Lønne Hede – an Early Roman Iron Age burial site with well-preserved textiles

By Ida Demant, Lene B. Frandsen, Lise Ræder Knudsen, Tine Lorange, Annemette Bruselius Scharff, Ina Vanden Berghe, Irene Skals, Ulla Lund Hansen and Ulla Mannering

Keywords: *Early Roman Iron Age / Denmark / burials / dress / textiles / textile production / dyestuff and colour / hairstyles*
Schlagwörter: *Frühe Römische Eisenzeit / Dänemark / Gräber / Tracht / Textilien / Textilproduktion / Farbstoffe und Farben / Haartrachten*
Mots-clés: *début de l'âge du Fer romain / Danemark / sépultures / robe / textiles / production de textiles / teintures et couleurs / coiffures*

Table of Contents

Introduction 208
1. The Lønne Hede site in Jutland, Denmark 209
1.2 Finding and excavating the Lønne Maiden 210
1.3 Excavations in 1995: techniques, preservation, and conservation 211
1.4 Two houses and a smithy from the Early Pre-Roman Iron Age 214
1.5 Extent, structure, stratigraphy and organization of the gravesite 216
1.5.1 Pottery depositions 216
1.5.2 Cremation graves 219
1.5.3 Inhumation graves: an overview 224
2. Introduction to textiles, textile production, and costume in Lønne Hede 225
2.1 Preliminary remarks 225
2.2 Textiles and costumes in the graves of Lønne Hede 226
2.2.1 Groups of textiles 227
2.2.1.1 Textile group 1: Dark reddish-brown twills with added-in weft stripes 227
2.2.1.2 Textile group 2: Plain twills 228
2.2.1.3 Textile group 3: Plain twill in undyed wool 231
2.2.2 Design 231
2.2.2.1 Stripes 231
2.2.2.2 Diamond twill 232
2.2.2.3 Tabby weaves 233
2.2.2.4 Foot wrappings 233
2.2.3 Textile production and the choice of loom 233
2.2.4 Woven borders 235
2.2.4.1 Tablet weaves 236
2.2.4.2 Warp-faced tabby borders with tubular selvedge 237
2.2.5 Female girdles in the Iron Age? 240
3. Graves with textiles: excavation, grave goods, and technical analysis 242
3.1 Grave 1969 (The Lønne Maiden) 242
3.1.1 Pottery 244

3.1.2 Small finds 244
3.1.3 Metal objects 246
3.1.4 Textiles in grave 1969 – an overview 247
3.1.5 Textile 1969.1, textile type 1 249
3.1.6 Textile 1969.2, textile type 2 250
3.1.7 Textile 1969.3, textile type 3 255
3.1.8 Textile 1969.4, textile type 4 257
3.1.9 Textile 1969.5, textile type 5 261
3.1.10 Textile 1969.6, textile type 6 263
3.1.11 Textile 1969.7, textile type 7 265
3.2 Grave 1 267
3.2.1 Overview of the textiles in grave 1 268
3.2.2 Textile 1.2 269
3.2.3 Textile 1.3 269
3.2.4 Textile 1.4 272
3.2.5 Textile 1.5 272
3.2.6 Textile 1.6 275
3.2.7 Textile 1.7 279
3.2.8 Animal hide 282
3.3 Grave 2 282
3.3.1 Overview of the textiles in grave 2 285
3.3.2 Textile 2.2 285
3.3.3 Textile 2.3 287
3.3.4 Textile 2.4 291
3.3.5 Textile 2.6 292
3.3.6 Fur 295
3.4 Grave 3 295
3.5 Grave 6 298
3.5.1 Overview of the textiles in grave 6 299
3.5.2 Textile 6.1 301
3.5.3 Textile 6.2 302
3.5.4 Textile 6.3 304
3.5.5 Animal hide 305
3.6 Grave 7 305
3.6.1 Overview of the textiles in grave 7 306
3.6.2 Textile 7.1 307
3.6.3 Textile 7.2 307
3.6.4 Textile 7.3 308
3.7 Grave 8 308
3.7.1 Overview of the textiles in grave 8 309
3.7.2 Textile 8.1 309
3.7.3 Textile 8.2 309
3.7.4 Textile 8.3 311
3.8 Grave 9 313
3.8.1 Overview of the textiles in grave 9 314
3.8.2 Textile 9.1 314
3.8.3 Textile 9.2 315
3.9 Grave 10 316
3.9.1 Overview of the textiles in grave 10 316

3.9.2 Textile 10.2 317
3.9.3 Textile 10.3 319
3.9.4 Textile 10.5 321
3.9.5 Textile 10.6 321
3.9.6 Textile 10.7 322
3.9.7 Animal hide 323
3.10 Grave 11 323
3.11 Grave 12 324
3.11.1 Overview of the textiles in grave 12 325
3.11.2 Textile 12.2 325
3.11.3 Textile 12.3 327
3.11.4 Textile 12.7 331
3.11.5 Animal hide 331
3.12 Grave 13 332
3.13 Dress in 1st century Lønne Hede: Everyday wear or Sunday best? 333
3.13.1 The different garments 334
3.14 Summing up the textiles 336
4. Dyestuff investigation of the Lønne Hede textiles 338
4.1 Samples 340
4.1.1 Samples for chromatographic analyses 340
4.1.2 Samples for element analyses 340
4.2 Methods 341
4.2.1 HPLC-DAD procedure and dye extraction 341
4.2.2 SEM-EDX procedure 342
4.3 Results of the chromatographic and element analyses 342
4.4 Biological sources of dyes and mordants 346
4.4.1 Blue dye source 346
4.4.2 Yellow dye sources 348
4.4.3 Red dye sources 349
4.5 Concluding and summarising the dye investigation 353
5. The hairstyles from Lønne Hede 354
5.1 Conservation conditions 355
5.2 Method – interpreting hairstyles 355
5.3 Description of preserved hairstyles at Lønne Hede 359
5.3.1 Grave 1969: the "Lønne Hede Maiden" – previous interpretations 359
5.3.1.1 Description of the hairstyle in grave 1969 360
5.3.1.2 Resume: the hairstyle from Lønne Hede 1969 367
5.3.2 Description and interpretation of the hairstyle from grave 6 369
5.3.3 Description and interpretation of the hairstyle from grave 9 371
5.3.4 Description and interpretation of the hairstyle from grave 10 371
5.3.5 Description and interpretation of hairstyle from grave 12 372
5.4 Hairpins and needles for styling the hair 372
5.4.1 Archaeological evidence of hairpins and needles 374
5.5 Finds of hair and information on hairstyles from the Early Iron Age in general 375
5.6 Summarising the hairstyles 376
6. Conclusion and summary 377
6.1 The Lønne Hede site 377
6.2 Textiles, weaves, designs, and technical detail 378

6.3 Lønne Hede graves with textiles 379
6.4 Dress in first century AD Lønne Hede 381
7. Acknowledgements 382
8. Bibliography 383

Introduction

The burial site of Lønne Hede in Southwest Jutland, Denmark, was discovered in 1968, and in the spring of 1969 an inhumation burial from the Early Roman Iron Age containing exceptionally well-preserved textiles was excavated[1]. The grave was interpreted as a female burial, and the textiles, which attracted a great deal of attention, were described as a costume comprising a blouse and a skirt of blue wool with red borders. The costume has been reconstructed on numerous occasions, and the depiction of the so-called "blue girl" or "Lønne Hede Maiden" is often encountered when visiting Danish museums or their websites (*fig. 1* and *fig. 141)*. This unique find has previously only been available as preliminary or popular presentations, but as is shown in the following, the initial interpretation and reconstructions of the costume are subject to debate.

In 1995, a new excavation was undertaken at Lønne Hede, and it became evident that the grave had originally been surrounded by a further 25 cremation burials from the Late Pre-Roman Iron Age and eleven inhumation burials from the Late Pre-Roman and Early Roman Iron Age, of which several contained textiles and styled hair. Furthermore, a settlement with long-houses and a smithy, as well as a small amount of pottery, possibly votive deposits from the Early Pre-Roman Iron Age, came to light.

In 2009, when the textiles from the 1995 excavations were to be transferred from the conservation department to the museum stores, Ulla Lund Hansen (University of Copenhagen) became aware of this extraordinary material. It was decided to build a team of experts and publish the find complex of Lønne Hede in full. The expert group consists of Ulla Lund Hansen (initiator, project lead, co-author), Lene B. Frandsen (head of the 1995 excavation) and Tine Lorange both from Varde Museum (presentation of the excavations and the finds), Ida Demant (textile analyses), Lise Ræder Knudsen (hair analyses), Annemette Bruselius Scharff and Ina Vanden Berghe (dyestuff investigations), Irene Skals (fibre analyses), Ulla Mannering (advisor), Pia Bennike † (burnt bone analyses) and Xenia Pauli Jensen (editor).

This interdisciplinary research has provided several important insights shedding light, for instance, not only on details regarding the use of dye in Iron Age textiles or the remarkable styled hair preserved in the inhumation graves. More importantly, it forces us to reconsider our perception of so-called "poor" graves with little or no grave goods. At Lønne Hede, these seemingly "poor" people were buried in beautifully coloured costumes made of extremely fine wool. Their hair was set in elaborate hairstyles inspired by the Roman world – some even with hair-extensions.

[1] Lønne Hede (Lønne Heath), matr. no. 19b Lønne Præstegård (Lønne vicarage), Lønne Sogn (Lønne parish), Vester Horne Herred (Vester Horne district), Ribe Amt (Ribe county), Stednr. 190708, lok. no. 1. The excavation report from the National Museum written / completed by Susanne Klingenberg (National Museum j. nr. 906/69/ 957/70, Klingenberg et al. 1995).

Fig. 1. Reconstruction of the Lønne Maiden's blue dress at Nymindegab Museum close to the find spot (photo: Varde Museum).

In this article, the Lønne Hede complex will be presented in full. However, as the Lønne Hede textiles represent the largest collection of textiles from Early Iron Age graves in Denmark, the article focuses primarily on the extremely well-preserved textiles, dyestuff analysis and the exquisite and complicated hairstyles.

1. The Lønne Hede site in Jutland, Denmark

The archaeological site Lønne Hede is situated in southwestern Jutland, Denmark, not far from the town Varde and close to the North Sea on the western edge of the so-called Varde drumlin, a moraine landscape formed during the Saale glaciation comprising mostly sand *(fig. 2)*. Towards the west, the otherwise rather flat landscape is characterised by major formations of inland dunes, traversing grasslands, and arable land of mediocre quality often plagued by sand drift. On the digital terrain model *(fig. 3,1.2)* it appears as though the site of the burial ground is somewhat hilly. This phenomenon is, however, of a more recent date and is due to the establishment of an artificial lake, which was the reason for the 1995 excavation. The site is located on a promontory at an elevation of 4–5 m above sea level surrounded on three sides by low meadows, which were probably already rich pastures in ancient times. Moreover, there was easy access to fresh water as the Nebel stream to the east and the Hejbøl stream to the north and west delimit the dry headland where Lønne Hede is situated. Today, the immediate vicinity of Lønne Hede is characterized by small, scattered farmsteads, and further west by summer holiday residences.

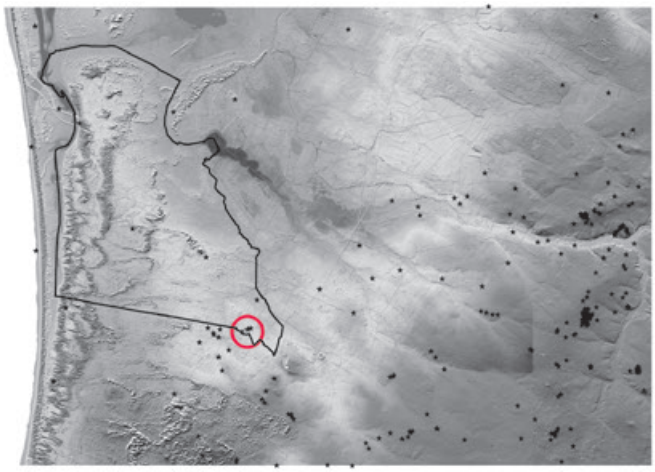
Fig. 2. Geological map showing Lønne Hede situated on the western edge of the sandy Varde drumlin (Varde Bakkeø) with modern towns. Light yellow: sand; green: marshland; light blue: Saalian moraine; grey: Weichselian outwash plains (illustration: T. Lorange).

1.2 Finding and excavating the Lønne Maiden

The first grave was discovered in 1968 by farmer Jens Jensen from Lønne Hede. He was removing stones on his field, but when he encountered a ceramic vessel he contacted the then director of Ølgod Museum, Søren Manøe, who continued the excavation. Manøe removed a quantity of stones packed closely all the way down to the bottom of a grave, approximately 1 m beneath ground level, and part of the original construction of the grave. The ground water level was so high that the lower 10–15 cm of the grave filled with water. Manøe described how the sides of the coffin were well preserved because of the high water-level: "the timber was light and fresh in colour and its condition was almost as if it had been just fetched from the timber yard". Museum curators Mogens Bencard and Ole Schørring from Den Antikvariske Samling (The Antiquarian Collection) in Ribe eventually took over, and when it became evident that the grave also contained something as unusual as well-preserved textiles and human hair, conservators Dorthe Ørsnes and Jørgen Nordquist from the National Museum of Denmark were called in (Nordquist / Ørsnes 1971; Klingenberg et al. 1995; Frandsen 2015). Manøe later recalled how when Bencard lifted a corner of fabric, brown and colourless on the outside, within its folds a clear greenish blue hue became visible and, in other parts, a reddish colour could be faintly recognized (Frandsen 2015, 114). It was the first time ancient coloured textiles were recovered in Denmark.

Because of inclement weather, a simple tent was erected over the excavation area, but finally it was decided to halt the *in situ* excavation of the fragile textile remains. Instead, the textiles in this part of the grave were extracted in an approximately 1 × 1 m plaster of

1



2

Fig. 3. 1. Lidar scanning – relief model, the excavation area is marked with red; 2. map of the Lønne Hede grave site as well as other well-known ancient monuments in the parish of Lønne; note that only very few known ancient monuments lie in the vicinity of the Lønne Hede site (illustration: T. Lorange).

Paris block. Surprisingly, the bottom planks of the coffin were so well-preserved that a saw was needed to cut out the block (Klingenberg et al. 1995). The block was transported to the National Museum in Copenhagen for excavation and conservation of the textiles. Already in the field it had become evident that the grave belonged to a woman; hence, she was nicknamed "Lønnepigen" (the Lønne Maiden). On the basis of the accompanying grave goods, it was possible to date the grave to the Early Roman Iron Age phase B1 (AD 1–70). In the last days of the excavation, several clay vessels were excavated from beneath the topsoil just outside the grave. However, the exact position of the vessels could not be determined.

1.3 Excavations in 1995: techniques, preservation, and conservation

It was not until 26 years later that the Lønne site was to be re-visited. Plans to establish a 3000 m^2 artificial lake at the precise location of the Lønne Maiden's grave led to new excavations in 1995 (Frandsen 1995). The Museum of Varde City and Environs commenced a pre-examination of the site, and, when a cremation grave was uncovered, a

Fig. 4. Conservators recovering a grave as a block of soil during the 1995 excavation (photo: Varde Museum).

proper excavation was initiated[2]. The excavation took place in the early summer of 1995, from April 1st to June 23rd.

The excavated area was low-lying, at approximately 4 m above sea level. The topsoil was approximately 30–40 cm thick and varied widely, but the burials were easy to identify. The Lønne Maiden excavation from 1969 stood out distinctly, and consequently this area was not re-excavated.

It was decided to strip the topsoil of the entire area. In the topmost layer, remnants of medieval ridge-and-furrow fields could be identified. These features were removed mechanically and beneath the topsoil the Iron Age graves and postholes from houses were clearly visible. All recognisable features at the site were excavated. The inhumation graves were examined by scraping off thin layers of soil with shovel and trowel within a rectangular area slightly larger than the grave feature. A transverse profile baulk was established in each grave. Whenever textiles were encountered, *in situ* excavation was halted and the grave was recovered as a block of soil *(fig. 4)*.

The initial numbering of individual features from the 1995 excavation has remained consistent throughout the examination and publishing process. All features interpreted as inhumation graves were accorded a G-number. During excavation of the 13 features, which

[2] The excavation was undertaken by the Museum of Varde City and Environs (VAM) as J.no. VAM 1272 (Lønne sogn, Vester-Horne herred, Ribe amt, 190708-1). Museum curator Lene B. Frandsen oversaw the excavation, assisted by graduate student Jørgen Westphal and archaeology students Joan Jensen, Peter Mikkelsen and Turi Høiler as well as amateur archaeologists Søren Christensen and Paw Jørgensen.

Fig. 5. Examples of textiles placed in a passe-partout frame from grave 1 from the 1995 excavation (photo: I. Demant).

were presumed to be inhumation graves, G4 turned out to be a looter's trench through grave 3, and grave 5 (G5) is interpreted as a votive pottery deposit. The initial inhumation grave from 1969 was named grave 1969, which produces a total of twelve inhumation graves at Lønne Hede. All remaining features were recorded with an A-number. Features with cremated bones were categorized as cremation graves.

After the field work had been finished, archaeologists and conservators alike were faced with an immense challenge. On the appearance of the first traces of textiles, it became evident that they were too fragile to be excavated on site. The inhumation graves were recovered in blocks of soil and transported to the Conservation Centre in Ølgod in order to dry out from their original wet condition. During the excavation, it had been observed that the textiles had significantly disintegrated, and when sprayed with water the threads would separate. None of the conservation services in Denmark had the storage capacity to take in all the graves from Lønne Hede. The Ølgod Conservation Centre solved the problem by hiring a refrigerated container where the blocks would slowly dry over the next couple of months. The textiles were manageable in their dry state and could then be carefully extracted with small excavating tools and a vacuum cleaner on exceptionally low setting. Textile conservator Frances Roberts performed the fine cleansing and conducted an initial analysis of the weaving technique (Klingenberg et al. 1995; Frandsen 2015, 117). The textiles were subsequently lifted from the graves and placed in a passe-partout cut to fit each piece *(fig. 5)*. No preservative agents were utilized.

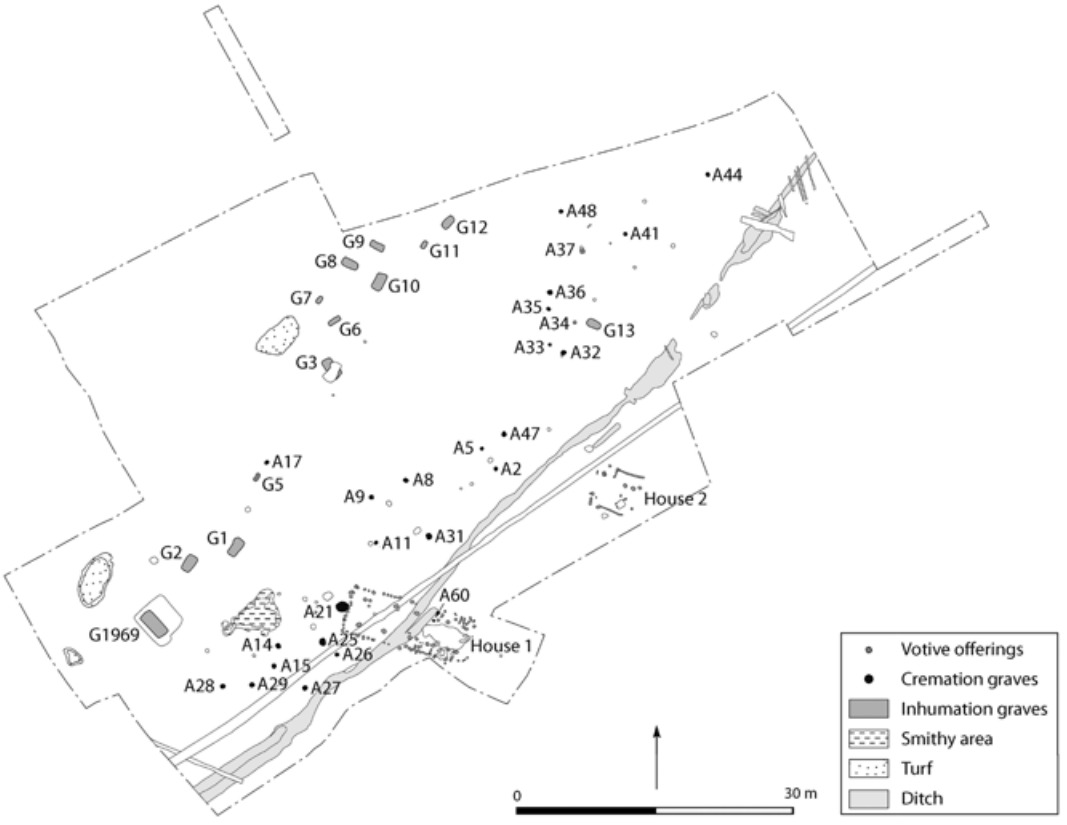


Fig. 6. Overall plan of the Lønne Hede excavation site with inhumation graves, cremation burials as well as pottery deposits, houses, and smithy area (illustration: Varde Museum).

The fact that the same site was excavated with a 26-year time lapse allows for an evaluation of the changing preservation condition of the site. Two factors have significantly influenced the preservation conditions at the site: drainage and cultivation. The combination of a high groundwater table and an acidic PH-value had preserved timber, wool, and hair in excellent condition. Apparently, the area had become dryer as the preservation conditions for the organic material had deteriorated in the period between the 1969 and 1995 excavations. The soil acidity, beneficial to the organic material, had damaged the iron – in many cases only a corrosion layer remained. Cultivation of the land has not disturbed the inhumation graves significantly, but if the burials were originally been marked by low mounds, these have long since disappeared. The cremation graves, however, have suffered considerable damage through cultivation, as in most cases the top had been ploughed away.

1.4 Two houses and a smithy from the Early Pre-Roman Iron Age

In the south-east corner of the excavation site, two long houses were identified *(fig. 6)*. House 1 is a small house with a rectangular layout of approximately 14 × 5 m. In the stables located in the eastern part of the house, remains of a dung channel and traces of stalls were preserved. Analysis show a high rate of phosphate throughout the entire eastern part of the house as well as around the southern entrance, indicating that this door was used by

Fig. 7. Aerial photo from 2015 of a non-excavated settlement with several fenced farms with long houses and economy buildings. This settlement is situated approximately 50–100 m Northeast of the burial ground and is probably contemporary with the graves (photo: L. Helles Olesen).

animals to access the stable. House 2 is poorly preserved and only the traces of four roof-bearing posts and remains of wall foundations were identified. The houses were oriented east-west. Both house typology and pottery from postholes suggest a date within the Early Pre-Roman Iron Age (c. 500–300 BC), as the ceramics belong in the early Pre-Roman Iron Age phase I (Becker 1961; Rindel 1997; Jensen 1997). Consequently, the houses are earlier than the inhumation graves dating to the Early Roman Iron Age (AD 1–160).

Slightly west of house 1, a sturdy clay floor was found. This has been interpreted as a smithy *(fig. 6)*. The area, which apparently had not been covered by a roof, is described as an uneven layer of firmly trodden, in places red-burnt clay and sand strewn with slags. The character of the slags indicates several work processes, as both plano-convex slags from cleansing of the iron bloom, forging slags with holes from the bellows' nozzle, as well as melted slag from the extraction of iron were identified. Furthermore, a small iron object, either a chisel or a mandrel, was recovered. A flat-bottomed pit adjacent to the work area produced ceramics dating to the early Pre-Roman Iron Age, e. g. contemporary with houses 1 and 2.

A settlement contemporary with the inhumation graves has yet to be found but could possibly be situated in the field towards the northwest, as the National Museum of Denmark identified an Iron Age settlement in this area in 1970. This settlement has not been excavated, but pottery and red-burnt areas of soil come to surface when ploughing. Furthermore, crop marks have been observed through aerial reconnaissance, and recently published air photos reveal at least three fenced farms comprising longhouses and outbuildings approximately 50–100 m northeast of the burial ground *(fig. 7)*; a minimum of six longhouses without fences have been identified (Olesen et al. 2019). Based on typology, these houses indicate continuous settlement from the Pre-Roman to the Early Roman Iron Age, but this has not been verified via excavation.

Feature no.	Diameter (cm)	Depth (cm)	Number of vessels	Misc.	Typological date
A34	35	8	1		?
A37	50	34	2–3	Packed with stones	E RIA
G5	90	10	2	One vessel upside-down	E RIA

Table 1. Lønne Hede, features interpreted as pottery depositions.

The distance between the burial ground and the possibly contemporary settlement is about 150 m, and the burial ground was undoubtedly visible from the settlement. It was not unusual for Early Iron Age people to bury their dead near their homes (Henriksen 2009, 58 with further references).

1.5 Extent, structure, stratigraphy and organization of the gravesite

A total of twelve inhumation graves and 25 cremation graves were excavated at Lønne Hede. It is possible that more burials and other traces of activity are hidden in the surrounding area, but only the 3000 m^2 area of the future lake was excavated. The graves are situated along two almost parallel rows running SW–NE with the cremation graves in the eastern of the two rows *(fig. 6)*. The area between these two rows may indicate the presence of a road leading to the settlement. The cremation burial area was laid out during the latter part of the Pre-Roman Iron Age (c. 250–1 BC), but evidently was still in use when the custom of burying the dead without cremation began, and it is apparent that there was a time-overlap between the two types of burials.

Along the eastern part of the burial site, a ditch was identified. It was deeper and more clearly defined towards the south, where it measured approximately 2 × 0.5 m. Towards the north, the ditch became increasingly difficult to follow and terminated in a band of grey shifting sand. It is worth noting that the ditch runs parallel to the graves, or rather the graves are situated parallel to the ditch, as it is stratigraphically older than house 1. The function of this ditch is unknown.

Regrettably, no clear stratigraphy between the houses and the cremation graves can be recognised, even though cremation grave A21 was found within the boundaries of house 1. The cremation graves dated from the pottery appear to be younger than houses 1–2, as the graves belong to the late Pre-Roman Iron Age, or possibly the beginning of the Early Roman Iron Age. The largest weapon grave, A25, appears typologically to belong to the beginning of the Early Roman Age. Consequently, the traditions of cremation and inhumation may have existed simultaneously at the site.

The content of the graves is described in connection with the presentation of the individual graves, furthermore, an overview is provided in *tables 2* and *3*.

1.5.1 Pottery depositions

Concentrations of potsherds without cremated bones were found deposited between the graves at Lønne Hede. They are not interpreted as cremation graves but rather as pottery depositions, i. e. a type of votive deposit in connection with the inhumation burials. Ritual depositions of pottery, weaponry and other goods are not uncommon at North European cemeteries from the Early Iron Age. These deposits have previously been interpreted as

Grave no.	Urn grave	Cremation pit	Diameter (cm)	Depth (cm)	Number of vessels	Sherd type	Knife	Sword	Misc.	Cremated bones (g)	Human / Animal	^{14}C-date*	Type date
A2		x	45	15	2	R/B/be	1		Slag	379	H		L PRI–E RI
A5		x	39	23						104	H		
A8		x	60	14	2	R				460	H/A		
A9			52	22	1	R			Iron	250	?/A		
A11		x	43	8						8	?/A		
A14		x	63	13	2	R/B	1			65	H		L PRI
A15		x	56		2	R/B				11	?/?		L PRI–E RI
A17	x		52	20	1	B/be	2		Bone pin Buckle	1493	H/A		L PRI–E RI
A21		x	80	36			1	1	Shield boss	28	H	379–203 BC	
A25		x	85	30	10–12	R/B/H	1	1	Chape Spearhead Gold drop	2350	H/A	204–49 BC	L PRI–E RI
A26		x	46	19					Slag	46	H/A		
A27		x	57	2	1	be			Slag	22	?/?		
A28		x	57	14	2	o	1			376	H/A		L PRI
A29		x	59	20	1	R	1			113	?/A		L PRI
A31		x	71	19	2–3	R/B				2	?/?		L PRI–E RI
A32		x	58	18									
A33		x	37	19						212	H/A		
A35	x		18	8		B							
A36		x	60	8						42	H		
A41		x	42	8			2			241	H/A	358–140 BC	
A44		x	46	16	1					26	?/?		L PRI–E RI
A47		x	61	20	2–3	R/be			Iron	24	?/?		
A48		x	48	4		B							
A60		x	30	14	1	B							
A73		x								11	?/?		

Table 2. Lønne Hede. Contents and characteristic features of the cremation graves from the Late Pre-Roman Iron Age (L PRI) and the Early Roman Iron Age (E RI). The number of pots in each burial is shown, as well as the type of sherd: rims (R), bases (B) handles (H) or roughcast potsherds (be). * ^{14}C-datings via Aarhus AMS Centre.

cenotaphs or as the remains of different rituals taking place at the burial sites, but could also be seen in connection with the pottery deposits on settlements of the same period (Becker 1961, 122–127; Henriksen 2009, 115–116; Nielsen et al. 2018). At Lønne Hede, three possible potsherd depositions were found: A34, G5 (originally interpreted as a grave) and A37 (*figs 6,8–10* and *table 1*).

Grave no.	Coffin	Wooden lid or branches	Depth (cm)	Length × width (cm)	Orientation	Stone packing	Support stones	Textiles Many (M) Few (F) None (-)	Trace of body	Hair	Knife	Number of ceramic vessels	Comb	Other	^{14}C-date*
1		X	51	192 × 156	NNE–SSW	Top		M			1		1	Hide	56 BC–56 AD
2			32	186 × 110	NNE–SSW	Top		M		(X)	1	3			65–180 AD
3	X		60	220 × 104	NW–SE	Top	Bottom	–				5		Wooden dish	
6			53	144 × 64	NE–SW			F	X	X			1	X	
7			11	70 × 38	NNE–SSW			F							85–233 AD
8			62	146 × 84	WNW–ESE			F	X						
9			18	150 × 100	WNW–ESE			F		X					123–238 AD
10		X	58	174 × 110	NNE–SSW			M		X					49–134 AD
11			22	70 × 48	NNE–SSW			-							
12		X	47	128 × 86	NE–SW			M		X					25–136 AD
13		(X)	67	150 × 84	VNW–ESE			(F)						Animal bones	
1969	X		C. 60		NW–SE	Top	Bottom	M		X	1	4		Fibulae etc.	

Table 3. Lønne Hede. Contents and characteristic features of the inhumation graves. *^{14}C-dating by Aarhus AMS Center.

A34 was situated in the eastern row of graves to the north, close to grave 13. The feature was disturbed by ploughing and only the bottom of the pot was preserved.

In the western row of inhumation graves a little to the north of grave 1, G5 was discovered. It consisted of three stones covering the lower part of a large storage vessel. The pot had most likely been broken at the time of deposition. It was clearly not a random rubbish pit, as the large vessel had been carefully placed covering the three smaller potsherds, and the entire assemblage then buttressed by the three stones *(fig. 8)*. As the find contained only base sherds, the dating is not precise, but a pronounced retracted base on one of the smaller vessels seems to indicate an Early Roman Iron Age date (Becker 1961; Jensen 1997; Rindel 2002).

A37 was found in the eastern row towards the north surrounded by cremation graves and roughly 7 m from the nearest inhumation burial. On the surface, A37 was visible as a grey-black circular feature with small pieces of charcoal in the fill. The pit was densely packed with stones, among them a hammer stone. A poorly burnt cap of clay adher-

Fig. 8. Excavation of pottery deposition G5 with a storage vessel deposited upside down (photo: Varde Museum).

Fig. 9. Excavation of pottery deposition A37 (photo: Varde Museum).

Fig. 10. Contents of pottery deposition A37. Two clay vessels and a flat stone with burnt-on remnants of what appears to be a clay lid (photo: Varde Museum).

ing to one of the stones could possibly be interpreted as a lid. At the bottom of the pit, two ceramic vessels came to light: a shallow dish with facetted horizontal handles and an impressive jar with a high neck, distinct foot, and a pronounced X-shaped handle *(figs 9–10)*. The pots are of exceptionally fine quality – for instance, the handle of the dish is clearly meant to resemble handles from Roman metal vessels (Rindel 2002, 174).

1.5.2 Cremation graves

The 25 cremation graves are identified by the white-burnt bone fragments. The majority consists of cremation pits, i. e. cremated bones, pottery sherds and other grave goods including remains of the funeral pyre deposited in a shallow pit. Only two graves can be identified as urn burials (A17 and A35), however A25 contained both an urn and remains of the pyre, i. e. was an urn cremation grave (for definitions, see Henriksen 2009, 67–70). All cremation graves were badly disturbed by ploughing and in most cases over

Fig. 11. Finds from cremation grave A2: slag, potsherds from two different vessels and an iron knife (photo: Varde Museum).

Fig. 12. Finds from urn grave A17: base of an urn with a large amount of charred bones, bone pin and two iron knives (photo: Varde Museum).

two thirds had disappeared; this is also evident from the shallow depths of the grave-pits, never exceeding 36 cm *(table 2)*.

Osteological analysis of the bone material from 21 cremation graves was undertaken by Pia Bennike of the Anthropological Laboratory of the Panum Institute, University of Copenhagen (Bennike 2002). In general, the material was highly fragmented with the amount of charred bones varying from 2 g to more than 2 kg. It was not possible to identify the gender of the deceased, but eleven graves belonged to adult humans, of which one could possibly have been of an older child. In the remaining graves, it was impossible to determine whether the bones were animal or human remains *(table 2)*.

The amount and quality of the grave goods was unevenly distributed. Two graves held the remains of poorly preserved weaponry (see below). Several artefacts had evidently been subject to deliberate destruction prior to burial: the swords were bent, and the pots had been heavily smashed – the missing potsherds cannot be explained by formation processes alone.

The cremation graves containing potsherds with distinctive features are typologically dated to the Late Pre-Roman Iron Age or the beginning of the Early Roman Iron Age, that is Becker's Pre-Roman Iron Age phase IIIb to Early Roman Iron Age phase B1 (Becker 1961, 262–263; Rindel 1997, 159–167).

Some graves are exceptional in terms of their grave goods (A2, A17, A21, A25 and A41) and are briefly mentioned in the following.

Cremation patch A2 was situated roughly in the middle of the eastern row of cremation graves. The burial was 45 cm in diameter and 15 cm deep. It contained a cohesive mass of potsherd flakes stuck together and 379 g of cremated human bones. In the fill, potsherds from two pots were recovered: the wall sherds from a large, rusticated storage vessel, and approximately half of a pot made of thin, reddish-brown clay with a flat base and a thickened, facetted rim (Varde Museum 1272x2). The pot dates to the transition between the Late Pre-Roman and the Early Roman Iron Age, around the beginning of our era. Furthermore, an approximately 20 cm long iron knife with a twisted tang, plano-convex slag and a quantity of porous sintered clay slag were recovered *(fig. 11)*. The presence of the forging

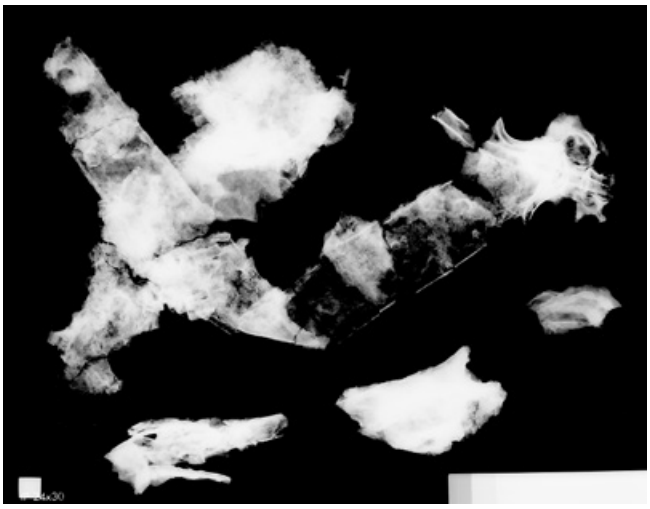
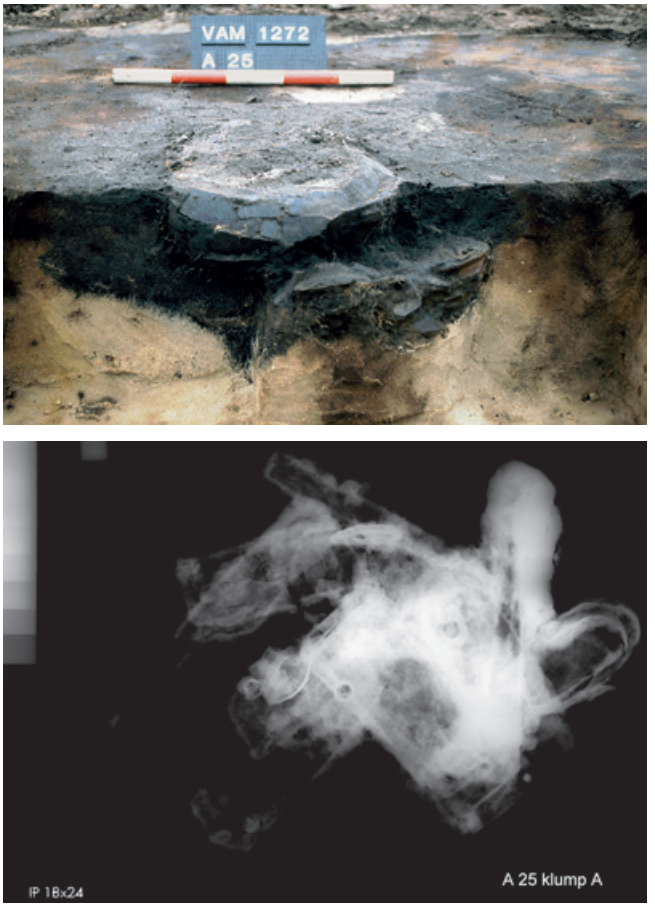


Fig. 13. X-ray of the iron objects from weapon grave A21. It was possible to identify a La Tène sword with a bell-shaped hilt, a shield boss and a knife with tang (photo: Moesgaard Museum).

slag could be purely coincidental and be explained by the proximity to the older building with iron forging activity. Another possibility is that the deceased was visualised as a blacksmith by burying him, for purely symbolic reasons, with forging slag and one of his products in the form of a fine knife (see also Wells 1960, 36; Olsen / Bech 1996, 191).

Urn grave A17 is the only cremation grave situated among the inhumation burials in the western row of graves *(fig. 6)*. Only the lowest 10 cm of a large container vessel utilized to hold the cremated bones were preserved (Varde Museum 1272x38). The pit was only dug a little larger than the urn. The grave goods were placed in the vessel alongside 1493 g of cremated bones, which is the second largest amount of charred bones from the burial site. Among the bones, an 11.4 cm long, white-burnt bone pin with a finely shaped knobbed terminal was found. Thin flakes of iron burnt onto the cremated bones are interpreted as a wide-bladed knife – perhaps crescent-shaped. In addition, an approximately 13 cm long iron knife with a tang terminating in a knob was recovered *(fig. 12)*.

The cremation pit A21 was found in the eastern row of cremation graves close to the western end of house 1 *(fig. 6)*, but it was impossible to determine a stratigraphic relationship between the house and the grave. Typologically, house 1 is older than the cremation grave, and it had most likely long disappeared when the grave was dug. The cremation grave was approximately 80 cm in diameter and 36 cm deep. The grave filling included a large amount of charcoal, but only 28 g of human bones. The remarkable find of a large clump of rusty iron led to the entire grave being extracted in a block. The iron was in a very poor condition, but X-rays showed several weapons in the block (Varde Museum 1272x101) *(fig. 13)*: a La Tène sword with a bell-shaped hilt, a shield boss with a short tip and a broad collar with large rivets, as well as a knife with tang. Moreover, remains of oak *(quercus)* were found. The sword type is most likely to be dated after 150 BC and, as the tradition of weapon graves in Denmark does not seem to appear before approximately 150 BC (Pauli Jensen 2015), the most likely dating of the grave would be 100–1 BC, which also fits with the dating of the shield boss. The weaponry was apparently placed on the funeral pyre, and the weapons were both broken and bent before being deposited in the grave-pit.



1

2

Fig. 14. 1. Weapon grave A25 during excavation; 2. X-ray of the iron artefacts from weapon grave A25 (photo: Varde Museum and Moesgaard Museum).

Urn cremation grave A25 was situated in the southern end of the cremation burial area close to weapon grave A21 *(fig. 6)*. The top of the grave was ploughed away. The grave measured 85 cm in diameter and was approximately 30 cm deep. The base of a large clay vessel with a rusticated exterior containing cremated bones and a large clump of iron was found at the centre of the grave *(fig. 14,1.2)*. The urn enclosed sherds from other pots, and underneath it was an agglomeration of more potsherds. Altogether, potsherds from at least ten different clay vessels were recovered. In amongst the large amount of a total of 2350 g of charred bone material from both humans and animals was a tiny drop of melted gold.

The grave was richly furnished with ceramics (Varde Museum 1272x105). In contrast to some of the other potsherds, the large clay vessel serving as an urn had not been placed on the funeral pyre. Many of the potsherds showed traces of secondary burning – it appears as if sherds from the same vessel were unevenly burnt in a secondary burning process, suggesting that some of the vessels were smashed, before they were placed on the funeral pyre *(fig. 15)*. Typologically, the ceramics are characteristic for the Pre-Roman Iron Age phase IIIb (according to Becker 1961) and the Earliest Roman Iron Age, with thickened, facetted rims and X-shaped ears. A few potsherds are embellished with dots.

Fig. 15. A selection of ceramics from weapon grave A25 (photo: Varde Museum).

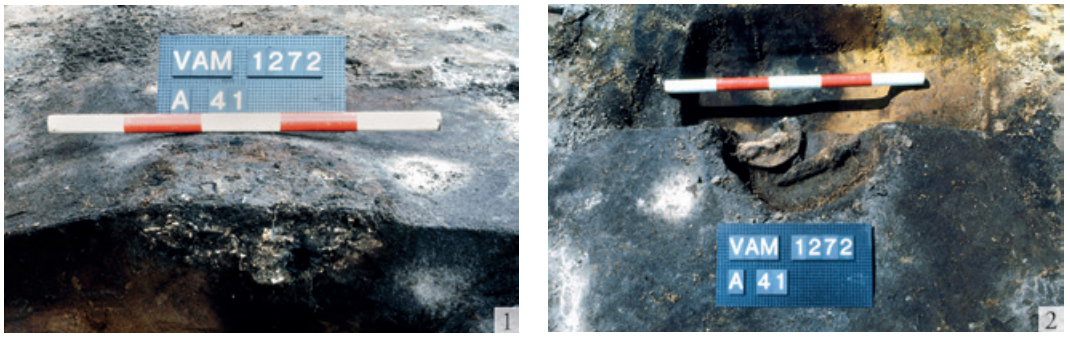


Fig. 16. Cremation grave A41 being excavated: 1. profile; 2. seen from the top (Photo: Varde Museum).

The iron was found in two separate concentrations and was highly damaged by deliberate destruction prior to or during the funeral ceremony, from burning on the funeral pyre, and from nearly 2000 years in the ground. The X-ray *(fig. 14,2)* led to the identification of a sword – possibly single-edged, a straight-backed knife, a rectangular copper-alloy chape perhaps on a wooden sheath, a spear head with a medial ridge as well as a shield boss with a long knobbed tip. The latter may be dated to the Early Roman Iron Age[3].

Cremation grave A41 was situated to the north of the eastern row of cremation graves *(fig. 6)*. It is a ploughed-out cremation patch containing traces of the pyre and measured 42 cm in diameter and 8 cm in depth *(fig. 16,1.2)*. The filling consisted of brown humus mixed with sand, in turn intermixed with clumps of greasy charcoal containing pieces of charcoal and fragments of cremated bones, 241 g in all. At the bottom of the grave, two

[3] Identification of the iron objects from the two weapon graves was undertaken by Xenia Pauli Jensen, Moesgaard Museum.

Fig. 17. The iron knifes from grave A41, especially the large crescent-shaped knife is noteworthy. Perhaps the deceased was a tanner or leatherworker buried with his tools (photo: Varde Museum).

iron knives were found *(fig. 17)*: a 13.2 cm long, single-edged knife with part of the tang missing, as well as a crescent-shaped knife (Varde Museum 1272x79). The latter measured 11.5 cm with the widest breadth of the blade being 6.7 cm. Crescent-shaped knives are quite common in Denmark from the end of the Pre-Roman Iron Age and are not known later than the Early Roman Iron Age (Henriksen 2009, 162). This fits very well with the grave being dated to either the late Pre-Roman or the Early Roman Iron Age.

1.5.3 Inhumation graves: an overview

The twelve inhumation graves from Lønne Hede vary in size, layout, orientation, grave goods etc. *(table 3)*. Despite this, the burial site probably belongs to the one and the same settlement. In general, the inhumation graves were rather poor in terms of grave goods – the sole exception being grave 1969 (Nordquist / Ørsnes 1971) with its remarkable content of fibulae, silver clasps, amber and other small objects, as well as an exclusive set of ceramic vessels (see below). Grave 3 contained several fragmented pots similar to the specimens from grave 1969. It had almost certainly been richly furnished but was re-opened shortly after burial. Between the rest of the graves, only a knife, two combs and three ceramic vessels were found (see below).

The only visible trace of the deceased was the body fat, which in a few of the graves had cemented the sand, revealing the deceased had been buried in a hocker position. An exceptional feature, however, is the preserved human hair in six inhumation graves (grave 1969, grave 2, grave 6, grave 9, grave 10 and grave 12).

All inhumation graves date to the Early Roman Iron Age, and the fact that they are placed in a line without any of the graves overlapping suggests that older graves were both visible and respected *(fig. 6)*. Stone packings were observed at the top of some graves – perhaps functioning as markers – but many stones have probably disappeared through centuries of ploughing. It is unclear whether the graves were marked with mounds, as no traces could be recognised, but the distance between some of the graves of only 2–3 m leaves little room for them. The fact that none of the graves intersect, implies that both inhumation graves and cremation graves in the Early Iron Age were clearly marked on the surface.

The inhumation graves vary in orientation with no clearly preferred trend. It is worth noting that the two largest graves (grave 1969 and grave 3) were aligned, implying a certain

association despite their distance. Construction of the graves also varies significantly: two graves (grave 1969 and grave 3) contained hefty oak plank coffins supported on the outside by stone packing. Grave 10 and grave 12 were once covered with planks, implying that the deceased had been placed in a dirt-free area. Grave 1 contained wood in the form of branches or smaller pieces of timber with bark placed over the body, as well as two pieces of timber alongside the body. These could be the remains of a bier to carry the deceased, or perhaps the branches formed a type of structure over the body. Grave 13 also contained decomposed wood spread across the body, but it was too deteriorated to allow for further interpretation.

The size of the inhumation graves is shown in *table 3*. Two of them (grave 7 and grave 11) are notable for their diminutive size, being only 70 cm in length, and are most likely children's burials. Where imprints of the body were detected, the deceased had been buried in hocker position and only occupied about two thirds of the grave. The graves vary in depth from only 10 to 70 cm, from the machine-stripped level to the bottom of the grave. The area has a high water-table which might explain the shallow graves.

During the excavation of grave 3, the combination of the large feature on the surface, the many stones and the grave's relatively great depth raised the expectation that a significant person was buried there. However, even before the top of the coffin was reached, it was obvious that the grave had been disturbed. Evidently, the re-opening occurred relatively soon after the burial, at least it must have happened while the body was still intact and could be completely extracted; not even a little piece of textile remained behind, and only broken pots were found. Re-opening of graves in the Early Roman Iron Age (and later) is a widespread custom known both from the close vicinity of Lønne Hede, at Årre, and from most of Northern Europe of the time (Frandsen 2009, 61, Rasch 1994; Kokowski 1999, 99–121; Lind 1991, 43–48). The custom has long been interpreted as simple looting of the valuables of the graves. However, an increasing knowledge of the different rituals comprising the burial-rites has led to a more nuanced understanding of the array of different ceremonies both prior and after the burial, including ritual re-opening of graves and feasting at the cemeteries (Henriksen 2009, 87–111; Lorange 2015, 30–33).

As already mentioned, several of the graves contained textiles *(table 3)*. These will be discussed in detail in the following, where each inhumation grave will be presented. First, however, an introduction to textiles and costume will be provided.

2. Introduction to textiles, textile production, and costume in Lønne Hede

This chapter contains an introduction to the use of textiles and animal hide in Lønne Hede, including a presentation of the different groups of textiles and the use of different designs or patterns. Furthermore, the production methods in general are discussed alongside with a clarification of special features such as woven borders and girdles.

2.1 Preliminary remarks

A total of ten graves contained preserved textiles (graves 1–2, 6–10, 12–13 and grave 1969, with only few traces of textiles in grave 13). All these textiles were made of wool.

The state of preservation of the different types of textile appears to be related to colour and dyeing. The white textiles are the worst preserved, whereas the textiles in darker shades are better preserved. A likely explanation may be that the latter had been exposed to a form of treatment, i. e. dying, which had improved their ability to withstand the 2000 years in the ground. However, this is impossible to prove. Such questions of natural pigmentation

Fig. 18. Schematic overview of the different weaves used at Lønne Hede. 1. twill; 2. 2/1 twill; 3. tabby (after Andersson 2003 fig. 6).

and dyestuffs used in the textiles will be explained in the chapter below by Bruselius Scharff and Ina Vanden Berge respectively.

In order to gain an insight into the number of textiles present in the graves, the preserved textiles were roughly separated into types during the initial *in situ* recording. Every type was analysed and numbered consecutively as they were discovered. The number system allows a textile to be related to both grave number and type of textile. Thus "textile 1.6" belongs to type 6 in grave 1. Every such combined number is unique for the individual grave, as it only refers to the particular weave found in this grave. During the later, more detailed analysis, it was necessary to revise the initial typology, as it turned out that some textiles, which at first had been referred to as of the same type, were in fact so different that they had to be separated into different types – or vice versa – while parts which had been separated at first were so alike that they could be combined into one type. In this presentation as much as possible of the original number system has been maintained. As a result, some numbers are missing in the present catalogue.

When the textiles from grave 1969 were analysed, the types were referred to as "type 1", "type 2" etc. In the present article this has been modified to "textile 1969.1", "textile 1969.2" etc. to avoid any confusion with textiles from the other graves.

2.2 Textiles and costumes in the graves of Lønne Hede

There were on average two or three types of weave in each grave, and only grave 1969 and grave 2 contained more than three. The textiles appeared mostly to have been used as clothing for the deceased. However, in several graves one of the weaves appeared to have been used for lining the grave along with an animal hide.

The most common weave in Lønne Hede is plain 2/2 twill with approximately 8/8, Z/Z threads per cm. Only a few were coarser with 6–7 threads per cm. Only three tabbies (grave 1969 textile 1969.4, 1969.7; grave 2 textile 2.6) and one diamond / herringbone twill are registered (grave 2 textile 2.3). Tablet weaving is identified twice as a border added on to a twill fabric (grave 1969 textile 1969.5), one in a very elaborate version (grave 1 part of textile 1.5). However, tabby woven ribbons with a tubular selvedge (a variant of a selvedge in which the outermost warp threads form a tube) are recorded / identified five times in four different graves (grave 1969 textile 1969.5; grave 1 textile 1.7; grave 10 textile 10.3 and 10.6; grave 12 textile 12.7), making this type of weave a remarkable feature of the Lønne Hede complex *(fig. 18)*[4].

[4] Note that Andersson 2003 fig. 6 uses the term "right broken lozenge twill" for the type of weave this article calls "diamond twill".

	Fabric			Ribbons	
	Plain 2/2 twill	Diamond / herringbone twill	Tabby	Tabby woven with tubular selvedge	Tablet weave
	Z/Z	Z/Z	Z/Z	Z/Z	Z/Z
Grave 1	3	–	–	2	1
Grave 2	1	1	1	–	–
Grave 6	2	–	–	–	–
Grave 7	2	–	–	–	–
Grave 8	2	–	–	–	–
Grave 9	2	–	–	––	–
Grave 10	3	–	–	2	–
Grave 12	2	–	–	2	–
Grave 13	–	–	–	–	–
Grave 1969	2	–	2	1	1
In all	19	1	3	7	1

Table 4. Lønne Hede. Textile patterns.

2.2.1 Groups of textiles

The data presented in *table 4* give the impression of a rather homogenous group of textiles. However, based on colour pattern and size it is possible to divide the plain 2/2 twills into three distinct groups, which can be assumed to have functional meaning as they have been identified at the same position in relation to the dead body in most of the graves:

Group 1: Dark reddish-brown twills with added-in weft stripes.
Group 2: Plain twills, typically in orange-light brown colour. One has weft stripes in red and undyed wool (textile 1.5) and one has blue dye preserved (textile 1969.2).
Group 3: Plain twill in undyed wool, often slightly coarser than type 1 and 2.
An overview is presented in *table 5*. Where it is possible to measure or estimate the size of the weave, it tends to be approximately the same. Size estimation is based on measurements of the area the textiles appeared to have covered in the grave.

2.2.1.1 Textile group 1: Dark reddish-brown twills with added-in weft stripes

At Lønne Hede the weaves of this group are mainly characterised by being rectangular, woven in dark reddish-brown wool with weft stripes in an undyed yarn and having warp-end fringes *(fig. 19)*. The stripes vary between plain 2/2 twill or weft-faced tabby with double warp. Most of the weaves are typically located as a double layer in the area of the upper part of the body with warp-end fringes only at one side and coherent on the opposite side, showing that is was folded. Thus, the length of the weave, as it lies in the grave, must be doubled to estimate the actual length of the textile, whereas the width will remain the same, that is 40–50 × 100–120 cm (textiles 1.5, 2.3, 12.1; *table 5*). The two layers are typically found above and below the weaves of group 2, therefore it must be safe to conclude

Fig. 19. Reconstruction of a textile from group 1: Red 2/2 twill with white stripes (textile 1969.1) (photo: I. Demant).

that their function was comparable to a shawl, worn wrapped around the upper part of the body.

Only textile 1969.1 from grave 1969, which is of a similar design, was found over and below the preserved hair of the deceased, but the size estimation is roughly the same – indicating that weaves of this size and pattern could also serve as head-covers.

The white stripes in the weave are generally very badly preserved, often leaving only empty spaces in the warp. Therefore, empty spaces in an otherwise dark reddish-brown twill weave indicate that similar textiles are present near the heads in grave 8 and 9 (textiles 8.1 and 9.2).

In addition, the chequered tabby weave in grave 1969 (textile 1969.4) must be mentioned. As the fragments of this textile were found in the area of the upper body covering the layers of what is believed to represent the main garments, this can also be interpreted as a shawl – and the size would probably have been roughly the same.

A parallel to the weaves of group 1 can be found in the chequered shawl of the Huldremose woman (Hald 1980, 47). According to the find description, it was wrapped around the neck, and the ends were tucked under an arm and secured with a pin made of a bird bone (Brothwell et al. 1990, 159). Furthermore, they fall into the group of small weaves with warp-end fringes at each end among the textiles found in bogs referred to by Mannering et al. as "scarves" (Mannering et al. 2012, 105), which are defined by a similar size and shape. It is, however, important to notice that they had multiple functions. Consequently, the position of the group 1 textiles in the graves from Lønne Hede indicates that they have been used both as head-covers and shawls.

2.2.1.2 Textile group 2: Plain twills

The weaves of this group are defined as plain twills covering the body of the deceased, mostly in one colour, though one case had woven-in stripes in reddish-brown and white. Selvedges are found near the head and feet respectively, meaning that the width of the weave corresponds with the length of the garment.

The best-preserved examples belong to graves 1 and 12 (textiles 1.5 and 12.3), where the width of the weave – from selvedge to selvedge – measures approximately 100 and 86 cm

Textile	Group	Definition (After Mannering et al. 2012)	Size of fragments	Covered area (length × width, cm)	Selvedge present	Estimated or measured size (cm)
Textile 1969.1	1	Scarf	–	22 × 40	1	–
Textile 1969.4	1	Scarf (tabby)	–	23 × 40	1	(40–50 × 100)
Textile 1.6	1	Scarf	–	50 × 64	1	50 × 110–120
Textile 2.3	1	Scarf	42 × 70 cm 42 × 30 cm	52 × 42	2	42 × 100
Textile 12.1	1	Scarf	–	34 × 40	–	40 × 110
Textile 12.3	2	Wrap / dress	–	86 × 34 (?)	1	90 × 80 (minimum)
Textile 1.5	2	Wrap / dress	–	100 × 55	2	100 × 110–120
Textile 1969.2	2	Wrap / dress	–	–	–	–
Textile 1969.6	3	Blanket	–	–	–	Unknown
Textile 1.2	3	–	–	–	–	Unknown
Textile 2.2	3	–	–	–	–	Unknown
Textile 10.5	3	–	–	–	–	Unknown

Table 5. Lønne Hede. Overview of textile groups, interpretation, and size of the textiles.

respectively. These weaves are also found as a double layer, so that the length of the weave will be at least double the measured length, that is a minimum of 100–120 cm long.

The selvedges are typically adorned with a narrow-woven border (textiles 1.7 and 12.7).

The weaves had clearly been wrapped around the body and, if worn like this, covered the body about down to the knees when the person was standing upright. As such they can be compared to the group referred to by Mannering and Ræder Knudsen as "wrap around-textiles" with a size of approximately 150 × 100 cm, and which are predominantly dated to the Pre-Roman Iron Age (Mannering et al. 2012, 103–105). They also resemble the tubular dress of the Hammerum girl, found only 50 km north of Lønne Hede and dated roughly 100 years later (Mannering / Ræder Knudsen 2013). From the position in which the Hammerum dress was found, it was evident that the dress had been fastened selvedge to selvedge over the shoulders in the style of a peplos (Mannering / Ræder Knudsen 2013, 158), in this context understood as a loose garment, typically tubular, held together by pins or fibulae at the shoulders. There were indications that the weave in Lønne Hede grave 1 was worn in a similar manner, as a curve resembling an arm opening was identified near the head region, but not enough textile was preserved in order to determine how the selvedges would have been held together. There were no visible stitches identified – this could have clarified whether the weave had been gathered into a tubular form mirroring how the dress from Hammerum and some of the garments found in bogs dated to the Pre-Roman Iron Age (Hald 1980, 53; Mannering et al. 2012, 108) had been. Lengthwise of the weave in grave 1 was a narrow tablet weave attached with an elaborate seam, but it was impossible to determine if it was only edging a transverse edge, or in fact was part of a stitching forming the weave into a tube *(fig. 20,1–3)*. The orange twill in grave 12 (textile 12.3) was best preserved in the area of the legs, but it was also present in the area of the upper body between the layers of the "shawl" (textile 12.1), demonstrating that it most probably was worn in the same manner.

The orange twills in graves 6, 8, 9 (textiles 6.1, 8.3, 9.1) may also have been worn as a peplos-style garment, but not enough material was preserved to prove this. However, parts

1

2

3

2 + 3

0 2 cm

Fig. 20. Reconstruction of the border on added to the transverse edge of textile 1.5. 1. A narrow tablet weave is stitched on to the fabric with loose stitches running from side to side forming an approximately 1.2 cm wide "ladder"; 2. The stiches are filled in with alternating reddish brown and white yarn as a weft-faced tabby forming a striped effect; 3. The finished border (photos: I. Demant).

of the plain blue twill from grave 1969 (textile 1969.2) appear to have been worn this way. Two copper-alloy fibulae had each been pinned through fragments of this weave near two selvedges which also had added woven borders *(fig. 52)*. They were found near the head, originally pinning the back and the front of the garment together over the shoulders. Furthermore, a fragment consisting of two pieces stitched together *(fig. 44a–b)* indicates that this garment had in fact been sewn together to form a tube. Due to the very fragmented state of this twill weave, it is impossible to determine the original width and length of this garment. It has previously been interpreted as a blouse worn together with a skirt (i. e. Munksgaard / Østergård 1988, 60). However, as it is worn in the same way as the dress in grave 1, it is likely that is was woven to nearly the same size, and thus was more than just a blouse.

