Estonian Journal of Archaeology, 2005, **9**, 1, 3–31

Aivar Kriiska, Mika Lavento and Jüri Peets

NEW AMS DATES OF THE NEOLITHIC AND BRONZE AGE CERAMICS IN ESTONIA: PRELIMINARY RESULTS AND INTERPRETATIONS

The AMS dates of the carbonized organics on eight Neolithic and Bronze Age potsherds found in Estonia are presented and interpreted considering the previous dates of textile-impressed pottery, ceramic typology and textile history. New dates confirmed the earlier supposition that making textile impressions on clay vessels (of the Late Combed Ware and Early Textile Ceramics) started already at the end of the Neolithic, yet the new results dated the appearance of the phenomenon to c. 2700 cal BC, which is approximately 1000 years earlier than hitherto assumed. By the beginning of the Late Bronze Age around 1100 cal BC, the ceramics, often termed Textile Ceramics, had formed on the present-day territory of Estonia.

The textile impressions on the surfaces of the vessels have been made using fabric woven in different techniques. The sherds analysed bear the impressions of textiles made in tabby and repp weave, the latter indicating the use of the loom for weaving the fabric. The impression observable on one of the potsherds presumably originates from fabric produced in needle-netting technique.

On esitatud kaheksa Eesti alalt leitud neoliitilise ja pronksiaegse savinõukillu kõrbekihist tehtud AMS-dateeringud ja tõlgendatud neid tekstiilijäljenditega keraamika senistest dateeringutest, keraamikatüpoloogiast ja tekstiiliajaloost lähtuvalt. Uued dateeringud kinnitavad varasemat oletust, et tekstiilijäljendeid hakati savinõudele (hiline kammkeraamika ja varane tekstiilkeraamika) tegema juba neoliitikumi lõpul, täpsustades selle algusajaks u 2700 aastat eKr, mis on ligi 1000 aastat seni arvatust varem. Noorema pronksiaja alguseks, u 1100 aastat eKr, oli Eesti alal välja kujunenud keraamika, mida nimetatakse sageli tekstiilkeraamikaks.

Tekstiilijäljendid on kantud nõude pinnale erinevates tehnikates valmistatud riidega. Analüüsitud kildudel esineb labases koes ja ripsis tehtud tekstiilide jäljendeid, kusjuures viimased osutavad kangakudumisele kangaspuudel. Ühel killul esinev vajutis pärineb arvatavasti nõeltehnikas tehtud riidest.

Aivar Kriiska, Chair of Archaeology, Department of History, University of Tartu (Tartu Ülikooli ajaloo osakonna arheoloogia õppetool), Lossi 3, 51003 Tartu, Estonia; aivar.kriiska@ut.ee
Mika Lavento, Institute for Cultural Research, University of Helsinki, Unioninkatu 38 F, 00014 Helsinki, Finland; mika.lavento@helsinki.fi
Jüri Peets, Laboratory of Geoarchaeology and Ancient Technology, Institute of History (Ajaloo Instituudi geoarheoloogia ja muinastehnoloogia labor), Rüütli 6, 10130 Tallinn, Estonia; jyri.peets@mail.ee

Introduction

Throughout the history of archaeology, ceramic typologies have played an important role in compiling periodizations and chronologies of prehistory. So far the other methods of dating antiquities have not succeeded to replace ceramic typology though several of its aspects have been criticized. In reference to the settlement sites in the Baltic Sea region, ceramic typology is especially relevant to the investigation of the Late Neolithic and younger dwelling sites. These are, in many cases, no longer shore-related as were the settlement sites of previous periods. Due to the Post-glacial compensational land uplift, people rather often abandoned dwelling sites on the shore in order to move according to the regression or transgression of the water.[1] Many of the later settlement sites are, on the other hand, multiperiodical, having been inhabited throughout several prehistoric periods either continuously or discontinuously. Therefore, it is difficult to find any certain context for ceramics as well as for any other finds at these sites, and exact or, at least, more exact results are to be provided by typologies. However, typology as a method is inexact unless the types are related to calendar years obtained by scientific methods.

Nowadays, ceramic typologies have largely been corrected by the accelerator mass spectrometry (AMS) datings of the small amounts of charred organic remains (originating from carbonized food remains) preserved on the surfaces of potsherds, and by the calibration of the obtained dates into calendar years. The burnt organics and the clay vessel have been considered synchronous unless some extraordinary processes occurred in the ground after the deposition of the cultural layer.

In Sweden the AMS datings of the carbonized organics have been performed since the mid-1980s (Segerberg *et al.* 1991, 85), and in Finland since the beginning of the 1990s. Though in most cases merely single samples have been analysed, systematic AMS datings of the burnt organics on the ceramics in order to compile chronologies have been carried out as well, in North Finland for instance (Carpelan 2004). Dates of this kind become more and more numerous also in other regions, including the other parts of Finland (see e.g. Pesonen 1999; Lavento 2001a, b). However, only a few AMS datings have been made in the Baltic countries and Russia, which are very important areas also in reference to the Finnish ceramic types.

Considering the possibility of comparing clay vessels, one has to realize that the age identification of pottery is still based mostly on the general characteristics of the archaeological sites, find contexts of sherds and changes in the form and ornamentation of vessels. Problems also emerge because many typologies have been compiled decades ago. In the meantime, however, large amounts of new

[1] In the Baltic Sea region shoreline displacements were used for chronological distinction of, for example, the Combed Ware in Finland (e.g. Europaeus-Äyräpää 1930; Siiriäinen 1974) and the Pitted Ware in Sweden (shortly presented e.g. in Segerberg *et al*. 1991, 83).

finds have been discovered. Therefore the typologies used in different countries no longer are unambiguously comparable. This is the case also with the Estonian Late Neolithic, Bronze Age and even Early Iron Age ceramics. New finds and contexts have come to contradiction with earlier typologies, necessitating their revision.

Starting-points of the ceramic dating project

The study of the Finnish, Karelian and Estonian textile-impressed ware has revealed that ceramics of the Sarsa-Tomitsa type on the east coast of the Baltic Sea, distinguished and dated to the Bronze Age more than half a century ago by Meinander (1954a, b), needs, in several respects, new specification. One of the diagnostic features of this pottery type, the textile impression, in fact occurs in several Neolithic ceramic groups. In the areas of present-day Estonia and Russia the use of textile-impressed clay vessels continued up to the middle of the Iron Age (Lavento 2001a). According to the existence of textile impression the sherds are considered to be of textile type. This type, therefore, involves several ceramic types regarded as separate groups at the present time (in Estonia Late Combed Ware, Corded Ware, Early Textile Ceramics, Textile Ceramics).

The "origin" of the textile-impressed ware is by no means less interesting: whether it originates from the tradition unambiguously related to some certain date and place, or is it rather a phenomenon independently "invented" in various regions of Europe. From the Finnish point of view, the suggestion of Meinander (1954b) that the ceramics of the Sarsa-Tomitsa type came from the south (from the Estonian area) as well as from the east (from the areas in the middle reaches of the Volga River in Russia), increased the relevance of the Estonian data.

The new datings also provide additional information about the sites where the dated potsherds come from. For half of the sites discussed in the present article, these dates are to be considered as the first dates obtained by scientific methods. Naturally, the dates are also important with reference to the history of textiles.

The main objective of dating the Estonian textile-impressed ware is to lay the foundations to a chronology based on the AMS dates of the textile-imprinted ware found in Estonia. The initial collection dated comprised 12 potsherds found at the oldest and most problematic settlement sites in Estonia. However, some samples taken from the charred organics of the potsherds did not contain enough carbon for dating and therefore we took additional new samples later. If the carbonized organics was not preserved on the textile-impressed sherds, the sample was taken, as an exception, from the ceramics of another type found at the same site. By the time of writing the current article, eight samples had been dated (Table 1) and, although the project has not yet come to an end, the results are interesting and worthy of immediate dissemination.

Table 1. The AMS dates of the carbonized organics collected from the surfaces of the ceramics
Tabel 1. Keraamika pinnalt kogutud kõrbekihi AMS-dateeringud

Site (store No.)	Region	Lab. No.	^{14}C years	Calibrated* age with the probability of 95.4% (cal BC)	Calibrated age with the probability of 68.2% (cal BC)
Loona (AI 4210: 649)	Saaremaa Island	Hela-751	4165 ± 90	2920–2480	2880–2700
Akali (AI 4013: 8521)	East Estonia	Hela-752	4055 ± 40	2860–2470	2840–2490
Kullamägi (AI 4045: 1052)	East Estonia	Hela-754	4140 ± 70	2900–2490	2870–2620
Kullamägi (AI 4045: 1109)	East Estonia	Hela-755	3605 ± 40	2130–1870	2030–1910
Akali (AI 4013: 3061)	East Estonia	Hela-761	4155 ± 65	2900–2570	2880–2630
Assaku Kükita (AI 5030: 1–2)	North Estonia	Hela-837	2765 ± 50	1020–800	960–830
Altküla (AI 4592: 1)	Southwest Estonia	Hela-838	2885 ± 45	1220–920	1190–990
Kõpu IA (AI 6007: 1734)	Hiiumaa Island	Hela-843	5540 ± 55	4500–4260	4450–4340

* Atmospheric data from Reimer *et al.* 2004; OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron].

Dated ceramics and typologically relevant inferences

Finding places of the dated ceramics

For dating, we selected potsherds from among three different types of ceramics with textile impressions (the Late Combed Ware, Early Textile Ceramics and Textile Ceramics), and from the ceramics that, according to its consistence and surface treatment, was initially classified as the Corded Ware. The last type originates from the settlement site where the sherds of (Early?) Textile Ceramics are represented but provide no burnt particles sufficient for AMS dating. However, we expected to date in this way the find context of textile-impressed ware and find an answer to the question of whether the Estonian so-called Late Corded Ware is contemporaneous with the Early Textile Ceramics.

Half of the dates presented in the current article come from the pottery originating from the settlement sites of Akali and Kullamägi in the boggy mouth areas of the River Emajõgi on the west coast of Lake Peipsi, East Estonia (Fig. 1). In regard to the Early Textile Ceramics, these settlement sites are the most important and abundant in Estonia. On the basis of the finds from these sites, that ceramic type was first distinguished and, by means of horizontal stratigraphy and co-finds there, dated by Lembit Jaanits (Янитс 1959, 140–149).

