid kasutati veel ka hilisneoliitikumis. Eestis on neid seni seotud eriti hilise kammkeraamika perioodiga, kuid aluseks sellele on just Tamula I asulakohalt ja matmispaigalt saadud rohked eksemplarid. Seniste teadmiste ja dateeringute alusel peaksid nii merevaik kui ka küüсталb olema saadud AMS-dateeringust minimaalselt 400 aastat nooremad.

Tuleb aga arvestada, et viimati 2000. aastate algul täiendatud ja korrigeeritud Eesti kiviaja kronoloogia ning periodiseering on loodud keskneoliitikumi osas väga väheste siinsete dateeringute ja naabermaade kronoloogiate alusel ning on seetõttu samamoodi kahtluse alla seatav kui Tamula VII haua dateering. Võimalusele, et tüüpilise kammkeraamika kultuurile (mis on aluseks keskneoliitilise alaperioodi eristamisele) iseloomulikud esemed, sh merevaik, on tulnud kasutusele juba enne aastat 4200 eKr, osutab Zvejnieki kalmistu kollektiivhauast nr 274–278 saadud dateering. Ka teised Zvejnieki merevaiguga varustatud hauad on võrdlemisi varaste dateeringutega, jäädes siiski keskneoliitikumi piiridesse. Praegu ei ole võimalik veenvalt tõestada ei Tamula VII luustiku dateeringute ekslikkust ega tüüpilise kammkeraamika kultuuri varasemat algust.

Vara- ja keskneoliitikumi piirile jäävad matused ja keskneoliitikumiga dateeritavad kalmed on rikkalike panustega: esineb nii rõivaste külge kinnitatud kaudistusi, tarbeesemeid kui ka toidujäänuseid. Sel perioodil on markantseimateks esemeteks haudades merevaikesemed (Tamula X) ja luust zoo- ning antropomorfseid figuurid (Tamula VIII ja XIX). Valdavalt on tegemist siiski loomahammastest või linnu toruluudest ripatsitega (Tamula III, XIX), esineb ka luust naaskleid (Tamula I) ja nooleotsi (Tamula I, III). See materjal korreleerub nii olemasoleva kiviaja kronoloogiaga, arheoloogilis-kultuurilise tausta kui ka uute dateeringutega.

Sama võib üldjoontes tõdeda ka hilisneoliitiliste matuste puhul. Kaasa on pandud savinõusid (Sope II, Ardu II, Tika), kivist kirveid (Ardu II, Karlova, Kunila), naaskleid (Sope II, Ardu II), talbu (Ardu II, Kunila), jõekarpe (Sope II) jms.

Ainus küsitavus tekib Karlova matuse puhul. Karlova-tüüpi kivikirved – eseme-tüüp, mis on oma nimetuse saanud just vaadeldava kalme järgi – on Eesti ala nöörikeramika kultuurile omane materjal. Nimetatud kirvetüüpi on peetud väljakujunenuks Lääne-Eestis ja oletatud tugevaid Soome nöörikeramika kultuuri mõjusid. Teisalt kuulub aga samast hauast leitud fülliidist nooleots kokku pigem kammkeramika kultuuride esemekompleksidega. Karlova nooleots kuulub nn Pyheensilta- või Nylevi-tüüpi, mis on levinud põhiliselt Soomes, Norras ja Koola poolsaarel, üksikeksemplaridena ka Baltimaades, ja on dateeritud hilisneoliitikumiga, kuigi mõnevõrra on neid leitud ka juba tüüpilise kammkeramika kultuuri asulakohtadest.

Eesti kiviaegsete matmispaikade AMS-dateeringud näitavad ühelt poolt matmis-kombestiku küllalt suurt sarnasust kogu neoliitikumi vältel. Erinevalt senisest domineerivast arvamusest, mille kohaselt maeti neoliitikumis kuni nöörikeramika kultuurini surnuid põhiliselt elupaikadesse, võib tõdeda, et teadaoleva materjali hulgas on peamiselt siiski elupaikadest eraldi rajatud kalmistud. Valdavalt on tegemist üksikmatustega (v.a Veibri nelikmatust). Kehaasendites tundub olevat enam variatsioone hilisneoliitikumis, kuid nii selili-siruli- kui ka kägerasend on olnud kasutusel juba alates varaneoliitikumist (Kõnnu matmispaik Saaremaal). Tamula I matmispaigas, kus ainsana on säilinud puitu, eristuvad vara- ja keskneoliitikumi piiriga dateeritud matused (VIII ja X), kus haua põhi on vooderdatud okstega. Tugevalt varieerub neoliitikumi jooksul aga panuseline materjal nii koostiselt kui ka hulgal. Varaneoliitilistes kalmetes on hauapanuseid reeglina vähe või puuduvad need üldse, samas kui vara- ja keskneoliitikumi piiriga ning keskneoliitikumiga dateeritavad hauad on rikkalike panustega. Eriilmelise inventariga on olnud varustatud hilisneoliitilised nöörikeramika kultuuri kalmed.