It is remarkable for grave 1969 that the plain twill (textile 1969.2) appears to represent two garments. The type is also recorded as stitched selvedge to selvedge to a 13 cm wide tabby weave (textile 1969.7) in the largest preserved fragment in grave 1969. It is 115 cm long and 13 cm wide *(fig. 57)*. The tabby woven piece had been held together with a piece of string close to the 1 cm wide tubular selvedge forming 2 cm deep pleats. The opposite selvedge was stitched selvedge to selvedge to fragments of the plain twill (textile 1969.2). The long fragment was found at the side in the middle of the grave, folded up as if collapsed in on itself. However, fragments of the same type of tabby weave are recorded across the whole of the middle part of the grave, indicating a very wide garment – as the length of the weave would correspond to the width of the garment. The tabby (textile 1969.7) is interpreted as a waistband on a large skirt, where some of the twill weave (textile 1969.2) constituted the actual skirt (Nordquist / Ørsnes 1971). This was originally considered also to be of a wrap-around style, as a tablet-woven border is found stitched to fragments of a transverse edge of the twill weave. However, a tiny fragment of a stitch on the opposite side of the tablet weave suggests that it was in fact sewn together to form a tubular skirt. The exact size of this textile is impossible to estimate due to the fragmented state of the textiles, but considering the length of the largest fragment of tabby (115 cm) (textile 1969.7), and the fact that it also reached across the grave, the length of these weaves must have been considerable compared to the other textiles of this group.

2.2.1.3 Textile group 3: Plain twill in undyed wool

These are the most elusive of the weaves in Lønne Hede. They are also twill weaves, but in some instances a bit coarser than the twills of groups 1 and 2 (textiles 1969.6, 1.2, 2.2, 10.5). They are mostly preserved as small patches in the graves – probably because they are made of undyed wool. Thus, the size of the weaves is impossible to estimate and therefore not included in *table 5*. The weaves are typically found at the bottom and/or at the top of the (textile) stratigraphy and along the gravesides, suggesting that they were used as a blanket for lining the graves. They may therefore resemble the group of large textiles described by Mannering et al. (2012, 115) of approximately 260 × 140 cm.

2.2.2 Design

2.2.2.1 Stripes

Stripes appear to be the favourite design feature in Lønne Hede. Both the dress in grave 1 (textile 1.5.) and the scarves presented above are decorated with stripes added in during weaving. Only the tabby woven scarf in grave 1969 (textile 1969.4) displays a chequered

Textile	Weft faced half panama	2/2 twill
Textile 1969.1	X	X
Textile 1.6	–	X
Textile 2.2	X	–
Textile 7.1	?	–
Textile 8.1	?	–
Textile 12.1	X	X

Table 6. Lønne Hede. Textile design.

pattern. A stripy dress and a chequered scarf indicate a general like for the use of colour-decoration; however, the large number of stripy scarves (textiles 1969.1, 1.6, 2.2, 8.1, 12.1) stand out as special. Common for the scarves is twill weave with a dark reddish-brown warp and white added-in stripes in undyed fibres. However, there are also variations *(table 6)*. The stripes can be either 2/2 twill, which creates an effect where both the dark as well as the white yarn is visible, or weft-faced tabby with double warp where only the undyed weft thread is visible – or it can be a mix of both types in the same weave, either in a set pattern or randomly distributed.

2.2.2.2 Diamond twill

The scarf in grave 2 (textile 2.2) is outstanding: between the stripes an all undyed weft is woven as a 2/2 diamond twill, which changes into a herringbone twill in the middle of the weave. These two patterns are closely related technically. The setup of the loom is the same; only for weaving diamond twill, you reverse the order of changing shed occasionally when you weave, either randomly or after a set schedule to form the diamond shapes. In textile 2.2 the reversion happens randomly. After weaving just about half of the scarf, the weaver has ceased to reverse the order of changing shed, thus the pattern turns into a herring bone.

The weft-faced stripe and the white twill stripes on a red background have strong similarities with the textiles found in the Hammerum girl's grave (Mannering / Ræder Knudsen 2013). There the dress was of the same reddish-brown colour as in Lønne Hede and with woven-in red stripes in plain twill. A shawl-type weave, also in plain twill, had woven-in stripes in half panama, and for both the basic weaves and the stripes undyed wool was used.

The diamond twill becomes a very popular weaving pattern in the Late Iron Age, and is today known as the "Virring type" (Bender Jørgensen 1986). It has been debated whether the Virring type should be considered a professionally produced type of weave which was imported from the Northern provinces of the Roman Empire in the 2nd–4th centuries AD (Bender Jørgensen 1986, 140; ead. 1992, 133). An argument against this is that the individual details used to define the type were all known in southern Scandinavia prior to the introduction of the Virring type (Demant 2000). Although it is a rare example of diamond twill in the 1st century AD, textile 2.2 from Lønne Hede may be another example of this pattern being known prior the second century. The Virring type diamond twill is furthermore distinguished by being in Z- and S-spun wool and only one colour, which adds a different character to the fabric than is seen in the diamond twill in textile 2.2. In the latter textile, the decorative effect of the diamond pattern is solely

emphasized by the contrasting colour of the weft, thus displaying an experiment of design in the combination of weaving technique and the use of colours, rather than being an almost formalized patterning of the stripes.

2.2.2.3 Tabby weaves

Three different tabby weaves were identified at Lønne Hede (textiles 1969.4, 1969.7, 2.6). According to Bender Jørgensen's recordings of textiles from the Iron Age (Bender Jørgensen 1986, 30), tabby is a relatively rare phenomenon in this period. It was the most common type of weave in the early Bronze Age, but in the Iron Age twill is by far dominant among the wool weaves (Bender Jørgensen 1986, 27; Mannering et al. 2012, 103–104). This may be due to the fact that twill weave produces a denser yet more flexible fabric that has a better drape, which matches the garments of large square and tubular weaves preferred in the Pre-Roman Iron Age (Mannering et al. 2012, 105). The few fragments of plant fibres such as flax and nettle show that the inflexible tabby weave was preferred for those fibres. However, textile 1969.7 demonstrates a very elegant and clever use of this inflexibility, which is further enhanced by being woven with a denser warp. In contrast to the thicker twill weave of the skirt (textile 1969.2) which, considering the probable width of the garment, would have been very clumsy if gathered round the waist, the thinner fabric of the tabby weave (textile 1969.7) gave a more stable and thinner waistband which was less clumsy around the waist and would carry the heavier twill weave more beautifully around the hips of the wearer.

Textile 1969.4 is interpreted as a shawl (group 1) due to the area of the grave where it was found. It is also tabby woven, red and blue in a chequered pattern. Both tabby weave and cheques are unusual for Lønne Hede, as stripes seem to be the preferred design feature.

2.2.2.4 Foot wrappings

The function of the tabby weave (textile 2.4) in grave 2 is difficult to determine but the almost triangular form into which one of the pieces are folded *(fig. 87)* suggests that they were a form of foot-wrapping worn inside shoes. Shaped footwear of woven fabrics is known from the Alpine regions dated to the Early Iron Age (Bazzanella et al. 2005), but from northern Europe we only see examples of folded fabrics worn inside shoes. One example is from one of the shoes found with a bog body in Søgårds Mose in 1942 (Hald 1980, 34) dated to the latest part of the Pre-Roman Iron Age (Mannering et al. 2010, 265). Also, in many of the oak-coffin graves from the Early Bronze age scraps of cloth in different shapes were found, which had been wrapped around the feet and/or tucked inside the shoes (Broholm / Hald 1940). The tradition of wrapping fabric around the feet is traceable up until the 19th century in northern parts of Scandinavia and in parts of Eastern Europe (Hald 1953, 14; ders. 1972, 21). Furthermore, folded fabric was used by the Russian Army instead of socks as late as the 20th century (Rio 2011, 79).

2.2.3 Textile production and the choice of loom

The technical details of the selvedges and transverse edges provide information on how a textile is produced. Particularly the transverse edges tell us how the warp was constructed, which again indicate which type of loom was used. Generally, the textiles from the Iron Age can be divided into two groups: the loop group and the band group (Ciszuk forthcoming).

Fig. 21. Reconstruction of a two-beam loom with a tubular warp at Sagnlandet Lejre 2018. The locking cord is the read cord visible in the back layer (photo: I. Demant).

Transverse edges can be identified in textile 1.6 (grave 1) and in textile 2.3 (grave 2), where parts of both transverse edges are preserved. They all end in looped warp-end fringes, which ascribe them to the loop group *(figs 71; 85)*. Almost all the textiles dated to the Pre-Roman Iron Age and 1st century AD from the Danish area belong to this group (Ciszuk forthcoming).

The loops are typically seen as a result of the warp being constructed in a tubular form with a warp lock on a so-called two-beam loom *(fig. 21)*. The beams would be positioned over each other in the loom, at a distance equivalent to half the length of the finished fabric and forming an upright standing frame. The warp lock, either a thread or possibly a stick, would be placed at a point between the two beams. The warp would be laid around both beams as a large tube, but each warp thread would be looped around the warp lock and laid back around the same beam again. Weaving would then begin right over the warp lock, the twill pattern being made with an inserted shed rod and three heddle rods, and continued right up to the warp lock. Eventually, the heddle rods were removed, and the last weft inserted with a needle or the fingers to get as close to the warp lock as possible (Hald 1980, 167; Ciszuk forthcoming).

In some well-preserved weaves, the warp lock is still intact and the pieces have been used as a garment in this shape. However, in most of the weaves the warp lock has been removed to form a rectangular piece with looped transverse edges. The loops have either been twisted into fringes or braided to form a firm edge for stitching to another edge (Mannering et al. forthcoming). On the weaves from Lønne Hede, the warp lock was apparently removed

every time, as no warp locks were identified. On textile 1.6 and textile 2.3 the loops are approximately 4 cm long and twisted into fringes. On textile 1969.2 (grave 1969) the loops only seem to be preserved at one transverse side. They are braided to form a firmer edge. The opposite side may have been cut and the fraying ends hidden in the hem before the two edges were stitched together *(fig. 44a–b)*. A similar seam has been identified in the skirt from Huldremose I (Hald 1980, 48; Mannering et al. forthcoming).

It was not possible to identify the method of braiding in textile 1969.2, but typically the loops would have been laid down in a bundle of two parallel with the edge, passing by four or six neighbouring loop ends and being locked by the next two or four ends being pulled through the loop (Hald 1980, 172)

The "band group" is characterized by a woven starting border. This has several purposes, but most importantly it is used to secure the warp to the upper beam of a warp-weighted loom. This loom may also be referred to as a "one beam loom". While weaving, the finished weave can be stored around the upper beam. The extra length of warp can be coiled up right above the loom weights, which hang above the ground keeping the warp taut. The warp-weighted loom is known through most of Europe and the Middle East probably since the Bronze Age and perhaps earlier (Rahmstorf 2015, 6), but in Denmark it doesn't seem to come into use until the end of the Early Roman Iron Age, around AD 180 (Bender Jørgensen 1986, 136). No starting borders were identified in the textiles from Lønne Hede, so it must be assumed that only the two-beam loom was in use at the Lønne Hede settlement.

However, one may question whether a tubular warping system was in use each time. The warp lock-construction is useful for very large weaves, as the loom only needs to be of a size half the length of the finished fabric, as the other half will be stored at the back of the loom. In fact, many of the textiles in Lønne Hede are rather small, only 1–1.5 m long. Considering that half of the warp/finished weave would be stored at the back of the loom, the distance between the beams will have to be only 50–75 cm. That is very little space for working with an inserted shed rod and the three heddle rods necessary for twill weaving. If the weave is only 50 cm wide, like those in textile group 1, one may imagine a smaller loom with thinner heddle rods – everything simply being scaled down. But if the weave is 1 m wide, like those in group 2, this would not be practical. One possibility is that the warp was longer, but weaving was not continued all the way to the warp lock. Instead, it was finished when there was no more space between the heddle rods and the warp lock for opening the weaving shed and inserting the weft. This may explain why there are only braided warp ends preserved on one end of textile 1969.2 *(fig. 44a–b)*. In the opposite end the warp-ends would be too long and had to be cut and hidden in a hem.

Alternatively, one may imagine a simpler warp construction where the warp threads are only laid from beam to beam in a flat form instead of a tubular form. Support for this idea can be found in a set of leg wrappers found in Thorup mose (Thorup I) dated to the last centuries BC (Mannering et al. 2010). Each was woven as a finished piece measuring 59 × 37 cm and 59 × 40 cm respectively, with looped warp-ends at both transverse edges (Petersen 2008, 40). Weaving to such a small size with a tubular warp would be very inconvenient. Petersen suggests that is was set up as a double warp (Petersen 2008, 44), which seems more complicated. A simple weaving frame with the warp laid out from beam to beam appears more likely.

2.2.4 Woven borders

There are a few woven borders which were sewn onto the woven textiles.

Fig. 22. Reconstruction of the tablet weave textile 1969.3 (photo: I. Demant).

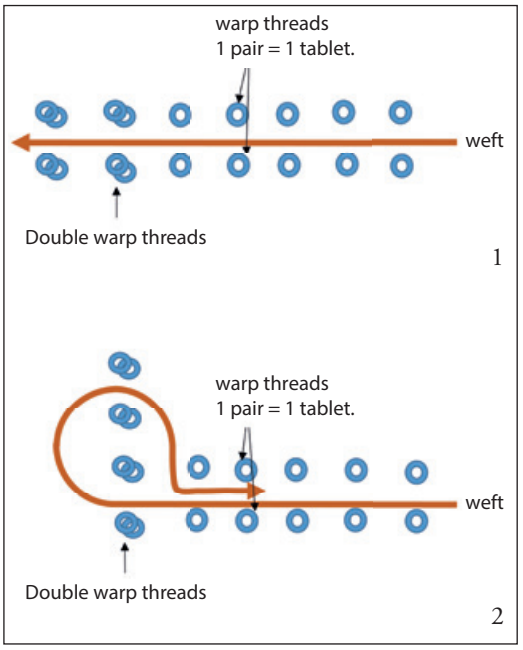


Fig. 23. The sequences of producing the selvedge in the tablet weave in textile 1.6 seen from the end. Each ring represents a warp thread in cross section. 1. The weft is inserted from the right side and all the way through the warp. 2. The weft is returned in the same shed, but the first two tablets with double warp is skipped, and as the weft is pulled tight, they will be on top of each other forming a tiny tubular selvedge (illustration: I. Demant).

2.2.4.1 Tablet weaves

Only two borders among the Lønne Hede finds appear to be woven with tablets, as they display cord-forming twisted warp threads typical for tablet weaving, though not of the typical tablet weave. Textile 1969.3 in grave 1969 was analysed by Hansen (1990, 46) and Ræder Knudsen (forthcoming) and (as described below) it is woven in a combination of a complicated double-faced weaving and warp-twine cords, making a rather elaborate pattern. Ræder Knudsen states "The pattern-woven border from Lønne Hede 1969 gives a contradictory impression, because making reconstructions show that the weaving method is very complicated, but the result not impressive. The weaver put a considerable effort into creating this band but was probably not familiar with the many different weaving methods that the tablet weaving technique provides" (Ræder Knudsen forthcoming). It is significant that the weaver seems to be using only two of the holes in the tablets in most of the border. Only in four of the 61 tablets does the weaver use all four holes, and that is to make the two lines of arrow patterns *(figs 22; 46)*.

The tablet weave attached to textile 1.6 from grave 1 also displays the cord forming twisted warp threads which are typical for tablet weaving *(fig. 53)*. But this one is unusual, as five of the cords are only made with two strands, which means that again only two of the usually four holes in a tablet were used. The two cords on the edge seems to be made of

four warp threads, but probably running double two and two, and it is woven so that a tiny tubular woven selvedge is formed by those two cords. Seen sideways, the two cords are on top of each other *(fig. 23)*. A similar selvedge is identified in the tablet-woven borders sewn onto the sleeves of the Thorsberg tunic, dated to AD 75–310/20 (Blankenfeld 2015, 278–291; Möller-Wiering 2011, 40; 137; Ræder Knudsen 2011, 196).

The two tablet weaves are among the earliest finds from the Danish area, and textile 1969.3 from grave 1969 is also the earliest example woven with a pattern. Only the tablet-woven borders that were part of the Skærsø-textile have a similar date. The Skærsø textile is a 206 × 150 cm weave in diamond twill with tablet weavings on all four sides. Unlike the tablet weaves from Lønne Hede, however, these were woven as an integrated part of the ground weave. All four holes of the tablets were used and display the cord forming twisted warp threads, which is the most common form of tablet weaving in the Roman Iron Age and Migration Period. It is ^{14}C-dated between 350 BC and AD 90 (Mannering et al. 2010, 265). Based on this date, Ræder Knudsen concludes that tablet weaving arrived in Denmark in a fully developed form. However, the main weave (diamond twill) is very unusual for the Pre-Roman Iron Age, so it is most likely that the correct date is in the latest part of the period (Ræder Knudsen forthcoming), which is contemporary with the inhumation graves from Lønne Hede.

The two pieces from Lønne Hede display a certain level of ingenuity, but considering that no ordinary tablet weave has been found in Lønne, they may not demonstrate actual knowledge, but may more be the result of "having heard of" or "having seen" someone using the tablets for weaving, but without being really familiar with the technique. It is also remarkable that these borders are sewn onto a fabric-edge for decoration. Woven borders of different techniques sewn onto weaves for decoration are known from the rich finds from the Hallstatt Early Iron Age (Grömer / Rösel-Mautendorfer 2013, 429; 455; 495), but in Denmark it does not seem to come into use until the 1st century AD.

2.2.4.2 Warp-faced tabby borders with tubular selvedge

This type of border is recorded five times among the Lønne Hede textiles, although in a varying state of preservation. Most are rather narrow, being 1.2–1.5 cm wide (textiles 1969.5, 1.7 [on two selvedges], 10.7 and 12.4) *(fig. 24)*, but one is approximately 3.5 cm wide (textile 10.3). The warp is divided in two parts lengthwise but woven with the same weft: one part has 9–13 threads. Here the warp is often in two colours, which create transverse stripes in the weave. The other part has 12–17 warp threads in one colour, which forms a tube when woven. The running of the weft varies. It is usually running double through the flat part and single through the tubular part *(fig. 25)*. However, in textile 10.3 and textile 10.6, where only the weft is preserved, it appears to be running twice through the tubular part and single through the flat part.

The same type of trim is also recorded in the later Hammerum find. Like the dress from Lønne Hede grave 1, the Hammerum dress was adorned along both selvedges with a narrow tabby woven border with tubular selvedge (Mannering / Ræder Knudsen 2013, 159). It must therefore be assumed that this type of trim was well known and commonly used for decoration and reinforcement of selvedges in the early centuries AD, at least in Central Jutland.

These borders have previously been interpreted as tablet weaves (Munksgaard / Østergård 1988; Ratje 1972; Ræder Knudsen forthcoming). However, they do not display the twisted warp threads typical for tablet weaving, but they can be woven using a combination of two- and four-hole tablet weave (like in textile 1969.3) by turning the

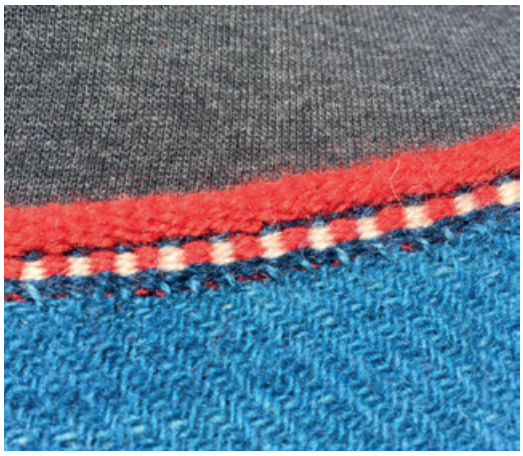


Fig. 24. Reconstruction of a tabby woven border (textile 1969.5) (photo: I. Demant).

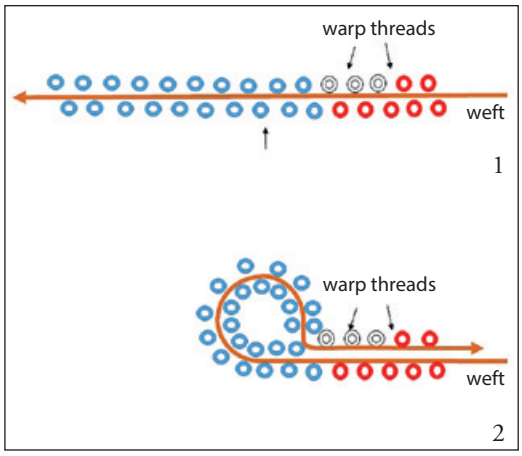
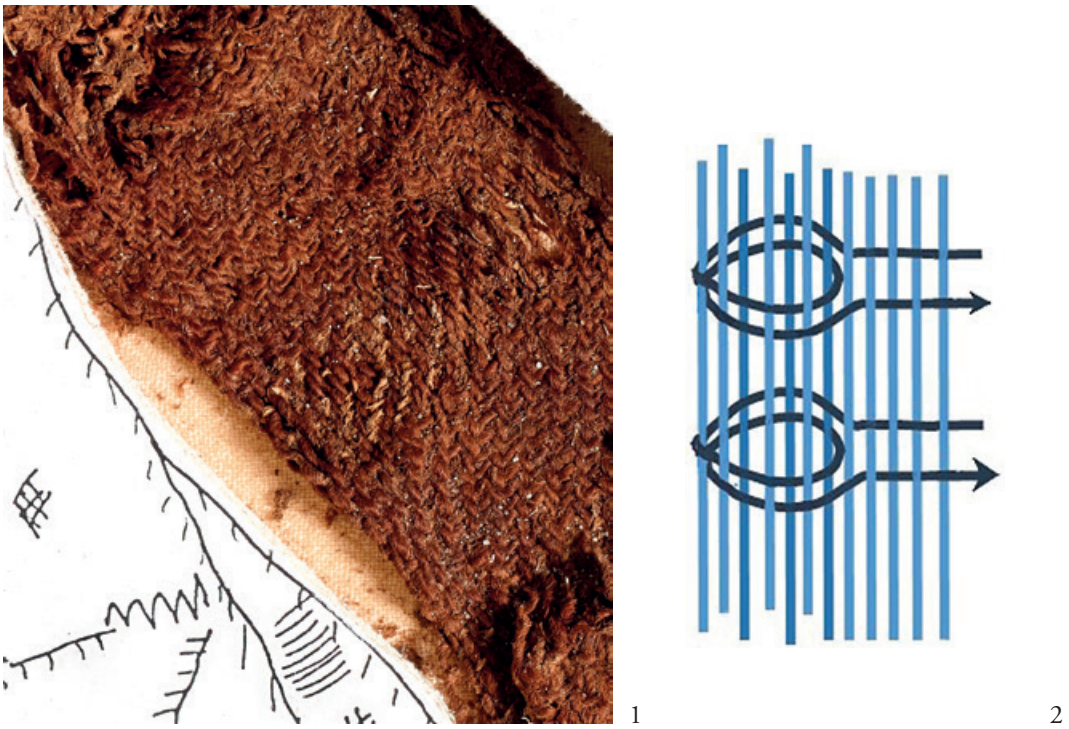


Fig. 25. The sequences of producing the tabby woven border with a tubular selvedge seen from the end. Each ring represents a warp thread in cross section. 1. The weft is inserted from the right side and all the way through the warp. 2. The weft is returned in the same shed, but the blue warp threads is skipped, and as the weft is pulled tight, they will be folded in forming the tubular selvedge (illustration: I. Demant).

tablets forwards and backwards. This technical similarity to textile 1969.3 is also the argument for tablet weaving of these borders. It is the present author's opinion that it is more likely that they were woven with a "stick and leash" system, which has its roots in the age-old weaving traditions of the Pre-Roman Iron Age. The reason for this shall be presented below.

The essential part is the tubular selvedge as this type of selvedge is a typical phenomenon in the weaving technology of the Pre-Roman and Roman Iron Age. They are formed during the weaving process by skipping the first outermost warp threads when turning the weft. As the weft is pulled in tightly, the warp threads of the edge will be folded in over the weave to form a double layer – resembling a very narrow hem. The weft can run once or twice through the tubular part, before entering back into the main weave *(fig. 26,1.2)*. Tubular selvedges are recorded on most of the weaves with preserved selvedge from Lønne Hede (textiles 1969.2, 1969.4, 1969.7, 1.5, 1.6, 10.2, 12.3). Most often it is only 0.5 cm wide, but it can be 1–2 cm wide. Among the textiles from bogs described by Hald are several examples of similar tubular selvedges dating back to the Pre-Roman Iron Age (Hald 1980, 154) when tablet weaving seemed to be unknown in the Danish area (Ræder Knudsen forthcoming). Therefore, these tubular selvedges were probably made using heddles, and the same principles can easily be transferred to simple warp-faced tabby band weaving with a "stick and leash" *(fig. 27)*.

Whereas tablet weaving still must be considered a new phenomenon at the time of the Lønne Hede settlement, bands woven in warp-faced tabby are known in Denmark from the Early Bronze Age. Warp-faced tabby woven bands were found in four oak coffin graves, where they functioned as girdles (Broholm / Hald 1940, 142). Among the large collection of textiles from the Pre-Roman Iron Age, warp-faced tabby bands or borders are more scarce: one was found with the Huldremose woman (Hald 1980, 52) dated to the Late Pre-Roman Iron Age and another was identified attached to the sprang cap presum-



1 2

Fig. 26. Textiles with tubular selvedge: 1. Textile 1.6 in the passe partout; 2. Principle for tubular selvedge with the weft running twice through the tubular part (illustration: I. Demant).

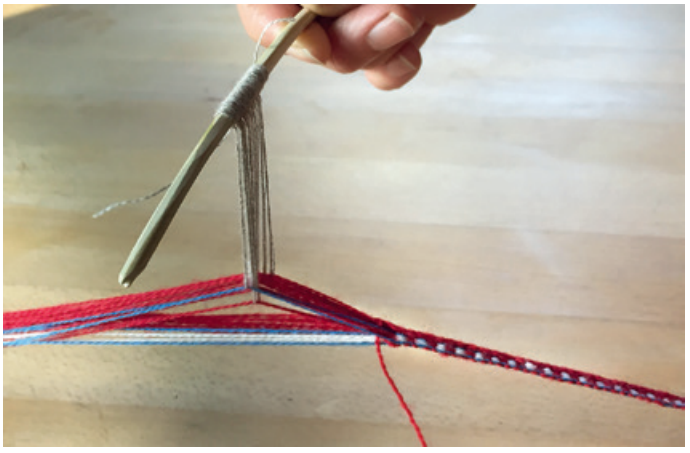


Fig. 27. Narrow tabby woven borders set up with "stich and leash" and the first shed opened (photo: I. Demant).

ably found with the Haraldskær woman (Hald 1980, 58), also dated to the last centuries BC (Mannering et al. 2010). Furthermore, a fragment of warp-faced tabby is recorded by Bender Jørgensen (1986, 194) from a cremation grave. These finds do not demonstrate a pronounced tradition for weaving bands or borders, neither for using them as decoration as in Lønne Hede. As already mentioned, attaching woven borders for adornment seems to be a new phenomenon in the Early Roman Iron Age in Denmark, but it does show that

the technique of weaving bands as warp-faced tabby was known earlier than the introduction of tablets for weaving. Tabby weaving of borders only had to be combined with the tubular selvedge known from ordinary weaving to make the borders used in Lønne Hede and later in Hammerum. Furthermore, it must be mentioned that warp-faced tabby band weaving continues in use, as the starting border of the Hammerum girl's dress was woven as warp-faced tabby (Mannering / Ræder Knudsen 2013, 159). No example of tablet weaving was identified in that grave.

Finally, it is remarkable that the narrow tablet-woven border from textile 1.5 in grave 1 was attached to the twill weave with a seam looking very much like the flat part of the tabby woven bands. It is made with yarn in alternate colours as if trying to replicate the appearance of the tabby woven borders but using tablets. That would not be necessary if the tabby borders were already produced with tablets.

It will never be known if these borders were woven with "stick and leash" or tablets, as both methods are possible. For reconstruction, it will be a matter of taste of the individual weaver whether one way or the other is the easiest.

2.2.5 Female girdles in the Iron Age?

The woven band, textile 10.3, from grave 10 appears to be a girdle. It is 3.5 cm wide and runs twice around the waist of the body though without a knot or a buckle to hold it in place. The estimated length is 132 cm. Textile 10.3 displays a tubular selvedge with the weft running twice through the tubular part like in textile 10.7 *(fig. 116)*. This may be the only example of a preserved woven girdle dated to the Iron Age.

Tabby woven bands of wool used as girdles are known from the Early Bronze Age, where they were part of the costumes preserved in the oak coffin burials. They are all woven as plain tabby, and some are finished with elaborate fringes at the ends (Broholm / Hald 1940). However, the Iron Age woven bands produced either in tabby or as tablet weaves are almost exclusively found attached to fabrics as decoration or reinforcement (Ræder Knudsen forthcoming). Only very few unattached pieces have been found (Hald 1980; Schlabow 1976), and, apart from the piece in grave 10, none is found in a context which could indicate their use as a girdle.

The narrow tabby woven band found with the Huldremose woman might be interpreted as a girdle. However, being only 74 cm long and 1.5 cm wide, it makes an interpretation as a hairband more likely (Mannering 2017, 121). The fact that a tabby woven band was part of the hairnet from Haraldskær (Hald 1980, 59) also makes it possible that the Huldremose band originally had been part of (or was intended as) a border for a cap or hairnet. Among the many tablet-woven pieces recorded by Ræder Knudsen (forthcoming), all but one tablet-woven border – a 0.5 cm narrow piece from Corzelitse – are recorded in relation to woven textiles. They are either stitched on for decoration or woven as an integrated part of a textile, such as a starting or finishing border, or side edgings (Ræder Knudsen forthcoming). Thus, it seems that tablet weave is a technique used mainly for decoration or for such practical purposes as starting borders for the warp-weighted loom (Mannering, personal discussion).

In a group of textiles collected during turf digging in Vaalermoor, north of the River Elbe, in the late 19th century and handed into the Textilmuseum Neumünster in 1943, were pieces of five different bands interpreted as girdles by Schlabow (1976, 24). All are undated and between 30 and 47 cm long. Three are tablet weaves, and one is a warp-faced tabby weave resembling girdles from the Bronze Age. The last is a 5 cm wide diamond twill weave with tablet-woven borders along the selvedges (Schlabow 1976, 91–92).

Although these pieces could have been used as girdles, other explanations may also be possible. As has been demonstrated for all tablet weaves found in the Danish area, the three tablet weaves may also once have been stitched onto a garment – or intended to be. The diamond twill may be part of a leg wrap, like a pair found with the bog body from Damendorf (Schlabow 1976, 88). Only the tabby woven piece, which shows resemblance to the woven girdles from the Bronze Age, may in fact be a girdle from either the Bronze Age, or perhaps the Iron Age. Also, a tablet-woven piece from Dätken Moor described by Schlabow (1976, 92) as a girdle was probably intended as edge-decoration for a cloak or other garment. Thus, among these six pieces described by Schlabow, only one may have been used as a girdle.

Impressions in the dress from Hammerum suggested that the deceased had been wearing a girdle (rostholm 2011, 117). But as it was totally decomposed, it could not have been made of wool. The Tollund man wore a belt made of thin leather, 77.5 cm long and only 1.9–2.4 cm wide, with the one end a bit wider at 3.5 cm. Here, a small eyelet was cut, and the other end was put through and tied with a half bow (Fisher 2007, 39). Around his neck was a longer "rope" which was also made of hide but braided with two 1.2 cm wide strips, 155 cm long (Fisher 2007, 40). Even though it was used as a rope to strangle the Tollund man, it may originally have been used as a belt. A similar belt may have made the impression in the Hammerum girl's dress.

Belt hooks from the Pre-Roman Iron Age and belt buckles from later periods are also evidence of the existence of belts in these periods. They are found in both men's and women's graves (Munksgaard / Østergård 1988, 45; Ethelberg 1990, 43). However, it must be assumed that these were also used with a strap of leather. A woven band of wool would be too fragile to function for long with either a hook or a buckle made of iron. Furthermore, when textiles are recorded in relation to buckles, they are either found over or under the buckle, and therefore more likely part of the textiles used in the burial.

It must also be mentioned that textile 10.3 has a similarity with the waistband of the Huldremose woman's skirt (Hald 1980, 47; Mannering et al. 2017, 119), ^{14}C-dated between 350 BC and AD 42 (Mannering et al. 2010, 264). This waistband was 3.5 cm wide and woven in warp-faced tabby with a tubular selvedge. This was, however, woven as part of the main fabric, which was in twill weave, serving as a selvedge (Hald 1980, 48). Textile 10.3 was not woven as part of a larger textile, and considering the position in the grave with the tubular selvedge lying to the north end (where the feet were placed) it is unlikely that it functioned as part of a skirt. However, instead of being a very unusual girdle in the Iron Age with signs of heavy wear (i. e. the frayed ends), it may originally have served as a waistband of a skirt. This would have been stitched onto another weaving in the same way as the skirt in grave 1969, but later torn off when the skirt was worn out and reused as a "girdle" in grave 10.

Secondary use of textiles as girdles may also be seen in the strip of cloth found with the Elling woman. It is interpreted as the remains of a girdle, but there is no information of precisely where it was found. The strip is only 67 cm long and 4 cm wide, and it was impossible to analyse the weave as it seems to have been repaired or reinforced with stiches (Hald 1980, 37; Mannering / Gleba forthcoming)

Grave no	Textile no	^{14}C age	δ^{13}C (dual-inlet)	68.2 % probability	95.4 % probability
Grave 1969	Textile 1969.2 (AAR 15476)	2000 ± 35	-23.19 ± 0.05	42 BC–49 AD	92 BC–77 AD
Grave 1	Textile 1.6 (AAR 15477)	2014 ± 25 (ext.)	-24.25 ± 0.05	44 BC–18 AD	89 BC–56 AD
Grave 2	Textile 2.2	1887 ± 23 δ^{13}C	-24.15 ± 0.05	80–130 AD	65–214 AD
Grave 7	Textile 7.1 (AAR: 15479)	1852 ± 23 (ext)	-24.59 ± 0.05	128–214 AD	85–233 AD
Grave 9	Textile (AAR 15480)	1844 ±23 (ext)	-24.67 ± 0.05	131–214 AD	88–238 AD
Grave 10	Textile 10.2 (AAR 15481)	1911 ±23 (ext)	-24.39 ± 0.05	70–125 AD	27–134 AD
Grave 12	Textile 12.1 (AAR 15482)	1909 ±24	-24.35 ± 0.05	71–125 AD	25–136 AD

Table 7. ^{14}C-datings of the textiles of the inhumation graves (Dating by Aarhus AMS Center, ReportID: 1858. Calibrated ages in calendar years have been obtained from the Calibration curves by the means of the Oxcal v4.1 calibration programme using the terrestrial calibration curve, IntCal13).

3. Graves with textiles: excavation, grave goods, and technical analysis

In the following, a presentation of each grave containing textiles is provided. As graves 4 and 5 turned out to be a looter's trench and a pottery deposit, respectively, these will not be presented.

As the evaluation of the quality and the fineness of the textiles is in focus, a brief introduction of the grave setting is followed by a short summery of the main results of the technical analysis, which then will be discussed in detail. Firstly, the textile types and their function are discussed, secondly the different designs are introduced, and lastly follows a general discussion on textile production. This overview of the different textiles and costumes is followed by an evaluation of each grave containing textiles. Each evaluation provides a resumé prior to the discussion of the quality and fineness of the fibres.

Finally, a general conclusion of textile production and costume in Lønne Hede and the Early Iron Age will be presented.

The use of dye will only be briefly mentioned here, as the thorough analysis of the dyestuff is presented in the following section. In *table 7*, ^{14}C-dating of the textiles can be compared.

3.1 Grave 1969 (The Lønne Maiden)

The northwest-southeast oriented grave is situated at the southern end of the line of inhumation burials *(fig. 6)*. The south-east corner of the grave was disturbed by farmer Jens Jensen's excavation. The documentation from the 1969 excavation does not allow for an identification of the dimensions of the grave-pit on the surface. Likewise, the depth of the grave is unclear since the bottom was apparently not levelled, but the grave had been dug down to a depth of roughly 60 cm beneath the surface. The grave fill contained many stones, especially along the edges of the grave *(fig. 28)*. During the field excavation, a plank-built coffin, pottery, and several other artefacts were registered *(fig. 29)*. The coffin

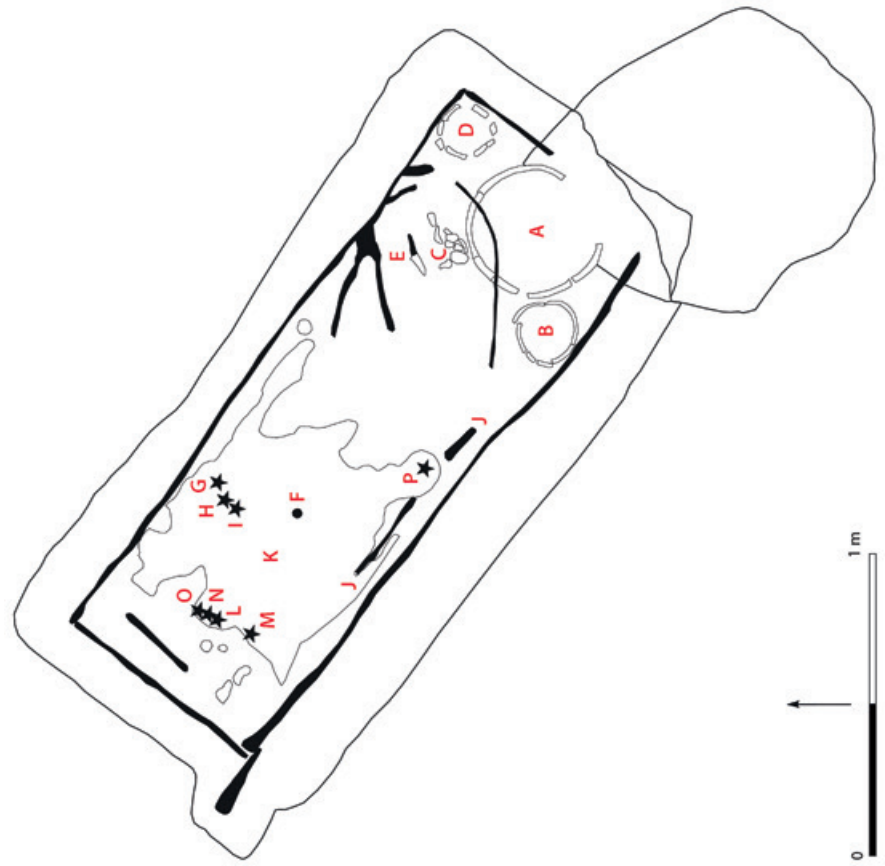


Fig. 29. Location of the artefacts in Grave 1969. A Dish; B vessel with handle; C footed beaker; D open / shallow bowl; E knife; F amber object; G lump of clay with copper-alloy band; H sea urchin; I flint nodule; J hazel cane; K textile; L silver clasp; M silver fibula; N copper-alloy fibula; O copper-alloy fibula; P copper-alloy pin inserted in the textile. Scale 1 : 25. (illustration: T. Lorange).

Fig. 28. Grave 1969 during excavation (photo: M. Bencard).

was constructed of oak planks and measured 80 × 220 cm, resting on a layer of closely packed stone. Several potsherds and slags from the grave fill must be considered random intermingling from the nearby settlement.

The grave fill included a base sherd of rough reddish clay from a thick-walled pot, two roughcast sherds, three uncharacteristic sherds of greyish-brown clay and a forging slag measuring 8 × 4 cm. However, remains of two ceramic vessels from the Early Roman Iron Age were placed outside the grave. Perhaps these were deposited in connection with the burial rituals. Moreover, single sherds and iron slag were found in the layer of topsoil around the grave – these were probably randomly mixed waste from the settlement. When landowner J. Jensen filled in the area after the excavation, he found the remains of an additional two vessels north of the grave[5].

The only human remains in the grave are the hair and a humerus (upper arm bone). The latter was found in the south-south-eastern side of the grave near the corner, and the hair was found centrally in the south-eastern part. However, it must be noted that this is a coffin grave, thus the body has decomposed in a hollow space, which soon must have filled up with water. This has undoubtedly resulted in a certain dispersion of the different parts as decay progressed. The hairstyle is described separately later in this article.

However, the shape of the textiles and the direction of the coiffure in grave 1969 give the impression that the deceased had been arranged in a hocker position, resting on the right side facing southwest.

The grave also contained a dark layer interpreted as animal hide. It was detected between textiles 1969.6 and 1969.2. In addition, patches of fur hair were found here.

3.1.1 Pottery

In the south-eastern end of the grave, four clay vessels had been deposited at the bottom of the coffin. The largest was a greyish-brown, roughly ornamented dish, 17 cm high, with a pair of opposing X-shaped handles and a small foot *(fig. 30)*. Next to the dish towards the west was a 13.5 cm tall fine, black-burnished, ornamented vessel with an X-shaped handle *(fig. 31)*. To the north, a black-burnished footed beaker was recovered. The vessel is rather crooked and 9.5–10.3 cm high *(fig. 32)*. The fourth vessel was placed in the south-eastern corner: it was a 5.5–6 cm high, black-burnished open bowl with a hint of a crack in the body and an outward sloping horizontal facetted rim. The surface was worn, although a hint of ornamentation in the form of triangles filled with lines is still visible *(fig. 33)*.

3.1.2 Small finds

Among the textiles near the torso to the northwest, several small objects and pieces of jewellery were found. A knife was situated close to the potsherds *(fig. 29E)*, but which is no longer preserved. In the stomach region, a large amber object came to light (*fig. 29F*, National Museum Inv.no. C33167). It resembles a large bead, biconical with rounded sides, its colour shifting from milky white to amber yellow. With a height of 2.1 cm, a diameter of 2.8 cm, and the perforation measuring 1.1 cm in diameter, it might be interpreted as a spindle whorl. A little further north, three tiny objects lying close together were recovered: A 2.4 cm high sea urchin with red patina and a diameter of 2.0 cm *(fig. 34)*, a

[5] National Museum, pottery Inv.nos C33156-59, C33270-74.

Fig. 30. The ornamented disc from grave 1969, cf. *fig. 29A* (National Museum Inv.no. C33161) Scale 1 : 6 (photo: L. Chr. Bentsen).

Fig. 31. Vessel with X-shaped handle from grave 1969, cf. *fig. 29B* (National Museum Inv.no C33162) Scale 1 : 4 (photo: L. Chr. Bentsen).

Fig. 32. Footed beaker from grave 1969, cf. *fig. 29C* (National Museum Inv.no. C33164) Scale 1 : 3 (photo: L. Chr. Bentsen).

Fig. 33. Open bowl from grave 1969, cf. *fig. 29D* (National Museum Inv.no. C33165) Scale 1 : 3 (photo: L. Chr. Bentsen).

Fig. 34. Sea urchin from grave 1969, cf. *fig. 29H* (National Museum Inv.no. C33229) Scale 1 : 1 (photo: L. Chr. Bentsen).

Fig. 35. Rattle-stone i. e. flint nodule with loose fossilized sponge material rattling inside, cf. *fig. 29I*. Originally with a cord was wrapped around the stone (National Museum Inv.no. C33230–C33231) Scale 1 : 1 (photo: L. Chr. Bentsen).

so-called rattle stone (a flint nodule with loose fossilized spongy material rattling inside) with a cord wrapped around, 2.5–2.8 cm in diameter *(fig. 35)*, as well as a chestnut-sized (1.9 cm in diameter) lump of what turned out to be a clay – probably in the form of

Fig. 36. Chestnut-sized lump of clay, possibly kaolinite, originally with a copper-alloy band, cf. *fig. 29G* (National Museum Inv.no. C33226) Scale 1 : 1 (photo: L. Chr. Bentsen).

Fig. 37. Silver clasp from Grave 1969, cf. *fig. 29L* (National Museum Inv.no. C33173) Scale 1 : 1 (photo: S. Greve).

Fig. 38. Silver fibula from Grave 1969, cf. *fig. 29M* (National Museum Inv.no. C33217) Scale c. 1 : 1 (photo: S. Greve).

kaolinite – with the remains of a copper-alloy band *(fig. 36)*[6]. If the material is indeed kaolinite, it would have appeared almost white and the copper-alloy band indicate that this is the remains of a pendant or amulet. This type is especially common in the Wielbark Culture, but is also known from the Danish isles, Northern Germany and sporadically in continental Europe north of Limes. They are almost exclusively found in graves of adult women (Stanek 1999, 361 *fig. 2*). Within present-day Denmark, kaolinite is only found on Bornholm. Another remarkable object was an 80 cm long debarked hazel cane that lay along the southern length of the coffin *(fig. 29J)* (Nordquist / Ørsnes 1971, 11). The hazel cane is not preserved.

3.1.3 Metal objects

The jewellery lay closer to the head. A silver filigree bead was found in the middle of the preserved hair (see chapter on hairstyles). Also found were a fine S-shaped silver clasp 2.3 cm in length *(fig. 37)*, and a very solid silver fibula 5.1 cm in length and richly deco-

[6] Analysed by Fourier transform infrared spectroscopy by Mads Chr. Christensen and Michelle Taube at Bevaring og Naturvidenskab, Miljø og Materialeforskning, National Museum of Copenhagen.

Fig. 39. Copper-alloy fibulae from Grave 1969, cf. *fig. 29N* (National Museum Inv.no. C 33176) (photo: L. Chr. Bentsen).

Fig. 40. Copper-alloy pin inserted in textile 1969.2, cf. *fig. 29P* (National Museum Inv.no C33214) (photo: R. Fortuna).

rated with dots and filigree *(fig. 38)*. The fibula belongs to Almgren group II dating to the early part of the Early Roman Iron Age phase B1 (Almgren 1923; Leube 1998, 55–66).

Two copper-alloy fibulae, both of Almgren group II, were quite worn. One *(fig. 39)* has a double-coiled spring and five threads on either side of the bow. The cover of the spiral is ornamented with rows of dots meeting in front at the centre of the bow. The bow is 1 cm wide and 1.4 cm in diameter. Tiny fragments of the pin are preserved. The second copper-alloy fibula *(fig. 29O)* has a similar double-coiled spring and five threads on either side of the bow. The bow is ribbon-shaped, and the plate is highly fragmented. Along the bow is a row of tiny dots. Most of the foot and the catch plate are missing. The bow is 1.4 cm wide and the spiral measures 3 cm in diameter in front. A simple copper-alloy pin was placed on the left side of the middle of the grave, inserted in textile *(fig. 40)*.

Several artefacts, primarily of iron, were recorded in the lists of findings but are not preserved. Objects mentioned in the description, which could not be found in 2013, include two iron fragments, a knife with a wooden handle and another iron object, perhaps a fibula[7].

3.1.4 Textiles in grave 1969 – an overview

When the excavators realized that the grave held well-preserved textiles covering roughly half of the grave, the north-western part (head end) was plastered and transported to the National Museum of Denmark, where the delicate work of excavating the well-preserved textiles continued. Here, the soil block was excavated by conservator D. Ørsnes and assistant J. Nordquist. The description of the grave from 1969 is based partly on a popular article in the journal Skalk in 1971"Pige i blåt" / "Girl in blue" (Nordquist / Ørsnes 1971), and on the excavation report from the National Museum completed by Susanne Klingenberg, approximately 26 years after the excavation (Klingenberg et al. 1995). Here, the final numbering of the artefacts and textiles was undertaken, and the objects were preserved and stored.

[7] Iron fragment (AS Inv.no. C33168); iron fragment (AT Inv.no. C33169); knife with a wooden handle (BA Inv.no. C33170), iron object, perhaps a fibula (BV Inv.no. C33216).

Fig. 41. One of the large fragments of textile 1969.1. Scale 1 : 2 (photo: R. Fortuna).

The textiles covered an area of 90 × 100 cm. They were preserved in a thicker layer than in the graves excavated in 1995, and in general they were in a better state of preservation. However, as was the case in the other graves the preservation varied. In some areas of the grave it was possible to separate different layers of textiles when lifted out of the grave, whereas in others they seem to have disintegrated completely.

Most of the small fragments were registered in relation to a 10 × 10 cm grid; however larger pieces were given individual reference numbers. The final excavation was performed by lifting smaller blocs out of the grave in order to secure the stratigraphy in the textiles. This turned out to be problematic, as it was difficult to distinguish between actual layers and folds (which could be either deliberate or have occurred accidentally when deposited or during the following decay).

The distributions of textiles and artefacts were registered on 1 : 1 horizontal plans based on photostats in three different levels as the excavation progressed. Furthermore, Nordquist and Ørsnes documented their work and observations in a diary. Unfortunately, parts of the documentary material have been lost. Only the diary, the three 1 : 1-drawings and some black and white photos are available to us today. Thus, an attempt to recreate the distribution and stratigraphy of the textile fragments was only partly successful.

Soon after the initial excavation and analysis was performed, a proposal for a possible reconstruction was presented in popular form (Nordquist / Ørsnes 1971; Munksgaard 1971) based on the seven types of textiles registered in the grave. Furthermore, a 1 : 1 "study model" was made by weaver Nina Ratje and her colleagues at Lejre Experimental Centre

Size (cm)	Binding system	Selvedge	Warp end border
–	2/2 Twill & weft-faced tabby	Possibly flat	Warp end fringe and weft-faced tabby

Table 8. Textile 1969.1, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Single	z	Hard	10	0.5–0.8	Reddish brown	Woad
Weft	Single	z	Hard	8	0.6–0.9	Reddish brown	Woad
Weft	Single	z	Hard	8	0.6–0.9	Dark reddish brown	Woad
Weft	Single	z	–	8 (twill)	0.6–0.8	White/ undyed	No dye detected
Weft	Single	z	–	(tabby)?	–	White/ undyed	–

Table 9. Textile 1969.1, yarn.

based on the textile evidence and discussions with the excavators. This "study model" is still in possession of Lejre Experimental Centre (now Sagnlandet Lejre). Most importantly, Ratje wrote a short report on her work (Ratje 1972). Both the proposal presented and the weaver's report hold observations regarding the shape of the costume, which are not mentioned in the diary or marked on the plan. Thus, these may be considered important supplements to the documentation of the initial examination of the grave.

In 1984, the textiles were analysed and described by conservator Else Østergård (Munksgaard / Østergård 1988; Østergård 1984). In the course of the work for the publication, the textiles were reanalysed by Irene Skals from the National Museum. As a result seven different weaves, including borders, could be identified in the grave. The reconstruction of the distribution and stratigraphy in the grave was performed by Ida Demant.

3.1.5 Textile 1969.1, textile type 1

This textile is a 2/2 twill in a dark reddish-brown colour, with weft stripes in white and darker red wool *(fig. 41; tables 8–9)*. It is preserved as six pieces of 26 × 17 cm to 7 × 5 cm, in all approximately 1400 cm^2. According to the horizontal plan, the fabric covered an area of some 22 × 40 cm, which is less than what is preserved. However, lengthways folds are recorded, and it may have been in two layers.

The white stripes appear every 1–3 cm and are from 3 mm to 1 cm wide, alternating between 2/2 twill and weft-faced tabby / half panama. Seven red stripes in the preserved parts are further striped by changes between darker brown and lighter reddish-brown every two wefts.

Flat selvedges are preserved on a small fragment. In association with the two copper-alloy fibulae found above and below the hair respectively were fragments of 2/2 twill and 2 cm weft-faced tabby with double warp and one preserved warp end fringe

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	Mode	Range	No. of fibres
Type 1 warp	99,6	0,4	0	14	7–23, 25, 27–28	500
Type 1 ground weft	99,6	0,4	0	14	7–24, 29, 39	589
Type 1 pattern weft	98,5	1,5	0	14	8–27, 29–30, 35	407

Table 10. Textile 1969.1, fibre analyses.

(Inv.no. C33177). These were previously described as belonging to textile 1969.2 (Østergård 1984), but the location suggests that they are part of this weave.

This textile is only recorded in the top of the stratigraphy overlaying textiles 1969.4, 1969.2 and 1969.7, but as more textile is preserved than the area it covered, it may have been in two layers wrapped around the hair. The fragments of the textile are relatively well preserved, though the white weft yarn in the stripes is partly decomposed. The fibres are still flexible and can be moved without breaking.

As this weave was found around the hair, the excavators suggested that it had served as a headscarf (Nordquist / Ørsnes 1971).

Technical details: yarns and fibres

Samples from all three yarns in this textile were picked for fibre analyses and the results show that they all have very high concentrations of fine fibres and in only one of the samples are a few medium sized fibres recorded *(table 10)*. The histograms of the warp and the ground weft are similar, with the highest concentration of similar measurements reaching just above 20 %. These two yarns could be made from similar raw material (see also the blue yarn in textile 1969.4 and the weft in textile 1969.5).

The histogram for the pattern weft differs slightly *(fig. 42)*. Its highest peaks represent 25 % and 30 % of the measurements and its curve is positioned slightly to the right of those of the warp and ground weft, although the modes are the same. This yarn could either be from different raw material or perhaps processed differently (see also the weft in textile 1969.2, the red warp in textile 1969.3, the red yarn in textile 1969.4, the warp and weft in textile 2.3, and the weft in textile 2.6).

No outliers are recorded in any of the yarns, and coarser fibres were either removed before spinning or not present.

3.1.6 Textile 1969.2, textile type 2

This is a 2/2 twill in a colour which varies between dark green and orange. At the time of excavation, blue colour was visible, but it has since turned dark green. In most of the textile, the colour is now orange. It is the most abundant weave in the grave with 76 recordings. Most are very small fragments, but they vary in size from a few cm^2 to 10 × 18 cm. It was found in most of the area where textiles were preserved, and in several layers, making estimation of the exact size difficult *(fig. 43; tables 11–13)*. The textile has been ^{14}C-dated to 42 BC–AD 49 (see *table 7*).

There are two different tubular selvedges preserved from this textile and three different finishing/starting borders, indicating that this type of weave represents at least two different weaves.

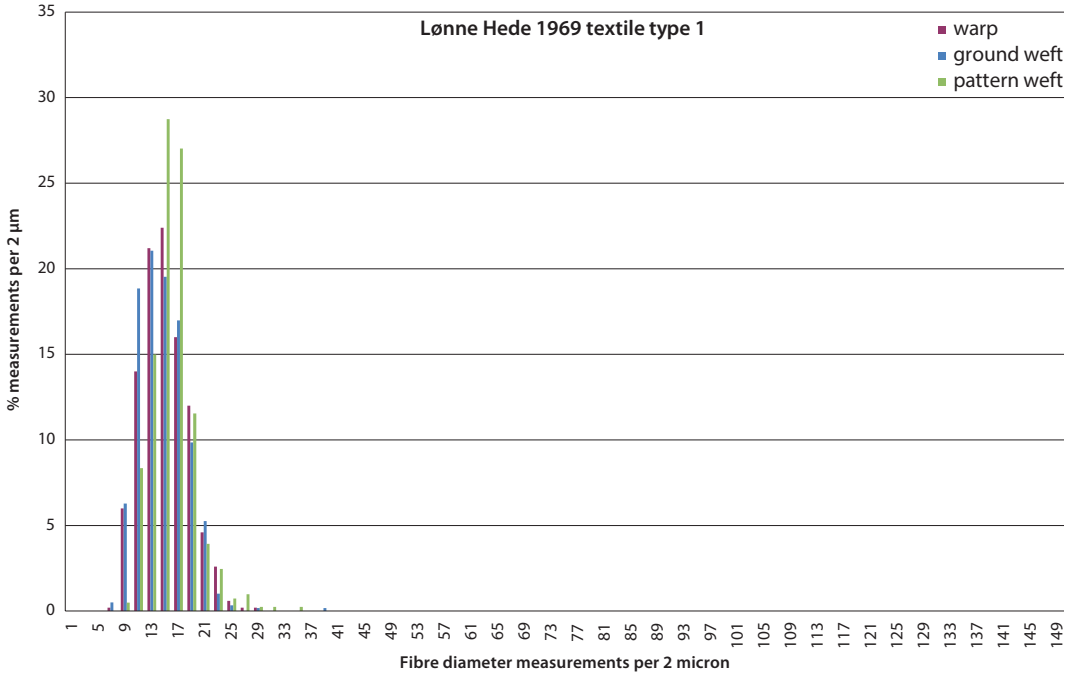


Fig. 42. Histogram of fibre analysis of textile 1969.1 (illustration: I. Skals).

Fig. 43. One of many fragments of textile 1969.2 with the blue colour preserved. Scale 2 : 3 (photo: R. Fortuna).

Textile	Size (cm)	Binding system	Selvedge	Warp end border
"top"	?	2/2 twill	Tubular Single weft turn over 14 warp threads	Warp end braid/ ?
"skirt"	?	2/2 twill	Tubular Double weft turn, over 14 (?) warp threads.	Warp end braid / possibly warp end fringes.

Table 11. Textile 1969.2.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	Hard	9	0.6–0.8	Dark green to orangey	Woad
Weft	Single	Z	Hard	9	0.7–0.9	Dark green to orangey	Woad

Table 12. Textile 1969.2, yarn.

Number	Stitch	Function	Twist direction	Twist angle	Thread diameter (mm)	Stitches / 10 cm	Length of stitch in mm	Dye
2	buttonhole	Seam (type 2 + type 2)	Z	Hard	C. 0.8	–	–	–
2	Whip stitch	Seam (type 2 + type 7)	Z	Hard	C. 0.8	Four per 2.5 cm	8	–
2	Whip stitch	Seam (type 2 + type 5)	Z	hard	C. 0.8	Nine per 5 cm	–	–

Table 13. Textile 1969.2, sewing thread.

The two tubular borders are different. One, identified in the middle of the grave attached to textile 1969.7, has double weft in the tubular part, whereas the other, located near the hair and attached to textile 1969.5, only has a single-weft turn. One finishing or starting border is braided and attached to textile 1969.3 located in the lower left side of the grave (unfortunately it has not been possible to identify the precise method of warp end braiding).

A warp-fringed twill woven fragment is found centrally in the grave, 10–20 cm from textile 1969.3 towards the centre of the grave but at the bottom of the stratigraphy (Inv. no. C33192).

Two pieces with seams were identified, both belonging to textile 1969.2. One is found in the same area as the fringed border, but in a layer above it. One side of the fragment is thickened as if it were an edge folded double. It is attached to a piece of 2/2 twill with a single stich (Inv.no. C33196).

Two fragments are stitched together with double buttonhole stitches. One has eight threads of weft-faced tabby ending in a braid, thus resembling either a starting or finishing

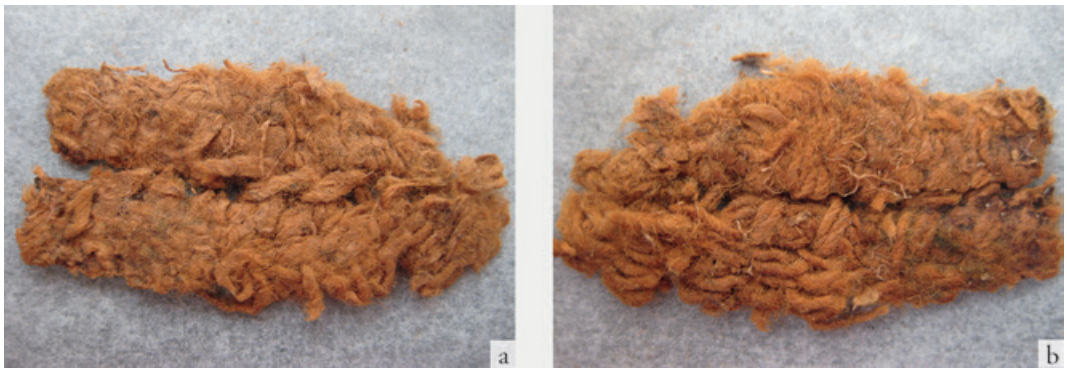


Fig. 44. Fragment of textile 1969.2, side a and b (National Museum Inv.no. C33299) with seam of "double button-hole stitches" (photo: R. Fortuna).

border, whereas the other is too felted to analyse. Most likely they both belong to textile 1969.2 (Inv.no. C33299)

Discussion and conclusion

Textile 1969.2 is the most frequent type in this grave. It is mostly found in multiple layers. The excavators report that it was difficult to differentiate between actual layers and just folds. The stratigraphy seems most clear in the right side of the grave – probably the area behind the back of the dead body – where four layers of textile 1969.2 are identified. One or two layers are attached to textile 1969.7: one at the top of the stratigraphy, and seemingly one in the bottom layer. In between are two other layers of a similar weave not attached to other types. Typologically, these layers cannot be separated, but they probably belong to two different weaves, as also stated by the excavators. In the southern part, excavators mentioned layers of this weave in between layers of the other types of textile.

The excavators suggested that the two weaves represented by textile 1969.2 came from a form of skirt and a top, respectively. This was based on the selvedge to selvedge attachments to textile 1969.7 and the fact that it was also found further south in the grave attached to the border textiles 1969.5 in the area of the hair. The stratigraphic observations in the western side support this conclusion.

A possible reconstruction of the shape of the garments can be based on the different borders and seams: The seam fragment found near the hair *(fig. 44a–b)* suggests that the piece interpreted as a top was stitched together to form a tube. At least one transverse side was finished with a weft-faced half panama and narrow warp end braid.