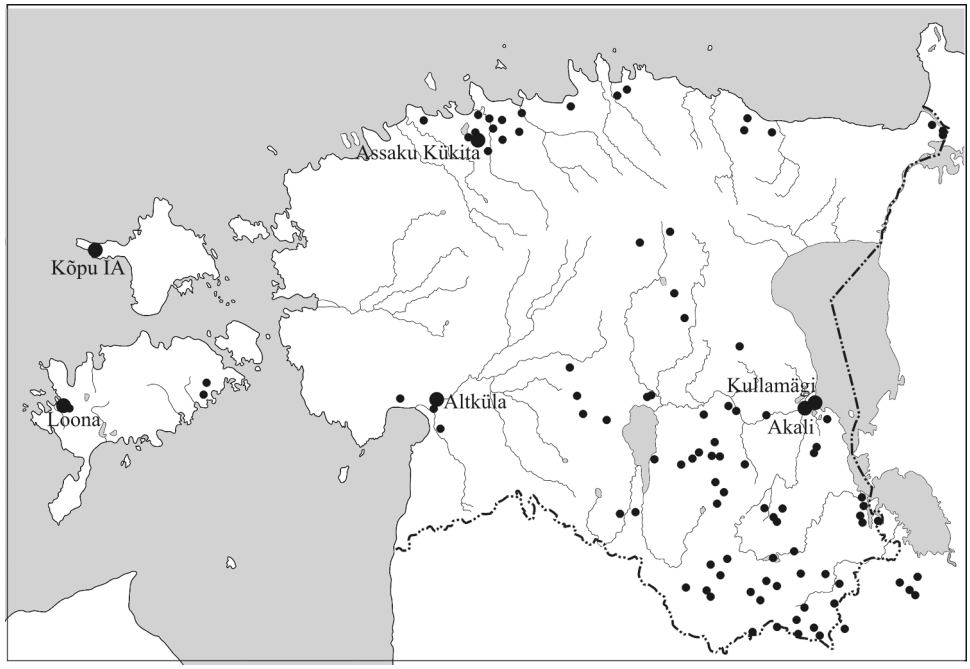

Fig. 1. Finding places of textile-impressed ceramics in Estonia (compiled by Arvis Kiristaja, Aivar Kriiska and Andres Vindi); sites discussed in the article are indicated by names.

Joon 1. Testiilkeraamika leiukohad Eesti alal (koostanud Arvis Kiristaja, Aivar Kriiska ja Andres Vindi); artiklis analüüsitud paigad on toodud nimeliselt.

The potsherds, which, for Estonian archaeologists, represent the Textile Ceramics in the so-to-speak narrower sense, originate from settlement sites whose context and supposed dates seemed to be promising in revealing new information on the "development" of this pottery type in the Late Bronze Age and Pre-Roman Iron Age.

The **Loona** settlement site is situated in the western part of Saaremaa Island. Originally it was located on the shore of a small bay. The site was discovered in 1956 by Aita Kustin and was investigated in 1956 under the supervision of Kustin and in 1959 by Jaanits. The place had been inhabited in the Late Neolithic; the pottery is of the Late Combed Ware type, a small amount of it having textile impressions (Jaanits 1965, 30). The AMS datings of the bones of a seal and a pig date the settlement site of Loona to the average time span of 2900–2600 cal BC[2].

[2] Here and henceforth, all the calibrations are based on the following sources: atmospheric data from Reimer *et al.* (2004); OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]. The base dates: 4270 ± 75 (Ua-4824) and 4050 ± 80 (Ua-4825) ^{14}C years.

The **Akali** settlement site lies in East Estonia, on the bank of the River Akali, a tributary of the River Emajõgi. The site was discovered in 1937 by Richard Indreko. Archaeological excavations were carried out there in 1938–1939 by Indreko and in 1949–1952 and 1968 by Jaanits. The cultural layer at the Akali settlement site covers a vast area of approximately 17 000 m^2, which, however, was not wholly in use at the same time. The settlement had been set up in the immediate vicinity of the river. As the level of the phreatic water rose, the place began to turn into a bog, and today the riverside part of the cultural layer is covered by a peat layer more than 2 m thick (Jaanits *et al.* 1982, 60). Therefore, in the course of time the inhabitants moved farther from the river. The oldest traces of life date to the Late Mesolithic but the site was nevertheless inhabited throughout the Neolithic as well as in the Bronze Age and at the beginning of the Iron Age (Jaanits *et al.* 1982, 43, 60). All the pottery types of those times are represented: the ceramics of the Narva type, Typical Combed Ware, Late Combed Ware, Corded Ware, Early Textile Ceramics, Textile Ceramics and other types. The only radiocarbon date (conventional) comes from the fire place where no ceramics was found, and it probably belongs to the Late Mesolithic period, the average of the dates being 5200 cal BC[3].

The **Kullamägi** settlement site is located in East Estonia, on the right bank of the River Emajõgi, about 2 km west of the Akali site, on a sand elevation rising a bit higher than the surface of the surrounding marsh. The site was discovered in 1938 by Indreko. In 1951–1952, archaeological excavations were conducted by Jaanits. The cultural layer covers a vast area of about 10 000 m^2. The place was used as a dwelling site from the Middle Neolithic. The Typical and Late Combed Ware, Early Textile Ceramics and other pottery types have been found there.

The **Assaku Kükita** settlement site is situated near Tallinn in North Estonia. The site was discovered in 1979 by an amateur archaeologist Oskar Raudmets. Two fire places were noted at the site, which was already damaged by land amelioration works, and the approximate area of the cultural layer was ascertained as 20–30 × 50 m (Lõugas 1979). No archaeological excavations have been performed at the site.

The **Altküla** settlement site is situated in Southwest Estonia, on the high bank of the River Pärnu. The small settlement site was discovered in 1972 by Vello Lõugas. A few potsherds, including these of the Textile Ceramics, were collected in the vicinity of a fire place that was destroyed by construction works (Jaanits *et al*. 1982, 176). No archaeological excavations have been carried out there.

The **Kõpu IA** settlement site is situated in the western part of Hiiumaa Island. At the time of its establishment, it was located on the seashore. The site was discovered in 1981 by Lõugas and excavated in 1994, 1998 and 2000 by Aivar Kriiska. The place was inhabited in the Early Neolithic (ceramics of the Narva type) and in the Late Neolithic (the Corded Ware and textile-impressed ware, the

[3] The base date: 6255 ± 100 (TA-103) ^{14}C years.

specified type of the latter is not identifiable because of too small sizes of the sherds – Kriiska 2001). The radiocarbon dates (conventional) of charcoal collected in the hearths indicate only the early habitation phase, that is, 4500–4200 cal BC[4].

Characteristics of the ceramics and obtained dates

1. AI 4210: 649 Loona settlement site (Fig. 2).

Inclusions of the modelling paste: Shell debris and vegetable mixture (on the surfaces[5] and fractures, long impressions of fibres are observable).

Modelling technique: Modelled of bands (broad bands with N-type attachment[6]).

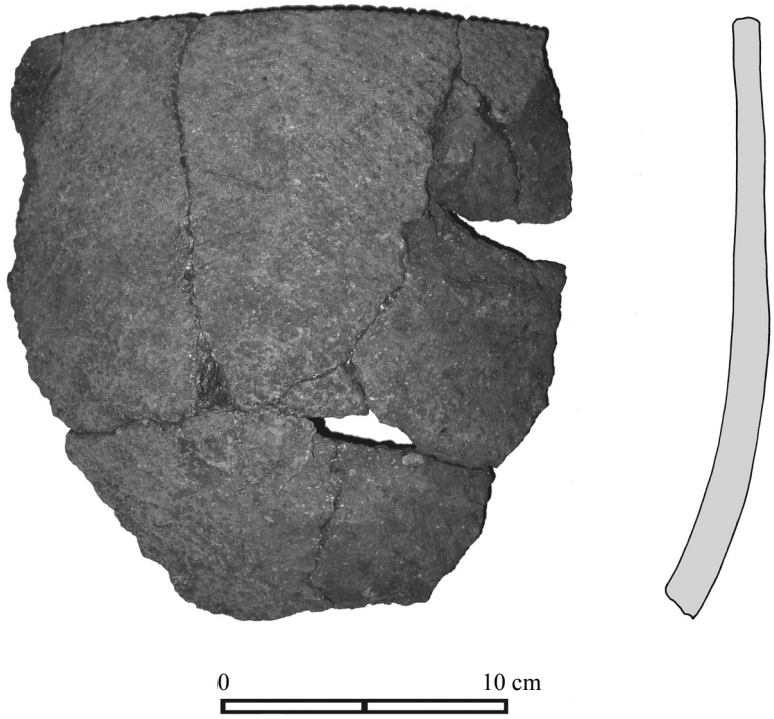

Fig. 2. Fragment of a clay vessel from Loona.

Joon 2. Loona savinõukatke.

[4] The base dates: 5698 ± 70 (Tln-1901), 5604 ± 52 (Tln-1873), 5575 ± 50 (Le-5452), 5464 ± 96 (Tln-1898), 5460 ± 100 (Ta-2686), 5370 ± 68 (Tln-1871), 5330 ± 90 (Ta-493) ^{14}C years.

[5] It is possible that the numerous fibriform impressions on the inner surface result from supporting the body of the vessel with a grass wisp while making the textile impression.

[6] Technological parameters defined as in Kriiska (1996).

Shape and size of the vessel: Probably a pot having a rounded bottom; diameter of the rim approximately 44 cm; height about 30–40 cm; the rim is thinning, unprofiled; thickness of the walls 11–13 mm; thickness of the rim 8–9 mm.

Surface treatment and ornamentation: The interior is striated, without ornamentation; the exterior is textile-impressed to the full extent, the rim bears diagonal grooves.

Textile impression: The impressions have been made with fabric woven in repp technique (Fig. 11a, Table 2). Both in the warp and the weft Z-spun yarns have been used, with the diameter of 1.5–2 and 3–3.5 mm, respectively. Thickness of the warp yarns has not been uniform. Weft yarns have been loosely spun but they are more uniform. In some places, the yarn has been flat and thus longitudinal unspun fibres are observable. The warp yarns were possibly made of nettle, and the weft yarns of bass (lime?).

Sample information: The sample was taken from the carbonized organics on the interior surface.

Date: 4165 ± 90 BP (Hela-751).

2. AI 4013: 8521 Akali settlement site (Fig. 3).

Inclusions of the modelling paste: Vegetable mixture.

Modelling technique: Modelled of bands.

Shape and size of the vessel: A pot; the rim is thickening, unprofiled; thickness of the walls 8 mm; thickness of the rim 11–12 mm.