Since the excavation of the find, it has been discussed whether the skirt was an open rectangular piece closed like a Scottish kilt (Nordquist / Ørsnes 1971; Ratje 1972) or was rather closed like a tube. It can be determined with certainty that along one transverse edge it was attached to the tablet-woven border, textile 1969.3 (see below), with the warp-ends being braided. The opposite transverse edge may either be represented by the fringed warp ends identified at the bottom of the stratigraphy, or it have been attached to the opposite side of the tablet weave, as suggested by Munksgaard / Østergård (1988). The issue will be further discussed in relation to the description of textile 1969.3.

Regarding the size of the garments, the excavators only concluded that it had been large, as "there was 1 m^2 of sticky mass of cloth" (Ratje 1972).

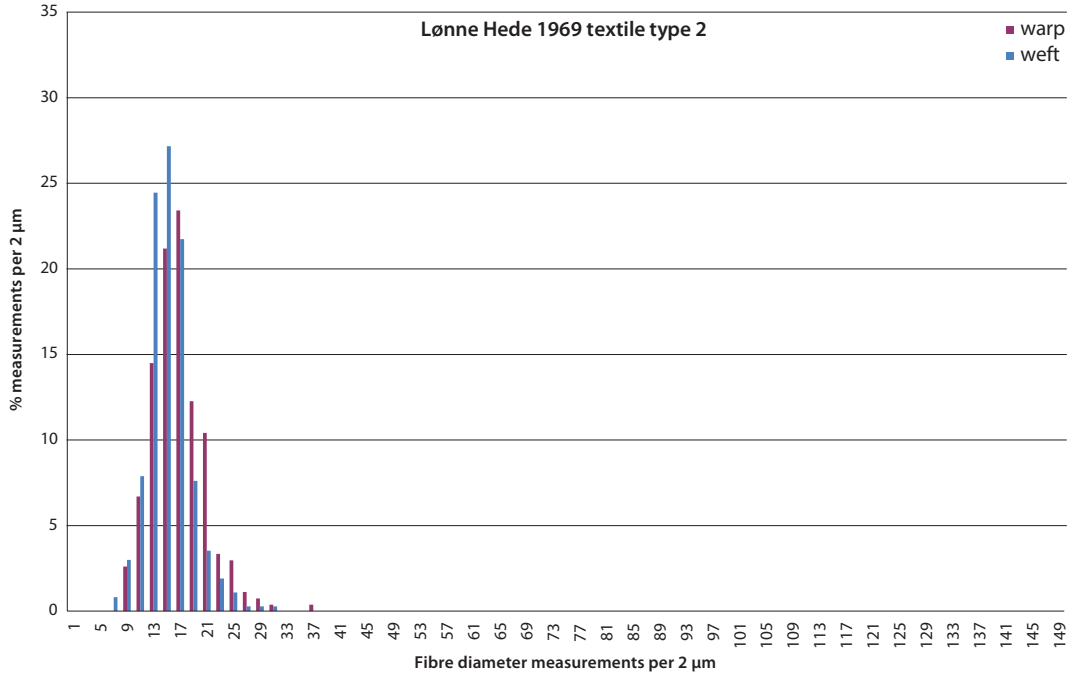


Fig. 45. Histogram of fibre analysis of Textile 1969.2 (illustration: I. Skals).

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
Type 2 warp	97	3	0	14	8–30, 37	268
Type 2 weft	99	1	0	14	6–26, 28, 31	368

Table 14. Textile 1969.2, fibre analyses.

Technical details: textile, yarn, fibres, and sewing thread

Fibre analyses were made of samples from both warp and weft of textile 1969.2. High concentrations of fine fibres, few medium sized fibres and no outliers have been recorded *(table 14)*. Minor differences are indicated in the histograms *(fig. 45)*. The peaks representing the extent of similar measurements are a bit lower in the case of the warp, and the curve of its histogram is oriented slightly to the right of the weft (see also the red warp in textile 1969.5, both samples from textile 1.3 B, the ground weft in textile 1.6 R, the weft and sewing yarn in textile 1.7 and both yarns in textile 12.1). The weft resembles the pattern weft in textile 1969.1 (see also the red warp in textile 1969.3, the red yarn in textile 1969.4, the warp and weft in textile 2.3, and the weft in textile 2.6).

The two yarns in this weaving are possibly from different raw materials but could also have been processed slightly differently.

Fig. 46. Fragment of textile 1969.3, a tablet woven border attached to Textile 1969.2 (photo: R. Fortuna).

Size (cm)	Binding system	Selvedge
5,6 broad	Tablet weave	Flat

Table 15. Textile 1969.3.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Visible colour	Detected dye
Warp	Single	Z	hard	Tablets pr cm: 11	0.6–0.8	Blue	Indigotin
Warp	Single	Z	hard		0.6–0.8	Red	No dye detected
Weft	2 Single	Z	hard	?	0.6–0.7	Blue	Indigotin

Table 16. Textile 1969.3, yarn.

3.1.7 Textile 1969.3, textile type 3

Ths is a 6 cm wide border woven with tablets, preserved in the eastern side of the grave, near the middle *(fig. 46)*. It was last analysed and described by Ræder Knudsen (2014). The band is woven in a combination of a complicated double-faced weaving and warp-twine cords with 61 tablets *(tables 15–16)*. Sections of red squares on a blue background are divided by lines of arrow patterns.

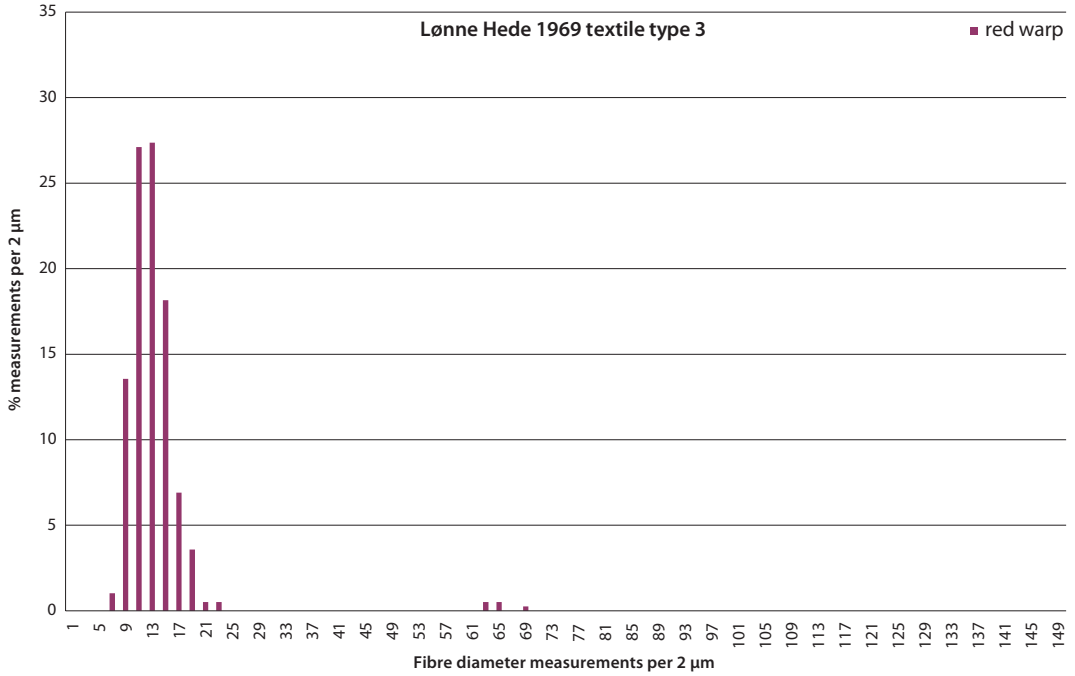


Fig. 47. Histogram of fibre analysis of textile 1969.3 (iIllustration: I. Skals).

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
Type 3 red warp	99	0	1	14	7–20, 22, 63, 65, 69	391

Table 17. Textile 1969.3, fibre analyses.

The squares appear to be made using only two holes in diagonally opposite corners on each tablet. The first was threaded with two warp threads of red, and the next with two warp threads of blue. Before weaving, the red warp-tablets were turned to face the empty holes in the tablets with the blue warp. The tablets have been positioned on their pointed edges, so two sheds were created and given a half turn forward and backwards, using both sheds for a weft. This weaving method produced a rep-like double weave with a red stripe on one side and a blue stripe on the other.

Between the rows of squares are lines of arrow patterns. They are made by using all four holes in the tablet threaded with two red and two blue warp threads and turned continuously the same way, thus forming the arrows. The blue background pattern is a double weave, also with only two warp threads per tablet and half turns in both directions (Hansen 1990, 62; 65). The weft is double, but the two threads are used individually in order to use both sheds in the squares.

The border had been attached to the braided edge of Textile 1969.2 with whip stitches along one or two sides.

The weave is preserved in four pieces in different levels of decomposition. Two of the pieces were still attached to fragments of textile 1969.2 on one side, and Østergård (1984) suggests that the fragments represent each end of the twill woven skirt, thus gath-

Fig. 48. Fragments of textile 1969.4. The checked tabby weave. In the middle is the gathered piece of textile 1969.7 with the tubular selvedge. Scale 2:3 (photo: R. Fortuna).

ering the weave to form a tube. She further finds support for this in two ends of sewing thread still preserved on the free side of one fragment.

Technical details: textile, yarn, sewing thread, and fibres

From textile 1969.3 the red warp was sampled for fibre analyses. The results show a high percentage of very fine fibres and a few outliers of which none larger than 100 microns are recorded *(table 17)*. The histogram is comparable to the pattern weft of textile 1969.1 *(fig. 47)* (see also the weft in textile 1969.2, the red yarn in textile 1969.4, the warp and weft in textile 2.3, and the weft in textile 2.6).

3.1.8 Textile 1969.4, textile type 4

This is a checked tabby weave, originally in blue and reddish-brown *(fig. 48)*. Today parts of the blue have turned green and orange. It is recorded in 18 numbers as many small fragments: only three pieces are approximately 8 × 8 cm, the rest are only a few cm^2 each and much degraded (Østergård 1984).

Fig. 49. Fragment of textile 1969.4 (National Museum Inv.no. C33244) with tubular selvedge (photo: I. Demant).

Size (cm)	Binding system	Selvedge	Warp end border
23 × 40 Two layers	Tabby	Tubular, double weft turn over nine warp threads	Possibly one warp end fringe

Table 18. Textile 1969.4.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Visible colour	Dyes detected
Warp	Single	Z	hard	10	0.5–0.8	Blue	Woad
Warp	Single	Z	hard	10	0.7–1.0	Red	No dye detected
Weft	Single	Z	hard	8	0.5–0.8	Blue	Woad
Weft	Single	Z	hard	8	0.7–1.0	Red	No dye detected

Table 19. Textile 1969.4, yarn.

The checked pattern is made up of red stripes on a blue background in both directions. The width of the red stripes varies between four and twelve threads or 0.5–1.5 cm *(tables 18–19)*.

Preserved selvedges are tubular, running over approximately nine threads. Most weft threads are running twice through the shed of the selvedge before entering back into the main weave *(fig. 49)*.

One piece seems to belong to a warp end of the weave; however, it looks quite worn. A 2 × 5 cm long dark green fragment in tabby is tied into a knot as a tattered piece on the end of a woven fabric. This was found in the area of the eastern side *(fig. 50)*.

Fig. 50. Fragment of textile 1969.4 (National Museum Inv. no. C33299). The owner has tied a knot on this (photo: I. Demant).

This weave was identified centrally in the grave. According to the excavation diary, this type was visible in more parts of the grave both on top and near the bottom of the stratigraphy, that is both under and over textile 1969.2 and textile 1969.7 across the grave. In the horizontal plan, the fabric covered an area of 23 × 40 cm. It was generally rather poorly preserved and could only be lifted out as small fragments, with only a few well preserved.

Since the weave was present both above and below the fabric of the main garment, the excavators suggested that it might have served as a scarf.

Technical details: textile, yarn, and fibres

Fibre analyses were made of samples from the two differently coloured yarns. Very high percentages of fine fibres, a few medium sized fibres in one case, and no outliers were recorded *(table 20)*. The histograms show slight differences *(fig. 51)* and the one of the red yarn is comparable to the pattern weft of textile 1969.1 (see also the weft in textile 1969.2, the red warp in textile 1969.3, the warp and weft in textile 2.3, and the weft in textile 2.6). The histogram for the blue yarn resembles the ones of warp and ground weft from textile 1969.1 (see also the weft in textile 1969.5).

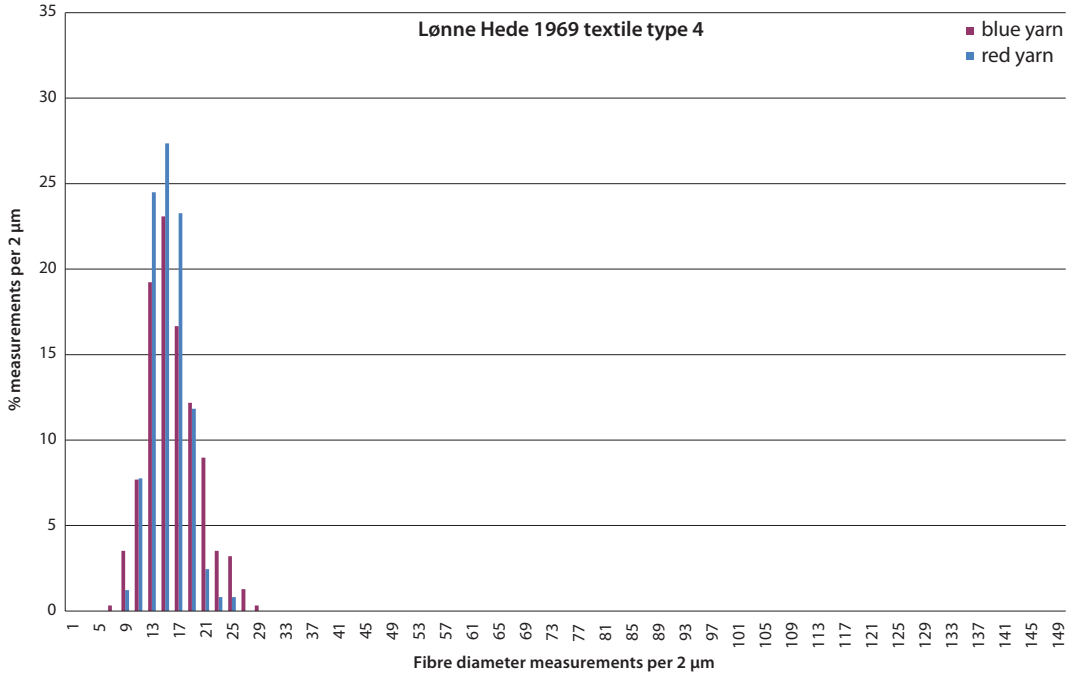


Fig. 51. Histogram of fibre analysis of textile 1969.4 (illustration: I. Skals).

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
Type 4 blue yarn	98	2	0	15	7–28	312
Type 4 red yarn	100	0	0	14	9–20, 22, 24	245

Table 20. Textile 1969.4, fibre analyses.

Size (cm)	Binding system	Selvedge
1.2 x 6–10	Tabby	One tubular, single weft turn – One flat, double weft

Table 21. Textile 1969.5.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Visible colour	Dyestuff Detected
Warp	Single	Z	hard	–	0.6–0.7	Blue	Woad
Warp	Single	Z	hard	–	0.6–0.9	Red	Woad / dyer's broom
Warp	2 ply	zz>S	hard	–	0.6–0.8	White	No dyes detected
Weft	Single	Z	hard	10 per cm	0.6–0.8	–	Woad

Table 22. Textile 1969.5, yarn.

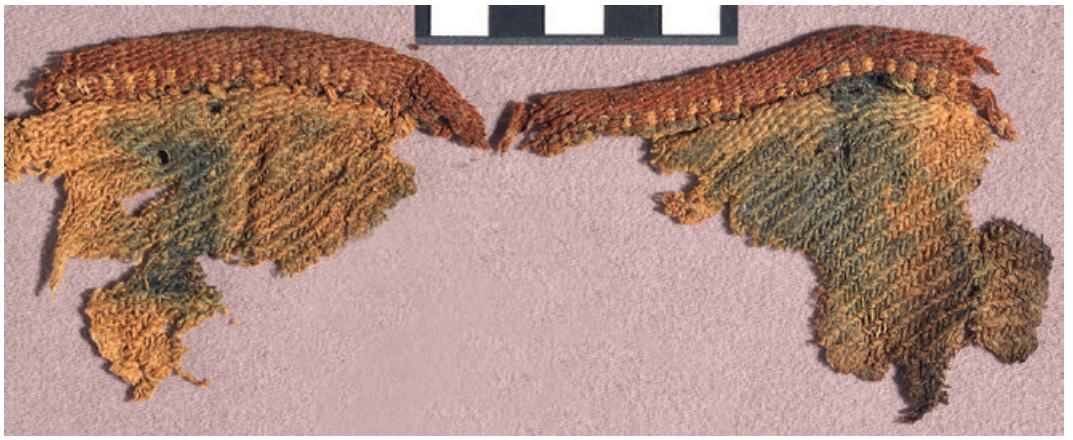


Fig. 52. Fragments of textile 1969.5 attached to textile 1969.2. The textiles were found near the head of the deceased with the copper-alloy fibulae attached (photo: R. Fortuna).

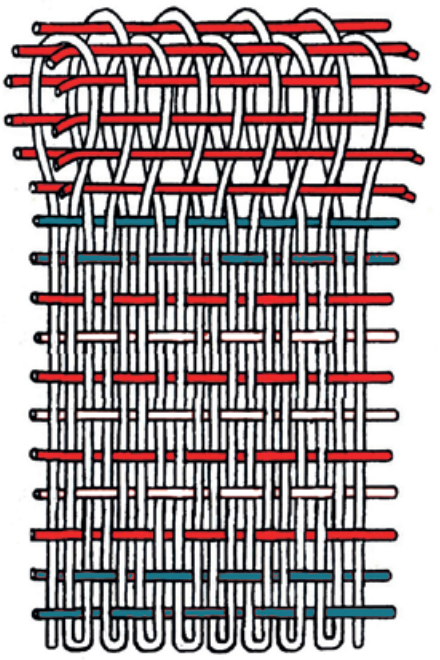


Fig. 53. Illustration of the sequence of the weft in textile 1969.5 (illustration I. Demant).

3.1.9 Textile 1969.5, textile type 5

This tabby woven border is 1.2 cm wide *(fig. 52; tables 21–22)*. Six pieces are recorded of this type measuring 6–10 cm in length. It was identified in the southern end of the grave. It has one tubular and one flat selvedge. It has 30 warp threads in red, blue and white. 17 red threads form the tubular selvedge. The other selvedge is formed by four blue threads. The middle part is formed by three red warp threads alternating with three white two-plied threads and two blue against the red tubular selvedge. The weft runs singly through the tubular part, but double through the flat part *(fig. 53)*.

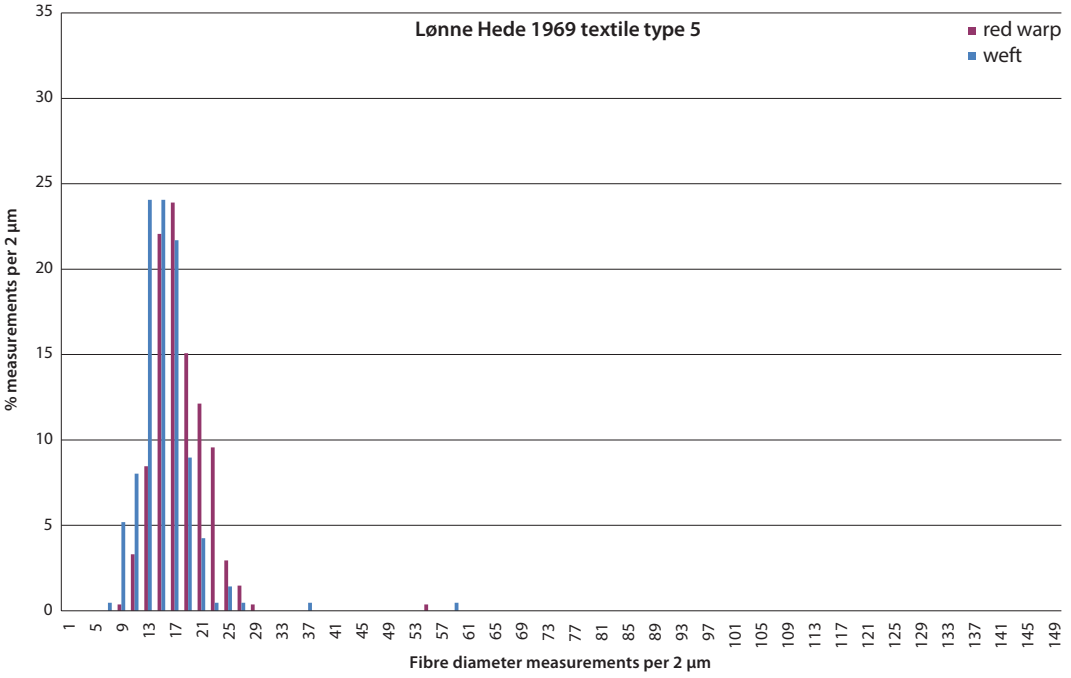


Fig. 54. Histogram of fibre analysis of textile 1969.5 (illustration: I. Skals).

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
Type 5 red warp	98	1.5	0.5	15	8, 10–28, 55	272
Type 5 weft	98.5	1	0.5	17	7–22, 25, 27, 36, 58	212

Table 23. Textile 1969.5, fibre analyses.

According to the horizontal plans, this type was recorded in the upper area of the grave, running over the hair towards the fibulae placed over the head. This position may reflect formation processes rather than the original position.

The pieces that could be lifted out of the grave are relatively well preserved as the fibres are still flexible. However other parts appear to have been more degraded or completely decomposed.

As it is found attached to parts of textile 1969.2 and found in the area around the head, it is very likely that it adorned the upper edge of the tubular garment. This is further supported by the fact that a pair of copper-alloy fibulae was found, each holding two pieces of this weave together. One was placed beneath the hair, the other over the hair near the southern edge of the grave.

Technical details: textile, yarn, and fibres

Fibre analyses were made of the red warp and the weft from this weaving and the results are very similar, with high percentages of fine fibres, a small amount of medium sized fibres, and no outliers *(table 23)*. Both histograms have medium sized peaks but slightly different slopes *(fig. 54)*. The histogram for the red warp is comparable to the warp in textile 1969.2 (see also the two samples from textile 1.3 B, the ground weft in textile 1.6 R, the weft and

Fig. 55. Fragments of textile 1969.6. The piece to the right is a little finer in quality (photo: R. Fortuna).

Size (cm)	Binding system	Selvedge	Warp end border
Many fragments from a few cm^2 to 15 × 10	2/2 twill	Not preserved	Not preserved

Table 24. Textile 1969.6.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Visible colour	Dyestuff detected
Warp	Single	z	hard	3.5	c. 1.5	Light brown	Woad
Weft	Single	z	hard	4	–	Light brown	No dye detected

Table 25. Textile 1969.6, yarn.

the sewing yarn in textile 1.7, and the warp and weft in textile 12.1). The histogram for the weft is comparable to the warp and ground weft in textile 1969.1 (see also the blue yarn in textile 1969.4).

3.1.10 Textile 1969.6, textile type 6

This weave is a white 2/2 twill, significantly coarser than the other textile types of this grave both in the weave and in the fibres *(fig. 55; tables 24–25)*. It is recorded under four

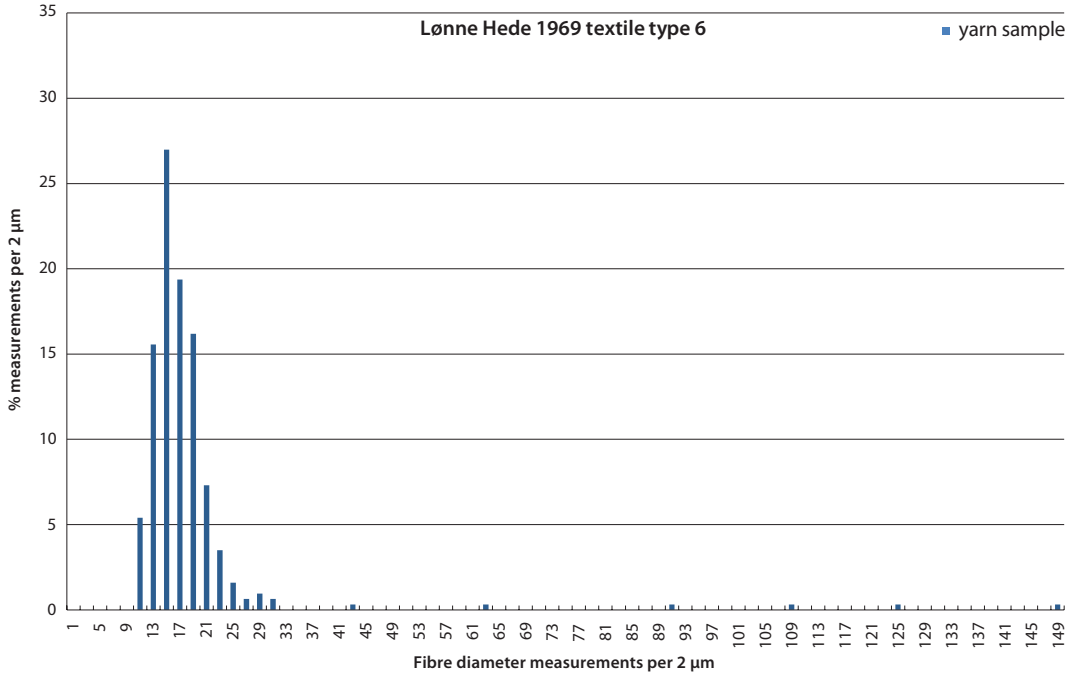


Fig. 56. Histogram of fibre analysis of textile 1969.6 (illustration: I. Skals).

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
Type 6 Sample 1	96	3	1	15	10–26, 28–31, 42, 63, 90, 109, 125	314

Table 26. Textile 1969.6, fibre analyses.

numbers as twelve fragments of up to 12 × 10 cm. There are no selvedges preserved from this type, and it is not possible to estimate the size. It was only identified at the bottom of the grave below other types of weave, mostly on the right side and centrally in the grave, and is generally in a good state. A dark layer interpreted as an animal hide was detected under the weave.

One fragment appeared a little finer, though still coarser than textile 1969.2. It measures 8 × 5 cm. The colour is orange, but down the middle of the fragment is a 12-thread wide dark stripe, probably originally blue. It is noted by Irene Skals in the fibre analyses below that the yarn of this fragment contained even more coarse fibres than that of the other fragments of this type. It may represent an eighth type of weave in the grave, but as only this fragment is preserved its function cannot be determined.

Technical details: textile, yarn, and fibres

The fibres of this weaving looked coarser to the naked eye than the ones in any of the other weavings. Fibre analysis was made of one sample. The results show a low percentage of fine fibres (96 %) and it is the only textile from this grave with fibres measuring more than 100 microns *(table 26)*. The histogram is not comparable to any of the above *(fig. 56)* (see all four yarns in textile 1.5 M, the two samples from textile 2.2, and the sample from textile 6.2).

Fig. 57. The largest preserved fragment of textile 1969.7. This piece was found in the right side of the grave. It was originally placed behind the back of the dead. It was unfolded after it had been lifted out of the grave (photo: R. Fortuna).

Size (cm)	Binding system	Selvedge	Warp end border
>115 × 13	Tabby, slightly warp faced	Tubular, double weft over 32 warpthreads Tubular, 10	Not preserved

Table 27. Textile 1969.7.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Visible colours	Dyestuff detected
Warp	Single	Z	Hard	12	0.8–0.9	Green-blue	Woad
Weft	single	Z	Hard	8	0.8–0.9	Green-blue	Woad
Warp	single	Z	Hard	8	0.7–0.8	Reddish brown	No dye detected

Table 28. Textile 1969.7, yarn.

Number	Stitch	Function	Twist direction	Twist angle	Thread diameter (mm)	Stitches / 10 cm	Length of stitch in mm	Dye
–	Blanket stitch / whip stitch	Attaching two parts	Z	–	–	–	–	–

Table 29. Textile 1969.7, sewing thread.

3.1.11 Textile 1969.7, textile type 7

This is a slightly warp-faced tabby woven textile attached to textile 1969.2. 14 numbers are recorded as belonging to this type of weave. Most of them are only a few cm^2 but one represents the largest textile fragment preserved in the grave (115 × 13 cm). It was identified centrally across the grave *(fig. 57; tables 27–29)*.

Both selvedges are preserved presenting a width of 13 cm. The weave is predominantly blue with one red tubular selvedge and four reddish-brown stripes running lengthwise

Fig. 58. Photo of grave 1 in plan (photo: Varde Museum).

down the middle. The stripes are separated into two groups of two – one 9 mm wide and one only 1.5 mm (three warp threads), with a distance between the stripes of 3–4 mm or four warp threads. The distance between the two groups is 3 cm.

The excavation diary referred to a stripy weave with the stripes running parallel with "the red border" which must be the broad tubular selvedge. This is the broadest tubular selvedge seen in Lønne Hede, made of 32 warp threads. The weft runs twice through each shed in the tubular part, before returning into the main weave. The opposite selvedge is likewise tubular but made of only approximately ten threads.

This weave is recorded on the horizontal plans as forming an arch across the centre of the grave approximately 40 cm long. From the descriptions in the diary it appears that is was present both at the top and at the bottom of the stratigraphy. However, only the weave on the right side of the grave was preserved well enough to be lifted out. The rest only survived as minor fragments, and much probably disintegrated during excavation. The long piece (115 × 13 cm) was found in the right side of the grave *(fig. 57)*. Originally, it was heavily folded, but it was unfolded by the conservators after being lifted out of the grave, which is why it is now a long flat piece. It has probably been placed round the back of the dead body, collapsing into a heap as it decomposed.

The type was mainly recognised by the broad red tubular selvedge, which is described as heavily folded, at least in some parts. A yellow thread ran through the folds, right under the selvedge. These folds are now opened in the long piece. However, another fragment from the bottom layer is preserved folded as it was found, showing that the folds were approximately 2 cm deep and very tight, almost vertical *(fig. 48)*.

In the description of the proposed reconstruction, it is considered to be an upper lining of a skirt, and it is mentioned that the heavy folding was only on the hips, but that on the back and on the front it was lying flat (Nordquist / Ørsnes 1971). In the study model, Ratje estimated 135 cm to each folded part, based on the large piece unfolded by the excavators (Ratje 1972).

The type is relatively well preserved in three fragments, but it is described as otherwise being much degraded and it was not possible to lift some parts.

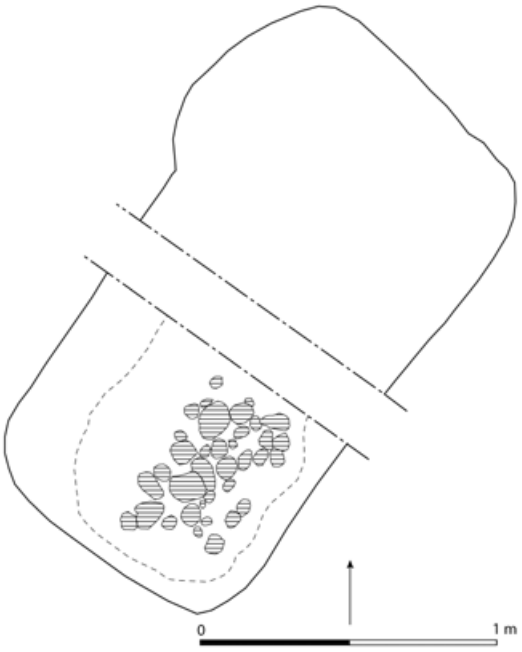


Fig. 59. Outline of grave 1 in plan (illustration: T. Lorange).

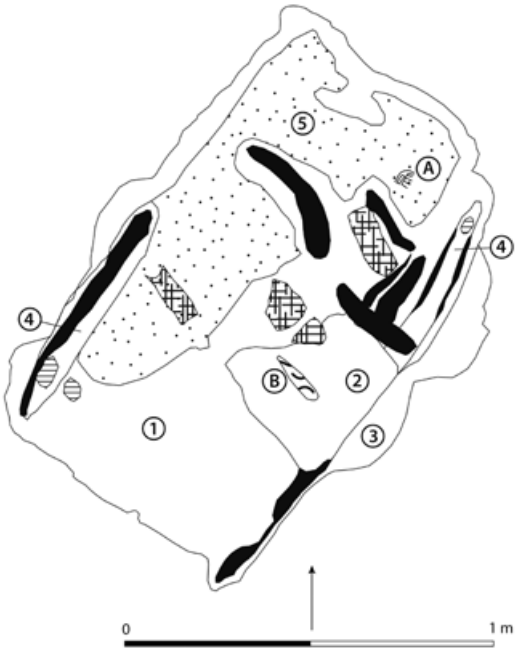


Fig. 60. Outline sketch of grave 1 after the first cleansing at the conservation centre. 1. Grey speckled grave fill spotted with hardpan subsoil and underground sand covered more or less the entire grave, part of the textiles and the decayed wood/bark lie uncovered; 2. Grey-brown layer with a slightly hard surface, which perhaps was turf, animal hide or other decayed organic material; 3. Similar to 2, but a little more compact; 4. Similar to 1, but darker, and intermixed with humus; 5. Within this area are clearly discernible textiles spread around beneath the sand. – A Bone comb; B Iron knife (illustration: T. Lorange).

3.2 Grave 1

Grave 1 is a clearly defined rectangular feature with rounded edges. On the surface, the grave measured 192 × 156 cm and was oriented NNE–SSW. The grave was 51 cm deep with a flat bottom. Around 20 cm beneath the surface, a small stone packing was uncovered in the southern part of the grave *(figs 58–59)*.

In situ excavations were halted at approximately 45 cm beneath the surface due to the appearance of organic material, and the entire grave was removed in a block of soil. The grave was moved to a refrigerated container in order to dry before excavation *(fig. 60)*. Traces of decomposed wood were found near the top, some of it with bark preserved, presumably birch. Along the longer edges of the grave, traces of decomposed wood were identified, most clearly towards the southeast. This could represent a type of bier for the deceased. The grave goods included an antler comb (Varde Museum 1272x130) and a small knife (Varde Museum 1272x131). They sat close together in the north-eastern part of the grave, partially covered by a fragment of textile *(fig. 61)*. Spread among the grave fill

Fig. 61. Bone comb and iron knife in grave 1 (photo: Konserveringscenter Vest, Ølgod).

Fig. 62. Bone comb from grave 1 (photo: R. Fortuna).

were ceramics with Iron Age features, most likely a random occurrence in connection with the filling in of the grave.

The comb *(fig. 62)* is an openwork single-layered comb cut from one piece, 10.3 cm long, 4.8 cm wide and 0.8 cm thick, with 4–5 teeth per cm. Some of the teeth are broken, but apart from a small area of the surface partially missing on the front, it is well preserved. The comb is slightly curved and decorated with four vertical zigzag ribs in the handle. The concave back is very well preserved with a zipper-like ornamentation consisting of two parallel horizontal dotted lines. Single-layered combs with openwork belong to Ilkjærs type 1a / Thomas type C respectively (Ilkjær 1993; Thomas 1960). The Lønne Hede comb is unusual and no parallel has been found in the Danish area, but similar combs dated to phase B1–B2 are known from Central Europe (Teuber 2005, 303). The small iron knife was highly corroded and broken into many pieces making the exact shape and type difficult to determine.

3.2.1 Overview of the textiles in grave 1

The textiles are preserved in an almost rectangular area of approximately 116 cm along the longer axis of the grave and 65 cm across *(fig. 63a–b)*. Five different textiles have been

Size of preserved fragment (cm)	Binding system	Selvedge	Warp end Border
22 × 10	2/2 twill	Not preserved	Not preserved

Table 30. Textile 1.2, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	45–50°	6	1,2	Cream	None
Weft	Single	Z	35–40°	6	1,2	Cream	None

Table 31. Textile 1.2, yarn.

identified, of which textile 1.6 has been ^{14}C-dated to 42 BC–AD 18 (68.2 % probability, see *table 7*).

No human remains survived in the grave, but the textiles seemed to be most degraded where they were in contact with the body. This left an outline of a body placed in hocker-position resting on its right side facing southeast *(fig. 63b)*.

The better-preserved textiles are found in layers along the sides and at the south-eastern end of the grave. That is, seen in relation to the trace of the body, behind the back of it, in front of the chest and below the shinbone. When recovered from the matrix, it was not possible to separate the layers of textiles as they are fragile and break easily. Thus, they are kept in fragment lumps showing the stratigraphic sequences in the different areas of the grave and enabling registration of the extent of the different textiles.

3.2.2 Textile 1.2

This is as cream coloured twill weave in wool. The size cannot be determined. It is identified as fragments found along both edges of the grave, one covering the comb and knife.

The yarn is thicker, making a coarser weave compared to the other textiles in the grave, and it shows traces of wear in the form of worn off threads (see *tables 30–31*).

The best-preserved piece was covering the knife and comb near the feet of the deceased *(fig. 61)*. Otherwise it mostly appears as half dissolved threads and weave, or as a dispersed layer of light fibres visible on top of other types of textile in the grave.

Stratigraphically, it generally overlays all other types of weave in the grave along the edge and near the feet, except for textile 1.3 but including the traces of fur. However, in the middle parts of the grave, the type is only visible at the bottom of the textile-stratigraphy and below the hairs of fur; it is not visible on the top. On the side of the grave this textile over-lays hairs from the fur.

The fabric seems to have lined the grave, partly folded over the deceased, i. e. covering the feet, but not the upper part of the body.

3.2.3 Textile 1.3

This orange 2/2 twill-weave in wool is preserved as a fragment of approximately 6 × 8 cm *(tables 32–33)*. The fibres are relatively well preserved. It is identified on top of textile 1.2 in the southwest corner of the grave and has not been located anywhere else in the grave.

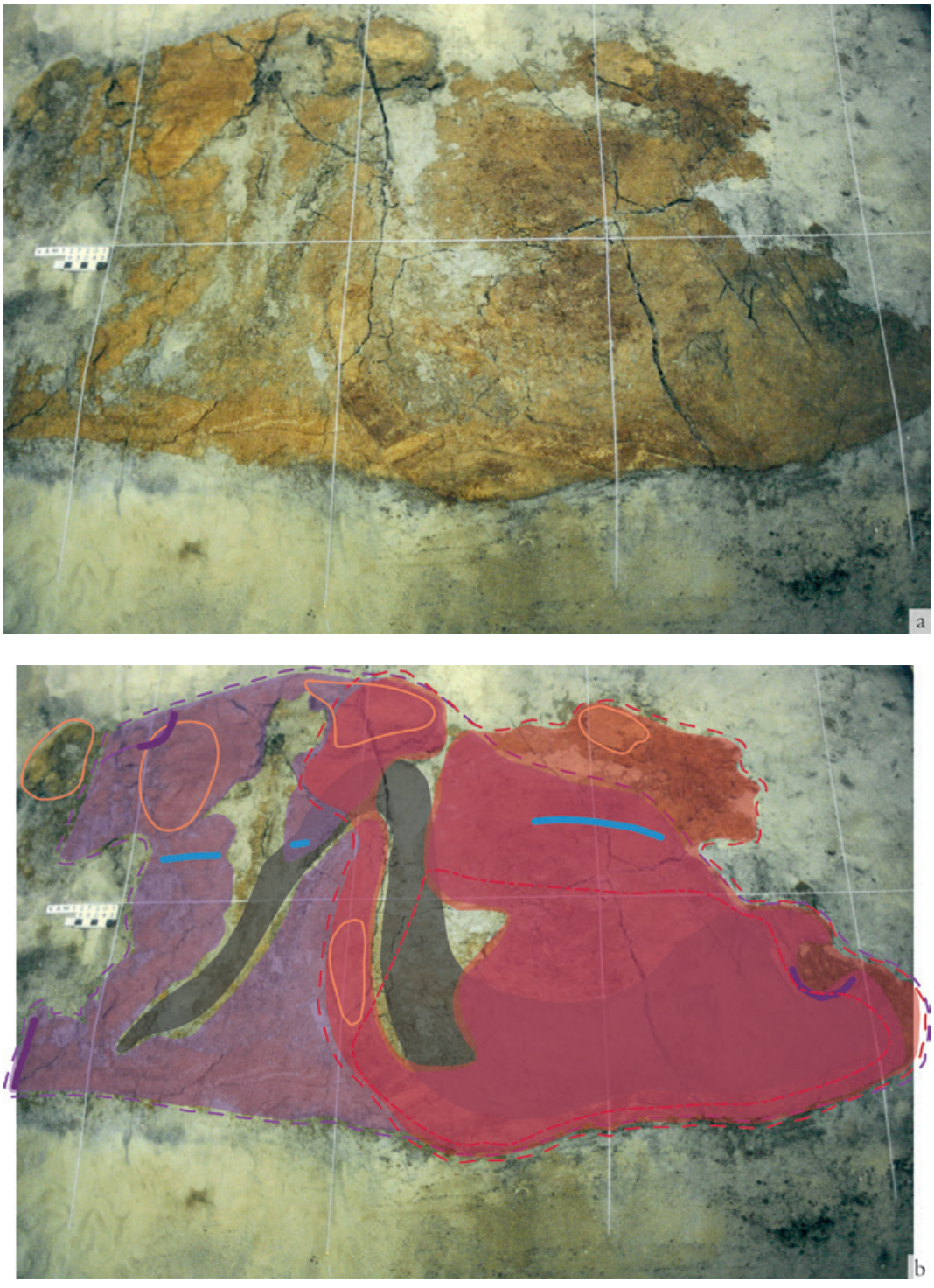


Fig. 63. Grave 1: a. The textiles are uncovered and the grave goods removed; b. Outline of the body (black) and textiles 1.2 (orange lines), 1.5 (purple and blue lines), 1.6 (red) and 1.7 (purple lines) (photo and illustration: Konserveringscenter Vest, Ølgod, I. Demant and T. Lorange).

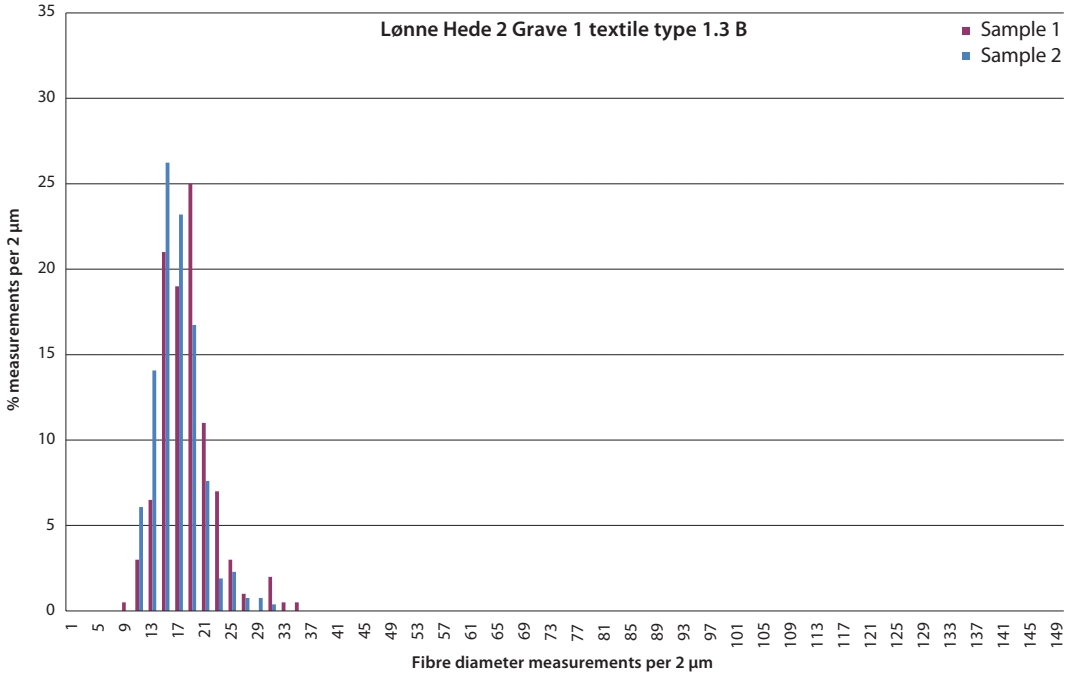


Fig. 64. Histogram of fibre analysis of textile 1.3B (illustration: I. Skals).

Size of preserved fragment (cm)	Binding system	Selvedge	Border
6 × 8 (fragment)	2/2 twill	Not preserved	Not preserved

Table 32. Textile 1.3, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
1	Single	Z	45°	11	0,8	Brown	Not analysed
2	Single	Z	45°	8–10	0,8	Brown	Not analysed

Table 33. Textile 1.3, yarn.

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
Tx. 1.3 B Sample 1	96	4	0	18	9–27, 30–32, 34	200
Tx 1.3 B Sample 2	98	2	0	15	10–30	263

Table 34. Textile 1.3, fibre analyses.

Technical details: textile, yarn, and fibres

Fibre analyses were made from samples from the two yarn systems with very similar results *(table 34)*. Narrow coherent curves, very high percentages of fibres measuring less than 25 microns and no outliers indicate well processed yarn. The histograms *(fig. 64)* are com-

Size (cm)	Binding system	Selvedge	Border
Unknown	2/2 twill	Not preserved	Not preserved

Table 35. Textile 1.4, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
1.	Single	Z	40°	9	0,8	Brown	Not analysed
2.	Single	Z	40°	9	0,8	white	Not analysed

Table 36. Textile 1.4, yarn.

parable to the warp in textile 1969.2 (see also the red warp in textile 1969.5, the ground weft in textile 1.6 R, the weft and the sewing yarn in textile 1.7, and the warp and weft in textile 12.1).

The original size is unknown, and it is not possible to ascribe this weave to any function in the grave.

3.2.4 Textile 1.4

It is a dark reddish-brown and white 2/2 twill-weave. The first thread system is reddish-brown, the second is white. The reddish-brown yarn is relatively well preserved, whereas the white is more degraded *(tables 35–36)*.

The textile is identified between the layers of textile 1.5 near the "arm opening" at the southern end of the grave. The function and original size of this fabric is unknown, as it is located between other layers of textiles and only visible along the upper edges near the "arm opening" of textile 1.6. It has not been possible to locate it in other parts of the grave.

The stratigraphic position of this type suggest that it belonged to a type of undergarment, but as it is only recognised in this one place it is impossible to conclude any more than that.

3.2.5 Textile 1.5

This is an orange-brown twill weave in wool with weft stripes. It was identified all over most of the area in the grave covered in textile, and was in two layers which are connected at the sides. There are parts of a selvedge preserved in both ends. It covers an area of approximately 116 × 62 cm *(fig. 63; tables 37–38)*.

The weft stripes alternate between white undyed wool and a darker reddish-brown at irregular intervals. They vary in width from a few millimetres up to 1.5 cm. There is a maximum of ten white stripes of varying width next to each other, followed by one or two red stripes *(fig. 65)*.

The selvedges of the twill are tubular woven over 14 warp threads. Narrow boarders are whip-stitched to these, also with a tubular woven selvedge (textile 1.7). As found, the fragments of the upper selvedge lay in a 10 cm wide and 5 cm high curve, as if forming an arm opening in a peplos-style dress. Not enough of the fabric was preserved to see how it would have been held together at the shoulders *(fig. 66)*.

Fig. 65. Textile 1.5 with red and white stripes and a damaged part of the border of the transverse edge. The red rectangle measures 5 cm in length (photo: Konserveringscenter Vest, Ølgod).

Fig. 66. The curve forming an arm opening, edged with a fragment of textile 1.7 (photo: R. Fortuna).

Size (cm)	Binding system	Selvedge	End/starting border
114 × 62 double layer	2/2 twill	Tubular in over 8 warp threads	braided finishing boarder

Table 37. Textile 1.5, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	45–50°	9	0,8	Light orange brown	No dyes detected
Weft	Single	Z	40–45°	8	0,8	Light brown	No dyes detected
Weft	Single	Z	35–40°	8	0,8	White	No dyes detected
Weft	Single	Z	40°	8	0,8	Reddish brown	Yellow, (luteolin) Dyers broom

Table 38. Textile 1.5, yarn.

Along the length of the grave ran what appears to be a finishing border attached to a transverse edge of the twill weave. It was visible in three different parts (*fig. 63b*, blue lines). The best-preserved part is approximately 15 cm long and found in front of the upper part of the body and towards the south-western end of the grave *(fig. 67)*. Only this part could be analysed. The border is made of two parts: a woven border, which looks like a form of tablet weave, and a seam. The approximately 1 cm wide tablet weaving is woven with seven or eight tablets. It appears to be made using only two holes in diagonally opposite corners on each tablet. Only in the two tablets along one selvedge were all four holes in the tablet used; or possibly the yarn was doubled in two of the holes and the tablets turned in the same direction after each weft. The weft runs normally in the one shed, but when the weft was inserted again, the two outermost tablets with four threads were avoided, thus forming a tiny round woven edge with these two tablets *(fig. 25)*. However, the weave is uneven making it hard to analyse, but this explanation may serve as the best suggestion.

The tablet weave is attached to the twill weave with double thread and very loose stiches running from side to side forming an approximately 1.2 cm wide "ladder". Afterwards, the stiches were filled in with alternating reddish-brown and white yarn as a weft-faced tabby forming a striped effect resembling the flat side of textile 1.7 (see below). In modern tapestry weaving, this pattern is called "pick and pick" *(fig. 20)*. It is not possible to determine whether this border was used to gather the fabric into a tube or if it only adorned a transverse edge.

The textile is decomposed in the areas with direct contact with body parts. It is best preserved in the area below the legs of the deceased and between the layers of textile 1.6, where it is recognizable from the dark and white stripes.

The threads of the main weave and the dark stripes are generally well preserved, whereas the white threads have almost disappeared. They are only visible as small fragments and fibres in the warp. Yellow dyestuff (luteolin) from dyer's broom (*Genista tinctoria* L., *Cytisus tinctorius* VIS.) was present in a sample from the dark reddish-brown stripe (Vanden Berghe 2012).

In the southern end of the grave, this textile is situated between two layers of textile 1.6. Near the northern end, the comb and knife were placed on top of the textile (near the legs

Fig. 67. The border added to textile 1.5 along a presumed transverse edge. Photo: R. Fortuna.

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 1.5 M warp	97	2	1	17	9–29, 43, 71, 91	287
tx 1.5 M ground weft	97	2	1	17	9–27, 38, 50, 52, 55	284
tx 1.5 M light weft	97	3	0	20	9, 11–24, 27–28	100
tx 1.5 M dark weft	96	4	1	19	10–27, 29–31, 46, 48	257

Table 39. Textile 1.5, fibre analyses.

of the deceased) and covered by textile 1.3. The original size of the textile can be estimated at approximately 116 × 124 cm.

Technical details: textile, yarn, and fibres

Fibre analyses were made of samples from all four yarns in this weaving *(table 39)*. The percentages of fine fibres below 25 microns are similar in three cases, and all four yarns also have some fibres between 25 and 40 microns. Outliers are recorded in three cases.

All histograms *(figs 68–69)* are comparable to the sample from textile 1969.6 (see also the two samples from textile 2.2 and the sample from textile 6.2).

As this striped textile was found covering the grave in a double layer, it must be concluded that it functioned as a dress for the deceased – either as a tubular or as a "wrap around" dress. It was probably held together at the shoulders, though it is unknown what held it in place.

3.2.6 Textile 1.6

This is a reddish-brown twill weave in wool with white weft stripes at irregular intervals. It was identified in the south-eastern end of the grave covering an area of approximately 50 × 64 cm in two layers connected through folds along the southern side of the grave

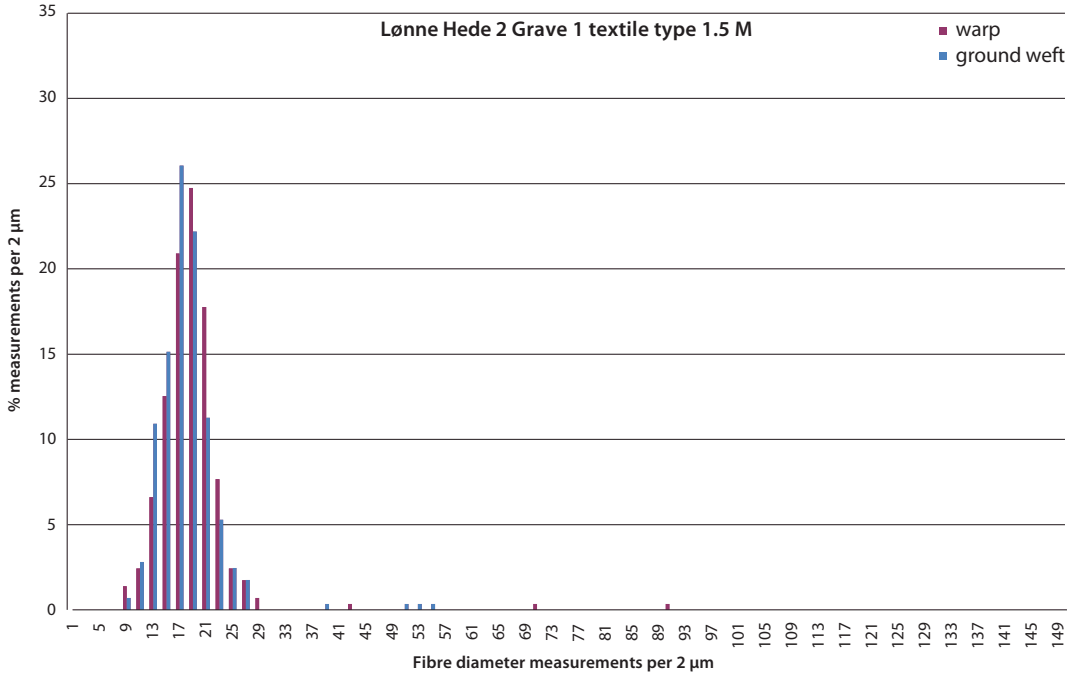


Fig. 68. Histogram of fibre analysis of textile 1.5 (illustration: I. Skals).

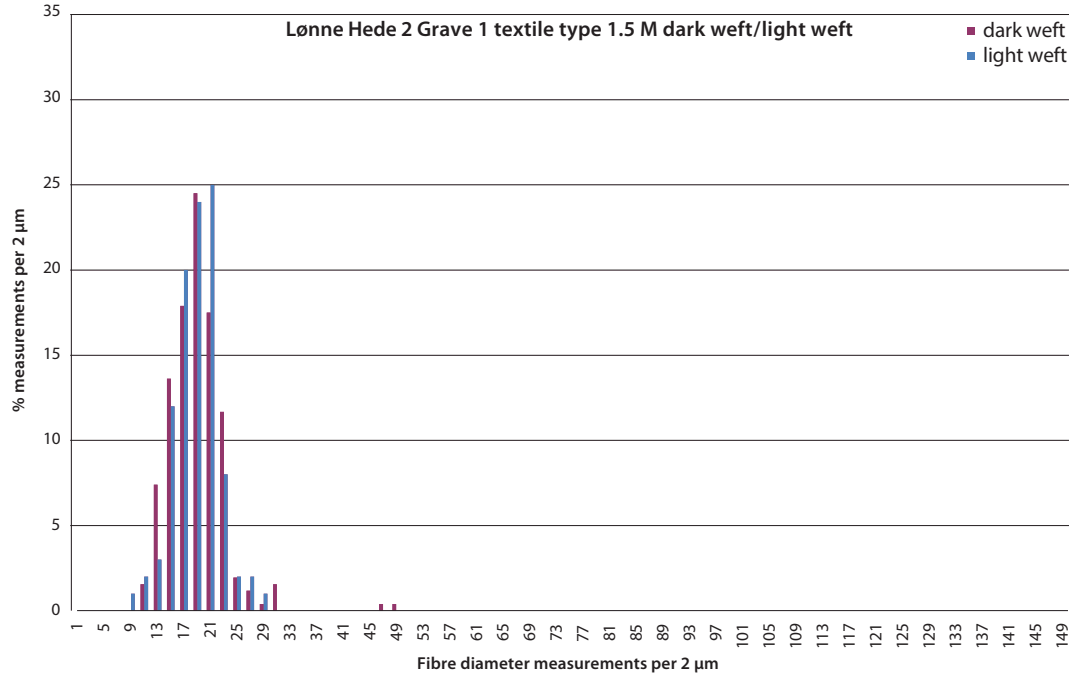


Fig. 69. Histogram of fibre analysis of textile 1.5 (iIllustration: I. Skals).

(figs 26,1.2; 63; tables 40–41). The size can be estimated at a minimum of 99 × 64 cm. That is the length of the upper and lower layer excluding the number of folds along the side. They were created when the fabric collapsed behind the back of the body as decay proceeded.

Fig. 70. Fragment of textile 1.6 with weft stripes (photo: R. Fortuna).

Fig. 71. Textile 1.6 with preserved selvedge (red arrow) (photo: R. Fortuna).

The weft stripes are approximately 1–1.2 cm wide and are repeated around every 0.8–2 cm *(fig. 70)*.

One selvedge could be identified along the western side of the textile. It is tubular in warp-faced tabby over eight warp threads with single weft *(fig. 71)*. The warp ends are

Size (cm)	Binding system	Selvedge	Border
Approximately 64 × 56 and 64 × 35 (Double layer)	2/2 twill	Tubular in tabby over 8 warp threads	Warp fringes, 2,2 cm. 2 warp threads double folded

Table 40. Textile 1.6, Technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	30–45°	8	0,8	Reddish brown	No dyes detected
Weft	Single	Z	40–45°	8–9	0,8	Reddish brown	No dyes detected
Weft	Single	S	30°	10	0,8	White	No dyes detected

Table 41. Textile 1.6, yarn.

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 1.6 R warp	94	5.5	0.5	19	8–30, 110	247
tx 1.6 R ground weft	97	2	1	16	8–29, 47, 62, 91	259
tx 1.6 R pattern weft	87	13	0	20	11–31, 33	183

Table 42. Textile 1.6, fibre analyses.

formed into 2.5 cm long fringes of 2–4 threads twisted together with closed loops at the ends. They are preserved from ends of the fabric.

In the grave, this type was found almost in one piece, though unevenly preserved. It is almost dissolved in the central parts, whereas the structure of the fabric is clear along edges of the grave. The dark threads are relatively well preserved, though slightly crisp, but the white threads in the stripes have almost disappeared. Only a few stripes have preserved fragments of the weft threads, thus most of the stripes are represented by "empty" warp-threads. The best parts were situated along the south eastern edge of the grave, where several layers of fabric are preserved as folds in a large lump.

The type sandwiches textile 1.5. The warp end reaches further out towards the north-western side in front of the body than textile 1.5, where it forms folds as if "tucked in" along the side of the grave, making the fringes mostly visible on the underside of the textile layers. In the lower layer, it only reaches halfway across the grave (approx. 35 cm) and is pushed up at bit. In this end of the weave, the selvedge seems to be damaged, and due to the relatively good state of preservation of the rest of this end, it may be safe to conclude that it was already damaged before the deposition.

Along the north western edges of the grave this textile is overlaid by textile 1.2.

Technical details: textile, yarn, and fibres

Fibre analyses were made of samples from the warp and the two wefts *(table 42)*. The percentages of fine fibres below 25 microns are 97 % in the ground weft, but in the warp and

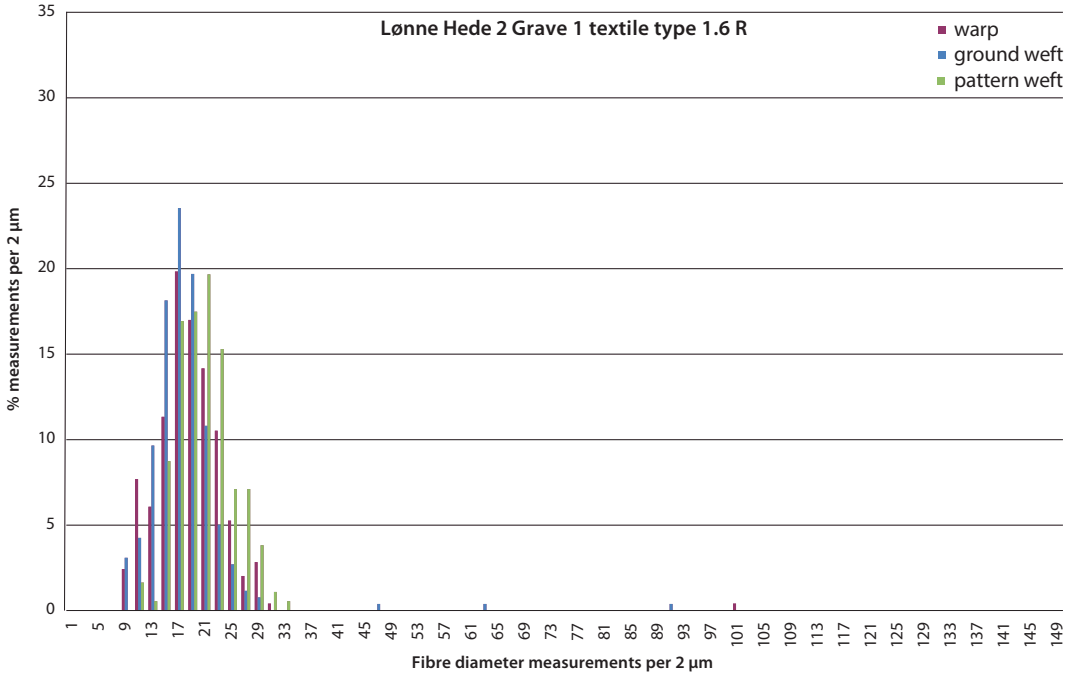


Fig. 72. Histogram of fibre analysis of textile 1.6 R (illustration: I. Skals).

the pattern weft only 94 % and 87 % respectively. The amount of fibres between 25 and 40 microns in these two yarns are significantly higher than in the warp. Outliers are recorded in two of the yarns.

The similarities in the calculations between the warp and the pattern weft are also detectable in the histograms *(fig. 72)*. The histograms are oriented more to the right than any of the above (see also the warp in textile 2.6 and the sample from textile 12.3). The histogram for the ground weft is comparable to the warp in textile 1969.2 (see also the red warp in textile 1969.5, the two samples from textile 1.3 B, the weft and the sewing yarn in textile 1.7, and the warp and weft in textile 12.1).

This brownish-red and white striped textile of at least 99 × 64 cm appears to have functioned as a shawl. It had been wrapped around the back of the deceased with the warp end fringes meeting in front of the chest. Curiously, it appears as though it had been difficult to place correctly: Under the body it only went halfway across, but in the upper layer the remaining fabric was then pulled straight across, and the end was then tucked down along the side.

3.2.7 Textile 1.7

Textile 1.7 is a narrow tabby woven border in wool with one tubular selvedge. It is preserved as six fragments of only few centimetres each and 1.3 cm wide *(fig. 73; tables 43–45)*. They are added to the selvedges of textile 1.5 with overcast stitches.

The border is made of five light brown warp threads and four red which are woven flat with double weft. Next are twelve reddish-brown warp threads woven in tabby and forming a tube. That is, in one shuttling the weft runs through all warp-threads, but before changing the shed, the weft skips twelve warp threads and goes back into the shed formed

Size (cm)	Binding system	Selvedge	Warp end border
1,3 (width)	Half panama/tabby	1 Flat 1tubular	Not preserved

Table 43. Textile 1.7, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count/cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	30–40°	14	0,8	Reddish brown/	Yellow, (luteolin) Dyers broom
Warp	Single	Z	30–40°	14	0,8	Light brown	No dyes detected
Weft	Single	Z	30–40°	4	1	Light brown	No dyes detected

Table 44. Textile 1.7, yarn.

Number	Stitch	Function	Twist direction	Twist angle	Thread diameter (mm)	Stitches / 10 cm	Length of stitch in mm	Dye
Textile 1.7	Whip stitch	Adding the border to the selvedge of textile 1.5	Z,Z	40°	0,8	20	4–5	Not analysed

Table 45. Textile 1.7, sewing thread.

Fig. 73. The best-preserved fragment of textile 1.7. From the NW end of the grave (photo: F. Roberts).

by the first nine warp treads, so that the twelve warp threads form a hollow tube. In textile 1.7, the four warp red threads are all parallel following the same sheds, leaving every second weft-thread visible. From a technological point of view, this is not possible, as they would soon bundle up when the weft is pulled tight. This shows that three warp threads are missing, and the border is made with the methods shown in *figure 53* (textile 1996.5).

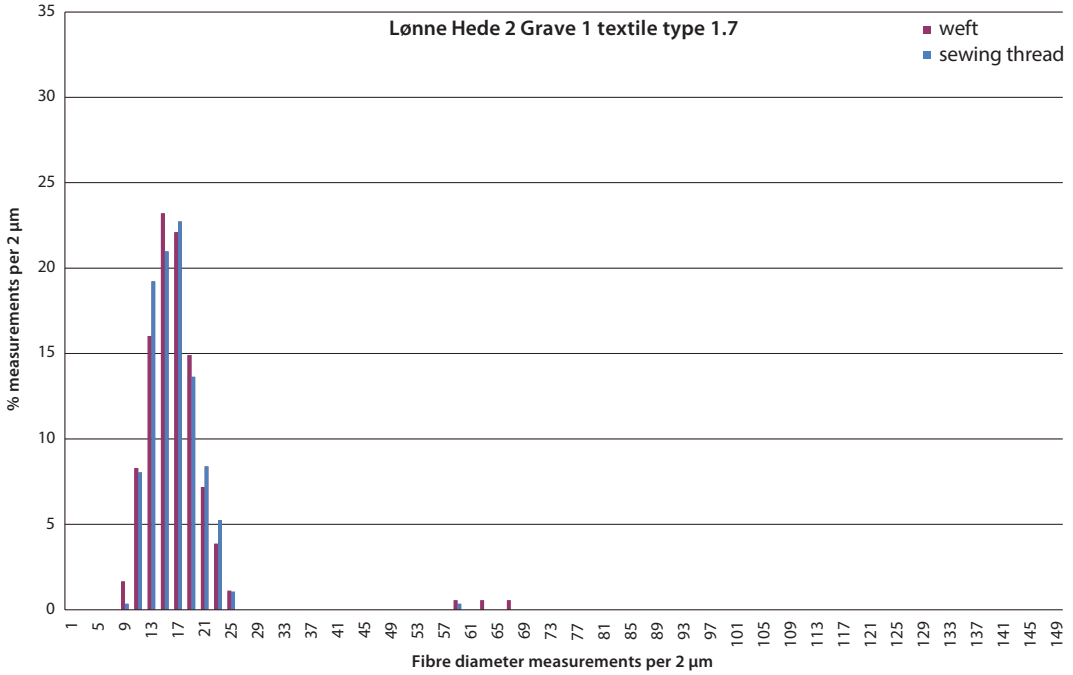


Fig. 74. Histogram of fibre analysis of textile 1.7 (illustration: I. Skals).

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 1.7 weft	98	0	2	15	8–25, 58, 62, 66	181
tx 1.7 sewing thread	99.7	0	0.3	14	9–25, 58	286

Table 46. Textile 1.7, fibre analyses.

Yellow dyestuff (luteolin), probably from dyer's broom, was present in a sample from the dark reddish-brown warp thread (Vanden Berghe 2012).

The borders are stitched to the selvedges of textile 1.5 with evenly distributed whip stitches with two strands of yarn. It is preserved in small fragments along the selvedges of textile 1.5. Three pieces have all threads intact, except for the missing 3–4 warp threads. Other fragments are more damaged with warp threads missing.

Technical details: textile, yarn, and fibres

Fibre analyses were made of samples from the weft and from the sewing thread *(table 46)*. The results are very similar with very high percentages of fine fibres. No fibres between 25 and 40 microns are recorded but a few outliers (not exceeding 66 and 58 microns) are registered.

The histograms are very similar *(fig. 74)* and comparable to the one from the warp in textile 1969.2 (see also the red warp in textile 1969.5, the two samples from textile 1.3 B, the ground weft in textile 1.6 R, and the warp and weft in textile 12.1). The two yarns could be made from similar raw material and with similar processing.

Fig. 75. Grave 2 *in situ* (photo: Varde Museum).

3.2.8 Animal hide

A dark, organic layer of decomposed material was found at the bottom of the grave under the textiles and along the sides. On both side of the textile stratigraphy, patches of parallel fibres from fur were identified.

In the bottom, however, it is present over the patches of fibres from textile 1.2. This was probably a hide with the fur side up that lined the grave.

3.3 Grave 2

On the surface, grave 2 presented itself as a rectangular feature with rounded corners, 186 × 110 cm, oriented NNE–SSW *(figs 75–76)*. The grave was only 32 cm deep. In the southern part of the grave, a stone packing of fist-sized stones was visible, among which a hammer stone (Varde Museum 1272x36) and a whetstone with traces of crushing were uncovered (Varde Museum 1272x36). Above the stones lay several broken potsherds, presumably from the same vessel (Varde Museum 1272x34), perhaps a sacrificial vessel. Beneath the stones, an approximately 1 cm thick layer containing charcoal was found. With the appearance of textiles about 25 cm beneath the surface, the entire grave was extracted in a block.

The grave was placed in a refrigerated container to dry out and was subsequently cleaned *(fig. 77)*. The textile remains were concentrated in the southern part of the grave, while the centre and the northern end of the grave contained three clay vessels. Most likely, the deceased was laid to rest in a hocker position with the head towards the south. The foot-end of the grave seemed to be edged with turf. At the bottom of the grave, 20 small pebbles of different shape and a colour were found *(fig. 77.3)*, among them a single piece of burnt flint. Furthermore, the grave goods included a fragmented iron knife (Varde Museum 1272x128) and three clay vessels *(fig. 78)*: a vessel with handles (Varde Museum 1272x125), an open bowl (Varde Museum 1272x126) and a tiny miniature clay pot (Varde Museum1272x237). The vessel with handles is of fine, black-burnished, tempered clay. The X-shaped handle was placed above the body of the vessel, roughly at its middle, and the rim is thickened and facetted. It is 9.7 cm high with a rim diameter of 13.5 cm. The slightly concave base is 6.6 cm in diameter. The open bowl is made from finely tempered

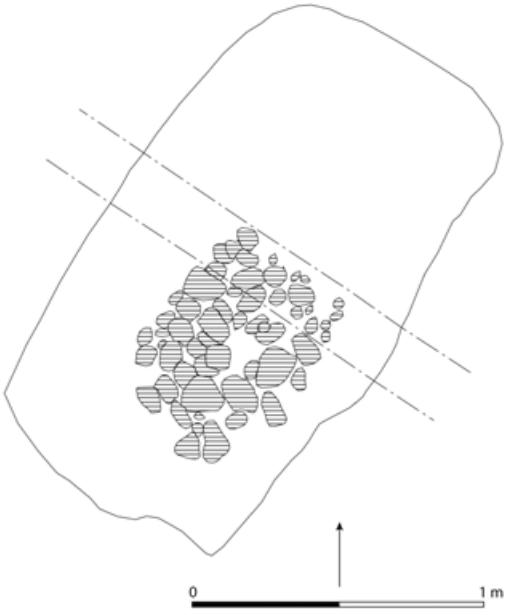


Fig. 76. Outline sketch of grave 2 (illustration: T. Lorange).

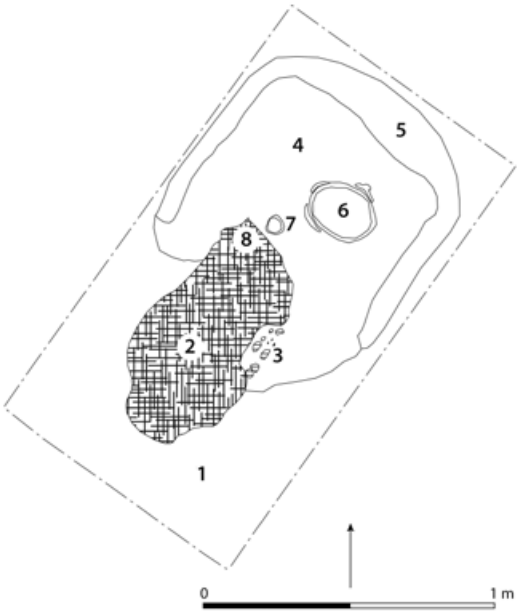


Fig. 77. Outline sketch of grave 2 after the first cleansing at the conservation centre: 1. Pale yellow to reddish brown sand with black iron sedimentation – below ground; 2. the body was most likely covered by textiles. At the top, the textile is very thin and deteriorated in places; 3 area with pebbles; 4. grave infill: greyish brown spotted sand; 5. a darker fill: greyish brown and turf like – possibly as lining of the foot end of the grave; 6. two clay vessels placed one on top of each other, the innermost is a pot with handles, the outermost a shallow bowl which was perhaps utilized as a lid; 7. a little cup; 8. iron knife (illustration: T. Lorange).

Fig. 78. Grave goods in grave 2: three pots and an iron knife. When brought to light, the bowl was inside the vessel with handles (photo: Varde Museum).

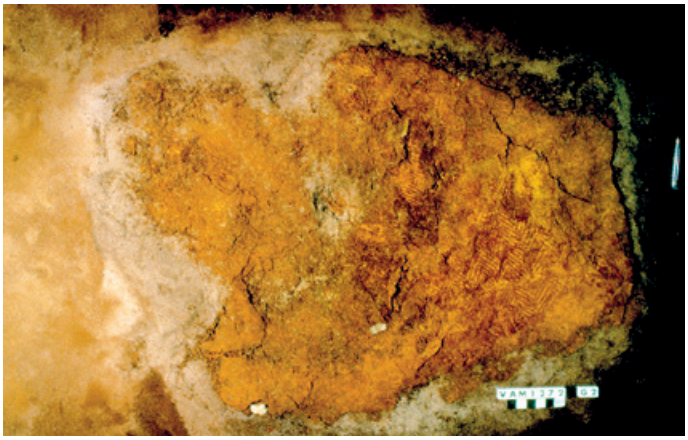


Fig. 79. Grave 2 with the grave goods *in situ* (photo: Konserveringscenter Vest, Ølgod).

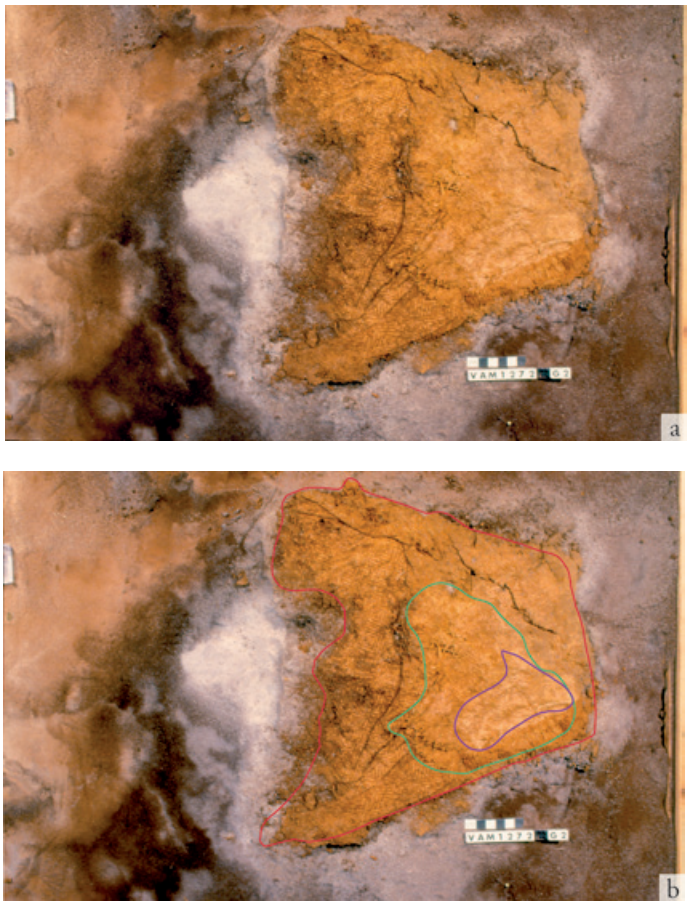


Fig. 80. a. Grave 2 after the textiles have been removed; b. Outlines of textile 2.2 (purple), textile 2.3 (red), textile 2.6 (green). Textile 2.4 was found in the area to the left, where white sand is visible. (photo: Konserveringscenter Vest, Ølgod, and I. Demant).

Size (cm)	Binding system	Selvedge	Warp end border
Many small fragments	2/2 twill	2 twisted warp-threads	Not preserved

Table 47. Textile 2.2, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
1.	Single	Z	40°	6–8	0.9–1	Cream	blue (indigotin) woad
2.	Single	Z	40°	6–8	0,9–1	Cream	Trace of blue (indigotin) woad

Table 48. Textile 2.2, yarn textile.

clay with the exterior changing from a reddish-brown to a greyish-black. The vessel is burnished, and the interior appears worn from use. The rim is thickened, facetted, and slightly inwards sloping. The base has a small foot. Its height is 8.4 cm, the diameter of the rim is 19.3 cm and the diameter of the base is 9.2 cm. The miniature vessel is made of coarsely tempered clay, it is slightly crooked with a rough uneven peeled off exterior and the handle has broken off. The slightly inward sloping rim is poorly preserved. The vessel is 4.4 cm high, with a rim 7.1 cm in diameter and a base of 4.3 cm in diameter.

3.3.1 Overview of the textiles in grave 2

The textiles were concentrated in one half of the grave covering an area of approximately 52 × 40 cm (*figs 79* and *80a*). The textiles are delicate and fragile, but relatively well preserved. Thus, when recovered from the matrix, it was possible to separate most of the fabrics into individual layers allowing for a more thorough analysis.

It was possible to identify four different textiles in this grave *(fig. 80b)*. A brownish-red and white twill weave was wrapped around the back of the deceased as a shawl with the fringes meeting in front of the body (textile 2.3). Each of the feet or part of the legs was wrapped in pieces of fabric cut out of the same tabby weave (textile 2.6). Around the head may have been a headdress in a very thin weave, but size, shape and pattern are unknown (textile 2.4). The grave was lined with a cow hide, which also covered parts of the body. Finally, the grave was closed with a blue twill weave (textile 2.2).

3.3.2 Textile 2.2

This is a 2/2 twill in cream coloured wool the size of which cannot be determined *(fig. 81; tables 47–48)*. The textile has been ^{14}C-dated to AD 80–130 (68.2 % probability, see *table 7*).

There were traces of this textile in the whole area of the grave where textile was preserved. However, the weave was best preserved in an area towards the middle of the grave, from where it could be lifted out as many small fragments.

The weave is relatively coarse and unevenly woven. A tiny fragment shows two twisted threads with little threads poking through each twist. This indicates that the weave had a

Fig. 81. Fragments of textile 2.2 (photo: R. Fortuna).

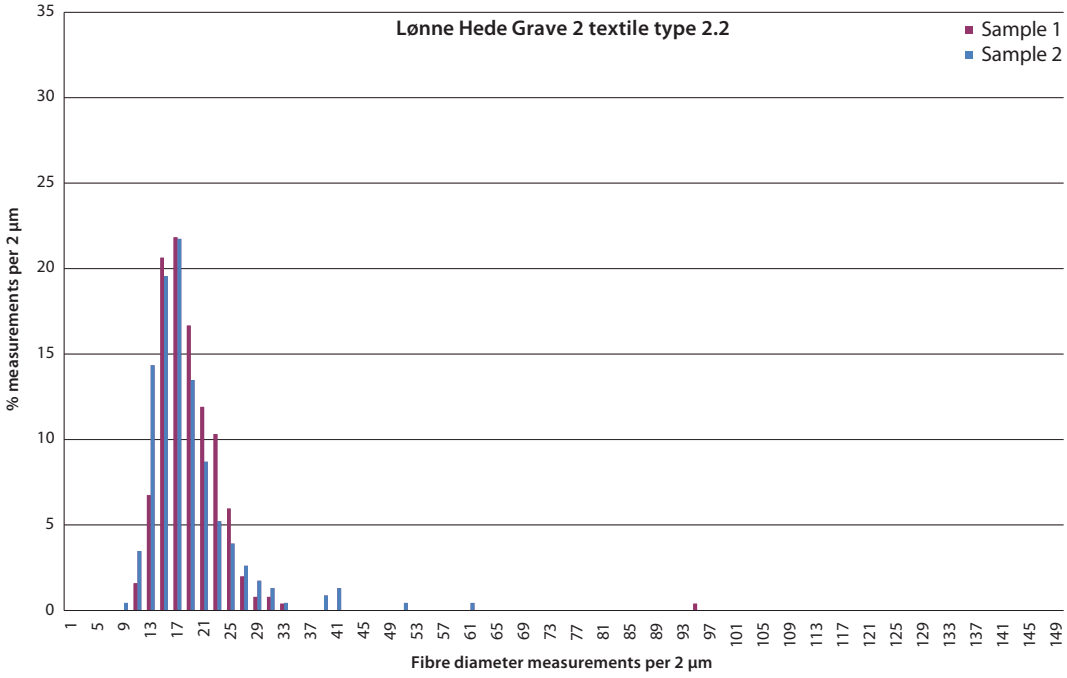


Fig. 82. Histogram of fibre analysis of Textile 2.2 (illustration: Irene Skals).

twist and fringe similar to textile 2.3. There was blue colour present (indigotin) from woad (*Isatis tinctorial* L.) in the yarn of the first direction and trace of indigotin in the second

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 2.2 sample 1	95.5	4	0.5	16	10–31, 33, 94	252
tx 2.2 sample 2	90.4	7.4	2.2	18	9–30, 32, 38, 40, 50, 60	230

Table 49. Textile 2.2, fibre analyses.

Size (cm)	Binding system	Selvedge	Border
42 × 52 (double layer)	2/2 twill, herring bone and diamond	Twisted warp and weft fringe	Two twisted weft threads and warp-end fringes

Table 50. Textile 2.3, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	45–50°	8–9	0,8	Dark reddish brown	No dye detected
Weft	Single	Z	45–50°	9	0,8	Cream	No dye detected
Weft stripe	Single	Z	45–50°	11–14	0,8	Cream	No dye detected
Weft Start and end	Single	Z	45–50°	–	0,8	Dark reddish brown	No dye detected

Table 51. Textile 2.3, yarn.

direction. This shows that the textile was originally a shade of blue (regarding the use and identification of woad and the find of woad seeds in Lønne Hede, see section 4 below and Nordquist / Ørsnes 1971).

This weave covered the remaining textiles in the grave. The trace of fur on the underside shows that it also covered an animal hide.

Technical details: textile, yarn, and fibres

Fibre analyses were made of samples from both yarn systems *(table 49)*. The percentages of fine fibres below 25 microns are 95.5 % and 90.4 % respectively. Some fibres between 25 and 40 microns are recorded in both yarns, as well as a few outliers, though none above 100 microns. The two histograms resemble each other *(fig. 82)* and are comparable to the sample from textile 1969.6 (see also all four yarns from textile 1.5 M and the sample from textile 6.2).

As this blue textile is located all over and above the rest of the textiles in this grave, it is likely that it was used to cover the dead body before closing the grave.

3.3.3 Textile 2.3

Textile 2.3 is a 2/2 twill in dark reddish-brown and cream / white *(fig. 83; tables 50–51)*. It originally covered an area of approximately 52 cm across the grave and 42 cm lengthwise,

Fig. 83. The end of textile 2.3 woven in irregular diamond twill (photo: R. Fortuna).

and was connected in two layers along the north western side of the grave *(fig. 80b)*. It was not equally well preserved in all parts. Only the best parts of both warp ends are preserved. The much-folded lower layer measured approximately 70 cm, including folds resulting from the material behind the back of the dead collapsing as the body decayed. To this the 30 cm of the straight upper layer must be added. The length of the fabric can thus be estimated as at least 100 cm. It was possible to lift two large fragments out of the matrix, representing most of the length of the weave.

At one end, the weave is 2/2 diamond twill (approx. 55 cm), at the other 2/2 herringbone twill. The transition from one pattern to the other is about halfway. Two small fragments indicate fringes on four sides.

The warp threads of the weave are preserved in a dark reddish-brown colour, whereas the weft is cream / white. The colour difference between weft and warp emphasize the diamond and herringbone twill patterns. The pattern reports are irregular in both warp and weft. In the warp, the twill direction mostly changes every 14th warp, but twice the direction is changed after eight threads and after twelve. In the weft, the direction seems even more random. Changes happen after four wefts or after 20. The only rule seems to be that the number is even, both warp and weft-wise.

At intervals of approximately 9–15 cm, this pattern is broken by densely woven white stripes of seven or nine weft-threads – always uneven numbers – in what is in modern weaving referred to as "weft-faced half panama". As in twill weave, the weft passes over and under two warp threads, but by using only every second shed. The weft is made to cover the warp completely.

At each end approximately 4 cm long warp fringes are twisted from two looped warp ends *(fig. 84)*. The transition between the fringes and the weave is marked by weft twists – one end with two single threads, the other end with two double threads. Five further wefts

Fig. 84. Textile 2.3. Twisted warp end fringes (photo: R. Fortuna).

Fig. 85. Textile 2.3. The two outer warp threads are twisted and the weft was extended, probably to form fringes along the selvedge (photo: R. Fortuna).

are added in the same yarn as the warp before the pattern begins with a white stripe. Two small fragments indicate that the selvedge of the fabric also have been fringed, though poor preservation makes it uncertain how long the fringes originally were *(fig. 85)*. On each

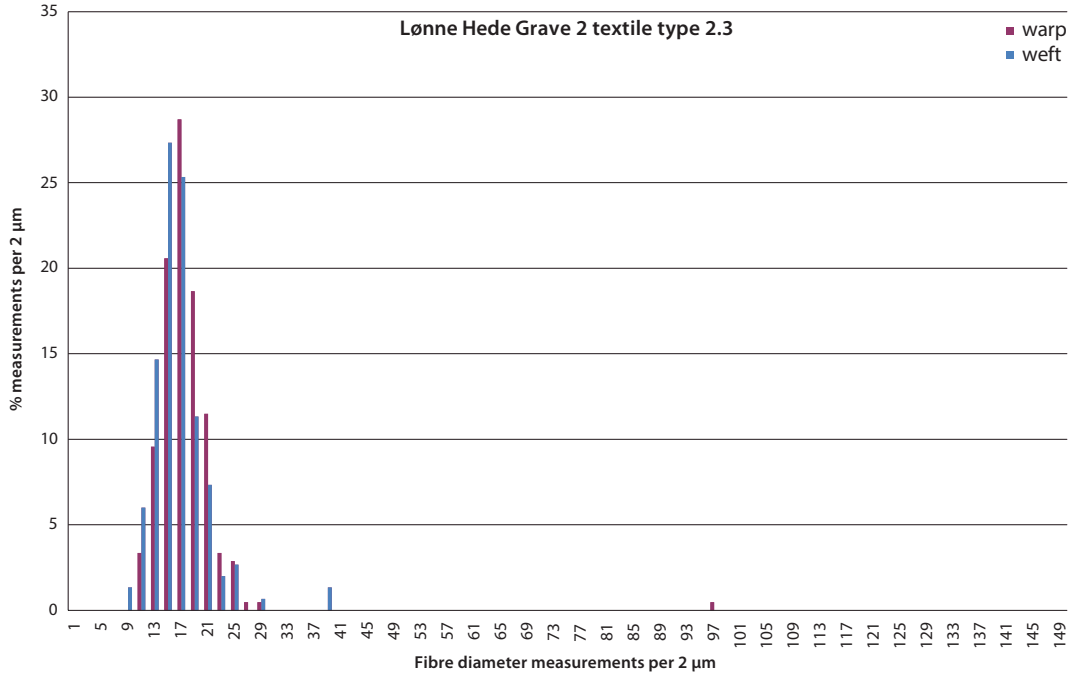


Fig. 86. Histogram of fibre analysis of textile 2.3 (illustration: I. Skals).

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 2.3 warp	98.5	1	0.5	17	11–25, 27–28, 97	209
tx 2.3 weft	98	2	0	15	9–25, 29, 38–39	150

Table 52. Textile 2.3, fibre analyses.

fragment two warp threads have been twisted once for every weft, and the weft threads appear to have been longer, now extending a few millimetres beyond the warp threads. These may be selvedges, though the weft ends do not give any indication of being twisted, as would be expected of fringes, and the exact location of the fragments is uncertain. Alternatively, the twisted warp threads may have run in the middle of the fabric, but the phenomenon is not observed in either of the two large fragments.

The dark reddish-brown threads are relatively well preserved. They are crisp and break easily, but the yarn seems intact. The white/cream coloured weft is more degraded, in some parts completely gone leaving only loose red/dark threads indicating where the textile had been.

This fabric was found under textile 2.2, whereas textile 2.6 was situated partly between the two layers of textile 2.3. Textile 2.4 may also have been above this, near the head.

Technical details: textile, yarn, and fibres

Fibre analyses were made from samples from the warp and weft of this textile with very similar results *(table 52)*. There are high percentages of fibres below 25 microns, very few fibres between 25 and 40 microns and few outliers – only one is recorded in the warp.

Fig. 87. Fragment of textile 2.4. Perhaps a form of foot-wrappings (photo: R. Fortuna).

The histograms for these two yarns are much alike *(fig. 86)* and are comparable to the pattern weft of textile 1969.1 (see also the weft in textile 1969.2, the red warp in textile 1969.3, the red yarn in textile 1969.4, and the weft in textile 2.6).

This red and white textile of approximately 100 × 52 cm appears to have been wrapped around the back of the dead body, like what today would be called a shawl, and with the fringes meeting in front of the chest.

3.3.4 Textile 2.4

This wool textile is preserved in a lump of organic material of approximately 4 × 6.5 cm *(fig. 87; tables 53–54)*. The weave is tabby in relatively thin thread. It was located on a little heap of sand where the head is assumed to have been *(fig. 79)*. It is visible from two sides of the lump. On the top side there is 1 cm^2 of relatively well-preserved white tabby with a few very thin orange-red two-ply threads stitched through in both directions. The rest of the surface is covered in broken white threads.

In places on the underside of the lump, the textile resembles textile 2.3 and might be part of this. There are dark warp threads and white weft of the same dimensions as in textile 2.3. It is even possible to identify a dense weft stripe. Next to this, a part with very thin light orange-red two-ply threads in rep-like weave runs parallel to the darker warp. The few fragments of weft are white.

The state of preservation is extremely bad as most of the cream coloured threads were broken into small fragments. It was covered in and held together by the flotation layer-debris. The textile may be resting on a layer of textile 2.3.

Size (cm)	Binding system	Selvedge	Border
unknown	Tabby	Not preserved	Not preserved

Table 53. Textile 2.4, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
1	two ply	S-z,z	40–45°	9 / 4 mm	0,35	Orange	Not analysed
2	Single	Z	40–45°	–	0,5	Crème	Not analysed

Table 54. Textile 2.4, yarn.

Size (cm)	Binding system	Selvedge	Border
Approx. 9 × 9 Unfolded approx. 9 × 25–30	Tabby	Not preserved	Fringed border, with one row of weft-twine.
Folded: 15 × 12 Unfolded approx. 15 × 30	Tabby	One flat	Not preserved

Table 55. Textile 2.6, technical details textile.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	40–50°	9	0,8	Cream	No dye detected
Weft	Single Occasional double.	Z	40–50°	7	0,7	Cream	No dye detected

Table 56. Textile 2.6, yarn.

It has been suggested that this fragment was part of a kind of a garment serving as a head-covering of unknown size and pattern. The thin threads may be a woven tabby-rep band.

3.3.5 Textile 2.6

This consists of two pieces of tabby weave in cream colour *(fig. 88)* found on top of each other. Each is folded like a tube, but they are probably cut from the same fabric *(tables 55–56)*.

The lower and largest piece was folded into a triangle with one corner cut off. In folded state it measures approximately 15 × 7–15 cm. The original shape of the fabric was

Fig. 88. The layers of textile 2.6 (photo: R. Fortuna).

rectangular, measuring approximately 15 × 30 cm with irregular cut edges on three sides and part of a selvedge along a fourth side. It is now folded like a tube. The tube is open at one side and at the bottom. To form the tube, the fabric was folded double along the short side. Near the ends of the fabric, each of the two layers were then folded diagonally and the excess material of at least one of the ends tucked inside. It is possible that it was stitched along the diagonal line, but no stitches or stitch marks are preserved.

The upper piece is smaller, only approximately 9 × 9 cm, but also folded as a tube and open at both ends. The textile was first folded double, then the ends of the two layers were folded back in a slanting line. It resembles the lower piece, though the excess fabric is not tucked inside the tube but is visible on one side and there is less of it. This piece was probably originally approximately 30 cm long, but the width is impossible to determine. Along the opening of the tube are parts of a finishing or starting border with fringes made of warp ends and one row of weft twine. Together the two pieces form an almost isosceles triangle with one corner pointing towards the bottom of the grave. The fringed / frayed openings of the two pieces form a rounded corner which point upwards to the southwestern part of the grave.

The textile was relatively well preserved and seems to have maintained most of its original shape. The fabric displays signs of wear along one short edge, as only part of a selvedge is preserved in the fabric that is tucked in. Furthermore, the cut edges seem worn and irregular.

The two weaves were found at the bottom of the textile area, partly between the two layers of textile 2.3. Much fur was preserved both on top and below the textile, as well as between the two pieces.

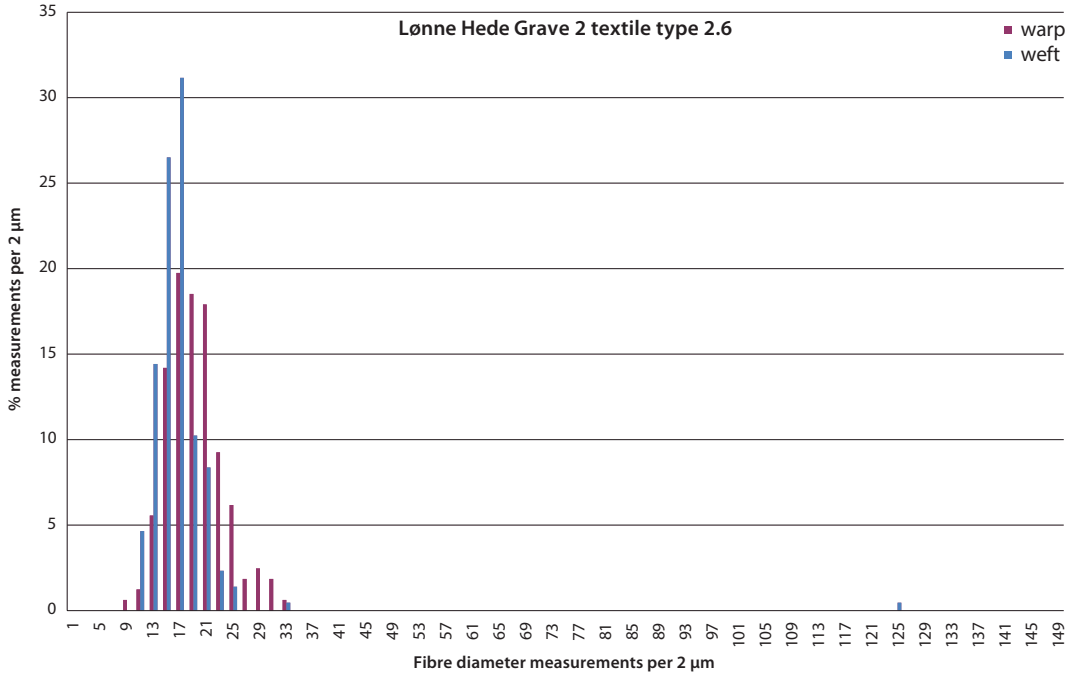


Fig. 89. Histogram of fibre analysis of Textile 2.6 (illustration: I. Skals).

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 2.6 warp	93	7	0	17	9–26, 28–31, 33	162
tx 2.6 weft	99	0.5	0.5	16	10–23, 25, 32, 125	215

Table 57. Textile 2.6, fibre analyses.

Technical details: textile, yarn, and fibres

Fibre analyses were made from samples from the warp and weft *(table 57)*. The results indicate differences in the raw material. The sample from the warp has a lower percentage (93 %) of very fine fibres and a high percentage (7 %) of fibres between 25 and 40 microns. In the sample from the weft the numbers are 99 % and 0.5 % respectively. The percentages of outliers are minimal.

These differences are also expressed in the histograms *(fig. 89)*. The one from the weft is comparable to the pattern weft of textile 1969.1 (see also the weft in textile 1969.2, the red warp in textile 1969.3, the red yarn in textile 1969.4, and both yarns in textile 2.3), whereas the histogram for the warp resembles the warp and the pattern weft in textile 1.6 R (see also the sample from textile 12.3).

The function of these two pieces is uncertain, but the folding and the situation in relation to textile 2.3 suggest that they functioned either as leg or feet wrappings.

Fig. 90. Grave 3 is seen in the front of the photo. In the background by the measuring scale, the looter's tunnel disturbing the foot end of the grave is visible (photo: Varde Museum).

3.3.6 Fur

Layers of animal hair are found in several places in the grave. They are most abundant on textile 2.4. The hairs are long, straight, and relatively thick compared to the wool-fleece in the woven textiles. They are probably from cow.

Only the hairs are preserved, though the leather may be present as a brown layer underneath the hairs found under textile 2.3. Animal hairs are registered under the lower layer of textile 2.2, under textile 2.3 and in abundance on textile 2.4.

The size of the hide is unknown, but it may have lined the grave under the deceased with the sides folded over before textile 2.2 was laid down on top.

3.4 Grave 3

In plan, grave 3 forms an L-shaped feature appearing dark grey against the lighter grey. At first, the feature was interpreted as two inhumation graves with G4 cutting across grave 3. At a deeper excavation level, it became evident that it was not two separate graves, but that a looter's trench was dug into the south-western part of grave 3 *(figs 90–91)*.

The grave measured 220 × 104 cm, oriented NW–SE. Covering the grave fill was a stone packing similar to graves 1 and 2, and beneath the stone packing a layer with charcoal appeared, as in grave 2. Further down, several tightly packed stones were uncovered – primarily along the edge of the grave. At the bottom there was a massive oak plank-built coffin measuring 210 × 68 cm. The grave was excavated *in situ* up to the bottom planks in the south end by the looter's trench – the presumed foot end – while the upper end was left untouched, as the excavators found what they interpreted as traces of textiles *(figs 92–93)*. The entire coffin was retrieved in a soil block.

Upon excavation at the conservation centre, it became apparent that the remains initially interpreted as textiles were in fact remains of the coffin. The timber of the coffin was black on the exterior whilst reddish-brown and fibrous in the interior, and was thus mistaken for textile remains. Presumably, the deceased had been dragged out through the

Fig. 91. Outline sketch of the top area of grave 3. 1. looter's trench; 2. Grave fill; 3.–4. yellow sand along the edge of the grave (illustration: T. Lorange).

looter's hole at the side of the coffin. It must have happened soon after the inhumation, as everything had been removed – not a shred of textile was left behind. Only the pieces of the smashed pots in the southern end and fatty black traces of remains (assumed to be a wooden bowl) at the foot end were found. The coffin was preserved to a height of 7–12 cm with oak planks of a maximum thickness of 1.5 cm.

The coffin was impregnated with PEG 2000. At the bottom of the coffin, in the grave fill, and around the looter's hole sherds from five ceramic vessels were found (Varde Museum 1272xC40, x42, x114). The potsherds derived from a small open bowl and a handled bowl with a slightly X-shaped handle. Almost a complete large pot with a rim diameter of over 30 cm with a large, thickened, facetted rim and a slightly loose base (Varde Museum 1272x47) was found at the centre of the coffin. In the southwestern corner, a flat, open dish with a slightly thickened, facetted rim with a diameter of approximately 17 cm came to light (Varde Museum 1272x115). Noteworthy are also two natural stones placed at the bottom of the grave-pit immediately outside the coffin to the north *(figs 92–93)*. The stones of light-coloured fine-grained rock had faint traces of crushing. They are very similar, almost white and measuring 13 cm and 14.5 cm in diameter respectively. They were apparently chosen with great care and placed outside the coffin as supports for the grave gable. Based on the ceramics, the grave belongs to the Early Roman Iron Age. An unsuccessful attempt was made at dendrochronological dating of the planks of the coffin.

No textiles were found in this grave.

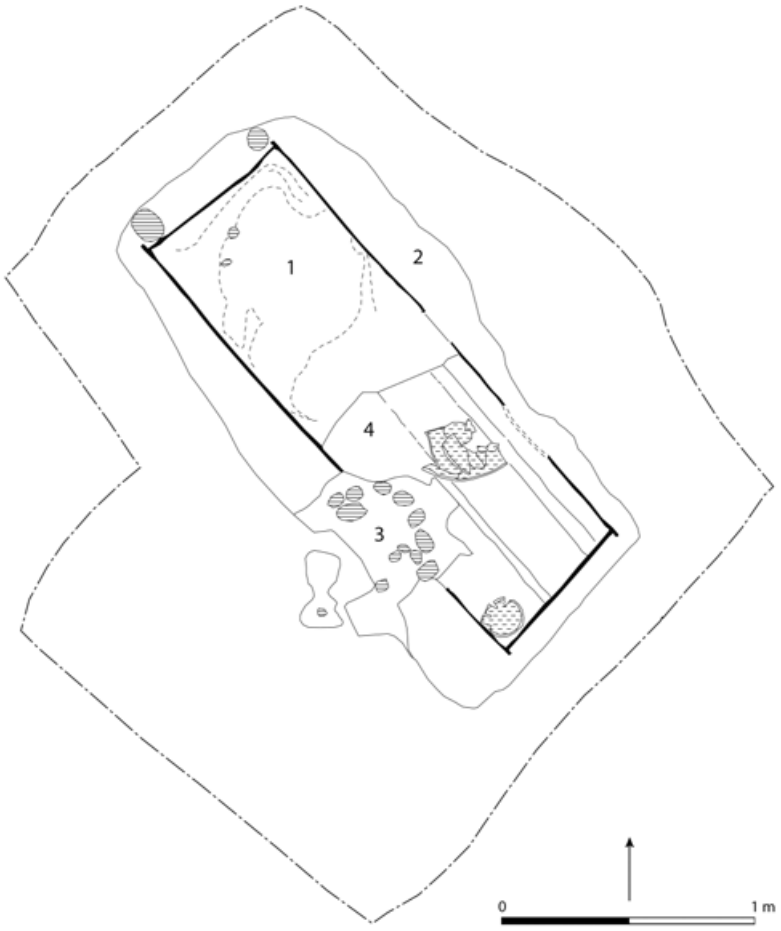


Fig. 92. Outline sketch of grave 3, bottom level. 1. Greyish-black fatty material, which includes disintegrated wooden residue; 2. the grave pit's fill of mixed greyish white sand; 3. the looter's hole filled med subsoil? and fist-sized stones; 4. the bottom of the coffin comprising longitudinal oak planks, with quite a few potsherds in it (illustration: T. Lorange).

Fig. 93. Grave 3, cleansed *in situ*, prior to being lifted in a soil block (photo: Varde Museum).

Fig. 94. Grave 6 during excavation (photo: Varde Museum).

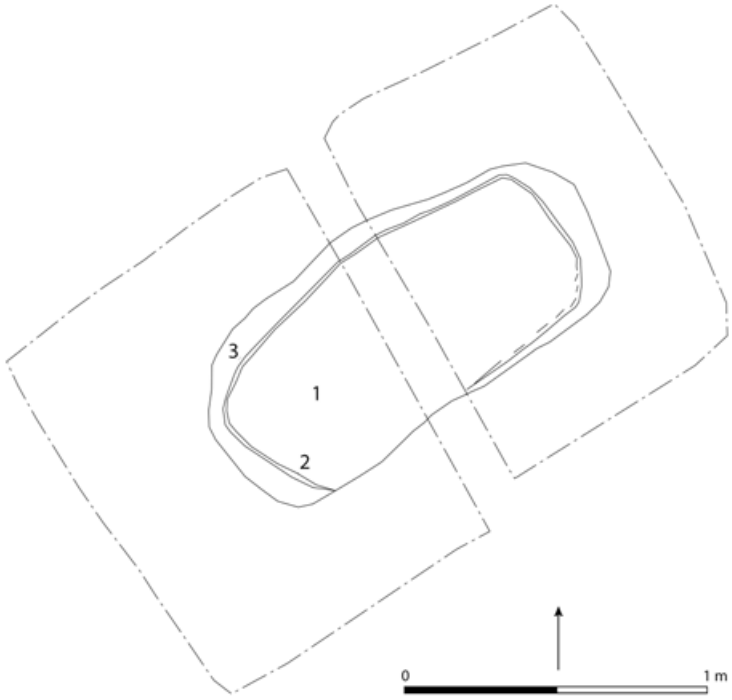


Fig. 95. Outline of grave 6: 1. Grave fill of mulch mixed sand; 2. decayed animal hide; 3. grave fill (illustration: T. Lorange).

3.5 Grave 6

Grave 6 presented itself as a smaller, oval feature with a few potsherds. It measured 144 × 64 cm at the surface and was oriented NE–SW. It was 53 cm deep. At an early stage of the excavation, a black fatty residue was interpreted as a plank coffin, but turned out to be the remains of an animal hide folded out up along the grave's sides for the body of the deceased to be placed upon *(figs 94–95)*. A faint contour at the bottom of the grave

Fig. 96. Outline sketch of grave 6 after cleansing at the conservation centre. 1. At the head end traces of reddish-brown organic material interpreted as animal hide and textile remains; 2. at the foot end of the grave decayed organic material – most likely remains of an animal hide; 3. faint contours of the body. 4) Flaxen hair in two delineated areas. The hair presumably lay on the back of the cranium in the form of a twisted hairstyle. 5) Small clumps of wood fibres. 6) a bone comb (illustration: T. Lorange).

revealed a person lying crouched in a hocker position on the right-hand side with the face towards the south-east.

The excavation *in situ* was halted when textile and hair appeared. Grave 6 was not placed in the refrigerated container but stored at ordinary room temperature until excavated at the conservation centre *(fig. 96)*. The human hair formed two flaxen knots with a fine blue fabric beneath *(fig. 97)*. Textile remains were few. In connection with the renewed analysis, the remains of a bone comb were recovered from a soil sample containing decomposed textiles *(fig. 98)*.

3.5.1 Overview of the textiles in grave 6

The preserved textiles covered an area of approximately 65 × 44 cm. Everything was covered in a layer of a brown substance of decomposed organic material. Much hair from fur was preserved over most of the grave in connection with the brown substance. Between the layers of fur and organic material were layers of woven wool textile. As this grave was not freeze-dried but left to dry, the textiles are collapsed and pressed together into one hard layer impossible to separate and, consequently, making analysis difficult *(fig. 99; tables 58–64)*.

Three different textiles could be identified, but due to the relatively poor state of preservation, it is impossible to make any detailed conclusion regarding dress. It can only be stated that at the time of deposition the body was covered or wrapped in a light twill weave with red spots of yarn, perhaps from a hem or a form of embroidery (textile 6.2). Behind the head of the deceased was another textile (textile 6.3), which does not seem to be part of the garments.

Fig. 97. The hair consisted of two flaxen knots with a fine blue fabric beneath (cf. *fig. 156)* (photo: Konserveringscenter Vest, Ølgod).

Fig. 98. A decayed bone comb from grave 6 (photo: Konserveringscenter Vest, Ølgod).

Fig. 99. Grave 6 with the textiles uncovered. The buns of hair are in the bottom of the picture. The comb was found approximately 10 cm above these (photo: Konserveringscenter Vest, Ølgod).

The head and hair were covered in a very thin twill weave (textile 6.1) dyed blue. Fur lined the grave.

3.5.2 Textile 6.1

This is a 2/2 twill of unknown size. It was identified in two areas: in the middle of the grave in front of the body as two fragments and along the north western side as one piece. The colour is light orange, but most significant are the red threads appearing on all the fragments *(fig. 100; tables 58–59)*. At times, they look like stitches, but the sporadic appearances make it impossible to make out any seams. In front of the body, they run across an elongated fragment (approx. 4 cm) in four bundles of two threads – they may represent fringes or perhaps remnants of embroidery.

In the red threads both blue and yellow dyestuff from woad and dyer's broom respectively was present (cf. analysis in section 4 below).

The textile is heavily degraded, and analysis for technical details was only possible in a few places. It was found between the layers of fur and can probably be interpreted at the main garment of the deceased.

Fig. 100. Textile 6.1 with stitches of red yarn (photo: R. Fortuna).

Size (cm)	Binding system	Selvedge	Border
–	2/2 twill	Not preserved	Not preserved

Table 58. Textile 6.1, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp (?)	Single	Z	40°	8	0,6–8	Light	Not analysed
Weft (?)	Single	Z	40°	8	0,6–8	Light	Not analysed
Stitch-yarn	Single	Z	40°	–	0.6–8	Red	Woad Dyers broom

Table 59. Textile 6.1, yarn.

3.5.3 Textile 6.2

This textile represents the finest textile recorded at Lønne Hede. It is a woven wool textile in 2/2 twill. It is preserved primarily as two fragments, each 2 × 2 cm in size *(fig. 101; tables 60–61)*. The yarn in one direction is remarkably thinner than normal for this site, whereas the yarn in other direction is about the same as in most of the Lønne-textiles. The colour is still visible as a bluish-green sheen over the textile, and blue dyestuff from woad was detected.

The textile was found under and on top of the braided buns of hair. Best preserved are the two 4 cm^2 fragments, but there are traces of it all around; under the knots it is visible as small patches of bluish-green textile. Under the upper bun, three folds overlapped. Each appears to have been folded diagonally under the bun.

This textile does not seem to have been in contact with the other textiles in the grave.

Fig. 101. Textile 6.2. Blue 2/2 twill found on top of the buns of hair (photo: R. Fortuna).

Size (cm)	Binding system	Selvedge	Border
Two fragments of 2 × 2	2/2 twill	Not preserved	Not preserved

Table 60. Textile 6.2, technical details textile.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	45°	16	0,5	Bluish Green	Woad
Weft	Single	Z	45°	9	0,8	Bluish Green	

Table 61. Textile 6.2, yarn.

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 6.2 Sample 1	88.5	11.5	0	20	8, 10–30, 32	156

Table 62. Textile 6.2, fibre analyses.

Technical details: textile, yarn, and fibres

A sample from one of the yarns in this textile was analysed and the results show a low percentage of very fine fibres below 25 microns and a high percentage of fibres between 25 and 40 microns *(table 62)*. No outliers were recorded.

The histogram *(fig. 102)* has a very uneven curve and somewhat resembles the sample from textile 1969.6 (see also the four yarns in textile 1.5 M and the two samples from textile 2.2).

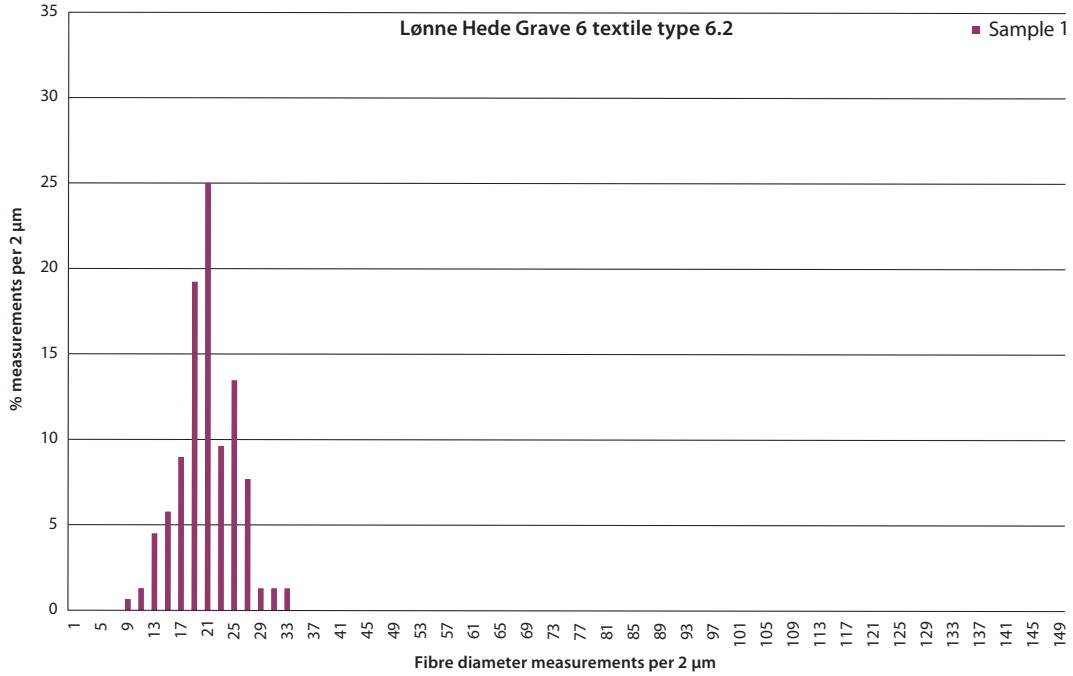


Fig. 102. Histogram of fibre analysis of Textile 6.2 (illustration: I. Skals).

Size (cm)	Binding system	Selvedge	Border
12 × 8	2/2 twill	Not preserved	Not preserved

Table 63. Textile 6.3, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp (?)	Single	Z	50°	6	1	Light orange	Not analysed
Weft (?)	Single	Z	50°	6	1	Light orange	Not analysed

Table 64. Textile 6.3, yarn.

3.5.4 Textile 6.3

This is a woven wool textile in 2/2 twill of a light colour. It was identified along the north-western part of the grave (behind the back of the body trace) between layers of fur. It has only been possibly to study in small areas where the fur has been scraped off. It appears to represent a third textile, as the threads are thicker and spun harder than in textile 6.1 and textile 6.2 *(tables 63–64)*.

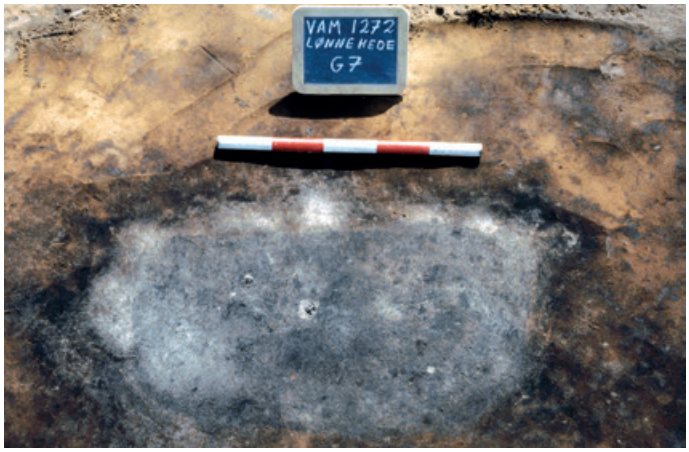


Fig. 103. A child's grave, grave 7, in *situ* (photo: Varde Museum).

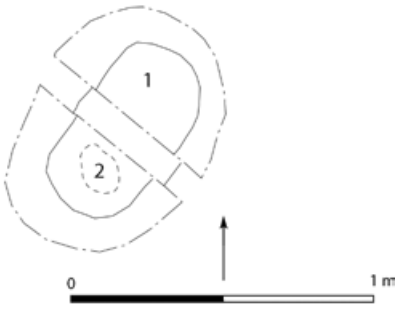


Fig. 104. Outline sketch of a child's grave, grave 7. 1. Grave fill of greyish black charcoal containing sand; 2. faint traces of textiles (illustration: T. Lorange).

3.5.5 Animal hide

Hair from animal fur was preserved on both sides of the textiles. The hair layers were covered by the organic layer of flotation debris. In some places, flakes of the hide surface seem to be preserved. The colours of the fur vary between light and dark, with the darker hairs appearing in patches.

3.6 Grave 7

Grave 7 emerged as a little oval marking measuring 70 × 38 cm, oriented NNE–SSW. Given its diminutive size, it was interpreted as a small child's grave. The grave was only 11 cm deep and had lightly rounded bottom and sides *(figs 103–104)*. As faint traces of textiles were discerned in its southern end, the entire grave was recovered in a block of soil. This grave was not placed in the refrigerated container. After cleansing at the conservation centre, it appeared as though the body had been laid on the animal hide and covered with a textile. This textile was poorly preserved and fragmented. However, it is remarkable that even such a tiny and shallow burial of a child could contain textiles.

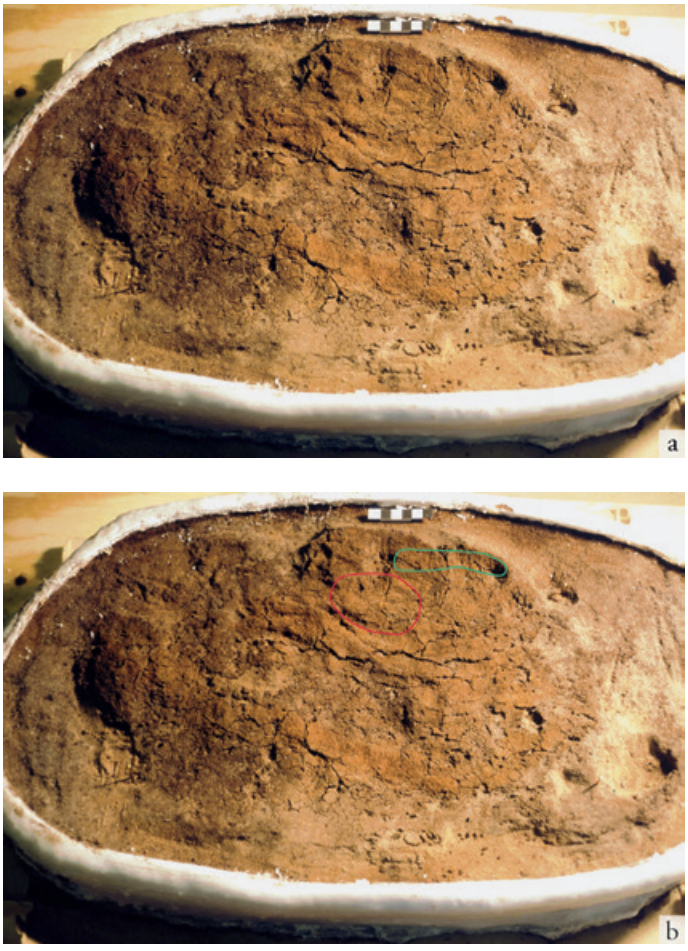


Fig. 105. The paraffin-capped grave 7: a. slightly cleansed – textile remains are clearly evident; b. outlines of textile 7.1 (red) and textile 7.2 (green) (photo: Konserveringscenter Vest, Ølgod, and I. Demant).

3.6.1 Overview of the textiles in grave 7

Textiles were found all over the grave covering an oval area of approximately 40 × 20 cm, and it was possible to identify three different weaves *(figs 105a–b)*. They were much degraded and covered in flotation debris. It has only been possible to clean off one side of the layers as it is estimated that it is only held together by the sand and debris. If this is removed, the textiles will fall apart.

The dead body, which was of a small child, was wrapped in two layers of fabric. The outer layer is darker reddish-brown twill weave, probably striped in a warp-covering tabby (textile 7.2). Along a transverse edge a seam or border was added in "pick and pick"-pattern, similar to the one described in textile 1.5. The textile appears to have been a fragment of a larger garment with long untwisted warp end fringes at the opposite edge. The inner textile was a grey looking twill weave. Long floating threads crossing the surface make it appear worn (textile 7.3). Indications of a weft-stripe in twill in this weave suggest that the two layers may be part of the same textile. The grave had probably been lined with a coarse tabby weave, which was only visible in the corner (textile 7.1).

Component	Size (cm)	Binding system	Selvedge	Border
Wool	2 × 2	Poss. Tabby	Not preserved	Not preserved

Table 65. Textile 7.1, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Singe	Z	45°	8	1	White	No dyes detected
Weft	Single	Z	45°	8	1	White	No dyes detected

Table 66. Textile 7.1, yarn.

Material	Size (cm)	Binding system	Selvedge	Border
Wool	–	2/2 twill	Not preserved	1 torn edge

Table 67. Textile 7.2, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Double	Z	45	4	0.7	orange brown	No dyes detected
Weft	Single	Z	45	9 (18)	0.7	reddish brown	No dyes detected

Table 68. Textile 7.2, yarn.

Component	Size (cm)	Binding system
Wool	11 × 1.2	Weft faced tabby

Table 69. Textile 7.2, seam.

3.6.2 Textile 7.1

This is possibly a tabby weave preserved as a 2 × 2 cm fragment in one corner of the block *(fig. 105b)*, but traces of textile 7.1 appear in several places on top of the other textiles, mostly recognised as coarse looking undyed fibres with kemp *(tables 65–66)*.