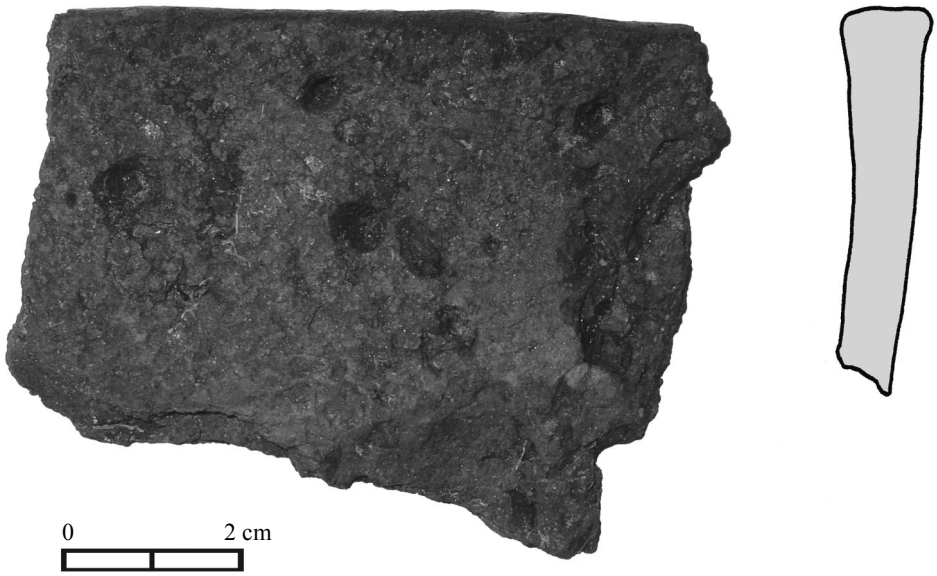

Fig. 3. Potsherd from Akali.

Joon 3. Akali savinõukild.

Surface treatment and ornamentation: The interior is smooth, without ornamentation; the exterior is textile-impressed to the full extent, two lines of pits occur below the rim.

Textile impression: The impressions have been made with fabric woven in repp technique that had an S-spun warp 2–2.5 mm in diameter, and a weft 4–5 mm in diameter (Table 2). The thickness of the warp yarns has not been uniform. The weft yarns have been loosely spun but they are uniform. In some places the yarn has been flat, unspun segments with longitudinal fibres are observable. The warp was probably made of nettle, but the weft material bass (lime?) could have been used as well.

Sample information: The sample was taken from the carbonized organics on the interior surface.

Date: 4055 ± 40 BP (Hela-752).

3. AI 4045: 1052 Kullamägi settlement site (Fig. 4).

Inclusions of the modelling paste: Vegetable mixture.

Modelling technique: Modelled of bands?

Shape and size of the vessel: A pot; the rim is thickening and curved outwards; thickness of the walls 8 mm; thickness of the rim 8.5–11 mm.

Surface treatment and ornamentation: The interior is smooth, without ornamentation; on the exterior a zigzag ornamentation of comb impressions (8 zones of zigzags) occurs on the rim, a textile impression is found below the rim, on the side wall.

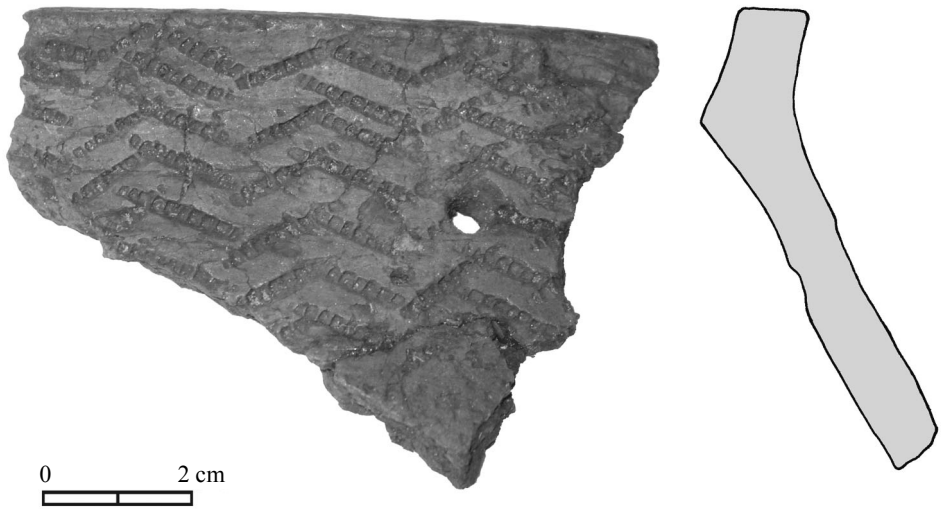

Fig. 4. Potsherd from Kullamägi.

Joon 4. Kullamäe savinõukild.

Textile impression: The impression is insufficiently preserved to be precisely identified.

Sample information: The sample was taken from the carbonized organics on the interior surface.

Date: 4140 ± 70 BP (Hela-754).

4. AI 4045: 1109 Kullamägi settlement site (Fig. 5).

Inclusions of the modelling paste: Vegetable mixture.

Modelling technique: Modelled of bands, 2–3 mm in width.

Shape and size of the vessel: A pot having a flat bottom; the rim is thickening and curved outwards; diameter of the orifice is approximately 40 cm; thickness of the wall 7–9 mm; thickness of the rim 14 mm.

Surface treatment and ornamentation: The interior is smoothed[7], on the rim there is a zigzag line of comb impressions; the exterior sides are textile-impressed to the full extent, the rim has horizontal and zigzag lines made by comb stamp (three single zigzag lines and four double horizontal lines).

Textile impression: The impression has been produced by textile made in tabby weave (?) (Fig. 11c, Table 2). The fabric has been quite dense; the thread count

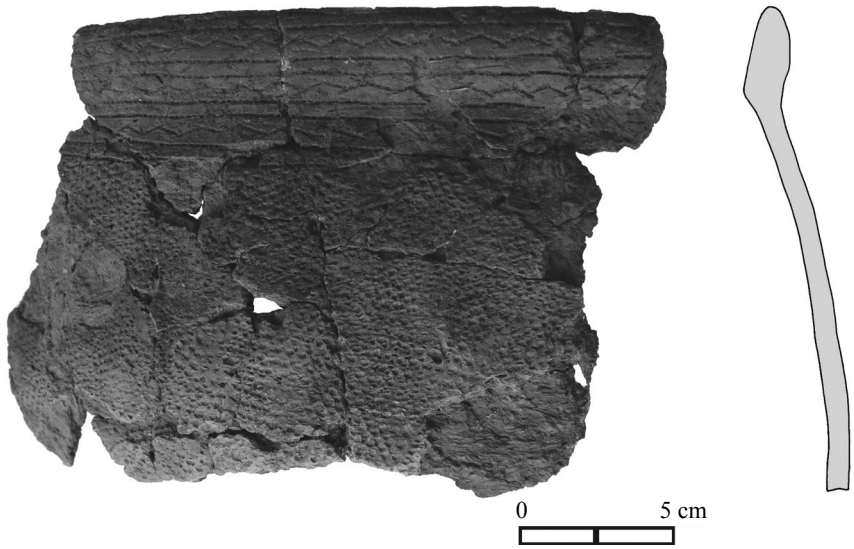

Fig. 5. Fragment of a clay vessel from Kullamägi.

Joon 5. Kullamäe savinõukatke.

[7] The interior surface is angular, possibly due to supporting the vessel with a hand while making the textile impression.

both in the warp and the weft is 6–8 per 1 cm, which is the largest number among the examined impressions. The warp was likely made of Z-spun yarn, while in case of weft yarn the spun was unidentifiable. The yarn has been tightly spun and is uniform in thickness. If the fabric has been woven on a loom (supposedly on the upright loom), it would be a firm evidence of fully established high-grade weaving skills and advanced technical implements. However, technically it is still possible that a material made in a simpler needle-netting technique was used as the matrix of the impression, since the impression of that material is very similar to the imprint of the fabric made in tabby weave (Fig. 13).

Sample information: The sample was taken from the interior surface of the vessel.

Date: 3605 ± 40 BP (Hela-755).

5. AI 4013: 3061 Akali settlement site (Fig. 6).

Inclusions of the modelling paste: Vegetable mixture.

Modelling technique: Modelled of bands?

Shape and size of the vessel: A pot having a flat bottom, the latter with salient edge; diameter of the bottom 10 cm; thickness of the walls 7–15 mm.

Surface treatment and ornamentation: The interior is striated, no ornamentation; the exterior is textile-impressed to the full extent, the salient bottom edge carries two lines of pits.

Textile impression: The impression is poorly examinable. Yarn 2.5–3.5 mm in diameter has been used as the warp, and yarn 3.5–4 mm in diameter as the weft (Table 2). The thickness of the warp yarns has not been uniform; the spun is unidentifiable (Fig. 11b).

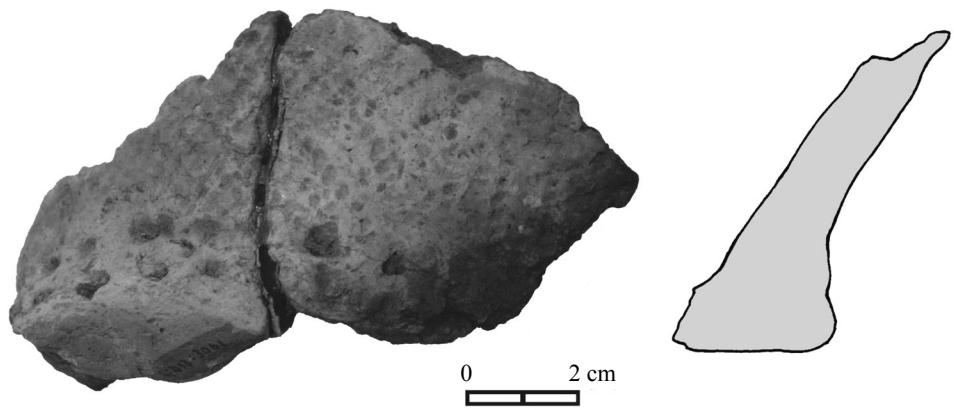

Fig. 6. Potsherd from Akali.

Joon 6. Akali savinõukild.

Sample information: The sample was taken from the carbonized organics on the interior surface.

Date: 4155 ± 65 BP (Hela-761).

6. AI 5030: 1–2 Assaku Kükita settlement site (Fig. 7).

Inclusions of the modelling paste: Rock debris.

Modelling technique: Modelled of bands (broad bands with U-type attachment).

Shape and size of the vessel: A pot; the rim is slightly curved outwards; diameter of the rim about 37–40 cm; thickness of the walls 11–12 mm; thickness of the rim 12–13 mm.

Surface treatment and ornamentation: The interior is smooth; the exterior is textile-impressed to the full extent, pits occur on the neck.

Textile impression: A fabric in tabby weave has been used as textile matrix (Fig. 11d, Table 2). The diameter of the unevenly spun yarn has been 2–2.5 mm in the warp and 2–3 mm in the weft. The density of both thread systems has been similar: in the warp 6–8 threads and in the weft 4–6 threads per 1 cm.

Sample information: The sample was taken from the carbonized organics on the interior surface.

Date: 2765 ± 50 BP (Hela-837).

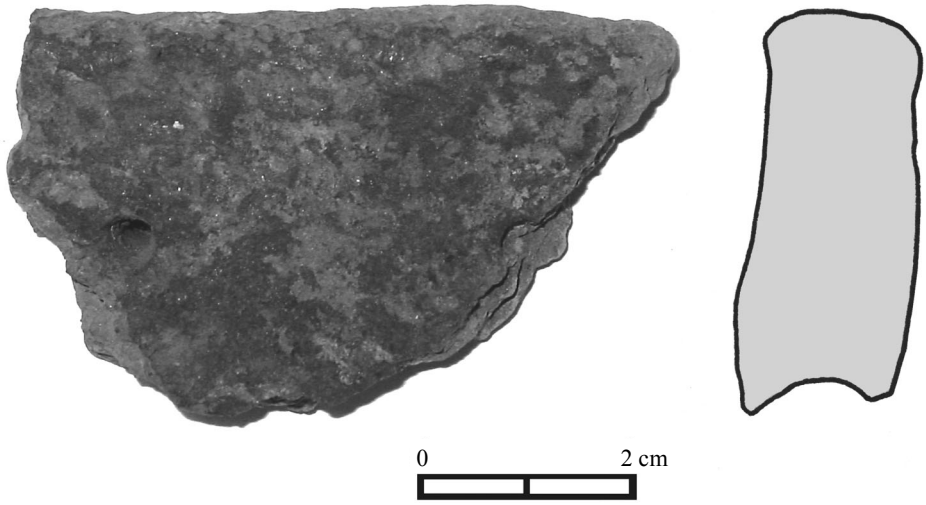

Fig. 7. Rim fragment of the dated clay vessel from Assaku Kükita.

Joon 7. Assaku Kükita dateeritud savinõu servaosa.

7. AI 4592: 1 Altküla settlement site (Fig. 8).

Inclusions of the modelling paste: Rock debris.

Modelling technique: Modelled of bands?

Shape and size of the vessel: A pot; the rim is thinning and slightly curved outwards; thickness of the walls 7–9 mm.

Surface treatment and ornamentation: The interior is smooth, without ornamentation; the exterior is textile-impressed to the full extent.

Textile impression: The material used for making the impressions has probably been made in the needle-netting technique (Fig. 12b, Table 2). The yarn, tight and Z-spun, was 2–2.5 mm in diameter.

Sample information: The sample was taken from the outer surface.

Date: 2885 ± 45 BP (Hela-838).

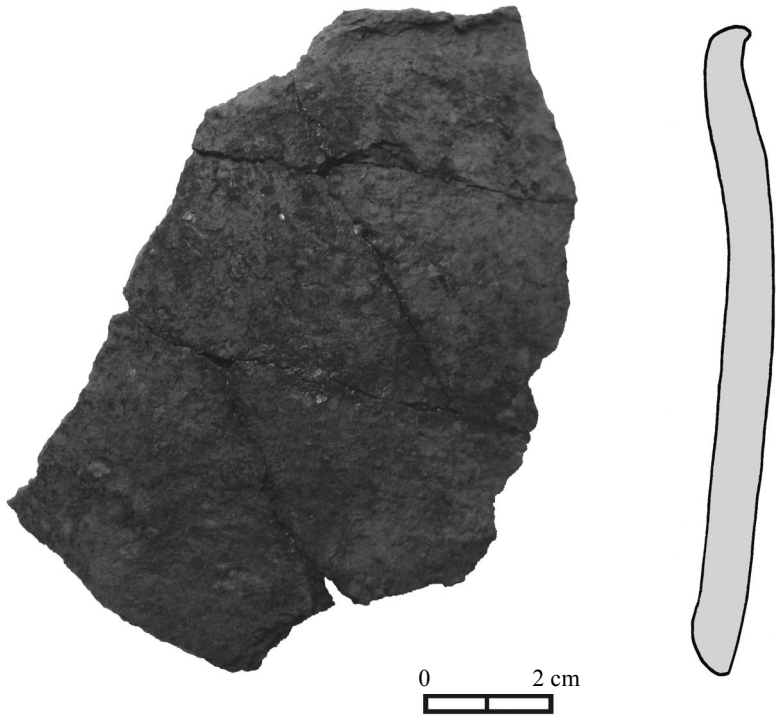

Fig. 8. Rim fragment of the dated clay vessel from Altküla.

Joon 8. Altküla dateeritud savinõu servaosa.

8. AI 6007: 1734 Kõpu IA settlement site (Fig. 9).

Inclusions of the modelling paste: Vegetable mixture.

Modelling technique: Modelled of bands (having U-type attachment).

Shape and size of the vessel: A pot; diameter of the rim approximately 20 cm; thickness of the walls 1.2 mm.

Surface treatment and ornamentation: The interior is smooth, without ornamentation; the exterior is smooth, without ornamentation.

Textile impression: No impression.

Sample information: The sample was taken from the interior surface.

Date: 5540 ± 55 BP (Hela-843).

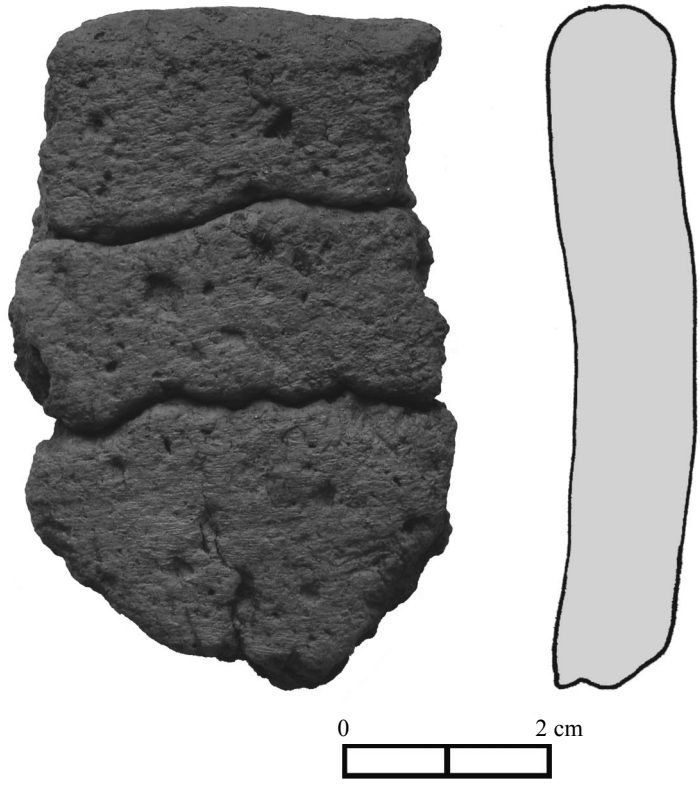

Fig. 9. Rim fragment of the dated clay vessel from Kõpu IA.

Joon 9. Kõpu IA dateeritud savinõu servaosa.

New dates and the ceramic typology

In Estonia, textile impressions occur on four types of ceramics. On rare occasions, textile impressions can be found on the surfaces of Late Combed Ware vessels. However, so far only few Late Neolithic (i.e. later than 3000 cal BC in date) settlement sites containing the Late Combed Ware pottery have yielded such finds. Sherds of this kind could be classified as the Late Combed Ware according to the composition of their modelling paste and modelling technique, as well as according to the shape and ornamentation (or the lack of the latter) of the vessel. In the frames of the current project, one potsherd supposedly of the Late Combed Ware type, found at the settlement site of Loona, has been dated.

In exceptional cases, textile impressions occur on the clay vessels which, on the basis of the other parameters and context, could be classified as the Corded Ware. In addition to the observations made in Estonia (Kriiska 2000, 66), the same phenomenon has been noted in Finland (Edgren 1970, 33) and in Latvia (Ванкина 1980, 56) as well. Also the Late Neolithic Pöljä Ware in Finland bears occasionally textile impressions (Meinander 1954a, 165–166).

In Estonia, the term "textile-impressed ware" is used in reference to two types of ceramics: (1) the Early Textile Ceramics and (2) the Textile Ceramics[8]. The former has been dated to the end of the Neolithic (in previous publications, the introduction of the textile-impressed ware has been dated to the 17th–16th centuries BC – Янитс 1959, 301) and to the Early Bronze Age, and the latter to the time span from the Late Bronze Age up to the middle of the Pre-Roman Iron Age in North and West Estonia (Valter Lang pers. comm. 15.03.2005), and up to the Middle Iron Age in Southeast Estonia (until the 6th century AD – Лаул 1997, 402). The Early Textile Ceramics and the Textile Ceramics differ from each other in the composition of the modelling paste as well as in the shape and ornamentation of the vessels.

The Early Textile Ceramics items are made of clay mixed with shell or rock debris, or with vegetable admixture. The vessels are large, although they have relatively small and flat bottoms. Their walls are strongly profiled; the rims are slightly curved outwards and, normally, a little thicker than the side walls of the vessel. The exterior sides of the vessels are covered by textile imprints and comb impressions (mostly in straight lines or in zigzag); the upper part of a vessel may bear sparse lines of pits or impressions made by cord coiled around a stick. Sometimes textile impressions are found on the rims and even on the interior sides of the vessel (Янитс 1959, 143–148).

[8] This is by no means a generally accepted designation. Thus, for instance, the Late Bronze Age coarse-grained pottery from the East European forest zone (including Estonia), which could also have textile impressions on the surfaces, has been termed as the ceramics of the Tapiola type and of the Asva type (Jaanusson 1981, 122; 1988, 173).

The Textile Ceramics vessels are made of clay tempered with mineral admixture consisting mainly of rock debris originating from the granite-gneiss group. The pots have been of various sizes, in exceptional cases even with the rim half a meter in diameter (Indreko 1939, 32). The shape of the vessels is simple: the walls are upright and the rims are slightly profiled. The rims are curved either outwards or inwards. In the latter case, the transition into the neck of the vessel is emphasized by a carinate extending sharply outwards (Lang 1991, 46). The textile impression covers either the entire exterior of the vessel or part of it, or is found only on the bottom. Sometimes textile impressions occur on the interior surface of the vessel as well. Ornamentation is relatively scanty and occurs usually only on the upper part of the vessel. The ornamentation elements include pits, circles, wound cord and finger-tip impressions, rarely also comb imprints (Vassar 1939, 80).

The new dates of the textile-impressed Late Combed Ware from Loona, and these of the Early Textile Ceramics from Akali and Kullamägi, indicate that both pottery types have been in use simultaneously in the Late Neolithic. Thus, they confirm the supposition made by Jaanits on the basis of the composition and find contexts of the ceramics that these types are partially synchronous, and that they first appear at the end of the Neolithic (Jaanits 1955, 181). The achieved dates do not enable us to ascertain the end date of these pottery types but, anyhow, the Late Bronze Age sites no longer contain this kind of ceramics.