The textile lies on top of the other textiles in the grave and has been ^{14}C-dated to AD 128–214 (68.2 % probability, see *table 7*).

3.6.3 Textile 7.2

Textile 7.2 is a 2/2 twill weave of an orange-brown colour. It is preserved in one half of the grave with an edge running across the grave. The 1–2 cm long unplied warp ends floating out of the weave suggest that it is a torn edge *(tables 67–69)*.

Fig. 106. Textile 7.2. Fragment of a seam or border (photo: R. Fortuna).

A possible weft stripe of approximately 1 cm width is visible close to the edge. All yarn has disappeared, leaving empty warp threads. These are paired, showing that the stripe was woven as weft-faced tabby rep.

Opposite the torn edge are fragments of a seam or border similar to that described for textile 1.5. The preserved piece is 11 cm long and 1.2 cm wide *(fig. 106)*. It is made with two single yarns in an orange colour and only every second weft of the "pick and pick" yarn is present, which is reddish-brown and relatively well preserved. The presumed other half is completely decomposed.

The textile is only well preserved in parts. Most of it is too degraded for analysis, being imbedded in flotation debris and only recognisable by its colour and the fact that it is situated in immediate proximity to the better-preserved parts.

It was identified under textile 7.1, but above textile 7.3.

3.6.4 Textile 7.3

This is a grey possible 2/2 twill, which is very much degraded. It appears much worn with long threads floating on the surface as if the threads in the other system have been worn off *(tables 70–71)*.

In one part, the threads look like empty warp threads from twill weave very much like some of the empty stripes described for textile 12.2. Thus, it is possibly the same textile as textile 7.2.

It was identified below textile 7.1 and textile 7.2.

3.7 Grave 8

Grave 8 presented itself as a rectangular to oval feature measuring 146 × 84 cm, oriented WNW–ESE. It was 62 cm deep. It was initially excavated *in situ*, but when traces of a

Component	Size (cm)	Binding system	Selvedge	Border
Wool	12 × 6	Possibly twill	–	–

Table 70. Textile 7.3, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Singe	Z	45°	?	0.7	Grey	No dye detected
Weft	Single	Z	45°	?	0.7	Grey	No dye detected

Table 71. Textile 7.3, yarn.

body appeared, the grave was recovered as a soil block. The deceased was placed crouched in a hocker position on its right side with the face turned towards the south-southwest *(figs 107–108)*. The grave was recovered as a soil block primarily for exhibition purposes, but cleansing at the conservation centre revealed several textile fragments. Some were loosened and extracted, but the most deteriorated fragments were left in the soil block and impregnated along with the traces of the body. No grave goods were recovered, but the body had been placed on an animal hide, which, however, was too decayed to be analysed. The few textiles revealed that the deceased had been dressed.

3.7.1 Overview of the textiles in grave 8

It was possible to identify three types of weave in the grave: one type in the area over the cranium, and two types could be identified below the hips. They were poorly preserved and difficult to analyse. Consequently, the very poorly preserved textiles do not allow for any real conclusions regarding clothing. The body was placed in a hocker position and there were indications of a scarf similar to textile 1969.1 or textile 2.3 wrapped around the head. The body had probably originally been covered by one or two twill weaves.

3.7.2 Textile 8.1

Textile 8.1 is a 2/2 twill weave of dark reddish-brown and white colour. Neither the size nor extent of the textiles in the grave can be determined. The textile is only preserved in the area above the cranium, where it is found in several layers, but very poorly preserved. One thread system was made in dark reddish-brown and hard-spun yarn. By separating the layers, it was possible to identify preserved areas with white undyed yarn of the second thread system and to determine the weave. However, due to the bad state of preservation it is impossible to determine whether the white represents stripes or the entire second thread system *(tables 72–73)*.

3.7.3 Textile 8.2

Textile 8.2 is also a 2/2 twill of indeterminable size, but of undyed wool. The textile is much degraded and only visible in the area below the hips as small patches overlaying

Fig. 107. Grave 8 during excavation. The bottom level was cleansed in situ, and the position of the body is clearly seen as a cohesive mass of sand with a trace of body fat (photo: Varde Museum).

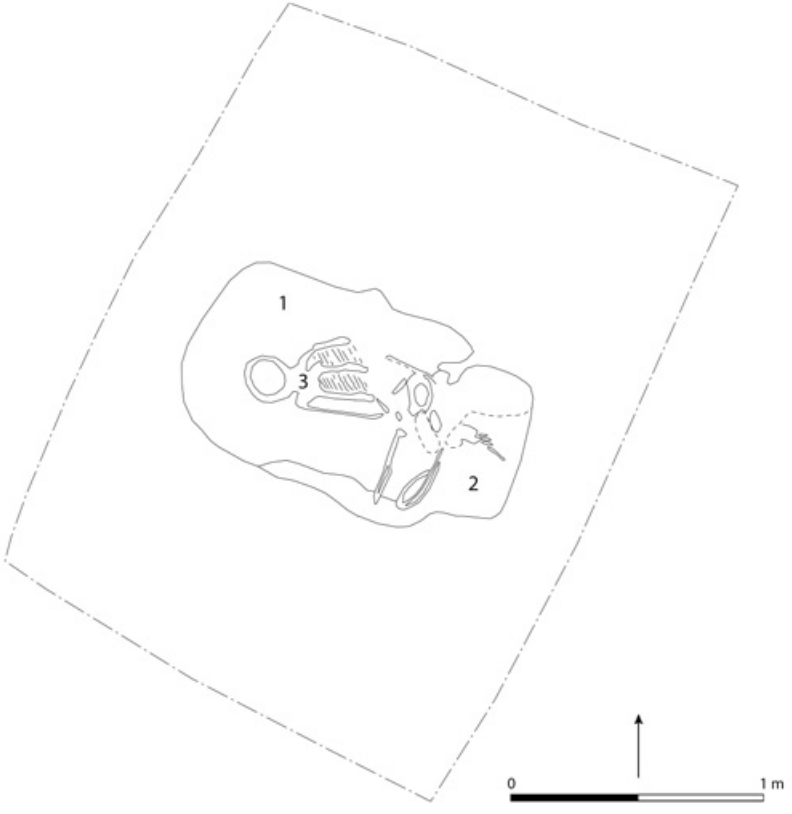


Fig. 108. Sketch of the bottom level of grave 8: 1. Greyish-brown fatty deposit, decayed remains of animal hide; 2. grave fill of spotted sand; 3. sketch of the body (illustration: T. Lorange).

Component	Size (cm)	Binding system	Selvedge	Border
Wool	–	2/2 twill	Not preserved	Not preserved

Table 72. Textile 8.1, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	45°	9	0.8	Reddish brown	Not analysed
Weft	Single	Z	40°	9	0.8	white	Not analysed

Table 73. Textile 8.1, yarn.

Component	Size (cm)	Binding system	Selvedge	Border
Wool	–	2/2 twill	Not preserved	Not preserved

Table 74. Textile 8.2, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	45°	–	1,0	White	Not analysed
Weft	Single	Z	45°	–	1,0	White	Not analysed

Table 75. Textile 8.2, yarn.

Component	Size (cm)	Binding system	Selvedge	Border
Wool	–	2/2 twill	–	–

Table 76. Textile 8.3, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
1.	Single	Z	45°	8	1,0	Reddish brown	–
2.	Single	Z	45°	?	0,8	Reddish brown	–

Table 77. Textile 8.3, yarn.

textile 8.3. A count of threads per cm was not possible, but it does seem to be of the same quality as most of the textiles in Lønne Hede. This textile was found overlaying the layers of textile 8.3 *(tables 74–75)*.

3.7.4 Textile 8.3

This is a 2/2 twill weave in a light reddish-brown colour. Neither the size nor extent of the textiles in the grave can be determined. It is only preserved in the area below the hips as three small fragments of approximately 3–5 × 2 cm. The number of threads per cm can only be counted in the first thread system; however, the weave appears relatively dense *(tables 76–77)*. It could be noted that the dark threads are relatively well preserved.

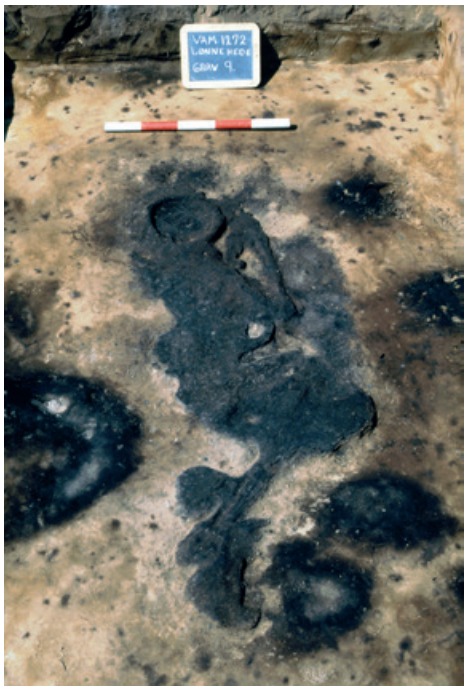


Fig. 109. Outline of grave 9, bottom level. The position of the body is seen as a cohesive mass of sand holding traces of body fat residue (photo: Varde Museum).

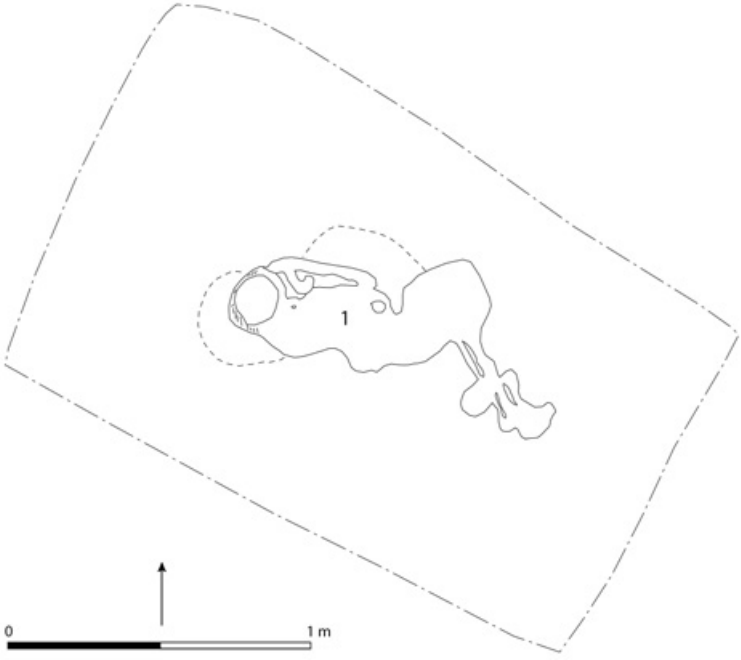


Fig. 110. Sketch outline of grave 9, bottom level. The position of the body is seen as a cohesive mass of sand holding traces of body fat residue (1) (illustration: T. Lorange).

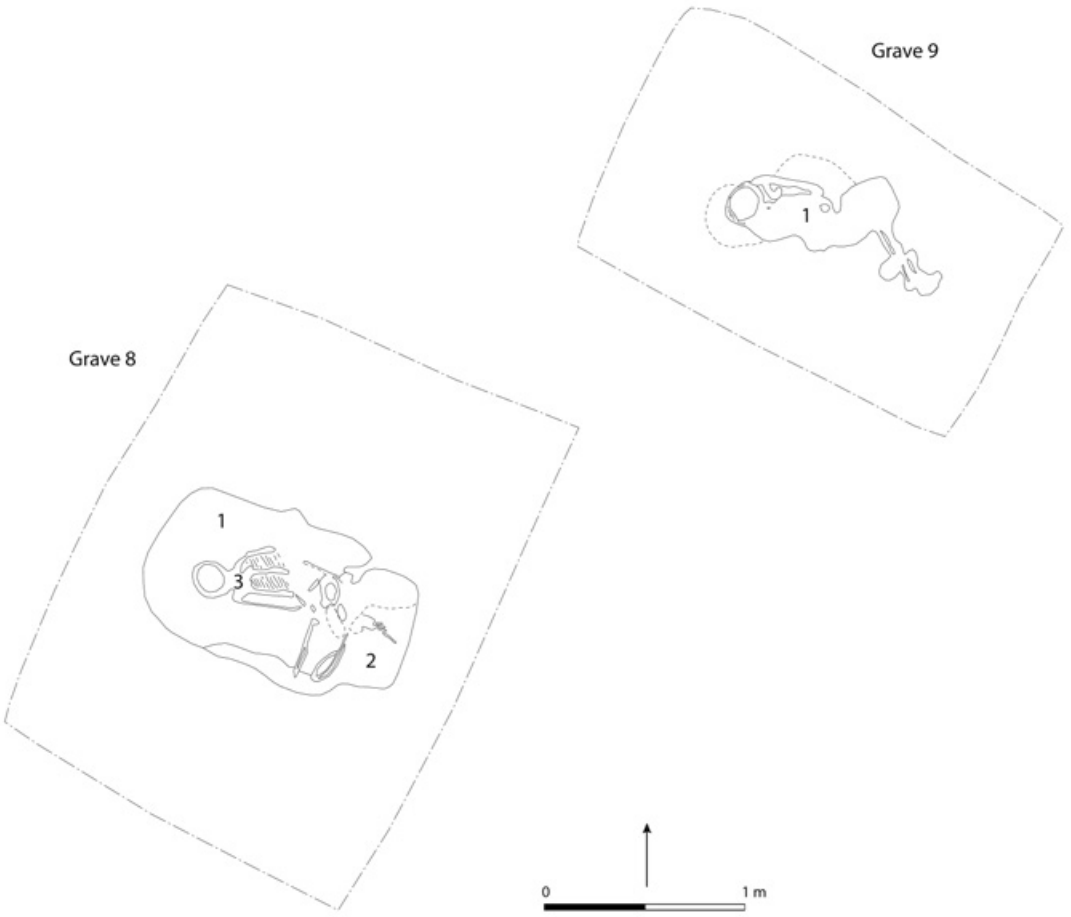


Fig. 111. Graves 8 and 9. The two graves with bodies crouched in a hocker position are close to each other in the grave site and are oriented in the same direction. What is remarkable is how they are placed demonstratively with their backs to each other (illustration: T. Lorange).

3.8 Grave 9

Grave 9 appeared on the surface as a rectangular feature with rounded corners, approximately 150 × 100 cm in size and oriented WNW–ESE. It was a 28 cm deep, flat-bottomed grave. The position of the deceased was recognised by a fatty, dark brown residue showing that the body had been placed in hocker position crouched on its left side with the face turned towards the north-northeast *(figs 109–110)*. The grave was excavated on site and subsequently encased in paraffin and recovered as a block.

No grave goods were found, but faint traces of textile residue indicate that the deceased had been clothed. Furthermore, remains of human hair were recovered from along the edge of the area where the head would have rested.

Graves 8 and 9 clearly resemble each other and, moreover, they were situated quite close and arranged back to back *(fig. 111)*.

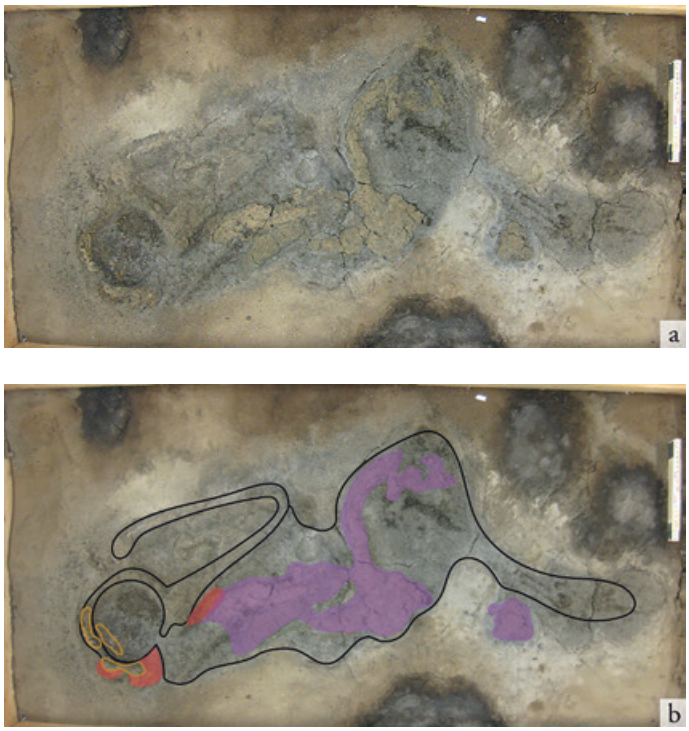


Fig. 112. Grave 9: a. the textiles cleaned off; b. outline of textile 9.1 (purple) and textile 9.2 (red) (photo: Konserveringscenter Vest, Ølgod).

3.8.1 Overview of the textiles in grave 9

Two types of weave could be identified in this grave. The deceased was dressed in a 2/2 twill weave covering the body from the shinbone to the armpits. Due to the poor state of preservation, it is not possible to determine if it was a tubular garment. However, it may have been worn in a similar manner, sitting tight under the armpits and pulled up to be secured over the shoulders. Around the head was a reddish-brown weave which probably served as a scarf.

The textiles were preserved on top of the greasy dark matter of the body from just below the arms to the shinbone and around the head, in an area of approximately 90 × 38 cm *(fig. 112a)*. It was possible to identify two different types of textile *(fig. 112b)*. Those on the body are fairly well preserved, but crisp and dry. In the area of the head the textiles are too degraded for a proper analysis.

It was not attempted to lift the textiles out of the grave for further analysis, as the intention was to keep the matrix with the skeleton for display purposes. However, the textile has been ^{14}C-dated to AD 131–214 (68.2 % probability, see *table 7*).

3.8.2 Textile 9.1

This light yellow 2/2 twill weave in wool is visible on most of the deceased from below the arm to the shinbone within an area measuring 70 cm along the longest point of the grave and 38 cm across at its widest point. It has not been identified on the shoulder and arms.

Component	Size (cm)	Binding system	Selvedge	Border
Wool	Many fragments covering areas up till 25 × 15	2/2 twill	Not preserved	Not preserved

Table 78. Textile 9.1, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	45°	9	0.8	Light yellow	Not analysed
Weft	Single	Z	45°	9	0.8	Light yellow	Not analysed

Table 79. Textile 9.1, yarn.

Material	Size (cm)	Binding system	Selvedge	Border
Wool	Small fragments, up to 5 × 2–3	Probably 2/2 twill.	Not preserved	Not preserved

Table 80. Textile 9.2, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	40°	–	0.5	Reddish brown	–
Weft	Single	Z	40°	–	0.5	Reddish brown	–

Table 81. Textile 9.2, yarn.

The textile is relatively well preserved, though degraded, dry and crisp. It is still possible to clean off and analyse it in detail in more places *(tables 78–79)*. It seems to be over-layered by textile 9.2 in the area of the shoulder.

3.8.3 Textile 9.2

Textile 9.2 is preserved as several small fragments, the largest measuring 5 × 2 cm, covering an area of 30 × 25 cm that represents the area of the head down to the lowest point of the neck.

It is a reddish-brown weave of wool, probably 2/2 twill. It was mostly identified around the head in relation to the hair. One fragment was found below the arm near the trace of the shoulder. It is very much degraded and impossible to analyse *(tables 80–81)*. The weave seems to overlay textile 9.1.

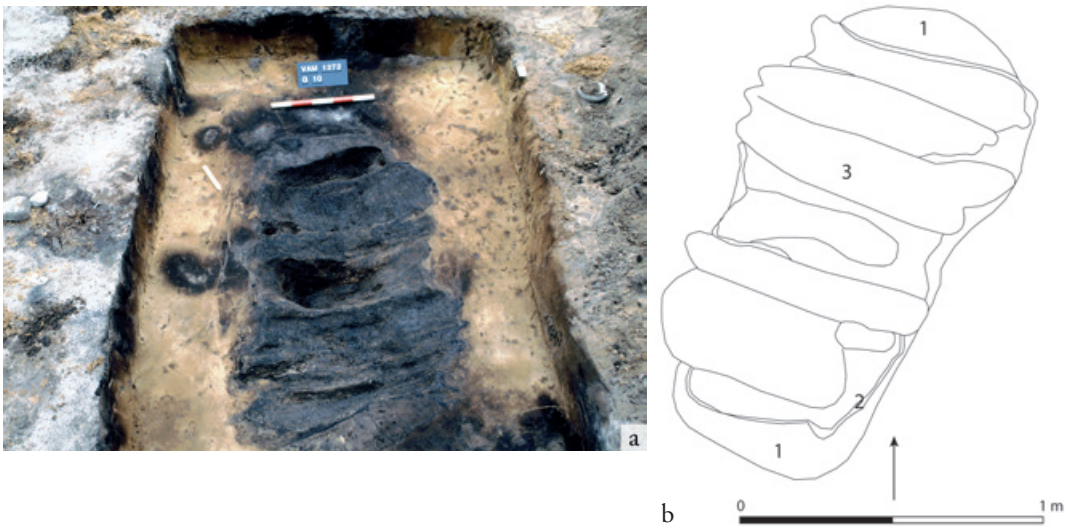


Fig. 113. Grave 10: a. The grave exposed up to the layer of planks that were placed across it. These planks have evidently sunk, as there is a difference in level of approximately 10 cm between the edge and the middle; b. sketch of grave 10: 1. grave fill; 2. fatty black irregular traces that are not a coffin but presumably a lining of the grave pit with animal skin or textiles; 3. planks laid across the grave pit (photo and illustration: Varde Museum and T. Lorange).

3.9 Grave 10

Grave 10 was a rectangular feature with rounded corners, measuring 174 × 110 cm, oriented NNE–SSW and 58 cm deep. About 30 cm beneath the surface, a plank lid with bark preserved on several of the planks was revealed. It became apparent that the lid or roof did not cover a coffin but a narrow, elongated bath-tub shaped inhumation grave, 134 cm long and 36 cm wide *(fig. 113a–b)*. The plank roof was removed *in situ* but with the emergence of textiles, the grave was recovered in a soil block. The grave was then deposited in the refrigerated container before excavation at the conservation centre. No accompanying grave goods were found in the grave, but the deceased had been dressed and apparently laid to rest on an animal hide or rug *(fig. 114a–b)*.

The only human remains in the grave were a few tufts of hair in the southwest corner indicating the position of the head. The deceased may have been placed in a supine position and must have been a relatively small person, only about 120–130 cm tall with a waist of 66 cm.

3.9.1 Overview of the textiles in grave 10

The grave had probably been lined with an animal hide, though no traces of fur were visible. The deceased appears to have been placed in supine position, and at least from the chest down to the feet the body was dresses in an orange twill weave (textile 10.2). This was held in place by a woven belt with a tubular woven selvedge (textile 10.3). The twill weave was adorned along the lower edge with a narrow woven border that also had a tubular selvedge, perhaps made with plant fibre in the warp (textile 10.6). Under and above the body, a white almost dissolved weave (textile 10.5) appeared. This probably served as a blanket

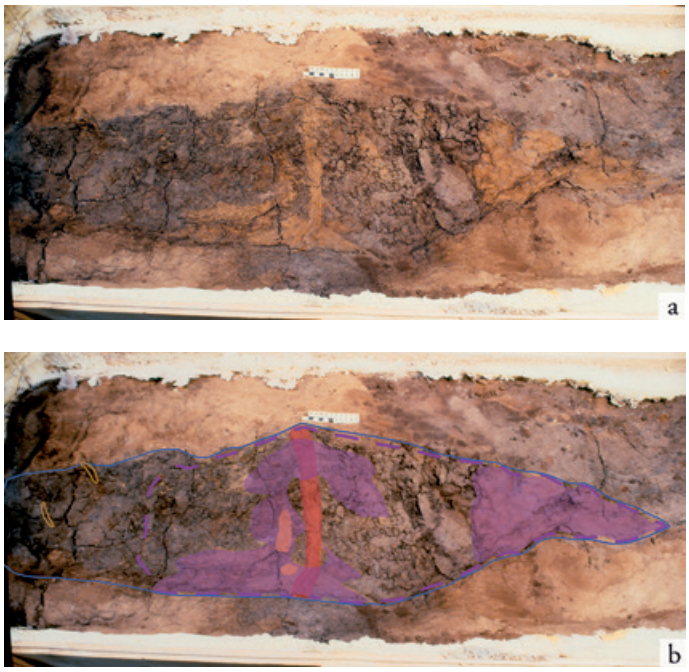


Fig. 114. a. The soil block of grave 10 supported by foam. A great deal of intact textile can be seen, especially in the central part of the grave; b. outlines of textile 10.2 (purple), textile 10.3 (red), textile 10.5 (orange); hair yellow (photo: Konserveringscenter Vest, Ølgod, and I. Demant).

covering the deceased and tucked in along the sides or wrapped all around the body. Under the feet a fourth textile type was identified: a 2/2 twill in dark reddish-brown wool (textile 10.7). The function of this last textile is unknown.

The textiles were preserved over an area measuring approximately 100 cm along the length of the grave and 36 cm across *(fig. 114b)*. Most are preserved in the middle of the grave and in the northern end (opposite the hair) where the textiles form a lengthy triangle filling out the hollow. There is no connection between the two areas. However, similarities between the textiles has allowed for gathering fragments from the two areas into one type, even if, theoretically, they could represent two different weaves.

It was not possible to separate the textile layers in this grave, and the weaves are now preserved in lumps with layers of the different types of weave.

3.9.2 Textile 10.2

This type is a 2/2 twill predominately in orange, but in some areas the weft threads appear reddish-brown. It is impossible to determine the original size of this fabric, as it is preserved in many fragments of different sizes up to 33 × 17 cm. The fabric is found in the middle and in the northern end of the grave. In the latter part it formed a lengthy triangle as if pressed into a very narrow depression. As there is no connection between the fragments found near the belt and those around the feet, it is not completely certain that all the twill weaves belonged to the same piece. However, as they are very similar, they are described as

Fig. 115. Textile 10.2 at the north-end of the grave placed around the feet of the deceased (photo: R. Fortuna).

one type in the following *(fig. 115)*. Textile 10.2 has been ^{14}C-dated to AD 70–125 (68.2 % probability, see *table 7*).

Near the feet of the deceased, parts of a woven boarder with tubular selvedge (textile 10.6) are stitched to the fabric. A few stitches are visible, and it was probably attached to the lower edge of the orange twill weave. The middle of the textile had been loosely gathered by the border of textile 10.3 creating folds lengthwise in the fabric. Just above the belt, three small stitches with double thread were identified. Traces of sewing thread could be identified, but only three stitches are visible. They run parallel to the long axis of the grave, and are 6 mm long with approximately 1 cm between them. The yarn is double, but not plied. Most likely they represent a repair and not an actual seam, but this cannot be determined with certainty *(tables 82–84)*.

The textile is crisp and dry in some areas, but with a fine definition of the weave, but in other areas more compressed. The textile was placed between the layers of the tabby woven border (textile 10.3), and above textile 10.5 and textile 10.7.

Size (cm)	Binding system	Selvedge	Warp end
Many small fragments of different size	2/2 twill	Flat	Not preserved

Table 82. Textile 10.2, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	40–45°	9	0.8	Orange	No dyes detected
Weft	Single	Z	40–45°	9	0.8	Orange/red?	No dyes detected

Table 83. Textile 10.2, yarn.

Number	Stitch	Function	Twist direction	Twist angle	Thread diameter (mm)	Stitches / 2 cm	Length of stitch in mm	Visible colour
Textile10.2	Whip stitch	Repair ?	Z×2	40–45°	0.8	3	6	Orange

Table 84. Textile 10.2, sewing thread.

This textile probably represents the clothing of the deceased, but it is impossible to determine the shape of this garment, only that it covered the lower part of the body and was held in place around the waist with a woven band (textile 10.3).

3.9.3 Textile 10.3

Textile 10.3 is a warp-faced tabby woven border in two colours with one tubular selvedge *(fig. 116)*. It was found in the middle of the grave, running transversely from one side to the other *(fig. 114b)*. The weave is preserved over a length of 33 cm on the upper side, and 9 cm on the underside of a lump of textile fragments. There are four layers: two visible on each side of the lump. On one side layers 2 and 3 are connected, whereas the other two terminate in frayed warp.

Only parts of the warp and weft are preserved. The weft is preserved for 8 cm in the upper layer indicating that the weave originally was a minimum of 3.5 cm wide. It is a well preserved dark reddish-brown yarn running double. In layer 3, the weft is also preserved showing that the weft was changed into a yarn in white undyed wool after the first 8 cm of weaving. In the third layer more warp threads are preserved, and the majority could be identified as white undyed wool. Furthermore, only ten warp threads of orange-brown are preserved in layer 1 and 2.

The orange-brown warp represents the flat part of the border, whereas the white undyed yarn was used in the centre and in the tubular part. It is not possible to say how many warp threads were used.

Fig. 116. Textile 10.3. Warp-faced tabby woven border in two colours with one tubular selvedge (photo: R. Fortuna).

Component	Size (cm) (estimated size of original fabric)	Binding system	Selvedge	Border
Wool	3.5 × 132	Warp faced tabby	Flat & tubular	–

Table 85. Textile 10.3, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	35–40°	9	0.8	Orange / undyed	–
Weft	Single × 2	Z	40–45°	3	0.8	Reddish brown/ Undyed	–

Table 86. Textile 10.3, yarn.

The double weft runs single through the flat part of the border, but in the tubular part runs twice around before going back into the flat part. The tubular selvedge faces towards the south of the grave, away from the deceased's hair. The part with the well-preserved weft is folded double lengthwise with the fold towards the north end (opposite the hair) and the tubular part beneath the flat part. In layers 2 and 3, the border lies flat with the tubular part.

The frayed curly warp ends show that the textile was worn and torn. Furthermore, the four layers ran twice around the body, which gives an approximate length of the original woven border of 132 cm *(tables 85–86)*.

The weave was found over and under textile 10.2 and seems to have served as a kind of belt.

Size (cm) (Estimation of original textile)	Binding system	Selvedge	Border
–	2/2 twill	–	–

Table 87. Textile 10.5, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	40°	?	0.8	White	–
Weft	Single	Z	40°	?	0.8	–	–

Table 88. Textile 10.5, technical details.

Fig. 117. Textile 10.6. Tabby woven border attached to textile 10.2. Only the weft yarn is preserved (photo: R. Fortuna).

3.9.4 Textile 10.5

This is a white undyed 2/2 twill weave identified at the bottom of the grave in the northern end and the middle of the grave. It was found on top of textile 10.2 as patches up to 5 × 5 cm in size. It is mostly preserved as patches of almost dissolved fibres which are difficult to analyse. Only a few threads could be identified *(tables 87–88)*.

This textile seems to have served as a blanket either covering the body and tucked in along the sides, or wrapped all around the body.

3.9.5 Textile 10.6

Textile 10.6 is a warp-faced tabby woven border with a tubular selvedge on one side. It was identified in four places at the southern end of the grave. Each fragment is 3–4 cm long and 1.5 cm wide *(fig. 117; tables 89–91)*.

Only five warp threads are preserved. They form the flat selvedge leaving parts of the weft open. The weft runs single through the flat tabby side and into the tubular formed warps, which it runs through twice *(fig. 26,2)*.

Three stitches are visible fastening the woven border to the twill weave textile 10.2.

Size (cm)	Binding system	Selvedge	Border
1,5 wide	Warpfaced tabby	Flat and tubular	–

Table 89. Textile 10.6, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	?	12	0,8	Orange	No dyes detected
Warp	–	?	?	?	?	?	?
Weft	Single	Z	?	6	0,8	Orange	No dyes detected

Table 90. Textile 10.6, yarn.

Number	Stitch	Function	Twist direction	Twist angle	Thread diameter (mm)	Stitches / 10 cm	Length of stitch in mm	Visible colour
Textile1.7	Whip stitch	Adding border to edge of textile	Z	40–45°	0,8	?	3–5	Orange

Table 91. Textile 10.6, sewing thread.

Size (cm)	Binding system	Selvedge	Border
8 × 7	2/2 twill	–	–

Table 92. Textile 10.7, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	40–45°	9	0,8	Reddish brown	–
Weft	Single	Z	40–45°	7	0,8	Reddish brown	–

Table 93. Textile 10.7, yarn.

3.9.6 Textile 10.7

This 2/2 twill weave is a dark reddish-brown colour. It was identified in the northern end of the grave as part of the lengthy triangle of textile. It is only preserved as one fragment of 8 × 7 cm. It is folded double along one side and shows traces of heavy wear at the opposite side with long loose yarn ends sticking out *(tables 92–93)*.

The individual threads are relatively well preserved, though generally dry and crisp. Textile 10.7 was identified between textile 10.5 and textile 10.2, but its function is unknown.

Fig. 118. Grave 11 during excavation (photo: Varde Museum).

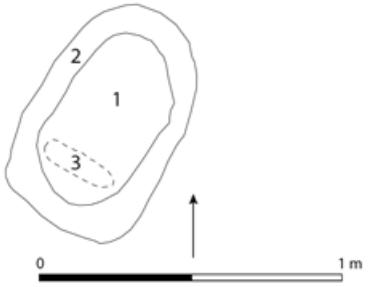


Fig. 119. Outline sketch of grave 11: 1. Grave fill, whitish-grey sand; 2. as in 1, but slightly darker, a characteristic feature being quite a bit of charcoal flecks; 3. traces of charcoal. Alongside the base of the grave pit, a thin black fatty layer of presumably burnt organic material – animal skin or human body traces – is identified (illustration: T. Lorange).

3.9.7 Animal hide

A dark organic layer of decomposed material was found at the bottom of the grave underneath the textiles. It resembles similar layers found in other graves, though no traces of hair were visible.

3.10 Grave 11

Grave 11 presented itself as an oval feature of 70 × 48 cm, oriented NNE–SSW. The grave was 22 cm deep with slightly rounded sides and a flat bottom. The diminutive size suggests a child's burial. The grave held no finds apart from a few potsherds in the grave fill. The grave was excavated *in situ (figs 118–119)*.

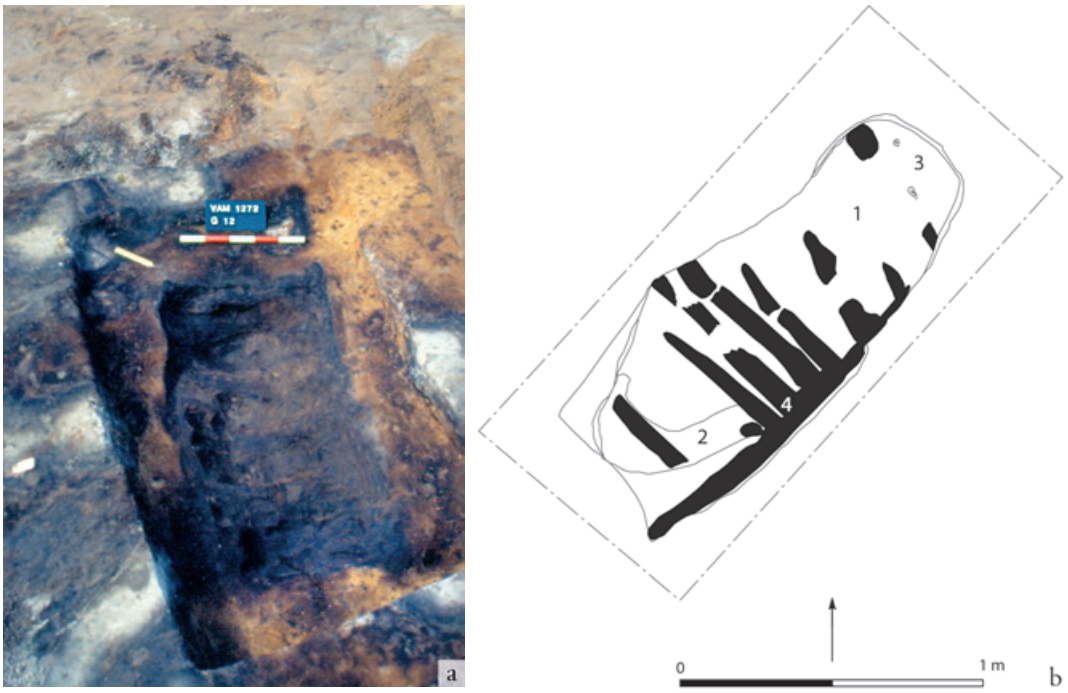


Fig. 120. Grave 12: a. excavated to the top of the plank layer. The lid comprised planks placed crossways that have broken and fallen into the grave; b. outline sketch made at the conservation centre after a mild cleansing. 1. Grave fill of greyish yellow sand; 2. beneath layer 1 lay a cohesive mass of brownish organic material; 3. hair; 4. planks / pieces of wood (photo and illustration: Varde Museum and T. Lorange).

3.11 Grave 12

Grave 12 was a roughly rectangular feature of 128 × 86 cm, oriented NE–SW. The 47 cm deep and slightly round-bottomed grave pit was lined with an animal hide and covered with a layer of narrow planks *(fig. 120a)*. After the emergence of human hair in the western end of the grave, the entire grave was recovered in a soil block and placed in a refrigerated container before excavation.

The planks were decayed and only partially intact. Most of the planks lay across the grave apart from one found along the grave's north-western edge. The planks do not appear to have been a bier for the deceased, as no plank was found along the opposite edge *(fig. 120b)*.

Once the planks and most of the grave fill were removed, textiles appeared roughly covering the surface in a very uneven layer with several folds and edges. The construction of this grave was similar to grave 10 in various ways: it has nearly the same orientation and comprises a round-bottomed grave-pit covered in timber in the form of planks. Neither grave 10 nor grave 12 contained grave goods.

The only trace of the deceased is a tuft of human hair in the western end of the grave. But the textiles seemed most degraded where they had been in contact with the body, leaving the impression of a body placed in hocker-position resting on its right side facing east *(fig. 121a)*.

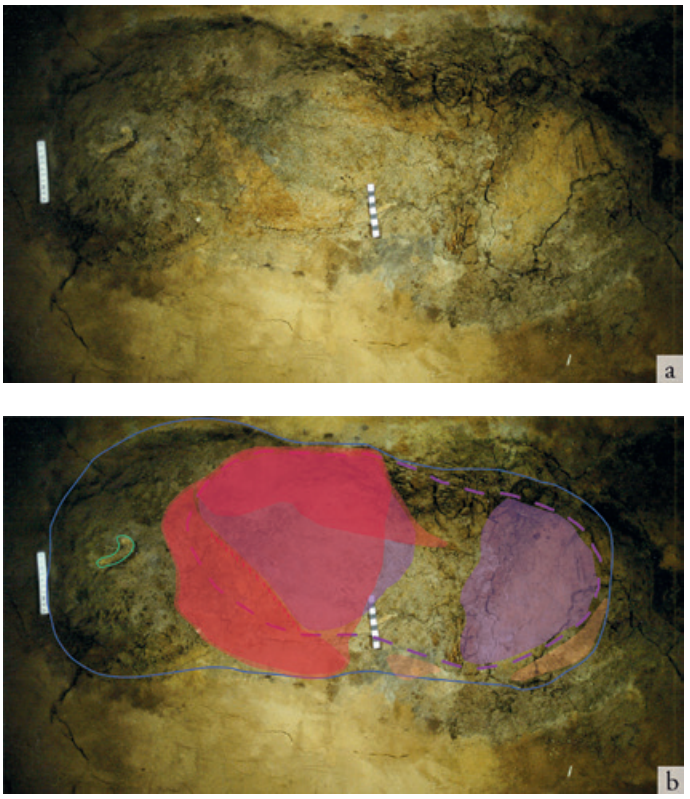


Fig. 121. Grave 12: a. under excavation with textiles; b. outline of textile 12.1 (orange), textile 12.2 (red), textile 12.3 (purple); hair green (photo: Konserveringscenter Vest, Ølgod, and I. Demant).

3.11.1 Overview of the textiles in grave 12

The grave was probably lined with an animal hide. The deceased was dressed in a monochrome twill woven dress, most likely tubular in shape. The lower selvedge was adorned with a tabby woven border with tubular selvedges. Around the upper part of the body was a rectangular weave, worn as a shawl.

The textiles are visible in most of the oval depression of the body, covering an area of approximately 86 cm lengthwise and 34 cm across. The depression is 10–12 cm deep, and particularly in the north western part the textiles are found against the edge of the depression.

In the centre of the grave, the textiles are partly decomposed and preserved as fragile lumps. Thus, it is impossible to separate the different layers. In the bottom of the grave, below the feet, one large, relatively well preserved piece of textile was found. Generally, it was easy to distinguish the different types of textiles in the grave, and three different weaves and one border were identified *(fig. 121b)*. The textile is ^{14}C-dated to AD 71–125 (68.2 % probability, see *table 7*).

3.11.2 Textile 12.2

In an area of approximately 34 × 35–40 cm across in the middle of the grave, a 2/2 twill of dark brownish-red colour with stripes in the weft direction was identified *(fig. 121b)*. In the north-western part of the grave, the weave is positioned against the side and stretches

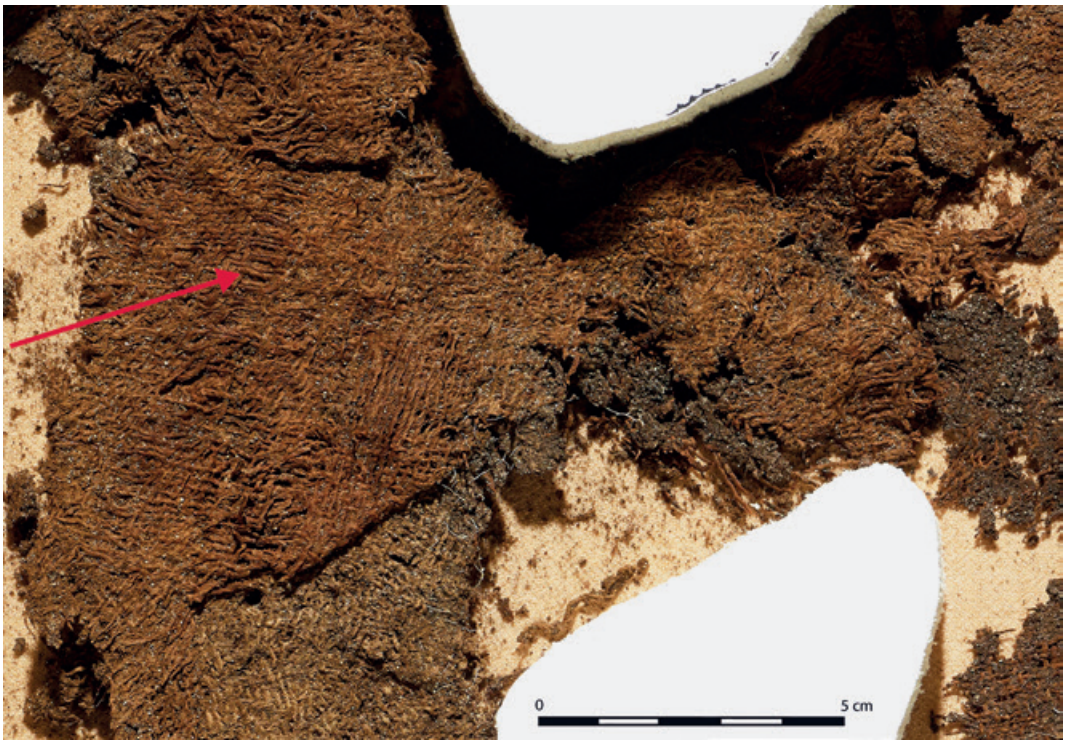


Fig. 122. Fragment of textile 12.2. The arrow points to an empty space after an in-woven stripe in half panama (photo: R. Fortuna).

approximately 40 cm towards the north-eastern end of the grave. Across the grave, textile 12.2 was found to run under textile 12.3 to the opposite side. Approx. 25–30 cm of the weave was folded back over textile 12.3 forming an upper layer. Thus, the size of the weave can be estimated at approximately 110 × 40 cm.

The warp thread and the dark brownish-red part of the weft are relatively well preserved, though dry and crisp, but the weft threads in the stripes are completely decomposed. Only empty spaces in the warp indicates their initial position, and impressions on the warp threads reveal that they were woven alternately in 2/2 twill, like the rest of the weave, and in weft-faced half panama. The width of the stripes varies from 5 to 15 mm for both the panama and the 2/2 twill stripes without an obvious pattern report *(fig. 122; tables 94–96)*.

There are no selvedges preserved in this weave. However, a few loose threads indicate that the weave terminated in warp fringes. The yarn appears evenly spun in both warp and weft. However, the fabric as such appears to have been worn before deposition in the grave. A few loose warp ends are visible in the north-western part. They are not twisted into fringes, only floating out of the weave. In other parts of the main weave threads of one direction are missing. This can be due to either wear or bad preservation.

The preserved threads are very crisp, dry and fragmented. This fabric was situated on top and below textile 12.3.

Technical details: textile, yarn, and fibres

Fibre analyses were made on samples from the warp and the weft *(table 94)*. The results indicate similarities between the two yarns, with low percentages of fine fibres below 25

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 12.1 warp	91.5	7	1.5	15	9–39, 32, 34, 92, 104–105	201
tx 12.1 weft	94	5	1	17	9–27, 36–37, 50, 55	201

Table 94. Textile 12.1, fibre analyses.

Size (cm)	Binding system	Selvedge	Border
110 × 40	2/2 twill Some stripes in weft faced half panama	Not preserved	Perhaps fringed

Table 95. Textile 12.2, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	35–40°	6–9	0.7	Dark reddish brown	No dye detected
Weft	Single	Z	35–40°	6–8	0.7	Dark reddish brown	No dye detected

Table 96. Textile 12.2, yarn.

microns, high percentages between 25 and 40 microns, and a few outliers. The similarities are also seen in the histograms *(fig. 123)* which both resemble the warp in textile 1969.2 (see also the red warp in textile 1969.5, the two samples from textile 1.3 B, the ground weft in textile 1.6 R, and the weft and the sewing yarn in textile 1.7).

This brownish-red textile with stripes appears to have functioned as a shawl. It was placed around the back of the deceased, but unlike in graves 1 and 2, the fringed terminals were not gathered in front of the chest, but rather draped separately along the sides.

3.11.3 Textile 12.3

Textile 12.3 is a woven wool textile in 2/2 twill and orange in colour. It was identified as a large fragment both at the northeast end and centrally in the grave, covering an area of approximately 76 cm lengthwise in the grave and 34 cm across *(fig. 121b)*. The two parts are divided by a line caused by the decaying body.

The selvedge of the weave is tubular. It is preserved over approximately 30 cm in the north-eastern end of the grave *(fig. 124)*. The outer 3–4 mm of warps are missing in most parts, leaving the weft-turns visible as small loops. Only in one small patch are fragments of warp threads preserved showing that textile was woven tubular in warp-faced tabby. Up to the selvedge the warp threads run twice as densely (15 threads/cm) as in the rest of the weave, which is a very characteristic detail in hand-woven fabric. The yarn appears unevenly spun, as some threads are remarkably thicker than others in both warp and weft.

The weave is edged with a tubular woven border along at least one selvedge (textile 12.7). Close to the selvedge and the border, a bunch of approximately twelve stitches in a dark reddish-brown yarn was identified. The stitches were made on top of each other forming

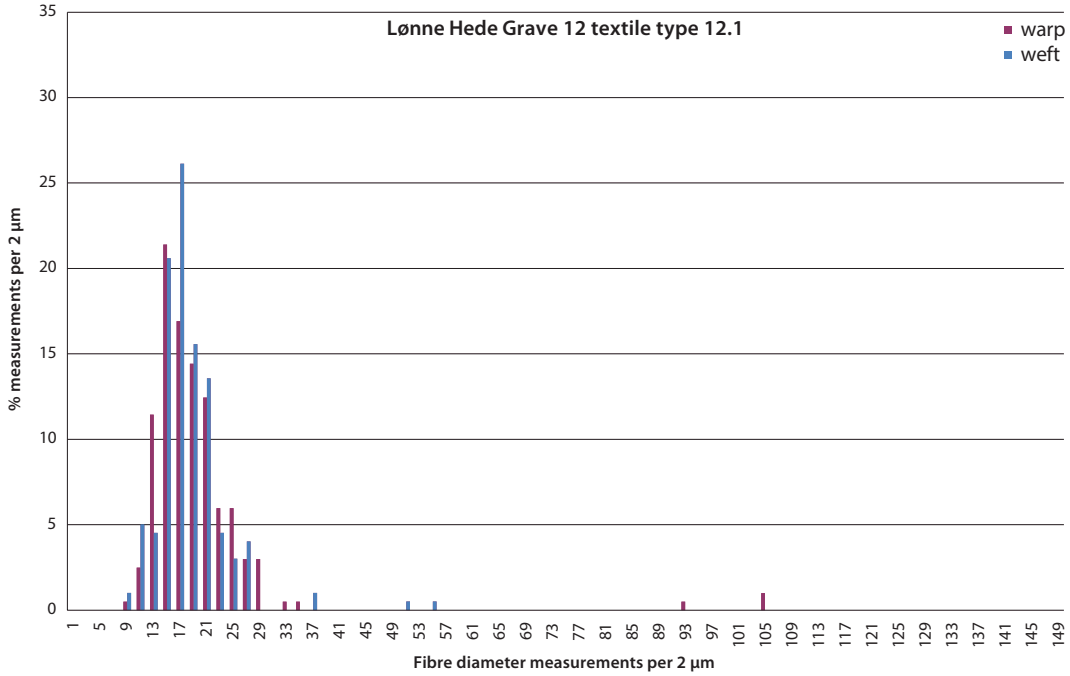


Fig. 123. Histogram of fibre analysis of textile 12.1 (illustration: I. Skals).

Fig. 124. Fragment of textile 12.3 seen from the backside with selvedge and Textile 12.7 visible. (photo: R. Fortuna).

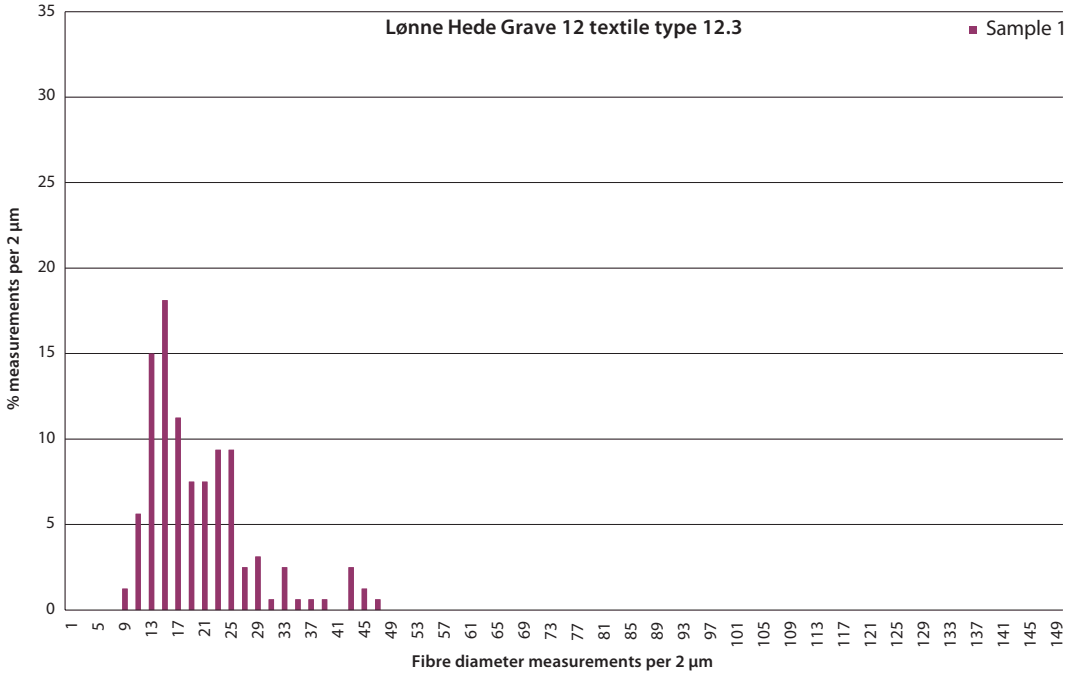


Fig. 125. Histogram of fibre analysis of textile 12.3 (illustration: I. Skals).

Size (cm) (Estimation of original textile)	Binding system	Selvedge	Border
>76 × 90	2/2 twill	tubular	Not preserved

Table 97. Textile 12.2, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count /cm	Thread diameter (mm)	Visible Colour	Detected dye
Warp	Single	Z	45–80°	7–10	<1,2 > 0,6	Orange	No dye detected
Weft	Single	Z	45–80°	7–8	<1,2 >0,6	Orange	No dye detected

Table 98. Textile 12.3, yarn.

Textile	% ≤ 25 µm	% >= 25.5 <= 40 µm	% of outliers	mode	range	no. of fibres
tx 12.3 Sample 1	84.5	11.2	4.3	15	8–29, 31–34, 36–38, 42–43, 45–46	161

Table 99. Textile 12.3, fibre analyses.

a little knob 1 cm long and 0.6 cm wide. It is impossible to decide whether the stitches belong to the fabric or the border *(fig. 126; tables 97–98)*.

The textile and fibres are best preserved in the area below the deceased's feet and shinbone, where they are found in several layers and folds. In the central area of the grave, the

Fig. 126. Fragment of textile 12.7 and the selvedge and red stitches on textile 12.3 (photo: R. Fortuna).

textile is decomposed and only visible as layers of orange twill weave found between the layers of textile 12.1.

Technical details: textile, yarn, and fibres

Fibre analyses were made on one sample of this textile. The results are a low percentage of fine fibres, a high percentage of fibres between 25 and 40 microns, and some outliers *(table 99)*. The histogram *(fig. 125)* resembles the ones for the warp and the pattern weft from textile 1.6 (see also the warp in textile 2.6).

As this twill weave appears to originally have been two-layered and covered the deceased, it is likely to have functioned as a dress. However, the exact shape is unknown.

Component	Size (cm)	Binding system	Selvedge	Border
Wool	1.3 cm wide	Half panama/tabby	One flat, one tubular	–

Table 100. Textile 12.7, technical details.

Direction	Thread	Twist direction	Twist angle	Thread count/cm	Thread diameter (mm)	Colour	Detected dye
Warp	Single	Z	30–40°	14	0.8	Light brown	–
Warp	Single	Z	30–40°	14	0.8	Light brown	–
Weft	Single	Z	30–40°	4	1	Light brown	–

Table 101. Textile 12.7, yarn.

Number	Stitch	Function	Twist direction	Twist angle	Thread diameter (mm)	Stitches / 10 cm	Length of stitch in mm	Visible colour
Textile 1.7	Whip stitch	Adding the border to the selvedge of Textile 12.3	Z	40–45°	0.9	30	3	Red

Table 102. Textile 12.7, sewing thread.

3.11.4 Textile 12.7

This is a woven border in wool and an unknown fibre. It is preserved as one 14 × 1.3 cm piece and two minor fragments, each 1.3 cm wide *(fig. 126; tables 100–102)*.

This narrow tabby woven border with one tubular selvedge was added with hem-stitches to the selvedge of textile 12.3. Approximately eight to ten light-brown warp threads are woven flat with double weft. On one side, the weft of the border extends into a tubular selvedge, but the warp threads are here almost disintegrated. Only a few surviving fragments indicate that the warp in this part was red and white. A small number of preserved stitches show that the border was sewn onto the selvedge of the twill weave with whip stitches. Each stitch is linked into a weft turn of the fabric selvedge.

The longest fragment is the best preserved. Here, most of the weft but only parts of the warp can be identified. The two minor fragments are less well preserved.

This border had been attached to the lower selvedge of the dress. It is unknown whether a similar border was attached to the opposite selvedge.

3.11.5 Animal hide

A dark organic layer of decomposed material was visible around the edges of the grave. In some parts, the layer is very dark and hard and has broken into smaller pieces. In other parts, the layer is brown and softer with a fibrous character. There was no sign of animal hair.

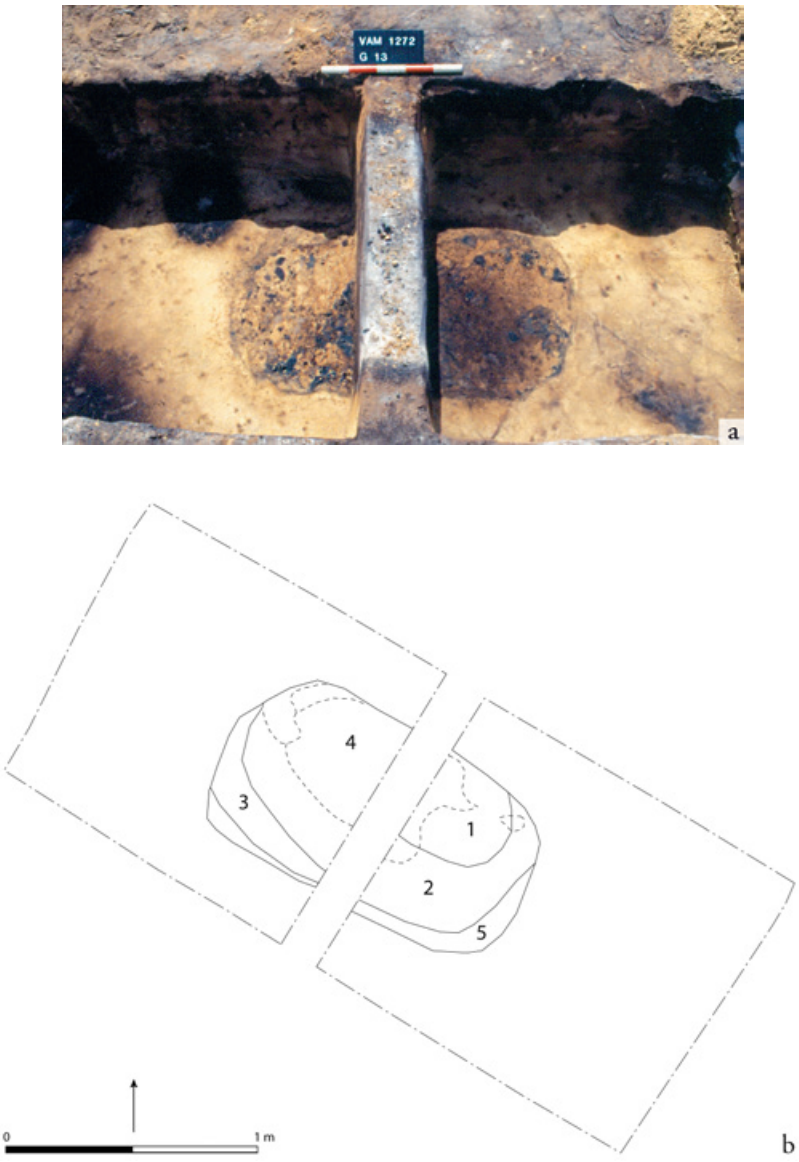


Fig. 127. Grave 13: a. *in situ*, approximately 50 cm beneath the surface; b. outline sketch: 1. mixed sand with smears of black charcoal intermixed with a great deal of subsoil; 2. as in 1 with smaller smears of decayed charcoal and charred bones; 3. pale, greyish-brown sand, charred bones and charcoal; 4. dark brown sand; 5. greyish-yellow homogeneous sand (photo and illustration: Varde Museum and T. Lorange).

3.12 Grave 13

Grave 13 was an oval feature of 150 × 84 cm, oriented WNW–ESE. The grave was 67 cm deep and thereby the deepest grave on the site. It was the only inhumation grave in the row of cremation graves towards the east *(figs 6; 127a–b)*. The grave had nearly vertical

sides and a slightly rounded bottom. A large number of white-burnt bone fragments and potsherds were found in the grave fill (Varde Museum 1272x55). Estimated from the rim forms, at least eight different pots were represented. Furthermore, base sherds from four different vessels as well as a faintly X-shaped handle and some 100 wall sherds of a greyish-brown tempered clay were recovered; amongst these were a few quite coarsely rusticated sherds. The ceramics are interpreted as a random mix of settlement pottery from the older settlement immediately east of the grave.

The bottom of the grave was recovered in a soil block and preserved in a refrigerated container until it was excavated at the conservation centre. Faint traces of the body were visible. It was placed on animal hide with the hair side upwards and presumably covered with plant remains such as twigs, leaves, straw, wood or bark. No grave goods and only very faint traces of textiles were found.

3.13 Dress in 1st century Lønne Hede: Everyday wear or Sunday best?

Before drawing any final conclusions on the outfits identified in the Lønne Hede graves, the theoretical question of how to interpret the content of a grave need to be addressed. The great variations observable in a cemetery like Lønne Hede, with two coffin graves with grave-goods and jewellery, and several graves without coffins and few or no grave-goods at all, serve to remind us that a grave is more than just a deposition of a dead relative. It must also be considered a medium through which the mourners could express themselves and their position in society, or even change it. This means that what is excavated are the preserved parts of a selection made by those who organized the funeral (this discussion is ongoing, but best summarised in Härke 1997).