The data from the settlement sites located in the mouth area of the River Emajõgi suggest that the Early Textile Ceramics and the Textile Ceramics have been "genetically" connected, i.e. merely the shape of vessels and composition of their modelling paste changed in the course of time. The fact that the Textile Ceramics in its characteristic features was fully formed already by the Late Bronze Age became evident by the investigations of the fortified settlements of Asva and Iru in the second half of the 1930s. The sample from Altküla provided a more exact date for the matter in question by locating this a little earlier than 1000 cal BC in the temporal scale.

Conclusions from material-technical analysis of textile impressions

Introductory remarks on the history of textiles

Concerning the oldest textile fabrics (in pure technical sense), references could be made to the fishing-nets made of bass or any other material, and to the other net-like braided artefacts that, evidentially, were in use in the Late Palaeolithic already. A find of the same kind from Estonia, the net remains and floats of pine bark found from the bog in Narva Siivertsi, is somewhat younger, dating to

the Late Mesolithic (Indreko 1931). The find from Antrea Korpilahti in Karelian Isthmus (Pälsi 1920), the net remains from Nidlöse and Ordrup bogs in Denmark (Becker 1941, 131; Hald 1980, 127, fig. 118) and from some other places belong to the same period. Net remains found from the settlement sites of Šventoji in Lithuania (Rimantienė 1979, 73–78) and Sārnate in Latvia (Ванкина 1970, 94–95) date to the Neolithic. The fishing-net of Antrea had been woven of common sallow (*Salix cinera*) bass (Kujala 1949), and these from Siivertsi, Šventoji and Sārnate of lime (*Tilia cordata*) bass (Indreko 1931, 56; Ванкина 1955, 144; 1970, 95). It is probable that already in those times, besides the fishing-nets also mats were braided, and perhaps some parts of the clothing as well. The Antrea net sheet wide of doubled bass yarn was approximately 27 m long and at least 1.3 m wide (Pälsi 1920, 17). It is hardly possible to produce this amount of high-quality yarn without special tools and, therefore, the use of a spinhook or even of a spindle already in the second half of the 9th millennium cal BC (^{14}C dates – Takala 2004, 151) should be assumed.

Along with the invention and development of new technical methods, the importance of various textiles in the everyday life increased. Unlike other materials used in prehistoric times, unfortunately very few textiles have preserved up to now. The oldest textile finds in Estonia (fragments of woollen stuff and bands) originate from as late as the Roman Iron Age. Therefore, the imprints of strings, yarn and cloth or cloth-like materials (mats for instance) on the ceramics provide, as a matter of fact, the only opportunity to have insight into the history of mastering and developing textile manufacture in Estonia and the neighbouring areas at the end of the Stone Age and in the early Metal Age. The study of impressions yields conclusions about the time of the emergence of several important textile manufacturing techniques and, to a certain extent, about their technical level. The AMS dates of textile-impressed ceramics allow us to suggest that some more advanced tools, such as hand spindle and weaving loom, came into use more than 1000 years earlier than hitherto believed.

Methods and results of the study of textile impressions

As the textile impressions on potsherds are in negative form, the surface imprints of the impressions were taken in order to obtain the reverse image using the dental modelling wax “Astynax”. The wax plates were softened by hot air. The gloss of the imprint was reduced and a light lustreless surface achieved with talc powder. A darker foil was achieved with extremely fine charcoal powder “Kindrus” used in photography. The image was examined in aslant falling light under binocular magnifier equipped with micro-measure. As in several cases

more than just one sherd of a particular vessel were available, it was possible to make complementary analyses in order to check the initial results. The averages of the obtained results are presented in Table 2.

By examining the textile impressions the type of weave, diameter of the yarn and, if possible, strand or spun of the latter, were identified. Yarn could have been spun clockwise (S-spun) or counter-clockwise (Z-spun). The binding of the fabric, i.e. the crossing-scheme of the warp and weft threads, as well as the density of the cloth, i.e. the number of the warp and weft threads in the section 1 cm long was ascertained. The impressions mostly originated from the fabric in tabby weave (Figs. 10a; 11b, d). At least one textile impression has resulted from a material made in the looped needle-netting technique (Fig. 12b). Tabby is the simplest weave when the weft passes alternately over and under the warp (Fig. 10a). The warp and weft are often of the same thickness and the distance between the threads is equal. Repp is a variation of tabby; the analysis is the same but one thread system is set closer than the other, or the warp and weft threads are of different thickness (Fig. 10b, c). Both the impressions of tabby and repp weave were represented. Looped needle-netting or simply needle-netting is a kind of sewing based on loops or meshes combined in various ways (Figs. 12, 13).

Table 2. Results of the technical analysis of textile impressions on the ceramics; wa – warp; we – weft

Tabel 2. Keraamika pinnal olevate tekstiilijäljendite tehnilise analüüsi tulemused

Site (store No.)	Binding	Density, thread/cm		Spun (S, Z)		Yarn diameter, mm	
		wa	we	wa	we	wa	we
Loona (AI 4210: 649)	repp	5–7	3.5–5	Z	Z	1.5–2	3–3.5
Akali (AI 4013: 8521)	repp	6–7	3–4	S	flat	2–2.5	4–5
Akali (AI 4013: 3061)	tabby	5–7	5–6	?	?	3–4	2–3
Kullamägi (AI 4045: 1109)	tabby (?)	6–(8)	6–(8)	S (?)	?	2–3	3–4
Assaku Kükita (AI 5030: 1–2)	tabby	6–7	4–6	S	S	2–3	2–2.5
Altküla (AI 4592: 1)	needle-netting	–	–	Z	–	2–2.5	–

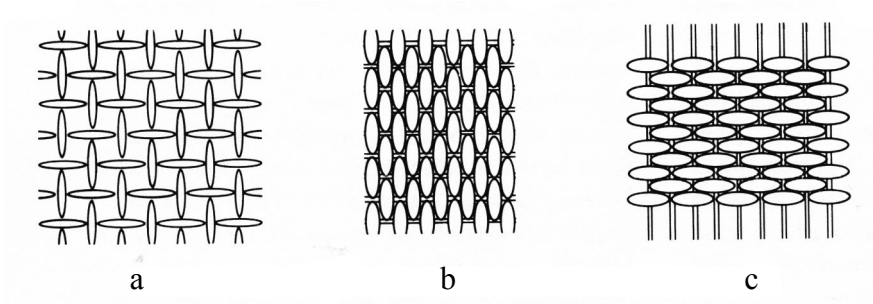

Fig. 10. Binding schemes. a plain tabby (linen), b, c repp.

Joon 10. Siduseskeemid. a lihtne labane sidus, b, c rips.

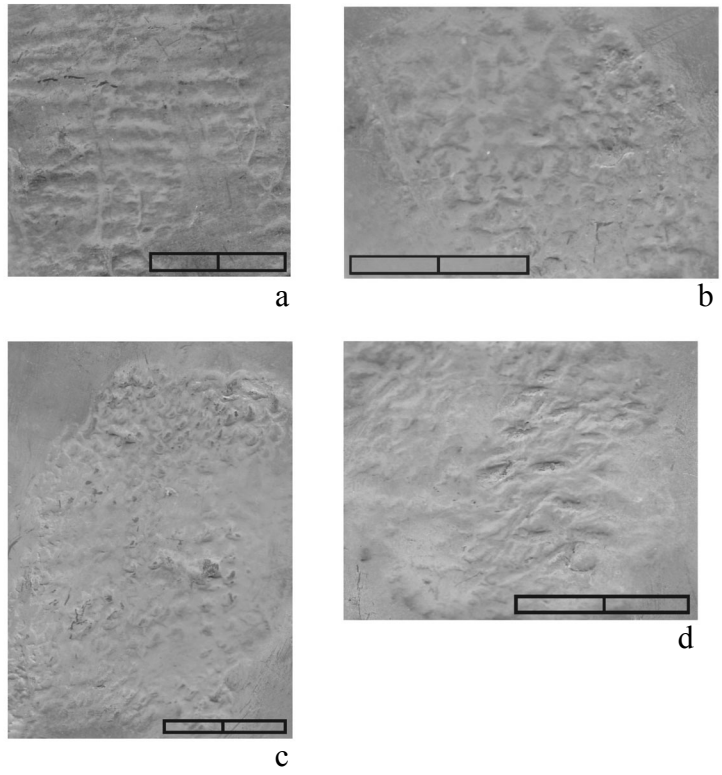

Fig. 11. Wax imprints from textile-impressed ceramics. a Loona AI 4210: 649 (repp), b Akali AI 4013: 3061 (tabby), c Kullamägi AI 4045: 1109 (tabby), d Assaku Kükita AI 5030: 1–2 (tabby).

Joon 11. Vahajäljendid tekstiilkeraamikalt. a Loona (rips), b Akali (labane), c Kullamägi (labane), d Assaku Kükita (labane).

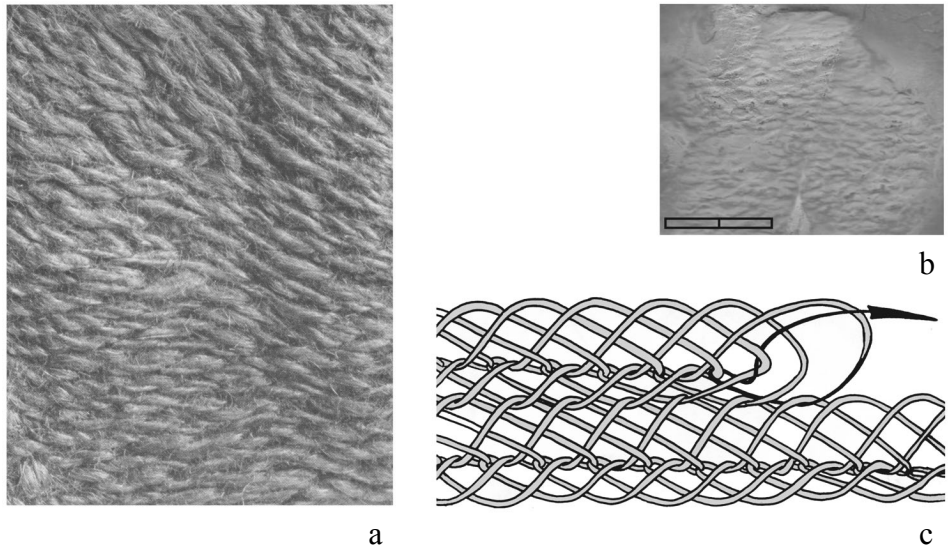

Fig. 12. Detail of the 1st century AD Åsle mitten made in needle-netting technique (after Hald 1980) (a), which is similar to the wax imprint from Textile Ceramics of Altküla (b), and scheme of type IIIc (c).

Joon 12. Detail 1. sajandil pKr nõeltehnikas valmistatud Åsle kindast (Hald 1980 järgi) (a), mis sarnaneb Altküla tekstiilkeraamikalt võetud vahajäljendiga (b), ja tüübi IIIc skeem (c).

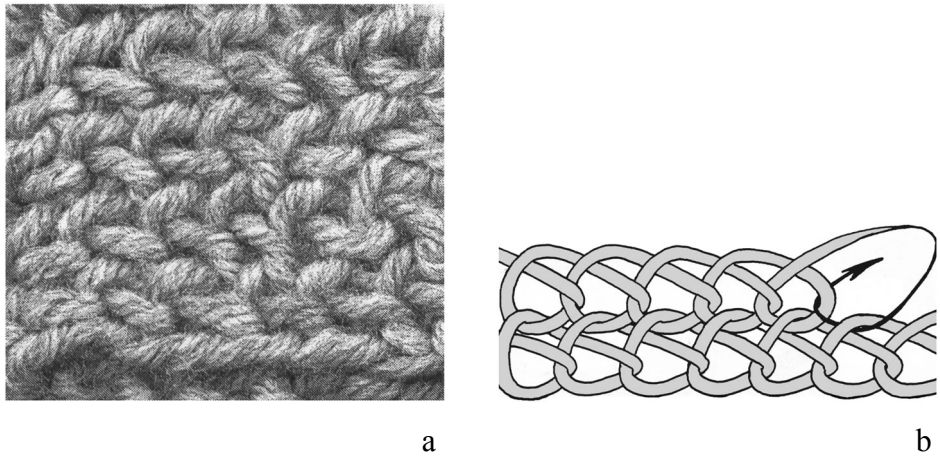

Fig. 13. A piece of cloth made in needle-netting technique of type IIb (a), and the corresponding scheme (b).

Joon 13. Nõeltehnika tüübi IIb kohaselt valmistatud tekstiililapp (a) koos skeemiga (b).

Materials of the textile matrices

In the forest zone the oldest sources for fibre have been, in all probability, bass and nettle. As mentioned above, fishing-nets stranded of bass cords were in use in the Mesolithic already. Later on, the bass was often used for making ropes. For instance, remains of bass cords frequently occur in the cultural layers of medieval towns.

Probably at the same time also nettle (*Urtica diocia*) came into use as a source for fibre. Together with hemp and hop, nettle belongs to the nettle order (at the same time, hop belongs to the Cannabaceae family). Nettle and hop are the components of the few remains of the Estonian relic flood plain forests. As the flood plain forests were among the first landscape components in the Estonian vegetation, which became influenced by human impact, the question emerges whether these species are the relics of the first plants naturalized in our region (Laasimer 1965, 74).

The North Siberian peoples still used thread of nettle fibre for sewing as late as at the beginning of the 20th century. In Europe, the nettle was utilized as an additional fibre source in Germany at the time of World War I (Stokar 1938, 57). In Finland the fabric of nettle fibre woven on handloom was used as wrapping material at the time of the Winter War and the War of Continuation (Leena Tomanterä pers. comm. 2002). Remains of the Neolithic and Bronze Age nettle fabric have been discovered in Denmark (finds from Slotshøj and Voldtofte). In North Europe, the nettle has been present since the Boreal climatic period (Tolonen 1981, 216; Hald 1980, 127); as a nitrofile, it grows especially willingly in the vicinity of human settlements. According to the description by U. T. Sirelius, transmitted by Manninen (1929, 305), in summertime the winter huts of the Khantys are "… often buried in a thick nettle coat that billows like a cornfield around them". Probably the picture was the same at the winter camps of hunter-fisher-gatherers of that time in our region as well. It is unlikely that the fibre source so easily obtainable and growing en masse remained unexploited. In some places, the Khanty and Mansi peoples of West Siberia braided nets of nettle fibre and wove nettle fabric as late as at the outset of the 20th century. For that purpose, they collected nettles after moving to their winter huts in autumn; subsequently the plants were sheaved and set under the eaves to wither (Manninen 1929, 305). It seems that trampling in the places where the nettle was growing en masse was wittingly avoided in order to protect these fibre plants.

To obtain fibre, the withered nettles were retted and barked with the help of a small wooden artefact, ethnographically called *luda*, or teeth (Manninen 1929, 306). Subsequently the material extracted from the pith was pounded with a pestle and scutched using wooden or bone knives (Hald 1980, 125). Also in the Far East and North America, fishing-nets were braided and cloth was woven of yarn spun of nettle fibre. Several languages contain evidence of the exploitation of the nettle as a fibre plant. Thus, once the original meaning of Finnish *pellava* (flax) was

"the nettle" (Toikonen *et al*. 1962, 514). In Latvian, an analogous relation exists between nettle – *nātre*, and linen – *nātns* (Mühlenbach 1925, 702).

The hop (*Humulus lupus*), too, could be considered as an important natural fibre plant. In Estonia, the hop started to spread in the Atlantic climatic period. Probably rather soon and along with the increasing cultivation of barley, hops became known as an appropriate admixture in making beer. However, direct evidence of the exploitation of the hop as a fibre source is absent in the archaeological record as well as in written sources and folklore. Yet, the hempen fibre is long and, due to various vegetable poison substances, it is resistant to mildew, especially to that caused by moisture (the observations made by Jüri Peets). If it was still used as a fibre source, it was presumably processed in the same manner as was flax or nettle. The other researchers, too, note the exploitation of the hop as a fibre plant (e.g. Hald 1980, 130).

The flax (*Linum usitatissimum*) is deservedly looked upon as one of the oldest cultured plants in the world. In Europe the evidence of its use has been obtained, for instance, from the Neolithic pile-dwellings in Switzerland and from the ancient settlement sites of the same age in East and Central Europe, in Belorussia and Germany, respectively (Чернявский 1969, 87; La Baume 1955). However, no analogous data are available from Estonia so far. The oldest remains of linen cloth from Estonia, small fragments of a fine-woven fabric, were found along with the hoard of Pilistvere, dating to the 6th century AD (Moora 1957, 203). In the lake sediments of South Finland (Häme) and North Sweden, the flax pollen appears relatively late as well, not until the 5th century AD. The same is also valid for hemp (*Canabis sativa*). Somewhat earlier, in the Pre-Roman Iron Age at the latest, flax cultivation had started in the Netherlands and North Germany (Lempiäinen 2003, 330).

In general, all the researchers who have studied textile-impressed ware have unanimously agreed that as the textile matrix, the fabric woven of plant fibre was used. First of all linen or hempen cloth has been considered, but the use of the nettle has been admitted, too (e.g. Laul 1966, 99). Woollen fabric, on the other hand, was *a priori* considered to be too soft for obtaining a clear imprint.[9] And yet, the impression on the ceramics found from the Altküla settlement site, made with the fabric that was identified with a considerable certainty as having been made in needle-netting technique, possibly indicates the use of woollen cloth. Whereas needle-netting has been often used for producing things of woollen yarn (mittens, socks, caps, etc.), J. Peets took, as an experiment, some wax imprints from modern woollen mittens made by needle-netting and knitting, and from a rather coarse medieval cloth fragment. While experimenting on dry textiles, difficulties arose in removing the hardened wax. Wet fabric, on the contrary, detached itself from the wax easily, leaving distinct and detailed weave imprints

[9] However, according to Russian researcher I. Tshernay (Чернай 1981, 84), the basis for the extensive spread of the textile-impressed pottery in the Dyakovo Culture area was created exactly by the outset of sheep rearing and, along with this, by the use of wool in cloth manufacturing in the third quarter of the 2nd millennium BC in the East European forest zone.

on it. Therefore, it is possible that the woollen fabric was applied as a textile matrix in the prehistoric times, too. From the technological point of view, it is possible that the textile impressions were pressed onto the surface of the clay vessel with a mittened hand. The mitten could have been sewn of woven fabric or made by needle-netting.

The relatively late start of flax cultivation in Estonia (presumably not much earlier than in Finland) excludes the possibility that the textile impressions on the Neolithic and Bronze Age[10] clay vessels originate from the fabric made of flax or hemp fibre. The impressions on the earlier textile-impressed ware have probably been made with the fabric of natural fibre material (of nettle or bass fibre), and these on the Textile Ceramics presumably also with linen or woollen cloth.

Conclusions

The new dates obtained confirmed the conclusion made on the basis of find context, first of all on the grounds of the horizontal stratigraphy of the Akali and Kullamägi sites, that in the Estonian area textile impressions were made on clay vessels already at the end of the Neolithic. However, the earliest of the recent dates – 2800–2700 cal BC – turned out to be approximately 1000 years older than hitherto assumed. The Late Combed Ware involving textile impressions and the Early Textile Ceramics that are clearly distinct from each other both in shape and ornamentation are, in general lines, contemporaneous. Although the dates are few in number, they still indicate that the Early Textile Ceramics has been produced during a considerably long period of time. For the present, the temporal distance between the earliest and the youngest date is a little less than 1000 years. Let us mention here that the textile-impressed sherds of the Corded Ware found in the Riigiküla XIV settlement site, which are the only sherds of this kind radiocarbon dated on the basis of charcoal collected from the site, originate from the same period (about 2500 cal BC in date[11]).

The new dates made some corrections also in regard to the younger pottery type or, as common in the Estonian research tradition, to the Textile Ceramics. The sample from Altküla shifts the date of the potsherds from this particular site approximately 1000 years back in time, as up to now it was assumed that the sherds originated from the Pre-Roman Iron Age settlement site (Jaanits *et al*. 1982, 176). At the same time this date, as that from the Assaku Kükita site, indicates

[10] The oblong bone and antler artefacts found from the cultural layer of the Late Bronze Age fortified settlement of Asva, interpreted as combs for scutching the flax, were formerly considered as the oldest sign of flax cultivation in the Estonian area (Jaanits *et al*. 1982, 144). However, ethnographical parallels allow us to consider them reaping tools, so-called weed sickles. Summer crop, especially lodged barley, was weeded together with roots, using an obtuse sickle or a fragment of it. On Saaremaa Island, for example, such weed sickles were still in use at the outset of the 20th century (Manninen 1933, 180–181).

[11] The base date: 3970 ± 100 (Ta-2680) ^{14}C years.

that the Textile Ceramics with its typical form and composition of clay mass was fully established already by the very beginning of the Late Bronze Age.

The potsherd found from the Kõpu IA settlement site was dated to the Early Neolithic, indicating that the fragment was not of the Corded Ware but of Narva type. This confirms once again that it is easy to be mistaken while identifying ceramics of similar composition, modelling technique and surface treatment, without additional support from the differences in typical ornamentation.

The textile impressions on the dated potsherds seem to have been pressed onto the surfaces of the vessels using fabrics made in different techniques. The majority of the impressions were made with fabric in tabby weave. The imprints studied were made with fabrics that had the same or similar density of the thread systems, as well as with repp. Only in case of repp it is possible to assert with 100% certainty that the fabric has been produced by weaving (the weft and warp yarns are different in diameter, which would be excluded in case of needle-netting technique). But problems emerge with textile impressions made with fabrics having the same density of the thread systems and threads of the same thickness, since it is not always possible to distinguish the woven fabric from the needle-netted material.