Following this, a crucial question is how the outfit presented in a grave should be regarded in relation to the outfit of the living. Was it a ritual funerary dress, the best clothing only used for special occasions, or was it just what they had – or what the family could spare? And – not least – how to distinguish these in the sparse finds? Since we do not know how much clothing the individual person in a small rural society of the 1st century AD like Lønne Hede would possess, it is difficult to provide an answer. However, if the costumes were especially made for the funerary rites, one would not expect to find signs of use; on the other hand, clothes used every day would have signs of tear and wear. Furthermore, calculations based on experiments and ancient texts of working time in relation to prehistoric textile production have shown that it would take more than a month of fulltime work to produce a small dress similar to the dress of grave 1 – from shearing the sheep and preparing the wool, to spinning and weaving (Andersson Strand / Cybulska 2013). Thus, a ritual funerary dress made for the purpose does not seem a likely interpretation. It is also questionable if each person possessed so many different items of clothing that they could separate between outfits for special occasions and everyday use. Following this line of thought, the fact that particularly the shawls in grave 12 (textile 12.2) and grave 1969 (textile 1969.4) – and the "girdle" (textile 10.3) from grave 10 – displayed heavy traces of wear is a significant observation. In textile 12.2, loose warp ends are floating out of the weave without being twisted into fringes, and in other parts the yarn of one direction is missing as if the shawl was in fact worn out. From textile 1969.4, a fragment turned out to be tied into a knot as a tattered piece on the end of a woven fabric *(fig. 50)*.

The blue garments and jewellery of grave 1969 give an immediate impression of being the best outfit, but the worn shawl tells us that there were also garments that had been used as more than Sunday best, and that the garments found in the graves probably mirror the clothing traditions – if not fashion – of the time.

3.13.1 The different garments

Most of the textiles in the graves from Lønne Hede could be divided into three groups, of which two were related to clothing. The fragmented state of the textiles may disguise any cutting to create a shape, but mostly the textiles gave the impression of the clothing being made up of square pieces. Furthermore, the textiles showed only few signs of being stitched to form garments. Only in a few cases was it evident that a weave was sewn to form a tube to be worn either as a dress or as a skirt (grave 1969). Otherwise, the weaves appeared mostly to be draped around the body.

Most of the textiles in group 1 are shawls, relatively small pieces (40–50 × 100–120 cm) which could be worn around the upper body. Only textile 1969.1 was found covering the hair, showing that the textiles in group 1 could have more functions, serving as both shawl and head-cover. Possible head-covering textiles of unknown size were also found in graves 2 and 6, but these were of a different quality woven with much thinner yarns. Textile 2.4 from grave 2 was woven with a very thin two-ply thread but was otherwise too badly preserved to analyse. The blue twill textile 6.2 identified in relation to the two buns of hair in grave 6 had very thin yarn in one thread system *(fig. 89)*, which indicate that it was a very light textile that had covered the hair of the deceased in the grave.

Evidence of headcovers are known from the Pre-Roman Iron Age in the form of form of bonnets made in so-called sprang-technique (Hald 1980), but finds of hairpins placed at the head in richly equipped graves from the Late Roman Iron Age (phase C1b-C2, i. e. approx. AD 200–310) indicate that head-covers also were part of the outfit in the Roman Iron Age (Ethelberg et al. 2000, 62). In Vorbasse (grave 4), Mannering has interpreted a balanced tabby weave as a head-cover secured to the hair by a silver pin (Mannering et al. forthcoming). This head-cover would reach to the upper part of the chest, and thus it may have been of roughly the same size as the textiles in Lønne Hede group 1. Also, the possible head-covers of grave 2 and 6 may have been of this size.

In general, it must be assumed that a head-cover was an important part of the outfit. Whereas sprang bonnets were fitted in shape and possibly fastened with the help of strings, we have no evidence of any shaping of the woven head-covers. The weavings were not large enough to be tied like a modern headscarf, which would be folded on the diagonal and the corners tied either under the chin or in the neck. The silver pins indicate, though, that a securing was if not necessary then perhaps practical, and we may assume that needles of organic material was also used as "hat pins" – the bone pin in cremation grave A17 might be an example. In grave 1969 the large silver fibula *(fig. 38)* was found in the area above the head. It had probably moved from its original place during the decomposition in the grave. It has previously been considered as part of the dress, placed at the chest for decoration. Alternatively, it may have been used to hold the head-cover like a fibula from Vorbasse grave 4 (Lund Hansen / Ethelberg forthcoming; Mannering et al. forthcoming).

The next group of textiles, group 2, is made up of the larger pieces which covered most of the body. In two graves it was indicated that they had been worn as a peplos-style dress, which is a type of dress that may have been known since the Bronze Age (Mannering et al. 2017, 11).

Three main points can be made: firstly, in graves without preserved textiles, the peplos-style dress is often identified by the presence of fibulae in pairs placed in the shoulder region. They would be used to fasten the dress on the shoulders. As metal is only present in c. 10 % of all graves (Ejstrud / Jensen 2000), it may seem that only the wealthier and more important people would be wearing this type of dress. But the textiles from Lønne Hede, along with the dress from Hammerum, proves that also whom we might term

"ordinary" people would be wearing this type of dress – and that it was a common type of clothing, even though it is still an open question how most of these dresses were fastened on the shoulders. Tacitus mentions that the Germanic people, if they did not have a fibula, would use a thorn to close their cloak (Lund 1993, 252). They may also have used thorns to hold their dresses on the shoulder. Pins of bone or antler, like in cremation grave A17, is another possibility.

Secondly, when the weaves are worn fastened on the shoulders, it is generally considered to be a typical woman's dress, to the extent that finds of fibulae in pairs of two placed in the shoulder region of graves is seen as an indication of the interred person being a woman. With this interpretation in mind it seems that at least the deceased in grave 1969, grave 1 and 12 were all women. The same may be true of the people buried in graves 6, 8 and 9, though in fact too little textile is preserved to allow for any gender identification. However, it must be mentioned that among the many textiles found in the Danish bogs dated to the 600–700 years of the Pre-Roman Iron Age and to the 1st century AD it has not been possible to identify a garment which unambiguously can be termed a man's garment, such as for instance trousers. Mannering et al. suggest that men also wore garments made of square textiles wrapped around the body (Mannering et al. 2012, 105), and thus it may be possible that one or two of the bodies buried at Lønne Hede were men, even though they cannot be identified on the basis of their outfit.

The size of the textiles in this group show a different fashion in tubular dresses than demonstrated both in the bog find Huldremose II (dated to the middle of the Pre-Roman period, Mannering et al. 2010), and the many representations in ancient Greek and Roman art which have inspired the interpretations of the fibulae found in pairs. In the latter examples, the textiles from which the tubular dresses were shaped were longer than the wearer was tall, so that the length had to be adjusted with a big fold at the top of the dress and a girdle. The Huldremose II garment was also very long, and it may also have been worn with a big fold (Hald 1980, 360). The dresses from Lønne Hede grave 1 and grave 12 are both shorter and tighter fitting and this is also the case in the later Hammerum grave (Mannering / Ræder Knudsen 2013).

The skirt from grave 1969 forms a subgroup of group 2. The evidence for the use of skirts in general is otherwise limited. This is probably due to the fact that no dress fasteners of wood, bone or metal are necessary in order to wear a skirt. It can be gathered round the waist with a string or a simple girdle. A small pin was found in the skirt, in a fragment placed close to the vertical border. This has in earlier interpretations been seen as an indication of this skirt being an open piece wrapped around the body, and the pin was supposed to hold the skirt closed at the front (Nordquist / Ørsnes 1971, 14). However, as it is now seen as a closed tubular garment, the pin has no obvious function in the skirt. Thus, only the fully preserved skirt from Huldremose demonstrates that skirts were used in the Iron Age in Denmark and support the interpretation of other more fragmented textiles as skirts, such as Karlby Mose and Krogens Mølle mose (Hald 1980; Mannering / Gleba forthcoming) as well as the skirt from Lønne Hede grave 1969.

Where skirts were found with bog-bodies, they were only combined with a shawl, a sheep-skin cloak, and possibly an undergarment of unknown shape made of plant fibres (Hald 1980, 147; Mannering et al. 2017, 123). The skirt in grave 1969 was worn with a tubular dress. We do not know the length of the dress, whether it was only a short top or an actual dress. It is here suggested that the dress had the same size as the other tubular dresses from Lønne and the one from Hammerum – that is almost knee-length and a relatively tight fit. The skirt might then serve as an extra garment, perhaps worn for extra warmth in the winter or for special occasions.

There were no shoes preserved in the graves. These would typically be made from animal hide. A dark substance found in the bottom and on the sides of the graves indicated that they had been lined with animal hide. Possible shoes would have melted into this substance as well and leave no trace of its own. Only the possible foot-wraps in grave 2 indicate the use of footwear.

The elusive textiles of group 3 seem to have served mostly as blankets. In an everyday life, these would probably function as (for instance) bedcovers, and therefore used as a lining and cover in the graves. The term "blanket", however, should be taken with caution, as a woolly weave like this may also have served more purposes – i. e. blanket at night and mantel during the day. A tiny selvedge fragment of textile 2.2 from grave 2 suggests that it also had a weft-fringe along the selvedge, which might indicate the use for more decorative purposes such as for instance a mantel.

We know little about men's clothing in the Iron Age, but even less is known about what children was wearing. The possible child in grave 2 had a shawl resembling shawls found in grave 1969, grave 1 and 12, and a very fine head-cover – besides the possible foot wraps. However, there was no sign of any other clothing. This may be due to poor preservation of other fibres than wool, as the deceased may have been dressed in garments made of plant fibres such as flax or nettle. The small child in grave 7 seemed to be wrapped in parts of old garments. At least two different weaves could be identified, but (with reservation for damages caused by the excavators) appeared worn.

3.14 Summing up the textiles

The thorough analysis of the textiles from Lønne Hede has revealed that the women at Lønne Hede continued to use a form of dress probably known since the Bronze Age (Mannering et al. 2017, 11). It was made from one piece of textile draped or wrapped around the body and fastened on each shoulder either with a fibula in precious metal or bronze or a pin made of organic material. The textiles could be gathered with a seam to form a tubular shape, but it is also possible that it could be an open rectangle just wrapped around the body and held in place with pins and a girdle *(fig. 128)*. As a supplement to the tubular dress a skirt could be worn. The tight-fitting knee-length dresses may mostly have been used alone in the summer, practical for everyday work. In winter, an added skirt would be a welcome addition to keep warm. Taking this argumentation further, we may even have an indication of a differentiation between winter and summer clothing.

It was not possible to identify any undergarments.

On the head, they appeared to be wearing a head-cover in the shape of a smaller rectangular piece, made in a very fine quality or in coarser weaves. It is not known how the head-cover was held in place, but an organic 'hat-pin' may be a possibility. In later historical periods, head-covers were always considered an essential part of the outfit, either for protection against the cold, vanity or as a social norm. It is very possible that head-covers were equally important in the Iron Age. It is important to note that some of the pieces used for head-covers may have had more purposes – such as shawls and scarves.

In several graves, similar rectangular pieces with warp end fringes was worn around the upper part of the body. These were typically in large bold patterns such as red and white stripes or chequers.

Skals' analysis of the fibres has shown that the wool used in all the textiles from Lønne Hede were relatively fine and rather homogenous. There is very little difference in the composition of fibres between the different garments, though it is indicated that the wool was assembled from more than one sheep. These very fine and homogenous fibres must be the

Fig. 128. Artists reconstruction of the costume from grave 1: a tubular dress with red and white stripes and a red shawl with white stripes (drawing: A. Højrup Batzer, 2014).

result of deliberate sheep breeding specifically aimed at producing good wool for textiles. It may, however, also demonstrate a careful separation of the wool fibres prior to spinning the yarn for the different garments (Skals / Mannering 2014).

The fact that such fine fibres were used also indicates that the garments would have been soft to touch and light to wear. It is not possible to weigh any of the textiles, but an experiment with production of a similar dress showed that a tubular dress the size of the dresses identified in grave 1 and 10 would weigh only c. 600 g (Demant 2018, 281).

Many of the textiles appeared to be woven in one colour, whereas others were woven in stripes in contrasting colours, a seemingly popular design feature, followed by chequered patterns such as the tablet-woven border (textile 1969.3) of the skirt and the shawl (textile 1969.4) in grave 1969. Particularly the shawl in grave 2 (textile 2.2) must have appeared bold in its combination of stripes and large diamonds woven in red and white.

The taste for large patterns can be seen as a continuation from the Pre-Roman Iron Age. Among the textiles found in bogs, the smaller pieces as well as some of the larger

ones display large chequered patterns based on contrasting colours used in both warp and weft (Mannering / Gleba forthcoming). Later, towards the end of the Roman Iron Age, the design tends to become more subtle with smaller chequers and emphasis on surface structure created with variations of twill weaving and creative combinations of both S- and Z-spun yarn (Bender Jørgensen 1986). However, this development must be seen as a part of a general change in the textile technology in this period, providing the ability to weave fabrics with more threads per cm (Demant forthcoming).

The clothing traditions and the design seem to be a subtle development from earlier periods, and the weaving technology also seems to have followed the same principles used at least since the earliest Iron Age, with a two-beam loom system. The warp-weighted loom known in central and southern Europe had not yet made its entry at the Lønne Hede settlement. However, the added borders and particularly the two tablet weaves indicate creativity and openness to new ideas and technology.

4. Dyestuff investigation of the Lønne Hede textiles

At the time of the discovery of the first grave in 1969, the identification of dyestuffs in archaeological textiles was a relatively new addition to textile research and it had mainly been used on ancient colourful textiles like for example pre-Columbian fragments (Fester 1951). However, in 1945 the Danish botanist Mogens Skytte Christiansen together with Margrethe Hald did a few spot tests on Danish archaeological Iron Age textiles and found indigotin in six different finds (Hald 1980). Apart from that, no other dyestuff analyses had been carried out on Danish textiles until the discovery of the Lønne Hede textiles, and around that time no laboratories specialized in these services. Therefore, Nordquist and Ørsnes at first solely used the colour of the yarns as the basis for their interpretation of which dye sources were used in the production of the colourful textiles. They suggested that the blue yarn was dyed with an indigoid dye source, and that it probably was the woad plant (Isatis tinctoria L.) that had been used in the dyeing process. The colouring matter in woad, indigotin, can be found in many other plants, but due to the context of the textiles it is most likely that the locally grown woad had been used rather than tropical species like *Indigofera sp.* or *Polygonum tinctoria* Ait (Hofenk de Graaff 2004b). The discovery of many woad seeds in the Lønne Hede grave soil supported this theory (Nordquist / Ørsnes 1971). The colour of the red yarn was suggested to originate from a madder-type dye source.

The first actual dyestuff analysis of the blue and red yarns was carried out in the mid-1970s when Dokkedal / Jensen (1976), with the help of spot test and Thin Layer Chromatography (TLC), showed that the blue colour originated from an indigoid dye source, whereas the red colour proved very difficult to identify. They obtained a satisfactory chromatogram for the red dye extract but were not able to match the result with any well-known red dye source. They could, however, rule out that the dyestuff originated from madder or a madder-like dye source, as none of the typical dye components like alizarin and purpurin were detected in the chromatogram. The TLC method they used is described in Nørgård et al. 1983. Later, in 1984, new attempts to identify the red dyestuffs in the Lønne Hede textiles were carried out. Six new samples were sent to Textile Research in York for dyestuff identification. This research unit, founded by textile researcher Penelope Walton in 1980 and joined by George Taylor in 1981, specialized in dyestuff analyses of archaeological textiles using TLC and UV/Vis spectrophotometry. The Lønne Hede samples were analysed with Taylor's method (1983) and the results were published in Jørgensen / Walton (1986). They identified the three blue samples from respectively the

top/skirt (textile 1969.2), the checkered shawl (textile 1969.4) and the upper lining (textile 1969.7) as indigotin, and suggested that in the given context woad (*Isatis tinctoria* L.) would be the most probable plant source. Three red samples were also analysed with the same method: the checkered shawl (textile 1969.4), the tubular woven border (textile 1969.5) and the upper lining (textile 1969.7). They all yielded an orange extract in the test for mordant dyes, but it proved impossible to identify any red dye components. Many references were tested: *Rubia spp., Galium spp,* dyewoods (such as brazilwood or sanderswood), insect reds (such as kermes and cochineal), fungus reds (such as *Dermocybe semisanguinea* and *Rumex crispus* [seeds]), but they could all be eliminated as dyestuffs for the Lønne Hede red (Walton 1988).

When the Lønne Hede area was re-excavated in 1995 and new inhumation graves with coloured textiles were found, the issue of dyestuff identification soon again became relevant, and six samples from textiles in grave 2 (textile 2.2 white, textile 2.3 red-brown plus white sample, textile 2.4 red-brown plus white, and textile 2.6 white) and three samples from grave 7 (textile 7.1 reddish-brown plus white and textile 7.2 reddish brown) were sent to Textile Research for dyestuff identification and detection of natural pigmentation in the fibres. They were analysed by the same methods as described by Taylor (1983), except for the TLC analysis, which since then had been improved (Walton / Taylor 1991). Natural pigmentation was investigated in transmitted light microscopy and the red-brown and white yarns from the shawl (textile 2.3) were further tested by Energy-dispersive X-ray spectroscopy (EDXRF) to investigate whether iron or other inorganic colourant could be identified in the red fibres. No red inorganic or organic dye components were identified, and according to Walton (1997) it was not possible to detect any natural pigmentation in the fibres from grave 2. Only the yarns from grave 7 contained a moderate amount of pigment grains similar to brown wool. The dyestuff analyses of all the red-brown yarns from grave 2 and 7 showed similar results as the ones obtained when analysing the red samples form the first excavated grave. They all yielded an orange coloured extract when tested for mordant dyes, and when analysing the aqueous extract in UV/Vis spectroscopy, they only provided a broad absorption spectrum at low wavelengths without any detection of distinguishing features. However, with the use of the improved thin layer chromatography, it was possible to show that the extracts of the red-brown yarn from the shawl (textile 2.3) had substantially more pyrogallol than the extract of the white yarn from the same textile. Pyrogallol is the breakdown product formed when tannin-based dyes are analysed. Walton therefore concluded that the red and red-brown yarns analysed most certainly all came from the same dye source, organic than rather inorganic, and from a tannin-based material. The fact that the red-dyed fibres often were better preserved than the white fibres was probably due to the biocidal effect of tannin, which would provide some protection from microbial attack after burial (Walton 1997).

To expand the knowledge on the dyestuffs in the Lønne Hede textiles, new analyses were carried out during the past decade. Reversed-phase high performance liquid chromatography was used for the identification of the organic dye components with detection of the absorbance spectra using a photo diode array (RP-HPLC-DAD). Several extraction protocols either aiming to recover a very wide range of organic dyes especially from archaeological wool fibres, or developed for a specific type of dyes have been applied (Vanden Berghe et al. 2009). Compared to the analytical technique applied in the earlier studies, RP-HPLC leads to the detection of a very broad range of organic constituents. Besides, it is a much more sensitive technique that also allows detection of compounds present in much lower amounts, hence providing an opportunity to detect minor compounds and not only the major marker compounds. This makes this technique very suitable for archaeological

samples in which the amounts of dye left in the fibres is usually very low, even in the case of very contaminated archaeological samples (Vanden Berghe 2013). Scanning electron microscopy with energy dispersive X-ray detection analysis (SEM/EDX) (Goldstein et al. 1981) was done to investigate the elemental composition of the fibre surface of the Lønne Hede textiles. The detection of any metal elements such as aluminium, iron or copper could indicate the presence of particular inorganic mordants, or the use of red inorganic pigments such as iron oxides (ochre pigments), used in ancient Egypt for the manufacturing of orange or red linen (Ahmed 2009).

4.1 Samples

Samples were taken from the textiles in the oak coffin grave 1969, and from six graves excavated in 1995. These textiles vary in several ways. The 1969 textiles are more colourful and better preserved and, furthermore, these textiles possibly went through some kind of treatment after excavation. Many textiles show clear signs of impregnation, but unfortunately no documentation has been found, and the materials and methods used are therefore unclear. Later analyses have verified that some textiles were impregnated with lanolin or beeswax (Henk 2010). A third impregnant was also detected, but not identified. However, the persistent rumour that soluble nylon was used as a stabilizer could not be verified (Henk 2010). The 1995 graves from which textiles were analysed were all simple, with the deceased buried either directly in the sandy soil or on a piece of animal hide or fur. Drainage of the area had occurred since the first excavation, and the area was therefore no longer waterlogged, although occasionally flooded. Each grave was block lifted and dried at low temperature before the actual excavation of the textiles took place. None of these later excavated textiles were rinsed or impregnated (Frandsen 1995; Roberts / Frandsen 1996).

4.1.1 Samples for chromatographic analyses

A total of 53 samples from 22 different textile fragments from the oak coffin grave (textile 1969), were selected for dye analyses. The majority were red yarns, but a broad selection of white, brown, green and blue coloured samples was also chosen for analysis. The amount and condition of the textiles from the 1995 excavation varied quite a bit and, consequently, only the most well-preserved textiles were selected for analysis. All in all, 43 samples of various colours from 24 textile fragments from graves 1, 2, 6, 7, 10, and 12 were selected for the analyses, and it was ensured that the samples represented a broad selection of colours ranging from brown, orange, red and blue to white and greyish shades.

4.1.2 Samples for element analyses

For the element analyses fragments were selected that were all clearly patterned either in red and blue, or in red-brown and white, in order to be able to compare the element content of the red and red-brown yarns with the undyed white and the vat-dyed blue yarns. Two samples from each of the four fragments selected were chosen for the element analyses: two fragments from grave 1969 (textile 1969.4 [fragment C33299] and textile 1969.7 [fragment C33297]) and two from the 1995 graves (textiles 1.6 and 2.3). Furthermore, two soil samples from grave 1 and 2 were analysed, along with new brown and white wool from North Ronaldsay sheep as reference material. Wool from these sheep was chosen as they belong to a native breed similar to the Iron Age sheep (Ryder 1981).

4.2 Methods

4.2.1 HPLC-DAD procedure and dye extraction

Micro samples of 5–8 mm of fibres were analysed with reversed-phase high performance liquid chromatography coupled to photo diode array detection (RP-HPLC-DAD)[8]. Absorbance spectra together with retention times were used to define each colouring compound by comparison with spectra from a user-generated reference spectra database developed from commercially and non-commercially available references of natural dye sources. The database covers a large group of mordant, direct and indigoid dye compounds belonging to a wide variety of vegetal and animal dye sources. The compound composition obtained provides information for the attribution of the biological dye source(s).

The dye analyses of the Lønne Hede samples were executed in different subseries between 2005 and 2011. They were either requisitioned by the Danish National Research Foundation Centre for Textile Research, or made within the framework of the doctoral thesis of Annemette Bruselius Scharff. All samples were systematically analysed after dye extraction with hydrochloric acid (HCl) in order to identify the categories of both mordant and indigoid dye compounds. In most cases, the ethyl acetate (HCl-EtAc) step was needed to eliminate as much as possible of organic contaminants present in the samples due to the burial conditions, in analogy with earlier dye studies of Scandinavian textiles (Vanden Berghe et al. 2009). When sample size allowed for a second sample, dimethylformamide (DMF) extraction was also applied to improve detection of indigoid compounds. Further tests, in particular for the identification of the red colourant, were carried out on three red

[8] The reverse phase chromatography system consists of an Alliance HPLC instrument with automatic injection (Waters Chromatography BV). The mobile phase is composed of (A) pure methanol (grade: for HPLC > 99.8%), (B) a mixture of methanol and ultrapure water (Milliq. water, Millipore, USA) in the volumetric ratio of 1/9 and (C) a 5% phosphoric acid solution (85 wt% pro analysis), run according to the following gradient: 0–3 minutes: isocratic 23A/67B/10C, 3–29 minutes: linear gradient to 90A/0B/10C, 30–35 minutes: isocratic 23A/67B/10C. The elution program has a constant flow rate of 1.2 ml / minute. For the stationary phase, a temperature-controlled end capped LiChrosorb RP-18 column is used. The PDA detector (model 996) uses 512 diodes, scanning the absorbance within the wavelength range between 200 and 800 nm, with a resolution of 1.2 nm with 1 scan / second. The applied software system for data treatment is Empower 2. All equipment is from Waters Chromatography BV. The analyses are systematically done on acidic extracts of the fibres.
The dye extraction with hydrochloric acid and ethyl acetate step consists of the treatment of each micro sample with 500 µL of a solution of water / methanol / 37% HCl (1:1:2, v:v:v) for 10 minutes at 105°C in open Pyrex tubes in a heating block. After rapid cooling under tap water, 1000 µl ethyl acetate is added to the solution. After decanting of the upper phase, this ethyl acetate solution is dried in a vacuum evaporator. The dry residues are taken up in 30/30 µL methanol / water (1 / 1, v / v) and 20 µL of this solution is injected in the chromatographic system. Only few well coloured samples are analysed without the ethyl acetate purification step. Dye extraction with a less harsh acid, possibly leading to the detection of dye glucosides or less stable dye compounds, is obtained after sample treatment in 250 µl in methanol / aceton / water / 2.1 M oxalic acid (30:30:40:1, v:v:v:v) for 15 minutes at 80°C in a heating bloc under constant stirring. Hereafter, the sample is centrifuged for 5 minutes at 5.000 RPM at room temperature and 200 µL of the upper part is dried in a vacuum evaporator. The dried material is redissolved in 30/30 µL methanol/water (1/1, v/v) from which 20 µL is taken for injection. Solvent extraction in dimethyl formamide concerns the treatment of the sample in 250 µL of hot dimethyl formamide for ten minutes at 140°C in the dark after which 20 µL of the extract is injected immediately in the HPLC system.

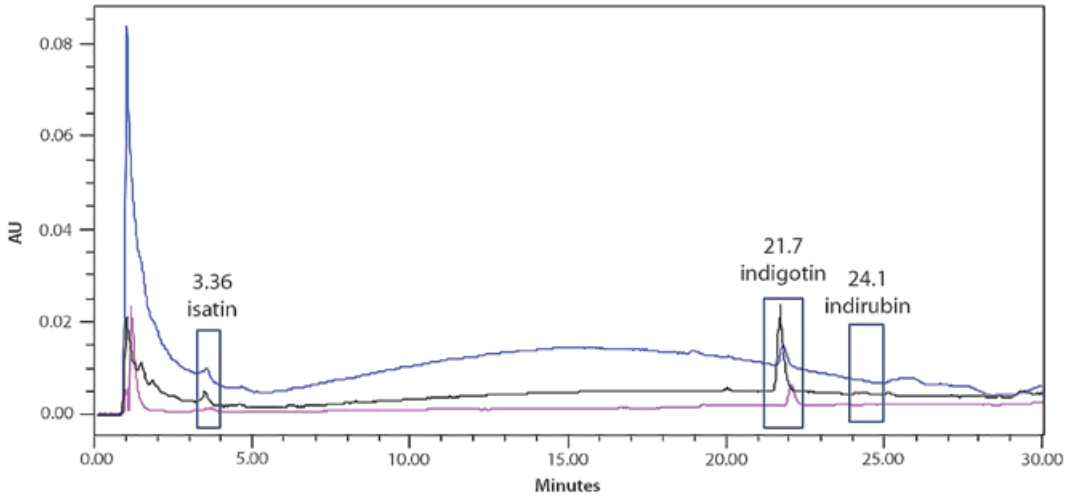


Fig. 129. Sample from red tape (1995, National Museum Inv.No. C33219, sample 08778c / 17). HPLC-DAD chromatogram at 288 nm wavelength of the dyes extracted with hydrochloric acid and ethyl acetate (black line), with hydrochloric acid (blue line) and with dimethylformamide (pink line) (illustration: A. Bruselius Scharff).

samples using a milder acidic extraction with oxalic acid (OA) and solvent extraction with dimethylformamide (detailed description of the analytical protocol is given in footnote 8). All the dyestuff analyses were made at the Royal Institute for Cultural Heritage in Brussels.

In *figure 129*, a comparison of the HPLC chromatograms obtained from different extracts from a woad dyed sample is provided. It shows that the use of the ethyl acetate step after hydrochloric acid extraction results in much less background noise and a higher peak intensity of the main peak indigotin compared to the hydrochloric acid method alone. In addition, the dimethylformamide extract did not deliver the expected improved indigoid intensity, which is not an artefact, as this was encountered in multiple archaeological samples. Possibly, it was influenced either by the degradation of the sample matrix or by the heterogeneity of the samples. Based on these observations, the hydrochloric acid and ethyl acetate treatment was preferred for the majority of the samples independent of their colour.

4.2.2 SEM-EDX procedure

Samples were mounted on carbon adhesive tabs on SEM aluminium stubs and analysed in a JEOL 5310LV scanning electron microscope (SEM) equipped with a Link ISIS Pentafet$_{ATW}$ Energy dispersive spectrometer (EDS) from Oxford Instruments. Link ATW allows the detection of low-energy X-ray photons so that the element boron (Z = 5, Kα = 0,183 Kev) can be detected. The analyses were carried out at 15 kV with a 20 mm working distance. Each analysis was run for 200 seconds live time. All the element analyses were made by Annemette Bruselius Scharff and Jørn Bredal Jørgensen at the School of Conservation in Copenhagen.

4.3 Results of the chromatographic and element analyses

The results of the chromatographic analysis of the Lønne Hede samples from the excavations in 1969 and 1995 are described in *tables 103–104*. All yarns sampled for analysis have a unique identity code (sample ID) given in column 5. Often, the samples have been

Excavation Lohne Hede in 1969

LH1969 NM No.	Textile	Fabric No.	Description	Sample ID KIK	HPLC extraction protocol	HPLC-PDA Dye compounds	λ (nm)	Biological dye source
No nr.	Headscarf	1	brown	08778 / 08	HCl-EtAc	no dyes detected	-	-
No nr.	Headscarf	1	brown	08778 / 08	HCl	no dyes detected	-	-
No nr.	Headscarf	1	brown	08778 / 22	HCl	no dyes detected	-	-
C33227	Headscarf	2	reddish brown warp	11132 / 01	HCl-EtAc	indigotin	288	Woad
C33227	Headscarf	2	reddish brown weft	11132 / 02	HCl-EtAc	indigotin	288	Woad
C33227	Headscarf	2	reddish brown weft	11132 / 03	HCl-EtAc	indigotin	288	Woad
C33227	Headscarf	2	light-missing weft	11132 / 04	HCl-EtAc	No dyes detected	-	-
C33300	Topskirt	3	blue-yellow	08778 / 10	HCl	indigotin	288	Woad
C33197	Topskirt	4	blue warp	11132 / 05	HCl-EtAc	50 isatin, 43 indigotin, 7 indirubin	288	Woad
C33197	Topskirt	4	blue weft	11132 / 06	HCl-EtAc	73 isatin, 9 indigotin, 18 indirubin	288	Woad
C33308	Tablet woven border	5	red warp 1	11132 / 07	HCl-EtAc	66 isatin, 15 genistein-luteolin, 2 apigenin, 2 marker lycopodium, 14 indigotin, 1 indirubin	255/288	Woad, dyer's broom and clubmoss
C33308	Tablet woven border	5	blue, warp 2	11132 / 08	HCl-EtAc	47 isatin, 48 indigotin, 5 indirubin	288	Woad
C33308	Tablet woven border	5	blue, weft	11132 / 09	HCl-EtAc	62 isatin, 32 indigotin, 6 indirubin	288	Woad
C33296	Checkered scarf	6	red, warp 1	11132 / 10	HCl-EtAc	No dyes detected	-	-
C33296	Checkered scarf	6	blue, warp 2	11132 / 11	HCl-EtAc	55 isatin, 30 indigotin, 15 indirubin	288	Woad
C33296	Checkered scarf	6	red, weft 1	11132 / 12	HCl-EtAc	No dyes detected	-	-
C33296	Checkered scarf	6	blue, weft 2	11132 / 13	HCl-EtAc	47 isatin, 44 indigotin, 9 indirubin	288	Woad
C33296	Checkered scarf	7	red	08778 / 11	HCl	(indigotin)	288	Trace of woad
C33296	Checkered scarf	7	red	08778c / 05	HCl-EtAc	(34 luteolin, 66 indigotin)	255	Traces of woad and luteolin yellow
C33296	Checkered scarf	7	red	11048 / 22	HCl-EtAc	No dyes detected	255/288	-
C33262	Checkered scarf	8	red	08778c / 05	HCl-EtAc	(34 luteolin, 66 indigotin)	255	Traces of woad and luteolin yellow
C33262	Checkered scarf	8	red	08778c / 05	OA	(indigotin)	288	
C33256	Checkered scarf	9	red, vertical	08778c / 08	HCl-EtAc	(indigotin)	255/288	Trace of woad
C33256	Checkered scarf	9	red, vertical	08778c / 08	OA	No dyes detected	-	
C33256	Checkered scarf	9	red, horizontal	08778c / 09	HCl-EtAc	(indigotin)	255/288	Trace of woad
C33256	Checkered scarf	9	red, horizontal	08778c / 09	DMF	No dyes detected	-	
C33256	Checkered scarf	9	red, horizontal	08778 / 14	HCl	indigotin	255/288	Woad
C33256	Checkered scarf	10	red vertical	08778c / 10	HCl-EtAc	No dyes detected	-	-
C33265	Checkered scarf	11	red vertical	08778c / 13	DMF	No dyes detected	-	Trace of tannin and woad
C33265	Checkered scarf	11	red vertical	08778c / 13	HCl	(ellagic acid, indigotin)	255/288	
C33265	Checkered scarf	11	red vertical	08778 / 16	HCl	(indigotin)	255/620	Trace of woad
C33265	Checkered scarf	11	red horizontal	08778c / 12	HCl-EtAc	(59 ellagic acid, 31 indigotin)	255/288	Trace of woad and tannin
C33265	Checkered scarf	11	red horizontal	08778c / 12	DMF	(indigotin)	288	
C33265	Checkered scarf	11	red horizontal	08778 / 15	HCl	no dyes detected	-	-
C33281	Checkered scarf	12	red horizontal	08778c / 14	HCl-EtAc	(indigotin)	288	Trace of woad
C33281	Checkered scarf	12	red horizontal	08778c / 14	DMF	No dyes detected	-	
C33281	Checkered scarf	12	red vertical	08778c / 15	DMF	No dyes detected	-	-
C33281	Checkered scarf	12	red vertical	08778 / 17	HCl	(indigotin)	255/620	Trace of woad
C33286	Checkered scarf	13	red horizontal	08778 / 18	HCl	indigotin	255/288	Woad
C33200	Checkered scarf	14	red horizontal	08778c / 18	HCl-EtAc	9 ellagic acid, 5 luteolin, 65 indigotin, 1 indirubin luteolin, (apigenin, marker lycopodium)	255/288 350	Woad, tannin and weld and a trace of clubmoss
C33277	Checkered scarf	15	red	08778c / 19	HCl-EtAc	(indigotin)	255/288	Trace of woad
C33277	Checkered scarf	15	red	08778c / 19	DMF	No dyes detected	-	-
C33277	Checkered scarf	15	red	08778c / 19	HCl	No dyes detected	-	
C33302	Tubular woven border	16	red, warp 1	11132 / 14	HCl-EtAc	52 genistein-luteolin, 19 apigenin, 14 marker lycopodium, 15 indigotin	255	Woad, dyer's broom and clubmoss
C33302	Tubular woven border	16	white, warp 2	11132 / 15	HCl-EtAc	No dyes detected	-	-
C33302	Tubular woven border	16	blue, warp 3	11132 / 16	HCl-EtAc	31 isatin, 59 indigotin, 10 indirubin	288	Woad
C33302	Tubular woven border	16	white, weft	11132 / 17	HCl-EtAc	(indigotin)	288	Trace of woad
C33299	?	17	brown	08778 / 23	HCl	no dyes detected	-	-
C33299	?	17	brown	08778c / 16	HCl-EtAc	86 ellagic acid, 7 luteolin, 7 indigotin	255	Tannin, woad and luteolin yellow
C33299	?	17	brown	08778c / 16	DMF	(ellagic acid)	255/288	Trace of tannin
C33225	?	18	light brown, warp/weft	11132 / 18	HCl-EtAc	(indigotin)	288	Trace of woad
C33225	?	18	light brown, warp/weft	11132 / 19	HCl-EtAc	No dyes detected	-	-
C33297	Upper lining	19	blue	08778 / 20	HCl	99 indigotin, 1 indirubin	255/288	Woad
C33297	Upper lining	19	light blue	08778 / 21	HCl	indigotin	255	Woad
C33297	Upper lining	19	red, warp 1	08778c / 07	HCl-EtAc	indigotin	288	Woad
C33297	Upper lining	19	red, warp 1	08778 / 12	HCl	indigotin + u 20.1 (abs max. 511 nm)	288	Woad + unknown red
C33297	Upper lining	19	red, warp 1	08778 / 12	OA	No dyes detected	255/288	-
C33208	Upper lining	20	red, warp	08778 / 19	HCl	indigotin	255	Woad
C33208	Upper lining	20	red, warp	08778c / 11	HCl-EtAc	No dyes detected	-	-
C33308	Upper lining	21	blue, warp 1	11132 / 20	HCl-EtAc	55 isatin, 34 indigotin, 11 indirubin	288	Woad
C33308	Upper lining	21	red, warp 2	11132 / 21	HCl-EtAc	50 isatin, 50 indigotin	288	Woad
C33308	Upper lining	21	blue, weft	11132 / 22	HCl-EtAc	54 isatin, 31 indigotin, 15 indirubin	288	Woad
C33219	Red tape	22	red	08778 / 13	HCl	indigotin	288	Woad
C33219	Red tape	22	red	08778c / 17	HCl-EtAc	99 indigotin, 1 indirubin	288	Woad
C33219	Red tape	22	red	08778c / 17	DMF	9 isatin, 88 indigotin, 3 indirubin	288	Woad
C33219	Red tape	22	red	08778c / 17	HCl	14 isatin, 82 indigotin, 4 indirubin	288	Woad

Table 103. Results of the chromatographic analysis of the Lønne Hede samples from the excavations in 1969.

divided in two or three parts to allow tests with different extractions, as given in column 6. In cases where different extracts were used, the detected dye compounds in column 7 are mentioned for each analysis separately. When more than one compound was found, the relative ratio between the peak areas of the compounds was calculated at the given wavelength as specified in column 8. The identified dye compounds, as well as their relative ratios, were considered for further interpretation of the possible biological sources applied for dyeing, and are listed for each of the samples in the last column. Dye components mentioned between brackets were found in very low amounts.

The SEM element analyses were done three to four times on each yarn sample. First an area was scanned at 200× magnification, then two to three spot analyses were obtained at 750× magnification. The spot analyses were carried out on the best-preserved fibres, thus, when possible, fibres with scales were selected. A spectrum was obtained for each SEM-EDX analysis and semi-quantitative data for each detected element were calculated as a percentage of total element content in the analysis.

The results of the SEM/EDX analyses are listed in *table 105*.

LH VM No.	Textile	Fabric No.	Description	Sample ID KIK	HPLC extraction protocol	HPLC-PDA Dye compounds	λ (nm)	Biological dye source
Textile 1.3	Extra fabric, no stripes	1	brown, dark	11132 / 33	HCl-EtAc	No dyes detected	-	-
Textile 1.5.1	Dress	2	reddish	08778 / 07	HCl-EtAc	No dyes detected	-	-
Tx 1.5.1	Dress	2	reddish	08778 / 07	HCl	No dyes detected	-	
Tx 1.5	Dress	3	red/brown warp	11132 / 26	HCl-EtAc	No dyes detected	-	-
Tx 1.5	Dress	3	red/brown weft	11132 / 27	HCl-EtAc	No dyes detected	-	-
Tx 1.5	Dress	3	red stripe, weft	11132 / 28	HCl-EtAc	85 genistein-luteolin, 8 apigenin, 7 marker lycopodium	255	Dyer's broom and clubmoss
Tx 1.5	Dress	3	white stripe, weft	11132 / 29	HCl-EtAc	No dyes detected	-	-
Tx 1.6p	Shawl	4	red/brown	08778 / 06	HCl	No dyes detected	-	-
Tx 1.6p	Shawl	4	red/brown	08778c / 03	HCl-EtAc	No dyes detected	-	-
Tx 1.6p	Shawl	4	red/brown	08778c / 04	HCl-EtAc	No dyes detected	-	-
Tx 1.6	Shawl	5	red/brown, warp	11132 / 23	HCl-EtAc	No dyes detected	-	-
Tx 1.6	Shawl	5	red/brown, weft	11132 / 24	HCl-EtAc	No dyes detected	-	-
Tx 1.6	Shawl	5	white stripe, weft	11132 / 25	HCl-EtAc	No dyes detected	-	-
Tx 1.7	Border	6	brown warp	11132 / 30	HCl-EtAc	No dyes detected	-	-
Tx 1.7	Border	6	red/brown stripe, warp	11132 / 31	HCl-EtAc	84 genistein-luteolin, 10 apigenin, 6 marker lycopodium	255	Dyer's broom and clubmoss
Tx 1.7	Border	6	reddish weft	11132 / 32	HCl-EtAc	No dyes detected	-	-
Tx 2.3	Shawl	7	beige-orange	08778 / 03	HCl	No dyes detected	-	-
Tx 2.3	Shawl	7	red	08778c / 01	HCl-EtAc	No dyes detected	-	-
Tx 2.3 E	Shawl	8	red/brown	08778c / 02	HCl-EtAc	No dyes detected	-	-
Tx 2.3	Shawl	9	red/brown	11132 / 34	HCl-EtAc	No dyes detected	-	-
Tx 2.3	Shawl	9	white, weft	11132 / 35	HCl-EtAc	No dyes detected	-	-
Tx 2.6	Tabby	10	white, warp	11132 / 36	HCl-EtAc	No dyes detected	-	-
Tx 2.6	Tabby	10	white, weft	11132 / 37	HCl-EtAc	(indigotin)	288	Trace of woad
Tx 2.2	Blanket	11	white, weft/warp	11132 / 38	HCl-EtAc	14 isatin, 85 indigotin, 1 indirubin	288	Woad
Tx 2.2	Blanket	11	white, weft/warp	11132 / 39	HCl-EtAc	(indigotin)	288	Trace of woad
Tx 6.2	Head dress	12	blue, warp/weft	11132 / 40	HCl-EtAc	57 isatin, 36 indigotin, 7 indirubin	288	Woad
Tx 6.1	Loose string	13	reddish	11132 / 41	HCl-EtAc	46 genistein-luteolin, 8 apigenin, 39 marker lycopodium, 7 indigotin	255	Woad, dyer's broom and clubmoss
Tx 7.1	Worn textile	14	red/brown, warp	11132 / 42	HCl-EtAc	No dyes detected	-	-
Tx 7.2	Worn textile	15	grey	11132 / 43	HCl-EtAc	No dyes detected	-	-
Tx 7.3	Worn textile	16	white	11132 / 44	HCl-EtAc	No dyes detected	-	-
Tx 10.4	Dress	17	orange, warp/weft	11132 / 45	HCl-EtAc	No dyes detected	-	-
Tx 10.4	Dress	17	orange, warp/weft	11132 / 46	HCl-EtAc	No dyes detected	-	-
Tx 10.3	Tabby rep. belt	18	orange, warp	11132 / 47	HCl-EtAc	No dyes detected	-	-
Tx 10.3	Tabby rep. belt	18	dark red, weft	11132 / 48	HCl-EtAc	No dyes detected	-	-
Tx 10.7	Textile by feet	19	red/brown, dark warp/weft	11132 / 49	HCl-EtAc	No dyes detected	-	-
Tx 10.7	Textile by feet	19	red/brown, dark warp/weft	11132 / 50	HCl-EtAc	No dyes detected	-	-
Tx 10.6	Border	20	orange weft	11132 / 51	HCl-EtAc	No dyes detected	-	-
Tx 12.1	Shawl	21	red/brown, warp	11132 / 52	HCl-EtAc	No dyes detected	-	-
Tx 12.1	Shawl	21	red/brown, weft	11132 / 53	HCl-EtAc	No dyes detected	-	-
Tx 12.1a	Shawl	22	brown	08778 / 02	HCl	u 11.2 (abs.max. 310 nm)	255/310	Unknown yellow
Tx 12.2		23	beige	08778 / 01	HCl	No dyes detected	-	-
Tx 12.2		23	beige	08778 / 01	HCl-EtAc	No dyes detected	-	
Tx 12.3	Dress	24	beigewarp	11132 / 54	HCl-EtAc	No dyes detected	-	-
Tx 12.3	Dress	24	reddish weft	11132 / 55	HCl-EtAc	No dyes detected	-	-
Tx 12.3	Stitch on Tx 12.3	24	dark sewing thread	11132 / 56	HCl-EtAc	No dyes detected	-	-

Table 104. Results of the chromatographic analysis of the Lønne Hede samples from the excavations in 1995.

	O	Na	Al	Si	P	S	K	Ca	Fe	Cu	Zn	Ti
C33299 Red area	66	2,7	3,3	3,4		16,6	0,2	0,7		4,1	2,9	
Spot 1	48,1	2,6	6,6	3,1		28,5	0,4	0,7		5,6	4,4	
Spot 2	45,5	1,9	3,4	2,1		34,6	0,5	0,4		6,9	4,9	
Spot No data												
C33299 Blue area	67,3	2,5	3,2	2		19,3	0,3	0,5		2,7	2,2	
Spot 1	46,7	2,6	7	2		35,4		0,3		3,5	2,5	
Spot 2	45,9	2,8	6,9	1,9		36,7	0,3	2,2		3,3	1,9	
Spot No data												
C33297 Frag 1 Red area	58,7	1,2	2,8	2,7		18,9	0,3	2,3	1,1	6	5,7	0,4
fiber spot	39,4	0,8	5,3	4,4	0,6	33,6	1	2	1	6	5	1
C33297 Frag 2 Red area	67	3,7	7	5,2		15,1	0,4	0,3	0,3	1		
Spot 1	54,7	3,2	7,8	4,3	0,2	27,7	0,2	0,4	0,5	1,2		
Spot 2	54,9	2,7	8,4	4,9		26,4	0,6	0,4		1,7		
Spot 3	59,2	3,7	7,6	5	0,4	20,3	1,1	0,3	1,1	1,4		
C33297 Frag. 2 Blue area	69,4	3,8	2,8	2,5	0,3	19,7	0,3	0,3		0,9		0,3
Spot 1	49,8	5,6	5,3	2,2		35,1	0,4	0,2		1,3		
Spot No data												
Spot 3	50,8	5	5,1	2,4		35,4	0,2	0,2		1		
Tx2.3 White area	69,7	0,7	8,4	3,9	1	16,1	0,3	0,4		0,5		
Spot 1	55,4	0,6	10,1	3,1	0,8	28,8	0,1	0,4		0,6		
Spot 2	51,4	0,6	9,6	2,4	0,4	34,3	0,2	0,3		0,9		
Spot 3	57,2	0,5	14,3	3,4	0,9	23,3		0,4				
Tx2.3 Red area	69,8	1,1	9	4,1	1	13,8	0,2	0,3		0,8		
Spot 1	55,1	0,5	16,7	3,9	0,7	22,1		0,5		0,6		
Spot 2	56,2	0,8	11,3	3,1	0,7	26,7		0,5		0,8		
Spot 3	53,7	0,5	10	6	0,2	28,8		0,3		0,4		

	O	Na	Al	Si	P	S	K	Ca	Fe	Cu	Zn	Ti
Tx2.2 Soil area	61		10,5	17,7	0,5	4,8	0,6	0,7	1,7	1,5	1	
Soil detail	61,4		13,3	16,5	0,9	3,3	0,7	0,7	1,5	1		0,3
fiber spot	38,5		7,4	22,2	0,9	26,7	0,6	0,8	0,6	1,5	0,7	0,8
Tx1.6p White area	67,7	0,7	7,8	3	0,6	19,3	0,2	0,2		0,6		
Spot 1	55,7	0,5	8,8	2,7		32,1		0,2				
Spot 2	49	0,6	12,7	4,2	0,4	31,8		0,3		0,6		0,4
Tx1.6p Red area	69,3	0,2	6,8	2,4		21,2		0,2				
Spot 1	47	0,4	9,8	1,5		41,1		0,2				
Spot 2	58	1	4,8	1,9		32,2				2,1		
Spot 3	46,3	0,3	6,5	1,9		43,3		0,2		1,5		
Tx1.5 Soil area	60,6		12,1	19,2	0,6	5,1	0,6	0,3	1,2			0,3
Soil detail	61,5	0,5	14,1	13,6	1,4	5,7	0,4	0,6	0,9			
Fiber spot	55,1		14,5	4,3	0,5	23,9			0,4	0,6		
White - NR Wool-area	75,2	1,6	1	0,9		16,3	0,3	1,2		2,5		
Spot 1	64,4	1,4	0,7	0,8		29,8		1,6		1,2		
Spot 2	68,7	1,4	0,6	0,6		26		1,8		0,8		
Spot 3	65,4	1,1	0,8	0,9		28,6		2,1		1,2		
Brown NR Wool area	71,4	1,7	2,3	1		19,8		2,4		1,4		
Spot 1	61,7	1,4	0,6	1		30,7		3,8		0,9		
Spot 2	65,3	1,4	0,5	0,8		25,1		5,9		0,9		
Spot 3	62	1,8	0,6	0,7		31,1		3,4		0,4		

Table 105. Results of the SEM/EDX analyses.

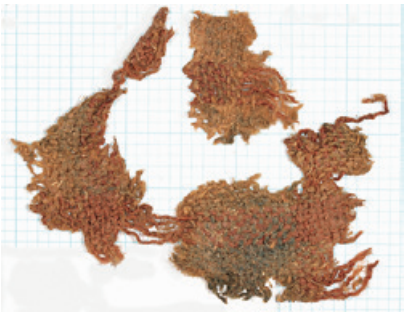


Fig. 130. Fragment of the checkered scarf C33299 from the excavation in 1969. The blue yarns contain indigotin, indirubin and isatin; the red yarns traces of indigotin and luteolin. (photo: A. Bruselius Scharff).

4.4 Biological sources of dyes and mordants

4.4.1 Blue dye source

An indigoid dye source was identified based on the detection of the major marker compound indigotin and its isomer indirubin. Sometimes, isatin, the precursor of indirubin, was also present. In the given context, woad *(Isatis tinctoria* L.) is the most plausible plant source used to dye the Lønne Hede wool samples. Indigotin was found in 19 textile fragments out of 22 from the 1969 excavation, but only in four out of 24 fragments from the 1995 graves *(tables 103–104)*.

Indigotin was identified in all blue coloured warp or weft yarns, as well as in many yarns that are today brown or reddish, although detected in much lower amounts *(fig. 130)*. Apart from the fact that some reddish and brown yarns contained a few blue fibres due to contamination during spinning *(fig. 131a)*, this suggests that indigotin particles were present in the reddish and brown yarns because of migration of the blue dye from neighbouring yarns or fabrics during the burial in the soil *(fig. 131b)*.

Experiments by Maj Ringgaard and dye compound investigations by Ina Vanden Berghe have proven that indigo-dyed textiles buried for eight months in peat under conditions that are either waterlogged and anoxic, or humid with low oxygen content show migration of the indigotin molecules from one textile to another. The migration varied significantly but was most obvious in the humid oxygen-containing peat (Ringgaard 2010; Vanden Berghe 2009). Moreover, oxygen-free waterlogged conditions provoked very pronounced colour degradation of the blue-dyed fibres, resulting in complete fading of the blue colour. This might be explained by the fact that indigotin pigments are reduced in such conditions to their olive-green water-soluble leucoform, thus facilitating their migration from the fibres into the waterlogged soil and neighbouring materials (Scharff / Ringgaard 2011).

Hence, dye analyses show that in the textiles from grave 1969, woad was used for blue dyeing of the yarns from the top and skirt (textile 1969.2, fragments C33300 and C33197) *(fig. 132a)*, the blue warp and weft yarns from the tablet-woven border (textile 1969.3, fragment C33308), the checkered scarf (textile 1969.4, fragment C33299), the upper lining (textile 1969.7, fragments C33297 and C33208), as well as the tubular woven border (the blue warp from textile 1969.5, fragment C33302). In all other samples, no clear link between the detection of indigotin and a blue colour was found. In the 1995 textiles that

Fig. 131. Optical microscopy images: a. red warp yarns from the upper lining C33208, LH 1969 (1131/21) with several spun blue fibres; b. yarn from blanket textile 2.2 (grave 2), LH 1995 (11132/39) with blue particles or aggregates (photo: I. Vanden Berghe).

Fig. 132. Optical microscopy images showing the heterogeneity of the woad degradation / discolouration: a. the top / skirt C33197, LH 1969 (11132/05); b. the head dress textile 6.2 (grave 6), LH 1995 (11132/40) (photo: I. Vanden Berghe).

were preserved by sandy, waterlogged conditions without the protection of an oak coffin, indigotin was only found in two graves: in the white warp and weft from blanket textile 2.2 from grave 2 and in two samples from grave 6, namely the blue yarns from the head dress textile 6.2 and in a dark red loose string from textile 6.1 *(fig. 132b)*.

The influence of water, and even more so of oxygen, was of major importance for the preservation of the blue colour of the fibres. Although the fabrics found in the oak coffin, grave 1969, were in general more intact, the colour-fading of the blue fragments was very heterogeneous on some very degraded and faded fragments.

4.4.2 Yellow dye sources

Luteolin (3',4',5,7-tetrahydroxyflavone) and genistein (4',5,7-trihydroxyisoflavone) in the presence of a minor amount of apigenin (4',5,7-trihydroxyflavone) have been identified in five textiles, more precisely in two red/brown warp yarns from the tablet-woven border fragments C33302 and C33308 from grave 1969, and in three reddish yarns from fragments textile 1.5 (dress), textile 1.7 (border) and textile 6.1 (loose string) from the excavation in 1995 *(tables 103–104)*. Their detection is evidence for the use of the yellow dye plant dyer's broom (*Genista tinctoria* L., *Cytisus tinctorius* (L.) Vis.), a 30–60 cm high plant with bright green smooth stems. It grows wild in pastures, thickets and borders throughout central and southern Europe as far as Russian Asia and the Baikal, and northward to southern Sweden. The plant has been used for yellow dyeing since prehistoric times. Dyer's broom is, as many other yellow dye sources, a mordant dye. Similar to weld (*Reseda luteola* L.), all plant parts are used for dyeing, except the roots. Applied on alum mordanted wool, it creates a yellow colour, while in combination with an iron or a copper mordant a chocolate brown or a yellowish-green colour respectively is obtained. A green colour can be obtained when wool is first dyed with woad, followed by a mordanting step involving alum and a second dyeing with dyer's broom (Hofenk de Graaff 2004a). Other, less-known broom species that might have been used are gorse (*Ulex europaeus* L. or *U. parviflorus* Pourret), according to Cardon mentioned as a traditional yellow dye source from northern Europe (Scotland, Ireland) to northern Africa, or Scotch broom *Cytisus scoparius* L. (Cardon 2007, 179–181; Schweppe 1993).

Fossil plant remains of dyer's broom and weld found abundantly on an excavation site in York revealed that both yellow dye sources were in use in Britain during the Viking period (Hall 1983). More recently, dyer's broom has been detected in the much older prestigious cloaks from the Roman Iron Age weapon deposit of Thorsberg in northern Germany (Archäologisches Landesmuseum, Stiftung Schleswig-Holsteinische Landesmuseen, Schloss Gottorf, Schleswig: Inv.no. FS 3686 and FS 3697). In these cloaks, with tablet-woven borders, dyer's broom in combination with woad was identified in the currently dark bluish / brown yarns from the ground weave (Vanden Berghe / Möller-Wiering 2013). This is identical to the two sources identified in the Lønne Hede tablet-woven border (textile 1969.3, fragment C33308), the tubular woven border (textile 1969.5, fragment C33302), and in the reddish loose string (textile 6.1). Furthermore, dyer's broom was detected in two Lønne Hede fragments: a red weft stripe from textile 1.5 and a red/brown warp stripe from textile 1.7, the tabby woven border found in grave 1.

Luteolin was further identified in the red horizontal yarns from the checkered scarf (textile 1969.4, fragment C33200) together with tannin and woad, as well as in very low amounts in the red yarns (fragments C33299 and C33262). The lack of luteolin in the samples from the other four checkered scarf fragments (C33256, C33265, C33281 and C33277) might be due to pronounced dye degradation and sample inhomogeneity. Finally,

luteolin was also found in the brown yarns from textile 1969.6 (fragment C33269) together with tannin and woad. This is the only sample in which a high amount of ellagic acid was detected – in this case presumably originating from the oak wood, as this blanket was located in close connection with the coffin, on top of the animal hide lining the bottom of the coffin.

The possibility of preservation of flavonoid dyes in oxygen and light-free, humid environments was presented in a study of a wide range of textiles from 22 Danish and two Norwegian peat bogs sites dated to the Early Iron Age (Vanden Berghe et al. 2009). In these finds, luteolin was found to be the predominant flavone compound, while no evidence for the presence of genistein was found. So far, no information on the stability of genistein in acidic burial environments is available. Thus, it is impossible to determine whether the lack of genistein in the samples containing luteolin from Lønne Hede would imply the use of a different yellow dye source, *in casu* weld, sawwort (*Serratula tinctoria* L.), chamomile types (*Anthemis* species), other local luteolin species, or again dyer's broom. Therefore, in all these cases the yellow dye plant was indicated by the general name 'luteolin yellow'. Another yellow, mentioned as 'unknown yellow' in *table 104*, was detected in one textile from the excavation in 1995: a brown yarn shawl from grave 12 (textile 12.1a). It represents a molecule with absorbance maximum at 310 nm in the visible wavelength range and eluting at 11.2 minutes, which did not match with any of the known dye spectra from the in-house library.

The five Lønne Hede samples dyed with dyer's broom also contained a marker compound of a clubmoss species (*Lycopodium* sp.) mentioned in *tables 103–104* as 'marker lycopodium'. Such plants were native to Denmark and known to have mordanting properties because of their aluminium content. As probably no inorganic mordants were present in Denmark at the time of the Lønne Hede finds, dye tradition could have been based on the use of such native plant material containing aluminium. Among the clubmoss species mentioned as being used as vegetal mordants in Scandinavian, German and Scottish written sources are fir clubmoss (*Lycopodium selago* L.), Stag's horn clubmoss (*L. clavatum* L.), alpine clubmoss (*L. alpinum* L.), and the species *L. complanatum* L. (Cardon 2007, 3). From the latter, evidence was found in York (AD 850–1050) at the same excavation site where the yellow plant remains mentioned above were found (Hall 1983). The UV-visible absorbance spectra of the four flavonoid molecules present in textile 1.7 (the red-brown warp stripe from the border) and the chromatogram at 350 nm wavelength of this sample are presented in *fig. 133*. The lycopodium marker compound has an absorbance spectrum close to chrysoeriol (luteolin 3'-methyl ether) present at 17.0 minutes.

SEM-EDX analyses of the burial soil from the graves 1 and 2, as well as of the selected red, blue and white yarns from the oak coffin grave and graves 1 and 2, revealed that all the samples, textiles as well as soil, held a large amount of aluminium compared to the reference samples of new white and brown wool *(table 105; fig. 134)*. This indicates that the samples were buried in aluminium-rich soil. However, this means it is not possible to establish a direct link between the aluminium content found in the fibres and the use of clubmoss as a mordant (Cardon 2007, 32–34).