At least the textile impressions on the Neolithic pottery were made using fabric woven of natural fibre material, that is, of nettle or bass fibre. Later, the linen or even woollen cloth could have been used as well.

Acknowledgements

The radiocarbon dating was performed in the laboratory of Helsinki University under the conduct of Professor Högne Jungner. The analyses were financed by the Jenny and Antti Wihur Foundation. Funding for this research was provided by grant No. 4558 of the Estonian Science Foundation. Thanks are extended to Kristel Külljastinen for preparing the illustrations.

References

Becker, C. J. 1941. Fund af Ruser fra Danmarks Stenalder. – Aarbøger for Nordisk Oldkyndighed og Historie, 1, 131–148.

Bronk Ramsey, C. 2005. OxCal (computer program). Version 3.10. The Manual (available at http://www.rlaha.ox.ac.uk/oxcal/oxcal.htm).

Carpelan, C. 2004. Environment, archaeology and radiocarbon dates. – Iskos, 13, 17–45.

Edgren, T. 1970. Studier över den snörkeramiska kulturens keramik i Finland. (SMYA, 72.) Helsingfors.

Europaeus-Äyräpää, A. 1930. Die relative Chronologie der steinzeitlichen Keramik in Finnland I. – Acta Archaeologica, 1, 165–190, 205–220.

Hald, M. 1980. Ancient Danish Textiles from Bogs and Burials. A Comparative Study of Costume and Iron Age Textiles. Copenhagen.

Indreko, R. 1931. Kiviaja võrgujäänuste leid Narvas. – Eesti Rahva Muuseumi aastaraamat, VII. Tartu, 48–67.

Indreko, R. 1939. Asva linnus-asula. – MEL, 17–52.
Jaanits, L. 1955. Neoliitilised asulad Eesti NSV territooriumil. – MAL, 176–201.
Jaanits, L. 1965. Über die Ergebnisse der Steinzeitforschung in Sowjetestland. – Finskt Museum, LXXII, 5–46.
Jaanits, L., Laul, S., Lõugas, V. & Tõnisson, E. 1982. Eesti esiajalugu. Tallinn.
Jaanusson, H. 1981. Hallunda. A Study of Pottery from a Late Bronze Age Settlement in Central Sweden. Stockholm.
Jaanusson, H. 1988. Beziehungen zwischen den Lausitzer und Nordischen Kulturprovinzen während der jüngeren Bronzezeit. – Forschungen zur Problematik der Lausitzer Kultur. Warszawa, 171–177.
Kriiska, A. 1996. The Neolithic pottery manufacturing technique of the lower course of the Narva River. – Coastal Estonia. Recent Advances in Environmental and Cultural History. (PACT, 51.) Rixensart, 373–384.
Kriiska, A. 2000. Corded Ware Culture sites in North-Eastern Estonia. – De temporibus antiquissimis ad honorem Lembit Jaanits. (Muinasaja teadus, 8.) Tallinn, 59–79.
Kriiska, A. 2001. Stone Age Settlement and Economic Processes in the Estonian Coastal Area and Islands. Dissertation. Helsinki. http://ethesis.helsinki.fi/julkaisut/kultt/vk/kriiska/
Kujala, V. 1949. Antrean Korpilahten kivikautisen verkon kuituaines. – Suomen Museo, 1947–1948, LVI.
Laasimer, L. 1965. Eesti NSV taimkate. Tallinn.
La Baume, W. 1931. Die vorgeschichtliche Handspindel und ihr Gebrauch. (Mannus, Ergänzungsband, VIII.)
Lang, V. 1991. Ühe savinõutüübi ajaloost Loode-Eestis. – Artiklite kogumik. (Muinasaja teadus, 1.) Tallinn, 45–65.
Laul, S. 1966. Tekstiilijälgedest keraamikakildudel Eestis. – Pronksiajast varase feodalismini. Tallinn, 96–101.
Lavento, M. 2000. Some viewpoints on Early Textile Ceramics in the Baltic countries, Russia and Finland. – De temporibus antiquissimis ad honorem Lembit Jaanits. (Muinasaja teadus, 8.) Tallinn, 103–131.
Lavento, M. 2001a. Textile Ceramics in Finland and on the Karelian Isthmus. Nine Variations and Fugue on a Theme of C. F. Meinander. (SMYA, 109.) Helsinki.
Lavento, M. 2001b. Textile ceramics in Finland – recent perspective. – Acta Archaeologica, 1999, 59–78.
Lempiäinen, T. 2003. Kasviarkeologiaa Auranjoen rannoila. – Kaupunkia pintaa syvemmältä. Turku, 323–340.
Lõugas, V. 1979. Assaku Kükita asulakoht. (Manuscript at the Institute of History, Tallinn.)
Manninen, I. 1929. Soome sugu rahvaste etnograafia. Tartu.
Manninen, I. 1933. Die Sachkultur Estlands, II. (Õpetatud Eesti Seltsi eriväljaanne, II.) Tartu.
Meinander, C. F. 1954a. Die Kiukaiskultur. (SMYA, 53.) Helsinki.
Meinander, C. F. 1954b. Die Bronzezeit Finnlands. (SMYA, 54.) Helsinki.
Moora, H. 1957. Varasemaid andmeid ketramisest ja kudumisest. – Eesti rahvarõivad XIX sajandist ja XX sajandi algult. Tallinn, 203–209.
Mühlenbach, K. 1925. Lettisch-deutsches Wörterbuch. Riga.
Pesonen, P. 1999. Radiocarbon dating of birch bark pitches in Typical Comb Ware in Finland. – Dig it All. Papers Dedicated to Ari Siiriäinen. Helsinki, 191–199.
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.
Rimantienė, R. 1979. Šventoji. Narvos kultūros gyvenvietės. Vilnius.
Pälsi, S. 1920. Ein steinzeitliche Moorfund bei Korpilahti Ksp. Antrea. – SMYA, XXVIII. Helsinki, 3–19.
Segerberg, A., Possnert, G., Arrhenius, B. & Lidén, K. 1991. Ceramic chronology in view of ^{14}C datings. – Laborativ Arkeologi, 5, 83–91.
Siiriäinen, A. 1974. Studies Relating to Shore Displacement and Stone Age Chronology in Finland. (Finskt Museum, 1973.) Helsinki.

Stokar, W. v. 1938. Spinnen und Weben bei den Germanen. (Mannus-Bücherei, LIX.)
Takala, H. 2004. The Ristola Site in Lahti and the Earliest Postglacial Settlement of South Finland. Jyväskylä.
Toikonen, H., Itkonen, E. & **Joki-Aulis, J.** 1962. Suomen kielen etymologinen sanakirja, III. Helsinki.
Tolonen, M. 1981. An absolute and relative pollen analytic study on prehistoric agriculture in South Finland. – Annales Botanici Fennici, XVIII, 213–220.
Vassar, A. 1939. Iru Linnapära. – MEL, 53–100.

Ванкина Л. В. 1955. Древнее поселение в Сарнатском торфянике (Латвийская ССР). – MAL, 138–152.
Ванкина Л. В. 1970. Торфяниковая стоянка Сарнате. Рига.
Ванкина Л. В. 1980. Шнуровая керамика на территории Латвии. – Из древнейшей истории балтских народов. Рига, 47–58.
Лаул С. 1997. Ранний железный век в Южной Эстонии и "предкурганная култура". – Памятники старины. Концепции. Открытия. Версии, I. Памяти Василия Дмитриевича Белецкого 1919–1997. Санкт-Петербург–Псков, 402–409.
Чернай И. Л. 1981. Выработка текстиля у племен дъяковской культуры (по материалам Селецкого городища). – Советская Археология, 4, 70–87.
Чернявский М. М. 1969. Исследование неолитических остатков растений Кривинского поселения. – Древности Белоруссии. Минск, 76–93.
Янитс Л. Ю. 1959. Поселения эпохи неолита и раннего металла в приустье р. Эмайыги (Эстонская ССР). Таллин.

Aivar Kriiska, Mika Lavento ja Jüri Peets

UUED AMS-DATEERINGUD EESTI NEOLIITILISEST JA PRONKSIAEGSEST KERAAMIKAST. ESIALGSED TULEMUSED JA INTERPRETEERINGUD

Resümee

Keraamikatüpoloogiatel on läbi arheoloogiaajaloo olnud oluline osa esiajaloo periodiseeringute ja kronoloogiate koostamisel. Muud muististe dateerimise meetodid ei ole keraamikatüpoloogiat tänini asendanud, kuigi viimast on mitmel põhjusel ka kritiseeritud. Hilisneoliitilised ja nooremad elupaigad on sageli multiperioodsed, kasutatud katkematult või vaheaegadega mitmel esiajalooperioodil. Seetõttu on neist keraamikale või ka teistele leidudele kindlat konteksti raske leida. Täpsemaid või vähemalt täpsustavaid tulemusi annavad tüpoloogiad, mis on aga samas meetodina ebatäpsed, kui tüüpe ei või siduda loodusteaduslike meetoditega saadud dateeringutega.

Tänapäeval on keraamikatüpoloogiaid oluliselt korrigeerinud savinõukildude pinnal säilinud väikestest söestunud orgaanikakogustest (karboniseerunud toidujäänustest) tehtavad AMS- (*Accelerator Mass Spectrometry*) dateeringud, saadud vanuste kalibreerimine päikeseaastateks. Kui pinnases ei ole pärast kultuurkihi ladestumist mingeid erakordseid protsesse toimunud, siis on kõrbekiht ja savinõu ühevanused.

Olles huvitatud võimalusest savinõusid võrrelda, tuleb tõdeda, et keraamika vanusemäärangud on enamasti ikka veel saadud kinnismuististe, savinõukildude leiukonteksti ja vormi- ning ornamendimuutuste põhjal. Probleemiks on samuti see, et mitmed keraamikatüpoloogiad on koostatud aastakümneid tagasi. Samas on aga olulisel määral lisandunud uusi leide. Nii ei ole eri maades kasutatavad tüpoloogiad enam üheselt võrdluskõlblikud. Ühelt poolt on uued leiud ja kontekstid sattunud vastuollu varasemate tüpoloogiatega, sundides aga teisalt ka nende aluseid ümber vaatama.

Soome, Karjala ja Eesti tekstiilkeraamika uurimisega on selgunud, et C. F. Meinanderi poolt enam kui poole sajandi eest Läänemere idarannikul eristatud ja pronksiajaga dateeritud Sarsa-Tomitsa tüüpi keraamika vajab mitmes osas uut määratlust. Üks selle keskne tunnus – tekstiilivajutus – esineb tegelikult mitmes neoliitilises keraamikarühmas ja Eesti ning Vene aladel jätkus tekstiilijäljendiga kaetud savinõude kasutamine kuni rauaaja keskpaigani. Kui tekstiilkeraamikaks loetakse kilde tekstiilivajutuse põhjal, katab see mitmeid praegu omaette rühmadena eristatavaid keraamikatüüpe (Eestis hiline kammkeraamika, nöörkeraamika, varane tekstiilkeraamika ja tekstiilkeraamika).