4.4.3 Red dye sources

Multiple textile fragments have a striped or checkered pattern including orange, reddish or red-brown coloured yarns *(fig. 135)*. Despite the visible reddish appearance, no organic red dye sources were identified *(tables 103–104)*. Moreover, apart from one analysis of one red warp yarn from textile 1969.7 (fragment C33297), no organic red molecules were present

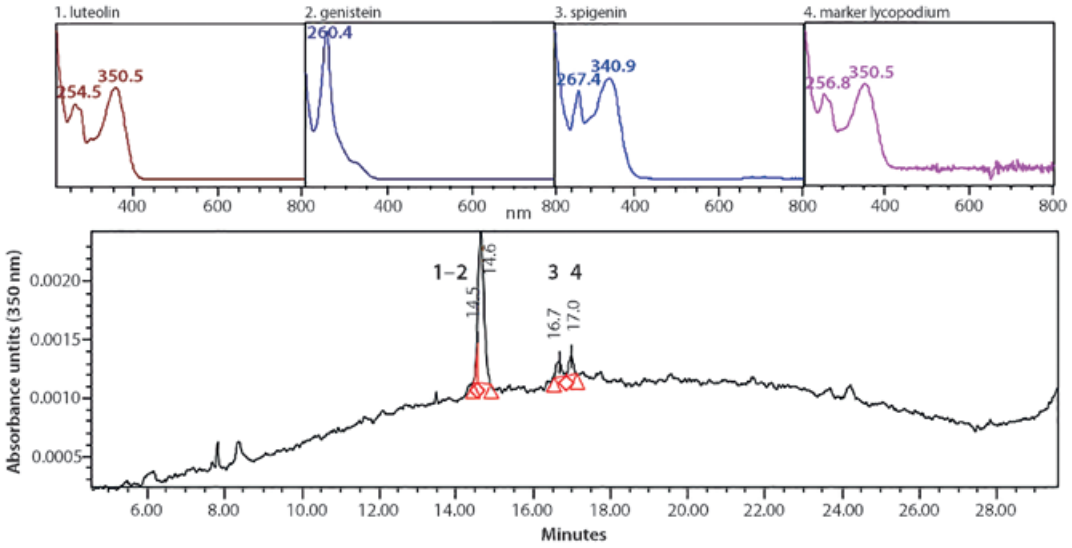


Fig. 133. Red-brown warp stripe from a border textile 1.7 from grave 1 (LH 1995, 11132/31). HPLC-DAD chromatogram at 350 nm wavelength and absorbance spectra of genistein, luteolin, apigenin and the lycopodium marker (illustration: A. Bruselius Scharff).

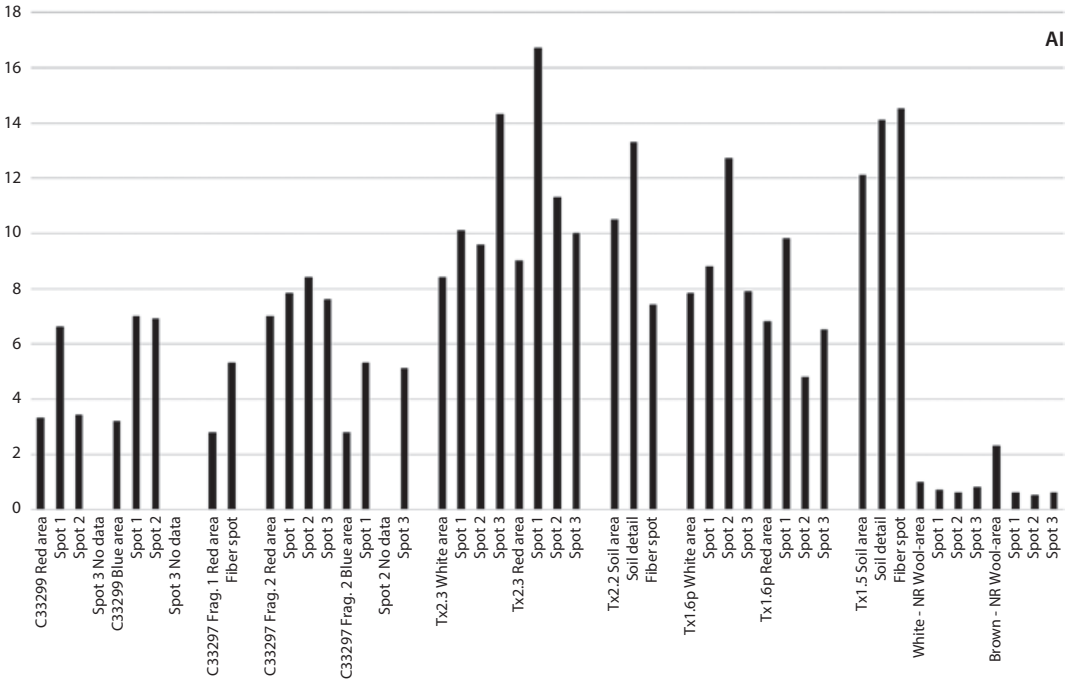


Fig. 134. Bar diagram showing the element concentration (percentage) for aluminium (Al) (illustration: A. Bruselius Scharff).

at all in the strong acidic extracts. Based on the earlier observations by Walton (1997) on an orange extract obtained in the test for mordant dyes, further analyses were done on three red yarns after extraction with milder acids (textile 1969.4, fragments C33262 and

Fig. 135. Checkered shawl T2.3 from grave 2. No dye compounds are detected in the red, red-brown and white yarns (photo: I. Vanden Berghe).

C33256, and textile 1969.7, fragment C33297), but this did not result in any detection of red dye compounds. Red samples from textile 1969.4 (fragment C33256, C33265, C33281 and C33277) and textile 1969.7 (fragment C33219) were also analysed after extraction of the dyes in dimethyl formamide, in order to detect dyes only soluble in such a solvent, but again without any positive detection. The only exception was one red warp yarn from textile 1969.7 (fragment C33297), which contained a red dye compound with an absorbance maximum at 511 nm in the visible wavelength range at 20.1 minutes retention time. However, no similarity was found with any of the dye spectra from the in-house library. The iron content in the red yarns in the upper lining from textile 1969.7 (fragment C33297) *(table 105)* might suggest the use of an inorganic dye like red ochre, but the amount detected was far too small to derive from an application with red ochre. In this case, it is much more likely that the iron originates from two iron objects found in the same area as the upper lining.

Therefore, we can state that no indication has been found in the Lønne Hede samples for the presence of red mordant dyes originating from the roots of dye plants of the *Rubiaceae* family (*Rubia*, *Galium* or *Asperula* sp.), from scale insects such as kermes (*Kermes vermillio* Planchon), cochineal species (*Porphyrophora* sp.) or lac dye (*Kerria lacca* KERR); also not from soluble red woods such as brasil or sappan wood from *Caesalpinia* sp., or insoluble red woods such as sandalwood of *Pterocarpus* sp.; nor from alkanet root (*Alkana tinctoria* L.), safflower red (*Carthamus tinctorius* L.) berries from shrubs or trees of the buckthorn fam-

ily (*Rhamnus* sp.), or of species of Rheum or Rumex; nor of the direct dye annatto (*Bixa orellana* L.), which produces an orange-red to yellow-orange colour. Furthermore, there is no evidence of the use of the mushroom dyes *Dermocybe semisanguineus* and *sanguineus* L., which contain anthraquinone dyes that give a bright red colour on alum mordanted wool.

In addition, it can also be stated that there is no indication that the Lønne Hede yarns contain an acid-sensitive red dye that produces a colour change depending on the degree of acidity. Therefore, lichen dyes such as cudbear (*Ochrolechia tartarea* L.), rock tripe (*Lasallia pustulata* L.) or many other are also unlikely (Hofenk de Graaff 2004c).

The red yarns might be the result of a tannin-based dyeing process. A wide range of botanical sources are tannin-rich and were used in the past to tan leather, as an organic mordant to improve textile dyeing, or as a dye source itself mainly to produce brown and black shades. They can be divided in two groups: hydrolysable tannins, which are decomposable in water forming small molecules such as gallic, protocatechuic or ellagic acids and sugars, and condensed tannins forming insoluble red precipitates such as catechin (Schweppe 1993). Condensed tannin is regarded as the dominating tannin type for leather tanning (Palo 1984). In addition, the two tannin types might occur together, depending on the season, temperature, fertilization and type of tissue, etc. (Graglia et al. 2001; Liimatainen et al. 2012).

Possible North European sources of hydrolysable tannin are alder, birch or oak species such as sticky alder tree (*Betula alnus* L. var. *glutinosa* L.), silver birch (*Betula pendula* L.), or common oak (*Quercus robur*). Condensed tannin may originate from conifers such as Scotch pine (*Pinus silvestris* L.) or the bark of willow trees such as silver (*Salix alba* L.), eared (*S. aurita* L.) or bay willow (*S. pentandra* L.), or other local sources. Willow species mainly contain condensed tannin of the catechin type, though in combination with some hydrolysable tannin, while birch species (*Betula sp.*) also used for tanning are mainly constituted of hydrolysable tannins (Schweppe 1993, 469–502). Tannin is also present in the roots of common tormentil (*Potentilla erecta* Ledeb.), a small plant growing wild in Scandinavia mainly on acid soils in meadows, moors and bogs, sandy soils and dunes, as well as on mountains. Dyed on wool, orange/red shades comparable to the reddish colour of many of the Lønne Hede yarns can be obtained *(fig. 136)* (Vajanto 2015). Ellagic acid was found as the only marker for the identification of this plant through HPLC. DAD analysis (Vanden Berghe 2012).

In the Lønne Hede textile finds, ellagic acid was the only organic component detected that indicates the use of hydrolysable tannins. Apart from two samples containing traces of this compound, it was encountered only twice in a more significant amount in the oak coffin grave find of 1969: once as the major compound in textile 1969.6 (brown yarns, fragment C33269), and once as a minor compound in the red horizontal yarns of the checkered scarf (textile 1969.4, C33200). Both times, it was found in combination with the vat dyes from woad and the mordant yellow luteolin dye, which makes it likely that hydrolysable tannins were used as organic mordant. On the other hand, we cannot exclude the possibility of cross-contamination from the wood from the oak coffin. No non-organic compounds related to tannins were identified in the samples from the 1995 excavation.

The current results are consistent with the earlier detection of pyrogallol in two red samples from textile 1969.4 and textile 1969.7, and in four samples from textile 2.3, textile 2.4, textile 7.1, and textile 7.2 (Walton 1997). As pyrogallol would have been converted to gallic and ellagic acid by acid extraction in the current study, it also indicates the presence of an (at least partly) hydrolysable tannin type. However, the fact that ellagic acid was identified in only two samples (one red, one brown) of the many reddish Lønne Hede yarns makes it unlikely that it was a source responsible for the red colour.

Fig. 136. Fragment of red and blue checkered scarf C33265, compared to wool dyed with common tormentil (photo: I. Vanden Berghe).

We can conclude that the lack of tannin compounds detected in the reddish archaeological samples narrows the range of likely tannin sources producing the red colour to either condensed tannins or a mixed-tannin type. Further study supporting this hypothesis is ongoing, while a second hypothesis on the possible role of natural pigmentation in the actual reddish coloured yarns have been investigated by Scharff (2018). Four of the most intense coloured red or red-brown yarns have been thoroughly analysed (textiles 1969.4, 1969.7, 1.6 and 2.3), and the results show that even though natural pigmentation is observed in three out of the four samples, it is only textile 2.3 that holds a sufficient amount of pigment granulate to explain the reddish-brown colour of the yarn. Furthermore, the study showed that re-assessing the amount of pigment in the archaeological fibres is difficult, as the pigment granules can be so degraded that they are no longer visible by traditional light microscopy. In the latter case, only transmitted light microscopy (TEM) can provide more exact information on the pigment content.

4.5 Concluding and summarising the dye investigation

The investigation of the dyes in 96 samples from 46 textile fragments from Lønne Hede led to the identification of blue vat dyes from the woad plant (*Isatis tinctoria* L.) in many blue or currently brown and reddish samples. Their presence in yarns other than blue may be accidental due to migration of blue-dyed fibres in the humid reducing environment, or as a result of the colour of the dyes fading within the yarns in the anaerobe burial conditions.

In line with the earlier larger study of the dyes in Scandinavian Iron Age peat bog textiles, yellow mordant dyes were found in several Lønne Hede fragments. In addition to the evidence of dyeing with a luteolin-based yellow dye plant such as chamomile, weld, sawwort or dyer's broom, in particular dyer's broom (*Genista tinctoria* L.) was identified in five textile fragments. This is the second case so far of evidence for the use of dyer's broom in 1st century AD North European textiles. Furthermore, the study showed that the fibres

dyed with dyer's broom had been mordanted with a clubmoss species (*Lycopodium* sp.), a local plant containing aluminium.

A large number of organic red mordant and direct dyes can be excluded from the current study of the orange, red and red-brown yarn samples. Furthermore, no indications suggested the use of lichen dyes. The use of natural pigmented wool can explain the darker colour of some red-brown to brown yarns, but the most intense red-coloured yarns seem mainly to have been produced from non-pigmented or light-pigmented wool that would have appeared white or slightly grey in undyed condition. The lack of any characteristic red dye chromophore in the study seems to indicate that the red dyeing might have been produced by condensed or (at least) a mixed type of tannin. However, further research is needed to give a definitive answer to this question.

The current study of the dyes in the grave textiles from the 1st century AD site at Lønne Hede are completely in line with the earlier research done by Walton (Walton 1988; ead. 1997) and fit very well with current knowledge on the dyes and dye technology of the population in Early Iron Age Scandinavia (Vanden Berghe et al. 2009). In particular, there is a very high correlation with the red dye source applied in red-brown textiles from the inhumation graves in Hammerum (Vanden Berghe 2019) and in a reddish textile fragment from the bog find Borremose VI (Vanden Berghe 2009), both from the 1st century AD. Furthermore, the yellow dye plant (dyer's broom) has previously been identified in two tablet-woven borders of textiles from the weapon deposit of Thorsberg in northern Germany, which – if deposited in connection with the weapons – dates to phase B2–C2 (Blankenfeld 2015, 278–291; Vanden Berghe / Möller-Wiering 2013). Such similarities in contemporary, though individual and diverse excavation sites, support the hypothesis that by that time a common and wide-spread dye tradition existed at least over the southern Scandinavian area.

5. The hairstyles from Lønne Hede

In the following, the result of the research into five preserved hairstyles from Lønne Hede is presented. The aim of the research is to understand and describe the hairstyles and (if possible) show the original method of achieving the look, as well as reconstructing how it appeared at the time of the burial.

The research shows that the hairstyle from Lønne Hede 1969 was very different and more complex than previously believed, and that it resembles the hairstyle of the Hammerum girl (HEM 3231x83, Møbjerg et al. 2019) from Museum Midtjylland and dated to the transition between the Early and Late Roman Iron Age. Both hairstyles bear a resemblance to contemporary Roman busts. The remaining hairstyles from Lønne Hede are not as well preserved as Lønne Hede 1969 and were probably simple hair buns.

The hairstyle of Lønne Hede 1969 has been stabilised by sowing elements of the hairstyle together with yarn, using a relatively long, thin and smooth needle with a large eye. This is a new interpretation of the use of a type of needle which was found in a group of jewellery from Vester Mellerup in Vendsyssel consisting of one needle of this type and 29 other hair needles (Norling-Christensen 1942). To this day, the extremely complicated hairstyle is conserved as a block, mounted on a layer of kitchen towel over a shell of gypsum, exactly as it was excavated from the inside, i. e. from underneath the hairstyle in c. 1970.

Furthermore, the analysis shows that as early as the Early Roman Iron Age "extensions" made from natural hair were used by sowing them onto the wearer's own hair to add length or fullness. The hairstyles are compared to similar Danish finds and examples from international iconography.

5.1 Conservation conditions

The conservation conditions for keratin must be extraordinarily good, as keratin is the main component of hair and wool, and extensive remains of the wool dress and the hair of the deceased were preserved in grave 1969. Artefacts of silver and amber were also well-preserved while bones, teeth and skin had completely disappeared.

From the grave National Museum Inv.no. C33240 from 1969, a block of c. 1 m^2 was lifted from the head end of the grave. The best-preserved inhumation graves from the excavations in 1995 (Varde Museum 1272), including grave 6, 9, 10, and 12 were lifted in their entirety. The graves were frozen and dried out without vacuum by the conservators Francis Roberts and Elmer Fabech at Konserveringscenter Vest, Ølgod (today Conservation Centre Vejle). The conditions for conservation were not as good as in the grave excavated in 1969, but careful excavation using a microscope resulted in a comprehensive documentation of textile fragments (Roberts / Frandsen 1996). Hairstyles have also been preserved, but not in the same excellent condition as the hairstyle from the 1969 excavation.

5.2 Method – interpreting hairstyles

Photos of the stages of the excavation in 1969–1970 and the preserved, but not fully conserved block with the hairstyle from Lønne Hede 1969, as well as research of the hair using light microscope and scanning electron microscope, form the basis for the interpretation of the hairstyle. For the less complex and less well-preserved hairstyles from later excavations (grave 6, 9, 10 and 12), only the conserved block forms the basis for the interpretations. Furthermore, experience from research into similar finds and experience from reconstruction of Iron Age hairstyles on models are used.

Human hair is most often found preserved on bog bodies, or desiccated or permafrozen bodies, as is the case with the mummies from Urumchi in China (Barber 1999, 96). The interpretation is generally uncomplicated as the hair is usually well preserved in the original context with the scalp and the cranium. However, in Denmark several inhumation graves have been found where keratin, i. e. the hair and thereby the hairstyle as well as textiles made from wool are preserved, while most other materials have become degraded and disappeared. This is the case for the recently excavated Hammerum girl (Mannering et al. 2010, 5; Mannering / Ræder Knudsen 2013, 157; Møbjerg et al. 2019). A situation with missing context presents an additional challenge when complicated hairstyles are interpreted, as the connection between the hairstyle and the cranium or skin has disappeared. This may result in problems determining which parts of the hairstyle are to be seen from "inwards" i. e. from the side of the skull, and what from "outwards" i. e. the side that is usually on show. Since braids, locks of hair, and hair in general are not attached to the scalp, it can be difficult to decide which way they should turn. Moreover, the partial degradation of the hair makes it difficult to identify the construction of the hairstyle and interpret exactly how it was presented at the time of the burial.

Deconstructing the description of a hairstyle into different elements may provide a better possibility for a qualitative interpretation of how the hairstyle was originally made, as well as how it may have looked. Several elements can be used in connection with this type of interpretation:

– Identification of the direction of the hair growth
– Location of partings
– Presence of twisted hair or braids
– The regularity of the braids and the number of locks used for the braids
– Identification of the direction of the braiding
– Possible additions of hair that is not attached to the skin ("extensions" and hair pads)
– Presence of bun(s) or tied-up hair
– Presence of thread or string which might have helped stabilise the hairstyle
– Presence of hairpins or a hair net
– Possible disruptions of the grave
– Review of excavation photos to determine the back, front, and inside of the hairstyle, if possible.

The growth direction of the hair is possible to determine if the scales of each strand of hair are visible. Hair has very characteristic scales, which when magnified look like the trunk of a palm tree, where the points of the scales lie in the direction of growth (Teerink 1991, 6–8). If the hair is exceptionally well preserved, it is possible to see the hair follicle in the innermost part of the hair, closest to the scalp. Any partings are distinguishable by strands of loose hair pointing towards the same line. This will not often be visible, as loose strands of hair will break down faster than braids or tied locks of hair.

Often, twisted locks of hair or braids are the most characteristic elements of a preserved hairstyle, as the hair styled in this tight fashion with many strands next to each other seems to preserve the hair better than a loose hairstyle. Of these, the three strand braids are by far the most common, but there are also hairstyles with twisted locks of hair, such as the hairstyle of the Elling woman from the Bjældskovdal (Fischer 1980, 20–21), and braiding with four or more strands is also possible.

The direction of the braiding will provide essential information on how the hairstyle was made. If one can determine the growth direction of the hair in the braid, it is a good indication of the direction of the braiding, as braids necessarily start at the scalp and are braided outwards to the tip of the hair. The identification is not clear-cut, as added loose parts of hair may lie in any direction. The direction of the braiding cannot be determined based on the braid alone, as there are two methods to make a three stranded braid: The first is to move the locks of hair from the outside of the braid behind the braid to the centre, the other is to move the locks of hair from the outside of the braid in front of the braid to the centre *(fig. 137)*. These two methods will give the braid different looks on the side turning away from the body. However, as a loose braid can be turned or simply seen from the reverse and thereby look as if it has been braided in the other style, this detail provides no help in the identification *(fig. 138)*. Asking friends and family, it seems that most persons braid in the way they have become accustomed to. It is possible to change the method, but it is difficult and if the person braiding is not concentrating, the hands will do what they usually do. It would very likely have been the same in the Iron Age. It would have been of interest to determine which method of braiding was used in the many braids in the hairstyle from Lønne Hede 1969. Had the braids been made with different methods, it could have indicated that several persons helped make the hairstyle. Unfortunately, this was not possible to verify.

An indication of the direction of the braiding is visible in the thickness of the braid. If the braid is thin in one end and thicker in the other, it is most likely that the thicker end was closest to the scalp. It is necessary to understand that loose hair may have been added during the braiding, in order to make the braid significantly longer and thicker.

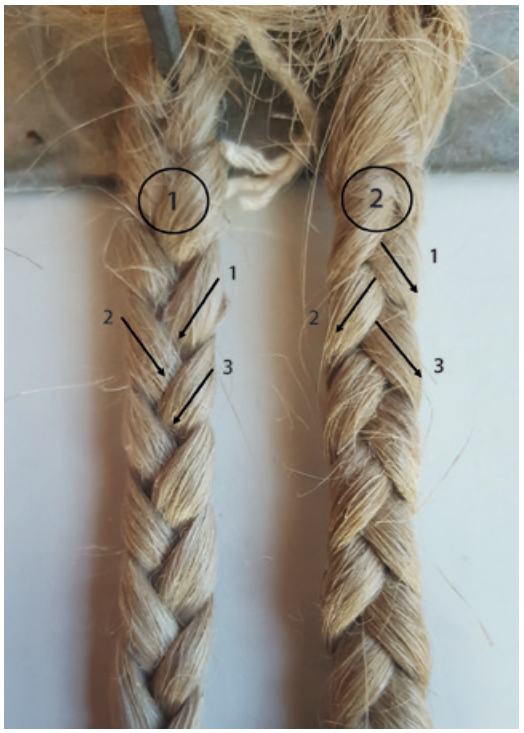


Fig. 137. There are two methods to braid three strand braids: Either the tufts can be moved from the outside edge in front of the braid (1) or the tufts can be taken from the middle of the braid and moved to the outside and behind the braid (2) (photo: L. Ræder Knudsen).

Fig. 138. When the braid (2) is turned, it becomes clear that they are now identical. It is therefore not possible to determine which method is used (photo: L. Ræder Knudsen).

The so-called "French braid" is another variation of braiding. During the braiding process, small locks of hair are plucked from the scalp, and added to the three strands, so the braid lies firmly close to and along the scalp. If this method of braiding is used, and the skull and skin has become degraded and disappeared, the inside of the braid will show small tufts of hair that point in the opposite direction to that of the braiding.

If the goal was a hairstyle with a garland of loose hair arcs near the hairline in front, another way of adding hair to a braid is used. To make this garland, small locks of hair from along the hairline area are braided into a thin braid pointing away from the hairline. If the braid is done while being held a short distance from the head during the braiding process, it will form a garland of arched locks of hair, for example along the hairline or covering the ears when the braid is laid close to the head. On the outwards side of the hairstyle, tufts of loose hair can be seen going into the braid *(fig. 139)*. Attention should be paid to the fact that loose hair added to a braid in a garland and in a French braid may not be distinguishable from each other in the braid. In other words: if loose locks of hair are added to the braid, it is neither a clear sign of a French braid, nor does it give any indication of the direction of braiding whatsoever.

Hair styled into a type of bun is often better preserved than loose hair. In this case, the way the hair is styled is revealed by twisted hair, yarn and hairpins which kept the bun in place. All in all, it is very important to check the hairstyle for remains of yarn and

Fig. 139. A garland of loose arcs of hair can be achieved by adding extra tufts of hair in a braid, which is held at an angle from the head while one braids. (photo: L. Ræder Knudsen).

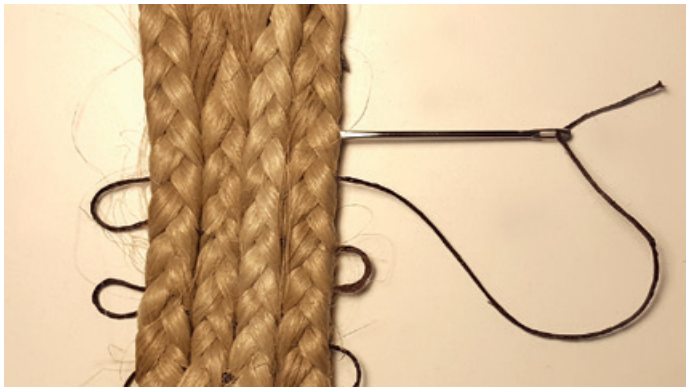


Fig. 140. If several braids lie parallel in a hairstyle, they are likely to be sown together with needle and thread. (photo: L. Ræder Knudsen).

thread *between* the strands of hairs, as this is an indication of yarn being used for styling. If remains of yarn are found *on top* of the hairstyle, it is most likely that the yarn belongs to the remains of a scarf or a cape that shrouded the deceased.

If the hairstyle includes several thin braids close together forming a band, it is very likely that the hairstyle has been sown together with a needle *(fig. 140)*, as documented in both Roman and Egyptian hairstyles (Stephens 2008, 112).

Fig. 141. Previous interpretation of the hairstyle of the Lønne Hede. This reconstruction drawing shows a hairstyle in which four braids on each side that goes from the forehead to a bun located in the nape (drawing: H. Ørsnes; after Nordquist / Ørsnes 1971, 14).

5.3 Description of preserved hairstyles at Lønne Hede

At the grave site at Lønne Hede, preserved hair has been found in six graves (graves 2, 6, 9, 10, 12 and 1969, see *table 3*), of which five are described and interpreted below. Grave 2 only contained faint traces of hair and is not included in the analysis.

5.3.1 Grave 1969: the "Lønne Hede Maiden" – previous interpretations

The hairstyle from Lønne Hede 1969 has previously been perceived as follows: "From a parting in the middle of the forehead, the hair is carried to the sides in two flat bands, each consisting of four three-band braids; they are carried around the head and tied together at the nape" (Nordquist / Ørsnes 1971, 11) *(fig. 141)*. Unfortunately, this preliminary and incomplete publication was not followed up on, and therefore the interpretation of the

Fig. 142. The hairstyle from Lønne Hede 1969 as it appears today with the inside facing upwards on a gypsum shell with a kitchen towel – precisely as when it was excavated c. 1970 (photo: National Museum of Denmark).

hairstyle is repeated in a number of publications (e. g. Ramskou 1976, 35; Munksgaard 1978, 15; Munksgaard / Østergaard 1988, 62; Ebbesen 2011, 85 *fig. 9*; Hvass 1980, 94) and on countless reconstructions in museum exhibitions.

However, the interpretation is incorrect, as the analysis of the excavation documentation and the preserved block shows. The original interpretation shows the hairstyle of the Lønne Hede Maiden as four narrow braids extending from the forehead, down over the ears and to a low knot in the nape. This interpretation has often been compared with one of the scenes from the Gundestrup cauldron (Ramskou 1976, 35; Munksgaard 1974, 198; Hvass 1980, 99; Jensen 2003, 330; Ebbesen 2011, 85). However, the comparison is not valid as the hairstyle from Lønne Hede 1969 is not identical to that from Gundestrup.

In the following, analysis and a new interpretation of the hairstyle of the Lønne Hede Maiden are presented.

5.3.1.1 Description of the hairstyle in grave 1969

Currently, the hairstyle is preserved in a block of plaster with the inside (scalp side) exposed *(fig. 142)*. The original look of the hairstyle is very complicated to interpret in the block. Consequently, it is necessary to examine the excavation photos from 1969–1970.

An overview photograph of the large block shows several squares, probably representing the areas of close-ups or subdivisions of the block *(fig. 143)*. The mark, CP58, at the top of

Fig. 143. Excavation photo of the plaster block of grave 1969 with close-ups marked. CP58 represents the area of the hair of the Lønne Hede Maiden (photo: National Museum of Denmark).

the photo shows the approximate area where the hair of the deceased was found. In addition, the area can be seen marked in blue under mark CI at the top of the excavation drawing *(fig. 144)*. The photo in *fig. 145* shows the first stage of the cleaning of the hairstyle with a garland of straight hair and a silver filigree bead. In *fig. 146*, the area around the hairstyle is cleaned to the surface of the hair with the remains of the scarf over it. Only hair and wool (both consisting of keratin) are preserved. The forehead of the deceased is probably located at the top beneath the heart-shaped stone. At the tip of the heart-shaped stone lies a round stone under which braided hair can be recognised, and furthermore, braided hair is found further down where the ear must have been located. From the forehead down to the ear, the hair lies in a smooth arc with no braids.

During the excavation of the block, a silver filigree bead was found in the middle of the hairstyle. Remains of thread were found passing through the bead, suggesting that it may have been part of a necklace. Likewise, it is possible that it was used as a decoration in the hairstyle, either as a bead or attached to a stick as a hairpin. Silver hairpins are frequently seen in the graves of rich women from Early and Late Roman Iron Age, and silver beads, which were probably included in hairstyles, have also been found (Munksgaard 1978, 17; Ramskou 1976, 33–35; Norling-Christensen 1943).

Another excavation photo shows the appearance of the hairstyle after the scarf and most of the stones lying on top of the hairstyle were removed *(fig. 147)*. It is obvious that a part

Fig. 144. Excavation sketch of the plaster block of grave 1969 (plan BZ). CI marks the area where the hair was found (drawing: E. Østergård).

Fig. 145. The hair during excavation with silver filigree bead in the middle left and the arc of hair from the forehead in the upper left corner going down to the area around the ear in the middle bottom of the image (photo: National Museum of Denmark).

Fig. 146. The hair of grave 1969 cleaned down to the surface of the hair with the scarf clearly visible. The forehead of the deceased is probably located at the top beneath the heart shaped stone (photo: National Museum of Denmark).

Fig. 147. The hair of grave 1969 after removing the scarf and most of the stones lying on top of the hairstyle (photo: National Museum of Denmark).

of the hairstyle is missing from the top of the head, and that a bundle of braids lies at an angle to the hairstyle. The missing part may have been damaged when a stone fell and landed on top of the hairstyle after the coffin lid broke. In any case, the positions of the stone on the hairstyle indicates that the grave had been disturbed. After the photo *fig. 147* was taken, a block was prepared in which the hairstyle was covered with a pad of damp kitchen towel and consequently with a plaster pad. A cut was then made around the plaster, and the resulting block was been removed from the part of the grave surrounding it. The block probably corresponds to the mark CI on plan BZ (see *fig. 144)*. This small block was then turned over and excavated from the back to remove all soil from the hairstyle. As

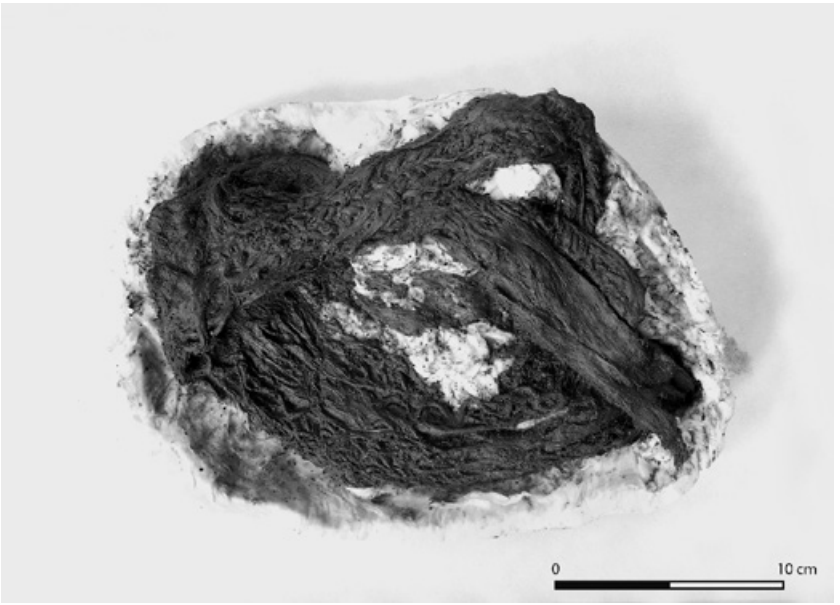


Fig. 148. The area around the hairs of grave 1969 was removed in a separate block and excavated from the back. A complicated hairstyle with many thin, irregular braids was exposed (photo: National Museum of Denmark).

Fig. 149. Part of the hairstyle of grave 1969 was lifted and put to one side – probably in order to identify the structure of the hairstyle (photo: National Museum of Denmark).

it was excavated from the back, several bands of narrow braids became visible *(fig. 148)*. After the hairstyle was exposed, it was decided to unfold a part of it by lifting one of the bands of braids and laying it to the side *(fig. 149)*. Thereafter, the unfolded band was laid on the edge of the block with no further action taken.

For this analysis, the hairstyle from Lønne Hede 1969 was inspected several times under the microscope and several details were documented by photography *(figs 142; 150*). In the following, the hairstyle is examined for the important characteristics listed in the introductory method section above.

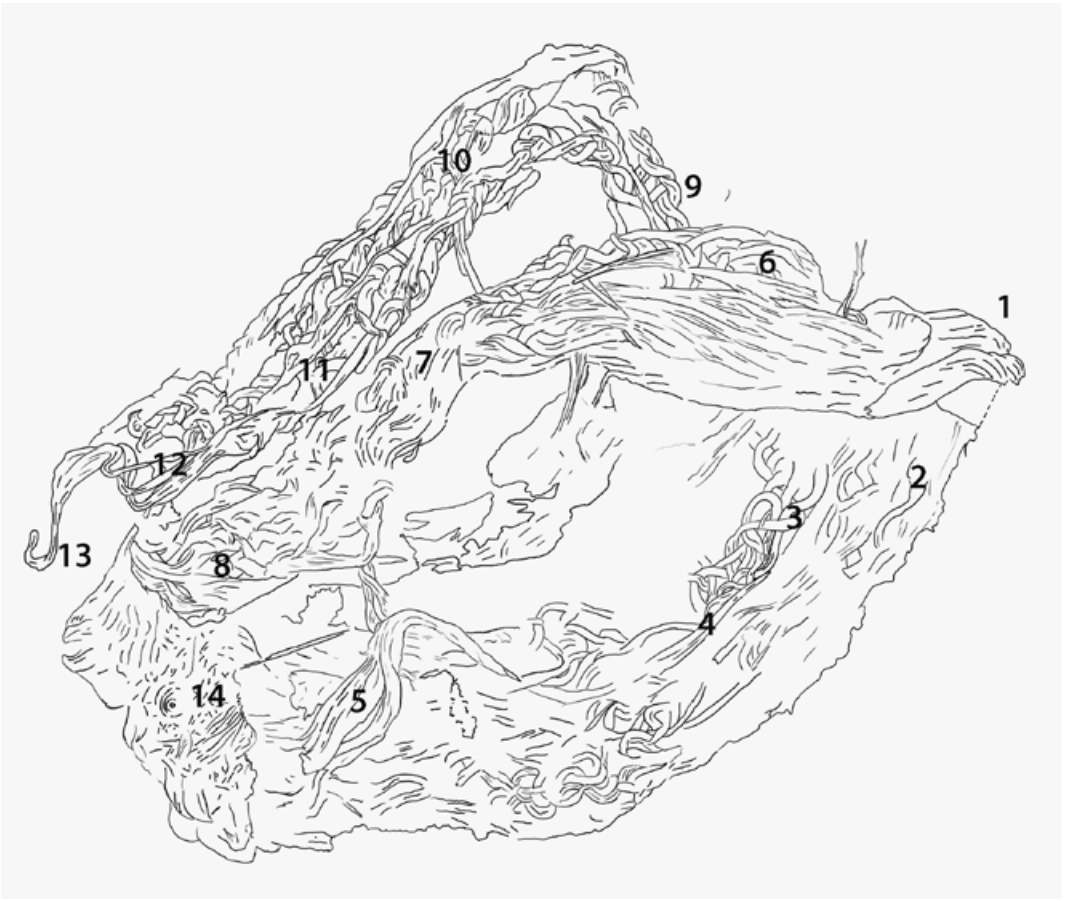


Fig. 150. Drawing of the hairstyle with numbers indicating areas described in detail in the text (illustration: L. Ræder Knudsen).

Figure 150 shows the right side of the head with the forehead to the right and the neck to the left. The preserved hair lies mainly in three separate bands. The lower band numbered 1-2-3-4-5 marks the inside of the arc of hair visible in the photos from the excavation *(figs 145–147)*. The middle band is marked 1-6-7-8 and shows the outside of the hairstyle on the right side of the head, while the upper band, marked 9-10-11-12, is the part of the hairstyle under the stone. The upper part would have been placed on the top on the head in the hairstyle. Determining precisely which is the inside and outside of the band of braids on the top of the head is not possible, but it may be the outside that is seen in the block.

In most of the hairstyle, remnants of thin braids are seen, but they have degraded making the course of the hair strands difficult to follow. Furthermore, they are very irregular in many places and do not resemble a normal three stranded braid. The band on the top of the head (marked 9 in *fig. 150)* seems to begin with two twisted locks of hair, each of these probably turning into two braids, making a total of four braids. As it lies, this band has been shifted upwards, so it looks as if it is raised in a kind of bun, but this was probably not the case. Above, it was mentioned that this part of the hairstyle might have been disturbed by a falling stone *(fig. 147)*. The nape (marked 14 in *fig. 150)* shows a small circular marking, which may be the remains of a hairpin. The hairstyle was X-rayed by Michelle Taube

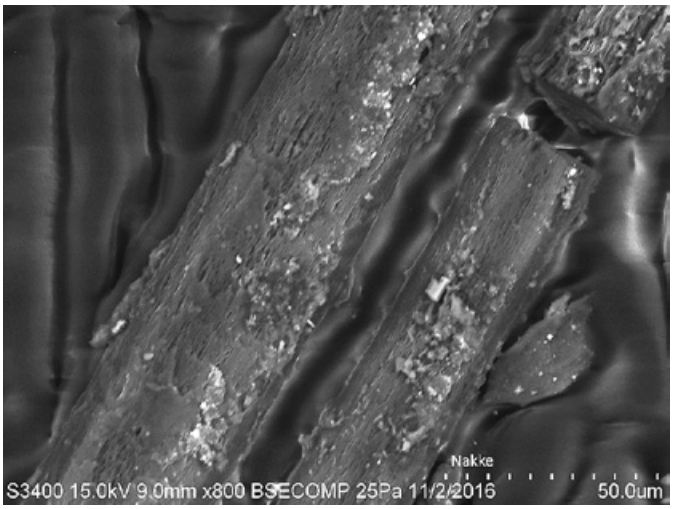


Fig. 151. SEM photo of a strand of hair from the band of braids on the top of the head. Remains of degraded dandruff show that the growth direction of the hair has been from the neck to the forehead, but this is not feasible with the braiding technique. Therefore, extra hair i. e. "extensions" must have been added to the hairstyle (photo: A. Bruselius Scharff).

at the National Museum of Denmark, but unfortunately the image did not reveal any signs of metal hairpins or anything else hidden in the hair. However, as the hairstyle rests on a support made of a plaster pad which considerably hampers the penetration of X-rays, it is possible that there either used to be a metal hairpin which has now degraded and disappeared, or that there is a hairpin but that it is made of bone or wood, for example, and so cannot be identified in the X-ray. The hook shaped lock of hair (marked 13 in *fig. 150)* indicates that it was twisted around a hairpin, but the band of braids on the top of the head had been pulled loose from the hairpin as the grave collapsed. If the "hook" was secured by the possible hairpin, the band of braids would be the right length. Consequently, it is most likely that the band of braids lay along the top of the head and was not been raised up, for example into a bun. At the time of the excavation, the band of braids had a characteristic square appearance *(fig. 149)* above the "hook". This may be due to the way that the remaining hair locks from the braids on the top of the head were twisted around both ends of the hairpin, which was probably inserted horizontally.

In the lower band there are indications of hair added from the inside (marked 4 in *fig. 150)* with several long, pointed tufts going from the right into the braid towards the left (French braid). This shows that the braiding direction of the two bands of braids along the hairline probably run from the forehead down to the nape.

The direction of the hair growth in the three bands is not clear. From a technical viewpoint, it is only possible to braid the top band of braids from the top of the head down to the nape, where the hook-shaped tuft finishes the four braids. But the SEM photo *(fig. 151)* shows that some of the hair strands display a growth direction from the nape to the forehead. In the middle band, the hairstyle is seen from the outside, and shows large flat tufts of hair added to the braids from the outside (marked 6 in *fig. 150)*, which mean that this

band is braided from the forehead to the right towards the nape of the neck to the left. But here too, a SEM photo shows that at least individual hair strands have grown from left to right, that is in the opposite direction. This phenomenon can only be explained by extra loose hair having been added to the hairstyle. It may be the hair from another person, or it may be the deceased's own hair that has previously been brushed out or cut off. The added hair can partly explain why some of the braids appear to be rather irregularly braided, since the addition of extra hair can be done by adding extra tufts in a way so that the hair is twisted into a loop that changes the look of the braid. This can be seen clearly in the left temple area (marked 3 in *fig. 150)*. In addition, there are some features lying close to and above the large surface of loose hair over the right temple (marked 6 in *fig. 150)*, which does not look like a normal three stranded braid. Furthermore, in some areas it is possible to see that the hair tufts have been twisted during braiding (marked 3 in *fig. 150)*. In some places in the braid the same twists lie together and thus do not lie individually. These observations support the idea that extra, loose hair has been added to the braid. This was probably done in order to make the braid longer than the natural length of hair allowed, or to give the hair more fullness, in other words, a form of "extension".

Above the forehead, the loose hair is incorporated into the underlying braids. At about every other lock, tufts from loose hair are added. Further down (marked 7 and 8 in *fig. 150)*, there are small arcs of loose hair hanging from the braid. It ought to be possible to identify a parting where the forehead must have been (marked 1 in *fig. 150)*, but a small piece of kitchen towel was placed here during the excavation.

In the nape, a few strands of hair can be seen to the right and below the possible hairpin (14 in *fig. 150)*. They originate from the underside of the loose fragment of hair marked 5 in *figure 150*. The fragment can also be identified in the excavation photo *(fig. 149)*. Below and above these strands of hair, a densely felted mass of hair is seen, probably a small pad of hair held in place by the hairpin. This pad has formed a small flat bun in the nape and the remaining hair from the braids has been wrapped around it (marked 5, 8 and 12 in *fig. 150)*.

Below the hairpin, and between the hair strands, remains of yarn can be identified; this is also the case in other parts of the hairstyle (e. g. 6 in *fig. 150)*. On the right side of the hairstyle (8 in *fig. 150)*, remains of yarn can also be seen, but in this case on top of the hair. The yarn might have kept the hairstyle in place, or it may be remnants of the scarf covering the neck of the deceased. In some places twisted hair lies in a way that cannot be explained by a braiding technique (e. g. between 6 and 11 in *fig. 150)*. Possibly, thread made from human hair was used to sew the braids together in a band.

5.3.1.2 Resume: the hairstyle from Lønne Hede 1969

The hairstyle from Lønne Hede 1969 consists partly of loose, unbraided hair, partly of two bands of four three-stranded braids, some of which are probably "French braids" with extra hair from the scalp added to the strands. The direction of braiding was most likely from the forehead towards the nape, but a SEM photo of hair samples shows that some strands of hair grow in the opposite direction. In some braids, each tuft consists of several twisted tufts added to each other. This results in a distinctive appearance that is due to tufts in the braid being extended with loose added hair twisted and placed around one of the strands of the braids. Thread is likely to have been used to secure the hairstyle, as seen in the hairstyle from Bredmose, Store Arden and the hairstyle from a severed head from Stridsholt (Munksgaard 1978, 5–12). In these hairstyles, cords are wrapped around tufts of hair forming a crown on the top of the head, but braids are not used. In the Lønne Hede 1969

Fig. 152. The Hammerum girl's hair with garlands of loose hair arcs turning into thin braids (photo: R. Fortuna).

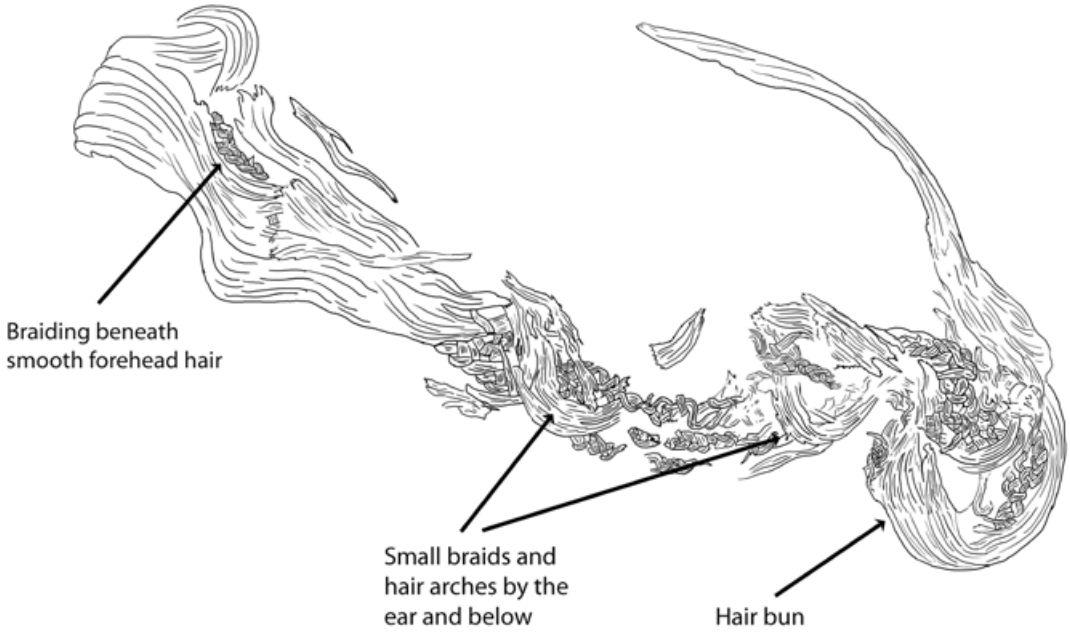


Fig. 153. Drawing of the Hammerum girl's hair (illustration: L. Ræder Knudsen).

hairstyle, a thin thread (probably made of both sheep's wool and of human hair) holds the hairstyle in place.

The hairstyle from Lønne Hede 1969 is unbraided from the middle parting at the forehead and down c. 11 cm on both sides. Along the hairline, locks of loose hair have been

Fig. 154. Possible reconstruction of the Hammerum girl's hairstyle (grave 83) (model: S. Le Beau; photo and hairstyling: L. Ræder Knudsen).

Fig. 155. Reconstruction of the Lønne Hede Maiden's (grave 1969) hairstyle (photo and hairstyling: L. Ræder Knudsen).

formed into arcs, which have then been incorporated into four thin, parallel braids. At several sites braids have been identified where strands of the braid end with loose hair, for instance the recently found Early Roman Iron Age hairstyle from Hammerum, where unbraided hair tufts are held in place by braided sections (Ræder Knudsen / Møbjerg 2019). In the case of the Hammerum girl, it is evident that the unbraided hair tufts provide a garland of soft arcs of hair along the hairline *(figs 152–154)*.

In addition to the indications from SEM photos, the hair from Lønne Hede 1969 shows several traces of braiding techniques indicating that extra hair was added to the hairstyle of the deceased. Large parts of the middle band of braids, which probably lay along the middle of the top of the head, appear to be made of hair added by wrapping tufts of the deceased's own hair with extra hair. The method of adding hair by twisting it around the deceased's own hair at the top of the head, c. 8 cm from the hairline of the forehead, seems to show that this part of the hairstyle is braided from this spot down to the nape. Here a hook-shaped hair tuft is most likely the thin ending of the four braids and has attached this part of the hairstyle to a transverse hairpin.

The flat bun at the nape is an unknown type. The bun is probably pierced by a transverse hairpin that was used to attach the bun to the head. Next, the braids from the two bands at the sides are attached, and lastly the braids from the upper middle band from the head attached to the hairpin. *Figure 155* shows a reconstruction of the hairstyle from Lønne Hede 1969.

5.3.2 Description and interpretation of the hairstyle from grave 6

A faint outline at the bottom of grave 6 exposed a person in hocker position lying on the right side with their face pointing southeast. During excavation in the field, textiles and hair were found. The report states that "Two light yellow knots were found with fine blue fabric on the underside" (see sections 3 and 4 on textiles and dyestuff above).

Fig. 156. Hair from Lønne Hede grave 6 (cf. *fig. 97)* (photo: L. Ræder Knudsen).

Fig. 157. Hair knot made from thick braid (photo: L. Ræder Knudsen).

Fig. 158. Reconstruction sketch of the hairstyle from Lønne Hede grave 6 (photo: L. Ræder Knudsen).

Today, the hair knots lie in a block where the outside is on show *(fig. 156)*. One knot appears intact and seems to consist of four thick tufts of hair resembling the start of a Fröbel star (a folded and braided Christmas decoration). This look can be achieved by

Fig. 159. Hair from Lønne Hede grave 10 with a thin worked band around a ponytail, which may have been twisted into a knot (photo: L. Ræder Knudsen).

arranging a plain three-stranded braid into a knot where the thickest part is outermost, and the thin portion of the braid is wrapped around the knot nearest the scalp and concealed by the knot *(fig. 157)*. The other knot is less dense and seems slightly disintegrated. It may represent a sort of ponytail, where the hair has been twisted around (Munksgaard 1974, 200–201) to wrap the thin end of the ponytail around the knot closest to the scalp. This part of the hairstyle will have required a hair length of at least 35 cm. In the excavation drawing, the two hair knots can clearly be seen located above each other and they were probably placed symmetrically in the neck area. Thus, one knot has been made by braiding three hair tufts from the neck area together and twisting the braid into one knot, while the other knot consists of a single tuft gathered from the hair on the head and perhaps the forehead and then twisted into a bun *(fig. 158)*.

5.3.3 Description and interpretation of the hairstyle from grave 9

In grave 9, faint traces of textiles and remains of hair were found along the edge of the skull. It is not possible to provide additional information about the hairstyle as the remains of hair are still in the preserved block.

5.3.4 Description and interpretation of the hairstyle from grave 10

In grave 10, the only trace of the deceased was a few tufts of smooth beige brown hair found in the south-eastern part of the grave. The hair consists partly of a folded, twisted tuft of hair with a hair length of at least 25 cm *(fig. 159)*, and partly of a bit of loose hair

Fig. 160. Close-up of the band from Lønne Hede grave 10 (photo: L. Ræder Knudsen).

of approximately 5 cm length with no further distinguishing features. A narrow band to tie around the ponytail before it was twisted was found around the twisted hair tufts *(fig. 160)*. The textile twisted around the hair is poorly preserved, but it is clear that the reddish threads on the edge of the ribbon are not cut but turn on the edge and go back into the ribbon in the way one would see in a diagonal braided ribbon. The location of the hair is assumed to show the position of the head in the grave. The deceased was probably a child with a height of approximately 120–130 cm and although no grave goods were found, the deceased was dressed and is assumed to have rested on a fur or rug. The hair is probably styled by tying a red braided or woven ribbon around a small thin ponytail and twisting it into a knot.

5.3.5 Description and interpretation of hairstyle from grave 12

There were no grave goods in grave 12, but the deceased was clothed. The only remaining part of the deceased was a folded tuft of hair at least 12 cm in length found at the western end of the pit *(fig. 161)*. Quite well-preserved textiles were found, which were degraded especially where they had been in contact with the body of the deceased. Therefore, it was possible to see that the body was lying on the right side in a hocker position with the face facing the east.

5.4 Hairpins and needles for styling the hair

The hairstyles from Lønne Hede 1969 and Hammerum (Ræder Knudsen / Møbjerg 2019) include elements where thin braids lie close together forming bands. It is impossible to keep several thin braids completely aligned and close simply by braiding. It can be done with French braids, but there will always be a gap between the braids, so that they will not lie very close to each other. Therefore, other methods explaining how to keep the hairstyle in place must be considered.

Fig. 161. Hair from Lønne Hede grave 12, minimum 12 cm long (photo: L. Ræder Knudsen).

It is well known that hairpins were used in the Roman Iron Age, and many fine specimens from graves have been excavated. The location in relation to the skull can show that the hairstyle or perhaps a headscarf has been held in place by one or more hairpins even though the hair itself has completely disintegrated and disappeared. Unfortunately, no grave with a hairstyle preserved with hairpins has been found. However, findings in graves without preserved hair show that several hairpins could adorn the hairstyle of the deceased, for example in Jullinge grave 1 at Lolland (Müller 1911; Beckmann 1966; Ethelberg et al. 2000, 62–64). Lise Bender Jørgensen and Mogens Bo Henriksen (Bender Jørgensen 1986, 201; Henriksen 2009, 124–125) suggest that hairpins may also be used to secure the dress and bead necklace, like the bronze hairpin found in the Lønne Hede grave from 1969. But most commonly, hairpins are found in the area where the head was located, and they had therefore been used for styling the hair.

Hairpins often have ornate heads, which protrude from the hairstyle whilst holding the hair or headscarf in place. Hairpins can be used to attach a bun to the back or the top of the head, and they would be suitable for holding a scarf in place, but they cannot explain how several quite thin braids are kept aligned. The review of different types of hairpins – and the fact that yarn is found in the hair from Lønne Hede lying between the strands of hair – provide the possible and probable explanation that a large sewing needle was used to sow the hairstyle together. This has also been demonstrated by Janet Stephens for Roman and Egyptian hairstyles. She shows how the elaborate hairstyles on marble busts can be styled on models with real hair (Stephens 2008). Here, the needle is an important tool, and it is no surprise that the needle is part of the personal equipment, on par with comb and mirror, for example.

In the following, archaeological material will be examined to determine whether it contains needles that convincingly could be used for this very purpose.

5.4.1 Archaeological evidence of hairpins and needles

In the National Museum of Denmark's annual report from 1943, Norling-Christensen describes the jewellery cache from Vester Mellerup in Vendsyssel, Northern Jutland, dated to the Early Roman Iron Age (approx. AD 1–150), which amongst other types of jewellery contains 30 hairpins, including 29 with ornate heads and one of copper-alloy resembling a modern sewing or darning needle (Norling-Christensen 1943, 86). This needle is 15.7 cm long and the piercing begins approximately 2.4 cm below the head of the needle, and thus is located somewhat further down on the pin than a normal modern darning needle. The head of the needle appears to be quite pointed without being sharp. Consequently, this needle would not be particularly suitable as a darning needle or for other tasks where one would use the fingers to press on the head of the needle to push it through a material. On the other hand, the long narrow head seems ideal for pushing the needle one way or the other through a hairstyle, as the resistance in the hair would be negligible and because its length seems ideal for the task *(fig. 162)*. Norling-Christensen states that: "It would not, in advance, be believed to be a hairpin, but it is, for it has been found in place in one of the Juellinge graves and in several Jutlandian graves; on top of that, it is a type of hair pin that is most common in Jutland" (Norling-Christensen 1943, 86). He described this type of hairpin as being made from iron or copper-alloy, with only a few made of silver. Norling-Christensen further notes, "Strangely, it also seems to have had a different use, as it is frequently found positioned some way from the deceased in connection with an iron knife. Occasionally, the needle lies in a small case made of sheep's bone" (Norling-Christensen 1943, 86). By re-interpreting the type of hairpin to also be a tool for styling the hair, Norling-Christensen's observation can be confirmed, and it becomes evident why this type is often found close to the deceased. It is likely that both knife and needle used for sewing hairstyles were included in the personal tools rather than in the actual hairstyle.

In a previous publication, Norling-Christensen also listed several graves with needles of this type, i. e. darning needles: 52 needles were found in 49 graves; 17 needles are made of iron, 34 of copper-alloy and one of silver. A single needle of the darning needle type was found in each of 46 graves, while three graves each contained two needles of iron and copper-alloy respectively. Six of the 52 needles were found in a bone needle case: in four graves a single example, while in two there were two (Norling-Christensen 1942, 354–371). In addition, it is very likely that the needle was inserted into the hairstyle, as Norling-Christensen describes in a grave from Juellinge (Norling-Christensen 1943, 86; Müller 1911). In this way it would have been at hand the next time it was needed. These findings were made before 1942, so it is to be expected that more examples of this needle type have been found in the intervening period.

In Bernhard Beckmann's extensive article *Studien über die Metallnadeln der römischen Kaiserzeit im Freien Germanien* (Beckmann 1966), the hairpins are arranged in a typology which includes the darning needle type from Vester Mellerup in "Group 1, simple needles with pierced head, shape 3" dated to the Early Roman Iron Age phase B2 (Beckmann 1966, 15).

A piece of information on the hairpin in Beckmann's group 1, shape 3 seems interesting in this connection: Norling-Christensen states that three hairpins of this type were found at Tornumskov, Haderslev county (Norling-Christensen 1942, 63–64). Amongst the textiles from the grave of the Lønne Hede Maiden, a red-white-blue edge band of a very special type was found, probably tablet-woven (see above). This type is otherwise only found in the grave of the Hammerum girl (Mannering / Ræder Knudsen 2013, 159) and at the cemetery at Tornumskov (Ræder Knudsen 2014, 35–36; 109). This may

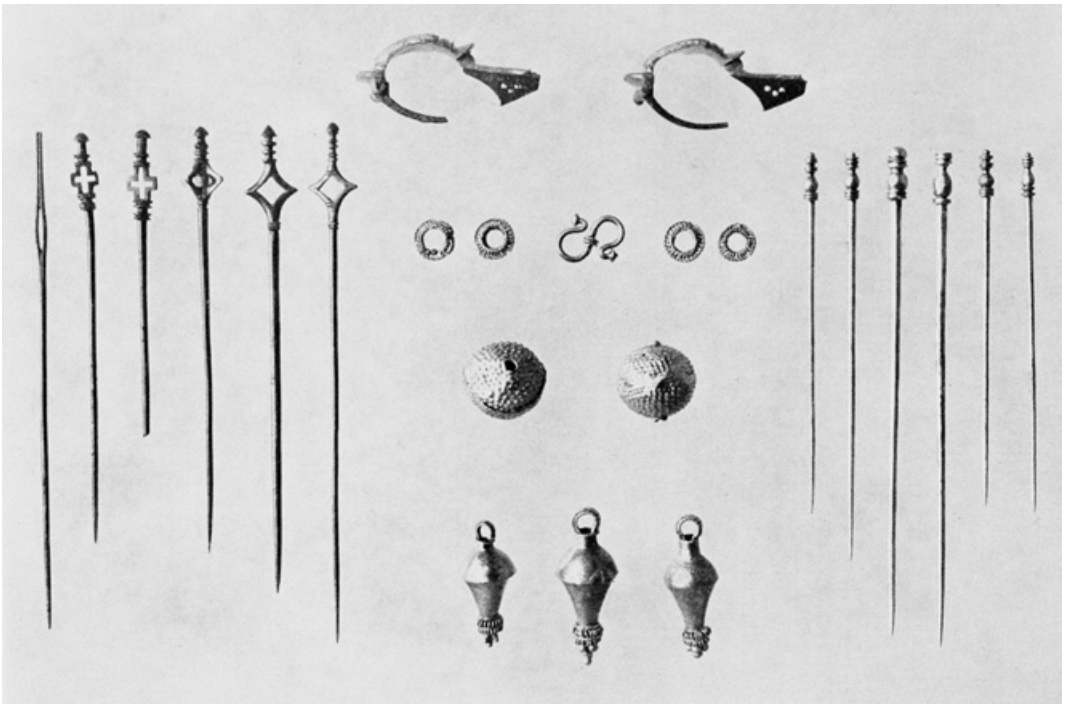


Fig. 162. Hairpins from Vester Mellerup with the sewing type (Bechmann's group 1, type 3) on the far left, with which the hairstyles have probably been sown (after Norling-Christensen 1942 *fig. 2)*.

suggest that the women from Tornumskov also had advanced hairstyles held together by sewing, and that the hairstyle fashions of the Iron Age included the use of textiles.

5.5 Finds of hair and information on hairstyles from the Early Iron Age in general

There are very few finds of hair from males from the Danish and Northern European area dated to the Early Iron Age. The Tollund man's chin is smooth and his hair is short, only 4–5 cm in length under his fur cap (Fischer 1988, 23). The Tollund man is dated to 375–210 BC (Fischer 2007, 72). The hair of the Grauballe man is approximately 15 cm long and he had no beard (Ramskou 1976, 26). His hair was long enough to be put up, but there is no evidence of this practice. The Grauballe man is dated to about 55 BC (Asingh / Lynnerup 2007). Both bog bodies were found in the Silkeborg area in central Jutland.

Two skulls with hair have been preserved in Osterby and Dätgen in northern Germany, and a similar find derives from a peat bog in the Hooghalen in Drenthe, the Netherlands. The two German finds both have long hair twisted into a Suebian knot, but whereas the Dätgen man's knot is in the nape, the Osterby man's knot is on the side of his head. However, there are doubts about the original location of the Osterby man's Suebian knot, which has probably been reconstructed from Tacitus' description (Haak 2007, 175–180; Lund 2016, 60). According to the information about the Dutch find, the hair was the length usually found in female hairstyles and it was tied in a knot (Munksgaard 1974, 200–201; van der Sanden 1996, 64, 114).