Samavõrd huvitav on ka tekstiilivajutistega kaetud keraamika "algupära" küsimus: kas see lähtub traditsioonist, mille alguse võime dateerida ja lokaliseerida ühte piirkonda, või on pigem tegu ilminguga, mis on "leiutatud" sõltumatult mitmes Euroopa piirkonnas?

AMS-dateeringud anavad aga lisateavet ka nende muististe kohta, kust konkreetsed savinõukillud pärinevad, ning loomulikult on uued vanusemäärangud olulised ka tekstiiliajaloo seisukohalt.

Eesti tekstiilijäljenditega keraamika dateerimisprojekti, mille esialgsed tulemused on käesolevas artiklis avaldatud, peamiseks eesmärgiks on luua alus Eestist leitud tekstiilivajutistega keraamika AMS-dateeringutele põhinevale kronoloogiale. Lähtekohaks oli algselt 12 proovist koosnev valim vanimatest ja probleemsetest Eesti asulakohtadest leitud savinõukildudest. Kõigilt keraamikakildudelt võetud kõrbekihtide proovides ei olnud aga dateeringute tegemiseks piisavalt süsinikku, mistõttu täiendati valimit hiljem uute proovidega. Kui kõrbekihti ei olnud tekstiilivajutistega savinõukildudel säilinud, siis võeti erandina proov samast asulakohast leitud teist tüüpi keraamikalt. Käesoleva artikli kirjutamise ajaks on Helsingi ülikooli dateerimislaboris tehtud 8 dateeringut.

Dateerimiseks valiti savinõukillud kolmest tekstiilijäljendiga kaetud keraamikatüübist ning keraamikast, mis koostise ja pinnatöötluse järgi liigitati algselt nöörkeraamikaks (Kõpu IA, joon 9). Viimane võeti asulakohast, kust on leitud ka (varast?) tekstiilkeraamikat, kuid selle pinnal ei olnud AMS-analüüsiks piisavalt kõrbekihti. Pooled käesolevas artiklis esitatavatest dateeringutest on keraamikast, mis pärineb Ida-Eestist Peipsi järve läänerannikul Emajõe suudmealal paiknevatest Akali ja Kullamäe asualakohtadest (joon 1: 3–6). Need asulakohad on aga ka kõige olulisemad ja rikkalikumad varase tekstiilkeraamika leiukohad kogu Eestis. Sealsete leidude põhjal see keraamikatüüp üldse Lembit Jaanitsa poolt eristati ning planigraafia ja kaasleidude järgi dateeriti. Kaks savinõukildu pärine-

vad asulakohtadest (Assaku Kükita ja Altküla, joon 7, 8), mille kontekst ja varasemad oletuslikud dateeringud andsid lootust saada teavet selle tekstiilijäljendiga keraamika "arengutest" nooremal pronksiajal ja eelrooma rauaajal.

Eestis esineb tekstiilijäljendeid neljal keraamikatüübil. Üksikjuhtudel on tekstiilijäljendid kantud hilise kammkeraamika nõude pinnale, kusjuures neid on seni leitud vaid vähestest hilisneoliitilistest hilise kammkeraamikaga asulakohtadest. Erandina esineb tekstiilivajutisi ka muude parameetrite ja konteksti järgi nöörkeraamikaks liigitatavatel savinõukildudel. Kahe savinõude tüübi puhul kasutatakse Eestis tekstiilkeraamika nimetust, jagades need varaseks tekstiilkeraamikaks ja tekstiilkeraamikaks. Esimene on dateeritud neoliitikumi lõpuga (varasemas kirjanduses on varase tekstiilkeraamika algus ajaldatud 17.–16. sajandiga eKr) ja varase pronksiajaga, teine nooremast pronksiajast kuni eelrooma rauaaja keskpaigaga Põhja- ja Lääne-Eestis ning keskmise rauaajaga Kagu-Eestis. Varane tekstiilkeraamika ja tekstiilkeraamika erinevad üksteisest nii vormimismassi koostiselt kui ka nõude kujult ja ornamendilt.

Varane tekstiilkeraamika on valmistatud teokarbi-, kivipurru- või taimse lisandiga segatud savist. Nõud on suured ja samas suhteliselt väikese lameda põhjaga. Külgseinad on neil tugevasti profileeritud, servad kergelt väljapoole pööratud ja tavaliselt külgseinast pisut paksemad. Nõude välispinda katavad tekstiilijäljendid ja kammivajutised; ülaosas võib olla harvade ridadena lohke või pulga ümber keeratud nööriga tehtud vajutisi. Mõnikord on tekstiilijäljendit ka serval ja isegi nõu sisepinnal.

Tekstiilkeraamika on valmistatud mineraalse lisandiga, peamiselt graniidigneissi rühma kivimite purruga segatud savist. Potid on olnud erineva suurusega, erandina isegi ligi poolemeetrise suuava läbimõõduga. Nõud on lihtsa kujuga: püstiste seinte ja vähe profileeritud servaosaga. Serv võib olla pööratud välja- või sissepoole. Viimasel juhul võib üleminek kaelaosale olla rõhutatud ka läbi teravalt väljaulatuva nivendi. Tekstiilijäljend võib katta kogu välispinda, osa sellest või olla vaid põhjal; mõnikord on tekstiilijäljend ka sisepinnal. Ornament (lohud, sõõr- ja näpuvajutised, ümber pulga mässitud nööri ning harva ka kammivajutised) on vähene ja tavaliselt vaid nõu ülaosas.

Uued dateeringud Loona tekstiilijäljendiga kaetud hilisest kammkeraamikast ning Akali ja Kullamäe varasest tekstiilkeraamikast osutavad, et need on olnud kasutuses üheaegselt hilisneoliitikumis (tabel 1). See kinnitab Jaanitsa poolt keraamika koostise ja leiukontekstide järgi tehtud oletust, et need tüübid on osaliselt samaaegsed ja saavad alguse neoliitikumi lõpul. Nende kasutamise lõppu ei võimalda saadud dateeringud määrata, kuid noorema pronksiaja muististes sellist keraamikat enam ei esine. See, et tekstiilkeraamika oma iseloomulike joontega oli välja kujunenud juba nooremal pronksiajal, sai selgeks Asva ja Iru kindlustatud asulakohtade uurimisel 1930. aastate teisel poolel. Altküla dateering täpsustab selle vanuse esialgselt veidi vanemaks kui 1000 aastat eKr.

Kuna esiajaloolised tekstiilid on säilinud vaid erandjuhtudel, on nööri, lõnga ja riide või riidelaadse materjali jäljendid keraamikal eriti oluliseks aluseks (kiviaja lõpu ja metalliaja varasemal järgul Eesti alal seni isegi ainsaks võima-

luseks), uurimaks tekstiilide valmistamisoskuse omandamist ja arengut. Jäljendite uurimine võimaldab teha otsuseid mitmete oluliste tekstiiltehniliste võtete kasutuseletuleku aja, aga teatud määral ka tehnilise taseme kohta.

Vaatlusaluses valimis määrati tekstiilijäljenditel koendi tüüp, kasutatud lõnga läbimõõt ja võimaluse korral säie ehk keerd. Lõng võib olla kedratud päripäeva (S-keere) või vastupäeva (Z-keere). Riidejäljenditel määrati koendi sidus ehk lõime- ja koelõngade ristumisskeem ning kanga tihedus, s.o lõime- ja koelõngade arv 1 cm pikkusel lõigul (tabel 2). Jäljendid pärinesid enamikus labasest (joon 10: a; 11: b–d), harvem ka ripssidusest riidest (joon 10: b, c; 11: a). Vähemalt üks tekstiilijäljend pärineb nõeltehnikas valmistatud esemelt (joon 12, 13). Varasemal keraamikal on tekstiilijäljendid tehtud ilmselt looduslikust kiudmaterjalist – nõgese- või niinekiust kootud riidega, hilisemal arvatavasti ka linasest või isegi villasest materjalist riidega. Viimasele võib osutada nõeltehnikana identifitseeritud tekstiilmaterjali jäljend Altküla asulakohast leitud keraamikal.

Dateeritud savinõukildudel esinevad tekstiilijäljendid on kantud nõude pinnale erinevates tehnikates valmistatud riietega. Nendest enamiku moodustas labases koes materjal. Esindatud jäljendid olid nii ühesuguse või lähedase tihedusega lõngasüsteemidega kangast kui ka ripsist. Vaid ripsi puhul võib kindlamalt väita kootud kanga kasutamist (koe- ja lõimelõngad on erineva läbimõõduga, mis nõeltehnikas valmistatud materjali puhul on välistatud). Seevastu ühesuguse tihedusega lõngasüsteemide ja samajämeduste lõngadega tekstiilijäljendite puhul tekib probleeme: alati pole võimalik eristada kootud kangast nõeltehnikas valmistatud materjalist (joon 13). Tänu tekstiilijäljenditega keraamika täpsustavatele AMS-dateeringutele nihkus täiuslikumate töövahendite – kedraga käsivärtna ja kangaspuude – kasutuseletuleku aeg seni aktsepteeritust enam kui 1000 aastat varasemaks. Vähemalt neoliitilisele keraamikale on tekstiilijäljendid tehtud arvatavasti looduslikust kiudmaterjalist – nõgese- või niinekiust kootud riidega, hiljem kasutati ehk ka linast või isegi villast riiet.

Kokkuvõttes kinnitasid AMS-dateeringud konteksti, ennekõike Akali ja Kullamäe planigraafia põhjal tehtud järeldust, et tekstiilijäljendeid hakati Eesti alal savinõudele tegema juba neoliitikumi lõpul. Tõsi, meie vanimad dateeringud – umbes 2700 aastat eKr – osutusid seni pakutust küll umbes 1000 aastat vanemaks. Tekstiilijäljenditega hiline kammkeraamika ja vormilt ning ornamendilt selgesti eristuv varane tekstiilkeraamika on laias laastus üheaegsed. Kuigi dateeringuid on veel vähe, osutavad need, et varast tekstiilkeraamikat on valmistatud küllalt pika aja jooksul.

Nooremasse, Eesti mõistes tekstiilkeraamikasse tõid uued dateeringud samuti korrektuure. Altküla keraamika dateering nihutab konkreetselt selle objekti savinõukillud ligi 1000 aasta võrra vanemaks varem esitatud oletusest, et tegemist võiks olla keraamikaga eelrooma rauaaja asulakohast. Samas osutab see koos Assaku Kükita dateeringuga, et päris noorema pronksiaja alguseks oli iseloomuliku vormimismassi koostise ja kujuga tekstiilkeraamika juba välja kujunenud.