There are several finds of preserved hair from women. From Bredmose in Store Arden and Stridsholt south of Sæby in Northern Jutland, hair has been found (without preserved skull

or textiles). In both cases, there is a hairstyle with long hair where the hair is divided into two thick hair tufts, around which thick yarn has been tied and which were subsequently wrapped around the head and secured by yarn (Munksgaard 1978, 5–8). Apparently, sewing needles were not used to secure the hairstyles, nor were hairpins used to hold them.

The Elling girl was found in a bog at Bjældskovdal near Silkeborg, very close to the Tollund man and with a similar date in the Pre-Roman Iron Age. The body of the Elling girl is less well-preserved, but the back of her head is well preserved with a complicated hairstyle consisting of braids and twisted hair. From the crown of the head, the hair is gathered and braided for some centimetres in a three-strand braid, while the hair from the back of the head is divided into four tufts, each of which are twisted and inserted into the three-strand braid so the three strands consist of respectively two, two, and three tufts. At some point, one of the strands was not long enough, and the two remaining strands have then been twisted. The long braid / twist was then wrapped twice around the braid on the top of the head and hung down the back. The hairstyle required a hair length of approximately 80 cm (Fischer 1980, 21; id. 2007, 80–84). There are no parallels to this hairstyle.

The Hammerum girl was found in 1993 and the block which was lifted and excavated in 2009. The block contained very well-preserved textiles and a hairstyle. There were no preserved remains of bones or other body parts. The Hammerum girl is dated to AD 128–222 (Møbjerg et al. 2019; Kanstrup / Heinemeier 2019). The hairstyle has many features in common with the hairstyle from Lønne Hede, with a combination of smooth, loose hair at the forehead, which further down is braided forming narrow flat bands of braids that are sewn together. Thus, the hair forms a garland of loose hair retained by narrow braids *(figs 152–154)* (Ræder Knudsen / Møbjerg 2019, 81–85). The closest parallel is a hairstyle worn by Empress Faustina the Younger (c. AD 130–175), the wife of the Roman Emperor Marcus Aurelius (AD 121–180).

From many other contexts, frequent contacts between Roman Iron Age society in the north and the Roman Empire to the south are known, as well as the exchange of gifts, goods and inspiration (Lund Hansen 1987). The same seems to be the case in hair fashion as well.

Regarding the hairstyle from Lønne Hede, unfortunately no immediate parallels have been found, neither in Denmark nor in iconographic representations, such as marble busts, for example. However, it seems that the fashion in Rome was well-known in Jutland, in this case with small buns, thin braids in the neck area and long, wavy smooth hair at the forehead which were the highest fashion in the first part of the 1st century AD (Croom 2010, 116–117).

5.6 Summarising the hairstyles

The hairstyle in grave 1969 – the Lønne Hede Maiden's grave – was published in a preliminary article in 1971, but this analysis shows that the hairstyle is very different than previously thought. From a middle parting, a part of the smooth hair was combed down to around the ear area. Here, it changed to probably four braids lying parallel and made in such a way that garlands of hair adorned the edge of the hairstyle from the ear down to a flat knot in the nape. The knot lies very close to the scalp and was styled with a flat hair pad. Approximately 8 cm from the forehead, on the top of the head, loose hair ("extensions") was added. These were twisted together with the hair of the deceased to form two twists, and then turned into perhaps four close-fitting braids in a flat band. Perhaps these middle braids were also adorned with garlands of loose hair. There was probably a wooden or bone hairpin inserted across the hairstyle to hold the hair pad in place and attach the

thin tufts from the band of braids at the side and the top of the head. Both the bands of braids at the sides and on the top of the head had extra hair added. Furthermore, the hairstyle was kept in place by sewing it together with woollen yarn and perhaps also with thread made of hair (see reconstruction in *fig. 155)*. To date, no hairstyles with extensions or hair pads, or hairstyles which were sewn or preserved with hairpins *in situ* have been found from the Roman Iron Age in the Danish area. The hairstyle from the grave of the Lønne Hede Maiden most closely resembles the slightly younger Hammerum grave 83 and Roman marble busts.

In grave 6, the hairstyle probably consisted partly of a braid which was rolled up like a knot at the nape, and partly a ponytail above it which may have been twisted and rolled up in a knot.

Grave 10 was most likely of a child 8–10 years of age. The hair is probably a thin ponytail tied up with a narrow red worked woollen ribbon and twisted into a knot.

Remains of hair have also been found from graves 2, 9 and 12, but has degraded to the point where it is no longer possible to determine the original appearance.

As the hairstyle from the grave of the Lønne Hede Maiden is held in place by having been sown with needle and thread, it was natural to look for a suitable tool for this work in the contemporary archaeological finds. Many types of needles could be used for this purpose, but the study shows that the hairpins which resemble a darning needle (Beckmann's group 1, type 3) seem particularly suitable. In addition, the needle size (approx. 16 cm), and the long slightly pointed piece above the eye support the fact interpretation that the type is suitable for securing a hairstyle by sowing. Furthermore, this type of hairpin is often found further from the deceased than the other types of hairpins.

6. Conclusion and summary

In this article, a group of experts have presented and analysed the Lønne site. In the following the results are briefly summarised.

6.1 The Lønne Hede site

The first grave from Lønne Hede in Southwest Jutland, Denmark, was discovered in 1968 and excavated in the spring of 1969. It turned out to be an inhumation burial containing exceptionally well-preserved textiles. It was a female burial, and the textiles attracted a great deal of attention. In 1995, a new excavation was undertaken at Lønne Hede and resulted in the finding of further cremation and inhumation burials. Several of the latter contained textiles and hairdos. Furthermore, a settlement with long houses and a smithy, as well as a small number of pottery- or votive depositions were discovered *(figs 2–11*). The settlement traces found at the site are not contemporary with the graves, but slightly older (from the Early Pre-Roman Iron Age).

The grave field Lønne Hede consists of 25 cremation graves from the late Pre-Roman and Early Roman Iron Age and twelve inhumation graves from the Early Roman Iron Age. The gender of the deceased in the cremation graves could not be identified, however, graves A21 and A25 contained weaponry *(figs 13–15*). The inhumation graves from the Early Roman Iron Age probably all belong to women and children – judging from the textiles. There are no skeletons preserved. The inhumation graves were laid out in a long, double row, whereas the cremation graves were placed in an area nearby with an empty zone between the two grave types *(fig. 6)*. The two grave sites are not contemporary, but might overlap in time.

The Lønne Hede burial site is typical of southwestern Jutland, with a combination of cremation and inhumation graves. The complex has been presented in full, but as the Lønne Hede textiles represent the largest collection of textiles from Early Roman Iron Age graves in Denmark, the article focuses on the extremely well preserved textiles, which provide a unique insight into textile production and dress in the Early Roman Iron Age. Of further great importance are the fibre analyses, the dyestuff analysis and the analyses of the exquisite and complicated hairstyles.

The inhumation graves from Lønne Hede cannot be characterised as rich graves, as the most common kinds of grave goods are pottery, sometimes a knife, and two rare types of combs. The best-preserved textiles belong to grave 1969 – the Lønne Maiden grave – which also contained the remains of the deceased's hair, set in an elaborate hairstyle. Of the graves excavated in 1995, all but one contain preserved textiles, although they were not as well preserved as the Lønne Maiden's textiles. Graves 2, 6, 9, 10 and 12 also contain preserved human hair, but here too the hairstyles are not as complete as in grave 1969. However, in some cases, the hairdos could be identified and reconstructed.

What makes the Lønne Hede site stand out are the many well-preserved textiles and hairdos, which are unique. The textiles document the high quality of textile craftmanship in the Early Roman Iron Age, and for this publication all aspects were analysed: the selection of wool and fibre, spinning and weaving techniques, comprehensive dyestuff analysis and reconstruction of dress and hairstyles.

6.2 Textiles, weaves, designs, and technical detail

There were on average two or three types of weave in each grave, only grave 1969 and grave 2 contained more than three. The textiles appear mostly to have been used as clothing, but in several graves one of the weaves seems to have been used for lining the grave along with an animal hide.

The most common weave in Lønne Hede is plain 2/2 twill. Only three tabbies and one diamond/herringbone twill were recorded *(fig. 18)*. Tablet weaving was identified twice as an added-on border to a twill fabric, in grave 1 in a very elaborate version. However, tabby woven ribbons with a tubular selvedge could be identified five times in four different graves, making this type of weave a remarkable feature of the Lønne Hede complex.

Based on colour pattern and size, it has been possible to divide the plain 2/2 twills into three distinct groups: Group 1: dark reddish-brown twills with added-in weft stripes; these are mostly interpreted as shawls wrapped around the upper body, but also as head-covers. Group 2: plain twills, typically in orange-light brown colour; these weaves have clearly been wrapped around the body as a peplos-style dress. Group 3: plain twill in undyed wool, often slightly coarser than type 1 and 2; these were often used as a lining and cover in the graves.

Stripes are the favourite design feature and only the tabby woven scarves in grave 1969 and grave 2 display a chequered pattern. The diamond twill becomes an immensely popular weaving pattern in the late Roman Iron age, but the diamond twill from Lønne Hede grave 2 from the first century AD is an example of this pattern being known prior to the second century.

Tabby weaves were identified in two graves, although they are relatively rare in early Roman Iron Age. It was the most common type of weave in the early Bronze Age, but in the Iron Age twill was by far dominant among the wool weaves. This may be because twill weave produces a denser yet more flexible fabric that has a better drape, which matches the garments of large square and tubular weaves preferred in the Pre-Roman Iron Age. The tabby weave in grave 2 is interpreted as a form of foot-wrapping worn inside shoes.

The technical details of the selvedges and transverse edges provide information on how a textile is produced and which type of loom was used. As no starting borders were identified in the textiles from Lønne Hede, it must be assumed that only the two-beam loom was in use at the Lønne Hede settlement *(fig. 21)*. Among the Lønne Hede finds only two borders appear to be woven with tablets, though not of the typical tablet weave. The two tablet weaves are among the earliest finds of the type from the Danish area, and Textile 1969.3 from grave 1969 is the earliest example woven with a pattern. The tubular selvedge is a typical phenomenon of weaving in the Pre-Roman and Roman Iron Age, and it is recorded on most of the weaves with a preserved selvedge from Lønne Hede. They were probably made using heddles and the same principles can easily be transferred to simple warp-faced tabby band weaving with "a stick and leash"

The 3.5 cm wide and (estimated) 132 cm long woven band from Lønne Hede grave 10 appears to be a girdle running twice around the waist of the body without a knot or a buckle to hold it in place. This may be the only example of a preserved woven girdle dated to the Iron Age.

The wool selected for the textiles was of a fine and homogenous quality providing light and soft garments. Thorough analysis of the dyes has identified blue, yellow, and red colour extracted from well-known dye sources such as woad, dyer's broom, and tannins. Building on wool's natural hues (white, grey, reddish-brown and black), the textiles will have been colourful, whether plain, striped or chequered *(figs 1; 19–24)*.

6.3 Lønne Hede graves with textiles

Grave 1969 is the richest grave and possibly the oldest of the inhumation graves. The combination of the ^{14}C-dating (92 BC–AD 77) and the silver fibula from phase B1 points to a date in the earliest phase of the Early Roman Iron Age. Consequently, grave 1969 could well be the founding grave that became the focus of the additional inhumation graves. It contained seven different types of textiles: a red and white striped kerchief or headscarf, a blue and red skirt, a blue and red peplos-style dress and a red and blue checkered scarf. The coffin was lined with a blanket and an animal hide. The grave goods include pottery, a kaolinite pendant set in a copper-alloy band, silver and copper-alloy fibulae, a silver bead and clasp, and a knife. The Lønne Maiden's grave is by far the richest of the burials, and the equipment is characteristic for a middle social group – in a higher social group one would expect gold rings, golden berloque pendants and/or Roman bronze vessels and glasses *(figs 28–57; 130–132; 136)*.

The hairstyle from Lønne Hede grave 1969 is much more complex than previously believed, and included among other features added "extensions". A wooden or bone hairpin had probably been inserted across the hairstyle. Furthermore, the hairstyle was kept in place by sewing it together with yarn of wool and perhaps with thread made of hair *(figs 141–151,* reconstruction in *fig. 155*). To date, neither hairstyles with extensions, nor hair pads or preserved hairstyles that were sewn or held in place with hairpins still in situ have been found from the Roman Iron Age in the Danish area. The hairstyle from the grave of the Lønne Hede Maiden most closely resembles the slightly younger Hammerum grave and Roman marble busts.

Grave 1 had originally contained a body placed in a hocker position on its right side resting on an animal hide *(figs 58–74; 128; 133–134)*. The grave goods included an openwork single-layered antler comb and a small iron knife. The comb is unusual and without parallel in the Danish area, but similar combs dated to B1–B2 are known from Central Europe. Five different textiles have been identified, of which textile 1.6 has been

^{14}C-dated to 42 BC–AD 18. The textiles include a type of undergarment, an orange-brown tubular or "wrap around dress" held together at the shoulders, and a white striped shawl.

In grave 2 the deceased was laid to rest in a hocker position with three clay vessels and an iron knife *(figs 75–89; 135)*. Four different, relatively well-preserved weaves were identified including: a bold brownish-red and white checkered shawl with the fringes meeting in front of the body, leg- or foot-wrappings of fabric cut out of the same tabby weave, and a headdress in a very thin weave. The grave was lined with a cowhide, which also covered parts of the body. Finally, the grave was closed with a blue twill weave. One of the textiles provided a ^{14}C dating to AD 80–130.

The deceased in grave 3 was originally laid to rest in a massive oak plank-built coffin *(figs 90–93)*. Presumably, the deceased had been dragged out through a hole at the side of the coffin soon after inhumation, as everything had been removed – not a shred of textile was left behind and of the grave goods only pieces of smashed pots were left.

A faint contour at the bottom of the fur-lined grave 6 revealed a person lying crouched in a hocker position on their right-hand side *(figs 94–102)*. The only grave good was a bone comb. The body was covered or wrapped in a light twill weave with red spots of yarn, perhaps from a hem or a form of embroidery. The head and hair were covered in a very thin twill weave dyed blue with woad. The hairstyle probably consisted partly of a braid, which was rolled up like a knot at the nape, and partly of a ponytail above it, which may have been twisted and rolled up in a knot *(figs 156–158)*.

Grave 7 probably belonged to a small child *(figs 103–106)*. The body had been laid on an animal hide and covered with a poorly preserved textile. The child was wrapped in two layers of fabric: a darker reddish-brown twill weave, probably striped in a warp-covering tabby, and a worn grey twill. The grave had probably been lined with a coarse tabby weave ^{14}C-dated to AD 128–214.

The deceased in grave 8 was placed crouched in a hocker position on their right *(figs 107–108)*. No grave goods were recovered, but the body had been placed on an animal hide. The few textiles revealed that the deceased had been dressed. Three types of weave were identified in the grave, including a scarf of dark reddish-brown and white colour wrapped around the head.

In grave 9, the body had been placed in a hocker position *(figs 109–112)*. No grave goods were found, but the deceased was dressed in a light yellow 2/2 twill weave covering the body from the shinbone up to the armpits and a reddish-brown scarf. Furthermore, remains of human hair were recovered from along the edge of the area where the head would have rested.

Grave 10 belonged to a relatively small person, probably a child, laid to rest on an animal hide or rug *(figs 113–117)*. The hair was probably set as a thin ponytail tied up with a narrow red worked wool ribbon and twisted into a knot *(figs 159–160)*. The body was dressed in an orange twill weave held in place by a woven belt with a tubular woven selvedge. An undyed white blanket had been tucked in along the sides or wrapped all around the body. The dress has been ^{14}C dated to AD 70–125.

The diminutive size of grave 11 suggests a child's burial. The grave contained no finds apart from a few potsherds in the grave fill *(figs 118–119)*.

Grave 12 was lined with an animal hide and covered with a layer of narrow planks. A tuft of human hair was found in the western end of the grave *(fig. 161)*. There were no grave goods *(figs 120–126)*. The deceased was dressed in a monochrome twill woven dress adorned with a tabby woven border with tubular selvedges. A shawl of dark brownish-red colour with stripes is ^{14}C dated to AD 71–125.

Grave 13 was the deepest grave on the site and the only inhumation grave in the row of cremation graves towards the east *(fig. 127a–b)*. There were faint traces of the body, which had been placed on an animal hide with the hairy side upwards, and presumably covered with plant remains such as twigs, leaves, straw, wood or bark. No grave goods and only very faint traces of textiles were found.

The analysis of the fibres has shown that the wool used in all the textiles from Lønne Hede was relatively fine and fairly homogenous. There is little difference in the composition of fibres between the different garments, although the wool was apparently taken from more than one sheep. These very fine and homogenous fibres must be the result of deliberate sheep breeding specifically aimed at producing good wool for textiles. It may, however, also demonstrate a careful separation of the wool fibres prior to spinning the yarn for the different garments.

The fact that such fine fibres were used also indicates that the garments would have been soft to the touch and light to wear. It is not possible to weigh any of the textiles, but an experiment with the production of a similar dress showed that a tubular dress the size of the dresses identified in Lønne Hede graves 1 and 10 would weigh only c. 600 g.

Calculations of working time in relation to prehistoric textile production based on experiments and ancient texts have shown that it would take more than a month of full-time work to produce a small dress similar to the dress of Lønne Hede grave 1 – from shearing the sheep and preparing the wool to spinning and weaving.

6.4 Dress in first century AD Lønne Hede

The analyses of the textiles from Lønne Hede reveal that the women at Lønne Hede continued to use a form of dress – the tubular or peplos-style dress – known since the Bronze Age. It could be made either as a tube or from one piece of textile draped around the body and fastened on each shoulder with either a fibula, a pin or a simple thread. The peplos could be combined with skirts, as seen in grave 1969 – perhaps a combination used in cooler seasons. A new element is the kerchief or headscarf, which was recently identified in the slightly younger graves from Vorbasse. Evidence of head-covers are already known from the Pre-Roman Iron Age in the form of bonnets made in so-called sprang technique, but finds of hairpins in richly equipped graves from the Late Roman Iron Age (phase C1b-C2) indicate that head-covers also were part of the outfit in the Roman Iron Age. There were no shoes preserved in the graves. Only the foot-wraps in Lønne Hede grave 2 indicate the use of footwear.

Little is known of children's clothing in the Iron Age. The child in Lønne Hede grave 2 had a shawl resembling those found in Lønne Hede graves 1969, 1 and 12, and a very fine head-cover – besides the possible foot wraps. The small child in Lønne Hede grave 7 had probably been wrapped in old garments.

It is an ongoing discussion whether the textiles were chosen especially for the burial or whether they reflect daily dress. The evidence from Lønne Hede suggests the latter: often the textiles were worn, and their use seem to parallel that of the textiles from the bog bodies. Several of the textiles displayed heavy traces of wear. The blue garments and jewellery of Lønne Hede grave 1969 give an immediate impression of being best clothes, but the worn shawl tells us that there were also garments that had been used for more than Sunday best, and that the garments found in the graves probably mirror the clothing traditions – if not the fashions – of the time.

The insights revealed by the detailed analysis of the preserved hairstyles are outstanding. In particular the Lønne Hede Maiden's elaborately styled hair with added extensions

provides a rare glimpse of the hairdos of ordinary people in first the centuries AD. Not only does her hairstyle show a strong Roman influence, but so does her dress. The exquisite hair indicates how surprisingly fashionable hairstyles – like dress – were for the common villagers in western Jutland in the Early Roman Iron Age. And furthermore, it shows that so-called poor graves could contain beautiful costumes of vibrant colour and elaborately styled hair of the latest fashion. It also underlines the vast of amount of information lost to us due to the lack of preservation of not only textiles and fur, but of organic material in general.

Apart from the famous Bronze and Iron Age textiles from the Danish bogs, the textiles from the Lønne Hede grave field are so far the largest and best preserved find of all textiles from Roman Iron Age graves in Northern Europe. For the first time we are provided with an insight into all the components of women's dress, as well as the way they wore their fibulae and other jewellery. We now also know that a cape or shawl was an important part of female dress – just as it was for the men. To the interesting but not so often-raised question – did they wear underwear? – the answer here seems to be negative. Of great further interest is the evidence that an important part of a woman´s look was the elaborately and complicatedly styled hair, which clearly required assistance. The enormous fortune of the Lønne Hede find lies in the information we get on an ordinary woman's dress, which we do not get from the bog textiles as they nearly always are single pieces of dress not worn by a person either in life or in death.

The relatively poor graves of Lønne Hede clearly show a village very much in contact with the outside world. The find forces us to finally put behind us the brown and grey imagery of the Barbaricum and embrace the bold and vibrant coloured everyday costumes of the farmers of Early Iron Age Scandinavia.

7. Acknowledgements

The authors would like to thank the National Museum of Denmark and the Varde Museums for making this large-scaled study possible by granting access to their Lønne Hede collections. We are particularly grateful to M.-C. Maquoi and A. Coudray for their dedicated technical work in the KIK textile lab, to Krista Vajanto for providing us with a range of wool reference samples, as well as to Jørn Bredal Jørgensen for his help with the SEM-EDX analyses at the School of Conservation.

We would like to thank Karen Høilund Nielsen, Tine Lorange, Anne Drewsen, Xenia Pauli Jensen and Cherine Munkholt for translating and proofreading.

Finally, we are immensely grateful for the funding we received from the Ministry of Culture, Elizabeth Munksgaards Fond, Farumgård-Fonden, Centre of Textile Research (University of Copenhagen) and the National Museum of Denmark.

8. Bibliography

Ahmed 2009
H. E. Ahmed, History of Natural Dyes in North Africa "Egypt". In: T. Bechtold / R. Mussak (eds), Handbook of Natural Colorants (Chichester 2009) 27–36.

Algreen Møller 2015
N. Algreen Møller, Døde i de levendes verden. Vestjyske gravfund i kontekst. In: P. Foss / N. Algreen Møller (eds), De dødes landskab. Grav og gravskik i ældre jernalder i Danmark. Beretning fra et colloquium i Ribe 19.–20. marts 2013. Ark. Skr. 13 (Copenhagen 2015) 215–236.

Almgren 1923
O. Almgren, Studien über nordeuropäische Fibelformen der ersten nachchristlichen Jahrhunderte mit Berücksichtigung der provinzial-römischen und südrussischen Formen[2] (Leipzig 1923).

Andersson 2003
E. Andersson, Excavations in the Black Earth 1990–1995. Tools for Textile Production from Birka and Hedeby. Birka Stud. 8 (Stockholm 2003).

Andersson Strand / Cybulska 2013
E. Andersson Strand / M. Cybulska, Visualising Ancient Textiles – how to make a Textiles Visible on the Basis of an interpretation of an Ur III Text. In: M.-L. Nosch / H. Koefoed / E. Andersson Strand (eds), Textile Production and Consumption in the Ancient Near East. Archaeology, epigraphy, iconography. Ancient Textiles Ser. 12 (Oxford 2013) 113–127.

Andersson Strand / Mannering 2011
E. Andersson Strand / U. Mannering, Textile production in the Late Roman Iron Age – a case study of textile production in Vorbasse, Denmark. In: L. Boye et al. (eds), Det 61. Internationale Sachsensymposion 2010 Haderslev, Danmark. Arkæologi i Slesvig / Archäologie in Schleswig. Sonderbd. (Neumünster 2011) 77–84.

Asingh / Lynnerup 2007
P. Asingh / N. Lynnerup, An Iron Age Bog Body Revisited. Jutland Arch. Soc. Publ. 49 (Højbjerg 2007).

Bazzanella / Dal Rì / Maspero† / Tomedi 2005
M. Bazzanella / L. Dal Rì / A. Maspero† / I. Tomedi, Iron Age Textile Artefacts from Riesenferner / Vedretta de Ries (Bolzano / Bozen, Italy). In: P. Bichler et al. (eds), Hallstatt Textiles. Technical Analysis, Scientific Investigation and Experiment on Iron Age Textiles. BAR Internat. Ser. 1351 (Oxford 2005) 151–160.

Barber 1999
E. W. Barber, The Mummies of Ûrümchi (New York, London 1999).

Becker 1961
C. J. Becker, Førromersk jernalder i Syd- og Midtjylland. Nationalmus. Skr., Større Beretninger 6 (Copenhagen 1961).

Beckmann 1966
B. Beckmann, Studien über die Metallnadeln der römischen Kaiserzeit im freien Germanien. Saalburg-Jahrb. 23, 1966, 5–100.

Bender Jørgensen 1986
L. Bender Jørgensen, Forhistoriske Textiler i Skandinavien. Nordiske Fortidsminder B9 (Copenhagen 1986).

Bender Jørgensen 1992
Ead., North European Textiles until AD 1000 (Aarhus 1992).

Bennike 2002
P. Bennike, Antropologisk undersøgelse af brændte ben fra Lønne Hede. VAM 1272, AS 36/00 (unpubl. report Anthr. Lab. Panum Inst. Univ. Copenhagen 2002).

Blankenfeld 2015
R. Blankenfeld, Das Thorsberger Moor 2: Die persönlichen Ausrüstungen (Schleswig 2015).

Boding-Jensen 2012
K. Boding-Jensen, Digitale tråde over landskabet. Midtjyske fortællinger 2012, 39–48.

Broholm / Hald 1940
H. Chr. Broholm / M. Hald et al., Costumes of the Bronze Age in Denmark. Contributions to the Archaeology and Textile-History of the Bronze Age (Copenhagen 1940).

Brothwell et al. 1990
D. R. Brothwell / D. Liversage / B. Gottlieb, Radiographic and forensic aspects of the female Huldremose body. Journal Danish Arch. 9, 1990, 157–179.
Cardon 2007
D. Cardon, Natural Dyes. Sources, Tradition, Technology and Science (London 2007).
Christensen 2015
L. Christensen, Enderupskov. En sønderjysk gravplads fra romersk og ældre germansk jernalder. In: P. Foss / N. Algreen Møller (eds), De dødes landskab. Grav og gravskik i ældre jernalder i Danmark. Beretning fra et colloquium i Ribe 19.–20. marts 2013. Ark. Skr. 13 (Copenhagen 2015) 73–87.
Ciszuk forthcoming
M. Ciszuk, Early Iron Age weaving technology. In: U. Mannering / M. Gleba (eds), Designed for Life and Death. Ancient Textiles Ser. (Oxford forthcoming).
Croom 2010
A. Croom, Roman Clothing and Fashion (Chalford 2010).
Demant 2000
I. Demant, Die Textilfragmente von Skovgårde. In: P. Ethelberg et al. 2000, 348–361.
Demant 2018
I. Demant, Making an Iron Age Dress on the Warp-Weighted Loom. The results of experimental archaeology. In: M. Bravermanová / H. Březinová / J. Malcolm-Davies (eds), Archaeological Textiles – Links between Past and Present. The North European Symposium for Archaeological Textiles NESAT XIII (Liberec, Prague 2018) 275–282.
Demant forthcoming
Ead., Textiles from Stålmosegård. Roskilde Museum (forthcoming).
Dokkedal / Jensen 1976
L. Dokkedal / E. S. Jensen, Om plantefarvning (Lejre 1976).
Ebbesen 2011
K. Ebbesen, Kvindens hår som offer. Aarb. Nordisk Oldkde. og Hist. 2008, 77–87.
Egebjerg 2015
T. Egebjerg, Store Skindbjerg og Lønhøjvej. To store gravpladser i Vestjylland. In: P. Foss / N. Algreen Møller (eds), De dødes landskab. Grav og gravskik i ældre jernalder i Danmark. Beretning fra et colloquium i Ribe 19.–20. marts 2013. Ark. Skr. 13 (Copenhagen 2015) 89–101.
Ejstrud / Jensen 2000
B. Ejstrud / C. K. Jensen, Vendehøj – Landsby og Gravplads. Jysk Ark. Selskabs Skr. 35 (Højbjerg 2000).
Ethelberg 1990
P. Ethelberg, Hjemsted 2 – tre gravpladser fra 3. & 4. årh. e. Kr. Skr. Museumsrådet Sønderjyllands Amt 3 (Haderslev 1990).
Ethelberg et al. 2000
P. Ethelberg et al., Skovgårde – ein Bestattungsplatz mit reichem Frauengräbern des 3. Jahrhunderts n. Chr. auf Seeland. Nordiske Fortidsminder 19 (Copenhagen 2000).
Fester 1951
A. Fester, Red dyes used by natives in South America. Rev. Fac. Ingeniería Química 20, 1951, 105–116.
Fischer 1980
Chr. Fischer, Døden og mosen. Skalk 1980/4, 18–26.
Fischer 1988
Chr. Fischer, På sporet af Tollundmanden (Copenhagen 1988).
Fischer 2007
Chr. Fischer, Tollundmanden. Gaven til guderne. Mosefund fra Danmarks forhistorie (Silkeborg 2007).
Frandsen 1995
L. B. Frandsen, Nye grave med tekstiler fra Lønne Hede. Mark og Montre 1995, 37–40.
Frandsen 2009
Ead., Horns Rev 2 udgravningerne. Opdatering. Museet for Varde By og Omegns Årb. 2008, 52–61.
Frandsen 2015
Ead., Lønne Hede-gravpladsen. Gammel sag – nye resultater. In: P. Voss / N. Algreen Møller (red.), De dødes landskab. Grav og gravskik i ældre jernalder i Danmark. Ark. Skr. 13 (Copenhagen 2015) 113–122.
Goldstein et al. 1981
J. I. Goldstein / D. E. Newbury / P. Echlin / D. C. Joy / C. Fiori / E. Lifshin,

Scanning Electron Microscopy and X-Ray Micro-analysis. A Test for Biologists, Materials Scientists, and Geologists (New York 1981).

Graglia et al. 2001
E. Graglia / R. Julkunen-Tiitto / G. R. Shaver / I. K. Schmidt / S. Jonasson / A. Michelsen, Environmental control and intersite variations of phenolics in Betula nana in tundra ecosystems. New Phytologist 151, 2001, 227–236.

Grömer / Rösel-Maulendorfer 2013
K. Grömer / H. Rösel-Maulendorfer, Catalogue of the Hallstatt Textiles. In: K. Grömer / A. Kern / H. Reschreiter / H. Rösel-Mautendorfer (eds), Textiles from Hallstatt. Weaving Culture in Bronze Age and Iron Age Salt mines (Budapest 2013) 237–574.

Haak 2007
B. Haak, Einige Bemerkungen zum so genannten "Suebenknoten". In: S. Burmeister / H. Derks / J. von Richthofen (eds), Zweiundvierzig. Festschr. M. Gebühr. Internat. Arch. Stud. Honoraria 16 (Rahden / Westf. 2007) 175–180.

Hald 1953
M. Hald, Fra bar fod til strømpe. In: L. Brahe Christensen (ed.), Om strømper. A/S Valby Strømpefabrik i anledning af virksomhedens 50 års jubilæum d. 14 maj 1953 (Valby 1953) 6–45.

Hald 1972
M. Hald, Primitive shoes: an archaeological-ethnological study based upon shoe finds from the Jutland peninsula. Nationalmus. Skr. Ark.-Hist. R. 13 (Copenhagen 1972).

Hald 1980
M. Hald, Ancient Danish textiles from bogs and burials: a comparative study of costume and Iron Age textiles. Publ. Nat. Mus. Arch.-Hist. Ser. 21 (Copenhagen 1980).

Hall 1983
A. R. Hall, Evidence of dye plants from Viking age York and Medieval Beverley. Dyes on Hist. and Arch. Textiles 2, 1983, 25.

Henk 2010
A. Henk, Undersøgelse for imprægneringsmiddel på udvalgte tekstilfragmenter fra Lønne Hede (unpubl. report School of Conservation Copenhagen 2010).

Hansen 1990
E. H. Hansen, Brikvævning: Historie, teknik, farver, mønstre (Højbjerg 1990).

Henriksen 2009
M. B. Henriksen, Brudager Mark – en romertidsgravplads nær Gudme på Sydøstfyn 1–2. Fynske Stud. 22 (Odense 2009).

Hofenk de Graaff 2004a
J. Hofenk de Graaff, Dyer's greenweed. In: J. Hofenk de Graaff (ed.), The Colourful Past. Origins, Chemistry and Identification of Natural Dyestuffs (Riggisberg, London 2004) 222–227.

Hofenk de Graaff 2004b
J. Hofenk de Graaff, Orchil. In: J. Hofenk de Graaff (ed.), The Colourful Past. Origins, Chemistry and Identification of Natural Dyestuffs (Riggisberg, London 2004) 274–280.

Hofenk de Graaff 2004c
J. Hofenk de Graaff, Tannin. In: J. Hofenk de Graaff (ed.), The Colourful Past. Origins, Chemistry and Identification of Natural Dyestuffs (Riggisberg, London 2004) 286–311.

Hvass 1980
L. Hvass, Landsbyen og samfundet i jernalderen. In: G. Vejen / V. von Magius / P. Kølle (red.), Lademanns Danmarkshistorie: Jernalderen 1 (Copenhagen 1980).

Härke 1997
H. Härke, The Nature of Burial Data. In: K. Højlund Nielsen / C. Kjell Jensen (eds), Burial and Society. The Chronological and Social Analysis of Archaeological Burial Data. Arch. Journal 155, 1997, 19–27.

Ilkjær 1993
J. Ilkjær, Illerup Ådal 3. Die Gürtel, Bestandteile und Zubehör: Textband. Jutland Arch. Soc. Publ. 25,2 (Højbjerg 1993).

Jensen 1997
C. K. Jensen, Kronologiske problemer og deres betydning for forståelsen af førromersk jernalder i Syd- og Midtjylland. In: J. Martens (ed.), Chronological Problems of the Pre-Roman Iron Age in Northern Europe. Symposium at the Institute of Prehistoric

and Classical Archaeology, University of Copenhagen, December 8, 1992 (Copenhagen 1997) 91–106.

Jensen 2003
C. K. Jensen, Danmarks Oldtid, Ældre Jernalder 500 f. Kr.–400 e. Kr. (Copenhagen 2003).

Jørgensen / Walton 1986
L. B. Jørgensen / P. Walton, Dyes and Fleece Types in Prehistoric Textiles from Scandinavia and Germany. Journal Danish Arch. 5, 1986, 177–188.

Kanstrup / Heinemeier 2019
M. Kanstrup / J. Heinemeier, AMS ^{14}C Datings. In: T. Møbjerg / U. Mannering / H. Rostholm / L. Ræder Knudsen (eds), The Hammerum Burial Site. Customs and Clothing in the Roman Iron Age. Jutland Arch. Soc. Publ. 103 (Højbjerg 2019) 103–108.

Klingenberg et al. 1995
S. Klingenberg / M. Bencard / J. Nordqvist / D. Ørsnes, u.d. beretning, NM j. nr. 906/69/ 957/70, ASR 43/69, Stensat grav fra ældre romersk jernalder. Lønne Hede, matr. 19b Lønne Præstegård, Lønne sogn sb. 1, Vester Horne herred, Ribe amt. Stednr. 190708, Nationalmus. København (unpubl. report 1995).

Kokowski 1999
A. Kokowski, Archäologie der Goten. Goten im Hrubieszów-Becken (Berlin 1999).

Leube 1998
A. Leube, Die Rollenkappefibeln Almgren Gruppe II, Fig. 24–29, im Gebiet zwischen Weser und Parseta. Studien zur Typologie und zur Fundgeographie. In: J. Kunow (ed.), 100 Jahre Fibelformen nach Oscar Almgren. Internationale Arbeitstagung 25.–28. Mai 1997 Klein Machnow, Land Brandenburg. Forsch. Arch. Land Brandenburg 5 (Wünsdorf 1998) 55–84.

Liimatainen et al. 2012
J. Liimatainen / M. Karonen / J. Sinkkonen / M. Helander / J.-P. Salminen, Phenolic Compounds of the Inner Bark of Betula pendula: Seasonal and Genetic Variation and Induction by Wounding. Journal Chemical Ecology 38, 2012, 1410–1418.

Lind 1991
B. Lind, Gravformer og Gravskikke. In: S. H. Andersen / B. Lind / O. Crumlin-Pedersen, Slusegårdgravpladsen 3. Gravformer og gravskikke. Bådgravene. Jysk Ark. Selskabs Skr. 14,3 (Højbjerg 1991) 13–92.

Lorange 2015
T. Lorange, Det sakrale landskab ved Årre. Landskabets hukommelse gennem 4000 års gravriter. In: P. Voss / N. Algreen Møller (red.), De dødes landskab. Grav og gravskik i ældre jernalder i Danmark. Ark. Skr. 13 (Copenhagen 2015) 21–36.

Lund 1993
A. A. Lund, De etnografiske kilder til nordens tidlige historie (Højbjerg 1993).

Lund 2016
A. A. Lund, Tacitus Germania, Forestillinger om germanerne (Højbjerg 2016).

Lund Hansen 1987
U. Lund Hansen, Römischer Import im Norden. Warenaustausch zwischen dem Römischen Reich und dem freien Germanien während der Kaiserzeit unter besonderer Berücksichtigung Nordeuropas. Nordiske Fortidsminder B10 (Copenhagen 1987).

Lund Hansen / Ethelberg et al. forthcoming
U. Lund Hansen / P. Ethelberg et al., Life and Death in 3rd century Vorbasse. A Case Study of Late Roman Society in Jutland and surrounding areas. Nordiske Fortidsminder (Copenhagen forthcoming).

Mannering 2017
U. Mannering, Forhistorisk dragt. In: U. Mannering (ed.), Arkæologisk Tekstilforskning. Baggrund og ny viden (Copenhagen 2017) 5–43.

Mannering et al. 2010
U. Mannering / H. Rostholm / L. Ræder Knudsen, Pigen fra Hammerum. Skalk 5, 2010, 3–8.

Mannering et al. 2010
U. Mannering / G. Possnert / J. Heinemeier / M. Gleba, Dating Danish textiles and skins from bog finds by means of ^{14}C AMS. Journal Arch. Scien. 37, 2010, 261–268.

Mannering et al. 2012
U. Mannering / M. Gleba / M. Bloch

Hansen, Denmark. In: M. Gleba / U. Mannering (eds), Textiles and Textile production in Europe. From Prehistory to AD 400. Ancient Textiles Ser. 11 (Oxford 2012) 91–118.

Mannering / Ræder Knudsen 2013
U. Mannering / L. Ræder Knudsen, Hammerum: The find of the Century. In: J. Banck-Burgess / C. Nübold, The North European Symposium for Archaeological Textiles 11, 10–13 May 2011 in Esslingen am Neckar. NESAT XI (Rahden/Westfalen 2013) 157–160.

Mannering et al. 2017
U. Mannering / K. Frey / A. L. Schmidt / I. Skals, Huldremosekvinden. In: U. Mannering (ed.), Arkæologisk Tekstilforskning. Baggrund og ny viden (Copenhagen 2017) 119–125.

Mannering et al. forthcoming
U. Mannering / I. Demant / L. Ræder Knudsen / I. Skals / I. Vanden Berghe, Textiles in the Vorbasse graves. In: Lund Hansen / Ethelberg et al. forthcoming.

Mannering / Gleba forthcoming
U. Mannering / M. Gleba (eds), Designed for Life and Death. Ancient Textiles Ser. (Oxford forthcoming).

Möller-Wiering 2011
S. Möller-Wiering, War and Worship. Textiles from 3rd to 4th century AD weapon Deposits in Denmark and Northern Germany. Ancient Textiles Ser. 9 (Oxford 2011).

Munksgaard 1971
E. Munksgaard, Et gravfund med tekstiler fra 1. årh e. kr. fra Lønne Hede, Ribe Amt. Nationalmus. Arbejdsmark 1971, 194–196.

Munksgaard 1974
E. Munksgaard, Oldtidsdragter. Nationalmuseet (Copenhagen 1974).

Munksgaard 1978
E. Munksgaard, Frisurer fra ældre jernalder. Mosefund og gravfund. Aarb. Nordisk Oldkde. og Hist. 1976, 5–21.

Munksgaard / Østergård 1988
E. Munksgaard / E. Østergård, Textiles and costume from Lønne Hede. An early Roman Iron Age Grave. In: L. Bender Jørgensen / B. Magnus / B. Munksgaard (eds), Archaeological Textiles. The North European Symposium for Archaeological Textiles NESAT II. Ark. Skr. 2 (Copenhagen 1988) 53–64.

Müller 1911
S. Müller, Juellinge-fundet og den romerske Periode. Nordiske Fortidsminder 2,1 (Copenhagen 1911).

Møbjerg et al. 2019
T. Møbjerg / U. Mannering / H. Rostholm / L. Ræder Knudsen (eds), The Hammerum Grave Site. Customs and Clothing in the Roman Iron Age. Jutland Arch. Soc. Publ. 103 (Højbjerg 2019).

Nielsen et al. 2018
E. K. Nielsen et al., Keramikrige gruber og velbevarede agre fra tidlig førromersk jernalder ved Boes Skov, Østjylland. Gefion 3, 2018, 82–96.

Nordquist / Ørsnes 1971
J. Nordquist / D. Ørsnes, Pigen i blåt. Skalk 1971/3, 9–15.

Norling-Christensen 1942
H. Norling-Christensen, Une trouvaille de parures de l'ancien âge du fer romain faite a Vester Mellerup, Vendsyssel. Acta Arch. 13, 1942, 332–355.

Norling-Christensen 1943
Id., Smykkefundet fra Vester Mellerup. Nationalmus. Arbejdsmark 1943, 85–90.

Nørgård et. al. 1983
A. Nørgård / L. Dokkedal / E. S. Jensen, Moseforsøg. Natur- og plantefarvede stofprøver. Tekstilværkstedet, Forsøgscentret, Lejre, Denmark, HAF, J.nr. 10/72 (Lejre 1983).

Østergård 1984
E. Østergård, Rapport om textilfundet fra Lønne Hede [unpubl. report] (n. p. 1984).

Olesen et al. 2019
L. H. Olesen / E. S. Mauritsen / M. C. Broch, Luftarkæologi 2. Luftfotos, droner, laser og geofysik (Holstebro 2019).

Olsen / Bech 1996
A.-L. H. Olsen / J.-H. Bech, Damsgård. En overpløjet høj fra ældre bronzealder per. III med stenkiste og ligbrændingsgrube. KUML 1995–1996, 155–195.

Palo 1984
R. T. Palo, Distribution of Birch (Betula SPP.), Willow (Salix SPP.), and Poplar (Populus SPP.) secondary Metabolite and their potential role as chemical defense against Herbivores. Journal Chemical Ecology 10/3, 1984, 499–520.

Pauli Jensen 2015
X. Pauli Jensen, Krig, kult og kontakter. Våbengrave og romersk militærimport i ældre jernalder. In: P. Foss / N. Algreen Møller (eds), De dødes landskab – Grav og gravskik i ældre jernalder i Danmark. Ark. Skr. 13 (Copenhagen 2015) 269–281.

Petersen 2008
M. Petersen, Genbrug i Jernalderen – om et vævet tæppe, svøbt om et toårigt barn og ofret i Thorup Mose. Viborg Bogen 2008 (Viborg 2008) 37–45.

Ramskou 1976
T. Ramskou, Noget om hår og skæg. Nationalmuseet (Copenhagen 1976).

Rahmstorf 2015
L. Rahmstorf, An introduction to the investigation of archaeological textile tools. In: E. Andersson Strand / M.-L. Nosch (eds), Tools Textiles and Contexts. Investigating Textile Production in the Agean and Eastern Mediterranean Bronze Age. Ancient Textiles Ser. 21 (Oxford 2015) 1–23.

Rasch 1994
M. Rasch, Burial Practices – Grave Furniture and Burial Methods During the Roman Iron Age. In: B. Stjernquist (ed.), Prehistoric Graves as a Source of Information. Kungl. Vitterhets Hist. och Ant. Akad. Konferenser 29 (Uppsala 1994) 181–200.

Ratje 1972
N. Ratje, Den blå pige (work report 19/11/1972).

Rindel 1997
P. O. Rindel, Den keramiske udvikling i sen førromersk og ældre romersk jernalder i Sønderjylland. In: J. Martens (ed.), Chronological Problems of the Pre-Roman Iron Age in Northern Europe. Symposium at the Institute of Prehistoric and Classical Archaeology, University of Copenhagen, December 8, 1992 (Copenhagen 1997) 159–167.

Rindel 2002
Id., Hvor kragerne vender? In: J. Pind et al. (eds), Drik – og du vil leve skønt: festskrift til Ulla Lund Hansen på 60-årsdagen 18. august 2002. Publ. Nat. Mus., Stud. Arch. and Hist. 7 (Copenhagen 2002) 165–176.

Ringgaard 2010
M. G. Ringgaard, To par strixstrømper oc en nattrøie naccarat: Filtede og strikkede tekstiler fra omkring år 1700, fundet i Københavnske byudgravninger – og sammenhænge mellem tekstilers farve og bevaring [unpubl. PhD thesis Univ. Copenhagen] (Copenhagen 2010).

Ringtved 1988
J. Ringtved, Jyske gravfund fra yngre romertid og ældre germanertid. Tendenser i samfundsudviklingen. KUML 1986, 95–233.

Rio 2011
P. Rio, The Soviet Soldier 1941–1945 (Havertown 2011).

Roberts / Frandsen 1996
F. Roberts / L. Frandsen, More Textiles at Lønne Hede. Arch. Textiles Newsletter, Spring 1996, 14–16.

Ryder 1981
M. L. Ryder, European Wool Types from the Iron Age to the Middle Ages. In: L. Bender Jørgensen / K. Tidow (eds), Archäologische Textilfunde. Textilsymposium Neumünster. The North European Symposium for Archaeological Textiles NESAT I (Neumünster 1981) 224–238.

Rostholm 2011
H. Rostholm, Nyt om Hammerumpigen. Naturvidenskabelige undersøgelser i 2010 og 2011. Midtjydske fortællinger 2011, 103–118.

Ræder Knudsen 2011
L. Ræder Knudsen, Tablet woven textiles from 3rd to 4th-century AD Weapon Deposits in Denmark and Northern Germany. In: S. Möller-Wiering, War and Worship. Textiles from 3rd to 4th-century AD Weapon Deposits in Denmark and Northern Germany. Ancient Textiles Ser. 9 (Oxford 2011) 163–198.

Ræder Knudsen 2014
L. Ræder Knudsen, Teknologihistorisk analyse af brikvævning fra ældre jernalder [Ph.d. afhandling. København: Det Kongelige Danske Kunstakademis Skoler for Arkitektur, Design og Konservering] (Copenhagen 2014).

Ræder Knudsen forthcoming
L. Ræder Knudsen, Tablet-woven Borders from Bogs and Burials of the Early Iron Age. In: U. Mannering / M. Gleba (eds), Designed for Life and Death. Ancient Textiles Ser. (Oxford forthcoming).

Ræder Knudsen / Møbjerg 2019
L. Ræder Knudsen / T. Møbjerg, The coiffures. In: T. Møbjerg / U. Mannering / H. Rostholm / L. Ræder Knudsen (eds), The Hammerum Burial Site. Customs and Clothing in the Roman Iron Age. Jutland Arch. Soc. Publ. 103 (Højbjerg 2019) 77–90.

van der Sanden 1996
W. van der Sanden, Udødeliggjorte i mosen – historierne om de nordvesteuropæiske moselig (Amsterdam 1996).

Scharff 2018
A. B. Scharff, The Assessment of Natural Pigmentation in Archaeological Wool. In: M. Bravermanová / H. Březinová / J. Malcolm-Davies (eds), Archaeological Textiles – Links between Past and Present. The North European Symposium for Archaeological Textiles NESAT XIII (Liberec, Prague 2018) 235–242.

Scharff / Ringgaard 2011
L. Ræder Knudsen / M. G. Ringgaard, Indigotin in Archaeological Textiles from Wet or Waterlogged Environments. In: J. Bridgland (ed.), ICOM-CC, 16th Triennial Conference, Lisbon 19–23 September 2011 (Lisbon 2011) 1–8.

Schlabow 1976
K. Schlabow, Textilfunde der Eisenzeit in Norddeutschland. Göttinger Schr. Vor- u. Frühgesch. 15 (Neumünster 1976).

Schweppe 1993
H. Schweppe, Handbuch der Naturfarbstoffe. Vorkommen, Verwendung und Nachweis (Hamburg 1993).

Skals / Mannering 2014
I. Skals / U. Mannering, Investigation of wool fibres from Danish prehistoric textiles. Arch. Textiles Rev. 56, 2014, 24–25.

Stanek 1999
K. Stanek, Wisiory opasane odmiany wschodniej w środkowoeuropejskim Barbaricum (Banded pendants of eastern group in central European Barbaricum). In: J. Andrzejowski (ed.), COMHLAN. Studia z archeologii okresu przedzymskiego I rzymskiego w Europie Środkowej dedykowane Teresie Dąbrowskiej w 65. rocznicę urodzin (Warszawa 1999) 331–367.

Stephens 2008
J. Stephens, Ancient Roman Hairdressing: on (hair)pins and needles. Journal Roman Arch. 21, 2008, 110–132.

Taylor 1983
G. W. Taylor, Detection and identification of dyes on Anglo-Scandinavian textiles. Stud. Conservation 28, 1983, 153–160.

Teerink 1991
B. J. Teerink, Hair of West-European Mammals: Atlas and Identification Key (Cambridge 1991).

Teuber 2005
S. W. Teuber, Die Einlagenkämme der Römischen Kaiserzeit und der Völkerwanderungszeit im Freien Germanien. Neue Ausgr. u. Forsch. Niedersachsen 25 (Neumünster 2005).

Thomas 1960
S. Thomas, Studien zu den germanischen Kämmen der römischen Kaiserzeit. Arbeits- u. Forschungsber. Sächs. Denkmalpfl. 8, 1960, 54–215.

Vajanto 2015
K. Vajanto, Dyes and Dyeing Methods in Late Iron Age Finland (PhD thesis Univ. Helsinki 2015).

Vanden Berghe 2009
I. Vanden Berghe, KIK-IRPA Analytical study of the dye composition of wool references aged in anoxic waterlogged or low oxygen humid conditions, DI2008.09943, 03.02.2009 (unpubl. report 2009).

Vanden Berghe 2012
I. Vanden Berghe, KIK-IRPA Analytical report DI2011.11114b, 20/04/2012 [unpubl. report] (n. p. 2012).

Vanden Berghe 2013
I. Vanden Berghe, Dye analysis of archaeological textile objects. In: J. Banck-Burgess / C. Nübold, The North European Symposium for Archaeological Textiles 11, 10–13 May 2011 in Esslingen am Neckar. NESAT XI (Rahden/Westfalen 2013) 57–62.

Vanden Berghe 2019
I. Vanden Berghe, Dye analysis. In: T. Møbjerg / U. Mannering / H. Rostholm / L. Ræder Knudsen (eds), The Hammerum Burial Site. Customs and Clothing in the Roman Iron Age. Jutland Arch. Soc. Publ. 103 (Højbjerg 2019) 159–162.

Vanden Berghe et al. 2009
I. Vanden Berghe / M. Gleba / U. Mannering, Towards the identification of dyestuffs in Early Iron Age Scandinavian peat bog textiles. Journal Arch. Scien. 36, 2009, 1910–1921.

Vanden Berghe / Möller-wiering 2013
I. Vanden Berghe / S. Möller-Wiering, Dye analyses on the 'Prachtmäntel' from Thorsberg. In: J. Banck-Burgess / C. Nübold, The North European Symposium for Archaeological Textiles 11, 10–13 May 2011 in Esslingen am Neckar. NESAT XI (Rahden/Westfalen 2013) 101–105.

Walton 1988
P. R. Walton, Dyes and wools in Iron Age Textiles from Norway and Denmark. Journal Danish Arch. 7, 1988, 144–158.

Walton 1997
P. R. Walton, Analyses of samples from the Lønne Hede, Western Jutland. Varde Museum, Denmark [unpubl. report] (n. p. 1997).

Walton / Taylor 1991
P. R. Walton / G. Taylor, The Characterisation of Dyes in Textiles from Archaeological Excavations. Chromatography and Analysis, June 1991, 5–7.

Wells 1960
C. Wells, A study of cremation. Antiquity 34, 1960, 29–37.

Lønne Hede – an Early Roman Iron Age burial site with well-preserved textiles

Summary · Zusammenfassung · Resumé

SUMMARY · In 1969 a female burial from the Early Roman Iron Age with exceptionally well preserved textiles was excavated in Lønne Hede in Southwest Jutland, Denmark. At the time, the find drew a great deal of attention and since then, the Lønne Hede Maiden and her blue and red dress have been copied and displayed in museums and textbooks as *the* female costume of the Scandinavian Iron Age. This article shows that the interpretation of both her costume and her hairstyle is debatable.

In 1995 further excavations were carried out revealing a cemetery with both cremation graves from the Late Pre-Roman Iron Age and inhumation graves from the Early Iron Age, as well as an older settlement with long houses, a smithy, and votive deposits from the Early Pre-Roman Iron Age. The burials are not rich graves, with the Lønne Hede Maiden with her pieces of silver jewellery as the exception. However, the Lønne Hede site is remarkable due to the well preserved, boldly coloured textiles and the exceptional preservation of elaborately styled hair, both of which are the focus of this article.

Analyses show that the women of Lønne Hede were dressed in a combination of tubular dresses, skirts, and shawls often woven in plain 2/2 twill or as tabbies. The textiles were made from fine wool, light and soft to the touch and coloured blue, yellow and red in stripes and sometimes checkered. The hairstyles were both elegant and elaborate, with the Lønne Hede Maidens hairstyle as the most exquisite with bands of three-stranded braids and extensions sewn together with a woollen thread. The overview of needles from the period reveal that needles from Beckmann's group 1, shape 3 is immanently suited to this purpose, and a re-evaluation of this type of "hair-pin" is suggested.

The relatively poor graves of Lønne Hede clearly show a village with knowledge of the outside world, as both dresses and hairstyles show inspiration from Roman fashion. The find forces us to re-evaluate the so-called poor graves and to recognise the bold and vibrant coloured everyday costumes of the farmers of Early Iron Age Scandinavia.

ZUSAMMENFASSUNG · Im Jahre 1969 kam in Lønne Hede in Südwestjütland, Dänemark, eine weibliche Bestattung der frühen römischen Eisenzeit mit außerordentlich gut erhaltenen Textilresten zum Vorschein. Der Fund erregte große Aufmerksamkeit und seither ist das Mädchen von Lønne Hede mit ihrem blau-roten Kleid in verschiedenen Museen und Lehrbüchern als exemplarisch für die Frauentracht der Skandinavischen Eisenzeit reproduziert und abgebildet worden. Dieser Beitrag zeigt nun, dass die Interpretation sowohl ihrer Tracht als auch ihrer Frisur neu diskutiert werden sollte.

Weitere Ausgrabungen wurden 1995 durchgeführt, bei denen einerseits ein Gräberfeld mit Brandgräbern der späten vorrömischen Eisenzeit und Körperbestattungen der frühen Eisenzeit, sowie andererseits eine ältere Siedlung mit Langhäusern, einer Schmiedewerkstatt und Weihegaben der frühen vorrömischen Eisenzeit untersucht werden konnten. Die Gräber waren keineswegs reich ausgestattet, sodass das Lønne Hede Mädchen mit seinem Silberschmuck eine Ausnahme darstellt. Dennoch ist die Fundstelle beachtenswert aufgrund ihrer gut erhaltenen bunt gefärbten Textilfunde sowie ihrer außerordentlich gut erhaltenen aufwändigen Haartrachten; auf beide Aspekte wird in diesem Beitrag näher eingegangen.

Aufgrund der Analysen konnte die Frauentracht in Lønne Hede als eine Kombination von Schlauchkleid, Rock und Schal aus feingewobenen Textilien in einfachen 2/2 Köper- oder Leinwandbindungen rekonstruiert werden. Die feinen Wollgewebe waren

sehr leicht und weich, blau gefärbt und mit roten und gelben Streifen sowie zuweilen Schachbrettmustern verziert. Die Haartrachten erwiesen sich als elegant und aufwändig. Die kunstvollste Frisur war die des Lønne Hede Mädchens: Sie bestand aus Bahnen von dreisträngigen Zöpfen und Verlängerungen, die mit einem Wollfaden angenäht wurden. Ein Überblick über die Nadeln aus der Zeit ergab, dass Beckmanns Gruppe 1, Typ 3 der Nadel aus dem Grab des Lønne Hede Mädchens am nächsten kommt, sodass eine Neuevaluation dieser „Haarnadel" angebracht scheint.

Die relativ arm ausgestatteten Gräber von Lønne Hede lassen ein Bild eines Dorfes zeichnen, welches durchaus Kontakt hatte zur Außenwelt, wie die Anzeichen des römischen Einflusses sowohl in der Kleidung als auch in der Haartracht klar zeigen. Die neu gewonnenen Erkenntnisse zwingen uns, diese sogenannten armen Gräber neu zu betrachten und die bunt gefärbte Alltagstracht der Bauern im früheisenzeitlichen Skandinavien entsprechend zu würdigen. (S. H.)

RESUMÉ · En 1969, une sépulture féminine datée du début de l'âge du Fer romain, contenant des textiles exceptionnellement bien conservés, a été mise au jour à Lønne Hede dans la partie sud-ouest du Jutland au Danemark. À l'époque, cette découverte a suscité un grand intérêt et depuis, la fille de Lønne Hede a été publiée et exposée dans des musées et des manuels avec sa robe bleue et rouge représentative du costume féminin par excellence de l'âge du Fer en Scandinavie. Cet article montre que l'interprétation tant de son costume que de sa coiffure est sujet à débat.

En 1995, des fouilles complémentaires ont été entreprises et ont révélé la présence d'une nécropole à incinérations datée de la fin de l'âge du Fer préromain et des inhumations datées du premier âge du Fer ainsi qu'un site d'habitat plus ancien compose de maisons longues, d'une forge et de dépôts votifs daté du début de l'âge du Fer préromain. Il ne s'agit pas de sépultures riches, celle de la fille de Lønne Hede avec ses parures en argent étant une exception. Cependant le site de Lønne Hede est remarquable en raison des textiles très colorés et bien conservés qu'il contient et de la conservation exceptionnelle de coiffures élaborées, qui sont tous deux au centre de cet article.

Les analyses ont montré que les femmes de Lønne Hede portaient des combinaisons de robes tubulaires, de jupes et d'étoles souvent tissées en sergé 2/2 ou en moiré. Les textiles ont été confectionnés avec de la laine fine, légère et douce, teinte en bleu, jaune et rouge avec un motif à rayures ou en damier. Les coiffures étaient élégantes et élaborées. La coiffure de la fille de Lønne Hede est la plus exquise avec des bandes de tresses à trois brins et des extensions assemblées avec des fils de laine. L'aperçu des épingles de cette période montre que l'épingle de type 3 du groupe 1 défini par Beckmann est particulièrement adaptée à cet usage et une réévaluation de ce type d'épingle à cheveux est suggérée.

Les tombes relativement pauvres de Lønne Hede témoignent clairement que le village était connecté au monde extérieur car aussi bien les robes que les coiffures s'inspirent de la mode romaine. La découverte nous oblige de réévaluer les dites tombes pauvres et d'identifier les vêtements ordinaires très colorés et éclatants du premier âge du Fer en Scandinavie. (K. M. d. K.)

Names and addresses of the authors

Ida Demant
Sagnlandet Lejre
Slangeallén 2
DK-4320 Lejre
ida@sagnlandet.dk

Lene B. Frandsen
Museum of Varde City and Environs
Lundvej 4
DK-6800 Varde
lbf@vardemuseum.dk

Lise Ræder Knudsen
Conservation Centre Vejle
Maribovej 10
DK-7100 Vejle
lrk@konsvejle.dk

Tine Lorange
Museum of Varde City and Environs
Lundvej 4
DK-6800 Varde
tbl@vardemuseum.dk

Annemette Bruselius Scharff
KADK, School of Architecture, Design and Conservation
Esplanaden 34
DK-1263 København K
abs@kadk.dk

Ina Vanden Berghe
Royal Institute for Cultural Heritage
Parc du Cinquantenaire 1
B-1000 Bruxelles
ina.vandenberghe@kikirpa.be

Irene Skals (emerita)
National Museum of Denmark
I. C. Modewegsvej, Brede
DK-2800 Kgs. Lyngby
ireneskals@hotmail.com

Ulla Lund Hansen
University of Copenhagen / Centre of Textile Research
Karen Blixens Plads 8
DK-2300 København S
ulhansen@hum.ku.dk

Ulla Mannering
National Museum of Denmark
Frederiksholms kanal 12
DK-1220 København K
ulla.mannering@natmus.dk